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

MOTOMAN INSTRUCTIONS
MOTOMAN-□□□ INSTRUCTIONS
DX200 INSTRUCTIONS
DX200 OPERATOR’S MANUAL (for each purpose)
DX200 MAINTENANCE MANUAL

The DX200 operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.
MANDATORY

• This manual explains the various components of the DX200 system and general operations. Read this manual carefully and be sure to understand its contents before handling the DX200.

• General items related to safety are listed in Chapter 1: Safety of the DX200 Instructions. To ensure correct and safe operation, carefully read the DX200 Instruction before reading this manual.

CAUTION

• Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.

• The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.

• YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.

• If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.

• YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product’s warranty.
We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-2012). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

Robotics Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
TEL: (734) 994-6088
FAX: (734) 994-3338
www.roboticsonline.com

Ultimately, well-trained personnel are the best safeguard against accidents and damage that can result from improper operation of the equipment. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the equipment. NEVER ALLOW UNTRAINED PERSONNEL TO OPERATE, PROGRAM, OR REPAIR THE EQUIPMENT!

We recommend approved YASKAWA training courses for all personnel involved with the operation, programming, or repair of the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the DX200.

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

⚠️ DANGER

Indicates an imminent hazardous situation which, if not avoided, could result in death or serious injury to personnel.

⚠️ WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.

⚠️ CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.

⚠️ MANDATORY

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

🚫 PROHIBITED

Must never be performed.

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

At any rate, be sure to follow these important items.

**NOTE**

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

• Before operating the manipulator, check that servo power is turned off when the emergency stop buttons on the front door of the DX 200 and programing pendant are pressed. When the servo power is turned off, the SERVO ON LED on the programing pendant is turned off.

Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.

Fig. : Emergency Stop Button

• Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON.

Injury may result from unintentional or unexpected manipulator motion.

Fig. : Release of Emergency Stop Button

• Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  – Be sure to use a lockout device to the safeguarding when going inside. Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
  – View the manipulator from the front whenever possible.
  – Always follow the predetermined operating procedure.
  – Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

• Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  – Turning on the power for the DX200.
  – Moving the manipulator with the programming pendant.
  – Running the system in the check mode.
  – Performing automatic operations.

Injury may result if anyone enters the working envelope of the manipulator during operation. Always press an emergency stop button immediately if there are problems.

The emergency stop button is located on the right of the front door of the DX 200 and programing pendant.
Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and supply cables.

In this manual, the equipment is designated as follows.

<table>
<thead>
<tr>
<th>Equipment</th>
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<td>DX200 controller</td>
<td>DX200</td>
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<tr>
<td>DX200 programming pendant</td>
<td>Programming pendant</td>
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<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
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Descriptions of the programming pendant keys, buttons, and displays are shown as follows:

<table>
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<tr>
<td>Symbol Keys</td>
<td></td>
</tr>
<tr>
<td>Axis Keys</td>
<td>“Axis Keys” and “Numeric Keys” are generic names for the keys for axis operation and number input.</td>
</tr>
<tr>
<td>Numeric Keys</td>
<td></td>
</tr>
<tr>
<td>Keys pressed</td>
<td>When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, ex. [SHIFT]+[COORD]</td>
</tr>
<tr>
<td>simultaneously</td>
<td></td>
</tr>
<tr>
<td>Displays</td>
<td>The menu displayed in the programming pendant is denoted with {}. ex. {JOB}</td>
</tr>
</tbody>
</table>

CAUTION

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
  - Check for problems in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the cabinet of the DX200 after use.
  The programming pendant can be damaged if it is left in the manipulator’s work area, on the floor, or near fixtures.
- Read and understand the Explanation of Warning Labels in the DX200 Instructions before operating the manipulator.
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

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and TM are omitted.

Safeguarding Tips

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. General safeguarding tips are as follows:

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this equipment, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this equipment.
- Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.
- The system must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06-2012, section 4.2.5, Sources of Energy, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

Mechanical Safety Devices

The safe operation of this equipment is ultimately the users responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06-2012 safety standards, and other local codes that may pertain to the installation and use of this equipment.

Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety equipment is provided as standard:

- Safety barriers
- Door interlocks
- Emergency stop palm buttons located on operator station

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.
Programming, Operation, and Maintenance Safety

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system must become familiar with the operation of this equipment. Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this equipment should be permitted to program, or maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- Inspect the equipment to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.

- Be sure that all safeguards are in place. Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.

- Check the E-Stop button on the operator station for proper operation before programming. The equipment must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.

- Back up all programs and jobs onto suitable media before program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.

- Any modifications to the controller unit can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to the controller unit. Making any changes without the written permission from YASKAWA will void the warranty.

- Some operations require a standard passwords and some require special passwords.

- The equipment allows modifications of the software for maximum performance. Care must be taken when making these modifications. All modifications made to the software will change the way the equipment operates and can cause severe personal injury or death, as well as damage parts of the system. Double check all modifications under every mode of operation to ensure that the changes have not created hazards or dangerous situations.

- This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

- Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.

- Use proper replacement parts.

- Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.
Maintenance Safety

Turn the power OFF and disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

Perform only the maintenance described in this manual. Maintenance other than specified in this manual should be performed only by YASKAWA-trained, qualified personnel.

Summary of Warning Information

This manual is provided to help users establish safe conditions for operating the equipment. Specific considerations and precautions are also described in the manual, but appear in the form of Dangers, Warnings, Cautions, and Notes.

It is important that users operate the equipment in accordance with this instruction manual and any additional information which may be provided by YASKAWA. Address any questions regarding the safe and proper operation of the equipment to YASKAWA Customer Support.
Customer Support Information

If you need assistance with any aspect of your Spot and Arc Welding Using Motor Gun system, please contact YASKAWA Customer Support at the following 24-hour telephone number:

(937) 847-3200

For routine technical inquiries, you can also contact YASKAWA Customer Support at the following e-mail address:

techsupport@motoman.com

When using e-mail to contact YASKAWA Customer Support, please provide a detailed description of your issue, along with complete contact information. Please allow approximately 24 to 36 hours for a response to your inquiry.

Please use e-mail for routine inquiries only. If you have an urgent or emergency need for service, replacement parts, or information, you must contact YASKAWA Customer Support at the telephone number shown above.

Please have the following information ready before you call Customer Support:

• Primary Application  Spot and Arc Welding Using Motor Gun
• Controller  DX200
• Software Version  Access this information on the Programming Pendant’s LCD display screen by selecting {MAIN MENU} - {SYSTEM INFO} - {VERSION}
• Robot Serial Number  Located on the robot data plate
• Robot Sales Order Number  Located on the DX200 controller data plate
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1 Introduction

1.1 DX200 Overview

The main power switch and the door lock are located on the front of the DX200 controller. The emergency stop button is installed in the upper right corner of the cabinet door and the programming pendant hangs from a hook below the button.

For information on setup, installation, and connection of the DX200 system, refer to the “DX200 INSTRUCTIONS”.

Fig. 1-1(a): DX200 Front View

Fig. 1-1(b): DX200 Front View (for Painting)
1.2 Programming Pendant

1.2.1 Programming Pendant Overview

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

*Fig. 1-2: Programming Pendant Overview*

- **Mode switch**: Located on the back of the programming pendant. When you lightly squeeze it, the power turns ON. When you firmly squeeze it, the power turns OFF.
- **Menu area**: General-purpose display area
- **Start button**
- **Hold button**
- **Emergency stop button**
- **Insertion slot for Compact Flash**
- **Page key**
- **Select key**
- **Manual speed keys**
- **Axis keys**
- **Enable switch (option)**
- **Enter key**
- **Motion Type key**
- **Numeric keys / Function keys**: Press to input numbers. These keys are also used as function keys to input instructions, etc. Key's function is automatically switched when function keys are available.
1.2.2 Key Description

1.2.2.1 Character Keys / Symbol Keys

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

The Numeric keys have additional functions along with their number values. Dual function keys are used in the context of the operation being performed. For example: [1] or [TIMER].

1.2.2.2 Axis Keys and Numeric Keys

The keys pictured in the following are referred to as the [Axis Key] and [Numeric Key] when described.

1.2.2.3 Keys Pressed Simultaneously

When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, such as [SHIFT]+[COORD].
### 1.2.3 Programming Pendant Keys

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>[START]</strong></td>
<td>Starts the manipulator motion in playback operation.</td>
</tr>
<tr>
<td></td>
<td>• The lamp on this button is lit during the play operation.</td>
</tr>
<tr>
<td></td>
<td>• The lamp also lights when the playback operation is started by the system input START signal.</td>
</tr>
<tr>
<td></td>
<td>• The lamp turns OFF when the playback operation is stopped by alarm occurrence, HOLD signal, or mode change.</td>
</tr>
<tr>
<td><strong>[HOLD]</strong></td>
<td>Holds the manipulator motion.</td>
</tr>
<tr>
<td></td>
<td>• This button is enabled in any mode.</td>
</tr>
<tr>
<td></td>
<td>• The lamp on this button is lit only while the button is being pressed.</td>
</tr>
<tr>
<td></td>
<td>• Although the lamp turns OFF when the button is released, the manipulator stays stopped until a START command is input.</td>
</tr>
<tr>
<td></td>
<td>• The HOLD lamp automatically lights in the following cases to indicate that the system is in HOLD status.</td>
</tr>
<tr>
<td></td>
<td>The start and axis operations are disabled while the lamp is lit.</td>
</tr>
<tr>
<td></td>
<td>1. The HOLD signal of system input is ON.</td>
</tr>
<tr>
<td></td>
<td>2. The HOLD request is being sent from an external device in remote mode.</td>
</tr>
<tr>
<td></td>
<td>3. In the HOLD status caused by an error occurred in working process such as wire sticking at arc welding.</td>
</tr>
<tr>
<td><strong>[E.STOP]</strong></td>
<td>Turns OFF the servo power.</td>
</tr>
<tr>
<td></td>
<td>• When the servo power is turned OFF, the SERVO ON LED on the programming pendant will extinguish.</td>
</tr>
<tr>
<td></td>
<td>• An emergency stop message is displayed on the screen.</td>
</tr>
<tr>
<td><strong>[MODE]</strong></td>
<td>Selects the Play mode, Teach mode, or Remote mode.</td>
</tr>
<tr>
<td>PLAY:</td>
<td>Play Mode</td>
</tr>
<tr>
<td></td>
<td>The playback of taught job is enabled.</td>
</tr>
<tr>
<td></td>
<td>The START signal from an external device is disabled.</td>
</tr>
<tr>
<td>TEACH:</td>
<td>Teach Mode</td>
</tr>
<tr>
<td></td>
<td>The axis operation and edition from the programming pendant are enabled.</td>
</tr>
<tr>
<td></td>
<td>The START signal from an external device is disabled.</td>
</tr>
<tr>
<td>REMOTE:</td>
<td>Remote Mode</td>
</tr>
<tr>
<td></td>
<td>The operation by external signals is enabled.</td>
</tr>
<tr>
<td></td>
<td>[START] is invalid during the remote mode.</td>
</tr>
<tr>
<td><strong>Enable Switch</strong></td>
<td>Turns ON the servo power.</td>
</tr>
<tr>
<td></td>
<td>When the Enable Switch is lightly squeezed while the SERVO ON LED is blinking and the Mode Switch is set to “TEACH”, the power is turned ON.</td>
</tr>
<tr>
<td></td>
<td>And when this switch is released or firmly squeezed while the power is turned ON, the power turns OFF.</td>
</tr>
</tbody>
</table>
### 1 Introduction

1.2 Programming Pendant

#### Spot and Arc Welding Using Motor Gun

**[SELECT]**
- Works as described below.
  - Selects menu items in (Main Menu) area and the menu area.
  - Makes the selected item ready to be set in the general-purpose display area.
  - Displays multiple messages in the human interface display area.

**Cursor**
- Moves the cursor in the direction of the arrow.
  - The size of the cursor and the range/place where the cursor can move will vary depending on the window.
  - If the UP cursor button is pressed when the cursor is on the first line, the cursor will move to the last line of the job. Conversely, if the cursor is on the last line of the job and the DOWN cursor button is pressed, the cursor will jump to the first line of the job.

  - **[SHIFT]** + UP
    Scrolls the screen upward.

  - **[SHIFT]** + DOWN
    Scrolls the screen downward.

  - **[SHIFT]** + RIGHT
    Scrolls the screen to the right.

  - **[SHIFT]** + LEFT
    Scrolls the screen to the left.

**[MAIN MENU]**
- Displays (Main Menu).
  - If this key is pressed while (Main Menu) is displayed, (Main Menu) disappears.
  - **[MAIN MENU]** + UP
    Increases the brightness of the screen.
  - **[MAIN MENU]** + DOWN
    Decreases the brightness of the screen.

**[SIMPLE MENU]**
- Displays the simple menu.
  - If this key is pressed while the simple menu is displayed, the simple menu disappears.
  - **[SHIFT]** + [SIMPLE MENU]
    Register the layout displayed in the general-purpose area to the user definition 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.
  - Press this key to enable the servo power supply to be turned ON if the servo power supply is shut OFF by the emergency stop or overrun signal.
  - When this key is pressed:
    - In the play mode, the servo power supply is turned ON if the safeguarding is securely closed.
    - In the teach mode, the SERVO ON lamp flashes and the servo power supply is turned ON when the Enable switch is ON.
    - The SERVO ON lamp is lit while the servo power is ON.
### [ASSIST]
Displays the menu to assist the operation for the currently displayed window.
Pressing this key with [SHIFT] or [INTERLOCK] displays the help guidance for the operation.
- [SHIFT] + [ASSIST]
  The function list of key combinations with [SHIFT] appears.
- [INTERLOCK] + [ASSIST]
  The function list of key combinations with [INTERLOCK] appears.

### [CANCEL]
Cancels the current status.
- Deletes the sub menu in {Main Menu} area and the menu area.
- Cancels the input data or the input status in the general-purpose display area.
- Cancels the multiple views in the human interface display area.
- Cancels the occurred error.

### [MULTI]
Works for the multi mode.
If this button is pressed when the multi mode is ON, the active window switches.
- [SHIFT] + [MULTI]
  Switches between the multi-window display and the single-window display when the multi mode is ON.

### [COORD]
Select the operation coordinate system when the manipulator is operated manually.
- The coordinates can be selected from the six coordinate systems, such as joint, cartesian, cylindrical, tool, user and teaching line. Each time this key is pressed, the coordinate system is switched in the following order: "JOINT" → "WLD/CYL" → "TOOL" → "USER" → "TEACHING LINE (only for arc welding purpose)"
- The selected coordinate system is displayed on the status display area.
- [SHIFT] + [COORD]
The coordinate number can be changed when the "TOOL" or "USER" coordinate system is selected.

### [DIRECT OPEN]
Displays the content related to the current line.
- To display the content of a CALL job or condition file, move the cursor to the next line and press [DIRECT OPEN]. The file will be displayed for the selected line. Display content will vary depending on the type of instruction used in the job.
  **Example:**
  For a CALL instruction, the content of the called job will be displayed.
  For a work instruction, the content of the condition file will be displayed.
  For Input/output instructions, the input/output condition will be displayed.
- The lamp on this button is lit while the direct open is ON. Press this button while the lamp is lit to return to the previous window.
1 Introduction

1.2 Programming Pendant

- [PAGE] Displays the next page.
  - The page can be switched only when the lamp on this button is lit.
  - [SHIFT] + [PAGE]
    - Switches to the previous page.

- [AREA] Moves the cursor in the following order: “Menu Area” → “General-Purpose Display Area” → “Human Interface Display Area” → “Main Menu Area”. If no item is displayed, the cursor does not move.
  - [SHIFT] + [AREA]
    - The language can be switched when the bilingual function is valid. (Bilingual function is optional.)
  - [AREA] + DOWN
    - Moves the cursor from the general-purpose display area to the operation button when the operation button is displayed.
  - [AREA] + UP
    - Moves the cursor to the general-purpose display area when the cursor is on the operation button.

- [SHIFT] Changes the functions of other keys by pressing together.
  - Can be used with [SIMPLE MENU], [ASSIST], [MULTI], [COORD], [AREA], [MOTION TYPE], [ROBOT], [EX. AXIS], the cursor or [Numeric Key] to access alternate functions.
  - Refer to the description of each key for the alternate [SHIFT] functions.

- [INTERLOCK] Changes the functions of other keys by pressing together.
  - Can be used with [ASSIST], [TEST START], [FWD], or [Numeric Key] (Numeric key customize function), [ROBOT].
  - Refer to the description of each key for the alternate [INTERLOCK] functions.

- [INFORM LIST] Displays instruction lists of commands available for job editing.

- [ROBOT] Enables the robot axis operation.
  - [ROBOT] is active for the system where multiple manipulators are controlled by one DX200 or the system with external axes.
  - [SHIFT] + [ROBOT]
    - The robot under axis operation can be switched to a robot axis which is not registered to the currently selected job.
  - [INTERLOCK] + [ROBOT]
    - Switches the application when several applications are set to a robot.
<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[EX. AXIS]</td>
<td>Enables the external axis (base axis or station axis) operation. [EX.AXIS] is active for the system with external axes. [SHIFT] + [EX. AXIS] The external axis under axis operation can be switched to an external axis which is not registered to the currently selected job.</td>
</tr>
<tr>
<td>[MOTION TYPE]</td>
<td>Selects the interpolation type for playback operation. The selected interpolation type is shown in the status display area on the screen. • Each time this key is pressed, the interpolation type changes in the following order: &quot;MOVJ&quot;→&quot;MOVL&quot;→&quot;MOVC&quot;→&quot;MOVS&quot; [SHIFT] + [MOTION TYPE] The interpolation mode changes in the following order: &quot;STANDARD&quot;→&quot;EXTERNAL REFERENCE POINT&quot;→&quot;CONVEYOR&quot;* Interpolation type can be changed in any mode.</td>
</tr>
<tr>
<td>[TEST START]</td>
<td>Moves the manipulator through taught steps in a continuous motion when [TEST START] and [INTERLOCK] are simultaneously pressed. The manipulator can be moved to check the path of taught steps. Operation stops immediately when this key is released. • The manipulator operates according to the currently selected operation cycle: &quot;AUTO&quot;, &quot;1CYCLE&quot;, or &quot;STEP&quot;. • The manipulator operates at the taught speed. However, if the taught speed exceeds the maximum teaching speed, the operation proceeds at the maximum teaching speed.</td>
</tr>
<tr>
<td>[FWD]</td>
<td>Moves the manipulator through the taught steps while this key is pressed. • Only move instructions are executed (one instruction at a time, no welding instructions). [INTERLOCK] + [FWD] All instructions are executed. [REFP] + [FWD] Moves to the reference point of the cursor line. See chapter 3.3.1.3 “Moving to Reference Point” at page 3-27. The manipulator operates at the selected manual speed. Make sure that the selected manual speed is the desired one before starting operation.</td>
</tr>
<tr>
<td>[BWD]</td>
<td>Moves the manipulator through the taught steps in the reverse direction while this key is pressed. • Only move instructions are executed (no weld commands). The manipulator operates at the selected manual speed. Make sure that the selected manual speed is the desired one before starting operation.</td>
</tr>
</tbody>
</table>
# Introduction

## 1.2 Programming Pendant

**Spot and Arc Welding Using Motor Gun**

<table>
<thead>
<tr>
<th>Button</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>[DELETE]</td>
<td>Deletes the registered instruction.</td>
</tr>
<tr>
<td><img src="image" alt="DELETE" /></td>
<td>• Deletion completes when [ENTER] is pressed while this key lamp is lit.</td>
</tr>
<tr>
<td>[INSERT]</td>
<td>Inserts a new instruction.</td>
</tr>
<tr>
<td><img src="image" alt="INSERT" /></td>
<td>• Insertion completes when [ENTER] is pressed while this key lamp is lit.</td>
</tr>
<tr>
<td>[MODIFY]</td>
<td>Modifies the taught position data or instruction.</td>
</tr>
<tr>
<td><img src="image" alt="MODIFY" /></td>
<td>• Modification completes when [ENTER] is pressed while this key lamp is lit.</td>
</tr>
<tr>
<td>[ENTER]</td>
<td>Registers instructions, data, current position of the manipulator, etc.</td>
</tr>
<tr>
<td><img src="image" alt="ENTER" /></td>
<td>• When [ENTER] is pressed, the instruction or data displayed in the input buffer line moves to the cursor position to complete a registration, insertion, or modification.</td>
</tr>
<tr>
<td>[MANUAL SPEED]</td>
<td>Sets the speed for manual operation. This speed is also valid for operations with [FWD] and [BWD].</td>
</tr>
<tr>
<td><img src="image" alt="MANUAL SPEED" /></td>
<td>• 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.</td>
</tr>
<tr>
<td></td>
<td>Each time [FAST] is pressed, manual speed changes in the following order:</td>
</tr>
<tr>
<td></td>
<td>&quot;INCH&quot;→&quot;SLOW&quot;→&quot;MED&quot;→&quot;FST&quot;.</td>
</tr>
<tr>
<td></td>
<td>Each time [SLOW] is pressed, manual speed changes in the following order:</td>
</tr>
<tr>
<td></td>
<td>&quot;FST&quot;→&quot;MED&quot;→&quot;SLOW&quot;→&quot;INCH&quot;.</td>
</tr>
</tbody>
</table>
| **[HIGH SPEED]** | Makes the manipulator move at high speed while this button and one of the axis keys are pressed simultaneously during manual operation. No need to change the setting of speed.
- The speed for [HIGH SPEED] is specified in advance. |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="HIGH SPEED" /></td>
<td></td>
</tr>
</tbody>
</table>

| **[Axis Key]** | Moves specified axes on manipulator.
- The manipulator axes only move while the key is pressed.
- Multiple axes can be operated simultaneously by pressing two or more keys at the same time. |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Axis Key" /></td>
<td>The manipulator operates in the selected coordinate system at the selected manual speed. Make sure that the selected coordinate system and the manual speed are the desired ones before starting the axis operation. It is possible to allocate any external axes to [E-] + [E+], [8-] + [8+] keys to operate them. Refer to chapter 6.9 “Jog Key Allocation” at page 6-102.</td>
</tr>
</tbody>
</table>

| **[Numeric Key]** | Enters the number or symbol when the “>” prompt appears on the input line.
- “.” is the decimal point. “-” is a minus sign or hyphen. [Numeric Key] is also used as function keys. Refer to the explanation of each function for details. |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Numeric Key" /></td>
<td></td>
</tr>
</tbody>
</table>
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.

■ 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” at page 1-4.

• Scrolling the window by touch operation:
  While touching the general-purpose display area, move it up and down or sideways, and release the touch.

(ex.) Touch the job window and slide it upwards (Scrolling towards the lower part of the window).
1.2 Programming Pendant

Moving the cursor

The cursor may be 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” at page 1-4.

- Moving the cursor by touch operation:
  Touch the position available for cursor moving in the general-purpose display area, and release the touch.

When the cursor by touch operation in the job window is moved, it is necessary to perform the following operations. (Operations can be switched by parameters.)

1. Press [INTERLOCK] + Touch operation
2. Touch operation + Confirming dialog
3. Cannot move the cursor by touch operation.
4. Press [INTERLOCK] + method of touch operation

1. Set the cursor moving specification (S2C1204) to 0 by touch operation on the job window.
2. While pressing [interlock], touch the position available for cursor moving on the job window.
(5) Touch operation + method of confirmation dialog

1. Set the cursor moving specification (S2C1204) to 1 by touch operation on the job window.
2. Touch the position available for cursor moving on the job window.
3. Select “YES” for the cursor moving confirmation dialog box.

---

### Page switching

When the [PAGE] lamp light is ON, the pages can be switched. Follow the procedure below to switch the pages.

- **Page switching by [PAGE]:**
  Refer to chapter 1.2.3 “Programming Pendant Keys” at page 1-4.

- **Displaying the next page by touch operation:**
  While touching the general-purpose display area, move it to the left side, and release the touch.

- **Displaying the previous page by touch operation:**
  While touching the general-purpose display area, move it to the right side, and release the touch.
# Operation buttons

On some windows, the operation button appears.

The operation process can be executed by pressing [SELECT] or by touching operation.

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

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

For the operation in the operation button area, use [←] or [→] and press [SELECT]

- **EXECUTE** : Continues operation displayed in the general-purpose area with the displayed contents.
- **CANCEL** : Cancels the contents in the general-purpose area and returns to the previous window.
- **COMPLETE** : Completes the setting operation displayed on the general-purpose display area.
- **STOP** : Stops operation when loading, saving, or verifying with an external memory device.
- **RELEASE** : Releases the overrun and shock sensor function.
- **RESET** : Resets an alarm. (Cannot reset major alarms.)
- **PAGE** : On the page that can be switched by specifying the page number, directly input the desired page number and press [ENTER].

* On the page where a list is selected, select a desired page number on the list by pressing [↓] or [↑], and then press [ENTER].
To disable touching operation in the general-purpose display area, change the parameter S2C1203 (Touch operation function specifications in the general-purpose area).
Refer to chapter 8.3.0.49 “S2C1203: TOUCH OPERATION FUNCTION IN GENERAL-PURPOSE DISPLAY AREA” at page 8-31

To switch the cursor moving method by touch operation on the job window, change the parameter S2C1204 (Cursor moving specifications by touch operation on the job window).
Refer to chapter 8.3.0.50 “S2C1204: CURSOR MOVEMENT FUNCTION BY TOUCH OPERATION ON JOB WINDOW” at page 8-31
1.2.4.3 Main Menu Area

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

1.2.4.4 Status Display Area

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

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

- : Robot Axes
- : Base Axes
- : Station Axes

A. Group operation axis
B. Operation coordinate system
C. Manual speed
D. Security mode
E. Operation cycle
F. State under execution
G. Mode
H. Tool number
I. Page
J. Multi Mode
K. Weak battery
L. Touch operation disable
M. Saving Data
B. Operation Coordinate System
Displays the selected coordinate system. Switched by pressing [COORD].

- Joint Coordinates
- Cartesian Coordinates
- Cylindrical Coordinates
- Tool Coordinates
- User Coordinates
- Teaching Line Coordinates (arc welding purpose)

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

- Inching
- Low Speed
- Medium Speed
- High Speed

D. Security Mode

- Operation Mode
- Edit Mode
- Management Mode
- Safety Mode
- One Time Manage Mode

E. Operation Cycle
Displays the present operation cycle.

- Step
- Cycle
- Continuous
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F. State Under Execution
Displays the present system status (STOP, HOLD, ESTOP, ALARM, or RUN).

- : Stop Status
- : Hold Status
- : Emergency Stop Status
- : Alarm Status
- : Operating Status

G. Mode
- : Teach mode
- : Play mode

H. Tool Number
From 11 to 36 : Displayed the tool No. which is chosen by a robot when the tool No. switch function is valid. (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 Panel Operation Disable
- : Displayed the touch panel operation is disabled.
- : Displayed when the battery of memory is weak and the touch panel operation is disabled.

M. Saving Data
- : Displayed while saving the data.
1.2.4.5 Human Interface Display Area

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

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

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

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

1.2.4.6 Menu Area

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

- The menu displayed in the programming pendant is denoted with { }. The above menu items are denoted with {DATA}, {EDIT}, {DISPLAY}, AND {UTILITY}.

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

**Full Window View**

```
JOB  EDIT  DISPLAY  UTILITY
CONTROL GROUP: R1  TOOL: --

0001 SET BOO 0
0002 SET DOO 1
0003 MOV CJ100.00
0004 MOV CJ100.00
0005 DOUT CJ100.00
0006 TMR 1000
0007 MOV CJ100.00
0008 MOV CJ100.00
0009 MOV CJ100.00
0010 MOV CJ100.00
0011 MOV CJ100.00

MOV CJ-0.70
```

**Upper Window View**

```
JOB  EDIT  DISPLAY  UTILITY
CONTROL GROUP: R1  TOOL: --

0001 SET BOO 0
0002 SET DOO 1
0003 MOV CJ100.00
0004 MOV CJ100.00
0005 DOUT CJ100.00
0006 TMR 1000
0007 MOV CJ100.00
0008 MOV CJ100.00
0009 MOV CJ100.00
0010 MOV CJ100.00
0011 MOV CJ100.00
```

**Middle Window View**

```
0001 SET BOO 0
0002 SET DOO 1
0003 MOV CJ100.00
0004 MOV CJ100.00
0005 DOUT CJ100.00
0006 TMR 1000
0007 MOV CJ100.00
0008 MOV CJ100.00
0009 MOV CJ100.00
0010 MOV CJ100.00
0011 MOV CJ100.00
```

**Lower Window View**

```
MOV CJ-0.70
```
### 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

<table>
<thead>
<tr>
<th>Keypad</th>
<th>Button on the Programming Pendant</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor</td>
<td><img src="image" alt="Cursor" /></td>
<td>Moves the cursor (focus).</td>
</tr>
<tr>
<td>[SELECT]</td>
<td><img src="image" alt="Select" /></td>
<td>Selects a character.</td>
</tr>
<tr>
<td>[CANCEL]</td>
<td><img src="image" alt="Cancel" /></td>
<td>Clears all the characters being typed. Pressing this second time cancels the software keypad.</td>
</tr>
<tr>
<td>[ENTER]</td>
<td><img src="image" alt="Enter" /></td>
<td>Enters the input characters.</td>
</tr>
<tr>
<td>Button Tab</td>
<td><img src="image" alt="Page" /></td>
<td>Switches the keypads displayed on the programming pendant.</td>
</tr>
<tr>
<td>-</td>
<td><img src="image" alt="Main Menu" /></td>
<td>Closes the software keypad.</td>
</tr>
<tr>
<td>Numeric Keys</td>
<td><img src="image" alt="Number Pad" /></td>
<td>Enters numbers.</td>
</tr>
</tbody>
</table>
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 (-).

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

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

For Numbers and Upper-case Characters

![Alphanumeric Input Window for Numbers and Upper-case Characters]

For Numbers and Lower-case Characters

![Alphanumeric Input Window for Numbers and Lower-case Characters]
1.2.6.4 Symbol Input

Press the [PAGE] to display the symbol input window.

Move the cursor to the desired symbol and press [SELECT] to enter the symbol.

Note that only some symbols are available for naming jobs.

*For Symbols*

![Symbol Input Window]

When the focus is in a text field of [Result], it is able to move a cursor position by pressing [Shift]+[→] or [Shift]+[←].
1.2.6.5 Register Word Function

This function enables to use the registered word when input a character by registering the word (character string) in advance. To use this function simplifies to input the same character strings. It is able to register the 32 words of eight characters.

- There is a limit to enter the character by input contents. If a registered word includes a limited character, it is unable to use the word.
- e.g. Unable to use the lower case characters, a decimal point and symbols to the job name.

Select {SET WORD} from {SETUP} in {Main Menu}.
- Register word window is displayed
- The registered words are displayed in the word area.
- If there is not any registered word, unable to select [Name order], [Delete] and [Delete All] in the button area.
Word Registration
It is able to register the 32 words of eight characters. Register a word by selecting [REGISTER WORD] button while the word editing is valid (S2C410=1) during using the keyboard, or register the word in the word register screen.

e.g. Register the word “TEST”.
Select (KEYBORD).

Enter “TEST” by using the keyboard, and select “Regist”.
– The dialog box appears.
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Select [REGISTER WORD].
- The word area appears.
- Confirm that [{TEST}] is in the word area.

- **Back Space**
  Delete the last character of the input character string.
  Select {Back space} in the word register screen.
  - Delete the last character of the input character string.

- **Cancel**
  Cancel the input character string.
  Select {Cancel} in the word register screen.
  - Cancel the character string if there is a character string is input.
  - End the word register screen if there is not any character string.
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- **Use of Words**
  
  e.g. Use the registered word (TEST).
  
  Select (REGISTER WORD).
  
  - The word area is displayed.

  There is a limit to enter the character by input contents. If a registered word includes a limited character, it is unable to use the word.
  
  e.g. Unable to use the lower case characters, a decimal point and symbols to the job name.

Select {TEST} in the word area.

- The registered word “TEST” appears in the input area.

Select (KEYBORD).

Move the focus to “1” by the programming pendant, and press [Select].
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– The “1” is added after “TEST” is displayed in the {Result}.

While “TEST1” is displayed in the {Result}, select {Regist}.
The dial box, which says {“TEST1” Word registration succeeded.} appears, and the registration is completed.
Change the Arrangement of the Words to Display
Able to change the arrangement of the words to display.

1. Name order display
Select (Name Order) in the button area.
- Displayed by the name order of the words.
- (Name Order) button changes to (Register order) button.

2. Register order display
Select (Register order) in the button area.
- Displayed by the register order of the words.
- (Register order) button changes to (Name Order) button.
Delete the Word
Able to delete the registered words.

Delete the words while the word editing is valid (S2C410=1) during using the keyboard, or delete the word in the word register screen.

e.g. Delete registered word “TEST”.
Select {REGISTER WORD}.
The word area appears.

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

Select “Yes”.
“TEST” in the word area is deleted.
Delete All Words
Able to delete all registered words.

Delete while the word editing is valid (S2C410=1) during using the keyboard, or delete the word in the word register screen.

- Delete all registered words.
  Select [Delete All] in the button area.
  - The dialog box, which asks “Do you delete all words?”, appears.
  Select “Yes”.
  - The all words are deleted.
1.2.7 Bilingual Function

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

1. Press [SHIFT] + [AREA]

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

- The two languages cannot be displayed alternately in the following conditions.
  - During character or number input operations, and when a confirmation dialog is on the window.
  - During axis operation, next-back or test mode in the teach mode.
  - Actual job names, other names and comments: the registered names and comments would remain.
1.3 Mode

The following three modes are available for DX200.

- Teach Mode
- Play Mode
- Remote Mode

1.3.1 Teach Mode

In the teach mode, the following can be done.

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

1.3.2 Play Mode

In the play mode, the following can be done.

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

1.3.3 Remote Mode

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

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

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

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

<table>
<thead>
<tr>
<th>Operation</th>
<th>Teach Mode</th>
<th>Play Mode</th>
<th>Remote Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servo ON Ready</td>
<td>PP</td>
<td>PP</td>
<td>External input signal</td>
</tr>
<tr>
<td>Start</td>
<td>Invalid</td>
<td>PP</td>
<td>External input signal</td>
</tr>
<tr>
<td>Cycle Change</td>
<td>PP</td>
<td>PP</td>
<td>External input signal</td>
</tr>
<tr>
<td>Call Master Job</td>
<td>PP</td>
<td>PP</td>
<td>External input signal</td>
</tr>
</tbody>
</table>

Note: “PP” indicates the programming pendant.

1.3.4 Teach Mode Priority

In the teach mode, following operations are disabled:

1. Playback using [START].
2. Playback from external input signals.
1.4 Security Mode

1.4.1 Types of Security Modes

The following three types of security modes are available for DX200.

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

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

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

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

- **Safety Mode**
  The operator who performs the safety management of the system can edit the safety functional relevant files in addition to the operations enabled in the management mode. When the functional safety function which is an optional function 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 “DX200 OPTIONS INSTRUCTIONS FOR FUNCTIONAL SAFETY BOARD OPERATION”.

- **One Time Manage Mode**
  Maintenance operations in higher security mode than management mode can be performed. The one time security code provided by YASKAWA is required to input.
  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.

Inputting of the password is required when operating in the edit, management and safety mode.

For the password of edit and management modes, 4 or more to less than 16 of characters/numbers should be specified, and 9 or more to less than 16 of characters/numbers are required to the safety mode password.
### Table 1-1: Menu & Security Mode (Sheet 1 of 4)

<table>
<thead>
<tr>
<th>Main Menu</th>
<th>Sub Menu</th>
<th>Allowed Security Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>JOB</td>
<td>JOB</td>
<td>DISPLAY Operation</td>
</tr>
<tr>
<td></td>
<td>SELECT JOB</td>
<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>CREATE NEW JOB</td>
<td>Edit Operation</td>
</tr>
<tr>
<td></td>
<td>MASTER JOB</td>
<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>JOB CAPACITY</td>
<td>Operation -</td>
</tr>
<tr>
<td></td>
<td>RES. START (JOB)</td>
<td>Edit Operation</td>
</tr>
<tr>
<td></td>
<td>RES. STATUS</td>
<td>Operation -</td>
</tr>
<tr>
<td></td>
<td>CYCLE</td>
<td>Operation Operation</td>
</tr>
<tr>
<td></td>
<td>TRASH JOB LIST</td>
<td>Edit Operation</td>
</tr>
<tr>
<td></td>
<td>JOB EDIT (PLAY)</td>
<td>Edit Operation</td>
</tr>
<tr>
<td></td>
<td>PLAY EDIT JOB LIST</td>
<td>Edit Operation</td>
</tr>
<tr>
<td>VARIABLE</td>
<td>BYTE</td>
<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>INTEGER</td>
<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>DOUBLE</td>
<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>REAL</td>
<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>STRING</td>
<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>POSITION (ROBOT)</td>
<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>POSITION (BASE)</td>
<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>POSITION (ST)</td>
<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>LOCAL VARIABLE</td>
<td>Operation -</td>
</tr>
<tr>
<td></td>
<td>TIMER</td>
<td>Operation Edit</td>
</tr>
<tr>
<td>IN/OUT</td>
<td>EXTERNAL INPUT</td>
<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>EXTERNAL OUTPUT</td>
<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>UNIVERSAL INPUT</td>
<td>Operation Operation</td>
</tr>
<tr>
<td></td>
<td>UNIVERSAL OUTPUT</td>
<td>Operation Operation</td>
</tr>
<tr>
<td></td>
<td>SPECIFIC INPUT</td>
<td>Operation -</td>
</tr>
<tr>
<td></td>
<td>SPECIFIC OUTPUT</td>
<td>Operation -</td>
</tr>
<tr>
<td></td>
<td>RIN</td>
<td>Operation -</td>
</tr>
<tr>
<td></td>
<td>REGISTER</td>
<td>Operation Management</td>
</tr>
<tr>
<td></td>
<td>AUXILIARY RELAY</td>
<td>Operation -</td>
</tr>
<tr>
<td></td>
<td>CONTROL INPUT</td>
<td>Operation -</td>
</tr>
<tr>
<td></td>
<td>PSEUDO INPUT SIG</td>
<td>Operation Management</td>
</tr>
<tr>
<td></td>
<td>NETWORK INPUT</td>
<td>Operation -</td>
</tr>
<tr>
<td></td>
<td>NETWORK OUTPUT</td>
<td>Operation -</td>
</tr>
<tr>
<td></td>
<td>ANALOG OUTPUT</td>
<td>Operation -</td>
</tr>
<tr>
<td></td>
<td>SV POWER STATUS</td>
<td>Operation -</td>
</tr>
<tr>
<td></td>
<td>LADDER PROGRAM</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>I/O ALARM</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>I/O MESSAGE</td>
<td>Management Management</td>
</tr>
<tr>
<td></td>
<td>TERMINAL</td>
<td>Operation Edit</td>
</tr>
<tr>
<td></td>
<td>I/O SIMULATION LIST</td>
<td>Operation Operation</td>
</tr>
<tr>
<td></td>
<td>SERVO ON FACTOR</td>
<td>Management -</td>
</tr>
<tr>
<td></td>
<td>RB STOP FACTOR MONITOR</td>
<td>Operation -</td>
</tr>
</tbody>
</table>
### Table 1-1: Menu & Security Mode  (Sheet 2 of 4)

<table>
<thead>
<tr>
<th>Main Menu</th>
<th>Sub Menu</th>
<th>Allowed Security Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DISPLAY</td>
<td>EDIT</td>
</tr>
<tr>
<td>ROBOT</td>
<td>CURRENT POSITION</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>COMMAND POSITION</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>SERVO MONITOR</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>WORK HOME POS</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>SECOND HOME POS</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>DROP AMOUNT</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>POWER ON/OFF POS</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>TOOL</td>
<td>Edit</td>
</tr>
<tr>
<td></td>
<td>INTERFERENCE</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>SHOCK SENS LEVEL</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>USER COORDINATE</td>
<td>Edit</td>
</tr>
<tr>
<td></td>
<td>HOME POSITION</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>MANIPULATOR TYPE</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>ANALOG MONITOR</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>OVERRUN&amp;S-SENSOR 1)</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>LIMIT RELEASE 1)</td>
<td>Edit</td>
</tr>
<tr>
<td></td>
<td>ARM CONTROL 1)</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>SHIFT VALUE</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>SOFTLIMIT SETTING</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>SHOCK SENS LV.(CURRENT)</td>
<td>Operation</td>
</tr>
<tr>
<td>SYSTEM INFO</td>
<td>VERSION</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>MONITORING TIME</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>CONTROLLER INFORMATION</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>ALARM HISTORY</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>I/O MSG HISTORY</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>LOGDATA</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>USER DEFINITION MENU</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>QR CODE</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>SECURITY</td>
<td>Operation</td>
</tr>
<tr>
<td>EX.MEMORY</td>
<td>LOAD</td>
<td>Edit</td>
</tr>
<tr>
<td></td>
<td>SAVE</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>VERIFY</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>DELETE</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>DEVICE</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>FOLDER</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>INITIALIZE 1)</td>
<td>Operation</td>
</tr>
<tr>
<td>PARAMETER</td>
<td>S1CxG</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>S2C</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>S3C</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>S4C</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>A1P</td>
<td>Management</td>
</tr>
<tr>
<td></td>
<td>A2P</td>
<td>Management</td>
</tr>
<tr>
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<td>A7P</td>
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### Table 1-1: Menu & Security Mode  (Sheet 3 of 4)

<table>
<thead>
<tr>
<th>Main Menu</th>
<th>Sub Menu</th>
<th>Allowed Security Mode</th>
<th>DISPLAY</th>
<th>EDIT</th>
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<td></td>
<td>RS Management</td>
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<td>S1E Management</td>
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<td>OPERATE COND. Management</td>
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<td>FUNCTION COND. Management</td>
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<td>DATE/TIME Management</td>
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<td>GRP COMBINATION Management</td>
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<td>SET WORD Edit</td>
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<td>USER ID Edit</td>
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<td>WRONG DATA LOG Management</td>
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<td>M- SAFETY SIGNAL ALLOC Operation</td>
<td>Safety</td>
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<td>TIMER DELAY SET Operation</td>
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<td>CHANGE FONT Operation</td>
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<td>CHANGE BUTTON Operation</td>
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<td>INITIALIZE LAYOUT Operation</td>
<td>Operation</td>
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</tr>
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<td></td>
<td>CHANGE WINDOW PATTERN Operation</td>
<td>Operation</td>
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### Table 1-1: Menu & Security Mode (Sheet 4 of 4)

<table>
<thead>
<tr>
<th>Main Menu</th>
<th>Sub Menu</th>
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<tr>
<td></td>
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<td>ARC WELDING</td>
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<td>Operation Edit</td>
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<tr>
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<td>ARC END COND.</td>
<td>Operation Edit</td>
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<td>ARC AUX COND.</td>
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<td>WELDER COND.</td>
<td>Operation Edit</td>
</tr>
<tr>
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<td>ARC WELD DIAG.</td>
<td>Operation Edit</td>
</tr>
<tr>
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<td>WEAVING</td>
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<td>ARC MONITOR</td>
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<td>ARC MONITOR (SAMPL)</td>
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<td>GUN CONDITION</td>
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<td>SPOT WELDER COND.</td>
<td>Management Management</td>
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<td>APPLICATION CONDITION SETTING</td>
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<td>GUN PRESSURE</td>
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<td>GUN CONDITION</td>
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<td>TIP INSTALLATION</td>
<td>Operation Management</td>
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<td>APPLICATION SETTING</td>
<td>Management Management</td>
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<td>PAINT</td>
<td>PAINT SYSTEM CONFIG.</td>
<td>Management Management</td>
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<td>PAINT SPECIAL</td>
<td>Management Management</td>
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<td>PAINT CONDITION</td>
<td>Operation Edit</td>
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<tr>
<td></td>
<td>CALIBRATION CONFIG.</td>
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<td>TIME CHART CONFIG.</td>
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<td></td>
<td>PAINT DATA CONFIG.</td>
<td>Operation Edit</td>
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<td></td>
<td>PAINT OUTPUT TEST</td>
<td>Management Management</td>
</tr>
<tr>
<td>COMMON TO ALL APPLICATIONS</td>
<td>I/O VARIABLE CUSTOMIZE</td>
<td>Operation Operation</td>
</tr>
</tbody>
</table>

1. Displayed in the teach mode only.
2. Displayed in the play mode only.
3. Displays only when the Job undelete function is enabled.

For the operation methods when the functional safety function is enabled, refer to “DX200 OPTIONS INSTRUCTIONS FOR FUNCTIONAL SAFETY BOARD OPERATION”.

---

**Note:**

1. Displayed in the teach mode only.
2. Displayed in the play mode only.
3. Displays only when the Job undelete function is enabled.
1.4.2 Changing Security Mode

1. Select {SYSTEM INFO} under {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 to when the input password is correct.
Follow the procedures below when changing the security to the one time manage mode.

1. Change the security 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”.

3. A key pad for character input is displayed. Input the one time security code provided by YASKAWA.

4. 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 DX200, 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.

- **Teaching Line Coordinates**
  The XYZ-Cartesian coordinates will be set from two steps and the Z-axis direction of the robot coordinates. The tool tip of the manipulator moves parallel to the coordinates. They can be used only for an arc welding purpose.
2.2 General Operations

2.2.0.1 Check Safety

Before doing any operations on the DX200, read the “Safety” of “DX200 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 DX200 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 → Teaching Line (only for arc welding purpose).

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.

- Each time [FAST] is pressed, the speed switches in the order of “INCH”→“SLOW”→“MED”→“FAST”.

- Each time [SLOW] is pressed, the speed switches in the order of “FAST”→“MED”→“SLOW”→“INCH”.

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

2.2.0.6 Servo ON

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

2.2.0.7 Axis Operation

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

2.2.0.8 HIGH SPEED

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

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

*Table 2-1: Axis Motion in Joint Coordinates*

<table>
<thead>
<tr>
<th>Axis Name</th>
<th>Axis Operation Key</th>
<th>Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Axes</td>
<td>S-axis</td>
<td><img src="X-" alt="S-" /> <img src="X+" alt="S+" /></td>
</tr>
<tr>
<td></td>
<td>L-axis</td>
<td><img src="Y-" alt="L-" /> <img src="Y+" alt="L+" /></td>
</tr>
<tr>
<td></td>
<td>U-axis</td>
<td><img src="Z-" alt="U-" /> <img src="Z+" alt="U+" /></td>
</tr>
<tr>
<td>Wrist Axes</td>
<td>R-axis</td>
<td><img src="X-" alt="R-" /> <img src="X+" alt="R+" /></td>
</tr>
<tr>
<td></td>
<td>B-axis</td>
<td><img src="Y-" alt="B-" /> <img src="Y+" alt="B+" /></td>
</tr>
<tr>
<td></td>
<td>T-axis</td>
<td><img src="Z-" alt="T-" /> <img src="Z+" alt="T+" /></td>
</tr>
<tr>
<td></td>
<td>E-axis</td>
<td><img src="E-" alt="E-" /> <img src="E+" alt="E+" /></td>
</tr>
</tbody>
</table>

• When two or more [Axis Key]s are pressed at the same time, the manipulator will perform a compound movement. However, if two different directional keys for the same axis are pressed at the same time (such as [S-] + [S+]), none of the axes operate.
When "ALL AXES ANGLE DISPLAY FUNCTION" is enabled, \{ABSO. ANGLE\} or \{GROUND ANGLE\} appears on the CURRENT POSITION window.

In case \{ABSO. ANGLE\} or \{GROUND ANGLE\} is selected at CURRENT POSITION COORDINATE, directions of L-axis, R-axis and T-axis angle differ from the pulse display.

<table>
<thead>
<tr>
<th>CURRENT POSITION COORDINATE PULSE</th>
<th>CURRENT POSITION COORDINATE ABSO. ANGLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>R 50000</td>
<td>R1 :S 34.8348 deg.</td>
</tr>
<tr>
<td>L 50000</td>
<td>L 38.4521 deg.</td>
</tr>
<tr>
<td>U 50000</td>
<td>U 35.1562 deg.</td>
</tr>
<tr>
<td>R 50000</td>
<td>R 51.5487 deg.</td>
</tr>
<tr>
<td>B 50000</td>
<td>B 51.0079 deg.</td>
</tr>
<tr>
<td>T 50000</td>
<td>T -103.9495 deg.</td>
</tr>
</tbody>
</table>

When operating in joint coordinates mode, check the movement direction and pay great attention to perform the operation.

For details, refer to chapter 8.3.0.47 "S2C684:ALL AXES ANGLE DISPLAY FUNCTION".
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

<table>
<thead>
<tr>
<th>Axis Name</th>
<th>Axis Operation Key</th>
<th>Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Axes</td>
<td>X-axis</td>
<td><img src="image" alt="X-axis" /></td>
</tr>
<tr>
<td></td>
<td>Y-axis</td>
<td><img src="image" alt="Y-axis" /></td>
</tr>
<tr>
<td></td>
<td>Z-axis</td>
<td><img src="image" alt="Z-axis" /></td>
</tr>
<tr>
<td>Wrist Axes</td>
<td>Motion about TCP is executed. See chapter 2.3.7 “Control Point Operation” at page 2-17.</td>
<td></td>
</tr>
</tbody>
</table>

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

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

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

Table 2-3: Axis Motion in Cylindrical Coordinates

<table>
<thead>
<tr>
<th>Axis Name</th>
<th>Axis Operation Key</th>
<th>Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Axes</td>
<td>0-axis</td>
<td>![Symbols] Main unit rolls around S-axis.</td>
</tr>
<tr>
<td></td>
<td>r-axis</td>
<td>![Symbols] Moves perpendicular to Z-axis.</td>
</tr>
<tr>
<td></td>
<td>Z-axis</td>
<td>![Symbols] Moves parallel to Z-axis.</td>
</tr>
<tr>
<td>Wrist Axes</td>
<td>Motion about TCP is executed. See chapter 2.3.7 “Control Point Operation” at page 2-17.</td>
<td></td>
</tr>
</tbody>
</table>

- When two or more [Axis Key]s are pressed at the same time, the manipulator will perform compound movement. However, if two different directional keys for the same axis are pressed at the same time (such as [Z-] + [Z+]), none of the axes operate.
2-9

Manipulator Coordinate Systems and Operations

2.3 Coordinate Systems and Axis Operation

Spot and Arc Welding Using Motor Gun

Fig. 2-3: Rolls around q-axis

Fig. 2-4: Moves perpendicular to r-axis
2.3.4 Tool Coordinates

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

Table 2-4: Axis Motion in Tool Coordinates

<table>
<thead>
<tr>
<th>Axis Name</th>
<th>Axis Operation Key</th>
<th>Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Axes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X-axis</td>
<td>$X_-$ $X_+$</td>
<td>Moves parallel to X-axis.</td>
</tr>
<tr>
<td>Y-axis</td>
<td>$Y_-$ $Y_+$</td>
<td>Moves parallel to Y-axis.</td>
</tr>
<tr>
<td>Z-axis</td>
<td>$Z_-$ $Z_+$</td>
<td>Moves parallel to Z-axis.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wrist Axes</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Motion about TCP is executed. See chapter 2.3.7 “Control Point Operation” at page 2-17.</td>
<td></td>
</tr>
</tbody>
</table>

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

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

In the tool coordinates motion, the manipulator can be moved using the effective tool direction as a reference regardless of the manipulator position or orientation. These motions are best suited when the manipulator is required to move parallel while maintaining the tool orientation with the workpieces.
For tool coordinates, the tool file should be registered in advance. For further details, refer to section 8.3 “Tool Data Setting” of coordinates in the “DX200 INSTRUCTIONS” (165292-1CD).
Spot and Arc Welding
Using Motor Gun

2.3 Coordinate Systems and Axis Operation

2.3.4.1 Selecting Tool

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

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

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

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

S2C431: Tool number switch specifying parameter
1: Can be switched
0: Cannot be switched

1. Press the [COORD] and select the tool coordinates.

   Each time [COORD] is pressed, the coordinate system switches in the following order:
   Joint → Cartesian (Cylindrical) → Tool → User → Teaching Line (only for arc welding purpose).
   Check the change on the status display area.

2. Press [SHIFT] + [COORD].

   The TOOL NO. SELECT window appears.

3. Move the cursor to the tool to use.

   The TOOL NO. SELECT window above shows an example; “TOOL NO. 0 TORCH MT-3501” is selected.

4. Press [SHIFT] + [COORD].

   The window goes back to the previous window.
2.3.5 User Coordinates

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

The figure and the table below describe the motion of each axis when the [Axis Key] is pressed.

**Table 2-5: Axis Motion in User Coordinates**

<table>
<thead>
<tr>
<th>Axis Name</th>
<th>Axis Operation Key</th>
<th>Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Axes</td>
<td>X-axis</td>
<td><img src="image" alt="X-" /> [X+]</td>
</tr>
<tr>
<td></td>
<td>Y-axis</td>
<td><img src="image" alt="Y-" /> [Y+]</td>
</tr>
<tr>
<td></td>
<td>Z-axis</td>
<td><img src="image" alt="Z-" /> [Z+]</td>
</tr>
<tr>
<td>Wrist Axes</td>
<td>Motion about TCP is executed. See chapter 2.3.7 “Control Point Operation” at page 2-17.</td>
<td></td>
</tr>
</tbody>
</table>

- When two or more [Axis Key]s are pressed at the same time, the manipulator will perform compound movement. However, if two different directional keys for the same axis are pressed at the same time (such as [X-] + [X+]), none of the axes operate.
Fig. 2-5: Moves parallel to X or Y-axis

Fig. 2-6: Moves parallel to Z-axis
2.3.5.1 Selecting User Coordinates

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

1. Press [COORD] to select the user coordinates.
   – Each time [COORD] is pressed, the coordinate system switches in the following order: Joint → Cartesian (Cylindrical) → Tool → User.
   Check the change on the status display area.

2. Press [SHIFT] + [COORD].
   – The USER COORD SELECT window appears.

   ![User Coordinate Select Window]

   For more information on registration of the user coordinates, refer to section 8.8 “User Coordinate Setting” of the “DX200 INSTRUCTIONS” (165292-1CD).

3. Select the desired user number.
2.3.5.2 Examples of User Coordinate Utilization

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

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

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

- When performing conveyor tracking operations, the moving direction of the conveyor is specified.
2.3.6 External Axis

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

<table>
<thead>
<tr>
<th>Axis Name</th>
<th>Axis Operation Key</th>
<th>Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASE or STATION</td>
<td>1st axis</td>
<td>The 1st axis moves.</td>
</tr>
<tr>
<td></td>
<td>X- S- X+ S+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2nd axis</td>
<td>The 2nd axis moves.</td>
</tr>
<tr>
<td></td>
<td>Y- L- Y+ L+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3rd axis</td>
<td>The 3rd axis moves.</td>
</tr>
<tr>
<td></td>
<td>Z- U- Z+ U+</td>
<td></td>
</tr>
</tbody>
</table>

2.3.7 Control Point Operation

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

Table 2-6: Axis Motion in Motion about TCP

<table>
<thead>
<tr>
<th>Axis Name</th>
<th>Axis Operation Key</th>
<th>Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Axes</td>
<td>X- S- X+ S+</td>
<td>TCP moves. These movements differ depending on cartesian, cylindrical, tool and user coordinates.</td>
</tr>
<tr>
<td>Wrist Axes</td>
<td>X- R- X+ R+</td>
<td>Wrist axes move with the TCP fixed. These movements differ depending on cartesian, cylindrical, tool and user coordinates.</td>
</tr>
<tr>
<td>E-axis</td>
<td>E- E+</td>
<td>* 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.)</td>
</tr>
</tbody>
</table>

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

Fig. 2-7: Torch Welding

Fig. 2-8: Gun Spot Welding

TCP
Turning of each wrist axis differs in each coordinate system.

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

- In tool coordinates, wrist axis rotations are based on X-, Y-, or Z-axis of the tool coordinates.
2.3.7.1 Control Point Change

The tool tip position (TCP) is the target point of axis operations and is set as the distance from the flange face. The control point change operation is an axis operation that involves selecting a tool from the list of registered tools (Refer to chapter 2.3.4.1 “Selecting Tool” at page 2-12), and then manipulating the axes while changing the TCP. This can be performed with all coordinates except the joint coordinates. The axis operation is the same as that of the motion about TCP.

Example 1: TCP Change Operation with Multiple Tools

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

Fig. 2-9: Selection of Tool 1 and axis operations with controlling P1  
Fig. 2-10: Selection of Tool 2 and axis operations with controlling P2
<Example 2> TCP Change Operation with a Single Tool

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

(2) By selecting two TCPs alternately, the workpiece can be moved as shown below:

For registration of the tool file, refer to section 8.3 “Tool Data Setting” of the “DX200 INSTRUCTIONS” (165292-1CD).
2.3.8 Teaching Line Coordinates

The teaching line coordinates is the coordinates that are set from the two successive steps and the Z-axis direction of the robot coordinates. They can be used only for the arc welding purpose.

Each axis of the teaching line coordinates system

<table>
<thead>
<tr>
<th>Axis</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-axis</td>
<td>Motion direction&lt;br&gt;Tangential direction in a circular arc path</td>
</tr>
<tr>
<td>Y-axis</td>
<td>Gy is outer product direction of the Z-axis of base coordinates and X-axis of teaching line coordinates.&lt;br&gt;$\theta_R$ is the angle of Gy and Z-axis of tool coordinates.&lt;br&gt;$\theta_L$ is the angle of $-Gy$ and Z-axis of tool coordinates.&lt;br&gt;When $\theta_R$ is smaller than $\theta_L$, Y-axis of teaching line coordinates is Gy.&lt;br&gt;When $\theta_L$ is smaller than $\theta_R$, Y-axis of teaching line coordinates is $-Gy$.</td>
</tr>
<tr>
<td>Z-axis</td>
<td>Z-axis of teaching line coordinates is the outer product direction of the X-axis of base coordinates and Gy.</td>
</tr>
</tbody>
</table>

Fig. 2-13: Teaching Line Coordinates

Fig. 2-14: Linear Interpolation and the Teaching Line Coordinates

<table>
<thead>
<tr>
<th>Step</th>
<th>Instruction</th>
<th>Teaching line coordinate system instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NOP</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>MOVL</td>
<td>$\Rightarrow$</td>
</tr>
<tr>
<td>3</td>
<td>MOVL</td>
<td>$\Rightarrow$</td>
</tr>
</tbody>
</table>

Fig. 2-15: Circular Interpolation and the Teaching Line Coordinates

<table>
<thead>
<tr>
<th>Step</th>
<th>Instruction</th>
<th>Teaching line coordinate system instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NOP</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>MOVC</td>
<td>$\Rightarrow$</td>
</tr>
<tr>
<td>3</td>
<td>MOVC</td>
<td>$\Rightarrow$</td>
</tr>
</tbody>
</table>
\section*{Torch Angle and Travel Angle}

\begin{tabular}{|l|l|}
\hline
Torch angle & The angle of Y-axis of teaching line coordinates and the direction that projected Z-axis of tool coordinates on YZ-plane of teaching line coordinates. \\
\hline
Travel angle & The angle subtracted 90 degrees from the angle of X-axis of teaching line coordinates and Z-axis of tool coordinates. \\
\hline
\end{tabular}

\textbf{Fig. 2-16: Torch Angle and Travel Angle}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{torch_angle_travel_angle.png}
\caption{Torch Angle and Travel Angle}
\end{figure}
Operations for Teaching Line Coordinates System

In the teaching line coordinates system, the manual operation can be done as follows:

<table>
<thead>
<tr>
<th>Axis Name</th>
<th>Axis Operation Key</th>
<th>Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Axes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X-axis</td>
<td></td>
<td>Moves parallel to X-axis.</td>
</tr>
<tr>
<td>Y-axis</td>
<td>[SHIFT]+[Y-], [SHIFT]+[Y+]</td>
<td>Moves parallel to Y-axis.</td>
</tr>
<tr>
<td>Z-axis</td>
<td>[INTERLOCK]+[Z-], [INTERLOCK]+[Z+]</td>
<td>Moves parallel to Z-axis.</td>
</tr>
</tbody>
</table>

| Wrist Axes | | |
| X-axis | [SHIFT]+[x-], [SHIFT]+[x+] | Tool posture changes around X-axis with the TCP fixed. |
| Y-axis | [SHIFT]+[y-], [SHIFT]+[y+] | Tool posture changes around Gy-axis with the TCP fixed. |
| Z-axis | [SHIFT]+[z-], [SHIFT]+[z+] | Tool posture changes around Z-axis of tool coordinates with the TCP fixed. |

When two or more [Axis Key]s are pressed at the same time, the manipulator will perform compound movement. However, if two different directional keys for the same axis are pressed at the same time (such as [X-] + [X+]), none of the axes operate.
In steps for circular interpolation or spline interpolation, perform manual operation after performing FWD, BWD or test operations.
In the following operations and cases, manual operation for teaching line coordinate is limited.

**Table 2-8: Limited Manual Operation for Teaching Line Coordinate**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Restrictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job is not selected.</td>
<td>Cannot perform manual operation.</td>
</tr>
<tr>
<td>The number of steps in the JOB is less than 2.</td>
<td></td>
</tr>
<tr>
<td>The cursor is at the 1st step.</td>
<td></td>
</tr>
<tr>
<td>The current step and the previous step are the same position, or the distance between these steps are short.</td>
<td></td>
</tr>
<tr>
<td>Motion direction is the same as the Z-axis direction of the base coordinate.</td>
<td></td>
</tr>
<tr>
<td>Move instruction of current step is MOVJ.</td>
<td></td>
</tr>
<tr>
<td>Move instruction of current step is IMOV.</td>
<td></td>
</tr>
<tr>
<td>The torch angle is about ± 90°.</td>
<td>The following manual operation cannot be done.</td>
</tr>
<tr>
<td>• Teaching line coordinate Y-axis</td>
<td>• Teaching line coordinate Y-axis</td>
</tr>
<tr>
<td>• Torch Angle</td>
<td>• Torch Angle</td>
</tr>
<tr>
<td>• Travel Angle</td>
<td>• Travel Angle</td>
</tr>
<tr>
<td>The travel angle is about ± 90°.</td>
<td></td>
</tr>
</tbody>
</table>
2.3.8.2 Display Welding-related Information

① Torch angle (-90.000 ~ 90.000)
   CURRENT: Degree of torch angle of current teaching line coordinates
   COMMAND: Target position of moving operation to torch angle/travel angle

② Travel angle (-90.000 ~ 90.000)
   CURRENT: Degree of travel angle of current teaching line coordinates
   COMMAND: Target position of moving operation to torch angle/travel angle

③ Downward angle (-90.000 ~ 90.000)
   CURRENT: Current downward angle
   The angle that is subtracted by 90 degrees from the angle of Z-axis of the base coordinates and X-axis of the teaching line coordinates.

In the following operations and cases, INFORMATION RELATED ARC is not displayed.

- Selecting a job
- Editing a job
- Moving the cursor
- The cursor is at the 1st step.
- The current step and the previous step are the same position, or the distance between these steps are short.
- The move instruction of current step is MOVJ.
- The move instruction of current step is IMOV.
- Motion direction is the same as the Z-axis of base coordinate.
Spot and Arc Welding Using Motor Gun

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

- **Switching Welding-related Information Display**

  Able to switch a state of ARC INFORMATION display to hide or show.

  1. Select the {JOB} under {Main Menu}.
  2. Select {JOB CONTENT}.
     - Job content window appears.
  3. Select {DISPLAY} in the menu area.
     - A pull-down menu appears.
  4. Select {ARC INFORMATION}.
     - Welding-related information is displayed.
Moving Operation to Torch Angle/Travel Angle

Able to move the manipulator to the torch angle/travel angle which are specified to the COMMAND (target position) in the ARC INFORMATION.

1. Display the ARC INFORMATION.
2. Touch the ARC INFORMATION.
   – The arc information becomes active.
3. Select a data input area of the torch angle or travel angle.
4. Input numeric value by [Numeric Key].
5. Press [ENTER].
   – The COMMAND is set.
6. Press [NEXT].

   – The confirmation dialog box appears to confirm to move the manipulator to the torch angle/travel angle.

   ![Image of confirmation dialog box]

   In the multi-window mode, moving operation to the torch angle/travel angle is unavailable. If [NEXT] is pressed when the cursor is on a move instruction, the next motion of the move instruction is operated.

7. Press [YES].

   – The confirmation dialog box disappears.
   – When the arc information is active, the confirmation dialog doesn’t appear again.

8. By pressing [NEXT] again, the manipulator moves to the target position.

   – The manipulator stops when the manipulator arrives to the target position.
   – The manipulator stops when [NEXT] is released.
3 Teaching

3.1 Preparation for Teaching

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

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

Then,

- Register a job.

3.1.1 Checking Emergency Stop Buttons

The Servo ON button on the programming pendant should be lit while the power is ON for the servo system. Perform the following operation to ensure that the emergency stop buttons on both the DX200 and the programming pendant are functioning correctly before operating the manipulator.

1. Press E. STOP button.
   - Press the emergency stop button on the DX200 or the programming pendant.

2. Confirm the servo power is turned OFF.
   - The SERVO ON button on the programming pendant lights while servo supply is turned ON.
   - When the emergency stop button is pressed and the servo power is turned OFF, the SERVO ON lamp will turn OFF.

   - After confirming correct operation, press [SERVO ON READY]. The servo power will be ready to turn ON.
   - The servo power can be turned ON while the SERVO ON button lamp blinks.

3.1.2 Setting the Teach Lock

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

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

3.1.3 Registering a Job

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

3.1.3.1 Registering Job Names

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

The following rules apply to the designation of job names:

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

<Example>

```
0 0 1 JOB - 1 WORK - A
```

3.1.3.2 Registering Jobs

1. Select {JOB} under {Main Menu}.
   - The sub-menu appears.

2. Select {CREATE NEW JOB}.
   - The NEW JOB CREATE window appears.
3.1 Preparation for Teaching

3. Input job name.
   – Move the cursor to JOB NAME, and press [SELECT]. Input job names using the character input operation. For information on character input operation, refer to chapter 1.2.6 “Character Input Operation” at page 1-22.

4. Press [ENTER].

3.1.3.3 Registering Comments

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

1. Enter a comment.
   – In the NEW JOB CREATE window, move the cursor to the comment and press [SELECT]. For information on character input operation, refer to chapter 1.2.6 “Character Input Operation” at page 1-22.

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.
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 Teaching Operation

3.2.2 Interpolation Type and Play Speed

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

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

3.2.2.1 Joint Interpolation

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

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

<Play Speed Setting Window>

- Speeds are indicated as percentages of the maximum rate.
- Setting “0:Speed Omit” sets the same speed as the previous determination.

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

<table>
<thead>
<tr>
<th>Speed</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast</td>
<td>100.00</td>
</tr>
<tr>
<td></td>
<td>50.00</td>
</tr>
<tr>
<td></td>
<td>25.00</td>
</tr>
<tr>
<td></td>
<td>12.50</td>
</tr>
<tr>
<td></td>
<td>6.25</td>
</tr>
<tr>
<td></td>
<td>3.12</td>
</tr>
<tr>
<td></td>
<td>1.56</td>
</tr>
<tr>
<td>Slow</td>
<td>0.78 (%)</td>
</tr>
</tbody>
</table>
3.2.2.2 Linear Interpolation

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

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

- There are two types of displays, and they can be switched depending on the application.

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

  ![Diagram of Single Circular Arc](image)

  Table 3-1: Interpolation Type for Single Circular Arc

<table>
<thead>
<tr>
<th>Point</th>
<th>Interpolation Type</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0</td>
<td>Joint or Linear</td>
<td>MOVJ</td>
</tr>
<tr>
<td>P1</td>
<td>Circular</td>
<td>MOVC</td>
</tr>
<tr>
<td>P2</td>
<td>Separated</td>
<td></td>
</tr>
<tr>
<td>P3</td>
<td>Circular</td>
<td>MOVC</td>
</tr>
<tr>
<td>P4</td>
<td>Joint or Linear</td>
<td>MOVJ</td>
</tr>
</tbody>
</table>

- **Continuous Circular Arcs**
  When two or more successive circular movements with different curvatures are required, the two circular movements can be continued by adding “FPT” tag to the step whose curvature is needed to be changed.

  ![Diagram of Continuous Circular Arcs](image)

  Table 3-2: Interpolation Type for Continuous Circular Arcs

<table>
<thead>
<tr>
<th>Point</th>
<th>Interpolation Type</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0</td>
<td>Joint or Linear</td>
<td>MOVJ</td>
</tr>
<tr>
<td>P1</td>
<td>Circular</td>
<td>MOVC</td>
</tr>
<tr>
<td>P2</td>
<td>Separated</td>
<td></td>
</tr>
<tr>
<td>P3</td>
<td>Circular</td>
<td>MOVC</td>
</tr>
<tr>
<td>P4</td>
<td>Circular</td>
<td>MOVC</td>
</tr>
<tr>
<td>P5</td>
<td>FPT</td>
<td></td>
</tr>
<tr>
<td>P6</td>
<td>Joint or Linear</td>
<td>MOVJ</td>
</tr>
</tbody>
</table>
In case the “FPT” tag is not added, two or more successive circular movements must be separated from each other. Thus, as shown in P4 of the following figure, the linear interpolation step or the joint must be inserted at an identical point in which the end point of the preceding circular movement coincide with the beginning point of the following circular movement.

However, if the step at the identical point is taught, the continuous movements cannot be performed.

<table>
<thead>
<tr>
<th>Point</th>
<th>Interpolation Type</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0</td>
<td>Joint or Linear</td>
<td>MOVJ, MOVL</td>
</tr>
<tr>
<td>P3</td>
<td>Circular</td>
<td>MOVC</td>
</tr>
<tr>
<td>P4</td>
<td>Joint or Linear</td>
<td>MOVJ, MOVL</td>
</tr>
<tr>
<td>P5</td>
<td>Circular</td>
<td>MOVC</td>
</tr>
<tr>
<td>P8</td>
<td>Joint or Linear</td>
<td>MOVJ, MOVL</td>
</tr>
</tbody>
</table>

<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.
3.2.4 Spline Interpolation

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

- **Single Spline Curve**

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

  \[\text{Table 3-3: Interpolation Type for Single Spline Curve}\]

<table>
<thead>
<tr>
<th>Point Type</th>
<th>Instruction</th>
</tr>
</thead>
</table>
| 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 with identical points are not required at the junction between two spline curves.

  \[\text{Table 3-4: Interpolation Type for Continuous Spline Curves}\]

<table>
<thead>
<tr>
<th>Point Type</th>
<th>Instruction</th>
</tr>
</thead>
</table>
| 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.
3 Teaching
3.2 Teaching Operation

<Play Speed>

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

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

3.2.3 Teaching Steps

3.2.3.1 Registering Move Instructions

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

This paragraph explains the teaching of Fig. 3-1 “Registering Move Instructions”, the operations involved in registering new steps.

Teaching of Fig. 3-2 “Inserting Move Instructions” is called “Inserting move instruction”, to distinguish it from the method shown in Fig. 3-1 “Registering Move Instructions”. For more details on this operation, see chapter 3.4.2 “Inserting Move Instructions” at page 3-34. The basic operations for registration and insertion are the same. The only difference is pressing [INSERT] in the case of insertion. For registration (Fig. 3-1 “Registering Move Instructions”), the instruction is always registered before the END instruction. Therefore, it is not necessary to press [INSERT]. For insertion (Fig. 3-2 “Inserting Move Instructions”), [INSERT] must be pressed.
3 Teaching

3.2 Teaching Operation

- Setting the Position Data
  1. Select {JOB} under {Main Menu}.
     - The sub-menu appears.

     ![Image of Setting the Position Data]

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

     ![Image of Job Content]

     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.
3.2 Teaching Operation

- **Spot and Arc Welding Using Motor Gun**

  **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.
     
     ![Tool Number Selection Window]

     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.

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

- **Using Multiple Tools with One Manipulator**
  - When multiple tools are to be used with one manipulator, set parameter S2C431 to 1.
  - See chapter 2.3.4 “Tool Coordinates” at page 2-10 for details on this operation.

  ![Supplement using multiple tools with a single manipulator]

**Notes:**
- The examples provided are for demonstration purposes and may not reflect real-world scenarios.
- The screenshot shows the tool selection interface, where users can choose from different tool types.
- The MOV S commands indicate the type of interpolation that can be used for tool positioning.

**Supplementary Material:**
- Additional resources and guidelines for tool coordinates are available in chapter 2.3.4.

---

**References:**
- Refer to the relevant sections of the manual for detailed instructions.
- Consult the tool selection interface documentation for specific tool types and their functionalities.

---

**Conclusion:**
- The selected tool number is displayed on the screen, allowing for precise control over the tool set used for welding operations.
- Understanding the interpolation types is crucial for efficient and accurate welding processes.
- Properly configuring the manipulator and tools is essential for successful spot and arc welding operations.

---

**Additional Information:**
- The worksheet includes a tool no. select window, which is a graphical user interface for selecting different tool numbers.
- The MOV S commands are used to specify the type of interpolation, with MOVJ for joint motion and MOVL for linear interpolation.
- The S2C431 parameter is a setting that enables the use of multiple tools with a single manipulator, enhancing operational efficiency.

---

**Guidance:**
- For detailed instructions and further clarification, refer to the relevant sections of the user manual.
- Ensure all necessary safety precautions are taken during the welding process.
- Regular maintenance and calibration of the welding equipment are recommended to maintain optimal performance.

---

**References:**
- Refer to the relevant sections of the tool selection and interpolation guides.
- Consult the manufacturer’s documentation for specific tool and manipulator configurations.

---

**Further Reading:**
- Explore advanced welding techniques and strategies for improved efficiency and quality.
- Stay updated with the latest developments in welding technology and safety practices.
### 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.)

**SUPPLEMENT**

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

- The position level can be set at the same time that the move instruction is registered.
- To display the position level tag as a default, select {EDIT} from the menu and then select “ENABLE POS LEVEL TAG”.

**Position Level:** The position level is the degree of approximation of the manipulator to a taught position. The position level can be added to move instructions MOVJ (joint interpolation) and MOVL (linear interpolation). If the position level is not set, the precision depends on the operation speed. Setting an appropriate level moves the manipulator in a path suitable to circumferential conditions and the workpiece.
3.2 Teaching Operation

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Using Motor Gun

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

<table>
<thead>
<tr>
<th>Position Levels</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Teaching position</td>
</tr>
<tr>
<td>1 to 8</td>
<td>Fine Rough</td>
</tr>
</tbody>
</table>

**Setting the Position Level**

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

   ![DETAIL EDIT Window](image1)

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

   ![Selection Dialog Box](image2)
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].
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:

```
MOV V=138 PL=3
```

Positioning point P3 and P6:

```
MOV V=138 PL=0
```
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 (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] lamp lights.
     When registering before the END instruction, pressing [INSERT] is not needed.
9. Press [ENTER].
   - The REFP instruction is registered.

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

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 [INSERT].
   – The [INSERT] lamp lights.
   – When registering before the END instruction, pressing [INSERT] is not needed.

6. 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.

1. Move the cursor to the first step line.
2. Press [FWD].
   - The manipulator moves to the first step position.
3. Move the cursor to the last step line.
   - The cursor starts blinking.
   - When the cursor line position and the manipulator position are different in the JOB CONTENT window, the cursor blinks.
4. Press [MODIFY].
   - The key lamp lights.
5. Press [ENTER].
   - The position data for the first step is registered on the line of the last step.
   - At this time, only the position data can be changed in the last step. Interpolation type and play speed do not change.
3.3 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.

Refer to chapter 8.3.0.4 “S2C198: EXECUTION UNITS AT "FORWARD" OPERATION” at page 8-12 and chapter 8.3.0.5 “S2C199: INSTRUCTION (EXCEPT FOR MOVE) EXECUTION AT "FORWARD" OPERATION” at page 8-13.
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.
3.3 Checking Steps

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- **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.

![Linear motion](Linear motion)

- 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.
3.1.2 Selecting Manual Speed

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

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

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

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

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

3.3.1.3 Moving to Reference Point

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

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

3.3.1.4 Test Operations

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

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

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

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

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

3.3 Checking Steps

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

1. Select {JOB} under {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 the teach mode, it is still “VALID” after switching to the play mode.
- The same applies when the mode is switched from the play mode to the teach mode.
- Note that the machine lock becomes “INVALID” if the following operation is performed.
  - Execution of “CANCEL ALL SELECT” in the SPECIAL PLAY window.
  - Turning off the main power.
3.4 Modifying Steps

Begin move instruction insertion.

Move step cursor to location where you want to insert the instruction.

Perform axis operations.

Set interpolation type.

Set play speed.

Set position level when necessary.

Press [INSERT].

Press [ENTER].

Insertion completed.

Begin move instruction deletion.

Move cursor to location of instruction to be deleted.

Press [DELETE].

Press [ENTER].

Deletion completed.
3 Teaching

3.4 Modifying Steps

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

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**Teaching**

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.
3 Teaching
3.4 Modifying Steps

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 Modifying Steps

3.4.1 Displaying the JOB CONTENT Window for Editing

3.4.1.1 Currently Called Up Job

1. Select {JOB} under {Main Menu}.
2. Select {JOB}.
   - The JOB CONTENT window appears.

3.4.1.2 Calling Up Other Jobs

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

1. Select {JOB} under {Main Menu}.
2. Select {SELECT JOB}.
   - The JOB LIST window appears.

3. Select the job name to be called.
3.4 Modifying Steps

### 3.4.2 Inserting Move Instructions

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

![Diagram](image-url)

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

   The line immediately before where the move instruction is to be added.
   - 0006  MOVL V=276
   - 0007  TIMER T=1.00
   - 0008  DOUT OT#(1) ON
   - 0009  MOVJ VJ=100.0

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 lamp 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.

   The move instruction is added.
   - 0006  MOVL V=276
   - 0007  TIMER T=1.00
   - 0008  DOUT OT#(1) ON
   - 0009  MOVJ VJ=100.0
   - 0009  MOVL V=558
   - 0010  MOVJ VJ=100.0

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
Position where the move instruction is added.

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 Modifying Steps

3.4.3 Deleting Move Instructions

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

2. Press [DELETE].
   - The key lamp will blink.

3. Press [ENTER].
   - The step indicated by cursor line is deleted.

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

1. Press [FWD] and move the manipulator to the position where the move instruction is to be deleted.

2. Press [MODIFY] → [ENTER] to change the position data of the blinking cursor position to the current manipulator position.
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 lamp will blink.

4. Press [ENTER].
   – The position data in the present position is registered.

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

3.4.4.2 Modifying Interpolation Type

1. Move the cursor to the move instruction to be modified.
   – Display the JOB CONTENT window, and move the cursor to the move instruction for which interpolation type is to be changed.

2. Press [FWD].
   – Turn ON the servo power and press [FWD] to move the manipulator to the position of the move instruction.

3. Press [DELETE].
   – The key lamp will blink.

4. Press [ENTER].
   – The cursor line step is deleted.

5. Press [MOTION TYPE].
   – Press [MOTION TYPE] to change the interpolation type.
   – Each time [MOTION TYPE] is pressed, the input buffer line instruction alternates.

6. Press [INSERT].

7. Press [ENTER].
   – The interpolation type and position data are changed at the same time.

   Modifying only interpolation type is impossible. The interpolation type can be modified as a choice for modifying the position data.
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} → {DISABLE UNDO} while editing a job.

• The undo operation can be performed even after the manipulator is moved by the FWD or BWD operation or test operation after inserting, deleting, or modifying a move instruction. However, the undo operation cannot be performed if other instructions are edited or a job is executed in the play mode after editing the move instruction.

• The undo operation works only for the last five edited instructions only.

1. Press [ASSIST].
   – The assist menu appears.

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

3. Select {REDO}.
   – The last UNDO operation is undone.
3.4.6 Modifying Reference Point Instructions

3.4.6.1 Deleting Reference Point Instructions

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

**NOTE**

- Press [REFP] + [FWD] to move the manipulator to the position to be deleted.
- Press [MODIFY] then [ENTER] to change the reference point position data to the current position of the manipulator.

1. Move the cursor to the reference point instruction to be deleted.
2. Press [DELETE].
   - The key lamp will blink.
3. Press [ENTER].
   - The reference point instruction at the cursor line is deleted.

3.4.6.2 Modifying Reference Point Instructions

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

3.4.7.1 Deleting Timer Instructions

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

   Timer instruction to be deleted
   0003  MOVJ VJ=50.00
   0004  TIMER T=1.00
   0005  MOVL V=138

2. Press [DELETE].
   – The key lamp will light.

3. Press [ENTER].
   – The timer instruction at the cursor line is deleted.

3.4.7.2 Modifying Timer Instructions

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

   0003  MOVJ VJ=50.00
   0004  TIMER T=1.00
   0005  MOVL V=138

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 Key]s to input data, move the cursor to the input buffer line timer value and press [SELECT].

4. Change the timer value.

5. Press [MODIFY].

6. Press [ENTER].
   – This key lamp will light.
3.5 Modifying Jobs

3.5.1 Calling Up a Job

1. Select {JOB} under {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 Modifying Jobs

3.5.3 JOB HEADER Window

1. Select {JOB} under {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 in the management mode or higher, this can be edited in this window.
9. CONTENTS DISPLAY
   Setting status whether displaying of the contents of a job is displayed with “PERMIT” or “PROHIBIT”. Set “PROHIBIT” to display “Invisible” for the instructions of the JOB CONTENT window to prohibit them from being displayed. When the security mode is in the management mode or higher, this can be edited in this window. (Setting the contents display is available in the software version DN1.91-00 or later.)
3.5 Modifying Jobs

10. SAVE JOB
Setting status whether saving of this job data to an external memory device is displayed with “PERMIT” or “PROHIBIT”. Set “PROHIBIT” to prohibit the data from being saved to an external memory device. When the security mode is in the management mode or higher, this can be edited in this window.
(Setting the save job is available in the software version DN1.91-00 or later.)

11. 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.

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

13. JOB KIND
Displays the kind of this job.

To return to the JOB CONTENT window from the JOB HEADER window, select (DISPLAY) from the menu and then select {JOB CONTENT}.
3.5 Modifying Jobs

3.5.4 JOB CONTENT Window

1. Select (JOB) under (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 each step.

B. Instruction Area
Displays instructions, additional items, and comments. Line editing is possible.
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 {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}.
3 Teaching

3.5 Modifying Jobs

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}.

![Image](image_url)

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 the teach mode.

![Image](image_url)
3.5 Modifying Jobs

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 the 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\}.

![Image of the display showing the modified settings.]

```plaintext
0001 SET NO001 1
0002 SET NO001 0
0003 MOVJ VJ=80.00
0004 MOVJ VJ=80.00
0005 DOUT OFF CO 1
0006 TRM2 T=0.00
0007 MOVJ VJ=80.00
0008 MOVJ VJ=100.00
0009 MOVJ VJ=100.00
0010 MOVJ VJ=100.00
0011 END
```
3.5.5 COMMAND POSITION Window

1. Select {ROBOT} under {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 Modifying Jobs

3.5.6 JOB CAPACITY Window

1. Select {JOB} under {Main Menu}.
2. Select {JOB CAPACITY}.

A. NUMBER OF JOBS
   Displays the total number of jobs currently registered in the memory of DX200.

B. USED MEMORY
   Displays the total amount of memory used in the DX200.

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 Editing Instructions

3.6.1 Instruction Group

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

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

**Instruction List**

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

![Instruction List Dialog Box](image1)

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

![Instruction List Dialog Box Example](image2)
3.6 Editing Instructions

3.6.2 Inserting Instructions

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

   ![Line before where instruction is to be added.](image)

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.
3 Teaching

3.6 Editing Instructions

– <When Additional Items are to be edited>

1. 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.

2. 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”.

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

(1) To change the data type of an additional item, move the cursor to the **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 Editing Instructions

3.6.3 Deleting Instructions

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

   The line to be deleted
   0003 MENU VJ=100.00
   0004 PILS (TR) 1
   0005 MENU VJ=100.00
   0006 COUT ON

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.

   The following lines move up.
   0005 MENU VJ=100.00
   0004 MENU VJ=100.00
   0005 COUT ON

3.6.4 Modifying Instructions

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

   Instruction line to be changed
   0005 MENU VJ=100.00
   0004 COUT ON
   0005 TIMER T1=3.00

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

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

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>**

   1. 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.

2. 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”.

3. Changing the data type

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

(2) After additional items have been added, modified or deleted as required, press [ENTER]. The DETAIL EDIT window closes and the JOB CONTENT window appears.
6. Press [MODIFY] and [ENTER].
   – 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.
   
<table>
<thead>
<tr>
<th>Number data to be modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>0004 MOV X:0</td>
</tr>
<tr>
<td>0005 DIREC100</td>
</tr>
<tr>
<td>0006 TIMES 1:0.00</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Instruction line for which numeric data was changed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0004 MOV X:0</td>
</tr>
<tr>
<td>0005 DIREC100</td>
</tr>
<tr>
<td>0006 TIMES 1:0.00</td>
</tr>
</tbody>
</table>
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.

```
Instruction line for
which additional
item was added.

0000 MNJ UX51000 00
0000 MNJ UX51000 00
0000 MNJ UX51000 00
```

3.6.8 Deleting Additional Items

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

1. Move the cursor to the instruction area in the JOB CONTENT window.
2. Select the line where the additional item is to be deleted.
   - 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 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.
3.7 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.

---

**Execute Base Reverse Paste**

```
MOVL V=100 ;Move to V=100
MOVL V=50 ;Move to V=50
MOVL V=80 ;Move to V=80
MOVL V=30 ;Move to V=30
MOVL V=70 ;Move to V=70
```

The speed and interpolation are the same going and returning.

---

**Execute Reverse Paste**

```
MOVL V=100 ;Move to V=100
MOVL V=50 ;Move to V=50
MOVL V=80 ;Move to V=80
MOVL V=30 ;Move to V=30
MOVL V=70 ;Move to V=70
```

The speed and interpolation are different going and returning.

---

**Execute Copy**

```
MOVL V=100 ;Move to V=100
MOVL V=50 ;Move to V=50
MOVL V=80 ;Move to V=80
MOVL V=30 ;Move to V=30
```

Copy a specified range to the buffer.

---

**Execute Cut**

```
MOVL V=100 ;Move to V=100
MOVL V=50 ;Move to V=50
MOVL V=80 ;Move to V=80
MOVL V=30 ;Move to V=30
```

Deletes a specified range from a job, and copies it to a buffer.
Spot and Arc Welding
Using Motor Gun

3.7 Editing Jobs

Copy
Cut
Paste
Reverse paste

Buffer content is inserted.
The buffer content order is reversed and inserted.

MOVJ VJ=50.00
TIMER T=1.00
MOVL V=100

0000 NOP
0001 TEST JOB
0002 MOVJ VJ=50.00
0003 TIMER T=1.00
0004 MOVL V=100
0005 MOVL V=100

0000 NOP
0001 TEST JOB
0002 MOVJ VJ=50.00
0003 TIMER T=1.00
0004 MOVL V=100
0005 MOVL V=100

0000 NOP
0001 TEST JOB
0002 MOVJ VJ=50.00
0003 TIMER T=1.00
0004 MOVL V=100
0005 MOVL V=100

0000 NOP
0001 TEST JOB
0002 MOVJ VJ=50.00
0003 TIMER T=1.00
0004 MOVL V=100
0005 MOVL V=100
3.7 Editing Jobs

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 Editing Jobs

3.7.2 Copying

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

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

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

3.7.3 Cutting

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

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

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

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

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

2. Select {EDIT} under the menu.

3. Select {PASTE}.
   – The confirmation dialog box appears.
   – When “YES” is selected, the contents of the buffer are inserted to the job.
   – When “NO” is selected, the pasting operation is cancelled.
3.7.5 Reverse Pasting

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

1. Move the cursor to the line immediately before the desired position in the JOB CONTENT window.

2. Select {EDIT} under the menu.

   - The pull-down menu appears.

3. Select (REVERSE PASTE).

   - The confirmation dialog box appears.

   - When “YES” is selected, the contents of the buffer are reverse pasted to the job.

   - When “NO” is selected, the reverse-pasting operation is cancelled.
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.

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).

NOP and END cannot be commented out.

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. 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 \textit{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.
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.

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.

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).

---

**Supplement**

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. 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.
### 3.7 Editing Jobs

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

   ![Image of job list]

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

   ![Image of 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.
When the lines to which the Edit Lock is not set are included in the selected lines, \textit{(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\} \(\rightarrow\) \{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 the teach mode with test operations. This function is convenient for checking continuous paths and operation instructions.

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

- Operation speeds greater than the maximum teaching speed are reduced to the maximum teaching speed.
- Only machine lock is available among special operations for playback in the play mode.
- Work instruction output, such as arc output, is not executed.

3.8.1 Test Operation Procedures

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

1. Select {JOB} under {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 Manual Full-speed Function

Manual full-speed function allows the manipulator to perform the test run or FWD/BWD operation at the speed set in the job.

3.8.2.1 Setting Method

1. Cause short-circuit between the connection numbers 13 and 14, and between 15 and 16 on the terminal block (JANCD-YFC22-E) respectively. (Normally, they are opened.)

2. The message "Full-speed test mode" is displayed as follows when the setting is finished.
3.8 Test Operations

3.8.2.2 Operation Speed

When the full-speed test mode is set, operation speed is limited depending on the setting of manual speed as follows.

<table>
<thead>
<tr>
<th>Manual speed</th>
<th>Limit of operation speed (default value)</th>
<th>Parameter (Unit: 0.01%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inching</td>
<td>20%</td>
<td>S1CxG60 (default value: 2000)</td>
</tr>
<tr>
<td>Slow</td>
<td>50%</td>
<td>S1CxG61 (default value: 5000)</td>
</tr>
<tr>
<td>Medium</td>
<td>75%</td>
<td>S1CxG62 (default value: 7500)</td>
</tr>
<tr>
<td>Fast</td>
<td>100% (fixed value)</td>
<td>-</td>
</tr>
</tbody>
</table>

• The limit values of operation speed described in the table above are the ratio against the manipulator's maximum speed, not against the taught speed. The values are for restraining the operation speed not to exceed the limit values of operation speed against the manipulator's maximum speed during the test run or FWD/BWD operation.

• Manual full-speed function allows the manipulator to perform the test run or FWD/BWD operation at the taught speed by a job during the teach mode. Make sure that there is no person around the manipulator and pay great attention to perform the operation.

• If the full-speed test mode is set or released while a servo power is ON, the servo power turns OFF.
### 3.8.3 Test Operation (High Accuracy)

#### 3.8.3.1 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).

---

**Motion Path for Test Operation**

**NORM** (NORMAL)  (HIGH ACCURACY)

**Motion Path for Playback Operation**

**Motion Path for Test Operation (NORMAL)**

**Motion Path for Test Operation (HIGH ACCURACY)**

**JOB EXAMPLE**

```plaintext
NOP
MOVJ VJ=50.0  ➔ A
MOVL V=1500.0  ➔ B
MOVL V=1500.0  ➔ C
```

---

For the “test operation”, refer to section 3.8.1 “Test Operation Procedures”.
3 Teaching
3.8 Test Operations

CAUTION

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

- Weaving function
- COMARC function
- Sensor function
- Twin/triple coordinated control function
- Conveyor synchronized function
- Weld line coordinate shift 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 Teaching
3.8 Test Operations

3.8.3.2 Setting Method

1. Select {SETUP} under 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.
   (Default setting is "NORMAL".)

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.)

<table>
<thead>
<tr>
<th>Type of Play Speed</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>VJ</td>
<td>Joint Speed</td>
</tr>
<tr>
<td>VT</td>
<td>TCP Speed</td>
</tr>
<tr>
<td>VR</td>
<td>Posture Angle Speed</td>
</tr>
<tr>
<td>VE</td>
<td>Base Axis Speed</td>
</tr>
</tbody>
</table>

3.9.1.2 Relative Modification

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

1. Select {JOB} under {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, selection dialog box appears. Select the speed type to be changed.

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

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

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

• If the speed data is limited by the maximum value, the following message is displayed.

[NOTE]

• 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” at page 3-71 and chapter 3.7.7 “Prohibiting Editing Line-by-Line” at page 3-81.)
3.9.2 Editing Interpolation Type

1. Select {JOB} under {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
   Joint 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.

Refer to DX200 Operator’s Manual of each application for information regarding the contents and editing methods of the condition file.
3.9 Other Job-editing Functions

3.9.4 User Variables

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

User variables have the following applications:

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

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

<table>
<thead>
<tr>
<th>Data Format</th>
<th>Variable No.</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byte Type</td>
<td>B000 to B099</td>
<td>Range of storable values is from 0 to 255. Can store I/O status. Can perform logical operations (AND, OR, etc.)</td>
</tr>
<tr>
<td>Integer Type</td>
<td>1000 to 1099</td>
<td>Range of storable values is from -32768 to 32767.</td>
</tr>
<tr>
<td>Double Precision</td>
<td>D000 to D099</td>
<td>Range of storable values is from -2147483648 to 2147483647.</td>
</tr>
<tr>
<td>Real Type</td>
<td>R000 to R099</td>
<td>Range of storable values is from -3.4E+38 to 3.4E38. Accuracy: 1.18E-38 ≤ x ≤ 3.4E38</td>
</tr>
<tr>
<td>Character Type</td>
<td>S000 to S099</td>
<td>Maximum storable number of characters is 16.</td>
</tr>
<tr>
<td>Position Type</td>
<td>P000 to P127</td>
<td>Can store position data in pulse form or in XYZ form.</td>
</tr>
<tr>
<td></td>
<td>BP000 to BP127</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>EX000 to EX127</td>
<td></td>
</tr>
<tr>
<td>Timer variable</td>
<td>TM000 to TM059</td>
<td>Range of storable values is from -2147483648 to 2147483647.</td>
</tr>
</tbody>
</table>

* For the timer variable, refer to section 6.18.2 “Timer Variable”.

Table 3-5: User Variables
• **Play Speed V:**
  MOVL V=I000
  The variable I000 is used for speed V with this move instruction.
  The unit for V is 0.1mm per second.
  For example, if I000 were set as 1000, the following would be true:
  I000=1000 → unit for V is 0.1mm/s → V=100.00mm/s
  Note that, depending on the unit being used, the value of the variable and the value of the actual speed on occasion might not match.

• **Play Speed VJ:**
  MOVL VJ=I000
  The unit for VJ is 0.01%.
  For example, if I000 were set as 1000, the following would be 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 were set as 1000, the following would be true:
  I000=1000 → unit for T is 0.01 seconds → T=10.00 seconds.

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

1. Select (VARIABLE) under (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 Key]s and press [ENTER].
  
  • Move the cursor to the menu area and select {EDIT} → {SEARCH}. Then input the variable No. with the [Numeric Key]s 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 {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 Key)s and press [ENTER].
     - Move the cursor to the menu area and select {EDIT} → {SEARCH}. Then input the variable No. with the [Numeric Key)s and press [ENTER]
3.9 Other Job-editing Functions

Spot and Arc Welding Using Motor Gun

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

5. Input the desired characters.
   - For information on character input operation, refer to chapter 1.2.6 “Character Input Operation” at page 1-22.

6. Press [ENTER].
   - The input characters are set to the variable on the cursor position.
3.9.3 Registering Variable Name

1. Select {VARIABLE} under {Main Menu}.

2. Select desired variable.

   – Select any variable type from among byte type, integer type, double precision integer type, real type, robot position type, base position type, and station position type.

3. Move the cursor to desired variable number.

   – If desired variable number is not displayed, move the cursor by either of following operations.

   • Select the variable number, input desired variable number and press [ENTER]. The cursor moves to the variable number to be input.

   • Move the cursor to the menu area and select {EDIT} → {SEARCH}. Input desired variable number and press [ENTER]. The cursor moves to the variable number to be input.

4. Select “NAME”.

   – The input buffer line appears.

   Refer to chapter 1.2.6 “Character Input Operation” at page 1-22 for the character input operation.

5. Input name.

6. Press [ENTER].

   – The variable name is registered.
3.9.4.4 Displaying Position Variables

1. Select \{VARIABLE\} under \{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 Key]s and press [ENTER].
     - Move the cursor to the menu area and select \{EDIT\} \rightarrow \{SEARCH\}. Then input the variable No. with the [Numeric Key]s and press [ENTER].
3.9.4.5 Setting Position Variables

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

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Pxxx (Robot)</th>
<th>BPxxx (Base)</th>
<th>EXxxx (Station)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pulse Type</td>
<td>XYZ Type</td>
<td>Pulse Type</td>
</tr>
<tr>
<td>Setting Method</td>
<td>Select coordinates from base, robot, user, tool.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Using the numeric keys

- Using the axis keys

![Diagram of a robot with axes indicating X, Y, Z]

![Diagram of a robot with pulse values]
3.9.4.6 Setting Position Variables Using the [Numeric Key]s

### Pulse Type

1. Select {VARIABLE} under {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.)

![Image of POSITION VARIABLE window]

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

![Image of selection dialog box]

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

![Image of confirmation dialog box]

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.

![Image of updated POSITION VARIABLE window]
### XYZ Type

1. Select **(VARIABLE)** under **(Main Menu)**.
2. Select desired position variable type.
3. Select the variable data type.
   - The selection dialog box appears.
4. Select desired coordinates except **PULSE**.
5. Move the cursor to desired data to be input and press **[SELECT]**.
6. Input the value.
7. Press **[ENTER]**.
   - The value is set in the cursor position.

(1) Setting of **<TYPE>**

- Each time **[SELECT]** is pressed when the cursor is on the setting data in the input buffer line, the settings alternate.

About **<TYPE>**

- It is not necessary to set a type if the position variable is to be used for parallel shift operations.
- When the position variable is used with a move instruction such as **"MOVJ P001"**, it is necessary to set a type. For details on types, refer to chapter 3.9.4.10 "Manipulator Types" at page 3-115. Current Position Window (XYZ) shows the current setting of a type.
3.9.7 Setting Position Variables Using the [Axis Key]s

**Pulse Type**

1. Select `{VARIABLE}` under `{Main Menu}`.
2. Select desired position variable type.
   - The desired variable window appears (robot, base, or station).
   1. When there are two or more robot, base, or a station, specify the axis with the following operation.
      - **Robot**
        Each time `[SHIFT] + [ROBOT]` is pressed, the axis displayed on the status line changes:
        R1 → R2 → ... → R8.
      - **Base or Station**
        Each time `[SHIFT]+[EX.AXIS]` is pressed, the axis displayed on the status line changes:
        B1 → B2 → ... → B8 → S1 → S2 → ...... → S24.
   2. Check the selected axis on the status line.
4. Move the manipulator with the [Axis Key]s.
   - 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 `{Main Menu}`.
2. Select desired position variable type.
   1. When there are two or more robot, base, or a station, specify the axis with the following operation.
      - **Robot**
        Each time `[SHIFT] + [ROBOT]` is pressed, the axis displayed on the status line changes:
        R1 → R2 → ... → R8.
      - **Base or Station**
        Each time `[SHIFT]+[EX.AXIS]` is pressed, the axis displayed on the status line changes:
        B1 → B2 → ... → B8 → S1 → S2 → ...... → S24.
   2. Check the selected axis on the status line.
3. Move the manipulator with the [Axis Key]s.
   - Move the manipulator or the external axis to the desired position to be set to position variable.
4. Press [MODIFY].
5. Press [ENTER].
3.9.4.8 Deleting Data Set of Position Variables

1. Select {VARIABLE} under {Main Menu}.
2. Select desired position variable type.
3. Select {DATA} under the menu.
   – The pull-down menu appears.
4. Select {CLEAR DATA}.
   – The position variable data on the displayed page are deleted.

3.9.4.9 Checking Positions by Position Variables

1. Select {VARIABLE} under {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 → ... → R8.

   • Base or Station
     Each time [SHIFT] + [EX.AXIS] is pressed, the axis displayed on the status line changes:
     B1 → B2 → ... → B8 → S1 → S2 → ...... → S24.

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

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

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

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

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

This is called “Type”.

Type varies according to the manipulator model.

For the manipulator with seven axes, X, Y, Z, Rx, Ry, Rz, Re and Type are used.

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.
### 3.9.5 Flip/No Flip

When the angle of B-axis is within (+) range ($\theta_B \geq 0^\circ$), it is called “Flip”, and when within (-) range ($\theta_B < 0^\circ$), “No Flip”.

![Flip/No Flip Diagram]

### 3.9.6 R-axis Angle

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

<table>
<thead>
<tr>
<th></th>
<th>$R &lt; 180^\circ$</th>
<th>$R \geq 180^\circ$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\theta_R$</td>
<td>$-180^\circ \leq \theta_R \leq 180^\circ$</td>
<td>$180^\circ &lt; \theta_R$ or $\theta_R \leq -180^\circ$</td>
</tr>
</tbody>
</table>

![R-axis Angle Diagram]

**NOTE**

$\theta_R$ is the angle when the R-axis home position is 0°.
3.9.7 T-axis Angle

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

<table>
<thead>
<tr>
<th>T &lt;180°</th>
<th>T ≥ 180°</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>0°</td>
</tr>
<tr>
<td>-180°</td>
<td>360°</td>
</tr>
<tr>
<td>180°</td>
<td>-360°</td>
</tr>
</tbody>
</table>

-180° < θ T ≤ 180°  180° < θ T or θ T ≤ -180°

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

3.9.8 Front/Back

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

Right-hand side

(S-axis 0°)
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.

<table>
<thead>
<tr>
<th>S-axis 0°</th>
<th>S-axis 180°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back</td>
<td>Front</td>
</tr>
<tr>
<td>Front</td>
<td>Back</td>
</tr>
</tbody>
</table>

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

When viewed from the right-hand side, the right of the S-axis rotation center is called the front, and the left is called the back.
## 3.9 Other Job-editing Functions

### 3.9.9 Upper Arm/Lower Arm

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

![Right-hand side diagram](image)

<table>
<thead>
<tr>
<th>Upper Arm</th>
<th>Lower Arm</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
</tbody>
</table>

### 3.9.10 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°.

<table>
<thead>
<tr>
<th>S &lt; 180°</th>
<th>S ≥ 180°</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Diagram" /></td>
<td><img src="image" alt="Diagram" /></td>
</tr>
</tbody>
</table>

-180° < θ < 180°

180° < θ or θ ≤ -180°

**NOTE**

θ S is the angle when the S-axis home position is 0°.
3.9.11 Editing Local Variables

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

Table 3-7: Local Variables

<table>
<thead>
<tr>
<th>Data Format</th>
<th>Variable No.</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byte Type</td>
<td>LB000 to LB☐☐☐</td>
<td>Range of storable values is from 0 to 255.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Can store I/O status.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Can perform logical operations (AND, OR, etc.)</td>
</tr>
<tr>
<td>Integer Type</td>
<td>LI000 to LI☐☐☐</td>
<td>Range of storable values is from -32768 to 32767.</td>
</tr>
<tr>
<td>Double Precision Integer Type</td>
<td>LD000 to LD☐☐☐</td>
<td>Range of storable values is from -2147483648 to 2147483647.</td>
</tr>
<tr>
<td>Real Type</td>
<td>LR000 to LR☐☐☐</td>
<td>Range of storable values is from -3.4E+38 to 3.4E+38.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Accuracy: 1.18E-38 &lt; x ≤ 3.4E+38</td>
</tr>
<tr>
<td>Character Type</td>
<td>LS000 to LS☐☐☐</td>
<td>Maximum storable number of characters is 16.</td>
</tr>
<tr>
<td>Position Type</td>
<td>Robot Axes</td>
<td>Can store position data in pulse form or in XYZ form.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>Base Axes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Station Axes</td>
<td></td>
</tr>
</tbody>
</table>

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.
3.9 Other Job-editing Functions

- **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.

- **Not Able to Display the Variable Contents**
  To display the local variable contents, user variables are needed. For example, to view the contents of local variable LP000, save it temporarily as user variable P001. Then execute the instruction SET P001 LP000, and view the POSITION VARIABLE window for P001.

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

**Precautions for Variables and Units**
As was the case with user variables, note that, depending on the value of the unit being used, the value of the variable and the value of the actual speed or time an occasion might not match. Refer to chapter 3.9.4 “User Variables” at page 3-103.
3.9 Other Job-editing Functions

3.9.1 Setting the Number of Local Variables

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

Only when expanding the “INSTRUCTION LEVEL”, it is possible to use local variables. However, when “PROHIBIT” is set to {CONTENT DISPLAY}, the number of local variables cannot be confirmed or changed.

Refer to section 8.12 Instruction Level Setting” of “DX200 INSTRUCTIONS” (165292-1CD) for details on setting the language level. Refer to chapter 5.8 “Prohibit Displaying the Contents of a Job” for setting the displaying of a job contents.

1. Select {JOB} under (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.

Refer to section 8.12 Instruction Level Setting” of “DX200 INSTRUCTIONS” (165292-1CD) for details on setting the language level. Refer to chapter 5.8 “Prohibit Displaying the Contents of a Job” for setting the displaying of a job contents.
6. Input the number of variables.

7. Press [ENTER].

- The number of local variables are set.

<table>
<thead>
<tr>
<th>JOB</th>
<th>EDIT</th>
<th>DISPLAY</th>
<th>UTILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>Number</td>
<td>Session</td>
<td>Local var.</td>
</tr>
<tr>
<td>Byte (256)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Int (32)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Double (64)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Real (80)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>String (160)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
3.9.12 Search

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

1. Select {JOB} under (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 Other Job-editing Functions

3.9.12.1 Line Search

This function moves the cursor to the desired line number.

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

   ![Image of LINE SEARCH function]

2. Input desired line number.

   ![Image of Line number input screen]

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

   ![Image of cursor moved to line number]

---

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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 Other Job-editing Functions

3.9.12.3 Label Search

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

1. Select {EDIT}, {SEARCH} and “LABEL SEARCH”.
   – The characters can be entered.

2. Input desired label name.
   – For information on character input operation, refer to chapter 1.2.6 “Character Input Operation” at page 1-22.
   – 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].
3.9.12.4 Instruction Search

This function moves the cursor to a desired instruction.

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

2. Select desired instruction group.

3. Select desired instruction.
   - The cursor is moved to the selected instruction and the window appears.
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].
3.9.12.5 Tag Search

This function moves the cursor to the desired tag.

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

2. Select desired instruction group.

3. Select desired instruction for which the tag is to be searched.
   - The tag list dialog box for selected instruction appears.
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].
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 {Main Menu}.

2. Select {SELECT JOB}.

   – The JOB LIST window appears.

3. Select the desired job.
4 Playback

4.1 Preparation for Playback

4.1.2 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 the teach mode.

1. Select {JOB} under {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.
4.1.3 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.

   ![Image of menu options]

2. Select {MASTER JOB}.

   - The master job is called, and the JOB CONTENT window appears.
4 Playback
4.1 Preparation for Playback

### Calling from the MASTER JOB Window

1. Select {JOB} under {Main Menu}.

   ![Job Menu]

2. Select {MASTER JOB}.
   - The MASTER JOB window appears.

   ![Master Job Window]

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

   ![Selection Dialog Box]

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

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

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

B. Override Speed Settings
   Displayed when override speed setting is performed.

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

D. Start No.
   First step in the measurement. Measurement starts when the start button lamp lights and the playback starts.

E. Motion Time
   Displays the weaving time of the manipulator.

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

4.1.2.1 Display of Cycle Time

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

1. Select (DISPLAY) under the menu.
2. Select (CYCLE TIME).
   - The cycle time is displayed.
   - Repeat the same operation to hide the cycle time display.
4.1.2.2 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 {Main Menu}, and then select {CYCLE}.
2. Select the operation cycle to be changed.
   - The operation cycle is changed.
4 Playback
4.1 Preparation for Playback

- **Automatic Setting for Operation Cycle**
  Automatic setting of the operation cycle can be changed by the following operation.
  This can be done in the management mode only.
  1. Select {SETUP} under {Main Menu}.
  2. Select {OPERATE COND}.
     - The OPERATING CONDITION window appears. Use the cursor to scroll the screen.
     3. Select the desired operation.
        - The selection dialog box appears.

**“NONE” setting**

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

- The operation cycle when switching modes is set.
4.2 Playback

4.2.1 Playback Operation

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

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

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

<table>
<thead>
<tr>
<th>Mode Switch on Programming Pendant</th>
<th>Job is started up by</th>
</tr>
</thead>
<tbody>
<tr>
<td>[PLAY]</td>
<td>[START] button on programming pendant</td>
</tr>
<tr>
<td>[REMOTE]</td>
<td>Peripheral device</td>
</tr>
</tbody>
</table>

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

4.2.1.1 Selecting the Start Device

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

4.2.1.2 Servo On

1. Press [Servo ON Ready].
   - DX200 servo power is ON and the Servo ON lamp on the programming pendant lights.

4.2.1.3 Start Operation

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

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

The following special operations can be performed during playback:

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

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

When the PLAYBACK window is displayed, move the cursor to the menu area and select (UTILITY) → (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.

Even if the manipulator is stopped its motion during the low speed operation, the low speed status would not be canceled before it reaches the first step.

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

1. Select “LOW SPEED START” on the SPECIAL PLAY window.
   - The setting alternates between “VALID” and “INVALID”.

2. Select “COMPLETE”.
   - The window returns to the PLAYBACK window.
4.2.2.2 Limited Speed Operations

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

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

4.2.2.3 Dry-run Speed Operations

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

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

4.2.2.5 Check Mode Operation

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

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

4.2.2.6 Weaving Prohibit Setting during Check Mode Operation

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

1. Select “WEAV PROHIBIT IN CHK-RUN” under the SPECIAL PLAY window.
   – The setting alternates between “VALID” and “INVALID”.
2. Select “COMPLETE”.
   – The window returns to the PLAYBACK window.
4.2.7 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 cancelled if the main power is shut OFF.
4.3 Stop and Restart

The manipulator stops in the following conditions:

- Hold
- Emergency stop
- Stop by alarm
- Others

4.3.1 Hold

Hold operation causes the manipulator to stop all motion.

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

4.3.1.1 Using the Programming Pendant

- Hold

1. Press [HOLD] on the programming pendant.

2. The manipulator stops. The [HOLD] lamp lights while the [HOLD] button is held down.

- Release

1. Press [START] on the programming pendant.

2. The manipulator restarts its operation from the position where it was stopped.

4.3.1.2 Using an External Input Signal (System Input)

- Hold

1. Turn ON the hold signal from an external input (system input).
   - The manipulator stops temporarily.
   - The output signal “HOLD” turns ON.
   - The programming pendant [HOLD] lamp lights.

- Release

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

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

- Button on the Front Door of the DX200
- Programming pendant
- External input signal (system input)

**Emergency Stop**

1. Press the emergency stop button. 
   - The servo power turns OFF and the manipulator stops immediately.
   - On the front door of the DX200:
   - On the programming pendant:

Using the Emergency Stop Button on the Programming Pendant

Using the External Input Signal (System Input)

**Release**

1. Turn the emergency stop button in the direction of the arrows.
   - On the front door of the DX200:
   - 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 after an emergency stop, confirm the position for the next operation and make sure there is no interference with the workpiece or fixture.

- The application of an emergency stop during high speed operations on continuous steps can result in the manipulator stopping two or three steps prior to the step that is being displayed. There is a risk of interference with the workpiece or fixture when the manipulator is restarted under such conditions.
4.3.2 Stop and Restart

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 {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.
4.3.4 Others

4.3.4.1 Temporary Stop by Mode Change

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

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

4.3.4.2 Temporary Stop by the PAUSE Instruction

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

To restart the operation, perform a start operation. The manipulator restarts from the next instruction.
4.4 Modifying Play Speed

4.4.1 Speed Override

Speed modifications using the speed override have the following features:

- Speed can be modified during playback. The job can be played back at various speeds until the play speed is properly adjusted.
- Speed can be increased or decreased by a ratio of the current play speed. The ratio settings range from 10% to 150% in increments of 1%. Therefore, it is convenient when, for example, all play speed settings are to be increased by 150% at the same time.

The operation flow is shown below.

```
Start speed override
   ↓
Call job to perform speed override
   ↓
Set speed override (Speed data modify: OFF, specify the ratio)
   ↓
Start playback
   ↓
Adjust the ratio during playback if needed
   ↓
YES
   ↓
Reset and playback?
   ↓
NO
   ↓
Modify?
   ↓
YES
   ↓
Call job to perform speed override
   ↓
Set speed override (Speed data modify: ON, specify the ratio)
   ↓
Start playback
   ↓
Modify play speed simultaneously
   ↓
(1cycle completed)
   ↓
End
```

Changes experimentally, without modifying registered speed

Modifies play speed
4.4.1.1 Setting Speed Overrides

1. Select {UTILITY} under the menu in the PLAYBACK window.

2. Select {SPEED OVERRIDE}.
   – The PLAYBACK window shows the speed override status.

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

4. Line up the cursor with the override ratio and move the cursor up and down to change the ratio.
   If you want to input the ratio number directly, move the cursor to the override ratio and press [SELECT].
   – The number input line appears. Input the override ratio using the [Numeric Key].
4.4 Modifying Play Speed

### 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 cancelled.

#### 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 cancelled before reaching step 2.
- The play speed after the modification by the speed override is limited by the maximum and the minimum speed of manipulator.
- When the safety speed operation is commanded with the setting of “MODIFY: ON”, the manipulator operates at the safety speed. However, the play speed in memory is modified as set by the speed override.
- Play speed set by the SPEED instruction is not modified.

### 4.4.1.3 Cancelling Speed Override Settings

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

#### NOTE

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

- When dry-run speed operation is set.
- When the mode is changed to any mode other than the play mode.
- When an alarm 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

1. Select {JOB} under {Main Menu}, and press {JOB}.

   - The PLAYBACK screen appears.

   ![PLAYBACK Screen](image)

   **NOTE**
   
   Set the mode selection switch to PLAY.
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.

Note: To directly enter the value, perform:

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

**NOTE**  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

**NOTE**  • 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 the TEACH mode.

<table>
<thead>
<tr>
<th>Manual Speed</th>
<th>Applicable Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inching</td>
<td>Maximum jog operation link speed x S1CxG045</td>
</tr>
<tr>
<td>Low</td>
<td>Maximum jog operation link speed x S1CxG045</td>
</tr>
<tr>
<td>Medium</td>
<td>Maximum jog operation link speed x S1CxG046</td>
</tr>
<tr>
<td>High</td>
<td>Maximum jog operation link speed x S1CxG047</td>
</tr>
</tbody>
</table>

4.4.2.7 Manual Speed in the TEACH Mode

The function is enabled by setting the parameter S2C699.

The manual speed (inching, low, medium, and high) in the 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 the TEACH mode.
- Turning OFF the SERVO power in the TEACH mode.
### 4.4 Modifying Play Speed

#### 4.4.2.8 Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Details</th>
<th>Setting Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2C699</td>
<td>Automatic change of manual speed to LOW</td>
<td>Automatically sets the manual speed to LOW.</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D7, D0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The mode is changed to TEACH: 1 (Enable)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The operation coordinates are changed: 4 (Enable)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>The Servo is turned OFF: 8 (Enable)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Speed fixed at LOW: 16 (Enable)</td>
<td></td>
</tr>
<tr>
<td>S2C701</td>
<td>Speed Override setting</td>
<td>Specifies the usage of Speed Override.</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0: Disables continuous cycle operation; Enables speed modification (standard specification).</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1: Enables the Continuous Cycle operation; Disables speed modification.</td>
<td></td>
</tr>
<tr>
<td>S2C702</td>
<td>Automatic Speed Override Setting 1 in mode change (When S2C701 = 1)</td>
<td>Specifies whether to automatically set Speed Override when the mode is changed to PLAY.</td>
<td>0 to 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0: Disables Speed Override.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1: Sets the percentage corresponding to the manual speed.</td>
<td></td>
</tr>
<tr>
<td>S2C709</td>
<td>Automatic Speed Override Setting 2 in mode change (When S2C701 = 1)</td>
<td>Specifies whether to automatically set Speed Override when the mode is changed to PLAY.</td>
<td>0 to 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0: Disables Speed Override.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1: Sets the percentage applied last time.</td>
<td></td>
</tr>
</tbody>
</table>
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*

- 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 Modifying Play Speed

4.4.3.2 Performing the Speed Override Function

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 Modifying Play Speed

Spot and Arc Welding
Using Motor Gun

4.4.3.4 Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Details</th>
<th>Setting Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2C701</td>
<td>Speed Override setting</td>
<td>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.</td>
<td>1</td>
</tr>
<tr>
<td>S4C287</td>
<td>Universal Input Group number setting (signals 1 to 8)</td>
<td>Specifies the signals to be used. Eight Universal Input points correspond to the signals 1 to 8 of S4C288 to S4C295.</td>
<td>1 to 512</td>
</tr>
<tr>
<td>S4C288</td>
<td>Speed percentage (%) Signal 1</td>
<td>Specifies the speed percentage by the Universal Input signals set in S4C287. Priority: Signal 1 &gt; Signal 8</td>
<td></td>
</tr>
<tr>
<td>S4C289</td>
<td>Speed percentage (%) Signal 2</td>
<td>If S4C288 to S4C295 are all &quot;0&quot;, the input status 1 to 255 of the Universal Input signals (8 points) will be applied to the speed percentage.</td>
<td>0 to 255</td>
</tr>
<tr>
<td>S4C290</td>
<td>Speed percentage (%) Signal 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S4C291</td>
<td>Speed percentage (%) Signal 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S4C292</td>
<td>Speed percentage (%) Signal 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S4C293</td>
<td>Speed percentage (%) Signal 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S4C294</td>
<td>Speed percentage (%) Signal 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S4C295</td>
<td>Speed percentage (%) Signal 8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 Playback with Reserved Start

4.5.1.1 Enabling Reserved Start

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

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

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

1. Select (SETUP) under (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”.

![Image of OPERATING CONDITION window]

![Image of OPERATING CONDITION window with selected items]
When the reserved start is enabled, the external start and the programming pendant start are prohibited even if setting is “PERMIT”. Regardless of the operation cycle selected, it is automatically set to 1 CYCLE.
4.5.1.2 Registering Reserved Start I/O Signal

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

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

1. Select {SETUP} under {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 Playback with Reserved Start

### 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 the teach mode and the setting of “RESERVED START JOB CHANGE” is “PERMIT” in the OPERATING CONDITION window.

---

1. Select {JOB} under {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.

![Reserved Start (JOB) Window](image1)

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

![Selection Dialog Box](image2)

4. Select “SETTING START JOB”.
   - The JOB LIST window appears.

![JOB List Window](image3)
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 the teach mode and the setting of “RESERVED START JOB CHANGE” is “PERMIT” in the operation condition display.

1. Select {JOB} under {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

4.5.2.1 Start Operation

1. Set the mode switch to “PLAY”.
2. Press start button on the station.
   - The job registered for the station starts up and the manipulator performs one cycle operation.

   **NOTE**
   - While the job is being executed, the start button lamp on the station lamps.
   - If the workpiece must be prepared at the station, prepare it before pressing the start button.
   - 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 lamp 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 operation.

   **SUPPLEMENT**
   Reservations are cancelled 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 {Main Menu}.
2. Select {RES. STATUS}.

– The RESERVATION STATUS window appears.

**A. STATUS**

Reservation status is displayed.

STARTING: Indicates the station currently working.

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

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

**B. START IN**

Input signal status is displayed.

“●”: Input signal ON

“O”: Input signal OFF
4.5.2.3 Resetting Job Reservation

If “STARTING” is displayed, the job cannot be reset.

1. Select {JOB} on the RESERVATION STATUS window.
2. Select {RESET RESERVATION} or {RESET ALL}.
   - When {RESET RESERVATION} is selected, job reservation stated to “RESERVE” is reset.
   - When {RESET ALL} is selected, job reservation stated to “STOP” and “RESERVE” is reset.
   - The confirmation dialog box appears.
3. Select “YES”.

All job reservations are reset automatically in the following conditions:

- When the reserved start sets to “PROHIBIT”. (When “RESERVED START” is set to “PROHIBIT” on the OPERATING CONDITION 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

4.5.3.1 [HOLD] on the Programming Pendant

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

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

4.5.3.2 Hold by External Input Signal (System Input)

- **Hold**
  1. Input ON signal to the external input (system input) specified for the hold operation.
     - The manipulator stops temporarily.
     - The hold lamp for the external output signal lights.
     - The [HOLD] lamp on the programming pendant lights and the [START] lamp turns OFF.

- **Release**
  1. Input OFF signal to the external input (system input) specified for the hold operation.
     - Hold is released.
  2. To continue the operation, press the start button on the suspended station.
     - The manipulator restarts its operation from the position where it was stopped.
4.5.3.3 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.

Stack Level 1

Job A

Job call

Return

Stack Level 2

Job A

Job B

Job call

Return

Stack Level 3

Job A

Job B

Job C

Job call

Return

Stack Level 4

Job A

Job B

Job C

Job D

Job call

Return

SUPPLEMENT

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 the Job C is called from Job B. Also, the Job B is called from Job A.

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

NOTE

Edit operations are restricted when the edit lock is applied.

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 section 3.4 “Modifying Steps” on page 3-29 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.

NOTE

Refer to section 1.2.6 “Character Input Operation” on page 1-22 for the character input operation.
5 Editing Jobs

5.1 Copying Jobs

This operation copies registered jobs and uses them to create new jobs. It is 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 {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.

See section 1.2.6 “Character Input Operation” on page 1-22 for information on letter input operations.
5. Press [ENTER].

- The confirmation dialog box appears.
- If "YES" is selected, the job is copied and the new job appears.
- If "NO" is selected, the job copy is not executed, and the process is cancelled.
5.1.0.2 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 {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.

See section 1.2.6 “Character Input Operation” on page 1-22 for information on letter input operations.
5. Press [ENTER].
   
   – The confirmation dialog box appears.
   
   – If “YES” is selected, the job is copied and the new job appears.
   
   – If “NO” is selected, the job copy is not executed, and the process is cancelled.
5.2 Deleting Jobs

This operation is used to delete jobs that are registered on the DX200. 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 {Main Menu}.
2. Select {JOB}.
   – The JOB CONTENT window appears.
3. Select {JOB} → {DELETE JOB} under the pull-down menu.
4. Press “YES”.
   – The confirmation dialog box appears.
   – When “YES” is selected, the edit job is deleted. When deletion is completed, the {JOB LIST} window appears.
   – When “NO” is selected, the job deletion is cancelled.
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 {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 cancelled and the JOB LIST window appears.

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

SUPPLEMENT
5 Editing Jobs

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 {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.

Supplement
See section 1.2.6 “Character Input Operation” on page 1-22 for information on letter input operations.
5. Press [ENTER].

- The confirmation dialog box appears.
- When “YES” is selected, the job name is changed and a new job name is displayed.
- When “NO” is selected, the job name is not changed, and the process is cancelled.
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 \{Main Menu\}.
   - The JOB LIST window appears.

2. Move the cursor to the name to be changed.

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

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

See section 1.2.6 “Character Input Operation” on page 1-22 for information on letter input operations.
5. Press [ENTER].

- The confirmation dialog box appears.
- When “YES” is selected, the job name is changed and a new job name is displayed.
- When “NO” is selected, the job name is not changed, and the process is cancelled.
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 {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.

See section 1.2.6 “Character Input Operation” on page 1-22 for information on letter input operations.
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.
5.5 Job Folder Function

- 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.

- 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 "***".
5.5.2 Operation for Canceling Displaying Jobs by Folders

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

1. Display the (JOB LIST) window.

![Image of JOB LIST window]

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

![Image of JOB LIST window with folder name removed]

– 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.

   ![NEW JOB CREATE Window]

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

   ![JOB FOLDER LIST]

   ![JOB FOLDER LIST with Folders Listed]
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.

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].
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.
5 Editing Jobs

5.5 Job Folder Function

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.
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.

   ![Displaying by name](image)

   - The jobs are displayed in name order for each folder.
5.5 Job Folder Function

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.

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

1. Select {JOB} under {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).
5.7 Enabling the Modification of Position Data Only

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

1. Select {Setup} under {Main Menu}.

2. Select {Teaching Condition Setting}.
   - The {Teaching Condition Setting} window appears.
   - The {Teaching Condition Setting} window is shown only when the security mode is edit mode or management mode.

3. Select "Step Only Changing" and press [Select].
   - Each time [Select] is pressed, the setting alternates between "Prohibit" and "Permit".

<table>
<thead>
<tr>
<th>Teaching Condition Setting</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language Level</td>
<td>Secret</td>
</tr>
<tr>
<td>Instruction Input Learning</td>
<td>Auto</td>
</tr>
<tr>
<td>Mode Instruction Set Position</td>
<td>Step</td>
</tr>
<tr>
<td>Buckup When Position Teaching</td>
<td>Prohibit</td>
</tr>
<tr>
<td>Step Only Changing</td>
<td>Prohibit</td>
</tr>
<tr>
<td>Rectangular/ Cylindrical</td>
<td>Auto</td>
</tr>
<tr>
<td>Tool No. Switch</td>
<td>Prohibit</td>
</tr>
<tr>
<td>Tool No. Interlock for Step Bury</td>
<td>Permit</td>
</tr>
<tr>
<td>POS Teach Only Job Control Group</td>
<td>Prohibit</td>
</tr>
<tr>
<td>Job Undelete Function</td>
<td>Default</td>
</tr>
</tbody>
</table>
5.8 Prohibit Displaying the Contents of a Job

Contents of a job can be nondisclosed on a job base. The job whose contents are set to be nondisclosed, "Invisible" is displayed instead of each job except NOP instruction, which comes to the first line of the job, and END instruction, which comes to the last line. (Setting the contents display is available in the software version DN1.91-00 or later.)

For the job whose contents are set to be displayed, only the name of the job and its control group are displayed on the JOB CONTENT:MASTER window.

Also, the following operations are limited.

- Job editing operation (adding, changing, deleting) cannot be operated.
- The job cannot be deleted, copied, or changed the names.
- Direct open cannot display the contents of the instructions.
- The command position does not appear on the COMMAND POSITION window.
- The job cannot be set as the target of the job conversion.
- The job cannot be edited during playback.

The contents display setting can be done on the JOB HEADER window to each job.

1. Select {JOB} under {Main Menu}.
2. Select {JOB}.
3. Select {DISPLAY} under the pull-down menu.
5 Editing Jobs

5.8 Prohibit Displaying the Contents of a Job

4. Select {JOB HEADER}.
   - The JOB HEADER window appears.

5. Select {CONTENTS DISPLAY} and set “PROHIBIT”.

The contents display of a job can be changed only when the security mode is in the management mode or higher.

When “PROHIBIT” is set to {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 to {CONTENTS DISPLAY}, comment, job folder, edit lock and save job can be changed when the edit lock is “ON”.

6. Select {DISPLAY} under the pull-down menu.
7. Select {JOB}.

- The JOB CONTENT window appears. “Invisible” is displayed instead of each job except NOP instruction, which comes to the first line of the job, and End instruction, which comes to the last line, and instructions are displayed in black regardless of the display color condition setting. (Refer to section 6.11 “Instruction Displaying Color Setting Function” for the display color condition setting.) The step No. and the tool No. are displayed on the general-purpose display area as asterisks “*”.

Edit operation cannot be conducted for the job whose contents are set to be nondisclosed.

Jobs whose contents can be modified during the playback operation, such as a job in the speed modification operation to a move instruction in the speed override function, are possible to be modified even if “PROHIBIT” is set to {CONTENTS DISPLAY}. (Refer to section 4.4 “Modifying Play Speed” for the speed override function.)

To prohibit modifying a job during playback, set “ON” to {EDIT LOCK}. (Refer to section 5.6 “Setting Edit Lock on Individual Job Units” for setting “ON” to {EDIT LOCK}.)

To prohibit saving a job data, to which “PROHIBIT” is set to its {CONTENT DISPLAY} item, to an external memory device, set “PROHIBIT” to {TO SAVE TO FD}.

Refer to section 5.9 “Prohibit: Saving The Job Data” for setting “PROHIBIT” to {SAVE JOB}.
5.9 Prohibit: Saving The Job Data

Data saving can be prohibited on a job base to prevent the job of the DX200 from being saved to the external memory device. (Setting the save job is available in the software version DN1.91-00 or later.)

Setting “PROHIBIT” to (SAVE JOB) can be set on the JOB HEADER window of each job.

1. Select {JOB} under {Main Menu}.
2. Select {JOB}.
3. Select {DISPLAY} under the pull-down menu.
4. Select {JOB HEADER}.
   – The JOB HEADER window appears.
5. Select {SAVE JOB} and set “PROHIBIT”.
6. The job “PROHIBIT” is set to (SAVE JOB) cannot be saved to the external memory device.

Refer to section 7.3.0.2 “Saving Data” for saving job data in an external memory device.

When saving a job to which “PROHIBIT” is set to (SAVE JOB) by using data transmission function, high-speed Ethernet server function, FTP function and MotoPlus function, an error occurs and it cannot be saved. (ERROR 2110 “This data cannot be accessed”.)

The save job setting can be changed only when the security mode is in the management mode or higher.

To prohibit displaying of the contents of a job, to which “PROHIBIT” is set to {JOB SAVE}, set “PROHIBIT” to {CONTENT'S DISPLAY}.

Refer to section 5.8 “Prohibit Displaying the Contents of a Job” for setting the displaying of a job contents.
6 Convenient Functions

6.1 One-touch Operation “Direct Open”

The direct open function immediately shows the JOB CONTENT window or condition file contents of a job called by the CALL instruction. Move the cursor to the desired job name or condition file name and simply press [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
1. In the JOB CONTENT window, move the cursor to the job name or the condition file for which the window is to be displayed.

2. Press [DIRECT OPEN].
   - This key lamp lights and the JOB CONTENT window or the condition file window appears.
   - When [DIRECT OPEN] is pressed once again, the key lamp turns OFF, and the window returns to the former JOB CONTENT window.

**NOTE**

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

<table>
<thead>
<tr>
<th>Line (Step)</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>NOP</td>
</tr>
<tr>
<td>0001(001)</td>
<td>MOVJ VJ=50.00</td>
</tr>
<tr>
<td>0002(002)</td>
<td>MOVL V=138</td>
</tr>
<tr>
<td>0003</td>
<td>SFTON PUF# (1)</td>
</tr>
<tr>
<td>0004(003)</td>
<td>MOVL V=138</td>
</tr>
<tr>
<td>0005(004)</td>
<td>MOVL V=138</td>
</tr>
<tr>
<td>0006(005)</td>
<td>MOVL V=138</td>
</tr>
<tr>
<td>0007</td>
<td>SFTOF</td>
</tr>
<tr>
<td>0008(006)</td>
<td>MOVL V=138</td>
</tr>
</tbody>
</table>

6.2.1.2 Parallel Shift of Job

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

```
SFTON P UF#
CALL JOB: 
SFTOF
```

Job to perform the shifting
6.2.2 Setting the Shift Value

6.2.2.1 Coordinate Systems

The shift value for parallel shift is X, Y, and Z increment in each coordinates. There are four coordinates: base coordinates, robot coordinates, tool coordinates, and user coordinates. In systems with no servo track, the base coordinates and robot coordinates are the same. Also, the teaching line coordinates system cannot be used.

6.2.2.2 Setting the Shift Value

When setting the shift value for the position variables, use the current position (coordinates) of the manipulator in the window.
The shift value is the X, Y, and Z difference between the shift position and teaching position and the difference in angular displacement RX, RY, And RZ (normally set at “0”). If shifting is executed at equal pitch intervals, for example for pelletizing, 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.
6 Convenient Functions
6.2 Parallel Shift Function

6.2.3 Registering Shift Instructions

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

1. Select (JOB) under (Main Menu).
2. Select (JOB).
   - The JOB CONTENT window appears.
3. Move the cursor to the address area.
6 Convenient Functions
6.2 Parallel Shift Function

6.2.3.1 SFTON Instruction

This is the instruction that starts a parallel shift.

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

   Line immediately before where SFTON instruction is to be registered.

   ![Instruction List Dialog Box]

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

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

   ![SFTON P000]

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

   ![SFTON]

   ![Value Input Dialogue]
6 Convenient Functions

6.2 Parallel Shift Function

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

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

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

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

6. Press [INSERT] and then [ENTER].

- The instruction displayed in the input buffer line is registered.
6 Convenient Functions
6.2 Parallel Shift Function

6.2.3.2 SFTOF Instruction

This is the instruction that ends a parallel shift.

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

   Line immediately before where SFTOF instruction is to be registered.

<table>
<thead>
<tr>
<th>Line</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>0006</td>
<td>MOVL V=138</td>
</tr>
<tr>
<td>0007</td>
<td>DOUT OT#(1) ON</td>
</tr>
<tr>
<td>0008</td>
<td>TIMER T=1.00</td>
</tr>
</tbody>
</table>

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.

   ![](image)

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

<table>
<thead>
<tr>
<th>Line</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>0006</td>
<td>MOVL V=138</td>
</tr>
<tr>
<td>0007</td>
<td>SFTOF</td>
</tr>
<tr>
<td>0008</td>
<td>DOUT OT#(1) ON</td>
</tr>
</tbody>
</table>
6 Convenient Functions

6.2 Parallel Shift Function

6.2.3.3 MSHIFT Instruction

When a parallel shift of the wrist posture is attempted, the manipulator may not be shifted to the target posture in the following cases.

- Posture displacement (Rx, Ry, Rz) is specified to the shift value set by the user.
- When a displacement between two points is calculated using an INFORM operating instruction (ADD instruction, SUB instruction, etc.), and a posture displacement (Rx, Ry, Rz) is specified in the shift value.

In such cases, the MSHIFT instruction can be used to automatically calculate the optimum shift value for an operation to reach the target shift position and posture. With an MSHIFT instruction, the shift value between the reference position and the target position (shift position) when the parallel shift is performed is determined in the specified coordinate system, and set as the specified position variable.

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

   Line immediately before where MSHIFT instruction is registered.

   0005  MOV J V=138
   0006  GETS PX001 $PX000
   0007  DOUT OT#(1) ON

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

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

   ⇒ MSHIFT PX000 BF PX001 PX002
6 Convenient Functions

6.2 Parallel Shift Function

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

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

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

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

- After the coordinate system modification is complete, press [ENTER]. The DETAIL EDIT window closes and the JOB CONTENT window appears.

6. Press [INSERT] and then [ENTER].

- The instruction displayed in the input buffer line is registered.
6.2.4 Continuation of the Parallel Shift Function

**CAUTION**

- If the shift function is cancelled through a job editing operation after the execution of a parallel shift instruction, the job must be started again from the beginning.
- Because no shift is performed when the operation is restarted, there is a possibility of interference between the workpiece and fixture.

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

- Job editing operation (changing, deleting, adding)
- Job copy, job name change
- Registering a new job, deleting a job, or modifying a selected job
- Restart after the alarm occurs
- When control power is turned OFF

**NOTE**

With any operation other than those listed above, the parallel shift function remains in effect.
6.2.5 Parallel Shift Function Operation Method

When a parallel shift is performed, there are several ways to move to the step position. The following three methods can be used to designate the way to move.

- **Previous Step Regarded (Constant B-axis sign)**
  - Effective when a job in which the B-axis does not pass the point 0° is performed. (i.e., the operation in which the B-axis always faces downward)

- **Previous Step Regarded (Minimum R-axis movement)**
  - Effective when a job in which the B-axis passes the point 0° is performed.

- **Type Regarded**
  - Effective when a job created by off-line teaching is performed.

The operation method can be specified by the following parameter.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Settings</th>
<th>Initial value</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2C439</td>
<td>0: Previous step regarded (Constant B-axis sign) 1: Type Regarded 2: Previous Step Regarded (Minimum R-axis movement)</td>
<td>0</td>
</tr>
</tbody>
</table>
6.2.6 Examples of Use

6.2.6.1 Example of Use of Shift Addition/Subtraction

Table 6-1: Workpiece Stacking Operation

<table>
<thead>
<tr>
<th>Line</th>
<th>Instruction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>NOP</td>
<td>Make the first shift value zero.</td>
</tr>
<tr>
<td>0001</td>
<td>SET B000 0</td>
<td>Make the first shift value zero.</td>
</tr>
<tr>
<td>0002</td>
<td>SUB P000 P000</td>
<td>Make the first shift value zero.</td>
</tr>
<tr>
<td>0003</td>
<td>*A</td>
<td>Make the first shift value zero.</td>
</tr>
<tr>
<td>0004</td>
<td>MOVJ</td>
<td>Step 1</td>
</tr>
<tr>
<td>0005</td>
<td>MOVL</td>
<td>Step 2</td>
</tr>
<tr>
<td>0006</td>
<td>*Gripping workpiece</td>
<td></td>
</tr>
<tr>
<td>0007</td>
<td>MOVL</td>
<td>Step 3</td>
</tr>
<tr>
<td>0008</td>
<td>MOVL</td>
<td>Step 4</td>
</tr>
<tr>
<td>0009</td>
<td>SFTON P000 UF#(1)</td>
<td>Shift start</td>
</tr>
<tr>
<td>0010</td>
<td>MOVL</td>
<td>Shift position Step 5</td>
</tr>
<tr>
<td>0011</td>
<td>*Releasing workpiece</td>
<td></td>
</tr>
<tr>
<td>0012</td>
<td>SFTOF</td>
<td>Shift end</td>
</tr>
<tr>
<td>0013</td>
<td>ADD P000 P001</td>
<td>Add the shift value for the next operation.</td>
</tr>
<tr>
<td>0014</td>
<td>MOVL</td>
<td>Step 6</td>
</tr>
<tr>
<td>0015</td>
<td>MOVL</td>
<td>Step 7</td>
</tr>
<tr>
<td>0016</td>
<td>INC B000</td>
<td></td>
</tr>
<tr>
<td>0017</td>
<td>JUMP *A IF B00&lt;6</td>
<td>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.</td>
</tr>
<tr>
<td>0018</td>
<td>SFTON P000 UF#(1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SFTOF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SUB P000 P001</td>
<td></td>
</tr>
</tbody>
</table>

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.
### Example of Use of MSHIFT Instruction

<table>
<thead>
<tr>
<th>Line</th>
<th>Instruction</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>NOP</td>
<td></td>
</tr>
<tr>
<td>0001</td>
<td>MOVJ VJ=20.00</td>
<td>Move the manipulator to the reference position.</td>
</tr>
<tr>
<td>0002</td>
<td>GETS PX000 $PX000</td>
<td>Set the reference position as position variable P000.</td>
</tr>
<tr>
<td>0003</td>
<td>MOVJ VJ=20.00</td>
<td>Move the manipulator to the target position.</td>
</tr>
<tr>
<td>0004</td>
<td>GETS PX001 $PX000</td>
<td>Set the target position as position variable P001.</td>
</tr>
<tr>
<td>0005</td>
<td>MSHIFT PX010 BF PX000 PX001</td>
<td>Set shift value and set it as position variable P010.</td>
</tr>
<tr>
<td>0006</td>
<td>END</td>
<td></td>
</tr>
</tbody>
</table>
6.3 Parallel Shift Job Conversion Function

6.3.1 Function Overview

If the manipulator and base positions are moved after a job has been taught, the entire job has to be modified. The parallel shift conversion function shortens the modification time required in cases like this by shifting all steps of the job by the same value to create a new job.

When the parallel shift conversion is performed, all job steps are shifted by the same value.

Steps Outside the P-point Maximum Envelope

• "OV" is added to the step when its position exceeds the P-point maximum envelope due to this conversion. At this time, the position after conversion is taught if the pulse limit is exceeded. If the interpolation motion is impossible, when the position is taught by the pulse value, the pulse value before conversion is taught, and when the position is taught by the XYZ value, the XYZ value after conversion is taught. When the position is corrected, "OV" display disappears.

Position Variable

• Position variables are not subject to the parallel shift job conversion.

Not Converted Job

• The following jobs cannot be converted. If conversion is attempted, no operation is performed.
  • Jobs without any group axes
  • Concurrent jobs (optional)

CAUTION

If a job name after conversion is not specified when executing the parallel shift job conversion, the position data of the job is shifted and converted, then the data is overwritten with a new position data after the shift. Be sure to save the job in the external memory device or create the same job by copying before executing conversion.
6.3.2 Coordinate Systems for Conversion

When performing the parallel shift job conversion, it is necessary to specify the coordinate systems in which the conversion is to be performed. The coordinate system can be selected from the following:

- Base coordinates
- Robot coordinates
- Tool coordinates
- User coordinates (64 types)
- Master tool coordinates (R*+R* job)
- Pulse coordinates

In the case of an ordinary job for which group axes are registered, shift conversion is performed in accordance with the selected coordinate system. The relationship between group combinations and coordinates are shown in the following table.

1 to 4 in the table are followed by their explanations.

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

<table>
<thead>
<tr>
<th>Group Combination in Job</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Usable Coordinate System</td>
</tr>
<tr>
<td>R</td>
<td>Shift is performed on the basis of selected coordinates.</td>
</tr>
<tr>
<td></td>
<td>Base coordinates, robot coordinates, tool coordinates, user coordinates, pulse coordinates</td>
</tr>
<tr>
<td>R(B)</td>
<td>Shift is performed on the basis of selected coordinates.</td>
</tr>
<tr>
<td>1. Base Coordinates</td>
<td>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.</td>
</tr>
<tr>
<td>2. Robot Coordinates</td>
<td>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.</td>
</tr>
<tr>
<td>3. Tool Coordinates</td>
<td>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.</td>
</tr>
<tr>
<td>4. User Coordinates</td>
<td>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.</td>
</tr>
<tr>
<td>5. Pulse Coordinates</td>
<td>The taught position of each axis is shifted by the specified amount on the basis of pulse values.</td>
</tr>
<tr>
<td>S</td>
<td>Shift is performed on the basis of pulse values regardless of the coordinates.</td>
</tr>
</tbody>
</table>
## 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.

<table>
<thead>
<tr>
<th>Combination</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R+S</td>
<td>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.</td>
</tr>
<tr>
<td>R(B)+S</td>
<td>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.</td>
</tr>
<tr>
<td>R+R</td>
<td>Two manipulators are shifted in the selected coordinates. Base coordinates, robot coordinates, tool coordinates, user coordinates, master tool coordinates(^1), pulse coordinates.</td>
</tr>
<tr>
<td>R(B)+R(B)</td>
<td>Two manipulators are shifted in the selected coordinate system, as in 1 to 5 above. Two base axes are also shifted.</td>
</tr>
</tbody>
</table>

1 In the master tool coordinates, conversion only occurs at the “slave” from the standpoint of the SMOV instruction.
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).

![Diagram of R1 (Master) and R2 (Slave) with motion paths]

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

R1 (Master)  R2 (Slave)

Y-axis  X-axis

Master tool coordinates  Z-axis

0001 MOV +MOV
0002 MOV +MOV
0003 SMOV +MOV
0004 SMOV +MOV
0005 SMOV +MOV
0006 MOV +MOV

Displays R2  Displays R1

Motion path after conversion
6 Convenient Functions

6.3 Parallel Shift Job Conversion Function

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].
6 Convenient Functions
6.3 Parallel Shift Job Conversion Function

**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.

The method using position variables by parameter setting is described in section 6.3.4 “Specifying the Shift Value by Position Variables” on page 6-30 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 {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 Key]s.

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.

If an alarm occurs during conversion, conversion is suspended.
6 Convenient Functions

6.3 Parallel Shift Job Conversion Function

Calculation by Teaching

1. Select {JOB} under (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 Key]s.
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 Key]s.

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.
6 Convenient Functions
6.3 Parallel Shift Job Conversion Function

14. Display the PARALLEL SHIFT JOB window. Select “EXECUTE”.

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

If an alarm occurs during conversion, conversion is suspended.
6 Convenient Functions

6.3 Parallel Shift Job Conversion Function

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” at page 6-32.
6 Convenient Functions
6.3 Parallel Shift Job Conversion Function

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” at page 6-33.
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](image)

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.
6 Convenient Functions
6.3 Parallel Shift Job Conversion Function

Use P011 for R2.

Example 2) When selecting EX005 for multiple jobs with four stations:
Use EX005 for S1.
Use EX006 for S2.
Use EX007 for S3.
Use EX008 for S4.

■ Relation between variables and jobs for conversion in an individual shift
6 Convenient Functions

6.3 Parallel Shift Job Conversion Function

- **In the case of independent job conversion:**
  - Coordinated job with R1 + R2
  - Different shift values can be set for each manipulator and base.

  ![Diagram of independent job conversion](image)

  - 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.

  ![Diagram of related job conversion](image)
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 section 3.9.4 “User Variables” on page 3-103.

3. Select {JOB} under {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 section 3.7.6 “Commenting Out a Line” on page 3-71 and section 3.7.7 “Prohibiting Editing Line-by-Line” on page 3-81.)
6 Convenient Functions

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.

<table>
<thead>
<tr>
<th>Data</th>
<th>Input Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Steps for Adjustment</td>
<td>Up to 10 steps can be adjusted at the same time.</td>
</tr>
<tr>
<td>Position Adjustment Range (X, Y, Z)</td>
<td>Unit: mm, valid to two decimal places, maximum ±10 mm</td>
</tr>
<tr>
<td>Posture Angle Adjustment Range (Rx, Ry, Rz)</td>
<td>Unit: deg, valid to two decimal places, maximum ±10 deg</td>
</tr>
<tr>
<td>Speed Adjustment Range (V)</td>
<td>Unit: %, valid to two decimal places, maximum ±50%</td>
</tr>
<tr>
<td>PL Adjustment Range</td>
<td>0 to 8</td>
</tr>
<tr>
<td>Adjustment Coordinates</td>
<td>Robot coordinates, base coordinates, tool coordinates, user coordinates (Default coordinates: robot coordinates)</td>
</tr>
</tbody>
</table>

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”.

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• 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 that has no speed tag causes an error.
6. Convenient Functions

6.4 PAM Function

6.4.2 Operating Methods

6.4.2.1 Setting Adjustment Data

1. Select \{JOB\} under \{Main Menu\}.
2. Select \{JOB\}.
   - The JOB CONTENT window (in the teach mode) or the PLAYBACK window (in the playback mode) appears.
3. Select \{UTILITY\} under the pull-down menu.
4. Select \{PAM\}.
   - The PAM window appears.
5. Set adjustment data.
   - Set adjustment data.
   - **A. Job**
     Set the job name to be adjusted.
     Line up the cursor and press [SELECT] to display the JOB LIST window.
     Move the cursor to the desired job and press [SELECT] to set the adjusted job.
   - **B. Status**
     Shows the status of adjustment in the PAM function.
     “NOT DONE” appears when adjustment is not executed. “DONE” appears when the execution of adjustment is completed.
   - **C. Input Coord**
     Set the desired coordinates.
     Line up the cursor and press [SELECT] to display the selection dialog box.
     Move the cursor to the desired coordinate system and press [SELECT] to set the input coordinates.
   - **D. Step Number**
     Set the step number to be adjusted.
     Line up the cursor and press [SELECT] to display the number input buffer line.
     Input the step number and press [ENTER] to set the value.
   - **E. XYZ Coordinate Adjustment**
     Set the direction and amount of the X, Y, and Z coordinates.
     Line up the cursor with the data to be adjusted and press [SELECT]
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].

**NOTE**

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 section 3.7.6 “Commenting Out a Line” on page 3-71 and section 3.7.7 “Prohibiting Editing Line-by-Line” on page 3-81.)
6.4.2.2 Executing the Adjustment

- Executing the Adjustment

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

2. Select “YES”.
   - In the teach mode, the job adjustment can be immediately executed.
     In the play mode, the job can be adjusted just before execution (move operation).
   - When the job adjustment is completed, the set data shown in the PAM window is cleared. However, if there is an step which exceeds the software limit or an step in which the interpolation motion is impossible during the job adjustment, an error occurs and only the data of the step cannot be cleared on the window.
■ Cancelling the Execution

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

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

6.4 PAM Function

### Clearing Data

If there is a mistake made when adjusting the data, or if the adjustment of the step becomes unnecessary, the data can be cleared.

1. Move the cursor to the step of the data to be cleared.

2. Select {EDIT} under the pull-down menu.

3. Select {LINE CLEAR}.
   - The line data is cleared.

### Copying Data

To input the same data as those set previously, perform the following operation.

1. Move the cursor to the line to be copied.

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

3. Select {LINE COPY}.

4. Move the cursor to the line where the item is to be copied.

5. Select {EDIT} under the menu.
6 Convenient Functions
6.4 PAM Function

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. Move the cursor to the line to be copied.
   – After the position adjustment, the status shows “DONE”.

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

3. Select {UNDO} under the pull-down menu.
   – The confirmation dialog box appears.

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

6.5.1 Function Overview

With the mirror shift function, a job is converted to the job in which the path is symmetrical to that of the original job. This conversion can be performed for the specified coordinate among the X-Y, X-Z, or Y-Z coordinate of the robot coordinates and the user coordinates.

The mirror shift function is classified into the following three: the pulse mirror-shift function, the robot-coordinates mirror-shift function, and the user-coordinates mirror-shift function.
6.5.2 Pulse Mirror-shift Function

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

6.5.2.1 Parameter Setting

Using the following parameter, specify the axes for which the sign is to be reversed.

S1CxG065: Mirror Shift Sign Reversing Axis Specification

<table>
<thead>
<tr>
<th>Axis</th>
<th>1st axis</th>
<th>7th axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Not reversed</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>Reversed</td>
<td>1</td>
</tr>
</tbody>
</table>

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.

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

   ![Diagram of 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

   ![Diagram of 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. When "/OV" is added to the step, the position after conversion is taught if the pulse limit is exceeded. If the interpolation motion is impossible, when the position is taught by the pulse value, the pulse value before conversion is taught, and when the position is taught by the XYZ value, the XYZ value after conversion is taught.
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 {Main Menu}.
  2. Select {JOB}.

- **For Another Job**
  1. Select {JOB} under {Main Menu}.
  2. Select {SELECT JOB}.
     - The JOB LIST window appears.
  3. Select the desired job.

6.5.6.2 Mirror Shift Conversion

1. Display the JOB CONTENT window.
2. Select {UTILITY} under the pull-down menu.
   - The MIRROR SHIFT window appears.
3. Select {MIRROR SHIFT}.
   - The MIRROR SHIFT window appears.
6.5.6.3 Explanation of the Mirror Shift Window

A. SOURCE JOB
Selects the conversion source job. To select another job to be converted, move the cursor to the name and press [SELECT] to call up the list of jobs. Select the desired job and press [SELECT].

B. SOURCE CTRL GROUP
Displays the control group of the conversion source job.

C. STEP SELECTION
Specifies the steps to be converted. From the first step to the last step of the selected job are specified as initial value.

D. DESTINATION JOB
Specifies the converted job name. To enter the name, move the cursor to the name and press [SELECT]. The name of the conversion source job is displayed in the input line as initial value. When "***" is displayed, the name for the converted job is to be the same as that of the conversion source job.

E. DEST CTRL GROUP
Selects the control group for the converted job. When the destination job name is entered, the same control group as the conversion source job is automatically set. To change it, move the cursor to the control group and press [SELECT] to call up the selection dialog box.

F. COORDINATES
Specifies the coordinates used for conversion.
"PULSE": Executes the pulse mirror-shift conversion.
"ROBOT": Executes the mirror-shift conversion on the basis of the cartesian coordinates.
"USER": Executes the mirror-shift conversion on the basis of the specified user coordinates.
G. USER COORD NO.
Specifies the user coordinates number when "USER" is selected in "6. COORDINATES".
This item cannot be set when "PULSE" or "ROBOT" is selected in “6. COORDINATES”.

H. TARGET
Specifies the coordinate where conversion is to be done when "ROBOT" or "USER" is selected in “6. COORDINATES”. "XY", "XZ", or "YZ" can be selected. Always specify "XZ" for "ROBOT".

I. EXECUTE
Mirror shift conversion is executed when pressing “EXECUTE” or [ENTER]. A job is created with the name of conversion source job when a job after conversion is not entered.
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)

<table>
<thead>
<tr>
<th>Number of the window</th>
<th>Dividing Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><img src="image" alt="1 window pattern" /></td>
</tr>
<tr>
<td>2</td>
<td><img src="image" alt="2 windows pattern" /></td>
</tr>
<tr>
<td>3</td>
<td><img src="image" alt="2 windows pattern" /></td>
</tr>
<tr>
<td>4</td>
<td><img src="image" alt="3 windows pattern" /></td>
</tr>
</tbody>
</table>
6 Convenient Functions
6.6 Multi Window Function

### Table 6-3: Display the dividing Pattern (Sheet 2 of 2)

<table>
<thead>
<tr>
<th>Number of the window</th>
<th>Dividing Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>![Pattern 1]</td>
</tr>
<tr>
<td>6</td>
<td>![Pattern 2]</td>
</tr>
<tr>
<td>7</td>
<td>![Pattern 3]</td>
</tr>
</tbody>
</table>

#### 6.6.2.1 Calling Up and Operating Methods of the Display Dividing Pattern Setting Window

Call up the dividing pattern setting window.


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 pattern 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.

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.
6 Convenient Functions

6.6 Multi Window Function

   - 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 section 6.6.2 “Setting the Dividing Pattern of the General-Purpose Display Area” on page 6-55. (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 section 6.6.2 “Setting the Dividing Pattern of the General-Purpose Display Area” on page 6-55. (1→2→3→4→1⋯⋯)

   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.

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.
6 Convenient Functions

6.6 Multi Window Function

- **Setting Value: 1**
  - Call up the confirmation dialog box to confirm the switch of the active window.
  - Message “Control group will be changed. Switch the active window?” is displayed
  - “Yes” ······ After switching the window to be active, a message appears in the human interface display area.
  - “No” ······ Cancel the window to be active.

- **Setting Value: 2**
  - Do not notify the control group change.
6.7 **Simple Menu Function ¹)**

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.

---

¹ Simple menu function is available in DS1.50-00 version or later.
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 {REGIST} 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.
   *It will not be registered when “NO” is selected.
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.

*It will not be registered when “NO” is selected.
6 Convenient Functions

6.7 Simple Menu Function

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.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. when the layout is already registered.</td>
<td>This layout is already registered.</td>
</tr>
<tr>
<td>2. when eight layouts are already registered.</td>
<td>There is not an undefined domain.</td>
</tr>
<tr>
<td>3. When the registering layout includes the window which cannot be started up in the {Main Menu}.</td>
<td>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” at page 6-55.</td>
</tr>
<tr>
<td>4. When a single window is displayed under the multi window mode.</td>
<td>Cannot register at current operation mode.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. when the layout is already registered.</td>
<td>This layout is already registered.</td>
</tr>
<tr>
<td>2. when eight layouts are already registered.</td>
<td>There is not an undefined domain.</td>
</tr>
<tr>
<td>3. When the registering layout includes the window which cannot be started up in the {Main Menu}.</td>
<td>The screen which I cannot register is included [W1W2W3W4]</td>
</tr>
<tr>
<td>4. When a single window is displayed under the multi window mode.</td>
<td>Cannot register at current operation mode.</td>
</tr>
</tbody>
</table>

The screens which cannot be started up in 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.

<table>
<thead>
<tr>
<th>Status of general-purpose display area</th>
<th>Name registered to “USER DEFINITION” Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Single window mode</td>
<td>(Same as the sub menu in main menu)</td>
</tr>
<tr>
<td>2. Multi window mode</td>
<td>Layout -n (“n” should be a number from 0 to 7)</td>
</tr>
</tbody>
</table>

It is possible to change the name even after the name is registered. Refer to chapter 6.7.4.3 “Change the Name of Registered Layout Name” at page 6-76.
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.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 When all the registered layout windows cannot be displayed due to security mode or its purpose of use.</td>
<td>There are no windows to display within the chosen layout.</td>
</tr>
</tbody>
</table>

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 Convenient Functions

6.7 Simple Menu Function

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 “USER DEFINITION MENU” window.

Those editions are executed on “USER DEFINITION MENU” window. Displaying of “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” Window

Displays “USER DEFINITION MENU” Window with {EDIT} button.

1. Press [SIMPLE MENU] or select (Simple Menu) button at the lower-left on the display.

   – “USER DEFINITION MENU” menu appears.

2. Press (EDIT) button.

   – “USER DEFINITION” menu closes.

   – “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 “USER DEFINITION MENU” window under main menu.

1. Select {SYSTEM INFO} under {Main Menu}.
   - {SYSTEM INFO} sub menu appears.

2. Select {USER DEFINITION}.
   - “USER DEFINITION MENU” window appears on the active window in the general-purpose display area.
6.7.4.3 Change the Name of Registered Layout Name

The registered layout names can be changed.

1. Display “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, then press [ENTER] or {ENTER} button.
   – The software key pad closes.
   – The name changes.

* If complete the software key pad operation with [CANCEL] or {CANCEL} button, the name editing operation is also canceled.

When the bilingual function is valid, name in each language can be set.
6.7.4.4 Deleting the Layout

The layout registered to “USER DEFINITION” menu can be deleted.

1. Display “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 Convenient Functions
6.7 Simple Menu Function

6.7.4.5 Delete All Layout

All layouts registered to “USER DEFINITION” menu can be deleted at a time.

1. Display “USER DEFINITION MENU” window.
2. Select {EDIT} in the menu.
   – A pull down menu appears.
   
   ![Image of Edit menu]

3. Select {SELECT ALL}.
   – “●” mark is indicated at the head of all the registered layouts.
   
   ![Image of SELECT ALL menu]
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.

---

Move the cursor to the line with “●” mark, and press [SHIFT] + [SELECT] to disappear “●” mark.
When select {EDIT} → {CANCEL SELECT} under the pull down menu to cancel select and “●” marks disappear.
### 6.7.5 Save/Load (to external memory devices) the User Definition Menu Data

The data registered to “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. MORITY} under {Main Menu}.
   - {EX. MORITY} sub menu appears.

2. Select {SAVE}.
   - {SAVE} window of external memory device appears.

3. Select {FILE/GENERAL DATA}.
   - {FILE/GENERAL DATA} window of 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.

* It 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 {Main Menu}.
   - {EX. MEMORY} sub menu appears.

2. Select {LOAD}.
   - {LOAD} window of external memory device appears.

3. Select {FILE/GENERAL DATA}.
   - {FILE/GENERAL DATA} window of external memory device appears.
6 Convenient Functions

6.7 Simple Menu Function

4. Select {USER MENU DATA}.
   - “★” mark is indicated at the head of {USER MENU DATA}.

```
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.
   - It 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” at page 8-1, 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 main menu.
6 Convenient Functions
6.8 Parameter Setting Function

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 Key]s and press [ENTER] to change the settings.
6.8 Parameter Setting Function

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” at page 8-14.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUBSET</td>
<td>0</td>
</tr>
<tr>
<td>STANDARD</td>
<td>1</td>
</tr>
<tr>
<td>EXPANDED</td>
<td>2</td>
</tr>
</tbody>
</table>

- **INSTRUCTION INPUT LEARNING (S2C214)**
  Refer to chapter 8.3.0.14 “S2C214: INSTRUCTION INPUT LEARNING FUNCTION” at page 8-15.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALID</td>
<td>0</td>
</tr>
<tr>
<td>INVALID</td>
<td>1</td>
</tr>
</tbody>
</table>

- **MOVE INSTRUCTION SET POSITION (S2C206)**
  Refer to chapter 8.3.0.8 “S2C206: ADDITIONAL STEP POSITION” at page 8-13.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP</td>
<td>0</td>
</tr>
<tr>
<td>LINE</td>
<td>1</td>
</tr>
</tbody>
</table>
6 Convenient Functions
6.8 Parameter Setting Function

- BUZZER WHEN POSITION TEACHING (S2C433)
  Refer to chapter 8.3.0.43 “S2C433: POSITION TEACHING BUZZER” at page 8-27.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSIDER</td>
<td>0</td>
</tr>
<tr>
<td>NOT CONSIDER</td>
<td>1</td>
</tr>
</tbody>
</table>

- STEP ONLY CHANGING (S2C203)
  Refer to chapter 8.3.0.6 “S2C203: CHANGING STEP ONLY” at page 8-13.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMIT</td>
<td>0</td>
</tr>
<tr>
<td>PROHIBIT</td>
<td>1</td>
</tr>
</tbody>
</table>

- RECT/CYL INDRICAL (S2C196)
  Refer to chapter 8.3.0.2 “S2C196: SELECTION OF CARTESIAN/ CYLINDRICAL” at page 8-12.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CYL.</td>
<td>0</td>
</tr>
<tr>
<td>RECT</td>
<td>1</td>
</tr>
</tbody>
</table>

- TOOL NO. SWITCH (S2C431)
  Refer to chapter 8.3.0.42 “S2C431: TOOL NO. SWITCHING” at page 8-27.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROHIBIT</td>
<td>0</td>
</tr>
<tr>
<td>PERMIT</td>
<td>1</td>
</tr>
</tbody>
</table>

- TOOL NO. INTERLOCK FOR STEP ENTRY(S2C234)
  Refer to chapter 8.3.0.29 “S2C234: STEP REGISTRATION AT TOOL NO. CHANGE” at page 8-19.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMIT</td>
<td>0</td>
</tr>
<tr>
<td>PROHIBIT</td>
<td>1</td>
</tr>
</tbody>
</table>

- POS. TEACH ONLY JOG CONTROL GROUP (S2C320)
  Refer to chapter 8.2.0.15 “S2C320: CONTROLLED GROUP JOB TEACHING POSITION CHANGE” at page 8-7.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROHIBIT</td>
<td>0</td>
</tr>
<tr>
<td>PERMIT</td>
<td>1</td>
</tr>
</tbody>
</table>
6 Convenient Functions

6.8 Parameter Setting Function

• **JOB UNDELETE FUNCTION (S2C413)**
  Refer to chapter 8.3.0.39 “S2C410: WORD REGISTRATION FUNCTION / WORD EDITING FUNCTION SPECIFICATION” at page 8-24.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>INVALID</td>
<td>0</td>
</tr>
<tr>
<td>VALID</td>
<td>1</td>
</tr>
</tbody>
</table>

• **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” at page 8-45.
  →This appears only when the independent control is valid.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SINGLE</td>
<td>0</td>
</tr>
<tr>
<td>ALL</td>
<td>1</td>
</tr>
</tbody>
</table>

• **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” at page 8-48.
  →This appears only when the independent control is valid.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Bit Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMIT</td>
<td>0</td>
</tr>
<tr>
<td>PROHIBIT</td>
<td>1</td>
</tr>
</tbody>
</table>

• **STATION TWIN (S2C434)**
  Refer to chapter 8.3.0.44 “S2C434: JOB LINKING DESIGNATION (When Twin Synchronous Function Used)” at page 8-27.
  →This appears only when the STATION TWIN SYNCHRONOUS JOB is valid.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>INVALID</td>
<td>0</td>
</tr>
<tr>
<td>VALID</td>
<td>1</td>
</tr>
</tbody>
</table>

• **CLEARANCE TEACHING METHOD (S2C612)**
  →This appears only when it is for motor gun use.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPPER TIP</td>
<td>0</td>
</tr>
<tr>
<td>LOWER TIP</td>
<td>1</td>
</tr>
<tr>
<td>GUN CLOSE</td>
<td>2</td>
</tr>
</tbody>
</table>
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” at page 8-17.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MM/SEC</td>
<td>0</td>
</tr>
<tr>
<td>CM/MIN</td>
<td>1</td>
</tr>
<tr>
<td>INCH/MIN</td>
<td>2</td>
</tr>
<tr>
<td>MM/MIN</td>
<td>3</td>
</tr>
</tbody>
</table>

• CYCLE SWITCH IN TEACH MODE (S2C313)
Refer to chapter 8.3.0.33 “S2C313: TEACH MODE FIRST CYCLE MODE” at page 8-20.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP</td>
<td>0</td>
</tr>
<tr>
<td>1 CYCLE</td>
<td>1</td>
</tr>
<tr>
<td>AUTO</td>
<td>2</td>
</tr>
<tr>
<td>NONE</td>
<td>3</td>
</tr>
</tbody>
</table>
### Convenient Functions

#### 6.8 Parameter Setting Function

- **CYCLE SWITCH IN PLAY MODE (S2C314)**
  Refer to chapter 8.3.0.34 “S2C314: PLAY MODE FIRST CYCLE MODE” at page 8-20.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP</td>
<td>0</td>
</tr>
<tr>
<td>1 CYCLE</td>
<td>1</td>
</tr>
<tr>
<td>AUTO</td>
<td>2</td>
</tr>
<tr>
<td>NONE</td>
<td>3</td>
</tr>
</tbody>
</table>

- **CYCLE SWITCH IN LOCAL MODE (S2C294)**
  Refer to chapter 8.3.0.31 “S2C294: LOCAL FIRST CYCLE MODE” at page 8-19.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP</td>
<td>0</td>
</tr>
<tr>
<td>1 CYCLE</td>
<td>1</td>
</tr>
<tr>
<td>AUTO</td>
<td>2</td>
</tr>
<tr>
<td>NONE</td>
<td>3</td>
</tr>
</tbody>
</table>

- **CYCLE SWITCH IN REMOTE MODE (S2C293)**
  Refer to chapter 8.3.0.30 “S2C293: REMOTE FIRST CYCLE MODE” at page 8-19.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP</td>
<td>0</td>
</tr>
<tr>
<td>1 CYCLE</td>
<td>1</td>
</tr>
<tr>
<td>AUTO</td>
<td>2</td>
</tr>
<tr>
<td>NONE</td>
<td>3</td>
</tr>
</tbody>
</table>

- **SET SYCLE ON POWER ON (S2C312)**
  Refer to chapter 8.3.0.32 “S2C312: POWER ON FIRST CYCLE MODE” at page 8-20.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP</td>
<td>0</td>
</tr>
<tr>
<td>1 CYCLE</td>
<td>1</td>
</tr>
<tr>
<td>AUTO</td>
<td>2</td>
</tr>
<tr>
<td>NONE</td>
<td>3</td>
</tr>
</tbody>
</table>
6 Convenient Functions
6.8 Parameter Setting Function

• SECURITY MODE WHEN POWER ON (S2C195)
  Refer to chapter 8.3.0.1 “S2C195: SECURITY MODE WHEN
  CONTROL POWER SUPPLY IS TURNED ON” at page 8-12.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPERATION MODE</td>
<td>0</td>
</tr>
<tr>
<td>EDITING MODE</td>
<td>1</td>
</tr>
<tr>
<td>MANAGEMENT MODE</td>
<td>2</td>
</tr>
</tbody>
</table>

• JOB STEP WHEN POWER ON (S2C215)
  Refer to chapter 8.3.0.15 “S2C215: ADDRESS SETTING WHEN
  CONTROL POWER IS TURNED ON” at page 8-15.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>POWER OFF</td>
<td>0</td>
</tr>
<tr>
<td>INITIAL</td>
<td>1</td>
</tr>
</tbody>
</table>

• GENERAL OUT KEEP WHEN POWER ON (S2C235)
  Refer to chapter 8.5.0.1 “S2C235: USER OUTPUT RELAY WHEN
  CONTROL POWER IS ON” at page 8-40.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>POWER OFF</td>
<td>0</td>
</tr>
<tr>
<td>INITIAL</td>
<td>1</td>
</tr>
</tbody>
</table>
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” at page 8-16.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMIT</td>
<td>0</td>
</tr>
<tr>
<td>PROHIBIT</td>
<td>1</td>
</tr>
</tbody>
</table>

- **PP START (S2C220)**
  Refer to chapter 8.3.0.20 “S2C220: PROGRAMMING PENDANT START” at page 8-16.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMIT</td>
<td>0</td>
</tr>
<tr>
<td>PROHIBIT</td>
<td>1</td>
</tr>
</tbody>
</table>

- **EXTERNAL MODE SWITCH (S2C225)**
  Refer to chapter 8.3.0.24 “S2C225: EXTERNAL MODE SWITCH” at page 8-17.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMIT</td>
<td>0</td>
</tr>
<tr>
<td>PROHIBIT</td>
<td>1</td>
</tr>
</tbody>
</table>
6 Convenient Functions
6.8 Parameter Setting Function

• EXTERNAL CYCLE SWITCH (S2C227)
  Refer to chapter 8.3.0.25 “S2C227: EXTERNAL CYCLE SWITCHING” at page 8-17.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMIT</td>
<td>0</td>
</tr>
<tr>
<td>PROHIBIT</td>
<td>1</td>
</tr>
</tbody>
</table>

• PP CYCLE SWITCH (S2C228)
  Refer to chapter 8.3.0.26 “S2C228: PROGRAMMING PENDANT CYCLE SWITCHING” at page 8-18.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMIT</td>
<td>0</td>
</tr>
<tr>
<td>PROHIBIT</td>
<td>1</td>
</tr>
</tbody>
</table>

• 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” at page 8-18.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Bit Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMIT</td>
<td>0</td>
</tr>
<tr>
<td>PROHIBIT</td>
<td>1</td>
</tr>
</tbody>
</table>
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” at page 8-14.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMIT</td>
<td>0</td>
</tr>
<tr>
<td>PROHIBIT</td>
<td>1</td>
</tr>
</tbody>
</table>

- **RESERVED START (S2C222)**
  Refer to chapter 8.3.0.22 “S2C222: RESERVED START” at page 8-17.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMIT</td>
<td>0</td>
</tr>
<tr>
<td>PROHIBIT</td>
<td>1</td>
</tr>
</tbody>
</table>

- **RESERVED START JOB CHANGE (S2C209)**
  Refer to chapter 8.3.0.11 “S2C209: RESERVED WORK JOB CHANGING OPERATION” at page 8-14.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMIT</td>
<td>0</td>
</tr>
<tr>
<td>PROHIBIT</td>
<td>1</td>
</tr>
</tbody>
</table>
6 Convenient Functions

6.8 Parameter Setting Function

• JOB SELECT WHEN REMOTE OR PLAY (S2C224)
  Refer to chapter 8.3.0.23 “S2C224: JOB SELECTION AT REMOTE FUNCTION (PLAY MODE)” at page 8-17.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMIT</td>
<td>0</td>
</tr>
<tr>
<td>PROHIBIT</td>
<td>1</td>
</tr>
</tbody>
</table>

• I/O-VARIABLE CUSTOMIZE FUNCTION (S2C397)
  Refer to chapter 8.3.0.38 “S2C397: I/O VARIABLE CUSTOMIZE FUNCTION” at page 8-23.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>INVALID</td>
<td>0</td>
</tr>
<tr>
<td>VALID</td>
<td>1</td>
</tr>
</tbody>
</table>

• GENERAO I/O NAME DISP. ON JOB (S2C544)
  Refer to chapter 8.3.0.46 “S2C544: I/O NAME DISPLAY FUNCTION FOR JOB” at page 8-29.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>INVALID</td>
<td>0</td>
</tr>
<tr>
<td>VALID</td>
<td>1</td>
</tr>
</tbody>
</table>

• ANTICIPATION FUNCTION (S2C646)
  Refer to chapter 8.8.0.1 “S2C646: ANTICIPATOR FUNCTION” at page 8-51.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>INVALID</td>
<td>0</td>
</tr>
<tr>
<td>VALID</td>
<td>1</td>
</tr>
</tbody>
</table>

• ALL AXES ANGLE DISP FUNCTION (S2C684 d0 bit)
  Refer to chapter 8.3.0.47 “S2C684: ALL AXES ANGLE DISPLAY FUNCTION” at page 8-29.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
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</thead>
<tbody>
<tr>
<td>INVALID</td>
<td>0</td>
</tr>
<tr>
<td>VALID</td>
<td>1</td>
</tr>
</tbody>
</table>
6.8.6 Jog Condition Setting

Select (SETUP) → {JOG CONDITION SETTING} to display the following window.

- COORD SWITCH WHEN JOG OPERATION (S2C197)
  Refer to chapter 8.3.0.3 "S2C197: COORDINATE SWITCHING PROHIBITED" at page 8-12.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOOL &amp; USER OK</td>
<td>0</td>
</tr>
<tr>
<td>TOOL NG</td>
<td>1</td>
</tr>
<tr>
<td>USER NG</td>
<td>2</td>
</tr>
<tr>
<td>TOOL &amp; USER NG</td>
<td>3</td>
</tr>
</tbody>
</table>

- MANUAL SPEED SAVE EVERY COORDS (S2C204)
  Refer to chapter 8.3.0.7 "S2C204: MANUAL SPEED STORING FOR EACH COORDINATE" at page 8-13.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>INVALID</td>
<td>0</td>
</tr>
<tr>
<td>VALID</td>
<td>1</td>
</tr>
</tbody>
</table>
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” at page 8-14.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMIT</td>
<td>0</td>
</tr>
<tr>
<td>PROHIBIT</td>
<td>1</td>
</tr>
</tbody>
</table>

- MASTER CALLING UP (S2C210)
  Refer to chapter 8.3.0.12 “S2C210: MASTER OR SUBMASTER CALL OPERATION IN PLAY MODE” at page 8-14.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERMIT</td>
<td>0</td>
</tr>
<tr>
<td>PROHIBIT</td>
<td>1</td>
</tr>
</tbody>
</table>

- INITIAL MOVE SPEED OF ROBOT (S2C217)
  Refer to chapter 8.3.0.17 “S2C217: INITIAL OPERATION OF MANIPULATOR” at page 8-16.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECIAL PLAY</td>
<td>0</td>
</tr>
<tr>
<td>LOW SPEED</td>
<td>1</td>
</tr>
</tbody>
</table>
### 6 Convenient Functions

#### 6.8 Parameter Setting Function

- **START METHOD AFTER ABSO OVER (S2C316)**
  Refer to *chapter 8.3.0.35 “S2C316: START CONDITION AFTER ALARM-4107 (“OUT OF RANGE (ABSO DATA)”)* at page 8-20.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>POS. CHECK</td>
<td>0</td>
</tr>
<tr>
<td>LOW SPEED</td>
<td>1</td>
</tr>
</tbody>
</table>

- **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”* at page 8-44.
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” at page 8-11.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASE</td>
<td>0</td>
</tr>
<tr>
<td>ROBOT</td>
<td>1</td>
</tr>
<tr>
<td>TOOL</td>
<td>2</td>
</tr>
<tr>
<td>USER #1</td>
<td>3</td>
</tr>
<tr>
<td>USER #63</td>
<td>65</td>
</tr>
</tbody>
</table>

- 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” at page 8-11.
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 programming pendant after setting any external axis to them.

CAUTION

- 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 Convenient Functions

6.9 Jog Key Allocation

6.9.2 Jog Key Allocation Setting

6.9.2.1 Allocation of the Jog Key

CAUTION

- 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 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 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”.

[Diagram of Jog Key Allocation Window]
6.9.2.3 Operating Method of Allocated External Axis

**CAUTION**

- When the same external axis (same group and axis number) is allocated to 7th- and 8th-[Axis Key]s, 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 Convenient Functions
6.10 Energy-Saving Function

6.10 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 (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.

CAUTION

This function is cancelled 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.

NOTE

This function will not be cancelled if the system input signal (signal to prohibit energy-saving #40580) is turned ON. This signal merely prohibits to shift the status to energy-saving status.
6.10 Energy-Saving Function

6.10.2 Energy-Saving Setting Method

6.10.2.1 Valid/Invalid of Energy-Saving Setting

**CAUTION**

- Valid/invalid of the energy-saving function is available only in the management mode while only confirmation of this function is available in the operation mode and edit mode.

1. Select {SETUP} under main menu.
2. Select {ENERGY SAVING FUNCTION}.
   - Energy-saving function window appears.
6 Convenient Functions
6.10 Energy-Saving Function

3. Move the cursor to “ENERGY SAVING FUNCTION” and press [SELECT].
   - Valid and invalid alternates at each press of [SELECT].

Press [SELECT].
6 Convenient Functions

6.10 Energy-Saving Function

4. Move the cursor to (SETTING TIME) and press [SELECT].
   – Input the time you want to start energy-saving after the robot is stopped into (SETTING TIME) section (unit: min.). The initial value is set to 10 min. and the range of the inputting value is from 1 to 60.

6.10.2.2 Accumulated Energy-Saving Time Clearance

1. Select (SETUP) under main menu.
2. Select (ENERGY SAVING FUNCTION).
   – Energy-saving function window appears.
3. Move the cursor to (ACCUMULATED ENERGY-SAVING TIME).
4. Move the cursor to (DATA) and press [SELECT].
   – “CLEAR ACCUMULATED” appears in the pull-down menu.
6 Convenient Functions
6.10 Energy-Saving Function

5. Select {CLEAR ACCUMULATED}
   – 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 main menu.
2. Select {ENERGY SAVING FUNCTION}.
   - 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 main menu.
2. Select {SPECIFIC OUTPUT}.
   - The specific 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 Displaying Color Setting Function

6.11.1 Setting the Instruction Displaying Color on the Job Window

With this function, each instruction can be displayed on a color to color basis on the job window.

Respective colors are specified on the following instruction basis.

- Move instruction
- DEVICE instruction
- Comment instruction
- Label instruction
- Macro instruction (when the macro function is effective)
- I/O instruction
- Instructions to which LINE EDIT LOCK is specified.
- Instructions 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 {Main Menu}.
2. Select {DISPLAY COLOR CONDITION SETTING}.
   – The display color condition setting window appears.

3. Move the cursor to the instruction to be changed and press [SELECT].
   – The list of the candidate colors for the instruction is displayed.
4. Select a color.
   - The color of each instruction is fixed.

5. Select JOB window.
   - Each instruction is displayed in the selected colors on the job window.
6 Convenient Functions
6.12 Present Manipulator Position Output Function

6.12.1 Outline
Output the present manipulator’s cartesian position (base coordinate) to the specified register.

6.12.2 Parameters
The following parameters specify the function and output register number.

<table>
<thead>
<tr>
<th>S1CxG</th>
<th>Meaning</th>
</tr>
</thead>
</table>
| 208   | Specify a function which outputs a specified value of the present cartesian position (base coordinate) to the register  
       | 0: invalid  
       | 1: Valid |
| 209   | Specify the output size to the register  
       | 0: 2 bytes output  
       | 1: 4 bytes output |
| 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   | Specify a function which outputs a FB value of the present cartesian position (base coordinate) to the register  
       | 0: invalid  
       | 1: Valid |
| 218   | Specify the output size to the register  
       | 0: 2 bytes output  
       | 1: 4 bytes output |
| 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 |
6 Convenient Functions
6.12 Present Manipulator Position Output Function

(Example 1)

<table>
<thead>
<tr>
<th>S1C1G</th>
<th>Setting value</th>
</tr>
</thead>
<tbody>
<tr>
<td>208</td>
<td>1</td>
</tr>
<tr>
<td>209</td>
<td>0</td>
</tr>
<tr>
<td>210</td>
<td>10</td>
</tr>
<tr>
<td>211</td>
<td>11</td>
</tr>
<tr>
<td>212</td>
<td>12</td>
</tr>
<tr>
<td>213</td>
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</tr>
<tr>
<td>214</td>
<td>14</td>
</tr>
<tr>
<td>215</td>
<td>15</td>
</tr>
<tr>
<td>216</td>
<td>16</td>
</tr>
</tbody>
</table>

When setting the parameter as above, the manipulator’s present cartesian 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]
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6 Convenient Functions

6.12 Present Manipulator Position Output Function

(Example 2)

<table>
<thead>
<tr>
<th>S1C1G</th>
<th>Setting value</th>
</tr>
</thead>
<tbody>
<tr>
<td>217</td>
<td>1</td>
</tr>
<tr>
<td>218</td>
<td>1</td>
</tr>
<tr>
<td>219</td>
<td>10</td>
</tr>
<tr>
<td>220</td>
<td>12</td>
</tr>
<tr>
<td>221</td>
<td>14</td>
</tr>
<tr>
<td>222</td>
<td>16</td>
</tr>
<tr>
<td>223</td>
<td>18</td>
</tr>
<tr>
<td>224</td>
<td>20</td>
</tr>
<tr>
<td>225</td>
<td>22</td>
</tr>
</tbody>
</table>

When setting the parameter as above, the manipulator’s present cartesian position is output to the registers as follows

M010= Lower 2 bytes of the manipulator’s present cartesian position (FB value) X [unit: µmm]
M011= Upper 2 bytes of the manipulator’s present cartesian position (FB value) X [unit: µmm]
M012= Lower 2 bytes of the manipulator’s present cartesian position (FB value) Y [unit: µmm]
M013= Upper 2 bytes of the manipulator’s present cartesian position (FB value) Y [unit: µmm]
M014= Lower 2 bytes of the manipulator’s present cartesian position (FB value) Z [unit: µmm]
M015= Upper 2 bytes of the manipulator’s present cartesian position (FB value) Z [unit: µmm]
M016= Lower 2 bytes of the manipulator’s present cartesian position (FB value) Rx [unit: 0.001deg]
M017= Upper 2 bytes of the manipulator’s present cartesian position (FB value) Rx [unit: 0.001deg]
M018= Lower 2 bytes of the manipulator’s present cartesian position (FB value) Ry [unit: 0.001deg]
M019= Upper 2 bytes of the manipulator’s present cartesian position (FB value) Ry [unit: 0.001deg]
M020= Lower 2 bytes of the manipulator’s present cartesian position (FB value) Rz [unit: 0.001deg]
M021= Upper 2 bytes of the manipulator’s present cartesian position (FB value) Rz [unit: 0.001deg]
M022= Lower 2 bytes of the manipulator’s present cartesian position (FB value) Re [unit: 0.001deg]
M023= Upper 2 bytes of the manipulator’s present cartesian position (FB value) Re [unit: 0.001deg]
• When validating the command value register output function (S1CxG208=1), never fail to set the output register number (S1CxG210 to 216) of each coordinate value.

• When validating the FB value register output function (S1CxG217=1), never fail to set the output register number (S1CxG219 to 225) of each coordinate value.

• In case 2 bytes is set as the register output size (S1CxG209=1 or S1CxG218=1), the unit of X, Y and Z-axes coordinate value becomes “mm” and that of Rx, Ry, Rz and Re coordinate value becomes “deg”. In both cases, only the lower 2 bytes are output.

• When setting 4 bytes to the register output size (S1CxG209=1 or S1CxG218=1), the unit of X, Y and Z-axes coordinate value becomes “µmm” and that of Rx, Ry, Rz and Re coordinate value becomes “0.0001deg”.

• When setting 4 bytes to the register output size (S1CxG209=1 or S1CxG218=1), upper byte of the coordinate value is output to the following register number to the specified output register number. In this consequence, confirm the register’s status of use before setting the output size to the register.
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

1. Select {ROBOT} in {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 (+) or 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 [DIRECT OPEN].
     • Press [Numeric Key].
     • Select the reserved display.
     • Switch the screen.
     • Switch the mode.
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6 Convenient Functions
6.13 Softlimit Setting Function

– 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 select [NO].

   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.

- 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 the 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 (Main Menu) {JOB}, then select the submenu {SELECT JOB}.
   - JOB LIST display appears.

2. Select {EDITING} under the pull-down menu {JOB}.
6 Convenient Functions

6.14 Job Edit Function During Playback

3. Select the job to be edited from JOB LIST.

![Image showing 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 the teach mode.

![Image showing Edit Job]

- Regarding restrictions on editing, refer to chapter 6.14.2.2 "Editing" at page 6-129.
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 "SUPPLEMENT" on the next page.
6.14.2.2 Editing

The data of the selected job (see the step 4 of chapter 6.14.2.1 “Basic Operation” at page 6-126) 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)” at page 6-130.

Fig. 6-1: Pull-down Menu (EDIT) * Cursor is on Line No.
6 Convenient Functions
6.14 Job Edit Function During Playback

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”.

6 Convenient Functions
6.14 Job Edit Function During Playback

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.

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 {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.
6 Convenient Functions

6.14 Job Edit Function During Playback

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 {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.
6 Convenient Functions
6.14 Job Edit Function During Playback

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.

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 the 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 the 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.

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 the 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 the 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 Convenient Functions

6.14 Job Edit Function During Playback

6.14.2.4 Canceling Write Request

The procedure to cancel a write request is described below.

**Canceling Write Request**

1. Select {Main Menu} {JOB}, then select the submenu {PLAY EDIT JOB LIST}, or select {Main Menu} {JOB}, then select the submenu {JOB EDIT (PLAY)}.

2. Select {WRITING CANCEL} under the pull-down menu {JOB}.
6 Convenient Functions
6.14 Job Edit Function During Playback

**CAUTION**

- When the mode switch is changed to the teach mode during job editing
  Even if the mode switch is changed to the teach mode without reflecting or canceling the edited data, the changed data will be saved. In this case, select {Main Menu} {JOB}, then select the submenu {SELECT JOB} or {PLAY EDIT JOB LIST} to edit data in the same manner as in the play mode. However, position teaching cannot be done.

  Regarding the job edited in the play mode, even after the mode is changed to the 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).

  - 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 Convenient Functions

6.15 Logging Function

6.15.1 Logging Function
The logging function allows to save the controller's operation and data editing history (log) in chronological order, and display them on the screen.
Users can select the log obtaining operation and store the log data to an external device.

6.15.2 Objected Data for Logging
The following data can be saved in this function:

- **OPERATION-related Data**
  - START, HOLD, and E-STOP (The operations in the remote mode are also saved in the log.)
  - Mode switching (PLAY/TEACH/REMOTE) (The operations in the remote mode are also saved in the log.)
  - Safety fence OPEN
  - Selecting jobs (including direct open)
  - Calling the master job
  - Initializing the files and jobs
  - Loading and saving files and jobs (normal termination/abnormal termination) (Loading and saving operations by the DCI function or the data transmission function are not saved in logs.)
  - Creating a new job, deleting, renaming, parallel shift job conversion, mirror shift conversion, PAM (position correcting during playback)
  - Changing the home position of the manipulator
  - Login/logoff (Only available when the password protection function (optional) is used.)

- **EDIT-related Data**
  - Job
    - Adding the instructions
    - Changing the requirements in the instructions
    - Deleting the instructions
    - The operation of cut, paste, and reverse paste
    - The operation of UNDO and REDO
    - Editing the job header
    - Line Edit Lock and the comment operation
    - Canceling all the line Edit Lock, canceling all the comment.
  - Editing the conditions file/general data
  - Editing the parameters
6 Convenient Functions
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- Editing the CIO
  Editing on the ladder program window. When compiling is executed, the edit histories (addition/changing/deletion of lines) are output. The recorded times are the actual times at which the lines were edited, so they may not match the time at which compiling was executed.

- Editing variables
  (The operations in the remote mode are not saved in the log.)

- Editing the I/O
  Logs of switching ON and OFF of the general input signals and general output signals are obtained.

**NOTE**
Only the editing operations by the user itself are targeted for log obtaining. Even if the variables or the I/O states are changed by executing the instructions in the job, they are not recorded in the log.

### 6.15.3 Number of Entries Stored in the Logs

The number of entries stored in the logs for each data is as follows:

- OPERATION-related Data: 100 entries
- EDIT-related Data: 200 entries

If the number of stored entries exceeds the number described above, old data will be deleted and the new data will be recorded.
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6.15.4 Operating Methods

6.15.4.1 Displaying Logs in List

The log list can be referred to with the following procedures:

Main menu → {SYSTEM INFO} → {LOGDATA}

Selecting {LOGDATA} displays the {LOGDATA} window.
The list of the logs to be displayed in the (LOGDATA) window can be arranged by the log types (OPERATION/EDIT). Selecting {DISPLAY} of the pull-down menu displays {ALL}, {OPERATION}, {EDITING}, and only the logs of the selected type will be displayed.

Displays only the OPERATION-related logs.

Displays only the EDIT-related logs.
6 Convenient Functions

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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 or EDIT.

- INDEX
- DATE
- EVENT
- LOGIN NAME
### Table 6-4: OPERATION-related Log

<table>
<thead>
<tr>
<th>Log Name</th>
<th>Remark</th>
<th>Items displayed in the detailed display section</th>
</tr>
</thead>
<tbody>
<tr>
<td>START</td>
<td>-</td>
<td>Series Job name Line number Current value -</td>
</tr>
<tr>
<td>HOLD</td>
<td>-</td>
<td>Series Job name Line number Current value -</td>
</tr>
<tr>
<td>ESP</td>
<td>-</td>
<td>Series Job name Line number Current value -</td>
</tr>
<tr>
<td>TEACH MODE</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PLAY MODE</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>REMOTE MODE</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SELECT JOB</td>
<td>-</td>
<td>Series Job name -</td>
</tr>
<tr>
<td>SAFETY FENCE OPEN</td>
<td>-</td>
<td>Series Job name Line number Current value -</td>
</tr>
<tr>
<td>MASTER JOB CALL</td>
<td>-</td>
<td>Series Job name -</td>
</tr>
<tr>
<td>FILE INIT</td>
<td>-</td>
<td>File name -</td>
</tr>
<tr>
<td>FILE LOAD END</td>
<td>-</td>
<td>File name -</td>
</tr>
<tr>
<td>FILE SAVE END</td>
<td>-</td>
<td>File name -</td>
</tr>
<tr>
<td>FILE LOAD ERROR</td>
<td>-</td>
<td>File name -</td>
</tr>
<tr>
<td>FILE SAVE ERROR</td>
<td>-</td>
<td>File name -</td>
</tr>
<tr>
<td>JOB CREATE</td>
<td>-</td>
<td>Job name -</td>
</tr>
<tr>
<td>JOB DELETE</td>
<td>-</td>
<td>Job name -</td>
</tr>
<tr>
<td>JOB RENAME</td>
<td>-</td>
<td>Job name -</td>
</tr>
<tr>
<td>PARALLEL SHIFT</td>
<td>-</td>
<td>Job name -</td>
</tr>
<tr>
<td>MIRROR SHIFT</td>
<td>-</td>
<td>Job name -</td>
</tr>
<tr>
<td>PAM</td>
<td>-</td>
<td>Job name -</td>
</tr>
<tr>
<td>ORG ABSO</td>
<td>-</td>
<td>Group number Axis number Setting Current value -</td>
</tr>
<tr>
<td>LOGIN</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LOGOUT</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
### Table 6-5: EDIT-related Log (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>Log Name</th>
<th>Remark</th>
<th>Items displayed in the detailed display section</th>
<th>Value after editing</th>
<th>Current value</th>
</tr>
</thead>
<tbody>
<tr>
<td>JOB EDIT(INS)</td>
<td>-</td>
<td>Series Job name Line number</td>
<td>Value after editing</td>
<td></td>
</tr>
<tr>
<td>JOB EDIT(MOD)</td>
<td>-</td>
<td>Series Job name Line number</td>
<td>Value after editing</td>
<td></td>
</tr>
<tr>
<td>JOB EDIT(DEL)</td>
<td>-</td>
<td>Series Job name Line number Deleted line</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>JOB EDIT(P. REG)</td>
<td>-</td>
<td>Series Job name Line number</td>
<td>Current value</td>
<td>-</td>
</tr>
<tr>
<td>JOB EDIT(P. MOD)</td>
<td>-</td>
<td>Series Job name Line number</td>
<td>Current value</td>
<td>-</td>
</tr>
<tr>
<td>JOB EDIT(CUT)</td>
<td>-</td>
<td>Series Job name Processing start position</td>
<td>Processing completion position</td>
<td>-</td>
</tr>
<tr>
<td>JOB EDIT(PASTE)</td>
<td>-</td>
<td>Series Job name Processing start position</td>
<td>Processing completion position</td>
<td>-</td>
</tr>
<tr>
<td>JOB EDIT(R. PST)</td>
<td>-</td>
<td>Series Job name Processing start position</td>
<td>Processing completion position</td>
<td>-</td>
</tr>
<tr>
<td>JOB EDIT(UNDO)</td>
<td>-</td>
<td>Series Job name - - -</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>JOB EDIT(REDO)</td>
<td>-</td>
<td>Series Job name - - -</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>JOB EDIT(HEADER)</td>
<td>Numeric value</td>
<td>Job name Element number Value before editing Value after editing</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>JOB EDIT(EDITLOCK)</td>
<td>-</td>
<td>Series Job name Processing start position</td>
<td>Processing completion position</td>
<td>-</td>
</tr>
<tr>
<td>JOB EDIT(EDITLOCK CLR)</td>
<td>-</td>
<td>Series Job name Processing start position</td>
<td>Processing completion position</td>
<td>-</td>
</tr>
<tr>
<td>JOB EDIT(EDITLOCK CLR ALL)</td>
<td>-</td>
<td>Series Job name Processing start position</td>
<td>Processing completion position</td>
<td>-</td>
</tr>
<tr>
<td>JOB EDIT(COMMENT)</td>
<td>-</td>
<td>Series Job name Processing start position</td>
<td>Processing completion position</td>
<td>-</td>
</tr>
<tr>
<td>JOB EDIT(COMMENT CLR)</td>
<td>-</td>
<td>Series Job name Processing start position</td>
<td>Processing completion position</td>
<td>-</td>
</tr>
<tr>
<td>JOB EDIT(COMMENT CLR ALL)</td>
<td>-</td>
<td>Series Job name Processing start position</td>
<td>Processing completion position</td>
<td>-</td>
</tr>
<tr>
<td>OTHER FILE EDT</td>
<td>Numeric value</td>
<td>File name Element number Value before editing Value after editing</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>PARAMETER EDIT</td>
<td>-</td>
<td>Parameter type Parameter number Value before editing Value after editing</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>LADDER EDIT(ADD)</td>
<td>-</td>
<td>Line number Value after editing System/User</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LADDER EDIT(CHG)</td>
<td>-</td>
<td>Line number Value after editing System/User</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LADDER EDIT(DEL)</td>
<td>-</td>
<td>Line number Deleted line System/User</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
### Table 6-5: EDIT-related Log (Sheet 2 of 2)

<table>
<thead>
<tr>
<th>Log Name</th>
<th>Remark</th>
<th>Items displayed in the detailed display section</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPILE</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>VARIABLE EDIT</td>
<td>Numeric value Variable type</td>
<td>Edit number</td>
</tr>
<tr>
<td></td>
<td>Character string Variable type</td>
<td>Edit number</td>
</tr>
<tr>
<td></td>
<td>Position variable Variable type</td>
<td>Edit number</td>
</tr>
<tr>
<td>I/O EDIT</td>
<td>-</td>
<td>I/O number</td>
</tr>
</tbody>
</table>
6.15.4.3 Updating Logging 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" or "EDIT", the confirmation dialog described above only when the log belongs to the displayed type is added and [SELECT] is pressed.
### 6.15.4.4 Deleting Logging 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 Operations to Acquire Logs

Selecting the operations whose logging data is to be acquired can avoid unnecessary logs from being acquired.

When selecting (Main Menu) → (SETUP) → (LOGDATA COND.), the LOGDATA CONDITION SETTING window appears.

Move the cursor to the item to which its logging data is the subject of acquisition, press [SELECT] and then "SAVE" and "NOT SAVE" alternate. Once "NOT SAVE" is selected to an item, its logging data would not be acquired even if "SAVE" is selected.
The item names and the targeted logs are as follows:

<table>
<thead>
<tr>
<th>Item Name</th>
<th>Target Log</th>
</tr>
</thead>
<tbody>
<tr>
<td>START OPERATION LOG</td>
<td>START</td>
</tr>
<tr>
<td>HOLD OPERATION LOG</td>
<td>HOLD</td>
</tr>
<tr>
<td>E. STOP OPERATION LOG</td>
<td>ESP</td>
</tr>
<tr>
<td>SAFETY FENCE LOG</td>
<td>SAFETY FENCE OPEN</td>
</tr>
<tr>
<td>MODE SWITCH LOG</td>
<td>• TEACH MODE</td>
</tr>
<tr>
<td></td>
<td>• PLAY MODE</td>
</tr>
<tr>
<td></td>
<td>• REMOTE MODE</td>
</tr>
<tr>
<td>JOB SELECTION LOG</td>
<td>SELECT JOB</td>
</tr>
<tr>
<td>MASTER JOB SELECTION LOG</td>
<td>MASTER JOB CALL</td>
</tr>
<tr>
<td>LOG ON/OFF LOG</td>
<td>• LOGIN</td>
</tr>
<tr>
<td></td>
<td>• LOGOUT</td>
</tr>
<tr>
<td>FILE INITIALIZE LOG</td>
<td>FILE INIT</td>
</tr>
<tr>
<td>FILE LOAD LOG</td>
<td>• FILE LOAD END</td>
</tr>
<tr>
<td></td>
<td>• FILE LOAD ERROR</td>
</tr>
<tr>
<td>FILE SAVE LOG</td>
<td>• FILE SAVE END</td>
</tr>
<tr>
<td></td>
<td>• FILE SAVE ERROR</td>
</tr>
<tr>
<td>JOB CREATE/DELETE LOG</td>
<td>• JOB CREATE</td>
</tr>
<tr>
<td></td>
<td>• JOB DELETE</td>
</tr>
<tr>
<td>JOB RENAME LOG</td>
<td>JOB RENAME</td>
</tr>
<tr>
<td>JOB SHIFT LOG</td>
<td>• PARALLEL SHIFT</td>
</tr>
<tr>
<td></td>
<td>• MIRROR SHIFT</td>
</tr>
<tr>
<td>JOB PAM LOG</td>
<td>PAM</td>
</tr>
<tr>
<td>ABSO SET LOG</td>
<td>ORG ABSO</td>
</tr>
<tr>
<td>JOB EDIT LOG</td>
<td>• JOB EDIT(INS)</td>
</tr>
<tr>
<td></td>
<td>• JOB EDIT(MOD)</td>
</tr>
<tr>
<td></td>
<td>• JOB EDIT(DEL)</td>
</tr>
<tr>
<td></td>
<td>• JOB EDIT(P. REG)</td>
</tr>
<tr>
<td></td>
<td>• JOB EDIT(P. MOD)</td>
</tr>
<tr>
<td>JOB CUT/PASTE LOG</td>
<td>• JOB EDIT(CUT)</td>
</tr>
<tr>
<td></td>
<td>• JOB EDIT(PASTE)</td>
</tr>
<tr>
<td></td>
<td>• JOB EDIT(R. PST)</td>
</tr>
<tr>
<td>JOB UNDO/REDO LOG</td>
<td>• JOB EDIT(UNDO)</td>
</tr>
<tr>
<td></td>
<td>• JOB EDIT(REDO)</td>
</tr>
<tr>
<td>JOB HEADER EDIT LOG</td>
<td>• JOB EDIT(HEADER)</td>
</tr>
<tr>
<td>LINE EDIT PROHIBIT/RELEASE LOG</td>
<td>• JOB EDIT(EDITLOCK)</td>
</tr>
<tr>
<td></td>
<td>• JOB EDIT(EDITLOCK CLR)</td>
</tr>
<tr>
<td></td>
<td>• JOB EDIT(EDITLOCK CLR ALL)</td>
</tr>
<tr>
<td>COMMENT/RELEASE LOG</td>
<td>• JOB EDIT(COMMENT)</td>
</tr>
<tr>
<td></td>
<td>• JOB EDIT(COMMENT CLR)</td>
</tr>
<tr>
<td></td>
<td>• JOB EDIT(COMMENT CLR ALL)</td>
</tr>
<tr>
<td>FILE EDIT LOG</td>
<td>OTHER FILE EDT</td>
</tr>
<tr>
<td>PARAMETER EDIT LOG</td>
<td>PARAMETER EDIT</td>
</tr>
<tr>
<td>VARIABLE EDIT LOG</td>
<td>VARIABLE EDIT</td>
</tr>
<tr>
<td>SIGNAL EDIT LOG</td>
<td>I/O EDIT</td>
</tr>
<tr>
<td>LADDER EDIT LOG</td>
<td>• LADDER EDIT(ADD)</td>
</tr>
<tr>
<td></td>
<td>• LADDER EDIT(CHG)</td>
</tr>
<tr>
<td></td>
<td>• LADDER EDIT(DEL)</td>
</tr>
</tbody>
</table>
6.16 Analog Output Function Corresponding to Speed

6.16.1 Overview

The analog output function corresponding to speed changes the analog output value automatically, according to the manipulator operating speed. This function does not need resetting of the analog output value according to the operating speed, so that the time required for job teaching can be reduced.

For example, when the thickness of sealing or painting should be constant, the discharged amount of seals or paints can be controlled by the manipulator operating speed.

For the analog output function corresponding to speed, the following circuit board is needed.

- Analog output expansion circuit board: JANCD-YEW02-E
6.16.2 Instructions

6.16.2.1 Instructions for Analog Output Function Corresponding to Speed

The instructions, ARATION and ARATIOF, are used for the analog output function corresponding to speed.

**ARATION**

The analog output function corresponding to speed is performed after executing ARATION instruction. This instruction is valid during circular interpolation, linear interpolation, or spline interpolation. It is executed only at playback or [FWD] operation; it is not executed during axis operation.

This instruction is also used when each set value for the analog output function corresponding to speed is to be changed.

\[
\text{ARATION AO#(1) BV=10.00 V=200.0 OFV=2.00}
\]

1. **Output port number**
   - General analog output port to execute the analog output corresponding to speed
   - Setting range: 1 to 40

2. **Basic voltage**
   - Voltage to be output at the speed set with the basic speed.
   - Setting range: -14.00 to +14.00V

3. **Basic speed**
   - Operating speed which becomes the basis for when the set voltage is output.
   - Setting range: 0.1 to 1500.0mm/sec
     - 1 to 9000cm/min

4. **Offset voltage**
   - Analog voltage when the operating speed is 0.
   - Setting range: -14.00 to +14.00V
According to the set value of the ARATION instruction, the output characteristics for the relation between the operating speed and the analog voltage are calculated. The analog output function corresponding to speed is executed depending on these output characteristics.

The following graph shows the output characteristics.

*Fig. 6-5: Output Characteristics When Analog Output Function Corresponding to Speed is Used*

![Graph showing output characteristics](image)

**NOTE**

When the analog output value exceeds ± 14.00 V because of the operating speed, the value is limited within ± 14.00 V.

- **ARATIOF**
  
  When the ARATIOF instruction is executed, the analog output corresponding to speed is completed, and the set offset voltage becomes the fixed output.

  
  **ARATIOF AO#(1)  
  ①**

  ① **Output port number**
  
  General analog output port to end the analog output corresponding to speed
  
  Setting range : 1 to 40
6 Convenient Functions

6.16 Analog Output Function Corresponding to Speed

6.16.2.2 Registration of Instructions

The instructions can be registered when the cursor is in the address area on the job content display in teach mode. Perform the following operations before registering an instruction.

1. Select {JOB} under {Main Menu}
2. Select {JOB CONTENT}
3. Move the cursor to the address area

- ARATION

1. Move the cursor to one line above the place to register the ARATION instruction

```
The line above the place to register
```

2. Press [INFORM LIST]
3. Select [IN/OUT]
   - The instruction list dialog appears.

4. Select “ARATION”
   - The ARATION instruction is indicated in the input buffer line.
5. Change any additional items and numerical values
   - <Register without changes>
     To register without changes, perform operation of step 6.
   - <Register with addition or change of the additional items>
     • To change the output port number
       In case of using [SHIFT] and the cursor, move the cursor to the
       output port number, and then press [SHIFT] and the cursor simul-
       taneously, to change the output port number.

     In case of using [Numeric Key]s, move the cursor to the output
     port number, and press [SELECT] to display an input buffer line.
     Enter the number, and then press [ENTER] to change the number
     displayed.

     • To change the basic voltage, the speed, and the offset voltage
       Move the cursor to the instruction in the input buffer line, and then
       press [SELECT]. The detail edit display is shown.

Move the cursor to “UNUSED” of the additional item to be
changed, and then press [SELECT]. The selection dialog is dis-
played.
Move the cursor to the additional item to be changed, and press
[SELECT].
6 Convenient Functions

6.16 Analog Output Function Corresponding to Speed

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.

The line where ARATIOF instruction is registered.

<table>
<thead>
<tr>
<th>Command</th>
<th>Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0030</td>
<td>MVCL</td>
<td>Y=138</td>
</tr>
<tr>
<td>0031</td>
<td>ARATIOF</td>
<td>A(1)</td>
</tr>
<tr>
<td>0032</td>
<td>MVCL</td>
<td>Y=138</td>
</tr>
</tbody>
</table>

ARATIOF

1. Move the cursor to one line above the place to register ARATIOF instruction

The line above the place to register ARATIOF instruction.

<table>
<thead>
<tr>
<th>Command</th>
<th>Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0030</td>
<td>MVCL</td>
<td>Y=138</td>
</tr>
<tr>
<td>0031</td>
<td>IN/OUT</td>
<td>A(1)</td>
</tr>
<tr>
<td>0032</td>
<td>MVCL</td>
<td>Y=138</td>
</tr>
</tbody>
</table>

2. Press [INFORM LIST]

3. Select [IN/OUT]

– The instruction list dialog appears.

4. Select “ARATIOF”

– The ARATIOF instruction is indicated in the input buffer line.

5. Press [INSERT] and [ENTER]

– The ARATIOF instruction is registered.

<table>
<thead>
<tr>
<th>Command</th>
<th>Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0030</td>
<td>MVCL</td>
<td>Y=138</td>
</tr>
<tr>
<td>0031</td>
<td>ARATIOF</td>
<td>A(1)</td>
</tr>
<tr>
<td>0032</td>
<td>MVCL</td>
<td>Y=138</td>
</tr>
</tbody>
</table>
6.16.2.3 Analog Output Display

The current settings can be confirmed on the analog output window.

1. Select {IN/OUT} in the {Main Menu}
2. Select {ANALOG OUTPUT}
   - The analog output window appears.
     The output terminal numbers which follow the AOUT4 can be switched and displayed by pressing [PAGE].
6.16.3 Examples

6.16.3.1 Examples of Output Characteristics

The graph below shows the change in the output characteristics when the following job is done.

![Graph showing output characteristics]

- MOVJ \( V_J = 50.00 \)
- ARATION AO#(1) \( B_V = 7.00 \) \( V = 150.0 \) \( O_F V = -10.00 \) \( 7.00 \)
- MOVL \( V = 50.0 \) \( -4.33 \)
- MOVC \( V = 100.0 \) \( 1.33 \)
- MOVC \( V = 100.0 \) \( 1.33 \)
- MOVC \( V = 100.0 \) \( 1.33 \)
- MOVL \( V = 200.0 \) \( 12.67 \)
6.16 Analog Output Function Corresponding to Speed

6.16.3.2 Example of Variation of Operating Speed and Analog Output Value

The following graph shows the change of the analog output according to the speed variation.

MOVL V=200.0

ARATION AO#(1) BV=10.00 V=200.0 OFV=-2.00

MOVC V=150.0

MOVC VR=20.0 (When the tool center point speed is 100 mm/s)

MOVC V=150.0

MOVL V=180.0

MOVL (When the tool center point speed is 180 mm/s)

AOUT AO#(1) 10.00

Fig. 6-6: Analog Voltage according to Speed

<table>
<thead>
<tr>
<th>Analog voltage (V)</th>
<th>Operating speed (mm/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>8.8</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>150</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

• Since the analog output corresponding to speed is made for the calculated speed, there may be little difference from the actual operating speed of the manipulator.

• When a posture speed is specified, the analog output corresponding to speed is made for the operating speed at the tool center point with the posture speed.
6.16.4 Filter Process

In the analog output function corresponding to speed, the output analog signal can be filtered by setting a filter constant at the parameters.

6.16.4.1 When Parameter is Set to “0”

The analog signal according to the speed reference (the speed determined by a path operation) is output.

6.16.4.2 When Parameter is Set to Values Other Than “0”

The analog signal according to the speed of filtered speed reference is output. By the filter process, the output signal can be close to the manipulator’s actual speed.

6.16.4.3 Parameter Setting

Adjust the settings of parameters during actual operations.

Table 6-6: Parameter (Sheet 1 of 3)

<table>
<thead>
<tr>
<th>Parameter Number</th>
<th>Analog Output</th>
<th>Content</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3C1111</td>
<td>Analog output No.1</td>
<td>Primary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1112</td>
<td>Analog output No.1</td>
<td>Secondary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1113</td>
<td>Analog output No.2</td>
<td>Primary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1114</td>
<td>Analog output No.2</td>
<td>Secondary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1115</td>
<td>Analog output No.3</td>
<td>Primary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1116</td>
<td>Analog output No.3</td>
<td>Secondary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1117</td>
<td>Analog output No.4</td>
<td>Primary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1118</td>
<td>Analog output No.4</td>
<td>Secondary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1119</td>
<td>Analog output No.5</td>
<td>Primary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1120</td>
<td>Analog output No.5</td>
<td>Secondary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1121</td>
<td>Analog output No.6</td>
<td>Primary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1122</td>
<td>Analog output No.6</td>
<td>Secondary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1123</td>
<td>Analog output No.7</td>
<td>Primary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1124</td>
<td>Analog output No.7</td>
<td>Secondary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1125</td>
<td>Analog output No.8</td>
<td>Primary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1126</td>
<td>Analog output No.8</td>
<td>Secondary filter constant</td>
<td>msec</td>
</tr>
</tbody>
</table>
### Table 6-6: Parameter (Sheet 2 of 3)

<table>
<thead>
<tr>
<th>Parameter Number</th>
<th>Analog Output</th>
<th>Content</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3C1127</td>
<td>Analog output No.9</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1128</td>
<td>Analog output No.9</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1129</td>
<td>Analog output No.10</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1130</td>
<td>Analog output No.10</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1131</td>
<td>Analog output No.11</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1132</td>
<td>Analog output No.11</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1133</td>
<td>Analog output No.12</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1134</td>
<td>Analog output No.12</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1135</td>
<td>Analog output No.13</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1136</td>
<td>Analog output No.13</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1137</td>
<td>Analog output No.14</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1138</td>
<td>Analog output No.14</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1139</td>
<td>Analog output No.15</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1140</td>
<td>Analog output No.15</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1141</td>
<td>Analog output No.16</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1142</td>
<td>Analog output No.16</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1143</td>
<td>Analog output No.17</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1144</td>
<td>Analog output No.17</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1145</td>
<td>Analog output No.18</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1146</td>
<td>Analog output No.18</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
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<tr>
<td>S3C1147</td>
<td>Analog output No.19</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1148</td>
<td>Analog output No.19</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1149</td>
<td>Analog output No.20</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1150</td>
<td>Analog output No.20</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1151</td>
<td>Analog output No.21</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1152</td>
<td>Analog output No.21</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1153</td>
<td>Analog output No.22</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1154</td>
<td>Analog output No.22</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1155</td>
<td>Analog output No.23</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1156</td>
<td>Analog output No.23</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1157</td>
<td>Analog output No.24</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1158</td>
<td>Analog output No.24</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1159</td>
<td>Analog output No.25</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1160</td>
<td>Analog output No.25</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1161</td>
<td>Analog output No.26</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1162</td>
<td>Analog output No.26</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1163</td>
<td>Analog output No.27</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1164</td>
<td>Analog output No.27</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1165</td>
<td>Analog output No.28</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1166</td>
<td>Analog output No.28</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1167</td>
<td>Analog output No.29</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1168</td>
<td>Analog output No.29</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1169</td>
<td>Analog output No.30</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1170</td>
<td>Analog output No.30</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1171</td>
<td>Analog output No.31</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1172</td>
<td>Analog output No.31</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1173</td>
<td>Analog output No.32</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1174</td>
<td>Analog output No.32</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1175</td>
<td>Analog output No.33</td>
<td>Primary filter constant</td>
<td>[msec]</td>
</tr>
<tr>
<td>S3C1176</td>
<td>Analog output No.33</td>
<td>Secondary filter constant</td>
<td>[msec]</td>
</tr>
</tbody>
</table>
6 Convenient Functions
6.16 Analog Output Function Corresponding to Speed

Table 6-6: Parameter  (Sheet 3 of 3)

<table>
<thead>
<tr>
<th>Parameter Number</th>
<th>Analog Output</th>
<th>Content</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3C1177</td>
<td>Analog output No.34</td>
<td>Primary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1178</td>
<td>Analog output No.34</td>
<td>Secondary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1179</td>
<td>Analog output No.35</td>
<td>Primary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1180</td>
<td>Analog output No.35</td>
<td>Secondary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1181</td>
<td>Analog output No.36</td>
<td>Primary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1182</td>
<td>Analog output No.36</td>
<td>Secondary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1183</td>
<td>Analog output No.37</td>
<td>Primary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1184</td>
<td>Analog output No.37</td>
<td>Secondary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1185</td>
<td>Analog output No.38</td>
<td>Primary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1186</td>
<td>Analog output No.38</td>
<td>Secondary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1187</td>
<td>Analog output No.39</td>
<td>Primary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1188</td>
<td>Analog output No.39</td>
<td>Secondary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1189</td>
<td>Analog output No.40</td>
<td>Primary filter constant</td>
<td>msec</td>
</tr>
<tr>
<td>S3C1190</td>
<td>Analog output No.40</td>
<td>Secondary filter constant</td>
<td>msec</td>
</tr>
</tbody>
</table>

The standard parameter settings are as follows.

- For small capacity robot with a payload 6 kg and 16 kg
  Primary filter constant : 50 msec
  Secondary filter constant : 50 msec

- For large capacity robot with a payload 60 kg and 130 kg
  Primary filter constant : 100 msec
  Secondary filter constant : 100 msec
6.16.5 Precautions

6.16.5.1 When Analog Output Corresponding to Speed is Interrupted

If the manipulator is stopped for some reason and the editing operation is performed, the analog output corresponding to speed is interrupted. This interruption is performed in all output terminals, and the analog voltage fixed immediately before the interruption is output to each output terminal.

The analog output corresponding to speed is not interrupted in any other cases.

6.16.5.2 When More than One Manipulator is Used

The attribute of the job where the instruction is executed determines the manipulator where the analog output corresponding to speed is performed.

For a coordinated job, the analog output corresponding to speed is performed at the operating speed of the manipulator at the slave side.
6 Convenient Functions

6.17 QR Code Creation Function

6.17.1 Outline

This function codifies the status of the DX200 (system configuration, alarm information, or current position data, etc.) into a QR code and displays it on the programming pendant display.

By using this function, user can send the current status of DX200 to YASKAWA representative rapidly and accurately when making inquiries or an abnormality happened.

Also, with an Android application called “MOTOMAN Touch!”, user can send both the QR code pasted on the DX200 in which its serial number, etc. are codified and its circumstantial pictures to the YASKAWA representative at a time. This application enables to send correct information in a short period of time and helps customer to reduce down time accordingly.
<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 section 6.17.5 “Operation Method”.

- [START]
- [HOLD]
- [E.STOP] button
- 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.

- When sending data using “MOTOMAN Touch!”, set a call center at your YASKAWA representative. Otherwise, reply from YASKAWA may delay.
6.17 QR Code Creation Function

6.17.2 Main Function

Main specifications of QR Code Creation function

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>QR Code Data</td>
<td>• ALARM (the latest four alarms)</td>
</tr>
<tr>
<td></td>
<td>• ALARM HISTORY (the latest ten alarms at each alarm)</td>
</tr>
<tr>
<td></td>
<td>MAJOR FAILURE ALARM</td>
</tr>
<tr>
<td></td>
<td>MINOR FAILURE ALARM</td>
</tr>
<tr>
<td></td>
<td>USER ALARM (SYSTEM)</td>
</tr>
<tr>
<td></td>
<td>USER ALARM (USER)</td>
</tr>
<tr>
<td></td>
<td>OFF-LINE ALARM</td>
</tr>
<tr>
<td></td>
<td>• MONITORING TIME</td>
</tr>
<tr>
<td></td>
<td>SYS MONITORING TIME</td>
</tr>
<tr>
<td></td>
<td>SERVRO POWER TIME</td>
</tr>
<tr>
<td></td>
<td>PLAYBACK TIME</td>
</tr>
<tr>
<td></td>
<td>MOVING TIME</td>
</tr>
<tr>
<td></td>
<td>OPERATING TIME</td>
</tr>
<tr>
<td></td>
<td>• HOME POSITION</td>
</tr>
<tr>
<td></td>
<td>• CURRENT POSITION</td>
</tr>
<tr>
<td></td>
<td>• SERVO MONITOR</td>
</tr>
<tr>
<td>Note:</td>
<td>Only “ALARM” and “ALARM HISTORY” data are available in the maintenance mode.</td>
</tr>
<tr>
<td>Function</td>
<td>• Operations executed by a key</td>
</tr>
<tr>
<td></td>
<td>Display switch ([FWD] or [BWD])</td>
</tr>
<tr>
<td></td>
<td>Completion of the</td>
</tr>
<tr>
<td></td>
<td>QR Code Creation Function</td>
</tr>
<tr>
<td></td>
<td>• Operations executed by a button on the display</td>
</tr>
<tr>
<td></td>
<td>Display switch (“Next”, “Back”, or “First”.)</td>
</tr>
<tr>
<td></td>
<td>Completion of the</td>
</tr>
<tr>
<td></td>
<td>QR Code Creation Function</td>
</tr>
<tr>
<td>QR Code Format</td>
<td>• Format type 10 to 18 (automatically set according to the number of data)</td>
</tr>
<tr>
<td></td>
<td>• Data 8-bit byte (binary)</td>
</tr>
<tr>
<td></td>
<td>• Error correction level</td>
</tr>
<tr>
<td></td>
<td>Level M</td>
</tr>
<tr>
<td></td>
<td>• Maximum number of data in a QR code</td>
</tr>
<tr>
<td></td>
<td>560-byte at maximum</td>
</tr>
<tr>
<td></td>
<td>(when the format type is 18)</td>
</tr>
</tbody>
</table>

The QR Code Creation function is applicable from version DN1.52-00 and later.
Main specifications of “MOTOMAN Touch!”

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading/Displaying of the DX200 serial number, etc.</td>
<td>Read the QR code on the DX200 with the smart phone QR code reader, and then displays the serial number, etc.</td>
</tr>
<tr>
<td>Reading/Displaying of the DX200 alarm history, etc.</td>
<td>Read the QR code on the programming with the smart phone QR code reader, and then displays the alarm history, etc.</td>
</tr>
<tr>
<td>Picture attachment</td>
<td>Attach circumstantial pictures to an e-mail.</td>
</tr>
<tr>
<td>Send mail</td>
<td>Attach above mentioned QR code data and pictures to an e-mail and send it to the in charge call center. (use the mailer)</td>
</tr>
</tbody>
</table>

“MOTOMAN Touch!” is an application which operates in Android 4.0.3 (API level 15) 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.
6.17.3 QR Code Creation Function Start-Up Method

6.17.3.1 Start-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.
6.17.3.2 Start-up the function by selecting {UTILITY} under the pull down menu → {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.
6.17 QR Code Creation Function

6.17.3.3 Start-up the function by selecting {UTILITY} under the pull down menu → {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 Convenient Functions

6.17 QR Code Creation Function

6.17.4 Display Configuration

The window for the QR Code Creation Function consists of two areas.

- Data for QR code select area
- QR code display area

![QR Code Creation Window](image)

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}

<table>
<thead>
<tr>
<th>Normal display</th>
<th>Active display</th>
<th>No display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Next</td>
<td>Next</td>
<td>Next</td>
</tr>
</tbody>
</table>

The QR code number and the total number of QR codes are displayed in the QR code display area.
6 Convenient Functions
6.17 QR Code Creation Function

6.17.5 Operation Method

6.17.5.1 Data for QR Code Select Area

Select data to be codified into a QR code and press {Create} button. A QR code appears.
For the above mentioned operation, use programming pendant keys or directly touch the display.
When using the programming pendant keys, following keys are available.

■ Cursor
  • Shift the area to be focused

■ [SELECT]
  • When the focus is In the list area of data to be codified into a QR code, select a data to be codified into the QR code
  • When the focus is on {Create}, create a QR code

■ [PAGE]
  • Display the following QR code one by one (if more than two QR codes are created)
  • Display the previous QR code by pressing [SHIFT] + [PAGE].

■ [AREA]
  • Shift the area to be focused

■ [CANCEL]
  • Complete the QR Code Creation Function.

6.17.5.2 QR Code Display Area

Display a QR code or switch QR codes one by one.
For the above mentioned operation, use programming pendant keys or directly touch the display.
When using the programming pendant keys, following keys are available.

■ Cursor
  • Shift the area to be focused

■ [SELECT]
  • When the focus is on {Return}:
    Display the first QR code
  • When the focus is on {Back}:
    Display the previous QR code
  • When the focus is on {Next}:
    Display the next QR code
  • When the focus is on {Close}:
    Complete the QR Code Creation Function.

■ [PAGE]
  • Display the following QR code one by one (if more than two QR codes are created)
  • Display the previous QR code by pressing [SHIFT] + [PAGE].
6 Convenient Functions

6.17 QR Code Creation Function

- [AREA]
  - Shift the area to be focused

- [CANCEL]
  - Complete the QR Code Creation Function.

6.17.6 QR Code Structure

6.17.6.1 Basic Structure

The basic structure 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 employed 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 Convenient Functions

6.17 QR Code Creation Function

6.17.6.2 Data Header

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Version</td>
<td>??x.xx</td>
</tr>
<tr>
<td>2</td>
<td>Year, month, date</td>
<td>YYMMDD</td>
</tr>
<tr>
<td>3</td>
<td>Time</td>
<td>HHTT</td>
</tr>
</tbody>
</table>

Note: "?": any one character, "***": any line, "X": any number

1. Version
   Structure: "??x.xx"
   ?? : Version of the controller
      If the controller is DX200, “D2” is indicated.
   x.xx : Version of the QR Code Creation function (decimal number)

2. Year, Month, Date
   Structure: "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
   Structure: "HHTT"
   HH : Hour when the QR code is created
   TT : Minute when the QR code is created
6.17 QR Code Creation Function

6.17.6.3 System Information

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>System version</td>
<td><em>.x.xx</em>(*)-xx</td>
</tr>
<tr>
<td>2</td>
<td>Parameter version</td>
<td>xx.xx</td>
</tr>
<tr>
<td>3</td>
<td>Purpose of system</td>
<td>*</td>
</tr>
</tbody>
</table>

Note: "?": any single character, "*": any line, "X": any number

1. System version
   Structure : "*.x.xx*(*)-xx"
   System version number displayed on the version window

2. Parameter version
   Structure : "xx.xx"
   Parameter version number displayed on the version window

3. Purpose of system
   Structure : " * "
   Purpose of system displayed on the version window
6 Convenient Functions

6.17 QR Code Creation Function

6.17.4 Alarm

Four alarms can be codified into the QR code at maximum in ascending order.

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alarm data code</td>
<td>&lt;Alarm&gt;</td>
</tr>
<tr>
<td>2</td>
<td>Alarm data</td>
<td>Refer to “Alarm Data”.</td>
</tr>
</tbody>
</table>

1. Alarm data code

   Structure :"<Alarm>"

   The first line of the alarm data

**Alarm Data**

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alarm number</td>
<td>xxxx</td>
</tr>
<tr>
<td>2</td>
<td>Sub code</td>
<td>*</td>
</tr>
<tr>
<td>3</td>
<td>Information about options</td>
<td>*</td>
</tr>
<tr>
<td>4</td>
<td>Date of alarm occurrence</td>
<td>YYYY/MM/DD</td>
</tr>
<tr>
<td>5</td>
<td>Time of alarm occurrence</td>
<td>HH:TT:SS</td>
</tr>
</tbody>
</table>

Note: "?": any single character, "*" : any line, "X": any number

1. Alarm number

   Structure :"xxxx"

   Alarm number

2. Sub code

   Structure :" * "

   Sub code

   Only the inverted characters are displayed if there are.

Example: Sub code

\[
\text{ALARM 4414 TASK#2 EXCESSIVE SEGMENT} \\
\text{[R1 : HIGH SLPRT]} \\
\text{[R1 : HIGH : RT]} \\
\]

3. Information about options

   Structure :" * "

   Sub code

   Information about options
6 Convenient Functions

6.17 QR Code Creation Function

4. Date of alarm occurrence
   Structure : "YYYY/MM/DD"
   Date when the alarm occurred

5. Time of alarm occurrence
   Structure : "HH:TT:SS"
   Time when the alarm occurred

6.17.6.5 Alarm History

The latest ten alarms, in the order of registration, for each alarm can be codified.

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alarm history data code</td>
<td>&lt;ALARM HISTORY&gt;</td>
</tr>
<tr>
<td>2</td>
<td>Major failure alarm code</td>
<td>MAJOR</td>
</tr>
<tr>
<td>3</td>
<td>Major failure alarm data</td>
<td>Refer to &quot;Alarm Data&quot;</td>
</tr>
<tr>
<td>4</td>
<td>Minor failure alarm code</td>
<td>MINOR</td>
</tr>
<tr>
<td>5</td>
<td>Minor failure alarm data</td>
<td>Refer to &quot;Alarm Data&quot;</td>
</tr>
<tr>
<td>6</td>
<td>User alarm (system) code</td>
<td>IO_SYS</td>
</tr>
<tr>
<td>7</td>
<td>User alarm (system) data</td>
<td>Refer to &quot;Alarm Data&quot;</td>
</tr>
<tr>
<td>8</td>
<td>User alarm (user) code</td>
<td>IO_USR</td>
</tr>
<tr>
<td>9</td>
<td>User alarm (user) data</td>
<td>Refer to &quot;Alarm Data&quot;</td>
</tr>
<tr>
<td>10</td>
<td>OFF line alarm code</td>
<td>OFFLINE</td>
</tr>
<tr>
<td>11</td>
<td>OFF line alarm data</td>
<td>Refer to &quot;Alarm Data&quot;</td>
</tr>
</tbody>
</table>

1. Alarm history data code
   Structure : "<ALARM HISTORY>"
   The first line of the alarm history data

2. Major failure alarm code
   Structure : "<MAJOR>"
   The first line of the major failure alarm data

4. Minor failure alarm code
   Structure : "<MINOR>"
   The first line of the minor failure alarm data

6. User alarm (system) code
   Structure : "IO_SYS"
   The first line of the user (system) alarm data

8. User alarm (user) code
   Structure : "IO_USR"
   The first line of the user (user) alarm data

10. OFF line alarm code
    Structure : "OFFLINE"
    The first line of the OFF line alarm data
6 Convenient Functions
6.17 QR Code Creation Function

- **Alarm History Data**
- Following shows the structure of the alarm history data (one line).

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alarm number</td>
<td>xxxxx</td>
</tr>
<tr>
<td>2</td>
<td>Sub code</td>
<td>*</td>
</tr>
<tr>
<td>3</td>
<td>Mode</td>
<td>*</td>
</tr>
<tr>
<td>4</td>
<td>Information about options</td>
<td>*</td>
</tr>
<tr>
<td>5</td>
<td>Date of alarm occurrence</td>
<td>YYYY/MM/DD</td>
</tr>
<tr>
<td>6</td>
<td>Time of alarm occurrence</td>
<td>HH:TT:SS</td>
</tr>
</tbody>
</table>

*Note: “?” : any single character, “*” : any line, “X” : any number*

1. **Alarm number**
   - Structure :“xxxx”
   - Alarm number

2. **Sub code**
   - Structure :“*”
   - Sub code
   - Only the inverted characters are displayed if there are.

   Example: Sub code
   
   ![Sub Code Example]
   
   [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
### 6.17.6.6 Monitoring Time

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Monitoring time data code</td>
<td><code>&lt;MONITORING TIME&gt;</code></td>
</tr>
<tr>
<td>2</td>
<td>System monitoring time code</td>
<td><code>SYS MONITORING TIME</code></td>
</tr>
<tr>
<td>3</td>
<td>System monitoring time data</td>
<td>Refer to ■ “System Monitoring Time Data”</td>
</tr>
<tr>
<td>4</td>
<td>Servo power time code</td>
<td><code>SERVO POWER TIME</code></td>
</tr>
<tr>
<td>5</td>
<td>Servo power time data</td>
<td>Refer to ■ “Data for Servo Power Time, Play Back Time and Moving Time”</td>
</tr>
<tr>
<td>6</td>
<td>Play back time code</td>
<td><code>PLAY BACK</code></td>
</tr>
<tr>
<td>7</td>
<td>Play back time data</td>
<td>Refer to ■ “Data for Servo Power Time, Play Back Time and Moving Time”</td>
</tr>
<tr>
<td>8</td>
<td>Moving time code</td>
<td><code>MOVING TIME</code></td>
</tr>
<tr>
<td>9</td>
<td>Moving time data</td>
<td>Refer to ■ “Data for Servo Power Time, Play Back Time and Moving Time”</td>
</tr>
<tr>
<td>10</td>
<td>Operating time code</td>
<td><code>OPERATING TIME</code></td>
</tr>
<tr>
<td>11</td>
<td>Operating time data</td>
<td>Refer to ■ “Data for Servo Power Time, Play Back Time and Moving Time”</td>
</tr>
</tbody>
</table>

1. Monitoring time data code
   - Structure : `<MONITORING TIME>`
   - The first line of the monitoring time data

2. System monitoring time code
   - Structure : `SYSTEM MONITORING TIME`
   - The first line of the system monitoring time data

4. Servo power time code
   - Structure : `SERVO POWER TIME`
   - The first line of the servo power time data

6. Play back time code
   - Structure : `PLAYBACK TIME`
   - The first line of the play back time data

8. Moving time code
   - Structure : `MOVING TIME`
   - The first line of the moving time data

10. Operating time code
    - Structure : `OPERATING TIME`
    - The first line of the operating time data
6 Convenient Functions
6.17 QR Code Creation Function

System Monitoring Time Data
Following shows the structure of the system monitoring time data (one line).

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Item code</td>
<td>&quot;*&quot;</td>
</tr>
<tr>
<td>2</td>
<td>Starting date of measurement</td>
<td>YY/MM/DD</td>
</tr>
<tr>
<td>3</td>
<td>Starting time of measurement</td>
<td>HH:TT</td>
</tr>
<tr>
<td>4</td>
<td>Elapsed time</td>
<td>xxxxx:xx'xx</td>
</tr>
</tbody>
</table>

Note: "?": any single character, "*": any line, "X": any number

1. Item code
   Structure : "*"
   - CONTROL POWER
   - SERVO POWER
   - PLAYBACK TIME
   - MOVING TIME
   - OPERATING TIME
   - ENERGY TIME

2. Starting date of measurement
   Structure : "YY/MM/DD"
   Date when the measurement is started

3. Starting time of measurement
   Structure : "HH:TT"
   Time when the measurement is started

4. Elapsed time
   Structure : "xxxxx:xx'xx"
   Elapsed time since the measurement is started
   (do not use "0".)
6 Convenient Functions

6.17 QR Code Creation Function

- **Data for Servo Power Time, Play Back Time and Moving Time**

Following shows the structure of the servo power time data, play back time data and moving time data (one line).

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Control group</td>
<td>*</td>
</tr>
<tr>
<td>2</td>
<td>Starting date of measurement</td>
<td>YY/MM/DD</td>
</tr>
<tr>
<td>3</td>
<td>Starting time of measurement</td>
<td>HH:TT</td>
</tr>
<tr>
<td>4</td>
<td>Elapsed time</td>
<td>xxxxx:xx’xx</td>
</tr>
</tbody>
</table>

Note: “?” : any single character, “*” : any line, “X” : any number

1. Control group
   - Structure : “?xx”
   - Control group
     - Robot : R1 to R8
     - Base : B1 to B8
     - Station : S1 to S24

(Setting is unnecessary if the control group does not exist in the system.

2. Starting date of measurement
   - Structure : “YY/MM/DD”
   - Date when the measurement is started

3. Starting time of measurement
   - Structure : “HH:TT”
   - Time when the measurement is started

4. Elapsed time
   - Structure : “xxxxx:xx’xx”
   - Elapsed time since the measurement is started
   (do not use “0”.)
6 Convenient Functions
6.17 QR Code Creation Function

■ Operating Time Data

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Purpose of operation</td>
<td>*</td>
</tr>
<tr>
<td>2</td>
<td>Starting date of measurement</td>
<td>YY/MM/DD</td>
</tr>
<tr>
<td>3</td>
<td>Starting time of measurement</td>
<td>HH:TT</td>
</tr>
<tr>
<td>4</td>
<td>Elapsed time</td>
<td>xxxxx:xx‘xx”</td>
</tr>
</tbody>
</table>

Note: “?” : any single character, “*” : any line, “X” : any number

1. Purpose of operation
   Structure : “*”
   Purpose of this operation
   (Setting is unnecessary if the control group does not exist in the system.

2. Starting date of measurement
   Structure : “YY/MM/DD”
   Date when the measurement is started

3. Starting time of measurement
   Structure : “HH:TT”
   Time when the measurement is started

4. Elapsed time
   Structure : “xxxxxx:xx’xx”
   Elapsed time since the measurement is started
   (do not use “0”.)
6 Convenient Functions

6.17 QR Code Creation Function

6.17.6.7 Home Position

---

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Home position data code</td>
<td><code>&lt;HOME POSITION&gt;</code></td>
</tr>
<tr>
<td>2</td>
<td>Home position data</td>
<td>Refer to ▶ “Home Position Data”.</td>
</tr>
</tbody>
</table>

1. Home position data code

Structure :“ `<HOME POSITION>` ”

The first line of the home position data

### Home Position Data

Following shows the structure of the home position data (one line).

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Control group (robot / station)</td>
<td>'?xx'</td>
</tr>
<tr>
<td>2</td>
<td>Axis name 1 to 8 : Absolute data 1 to 8</td>
<td>'?:-xxxxxx • • •'</td>
</tr>
<tr>
<td>3</td>
<td>Control group (base)</td>
<td>'?xx'</td>
</tr>
<tr>
<td>4</td>
<td>Axis name 1 to 8 : Absolute data 1 to 8</td>
<td>'?:-xxxxxx • • •'</td>
</tr>
</tbody>
</table>

**Note:** 

- "?": any single character, "*": any line, "X": any number

1. Control group (robot / station)

Structure :“ '?xx' ”

Control group

- Robot :R1 to R8
- Station :S1 to S24

(Setting is unnecessary if the control group does not exist in the system.)

2. Axis name: Absolute data

Structure :“ '?:-xxxxxx • • •' ”

- :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)

Structure :“ '?xx' ”

Control group

- Base :B1 to B8

(Setting is unnecessary if this control group does not exist in the system.)
6 Convenient Functions

6.17 QR Code Creation Function

4. Axis name: Absolute data
   Structure: “?:-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.)

6.17.6.8 Current Position

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Current position data code</td>
<td>&lt;CURRENT POSITION&gt;</td>
</tr>
<tr>
<td>2</td>
<td>Current position data</td>
<td>Refer to “Current Position Data (Pulse coordinate)” and section 6.8.2 “Teaching Condition Setting”.</td>
</tr>
</tbody>
</table>

1. Current position data code
   Structure: “<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 structure of the current position data (one line).

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coordinate</td>
<td>*</td>
</tr>
<tr>
<td>2</td>
<td>Tool</td>
<td>TOOL:xx</td>
</tr>
<tr>
<td>3</td>
<td>Control group (robot / station)</td>
<td>?xx</td>
</tr>
<tr>
<td>4</td>
<td>Axis name 1 to 8:Absolute data 1 to 8</td>
<td>?:xxxxx...</td>
</tr>
<tr>
<td>5</td>
<td>Control group (base)</td>
<td>?xx</td>
</tr>
<tr>
<td>6</td>
<td>Axis name 1 to 8:Absolute data 1 to 8</td>
<td>?:xxxxx...</td>
</tr>
</tbody>
</table>

Note: “?”: any single character, “*”: any line, “X”: any number
6 Convenient Functions
6.17 QR Code Creation Function

1. Coordinate
   Structure :“* ”
   * :PULSE (pulse coordinate)

2. Tool
   Structure :“ TOOL:xx”
   xx :00 to 63 (tool number)

3. Control group (robot / station)
   Structure :“?xx ”
   Control group
   Robot :R1 to R8
   Station :S1 to S24
   (Setting is unnecessary if this control group does not exist in the system.)

4. Axis name: Current position data
   Structure :“?::-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)
   Structure :“?xx ”
   Base :B1 to B8
   (Setting is unnecessary if this control group does not exist in the system.)

6. Axis name: Current position data
   Structure :“?: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
6 Convenient Functions
6.17 QR Code Creation Function

Current Position Data (Base / user / robot coordinate)
Following shows the structure of the current position data (base / user / robot coordinate (one line)).

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coordinate</td>
<td>*</td>
</tr>
<tr>
<td>2</td>
<td>Tool</td>
<td>TOOL:xx</td>
</tr>
<tr>
<td>3</td>
<td>Control group (robot)</td>
<td>?xx</td>
</tr>
<tr>
<td>4</td>
<td>X-axis coordinate</td>
<td>X:-xxx.xxxmm</td>
</tr>
<tr>
<td>5</td>
<td>Y-axis coordinate</td>
<td>Y:-xxx.xxxmm</td>
</tr>
<tr>
<td>6</td>
<td>Z-axis coordinate</td>
<td>Z:-xxx.xxxmm</td>
</tr>
<tr>
<td>7</td>
<td>Rx angle</td>
<td>Rx:-xxx.xxxxxdeg.</td>
</tr>
<tr>
<td>8</td>
<td>Ry angle</td>
<td>Ry:-xxx.xxxxxdeg.</td>
</tr>
<tr>
<td>9</td>
<td>Rz angle</td>
<td>Rz:-xxx.xxxxxdeg.</td>
</tr>
<tr>
<td>10</td>
<td>Re angle (7-axis robot)</td>
<td>Re:-xxx.xxxxxdeg.</td>
</tr>
<tr>
<td>11</td>
<td>Figure (front or back)</td>
<td><em>:</em></td>
</tr>
<tr>
<td>12</td>
<td>Figure (up or down)</td>
<td><em>:</em></td>
</tr>
<tr>
<td>13</td>
<td>Figure (flip or no flip)</td>
<td><em>:</em></td>
</tr>
<tr>
<td>14</td>
<td>X0-axis coordinate (base)</td>
<td>X0:-xxx.xxxmm</td>
</tr>
<tr>
<td>15</td>
<td>Y0-axis coordinate (base)</td>
<td>Y0:-xxx.xxxmm</td>
</tr>
<tr>
<td>16</td>
<td>Z0-axis coordinate (base)</td>
<td>Z0:-xxx.xxxmm</td>
</tr>
</tbody>
</table>

Note: “?” : any single character, “*” : any line, “X” : any number

1. Item code
   - Structure :“*”
     - * :ROBOT (robot coordinate)
     - :BASE (base coordinate)
     - :USER#1 to USER#63 (user coordinate)

2. Tool
   - Structure :“TOOL:xx”
     - xx :00 to 63 (tool number)

3. Control group
   - Structure :“?xx”
   - Control group
     - Robot :R1 to R8
     (Setting is unnecessary if this control group does not exist in the system.)

4. X-axis coordinate
   - Structure :“X:-xxx.xxxmm”
     - - (- minus sign)
     (Setting is unnecessary if the data is not a negative data.)
     - xxx.xxx- ... :Current position data (unit: mm)
6 Convenient Functions

6.17 QR Code Creation Function

5. Y-axis coordinate
   Structure:  "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
   Structure:  "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
   Structure:  "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
   Structure:  "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
   Structure:  "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
    Structure:  "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)
    Structure:  "*:*"
    * :FRONT
    REAR
    * :S<180
    S>=180
6 Convenient Functions
6.17 QR Code Creation Function

12. Figure (up or down)
   Structure :"*:*
   * :UP
   * :DOWN
   * :R<180
   * :R>=180
   xxx.xxx- • :Current position data (unit: deg)

13. Figure (frip or no flip)
   Structure :"*:*
   * :FLIP
   * :NO FLIP
   * :T<180
   * :T>=180
   xxx.xxx- • :Current position data (unit: deg)

14. X0-axis coordinate
   Structure :" X0:xxx.xxxmm"
   - : (minus sign)
   (Setting is unnecessary if the data is not a negative data.)
   xxx.xxx- • :Current position data (unit: deg)

15. Y0-axis coordinate
   Structure :" Y0:xxx.xxxmm"
   - : (minus sign)
   (Setting is unnecessary if the data is not a negative data.)
   xxx.xxx- • :Current position data (unit: deg)

16. Z0-axis coordinate
   Structure :" Z0:xxx.xxxmm"
   - : (minus sign)
   (Setting is unnecessary if the data is not a negative data.)
   xxx.xxx- • :Current position data (unit: deg)
### Servo Monitor

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Servo monitor data code</td>
<td><code>&lt;SERVO MONITOR&gt;</code></td>
</tr>
<tr>
<td>2</td>
<td>Feedback pulse code</td>
<td>FEEDBACK PULSE</td>
</tr>
<tr>
<td>3</td>
<td>Feedback pulse data</td>
<td>Refer to ■ “Servo Monitor Data”.</td>
</tr>
<tr>
<td>4</td>
<td>Error pulse code</td>
<td>ERROR PULSE</td>
</tr>
<tr>
<td>5</td>
<td>Error pulse data</td>
<td>Refer to ■ “Servo Monitor Data”.</td>
</tr>
<tr>
<td>6</td>
<td>Speed deviation code</td>
<td>SPEED DEVIATION</td>
</tr>
<tr>
<td>7</td>
<td>Speed deviation data</td>
<td>Refer to ■ “Servo Monitor Data”.</td>
</tr>
<tr>
<td>8</td>
<td>Speed instruction code</td>
<td>SPEED INST</td>
</tr>
<tr>
<td>9</td>
<td>Speed instruction data</td>
<td>Refer to ■ “Servo Monitor Data”.</td>
</tr>
<tr>
<td>10</td>
<td>Speed feedback code</td>
<td>FEEDBACK SPEED</td>
</tr>
<tr>
<td>11</td>
<td>Speed feedback data</td>
<td>Refer to ■ “Servo Monitor Data”.</td>
</tr>
<tr>
<td>12</td>
<td>Torque instruction code</td>
<td>TORQUE SPEC</td>
</tr>
<tr>
<td>13</td>
<td>Torque instruction data</td>
<td>Refer to ■ “Servo Monitor Data”.</td>
</tr>
<tr>
<td>14</td>
<td>Maximum torque code</td>
<td>MAX TORQUE</td>
</tr>
<tr>
<td>15</td>
<td>Maximum torque data</td>
<td>Refer to ■ “Servo Monitor Data”.</td>
</tr>
<tr>
<td>16</td>
<td>Encoder accumulative rotation code</td>
<td>ENCODER ROTATE SUM</td>
</tr>
<tr>
<td>17</td>
<td>Encoder accumulative rotation data</td>
<td>Refer to ■ “Servo Monitor Data”.</td>
</tr>
<tr>
<td>18</td>
<td>Position code in 1 turn</td>
<td>IN 1 TURN POSITION</td>
</tr>
<tr>
<td>19</td>
<td>Position data in 1 turn</td>
<td>Refer to ■ “Servo Monitor Data”.</td>
</tr>
<tr>
<td>20</td>
<td>Motor absolute value code</td>
<td>MOTOR ABSOLUTE</td>
</tr>
<tr>
<td>21</td>
<td>Motor absolute value data</td>
<td>Refer to ■ “Servo Monitor Data”.</td>
</tr>
<tr>
<td>22</td>
<td>Encoder temperature code</td>
<td>ENCODER TEMP.</td>
</tr>
<tr>
<td>23</td>
<td>Encoder temperature data</td>
<td>Refer to ■ “Servo Monitor Data”.</td>
</tr>
<tr>
<td>24</td>
<td>Maximum torque (constant speed) code</td>
<td>MAX TRQ (CONST)</td>
</tr>
<tr>
<td>25</td>
<td>Maximum torque (constant speed) data</td>
<td>Refer to ■ “Servo Monitor Data”.</td>
</tr>
<tr>
<td>26</td>
<td>Minimum torque (constant speed) code</td>
<td>MIN TRQ (CONST)</td>
</tr>
<tr>
<td>27</td>
<td>Minimum torque (constant speed) data</td>
<td>Refer to ■ “Servo Monitor Data”.</td>
</tr>
<tr>
<td>28</td>
<td>Motor torque load ratio code</td>
<td>MOTOR DUTY CYCLE</td>
</tr>
<tr>
<td>29</td>
<td>Motor torque load ratio data</td>
<td>Refer to ■ “Servo Monitor Data”.</td>
</tr>
<tr>
<td>30</td>
<td>Load ratio measure time code</td>
<td>MEASURE TIME DUTY</td>
</tr>
<tr>
<td>31</td>
<td>Load ratio measure time data</td>
<td>Refer to ■ “Servo Monitor Data”.</td>
</tr>
</tbody>
</table>

1. **Servo monitor data code**
   - **Structure**: `<SERVO MONITOR>`
   - The first line of the servo monitor data

2. **Feedback pulse code**
   - **Structure**: `FEEDBACK PULSE`
   - The first line of the feedback pulse data
6 Convenient Functions
6.17 QR Code Creation Function

4. Error pulse code
   Structure : "ERROR PULSE"
   The first line of the error pulse data

6. Speed deviation code
   Structure : "SPEED DEVIATION"
   The first line of the speed deviation data

8. Speed instruction code
   Structure : "SPEED INST"
   The first line of the speed instruction data

10. Speed feedback code
    Structure : "FEEDBACK SPEED"
    The first line of the speed feedback data

12. Torque instruction code
    Structure : "TORQUE SPEC"
    The first line of the torque instruction data

14. Maximum torque code
    Structure : "MAX TORQUE"
    The first line of the maximum torque data

16. Encoder accumulative rotation code
    Structure : "ENCODER ROTATION SUM"
    The first line of the encoder accumulative rotation data

18. Position code in 1 turn
    Structure : "IN 1 TURN POSITION"
    The first line of the position data in 1 turn

20. Motor absolute value code
    Structure : "MOTOR ABSOLUTE"
    The first line of the motor absolute value data

22. Encoder temperature code
    Structure : "ENCODER TEMP."
    The first line of the encoder temperature data

24. Maximum torque (constant speed) code
    Structure : "MAX TRQ(CONST)"
    The first line of the maximum torque (constant speed) data

26. Minimum torque (constant speed) code
    Structure : "MIN TRQ(CONST)"
    The first line of the minimum torque (constant speed) data

28. Motor torque load ratio code
    Structure : "MOTOR DUTY CYCLE"
    The first line of the motor torque load ratio data

30. Load ratio measure time code
    Structure : "MEASURE TIME DUTY"
    The first line of the load ratio measure time data
6 Convenient Functions

6.17 QR Code Creation Function

■ Servo Monitor Data

Following shows the structure of the servo monitor (one line).

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Control group (robot / station)</td>
<td>?xx</td>
</tr>
<tr>
<td>2</td>
<td>Axis name 1 to 8 : Servo monitor data 1 to 8</td>
<td>?:-xxxxx • • •</td>
</tr>
<tr>
<td>3</td>
<td>Control group (base)</td>
<td>?xx</td>
</tr>
<tr>
<td>4</td>
<td>Axis name 1 to 8 : Servo monitor data 1 to 8</td>
<td>?:-xxxxx • • •</td>
</tr>
</tbody>
</table>

Note: “?” : any single character, “*” : any line, “X” : any number

1. Control group (robot / station)

   Structure : “ ?xx ”

2. Axis name: Servo monitor data

   Structure : “ ?:-xxxxx • • • ”

   ? : S, L, U, R, B, T, E, 1, 2, 3, 4, 5, 6 (axis name)

   - : -(minus sign)

   (Setting is unnecessary if the data is not a negative data.)

   xxxxx• • • : Current position data

5. Control group (base)

   Structure : “ ?xx ”

   Base : B1 to B8

   (Setting is unnecessary if this control group does not exist in the system.)

6. Axis name: Servo monitor data

   Structure : “ ?:-xxxxx • • • ”

   ? : 1, 2, 3, 4, 5, 6 (axis name)

   - : -(minus sign)

   (Setting is unnecessary if the data is no a negative data.)

   xxxxx• • • : Current position data
6 Convenient Functions

6.17 QR Code Creation Function

6.17.7 MOTOMAN Touch!

6.17.7.1 Installing Method of MOTOMAN Touch! (In case downloading from Google Play is not available)

1. Connect a smart phone to the PC using an USB cable.
2. Start Explorer on the PC, and then copy “MOTOMAN Touch.apk” file and paste it in the “Download” folder on the smart phone (refer to fig. 6-7).
3. Tap the Download folder in the file manager of the smart phone (refer to fig. 6-8).
4. Tap “MOTOMAN Touch.apk” (refer to fig. 6-9).
5. Tap {Settings} when “Install blocked” dialog box appeared (refer to fig. 6-10).

Fig. 6-7:

Fig. 6-8:

Fig. 6-9:

Fig. 6-10:
6 Convenient Functions
6.17 QR Code Creation Function

**Setting of “apk file” install permission to smart phone**

1. Scroll to find “Security” screen and then check “Unknown sources” (refer to fig. 6-11 and fig. 6-12).
2. Tap {OK} on the “Unknown sources” dialog box (refer to fig. 6-13).
3. Tap {Install} (refer to fig. 6-14).
6 Convenient Functions
6.17 QR Code Creation Function

6.17.7 Start-Up MOTOMAN Touch! Application

1. Tap “MOTOMAN Touch!” icon.

2. “Software License Agreement” screen appears at the first start-up. Confirm it and tap {Agree} (refer to fig. 6-15).

3. “MOTOMAN Touch!” log-in screen appears. Tap {Use without log-in} (refer to fig. 6-16).

   CAUTION

   • Log-in function is not available yet.

4. “MOTOMAN Touch!” home screen appears (refer to fig. 6-17).
   - Basic operation
     • To return to the previous screen, press return button on the smart phone.
     • To return to the “MOTOMAN Touch!” home screen, tap the robot icon on the screen.

---

Fig. 6-15: Software License Agreement
Fig. 6-16: MOTOMAN Touch!
Fig. 6-17: MOTOMAN Touch!

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斑点和弧焊

使用电动枪

6.17 QR码创建函数

6.17.7 启动MOTOMAN Touch！应用程序

1. 点击“MOTOMAN Touch!”图标。

2. “软件许可协议”屏幕出现在第一次启动时。确认它并点击{Agree}（参见图6-15）。

3. “MOTOMAN Touch!”登录屏幕出现。点击{Use without log-in}（参见图6-16）。

   CAUTION

   • 登录功能尚未启用。

4. “MOTOMAN Touch!”主屏幕出现（参见图6-17）。
   - 基本操作
     • 要返回上一个屏幕，请按手机上的返回按钮。
     • 要返回到“MOTOMAN Touch!” 主屏幕，请点击屏幕上的机器人图标。
6.17.7.3 Setting of Call Center

Initially set a call center as a destination of the e-mail. This setting is necessary for the use of “MOTOMAN Touch!”.

The e-mail created with “MOTOMAN Touch!” application is sent to this call center.

1. Tap “Call center information setting” on the “MOTOMAN Touch!” home screen (refer to fig. 6-17).

2. Tap the pen mark at the very bottom of the "Call Center Information" screen (refer to fig. 6-18).

3. Tap the vacant box next to “Country” on the “Call Center Select” screen (refer to fig. 6-19).

4. Select a country where the user is (refer to fig. 6-20).

5. Choose and tap your YASKAWA representative on “Company/Office” screen (refer to fig. 6-21).

6. The screen returns to “MOTOMAN Touch!” home screen and shows the details of the YASKAWA representative the customer has chosen (refer to fig. 6-22).

7. To return to “MOTOMAN Touch!” home screen, press return button on the smart phone (refer to fig. 6-23).
6.17.4 Registration of Customer Information

Initially set the corresponding information. To the e-mail address set in this chapter, an reply mail is returned from the call center to which the customer has sent the QR code information. In this consequence, set the information correctly.

1. Tap (Registration of Customer Info) on the “MOTOMAN Touch!” home screen (refer to fig. 6-17).
2. Input data to “Company name”, “Address”, “Post Code”, “Country”, and “Name” (refer to fig. 6-25).
3. Tap the check mark at the bottom of the screen (refer to fig. 6-26).

**CAUTION**

- Tap the check mark to save the input customer information to the smart phone memory.

To confirm the saved customer information, return to the “MOTOMAN Touch!” home screen, and then tap (Registration of Customer Info) (refer to fig. 6-26).

**Fig. 6-24:**

- Customer Information
  - Company name
  - Address
  - Post Code
  - Country
  - Name
  - E-mail Address
  - Phone Number

**Fig. 6-25:**

- Customer Information
  - Company Name
  - Address
  - Post Code
  - Country
  - Name

**Fig. 6-26:**

- Customer Information
  - Company Name
  - Address
  - Post Code
  - Country
  - Name
  - E-mail Address
  - Phone Number
6.17.7.5 Reading of Product Code

This function reads the QR code pasted on the DX200. Setting of this function is necessary for the use of “MOTOMAN Touch!”.

1. Tap {Product code reading} on the “MOTOMAN Touch!” home screen (refer to fig. 6-17).

2. Start the camera function of the “MOTOMAN Touch!” (refer to fig. 6-27). Focus the QR code on the DX200 so that it is captured in the red square.

3. When the QR code is successfully captured, “Serial number of product” appears on “Product Information” screen (refer to fig. 6-28). Tap the mail button and proceed to the step described in section 6.17.7.7 “Inquiry Mail”.

CAUTION

- Use zoom or flash function in accordance with the imaging condition. If the image is not appropriately auto focused, touch the QR code in the screen to adjust the focus.
6 Convenient Functions

6.17 QR Code Creation Function

6.17.7.6 Calling Up of the Product Code

Up to 100 QR codes can be called up again on “Reading history of product code” screen.

1. Tap (Reading history of product code) on the “MOTOMAN Touch!” home screen (refer to fig. 6-17).

2. Tap the desired QR code on “Reading history of product code” screen (refer to fig. 6-29) to see the serial number of the product (refer to fig. 6-28).

3. Tap the mail button and proceed to the next step (section 6.17.7.7 “Inquiry Mail”).

CAUTION

- To delete all the history, tap the deleting button at the bottom of the screen. Please be careful that the deleted history data is never restored again.
After reading the QR code of the product, user can choose attaching data and send an e-mail to the customer’s call center on this screen (refer to fig. 6-30).

1. {Add controller data (Read the QR code)}
   With this button, reading of the DX200 QR code displayed on the programming pendant window and sending of the code by attaching to an e-mail are available.
   (In this case, this code is not left in the creation history.)

2. {Attach photo}
   Attaching of pictures already taken by the smart phone to an e-mail is available. Tap this button to open the photo gallery and select desired pictures one by one. It is not possible to select all the desired pictures at a time.

3. {e-mail sending}
   This button enables to send a QR code of a product to the customer’s call center. If the DX200 QR code and pictures are already selected, they are also sent as attachments.

   There are three ways of accessing methods to the call center:

   - **{QR code transmission only}:**
     Send an inquiry e-mail
     This method is employed if corresponding with the call center through phone call is already started. The QR code information is sent as supplementary information.

   - **{QR code transfer and incoming call}:
     Make a phone call to the call center after sending an inquiry e-mail
     This method is employed if the customer is planning to make an inquiry phone call to the call center after sending the e-mail.

   - **{Call back request with QR code}:
     Require a phone call from the call center after sending an inquiry e-mail
     This method is employed if the customer requires a reply call from the call center after sending the e-mail.

![Fig. 6-30: Inquiry Email](image)
6 Convenient Functions

6.17 QR Code Creation Function

6.17.8 Sending Method of Controller Data

1. Tap {Add controller data (Read the QR code)} on the “Inquiry Email” screen (refer to fig. 6-30).

2. “QR codes that has already been read” screen appears and those QR codes are displayed (Refer to fig. 6-31). No codes are displayed at the beginning.

3. Tap camera button 📸.

4. The camera function starts (refer to fig. 6-32). Focus the QR code on the programming pendant so that it is captured in the red square.

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use zoom 📸 or flash ⚡ function in accordance with the imaging condition. If the image is not appropriately auto focused, touch the QR code in the screen to adjust the focus.</td>
</tr>
</tbody>
</table>

5. When the QR code is successfully captured, the product information appears on {Controller Data} screen (refer to fig. 6-33).

6. Repeat the above mentioned step 3 📸 to take more than two codes (refer to fig. 6-34).

7. After all the codes are read, tap the complete button ✔️ (refer to fig. 6-34).

8. “Inquiry Email” screen appears again. The box on the left side of {Add controller data (Read the QR code)} button is checked to report that reading of all the codes are complete (refer to fig. 6-35).
6 Convenient Functions
6.17 QR Code Creation Function
6 Convenient Functions
6.17 QR Code Creation Function

6.17.7.9 Attaching Method of Picture

1. Tap {Attach photo} on “Inquiry Email” screen (refer to fig. 6-30).
2. Select {Gallery} on the application selecting screen (refer to fig. 6-36).
3. Tap to choose desired pictures in the photo gallery (refer to fig. 6-37). Only one picture is chosen to attach at a time, therefore, to choose more than two desired pictures, return to “Inquiry Email” screen (refer to fig. 6-38) and tap a desired one each time choosing the picture.
4. Total memory capacity of the pictures chosen is indicated at the bottom of {Attach photo} button (refer to fig. 6-38).
5. Tap the cancellation button when cancelling the attached photos.
6.17.7.10 Sending an E-Mail: Transmission type (QR code transmission only)

1. Tap {e-mail sending} on “Inquiry Email” screen (refer to fig. 6-30).

2. Select {QR code transmission only} on the “Transmission type” dialog box, and then tap {OK} (refer to fig. 6-39).

(Supplementary Explanation)
From the next time, the “Transmission type” selected in this step is repeatedly and automatically selected.

3. Tap {OK} on “e-mail sending” screen (refer to fig. 6-40).

(Supplementary Explanation)
On this screen, the transmission type can be selected by not only tapping {OK}, but also by tapping the indication, {QR code transmission only}.
Furthermore, by tapping the indication of the call center, which is right below the “e-mail address”, customer can change the e-mail sending address.

4. Select a mailer on “e-mail sending” screen, here, tap {Gmail} as an example (refer to fig. 6-41).

5. The selected mailer starts-up, title of the {QR code transmission only} mail and QR code information are posted to this mail, and the selected pictures are attached. Also, the customer information registered on {Registration of Customer Info} screen is posted at the end of the mail (refer to fig. 6-42).

6. The e-mail is finally sent out with some messages if any.

Gmail is a trademark of Google Inc.
6.17.7.11 Sending an E-Mail: Transmission type (QR code transfer and incoming call)

1. Tap {e-mail sending} on "Inquiry Email" screen (refer to fig. 6-30).
2. Select {QR code transfer and incoming call} on the "Transmission type" dialog box, and then tap {OK} (refer to fig. 6-39).

(Supplementary Explanation)
From the next time, the "Transmission type" selected in this step is repeatedly and automatically selected.
3. Tap {OK} on "e-mail sending" screen (refer to fig. 6-43).

(Supplementary Explanation)
On this screen, the transmission type can be selected by not only tapping {OK}, but also by tapping the indication, {QR code transfer and incoming call}.
Furthermore, by tapping the indication of the call center, which is right below the "e-mail address", customer can change the e-mail sending address. This modification is reflected to the call center information. And the newly selected e-mail address appears prior to other addresses from the next time.
4. Select a mailer on "e-mail sending" screen, here, tap {Gmail} as an example (refer to fig. 6-41).
5. The selected mailer starts-up, title of the {QR code transfer and incoming call} mail and QR code information are posted to this mail, and the selected pictures are attached. Also, the customer information registered on (Registration of Customer Info) screen is posted at the end of the mail (refer to fig. 6-41).
6. The e-mail is finally sent out with some messages if any.
7. When the screen returns to "e-mail sending" screen (refer to fig. 6-43) after the e-mail is successfully sent, tap a telephone number indicated right below "Phone number of call center".
8. Select a telephone application (refer to fig. 6-44). Here, tap {Dial}.
9. The call center phone number is posted to the dial application. Tap the call button to make a phone call (refer to fig. 6-45).

Fig. 6-43:  
Fig. 6-44:  
Fig. 6-45:
6.17.7.12 Sending an E-Mail: Transmission type (Call back request with QR code)

1. Tap {e-mail sending} on “Inquiry Email” screen (refer to fig. 6-30).
2. Select {Call back request with QR code} on the “Transmission type” dialog box, and then tap {OK} (refer to fig. 6-39).

(Supplementary Explanation)
From the next time, the “Transmission type” selected in this step is repeatedly and automatically selected.

3. Tap {OK} on “e-mail sending” screen (refer to fig. 6-46).

(Supplementary Explanation)
On this screen, the transmission type can be selected by not only tapping {OK}, but also by tapping the indication, {Call back request with QR code}.

Furthermore, by tapping the indication of the call center, which is right below the “e-mail address”, customer can change the e-mail sending address. This modification is reflected to the call center information. And the newly selected e-mail address appears prior to other addresses from the next time.

Likewise, by tapping a telephone number indicated right below “Phone number of call center”, the phone number the customer desired to be called can be changed. However, this modification is valid only once and for all and does not influence the previously registered telephone number to customer information.

4. Select a mailer on "e-mail sending" screen, here, tap {Gmail} as an example (refer to fig. 6-41).

5. The selected mailer starts-up, title of the {Call back request with QR code} mail and QR code information are posted to this mail, and the selected pictures are attached. Also, the customer information registered on {Registration of Customer Info} screen is posted at the end of the mail (refer to fig. 6-47 and fig. 6-48).

6. The e-mail is finally sent out with some messages if any.
6.18 Time Measuring Function

6.18.1 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.

6.18.2 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.
6.18.3 Time Measuring Method

To measure the time, use the SETTM instruction of INFORM instructions.

**SETTM**

<table>
<thead>
<tr>
<th>SUBSET</th>
<th>STANDARD</th>
<th>EXPANDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Available</td>
<td>Available</td>
<td>Available</td>
</tr>
</tbody>
</table>

**Function**

Execute these function, such as to start measuring, to end, to reset, and to set the time.

**Construction**

1. **TM variable number**

Add the following tag.

<table>
<thead>
<tr>
<th>No</th>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TM variable number</td>
<td>Specifies the TM variable number for the measurement time writing.</td>
<td>Number: 0 to 59</td>
</tr>
</tbody>
</table>
6 Convenient Functions
6.18 Time Measuring Function

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.

<table>
<thead>
<tr>
<th>No</th>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>TSTART</td>
<td>Specifies to start the time measurement.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>TSTOP</td>
<td>Specifies to finish the time measurement.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>TRESET</td>
<td>Specifies to reset the time measurement.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>D Variable number / LD Variable number / D [Arrangement number] / LD [Arrangement number] / [Constant]</td>
<td>Specifies the time measurement by the integer type variable.</td>
<td>Number: -2147483648 to 2147483647</td>
</tr>
<tr>
<td>6</td>
<td>TM variable number</td>
<td>Specifies the time measurement by timer variable.</td>
<td>Number: 0 to 59</td>
</tr>
</tbody>
</table>

**Example**

The motion setting of SETTM is shown below.

```
<table>
<thead>
<tr>
<th>SETTM SETUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>TM000</td>
</tr>
<tr>
<td>DISPLAY ON JOB CONTENT</td>
</tr>
<tr>
<td>TARGET</td>
</tr>
<tr>
<td>LOCAL/GLOBAL</td>
</tr>
<tr>
<td>ADDITIONAL OUTPUT</td>
</tr>
</tbody>
</table>
```

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.
6.18.4 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. 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”, “UNIVERSAL OUTPUT (2GROUP)”, “UNIVERSAL OUTPUT (4GROUP)”, “REGISTER (1)” or “REGISTER (2)”. When “UNIVERSAL OUTPUT (2GROUP)”, “UNIVERSAL OUTPUT (4GROUP)”, “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 “UNIVERSAL OUTPUT 2 GROUP” or “UNIVERSAL OUTPUT 4 GROUP”.
* (example) -32768 to 32767 is output for “UNIVERSAL 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.

6.18.5 Displaying the Time Measuring Result in the 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.
6 Convenient Functions

6.18 Time Measuring Function

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.
### 7 External Memory Devices

#### 7.1 Memory Devices

The following memory devices can be used in the DX200 to save and load data such as jobs and parameters.

<table>
<thead>
<tr>
<th>Device</th>
<th>Function</th>
<th>Media (destination of saved/ loaded data)</th>
<th>Optional function requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF: Pendant</td>
<td>Standard</td>
<td>Compact Flash Card (CF card)</td>
<td>No requirement. Programming pendant is equipped with a slot.</td>
</tr>
<tr>
<td>USB: Pendant</td>
<td>Standard</td>
<td>USB Memory Stick</td>
<td>No requirement. Programming pendant is equipped with a slot.</td>
</tr>
<tr>
<td>FC1(DX)</td>
<td>Optional¹</td>
<td>Personal computer (FC1 emulator)</td>
<td>Personal computer with &quot;FC1 emulator&quot;</td>
</tr>
<tr>
<td>PC</td>
<td>Optional¹</td>
<td>Personal computer (MOTOCOM32 host)</td>
<td>Via RS-232C: &quot;Data transmission function&quot; and &quot;MOTOCOM32&quot; Via Ethernet: &quot;Ethernet function&quot; plus above two requirements</td>
</tr>
<tr>
<td>FTP</td>
<td>Optional¹</td>
<td>FTP server such as personal computer</td>
<td>&quot;Data transmission function&quot;, &quot;MOTOCOM32&quot;, and &quot;FTP function&quot;</td>
</tr>
<tr>
<td>USB1: Controller</td>
<td>Standard</td>
<td>USB Memory Stick</td>
<td>No requirement. CPU circuit board (JANCD-YCP21) is equipped with a slot.</td>
</tr>
<tr>
<td>USB2: Controller</td>
<td>Standard</td>
<td>USB Memory Stick</td>
<td>No requirement. CPU circuit board (JANCD-YCP21) is equipped with a slot.</td>
</tr>
</tbody>
</table>

¹ For the operation, refer to instruction manuals for each optional function.
7 External Memory Devices
7.1 Memory Devices

7.1.1 Compact Flash (CF Cards)

The programming pendant is equipped with CF card slot. Use the FAT16 or FAT32 formatted Compact Flash.

7.1.1.1 Recommended Compact Flash Cards

Refer to section 9.1.2 “Device” in “DX200 INSTRUCTIONS (165292-1CD)” for the recommended products used for external memory of DX200. 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 Compact Flash

- Do not drop or bend exerting any shock or strong force to the Compact Flash.
- Keep away from water, oil, organic solvent, dust, and dirt.
- Do not use or keep the Compact Flash in places where strong static electricity or electronic noise may occur.
- Do not insert or remove the Compact Flash or turn OFF the power when accessing the Compact Flash (writing-in or reading-out the Compact Flash data).
- To protect the data, back up the data regularly on other media. Damages or loss of data due to operation errors or accidents can be minimized.

*Compact Flash has a limited life span.

The life span differs depending on products or status of use. However, normal use of Compact Flash as an external memory device for the DX200 does not adversely affect the Compact Flash. For details, refer to instruction manuals for each medium.
7.1.3 Inserting a Compact Flash

When inserting a Compact Flash, take note of insertion direction.

With the notch and clip of the Compact Flash downward, insert the Compact Flash slowly into the slot of the programming pendant of which display faces up.

Forcible insertion may result in damage to the Compact Flash or CF card slot.

After inserting the card, be sure to close the cover of the slot before starting operation.

*Fig. 7-1: Using a Compact Flash Card*
7.1.2 USB Memory Stick

The programming pendant or the CPU circuit board (JANCD-YCP21) 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 section 9.1.2 “Device” in the “DX200 INSTRUCTIONS (165292-1CD)” for the recommended products used for external memory of DX200. 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 or bend exerting any shock or strong force to the Compact Flash.
- Keep away from water, oil, organic solvent, dust, and dirt.
- Do not use or keep the Compact Flash in places where strong static electricity or electronic noise may occur.
- Do not insert or remove the Compact Flash or turn OFF the power when accessing the Compact Flash (writing-in or reading-out the Compact Flash data).
- To protect the data, back up the data regularly on other media. Damages or loss of data due to operation errors or accidents can be minimized.

*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 DX200 does not adversely affect the USB memory stick. For details, refer to instruction manuals for each medium.
7.1.2.3 Rules for USB Drive and USB Memory Stick

Followings are the rules of the USB drive on the CPU circuit board (JANCD-YCP21) and the USB memory stick to be installed.

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 DX200.

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 port on the front surface of the CPU circuit board (JANCD-YCP21)**
   The USB port on the front surface of the CPU circuit board (JANCD-YCP21) accepts only the USB memory stick.
   Do not connect a USB hub or other USB devices.

6. **Capacity of USB memory stick**
   The capacity of the memory stick must be 4Gbyte or less.
7 External Memory Devices

7.1 Memory Devices

7.1.2.4 Inserting a USB Memory Stick in the Programming Pendant

When inserting a USB memory stick, take note of insertion direction.

With the USB memory stick face-up and the connector upwards, insert the stick slowly into the slot of the programming pendant of which display face-down.

Forcible insertion may result in damage to the USB memory stick or USB connector.

After inserting the stick, be sure to close the cover of the connector before starting operation.

Fig. 7-2: Using a USB Memory Stick

When a USB memory stick is used, the waterproofing of programming pendant cannot be maintained.

If the USB memory stick is always set in the programming pendant, the stick may fall out of the pendant.

If it is impossible to maintain the waterproofing of programming pendant or to prevent the USB memory stick from falling out of the programming pendant, use a Compact Flash card instead.
7.1.2.5 Inserting a USB Memory Stick in the CPU Circuit Board (JANCD-YCP21)

Be careful about the inserting direction of the USB connector: The USB memory should be inserted slowly with the upper surface right. Forcible insertion may result in damage to the USB memory stick or USB connector.

* There are two USB connectors. The left side is for USB1 and the right side is for USB2.
7.2 Handling Data

7.2.1 Data Classification

For the DX200, data that can be saved online are classified into six categories.

1. JOB
2. FILE/GENERAL DATA
3. PARAMETER*1
4. I/O DATA
5. SYSTEM DATA
6. SYSTEM BACKUP (CMOS.BIN)

Data saved on the external memory device can be loaded again into the DX200.

Each data in the six 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(DX)”.

*1: “PARAMETER BATCH” includes all “3. PARAMETER”.

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.
### Table 7-1: Data List (Sheet 1 of 3)

<table>
<thead>
<tr>
<th>Data Classification</th>
<th>File Name (Saved Data)</th>
<th>Save</th>
<th>Load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>OPN</td>
<td>EDIT</td>
</tr>
<tr>
<td>6. SYSTEM BACKUP (CMOS.BIN)</td>
<td>CMOS.BIN</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>1. JOB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single job</td>
<td>JOBNAME.JBI</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Related job</td>
<td>JOBNAME.JBR</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>(Job+Condition)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 FILE/GENERAL DATA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tool data</td>
<td>TOOL.CND</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Weaving data</td>
<td>WEAV.CND</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>User coordinate data</td>
<td>UFRAME.CND</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Variable data</td>
<td>VAR.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Arc start condition data</td>
<td>ARCSRT.CND</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Arc end condition data</td>
<td>ARCEND.CND</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Welding condition auxiliary data</td>
<td>ARCSUP.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Welder characteristic data</td>
<td>WELDER.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Welder characteristic definition data</td>
<td>WELDUDEF.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Shock detection level data</td>
<td>SHOCKLVL.CND</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Job registration data</td>
<td>JET.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Interference area file</td>
<td>CUBEINTF.CND</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Motor Gun Pressure Data</td>
<td>SGPRS.CND</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Motor Gun Dry Pressure Data</td>
<td>SGPRSCL.CND</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Spot Gun Condition Data</td>
<td>SGSPEC.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Spot Welder I/F Data</td>
<td>SGWELDI.FAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Gun Open Position Data</td>
<td>STROKE.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Spot I/O Allocation Data</td>
<td>SGIO.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Spot Welding Condition Data</td>
<td>SPOTWELD.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Clearance Setting Data</td>
<td>SGCLARNC.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Motor Gun Auto Tuning Data</td>
<td>SGUNAUTO.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Gun Detail Setting Data</td>
<td>SGDTL.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Spot Management Data</td>
<td>SGSPTMNG.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Manual Press Condition Data</td>
<td>SGMLNPRS.CND</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Tip Dress Condition Data</td>
<td>SGTPDRS.CND</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Airgun condition data</td>
<td>AIRGUN.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>User menu data</td>
<td>USERMENU.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Timer variable data</td>
<td>TMVAR.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Paint condition</td>
<td>PNTCND.CND</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Paint calibration set</td>
<td>PNTCLB.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Paint time chart</td>
<td>PNTTC.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Paint data set</td>
<td>PNTDATA.DAT</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>
### Table 7-1: Data List (Sheet 2 of 3)

<table>
<thead>
<tr>
<th>Data Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. PARA-METER</td>
</tr>
<tr>
<td>3. PARA-METER</td>
</tr>
<tr>
<td>Robot matching</td>
</tr>
<tr>
<td>parameter</td>
</tr>
<tr>
<td>System definition</td>
</tr>
<tr>
<td>parameter</td>
</tr>
<tr>
<td>Coordinate home</td>
</tr>
<tr>
<td>position parameter</td>
</tr>
<tr>
<td>System matching</td>
</tr>
<tr>
<td>parameter</td>
</tr>
<tr>
<td>CIO parameter</td>
</tr>
<tr>
<td>Function definition</td>
</tr>
<tr>
<td>parameter</td>
</tr>
<tr>
<td>Application parameter</td>
</tr>
<tr>
<td>Transmission (general)</td>
</tr>
<tr>
<td>parameter</td>
</tr>
<tr>
<td>Sensor parameter</td>
</tr>
<tr>
<td>Servo parameter</td>
</tr>
<tr>
<td>Servomotor parameter</td>
</tr>
<tr>
<td>Operation control</td>
</tr>
<tr>
<td>parameter</td>
</tr>
<tr>
<td>Servo power block</td>
</tr>
<tr>
<td>parameter</td>
</tr>
<tr>
<td>Motion function</td>
</tr>
<tr>
<td>parameter</td>
</tr>
<tr>
<td>SERVOPACK parameter</td>
</tr>
<tr>
<td>Converter parameter</td>
</tr>
<tr>
<td>Robot control expand</td>
</tr>
<tr>
<td>parameter</td>
</tr>
<tr>
<td>Safety function</td>
</tr>
<tr>
<td>parameter</td>
</tr>
<tr>
<td>4. I/O DATA</td>
</tr>
<tr>
<td>CIO program</td>
</tr>
<tr>
<td>I/O name data</td>
</tr>
<tr>
<td>Pseudo input signals</td>
</tr>
<tr>
<td>External I/O name</td>
</tr>
<tr>
<td>data</td>
</tr>
<tr>
<td>Register name data</td>
</tr>
<tr>
<td>YSF logic file</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>File Name (Saved Data)</th>
<th>Save</th>
<th>Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>RC.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>SD.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>RO.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>SC.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>CIO.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>FD.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>AP.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>RS.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>SE.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>SV.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>SVM.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>AMC.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>SVP.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>MF.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>SVS.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>SVC.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>RE.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>FMS.PRM</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>CIOPRG.LST</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>IONAME.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>PSEUDOIN.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>EXIONAME.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>IOMNAME.DAT</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>YSFLOGIC.DAT</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>
Table 7-1: Data List (Sheet 3 of 3)

<table>
<thead>
<tr>
<th>Data Classification</th>
<th>File Name (Saved Data)</th>
<th>Save</th>
<th>Load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>OPN</td>
<td>EDIT</td>
</tr>
<tr>
<td>6 5. SYSTEM DATA</td>
<td>Second home position</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>User word</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>SV monitor signal</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Variable name</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Alarm history data</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Home position calibrating data</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>System information</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Controller information</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Work home position data</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>I/O message history data</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Function key allocation data</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Arc monitor data</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Wear detection base position data</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>External IO ALLOC data</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Max/ Min torque data</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Logdata</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>PM (reducer) file</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>PM (reducer) condition</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Encoder maintenance</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Inspection record file</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Robot stop FACTR file</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>SETTM setup file</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Timer variable name</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Paint system</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Paint special</td>
<td>O</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Paint time chart set</td>
<td>O</td>
<td>X</td>
</tr>
</tbody>
</table>

* OPN: Operation Mode, EDIT: Edit Mode, MAN: Management Mode
  O: Can be done,  X: Cannot be done
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.

Whether the job after editing is saved or not can be judged by checking “TO SAVE TO FD” in the JOB HEADER window.

**Fig. 7-3: Example of JOB**

**Fig. 7-4: Example of FILE/GENERAL DATA**
7.2.2.1 Saving by Overwriting

“6. 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 cannot be overwritten. Delete the target file in the device before the saving operation.

If “CF: Programming pendant”, “USB: Programming pendant”, “USB1: Controller” or “USB2: Controller” is used as the device, the file does not need to be deleted because another folder can be created to save the data.
7.3 Operation Flow

The following description is the operation flow for external memory devices.

- **SELECT DEVICE**
  Select {EXTERNAL MEMORY DEVICE} → {DEVICE}, and the destination device for saving.
  The device selected is valid after turning the power supply ON again.

- **SELECT FOLDER**
  Select {EXTERNAL MEMORY DEVICE} → {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 “CF: Programming pendant”, “USB: Programming pendant”, “USB1: Controller” or “USB2: 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.
  “6.SYSTEM BACKUP (CMOS.BIN)” does not require this operation.
  *4 Individual selection, batch selection, marker (*) selection, and canceling selection can be performed.

- **EXECUTE**
  Select [ENTER] or {EXECUTE}. 

![Diagram of operation flow](image-url)
Spot and Arc Welding Using Motor Gun

7 External Memory Devices
7.3 Operation Flow

7.3.1 Operating a Folder

Folders can be used in order to classify and sort out the data such as jobs and condition files when using the "CF: Programming pendant", “USB: Programming pendant”, “USB1: Controller” or “USB2: Controller”. The folders can be created in hierarchical structure positioning a root folder at the top.

- **Restrictions**
  - **Folder name:** Up to 8 one-byte characters + 3 characters for extension
  - *Long folder names cannot be used such as the name that exceeds the restricted number of characters mentioned above as created in PC, etc.

  - Maximum path length: 42 one-byte characters
  - "ERROR 3360: INVALID FOLDER" appears when selecting the folder of which name exceeds the maximum path length.

- **Selecting a Folder**
  1. Select {EXTERNAL MOMERY DEVICE} under {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. Change the security to management mode. Select {EXTERNAL MOMERY DEVICE} under {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. Input folder name using the keyboard on the screen and press [ENTER].
   – A folder is created.

### Deleting a Folder

1. Change the security to management mode. Select {EXTERNAL MEMORY DEVICE} under {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.
7 External Memory Devices

7.3 Operation Flow

- **Initial Folder Setting**
  The folder that is contained in a deep hierarchy can be selected in a shortened operation.
  
  When selecting {LOAD}, {SAVE}, {VERIFY}, or {DELETE} from the sub menu of {EXTERNAL MEMORY DEVICE}, the folder that has been set as an initial folder becomes a current folder.

  1. Change the security to management mode. Select {EXTERNAL MEMORY DEVICE} under {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.

     ![Initial Folder Setting Window]

     - A folder currently selected appears in “CURRENT FOLDER” and the initial folder appears in “ROOT FOLDER”.

     ![Root Folder Setting Window]
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”.

When the initial folder is missing due to exchange of the Compact Flash, etc., “ERROR 3360: INVALID FOLDER” appears when selecting {LOAD}, {SAVE}, {VERIFY}, {DELETE} or {FOLDER} menu from {EXTERNAL MEMORY DEVICE}, and simultaneously the initial folder becomes invalid. Set “ON” in “AUTO CHANGE” when the initial folder setting needs to be valid.
To download data from the memory of the DX200 to the external memory device, perform the following procedure.

**NOTE**

Data such as PARAMETER, SYSTEM DATA, I/O DATA, and the batch data such as PARAMETER BATCH, BATCH CMOS, ALL CMOS AREA, that include PARAMETER, SYSTEM DATA, I/O DATA, contain the information specific to each robot controller.

Those data are prepared as backup data for reloading into the controller used for saving.

Loading the data from other controller may result in destruction or loss of critical system information.

Take extra care for the saved data.

### Saving a Job

1. Select **{EXTERNAL MEMORY DEVICE}** under **{Main Menu}**.
2. Select **{SAVE}**.
   - The following window appears.
3. Select **{JOB}**.
   - The **JOB LIST** window appears.

---

7.3.0.2 Saving Data

To download data from the memory of the DX200 to the external memory device, perform the following procedure.

**NOTE**

Data such as PARAMETER, SYSTEM DATA, I/O DATA, and the batch data such as PARAMETER BATCH, BATCH CMOS, ALL CMOS AREA, that include PARAMETER, SYSTEM DATA, I/O DATA, contain the information specific to each robot controller.

Those data are prepared as backup data for reloading into the controller used for saving.

Loading the data from other controller may result in destruction or loss of critical system information.

Take extra care for the saved data.

### Saving a Job

1. Select **{EXTERNAL MEMORY DEVICE}** under **{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 {EXTERNAL MEMORY DEVICE} under {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.
7 External Memory Devices

7.3 Operation Flow

- **Saving a Parameter**

1. Select (EXTERNAL MEMORY DEVICE) under (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 {EXTERNAL MEMORY DEVICE} under {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.
7 External Memory Devices

7.3 Operation Flow

Saving System Data

1. Select {EXTERNAL MEMORY DEVICE} under {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.

As for “JOB”, “FILE/GENERAL DATA”, “PARAMETER”, “SYSTEM DATA”, and “I/O DATA”, the data cannot be overwritten. In this case, delete the file of the same name in the folder beforehand or create a new folder so that the data can be stored inside.
SYSTEM BACKUP (CMOS.BIN) Saving

1. Select {EXTERNAL MEMORY DEVICE} under (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. A confirmation dialog box to ask over-writing the data appears.

![Confirmation Dialog Box]

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 35MB.

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.
7.3.0.3 Loading Data

To upload data from the external memory device to the memory of the DX200, follow the procedure in the following.

**NOTE**

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.

Take extra care for the saved data.

When the ladder program used in the DX200 is tried to be loaded, the confirmation dialog "DX200 CIOPRG DOWNLOAD?" 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 will not be loaded.

When the ladder program used in the DX200 is loaded to the DX200, make sure to confirm that the APPLI of the program in the DX200 system and the DX200 system to which the program is loaded are the same. Do not load the ladder program which has a different APPLI. The "different APPLI" also means the case that the number of APPLIs are different (ex. "Arc" and "Arc + Arc").

If the ladder program used in DX200 arc is loaded to DX200, some new functions added in DX200 cannot be used (only for arc welding purpose). In order to use the new functions added in DX200, reflect the content edited in DX200 to the DX200 ladder program without loading the ladder program of DX200.
Loading a Job

1. Select {EXTERNAL MEMORY DEVICE} under {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 “★”.

![External Memory Device](image)

5. Press [ENTER].
   – The confirmation dialog box appears.

![Confirmation Dialog](image)

6. Select “YES”.
   – The selected jobs are loaded.
Spot and Arc Welding
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7 External Memory Devices

7.3 Operation Flow

Loading a Condition File/General Data

1. Select {EXTERNAL MEMORY DEVICE} under {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 {EXTERNAL MOMERY DEVICE} under {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.
7 External Memory Devices

7.3 Operation Flow

Loading I/O Data

1. Select {EXTERNAL MEMORY DEVICE} under {Main Menu}.

2. Select {LOAD}.

   – The following window appears.

   ![Window for selecting external memory device]

3. Move the cursor to {I/O DATA} and select.

   – The selection window for I/O data appears.

   ![Window for selecting I/O data]

4. Select I/O data to be loaded.

   – The selected I/O data are marked with "★".

   ![Marked I/O data]

5. Press [ENTER].

   – The confirmation dialog box appears.

   ![Confirmation dialog box]

6. Select “YES”.

   – The selected I/O data are loaded.
7 External Memory Devices

7.3 Operation Flow

Loading System Data

1. Select (EXTERNAL MEMORY DEVICE) under (Main Menu).
2. Select (LOAD).
   - The following window appears.

   ![System Data Selection Window]

3. Move the cursor to (SYSTEM DATA) and select.
   - The selection window for system data appears.

   ![System Data Selection Window]

4. Select system data to be loaded.
   - The selected system data are marked with "★".

   ![System Data Selection Window]
5. Press [ENTER].
   – The confirmation dialog box appears.

   ![Confirmation Dialog Box](image)

6. Select “YES”.
   – The selected system data are loaded.
Follow the procedure below to verify data in the memory of the DX200 with data saved in the external memory device.

**NOTE**

“SYSTEM BACKUP (CMOS.BIN)” cannot be verified.

### Verifying a Job

1. Select {EXTERNAL MEMORY DEVICE} under {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.
7 External Memory Devices

7.3 Operation Flow

Verifying a File

1. Select {EXTERNAL MEMORY DEVICE} under {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.
7.3.0.5 Deleting Data

Follow the procedure below to delete a file or files on an external memory device.

- **Deleting a Job**

1. Select {EXTERNAL MOMERY DEVICE} under (Main Menu).
2. Select {DELETE}.
   - The following window appears.

   ![Window](image1)

3. Select {JOB}.
   - The job selection window appears.

   ![Window](image2)

4. Select a job to be deleted.
   - The selected jobs are marked with “★”.

   ![Window](image3)

5. Press [ENTER].
   - The confirmation dialog box appears.

   ![Dialog Box](image4)

6. Select “YES”.
   - The selected jobs are deleted.

    ![Confirmation Dialog](image5)
Deleting a File
(Condition file/General data, Parameter, System data and I/O data)

1. Select {EXTERNAL MEMORY DEVICE} under {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 {EXTERNAL MEMORY DEVICE} under {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 won't 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 External Memory Devices

7.3 Operation Flow

7.3.6 Job Selection Mode

The method of selecting a job and various data files when loading, saving, verifying, and deleting are described in the following:

- **Individual Selection**
  Jobs and data files are selected individually one at a time.

- **Batch Selection**
  Jobs and data files are selected all at one time.

- **Marker (*) Selection**
  Loading: selects the files in the external memory device.
  Saving: selects the files in the memory of the DX200.
  Verifying: selects both the files in the external memory device and in the memory of the DX200.

## Using Individual Selection

1. In either the external memory JOB LIST window or the file selection window, move the cursor to a job or a file to be selected.

2. Press [SELECT].
   Move the cursor to a file needed and press [SELECT] again.
   *To cancel the selected items, select {EDIT} and then {CANCEL SELECT}.
   - The selected jobs are marked with "★".
7 External Memory Devices

7.3 Operation Flow

Viewing Batch Selection

1. In either the external memory JOB LIST window or the file selection window, select {EDIT} under the menu.
   - The pull-down menu appears.

2. Select {SELECT ALL}.
   *To cancel the selected items, select {EDIT} and then {CANCEL SELECT}.
   - All jobs are selected.
7 External Memory Devices

7.3 Operation Flow

- **Using Marker (*) Selection**

1. In either the external memory JOB LIST window or the file selection window, select {EDIT} under the menu.
   - The pull-down menu appears.

2. Select {SELECT MARKER (*)}.
   *To cancel the selected items, select {EDIT} and then {CANCEL SELECT}.

---

**Image Description:**
- Screenshots of external memory device selection windows, showing the process of selecting and canceling markers.

---

**Additional Notes:**
- Instructions on how to select and cancel marker items are visually depicted through screenshots.
8 Parameter

8.1 Parameter Configuration

The parameters of DX200 can be classified into the following seven:

- **Motion Speed Setting Parameter**
  Determines the manipulator motion speed for jog operation at teaching, test operation, or playback operation.

- **Mode Operation Setting Parameter**
  Makes the setting for various operations in the teach mode or remote mode.

- **Parameter according to Interference Area**
  Limits the P-point maximum envelope of the manipulator or sets the interference area for axis interference or cubic interference.

- **Parameter according to Status I/O**
  Sets the parity check or I/O setting for user input/output signals.

- **Parameter according to Coordinated or Synchronized Operation**
  Makes the settings for coordinated or synchronized operations between manipulators or between manipulators and stations.

- **Parameter for Other Functions or Applications**
  Makes the settings for other functions or applications.

- **Hardware Control Parameter**
  Makes the hardware settings for fan alarm or relay operation, etc.

---

**SUPPLEMENT**

**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 TCPmax speed.

8.2.0.2 S1CxG001: DRY-RUN SPEED

Units: 0.01%

This is a dry-run operation speed setting value used when checking the path. Take safety into consideration when setting changes are unnecessary.

8.2.0.3 S1CxG002 to S1CxG009: JOINT SPEED FOR REGISTRATION

Units: 0.01%

The value set in these parameters is registered as the joint speed for each speed level when teaching the position data with the programming pendant. The percentage corresponding to the set value at each level is registered as 100% of the value set in the playback speed limit. Values greater than those set as speed limit values cannot be set.

S1CxG002: Level 1
S1CxG003: Level 2

S1CxG009: Level 8
8.2 Motion Speed Setting Parameters

8.2.0.4 S1CxG010 to S1CxG017: LINEAR SPEED FOR REGISTRATION

Units: 0.1mm/s

The value set in these parameters is registered as the linear speed for each speed level when teaching the position data with the programming pendant. Values greater than those set as playback speed limit values cannot be set.

- S1CxG010: Level 1
- S1CxG011: Level 2
- ...
- S1CxG017: Level 8

8.2.0.5 S1CxG018 to S1CxG025: POSITION ANGLE SPEED

Units: 0.1°/s

The value set in these parameters is registered as the position angle speed for each speed level when teaching the position data with the programming pendant. Values greater than those set as playback speed limit cannot be set.

- S1CxG018: Level 1
- S1CxG019: Level 2
- ...
- S1CxG025: Level 8

8.2.0.6 S1CxG026 to S1CxG029: JOG OPERATION ABSOLUTE VALUE SPEED

Units: 0.1mm/s

These are setting values of jog operation speed set by the programming pendant. Values greater than those set as jog operation speed limit value cannot be set.

- S1CxG026 Low level: Jog operation speed when “LOW” manual speed is specified.
- S1CxG027 Medium level: Jog operation speed when “MEDIUM” manual speed is specified.
- S1CxG028 High level: Jog operation speed when “HIGH” manual speed is specified.
- S1CxG029 High-speed-level: Jog operation speed when [HIGH SPEED] is pressed.
8.2.0.7 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.

\[
\begin{align*}
\text{S1CxG030} & : \text{Joint Operation (Unit: 1 pulse)} \\
\text{S1CxG031} & : \text{Cartesian/cylindrical (Unit: 0.001 mm)} \\
\text{S1CxG032} & : \text{Motion about TCP (Unit: 0.0001 degree)}
\end{align*}
\]

If the value set for S1CxG031 or S1CxG032 is too small, the inching operation does not proceed.

Note that the units of S1CxG031 and S1CxG032 are smaller than those for the NX100.

8.2.0.8 S1CxG033 to S1CxG040: POSITIONING ZONE

This parameter value will be referenced when positioning is specified with the “MOVE” instruction: MOVJ (joint movement) or MOVL (linear movement).

**Example**

\[
\text{MOVL V=100.0 PL=1}
\]

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.

\[
\begin{align*}
\text{S1CxG033: Positioning level 1} \\
\text{S1CxG034: Positioning level 2} \\
\end{align*}
\]

S1CxG040: Positioning level 8
Since operation will be turning inward during playback, as shown in the following diagram, use setting values taking safety aspects into consideration.

This process becomes effective when change in direction of steps is between 25° and 155°.

Position Level

Position levels are divided into nine stages of 0 to 8 with the "MOV" instruction.

e.g. MOVL V=500 PL=1 (PL: Position Level)

The functions at each level are as follows:

0: Complete positioning to the target point
1 to 8: Inward turning operation

Following are explanations of the respective processing details and their relations with the parameter.

• Level 0
  Determines positioning completion when the amount of deviation (number of pulses) to the target point of each axis comes within the position set zone specified by the parameter.
  After the positioning completes, the instruction system starts instruction to the next target point.

• Level 1 to 8
  Recognizes virtual positioning before the target point. The distance of the virtual target position from the target point is specified at the positioning level.
  Distance data corresponding to each level are set in the parameter. Determination of the virtual target position is carried out in the instruction system.
  Set zone: The zone of each positioning level set in the parameter. (µm)
8.2.0.9 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: When manipulator TCP is selected*
8 Parameter
8.2 Motion Speed Setting Parameters

Fig. 8-2: 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 : Move to the indicated step (initial setting).
1 : After moving back to the deviated position, move to the indicated step.
2 : Move back to the deviated position and stop.

Table 8-1: S2C422

<table>
<thead>
<tr>
<th>Parameter Setting Value</th>
<th>Movement When Restarting</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Move to next step.</td>
</tr>
<tr>
<td></td>
<td>Emergency stop</td>
</tr>
<tr>
<td></td>
<td>Movement when restarting</td>
</tr>
<tr>
<td></td>
<td>Move to next step.</td>
</tr>
<tr>
<td>1</td>
<td>After moving back to the deviated position, move to the indicated step.</td>
</tr>
<tr>
<td></td>
<td>Emergency stop</td>
</tr>
<tr>
<td></td>
<td>Move back to the deviated position and stop. When restarting, move to the indicated step.</td>
</tr>
<tr>
<td>2</td>
<td>Emergency stop (Servo OFF)</td>
</tr>
<tr>
<td></td>
<td>Move back the deviated position and then move to the indicated step.</td>
</tr>
</tbody>
</table>
8.2 Motion Speed Setting Parameters

### Table 8-2: S2C423

<table>
<thead>
<tr>
<th>Parameter Setting Value</th>
<th>Movement When Restarting</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Move to the next step.</td>
</tr>
<tr>
<td></td>
<td><img src="Diagram1.png" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td>Movement when restarting Move to next step.</td>
</tr>
<tr>
<td>1</td>
<td>After moving back to the deviated position, move to the indicated step.</td>
</tr>
<tr>
<td></td>
<td><img src="Diagram2.png" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td>Emergency stop (Servo OFF) Move back to the deviated position and move to the indicated step.</td>
</tr>
<tr>
<td>2</td>
<td>Emergency stop (Servo OFF) Move back to the deviated position and stop. When restarting, move to the indicated step.</td>
</tr>
<tr>
<td></td>
<td><img src="Diagram3.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

**NOTE**
- To the path deviated position, the manipulator moves in a straight line at low speed operation (SICxG044). It is linear movement. After resetting from deviation, the speed becomes the same as taught speed.
- The initial setting (prior to shipping) is 0: The manipulator moves in a straight line from the present position to the indicated step.

### 8.2.0.18 S2C424: DEVIATED POSITION

This parameter specifies whether deviated position is to be robot current (reference) position or feedback position.

0 : Return to the feedback position.
1 : Return to the current value (reference) position.
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.

![Diagram showing feedback position, current value (reference) position, and emergency stop]

### 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.

![Diagram comparing fixed angle position and 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.

![Diagram](image)

8.2.0.22 S2C655: EMERGENCY STOP ADVANCE CONTROL FUNCTION WORK START INSTRUCTION STEP MOTION COMPLETION DELAY TIME

Units: ms

In order to recognize securely the completion of motion to the step of work start instruction (such as ARCON instruction), this parameter specifies the delay time for motion completion of the work start instruction step only.

8.2.0.23 S2C698: BASE AXIS OPERATION KEY ALLOCATION SETTING

<table>
<thead>
<tr>
<th>Coordinates/Parameter</th>
<th>S2C698= “0”</th>
<th>S2C698= “1”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint</td>
<td>Axis number order</td>
<td>Specified</td>
</tr>
<tr>
<td>Cylindrical</td>
<td>Axis number order</td>
<td>Specified</td>
</tr>
<tr>
<td>Cartesian</td>
<td>Specified</td>
<td>Specified</td>
</tr>
<tr>
<td>Tool</td>
<td>Specified</td>
<td>Specified</td>
</tr>
<tr>
<td>User</td>
<td>Specified</td>
<td>Specified</td>
</tr>
</tbody>
</table>

Axis number order: X: First axis, Y: Second axis, Z: Third axis
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
  26: User 24
- **S3C1102** Specifies the limit of posture angle adjustment range (Units: 0.01°)
8.3 Mode Operation Setting Parameters

These parameters set various operations in the teach mode or remote mode.
Some parameters can be set through {SETUP} → {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.

<table>
<thead>
<tr>
<th>Parameter Setting Value</th>
<th>Operation Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>MOVL DOUT TIMER DOUT MOVL</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MOVL DOUT TIMER DOUT MOVL</td>
</tr>
</tbody>
</table>
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>**

<table>
<thead>
<tr>
<th>Line</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>MOVL V=100</td>
</tr>
<tr>
<td>11</td>
<td>TIMER T=1.00</td>
</tr>
<tr>
<td>12</td>
<td>DOUT OT# (1) ON</td>
</tr>
<tr>
<td>13</td>
<td>MOVL V=50</td>
</tr>
</tbody>
</table>

**Fig. 8-4: S2C206-0 (Before the Next Step)**

<table>
<thead>
<tr>
<th>Line</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>MOVL V=100</td>
</tr>
<tr>
<td>11</td>
<td>TIMER T=1.00</td>
</tr>
<tr>
<td>12</td>
<td>DOUT OT# (1) ON</td>
</tr>
<tr>
<td>13</td>
<td>MOVL V=100 (Before the Next Step)</td>
</tr>
<tr>
<td>14</td>
<td>MOVL V=50</td>
</tr>
</tbody>
</table>
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 DX200,
8 Parameter
8.3 Mode Operation Setting Parameters

All robot instructions can be executed regardless of specification of instruction sets. The specification can be done on the TEACHING CONDITION window.

0: Contracted Level
Only frequently used robot instructions are selected to reduce the number of instructions to be registered. Robot instructions displayed on the instruction dialog box are also reduced so that specification is simplified.

1: Standard Level
2: Expanded Level
All the robot instructions are available in standard and expanded levels. The two levels are distinguished by the number of additional information items (tags) that can be used with robot instructions. At the expanded level, the following 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”

<table>
<thead>
<tr>
<th>Parameter Setting Value</th>
<th>Operation Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>MOVL</td>
</tr>
<tr>
<td></td>
<td>DOUT</td>
</tr>
<tr>
<td></td>
<td>TIMER</td>
</tr>
<tr>
<td></td>
<td>DOUT</td>
</tr>
<tr>
<td></td>
<td>MOVL</td>
</tr>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MOVL</td>
</tr>
<tr>
<td></td>
<td>DOUT</td>
</tr>
<tr>
<td></td>
<td>TIMER</td>
</tr>
<tr>
<td></td>
<td>DOUT</td>
</tr>
<tr>
<td></td>
<td>MOVL</td>
</tr>
</tbody>
</table>

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 1 cm/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.

$$d_7 d_0$$

- External input prohibited : 1 (VALID)
- Programming pendant : 2 (VALID)
- DSW : 4 (VALID)

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.

$$d_7 d_0$$

- Programming pendant ([SERVO ON READY] key) valid/invalid : 1 (VALID)
- Programming pendant (Enable switch) valid/invalid : 2 (VALID)
- Mode switching valid/invalid : 4 (VALID)
- Master call valid/invalid : 8 (VALID)
- Cycle switching valid/invalid : 16 (VALID)
- Start valid/invalid : 32 (VALID)
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 the 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 the 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 the play mode to the 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 the teach mode to the 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 Parameter
8.3 Mode Operation Setting Parameters

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

<table>
<thead>
<tr>
<th>Parameter Setting Value</th>
<th>Valid/Invalid</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Function invalid</td>
</tr>
<tr>
<td>1</td>
<td>Function valid</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>S2C395=0 : DOUT OT#(1) ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2C395=1 : DOUT OT#(OUTPUT 1) ON</td>
</tr>
</tbody>
</table>

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...


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”

<table>
<thead>
<tr>
<th>S2C395=0 : DOUT OT#(2) ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2C395=1 : DOUT OT#(2) ON</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Parameter Setting Value</th>
<th>Valid/Invalid</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Function invalid</td>
</tr>
<tr>
<td>1</td>
<td>Function valid</td>
</tr>
</tbody>
</table>

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...

When the name begins with “ ‘ ”, it is regarded as a comment and the same comment can be registered for two or more variables. In this case, although this function is valid, the number is displayed on the JOB CONTENT window instead of the name.

<Example> Registration of the byte type variable B001 as “WORKNUM”
S2C396=0 : SET B001 10
S2C396=1 : SET B001 10
8.3.0.38 S2C397: I/O VARIABLE CUSTOMIZE FUNCTION

This function enables registration of any particular input/output signal/variable. Reference and editing of signals/variables are possible on the same window.

Table 8-6: S2C397

<table>
<thead>
<tr>
<th>Parameter Setting Value</th>
<th>Valid/Invalid</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Function Invalid</td>
</tr>
<tr>
<td>1</td>
<td>Function Valid</td>
</tr>
</tbody>
</table>

With this function valid, the sub-menu (I/O-VARIABLE CUSTOMIZE) opens under {Main Menu} {ARC WELDING}, {SPOT WELDING}, {GENERAL}, {HANDLING} (differs by application). Select (I/O-VARIABLE CUSTOMIZE), and the I/O-VARIABLE CUSTOMIZE window appears as follows.

Fig. 8-6: I/O VARIABLE CUSTOMIZE Window

On the I/O-VARIABLE CUSTOMIZE window, any of the input/output signals/variables can be selected and registered (up to 32 items). Registrable signals/variables are as follows:

Table 8-7: Registrable Items on the I/O-VARIABLE CUSTOMIZE Window

<table>
<thead>
<tr>
<th>Input/Output Signals</th>
<th>USER INPUT SIGNAL</th>
<th>USER OUTPUT SIGNAL</th>
<th>PSEUDO INPUT SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
<td>BYTE TYPE VARIABLE (B VARIABLE)</td>
<td>INTEGER TYPE VARIABLE (I VARIABLE)</td>
<td>DOUBLE-PRECISION INTEGER TYPE VARIABLE (D VARIABLE)</td>
</tr>
</tbody>
</table>

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} \(\rightarrow\) {LOAD} {SAVE} {VERIFY} {DELETE} \(\rightarrow\) {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 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 {Main Menu} and the deleted job is listed on it.

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.
8 Parameter
8.3 Mode Operation Setting Parameters

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.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Prohibited (Only number &quot;0&quot; can be used.)</td>
</tr>
<tr>
<td>1</td>
<td>Permitted (64 type of tools from number &quot;0&quot; to &quot;63&quot; can be used.)</td>
</tr>
</tbody>
</table>

### 8.3.0.43 S2C433: POSITION TEACHING BUZZER

This parameter specifies whether the buzzer sound at position teaching is used or not.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>With buzzer</td>
</tr>
<tr>
<td>1</td>
<td>Without buzzer</td>
</tr>
</tbody>
</table>

### 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.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Not operating</td>
</tr>
<tr>
<td>1</td>
<td>Linking</td>
</tr>
</tbody>
</table>

*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

<table>
<thead>
<tr>
<th>Parameter Setting Value</th>
<th>Where the Playback Resumes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Resumes where the cursor is located in the job displayed at the moment.</td>
</tr>
<tr>
<td>1</td>
<td>Resumes where the cursor has been located when the playback suspended OR where the cursor is located in the job displayed at the moment.</td>
</tr>
</tbody>
</table>

<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.

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.

```
JOB CONTENT: MASTER
J:=SAMPLE01
CONTROL GROUP: RO
0000 NOP
0001 OUT OTH(1) ON //OUTPUT01
0002 MOVU UJ=0.78
0003 WAIT 2INH(1) ON //INPUT01
0004 MOVU UJ=0.78
0005 END
```

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

```
d7  d0

Function Valid/Invalid :1:(Valid)
Coordinated system Pulse/Angle :2:(Angle)
Data system when angle is specified Absolute/Ground :4:(Ground)
```

This function can be valid/invalid on {FUNCTION ENABLE} window.

Select {DISPLAY} on the pull down menu while this function is valid, then {PUSLE}, {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.

<table>
<thead>
<tr>
<th>d7</th>
<th>d6</th>
<th>d5</th>
<th>d4</th>
<th>d3</th>
<th>d2</th>
<th>d1</th>
<th>d0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

- Window scrolling Valid/Invalid: 1: (Invalid)
- Page switching Valid/Invalid: 2: (Invalid)
- Cursor movement Valid/Invalid: 4: (Invalid)

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 area) 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 S1CxG400 to S1CxG415: PULSE SOFT LIMIT

Soft limit is set independently for each axis by pulse value setting. Set current value (pulse value) of the axis at the soft limit set up position.

8.4.0.2 S2C001: CUBE SOFT LIMIT CHECK

This parameter specifies whether to check the cube soft limit. More than one soft limit can be specified.

If "WITH CHECK" is selected, set up the following parameters.

Units: μm
8 Parameter
8.4 Parameters According to Interference Area

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
S3C007: Robot 2: + side: X
S3C008: Robot 2: + side: Y
S3C009: Robot 2: + side: Z
S3C010: Robot 2: - side: X
S3C011: Robot 2: - side: Y
S3C012: Robot 2: - side: Z
S3C042: Robot 8: + side: X
S3C043: Robot 8: + side: Y
S3C044: Robot 8: + side: Z
S3C045: Robot 8: - side: X
S3C046: Robot 8: - side: Y
S3C047: Robot 8: - 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.

- Pulse Soft Limit (Independent Axis Soft Limit)
  Refer to chapter 8.4.0.1 “S1CxG400 to S1CxG415: PULSE SOFT LIMIT” at page 8-32.
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 (-)
- S3C063: S-axis Interference Area Robot 8 (-)
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.
   
<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Cube Interference/Axis Interference Not Used</td>
</tr>
<tr>
<td>1</td>
<td>Robot 1</td>
</tr>
<tr>
<td>2</td>
<td>Robot 2</td>
</tr>
<tr>
<td>8</td>
<td>Robot 8</td>
</tr>
<tr>
<td>9</td>
<td>Base Axis 1</td>
</tr>
<tr>
<td>10</td>
<td>Base Axis 2</td>
</tr>
<tr>
<td>16</td>
<td>Base Axis 8</td>
</tr>
<tr>
<td>17</td>
<td>Station Axis 1</td>
</tr>
<tr>
<td>18</td>
<td>Station Axis 2</td>
</tr>
<tr>
<td>40</td>
<td>Station Axis 24</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Checking Method Designation</th>
<th>Servo Power Supply ON</th>
<th>Servo Power Supply OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command</td>
<td>Command</td>
<td>Feedback</td>
</tr>
<tr>
<td>Feedback</td>
<td>Feedback</td>
<td>Feedback</td>
</tr>
</tbody>
</table>

   During the servo float function operation, checking is performed by feedback regardless of the checking method designation.
**Interference Area**

It is possible to output whether the TCP during operation is inside or outside as a status signal, and to set the area to control the position by parameters S2C003 to S2C194. When the manipulator attempts to enter this area, the corresponding input signal (e.g. an “entrance prohibit signal”) is detected. The manipulator stops immediately if there is an input signal and goes into waiting status until this signal is cleared. This signal is processed in the I/O section. Three methods of interference area settings are prepared for manipulators and stations. For a system with one manipulator, use robot 1.

- **S-axis Interference Area**
  Position is controlled by the pulse value of the S-axis.

- **Cubic Interference Area**
  Up to 64 cubic areas can be set. The edges of the cubes are set parallel to the robot coordinates or the user coordinates.

- **Axis Interference Area**
  Up to 64 areas can be set. Each operation area maximum and minimum value are set for the robot, base axis, and station axis plus and minus side.
8.4 Parameters According to Interference Area

8.4.0.5 S2C067 to S2C194: CUBE USING METHOD

These parameters specify the coordinates for defining the cube. If the user coordinates are selected, also specify the user coordinate system numbers. Set cubic area referring to the cubic interference areas shown below.

Coordinate specification

0 : Pulse (axis interference)
1 : Base coordinates
2 : Robot coordinates
3 : User coordinates

Coordinate No.: Specify the user coordinate number when selecting “3: User Coordinates”.

Units: 1μm

Precaution When Setting the Interference Area

It will be necessary to consider the following when setting the cubic interference and S-axis interference areas. The manipulator is processed to decelerate to stop from the point where it enters in the area. Therefore, set the areas in consideration of the amount of the manipulator movement in the deceleration section shown in the figure below.

The move amount in the speed reduction section is dependent on the moving speed of the manipulator at that time:

- $V = 1500\text{mm/s} \rightarrow \text{approx. 300mm (Max.)}$
- $V = 1000\text{mm/s} \rightarrow \text{approx. 160mm}$
- $V = 30\text{mm/s} \rightarrow \text{approx. 3 to 4 mm}$
- $V = 20\text{mm/s} \rightarrow \text{approx. 2mm}$
**Interference Prevention in Interference Area**

Processing to prevent interference is executed in the I/O processing section. The relation between the DX200 I/O signal and manipulator operation is shown below.

In wait status with the entrance prohibit signal, the manipulator just barely enters the area for speed reduction processing and then stops.

**Fig. 8-9: Connection Example Where Two Manipulators are Operated in the Same Area**

![Diagram showing the connection example with two manipulators](image)
8.4.0.6  S3C000 to S3C047: CUBE SOFT LIMIT

These parameters specify auxiliary functions of S2C001 parameter. For details, see chapter 8.4.0.2 “S2C001: CUBE SOFT LIMIT CHECK” at page 8-32.

8.4.0.7  S3C048 to S3C063: S-AXIS INTERFERENCE AREA

These parameters specify auxiliary functions of S2C002 parameter. For details, see chapter 8.4.0.3 “S2C002: S-AXIS INTERFERENCE CHECK” at page 8-34.

8.4.0.8  S3C064 to S3C1087: CUBIC INTERFERENCE AREA

These parameters specify auxiliary functions of S2C003 to S2C066 parameters. For details, see chapter 8.4.0.4 “S2C003 to S2C066: CUBE/AXIS INTERFERENCE CHECK” at page 8-35.

8.4.0.9  S3C1089 to S3C1096: ROBOT INTERFERENCE AREA

These parameters specify auxiliary functions of S2C236 to S2C263 parameters. For details, see chapter 8.4.0.6 “S3C000 to S3C047: CUBE SOFT LIMIT” at page 8-39.

8.4.0.10 S3C1097: A SIDE LENGTH OF WORK-HOME-POSITION CUBE

Units: 1μm

This parameter specifies a side length of the cube for the work home position.
8.5 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 Parameters According to Status I/O

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)
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]

<table>
<thead>
<tr>
<th>State</th>
<th>Binary Case</th>
<th>BCD Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2⁰ = 1</td>
<td>2⁰ = 1</td>
</tr>
<tr>
<td>0</td>
<td>2¹ = 2</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2² = 4</td>
<td>4</td>
</tr>
<tr>
<td>0</td>
<td>2³ = 8</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2⁴ = 16</td>
<td>16</td>
</tr>
<tr>
<td>0</td>
<td>2⁵ = 32</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2⁶ = 64</td>
<td>64</td>
</tr>
<tr>
<td>0</td>
<td>2⁷ = 128</td>
<td>0</td>
</tr>
</tbody>
</table>

**Total**
- **Case**: 1
- **Total is in ones**: 0
- **Total is in tens**: 0

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
+MOV L ← Master side
Speed specification not provided

<Example> 1: Provided
SMOVL V=100
+MOV L ← 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.
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.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Master job</td>
</tr>
<tr>
<td>1</td>
<td>Root job</td>
</tr>
</tbody>
</table>

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.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Invalid</td>
</tr>
<tr>
<td>1</td>
<td>Valid</td>
</tr>
</tbody>
</table>

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” at page 8-46.

8.6.0.6 S2C265 to S2C288: STATION AXIS DISPLAYED UNIT

This parameter specifies the station axis displayed unit (bit specification).

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Display angle (deg)</td>
</tr>
<tr>
<td>1</td>
<td>Display in distance (mm)</td>
</tr>
</tbody>
</table>
### Setting Method

Set a numerical value (decimal) where the bit of the axis to be displayed in the units of distance becomes 1.

<table>
<thead>
<tr>
<th>d7</th>
<th>d6</th>
<th>d5</th>
<th>d4</th>
<th>d3</th>
<th>d2</th>
<th>d1</th>
<th>d0</th>
</tr>
</thead>
<tbody>
<tr>
<td>(32)</td>
<td>(16)</td>
<td>(8)</td>
<td>(4)</td>
<td>(2)</td>
<td>(1)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Decimal**: Station 1st axis
- **d6**: Station 2nd axis
- **d5**: Station 3rd axis
- **d4**: Station 4th axis
- **d3**: Station 5th axis
- **d2**: Station 6th axis

#### Example

When 1st and 3rd axes of station 1 are displayed in the units of distance:

<table>
<thead>
<tr>
<th>d7</th>
<th>d6</th>
<th>d5</th>
<th>d4</th>
<th>d3</th>
<th>d2</th>
<th>d1</th>
<th>d0</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Set 1 to axis displayed in distance.

\[4 + 1 = 5\]

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).

- 0: Previous step with priority (B-axis moving distance minimized.)
- 1: Form with priority
- 2: Previous step with priority (R-axis moving distance minimized.)

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.
8.7.0.7  **S2C1135 : PROHIBIT WELDING SECTION SPEED OVERRIDE**

This parameter prohibits the speed override within the welding section. While the manipulator is in the welding section, it moves at the same speed as in the situation where the speed override is not specified.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Invalid</td>
</tr>
<tr>
<td>1</td>
<td>Valid</td>
</tr>
</tbody>
</table>

```
0000 NOP
0001 MDML P000 V=50
0002 ARCON ASF1(1)
0003 MDML P001 V=30
0004 MDML P002 V=30
0005 MDML P003 V=30
0006 ARCOF
0007 MDML P004 V=50
0008 END
```

Speed override is prohibited

8.7.0.8  **S2C1137 : DISPLAY WELDING CONDITION FILE COMMENT ON THE JOB WINDOW FUNCTION**

This parameter specifies a comment to the welding start condition file or the welding end condition file, and then displays the comment on the job window when teaching the file by ARCON, ARCOF or ARCSET instruction.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Invalid</td>
</tr>
<tr>
<td>1</td>
<td>Valid</td>
</tr>
</tbody>
</table>

```
0000 NOP
0001 MDML P000 V=50
0002 ARCON ASF1(1)  /電流200A 電圧10V
0003 MDML P001 V=30
0004 MDML P002 V=30
0005 MDML P003 V=30
0006 ARCOF
0007 MDML P004 V=50
0008 END
```

8.7.0.9  **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.

8.7.0.10  **S3C1191: CUT WIDTH CORRECTION VALU**

(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.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Invalid</td>
</tr>
<tr>
<td>1</td>
<td>Valid</td>
</tr>
</tbody>
</table>

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.

<Delayed Signal Output>

Signal output is carried out after the step is reached.
8.8.2 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 1024 in the parameters, the following must be taken into consideration.

- Avoid setting duplicate numbers.
- The signal turned ON or OFF with the programming pendant is operated again or remains unchanged until the instruction is executed.

8.8.3 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.

<table>
<thead>
<tr>
<th>Parameter Setting Value</th>
<th>Operation of Output Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ON</td>
</tr>
<tr>
<td>0</td>
<td>ON</td>
</tr>
<tr>
<td>1</td>
<td>ON while the key is pressed</td>
</tr>
</tbody>
</table>

8.8.4 S2C786 to S2C788: COOLING FAN ALARM DETECTION

This parameter specifies a detection display for cooling fan 1 to 3 with alarm sensor, connected to power ON unit.

- 0 : No detection
- 1 : Detected with message display
- 2 : Detected with message and alarm display

8.8.5 S2C1170 to S2C1171: COOLING FAN ALARM DETECTION

This parameter specifies a detection display for cooling fan 4 to 5 with alarm sensor, connected to power ON unit.

- 0 : No detection
- 1 : Detected with message display
- 2 : Detected with message and alarm display
8.8.0.6  S2C789 to S2C792: COOLING FAN ALARM 1 OPERATION

8.8.0.7  S2C793 to S2C796: COOLING FAN ALARM 2 OPERATION

8.8.0.8  S2C797 to S2C800: COOLING FAN ALARM 3 OPERATION

These parameters specify the operation of cooling fan 1 to 3 with alarm sensor, connected to power ON unit.

Each bit specifies the power ON unit to which the detecting sensor is connected.

8.8.0.9  S2C1174: COOLING FAN ALARM 4 OPERATION

8.8.0.10 S2C1175: COOLING FAN ALARM 5 OPERATION

These parameters specify the operation of cooling fan 4 to 5 with alarm sensor, connected to power ON unit.

8.8.0.11 S2C801 to S2C804: FAN ALARM 1 WELDER STATUS

8.8.0.12 S2C805 to S2C808: FAN ALARM 2 WELDER STATUS
8.8.0.13 S2C809 to S2C812: FAN ALARM 3 WELDER STATUS

These parameters specify the power status that detects a fan alarm.

0: Detect during control power ON
1: Detect during servo power ON

8.8.0.14 S2C1178: FAN ALARM 4 WELDER STATUS

8.8.0.15 S2C1179: FAN ALARM 5 WELDER STATUS

This parameter specifies the power status that detects a fan alarm.

0: Detect during control power ON
1: Detect during servo power ON
8 Parameter

8.9 TRANSMISSION PARAMETERS

These parameters are used when the optional FC1, FC2, or data transmission function is used.

For details, refer to the optional manual “DX200 DATA TRANSMISSION FUNCTION”.

8.10 Application Parameters

8.10.1 Arc Welding

8.10.1.1 AxP000: APPLICATION

This parameter specifies the application. Set “0” for arc welding.

8.10.1.2 AxP003: WELDING ASSIGNMENT OF WELDING START CONDITION FILE

This parameter specifies the beginning condition number in the welding start condition file to be assigned to Welder 2. Condition files of a lower number are automatically assigned to Welder 1. For a system with one Welder, set “49” (maximum value).

8.10.1.3 AxP004: WELDING ASSIGNMENT OF WELDING END CONDITION FILES

This parameter specifies the beginning condition number in the welding END condition file to be assigned to Welder 2. Condition files of a lower number are automatically assigned to Welder 1. For a system with one Welder, set “13” (maximum value).

8.10.1.4 AxP005: WELDING SPEED PRIORITY

This parameter specifies whether the welding speed is specified by the “ARCON” instruction, by the welding start condition file, or by the additional times of the “MOV” instruction.

8.10.1.5 AxP009: WORK CONTINUING

This parameter specifies whether to output an “ARCON” instruction to restart after the manipulator stopped while the “ARCON” instruction is being output.
8.10.1.6 AxP010: WELDING INSTRUCTION OUTPUT

This parameter specifies the beginning number (0 to 12) of the analog output channel to the Welder. “0” indicates that no Welder exists.

8.10.1.7 AxP011, AxP012: MANUAL WIRE OPERATION SPEED

These parameters specify the manual wire operation speed as a percentage of the maximum instruction value. Instruction polarity is determined by the current instruction in the Welder characteristic file. The setting range is from 0 to 100.

8.10.1.8 AxP013, AxP014: WELDING CONTROL TIME

These parameters specify the welding control time in units of minutes. The setting range is from 0 to 999.

8.10.1.9 AxP015 to AxP017: NUMBER OF WELDING CONTROL

These parameters specify the number of welding controls. The setting range is from 0 to 99.

8.10.1.10 AxP026 to AxP029: TOOL ON/OFF USER OUTPUT NO. (Jigless system)

These parameters specify the user output number for the tool open/close operation by specific keys.

8.10.2 Handling Application

8.10.2.1 AxP002, AxP004: f1 KEY FUNCTION

These parameters set the output signal to assign for f1 key.

- 0: Not specified
- 1 to 4: Specific outputs for HAND-1 to HAND4-1
- 5: User output (No. is specified by AxP004).

8.10.2.2 AxP003, AxP005: f2 KEY FUNCTION

These parameters set the output signal to assign for f2 key.

- 0: Not specified
- 1 to 4: Specific outputs for HAND-2 to HAND4-2
- 5: User output (No. is specified by AxP005)
8.10.3.1 AxP003: MAXIMUM NUMBER OF CONNECTED WELDERS

This parameter specify the maximum number of welders which are to be used. The value is automatically set at start-up. No modification is needed.

8.10.3.2 AxP004: GUN FULL OPEN STROKE ON/OFF SIGNAL

This parameter specifies which stroke switching signal is output ON or OFF to make the gun fully-opened for each gun.

Bit specification (1 for 01) for 8 guns. The initial setting is “0”.

```
0 0 0 0 0 0 0 0
```
```
|   |   |   |   |   |   |   |
```
```
8 7 6 5 4 3 2 1     Gun number
```

8.10.3.3 AxP005: STROKE CHANGE ANSWER TIME LIMIT

When using the X2 gear mechanical stopper gun and switching gun stroke, this parameter sets the time from the stroke-switching-sequence start until the pressure instruction end.

The initial setting is “0”, with which the switching signal is output for the “stopper-type stroke switching time” set in the file, and then the gun pressure instruction is turned OFF.

8.10.3.4 AxP006: PARITY SPECIFICATION FOR WELDING CONDITIONS

When adding the parity signal to the welding condition signal with the Welder connected to each welding gun, this parameter specifies odd or even parity.

Bit specification for 4 Welders. (0 : odd number, 1 : even number) The initial setting is “0”.

```
0 0 0 0 0 0 0 0
```
```
|   |   |   |
```
```
4 3 2 1     Welder number
```
8.10.3.5 AxP007: ANTICIPATE TIME

When executing the GUNCL or SPOT instruction with NWAIT specified in the previous move instruction but the time is not specified by ATT in the GUNCL or SPOT instruction, this parameter specifies the anticipate condition (time). The initial setting is “0”, with which the each instruction is executed as soon as the taught position of the previous move instruction is reached, as normal operation.

8.10.3.6 AxP015: WELDING ERROR RESET OUTPUT TIME

This parameter sets the output time of the welding error reset signal to the Welder when the alarm reset signal is input.

If the setting is “0”, the welding error reset signal is not output to the Welder even if the alarm reset signal is input.

8.10.3.7 AxP016, AxP017: tip WEAR AMOUNT ALARM VALUE

These parameters set the tip wear amount alarm values (AxP016: movable side, AxP017: fixed side) at the wear detection.

8.10.4 General-purpose Application

8.10.4.1 AxP009: WORK CONTINUE PROHIBIT

This parameter specifies whether to output TOOLON instruction or not at restarting when the work is stopped for some reasons during the output of TOOLON instruction.

8.10.5 Painting Application

8.10.5.1 AxP080: Specify the Robot With the Paint Gun 1

To specify the robot with the paint gun 1 connected, the robot 1 to the robot 8 must be set as 0 to 7. The initial value is 0 (robot 1).

8.10.5.2 AxP081: Specify the Robot With the Paint Gun 2

To specify the robot with the paint gun 2 connected, the robot 1 to the robot 8 must be set as 0 to 7. The initial value is 0 (robot 1).

8.10.5.3 AxP082: Specify the Robot With the Paint Gun 3

To specify the robot with the paint gun 3 connected, the robot 1 to the robot 8 must be set as 0 to 7. The initial value is 0 (robot 1).

8.10.5.4 AxP083: Specify the Robot With the Paint Gun 4

To specify the robot with the paint gun 4 connected, the robot 1 to the robot 8 must be set as 0 to 7. The initial value is 0 (robot 1).
9 Spot Welding Application Using a Motor Gun

9.1 System Overview (Motor Gun)

An I/O signal diagram of a typical system is shown below.

Fig. 9-1: Spot Welding System I/O Signal Diagram
9.1 System Overview (Motor Gun)

- Welding conditions (level signals)
  - Sets the welding conditions for the welder.
  - The output format can be set as binary or discrete.
  - Can handle up to 255 conditions in binary.

<table>
<thead>
<tr>
<th>8 bits</th>
<th>128</th>
<th>64</th>
<th>32</th>
<th>16</th>
<th>8</th>
<th>4</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>(8)</td>
<td>(7)</td>
<td>(6)</td>
<td>(5)</td>
<td>(4)</td>
<td>(3)</td>
<td>(2)</td>
<td>(1)</td>
<td></td>
</tr>
</tbody>
</table>

The numbers in parentheses are for discrete.

- WELDING COMMAND (level/pulse)
  Outputs the start instruction to the welder.

- WELDING ERROR RESET(level)
  Resets the welding alarm status of the welder.

For details on signal contents, refer to section 9.4.2.2 “Welding I/F File” on page 9-37.
9.2 Function Keys

Each function used for spot welding is allocated on the [NUMERIC KEY]s of the programming pendant.

- **Displays the MANUAL PRESS window.**

- **[INTERLOCK] + [WELD COMPLETE]**
  - Forcibly resets the WAIT instruction.
  - (Only when the specification to forcibly reset the WAIT instruction is enabled (S2C317d1 bit = 1).)

- **Displays the SVSPOT instruction in the input buffer line in order to register spot welding operation.**

- **[INTERLOCK] + [SPOT]**
  - With the MANUAL PRESS window, press these keys to execute manual spot welding.

- **Displays the SVGUNCL instruction in the input buffer line in order to register dry spot welding operation.**

- **[INTERLOCK] + [GUN CLOSE]**
  - With the MANUAL PRESS window, press these keys to execute manual dry spot welding.

- **[INTERLOCK] + [WELD ON/OFF]**
  - Turns the welding ON/OFF signal ON or OFF.
9.2 Function Keys

<table>
<thead>
<tr>
<th>Key Combination</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[INTERLOCK] + [SHORT OPEN]</td>
<td>The movable side tip moves to the selected short open position.</td>
</tr>
<tr>
<td>[INTERLOCK] + [FULL OPEN]</td>
<td>The movable side tip moves to the selected full open position.</td>
</tr>
<tr>
<td>[INTERLOCK] + [WELD ALM RESET]</td>
<td>A welder alarm reset signal is output to the welder while these keys are held down.</td>
</tr>
<tr>
<td>[INTERLOCK] + [PRESSURE]</td>
<td>With the MANUAL PRESS window or the JOB window, press these keys to execute pressurizing.</td>
</tr>
<tr>
<td>[INTERLOCK] + [RELEASE]</td>
<td>Executes releasing.</td>
</tr>
<tr>
<td>[INTERLOCK] + [SEARCH]</td>
<td>Executes searching a work.</td>
</tr>
</tbody>
</table>
9.2 Function Keys

9.2.1 Switching of the Function Key

Function keys can be switched between for spot welding (motor gun) use and for arc welding use by following the procedures below:
9.2.1.1 Two-Robot System

1. Select a robot job for SPOT welding (motor gun).
   (CONTROL GROUP: R1 + S1)
   - Keys change for spot welding (motor gun) use automatically. 
     {ARC/SPOT} icon on the main menu changes to {SPOT}.

2. Select a robot job for ARC welding.
   (CONTROL GROUP: R2)
   - Keys change for arc welding use automatically. 
     {ARC/SPOT} icon on the main menu changes to {ARC}.
9.2.1.2 Single-Robot System

Function keys can be switched between for spot welding (motor gun) use and for arc welding use on APPLI SELECT window.

1. Select {ARC/SPOT} under main menu.
2. Select {APPLI SELECT}.
   – APPLI SELECT window appears.
   This window also appears by selecting [INTERLOCK]+[ROBOT].

3. Select {MOTOR GUN}.
   – Move the cursor to {MOTOR GUN} and press [SELECT], then the function keys become valid for SPOT welding (motor gun) use.
   {ARC/SPOT} icon on the main menu changes to {SPOT}.
4. Select (ARC WELD).
   Move the cursor to (ARC WELD) and press [SELECT], then the function keys become valid for ARC welding use.
   (ARC/SPOT) icon on the main menu changes to (ARC)
9.3 Setting of Motor Gun

Set up the motor gun by following the procedures below. The dynamic characteristics of the motor gun need to be automatically identified by the Motor Gun Auto Turning function so that the pressurization is executed by the optimum pressure torque instruction for the each motor gun.

Before execution of Motor Gun Auto Turning function, procedures described in the chapters from section 9.3.1 “Posture of Motor Gun” on page 9-10 to section 9.3.5 “Register the Base Position for Wear Detection (Fixed Side)” on page 9-13 are necessary.

After execution of Motor Gun Auto Turning, register the base position for the wear detection again because of the changes of the detection accuracy.

Prepare for Motor Gun Auto Tuning operation

1. Set the posture of the motor gun to press downward (Refer to Chap. 9.3.1)
2. Configure the basic of Gun Condition file (Refer to Chap. 9.3.2)
3. Set the pulse to stroke conversion data (Refer to Chap. 9.3.3)
4. Tentative setting of the torque to pressure conversion data (Refer to Chap. 9.3.4)
5. Register the base position for wear detection (fixed side) (Refer to Chap. 9.3.5)
6. Execution of Motor Gun Auto Tuning (Refer to Chap. 9.3.6)
7. Setting of the torque to pressure conversion data (Refer to Chap. 9.12.7)
8. Register the base position for wear detection (fixed side) (Refer to Chap. 9.3.5)
9.3 Setting of Motor Gun

9.3.1 Posture of Motor Gun

Set up the motor gun to the posture shown in the figure below.

![Posture of Motor Gun](image)

9.3.2 Basic Configuration

By referring to section 9.4.1 "Gun Condition File" on page 9-27, set up the following items in the Gun Condition file.

- GUN TYPE
- WELDER NO.
- TORQUE DIR
- MAX PRESSURE

9.3.3 Setting of Pulse to Stroke Conversion Data

Refer to section 9.4.1.1 “Entering Pulse to Stroke Conversion Data” on page 9-32 for this setting.

In case of the manipulators of high speed spot welding specification, the weld complete signal may be already turned ON at the beginning of the welding instruction. At that time, "AL4621: WELD COMPLETE SIGNAL ERROR" may occur.

To prevent the alarm, set the item "WELD COMPLETE OFF WAIT TIME" in chapter section 9.4.7 "Application Condition Setting". Setting the item allows the controller to wait a set time until the weld complete signal is turned OFF.

Also, the alarm can be prevented by adjusting the output pulse time of the weld complete signal by the welder. Please contact to the welder manufacturer if they allows changing the output pulse time.
9.3.4 Tentative Setting of Torque to Pressure Conversion Data

In order to use Motor Auto Tuning function, it is necessary to set the torque to pressure conversion data of the Gun Condition file tentatively.

Normally, the tentative setting is already set. Therefore, confirm that pressing can be done correctly by the maximum pressure and half of the maximum pressure.

If the tentative setting is not set, set the gun motor torque at the maximum pressure and half of the maximum pressure as shown in the following procedures.

<Ex. when the maximum pressure is 6000(N)>

Find and set the torques(%) at 6000(N) and 3000(N)

1. Set a value to {THICKNESS FORCE GAUGE} and select “ENABLE” at {PRESS MEASUREMENT MODE} on the “MANUAL PRESS” window.
2. Set the pressure value to the pressure file.
   – As the unit of this pressure, specify torque(%).
   – Specify 5(%) to the touch speed of the pressure file.

3. Register SVGUNCL instruction to a JOB.
   – Specify the pressure file set at the step 2.

4. Execute the JOB and measure the pressure with the force gauge.

5. Execute the above procedures 2 through 4 with the different torque(%) to find a torque(%) for the pressure to be maximum.

6. Execute the above procedures 2 through 4 with the different torque(%) to find a torque(%) for the pressure to be half of the maximum one.

7. Set torques (%) for both maximum and half of the maximum pressure. And then, change the setting from “NOT DONE” to “DONE”.

NOTE
Pressurization will not be executed in case the Gun Condition file is incomplete.
When applying the pressure for the first time, set a tentative value to the Gun Condition file.
9.3.5 Register the Base Position for Wear Detection (Fixed Side)

Register the base position for wear detection by following the procedures below.

1. Mount a new tip
2. Clear the base position for the wear detection. (Refer to Chap 9.12.3)
3. Register a base position by dry spotting touch motion. (Refer to Chap. 9.12.2.1)

In case a gun is shipped with the manipulator, the base position for the wear compensation (fixed side) setting is done.

5% is set to touch speed and 1000N is set to the pressure as its initial condition for the gun shipped with the manipulator.

In this consequence, when the wear detection is executed, follow the conditions described above (touch speed: 5%, pressure: 1000N).

When modifying those values, clear the base position for the wear compensation data and register the new base position again.

Execute the wear detection operation. If the wear detection operation is not done, the stable pressure cannot be acquired.
9.3.6 Execution of Motor Gun Auto Tuning Function

By referring to the following procedures, execute Motor Gun Auto Tuning.

This function automatically repeats applying pressure to identify the dynamic characteristics parameter of the motor gun.

This identification takes 5 to 10 minutes.

---

**NOTE**
Before execution of the auto tuning operation, assure the safety.

**NOTE**
Before the execution of the auto tuning operation, confirm that the center of both gun tips matches well at the contact position because tips are pressed at maximum pressure by the dry spotting motion during the auto tuning operation.

**NOTE**
After the execution of Motor Gun Auto Tuning function, do not fail to re-measure the pressure and reset the torque to pressure conversion data.

**NOTE**
An alarm “4708: Motor Gun Auto Tuning incomplete” occurs, in case SVSPOT instruction is executed while Motor Gun Auto Tuning is in incomplete status.

Be sure to execute the Motor Gun Auto Tuning function.

---

1. Select {SPOT WELDING} on the {Main Menu}.
2. Select {MOTOR GUN AUTO TUNING}.

   – The MOTOR GUN AUTO TUNING window appears.

---

**WARNING:** Press ‘EXECUTE’ to execute the auto tuning. If you press the start button, the job will be executed.
3. Select the gun number using [PAGE] key or (PAGE) button.

4. Change the mode to the play mode, and then press [SERVO ON READY] key.

   – The servo power is turned ON, then (EXECUTE) button appears.

   – When pressing the start button on the programming pendant while the MOTOR GUN AUTO TUNING window is appeared, the following confirmation dialog appears. Select “NO” to execute the Motor Gun Auto Tuning.

   ![Motor Gun Auto Tuning Window]

   ![Confirmation Dialog]

   If pressing the [START] button after selecting the “YES” in the confirmation dialog, the JOB will be played back.

   Do not press the [START] button unintentionally.
5. Press (EXECUTE) button.

- If the wear compensation has not been executed, the confirmation dialog to prompt performing the wear compensation will appear. Refer to section 9.3.5 “Register the Base Position for Wear Detection (Fixed Side)” on page 9-13, and execute the wear compensation.

- If the wear compensation has been executed, the confirmation dialog to execute the Motor Gun Auto Tuning will appear.
6. Select “YES” in the dialog box.

– The MOTOR GUN AUTO TUNING operation is executed.

– The status of MOTOR GUN AUTO TUNING operation can be confirmed by the SPECIFIED OUTPUT signal (#50906).

• Select {IN/OUT} under the {Main Menu}.

• Select {SPECIFIED OUTPUT}.

• Press [PAGE] key, (PAGE) button, or the select button to indicate SOUT#0719(#50906).

• This signal is turned ON during the MOTOR GUN AUTO TUNING operation.
During the MOTOR GUN AUTO TUNING operation, the following operations are not available:

- Moving to other windows
- Key operation
- Operations by the start button
- External start operation
- IO JOG operation
- Work home position return operation
- Operations by the moving type command of the data transmitting function

**<During the MOTOR GUN AUTO TUNING operation>**

Seeing the dialog “Do you carry out motor gun auto” after pressing the {EXECUTE} button on the MOTOR GUN AUTO TUNING window is the start of this operation, and the end of this operation is pressing the button to close the dialog “Motor gun auto tuning was completed” or the dialog “Result of tuning had abnormalities.”.

Also, it is defined as “during the MOTOR GUN AUTO TUNING operation” while the dialog “Do you continue motor gun auto tuning?” is displayed after Hold is executed while execution of this function.
The MOTOR GUN AUTO TUNING operation is stopped or suspended in case one of the following operation is executed.

- **Stop: Impossible to continue**
  - Emergency stop
  - Mode change

- When the operation is stopped, the MOTOR GUN AUTO TUNING operation finishes incompletely.

- **Suspend: Possible to continue**
  - Hold operation

- When it is suspended (by Hold operation), a confirmation dialog box appears to ask "CONTINUE" or "SUSPEND".

- Select "CONTINUE" to continue the operation.

- Select "SUSPEND" and the MOTOR GUN AUTO TUNING operation finishes incompletely.
- After MOTOR GUN AUTO TUNING operation is successfully done, a confirmation dialog box for registration appears as shown in the figure below. Then, move to step 8.

- In case there is a possibility of false detection of touch due to high friction torque of the gun, a dialog box appears as shown in the figure below to notify an error in MOTOR GUN AUTO TUNING operation. Then, move to step 7.
9 Spot Welding Application Using a Motor Gun

9.3 Setting of Motor Gun

7. Select “OK”.

   - A message “The false detection of touch may occur by friction torque of motor gun. Check the factor of high friction torque.” appears.

   - If no failure is found to the gun, set the touch pressure a higher value than the value of friction torque value. Then, start the MOTOR GUN AUTO TUNING operation from the step 4 again. For the setting of touch pressure, refer to section 9.4.6 “Gun Detail Setting File” on page 9-52.

8. Select “REGIST”.

   - (STATUS) on the window changes from (INCOMPLETE) to (COMPLETE). The date is registered to (ENFORCEMENT DAY).

   - If “CANCEL” is selected, the MOTOR GUN AUTO TUNING operation does not complete.
9.3 Setting of Motor Gun

9.3.7 Confirmation of Motor Gun Auto Tuning Operation Status

1. Select {SPOT WELDING} under the {Main Menu}.
2. Select {MOTOR GUN AUTO TUNING}.
   – The MOTOR GUN AUTO TUNING window appears.
3. Select the gun number using [PAGE] key or {PAGE} button.
   – The operation is completed if {COMPLETE} is indicated at {STATUS}.
   – The operation is not completed if {INCOMPLETE} is indicated at {STATUS}.

---

The result of the MOTOR GUN AUTO TUNING operation is stored in the MOTOR GUN AUTO TUNING file.
And the MOTOR GUN AUTO TUNING file is stored in FILE/GENERAL DATA.
Please do not load MOTOR GUN AUTO TUNING file to other controllers.

**NOTE**

WARNING: Press ‘EXECUTE’ to execute the auto tuning.
If you press the start button, the job will be executed.
9.3.8 Clearance of MOTOR GUN AUTO TUNING Setting

When re-setting the gun condition file due to the change of the gun, etc, clear the Motor Gun Auto Tuning setting by following the procedures below.

1. Select {SPOT WELDING} under the {Main Menu}.
2. Select {MOTOR GUN AUTO TUNING}.
   - The MOTOR GUN AUTO TUNING window appears.
3. Select the gun number using [PAGE] key or {PAGE} button.
4. Select {DATA} - {CLEAR DATA}.

– A confirmation dialog box appears.
5. Select “YES”.
   - (STATUS) changes from (COMPLETE) to (INCOMPLETE).
   - The data will not be deleted if “NO” is selected.
9.3.9 Setting of Torque to Pressure Conversion Data

After the execution of Motor Gun Auto Turning function, by following the procedure below, re-measure the pressure and reset the torque to pressure conversion data.

1. Set a value to \( \text{THICKNESS FORCE GAUGE} \) and select “ENABLE” at \{PRESS MEASUREMENT MODE\} on MANUAL PRESS window.

2. Set the pressure value to the pressure file.
   - As the unit of this pressure, specify torque(%).
   - Specify 5(%) to the touch speed of the pressure file.

3. Register SVGUNCL instruction to a JOB.
   - Specify the pressure file set at the step 2.

4. Execute the JOB and measure the pressure with the force gauge.

5. Execute the above procedures 2 through 4 with the different torque(%) to measure a torque(%) for the pressure.

6. Input the acquired data to “Torque to pressure conversion” in the gun condition file. Up to 12 data can be registered.

On MANUAL PRESS window, set a value to \( \text{THICKNESS FORCE GAUGE} \) and select “ENABLE” to \{PRESS MEASUREMENT MODE\}.

The PRESS MEASUREMENT MODE becomes “UNABLE” in case the mode is changed from the teach mode to the play mode. Set “ENABLE” again when the mode is changed.
### 9.3.10 Alarm

<table>
<thead>
<tr>
<th>Alarm No.</th>
<th>Message</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
</table>
| 4708      | Motor Gun Auto Tuning is not executed | Motor Gun Auto Tuning operation is not executed but SVSPOT instruction is executed | Motor Gun Auto Tuning function by following the procedures below.  
1. Select (SPOT WELDING) - (MOTOR GUN AUTO TUNING).  
2. Change the mode to the play mode, turn the servo power ON, and then press (EXECUTE) button.  
3. Select “REGIST” after Motor Gun Auto Tuning operation is completed.  
4. After Motor Gun Auto Tuning function, do not fail to re-measure the gun pressure and reset the torque to pressure conversion data. |
9.4 System Setting (Motor Gun)

The items to be determined at the system setting, such as the gun and the welder, are specified in the system setting files.

9.4.1 Gun Condition File

The gun characteristics are set in the gun condition file.

- Gun Condition Window

![Gun Condition Window Diagram]
9.4 System Setting (Motor Gun)

1. **GUN NO.**
   Shows the No. of the gun to be used.
   When using two guns or more, select the No. by pressing [PAGE] key.

2. **SETTING**
   Shows whether the gun condition file has been set or not. For the file
   where the values have not been entered, “NOT DONE” appears, while
   for the file where the values have already been entered, “DONE”
   appears.

3. **GUN TYPE**
   Shows the gun type. Select from “C-GUN,” “X-GUN (SINGLE ARM
   MOVE)” and “X-GUN (DOUBLE ARM MOVE).”

4. **WELDER NO.**
   Shows the No. of the connected welder.

5. **TORQUE DIR**
   Specifies the pressure direction of the gun axis motor. When the
   direction to increment the motor encoder value and the pressure
   direction of the gun are the same, select “+”. When they are different,
   select “-”.

6. **PULSE, STROKE**
   Shows the relationship between the encoder pulse value of the gun axis
   motor and the gun stroke. The pulse value for the specified gun stroke
   can be calculated by interpolation of these values. Refer to section
   9.4.1.1 “Entering Pulse to Stroke Conversion Data” on page 9-32
   for more details.

7. **TORQUE, PRESSURE**
   Shows the relationship between the gun axis motor torque and the tip
   pressure. The torque value for the specified pressure can be calculated
   by interpolation of these values. Refer to section 9.4.1.2 “Entering
   Torque to Pressure Conversion Data” on page 9-33 for more details.

8. **MAX PRESSURE**
   Enter the maximum pressure that the gun can apply.
   If the value specified by the pressure file exceeds it, an alarm occurs
   when executed.
   In the teach mode, the torque is restricted by the maximum pressure.
   In case an appropriate value is specified to the maximum pressure, an
   alarm “4328 SERVO TRACKING ERROR” or “1303 ARITHMETIC
   ERROR (SERVO)” may occur in the teach mode.

9. **PRESSURE COMPENSATION**
   Set the difference of the pressure between the upwards and the
   downwards.
   Refer to section 9.14.5 “Gun Pressure Compensation Function” on page
   9-181 for the details.

10. **GUN ARM BEND COEF.**
    Set the gun arm bend compensation volume per 1000N.
    Refer to section 9.14.6 “Compensation of Gun Arm Bend for C-Gun and
    X-Gun (SINGLE ARM MOVE)” on page 9-188 for the details.

11. **GUN PUSHING COEF**
    Set the gun axis pushing volume per 1000N.
    Refer to section 9.10.7.4 “Setting the Gun Pushing Coefficient” on page
    9-105 for the details.
12. GUN INSTALLATION STATUS
Set the gun installation status.
Select “ROBOT-HANDLE” or “FIXED”.

13. TOOL NO.
Displayed after validating the “AUTO TOOL. NO. SELECT FOR GUN” on the APPLICATION CONDITION SETTING window when “12.GUN INSTALLATION STATUS” is “ROBOT-HANDLE”.
Refer to section 9.14.9 “Automatic Tool Number Select Function for Guns” on page 9-216.

14. USER COORDINATE NO.
Displayed when “12.GUN INSTALLATION STATUS” is “FIXED”.
Set the user coordinate No. for the gun to use. Refer to section 9.4.7 “Application Condition Setting” on page 9-57.

15. MOVEMENT RATIO AFTER CLOSE (LOW) (displayed only when “X-GUN (DOUBLE ARM MOVE)” is selected)
Shows the lower tip movement ratio when the gun closes more by the tip wear. Enter 60% when the ratio of upper tip movement: the lower tip movement = 4:6.

16. MOVEMENT RATIO IN SENSING (UP) (displayed only when “X-GUN (DOUBLE ARM MOVE)” is selected)
Shows the ratio when the upper side tip passes the sensor, for detecting the upper side tip wear using a sensor. Enter 70% when the ratio of the upper side tip movement: the lower side tip movement = 7:3.

17. COMPLETE
Press this button to complete “2. SETTING”.
9 Spot Welding Application Using a Motor Gun
9.4 System Setting (Motor Gun)

Operation

1. Select (SPOT WELDING) from the main menu.
2. Select (GUN CONDITION).

- GUN CONDITION window appears.

3. Select a gun No. by pressing [PAGE] key.
4. Select the item to be set.


5. Enter the numerical value, and press [ENTER].
9.4.1.1 Entering Pulse to Stroke Conversion Data

To specify the gun stroke in mm, enter data about the relationship between the gun axis motor encoder pulse value and the gun stroke (mm).

Follow the procedures explained below.

Up to 12 points of data can be entered.

1. Set the applicable gun stroke by a jog operation with the programming pendant.
   - Read the pulse value of the gun axis motor encoder on the programming pendant.

2. Repeat the steps 1 for 12 points in total.
   - When the relationship between two values are known from the machine drawing, calculate the data for the 12 points.

3. Enter the obtained data of 12 items in “PULSE” and “STROKE” in the gun condition file.
9.4.1.2 Entering Torque to Pressure Conversion Data

To specify the pressure in N, enter data about the relationship between the gun axis motor torque (%) and the pressure (N).

Refer to section 9.3.9 "Setting of Torque to Pressure Conversion Data" on page 9-25 for setting procedures.

When the gun condition file has not been set, the pressure cannot be applied.

When applying the pressure for the first time, set any value in the gun condition file.
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.4.2</td>
<td>I/O Signals for a Motor Gun</td>
</tr>
</tbody>
</table>
## 9.4.2.1 Major I/O signal (Motor Gun)

### Table 9-1: Input Signals to DX200

<table>
<thead>
<tr>
<th>Signal</th>
<th>Contents</th>
<th>To</th>
<th>Standard Setting</th>
<th>Setting Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>WELD COMPLETE</td>
<td>Shows that the welder completed the welding normally. Used as a confirmation signal for welding instruction (SVSPOT, SVSPOTMOV) and manual spot welding. After this signal is input, the welding sequence is completed, and the operation moves to the next step.</td>
<td>Welder</td>
<td>IN13</td>
<td>Welder I/F Refer to section 9.4.2.2</td>
</tr>
<tr>
<td>DRY TIP DRESS (WITHOUT PRESSING)</td>
<td>Use to perform the TIP DRESS instruction (SVDRESMOV) without pressing or dressing.</td>
<td>Interlock board, etc.</td>
<td>Unused</td>
<td>I/O Allocation Refer to section 9.4.2.3</td>
</tr>
<tr>
<td>TMR COOL WTR ERR</td>
<td>Monitors an abnormal state of the cooling water for the welder. When this signal is input, an alarm occurs to stop the manipulator. The servo power supply stays ON.</td>
<td>Cooling water flow switch</td>
<td>IN9</td>
<td>Pseudo Input Signal Refer to section 9.4.2.4</td>
</tr>
<tr>
<td>GUN COOL WTR ERR</td>
<td>Monitors an abnormal state of the cooling water for the gun. When this signal is input, an alarm occurs to stop the manipulator. The servo power supply stays ON when the alarm occurs.</td>
<td>Cooling water flow switch</td>
<td>IN10</td>
<td>Pseudo Input Signal Refer to section 9.4.2.4</td>
</tr>
<tr>
<td>TRANS THERMO ERR</td>
<td>This alarm signal from the gun transformer is input directly into the DX100. This signal is normally ON (normally closed) and when it is OFF, an alarm occurs. The servo power supply stays ON when the alarm occurs.</td>
<td>Gun transformer</td>
<td>IN11</td>
<td>Pseudo Input Signal Refer to section 9.4.2.4</td>
</tr>
<tr>
<td>WELD ON/OFF (from PLC)</td>
<td>Inputs the WELD ON/OFF selector switch status from a PLC such as the interlock board. The WELD ON/OFF signal is output to the welder according to this signal and the manipulator status. When this signal is input (ON), the state of the WELD ON/OFF signal to the welder becomes OFF, and welding is not done.</td>
<td>Interlock board, etc.</td>
<td>#20022</td>
<td>Pseudo Input Signal Refer to section 9.4.2.4</td>
</tr>
</tbody>
</table>
### Table 9-2: Output Signals from DX200

<table>
<thead>
<tr>
<th>Signal</th>
<th>Contents</th>
<th>To</th>
<th>Standard Setting</th>
<th>Setting Window</th>
</tr>
</thead>
<tbody>
<tr>
<td>WELDING CONDITION (LEVEL signals)</td>
<td>Sets the welding conditions for the welder. • The output format can be set as binary or discrete (bit number.)  • Can handle up to 255 conditions. The most significant bit is the parity bit when specified.</td>
<td>Welder</td>
<td>4 bits from OUT11</td>
<td>Welder I/F Refer to section 9.4.2.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>OUT19 OUT20 OUT21 OUT21</td>
<td>Unused</td>
</tr>
<tr>
<td>WELDING CONDITION PARITY</td>
<td>Outputs the start command to the welder. This command is NOT necessary for the welder which uses the WELDING CONDITION signal as a start signal.</td>
<td>Welder</td>
<td>Unused</td>
<td>Welder I/F Refer to section 9.4.2.2</td>
</tr>
<tr>
<td>WELDING COMMAND</td>
<td>Outputs by &quot;INTERLOCK&quot; + &quot;WELD ALM RST&quot;.</td>
<td>Welder</td>
<td>OUT18</td>
<td>Welder I/F Refer to section 9.4.2.2</td>
</tr>
<tr>
<td>WELD ON/OFF</td>
<td>Outputs the status of the input signals from the interlock board by considering the robot status.</td>
<td>Welder</td>
<td>OUT17</td>
<td>Welder I/F Refer to section 9.4.2.2</td>
</tr>
</tbody>
</table>
9 Spot Welding Application Using a Motor Gun

9.4 System Setting (Motor Gun)

9.4.2.2 Welding I/F File

The welder characteristics are set in the welding I/F file.

<table>
<thead>
<tr>
<th>Welding I/F</th>
<th>Welder No.: 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT</td>
<td></td>
</tr>
<tr>
<td>WELD COMPLETE</td>
<td></td>
</tr>
<tr>
<td>WAIT TIME</td>
<td>5.00 sec</td>
</tr>
<tr>
<td>OUTPUT</td>
<td></td>
</tr>
<tr>
<td>MELD COMPLETE</td>
<td></td>
</tr>
<tr>
<td>WELD COMPLETE SIGNAL</td>
<td></td>
</tr>
<tr>
<td>OUTF# [010]</td>
<td></td>
</tr>
</tbody>
</table>
8. WELD COND OUTPUT TIME
When the WELD COND OUTPUT TYPE is “PULSE” or “START SIGNAL”, the welding condition signals are turned ON for the time specified at this item.
Refer to "Welder Start Timing" on page 9-39.

9. WELD COND MAX NUM
Set the maximum number of the welding condition.
If the greater value than this setting is set as the WELDING CONDITION (WTM tag) the value will not be outputted through the welding condition signals.

10. WELDING CONDITION PARITY
The parity signal for the WELDING CONDITION.
When executing the welding instruction (SVSPOT, SVSPOTMOV) or the manual spot, the value of WELDING CONDITION PARITY and WELDIG CONDITION are outputted at the same time.
Settings of the odd/even number parity is performed using the parameter. (For the details, refer to section 8.10.3.4 “AxP006: PARITY SPECIFICATION FOR WELDING CONDITIONS” on page 8-57.)

11. WELDING COMMAND
The welding command signal to the welder.
This signal is output when executing the welding instruction (SVSPOT, SVSPOTMOV) or the manual spot.
Setting is unnecessary when WELD CONDITION functions as welder start instruction.

12. WELD GROUP OUTPUT
The weld group output signal for the welder.
The set welding group output No. (set at WGO tag) is outputted through the setting signal in this item when executing the welding instruction (SVSPOT, SVSPOTMOV) or the manual spot.

13. STICK DETECT DELAY TIME
Set the sticking detect delay time.
An alarm occurs if the gun does not open for more than the setting time because the gun has stuck when execute the welding instruction (SVSPOT, SVSPOTMOV) or the manual spot.

---

**NOTE**
Be sure that the allocated user signals are not used in the any JOBs. If the same signals are used in the JOBs, malfunctions will result.
9 Spot Welding Application Using a Motor Gun
9.4 System Setting (Motor Gun)

**Welder Start Timing**
- When the weld cond output type is set to "LEVEL":

As for WST (welder start timing), refer to section 9.7 "Welding Instruction (SVSPOT Instruction)" on page 9-70.
9.4 System Setting (Motor Gun)

When the weld cond output type is set to “PULSE”:

- When WST=0
- When WST=1
- When WST=2

As for WST (welder start timing), refer to section 9.7 “Welding Instruction (SVSPOT Instruction)” on page 9-70.
Spot and Arc Welding Using Motor Gun

9 Spot Welding Application Using a Motor Gun
9.4 System Setting (Motor Gun)

- When the weld cond output type is set to “START SIGNAL”:

As for WST(welder start timing), refer to section 9.7 “Welding Instruction (SVSPOT Instruction)” on page 9-70.
### Operation

1. Select (SPOT WELDING) from the main menu.
2. Select (WELDER IF).

   - The WELDER IF window appears.

3. Select a welder No. by pressing [PAGE] key.
4. Select the item to be set.
5. Enter a numerical value, and press [ENTER].
9.4.2.3 I/O Allocation

I/O Allocation Window

1. DRY TIP DRESS (WITHOUT PRESSING)
   Use this signal to execute the tip dresser instruction (SVDRESMOV) without pressure of the gun.
   Refer to section 9.11.6 “Dry Tip Dressing Operation” on page 9-124.

2. DRY TIP DRESS (WITHOUT DRESSING)
   Use this signal to execute the tip dresser instruction (SVDRESMOV instruction) without dressing.
   Refer to section 9.11.6 “Dry Tip Dressing Operation” on page 9-124.

3. GUN CHUCK (WELDER1)
   Displayed when the gun change function is valid.
   Also, shows the item(s) according to the number of the welders.
   Use this signal to confirm the connection of the gun. In general, allocate the chuck confirmation signal of ATC.
   Refer to section 9.14.2 “Gun Change” on page 9-166.

4. GUN UNCHUCK (WELDER1)
   Displayed when the gun change function is valid.
   Also, shows the item(s) according to the number of the welders.
   Use this signal to confirm the disconnection of the gun. In general, allocate the unchuck confirmation signal of ATC.
   Refer to section 9.14.2 “Gun Change” on page 9-166.

5. GUN ID NO. (WELDER1)
   Displayed when the gun change function is valid.
   Also, shows the item(s) according to the number of the welders.
   This signals are binary signals to confirm the gun number.
   Refer to section 9.14.2 “Gun Change” on page 9-166.

6. GUN UNCHUCK REQUEST (WELDER1)
   Displayed when the gun change function is valid.
   Also, shows the item(s) according to the number of the welders.
   Use this signal to disconnect the gun. In general, allocate the unchuck signal of ATC. (Chuck=OFF, Unchuck=ON)
   Refer to section 9.14.2 “Gun Change” on page 9-166.
9.4 System Setting (Motor Gun)

Operation
1. Select (SPOT WELDING) from the main menu.
2. Select (I/O ALLOCATION).

- The I/O ALLOCATION window appears.
3. Select the signal No. to be set.
   - The number can now be entered.

4. Enter the numerical value and press [ENTER].

   **NOTE**
   Be sure that the allocated user signals are not used in any JOBs. If the same signals are used in the JOBs, malfunctions will result.
9.4.2.4 PSEUDO INPUT SIGNAL Window

The following signals can be validated in the PSEUDO INPUT SIGNAL window.

- TMR COOL WTR ERR (timer cooling water error)
- GUN COOL WTR ERR (gun cooling water error)
- TRANSTHERMO ERR (transformer thermostat error)
- WELD ON/OFF (welding ON/OFF)

1. Select {IN/OUT} from the main menu.
2. Select (PSEUDO INPUT SIG).

- The PSEUDO INPUT SIGNAL window appears.

3. Move the cursor to the signal whose validity/invalidity is to be set, and press [INTERLOCK] + [SELECT].

- Each time [INTERLOCK] + [SELECT] are pressed, “○ (invalid)” and “● (valid)” alternately appear.
9.4.3 Registering the Operation Tool

The registration method of operation tool differs depending on whether it is a single arm move gun or a double arm move gun.

Considering the following cases, refer to section 8.3 Tool Data Setting" of “DX 200 INSTRUCTIONS” (165292-1CD) for the tool coordinate value and tool data setting.
9.4.3.1 When Using a Single Arm Move Gun

Register the tool coordinate value so that TCP is the tip position of the fixed side tip.

Set the tool posture data so that the direction from the fixed side tip to the movable side tip is positive (+) side of Z-axis.

Be sure to set the direction of tool Z-axis facing the movable side tip.
If the Z-axis is not set in the correct direction, the tip wear cannot be properly compensated for.
9.4.3.2 When Using a Double Arm Move Gun

Register the tool coordinate value so that TCP is the contact position of the both fixed side tip and movable side tip.

Set the tool posture data so that the direction from the lower side tip to the upper side tip is positive (+) side of Z-axis.

Be sure to set the tool Z-axis in the direction from the lower side tip to the upper side tip. If the Z-axis is not set in the correct direction, the wear tip cannot be properly compensated for.
9.4.4 Setting the Software Limit Value

For the motor guns, the position where the new tip contacts each other is set as the zero-point (pulse = 0), and the pulse software limit is set at further pressing position from the zero-point.

It is because the gun needs to be closed more than the zero-point when the tips become worn.

<Setting Example>

The contact position of the new tip is set as the zero-point. Since the softlimit is set as the zero-point, the tips do not reach the contact position when the tips become worn. When the softlimit is set at further pressing position from the zero-point, the tips reach the contact position.

Parameters

S1CxG400: Pulse software limit (+ side)
S1CxG408: Pulse software limit (- side)

<Example>

When S1CxG400=50000 and S1CxG408=0:

The motor gun moves in the range from 0 to 50,000 pulses.

To move the tip to the contact position when the tips become worn, set -3,000 for S1CxG408 so that the motor gun moves in the range from -3,000 to 50,000 pulses.

When setting the value for S1CxG408, consider the pulse amount equivalent to the total of maximum wear amounts of both tips and the gun arm bend when maximum gun pressure is applied.
9.4.5 Setting the Lost-tip Detection Value

The gun-axis pulse can be monitored to output the signal when the tips of motor gun are detached.

<Setting Example>

The signal is output when the tips are detached, and the shank moves out of its normal motion range.

Parameters

S2C003=17 (S1 (gun-axis) uses Interference 1.)
S2C067=0 (Monitors pulses.)
S3C064=-3000, S3C072=-10000
(The signal is output in the range of -3000 to -10000.)
9.4.6 Gun Detail Setting File

Set the special gun related setting in the GUN DETAIL SETTING window.

### Gun Detail Setting Window

<table>
<thead>
<tr>
<th>No.</th>
<th>Setting Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>GUN No.</strong></td>
<td>Shows the gun No. to use. When using two guns or more, select the gun No. by pressing [PAGE].</td>
</tr>
<tr>
<td>2</td>
<td><strong>STROKE MOTION SPEED</strong></td>
<td>Set the speed to move to the welding start stroke value (specified value at BWS tag) when executing the welding instruction (SVSPOT). Refer to section 9.7.4 &quot;Gun Stroke Setting before Welding&quot; on page 9-74.</td>
</tr>
<tr>
<td>3</td>
<td><strong>TOUCH SPEED</strong></td>
<td>Performs the closing motion of the gun by the specified speed in this item when using the gun pressure tag (WP tag) of the press instructions (SVSPOT, SVGUNCL, SVSPOTMOV). Inputting the DRY SPOT SIGNAL (CONTINUE) performs the closing motion of the gun by the specified speed in this item as well.</td>
</tr>
<tr>
<td>4</td>
<td><strong>FINAL TOUCH SPEED START POSITION</strong></td>
<td>Set the position to decelerate to the speed set in &quot;4. FINAL TOUCH SPEED&quot;. The followings are the actual position to reduce the speed by the each pressure instruction.</td>
</tr>
<tr>
<td>5</td>
<td><strong>FINAL TOUCH SPEED</strong></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td><strong>TOUCH PRESSURE</strong></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td><strong>ALLOWABLE TOUCH RANGE (MOVABLE SIDE)</strong></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td><strong>ALLOWABLE TOUCH RANGE (FIXED SIDE)</strong></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td><strong>PRESSURE FILE NO.</strong></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td><strong>DRY SPOT SIGNAL (FILE)</strong></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td><strong>DRY SPOT PRESSURE (CONTINUE)</strong></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td><strong>DRY SPOT SIGNAL (CONTINUE)</strong></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td><strong>TOUCH TEACHING</strong></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td><strong>GUN STROKE</strong></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td><strong>TOP ADJUSTMENT</strong></td>
<td></td>
</tr>
</tbody>
</table>

1. **GUN No.**

Shows the gun No. to use.
When using two guns or more, select the gun No. by pressing [PAGE].

2. **STROKE MOTION SPEED**

Set the speed to move to the welding start stroke value (specified value at BWS tag) when executing the welding instruction (SVSPOT).
Refer to section 9.7.4 "Gun Stroke Setting before Welding" on page 9-74.

3. **TOUCH SPEED**

Performs the closing motion of the gun by the specified speed in this item when using the gun pressure tag (WP tag) of the press instructions (SVSPOT, SVGUNCL, SVSPOTMOV).
Inputting the DRY SPOT SIGNAL (CONTINUE) performs the closing motion of the gun by the specified speed in this item as well.

4. **FINAL TOUCH SPEED START POSITION**

Set the position to decelerate to the speed set in "4. FINAL TOUCH SPEED". The followings are the actual position to reduce the speed by the each pressure instruction.

1) SVSPOT or SVGUNCL without TWC-B/TWC-BE tag.
Reduces the speed from the position where it is away by the setting value towards the gun open direction from the last touch position detected by the dry spot touch motion of the wear detection. (Refer to section 9.12.2.1 "Dry Spot Touch Motion" on page 9-131.)
When the dry spot touch motion of the wear detection has not been executed,
   – In case of SVSPOT or SVGUNCL without TWC-A/TWC-AE tag, the speed is not reduced, and the gun closes by the touch speed set in the pressure file from the beginning until it detects the contact to the work.
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—In case of SVGUNCL with TWC-A/TWC-AE tag, the gun closes by the set speed in the “5. FINAL TOUCH SPEED” from the beginning until it detects the contact to the work.

(2) SVGUNCL with TWC-B/TWC-BE tag.
Reduces the speed from the position where it is away by the setting value towards the gun open direction from the last movable tip position detected by the movable tip detecting motion of the wear detection. (Refer to section 9.12.2.2 “Movable Side Tip Detection” on page 9-132.)
When the movable tip detecting motion of the wear detection has not been executed, the gun closes by the set touch speed in “5. FINAL TOUCH SPEED” from the beginning of the SVGUNCL until it detects the contact to the work.

(3) SVSVPOTMOV
The fixed tip and the movable tip move to the teaching position of the SVSVPOTMOV (the position where the fixed tip and movable tip touch the work) by the specified speed in the SVSVPOTMOV instruction. After that, the gun executes the touch motion by the speed set in the “5. FINAL TOUCH SPEED”.

5. FINAL TOUCH SPEED
When operating the pressure instruction (SVSPOT, SVGUNCL, SVSVPOTMOV), the gun starts the closing motion by the touch speed set in the pressure file. However, before contacting the work, the speed is reduced to the set speed in this item according to “4. FINAL TOUCH SPEED START POSITION”.

If the touch speed set in the pressure file is smaller than this setting, the gun closes by the touch speed in the pressure file until it touches the work.
When setting “0”, the final touch speed becomes 5%.

6. TOUCH PRESSURE
Set the detection pressure for the touch detection (when the gun detects the contact to the work).
After the touch detection, the gun executes the pressure by the set pressure in the pressure file.
Also, when “0” is set in the touch pressure, the touch pressure becomes 600N.

7. ALLOWABLE TOUCH RANGE (MOVABLE SIDE)
8. ALLOWABLE TOUCH RANGE (FIXED SIDE)
Set the allowable range of the touch detection position for the both movable side (gun open side) and the fixed side (gun close side).

Enables to detect an error, such as the tips installing error, by monitoring the allowable touch range of the touch detection position in the each operation of the pressure instruction (SVSPOT, SVGUNCL, SVSVPOTMOV).
If the difference between the touch reference position and the touch detection position when executing the pressure instruction is not within the range, an alarm “TOUCH DETECTION RANGE OVER” occurs.
When setting “0”, the monitoring for the allowance touch range becomes invalid.
The touch reference position is described below according to each pressure instruction to be used.
9.4 System Setting (Motor Gun)

- **SVSPOT or SVGUNCL without TWC-B/TWC-BE tag.**
  The touch reference position is the last touch position detected by the dry spot touch motion of the wear detection (Refer to section 9.12.2.1 “Dry Spot Touch Motion” on page 9-131).

  When the dry spot touch motion of the wear detection has not been executed, the monitoring for the allowance touch range becomes invalid.

- **SVGUNCL with TWC-B/TWC-BE tag.**
  The touch reference position is the last movable tip position detected by the movable tip detecting motion of the wear detection (Refer to section 9.12.2.2 “Movable Side Tip Detection” on page 9-132).

  When the movable tip detecting motion of the wear detection has not been executed, the monitoring for the allowance touch range becomes invalid.

- **SVSVPOTMOV**
  The touch reference position is the gun teaching position of SVSVPOTMOV.

9. PRESSURE FILE NO.
Specify the pressure file No. for the “DRY SPOT SIGNAL(FILE)”. Refer to section 9.14.4 “Signal Dry Spot” on page 9-178 for more details.

10. DRY SPOT SIGNAL (FILE)
Operates the dry spot by the universal input set in this item according to the pressure file specified in the “9. PRESSURE FILE NO.”. Refer to section 9.14.4 “Signal Dry Spot” on page 9-178 for more details.

11. DRY SPOT PRESSURE (CONTINUE)
Set the pressure for the “DRY SPOT PRESSURE (CONTINUE)”. Refer to section 9.14.4 “Signal Dry Spot” on page 9-178 for more details.

12. DRY SPOT SIGNAL (CONTINUE)
Operates the dry spot by the universal input set in this item according to the pressure specified in the “11. DRY SPOT PRESSURE (CONTINUE)”. Refer to section 9.14.4 “Signal Dry Spot” on page 9-178 for more details.

13. THICKNESS
Input the thickness of the work to operate the welding. Refer to section 9.14.3 “Touch Teaching Function” on page 9-173 for more details.

14. GUN STROKE
Shows the distance between tips when operating the TOUCH TEACHING function.
The value changes when pressing the [SHIFT]+[ENTER] at the same time in a JOB window. Refer to section 9.14.3 “Touch Teaching Function” on page 9-173 for more details.

15. TCP ADJUSTMENT
Shows the adjustment distance of the fixed tip when operating the TOUCH TEACHING function. Refer to section 9.14.3 “Touch Teaching Function” on page 9-173 for more details.
If the value of the TOUCH PRESSURE is too small, the gun mis-detects the touch and may bounce. In this case, set the value, which is greater than the current setting value of the touch pressure. The touch pressure should be set from 600N to 1000N.
### Operation

1. Select (SPOT WELDING) from the main menu.

2. Select (GUN DETAIL SETTING).

   - The GUN DETAIL SETTING window appears.

3. Select the gun No. by pressing the [PAGE] button.

4. Select the item to set.

5. Input the value, and press “ENTER”.
9.4.7 Application Condition Setting

Regarding the miscellaneous items for the spot (motor gun) application, set them in the APPLICATION CONDITION SETTING window.

- **Application Condition Setting**

![APPLICATION CONDITION SETTING Window]

1. **CLEARANCE TEACHING METHOD**
   Set the teaching method of the clearance teaching function. Select from the three teaching methods below.
   - **UPPER TIP**: Teaching with the upper tip contacting the workpiece.
   - **LOWER TIP**: Teaching with the lower tip contacting the workpiece.
   - **GUN CLOSE**: Teaching with both tips contacting the workpiece.

Refer to section 9.10.2 “Setting the Teaching Type” on page 9-92 for more details.

2. **MAX NUMBER OF WELDER CONNECT**
   Set the number of the welders.

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3. WEAR DETECT METHOD
Set the method of wear detection.
Select from the two methods below.
RIN: Operates the wear detection by using a sensor.
TOUCH: Operates the wear detection by performing the board touch.

4. WEAR VALUE CALCULATE METHOD
Set the calculate method of the wear value when operating the wear detection by using the TWC-C.
Select from the two conditions below.
TOTAL VALUE: Multiplying the current detected total value of the wear (fixed side wear value + movable side wear value) by the value of the "WEAR RATIO (FIXED SIDE)" in the SPOT SUPERVISION window makes the fixed side wear value, and the rest of the wear value becomes the movable side wear value.
ADD: Multiplying the wear difference between the current and the last detected total value of the wear by the value of the "WEAR RATIO (FIXED SIDE)" in the SPOT SUPERVISION window, and adding the product above and the last fixed side wear makes the fixed side wear value. Also, the addition of the rest of the wear difference and the last movable side wear value becomes the movable side wear value.

5. ORDER OF WEAR DETECT INSTRUCTION
Set the order of the wear detect instruction.
Select from the two conditions below.
TWC-A → TWC-B: Calculates the wear value only when TWC-A is executed first (dry spotting touch motion), and then TWC-B (movable side tip detection motion) is executed next.
NO LIMIT: There is no order to execute the instructions.

6. WEAR COMPENSATE TEACH METHOD
Set the confirmation method when teaching the positions under the condition that the tip is worn out.
Select from the three conditions below.
MESSAGE: Displays the message "Compensated position" after teaching the positions.
CONFIRM+MSG: The confirmation dialog "Compensate?" appears when teaching operation. If pressing "YES", the positions will be registered. After the registration, the message "Compensated position" appears.
NOT CONFIRM: The confirmation dialog and the message do not appear on the screen when teaching the positions.
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7. THICKNESS DETECTION FUNCTION
Set “VALID” or “INVALID” of the THICKNESS DETECTION FUNCTION. Refer to section 9.14.8 “Group Output” on page 9-200 for more details.

8. THICKNESS ERROR NOTICE
Set the action when the thickness error occurs.

ALARM: Raise an alarm when the thickness error occurs.

SIGNAL: Outputs the universal signal for 100msec pulse instead of raising an alarm.

9. THICKNESS ERROR NOTICE GOUT#
When setting the “SIGNAL” at the “8. THICKNESS ERROR NOTICE”, this item is displayed. Set the universal signal to output when the thickness error occurs. If “0” is set, the signal is not outputted.

10. THICKNESS CHECK MODE SELECT GIN#
Set the universal signal No. to switch to the THICKNESS MEASURE MODE. Setting the value except “0” validates this item. If validated, unable to switch to the THICKNESS MEASURE MODE by using the programming pendant.

11. THICKNESS ALARM IGNORE GIN#
Set the universal signal No. to ignore the THICKNESS DETECTION function. Setting the value except “0” validates this item.

12. WELD GROUP NUMBER
Set the maximum value of the group number when performing the group output to the welder. Refer to section 9.14.7 “Welding Conditions Group Output Function” on page 9-193.

13. WELD GROUP ORIGINAL NO.
Set the signal outputting method when performing the group output to the welder.

Select from the two methods below.

0 Origin: The set value in the group output number (WGO tag) minus 1 is outputted as the signal.

1 Origin: The set value in the group output number (WGO tag) is outputted as the signal.


14. WELD COMPLETE DETECT METHOD
Set the detection method of the weld complete signal, which is inputted from the welder.

Select from the two conditions below.

BIT UP: Rising the signal is regarded as the completion of the welding.

STATUS: It is regarded as the completion of the welding, when the status of the signal is ON. If the weld complete signal is already turned ON at the beginning of the welding instruction, the welding instruction will be terminated immediately.
15. WELD COMPLETE OFF WAIT TIME
When “14. WELD COMPLETE DETECT METHOD” is “STATUS”, setting becomes valid.
The controller waits for the setting time until the weld complete signal is turned OFF if it is already turned ON at beginning of the welding instruction. If the weld complete signal is not turned OFF after passing the setting time, an alarm occurs.

16. WEAR WARNING VALUE (UPPER)

17. WEAR WARNING VALUE (LOWER)
Outputs the pulse (pulse time length for 500msec) of the wear detection error signal (specified output #51535) when the wear value is more than the setting value.
Becomes invalid when “0” is set.

18. WEAR MINUS THRESHOLD (UPPER)

19. WEAR MINUS THRESHOLD (LOWER)
Outputs the pulse (pulse time length for 500msec) of the wear detection error signal (specified output #51534) when the wear value is less than the setting value.
Becomes invalid when “0” is set.

20. WEAR DIFFERENT THRESHOLD (UPPER)

21. WEAR DIFFERENT THRESHOLD (LOWER)
Outputs the pulse (pulse time length for 500msec) of the wear detection error signal (specified output #51534) when the difference between the wear value from the last time and the current value is more than the setting value.

22. WEAR POS. THRSHLD AFTER CHG (UP)

23. WEAR POS. THRSHLD AFTER CHG (LOW)

24. WEAR NEG. THRSHLD AFTER CHG (UP)

25. WEAR NEG. THRSHLD AFTER CHG (LOW)
If performing the wear detection while the tip change signal (specified input #41135) is turned ON, the wear value is compared with the set threshold value. Outputs the pulse (pulse time length for 500msec) of the wear detection error signal (specified output #51534) when the wear value is out of the threshold range.

26. ERROR DISP TYPE
Set the indication type to show an alarm when the alarm occurs by the NADEX welder side.
Select from the two types below.
DISP ALARM: Displays the alarm.
DISP MESSAGE: Displays the message.

27. ALARM SIGNAL SELECT BIT (WELD1)
The items are shown according to the set numbers in the “2.MAX NUMBER OF WELDER CONNECT”.
Specify the signal by a bit (up to 16-bit) which is used as alarm signals among the signals from the NADEX welder when NADEX welder generates an alarm.
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9.4 System Setting (Motor Gun)

28. ERROR CODE BIT (WELD1)

The items are shown according to the set numbers in the “2.MAX NUMBER OF WELDER CONNECT”.
Specify the signal by a bit (up to 16-bit) which is used as error code among the signals from the NADEX welder when NADEX welder generates an error.

29. AUTO TOOL NO. SELECT FOR GUN

Set “VALID” or “INVALID” of the “AUTO TOOL NO. SELECT FOR GUN” function.
When “AUTO TOOL NO. SELECT FOR GUN” is “VALID”, and the status is selected as “ROBOT-HANDLING” in the “GUN INSTALLATION STATUS” of the GUN CONDITION window, the tool, which is set at the “TOOL NO.” in the GUN CONDITION window, is automatically selected when selecting the JOB.
Refer to section 9.14.9 “Automatic Tool Number Select Function for Guns” on page 9-216.

30. MOTION WHEN MANUAL HANDLING

Set whether to permit or prohibit moving the manipulator by the programming pendant during the manual handling (Refer to section 9.8.3 “Workpiece Transfer Function Using a Motor Gun” on page 9-82).
Select from the three conditions below.
PERMIT: Permits to move the all manipulators.
PROHIBIT: Prohibits the FWD, BWD and TEST operations.
CONFIRM: Displays the confirmation dialog when starting the JOG, FWD, BWD and TEST operations. If selecting the “YES” in the dialog, JOG, FWD, BWD and TEST operations can be performed.

31. WEAR COMP. METHOD FOR TWIN GUN

Set the wear compensation method of the twin guns.
Select from the four methods below.
NO COMP: The wear compensation is not executed.
USE 1ST GUN: Executes the wear compensation by the wear value of the gun specified at the first GUN tag in the SVSPOT instruction.
USE 2ND GUN: Executes the wear compensation by the wear value of the gun specified at the second GUN tag in the SVSPOT instruction.
AUG. VALUE: Executes the wear compensation by the average value of the both guns.
Operation
1. Select (SPOT WELDING) from the main menu.
2. Select (APPLI COND.).

- The APPLICATION CONDITION SETTING window appears.

3. Select the item to set.
4. Input the value, and press “ENTER”.
9.5 **Before Teaching**

Before using the motor gun, confirm the following operation instructions.

### 9.5.1 Manual Spot

For manual spot, perform the following operations.

1. Press [0/MANUAL SPOT] of the [Numeric Key].
2. Press [INTERLOCK] + [.SPOT].
   - Spot welding is started and finished after the specified time.

Manual spot is executed while these keys are held down when the MANUAL PRESS window is displayed.

Manual spot operates under the conditions that are set in the MANUAL PRESS window.

Refer to section 9.9 “Manual Pressure” on page 9-88 for the condition settings.

### 9.5.2 Manual Dry Spot

For manual dry spot, perform the following operations.

1. Press [0/MANUAL SPOT] of the [Numeric Key].
2. Press [INTERLOCK] + [2/GUN CLOSE].
   - Dry spot is started and finished after the specified time.

Manual dry spot operates under the conditions that are set in the MANUAL PRESS window.

Refer to section 9.9 “Manual Pressure” on page 9-88 for the condition settings.

### 9.5.3 Manual Press

For manual press, perform the following operations.

1. Press [0/MANUAL SPOT] of the [Numeric Key].
2. Press [INTERLOCK] + [8/PRESSURE].
   - Pressurizing is started and is kept till the next releasing operation is started.
3. Press [INTERLOCK] + [9/RELEASE].
   - Pressurizing is released and the gun is opened.

Manual press operates under the conditions that are set in the MANUAL PRESS window.

Refer to section 9.9 “Manual Pressure” on page 9-88 for the condition settings.
9.5.4 Open/Close of Motor Gun

Open and close the motor gun in the following operations.

1. Press [EX. AXIS].
   - The LED on [EX. AXIS] lights up.

2. Choose the control group of the gun-axis
   - Each time [EX.AXIS] is pressed, the objective external axis alternates.

3. Press [FAST] or [SLOW] key to select the axis manual speed.
   - Refer to section 2.2 “General Operations” on page 2-3 for the details.

4. Press [S+] or [S-].
   - The motor gun performs an “open motion” or a “close motion.”

   • The opening and closing directions of the motor gun differ depending on the gun type.

   • When setting the manual speed, be sure to select “slow speed” to check the opening and closing directions of the gun.

9.5.5 Mounting Tips

Mount a tip in a dry spot motion.

For dry spot, refer to section 9.5.2 “Manual Dry Spot” on page 9-63.

   For teaching, be sure to use a new tip with no wears.
9.5.6 Creation of Job

This section explains how to prepare a job for a robot axis and a gun axis.
9.5.6.1 Job Creating Procedures for Pressure Instruction Registration

1. Select {JOB} under {Main Menu}.
2. Select {CREATE NEW JOB}.
3. Enter a job name.
4. Set a control group.
   – Set a control group which includes a gun-axis.
   – The gun-axis is registered as a station.
   – When it is a gun mounted on a robot, be sure to register “Robot + Station (gun-axis)” control group.
   – The pressure compensation function and gun arm bend compensation function do not work properly when the job is only for a control group of gun-axis.
5. Press [ENTER]

   – Refer to section 3.1.3 “Registering a Job” on page 3-2 for the details.
9.5.6.2 Registering Steps

- **When using SVSPOT instruction**
  Register steps in the following procedures.

  1. Register the positions from 1 to 4 as steps 1 to 4.
  2. Close the gun till it reaches to the position 5, and then register it as step 5 in the job.
  3. Open the gun till it reaches to the position 6, and then register it as step 6 in the job.
  4. Register the positions from 7 to 9 as steps 7 to 9.

  - Position 5 should not touch the workpiece. Give 5 to 10 mm space between the workpiece and the tip.
  - By registering SVSPOT (Welding Execution) instruction after step 5, the tool end touches the workpiece in the touch motion.
  - For the double arm move gun, teach positions 4 and 5 in the same step, and also positions 6 and 7 in the same step.

- **When using SVSPOTMOV instruction**
  Execution of teaching operation using SVSPOTMOV instruction requires less procedures than using SVSPOT instruction. For the details, refer to section 9.10 “Clearance Move Instruction (SVSPOTMOV Instruction)” on page 9-91.
9.6 Playback (Motor Gun)

This section explains about the check run and the actual welding.

9.6.1 Check Run

Confirm the taught path in the check run. Dry run is possible during the check run operation because welding instructions such as SVSPOT are not carried out in the check run operation.

1. Set the mode switch to “PLAY” on the programming pendant.
2. Select {UTILITY} in the menu area.
3. Select {SETUP SPECIAL RUN}.
4. Select “CHECK-RUN” and set “VALID” to it.

9.6.2 Execute Welding

After having confirmed the taught path, start the welding operation.

SVSPOT instruction becomes available after turning OFF the check run operation.
9.7 Welding Instruction (SVSPOT Instruction)

9.7.1 Registration of Welding Instruction (SVSPOT Instruction)
Press [/SPOT] on the programming pendant to register SVSPOT instruction.

SVSPOT GUN#(1) PRESS#(1) WTM=1 WST=1

1               2              3           4

1. Gun No.
   Specifies a gun No. to be used for welding.
2. Gun pressure file No.
   Specifies a file No. to which a pressure is set.
   Or, the pressure can be directly specified by WP tag instead of using PRESS tag.
   In case specification by both Press and WP tags are omitted, the pressure file is used as its pressure condition. At this time, the file number becomes the number set to the welding condition number (WTM tag).
3. Welding condition No.
   Specifies a welding condition No. set to the welder.
4. Welder startup timing
   Specifies a timing to start the welder.
   The timing is chosen from the following conditions.
   • WST=0: The welder starts at the same time as the execution of SVSPOT instruction.
     As the welder starts its operation before pressurization, a squeeze time at the welder is required.
   • WST=1: The welder starts at the same time as the pressure reaches the 1st pressure.
   • WST=2: The welder starts at the same time as the pressure reaches the 2nd pressure.
9 Spot Welding Application Using a Motor Gun

9.7 Welding Instruction (SVSPOT Instruction)

- **Welder startup timing**

- **Gun Pressure window**

  9.7.2 Setting of Gun Pressure
  
  The pressure for welding can be specified by the pressure file selected by SVSPOT instruction.

  1. **CONDITION NO.**
     Shows the pressure file number. Press [PAGE] to select a file number.

  2. **SETTING.**
     Shows the setting status of the pressure file.
     “NOT DONE” is indicated if a value is not input.
     “DONE” is indicated if a value is input.

  3. **TOUCH SPEED**
     Shows the gun closing speed with a link speed (%).

  4. **1ST TO 4TH PRESS**
     Shows the pressure at each step.
5. 1ST TO 4TH END CONDITION
Shows the corresponding pressurization condition at each level.
Select either “PRESS” or “END WAIT”.
PRESS TIME: Apply pressure for a time specified at “6” item on
this window.
END WAIT: Stop applying pressure when a weld complete signal
is input from the welder.
In case “END WAIT” is specified to either {1ST PRESS}, {2ND PRESS}
or {3RD PRESS}, the pressure condition of the press next to the
specified press is no longer indicated.

6. 1ST TO 4TH PRESS TIME
Shows the pressure time for each pressure. In case “END WAIT” is
selected at item “5”, this item does not appear.

To item “4”, set a value so that the following equality to be
true.

NOTE
1000 <= 1ST to 4TH PRESS
If the gun pressure is not set by following the above
mentioned instructions, the actual pressure over the
specified pressure cannot be guaranteed.

Operation procedures
1. Press {SPOT WELDING} on the {Main Menu}.
2. Select {GUN PRESSURE}.

– The GUN PRESSURE window appears.
3. Select a file number by pressing [PAGE].
4. Select an item to be specified.
5. Input a numeric value and press [ENTER].
   - For (END CONDITION), “PRESS TIME” and “END WAIT” alternate each time [SELECT] is pressed.
6. Move the cursor to (SETTING) and press [SELECT].
   - “DONE” appears to this item.

Table 9-3: <Example>

<table>
<thead>
<tr>
<th>PRESS (N)</th>
<th>END CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ST PRESS</td>
<td>PRESS TIME</td>
</tr>
<tr>
<td>2000</td>
<td>0.20 sec</td>
</tr>
<tr>
<td>2ND PRESS</td>
<td>PRESS TIME</td>
</tr>
<tr>
<td>1500</td>
<td>0.10 sec</td>
</tr>
<tr>
<td>3RD PRESS</td>
<td>PRESS TIME</td>
</tr>
<tr>
<td>2200</td>
<td>0.20 sec</td>
</tr>
<tr>
<td>4TH PRESS</td>
<td>END WAIT</td>
</tr>
<tr>
<td>1800</td>
<td>-</td>
</tr>
</tbody>
</table>

Gun pressure can be edited during the playback operation. The edited content is reflected after the gun pressure setting is done.
9.7.3 Welding Current and Welding Time Settings

The welding current and the welding time are set to the welder.
Refer to the Operator’s manual of the welder.

*NOTE*

The welding condition No. set to the welder should be the same as the welding condition No. specified in the SVSPOT instruction.

9.7.4 Gun Stroke Setting before Welding

At the execution of SVSPOT instruction, the gun can move to a specified position before the touch motion starts.

Without gun stroke setting | With gun stroke setting
---|---

Without gun stroke setting:
- Touch motion

With gun stroke setting:
- Stroke motion
- Touch motion

• If the touch speed is too fast, the gun axis may bounce. Reduce the speed to be slower than the present value.

• Modified settings are deleted in case following operations are executed while editing the gun pressure.
  1. Change the page
  2. Change the mode from play to teach
  3. Switch to other file editing menu
  4. Turn OFF the power supply

• The touch speed is limited to the maximum teaching speed in the teach mode.
9.7.4.1 Setting the Gun Stroke Position

SVSPOT GUN#(1) PRESS#(1) WTM=1 WST=1 BWS=10.0

1

1. Gun stroke position before welding

At the execution of SVSPOT instruction, the gun moves to a specified opening position. Then, the touch motion starts and the gun moves to the pressurizing position. When this item is omitted, the touch motion starts immediately at the SVSPOT instruction.
### 9.7.4.2 Setting the Gun Stroke Motion Speed

1. Select {SPOT WELDING} on the {Main Menu}.
2. Select {GUN DETAIL SETTING}.
   - The GUN DETAIL SETTING window appears.
3. Select a gun No. by pressing [PAGE].
4. Select {STROKE MOTION VELOCITY}.
   - STROKE MOTION VELOCITY
     The gun stroke motion speed under the SVSPOT instruction is specified.
5. Enter a numerical value, and press [ENTER].
9.7.4.3 Motion Example

The figure below shows an example of a motion with the following conditions.
Gun stroke position before welding: 10.0 mm
Gun stroke motion speed: 100.0%
Touch press motion speed: 20%.
9.8 **Dry Spot (Motor Gun)**

For dressing a tip and mounting a tip, a gun motion to apply pressure without welding (dry spot) is required.

Dry spot can be also registered in a job to be executed.

9.8.1 **Registration of Dry Spot Instruction (SVGUNCL Instruction)**

Register SVGUNCL instruction by pressing [2/GUN CLOSE] among the [Numeric Key] on the programming pendant.

SVGUNCL GUN#(1) PRESSCL#(1)

1                  2

**1. Gun No.**

Specifies a gun No. to execute dry spot.

It is used in common with SVSPOT instruction.

**2. Pressure file No.**

As a pressure condition, choose one out of the following four tags.

- PRESSCL tag (dry spot pressure file)
  
  The dry spot pressure file is regarded as its pressure condition.
  
  Set a file number to the tag.

- WP tag (direct pressure setting)
  
  A pressure is directly specified to a tag.

- PRESSTWC tag (pressure condition for the wear detection)
  
  A pressure condition for the wear detection.
  
  Apply pressure by the values set to {TOUCH SPEED} and {DETECTION PRESSURE} in the spot supervision file.
  
  For the details, refer to section 9.12 “Tip Wear Detection and Wear Compensation (Motor Gun)” on page 9-129.

- DRS tag (tip dress condition)
  
  The tip dress condition file is regarded as its pressure condition.
  
  Setting at {PRESSURE CONDITION} in the tip dress condition file is employed and other settings are not.
  
  Set a file number to the tag.
  
  For the details, refer to section 9.11 “Tip Dressing Instruction (SVDRESMOV Instruction)” on page 9-110.
9.8.2 Dry Spot Pressure Setting

The pressure for dry spot is specified by the pressure file selected by the SVGUNCL instruction.

- **PRESSURE window**

  ![PRESSURE window diagram]

  1. **FILE NO.**
     Shows the dry spot pressure file No.
     Select a number by pressing [PAGE].

  2. **TIP DRESSER ROTATION REQUEST**
     Shows the universal output signal number in synchronization with the dry spot pressure.

  3. **PRE CUT TIME**
     Shows the time from when the tip dresser rotation request is output till the moment the gun starts applying pressure.

  4. **END CUT TIME**
     Shows the time after the pressurization is finished and before the tip dresser rotation request is turned OFF.

  5. **TOUCH SPEED**
     Shows the gun closing speed with a link speed (%).

  6. **PRESS UNIT**
     Shows the units for dry spot pressure. Select “N” or “% (TORQUE).”

  7. **1ST to 4TH PRESS**
     Shows the dry spot pressure at each step.

  8. **1ST to 4TH PRESS TIME**
     Shows the pressure time of each dry spot pressure.

  9. **1ST to 4TH PRESS OUT**
     Shows the ON/OFF status of the universal output signal which is output in synchronization with each dry spot pressure.
     When a synchronizing signal is output to a tip dresser, etc., select “ON.”

  10. **1ST to 4TH PRESS SIGNAL**
      Shows the No. of the universal output signal which is output in synchronization with each dry spot pressure.
As for a value to "7", set a value so that the following equality to be true.

\[ 1000 \leq 1ST \text{ to } 4TH \text{ PRESS} \]

If the gun pressure is not set following the above mentioned instructions, the actual pressure over the specified pressure cannot be guaranteed.

### Operating procedure

1. Select {SPOT WELDING} on the {Main Menu}.
2. Select {PRESSURE}.
   - Pressure window appears.
3. Select a file No. by pressing [PAGE].
4. Select an item to be set.
5. Enter a numerical value, and press [ENTER].
   - To {PRESS UNIT}, press [SELECT] to display “N” and “% (TORQUE)” alternately.
   - To {OUT} item, press [SELECT] to display “ON” and “OFF” alternately.
Table 9-4: <Example>

<table>
<thead>
<tr>
<th>PRESS (N)</th>
<th>END CONDITION</th>
<th>OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ST PRESS</td>
<td>2000</td>
<td>0.50</td>
</tr>
<tr>
<td>2ND PRESS</td>
<td>2200</td>
<td>0.50</td>
</tr>
<tr>
<td>3RD PRESS</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>4TH PRESS</td>
<td>0.0</td>
<td>0.00</td>
</tr>
<tr>
<td>Tip dresser</td>
<td>rotating signal</td>
<td></td>
</tr>
</tbody>
</table>

PRE CUT TIME = 1.0 (sec) and END CUT TIME = 1.0 (sec)

If the touch speed is too fast, the gun axis may bounce. Reduce the speed to be slower than the present setting.

The touch speed is limited to the maximum teaching speed in the teach mode.
9.8.3 Workpiece Transfer Function Using a Motor Gun
9.8.3.1 Operation Flow Chart

With the dry spot instruction, workpieces can be transferred. When this instruction is performed, the force control for grasping a workpiece and the tip wear compensation are available so that the workpiece can be stably handled using a motor gun.

The following shows the operation flow chart for the workpiece transfer function.

Start

Set the conditions for grasping/releasing workpieces

Teach a position

Register instructions for grasping/releasing workpieces

End
9.8.3.2 Instruction for Grasping/Releasing Workpieces

<Example>

```
SVGUNCL  GUN#(1) PRESSCL#(1) ON
1    2    3    4
```

1. **Instruction for grasping/releasing workpieces**

2. **GUN#(1)**
   Specifies the gun No. to grasp the workpiece.

3. **PRESSCL#(1)**
   Specifies a dry spot condition file (pressure for grasping workpiece setting) No.
   Or, the pressure can be directly specified by using WP tag instead of using PRESS tag.

4. **ON**
   Specifies whether the workpiece is grasped (ON) or released (OFF).

1. Select {JOB} on the {Main Menu}.
2. Select {JOB CONTENT}.
   - JOB CONTENT window appears.
   ```
   JOB CONTENT
   A: EFFECT
   CONTROL GROUP: RC1
   TOOL: XX
   EO: 001 ESD
   MENU: 010.70
   ```
3. Press [INFORM LIST].
4. Select {DEVICE}.
   - Select {SVGUNCL} for the instruction of grasping.
5. Move the cursor to \{SVGUNCL\} and press [SELECT] twice.
   – DETAIL EDIT window appears.
   (For transferring workpieces, adding the transfer tag is required on
   this window.).

   ![IMAGE OF DETAIL EDIT WINDOW]

   – When “UNUSED” is selected for \{WEAR DETECT\}, the following
   dialog box appears.

   ![IMAGE OF DIALOG BOX]

6. Edit the tag item of the instruction.
   – Select \{CONSTANT\} from the dialog box.
   • ON: Grasps the workpiece
   • OFF: Releases the workplace

   ![IMAGE OF DIALOG BOX WITH TAG ITEM EDITED]
7. Press [INSERT] and then press [ENTER].

(1) The window returns to JOB CONTENT window after pressing [ENTER].

(2) The instruction can be inserted by pressing [ENTER] while LED indicator is lit by pressing [INSERT].
9.8.3.3 Manual Operation for Grasping/Releasing Workpieces

This section describes how to grasp/release workpieces by manual operation from the programming pendant.

With this operation, the workpiece can be easily grasped/released when teaching the position for transferring workpieces.

This operation can be performed only in the teach mode.

1. Contact the fixed side tip to the workpiece to let the manipulator grasp the workpiece.
   - Pressure is applied when pressing [INTERLOCK] + [8].
     To set the pressure conditions, use {TOUCH SPEED}, {PRESS UNIT} or {PRESSURE} on MANUAL PRESS window.

2. Release the Workpiece
   - Press [INTERLOCK] + [9] to release the gun axis.
9.9 Manual Pressure

Manual pressure window

1. **GUN NO.**
   Specifies the gun number to execute pressurization.

2. **PRESS MEASUREMENT MODE**
   Select “ENABLE” when measuring the pressure with a force gauge. For the gun closing speed, just before the upper and lower tips to contact, the gun decreases its speed till the speed to the final touch speed specified on GUN DETAIL SETTING window. When “ENABLE” is set to {PRESS MEASUREMENT MODE}, the gun’s position where it starts decreasing the speed is offset for the distance equal to the thickness of the force gauge, and start decreasing the speed before the upper and lower tips contact the gauge. With this setting, measurement of the pressure with the same condition as the normal pressurization becomes possible.

   This mode is disabled when the mode is changed to play even if “ENABLE” is selected.

3. **THICKNESS FORCE GAUGE**
   Specify the thickness of the force gauge to this item after “PRESS MEASUREMENT MODE” is enabled.

4. **ROBOT FOR PRESSURE/BEND COMPENSATION**
   Select a robot for the pressure and bend compensation operations.

   **NOTE**
   The bend compensation is not executed by MANUAL DRY SPOT ([INTERLOCK] + [2]).

5. **TOUCH SPEED**
   Specifies a touch speed when applying pressure manually.

6. **PRESS UNIT**
   Shows the units for manual pressure. Select “N” or “% (TORQUE).”

7. **PRESSURE**
   Specifies the pressure for manual pressure.
8. MANUAL DRY SPOT MODE

Pressurizing method for the dry spot is specified by selecting either “FILE” or “CST PRESS”. With this procedure, “TOUCH SPEED” and “PRESSURE” are specified as follows.

- When “FILE” is selected
  TOUCH SPEED: It is defined by the dry spot pressure file condition specified by “PRESSURE FILE NO.”
  PRESSURE: It is defined by the dry spot pressure file condition specified by “PRESSURE FILE NO.”.

- When “CST PRESS” is selected
  TOUCH SPEED: It is defined by the value input to “CONST PRESS TOUCH SPEED”.
  PRESSURE: It is defined by the pressure input to “CONST PRESSURE”.

9. PRESSURE FILE NO.

This item appears when “FILE” is selected to “MANUAL DRY SPOT MODE”. Specifies the dry spot pressure file number for the manual dry spot operations.

10. CONST PRESS TOUCH SPEED

This item appears when “CST PRESS” is selected to “MANUAL DRY SPOT MODE”. Specifies the touch speed for the constant pressurizing operations.

11. CONST PRESSURE

This item appears when “CST PRESS” is selected to “MANUAL DRY SPOT MODE”. Specifies the pressure for the constant pressurizing operations.

12. MANUAL SPOT MODE

“FILE” is always specified while executing the pressurizing operations at the manual spot.

13. GUN PRESSURE FILE NO.

Specifies the gun pressure file number in welding operation.

14. WELDING CONDITION(WTM)

Specifies the welding condition number to be output to the welder.

15. WELDER STARTUP TIMING(WST)

Shows the timing to start-up the welder. Select one condition out of the following three conditions.

- Touch motion: Start-up the welder at the same timing with the execution of SVSPOT instruction. A squeeze time at the welder is required because the welder starts its operation before pressurization starts.
- 1ST PRESSURE: Start-up the welder at the same timing with the execution of the 1ST PRESSURE.
- 2ND PRESSURE: Start-up the welder at the same timing with the execution of the 2ND PRESSURE.

16. WELD GROUP OUTPUT(WGO)

Specifies a welding group No. output to the welder.
9 Spot Welding Application Using a Motor Gun

9.9 Manual Pressure

- **Operating procedures**
  1. Press [0/MANUAL SPOT] of the [Numeric Key].
     - MANUAL PRESS window appears.
  2. Select an item to set.
  3. Input a value, and press [ENTER].
     - To {WELDER STARTUP TIMING(WST)}, press [SELECT] to alternate “TOUCH MOTION”, “1ST PRESSSURE” and “2ND PRESSSURE”.
     - To {MANUAL SPOT MODE}, press [SELECT] to alternate “FILE” and “CST PRESS”.

- **Manual Press Operation**

The manual press ([INTERLOCK] +[8]) and the manual dry spot ([INTERLOCK] +[2]) are available even if the MANUAL PRESSURE window is not opened.

However, in this case, the available gun is not the one selected on the manual pressure window but the gun included in the job currently selected. For this reason, these operations are not available when a gun is not included in the currently selected job.

Also, the robot for pressure/bend compensation is the one included in the currently selected job. For this reason, pressure/bend compensation is not available when a robot is not included in the currently selected job.
9.10 Clearance Move Instruction (SVSPOTMOV Instruction)

After teaching this instruction at the welding points, execution of all the following operations become enabled by this instruction only.

1. Moving to a position short before the welding operation point. (moving to a clearance position)
2. Moving to a welding position
3. Welding operation
4. Moving to a position just behind the welding operation point. (moving to a clearance position)

The clearance position mentioned above means the position where the gun is opened over the welding position by the clearance distance specified by the clearance file.

9.10.1 Operation Flow

The following shows the teaching operation flow chart for the clearance move instruction.

```
Start

Specify a teaching type
- Specify following teaching types
  - Teaching type 1: Lower-tip teaching
  - Teaching type 2: Upper-tip teaching
  - Teaching type 3: Gun-close teaching

Specify a clearance file
- Set the following clearance data
  - Upper tip clearance distance
  - Lower-tip clearance distance
  - Board thickness (for the teaching type 1 and 2)

Teach a welding point
- Specify following teaching data
  - Teaching point (teaching)
  - Moving speed
  - Clearance file No.
  - Pressure/welding conditions

End
```
9.10.2 Setting the Teaching Type

The following three types of settings are available; the lower-tip teaching, the upper-tip teaching, and the gun-close teaching.

Follow the procedures to select one out of the three types before teaching the welding point.

1. Select {SPOT WELDING} on the {Main Menu}.
2. Select {APPLI COND.}.

- APPLICATION CONDITION SETTING window appears
3. Select {CLEARENCE TEACHING METHOD}.

   – Move the cursor to {CLEARENCE TEACHING METHOD} and press [SELECT]. A selection dialog box for the teaching methods appears.

   – Three teaching methods are available.
   • UPPER TIP: Teaching with the upper tip contacting the workpiece
   • LOWER TIP: Teaching with the lower tip contacting the workpiece
   • GUN CLOSE: Teaching with both tips contacting the workpiece

4. Select a desired teaching method.

   – Press (SELECT) to change the method.
Spot and Arc Welding
Using Motor Gun

9.10 Clearance Move Instruction (SVSPOTMOV Instruction)

9.10.3 Setting the Clearance Files

In this section, setting procedures of various data to the clearance file are explained.

- When selecting “UPPER TIP” or “LOWER TIP” as the clearance teaching method, setting of (TICKNESS) in the clearance file before teaching the welding point is required.

- No need to set (TICKNESS) in the clearance file before teaching the welding point when selecting “GUN CLOSE” for the clearance teaching method.

- Up to 32 clearance files can be used.

1. Select (SPOT WELDING) on the (Main Menu).
2. Select (CLEARANCE SETTING).

- CLEARANCE SETTING window appears.
9 Spot Welding Application Using a Motor Gun

9.10 Clearance Move Instruction (SVSPOTMOV Instruction)

- Amount of clearance and operation conditions can be set.
- There are three moving patterns.
  - MOVE&CLOSE
  - SQUARE
  - MOVE&OPEN

- \{DISTANCE TO UPPER TIP(IN)} and \{DISTANCE TO LOWER TIP(IN)} are the amount of clearance for closing motion.
- \{DISTANCE TO UPPER TIP(OUT)} and \{DISTANCE TO LOWER TIP(OUT)} are the amount of clearance for opening motion.

- This file is specified by the SVSTPOTMOV instruction’s clearance tag.
  (Up to 32 files can be specified.)

3. Select desired items.
- \{DISTANCE TO UPPER TIP}, \{DISTANCE TO LOWER TIP}, and \{THICKNESS} can be set in the 1/10mm length.

4. Input a value and press [ENTER].
- Move the cursor and press [SELECT] to enter the value.
9.10 Clearance Move Instruction (SVSPOTMOV Instruction)

- After entering each value, press [ENTER] to set the value.

9.10.4 Operations for Teaching Welding Points

The following describes the outline of the procedure for teaching the welding point.

1. Select {JOB} on the {Main Menu}.
2. Select {JOB}.

- JOB CONTENT window appears.

When registering pressure instructions (SVSOPT, SVGUNCL, SVSPOTMOV and SVDRESMOV), create a job which includes a gun axis control group.
3. Press [SHIFT] + [MOTION TYPE] to display SVSPOTMOV.

   - To execute the clearance teaching, display SVSPOTMOV by changing motion type ([SHIFT] + [MOTION TYPE]) and register it.
   - This can be done only when the manipulator is in operating status (while the [ROBOT] LED indicator is lit.).

4. Edit the tag item of the instruction.

5. Press [INSERT], then press [ENTER].

   - Following window appears when the clearance move instruction has been registered.
9.10.5 Clearance Move Instruction

The following describes the clearance move instruction.

<Example>

SVSPOTMOV V=1000.0 PLIN=1 PLOUT=1 CLF#(1) GUN#(1) PRESS#(1) WTM=1 WST=1 WGO=1

SVSPOTMOV : Clearance move instruction
V=1000.0 : Linear motion speed for clearance
(1000.0 mm/s for this example)
PLIN=1 : Positioning level at the clearance position before welding
PLOUT=1 : Positioning level at the clearance position after welding
CLF#(1) : Clearance file number (file 1 for this example)
GUN#(1) : Motor gun number (Motor gun 1 is used for this example.)
PRESS#(1) : Pressure condition file number
(Pressure condition file 1 is used for this example.)
WTM=1 : Welding condition number (Welding condition 1 is used for this example.)
WST=1 : Welder start-up timing
WGO=1 : Welding condition group output (Refer to section 9.14 “Other Functions Using a Motor Gun” on page 9-160)

The tag using method of GUN, PRESS, WTM, and WST, etc. are same as that of SVSPOT instruction.

For the details of these tags, refer to section 9.7.1 “Registration of Welding Instruction (SVSPOT Instruction)” on page 9-70.
9.10.6 Clearance Move

The following describes the clearance move.

### When the positioning level (PLIN) is used

<table>
<thead>
<tr>
<th>Table 9-5: Job Example: Work 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000 NOP</td>
</tr>
<tr>
<td>0001 MOVJ VJ=100.0</td>
</tr>
<tr>
<td>0002 SVSPOTMOV V=1000.0 PLIN=0 CLF#(1) GUN#(1) PRESS#(1) WTM=1 WST=1</td>
</tr>
<tr>
<td>0003 SVSPOTMOV V=1000.0 PLIN=0 CLF#(1) GUN#(1) PRESS#(1) WTM=1 WST=1</td>
</tr>
<tr>
<td>0004 SVSPOTMOV V=1000.0 PLIN=0 CLF#(1) GUN#(1) PRESS#(1) WTM=1 WST=1</td>
</tr>
<tr>
<td>0005 SVSPOTMOV V=1000.0 PLIN=0 CLF#(1) GUN#(1) PRESS#(1) WTM=1 WST=1</td>
</tr>
<tr>
<td>0006 SVSPOTMOV V=1000.0 PLIN=0 CLF#(1) GUN#(1) PRESS#(1) WTM=1 WST=1</td>
</tr>
<tr>
<td>0007 MOVL V=1000.0</td>
</tr>
<tr>
<td>0008 END</td>
</tr>
</tbody>
</table>

Clearance file setting: 1

PLIN = 0

DISTANCE TO UPPER TIP (IN, OUT) : 20.0mm
DISTANCE TO LOWER TIP (IN, OUT) : 10.0mm
THICKNESS : 2.0mm
9 Spot Welding Application Using a Motor Gun

9.10 Clearance Move Instruction (SVSPOTMOV Instruction)

When the positioning level (PLOUT) is used

Table 9-6: Job Example: Work 1

<table>
<thead>
<tr>
<th>Line</th>
<th>Command</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>NOP</td>
<td></td>
</tr>
<tr>
<td>0001</td>
<td>MOVJ VJ=100.0</td>
<td></td>
</tr>
<tr>
<td>0002</td>
<td>SVSPOTMOV V=1000.0 PLOUT=0 CLF#(1) GUN#(1) WTM=1 WST=1</td>
<td></td>
</tr>
<tr>
<td>0003</td>
<td>SVSPOTMOV V=1000.0 PLOUT=0 CLF#(1) GUN#(1) WTM=1 WST=1</td>
<td></td>
</tr>
<tr>
<td>0004</td>
<td>SVSPOTMOV V=1000.0 PLOUT=0 CLF#(1) GUN#(1) WTM=1 WST=1</td>
<td></td>
</tr>
<tr>
<td>0005</td>
<td>SVSPOTMOV V=1000.0 PLOUT=0 CLF#(1) GUN#(1) WTM=1 WST=1</td>
<td></td>
</tr>
<tr>
<td>0006</td>
<td>SVSPOTMOV V=1000.0 PLOUT=0 CLF#(1) GUN#(1) WTM=1 WST=1</td>
<td></td>
</tr>
<tr>
<td>0007</td>
<td>MOVL V=1000.0</td>
<td></td>
</tr>
<tr>
<td>0008</td>
<td>END</td>
<td></td>
</tr>
</tbody>
</table>

Clearance file setting: 1

PLOUT = 0

DISTANCE TO UPPER TIP (IN, OUT) : 20.0mm
DISTANCE TO LOWER TIP (IN, OUT) : 10.0mm
THICKNESS : 2.0mm
9.10.7 Press Teaching Function
9.10.7.1 Operation Flow Chart

Teaching of the clearance move instruction can be executed while the gun is applying pressure.

The following shows the operation flow chart for this function.

1. Start
2. Select “GUN CLOSE” as a teaching type
3. Move the manipulator to the welding point
4. Apply pressure
5. Register the welding point
6. Release applying pressure
7. End

Refer to chapter 9.10.2 “Clearance Teaching Function”.
9.10.7.2 Procedure for Registering the Position

The following describes the procedures for registering the position.

Note that this function is a part of the clearance teaching function, and is available only when the clearance teaching type is the gun-close teaching.

1. Move the fixed side tip until it contacts the workpiece, and then apply pressure.
   – To apply pressure, press [8] + [INTERLOCK].
   – The condition under MANUAL PRESS ([INTERLOCK] + [8]) on MANUAL PRESS window is used as the pressure condition.

2. Confirm the pressure status and register the position.
   – SVSPOTMOV instruction appears in the input buffer line of the job input display while it is pressurized.
     In case it doesn't appear, press [8] to switch the indication.
   – The taught position is registered after the wear compensation amount of the gun axis is added. Yaskawa recommends that the pressure is applied in the level which the gun axis does not bend when teaching.

3. Stop applying the pressure.
   – Press [INTERLOCK] + [9] to release the gun axis.
9.10.7.3 Setting the Pressure Conditions

The following describes settings for the pressure conditions.

The pressure condition is specified with {TOUCH SPEED}, {PRESS UNIT} and {PURESSURE}.

The following window can be displayed by pressing [0].

![Diagram of pressure setting window]
9.10.7.4 Setting the Gun Pushing Coefficient

By setting a value to the gun pushing coefficient, the position of the gun is registered after subtracting the pressure pushing value from the gun position when executing press teaching.

By setting the gun pushing coefficient correctly, the contact point of the tip and the workpiece can be registered as a teaching point regardless of the pressure during press teaching operation.

- **Setting of gun pushing coefficient**
  1. Select {SPOT WELDING} on the {Main Menu}.
  2. Select {GUN CONDITION}.
     - GUN CONDITION window appears.

![Diagram showing gun positions and coefficients](image-url)
3. Set a value to (GUN PUSHING COEF).
   - Set the value (0 to 10.0 [mm/1000N]) to the gun pushing coefficient to compensate the registering position when press teaching is performed.
   - Press [SELECT] to input the numerical value.

4. Press [ENTER].

**Calculation of Gun Pushing Coefficient**
To (GUN PUSHING COEF), set pushing amount [mm] per 1000N.

*Fig. 9-2: Relation Between Pressure and Gun Axis Position [mm]*

Following the relation mentioned above, calculate the change of gun axis position per 1000N pressure and set it to (GUN PUSHING COEF).

(GUN PUSHING COEF) is set with [mm] unit.
9.10.8 Work Search Function

The workpiece position over the tool Z-axis direction can be automatically detected.
9.10.8.1 Operating procedures

1. Manually move the motor gun to the welding point.

2. Start the searching operation.
   – Press [INTERLOCK] + [5] to down the movable side tip. When the movable side tip touches the workpiece, the fixed side tip is moved up with the movable side tip keeping touch to the workpiece until the workpiece is detected.
   – While the workpiece is being detected, a message "In process of search" appears and it is deleted after the detection is completed.

3. Release pressing [INTERLOCK] + [5] after the message is deleted.

After the detection, confirm the positions of the motor gun and the workpiece, register SVSPOTMOV instruction by referring to section 9.10.7 "Press Teaching Function" on page 9-101.

In case pressing [INTERLOCK] + [5] is released or Hold is pressed during the workpiece detection, the detecting operation is discontinued.
9.10.8.2 Parameter

SICxG175: Threshold of the workpiece detection by the movable side tip

Specifies the threshold of workpiece detection by the movable side tip

0: 10 [N]

Others: SICxG175 [N]

<example> When the following value is set, the detecting threshold is 20 [N].

\[
\text{SICxG175}=20
\]

- When the workpiece rigidity is low, detection may take time and this delay can cause a damage to the workpiece. For this reason, do not use this function when the workpiece rigidity is low.

- Should an error occurred, increase the value of S1CxG175 one by one from its default value to find a value with which the error does not occur. In case an error is detected when the value is 0, increase the value of S1CxG175 one by one from 11 to find a value with which the error does not occur.

- This function is not available to the double arm moving gun.
9.11 Tip Dressing Instruction (SVDRESMOV Instruction)

As well as the clearance move instruction (SVSPOTMOV Instruction), all the following operations become available only by this instruction after teaching this instruction at a dressing position.

1. Moving to a position short before the dressing position (moving to the clearance position)
2. Moving to a dressing position
3. Dressing operation
4. Moving to a position just behind the dressing position (moving to the clearance position)

The clearance position mentioned above means the position where the gun is opened over the dressing position by the clearance distance specified by the tip dress condition file.

9.11.1 Operation Flow

The following shows the operation flow chart for the tip dressing instruction teaching.

```
Start

Select a teaching type
- Teaching type 1: Lower-tip teaching
- Teaching type 2: Upper-tip teaching
- Teaching type 3: Gun-close teaching

Set a clearance file
- Pressure condition
- Clearance condition
- Dresser condition

Teach a dressing point
- Teaching position (teaching)
- Moving speed
- Tip dress condition file No.

End
```
9.11 Tip Dressing Instruction (SVDRESMOV Instruction)

9.11.2 Teaching Type Setting

The teaching type setting procedures are same as that of the clearance move instruction (SVSPOTMOV). Refer to section 9.10.2 “Setting the Teaching Type” on page 9-92.

9.11.3 Tip Dress Condition

The pressure, clearance and dressing conditions when the tip dress instruction (SVDRESMOV) is executed are set on the tip dress condition window.

- Tip dress condition window

1. **FILE NO.**
   Shows the tip dress condition file No.
   Press [PAGE] to choose the number.

2. **DRESSER**
   Select “IO” when using a dresser which is controlled by IO.
   When using a servo dresser, select the servo dresser’s control group.

3. **PRESS CONDITION**
   This pressure condition is used when executing a tip dressing instruction (SVDRESMOV), or a dry spot instruction (SVGUNCL) which uses a tip dress condition file (DRS tag).

4. **TOUCH SPEED**
   Shows the gun closing speed with a link speed (%).

5. **1ST TO 2ND PRESS**
   Set the pressure at each step
6. END CONDITION

Functions are expanded in DN1.71.00-00 and later versions so that either “PRESS TIME” or “DRESS LENGTH” is selected as its operation ending condition.

- When “PRESS TIME” is selected
  Pressing time is designated.
  When “0” is set, no pressing is executed and the manipulator completes its operation.
  In case “PRESS TIME” is selected (FIRST PRESS), set values other than 0.00 to “PRESS TIME”.

- When DRESS LENGTH” is selected
  Length for dressing is designated.
  An alarm with a message “Tip Dress Time Over” occurs in case the manipulator does not dress the designated length within ten seconds. The time to alarm can be modified with the following parameter.

  AXP108: Tip Dress Time Over Detecting Time
  (Unit: 0.1 sec, Initial value: 0)
  Set “50” for 5.0 seconds
  Set “0” for 10 seconds

7. CLEARANCE CONDITION

Set the clearance conditions for the execution of the tip dress instruction (SVDRESMOV).

In the tip dress instruction (SVDRESMOV), the clearance file is not used but the clearance operation is done in this condition.

The pattern of the SVDRESMOV is always SQUARE, whereas one out of three clearance operation patterns (MOVE&CLOSE, SQUARE AND MOVE&OPEN) can be selected in the SVSPOTMOV.

8. DISTANCE TO UPPER TIP
9. DISTANCE TO LOWER TIP

Set the distance between the dresser and the point of the tip.

In the tip dress instruction (SVDRESMOV), the manipulator and the gun will move so that tips are distanced from the dresser by the distance set in this item before and after the dressing operation.

10. THICKNESS

When “upper-tip” or “lower-tip” is selected for the teaching type, this item need to be set.

11. ROTATION WAIT TIME

Set this item as a waiting time from starting the tip dressing instruction (SVDRESMOV) to the gun closing.

12. IO CONDITION

Set IO for the tip dress instruction (SVDRESMOV).

13. ROTATION REQUEST

This item appears when “IO” is specified to {DRESSOR}.

Set a signal which is output same time with the execution of the tip dress instruction (SVDRESMOV).

14. DRESS EXECUTING

This item appears when a servo dresser control group is specified to {DRESSOR}.

Set a signal which is output same time with the execution of the tip dress instruction (SVDRESMOV).

15. SERVO DRESSER CONDITION
This item appears when a servo dresser control group is specified to (DRESSOR).

16. **ROTATION DIRECTION**
   Set a rotating direction of the servo dresser.

17. **ROTATION SPEED (1ST PRESS)**
18. **ROTATION SPEED (2ND PRESS)**
   Set a rotating speed of the servo dresser.
   When the tip dress instruction (SVDRESMOV) is started, the dresser rotates at a rotation speed (1st press), and the speed shifts to a rotation speed (2nd press) when the gun pressure is changed to the 2nd press and this speed is kept till the tip dress instruction (SVDRESMOV) is completed.

19. **SPEED FLUCTUATION LIMIT**
   Set the speed fluctuation tolerance value for the tip dress instruction (SVDRESMOV). Alarm may occur in case the actual speed is decreased (or increased) from the speed specified at (ROTATION SPEED (1ST PRESS)) or (ROTATION SPEED (2ND PRESS)).
9 Spot Welding Application Using a Motor Gun
9.11 Tip Dressing Instruction (SVDRESMOV Instruction)

- Operating procedures

1. Select (SPOT WELDING) on the (Main Menu).
2. Select (TIP DRESS CONDITION).

3. Select a file No. by pressing [PAGE].
4. Select a desired item.
5. Input a numeric value and press [ENTER].
### 9.11.4 Dressing Position Teaching Operation

1. Select {JOB} on the {Main Menu}.  
2. Select {JOB}.

![Image of the JOB CONTENT window]

When registering a pressure instruction (SVSPOT, SVGUNCL, SVSPOTMOV or SVDRESMOV), create a job in which a gun axis control group is included.
9.11 Tip Dressing Instruction (SVDRESMOV Instruction)

3. Press [SHIFT] + [MOTION TYPE] to indicate SVSPOTMOV.

```
SVSPOTMOV CLF#(1) GUN#(1) PRESS#(1) WTM=1 WST=1
```

4. Press [MOTION TYPE] to indicate SVDRESMOV.

```
SVDRESMOV GUN#(1) DRS#(1)
```

* Changing the motion type with [MOTION TYPE] is available only while the manipulator is in operation status ([ROBOT] LED light is lit status).
* SVSPOTMOV and SVDRESMOV alternate each time [MOTION TYPE] is pressed.

5. Edit the instruction tag item.

6. Press [INSERT], and then press [ENTER].

* Following items appear on the window when the tip dress instruction is registered.

```
JOB   EDIT   DISPLAY   UTILITY
J-TEST
CONTROL GROUP: R1+R2
S:0001
TOOL: 00
0000 NOP
0001 SVDRESMOV GUN#(1) DRS#(1)
0002 END
```

```
SVDRESMOV GUN#(1) DRS#(1)
```
9.11.5 Tip Dress Instruction

Following shows the tip dress instruction.

SVDRESMOV

\[ V=500.0 \quad VCL=100.0 \quad VOP=100.0 \quad PLIN=0 \quad POUT=0 \quad GUN#(1) \quad DRS#(1) \]

1. **Speed**
   Set the speed.

2. **Gun pressure speed**
   Set the closing speed for the manipulator and the gun before dressing operation.
   In case this tag is omitted, the speed specified at 1.Speed is employed.

3. **Gun open speed**
   Set the opening speed for the manipulator and the gun after dressing operation.
   In case this tag is omitted, the speed specified at 1.Speed is employed.

4. **Positioning IN level**
   Set the positioning level at the clearance position before dressing.

5. **Positioning OUT level**
   Set the positioning level at the clearance position after dressing.

6. **Gun number**
   Set a gun number for executing the tip dress operation.

7. **Tip dress condition**
   Set a condition file number for executing the tip dress operation.
9.11.5.1 Tip Dress Instruction (SVDRESMOV) Flow

Move to the clearance position
Dresser rotation start

Closing operation

Apply pressure

Opening operation
Dresser rotation finish

Rotation wait time

I/O dresser

Rotation request

Dresser rotation speed

Dresser executing signal

Rotation speed (1st press)

Rotation speed (2nd press)

1st press

2nd press

Dresser rotation speed

Gun pressuring status
9.11.5.2 Suspend and Restart of the Tip Dress Operation

- In case the execution of the tip dress instruction (SVERESMOV) is suspended with Hold operation after the gun close motion is started, the robot and the gun will stop after they move to the clearance position.

- In case the execution of the tip dress instruction (SVERESMOV) is suspended with Hold operation or by an emergency stop and then restarted, tip dressing instruction (SVERESMOV) is executed from the beginning.

- Even if the execution of the tip dress instruction (SVERESMOV) is suspended by an emergency stop, outputting of “rotation request” (for the IO dresser) or “dress executing signal” (for the servo dresser) is kept ON.

- In case the execution of the tip dress instruction (SVERESMOV) is suspended with Hold operation or by an emergency stop, the rotation of the servo dresser will stop.
9.11 Tip Dressing Instruction (SVDRESMOV Instruction)

9.11.5.3 Individual Control Instruction to a Dresser and a Gun

In the tip dress instruction (SVERESMOV), coordinated motion of the manipulator, gun and dresser is available. However, instructions below enable independent operations of the gun and the dresser.

- **DRESSON Instruction**
  
  Use this instruction when dresser rotation is required.

**DRESSON DRS#(1)**

1

1. **Tip dress condition**

  Specifies the tip dress condition file number

About DRESSON instruction

- This instruction turns ON the outputting of “rotation request” (for the IO dresser) or “dress executing signal” (for the servo dresser) set to the specified tip dress condition.

- For the servo dresser, this instruction rotates the servo dresser.

- This instruction waits for the time set to {ROTATION WAIT TIME} in the specified tip dress condition.

In case a job is suspended with Hold operation or by an emergency stop after the execution of DRESSON instruction.

- Outputting of “rotation request” (for the IO dresser) or “dress executing signal” (for the servo dresser) are kept turned ON.

- For the servo dresser, the servo dresser rotation is stopped.
  (And it resumes the rotation after the job is re-executed.)

In the DRESSON instruction, pressurizing of the gun is not executed.
**Spot and Arc Welding Using Motor Gun**

9 Spot Welding Application Using a Motor Gun

9.11 Tip Dressing Instruction (SVDRESMOV Instruction)

- **DRESSOF Instruction**
  Use this instruction when stopping the rotation of the dresser.

  DRESSOF DRS#(1)
  
  1

- **1. Tip dress condition**
  Specifies the tip dress condition file number

About DRESSOF instruction

- This instruction turns OFF the outputting of “rotation request” (for the IO dresser) or “dress executing signal” (for the servo dresser) set to the specified tip dress condition.
- For the servo dresser, this instruction stops rotating the servo dresser.

- **SVGUNCL Instruction**
  The tip dress condition file can be specified to SVGUNCL instruction.

  SVGUNCL GUN#(1) DRS#(1)
  
  1  2

  **1. Gun number**
  Set the gun number to execute the tip dress operation.

  **2. Tip dress condition**
  Specify the tip dress condition file number

When specifying the tip dress condition file to SVGUNCL instruction

- Pressure is applied under the pressure condition in the specified tip dress condition.
- When the servo dresser is rotated by DRESSON instruction, the rotation speed is shifted to the rotation speed (2nd press) at the same time when the 2nd pressure is reached.
- The wear compensation at the previous move instruction and arm bend compensation at pressurization are executed.

Even if the tip dress condition file is specified in SVGUNCL instruction, “rotation request” (for the IO dresser) or “dress executing signal” (for the servo dresser) will not be turned ON. Also, the servo dresser doesn’t rotate.
9.11.5.4 Wear Detection with Tip Dressing Instruction

Wear detection function is added to DN1.71.00-00 and later versions so that wears can be detected with Tip Dressing Instruction (SVDRESMOV Instruction).

By adding tags for wear detection (TWC-A, TWC-C) to Tip Dressing Instruction (SVDRESMOV Instruction), amount of wear is detected.

<Example>

SVDRESMOV GUN#(1) DRS#(1) TWC-A
SVDRESMOV GUN#(1) DRS#(1) TWC-C

For the details of TWC-A, TWC-C and wear detecting operation, refer to section 9.12 “Tip Wear Detection and Wear Compensation (Motor Gun)”.

When detecting wears with Tip Dressing Instruction (SVDRESMOV Instruction), set a value to {DRESSER THICKNESS} on SPOT SUPERVISION window.

Please note that this instruction is not available for registering the base position for wear detection.
Spot and Arc Welding Using Motor Gun

9.11 Tip Dressing Instruction (SVDRESMOV Instruction)

**DRESSER THICKNESS setting**

1. On APPLICATION CONDITION SETTING window, select "GUN CLOSE" at {CLEARANCE TEACHING METHOD}.

2. Contact the fixed side tip to the servo dresser, and then press [INTERLOCK] + [8] to apply pressure.

3. Select {SPOT WELDING} on the {Main Menu}.

4. Select {SPOT SUPERVISION}
   - SPOT SUPERVISION window appears.

5. Select a gun number by pressing [PAGE].

6. Select {DATA} and {DRESSER THICKNESS REGISTER}.
   - Thickness of the dresser is registered.


In case a certain thickness is to be fixed, directly input the value to {DRESSER THICKNESS}. At this time, it is not necessarily apply pressure by pressing [INTERLOCK] + [8].
### 9.11.6 Dry Tip Dressing Operation

(DRY TIP DRESS (WITHOUT PRESSING)) and (DRY TIP DRESS (WITHOUT DRESSING)) signals enable dry tip dressing operation.

For the settings of this signal, refer to section 9.4.2.3 “I/O Allocation” on page 9-43.

- **Dry tip dressing operation (without pressing) signal**
  - When executing SVDRESMOV instruction after turning ON this signal:
    - the gun close motion is not executed.
    - the gun pressurization is not executed.
    - in case of the servo dresser, although the gun pressurization is not executed, the dresser’s rotating speed changes to the 2nd rotation speed after the manipulator and the gun move to the clearance position and the time set to {1st time} elapsed.

  Also, when this signal is turned ON, SVGUNCL instruction to which the tip dress condition file is specified (SVGUNCL instruction to which DRS# tag is used) is no longer executed.

- **Dry tip dressing operation (without dressing) signal**
  - When executing SVDRESMOV instruction after turning ON this signal:
    - Outputting of “rotation request” (for the IO dresser) or “dress executing signal” (for the servo dresser) at the tip dress condition file specified by SVDRESMOV is not turned ON.
    - The servo dresser is not rotated even if it is a servo dresser.
    - It does not wait for the time specified at {ROTATION WAIT TIME} on the tip dress condition file specified by SVDRESMOV.

  Also, DRESSON instruction is no longer executed when this signal is turned ON.
9.11.7 Tip Dress Supervision

On this window, dress length, dress time, servo dresser starting torque and dressing torque can be monitored.

Furthermore, by setting the allowable values and universal output signal numbers, designated signal can be turned ON in case one of the above mentioned values exceeded the value in {TOLERANCE}.

Updating of the current value and comparing of the current value with the value in {TOLERANCE} are performed when executing the SVGUNCL Instruction (SVGUNCL DRS#( ) ...) or SVDRESMOV Instruction to which TIP DRESS COND FILE is designated.

However, updating of the current value and comparing of the current value with the value in {TOLERANCE} would not be performed in case above mentioned instructions are suspended due to emergency stop, Hold operation or occurrence of an alarm.

Also, in case a selected dresser designated by Tip Dress Condition File is I/O dresser, set “0” to both (STARTING TORQUE) and (DRESSING TORQUE) and comparing of the current value with the value in {TOLERANCE} is not performed.

This function is available in DN1.71.00-00 and later versions.
9.11 Tip Dressing Instruction (SVDRESMOV Instruction)

TIP DRESS COND. Window

1. DRESS LENGTH (CURRENT, TOLERANCE, SETTING(OUT#))
   Current length for dressing operation is indicated.
   Tolerance range for this operation: 0.00 to 9.99 mm
   – Condition to ON the signal
     Current value < Tolerance range
   – Condition to OFF the signal
     Current value >= Tolerance range

2. DRESS TIME (CURRENT, TOLERANCE, SETTING(OUT#))
   Current dressing time is indicated.
   Tolerance range for this operation: 0.00 to 9.99 sec
   – Condition to ON the signal
     Current value > Tolerance range
   – Condition to OFF the signal
     Current value <= Tolerance range

3. STARTING TORQUE (CURRENT, TOLERANCE, SETTING(OUT#))
   An absolute data for servo dresser average torque, which is measured between 100 msec and 300 msec after the rotation is started, is indicated.
   Tolerance range for this operation: 0 to 300%
   In case pressure is applied no later than 300 msec after the rotation is started, “0” is indicated to (CURRENT) of (STARTING TORQUE). Also, at this time, the universal signal will not be controlled.
   – Condition to ON the signal
     Current value < Tolerance range (minimum value) or Current value > Tolerance range (maximum value)
   – Condition to OFF the signal
     Tolerance range (minimum value) <= Current value <= Tolerance range (maximum value)
9.11 Tip Dressing Instruction (SVDRESMOV Instruction)

4. DRESSING TORQUE (CURRENT, TOLERANCE, SETTING (OUT#))
Servo dresser average torque absolute data measured between the pressure reach time and pressure complete time is indicated. Tolerance range for this operation: 0 to 300%
- Condition to ON the signal
  Current value < Tolerance range (minimum value) or Current value > Tolerance range (maximum value)
- Condition to OFF the signal
  Tolerance range (minimum value) <= Current value <= Tolerance range (maximum value)

5. CLEAR Tolerance OUTPUT
OFF all the universal output signals designated to DRESS LENGTH, DRESS TIME, STARTING TORQUE and DRESSING TORQUE when a specified CLEAR TOLERANCE OUTPUT is changed from OFF to ON.
9 Spot Welding Application Using a Motor Gun
9.11 Tip Dressing Instruction (SVDRESMOV Instruction)

- Operating procedures

1. Select (SPOT WELDING) on the (Main Menu).

2. Select (TIP DRESS SUPERVISION).

- TIP DRESS SUPERVISION window appears.

3. Select a COND No. by pressing [PAGE].

4. Select a desired item.

5. Input a numeric value and press [ENTER].
9.12 Tip Wear Detection and Wear Compensation (Motor Gun)

9.12.1 Wear Detection and Wear Compensation Operation Flow Chart

- Mount a new tip
- Teach the manipulator operation position
- Clear the base positions. (Refer to chapter 9.12.3)
- Register the base position (fixed side) by dry spot touch motion. (Refer to chapter 9.12.2.1.)
- Register the base position (movable side) by dry spot movable side tip detecting motion. (Refer to chapter 9.12.2.2.)
- Perform welding
- Tip dressing
- Read the position by dry spot touch motion. (Refer to 9.12.2.1.)
- Read the position by movable side tip detecting motion. (Refer to 9.12.2.2.)
- Calculate the wear amount for movable and fixed side tips.
- When the wear amount is less than the allowable value.
- Outputting a tip replacement request signal (only when specified).
- Tip replacement
9.12 Tip Wear Detection and Wear Compensation (Motor Gun)

9.12.2 Wear Detection

This section explains the method to detect the tip wear amount by dry spot touch motion and movable side tip detection.

**NOTE**

After registering the wear base position, do not change the pressure condition settings used for the wear detection dry spot motion.

- In case the setting is changed, the wear detection may not be executed appropriately.

As a pressure condition for the wear detection dry spot motion, the dry spot pressure file (PRESSCL tag) can be used other than the wear detection pressure condition (PRESSTWC tag) described in section 9.12.2.1 “Dry Spot Touch Motion” on page 9-131 and section 9.12.2.2 “Movable Side Tip Detection” on page 9-132.

When the wear detection pressure condition (PRESSTWC tag) is used, the dry spot is executed under the condition of the {TOUCH SPEED} and {DETECT PRESSURE} on the spot supervision window.

When the dry spot pressure file (PRESSCL tag) is used, the dry spot is executed under the dry spot pressure file condition.

Setting in the dry spot pressure file can be changed during the operation because the file may be used in other purposes other than wear detecting. For this reason, it is recommended to use the wear detection pressure condition (RESSTWC tag).
9.12.2.1 Dry Spot Touch Motion

The gun axis position is acquired when the movable side (upper) tip touches the fixed side (lower) tip.

Dry spot touch motion is carried out by a SVGUNCL (dry spot) instruction.

“Base position (fixed)” will be registered when this operation is executed while “base position (fixed)” is not registered on the spot supervision window.

When executing the dry spot touch motion again after this registration is done, the position difference between the detected position and the base position is calculated as the whole wear amount (total amount of fixed side wear amount and movable side ware amount).

<Example>

SVGUNCL GUN#(1) PRESSTWC TWC-A

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

1. Gun No.
2. Wear detection pressure condition
3. Wear detection operation type
9.12.2.2 Movable Side Tip Detection

The gun axis position is acquired when the movable side (upper) tip passes the sensor.

The movable side tip detection operation is carried out by a SVGUNCL (dry spot) instruction.

"Base position (movable)" will be registered when this operation is executed while "base position (movable)" is not registered on SPOT SUPERVISION window.

When executing the movable side tip detection motion again after this registration is done, the position difference between the detected position and the base position is calculated as the wear amount at the movable side.

If this operation is done after the procedures described in section 9.12.2.1 "Dry Spot Touch Motion" on page 9-131, the wear amount of the fixed side and the movable side are calculated independently and the results are indicated on the spot supervision window.

<Example>

SVGUNCL GUN#(1) PRESSTWC TWC-B

1        2        3

1. Gun No.
2. Wear detection pressure condition
3. Wear detection operation type
9.12.2.3 Example of Wear Detection

<Job Example>
1. MOVJ
2. SVGUNCL GUN#(1) PRESSCTWC TWC-A  
   (Dry spot touch motion)
3. MOVJ
4. MOVJ
5. SVGUNCL GUN#(1) PRESSTWC TWC-B  
   (Movable side tip detecting motion)
6. MOVJ

For the double arm move gun, teach a job so that the upper side tip passes the sensor detecting zone when using the sensor detection.

Also, set the polarity of the signal that is output from the sensor, by the setting item “WEAR DETECT SENSOR POLARITY” in section 9.12.3 “Spot Supervision Window Setting” on page 9-134.
9.12.3 Spot Supervision Window Setting

Shows the tip wear amount, etc.

Also, the wear amount detection relevant settings can be performed.

- **Spot supervision window**

![Spot Supervision Window](image)

1. **GUN NO.**
   Shows the gun No.
   Select the No. by pressing [PAGE].

2. **WELD COUNT**
   *(CURRENT, TOLERANCE, SETTING(OUT#))*
   The numbers that the welding instruction (SVSPOT, SVSPOTMOV) is performed is indicated to {CURRENT} as the present value.
   Also, the universal output signal specified at {SETTING (OUT#)} is turned ON when a value in {CURRENT} has exceeded a value in {TOLERANCE}.

3. **RESET COUNT**
   The value at {WELD COUNT (CURRENT)} can be cleared when the signal specified to {RESET COUNT} is turned ON.

4. **WEAR (M) (CURRENT, TOLERANCE, SETTING(OUT#))**
   Present wear amount at the movable side tip is indicated.
   The value is updated when the wear detection is finished.
   Also, the universal output signal specified at {SETTING (OUT#)} is turned ON when the value in {CURRENT} has exceeded the value in {TOLERANCE}.
5. **WEAR (F)**
   Present wear amount at the fixed side tip is indicated.
   The value is updated when the wear detection is finished.
   Also, the universal output signal specified at \{SETTING (OUT#)\} is turned ON when the value in \{CURRENT\} has exceeded the value in \{TOLERANCE\}.

6. **RESET WEAR (M)**
   The value at \{RESET WEAR (M)\} can be cleared when the signal specified to \{RESET WEAR (M)\} is turned ON.

7. **RESET WEAR (F)**
   The value at \{RESET WEAR (F)\} can be cleared when the signal specified to \{RESET WEAR (F)\} is turned ON.

8. **TIP MOUNTING ERROR (M)**
   Movable side tip mounting error is indicated.
   The value is updated when the tip mounting error detection is finished.

9. **TIP MOUNTING ERROR (F)**
   Fixed side tip mounting error is indicated.
   The value is updated when the tip mounting error detection is finished.
   For the details, refer to chapter 9.12.8.

10. **BASE POS (M)**
    In case \{BASE POS (M)\} has not been register, the detected position is registered as the base position by the execution of the movable side tip detection motion.

11. **BASE BOS (F)**
    In case \{BASE POS (F)\} has not been register, the detected position is registered as the base position by the execution of the dry spot touch motion.

12. **DETECTED THICKNESS (CURRENT, SETTING(M))**
    Detected thickness of the workpiece is indicated to this item when the workpiece thickness detecting function is used.
    If a value more than 0 is set to \{SETTING (M)\}, the detected thickness is written to the specified register.

13. **TOUCH SPEED**
    Set the gun closing speed with a link speed (%) when executing a wear detecting dry spot motion (executing SVGUNCL using PRESSTWC tag).

14. **DETECT PRESSURE**
    Set the detecting pressure for the touch detection when executing the wear detecting dry spot motion (executing SVGUNCL using PRESSTWC tag).

15. **WEAR RATIO (FIXED SIDE)**
    To the wear amount detected by the wear detection operation (TWC-C), specify the wear ratio to the fixed side tip.

16. **WEAR COMPENSATION OFFSET (FIXED SIDE)**
    If the fixed side tip is required to be always shifted for a certain amount, set the certain shifting amount to this item.

17. **WEAR DETECT SENSOR DIN NO.**
    Set a direct-in No. to which a sensor signal used for the movable side tip detecting motion (wear detecting operation (TWC=B)) is input.
9 Spot Welding Application Using a Motor Gun
9.12 Tip Wear Detection and Wear Compensation (Motor Gun)

18. WEAR DETECT SENSOR POLARITY
Set the polarity of the sensor signal used for the movable side tip detecting motion (wear detecting motion (TWC=B)).
Select {ON -> OFF}: Normal status is ON and it turns OFF when the tip passes the sensor.
Select {OFF -> ON}: Normal status is OFF and it turns ON when the tip passes the sensor.

- Operating procedures
1. Select (SPOT WELDING) on the (Main Menu).
2. Select (SPOT SUPERVISION).

3. Select a gun No. by pressing [PAGE].
4. Select a desired item.
5. Input a numeric value and press [ENTER].
9. Spot Welding Application Using a Motor Gun

9.12 Tip Wear Detection and Wear Compensation (Motor Gun)

- **Manual clearing procedures of weld count and wear amount**

  1. Select {DATA} in the menu area.
  2. Select {CLEAR W.COUNT/WEAR}.

![Clearing Procedure Image]

3. Select “YES”.

![Confirmation Dialog Image]
Spot Welding Application Using a Motor Gun

9.12 Tip Wear Detection and Wear Compensation (Motor Gun)

- **Clearing the wear detection base position**
  After modifying the wear detection motion, etc. clear this value.

  1. Select (DATA) in the menu area.
  2. Select (CLEAR BASE POS).
  3. Select “YES”.

9.12.4 Wear Compensation

The manipulator motion and the gun stroke are adjusted according to the amount of tip wear.

Wear compensation is performed to the following positions.

- To the teaching position short before SVSPOT instruction
- To the teaching position short before SVGUNCL instruction to which WP tag or DRS tag is used.
- SVSPOTMOV teaching position
- SVDRESMOV teaching position

The figure below shows an example of the compensation under the following conditions.

Single arm gun, Movable side wear amount: 3 mm, Fixed side wear amount: 5 mm

<Job Example>

MOVJ

MOVJ ← In this position, wear compensation is done.

SVSPOT GUN#(1) PRESS#(1) WTM=1 WST=1

MOVJ

MOVJ

The fixed side tip is always shifted in the Z-axis + direction on the tool coordinates. Therefore, be sure to register the tool position and direction correctly. (Refer to section 9.4.3 “Registering the Operation Tool” on page 9-47.)
9.12.5 Tip Wear Compensation for Fixed Gun

The tip wear for the fixed gun (the gun that is not mounted on the manipulator) can be detected and compensated in the following manner.

**NOTE**

The wear amount of the tip for the fixed gun cannot be detected by the fixed sensor.

Build a system so that the sensor can move into the fixed gun’s motion range to detect the tip wear.
9.12.5.1 Setting the User Coordinates

Set the user coordinate with its home position located on the fixed tip end. The + direction of the Z-axis must be directed towards the movable tip.

The DX200 has the External Reference Point Control Function (the function to execute teaching or playback operation with the manipulator TCP set to a point in space). If the direction of coordinates used for the External Reference Point Control Function is the same as that of the above coordinates, resetting the user coordinates is not required.
9.12.5.2 User Coordinate Number Setting

1. Select {SPOT WELDING} on the {Main Menu}.

2. Select {GUN CONDITION}.

3. Move the cursor to (GUN INSTALLATION STATUS) and press [SELECT].
   - Select “FIXED”.
   - {USER COORDINATE NO.} is indicated.

4. To {USER COORDINATE NO.}, specify a user coordinate No.
   specified to the gun.
9.12.5.3 Example of Compensation

The manipulator motion and the gun stroke are adjusted according to the amount of tip wear.

Wear compensation is performed to the following positions.

- To the teaching position short before SVSPOT instruction
- To the teaching position short before SVGUNCL instruction to which WP tag or DRS tag is used.
- SVSPOTMOV teaching position
- SVDREMOV teaching position

<Job Example>

MOVJ

MOVJ ← In this position, wear compensation is done.

SVSPOT GUN#(1) PRESS#(1) WTM=1 WST=1

MOVJ

MOVJ

<Example of compensation>

Single arm move, Movable side wear amount: 3 mm, Fixed side wear amount: 5mm

Movable side tip

Workpiece

3 mm

Fixed side tip

5 mm

Compensate the fixed side tip 5mm in the Z-axis+ direction on the user coordinates.

Compensate the gun strok for 8 (=5+3) mm.

Note: The workpieces is compensated in the Z-axis + direction on the specified user coordinates. Therefore, be sure to register the position and direction of the user coordinates correctly. (Refer to section 9.12.5.1 “Setting the User Coordinates” on page 9-141.)
9.12.6 Teaching Positions with a Worn Tip

When teaching positions with a worn tip, the teaching position is registered, adjusted by tip wear amount.
9.12.6.1 Teaching Example

- Adjustment of the teaching point on the basis of the wear amount is performed to the following positions.
  - To the move instruction teaching point short before the SVSPOT instruction.
  - To the move instruction teaching point short before the SVGUNCL instruction to which WP or DRS tag is used.
  - To the SVSPOTMOV teaching point.
  - To the SVDRESMOV teaching point.
- The wear amount is ignored when registering positions in other move instructions.
9.12.6.2 Parameters

AxP010: Invalid wear range for teaching point adjustment (units: \( \mu m \))

Set the invalid range of the wear amount out of which compensation becomes enabled. Compensation is not carried out when the wear amount is within the invalid range.

<Example>

In case of AxP010 = 1000:

- Wear amount \( \geq 1 \text{mm} \) : The taught position is registered adjusted by the wear amount.
- Wear amount \( < 1 \text{mm} \) : The taught position is registered disregarding the wear amount.

AxP014: Displaying method when the teaching is performed

- 0 : A message “Compensated position.” appears when the position is registered.
- 1 : The dialog box appears before the position is registered with a message “Compensate? YES/NO.”.
9.12 Tip Wear Detection and Wear Compensation (Motor Gun)

9.12.7 Wear Amount Loading

Detected wear amount can be loaded in a job.

The wear amount is stored in the system D variable (D). Use GETS instruction and load the wear amount.

Example:

GETS D000 $D030

The wear amount of Gun 1 (movable side) is stored in D000.

<table>
<thead>
<tr>
<th>$D30</th>
<th>Gun 1 movable side (upper) wear amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>$D31</td>
<td>Gun 1 fixed side (lower) wear amount</td>
</tr>
<tr>
<td>$D32</td>
<td>Gun 2 movable side (upper) wear amount</td>
</tr>
<tr>
<td>$D33</td>
<td>Gun 2 fixed side (lower) wear amount</td>
</tr>
<tr>
<td>$D34</td>
<td>Gun 3 movable side (upper) wear amount</td>
</tr>
<tr>
<td>$D35</td>
<td>Gun 3 fixed side (lower) wear amount</td>
</tr>
<tr>
<td>$D36</td>
<td>Gun 4 movable side (upper) wear amount</td>
</tr>
<tr>
<td>$D37</td>
<td>Gun 4 fixed side (lower) wear amount</td>
</tr>
<tr>
<td>$D38</td>
<td>Gun 5 movable side (upper) wear amount</td>
</tr>
<tr>
<td>$D39</td>
<td>Gun 5 fixed side (lower) wear amount</td>
</tr>
<tr>
<td>$D40</td>
<td>Gun 6 movable side (upper) wear amount</td>
</tr>
<tr>
<td>$D41</td>
<td>Gun 6 fixed side (lower) wear amount</td>
</tr>
<tr>
<td>$D42</td>
<td>Gun 7 movable side (upper) wear amount</td>
</tr>
<tr>
<td>$D43</td>
<td>Gun 7 fixed side (lower) wear amount</td>
</tr>
<tr>
<td>$D44</td>
<td>Gun 8 movable side (upper) wear amount</td>
</tr>
<tr>
<td>$D45</td>
<td>Gun 8 fixed side (lower) wear amount</td>
</tr>
<tr>
<td>$D46</td>
<td>Gun 9 movable side (upper) wear amount</td>
</tr>
<tr>
<td>$D47</td>
<td>Gun 9 fixed side (lower) wear amount</td>
</tr>
<tr>
<td>$D48</td>
<td>Gun 10 movable side (upper) wear amount</td>
</tr>
<tr>
<td>$D49</td>
<td>Gun 10 fixed side (lower) wear amount</td>
</tr>
<tr>
<td>$D50</td>
<td>Gun 11 movable side (upper) wear amount</td>
</tr>
<tr>
<td>$D51</td>
<td>Gun 11 fixed side (lower) wear amount</td>
</tr>
<tr>
<td>$D52</td>
<td>Gun 12 movable side (upper) wear amount</td>
</tr>
<tr>
<td>$D53</td>
<td>Gun 12 fixed side (lower) wear amount</td>
</tr>
</tbody>
</table>
9.12.8 Tip Mounting Position Error Detection

The cause of the pressure position error when pressure is applied can be sorted to two causes; tip wear and tip mounting position error.

By handling the causes separately, the real wear amount of tip itself can be handled to decide the tip ideal replacing timing.
9 Spot Welding Application Using a Motor Gun
9.12 Tip Wear Detection and Wear Compensation (Motor Gun)

9.12.8.1 Tip Mounting Position Error Detection Flow Chart

- When the wear amount is imported to a tip mounting position error after a wear amount detection job is executed.

1. Mount a new tip
2. Teach a manipulator motion positions
3. Clear the base positions (Refer to 9.12.3)
4. Execute wear detection job
   - Register the base position (fixed side) with dry spot touch motion (Execute TWC-A) (Refer to 9.12.2.1)
   - Register the base position (movable side) with movable side tip detecting motion (Execute TWC-B) (Refer to 9.12.2.2)
5. Execute welding
6. Tip dressing
7. Execute wear detection job (Execute TWC-A, TWC-B)
8. Calculate wear amount
9. If the wear amount is less than tolerance amount
   - Tip replacement request signal output (only when it is specified)
   - Tip replacement
   - Execute wear detection job (Execute TWC-A, TWC-B)
   - Import tip mounting position error on the SPOT SUPERVISION window
   - Calculate tip mounting position error
   - Clear the wear amount
When the tip mounting position error is detected with a job for tip mounting position error detection.

- Mount a new tip
- Teach a manipulator motion position
- Clear the base positions (Refer to 9.12.3)
- Execute wear detection job or tip mounting position error detection job
  - Register the base position (fixed side) with dry spot touch motion (Execute TWC-A or TWC-AE) (Refer to 9.12.2.1)
  - Register the base position (movable side) with movable side tip detecting motion (Execute TWC-B or TWC-BE) (Refer to 9.12.2.2)
- Execute welding
- Tip dressing
- Execute wear detection job (Execute TWC-A, TWC-B)
- Calculate wear amount

If the wear amount is less than tolerance amount
- Tip replacement request signal output (only when it is specified)
- Tip replacement
- Execute tip mounting position error detection job (Execute TWC-AE, TWC-BE)
- Calculate tip mounting position error
- Clear the wear amount
9.12.8.2 Tip Mounting Position Error Detection

The method to execute the tip mounting position error detection operation by dry spot touch motion and by movable side tip detection motion are described here.

The following two methods are for detecting the tip mounting position error.

- **Dry spot touch motion (TWC-A)**
  The gun axis position is acquired when the movable side tip touches the fixed side tip.
  Execute SVGUNCL instruction (dry spot) for the dry spot touch motion.

  ```
  <Example>
  SVGUNCL GUN#(1) PRESSTWC TWC-A
  ```

- **Movable side tip detecting motion (TWC-B)**
  The gun axis position is acquired when the movable side tip position is detected.
  Execute SVGUNCL instruction (dry spot) for the movable side tip detecting motion.

  ```
  <Example>
  SVGUNCL GUN#(1) PRESSTWC TWC-B
  ```

This operation must be performed after new tips are mounted.

**NOTE**

If this operation is executed with the worn tip, signals on wear (signal to request tip replacement, etc.) will not be output properly since the wear itself is regarded as the tip mounting position error.

---

When the wear amount is imported to a tip mounting position error after a wear amount detection job is executed.

Apply this method when wear detection and tip mounting position error detection are to be executed in the common job.

- Dry spot touch motion (TWC-A)
  The gun axis position is acquired when the movable side tip touches the fixed side tip.
  Execute SVGUNCL instruction (dry spot) for the dry spot touch motion.

  ```
  <Example>
  SVGUNCL GUN#(1) PRESSTWC TWC-A
  ```

- Movable side tip detecting motion (TWC-B)
  The gun axis position is acquired when the movable side tip position is detected.
  Execute SVGUNCL instruction (dry spot) for the movable side tip detecting motion.

  ```
  <Example>
  SVGUNCL GUN#(1) PRESSTWC TWC-B
  ```

After wear is detected by the above mentioned instruction, import the wear amount to the tip mounting position error on the SPOT SUPERVISION window.
When the tip mounting position error is detected with a job for tip mounting position error detection.
By adding tags for tip mounting position error detection (TWC-AE, TWC-BE) to the dry spot instruction (SVGUNCL), tip mounting position errors can be detected.

- Dry spot touch motion (TWC-AE)
  The gun axis position is acquired when the movable side tip touches the fixed side tip.
  Execute SVGUNCL instruction (dry spot) for the dry spot touch motion.

  <Example>
  SVGUNCL GUN#(1) PRESSTWC TWC-AE

- Movable side tip detecting motion (TWC-BE)
  The gun axis position is acquired when the movable side tip position is detected.
  Execute SVGUNCL instruction (dry spot) for the movable side tip detecting motion.

  <Example>
  SVGUNCL GUN#(1) PRESSTWC TWC-BE
9.12.8.3 Job Examples

- When the wear amount is imported to a tip mounting position error after a wear amount detection job is executed.
  1. MOVJ
  2. SVGUNCL GUN#(1) PRESSTWC TWC-A  
     (Dry spot touch motion)
  3. MOVJ
  4. MOVJ
  5. SVGUNCL GUN#(1) PRESSTWC TWC-B  
     (Movable side tip detecting motion)
     On the SPOT SUPERVISION window, import the present wear amount to the tip mounting position error.
  6. MOVJ
     Welding operation

- When the tip mounting position error is detected with a job for tip mounting position error detection.
  1'. MOVJ
  2'. SVGUNCL GUN#(1) PRESSTWC TWC-AE  
     (Dry spot touch motion)
  3'. MOVJ
  4'. MOVJ
  5'. SVGUNCL GUN#(1) PRESSTWC TWC-BE  
     (Movable side tip detecting motion)
  6'. MOVJ

Dry spot touch motion  Movable side tip detecting motion
Teach the following two positions to be the same position.

- in the job for tip mounting position error detection: the position short before the dry spot touch motion
  - “1′” in the above explanation
- in the wear detection job: the position short before the dry spot touch motion
  - “1” in the above explanation

Also, teach positions short before the movable side tip detecting motion (“4” and “4′” in the above explanation) to be the same position.
9.12.8.4 Importing the Tip Mounting Position Error

- **Operation Procedures**
  1. Select (SPOT WELDING) on the (Main Menu).
  2. Select (SPOT SUPERVISION).

  - SPOT SUPERVISION window appears.

  3. Select a gun No. by pressing [PAGE].
9.12 Tip Wear Detection and Wear Compensation (Motor Gun)

4. Select {DATA} - {IMPORT T.M.ERROR}.

5. Select “YES”.
9.12.8.5 Monitoring the Failure of Mounting Tips

The failure of mounting tips can be monitored by the following parameters.

A1P56 : Universal output for the failure of mounting tips
A1P57 : Limit of tip mounting position error (movable side) [μm]
A1P58 : Limit of tip mounting position error (fixed side) [μm]

Example:
A1P56=5, A1P57=1000 and A1P58=2000

The universal output signal 5 is output when either of the following conditions meets.

- The limit of tip mounting position error (movable side) $\geq 1\text{mm}$
- The limit of tip mounting position error (fixed side) $\geq 2\text{mm}$

NOTE

The signal is not output when the value of the universal output parameter (A1P56) or the value of both A1P57 and A1P58 are 0.
9.13 High Speed Spot Welding Function

9.13.1 High Speed Spot Welding Function

This function is created for the purpose of reducing the cycle time of a spot welding operation by improving the control of the manipulator’s motion and the motor gun’s pressure control.

9.13.2 Changes by Validating this Function

- **Motion Path**
  The shortcut volume while robot axes and gun axes are in operation may change due to the reduction of robot axis acceleration/deceleration time.

  Also, during SVSPOTMOV operation, to secure the clearance, the gun axis opening motion after welding is completed is made faster than the robot axis motion.

  When applying this function to the existing system, confirm motions of all JOBs.

9.13.3 Validating Method of High Speed Spot Welding Function

1. Turn ON the power supply of the DX200 while pressing {Main Menu} on the programming pendant.

2. After startup in maintenance mode, change the security mode to the management mode.

3. Select {SYSTEM} on the {Main Menu}.

   - Sub menu appears. Select (SET) - {OPTION FUNCTION}, and then the list of optional function is displayed.

4. Move the cursor to {SPOT HIGH SPEED SPEC}, press [SELECT], and then, select “USED”.

   ![Option Function Menu](image)

   - **NOTE**
     For the applicable manipulator types and operating conditions, please contact Yaskawa representative.
After setting “USED” to {SPOT HIGH SPEED SPEC} to the manipulators which are not applicable to this function or under inappropriate condition, “Error: 8216” is indicated.

Also, if a base axis or a station axis is added to the system where “USED” is selected to {SPOT HIGH SPEED SPEC} “Error: 8217” may be indicated.

To clear this error, set “NOT USED” to {HIGH SPEED SPEC} firstly, and then add a base axis or a station axis.
9.14 Other Functions Using a Motor Gun

9.14.1 Motor Gun Stroke

The motor gun stroke is classified into two; full open and short open.
9.14.1.1 Registering the Full-open/Short-open Position

Eight stroke positions can be registered for full open and short open respectively.

- **Full Open Position Setting**

  1. **GUN NO.**
     - Shows the gun for position setting.
     - Select a gun No. by pressing [PAGE].

  2. **SEL**
     - The mark “●” is displayed at the currently selected position.

  3. **POSITION**
     - Shows the gun stroke.
9.14.1.2 Registering the current position

   - FULL OPEN POS SET window (or SHORT OPEN POS SET window) appears.
   
   ![FULL OPEN POS SET window](image)

2. Select a gun No. by pressing [PAGE].
3. Select a position to register a gun stroke and press [MODIFY] + [ENTER].
9.14.1.3 Registering by entering a numerical value

   - FULL OPEN POS SET window (or SHORT OPEN POS SET window) appears.

2. Select a position to register a gun stroke.

3. Enter a numerical value, and press [ENTER].
9.14.1.4 Moving to Full-open/Short-open Position

   - FULL OPEN POS SET window (or SHORT OPEN POS SET window) appears.

2. Select a gun No. by pressing [PAGE].

3. Change the position by pressing repeatedly [3/FULL OPEN] or [-/SHORT OPEN].

   - While FULL OPEN POS SET window (or SHORT OPEN POS SET window) appears, pressing [NEXT] moves the gun to the stroke set in the (POSITION) which the cursor stay at.
9.14.1.5 Moving to Full-open/Short-open Position While Other Window is Displayed

By pressing [INTERLOCK] + [3/FULL OPEN] or [INTERLOCK] + [-/ SHORTOPEN] while the control group of the gun axis is selected by the operation of pressing [SHIFT] + [EX. AXIS], the gun axis of the selected group moves to FULL OPEN or SHORT OPEN position.
| 9.14.2 | Gun Change |
9.14.2.1 Gun Change Instruction

Gun change is executed by the GUNCHG (gun change) instruction.

<Example>

GUNCHG GUN#(1) PICK

A          B

1. Gun No.
2. Designation of connecting or disconnecting a gun

When “PICK (gun connected)” is selected, the power supply of the gun motor is turned ON.
When “PLACE (gun disconnected)” is selected, the power supply of the gun motor is turned OFF.
### 9.14.2.2 Signal Status to Execute GUNCHG Instruction

The signals must be in the status shown in the following table when executing GUNCHG instruction.

<table>
<thead>
<tr>
<th>Signal Name</th>
<th>Input/Output</th>
<th>Explanation</th>
<th>Signal Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gun ID No.</td>
<td>Input (3 bits)</td>
<td>A binary signal to identify the gun number.</td>
<td>Agree with Gun No. 1)</td>
</tr>
<tr>
<td>Gun Chuck</td>
<td>Input</td>
<td>The signal to confirm that the gun is connected. Normally, a chucking confirmation signal of ATC is allocated.</td>
<td>ON</td>
</tr>
<tr>
<td>Gun Unchuck</td>
<td>Input</td>
<td>The signal to confirm that the gun is disconnected. Normally, an unchucking confirmation signal of ATC is allocated.</td>
<td>OFF</td>
</tr>
<tr>
<td>Gun Unchuck Request</td>
<td>Output</td>
<td>The signal to connect the gun. Normally, a chucking signal of ATC is allocated. (CHUCK = OFF, UNCHUCK = ON)</td>
<td>OFF</td>
</tr>
</tbody>
</table>

1 The signal must agree with the gun number as shown in the following example.
9.14 Other Functions Using a Motor Gun

<When the Gun ID No. signal start with IN10, and the Gun ID No. signal end with IN12:>

<table>
<thead>
<tr>
<th>Gun No.</th>
<th>IN10</th>
<th>IN11</th>
<th>IN12</th>
</tr>
</thead>
<tbody>
<tr>
<td>GUN# (1)</td>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>GUN# (2)</td>
<td>OFF</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>GUN# (3)</td>
<td>ON</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>GUN# (4)</td>
<td>OFF</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>GUN# (5)</td>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>GUN# (6)</td>
<td>OFF</td>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>

The signals listed in the table above are confirmed when the DX200 control power supply is turned ON.

If the signal status indicates that the gun is connected when DX200 controller is turned ON, the servo power supply for the gun motor turns ON when the servo is turned ON.

If the signal status indicates that the gun is not connected when DX200 controller is turned ON, the servo power supply for the robot motor turns ON when the servo is turned ON, but the servo power supply for the gun motor is not turned ON.
9.14.2.3 Gun Change Job

The following example explains the gun change job.

**<Example of I/O Allocation>**

<table>
<thead>
<tr>
<th>Input Signal</th>
<th>Output Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gun Chuck</td>
<td>Gun connect/disconnect SOL OUT1</td>
</tr>
<tr>
<td>Gun Unchuck</td>
<td>Gun 1 cover open/close SOL OUT2</td>
</tr>
<tr>
<td>Coupling confirmation</td>
<td>IN3</td>
</tr>
<tr>
<td>Gun 1 presence LS</td>
<td>IN4</td>
</tr>
<tr>
<td>Gun 1 cover open limit</td>
<td>IN5</td>
</tr>
<tr>
<td>Gun 1 cover close limit</td>
<td>IN6</td>
</tr>
<tr>
<td>Gun ID No. signal (start)</td>
<td>IN21</td>
</tr>
<tr>
<td>Gun ID No. signal (end)</td>
<td>IN23</td>
</tr>
</tbody>
</table>

**<Example of Mounting a Gun>**

Job name: GUN 1 PICK

Control group: R1

NOP

MOVJ VJ=30 Moves to the standby position.

WAIT IN#(3)=OFF Confirms ATC uncoupling.

WAIT IN#(2)=ON Confirms ATC unchucking

WAIT IN#(4)=ON Confirms Gun 1 presence.

DOUT OT#(2)=ON Opens Gun 1 cover.

WAIT IN#(5)=ON Confirms Gun 1 cover opened.

: MOVL V=500 Moves to the position which is just above the Gun 1’s placing table.

MOVL V=100 PL=0 Moves to the ATC coupling position.

WAIT IN#(3)=ON Confirms ATC coupling.

DOUT OT#(1)=OFF ATC chucking.

WAIT IN#(1)=ON Confirms ATC chucking.

GUNCHG GUN#(1) PICK Turns ON the gun motor power.

TIMER T=0.2 Waits for 0.2 seconds.

MOVL V=1000 Lifts the Gun 1.

: WAIT IN#(4)=OFF Confirms Gun 1 absence.

DOUT OT#(2)=OFF Closes Gun 1 cover.

WAIT IN#(6)=ON Confirms Gun 1 cover closed.

: MOVJ VJ=30 Moves to the standby position.

END
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9.14 Other Functions Using a Motor Gun

<Example of Removing a Gun>

Job name: GUN 1 PLACE

Control group: R1

NOP
MOVJ VJ=30 Moves to the standby position.
WAIT IN#(3)=ON Confirms ATC coupling.
WAIT IN#(4)=OFF Confirms Gun 1 absence.
DOUT OT#(2)=ON Opens Gun 1 cover.
WAIT IN#(5)=ON Confirms Gun 1 cover opened.

MOVL V=500 Moves to the position which is just above the Gun 1’s placing table.
MOVL V=100 PL=0 Moves to Gun 1 placing position.
WAIT IN#(4)=ON Confirms Gun 1 presence.
GUNCHG GUN#(1) PLACE Turns OFF gun motor power.
TIMER T=0.2 Waits for 0.2 seconds.
DOUT OT#(1)=ON ATC unchucking
WAIT IN#(2)=ON Confirms ATC unchucking
MOVVL V=1000 Disconnects the gun.

WAIT IN#(4)=ON Confirms Gun 1 presence.
DOUT OT#(2)=OFF Closes Gun 1 cover.
WAIT IN#(6)=ON Confirms Gun 1 cover closed.

MOVJ VJ=30 Moves to the standby position.
END

NOTE Be sure to confirm the unchucking status when moving an automatic tool changer to the chuck position.
### 9.14.2.4 Gun Changing Timing

The timing to change a gun is illustrated below.

<table>
<thead>
<tr>
<th>Gun Status</th>
<th>PLACE</th>
<th>PICK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupling Confirmation</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Gun ID No. Signal</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Connect/Disconnect SOL</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Gun Chuck</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Gun Unchuck</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>Gun-Axis Servo</td>
<td>OFF</td>
<td></td>
</tr>
</tbody>
</table>

**GUNCHG PICK**

**GUNCHG PLACE**
9.14.3 Touch Teaching Function

Even if the fixed tip position cannot be visually confirmed when teaching, it is possible to register the position where the fixed tip touches the workpiece by moving the movable tip to touch the workpiece.

![Diagram showing workpiece thickness and correction in the Tool Z+ direction for (s-d) mm.](image-url)
9.14.3.1 Setting the Workpiece Thickness

**GUN DETAIL SETTING Window (Workpiece Thickness Setting)**

1. **THICKNESS**
   Enter the thickness of workpiece to be welded.

2. **GUN STROKE**
   Shows the distance between tips at the touch teaching. Pressing [SHIFT] + [ENTER] on the JOB window changes the value.

3. **TCP ADJUSTMENT**
   Shows the corrected distance of fixed tip at the touch teaching.
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9.14 Other Functions Using a Motor Gun

- **Operation**

1. Select {SPOT WELDING} in the {Main Menu}.
2. Select {GUN DETAIL SETTING}.

- GUN DETAIL SETTING window appears.

3. Select a gun No. by pressing [PAGE].
4. Select “THICKNESS.”
5. Enter a numerical value, and press [ENTER].
9.14.3.2 Registering and Confirming Positions by Touch Teaching

1. Select {JOB} on the {Main Menu}.
2. Select {JOB}.

3. Move the manipulator to the welding position.
4. Move the movable tip to touch the workpiece.
5. Press [SHIFT] + [ENTER].

- Press [SHIFT] + [ENTER] on the JOB window to make a correction in the tool coordinates Z+ axis direction.
- Press [FWD] to move the manipulator to confirm the corrected position that is actually registered.
- After having taught the position by pressing [SHIFT] + [ENTER], the manipulator correction amount can be confirmed on GUN DETAIL SETTING window.
9.14.4 Signal Dry Spot
Gun-pressure can be applied by inputting an external signal.

NOTE
Gun-pressure can be applied by an external signal for dry spot only.
Welding cannot be carried out by an external signal.
9.14.4.1 Setting an Input Signal Number

1. Select {SPOT WELDING} on the {Main Menu}.
2. Select {GUN DETAIL SETTING}.

– GUN DETAIL SETTING window appears.

3. Select a signal number to be set.
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9.14 Other Functions Using a Motor Gun

- **DRY SPOT SIGNAL(FILE)**
  - After the signal is input, pressurizing is started.
  - Pressure is applied according to the settings in the dry spot pressure file specified by {PRESSURE FILE NO.}
  - The gun stops applying pressure after a specified time period.
  - In case DRY SPOT (FILE) motion is stopped by the emergency stop, the gun will stay at the position where it is stopped.

- **DRY SPOT SIGNAL(CONTINUE)**
  - The signal input and pressurizing is started as well as the above, but pressurizing is continued during the signal input.
  - Pressure is applied according to the setting specified by {DRY SPOT PRESSURE(CONTINUE)}.
  - When the signal is turned OFF, the gun stops applying pressure.
  - In case DRY SPOT (CONTINUE) motion is stopped by the emergency stop during the gun closing or opening, the gun will stay at the position where it is stopped. But when the gun is stopped by the emergency stop during pressurization, by turning ON the servo and then turning OFF the signal, the gun can return to the position where DRY SPOT (CONTINUE) motion is started.

**NOTE**

- When the signal number “0” is selected, the Signal Dry Spot is disabled.
- The dry spot signal (file) motion is executed when specifying the same signal to both DRY SPOT SIGNAL(FILE) and DRY SPOT SIGNAL(CONTINUE) and inputting the signal.
- In case the same signal is specified to several guns and it is input, only the gun with the smallest gun number among the same-number specified guns executes pressurization.
9.14.5 Gun Pressure Compensation Function
9.14.5.1 Operation Flow Chart

With the gun pressure compensation function, the gun pressure can be kept stable even when the motor gun posture changes.

The following shows the operation flow chart for the gun pressure compensation.

1. **Start**

2. Register the data for applying pressure downwards in the GUN CONDITION file.

3. Set the PRESSURE COMPENSATION value in the GUN CONDITION file.

4. Teach the welding point.

5. **End**
9.14.5.2 Overview

The following describes outline of the gun pressure compensation function.

The pattern 1 is shown in the fig. 9-3; applying pressure downwards, and the pattern 2 is shown in the fig. 9-4; applying pressure upwards.

In case of the pattern 1, since the pairs of pressure and torque data (twelve pairs at maximum) is set with the gun pressurizing downwards (see fig. 9-6 “Pressure-to-torque Conversion (For Pattern 1)” at page 9-184) in the GUN CONDITION file, the torque of the motor gun for the specified pressure is calculated just by interpolation of these pairs of data.

Fig. 9-3: Pattern 1 (Applying Pressure Downwards)

Fig. 9-4: Pattern 2 (Applying Pressure Upwards)
9 Spot Welding Application Using a Motor Gun

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Fig. 9-5: GUN CONDITION File (Downward Pressure)

Fig. 9-6: Pressure-to-torque Conversion (For Pattern 1)
For the pattern 2 shown in fig. 9-4 "Pattern 2 (Applying Pressure Upwards)" at page 9-183, the weight of the motor gun itself may cause deviation of pressure.

Using the gun pressure compensation function, by setting one pressure compensation value (see fig. 9-7), the motor torque of the motor gun is calculated using the pressure-to-torque conversion value of pattern 1 and the inclination of the Z-axis + on the tool coordinates at welding so that the pressure can be kept stable even when the motor gun posture changes. (See fig. 9-8.)

**Fig. 9-7: Pressure Compensation (For Pattern 2)**

![Pressure Compensation Diagram](attachment:image)

**Fig. 9-8: Motor Gun Posture**

![Motor Gun Posture Diagram](attachment:image)

- Z-axis + direction on the tool coordinates
- Upper tip
- Lower tip
- Inclination $\theta$ of Z-axis + on the tool coordinates
- Inclination $\theta$ of Z-axis + on the tool coordinates
9.14.5.3 Setting the Pressure Compensation Value

The following describes settings for pressure compensation value of pattern 2.

For details on the data registration of pattern 1; applying pressure downwards (settings for pressure-to-torque conversion value), refer to section 9.3.9 “Setting of Torque to Pressure Conversion Data” on page 9-25.

1. Select {SPOT WELDING} on the {Main Menu}.
2. Select {GUN CONDITION}.

– GUN CONDITION window appears.
3. Select \{PRESSURE COMPENSATION\}.
   – By Specifying the pressure for compensation (0 to 9999N) at PRESSURE COMPENSATION, the pressure is compensated when the motor gun changes its posture.
   – Press [SELECT] to input the value for compensation.

4. Press [ENTER] after inputting the value.
9.14.6 Compensation of Gun Arm Bend for C-Gun and X-Gun (SINGLE ARM MOVE)

The gun arm bend at pressurizing can be compensated by the corrective manipulator motion.

Specify each compensation value (X, Y, Z directions of the tool coordinate) for the gun arm bend with the pressure of 1000N.

When K is defined as the gun arm bend compensation coefficient (mm/1000N) and F is the gun pressure (N), the robot position is corrected in each coordinate direction of the tool for \((K \times F \div 1000)\) mm in synchronization with gun pressure.

Compensation motion in the tool Z+ direction for \((K \times F \div 1000)\) mm
9.14.6.1 Setting the Gun Arm Bend Compensation Coefficient

1. Select {SPOT WELDING} on the {Main Menu}.
2. Select {GUN CONDITION}.

   - GUN CONDITION window appears.

3. Select a gun No. by pressing [PAGE].
4. Select “GUN ARM BEND DOE.”

   GUN ARM BEND DOE.
   Set the compensation amount for gun arm bend per 1000N pressure.

5. Enter a numerical value, and press [ENTER].

   **NOTE**
   If “0” is entered, the gun arm bend compensation function will not be effective.
9.14.6.2 Compensation Example

The gun arm bend compensation operation is done by the robot when following instructions are executed.

- SVSPOT instruction
- SVGUNCL instruction to which DRS tag is added.
- SVSPOTMOV instruction
- SVDRESMOV instruction

In case the robot is not included in the job control group, the gun arm bend compensation will not be executed.

**Example**

R1+S1 : Gun arm bend compensation is executed
S1R1+ : Gun arm bend compensation is unexecuted

<table>
<thead>
<tr>
<th>Gun Pressure (N)</th>
<th>Gun Arm Bend Compensation Amount (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>1000</td>
<td>2.0</td>
</tr>
<tr>
<td>2000</td>
<td>4.0</td>
</tr>
<tr>
<td>3000</td>
<td>6.0</td>
</tr>
</tbody>
</table>
9.14.6.3 Disabling Gun Arm Bend Compensation

The gun arm bend compensation can be disabled at each SVSPOT/SVSPOTMOV instruction.

Set the gun arm bend compensation disabling tag (BCOFF tag) to SVSPOT/SVSPOTMOV instruction to disable it.
9.14.7 Welding Conditions Group Output Function
9.14.7.1 Operation Flow Chart

With the welding conditions group output function, a group signal is output to the welder during welding.

The following shows the operation flow chart for the welding conditions group output function.

```
Start

Assign the universal signal for the group output

Set the group output tag

End
```
9.14.7.2 Procedure for Assigning the Group Output Signal

The following describes how to assign the signal number for group output when executing the SVSPOT/SVSPOTMOV instruction.

1. Select {SPOT WELDING} on the {Main Menu}.
2. Select {WELDER IF}.

![Diagram showing menu options for spot welding application using a motor gun.](image-url)
3. Select the desired item.
   - Set {GROUP OUTPUT},
     Enter the LSB output number to the start and MSB output number to the end.

4. Input the numerical value and press [ENTER].
9.14.7.3 Setting the Group Output Tag

The following describes the settings for the group output.

When the job contents are displayed, by pressing [MOTION TYPE] + [SHIFT], the instruction in the input line can be switched from the normal motion interpolation (MOVJ, MOVL, MOVC, MOVS) to the clearance move interpolation.

1. Select {JOB} on the {Main Menu}.
2. Select {JOB}.

– JOB CONTENT window is displayed.
3. Press [MOTION TYPE] + [SHIFT] to display “SVSPOTMOV” or “SVSPOT”.

– The group output can be set to either the following two instructions.
  • SVSPOTMOV
  • SVSPOT
4. Press [SELECT].
– The cursor moves to “SVSPOTMOV” or “SVSPOT”
– The DETAIL EDIT window appears.
6. Select {WELD GRP OUT}.
   – Press [SELECT] to display the selection dialog box. (The initial value is "UNUSED.")

(1) Select (WGO=).

   ![Selection Dialog Box]

(2) Set the output value.

   ![Output Value Dialog Box]

7. Press [ENTER].

9.14.7.4 Group Output

The origin of the group output can be set with "0".

"0 origin" or "1 origin" can be selected from \{WELD GROUP ORIGINAL NO.\} on APPLICATION CONDITION SETTING window.

When "0 origin" is selected: the value set to WAGO is output as a signal.

When "1 origin" is selected: the value 1 is subtracted from the value set to WAGO is output as a signal.
9.14.8 Workpiece Thickness Detection Function
9.14.8.1 Outline

The workpiece thickness detection function monitors the thickness of workpiece to be welded at the every SVSPOT instruction and SVGUNCL instruction. This function does not, however, monitor the workpiece thickness when executing the SVGUNCL instruction. An alarm can be generated if the workpiece is missing.

![Diagram](image-url)
9.14.8.2 Instruction

**SVSPOT (Spot Welding Instruction)**
To use the workpiece thickness detection function, set the tag for the function to SVSPOT/SVSPOTMOV instruction.

1. **TH**=
   Workpiece thickness (unit: mm, -999.9 to 999.9)
   Set the workpiece thickness to be welded.
   The detected thickness can be automatically specified if the thickness measuring mode is used.

2. **THA**=
   Allowable ratio of workpiece thickness (unit: %, 0 to 100)
   Set the allowable value to THA by the ratio over the thickness value which is set to “TH”.

3. **THM**=
   Allowable workpiece thickness (unit: mm, 0.0 to 10.0)
   Set the allowable value to THM by the unit mm.
9.14.8.3 Operation Procedures

- Setting of Workpiece Thickness Monitoring

- Set the mode switch of programming pendant to the teach mode.
- Set the security mode to the edit mode or management mode to edit job data.
- In the operation mode, only error contents reference is allowed.

1. Select {JOB}, then {JOB} on the {Main Menu}.

- JOB CONTENT window appears.
2. Set SVSPOT/SVSPOTMOV instruction.

- Move the cursor to the “SVSPOT/SVSPOTMOV” and press [SELECT].

- Press [SELECT] again to display DETAIL EDIT window.

- Move the cursor to “THICKNESS” and press [SELECT]. Then, select “TH=”. 
3. Set the workpiece thickness (TH).
   - Move the cursor to “THICKNESS”, and press [SELECT].

   - Enter a value and press [ENTER].
Set the allowable workpiece thickness (THA, THM).

- Set THA = 0 to 100 [%]
  (THA: Specifies the allowable range for the detected workpiece thickness by using a percentage.)

or THM= 0.0 to 10.0 [mm]
  (THM: Specifies the allowable range for the detected workpiece thickness by using an absolute value).

Move the cursor to “THICK RATIO”, and press [SELECT].

- Enter a value, and press [ENTER].
  (Value: Specify by a numeric value or I variable.)

- Press [ENTER] again.
  * Returns to the JOB CONTENT window.
Setting of Workpiece Thickness Measurement

- Set the mode switch of programming pendant to the Play mode.
- When it is in the thickness measure mode, whether the detected thickness is within the allowable range or not is not monitored.

1. Set the mode switch of programming pendant to the Play mode.
2. Select {JOB}, then {JOB} on the {Main Menu}.

- JOB CONTENT window appears.
3. Select {THICKNESS MEASURE} under {UTILITY}.

- “Thickness measure mode” appears in the message display area. The {THICKNESS MEASURE} is displayed with an asterisk mark.
Universal signal can be used to switch to the measure mode.

When using the universal signal to switch to the thickness measure mode, perform the following settings to “THICKNESS CHECK MODE SELECT GIN#” on APPLICATION CONDITION SETTING window.

THICKNESS CHECK MODE SELECT GIN#

0: Switches to the thickness measure mode by using the programming pendant.
1 to 2048: Switches to the thickness measure mode while the specified universal signal is input.

Note that when “THICKNESS CHECK MODE SELECT GIN#” on APPLICATION CONDITION SETTING window is set with other than 0, it is impossible to switch to the thickness measure mode by using the programming pendant.

While above universal signal is input, to switch again to the thickness measure mode after the measure mode is canceled by one of the operations described in “How to Cancel Thickness Measure Mode” at page 9-214, turn off then on the universal signal.
4. Execute the job.

   - The “TH” tag value of SVSPOT instruction will be rewritten with the detected workpiece thickness, the value when the pressure reaches the touch pressure, at each weld point.
   
   The following formula is used to calculate the “TH” value.

   \[
   \text{Value of measured workpiece thickness} = \text{Gun axis position at the touch detection (mm)} + \text{DMF (Fixed side wear amount + Movable side wear amount, mm)} - \text{SMF (Fixed side tip mounting error + Movable side tip mounting error, mm)}
   \]

   • The value close to the actual workpiece thickness can be obtained by considering the gun bend or pushing length. The following parameter can decide whether to consider the gun bend or pushing length.

   A1P59: Consider the gun bend or pushing length when detecting workpiece thickness

   0  : Not consider the gun bend and pushing length.
   1  : Consider the gun bend length.

   The value of measured workpiece thickness is compensated by the gun bend length calculated with the following formula.

   \[\text{“GUN ARM BEND COEF.” of the gun condition file} \times \text{Touch pressure}\]

   2  : Consider the gun pushing length.

   The value of measured workpiece thickness is compensated by the gun pushing length calculated with the following formula.

   \[\text{“GUN PUSHING COEF” of the gun condition file} \times \text{Touch pressure}\]

   • Do not change the above parameter between when measuring and when monitoring. Detection cannot be performed properly.

   • A1P59 is set with 2 (The gun pushing amount is considered) as the default.
## Execution of Workpiece Thickness Monitoring

- Set the mode switch of programming pendant to the play mode.
- Cancel the thickness measure mode.

* Refer to “How to Cancel Thickness Measure Mode” at page 9-214.

If playback of a job is performed with the thickness measure mode canceled, the workpiece thickness detected at each weld point is compared with the value of “TH”, “THA”, and “THM” tag.

If the comparison result is not acceptable, the alarm “Thickness Error” occurs.

The formula for comparison is as follow.

For THM tag:

- **[Acceptable Result]**
  \[
  \text{TH} - \text{THM} \leq \text{The detected thickness} \leq \text{TH} + \text{THM}
  \]

- **[Not-Acceptable Result]**
  \[
  \text{TH} - \text{THM} > \text{The detected thickness} \\
  \text{Or} \\
  \text{The detected thickness} > \text{TH} + \text{THM}
  \]

For THA tag:

- **[Acceptable Result]**
  \[
  \text{TH} - (\text{TH} \times \text{THA} / 100) \leq \text{The detected thickness} \\
  \text{TH} + (\text{TH} \times \text{THA} / 100)
  \]

- **[Not-Acceptable Result]**
  \[
  \text{TH} - (\text{TH} \times \text{THA} / 100) > \text{The detected thickness} \\
  \text{Or} \\
  \text{The detected thickness} > \text{TH} + (\text{TH} \times \text{THA} / 100)
  \]
By modifying the following items on APPLICATION CONDITION SETTING window, the universal output is output by pulse (pulse width: 100 msec) instead of generating alarms when the result of comparing is NG.

- Thickness error notice
  Select "Alarm" or "Signal".

- Thickness error notice gout#
  This item is indicated when "Signal" is selected to {Thickness error notice}.
  Set a pulse output signal which is output when the result is NG.

The job execution is not suspended even if the result is NG when "Signal" is selected to {Thickness error notice}.

At this time, whether to execute SVSPOT/SVSPOTMOV instructions or to skip the execution and execute the next instruction can be set with the following parameters

- AIP60: Specifying the operation of SVSPOT/SVSPOTMOV instructions which was detected to be NG.
  0 : Execute SVSPOT/SVSPOTMOV instructions which was detected to be NG.
  1 : Skip SVSPOT/SVSPOTMOV instructions which was detected to be NG and execute the next instruction.
9.14.8.4 Related Functions

- **Signal Output during Thickness Measure Mode**
  During the thickness measure mode, the universal output set in the parameter S4C165 is turned ON. For example, if the parameter S4C168 is 20 (S4C168=20), OUT20 is turned ON.
  This parameter can be used to stop welding during the thickness measure mode.

- **Disabling Thickness Monitoring**
  While the universal input signal specified to "THICKNESS ALARM IGNORE GIN#" on APPLICATION CONDITION SETTING window is input, the workpiece thickness monitoring function is disabled, and the same operation is performed as when the TH tag is unused.

  **THICKNESS ALARM IGNORE GIN#**
  - 0 : Not used
  - 1 to 2048 : When the specified universal signal is input, the workpiece thickness monitoring function is disabled.

- **Display and Output of Detected Thickness**
  - The detected thickness is displayed in mm on the SPOT SUPERVISION window.
  - The latest detected thickness is always displayed on the window.
  - Even if the power to the controller is turned OFF, the detected thickness value will remain.
  - If the value is set to the setting "M" of "DETECTED THICKNESS" on the SPOT SUPERVISION window, the detected thickness value is output to the register of the set number.

1. Select {SPOT WELDING} under {Main Menu}, then select (SPOT SUPERVISION).
Spot and Arc Welding
Using Motor Gun

9 Spot Welding Application Using a Motor Gun
9.14 Other Functions Using a Motor Gun

- SPOT SUPERVISION window appears.

2. Set the value to the setting “M” of “THICKNESS DETECTED”. Set the register number when outputting the detected thickness value to register.

■ How to Cancel Thickness Measure Mode

1. Cancel the thickness measure mode, and switched to the monitoring mode.

- Performing one of the following operations cancels the thickness measure mode and switches to the monitoring mode:

1) Execution of END instruction in Playback
2) Switching to Teach Mode
3) Canceling [THICKNESS MEASURE] from the menu
<table>
<thead>
<tr>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. It is recommended that the &quot;TH&quot; tag of SVSPOT/SVSPOTMOV instruction be set just before thickness measurement after teaching operation. If the &quot;TH&quot; tag is specified before that, the alarm &quot;Thickness Error&quot; may occur during test operation, which results in less operating efficiency.</td>
</tr>
<tr>
<td>2. The value of detected workpiece thickness is affected by the delay of detection timing and gun arm bend at the touch motion. Therefore, an absolute accuracy cannot be guaranteed. The faster the touch speed becomes and the more the touch pressure increases, the bigger the error will be. If the pressure specified in the thickness measure mode is equal to that in the monitoring mode, the absolute accuracy will be approximately 1 mm or less.</td>
</tr>
<tr>
<td>3. The detected workpiece thickness is calculated by converting the pulse data at touch detection to the stroke according to the pulse-to-stroke conversion table registered in the Gun Condition file. Therefore, the detected workpiece thickness is affected by the accuracy of the pulse-to-stroke conversion data.</td>
</tr>
</tbody>
</table>
9.14.9 Automatic Tool Number Select Function for Guns

When using a JOB including a gun, a tool corresponding to the gun can be automatically selected by this function.

If more than one gun are used in cases such as the gun change, set the tool file corresponding to each gun according to section 9.4.3 "Registering the Operation Tool" on page 9-47.

When teaching a gun, the appropriate tool needs to be selected according to the gun for teaching. This tool selection can be automatically performed by this function.

The automatic tool selection is performed when a JOB is selected and an executed JOB is changed by a CALL or JUMP instruction. However, if a JOB does not include a robot or gun, the tool remains unchanged. Also, even if a tool is selected by this function, it can be manually changed to other ones. (Refer to section 2.3.4.1 “Selecting Tool” on page 2-12.) The correspondence of a gun and a tool number needs to be performed in the gun condition file.
9.14.9.1 Setting of Validating the Function

When using the automatic tool number select function for guns, validate “AUTO TOOL NO. SELECT FOR GUN” on the application condition setting window. (Refer to section 9.4.7 "Application Condition Setting" on page 9-57 for the operating procedure.) When setting “GUN INSTALLATION STATUS” in the gun condition file for “FIXED”, the automatic tool selection is not performed to the gun even if this function is validated.
9.14.9.2 Setting of Tool Number

Set “TOOL NO.” in the gun condition file.
(Refer to section 9.4.1 “Gun Condition File” on page 9-27 for the operating procedure.)
9.15 Loading the DX100 Motor Gun Condition File

Some files in the DX100 motor gun condition files cannot be loaded to the DX200 due to different formats. Thus, load the DX100 condition files in the table below to the DX200 by using the {LOAD DX100 SPOT FILES} in the sub-menu of the {EX. MEMORY} in the main menu.

<table>
<thead>
<tr>
<th>The DX100 condition file to be loaded</th>
<th>The DX200 condition file to which the setting in the loaded files are reflected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Gun Pressure Data SPRESS.CND</td>
<td>Motor Gun Pressure Data SGPRS.CND</td>
</tr>
<tr>
<td>Pressure Data SPRESSCL.CND</td>
<td>Pressure Data SGPRSL.CND</td>
</tr>
<tr>
<td>Spot Gun Cond Data SGUN.DAT</td>
<td>Spot Gun Cond Data SGSPEC.DAT</td>
</tr>
<tr>
<td>Spot Gun Cond Data SGUN.DAT</td>
<td>Spot Management Data SGSPTMNG.DAT</td>
</tr>
<tr>
<td>Spot I/O Allocation data SPOTIO.DAT</td>
<td>Spot I/O Allocation Data SGIO.DAT</td>
</tr>
<tr>
<td>Spot Welder Cond Data SWELDER.DAT</td>
<td>Spot Welder IF Data SGWELDIF.DAT</td>
</tr>
<tr>
<td>Clearance Setting CLEARNCE.DAT</td>
<td>Clearance Setting SGCLARNC.DAT</td>
</tr>
</tbody>
</table>

- **Operation**
  1. Select {LOAD DX100 SPOT FILES} in the {EX. MEMORY}.  

![Image of menu showing the options to load DX100 SPOT FILES]
9.15 Loading the DX100 Motor Gun Condition File

- The Load DX100 Spot Files window appears.

2. Select (FOLDER SELECT) tab.

3. Select the connecting device in the DEVICE SELECT combo box.
Spot and Arc Welding
Using Motor Gun

9. Spot Welding Application Using a Motor Gun

9.15 Loading the DX100 Motor Gun Condition File

4. Select the folder containing the files to be loaded in the FOLDER SELECT list.

5. Select {FILE SELECT} tab.
6. Select the item(s) to load in the DX200 file list.

7. Press (LOAD) in the bottom right in the window.
   – The confirmation dialog appears.
9. Press \{LOAD\} in the dialog box.
   – The selected condition files are loaded.

10. Press \{CLOSE\} in the bottom right in the window.
    – The Load DX100 Spot Files window is closed.
### 9.16 The Instruction List (Motor Gun)

The following table shows the instruction list regarding the motor gun.

- `<>` indicates numerical or alphabetical data.
- If multiple items are shown in one section, select one of the items.

<table>
<thead>
<tr>
<th>SVSPOT</th>
<th>Function</th>
<th>Additional Item</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Executes the gun pressure and welding.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GUN# (&lt;gun 1 condition file number&gt;)</td>
<td>1 to 12</td>
</tr>
<tr>
<td></td>
<td>PRESS# (&lt;gun 1 pressure file number&gt;)</td>
<td>1 to 255</td>
</tr>
<tr>
<td></td>
<td>WP= &lt;gun 1 pressure value&gt;</td>
<td>1 to 9999N</td>
</tr>
<tr>
<td></td>
<td>WTM=&lt;gun 1 welding condition&gt;</td>
<td>1 to 255</td>
</tr>
<tr>
<td></td>
<td>WST=&lt;gun 1 welder startup timing&gt;</td>
<td>0 to 2</td>
</tr>
<tr>
<td></td>
<td>BWS=&lt;gun 1 start stroke position&gt;</td>
<td>0.0 to 1000.0mm</td>
</tr>
<tr>
<td></td>
<td>WGO=&lt;gun 1 group output&gt;</td>
<td>0 to 255</td>
</tr>
<tr>
<td></td>
<td>TH=&lt;gun 1 thickness&gt;</td>
<td>-999.9 to 999.9mm</td>
</tr>
<tr>
<td></td>
<td>THA=&lt;gun 1 thickness allowable range&gt;</td>
<td>0 to 100%</td>
</tr>
<tr>
<td></td>
<td>THM=&lt;gun 1 thickness allowable range&gt;</td>
<td>0 to 10.0mm</td>
</tr>
<tr>
<td></td>
<td>GUN# (&lt;gun 2 condition file number&gt;)</td>
<td>1 to 12</td>
</tr>
<tr>
<td></td>
<td>PRESS# (&lt;gun 2 pressure file number&gt;)</td>
<td>1 to 255</td>
</tr>
<tr>
<td></td>
<td>WP= &lt;gun 1 pressure value&gt;</td>
<td>1 to 9999N</td>
</tr>
<tr>
<td></td>
<td>WTM=&lt;gun 2 welding condition&gt;</td>
<td>1 to 255</td>
</tr>
<tr>
<td></td>
<td>WST=&lt;gun 2 welder startup timing&gt;</td>
<td>0 to 2</td>
</tr>
<tr>
<td></td>
<td>BWS=&lt;gun 2 start stroke position&gt;</td>
<td>0.0 to 1000.0mm</td>
</tr>
<tr>
<td></td>
<td>WGO=&lt;gun 2 group output&gt;</td>
<td>0 to 255</td>
</tr>
<tr>
<td></td>
<td>TH=&lt;gun 2 thickness&gt;</td>
<td>-999.9 to 999.9mm</td>
</tr>
<tr>
<td></td>
<td>THA=&lt;gun 2 thickness allowable range&gt;</td>
<td>0 to 100%</td>
</tr>
<tr>
<td></td>
<td>THM=&lt;gun 2 thickness allowable range&gt;</td>
<td>0 to 10.0mm</td>
</tr>
<tr>
<td></td>
<td>GUN# (&lt;gun 3 condition file number&gt;)</td>
<td>1 to 12</td>
</tr>
<tr>
<td></td>
<td>PRESS# (&lt;gun 3 pressure file number&gt;)</td>
<td>1 to 255</td>
</tr>
<tr>
<td></td>
<td>WP= &lt;gun 3 pressure value&gt;</td>
<td>1 to 9999N</td>
</tr>
<tr>
<td></td>
<td>WTM=&lt;gun 3 welding condition&gt;</td>
<td>1 to 255</td>
</tr>
<tr>
<td></td>
<td>WST=&lt;gun 3 welder startup timing&gt;</td>
<td>0 to 2</td>
</tr>
<tr>
<td></td>
<td>BWS=&lt;gun 3 start stroke position&gt;</td>
<td>0.0 to 1000.0mm</td>
</tr>
<tr>
<td></td>
<td>WGO=&lt;gun 3 group output&gt;</td>
<td>0 to 255</td>
</tr>
<tr>
<td></td>
<td>TH=&lt;gun 3 thickness&gt;</td>
<td>-999.9 to 999.9mm</td>
</tr>
<tr>
<td></td>
<td>THA=&lt;gun 3 thickness allowable range&gt;</td>
<td>0 to 100%</td>
</tr>
<tr>
<td></td>
<td>THM=&lt;gun 3 thickness allowable range&gt;</td>
<td>0 to 10.0mm</td>
</tr>
<tr>
<td></td>
<td>BCOFF (&lt;bend compensation invalid&gt;)</td>
<td></td>
</tr>
</tbody>
</table>

**Example**

MOVL V=1000
SVSPOT GUN#(1) PRESS#(1) WTM=1 WST=1 MOVL V=1000
### Spot and Arc Welding Using Motor Gun

#### 9.16 The Instruction List (Motor Gun)

##### Spot Welding Application Using a Motor Gun

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SVGUNCL</strong></td>
<td>Executes the gun pressure.</td>
</tr>
<tr>
<td><strong>Additional Item</strong></td>
<td><strong>GUN#</strong> (&lt;gun 1 condition file number&gt;) 1 to 12</td>
</tr>
<tr>
<td></td>
<td><strong>PRESSCL#</strong> (&lt;dry pressure file number&gt;)</td>
</tr>
<tr>
<td></td>
<td><strong>WP</strong> (&lt;gun pressure value&gt;)</td>
</tr>
<tr>
<td></td>
<td><strong>PRESSSTWC</strong> (&lt;wear detection condition&gt;)</td>
</tr>
<tr>
<td></td>
<td><strong>DRS#</strong> (&lt;tip dress condition file number&gt;) 1 to 16</td>
</tr>
<tr>
<td></td>
<td><strong>TWC-A</strong> (&lt;wear detection motion&gt;)</td>
</tr>
<tr>
<td></td>
<td><strong>TWC-B</strong> (&lt;wear detection motion&gt;)</td>
</tr>
<tr>
<td></td>
<td><strong>TWC-C</strong> (&lt;wear detection motion&gt;)</td>
</tr>
<tr>
<td></td>
<td><strong>TWC-AE</strong> (&lt;tip mounting error detection motion&gt;)</td>
</tr>
<tr>
<td></td>
<td><strong>TWC-BE</strong> (&lt;tip mounting error detection motion&gt;)</td>
</tr>
<tr>
<td></td>
<td><strong>T</strong> (&lt;pressure time&gt;)</td>
</tr>
<tr>
<td></td>
<td><strong>ON/OFF</strong> (&lt;ON/OFF&gt;)</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>MOV L V=1000</td>
</tr>
<tr>
<td></td>
<td>SVGUNCL GUN#(1) PRESSCL#(1)</td>
</tr>
<tr>
<td></td>
<td>MOV L V=1000</td>
</tr>
</tbody>
</table>

##### SVSPOTMOV

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Additional Item</strong></td>
<td><strong>V</strong> (&lt;play speed&gt;) 0.1 to the max speed mm/sec</td>
</tr>
<tr>
<td></td>
<td><strong>VCL</strong> (&lt;gun pressure speed&gt;) 0.1 to the max speed mm/sec</td>
</tr>
<tr>
<td></td>
<td><strong>VOP</strong> (&lt;gun open speed&gt;) 0.1 to the max speed mm/sec</td>
</tr>
<tr>
<td></td>
<td><strong>PLIN</strong> (&lt;position IN level&gt;) 0 to 8</td>
</tr>
<tr>
<td></td>
<td><strong>PLOUT</strong> (&lt;position OUT level&gt;) 0 to 8</td>
</tr>
<tr>
<td></td>
<td><strong>CLF#</strong> (&lt;clearance file number&gt;) 1 to 32</td>
</tr>
<tr>
<td></td>
<td><strong>GUN#</strong> (&lt;gun condition file number&gt;) 1 to 12</td>
</tr>
<tr>
<td></td>
<td><strong>PRESS#</strong> (&lt;gun pressure file number&gt;) 1 to 255</td>
</tr>
<tr>
<td></td>
<td><strong>WP</strong> (&lt;gun pressure value&gt;) 1 to 255</td>
</tr>
<tr>
<td></td>
<td><strong>WTM</strong> (&lt;welding condition&gt;) 1 to 255</td>
</tr>
<tr>
<td></td>
<td><strong>WST</strong> (&lt;welder startup timing&gt;) 0 to 2</td>
</tr>
<tr>
<td></td>
<td><strong>WGO</strong> (&lt;group output&gt;) 0 to 255</td>
</tr>
<tr>
<td></td>
<td><strong>TH</strong> (&lt;thickness&gt;) -999.9 to 999.9mm</td>
</tr>
<tr>
<td></td>
<td><strong>THA</strong> (&lt;thickness allowable range&gt;) 0 to 100%</td>
</tr>
<tr>
<td></td>
<td><strong>THM</strong> (&lt;thickness allowable range&gt;) 0 to 10.0mm</td>
</tr>
<tr>
<td></td>
<td><strong>BCOFF</strong> (&lt;bend compensation invalid&gt;)</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>SVSPOTMOV V=1600.0 CLF#(1) GUN#(1) PRESS#(1) WTM=1</td>
</tr>
<tr>
<td></td>
<td>WST=1</td>
</tr>
<tr>
<td>Additional Item</td>
<td>V=&lt;play speed&gt;</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td></td>
<td>VCL=&lt;gun pressure speed&gt;</td>
</tr>
<tr>
<td></td>
<td>VOP=&lt;gun open speed&gt;</td>
</tr>
<tr>
<td></td>
<td>PLIN= &lt;position IN level &gt;</td>
</tr>
<tr>
<td></td>
<td>PLOUT= &lt;position OUT level&gt;</td>
</tr>
<tr>
<td></td>
<td>GUN# (&lt;gun condition file number&gt;)</td>
</tr>
<tr>
<td></td>
<td>DRS# (&lt;tip dress condition file number&gt;)</td>
</tr>
<tr>
<td></td>
<td>SVDRESMOV V=1600.0 GUN#(1) DRS#(1)</td>
</tr>
</tbody>
</table>

**Example**

**DRESSON**

<table>
<thead>
<tr>
<th>Function</th>
<th>Rotates the dresser.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>DRS# (&lt;tip dress condition file number&gt;)</th>
<th>1 to 16</th>
</tr>
</thead>
</table>

**Example**

**DRESSOF**

<table>
<thead>
<tr>
<th>Function</th>
<th>Stops rotating the dresser.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>DRS# (&lt;tip dress condition file number&gt;)</th>
<th>1 to 16</th>
</tr>
</thead>
</table>

**Example**

**GUNCHG**

<table>
<thead>
<tr>
<th>Function</th>
<th>Connects or disconnects the gun.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>GUN# (&lt;gun condition file number&gt;)</th>
<th>1 to 12</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PICK (&lt;connect the gun&gt;)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PLACE (&lt;disconnect the gun&gt;)</td>
<td></td>
</tr>
</tbody>
</table>

**Example**

**GUNCHG GUN#(1) PICK**
10 Arc Welding Application

10.1 System Structure Example of Arc Welding System

*Fig. 10-1: System Structure of Welding Robot*
10.2 General Descriptions of Instructions and Functions

10.2.1 Setup

Connect peripheral devices.

- Wire inching function (See section 10.3 “Function Keys” on page 10-5).
- Gas flow control function (See section 10.3 “Function Keys” on page 10-5).

Setup the Power Source.
See section 10.4 “Power Source Condition File” on page 10-12.

10.2.2 Teaching Operation

Teach a welding line.

Register work instructions.

- ARCON section 10.5.1 “ARCON” on page 10-27
- ARCOF section 10.5.2 “ARCOF” on page 10-42
- ARCSET section 10.5.3 “ARCSET” on page 10-57
Set welding conditions.
- Arc welding start condition section 10.5.1 “ARCON” on page 10-27
- Arc welding end condition section 10.5.2 “ARCOF” on page 10-42

Set other welding functions.
- Weaving section 10.12 “Weaving Condition File” on page 10-140
- Arc retry function section 10.6 “Arc Retry Function” on page 10-107
- Arc restart function section 10.7 “Arc Restart Function” on page 10-109
- Wire-stick check function section 10.9 “Wire-stick Check Function” on page 10-117
- Automatic wire-stick release function section 10.8 “Automatic Wire-stick Release Function” on page 10-114
- Slope up/down function section 10.10 “Slope Up/Down Function” on page 10-118
Check the operation.
- Test operations (See section 3.8 “Test Operations” on page 3-91).
- Welding execution function during teach mode section 10.5.9 “Welding Execution Function During Teach Mode” on page 10-104

10.2.3 Playback

Fine-control the welding conditions.
- Changing welding conditions during playback section 10.13 “Changing Welding Conditions During Playback” on page 10-167
- Arc monitor function section 10.16 “Arc Monitor Function” on page 10-180

10.2.4 Production (Automatic Operation)

Control the arc welding operation.
- Check for welding errors section 10.14 “Displaying Welding Alarm History” on page 10-175
- Arc welding management and maintenance section 10.15 “Arc Welding Management and Maintenance” on page 10-177
- Welding condition check section 10.16 “Arc Monitor Function” on page 10-180
10.3 Function Keys

Each function used for arc welding is allocated on the [Numeric Key]s of the programming pendant.

- **WELD COMPLETE TIMER**
  Registers a timer instruction “TIMER” in a job.

- **0 MANUAL SPOT REFP**
  Registers a reference point “REFP” in a job, or modifies the registered reference point.
  
  \[[REFP] + [FWD]\]
  Moves the manipulator to the registered reference point.

- **8 PRESSURE ARCON**
  Registers a welding start instruction “ARCON”.
  \[[INTERLOCK]+ [ARCON]\]
  Switches welding path shift ON/OFF.

- **5 SEARCH ARCOFF**
  Registers a welding end instruction “ARCOFF”.

- **2 GUN CLOSE GAS**
  Use this key to control the gas flow. Gas is fed only while [GAS] is pressed.
  (Refer to section 10.3.3 “Gas Flow Control Function” on page 10-11.)
10 Arc Welding Application

10.3 Function Keys

Used for wire inching. Press [FEED] to feed the wire, and press [RETRACT] to retract the wire. While these keys are pressed, the wire feed motor operates.

Three speed levels are available for wire feeding:

- [FEED]: Slow
- [FEED] + [FAST]: Medium
- [FEED] + [HIGH SPEED]: Fast

Two speed levels are available for wire retraction:

- [RETRACT]: Slow
- [RETRACT] + [HIGH SPEED]: Fast

(Refer to section 10.3.2 “Wire Inching Function” on page 10-11.)

Modifies the welding current/voltage while welding during the play mode.

Press [3/CUR/VOL] to increase the current/voltage value, and press [−/CUR/VOL] to decrease the current/voltage value.

(Refer to section 10.13 “Changing Welding Conditions During Playback” on page 10-167.)

When the security mode is the management mode, press this key to light the LED and welding can be performed during the test run.

Use this key for welding check during teaching.

* When [WELD ON/OFF] is pressed and the LED is lit, a beep is sounded.

- Wire retraction, high-speed inching, or high-speed retraction cannot be performed depending on the Power Source.
- The function key is not available if the window (subject of key operation) is active while Arc Start Cond. or Arc End Cond. window is displayed.
10.3.1 Switching of the Function Key

Function keys can be switched between for spot welding (motor gun) use and for arc welding use by following the procedures below:
10.3.1.1 Two-Robot System

1. Select a robot job for SPOT welding (motor gun).
   (CONTROL GROUP: R1 + S1)
   - Keys change for spot welding (motor gun) use automatically.
     (ARC/SPOT) icon on the main menu changes to (SPOT).

2. Select a robot job for ARC welding.
   (CONTROL GROUP: R2)
   - Keys change for arc welding use automatically.
     (ARC/SPOT) icon on the main menu changes to (ARC).
10.3.1.2 Single-Robot System

Function keys can be switched between for spot welding (motor gun) use and for arc welding use on APPLI SELECT window.

1. Select \{ARC/SPOT\} under main menu.

2. Select \{APPLI SELECT\}.

   - APPLI SELECT window appears.
   
   This window also appears by selecting [INTERLOCK]+[ROBOT].

3. Select \{MOTOR GUN\}.

   - Move the cursor to \{MOTOR GUN\} and press [SELECT], then the function keys become valid for SPOT welding (motor gun) use.

   \{ARC/SPOT\} icon on the main menu changes to \{SPOT\}. 
4. Select (ARC WELD).
   Move the cursor to (ARC WELD) and press [SELECT], then the
   function keys become valid for ARC welding use.
   (ARC/SPOT) icon on the main menu changes to (ARC).
10.3.2 Wire Inching Function

Wire Inching

The term wire inching refers to gradually feeding or retracting the welding wire through the torch. [FEED] and [RETRACT] are used to perform wire inching. The wire inching simply feeds or retracts the wire, it has nothing to do with the job procedure being taught. The wire inching is performed only in the teach mode when the arc does not occur.

Wire Feeding

The wire is fed only while [FEED] is pressed.

Three speed levels are available for wire feeding:

- [FEED]: Slow
- [FEED] + [FAST]: Medium
- [FEED] + [HIGH SPEED]: Fast

Wire Retraction

The wire is retracted only while [RETRACT] is pressed.

Two speed levels are available for wire retraction:

- [RETRACT]: Slow
- [RETRACT] + [HIGH SPEED]: Fast

Supplement

Wire retraction, high-speed inching, or high-speed retraction cannot be performed depending on the Power Source.

10.3.3 Gas Flow Control Function

Gas Flow Control

The Gas Flow Control function is used to adjust the flow amount of shielding gas by opening or closing the solenoid valve.

The solenoid valve can be opened or closed by pressing [GAS].

This function simply opens or closes the solenoid valve for shielding gas. Therefore, the operation does not cause any changes in the job contents.

The Gas Flow Control function is enabled in the teach mode only.
10.4 Power Source Condition File

10.4.1 About Power Source Condition File

This is the file where the Power Source characteristics: voltage characteristic, etc., is registered. This file contains the information for Power Source control.

For precise control of the welding current and voltage, the control signals sent from the controller to the Power Source must be properly adjusted.

The voltage of the current control signal is called the welding current reference value; the voltage of the voltage control signal is called the welding voltage reference value. A reference value is in the range between 0 and 14V (or between 0 and -14 depending on Power Sources).

How the output of the welding current or voltage changes with the reference value depends on the Power Source model, and this relationship between the reference value and output value is called an output characteristics. Each Power Source condition data file contains the output values (measured values) associated with several reference values. The figure below is an example of the welding current output characteristic curve.

Fig. 10-2: Welding Current Output Characteristics (Example)

Note that the data points (points of measurement) are automatically connected by straight lines, which define the output values of any points off these data points.

The inclination between the last two data points is extended as a straight line beyond the last point until it reaches the end of the measuring range.

If the intended welding current or voltage is not output due to a fluctuation in the Power Source's power supply voltage, adjust the output by specifying a correction value. The figure (Fig. 10-2 "Welding Current Output Characteristics (Example)") shows how a correction value works.
The following are the three types of the Power Source condition files. Each file consists of two windows.

*Fig. 10-3: Power Source Condition Files*

- The execution file is used to set the condition file of the Power Source being used.
- The user registered file is used by the user to save the Power Source condition files, and the data for 64 models can be registered.
- Yaskawa also offers initial value files which contain common Power Source characteristics. Data for 24 models have already been registered.

A Power Source condition file can be set only by reading from either the user registered file or initial value file to the execution file.

When it is necessary to make adjustments to the data, refer to section 10.4.4 “Editing the Power Source Condition Files” on page 10-19.

### 10.4.2 Specifying Welding Voltage when Synergic Power Supply is Used

When a synergic power supply is used, the DX200 requests the user to specify the welding voltage by a ratio against the proper output value (not by the output value as conventionally done).

For that, the voltage characteristics associated with a certain welding current output value must be determined by measurement, and the results should be stored in the Power Source condition data file as representative values.

The welding current output value for the measurement should be a value that is assumed relatively often in actual situations.

Each of the provided Power Source condition data files already contains the representative values for the associated Power Source model.

#### <Example>

An example is shown with the ARCON instruction.

If the welding current output is 250A, the welding voltage can be specified as follows:

<table>
<thead>
<tr>
<th>ARCON</th>
<th>AC=250</th>
<th>AVP=100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welding current</td>
<td>250A</td>
<td>100% of proper output, assuming the use of synergic power supply.</td>
</tr>
</tbody>
</table>
With the voltage characteristics with the following Figure A, the above instruction causes the output of 7.5V control signal to the Power Source.

If the welding current output value is changed to 220A, a minor correction to the ARCON instruction causes the output of the control signal associated with 100% of the proper output value at 220A. (Fig.B)

\[
\begin{array}{c|c|c}
\text{ARCON} & \text{AC}=220 & \text{AVP}=100 \\
\hline
\end{array}
\]

\[\ldots \ldots \ldots \ldots \text{100% output}\]

Also note that a minor adjustment of the welding voltage can be instructed easily. (Fig.C)

e.g. The control signal is output 110% of the proper output value at 220A.

\[
\begin{array}{c|c|c}
\text{ARCON} & \text{AC}=220 & \text{AVP}=110 \\
\hline
\end{array}
\]

\[\ldots \ldots \ldots \ldots \text{110% output}\]

or

e.g. The control signal is output 94% of the proper output value at 220A.

\[
\begin{array}{c|c|c}
\text{ARCON} & \text{AC}=220 & \text{AVP}=94 \\
\hline
\end{array}
\]

\[\ldots \ldots \ldots \ldots \text{94% output}\]

This setting method enables easy adjustment without calculating the voltage output.

This method can be also applied to condition data files and instructions other than ARCON.

Another advantage is that a single welding job can be used with more than one Power Source with a synergic power supply by changing the welder condition data file.

If welding current output is significantly different from the voltage characteristics measurement used, voltage output may vary. Write the welding current value used for the voltage characteristics measurement as a comment for reference.
10.4.3 POWER SOURCE CONDITION File

A Power Source condition data file has the following two windows:

- POWER SOURCE CONDITION Window
- POWER SOURCE CONDITION Window (for current/voltage output)
10.4 Power Source Condition File

10.4.3.1 POWER SOURCE CONDITION Window

**A. POWER SOURCE NO. (1 to 8)**
Displays a Power Source number between 1 and 8 (for each welder).

**B. SETTING**
If this file is modified, the status automatically changes to “NONE”, indicating that the modification is not saved yet. To save the modification to the file, move the cursor to “SETTING” and press [SELECT]. Then the status changes to “DONE”.

**C. POWER SOURCE NAME**
Displays a Power Source name of 16 characters or less.

**D. COMM. (COMMENT)**
Displays a comment of 32 characters or less.

**E. POWER SUPPLY (A/V, A/%)**
- When “A/%” is displayed: Measured values of voltage can be input by the unit of “%” for “D. MEASURE” in the POWER SOURCE CONDITION window for current/voltage output shown in the next page.
- When “A/V” is displayed: Measured values of voltage can be input by the unit of “V” for “D. MEASURE” in the POWER SOURCE CONDITION window for current/voltage output shown in the next page.

*To switch between “A/%” and “A/V” in the POWER SOURCE CONDITION window, select [DATA] -> [READING] to read the initial value file (maker offer) or user registered file once again.

*This function is available for the standard software version NS4.00.00A (□)-00 or later.

**F. SHIELDING GAS (CO2,MAG)**
Specifies the shielding gas type.

**G. WIRE DIA. (0 dia. to 9.9mm dia.)**
Specifies the wire diameter.
H. WIRE STICKOUT (0 to 99mm)
   Specifies the length of the welding wire protruding from the torch tip.
I. WIRE ANTI-STICKING (0 to 9.9 seconds)
   Specifies the duration of the wire anti-stick process at the end of welding.
J. ARC FAILURE STOP (0 to 2.55 seconds)
   Specifies the time between the detection of arc failure and the stopping of the manipulator movement.
### 10.4.3.2 POWER SOURCE CONDITION Window for Current/Voltage Output

<table>
<thead>
<tr>
<th>No.</th>
<th>REF. (V)</th>
<th>MEASURE (A)</th>
<th>REF. (V)</th>
<th>MEASURE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>7.00</td>
<td>0.00</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>7.30</td>
<td>0.00</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>7.70</td>
<td>0.00</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>8.00</td>
<td>0.00</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>8.30</td>
<td>0.00</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>8.50</td>
<td>0.00</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>07</td>
<td>8.80</td>
<td>0.00</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>08</td>
<td>9.00</td>
<td>0.00</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

#### A. RANGE
Indicates the polarity of the reference value for the welding current and voltage. If the range is positive(+), the reference value is in the range between 0 and 14.00V. If the range is negative(-), the reference value is in the range between 0 and -14.00V.

#### B. ADJUST (0.80 to 1.20)
A correction value to adjust the welding current/voltage output.

#### C. REF. (V) (0 to 14.00V)
Welding current/voltage reference values.

#### D. MEASURE (0 to 999A, 0 to 50.0V, or 50 to 150%)
The welding current/voltage output values measured at the reference values as given under C.
10.4.4 Editing the Power Source Condition Files

When the Power Source condition file is modified or the file is read in, the SETTING status in the POWER SOURCE CONDITION window changes from “DONE” to “NONE”. After editing, move the cursor to SETTING then press [SELECT] to save the modification. Then the SETTING status changes from “NONE” to “DONE”.

NOTE
10.4.4.1 Displaying a Power Source Condition File

1. Select {ARC WELDING} under the main menu.
2. Select {POWER SOURCE CONDITION}.

   - The POWER SOURCE CONDITION window appears.

<table>
<thead>
<tr>
<th>DATA</th>
<th>EDIT</th>
<th>DISPLAY</th>
<th>UTILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   **POWER SOURCE CONDITION**

   **POWER SOURCE NO.: 1/1**

   **SETTING**
   - POWER SOURCE NAME: MOTOWELD-E350
   - COMM: STC CONTROL NONE
   - POWER SUPPLY: AC/DC
   - SHIELING GAS: CO2
   - WIRE DIA.: 0.8 mm
   - WIRE STICKOUT: 65 mm
   - WIRE ANTI-STICKING: 0.1 sec
   - ARC FAILURE STOP: 1.5 sec

   <CURRENT OUTPUT CHAR.> <WELDING VOLTAGE OUTPUT CHAR.>

   RANGE: +
   ADJUST: 1.00

   NO. | REF.(V) | MEASURE (A) | REF.(V) | MEASURE (%) |
   --- | ------- | ----------- | ------- | ----------- |
   01  | 0.00   | 0.00       | 0.00   | 0.00        |

   Turn on servo power
10.4.4.2 Reading a Power Source Condition File

1. Select {DATA} from the menu.
2. Select {READING}.
3. Select the Power Source condition file number of the data to be read.
   - Each time [PAGE] is pressed, the window alternates between MAKER INITIAL VALUE window and USER INITIAL VALUE window.
   - On the MAKER INITIAL VALUE window, the registered initial value file list (1 to 24) appears.

<table>
<thead>
<tr>
<th>NO.</th>
<th>NAME</th>
<th>POWER</th>
<th>DIA.</th>
<th>GAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>MOTOWELD-E350</td>
<td>2 A/%</td>
<td>1.2</td>
<td>MAG</td>
</tr>
<tr>
<td>02</td>
<td>MOTOWELD-E350</td>
<td>2 A/V</td>
<td>1.2</td>
<td>MAG</td>
</tr>
<tr>
<td>03</td>
<td>MOTOWELD-S350</td>
<td>2 A/%</td>
<td>1.2</td>
<td>CO2</td>
</tr>
<tr>
<td>04</td>
<td>MOTOWELD-S350</td>
<td>2 A/V</td>
<td>1.2</td>
<td>CO2</td>
</tr>
<tr>
<td>05</td>
<td>MOTOWELD-S350</td>
<td>1 A/V</td>
<td>1.2</td>
<td>MAG</td>
</tr>
<tr>
<td>06</td>
<td>MOTOWELD-S350</td>
<td>2 A/V</td>
<td>1.2</td>
<td>MAG</td>
</tr>
<tr>
<td>07</td>
<td>MOTOWELD-S350</td>
<td>1 A/%</td>
<td>0.9</td>
<td>CO2</td>
</tr>
<tr>
<td>08</td>
<td>MOTOWELD-S350</td>
<td>1 A/V</td>
<td>0.9</td>
<td>MAG</td>
</tr>
<tr>
<td>09</td>
<td>MOTOWELD-S350</td>
<td>1 A/V</td>
<td>1.2</td>
<td>CO2</td>
</tr>
<tr>
<td>10</td>
<td>MOTOWELD-S350</td>
<td>1 A/V</td>
<td>0.9</td>
<td>MAG</td>
</tr>
<tr>
<td>11</td>
<td>MOTOWELD-S350</td>
<td>1 A/V</td>
<td>1.2</td>
<td>CO2</td>
</tr>
<tr>
<td>12</td>
<td>MOTOWELD-S350</td>
<td>1 A/V</td>
<td>1.2</td>
<td>CO2</td>
</tr>
<tr>
<td>13</td>
<td>MOTOWELD-S350</td>
<td>1 A/V</td>
<td>0.9</td>
<td>CO2</td>
</tr>
<tr>
<td>14</td>
<td>MOTOWELD-S350</td>
<td>1 A/V</td>
<td>0.9</td>
<td>CO2</td>
</tr>
</tbody>
</table>

   - On the USER INITIAL VALUE window, the registered user registration file list (1 to 4) appears.

<table>
<thead>
<tr>
<th>NO.</th>
<th>NAME</th>
<th>POWER</th>
<th>DIA.</th>
<th>GAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>USER-1</td>
<td>1.2</td>
<td>2</td>
<td>CO2</td>
</tr>
<tr>
<td>02</td>
<td>USER-2</td>
<td>1.2</td>
<td>1.2</td>
<td>MAG</td>
</tr>
<tr>
<td>03</td>
<td>USER-3</td>
<td>1.2</td>
<td>1.2</td>
<td>CO2</td>
</tr>
<tr>
<td>04</td>
<td>USER-4</td>
<td>1.2</td>
<td>1.2</td>
<td>MAG</td>
</tr>
</tbody>
</table>

4. Select “YES”.
   - The confirmation dialog box appears. Select “NO” to return to the POWER SOURCE CONDITION window without the read-in.
10.4.4.3 Editing a Power Source Condition File

- Editing the “WELDER NAME” or “COMMENT”
  1. Select “POWER SOURCE NAME” or “COMMENT”.
  2. Input characters.

- Editing Other Items
  1. Select the item to be edited.
  2. Input the number using [Numeric Key].
10.4.4.4 Editing a Power Source Condition File for Current/Voltage Output

**Editing the “RANGE”**

1. Select “RANGE”.
   - Each time [SELECT] is pressed, the indication alternates between “+” (positive) and “−” (negative).

```
<CURRENT OUTPUT CHAR.> <WELDING VOLTAGE OUTPUT CHAR.>
RANGE: + +
ADJUST: 1.00  1.00
```

**Editing “ADJ”, “REF”, or “MEASURE”**

1. Select {ADJ}, {REF}, or {MEASURE}.
2. Input the number using [Numeric Key].
   - When some data is modified, the SETTING status is changed to “NONE”.

```
<table>
<thead>
<tr>
<th>NO.</th>
<th>REF.(V)</th>
<th>MEASURE (A)</th>
<th>REF.(V)</th>
<th>MEASURE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>0.00</td>
<td>30</td>
<td>0.00</td>
<td>50</td>
</tr>
<tr>
<td>02</td>
<td>1.35</td>
<td>62</td>
<td>2.70</td>
<td>62</td>
</tr>
<tr>
<td>03</td>
<td>2.70</td>
<td>94</td>
<td>2.55</td>
<td>90</td>
</tr>
<tr>
<td>04</td>
<td>10.80</td>
<td>286</td>
<td>7.80</td>
<td>60</td>
</tr>
</tbody>
</table>
```

3. After the modification, move the cursor to “SETTING” and press [SELECT].
   - The setting is completed.

```
SETTING: DONE
POWER SOURCE NAME: MOTOWELD-E350
COMM.: STC CONTROL NONE
```

**Notes on Power Source Data Condition File Modification:**

When changing “POWER SUPPLY” in Power Source condition file, the welding condition files (Arc Welding Start Condition File, Arc Welding End Condition File, and Arc Auxiliary Condition File) are formatted.
10.4.5 Registering the Power Source Condition File Data

Other than the 24 types of initial value data that Yaskawa has provided, 4 types of Power Source condition files can be registered. The data partially modified using the initial value file can also be registered.

1. Select {ARC WELDING} under the main menu.

2. Select {POWER SOURCE COND.}.

3. Select {WRITING} from {DATA} in the menu.
   – The user registered file list appears.

<table>
<thead>
<tr>
<th>USER INITIAL VALUE NO.</th>
<th>NAME</th>
<th>POWER</th>
<th>DIA.</th>
<th>GAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 USER-1</td>
<td></td>
<td>A/[%]</td>
<td>1.2</td>
<td>CO2</td>
</tr>
<tr>
<td>02 USER-2</td>
<td></td>
<td>A/[%]</td>
<td>1.2</td>
<td>MAG</td>
</tr>
<tr>
<td>03 USER-3</td>
<td></td>
<td>A/V</td>
<td>1.2</td>
<td>CO2</td>
</tr>
<tr>
<td>04 USER-4</td>
<td></td>
<td>A/V</td>
<td>1.2</td>
<td>MAG</td>
</tr>
</tbody>
</table>
4. Select the Power Source condition file number of the data to be written.
   - The confirmation dialog box appears.

5. Select “YES”.
   - Select “YES” to register the Power Source condition file data. Select “NO” to return to the POWER SOURCE CONDITION window.
10.5 Basic Functions

10.5.1 ARCON
10.5.1.1 Function

This instruction outputs an arc start command.

The arc start signal to the Power Source is turned ON to start welding by this instruction.

The function key [ARCON] can be used for registration.

To register the ARCON instruction using [INFORM LIST], select “DEVICE” from the instruction group list.
10.5.1.2 Syntax

```plaintext
ARCON
1 WELDn
2 ASF#
3 AC=
   Current output value (A)
   Arc welding start condition file number

A
4 AV=
   Voltage output value (V)

B
5 AV/P=
   Percentage against the proper voltage output value (%)

C
6 T=
   Time (seconds)

D
7 V=
   Welding speed

E
8 RETRY

F
9 REPLAY

END
```
10.5.1.3 **Explanation**

- **WELDn [1]**
  Choose one of the following tags.
  These tags are enabled only when multiple applications are in use and two or more applications are set as arc welding application.
  When there is only one application, these tags are not displayed.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>WELDn</td>
<td>Selects the Power Source</td>
<td>1 to 8.</td>
</tr>
</tbody>
</table>

- **ASF# (Arc welding start condition file number) [2] /AC = Current output value [3]**
  Be sure to choose either of the following.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASF# (Arc welding start condition file number)</td>
<td>Specifies the arc welding start condition file number. Conditions to start welding are registered in the arc welding start condition file.</td>
<td>No. 1 to 1000 The number can be specified by B/I/D/LB/LI/LD variable.</td>
</tr>
<tr>
<td>AC = Current output value</td>
<td>Specifies the output value of welding current.</td>
<td>Current value: 1 to 999 A The current output value can be specified by B/I/D/LB/LI/LD/LB/LI/LD variable.</td>
</tr>
</tbody>
</table>

- **AV = Voltage output value /AVP [4] = Percentage against the proper voltage output value [5]**
  Only when “AC = Current output value” is selected in the above “ASF# (Arc welding start condition file number) [2] /AC = Current output value [3]”, be sure to choose either of the following.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV = Voltage output value</td>
<td>Specifies the output value of welding voltage. The output value of welding voltage is specified when the power supply is independent.</td>
<td>Voltage value: 0.1 to 50.0 V The voltage output value can be specified by B/I/D/LB/LI/LD/LB/LI/LD variable. (Unit: 0.1 V)</td>
</tr>
<tr>
<td>AVP = Percentage against the proper voltage output value</td>
<td>Specifies the percentage against the proper output value of welding voltage. The percentage against the proper voltage output value is specified when the power supply is synergic.</td>
<td>Percentage: 50 to 150% The voltage output value can be specified by B/I/D/LB/LI/LD/LB/LI/LD variable.</td>
</tr>
</tbody>
</table>
### 10.5 Basic Functions

#### Spot and Arc Welding Using Motor Gun

- **T = Time [6]**
  This tag is added or omitted only when “AC = Current output value” is selected in the above “ASF# (Arc welding start condition file number) [2] / AC = Current output value [3]”.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>T =Time</td>
<td>Specifies the timer value at the start of welding.</td>
<td>Unit: seconds&lt;br&gt;The time can be specified by I/LI[I]/LI[ ] variable. (Unit: 0.01 sec.)</td>
</tr>
</tbody>
</table>

- **V = Welding speed [7]**
  This tag is added or omitted only when “AC = Current output value” is selected in the aforementioned “ASF# (Arc welding start condition file number) [2] / AC = Current output value [3]”.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>V = Welding speed</td>
<td>Specifies the welding speed. Speed: 0.1 to 1500.0 mm/sec. The unit displayed can be changed by the setting of the parameter (S2C101). The speed can be specified by B/B[ ]/LB/LB[ ]/LI/I[ ]/LI/LI[ ]/D/D[ ]/LD/LD[ ] variable. (Unit: 0.1 mm/sec.)</td>
<td></td>
</tr>
</tbody>
</table>

- **RETRY [8]**
  This tag is added or omitted only when “AC = Current output value” is selected in the aforementioned “ASF# (Arc welding start condition file number) [2] / AC = Current output value [3]”.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>RETRY</td>
<td>Specifies the retry function. The retry function works to prevent the interruption of operation when an arc start failure occurs.</td>
<td>Refer to section 10.6 “Arc Retry Function” on page 10-107.</td>
</tr>
</tbody>
</table>

- **REPLAY [9]**
  Only when RETRY is added in the above “RETRY [8]”, be sure to add this tag.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>REPLAY</td>
<td>Specifies the replay mode. The replay mode is one of the modes to repeat the ARCON process when the retry function is enabled.</td>
<td>Refer to section 10.6 “Arc Retry Function” on page 10-107.</td>
</tr>
</tbody>
</table>
10.5.1.4 Registering the ARCON Instruction

1. Press [ARCON].
2. Press [ENTER].

ARCON instruction cannot be modified after it is registered to the job.

(Refer to section 3.6.4 “Modifying Instructions” on page 3-56.) If the ARCON instruction needs to be modified, delete it and then, add the necessary instruction.
10.5.1.5 Setting Welding Start Conditions

The ARCON instruction can be registered in any of the following three ways:

- With additional items to specify conditions
  ARCON AC=200   AVP=100   T=0.50   V=60   RETRY

- With an arc welding start condition file
  ARCON ASF# (1)
  In this case, the welding condition is set using the arc welding start condition file. (Refer to section 10.5.4 “Arc Start Condition File” on page 10-68.)

- Without additional items
  ARCON
  In this case, the welding condition must be set using the welding condition set instruction (ARCSET) before the ARCON instruction is executed. (Refer to section 10.5.3 “ARCSET” on page 10-57.)

- With Additional Items to Specify Conditions

  1. Select the ARCON instruction in the instruction area.
     – The ARCON instruction appears in the input buffer line.

     ![ARCON Instruction in Instruction Area]

  2. Press [SELECT].
     – The DETAIL EDIT window appears.

  3. Select “UNUSED”.

     ![DETAIL EDIT Window with UNUSED Selection]
4. Press [SELECT] and select “AC=” from the selection dialog.

5. Place the cursor on “ASF#( )” and press [SELECT], then select “AC=” from the selection dialog.

6. Input the welding condition.
– Set each welding condition.

![Data Edit Display Utility](image1)

7. Press [ENTER].

– The set contents are displayed in the input buffer line.

![Data Edit Display Utility](image2)
8. Press [ENTER].
   – The set contents are registered in the job.

   ![JOB EDIT DISPLAY UTILITY](image)

   ![Simple Menu]

   – Press [CANCEL] to return to the JOB CONTENT window if the set contents are not to be registered.

   ![JOB EDIT DISPLAY UTILITY](image)
With an Arc Welding Start Condition File

1. Select the ARCON instruction in the instruction area.
   - The ARCON instruction appears in the input buffer line.

```
JOB CONTENT
JOB NAME: WORK A
CONTROL GROUP: R1
STEP NO: 0003
TOOL: 00

0000 NOP
0001 MOVL V=80.00
0002 MOVL V=500
0003 END
```

2. Press [SELECT].
   - The DETAIL EDIT window appears.

3. Place the cursor on “UNUSED”.

4. Press [SELECT] and select “ASF#( )” from the selection dialog.
Spot and Arc Welding
Using Motor Gun

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– If the welding conditions have already been set in the ARCON instruction additional items, the DETAIL EDIT window appears.

5. Place the cursor on “AC=” and press [SELECT], then select “ASF#()” from the selection dialog.

6. Set the file number.

– Specify the file number (1 to 64).

(1) Move the cursor to the file number and press [SELECT].
(2) Type the file number using [Numeric Key] and press [ENTER].

7. Press [ENTER];
   - The set contents are displayed in the input buffer line.
     
    ⇒ ARCON ASF# (10)

8. Press [ENTER];
   - The set contents are registered in the job.

   ⇒ ARCON ASF# (10)

   – Press [CANCEL] to return to the JOB CONTENT window if the set contents are not to be registered.
Spot and Arc Welding Application
10.5 Basic Functions

Without Additional Items

When an additional item is not provided for the ARCON instruction, set the welding conditions in advance with the welding condition setting instruction (ARCSET) before executing the ARCON instruction. (Refer to section 10.5.3 “ARCSET” on page 10-57.)

1. Select the ARCON instruction in the instruction area.
   – The ARCON instruction appears in the input buffer line.

2. Press [SELECT].
   – The DETAIL EDIT window appears.
3. Place the cursor on “ASF#( )” or “AC=”.

   ![JOB EDIT DISPLAY UTILITY]

   ![DATA EDIT DISPLAY UTILITY]
4. Press [SELECT] and select “UNUSED” from the selection dialog.

5. Press [ENTER].
   – The set contents are displayed in the input buffer line.

6. Press [ENTER].
   – The set contents are registered in the job.
   – Press [CANCEL] to return to the JOB CONTENT window if the set contents are not to be registered.
10.5.2 ARCOF
10.5.2.1 Function

This instruction outputs an arc end command. The arc start signal to the Power Source is turned OFF to end welding by this instruction.

The function key [ARCOF] can be used for registration.

To register the ARCOF instruction using [INFORM LIST], select “DEVICE” from the instruction group list.
10.5.2.2 Syntax

ARCOF

1. WELDn
2. AEF# (Arc welding end condition file number)
3. AC= Current output value (A)

Voltage output value (V)

4. AV= 
5. AVP= Percentage against the proper voltage output value (%)

Time (seconds)

6. T=

7. ANTSTK

END

ANTSTK
10 Arc Welding Application
10.5 Basic Functions

10.5.2.3 Explanation

- **WELDn [1]**
  Choose one of the following tags.
  
  These tags are enabled only when multiple applications are in use and two or more applications are set as arc welding application.
  
  When there is only one application, these tags are not displayed.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>WELDn</td>
<td>Selects the Power Source 1 to 8.</td>
<td></td>
</tr>
</tbody>
</table>

- **AEF# (Arc welding end condition file number) [2] /AC = Current output value [3]**
  Be sure to choose either of the following.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEF# (Arc welding end condition file number)</td>
<td>Specifies the arc welding end condition file number. Conditions to end welding are registered in the arc welding end condition file.</td>
<td>No. 1 to 1000 The number can be specified by B/I/D/LB/LI/LD variable.</td>
</tr>
</tbody>
</table>

- **AV = Voltage output value /AVP [4] = Percentage against the proper voltage output value [5]**
  Only when “AC = Current output value” is selected in the above “AEF# (Arc welding end condition file number) [2] /AC = Current output value [3]”, be sure to choose either of the following.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV = Voltage output value</td>
<td>Specifies the output value of welding voltage. The output value of welding voltage is specified when the power supply is independent.</td>
<td>Voltage value: 0.1 to 50.0 V The voltage output value can be specified by B/I/D/B[I]/I/D/LB/LI/LD/LB[I]/LI[L]/LD[L] variable. (Unit: 0.1 V)</td>
</tr>
<tr>
<td>AVP = Percentage against the proper voltage output value</td>
<td>Specifies the percentage against the proper output value of welding voltage. The percentage against the proper voltage output value is specified when the power supply is synergic.</td>
<td>Percentage: 50 to 150% The voltage output value can be specified by B/I/D/B[I]/I/D/LB/LI/LD/LB[I]/LI[L]/LD[L] variable.</td>
</tr>
</tbody>
</table>
### T = Time [6]
This tag is added or omitted only when “AC = Current output value” is selected in the above “AEF# (Arc welding end condition file number) [2] / AC = Current output value [3]”.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>T = Time</td>
<td>Specifies the timer value at the end of welding.</td>
<td>Unit: seconds The time can be specified by I/L/I/I/L/I variable. (Unit: 0.01 sec.)</td>
</tr>
</tbody>
</table>

### ANTSTK [7]
This tag is added or omitted only when “AC = Current output value” is selected in the aforementioned “AEF# (Arc welding end condition file number) [2] / AC = Current output value [3]”.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTSTK</td>
<td>Specifies the automatic wire-stick release function. When the automatic wire-stick release function is used, the manipulator does not immediately output the wire sticking signal upon detecting a wire stick, but automatically attempts to release the sticking by applying a certain voltage.</td>
<td>Refer to section 10.8 &quot;Automatic Wire-stick Release Function&quot; on page 10-114.</td>
</tr>
</tbody>
</table>
10.5.2.4 Registering the ARCOF Instruction

1. Press [ARCOF].
   
   ![Image showing the ARCOF instruction in the control interface]

2. Press [ENTER].
   
   ![Image showing the job content after registering the ARCOF instruction]

ARCOF instruction cannot be modified after it is registered to the job.

(Refer to section 3.6.4 "Modifying Instructions" on page 3-56.)

If the ARCOF instruction needs to be modified, delete it and then, add the necessary instruction.
10.5.2.5 Setting Arc Welding End Conditions (Crater Processing)

The ARCOF instruction can be registered in any of the following four ways:

- With additional items to specify conditions
  ARCOF AC=160  AVP=70  T=0.50  ANTSTK

- With an arc welding end condition file
  ARCOF AEF##(1)
  In this case, the welding condition is set using the arc welding end condition file. (Refer to section 10.5.5 “Arc End Condition File” on page 10-77.)

- Without additional items
  ARCOF
  When the crater process is performed by changing the welding condition when welding is completed, before the ARCOF instruction is executed, the welding condition needs to be set using the welding condition setting instruction. (Refer to section 10.5.3 “ARCSET” on page 10-57.)
With Additional Items to Specify Conditions

1. Select the ARCOF instruction in the instruction area.
   - The ARCOF instruction appears in the input buffer line.

2. Press [SELECT].
   - The DETAIL EDIT window appears.

3. Place the cursor on “UNUSED”.

4. Press [SELECT] and select “AC=” from the selection dialog.
   - If the arc welding end condition file has already been set in the ARCOF instruction additional items, the DETAIL EDIT window appears.
10 Arc Welding Application
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5. Place the cursor on “AEF#( )” and press [SELECT], then select “AC=” from the selection dialog.

6. Input the welding condition.
   – Set each welding condition.

7. Press [ENTER].
   – The set contents are displayed in the input buffer line.
10 Arc Welding Application

10.5 Basic Functions

8. Press [ENTER].

   – The set contents are registered in the job.

```
JOB CONTENT
JOB NAME: WORK A
CONTROL GROUP: R1
STEP NO: 0003
TOOL: 00
```

```
0000 NOP
0001 MOVJ VJ=80.00
0002 MOVIL V=800
0003 ARCON
0004 MOVIL V=50
0005 MOVIL V=50
0006 MOVIL V=50
0007 ARCOF AC=200 AVP=100 T=0.30 ANTSTK
0008 MOVIL V=800
0009 MOVJ VJ=80.00
0010 END
```

   – Press [CANCEL] to return to the JOB CONTENT window if the set contents are not to be registered.

```
JOB CONTENT
JOB NAME: WORK A
CONTROL GROUP: R1
STEP NO: 0003
TOOL: 00
```

```
0000 NOP
0001 MOVJ VJ=80.00
0002 MOVIL V=800
0003 ARCON
0004 MOVIL V=50
0005 MOVIL V=50
0006 MOVIL V=50
0007 ARCOF
0008 MOVIL V=800
0009 MOVJ VJ=80.00
0010 END
```

– Press [CANCEL] to return to the JOB CONTENT window if the set contents are not to be registered.
10 Arc Welding Application
10.5 Basic Functions

With an Arc Welding End Condition File

1. Select the ARCOF instruction in the instruction area.
   - The ARCOF instruction appears in the input buffer line.

2. Press [SELECT].
   - The DETAIL EDIT window appears.

3. Place the cursor on “UNUSED”.

4. Press [SELECT] and select “AEF#()” from the selection dialog.
If the welding conditions have already been set in the ARCOF instruction additional items, the DETAIL EDIT window appears.

5. Place the cursor on “AC=” and press [SELECT], then select “AEF#()” from the selection dialog.

6. Set the file number.
   - Specify the file number (1 to 1000).
     (1) Move the cursor to the file number and press [SELECT].
     (2) Type the file number using [Numeric Key] and press [ENTER].

7. Press [ENTER].
   - The set contents are displayed in the input buffer line.
8. Press [ENTER].

- The set contents are registered in the job.

```
JOB CONTENT
JOB NAME: WORK A
CONTROL GROUP: R1
STEP NO: 0003
TOOL: 00
0000: NOP
0001: MOVJ VJ=80.00
0002: MOVV V=800
0003: ARCON
0004: MOVV V=50
0005: MOVV V=50
0006: MOVV V=50
0007: ARCOF AEF# (10)
0008: MOVV V=800
0009: MOVV VJ=80.00
0010: END
```

- Press [CANCEL] to return to the JOB CONTENT window if the set contents are not to be registered.

```
JOB CONTENT
JOB NAME: WORK A
CONTROL GROUP: R1
STEP NO: 0003
TOOL: 00
0000: NOP
0001: MOVJ VJ=80.00
0002: MOVV V=800
0003: ARCON
0004: MOVV V=50
0005: MOVV V=50
0006: MOVV V=50
0007: ARCOF
0008: MOVV V=800
0009: MOVV VJ=80.00
0010: END
```

...
### Without Additional Items

1. Select the ARCOF instruction in the instruction area.
   - The ARCOF instruction appears in the input buffer line.

   ![JOB EDIT DISPLAY UTILITY](image)

   ```plaintext
   JOB CONTENT
   JOB NAME: WORK A
   CONTROL GROUP: R1
   0000 NOP
   0001 MOVJ VJ=80.00
   0002 MOVVL V=800
   0003 ARCON
   0004 MOVVL V=50
   0005 MOVVL V=50
   0006 MOVVL V=50
   0007 ARCOF AC=200 AVP=100 T=0.30 ANTSTK
   0008 MOVVL V=800
   0009 MOVJ VJ=80.00
   0010 END
   ```

   ![DATA EDIT DISPLAY UTILITY](image)

2. Press [SELECT].
   - The DETAIL EDIT window appears.

3. Place the cursor on “AEF#()” or “AC=“.

   ![DETAIL EDIT](image)

4. Press [SELECT] and select “UNUSED” from the selection dialog.

   ![DATA EDIT DISPLAY UTILITY](image)

5. Press [SELECT].
   - The set contents are displayed in the input buffer line.

   ![DATA EDIT DISPLAY UTILITY](image)
6. Press [ENTER].

- The set contents are registered in the job.

```plaintext
JOB CONTENT
JOB NAME: WORK A
CONTROL GROUP: R1
STEP NO: 0003
0000  NOP
0001  MOVJ VJ=80.00
0002  MOVL V=800
0003  ARC ON
0004  MOVL V=50
0005  MOVL V=50
0006  MOVL V=50
0007  ARCOF
0008  MOVL V=800
0009  MOVJ VJ=80.00
0010  END
```

- Press [CANCEL] to return to the JOB CONTENT window if the set contents are not to be registered.

```plaintext
JOB CONTENT
JOB NAME: WORK A
CONTROL GROUP: R1
STEP NO: 0003
0000  NOP
0001  MOVJ VJ=80.00
0002  MOVL V=800
0003  ARC ON
0004  MOVL V=50
0005  MOVL V=50
0006  MOVL V=50
0007  ARCOF AC=200 AVP=100 T=0.30 ANTSTK
0008  MOVL V=800
0009  MOVJ VJ=80.00
0010  END
```

```
ARCOF AC=200 AVP=100 T=0.30 ANTSTK
```
10.5.3 ARCSET
10.5.3.1 Function

This is the instruction to set the welding conditions (current, voltage, etc.) individually.

The ARCSET instruction can be registered in any of the following two ways:

- With additional items to specify conditions
  ARCSET AC=200  AVP=100

- With an arc welding start condition file
  ARCSET ASF# (1)

In this case, the welding condition is set using the arc start condition file.

ACOND=0: Set by “start condition”
ACOND=1: Set by “main condition”
(Refer to section 10.5.4 “Arc Start Condition File” on page 10-68.)
10.5.3.2 Syntax

```
ARCSET
  WELDn
    AC= Current output value (A)
    ASF# Arc welding start condition file number

A
  AV= Voltage output value (V)
  AVP= Percentage against the proper voltage output value (%)

B
  AN3= Voltage target value (V)
  AN4= Voltage target value (V)

C
  V= Welding speed
```
### 10.5.3.3 Explanation

- **WELDn [1]**
  
  Choose one of the following tags.

  These tags are enabled only when multiple applications are in use and two or more applications are set as arc welding application.

  When there is only one application, these tags are not displayed.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>WELDn</td>
<td>Selects the Power Source 1 to 8.</td>
<td></td>
</tr>
</tbody>
</table>

- **AC = Current output value [2]/ASF# (Arc welding start condition file number) [3]**
  
  This tag can be added or omitted.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC = Current output value</td>
<td>Specifies the output value of welding current.</td>
<td>Current value: 1 to 999 A The current output value can be specified by B/I/D/B[I]/D/I/LD/LB/LB[I]/LI/LD variable.</td>
</tr>
<tr>
<td>ASF# (Arc welding start condition file number)</td>
<td>Specifies the arc welding start condition file number. Conditions to start welding are registered in the arc welding start condition file.</td>
<td>No. 1 to 1000 The number can be specified by B/I/D/LB/LI/LD variable.</td>
</tr>
</tbody>
</table>

- **AV = Voltage output value /AVP [4]= Percentage against the proper voltage output value [5]**
  
  Be sure to choose either of the following.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV = Voltage output value</td>
<td>Specifies the output value of welding voltage.</td>
<td>Voltage value: 0.1 to 50.0 V The voltage output value can be specified by B/I/D/B[I]/D/I/LD/LB/LB[I]/LI/LD variable. (Unit: 0.1 V)</td>
</tr>
<tr>
<td>AVP = Percentage against the proper voltage output value</td>
<td>Specifies the percentage against the proper output value of welding voltage. The percentage against the proper voltage output value is specified when the power supply is synergic.</td>
<td>Percentage: 50 to 150% The voltage output value can be specified by B/I/D/B[I]/D/I/LD/LB/LB[I]/LI/LD variable.</td>
</tr>
</tbody>
</table>
### 10.5 Basic Functions

#### Spot and Arc Welding Using Motor Gun

- **V = Welding speed [6]**
  
  This tag can be added or omitted.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>V = Welding speed</td>
<td>Specifies the welding speed.</td>
<td>Speed: 0.1 to 1500.0 mm/sec. The unit displayed can be changed by the setting of the parameter (S2C101). The speed can be specified by B/[LB]/LB[B]/I/[LI/LI][D]/D[D]/LD/LD[ ] variable. (Unit: 0.1 mm/sec.)</td>
</tr>
</tbody>
</table>

- **AN3 = Voltage target value [7]**
  
  This tag can be added or omitted.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN3 = Voltage target value</td>
<td>Specifies the voltage target value for the analog output 3.</td>
<td>Target value: -14.00 to +14.00 V The voltage target value can be specified by I/LI/I[ ]/LI[ ] variable. (Unit: 0.01 V)</td>
</tr>
</tbody>
</table>

- **AN4 = Voltage target value [8]**
  
  This tag can be added or omitted.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN4 = Voltage target value</td>
<td>Specifies the voltage target value for the analog output 4.</td>
<td>Target value: -14.00 to +14.00 V The voltage target value can be specified by I/LI/I[ ]/LI[ ] variable. (Unit: 0.01 V)</td>
</tr>
</tbody>
</table>
10.5.3.4 Registering the ARCSET Instruction

- **With Additional Items to Specify Conditions**

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

2. Select the ARCSET instruction.
   - The ARCSET instruction appears in the input buffer line.

3. Press [SELECT] and set the welding condition on the DETAIL EDIT window.
   - The DETAIL EDIT window appears.
(1) Move the cursor to the item to be set, and press [SELECT].

(2) Type the welding conditions using [Numeric Key], and press [ENTER].

(3) To add the additional items, place the cursor on the item with the “UNUSED” status and press [SELECT], then the selection dialog appears.

(4) To delete the additional items, line up the cursor with the additional items and press [SELECT] to select “UNUSED”.

4. Press [ENTER].

– The set contents are displayed in the input buffer line.
5. Press [ENTER].

- The set contents are registered in the job.

![Job Content with ARCSET AC=134 AVP=100](image1.png)

- Press [CANCEL] to return to the JOB CONTENT window if the set contents are not to be registered.

![Job Content with ARCSET AC=200 AVP=100](image2.png)
With an Arc Start Condition File

1. Select the ARCSET instruction in the instruction area.
   - The ARCSET instruction appears in the input buffer line.

2. Press [SELECT].
   - The DETAIL EDIT window appears.
   - Place the cursor on “UNUSED”.
   - Press [SELECT] and select “ASF#()” from the selection dialog.
3. Set the file number.
   – Specify the file number (1 to 396).
   (1) Move the cursor to the file number and press [SELECT].

4. Specify the condition set.
   • When the welding condition file is the enhanced type
     – Specify the number for the condition set (0 or 1).
   (1) Move the cursor to the ACOND number at the condition set, and
     press [SELECT].
(2) Type the file number using [Numeric Key] and press [ENTER].

- "By selecting the condition set number, either one of the “start condition” or “main condition” in the condition file can be specified.
- ACOND=0 : Sets the welding current and voltage which are specified in the “start condition”.
- ACOND=1 : Sets the welding current and voltage which are specified in the “main condition”.

5. Press [ENTER].
- The set contents are displayed in the input buffer line.

   ➤ ARCSET ASF# (10) ACOND=1

6. Press [ENTER].
- Press [ENTER]. The set contents are registered in the job.

   ➤ ARCSET ASF# (10) ACOND=1

   ➤ ARCSET ASF# (10) ACOND=1

- Press [CANCEL] to return to the JOB CONTENT window if the set contents are not to be registered.
10.5.4 Arc Start Condition File
<table>
<thead>
<tr>
<th>10.5.4.1 Displayed File Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two types of file numbers are displayed: The sequential serial number of all welding files and the file number allocated for each power source. Either number can be entered.</td>
</tr>
<tr>
<td>When specifying the condition file number for the ARCON or the ARCSET command of a job, set the number shown in the sequential serial number field.</td>
</tr>
</tbody>
</table>
10.5.4.2 Tabs

Conditions of the arc start condition file are divided into the tabs: “PREFLOW”, “START”, “MAIN COND.”, and “OTHER”.

To switch tabs, use the cursor (left and right).

■ “Main Condition” Tab Window

1. START COND. ON
   Check this box to enable the start condition.

2. CURRENT (30 to 500 A)
   Welding current output value.

3. VOLTAGE (12.0 to 45.0 V, 50 to 150%)
   Welding voltage output value.

4. ANALOG OUTPUT 3 (-14.00 to 14.00)
   Displayed when the enhanced welding condition file function is enabled.
   This is the reference value to the Power Source through the analog output 3.
   To use this, YEW circuit board or XEW02 circuit board, etc. with analog output ports must be added.

5. ANALOG OUTPUT 4 (-14.00 to 14.00)
   Displayed when the enhanced welding condition file function is enabled.
   This is the reference value to the Power Source through the analog output 4.
   To use this, YEW circuit board or XEW02 circuit board, etc. with analog output ports must be added.

6. ROBOT PAUSE TIME (0 to 10.00 seconds)
   The length of time when the manipulator pauses at the beginning of welding.
   If the start condition is enabled, the robot pause time is specified in the “START” tab and is not displayed in the “MAIN COND.” tab.

7. ROBOT SPEED (1 to 600 cm/min)
   Set the travel speed of the torch tip during welding.
   However, if the move instruction specifies a particular speed in the welding section, this particular speed is given priority.

■ “START” Tab Window

Check the box of “SLOPE ON” to specify whether the conditions set in “START” tab should be changed stepwisely or gradually to the conditions set in “MAIN COND.” tab when starting welding.
The setting window switches as shown in the following.

Fig. 10-4: With “SLOPE ON” Checked
1. The values of CURRENT, VOLTAGE, ANALOG OUTPUT 3, and ANALOG OUTPUT 4 of the start condition at the beginning of welding
   Check the box of “START COND. ON” in the “MAIN COND.” tab to set the values.
   To use the analog output 3 and 4, YEW circuit board or XEW02 circuit board, etc. with analog output ports must be added.

2. ROBOT PAUSE TIME (0 to 10.00 seconds)
   The length of time when the manipulator pauses at the beginning of welding.

3. ROBOT MOVE DIST (DISTANCE)
   Displayed only when the slope function is OFF.
   The distance which the manipulator moves along the welding line with the conditions set in “START” tab.
   The manipulator moves at the speed specified in the “MAIN COND.”

4. ROBOT SPEED (1 to 600 cm/min)
   Displayed only when the slope function is ON.
   Specifies the initial velocity when the manipulator starts moving after the robot pause time (specified in B. above).
   Then, the speed gradually increases to the speed specified in the “MAIN COND.”

5. SLOPE DIST : Distance Specification
   Displayed only when the slope function is ON.
   The interval where the conditions are gradually changed from the ones set in the “START” tab to the ones set in the “MAIN COND.” tab can be specified by millimeter.
“PREFLOW” Tab Window
Specifies the process before the beginning of welding.

A. GAS: PREFLOW TIME
When the manipulator moves to the welding start point, feeding of the shielding gas can be started before the manipulator reaches the welding start point.

When to start feeding the shielding gas before the manipulator reaches the welding start point can be specified by seconds.

If the manipulator’s traveling time from the preceding step to the welding start point step becomes shorter than the gas preflow time due to the job teaching, the shielding gas is fed when the manipulator starts traveling to the welding start point, thus the preflow time becomes shorter than the time specified.

NOTE
“OTHER” Tab Window

1. **RETRY ON**
   Specifies whether the retry function is ON or OFF. Check this box to turn the retry function ON. At this time, the retry function is turned ON with following the setting of “RETRY FUNCTION SET” of “Arc Auxiliary Condition File”.

2. **ARC FAILURE RESTART**
   - ARC AUX. COND: If select “ARC AUX. COND”, the arc failure restart setting turns ON according to the settings of the Arc Auxiliary Condition File.
   - NO RESTART: If select “NO RESTART”, arc failure restart setting becomes invalid.

3. **PZ: POSITION SET ZONE**
   Specifies the distance from the actual position of the manipulator (the position fed back from the encoder of each axis of the manipulator) to the welding start point, where the manipulator is regarded to have reached the welding start point.
   When the position set zone is set to 0, the welding start signal is output to the power source after the manipulator completely reaches the welding start point and stops.

4. **WELDER PATH COORD SHIFT**
   Check this box to enable welding path shift. For the details, refer to section 10.17 “Welding Path Shift Function” on page 10-204.

5. **UB: UPPER BOARD (-5.0 to 5.0 mm)**
   Shifting amount to the upper board direction.

6. **UB: LOWER BOARD (-5.0 to 5.0 mm)**
   Shifting amount to the lower board direction.
10.5.4.3 Comment

Comment can be added to every ARC START COND. file number. It is input or displayed with the Arc Start Cond. window.

1. COMMENT

The comment added to each file number is displayed in this box. Up to 32 characters can be input for the comment.

Inputting Comment

1. Move the cursor to the comment displaying box.

2. Press [ENTER].

   – The software keypad window appears.
3. Input the comment and press [ENTER].

- The window returns to the Arc Start Cond. window and the input comment is displayed.
10.5.5 Arc End Condition File
10.5.5.1 Displayed File Numbers

Two types of file numbers are displayed: The serial number of all welding files (Serial No) and the file number allocated for each welder. Either number can be entered.

When specifying the condition file number for the ARCOF instruction of a job, set the number shown in the “Serial No” field.
10.5.5.2 Tabs

Conditions of the arc end condition file are divided into the tabs: “CRATER COND. 1”, “CRATER COND. 2”, and “OTHER”.

To switch tabs, use the cursor (left and right).

- **“CRATER COND. 1” Tab Window**

Check the box of “SLOPE ON” to specify whether the welding conditions should be gradually changed to the crater condition before the manipulator reaches to the welding end point, or should be changed to the crater condition immediately after the manipulator reaches the welding end point.

The setting window switches as shown in the following.

*Fig. 10-6: With “SLOPE ON” Checked*
1. The values of CURRENT, VOLTAGE, ANALOG OUTPUT 3, and ANALOG OUTPUT 4 of the crater condition 1 at the beginning of welding
   The analog output 3 and 4 are displayed when the enhanced welding condition file function is enabled.
   To use the analog output 3 and 4, YEW circuit board or XEW02 circuit board, etc. with analog output ports must be added.

2. ROBOT SPEED (1 to 600 cm/min)
   Displayed only when the slope function is ON.
   This is the manipulator’s travel speed at the welding end point.
   The manipulator’s travel speed changes from the speed specified with the move instruction of a job or the speed specified by the welding start condition file to the speed specified above.

3. ROBOT PAUSE TIME (0 to 10.00 seconds)
   The length of time when the manipulator continues welding while the manipulator is stopped at the welding end point.

4. SLOPE DIST : Distance Specification
   Displayed only when the slope function is ON.
   The interval where the conditions are gradually changed from the ones set in the “MAIN COND.” tab to the ones set in the “CRATER COND. 1” tab can be specified by millimeter.
“CRATER COND. 2” Tab Window
Check the box of “CRATER2 ON” to set the condition to either of the following:

- Check “CRATER2 ON” to change the crater condition stepwisely after the manipulator reaches the welding end point
- Uncheck “CRATER2 ON” to continue welding with the crater condition 1

The setting window switches as shown in the following.

**Fig. 10-8: With “CRATER2 ON” Checked**

![Diagram showing the setting window with “CRATER2 ON” checked.]

**Fig. 10-9: With “CRATER2 ON” Unchecked**

![Diagram showing the setting window with “CRATER2 ON” unchecked.]

1. The values of CURRENT, VOLTAGE, ANALOG OUTPUT 3, and ANALOG OUTPUT 4 of the start condition at the beginning of welding

   Check the box of “CRATER2 ON” to set the value. The analog output 3 and 4 are displayed when the enhanced welding condition file function is enabled. To use the analog output 3 and 4, YEW circuit board or XEW02 circuit board, etc. with analog output ports must be added.

2. **ROBOT PAUSE TIME (0 to 10.00 seconds)**

   The length of time when the manipulator continues welding while the manipulator is stopped at the welding end point.
“OTHER” Tab Window

Fig. 10-10: With “AST: ANTI-STICK ON” Checked

Fig. 10-11: With “AST: ANTI-STICK ON” Unchecked

Fig. 10-12: Timing of Each Process Time of Arc End Process
10 Arc Welding Application

10.5 Basic Functions

1. PZ: POSITION SET ZONE
   Specifies the distance from the actual position of the manipulator (the position fed back from the encoder of each axis of the manipulator) to the welding end point, where the manipulator is regarded to have reached the welding end point.
   When the position set zone is set to 1, the condition switches to the crater condition after the manipulator completely reaches the welding end point and stops.

   **Crater at the end of the weld bead**

   If the timings of the manipulator’s stop and the switch of the crater condition are not right, there may be rare occasions when the crater part becomes longer as shown below.

   In this case, it is effective to set the position set zone to 0 in order to synchronize precisely the timings of the manipulator’s stop and the switch of the crater condition.

   ![Crater at the end of the weld bead](image)

   When the position set zone is set to 1, the cycle time extends by 0.1 to 0.2 seconds, because the judgment that the manipulator has reached the welding end point is delayed, compared with when the position set zone is set to other than 0.

   Set the appropriate position set zone depending on the shape of crater.

2. MTS: MONITORING TIME
   Wire stick monitoring time at the end of welding.

3. AST: ANTI-STICK ON
   Check this box so that the process of automatic wire-stick release will be performed if wire-stick is detected at the end of welding.

   When the anti-stick function is ON, the cycle time becomes longer than when it is OFF.

   - When the anti-stick is ON:
     After the wire stick monitoring of the step B above, the manipulator starts to move.

   - When the anti-stick is OFF:
     Simultaneously with the start of the wire stick monitoring of the step B above, the manipulator starts to move.

4. GAS: AFTERFLOW TIME
   Specifies with the length of time to feed the shielding gas while the manipulator is moving from the end of welding to the next step.
10.5.5.3 Comment

Comment can be added to every ARC END COND. file number. It is input or displayed with the Arc Start Cond. window.

1. COMMENT

The comment added to each file number is displayed in this box. Up to 32 characters can be input for the comment.

- Inputting Comment
  1. Move the cursor to the comment displaying box.
  2. Press [ENTER].
     - The software keypad window appears.
3. Input the comment and press [ENTER].

4. The window returns to the Arc End Cond. window and the input comment is displayed.
10.5.6 Condition File Edit Function (Copying of the Welding Conditions)

**Outline**
Contents of the welding conditions set in ARC START COND. or ARC END COND. files can be batch copied into other ARC START COND. or ARC END COND. files.

**Copying Procedures**

1. Display [WELD COND COPY].
2. Select a file to be copied. (Select 1 file.)
3. Select a copy destination file. (Select 1 or more files.)
4. Start copying.
5. End

---

CAUTION
Perform copying under the following status.
- Security mode: Edit mode or higher
- Teach mode
- No alarm is occurred

Note 1: Copying cannot be executed during playback operation.
Note 2: Copying cannot be executed between different welding devices.
## Procedure

1. Display \{WELD COND COPY\}.

   - Display either ARC START COND. or ARC END COND. file, and then select (DATA).

   ![Display Screen]

2. Select a file to be copied.

   - Move the cursor to the row of the “No.” (① in the figure below), and then press [SELECT]. Specification of the file number is enabled and the cursor jumps to the relevant file.

   - The cursor can be moved or the window can be scrolled by pressing [↑], [↓], or [SHIFT] + [↑] or [↓].

   - When moving the cursor to the row of the “Src No.” (② in the figure below), and then press [SELECT]. “●” is marked on the relevant file and a file to be copied becomes in a selected status.

   ![Select Screen]

3. Select a copy destination file.

   - Move the cursor to the row of the “No.” (① in the figure below), and then press [SELECT]. Specification of the file number is enabled and the cursor jumps to the relevant file.

   - The cursor can be moved or the window can be scrolled by pressing [↑], [↓], or [SHIFT] + [↑] or [↓].

   - When moving the cursor to the row of the “Src No.” (② in the figure below), and then press [SELECT]. “●” is marked on the relevant file and a copy destination file becomes in a selected status.
Note: Selecting more than one copy destination files.

- The copy destination file can be selected by moving the cursor to the row of the "DestNo." (③ in the figure below), and then press [SELECT].

- When selecting more than two destination files, press [SHIFT]+[SELECT] first, then move the cursor to other files. "●" is marked on each file and those copy destination file becomes in a selected status.

4. Execute copying

- When pressing [EXECUTE] (④ in the figure below), a confirmation dialog box appears

- Select [YES] to execute copying.

- Select [NO] to cancel copying.
### Other Operations

5. **Jumps to (TOP LINE).**
   Jumps to the top line of the available file at a welding robot for editing.

6. **Jumps to (ENDLINE).**
   Jumps to the last line of the available file at a welding robot for editing.

7. **Jumps to (DESIGNATED LINE).**
   Jumps to the designated line of the available file at a welding robot for editing.

8. **Jumps to (SOURCE LINE).**
   Jumps to the source line for copying.

9. **Jumps to (SELECT ALL (COPYING)).**
   All the lines are selectable.

10. **Jumps to (CANCEL ALL (COPYING)).**
    Cancels all the lines selected as destinations for copying.
10.5.7 Welding Speed Specifications

The welding speed is determined by one of the following:

- Welding speed specified by the play speed of the move instruction
- Welding speed specified by the ARCON instruction or the arc start condition file

**When the move instruction does not specify a speed**

Welding is performed at the welding speed of the ARCON instruction.

**When the move instruction and ARCON instruction specify different speeds**

Priority is given to one according to the parameter values described below. To switch the priorities, change the parameter setting.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Contents</th>
<th>Initial Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AxP005</td>
<td>Move instruction speed is priority</td>
<td>0</td>
</tr>
<tr>
<td>x: Application number</td>
<td>ARCON instruction speed is priority : 1</td>
<td>1</td>
</tr>
</tbody>
</table>
10.5.8 Welding Condition Batch Change Function

This function changes all the welding conditions in the job collectively. This change varies in the following ways.

- Changes specified jobs collectively
- Changes jobs within the specified range collectively.

Welding conditions changeable are as follows.

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Changeable to</th>
<th>Input range</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>Changes the AC (welding current value) specified by the welding instruction to the value input in {VALUE}.</td>
<td>1 to 999</td>
</tr>
<tr>
<td>AV</td>
<td>Changes the AV (welding voltage value) specified by the welding instruction to the value input in {VALUE}.</td>
<td>0.1 to 50.0</td>
</tr>
<tr>
<td>AVP</td>
<td>Changes the APV (proportion to appropriate voltage) specified by the welding instruction to the value input in {VALUE}.</td>
<td>50?150</td>
</tr>
<tr>
<td>Relative:AC</td>
<td>Changes the AC (welding current value) specified by the welding instruction to the proportion of the value input in {VALUE}.</td>
<td>1 to 200</td>
</tr>
<tr>
<td>Relative:AV</td>
<td>Changes the AV (welding voltage value) specified by the welding instruction to the proportion of the value input in {VALUE}.</td>
<td>1 to 200</td>
</tr>
<tr>
<td>Relative:AVP</td>
<td>Changes the APV (proportion to appropriate voltage) specified by the welding instruction to the proportion of the value input in {VALUE}.</td>
<td>1 to 200</td>
</tr>
<tr>
<td>Relative</td>
<td>Changes the value of either AC, AV, or APV specified by the welding instruction to the proportion of the value input in {VALUE}.</td>
<td>1 to 200</td>
</tr>
</tbody>
</table>

When “RELATIVE:**” or “RELATIVE” is set to {CONDITION TYPE} and change of the welding condition is executed, the maximum value is set to the welding condition in case the changed value exceeds the upper limit of the input range.
10.5.8.1 Batch Change of Welding Conditions in Specified Job

Welding conditions of a whole job can be changed collectively.

1. Display a job in which the welding conditions are to be changed.

2. Move the cursor to the instruction area.

3. Select {EDIT} → {CHANGE WELD. COND.} under the main menu.

   - {WELDING CONDITION CHANGE} window appears.

4. Set “NO CONFIRM” to {CHANGE METHOD}.
5. Specify {CONFIRM} to {CHANGE METHOD}.

6. Input a value to {VALUE}.

7. Select {EXECUTE} or press [ENTER].
   – Welding condition in the selected job.
10.5.8.2 Batch Change of Welding Conditions in Specified Job after Confirmed Individually

Welding conditions of a whole job can be changed after confirmed by instructions.

1. Display a job in which the welding conditions are to be changed.
2. Move the cursor to the instruction area.

3. Select \{EDIT\} \rightarrow \{CHANGE WELD. COND.\} under the main menu.

   – \{WELDING CONDITION CHANGE\} window appears.

4. Set “NO CONFIRM” to \{CHANGE METHOD\}
5. Specify {CONFIRM} to {CHANGE METHOD}.

6. Input a value to {VALUE}.

7. Select {EXECUTE} or press [ENTER].
   - A message “Changing welding condition.” appears in the human interface area.
   - The cursor moves to the instruction in which the specified welding condition is included.
8. Press [ENTER].
   - The welding condition to which the cursor is moved is changed.
   - The cursor moves to the next instruction.

9. Press [↑] or [↓].
   - The cursor moves to the upper or lower instruction that includes the specified welding condition.

10. The instruction at the last line of the welding condition job is changed or press [CANCEL].
    - Change of the welding condition operation is completed.
    - A message “Changing welding condition.” in the human interface area disappears.
10.5.8.3 Batch Change of Welding Conditions within Specified Range

Welding conditions in a specified range can be changed.

1. Display a job in which the welding conditions are to be changed.

2. Move the cursor to the welding condition change start line, and then press [→] to move it to the instruction area.

3. Press [SHIFT] + [SELECT].
   - A line in the window becomes in a selectable status.

4. Press [↓] or [↑] to select the range in which the welding conditions are to be changed.
   - Two or more lines are selected.
5. Select \{EDIT\} \rightarrow \{CHANGE WELD. COND.\} under the main menu.

- \{WELDING CONDITION CHANGE\} window appears.
- \{START LINE NO.\}: Start line No. of the selected range is displayed.
- \{END LINE NO.\}: End line No. of the selected range is displayed.

6. Set "NO CONFIRM" to \{CHANGE METHOD\}.

7. To \{CONDITION TYPE\}, Specify a condition to be changed.
10  Arc Welding Application
10.5 Basic Functions

8. Input a value to \{VALUE\}.

9. Select \{EXECUTE\} or press [ENTER].

– The welding conditions within the selected range are changed.

Instructions with no welding conditions specified by \{CONDITION TYPE\} would not be changed even if they are within the selected range.
10.5.8.4 Batch Change of Welding Conditions in Specified Range after Confirmed Individually

Welding conditions within the specified range can be changed after confirmed by instructions.

1. Display a job in which the welding conditions are to be changed.

2. Move the cursor to the welding condition change start line, and then press [→] to move it to the instruction area.

3. Press [SHIFT] + [SELECT].
   
   - A line in the window becomes in a selectable status.

4. Press [↓] or [↑] to select the range in which the welding conditions are to be changed.
   
   - Two or more lines are selected.
5. Select {EDIT} → {CHANGE WELD. COND.} under the main menu.

[Diagram of a user interface showing a menu with options such as EDIT, DISPLAY, UTILITY, JOB, and others, with a section labeled "WELDING CONDITION CHANGE".

- "WELDING CONDITION CHANGE" window appears.
- START LINE NO.: Start line No. of the selected range is displayed.
- END LINE NO.: End line No. of the selected range is displayed.

6. Set "CONFIRM" to {CHANGE METHOD}.

7. To {CONDITION TYPE}, Specify a condition to be changed.
8. Input a value to {VALUE}.

9. Select {EXECUTE} or press [ENTER].
   - A message “Changing welding condition.” appears in the human interface area.
   - The cursor moves to the instruction in which the specified welding condition is included.

10. Press [ENTER].
    - The welding condition to which the cursor is moved is converted.
    - The cursor moves to the next instruction.
11. Press [↑] or [↓].
   – The cursor moves to the upper or lower instruction that includes the specified welding condition.

12. The instruction at the last line of the welding condition job is changed or press [CANCEL].
   – Change of the welding condition operation is completed.
   – A message “Changing welding condition.” in the human interface area disappears.
10.5.9 Welding Execution Function During Teach Mode

When the [WELD ON/OFF] is pressed, the LED is lit with a beep sound, turning ON the system output signal "#50065: PERMISSIBLE WORK IN TEST RUN".

When pressing these keys once again, the LED goes out and the beep sound stops, then the system output signal "#50065: PERMISSIBLE WORK IN TEST RUN" turns OFF.

The standard ladder program of arc welding application supports the function that welding can be performed during the teach mode by the signal "#50065: PERMISSIBLE WORK IN TEST RUN".

*Welding can be performed during a test run only when the security mode is the management mode.

*Welding cannot be performed during a test run even while the LED is lit unless the security mode is the management mode.

During a test run of the teach mode, the manipulator may not move at the actual welding speed due to the speed limit in some cases. (e.g. at a welding position/point where the manipulator significantly changes its posture during a coordinated motion with a station)

In these cases, weld bead may be thicker compared with the bead that is formed during the playback operation, or burn through may occur as the speed of the welding is different from the speed that is appropriate for the welding conditions (current and voltage).

10.5.10 Test Run Operation Mode

In a test run, the manipulator is moved through taught steps in a continuous motion by pressing [INTERLOCK] and [TEST START] simultaneously.

Normally the manipulator moves only while [TEST START] is pressed after the above-mentioned keys are pressed simultaneously. However, by setting the following parameter, the manipulator becomes to be moved only while [INTERLOCK] is pressed.

- Test run operation mode (S2C308 d1 bit)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Contents and setting value</th>
<th>Initial value</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2C308</td>
<td>Continue test run by pressing [TEST START] : 1 Continue test run by pressing [INTERLOCK] : 3 (Pressing [TEST START] is also available to continue test run.)</td>
<td>1</td>
</tr>
</tbody>
</table>
10.5.11 Notes on Arc Welding
Notes on Restarting

If the manipulator stops during welding, the arc is automatically turned OFF. When restarted, the arc is automatically turned ON, and the manipulator starts welding towards the step where the cursor is located on the screen. The welding current and voltage when arc is turned ON again are the same as those before stopping.

If the manipulator is moved from the stopped position using [Axis Key], return the manipulator to the stopped position before restarting for safe operation.

It is possible to move the manipulator to the stopped position automatically at restarting and start welding again by the parameter setting (S2C422, S2C423).

[FWD] or [BWD] can be used for moving to the stopped position.

S2C422: Restart Operation after E-Stop (Set 2).
S2C423: Restart Operation after Jog Operation (Set 2).

Refer to chapter 8 “Parameter”.

DANGER!
10.6 Arc Retry Function

An attachment to the welding start position of a non-conductive material, such as rust, soot, and oil, may cause an arc start failure during arc start. An arc start failure stops the manipulator and interrupts work. This is prevented by using the arc retry function.

When an arc start failure occurs and this arc retry function is performed, the ARCON process is repeated according to the retry condition defined in the Arc Auxiliary Condition File. The manipulator repeats the ARCON procedure as it slightly shifts its position near the arc starting point. After that, the manipulator returns to the starting point when an arc starts and continues working.

Fig. 10-13: Retry Function Example

1. Arc Start Failure
2. The Retry Procedure
   - Returns toward the previous step and performs a retract inching, then returns to the teaching starting point and repeats the ARCON procedure.
3. After a successful arc start, the manipulator continues to weld.
10.6 Arc Retry Function

10.6.1 Arc Retry Function Setting

1. **NO. (0 to 9 times)**
   Maximum repetition count for the arc retry process.

2. **RETRACT TIME (0 to 2.50 seconds)**
   Wire retracting time in the arc retry process.

3. **REPLAY DISTANCE (0 to 99.9 mm)**
   Manipulator moving distance for an arc retry process at the replay mode.

4. **SPEED (1 to 600 cm/min)**
   Speed of the manipulator when it returns to the welding start point at arc retry.
   When the welding start condition file (ASF#()) is specified in ARCON instruction or "REPLAY" is specified in the retry mode, the retry operation is executed in the speed specified by the move instruction before ARCON instruction, not in the speed of the arc auxiliary condition.

5. **CURRENT (1 to 999A)**
   Welding current output when the manipulator returns to the welding start point at arc retry.
   When the welding start condition file (ASF#()) is specified in ARCON instruction or "REPLAY" is specified in the retry mode, the current value of the welding start condition file or the value specified to the AC tag in ARCON instruction, not the current of the arc auxiliary condition.

6. **VOLTAGE (0 to 50.0V, 50 to 150%)**
   Welding voltage output when the manipulator returns to the welding start point at arc retry.
   When the welding start condition file (ASF#()) is specified in ARCON instruction or "REPLAY" is specified in the retry mode, the voltage value of the welding start condition file or the value specified to the AV/AVP tag in ARCON instruction, not the voltage of the arc auxiliary condition.

---

**SUPPLEMENT**

When the twin synchronous function, etc. is used, the arc retry function cannot be used.
10.7 Arc Restart Function

When the manipulator stops because of an arc failure, a simple start would leave a break in the welding line. This is prevented by using the arc restart function.

When the arc restart function is executed, the manipulator is restarted using the method specified in the Arc Auxiliary Condition File.

There are three methods to restart the manipulator after an arc failure:

• With the arc OFF the controller outputs an error signal and the message “RESTARTING FOR ARC”, but continues manipulator’s movement. After exiting the arc section, the controller outputs the message “END OF ARC RESTARTING”, and continues the operation.

• With the arc ON trial, the manipulator automatically returns for the specified overlap length, and then continues welding.

• The manipulator stops and waits for a manual intervention. After intervention (A), the operator should return the manipulator to the original stop position (B). And then press [START] again. The manipulator returns for the specified overlap length (C) and continues the work.

*1 The arc auxiliary condition file defines the following: current, voltage and speed at restart; method of restart after a gas shortage or wire shortage.
*2 The overlap length (the length of the section where welding is repeated after a restart) can be set as desired (0 to 99.9mm).

**NOTE**

A cursor operation resets the “restaring” status. Therefore, the arc restart function cannot be executed after the cursor operation.
10.7.1 Arc Auxiliary Condition File
10.7.1.1 Arc Restart Function Setting

1. NO. (0 to 9 times)
   Maximum repetition count for the arc restart process regarding the same welding section.

2. LAP DISTANCE (0 to 99.9mm)
   Overlapped welding distance in a restart process.

3. SPEED (1 to 600 cm/min)
   Speed of the manipulator as it moves backward in an arc restart process.

4. CURRENT (1 to 999A)
   Welding current output when the manipulator moves backward in an arc restart process.

5. VOLTAGE (0 to 50.0V, 50 to 150%)
   Welding voltage output when the manipulator moves backward in an arc restart process.

F. RESTART MODE

1. ARC FAILURE
   (1) NO RESTART :
   – Arc restart function is not used. The manipulator stops with the arc failure alarm.
   (2) ARCOF CONTINUE :
   – With the arc OFF, the controller outputs the “Restarting for Arc” message and the manipulator keeps moving.
   – After moving through the arc section, the controller outputs the “End of Arc Restarting” message and resumes a normal welding operation.
   – The message is reset when OUT #4093 is turned ON and OFF.
   (3) AUTO RESTART :
   – The manipulator automatically restarts.
   (4) SEMI-AUTO RESTART :
   – The manipulator stops and waits for manual intervention.
   – The manipulator restarts as the operator presses [START] again.
   – The restart status is reset when OUT #4094 is turned ON and OFF.

2. GAS FAILURE
10. Arc Welding Application
10.7 Arc Restart Function

(1) NO RESTART:
– Arc restart function is not used. The manipulator moves with the gas shortage alarm.

(2) ALARM AT ARC END:
– The manipulator continues the welding operation until it reaches the welding end point, where it stops with an alarm.

(3) SEMI-AUTO RESTART:
– The manipulator stops and waits for manual intervention.
– The manipulator restarts as the operator presses [START] again.
– The restart status is reset when OUT #2046 is turned ON and OFF.

3. WIRE FAILURE

(1) NO RESTART:
– Arc restart function is not used. The manipulator moves with the wire shortage alarm.

(2) ALARM AT ARC END:
– The manipulator continues the welding operation until it reaches the welding end point, where it stops with an alarm.

(3) SEMI-AUTO RESTART:
– The manipulator stops and waits for manual intervention.
– The manipulator restarts as the operator presses [START] again.
– The restart status is reset when OUT #2046 is turned ON and OFF.

When the complete synchronization of the twin synchronous function is used, the arc restart function cannot be used.
### 10.8 Automatic Wire-stick Release Function

#### Automatic Wire-stick Release Function

The automatic wire-stick release function can be used if wire stick is detected in spite of the anti-stick process.

When this function is used, the manipulator does not immediately output the wire sticking signal upon detecting a wire stick, but automatically attempts to release the sticking by applying a certain voltage.

Only when the stick release process has failed for a specified number of times, the manipulator stops and outputs the wire stick signal.

This function is specified in the arc end condition file or the ARCOF instruction's additional items. When it is used, the voltage and number of attempts are set in the arc auxiliary condition file.

#### Manipulator Stopped by Wire Stick

If a wire stick occurs at the end of welding, the manipulator immediately stops in the hold status. While the manipulator remains in the hold status, the [HOLD] lamp lights and the external system output signal "Wire Sticking" is output.
10.8.1 Arc Auxiliary Condition File
10 Arc Welding Application

10.8 Automatic Wire-stick Release Function

10.8.1.1 Automatic Wire Anti-stick Function Setting

1. **NO. (0 to 9 times)**
   Maximum repetition count for the wire-sticking release process.

2. **CURRENT (1 to 999A)**
   The welding current output in the wire-sticking release process.

3. **VOLTAGE (0 to 50.0V, 50 to 150%)**
   The welding voltage output in the wire-sticking release process.

4. **CLOCK (0 to 2.00 seconds)**
   Sticking release process duration.
10.9 Wire-stick Check Function

- **Anti-Stick Function**
  The wire may stick to the workpiece after welding is completed (1).
  As an anti-stick process, the Power Source temporarily increases the voltage at the end of welding (2).
  After the anti-stick process, a wire stick check is performed (3).
  If the anti-stick process failed and a wire stick is detected, the manipulator enters a hold status or performs the automatic sticking release process, depending on the anti-stick condition specified.
  Time required for the anti-stick process differs depending on the Power Sources.
  The anti-stick process times for different Power Sources is registered in the Power Source characteristic file.
  The wire check is performed after the anti-stick process time has elapsed.

**Wire stick**

“Wire stick” refers to the contact of the wire to the workpiece as observed after the arc-OFF.

1. **Welding End (Wire Stick Occurrence)**

2. **Anti-stick Process**

3. **Wire Stick Check**
   - Wire stick check is performed after elapsing of the anti-stick process time defined in the Power Source characteristic file.
10.10 **Slope Up/Down Function**

The slope up/down function is used during welding to gradually change the welding condition.

This function is extremely effective in conducting heat for such operations on workpieces such as the one shown below.

During the welding of a workpiece as shown below, especially during the period before the end of welding, the tearing or dropping of metal can occur quite frequently due to heat conduction.

However, even in this example, if the welding condition is gradually decreased before the end of welding, tearing and dropping of metal can be prevented.

```
Reference Job

NOP

MOVL V=500
ARCON AC=210 AVP=100
MOVC V=80
MOVC V=80
MOVC V=80
ARCCTE AC=180 AVP=100 DIS=20.0
MOVC V=80
ARCOF AC=160 AVP=80 T=0.30

END
```

- Moves to welding start point P1.
- Arc starts.
- Moves to taught point Pn-1.
- Gradually decreases the current from the point 20mm short of the welding end point.
- Moves to welding end point Pn.
- Arc ends.

![Diagram showing welding process and slope up/down function](image_url)
10.10.1 ARCCTS
10.10.1.1 Function

The ARCCTS instruction is used with a move instruction to gradually change the welding current and voltage during welding.

A gradual change in the current or voltage is specified by an aimed value and the length of the slope up/down section. The length of the slope up/down section is set from the move start point (DIS).

If no length is specified, the entire section of the move instruction is used.
10.10.1.2 Syntax

```
ARCCTS
  1 WELDn
  2 AC= Current output value (A)

A
  3 AV= Voltage output value (V)
  4 AVP= Percentage against the proper voltage output value (%)

B
  5 AN3= Voltage target value (V)
  6 AN4= Voltage target value (V)

C
  7 AMP= Weaving half-amplitude
  8 V= TCP speed
  9 ASF= File number

END
```

TCP speed
Slope up/down section length (mm)
File number
## 10.10.1.3 Explanation

- **WELD1/WELD2/WELD3/WELD4/WELD5/WELD6/WELD7/WELD8** [1]
  
  Choose one of the following tags.

  These tags are enabled only when multiple applications are in use and two or more applications are set as arc welding application.

  When there is only one application, these tags are not displayed.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>WELDn</td>
<td>Selects the Power Source 1 to 8</td>
<td></td>
</tr>
</tbody>
</table>

- **AC = Current output value** [2]
  
  This tag can be added or omitted.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
</table>
| AC = Current output value | Specifies the target value of welding current. | Current value: 1 to 999 A  
The current output value can be specified by B/I/D/B{/I{/D{/LB/LI/LD/LB{/LI{/LD} variable. |

- **AV = Voltage output value /AVP** [3] = Percentage against the proper voltage output value [4]
  
  Be sure to choose either of the following.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
</table>
| AV = Voltage output value | Specifies the target value of welding voltage.  | Voltage value: 0.1 to 50.0 V  
The voltage output value can be specified by B/I/D/B{/I{/D{/LB/LI/LD/LB{/LI{/LD} variable.  
(Unit: 0.1 V) |
| AVP = Percentage against the proper voltage output value | Specifies the target value of welding voltage by the percentage against the proper output value of welding voltage. | Percentage: 50 to 150%  
The voltage output value can be specified by B/I/D/B{/I{/D{/LB/LI/LD/LB{/LI{/LD} variable. |
**AN3 = Voltage target value [5]**
This tag can be added or omitted.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
</table>
| AN3 = Voltage target value | Specifies the voltage target value for the analog output 3. | Target value: -14.00 to +14.00 V  
The voltage target value can be specified by I/LI/I/[]/LI[] variable.  
(Unit: 0.01 V) |

**AN4 = Voltage target value [6]**
This tag can be added or omitted.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
</table>
| AN4 = Voltage target value | Specifies the voltage target value for the analog output 4. | Target value: -14.00 to +14.00 V  
The voltage target value can be specified by I/LI/I/[]/LI[] variable.  
(Unit: 0.01 V) |

**DIS = Slope up/down section length [9]**
This tag can be added or omitted.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
</table>
| DIS = Slope up/down section length | Specifies the slope up/down section length where the current and voltage are gradually changed. The length is set as the distance from the move start point. If no length is specified, the entire section of the move instruction is used. | Length: 0.1 to 6553.5 mm  
The slope up/down section length can be specified by B/I/D/B/[]/[]/D/[]/LB/LI/LD/ LB/[]/LI/[]/LD/[] variable.  
(Unit: 0.1 mm) |

**Example**

The current and voltage are gradually changed as the manipulator moves toward the move end point specified by the move instruction. The aimed current and voltage values are 150A and 16.0V respectively. The slope up/down section length is 100mm from the move start point.

```
ARCCTS AC=150
      Target value of welding current
AV=16.0
      Target value of welding voltage
DIS=100.0
      Slope up/down section length  
              (distance from move start point)
MOVL V=80
```
Spot and Arc Welding Using Motor Gun

10 Arc Welding Application
10.10 Slope Up/Down Function

Gradually Decreasing Current or Voltage

- The ARCCTS or ARCCTE instruction is valid for only one step.
- If the move section specified by the move instruction is shorter than the distance specified by the slope up/down section length (DIS=XXX), the change is performed equally in the entire section of the move instruction.
- If the ARCCTS or ARCCTE instruction specifies the distance as zero (DIS=0.00), the change is performed equally in the entire section of the move instruction.
- A pair of ARCCTS and ARCCTE instructions can be used on one move instruction. In this case, the ARCCTS instruction is executed first, then the ARCCTE instruction is executed in the remaining part of the move section. If the remaining part of the move section is 0mm, the value instantly changes to the value specified in the ARCCTE instruction.
10.10.1.4 Registering the ARCCTS Instruction

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

2. Select the ARCCTS instruction.
   - The ARCCTS instruction appears in the input buffer line.

3. Press [SELECT] and set the welding condition in the DETAIL EDIT window.
   - The DETAIL EDIT window appears.

---

**JOB CONTENT**

<table>
<thead>
<tr>
<th>JOB NAME: WORK A</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTROL GROUP: R1</td>
</tr>
<tr>
<td>STEP NO: 0003</td>
</tr>
</tbody>
</table>

**DATA EDIT DISPLAY UTILITY**

- **ARCCTS AC=200 AVP=100**
  - AC: 200
  - AVP: 100
  - UNUSED
  - UNUSED
  - UNUSED
  - UNUSED
  - UNUSED

---

**DETAIL EDIT**

- **ARCCTS**
  - WELDING CURR: 200
  - WELDING VOLT: 100
  - SPEED: UNUSED
  - ANALOG OUTPUT3: UNUSED
  - ANALOG OUTPUT4: UNUSED

---

**Main Menu**

- **Turn on servo power**
10 Arc Welding Application

10.10Slope Up/Down Function

(1) Move the cursor to the item to be set and press [SELECT].

(2) Type the welding conditions using [Numeric Key] and press [ENTER].

(3) To add the additional items, place the cursor on the item with the “UNUSED” condition and press [SELECT]. The selection dialog box appears.

   To delete the additional items, line up the cursor with the additional items and select “UNUSED”.

4. Press [ENTER].
   - The set contents are displayed in the input buffer line.
10 Arc Welding Application
10.10 Slope Up/Down Function

5. Press [ENTER].
   – The set contents are registered in the job.

```
JOB CONTENT
JOB NAME: WORK A
CONTROL GROUP: R1
STEP NO: 0003
TOOL: 00
0000  NOP
0001  MOVJ VJ=80.00
0002  MOVL V=800
0003  ARCON
0004  MOVL V=50
0005  AR CCS AC=134 AVP=100
0006  END
```

– Press [CANCEL] to return to the JOB CONTENT window when the set contents are not to be registered.

```
JOB CONTENT
JOB NAME: WORK A
CONTROL GROUP: R1
STEP NO: 0003
TOOL: 00
0000  NOP
0001  MOVJ VJ=80.00
0002  MOVL V=800
0003  ARCON
0004  MOVL V=50
0005  END
```

```
10 Arc Welding Application
10.10Slope Up/Down Function

10.10.2 ARCCTE
10.10.2.1 Function

The ARCCTE instruction is used with a move instruction to gradually change the welding current and voltage during welding.

A gradual change in the current or voltage is specified by an aimed value and the length of the slope up/down section. The length of the slope up/down section is measured from the move end point (DIS).

If no length is specified, the entire section of the move instruction is used.
10.10.2.2 Syntax

```
ARCCTE
  └── WELDn
      └── AC=
        └── Current output value (A)

A
  ├── AV=
  │   └── Voltage output value (V)
  │        └── Percentage against the proper voltage output value (%)
  ├── AVP=
  │   └── Voltage output value (V)
  │        └── Percentage against the proper voltage output value (%)

B
  ├── AN3=
  │   └── Voltage target value (V)

C
  ├── AN4=
  │   └── Voltage target value (V)

B
  ├── AN=
  │   └── Voltage target value (V)

C
  ├── DIS=
  │   └── Slope up/down section length (mm)

END
  └── AEF=
        └── File number
```
10.10.2.3 Explanation

- **WELDn [1]**
  Choose one of the following tags.
  These tags are enabled only when multiple applications are in use and two or more applications are set as arc welding application.
  When there is only one application, these tags are not displayed.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>WELDn</td>
<td>Selects the Power Source 1 to 8.</td>
<td></td>
</tr>
</tbody>
</table>

- **AC = Current output value [2]**
  This tag can be added or omitted.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC = Current output value</td>
<td>Specifies the target value of welding current.</td>
<td>Current value: 1 to 999 A The current output value can be specified by B/I/D/ B[ ]/I[ ]/D[ ]/LB/LI/LD/LB[ ]/LI[ ]/LD[ ] variable.</td>
</tr>
</tbody>
</table>

- **AV = Voltage output value /AVP [3] = Percentage against the proper voltage output value [4]**
  Be sure to choose either of the following.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV = Voltage output value</td>
<td>Specifies the target value of welding voltage.</td>
<td>Voltage value: 0.1 to 50.0 V The voltage output value can be specified by B/I/D/ B[ ]/I[ ]/D[ ]/LB/LI/LD/LB[ ]/LI[ ]/LD[ ] variable. (Unit: 0.1 V)</td>
</tr>
<tr>
<td>AVP = Percentage against the proper voltage output value</td>
<td>Specifies the target value of welding voltage by the percentage against the proper output value of welding voltage.</td>
<td>Percentage: 50 to 150% The voltage output value can be specified by B/I/D/ B[ ]/I[ ]/D[ ]/LB/LI/LD/LB[ ]/LI[ ]/LD[ ] variable.</td>
</tr>
</tbody>
</table>
10 Arc Welding Application
10.10Slope Up/Down Function

■ AN3 = Voltage target value [5]
This tag can be added or omitted.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
</table>
| AN3 = Voltage target value | Specifies the voltage target value for the analog output 3. | Target value: -14.00 to +14.00 V
The voltage target value can be specified by I/LI/I[/]L[] variable. (Unit: 0.01 V) |

■ AN4 = Voltage target value [6]
This tag can be added or omitted.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
</table>
| AN4 = Voltage target value | Specifies the voltage target value for the analog output 4. | Target value: -14.00 to +14.00 V
The voltage target value can be specified by I/LI[/]L[] variable. (Unit: 0.01 V) |

■ DIS = Slope up/down section length [7]
This tag can be added or omitted.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
</table>
| DIS = Slope up/down section length | Specifies the slope up/down section length where the current and voltage are gradually changed. The length is set as the distance from the move start point. If no length is specified, the entire section of the move instruction is used. | Length: 0.1 to 6553.5 mm
The slope up/down section length can be specified by B/I/D/LB/I[]LB/LD/LI/LD/LB/LI/LD/LB[]LD variable. (Unit: 0.1 mm) |
| AEF# (Arc welding end condition file number) | Specifies the arc welding end condition file number. Conditions to end welding are registered in the arc welding end condition file. | No. 1 to 1000
The number can be specified by B/I/D/LB/LI/LD variable. |

**<Example>**

The current and voltage are gradually changed as the manipulator moves toward the move end point specified by the move instruction. The aimed current and voltage values are 150A and 16.0V respectively. The slope up/down section length is 100mm from the move end point.

```
ARCCTE AC=150 AV=16.0 DIS=100.0
MOVL V=80
```
10.10 Slope Up/Down Function

**Gradually Decreasing Current or Voltage**

- Value immediately before execution of move instruction
- ARCCTE target value
- ARCCTE executed
- DIS=xxx
- Move section specified by move instruction
- Welding continues

**Gradually Increasing Current or Voltage**

- Value immediately before execution of move instruction
- ARCCTE target value
- ARCCTE executed
- DIS=xxx
- Move section specified by move instruction
- Welding continues

**NOTE**

- The ARCCTS or ARCCTE instruction is valid for only one step.
- If the move section specified by the move instruction is shorter than the distance specified by the slope up/down section length (DIS=XXX), the change is performed equally in the entire section of the move instruction.
- If the ARCCTS or ARCCTE instruction specifies the distance as zero (DIS=0.00), the change is performed equally in the entire section of the move instruction.
- A pair of ARCCTS and ARCCTE instructions can be used on one move instruction. In this case, the ARCCTS instruction is executed first, then the ARCCTE instruction is executed in the remaining part of the move section. If the remaining part of the move section is 0mm, the value instantly changes to the value specified in the ARCCTE instruction.
10.10Slope Up/Down Function

10.10.4 Registering the ARCCTE Instruction

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

2. Select the ARCCTE instruction.
   - The ARCCTE instruction appears in the input buffer line.

3. Press [SELECT] and set the welding condition in the DETAIL EDIT window.
   - The DETAIL EDIT window appears.
10.10 Slope Up/Down Function

(1) Move the cursor to the item to be set and press [SELECT].

(2) Type the welding conditions using [Numeric Key] and press [ENTER].

(3) To add the additional items, place the cursor on the item with the “UNUSED” condition and press [SELECT]. The selection dialog box appears.
   To delete the additional items, line up the cursor with the additional items and select “UNUSED”.

4. Press [ENTER].
   – The set contents are displayed in the input buffer line.
5. Press [ENTER].

- The set contents are registered in the job.

![Job Content 1](image1)

- Press [CANCEL] to return to the JOB CONTENT window when the set contents are not to be registered.

![Job Content 2](image2)
10.11 Enhanced Welding Condition File Function

The enhanced welding condition file function improves the method of setting the welding condition file. This function can be used as follows:

- Analog output to the Power Source increases by 2 channels. Therefore, Power Sources with polarity ratio control can be used.

When the type of the file changes, the welding start/end condition file is initialized.

To load a welding condition file that has been saved on an external memory device, files that are different type from those being used cannot be loaded. Load files of the same type.

10.11.1 Function Setting

To change the type of the welding condition file, set as described below.

Change the setting of the welding condition files in the management mode.

In the operation mode or editing mode, the setting status can only be referred to.

1. While pressing {Main Menu}, turn ON the power. Then change the security mode to the management mode.
2. Select {SYSTEM} from the main menu and select {SETUP}.

![Main Menu](image)
3. Select “OPTION FUNCTION”.
   – The OPTION FUNCTION window appears.

4. Select “ARC WELDING”, then select either “STANDARD” or “ENHANCED”.
   – The selection dialog box appears.
10.11 Enhanced Welding Condition File Function

The confirmation dialog box appears. Selecting “YES” changes the file type and initializes the related files (welding start/end condition files).

Selecting “NO” does not change the file type or initialize the related files.

5. Turn ON the power supply again.
10.12 Weaving Condition File

10.12.1 Weaving Basic Coordinate System

Weaving is performed based on the following coordinate system. This coordinate system is automatically generated when weaving is executed.

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

The approach point is a point indicated by a step immediately before the step where weaving starts.
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 or REFP 2.

For details, refer to section 10.12.4.2 "Editing the Condition Data" on page 10-162.
10.12.1.1 Cases that Require the Registration of Reference Points

The registration of the reference point REFP1 or REFP2 is not usually required. They are required only with a special workpiece condition, etc. The REFP1, that defines the wall direction, is a point on the wall surface or its expansion plane. The REFP2, which defines the horizontal direction, is a point at the right or left side of the wall.

**< Example 1 >** REFP1 is registered because the wall direction is not parallel to the Z-axis of the robot coordinates.

```
0003 MOVL V=120
0004 WVON WEV#(1)
0005 REFP1
0006 MOVL V=50
0007 WVOF
```

**< Example 2 >** REFP2 is registered because the approach point is at another side of the wall.

```
0009 MOVJ VJ=25.00
0010 MOVL V=120
0011 WVON WEV#(1)
0012 REFP2
0013 MOVL V=50
0014 WVOF
```

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 REFP2.
10.12.2  WVON
10.12.2.1 Function

This is the weaving start operation.
10.12.2 Syntax

The tag to be used varies according to the control group of job.

**Table 10-1: Job Type and Control Group**

<table>
<thead>
<tr>
<th>Type</th>
<th>Control Group of Job</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent</td>
<td>Job with one manipulator (Standard)</td>
<td></td>
</tr>
<tr>
<td>Coordinated</td>
<td>Job with two manipulators</td>
<td>Option</td>
</tr>
</tbody>
</table>

**Table 10-2: Tag Usage Limitation**

<table>
<thead>
<tr>
<th>Tag</th>
<th>Control Group of Job</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>RB1</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>RB2</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>RB3</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>RB4</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>RB5</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>RB6</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>RB7</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>RB8</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>WEV#(*)</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>AMP=</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>FREQ=</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>ANGL=</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>DIR=</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

O: Available  
X: Not available
**10.12.2.3 Explanation**

- **RBn [1]**
  Be sure to choose one of the following tags.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBn</td>
<td>Specifies the weaving motion of robot 1 to 8.</td>
<td></td>
</tr>
</tbody>
</table>

- **WEV# (Weaving condition file number)/AMP [2] = Weaving half-amplitude [3]**
  Be sure to choose one of the following tags.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEV# (Weaving condition file number)</td>
<td>Specifies the weaving condition file number. Conditions for the weaving motion are registered in the weaving condition file.</td>
<td>No. 1 to 16 The number can be specified by B/I/D/LB/LI/LD variable.</td>
</tr>
<tr>
<td>AMP = Weaving half-amplitude</td>
<td>Specifies the half-amplitude of weaving.</td>
<td>Half-amplitude: 0.1 to 99.9 mm The half-amplitude can be specified by B/B[L]LB/LB[I/L][I/D][I/LD][I/LD] variable. (Unit: 0.1 mm)</td>
</tr>
</tbody>
</table>
10.12 Weaving Condition File

- **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]” at page 10-146, be sure to add the following tag.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>FREQ =</td>
<td>Specifies the weaving frequency.</td>
<td>Frequency: 0.1 to 5.0 Hz</td>
</tr>
<tr>
<td>Weaving</td>
<td></td>
<td>The frequency can be specified by B/I/D/B[I]/D[I]/LD[I]/LD[I] variable.</td>
</tr>
<tr>
<td>frequency</td>
<td></td>
<td>(Unit: 0.1 Hz)</td>
</tr>
</tbody>
</table>

- **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]” at page 10-146, this tag is added or omitted after “FREQ = Weaving frequency [4]” at page 10-147.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANGL =</td>
<td>Specifies the weaving angle.</td>
<td>Angle: 0.0 to 180.0 degree</td>
</tr>
<tr>
<td>Weaving</td>
<td></td>
<td>The degree can be specified by B/I/D/B[I]/D[I]/LD[I]/LD[I] variable.</td>
</tr>
<tr>
<td>angle</td>
<td></td>
<td>(Unit: 0.1)</td>
</tr>
</tbody>
</table>

- **DIR = Starting direction of weaving [6]**
  This tag can be added or omitted.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIR =</td>
<td>Specifies the starting direction of weaving.</td>
<td>Direction: 0 to 1</td>
</tr>
<tr>
<td>Starting</td>
<td></td>
<td>0: Forward</td>
</tr>
<tr>
<td>direction</td>
<td></td>
<td>1: Backward</td>
</tr>
<tr>
<td>of weaving</td>
<td></td>
<td>The direction can be specified by B/I/D/B[I]/D[I]/LD[I]/LD[I] variable.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Setting conditions for weaving

- **Weaving half-amplitude**
  Specifies the amplitude size of weaving motion.

- **Weaving angle**
  Specifies the angle of weaving motion.

- **Starting direction of weaving**
  Specifies the starting direction of weaving motion.

---

**Weaving half-amplitude**

![Half-amplitude](image)

**Weaving angle**

![Weaving angle](image)

**Starting direction of weaving**

![Starting direction](image)
10.12.2.4 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 16).
   (1) Move the cursor to the file number and press [SELECT].
   (2) Input the file number using [Numeric Key] and press [ENTER].

6. Press [ENTER].
   – The set contents are displayed in the input buffer line.

   – 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.
10.12.3 WVOF Instruction
10.12.3.1 Function

This is the weaving end instruction.
10.12.3.2 Syntax

The control group of job limits the tag usage.

![Diagram](image)

**Table 10-3: Job Type and Control Group**

<table>
<thead>
<tr>
<th>Type</th>
<th>Control Group of Job</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent</td>
<td>Job with one manipulator (Standard)</td>
<td></td>
</tr>
<tr>
<td>Coordinated</td>
<td>Job with two manipulators</td>
<td>Option</td>
</tr>
</tbody>
</table>

**Table 10-4: Tag Usage Limitation**

<table>
<thead>
<tr>
<th>Tag</th>
<th>Control Group of Job</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RB1</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>RB2</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>RB3</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>RB4</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>RB5</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>RB6</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>RB7</td>
<td>X</td>
<td>O</td>
</tr>
<tr>
<td>RB8</td>
<td>X</td>
<td>O</td>
</tr>
</tbody>
</table>

O: Available
X: Not available
10.12.3.3 Explanation

**RB1/RB2/RB3/RB4/RB5/RB6/RB7/RB8 [1]**

Be sure to choose one of the following tags.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBn</td>
<td>Specifies the weaving motion of robot 1 to 8.</td>
<td></td>
</tr>
</tbody>
</table>

<Example>

```
NOP
MOVJ VJ=50.00
MOV L V=220      Step 1
MOV L V=200      Step 2
WVON WEV#(2)     Weaving start
ARCON AC=220 AVP=100 T=0.50 Step 4
MOV L V=138      Welding start
ARCOF AC=160 AVP=90 T=0.50 Step 5
WVOF             Weaving end
MOV L V=200      Weaving end
MOVJ VJ=50.00    Step 6
END              
```
### 10.12.3.4 Registering 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.
### 10.12.4 WEAVING CONDITION Window

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>COND NO.</td>
<td>MODE</td>
<td>SMOOTH</td>
<td>SPEED TYPE</td>
<td>FREQUENCY</td>
<td>&lt;PATTERN&gt;</td>
<td>POINT1</td>
<td>POINT2</td>
<td>POINT3</td>
<td>POINT4</td>
</tr>
<tr>
<td>1-255</td>
<td>SINGLE</td>
<td>ON</td>
<td>MOVING TIME</td>
<td>3.5 Hz</td>
<td>2.000 mm</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10.000 mm</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10.000 mm</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>45.00 deg.</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5.00 deg.</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.1 sec</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.1 sec</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.1 sec</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.1 sec</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0 sec</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0 sec</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0 sec</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0 sec</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0 sec</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0 sec</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0 sec</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0 sec</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>OFF</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
<td>WEAV STOP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0 sec</td>
<td>IN#000</td>
<td>DIRECT PAGE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**A. COND NO. (1 to 255)**

Displays a weaving condition file number between 1 and 255.

**B. MODE, C. SMOOTH**

There are three weaving modes: single, triangle, and L-type. Each mode can be specified with or without smoothing.

![Single Mode](image1.png)  
![Triangle Mode](image2.png)  
![L-type Mode](image3.png)  

**D. SPEED TYPE (FREQUENCY, MOTION TIME)**

Specifies the setting type of the weaving motion speed.  
Two types are available: setting by frequency and setting by the weaving time in each weaving section.
E. FREQUENCY
Specifies the weaving frequency if “SPEED TYPE” is set to “FREQUENCY”. Note that the maximum frequency is determined by the amplitude as illustrated in the graph below. Specify a frequency within the allowable range.

![Graph of Frequency vs. Amplitude](image)

Maximum Frequencies for Different Amplitudes

F. PATTERN
• AMPLITUDE
  Specifies the amplitude size at weaving when “MODE” is set to “SINGLE”.

![Amplitude Graph](image)

• VERTICAL, HORIZONTAL
  If “MODE” is set to “TRIANGLE” or “L-TYPE”, the data for the triangle must be set to define the weaving pattern.

![Pattern Diagram](image)

MODE: TRIANGLE, L-TYPE
• **ANGLE**
  Specifies the angle of weaving motion.

  ![Diagram of Angle](image)

  **MODE: SINGLE**

• **TRAVEL ANGLE**
  Specifies the travel angle of weaving motion.

  ![Diagram of Travel Angle](image)

  **MODE: TRIANGLE, L-TYPE**
**G. 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.

**H. MOTION TIME**

If “SPEED TYPE” is set to “MOTION TIME”, the weaving time specified here determines the moving speed in each of the weaving sections (explained in “TIMER (MODE)” above).

**I. STOP TIMER**

Specifies the timer to determine weaving stop or manipulator stop for each section (explained in “TIMER (MODE)” above).
J. HOVER WEAVING COND. (option)

- **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

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOP</td>
<td></td>
</tr>
<tr>
<td>MOVJ VJ=10.00</td>
<td></td>
</tr>
<tr>
<td>MOVJ VJ=25.00</td>
<td></td>
</tr>
<tr>
<td>REFP 3</td>
<td></td>
</tr>
<tr>
<td>ARCON ASF#(1)</td>
<td>Welding start point.</td>
</tr>
<tr>
<td>WVON WEV#(1)</td>
<td>Reference point for defining the direction of travel.</td>
</tr>
<tr>
<td>MOVL V=60</td>
<td></td>
</tr>
<tr>
<td>WVOF</td>
<td></td>
</tr>
<tr>
<td>ARCOF</td>
<td></td>
</tr>
<tr>
<td>MOVJ VJ=25.00</td>
<td></td>
</tr>
<tr>
<td>MOVJ VJ=25.00</td>
<td></td>
</tr>
<tr>
<td>END</td>
<td></td>
</tr>
</tbody>
</table>

*Teaching by interpolation instruction, not by joint interpolation.

The same point with the welding start point.

---

**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.

Wall Direction: Robot axis Z+ direction

Horizontal Direction: Direction from the wall to approach point

Direction of Travel: Direction from weaving start point to REFP3

---

**NOTE**

In hover weaving, the start and end points are the same. Therefore, the arc retry function and arc restart function are not available.
10.12.4.1 Displaying a Weaving File

1. Select {ARC WELDING} 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.
10.12.4.2 Editing the Condition Data

1. Select the item to be edited.

2. Input the value using [Numeric Key].
10.12.5 Prohibiting Weaving

If the weaving instruction is registered during the “CHECK” operation in the play mode or “TEST RUN” or [FWD] operation in the 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.
10.12.5.1 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.
10.12.5.2 Method to Prohibit Weaving During the “TEST RUN” or FWD Operation

1. Press {AREA} on the JOB CONTENT window in the TEACH mode.
2. Select {UTILITY}.

3. Select {SETUP SPECIAL RUN}.

   – The SPECIAL TEACH window appears.

4. Select “WEAV PROHIBIT IN TEST RUN/NEXT”.
10.12.5.3 Method to Prohibit Weaving by Means of a System Input Signal

The system input signal 40047 is used.

The system input signal can prohibit weaving at any time during a play operation, regardless of whether or not it is a check operation.
10.13 Changing Welding Conditions During Playback

10.13.1 ARC COND ADJUSTMENT Window

While the ARC COND ADJUSTMENT window is displayed in the playback mode, the welding current and voltage can be changed using the function keys.

The arc welding performance during playback changes with the welding current and voltage. The adjusted data of the current and voltage values can be reflected in the associated instructions or welding condition files.

A. CURR (A)/VOLT (%)
   The welding current value and welding voltage value are displayed.

B. DATA (Change data or No change data)
   Specifies whether or not to rewrite the data of condition file or additional item.
   The data are rewritten when the execution of the instruction which includes the changed condition data ends.

C. INST
   The last instruction that sets the welding current or voltage is displayed.
   The instruction includes the following:
   - ARCON
   - ARCSET

NOTE Changing the welding conditions during playback is enabled only when the command condition is analog type.
10.13.1.1 Displaying the ARC COND ADJUSTMENT Window

1. Press (AREA) on the PLAYBACK window.
2. Select (UTILITY).
3. Select (WELD COND. ADJUST.).

Changing the Welding Conditions

1. Line up the cursor with the current or voltage condition to be adjusted.
   - The current and voltage can be independently changed.
10.13 Changing Welding Conditions During Playback

2. Select {WELD COND. ADJUST.}.
   - Press [↑CUR/VOL ] to increase the welding current and the welding voltage.
   - Press [↓CUR/VOL] to decrease the welding current and the welding voltage.
   - Each time the key is pressed, the current value changes in increments of 1A, and the voltage value changes in increments of 1% or 0.1V.

### Editing “DATA”

1. Select “DATA”.

   - Each time [SELECT] is pressed, the setting alternates between “No change data” and “Change data”.

   ![](image1.png)

   ![](image2.png)

   **NOTE**

   Even if control jumps from one job to another job, rewriting of the arc condition for the former job is performed.
10.13.2 Notes on Modification of Welding Conditions
10.13.2.1 When Condition Data cannot be Modified

In the following cases, the window returns to the previous window of the ARC COND ADJUSTMENT window. Even if the function keys are pressed, current and voltage cannot be modified.

- When the mode is switched (to the teach mode, etc).
- When the emergency stop is activated.

The maximum current and voltage values are determined according to the voltage and current characteristics of the Power Source.

< Example >

When using a Power Source with the current characteristics as shown in the following table:

When the data points are interpolated on the graph, it can be observed that the maximum reference value (14.00V) is reached when the welding current specified by the ARCON instruction is 395 A. This becomes the maximum value.

---

**Fig. 10-14: Welding Current Output Characteristics**

<table>
<thead>
<tr>
<th>(V)</th>
<th>(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>10.50</td>
<td>315</td>
</tr>
<tr>
<td>8.30</td>
<td>265</td>
</tr>
<tr>
<td>6.40</td>
<td>220</td>
</tr>
<tr>
<td>4.40</td>
<td>165</td>
</tr>
<tr>
<td>1.80</td>
<td>110</td>
</tr>
</tbody>
</table>
10.13.2.2 ARCON Instruction

The ARCON instruction without an additional item is not subject to arc condition rewriting.

- **ARCON ASF#(1)**: Current and voltage values can be rewritten.
- **ARCON AC=220 AVP=100**: Current and voltage values can be rewritten.
- **ARCON**: Conditions cannot be rewritten.
10.13.2.3 ARCOF Instruction

The conditions of the ARCOF instruction cannot be rewritten.
10.13.2.4 ARCCTS and ARCCTE Instructions

The arc condition adjustment operation is invalid while the slope up/down instruction ARCCTS or ARCCTE is executed.

Even if “Change data” is set on the ARC COND ADJUSTMENT window, rewriting cannot be done after the ARCCTS or ARCCTE instruction.

No Rewriting:

\[
\begin{align*}
\text{ARCON} & \quad \text{ASF\#(1)} \\
\text{ARCCTE} & \quad AC=150 \quad AVP=100 \\
& \quad \text{MOVL} \\
& \quad \text{ARCSET AC=200} \\
& \quad \text{MOVL} \\
& \quad 
\end{align*}
\]

Refer to section 10.8.1 “Arc Auxiliary Condition File” on page 10-115 for details regarding the ARCCTS and ARCCTE instructions.
10.14 Displaying Welding Alarm History

The historical records of welding-related alarms can be viewed on the user alarm (system section) window.

To view the detailed information about alarm occurrence, use the alarm detailed window.

10.14.1 Alarm History Windows

There are 5 types of alarm history windows:

- MAJOR ALARM
- MINOR ALARM
- USER ALARM (SYSTEM)
- USER ALARM (USER)
- OFF-LINE ALARM

In each window, the alarm code, occurrence date, time, and detailed information are displayed.

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

2. Select {ALARM HISTORY}.
   - The alarm history window appears.
3. Using [PAGE] to change the window.
   - Each time [PAGE] is pressed, the window alternates between
     “MAJOR ALARM”, “MINOR ALARM”, “USER ALARM (SYSTEM)”,
     “USER ALARM (USER)”, and “OFF-LINE ALARM”.

```
<table>
<thead>
<tr>
<th>USER ALARM (USER)</th>
<th>CODE</th>
<th>DATE</th>
<th>CLOCK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>01</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>02</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>03</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>04</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>05</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>06</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>07</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>08</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>09</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

[Run on same page]
10.15 Arc Welding Management and Maintenance

10.15.1 ARC WELD DIAGNOSIS Window

An optimum arc welding requires timely contact-tip replacement and nozzle cleaning.

It is also recommended that the user check how often such functions as arc retry, arc restart, and automatic anti-stick have been used and adjust the operating environment and work conditions accordingly.

The usage of the above-mentioned functions can be controlled or confirmed on the ARC WELD DIAGNOSIS window.

For example, contact-tip replacement is initially set at 180 minutes. When the welding time reaches 180 minutes, an external output signal (system output) is output. The operator can then replace the tip or adjust as necessary.

A. WORK CONTINUE(CONT, STOP)

When the manipulator is restarted after it stops in the middle of a work section, the manipulator either performs welding over the remaining part of the section or moves without performing welding.

B. TIP REPLACE, NOZZLE CLEAN (0 to 999 minutes)

In the “SETTING” fields, specify the optimum timings for contact-tip replacement and nozzle cleaning. The initial values are 180 minutes for contact-tip replacement; 30 minutes for nozzle cleaning. The “ACCUM.” fields display an accumulated service duration.

C. RETRY, RESTART (ARC), ANTI-STICK

In each of the “SETTING” fields, specify a reference value for the number of times each function is used. As an initial setting, 10 is specified for each function. Each of the “ACCUM.” fields displays the accumulated count, showing how many times the function has been used.

ARC RETRY, ARC RESTART, and ANTI-STICK counts:

These counts are different from the maximum repetition counts specified in the arc auxiliary condition file. These counts show how many times these functions have actually been used.
10.15.2 Editing the ARC WELD DIAGNOSIS Window

1. Select {ARC WELDING} under the main menu.

2. Select {ARC WELD DIAG.}.

3. Line up the cursor with each set item and press [SELECT] to edit it.

4. Set the work continue specification.
   - Each time [SELECT] is pressed, the setting alternates between “CONT” and “STOP”.

```
ARC WELD DIAGNOSIS
NO.: 1/1
WORK CONTINUE: CONT <ACCUM.> 180 min  <SETTING> 30 min
TIP REPLACE: 12 min
NOZZLE CLEAN: 12 min
```
5. Set the control value.
   - Move the cursor to the setting value to be changed and press [SELECT].
6. Input the desired value using [Numeric Key] and press [ENTER].

The accumulated value can be cleared by either of the following:
- ARC WELD DIAGNOSIS window
- External input signal (system input signal)
10.16 Arc Monitor Function

The arc monitor function is used to monitor, analyze and control the welding conditions (welding current and welding voltage) of the specified welding section.

- Samples the welding conditions and show them on the display.
- Calculates the average and deviation and detects the error.
- Saves the results of measurement and analysis in the file.

```
000 NOP
001 MOVJ VJ=10.00
002 MOVJ VJ=80.00
003 MOVL V=800
004 ARCON ASF#(1)   Welding start
005 ARCMONON AMF#(1) Arc monitor start
006 MOVL V=50
007 ARCMONOF        Arc monitor end
008 ARCOF AEF#(1)    Welding end
009 MOVL V=800
010 MOVJ VJ=50.00
011 END
```
10.16.1 Hardware Specification

For the arc monitor function, the following circuit board is needed.

- Welding I/F circuit board: JANCD-YEW01
### 10.16.1.1 Signal Specifications of JANCD-YEW01 Circuit Board (Analog Input/Output)

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel Number</td>
<td>Output: 2ch (1ch: Voltage, 2ch: Current) Input: 2ch (1ch: Voltage, 2ch: Current)</td>
</tr>
<tr>
<td>Analog Voltage</td>
<td>Output: -14.00 to 14.00 Input: 0 to +5 V</td>
</tr>
<tr>
<td>Voltage/Current Converted Value</td>
<td>10.0 V/V, 100 A/V (can be modified by the parameter)</td>
</tr>
<tr>
<td>Monitor Minimum Unit</td>
<td>Voltage: 0.1 V, Current: 1 A</td>
</tr>
</tbody>
</table>
10.16.1.2 Connection

<table>
<thead>
<tr>
<th>Signal</th>
<th>Connection Channel</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welding Voltage Input</td>
<td>Analog Input (CH1)</td>
<td>CN322-11 (Voltage Input)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CN322-12 (GND)</td>
</tr>
<tr>
<td>Welding Current Input</td>
<td>Analog Input (CH2)</td>
<td>CN322-8 (Current Input)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CN322-28 (GND)</td>
</tr>
</tbody>
</table>

10.16.2 Arc Monitor (Sampling) Window

The following data is always displayed whether or not welding is being done.

- Welding Current Reference Value
- Welding Voltage Value
- Welding Current Measured Value
- Welding Voltage Measured Value

• Due to the variation, etc. in the electric resistance of welding power cable and the detectors, the values displayed in the sampling window may be different from the actual welding current value and welding voltage value.

• In order to monitor the exact value, measure the actual welding current value and welding voltage value with calibrated measuring instruments and adjust the magnification and offset. (See section 10.16.7 “Parameter” on page 10-202.)
10.16.3 ARCMONON
10.16.3.1 Function

This is the instruction to start sampling the welding condition data.
10.16.3.2 Syntax

```
ARCMONON

1. WELD1
2. WELD2
3. WELD3
4. WELD4
5. WELD5
6. WELD6
7. WELD7
8. WELD8

AMF#(Arc monitor file number)

END
```
10.16.3.3 Explanation

- **WELD[1]/WELD[2]/WELD[3]/WELD[4]/WELD[5]/WELD[6]/WELD[7]/WELD[8]**
  Choose one of the following tags.
  These tags are enabled only when multiple applications are in use and two or more applications are set as arc welding application.
  When there is only one application, these tags are not displayed.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>WELD1</td>
<td>Selects the Power Source 1.</td>
<td></td>
</tr>
<tr>
<td>WELD2</td>
<td>Selects the Power Source 2.</td>
<td></td>
</tr>
<tr>
<td>WELD3</td>
<td>Selects the Power Source 3.</td>
<td></td>
</tr>
<tr>
<td>WELD4</td>
<td>Selects the Power Source 4.</td>
<td></td>
</tr>
<tr>
<td>WELD5</td>
<td>Selects the Power Source 5.</td>
<td></td>
</tr>
<tr>
<td>WELD6</td>
<td>Selects the Power Source 6.</td>
<td></td>
</tr>
<tr>
<td>WELD7</td>
<td>Selects the Power Source 7.</td>
<td></td>
</tr>
<tr>
<td>WELD8</td>
<td>Selects the Power Source 8.</td>
<td></td>
</tr>
</tbody>
</table>

- **AMF# (Arc monitor file number) [9]**

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMF# (Arc monitor file number)</td>
<td>Specifies the arc monitor file number. The sampling results and statistical data are recorded in the arc monitor file.</td>
<td>No.: 1 to 100 The number can be specified by B/I/D/LB/LI/LD variable.</td>
</tr>
</tbody>
</table>

10.16.4 ARCMONOF
<table>
<thead>
<tr>
<th>Spot and Arc Welding Using Motor Gun</th>
<th>10 Arc Welding Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.16 Arc Monitor Function</td>
<td></td>
</tr>
</tbody>
</table>

10.16.4.1 Function

This is the instruction to end sampling the welding condition data.
10.16.4.2 Syntax

```
ARCMONOF
  1  WELD1
  2  WELD2
  3  WELD3
  4  WELD4
  5  WELD5
  6  WELD6
  7  WELD7
  8  WELD8
END
```
10.16.4.3 Explanation

- **WELD1/WELD2/WELD3/WELD4/WELD5/WELD6/WELD7/WELD8**

Choose one of the following tags.

These tags are enabled only when multiple applications are in use and two or more applications are set as arc welding application.

When there is only one application, these tags are not displayed.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>WELD1</td>
<td>Selects the Power Source 1.</td>
<td></td>
</tr>
<tr>
<td>WELD2</td>
<td>Selects the Power Source 2.</td>
<td></td>
</tr>
<tr>
<td>WELD3</td>
<td>Selects the Power Source 3.</td>
<td></td>
</tr>
<tr>
<td>WELD4</td>
<td>Selects the Power Source 4.</td>
<td></td>
</tr>
<tr>
<td>WELD5</td>
<td>Selects the Power Source 5.</td>
<td></td>
</tr>
<tr>
<td>WELD6</td>
<td>Selects the Power Source 6.</td>
<td></td>
</tr>
<tr>
<td>WELD7</td>
<td>Selects the Power Source 7.</td>
<td></td>
</tr>
<tr>
<td>WELD8</td>
<td>Selects the Power Source 8.</td>
<td></td>
</tr>
</tbody>
</table>
10.16.5  GETFILE
10.16.5.1 Function
Retrieves the data of arc monitor file into the variable (D variable).
10.16.5.2 Syntax

GETFILE<DATA 1> Condition file specification (element number)
10.16.5.3 Explanation

- **D Variable Number/LD Variable Number/D [Element Number]/LD [Element Number] [1]**
  Be sure to add the following tag.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>D Variable Number/LD Variable Number/D</td>
<td>Specifies the double-precision integer type variable in which the retrieved data is stored.</td>
<td>&lt;DATA 1&gt;</td>
</tr>
<tr>
<td>[Element Number]/LD [Element Number]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **SPR# (Application quantity correcting condition file number) [2]/UDC# (Application quantity correcting condition file number) [3]/WEV# (Weaving condition file number) [4]/AMF# (Arc monitor file number) [5]**
  Be sure to choose one of the following tags.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEV# (Weaving condition file number)</td>
<td>Specifies the weaving condition file number.</td>
<td>No.: 1 to 16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The number can be specified by B/I/D/LB/LI/ LD variable.</td>
</tr>
<tr>
<td>AMF# (Arc monitor file number)</td>
<td>Specifies the arc monitor file number.</td>
<td>No.: 1 to 50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The number can be specified by B/I/D/LB/LI/ LD variable.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Only the arc monitor function (optional) is available.</td>
</tr>
</tbody>
</table>

- **(Element number) [6]**
  Be sure to add the following tag.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Element number)</td>
<td>Specifies the element of the condition file from which the data are retrieved.</td>
<td>Element No.: 1 to 255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The number can be specified by B/LB variable.</td>
</tr>
</tbody>
</table>
10.16.5.4 Registering the GETFILE instruction

1. Move the cursor to the address area.
2. Press {INFORM LIST}.
3. Select {ARITH}.
4. Select the GETFILE instruction.
   – The instruction is displayed on the input buffer line with the same additional items as registered previously.
5. Press [ENTER].
   – The set contents are registered in the job.
10.16.5.5 File Data and Element Number

The relation between the element numbers of GETFILE instruction and the arc monitor file is shown as follows.

The numbers below denote the element numbers.

1. STATUS
2. CURRENT
3. VOLTAGE
4. CURRENT AVERAGE
5. CURRENT AVERAGE
6. CURRENT DEVIATION
7. VOLTAGE DEVIATION
8. NUMBER OF DATA (NORMAL)
9. NUMBER OF DATA (ERROR)
10.16.6 Arc Monitor File
10.16.6.1 Function

One hundred files for the arc monitor function are prepared.
The arc monitor file can be saved in an external memory device.
(Cannot be loaded.)
### 10.16.6.2 Arc Monitor File

A. **FILE NUMBER (1 to 100)**  
Shows the file number.

B. **CURRENT**  
Shows the average value of current data between the last-performed ARCMONON and ARCMONOF.

C. **VOLTAGE**  
Shows the average value of voltage data between the last-performed ARCMONON and ARCMONOF.

D. **STATUS**  
Shows the result (normal/error) of the last-performed arc monitor.

E. **CURRENT AVERAGE/DEVIATION**  
Shows the average/standard deviation of the retrieved average current value.

F. **VOLTAGE AVERAGE/DEVIATION**  
Shows the average/standard deviation of the retrieved average current value.

G. **NUMBER OF DATA**  
Shows the number of retrieved data (normal/error).
10.16.6.3 Displaying the File

- **Procedure 1**
  1. Place the cursor on the ARCMONON instruction.
  2. Press [DIRECT OPEN].
     - The arc monitor file window is displayed.
     - Press [PAGE] to call the next file number.
     - Press [SHIFT] + [PAGE] to call the previous file number.

- **Procedure 2**
  1. Select {ARC WELDING} under the main menu.
  2. Select {ARC MONITOR} under the sub menu.
     - The arc monitor file window is displayed.
     - Press [PAGE] to call the next file number.
     - Press [SHIFT] + [PAGE] to call the previous file number.
**File Initialization**

All the files become ‘0’ after file initialization.

1. Display the arc monitor file window.
2. Select {CLEAR DATA} from the pull-down menu {DATA}.
   - Select {CLEAR DATA} and the confirmation dialog box appears.
   - {CLEAR DATA} from the arc monitor file window initializes only the displayed file number.
   - To initialize all the files, perform the initialization in the maintenance mode.

![Image of file initialization process]

**NOTE**
The data of arc monitor file cannot be edited.
### Table 10-5: Parameter

<table>
<thead>
<tr>
<th>Parameter No.</th>
<th>Description</th>
<th>Initial Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2C453</td>
<td>Current Conversion Ratio (Power Source 1)</td>
<td>200</td>
</tr>
<tr>
<td>S2C454</td>
<td>Current Conversion Offset (Power Source 1)</td>
<td>0</td>
</tr>
<tr>
<td>Unit: 1 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2C455</td>
<td>Voltage Conversion Ratio (Power Source 1)</td>
<td>200</td>
</tr>
<tr>
<td>S2C456</td>
<td>Voltage Conversion Offset (Power Source 1)</td>
<td>0</td>
</tr>
<tr>
<td>Unit: 0.1 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2C457</td>
<td>Current Conversion Ratio (Power Source 2)</td>
<td>200</td>
</tr>
<tr>
<td>S2C458</td>
<td>Current Conversion Offset (Power Source 2)</td>
<td>0</td>
</tr>
<tr>
<td>Unit: 1 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2C459</td>
<td>Voltage Conversion Ratio (Power Source 2)</td>
<td>200</td>
</tr>
<tr>
<td>S2C460</td>
<td>Voltage Conversion Offset (Power Source 2)</td>
<td>0</td>
</tr>
<tr>
<td>Unit: 0.1 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2C461</td>
<td>Current Conversion Ratio (Power Source 3)</td>
<td>200</td>
</tr>
<tr>
<td>S2C462</td>
<td>Current Conversion Offset (Power Source 3)</td>
<td>0</td>
</tr>
<tr>
<td>Unit: 1 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2C463</td>
<td>Voltage Conversion Ratio (Power Source 3)</td>
<td>200</td>
</tr>
<tr>
<td>S2C464</td>
<td>Voltage Conversion Offset (Power Source 3)</td>
<td>0</td>
</tr>
<tr>
<td>Unit: 0.1 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2C465</td>
<td>Current Conversion Ratio (Power Source 4)</td>
<td>200</td>
</tr>
<tr>
<td>S2C466</td>
<td>Current Conversion Offset (Power Source 4)</td>
<td>0</td>
</tr>
<tr>
<td>Unit: 1 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2C467</td>
<td>Voltage Conversion Ratio (Power Source 4)</td>
<td>200</td>
</tr>
<tr>
<td>S2C468</td>
<td>Voltage Conversion Offset (Power Source 4)</td>
<td>0</td>
</tr>
<tr>
<td>Unit: 0.1 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2C469</td>
<td>Current Conversion Ratio (Power Source 5)</td>
<td>200</td>
</tr>
<tr>
<td>S2C470</td>
<td>Current Conversion Offset (Power Source 5)</td>
<td>0</td>
</tr>
<tr>
<td>Unit: 1 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2C471</td>
<td>Voltage Conversion Ratio (Power Source 5)</td>
<td>200</td>
</tr>
<tr>
<td>S2C472</td>
<td>Voltage Conversion Offset (Power Source 5)</td>
<td>0</td>
</tr>
<tr>
<td>Unit: 0.1 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2C473</td>
<td>Current Conversion Ratio (Power Source 6)</td>
<td>200</td>
</tr>
<tr>
<td>S2C474</td>
<td>Current Conversion Offset (Power Source 6)</td>
<td>0</td>
</tr>
<tr>
<td>Unit: 1 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2C475</td>
<td>Voltage Conversion Ratio (Power Source 6)</td>
<td>200</td>
</tr>
<tr>
<td>S2C476</td>
<td>Voltage Conversion Offset (Power Source 6)</td>
<td>0</td>
</tr>
<tr>
<td>Unit: 0.1 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2C477</td>
<td>Current Conversion Ratio (Power Source 7)</td>
<td>200</td>
</tr>
<tr>
<td>S2C478</td>
<td>Current Conversion Offset (Power Source 7)</td>
<td>0</td>
</tr>
<tr>
<td>Unit: 1 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2C479</td>
<td>Voltage Conversion Ratio (Power Source 7)</td>
<td>200</td>
</tr>
<tr>
<td>S2C480</td>
<td>Voltage Conversion Offset (Power Source 7)</td>
<td>0</td>
</tr>
<tr>
<td>Unit: 0.1 V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2C481</td>
<td>Current Conversion Ratio (Power Source 8)</td>
<td>200</td>
</tr>
<tr>
<td>S2C482</td>
<td>Current Conversion Offset (Power Source 8)</td>
<td>0</td>
</tr>
<tr>
<td>Unit: 1 A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2C483</td>
<td>Voltage Conversion Ratio (Power Source 8)</td>
<td>200</td>
</tr>
<tr>
<td>S2C484</td>
<td>Voltage Conversion Offset (Power Source 8)</td>
<td>0</td>
</tr>
<tr>
<td>Unit: 0.1 V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The conversion parameter (for conversion ratio and offset) to calculate the current value and voltage value using the analog input value is available.

The input voltage is converted to the current value and voltage value according to the following charts.
10.17 Welding Path Shift Function

The welding path shift function shifts the welding path to upper board direction/lower board direction.

- The shifting path is from the welding start (ARCON) step to the welding end (ARCOFF) step.
- The shifting direction is to upper board direction/lower board direction.
- The shifting amount is to be set to Arc Start Condition File and the setting range is between -5.0 to 5.0 mm.

Usually, the welding path is taught when it is deviated slightly from the joint of boards. This function can perform welding the deviating path by teaching the joint of boards and set deviating amount as the shifting amount to Arc Start Condition File.

This function has the following effects:

- The welding path is high accuracy, because it is easy to teach the joint of boards than the deviating path from it.
- The welding path can be managed with Arc Start Condition File, and it is easy to modify.

When correcting the workpieces position or welding many workpieces of the same shape, use the Parallel Shift Function. For the details of this function section 6.2 “Parallel Shift Function” on page 6-3.

The shifting direction of the welding path shift function

<table>
<thead>
<tr>
<th>Direction</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper board direction</td>
<td>Z-axis direction on the base coordinates</td>
</tr>
<tr>
<td>Lower board direction</td>
<td>The direction that turned 90 degrees Z-axis of base coordinates to Z-axis of tool coordinates</td>
</tr>
</tbody>
</table>

Fig. 10-15: Shifting Direction of the Welding Path Shift Function
10.17.1 Setting the Shifting Amount of Welding Path

The shifting amount of the welding path is set with the procedures described in “OTHER Tab Window” at section 10.5.4.2 “Tabs” on page 10-70.

10.17.2 Cancel the Welding Path Shift

Welding path shift is canceled with the following operations.

- Function keys.
- Menu on JOB CONTENT window.
- Editing the move instruction.

- **Function keys**

  By the simultaneous pressing of [INTERLOCK] + [8 ARCON], the welding path shift is canceled and it is enabled when pressing those keys again.

- **Menu on JOB CONTENT window**

  1. Select {JOB} under the main menu.
  2. Select {JOB CONTENT}.
     - Contents of the job appear.
  3. Select {UTILITY} under the pull down menu.
4. Select (ARC SHIFT CANCEL).
   - A dialog box confirming the cancel of welding path shift
     Select “YES” to cancel it and the window returns to the JOB CONTENT window.

Note: Select “NO” to keep it and the window returns to the JOB CONTENT window.

- Editing the move instruction
  The welding path shift is canceled, when the present position is selected in inserting or modifying the move instruction. For the details, please refer to section 10.17.3 “Teaching Move Instruction while Welding Path Shift” on page 10-207.
10.17.3 Teaching Move Instruction while Welding Path Shift

When inserting or modifying the move instruction while welding path shift, the teaching position can be selected from the following two positions.

The welding path shift is canceled when the present position is selected.

- Present position
  Select this mode in teaching the joint of boards.
  In playback, the manipulator moves to the position where the shifting amount is added to the teaching position.

- Position where the shifting amount is subtracted from present position.
  In playback, the manipulator moves to the present position.

1. Insert or modify the moving instruction.

   - A dialog box which confirms teaching the position where the shifting amount is subtracted from present position is displayed.
   Select "YES" to teach the position where the shifting amount is subtracted from present position. And the window returns to the JOB CONTENT window.
   Select "NO" to teach the present position. And the window returns to the JOB CONTENT window.
10.17.4 Restriction

Followings are the restrictions to this function

1. Register ARCON or ARCOF instruction to the job to which the welding section (move instruction) is registered. If ARCON instruction is executed in the CALL destination job, the welding path shift would not be operated in the welding section at the CALL source job.

2. In case modifying the shifting amount, set ARCSET with Arc Start Condition File that the next shifting amount is registered. Do not set ARCON instruction.

3. The welding path shift cannot be canceled in the welding section. Set “0” to the shifting amount in arc Arc Start Condition File.

4. This function cannot be used in the external reference point motion.

5. Do not register IMOV instruction in the welding section where the welding path shift is available. The manipulator moves to the position where the shifting amount is doubled.

6. The welding path shift will be limited if teaching is performed in the following conditions.

<table>
<thead>
<tr>
<th>Condition of welding section</th>
<th>Restriction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-axis of tool coordinates is parallel to Z-axis direction on the base coordinates.</td>
<td>ALARM 4987 WELD LINE CORD SHIFT MOV DISABLE</td>
</tr>
<tr>
<td>-Same point</td>
<td>1st step</td>
</tr>
<tr>
<td>-Short distance</td>
<td>2nd step</td>
</tr>
<tr>
<td>-Traveling direction is same as Z-axis direction on the base coordinates</td>
<td>Execute shifting operation to the upper/lower board direction of the previous step</td>
</tr>
</tbody>
</table>
### 10.18 Appendix 1

**10.18.1 Table of Work Instructions**

- `< >` indicates alpha-numerical data.
- If multiple items are shown in one additional item section, select one.

Table 10-6: Arc Welding Instructions (Sheet 1 of 3)

<table>
<thead>
<tr>
<th>Function</th>
<th>Outputs arc start conditions and an arc start instruction for the Power Source.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ARCON</strong></td>
<td></td>
</tr>
<tr>
<td>Additional Item</td>
<td>WELD1, WELD2, WELD3, WELD4 WELD5, WELD6, WELD7, WELD8</td>
</tr>
<tr>
<td>AC = <code>&lt;welding current&gt;</code></td>
<td>AC: 1 to 999A</td>
</tr>
<tr>
<td>ASF#<code>(&lt;arc start condition file number&gt;)</code></td>
<td>ASF#: 1 to 1000</td>
</tr>
<tr>
<td>AV = <code>&lt;welding voltage&gt;</code></td>
<td>AV: independent 0.1 to 50.0V</td>
</tr>
<tr>
<td>AVP = <code>&lt;percentage against proper welding voltage&gt;</code></td>
<td>AVP: synergic 50 to 150%</td>
</tr>
<tr>
<td>T = <code>&lt;manipulator stopping time&gt;</code></td>
<td>0.01 to 655.35 sec</td>
</tr>
<tr>
<td>V = <code>&lt;manipulator moving speed&gt;</code></td>
<td>0.1 to 1500.0 mm/sec 1 to 9000 cm/min</td>
</tr>
<tr>
<td>RETRY</td>
<td>Specifies use of arc retry function.</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>ARCON AC=200 AVP=100 T=0.30 RETRY ARCON AC=200 AV=22.0 T=0.30 ARCON ASF#(1) ARCON</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Outputs arc end conditions and an arc end instruction for the Power Source.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ARCOF</strong></td>
<td></td>
</tr>
<tr>
<td>Additional Item</td>
<td>WELD1, WELD2, WELD3, WELD4 WELD5, WELD6, WELD7, WELD8</td>
</tr>
<tr>
<td>AC = <code>&lt;welding current&gt;</code></td>
<td>AC: 1 to 999A</td>
</tr>
<tr>
<td>AEF#<code>(&lt;arc end condition file number&gt;)</code></td>
<td>AEF#: 1 to 396</td>
</tr>
<tr>
<td>AV = <code>&lt;welding voltage&gt;</code></td>
<td>AV: independent 0.1 to 50.0V</td>
</tr>
<tr>
<td>AVP = <code>&lt;percentage against proper welding voltage&gt;</code></td>
<td>AVP: synergic 50 to 150%</td>
</tr>
<tr>
<td>T = <code>&lt;manipulator stopping time&gt;</code></td>
<td>0.01 to 655.35 sec</td>
</tr>
<tr>
<td>ANTSTK</td>
<td>Specifies use of wire anti-stick function.</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>ARCOF AC=180 AVP=80 T=0.30 ANTSTK ARCOF AC=180 AV20.0 T=0.30 ARCOF AEF#(1) ARCOF</td>
</tr>
</tbody>
</table>
### Table 10-6: Arc Welding Instructions (Sheet 2 of 3)

<table>
<thead>
<tr>
<th>Function</th>
<th>Changes the welding conditions individually.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ARCSET</strong></td>
<td>Displays only when using multiple manipulators.</td>
</tr>
<tr>
<td><strong>Additional Item</strong></td>
<td><strong>WELD1, WELD2, WELD3, WELD4</strong>&lt;br&gt;<strong>WELD5, WELD6, WELD7, WELD8</strong>&lt;br&gt;<strong>AC = &lt;welding current &gt;</strong>&lt;br&gt;<strong>ASF#(&lt;arc start condition file number&gt;)</strong>&lt;br&gt;<strong>AV = &lt;welding voltage &gt;</strong>&lt;br&gt;<strong>AVP = &lt;percentage against proper welding voltage &gt;</strong>&lt;br&gt;<strong>V = &lt;manipulator moving speed&gt;</strong>&lt;br&gt;<strong>AN3 = &lt;analog output 3&gt;</strong>&lt;br&gt;<strong>AN4 = &lt;analog output 4&gt;</strong>&lt;br&gt;<strong>Example</strong>&lt;br&gt;<strong>ARCSET AC=200</strong>&lt;br&gt;<strong>ARCSET AV=20.0</strong>&lt;br&gt;<strong>ARCSET AVP=95</strong>&lt;br&gt;<strong>ARCSET V=80</strong>&lt;br&gt;<strong>ARCSET AN3=10.00</strong></td>
</tr>
<tr>
<td><strong>ARCCTS</strong></td>
<td>Changes the welding conditions gradually during execution of welding.</td>
</tr>
<tr>
<td><strong>Additional Item</strong></td>
<td><strong>WELD1, WELD2, WELD3, WELD4</strong>&lt;br&gt;<strong>WELD5, WELD6, WELD7, WELD8</strong>&lt;br&gt;<strong>AC = &lt;welding current &gt;</strong>&lt;br&gt;<strong>AV = &lt;welding voltage &gt;</strong>&lt;br&gt;<strong>AVP = &lt;percentage against proper welding voltage &gt;</strong>&lt;br&gt;<strong>AN 3 = &lt;analog output 3&gt;</strong>&lt;br&gt;<strong>AN4 = &lt;analog output 4&gt;</strong>&lt;br&gt;<strong>DIS = &lt;distance from the movement’s start position&gt;</strong>&lt;br&gt;<strong>Example</strong>&lt;br&gt;<strong>ARCCTS AC=200 AVP=100 DIS=100.0</strong>&lt;br&gt;<strong>ARCCTS AC=200 AV=22.0 AN3=10.0 DIS=5.0</strong></td>
</tr>
<tr>
<td><strong>ARCCTE</strong></td>
<td>Changes the welding conditions gradually during execution of welding.</td>
</tr>
<tr>
<td><strong>Additional Item</strong></td>
<td><strong>WELD1, WELD2, WELD3, WELD4</strong>&lt;br&gt;<strong>WELD5, WELD6, WELD7, WELD8</strong>&lt;br&gt;<strong>AC = &lt;welding current &gt;</strong>&lt;br&gt;<strong>AV = &lt;welding voltage &gt;</strong>&lt;br&gt;<strong>AVP = &lt;percentage against proper welding voltage &gt;</strong>&lt;br&gt;<strong>AN 3 = &lt;analog output 3&gt;</strong>&lt;br&gt;<strong>AN4 = &lt;analog output 4&gt;</strong>&lt;br&gt;<strong>DIS = &lt;distance from the movement’s end position&gt;</strong>&lt;br&gt;<strong>Example</strong>&lt;br&gt;<strong>ARCCTE AC=200 AVP=100 DIS=100.0</strong>&lt;br&gt;<strong>ARCCTE AC=200 AV=22.0 AN3=10.0 DIS=5.0</strong></td>
</tr>
<tr>
<td><strong>AWELD</strong></td>
<td>Specifies welding current by current reference value.</td>
</tr>
<tr>
<td><strong>Additional Item</strong></td>
<td><strong>WELD1, WELD2, WELD3, WELD4</strong>&lt;br&gt;<strong>WELD5, WELD6, WELD7, WELD8</strong>&lt;br&gt;<strong>&lt;Current reference value&gt;</strong>&lt;br&gt;<strong>Example</strong>&lt;br&gt;<strong>AWELD 12</strong></td>
</tr>
<tr>
<td>Function</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>-------------</td>
</tr>
<tr>
<td>VWELD</td>
<td>Specifies welding voltage by voltage value.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>WVON</td>
<td>Starts weaving.</td>
</tr>
<tr>
<td>WVOF</td>
<td>Ends weaving.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Example usage for VWELD**

```
VWELD 2.5
```

**Example usage for WVON**

```
WVON WEV#(1)
```

**Example usage for WVOF**

```
WVOF
```
## 10.19 Appendix 2

### 10.19.1 Power Source Condition File Initial Value

The initial value data for 24 Power Sources are prepared as follows:

*Table 10-7: Welder Condition Data File*

<table>
<thead>
<tr>
<th>Power Source No.</th>
<th>Power Source Name</th>
<th>Power Supply</th>
<th>Shielding Gas</th>
<th>Wire Diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MOTOWELD-E series 350A class</td>
<td>Synergic</td>
<td>MAG (or CO2)</td>
<td>1.2 (or any)</td>
</tr>
<tr>
<td>2</td>
<td>MOTOWELD-E series 350A class</td>
<td>Independent</td>
<td>MAG (or CO2)</td>
<td>1.2 (or any)</td>
</tr>
<tr>
<td>3</td>
<td>MOTOWELD-E series 500A class</td>
<td>Synergic</td>
<td>MAG (or CO2)</td>
<td>1.2 (or any)</td>
</tr>
<tr>
<td>4</td>
<td>MOTOWELD-E series 500A class</td>
<td>Independent</td>
<td>MAG (or CO2)</td>
<td>1.2 (or any)</td>
</tr>
<tr>
<td>5</td>
<td>MOTOWELD-S350-AJ2/3 (without STC)</td>
<td>Synergic</td>
<td>CO2</td>
<td>1.2</td>
</tr>
<tr>
<td>6</td>
<td>MOTOWELD-S350-AJ2/3 (without STC)</td>
<td>Synergic</td>
<td>MAG</td>
<td>1.2</td>
</tr>
<tr>
<td>7</td>
<td>MOTOWELD-S350-AJ2/3 (without STC)</td>
<td>Independent</td>
<td>CO2</td>
<td>1.2</td>
</tr>
<tr>
<td>8</td>
<td>MOTOWELD-S350-AJ2/3 (without STC)</td>
<td>Independent</td>
<td>MAG</td>
<td>1.2</td>
</tr>
<tr>
<td>9</td>
<td>MOTOWELD-S350-AJ2/3 (without STC)</td>
<td>Synergic</td>
<td>CO2</td>
<td>0.9 (or 1.0)</td>
</tr>
<tr>
<td>10</td>
<td>MOTOWELD-S350-AJ2/3 (without STC)</td>
<td>Synergic</td>
<td>MAG</td>
<td>0.9 (or 1.0)</td>
</tr>
<tr>
<td>11</td>
<td>MOTOWELD-S350-AJ2/3 (without STC)</td>
<td>Independent</td>
<td>CO2</td>
<td>0.9 (or 1.0)</td>
</tr>
<tr>
<td>12</td>
<td>MOTOWELD-S350-AJ2/3 (without STC)</td>
<td>Independent</td>
<td>MAG</td>
<td>0.9 (or 1.0)</td>
</tr>
<tr>
<td>13</td>
<td>MOTOWELD-S350-AJ2/3 (with STC)</td>
<td>Synergic</td>
<td>CO2</td>
<td>1.2</td>
</tr>
<tr>
<td>14</td>
<td>MOTOWELD-S350-AJ2/3 (with STC)</td>
<td>Synergic</td>
<td>MAG</td>
<td>1.2</td>
</tr>
<tr>
<td>15</td>
<td>MOTOWELD-S350-AJ2/3 (with STC)</td>
<td>Independent</td>
<td>CO2</td>
<td>1.2</td>
</tr>
<tr>
<td>16</td>
<td>MOTOWELD-S350-AJ2/3 (with STC)</td>
<td>Independent</td>
<td>MAG</td>
<td>1.2</td>
</tr>
<tr>
<td>17</td>
<td>MOTOWELD-S350-AJ2/3 (with STC)</td>
<td>Synergic</td>
<td>CO2</td>
<td>0.9 (or 1.0)</td>
</tr>
<tr>
<td>18</td>
<td>MOTOWELD-S350-AJ2/3 (with STC)</td>
<td>Synergic</td>
<td>MAG</td>
<td>0.9 (or 1.0)</td>
</tr>
<tr>
<td>19</td>
<td>MOTOWELD-S350-AJ2/3 (with STC)</td>
<td>Independent</td>
<td>CO2</td>
<td>0.9 (or 1.0)</td>
</tr>
<tr>
<td>20</td>
<td>MOTOWELD-S350-AJ2/3 (with STC)</td>
<td>Independent</td>
<td>MAG</td>
<td>0.9 (or 1.0)</td>
</tr>
<tr>
<td>21</td>
<td>SHINKO ES 350</td>
<td>Synergic</td>
<td>CO2</td>
<td>1.2</td>
</tr>
<tr>
<td>22</td>
<td>DAIHEN CPV 350</td>
<td>Synergic</td>
<td>CO2</td>
<td>1.2</td>
</tr>
<tr>
<td>23</td>
<td>MOTOWELD-S500 (without STC)</td>
<td>Synergic</td>
<td>CO2</td>
<td>1.2</td>
</tr>
<tr>
<td>24</td>
<td>MOTOWELD-S500 (without STC)</td>
<td>Synergic</td>
<td>MAG</td>
<td>1.2</td>
</tr>
</tbody>
</table>
### Appendix 2: Spot and Arc Welding Using Motor Gun

#### 10.19.2 Contents of 24 Welder Condition Files

The following tables give the original contents of the provided Power Source condition files, that are associated with the Power Source numbers 1 through 24:

<table>
<thead>
<tr>
<th>POWER SOURCE NO.: 1</th>
<th>POWER SOURCE NO.: 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>POWER SOURCE NAME:</td>
<td>POWER SOURCE NAME:</td>
</tr>
<tr>
<td>MOTOWELD-E series 350A class</td>
<td>MOTOWELD-E series 350A class</td>
</tr>
<tr>
<td>COMMENT: COMBINATION GAS AND WIRE</td>
<td>COMMENT: COMBINATION GAS AND WIRE</td>
</tr>
<tr>
<td>POWER SUPPLY: A (synergic)</td>
<td>POWER SUPPLY: independent</td>
</tr>
<tr>
<td>SHIELDING GAS: MAG</td>
<td>SHIELDING GAS: MAG</td>
</tr>
<tr>
<td>WIRE DIA.: 1.2 mm</td>
<td>WIRE DIA.: 1.2 mm</td>
</tr>
<tr>
<td>WIRE STICKOUT: 15 mm</td>
<td>WIRE STICKOUT: 15 mm</td>
</tr>
<tr>
<td>WIRE ANTI-STICKING: 0.1 sec</td>
<td>WIRE ANTI-STICKING: 0.1 sec</td>
</tr>
<tr>
<td>ARC FAILURE STOP: 0.6 sec</td>
<td>ARC FAILURE STOP: 0.6 sec</td>
</tr>
</tbody>
</table>

#### Current and Voltage

<table>
<thead>
<tr>
<th>CURRENT</th>
<th>VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>RANGE: positive</td>
<td>RANGE: positive</td>
</tr>
<tr>
<td>ADJ.: 1.00</td>
<td>ADJ.: 1.00</td>
</tr>
<tr>
<td>REF. (V)</td>
<td>MEA. (A)</td>
</tr>
<tr>
<td>0.00</td>
<td>30</td>
</tr>
<tr>
<td>1.35</td>
<td>62</td>
</tr>
<tr>
<td>2.70</td>
<td>94</td>
</tr>
<tr>
<td>10.80</td>
<td>286</td>
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<tr>
<td>12.15</td>
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<tr>
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<td>0</td>
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<tr>
<td>0.00</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CURRENT</th>
<th>VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>RANGE: positive</td>
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</tr>
<tr>
<td>ADJ.: 1.00</td>
<td>ADJ.: 1.00</td>
</tr>
<tr>
<td>REF. (V)</td>
<td>MEA. (A)</td>
</tr>
<tr>
<td>0.00</td>
<td>30</td>
</tr>
<tr>
<td>1.35</td>
<td>62</td>
</tr>
<tr>
<td>2.70</td>
<td>94</td>
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<td>318</td>
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<td>0.00</td>
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<tr>
<td>0.00</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CURRENT</th>
<th>VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>RANGE: positive</td>
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</tr>
<tr>
<td>ADJ.: 1.00</td>
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</tr>
<tr>
<td>REF. (V)</td>
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<tr>
<td>0.00</td>
<td>30</td>
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<tr>
<td>1.35</td>
<td>77</td>
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<tr>
<td>2.70</td>
<td>124</td>
</tr>
<tr>
<td>10.80</td>
<td>406</td>
</tr>
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<td>12.15</td>
<td>453</td>
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<td>13.50</td>
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<tr>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>CURRENT</th>
<th>VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>RANGE: positive</td>
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<tr>
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<td>REF. (V)</td>
<td>MEA. (A)</td>
</tr>
<tr>
<td>0.00</td>
<td>30</td>
</tr>
<tr>
<td>1.35</td>
<td>77</td>
</tr>
<tr>
<td>2.70</td>
<td>124</td>
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<td>10.80</td>
<td>406</td>
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<td>0</td>
</tr>
<tr>
<td>0.00</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CURRENT</th>
<th>VOLTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>RANGE: positive</td>
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</tr>
<tr>
<td>ADJ.: 1.00</td>
<td>ADJ.: 1.00</td>
</tr>
<tr>
<td>REF. (V)</td>
<td>MEA. (A)</td>
</tr>
<tr>
<td>0.00</td>
<td>30</td>
</tr>
<tr>
<td>1.35</td>
<td>77</td>
</tr>
<tr>
<td>2.70</td>
<td>124</td>
</tr>
<tr>
<td>10.80</td>
<td>406</td>
</tr>
<tr>
<td>12.15</td>
<td>453</td>
</tr>
<tr>
<td>13.50</td>
<td>500</td>
</tr>
<tr>
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<td>0</td>
</tr>
<tr>
<td>0.00</td>
<td>0</td>
</tr>
</tbody>
</table>
### Spot and Arc Welding

#### Using Motor Gun

**POWER SOURCE NO.: 5**
- **POWER SOURCE NAME:** MOTOWELD-S350-AJ2/3
- **COMMENT:** STC NO-CONTROL
- **POWER SUPPLY:** A (synergic)
- **SHIELDING GAS:** CO2
- **WIRE DIA.:** 1.2 mm
- **WIRE STICKOUT:** 15 mm
- **WIRE ANTI-STICKING:** 0.3 sec
- **ARC FAILURE STOP:** 0.6 sec

**CURRENT** | **VOLTAGE**
---|---
| RANGE: positive | RANGE: positive |
| ADJ.: 1.00 | ADJ.: 1.00 |
| REF. (V) | MEA. (A) | REF. (V) | MEA. (%) |
| 1.00 | 100 | 3.00 | 85 |
| 2.00 | 145 | 5.00 | 95 |
| 3.50 | 185 | 7.00 | 100 |
| 5.00 | 230 | 9.00 | 105 |
| 7.00 | 270 | 10.00 | 110 |
| 10.00 | 350 | 0.00 | 0 |
| 0.00 | 0 | 0.00 | 0 |
| 0.00 | 0 | 0.00 | 0 |

**POWER SOURCE NO.: 6**
- **POWER SOURCE NAME:** MOTOWELD-S350-AJ2/3
- **COMMENT:** STC NO-CONTROL
- **POWER SUPPLY:** A (synergic)
- **SHIELDING GAS:** MAG
- **WIRE DIA.:** 1.2 mm
- **WIRE STICKOUT:** 15 mm
- **WIRE ANTI-STICKING:** 0.3 sec
- **ARC FAILURE STOP:** 0.6 sec

**CURRENT** | **VOLTAGE**
---|---
| RANGE: positive | RANGE: positive |
| ADJ.: 1.00 | ADJ.: 1.00 |
| REF. (V) | MEA. (A) | REF. (V) | MEA. (%) |
| 1.00 | 95 | 3.00 | 85 |
| 2.00 | 150 | 5.00 | 95 |
| 3.50 | 200 | 7.00 | 100 |
| 5.00 | 240 | 9.00 | 105 |
| 7.00 | 280 | 10.00 | 110 |
| 10.00 | 350 | 0.00 | 0 |
| 0.00 | 0 | 0.00 | 0 |
| 0.00 | 0 | 0.00 | 0 |

**POWER SOURCE NO.: 7**
- **POWER SOURCE NAME:** MOTOWELD-S350-AJ2/3
- **COMMENT:** STC NO-CONTROL
- **POWER SUPPLY:** independent
- **SHIELDING GAS:** CO2
- **WIRE DIA.:** 1.2 mm
- **WIRE STICKOUT:** 15 mm
- **WIRE ANTI-STICKING:** 0.3 sec
- **ARC FAILURE STOP:** 0.6 sec

**CURRENT** | **VOLTAGE**
---|---
| RANGE: positive | RANGE: positive |
| ADJ.: 1.00 | ADJ.: 1.00 |
| REF. (V) | MEA. (A) | REF. (V) | MEA. (V) |
| 1.00 | 100 | 2.00 | 18.0 |
| 2.00 | 145 | 3.10 | 20.0 |
| 3.50 | 185 | 4.90 | 23.0 |
| 5.00 | 230 | 7.00 | 26.5 |
| 7.00 | 270 | 10.70 | 33.0 |
| 10.00 | 350 | 0.00 | 0.0 |
| 0.00 | 0 | 0.00 | 0.0 |
| 0.00 | 0 | 0.00 | 0.0 |

**POWER SOURCE NO.: 8**
- **POWER SOURCE NAME:** MOTOWELD-S350-AJ2/3
- **COMMENT:** STC NO-CONTROL
- **POWER SUPPLY:** independent
- **SHIELDING GAS:** MAG
- **WIRE DIA.:** 1.2 mm
- **WIRE STICKOUT:** 15 mm
- **WIRE ANTI-STICKING:** 0.3 sec
- **ARC FAILURE STOP:** 0.6 sec

**CURRENT** | **VOLTAGE**
---|---
| RANGE: positive | RANGE: positive |
| ADJ.: 1.00 | ADJ.: 1.00 |
| REF. (V) | MEA. (A) | REF. (V) | MEA. (V) |
| 1.00 | 95 | 1.20 | 16.0 |
| 2.00 | 150 | 2.00 | 18.0 |
| 3.50 | 200 | 3.60 | 21.0 |
| 5.00 | 240 | 6.30 | 26.0 |
| 7.00 | 280 | 10.00 | 32.5 |
| 10.00 | 350 | 0.00 | 0.0 |
| 0.00 | 0 | 0.00 | 0.0 |
| 0.00 | 0 | 0.00 | 0.0 |
**10 Arc Welding Application**

**10.19 Appendix 2**

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**Spot and Arc Welding Using Motor Gun**

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<tr>
<th>Power Source No.</th>
<th>Power Source Name</th>
<th>Comment</th>
<th>Power Supply</th>
<th>Shielding Gas</th>
<th>Wire Dia.</th>
<th>Wire Stickout</th>
<th>Wire Anti-Sticking</th>
<th>Arc Failure Stop</th>
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<td>A (synergic)</td>
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<td>0.6 sec</td>
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<td>STC NO-CONTROL</td>
<td>A (synergic)</td>
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**Power Source No. 11**

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### Spot and Arc Welding Using Motor Gun

#### 10 Arc Welding Application

10.19 Appendix 2

**POWER SOURCE NO.: 13**  
**POWER SOURCE NAME:** MOTOWELD-S350-AJ2/3  
**COMMENT:** STC CONTROL  
**POWER SUPPLY:** A (synergic)  
**SHEILDING GAS:** CO₂  
**WIRE DIA.:** 1.2 mm  
**WIRE STICKOUT:** 15 mm  
**WIRE ANTI-STICKING:** 0.3 sec  
**ARC FAILURE STOP:** 0.6 sec

**CURRENT**  
RANGE: positive  
ADJ.: 1.00

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<th>MEA. (%)</th>
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**POWER SOURCE NO.: 14**  
**POWER SOURCE NAME:** MOTOWELD-S350-AJ2/3  
**COMMENT:** STC CONTROL  
**POWER SUPPLY:** A (synergic)  
**SHEILDING GAS:** MAG  
**WIRE DIA.:** 1.2 mm  
**WIRE STICKOUT:** 15 mm  
**WIRE ANTI-STICKING:** 0.3 sec  
**ARC FAILURE STOP:** 0.6 sec

**CURRENT**  
RANGE: positive  
ADJ.: 1.00

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<th>REF. (V)</th>
<th>MEA. (%)</th>
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**POWER SOURCE NO.: 15**  
**POWER SOURCE NAME:** MOTOWELD-S350-AJ2/3  
**COMMENT:** STC CONTROL  
**POWER SUPPLY:** independent  
**SHEILDING GAS:** CO₂  
**WIRE DIA.:** 1.2 mm  
**WIRE STICKOUT:** 15 mm  
**WIRE ANTI-STICKING:** 0.3 sec  
**ARC FAILURE STOP:** 0.6 sec

**CURRENT**  
RANGE: positive  
ADJ.: 1.00

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<th>MEA. (%)</th>
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**POWER SOURCE NO.: 16**  
**POWER SOURCE NAME:** MOTOWELD-S350-AJ2/3  
**COMMENT:** STC CONTROL  
**POWER SUPPLY:** independent  
**SHEILDING GAS:** MAG  
**WIRE DIA.:** 1.2 mm  
**WIRE STICKOUT:** 15 mm  
**WIRE ANTI-STICKING:** 0.3 sec  
**ARC FAILURE STOP:** 0.6 sec

**CURRENT**  
RANGE: positive  
ADJ.: 1.00

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### Spot and Arc Welding
### Using Motor Gun

#### 10 Arc Welding Application

### 10.19 Appendix 2

**POWER SOURCE NO.: 17**  
**POWER SOURCE NAME:** MOTOWELD-S350-AJ2/3  
**COMMENT:** STC CONTROL  
**POWER SUPPLY:** A (synergic)  
**SHIELDING GAS:** CO2  
**WIRE DIA.:** 0.9 mm  
**WIRE STICKOUT:** 10 mm  
**WIRE ANTI-STICKING:** 0.3 sec  
**ARC FAILURE STOP:** 0.6 sec

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**POWER SOURCE NAME:** MOTOWELD-S350-AJ2/3  
**COMMENT:** STC CONTROL  
**POWER SUPPLY:** A (synergic)  
**SHIELDING GAS:** MAG  
**WIRE DIA.:** 0.9 mm  
**WIRE STICKOUT:** 10 mm  
**WIRE ANTI-STICKING:** 0.3 sec  
**ARC FAILURE STOP:** 0.6 sec

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**POWER SOURCE NO.: 19**  
**POWER SOURCE NAME:** MOTOWELD-S350-AJ2/3  
**COMMENT:** STC CONTROL  
**POWER SUPPLY:** independent  
**SHIELDING GAS:** CO2  
**WIRE DIA.:** 0.9 mm  
**WIRE STICKOUT:** 10 mm  
**WIRE ANTI-STICKING:** 0.3 sec  
**ARC FAILURE STOP:** 0.6 sec

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**POWER SOURCE NAME:** MOTOWELD-S350-AJ2/3  
**COMMENT:** STC CONTROL  
**POWER SUPPLY:** independent  
**SHIELDING GAS:** MAG  
**WIRE DIA.:** 0.9 mm  
**WIRE STICKOUT:** 10 mm  
**WIRE ANTI-STICKING:** 0.3 sec  
**ARC FAILURE STOP:** 0.6 sec

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**Spot and Arc Welding Using Motor Gun**

10 Arc Welding Application

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<td>SHIELDING GAS: CO2</td>
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<tr>
<td>WIRE DIA.: 1.2 mm</td>
<td>WIRE DIA.: 1.2 mm</td>
</tr>
<tr>
<td>WIRE STICKOUT: 15 mm</td>
<td>WIRE STICKOUT: 15 mm</td>
</tr>
<tr>
<td>WIRE ANTI-STICKING: 0.3 sec</td>
<td>WIRE ANTI-STICKING: 0.3 sec</td>
</tr>
<tr>
<td>ARC FAILURE STOP: 0.6 sec</td>
<td>ARC FAILURE STOP: 0.6 sec</td>
</tr>
</tbody>
</table>

**CURRENT** | **VOLTAGE**
---|---
RANGE: positive | RANGE: positive
ADJ.: 1.00 | ADJ.: 1.00

<table>
<thead>
<tr>
<th>REF. (V)</th>
<th>MEA. (A)</th>
<th>REF. (V)</th>
<th>MEA. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.80</td>
<td>100</td>
<td>4.80</td>
<td>88</td>
</tr>
<tr>
<td>3.90</td>
<td>150</td>
<td>7.00</td>
<td>100</td>
</tr>
<tr>
<td>5.80</td>
<td>200</td>
<td>9.20</td>
<td>112</td>
</tr>
<tr>
<td>7.60</td>
<td>250</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>8.90</td>
<td>300</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>0.00</td>
<td>0</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>0.00</td>
<td>0</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>0.00</td>
<td>0</td>
<td>0.00</td>
<td>0</td>
</tr>
</tbody>
</table>

| CURRENT | VOLTAGE |
---|---
| RANGE: positive | RANGE: positive |
| ADJ.: 1.00 | ADJ.: 1.00 |

<table>
<thead>
<tr>
<th>REF. (V)</th>
<th>MEA. (A)</th>
<th>REF. (V)</th>
<th>MEA. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.40</td>
<td>100</td>
<td>3.00</td>
<td>85</td>
</tr>
<tr>
<td>3.10</td>
<td>160</td>
<td>7.00</td>
<td>100</td>
</tr>
<tr>
<td>4.00</td>
<td>200</td>
<td>11.00</td>
<td>115</td>
</tr>
<tr>
<td>5.90</td>
<td>280</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>8.00</td>
<td>340</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>9.00</td>
<td>380</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>10.00</td>
<td>400</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>11.00</td>
<td>440</td>
<td>0.00</td>
<td>0</td>
</tr>
</tbody>
</table>

**POWER SOURCE NO.: 22**

<table>
<thead>
<tr>
<th>POWER SOURCE NAME: DAIHEN CPV350</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMENT:</td>
</tr>
<tr>
<td>POWER SUPPLY: A (synergic)</td>
</tr>
<tr>
<td>SHIELDING GAS: CO2</td>
</tr>
<tr>
<td>WIRE DIA.: 1.2 mm</td>
</tr>
<tr>
<td>WIRE STICKOUT: 15 mm</td>
</tr>
<tr>
<td>WIRE ANTI-STICKING: 0.3 sec</td>
</tr>
<tr>
<td>ARC FAILURE STOP: 0.6 sec</td>
</tr>
</tbody>
</table>

**CURRENT** | **VOLTAGE**
---|---
RANGE: positive | RANGE: positive
ADJ.: 1.00 | ADJ.: 1.00

<table>
<thead>
<tr>
<th>REF. (V)</th>
<th>MEA. (A)</th>
<th>REF. (V)</th>
<th>MEA. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.40</td>
<td>50</td>
<td>5.00</td>
<td>75</td>
</tr>
<tr>
<td>2.80</td>
<td>100</td>
<td>7.50</td>
<td>100</td>
</tr>
<tr>
<td>4.30</td>
<td>150</td>
<td>10.00</td>
<td>125</td>
</tr>
<tr>
<td>5.70</td>
<td>200</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>7.80</td>
<td>250</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>9.50</td>
<td>300</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>12.60</td>
<td>350</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>0.00</td>
<td>0</td>
<td>0.00</td>
<td>0</td>
</tr>
</tbody>
</table>

| CURRENT | VOLTAGE |
---|---
| RANGE: positive | RANGE: positive |
| ADJ.: 1.00 | ADJ.: 1.00 |

<table>
<thead>
<tr>
<th>REF. (V)</th>
<th>MEA. (A)</th>
<th>REF. (V)</th>
<th>MEA. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.40</td>
<td>100</td>
<td>3.00</td>
<td>85</td>
</tr>
<tr>
<td>2.80</td>
<td>160</td>
<td>7.00</td>
<td>100</td>
</tr>
<tr>
<td>3.70</td>
<td>200</td>
<td>11.00</td>
<td>115</td>
</tr>
<tr>
<td>5.00</td>
<td>250</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>6.40</td>
<td>300</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>7.50</td>
<td>360</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>8.00</td>
<td>390</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>9.00</td>
<td>430</td>
<td>0.00</td>
<td>0</td>
</tr>
</tbody>
</table>

**POWER SOURCE NO.: 23**

<table>
<thead>
<tr>
<th>POWER SOURCE NAME: MOTOWELD-S500</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMENT: STC NO-CONTROL</td>
</tr>
<tr>
<td>POWER SUPPLY: A (synergic)</td>
</tr>
<tr>
<td>SHIELDING GAS: CO2</td>
</tr>
<tr>
<td>WIRE DIA.: 1.2 mm</td>
</tr>
<tr>
<td>WIRE STICKOUT: 15 mm</td>
</tr>
<tr>
<td>WIRE ANTI-STICKING: 0.3 sec</td>
</tr>
<tr>
<td>ARC FAILURE STOP: 1.5 sec</td>
</tr>
</tbody>
</table>

**CURRENT** | **VOLTAGE**
---|---
RANGE: positive | RANGE: positive
ADJ.: 1.00 | ADJ.: 1.00

<table>
<thead>
<tr>
<th>REF. (V)</th>
<th>MEA. (A)</th>
<th>REF. (V)</th>
<th>MEA. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.40</td>
<td>100</td>
<td>3.00</td>
<td>85</td>
</tr>
<tr>
<td>3.10</td>
<td>160</td>
<td>7.00</td>
<td>100</td>
</tr>
<tr>
<td>4.00</td>
<td>200</td>
<td>11.00</td>
<td>115</td>
</tr>
<tr>
<td>5.90</td>
<td>280</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>8.00</td>
<td>340</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>9.00</td>
<td>380</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>10.00</td>
<td>400</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>11.00</td>
<td>440</td>
<td>0.00</td>
<td>0</td>
</tr>
</tbody>
</table>

**POWER SOURCE NO.: 24**

<table>
<thead>
<tr>
<th>POWER SOURCE NAME: MOTOWELD-S500</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMENT: STC NO-CONTROL</td>
</tr>
<tr>
<td>POWER SUPPLY: A (synergic)</td>
</tr>
<tr>
<td>SHIELDING GAS: MAG</td>
</tr>
<tr>
<td>WIRE DIA.: 1.2 mm</td>
</tr>
<tr>
<td>WIRE STICKOUT: 15 mm</td>
</tr>
<tr>
<td>WIRE ANTI-STICKING: 0.3 sec</td>
</tr>
<tr>
<td>ARC FAILURE STOP: 1.5 sec</td>
</tr>
</tbody>
</table>

**CURRENT** | **VOLTAGE**
---|---
RANGE: positive | RANGE: positive
ADJ.: 1.00 | ADJ.: 1.00

<table>
<thead>
<tr>
<th>REF. (V)</th>
<th>MEA. (A)</th>
<th>REF. (V)</th>
<th>MEA. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.70</td>
<td>100</td>
<td>3.00</td>
<td>85</td>
</tr>
<tr>
<td>2.80</td>
<td>160</td>
<td>7.00</td>
<td>100</td>
</tr>
<tr>
<td>3.70</td>
<td>200</td>
<td>11.00</td>
<td>115</td>
</tr>
<tr>
<td>5.00</td>
<td>250</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>6.40</td>
<td>300</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>7.50</td>
<td>360</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>8.00</td>
<td>390</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>9.00</td>
<td>430</td>
<td>0.00</td>
<td>0</td>
</tr>
</tbody>
</table>
# 11 Table of Basic Instructions

- <> indicates numerical or alphabetical data.
- If multiple items are shown in one section, select one of the items.

## 11.1 Move Instructions

<table>
<thead>
<tr>
<th>MOVJ</th>
<th>Function</th>
<th>Moves to a taught point with joint interpolation type.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional Item</td>
<td></td>
<td>Position data, Base axis position data, Station axis position data</td>
</tr>
<tr>
<td>VJ=&lt;play speed&gt;</td>
<td>VJ: 0.01 to 100.00%</td>
<td></td>
</tr>
<tr>
<td>PL=&lt;position level&gt;</td>
<td>PL: 0 to 8</td>
<td></td>
</tr>
<tr>
<td>NWAIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNTIL statement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACC=(acceleration adjustment ratio)</td>
<td>ACC: 20 to 100%</td>
<td></td>
</tr>
<tr>
<td>DEC=(deceleration adjustment ratio)</td>
<td>DEC: 20 to 100%</td>
<td></td>
</tr>
<tr>
<td>Example</td>
<td>MOVJ VJ=50.00 PL=2 NWAIT UNTIL IN#(16)=ON</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MOVL</th>
<th>Function</th>
<th>Moves to a taught point with linear interpolation type.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional Item</td>
<td></td>
<td>Position data, Base axis position data, Station axis position data</td>
</tr>
<tr>
<td>V=&lt;play speed&gt;, VR=&lt;play speed of the posture&gt;, VE=&lt;play speed of external axis&gt;</td>
<td>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%</td>
<td></td>
</tr>
<tr>
<td>PL=&lt;position level&gt;</td>
<td>PL: 0 to 8</td>
<td></td>
</tr>
<tr>
<td>CR=(corner radius)</td>
<td>CR: 0.1 to 6553.5mm</td>
<td></td>
</tr>
<tr>
<td>NWAIT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNTIL statement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACC=(acceleration adjustment ratio)</td>
<td>ACC: 20 to 100%</td>
<td></td>
</tr>
<tr>
<td>DEC=(deceleration adjustment ratio)</td>
<td>DEC: 20 to 100%</td>
<td></td>
</tr>
<tr>
<td>COORD= (Arc attitude control specification)</td>
<td>COORD: 0 to 1</td>
<td></td>
</tr>
<tr>
<td>FPT: Arc end-point setting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Example</td>
<td>MOVL V=138 PL=0 NWAIT UNTIL IN#(16)=ON</td>
<td></td>
</tr>
</tbody>
</table>
### Spot and Arc Welding
#### Using Motor Gun

### 11 Table of Basic Instructions

#### 11.1 Move Instructions

<table>
<thead>
<tr>
<th>Function</th>
<th>Moves to a taught point with circular interpolation type.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MOVC</strong></td>
<td>Position data, Base axis position data, Station axis position data</td>
</tr>
<tr>
<td><strong>Additional Item</strong></td>
<td>V=(&lt;\text{play speed}&gt;) , VR=(&lt;\text{play speed of the posture}&gt; , VE=(&lt;\text{play speed of external axis}&gt;</td>
</tr>
<tr>
<td></td>
<td>PL=(&lt;\text{position level}&gt;</td>
</tr>
<tr>
<td></td>
<td>NWAIT</td>
</tr>
<tr>
<td></td>
<td>ACC=((\text{acceleration adjustment ratio})</td>
</tr>
<tr>
<td></td>
<td>DEC=((\text{deceleration adjustment ratio})</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>MOVC V=138 PL=0 NWAIT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Moves to a taught point with spline interpolation type.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MOVS</strong></td>
<td>Position data, Base axis position data, Station axis position data</td>
</tr>
<tr>
<td><strong>Additional Item</strong></td>
<td>V=(&lt;\text{play speed}&gt;) , VR=(&lt;\text{play speed of the posture}&gt; , VE=(&lt;\text{play speed of external axis}&gt;</td>
</tr>
<tr>
<td></td>
<td>PL=(&lt;\text{position level}&gt;</td>
</tr>
<tr>
<td></td>
<td>NWAIT</td>
</tr>
<tr>
<td></td>
<td>ACC=((\text{acceleration adjustment ratio})</td>
</tr>
<tr>
<td></td>
<td>DEC=((\text{deceleration adjustment ratio})</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>MOVS V=120 PL=0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Moves the specified increment from the current position with linear interpolation type.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IMOV</strong></td>
<td>P&lt;\text{variable number}&gt;, BP&lt;\text{variable number}&gt;, EX&lt;\text{variable number}&gt;</td>
</tr>
<tr>
<td><strong>Additional Item</strong></td>
<td>V=(&lt;\text{play speed}&gt;) , VR=(&lt;\text{play speed of the posture}&gt; , VE=(&lt;\text{play speed of external axis}&gt;</td>
</tr>
<tr>
<td></td>
<td>PL=(&lt;\text{position level}&gt;</td>
</tr>
<tr>
<td></td>
<td>NWAIT</td>
</tr>
<tr>
<td></td>
<td>BF,RF,TF,UF# (&lt;\text{user coordinate number}&gt;</td>
</tr>
<tr>
<td></td>
<td>UNTIL statement</td>
</tr>
<tr>
<td></td>
<td>ACC=((\text{acceleration adjustment ratio})</td>
</tr>
<tr>
<td></td>
<td>DEC=((\text{deceleration adjustment ratio})</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>IMOV P000 V=138 PL=1 RF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Defines a reference point (e.g. wall point for weaving).</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>REFP</strong></td>
<td>&lt;\text{reference point number}&gt;</td>
</tr>
<tr>
<td><strong>Additional Item</strong></td>
<td>Position data, Base axis position data, Station axis position data</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>REFP 1 P000</td>
</tr>
</tbody>
</table>
11 Table of Basic Instructions

11.1 Move Instructions

**Spot and Arc Welding Using Motor Gun**

### SPEED

<table>
<thead>
<tr>
<th>Function</th>
<th>Sets play speed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional Item</td>
<td></td>
</tr>
<tr>
<td>( V_J = \langle \text{joint speed} \rangle, )</td>
<td>( V_J = \text{MOVJ} )</td>
</tr>
<tr>
<td>( V = \langle \text{TCP speed} \rangle, )</td>
<td>( V, V_R, V_E = \text{MOVJ} )</td>
</tr>
<tr>
<td>( V_R = \langle \text{play speed of the posture} \rangle, )</td>
<td>Same as</td>
</tr>
<tr>
<td>( V_E = \langle \text{play speed of external axis} \rangle )</td>
<td>MOVL.</td>
</tr>
</tbody>
</table>

#### Example

**CAUTION**

When start IMOV instruction again after IMOV instruction was aborted due to execute the following operations, the manipulator moves the added values, which is set anew from the aborted position, in the linear interpolation. The values become greater than the set added value. Please do not execute the IMOV instruction when changing move distance by the abort causes a problem.

- External servo OFF signal 2 (#40066)
- Turning OFF the servo power due to alarm occurring
- Enable signal
- Mode switch
- Enable switch
## 11.2 I/O Instructions

<table>
<thead>
<tr>
<th>Function</th>
<th>DOUT</th>
<th>Turn the external output signals ON and OFF.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional Item</td>
<td>OT# (&lt;output number&gt;), OGH# (&lt;output group number&gt;), OG# (&lt;output group number&gt;)</td>
<td></td>
</tr>
<tr>
<td>Number of addressed output signals:</td>
<td>OT#(xx)=1; OGH#(xx)=4 (per group); OG#(xx)=8 (per group)</td>
<td></td>
</tr>
<tr>
<td>OGH#(xx) is not subject to parity check; only the binary specification is allowed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Example</td>
<td>DOUT OT#(12) ON</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>PULSE</th>
<th>Outputs a pulse signal as an external output signal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional Item</td>
<td>OT# (&lt;output number&gt;), OGH# (&lt;output group number&gt;), OG# (&lt;output group number&gt;)</td>
<td></td>
</tr>
<tr>
<td>T=&lt;time (seconds)&gt;</td>
<td>0.01 to 655.35 s</td>
<td></td>
</tr>
<tr>
<td>0.30 s unless otherwise specified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Example</td>
<td>PULSE OT# (10) T=0.60</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>DIN</th>
<th>Sets input signals in variables.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional Item</td>
<td>B&lt;variable number&gt;</td>
<td></td>
</tr>
<tr>
<td>IN# (&lt;input number&gt;), IGH# (&lt;input group number&gt;), IG# (&lt;input group number&gt;), OT# (&lt;output number&gt;), OGH# (&lt;output group number&gt;), OG# (&lt;output group number&gt;), SIN# (&lt;system input number&gt;), SOUT# (&lt;system output number&gt;)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of addressed input signals:</td>
<td>IN#(xx)=1; IGH#(xx)=4 (per group); IG#(xx)=8 (per group)</td>
<td></td>
</tr>
<tr>
<td>Number of addressed output signals:</td>
<td>OT#(xx)=1; OGH#(xx)=4 (per group); OG#(xx)=8 (per group)</td>
<td></td>
</tr>
<tr>
<td>IGH#(xx) and OGH#(xx) are not subject to parity check; only the binary specification is allowed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Example</td>
<td>DIN B016 IN#(16)</td>
<td></td>
</tr>
<tr>
<td>DIN B002 IG#(2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function</td>
<td>WAIT</td>
<td>Function</td>
</tr>
<tr>
<td>----------</td>
<td>------</td>
<td>----------</td>
</tr>
<tr>
<td>Function</td>
<td>Waits until the external input signal status matches the specified status.</td>
<td>Additional Item</td>
</tr>
</tbody>
</table>
### 11.3 Control Instructions

<table>
<thead>
<tr>
<th><strong>JUMP</strong></th>
<th><strong>Function</strong></th>
<th>Jumps to the specified label or job.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Additional Item</strong></td>
<td>*&lt;label character string&gt;, JOB:&lt;job name&gt;, LABEL:&lt;label elements&gt;, IG# (&lt;input group number&gt;), B&lt;variable number&gt;, I&lt;variable number&gt;, D&lt;variable number&gt;, S&lt;variable number&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UF# (user coordinates number)</td>
<td></td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>JUMP JOB:TEST1 IF IN#(14)=OFF</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>CALL</strong></th>
<th><strong>Function</strong></th>
<th>Calls the specified job.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Additional Item</strong></td>
<td>JOB:&lt;job name&gt;, IG# (&lt;input group number&gt;), B&lt;variable number&gt;, I&lt;variable number&gt;, D&lt;variable number&gt;, S&lt;variable number&gt;, ARGF&lt;argument 1&gt;, ARGF&lt;argument 2&gt;, ARGF&lt;argument 3&gt;, ARGF&lt;argument 4&gt;, ARGF&lt;argument 5&gt;, ARGF&lt;argument 6&gt;, ARGF&lt;argument 7&gt;, ARGF&lt;argument 8&gt;, UF# (user coordinates number)</td>
<td></td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>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.)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>RET</strong></th>
<th><strong>Function</strong></th>
<th>Returns to the call source job.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Additional Item</strong></td>
<td>B&lt;variable number&gt;, I&lt;variable number&gt;, D&lt;variable number&gt;, R&lt;variable number&gt;, S&lt;variable number&gt;, Constant, String</td>
<td></td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>RET IF IN#(12)=OFF</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>END</strong></th>
<th><strong>Function</strong></th>
<th>Declares the end of a job.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Additional Item</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>END</td>
<td></td>
</tr>
<tr>
<td>Function</td>
<td>Description</td>
<td>Example</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------------------------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>NOP</td>
<td>No operation.</td>
<td>NOP</td>
</tr>
<tr>
<td><strong>TIMER</strong></td>
<td>Stops for the specified time.</td>
<td>TIMER T=12.50</td>
</tr>
<tr>
<td><strong>IF</strong></td>
<td>Evaluates the specified condition and makes a judgment accordingly. Described after an instruction that specifies a certain action. Format: <code>&lt;Item1&gt;=,&lt;&gt;,&lt;=,&gt;=,&lt;,&gt;&lt;Item2&gt;</code></td>
<td>JUMP *12 IF IN#(12)=OFF</td>
</tr>
<tr>
<td><strong>UNTIL</strong></td>
<td>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.</td>
<td>MOVVL V=300 UNTIL IN#(10)=ON</td>
</tr>
<tr>
<td><strong>PAUSE</strong></td>
<td>Instructs a pause.</td>
<td>PAUSE IF IN#(12)=OFF</td>
</tr>
<tr>
<td><strong>(comment)</strong></td>
<td>Displays a comment.</td>
<td><code>*</code> Draws 100mm size square.</td>
</tr>
<tr>
<td><strong>CWAIT</strong></td>
<td>Waits for execution of the instruction on the next line. Used with the NWAIT tag which is an additional item of a move instruction.</td>
<td>MOVL V=100 NWAIT DOUT OT#(1) ON CWAIT DOUT OT#(1) OFF MOVL V=100</td>
</tr>
<tr>
<td><strong>ADVINIT</strong></td>
<td>Initializes the prereading instruction processing. Used to adjust the access timing for variable data.</td>
<td>ADVINIT</td>
</tr>
<tr>
<td><strong>ADVSTOP</strong></td>
<td>Stops the prereading instruction processing. Used to adjust the access timing for variable data.</td>
<td>ADVINIT</td>
</tr>
</tbody>
</table>
### 11.4 Shift Instructions

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SFTON</strong></td>
<td>Starts a shift operation.</td>
</tr>
<tr>
<td><strong>SFTOF</strong></td>
<td>Stops a shift operation.</td>
</tr>
<tr>
<td><strong>MSHIFT</strong></td>
<td>Obtains the shift value in the specified coordinate system from Data 2 and 3, and stores the obtained element values in Data 1.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SFTON</strong></td>
<td>SFTON P001 UF#(1)</td>
</tr>
<tr>
<td><strong>SFTOF</strong></td>
<td>SFTOF</td>
</tr>
<tr>
<td><strong>MSHIFT</strong></td>
<td>MSHIFT PX000 RF PX001 PX002</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Function</th>
<th>Format</th>
<th>Additional Item</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SFTON</strong></td>
<td>BF: base coordinates</td>
<td></td>
</tr>
<tr>
<td><strong>SFTOF</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MSHIFT</strong></td>
<td>BF: base coordinates</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coordinate</th>
<th>Additional Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>BF, RF, TF, UF# (&lt;user coordinate number&gt;)</td>
<td></td>
</tr>
<tr>
<td>MTIF</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data1</th>
<th>PX&lt;variable number&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data2</td>
<td>PX&lt;variable number&gt;</td>
</tr>
<tr>
<td>Data3</td>
<td>PX&lt;variable number&gt;</td>
</tr>
</tbody>
</table>

**Example**

- SFTON P001 UF#(1)
- SFTOF
- MSHIFT PX000 RF PX001 PX002
### 11.5 Operating Instructions

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
<th>Additional Item</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADD</strong></td>
<td>Adds Data1 and Data2, and stores the result in Data1.</td>
<td>Data1: B&lt;variable number&gt;, I&lt;variable number&gt;, D&lt;variable number&gt;, R&lt;variable number&gt;, P&lt;variable number&gt;, BP&lt;variable number&gt;, EX&lt;variable number&gt;</td>
<td>ADD I012 I013</td>
</tr>
<tr>
<td></td>
<td>Format: ADD&lt;Data1&gt;&lt;Data2&gt;</td>
<td>Data2: Constant, B&lt;variable number&gt;, I&lt;variable number&gt;, D&lt;variable number&gt;, R&lt;variable number&gt;, P&lt;variable number&gt;, BP&lt;variable number&gt;, EX&lt;variable number&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>SUB</strong></td>
<td>Subtracts Data2 from Data1, and stores the result in Data1.</td>
<td>Data1: B&lt;variable number&gt;, I&lt;variable number&gt;, D&lt;variable number&gt;, R&lt;variable number&gt;, P&lt;variable number&gt;, BP&lt;variable number&gt;, EX&lt;variable number&gt;</td>
<td>SUB I012 I013</td>
</tr>
<tr>
<td></td>
<td>Format: SUB&lt;Data1&gt;&lt;Data2&gt;</td>
<td>Data2: Constant, B&lt;variable number&gt;, I&lt;variable number&gt;, D&lt;variable number&gt;, R&lt;variable number&gt;, P&lt;variable number&gt;, BP&lt;variable number&gt;, EX&lt;variable number&gt;</td>
<td></td>
</tr>
</tbody>
</table>
## MUL

**Function**
Multiplying 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

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Data1</th>
<th>B&lt;variable number&gt;, I&lt;variable number&gt;, D&lt;variable number&gt;, R&lt;variable number&gt;, P&lt;variable number&gt;, BP&lt;variable number&gt;, EX&lt;variable number&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data2</td>
<td></td>
<td>Constant, B&lt;variable number&gt;, I&lt;variable number&gt;, D&lt;variable number&gt;, R&lt;variable number&gt;</td>
</tr>
</tbody>
</table>

**Example**
- MUL I012 I013
- MUL P000 (3) 2 (Multiply the Z-axis data by 2.)

## DIV

**Function**
Dividing 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

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Data1</th>
<th>B&lt;variable number&gt;, I&lt;variable number&gt;, D&lt;variable number&gt;, R&lt;variable number&gt;, P&lt;variable number&gt;, BP&lt;variable number&gt;, EX&lt;variable number&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data2</td>
<td></td>
<td>Constant, B&lt;variable number&gt;, I&lt;variable number&gt;, D&lt;variable number&gt;, R&lt;variable number&gt;</td>
</tr>
</tbody>
</table>

**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.

**Example**
- INC I043
### DEC Function
Decrement the value of the specified variable by 1.

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>B&lt;variable number&gt;, I&lt;variable number&gt;, D&lt;variable number&gt;</td>
<td>DEC I043</td>
</tr>
</tbody>
</table>

### AND Function
Obtains the AND of Data1 and Data2, and stores the result in Data1.

**Format:** \( \text{AND} \langle \text{Data1} \rangle \langle \text{Data2} \rangle \\
\)

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data1 B&lt;variable number&gt;</td>
<td>AND B012 B020</td>
</tr>
<tr>
<td>Data2 B&lt;variable number&gt;, Constant</td>
<td></td>
</tr>
</tbody>
</table>

### OR Function
Obtains the OR of Data1 and Data2, and stores the result in Data1.

**Format:** \( \text{OR} \langle \text{Data1} \rangle \langle \text{Data2} \rangle \\
\)

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data1 B&lt;variable number&gt;</td>
<td>OR B012 B020</td>
</tr>
<tr>
<td>Data2 B&lt;variable number&gt;, Constant</td>
<td></td>
</tr>
</tbody>
</table>

### NOT Function
Obtains the NOT of Data2, and stores the result in Data1.

**Format:** \( \text{NOT} \langle \text{Data1} \rangle \langle \text{Data2} \rangle \\
\)

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data1 B&lt;variable number&gt;</td>
<td>NOT B012 B020</td>
</tr>
<tr>
<td>Data2 B&lt;variable number&gt;, Constant</td>
<td></td>
</tr>
</tbody>
</table>

### XOR Function
Obtains the exclusive OR of Data1 and Data2, and stores the result in Data1.

**Format:** \( \text{XOR} \langle \text{Data1} \rangle \langle \text{Data2} \rangle \\
\)

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data1 B&lt;variable number&gt;</td>
<td>XOR B012 B020</td>
</tr>
<tr>
<td>Data2 B&lt;variable number&gt;, Constant</td>
<td></td>
</tr>
</tbody>
</table>

### SET Function
Sets Data2 to Data1.

**Format:** \( \text{SET} \langle \text{Data1} \rangle \langle \text{Data2} \rangle \\
\)

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data1 B&lt;variable number&gt;, I&lt;variable number&gt;, D&lt;variable number&gt;, R&lt;variable number&gt;, P&lt;variable number&gt;, S&lt;variable number&gt;, BP&lt;variable number&gt;, EX&lt;variable number&gt;</td>
<td>SET I012 I020</td>
</tr>
<tr>
<td>Data2 Constant, B&lt;variable number&gt;, I&lt;variable number&gt;, D&lt;variable number&gt;, R&lt;variable number&gt;, EXPRESS</td>
<td></td>
</tr>
<tr>
<td>Data1 must always be a variable.</td>
<td></td>
</tr>
</tbody>
</table>
### 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

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Data 1</th>
<th>Data 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P&lt;variable number&gt;,</td>
<td>D&lt;variable number&gt;,</td>
</tr>
<tr>
<td></td>
<td>(element number),</td>
<td>double-precision</td>
</tr>
<tr>
<td></td>
<td>BP&lt;variable number&gt;,</td>
<td>integer type constant</td>
</tr>
<tr>
<td></td>
<td>(element number),</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EX&lt;variable number&gt;,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(element number)</td>
<td></td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>D&lt;variable number&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P&lt;variable number&gt;,</td>
</tr>
<tr>
<td></td>
<td>(element number),</td>
</tr>
<tr>
<td></td>
<td>BP&lt;variable number&gt;,</td>
</tr>
<tr>
<td></td>
<td>(element number),</td>
</tr>
<tr>
<td></td>
<td>EX&lt;variable number&gt;,</td>
</tr>
<tr>
<td></td>
<td>(element number)</td>
</tr>
</tbody>
</table>

**Example**  
GETE D006 P012 (4)

### GETS Function
Sets a system variable to the specified variable.

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>B&lt;variable number&gt;,</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I&lt;variable number&gt;,</td>
</tr>
<tr>
<td></td>
<td>D&lt;variable number&gt;,</td>
</tr>
<tr>
<td></td>
<td>R&lt;variable number&gt;,</td>
</tr>
<tr>
<td></td>
<td>PX&lt;variable number&gt;,</td>
</tr>
<tr>
<td></td>
<td>S&lt;variable number&gt;,</td>
</tr>
<tr>
<td></td>
<td>$B&lt;variable number&gt;,</td>
</tr>
<tr>
<td></td>
<td>$I&lt;variable number&gt;,</td>
</tr>
<tr>
<td></td>
<td>$D&lt;variable number&gt;,</td>
</tr>
<tr>
<td></td>
<td>$R&lt;variable number&gt;,</td>
</tr>
<tr>
<td></td>
<td>$PX&lt;variable number,</td>
</tr>
<tr>
<td></td>
<td>$S&lt;variable number,</td>
</tr>
<tr>
<td></td>
<td>$RV</td>
</tr>
</tbody>
</table>

**System variable**

**Example**  
GETS B000 $B000  
GETS I001 $I[1]  
GETS PX003 $PX001
<table>
<thead>
<tr>
<th>Function</th>
<th>CNVRT</th>
<th>CLEAR</th>
<th>SIN</th>
<th>COS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function</strong></td>
<td>Converts the position variable (Data2) into a position variable of the specified coordinate system, and stores the converted variable in Data1. Format: CNVRT&lt;Data1&gt;&lt;Data2&gt; coordinate tool</td>
<td>Starting with the variable number in Data1, clears (sets to zero) as many variables as specified by a number in Data2. Format: CLEAR&lt;Data1&gt;&lt;Data2&gt;</td>
<td>Obtains the sine of Data2, and stores the result in Data1. Format: SIN&lt;Data1&gt;&lt;Data2&gt;</td>
<td>Obtains the cosine of Data2, and stores the result in Data1. Format: COS&lt;Data1&gt;&lt;Data2&gt;</td>
</tr>
<tr>
<td><strong>Additional Item</strong></td>
<td><strong>Data1</strong> PX&lt;variable number&gt;</td>
<td><strong>Data1</strong> B&lt;variable number&gt;, I&lt;variable number&gt;, D&lt;variable number&gt;, R&lt;variable number&gt;, $B&lt;variable number&gt;, $I&lt;variable number&gt;, $D&lt;variable number&gt;, $R&lt;variable number&gt;</td>
<td><strong>Data1</strong> R&lt;variable number&gt;</td>
<td><strong>Data1</strong> R&lt;variable number&gt;</td>
</tr>
<tr>
<td></td>
<td><strong>Data2</strong> PX&lt;variable number&gt;</td>
<td><strong>Data2</strong> &lt;number of variables&gt;, ALL, STACK</td>
<td><strong>Data2</strong> &lt;constant&gt;, R&lt;variable number&gt;</td>
<td><strong>Data2</strong> &lt;constant&gt;, R&lt;variable number&gt;</td>
</tr>
<tr>
<td><strong>Example</strong></td>
<td>CNVRT PX000 PX001 BF</td>
<td>CLEAR B000 ALL CLEAR STACK</td>
<td>SIN R000 R001 (Sets the sine of R001 to R000.)</td>
<td>COS R000 R001 (Sets the cosine of R001 to R000.)</td>
</tr>
</tbody>
</table>

Additional Items:
- BF: base coordinates
- RF: robot coordinates
- TF: tool coordinates
- UF: user coordinates
- MTF: tool coordinates for the master
- TL#:<tool number>
### ATAN Function
Obtains the arc tangent of Data2, and stores the result in Data1.
Format: \( \text{ATAN<Data1><Data2>} \)

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Data1</th>
<th>Data2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data1</td>
<td>R&lt;variable number&gt;</td>
<td>&lt;constant&gt;, R&lt;variable number&gt;</td>
</tr>
</tbody>
</table>

#### 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: \( \text{SQRT<Data1><Data2>} \)

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Data1</th>
<th>Data2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data1</td>
<td>R&lt;variable number&gt;</td>
<td>&lt;constant&gt;, R&lt;variable number&gt;</td>
</tr>
</tbody>
</table>

#### 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. \(<\text{Data1}>\) indicates the definition point ORG position data, \(<\text{Data2}>\) the definition point XX position data, and \(<\text{Data3}>\) the definition point XY position data.
Format: \( \text{MFRAME <user coordinate> <Data1> <Data2> <Data3>} \)

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Data1</th>
<th>Data2</th>
<th>Data3</th>
</tr>
</thead>
<tbody>
<tr>
<td>UF#(&lt;user coordinate number&gt;)</td>
<td>PX &lt;variable number&gt;</td>
<td>PX &lt;variable number&gt;</td>
<td></td>
</tr>
</tbody>
</table>

#### Example
MFRAME UF#(1) PX000 PX001 PX002

### MULMAT Function
Obtains the matrix product of Data2 and Data3, and stores the result in Data1.
Format: \( \text{MULMAT <Data1> <Data2> <Data3>} \)

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Data1</th>
<th>Data2</th>
<th>Data3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data1</td>
<td>P&lt;variable number&gt;</td>
<td>P&lt;variable number&gt;</td>
<td></td>
</tr>
</tbody>
</table>

#### Example
MULMAT P000 P001 P002

### INVMAT Function
Obtains the inverse matrix of Data2, and stores the result in Data1.
Format: \( \text{INVMAT <Data1> <Data2>} \)

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Data1</th>
<th>Data2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data1</td>
<td>P&lt;variable number&gt;</td>
<td>P&lt;variable number&gt;</td>
</tr>
</tbody>
</table>

#### 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.

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Contents data of a condition file</th>
<th>Data1</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEV#(&lt;condition file number&gt;)(&lt;element number&gt;)</td>
<td>Constant, D&lt;variable number&gt;</td>
<td></td>
</tr>
</tbody>
</table>

#### 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.

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Data1</th>
<th>D &lt;variable number&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contents data of a condition file</td>
<td>WEV#(&lt;condition file number&gt;)(&lt;element number&gt;)</td>
<td></td>
</tr>
</tbody>
</table>

**Example**
GETFILE D000 WEV#(1)(1)

### GETPOS Function
Stores the position data of Data2 (step number) in Data1.

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Data1</th>
<th>PX &lt;variable number&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data2</td>
<td>STEP# (&lt;step number&gt;)</td>
<td></td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Data1</th>
<th>B &lt;variable number&gt;, I &lt;variable number&gt;, D &lt;variable number&gt;, R &lt;variable number&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data2</td>
<td>Character string, S &lt;variable number&gt;</td>
<td></td>
</tr>
<tr>
<td>RADIX=&lt;variable number&gt;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Data1</th>
<th>B &lt;variable number&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data2</td>
<td>Character string, S &lt;variable number&gt;</td>
<td></td>
</tr>
</tbody>
</table>

**Example**
ASC B000 "ABC"

### CHR$ Function
Obtains the character (ASCII) with the character code of Data2, and stores the result in Data1.

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Data1</th>
<th>S &lt;variable number&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data2</td>
<td>Constant, B &lt;variable number&gt;</td>
<td></td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Data1</th>
<th>S &lt;variable number&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data2</td>
<td>Character string, S &lt;variable number&gt;</td>
<td></td>
</tr>
<tr>
<td>Data3</td>
<td>Constant, B &lt;variable number&gt;, I &lt;variable number&gt;, D &lt;variable number&gt;</td>
<td></td>
</tr>
<tr>
<td>Data4</td>
<td>Constant, B &lt;variable number&gt;, I &lt;variable number&gt;, D &lt;variable number&gt;</td>
<td></td>
</tr>
</tbody>
</table>

**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>

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Data1</th>
<th>Data2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B &lt;variable number&gt;, I &lt;variable number&gt;, D &lt;variable number&gt;</td>
<td>Character string, S &lt;variable number&gt;</td>
</tr>
</tbody>
</table>

**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>

<table>
<thead>
<tr>
<th>Additional Item</th>
<th>Data1</th>
<th>Data2</th>
<th>Data3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S &lt;variable number&gt;</td>
<td>Character string, S &lt;variable number&gt;</td>
<td>Character string, S &lt;variable number&gt;</td>
</tr>
</tbody>
</table>

**Example**
CAT$ S000 "ABC" "DEF"
DX200
OPERATOR’S MANUAL
FOR SPOT AND ARC WELDING USING MOTOR GUN

Specifications are subject to change without notice for ongoing product modifications and improvements.