YRC1000
OPERATOR’S MANUAL
FOR SPOT WELDING USING MOTOR GUN

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

MOTOMAN INSTRUCTIONS
MOTOMAN-□□□ INSTRUCTIONS
YRC1000 INSTRUCTIONS
YRC1000 OPERATOR’S MANUAL (GENERAL) (SUBJECT SPECIFIC)
YRC1000 MAINTENANCE MANUAL
YRC1000 ALARM CODES (MAJORALARMS) (MINORALARMS)

The YRC1000 operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.
The YRC1000 operator’s manual above consists of “GENERAL” and “SUBJECT SPECIFIC”.
The YRC1000 alarm codes above consists of “MAJORALARMS” and “MINORALARMS”.

Please have the following information available when contacting Yaskawa Customer Support:
• System
• Primary Application
• Software Version (Located on Programming Pendant by selecting: {Main Menu} - {System Info} - {Version})
• Robot Serial Number (Located on robot data plate)
• Robot Sales Order Number (Located on controller data plate)

Part Number: 182903-1CD
Revision: 0
DANGER

- This manual explains the various components of the YRC1000 system and general operations. Read this manual carefully and be sure to understand its contents before handling the YRC1000.
- General items related to safety are listed in “Chapter 1. Safety” of the YRC1000 INSTRUCTIONS. To ensure correct and safe operation, carefully read the YRC1000 Instructions before reading this manual.

CAUTION

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

NOTICE

- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the YRC1000.

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

---

**DANGER**

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

---

**WARNING**

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

---

**CAUTION**

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

---

**NOTICE**

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

---

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

---

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

• Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.
  – Press the emergency stop buttons on the front door of the YRC1000, on the programming pendant, on the external control device, etc.
  – Disconnect the safety plug of the safety fence. (when in the play mode or in the remote mode).

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

Fig. : Emergency Stop Button

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

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

Fig. : Release of Emergency Stop

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

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

• Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:
  – Turning ON the YRC1000 power
  – Moving the manipulator by using the programming pendant
  – Running the system in the check mode
  – Performing automatic operations

Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the right of the programming pendant.

Read and understand the Explanation of the Warning Labels before operating the manipulator.
Definition of Terms Used Often in This Manual

The MOTOMAN is the YASKAWA industrial robot product.

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

In this manual, the equipment is designated as follows.

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>YRC1000 Controller</td>
<td>YRC1000</td>
</tr>
<tr>
<td>YRC1000 Programming Pendant</td>
<td>Programming Pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>
Descriptions of the programming pendant keys, buttons, and displays are shown as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming Pendant</td>
<td><strong>Character Keys</strong> /Symbol Keys</td>
</tr>
<tr>
<td></td>
<td>The keys which have characters or its symbol printed on them are denoted with [ ], ex. [ENTER]</td>
</tr>
<tr>
<td>Axis Keys /Numeric Keys</td>
<td>[Axis Key] and [Numeric Key] are generic names for the keys for axis operation and number input.</td>
</tr>
<tr>
<td>Keys pressed simultaneously</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>Displays</td>
<td>The menu displayed in the programming pendant is denoted with { }. ex. {JOB}</td>
</tr>
</tbody>
</table>

**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.
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1 Spot Welding Application Using a Motor Gun

1.1 System Overview (Motor Gun)

An I/O signal diagram of a typical system is shown below.

Fig. 1-1: Spot Welding System I/O Signal Diagram
1 Spot Welding Application Using a Motor Gun
1.1 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></td>
<td>(8)</td>
<td>(7)</td>
<td>(6)</td>
<td>(5)</td>
<td>(4)</td>
<td>(3)</td>
<td>(2)</td>
<td>(1)</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 chapter 1.4.2.2 Welding I/F File.
### 1.2 Function Keys

Each function used for spot welding is allocated on the [NUMERIC KEY]s of the programming pendant.

<table>
<thead>
<tr>
<th>Key Combination</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Displays the MANUAL PRESS window.</td>
</tr>
<tr>
<td>8</td>
<td>Displays the WORK HOME POSITION window.</td>
</tr>
<tr>
<td>9</td>
<td>Displays the SVSPOT instruction in the input buffer line in order to register spot welding operation.</td>
</tr>
<tr>
<td>4</td>
<td>[FWD] + [TASK ORIGIN] With the WORK HOME POSITION window in the teach mode, press these keys to move the manipulator to the work home position.</td>
</tr>
<tr>
<td>5</td>
<td>Displays the SVGUNCL instruction in the input buffer line in order to register dry spot welding operation.</td>
</tr>
<tr>
<td>6</td>
<td>[INTERLOCK] + [SPOT] With the MANUAL PRESS window, press these keys to execute manual spot welding.</td>
</tr>
<tr>
<td>1</td>
<td>[INTERLOCK] + [GUN CLOSE] With the MANUAL PRESS window, press these keys to execute manual dry spot welding.</td>
</tr>
<tr>
<td>0</td>
<td>[INTERLOCK] + [WELD ON/OFF] Turns the welding ON/OFF signal ON or OFF.</td>
</tr>
</tbody>
</table>
1. Spot Welding Application Using a Motor Gun

1.2 Function Keys

<table>
<thead>
<tr>
<th>Function Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHORT OPEN</td>
<td>The SHORT OPEN POSITION SETTING window appears the first time this key is pressed. The selection No. for the short open position is replaced by pressing this key while the SHORT OPEN POSITION SETTING window is appeared. [INTERLOCK] + [SHORT OPEN] The movable side tip moves to the selected short open position.</td>
</tr>
<tr>
<td>FULL OPEN</td>
<td>The FULL OPEN POSITION SETTING window appears the first time the key is pressed. The selection No. for the full open position is replaced by pressing this key while the FULL OPEN POSITION SETTING window is appeared. [INTERLOCK] + [FULL OPEN] The movable side tip moves to the selected full open position.</td>
</tr>
<tr>
<td>WELD ALM RST</td>
<td>[INTERLOCK] + [WELD ALM RST] A welder alarm reset signal is output to the welder while these keys are held down.</td>
</tr>
<tr>
<td>PRESSURE</td>
<td>[INTERLOCK] + [PRESSURE] With the MANUAL PRESS window or the JOB window, press these keys to execute pressurizing.</td>
</tr>
<tr>
<td>RELEASE</td>
<td>[INTERLOCK] + [RELEASE] Executes releasing.</td>
</tr>
<tr>
<td>SEARCH</td>
<td>[INTERLOCK] + [SEARCH] Executes searching a work.</td>
</tr>
</tbody>
</table>
1.3 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 each motor gun.

Before execution of Motor Gun Auto Turning function, procedures described in the chapters from chapter 1.3.1 "Posture of Motor Gun" to chapter 1.3.5 "Register the Base Position for Wear Detection (Fixed Side)" 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.
1.3 Setting of Motor Gun

1.3.1 Posture of Motor Gun

Set up the motor gun to the posture shown in the figure below.

When executing the welding instruction, 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 1.4.7 "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.

1.3.2 Basic Configuration

By referring to chapter 1.4.1 "Gun Condition File", set up the following items in the Gun Condition file.

- GUN TYPE
- WELDER NO.
- TORQUE DIR
- MAX PRESSURE

1.3.3 Setting of Pulse to Stroke Conversion Data

Refer to chapter 1.4.1.1 Entering Pulse to Stroke Conversion Data for this setting.
1.3.4 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.
1. Spot Welding Application Using a Motor Gun
1.3 Setting of Motor Gun

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.
1.3.5 Register the Base Position for Wear Detection (Fixed Side)

Register the base position for wear detection by following the procedures below.

![Flowchart]

- Mount a new tip
- Clear the base position for the wear detection. (Refer to Chap. 1.12.3)
- Register a base position by dry spotting touch motion. (Refer to Chap. 1.12.2.1)

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.

**NOTE**

Execute the wear detection operation. If the wear detection operation is not done, the stable pressure cannot be acquired.


1.3.6 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.

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.

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.

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.
3. Select the gun number using [PAGE] or (PAGE).

4. Change the mode to the play mode, and then press [SERVO ON READY].
   - The servo power is turned ON, then (EXECUTE) button appears.

   ![Motor Gun Auto Tuning Window]

   ![Confirmation Dialog]

   - 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.

   ![Start Job Confirmation]

   **NOTE:**
   - 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 chapter 1.3.5 "Register the Base Position for Wear Detection (Fixed Side)", 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], {PAGE}, 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

**NOTE**

**<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.
1 Spot Welding Application Using a Motor Gun
1.3 Setting of Motor Gun

- 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.
1.3 Setting of Motor Gun

– 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.
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 chapter 1.4.6 “Gun Detail Setting File”.

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.
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.

1.3.7 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] or {PAGE}.
   - The operation is completed if {COMPLETE} is indicated at {STATUS}.
   - The operation is not completed if {INCOMPLETE} is indicated at {STATUS}.

"WARNING: Press 'EXECUTE' to execute the auto tuning. If you press the start button."
1.3.8 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] or (PAGE).
4. Select (DATA) - {CLEAR DATA}.

   ![Confirmation Dialog Box]

→ A confirmation dialog box appears.
5. Select “YES”.
   - {STATUS} changes from {COMPLETE} to {INCOMPLETE}.
   - The data will not be deleted if “NO” is selected.

![Image of a software interface with columns for Gun Number, Comment, Enforcement Day, and Status, with a warning message to press 'EXECUTE' to execute the auto tuning and if you press the start button.]
1.3.9 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 (THICKNESS FORCE GAUGE) and select “ENABLE” at (PRESS MEASUREMENT MODE) on MANUAL PRESS window.

![Manual Press Window](image)

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 (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.
### 1.3.10 Alarm

<table>
<thead>
<tr>
<th>Alarm No.</th>
<th>Message</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>4708</td>
<td>Motor Gun Auto Tuning is not executed</td>
<td>Motor Gun Auto Tuning operation is not executed but SVSPOT instruction is executed</td>
<td>Motor Gun Auto Tuning function by following the procedures below.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1. Select (SPOT WELDING) - {MOTOR GUN AUTO TUNING).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Change the mode to the play mode, turn the servo power ON, and then press (EXECUTE) button.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Select &quot;REGIST&quot; after Motor Gun Auto Tuning operation is completed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4. After Motor Gun Auto Tuning function, do not fail to re-measure the gun pressure and reset the torque to pressure conversion data.</td>
</tr>
</tbody>
</table>
1.4 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.

1.4.1 Gun Condition File

The gun characteristics are set in the gun condition file.

**Gun Condition Window**

![Gun Condition Window](image)
1. **GUN NO.**  
   Shows the No. of the gun to be used.  
   When using two guns or more, select the No. by pressing [PAGE].

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 direc-
   tion 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  
   chapter 1.4.1.1 Entering Pulse to Stroke Conversion Data 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 chapter 1.4.1.2 Entering  
   Torque to Pressure Conversion Data for more details.

8. **MAX PRESSURE**  
   Enter a 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 occure in the teach mode.

9. **PRESSURE COMPENSATION**  
   Set the difference of the pressure between the upwards and the down-
   wards.  
   Refer to chapter 1.13.5 “Gun Pressure Compensation Function” for  
   the details.

10. **GUN ARM BEND COEF.**  
    Set the gun arm bend compensation volume per 1000N.  
    Refer to chapter 1.13.6 “Compensation of Gun Arm Bend for C-Gun  
    and X-Gun (SINGLE ARM MOVE)” for the details.

11. **GUN PUSHING COEF**  
    Set the gun axis pushing volume per 1000N.  
    Refer to chapter 1.10.7.4 Setting the Gun Pushing Coefficient 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 chapter 1.13.9 "Automatic Tool Number Select Function for
Guns".

14. USER COORDINATE NO.
Displayed when "12.GUN INSTALLATION STATUS" is "FIXED".
Set the user coordinate No. for the gun to use. Refer to
chapter 1.4.7 "Application Condition Setting".

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".
1. Select {SPOT WELDING} from the main menu.

2. Select {GUN CONDITION}.

3. Select a gun No. by pressing [PAGE].
4. Select the item to be set.


5. Enter the numerical value, and press [ENTER].
1.4.1.1 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.

1.4.1.2 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 chapter 1.3.9 “Setting of Torque to Pressure Conversion Data” 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.
### 1.4.2 I/O Signals for a Motor Gun

#### 1.4.2.1 Major I/O signal (Motor Gun)

**Table 1-1: Input Signals to YRC1000**

<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><strong>WELD COMPLETE</strong></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 chapter 1.4.2.2</td>
</tr>
<tr>
<td><strong>DRY TIP DRESS (WITHOUT PRESSING)</strong></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 chapter 1.4.2.3</td>
</tr>
<tr>
<td><strong>TMR COOL WTR ERR</strong></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 chapter 1.4.2.4</td>
</tr>
<tr>
<td><strong>GUN COOL WTR ERR</strong></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 chapter 1.4.2.4</td>
</tr>
<tr>
<td><strong>TRANS THERMO ERR</strong></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 chapter 1.4.2.4</td>
</tr>
<tr>
<td><strong>WELD ON/OFF (from PLC)</strong></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 chapter 1.4.2.4</td>
</tr>
</tbody>
</table>
### Table 1-2: Output Signals from YRC1000

<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</td>
<td>Sets the welding conditions for the welder.</td>
<td>Welder</td>
<td>4 bits from OUT11</td>
<td>Welder I/F Refer to chapter 1.4.2.2</td>
</tr>
<tr>
<td>(LEVEL signals)</td>
<td>• The output format can be set as binary or discrete (bit number.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (1)</td>
<td>• Can handle up to 255 conditions. The most significant bit is the parity bit when specified.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 (2)</td>
<td></td>
<td>OUT19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 (3)</td>
<td></td>
<td>OUT20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 (4)</td>
<td></td>
<td>OUT21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 (5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 (6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>64 (7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>128 (8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WELDING CONDITION PARITY</td>
<td>Unused</td>
<td>Welder</td>
<td>Unused</td>
<td>Welder I/F Refer to chapter 1.4.2.2</td>
</tr>
<tr>
<td>WELDING COMMAND</td>
<td>Outputs the start command to the welder.</td>
<td>Welder</td>
<td>Unused</td>
<td>Welder I/F Refer to chapter 1.4.2.2</td>
</tr>
<tr>
<td></td>
<td>This command is NOT necessary for the welder which uses the WELDING CONDITION signal as a start signal.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WELDING ERROR RESET</td>
<td>Resets the error status in the welder.</td>
<td>Welder</td>
<td>OUT18</td>
<td>Welder I/F Refer to chapter 1.4.2.2</td>
</tr>
<tr>
<td></td>
<td>Outputs by “INTERLOCK” + “WELD ALM RST”.</td>
<td></td>
<td></td>
<td></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 chapter 1.4.2.2</td>
</tr>
</tbody>
</table>
1.4.2 Welding I/F File

The welder characteristics are set in the welding I/F file.

1. WELDER NO.
   Shows the number of the welder to be used.
   When using two welders or more, select the welder No. by pressing [PAGE].

2. WELD COMPLETE
   Indicates the signal that welding is completed normally.
   This signal is used to confirm the completion of the welding when executing the welding instruction (SVSPOT, SVSPOTMOV) or the manual spot.
   After this signal is input, the welding sequence is completed, and the operation moves to the next step.

3. WELD COMPLETE WAIT TIME
   Set the wait time from the start of the welding instruction (SVSPOT, SVSPOTMOV) or the manual spot to the inputting the WELD COMPLETE signal.

4. WELDING ERROR RESET
   Resets the error status in the welder. Outputs by [INTERLOCK] + [WELD ALM RST].

5. WELDING CONDITION
   Outputs the welding condition signal to the welder.
   The set welding condition No. (set at WTM tag) is outputted through the signal set in this item when executing the welding instruction (SVSPOT, SVSPOTMOV) or the manual spot.

6. WELD Cond OUTPUT FORMAT
   Set the output format of the welding condition.
   Select “BINARY” or “DISCRETE”.

7. WELD Cond OUTPUT TYPE
   Set the output type of the welding condition signal.
   Select “LEVEL”, “PULSE” or “START SIGNAL”.
   Refer to Welder Start Timing.
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.

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 WELDING CONDITION are outputted at the same time.
Settings of the odd/even number parity is performed using the parameter. (For the details, refer to "YRC1000 GENERAL OPERATOR’S MANUAL (RE-CSO-A051) 8.10.3.4 AxP006: PARITY SPECIFICATION FOR WELDING CONDITIONS").

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.
Refer to chapter 1.13.7 "Welding Conditions Group Output Function".

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.

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.
1 Spot Welding Application Using a Motor Gun
1.4 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 chapter 1.7 Welding Instruction (SVSPOT Instruction).
• When the weld cond output type is set to “PULSE”:

- When WST=0
  - Welding Condition
  - Welding Command

- When WST=1
  - Welding Condition
  - Welding Command

- When WST=2
  - Welding Condition
  - Welding Command

As for WST(welder start timing), refer to chapter 1.7 Welding Instruction (SVSPOT Instruction).
• When the weld cond output type is set to “START SIGNAL”:

As for WST (welder start timing), refer to chapter 1.7 Welding Instruction (SVSPOT Instruction).
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].

4. Select the item to be set.

5. Enter a numerical value, and press [ENTER].
1.4.2.3 I/O Allocation

**I/O Allocation Window**

<table>
<thead>
<tr>
<th></th>
<th>DATA</th>
<th>EDIT</th>
<th>DISPLAY</th>
<th>UTILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. **DRY TIP DRESS (WITHOUT PRESSING)**
   Use this signal to execute the tip dresser instruction (SVDRESMOV) without pressure of the gun.
   Refer to chapter 1.11.6 "Dry Tip Dressing Operation".

2. **DRY TIP DRESS (WITHOUT DRESSING)**
   Use this signal to execute the tip dresser instruction (SVDRESMOV) without dressing.
   Refer to chapter 1.11.6 "Dry Tip Dressing Operation".

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 chapter 1.13.2 "Gun Change".

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 chapter 1.13.2 "Gun Change".

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 chapter 1.13.2 "Gun Change".

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 chapter 1.13.2 "Gun Change".
1. Spot Welding Application Using a Motor Gun

1.4 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 the any JOBs. If the same signals are used in the JOBs, malfunctions will result.
1.4.2.4 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}.

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.
1.4.3 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 "YRC1000 INSTRUCTIONS (RE-CTO-A221) 8.3 Tool Data Setting" for the tool coordinate value and tool data setting.

1.4.3.1 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.
1.4.3.2 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.

---

**NOTE**

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.
1.4.4 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>*

Parameters

S1CxG800: Pulse software limit (+ side)
S1CxG810: Pulse software limit (- side)

*<Example>*

When S1CxG800=50000 and S1CxG810=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 S1CxG810 so that the motor gun moves in the range from -3,000 to 50,000 pulses.
When setting the value for S1CxG810, 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.
1.4.5 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>

![Diagram showing shank position and motion ranges](image)

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.)
1.4.6 Gun Detail Setting File

Set the special gun related setting in the GUN DETAIL SETTING window.

**Gun Detail Setting Window**

- **1. GUN No.**
  Shows the gun No. to use.

- **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).

- **3. TOUCH SPEED**
  Refer to chapter 1.7.4 "Gun Stroke Setting before Welding".

- **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 chapter 1.12.2.1 Dry Spot Touch Motion.)
   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.
Spot Welding Application Using a Motor Gun

1.4 System Setting (Motor Gun)

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 chapter 1.12.2.2 Movable Side Tip Detection.)
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) SVSPOTMOV
The fixed tip and the movable tip move to the teaching position of the SVSPOTMOV (the position where the fixed tip and movable tip touch the work) by the specified speed in the SVSPOTMOV 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, SVSPOTMOV), 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 each operation of the pressure instruction (SVSPOT, SVGUNCL, SVSPOTMOV).

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 of the allowance touch range becomes invalid.
The touch reference position is described below according to the each pressure instruction to be used.
1. Spot Welding Application Using a Motor Gun
1.4 System Setting (Motor Gun)

(1) 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 chapter 1.12.2.1 Dry Spot Touch Motion).

When the dry spot touch motion of the wear detection has not been executed, the monitoring for the allowance touch range becomes invalid.

(2) 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 chapter 1.12.2.2 Movable Side Tip Detection).

When the movable tip detecting motion of the wear detection has not been executed, the monitoring for the allowance touch range becomes invalid.

(3) SVSPOTMOV
The touch reference position is the gun teaching position of SVSPOTMOV.

9. PRESSURE FILE NO.
Specify the pressure file No. for the “DRY SPOT SIGNAL(FILE)”. Refer to chapter 1.13.4 “Signal Dry Spot” 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 chapter 1.13.4 “Signal Dry Spot” for more details.

11. DRY SPOT PRESSURE (CONTINUE)
Set the pressure for the “DRY SPOT PRESSURE (CONTINUE)”. Refer to chapter 1.13.4 “Signal Dry Spot” 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 chapter 1.13.4 “Signal Dry Spot” for more details.

13. THICKNESS
Input the thickness of the work to operate the welding. Refer to chapter 1.13.3 “Touch Teaching Function” 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 chapter 1.13.3 “Touch Teaching Function” for more details.

15. TCP ADJUSTMENT
Shows the adjustment distance of the fixed tip when operating the TOUCH TEACHING function. Refer to chapter 1.13.3 “Touch Teaching Function” for more details.

**NOTE**
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.
1 Spot Welding Application Using a Motor Gun

1.4 System Setting (Motor Gun)

- **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].
1.4.7 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](image)

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 chapter 1.10.2 "Setting the Teaching Type" for more details.

2. **MAX NUMBER OF WELDER CONNECT**
   - Set the number of the welders.
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.
7. THICKNESS DETECTION FUNCTION
Set “VALID” or “INVALID” of the THICKNESS DETECTION FUNCTION. Refer to chapter 1.13.7.4  Group Output 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 chapter 1.13.7  "Welding Conditions Group Output Function”.

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.

Refer to chapter 1.13.7  "Welding Conditions Group Output Function” more details.

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.
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 chapter 1.13.9 “Automatic Tool Number Select Function for Guns”.

30. MOTION WHEN MANUAL HANDLING
Set whether to permit or prohibit moving the manipulator by the programming pendant during the manual handling (Refer to chapter 1.8.3 “Workpiece Transfer Function Using a Motor Gun”). 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.
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].
1.5 Before Teaching

Before using the motor gun, confirm the following operation instructions.

1.5.1 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 chapter 1.9 Manual Pressure for the condition settings.

1.5.2 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 chapter 1.9 Manual Pressure for the condition settings.

1.5.3 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 chapter 1.9 Manual Pressure for the condition settings.
1.5.4 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 “YRC1000 GENERAL OPERATOR’S MANUAL (RE-CSO-A051) 2.2.0.5 Select Manual Speed” 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.

1.5.5 Mounting Tips

Mount a tip in a dry spot motion.

For dry spot, refer to chapter 1.5.2 “Manual Dry Spot”.

   For teaching, be sure to use a new tip with no wears.
1.5.6 Creation of Job

This section explains how to prepare a job for a robot axis and a gun axis.

1.5.6.1 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.
   - Refer to chapter 1.13.5 “Gun Pressure Compensation Function” for the details of gun pressure compensation.
   - Refer to chapter 1.13.6 “Compensation of Gun Arm Bend for C-Gun and X-Gun (SINGLE ARM MOVE)” for the details of arm bend compensation.
(Example Case) Robot: R1, Gun-Axis: S1

Select “R1+S1” for a control group

5. Press [ENTER]

– Refer to "YRC1000 GENERAL OPERATOR’S MANUAL (RE-CSO-A051) 3.1.3 Registering a Job" for the details.
1.5.6.2 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.

- **NOTE**
  - 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 chapter 1.10 Clearance Move Instruction (SVSPOTMOV Instruction).
1.6  Playback (Motor Gun)

This section explains about the check run and the actual welding.

1.6.1  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.

1.6.2  Execute Welding

After having confirmed the taught path, start the welding operation.

SVSPOT instruction becomes available after turning OFF the check run operation.
1.7 Welding Instruction (SVSPOT Instruction)

1.7.1 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.
1.7.2 Setting of Gun Pressure

The pressure for welding can be specified by the pressure file selected by SVSPOT instruction.

- **Gun Pressure window**

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.

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.
1. Spot Welding Application Using a Motor Gun

1.7 Welding Instruction (SVSPOT Instruction)

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 1-3: Example**

<table>
<thead>
<tr>
<th>PRESS (N)</th>
<th>END CONDITION</th>
<th>PRESS TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ST PRESS</td>
<td>2000</td>
<td>PRESS TIME</td>
</tr>
<tr>
<td>2ND PRESS</td>
<td>1500</td>
<td>PRESS TIME</td>
</tr>
<tr>
<td>3RD PRESS</td>
<td>2200</td>
<td>PRESS TIME</td>
</tr>
<tr>
<td>4TH PRESS</td>
<td>1800</td>
<td>END WAIT</td>
</tr>
</tbody>
</table>

---

**Graphic:**

- **Graph:**
  - Pressure: 1000, 1500, 2000, 2200
  - Weld Complete: 1800

**Note:**

Gun pressure can be edited during the playback operation. The edited content is reflected after the gun pressure setting is done.
1.7 Welding Instruction (SVSPOT Instruction)

1.7.3 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.

\[ SVSPOT \text{ GUN#(1) PRESS#(1) WTM=1 WST=1 BWS=10.0} \]

- 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.

1.7.4 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

1.7.4.1 Setting the Gun Stroke Position

\[ SVSPOT \text{ GUN#(1) PRESS#(1) WTM=1 WST=1 BWS=10.0} \]

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.
1.7.4.2 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].

1.7.4.3 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%.
1.8 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.

1.8.1 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. 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 chapter 1.12 Tip Wear Detection and Wear Compensation (Motor Gun).
- 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 chapter 1.11 Tip Dressing Instruction (SVDRESMOV Instruction).
1.8.2 Dry Spot Pressure Setting

The pressure for dry spot is specified by the pressure file selected by the SVGUNCL instruction.

- PRESSURE window

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.
1.8 Dry Spot (Motor Gun)

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.

As for a value to “7”, set a value so that the following equality to be true.

\[
1000 \leq 1\text{ST to 4TH PRESS}
\]

If the gun pressure is not set following the above mentioned instructions, the actual pressure over the specified pressure cannot be guaranteed.
Table 1-4: 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>
</tbody>
</table>

Tip dresser rotating signal

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.
1.8.3 Workpiece Transfer Function Using a Motor Gun

1.8.3.1 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
```

Set pressure for grasping workpieces
1.8.3.2 Instruction for Grasping/Releasing Workpieces

**Example**

<table>
<thead>
<tr>
<th>SVGUNCL</th>
<th>GUN#(1)</th>
<th>PRESSCL#(1)</th>
<th>ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

**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.

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.).

6. Edit the tag item of the instruction.
   – Select {CONSTANT} from the dialog box.
     • ON: Grasps the workpiece
     • OFF: Releases the workplace
1.8.3.3 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.
1.9 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.
For the details, refer to chapter 1.13.7 "Welding Conditions Group Output Function"
1. Spot Welding Application Using a Motor Gun
1.9 Manual Pressure

- **Operating procedures**
  1. Press [0/MANUAL SPOT] of the [Numeric Key].
     - MANUAL PRESS window appears.

     ![Image]

     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**

Refer to chapter 1.5.1 "Manual Spot", chapter 1.5.2 "Manual Dry Spot" and chapter 1.5.3 "Manual Press" for the manual press operation.

---

**NOTE**

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.
1.10 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.

1.10.1 Operation Flow

The following shows the teaching operation flow chart for the clearance move instruction.

1. Specify following teaching types
   -Teaching type 1: Lower-tip teaching
   -Teaching type 2: Upper-tip teaching
   -Teaching type 3: Gun-close teaching

2. Specify following teaching data
   -Teaching point (teaching)
   -Moving speed
   -Clearance file No.
   -Pressure/welding conditions

3. Set the following clearance data
   -Upper tip clearance distance
   -Lower-tip clearance distance
   -Board thickness
   (for the teaching type 1 and 2)

4. Specify following teaching data

   -Teaching point (teaching)
   -Moving speed
   -Clearance file No.
   -Pressure/welding conditions

End
1.10.2 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.}.

[Diagrams of lower-tip teaching, upper-tip teaching, and gun-close teaching]

– APPLICATION CONDITION SETTING window appears
1 Spot Welding Application Using a Motor Gun
1.10 Clearance Move Instruction (SVSPOTMOV Instruction)

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.
1.10 Clearance Move Instruction (SVSPOTMOV Instruction)

1.10.3 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.
1.10 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 SVSPOTMOV 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.
1.10.4 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.
1. Spot Welding Application Using a Motor Gun

1.10 Clearance Move Instruction (SVSPOTMOV Instruction)

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.
1.10.5 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 chapter 1.13 Other Functions Using a Motor Gun)

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 chapter 1.7.1 "Registration of Welding Instruction (SVSPOT Instruction)."
1.10 Clearance Move Instruction (SVSPOTMOV Instruction)

1.10.6 Clearance Move

The following describes the clearance move.

- **When the positioning level (PLIN) is used**

*Table 1-5: Job Example: Work 1*

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>NOP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0001</td>
<td>MOVJ VJ=100.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0002</td>
<td>SVSPOTMOV V=1000.0 PLIN=0 CLF#(1) GUN#(1)</td>
<td>→ 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PRESS#(1) WTM=1 WST=1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0003</td>
<td>SVSPOTMOV V=1000.0 PLIN=0 CLF#(1) GUN#(1)</td>
<td>→ 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PRESS#(1) WTM=1 WST=1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0004</td>
<td>SVSPOTMOV V=1000.0 PLIN=0 CLF#(1) GUN#(1)</td>
<td>→ 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PRESS#(1) WTM=1 WST=1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0005</td>
<td>SVSPOTMOV V=1000.0 PLIN=0 CLF#(1) GUN#(1)</td>
<td>→ 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PRESS#(1) WTM=1 WST=1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0006</td>
<td>SVSPOTMOV V=1000.0 PLIN=0 CLF#(1) GUN#(1)</td>
<td>→ 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PRESS#(1) WTM=1 WST=1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0007</td>
<td>MOVL V=1000.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0008</td>
<td>END</td>
<td></td>
<td></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

![Diagram showing clearance for upper and lower tips with dimensions for weld positions](image-url)
When the positioning level (PLOUT) is used

Table 1-6: Job Example: Work 1

<table>
<thead>
<tr>
<th>Line</th>
<th>Code/Description</th>
<th>Notes</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>→ 1</td>
</tr>
<tr>
<td>0002</td>
<td>SVSPOTMOV V=1000.0 PLOUT=0 CLF#(1) GUN#(1)</td>
<td>→ 2</td>
</tr>
<tr>
<td></td>
<td>PRESS#(1) WTM=1 WST=1</td>
<td></td>
</tr>
<tr>
<td>0003</td>
<td>SVSPOTMOV V=1000.0 PLOUT=0 CLF#(1) GUN#(1)</td>
<td>→ 3</td>
</tr>
<tr>
<td></td>
<td>PRESS#(1) WTM=1 WST=1</td>
<td></td>
</tr>
<tr>
<td>0004</td>
<td>SVSPOTMOV V=1000.0 PLOUT=0 CLF#(1) GUN#(1)</td>
<td>→ 4</td>
</tr>
<tr>
<td></td>
<td>PRESS#(1) WTM=1 WST=1</td>
<td></td>
</tr>
<tr>
<td>0005</td>
<td>SVSPOTMOV V=1000.0 PLOUT=0 CLF#(1) GUN#(1)</td>
<td>→ 5</td>
</tr>
<tr>
<td></td>
<td>PRESS#(1) WTM=1 WST=1</td>
<td></td>
</tr>
<tr>
<td>0006</td>
<td>SVSPOTMOV V=1000.0 PLOUT=0 CLF#(1) GUN#(1)</td>
<td>→ 6</td>
</tr>
<tr>
<td></td>
<td>PRESS#(1) WTM=1 WST=1</td>
<td></td>
</tr>
<tr>
<td>0007</td>
<td>MOVL V=1000.0</td>
<td>→ 7</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
1.10.7 Press Teaching Function

1.10.7.1 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.

Start

Select “GUN CLOSE” as a teaching type

Move the manipulator to the welding point

Apply pressure

Register the welding point

Release applying pressure

End

Refer to chapter 1.10.2 “Clearance Teaching Function”.

1 Spot Welding Application Using a Motor Gun
1.10 Clearance Move Instruction (SVSPOTMOV Instruction)
1.10.7.2 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 [INTERLOCK] + [8].
   – 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.

1.10.7.3 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].
1.10.7.4 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.
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. 1-2: 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.
1.10.8 Work Search Function

The workpiece position over the tool Z-axis direction can be automatically detected.

1.10.8.1 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 chapter 1.10.7 "Press Teaching Function".

In case pressing [INTERLOCK] + [5] is released or Hold is pressed during the workpiece detection, the detecting operation is discontinued.
1.10.8.2 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].

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.
1.11 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.

1.11.1 Operation Flow

The following shows the operation flow chart for the tip dressing instruction teaching.

- Start
  - Select a teaching type
    - Set the following teaching type
      - Teaching type 1: Lower-tip teaching
      - Teaching type 2: Upper-tip teaching
      - Teaching type 3: Gun-close teaching
  - Set a clearance file
    - Set the following conditions:
      - Pressure condition
      - Clearance condition
      - Dresser condition
  - Teach a dressing point
    - Set the following teaching data
      - Teaching position (teaching)
      - Moving speed
      - Tip dress condition file No.
  - End
### 1.11.2 Teaching Type Setting

The teaching type setting procedures are same as that of the clearance move instruction (SVSPOTMOV). Refer to chapter 1.10.2 "Setting the Teaching Type".

### 1.11.3 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

<table>
<thead>
<tr>
<th>FILE NO.</th>
<th>SHOWS THE TIP DRESS CONDITION FILE NO. PRESS [PAGE] TO CHOOSE THE NUMBER.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRESSER</td>
<td>SELECT &quot;IO&quot; WHEN USING A DRESSER WHICH IS CONTROLLED BY IO. WHEN USING A SERVO DRESSER, SELECT THE SERVO DRESSER'S CONTROL GROUP.</td>
</tr>
<tr>
<td>PRESS CONDITION</td>
<td>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).</td>
</tr>
<tr>
<td>TOUCH SPEED</td>
<td>SHOWS THE GUN CLOSING SPEED WITH A LINK SPEED (%).</td>
</tr>
<tr>
<td>1ST TO 2ND PRESS</td>
<td>SET THE PRESSURE AT EACH STEP</td>
</tr>
</tbody>
</table>

---

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
“PRESS TIME” and “DRESS LENGTH” can be selected as the condition for ending the operation.

- 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 to {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
1 Spot Welding Application Using a Motor Gun
1.11 Tip Dressing Instruction (SVDRESMOV Instruction)

(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)).
Spot Welding Application Using a Motor Gun

1.11 Tip Dressing Instruction (SVDRESMOV Instruction)

- **Operating procedures**
  1. Select `{SPOT WELDING}` on the `{Main Menu}`.
  2. Select `{TIP DRESS CONDITION}`.

- TIP DRESS CONDITION window appears.

  4. Select a desired item.
  5. Input a numeric value and press `[ENTER]`.
1.11.4 Dressing Position Teaching Operation

1. Select {JOB} on the {Main Menu}.
2. Select {JOB}.

– JOB CONTENT window appears.

When registering a pressure instruction (SVSPOT, SVGUNCL, SVSPOTMOV or SVDRESMOV), create a job in which a gun axis control group is included.
1.11 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 in 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.
1.11.5 Tip Dress Instruction

Following shows the tip dress instruction.

SVDRESMOV

\[ \begin{align*}
V &= 500.0 \\
VCL &= 100.0 \\
VOP &= 100.0 \\
PLIN &= 0 \\
POUT &= 0 \\
GUN#(1) &= 1 \\
DRS#(1) &= 2
\end{align*} \]

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.
1.11.5.1 Tip Dress Instruction (SVDRESMOV) Flow

- Move to the clearance position
- Dresser rotation start
- Rotation wait time
- Rotation request
- Dresser rotation speed
- Dresser executing signal
- Rotation speed (1st press)
- 1st press
- Gun pressuring status
- Rotation speed (2nd press)
- 2nd press
- Rotation speed (2nd press)
- Rotation rotation finish
- Closing operation
- Apply pressure
- Opening operation
- Dresser rotation speed
- I/O dresser
- Servo dresser
1.11.5.2 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.

1.11.5.3 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. 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.
1 Spot Welding Application Using a Motor Gun
1.11 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.
1.11.5.4 Wear Detection with Tip Dressing 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 chapter 1.12 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.
1. Spot Welding Application Using a Motor Gun
1.11 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.

```
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].
```
1.11.6 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 chapter 1.4.2.3 I/O Allocation.

- **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.
1.11.7 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.
1. **Spot Welding Application Using a Motor Gun**

1.11 **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)
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.
1. Spot Welding Application Using a Motor Gun
1.11 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].
1.12 Tip Wear Detection and Wear Compensation (Motor Gun)

1.12.1 Wear Detection and Wear Compensation Operation Flow Chart

- Mount a new tip
- Teach the manipulator operation position
- Clear the base positions. (Refer to chapter 1.12.3)
- Register the base position (fixed side) by dry spot touch motion. (Refer to chapter 1.12.2.1.)
- Register the base position (movable side) by dry spot movable side tip detecting motion (Refer to chapter 1.12.2.2.)
- Perform welding
- Tip dressing
- Read the position by dry spot touch motion. (Refer to 1.12.2.1.)
- Read the position by movable side tip detecting motion. (Refer to 1.12.2.2.)
- 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
1.12 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.

- **SUPPLEMENT**
  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 chapter 1.12.2.1 Dry Spot Touch Motion and chapter 1.12.2.2 Movable Side Tip Detection.

  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).

1.12.2.1 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

1. Gun No.
2. Wear detection pressure condition
3. Wear detection operation type
1.12.2.2 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 chapter 1.12.2.1  Dry Spot Touch Motion, 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

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gun No.</td>
<td>Wear detection pressure condition</td>
<td>Wear detection operation type</td>
</tr>
</tbody>
</table>
1.12.2.3 Example of Wear Detection

**<Job Example>**

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)
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.

**NOTE**

Also, set the polarity of the signal that is output from the sensor, by the setting item “WEAR DETECT SENSOR POLARITY” in chapter 1.12.3 “Spot Supervision Window Setting”.
### 1.12.3 Spot Supervision Window Setting

Shows the tip wear amount, etc.
Also, the wear amount detection relevant settings can be performed.

#### Spot supervision window

<table>
<thead>
<tr>
<th>DATA</th>
<th>EDIT</th>
<th>DISPLAY</th>
<th>UTILITY</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Gun No.</th>
<th>Meld Count</th>
<th>Current</th>
<th>Tolerance</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 at (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.
   For the details, refer to chapter 1.12.8 “Tip Mounting Position Error Detection”.

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 1.12.8.

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.
    For the details, refer to chapter 1.13.8 “Workpiece Thickness Detection Function”.

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.
1. Spot Welding Application Using a Motor Gun
1.12 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}.

- SPOT SUPERVISION window appears.

3. Select a gun No. by pressing [PAGE].
4. Select a desired item.
5. Input a numeric value and press [ENTER].
1. Spot Welding Application Using a Motor Gun

1.12 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.
  3. Select "YES".
1.12 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".

![Clearing the Wear Detection Base Position](image-url)
1.12.4 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

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 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 chapter 1.4.3 "Registering the Operation Tool").
1.12.5 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.

1.12.5.1 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.

![User coordinates diagram](image)

The YRC1000 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.
1.12.5.2 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.
1.12.5.3 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
- SVDRESMOV 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

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 chapter 1.12.5.1 Setting the User Coordinates.)
1.12.6 Teaching Positions with a Worn Tip

When teaching positions with a worn tip, the teaching position is registered, adjusted by tip wear amount.

1.12.6.1 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.

1.12.6.2 Parameters

AxP010: Invalid wear range for teaching point adjustment (units: μm)
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 ≥ 1mm: The taught position is registered adjusted by the wear amount.
- Wear amount < 1mm: 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.".
1.12.7 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>

(Unit: μm)
1.12.8 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.
1.12 Tip Wear Detection and Wear Compensation (Motor Gun)

1.12.8.1 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.**

```
Mount a new tip
Teach a manipulator motion positions
Clear the base positions (Refer to 1.12.3)
Execute wear detection job
Register the base position (fixed side) with dry spot touch motion (Execute TWC-A) (Refer to 1.12.2.1)
Register the base position (movable side) with movable side tip detecting motion (Execute TWC-B) (Refer to 1.12.2.2)
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 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 1.12.3)
  - 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 1.12.2.1)
    - Register the base position (movable side) with movable side tip detecting motion (Execute TWC-B or TWC-BE) (Refer to 1.12.2.2)
  - Execute welding
  - Tip dressing
  - Execute wear detection job (Execute TWC-A, TWC-B)
  - Calculate wear 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
1.12 Tip Wear Detection and Wear Compensation (Motor Gun)

1.12.8.2 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.

  ```
  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.

  ```
  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.

---

**NOTE**

This operation must be performed after new tips are mounted.

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.

  ```
  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.

  ```
  SVGUNCL GUN#(1) PRESSTWC TWC-B
  ```
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
1.12.8.3 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
1.12 Tip Wear Detection and Wear Compensation (Motor Gun)

1.12.8.4 Importing the Tip Mounting Position Error

- **Operation Procedures**
  1. Select {SPOT WELDING} on the {Main Menu}.
  2. Select {SPOT SUPERVISION}.

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.
1. Spot Welding Application Using a Motor Gun
1.12 Tip Wear Detection and Wear Compensation (Motor Gun)

- SPOT SUPERVISION window appears.

3. Select a gun No. by pressing [PAGE].
5. Select “YES”.

![Image of spot welding application using a motor gun](image-url)

<table>
<thead>
<tr>
<th>Spot Supervision</th>
<th>Current</th>
<th>Tolerance</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gun No. 1/2</td>
<td></td>
<td></td>
<td>INF</td>
</tr>
<tr>
<td>Reset Wear</td>
<td>0.0 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tip Mounting Error (W)</td>
<td>0.0 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tip Mounting Error (F)</td>
<td>0.0 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base Pos(W)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base Pos(F)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thickness Detect</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tip Mounting Error (W)</td>
<td>0.0 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tip Mounting Error (F)</td>
<td>0.0 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base Pos(W)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base Pos(F)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wear Detection On</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wear Detection On</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wear Detection Off</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wear Detection Off</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wear Compensation Offset (Fixed Side)</td>
<td>0.001 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wear Detection Sensor D1 No.</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wear Detection Sensor Polarity</td>
<td>OFF-ON</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Import Wear to Tip Mounting Error?](image-url)

Options: YES, NO
1.12.8.5 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**


The universal output signal 5 is output when either of the following conditions meet.

- The limit of tip mounting position error (movable side) \( \geq 1\text{mm} \)
- The limit of tip mounting position error (fixed side) \( \geq 2\text{mm} \)

The signal is not output when the value of the universal output parameter (A1P56) or the value of both A1P57 and A1P58 are 0.
1.13 Other Functions Using a Motor Gun

1.13.1 Motor Gun Stroke

The motor gun stroke is classified into two; full open and short open.

1.13.1.1 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.
1.13.1.2 Registering the current position

   - FULL OPEN POS SET window (or SHORT OPEN POS SET window) appears.

2. Select a gun No. by pressing [PAGE].
3. Select a position to register a gun stroke and press [MODIFY] + [ENTER].

1.13.1.3 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].
1.13.4 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 [FWD] moves the gun to the stroke set in the (POSITION) which the cursor stay at.

1.13.5 Moving to Full-open/Short-open Position While Other Window is Displayed

By pressing [INTERLOCK] + [3/FULL OPEN] or [INTERLOCK] + [-/SHORT OPEN] 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.
1.13.2 Gun Change

1.13.2.1 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.

1.13.2.2 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.
<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 YRC1000 control power supply is turned ON.

If the signal status indicates that the gun is connected when YRC1000 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 YRC1000 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.
1.13.2.3 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>IN1</td>
</tr>
<tr>
<td>Gun Unchuck</td>
<td>IN2</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  
WAIT IN#(3)=OFF  
WAIT IN#(2)=ON  
WAIT IN#(4)=ON  
DOUT OT#(2)=ON  
WAIT IN#(5)=ON  
MOVJ VJ=30  
MOVJ VJ=30

MOVJ VJ=30  
WAIT IN#(3)=ON  
DOUT OT#(1)=OFF  
WAIT IN#(1)=ON  
GUNCHG GUN#(1) PICK  
TIMER T=0.2  
MOVJ VJ=30  
WAIT IN#(4)=OFF  
DOUT OT#(2)=OFF  
WAIT IN#(6)=ON  
MOVJ VJ=30  
END
1 Spot Welding Application Using a Motor Gun
1.13 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
MOVL 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.
1.13.2.4 Gun Changing Timing

The timing to change a gun is illustrated below.

```
Gun Status
Coupling Confirmation
Gun ID No. Signal
Connect/Disconnect SOL
Gun Chuck
Gun Unchuck
Gun-Axis Servo

PLACE
PICK
ON
OFF
ON
OFF
CHUCK
UNCHUCK
ON
OFF
ON
OFF
GUNCHG PICK
GUNCHG PLACE
```

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1.13.3 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 touch teaching function with workpiece thickness and distance between tips marked as d mm and s mm respectively.]

1.13.3.1 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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**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].
1.13.3.2 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.
1.13.4 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.

1.13.4.1 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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- **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.
1.13.5 Gun Pressure Compensation Function

1.13.5.1 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.

- Start
- Register the data for applying pressure downwards in the GUN CONDITION file.
- Set the PRESSURE COMPENSATION value in the GUN CONDITION file.
- Teach the welding point.
- End
The following describes outline of the gun pressure compensation function.

The pattern 1 is shown in the fig. 1-3; applying pressure downwards, and the pattern 2 is shown in the fig. 1-4; 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. 1-6 Pressure-to-torque Conversion (For Pattern 1)) 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. 1-3: Pattern 1 (Applying Pressure Downwards)**

![Pattern 1](image1)

**Fig. 1-4: Pattern 2 (Applying Pressure Upwards)**

![Pattern 2](image2)
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Fig. 1-5: GUN CONDITION File (Downward Pressure)

Fig. 1-6: Pressure-to-torque Conversion (For Pattern 1)
For the pattern 2 shown in fig. 1-4 (Applying Pressure Upwards), 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. 1-7), 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. 1-8.)
1.13.5.3 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 chapter 1.3.9 “Setting of Torque to Pressure Conversion Data”.

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.
1.13.6 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 \((K \times \frac{F}{1000})\) mm in synchronization with gun pressure.

1.13.6.1 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 DOEF.”

- **GUN ARM BEND DOEF.**
  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.

### 1.13.6.2 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

**NOTE**

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
S1 : Gun arm bend compensation is unexecuted

When 2.0 (mm/1000N) is specified for the gun arm bend compensation coefficient:

<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>
1.13.6.3 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.
1.13.7 Welding Conditions Group Output Function

1.13.7.1 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
```

1.13.7.2 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}.
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].
1.13.7.3 Setting the Group Output Tag

The following describes the settings for the group output.

When the job contents are displayed, by pressing [SHIFT] + [MOTION TYPE], 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).

3. Press [SHIFT] + [MOTION TYPE] 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.
1.13 Other Functions Using a Motor Gun

6. Select {WELD GRP OUT}.
   – Press [SELECT] to display the selection dialog box. (The initial value is “UNUSED.”)

   (1) Select {WGO=}.

   (2) Set the output value.

   7. Press [ENTER].


1.13.7.4 Group Output

The origin of the group output can be set with “0”.

“0 origin” or “1 origin” can be selected from {WELD GROUP ORIGIN 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.
1.13.8 Workpiece Thickness Detection Function

1.13.8.1 Outline

The workpiece thickness detection function monitors the thickness of workpiece to be welded at every SVSPOT instruction and SVSPOTMOV 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.
1.13.8.2 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.
1.13.8.3 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.

![Image of the JOB CONTENT window]
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].
4. 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.
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- 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}.

---

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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, 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.

\[
\text{Value of measured workpiece thickness} = \text{Gun axis position at the touch detection (mm)} + \text{DMF} \text{ (Fixed side wear amount + Movable side wear amount, mm)} - \text{SMF} \text{ (Fixed side tip mounting error + Movable side tip mounting error, mm)}
\]

- 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.
   "GUN ARM BEND COEF." of the gun condition file x 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.
   "GUN PUSHING COEF" of the gun condition file x 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.

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]
TH - THM ≤ The detected thickness ≤ TH + THM

[Not-Acceptable Result]
TH - THM > The detected thickness
Or
The detected thickness > TH + THM

For THA tag:

[Acceptable Result]
TH - (TH × THA / 100) ≤ The detected thickness
TH + (TH × THA / 100)

[Not-Acceptable Result]
TH - (TH × THA / 100) > The detected thickness
Or
The detected thickness > TH + (TH × 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.
1.13 Other Functions Using a Motor Gun

1.13.4 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#**
  
<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Not used</td>
</tr>
<tr>
<td>1 to 2048</td>
<td>When the specified universal signal is input, the workpiece thickness monitoring function is disabled.</td>
</tr>
</tbody>
</table>

- **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}.
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- 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
1. It is recommended that the “TH” tag of SVSPOT/SVSPOTMOV instruction be set just before thickness measurement after teaching operation. If the “TH” tag is specified before that, the alarm “Thickness Error” may occur during test operation, which results in less operating efficiency.

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.

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.
1.13 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 chapter 1.4.3 "Registering the Operation Tool".

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 "YRC1000 GENERAL OPERATOR'S MANUAL (RE-CSO-A051) 2.3.4.1 Selecting Tool"). The correspondence of a gun and a tool number needs to be performed in the gun condition file.

1.13.9.1 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 chapter 1.4.7 "Application Condition Setting" 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.

1.13.9.2 Setting of Tool Number

Set "TOOL NO." in the gun condition file. (Refer to chapter 1.4.1 "Gun Condition File" for the operating procedure.)
1.14 Loading the DX100 Motor Gun Condition File

Some files in the DX100 motor gun condition files cannot be loaded to the YRC1000 due to different formats. Thus, load the DX100 condition files in the table below to the YRC1000 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 YRC1000 condition file to which the setting in the loaded files are reflected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Gun Pressure Data</td>
<td>Motor Gun Pressure Data</td>
</tr>
<tr>
<td>SPRESS.CND</td>
<td>SGPRSCN.DN</td>
</tr>
<tr>
<td>Pressure Data</td>
<td>Pressure Data</td>
</tr>
<tr>
<td>SPRESSCL.CND</td>
<td>SGPRSCCL.CN</td>
</tr>
<tr>
<td>Spot Gun Cond Data</td>
<td>Spot Gun Cond Data</td>
</tr>
<tr>
<td>SGUN.DAT</td>
<td>SGSPEC.DAT</td>
</tr>
<tr>
<td>Spot I/O Allocation data</td>
<td>Spot I/O Allocation Data</td>
</tr>
<tr>
<td>SPOTIO.DAT</td>
<td>SGIO.DAT</td>
</tr>
<tr>
<td>Spot Welder Cond Data</td>
<td>Spot Welder IF Data</td>
</tr>
<tr>
<td>SWELDER.DAT</td>
<td>SGWELDF.DAT</td>
</tr>
<tr>
<td>Clearance Setting</td>
<td>Clearance Setting</td>
</tr>
<tr>
<td>CLEARNCE.DAT</td>
<td>SGCLARNC.DAT</td>
</tr>
</tbody>
</table>

Operation
1. Select {LOAD DX100 SPOT FILES} in the {EX.MEMORY}.
– The Load DX100 Spot Files window appears.

2. Select (FOLDER SELECT) tab.

3. Select the connecting device in the DEVICE SELECT combo box.
4. Select the folder containing the files to be loaded in the FOLDER SELECT list.

6. Select the item(s) to load in the YRC1000 file list.

7. Press {LOAD} in the bottom right in the window.
   – The confirmation dialog appears.
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8. Press (LOAD) in the dialog box.
   – The selected condition files are loaded.

9. Press (CLOSE) in the dialog box.
   – The dialog box is closed.

10. Press (CLOSE) in the bottom right in the window.
    – The Load DX100 Spot Files window is closed.
1.15 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>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>GUN# (&lt;gun 1 condition file number&gt;)</td>
<td>1 to 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PRESS# (&lt;gun 1 pressure file number&gt;)</td>
<td>1 to 255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WP= &lt;gun 1 pressure value&gt;</td>
<td>1 to 9999N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WTM=&lt;gun 1 welding condition&gt;</td>
<td>1 to 255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WST=&lt;gun 1 welder startup timing&gt;</td>
<td>0 to 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BWS=&lt;gun 1 start stroke position&gt;</td>
<td>0.0 to 1000.0mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WGO=&lt;gun 1 group output&gt;</td>
<td>0 to 255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TH=&lt;gun 1 thickness&gt;</td>
<td>-999.9 to 999.9mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>THA=&lt;gun 1 thickness allowable range&gt;</td>
<td>0 to 100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>THM=&lt;gun 1 thickness allowable range&gt;</td>
<td>0 to 10.0mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GUN# (&lt;gun 2 condition file number&gt;)</td>
<td>1 to 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PRESS# (&lt;gun 2 pressure file number&gt;)</td>
<td>1 to 255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WP= &lt;gun 1 pressure value&gt;</td>
<td>1 to 9999N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WTM=&lt;gun 2 welding condition&gt;</td>
<td>1 to 255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WST=&lt;gun 2 welder startup timing&gt;</td>
<td>0 to 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BWS=&lt;gun 2 start stroke position&gt;</td>
<td>0.0 to 1000.0mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WGO=&lt;gun 2 group output&gt;</td>
<td>0 to 255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TH=&lt;gun 2 thickness&gt;</td>
<td>-999.9 to 999.9mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>THA=&lt;gun 2 thickness allowable range&gt;</td>
<td>0 to 100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>THM=&lt;gun 2 thickness allowable range&gt;</td>
<td>0 to 10.0mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GUN# (&lt;gun 3 condition file number&gt;)</td>
<td>1 to 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PRESS# (&lt;gun 3 pressure file number&gt;)</td>
<td>1 to 255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WP= &lt;gun 3 pressure value&gt;</td>
<td>1 to 9999N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WTM=&lt;gun 3 welding condition&gt;</td>
<td>1 to 255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WST=&lt;gun 3 welder startup timing&gt;</td>
<td>0 to 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BWS=&lt;gun 3 start stroke position&gt;</td>
<td>0.0 to 1000.0mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WGO=&lt;gun 3 group output&gt;</td>
<td>0 to 255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TH=&lt;gun 3 thickness&gt;</td>
<td>-999.9 to 999.9mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>THA=&lt;gun 3 thickness allowable range&gt;</td>
<td>0 to 100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>THM=&lt;gun 3 thickness allowable range&gt;</td>
<td>0 to 10.0mm</td>
</tr>
<tr>
<td></td>
<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
### SVGUNCL Function
Executes the gun pressure.

**Additional Item**
- **GUN#** (<gun 1 condition file number>) 1 to 12
- **PRESSCL#** (<dry pressure file number>) 1 to 32
- **WP** (<gun pressure value>) 1 to 9999N
- **PRESSSTWC** (<wear detection condition>)
- **DRS#** (<tip dress condition file number>) 1 to 16
- **TWC-A** (<wear detection motion>)
- **TWC-B** (<wear detection motion>)
- **TWC-C** (<wear detection motion>)
- **TWC-AE** (<tip mounting error detection motion>)
- **TWC-BE** (<tip mounting error detection motion>)
- **T** (<pressure time>)
- **ON/OFF** (<ON/OFF>)

**Example**
```
MOVL V=1000
SVGUNCL GUN#(1) PRESSCL#(1)
MOVL V=1000
```

### SVSPOTMOV Function
Executes the motion to the clearance position, the gun pressure and welding.

**Additional Item**
- **V** (<play speed>) 0.1 to the max speed mm/sec
- **VCL** (<gun pressure speed>) 0.1 to the max speed mm/sec
- **VOP** (<gun open speed>) 0.1 to the max speed mm/sec
- **PLIN** <position IN level > 0 to 8
- **PLOUT** <position OUT level > 0 to 8
- **CLF#** (<clearance file number>) 1 to 32
- **GUN#** (<gun condition file number>) 1 to 12
- **PRESS#** (<gun pressure file number>)
  - **WP** (<gun pressure value>) 1 to 255
  - **1 to 9999N**
- **WTM** (<welding condition>) 1 to 255
- **WST** (<welder startup timing>) 0 to 2
- **WGO** (<group output>) 0 to 255
- **TH** (<thickness>) -999.9 to 999.9mm
- **THA** (<thickness allowable range>) 0 to 100%
- **THM** (<thickness allowable range>) 0 to 10.0mm
- **BCOFF** (<bend compensation invalid>)

**Example**
```
SVSPOTMOV V=1600.0 CLF#(1) GUN#(1) PRESS#(1) WTM=1
WST=1
```
# Spot Welding Application Using a Motor Gun

## 1.15 The Instruction List (Motor Gun)

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
<th>Additional Item</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SVDRESMOV</strong></td>
<td>Executes the motion to the clearance position, the gun pressure and the dress.</td>
<td>V=&lt;play speed&gt;</td>
<td>SVDRESMOV V=1600.0 GUN#(1) DRS#(1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VCL=&lt;gun pressure speed&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>VOP=&lt;gun open speed&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PLIN= &lt;position IN level &gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PLOUT= &lt;position OUT level&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>GUN# (&lt;gun condition file number&gt;)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DRS# (&lt;tip dress condition file number&gt;)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DRESSON</strong></td>
<td>Rotates the dresser.</td>
<td>DRS# (&lt;tip dress condition file number&gt;)</td>
<td>DRESSON DRS#(1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>DRESSOF</strong></td>
<td>Stops rotating the dresser.</td>
<td>DRS# (&lt;tip dress condition file number&gt;)</td>
<td>DRESSOF DRS#(1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>GUNCHG</strong></td>
<td>Connects or disconnects the gun.</td>
<td>GUN# (&lt;gun condition file number&gt;)</td>
<td>GUNCHG GUN#(1) PICK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PICK (&lt;connect the gun&gt;)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PLACE (&lt;disconnect the gun&gt;)</td>
<td></td>
</tr>
</tbody>
</table>