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

YRC1000
OPERATOR’S MANUAL
FOR SPOT WELDING USING AIR GUN

MOTOMAN INSTRUCTIONS
MOTOMAN-INSTRUCTIONS
YRC1000 INSTRUCTIONS
YRC1000 OPERATOR’S MANUAL (GENERAL) (SUBJECT SPECIFIC)
YRC1000 MAINTENANCE MANUAL
YRC1000 ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)

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 “MAJOR ALARMS” and “MINOR ALARMS”.

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: 182902-1CD
Revision: 0

MANUAL NO. RE-CSO-A055
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”. 
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></td>
</tr>
<tr>
<td>Character Keys/Symbol Keys</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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</tr>
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<td>1-43</td>
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<tr>
<td>1.7 Instruction List</td>
<td>1-47</td>
</tr>
</tbody>
</table>
1 Spot Welding Application Using an Air Gun

1.1 System Overview of Spot Welding System Using an Air Gun

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

Fig. 1-1: I/O Signal Diagram for Spot Welding System

- **WELD COND** (level signal)
  - Sets the welding conditions for the welder.
  - The output format can be set as binary or discrete.
  - Can handle up to 255 conditions (for binary).

<table>
<thead>
<tr>
<th>8-bit</th>
<th>128</th>
<th>64</th>
<th>32</th>
<th>16</th>
<th>8</th>
<th>4</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>(8)</td>
<td>(7)</td>
<td>(6)</td>
<td>(5)</td>
<td>(4)</td>
<td>(3)</td>
<td>(2)</td>
<td>(1)</td>
<td></td>
</tr>
</tbody>
</table>

* Values in parentheses are for discrete.

- **WELD REQUEST** (level/pulse)
  - Outputs the start instruction to the welder.

- **WELD ERROR RESET** (level)
  - Resets the welding alarm status of the welder.

- **GUN PRESSURE** (level)
  - Outputs gun pressure instruction to the welding gun.
1.1 System Overview of Spot Welding System Using an Air Gun

• STROKE CHANGE (level)
  Select the stroke of the gun.
  • In case of single solenoid: Change by 1 signal
  • In case of double solenoid: Change by 2 signal

For details on signal contents, refer to chapter 1.6 Spot Gun Motion Control.
For details on I/O allocation, refer to chapter 1.6.5 "I/O Allocation".
1.2 Function Keys

Each function used for spot welding is allocated on [Numeric Key]s of the programming pendant. These keys become available when the WORK HOME POSITION is on the display.

<table>
<thead>
<tr>
<th>Function Key Combination</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[FWD] + [TASK ORIGIN]</td>
<td>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>[INTERLOCK] + [SPOT]</td>
<td>With the MANUAL SPOT window displayed, press these keys to perform manual welding.</td>
</tr>
<tr>
<td>[INTERLOCK] + [GUN CLOSE]</td>
<td>With the MANUAL SPOT window displayed, press these keys to perform manual dry spot welding.</td>
</tr>
<tr>
<td>[INTERLOCK] + [WELD ON/OFF]</td>
<td>Press these keys to turn on or off the welding ON/OFF signal.</td>
</tr>
</tbody>
</table>
### 1. Spot Welding Application Using an Air Gun

#### 1.2 Function Keys

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Instruction to change the stroke to the short open position when using a double stroke gun:** | Displays the STROKE SHORT instruction in the input buffer. The SHORT OPEN POSITION SETTING window appears the first time the key is pressed. The selection No. for the short open position appears from the second time the key is pressed. **[INTERLOCK] + [SHORT OPEN]**
| | The movable side electrode moves to the selected short open position. |
| **Instruction to change the stroke to the full open position when using a double stroke gun:** | Displays the STROKE LONG instruction in the input buffer. The FULL OPEN POSITION SETTING window appears the first time the key is pressed. The selection number for the full open position appears from the second time the key is pressed. **[INTERLOCK] + [FULL OPEN]**
| | The movable side electrode moves to the selected full open position. |
| **[INTERLOCK] + [WELD ALM RESET]** | A Power Source alarm reset signal is output to the Power Source only while these keys are held down. The welding conditions, gun pressure and weld request are reset with this function. |

However, the following two keys are for the function keys for spot welding with motor gun and not for spot welding with air gun.

<table>
<thead>
<tr>
<th>Function Keys</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Release</td>
</tr>
<tr>
<td>9</td>
<td>Release</td>
</tr>
</tbody>
</table>
1.3 Teaching

In order to use the air gun function, first perform teaching as described below.

1.3.1 Manual Spot Welding Function

To perform manual spot welding, carry out the following operation.

2. Press [INTERLOCK] + [SPOT] simultaneously.

To perform manual spot welding, press these keys simultaneously while the MANUAL SPOT window is called up.

The conditions displayed in the MANUAL SPOT window are used for manual spot welding.

Regarding the condition setting, refer to chapter 1.4.1 "Settings for Manual Spot Welding".

When registering the welding instruction [SPOT], the values set in the MANUAL SPOT window are used as the initial data.

1.3.1.1 Manual Dry Spotting

To perform manual dry spotting, carry out the following operation.

1. Press [0/MANUAL SPOT] of [Numeric Key]s
2. Press [INTERLOCK] + [GUN CLOSE] simultaneously.

To perform manual dry spotting, press these keys simultaneously while the MANUAL SPOT window is called up.

The conditions displayed in the MANUAL SPOT window are used for manual dry spotting.

Note that the numbers specified in the MANUAL SPOT window are used as the initial values for the gun number of the gun to be operated and the gun number used when registering the dry spot instruction GUNCL.

While the key is being pressed, the dry spotting motion is performed. When the key is released, the operation stops.

1.3.1.2 Stroke Switching

- Press [INTERLOCK] and [FULL OPEN] simultaneously to switch to the full open position.
- Press [INTERLOCK] and [SHORT OPEN] simultaneously to switch to the short open position.

Note that the numbers specified in the MANUAL SPOT window are used as the initial values for the gun number of the gun to be operated and the gun number used when registering the stroke switching instruction STROKE.

AP parameter specifies whether the stroke signal should be set ON or OFF to make the stroke full open. (The initial setting is OFF.)
1.3.1.3 Welding On/Off

Press [INTERLOCK] and [WELD ON/OFF] simultaneously in the teach mode to turn on or off the welding ON/OFF signal to all connected welders.

A user message appears when the welding ON/OFF signal is turned ON in the teach mode.

During manual spot welding, the welding current flows only when this message appears.

The output destination must be allocated in the spot input/output allocation information window before this function is used.

For information on the signal allocation method, see chapter 1.6.5 “I/O Allocation”.
1.3.1.4 Resetting Alarms

The alarm reset signal to all connected welders remains ON while [INTERLOCK] and [WELD ALM RESET] are being pressed simultaneously. The welding conditions, gun pressure and weld request are reset with this function.

The output destination must be allocated in the spot input/output allocation information window before this function is used.

For information on signal allocation method, see chapter 1.6.5 "I/O Allocation".
1.3 Teaching

1.3.2 Registering Work Instructions

The function keys [GUNCLOSE](GUNCL instruction), [SPOT](SPOT instruction), [SHORT OPEN]/[FULL OPEN](STROKE instruction) can be used for registering the work instructions.

The STRWAIT instruction is registered using [INSTRUCTION LIST].

Table 1-1: Registering Work Instructions

<table>
<thead>
<tr>
<th>Specific Keys</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>[GUNCLOSE]</td>
<td>GUNCL instruction</td>
</tr>
<tr>
<td>[SPOT]</td>
<td>SPOT instruction</td>
</tr>
<tr>
<td>[SHORT OPEN]</td>
<td>STROKE instruction</td>
</tr>
<tr>
<td>[FULL OPEN]</td>
<td></td>
</tr>
</tbody>
</table>

Instructions are registered during the teach mode when the cursor is in the address area of the job content window.

1. Select {JOB} under the main menu.
2. Select {JOB CONTENT}.

– The JOB CONTENT window is displayed.

3. Move the cursor to the address area.
1.3.2.1 GUNCL Instruction

This is the dry spotting instruction. It performs dry spotting for the specified time. The gun performs dry spotting then returns to the start position after the time-up timer counts out. Use this instruction when spotting is required, such as after automatic tip dressing or automatic tip replacement.

**NOTE**

Be sure to use this instruction in the short open status with a double stroke gun other than X double stroke mechanical stopper type gun.

The instruction controls only one gun at one time. Two guns cannot perform dry spotting simultaneously. When GUNCL instruction is executed, it takes a time for the stroke action and dry spotting time is shortened.

### Additional Items

1. **GUN# (X)**
   - Specifies a gun to be pressed.

2. **T = X**
   - Specifies the time when the gun is closed.

3. **ATT = X**
   - Starts execution of GUNCL X second(s) before reaching the move instruction located immediately before it. However, it is necessary to specify “NWAIT” to the move instruction immediately before the GUNCL instruction.

<table>
<thead>
<tr>
<th>GUN#(X)</th>
<th>T = X</th>
<th>ATT = X</th>
</tr>
</thead>
<tbody>
<tr>
<td>GUN NO.</td>
<td>GUN PRESSURE TIME</td>
<td>ANTICIPATION CONDITION</td>
</tr>
<tr>
<td>X: 1 to 8</td>
<td>X: 0.01 to 655.35 sec.</td>
<td>X: 0 to 655.35 sec.</td>
</tr>
</tbody>
</table>
1. Spot Welding Application Using an Air Gun
1.3 Teaching

**Operation Procedure**

1. Move the cursor to the line before the place where the GUNCL instruction is to be registered.
2. Press [2/GUN CLOSE] or [INSTRUCTION LIST].
3. Select the {GUNCL} instruction.
   - When [2/GUN CLOSE] is pressed, the “GUNCL” instruction appears in the input buffer line.
   - When [INSTRUCTION LIST] is pressed, the instruction list dialog appears. Select “GUNCL” from the list.
4. Move the cursor to the address area.
5. Add items and modify the number data.
6. Press [ADD], then press [ENTER].
   - The GUNCL instruction is registered.

**Example**

The gun pressure signal is turned ON 0.5 seconds before the manipulator reaches the step 5 position and then turns OFF after 2 seconds (1.5 seconds after reaching there) and moves to the execution of step 6.
This instruction starts the spot welding sequence. It outputs the gun pressure signal then executes the welding sequence appropriate for the gun type. The function key [SPOT] can be used for its registration.

The condition number used for the registration of the spot instruction is a value set on the manual spot condition window.

Two guns can be controlled simultaneously.

Under two-gun control, this instruction is completed when the gun with the slower welding sequence completes welding. See chapter 1.6 Spot Gun Motion Control for information on the welding sequence executed by this instruction.

**Additional Items**

1. **GUN # (X)**
   Specifies the number of welding condition set to the welder.

2. **MODE = X**
   Specifies the gun move operation mode.
   In the case of double stroke, specifies the open status before and after the welding.

3. **WTM = X**
   Specifies the number of welding conditions set to the welder.

4. **GUN # (X)**
   Specifies the second gun at two-gun control.
   Cannot be omitted at simultaneous two-gun control. Do not set when only one gun is used.

5. **MODE = X**
1 Spot Welding Application Using an Air Gun
1.3 Teaching

Specifies the operation mode of the second gun at two-gun control. Specifies the open status before and after welding in the case of double stroke. Do not set when only one gun is used. Setting data is the same as shown in the table in (2).

(6) WTM=X
Specifies the number of the welding conditions set to the second welder at two-gun control. Do not set when only one gun is used.

(7) ATT=X
Starts execution of SPOT X second(s) before reaching the move instruction immediately before it. However, it is necessary to specify "NWAIT" to the move instruction immediately before the SPOT instruction. By omitting this item, the SPOT instruction is executed as usual after reaching the move instruction.

■ Operation Procedure

1. Move the cursor to the line before the place where the SPOT instruction is to be registered.
2. Press [/SPOT] or [INSTRUCTION LIST].
   – When [/SPOT] is pressed, the “SPOT” instruction appears in the input buffer line.
   – When [INSTRUCTION LIST] is pressed, the instruction list dialog appears. Select {SPOT} from the list.

3. Add items and modify the number data.
4. Press [ADD], then press [ENTER].
   – The SPOT instruction is registered.
1.3 Teaching

■ Examples

The sequence of the SPOT instruction is started from the short open 0.5 seconds before the manipulator reaches the position of step 5. After completion of the sequence, the status becomes full open to move to the execution of step 6.

If the manipulator starts moving before the gun opens when gun open status is not verified, adjust the timing with the TIMER instruction as shown below.

Do not use the “ATT” unless it is indispensable. As the gun will be closed during the robot move operation by the use of ATT, the robot might possibly move with its gun closed. Set the ATT value after setting the ATT minimum value (0.01 seconds) and execute a confirmatory operation.
1.3.2.3 STROKE Instruction

This is an instruction to alternate short open and full open of a double stroke gun at any time other than welding.

It executes the stroke changes sequence with an X double stroke mechanical stopper type gun, and with the other double stroke guns, it changes the change signal to full open or to short open status.

This instruction can control only one gun at a time. Two guns cannot be pressed at the same time.

For details on the stroke change sequence of an X double stroke mechanical stopper type gun to be executed by this instruction, see chapter 1.6 Spot Gun Motion Control.

When using an X double stroke mechanical stopper type gun, stroke change is enabled only at pressing. With an execution of this instruction, the gun performs dry spotting: the stroke can be changed while the dry spotting is executed. (In case of the other types of guns, this instruction only turns the stroke change signal ON/OFF.)

Additional Items

- **GUN# (X)**
  - Specifies a gun characteristic file number of stroke to be changed.

- **LONG or SHORT**
  - Specifies the stroke status by alternating LONG and SHORT.

```
<table>
<thead>
<tr>
<th>STROKE</th>
<th>(1) GUN#(X)</th>
<th>(2) LONG/SHORT</th>
</tr>
</thead>
<tbody>
<tr>
<td>GUN NO.</td>
<td>X: 1 to 8</td>
<td>GUN STROKE</td>
</tr>
</tbody>
</table>
```
1. Operation Procedure

1. Move the cursor to the line before the place where the STROKE instruction is to be registered.

2. Press [-/SHORT OPEN], [3/FULL OPEN], or [INSTRUCTION LIST].
   - The “STROKE GUN#(1) SHORT” instruction appears in the input buffer line when [-/SHORT OPEN] is pressed; the “STROKE GUN#(1) LONG” instruction appears in the input buffer line when the key [3/FULL OPEN] is pressed.
   - When [INSTRUCTION LIST] is pressed, the instruction list dialog appears. Select (STROKE) from the list.

3. Add items and modify the number data.

4. Press [ADD], then press [ENTER].
   - The STROKE instruction is registered.

Example

Stroke is fully opened in order to avoid interference when the manipulator reaches the position of step 5. Then the manipulator moves to step 6 to avoid interference.
1.3.2.4 STRWAIT Instruction

This is an instruction to verify the double stroke gun status short open or full open, at any time other than welding. It waits until a signal to verify full open or short open is turned ON.

This instruction can control only one gun at a time; it cannot control two guns simultaneously.

- **Additional Items**

  - (1) **GUN# (X)**
    Specified a gun characteristic file number of which stroke is verified.

  - (2) **LONG or SHORT**
    Specifies the stroke status to be verified by alternating LONG and SHORT.

- **Operation Procedure**

  1. Move the cursor to the line before the place where the STRWAIT instruction is to be registered.

  2. Select the `{STRWAIT}` from the instruction list.

  3. Add items and modify the number data.

  4. Press [ADD], then press [ENTER].

    - The STRWAIT instruction is registered.

- **Example**

  Stroke is fully opened in order to avoid interference when the manipulator reaches the position of step 5. Then the STRWAIT instruction verifies that the stroke has become full open status and the manipulator moves to step 6 to avoid interference.
1.4 Setting Welding Conditions (for Air Gun)

1.4.1 Settings for Manual Spot Welding

- **Manual Spot Window**

  ![Manual Spot Window Diagram]

  **A. TWO GUN CONTROL**
  Specifies whether the simultaneous control is turned ON or OFF when using two guns.

  **B. GUN NO.**
  Specifies the gun number of the gun to be used for manual spot welding.

  **C. WELDING COND (WTM)**
  Specifies the manual spot welding condition number to be used for welding.

  **D. ACTION MODE**
  Specifies the gun operation mode.
  Shows the gun open status before and after the welding.
2. Select the desired mode.
3. Select the item to be set.
1.4.2 Spot Welder Condition Data Setting

The spot welder condition data file makes the welder-related settings using the welding sequence I/O signal control method.

- **Welder Condition Window**

<table>
<thead>
<tr>
<th>A. WELDER NO.</th>
<th>B. WELD INST OUTPUT TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welder (system) numbers are specified.</td>
<td>Specifies welder output start timing.</td>
</tr>
<tr>
<td>In the start timing, there are &quot;PULSE&quot;, &quot;LEVEL&quot;, and &quot;START SIGNAL&quot;.</td>
<td></td>
</tr>
</tbody>
</table>

- **PULSE**

  - PRESSURE COMMAND
  - WELDING CONDITION
  - WELDING COMMAND
  - WELD COMPLETE

- **LEVEL**

  - PRESSURE COMMAND
  - WELDING CONDITION
  - WELDING COMMAND
  - WELD COMPLETE
1.4 Setting Welding Conditions (for Air Gun)

C. WELD INST OUTPUT TIME
When “WELD INST OUTPUT TYPE” is specified as “PULSE” or “START SIGNAL”, set the welder condition signal to the pulse output time.
When “WELD INST OUTPUT TYPE” is specified as “LEVEL”, the time cannot be set.

D. WELD COND OUTPUT TYPE
Specifies welding condition output form.
There are two output forms: “BINARY” and “DISCRETE”.

E. WELD COND MAX NUM
Specifies the number of welding conditions that can be set.
When “WELD COND OUTPUT TYPE” is “DISCRETE”, the number of welding conditions cannot be set.

F. WELD END WAIT TIME
Specifies how many seconds to monitor the welding complete signal after the welding command is output from the SPOT instruction execution.
An alarm occurs if the welding complete signal is not received within the set time.

G. STICK DETECT DELAY TIME
Once the welding end signal has been input, set the length of wait time that the wire sticking signal should be observed.
After this wait time has elapsed, if a wire sticking signal has been input, an alarm occurs.
1. Select (SPOT WELDING) under the main menu.
2. Select (WELDER CONDITION).
3. Select the item to be set.
1.4.3 Spot Gun Condition Data File

Set the type of a gun, the number of the welder to be used, etc. for welding gun numbers 1 to 8.

- **Gun Condition Window**

  ![Gun Condition Window](image)

  **A. GUN NO.**
  Sets the gun condition file number.

  **B. GUN TYPE**
  Specifies the type of the welding gun. The sequence to be executed is specified by this value.
  Four gun-types are available:
  - Single Gun
  - C double stroke cylinder type gun
  - X double stroke mechanical stopper type gun
  - X double stroke cylinder type gun

  When the gun type other than the single gun is set, the new setting items are displayed.

  **C. WELDER NO.**
  Specifies the welder to which the gun is connected.

  **D. OPEN MONITOR**
  Specifies whether the short-open status is verified or not at welding sequence execution.

  **E. GUN OPEN/CLOSE SET AT STOP**
  Specifies the gun open/close setting for when a hold, emergency stop, or alarm occurs during welding instruction execution.
  - **ON**: welding instruction, welding condition, and pressure instruction are turned off.
  - **OFF**: welding instruction, welding condition are turned off.

  **F. FULL OPEN MONITOR**
  Specifies whether the full-open status is verified or not at welding sequence execution.

  **G. CHANGE TIME (OPEN -> FULL-OPEN)**
  Sets the time from when the welding completion signal is received to when the manipulator actually starts moving after becoming the short-open status or the full-open status.
  Valid when the full open monitor is OFF.
H. OPEN STROKE OUT DELAY TIME

Specifies the timing to change the stroke change signal to the short-open status after the gun pressure instruction is output (ON) when a mechanical stopper type gun is used. (Used when changing from the full-open status to the short-open status.)

This function can be used when the LS pressure is not set.

I. FULL OPEN STROKE OUT DELAY TIME

Specifies the timing to change the stroke change signal to the full-open status after the gun pressure instruction is output (ON) when a mechanical stopper type gun is used. (Used when changing from the short-open status to the full-open status.)

This function can be used when the LS pressure is not set.

J. STROKE CHANGE OUTPUT TIME

Sets the time to output the stroke change signal when a mechanical stopper type gun is used.
1. Spot Welding Application Using an Air Gun
2. Setting Welding Conditions (for Air Gun)

**Operation Procedure**

1. Select {SPOT WELDING} under the main menu.
2. Select {GUN CONDITION}.
   - The GUN CONDITION window is displayed.
3. Select the item to be set.
1.5 Spot Welding Diagnosis

1.5.1 Spot Welding Diagnosis Window

This window shows the maintenance information for tip replacement. It shows the set number of welds to tip replacement and the number currently completed.

1.5.1.1 Setting Tolerance Value

1. Select (SPOT WELDING) under the main menu.
2. Select (WELD DIAGNOSIS).
3. Select “GUN NO.”
   – Enter the desired gun number, and press [ENTER].
4. Select “TOLERANCE”.
   – Input the desired tip replacement value, and press [ENTER].
1. Select {SPOT WELDING} under the main menu.
2. Select {WELD DIAGNOSIS}.
   - The SPOT WELD DIAGNOSIS window appears.
3. Select {CLEAR CURRENT POS} from {DATA}.
4. Select “YES”.
   - The confirmation dialog appears.
   - The current tip hit count is cleared.
1.6 Spot Gun Motion Control

As regards to the guns for each stroke methods, the motion control described in chapter 1.6.1 “Gun Motion Control” can be executed. The following gun types are available:

- X, C types single stroke method
- X type double stroke method
- C type double stroke method

1.6.1 Gun Motion Control

The ways to control the gun motions are shown on the following pages.

1.6.1.1 X Type Gun

- **Single stroke**

  ![Diagram of Single Stroke Motion]

  - SHORT OPEN → WELD → SHORT OPEN

- **Double stroke**

  ![Diagram of Double Stroke Motion]

  - SHORT OPEN → WELD → SHORT OPEN
  - FULL OPEN → WELD → SHORT OPEN
  - SHORT OPEN → WELD → FULL OPEN
1.6 Spot Gun Motion Control

- Stroke change

1.6.1.2 C Type Gun

- Single stroke

- Double stroke
1.6 Spot Gun Motion Control

- Stroke change

- SHORT OPEN → WELD → FULL OPEN
- FULL OPEN → WELD → FULL OPEN
- FULL OPEN → SHORT OPEN
1.6.2 Process Timing

1.6.2.1 OPERATION MODE = 0 (SINGLE GUN, OPEN → WELDING → OPEN)

- **Gun Motion Control (With X gun, C gun, single type)**

  Manipulator starts moving by welding completion (Input) signal when "GUN OPEN" is not specified in spot input allocation information display.

  Turns ON/OFF welding instruction, welding condition and pressure instruction simultaneously. However, strictly speaking, output welding instruction follows immediately after welding condition output.

  In case if the "GUN OPEN" is OFF, manipulator starts moving immediately after the OFF of the signal.

**NOTE**

Connect “OPEN DETECTION” signal for “GUN OPEN” signal in case of using a single gun.
1.6.3 OPERATION MODE = 1 (SHORT OPEN → WELDING → SHORT OPEN)

- **Gun Motion Control (With C gun double stroke)**
  (With X gun double stroke, cylinder type)

  Manipulator starts moving by welding completion (Input) signal when "GUN OPEN" is not specified in spot input allocation information display.

  Turns ON/OFF welding instruction, welding condition and pressure instruction simultaneously. However, strictly saying, output welding instruction immediately after welding condition output.

  Stroke Change (Output) characteristic can be changed by parameter (Figure shows on setting at FULL OPEN).

  In case if the "GUN OPEN" is OFF, manipulator starts moving immediately after the OFF of the signal.

- **Gun Motion Control (With X gun double stroke, mechanical stopper type)**

  Manipulator starts moving by welding completion (Input) signal when "GUN OPEN" is not specified in spot input allocation information display.

  Turns ON/OFF welding instruction, welding condition and pressure instruction simultaneously. However, strictly saying, output welding instruction immediately after welding condition output.

  Stroke change is of a double solenoid method (Stroke Change 1, 2) when an x gun double stroke mechanical stopper type is used.

  In case if the "GUN OPEN" is OFF, manipulator starts moving immediately after the OFF of the signal.
1.6.3.1 OPERATION MODE = 2 (SHORT OPEN → WELDING → FULL OPEN)

**Gun Motion Control (With C gun double stroke)**

*With X gun double stroke, cylinder type*

- **Gun Motion Control (With C gun double stroke)**
- **(With X gun double stroke, cylinder type)**

Stroke change (Output) characteristics can be changed by parameter.

When "FULL OPEN MONITOR" is OFF in spot gun condition data file operation starts elapse of "CHANGE TIME (OPEN -> FULL OPEN)" of spot gun condition data file after stroke change (Output) is output.

**Signal Control Order**

- **Manipulator Movement**
- **Welding Instruction (Output)**
- **Welding Conditions (Output)**
- **Pressure Instruction (Output)**
- **Complete of Welding (Input)**
- **Stroke Change (Output)**
- **Gun Short Open Detection (Input)**
- **Gun Full Open Detection (Input)**

Turns ON/OFF welding instruction, welding condition and pressure instruction simultaneously. However, strictly saying, output welding instruction immediately after welding condition output.

**Mechanical Stopper Type**

- **X Mechanical Stopper Type**
- **Stopper Stroke Change Output Time**

Stroke Change (Output) is output for the time set to "STRIK CHANGE OUT TIME(STOPPER)" of spot gun condition data file.

When "GUN PRESSUREDETECTION" is not set, Stroke Change (Output) is output in elapse of "FULL-OPEN STRK OUT DLY(STOPPER)" of spot gun condition data file after pressure instruction is output.

When "FULL OPEN MONITOR" is OFF in spot gun condition data file, operation starts elapse of "CHANGE TIME(OPEN -> FULL OPEN)" of gun condition data file after stroke change (Output) is output.

**Signal Control Order**

- **Manipulator Movement**
- **Welding Instruction (Output)**
- **Welding Conditions (Output)**
- **Pressure Instruction (Output)**
- **Complete of Welding (Input)**
- **Stroke Change 1 (Output)**
- **X Mechanical Stopper Type**
- **Stroke Change 2 (Output)**
- **X Mechanical Stopper Type**
- **Gun Pressure Detection (Input) X Mechanical Stopper Type**
- **Gun Short Open Detection (Input)**
- **Gun Full Open Detection (Input)**

- **Stopper Stroke Change Output Time**

When "FULL OPEN MONITOR" is OFF in spot gun condition data file operation starts elapse of "CHANGE TIME(OPEN -> FULL OPEN)" of gun condition data file after stroke change (Output) is output.
1.6.3.2 OPERATION MODE = 3 (FULL OPEN → WELDING → SHORT OPEN)

- **Gun Motion Control (With C gun double stroke)**
  (With X gun double stroke, cylinder type)

  - **Signal Control Order**
    - **Manipulator Movement**
    - **Welding Instruction (Output)**
    - **Welding Conditions (Output)**
    - **Pressure Instruction (Output)**
    - **Complete of Welding (Input)**
    - **Stroke Change (Output)**
    - **Gun Short Open Detection (Input)**
    - **Gun Full Open Detection (Input)**

  - **Anticipator Designation**
    - Turns ON/OFF welding instruction, welding condition and pressure instruction simultaneously. However, strictly saying, output welding instruction immediately after welding condition output.
    - Stroke Change (Output) characteristics can be changed by parameter.
    - When "OPEN MONITOR" is OFF in spot gun condition data file, operation starts moving after welding completion signal (Input) is input.

- **Gun Motion Control (With X gun double stroke, mechanical stopper type)**

  - **Signal Control Order**
    - **Manipulator Movement**
    - **Welding Instruction (Output)**
    - **Welding Conditions (Output)**
    - **Pressure Instruction (Output)**
    - **Complete of Welding (Input)**
    - **Stroke Change 1 (Output)**
    - **Stroke Change 2 (Output)**
    - **Gun Pressure Detection (Output)**
    - **Gun Short Open Detection (Input)**
    - **Gun Full Open Detection (Input)**

  - **Stopper Type**
    - Output Time
    - When "GUN PRESSURE DETECTION" is OFF, Stroke Change (Output) is output in elapse of "OPEN STRK OUT DLY (STOPPER)" time after pressure instruction is output.
    - When "OPEN MONITOR" is OFF, manipulator starts moving after welding completion signal (Input) is input.
1.6 Spot Gun Motion Control

### 1.6.3.3 OPERATION MODE = 4 (FULL OPEN → WELDING → FULL OPEN)

- **Gun Motion Control (With C gun double stroke)**
  (With X gun double stroke, cylinder type)

  - **Gun Motion Control (With X gun double stroke, mechanical stopper type)**

When "FULL-OPEN MONITOR" is OFF, manipulator starts moving after elapse of "CHANGE TIME (OPEN - > FULL OPEN)" of gun condition file.
1.6.4 Stroke Change Control Method

1.6.4.1 Single Gun, C Double Gun, X Double Cylinder Gun

When OPEN (SHORT) is specified, change the stroke change signal (general output) to short open; when FULL OPEN (LONG) is specified, change the stroke change 1 signal (general output) to full open. However, the stroke change signal ON/OFF characteristics depend on the AP parameter setting.

**For the use of C double gun, X double cylinder gun with double solenoid specifications:**

Set signal numbers for stroke change 1 and 2 in the spot I/O allocation information window. The inverse signal of stroke change 1 is output as stroke change 2 signal.

1.6.4.2 X Double Mechanical Stopper Type

Stroke change signal (output) is output with double solenoid specifications. The stroke change signal ON/OFF characteristics depend on the AP parameter setting.

- **When OPEN (SHORT) is Specified**

  **Process Timing**

  ![Diagram of process timing](image)
When FULL OPEN (LONG) is Specified

Process Timing

- When FULL OPEN (LONG) is Specified
  - Process Timing
    - When FULL OPEN (LONG) is Specified
      - Process Timing
        - Stopper Type Stroke Full Open Output Delay Time (when pressure detection OFF)
        - Stopper Type Stroke Change Output Time
        - Gun Pressure Detection (Input)
        - Gun Short Open Detection (Input)
        - Gun Full Open Detection (Input)
        - Pressure Instruction (Output)
        - Stroke Change 2 (Output)
        - Stroke Change 1 (Output)
        - Manipulator Movement
        - Signal Control Order
          - Pressure Instruction (Output)
          - Stroke Change 2 (Output)
          - Stroke Change 1 (Output)
          - Gun Pressure Detection (Input)
          - Gun Short Open Detection (Input)
          - Gun Full Open Detection (Input)
          - Manipulator Movement
          - Signal Control Order

When pressure detection is OFF, stroke is changed after elapse of stopper type stroke full open output delay time.
Manipulator moves immediately without detecting when full open detection is OFF.
1.6 Spot Gun Motion Control

1.6.5 I/O Allocation

The I/O necessary for each welder can be set in the general-purpose I/O signal. The following signals are specified on the pseudo input signal window.

- Timer Cooling Water Error
- Gun Cooling Water Error
- Transthermo Error
- Air Pressure Decrease
- Weld On/Off

1.6.5.1 Input Allocation Window

1. Select (SPOT WELDING) under the main menu.

2. Select (I/O ALLOCATION).

   – The input allocation window appears.

3. Specify the signal number.

   – Input the numerical value of the desired signal number, and press [ENTER].
1.6.5.2 Output Allocation Window

1. Select {SPOT WELDING} under the main menu.
2. Select {I/O ALLOCATION}.

– The input allocation window appears.
3. Select {DISPLAY} from {DATA}.

– The output allocation window appears.
4. Select {ALLOCATE OUTPUT}.

– The output allocation window appears.
5. Specify the signal number.
   – Input the numerical value of the desired signal number, and press [ENTER].

   **NOTE**
   • Be sure to confirm that the allocated general-purpose signal is not used in the job. If it is used in the job, the signal is duplicated and the job does not operate normally.
   • When the output "WELDING CONDITION PARITY" is set, the parity number is automatically output during welding condition output. The setting of the parity whether it is odd or even is established in the parameter.
   • In case if the stroke switching signal is the double-solenoid type (X type 2 step stroke gun mechanical stopper type), allocate two guns; in case if it is the single-solenoid type (other guns), allocate one gun.

1.6.5.3 Pseudo Input Signal Window

1. Select (IN/OUT) under the main menu.
2. Select (PSEUDO INPUT SIG).

   The pseudo input signal window appears.

3. Move the cursor to “ON” or “OFF”, and press [INTERLOCK] + [SELECT].
   – Each time [INTERLOCK] + [SELECT] is pressed, “O (OFF)” and “● (ON)” alternate.
### 1.6.6 Allocation Signal Meanings

**Table 1-2: Robot Controller Input Signal**

<table>
<thead>
<tr>
<th>Signal</th>
<th>Content</th>
<th>Source</th>
<th>Standard Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>WELD COMPLETE</td>
<td>This signal specifies that welding has been completed. When the welding command manual spot operation is executed, it is used as a confirmation signal. When there is no LS open/close confirmation, the welding sequence ends and the next step is executed.</td>
<td>Welder</td>
<td>IN13</td>
</tr>
<tr>
<td>WELD ERR</td>
<td>This signal specifies an error in welding results or in the welder. During welding, an alarm occurs and the robot stops.</td>
<td>Welder</td>
<td>IN14</td>
</tr>
<tr>
<td>WIRE STICK DETECT</td>
<td>Specifies when a wire stick is detected. An alarm occurs and the robot stops.</td>
<td>Wire Stick Detector, Welder</td>
<td>NOT USED</td>
</tr>
<tr>
<td>TMR COOL WTR ERR</td>
<td>Specifies a timer cool water error. An alarm occurs and the robot stops. The servo power stays on.</td>
<td>Cool Water Flow Switch</td>
<td>IN9</td>
</tr>
<tr>
<td>GUN COOL WTR ERR</td>
<td>Specifies a gun cool water error. An alarm occurs and the robot stops. The servo power stays on.</td>
<td>Cool Water Flow Switch</td>
<td>IN10</td>
</tr>
<tr>
<td>TRANSTHERMO ERROR</td>
<td>Specifies an error from the gun transformer is transmitted directly to the robot controller. It is normally ON (NC), and when OFF, an alarm occurs. The servo power stays on.</td>
<td>Gun Transformer</td>
<td>IN11</td>
</tr>
<tr>
<td>WELD ON/OFF (from PLC)</td>
<td>Interlock circuit board, etc. PLC welder ON/OFF select switch. Welder status signal which outputs welder ON/OFF signal. While in the ON status, if the welder is switched OFF, spot welding is not performed.</td>
<td>Interlock Circuit Board, etc.</td>
<td>CN308-B6</td>
</tr>
<tr>
<td>TIP REPLACE COMPLETE</td>
<td>If this signal occurs after tip replacement, turn off the tip replacement demand signal, and the tip hit count is cleared.</td>
<td>Interlock Circuit Board, etc.</td>
<td>IN16</td>
</tr>
<tr>
<td>GUN FULL OPEN DETECT</td>
<td>When there is a 2 step stroke gun, this signal specifies stroke full open status.</td>
<td>Welding Gun (Full Open Status Detect LS)</td>
<td>NOT USED</td>
</tr>
<tr>
<td>GUN OPEN DETECT</td>
<td>The open/close confirmation LS of a single gun and short open confirmation LS of the 2 step stroke gun are connected, and the gun open/close confirmation is performed.</td>
<td>Welding Gun (Open/Close Confirmation Detect LS)</td>
<td>IN15</td>
</tr>
<tr>
<td>GUN PRESS DETECT</td>
<td>Specifies the gun pressure status.</td>
<td>Welding Gun (Pressure Status Detect LS)</td>
<td>NOT USED</td>
</tr>
<tr>
<td>AIR PRESS LOW</td>
<td>An alarm occurs if the air pressure is low. The servo power stays on.</td>
<td></td>
<td>IN12</td>
</tr>
</tbody>
</table>
### Table 1-3: Robot Controller Output Signal

<table>
<thead>
<tr>
<th>Signal</th>
<th>Content</th>
<th>Source</th>
<th>Standard Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>WELD COND (Level Signal)</td>
<td>Specifies the welding condition for the welder. Binary/discrete (bit number) can be selected as the output format. Corresponding to 255 conditions or less (Parity Bit Specification) is the most significant bit.</td>
<td>Welder</td>
<td>OUT19 used from 4 bit</td>
</tr>
<tr>
<td>1 (1)</td>
<td></td>
<td></td>
<td>OUT19</td>
</tr>
<tr>
<td>2 (2)</td>
<td></td>
<td></td>
<td>OUT20</td>
</tr>
<tr>
<td>4 (3)</td>
<td></td>
<td></td>
<td>OUT21</td>
</tr>
<tr>
<td>8 (4)</td>
<td></td>
<td></td>
<td>OUT22</td>
</tr>
<tr>
<td>16 (5)</td>
<td></td>
<td></td>
<td>NOT USED</td>
</tr>
<tr>
<td>32 (6)</td>
<td></td>
<td></td>
<td>NOT USED</td>
</tr>
<tr>
<td>64 (7)</td>
<td></td>
<td></td>
<td>NOT USED</td>
</tr>
<tr>
<td>128 (8)</td>
<td></td>
<td></td>
<td>NOT USED</td>
</tr>
<tr>
<td>WELD COMMAND</td>
<td>The start instruction is output to the welder. It is not necessary for welders which assume the welding condition signal is a start instruction.</td>
<td>Welder</td>
<td>NOT USED</td>
</tr>
<tr>
<td>WELD ERR RESET</td>
<td>Resets the welder after welder error status. Programming pendant operation output.</td>
<td>Welder</td>
<td>OUT18</td>
</tr>
<tr>
<td>WELD ON/OFF</td>
<td>Screens the robot situation when a signal is input from the interlock circuit board, etc., and outputs.</td>
<td>Welder</td>
<td>OUT17</td>
</tr>
<tr>
<td>TIP CHANGE REQUEST</td>
<td>Specifies when the set tip hit count limit has been reached.</td>
<td>Interlock Circuit Board, etc.</td>
<td>OUT9</td>
</tr>
<tr>
<td>GUN PRESS COMMAND</td>
<td>Outputs gun pressure command.</td>
<td>Welding Gun</td>
<td>NOT USED</td>
</tr>
<tr>
<td>STROKE CHANGE</td>
<td>When using a 2 step stroke gun, welder open/close status can be changed.</td>
<td>Welding Gun</td>
<td>NOT USED</td>
</tr>
<tr>
<td>Single Solenoid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double Solenoid</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Monitor Function for Spot Welding Equipment

**Table 1-4: Function List**

<table>
<thead>
<tr>
<th>Function</th>
<th>Content</th>
<th>Signal Condition</th>
<th>Method of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR PRESS LOW Input Signal</td>
<td>When the air pressure is low and this signal turns on, an alarm occurs. The servo power stays on. This function signal must be set in the Concurrent I/O Parameter.</td>
<td>Normal: OFF (NO) Signal Function</td>
<td>This signal can be used during the low air pressure signal in the spot input allocation display if the set general-purpose input external input is on. To reset the alarm, turn the signal off, and it will return to the alarm reset operation.</td>
</tr>
<tr>
<td>TIMER COOL WATER ERROR GUN COOL WATER ERROR</td>
<td>When the water cooling is low and this signal turns on, an alarm occurs. The servo power stays on. This function signal must be set in the Concurrent I/O Parameter.</td>
<td>Normal: OFF (NO) Signal Function</td>
<td>This signal can be used during the low water cooling signal in the spot input allocation display if the set general-purpose input external input is on. To reset the alarm, turn the signal off, and it will return to the alarm reset operation.</td>
</tr>
<tr>
<td>TRANSTHERMO ERROR</td>
<td>When a gun transformer error occurs, this input turns off and an alarm occurs. The servo power stays on. This function signal must be set in the Concurrent I/O Parameter.</td>
<td>Normal: ON (NC) Signal Function</td>
<td>Even though usually a timer error is transmitted to the timer from the gun, and the main signal is transmitted from the gun transformer, an alarm may occur. Also if the pressure, full open status, short open status signal, etc. is transmitted from the robot controller, the signal line from the timer to the gun becomes a transthermo error only. If this signal is checked on the robot side, the signal line transmitted to the timer disappears, and the cable handling is made easier.</td>
</tr>
</tbody>
</table>
### 1.6.8 Spot Welding Exclusive Signal Allocation List

- **O:** Connector
- ** Satoshi:** Connector and terminal block

#### Table 1-5: Spot Welding Exclusive Signal Allocation List (20010 to 20037)

<table>
<thead>
<tr>
<th>Input Signal Number</th>
<th>Input Method</th>
<th>Signal Name</th>
<th>No Allocation Set</th>
<th>Allocation Set</th>
</tr>
</thead>
<tbody>
<tr>
<td>20010</td>
<td>O</td>
<td>EXTERNAL START</td>
<td>EXTERNAL START</td>
<td></td>
</tr>
<tr>
<td>20011</td>
<td>O</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>20012</td>
<td>O</td>
<td>MASTER JOB CALL</td>
<td>MASTER JOB CALL</td>
<td></td>
</tr>
<tr>
<td>20013</td>
<td>O</td>
<td>ALARM/ ERROR RESET</td>
<td>ALARM/ ERROR RESET</td>
<td></td>
</tr>
<tr>
<td>20014</td>
<td>O</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>20015</td>
<td>O</td>
<td>SELECT PLAY MODE</td>
<td>SELECT PLAY MODE</td>
<td></td>
</tr>
<tr>
<td>20016</td>
<td>O</td>
<td>SELECT TEACH MODE</td>
<td>SELECT TEACH MODE</td>
<td></td>
</tr>
<tr>
<td>20017</td>
<td>O</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>20020</td>
<td>O</td>
<td>INTERFERENCE 1 ENTANCE PROHIBITED</td>
<td>INTERFERENCE 1 ENTANCE PROHIBITED</td>
<td></td>
</tr>
<tr>
<td>20021</td>
<td>O</td>
<td>INTERFERENCE 2 ENTANCE PROHIBITED</td>
<td>INTERFERENCE 2 ENTANCE PROHIBITED</td>
<td></td>
</tr>
<tr>
<td>20022</td>
<td>O</td>
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## Table 1-6: Spot Welding Exclusive Signal Allocation List (30010 to 30037)

<table>
<thead>
<tr>
<th>Output Signal Number</th>
<th>Input Method</th>
<th>Signal Name</th>
<th>No Allocation Set</th>
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<tbody>
<tr>
<td>30010</td>
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<td>30011</td>
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1 Spot Welding Application Using an Air Gun
1.6 Spot Gun Motion Control

O: Connector
Ο: Connector and terminal block

Table 1-7: Spot Welding Exclusive Signal Allocation List (20040 to 20067)

<table>
<thead>
<tr>
<th>Output Signal Number</th>
<th>Input Method</th>
<th>Signal Name</th>
<th>No Allocation Set</th>
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### Spot Welding Application Using an Air Gun

#### 1.6 Spot Gun Motion Control

O :Connector

⊗ :Connector and terminal block

<table>
<thead>
<tr>
<th>Output Signal Number</th>
<th>Input Method</th>
<th>Signal Name</th>
<th>No Allocation Set</th>
<th>Allocation Set</th>
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### 1.7 Instruction List

Data variables are denoted in parentheses "<>". If multiple items are shown in one section, select one of the items.

**Table 1-9: Spot Welding Instructions**

<table>
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<tr>
<th>GUNCL</th>
<th>Function</th>
<th>Format</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Presses a gun.</td>
<td>GUN # (&lt;gun No.&gt;) 1-8</td>
<td>MOVL V=1000 NWAIT GUNCL GUN # (1) T=2.0 ATT=0.5 MOVL V=1000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T=&lt;gun pressing time (sec.)&gt; 0.01-655.35</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ATT=&lt;anticipator condition (sec.)&gt; 0-655.35</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>MOVL V=1000 NWAIT GUNCL GUN # (1) T=2.0 ATT=0.5 MOVL V=1000</td>
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</tbody>
</table>

<table>
<thead>
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<th>SPOT</th>
<th>Function</th>
<th>Format</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start up the welding sequence from gun pressure.</td>
<td>GUN # (&lt;gun 1 No.&gt;) 1-8</td>
<td>MOVL V=1000 NWAIT SPOT GUN # (1) MODE=2 WTM=2 ATT=0.5 MOVL V=1000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MODE=&lt;gun 1 operation mode specification&gt; 0-4</td>
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<td>WTM=&lt;gun 1 welding condition&gt; 1-255</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>GUN # (&lt;gun 2 No.&gt;) 1-8</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>MODE=&lt;gun 2 operation mode specification&gt; 0-4</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>WTM=&lt;gun 2 welding condition&gt; 1-255</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>ATT=&lt;anticipator condition (sec.)&gt; 0-655.35</td>
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<table>
<thead>
<tr>
<th>STROKE</th>
<th>Function</th>
<th>Format</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Alternates short open and full open of a double stroke gun at any time than welding.</td>
<td>GUN # (&lt;gun No.&gt;) 1-8</td>
<td>MOVL V=1000 STROKE GUN #(1) LONG MOVL V=1000</td>
</tr>
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<td>LONG</td>
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<tr>
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<td>SHORT</td>
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</tr>
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YRC1000
OPERATOR’S MANUAL
FOR SPOT WELDING USING AIR GUN

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