YRC1000 OPTIONS INSTRUCTIONS
FOR MULTISTEP PRESSURE FUNCTION

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

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: 182145-1CD
Revision: 0
DANGER

• This manual explains the multistep pressure function of the YRC1000 system. Read this manual carefully and be sure to understand its contents before handling the YRC1000. Any matter, including operation, usage, measures, and an item to use, not described in this manual must be regarded as "prohibited" or "improper".

• General information related to safety are described in "Chapter 1. Safety" of the YRC1000 INSTRUCTIONS. To ensure correct and safe operation, carefully read "Chapter 1. Safety" of the YRC1000 INSTRUCTIONS.

CAUTION

• In some drawings in this manual, protective covers or shields are removed to show details. Make sure that all the covers or shields are installed in place before operating this product.

• YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids the product warranty.

NOTICE

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

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

• If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. 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>Character Keys /Symbol Keys: The keys which have characters or symbols printed on them are denoted with [ ]. ex. [ENTER]</td>
</tr>
<tr>
<td></td>
<td>Axis Keys /Numeric Keys: [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 ™ are omitted.
Contents

1  Multistep Pressure Function ................................................................. 1-1
   1.1  Features ....................................................................................... 1-1
   1.2  Restrictions .............................................................................. 1-3

2  How to Use the Multistep Pressure Function .............................................. 2-1
   2.1  Setting the Functions of the Multistep Pressure Function .................. 2-1
      2.1.1  Pressure File Window .......................................................... 2-1
      2.1.2  DETAIL EDIT Window ......................................................... 2-2
      2.1.3  Details of the SVSPOT Instruction ......................................... 2-4
      2.1.4  Details of the SVSPOTMOV Instruction ................................. 2-5
   2.2  Corrective Action in the Event that a WELD COMPLETE SIGNAL ERROR Alarm Occurs  2-6
1 Multistep Pressure Function

The conventional spot welding instruction (SVSPOT/SVSPOTMOV) was ended, and the motor gun was opened, when one welding completion signal was received. The multistep pressure function is an extension of the conventional welding command. It starts the power source multiple times (maximum of four times) during the first opening and closing operation of the motor gun, enabling high quality spot welding to be realized.

1.1 Features

The multistep pressure function has the functions and features indicated in the table below.

<table>
<thead>
<tr>
<th>No.</th>
<th>Functions and Features</th>
<th>Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>It extends the SVSPOT/SVSPOTMOV instruction, and permits multistage pressurization in up to four steps.</td>
<td>Higher quality spot welding can be realized.</td>
</tr>
<tr>
<td>2</td>
<td>The number of pressurization steps can be specified in the DETAIL EDIT window for the SVSPOT/SVSPOTMOV instruction.</td>
<td>The number of pressurization steps can be varied between one and four times.</td>
</tr>
<tr>
<td>3</td>
<td>Multiple “END WAIT” settings can be made in the pressure file window.</td>
<td>The pressure value at each step of multistep pressurization can be set in detail.</td>
</tr>
</tbody>
</table>

The operation of the motor gun during multistep pressurization, and the relationship between the gun pressure and the signal are as shown in the figure below.

Motor gun operation (SVSPOTMOV, 2-Step pressure)

- Teaching of the pressurization points is done by pressurization teaching. The gun stroke is set in the clearance file.
- A welding command is output twice, and welding takes place twice. Welding is completed at the second welding completion signal.
1 Multistep Pressure Function

1.1 Features

- Relationship between the gun pressure and the signal

When the pressure reaches the first pressure value after the motor gun touched the workpiece, the welding start signal is output to the timer.

As soon as the first welding completion signal is input from the timer, the motor gun proceeds to the second pressure value.

After the second pressure value is reached, the second welding start signal is output.

As soon as the second welding completion signal is input from the timer, the motor gun stops pressurization, and then opens.
1.2 Restrictions

1. The maximum number of multistep pressurizations in this function is the upper limit (four) of the number of pressurization settings in “Pressure file.”

2. The “welding conditions group output: WGO=” is common for one multistep pressurization welding operation. (The welding conditions group output value in each welding condition output cannot be changed during multistep pressurization welding.)

3. When multistep pressurization welding is taking place, I/O output control of the power source start signal according to "WELD COND OUTPUT TYPE" in the WELDER I/F file and “STARTUP TIMING (WST)” is applied only to the first start signal output. The second and subsequent start signal outputs are assumed to level-output "WELDING COND (WTM)" and "WELDING COMMAND" at the same timing.

4. The execution timing for bending correction is the same as that of the former controller. (Bending correction does not take place during the second and subsequent pressurization welding phases.)

5. When the power source is restarted after being interrupted during multistep pressurization welding, the welding sequence from the first pressurization is reattempted.

6. The actual pressure values in the case where the pressure rises from the first pressure value to the Nth pressure value may differ from the corresponding values in the case where the pressure falls, due friction torque, for example, even when the set pressure values on the gun pressure window are the same.
2 How to Use the Multistep Pressure Function

2.1 Setting the Functions of the Multistep Pressure Function

2.1.1 Pressure File Window

When the multistep pressure function is enabled, “END WAIT” can be set multiple times in the pressure specified in the pressure file window.

The end condition between the first and fourth pressurization can be selected from the following table.

<table>
<thead>
<tr>
<th>Pressure</th>
<th>Selectable END CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ST PRESS</td>
<td>PRESS TIME, END WAIT</td>
</tr>
<tr>
<td>2ND PRESS</td>
<td>PRESS TIME, END WAIT, UNUSED</td>
</tr>
<tr>
<td>3RD PRESS</td>
<td>PRESS TIME, END WAIT, UNUSED</td>
</tr>
<tr>
<td>4TH PRESS</td>
<td>END WAIT, NOT USED</td>
</tr>
</tbody>
</table>

If “UNUSED” is selected, the subsequent pressurization operations will be ignored, and nothing will be displayed.

If “PRESS TIME” or “END WAIT” is selected, the pressurization operations for the subsequent steps will be displayed.

Select “END WAIT” as the end condition for the last step. If “DONE” is set while the “PRESS TIME” remains selected, “Error 2210: Illegal data setting” will occur.

Example: In case of 3-step pressure

<table>
<thead>
<tr>
<th>PRESS NO.</th>
<th>END CONDITION</th>
<th>END CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>T001</td>
<td>1000</td>
<td>END WAIT</td>
</tr>
<tr>
<td>T002</td>
<td>2000</td>
<td>END WAIT</td>
</tr>
<tr>
<td>T003</td>
<td>3000</td>
<td>END WAIT</td>
</tr>
<tr>
<td>T004</td>
<td>4000</td>
<td>UNUSED</td>
</tr>
</tbody>
</table>

Press: T001 1000 END WAIT
Press: T002 2000 END WAIT
Press: T003 3000 END WAIT
Press: T004 4000 UNUSED

Press: Done

Comment: No comment.
2.1.2 DETAIL EDIT Window

While the multistep pressure function is enabled, make a selection to enable the item for setting the number of welding to be displayed, using the DETAIL EDIT window for the SVSPOT/SVSPOTMOV instruction. As a result, the "WELD COND NO.." of the set number of steps will be set.

Example: In case switching from 1-step pressure to 2-step pressure

1. Open the DETAIL EDIT window of the SVSPOT instruction or the SVSPOTMOV instruction.

2. Move the cursor to "WELD COND NO. 2."

3. Press [SELECT], and the selection dialog box appears.
2 How to Use the Multistep Pressure Function

2.1 Setting the Functions of the Multistep Pressure Function

4. Move the cursor to "WTM2=" and press [SELECT]. Then, it becomes possible to set the second step welding condition number, and select whether to use the third step welding condition number or not.

In addition, to switch from 2-step pressure to 1-step pressure, select "UNUSED" in 3. above.
2.1.3 Details of the SVSPOT Instruction

The SVSPOT instruction that exists when the multistep pressure function is enabled consists of the following instruction configuration. The motor gun opens as soon as welding for the last step is completed.

SVSPOT GUN#(1) PRESS#(1) WTM=1 (WTM2=2) (WTM3=3) (WTM4=4) WST=1 BWS=0.0 WGO=1

- GUN#: Gun No.
- PRESS#: Gun pressure file No. (Can be omitted.)
- WTM: Welding condition No. when applying pressure first step.
- WST: Power source start-up timing when applying pressure first step.
- WTM2: Welding condition No. when applying pressure second step. (Can be omitted.)
- WTM3: Welding condition No. when applying pressure third step. (Can be omitted.)
- WTM4: Welding condition No. when applying pressure fourth step. (Can be omitted.)
- BWS: Welding start stroke position (Can be omitted.)
- WGO: Welding conditions group output when applying pressure first step. (Can be omitted.)

CAUTION

Items between WTM2 and WTM4 may or may not be displayed depending upon the set value of “Number of welding steps” in the DETAIL EDIT window.

Also, while the SVSPOT instruction is being executed, if the number of welding steps in the instruction does not agree with the number of “END WAIT” in the pressure file, the following alarm will be displayed.

Alarm 4667 : DEFECTIVE GUN PRESSURE FILE
2.1.4 Details of the SVSPOTMOV Instruction

The SVSPOTMOV instruction that exists when the multistep pressure function is enabled consists of the following instruction configuration.

The motor gun opens as soon as welding for the last step is completed.

SVSPOTMOV V=100 PLIN=1 PLOUT=1 CLF#(1) GUN#(1) PRESS#(1) WTM=1 (WTM2=2) (WTM3=3) (WTM4=4) WST=1 WGO=1 …

V: Linear moving speed for clearance
PLIN: Position level at the clearance position before hit
PLOUT: Position level at the clearance position after hit
CLF#( ): Clearance file No.
GUN#( ): Gun No.
PRESS#( ): Gun pressure file No. …Can be omitted.
WTM: Welding condition No. when applying pressure first step.
WTM2: Welding condition No. when applying pressure second step. …Can be omitted.
WTM3: Welding condition No. when applying pressure third step. …Can be omitted.
WTM4: Welding condition No. when applying pressure fourth step. …Can be omitted.
WST: Power source start-up timing when applying pressure first step. …Can be omitted.
WGO: Welding conditions group output when applying pressure first step. …Can be omitted.
// : Comment …Can be omitted.

CAUTION

Items between WTM2 and WTM4 may or may not be displayed depending upon the set value of “Number of welding steps” in the DETAIL EDIT window.

Also, while the SVSPOTMOV instruction is being executed, if the number of welding steps in the instruction does not agree with the number of “END WAIT” in the pressure file, the following alarm will be displayed.

Alarm 4667 : DEFECTIVE GUN PRESSURE FILE
2.2 Corrective Action in the Event that a WELD COMPLETE SIGNAL ERROR Alarm Occurs

During multistep pressurization, a WELD COMPLETE SIGNAL ERROR alarm may occur. It occurs if the power source side has not turned OFF the welding completion signal when the YRC1000 reached the next pressure value and output a welding signal, after the welding completion signal from the power source was received. If this alarm is output, set the following parameters.

AxP66: Check the welding completion signal at the commencement of welding. (Welding completion signal OFF time Unit: sec)

<table>
<thead>
<tr>
<th>Setting No.</th>
<th>Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>If the welding completion signal was ON when starting spot welding, an alarm occurs.</td>
</tr>
<tr>
<td>1 - 60</td>
<td>If the welding completion signal is ON at the commencement of welding, an alarm will be output unless the signal is turned OFF, even after the lapse of set number of seconds.</td>
</tr>
</tbody>
</table>

Although the recommended value is 1 (sec), adjust the value according to the actual condition.

**NOTE**

If a value other than 0 was set, processing to enable the system to wait for the welding completion signal to go OFF will take place, so the welding instruction execution time may sometimes be extended.
YRC1000 OPTIONS
INSTRUCTIONS
FOR MULTISTEP PRESSURE FUNCTION

HEAD OFFICE
2-1 Kurosakishiroishi, Yahatanishi-ku, Kitakyushu 806-0004, Japan
Phone  +81-93-645-7703    Fax  +81-93-645-7802

YASKAWA America Inc. (Motoman Robotics Division)
100 Automation Way, Miamisburg, OH 45342, U.S.A.
Phone  +1-937-847-6200    Fax  +1-937-847-6277

YASKAWA Europe GmbH (Robotics Division)
Yaskawastrasse 1, 85391 Allershausen, Germany
Phone  +49-8166-90-100    Fax  +49-8166-90-103

YASKAWA Nordic AB
Verkadsgatan 2, Box 504 ,SE-385 25 Torsas, Sweden
Phone  +46-480-417-800    Fax  +46-480-414-10

YASKAWA Electric (China) Co., Ltd.
22F, One Corporate Avenue, No.222, Hubin Road, Huangpu District, Shanghai 200021, China
Phone  +86-21-5385-2200    Fax  +86-21-5385-3299

YASKAWA SHOUGANG ROBOT Co. Ltd.
No7 Yongchang North Road, Beijing E&T Development Area, China 100176
Phone  +86-10-6788-2858    Fax  +86-10-6788-2878

YASKAWA India Private Ltd. (Robotics Division)
#426, Udyog Vihar, Phase- IV, Gurgaon, Haryana, India
Phone  +91-124-475-8500    Fax  +91-124-475-8542

YASKAWA Electric Korea Corporation
35F, Three IFC, 10 Gukjegeumyung-ro, Yeongdeungpo-gu, Seoul, Korea  07326
Phone  +82-2-784-7844    Fax  +82-2-784-8495

YASKAWA Electric Taiwan Corporation
12F, No.207, Sec. 3, Beishin Rd., Shindian District, New Taipei City 23143, Taiwan
Phone  +886-2-8913-1333    Fax  +886-2-8913-1513

YASKAWA Electric (Singapore) PTE Ltd.
151 Lorong Chuan, #04-02A, New Tech Park, Singapore 556741
Phone  +65-6282-3003    Fax  +65-6289-3003

YASKAWA Electric (Thailand) Co., Ltd.
59,1st-5th Floor, Flourish Building, Sai Ratchadapisek 18,Ratchadapisek Road, Huaykwang, Bangkok 10310, THAILAND
Phone  +66-2-017-0099    Fax  +66-2-017-0199

PT. YASKAWA Electric Indonesia
Secure Building-Gedung B Lantai Dasar & Lantai 1 Jl. Raya Protokol Halim Perdanakusuma,
Jakarta 13610, Indonesia
Phone  +62-21-2982-6470    Fax  +62-21-2982-6741

Specifications are subject to change without notice for ongoing product modifications and improvements.

YASKAWA
YASKAWA ELECTRIC CORPORATION

© Printed in Japan October 2017 17-10

MANUAL NO.
HW1483406