YRC1000micro OPTIONS
INSTRUCTIONS

FOR ENDLESS FUNCTION

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

MOTOMAN INSTRUCTIONS

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

The YRC1000micro 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: 181261-1CD
Revision: 0
DANGER

• This manual explains the endless function of the YRC1000micro system. Read this manual carefully and be sure to understand its contents before handling the YRC1000micro. Any matter not described in this manual must be regarded as "prohibited" or "improper".

• General information related to safety are described in “Chapter 1. Safety” of the YRC1000micro INSTRUCTIONS. To ensure correct and safe operation, carefully read “Chapter 1. Safety” of the YRC1000micro INSTRUCTIONS.

CAUTION

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

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

NOTICE

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

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

• If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. 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 YRC1000micro.

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”.
Before operating the manipulator, make sure the servo power is turned OFF by performing the following operations. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

- Press the emergency stop button on the programming pendant or 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 YRC1000micro power
  - Moving the manipulator by using the programming pendant
  - Running the system in the check mode
  - Performing automatic operations

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

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

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

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

WARNING

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

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

The MOTOMAN is the YASKAWA industrial robot product.

The MOTOMAN usually consists of the manipulator, the YRC1000micro controller, manipulator cables, the YRC1000micro programming pendant (optional), and the YRC1000micro programming pendant dummy connector (optional).

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>YRC1000micro controller</td>
<td>YRC1000micro</td>
</tr>
<tr>
<td>YRC1000micro programming pendant</td>
<td>Programming pendant (optional)</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
<tr>
<td>YRC1000micro programming pendant dummy connector</td>
<td>Programming pendant dummy connector (optional)</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 /Number Keys: [Axis Key] and [Numeric Key] are generic names for the keys for axis operation and number input.</td>
</tr>
<tr>
<td></td>
<td>Keys pressed simultaneously: When two keys are to be pressed simultaneously, the keys are shown with a “+” sign between them, ex. [SHIFT]+[COORD]</td>
</tr>
<tr>
<td></td>
<td>Mode Key: Three kinds of modes that can be selected by the mode key are denoted as follows: REMOTE, PLAY, or TEACH</td>
</tr>
<tr>
<td></td>
<td>Button: Three buttons on the upper side of the programming pendant are denoted as follows: HOLD button, START button, EMERGENCY STOP button</td>
</tr>
<tr>
<td></td>
<td>Displays: The menu displayed in the programming pendant is denoted with { }. e.g. {JOB}</td>
</tr>
<tr>
<td></td>
<td>PC Keyboard: The name of the key is denoted. e.g. Ctrl key on the keyboard</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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1.2 Resetting the Rotating Amount

1.3 Job Example

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2.2.2 Construction

2.2.3 Explanation

2.2.4 Registration of MRESET instruction

3 Display of Endless Axis Rotation Amount

3.1 Display of the rotating amount screen

3.2 Resetting the Axis Rotation Amount

4 Setting of Endless Axis

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6 Alarm Message List
1 Endless Function

For the station axis and the end axis of the manipulator, there is no limit for the range of motion.

In this function, these axes are called the endless axes and following motions by using their specifications are available.

- Endless rotation: Rotate the endless axes multiple times.
- Resetting the rotating amount: Switch the position of the endless axis to the position within one rotation.

In the earlier controller than the YRC1000 micro, when the endless axis is the station axis, it is called the external axis endless function, and when the endless axis is T-axis of the manipulator, it is called T-axis endless function.

1.1 Endless Rotation

By specifying the endless axis rotating amount (MT=MTE=) for a moving instruction (MOVJ), the endless axis moves to “the endless axis rotating amount + the taught position pulse”.

For the endless axis rotating amount, from -32768 to 32767 revolutions can be specified.

1.1.1 Relative motion and Absolute motion

Endless rotation has two types of motion; relative motion and absolute motion.

Relative motion enables the endless axis to move to target position from taught position by rotating for the sum of the endless axis rotating amount and the rotating amount of start position.

target position = taught position + (endless axis rotating amount + start position rotating amount)

To rotate the axis continuously, move instruction (same position) is to be registered consecutively.

When emergency stop is executed, and then restart is executed, the target position will be changed, and the endless axis moves to the position from taught position by rotating from the sum of the endless axis rotating amount and the rotating amount of restart position.

Absolute motion enables endless axis to move to target position from taught position by rotating for the endless axis rotating amount.

target position = taught position + endless axis rotating amount

Even in case that the emergency stop is executed during endless rotation, and then the restart is executed, the target position is not changed.

■ S2C710 Endless function motion instruction

Motion method for endless function is to be set with this parameter

<table>
<thead>
<tr>
<th>d7</th>
<th>d0</th>
</tr>
</thead>
</table>
| 0  | 0  | Relative motion
| 0  | 1  | Absolute motion
| 1  | 0  | Absolute motion
| 1  | 1  | Absolute motion
1.2 Resetting the Rotating Amount

To perform an interpolation after completion of endless rotation, re-create the endless axis current value pulse and the motor feedback pulse at a position within one revolution in one of the following operations.

- Execution of MRESET instruction
- Operation from the programming pendant

The position of the endless axis after resetting the rotating amount is one of the following two areas depending on the position before reset.

When the position before reset is 0 degree or higher: 0 to 360 [degree]
When the position before reset is 0 degree or lower: -360 to 0 [degree]

**<Example>**
The position after reset when the endless axis is reset at a position of -120 degree between -3 to 3 revolutions.

<table>
<thead>
<tr>
<th>Position of endless axis</th>
<th>[Angle]</th>
</tr>
</thead>
<tbody>
<tr>
<td>-120</td>
<td>-120</td>
</tr>
<tr>
<td>-840</td>
<td>-840</td>
</tr>
<tr>
<td>-480</td>
<td>-480</td>
</tr>
<tr>
<td>-120</td>
<td>-120</td>
</tr>
<tr>
<td>240</td>
<td>240</td>
</tr>
<tr>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>960</td>
<td>960</td>
</tr>
<tr>
<td>1320</td>
<td>1320</td>
</tr>
</tbody>
</table>

Perform teaching so that the rotation starts at a position between 0 to 360 degree when you want to rotate the axis in “+” direction or so that the rotation starts at a position between -360 to 0 degree when you want to rotate the axis in “-” direction.

When the axis is performed the endless rotation from the position at -360 to 0 degree to “+” direction or from the position at 0 to 360 degree to “-” direction, the difference between the rotating amount and the reset rotating amount is one rotation.
Therefore, note that the endless axis rotates one rotation when it is moved to the position before rotation or around the position.

**<Example>**
When the rotating amount is reset after it is rotated 4 rotations in “+” direction from the position at -120 degree:
## 1.3 Job Example

The examples of making the job are as follows.

<table>
<thead>
<tr>
<th>Line</th>
<th>Instruction</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>0000</td>
<td>NOP</td>
<td></td>
</tr>
<tr>
<td>0001</td>
<td>MOVJ VJ=25.00</td>
<td>Normal move instruction</td>
</tr>
<tr>
<td>0002</td>
<td>MOVL V=500.0</td>
<td>Normal move instruction</td>
</tr>
<tr>
<td>0003</td>
<td>MOVJ VJ=25.00</td>
<td>Normal move instruction</td>
</tr>
<tr>
<td>0004</td>
<td>MOVJ VJ=25.00 MTE=100</td>
<td>The station axis rotates 100 times until reaching the step 4.</td>
</tr>
<tr>
<td>0005</td>
<td>MOVJ VJ=25.00 MTE=100</td>
<td>The station axis rotates 100 times until reaching the step 5. (If endless rotation method is set for absolute motion, it does not rotate.)</td>
</tr>
<tr>
<td>0006</td>
<td>MRESET</td>
<td>MRESET instruction is executed to reset the station axis position to a position within one revolution.</td>
</tr>
<tr>
<td>0007</td>
<td>MOVL V=500.0</td>
<td>Linear interpolation motion</td>
</tr>
<tr>
<td>0008</td>
<td>MOVJ VJ=25.00</td>
<td>Normal move instruction</td>
</tr>
<tr>
<td>0009</td>
<td>END</td>
<td>End of the job</td>
</tr>
</tbody>
</table>
2 Instructions for Endless Function

2.1 Tag for Specified Endless Axis Rotating Amount (MT=/MTE=)

2.1.1 Function

The endless rotation of the endless axis rotating amount is performed when the specified move command is executed. It is set as an additional item to the move instruction.

- MOVJ
- MOVL
- MOVC

2.1.2 Construction

2.1.3 Explanation

<table>
<thead>
<tr>
<th>No</th>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
</table>
| 1  | MT= Amount of the T-axis rotation| Specifies the endless axis rotating amount of the T-axis. | Amount of rotation: -32768 to 32767
|    |                                   |                                                  | Can be added or omitted.                      |
| 2  | MTE= Amount of the station axis rotation | Specifies the endless axis rotating amount of the station axis. | Amount of rotation: -32768 to 32767
|    |                                   |                                                  | Can be added or omitted.                      |

* Two or more tags can be set in portions A and B, though the description is omitted here.
2.1.4 Specifying Endless Axis Rotating Amount

1. Move the cursor to the instruction area.

2. Select the move command to add the tag for specified endless axis rotating amount (MT=/MTE=).
   – The detailed edit screen will be displayed.

3. Set the endless axis rotating amount.
   (1) Move the cursor to “T-ROTATION” or “ST AXIS ROT” and press [SELECT].
2 Instructions for Endless Function
2.1 Tag for Specified Endless Axis Rotating Amount (MT= / MTE=)

(2) Move the cursor to “MT=” or “MTE=” and press [SELECT].

(3) Move the cursor to the right, press [SELECT] enter the value using the numeric keypad, and press [ENTER].

4. Press [ENTER] two times
   – The set contents are registered in the job.
2.2 MRESET Instruction

2.2.1 Function

MRESET INST is used to reset the endless axis rotating amount.

2.2.2 Construction

```
MRESET
```

2.2.3 Explanation

<table>
<thead>
<tr>
<th>No</th>
<th>Tag</th>
<th>Explanation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ST= Specification of the station axis</td>
<td>Set to reset the station axis rotating amount. When omitting, the T-axis rotating amount is reset.</td>
<td>No</td>
</tr>
</tbody>
</table>

2.2.4 Registration of MRESET instruction

1. Move the cursor to the address area
2. Press [INFORM LIST]
3. Select “MRESET”

   (1) Move the cursor to [OTHER] and press [SELECT]

   (2) Move the cursor to [MRESET] and press [SELECT].

4. Press [ENTER]
   – The set contents are registered in the job.
3 Display of Endless Axis Rotation Amount

The endless axis rotating amount will be displayed.

The endless axis rotating amount can also be reset.

3.1 Display of the rotating amount screen

1. Select {ROBOT} under the main menu
2. Select {ROTATION}
   – The rotation display window appears.

3.2 Resetting the Axis Rotation Amount

1. Select {ROBOT} under the main menu
2. Select {ROTATION}
3. Select {DATA} of the menu
   – A pull-down menu appears.
4. Select {RESET ROTATION}
   – The endless axis rotating amount is reset to "0".
4 Setting of Endless Axis

Set the endless axis for performing the endless rotating.

4.1 Starting up Maintenance Mode

This mode is used for the setting up of the manipulator system and the maintenance.

1. Turn ON the power while pressing (MAIN MENU) of the programming pendant.
   – Turn ON the power while pressing (MAIN MENU), start up the maintenance mode.

2. Select (SYSTEM) of the Main Menu.
   – Sub menu appears.
4 Setting of Endless Axis
4.1 Starting up Maintenance Mode

3. Select {SECURITY}.
   - Mode selection window of the SECURITY appears.

4. Press [SELECT].
   - “OPERATION MODE”, “EDITING MODE”, “MANAGEMENT MODE”, and “SAFETY MODE” appears.

5. Move the cursor to “MANAGEMENT MODE” and select it.
   - Input the password state window appears.
4. Setting of Endless Axis
4.1 Starting up Maintenance Mode

6. Input the password for the management mode and press [Enter].
   - Input the correct password, the management mode will be displayed.
4.2 Setting of the Endless Axis

1. Select {SYSTEM} of the Main Menu.
   – Sub menu appears.

2. Select {SETUP}.
   – Setup selection window appears.
3. Select “OPTION FUNCTION”.
   – Option function window appears.
   – Move the cursor downward, the items of the endless function appears.

4. Select “ENDLESS FUNCTION”.
   – Detail setting window for the endless function appears.
5. Change the settings.
   – Move the cursor to the group of the endless axis to change the settings, and press [SELECT].

![Endless Axis Settings](image1)

6. Press [Enter].
   – A confirming dialog box for the modifying the parameter appears.

![Confirming Dialog Box](image2)

7. Select {YES}.
   – When selecting “YES” for the confirming dialog box, the system parameter will be set automatically, and then return to the option function window.

![Confirmation (YES or NO)](image3)
4.3 Requirements

When the group which cannot perform the endless rotating is set as the endless axis, the following errors occur.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Error</th>
</tr>
</thead>
</table>
| Specifying group is not supported model for the endless function. | Error 8280  
Can’t set the endless axis to this control group. |
| The motion range of the endless axis for the specified group is 360° or less. | Error 8281  
The motion area of endless axis is under 360 degree.  |
5 Restrictions

The restrictions for the endless axis endless function are as follows.

5.1 FWD and BACK Operations

During FWD and BACK operations, the endless axis does not perform an endless rotation.

Also when a playback is executed after having executed the FWD operation until 1 to 3 steps before the step where an endless rotation is specified, the endless axis does not perform a endless rotation. This is because the status of FWD operation and BACK operation remains. In this case, after having executed the FWD and BACK operation, move the cursor and start the job in play mode. Thus, the endless axis performs a endless rotation.

Normally, when the manipulator current value coincides with the reference position value after having reached the target step by FWD or BACK operation, the cursor stops blinking. After performing the endless rotation of the endless axis for the playback operation, for the playback operation, the FWD or BACK operation will not make the blinking cursor stop, even when having reached the target position, because the current position of the endless axis is not equal to the taught position. In this case, execute a MRESET instruction before FWD or BACK operation so that the cursor stops blinking when the manipulator reaches the target position.

5.2 When NWAIT is Specified

Normally, when a move instruction where a NWAIT is added is executed, the instructions that are registered before the next move instruction, are executed sequentially. However, for the MRESET instruction, NWAIT specification is not applied and the MRESET instruction is executed after completion of the move instruction.

5.3 Maximum Endless Axis Rotating Amount

The maximum endless axis rotating amount can be obtained by the following equation. The amount differs depending on the endless axis resolution.

\[
\text{Maximum endless axis rotating amount} = \pm \frac{536870912 \text{ (pulse)}}{\text{Resolution (pulse/revolution)}}
\]

5.4 Execution of MRESET Instruction

Since the execution of MRESET instruction is processed for the manipulator feedback pulse, it is executed in the status that the manipulator is completely stopped.

Accordingly, it takes a several seconds to execute the MRESET instruction.

In the meantime, the manipulator does not stop and the start lamp is not unlit even by hold or changing mode operation.
5.5 Endless Axis Position at Teaching

In a position where the endless axis has rotated more than one time, the teaching is disabled. If teaching is executed in this state, the following error occurs.

Error 2110 : Over softlimit

When the above error occurs, reset the endless axis rotating amount manually.

5.6 Display of Rotating Amount

When the sign of the taught position of the moving instruction where endless axis rotating amount is specified and the sign of the specified endless axis rotating amount are different, the display value of rotating amount may be one revolution less than the specified endless axis rotating amount.

For example, when moving operation is executed as the taught position is specified at -1000 pulsed and the endless rotating amount is specified at 100 revolutions, the rotating amount after the execution is 99 revolutions.
## 6 Alarm Message List

<table>
<thead>
<tr>
<th>Alarm No.</th>
<th>Message</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>4490</td>
<td>DEFECTIVE TAUGHT POINT (ENDLESS)</td>
<td>1 One of the interpolation instructions (MOVL, MOVC, etc.) is executed after the endless rotation is completed and before MRESET is executed. (1) Confirm the settings below. Execute MRESET if you want to perform one of the interpolation actions (MOVL, MOVC, etc.) after the endless rotation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 The endless rotation axis is set to the basic axis. The endless function cannot be used for the basic axis. (1) Confirm the settings below. Check the parameter setting for the specification of the endless rotation axis.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 The endless function is executed despite the endless axis has not specified. (1) Confirm the settings below. Check the parameter setting for the specification of the endless rotation axis.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 The pulse number of the endless axis exceeds the max. pulse value (536870911). (1) Confirm the settings below. Set the rotating amount so that the pulse value does not exceed the max. pulse number.</td>
</tr>
</tbody>
</table>