MOTOMAN-GP12
INSTRUCTIONS

TYPE:
YR-1-06VXH12-C00 (DRIP-PROOF SPECIFICATION)

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

MOTOMAN INSTRUCTIONS
MOTOMAN-GP12 INSTRUCTIONS
YRC1000 INSTRUCTIONS
YRC1000 OPERATOR'S MANUAL (GENERAL) (SUBJECT SPECIFIC)
YRC1000 MAINTENANCE MANUAL
YRC1000 ALARM CODES (MAJOR ALARMS) (MINOR ALARMS)

YRC1000micro INSTRUCTIONS
YRC1000micro OPERATOR'S MANUAL
YRC1000micro MAINTENANCE MANUAL
YRC1000micro ALARM CODES (MAJOR ALARMS) (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: 186432-1CD
Revision: 0
• This instruction manual is intended to explain mainly on the mechanical part of the MOTOMAN-GP12 for the application to the actual operation and for proper maintenance and inspection. It describes on safety and handling, details on specifications, necessary items on maintenance and inspection, to explain operating instructions and maintenance procedures. Be sure to read and understand this instruction manual thoroughly before installing and operating the manipulator. 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 YRC1000/YRC1000micro INSTRUCTIONS. To ensure correct and safe operation, carefully read “Chapter 1. Safety” of the YRC1000/YRC1000micro INSTRUCTIONS.

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

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

• 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 MOTOMAN-GP12.

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

**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

- Do not remove the motor, and do not release the brake.
Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator's arm.

WARNING

- Maintenance and inspection must be performed by specified personnel.
Failure to observe this caution may result in electric shock or injury.
- For disassembly or repair, contact your YASKAWA representative.
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.

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.

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.
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.

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

![Emergency Stop Button](image1)

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.

![Release of Emergency Stop](image2)

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 upper right of the programming pendant.

Read and understand the Explanation of the Warning Labels before operating the manipulator.
<YRC1000micro only>

**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.

<YRC1000/YRC1000micro>

**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.
- Always return the programming pendant to the hook on the YRC1000/YRC1000micro cabinet 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 <YRC1000>

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>

Definition of Terms Used Often in This Manual <YRC1000micro>

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>

Registered Trademark <YRC1000/YRC1000micro>

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.
Explanation of Warning Labels

The following warning labels are attached to the manipulator. Always follow the warnings on the labels. Also, an identification label with important information is placed on the body of the manipulator. Prior to operating the manipulator, confirm the contents.

Note: Taking the maintenance-relevant trainings offered by YASKAWA is indispensable for replacing the L-axis of the balancer-equipped manipulator.

Fig. : Warning Label Locations

**Description**

Make sure to secure the manipulator base by using the bolts of the specified sizes and by tightening the bolts with the specified tightening torques. If the power is turned ON and the manipulator is operated without securing the manipulator properly, the manipulator may fall down, which may result in personal injury and/or equipment damage.
Collision hazard label

Description
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. 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/YRC1000micro power
- Moving the manipulator by using the programming pendant
- Running the system in the check mode
- Performing automatic operations

Crush hazard label

Description
Keep clear of moving parts when performing a teaching operation within the manipulator's operating range. Failure to observe this instruction may result in personal injury.
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<td>9-20</td>
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<td>Grease Replenishment Procedures for R-axis Speed Reducer</td>
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<td>9.4.2.5</td>
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<td>10-1</td>
</tr>
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</table>
1 Product Confirmation

1.1 Contents Confirmation

- Confirm the contents of the delivery when the product arrives.
- Standard delivery includes the following five items (Information for the content of optional goods is given separately):
  - YRC1000 Packing contents
    - Manipulator (accessories included)
    - YRC1000 (spare parts included)
    - Manipulator Cable (between manipulator and the YRC1000)
    - Complete set of manuals (in the CD-ROM which is connected to the USB connector)
    - Programming pendant

**CAUTION**

- Confirm that the manipulator and the YRC1000/YRC1000micro have the same order number. Pay special attention when installing two or more manipulators.

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

1.1 Contents Confirmation

- **YRC1000**
  - Confirm the contents of the delivery when the product arrives.
  - Standard delivery includes the following five items (Information for the content of optional goods is given separately):
    - YRC1000 Packing contents
      - Manipulator (accessories included)
      - YRC1000 (spare parts included)
      - Manipulator Cable (between manipulator and the YRC1000)
      - Complete set of manuals (in the CD-ROM which is connected to the USB connector)
      - Programming pendant
1 Product Confirmation
1.1 Contents Confirmation

- **YRC1000micro**
  Confirm the contents of the delivery when the product arrives.
  Standard delivery includes the following four (to six) items (Information for the content of optional goods is given separately):
  
  - Manipulator (accessories included)
  - YRC1000micro (spare parts included)
  - Manipulator Cable (between manipulator and the YRC1000micro)
  - Complete set of manuals (in the CD-ROM which is connected to the USB connector)
  - Programming pendant (optional)
  - Programming pendant dummy connector (optional)

  **Fig. 1-1(b): Four (to six) Items for Standard Delivery**

<table>
<thead>
<tr>
<th>Accessories of Manipulator</th>
<th>Pcs</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexagon socket head cap screw M16 (length: 50 mm)</td>
<td>4</td>
<td>For installing the manipulator</td>
</tr>
<tr>
<td>Conical spring washer M16</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Grease zerk A-MT6X1</td>
<td>3</td>
<td>For grease replenishment of B-, T-axes</td>
</tr>
<tr>
<td>Grease zerk A-PT1/8</td>
<td>3</td>
<td>For grease replenishment of R-axis</td>
</tr>
<tr>
<td>Grease zerk A-PT3/8</td>
<td>3</td>
<td>For grease replenishment of S-, L-, U-axes</td>
</tr>
</tbody>
</table>
1.2 Order Number Confirmation

Confirm the order number of the manipulator corresponds to the YRC1000/YRC1000micro. The order number is located on a label as shown below.

*Fig. 1-2(a): Location of Order Number Labels (YRC1000)*
1 Product Confirmation
1.2 Order Number Confirmation

Fig. 1-2(b): Location of Order Number Labels (YRC1000micro)

THE MANIPULATOR AND THE CONTROLLER SHOULD HAVE SAME ORDER NUMBER.

ORDER NO.

NJ4014-1

YRC1000micro (Top View)

Manipulator (Side View)
2 Transport

WARNING

• Operation of the crane, sling, or forklift must be performed only by authorized personnel.
   Failure to observe this instruction may result in personal injury and/or equipment damage.

NOTICE

• Avoid excessive vibration or shock while transporting or moving the YRC1000/YRC1000micro.
   Failure to observe this instruction may adversely affect the performance of the YRC1000/YRC1000micro because it consists of precision components.
2.1 Transport Method

2.1.1 Using a Crane

As a rule, the manipulator must be lifted by a crane with two wire ropes when removing the manipulator from the package and moving it. Be sure to fix the manipulator with the cushioning materials for transport, and lift it in the posture as shown in fig. 2-1 “Transporting Position (factory setting)”. The length of the wire rope must be 1200 mm or longer.

*NOTE* When lifting the manipulator, be careful not to damage the motor, connector, cable or etc.
2.1.2 Using a Forklift

When using a forklift, fix the manipulator on a pallet with shipping bolts as shown in Fig. 2-2 "Using a Forklift". Insert claws under the pallet and lift it. The pallet must be strong enough to support the manipulator. Transport the manipulator slowly with due caution in order to avoid overturning or slippage.

**Fig. 2-2: Using a Forklift**

- The weight of the manipulator is approximately 160 kg (including the shipping bolts and brackets). Use a wire rope strong enough to withstand the weight.
- When transporting, be sure to install the shipping bolts and brackets.
- Avoid applying external force on the arm or motor unit when transporting by a crane, forklift, or other equipment. Failure to observe this instruction may result in injury.

**NOTE**
2.2 Shipping Bracket

To protect the manipulator’s machinery from external forces during transportation, the cushioning materials for transport are installed. (See fig. 2-3 “Shipping Bracket”.)

Fig. 2-3: Shipping Bracket

- The shipping bracket is painted yellow.
- The shipping bracket is fixed with the hexagon socket head cap screws M10 (length: 25mm) (2 screws) and the conical spring washers M10.

NOTE

Before turning ON the power, check to be sure that the shipping screws and brackets are removed. The shipping screws and brackets then must be stored for future use, in the event that the manipulator must be moved again.
2.3 Cushioning Material for Transport

To protect the manipulator's machinery from external forces during transportation, the cushioning materials for transport are installed in the sections A and B. (See fig. 2-4 “Cushioning Materials for Transport”.)

Fig. 2-4: Cushioning Materials for Transport

- A rubber cushion is respectively wedged at the sections A and B.

**NOTE**

Before turning ON the power, check to be sure that the cushioning materials for transport are removed.

In the event that the manipulator must be moved again, to avoid its main body from being damaged, the cushioning materials such as rubber plate, etc. must be used.
3 Installation

**DANGER**

- Install the safety fence.

Failure to observe this warning may result in injury or damage.

**WARNING**

- Do not perform the welding operation for a pedestal or etc. when the power cable is being connected.

Failure to observe this instruction may result in damage to an electric device due to the current of welding.

- Install the manipulator in a location where the tool or the workpiece held by its fully extended arm will not reach the wall, the safety fence, or the YRC1000/YRC1000micro, etc.

Failure to observe this warning may result in injury or damage.

- Make sure to firmly anchor the manipulator before turning ON the power and operating the manipulator.

Failure to observe this instruction may cause overturning of the manipulator, which may result in personal injury and/or equipment damage.

- When mounting the manipulator on the wall, the wall must have sufficient strength and rigidity to support the weight of the manipulator. In addition, take precautionary measures on the manipulator base to prevent the manipulator from falling.

Failure to observe this instruction may result in personal injury and/or equipment damage.

- Do not install or operate a damaged manipulator or a manipulator any of whose components is missing.

Failure to observe this instruction may cause improper movement, etc. of the manipulator, which may result in personal injury and/or equipment damage.

**NOTICE**

- After completing the installation of the manipulator, make sure to remove the shipping bolts and brackets before turning ON the power.

Failure to observe this instruction may result in damage to the main drive unit.
3 Installation

3.1 Installation of the Safety fence

To insure safety, be sure to install safety fence. It prevents unforeseen accidents with personnel and damage to equipment. Refer to the following quoted clause for your information and guidance.

Responsibility for Safeguarding (ISO10218)

The user of a manipulator or robot system shall ensure that safety fences are provided and used in accordance with Sections 6, 7, and 8 of this standard. The means and degree of safeguarding, including any redundancies, shall correspond directly to the type and level of hazard presented by the robot system consistent with the robot application. Safeguarding may include but not be limited to safeguarding devices, barriers, interlock barriers, perimeter guarding, awareness barriers, and awareness signals.
3 Installation

3.2 Mounting Procedures for Manipulator Base

The manipulator should be firmly mounted on a base plate or foundation strong enough to support the manipulator and withstand reaction forces during acceleration and deceleration.

Construct a solid foundation with the appropriate thickness to withstand maximum reaction forces of the manipulator referring to Table 3-1 “Manipulator Reaction Force and Torque”.

A base plate flatness must be kept at 0.5 mm or less: insufficient flatness of installation surface may deform the manipulator shape and affect its functional abilities. Mount the manipulator base as instructed in chapter 3.2.1 “Mounting Example”.

Table 3-1: Manipulator Reaction Force and Torque

<table>
<thead>
<tr>
<th></th>
<th>Horizontal rotation</th>
<th>Vertical rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reaction force $F_H$</td>
<td>Torque $M_H$</td>
</tr>
<tr>
<td>Emergency stop</td>
<td>8340 N (850 kgf)</td>
<td>4120 Nm (420 kgf·m)</td>
</tr>
<tr>
<td>Acceleration/</td>
<td>2945 N (300 kgf)</td>
<td>1275 Nm (130 kgf·m)</td>
</tr>
<tr>
<td>deceleration</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 3-1: Manipulator Reaction Force and Torque
3.2 Mounting Procedures for Manipulator Base

3.2.1 Mounting Example

For the first process, anchor the base plate firmly to the ground. The base plate should be rugged and durable to prevent shifting of the manipulator or the mounting fixture. It is recommend to prepare a base plate of 40 mm or more thick, and anchor bolts of M16 or larger size.

The manipulator base is tapped for four mounting holes; securely fix the manipulator base to the base plate with four hexagon head bolts M16 (Tensile strength: 1200N/mm²) (50 mm long is recommended) by using a tightening torque 206N·m.

Next, fix the manipulator base to the base plate. Tighten the hexagon head bolts and anchor bolts firmly so that they will not work loose during the operation. Refer to fig. 3-2 “Mounting the Manipulator on Base Plate”.

To improve the precision of installing position, holes or surface for reference are designed. Use a knock pin or a fitting surface when precision is required for installation.

Fig. 3-2: Mounting the Manipulator on Base Plate
3 Installation

3.3 Mounting method

The YR-1-06VXH12-C00 can be mounted in four ways: floor-mounted way (standard), wall-mounted way, tilt-mounted way and ceiling-mounted way. For wall-mounted, tilt-mounted and ceiling-mounted ways, the following points are different from the floor-mounted way.

- S-Axis Operating Range
- Precautions to Prevent the Manipulator from Falling

3.3.1 S-Axis Operating Range

For wall-mounted way, the S-axis operating range is ±30°.

For the tilt-mounted way, the operating range of the S-axis varies as shown in the following table.

<table>
<thead>
<tr>
<th>Installation Angle (θ)</th>
<th>Operating range of S-axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>0° ≤ θ ≤ 30°</td>
<td>within ±170° (no limit)</td>
</tr>
<tr>
<td>30° &lt; θ ≤ 35°</td>
<td>within ±60°</td>
</tr>
<tr>
<td>35° &lt; θ ≤ 45°</td>
<td>within ±45°</td>
</tr>
<tr>
<td>45° &lt; θ</td>
<td>within ±30°</td>
</tr>
</tbody>
</table>

For the wall-, tilt-, and ceiling-mounted type, the installation angle relative to the ground must be input by using the programming pendant. For the input procedures, refer to Chapter 8.4 ARM Control in YRC1000 INSTRUCTIONS (Manual No: RE-CTO-A221) /YRC1000micro INSTRUCTIONS (Manual No: RE-CTO-A222). Also, the operating range of S-axis must be altered by referring to chapter 5.5 “Alterable Operating Range”.

Fig. 3-3: Installation Angle for Tilt-Mounted Way
3.3 Mounting method

3.3.2 Precautions to Prevent the Manipulator from Falling

For the wall- or ceiling-mounted ways, take appropriate measures to avoid the falling of the manipulator in case of emergency. Refer to Fig. 3-4 “Precaution against Falling” for details.

Fig. 3-4: Precaution against Falling

In case of using the wall/ceiling-mounted way, inform YASKAWA of the matter when placing an order. Be sure to contact your YASKAWA representative (listed on the back cover of this instruction manual) to perform a wall/ceiling installation on site.
3.4 Location

When installing a manipulator, it is necessary to satisfy the following environmental conditions:

- Ambient temperature: 0°C to +45°C
- Humidity: 20 to 80% RH
- Free from dust, soot, or oil
- Free from corrosive gas or liquid, or explosive gas or liquid.
- Free from excessive vibration (Vibration acceleration: 4.9 m/s² [0.5 G] or less)
- Free from large electrical noise (plasma)
- Flatness for installation: 0.5 mm or less
- Free from the strong magnetic field
- Altitude: 1000 m or less

**NOTE**
When the operation is started after the manipulator has been out of operation and left in the low temperature (almost 0°C) for a long period, the alarm may occur since the friction torque of the drive unit is large. If the alarm occurs, perform the break-in for few minutes.
3.5 Notes on Dust-Poof/Water-Proof Specifications

The YR-1-06VXH12-C00 conforms to:

- IP67 for the wrist part
- IP65 for the main part of the manipulator

However, the following precautions must be observed:

- Do not use the following liquids, because the rubber parts of the manipulator (gasket, oil seal, O-ring, etc.) may be deteriorated or corroded:
  - Organic solvent
  - Chlorine-based cutting fluid
  - Amine-based cleaning fluid
  - Corrosive substances such as acids, alkalis, or liquids/solutions causing rust
  - Other liquids/solutions to which nitrile-butadiene rubber (NBR) is not resistant

- After removing a gasket for parts replacement or maintenance/inspection, make sure to replace the gasket with a new one.
- Do not use cutting fluid or cleaning fluid which contains unknown chemical substances.

< Definition of IP (protection class) >

- Definition of IP67
  - IP6□: Protection from the entry of dust
  - IP □7: Protection from immersion in water with being submerged for a specified duration and pressure

- Definition of IP65
  - IP6□: Protection from the entry of dust
  - IP □5: Protection from water that is directly sprayed from any direction
4 Wiring

WARNING

- Ground resistance must be 100 Ω or less. Failure to observe this warning may result in fire and/or electric shock.
- Before wiring, make sure to turn the primary power supply OFF, and put up a warning sign. (ex. DO NOT TURN THE POWER ON.) Failure to observe this warning may result in electric shock and/or personal injury.
- Wiring must be performed by authorized or certified personnel. Failure to observe this caution may result in fire and/or electric shock.
- When laying the cables from the manipulator to the YRC1000/ YRC1000micro, DO NOT cover the cable with heat insulating material and avoid multiple cabling. Failure to observe this caution may result in burn caused by cable heat emission failure.
4.1 Grounding

Follow electrical installation standards and wiring regulations for grounding. A ground wire of 5.5 mm² or more is recommended.

Refer to fig. 4-1 “Grounding Method” to connect the ground line directly to the manipulator.

NOTE

- Never use this wire sharing with other ground lines or grounding electrodes for other electric power, motor power, welding devices, etc.
- Where metal ducts, metallic conduits, or distributing racks are used for cable laying, ground in accordance with electrical installation standards.

Fig. 4-1: Grounding Method
4 Wiring
4.2 Cable Connection

4.2 Cable Connection

Connect the both edge of the manipulator cable to the manipulator base connectors and to the YRC1000/YRC1000micro. Before connecting the cable to the manipulator, verify the numbers on the connector as shown in fig. 4-3(a) “Manipulator Cables (YRC1000)” and fig. 4-3(b) “Manipulator Cables (YRC1000micro)”. For the connecting position, refer to fig. 4-4 “Manipulator Cable Connection (Manipulator Side)”, fig. 4-5(a) “Manipulator Cable Connection (YRC1000 Side)” and fig. 4-5(b) “Manipulator Cable Connection (YRC1000micro Side)”. Refer to table 4-1 “Specifications of Manipulator Cable” and fig. 4-6 “Overhead View of Manipulator Cable Connection (Manipulator Side)” for the outside diameter and the minimum bending radius (for fixed part and moving part) of the manipulator cable and the details of the manipulator cable connection on the manipulator side.

- Procedures for inserting the connector
  1. Confirm the connector lever of the manipulator cable is at the initial position. Insert the cable straight into the connector on the back side of the YRC1000/YRC1000micro. Insert the manipulator cable to a fixed depth then the lever rotates about 30 degree forward automatically.
  2. Push the lever with hand and turn it (about 30 degree) until the lock is clicked.

- Procedures for removing the connector
  1. Release the lock by pushing the unlock part of the lever to unlock. Turn the lever about 60 degree to return to the initial position.
  2. Pull out the connector straight.

Fig. 4-2: Connection of Manipulator Cable
4 Wiring
4.2 Cable Connection

*Fig. 4-3(a): Manipulator Cables (YRC1000)*

The YRC1000 side  The Manipulator side

*Fig. 4-3(b): Manipulator Cables (YRC1000micro)*

The YRC1000micro side  The Manipulator side

*Fig. 4-4: Manipulator Cable Connection (Manipulator Side)*

Connector Details (Manipulator side)
4 Wiring
4.2 Cable Connection

Fig. 4-5(a): Manipulator Cable Connection (YRC1000 Side)

Fig. 4-5(b): Manipulator Cable Connection (YRC1000micro Side)

Table 4-1: Specifications of Manipulator Cable

<table>
<thead>
<tr>
<th>Outside diameter (mm)</th>
<th>Minimum bending radius (mm)</th>
<th>Distance between A and B (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.1 dia.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fixed part</td>
<td>Moving part</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>260</td>
</tr>
</tbody>
</table>

240
4.2 Cable Connection

Fig. 4-6: Overhead View of Manipulator Cable Connection (Manipulator Side)
5  Basic Specifications

5.1  Basic Specifications

Table 5-1: Basic Specifications 1)

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>YR-1-06VXH12-C00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure</td>
<td>Verticaly Articulated</td>
<td></td>
</tr>
<tr>
<td>Degree of freedom</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Payload</td>
<td>Wrist part</td>
<td>12 kg</td>
</tr>
<tr>
<td></td>
<td>U-arm 2)</td>
<td>10 kg</td>
</tr>
<tr>
<td>Repeatability 3)</td>
<td>±0.06 mm</td>
<td></td>
</tr>
<tr>
<td>Range of Motion 4)</td>
<td>S-Axis (turning) 5)</td>
<td>-170° - +170° (Wall-mounted way: -30° - +30°)</td>
</tr>
<tr>
<td></td>
<td>L-Axis (lower arm)</td>
<td>-90° - +155°</td>
</tr>
<tr>
<td></td>
<td>U-Axis (upper arm)</td>
<td>-85° - +150°</td>
</tr>
<tr>
<td></td>
<td>R-Axis (wrist roll)</td>
<td>-200° - +200°</td>
</tr>
<tr>
<td></td>
<td>B-Axis (wrist pitch/yaw)</td>
<td>-150° - +150°</td>
</tr>
<tr>
<td></td>
<td>T-Axis (wrist twist)</td>
<td>-455° - +455°</td>
</tr>
<tr>
<td>Maximum Speed</td>
<td>S-Axis</td>
<td>4.53 rad/s, 260°/s</td>
</tr>
<tr>
<td></td>
<td>L-Axis</td>
<td>4.01 rad/s, 230°/s</td>
</tr>
<tr>
<td></td>
<td>U-Axis</td>
<td>4.53 rad/s, 260°/s</td>
</tr>
<tr>
<td></td>
<td>R-Axis</td>
<td>8.20 rad/s, 470°/s</td>
</tr>
<tr>
<td></td>
<td>B-Axis</td>
<td>8.20 rad/s, 470°/s</td>
</tr>
<tr>
<td></td>
<td>T-Axis</td>
<td>12.2 rad/s, 700°/s</td>
</tr>
<tr>
<td>Allowable Moment 5)</td>
<td>R-Axis</td>
<td>22 N•m (2.2 kgf•m)</td>
</tr>
<tr>
<td></td>
<td>B-Axis</td>
<td>22 N•m (2.2 kgf•m)</td>
</tr>
<tr>
<td></td>
<td>T-Axis</td>
<td>9.8 N•m (1.0 kgf•m)</td>
</tr>
<tr>
<td>Allowable Inertia (GB24) 6)</td>
<td>R-Axis</td>
<td>0.65 kg•m²</td>
</tr>
<tr>
<td></td>
<td>B-Axis</td>
<td>0.65 kg•m²</td>
</tr>
<tr>
<td></td>
<td>T-Axis</td>
<td>0.17 kg•m²</td>
</tr>
<tr>
<td>Approx. Mass</td>
<td>155 kg</td>
<td></td>
</tr>
<tr>
<td>Protective enclosure</td>
<td>Body: IP65  Wrist part: IP67</td>
<td></td>
</tr>
<tr>
<td>Mounting method 4)</td>
<td>Floor-, wall-, tilt-, ceiling-mounted</td>
<td></td>
</tr>
<tr>
<td>Ambient Conditions 7)</td>
<td>temperature</td>
<td>0 to 45°C</td>
</tr>
<tr>
<td></td>
<td>Humidity</td>
<td>20 to 80% RH</td>
</tr>
<tr>
<td></td>
<td>Vibration</td>
<td>4.9 m/s² (0.5G) or less</td>
</tr>
<tr>
<td></td>
<td>Altitude</td>
<td>1000 m or less</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>Free from corrosive gas or liquid, or explosive gas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Free from excessive electrical noise (plasma)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Free from strong magnetic field</td>
</tr>
<tr>
<td>Power Capacity</td>
<td>1.5 kVA</td>
<td></td>
</tr>
<tr>
<td>Applicable controller</td>
<td>YRC1000/YRC1000micro</td>
<td></td>
</tr>
<tr>
<td>Equivalent continuous sound pressure level 6)</td>
<td>73 dB or less</td>
<td></td>
</tr>
</tbody>
</table>

1) SI units are used in this table. However, gravitational unit is used in ( )
2) The load applied on the U-arm will vary depending on the load mass of the wrist part. For details, refer to chapter 7.1.1 “Allowable Load”.
3) Conformed to ISO9283
4) For the tilt- and the wall-mounted ways, S-axis has the limited operating range. For details, refer to chapter 3.3.1 “S-Axis Operating Range”
5) Refer to chapter 6.1 “Allowable Wrist Load” for details on the allowable inertia.
6) Conformed to equivalent continuous A-weighted sound pressure level measured in accordance with ISO11201(EN31201)

1. Measurement is carried out when the maximum load is mounted to the manipulator and operated in the maximum speed.
2. Measurement is carried out:
   - between 1.2m and 1.5m above the ground.
   - 400mm away from the P-point maximum envelope.
5.2 Part Names and Working Axes

Fig. 5-1: Part Names and Working Axes

- Wrist flange
- U-arm
- L-arm
- S-head
- Manipulator base
- T+
- U+
- B+
- R+
- U-
- B-
- S+
- S-
5.3 Dimensions and P-Point Maximum Envelope

Fig. 5-2: Dimensions and P-Point Maximum Envelope
Fig. 5-3: Home Position and Operating Range of Each Axis
5 Basic Specifications
5.4 Stopping Distance and Time for S-, L-, and U-Axes

5.4.1 General Information

• The stopping distance is an angle traveled by the manipulator from the moment when the stop signal is activated until the manipulator comes to a complete standstill.

• The stopping time is a time elapsed from the moment that the stop signal is activated until the manipulator comes to a complete standstill.

• The data that are given for the main axes S, L and U are the maximum displacement.

• Superposed axes motions may result in longer stopping distance.

• Stopping distance and stopping time are measured in accordance with ISO 10218-1, Annex B

• Stop categories: According to IEC60204-1
  • Stop category 0
  • Stop category 1

• The values specified for Stop category 0 are the reference values that are determined by tests and simulations. The actual stopping distance and stopping time may differ.

5.4.2 Definition of Use

Load: Rated load weight and load on an arm
Speed: Operating speed of the manipulator
Extension: Distance between the rotation center and the P-point of each axis

5.4.3 Stopping Distance and Time for Stop Category 0: S-, L- and U-Axes

Measurement Conditions

• Load: Maximum load
• Speed: Maximum speed
• Posture: Maximum inertia generation posture

<table>
<thead>
<tr>
<th>Axis</th>
<th>Stopping distance (deg)</th>
<th>Stopping Time (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>24.3</td>
<td>0.157</td>
</tr>
<tr>
<td>L-axis</td>
<td>22.6</td>
<td>0.159</td>
</tr>
<tr>
<td>U-axis</td>
<td>30.7</td>
<td>0.213</td>
</tr>
</tbody>
</table>
5.4.4 Stop Category 1: Stopping Distance and Time for Stop Category 1: S-, L- and U-Axes

5.4.4.1 Extension

Refer to fig. 5-4 “S-Axis Extension”, fig. 5-5 “L-Axis Extension” and fig. 5-6 “U-Axis Extension” for each axis arm extension.

Fig. 5-4: S-Axis Extension

Fig. 5-5: L-Axis Extension

Fig. 5-6: U-Axis Extension
5.4 Stopping Distance and Time for S-, L-, and U-Axes

Fig. 5-6: U-Axis Extension
5.4 Stopping Distance and Time for S-, L-, and U-Axes

5.4.4.2 Stopping Distance and Time for Stop Category 1: S-axis

![Graphs showing stopping distance and time for S-axis with different load conditions and extensions.](image-url)
5.4 Stopping Distance and Time for S-, L-, and U-Axes

5.4.4.3 Stopping Distance and Time for Stop Category 1: L-axis

[Graphs showing stopping distance and time for different loads and extensions]
5.4.4 Stopping Distance and Time for Stop Category 1: U-axis
5.5 Alterable Operating Range

The operating range of the S-axis can be altered in accordance with the operating conditions as shown in Table 5-2 “S-Axis Operating Range”. If alteration is necessary, contact your YASKAWA representative in advance.

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-Axis Operating Range</td>
<td>-170° ~ +170° (standard)</td>
</tr>
<tr>
<td></td>
<td>-150° ~ +150°</td>
</tr>
<tr>
<td></td>
<td>-135° ~ +135°</td>
</tr>
<tr>
<td></td>
<td>-120° ~ +120°</td>
</tr>
<tr>
<td></td>
<td>-105° ~ +105°</td>
</tr>
<tr>
<td></td>
<td>-90° ~ +90°</td>
</tr>
<tr>
<td></td>
<td>-75° ~ +75°</td>
</tr>
<tr>
<td></td>
<td>-60° ~ +60°</td>
</tr>
<tr>
<td></td>
<td>-45° ~ +45°</td>
</tr>
<tr>
<td></td>
<td>-30° ~ +30°</td>
</tr>
</tbody>
</table>

5.5.1 Components for Altering Operating Range

Arrange the components listed in Fig. 5-7 “Components of the S-Axis Stopper and Stopper Mounting Position”, when modifying the angle of S-axis.

- Dog (drawing No. HW0414041-4) (2 dogs)
- Hexagon socket head cap screw M12 "FA coat" (length: 30 mm) (2 screws) (Tensile strength: 1200 N/mm² or more)
- Conical spring washer M12 "FA coat" (2 washers)

**Fig. 5-7: Components of the S-Axis Stopper and Stopper Mounting Position**
5.5.2 Notes on the Mechanical Stopper Installation

When mounting the S-axis mechanical stopper, as shown in fig. 5-7 “Components of the S-Axis Stopper and Stopper Mounting Position”, mount a dog (HW0414041-4) on the S-head with the hexagon socket head cap screw M12 (length: 30 mm) (2 places) by using a tightening torque 84N·m (tensile strength: 1200 N/mm² or more). The mechanical stopper is not necessary when the operating range is set to ±170° (Standard specification).

The mechanical stopper can be set at 15° pitch intervals from 30° to 150° range.

For the settable angles, refer to table 5-3 “The Settable Angle for S-Axis Stopper”.

1. Apply the specified components when mounting the S-Axis mechanical stopper.
2. TURN OFF the electric power supply before mounting.

5.5.3 Adjustment to the Pulse Limitation of S-Axis

For altering the range of motion of S-Axis, refer to Chapter 6.13 Softlimit Setting Function in YRC1000 GENERAL OPERATOR'S MANUAL (manual No. RE-CSO-A051)/YRC1000micro GENERAL OPERATOR'S MANUAL (manual No. RE-CSO-A058). With programming pendant, input the numeric value as shown in the following table to modify the parameter.

### Degree

<table>
<thead>
<tr>
<th>± 30°</th>
<th>± 45°</th>
<th>± 60°</th>
<th>± 75°</th>
<th>± 90°</th>
</tr>
</thead>
<tbody>
<tr>
<td>± 43061</td>
<td>± 64591</td>
<td>± 86121</td>
<td>± 107651</td>
<td>± 129182</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>± 105°</th>
<th>± 120°</th>
<th>± 135°</th>
<th>± 150°</th>
<th>± 170°</th>
</tr>
</thead>
<tbody>
<tr>
<td>± 150712</td>
<td>±172242</td>
<td>± 193772</td>
<td>± 215303</td>
<td>± 244010</td>
</tr>
</tbody>
</table>

**NOTE**
Adjust both of the pulse limitation and the angle of S-Axis mechanical stopper as modifying the range of motion for machinery.
Table 5-3: The Settable Angle for S-Axis Stopper

The table indicates the angle range which allows the S-axis to be set for + direction and - direction angles. For example, the range from -150° to +150° is settable, but 0° to +135° is not settable.
6 Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

The allowable payload of the wrist axis is 12 kg. However, the requirements listed in table 6-1 “Allowable Wrist Load” must be satisfied regarding the moment and the inertia.

Even if the load is not applied as mass but applied as force, the values in table 6-1 must not be exceeded.

When the volume of the load is relatively small, refer to the moment arm rating (LB, LT) shown in fig. 6-1 “Moment Arm Rating”. Each value of the allowable inertia above is calculated assuming that the moment load is at the maximum. Thus, in the case when only the inertia load is applied, when the moment load is small while the inertia load is large, or when the load is not applied as mass but applied as force, etc., contact your YASKAWA representative in advance.

When a tool is installed, the tool information and the load information must be set. For the setting, refer to Chapter 8.3 Tool Data Setting and Chapter 8.4 ARM Control in YRC1000 INSTRUCTIONS (Manual No: RE-CTO-A221)/YRC1000micro INSTRUCTIONS (Manual No: RE-CTO-A222).

**Table 6-1: Allowable Wrist Load**

<table>
<thead>
<tr>
<th>Axis</th>
<th>Allowable moment N·m (kgf·m)^1</th>
<th>Allowable inertia (GD^2/4) kg·m^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-Axis</td>
<td>22 (2.2)</td>
<td>0.65</td>
</tr>
<tr>
<td>B-Axis</td>
<td>22 (2.2)</td>
<td>0.65</td>
</tr>
<tr>
<td>T-Axis</td>
<td>9.8 (1.0)</td>
<td>0.17</td>
</tr>
</tbody>
</table>

1 ( ) : Gravitational unit

When the volume of the load is relatively small, refer to the moment arm rating (LB, LT) shown in fig. 6-1 “Moment Arm Rating”. Each value of the allowable inertia above is calculated assuming that the moment load is at the maximum. Thus, in the case when only the inertia load is applied, when the moment load is small while the inertia load is large, or when the load is not applied as mass but applied as force, etc., contact your YASKAWA representative in advance.

When a tool is installed, the tool information and the load information must be set. For the setting, refer to Chapter 8.3 Tool Data Setting and Chapter 8.4 ARM Control in YRC1000 INSTRUCTIONS (Manual No: RE-CTO-A221)/YRC1000micro INSTRUCTIONS (Manual No: RE-CTO-A222).

**Fig. 6-1: Moment Arm Rating**

![Moment Arm Rating Diagram](image-url)
6 Allowable Load for Wrist Axis and Wrist Flange
6.2 Wrist Flange

The wrist flange dimensions are shown in Fig. 6-2 “Wrist Flange”. It is recommended that the attachment be mounted outside the fitting in order to identify the alignment marks. Fitting depth shall be 3 mm or less. The attachment should be mounted inside the range shown in the figure below.

Fig. 6-2: Wrist Flange

During initial operations, the lubricant may seep from the lip part of the oil seal. Wipe off the seeped lubricant with a cloth before use.
7 System Application

7.1 Peripheral Equipment Mounts

CAUTION

- Do not make any additional holes or tapped holes on the manipulator's body. Failure to observe this instruction may adversely affect the safety and/or performance of the manipulator.
- YASKAWA provides no guarantee against damages, malfunctions, failures, etc. caused by using any means other than the tapped holes shown in the following figure. The tightening bolts used for the mechanical parts of the manipulator must be used only to secure the mechanical parts. Do not additionally secure or attach any other things by using these tightening bolts.

7.1.1 Allowable Load

The maximum allowable load on the U-axis is 22 kg, including the wrist load. For instance, when the mass installed on the wrist point is 6 kg, the mass which can be installed on the upper arm is 16 kg.

The maximum allowable load on the S-axis is 20 kg. Install the peripheral equipment on the S-axis so that the moment of inertia (GD^2/4) from the S-axis rotation center is 1.25 kg•m^2 or less.

When a load is applied on the upper arm or the rotary head, the load setting must be performed. For setting procedures, refer to Chapter 8.4 ARM Control in YRC1000 INSTRUCTIONS (Manual No: RE-CTO-A221) / YRC1000micro INSTRUCTIONS (Manual No: RE-CTO-A222).

7.1.2 Installation Position

There is a limitation on where to install the peripheral equipment as shown in fig. 7-1.

NOTE

When installing cables or cable guides, check cables for torsions or behaviors caused by bending using the actual manipulator so that unnecessary force is applied to the cables, manipulator or peripheral devices.
Fig. 7-1: Installing Peripheral Equipment

Mount the peripheral equipment within this area.

Center of gravity of the peripheral equipment on the U-arm must be within this area.

<table>
<thead>
<tr>
<th>Hole Type</th>
<th>Dimensions</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tapped hole M8 (4 holes)</td>
<td>(Depth: 18) (Pitch: 1.25)</td>
<td></td>
</tr>
<tr>
<td>Tapped hole M6 (2 holes)</td>
<td>(Depth: 12) (Pitch: 1.0)</td>
<td></td>
</tr>
<tr>
<td>Through tap M5 (4 holes)</td>
<td>(Depth: 18) (Pitch: 0.8)</td>
<td></td>
</tr>
<tr>
<td>Tapped hole M5 (4 holes)</td>
<td>(Pitch: 0.8)</td>
<td></td>
</tr>
<tr>
<td>Through tap M5 (4 holes)</td>
<td>(Depth: 11) (Pitch: 0.8)</td>
<td></td>
</tr>
<tr>
<td>Tapped hole M5 (2 holes)</td>
<td>(Depth: 11) (Pitch: 0.8)</td>
<td></td>
</tr>
<tr>
<td>Tapped hole M5 (2 holes)</td>
<td>(Depth: 11) (Pitch: 0.8)</td>
<td></td>
</tr>
<tr>
<td>Tapped hole M6 (4 holes)</td>
<td>(Depth: 14) (Pitch: 1.5)</td>
<td></td>
</tr>
<tr>
<td>Tapped hole M8 (2 holes)</td>
<td>(Depth: 12) (Pitch: 1.0)</td>
<td></td>
</tr>
<tr>
<td>Tapped hole M10 (4 holes)</td>
<td>(Depth: 18) (Pitch: 1.0)</td>
<td></td>
</tr>
</tbody>
</table>

Dimensions of the casting:

- Center of gravity of the peripheral equipment on the U-arm must be within this area.

- Mount the peripheral equipment within this area.
7.2 Internal User I/O Wiring Harness and Air Line

Internal user I/O wiring harness (16 wires: 0.2 mm$^2$ x 10 wires, 0.75 mm$^2$ x 2 wires and 1.25 mm$^2$ x 4 wires) and two air lines are incorporated in the manipulator for the drive of peripheral devices mounted on the upper arm as shown in fig. 7-2 "Connectors for Internal User I/O Wiring Harness and Air Line". The connector pins 1 to 16 are assigned as shown in fig. 7-3 "Details of the Connector Pin Numbers" on the following page. Wiring must be performed by users.

The operating conditions are shown in the following table.

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Allowable Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>The allowable current for internal user I/O wiring harness</td>
<td>3 A or less for each wire (Total current value for pins 1 to 16 must be 40 A or less.)</td>
</tr>
<tr>
<td>The maximum pressure for the air line</td>
<td>490 kPa (5 kgf/cm$^2$) or less (Inside diameter: 6.5 mm for air line A, 5.0 mm for air line B (A01 only))</td>
</tr>
<tr>
<td>The temperature for using air line</td>
<td>0$^\circ$C to + 45$^\circ$C</td>
</tr>
</tbody>
</table>
7 System Application
7.2 Internal User I/O Wiring Harness and Air Line

Fig. 7-2: Connectors for Internal User I/O Wiring Harness and Air Line

Exhaust port A
Rc3/8
with a pipe plug

Exhaust port B
Rc3/8
with a pipe plug

Connector for the internal user
I/O wiring harness: JL05-2A20-29SC
(socket connector with a cap)
Prepare pin connector JL05-6A20-29P

Air Inlet A
Rc3/8
with a pipe plug

Air Inlet B
Rc3/8
with a pipe plug

Connector for the internal user
I/O wiring harness: JL05-2A20-29PC
(pin connector with a cap)
Prepare socket connector JL05-6A20-29S
7 System Application
7.2 Internal User I/O Wiring Harness and Air Line

Fig. 7-3: Details of the Connector Pin Numbers

The same pin-number connectors (1 to 16) at both connector base part and arm part are connected with the single wire lead of 0.2 mm², 0.75 mm² or 1.25 mm².

For wiring, refer to fig. 8-5(a) “Internal Connection Diagram” and fig. 8-5(b) “Internal Connection Diagram”.

The same pin-number connectors (1 to 16) at both connector base part and arm part are connected with the single wire lead of 0.2 mm², 0.75 mm² or 1.25 mm².
7.3 Mating Connector for Internal User I/O Wiring Harness (Option)

The mating connector for internal user I/O wiring harness is optional. For the mating connector for internal user I/O wiring harness, two different types of the end bell are prepared depending on the form: Straight type and Elbow type. Select either one type.

<table>
<thead>
<tr>
<th>Straight Type</th>
<th>U-arm part</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plug: JL05-6A20-29S-R or the equivalent</td>
<td>Plug: JL05-6A20-29P-R or the equivalent</td>
</tr>
<tr>
<td>End bell: JL05-20EB1A-R</td>
<td>End bell: JL05-20EB1A-R</td>
</tr>
<tr>
<td>Cable clamp: N/MS3057-12A</td>
<td>Cable clamp: N/MS3057-12A</td>
</tr>
<tr>
<td>(straight form)</td>
<td>(straight form)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elbow Type</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Plug: JL05-6A20-29S-R or the equivalent</td>
<td>Plug: JL05-6A20-29P-R or the equivalent</td>
</tr>
<tr>
<td>End bell: JL05-20EB1A-R</td>
<td>End bell: CE-20BA-S-D</td>
</tr>
<tr>
<td>Cable clamp: N/MS3057-12A</td>
<td>Cable clamp: N/MS3057-12A</td>
</tr>
<tr>
<td>(straight form)</td>
<td>(elbow form)</td>
</tr>
</tbody>
</table>

- **Straight Type**

The appearance of the manipulator with the connector installed is shown in Fig. 7-4(a) “Manipulator with the mating connector for internal user I/O wiring harness (straight type)”.

When the connector with the straight type of end bell is installed, the connector of the U-arm part sticks out to the back of the manipulator. Thus, the operating range of the U-axis must be limited.

When operating, be careful not to let the connector and/or the cable touch the manipulator’s body.

*Fig. 7-4(a): Manipulator with the mating connector for internal user I/O wiring harness (straight type)*
7 System Application
7.3 Mating Connector for Internal User I/O Wiring Harness (Option)

- Elbow Type

The appearance of the manipulator with the connector installed is shown in fig. 7-4(b) “Manipulator with the mating connector for internal user I/O wiring harness (elbow type)”. When the connector with the elbow type of end bell is installed, the direction shown in the following figure is recommended for the connector installation. When assembling the connector, the key must be located at the position shown in the following figure.

Fig. 7-4(b): Manipulator with the mating connector for internal user I/O wiring harness (elbow type)
8 Electrical Equipment Specification

8.1 Position of Limit Switch

The limit switches are optional. See fig. 8-1 “Location of Limit Switches”.

Fig. 8-1: Location of Limit Switches

The angles of the soft limit and the limit switch for S-, L-, and U-axes are set as the factory setting. Refer to table 8-1 “Degrees of Angle (with limit switch installed)”. When altering the operating angle of the manipulator, adjust both the soft limit and the limit switch. The angle of the limit switch must be larger than the soft limit (Difference of 1.5 degree is recommended).


For adjusting limit switch, refer to the following page.

Table 8-1: Degrees of Angle (with limit switch installed)

<table>
<thead>
<tr>
<th></th>
<th>Soft limit</th>
<th>Limit switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>-170° to +170°</td>
<td>-171.5° to +171.5°</td>
</tr>
<tr>
<td>L-axis</td>
<td>-90° to +95°</td>
<td>-91.5° to +96°</td>
</tr>
<tr>
<td>U-axis</td>
<td>-85° to +150°</td>
<td>-86.5° to +151.5°</td>
</tr>
</tbody>
</table>
8 Electrical Equipment Specification
8.1 Position of Limit Switch

• Adjusting limit switch of S-axis
  The angle of limit switch of S-axis can be adjusted by altering the position of S-axis stopper. For altering the stopper’s position, refer to chapter 5.5 “Alterable Operating Range”.

• Adjusting limit switch of L-axis
  The angle of limit switch of L-axis can be adjusted by altering the position of dog on the ring which is mounted on the L-axis. Refer to fig. 8-2 “Assembly of Dog (L-axis)”.

• Adjusting limit switch of U-axis
  The angle of limit switch of U-axis can be adjusted by altering the position of dog on the ring which is mounted on the U-axis. Refer to fig. 8-3 “Assembly of Dog (U-axis)”.

Fig. 8-2: Assembly of Dog (L-axis)

Fig. 8-3: Assembly of Dog (U-axis)
8.2 Position of Servo ON Lamp

The servo ON lamp is optional. See fig. 8-4 “Location of Servo On Lamp”
8.3 Internal Connections

Diagrams for Internal connections of the manipulator and the YRC1000/ YRC1000micro are shown in fig. 8-5(a) "Internal Connection Diagram" and fig. 8-5(b) "Internal Connection Diagram".
Fig. 8-5(a): Internal Connection Diagram

- **S-Axis Overrun L.S.** Connected to A1
- **L-Axis Overrun L.S.** Connected to A2
- **SLU-axes with Limit Switch Specification**
- **S-axis with Limit Switch Specification**

**Board for encoder power**

**Multi-port Connector (g)**

**LA2**
- **S+(IN)**
- **S-(IN)**
- **S+(OUT)**
- **S-(OUT)**

**LA3**
- **S+(IN)**
- **S-(IN)**
- **S+(OUT)**
- **S-(OUT)**

**LA1**
- **S+(IN)**
- **S-(IN)**
- **S+(OUT)**
- **S-(OUT)**

**CN1**
- **DATA+**
- **DATA-**
- **+24V(OT1-1+)**
- **+24V(OT1-2+)**
- **+24V(LAMP+)**
- **BC2(LAMP-)**

**CN2**
- **+24V(LAMP+)**
- **BC2(LAMP-)**

**CN3**
- **SIG shield**
- **SIG shield**
- **0BT**
- **BAT**
- **+5V**
- **0V**

**LA1**
- **LD1**
- **LC2**
- **LB1**
- **LB2**
- **LD2**
- **LB3**

**LA2**
- **LB2**
- **LD2**
- **LB3**
- **LD2**
- **LB3**
- **LD2**

**LA3**
- **LC2**
- **LD2**
- **LB2**
- **LD2**
- **LB2**
- **LD2**
8 Electrical Equipment Specification
8.3 Internal Connections

Fig. 8-5(b): Internal Connection Diagram

Note:
1. For the limit switch specification, the part ( ) is different.

For Spare Cable
9 Maintenance and Inspection

9.1 Inspection Schedule

Proper inspections are essential not only to assure that the mechanism will be able to function for a long period, but also to prevent malfunctions and assure safe operation. Inspection intervals are classified into six levels as shown in table 9-1 “Inspection Items”.

In table 9-1, the inspection items are categorized by three types of operations: operations which can be performed by personnel authorized by the user, operations to be performed by trained personnel, and operations to be performed by service company personnel. Only specified personnel shall perform the inspection work.

- The inspection interval depends on the total servo operation time.
- If the manipulator is used under special conditions, a case-by-case examination is required. The inspection may be conducted at shorter intervals if the manipulator is used very frequently for the application such as handling; in this case, contact your YASKAWA representative.

---

DANGER

- Do not remove the motor, and do not release the brake. Failure to observe these safety precautions may result in death or serious injury from unexpected turning of the manipulator’s arm.

WARNING

- Maintenance and inspection must be performed by specified personnel. Failure to observe this caution may result in electric shock or injury.
- For disassembly or repair, contact your YASKAWA representative.
- Before maintenance or inspection, be sure to turn the main power supply OFF, and put up a warning sign. (ex. DO NOT TURN THE POWER ON.) Failure to observe this warning may result in electric shock or injury.

NOTICE

- Do not remove the connector between the motor and the multi-port connector during maintenance and inspection. Failure to observe this caution may result in the loss of home position data.
<table>
<thead>
<tr>
<th>Items</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Alignment mark</td>
<td>Daily, 10000H cycle, 12000H cycle, 24000H cycle</td>
<td>Visual</td>
<td>Check alignment mark accuracy at the home position. Check for misalignment at the check point.</td>
<td>Specified Personnel</td>
</tr>
<tr>
<td>2. Working area and manipulator</td>
<td>Daily</td>
<td>Visual</td>
<td>Check for damage. Clean the work area if dust, spatter or seeped oil is present. Check for damage and outside cracks.</td>
<td></td>
</tr>
<tr>
<td>5. Drain plug</td>
<td>Daily</td>
<td>Wrench</td>
<td>Discharge water content due to dew condensation in the manipulator.</td>
<td></td>
</tr>
<tr>
<td>6. Timing belts for B- and T-axes</td>
<td>Daily</td>
<td>Manual, Visual</td>
<td>Check for belt tension and the condition. (Replace if failure of tooth, swelling, or abnormal abrasion occurs.)</td>
<td></td>
</tr>
<tr>
<td>7. Wire harness in manipulator (Lead for the SLU-axes wires) (Power supply board included)</td>
<td>Daily</td>
<td>Visual</td>
<td>Check for damage. Clean the part if it is dirty.</td>
<td></td>
</tr>
<tr>
<td>8. Wire harness in manipulator (Lead for the BT-axis wires)</td>
<td>Daily</td>
<td>Visual</td>
<td>Check the condition of the fixed part.</td>
<td></td>
</tr>
<tr>
<td>9. Battery pack in manipulator</td>
<td>Daily</td>
<td></td>
<td>Replace the battery pack when the battery alarm occurs or the manipulator drove for 24000H.</td>
<td></td>
</tr>
<tr>
<td>11. S.L.U.-axis speed reducer</td>
<td>Daily</td>
<td>Grease Gun</td>
<td>Check for malfunction. (Replace if necessary.) Replace grease every 12000H cycle.</td>
<td></td>
</tr>
</tbody>
</table>
## Table 9-1: Inspection Items (Sheet 2 of 2)

<table>
<thead>
<tr>
<th>No.</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Daily</td>
<td>Hand Pump, Injection Syringe</td>
<td>Check for malfunction. (Replace if necessary.) Supply grease (12000H cycle)</td>
<td>● ●</td>
</tr>
<tr>
<td>13</td>
<td>12000H/Cycle</td>
<td>Hand Pump, Injection Syringe</td>
<td>Check for malfunction. (Replace if necessary.) Supply grease (12000H cycle)</td>
<td>● ●</td>
</tr>
<tr>
<td>14</td>
<td>Specified Personnel</td>
<td></td>
<td></td>
<td>●</td>
</tr>
</tbody>
</table>

1. Inspection No. correspond to the numbers in fig. 9-1 "Inspection Items".
2. For the grease, refer to table 9-2 "Inspection Parts and Grease Used".

## Table 9-2: Inspection Parts and Grease Used

<table>
<thead>
<tr>
<th>No.</th>
<th>Grease Used</th>
<th>Inspected Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>RV Grease L800</td>
<td>S-, L- and U-axes speed reducers</td>
</tr>
<tr>
<td>12,13</td>
<td>Harmonic Grease SK-1A</td>
<td>R- and B-axes speed reducers, R, T-axes gear</td>
</tr>
</tbody>
</table>
The numbers in the above table correspond to the numbers in table 9-1, "Inspection Items."
9.2 Notes for Maintenance

9.2.1 Casing

Because the motor, the battery pack are located in the casing, the mating surfaces between the casing and the cover are sealed by using gaskets to prevent the ingress of liquid.

After removing the cover for maintenance, make sure to replace the gasket.

*Fig. 9-2: Sealing Part in Casing*

9.2.2 U-arm

Because the motor, the battery pack, and the belt drive part are located in the U-arm, the mating surfaces between the U-arm and the covers and the mating surfaces between the B-axis and T-axis and the M-bases are sealed by using gaskets to prevent the ingress of liquids or fumes generated by welding.

After removing the cover or M-base for maintenance, make sure to replace the gasket. Refer to table 10-1 “Spare Parts for the YR-1-06VXH12-C00”.

*Fig. 9-3: Sealing Part of U-arm*
9.2.3 Multi-Port Connector

Three multi-port connectors (refer to fig. 9-4 “Multi-Port Connector”) for the motor signals are mounted on each part of the manipulator. (For the locations, refer to fig. 9-9 “Location of the Battery and Multi-port Connector”) The multi-port connector has four ports: two for the motor and the other two for the wire harness. (Refer to fig. 9-5 “Wiring of Multi-Port Connector Part”)

When disconnecting the connector of the multi-port connector during the battery replacement, be careful not to disconnect the connector between the motor and the multi-port connector. If the connector between the motor and the multi-port connector is disconnected, the encoder absolute data will disappear.

Fig. 9-4: Multi-Port Connector

![Multi-Port Connector Diagram]

Port designation

Motor 1
Motor 2

Wire Harness "IN"

Wire Harness "OUT"

*For the multi-port connector for B-, T-axes, the water-proof connector is installed instead of the wire harness.

Fig. 9-5: Wiring of Multi-Port Connector Part

![Wiring Diagram]
9.3 Notes on Maintenance Procedures

9.3.1 Home Position Check

There are alignment marks on each axis to check the home position. (Refer to fig. 9-6 “Alignment Mark Check”)

With those alignment marks, check for home position deviation on regular basis. When home position is disappeared or deviated, contact YASKAWA representative.

Fig. 9-6: Alignment Mark Check
9.3.2 Seeped Oil Check

Check for seeped oil and/or oil spot periodically. Especially the parts indicated in fig. 9-7 "Inspection Parts for Seeped Oil Check" must be inspected carefully. Wipe off seeped oil or oil spot with a cloth before use.

*Fig. 9-7: Inspection Parts for Seeped Oil Check*
9.3.3 S-,L-,U-,R-axis Motors

For the S-, L-, U-, and R-axis motors, there are holes for grease-leakage detection. Remove the screws from the holes to check for grease leaking from the motor. For these procedures of each axis, refer to fig. 9-8(a) "Positions of Grease-Leakage Detection Hole (S-,L-axis)" and fig. 9-8(b) "Positions of Grease-Leakage Detection Hole (U-,R-axis)". When grease leakage is detected, contact YASKAWA representative.

Fig. 9-8(a): Positions of Grease-Leakage Detection Hole (S-,L-axis)

Ultra low-head machine screw M4
- Trivalent chromate (length: 6 mm) (1 screw)
- Tightening torque: 0.75 N•m (0.07 kgf•m)

Grease-leakage check operation is necessary for wall-, lift-, and ceiling-mounted, but not for floor-mounted type.

Enlarged view shows the example of floor-mounted type.

For the "•" parts, the screw whose head faces to the ground must be removed to check the hole.
9 Maintenance and Inspection
9.3 Notes on Maintenance Procedures

Fig. 9-8(b): Positions of Grease-Leakage Detection Hole (U-,R-axis)

Ultra low-head machine screw M4
*Trivalent chromate (length: 6 mm) (1 screw)
Tightening torque: 0.75 N•m (0.07 kgf•m)

Enlarged view shows the example of floor-mounted type.

Move the manipulator to make the either one of screws marked with
*“* face to the ground and remove it to check the hole.

Hexagon socket head cap screw M3
(length: 6 mm) (1 screw)
Tightening torque: 1.4 N•m (0.14 kgf•m)

Enlarged view shows the example of floor-mounted type.

Move the manipulator to make the either one of screws marked with
*“* face to the ground and remove it to check the hole.
9.3.4 Battery Pack Replacement

The battery packs are installed in the position shown in Fig. 9-9. If the battery alarm occurs in the YRC1000/YRC1000micro, replace the battery in accordance with the following procedure:

*Fig. 9-9: Location of the Battery and Multi-port Connector*
9 Maintenance and Inspection

9.3 Notes on Maintenance Procedures

- **Normal (The control power supply of the YRC1000/YRC1000micro can be turned ON)**

  Fig. 9-10: Battery connection (the control power supply of the YRC1000/ YRC1000micro can be turned ON)

1. Turn ON the control power supply of the YRC1000/YRC1000micro and turn OFF the servo power.

   ![](image)

   **DANGER**

   - Make sure to perform the battery replacement with the emergency stop button being pressed. Failure to observe this instruction may cause improper movement of the manipulator which may result in personal injury and/or equipment damage.

2. Loosen the cover mounting bolts and remove the cover.

3. The old battery pack is fixed with the protective tube and the cable tie. Cut the cable tie to remove the old battery pack from the protective tube.

4. Remove the old battery pack from the multi-port connector and mount the new battery pack.

5. After placing the new battery pack into the protective tube, fix it with the cable tie T18L.

6. Tighten the cover mounting bolts by using the tightening torque shown in fig. 9-9 “Location of the Battery and Multi-port Connector” to reinstall the cover.

   **NOTE**

   When reinstalling the cover, be careful not to get caught the cable.
When the control power supply of the YRC1000/YRC1000micro cannot be turned ON

Fig. 9-11: Battery connection (the control power supply of the YRC1000/ YRC1000micro cannot be turned ON)

1. Prepare the lead for battery replacement and the battery pack for backup. (Apart from the new battery pack for replacement, prepare the battery pack for backup)
2. Loosen the cover mounting bolts and remove the cover.
3. Remove the connector from the “IN” port of the multi-port connector. Connect the lead for battery replacement to the “IN” port of the multi-port connector.
4. Connect the battery pack for backup to the lead for battery replacement.
5. The old battery pack is fixed with the protective tube and the cable tie. Cut the cable tie to remove the old battery pack from the protective tube.

**NOTE**
Before removing the old battery pack, make sure to connect the battery pack for backup to prevent the encoder absolute data from disappearing.

6. Remove the old battery pack from the multi-port connector and mount the new battery pack.
7. Remove the lead for battery replacement and the battery pack for backup from the multi-port connector, connect the connector which has been removed in no.3 of this procedure to the “IN” connector again.

**NOTE**
If the battery pack for backup remains connected, an electric current flows from the new battery to the backup battery and which may result in the voltage drop in the new battery. Remove the battery pack for backup immediately after connecting the new battery.

8. After placing the new battery pack into the protective tube, fix it with the cable tie T18L.
9. Tighten the cover mounting bolts by using the tightening torque shown in fig. 9-9 "Location of the Battery and Multi-port Connector" to reinstall the cover.

**NOTE** When reinstalling the cover, be careful not to get caught the cable.
9.4 Notes on Grease Replenishment/Exchange Procedures

9.4.1 Grease Exchange Procedures for S, L, U-axis Speed Reducer

9.4.1.1 Notes on Grease Exchange Procedures

Make sure to follow the instructions listed below at grease replenishment/exchange. Failure to observe the following notes may result in damage to motor and speed reducer.

- If grease is injected without removing the plug from the grease exhaust port, the grease will leak inside a motor, or an oil seal of a speed reducer will come off. Make sure to remove the plug or it may result in a failure. Also, when using a tube, the length must be 150 mm or shorter and the inside diameter must be 6 mm or longer. If the tube is too long, the exhaust resistance at the tube part is increased, and the inner pressure of the grease bath is raised. It may result in coming off of an oil seal.

- Make sure to use a grease pump to inject grease. Set the grease injection rate to 7 g/s or less. (Air supply pressure to the grease pump: 0.3 MPa or less (rough standard))

- When using extrusion air for discharging the grease, set air supply pressure at 0.025 MPa or less. If the air supply pressure is higher than above mentioned value, an oil seal of a speed reducer will come off, and it may result in a failure.

- When using extrusion air for discharging grease, grease may be vigorously discharged from the exhaust port. Perform an operation such as using a tube at the grease exhaust port to pour into an appropriate container.

- Make sure to fill the hose on the grease inlet with grease beforehand to prevent air from leaking into the speed reducer.

- After injecting grease, discharge the specified amount of grease. If insufficient, the inner pressure is raised during the operation, and grease may leak. When discharged too much, the speed reducer is not lubricated sufficiently during the operation, and it may cause the early failure of the speed reducer.

- When filling/exchanging grease, the grease may flow out from the grease inlet or the grease exhaust port. Prepare a container to receive the grease and a waste cloth to wipe the grease in advance.

**WARNING**

- When operating the manipulator, do not enter into the working area of the manipulator. Injury may result if anyone enter into the working area during operation.
9.4.1.2 Grease Exchange Procedure

**Fig. 9-12: S, L, U-Axis Speed Reducer Diagram**

- **L-axis speed reducer**
  - Grease exhaust port of L-axis (Hexagon socket head tapered pipe plug NPTF3/8)
  - Grease inlet port: when mounted on the ceiling

- **S-axis speed reducer**
  - Grease exhaust port of S-axis (Hexagon socket head tapered pipe plug NPTF3/8)
  - Grease inlet port: when mounted on the ceiling

- **U-axis speed reducer**
  - Grease exhaust port of U-axis (Hexagon socket head tapered pipe plug NPTF3/8)
  - Grease inlet port: when mounted on the ceiling

- **Grease inlet of L-axis** (Hexagon socket head tapered pipe plug NPTF3/8)
  - Grease exhaust port: when mounted on the ceiling

- **Grease inlet of S-axis** (Hexagon socket head tapered pipe plug NPTF3/8)
  - Grease exhaust port: when mounted on the ceiling

- **Grease inlet of U-axis** (Hexagon socket head tapered pipe plug NPTF3/8)
  - Grease exhaust port: when mounted on the ceiling
1. Before injecting grease, the posture of the manipulator must be set as indicated in Table 9-3 "Recommended Posture for Grease Injection". If it is difficult to make the recommended posture because of external cabling or etc., adjust the posture as much as possible to make the position of grease inlet located in the lower part and the position of exhaust port located in the upper part. If the exhaust port is located in the lower part, grease may not be exchanged properly.

Table 9-3: Recommended Posture for Grease Injection

<table>
<thead>
<tr>
<th>Mounting Condition</th>
<th>Axis to inject</th>
<th>S-axis</th>
<th>L-axis</th>
<th>U-axis</th>
<th>R-axis</th>
<th>B-axis</th>
<th>T-axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor-mounted</td>
<td>S-axis</td>
<td>0°</td>
<td>Any</td>
<td>Any</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>L-axis</td>
<td>Any</td>
<td>0°</td>
<td>Any</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>U-axis</td>
<td>Any</td>
<td>0° *</td>
<td>0° *</td>
<td>Any</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceiling-mounted</td>
<td>S-axis</td>
<td>0°</td>
<td>Any</td>
<td>Any</td>
<td></td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td></td>
<td>L-axis</td>
<td>Any</td>
<td>0°</td>
<td>Any</td>
<td></td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td></td>
<td>U-axis</td>
<td>Any</td>
<td>0° *</td>
<td>0° *</td>
<td>Any</td>
<td>Any</td>
<td>Any</td>
</tr>
<tr>
<td>Wall-mounted</td>
<td>S-axis</td>
<td>0°</td>
<td>Any</td>
<td>Any</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>L-axis</td>
<td>0°</td>
<td>±90°</td>
<td>Any</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>U-axis</td>
<td>0°</td>
<td>±90° *</td>
<td>±90° *</td>
<td>Any</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* If the recommended posture of the L-axis cannot be made, rotate the U-axis to make the U-arm horizontal to the ground.

2. Remove the hexagon socket head plugs from the grease inlet and grease exhaust port.

The positions of grease inlet and exhaust port are different depending on the mounting condition of the manipulator. Confirm the positions beforehand.

3. Install a grease zerk A-PT3/8 to the grease inlet.
   (The grease zerk is delivered with the manipulator.)

4. Inject the grease through the grease inlet using a grease gun
   - Grease type: RV Grease LB00
   - Recommended grease lubricator: "Powerlube P3C (made by Macnaught)"
   - Amount of grease: 7 g/s or less
   (For example, if grease is supplied from the lubricator at 2 times/s, set the amount to 3.5 g/time or less)
   - Air supply pressure of grease pump: Approximately 0.3 MPa or less

Table 9-4: Amount of Grease

<table>
<thead>
<tr>
<th>Axis to exchange grease</th>
<th>Amount of grease</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>Approx.700 g</td>
</tr>
<tr>
<td>L-axis</td>
<td>Approx.450 g</td>
</tr>
<tr>
<td>U-axis</td>
<td>Approx.350 g</td>
</tr>
</tbody>
</table>
9.4 Notes on Grease Replenishment/Exchange Procedures

5. Injection stop:
   - <When replacing the speed reducer>
     Stop injecting grease when grease can be seen from the exhaust port.
   - <When exchanging grease>
     The old grease is discharged from the grease exhaust port. At this time, stop injection when the mixture of the old grease and the new grease in an equal ratio is seen. And then, skip the steps 6 and 7, and proceed to the step 8.

6. Operate each axis about 5 times in the teach mode as shown in table 9-5 "Teaching Operation for Each Axis".

   Table 9-5: Teaching Operation for Each Axis
<table>
<thead>
<tr>
<th>Axis to replenish grease</th>
<th>Angle for teaching operation</th>
<th>Speed for teaching operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>S-axis ±45°</td>
<td>User-specified</td>
</tr>
<tr>
<td>L-axis</td>
<td>L-axis ±45°</td>
<td></td>
</tr>
<tr>
<td>U-axis</td>
<td>U-axis ±45°</td>
<td></td>
</tr>
</tbody>
</table>

7. Inject grease again, and when grease comes out of the exhaust port, grease injection is completed.

8. Discharge the specified amount of grease from the grease inlet or grease exhaust port. (Refer to table 9-6 "Amount of Grease Discharged from Each Axis".) In order to discharge the specified amount of grease, receive the discharged grease by using a container, and then measure the weight of the discharged grease by weighing the container till the amount reaches to the specified amount.

Use one of the following methods to discharge grease.

Method 1: Extruding grease by air
   1. Connect the joint and the hose to the grease inlet.
   2. Connect the regulator to the grease exhaust port.
   3. Inject air from the grease exhaust port to extrude grease by air. (Extrusion air pressure: 0.025 MPa or less)
   4. If the grease is not discharged enough by injecting air, operate the manipulator about 5 times in the teach mode as shown in table 9-7 "Grease Discharging Operation for Each Axis".

Method 2: Suctioning grease out
   1. Keep the inlet open and insert the tube into the exhaust port.
   2. Discharge grease by suctioning grease out of the exhaust port. (Suction pressure: 0.025 MPa or less)
   3. If grease is not discharged by suctioning, operate the manipulator again about 5 times in the teach mode as shown in table 9-7.

   Table 9-6: Amount of Grease Discharged from Each Axis
<table>
<thead>
<tr>
<th>Axis to exchange grease</th>
<th>Amount of exhausted grease</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[g]</td>
</tr>
<tr>
<td>S-axis</td>
<td>25±5</td>
</tr>
<tr>
<td>L-axis</td>
<td>50±5</td>
</tr>
<tr>
<td>U-axis</td>
<td>40±5</td>
</tr>
</tbody>
</table>
9.4 Notes on Grease Replenishment/Exchange Procedures

9. For the axis where grease is exchanged, perform a playback operation indicated in Table 9-8 “Running-In Operation for Each Axis” for running-in the speed reducer with grease. At this time, grease may be discharged during the operation. Remove the grease zerk from the grease inlet, and clean and degrease the tap part and the thread part of the plug. Wrap the seal tape TB4501 around the plug. Tighten the plug on the grease inlet with the tightening torque of 16.5 N·m (1.7 kgf·m). Also, discharge the excess grease in order not to increase the inner pressure of the speed reducer. Attach a bag to receive grease such as indicated in Fig. 9-13 “Grease Receiving Bag (Rough Standard)”, and then perform the running-in operation.

Table 9-8: Running-In Operation for Each Axis

<table>
<thead>
<tr>
<th>Axis to exchange grease</th>
<th>Running-in operation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operation angle</td>
</tr>
<tr>
<td>S-, L-, U-axes</td>
<td>±45°</td>
</tr>
</tbody>
</table>

10. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, clean and degrease the tap part and the thread part of the plug. Wrap the seal tape TB4501 around the plug. Tighten the plug on the grease exhaust port by using the tightening torque 16.5 N·m (1.7 kgf·m).
9.4.2 Grease Replenishment Procedures for R,B-axis Speed Reducer and R,T-axis Gear

9.4.2.1 Notes on Grease Replenishment Procedures

Make sure to follow the instructions listed below at grease exchange. Failure to observe the following notes may result in damage to motor and speed reducer.

- If grease is injected without removing the plug from the air exhaust port, the grease may leak inside of the motor, and/or an oil seal of a speed reducer may come off and/or grease may leak inside of the manipulator. Make sure to remove the plug before injection.
- Use the hand pump or injection syringe for grease injection.
- Make sure to fill the hose on the grease inlet with grease beforehand to prevent air from leaking into the speed reducer.

NOTE

The positions of grease inlet and exhaust port are different depending on the mounting condition of the manipulator. Confirm the positions beforehand.

9.4.2.2 Grease Replenishment Procedures for R-axis Speed Reducer

Fig. 9-14: R-Axis Speed Reducer Diagram

1. Make the posture of the U-arm horizontal to the ground.
2. Remove the hexagon socket head plugs from the grease inlet and the air exhaust port.
3. Install a grease zerk A-PT1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)
4. Inject the grease through the grease inlet using a grease gun
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 7 g
5. Remove the grease zerk from the grease inlet and install the plug. Wrap the seal tape TB4501 around the plug and then tighten the plug by using the tightening torque 4.9 N\textperiodcentered m (0.49 kgf\textperiodcentered m).

6. Install the plug to the air exhaust port. Wrap the seal tape TB4501 around the plug and then tighten the plug by using the tightening torque 4.9 N\textperiodcentered m (0.49 kgf\textperiodcentered m).

9.4.2.3 Grease Replenishment Procedures for B-axis Speed Reducer

*Fig. 9-15: B-Axis Speed Reducers Diagram*

1. Adjust the posture of the manipulator to perform grease replenishment smoothly.

2. Remove the hexagon socket head cap screws M6 from the grease inlet and the air exhaust port.

3. Install a grease zerk A-MT6×1 to the grease inlet. (The grease zerk is delivered with the manipulator.)

4. Inject the grease into the grease inlet.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 7 g

*NOTE* Grease is not exhausted from the air exhaust port. Do not inject excessive grease into the grease inlet.
9.4 Notes on Grease Replenishment/Exchange Procedures

5. Remove the grease zerk from the grease inlet. Install the hexagon socket head cap screw M6 to the grease inlet. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 6 N·m (0.6 kgf·m).

6. Install the hexagon socket head cap screw M6 to the air exhaust port. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 6 N·m (0.6 kgf·m).

9.4.2.4 Grease Replenishment Procedures for R-axis Gear

Fig. 9-16: R-Axis Gear Diagram

1. Make the posture of the U-arm horizontal to the ground.

2. Remove the hexagon socket head plug from the grease inlet and the air exhaust port.

NOTE
The positions of grease inlet and exhaust port are different depending on the mounting condition of the manipulator. Confirm the positions beforehand.

3. Install a grease zerk A-PT1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)

4. Inject the grease into the grease inlet.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 3 g (for replenishment) 55 g (when the speed-reducer is replaced)

NOTE
Grease is not exhausted from the air exhaust port.
Do not inject excessive grease into the grease inlet.
9.4 Notes on Grease Replenishment/Exchange Procedures

5. Remove the grease zerk from the grease inlet and install the plug. Wrap the seal tape TB4501 around the plug and then tighten the plug by using the tightening torque 4.9 N·m (0.49 kgf·m).

6. Install the plug to the air exhaust port. Wrap the seal tape TB4501 around the plug and then tighten the plug by using the tightening torque 4.9 N·m (0.49 kgf·m).

9.4.2.5 Grease Replenishment Procedures for T-axis Gear

![T-Axis Gear Diagram](image)

1. Adjust the posture of the manipulator to perform grease replenishment smoothly.
2. Remove the hexagon socket head cap screws M6 from the grease inlet 1 and the air exhaust port.
3. Install a grease zerk A-MT6×1 to the grease inlet 1. (The grease zerk is delivered with the manipulator.)
4. Inject the grease into the grease inlet 1.
   - Grease type: Harmonic Grease SK-1A
   - Amount of grease: 2 g

**NOTE**

Grease is not exhausted from the air exhaust port. Do not inject excessive grease into the grease inlet.

5. Remove the grease zerk from the grease inlet 1. Install the hexagon socket head cap screw M6 to the grease inlet 1. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 6 N·m (0.6 kgf·m).
6. Remove the hexagon socket head cap screw M6 from the grease inlet 2.
7. Install a grease zerk A-MT6×1 to the grease inlet 2. (The grease zerk is delivered with the manipulator.)
8. Inject the grease into the grease inlet 2.
   – Grease type: Harmonic Grease SK-1A
   – Amount of grease: 2 g

**NOTE**
Grease is not exhausted from the air exhaust port.
Do not inject excessive grease into the grease inlet.

9. Remove the grease zerk from the grease inlet 2. Install the hexagon socket head cap screw M6 to the grease inlet 2. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 6 N·m (0.6 kgf·m).
10. Install the hexagon socket head cap screw M6 to the air exhaust port. When installing the screw, apply ThreeBond 1206C on the thread part of the screw and then tighten the screw with a tightening torque of 6 N·m (0.6 kgf·m).
9.5 How to Drain Condensation Water from the Drain Plug

Water from dew concentration accumulates because the U-arm is sealed. Remove the plug attached to the exhaust port and discharge the water on a regular basis.

9.5.1 In Case of Floor Installation

![Diagram](image)

1. Make the U-axis horizontal to the ground as shown in fig. 9-18 "Dew Condensation Water Exhaust (Floor Installation)".
2. Remove the plug from the water exhaust port.
3. Rotate the U-axis about ±5° to discharge the water.
4. Attach the plug to the exhaust port. After wrapping the plug with sealant tape (TB4501), tighten the plug with a tightening torque of 4.9 N•m (0.49 kgf•m).
In Case of Wall Installation

1. Make the U-axis horizontal to the ground as shown in Fig. 9-19 “Dew Condensation Water Exhaust (Wall Installation)”.
2. Remove the plug from the water exhaust port.
3. Rotate the U-axis about ±5° to discharge the water.
4. Attach the plug to the exhaust port. After wrapping the plug with sealant tape (TB4501), tighten the plug with a tightening torque of 4.9 N•m (0.49 kgf•m).
9.5.3 In Case of Ceiling Installation

Fig. 9-20: Dew Condensation Water Exhaust (Ceiling Installation)

1. Make the U-axis horizontal to the ground as shown in fig. 9-20 "Dew Condensation Water Exhaust (Ceiling Installation)".
2. Remove each plug from the water exhaust port.
3. Rotate the U axis about ±5° to discharge the water.
4. Attach the plug to the exhaust port. After wrapping the plug with sealant tape (TB4501), tighten the plug with a tightening torque of 4.9 N•m (0.49 kgf•m).
10 Recommended Spare Parts

It is recommended to keep the parts and components in the following table in stock as spare parts for the MOTOMAN-GP12.

To purchase lead wires of the wire harness or etc., check the order/ manufacture no. and contact YASKAWA representative.

Product performance cannot be guaranteed when using spare parts from any company other than YASKAWA. The spare parts are ranked as follows:

- Rank A: Expendable and frequently replaced parts.
- Rank B: Parts for which replacement may be necessary as a result of frequent operation.
- Rank C: Drive unit.

NOTE
For replacing parts in Rank B or Rank C, contact your YASKAWA representative.

Table 10-1: Spare Parts for the YR-1-06VXH12-C00 (Sheet 1 of 3)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>Grease</td>
<td>RV Grease LB00</td>
<td>YASKAWA Electric Corporation</td>
<td>16 kg</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>Grease</td>
<td>Harmonic Grease SK-1A</td>
<td>Harmonic Drive Systems Co., Ltd.</td>
<td>2.5 kg</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>3</td>
<td>Grease</td>
<td>Multemp PS2A</td>
<td>KYODO YUSHI CO., LTD</td>
<td>2.5 kg</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>Grease</td>
<td>MP-1</td>
<td>NIPPON GREASE CO., LTD</td>
<td>2.5 kg</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>5</td>
<td>Liquid Gasket</td>
<td>TB1208C</td>
<td>ThreeBond Co., Ltd</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>6</td>
<td>Adhesive</td>
<td>LOCTITE243</td>
<td>Henkel Japan Ltd</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>7</td>
<td>Seal Tape</td>
<td>TB4501</td>
<td>ThreeBond Co., Ltd</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>8</td>
<td>Battery Pack</td>
<td>HW1483880-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>A</td>
<td>9</td>
<td>Lead Wire for Battery Replacement</td>
<td>HW1471281-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>For the battery replacement</td>
</tr>
<tr>
<td>A</td>
<td>10</td>
<td>Gasket</td>
<td>HW1306400-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>For the U-arm cover (B-axis)</td>
</tr>
<tr>
<td>A</td>
<td>11</td>
<td>Gasket</td>
<td>HW1306401-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>For the U-arm cover (T-axis)</td>
</tr>
<tr>
<td>A</td>
<td>12</td>
<td>Gasket</td>
<td>HW1407822-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>For the motor base (B-axis)</td>
</tr>
<tr>
<td>A</td>
<td>13</td>
<td>Gasket</td>
<td>HW1407823-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>For the motor base (T-axis)</td>
</tr>
<tr>
<td>A</td>
<td>14</td>
<td>Gasket</td>
<td>HW1308043-1</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>For the casing cover</td>
</tr>
<tr>
<td>A</td>
<td>15</td>
<td>O-ring</td>
<td>S50</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>For the motor base (R-, B-, and T-axes)</td>
</tr>
</tbody>
</table>

10-1
<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name Type</th>
<th>Manufacturer</th>
<th>Qty per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 16</td>
<td>B-Axis Timing Belt</td>
<td>60S5M675</td>
<td>Mitsuboshi Belting Limited</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>A 17</td>
<td>T-Axis Timing Belt</td>
<td>150Xcet-653M954</td>
<td>Bando Chemical Industries, Ltd.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B 18</td>
<td>Replacement Kit for S-Axis Speed Reducer</td>
<td>HW1485823-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B 19</td>
<td>Replacement Kit for L-Axis Speed Reducer</td>
<td>HW1485824-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
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<tr>
<td>B 20</td>
<td>Replacement Kit for U-Axis Speed Reducer</td>
<td>HW1485825-A</td>
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<tr>
<td>B 21</td>
<td>Replacement Kit for R-Axis Speed Reducer</td>
<td>HW1485826-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B 22</td>
<td>Replacement Kit for B-Axis Speed Reducer</td>
<td>HW1485827-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
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<tr>
<td>B 23</td>
<td>Replacement Kit for R-Axis Unit</td>
<td>HW1485828-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
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<tr>
<td>B 24</td>
<td>Wrist Unit</td>
<td>HW1173820-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B 25</td>
<td>Wire Harness in Manipulator</td>
<td>HW1173740-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
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<tr>
<td>B 26</td>
<td>Wire Harness in Manipulator for B, T-Axes</td>
<td>HW1271557-D</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
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<tr>
<td>B 27</td>
<td>Lead Wire for S-Axis Signal</td>
<td>HW1372597-A</td>
<td>YASKAWA Electric Corporation</td>
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<tr>
<td>B 28</td>
<td>Lead Wire for L-Axis Signal</td>
<td>HW1372597-B</td>
<td>YASKAWA Electric Corporation</td>
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<tr>
<td>B 29</td>
<td>Lead Wire for U-Axis Signal and Power</td>
<td>HW1373559-A</td>
<td>YASKAWA Electric Corporation</td>
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<tr>
<td>B 30</td>
<td>Extend Lead Wire for R-Axis Signal</td>
<td>HW1372642-D</td>
<td>YASKAWA Electric Corporation</td>
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<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name Type</th>
<th>Manufacturer</th>
<th>Qty</th>
<th>Qty per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>31</td>
<td>Lead Wire for R-Axis Power</td>
<td>HW1373502-A YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
<td>Lead wire between R-Axis motor and the wire harness in Manipulator</td>
</tr>
<tr>
<td>B</td>
<td>32</td>
<td>Lead Wire for B,T-Axis Power</td>
<td>HW1372678-A YASKAWA Electric Corporation</td>
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<td>2</td>
<td>Lead wire between B,T-Axis motor and the wire harness in Manipulator</td>
</tr>
<tr>
<td>B</td>
<td>33</td>
<td>Bypass Cable</td>
<td>HW1471212-A YASKAWA Electric Corporation</td>
<td>1</td>
<td>-</td>
<td>Signal lead wires for tentative recovery from failure</td>
</tr>
<tr>
<td>B</td>
<td>34</td>
<td>S- and U-Axes AC Servomotor</td>
<td>SGM7G-05APK-YR1* HW1385162-A YASKAWA Electric Corporation</td>
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<tr>
<td>C</td>
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<td>L-Axis AC Servomotor</td>
<td>SGM7G-09APK-YR1* HW1385163-A YASKAWA Electric Corporation</td>
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<td>R-, B- and T-Axis AC Servomotors</td>
<td>SGM7J-01APK-YR1* HW1385161-A YASKAWA Electric Corporation</td>
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<td>C</td>
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<tr>
<td>C</td>
<td>39</td>
<td>Dummy Connector</td>
<td>HW1471285-A YASKAWA Electric Corporation</td>
<td>1</td>
<td>-</td>
<td>For the axes detachment function</td>
</tr>
</tbody>
</table>

1 The replacement kit for speed reducer includes the speed reducer and gear described in the remarks column. For details on the speed reducer replacement kit, contact your YASKAWA representative.
MOTOMAN-GP12
INSTRUCTIONS

HEAD OFFICE
2-1 Kurosakishiroishi, Yahatanishi-ku, Kitakyushu 806-0004, Japan
Phone +81-93-645-7703 Fax +81-93-645-7902

YASKAWA America Inc. (Motoman Robotics Division)
109 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
Verkstadsgatan 2, Box 504, SE-385 25 Torsas, Sweden
Phone +46-468-417-800 Fax +46-468-414-10

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.
No.7 Yongchang North Road, Beijing E&T Development Area, China 100176
Phone +86-10-6788-2858 Fax +86-10-6788-2878

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, Soi 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

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