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

YASKAWA

MOTOMAN-PL500
INSTRUCTIONS

TYPE:
YR-1-04LXH500-A00
(MOTOMAN-PL500 STANDARD SPECIFICATION)

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: 187833-1CD
Revision: 0

MANUAL NO. HW1485966
DANGER

- This instruction manual is intended to explain mainly on the mechanical part of this manipulator 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 INSTRUCTIONS. To ensure correct and safe operation, carefully read “Chapter 1. Safety” of the YRC1000 INSTRUCTIONS.

CAUTION

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

NOTICE

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

Read this manual carefully before installation, operation, maintenance, or inspection of your manipulator.

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.

Fig. : Emergency Stop Button

Before releasing the emergency stop, make sure to remove the obstacle or error caused the emergency stop, if any, and then turn the servo power ON.
Failure to observe this instruction may cause unintended movement of the manipulator, which may result in personal injury.

Fig. : Release of Emergency Stop

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

Confirm that no person is present in the manipulator's operating range and that the operator is in a safe location before:
- Turning ON the YRC1000 power
- Moving the manipulator by using the programming pendant
- Running the system in the check mode
- Performing automatic operations
Personal injury may result if a person enters the manipulator's operating range during operation. Immediately press an emergency stop button whenever there is a problem. The emergency stop buttons are located on the front panel of the YRC1000 and on the right of the programming pendant.

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

The MOTOMAN is the YASKAWA industrial robot product.

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

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>YRC1000 controller</td>
<td>YRC1000</td>
</tr>
<tr>
<td>YRC1000 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Robot</td>
<td>Manipulator</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>

Registered Trademark

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and ™ are omitted.
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
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.

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 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.

Balancer disassembly prohibited label

Description
Do not disassemble the balancer. When disassembling the balancer, the internal energy is released and the L-arm rotates. Failure to observe this caution may result in injury or malfunction.

Motor removing prohibited label

Description
Do not remove the motor without mounting the jig for fixing the motor. Failure to observe this safety precaution may result in injury from unexpected turning of the manipulator's arm.
1 Product Confirmation ...................................................................................................................... 1-1
  1.1 Contents Confirmation ........................................................................................................... 1-1
  1.2 Order Number Confirmation ............................................................................................... 1-3

2 Transport ........................................................................................................................................... 2-1
  2.1 Transport Method ................................................................................................................... 2-1
    2.1.1 Using a Crane ................................................................................................................ 2-1
  2.2 Shipping Bracket ..................................................................................................................... 2-3
  2.3 Cushioning Brackets for Transport ....................................................................................... 2-4

3 Installation ....................................................................................................................................... 3-1
  3.1 Installation of the Safety Fence .............................................................................................. 3-2
  3.2 Mounting Procedures for Manipulator Base ........................................................................... 3-2
    3.2.1 Mounting Example ........................................................................................................... 3-4
  3.3 Mounting Method ..................................................................................................................... 3-5
  3.4 Location .................................................................................................................................... 3-6
  3.5 Notes on Dust-Proof/Water-Proof Specifications .................................................................... 3-7

4 Wiring .............................................................................................................................................. 4-1
  4.1 Grounding ................................................................................................................................... 4-2
  4.2 Cable Connection ....................................................................................................................... 4-3

5 Basic Specifications ......................................................................................................................... 5-1
  5.1 Basic Specifications .................................................................................................................... 5-1
  5.2 Part Names and Working Axes ............................................................................................... 5-2
  5.3 Dimensions and P-Point Maximum Envelope ......................................................................... 5-3
  5.4 Stopping Distance and Time for S-, L-, and U-Axes ................................................................. 5-5
    5.4.1 General Information ........................................................................................................... 5-5
    5.4.2 Definition of Use ................................................................................................................ 5-5
    5.4.3 Stopping Distance and Time for Stop Category 0: S-, L- and U-Axes ............................... 5-5
    5.4.4 Stop Category 1: Stopping Distance and Time for Stop Category 1: S-, L- and U-Axes ............................ 5-6
      5.4.4.1 Extension ....................................................................................................................... 5-6
      5.4.4.2 Stopping Distance and Time for Stop Category 1: S-axis ............................................ 5-6
      5.4.4.3 Stopping Distance and Time for Stop Category 1: L-axis ............................................ 5-9
      5.4.4.4 Stopping Distance and Time for Stop Category 1: U-axis ............................................ 5-9
  5.5 Alterable Operating Range ......................................................................................................... 5-10
5.5.1 Components for Altering Operating Range ........................................................ 5-11
5.5.2 Notes on the Mechanical Stopper Installation .................................................... 5-12
5.5.3 Adjustment to the Pulse Limitation of S-Axis ....................................................... 5-12

6 Allowable Load for Wrist Axis and Wrist Flange ....................................................... 6-1
   6.1 Allowable Wrist Load ............................................................................................... 6-1
   6.2 Wrist Flange ............................................................................................................ 6-3
   6.3 Levelness of the Wrist Flange .................................................................................. 6-4

7 System Application ......................................................................................................... 7-1
   7.1 Peripheral Equipment Mounts ................................................................................. 7-1
      7.1.1 Allowable Load ............................................................................................... 7-1
      7.1.2 Installation Position ......................................................................................... 7-2
   7.2 Internal User I/O Wiring Harness and Air Line ....................................................... 7-3
   7.3 Mating Connector for Internal User I/O Wiring Harness (Optional) ......................... 7-5
   7.4 Fieldbus Cable Connection ..................................................................................... 7-8
   7.5 Hollow-Shaft Structure of the Wrist Part ............................................................... 7-10

8 Electrical Equipment Specification ............................................................................... 8-1
   8.1 Position of Limit Switch ......................................................................................... 8-1
   8.2 Internal Connections ............................................................................................... 8-2

9 Maintenance and Inspection ......................................................................................... 9-1
   9.1 Inspection Schedule ............................................................................................... 9-1
   9.2 Notes for Maintenance ........................................................................................... 9-4
      9.2.1 Multi-Port Connector ....................................................................................... 9-4
   9.3 Notes on Maintenance Procedures ......................................................................... 9-5
      9.3.1 Home Position Check ...................................................................................... 9-5
      9.3.2 Seeped Oil Check ............................................................................................ 9-6
      9.3.3 L- and U-axis Motors ...................................................................................... 9-7
      9.3.4 Battery Pack Replacement ............................................................................ 9-8
   9.4 Notes on Grease Replenishment/Exchange Procedures ........................................ 9-12
      9.4.1 Grease Exchange Procedures for Gear of Each Axis Speed Reducer ............ 9-12
         9.4.1.1 Notes on Grease Exchange Procedures ............................................... 9-12
         9.4.1.2 Grease Exchange Procedure ................................................................. 9-13
         9.4.1.3 Grease Replenishment for U-axis Cross Roller Bearing Part ............... 9-19
         9.4.1.4 Grease Replenishment for Links ......................................................... 9-20
         9.4.1.5 Grease Replenishment for Balancer Link Part ...................................... 9-22
10 Recommended Spare Parts
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 are given separately):

- Manipulator (accessories included)
- YRC1000 (spare parts included)
- Programming pendant
- Manipulator cable (between the YRC1000 and the Manipulator)
- Manual

Fig. 1-1: Five Items for Standard Delivery

CAUTION

- Confirm that the manipulator and the YRC1000 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 Product Confirmation
### 1.1 Contents Confirmation

<table>
<thead>
<tr>
<th>Accessories of Manipulator</th>
<th>Pcs</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexagon socket head cap screw M20</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>(length: 80 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring washer M20 &quot;stainless&quot;</td>
<td>8</td>
<td>For mounting the manipulator</td>
</tr>
<tr>
<td>Washer M20 &quot;stainless&quot;</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Grease zerk A-PT1/4</td>
<td>1</td>
<td>For grease replenishment of S-axis</td>
</tr>
<tr>
<td>Grease zerk A-PT1/8</td>
<td>8</td>
<td>For grease replenishment of L-, U-, and T-axes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For grease replenishment of links</td>
</tr>
</tbody>
</table>
1.2 Order Number Confirmation

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

Fig. 1-2: Location of Order Number Nameplates
2 Transport

2.1 Transport Method

### Using a Crane

As a rule, the manipulator must be lifted by a crane with four 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 4000 mm or longer.

---

**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.

Failure to observe this instruction may adversely affect the performance of the YRC1000 because it consists of precision components.
2 Transport
2.1 Transport Method

Fig. 2-1: Transporting Position (factory setting)

<table>
<thead>
<tr>
<th>Angle</th>
<th>Pulse (Approximately)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>180</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-107638</td>
</tr>
<tr>
<td>2</td>
<td>-58799</td>
</tr>
</tbody>
</table>

When lifting the manipulator, be careful not to damage the motor, connector, cable, etc.

NOTE
When lifting the manipulator, be careful not to damage the motor, connector, cable, etc.

The approximate weight of the manipulator is shown below.

- YR-1-04LXH500-A00: 2440 kg (including the shipping bolts/screws and brackets)

Use a wire rope strong enough to withstand the weight.

- When transporting, be sure to install the shipping 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.

When lifting the manipulator, be careful not to damage the motor, connector, cable, etc.
2.2 Shipping Bracket

To protect the manipulator’s machinery from external forces during transportation, shipping brackets are installed. (Refer to fig. 2-2 “Shipping Bracket”.)

![Fig. 2-2: Shipping Bracket](image)

- The shipping brackets are painted yellow.
- The shipping brackets are fixed with the hexagon head screw M20 “trivalent chromate” (length: 90 mm) (two screws) (four places), the spring washer M20 “stainless” (two washers) (four places) and washer M20 “stainless” (two washers) (four places).

**NOTE**

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

To protect the manipulator’s machinery from external forces during transportation, cushioning brackets are installed. (Refer to fig. 2-3 “Cushioning Brackets for Transport”.)

- The cushioning brackets are painted yellow.
- The brackets are fixed with the following screws.

**Fig. 2-3: Cushioning Brackets for Transport**

Before turning ON the power, check to be sure that the cushioning brackets for transport are removed. In the event that the manipulator must be moved again, to avoid its main body from being damaged, the cushioning brackets 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, 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.
- 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/screws 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.

3.2 Mounting Procedures for Manipulator Base
The manipulator should be firmly mounted on a baseplate 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 baseplate 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>12740 N (1300 kgf)</td>
<td>39200 N•m (4000 kgf•m)</td>
</tr>
<tr>
<td>Acceleration/</td>
<td>5880 N (600 kgf)</td>
<td>11760 N•m (1200 kgf•m)</td>
</tr>
<tr>
<td>deceleration</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3 Installation
3.2 Mounting Procedures for Manipulator Base

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 baseplate firmly to the ground. The baseplate must be rugged and durable to prevent shifting of the manipulator or the mounting fixture. It is recommended to prepare a baseplate of 50 mm or more in thickness, and anchor bolts of M24 or larger size.

The manipulator base is tapped for eight mounting holes; securely fix the manipulator base to the baseplate with eight hexagon socket head cap screws M20 (Tensile strength: 1200 N/mm² or more) (90 mm long is recommended) by using a tightening torque 402 N·m.

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

Fig. 3-2: Mounting the Manipulator on Baseplate
3.3 Mounting Method

This manipulator is mounted on the floor only. A wall-mounted way, a tilt-mounted way, and a ceiling-mounted way are not available.
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 (no-condensing)
- Free from dust, soot, oil, or water
- 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)
- Free from the strong magnetic field
- Altitude: 1000 m or less
- Flatness for installation: 0.5 mm 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-Proof/Water-Proof Specifications

This manipulator conforms to:
- IP54 for the wrist part
- IP54 for the main part of the manipulator

**NOTE**

- Definition of IP (protection class)
  - IP54: Protection from a certain amount of dust which is harmful enough to affect the normal operation of equipment.
  - IP64: Protection from sprays and splashing of water in all directions.

However, the following precautions must be observed:
- Do not use the following liquids, because the rubber parts of the manipulator (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/FKM) is not resistant
- Do not use cutting fluid or cleaning fluid which contains unknown chemical substances.
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, 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.

- 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

- Bolt M8 (For grounding) Delivered with the manipulator
4.2 Cable Connection

Connect the both edge of the manipulator cable to the manipulator base connectors and to the YRC1000. Before connecting the cable to the manipulator, verify the numbers on the connector as shown in fig. 4-3 "Manipulator Cables". For the connecting position, refer to fig. 4-4 "Manipulator Cable Connection (Manipulator Side)" and fig. 4-5 "Manipulator Cable Connection (YRC1000 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. 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: Manipulator Cables

The YRC1000 side

The Manipulator side

Fig. 4-4: Manipulator Cable Connection (Manipulator Side)
4 Wiring
4.2 Cable Connection

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

Fig. 4-6: Overhead View of Manipulator Cable Connection (Manipulator 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></td>
<td>Fixed part</td>
<td>Moving part</td>
</tr>
<tr>
<td>36</td>
<td>135</td>
<td>320</td>
</tr>
</tbody>
</table>

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

## 5.1 Basic Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Type</th>
<th>YR-1-04LXH500-A00</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structure</strong></td>
<td>Structure Vertically articulated</td>
<td></td>
</tr>
<tr>
<td><strong>Degree of freedom</strong></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td><strong>Payload</strong></td>
<td>Wrist part</td>
<td>500 kg</td>
</tr>
<tr>
<td><strong>Repeatability</strong></td>
<td>±0.5 mm</td>
<td></td>
</tr>
<tr>
<td><strong>Range of Motion</strong></td>
<td>S-Axis (turning)</td>
<td>-180° - +180°</td>
</tr>
<tr>
<td></td>
<td>L-Axis (lower arm)</td>
<td>-45° - +90°</td>
</tr>
<tr>
<td></td>
<td>U-Axis (upper arm)</td>
<td>-120° - +15.5°</td>
</tr>
<tr>
<td></td>
<td>T-Axis (wrist twist)</td>
<td>-360° - +360°</td>
</tr>
<tr>
<td><strong>Maximum Speed</strong></td>
<td>S-Axis</td>
<td>1.48 rad/s, 85°/s</td>
</tr>
<tr>
<td></td>
<td>L-Axis</td>
<td>1.48 rad/s, 85°/s</td>
</tr>
<tr>
<td></td>
<td>U-Axis</td>
<td>1.48 rad/s, 85°/s</td>
</tr>
<tr>
<td></td>
<td>T-Axis</td>
<td>3.40 rad/s, 195°/s</td>
</tr>
<tr>
<td><strong>Allowable Inertia</strong></td>
<td>T-Axis</td>
<td>200 kg•m²</td>
</tr>
<tr>
<td><strong>Approx. Mass</strong></td>
<td></td>
<td>2390 kg</td>
</tr>
<tr>
<td><strong>Protective enclosure</strong></td>
<td>Body: IP54</td>
<td>Wrist part: IP54</td>
</tr>
<tr>
<td><strong>Mounting method</strong></td>
<td>Floor-mounted</td>
<td></td>
</tr>
<tr>
<td><strong>Ambient Conditions</strong></td>
<td>Temperature</td>
<td>0°C - 45°C</td>
</tr>
<tr>
<td></td>
<td>Humidity</td>
<td>20% - 80%RH</td>
</tr>
<tr>
<td></td>
<td>Vibration</td>
<td>4.9 m/s² (0.5 G) 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 dust, soot, or water</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><strong>Power Capacity</strong></td>
<td></td>
<td>8.0 kVA</td>
</tr>
<tr>
<td><strong>Applicable controller</strong></td>
<td></td>
<td>YRC1000</td>
</tr>
<tr>
<td><strong>Equivalent continuous sound pressure level</strong></td>
<td>69 dB or less</td>
<td></td>
</tr>
</tbody>
</table>

1. SI units are used in this table. However, gravitational unit is used in ( ).
2. Conformed to ISO9283
3. Refer to chapter 6.1 “Allowable Wrist Load” for details on the allowable inertia.
4. 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 1.2 m and 1.5 m above the ground.
      - 400 mm away from the ( )-point maximum envelope.
5.2 Part Names and Working Axes

Fig. 5-1: Part Names and Working Axes

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

Fig. 5-2: Dimensions and T-Point Maximum Envelope
5 Basic Specifications
5.3 Dimensions and T-Point Maximum Envelope

*Fig. 5-3: Home Position and Operating Range of Each Axis*

(1) S-axis
(2) L- and U-axes
(3) T-axis
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>36.3</td>
<td>0.959</td>
</tr>
<tr>
<td>L-axis</td>
<td>14.2</td>
<td>0.316</td>
</tr>
<tr>
<td>U-axis</td>
<td>15.2</td>
<td>0.386</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

<table>
<thead>
<tr>
<th>Type</th>
<th>100% extension length (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YR-1-04LXH500-A00</td>
<td>2890</td>
</tr>
</tbody>
</table>

Fig. 5-5: L-Axis Extension

<table>
<thead>
<tr>
<th>Type</th>
<th>100% extension length (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YR-1-04LXH500-A00</td>
<td>2620</td>
</tr>
</tbody>
</table>
5.4 Stopping Distance and Time for S-, L-, and U-Axes

Fig. 5-6: U-Axis Extension

<table>
<thead>
<tr>
<th>Type</th>
<th>100% extension length (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YR-1-04LXH500-A00</td>
<td>1650</td>
</tr>
</tbody>
</table>

100% Load
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 extensions and loads.](image-url)
5.4.4.3 Stopping Distance and Time for Stop Category 1: L-axis

5.4.4.4 Stopping Distance and Time for Stop Category 1: U-axis
5 Basic Specifications
5.5 Alterable Operating Range

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 5-3 “S-Axis Operating Range”. If alteration is necessary, contact your YASKAWA representative in advance.

Table 5-3: S-Axis Operating Range

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis operating range(^1)</td>
<td>-180° - +180° (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>

\(^1\) For settable angles, refer to table 5-4 “The Settable Angle for S-Axis Stopper”. 
5 Basic Specifications
5.5 Alterable Operating Range

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.

- Pin (drawing No. HW0407007-1) (1 pin)
- Stopper (drawing No. HW0307574-4) (1 pc)
- Hexagon head screw M20 "FA coat" (length: 60 mm) (3 screws)
- Washer M20 "stainless" (3 washers)

Fig. 5-7: Components of the S-Axis Stopper and Stopper Mounting Position

<table>
<thead>
<tr>
<th>S-axis operating range</th>
<th>Stopper position</th>
</tr>
</thead>
<tbody>
<tr>
<td>-180° ~ +180°</td>
<td>0°</td>
</tr>
<tr>
<td>-165° ~ +165°</td>
<td>0°</td>
</tr>
<tr>
<td>-150° ~ +150°</td>
<td>15°</td>
</tr>
<tr>
<td>-135° ~ +135°</td>
<td>30°</td>
</tr>
<tr>
<td>-120° ~ +120°</td>
<td>45°</td>
</tr>
<tr>
<td>-90° ~ +90°</td>
<td>75°</td>
</tr>
<tr>
<td>-75° ~ +75°</td>
<td>90°</td>
</tr>
<tr>
<td>-60° ~ +60°</td>
<td>105°</td>
</tr>
<tr>
<td>-45° ~ +45°</td>
<td>120°</td>
</tr>
<tr>
<td>-30° ~ +30°</td>
<td>135°</td>
</tr>
<tr>
<td>-15° ~ +15°</td>
<td>150°</td>
</tr>
</tbody>
</table>

Section A-A Dog Mounting Position

- 22 through holes (16 places)

- Hexagon head screw M20 (length: 60 mm) (3 screws)
  - Tensile strength: 1200 N/mm² or more
  - Washer M20 "stainless" (3 washers)
  - Tightening torque: 166 N•m
5 Basic Specifications
5.5 Alterable Operating Range

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 pin (HW0407007-1) down on the stopper (HW0307574-4). When mounting the pin on the stopper, apply LOCTITE 243 to the thread part.

Mount the stopper by using the hexagon head screw M20 (length: 60 mm) (three screws) (FA coated) on the S-head and tighten them with the tightening torque 166 N•m.

If the operating range is ± 180°, the mechanical stopper is mounted as shown in fig. 5-7 “Components of the S-Axis Stopper and Stopper Mounting Position”.

The S-axis mechanical stopper can be set at a pitch of 15°, however, stoppers may be overlapped, for example, ± 15° or ± 165°. Therefore, mount the S-axis mechanical stopper using the combinations in table 5-4 “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 (RECSO-A051)”. With programming pendant, input the numeric value as shown in the following table to modify the parameter.

<table>
<thead>
<tr>
<th>Degree</th>
<th>0°</th>
<th>±15°</th>
<th>±30°</th>
<th>±45°</th>
<th>±60°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse</td>
<td>0</td>
<td>±34092</td>
<td>±68183</td>
<td>±102275</td>
<td>±136367</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Degree</th>
<th>±75°</th>
<th>±90°</th>
<th>±105°</th>
<th>±120°</th>
<th>±135°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse</td>
<td>±170458</td>
<td>±204550</td>
<td>±238642</td>
<td>±272733</td>
<td>±306825</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Degree</th>
<th>±150°</th>
<th>(±165°)</th>
<th>±180°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse</td>
<td>±340917</td>
<td>±375008</td>
<td>±409100</td>
</tr>
</tbody>
</table>

* Refer to chapter 5.5 “Alterable Operating Range”.

Adjust both of the pulse limitation and the angle of S-Axis mechanical stopper as modifying the range of motion for machinery.
### 5.5 Alterable Operating Range

#### Table 5-4: The Settable Angle for S-Axis Stopper

<table>
<thead>
<tr>
<th>Angle (°)</th>
<th>+ Direction</th>
<th>- Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>-180</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-165</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-135</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-105</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>105</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>135</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>165</td>
<td></td>
<td></td>
</tr>
<tr>
<td>180</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Angle of S-Axis Stopper for + Direction

The Angle of S-Axis Stopper for - Direction
6 Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

The allowable payload of the wrist axis including the mass of the grip is 500 kg maximum. However, the condition listed in Table 6-1 “Allowable Wrist Load” must be satisfied due to limits of the moment of inertia. The values in Table 6-1 must not be exceeded even if the load is not applied as mass but applied as force.

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 or when the moment load is small while the inertia load is large, contact your YASKAWA representative in advance. Additionally, in special cases, such as when the load is not applied as mass but applied as force, etc., contact your YASKAWA representative in advance.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Allowable inertia (GD^2/4) kg•m^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-Axis</td>
<td>200</td>
</tr>
</tbody>
</table>

Table 6-1: Allowable Wrist Load
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 (RE-CTO-A221)".

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

![Diagram showing moment arm rating with labels for LB, LT, center of gravity, and T-axis rotation center.](image-url)
6.2 Wrist Flange

The wrist flange dimensions are shown in fig. 6-2. “Wrist Flange”.
It is recommended that the attachment be mounted inside the fitting in order to identify the alignment marks. Fitting depth shall be 10 mm or less for the inside fitting and 9 mm or less for the outside fitting.

Fig. 6-2: Wrist Flange

**NOTE**
Wash off anti-corrosive paint (yellow) on the wrist flange surface with thinner before mounting the tools.
6.3 Levelness of the Wrist Flange

The wrist flange is kept level to the mounting surface of the manipulator in the full range of motion. However, minor tilting may occur due to the posture and load conditions.

When the manipulator will be used in applications in which the levelness of the wrist flange is important, first evaluate and check tilting with the actual posture and load conditions.

*Fig. 6-3: Tilting of Wrist Flange*
7 System Application

7.1 Peripheral Equipment Mounts

The peripheral equipment mounts are provided as shown in fig. 7-1 "Installation Position" for easier installation of the user's system applications. The following conditions shall be observed to attach or install peripheral equipment.

7.1.1 Allowable Load

The peripheral equipment (A1, A2, and A3) on the wrist part is used for fixing cables. The allowable load including the mass of the installed wrist part is 500 kg or less.

When a load is applied on the S-head, the load setting must be performed. For setting procedures, refer to chapter 8.4 "ARM Control" in "YRC1000 INSTRUCTIONS (RE-CTO-A221)".

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.
7.1.2 Installation Position

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

Fig. 7-1: Installation Position
7 System Application
7.2 Internal User I/O Wiring Harness and Air Line

**7.2 Internal User I/O Wiring Harness and Air Line**

Internal user I/O wiring harness (0.5 mm² x 23 wires) and one air line are incorporated into the manipulator for driving peripheral devices mounted on the U-arm as shown in fig. 7-2 “Connectors for Internal User I/O Wiring Harness and Air Line”.

The connector pins are assigned as shown in fig. 7-3 “Details of the Connector Pin Numbers”. Wiring must be performed by user.

The operating conditions are shown as follows:

- The allowable current for cables: 7.5 A or less for each wire (0.5 mm²)
- The total current value for connectors: 34.5 A or less (connector of the internal user I/O wiring harness)
- The maximum pressure for the air line: 784 kPa (8 kgf/cm²) or less (The inside diameter: 7.5 mm)
- The allowable temperature range of the air line: 0°C to +45°C

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

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

For the Connector Base: View A

For the Wrist Base: View B

Pin number details of the connector for internal user I/O wiring harness

0.5 mm² × 23 cables

Internal user I/O wiring harness: 23×0.5 mm²

Pins used

Pin number details of the connector for internal user I/O wiring harness

Pins used

0.5 mm² × 23 cables

Internal user I/O wiring harness: 23×0.5 mm²
7 System Application
7.3 Mating Connector for Internal User I/O Wiring Harness (Optional)

The mating connector for internal user I/O wiring harness is optional.

For the position of the mating connector for internal user I/O wiring harness, refer to fig. 7-4 “Location of Connector”.

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.

**Fig. 7-4: Location of Connector**

<table>
<thead>
<tr>
<th>Straight Type</th>
<th>Connector for the internal user I/O wiring harness</th>
<th>Plug: JL05-6A24-28S or the equivalent</th>
<th>End bell: JL05-24EB1A-R or the equivalent</th>
<th>Cable clamp: N/MS3057-16A or the equivalent (straight form)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elbow Type</td>
<td>Connector for the internal user I/O wiring harness</td>
<td>Plug: JL05-6A24-28S or the equivalent</td>
<td>End bell: JL05-24EB1A-R or the equivalent</td>
<td>Cable clamp: N/MS3057-16A or the equivalent (elbow form)</td>
</tr>
</tbody>
</table>
7 System Application

7.3 Mating Connector for Internal User I/O Wiring Harness (Optional)

□ Straight Type

The appearance of the manipulator with the connector installed is shown in fig. 7-5(a) “Manipulator With the Mating Connector for Internal User I/O Wiring Harness (straight type)”. When operating, be careful not to let the connector and/or cable touch the other equipment.

Fig. 7-5(a): Manipulator With the Mating Connector for Internal User I/O Wiring Harness (straight type)
Elbow Type

The appearance of the manipulator with the connector installed is shown in fig. 7-5(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. 7-5(b): Manipulator With the Mating Connector for Internal User I/O Wiring Harness (elbow type)
7.4 Fieldbus Cable Connection

The manipulator has built-in tubes for fieldbus cables. The cables with a cross-sectional area of 2 mm² are provided in the tubes in advance. To run a fieldbus cable through the manipulator, remove the covers of the connector base and the junction box, fix the fieldbus cable with the cable on the connector base side, and pull the cable on the wrist. As shown in the following fig. 7-6 “FieldBus Cable Connection”, the tube for a fieldbus cable (inside dia.: 12 mm) is connected by a union in the Z part of the S-head.

Run the fieldbus cable by following steps 1 through 5.
1. The tube for a fieldbus cable (inside dia.: 12 mm) is connected by a union, in which the cable runs. (See the step 1 on the left.)

2. Remove the union from the tube for a fieldbus cable. (See the step 2 on the left.)

3. Pull the fieldbus cable fixed to the cable until it reaches the union. (See the step 3 on the left.)

4. Cut the cable from the fieldbus cable. (See the step 4 on the left.)

5. Remove the union, fix the cable to the fieldbus cable, and run it through the manipulator. (See the step 5 on the left.)
7 System Application
7.5 Hollow-Shaft Structure of the Wrist Part

The wrist part of the manipulator has a hollow structure for the internal user I/O wiring harness, air line, etc.

To run the internal user I/O wiring harness, air line, etc. through the hollow part, follow the conditions below.

Table 7-1: Conditions to Run the Wiring Harness, Air Line, etc. through the Hollow Part

<table>
<thead>
<tr>
<th>Item</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>① Inside diameter of the hollow part: 60 mm</td>
<td></td>
</tr>
<tr>
<td>② Inside diameter of the protective material for the wiring harness etc.: 50 mm or less</td>
<td>Before running the wiring harness etc., protect it with protective springs etc. Also, clearance of 10 mm or more is needed between the hollow part and the protective material.</td>
</tr>
<tr>
<td>③ Ratio of the cross section of the wiring harness etc. to the protective material: 30% or less</td>
<td>Since sufficient clearance is also needed between the protective material and the wiring harness etc., make sure that the ratio of the total cross section of the wiring harness etc. to the cross section of the protective material is 30% or less.</td>
</tr>
</tbody>
</table>

Fig. 7-7: Conditions to Run the Wiring Harness, Air Line, etc. through the Hollow Part

Note ②

Clearance between the protective material and the hollow part must be 10 mm or more.

Note ③

Total cross section of the internal user I/O wiring harness, air line, etc.

④ must be 30% or less of ⑤.

⑤ Cross section of protective material
8 Electrical Equipment Specification

8.1 Position of Limit Switch

The limit switches are optional. Refer to fig. 8-1 "Location of Limit Switches".

Fig. 8-1: Location of Limit Switches

The angle of the soft limit and the limit switch for S-axis is 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.

For adjusting soft limit, refer to chapter 6.13 "Softlimit Setting Function" in "YRC1000 GENERAL OPERATOR'S MANUAL (RE-CSO-A051)".

For releasing soft limit, refer to chapter 8.10 "Soft Limit Release Function" in "YRC1000 INSTRUCTIONS (RE-CTO-A221)".

For adjusting limit switch, refer to the following page.

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

<table>
<thead>
<tr>
<th>Soft limit</th>
<th>Limit switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>-180° - +180°</td>
</tr>
</tbody>
</table>

• Adjusting limit switch of S-axis

The angle of limit switch of S-axis can be adjusted by altering the position of the S-axis stopper. For altering the stopper's position, refer to chapter 5.5 "Alterable Operating Range".
8.2 Internal Connections

Diagrams for internal connections of the manipulator are shown in fig. 8-2(a) "Internal Connection Diagram", fig. 8-2(b) "Internal Connection Diagram".
Band parts are changed as follows:

61/87

Fig. 8-2(a): Internal Connection Diagram

Notes
1. For the limit switch specification, the connection of the section \( \bigcirc \) and \( \bigcirc \) parts are changed as follows:

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L4</td>
<td>S-AXIS OVERRUN L.S. Connected to ( \bigcirc )</td>
</tr>
<tr>
<td>L5</td>
<td>S-AXIS OVERRUN L.S. Connected to ( \bigcirc )</td>
</tr>
<tr>
<td>L6</td>
<td>S-axis with Limit Switch Specification</td>
</tr>
</tbody>
</table>

Controller

Multi-port Connector (2)

Multi-port Connector (1)

Board for encoder power

Controller
8 Electrical Equipment Specification
8.3 Internal Connections

Fig. 8-2(b): Internal Connection Diagram
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 interval between inspections is calculated according to the total servo operation time.
- If axes are used very frequently (in handling applications, etc.), inspections may be required at shorter intervals. 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.

NOTE
- The interval between inspections is calculated according to the total servo operation time.
- If axes are used very frequently (in handling applications, etc.), inspections may be required at shorter intervals. Contact your YASKAWA representative.
<table>
<thead>
<tr>
<th>Items</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily</td>
<td>1000 h Cycle</td>
<td>5000 h Cycle</td>
<td>9000 h Cycle</td>
</tr>
<tr>
<td>1. Alignment mark</td>
<td>Visual</td>
<td>Check alignment mark accordance at the home position. Check for damage. Check for misalignment of the position at the check point.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Working area and manipulator</td>
<td>Visual</td>
<td>Check for seeped oil. Check the work area if dust, spatter or seeped oil is present. Check for damage and outside cracks.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Covers, bolts for the connector base</td>
<td>Driver Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Wire harness in manipulator (lead wires for the S-, L-, U-, T-axes) (Power supply board included)</td>
<td>Visual</td>
<td>Check the condition of the internal wiring harness. Check wear to the protective spring. Replace if there is abnormal wear.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Battery pack in manipulator</td>
<td>Grease Gun</td>
<td>Check if the battery pack when the battery alarm occurs or the manipulator drove for 18000 h.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Motors for all axes</td>
<td>Visual</td>
<td>Check for grease leakage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Speed reducers for all axes</td>
<td>Grease Gun</td>
<td>Check for malfunction. Replace if necessary. Replace grease (9000 h cycle).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. L- and U-arm links Joint of the spring balancer Links</td>
<td>Grease Gun</td>
<td>Supply grease to the links and joint.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Overhaul</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Inspection No. correspond to the numbers in fig. 9-1 “Inspection Items (Home position figure)”.
2. For the grease, refer to table 9-2 “Inspection Parts and Grease Used”.
9 Maintenance and Inspection

9.1 Inspection Schedule

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>9</td>
<td>Molywhite RE No.00</td>
<td>Speed reducers for all axes</td>
</tr>
<tr>
<td>10</td>
<td>Alvania EP grease 2</td>
<td>L- and U-arm links, Joint of the spring balancer, Links</td>
</tr>
</tbody>
</table>

The numbers in the above table correspond to the numbers in table 9-1 “Inspection Items”.

Fig. 9-1: Inspection Items (Home position figure)
9.2 Notes for Maintenance

9.2.1 Multi-Port Connector

Two multi-port connectors (refer to fig. 9-2 “Multi-Port Connector”) for the motor signals are mounted on each part of the manipulator. (For the locations, refer to fig. 9-7 “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. 9-3 “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. 9-2: Multi-Port Connector**

![Multi-Port Connector Diagram]

**Fig. 9-3: 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. With those alignment marks, periodically check for home position deviation. When home position is disappeared or deviated, contact your YASKAWA representative.

Fig. 9-4: Alignment Mark Check
9.3.2 Seeped Oil Check

Periodically check for contamination due to seeped oil or oil spot. Especially the parts indicated in fig. 9-5 “Inspection Parts for Seeped Oil Check” must be inspected carefully. Wipe off seeped oil or oil spot with a cloth before use.

Fig. 9-5: Inspection Parts for Seeped Oil Check
9.3.3 L- and U-axis Motors

For castings of the L- and U-axis motors, there are tubes or holes for detecting grease leakage. Check if grease is leaking from the tubes or holes. For the positions of the hole or the tube of each axis, refer to fig. 9-6 "Positions of Grease-Leakage Detection Holes or Tubes". If grease leakage is detected, contact your YASKAWA representative.

Fig. 9-6: Positions of Grease-Leakage Detection Holes or Tubes
9.3.4 Battery Pack Replacement

Two battery packs are installed in the position shown in fig. 9-7 "Location of the Battery and Multi-port Connector".

If the battery alarm occurs in the YRC1000, refer to chapter 9.2 “Notes for Maintenance” and replace the battery in accordance with either of the following two procedures.

Fig. 9-7. Location of the Battery and Multi-port Connector
9.3 Notes on Maintenance Procedures

- Normal (The power supply of the YRC1000 can be turned ON)

   Fig. 9-8: Battery connection (the power supply of the YRC1000 can be turned ON)

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

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

3. The old battery pack is fixed by using the cable tie. Cut the cable tie (1 place) to remove the old battery pack from the protective tube.

4. The connector is in the protective tube. Cut the cable ties (2 places) fixing the protective tube, and take out the connector.

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

6. Fix the new battery pack by using the cable tie T50R-HSW.

7. After placing the connector and the lead wires around the connector into the protective tube, fix the opening of the protective tube by using the cable tie T18L-HSW.

8. Fix the new battery pack and the protective tube in which the connector is placed at step 7 by using the cable tie T18L-HSW.

9. Tighten the cover mounting bolts to reinstall the cover.

**NOTE**

- When reinstalling the cover, be careful not to get caught the cable.

**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.
When the Power Supply of the YRC1000 Cannot Be Turned ON

Fig. 9-9: Battery Connection (the power supply of the YRC1000 cannot be turned ON)

1. Prepare lead wires for battery replacement and a battery pack for backup. (Apart from the new battery pack for replacement, prepare a battery pack for backup)
2. Loosen the cover mounting bolts and remove the cover.
3. Remove the connector from the “IN” or “Y” port of the multi-port connector.
   Connect the lead wires for battery replacement to the “IN” or “Y” port of the multi-port connector.
4. Connect the battery pack for backup to the lead wires for battery replacement.
5. The old battery pack is fixed by using the cable tie. Cut the cable tie (1 place) to remove the old battery pack from the protective tube.
6. The connector is in the protective tube. Cut the cable ties (2 places) fixing the protective tube, and take out the connector.
7. Remove the old battery pack from the multi-port connector and mount the new battery pack.
8. Remove the lead wires for battery replacement and the battery pack for backup from the multi-port connector, connect the connector which has been removed at step 3 of this procedure to the “IN” or “Y” port again.
   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.
9. Fix the new battery pack by using the cable tie T50R-HSW.

NOTE
Before removing the old battery pack, make sure to connect the battery pack for backup to prevent the encoder absolute data from disappearing.
9 Maintenance and Inspection
9.3 Notes on Maintenance Procedures

10. After placing the connector and the lead wires around the connector into the protective tube, fix the opening of the protective tube by using the cable tie T18L-HSW.

11. Fix the new battery pack and the protective tube in which the connector is placed at step 10 by using the cable tie T18L-HSW.

12. Tighten the cover mounting bolts 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 Replenishment Procedures for Gear of Each Axis Speed Reducer

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.

- After mounting a speed reducer or a motor, and then wait for 30 minutes or more and then inject grease. If grease is filled before the sealing bond is solidified, it may cause grease to leak.
9.4 Notes on Grease Replenishment/Exchange Procedures

9.4.1.2 Grease Exchange Procedure

**Fig. 9-10: Grease Inlets and Exhaust Ports for Each Axis**

**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.

**S-axis**
- Grease exhaust port of S-axis (Hexagon socket head plug PT3/8)
- Grease inlet of S-axis (Hexagon socket head plug PT1/4)

**L- and U-axes**
- Grease exhaust port of U-axis (Hexagon socket head plug PT3/8)
- Grease inlet of U-axis (Hexagon socket head plug PT1/8)

**T-axis gear**
- Grease exhaust port of T-axis (Hexagon socket head plug PT3/8)
- Grease inlet of T-axis (Hexagon socket head plug PT1/8)
9 Maintenance and Inspection
9.4 Notes on Grease Replenishment/Exchange Procedures

CAUTION

- If the L-arm is tilted at 80 degrees or more, the link-C interferes with the plug for air exhaust. Do not tilt the L-arm over 80 degrees when verifying the manipulator operation.
9.4 Notes on Grease Replenishment/Exchange Procedures

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 the grease inlet located in the lower part and the position of the exhaust port located in the upper part. If the exhaust port is located in the lower part, grease may not be exchanged properly.

<table>
<thead>
<tr>
<th>Axis to inject</th>
<th>Posture</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>Any</td>
</tr>
<tr>
<td>L-axis</td>
<td>Any</td>
</tr>
<tr>
<td>U-axis</td>
<td>Any</td>
</tr>
<tr>
<td>T-axis</td>
<td>Any</td>
</tr>
</tbody>
</table>

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

3. Install an applicable grease zerk to each grease inlet. (The grease zerk is delivered with the manipulator.)

4. Inject the grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE No.00
   - 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>
<thead>
<tr>
<th>Axis to exchange grease</th>
<th>Amount of grease</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>Approx. 8640 g</td>
</tr>
<tr>
<td>L-axis</td>
<td>Approx. 1720 g</td>
</tr>
<tr>
<td>U-axis</td>
<td>Approx. 2050 g</td>
</tr>
<tr>
<td>T-axis</td>
<td>Approx. 1275 g</td>
</tr>
</tbody>
</table>

Table 9-3: Recommended Posture for Grease Injection

Table 9-4: Amount of Grease
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 -80° - +10°</td>
<td></td>
</tr>
<tr>
<td>T-axis</td>
<td>T-axis ±90°</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 9-5.

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 9-5.
9 Maintenance and Inspection
9.4 Notes on Grease Replenishment/Exchange Procedures

For the axis where grease is exchanged, perform a playback operation indicated in table 9-7 "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, and then attach it to the grease inlet. Tighten the plug with the tightening torque shown in table 9-8 "Plug Type and Tightening Torque for Each Axis". 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. 9-11 "Grease Receiving Bag (Rough Standard)", and then perform the running-in operation.

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>430 ± 65</td>
</tr>
<tr>
<td>L-axis</td>
<td>85 ± 15</td>
</tr>
<tr>
<td>U-axis</td>
<td>105 ± 15</td>
</tr>
<tr>
<td>T-axes</td>
<td>65 ± 10</td>
</tr>
</tbody>
</table>

Table 9-7: 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-axis</td>
<td>S-axis ±45°</td>
</tr>
<tr>
<td>L-axis</td>
<td>L-axis ±45°</td>
</tr>
<tr>
<td>U-axis</td>
<td>U-axis -80° - +10°</td>
</tr>
<tr>
<td>T-axis</td>
<td>T-axis ±90°</td>
</tr>
</tbody>
</table>

Table 9-8: Plug Type and Tightening Torque for Each Axis

<table>
<thead>
<tr>
<th>Axis to exchange grease</th>
<th>Plug for the grease inlet</th>
<th>Plug for the grease exhaust port</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Plug type</td>
<td>Tightening torque</td>
</tr>
<tr>
<td>S-axis</td>
<td>PT1/8</td>
<td>12 Nm (1.2 kgf•m)</td>
</tr>
<tr>
<td>L-axis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-axis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T-axis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
10. Wipe the discharged grease with a cloth, and reinstall the plug. Clean and degrease the tap part and the thread part of the plug. Wrap the seal tape TB4501 around the plug, attach the plug with seal tape to the grease exhaust port, and then tighten it with the tightening torque shown in table 9-8 “Plug Type and Tightening Torque for Each Axis”.
9.4.1.3 Grease Replenishment for U-axis Cross Roller Bearing Part

1. Remove the hexagon socket head plugs from the grease inlet and from the air exhaust port. (Refer to fig. 9-12 “U-axis Cross Roller Bearing Part”.)

2. Inject the grease through the grease inlet using a grease gun.
   - Grease type: Alvania EP Grease 2
   - Amount of grease: 19 cc

3. Reinstall the plug to the air exhaust port.
   Before installing the plug, clean and degrease the thread part of the plug. Wrap the seal tape TB4501 around the thread part, and then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

4. Reinstall the plug to the grease inlet.
   Before installing the plug, clean and degrease the thread part of the plug. Wrap the seal tape TB4501 around the thread part, and then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

**NOTE**
Grease will not flow out of the air exhaust port. Be careful not to inject too much grease.
9.4 Notes on Grease Replenishment/Exchange Procedures

9.4.4 Grease Replenishment for Links

Fig. 9-13: Link Part

1. Remove the plugs from the grease inlet and from the air exhaust port of the link 1 to 9.
(Refer to fig. 9-13 “Link Part”.)
9.4 Notes on Grease Replenishment/Exchange Procedures

2. Inject grease through the grease inlet of the link ① to ② using a grease gun.
   - Grease type: Alvania EP Grease 2
   - Amount of grease: to the link: 9 cc (18 cc for 1st supply only)

   **NOTE**
   Grease will not flow out of the air exhaust port.
   Be careful not to inject too much grease.

3. Reinstall the plug to the air exhaust port of the link ① to ②.
   Before installing the plug, clean and degrease the thread part of the plug. Wrap the seal tape TB4501 around the thread part, and then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

4. Reinstall the plug to the grease inlet of the link ① to ②.
   Before installing the plug, clean and degrease the thread part of the plug. Wrap the seal tape TB4501 around the thread part, and then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
9.4.5 Grease Replenishment for Balancer Link Part

1. Remove the plugs from the grease inlet and from the air exhaust port of the link 1 and 2.
(Refer to fig. 9-14 “Balancer Link Part”)

2. Inject grease through the grease inlet of the link 1 and 2 using a grease gun.
   - Grease type: Alvania EP Grease 2
   - Amount of grease: to the link: 5 cc (10 cc for 1st supply only)

3. Reinstall the plug to the air exhaust port of the link 1 and 2. Before installing the plug, clean and degrease the thread part of the plug. Wrap the seal tape TB4501 around the thread part, and then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

4. Reinstall the plug to the grease inlet of the link 1 and 2. Before installing the plug, clean and degrease the thread part of the plug. Wrap the seal tape TB4501 around the thread part, and then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

**NOTE**
Grease will not flow out of the air exhaust port. Be careful not to inject too much grease.
# 10 Recommended Spare Parts

It is recommended to keep the parts and components in the following table in stock as spare parts for your manipulator.

To purchase lead wires of the wire harness or etc., check the order/ manufacture no. and contact your 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: Recommended Spare Parts for the YR-1-04LXH500-A00 (Sheet 1 of 2)

<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</td>
<td>1</td>
<td>Grease Molywhite RE No.00</td>
<td>YASKAWA Electric Corporation</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>Grease Alvania EP Grease 2</td>
<td>Showa Oil Co., Ltd.</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>3</td>
<td>Liquid Gasket TB1206C</td>
<td>Three Bond Co., Ltd.</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>Seal Tape TB4501</td>
<td>Three Bond Co., Ltd.</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>5</td>
<td>Battery Pack HW1483880-A</td>
<td>YASKAWA Electric Corporation</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>6</td>
<td>Lead Wire for Battery Replacement HW1471281-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>Replacement Kit for S-Axis Speed Reducer 1) HW1486046-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>Speed reducer HW0281280-A Gear unit HW0172031-B</td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>Replacement Kit for L-Axis Speed Reducer 1) HW1486047-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>Speed reducer HW9381442-B Input gear HW9462358-A</td>
</tr>
<tr>
<td>B</td>
<td>9</td>
<td>Replacement Kit for U-Axis Speed Reducer 1) HW1486048-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>Speed reducer HW9381442-B Input gear HW9462358-A</td>
</tr>
<tr>
<td>B</td>
<td>10</td>
<td>Replacement Kit for T-Axis Speed Reducer 1) HW1486049-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>Speed reducer HW0389883-A</td>
</tr>
</tbody>
</table>
# Recommended Spare Parts

## Table 10-1: Recommended Spare Parts for the YR-1-04LXH500-A00 (Sheet 2 of 2)

<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>B</td>
<td>11</td>
<td>Wrist Unit HW1173784-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>Internal Wiring Harness HW1173759-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>13</td>
<td>Lead Wire for S-Axis Signal HW1372597-BZ</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>14</td>
<td>Lead Wire for L-Axis Signal HW1372597-CA</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>15</td>
<td>Lead Wire for U-Axis Signal HW1372597-CB</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>16</td>
<td>Lead Wire for T-Axis Signal HW1372597-CC</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>17</td>
<td>Lead Wire HW1471359-B</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>18</td>
<td>Bypass Cable HW1471212-C</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>19</td>
<td>S-Axis AC Servomotor SGM7G-44APK-YR2* HW1385399-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>20</td>
<td>L- and U-Axes AC Servomotor SGM7G-55APK-YRT1* HW1385400-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>21</td>
<td>T-Axis AC Servomotor SGM7G-13APK-YR1* HW1385395-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>22</td>
<td>Power Supply Board Box HW1384624-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>23</td>
<td>Dummy Connector HW1471285-A</td>
<td>YASKAWA Electric Corporation</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

1 Replacement kit for the speed reducer includes the speed reducer and the gear described in the Remarks. For details of the replacement kit for the speed reducer, contact your YASKAWA representative.