MOTOMAN-UP350D, UP350D-200, UP350D-500, UP350D-400 INSTRUCTIONS

TYPE: YR-UP350D-A00 (UP350D, STANDARD SPECIFICATION)
YR-UP350D-A01 (UP350D, WITH LIMIT SWITCHES FOR S-, L-, U-AXES)
YR-UP350D-A10 (UP350D-200, STANDARD SPECIFICATION)
YR-UP350D-A11 (UP350D-200, WITH LIMIT SWITCHES FOR S-, L-, AXES)
YR-UP350D-A20 (UP350D-500, STANDARD SPECIFICATION)
YR-UP350D-A21 (UP350D-500, WITH LIMIT SWITCHES FOR S-, L-, U-AXES)
YR-UP350D-A40 (UP350D-400, STANDARD SPECIFICATION)
YR-UP350D-A41 (UP350D-400, WITH LIMIT SWITCHES FOR S-, L-, U-AXES)

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

MOTOMAN INSTRUCTIONS
MOTOMAN-UP350D, UP350D-200, UP350D-500, UP350D-400 INSTRUCTIONS
DX100 INSTRUCTIONS
DX100 OPERATOR'S MANUAL
DX100 MAINTENANCE MANUAL

The DX100 operator’s manuals above correspond to specific usage.
Be sure to use the appropriate manual.

Part Number: 157451-1CD
Revision: 4
MANDATORY

• This instruction manual is intended to explain mainly on the mechanical part of the MOTOMAN-UP350D, UP350D-200, UP350D-500, UP350D-400 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.

• General items related to safety are listed in Chapter 1: Safety of the DX100 Instructions. To ensure correct and safe operation, carefully read the DX100 Instructions before reading this manual.

CAUTION

• Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced 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 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.

• YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product’s warranty.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the MOTOMAN-UP350D, UP350D-200, UP350D-500, UP350D-400.

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

- **WARNING**
  Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.

- **CAUTION**
  Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.

- **MANDATORY**
  Always be sure to follow explicitly the items listed under this heading.

- **PROHIBITED**
  Must never be performed.

Even items described as “CAUTION” may result in a serious accident in some situations.

At any rate, be sure to follow these important items:

To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as "CAUTION" and "WARNING".
WARNING

• Before operating the manipulator, check that servo power is turned OFF pressing the emergency stop buttons on the front door of the DX100 and the programming pendant. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

Injury or damage to machinery may result if the emergency stop circuit cannot stop the manipulator during an emergency. The manipulator should not be used if the emergency stop buttons do not function.

*Figure 1: Emergency Stop Button*

• Once the emergency stop button is released, clear the cell of all items which could interfere with the operation of the manipulator. Then turn the servo power ON.

Injury may result from unintentional or unexpected manipulator motion.

*Figure 2: Release of Emergency Stop*

• Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  – View the manipulator from the front whenever possible.
  – Always follow the predetermined operating procedure.
  – Keep in mind the emergency response measures against the manipulator’s unexpected motion toward you.
  – Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

• Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  – Turning ON the power for the DX100.
  – Moving the manipulator with the programming pendant.
  – Running the system in the check mode.
  – Performing automatic operations.

Injury may result if anyone enters the P-point maximum envelope of the manipulator during operation. Always press an emergency stop button immediately if there is a problem.

The emergency stop buttons are located on the right of front door of the DX100 and the programming pendant.
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>DX100 controller</td>
<td>DX100</td>
</tr>
<tr>
<td>DX100 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**

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:

- CAUTION
  - Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
    - Check for problems in manipulator movement.
    - Check for damage to insulation and sheathing of external wires.
  - Always return the programming pendant to the hook on the cabinet of the DX100 after use.
  - The programming pendant can be damaged if it is left in the manipulator's work area, on the floor, or near fixtures.
  - Read and understand the Explanation of Warning Labels in the DX100 Instructions before operating the manipulator:
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.

Figure 3: Warning Label Locations
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1 Product Confirmation

1.1 Contents Confirmation

Confirm the contents of the delivery when the product arrives. Standard delivery includes the following four items (information for the content of optional goods are given separately):

- Manipulator
- DX100
- Programming pendant
- Manipulator cables (between the DX100 and the Manipulator)

CAUTION

- Confirm that the manipulator and the DX100 have the same order number. Special care must be taken when more than one manipulator is to be installed.

If the numbers do not match, manipulators may not perform as expected and cause injury or damage.
1.2 Order Number Confirmation

Check that the order number of the manipulator corresponds to the DX100. The order number is located on a label as shown below.

Fig. 1-1: Location of Order Number Labels

THE MANIPULATOR AND THE CONTROLLER SHOULD HAVE SAME ORDER NUMBER.

Check that the manipulator and the DX100 have the same order number.

(a) DX100 (Front View)          (b) Manipulator (Side View)
2 Transport

2.1 Transport Method

CAUTION

- Sling applications and crane or forklift operations must be performed by authorized personnel only. Failure to observe this caution may result in injury or damage.
- Avoid excessive vibration or shock during transport. The system consists of precision components. Failure to observe this caution may adversely affect performance.

NOTE

- Check that the eyebolts are securely fastened.
- The weight of the manipulator, including the shipping bolts and brackets, is approximately 2300 kg for the UP350D, 2350 kg for the UP350D-200, 2400 kg for the UP350D-500, 2470 kg for the UP350D-400. Use a wire rope strong enough to withstand the weight.
- Attached eyebolts are designed to support the manipulator mass. Do not use them for anything other than transporting the manipulator.
- Mount the shipping bolts and brackets for transporting the manipulator.
- Avoid putting 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 up the manipulator, make sure to avoid the interference between the motor connector and the wire rope slings. (refer to the following figure)

Motor connector

Recommended sling length: 1500mm
2.1 Using a Crane

As a rule, the manipulator should be lifted by a crane with four wire ropes using the attached eyebolts when removing it from the package and moving it. Be sure that the manipulator is fixed with the shipping bolts and brackets before transport, and lift it in the posture as shown in Fig. 2-1 Transporting Position.

Fig. 2-1: Transporting Position
2.2 Shipping Bolts and Brackets

The manipulator is provided with shipping bolts and brackets at positions A, B, C, and D. (See Fig. 2-1 Transporting Position on page 2-2.)

- The shipping brackets are painted yellow.

<table>
<thead>
<tr>
<th>Position</th>
<th>Screw Type</th>
<th>Pcs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Hexagon socket head cap screw M10</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>(length: 25 mm) (tensile strength: 1200 N/mm² or more)</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Hexagon socket head cap screw M12</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>(length: 20 mm) (tensile strength: 1200 N/mm² or more)</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Hexagon socket head cap screw M8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>(length: 35 mm) (tensile strength: 1200 N/mm² or more)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hexagon head screw M30</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>(length: 60 mm)</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Nut M12</td>
<td>2</td>
</tr>
</tbody>
</table>

Before turning ON the power, check to be sure that the shipping bolts and brackets are removed. The shipping bolts and brackets then must be stored for future use, in the event that the manipulator must be moved again.
3 Installation

**WARNING**

- Install the safeguarding. Failure to observe this warning may result in injury or damage.
- Install the manipulator in a location where the tool or the workpiece held by its fully extended arm will not reach the wall, safeguarding, or controller. Failure to observe this warning may result in injury or damage.
- Do not start the manipulator or even turn ON the power before it is firmly anchored. The manipulator may overturn and cause injury or damage.

**CAUTION**

- Do not install or operate the manipulator that is damaged or lacks parts. Failure to observe this caution may cause injury or damage.
- Before turning ON the power, check to be sure that the shipping bolts and brackets explained in Section 2.2 “Shipping Bolts and Brackets” on page 2-3 are removed. Failure to observe this caution may result in damage to the driving parts.
3 Installation
3.1 Safeguarding Installation

3.1 Safeguarding Installation

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

Responsibility for Safeguarding (ISO10218)

The user of a manipulator or robot system shall ensure that safeguards 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 repulsion forces during acceleration and deceleration.

Construct a solid foundation with the appropriate thickness to withstand maximum repulsion forces of the manipulator referring to Table 3-1 Maximum Repulsion Forces of the Manipulator at Emergency Stop.

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 Section 3.2.1 “When the Manipulator and Mounting Fixture are Installed on a Baseplate” on page 3-3 or Section 3.2.2 “When the Manipulator is Mounted Directly on the Floor” on page 3-4.

Table 3-1: Maximum Repulsion Forces of the Manipulator at Emergency Stop

<table>
<thead>
<tr>
<th>Description</th>
<th>Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum torque in horizontal rotation</td>
<td>54000 N•m</td>
</tr>
<tr>
<td>(S-axis moving direction)</td>
<td>(5500 kgf•m)</td>
</tr>
<tr>
<td>Maximum torque in vertical rotation</td>
<td>88300 N•m</td>
</tr>
<tr>
<td>(L-, U-axes moving direction)</td>
<td>(9000 kgf•m)</td>
</tr>
</tbody>
</table>
3.2.1 When the Manipulator and Mounting Fixture are Installed on a Baseplate

For the first process, anchor the baseplate firmly to the ground. The baseplate should 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 thickness, and anchor bolts of M24 or larger size.

Next, fix the manipulator base to the baseplate. The manipulator base is tapped for eight mounting holes; securely fix the manipulator base to the baseplate with eight hexagon socket head cap screws M24 (tensile strength: 1200 N/mm² or more; 80 mm long is recommended.)

Tighten the hexagon socket head cap screws with a tightening torque of 700 N•m (71 kgf•m). Tighten the screws and anchor bolts firmly so that they will not work loose during the operation.

Refer to Fig. 3-1 Mounting the Manipulator on Baseplate.

Fig. 3-1: Mounting the Manipulator on Baseplate

![Diagram of Mounting the Manipulator on Baseplate]
3.2.2 When the Manipulator is Mounted Directly on the Floor

The floor should be strong enough to support the manipulator. Construct a solid foundation with the appropriate thickness to withstand maximum repulsion forces of the manipulator. As a rough standard, when there is a concrete thickness (floor) is 250 mm or more, the manipulator base can be fixed directly to the floor with anchor bolts M24. Before mounting the manipulator, however, check that the floor is level and that all cracks, etc. are repaired. Any thickness less than 250 mm is insufficient for mounting, even if the floor is concrete.

*Fig. 3-2: Direct Mounting on the Floor*

Bolt A: M24 bolt (length: 80 mm, 8 bolts), spring washer, flat washer
Bolt B: M24 bolt (length: 75 mm, 8 bolts), spring washer
Bolts, base A and B should be prepared by user.
3.3 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 (non-condensing)
- Free from dust, soot, 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)
- Flatness for installation: 0.5 mm or less
4 Wiring

4.1 Grounding

Follow electrical installation standards and wiring regulations for grounding. A ground wire of 8.0 mm² or more is recommended.

Refer to Fig. 4-1 Grounding Method on page 4-2 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.

WARNING

- Ground resistance must be 100 Ω or less.
  Failure to observe this warning may result in fire 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 fire or electric shock.

CAUTION

- Wiring must be performed by authorized or certified personnel.
  Failure to observe this caution may result in fire or electric shock.

NOTE
4.2 Cable Connection

Three manipulator cables are delivered with the manipulator: an encoder cable (1BC) and two power cables (2BC and 3BC). (Refer to Fig. 4-2 Manipulator Cables on page 4-3.)

Connect these cables to the manipulator base connectors and to the DX100. Refer to Fig. 4-3(a) Manipulator Cable Connectors (Manipulator Side) on page 4-4 and Fig. 4-3(b) Manipulator Cable Connection (DX100 Side) on page 4-4.

4.2.1 Connection to the Manipulator

Before connecting two cables to the manipulator, verify the numbers on both manipulator cables and the connectors on the connector base of the manipulator. When connecting, adjust the cable connector positions to the main key positions of the manipulator, and insert cables in the order of 2BC, 3BC, then 1BC. After inserting the cables, depress the lever until it clicks.

4.2.2 Connection to the DX100

Before connecting cables to the DX100, verify the numbers on both manipulator cables and the connectors on the DX100. When connecting, insert the cables in the order of X21, X22, then X11, and depress each lever until it clicks.
4 Wiring
4.2 Cable Connection

Fig. 4-2: Manipulator Cables
4.2 Cable Connection

Fig. 4-3(a): Manipulator Cable Connectors (Manipulator Side)

Fig. 4-3(b): Manipulator Cable Connection (DX100 Side)
## 5 Basic Specifications

### 5.1 Basic Specifications

**Table 5-1: Basic Specifications**

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>MOTOMAN-UP350D</th>
<th>MOTOMAN-UP350D-200</th>
<th>MOTOMAN-UP350D-500</th>
<th>MOTOMAN-UP350D-400</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(YR-UP0350D-A00)</td>
<td>(YR-UP0350D-A10)</td>
<td>(YR-UP0350D-A20)</td>
<td>(YR-UP0350D-A40)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(YR-UP0350D-A01)</td>
<td>(YR-UP0350D-A11)</td>
<td>(YR-UP0350D-A21)</td>
<td>(YR-UP0350D-A41)</td>
</tr>
<tr>
<td>Structure</td>
<td>Vertically Articulated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree of Freedom</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payload</td>
<td>350 kg</td>
<td>200 kg</td>
<td>500 kg</td>
<td>400 kg</td>
<td></td>
</tr>
<tr>
<td>Repeatability&lt;sup&gt;2)&lt;/sup&gt;</td>
<td>±0.5 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range of Motion</td>
<td>S-Axis (turning)</td>
<td>±150°</td>
<td>1.66 rad/s, 95°/s</td>
<td>1.4 rad/s, 80°/s</td>
<td>1.05 rad/s, 60°/s</td>
</tr>
<tr>
<td></td>
<td>L-Axis (lower arm)</td>
<td>+61°, -55°</td>
<td>1.66 rad/s, 95°/s</td>
<td>1.4 rad/s, 80°/s</td>
<td>1.22 rad/s, 70°/s</td>
</tr>
<tr>
<td></td>
<td>U-Axis (upper arm)</td>
<td>+30°, -113°</td>
<td>1.66 rad/s, 95°/s</td>
<td>1.4 rad/s, 80°/s</td>
<td>1.22 rad/s, 70°/s</td>
</tr>
<tr>
<td></td>
<td>R-axis (wrist roll)</td>
<td>±360°</td>
<td>1.75 rad/s, 100°/s</td>
<td>1.4 rad/s, 80°/s</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B-Axis (wrist pitch/yaw)</td>
<td>±125°</td>
<td>1.75 rad/s, 100°/s</td>
<td>1.4 rad/s, 80°/s</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T-Axis (wrist twist)</td>
<td>±360°</td>
<td>2.79 rad/s, 160°/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Speed</td>
<td>S-Axis</td>
<td>1.66 rad/s, 95°/s</td>
<td>1.66 rad/s, 95°/s</td>
<td>1.4 rad/s, 80°/s</td>
<td>1.05 rad/s, 60°/s</td>
</tr>
<tr>
<td></td>
<td>L-Axis</td>
<td>1.66 rad/s, 95°/s</td>
<td>1.66 rad/s, 95°/s</td>
<td>1.4 rad/s, 80°/s</td>
<td>1.22 rad/s, 70°/s</td>
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<tr>
<td></td>
<td>U-Axis</td>
<td>1.66 rad/s, 95°/s</td>
<td>1.66 rad/s, 95°/s</td>
<td>1.4 rad/s, 80°/s</td>
<td>1.22 rad/s, 70°/s</td>
</tr>
<tr>
<td></td>
<td>R-Axis</td>
<td>1.75 rad/s, 100°/s</td>
<td>1.4 rad/s, 80°/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>B-Axis</td>
<td>1.75 rad/s, 100°/s</td>
<td>1.4 rad/s, 80°/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T-Axis</td>
<td>2.79 rad/s, 160°/s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowable Moment&lt;sup&gt;3)&lt;/sup&gt;</td>
<td>R-Axis</td>
<td>1960 N•m (200 kgf•m)</td>
<td>1666 N•m (170 kgf•m)</td>
<td>1960 N•m (200 kgf•m)</td>
<td>2450 N•m (250 kgf•m)</td>
</tr>
<tr>
<td></td>
<td>B-Axis</td>
<td>1960 N•m (200 kgf•m)</td>
<td>1666 N•m (170 kgf•m)</td>
<td>1960 N•m (200 kgf•m)</td>
<td>2450 N•m (250 kgf•m)</td>
</tr>
<tr>
<td></td>
<td>T-Axis</td>
<td>823 N•m (84 kgf•m)</td>
<td>686 N•m (70 kgf•m)</td>
<td>823 N•m (84 kgf•m)</td>
<td>823 N•m (84 kgf•m)</td>
</tr>
<tr>
<td>Allowable Inertia (GD&lt;sup&gt;2&lt;/sup&gt;/4)</td>
<td>R-Axis</td>
<td>150 kg•m&lt;sup&gt;2&lt;/sup&gt;</td>
<td>150 kg•m&lt;sup&gt;2&lt;/sup&gt;</td>
<td>150 kg•m&lt;sup&gt;2&lt;/sup&gt;</td>
<td>200 kg•m&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>B-Axis</td>
<td>150 kg•m&lt;sup&gt;2&lt;/sup&gt;</td>
<td>150 kg•m&lt;sup&gt;2&lt;/sup&gt;</td>
<td>150 kg•m&lt;sup&gt;2&lt;/sup&gt;</td>
<td>200 kg•m&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>T-Axis</td>
<td>90 kg•m&lt;sup&gt;2&lt;/sup&gt;</td>
<td>30 kg•m&lt;sup&gt;2&lt;/sup&gt;</td>
<td>90 kg•m&lt;sup&gt;2&lt;/sup&gt;</td>
<td>50 kg•m&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Approx. Mass</td>
<td>2200 kg</td>
<td>2250 kg</td>
<td>2380 kg</td>
<td>2370 kg</td>
<td></td>
</tr>
<tr>
<td>Ambient Conditions</td>
<td>Temperature</td>
<td>0 to 45°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Humidity</td>
<td>20 to 80% RH (non-condensing)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vibration Acceleration</td>
<td>4.9 m/s&lt;sup&gt;2&lt;/sup&gt; (0.5G) or less</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>Free from corrosive gas or liquid, or explosive gas or liquid</td>
<td>Free from exposure to dust, oil, or water</td>
<td>Free from excessive electrical noise (plasma)</td>
<td></td>
</tr>
<tr>
<td>Power Requirements</td>
<td>5.5 kVA</td>
<td></td>
<td></td>
<td></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 Section 6.1 “Allowable Wrist Load” on page 6-1 for details on the permissible moment of inertia.
5.2 Part Names and Working Axes

*Fig. 5-1: Part Names and Working Axes*

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Working Axes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper arm</td>
<td>U-axis</td>
</tr>
<tr>
<td>(U-arm)</td>
<td>R-axis</td>
</tr>
<tr>
<td>Lower arm</td>
<td>B-axis</td>
</tr>
<tr>
<td>(L-arm)</td>
<td>T-axis</td>
</tr>
<tr>
<td>Rotary head</td>
<td>S-axis</td>
</tr>
<tr>
<td>(S-head)</td>
<td>Base</td>
</tr>
</tbody>
</table>

5.3 Manipulator Base Dimensions

*Fig. 5-2: Manipulator Base Dimensions*

- Units: mm
- 12 \( \varnothing 0.018 \) dia. holes
- 28 dia. holes (8 holes)
- 365 \( \pm 0.3 \)
- 405 \( \pm 0.3 \)
- 640
- 760
- 410 \( \pm 0.3 \)
- View A

Units: mm
5.4 Dimensions and P-point Maximum Envelope

Fig. 5-3(a): Dimensions and P-Point Maximum Envelope (YR-UP0350D-A00, -A01)

Units: mm
5.4 Dimensions and P-point Maximum Envelope

Fig. 5-3(b): Dimensions and P-Point Maximum Envelope (YR-UP0350D-A10, -A11)
5.4 Dimensions and P-point Maximum Envelope

Fig. 5-3(c): Dimensions and P-Point Maximum Envelope (YR-UP0350D-A20, -A21)
5.4 Dimensions and P-point Maximum Envelope

Fig. 5-3(d): Dimensions and P-Point Maximum Envelope (YR-UP0350D-A40, -A41)
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</td>
<td>±150° (standard)</td>
</tr>
<tr>
<td>Range</td>
<td>±120°</td>
</tr>
<tr>
<td></td>
<td>± 90°</td>
</tr>
<tr>
<td></td>
<td>± 60°</td>
</tr>
<tr>
<td></td>
<td>± 30°</td>
</tr>
</tbody>
</table>
6 Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

The allowable wrist load including the weight of the gripper is as follows:

YR-UP350D-A00, A01: 350 kg maximum
YR-UP350D-A10, A11: 200 kg maximum
YR-UP350D-A20, A21: 500 kg maximum
YR-UP350D-A40, A41: 400 kg maximum

If force is applied to the wrist instead of the load, force on R-, B-, and T-axes should be within the value shown in Table 6-1 Allowable Wrist Load. Contact your Yaskawa representative for further information or assistance.

Table 6-1: Allowable Wrist Load

<table>
<thead>
<tr>
<th>Type</th>
<th>Axis</th>
<th>Moment N·m (kgf·m) (^1)</th>
<th>GD(^2/4) Total Moment of Inertia kg·m(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YR-UP0350D-A00, -A01</td>
<td>R-Axis</td>
<td>1960(200)</td>
<td>150</td>
</tr>
<tr>
<td>YR-UP0350D-A20, -A21</td>
<td>R-Axis</td>
<td>1960(200)</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>B-Axis</td>
<td>823(84)</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>T-Axis</td>
<td>823(84)</td>
<td>90</td>
</tr>
<tr>
<td>YR-UP0350D-A10, -A11</td>
<td>R-Axis</td>
<td>1666(170)</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>B-Axis</td>
<td>1666(170)</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>T-Axis</td>
<td>686(70)</td>
<td>30</td>
</tr>
<tr>
<td>YR-UP0350D-A40, -A41</td>
<td>R-Axis</td>
<td>2450(250)</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>B-Axis</td>
<td>2450(250)</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>T-Axis</td>
<td>823(84)</td>
<td>50</td>
</tr>
</tbody>
</table>

\(^1\) ( ): Gravitational unit

When the volume load is small, refer to the moment arm rating shown in Fig. 6-1(a) Moment Arm Rating (YR-UP0350D-A00, -A01) on page 6-2 to Fig. 6-1(d) Moment Arm Rating (YR-UP0350D-A40, -A41) on page 6-3.

The allowable total moment of inertia is calculated when the moment is at the maximum. Contact your Yaskawa representative beforehand when only the moment of inertia is created, or when the load moment is small while the moment of inertia is large. Also, when the load mass is combined with an outside force, contact your Yaskawa representative beforehand.
6 - Allowable Load for Wrist Axis and Wrist Flange
6.1 Allowable Wrist Load

Fig. 6-1(a): Moment Arm Rating (YR-UP0350D-A00, -A01)

Fig. 6-1(b): Moment Arm Rating (YR-UP0350D-A10, -A11)
6. Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

Fig. 6-1(c): Moment Arm Rating (YR-UP0350D-A20, -A21)

Fig. 6-1(d): Moment Arm Rating (YR-UP0350D-A40, -A41)
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 of inside and outside fittings must be 8 mm or less.

**NOTE** Wash off anti-corrosive paint (yellow) on the wrist flange surface with thinner or light oil before mounting the tools.

**Fig. 6-2: Wrist Flange**

**Manipulator in the Home Position**

Units: mm
7 System Application

7.1 Peripheral Equipment Mounts

The peripheral equipment mounts are provided on the U-axis (upper arm) as shown in Fig. 7-1(a) Installing Peripheral Equipment (YR-UP0350D-A00, -A01) to Fig. 7-1(d) Installing Peripheral Equipment (YR-UP0350D-A40, -A41) on page 7-3 for easier installation of the users’ system applications. The following conditions in Table 7-1 Conditions for Installation on page 7-3 should be observed to attach or install peripheral equipment.

Fig. 7-1(a): Installing Peripheral Equipment (YR-UP0350D-A00, -A01)
Fig. 7-1(b): Installing Peripheral Equipment (YR-UP0350D-A10, -A11)

Fig. 7-1(c): Installing Peripheral Equipment (YR-UP0350D-A20, -A21)
7 System Application
7.1 Peripheral Equipment Mounts

Fig. 7-1(d): Installing Peripheral Equipment (YR-UP0350D-A40, -A41)

Table 7-1: Conditions for Installation

<table>
<thead>
<tr>
<th>Application</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Cable Processing</td>
<td>350 kg max. (YR-UP0350D-A00, -A01), 200 kg max. (YR-UP0350D-A10, -A11), 500 kg max. (YR-UP0350D-A20, -A21), 400 kg max. (YR-UP0350D-A40, -A41), including the peripheral equipment mass attached to the wrist unit.</td>
</tr>
<tr>
<td>B Cable Processing and Valve Load</td>
<td>50 kg max. 49 N•m (5 kgf•m) max. for increased moment amount of upper arm</td>
</tr>
</tbody>
</table>
7.2 Internal User I/O Wiring Harness and Air Lines

Internal user I/O wiring harness (0.5 mm² x 17 wires) and one air line are incorporated in the manipulator for the drive of peripheral device 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 17 are assigned as shown in Fig. 7-2 Connectors for Internal User I/O Wiring Harness and Air Line. Wiring must be performed by users.

<table>
<thead>
<tr>
<th>The allowable current for internal user I/O wiring harness</th>
<th>2.7 A or less for each wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>The maximum pressure for the air line</td>
<td>490 kPa (5 kgf/cm²) or less. (The air line inside diameter: 8.0 mm)</td>
</tr>
</tbody>
</table>

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

Connector for the internal user I/O wiring harness: JL05-2A22-14SC (socket connector with a cap)
Prepare pin connector: JL05-6A22-14PC

Connector for the internal user I/O wiring harness: JL05-2A22-14PC (pin connector with a cap)
Prepare socket connector: JL05-6A22-14SC

Air inlet
PT3/8 with a pipe plug

Detailed Drawing of Connector Pin Numbers

The same numbered pins (1 to 17) of the two connectors are connected with a single lead wire of 0.5 mm².
8 Electrical Equipment Specification

8.1 Position of Limit Switch

For location of limit switches, refer to Fig. 8-1 Location of Limit Switches.
(YR-UP0350D-A01, YR-UP0350D-A11, YR-UP0350D-A21, YR-UP0350D-A41)

*Fig. 8-1: Location of Limit Switches*
8.2 Setting of Operation Range

8.2.1 S-Axis Operation Range
By the S-axis limit switch, S-axis operation range can be set to those ranges mentioned in Table 5-2 S-Axis Operating Range on page 5-7.

8.2.2 L-Axis Operation Range
By the L-axis limit switch, the L-axis operation range can be set to any angles within -56° to 62° (-26° to 92° from the L-axis home position).

Fig. 8-2: L-Axis Overrun Limit Switch Setting Range
8.2.3 Setting Range of LU-Axes Interference Angle

L- and U-axes interference limit switches are designed to check the interference angle of L- and U-axes.

As shown in Fig. 8-3 LU-Axes Interference Angle, the operation range of U-axis can be set to any angles within +25° to +152°.

(However, the manipulator can take a posture at the maximum angle when the L-axis is more than +31° more than +61° from the L-axis home position.)

Fig. 8-3: LU-Axes Interference Angle

8.3 Internal Connections

Diagrams for internal connections of the manipulator are shown in Fig. 8-4(a) Internal Connection Diagram on page 8-2 and Fig. 8-4(b) Internal Connection Diagram on page 8-3.
Fig. 8-4(a): Internal Connection Diagram

Note: 1. This diagram is for the standard specifications of the MOTOMAN-UP350D.
2. Refer to "Optional Connection Diagram" below for optional specifications.
3. For manipulators with a lamp, connection on the U-arm is as shown in "Optional 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 on page 9-2.

In Table 9-1 Inspection Items on page 9-2, 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.
- 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.
### Table 9-1: Inspection Items (Sheet 1 of 3)

<table>
<thead>
<tr>
<th>Items 1)</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>6000 H Cycle</td>
<td>12000 H Cycle</td>
</tr>
<tr>
<td>1</td>
<td>Alignment mark</td>
<td>●</td>
<td>Visual</td>
<td>Check alignment mark accordance and damage at the home position.</td>
</tr>
<tr>
<td>2</td>
<td>External lead</td>
<td>●</td>
<td>Visual</td>
<td>Check for damage and deterioration of leads.</td>
</tr>
<tr>
<td>3</td>
<td>Working area and manipulator</td>
<td>●</td>
<td>Visual</td>
<td>Clean the work area if dust or spatter is present. Check for damage and outside cracks.</td>
</tr>
<tr>
<td>4</td>
<td>Motors for L-and U-axes</td>
<td>●</td>
<td>Visual</td>
<td>Check for grease leakage. 2)</td>
</tr>
<tr>
<td>5</td>
<td>Baseplate mounting bolts</td>
<td>●</td>
<td>Spanner Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
</tr>
<tr>
<td>6</td>
<td>Cover mounting screws</td>
<td>●</td>
<td>Screwdriver, Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
</tr>
<tr>
<td>8</td>
<td>Connector base</td>
<td>●</td>
<td>Manual</td>
<td>Check for loose connectors.</td>
</tr>
<tr>
<td>9</td>
<td>Cable protector in S-axis</td>
<td>●</td>
<td>Visual</td>
<td>Remove the cover and check for wear.</td>
</tr>
<tr>
<td>01</td>
<td>L-axis balancer</td>
<td>●</td>
<td>Visual, Grease Gun</td>
<td>Tighten loose nuts and shaft. Supply grease. 3)See Section 9.3.9 on page 9-22.</td>
</tr>
</tbody>
</table>
### Table 9-1: Inspection Items (Sheet 2 of 3)

<table>
<thead>
<tr>
<th>Items 1)</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24000 H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36000 H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Wire harness in manipulator (for S-, L-, U-, R-, B-, T-axes)</td>
<td>Daily</td>
<td>Visual, Multimeter</td>
<td>Check for conduction between the main connector of base and intermediate connector by manually shaking the wire. Check for wear of protective spring. 4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24000 H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36000 H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 S-axis limit switch dog</td>
<td>Daily</td>
<td>Screwdriver, Wrench, Multimeter</td>
<td>Check for stain, damage, and looseness. Tighten and check the dog movement.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24000 H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36000 H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24000 H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36000 H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 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 36000H. See Section 9.2.1 on page 9-7 .</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24000 H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36000 H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>24000 H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36000 H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1000 H Cycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6000 H Cycle</td>
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<td></td>
<td>12000 H Cycle</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>24000 H</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>36000 H</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) See Section 9.3.7 on page 9-20.
<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>6000 H Cycle</td>
<td>12000 H Cycle</td>
</tr>
<tr>
<td>8</td>
<td>R-axis speed reducer</td>
<td>●</td>
<td>●</td>
<td>Grease Gun</td>
</tr>
<tr>
<td>9</td>
<td>B-axis speed reducer and gear</td>
<td>●</td>
<td>●</td>
<td>Grease Gun</td>
</tr>
<tr>
<td>0</td>
<td>T-axis speed reducer and gear</td>
<td>●</td>
<td>●</td>
<td>Grease Gun</td>
</tr>
<tr>
<td>1</td>
<td>Cross roller bearings for S- and L-axes</td>
<td>●</td>
<td>Grease Gun</td>
<td>Check for malfunction. ( Replace if necessary.) Supply grease(^3) (6000H cycle). See Section 9.3.6 on page 9-19 and Section 9.3.7 on page 9-20. Replace grease(^3) (12000H cycle). See Section 9.3.6 on page 9-19 and Section 9.3.7 on page 9-20.</td>
</tr>
<tr>
<td>2</td>
<td>Overhaul</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Inspection item numbers correspond to the numbers in Fig. 9-1 Inspection Items on page 9-5.
2 The occurrence of a grease leakage indicates the possibility that grease has seeped into the motor. This can cause a motor breakdown. Contact your Yaskawa representative.
3 For the grease, refer to Table 9-2 Inspection Parts and Grease Used on page 9-6.
4 When checking for conduction with multimeter, connect the battery to “BAT” and “OBT” of connectors on the motor side for each axis, and then remove connectors on detector side for each axis from the motor. Otherwise, the home position may be lost. (Refer to Section 9.3.10 “Notes for Maintenance” on page 9-23.)
5 Wire harness in manipulator to be replaced at 24000H inspection.
Fig. 9-1: Inspection Items
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>16, 17, 18, 19, 20</td>
<td>Molywhite RE No.00</td>
<td>Speed reducers for all axes, Gears for B- and T-axes</td>
</tr>
<tr>
<td>10, 14, 21</td>
<td>Alvania EP Grease 2</td>
<td>Cross roller bearings for S- and L- axes, Tapered roller bearings for links, L-axis balancer</td>
</tr>
</tbody>
</table>

The numbers in the above table correspond to the numbers in Table 9-1 Inspection Items on page 9-2.
9.2 Notes on Maintenance Procedures

9.2.1 Battery Pack Replacement

The battery packs are installed in the position shown in Fig. 9-2 Battery Location. If the battery alarm occurs in the DX100, replace the battery in accordance with the following procedure:

Fig. 9-2: Battery Location
9 Maintenance and Inspection
9.2 Notes on Maintenance Procedures

1. Turn off the DX100 main power supply.
2. Remove the cover of the connector base.
3. Remove the plate fixing screws and the plate, then pull the battery pack out to replace it with the new one.
4. Remove the battery pack from the battery holder.
5. Connect the new battery pack to the unoccupied connector on the board.
6. Remove the old battery pack from the board.

**NOTE**  Remove the old battery pack after connecting the new one so that the encoder absolute data does not disappear.

7. Mount the new battery pack to the holder.
8. Reinstall the plate.

**NOTE**  Do not allow the plate to pinch the cables when reinstalling the plate.
9.3 Notes on Grease Replenishment/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 added without removing the plug/screw from the grease exhaust port, the grease will leak inside a motor or an oil seal of a speed reducer will come off, which may result in damage to the motor. Make sure to remove the plug/screw.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.
- Make sure to use a grease pump to inject grease. Set air supply pressure to the grease pump at 0.3 MPa or less, and the grease injection rate at 8 g/s or less.
- Make sure to fill hoses, which are joined to the grease inlet, with grease beforehand to prevent air from intruding into the speed reducer.

9.3.1 Grease Replenishment/Exchange for S-axis Speed Reducer

Fig. 9-4: S-Axis Speed Reducer Diagram

9.3.1.1 Grease Replenishment

(Refer to Fig.9-4 S-Axis Speed Reducer Diagram.)

1. Remove the hexagon socket head plugs PT1/4 from the grease inlet and grease exhaust port.

   - If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
   - Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Install a grease zerk A-PT1/4 to the grease inlet.
   (The grease zerk is delivered with the manipulator.)
3. Inject the grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE No.00
   - Amount of grease: 750 cc
     (1500 cc for 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

4. Move the S-axis for a few minutes to discharge excess grease.

5. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet, and reinstall the plugs to the grease inlet and the grease exhaust port. Before installing the plugs, apply Three Bond 1206C on the thread part of each plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

9.3.1.2 Grease Exchange

(Refer to Fig. 9-4 S-Axis Speed Reducer Diagram on page 9-9.)

1. Remove the hexagon socket head plugs PT1/4 from the grease inlet and grease exhaust port.

   • If grease is injected with the plug on, grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.

   • Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Install a grease zerk A-PT1/4 to the grease inlet. (The grease zerk is delivered with the manipulator.)

3. Inject grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE No.00
   - Amount of grease: approx. 2500 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

4. The grease exchange is completed when new grease appears in the grease exhaust port. (The new grease can be distinguished from the old grease by color.)

5. Move the S-axis for a few minutes to discharge excess grease.

6. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet, and reinstall the plugs to the grease inlet and the grease exhaust port. Before installing the plugs, apply Three Bond 1206C on the thread part of each plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

   If the plug is installed while grease is being exhausted, grease will leak inside the motor and may cause a damage. Make sure to install the plug when the grease exhaust is completed.
9.3.2 Grease Replenishment/Exchange for L- and U-Axes Speed Reducers

*Fig. 9-5: L- and U-Axes Speed Reducers Diagram*

9.3.2.1 Grease Replenishment

(Refer to *Fig. 9-5 L- and U-Axes Speed Reducers Diagram.*)

1. Remove the hexagon socket head plug PT1/8 on the grease inlet and the air breezer or the hexagon socket head plug PT1/8 on the grease exhaust port.

   - If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
   - Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

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

3. Inject the grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE No.00
   - Amount of grease: 600 cc  
   (1200 cc for 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

4. Move the L- and U-axes for a few minutes to discharge excess grease.

5. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet, and reinstall the plug to the grease inlet and the air breezer or the plug to the grease exhaust port. Before installing the plugs, apply Three Bond 1206C on the thread part of each plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

9.3.2.2 Grease Exchange

(Refer to *Fig. 9-5 L- and U-Axes Speed Reducers Diagram on page 9-11.*)
9 Maintenance and Inspection

9.3 Notes on Grease Replenishment/Exchange Procedures

1. Remove the hexagon socket head plug PT1/8 on the grease inlet and the air breezer or the hexagon socket head plug PT1/8 on the grease exhaust port.

   • If grease is injected with the plug on, grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.

   • Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

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

3. Inject grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE No.00
   - Amount of grease: approx. 1800 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

4. The grease exchange is completed when new grease appears in the grease exhaust port. (The new grease can be distinguished from the old grease by color.)

5. Move the L- and U-axes for a few minutes to discharge excess grease.

6. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet, and reinstall the plug to the grease inlet and the air breezer or the plug to the grease exhaust port. Before installing the plugs, apply Three Bond 1206C on the thread part of each plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).

   If the plug is installed while grease is being exhausted, grease will leak inside the motor and may cause a damage. Make sure to install the plug when the grease exhaust is completed.
9.3.3 Grease Replenishment/Exchange for R-Axis Speed Reducer

Fig. 9-6: R-Axis Speed Reducer Diagram

9.3.3.1 Grease Replenishment

(Refer to Fig.9-6 R-Axis Speed Reducer Diagram.)

1. Remove the hexagon socket head plug PT1/8 on the grease inlet.
2. Remove the cap and the hexagon socket head plug PT1/8 on the grease exhaust port.
3. Install a grease zerk A-PT1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)
4. Inject grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE No.00
   - Amount of grease: 700 cc (1400 cc for 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less
5. Move the R-axis for a few minutes to discharge excess grease.
6. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet, and reinstall the plugs to the grease inlet and the grease exhaust port. Before installing the plugs, apply Three Bond 1206C on the thread part of each plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
7. Reinstall the cap.

• If grease is injected with the plug on, grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.

• Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.
9.3 Notes on Grease Replenishment/Exchange Procedures

9.3.2 Grease Exchange

(Refer to Fig. 9-6 R-Axis Speed Reducer Diagram on page 9-13.)

1. Remove the hexagon socket head plug PT1/8 on the grease inlet.
2. Remove the cap and the hexagon socket head plug PT1/8 on the grease exhaust port.

3. Install a grease zerk A-PT1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)
4. Inject grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE No.00
   - Amount of grease: approx. 3200 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

5. The grease exchange is completed when new grease appears in the grease exhaust port. (The new grease can be distinguished from the old grease by color.)

6. Move the R-axis for a few minutes to discharge excess grease.
7. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet, and reinstall the plugs to the grease inlet and the grease exhaust port. Before installing the plugs, apply Three Bond 1206C on the thread part of each plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
8. Reinstall the cap.

**NOTE**

- If grease is injected with the plug on, grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.
- If the plug is installed while grease is being exhausted, grease will leak inside the motor and may cause a damage. Make sure to install the plug when the grease exhaust is completed.
9.3.4 Grease Replenishment/Exchange for B-Axis Speed Reducer and Gear

Fig. 9-7: B-Axis Speed Reducer and Gear Diagram

9.3.4.1 Grease Replenishment

(Refer to Fig.9-7 B-Axis Speed Reducer and Gear Diagram.)

1. Remove the hexagon socket head plug PT1/8 from the grease inlet and the hexagon socket head cap screw M6 from the grease exhaust port.

- If grease is injected with the screw on, the grease will leak inside the motor and may cause a damage. Make sure to remove the screw before the grease injection.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

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

3. Inject the grease through the grease inlet using a grease gun.

   – Grease type: Molywhite RE No.00
   – Amount of grease: 260 cc (520 cc for 1st supply)
   – Air supply pressure of grease pump: 0.3 MPa or less
   – Grease injection rate: 8 g/s or less

4. Move the B-axis for a few minutes to discharge excess grease.

5. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet, and reinstall the plug to the grease inlet and the screw to the grease exhaust port. Before installing the plug and the screw, apply Three Bond 1206C on the thread part of the plug and the screw, then tighten the plug and the screw with a tightening torque of 4.9 N•m (0.5 kgf•m).
9.3.4.2 Grease Exchange

(Refer to Fig. 9-7 B-Axis Speed Reducer and Gear Diagram on page 9-15.)

1. Remove the hexagon socket head plug PT1/8 from the grease inlet and the hexagon socket head cap screw M6 from the grease exhaust port.

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

3. Inject grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE No.00
   - Amount of grease: approx. 1300 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

4. The grease exchange is completed when new grease appears in the grease exhaust port. (The new grease can be distinguished from the old grease by color.)

5. Move the B-axis for a few minutes to discharge excess grease.

6. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet, and reinstall the plug to the grease inlet and the screw to the grease exhaust port. Before installing the plug and the screw, apply Three Bond 1206C on the thread part of the plug and the screw, then tighten the plug and the screw with a tightening torque of 4.9 N•m (0.5 kgf•m).

   - If grease is injected with the screw on, grease will leak inside the motor and may cause a damage. Make sure to remove the screw before the grease injection.
   - Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

   - If the screw is installed while grease is being exhausted, grease will leak inside the motor and may cause a damage. Make sure to install the screw when the grease exhaust is completed.
9.3.5 Grease Replenishment/Exchange for T-Axis Speed Reducer and Gear

Fig. 9-8: T-Axis Speed Reducer and Gear Diagram

9.3.5.1 Grease Replenishment

(Refer to Fig.9-8 T-Axis Speed Reducer and Gear Diagram.)

1. Remove the hexagon socket head plug PT1/8 from the grease inlet and the hexagon socket head cap screw M5 from the grease exhaust port.

   • If grease is injected with the screw on, the grease will leak inside the motor and may cause a damage. Make sure to remove the screw before the grease injection.
   
   • Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

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

3. Inject the grease through the grease inlet using a grease gun.
   
   − Grease type: Molywhite RE No.00
   
   − Amount of grease: 260 cc
     (520 cc for 1st supply)
   
   − Air supply pressure of grease pump: 0.3 MPa or less
   
   − Grease injection rate: 8 g/s or less

4. Move the T-axis for a few minutes to discharge excess grease.

5. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet, and reinstall the plug to the grease inlet and the screw to the grease exhaust port. Before installing the plug and the screw, apply Three Bond 1206C on the thread part of the plug and the screw, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m), and the screw with a tightening torque of 6 N•m (0.6 kgf•m).
9.3.5.2 Grease Exchange

(Refer to Fig. 9-8 T-Axis Speed Reducer and Gear Diagram on page 9-17.)

1. Remove the hexagon socket head plug PT1/8 from the grease inlet and the hexagon socket head cap screw M5 from the grease exhaust port.

- If grease is injected with the screw on, grease will leak inside the motor and may cause a damage. Make sure to remove the screw before the grease injection.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

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

3. Inject grease through the grease inlet using a grease gun.
   - Grease type: Molywhite RE No.00
   - Amount of grease: approx. 1300 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

4. The grease exchange is completed when new grease appears in the grease exhaust port. (The new grease can be distinguished from the old grease by color.)

5. Move the T-axis for a few minutes to discharge excess grease.

6. Wipe the discharged grease with a cloth. Remove the grease zerk from the grease inlet, and reinstall the plug to the grease inlet and the screw to the grease exhaust port. Before installing the plug and the screw, apply Three Bond 1206C on the thread part of the plug and the screw, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m), and the screw with a tightening torque of 6 N•m (0.6 kgf•m).

- If the screw is installed while grease is being exhausted, grease will leak inside the motor and may cause a damage. Make sure to install the screw when the grease exhaust is completed.
9.3.6 Grease Replenishment for S-Axis Cross Roller Bearing

Fig. 9-9: S-Axis Cross Roller Bearing Diagram

1. Remove the hexagon socket head plug PT1/8 from the grease inlet.
2. Install the grease zerk A-PT1/8.
   (The grease zerk is delivered with the manipulator.)
3. Inject grease through the grease inlet using a grease gun.
   - Grease type: Alvania EP grease 2
   - Amount of grease: approx. 130 cc

![Grease inlet (Hexagon socket head plug PT1/8)](Image)

**NOTE** Do not inject excessive grease through the grease inlet.

4. Remove the grease zerk from the grease inlet and reinstall the plug.
   Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 4.9 N·m (0.5 kgf·m).
9.3.7 Grease Replenishment for L-Axis Cross Roller Bearing

*Fig. 9-10: L-Axis Cross Roller Bearing Diagram*

1. Remove the hexagon socket head plug PT1/8 from the grease inlet and the exhaust port.

2. Install the grease zerk A-PT1/8. (The grease zerk is delivered with the manipulator.)

3. Inject grease through the grease inlet using a grease gun. (See *Fig. 9-10 L-Axis Cross Roller Bearing Diagram*.)
   - Grease type: Alvania EP grease 2
   - Amount of grease: approx. 19 cc

   **NOTE**
   Do not inject excessive grease through the grease inlet.

4. Remove the grease zerk from the grease inlet and reinstall the plugs to the grease inlet and the exhaust port. Before installing the plugs, apply Three Bond 1206C on the thread part of each plug, then tighten the plugs with a tightening torque of 4.9 N\(\cdot\)m (0.5 kgf\(\cdot\)m).
9.3.8 Grease Replenishment for Tapered Roller Bearing for Link

Fig. 9-11: Link Diagram

1. Remove the hexagon socket head plug PT1/8 from the grease inlet.

2. Install the grease zerk A-PT1/8.
   (The grease zerk is delivered with the manipulator.)

3. Inject grease through the grease inlets (6 inlets) using a grease gun.
   (See Fig.9-11 Link Diagram.)
   - Grease type: Alvania EP grease 2
   - Amount of grease: approx. 6 cc
   (12 cc for 1st supply)

   **NOTE** Do not inject excessive grease through the grease inlet.

4. Remove the grease zerk from the grease inlet and reinstall the plug.
   Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
9.3.9 Grease Replenishment for Balancer Connection

Fig. 9-12: Balancer Connection Diagram

1. Remove the hexagon socket head plug PT1/8 from the grease inlet.
2. Install the grease zerk A-PT1/8.
   (The grease zerk is delivered with the manipulator.)
3. Inject grease through the grease inlets (4 inlets) using a grease gun.
   (See Fig. 9-12 Balancer Connection Diagram.)
   - Grease type: Alvania EP grease 2
   - Amount of grease: approx. 5 cc
     (10 cc for 1st supply)
4. Remove the grease zerk from the grease inlet and reinstall the plug.
   Before installing the plug, apply Three Bond 1206C on the thread part of
   the plug, then tighten the plug with a tightening torque of 4.9 N•m
   (0.5 kgf•m).

**Note**
Do not inject excessive grease through the grease inlet.
9.3.10 Notes for Maintenance

When performing maintenance such as replacement of a wire harness in the manipulator, the encoder connector may be necessary to be removed. In this case, be sure to connect the battery pack to the battery backup connector before removing the encoder connector.

Removing the encoder connector without connecting the battery pack leads to disappearance of the encoder absolute data.

For the battery pack connection, refer to Fig. 9-13 Battery Pack Connection on page 9-24.

9.3.10.1 Battery Pack Connection

The connectors (crimped contact-pin) for the battery backup are installed at the end point of the motors (BAT and OBT are marked). Connect the battery packs according to the following procedure.

1. Remove the cap attached to the battery backup connector of the motors.

2. Connect the battery packs (HW9470932-A) with the battery backup connectors (BAT and OBT are marked) located at the end point of the cables for the encoder. (Under this condition, remove the encoder connector and carry out the maintenance checks.)

3. Confirm all connectors connected after the maintenance check, and remove the battery packs. Install the caps attached to the battery backup connectors of the motors.

Do not remove the battery pack in the connector base.
9 Maintenance and Inspection
9.3 Notes on Grease Replenishment/Exchange Procedures

**Fig. 9-13: Battery Pack Connection**

- Motor
- Motor power connector
- Connector for motor encoder
- Battery pack: HW9470932-A
- Battery backup connector

a: Crimped contact-pin (pin)
b: Crimped contact-pin (socket)
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-UP350D. 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 MOTOMAN-UP350D, UP350D-200, UP350D-500, UP350D-400 (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty</th>
<th>Qty per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>Grease</td>
<td>Molywhite RE No.00</td>
<td>Yaskawa</td>
<td>16 kg</td>
<td>-</td>
<td>For each axis speed reducer and wrist unit</td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>Grease</td>
<td>Alvania EP Grease 2</td>
<td>Showa Shell Sekiyu.K.K.</td>
<td>16 kg</td>
<td>-</td>
<td>For balancer connection and cross roller bearing</td>
</tr>
<tr>
<td>A</td>
<td>3</td>
<td>Liquid Gasket</td>
<td>Three Bond 1206C</td>
<td>Three Bond Co., Ltd.</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>4</td>
<td>Battery Pack</td>
<td>HW0470360-A</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td>For replacement of wire harness in manipulator</td>
</tr>
<tr>
<td>A</td>
<td>5</td>
<td>Battery Pack</td>
<td>HW9470932-A</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>R-axis Timing Belt</td>
<td>200S8M824</td>
<td>Mitsuboshi Belting Ltd.</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>B-axis Timing Belt</td>
<td>200S8M760</td>
<td>Mitsuboshi Belting Ltd.</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>T-axis Timing Belt</td>
<td>200S8M656</td>
<td>Mitsuboshi Belting Ltd.</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>9</td>
<td>S-axis Speed Reducer</td>
<td>HW9381006-C</td>
<td>Yaskawa</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>10</td>
<td>S-axis Input Gear</td>
<td>HW9481714-A</td>
<td>Yaskawa</td>
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<td>B</td>
<td>11</td>
<td>Speed Reducers for L- and U-axes</td>
<td>HW9381442-B</td>
<td>Yaskawa</td>
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<td>B</td>
<td>12</td>
<td>Input Gears for L- and U-axes</td>
<td>HW9482358-A</td>
<td>Yaskawa</td>
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<td>13</td>
<td>R-axis Speed Reducer</td>
<td>HW0380393-A</td>
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<td>HW9381453-A</td>
<td>Yaskawa</td>
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Table 10-1: Spare Parts for the MOTOMAN-UP350D, UP350D-200, UP350D-500, UP350D-400 (Sheet 2 of 2)

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty</th>
<th>Qty per Unit</th>
<th>Remarks</th>
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<tr>
<td>B</td>
<td>15</td>
<td>T-axis Speed Reducer</td>
<td>HW0389041-A (UP350D, UP350D-500, UP350D-400) HW9381529-B (UP350D-200)</td>
<td>Yaskawa</td>
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<td>B</td>
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<td>Wrist Unit</td>
<td>HW0171431-A (UP350D, UP350D-500, UP350D-400) HW0171431-B (UP350D-200)</td>
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<td>B</td>
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<td>Cross Roller Bearing</td>
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<td>C</td>
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<td>AC Servomotors for S-, L-, and U-axes</td>
<td>HW0382157-A SGMRS-37A2A-YR1*</td>
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<td>AC Servomotors for R-, B-, and T-axes</td>
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MOTOMAN-UP350D, UP350D-200, UP350D-500, UP350D-400

INSTRUCTIONS

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