Motoman® NX100 Controller

EPH130R
Manipulator Manual

Part Number: 154769-1CD
Revision: 0
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Chapter 1

Introduction

1.1 About This Document

This manual provides information for the EPH130R manipulator and contains the following sections:

CHAPTER 1 - INTRODUCTION
Provides general information about the structure of this manual, a list of reference documents, and customer service information.

CHAPTER 2 - SAFETY
This section provides information regarding the safe use and operation of Motoman products.

CHAPTER 3 - EPH130R SUPPLEMENTARY INSTRUCTIONS
Provides supplementary information for the EPH130R manipulator.

CHAPTER 4 - EPH130R INSTRUCTIONS
Provides detailed information for the EPH130R manipulator.

1.2 Reference to Other Documentation

For additional information refer to the following:
- NX100 Controller Manual (P/N 149201-1)
- Concurrent I/O Manual (P/N 149230-1)
- Operator's Manual for your application
- Vendor manuals for system components not manufactured by Motoman

1.3 Customer Service Information

If you are in need of technical assistance, contact the Motoman service staff at (937) 847-3200. Please have the following information ready before you call:
- Robot Type (EPH130R)
- Application Type (welding, handling, etc.)
- Robot Serial Number (located on back side of robot arm)
- Robot Sales Order Number (located on back of controller)
Notes
Chapter 2

Safety

2.1 Introduction

It is the purchaser’s responsibility to ensure that all local, county, state, and national codes, regulations, rules, or laws relating to safety and safe operating conditions for each installation are met and followed.

We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems. This information can be obtained from the Robotic Industries Association by requesting ANSI/RIA R15.06-1999. The address is as follows:

Robotic Industries Association
900 Victors Way
P.O. Box 3724
Ann Arbor, Michigan 48106
TEL: (734) 994-6088
FAX: (734) 994-3338
INTERNET: www.roboticsonline.com

Ultimately, the best safeguard is trained personnel. The user is responsible for providing personnel who are adequately trained to operate, program, and maintain the robot cell. The robot must not be operated by personnel who have not been trained!

We recommend that all personnel who intend to operate, program, repair, or use the robot system be trained in an approved Motoman training course and become familiar with the proper operation of the system. This safety section addresses the following:

- Standard Conventions (Section 2.2)
- General Safeguarding Tips (Section 2.3)
- Mechanical Safety Devices (Section 2.4)
2.2 Standard Conventions

This manual includes the following alerts – in descending order of severity – that are essential to the safety of personnel and equipment. As you read this manual, pay close attention to these alerts to insure safety when installing, operating, programming, and maintaining this equipment.

**DANGER!**
Information appearing in a DANGER concerns the protection of personnel from the immediate and imminent hazards that, if not avoided, will result in immediate, serious personal injury or loss of life in addition to equipment damage.

**WARNING!**
Information appearing in a WARNING concerns the protection of personnel and equipment from potential hazards that can result in personal injury or loss of life in addition to equipment damage.

**CAUTION!**
Information appearing in a CAUTION concerns the protection of personnel and equipment, software, and data from hazards that can result in minor personal injury or equipment damage.

Note: Information appearing in a Note provides additional information which is helpful in understanding the item being explained.
2.3 General Safeguarding Tips

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. All personnel involved with the operation of the equipment must understand potential dangers of operation. General safeguarding tips are as follows:

- Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation of this robot, the operator's manuals, the system equipment, and options and accessories should be permitted to operate this robot system.
- Do not enter the robot cell while it is in automatic operation. Programmers must have the teach pendant when they enter the robot cell.
- Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
- The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06-1999, section 4.2.5, Sources of Energy, use lockout/tagout procedures during equipment maintenance. Refer also to Section 1910.147 (29CFR, Part 1910), Occupational Safety and Health Standards for General Industry (OSHA).

2.4 Mechanical Safety Devices

The safe operation of the robot, positioner, auxiliary equipment, and system is ultimately the user's responsibility. The conditions under which the equipment will be operated safely should be reviewed by the user. The user must be aware of the various national codes, ANSI/RIA R15.06-1999 safety standards, and other local codes that may pertain to the installation and use of industrial equipment. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. The following safety equipment is provided as standard:

- Safety fences and barriers
- Light curtains and/or safety mats
- Door interlocks
- Emergency stop palm buttons located on operator station, robot controller, and programming pendant

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.
2.5 Installation Safety

Safe installation is essential for protection of people and equipment. The following suggestions are intended to supplement, but not replace, existing federal, local, and state laws and regulations. Additional safety measures for personnel and equipment may be required depending on system installation, operation, and/or location. Installation tips are as follows:

- Be sure that only qualified personnel familiar with national codes, local codes, and ANSI/RIA R15.06-1999 safety standards are permitted to install the equipment.
- Identify the work envelope of each robot with floor markings, signs, and barriers.
- Position all controllers outside the robot work envelope.
- Whenever possible, install safety fences to protect against unauthorized entry into the work envelope.
- Eliminate areas where personnel might get trapped between a moving robot and other equipment (pinch points).
- Provide sufficient room inside the workcell to permit safe teaching and maintenance procedures.

2.6 Programming, Operation, and Maintenance Safety

All operators, programmers, plant and tooling engineers, maintenance personnel, supervisors, and anyone working near the robot must become familiar with the operation of this equipment. Improper operation can result in personal injury and/or damage to the equipment. Only trained personnel familiar with the operation, manuals, electrical design, and equipment interconnections of this robot should be permitted to program, operate, and maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- Inspect the robot and work envelope to be sure no potentially hazardous conditions exist. Be sure the area is clean and free of water, oil, debris, etc.
- Be sure that all safeguards are in place. Check all safety equipment for proper operation. Repair or replace any non-functioning safety equipment immediately.
- Do not enter the robot cell while it is in automatic operation. Be sure that only the person holding the programming pendant enters the workcell.
- Check the E-STOP button on the programming pendant for proper operation before programming. The robot must be placed in Emergency Stop (E-STOP) mode whenever it is not in use.
- Back up all programs and jobs onto suitable media before program changes are made. To avoid loss of information, programs, or jobs, a backup must always be made before any service procedures are done and before any changes are made to options, accessories, or equipment.
• Any modifications to PART 1, System Section, of the robot controller concurrent I/O program can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to PART 1, System Section. Making any changes without the written permission of Motoman will VOID YOUR WARRANTY!

• Some operations require standard passwords and some require special passwords. Special passwords are for Motoman use only. YOUR WARRANTY WILL BE VOID if you use these special passwords.

• The robot controller allows modifications of PART 2, User Section, of the concurrent I/O program and modifications to controller parameters for maximum robot performance. Great care must be taken when making these modifications. All modifications made to the controller will change the way the robot operates and can cause severe personal injury or death, as well as damage the robot and other parts of the system. Double-check all modifications under every mode of robot operation to ensure that you have not created hazards or dangerous situations.

• Check and test any new or modified program at low speed for at least one full cycle.

• This equipment has multiple sources of electrical supply. Electrical interconnections are made between the controller and other equipment. Disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

• Do not perform any maintenance procedures before reading and understanding the proper procedures in the appropriate manual.

• Use proper replacement parts.

• Improper connections can damage the robot. All connections must be made within the standard voltage and current ratings of the robot I/O (Inputs and Outputs).
Notes
MOTOMAN-EPH130R
INSTRUCTIONS
TYPE: YR-EPH130R-A00

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.
• This instruction manual explains operating instructions and maintenance procedures primarily for the MOTOMAN-EPH130R.

• General items related to safety are listed in Section 1: Safety of the NX100 Instructions. To ensure correct and safe operation, carefully read the NX100 instructions before reading this manual.

• 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 NX100.

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.

**NOTE**

To ensure safe and efficient operation at all times, be sure to follow all instructions, even if not designated as “CAUTION” and “WARNING”.
• Before operating the manipulator, check that servo power is turned OFF when the emergency stop buttons on the front door of the NX100 and programming pendant are pressed.

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.

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

Injury may result from unintentional or unexpected manipulator motion.

• Observe the following precautions when performing teaching operations within the working envelope of the manipulator:
  - View the manipulator from the front whenever possible.
  - Always follow the predetermined operating procedure.
  - 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 persons are present in the manipulator's work envelope and that you are in a safe location before:
  - Turning on the NX100 power.
  - Moving the manipulator with the programming pendant.
  - Running check operations.
  - Performing automatic operations.

Injury may result if anyone enters the working 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 the front door of the NX100 and the programming pendant.
Definition of Terms Used Often in This Manual

The MOTOMAN manipulator is the YASKAWA industrial robot product. The manipulator usually consists of the controller, the programming pendant, and manipulator 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>NX100 controller</td>
<td>NX100</td>
</tr>
<tr>
<td>NX100 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>

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 NX100 cabinet 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 the Warning Labels in the NX100 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.
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1 Product Confirmation

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Confirm that the manipulator and the NX100 have the same order number. Special care must be taken when more than one manipulator is to be installed.</td>
</tr>
<tr>
<td>If the numbers do not match, manipulators may not perform as expected and cause injury or damage.</td>
</tr>
</tbody>
</table>

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 is given separately):
• Manipulator
• NX100
• Programming pendant
• Manipulator cables (three cables, between manipulator and NX100)
1.2 Order Number Confirmation

Check that the order number of the manipulator corresponds to the NX100. The order number is located on a label as shown below.

---

**Fig. 1 Location of Order Number Labels**

(a) NX100 (Front View)

(b) Manipulator (Top View)

---

THE MANIPULATOR AND THE CONTROLLER
SHOULD HAVE SAME ORDER NUMBER.

ORDER NO. [Label (Enlarged View)]

Check that the manipulator and the NX100 have the same order number.
2 Transport

### 2.1 Transporting Method

#### 2.1.1 Using a Crane

As a rule, when removing the manipulator from the package and moving it, a crane should be used. Lift the manipulator with a four-leg bridle sling using the attached eyebolts. Be sure the manipulator is fixed with the shipping bolts and brackets before transport, and lift it in the posture as shown in "Fig. 2 Transporting Position".

---

**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. Failure to observe this caution may adversely affect the performance as the system consists of precision components.

**NOTE**

- Check that the eyebolts are securely fastened.
- The mass of the manipulator is approximately 1420 kg including the shipping bolts and brackets. 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.
- Make sure to mount the shipping bolts and brackets when transporting the manipulator.
- When transporting the manipulator with other transportation equipment, make sure to avoid external force on the arm or motor unit as in the case of transportation with a crane or forklift.
2.1 Transporting Method

Fig. 2 Transporting Position
2.2 Shipping Bolts and Brackets

The manipulator is equipped with shipping bolts and brackets as shown below at points A, B, and C indicated in "Fig. 2 Transporting Position".

- The bolts and brackets illustrated at A, B, and C are painted yellow.

<table>
<thead>
<tr>
<th>Installation Position</th>
<th>Bolt Type</th>
<th>Pcs</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Hexagon socket head cap screw M8 (length: 25 mm) (Tensile strength: 1200 N/mm²)</td>
<td>2</td>
</tr>
<tr>
<td>B</td>
<td>Hexagon head nut M12</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>Hexagon head nut M12</td>
<td>2</td>
</tr>
</tbody>
</table>

NOTE

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

<table>
<thead>
<tr>
<th><strong>WARNING</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• <strong>Install the safeguarding.</strong></td>
</tr>
<tr>
<td>Failure to observe this warning may result in injury or damage.</td>
</tr>
<tr>
<td>• <strong>Install the manipulator in a location where the manipulator's tool or the workpiece held by the manipulator will not reach the wall, safeguarding, or NX100 when the arm is fully extended.</strong></td>
</tr>
<tr>
<td>Failure to observe this warning may result in injury or damage.</td>
</tr>
<tr>
<td>• <strong>Do not start the manipulator or even turn on the power before it is firmly anchored.</strong></td>
</tr>
<tr>
<td>The manipulator may overturn and cause injury or damage.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>CAUTION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• <strong>Do not install or operate the manipulator which is damaged or lacks parts.</strong></td>
</tr>
<tr>
<td>Failure to observe this caution may cause injury or damage.</td>
</tr>
<tr>
<td>• <strong>Before turning on the power, check to be sure that the shipping bolts and brackets explained in &quot;2.2 Shipping Bolts and Brackets&quot; are removed.</strong></td>
</tr>
<tr>
<td>Failure to observe this caution may result in damage to the driving parts.</td>
</tr>
</tbody>
</table>
3.1 Safeguarding Installation

To insure safety, be sure to install safeguarding. They prevent unforeseen accidents with personnel and damage to equipment. The following term is quoted for your information and guidance.

**Responsibility for Safeguarding [ISO 10218]**

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 manipulator base mount strong enough to support the robot 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 1 Maximum Repulsion Forces of the Manipulator at Emergency Stop" and "Table 2 Endurance Torque in Operation". A base mount 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.

| Table 1   Maximum Repulsion Forces of the Manipulator at Emergency Stop |
| Max torque in horizontal rotation (S-axis moving direction) | 45000 N·m (4592 kgf·m) |
| Max torque in vertical rotation (L-,U-axis moving direction) | 77000 N·m (7858 kgf·m) |

| Table 2   Endurance Torque in Operation |
| Endurance torque in horizontal operation | 13500 N·m (1378 kgf·m) |
| Endurance torque in vertical operation | 23100 N·m (2358 kgf·m) |
3.2 Mounting Procedures for Manipulator Base

3.2.1 Mounting the Manipulator on the Baseplate

The baseplate should be rugged and durable to withstand maximum repulsion force of the manipulator and to ensure that the manipulator and fixture are in the correct relative position. The thickness of the baseplate is 50 mm or more and an M24 size or larger anchor bolt is recommended.

After anchoring the baseplate firmly on the floor, fix the manipulator base to the baseplate with the hexagon head screw M20 (8 screws, length of 80 mm or more is recommended) using mounting holes on the manipulator base. The manipulator base is tapped for eight mounting holes. Tighten the hexagon head bolts and anchor bolts securely so that they will not work loose during operation. For details, refer to "Fig. 3 Mounting the Manipulator on Baseplate".

![Fig. 3 Mounting the Manipulator on Baseplate](image-url)
3.3 Location

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

- Ambient temperature: 0 to 45°C.
- Humidity: 20 to 80%RH at constant temperature.
- Free from exposure to water, oil, or dust.
- Free from corrosive gases or liquids, or explosive gases.
- Free from excessive shock or vibration (vibration acceleration: 9.8 m/s² [1.0 G] or less).
- Free from large electrical noise (plasma).
- Flatness for installation is 0.5 mm or less.
4  Wiring

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 OFF the primary power supply, and put up a warning sign such as: “DO NOT TURN ON THE POWER.”**
  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.

• **Do not cover the cable with heat insulating material, and avoid multiple cabling when laying manipulator cables from the manipulator to the NX100.**
  Failure to observe this caution may result in burn due to undissipated heat of the cable.
4.1 Grounding

Follow local regulations for grounding line size. A line of 5.5 mm² or more is recommended. Refer to "Fig. 4 Grounding Method" to connect the ground line directly to the manipulator.

- Never use this line 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 Electric Equipment Technical Standards.

4.2 Manipulator Cable Connection

As shown in "Fig. 5 Manipulator Cables", three manipulator cables are provided: one encoder cable (1BC) and two power cables (2BC, 3BC).

Connect these cables to the connectors on the manipulator connector base and the NX100 by referring to "Fig. 6 (a) Manipulator Cable Connectors (Manipulator Side)" and "Fig. 6 (b) Manipulator Cable Connectors (NX100 Side)".

4.2.1 Connection to the Manipulator

Before connecting the manipulator cables to the manipulator, confirm the numbers on both the manipulator cables and the connectors on the manipulator connector base. Then, connect the cables in the order of 2BC, 3BC, 1BC. Insert the connectors adjusting the cable connector positions to the main key positions of the manipulator, and then set the lever until it clicks. Refer to "Fig. 6 (a) Manipulator Cable Connectors (Manipulator Side)".

5.5 mm² or more

Fig. 4 Grounding Method
4.2.2 Connection to the NX100

Before connecting the manipulator cables to the NX100, confirm the numbers on both the manipulator cables and the NX100 board connectors. Then, connect the cables in order of X21, X22, X11. Insert the connectors adjusting the cable connector positions to the main key positions of the NX100, and set the lever until it clicks. Refer to "Fig. 6 (b) Manipulator Cable Connectors (NX100 Side)".

**CAUTION**

- **Do not cover the cable with heat insulating material, and avoid multiple cabling.**

Failure to observe this caution may result in burn due to undissipated heat of the cable.
Fig. 6 (a) Manipulator Cable Connectors (Manipulator Side)

Fig. 6 (b) Manipulator Cable Connectors (NX100 Side)
# 5 Basic Specifications

## 5.1 Basic Specifications

### Table 3 Basic Specifications *

<table>
<thead>
<tr>
<th>Item</th>
<th>MOTOMAN-EPH130R</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Configuration</strong></td>
<td>Vertically Articulated</td>
</tr>
<tr>
<td><strong>Degree of Freedom</strong></td>
<td>6</td>
</tr>
<tr>
<td><strong>Payload</strong></td>
<td>130 kg</td>
</tr>
<tr>
<td><strong>Repeatability</strong></td>
<td>±0.2 mm</td>
</tr>
</tbody>
</table>

### Range of Motion

<table>
<thead>
<tr>
<th>Item</th>
<th>Range of Motion</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis (turning)</td>
<td>±180°</td>
</tr>
<tr>
<td>L-axis (lower arm)</td>
<td>+70°, -130°</td>
</tr>
<tr>
<td>U-axis (upper arm)</td>
<td>+95°, -70°</td>
</tr>
<tr>
<td>R-axis (wrist roll)</td>
<td>±360°</td>
</tr>
<tr>
<td>B-axis (wrist pitch/yaw)</td>
<td>±130°</td>
</tr>
<tr>
<td>T-axis (wrist twist)</td>
<td>±360°</td>
</tr>
</tbody>
</table>

### Maximum Speed

<table>
<thead>
<tr>
<th>Item</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-axis</td>
<td>1.92 rad/s, 110°/s</td>
</tr>
<tr>
<td>L-axis</td>
<td>1.92 rad/s, 110°/s</td>
</tr>
<tr>
<td>U-axis</td>
<td>1.92 rad/s, 110°/s</td>
</tr>
<tr>
<td>R-axis</td>
<td>3.14 rad/s, 215°/s</td>
</tr>
<tr>
<td>B-axis</td>
<td>3.14 rad/s, 180°/s</td>
</tr>
<tr>
<td>T-axis</td>
<td>5.23 rad/s, 390°/s</td>
</tr>
</tbody>
</table>

### Allowable Moment

<table>
<thead>
<tr>
<th>Item</th>
<th>Moment</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-axis</td>
<td>735 N•m (75 kgf•m)</td>
</tr>
<tr>
<td>B-axis</td>
<td>735 N•m (75 kgf•m)</td>
</tr>
<tr>
<td>T-axis</td>
<td>421 N•m (43 kgf•m)</td>
</tr>
</tbody>
</table>

### Ambient Conditions

<table>
<thead>
<tr>
<th>Item</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>0°C to 45°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>20 to 80% RH at constant temperature</td>
</tr>
<tr>
<td>Vibration Acceleration</td>
<td>9.8 m/s² (1.0 G) or less</td>
</tr>
<tr>
<td>Others</td>
<td>• Free from corrosive gas or liquid.</td>
</tr>
<tr>
<td></td>
<td>• Free from explosive gas.</td>
</tr>
<tr>
<td></td>
<td>• Free from water, oil, or dust.</td>
</tr>
<tr>
<td></td>
<td>• Free from excessive electrical noise (plasma).</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 *6.1 Allowable Wrist Load* for details on the allowable moment of inertia.
5.2 Part Names and Working Axes

Fig. 7 Part Names and Working Axes

5.3 Manipulator Base Dimensions

Fig. 8 Baseplate Dimensions (mm)
5.4 Dimensions and P-point Maximum Envelope

Fig. 9 Dimensions and P-Point Maximum Envelope
5.5 B-Axis Working Range

The working range of the B-Axis maintaining a constant angle to the center of U-axis is shown in "Fig. 10 B-Axis Working Range".
5.6 Alterable Operating Range

The operating range of the S-axis can be altered according to the operating conditions as shown in "Table 4 S-Axis Operating Range". If alteration is necessary, contact your Yaskawa representative in advance.

Table 4 S-Axis Operating Range

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-Axis Operating Range</td>
<td>±160° (standard)</td>
</tr>
<tr>
<td></td>
<td>±125°</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>
6.1 Allowable Wrist Load

6. Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

The allowable wrist load including the mass of the gripper is 130 kg. This section explains the allowable values and conditions.

1. As shown in "Table 5 Moment and Total Moment of Inertia" the moment of the R-, B-, and T-axes are restricted. Observe the condition in this table when applying load on the wrist.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Moment N•m (kgf•m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-axis</td>
<td>735 (75)</td>
</tr>
<tr>
<td>B-axis</td>
<td>735 (75)</td>
</tr>
<tr>
<td>T-axis</td>
<td>421 (43)</td>
</tr>
</tbody>
</table>

*: Gravitational unit

2. The allowable moment of inertia varies depending on the load torque, as shown in "Fig. 11 (a) R- and B-axes Allowable Moment of Inertia Diagram (Measured Value from the P-Point)" and "Fig. 11 (b) T-axis Allowable Moment of Inertia Diagram (Measured Value from the Rotation Center of the T-axis Flange Surface)". Use the manipulator to meet those conditions. For example, with MOTOMAN-UP130R, the allowable moment of inertia on the T-axis is 15 kg•m² when the static load is 421 N•m, and 38 kg•m² when 0 N•m.
6.2 Wrist Flange

It is recommended that the attachment be mounted inside the fitting to identify the alignment marks. Fitting depth of inside and outside fittings must be 8 mm or less.

![Diagram of Wrist Flange](image)

Fig. 12 Wrist Flange

**NOTE**

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

7.1 Peripheral Equipment Mounts

The manipulator is equipped with peripheral equipment mounts and tapped holes on its upper arm for easier installation of the user's system application as shown in "Fig. 13 Tapped Holes for Peripheral Equipment Mounts". Make efficient use of these mounts following the conditions in "Table 6 Constraint for Attaching".

Fig. 13 Tapped Holes for Peripheral Equipment Mounts

<table>
<thead>
<tr>
<th>Section</th>
<th>Application</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Cabling</td>
<td>Up to 130 kg for attaching load including wrist load mass.</td>
</tr>
<tr>
<td>B</td>
<td>Cabling, equipment installation including valves.</td>
<td>Up to 10 kg, 48 N•m (4.9 kgf•m) max. for increased moment on upper arm</td>
</tr>
</tbody>
</table>

Table 6 Constraint for Attaching
7.2 Internal User I/O Wiring Harness and Air Line

1. An internal user I/O wiring harness (0.75 mm² x 23 wires) and two air lines are built into the manipulator for the drives of the peripheral devices mounted on the upper arm as described in "Fig. 14 Internal User I/O Wiring Harness and Air Line". The connector pins and the terminals are assigned as shown in "Fig. 14 Internal User I/O Wiring Harness and Air Line". Wiring must be performed by user.

   • The allowable current for wires: 6.6 A or less for each wire.
     (The total current value for pins 1 to 23 must be 60 A or less.)
   • The maximum pressure for the air lines: 490 kPa (5 kgf/cm²) or less for each line.

2. The same pin number (1-23) of two connectors is connected with a 0.75 mm² wire.
8 Electrical Equipment Specifications

8.1 Internal Connections

Highly reliable connectors are equipped on each connection part of the manipulator to enable easy removal and installation for maintenance and inspection. For the numbers, types, and locations of the connectors, see "Fig. 15 Location and Numbers of Connectors" and "Table 7 List of Connector Types". As to the internal connections between the manipulator and the NX100, see the connection diagrams in the following pages.

![Diagram of internal connections]

Fig. 15 Location and Numbers of Connectors

<table>
<thead>
<tr>
<th>Name</th>
<th>Type of Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector for internal user I/O wiring harness on connector base</td>
<td>JL05-2A24-28PC (JL05-6A24-28S: Optional)</td>
</tr>
<tr>
<td>Connector for internal user I/O wiring harness on U-arm</td>
<td>JL05-2A24-28SC (JL05-6A24-28P: Optional)</td>
</tr>
</tbody>
</table>
Fig. 16 (a) Internal Connection Diagram
Fig. 16 (b) Internal Connection Diagram
9  Maintenance and Inspection

<table>
<thead>
<tr>
<th>WARNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Before maintenance or inspection, be sure to turn OFF the main power supply, and put up a warning sign. (ex. DO NOT TURN ON THE POWER.)</td>
</tr>
</tbody>
</table>

Failure to observe this warning may result in electric shock or injury.

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Maintenance and inspection must be performed by specified personnel.</td>
</tr>
<tr>
<td>• For disassembly or repair, contact your Yaskawa representative.</td>
</tr>
<tr>
<td>• Do not remove the motor, and do not release the brake.</td>
</tr>
</tbody>
</table>

Failure to observe this caution may result in injury from unexpected turning of the manipulator's arm.

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The battery pack must be connected before removing encoder connector when maintenance and inspection.</td>
</tr>
</tbody>
</table>

Failure to observe this caution may result in the loss of home position data.

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 8  Inspection Items". Conduct periodical inspections according to the inspection schedule in this table.

In the table, the inspection items are categorized by three types of operations: operations to be performed by personnel authorized by the user, operations to be performed by personnel being trained, and operations to be performed by service company personnel. Only specified personnel are to do the inspection work.
9.1 Inspection Schedule

- The inspection interval depends on the total servo operation time.
- For axes which are used very frequently (in handling applications, etc.), it is recommended that inspections be conducted at shorter intervals. Contact your Yaskawa representative.

### Table 8 Inspection Items

<table>
<thead>
<tr>
<th>Items</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alignment mark</td>
<td></td>
<td>Visual</td>
<td>Check alignment mark accordance and damage at the home position.</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>②</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External leads</td>
<td></td>
<td>Visual</td>
<td>Check for damage and deterioration of leads.</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>③</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manipulator (whole exterior)</td>
<td></td>
<td>Visual</td>
<td>Clean the work area if dust or spatter is present. Check for damage and outside checks.</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>④</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L, U-axis motors</td>
<td></td>
<td>Visual</td>
<td>Check for grease leakage.</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>⑤</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manipulator base mounting screws</td>
<td></td>
<td>Spanner, Wrench</td>
<td>Tighten loose screws. Replace if necessary.</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>⑥</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cover mounting screws</td>
<td></td>
<td>Screwdriver, Wrench</td>
<td>Tighten loose screws. Replace if necessary.</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>⑦</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S, L, U-axis motor connectors</td>
<td></td>
<td>Manual</td>
<td>Check for loose connectors and tighten if necessary.</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>⑧</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connector base</td>
<td></td>
<td>Manual</td>
<td>Check for loose connectors.</td>
<td>○ ○ ○</td>
</tr>
<tr>
<td>⑨</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R, B, T-axis timing belts</td>
<td></td>
<td>Manual</td>
<td>Check for ball tension an wear.</td>
<td>○ ○</td>
</tr>
<tr>
<td>⑩</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wire harness in manipulator (for S, L, U-axes and for R, B, T-axes)</td>
<td></td>
<td>Visual, Multimeter</td>
<td>Check for conduction between the main connector of connector base and intermediate connector by manually shaking the wires. Check for wear of protective spring.</td>
<td>○ ○</td>
</tr>
<tr>
<td>⑪</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L, U-axes arm / link parts</td>
<td></td>
<td>Visual, Manual</td>
<td>Check for a backlash of the bearing by moving the LU-axes back and forth, and up and down. Supply grease.</td>
<td>○ ○</td>
</tr>
<tr>
<td>Items</td>
<td>Schedule</td>
<td>Method</td>
<td>Operation</td>
<td>Inspection Charge</td>
</tr>
<tr>
<td>-------</td>
<td>----------</td>
<td>--------</td>
<td>-----------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Battery pack in manipulator</td>
<td></td>
<td></td>
<td>Replace the battery pack when the battery alarm occurs or the manipulator has been driven for 36000H.</td>
<td></td>
</tr>
<tr>
<td>S-axis speed reducer</td>
<td>Check for malfunction. (Replace if necessary.)</td>
<td>Exchange grease. (Initial exchange: at 3000H inspection.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(6000H cycle after the initial exchange.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L-, U-axis speed reducers</td>
<td>Check for malfunction. (Replace if necessary.)</td>
<td>Exchange grease. (Initial exchange: at 3000H inspection.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(6000H cycle after the initial exchange.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-axis speed reducer</td>
<td>Check for malfunction. (Replace if necessary.)</td>
<td>Exchange grease.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(6000H cycle after the initial exchange.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B, T-axis speed reducers, BT-axis gears</td>
<td>Check for malfunction. (Replace if necessary.)</td>
<td>Exchange grease. (Initial exchange: at 3000H inspection.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(6000H cycle after the initial exchange.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-axis cross roller bearing</td>
<td>Check for malfunction. (Replace if necessary.)</td>
<td>Supply grease. (Initial exchange: at 3000H inspection.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(12000H cycle after the initial exchange.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overhaul</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9.1 Inspection Schedule

Table 8  Inspection Items

<table>
<thead>
<tr>
<th>Items</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery pack in manipulator</td>
<td></td>
<td></td>
<td>Replace the battery pack when the battery alarm occurs or the manipulator has been driven for 36000H.</td>
<td></td>
</tr>
<tr>
<td>S-axis speed reducer</td>
<td>Check for malfunction. (Replace if necessary.)</td>
<td>Exchange grease. (Initial exchange: at 3000H inspection.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(6000H cycle after the initial exchange.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L-, U-axis speed reducers</td>
<td>Check for malfunction. (Replace if necessary.)</td>
<td>Exchange grease. (Initial exchange: at 3000H inspection.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(6000H cycle after the initial exchange.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-axis speed reducer</td>
<td>Check for malfunction. (Replace if necessary.)</td>
<td>Exchange grease.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(6000H cycle after the initial exchange.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B, T-axis speed reducers, BT-axis gears</td>
<td>Check for malfunction. (Replace if necessary.)</td>
<td>Exchange grease. (Initial exchange: at 3000H inspection.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(6000H cycle after the initial exchange.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-axis cross roller bearing</td>
<td>Check for malfunction. (Replace if necessary.)</td>
<td>Supply grease. (Initial exchange: at 3000H inspection.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(12000H cycle after the initial exchange.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
When checking for conduction with a multimeter, remove connectors on encoder side for each axis from the motor to secure the home position data. See "9.3.9 Notes for Maintenance".

The internal wiring harness (for SLURBT-axes) is to be replaced at 24000H inspection.

For the grease, refer to "Table 9 Inspection Parts and Grease Used".

Inspection numbers correspond to the numbers in "Fig. 17 Dimensions and P-Point Maximum Envelope".

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.

The initial grease exchange should be performed at 3000 H inspection.

<table>
<thead>
<tr>
<th>No.</th>
<th>Grease Used</th>
<th>Inspected Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>13, 14, 15, 16</td>
<td>VIGO Grease RE No. 0</td>
<td>Speed reducers for all axes, B-, T-axis gears</td>
</tr>
<tr>
<td>11, 17</td>
<td>Alvania EP Grease 2</td>
<td>U-Axis: cross roller bearing, Link part: tapered roller bearings</td>
</tr>
</tbody>
</table>

The numbers in the above table correspond to the numbers in "Table 8 Inspection Items".
Note:
The manipulator is in the home position.

Fig. 17 Dimensions and P-Point Maximum Envelope
9.2 Notes on Maintenance Procedures

9.2.1 Battery Pack Replacement

Two battery packs are installed in the position described in "Fig. 18 Battery Location". If a battery alarm shows up on the NX100, replace the battery according to the following procedure:

![Fig. 18 Battery Location](image1)

![Fig. 19 Battery Connection](image2)
1. Turn OFF the NX100 main power supply.
2. Remove the battery pack mounting screws on the connector base, and pull the battery pack out to replace it with the new battery pack.
3. Remove the battery pack from the battery holder.
4. Connect the new battery pack to the unoccupied connector on the board.
5. 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.

6. Mount the new battery pack to the battery holder.
7. Reinstall the battery pack into the connector base with mounting screws.
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 instructions may result in damage to a motor and a speed reducer.

**Note**: If grease is added with a plug on, the grease will go inside the motor or an oil seal of the speed reducer will come off, resulting in damage to the motor and speed reducer. Make sure to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to a 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 a hose on the grease inlet with grease to keep air from entering into the speed reducer.

9.3.1 Grease Exchange for the S-Axis Speed Reducer and Gear

![Diagram of S-Axis Speed Reducer and Gear]

Fig. 20 S-Axis Speed Reducer and Gear
Grease Exchange (Refer to "Fig. 20 S-Axis Speed Reducer and Gear").

1. Remove the plug from the So grease exhaust port.

   **NOTE**
   - If grease is added with the plug on, the grease will go 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 a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

2. Inject the grease into the Si grease inlet using a grease gun.

   | Grease type: VIGO Grease RE No. 0 |
   | Amount of grease: approx. 3000 cc |
   | Air supply pressure of grease pump: 0.3 MPa or less |
   | Grease injection rate: 8 g/s or less |

3. The grease exchange is completed when new grease appears in the So grease exhaust port. The new grease can be distinguished from the old grease by its color.

4. Before putting the plug back on the So grease exhaust port, move the S-axis for a few minutes to discharge the excess grease.

5. Wipe the discharged grease with a cloth and reinstall the plug on the So grease exhaust port. Tighten the plug with a tightening torque of 23 N·m (2.34 kgf·m). (Apply Three Bond 1206C on the thread part of the plug.)
9.3.2 Grease Exchange for the L-Axis Speed Reducer

- Grease Exchange (Refer to "Fig. 21  L-Axis Speed Reducer").

1. Make the L-arm posture as shown in "Fig. 21  L-Axis Speed Reducer".
2. Remove the plug from the Lo grease exhaust port.
3. Inject the grease into the Li grease inlet using a grease gun.
4. The grease exchange is completed when new grease appears in the Lo grease exhaust port. The new grease can be distinguished from the old grease by its color.

**NOTE**
- If grease is added with the plug on, the grease will go 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 a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.

Grease type: VIGO Grease RE No. 0
Amount of grease: approx. 2000 cc
Air supply pressure of grease pump: 0.3 MPa or less
Grease injection rate: 8 g/s or less
5. Before putting the plug back on the Lo grease exhaust port, move the L-axis for a few minutes to discharge the excess grease.

6. Wipe the discharged grease with a cloth and reinstall the plug on the Lo grease exhaust port. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C on the thread part of the plug.)

9.3.3 Grease Exchange for the U-Axis Speed Reducer

- Grease Exchange (Refer to "Fig. 22 U-Axis Speed Reducer").
  1. Make the L-arm posture as shown in "Fig. 22 U-Axis Speed Reducer".
  2. Remove the plug from the Uo grease exhaust port.

**NOTE**
- If grease is added with the plug on, the grease will go inside the motor and may cause damage. Make sure to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to a grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.
3. Inject the grease into the Ui grease inlet using a grease gun.

| Grease type: VIGO Grease RE No. 0 |
| Amount of grease: approx. 800 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 Uo grease exhaust port. The new grease can be distinguished from the old grease by its color.

5. Before putting the plug back on the Uo grease exhaust port, move the U-axis for a few minutes to discharge the excess grease.

6. Wipe the discharged grease with a cloth and reinstall the plug on the Uo grease exhaust port. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C on the thread part of the plug.)

9.3.4 Grease Exchange for the R-Axis Speed Reducer

1. Remove the plug from the Ro grease exhaust port.

2. Inject the grease into the Ri grease inlet using a grease gun.

| Grease type: VIGO Grease RE No. 0 |
| Amount of grease: approx. 140 cc |
| Air supply pressure of grease pump: 0.3 MPa or less |
| Grease injection rate: 8 g/s or less |
3. The grease exchange is completed when new grease appears in the Ro grease exhaust port. The new grease can be distinguished from the old grease by its color.
4. Before putting the plug back on the Ro grease exhaust port, move the R-axis for a few minutes to discharge the excess grease.
5. Wipe the discharged grease with a cloth and reinstall the plug on the Ro grease exhaust port. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C on the thread part of the plug.)

9.3.5 Grease Exchange for the B-Axis Speed Reducer and Gear

![Fig. 24 B-Axis Speed Reducer and Gear](image)

- **Grease Exchange (Refer to "Fig. 24 B-Axis Speed Reducer and Gear").**

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

2. Inject the grease into the Bi grease inlet using a grease gun.

<table>
<thead>
<tr>
<th>Grease type: VIGO Grease RE No. 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of grease: approx. 900 cc</td>
</tr>
<tr>
<td>Air supply pressure of grease pump: 0.3 MPa or less</td>
</tr>
<tr>
<td>Grease injection rate: 8 g/s or less</td>
</tr>
</tbody>
</table>

**NOTE**
3. The grease exchange is completed when new grease appears in the Bo grease exhaust port. The new grease can be distinguished from the old grease by its color.
4. Before putting the plug back on the Bo grease exhaust port, move the B-axis for a few minutes to discharge the excess grease.
5. Wipe the discharged grease with a cloth and reinstall the plug on the Bo grease exhaust port. Tighten the plug with a tightening torque of 5 N·m (0.51 kgf·m). (Apply Three Bond 1206C on the thread part of the plug.)

9.3.6 Grease Exchange for the T-Axis Speed Reducer and Gear

1. Remove the hexagon socket set screw from the To grease exhaust port.

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

2. Inject the grease into the Ti grease inlet using a grease gun.

   Grease type: VIGO Grease RE No. 0
   Amount of grease: approx. 900 cc
   Air supply pressure of grease pump: 0.3 MPa or less
   Supply flow rate of grease: 8 g/s or less
3. The grease exchange is completed when new grease appears in the To grease exhaust port. The new grease can be distinguished from the old grease by its color.
4. Before putting the plug back on the To grease exhaust port, move the T-axis for a few minutes to discharge the excess grease.
5. Wipe the discharged grease with a cloth and reinstall the hexagon socket set screw on the To grease exhaust port. (Apply Three Bond 1206C on the thread part of the plug.)

### 9.3.7 Grease Replenishment for U-Axis Cross Roller Bearing

1. Remove the hexagon socket head cap screws from the exhaust port.
2. Remove the hexagon socket head cap screws from the Uc grease inlet.
3. Install a grease zerk A-MT6 on the Uc grease inlet.
4. Inject the grease into the Uc grease inlets using a grease gun.

**Grease Replenishment** (Refer to "Fig. 26 U-Axis Cross Roller Bearing").

- Grease type: Alvania EP grease 2
- Amount of grease: 19 cc

**NOTE**

The exhaust port is used for air flow; the grease is not exhausted from the exhaust port.
5. Remove the grease zerk A-MT6 on the Uc grease inlet, and reinstall the hexagon socket head cap screw.
   (Apply Three Bond 1206C on the thread part of the screw when installing the screw.)

9.3.8 Grease Replenishment for Tapered Roller Bearing in the Link part

- Grease Replenishment (Refer to "Fig. 27  Tapered Roller Bearing in the Link Parts").
  1. Remove the hexagon socket set screws (6 places) from the exhaust ports of each link.
     (Refer to "Fig. 27  Tapered Roller Bearing in the Link Parts")
  2. Inject grease into each Hc grease inlet (6 places).

- Exhaust port: Hexagon socket set screw M6 (length: 8mm) (2 set screw)
- Tapered roller bearing for link (2 bearings)
- Hc: Grease inlet for link
- Grease zerk A-PT1/8 (2 grease zerks)

**Grease type:** Alvania EP grease 2
Amount of grease: 6 cc
(12 cc for 1st supply)

**NOTE** The exhaust port is used for air flow. Do not inject excessive grease into the grease inlet.

3. Reinstall the hexagon socket set screws on the exhaust ports.
   (Apply Three Bond 1206C on the thread part of the screws when installing the screws.)
9.3.9 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. 28 Battery Pack Connection for Motor".

Battery Pack Connection for Motors

A motor is equipped with connectors (crimped contact-pins; each marked with "BAT", "OBT") for battery backup. Connect the battery pack and connectors with the same marks respectively by following the procedure below.

1. Remove the cap attached to the battery backup connector of the motor.
2. Connect the battery pack (HW9470932-A) with the battery backup connector. With the battery pack connected to the battery backup connectors, disconnect the encoder connector and perform the maintenance work.
3. After the maintenance work, verify that all connectors are connected, then disconnect the battery pack from the battery backup connector.
4. Install the cap to the battery backup connector.

NOTE: Do not remove the battery pack in the connector base.

Fig. 28 Battery Pack Connection for Motor
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-EPH130R. Product performance cannot be guaranteed in case of using the spare parts other than the recommended parts listed below.

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

### Table 10  Spare Parts for the MOTOMAN-EPH130R

<table>
<thead>
<tr>
<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty per Unit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 1</td>
<td>HW0470360-A</td>
<td>Battery Pack</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>A 2</td>
<td>HW0470932-A</td>
<td>Battery Pack</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>A 3</td>
<td></td>
<td>Liquid Gasket</td>
<td>Three Bond 1206C</td>
<td>ThreeBond Co., Ltd.</td>
<td>1</td>
<td>1</td>
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<tr>
<td>A 4</td>
<td></td>
<td>Grease</td>
<td>VIGO Grease RE No. 0</td>
<td>Yaskawa Electric Corporation</td>
<td>16 kg -</td>
<td>For all axis-speed reducers and wrist unit</td>
</tr>
<tr>
<td>A 5</td>
<td></td>
<td>Grease</td>
<td>Alvania EP Grease 2</td>
<td>Showa Shell Sekiyu K.K.</td>
<td>16 kg -</td>
<td>For cross roller bearing and tapered roller bearings</td>
</tr>
<tr>
<td>B 6</td>
<td>20058M896</td>
<td>R-axis Timing Belt</td>
<td>Mitsubishi Belt- ing Ltd.</td>
<td>1</td>
<td>1</td>
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<tr>
<td>B 7</td>
<td>20058M800</td>
<td>B-axis Timing Belt</td>
<td>Mitsubishi Belt- ing Ltd.</td>
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<tr>
<td>B 8</td>
<td>20058M656</td>
<td>T-axis Timing Belt</td>
<td>Mitsubishi Belt- ing Ltd.</td>
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<tr>
<td>B 9</td>
<td>HW0384952-A</td>
<td>S-axis Speed Reducer</td>
<td>Yaskawa Electric Corporation</td>
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<tr>
<td>B 10</td>
<td>HW0172031-C</td>
<td>Gear Unit</td>
<td>Yaskawa Electric Corporation</td>
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</table>

**NOTE** To replace parts in Rank B or Rank C, contact your Yaskawa representative.
<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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<tbody>
<tr>
<td>B</td>
<td>11</td>
<td>L-axis Speed Reducer</td>
<td>HW0384781-A</td>
<td>Yaskawa Electric Corporation</td>
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<td>B</td>
<td>12</td>
<td>L-axis Input Gear</td>
<td>HW0409603-1</td>
<td>Yaskawa Electric Corporation</td>
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<td>B</td>
<td>13</td>
<td>U-axis Speed Reducer</td>
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<td>B</td>
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<td>B</td>
<td>17</td>
<td>T-axis Speed Reducer</td>
<td>HW9381400-A</td>
<td>Yaskawa Electric Corporation</td>
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<tr>
<td>B</td>
<td>18</td>
<td>U-axis cross roller bearing</td>
<td>HW9482144-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
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<tr>
<td>C</td>
<td>19</td>
<td>Wrist Unit</td>
<td>HW9171481-A</td>
<td>Yaskawa Electric Corporation</td>
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<td>C</td>
<td>20</td>
<td>AC Servo Motors for S-, L-axes</td>
<td>HW9383523-A</td>
<td>SGMRS-44A2A-YR2*</td>
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<td>2</td>
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<tr>
<td>C</td>
<td>21</td>
<td>AC Servo Motors for U-axis</td>
<td>HW9382157-A</td>
<td>SGMRS-37A2A-YR1*</td>
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<tr>
<td>C</td>
<td>23</td>
<td>Wire Harness in Manipulator</td>
<td>HW90172611-A</td>
<td>Yaskawa Electric Corporation</td>
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<td></td>
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</table>