MOTOMAN-ECR3J
INSTRUCTIONS
TYPE: YR-ECR3J-A00

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

MOTOMAN INSTRUCTIONS
MOTOMAN-ECR3J INSTRUCTIONS
NXC100 INSTRUCTIONS
NX100 OPERATOR’S MANUAL
NX100 MAINTENANCE MANUAL

The NX100 operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.

Part Number: 156090-1CD
Revision: 0
• This instruction manual is intended to explain operating instructions and maintenance procedures primarily for the MOTOMAN-HP3J.

• General items related to safety are listed in the Section 1: Safety of the NXC100 Instructions. To ensure correct and safe operation, carefully read the NXC100 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 NXC100.

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”.

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.
• Before operating the manipulator, check that servo power is turned OFF when the emergency stop buttons on the front face of the NXC100 and on the right side of the 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.

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.

Release of Emergency Stop
WARNING

- Observe the following precautions when performing teaching operations:
  - Always follow the predetermined operating procedure.
  - Ensure that you have a safe place to retreat in case of emergency.

Improper operation or unintended manipulator motion may result in injury.

- Confirm that no persons are present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  - Turning ON the robot system power.
  - 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 button is located on the right side of the programming pendant and on the front face of the NXC100.
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 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>NXC100 Controller</td>
<td>NXC100</td>
</tr>
<tr>
<td>NXC100 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 movement of the manipulator and servo track.
  - Check for damage to insulation and sheathing of external wires.

• Read and understand the Explanation of Warning Labels before operating the robot system.

• For safety, operate under the proper lighting.
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.

**WARNING**
Do not enter robot work area.

**WARNING**
Moving parts may cause injury.

**WARNING**
Do not enter robot work area.
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       2.1.1 Using a Crane ................................... 2-2
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10 Recommended Spare Parts
1 Product Confirmation

CAUTION

- Confirm that the manipulator and the NXC100 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.

1.1 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
- NXC100
- Programming pendant
- Manipulator cable (2 cables, between the manipulator and NXC100)
1.2 Order Number Confirmation

Check that the order number of the manipulator corresponds to the NXC100. The order number is located on a label as shown below.

---

**THE MANIPULATOR AND THE CONTROLLER SHOULD HAVE SAME ORDER NUMBER.**

<table>
<thead>
<tr>
<th>ORDER NO.</th>
<th>Check that the manipulator and the NXC100 have the same order number.</th>
</tr>
</thead>
</table>

---

(a) NXC100 (Top View)  
(b) Manipulator (Top View)

---

Fig. 1 Location of Order Number Labels
# 2 Transporting

## CAUTION

- **Sling 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 transportation.**
  
  The system consists of precision components, so failure to observe this caution may adversely affect performance.

## NOTE

- Check that the eyebolts are securely fastened before transporting the manipulator.
- The mass of the manipulator is approximately 28 kg. Use a wire rope strong enough to withstand the mass.
- Attached eyebolts are designed to support the manipulator mass. Do not use them for anything other than transporting the manipulator.
- Be sure to mount the shipping bolts and brackets before transporting the manipulator.
- With any transportation equipment, make sure to avoid external force on the arm or motor unit when transporting the manipulator.
2.1 Transporting Method

2.1.1 Using a Crane

As a rule, when uncrating the manipulator and moving it, a crane should be used. The manipulator should be lifted using a two-leg bridle sling threaded through attached eyebolts. Be sure to lift the manipulator in the posture as shown in "Fig. 2 Transporting Position".

![Fig. 2 Transporting Position]
2.1.2 Using a Forklift

When using a forklift, the manipulator should be fixed on a pallet as shown in "Fig. 3 Using a Forklift". Insert claws under the pallet and lift it. The pallet must be strong enough to support the manipulator. Transportation of the manipulator must be performed slowly in order to avoid overturning or slippage.

Fig. 3 Using a Forklift
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 manipulator's tool or the workpiece held by the manipulator will not reach the wall, safeguarding, or NXC100 when the arm is fully extended.**
  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.

- **When mounting the manipulator on the ceiling or wall, the base section must have sufficient strength and rigidity to support the mass of the manipulator. Also, it is necessary to consider countermeasures to prevent the manipulator from falling.**
  Failure to observe these warning may result in 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 eyebolts explained in "2.1.1 Using a Crane" are removed.**
  Failure to observe this caution may result in damage to the driving parts.
3.1 Installation of Safeguarding

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

Responsibility for Safeguarding (ISO10218)
The user of a manipulator or robot system shall ensure that the safeguarding is 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. Refer to "Table. 1 Maximum Repulsion Forces of the Manipulator" and "Table. 2 Endurance Torque in Operation" to construct a solid foundation with the appropriate thickness to withstand maximum repulsion forces of the manipulator.

A manipulator base 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 described in "3.2.1 When the Manipulator and Mounting Fixture are Installed on a Baseplate" or "3.2.2 When the Manipulator is Mounted Directly on the Floor without the Mounting Fixture".

<table>
<thead>
<tr>
<th>Table. 1 Maximum Repulsion Forces of the Manipulator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal rotating maximum torque</td>
</tr>
<tr>
<td>(S-axis moving direction) 294 N·m (30 kgf·m)</td>
</tr>
<tr>
<td>Vertical rotating maximum torque</td>
</tr>
<tr>
<td>(LU-axes moving direction) 627 N·m (64 kgf·m)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table. 2 Endurance Torque in Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endurance torque in horizontal operation</td>
</tr>
<tr>
<td>(S-axis moving direction) 59 N·m (6 kgf·m)</td>
</tr>
<tr>
<td>Endurance torque in vertical operation</td>
</tr>
<tr>
<td>(LU-axes moving direction) 194 N·m (20 kgf·m)</td>
</tr>
</tbody>
</table>
3.2.1 When the Manipulator and Mounting Fixture are Installed on a Baseplate

First, 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 in 25 mm in thickness, and anchor bolts in M8 or larger size. Next, fix the manipulator base to the baseplate. The manipulator base is tapped for four mounting holes; securely fix the manipulator base to the baseplate with four hexagon socket head screws M8 (grade: A2-70) (30 mm long is recommended) and tighten the screw to a tightening torque of 20.1 N-m (2.05 kgf-m). Tighten the hexagon socket head cap screws and anchor bolts firmly so that they will not work loose during the operation. See "Fig. 4 Manipulator Installation Example" for the method.
3.2 Mounting Procedures for Manipulator Base

3.2.2 When the Manipulator is Mounted Directly on the Floor without the Mounting Fixture

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 shown in "Table. 1 Maximum Repulsion Forces of the Manipulator". When there is a concrete thickness (floor) of 150 mm or more, the base of the manipulator can be fixed directly to the floor with M8 anchor bolts. (The concrete breaking-stress should be 250 kg/cm² or more.) Before mounting the manipulator, check that the floor is level and that all cracks, etc. are repaired. Any thickness less than 150 mm is insufficient for mounting, even if the floor is concrete.

![Diagram](image)

**Note:** In case of interference with the spot-faced hole of the base, secure the bolt by placing a washer WSSS14-8-5 (by MISUMI Corp.) or the like.
3.3 Installation Method

The MOTOMAN-ECR3J is a floor-mounted type.

3.4 Location

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

- Ambient temperature: +20°C to +35°C (ambient temperature)
- Humidity: 20 to 80%RH (no moisture, at constant temperature)
- Free from water
- Free from corrosive gases or liquids, or explosive gases
- Free from excessive impact or vibration (vibration acceleration: 4.9 m/s² [0.5 G] or less)
- Free from large electrical noise (plasma)
- The 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 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.

- **Do not cover the cable or allow it to tangle. Keep the cable as straight as possible.**
  
  Failure to observe this caution may result in preventing heat of the cable from being discharged.
4.1 Grounding

Follow the local regulations and electrical installation standards for grounding. The recommended grounding wire size is 5.5 mm² at minimum.

For grounding, connect the ground wire directly to the manipulator as shown in "Fig. 6 Grounding Method."

**NOTE**
- Do not use this line in common 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.

![Fig. 6 Grounding Method](image-url)
4.2 Manipulator Cable Connection

There are two manipulator cables; an encoder cable for (1BC) and power cable (2BC). (See "Fig. 7 Manipulator Cables (1BC and 2BC).") Connect these cables respectively to the connectors at the manipulator connector base and the NXC100. Refer to "Fig. 8 (a) Manipulator Cable Connectors (Manipulator Side)" and "Fig. 8 (b) Manipulator Cable Connectors (NXC100 Side)".

4.2.1 Connection to the Manipulator

Before connecting the manipulator cables to the manipulator, verify the numbers on both the cables and the connectors of manipulator connector base. Connect 2BC first, and then 1BC. Insert the cables and lower each lever until it clicks.

4.2.2 Connection to the NXC100

Before connecting the manipulator cables to the NXC100, verify the numbers on both the cables and the NXC100 connectors. Connect 2BC first to the connector X21 of NXC100, then 1BC to the connector X11 of NXC100. When connecting, insert the connector until it clicks.

CAUTION

* Do not cover the cable with heat insulating material, and avoid multiple cabling.
4.2 Manipulator Cable Connection

Fig. 7 Manipulator Cables (1BC and 2BC)
4.2 Manipulator Cable Connection

Fig. 8 (a) Manipulator Cable Connectors (Manipulator Side)

Fig. 8 (b) Manipulator Cable Connectors (NXC100 Side)
5 Basic Specifications

5.1 Basic Specifications

Table 3 Basic Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration</td>
<td>Vertically Articulated</td>
</tr>
<tr>
<td>Degree of Freedom</td>
<td>6</td>
</tr>
<tr>
<td>Payload</td>
<td>3 kg</td>
</tr>
<tr>
<td>Repeatability(^{2})</td>
<td>±0.03 mm</td>
</tr>
<tr>
<td>Range of Motion(^{1})</td>
<td></td>
</tr>
<tr>
<td>S-axis (turning)</td>
<td>±160°</td>
</tr>
<tr>
<td>L-axis (lower arm)</td>
<td>+90°, -85°</td>
</tr>
<tr>
<td>U-axis (upper arm)</td>
<td>+260°, -105°</td>
</tr>
<tr>
<td>R-axis (wrist roll)</td>
<td>±170°</td>
</tr>
<tr>
<td>B-axis (wrist pitch/yaw)</td>
<td>±120°</td>
</tr>
<tr>
<td>T-axis (wrist twist)</td>
<td>±360°</td>
</tr>
<tr>
<td>Maximum Speed(^{2})</td>
<td></td>
</tr>
<tr>
<td>S-axis</td>
<td>3.49 rad/s, 200 °/s</td>
</tr>
<tr>
<td>L-axis</td>
<td>2.23 rad/s, 128 °/s</td>
</tr>
<tr>
<td>U-axis</td>
<td>3.32 rad/s, 190 °/s</td>
</tr>
<tr>
<td>R-axis</td>
<td>3.67 rad/s, 210 °/s</td>
</tr>
<tr>
<td>B-axis</td>
<td>3.67 rad/s, 210 °/s</td>
</tr>
<tr>
<td>T-axis</td>
<td>5.93 rad/s, 340 °/s</td>
</tr>
<tr>
<td>Allowable Moment(^{3})</td>
<td></td>
</tr>
<tr>
<td>R-axis</td>
<td>7.35 N·m (0.76 kgf·m)</td>
</tr>
<tr>
<td>B-axis</td>
<td>7.35 N·m (0.76 kgf·m)</td>
</tr>
<tr>
<td>T-axis</td>
<td>2.94 N·m (0.3 kgf·m)</td>
</tr>
<tr>
<td>Allowable Inertia(^{(GD^2)/4})</td>
<td></td>
</tr>
<tr>
<td>R-axis</td>
<td>0.4 kg·m(^{2})</td>
</tr>
<tr>
<td>B-axis</td>
<td>0.4 kg·m(^{2})</td>
</tr>
<tr>
<td>T-axis</td>
<td>0.12 kg·m(^{2})</td>
</tr>
<tr>
<td>Approx. Mass</td>
<td>28 kg</td>
</tr>
<tr>
<td>Ambient Conditions</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>+20 to +35 °C</td>
</tr>
<tr>
<td>Humidity</td>
<td>20 to 80% RH (at constant temperature)</td>
</tr>
<tr>
<td>Vibration Acceleration</td>
<td>Less than 4.9 m/s(^{2}) (0.5G)</td>
</tr>
<tr>
<td>Others</td>
<td>• Free from corrosive gas or liquid, or 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>
<tr>
<td>Power Requirements</td>
<td>0.5 kVA</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. 9 Part Names and Working Axes

5.3 Manipulator Base Dimensions

Fig. 10 Manipulator Base Dimensions
5.4 Dimensions and P-Point Maximum Envelope

Fig. 11 (a) Dimensions and P-Point Maximum Envelope

(*1) Shows the LU-axes working envelope within the range of S-axis motion: -40° to 40°.

(*2) Shows the LU-axes working envelope within the range of S-axis motion: -160° to 125° or 125° to 160°.

Refer to "5.5 Special Interference Area" for details.
5.5 Special Interference Area

1. LU-axes working envelope within the range of S-axis motion: \(-160^\circ\) to \(125^\circ\) or \(125^\circ\) to \(160^\circ\).

2. LU-axes working envelope within the range of S-axis motion: \(-40^\circ\) to \(40^\circ\).

Fig. 11 (b) Special Interference Area (LU interference)
5.6 B-Axis Operating Range

"Fig. 12 B-axis Operating Range" shows the operating range of the B-axis maintaining a constant angle to the center of U-axis.

5.7 Alterable Operating Range

The operating range of 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>±180° (standard)</td>
</tr>
<tr>
<td></td>
<td>±120°</td>
</tr>
<tr>
<td></td>
<td>±90°</td>
</tr>
<tr>
<td></td>
<td>±60°</td>
</tr>
<tr>
<td></td>
<td>±25°</td>
</tr>
</tbody>
</table>

NOTE: If readjustment (alteration of the S-axis operating range) is necessary, contact your Yaskawa representative.
6.1 Allowable Wrist Load

6   Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

The allowable wrist load is up to 3 kg. 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. 5 Allowable Moment and Inertia *". Contact your Yaskawa representative for further information or assistance.

*1 ( ) : Gravitational unit

When the volume load is small, refer to the moment arm rating shown in "Fig. 13 Moment Arm Rating ".

The allowable inertia is calculated when the moment is at the maximum. Contact your Yaskawa representative when only load inertia, or load moment is small and inertia is large. Also, when the load is combined as a force but a mass, contact your Yaskawa representative.

![Diagram](image)

** Fig. 13  Moment Arm Rating **

<table>
<thead>
<tr>
<th>Axis</th>
<th>Moment N·m (kgf·m)*1</th>
<th>Inertia kg·m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-axis</td>
<td>7.35 (0.75)</td>
<td>0.4</td>
</tr>
<tr>
<td>B-axis</td>
<td>7.35 (0.75)</td>
<td>0.4</td>
</tr>
<tr>
<td>T-axis</td>
<td>2.94 (0.3)</td>
<td>0.12</td>
</tr>
</tbody>
</table>

*1 (): Gravitational unit
6.2 Wrist Flange

The wrist flange dimensions are shown in "Fig. 14 Wrist Flange". It is recommended that the attachment be mounted inside the fitting. Fitting depth of inside and outside fittings must be 5 mm or less.

Fig. 14 Wrist Flange
7 System Application

7.1 Peripheral Equipment Mount

The peripheral equipment mount is on the upper arm for easier installation of the user’s system application as shown in "Fig. 15 Installing Peripheral Equipment Mounts".

Fig. 15 Installing Peripheral Equipment Mounts
7.2 Internal User I/O Wiring Harness and Air Lines

Internal user I/O wiring harness (0.2 mm² x 10 wires) and four air lines are used in the manipulator for the drives of the peripheral devices mounted on the upper arm as shown in "Fig. 16 Connectors for Internal User I/O Wiring Harness and Air Lines". The connector pins (1 to 10) are assigned as shown in "Fig. 16 Connectors for Internal User I/O Wiring Harness and Air Lines". Wiring must be performed by users, following the conditions below:

- The allowable current for cables: 2.5 A or less for each cable
- The maximum pressure for the air line: 490 kPa (5 kgf/cm²) or less (the inside diameter: 2.5 mm)

The pins of two connectors with the same number (1 to 10) are connected by a 0.2 mm² lead wire.

Fig. 16 Connectors for Internal User I/O Wiring Harness and Air Lines

The pins are connected by a 0.2 mm² lead wire.
8 Electrical Equipment Specification

8.1 Internal Connections

High reliability connectors which can be easily put on and removed are used with each connector part. For the numbers, types, and locations of connectors, see "Fig. 17 Location Connectors" and "Table. 6 List of Connector Types". Diagrams for internal connections of the manipulator are shown in "Fig. 19 (a) Internal Connection Diagram" and "Fig. 19 (b) Internal Connection Diagram".

![Diagram of internal connections](image)

Table. 6 List of Connector Types

<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>HR10A-10R-12P(73) (HR10A-10P-12S(77): Optional)</td>
</tr>
<tr>
<td>Connector for internal user I/O wiring harness on U-arm</td>
<td>HR10A-10R-12S(71) (HR10A-10P-12P(74): Optional)</td>
</tr>
</tbody>
</table>
Fig. 19(a) Internal Connection Diagram
8.1 Internal Connections

Fig. 19 (b) Internal Connection Diagram
9 Maintenance and Inspection

### WARNING

- Before maintenance or inspection, be sure to turn the main power supply OFF, and put up a warning sign. (ex. DO NOT TURN THE POWER ON.)

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

### CAUTION

- Maintenance and inspection must be performed by specified personnel.

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

- For disassembly or repair, contact your Yaskawa representative.

- Do not remove the motor or release the brake.

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

- The battery pack must be connected before removing detection connector when maintenance and inspection.

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. Conduct periodical inspections according to the inspection schedule in "Table. 7 Inspection Items". In "Table. 7 Inspection Items", the inspection items are categorized by three types of operations: operations which can be performed by personnel authorized of the user, operations which can be performed by personnel being trained, and operations which can be performed by service company personnel. Only specified personnel are to do the inspection work.
### Table. 7 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>☀ Working area and whole exterior of manipulator</td>
<td>Daily</td>
<td>Visual</td>
<td>Clean the working area if dust, spatter, or grease is present. Check for damage and exterior cracks.</td>
<td>☐ ☐ ☐</td>
</tr>
<tr>
<td>☀ LU-axis joint</td>
<td>1000 H Cycle</td>
<td>Visual</td>
<td>Check for grease leakage.</td>
<td>☐ ☐ ☐</td>
</tr>
<tr>
<td>☀ Manipulator base mounting bolts</td>
<td>6000 H Cycle</td>
<td>Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>☐ ☐ ☐</td>
</tr>
<tr>
<td>☀ Screw mounting screws</td>
<td>12000 H Cycle</td>
<td>Philips screwdriver, wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td>☐ ☐ ☐</td>
</tr>
<tr>
<td>☀ Connector base</td>
<td>18000 H Cycle</td>
<td>Manual</td>
<td>Check for loose connections.</td>
<td>☐ ☐ ☐</td>
</tr>
<tr>
<td>☀ LURBT-axis timing belts</td>
<td>24000 H Cycle</td>
<td>Manual</td>
<td>Check for belt tension and wear.</td>
<td>☐ ☐</td>
</tr>
<tr>
<td>☀ Wire harness in manipulator</td>
<td>☐</td>
<td>Visual, multimeter</td>
<td>Check for conduction between the main connector of connector base and intermediate connector with manually shaking the wire. Check for wear of protective spring.</td>
<td>☐ ☐</td>
</tr>
<tr>
<td>☀ Battery pack in manipulator</td>
<td>☐</td>
<td>Multimeter</td>
<td>Replace the battery pack when the battery alarm occurs or the manipulator travels for 24000H.</td>
<td>☐ ☐</td>
</tr>
<tr>
<td>☀ S-axis speed reducer</td>
<td>☐</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.) Supply grease. See Par 9.2.2.</td>
<td>☐ ☐</td>
</tr>
<tr>
<td>☀ LU-axis speed reducer</td>
<td>☐</td>
<td>Grease gun</td>
<td>Check for malfunction. (Replace if necessary.) Supply grease. See Par 9.2.2 and 9.2.4.</td>
<td>☐ ☐</td>
</tr>
</tbody>
</table>

**NOTE:** The inspection interval must be based on the servo power supply ON time.
### 9.1 Inspection Schedule

#### Table 7 Inspection Items

<table>
<thead>
<tr>
<th>Items*4</th>
<th>Schedule</th>
<th>Method</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily</td>
<td>1000 H Cycle</td>
<td>6000 H Cycle</td>
</tr>
<tr>
<td>R-axis speed reducer</td>
<td>-</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>BT-axis speed reducer and T-axis gear</td>
<td>-</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>Overhaul</td>
<td>-</td>
<td>-</td>
<td>O</td>
</tr>
</tbody>
</table>

*1 When checking for conduction with multimeter, connect the battery pack 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 “9.2.6 Notes for Maintenance.”)

*2 Internal cables to be replaced at 18000H inspection.

*3 For the grease, refer to “Table 8 Inspection Parts and Grease Used.”

*4 Inspection No. correspond to the numbers in “Fig. 20 Inspection Parts and Inspection Numbers.”
9.1 Inspection Schedule

---

**Fig. 20 Inspection Parts and Inspection Numbers**

**Table. 8 Inspection Parts and Grease Used**

<table>
<thead>
<tr>
<th>No.</th>
<th>Grease Used</th>
<th>Inspected Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Harmonic Grease SK-1A</td>
<td>S-, L-, U-, R-, B- and T-axis speed reducers, T-axis gear</td>
</tr>
</tbody>
</table>

The numbers in the above table correspond to the numbers in "Table. 7 Inspection Items".
9.2 Notes on Maintenance Procedures

9.2.1 Battery Pack Replacement

The battery packs are installed in the two positions indicated in "Fig. 21 (a) Battery Pack Location."

- Battery Pack Type: HW0470360-C

If the battery alarm occurs in the NXC100, replace the battery pack in accordance with the following procedure:

![Diagram of Battery Pack Location](image1)

![Diagram of Battery Pack Connection](image2)
9.2 Notes on Maintenance Procedures

1. Turn the NXC100 main power supply OFF.
2. Remove the connector base fixing screws and pull out the connector base.
3. Remove the INSULOK-tie that ties the battery pack.
4. Connect the new battery pack to an unconnected connector.
5. Remove the old battery pack.

**NOTE**

Connect the new battery pack before removing the old one so that the encoder absolute data do not disappear.

6. Tie the new battery pack with INSULOK-tie, and reinstall the connector base.

**NOTE**

Do not pinch the cable when the connector base is installed.
9.2 Notes on Maintenance Procedures

9.2.2 Grease Replenishment for S-axis Speed Reducer

**Fig. 22 S-axis Speed Reducer Diagram**

- **Grease Replenishment (Refer to "Fig. 22 S-axis Speed Reducer Diagram").**

1. Remove the hexagon socket head plug PT1/8 on the So exhaust port.

   **NOTE** Injecting grease with the plug on increases inner pressure and may cause damage. Never fail to remove the plug before the grease injection.

2. Remove the hexagon socket head plug PT1/8 on the Si grease inlet.
3. Install the grease zerk PT1/8 to the Si grease inlet. (The grease zerk PT1/8 is delivered with the manipulator.)
4. Inject the grease into the Si grease inlet using a grease gun.

   **Grease type:** Harmonic Grease SK-1A  
   **Amount of grease:** 10 cc

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

5. Remove the grease zerk on the Si grease inlet and reinstall the hexagon socket head plug PT1/8. Tighten the plug to a tightening torque of 4.9 N·m (0.5 kgf·m). Apply Three Bond 1206C on the thread part of the plug.
6. Reinstall the hexagon socket head plug PT1/8 on the So exhaust port. Apply Three Bond 1206C on the thread part of the plug.
9.2.3 Grease Replenishment for L-axis Speed Reducer

1. Remove the plug on the Lo exhaust port.

2. Remove the hexagon socket head cap screw M6×6 on the Li grease inlet.
3. Install the grease zerk A-MT6×1 to the Li grease inlet. (The grease zerk A-MT6×1 is delivered with the manipulator.)
4. Inject the grease into the Li grease inlet using a grease gun.

**Grease type:** Harmonic Grease SK-1A

**Amount of grease:** 15 cc

5. Remove the grease zerk on the Li grease inlet and reinstall the hexagon socket head cap screw M6×6. Tighten the screw to a tightening torque of 8.3 N·m (0.85 kgf·m). Apply Three Bond 1206C on the thread part of the screw.
6. Reinstall the plug on the Lo exhaust port. Apply Three Bond 1206C on the thread part of the plug.

Injecting grease with the plug on increases inner pressure and may cause damage. Never fail to remove the plug before the grease injection.

The Lo exhaust port is used for air flow. Do not inject excessive grease into the Li grease inlet.
9.2.4 Grease Replenishment for Speed Reducers of U- and R-axes

Fig. 24 UR-Axis Speed Reducer Diagram

- Grease Replenishment (Refer to "Fig. 24 UR-Axis Speed Reducer Diagram").

1. Uninstall the cover to remove the plug on the Uo/Ro exhaust port.

2. Remove the hexagon socket head cap screw M6×6 on the Ui/Ri grease inlet.

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

4. Inject the grease into the Ui/Ri grease inlet using a grease gun.

Grease type: Harmonic Grease SK-1A
Amount of grease: 10 cc (Ui)
10 cc (Ri)

5. Remove the grease zerk on the Ui/Ri grease inlet and reinstall the hexagon socket head cap screw M6×6. Tighten the screw to a tightening torque of 8.3 N·m (0.85 kgf·m). Apply Three Bond 1206C on the thread part of the screw.

6. Reinstall the plug on the Uo/Ro exhaust port. Apply Three Bond 1206C on the thread part of the plug.

**NOTE**

The Uo/Ro exhaust port is used for air flow. Do not inject excessive grease into the Ui/Ri grease inlet.

**NOTE**

If grease is injected with the plug on, the grease will go inside the motor and may damage it. Never fail to remove the plug before the grease injection.
9.2.5 Grease Replenishment for Speed Reducers of B- and T-axes, and T-axis Gear

Grease Replenishment (Refer to "Fig. 25 BT-Axis Speed Reducer and T-axis Gear Diagram ".)

1. Uninstall the cover to remove the plug on the Bo/To exhaust port.

2. Remove the hexagon socket head cap screw M6 × 6 on the Bi/Ti grease inlet.
3. Install the grease zerk A-MT6 × 1 to the Bi/Ti grease inlet. (The grease zerk A-MT6 × 1 is delivered with the manipulator.)
4. Inject the grease into the Bi/Ti grease inlet using a grease gun.

- Grease type: Harmonic Grease SK-1A
- Amount of grease: 10 cc (Bi); 5 cc (Ti)

The Bo/To exhaust port is used for airflow. Do not inject excessive grease into the Bi/Ti grease inlet.

5. Remove the grease zerk on the Bi/Ti grease inlet and reinstall the hexagon socket head cap screw M6 × 6. Tighten the screw to a tightening torque of 8.3 N·m (0.85 kgf·m). Apply Three Bond 1206C on the thread part of the screw.
6. Reinstall the plug on the Bo/To exhaust port. Apply Three Bond 1206C on the thread part of the plug.
9.2.6 Notes for Maintenance

- Battery Pack Connection

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

1. Connect the battery packs (HW9470932-A) with the battery backup connectors located at the end point of the cables for the encoder. (Under this condition, remove the encoder connector and carry out the maintenance checks).
2. After the maintenance check, verify that all the connectors are connected and remove the battery pack.

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

---

**CAUTION**
Connect battery to encoder to save the data before removing connector.

---

Fig. 26 Encoder Connector
10 Recommended Spare Parts

It is recommended that the following parts and components be kept in stock as spare parts for the MOTOMAN-HP3J. The spare parts list for the MOTOMAN-HP3J is shown below.

Check the serial number and contact your Yaskawa representative for preparing lead wires for internal wiring, etc.

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** To replace parts in Rank B or Rank C, be sure to contact your Yaskawa representative.

### Table 9  Spare Parts for the MOTOMAN-HP3J

<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>Harmonic Grease</td>
<td>SK-1A Harmonic Drive Systems Inc.</td>
<td>2.5 kg</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>2</td>
<td>Battery Pack</td>
<td>HW0470360-C</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></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>B</td>
<td>4</td>
<td>L-axis Timing Belt</td>
<td>06033M255</td>
<td>Mitsuboshi Belt- ing Limited</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>U-axis Timing Belt</td>
<td>06033M318</td>
<td>Mitsuboshi Belt- ing Limited</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>R-axis Timing Belt</td>
<td>06033M267</td>
<td>Mitsuboshi Belt- ing Limited</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>B-axis Timing Belt</td>
<td>06033M276</td>
<td>Mitsuboshi Belt- ing Limited</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>8</td>
<td>T-axis Timing Belt</td>
<td>06033M312</td>
<td>Mitsuboshi Belt- ing Limited</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>9</td>
<td>S-axis Speed Reducer</td>
<td>HW0385336-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>10</td>
<td>L-axis Speed Reducer</td>
<td>HW0385337-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
### Table 9: Spare Parts for the MOTOMAN-HP3J

<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>B</td>
<td>11</td>
<td>U-axis Speed Reducer</td>
<td>HW0385338-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>12</td>
<td>R-axis Speed Reducer</td>
<td>HW0385323-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>13</td>
<td>B-axis Speed Reducer</td>
<td>HW0385324-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>14</td>
<td>T-axis Speed Reducer</td>
<td>HW0385325-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>15</td>
<td>T-axis Gear</td>
<td>HW0385403-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>16</td>
<td>AC Servomotor for S-, L-, U-axes</td>
<td>HW0388024-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>With brake and lead terminal treatment</td>
</tr>
<tr>
<td>C</td>
<td>17</td>
<td>AC Servomotor for R-, B-, T-axes</td>
<td>HW0388025-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td>With brake and lead terminal treatment</td>
</tr>
<tr>
<td>C</td>
<td>18</td>
<td>Wire Harness in Manipulator</td>
<td>HW0173957-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>19</td>
<td>Wire Harness in Manipulator</td>
<td>HW0471411-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>20</td>
<td>Wire Harness in Manipulator</td>
<td>HW0471412-A</td>
<td>Yaskawa Electric Corporation</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
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YASKAWA ELECTRIC CORPORATION

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