MOTOMAN-MH12 INSTRUCTIONS

TYPE:
YR-MA1440/MH12-A00 (STANDARD SPECIFICATION)
YR-MA1440/MH12-A02 (TWO AIR LINES SPECIFICATION)

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

MOTOMAN INSTRUCTIONS
MOTOMAN-MH12 INSTRUCTIONS
DX200 INSTRUCTIONS
DX200 OPERATOR’S MANUAL (for each purpose)
DX200 MAINTENANCE MANUAL
FS100 INSTRUCTIONS
FS100 OPERATOR’S MANUAL
FS100 MAINTENANCE MANUAL

The DX200 or FS100 operator’s manual above corresponds to specific usage. Be sure to use the appropriate manual.

Part Number: 167105-1CD
Revision: 4

MANUAL NO.
HW1481305
### MANDATORY

- This instruction manual is intended to explain mainly on the mechanical part of the MOTOMAN-MH12 for the application to the actual operation and for proper maintenance and inspection. It describes on safety and handling, details on specifications, necessary items on maintenance and inspection, to explain operating instructions and maintenance procedures. Be sure to read and understand this instruction manual thoroughly before installing and operating the manipulator.
- General items related to safety are listed in Chapter 1: Safety of the DX200/FS100 Instructions. To ensure correct and safe operation, carefully read the DX200/FS100 Instructions before reading this manual.

### CAUTION

- Some drawings in this manual are shown with the protective covers or shields removed for clarity. Be sure all covers and shields are replaced before operating this product.
- The drawings and photos in this manual are representative examples and differences may exist between them and the delivered product.
- YASKAWA may modify this model without notice when necessary due to product improvements, modifications, or changes in specifications. If such modification is made, the manual number will also be revised.
- If your copy of the manual is damaged or lost, contact a YASKAWA representative to order a new copy. The representatives are listed on the back cover. Be sure to tell the representative the manual number listed on the front cover.
- YASKAWA is not responsible for incidents arising from unauthorized modification of its products. Unauthorized modification voids your product's warranty.
We suggest that you obtain and review a copy of the ANSI/RIA National Safety Standard for Industrial Robots and Robot Systems (ANSI/RIA R15.06-2012). You can obtain this document from the Robotic Industries Association (RIA) at the following address:

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

Ultimately, well-trained personnel are the best safeguard against accidents and damage that can result from improper operation of the equipment. The customer is responsible for providing adequately trained personnel to operate, program, and maintain the equipment. NEVER ALLOW UNTRAINED PERSONNEL TO OPERATE, PROGRAM, OR REPAIR THE EQUIPMENT!

We recommend approved YASKAWA training courses for all personnel involved with the operation, programming, or repair of the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.
Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the MOTOMAN-MH12.

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

- **DANGER**: Indicates an imminent hazardous situation which, if not avoided, could result in death or serious injury to personnel.

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

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

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

- **PROHIBITED**: Must never be performed.

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

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

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

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**DANGER**

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

• Before operating the manipulator, check that servo power is turned OFF pressing the emergency stop buttons on the front door of the DX200 and the programming pendant. When the servo power is turned OFF, the SERVO ON LED on the programming pendant is turned OFF.

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

Fig. : 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.

Fig. : Release of Emergency Stop

• Observe the following precautions when performing teaching operations within the P-point maximum envelope of the manipulator:
  – Be sure to use a lockout device to the safeguarding when going inside. Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
  – View the manipulator from the front whenever possible.
  – Always follow the predetermined operating procedure.
  – Keep in mind the emergency response measures against the manipulator’s unexpected motion toward you.
  – Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.

• Confirm that no person is present in the P-point maximum envelope of the manipulator and that you are in a safe location before:
  – Turning ON the power for the DX200.
  – Moving the manipulator with the programming pendant.
  – Running the system in the check mode.
  – Performing automatic operations.

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

The emergency stop buttons are located on the right of front door of the DX200 and the programming pendant.
<FS100>

WARNING

• Before operating the manipulator, check that servo power is turned OFF when the emergency stop button on the programming pendant is 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 button does not function.

Fig. : Emergency Stop Button

• In the case of not using the programming pendant, be sure to supply the emergency stop button on the equipment. Then before operating the manipulator, check to be sure that the servo power is turned OFF by pressing the emergency stop button.

Connect the external emergency stop button to the 5-6 pin and 16-17 pin of the robot system signal connector (CN2).

• Upon shipment of the FS100, this signal is connected by a jumper cable in the dummy connector. To use the signal, make sure to supply a new connector, and then input it.

If the signal is input with the jumper cable connected, it does not function, which may result in personal injury or equipment damage.

• 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.

Fig. : Release of Emergency Stop Button

• Observe the following precautions when performing teaching operations within the manipulator’s operating range:
  – Be sure to use a lockout device to the safeguarding when going inside.
  Also, display the sign that the operation is being performed inside the safeguarding and make sure no one closes the safeguarding.
  – View the manipulator from the front whenever possible.
  – Always follow the predetermined operating procedure.
  – Keep in mind the emergency response measures against the manipulator’s unexpected motion toward you.
  – Ensure that you have a safe place to retreat in case of emergency.

Improper or unintended manipulator operation may result in injury.
WARNING

- Confirm that no person is present in the manipulator’s operating range and that you are in a safe location before:
  - Turning ON the power for the DX200/FS100.
  - Moving the manipulator with the programming pendant.
  - Running the system in the check mode.
  - Performing automatic operations.

Injury may result if anyone enters the manipulator’s operating range during operation. Always press an emergency stop button immediately if there are problems.
The emergency stop button is located on the programming pendant.

CAUTION

- Perform the following inspection procedures prior to conducting manipulator teaching. If problems are found, repair them immediately, and be sure that all other necessary processing has been performed.
  - Check for problems in manipulator movement.
  - Check for damage to insulation and sheathing of external wires.
- Always return the programming pendant to the hook on the cabinet of the DX200/FS100 after use.
The programming pendant can be damaged if it is left in the manipulator’s work area, on the floor, or near fixtures.
- Read and understand the Explanation of Warning Labels in the DX200/FS100 Instructions before operating the manipulator:
Definition of Terms Used Often in This Manual (DX200)

The MOTOMAN is the YASKAWA industrial robot product.
The MOTOMAN usually consists of the manipulator, the controller, the programming pendant, and supply cables.

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DX200 controller</td>
<td>DX200</td>
</tr>
<tr>
<td>DX200 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator cable</td>
</tr>
</tbody>
</table>

Definition of Terms Used Often in This Manual (FS100)

The MOTOMAN is the YASKAWA industrial robot product.
The MOTOMAN usually consists of the manipulator, the FS100 controller, manipulator cables, the FS100 programming pendant (optional), and the FS100 programming pendant dummy connector (optional).

In this manual, the equipment is designated as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS100 controller</td>
<td>FS100</td>
</tr>
<tr>
<td>FS100 programming pendant</td>
<td>Programming pendant</td>
</tr>
<tr>
<td>Cable between the manipulator and the controller</td>
<td>Manipulator Cable</td>
</tr>
<tr>
<td>FS100 programming pendant dummy connector</td>
<td>Programming pendant dummy connector</td>
</tr>
</tbody>
</table>

Description of the Operation Procedure

In the explanation of the operation procedure, the expression “Select • • •” means that the cursor is moved to the object item and the SELECT key is pressed, or that the item is directly selected by touching the screen.

Registered Trademark

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

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

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

Fig. : Warning Label Locations
Safeguarding Tips

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system 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 equipment, the operator’s manuals, the system equipment, and options and accessories should be permitted to operate this equipment.
- Improper connections can damage the equipment. All connections must be made within the standard voltage and current ratings of the equipment.
- The system must be placed in Emergency Stop (E-Stop) mode whenever it is not in use.
- In accordance with ANSI/RIA R15.06-2012, 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).

Mechanical Safety Devices

The safe operation of this equipment is ultimately the users 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 R15.06-2012 safety standards, and other local codes that may pertain to the installation and use of this 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 barriers
- Door interlocks
- Emergency stop palm buttons located on operator station

Check all safety equipment frequently for proper operation. Repair or replace any non-functioning safety equipment immediately.
Programming, Operation, and Maintenance Safety

All operators, programmers, maintenance personnel, supervisors, and anyone working near the system 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 equipment should be permitted to program, or maintain the system. All personnel involved with the operation of the equipment must understand potential dangers of operation.

- Inspect the equipment 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.
- Check the E-Stop button on the operator station for proper operation before programming. The equipment 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 the controller unit can cause severe personal injury or death, as well as damage to the robot! Do not make any modifications to the controller unit. Making any changes without the written permission from YASKAWA will void the warranty.
- Some operations require a standard passwords and some require special passwords.
- The equipment allows modifications of the software for maximum performance. Care must be taken when making these modifications. All modifications made to the software will change the way the equipment operates and can cause severe personal injury or death, as well as damage parts of the system. Double check all modifications under every mode of operation to ensure that the changes have not created hazards or dangerous situations.
- 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 equipment. All connections must be made within the standard voltage and current ratings of the equipment.
Maintenance Safety

Turn the power OFF and disconnect and lockout/tagout all electrical circuits before making any modifications or connections.

Perform only the maintenance described in this manual. Maintenance other than specified in this manual should be performed only by YASKAWA-trained, qualified personnel.

Summary of Warning Information

This manual is provided to help users establish safe conditions for operating the equipment. Specific considerations and precautions are also described in the manual, but appear in the form of Dangers, Warnings, Cautions, and Notes.

It is important that users operate the equipment in accordance with this instruction manual and any additional information which may be provided by YASKAWA. Address any questions regarding the safe and proper operation of the equipment to YASKAWA Customer Support.
Customer Support Information

If you need assistance with any aspect of your MH12 system, please contact YASKAWA Customer Support at the following 24-hour telephone number:

(937) 847-3200

For routine technical inquiries, you can also contact YASKAWA Customer Support at the following e-mail address:

techsupport@motoman.com

When using e-mail to contact YASKAWA Customer Support, please provide a detailed description of your issue, along with complete contact information. Please allow approximately 24 to 36 hours for a response to your inquiry.

Please use e-mail for routine inquiries only. If you have an urgent or emergency need for service, replacement parts, or information, you must contact YASKAWA Customer Support at the telephone number shown above.

Please have the following information ready before you call Customer Support:

• System: MH12
• Primary Application
• Controller: DX200/DX100
• Software Version
  Access this information on the Programming Pendant’s LCD display screen by selecting {MAIN MENU} - {SYSTEM INFO} - {VERSION}
• Robot Serial Number
  Located on the robot data plate
• Robot Sales Order Number
  Located on the DX200/DX100 controller data plate
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#### 9.3.2.2 Grease Exchange

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#### 9.3.8.2 Battery Pack Connection

# Recommended Spare Parts

## 10 Parts List

### 11.1 S-Axis Unit

### 11.2 L-Axis Unit

### 11.3 U-Axis Unit

### 11.4 R-Axis Unit (Shipped in or After August 2014)

### 11.5 Wrist Unit

### 11.6 Gear Unit (No. 5040)
1 Product Confirmation

1.1 Contents Confirmation

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

- Manipulator
- DX200/FS100
- Programming pendant
- Manipulator cables (between the DX200/FS100 and the Manipulator)

CAUTION

- Confirm that the manipulator and the DX200/FS100 have the same order number. Special care must be taken when more than one manipulator is to be installed.

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

Check that the order number of the manipulator corresponds to the DX200/FS100. The order number is located on a label as shown below.

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

2.1 Transport Method

CAUTION

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

NOTE

- The weight of the manipulator is approximately 135 kg including the shipping bolts and brackets. Use a wire rope strong enough to withstand the weight.
- Mount the shipping bolts and brackets for transporting the manipulator.
- Avoid putting external force on the arm or motor unit when transporting by a crane, forklift, or other equipment. Failure to observe this instruction may result in injury.
2 Transport

2.1 Transport Method

2.1.1 Using a Crane

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

Fig. 2-1: Transporting Position

2.1.2 Using a Forklift

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

Fig. 2-2: Using a Forklift
2.2 Shipping Bolts and Brackets

The manipulator is provided with two shipping bolts and a shipping bracket. (See Fig. 2-4 “Cushioning Materials for Transport”.)

Fig. 2-3: Shipping Bolts and Brackets

- The shipping bolts and bracket are painted yellow.
- The shipping bracket is to be fixed with the hexagon socket head cap screws M10 (length: 25mm) (2 screws).

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

The manipulator is provided with the cushioning materials for transport at sections A and B. (See Fig. 2-4 “Cushioning Materials for Transport”.)

Fig. 2-4: Cushioning Materials for Transport

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

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

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

**WARNING**

- Install the safeguarding. Failure to observe this warning may result in injury or damage.
- Install the manipulator in a location where the tool or the workpiece held by its fully extended arm will not reach the wall, safeguarding, or controller. Failure to observe this warning may result in injury or damage.
- Do not start the manipulator or even turn ON the power before it is firmly anchored. The manipulator may overturn and cause injury or damage.
- When mounting the manipulator on the wall, the base section must have sufficient strength and rigidity to support the weight of the manipulator. Also, it is necessary to consider countermeasures to prevent the manipulator from falling. Failure to observe these warnings 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 shipping bolts and brackets explained in Fig. 2-4 “Cushioning Materials for Transport” are removed. Failure to observe this caution may result in damage to the driving parts.
3 Installation

3.1 Safeguarding Installation

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

Responsibility for Safeguarding (ISO10218)

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

3.2 Mounting Procedures for Manipulator Base

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

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

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

Table 3-1: Manipulator Reaction Force and Torque

<table>
<thead>
<tr>
<th></th>
<th>Horizontal rotation</th>
<th>Vertical rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reaction force $F_H$</td>
<td>Torque $M_H$</td>
</tr>
<tr>
<td>Emergency stop</td>
<td>9025 N (920 kgf)</td>
<td>4120 N•m (420 kgf•m)</td>
</tr>
<tr>
<td>Acceleration/ deceleration</td>
<td>3140 N (320 kgf)</td>
<td>1275 N•m (130 kgf•m)</td>
</tr>
</tbody>
</table>
Fig. 3-1: Manipulator Reaction Force and Torque
3 Installation

3.2 Mounting Procedures for Manipulator Base

3.2.1 Mounting Example

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

The manipulator base is tapped for four mounting holes; securely fix the manipulator base to the base plate with four hexagon head bolts M16 (50 mm long is recommended).

Next, fix the manipulator base to the base plate. Tighten the hexagon head bolts and anchor bolts firmly so that they will not work loose during the operation.

Refer to Fig. 3-2 "Mounting the Manipulator on Base Plate".

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

The MOTOMAN-MH12 is available in three ways: floor-mounted way (standard), wall-mounted way, and ceiling-mounted way. For wall-mounted and ceiling-mounted ways, the three points listed below are different from the floor-mounted way.

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

3.3.1 S-Axis Operating Range

For wall-mounted way, the S-axis operating range is ±30°. (The range is adjusted prior to the shipment.)

3.3.2 Fixing the Manipulator Base

For wall- and ceiling-mounted ways, be sure to use four hexagon socket head cap screws M16 (tensile strength: 1200 N/mm² or more) when fixing the manipulator base. Use a torque of 206 N•m when tightening the screws.

3.3.3 Precautions to Prevent the Manipulator from Falling

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

Fig. 3-3: Precaution Against Falling

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

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

- Ambient temperature: 0°C to + 45°C
- Humidity: 20 to 80%RH (no-condensing)
- Free from dust, soot, oil, or water
- Free from corrosive gas or liquid, or explosive gas or liquid.
- Free from excessive vibration (Vibration acceleration: 4.9 m/s² [0.5 G] or less)
- Free from large electrical noise (plasma)
- Flatness for installation: 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 electrical installation standards and wiring regulations for grounding. A ground wire of 5.5 mm² or more is recommended. Refer to Fig. 4-1 “Grounding Method” to connect the ground line directly to the manipulator.

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

Fig. 4-1: Grounding Method

![Grounding Method Diagram]
4.2 Cable Connection

Two manipulator cables are delivered with the manipulator; an encoder cable (1BC) and a power cable (2BC).

(Refer to Fig. 4-2(a) "Manipulator Cables (DX200)" Fig. 4-2(b) "Manipulator Cables (FS100)"

Connect these cables to the manipulator base connectors and to the DX200/FS100. Refer to Fig. 4-3 "Manipulator Cable Connectors (Manipulator Side)" Fig. 4-4(a) "Manipulator Cable Connection (DX200 Side)" and Fig. 4-4(b) "Manipulator Cable Connection (FS100 Side)".

4.2.1 Connection to the Manipulator

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

4.2.2 Connection to the DX200/FS100

Before connecting two cables to the DX200/FS100, verify the numbers on both manipulator cables and the connectors on the DX200/FS100. When connecting, insert the cables in the order of X21, then X11, and depress each lever low until it clicks.
Fig. 4-2(a): Manipulator Cables (DX200)

DX200 Side

Encoder Cable

Manipulator Side

Power Cable

DX200 Side

Manipulator Side
4 Wiring
4.2 Cable Connection

Fig. 4-2(b): Manipulator Cables (FS100)

Fig. 4-3: Manipulator Cable Connectors (Manipulator Side)
4 Wiring
4.2 Cable Connection

Fig. 4-4(a): Manipulator Cable Connection (DX200 Side)

Fig. 4-4(b): Manipulator Cable Connection (FS100 Side)
5 Basic Specifications

5.1 Basic Specifications

Table 5-1: Basic Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Model MOTOMAN-MH12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure</td>
<td>Vertically Articulated</td>
</tr>
<tr>
<td>Degree of Freedom</td>
<td>6</td>
</tr>
<tr>
<td>Payload</td>
<td>12 kg</td>
</tr>
<tr>
<td>Repeatability²)</td>
<td>±0.08 mm</td>
</tr>
<tr>
<td>Range of Motion</td>
<td></td>
</tr>
<tr>
<td>S-Axis (turning)</td>
<td>-170° ~ +170°</td>
</tr>
<tr>
<td>L-Axis (lower arm)</td>
<td>-90° ~ +155°</td>
</tr>
<tr>
<td>U-Axis (upper arm)</td>
<td>-175° ~ +240°</td>
</tr>
<tr>
<td>R-Axis (wrist roll)</td>
<td>-180° ~ +180°</td>
</tr>
<tr>
<td>B-Axis (wrist pitch/yaw)</td>
<td>-135° ~ +135°</td>
</tr>
<tr>
<td>T-Axis (wrist twist)</td>
<td>-360° ~ +360°</td>
</tr>
<tr>
<td>Maximum Speed</td>
<td></td>
</tr>
<tr>
<td>S-Axis</td>
<td>3.84 rad/s, 220°/s</td>
</tr>
<tr>
<td>L-Axis</td>
<td>3.49 rad/s, 200°/s</td>
</tr>
<tr>
<td>U-Axis</td>
<td>3.84 rad/s, 220°/s</td>
</tr>
<tr>
<td>R-Axis</td>
<td>7.16 rad/s, 410°/s</td>
</tr>
<tr>
<td>B-Axis</td>
<td>7.16 rad/s, 410°/s</td>
</tr>
<tr>
<td>T-Axis</td>
<td>10.6 rad/s, 610°/s</td>
</tr>
<tr>
<td>Allowable Moment³)</td>
<td></td>
</tr>
<tr>
<td>R-Axis</td>
<td>22 N•m (2.2 kgf•m)</td>
</tr>
<tr>
<td>B-Axis</td>
<td>22 N•m (2.2 kgf•m)</td>
</tr>
<tr>
<td>T-Axis</td>
<td>9.8 N•m (1.0 kgf•m)</td>
</tr>
<tr>
<td>Allowable Inertia (GD²/4)</td>
<td></td>
</tr>
<tr>
<td>R-Axis</td>
<td>0.65 kg•m²</td>
</tr>
<tr>
<td>B-Axis</td>
<td>0.65 kg•m²</td>
</tr>
<tr>
<td>T-Axis</td>
<td>0.17 kg•m²</td>
</tr>
<tr>
<td>Approx. mass</td>
<td>130 kg</td>
</tr>
<tr>
<td>Ambient Conditions</td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>0°C to 45°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>20 to 80% RH (non-condensing)</td>
</tr>
<tr>
<td>Vibration Acceleration</td>
<td>4.9 m/s² or less (0.5 G)</td>
</tr>
<tr>
<td>Others</td>
<td>Free from corrosive gasses or liquids, or explosive gasses Free from exposure to water, oil, or dust Free from excessive electrical noise (plasma)</td>
</tr>
<tr>
<td>Power Requirements</td>
<td>1.5 kVA</td>
</tr>
<tr>
<td>Noise⁴)</td>
<td>Less than 78.8 dB</td>
</tr>
</tbody>
</table>

1 SI units are used in this table. However, gravitational unit is used in ( ).
2 Conformed to ISO9283
3 Refer to chapter 6 "Allowable Load for Wrist Axis and Wrist Flange" for details on the permissible moment of inertia.
4 Conformed to ISO6926

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

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

5.3 Manipulator Base Dimensions

*Fig. 5-2: Manipulator Base Dimensions*
5.4 Dimensions and P-Point Maximum Envelope

Fig. 5-3: Dimensions and P-Point Maximum Envelope
5.5 Stopping Angles and Times for S-, L- and U-Axes (DX200)

Following data on stopping angle and time for each axis measured under the standard of ISO10218.

5.5.1 Stop Category 0: Stopping Angles and Times

5.5.1.1 Position 100%

Fig. 5-4: Stop Category 0, Position 100% : Stopping Angle and Time for each Axis
5.5 Stopping Angles and Times for S-, L- and U-Axes (DX200)

5.5.1.2 Position 66%

Fig. 5-5: Stop Category 0, Position 66% : Stopping Angle and Time for each Axis

(a) S-Axis

(b) L-Axis

(c) U-Axis
5.5.1.3 Position 33%

Fig. 5-6: Stop Category 0, Position 33% : Stopping Angle and Time for each Axis

(a) S-Axis

(b) L-Axis

(c) U-Axis
5.5 Stopping Angles and Times for S-, L- and U-Axes (DX200)

5.5.2 Stop Category 1: Stopping Angles and Times

Stopping angles and times at Stop category 1 are not subjected to the load of the manipulator.

5.5.2.1 Position 100%

Fig. 5-7: Stop Category 1: Position 100% Stopping Angle and Time for each Axis

(a) S-Axis

Notes: Not depends on the load

(b) L-Axis

Notes: Not depends on the load

(c) U-Axis

Notes: Not depends on the load
5.5.2.2 Position 66%

Fig. 5-8: Stop Category 1: Position 66% Stopping Angle and Time for each Axis

Notes) Not depends on the load
5.5 Stopping Angles and Times for S-, L- and U-Axes (DX200)

5.5.2.3 Position 33%

Fig. 5-9: Stop Category 1: Position 33% Stopping Angle and Time for each Axis

(a) S-Axis

Notes) Not depends on the load

(b) L-Axis

Notes) Not depends on the load

(c) U-Axis

Notes) Not depends on the load
5.6 Stopping Angles and Times for S-, L- and U-Axes (FS100)

Following data on stopping angle and time for each axis measured under the standard of ISO10218.

5.6.1 Stop Category 0: Stopping Angles and Times

5.6.1.1 Position 100%

Fig. 5-10: Stop Category 0, Position 100% : Stopping Angle and Time for each Axis

(a) S-Axis

(b) L-Axis

(c) U-Axis
5.6.1.2 Position 66%

Fig. 5-11: Stop Category 0, Position 66% : Stopping Angle and Time for each Axis

(a) S-Axis

(b) L-Axis

(c) U-Axis
5.6.1.3 Position 33%

Fig. 5-12: Stop Category 0, Position 33% : Stopping Angle and Time for each Axis

(a) S-Axis

(b) L-Axis

(c) U-Axis
5.6.2 Stop Category 1: Stopping Angles and Times

**Note:** Stopping angles and times at Stop category 1 are not subjected to the load of the manipulator.

5.6.2.1 Position 100%

*Fig. 5-13: Stop Category 1: Position 100% Stopping Angle and Time for each Axis*

(a) S-Axis

Notes: Not depends on the load

(b) L-Axis

Notes: Not depends on the load

(c) U-Axis

Notes: Not depends on the load
5.6.2.2 Position 66%

Fig. 5-14: Stop Category 1: Position 66% Stopping Angle and Time for each Axis

(a) S-Axis

Notes) Not depends on the load

(b) L-Axis

Notes) Not depends on the load

(c) U-Axis

Notes) Not depends on the load
5.6 Stopping Angles and Times for S-, L- and U-Axes (FS100)

5.6.2.3 Position 33%

Fig. 5-15: Stop Category 1: Position 33% Stopping Angle and Time for each Axis

(a) S-Axis

(b) L-Axis

(c) U-Axis

Notes: Not depends on the load
5.7 Alterable Operating Range

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

Table 5-2: S-Axis Operating Range

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

5.7.1 Components for Altering Operating Range

Arrange the components listed in Fig. 5-16 "The Components of the S-Axis Stopper and Stopper Mounting Position", when modifying the angle of S-axis.

1. Dog (drawing No. HW0414041-2) (2 dogs)
2. Hexagon socket head cap screw M12 (length: 30 mm) (2 screws)
   (Tensile strength: 1200 N/mm² or more)
3. Conical spring washer M12 (2 washers)
5.7.2 Notes on the Mechanical Stopper Installation

As shown in Fig. 5-16 "The Components of the S-Axis Stopper and Stopper Mounting Position", as a mechanical stopper, mount a dog (HW0414041-2) on the S-head by using one hexagon socket head cap screw M12 (length: 30 mm) (2 places) (tensile strength: 1200 N/mm² or more). The mechanical stopper is not necessary when the operating range is set to ±170° (Standard specification).

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

For the settable angles, refer to Table 5-3 "The Settable Angle for S-Axis Stopper"

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

5.7.3 Adjustment to the Pulse Limitation of S-Axis

Apply the Instruction for "DX200 Instructions chapter 8.17 Changing the Parameter Setting (manual No. RE-CTO-A220)" as part of reference materials for adjusting the programming pendant when modifying the range of motion of S-Axis.

The limitation to the pulse (Pulse Soft Limit + 1st Axis) : SICxG400
The limitation to the pulse (Pulse Soft Limit - 1st Axis) : SICxG408

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

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

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

<table>
<thead>
<tr>
<th>Settable Angle (°)</th>
<th>Non-settable Angle (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-150</td>
<td>+150</td>
</tr>
<tr>
<td>-135</td>
<td>+135</td>
</tr>
</tbody>
</table>

"Table 5-3 The Settable Angle for S-Axis Stopper" indicates the angle range which allows S-axis to be set for + direction and - direction angles. (Ex. -150° to +150° is settable, however 0° to +135° is not settable.)
6 Allowable Load for Wrist Axis and Wrist Flange

6.1 Allowable Wrist Load

The allowable wrist load is 12 kg maximum. If force is applied to the wrist instead of the load, force on R-, B-, and T-axes should be within the value shown in Table 6-1 "Allowable Wrist Load". Contact your YASKAWA representative for further information or assistance.

When the volume load is small, refer to the moment arm rating shown in Fig. 6-1 "Moment Arm Rating".

Each value of the allowable inertia above is calculated assuming that the moment load is at the maximum. Thus, in the case when only the inertia load is applied, when the moment load is small while the inertia load is large, or when the load is not applied as mass but applied as force, etc., contact your YASKAWA representative in advance.

Table 6-1: Allowable Wrist Load

<table>
<thead>
<tr>
<th>Axis</th>
<th>Allowable Moment N-m (kgf•m)</th>
<th>Allowable Inertia (GD²/4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-Axis</td>
<td>22 (2.2)</td>
<td>0.65</td>
</tr>
<tr>
<td>B-Axis</td>
<td>22 (2.2)</td>
<td>0.65</td>
</tr>
<tr>
<td>T-Axis</td>
<td>9.8 (1.0)</td>
<td>0.17</td>
</tr>
</tbody>
</table>

1 ( ): Gravitational unit

When the volume load is small, refer to the moment arm rating shown in Fig. 6-1 "Moment Arm Rating".

Each value of the allowable inertia above is calculated assuming that the moment load is at the maximum. Thus, in the case when only the inertia load is applied, when the moment load is small while the inertia load is large, or when the load is not applied as mass but applied as force, etc., contact your YASKAWA representative in advance.

Fig. 6-1: Moment Arm Rating
6.2 Wrist Flange

The wrist flange dimensions are shown in Fig. 6-2 "Wrist Flange". It is recommended that the attachment be mounted outside the fitting in order to identify the alignment marks. Fitting depth shall be 5 mm or less. The attachment should be mounted inside the range shown in the figure below.

Fig. 6-2: Wrist Flange

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 peripheral equipment mounts are provided on the U-axis (upper arm) and S-axis (rotary head) as shown in Fig. 7-1 "Installing Peripheral Equipment" for easier installation of the user's system applications. The following conditions shall be observed to attach or install peripheral equipment.

7.1.1 Allowable Load

The maximum allowable load on the U-axis is 22 kg, including the wrist load. For instance, when the mass installed on the wrist point is 12 kg, the mass which can be installed on the upper arm is 10 kg.

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

7.1.2 Installation Position

There is a limitation on where to install the peripheral equipment as shown in Fig. 7-1 "Installing Peripheral Equipment" on the following page.

Fig. 7-1: Installing Peripheral Equipment
7 System Application
7.2 Internal User I/O Wiring Harness and Air Line

7.2 Internal User I/O Wiring Harness and Air Line

Internal user I/O wiring harness (14 wires: 0.2 mm² x 8 wires, 0.75 mm² x 2 wires and 1.25 mm² x 4 wires), and an air line are incorporated in the manipulator for the drive of peripheral devices mounted on the upper arm as shown in Fig. 7-2 “Connectors for Internal User I/O Wiring Harness and Air Line”.

The connector pins 1 to 16 are assigned as shown in Fig. 7-3 “Details of the Connector Pin Numbers” on the following page. Wiring must be performed by users. For the two air lines specification (optional), one more air line is added. The conditions are below.

<table>
<thead>
<tr>
<th>The allowable current for internal user I/O wiring harness</th>
<th>3 A or less for each wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>The maximum pressure for the air line</td>
<td>490 kPa (5 kgf/cm²) or less</td>
</tr>
<tr>
<td>(The air line inside diameter: 8.0mm, 6.5 mm (for two air lines only))</td>
<td></td>
</tr>
<tr>
<td>The allowable current for arc welding power cable (With optional A)</td>
<td>Rated current of 350A or less and the rated operational ratio should be 60% or lower.</td>
</tr>
<tr>
<td></td>
<td>The allowable operational ratio when it is operated with less current than the allowable current is calculated by the following formula. allowable operational ratio = 60% x (350A/operating current)²</td>
</tr>
</tbody>
</table>

Allowable operational ratio = 60% x (350A/operating current)²
**Fig. 7-2: Connectors for Internal User I/O Wiring Harness and Air Line**

Exhaust port A
PT3/8 with a pipe plug

Exhaust port B
PT3/8 with a pipe plug

Connector for the internal user I/O wiring harness:
JL05-2A20-29SC (socket connector with a cap)
Prepare pin connector JLS-6420-29P

Air Inlet A
PT3/8 with a pipe plug

Air Inlet B
PT3/8 with a pipe plug

Connector for the internal user I/O wiring harness:
JL05-2A20-29PC (with a cap)
Prepare connector JLS-6420-29S

Two air lines specification (-A02)

Standard specification (-A00)

Note: Available for two air lines specification only

View A.
7 System Application
7.2 Internal User I/O Wiring Harness and Air Line

**Details of the Connector Pin Numbers**

**Connector for Internal User I/O Wiring Harness on the Connector Base**
- Pins used: 1, 3, 4, 5, 6, 7, 8, 9, 10
- Internal user I/O wiring harness: 0.2 mm², 8 wires; 0.75 mm², 2 wires; 1.25 mm², 4 wires

**Connector for Internal User I/O Wiring Harness on the U-arm**
- Pins used: 1, 2, 3, 4, 5, 6, 7, 8
- Internal user I/O wiring harness: 0.2 mm², 8 wires; 0.75 mm², 2 wires; 1.25 mm², 4 wires

**NOTE**

- For the standard specification, the pins No.7 and No.8 of 3BC connector on the U-arm are respectively connected with the shock sensor power supply and shock sensor signal input port of the DX200/FS100 controller.
- The pins No.7 and No.8 of respective 3BC connectors on the connector base side and the U-arm side are not connected with each other.
- For wiring, refer to Fig. 8-4(a) "Internal Connection Diagram DX200" through Fig. 8-4(c) "Internal Connection Diagram (FS100)."

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

8.1 Position of Limit Switch

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

Fig. 8-1: Location of Limit Switches
8.2 Position of Servo ON Lamp

The limit switches are optional. See Fig. 8-2 "Location of Servo On Lamp"

![Servo ON Lamp](image_url)
8.3 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 number and location of connectors, see Fig. 8-3 "Locations and Numbers of Connectors".

Diagrams for Internal connections of the manipulator are shown in Fig. 8-4(a) "Internal Connection Diagram DX200)". Fig. 8-4(a) "Internal Connection Diagram DX200)". Fig. 8-4(c) "Internal Connection Diagram (FS100)" and Fig. 8-4(d) "Internal Connection Diagram (FS100)".

![Fig. 8-3: Locations and Numbers of Connectors](image)

<table>
<thead>
<tr>
<th>Name</th>
<th>Type of Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector for the internal user I/O wiring harness on the connector base</td>
<td>JL05-2A20-29PC (JL05-6A20-29S: Optional)</td>
</tr>
<tr>
<td>Connector for the internal user I/O wiring harness on the U-arm</td>
<td>JL05-2A20-29SC (JL05-6A20-29P: Optional)</td>
</tr>
</tbody>
</table>
Note
1. For the limit switch specification, the connection of the section A→B is changed as follows.
Fig. 8-4(b): Internal Connection Diagram (DX200)
Fig. 8-4(c): Internal Connection Diagram (FS100)
Fig. 8-4(d): Internal Connection Diagram (FS100)
9 Maintenance and Inspection

9.1 Inspection Schedule

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

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

- The inspection interval depends on the total servo operation time.
- The following inspection schedule is based on the case where the manipulator is used for arc welding application. If the manipulator is used for other application or if it is used under special conditions, a case-by-case examination is required.

The inspection may be conducted at shorter intervals if the manipulator is used very frequently for the application such as handling; in this case, contact your YASKAWA representative.

DANGER

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

WARNING

- 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

- 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.
Table 9-1: Inspection Items (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>Items</th>
<th>Schedule Method</th>
<th>Operation</th>
<th>Inspection Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Alignment mark</td>
<td>Visual</td>
<td>Check alignment mark accordance at the home position. Check for damage.</td>
<td></td>
</tr>
<tr>
<td>2 External lead</td>
<td>Visual</td>
<td>Check for damage and deterioration of leads.</td>
<td></td>
</tr>
<tr>
<td>3 Working area and manipulator</td>
<td>Visual</td>
<td>Clean the work area if dust or spatter is present. Check for damage and outside cracks.</td>
<td></td>
</tr>
<tr>
<td>4 Motors for S-, L-, U-axes</td>
<td>Visual</td>
<td>Check for grease leakage.</td>
<td></td>
</tr>
<tr>
<td>5 Baseplate mounting bolts</td>
<td>Spanner, Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td></td>
</tr>
<tr>
<td>6 Cover mounting screws</td>
<td>Screwdriver, Wrench</td>
<td>Tighten loose bolts. Replace if necessary.</td>
<td></td>
</tr>
<tr>
<td>7 Connector base</td>
<td>Manual</td>
<td>Check for loose connectors.</td>
<td></td>
</tr>
<tr>
<td>8 Timing belts for B- and T-axes</td>
<td>Manual</td>
<td>Check for belt tension and wear.</td>
<td></td>
</tr>
<tr>
<td>9 Wire harness in manipulator (SLU-axes wires)</td>
<td>Visual, Multimeter</td>
<td>Check for conduction between the main connector of base and intermediate connector with manually shaking the wires. Check for wear of protective spring.</td>
<td></td>
</tr>
<tr>
<td>10 Wire harness in manipulator (BT-axes wires)</td>
<td>Visual, Multimeter</td>
<td>Check for conduction between terminals and wear of protective spring.</td>
<td></td>
</tr>
<tr>
<td>11 Protective tubing (velcro type)</td>
<td>Visual</td>
<td>Check for holes or tears, and adhesion of spatters. Replace it if any.</td>
<td></td>
</tr>
<tr>
<td>12 Battery pack in manipulator</td>
<td>Replace the battery pack when the battery alarm occurs or the manipulator drove for 36000H.</td>
<td>Replace spatters.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Service Company</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Table continues on Sheet 2.
9 Maintenance and Inspection

9.1 Inspection Schedule

MH12

13 S-axis speed reducer
- Grease Gun Check for malfunction. (Replace if necessary.)
- Supply grease (6000H cycle). See section 9.3.1.
- Replace grease (12000H cycle). See section 9.3.1.

14 Speed reducers for L- and U-axes
- Grease Gun Check for malfunction. (Replace if necessary.)
- Supply grease (6000H cycle). See section 9.3.2 and section 9.3.3.
- Replace grease (12000H cycle). See section 9.3.2 and section 9.3.3.

15 R-axis speed reducer
- Grease Gun Check for malfunction. (Replace if necessary.)
- Supply grease (6000H cycle). See section 9.3.4.

16 B-axis speed reducer
- Grease Gun Check for malfunction. (Replace if necessary.)
- Supply grease (6000H cycle). See section 9.3.5.

17 T-axis gear
- Grease Gun Check for malfunction. (Replace if necessary.)
- Supply grease (6000H cycle). See section 9.3.6.

18 Overhaul

Table 9-2: Inspection Parts and Grease Used

<table>
<thead>
<tr>
<th>No.</th>
<th>Grease Used</th>
<th>Inspected Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>12, 13</td>
<td>VIGO Grease RE No. 6</td>
<td>Speed reducers for S-, L- and U-axes</td>
</tr>
<tr>
<td>14, 15</td>
<td>Harmonic Grease SK-1A</td>
<td>Speed reducers for R- and B-axes, R-axis gear</td>
</tr>
<tr>
<td>16</td>
<td>Alvania EP Grease 2</td>
<td>T-axis gear</td>
</tr>
</tbody>
</table>

1 Inspection No. correspond to the numbers in Fig. 9-1 “Inspection Items”.
2 The occurrence of a grease leakage indicates the possibility that grease has seeped into the motor. This can cause a motor breakdown. Contact your YASKAWA representative.
3 When checking for conduction with multimeter, connect the battery to “BAT” and “OBT” of connectors on the motor side for each axis, and then remove connectors on the detector side for each axis from the motor. Otherwise, the home position may be lost. (Refer to section 9.3.8 “Notes for Maintenance”)
4 Wire harness in manipulator to be replaced at 24000H Inspection.
5 For the grease, refer to Table 9-2 “Inspection Parts and Grease Used”.

Table 9-1: Inspection Items (Sheet 2 of 2)
The numbers in the above table correspond to the numbers in Table 9-1 “Inspection Items”.

Fig. 9-1: Inspection Items
9.2 Notes on Maintenance Procedures

9.2.1 Battery Pack Replacement

The battery packs are installed in the position shown in Fig. 9-2 “Battery Location”. If the battery alarm occurs in the DX200/FS100, replace the battery in accordance with the following procedure:

1. Turn OFF the DX200/FS100 main power supply.
2. Remove the plate fixing screws and the plate on the connector base, then pull the battery pack out to replace it with the new one.
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.

![Battery Location Diagram]

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

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

**NOTE**
Do not allow plate to pinch the cables when reinstalling the plate.
9.3 Notes on Grease Replenishment/Exchange Procedures

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

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

9.3.1 Grease Replenishment/Exchange for S-Axis Speed Reducer

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

![S-Axis Speed Reducer Diagram]

9.3.1.1 Grease Replenishment

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

Replenish the grease according to the following procedure:

1. Remove the hexagon socket head plugs PT3/8 from the grease inlet and grease exhaust port.
2. Install a grease zerk A-PT3/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)
3. Inject the grease through the grease inlet using a grease gun
   - Grease type: VIGO Grease RE No. 0
   - Amount of grease: 70 cc (140 cc for 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less
4. Move the S-axis for a few minutes to discharge excess grease.
5. Remove the grease zerk from the grease inlet, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug. Then tighten the screw with a tightening torque of 23 N•m (2.34 kgf•m).
6. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plugs. Then tighten the plug with a tightening torque of 23 N•m (2.34 kgf•m).

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**NOTE**

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

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9.3.1.2 Grease Exchange

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

1. Remove the hexagon socket head plugs PT3/8 from the grease inlet and grease exhaust port.

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

3. Inject the grease through the grease inlet using a grease gun.
   - Grease type: VIGO Grease RE No. 0
   - Amount of grease: approx. 450 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

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

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

6. Remove the grease zerk from the grease inlet, and reinstall the plug.
   Before installing the plug, apply Three Bond 1206C on the thread part of the plug. Then tighten the screw with a tightening torque of 23 N•m (2.34 kgf•m).

7. Wipe the discharged grease with a cloth, and reinstall the plug.
   Before installing the plug, apply Three Bond 1206C on the thread part of the plugs. Then tighten the plug with a tightening torque of 23 N•m (2.34 kgf•m).

- Note that the function of grease inlet and grease exhaust port exchanges when the manipulator is mounted on the ceiling.
- If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
- Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.
9.3 Notes on Grease Replenishment/Exchange Procedures

9.3.2 Grease Replenishment/Exchange for L-Axis Speed Reducer

Fig. 9-5: L-Axis Speed Reducer Diagram

9.3.2.1 Grease Exchange

(Refer to Fig. 9-5 "L-Axis Speed Reducer Diagram").

1. Make the L-arm vertical to the ground.
2. Remove the hexagon socket head tapered pipe plug (NPTF type) NPTF3/8 from the grease inlet and remove the hexagon socket head plug PT3/8 from the grease exhaust port.
3. Install a grease zerk A-PT3/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)
4. Inject grease through the grease inlet using a grease gun.
   - Grease type: VIGO Grease RE No. 0
   - Amount of grease: 65 cc (130 cc for 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less
5. Move the L-axis for a few minutes to discharge excess grease.

• Note that the function of grease inlet and grease exhaust port exchanges when the manipulator is mounted on the ceiling.
• If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
• Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.
6. Remove the grease zerk from the grease inlet, and reinstall the hexagon socket head tapered pipe plug (NPTF type) NPTF3/8. Before installing the plug, apply Three Bond 1206C on the thread part of it. Then tighten it with a tightening torque of 23 N•m (2.34 kgf•m). The hexagon socket head tapered pipe plug (NPTF type) protrudes from the L-arm mounting surface. Be careful not to tighten it too much.

7. Wipe the discharged grease with a cloth, and reinstall the hexagon socket head plug PT3/8. Before installing the plug 3/8, apply Three Bond 1206C on the thread part of it. Then tighten it with a tightening torque of 23 N•m (2.34 kgf•m).

### NOTE
When installing a plug to the grease inlet or the grease exhaust port, please be careful not to install the wrong plug. For the corresponding plugs and their installing positions, refer to Fig. 9-5 “L-Axis Speed Reducer Diagram”. Should wrong plug is installed, the tapped hole may damage or the plug may fall inside the L-axis driving part.

### 9.3.2.2 Grease Exchange
(Refer to Fig. 9-5 “L-Axis Speed Reducer Diagram”.)

1. Make the L-arm vertical to the ground.

2. Remove the hexagon socket head tapered pipe plug (NPTF type) NPTF3/8 from the grease inlet and remove the hexagon socket head plug PT3/8 from the grease exhaust port.

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

4. Inject grease through the grease inlet using a grease gun.
   - Grease type: VIGO Grease RE No. 0
   - Amount of grease: approx. 420 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

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

6. Move the L-axis for a few minutes to discharge excess grease.
7. Remove the grease zerk from the grease inlet, and reinstall the hexagon socket head tapered pipe plug (NPTF type) NPTF3/8. Before installing the plug, apply Three Bond 1206C on the thread part of it. Then tighten it with a tightening torque of 23 N•m (2.34 kgf•m). The hexagon socket head tapered pipe plug (NPTF type) protrudes from the L-arm mounting surface. Be careful not to tighten it too much.

8. Wipe the discharged grease with a cloth, and reinstall the hexagon socket head tapered pipe plug (NPTF type) NPTF3/8. Before installing the hexagon socket head tapered pipe plug (NPTF type), apply Three Bond 1206C on the thread part of it. Then tighten it with a tightening torque of 23 N•m (2.34 kgf•m).

When installing a plug to the grease inlet or the grease exhaust port, please be careful not to install the wrong plug. For the corresponding plugs and their installing positions, refer to Fig. 9-5 “L-Axis Speed Reducer Diagram”. Should wrong plug be installed, the tapped hole may damage or the plug may fall inside the L-axis driving part.
9.3.3 Grease Replenishment/Exchange for U-Axis Speed Reducer

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

9.3.3.1 Grease Replenishment

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

1. Make the U-arm horizontal to the ground.
2. Remove the hexagon socket head plug PT3/8 from the grease inlet and the hexagon socket head tapered pipe plug (NPTF type) NPTF3/8 from the grease exhaust port.
3. Install a grease zerk A-PT3/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)
4. Inject grease through the grease inlet using a grease gun.
   - Grease type: VIGO Grease RE No. 0
   - Amount of grease: 40 cc (80 cc for 1st supply)
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less
5. Move the U-axis for a few minutes to discharge excess grease.
6. Remove the grease zerk from the grease inlet, and reinstall the hexagon socket head plug PT3/8. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 23 N·m (2.3 kgf·m).

**NOTE**

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

7. Remove the grease zerk A-PT3/8 from the grease inlet.
7. Wipe the discharged grease with a cloth, and reinstall the hexagon socket head tapered pipe plug (NPTF type) NPTF3/8 to the grease exhaust port. Before installing the plug, apply Three Bond 1206C on the thread part of it, then tighten it with a tightening torque of 23 N•m (2.34 kgf•m). The hexagon socket head tapered pipe plug (NPTF type) NPTF3/8 protrudes from the L-arm mounting surface. Be careful not to tighten it too much.

When installing a plug to the grease inlet or the grease exhaust port, please be careful not to install the wrong plug. For the corresponding plugs and their installing positions, refer to Fig. 9-6 “U-Axis Speed Reducer Diagram”. Should wrong plug is installed, the tapped hole may damage or the plug may fall inside the U-axis driving part.
9.3 Notes on Grease Replenishment/Exchange Procedures

9.3.3.2 Grease Exchange

(Refer to Fig. 9-6 “U-Axis Speed Reducer Diagram”.)

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

2. Remove the hexagon socket head plug PT3/8 from the grease inlet and the hexagon socket head tapered pipe plug (NPTF type) NPTF3/8 from the grease exhaust port.

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

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

   - Grease type: VIGO Grease RE No. 0
   - Amount of grease: approx. 250 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less

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

6. Move the U-axis for a few minutes to discharge excess grease.

7. Remove the grease zerk from the grease inlet, and reinstall the hexagon socket head plug PT3/8. Before installing the plug, apply Three Bond 1206C on the thread part of it, then tighten it with a tightening torque of 23 Nm (2.34 kgf•m).

8. Wipe the discharged grease with a cloth, and reinstall the hexagon socket head tapered pipe plug (NPTF type) NPTF3/8 to the grease exhaust port. Before installing the plug, apply Three Bond 1206C on the thread part of it, then tighten it with a tightening torque of 23 Nm (2.34 kgf•m). The hexagon socket head tapered pipe plug (NPTF type) NPTF3/8 protrudes from the L-arm mounting surface. Be careful not to tighten it too much.

   **NOTE**

   - Note that the function of grease inlet and exhaust port exchanges when the manipulator is mounted on the ceiling.
   - If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
   - Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.
   - When installing a plug to the grease inlet or the grease exhaust port, please be careful not to install the wrong plug. For the corresponding plugs and their installing positions, refer to Fig. 9-6 “U-Axis Speed Reducer Diagram”. Should wrong plug is installed, the tapped hole may damage or the plug may fall inside the U-axis driving part.
9.3 Notes on Grease Replenishment/Exchange Procedures

9.3.4 Grease Replenishment for R-Axis Speed Reducer

Fig. 9-7: R-Axis Speed Reducer Diagram

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

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

3. Inject grease through the grease inlet using a grease gun. (Refer to Fig. 9-7 “R-Axis Speed Reducer Diagram.”)
   - Grease type: Harmonic grease SK-1A
   - Amount of grease: 6 cc

4. Remove the grease zerk from the grease inlet, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 4.9 N•m (0.49 kgf•m).

5. Reinstall the plug to the exhaust port. Before installing the plug, apply Three Bond 1206C on the thread part of the plug, then tighten the plug with a tightening torque of 4.9 N•m (0.49 kgf•m).

**NOTE**

Note that the function of grease inlet and exhaust port exchanges when the manipulator is mounted on the ceiling.

The exhaust port is used for air exhaust, and the grease is not exhausted from the exhaust port. Do not inject excessive grease through the grease inlet.
9.3.5 Grease Replenishment for B-Axis Speed Reducer

Fig. 9-8: B-Axis Speed Reducers Diagram

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

2. Install a grease zerk A-MT6X1 to the grease inlet.
   (The grease zerk is delivered with the manipulator.)

3. Inject grease through the grease inlet using a grease gun
   (Refer to Fig. 9-8 "B-Axis Speed Reducers Diagram").
   - Grease type: Harmonic grease SK-1A
   - Amount of grease: 6 cc

   **NOTE**
   The exhaust port is used for air exhaust, and the grease is not exhausted from the exhaust port. Do not inject excessive grease through the grease inlet.

4. Remove the grease zerk from the grease inlet, and reinstall the screw.
   Before installing the screw, apply Three Bond 1206C on the thread part of the screw, then tighten the screw with a tightening torque of 6 Nm (0.6 kgf•m).

5. Reinstall the screw to the exhaust port. Before installing the screw, apply Three Bond 1206C on the thread part of the screw, then tighten the screw with a tightening torque of 6 Nm (0.6 kgf•m).
9.3.6 Grease Replenishment for T-Axis Gear

Fig. 9-9: T-Axis Gear Diagram

1. Remove the hexagon socket head cap screws M6 from the grease inlet 1 and exhaust port.
2. Install a grease zerk A-MT6X1 to the grease inlet 1. (The grease zerk is delivered with the manipulator.)
3. Inject grease through the grease inlet 1 using a grease gun.
   - Grease type: Alvania EP Grease 2
   - Amount of grease: 2 cc

   The exhaust port is used for air exhaust, and the grease is not exhausted from the exhaust port. Do not inject excessive grease through the grease inlet.

4. Remove the grease zerk from the grease inlet 1, and reinstall the screw. Before installing the screw, apply Three Bond 1206C on the thread part of the screw, then tighten the screw with a tightening torque of 6 N•m (0.6 kgf•m).
5. Remove the hexagon socket head cap screw M6 from the grease inlet 2.
6. Install a grease zerk A-MT6X1 to the grease inlet 2. (The grease zerk is delivered with the manipulator.)
9.3 Notes on Grease Replenishment/Exchange Procedures

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

   **NOTE**  
   The exhaust port is used for air exhaust, and the grease is not exhausted from the exhaust port. Do not inject excessive grease through the grease inlet.

8. Remove the grease zerk from the grease inlet 2, and reinstall the screw. Before installing the screw, apply Three Bond 1206C on the thread part of the screw, then tighten the screw with a tightening torque of 6 N•m (0.6 kgf•m).

9. Reinstall the set screw to the exhaust port. Before installing the set screw, apply Three Bond 1206C on the thread part of the screw, then tighten the screw with a tightening torque of 6 N•m (0.6 kgf•m).
9.3.7 Grease Replenishment for R-Axis Gear

Fig. 9-10: R-Axis Gear Diagram

1. Make the U-arm vertical to the ground.
2. Remove the hexagon socket head plugs PT1/8 from the grease inlet and exhaust port.
   - Note that the function of grease inlet and exhaust port exchanges when the manipulator is mounted on the ceiling.
   - If grease is injected with the plug on, the grease will leak inside the motor and may cause a damage. Make sure to remove the plug before the grease injection.
   - Do not install a joint, a hose, etc. to the grease exhaust port. Failure to observe this instruction may result in damage to the motor due to coming off of an oil seal.
3. Install a grease zerk A-PT1/8 to the grease inlet. (The grease zerk is delivered with the manipulator.)
4. Inject grease through the grease inlet using a grease gun. (Refer to Fig. 9-10 "R-Axis Gear Diagram").
   - Grease type: Harmonic grease SK-1A
   - Amount of grease: 3 cc
   - Air supply pressure of grease pump: 0.3 MPa or less
   - Grease injection rate: 8 g/s or less
5. Move the R-axis for a few minutes to discharge excess grease.
6. Remove the grease zerk from the grease inlet, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug. Then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
7. Wipe the discharged grease with a cloth, and reinstall the plug. Before installing the plug, apply Three Bond 1206C on the thread part of the plug. Then tighten the plug with a tightening torque of 4.9 N•m (0.5 kgf•m).
9.3 Notes on Grease Replenishment/Exchange Procedures

9.3.8 Notes for Maintenance

9.3.8.1 Wrist Unit

The motor and encoder units are provided with the wrist unit. To prevent fumes from penetrating into the wrist unit, the matched parts are sealed with sealing bond. If the wrist cover is disassembled, make sure to reseal with sealing bond (Three Bond 1206C, refer to Table 10-1 “Spare Parts for the YR-MA1440/MH12-A00").

Fig. 9-11: Sealing Part of Wrist Unit

9.3.8.2 Battery Pack Connection

When performing maintenance such as replacement of a wire harness in the manipulator, the encoder connector (with CAUTION label) will be removed. In this case, be sure to connect the battery pack to the battery backup connector before removing the encoder connector.

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

For the battery pack connection, refer to Fig. 9-12(a) "Encoder connector Diagram (for S-, L- and U-Axes)" and Fig. 9-12(b) "Encoder Connector Diagram (for R-, B-, and T-Axes)".

Before removing the encoder connector (with CAUTION label), connect the battery pack referring to the following figures.
9 Maintenance and Inspection
9.3 Notes on Grease Replenishment/Exchange Procedures

Fig. 9-12(a): Encoder connector Diagram (for S-, L- and U-Axes)

Fig. 9-12(b): Encoder Connector Diagram (for R-, B-, and T-Axes)

CAUTION
Connect battery to encoder to save the data before removing connector.
## 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-MH12. 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.

### Table 10-1: Spare Parts for the YR-MA1440/MH12-A00 (Sheet 1 of 2)

<table>
<thead>
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<th>Rank</th>
<th>Parts No.</th>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty per Unit</th>
<th>Remarks</th>
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<td>VIGO Grease RE No. 0</td>
<td>YASKAWA</td>
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<tr>
<td>A</td>
<td>2 Grease</td>
<td>Harmonic Grease SK-1A</td>
<td>Harmonic Drive Systems Co., Ltd.</td>
<td>2.5 kg</td>
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<tr>
<td>A</td>
<td>3 Grease</td>
<td>Alvania EP Grease 2</td>
<td>Showa Shell Sekiyu K.K.</td>
<td>16 kg</td>
<td>-</td>
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<tr>
<td>A</td>
<td>4 Liquid Seal</td>
<td>Three Bond 1206C</td>
<td>Three Bond Co., Ltd.</td>
<td>-</td>
<td>-</td>
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<td>A</td>
<td>5 Battery Pack</td>
<td>HW0A70360-A</td>
<td>YASKAWA</td>
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<tr>
<td>A</td>
<td>6 Battery Pack</td>
<td>HW0470932-A</td>
<td>YASKAWA</td>
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<td>-</td>
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<tr>
<td>A</td>
<td>7 Protective Tubing (velcro type)</td>
<td>MTK-50FR</td>
<td>YASKAWA</td>
<td>1.1 m</td>
<td>-</td>
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<td>B</td>
<td>8 B-Axis Timing Belt</td>
<td>60S3M642</td>
<td>Mitsubishi Belting Limited</td>
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<td>60S3M6819</td>
<td>Mitsubishi Belting Limited</td>
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<td>YASKAWA</td>
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<td>B</td>
<td>11 S-Axis Input Gear</td>
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<td>B</td>
<td>14 U-Axis Speed Reducer</td>
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<td>B</td>
<td>15 U-Axis Input Gear</td>
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<td>YASKAWA</td>
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<td>B</td>
<td>16 R-Axis Speed Reducer</td>
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<td>B</td>
<td>17 B-Axis Speed Reducer</td>
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<td>B</td>
<td>18 R-Axis Gear</td>
<td>HW1303246-1 HW1303247-1</td>
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<td>1 each 1 each</td>
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<td>B</td>
<td>19 T-Axis Gear (Output Side)</td>
<td>HW1371294-A</td>
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For replacing parts in Rank B or Rank C, contact your YASKAWA representative.
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<th>Type</th>
<th>Manufacturer</th>
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<td>HW1270926-A</td>
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<td>1</td>
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<td>C</td>
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<td>AC Servomotor for S- and U-Axes</td>
<td>SGMRV-09ANA-YR2*</td>
<td>YASKAWA</td>
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<td>2</td>
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<tr>
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<td>L-Axis AC Servomotor</td>
<td>SGMRV-09ANA-YR1*</td>
<td>YASKAWA</td>
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<tr>
<td>C</td>
<td>26</td>
<td>R-, B- and T-Axis AC Servomotors</td>
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<td>YASKAWA</td>
<td>1</td>
<td>1</td>
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<td>C</td>
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<td>SGDR-EFBA02A</td>
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11 Parts List

11.1 S-Axis Unit

Fig. 11-1: S-Axis Unit
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<th>DWG No.</th>
<th>Name</th>
<th>Pcs</th>
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<tr>
<td>1002</td>
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<td>Speed reducer</td>
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</tr>
<tr>
<td>1003</td>
<td>HW0312734-2</td>
<td>Gear</td>
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<tr>
<td>1004</td>
<td>2L-5</td>
<td>Conical spring washer</td>
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<tr>
<td>1005</td>
<td>M5×85</td>
<td>Hexagon socket head cap screw</td>
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<tr>
<td>1006</td>
<td>ATSH8-03</td>
<td>Union</td>
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<td>1007</td>
<td>NB-0860-0.3</td>
<td>Tube</td>
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<td>1008</td>
<td>M6×35</td>
<td>GT-SA bolt</td>
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<td>HW1303263-1</td>
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<td>M8×25</td>
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<td>HW1100499-1</td>
<td>S head</td>
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<td>1028</td>
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<td>TA1-S10</td>
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<td>EZ5036A0</td>
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11.2 L-Axis Unit

Fig. 11-2: L-Axis Unit
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<th>Pcs</th>
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<td>HW1100500-1</td>
<td>L-arm</td>
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<td>HW1304187-1</td>
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<td>HW1405226-1</td>
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<td>HW1100499-1</td>
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11.3 U-Axis Unit

Fig. 11-3: U-Axis Unit
### Table 11-3: U-Axis Unit

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11.4 R-Axis Unit (Shipped in or After August 2014)

Fig. 11-4: R-Axis Unit
### Table 11-4: R-Axis Unit

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*1 Use items shipped in or after August 2014
*2 Use items shipped in or before July 2014
11.5 Wrist Unit

Fig. 11-5: Wrist Unit
Table 11-5: Wrist Unit  (Sheet 1 of 2)

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*1 Use items shipped in or before October 2014
*2 Use items shipped in or after November 2014
*3 Use items shipped in or before December 2014
*4 Use items shipped in or after January 2015
11.6 Gear Unit (No. 5040)

Table 11-6: Gear Unit (No. 5040)

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Fig. 11-6: Gear Unit (No. 5040)