MOTOMAN-MPP3H
MAINTENANCE MANUAL

TYPE:
YR-MPP003H-A00

Procedures described in this maintenance manual should be carried out by the person who took the maintenance-relevant trainings offered by YASKAWA.

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

MOTOMAN INSTRUCTIONS
MOTOMAN-MPP3H INSTRUCTIONS
FS100 INSTRUCTIONS
FS100 OPERATOR’S MANUAL
FS100 MAINTENANCE MANUAL

The FS100 OPERATOR’S MANUAL above is applicable to both FS100 and FS100L controllers.

Part Number: 178464-1CD
Revision: 0
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1 Introduction

MANDATORY

- This maintenance manual is intended to explain maintenance procedures primarily for the MOTOMAN-MPP3H.
- General items related to safety are listed in Chapter 1: Safety of the FS100 Instructions. To ensure correct and safe operation, carefully read the 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 and maintenance 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.
1 Introduction

1.1 National Safety Standard for Industrial Robots and Robot Systems

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.
1.2 Notes for Safe Operation

Read this manual carefully before installation, operation, maintenance, or inspection of the FS100.

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.

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

**DANGER**

- 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.
1.2 Notes for Safe Operation

**WARNING**

- Before maintenance, inspection, or wiring, 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.

- After maintenance, check the home position before operating the manipulator.

Injury may result from unexpected manipulator motion.

- Before operating the manipulator, check that servo power is turned OFF by pressing the emergency stop buttons on 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. 1-1: 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. 1-2: 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.
1 Introduction
1.2 Notes for Safe Operation

WARNING

- 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 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 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 the programming pendant.

CAUTION

- Perform maintenance inspection with the specific person who took the maintenance training course in YASKAWA.

Failure to observe this may result in electric shock or injury.
- When the maintenance inspection is performed, be sure to mount the battery pack before removing the motor encoder connector.

Failure to observe this caution may result in disappearance of the home position data.
- 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 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 FS100 Instructions before operating the manipulator.
1.3 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 defined as follows:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Manual Definition</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>Robot</td>
<td>Manipulator</td>
</tr>
<tr>
<td>FS100 programming pendant dummy connector</td>
<td>Programming pendant dummy connector</td>
</tr>
</tbody>
</table>

1.4 Registered Trademark

In this manual, names of companies, corporations, or products are trademarks, registered trademarks, or brand names for each company or corporation. The indications of (R) and TM are omitted.
1.5 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.
1.6 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).

1.7 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.
1.8 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.
1.9 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.

1.10 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.
1.11 Customer Support Information

If you need assistance with any aspect of your MPP3H 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: MPP3H
- Primary Application: ___________________________
- Controller: FS100/FS100L
- 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 FS100/FS100L controller data plate
2 Notes for Maintenance

2.1 Battery Pack Connection

- Prepare a battery (HW9470932-A)
  For the battery, refer to “Chapter 11 Recommended Spare Parts” in "MOTOMAN-MPP3H INSTRUCTIONS (170715-1CD).

Before removing the encoder connector (with CAUTION label), connect the battery pack referring to the following figure.

*Fig. 2-1: Battery Pack Connector Diagram for S-, L-, U-, and T-axes*
3 Home Position Return

In the following cases, perform calibration and set manipulator geometrical positions.

- Change in the combination of the MOTOMAN and the control unit
- Replacement of the motor or absolute encoder
- Clearing stored memory
- Home position deviation caused by hitting the MOTOMAN against a workpiece, etc.
- Replacement, disassembly, and reassembly of the main body parts such as speed reducers etc.

Before the calibration, be sure that the manipulator satisfies following conditions.

- No external force is applied to the manipulator.
- The hand and other parts attached to the wrist unit are removed.

Table 3-1: List of Required Parts

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Manufacturer</th>
<th>Qty</th>
<th>Configuration</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positioning key</td>
<td>HW1404899-1</td>
<td>YASKAWA</td>
<td>1</td>
<td></td>
<td>Delivered with the manipulator</td>
</tr>
</tbody>
</table>

The parts in Table 3-1 “List of Required Parts” is required for calibration.
3.1 S-, L-, and U-Axes Positioning

- To return the manipulator to the home position, refer to Fig. 3-1 “S-, L-, and U-axes Home Position Calibration” while performing the following procedures.

1. Place 5f7 part of the positioning key (HW1404899-1) to each axis positioning area on the base unit, and then perform a temporal home position registration with the positioning key between the arm. (Perform this positioning to each axis.)

2. Rotate the arm "+20134 pulse" from the position registered in step 1, and then register the home position again. (Position where the rotational center and ball joint are horizontal)

Fig. 3-1: S-, L-, and U-axes Home Position Calibration

3.2 T-Axis Positioning

As shown in Fig. 3-2 “T-axis Home Position Calibration”, insert the positioning key (HW1404899-1) in the keyways in the base unit and turn the flange to the + side at a low (or inching) speed.

Register the position where the positioning key is fixed with the keyways as a home position.

Fig. 3-2: T-axis Home Position Calibration
4 Grease Replenishment and Exchange

4.1 Notes on Grease Replenishment Procedures

Make sure to follow the instructions listed below at grease replenishment. 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, 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.
- Use a hand grease gun or an injector to inject grease.
4.1.1 Grease Replenishment for S-, L-, and U-axes Speed Reducer

*Fig. 4-1: S-, L-, and U-Axes Grease Inlet*
4 Grease Replenishment and Exchange

4.1 Notes on Grease Replenishment Procedures

Table 4-1: S-, L-, and U-Axes Grease inlet Checklist

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Qty</th>
<th>Remark</th>
</tr>
</thead>
</table>
| 1  | Cap HW1404660-1  
     | Gasket HW1404661-1 | 1 each |        |
| 2  | Eyebolt M16 (stainless) | 3 |        |
| 3  | Hexagon socket head cap sems screw M5  
     | (length: 16 mm) (stainless) | 12 | Tightening torque: 5.0N\(\cdot\)m (0.49kgf\(\cdot\)m) |
| 4  | Hexagon socket head cap sems screw M4  
     | (length: 10 mm) (stainless) | 6 | Tightening torque: 2.4N\(\cdot\)m (0.24kgf\(\cdot\)m) |
| 5  | Cover HW1304209-1  
     | Gasket HW1304120-1 | 1 each |        |
| 6  | Connector base unit HW1371524-A  
     | Gasket HW1404665-1 | 1 each |        |
| 7  | Plug KQP-08 | 1 |        |
| 8  | Plug KQP-06 | 1 |        |

4.1.1 Grease Replenishment

(Refer to Fig. 4-1 “S-, L-, and U-Axes Grease Inlet”.)

Replenish the grease according to the following procedure:

1. Turn OFF the power supply to the FS100.
2. Remove the manipulator cables.
3. Remove the cap and its gasket ①, the eyebolt ② and the hexagon socket head cap sems screws ③ and ④. And then, remove the cover and its gasket ⑤, the connector base unit and its gasket ⑥. (Rotate to down the connector base ⑥ into the connector base fitting hole on the cover ⑤, and then remove the cover ⑤.)
4. Remove the plug ⑦ from the exhaust port and remove the plug ⑧ from the grease inlet.
5. Install a hand grease gun or an injector to the grease inlet.
6. Inject grease through the grease inlet.
   - Grease type: Synaxreme FG-0
   - Amount of grease: 5 cc (10 cc for 1st supply)
7. Remove the grease gun or the injector from the grease inlet, and then reinstall the plug ⑦ to the exhaust port and the plug ⑧ to the grease inlet.
8. Pull up the connector base unit ⑥ from the connector base fitting hole on the cover ⑤.
9. Reinstall the cover and its gasket ⑤ with the hexagon socket head cap sems screws ③. Reinstall the connector base and its gasket ⑥ with the hexagon socket head cap sems screws ④. Tighten the screws with the tightening torque shown in Table 4-1 “S-, L-, and U-Axes Grease inlet Checklist”.
10. Reinstall the cap and its gasket ① and the eyebolt ②.
4.1.2 Grease Replenishment for T-axis Speed Reducer

Fig. 4-2: T-axis Speed Reducer Diagram

4.1.2.1 Grease Replenishment

(Refer to Fig. 4-2 “T-axis Speed Reducer Diagram”.)

Replenish the grease according to the following procedure:

1. Remove the cover, and then remove the M6 × 6 (one screw) bolt and LP-M5 (one plug) plug from the grease inlet and from the grease exhaust port.

2. Install a grease zerk A-MT6 x 1 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: Synaxreme FG-0
   - Amount of grease: 1cc (2cc for 1st supply)

4. Remove the grease zerk from the grease inlet, and install the hexagon socket head cap screw M6 × 6 (one screw) to the grease inlet.
   (Tightening torque: 8N·m (0.81kgf·m))
   Before installing the bolt, apply Three Bond 1206C on the thread part of the screw.

5. Before installing the plug to the grease exhaust port, operate T-axis for several tens of minutes to purge all grease from the exhaust port.

6. Wipe away any grease that was discharged, and then install the LP-M5 (one plug) plug to the grease exhaust port.
   Before installing the plug, apply Three Bond 1206C on the thread part of the plug.

7. Install the cover.
5 Disassembly and Reassembly of the Motor

5.1 Disassembly and Reassembly of the S-, L-, and U-axes Motor

- Refer to Fig. 5-1 “Disassembly and Reassembly of S-, L-, and U-axes Motor”.


If you replace the motor, you don’t need to insert the backup battery.

Disassembly

1. Turn OFF the power supply to the FS100.
2. Remove the manipulator cables from the manipulator.
3. Remove the seal cap ②. Unscrew the hexagon socket head cap screws ③ to remove the U-arm ④.  
   (Refer to chapter 10 “Disassembly and Reassembly of the U-arm”.)
4. Remove the cap and its gasket ⑤, the eyebolts ⑥, and the hexagon socket head cap screws ⑦ and ⑧. And then remove the cover and its gasket ⑨ and the connector base unit and its gasket ⑩.  
   (Rotate to down the connector base unit ⑪ into the connector base fitting hole on the cover ⑫ (Arrow B), and then remove the cover ⑬.)
5. Cut the cable ties to remove the joint and the cable which are fixed to the plate ⑬.  
   Only for the S-axis, unscrew the hexagon socket head cap screws ⑭ to remove the battery unit ⑮.
6. Unscrew the hexagon socket head cap screws ⑯ to remove the plate ⑰ and the sheets ⑱.
7. Remove the vinyl cover protecting the connector (encoder cables) parts of the internal wiring harness connected to the motor ⑳. Then connect the backup battery.  
   (Refer to chapter 2 “Notes for Maintenance” at page 2-1)
8. Remove the vinyl cover protecting the connector (power cables) parts of the internal wiring harness connected to the motor ⑳. Then disconnect the cables (both power and encoder cables).
9. Unscrew the hexagon socket head cap screws ㉑ to remove the S-, L-, and U-axes drive unit ㉒.
10. Unscrew the screws ㉓ and ㉔ to remove the motor ㉕ from the drive unit.
11. Unscrew the hexagon socket head cap screw ㉖ to remove the pulley ㉗.  
    (For preventing the pulley ㉗ from rotating, use the 3 dia. hole (2 places) located on the surface of the pulley.)
12. Unscrew the hexagon socket head cap screws ㉘ to remove the M-base ㉙ and the motor ㉚.
Disassembly and Reassembly of the Motor
5.1 Disassembly and Reassembly of the S-, L-, and U-axes Motor

Reassembly

1. Install the motor ⚫ to the M-base ⚫ by tightening the hexagon socket head cap screws ⚫ with the tightening torque shown in Table 5-1 “S-, L-, and U-axes Motor Parts Checklist”.

2. Install the pulley ⚫ to the motor ⚫.

3. Apply LOCTITE 243 to the thread part of the hexagon socket head cap screw ⚫. Tighten the screw with the tightening torque shown in Table 5-1. (For preventing the pulley ⚫, use the 3 dia. hole (2 places) located on the surface of the pulley ⚫.)

4. Hook the belt on the pulley ⚫, and then set the hexagon socket head cap screws ⚫.

5. Install the motor ⚫ to the drive unit ⚫ using the hexagon socket head cap screw ⚫ with the tightening torque shown in Table 5-1. (Refer to chapter 7 “Adjustment of S-, L-, and U-axes Timing Belt” to adjust the tension of the belt.)

6. Tighten the hexagon socket head cap screws ⚫ to install the drive unit ⚫ to the base.

7. Connect the cables (both encoder and power cables) of the internal wiring harness to the motor ⚫, disconnect the backup battery, and then protect the connector parts with the vinyl cover.

8. Cut the sheets (two pieces) (180 x 60) ⚫ to the size (135 x 60) and (45 x 60) respectively. Superpose the sheet (two pieces) (135 x 60) on the motor, and arrange other two sheets (45 x 60) on the base machined part, and then attach them without air entrainment.

9. Install the plate ⚫ with the hexagon socket head cap screws ⚫. (Apply the tightening torque shown in Table 5-1.)

10. Fix the joint and the cable with the cable ties. Only for the S-axis, install the battery unit ⚫ with the hexagon socket head cap screws ⚫. (Apply the tightening torque shown in Table 5-1.)

11. Pull up the connector base unit ⚫ from the connector base fitting hole on the cover ⚫. (Opposite direction to Arrow B in Fig. 5-1.)

12. Install the cover and its gasket ⚫ with the hexagon socket head cap screws ⚫, and the connector base and its gasket ⚫ with the hexagon socket head cap screws ⚫ respectively. (Apply the tightening torque shown in Table 5-1.)

13. Install the cap and its gasket ⚫ and the eyebolts ⚫.

14. Install the U-arm ⚫ with the hexagon socket head cap screws ⚫, and then cover it with the seal cap ⚫. (Refer to chapter 10 “Disassembly and Reassembly of the U-arm”.)

15. Calibrate the home positions of the axis that have been replaced. (Refer to section 3.1 “S-, L-, and U-Axes Positioning”.)
Table 5-1: S-, L-, and U-axes Motor Parts Checklist

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Qty</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Motor of each axis HW13801060-1</td>
<td>1</td>
<td>SGMAV-10ANA-YR1* Parts for S-, L- and U-axes motor kit</td>
</tr>
<tr>
<td>②</td>
<td>Seal cap SC90-10N</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>③</td>
<td>Hexagon socket head cap screw M8 (length: 55 mm) GT-LH Washer M8</td>
<td>6 each</td>
<td>Tightening torque: 40 N(\cdot)m (4.1 kgf(\cdot)m) Parts for S-, L- and U-axes motor kit</td>
</tr>
<tr>
<td>④</td>
<td>U arm HW1200153-2 HW1200153-3</td>
<td>1 each</td>
<td>For S-axis For L-, and U-axes</td>
</tr>
<tr>
<td>⑤</td>
<td>Cap HW1404660-1 Gasket HW1404661-1</td>
<td>1 each</td>
<td></td>
</tr>
<tr>
<td>⑥</td>
<td>Eyebolt M16 (STAINLESS)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>⑦</td>
<td>Hexagon socket head cap screw M5 (length: 16 mm) (STAINLESS)</td>
<td>12</td>
<td>Tightening torque: 5.0 N(\cdot)m (0.49 kgf(\cdot)m)</td>
</tr>
<tr>
<td>⑧</td>
<td>Hexagon socket head cap screw M4 (length: 10 mm) (STAINLESS)</td>
<td>6</td>
<td>Tightening torque: 2.4 N(\cdot)m (0.24 kgf(\cdot)m)</td>
</tr>
<tr>
<td>⑨</td>
<td>Cover HW1304209-1 Gasket HW1304210-1</td>
<td>1 each</td>
<td></td>
</tr>
<tr>
<td>⑩</td>
<td>Connector base unit HW1371524-A Gasket HW1404665-1</td>
<td>1 each</td>
<td></td>
</tr>
<tr>
<td>⑪</td>
<td>Plate HW1304211-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑫</td>
<td>Hexagon socket head cap screw M4 (length: 10 mm) Washer M4</td>
<td>2 each</td>
<td>Tightening torque: 2.8 N(\cdot)m (0.29 kgf(\cdot)m)</td>
</tr>
<tr>
<td>⑬</td>
<td>Battery unit</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑭</td>
<td>Hexagon socket head cap screw M4 (length: 20 mm) Washer M4</td>
<td>2 each</td>
<td>Tightening torque: 1.2 N(\cdot)m (0.12 kgf(\cdot)m)</td>
</tr>
<tr>
<td>⑮</td>
<td>Sheet HW1482394-B</td>
<td>2</td>
<td>Parts for S-, L- and U-axes motor kit</td>
</tr>
<tr>
<td>⑯</td>
<td>Hexagon socket head cap screw M6 (length: 30 mm) GT-LH Washer M6</td>
<td>5 each</td>
<td>Tightening torque: 16.5 N(\cdot)m (1.7 kgf(\cdot)m) Parts for S-, L- and U-axes motor kit</td>
</tr>
<tr>
<td>⑰</td>
<td>M base HW1200063-1</td>
<td>1</td>
<td>Drive unit</td>
</tr>
<tr>
<td>⑱</td>
<td>Hexagon socket head cap screw M5 (length: 30 mm) Washer M5</td>
<td>2 each</td>
<td></td>
</tr>
<tr>
<td>⑲</td>
<td>Hexagon socket head cap screw M5 (length: 30 mm) Conical spring washer 2H-5 Washer M5 Washer HW8411125-3</td>
<td>4 each</td>
<td>Tightening torque: 6.0 N(\cdot)m (0.6 kgf(\cdot)m)</td>
</tr>
<tr>
<td>⑳</td>
<td>Hexagon socket head cap screw M6 (length: 20 mm) Conical spring washer 2H-6</td>
<td>1 each</td>
<td>Tightening torque: 16.5 N(\cdot)m (1.7 kgf(\cdot)m) Parts for S-, L- and U-axes motor kit</td>
</tr>
<tr>
<td>㉑</td>
<td>Pulley HW1401219-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>㉒</td>
<td>Hexagon socket head cap screw M5 (length: 20 mm) Conical spring washer 2H-5 Washer M5</td>
<td>4 each</td>
<td>Tightening torque: 8.4 N(\cdot)m (0.85 kgf(\cdot)m) Parts for S-, L- and U-axes motor replacement kit</td>
</tr>
<tr>
<td>㉓</td>
<td>M base HW1401298-1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Fig. 5-1: Disassembly and Reassembly of S-, L-, and U-axes Motor
5.2 Disassembly and Reassembly of T-axis Motor

- Refer to Fig. 5-2 “Disassembly and Reassembly of T-axis Motor”.

**Disassembly**

1. Place the T-axis unit on a working table carefully so that the unit does not fall off the table.
2. Turn OFF the power supply to the FS100.
3. Remove the L-arm (Refer to section 10.2.3 L-Arm Removal and Installation and Relay Lead Fixing Procedures” in “Chapter 10 Maintenance and Inspection” in MOTOMAN-MPP3H INSTRUCTIONS (170715-1CD).)
4. Remove the cover (Refer to chapter 2 “Notes for Maintenance”.
5. Remove the vinyl cover protecting the connector (encoder cable) parts of the relay lead connected to the T-axis motor. Then connect the backup battery. (Refer to chapter 2 “Notes for Maintenance”)
6. Remove the vinyl cover protecting the connector (power cable) parts of the relay lead connected to the T-axis motor. Then disconnect the cables (encoder and power cables) of the internal wiring harness.
7. Unscrew the hexagon socket head cap screws and.
8. Remove the flange (with the circular spline attached).
9. Unscrew the hexagon socket head cap screw to remove the wave generator. (To fix the wave generator, use the 4 dia. hole (2 places) located on the surface of the wave generator.)

**Reassembly**

1. Set the T-axis motor to the base, and then install the wave generator to the motor shaft.
2. Apply LOCTITE 243 to the thread part of the hexagon socket head cap screw. 
   (To fix the wave generator, use the 4 dia. hole (2 places) located on the surface of the wave generator.)
3. Apply ThreeBond 1206C to the contact surface between the circular spline and the base.
4. Install the flange (with the circular spline attached) with the hexagon socket head cap screws.
   (Apply the tightening torque shown in Table 5-2.)
5. Install the T-axis motor ① with the GT-SA bolts ②.  
   (Apply the tightening torque shown in Table 5-2.)

6. Connect the cables (encoder, power and application cables) of the 
   relay lead to the T-axis motor ③, disconnect the backup battery, and 
   then protect the connector parts with the vinyl covers.

7. Install the cover ④.

8. Install the L-arm ⑤.  
   (Refer to section 10.2.3 L-Arm Removal and Installation and Relay 
   Lead Fixing Procedures" in "Chapter 10  Maintenance and Inspection" 
   in MOTOMAN-MPP3H INSTRUCTIONS (170715-1CD).)

9. Turn ON the power supply to the FS100.

Table 5-2: T-axis Motor Parts Checklist

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Qty</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>T-axis Motor HW1382892-A</td>
<td>1</td>
<td>SGMAV-01ANA-YR22</td>
</tr>
<tr>
<td>②</td>
<td>L-arm HW1303760-B</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>③</td>
<td>Cover HW1404415-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>④</td>
<td>GT-SA bolt M3 x 10</td>
<td>2</td>
<td>Tightening torque: 1.4 N·m (0.14 kgf·m)</td>
</tr>
<tr>
<td>⑤</td>
<td>Hexagon socket head cap screw M3</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(length: 25 mm)</td>
<td></td>
<td>Tightening torque: 1.4 N·m (0.14 kgf·m)</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>⑥</td>
<td>Flange HW1301665-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑦</td>
<td>Hexagon socket head cap screw M3</td>
<td>1</td>
<td>Tightening torque: 2.25 N·m (0.23 kgf·m)</td>
</tr>
<tr>
<td></td>
<td>(length: 12 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑧</td>
<td>Speed reducer HW1380868-A</td>
<td>1</td>
<td>Wave generator</td>
</tr>
<tr>
<td>⑨</td>
<td>Base HW1200291-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑩</td>
<td>Speed reducer HW1380868-A</td>
<td>1</td>
<td>Circular spline</td>
</tr>
</tbody>
</table>

Fig. 5-2: Disassembly and Reassembly of T-axis Motor
6 Disassembly and Reassembly of Speed Reducer

6.1 Disassembly and Reassembly of S-, L-, and U-axes Speed Reducer

• Refer to Fig. 6-1 “Disassembly and Reassembly of S-, L-, and U-axes Speed Reducer”.

**NOTE** Refer to chapter 3 “Home Position Return”, chapter 4 “Grease Replenishment and Exchange”, chapter 5 “Disassembly and Reassembly of the Motor”.

**Disassembly**

1. Follow steps from (1) to (9) of “Disassembly” in section 5.1 “Disassembly and Reassembly of the S-, L-, and U-axes Motor”.
2. Loosen the hexagon socket head cap screws ② and ③ to remove the belt ①.
3. Unscrew the hexagon socket head cap screws ④ to remove the speed reducer ⑤ from the drive unit ⑥.
4. Unscrew the hexagon socket head cap screw ⑦ to remove the pulley ⑧. (For preventing the pulley ⑧ from rotating, use the two areas (width: 36 mm) of the tip of the pulley.)
5. Loosen the hexagonal part of the elbow joints ⑨ and ⑩, and then remove all the pipings for grease.

**Reassembly**

1. Fill the pipings for grease replenishment with grease without air entrainment.
   – Grease type: SYNXTREME FG-0
2. Install the respective pipings for grease replenishment and for air exhaust on the speed reducer ① and tie them up using the cable ties below the motor. (Pay attention not to install them on the wrong places.)
3. Install the speed reducer ① to the pulley ⑧.
4. Apply LOCTITE 243 to the thread part of the hexagon socket head cap screw ⑦. Tighten the screw with the tightening torque shown in Table 6-2 “S-, L-, and U-axes Motor Parts Checklist”. (For preventing the pulley ⑧ from rotating, use the two areas (width: 36 mm) of the tip of the pulley.)
5. Install the speed reducer ① to the drive unit ⑥ with the hexagon socket head cap screws ⑧. (Apply the tightening torque shown in table Table 6-2.)
6. Hook the belt ① on the pulley ⑧.
7. Install the motor ① to the drive unit ⑥ by tightening the hexagon socket head cap screw ② with the tightening torque shown in Table 6-2. Refer to chapter 7 “Adjustment of S-, L-, and U-axes Timing Belt” to adjust the tension of the belt.
8. Follow steps from (5) to (15) of “Reassembly” in section 5.1 “Disassembly and Reassembly of the S-, L-, and U-axes Motor”.

Refer to chapter 3 “Home Position Return”, chapter 4 “Grease Replenishment and Exchange”, chapter 5 “Disassembly and Reassembly of the Motor”.
Table 6-2: S-, L-, and U-axes Motor Parts Checklist

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Qty</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Speed reducer HW13801062-A</td>
<td>1</td>
<td>Parts for S-, L-, and U-axes speed reducer kit</td>
</tr>
<tr>
<td>2</td>
<td>Hexagon socket head cap screw M5 (length: 30 mm) Conical spring washer 2H-5 Nut M5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Hexagon socket head cap screw M5 (length: 30 mm) Conical spring washer 2H-5 Washer M5 Washer HW8411125-3</td>
<td>4 each</td>
<td>Tightening torque: 6.0 N·m (0.6 kgf·m)</td>
</tr>
<tr>
<td>4</td>
<td>Belt 250HP-S5M560</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Hexagon socket head cap screw M10 (length: 40 mm) Conical spring washer 2H-10</td>
<td>4 each</td>
<td>Tightening torque: 68 N·m (6.9 kgf·m)</td>
</tr>
<tr>
<td>6</td>
<td>M base HW1200063-1</td>
<td>1</td>
<td>Drive unit</td>
</tr>
<tr>
<td>7</td>
<td>Hexagon socket head cap screw M6 (length: 20 mm) Conical spring washer 2H-6</td>
<td>1 each</td>
<td>Tightening torque: 16.5 N·m (1.7 kgf·m) Parts for S-, L-, and U-axes speed reducer kit</td>
</tr>
<tr>
<td>8</td>
<td>Pulley HW1401218-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Joint elbow: PH6-01</td>
<td>1</td>
<td>For grease replenishment</td>
</tr>
<tr>
<td>10</td>
<td>Joint elbow: PH8-01</td>
<td>1</td>
<td>For air exhaust</td>
</tr>
</tbody>
</table>

Fig. 6-1: Disassembly and Reassembly of S-, L-, and U-axes Speed Reducer

![Diagram of S-, L-, and U-axes Speed Reducer]
6.2 Disassembly and Reassembly of T-axis Speed Reducer

- Refer to Fig. 6-2 “Disassembly and Reassembly of the T-axis Speed Reducer”.

Refer to chapter 3 “Home Position Return”, chapter 4 “Grease Replenishment and Exchange”, chapter 5 “Disassembly and Reassembly of the Motor”. Remove old sealing from each parts before assembling.

**Disassembly**
1. Follow steps from (1) to (9) of ■ “Disassembly” in section 5.2 “Disassembly and Reassembly of T-axis Motor”.
2. Remove the built-up grease inside the flange ② (with the circular spline ① attached).
3. Unscrew the hexagon socket head cap screws ③ to remove the flange ② and the circular spline ①.
4. Remove the oil seal ④.

**Reassembly**
1. Install the oil seal ④.
2. Apply ThreeBond 1206C to the contact surface between the flange ② and the circular spline ①, and then attach the circular spline ① to the flange ②.
3. Attach the circular spline ① by tightening the hexagon socket head cap screw ③ with the tightening torque shown in Table 6-1.
4. Fill the circular spline ① with grease.
   - Grease type: SYNXTREME FG-0
5. Follow steps from (1) to (9) of ■ “Reassembly” in section 5.2 “Disassembly and Reassembly of T-axis Motor”.

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Qty</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Speed reducer HW1380868-A</td>
<td>1</td>
<td>Circular spline Parts for T-axis speed reducer kit</td>
</tr>
<tr>
<td>②</td>
<td>Flange HW1301665-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>③</td>
<td>Hexagon socket head cap screw M3 (length: 25 mm) Conical spring washer 2H-3</td>
<td>14 each</td>
<td>Tightening torque: 1.4 N·m (0.14 kgf·m) Parts for T-axis speed reducer kit</td>
</tr>
<tr>
<td>④</td>
<td>Oil seal SC12.67X22.22X4.7/FK</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
6 Disassembly and Reassembly of Speed Reducer
6.2 Disassembly and Reassembly of T-axis Speed Reducer

Fig. 6-2: Disassembly and Reassembly of the T-axis Speed Reducer
7 Adjustment of S-, L-, and U-axes Timing Belt

7.1 Disassembly and Reassembly of S-, L-, and U-Axes Timing Belt

- Refer to Table 7-1 “S-, L-, and U-axes Timing Belt Parts Checklist” and Fig. 7-1 “Disassembly and Reassembly of S-, L-, and U-axes Timing Belt”.
- Refer to section 5.1 “Disassembly and Reassembly of the S-, L-, and U-axes Motor”.

**Disassembly**
1. Follow steps from (1) to (10) of “Disassembly” in section 5.1 “Disassembly and Reassembly of the S-, L-, and U-axes Motor”.
2. Remove the S-, L-, and U-axes motor ① and unhook the S-, L-, and U-axes timing belt ②.

**Reassembly**
1. Follow steps from (4) to (16) of “Reassembly” in section 5.1 “Disassembly and Reassembly of the S-, L-, and U-axes Motor”.

### Table 7-1: S-, L-, and U-axes Timing Belt Parts Checklist

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Qty</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Motor of each axis HW13801060-1</td>
<td>1</td>
<td>SGMAV-10ANA-YR11</td>
</tr>
<tr>
<td>②</td>
<td>Belt 250HP-S5M560</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>③</td>
<td>Hexagon socket head cap screw M5 (length: 30 mm)</td>
<td>4 each</td>
<td>Tightening torque: 6.0 N-m (0.6 kgf-m)</td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Washer M5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Washer HW8411125-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>④</td>
<td>Hexagon socket head cap screw M5 (length: 30 mm)</td>
<td>2 each</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conical spring washer 2H-5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nut M5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7 Adjustment of S-, L-, and U-axes Timing Belt

7.1 Disassembly and Reassembly of S-, L-, and U-Axes Timing Belt

Fig. 7-1: Disassembly and Reassembly of S-, L-, and U-axes Timing Belt
7.2 Adjustment of Timing Belt

1. Follow steps from (1) to (5) of  “Disassembly” in section 5.1 “Disassembly and Reassembly of the S-, L-, and U-axes Motor”.

2. Cut the cable ties to remove the joint and the cable which are fixed to the plate.
   Only for the S-axis, unscrew the hexagon socket head cap screws to remove the battery unit.

3. Unscrew the hexagon socket head cap screws to remove the plate.

4. Loosen the hexagon socket head cap screws. Adjust the tension of the timing belt by tightening the hexagon socket head cap screws to the direction that the timing belt is stretched.

5. Using a tension meter, adjust the tension of the timing belt to fall within the initial tension range shown in Table 7-2 “Initial Tension of Timing Belt”.

6. Tighten the hexagon socket head cap screws with the specified tightening torque. Double-check that the initial tension of the timing belt falls within the initial tension range shown in Table 7-2.
   (Set a tension meter as follows: belt mass as 38g (10 mm (W) x 1 m (L)), belt width as 25 mm, and distance between axes as 191 mm.)

7. Tighten the hexagon socket head cap screws to install the plate.

8. Fix the joint and the cable with using the cable ties.
   Only for the S-axis, install the battery unit with the hexagon socket head cap screws.
   (Apply the tightening torque shown in Table 5-2 “T-axis Motor Parts Checklist”.)

9. Follow steps from (1) to (5) of  “Reassembly” in section 5.1 “Disassembly and Reassembly of the S-, L-, and U-axes Motor”.

Table 7-2: Initial Tension of Timing Belt

<table>
<thead>
<tr>
<th>S-, L-, and U-axes</th>
<th>Initial Tension</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>250 to 291 N (25.5 to 29.7 kgf)</td>
</tr>
</tbody>
</table>
8 Battery Pack Replacement

8.1 Battery Pack Replacement

The battery packs are installed in the position shown in Fig. 8-1 “Battery Location”.

If the battery alarm occurs in the FS100, replace the battery in accordance with the following procedure:

Fig. 8-1: Battery Location

NOTE

Remove the old battery pack after connecting the new one so that the encoder absolute data does not disappear.
8. Battery Pack Replacement
8.1 Battery Pack Replacement

1. Follow steps from (1) to (4) of "Disassembly" in section 5.1 "Disassembly and Reassembly of the S-, L-, and U-axes Motor".

2. Unscrew the two bolts which are fixing the battery holder to remove the battery unit.

3. Connect the new battery connector to the unoccupied connector on the board.

4. Remove the old battery connector from the board.

5. Remove the old battery from the battery holder, mount the new battery to the holder.

6. Mount the battery holder in its original position.

**NOTE** Do not allow plate to pinch the cables when reinstalling the holder.
9 Relay Lead Cable Replacement

9.1 Relay Lead Cable Replacement

• Refer to Fig. 9-1 “Relay Lead Cable Replacement”.

Disassembly
1. Place the T-axis unit on a working table carefully so that the unit does not fall off the table.
2. Turn OFF the power supply to the FS100.
3. Remove the cover from the T-axis unit.
4. Remove the vinyl cover from the connector (encoder cable) parts of the relay lead connected to the T-axis motor. Then connect the backup battery. (Refer to chapter 2 “Notes for Maintenance”.)
5. Remove the cable ties tying the relay lead cables which are wired to U-arm and L-arm of the S-axis. There are six cable-tied parts to the right side of the L-arm.
6. Separate the T-axis unit by removing the L-arm. At this time, treat the axis unit with caution so that it does not fall off. Also, avoid the relay lead from excess stretching. (Refer to section 10.2.3.1 L-Arm Removal in “Chapter 10 Maintenance and Inspection” in MOTOMAN-MPP3H INSTRUCTIONS (170715-1CD).)
7. Manually loosen the hexagon cap nut on the cable connector, remove multi-opening gasket from the cable and pull out the connector, which is at the cable-relay part, and then remove the connector.

- The battery pack must be connected before removing the detection connector to avoid home position data from loosing.
- Place the T-axis unit (relay lead are equipped) on an appropriate place for working.

8. Remove the vinyl cover protecting the connector (power cable) parts of the relay lead connected to the T-axis motor. Then disconnect the cables (encoder and power cables) of the internal wiring harness.
9. Unscrew the hexagon socket head cap screws. Use a short type tapered head socket set screw wrench to unscrew the screws.

Table 9-1: Relay Lead Cable Replacement

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Qty</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
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<td>④</td>
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<td>Hexagon cap nut</td>
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9 Relay Lead Cable Replacement

9.1 Relay Lead Cable Replacement

Fig. 9-1: Relay Lead Cable Replacement

- (HW1371525( Relay lead assy ))
- Storage place of the connector for PG side
- Storage place of the connector for PW side

Section A-A

<Disassembly and Assembly of Cable Relaying Part>

1. Relaying part of the cable
2. Cable fixing part
3. Blue tube
4. Screwing jig:
   Short type tapered head socket set screw wrench

S-axis side
L-axis side
PG + PW
PG
PW
S-axis
L-axis
U-axis side
U-axis

S-axis side
U-axis side
PG + PW
PG
PW

9 Relay Lead Cable Replacement

9.1 Relay Lead Cable Replacement

**Assembly**

1. Connect the relay lead to the T-axis unit. (By referring to Fig. 9-1 “Relay Lead Cable Replacement”, connect two relay leads (encoder and power) to the left side of the L-arm, and then connect one relay lead (application) to the right side of the L-arm.)

2. Mount the hexagon socket head cap screws (stainless). Use short type tapered head socket set screw wrench to unscrew the screws.

3. Connect the cables (encoder, power and application cables) of the relay lead to the T-axis motor.

4. Store the connectors and the cables into the T-axis base.

5. Connect the relay lead connectors of the base-axis side, and then store them into the T-axis base. At this time, set and fix the multi-opening gasket to the position shown in the Fig. 9-1 “Relay Lead Cable Replacement”. (A thermal compressed tube (black) is attached to one relay lead of the three as a fixing position for the multi-opening gasket.)

6. Disconnect the backup battery, and then protect the connector parts with the vinyl cover.

7. Wipe the L-arm and the ball joint, and then install the L-arm. (Refer to section 10.2.3.2 L-Arm Installation” in “Chapter 10 Maintenance and Inspection” in MOTOMAN-MPP3H INSTRUCTIONS (170715-1CD).)

8. Wire the relay lead to the U-arm and the L-arm of the S-axis. (This wiring helps differentiate each axis.) For the wiring method, refer to section 10.2.3.3 Relay Lead Fixing” in “Chapter 10 Maintenance and Inspection” in MOTOMAN-MPP3H INSTRUCTIONS (170715-1CD).

9. In the low-speed, confirm that there is no interference or no excess tension to the relay lead, and then start the normal operation.
10 Disassembly and Reassembly of the U-arm

After replacing the U-arm, note that re-adjustment of the home position is necessary.

1. From the U-arm, remove the L-arm and its lead wire and air line which are attached to the L-arm.

   • When removing the U-arm, support the T-axis unit not to fall (including the hand).

   • For more information about L-arm removal, refer to section 10.2.3 L-Arm Removal and Installation and Relay Lead Fixing Procedures” in Chapter 10 “Maintenance and Inspection” in MOTOMAN-MPP3H INSTRUCTIONS (170715-1CD).

2. Set the internal two-jaw puller to the U-arm to make a hole near the center of the cap.

   Tool: Internal two-jaw puller (For the size, refer to the following figure.)

   The clearance to which the puller can be inserted is about 5 mm.
   Please note the thickness of the jaw tip.
3. Remove the U-arm cap.
   Insert a penetration screwdriver or a bar, etc. to the hole which is made in step 2, and then gouge it.
   
   – Tool: Penetration screwdriver or bar

   **NOTE**
   The cap may pop out, so put a hand on the cap during the work.
   In order to prevent the arm from being damaged while gouging, place a waste cloth on the contact part with the arm.

4. Loosen the bolts M8 shown below (length: 55 mm) (6 bolts) and remove the U-arm.

After the maintenance, return the U-arm to the original position.
5. Apply a thin layer of food grease to the lip of the oil seal (VC851009) as shown below.
   - Grease: LUBRIPLATE SYNXTREME FG-0
   - Amount applied: 0.4 cc
     (Apply evenly at 0.5 mm thick and 3 mm wide.)

6. Fix the U-arm to the speed reducer.
   - Bolt: M8 (length: 55 mm)
   - Washer: GT-LH washer M8
   - Tightening torque: 40 N·m (4.1 kgf·m)

7. Apply a thin layer of food grease to the housing and the cap peripheral part of the U-arm.
   - Grease: LUBRIPLATE SYNXTREME FG-0
8. Install the U-arm cap.
   Set the splint to the internal two-jaw puller, and then insert the cap until the edge face of the U-arm becomes flush with the cap.
   
   Tool: Internal two-jaw puller
   (thickness of the jaw tip: within 5 mm)
   Splint

9. Wipe the excessed grease.

10. Install the L-arm to the U-arm.

   For more information about L-arm installation, refer to section 10.2.3.2 "L-arm Installation" in the MPP3H INSTRUCTIONS (170715-1CD).

11. Fix the lead wire and the air line to the L-arm.

   For more information about lead wire and air line fixing, refer to section 10.2.3.3 "Relay Lead Fixing" in the MPP3H INSTRUCTIONS (170715-1CD).

12. Perform the home position calibration of the axis of which the U-arm was removed.

   For more information about calibrating the home position, refer to section 10.2.2 "Home Position Calibration" in the MPP3H INSTRUCTIONS (170715-1CD).

13. Perform a low-speed operation check to confirm that the L-arm is installed on the ball joint normally and that there is no interference or no excess tension to the lead wire, and then start the normal operation.
11 Parts List

11.1 Wiring and Piping Unit

Fig. 11-1: Wiring and Piping Unit
## Table 11-1: Wiring and Piping Unit

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11.2 Drive Unit

Fig. 11-2: Drive Unit

L-Axis
(Same as S-Axis)

U-Axis
(Same as S-Axis)
### Table 11-2: Drive Unit (Sheet 1 of 2)

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### Table 11-2: Drive Unit (Sheet 2 of 2)

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11.3 L-Arm and T-Axis Unit

Fig. 11-3: L-Arm and T-Axis Unit

L-Axis Arm
### Table 11-3: L-Arm and T-Axis Unit

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