MOTOMAN-MA1440
MAINTENANCE MANUAL

**TYPE:**
YR-MA1440/MH12-A00 (STANDARD SPECIFICATION)

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-MA1440 INSTRUCTIONS
- DX200 INSTRUCTIONS
- DX200 OPERATOR’S MANUAL (for each purpose)
- DX200 MAINTENACE MANUAL

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

Part Number: 165831-1CD
Revision: 2
Table of Contents

1 Introduction ..................................................................................................................................... 1-1
  1.1 National Safety Standards ...................................................................................................... 1-2
  1.2 Notes for Safe Operation ....................................................................................................... 1-3
  1.3 Definition of Terms Used Often in This Manual ..................................................................... 1-6
  1.4 Registered Trademark ........................................................................................................... 1-7
  1.5 Explanation of Warning Labels .............................................................................................. 1-7
  1.6 Safeguarding Tips ................................................................................................................... 1-8
  1.7 Mechanical Safety Devices ..................................................................................................... 1-8
  1.8 Programming, Operation, and Maintenance Safety ............................................................... 1-9
  1.9 Maintenance Safety ............................................................................................................... 1-10
  1.10 Summary of Warning Information ....................................................................................... 1-10
  1.11 Customer Support Information ............................................................................................ 1-11

2 Notes for Maintenance .................................................................................................................... 2-1
  2.1 Wrist Axis ............................................................................................................................ 2-1
  2.2 Battery Pack Connection ....................................................................................................... 2-2

3 Home Position Return ..................................................................................................................... 3-1
  3.1 Home Position Return after Motor Replacement ................................................................... 3-1
    3.1.1 Home Position Return by Zeroing Function .................................................................... 3-1
    3.1.2 Home Position Return by Robot Calibration (MOTOCALV EG) ..................................... 3-1
    3.1.3 Home Position Return by Setting the Teaching Point for Home Position Setting before Replacement ........................................................................................................... 3-2
  3.2 Homing Method When the Robot-Axis Motor Battery Runs Out ............................................ 3-7
    3.2.1 With the Home Position Calibration Function for Restoration from the Battery Back Up ......................................................................................................................... 3-7
    3.2.2 With the Return Keys (S-, L-, U-, R- and B-axes) .......................................................... 3-7

4 Grease Replenishment/Exchange .................................................................................................. 4-1
  4.1 Notes on Grease Replenishment/Exchange Procedures .......................................................... 4-1
    4.1.1 Grease Replenishment/Exchange for S-Axis Speed Reducer ........................................... 4-2
      4.1.1.1 Grease Replenishment .............................................................................................. 4-2
      4.1.1.2 Grease Exchange ..................................................................................................... 4-3
    4.1.2 Grease Replenishment/Exchange for L-Axis Speed Reducer ........................................... 4-4
      4.1.2.1 Grease Exchange ..................................................................................................... 4-4
      4.1.2.2 Grease Exchange ..................................................................................................... 4-5
4.1.3   Grease Replenishment/Exchange for U-Axis Speed Reducer ........................................ 4-7
  4.1.3.1   Grease Replenishment ....................................................................................... 4-7
  4.1.3.2   Grease Exchange .............................................................................................. 4-9

4.1.4   Grease Replenishment for R-Axis Speed Reducer ...................................................... 4-10

4.1.5   Grease Replenishment for B-Axis Speed Reducer ...................................................... 4-11

4.1.6   Grease Replenishment for T-Axis Gear ....................................................................... 4-12

4.1.7   Grease Replenishment for R-Axis Gear ..................................................................... 4-14

5   Disassembly/Reassembly of the Motor ........................................................................... 5-1
  5.1   Disassembly and Reassembly of the S-axis Motor ....................................................... 5-1
  5.2   Disassembly and Reassembly of the L-axis Motor ....................................................... 5-3
  5.3   Disassembly and Reassembly of the U-axis Motor ....................................................... 5-5
  5.4   Disassembly and Reassembly of the R-axis Motor ....................................................... 5-7
  5.5   Disassembly/Reassembly of B-Axis Motor ................................................................. 5-9
  5.6   Disassembly/Reassembly of T-Axis Motor ................................................................. 5-12

6   Disassembly/Reassembly of Speed Reducer ..................................................................... 6-1
  6.1   Disassembly/Reassembly of S-axis Speed Reducer ....................................................... 6-1
  6.2   Disassembly/Reassembly of L-Axis Speed Reducer ....................................................... 6-3
  6.3   Disassembly/Reassembly of U-Axis Speed Reducer ....................................................... 6-5
  6.4   Disassembly/Reassembly of R-Axis Speed Reducer ....................................................... 6-7
  6.5   Disassembly/Reassembly of B-Axis Speed Reducer ....................................................... 6-11

7   Disassembly/Reassembly of Wrist Unit ............................................................................. 7-1

8   Disassembly/Reassembly and Adjustment of B- and T-Axes Timing Belts .............................. 8-1
  8.1   Disassembly/Reassembly of B- and T-axes Timing Belts ............................................. 8-1
  8.2   Adjustment of Timing Belts ......................................................................................... 8-3

9   Battery Pack Replacement ................................................................................................ 9-1
  9.1   Battery Pack Replacement .......................................................................................... 9-1

10  Parts List ............................................................................................................................... 10-1
  10.1   S-Axis Unit .................................................................................................................. 10-1
  10.2   L-Axis Unit ................................................................................................................. 10-3
  10.3   U-Axis Unit .................................................................................................................. 10-4
10.4 R-Axis Unit............................................................................................................. 10-6
10.5 Wrist Unit..................................................................................................................... 10-8
10.6 Gear Unit (No. 5040) ................................................................................................. 10-11
1 Introduction

**DANGER**

- This maintenance manual is intended to explain maintenance procedures primarily for the MOTOMAN-MA1440.
- General items related to safety are listed in Chapter 1: Safety of the DX200 Instructions. To ensure correct and safe operation, carefully read the DX200 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 Standards

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 DX200.

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

- **DANGER**: Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Safety Signs identified by the signal word DANGER should be used sparingly and only for those situations presenting the most serious hazards.

- **WARNING**: Indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury. Hazards identified by the signal word WARNING present a lesser degree of risk of injury or death than those identified by the signal word DANGER.

- **CAUTION**: Indicates a hazardous situation, which if not avoided, could result in minor or moderate injury. It may also be used without the safety alert symbol as an alternative to “NOTICE”.

- **NOTICE**: NOTICE is the preferred signal word to address practices not related to personal injury. The safety alert symbol should not be used with this signal word. As an alternative to “NOTICE”, the word “CAUTION” without the safety alert symbol may be used to indicate a message not related to personal injury.

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”, “CAUTION” and “WARNING.”
1 Introduction
1.2 Notes for Safe Operation

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 Introduction

1.2 Notes for Safe Operation

**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.
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>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>
1.4 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.

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.
If you need assistance with any aspect of your MA1440 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: MA1440
- Primary Application: ___________________________
- Controller: DX200
- 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 controller data plate
2 Notes for Maintenance

2.1 Wrist Axis

The motor and encoder units are provided with the wrist unit. To prevent fumes from penetrating into the wrist unit, the matching face of the cover is sealed with sealing bond. If the wrist cover is disassembled, make sure to reseal with sealing bond (Three Bond 1206C).

Fig. 2-1: Sealing Part of Wrist Unit
2.2 Battery Pack Connection

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

**Fig. 2-2(a): Encoder connector Diagram (for S-, L- and U-Axes)**

![Encoder connector Diagram (for S-, L- and U-Axes)]

**Fig. 2-2(b): Encoder Connector Diagram (for R-, B-, and T-Axes)**

![Encoder Connector Diagram (for R-, B-, and T-Axes)]

---

**CAUTION**

Connect battery to encoder to save the data before removing connector.
3 Home Position Return

3.1 Home Position Return after Motor Replacement

3.1.1 Home Position Return by Zeroing Function

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

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

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

• No external force is exerted on the manipulator.

The hand and other parts attached to the wrist unit are removed.

3.1.2 Home Position Return by Robot Calibration (MOTOCALV EG)

The MOTOCALV EG allows the home position reset by teaching the five-point-in-five-posture.

Refer to "MOTOCALV EG Operator's Manual" (152646-1CD) for details on the operation.
3 Home Position Return
3.1 Home Position Return after Motor Replacement

3.1.3 Home Position Return by Setting the Teaching Point for Home Position Setting before Replacement

The DX200 holds the position data of the job program (hereinafter called as JOB) as the pulse number from the home position of each axis. Stated differently, the precise adjustment of home position allows use of the JOB, which had been used before the motor replacement, without correction even after the motor replacement.

This section explains how to set the DX200.

■ Preparation before Replacement
   • Refer to the Fig. 3-1 “Preparation before Replacement (Example)”.

Before replacement, create the standard position (hereinafter called the check-point) for home position adjustment after replacement. The check-point must satisfy the conditions below. Furthermore, create the JOB so that the manipulator safely moves to the check-point from the standby position. (The JOB created in this manner will be hereinafter called the check-JOB.)

① The position should not be deviated by turning the power ON or OFF, or lowering air pressure. Do not create the check point in the working part of the tool (end effector) or the jigs (related unit including the rotary table). It is recommended to use a specific jig if necessary.

② Use pointed jigs to create the position so that the deviation is easily found.
Keep a distance as long as possible from the rotational center of the replacing axis.

③ Considering the moving direction of the replacing axis, create the position at the point where any deviation is easily found and the axis will not interfere with jigs even if it is deviated.
Example of Check-point Creation

- The check-point cannot be created unless each axis moves to operate. Stated differently, the check-point cannot be created if the axis does not move due to a failure. It is, therefore, recommended to create the check-point for each axis under normal operating conditions.
- Check the home position of the replacing axis. Use the position screen and move the replacing axis to the 0-pulse position: the home position, then check the position of the home position mark. Please execute the adjustment if it is deviated.

The Fig. 3-1 “Preparation before Replacement (Example)” shows the MA1440-A00 U-axis replacement as an example.
Replacement

- Refer to the Fig. 3-2 “Replacement (Example)”.

**CAUTION**

- Since the motor is removed, the manipulator cannot keep its posture during the replacement operation. When replacing the motor, hold the manipulator arm with a chain block, etc.

Failure to observe this caution may cause a hazardous condition. Also, when replacing the motor with due care.

The figure Fig. 3-2 “Replacement (Example)” shows the motor in MA1440-A00 U-axis replacement as an example. Remove the motor, then conduct the replacement of the U-axis.

*Fig. 3-2: Replacement (Example)*

[Diagram of manipulator arm with chain block and hanging tool]
3 Home Position Return
3.1 Home Position Return after Motor Replacement

**Home Position Adjustment**
After replacement, move the replaced axis to the position of the home position mark. Perform the home position alignment only to the replaced axis.

(For more detailed information, refer to "DX200 INSTRUCTIONS" (165292-1CD).)

Move the axis to the check-point by the check-JOB. (Be careful when moving the axis so that the manipulator may not interfere with jigs.) Move only the replaced axis to adjust the deviation from the check-point created before alignment.

Display the position screen (command value).

The following figure shows the position screen for U-axis.

![Position Screen](image)

Using the above values, calculate the amount of deviation. (Subtract the command value from the present value.)

Present value - Command value = the amount of deviation

U (-3067) - (-2989) = -78

Perform stepping back, etc. of the check JOB and move the replaced axis to the position where the replaced axis will not interfere with jigs when it moves to the home position. (Be careful when moving the axis so that the manipulator may not interfere with jigs.) Use the position screen and move the replaced axis to the pulse position equal to the amount of deviation.

Refer to the example below:
3 Home Position Return
3.1 Home Position Return after Motor Replacement

Perform the home position alignment only for the replaced axis on this position. (For more detailed information, refer to "DX200 INSTRUCTIONS" (165292-1CD).)

Move the axis again to the check-point by the check-JOB. Check if the axis is in the check-point created before the operation to complete the adjustment. (If it is deviated, repeat the adjustment procedures.)

Perform an operation check by using the JOB program used before the replacement. If no problem is found, write down the modified home position data (ABSO data) and the date in the label attached inside the DX200.
3.2 Homing Method When the Robot-Axis Motor Battery Runs Out

3.2.1 With the Home Position Calibration Function for Restoration from the Battery Back Up

This is the method to return the manipulator to its home position by executing the "Backup alarm restoration" software on the programming pendant after moving the manipulator close to its home position (within the motor rotation).

The home position returned by this function updates the multi-turn data for motor.

3.2.2 With the Return Keys (S-, L-, U-, R- and B-axes)

This is the method to return the manipulator to its home position by writing down the difference of the pulse between the key position and the home position, which is set when MOTOMAN is delivered, on the home position label affixed inside of the DX200.

When the home position data disappears, move the manipulator to the key position and set the position where the above mentioned difference of the pulse is reflected in the key position as the home position.

- **Calibration Operation**
  The parts in Table 3-1 "Parts List" is required for calibration.

*Table 3-1: Parts List*

<table>
<thead>
<tr>
<th>Drawing No.</th>
<th>Name</th>
<th>Qty.</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFJW6-70</td>
<td>Shaft</td>
<td>1</td>
<td>For S-,L-,U-,R-,B-axes</td>
</tr>
</tbody>
</table>
3.2 Homing Method When the Robot-Axis Motor Battery Runs Out

1. S-axis Positioning
As shown in Fig. 3-3 “S-Axis Positioning”, insert the shaft SFJW6-70 from the pin hole (6\(^{+0.012}_{0}\)) on the S-head and perform positioning with the programming pendant so that the shaft fits into the slot of the base.

Fig. 3-3: S-Axis Positioning

2. L-axis Positioning
As shown in Fig. 3-4 “L-Axis Positioning”, insert the shaft SFJW6-70 from the pin hole (6\(^{+0.012}_{0}\)) on the S-head and perform positioning with the programming pendant so that the shaft fits into the slot of the L-arm.

Fig. 3-4: L-Axis Positioning
3. Home Position Return
   3.2 Homing Method When the Robot-Axis Motor Battery Runs Out

3. U-axis Positioning
   As shown in Fig. 3-5 “U-Axis Positioning”, insert the shaft SFJW6-70 from the pin hole (6 \( \pm 0.012 \) dia.) on the casing and perform positioning with the programming pendant so that the shaft fits into the slot of the L-arm.

   Fig. 3-5: U-Axis Positioning

4. R-axis Positioning
   As shown in Fig. 3-6 “R-Axis Position”, insert the shaft SFJW6-70 from the pin hole (6 \( \pm 0.012 \) dia.) on the casing and perform positioning with the programming pendant so that the shaft fits into the slot of the U-arm.

   Fig. 3-6: R-Axis Position
5. B-axis Positioning

As shown in Fig. 3-7 "B-Axis Position", insert the shaft SFJW6-70 from the pin hole (6 dia. +0.012) on the U-arm cover and perform positioning with the programming pendant so that the shaft fits into the slot of the wrist.

Fig. 3-7: B-Axis Position
4 Grease Replenishment/Exchange

4.1 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 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.

- 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 the hose on the grease inlet with grease beforehand to prevent air from leaking into the speed reducer.
4.1.1 Grease Replenishment/Exchange for S-Axis Speed Reducer

Fig. 4-1: S-Axis Speed Reducer Diagram

4.1.1.1 Grease Replenishment

(Refer to Fig. 4-1 “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).
4 Grease Replenishment/Exchange
4.1 Notes on Grease Replenishment/Exchange Procedures

4.1.1.2 Grease Exchange

(Refer to Fig. 4-1 “S-Axis Speed Reducer Diagram”.)

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

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

2. Install a grease zerk A-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).
4.1.2 Grease Replenishment/Exchange for L-Axis Speed Reducer

Fig. 4-2: L-Axis Speed Reducer Diagram

4.1.2.1 Grease Exchange

(Refer to Fig. 4-2 “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) NPTF 3/8 from the grease inlet and remove the hexagon socket head plug PT 3/8 from the grease exhaust port.

3. Install a grease zerk A-PT 3/8 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.

6. Remove the grease zerk from the grease inlet, and reinstall the hexagon socket head tapered pipe plug (NPTF type) NPTF 3/8. Before installing the plug, apply Three Bond 1206 C 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.

• 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. 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).

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. 4-2 “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.

4.1.2.2 Grease Exchange
(Refer to Fig. 4-2 “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. 4-2 “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.
4.1.3 Grease Replenishment/Exchange for U-Axis Speed Reducer

(Refer to Fig. 4-3 “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).
4 Grease Replenishment/Exchange
4.1 Notes on Grease Replenishment/Exchange Procedures

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\(\cdot\)m (2.34 kgf\(\cdot\)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. 4-3 “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.
4 Grease Replenishment/Exchange
4.1 Notes on Grease Replenishment/Exchange Procedures

4.1.3.2 Grease Exchange
(Refer to Fig. 4-3 “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 N•m (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 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.

---

**NOTE**
- 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. 4-3 “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.
4.1.4 Grease Replenishment for R-Axis Speed Reducer

Fig. 4-4: 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. 4-4 “R-Axis Speed Reducer Diagram”.)
   - Grease type: Harmonic grease SK-1A
   - Amount of grease: 6 cc (12cc for the first supply)

   **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 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).
4.1.5 Grease Replenishment for B-Axis Speed Reducer

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. 4-5 “B-Axis Speed Reducers Diagram.”)
   - Grease type: Harmonic grease SK-1A
   - Amount of grease: 6 cc (12 cc for the 1st supply)

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 N•m (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 N•m (0.6 kgf•m).
4.1.6 Grease Replenishment for T-Axis Gear

Fig. 4-6: 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

**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 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.)
4 Grease Replenishment/Exchange
4.1 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

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).

**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.
4.1.7 Grease Replenishment for R-Axis Gear

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.
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. 4-7 “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).
5 Disassembly/Reassembly of the Motor

5.1 Disassembly and Reassembly of the S-axis Motor


* Refer to Fig. 5-1 “Disassembly & Assembly of S-Axis Motor”.

** NOTE **

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

Remove old sealing from each parts before starting assembling.

** Disassembly **

1. Turn OFF the DX200 power supply.
2. Connect the backup battery with the cable of S-axis motor ①.
   (Refer to chapter 2 “Notes for Maintenance”.)
3. Disconnect the cables (both encoder and power-cables) of the S-axis motor ① from the internal wiring harness.
4. Unscrew the GT-SA bolts ②, and then remove the S-axis motor ① from the M-base ② by using the tapped holes which are on the motor flanged face.
5. Unscrew the hexagon socket head cap screws ③ and key ④, then remove the input gear ④.

** Reassembly **

1. Install the key ④ and the input gear ④ on the S-axis motor ①. 
   (The key ④ is delivered with the S-axis motor ①.)
2. Pass the hexagon socket head cap screws ③ through the conical spring washers, then apply LOCTITE 243 to their screw parts and tighten them with the tightening torque shown in Table 5-1 “S-Axis Motor Parts Checklist”.
4. Tighten the GT-SA bolts ② with the tightening torque shown in Table 5-1.
5. Connect the cables (both encoder and power-cables) of the S-axis motor ① with the internal wiring harness.
6. Remove the backup battery.
7. Turn ON the DX200 power supply.
5 Disassembly/Reassembly of the Motor
5.1 Disassembly and Reassembly of the S-axis Motor

Table 5-1: S-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>S-Axis Motor</td>
<td>1</td>
<td>SGMRV-05ANA-YR2*</td>
</tr>
<tr>
<td>②</td>
<td>GT-SA Bolt M8 (length: 25mm)</td>
<td>3</td>
<td>Tightening Torque 24.5 N•m</td>
</tr>
<tr>
<td>③</td>
<td>Input Gear HW0312734-2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>④</td>
<td>Key</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑤</td>
<td>M-Base HW1303263-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑥</td>
<td>Hexagon Socket Head Cap Screw M5 (length: 85mm) Conical Spring Washer 2L-5</td>
<td>1</td>
<td>Tightening Torque 10.0 N•m</td>
</tr>
</tbody>
</table>

Fig. 5-1: Disassembly & Assembly of S-Axis Motor
5.2 Disassembly and Reassembly of the L-axis Motor

- Refer to Fig. 5-2 “Disassembly & Assembly of L-Axis Motor”.

**Disassembly**

1. Turn OFF the DX200 power supply.
2. Connect the backup battery with the cable of L-axis motor \( \oplus \).
   (Refer to Chapter chapter 2 “Notes for Maintenance”.)
3. Disconnect the cables (both encoder and power-cables) of the L-axis motor \( \oplus \) from the internal wiring harness.
4. Before removing the L-axis motor \( \ominus \), support the L-arm with a chain block, etc. to avoid it from rotating.
5. Unscrew the GT-SA bolts \( \ominus \), then remove the L-axis motor \( \oplus \) from the S-head by using the tapped holes which are on the motor flanged face.
6. Unscrewing the hexagon socket head cap screw \( \ominus \), then remove the key \( \ominus \) and the input gear \( \ominus \).

**Reassembly**

1. Mount the key \( \ominus \) and the input gear \( \ominus \) on the L-axis motor \( \ominus \).
   (The key \( \ominus \) is provided with the L-axis motor \( \ominus \).)
2. Pass the hexagon socket head cap screws \( \ominus \) through the conical spring washers, then apply LOCTITE 243 to their screw parts and tighten them with the tightening torque shown in Table 5-2 “L-Axis Motor Parts Checklist”.
3. Before mounting the L-axis motor \( \ominus \) on the S-head, apply Three Bond 1206C to the matching face between them.
4. Tighten the GT-SA bolts \( \ominus \) with the tightening torque shown in Table 5-2.
5. Connect the cables (both encoder and power-cables) of the L-axis motor \( \ominus \) with the internal wiring harness.
6. Remove the backup battery.
7. Turn ON the DX200 power supply.
5.2 Disassembly and Reassembly of the L-axis Motor

Table 5-2: L-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>L-Axis Motor</td>
<td>1</td>
<td>SGMRV-09ANA-YR1*</td>
</tr>
<tr>
<td>②</td>
<td>GT-SA Bolt M8 (length: 25 mm)</td>
<td>4</td>
<td>Tightening Torque 24.5 N•m</td>
</tr>
<tr>
<td>③</td>
<td>Input Gear HW0312735-2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>④</td>
<td>Key</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑤</td>
<td>Hexagon Socket Head Cap Screw M6 (length: 75mm)</td>
<td>1 each</td>
<td>Tightening Torque 16.5 N•m</td>
</tr>
<tr>
<td></td>
<td>Conical Spring Washer 2L-6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 5-2: Disassembly & Assembly of L-Axis Motor
5.3 Disassembly and Reassembly of the U-axis Motor

- Refer to Fig. 5-3 "Disassembly & Assembly of U-Axis Motor".

**Disassembly**

1. Turn OFF the DX200 power supply.
2. Connect the backup battery with the cable of the U-axis motor.
   (Refer to chapter 2 “Notes for Maintenance”.)
3. Disconnect the cables (both encoder and power cables) of the U-axis motor from the internal wiring harness.
4. Before removing the L-axis motor, support the L-arm with a chain block, etc. to avoid it from rotating.
5. Unscrew the GT-SA bolts, then remove the U-axis motor from the casing.
6. Unscrew the hexagon socket head cap screw, then remove the input gear and the key.

**Reassembly**

1. Mount the key and input gear on the U-axis motor.
   (The key is provided with the U-axis motor.)
2. Pass the hexagon socket head cap screw through the conical spring washers, then apply LOCTITE 243 to its screw part and tighten it with the tightening torque shown in Table 5-3 “U-Axis Motor Parts Checklist”.
3. Before mounting the U-axis motor on the casing, apply Three Bond 1206C to the matching face between the U-axis motor flange side and the casing.
4. Tighten the GT-SA bolts with the tightening torque shown in Table 5-3.
5. Connect the cables (both encoder and power-cables) of the U-axis motor with the internal wiring harness.
6. Remove the backup battery.
7. Turn ON the DX200 power supply.
5 Disassembly/Reassembly of the Motor
5.3 Disassembly and Reassembly of the U-axis Motor

Table 5-3: U-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>U-axis Motor</td>
<td>1</td>
<td>SGMRV-05ANA-YR2*</td>
</tr>
<tr>
<td>②</td>
<td>GT-SA Bolts M8 (length: 30mm)</td>
<td>4</td>
<td>Tightening Torque 24.5 N•m</td>
</tr>
<tr>
<td>③</td>
<td>Input Gear HW1303245-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>④</td>
<td>Key</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑤</td>
<td>Hexagon Socket Head Cap Screw M5</td>
<td>1</td>
<td>Tightening Torque 10.0 N•m</td>
</tr>
<tr>
<td></td>
<td>(length: 75mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conical Spring Washer 2L-5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 5-3: Disassembly & Assembly of U-Axis Motor

![Disassembly & Assembly of U-Axis Motor](image_url)
5.4 Disassembly and Reassembly of the R-axis Motor

- Refer to Fig. 5-4 “R-Axis Motor Parts Checklist”.

**Disassembly**

1. Turn OFF the DX200 power supply.
2. Unscrew the GT-SA bolts and then remove the cover.
3. Connect the backup battery with the cable of the R-axis motor. (Refer to chapter 2 “Notes for Maintenance”.)
4. Disconnect the cables (both encoder and power-cables) of the R-axis motor from the internal wiring harness.
5. Unscrew the GT-SA bolts to remove the cover.
6. Unscrew the GT-SA bolts and then, from the U-arm unit, remove the M-base.
7. Unscrew the hexagon socket head cap screw to remove the gear.
8. Unscrew the GT-SA bolts and then, from the M-base, remove the R-axis motor.

**Reassembly**

1. Mount the gear to the oil sealing side of the M-base, and then mount the R-axis motor to the opposite side of the M-base. Also, apply grease to the oil seal on the M-base.
2. Attach a conical spring washer to the hexagon socket head cap screw, apply LOCTITE 243 to the screw part of it, and then tighten it with the tightening torque shown in Table 5-4 “R-Axis Motor Parts Checklist”.
3. Tighten the GT-SA bolts with the tightening torque shown in Table 5-4.
4. Before mounting the M-base to the U-arm unit, apply Three Bond 1206C to the matching face between the M-base and the U-arm unit.
5. Tighten the GT-SA bolts with the tightening torque shown in Table 5-4.
6. Mount the cover using the GT-SA bolts.
7. Tighten the GT-SA bolts with the tightening torque shown in Table 5-4.
8. Connect the cables (both encoder and power-cables) of the R-axis motor with the internal wiring harness.
9. Remove the backup battery.
10. Mount the cover using the GT-SA bolts.
11. Tighten the GT-SA bolts with the tightening torque shown in Table 5-4.
12. Turn ON the DX200 power supply.
# 5 Disassembly/Reassembly of the Motor

## 5.4 Disassembly and Reassembly of the R-axis Motor

Table 5-4: R-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>R-axis Motor</td>
<td>1</td>
<td>SGMAV-01ANA-YR1*</td>
</tr>
<tr>
<td>②</td>
<td>GT-SA Bolt M3 (length: 16mm)</td>
<td>3</td>
<td>Tightening Torque 1.4 N•m</td>
</tr>
<tr>
<td>③</td>
<td>GT-SA Bolt M4 (length: 12mm)</td>
<td>2</td>
<td>Tightening Torque 2.8 N•m</td>
</tr>
<tr>
<td>④</td>
<td>GT-SA Bolt M4 (length: 12mm)</td>
<td>2</td>
<td>Tightening Torque 2.8 N•m</td>
</tr>
<tr>
<td>⑤</td>
<td>M-Base HW1404045-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑥</td>
<td>Gear HW1303246-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑦</td>
<td>Hexagon Socket Head Cap Screws M4 (length: 16mm)</td>
<td>1 each</td>
<td>Tightening Torque 4.8 N•m</td>
</tr>
<tr>
<td></td>
<td>Conical Spring Washer 2L-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>⑧</td>
<td>Cover HW1404056-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑨</td>
<td>Cover HW1303241-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑩</td>
<td>GT-SA Bolt M4 (length: 12mm)</td>
<td>7</td>
<td>Tightening Torque 2.8 N•m</td>
</tr>
</tbody>
</table>

Fig. 5-4: Disassembly & Assembly of R-Axis Motor

1. Apply MP-1 grease
5.5 Disassembly/Reassembly of B-Axis Motor

- Refer to Fig. 5-6 “Disassembly & Reassembly of B-Axis Motor”.

**Disassembly**

1. Turn OFF the DX200 power supply.
2. Unscrew the GT-SA bolts to remove the cover.
3. Unscrew the GT-SA bolts to remove the cover.
4. Connect the backup battery with the cable of the R-axis motor. (Refer to chapter 2 “Notes for Maintenance”.)
5. Disconnect the cables (both encoder and power-cables) of the B-axis motor from the internal wiring harness.
6. Unscrew the GT-SA bolts to remove the M-base from the U-arm.
7. Unscrew the GT-SA bolts to remove the B-axis motor. (To fix the pulley, use 2 holes of 3.3 dia.-hole which are on the surface of it.)
8. Unscrew the hexagon socket head cap screw to remove the pulley.

**Reassembly**

1. Install the pulley to the B-axis motor.
2. Attach a conical spring washer to the hexagon socket head cap screw, apply LOCTITE 243 to the thread part of it, and then tighten the screw with the tightening torque shown in Table 5-5 “B-Axis Motor Parts Checklist”.
3. Install the B-axis motor to the M-base.
4. With the cable tie T18L, fix the B-axis motor lead wire like shown in Fig. 5-5 “B-Axis Motor Lead Wire Fixing Method”.
5. Tighten the GT-SA bolts with the tightening torque shown in Table 5-5. Install the M-base to the U-arm, then hang the timing belt on the pulley. Tighten the GT-SA bolts with the tightening torque shown in Table 5-5. (Adjust the tension of the timing belt by referring to chapter 8 “Disassembly/Reassembly and Adjustment of B- and T-Axes Timing Belts”.)
6. Connect the cables (both encoder and power-cables) of the B-axis motor with the internal wiring harness.
7. Remove the backup battery.
8. Accommodate the cable connector part into the space made by the B-axis motor and the T-axis motor. And then, install the cover with the GT-SA bolts.
9. Tighten the GT-SA bolts with the tightening torque shown in Table 5-5.
10. Install the cover to the U-arm with the GT-SA bolts. (Apply Three Bond 1206C to the matching surfaces of them.)
11. Tighten the GT-SA bolts with the tightening torque shown in Table 5-5.
12. Turn ON the DX200 power supply.
5 Disassembly/Reassembly of the Motor

5.5 Disassembly/Reassembly of B-Axis Motor

• Should the motor is fixed without fixing the B-axis lead wires with the cable tie T18L, the wire may lost during the following procedures.

Do not fail to fix the wire lead.

• When fixing the wire lead, do not fix them to tight.

Failure to observe this may cause lead disconnections, etc.

Fig. 5-5: B-Axis Motor Lead Wire Fixing Method

Table 5-5: B-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>B-axis Motor</td>
<td>1</td>
<td>SGMAV-01ANA-YR1*</td>
</tr>
<tr>
<td>②</td>
<td>GT-SA Bolt M4 (length: 10 mm)</td>
<td>2</td>
<td>Tightening torque 2.8 N*m</td>
</tr>
<tr>
<td>③</td>
<td>Pulley HW140436-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>④</td>
<td>Hexagon Socket Head Cap Screw M4 (length: 12 mm) Conical Spring Washer 2L-4</td>
<td>1 each</td>
<td>Tightening torque 4.8 N*m</td>
</tr>
<tr>
<td>⑤</td>
<td>Cover HW1303243-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑥</td>
<td>GT-SA Bolt M4 (length: 12 mm)</td>
<td>10</td>
<td>Tightening torque 2.8 N*m</td>
</tr>
<tr>
<td>⑦</td>
<td>GT-SA Bolt M4 (length: 16 mm)</td>
<td>2</td>
<td>Tightening torque 2.8 N*m</td>
</tr>
<tr>
<td>⑧</td>
<td>M-Base HW1404046-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑨</td>
<td>Cover HW1404516-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑩</td>
<td>GT-SA Bolt M4 (length: 8 mm)</td>
<td>2</td>
<td>Tightening torque 2.8 N*m</td>
</tr>
</tbody>
</table>
Fig. 5-6: Disassembly & Reassembly of B-Axis Motor
5.6 Disassembly/Reassembly of T-Axis Motor

• Refer to Fig. 5-7 “Disassembly & Reassembly of T-Axis Motor”.

- Disassembly
  1. Turn OFF the DX200 power supply.
  2. Unscrew the GT-SA bolts to remove the cover.
  3. Unscrew the GT-SA bolts to remove the cover.
  4. Unscrew the GT-SA bolts to remove the cover.
  5. Connect the backup battery with the cable of the T-axis motor.
     (Refer to chapter 2 “Notes for Maintenance”.)
  6. Disconnect the cables (both encoder and power-cables) of the T-axis motor from the internal wiring harness.
  7. Unscrew the GT-SA bolts to remove the M-base from the U-arm.
  8. Unscrew the GT-SA bolts to remove the T-axis motor.
  9. Unscrew the hexagon socket head cap screw to remove the pulley and the fly wheel.

- Reassembly
  1. Install the pulley and the fly wheel to the T-axis motor.
  2. Attach a conical spring washer to the hexagon socket head cap screw, apply LOCTITE 243 to the thread part of the hexagon socket head cap screw, and then tighten the screw with the tightening torque shown in Table 5-6 “T-Axis Motor Parts Checklist”.
  3. Install the T-axis motor to the M-base.
  4. Tighten the GT-SA bolts with the tightening torque shown in Table 5-6. Install the M-base to the U-arm, then hang the timing belt on the pulley. Tighten the GT-SA bolts with the tightening torque shown in Table 5-6. (Adjust the tension of the timing belt by referring to chapter 8 “Disassembly/Reassembly and Adjustment of B- and T-Axes Timing Belts”.)
  5. Connect the cables (both encoder and power-cables) of the T-axis motor with the internal wiring harness.
  6. Remove the backup battery.
  7. Accomodate the cable connector part into the space made by the B-axis motor and the T-axis motor. And then, install the cover with the GT-SA bolts.
  8. Tighten the GT-SA bolts with the tightening torque shown in Table 5-5.
  9. Install each cover to the U-arm with the GT-SA bolts respectively.
     (Apply Three Bond 1206C to the matching surfaces with the covers and to the U-arm. Refer to chapter 2 “Notes for Maintenance”.)
  10. Tighten the GT-SA bolts with the tightening torque shown in Table 5-6.
  11. Turn ON the DX200 power supply.
### Table 5-6: 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</td>
<td>1</td>
<td>SGMAV-01ANA-YR1*</td>
</tr>
<tr>
<td>2</td>
<td>GT-SA Bolt M4 (length: 10 mm)</td>
<td>2</td>
<td>Tightening torque 2.8 N·m</td>
</tr>
<tr>
<td>3</td>
<td>Pulley HW1404038-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pulley HW1404038-B</td>
<td>1</td>
<td>(For the manipulator assembled after Jun 21, 2015)</td>
</tr>
<tr>
<td>4</td>
<td>Fly Wheel HW1404353-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Hexagon Socket Head Cap Screw M4 (length: 16 mm) Conical Spring Washer 2L-4</td>
<td>1 each</td>
<td>Tightening torque 4.8 N·m</td>
</tr>
<tr>
<td></td>
<td>Hexagon Socket Head Cap Screw M4 (length: 20 mm) Conical Spring Washer 2L-4</td>
<td>1 each</td>
<td>Tightening torque 4.8 N·m (For the manipulator assembled after Jun 21, 2015)</td>
</tr>
<tr>
<td>6</td>
<td>Cover HW1303244-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>GT-SA Bolt M4 (length: 12 mm)</td>
<td>9</td>
<td>Tightening torque 2.8 N·m</td>
</tr>
<tr>
<td>8</td>
<td>GT-SA Bolt M4 (length: 16 mm)</td>
<td>2</td>
<td>Tightening torque 2.8 N·m</td>
</tr>
<tr>
<td>9</td>
<td>M-Base HW1404052-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Cover HW1404516-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>GT-SA Bolt M4 (length: 8 mm)</td>
<td>2</td>
<td>Tightening torque 2.8 N·m</td>
</tr>
<tr>
<td>12</td>
<td>Cover HW1303243-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>GT-SA Bolt M4 (length: 12 mm)</td>
<td>2</td>
<td>Tightening torque 2.8 N·m</td>
</tr>
</tbody>
</table>

**Fig. 5-7: Disassembly & Reassembly of T-Axis Motor**
6 Disassembly/Reassembly of Speed Reducer

6.1 Disassembly/Reassembly of S-axis Speed Reducer.

Refer to chapter 3 “Home Position Return”, chapter 4 “Grease Replenishment/Exchange”, chapter 5 “Disassembly/Reassembly of the Motor” and chapter 7 “Disassembly/Reassembly of Wrist Unit”. Remove old sealing from each parts before assembling.

6.1 Disassembly/Reassembly of S-axis Speed Reducer.

• Refer to Fig. 6-1 “Disassembly & Reassembly of the S-Axis Speed Reducer”.

Disassembly

1. Turn OFF the DX200 power supply.

2. Remove the S-axis motor \( \oplus \) to remove the input gear \( \ominus \). (Execute “Disassembly” (2) ~ (5) in section 5.1 “Disassembly and Reassembly of the S-axis Motor”.)

3. Remove the GT-SA bolts \( \odot \), then, by using a chain block, lift up the upper part of the manipulator including the S-head and down it next to the base. (When putting it down, put it on a base and handle it with care not to pinch its internal lead.)

4. Unscrew the GT-SA bolts \( \odot \), then remove the M-base \( \ominus \) by using a stud bolt.

5. Unscrew the GT-SA bolts \( \odot \), then remove the speed reducer \( \oplus \) by using a bolt remover.

6. Discharge the built-up grease inside the base.

Reassembly

1. Before mounting the speed reducer \( \oplus \) on the base, apply Three Bond 1206C to the matching face between them.

2. Tighten the GT-SA bolts \( \odot \) with the tightening torque shown in Table 6-1 “S-Axis Speed Reducer Parts Checklist”.

3. Remove old sealing from the M-base \( \ominus \). Mount the M-base \( \ominus \) on the S-head, then tighten the GT-SA bolts \( \odot \) with the tightening torque shown in Table 6-1. (Before mounting the M-base \( \ominus \), apply ThreeBond 1206C to the matching face between the M-base \( \ominus \) and the S-head.)

4. Apply Three Bond 1206C to the matching face between the speed reducer \( \oplus \) and the M-base \( \ominus \). By using a chain block, lift up the S-head to install it to the speed reducer \( \oplus \).

5. Tighten the GT-SA bolts \( \odot \) with the tightening torque shown in Table 6-1.

6. Mount the input gear \( \ominus \) to the S-axis motor \( \ominus \) and mount them to the M-base \( \ominus \). (Execute “Reassembly” (3) ~ (6) in section 5.1. When replacing the speed reducer \( \oplus \), replace the input gear \( \ominus \), too.)

7. Replenish VIGO Grease RE NO.0 from the grease inlet.

8. Turn ON the DX200 power supply.
6 Disassembly/Reassembly of Speed Reducer

6.1 Disassembly/Reassembly of S-axis Speed Reducer.

Table 6-1: S-Axis Speed Reducer 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 HW0386621-B</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>②</td>
<td>GT-SA Bolt M6 (length: 35mm)</td>
<td>16</td>
<td>Tightening Torque 16.5 N•m</td>
</tr>
<tr>
<td>③</td>
<td>GT-SA Bolt M8 (length: 25mm)</td>
<td>18</td>
<td>Tightening Torque 24.5 N•m</td>
</tr>
<tr>
<td>④</td>
<td>S-Axis Motor</td>
<td>1</td>
<td>SGMRV-05ANA-YR2*</td>
</tr>
<tr>
<td>⑤</td>
<td>Input Gear HW0312734-2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑥</td>
<td>M-Base HW1303263-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑦</td>
<td>GT-SA Bolt M8 (length: 25mm)</td>
<td>7</td>
<td>Tightening Torque 24.5 N•m</td>
</tr>
</tbody>
</table>

Fig. 6-1: Disassembly & Reassembly of the S-Axis Speed Reducer
6.2 Disassembly/Reassembly of L-Axis Speed Reducer

- Refer to Fig. 6-2 “Disassembly & Reassembly of the L-Axis Speed Reducer”.

**Disassembly**

1. Turn OFF the DX200 power supply.
2. Before detaching the L-arm ☐, to avoid the L-arm from falling down, support it with a chain block, etc.
3. Remove the L-axis motor ☐ and also remove the input gear ☐.
   (Execute “Disassembly” (2) ~ (5) in section 5.2 “Disassembly and Reassembly of the L-axis Motor”.)
4. Unscrew the GT-SA bolts ☐, then remove the L-arm ☐ from the speed reducer ☐.
5. Unscrew the GT-SA bolts ☐, then remove the speed reducer ☐ from the S-head.
6. Remove old sealing from the L-arm ☐ and the S-head.

**Reassembly**

1. Mount the input gear ☐ to the L-axis motor ☐.
   (Execute “Reassembly” (1) ~ (2) in section 5.2. When replacing the speed reducer ☐, replace the input gear ☐, too.)
2. Before mounting the speed reducer ☐ to the S-head, apply Three Bond 1206C to the matching face between them.
3. Tighten the GT-SA bolts ☐ with the tightening torque shown in Table 6-2.
4. Before mounting the L-arm ☐ to the speed reducer ☐, apply Three Bond 1206C to the matching face between them.
5. Tighten the GT-SA bolts ☐ with the tightening torque shown in Table 6-2.
6. Mount the L-arm ☐. (Execute “Reassembly” (3) ~ (6) in section 5.2.)
7. Replenish VIGO Grease RE No.0 from the grease inlet.
8. Turn ON the DX200 power supply.
Table 6-2: L-Axis Speed Reducer 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 HW0387809-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>②</td>
<td>GT-SA Bolt M8 (length: 25mm)</td>
<td>18</td>
<td>Tightening Torque 40.0 N•m</td>
</tr>
<tr>
<td>③</td>
<td>L-Arm</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>④</td>
<td>GT-SA Bolt M6 (length: 60mm)</td>
<td>16</td>
<td>Tightening Torque 16.5 N•m</td>
</tr>
<tr>
<td>⑤</td>
<td>L-Axis Motor SGMRV-09ANA-YR1*</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑥</td>
<td>Input Gear HW0312735-2</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 6-2: Disassembly & Reassembly of the L-Axis Speed Reducer
6.3 Disassembly/Reassembly of U-Axis Speed Reducer

- Refer to Fig. 6-3 “Disassembly & Reassembly of the U-Axis Speed Reducer”.

**Disassembly**

1. Turn OFF the DX200 power supply.
2. Before detaching the U-arm unit, to avoid the unit from falling down, support it with a chain block, etc.
3. Remove the U-axis motor  to remove the input gear .
   (Execute “Disassembly” (2) ~ (6) in section 5.3 “Disassembly and Reassembly of the U-axis Motor”.)
4. Unscrew the GT-SA bolts , then remove the U-arm unit from the L-arm.
5. Unscrew the GT-SA bolts , then remove the speed reducer .
6. Remove old sealing from the L-arm and the U-arm unit.

**Reassembly**

1. Mount the input gear to the U-axis motor .
   (Execute “Reassembly” (1) ~ (2) in section 5.3. When replacing the speed reducer , replace the input gear , too.)
2. Before mounting the speed reducer to the L-arm unit, apply Three Bond 1206C to the matching face between them.
3. Tighten the GT-SA bolts with the tightening torque shown in Table 6-3 “U-Axis Speed Reducer Parts Checklist”.
4. Before mounting the U-arm to the L-arm unit, to which the speed reducer is attached, apply Three Bond 1206C to the matching face between the speed reducer and the U-arm.
5. Before tightening the GT-SA bolts , tighten them with the tightening torque shown in Table 6-3.
6. Mount the U-axis motor with the tightening torque shown in Table 6-3. (Execute “Reassembly” (3) ~ (6) in section 5.3.)
7. Replenish VIGO Grease RE NO.0 from the grease inlet.
8. Turn ON the DX200 power supply.
6 Disassembly/Reassembly of Speed Reducer
6.3 Disassembly/Reassembly of U-Axis Speed Reducer

Table 6-3: U-Axis Speed Reducer 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 HW1380153-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>②</td>
<td>GT-SA Bolt M5 (length: 25 mm)</td>
<td>16</td>
<td>Tightening Torque 10.0 N•m</td>
</tr>
<tr>
<td>③</td>
<td>GT-SA Bolt M10 (length: 30 mm)</td>
<td>6</td>
<td>Tightening Torque 82.0 N•m</td>
</tr>
<tr>
<td>④</td>
<td>GT-SA Bolt M6 (length: 25 mm)</td>
<td>3</td>
<td>Tightening Torque 16.5 N•m</td>
</tr>
<tr>
<td>⑤</td>
<td>U-Axis Motor</td>
<td>1</td>
<td>SGMRV-05ANA-YR2*</td>
</tr>
<tr>
<td>⑥</td>
<td>Input Gear HW1303245-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑦</td>
<td>GT-SA Bolt M4 (length: 12 mm)</td>
<td>3</td>
<td>Tightening Torque 2.8 N•m</td>
</tr>
</tbody>
</table>

Fig. 6-3: Disassembly & Reassembly of the U-Axis Speed Reducer
6 Disassembly/Reassembly of Speed Reducer
6.4 Disassembly/Reassembly of R-Axis Speed Reducer

**6.4 Disassembly/Reassembly of R-Axis Speed Reducer**

- Refer to Fig. 6-4 “Disassembly & Reassembly of the R-Axis Speed Reducer”.

**Disassembly**

1. Turn OFF the DX200 power supply.
2. Remove the R-axis motor. (Execute “Disassembly” (2) ~ (6) in section 5.4 “Disassembly and Reassembly of the R-axis Motor”.)
3. Remove the wrist unit. (Execute “Disassembly” in chapter 7 “Disassembly/Reassembly of Wrist Unit”.)
4. Unscrew the cross head APS bolts, and then remove the saddle.
5. Unscrew the GT-SA bolts, and then remove the cover.
6. Unscrew the cross head APS bolts, and then remove the saddle.
7. Unscrew the GT-SA bolts, and then remove the support.
8. Unscrew the GT-SA bolts, and then remove the support.
9. Unscrew the GT-SA bolts, and then remove the shaft.
10. Unscrew the GT-SA bolts, and then remove the housing.
11. Unscrew the GT-SA bolts, and then remove the gear.
12. Unscrew the GT-SA bolts, and then remove the R-axis speed reducer, and the shafts.
13. Unscrew the GT-SA bolts, and then remove the shaft.
14. Unscrew the GT-SA bolts, and then remove the shaft.

**Reassembly**

1. Before mounting the shaft with the GT-SA bolts to the R-axis speed reducer, apply Three Bond 1206C to the matching face between the shaft and the R-axis speed reducer. Also, apply grease to the oil seal on the shaft. (See “Enlarged View A” in Fig. 6-4 “Disassembly & Reassembly of the R-Axis Speed Reducer”).
2. Tighten the GT-SA bolts with the tightening torque shown in Table 6-4 “R-Axis Speed Reducer Parts Checklist”.
3. Before mounting the shaft to the shaft with the GT-SA bolts, apply Three Bond 1206C to the matching face between the shafts.
4. Tighten the GT-SA bolts with the tightening torque shown in Table 6-4.
5. Insert the R-axis speed reducer assembled in the step 2 and 3 to the U-arm unit. Apply grease to the oil seal on U-arm unit. (See “Enlarged View B” in Fig. 6-4).
6. Tighten the GT-SA bolts with the tightening torque shown in Table 6-4. (When screwing the bolts, be careful to the position of the speed reducer.)
7. Mount the gear with the GT-SA bolts.
8. Tighten the GT-SA bolts with the tightening torque shown in Table 6-4.
6. Disassembly/Reassembly of Speed Reducer
6.4 Disassembly/Reassembly of R-Axis Speed Reducer

9. Before mounting the housing to the R-axis speed reducer with the GT-SA bolts, apply Three Bond 1206C to the matching face between them.

10. Tighten the GT-SA bolts with the tightening torque shown in Table 6-4.

11. Before mounting the shaft with the GT-SA bolts, apply Three Bond 1206C to the thread part of the GT-SA bolts.

12. Tighten the GT-SA bolts with the tightening torque shown in Table 6-4.

13. Mount the support with the GT-SA bolts.

14. Tighten the GT-SA bolts with the tightening torque shown in Table 6-4.

15. Mount the support with the GT-SA bolts.

16. Tighten the GT-SA bolts with the tightening torque shown in Table 6-4.

17. Mount the wrist unit (Execute “Reassembly” in chapter 7 “Disassembly/Reassembly of Wrist Unit”). At this time, fix the internal wiring harness in the U-arm unit on the support using the saddle and the cross head APS bolts. Also, mount the cover with the GT-SA bolts.

18. Tighten the GT-SA bolts with the tightening torque shown in Table 6-4.


20. Replenish Harmonic Grease SK-1A only to the grease inlet on the R-axis gear part because the grease is already replenished to the new R-axis speed reducer.

21. Turn ON the DX200 power supply.
## Table 6-4: R-Axis Speed Reducer 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 HW1382521-A</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>GT-SA Bolt M5 (length: 45 mm)</td>
<td>6</td>
<td>Tightening torque 6.0 N·m</td>
</tr>
<tr>
<td>3</td>
<td>GT-SA Bolt M6 (length: 20 mm)</td>
<td>7</td>
<td>Tightening torque 10.0 N·m</td>
</tr>
<tr>
<td>4</td>
<td>Shaft HW1303240-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>GT-SA Bolt M6 (length: 20 mm)</td>
<td>7</td>
<td>Tightening torque 10.0 N·m</td>
</tr>
<tr>
<td>6</td>
<td>Shaft HW1303256-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Gear HW1303247-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>GT-SA Bolt M3 (length: 12 mm)</td>
<td>6</td>
<td>Tightening torque 1.4 N·m</td>
</tr>
<tr>
<td>9</td>
<td>Housing HW1303242-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>GT-SA Bolt M4 (length: 12 mm)</td>
<td>4</td>
<td>Tightening torque 2.8 N·m</td>
</tr>
<tr>
<td>11</td>
<td>Shaft HW1303257-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>GT-SA Bolt M3 (length: 12 mm)</td>
<td>5</td>
<td>Tightening torque 1.4 N·m</td>
</tr>
<tr>
<td>13</td>
<td>Saddle PZ1208</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Cross head APS bolt M4 (length: 6 mm)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Saddle PZ1212</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>GT-SA Bolt M4 (length: 12 mm)</td>
<td>2</td>
<td>Tightening torque 2.8 N·m</td>
</tr>
<tr>
<td>17</td>
<td>Support HW1404042-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>GT-SA Bolt M4 (length: 12 mm)</td>
<td>2</td>
<td>Tightening torque 2.8 N·m</td>
</tr>
<tr>
<td>19</td>
<td>Support HW1404043-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Cover HW1404499-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>GT-SA Bolt M4 (length: 12 mm)</td>
<td>1</td>
<td>Tightening torque 2.8 N·m</td>
</tr>
<tr>
<td>22</td>
<td>Saddle PZ1208</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Cross head APS bolt M4 (length: 6 mm)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Saddle PZ1212</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Fig. 6-4: Disassembly & Reassembly of the R-Axis Speed Reducer

Apply MP-1 grease

U-arm unit

Wrist Unit

Enlarged View B

Enlarged View A

R-axis motor
6.5 Disassembly/Reassembly of B-Axis Speed Reducer

- Refer to Fig. 6-5 “Disassembly & Reassembly of the B-Axis Speed Reducer”.

**Disassembly**

1. Turn OFF the DX200 power supply.
2. Unscrew the GT-SA bolts ① to remove the cover ①.
3. Loosen the GT-SA bolts ② which are fixing the B-axis motor, then remove the timing belt ②.
4. Unscrew the GT-SA bolts ③ to remove the pulley ①, the housing ③, the wave generator ②, and the bearings ② ④.
5. Unscrew the GT-SA bolt ① to remove the pulley ②.
6. Unscrew the GT-SA bolts ② ③ to remove the circular spline ② and the shaft ②.
7. Unscrew the GT-SA bolts ① to remove the flex spline ①.

**Reassembly**

1. Press fit the bearing ① into the wave generator ②.
2. Press fit the bearing ① into the housing ③, and then fit the retaining ring ①.
   (Replace the bearing ① and ② when replacing the speed reducer.)
3. Apply Harmonic Grease SK-1A to the inside wall of the flex spline ① and gear slots outside of it.
4. Before mounting the flex spline ① to the wrist unit, apply ThreeBond 1206C to the fitting face between them.
5. Tighten the GT-SA bolts ① with the tightening torque shown in Table 6-5 “B-Axis Speed Reducer Parts Checklist”.
6. Apply Harmonic Grease SK-1A to the gear slot of the circular spline ②.
7. Mount the circular spline ② and the shaft ② with the GT-SA bolts ② ③.
   (Apply ThreeBond 1206C to the fitting face between the shaft ② and the circular spline ② and the shaft ② and the wrist unit.)
8. Tighten the GT-SA bolts ② ③ with the tightening torque shown in Table 6-5.
9. Apply Harmonic Grease SK-1A to the bearing part of the wave generator ①.
10. Mount the wave generator ① and the housing ① (assembled in above mentioned step 2) using the GT-SA bolts ①. (Apply ThreeBond 1206C to the fitting face between the housing ① and the shaft ①.)
11. Tighten the GT-SA bolts ① with the tightening torque shown in Table 6-5.
12. Mount the pulley ① with the GT-SA bolts ①.
13. Tighten the GT-SA bolts ① with the tightening torque shown in Table 6-5.
14. Hang the timing belt ① on the pulley ①.
6 Disassembly/Reassembly of Speed Reducer
6.5 Disassembly/Reassembly of B-Axis Speed Reducer

15. Adjust the initial tension of the timing belt to the designated tension, then tighten the GT-SA bolts with the tightening torque shown in Table 6-5. (Refer to chapter 8 “Disassembly/Reassembly and Adjustment of B- and T-Axes Timing Belts”.)

16. Before mounting the cover to the U-arm, apply Three Bond 1206C to the matching face between them. (Remove old sealing from the cover and the U-arm.)

17. Tighten the GT-SA bolts with the tightening torque shown in Table 6-5.

18. Turn ON the DX200 power supply.

Table 6-5: B-Axis Speed Reducer 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 HW1382522-A</td>
<td>1</td>
<td>Flex Spline</td>
</tr>
<tr>
<td>②</td>
<td>Speed Reducer HW1382522-A</td>
<td>1</td>
<td>Circular Spline</td>
</tr>
<tr>
<td>③</td>
<td>Speed Reducer HW1382522-A</td>
<td>1</td>
<td>Wave Generator</td>
</tr>
<tr>
<td>④</td>
<td>GT-SA Bolt M3 (length: 28 mm)</td>
<td>12</td>
<td>Tightening torque 1.4 Nm</td>
</tr>
<tr>
<td>⑤</td>
<td>Shaft HW1303259-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑥</td>
<td>GT-SA Bolt M3 (length: 10 mm)</td>
<td>11</td>
<td>Tightening torque 1.4 Nm</td>
</tr>
<tr>
<td>⑦</td>
<td>Housing HW1404047-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑧</td>
<td>GT-SA Bolt M3 (length: 16 mm)</td>
<td>4</td>
<td>Tightening torque 1.4 Nm</td>
</tr>
<tr>
<td>⑨</td>
<td>GT-SA Bolt M3 (length: 20 mm)</td>
<td>12</td>
<td>Tightening torque 1.4 Nm</td>
</tr>
<tr>
<td>⑩</td>
<td>Pulley HW1404037</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑪</td>
<td>GT-SA Bolt M3 (length: 10 mm)</td>
<td>4</td>
<td>Tightening torque 1.4 Nm</td>
</tr>
<tr>
<td>⑫</td>
<td>Bearing 6803LLU</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑬</td>
<td>Retaining Ring IRTW26</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑭</td>
<td>Bearing 6902</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑮</td>
<td>GT-SA Bolt M4 (length: 16 mm)</td>
<td>2</td>
<td>Tightening torque 2.8 Nm</td>
</tr>
<tr>
<td>⑯</td>
<td>Cover HW1303243-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>⑰</td>
<td>GT-SA Bolt M4 (length: 12 mm)</td>
<td>10</td>
<td>Tightening torque 2.8 Nm</td>
</tr>
<tr>
<td>⑱</td>
<td>Timing Belt 60S3M642</td>
<td>11</td>
<td></td>
</tr>
</tbody>
</table>
Fig. 6-5: Disassembly & Reassembly of the B-Axis Speed Reducer
7 Disassembly/Reassembly of Wrist Unit

• Refer to Fig. 7-1 “Disassembly & Reassembly of Wrist Unit”.

Refer to the following chapters in this manual as needed: chapter 2 “Notes for Maintenance” and chapter 3 “Home Position Return”.

Disassembly
1. Turn OFF the DX200 power supply.
2. Unscrew the GT-SA bolts to remove the cover.
3. Unscrew the GT-SA bolts to remove the cover.
4. Connect backup batteries to the B- and T-axes motors.
5. Disconnect the connectors of the B- and T-axes internal wiring harness.
6. Unscrew the GT-SA bolts to remove the wrist unit.

Reassembly
1. Apply Three Bond 1206C to the matching face between the wrist unit and the shaft inside the U-arm.
2. Pass the BT-axes internal wiring harness through the wrist unit, then fix the wrist unit with the GT-SA bolts.
3. Tighten the GT-SA bolts with the tightening torque shown in Table 7-1 “Wrist Unit Parts Checklist”.
4. Connect the B- and T-axes internal wiring harness to the B- and T-axes motors, then disconnect the backup batteries.
5. Before mounting the cover and to the wrist unit with the GT-SA bolts and , apply Three Bond 1206C to the matching face between them.
6. Tighten the GT-SA bolts and with the tightening torque shown in Table 7-1.
7. Turn ON the DX200 power supply.

Table 7-1: Wrist Unit 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>Wrist Unit</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>GT-SA Bolt M6 (length: 20 mm)</td>
<td>6</td>
<td>Tightening torque 10.0 N(\cdot)m</td>
</tr>
<tr>
<td>3</td>
<td>Cover HW1303244-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>GT-SA Bolt M4 (length: 12 mm)</td>
<td>9</td>
<td>Tightening torque 2.8 N(\cdot)m</td>
</tr>
<tr>
<td>5</td>
<td>Cover HW1303243-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>GT-SA Bolt M4 (length: 12mm)</td>
<td>10</td>
<td>Tightening torque 2.8 N(\cdot)m</td>
</tr>
</tbody>
</table>
Fig. 7-1: Disassembly & Reassembly of Wrist Unit
8 Disassembly/Reassembly and Adjustment of B- and T-Axes Timing Belts

8.1 Disassembly/Reassembly of B- and T-axes Timing Belts

- Refer to Fig. 8-1 “Disassembly & Reassembly of B- and T-Axes Timing Belt” and Table 8-1 “B- and T-Axes Timing Belt Parts Checklist”.
- Refer to section 5.5 “Disassembly/Reassembly of B-Axis Motor” and section 5.6 “Disassembly/Reassembly of T-Axis Motor”.

**Disassembly**

1. Unscrew the GT-SA bolts and to remove the cover and.
2. Loosen the GT-SA bolts which are fixing the M-base, then remove the timing belt.
3. Loosen the GT-SA bolts which are fixing the M-base, then remove the timing belt.

**Reassembly**

1. After hanging the T-axis timing belt, fix the M-base by tightening the GT-SA bolts with the tightening torque shown in Table 8-1 “B- and T-Axes Timing Belt Parts Checklist”.
2. After hanging the B-axis timing belt, fix the M-base by tightening the GT-SA bolts with the tightening torque shown in Table 8-1.
3. Before mounting the cover and to the wrist unit, apply Three Bond 1206C to the matching face between them.
4. Tighten the GT-SA bolts and with the tightening torque shown in table Table 8-1.
8 Disassembly/Reassembly and Adjustment of B- and T-Axes Timing Belts
8.1 Disassembly/Reassembly of B- and T-axes Timing Belts

Table 8-1: B- and T-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>B-Axis Timing Belt 60S3M642</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>T-Axis Timing Belt 80S3M819</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>M-Base HW1404052-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>GT-SA Bolt M4 (length: 16 mm)</td>
<td>2</td>
<td>Tightening torque 2.8 N*m</td>
</tr>
<tr>
<td>5</td>
<td>M-Base HW1404046-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>GT-SA Bolt M4 (length: 16 mm)</td>
<td>2</td>
<td>Tightening torque 2.8 N*m</td>
</tr>
<tr>
<td>7</td>
<td>Cover HW1303243-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>GT-SA Bolt M4 (length: 12 mm)</td>
<td>10</td>
<td>Tightening torque 2.8 N*m</td>
</tr>
<tr>
<td>9</td>
<td>Cover HW1303244-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>GT-SA Bolt M4 (length: 12 mm)</td>
<td>9</td>
<td>Tightening torque 2.8 N*m</td>
</tr>
</tbody>
</table>

Fig. 8-1: Disassembly & Reassembly of B- and T-Axes Timing Belt
8.2 Adjustment of Timing Belts

Refer to Fig. 8-1 “Disassembly & Reassembly of B- and T-Axes Timing Belt” and Table 8-1 “B- and T-Axes Timing Belt Parts Checklist”.

- **B-axis**
  1. Loosen the GT-SA bolts.
  2. With the tension meter, adjust the initial tension to be the specific initial tension as shown in Table 8-2 “Initial Tension of Timing Belt” with a tension meter.
  3. Tighten the GT-SA bolts with the tightening torque shown in Table 8-1 “B- and T-Axes Timing Belt Parts Checklist”.

- **T-axis**
  1. Loosen the GT-SA bolts.
  2. With the tension meter, adjust the initial tension to be the specific initial tension as shown in Table 8-2.
  3. Tighten the GT-SA bolts with the tightening torque shown in Table 8-1.

### Table 8-2: Initial Tension of Timing Belt

<table>
<thead>
<tr>
<th></th>
<th>Initial Tension</th>
<th>Width (W)</th>
<th>Span (S)</th>
<th>Mass/ (Width, Length)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-axis</td>
<td>19.6 to 26.5 N</td>
<td>6 mm</td>
<td>260.5 mm</td>
<td>19g/(W=10 mm, L=1m)</td>
</tr>
<tr>
<td>T-axis</td>
<td>19.6 to 36.3 N</td>
<td>8 mm</td>
<td>337 mm</td>
<td></td>
</tr>
</tbody>
</table>
9 Battery Pack Replacement

9.1 Battery Pack Replacement

The battery packs are installed in the position shown in Fig. 9-1 “Battery Location”. If the battery alarm occurs in the DX200, replace the battery in accordance with the following procedure:

1. Turn OFF the DX200 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.

Fig. 9-1: Battery Location

Fig. 9-2: Battery Connection
9 Battery Pack Replacement

9.1 Battery Pack Replacement

5. Remove the old battery pack from the board.

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

6. Mount the new battery pack to the holder.

7. Reinstall the plate.

**NOTE** Do not allow plate to pinch the cables when reinstalling the plate.
10 Parts List

10.1 S-Axis Unit

Fig. 10-1: S-Axis Unit
Table 10-1: S-Axis Unit

<table>
<thead>
<tr>
<th>No.</th>
<th>DWG No.</th>
<th>Name</th>
<th>Pcs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001</td>
<td>HW1100498-1</td>
<td>Base</td>
<td>1</td>
</tr>
<tr>
<td>1002</td>
<td>HW0386621-B</td>
<td>Speed reducer</td>
<td>1</td>
</tr>
<tr>
<td>1003</td>
<td>HW0312734-2</td>
<td>Gear</td>
<td>1</td>
</tr>
<tr>
<td>1004</td>
<td>2L-5</td>
<td>Conical spring washer</td>
<td>1</td>
</tr>
<tr>
<td>1005</td>
<td>M5×85</td>
<td>Hexagon socket head cap screw</td>
<td></td>
</tr>
<tr>
<td>1006</td>
<td>ATSH8-03</td>
<td>Union</td>
<td>2</td>
</tr>
<tr>
<td>1007</td>
<td>NB-0860-0.3</td>
<td>Tube</td>
<td>1</td>
</tr>
<tr>
<td>1008</td>
<td>M6×35</td>
<td>GT-SA bolt</td>
<td>16</td>
</tr>
<tr>
<td>1009</td>
<td>HW1303263-1</td>
<td>M base</td>
<td>16</td>
</tr>
<tr>
<td>1010</td>
<td>M8×25</td>
<td>GT-SA bolt (STAINLESS)</td>
<td>1</td>
</tr>
<tr>
<td>1011</td>
<td>HW1100499-1</td>
<td>S head</td>
<td>1</td>
</tr>
<tr>
<td>1012</td>
<td>PT3/8</td>
<td>Hexagon socket head plug</td>
<td>1</td>
</tr>
<tr>
<td>1013</td>
<td>NB-0860-0.2</td>
<td>Tube</td>
<td>2</td>
</tr>
<tr>
<td>1014</td>
<td>SGMRV-05ANA-YR2X</td>
<td>Motor</td>
<td>16</td>
</tr>
<tr>
<td>1015</td>
<td>M5×16</td>
<td>Hexagon socket head cap screw</td>
<td>2</td>
</tr>
<tr>
<td>1016</td>
<td>2L-5</td>
<td>Conical spring washer</td>
<td>2</td>
</tr>
<tr>
<td>1017</td>
<td>TS200CHM</td>
<td>Terminal</td>
<td>1</td>
</tr>
<tr>
<td>1018</td>
<td>CD31</td>
<td>Saddle</td>
<td>1</td>
</tr>
<tr>
<td>1019</td>
<td>M5×8</td>
<td>Hexagon socket head cap screw</td>
<td>4</td>
</tr>
<tr>
<td>1020</td>
<td>2L-5</td>
<td>Conical spring washer</td>
<td>4</td>
</tr>
<tr>
<td>1021</td>
<td>HW0414670-1</td>
<td>Support</td>
<td>1</td>
</tr>
<tr>
<td>1022</td>
<td>HW0414670-2</td>
<td>Support</td>
<td>1</td>
</tr>
<tr>
<td>1023</td>
<td>HW1303253-1</td>
<td>Cover</td>
<td>1</td>
</tr>
<tr>
<td>1024</td>
<td>M6×15</td>
<td>GT-SA bolt (STAINLESS)</td>
<td>22</td>
</tr>
<tr>
<td>1025</td>
<td>M5×10 (STAINLESS)</td>
<td>APS bolt</td>
<td>6</td>
</tr>
<tr>
<td>1026</td>
<td>HW1303254-1</td>
<td>Cover</td>
<td>1</td>
</tr>
<tr>
<td>1027</td>
<td>C-30-SG-30A</td>
<td>Glomet</td>
<td>1</td>
</tr>
<tr>
<td>1028</td>
<td>HW1303255-1</td>
<td>Cover</td>
<td>1</td>
</tr>
<tr>
<td>1029</td>
<td>TA1-S10</td>
<td>Clamp</td>
<td>2</td>
</tr>
<tr>
<td>1030</td>
<td>M5×8 (STAINLESS)</td>
<td>Pan-head sems screw</td>
<td>2</td>
</tr>
<tr>
<td>1031</td>
<td>T50R</td>
<td>Cable tie</td>
<td>2</td>
</tr>
<tr>
<td>1032</td>
<td>EZ5036A0</td>
<td>Cap</td>
<td>1</td>
</tr>
<tr>
<td>1033</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
10.2 L-Axis Unit

Fig. 10-2: L-Axis Unit

Table 10-2: L-Axis Unit

<table>
<thead>
<tr>
<th>No.</th>
<th>DWG No.</th>
<th>Name</th>
<th>Pcs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>M6x60</td>
<td>GT-SA bolt</td>
<td>16</td>
</tr>
<tr>
<td>2002</td>
<td>NPTF3/8 (STAINNESS)</td>
<td>Hexagon socket head tapered pipe plug (NPTF type)</td>
<td>1</td>
</tr>
<tr>
<td>2003</td>
<td>M6x75</td>
<td>Hexagon socket head cap screw</td>
<td>1</td>
</tr>
<tr>
<td>2004</td>
<td>2L-6</td>
<td>Conical spring washer</td>
<td>1</td>
</tr>
<tr>
<td>2005</td>
<td>HW0312735-2</td>
<td>Gear</td>
<td>1</td>
</tr>
<tr>
<td>2006</td>
<td>M6x15</td>
<td>GT-SA bolt</td>
<td>4</td>
</tr>
<tr>
<td>2007</td>
<td>SGMRV-09ANA-YR1X</td>
<td>Motor</td>
<td>1</td>
</tr>
<tr>
<td>2008</td>
<td>M8x25</td>
<td>GT-SA bolt</td>
<td>22</td>
</tr>
<tr>
<td>2009</td>
<td>PT3/8</td>
<td>Hexagon socket head plug</td>
<td>1</td>
</tr>
<tr>
<td>2010</td>
<td>HW0387809-A</td>
<td>Speed reducer</td>
<td>1</td>
</tr>
<tr>
<td>2011</td>
<td>HW1100500-1</td>
<td>L-arm</td>
<td>1</td>
</tr>
<tr>
<td>2012</td>
<td>HW1404040-1</td>
<td>Cover</td>
<td>1</td>
</tr>
<tr>
<td>1011</td>
<td>HW1100499-1</td>
<td>S head</td>
<td>1</td>
</tr>
</tbody>
</table>
10.3 U-Axis Unit

Fig. 10-3: U-Axis Unit
### Table 10-3: U-Axis Unit

<table>
<thead>
<tr>
<th>No.</th>
<th>DWG No.</th>
<th>Name</th>
<th>Pcs</th>
</tr>
</thead>
<tbody>
<tr>
<td>3001</td>
<td>HW1100501-1</td>
<td>Casing</td>
<td>1</td>
</tr>
<tr>
<td>3002</td>
<td>M12×20</td>
<td>Hexagon socket head cap screw</td>
<td>2</td>
</tr>
<tr>
<td>3003</td>
<td>M4×12</td>
<td>GT-SA bolt</td>
<td>5</td>
</tr>
<tr>
<td>3004</td>
<td>M5×75</td>
<td>Hexagon socket head cap screw</td>
<td>1</td>
</tr>
<tr>
<td>3005</td>
<td>2L-5</td>
<td>Conical spring washer</td>
<td>1</td>
</tr>
<tr>
<td>3006</td>
<td>HW1303245-1</td>
<td>Gear</td>
<td>1</td>
</tr>
<tr>
<td>3007</td>
<td>NPTF3/8 (STAINLESS)</td>
<td>Hexagon socket head tapered pipe plug (NPTF type)</td>
<td>1</td>
</tr>
<tr>
<td>3008</td>
<td>HW1380153-A</td>
<td>Speed reducer</td>
<td>1</td>
</tr>
<tr>
<td>3009</td>
<td>M5×25</td>
<td>GT-SA bolt</td>
<td>16</td>
</tr>
<tr>
<td>3010</td>
<td>M10×30</td>
<td>GT-SA bolt</td>
<td>6</td>
</tr>
<tr>
<td>3011</td>
<td>SGMRV-05ANA-YR2</td>
<td>Motor</td>
<td>1</td>
</tr>
<tr>
<td>3012</td>
<td>M8×30</td>
<td>GT-SA bolt</td>
<td>4</td>
</tr>
<tr>
<td>3013</td>
<td>M6×25</td>
<td>GT-SA bolt</td>
<td>3</td>
</tr>
<tr>
<td>3014</td>
<td>HW1404044-1</td>
<td>Plate</td>
<td>1</td>
</tr>
<tr>
<td>3015</td>
<td>PT3/8</td>
<td>Hexagon socket head plug</td>
<td>1</td>
</tr>
<tr>
<td>3016</td>
<td>HW1404041-1</td>
<td>Support</td>
<td>1</td>
</tr>
<tr>
<td>3017</td>
<td>HW0404554-2</td>
<td>N base</td>
<td>1</td>
</tr>
<tr>
<td>3018</td>
<td>M3×16 (STAINLESS)</td>
<td>Pan-head sems screw</td>
<td>2</td>
</tr>
<tr>
<td>3019</td>
<td>M3</td>
<td>Nut</td>
<td>2</td>
</tr>
<tr>
<td>3020</td>
<td>M4×12</td>
<td>GT-SA bolt</td>
<td>4</td>
</tr>
<tr>
<td>3021</td>
<td>KQE10-03</td>
<td>Union</td>
<td>1</td>
</tr>
<tr>
<td>3022</td>
<td>KQE12-03</td>
<td>Union</td>
<td>1</td>
</tr>
<tr>
<td>2011</td>
<td>HW1100500-1</td>
<td>L-arm</td>
<td>1</td>
</tr>
</tbody>
</table>
10.4 R-Axis Unit

Fig. 10-4: R-Axis Unit
### Table 10-4: R-Axis Unit

<table>
<thead>
<tr>
<th>No.</th>
<th>DWG No.</th>
<th>Name</th>
<th>Pcs</th>
</tr>
</thead>
<tbody>
<tr>
<td>4001</td>
<td>M4×12</td>
<td>GT-SA bolt</td>
<td>10</td>
</tr>
<tr>
<td>4002</td>
<td>PT1/8</td>
<td>Hexagon socket head plug</td>
<td>4</td>
</tr>
<tr>
<td>4003</td>
<td>HW1303240-1</td>
<td>Shaft</td>
<td>1</td>
</tr>
<tr>
<td>4004</td>
<td>M6×20</td>
<td>GT-SA bolt</td>
<td>20</td>
</tr>
<tr>
<td>4005</td>
<td>HW1303256-1</td>
<td>Shaft</td>
<td>1</td>
</tr>
<tr>
<td>4006</td>
<td>TC1151306</td>
<td>Oil seal</td>
<td>1</td>
</tr>
<tr>
<td>4007</td>
<td>AE0478G</td>
<td>Oil seal</td>
<td>1</td>
</tr>
<tr>
<td>4008</td>
<td>TC52647</td>
<td>Oil seal</td>
<td>1</td>
</tr>
<tr>
<td>4009</td>
<td>HW1303247-1</td>
<td>Gear</td>
<td>1</td>
</tr>
<tr>
<td>4010</td>
<td>HW1382521-A</td>
<td>Speed reducer</td>
<td>1</td>
</tr>
<tr>
<td>4011</td>
<td>M5×45</td>
<td>GT-SA bolt</td>
<td>6</td>
</tr>
<tr>
<td>4012</td>
<td>HW1303242-1</td>
<td>Housing</td>
<td>1</td>
</tr>
<tr>
<td>4013</td>
<td>HW1303257-1</td>
<td>Shaft</td>
<td>1</td>
</tr>
<tr>
<td>4014</td>
<td>M3×12</td>
<td>GT-SA bolt</td>
<td>11</td>
</tr>
<tr>
<td>4015</td>
<td>HW1303246-1</td>
<td>Gear</td>
<td>1</td>
</tr>
<tr>
<td>4016</td>
<td>HW1404045-1</td>
<td>M base</td>
<td>1</td>
</tr>
<tr>
<td>4017</td>
<td>M3×16</td>
<td>GT-SA bolt</td>
<td>3</td>
</tr>
<tr>
<td>4018</td>
<td>M4×16</td>
<td>Hexagon socket head cap screw</td>
<td>1</td>
</tr>
<tr>
<td>4019</td>
<td>2L-4</td>
<td>Conical spring washer</td>
<td>1</td>
</tr>
<tr>
<td>4020</td>
<td>HW0404304-2</td>
<td>Gasket</td>
<td>1</td>
</tr>
<tr>
<td>4021</td>
<td>HW1404056-1</td>
<td>Cover</td>
<td>1</td>
</tr>
<tr>
<td>4022</td>
<td>SGMAV-01ANA-YR13</td>
<td>Motor</td>
<td>1</td>
</tr>
<tr>
<td>4023</td>
<td>M4×12</td>
<td>GT-SA bolt</td>
<td>11</td>
</tr>
<tr>
<td>4024</td>
<td>HW9481319-D</td>
<td>Cable bushing</td>
<td>1</td>
</tr>
<tr>
<td>4025</td>
<td>HW1303241-1</td>
<td>Cover</td>
<td>1</td>
</tr>
<tr>
<td>4026</td>
<td>PZ1212</td>
<td>Saddle</td>
<td>2</td>
</tr>
<tr>
<td>4027</td>
<td>M4×6 (STAINLESS)</td>
<td>APS bolt</td>
<td>8</td>
</tr>
<tr>
<td>4028</td>
<td>PZ1208</td>
<td>Saddle</td>
<td>2</td>
</tr>
<tr>
<td>4029</td>
<td>HW1404042-1</td>
<td>Support</td>
<td>1</td>
</tr>
<tr>
<td>4030</td>
<td>HW1404043-1</td>
<td>Support</td>
<td>1</td>
</tr>
<tr>
<td>4032</td>
<td>HW1404499-1</td>
<td>Cover</td>
<td>1</td>
</tr>
<tr>
<td>3001</td>
<td>HW1100501</td>
<td>Casing</td>
<td>1</td>
</tr>
<tr>
<td>5063</td>
<td>HW1100502-1</td>
<td>U-arm</td>
<td>1</td>
</tr>
</tbody>
</table>
10.5 Wrist Unit

Fig. 10-5: Wrist Unit
### Table 10-5: Wrist Unit (Sheet 1 of 2)

<table>
<thead>
<tr>
<th>No.</th>
<th>DWG No.</th>
<th>Name</th>
<th>Pcs</th>
</tr>
</thead>
<tbody>
<tr>
<td>5001</td>
<td>M6X6</td>
<td>Hexagon socket head cap screw</td>
<td>5</td>
</tr>
<tr>
<td>5002</td>
<td>HW0404371-1</td>
<td>Bolt</td>
<td>1</td>
</tr>
<tr>
<td>5003</td>
<td>HW1404058-1</td>
<td>Cover</td>
<td>1</td>
</tr>
<tr>
<td>5004</td>
<td>M3×12</td>
<td>GT-SA bolt</td>
<td>2</td>
</tr>
<tr>
<td>5005</td>
<td>M3×10</td>
<td>GT-SA bolt</td>
<td>37</td>
</tr>
<tr>
<td>5006</td>
<td>HW1404060-1</td>
<td>Gasket</td>
<td>1</td>
</tr>
<tr>
<td>5007</td>
<td>HW1404069-1</td>
<td>Cover</td>
<td>1</td>
</tr>
<tr>
<td>5008</td>
<td>M4X10 (STAINLESS)</td>
<td>APS bolt</td>
<td>2</td>
</tr>
<tr>
<td>5009</td>
<td>M4×12</td>
<td>GT-SA bolt</td>
<td>23</td>
</tr>
<tr>
<td>5010</td>
<td>M4×10</td>
<td>GT-SA bolt</td>
<td>4</td>
</tr>
<tr>
<td>5011</td>
<td>HW1404053-1</td>
<td>Fly wheel</td>
<td>1</td>
</tr>
<tr>
<td>5012</td>
<td>HW1404038-A</td>
<td>Pulley</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>HW1404038-B</td>
<td>Pulley</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(For the manipulator assembled after Jun 21, 2015)</td>
<td></td>
</tr>
<tr>
<td>5013</td>
<td>M4×16</td>
<td>Hexagon socket head cap screw</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>M4×20</td>
<td>Hexagon socket head cap screw</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(For the manipulator assembled after Jun 21, 2015)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5014</td>
<td>2L-4</td>
<td>Conical spring washer</td>
<td>2</td>
</tr>
<tr>
<td>5015</td>
<td>M4×16</td>
<td>GT-SA bolt</td>
<td>4</td>
</tr>
<tr>
<td>5016</td>
<td>HW1303244-1</td>
<td>Cover</td>
<td>1</td>
</tr>
<tr>
<td>5017</td>
<td>80S3M819</td>
<td>Belt</td>
<td>1</td>
</tr>
<tr>
<td>5018</td>
<td>WR20</td>
<td>Circlip</td>
<td>1</td>
</tr>
<tr>
<td>5019</td>
<td>HW1303260-1</td>
<td>Shaft</td>
<td>1</td>
</tr>
<tr>
<td>5020</td>
<td>HW1404049</td>
<td>Cover</td>
<td>1</td>
</tr>
<tr>
<td>5021</td>
<td>M8×40</td>
<td>Hexagon socket head cap screw</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(For the manipulator assembled after Jun 21, 2015)</td>
<td></td>
</tr>
<tr>
<td>5022</td>
<td>2L-8</td>
<td>Conical spring washer</td>
<td>1</td>
</tr>
<tr>
<td>5023</td>
<td>HW1481728-A</td>
<td>Bearing</td>
<td>1</td>
</tr>
<tr>
<td>5024</td>
<td>6809DDU</td>
<td>Bearing</td>
<td>1</td>
</tr>
<tr>
<td>5025</td>
<td>HW1404059-6</td>
<td>Spring</td>
<td>1</td>
</tr>
<tr>
<td>5026</td>
<td>HW1303248-1</td>
<td>Gear</td>
<td>1</td>
</tr>
<tr>
<td>5027</td>
<td>6804</td>
<td>Bearing</td>
<td>1</td>
</tr>
<tr>
<td>5028</td>
<td>M3×28</td>
<td>GT-SA bolt</td>
<td>18</td>
</tr>
<tr>
<td>5029</td>
<td>M8×20</td>
<td>Hexagon socket head cap screw</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(For the manipulator assembled after Jun 21, 2015)</td>
<td></td>
</tr>
<tr>
<td>5030</td>
<td>2L-8</td>
<td>Conical spring washer</td>
<td>1</td>
</tr>
<tr>
<td>5031</td>
<td>HW1404039-1</td>
<td>Pulley</td>
<td>1</td>
</tr>
<tr>
<td>5032</td>
<td>HW1303249-1</td>
<td>Gear</td>
<td>1</td>
</tr>
<tr>
<td>5033</td>
<td>HW1404048-1</td>
<td>B cover (holder)</td>
<td>1</td>
</tr>
<tr>
<td>5034</td>
<td>HW1404054-1</td>
<td>Shaft</td>
<td>1</td>
</tr>
<tr>
<td>5035</td>
<td>TC50606</td>
<td>Oil seal</td>
<td>1</td>
</tr>
<tr>
<td>5036</td>
<td>AR28</td>
<td>Circlip</td>
<td>1</td>
</tr>
<tr>
<td>5037</td>
<td>WR15</td>
<td>Circlip</td>
<td>1</td>
</tr>
<tr>
<td>5038</td>
<td>NA4902</td>
<td>Needle bearing</td>
<td>1</td>
</tr>
<tr>
<td>5039</td>
<td>HW1303250-1</td>
<td>Gear</td>
<td>1</td>
</tr>
</tbody>
</table>
# Table 10-5: Wrist Unit  (Sheet 2 of 2)

<table>
<thead>
<tr>
<th>No.</th>
<th>DWG No.</th>
<th>Name</th>
<th>Pcs</th>
</tr>
</thead>
<tbody>
<tr>
<td>5040</td>
<td>HW1371294-A</td>
<td>Gear assy</td>
<td>1</td>
</tr>
<tr>
<td>5041</td>
<td>RA9008CO</td>
<td>Cross roller bearing</td>
<td>1</td>
</tr>
<tr>
<td>5042</td>
<td>TC1001105</td>
<td>Oil seal</td>
<td>1</td>
</tr>
<tr>
<td>5043</td>
<td>TC64746</td>
<td>Oil seal</td>
<td>1</td>
</tr>
<tr>
<td>5044</td>
<td>HW1303261-1</td>
<td>Flange</td>
<td>1</td>
</tr>
<tr>
<td>5045</td>
<td>HW1404055-1</td>
<td>Holder</td>
<td>1</td>
</tr>
<tr>
<td>5046</td>
<td>HW1303262-1</td>
<td>Flange</td>
<td>1</td>
</tr>
<tr>
<td>5047</td>
<td>HW1100503-1</td>
<td>Wrist</td>
<td>1</td>
</tr>
<tr>
<td>5048</td>
<td>HW1303259-1</td>
<td>Shaft</td>
<td>1</td>
</tr>
<tr>
<td>5049</td>
<td>M3×20</td>
<td>GT-SA bolt</td>
<td>12</td>
</tr>
<tr>
<td>5050</td>
<td>IRTW26</td>
<td>Retaining ring</td>
<td>1</td>
</tr>
<tr>
<td>5051</td>
<td>6803LLU</td>
<td>Bearing</td>
<td>1</td>
</tr>
<tr>
<td>5052</td>
<td>HW1404037-1</td>
<td>Pulley</td>
<td>1</td>
</tr>
<tr>
<td>5053</td>
<td>M3×16</td>
<td>GT-SA bolt</td>
<td>4</td>
</tr>
<tr>
<td>5054</td>
<td>HW1404047-1</td>
<td>Housing</td>
<td>1</td>
</tr>
<tr>
<td>5055</td>
<td>HW1382522-A</td>
<td>Speed reducer</td>
<td>1</td>
</tr>
<tr>
<td>5056</td>
<td>60S3M642</td>
<td>Belt</td>
<td>1</td>
</tr>
<tr>
<td>5057</td>
<td>HW1303243-1</td>
<td>Cover</td>
<td>1</td>
</tr>
<tr>
<td>5058</td>
<td>SGMAV-01ANA-YR13</td>
<td>Motor</td>
<td>2</td>
</tr>
<tr>
<td>5059</td>
<td>HW1404046-1</td>
<td>M base</td>
<td>1</td>
</tr>
<tr>
<td>5060</td>
<td>HW1404036-1</td>
<td>Pulley</td>
<td>1</td>
</tr>
<tr>
<td>5061</td>
<td>M4×12</td>
<td>Hexagon socket head cap screw</td>
<td>1</td>
</tr>
<tr>
<td>5062</td>
<td>HW1404052-1</td>
<td>M base</td>
<td>1</td>
</tr>
<tr>
<td>5063</td>
<td>HW1100502-1</td>
<td>U-arm</td>
<td>1</td>
</tr>
<tr>
<td>5064</td>
<td>6902</td>
<td>Bearing</td>
<td>1</td>
</tr>
<tr>
<td>5065</td>
<td>HW1404516-1</td>
<td>Cover</td>
<td>2</td>
</tr>
<tr>
<td>3001</td>
<td>HW1100501-1</td>
<td>Casing</td>
<td>1</td>
</tr>
</tbody>
</table>
10.6 Gear Unit (No. 5040)

Fig. 10-6: Gear Unit (No. 5040)

Table 10-6: Gear Unit (No. 5040)

<table>
<thead>
<tr>
<th>No.</th>
<th>DWG No.</th>
<th>Name</th>
<th>Pcs</th>
</tr>
</thead>
<tbody>
<tr>
<td>6001</td>
<td>HW1303251-1</td>
<td>Gear</td>
<td>1</td>
</tr>
<tr>
<td>6002</td>
<td>HW1303252-1</td>
<td>Gear</td>
<td>1</td>
</tr>
<tr>
<td>6003</td>
<td>HW1404051-1</td>
<td>Collar</td>
<td>2</td>
</tr>
<tr>
<td>6004</td>
<td>HW1404050-1</td>
<td>Pin</td>
<td>6</td>
</tr>
<tr>
<td>6005</td>
<td>WBS-30</td>
<td>Coil spring</td>
<td>3</td>
</tr>
<tr>
<td>6006</td>
<td>M3×12</td>
<td>GT-SA bolt</td>
<td>2</td>
</tr>
<tr>
<td>6007</td>
<td>M3×16</td>
<td>GT-SA bolt</td>
<td>2</td>
</tr>
</tbody>
</table>
Specifications are subject to change without notice for ongoing product modifications and improvements.

YASKAWA