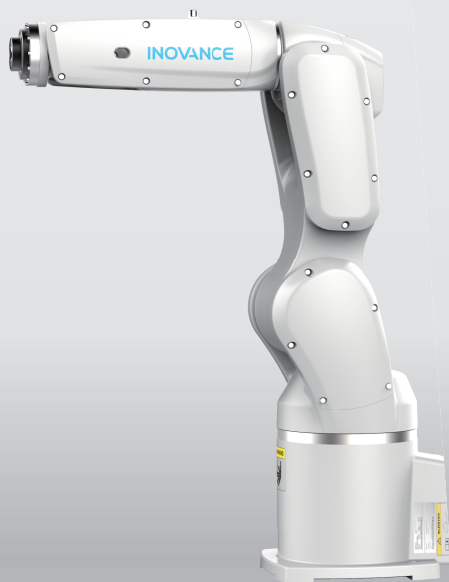




IRS311-7 Series 6-Axis Robot

Maintenance Guide



Industrial
Automation



Intelligent
Elevator



New Energy
Vehicle



Industrial
Robot



Rail
Transit



Data code PS00014403A02

Preface

Introduction

With a reach of 717 mm (standard version) or 911 mm (extended version), and up to 7 kg payload, the IRS311-7 series 6-axis robots features compact structure, lightweight, and high flexibility, repeatability, and speed. It offers great usability and reliability when working with a high-performance control system. It is applicable to assembly, labeling, patching, dispensing, inserting, soldering, sorting, grinding, polishing, and other applications in the 3C industry, automotive, hard drive, healthcare, laboratory automation, consumer products, industrial products, telecommunications, pharmaceuticals, packaging, semiconductors, electronics, and other industries.

This guide describes the inspection and maintenance of IRS311-7 series 6-axis robots.

Note

- The drawings in the user guide are shown for illustration only and may be different from the product. Actual products may vary.
- The instructions are subject to change without notice due to product upgrade, specification modification as well as efforts to improve the accuracy and convenience of the guide.

More Data

Name	Data Code	Description
IRS311-7 Series 6-Axis Robot User Guide - Manipulator	PS00017654	Describes the basic information, installation, wiring, motion range, maintenance and more of the product.
IRS311-7 Series 6-Axis Robot Maintenance Guide (hereinafter "this guide")	PS00014403	Describes the inspection and maintenance of IRS311-7 series 6-axis robots.

Revision History

Date	Version	Description
April 2025	A02	Addition Added <i>"3.5 Daily Control Cabinet Cable Inspection" on page 23.</i> Added <i>"3.6.2 Oil Leakage Inspection Parts" on page 24.</i> Added <i>"3.10.4 Zero Calibration of Each Joint" on page 62.</i> Update Updated <i>"2.1 Model Description" on page 16.</i> Updated <i>"3.3 Inspection and Maintenance Items" on page 20.</i> Updated <i>"3.11.2 Removing Cables Inside Robot" on page 65.</i>
August 2024	A01	Addition Added section "Cable Replacement". Update Made minor corrections.
October 2023	A00	First release.

Access to the Guide

This guide is not delivered with the product. You can obtain the PDF version in the following way:

- Visit www.inovance.com, go to Support > Download, search by keyword, and then download the PDF file.
- Scan the QR code on the product with your smart phone.
- Scan the QR code below to install the My Inovance app, where you can search for and download guides.



Warranty

For faults and damage incurred during normal use in the warranty period, Inovance provides free repair service. (For details of the warranty period, see the purchase order.) A maintenance fee will be charged out of the warranty period.

Even in the warranty period, a maintenance fee will be charged for repair of the following damage:

- Damage caused by operations not following the instructions in the guide
- Damage caused by fire, flood, or abnormal voltage
- Damage caused by unintended use of the product
- Damage caused by use beyond the specified scope of application of the product
- Damage or secondary damage caused by force majeure (such as natural disaster, earthquake, and lightning strike)

The maintenance fee will be charged according to our latest Price List if not otherwise agreed upon.

For details, see the Product Warranty Card.

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1 Safety

1.1 Safety Precautions

Safety Disclaimer

- This chapter provides essential safety instructions for proper use of the product. Before using this product, read through the user guide, especially the safety instructions. Failure to observe the safety instructions may result in equipment damage, personal injuries, or even death.
- "DANGER", "WARNING", and "CAUTION" items in this guide do not indicate all safety precautions that need to be followed; instead, they just supplement the safety precautions.
- Use this product according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
- Inovance shall take no responsibility for any personal injuries or property damage caused by improper usage.

Safety Levels and Definitions



indicates that failure to comply with the notice will result in severe personal injuries or even death.



indicates that failure to comply with the notice may result in severe personal injuries or even death.



indicates that failure to comply with the notice may result in minor or moderate personal injuries or equipment damage.

Safety Precautions

- Some drawings in the guide shows the product without covers or protective guards to display more details. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
- Operators must take mechanical precautions to protect personal safety and wear protective equipment, such as anti-smashing shoes, safety clothing, safety glasses, protective gloves, and protective sleeves.

Unpacking**WARNING**

- Do not install the product when you find that the product and its accessories have any damage or corrosion or they have been used.
- Do not install the product when there is water inside the product or any of its parts is missing or damaged.
- Do not install the product when the product name is inconsistent with that in the packing list.

**CAUTION**

- Before unpacking, check whether the package is intact, without damage, water seepage, damp, and deformation.
- Unpack the product layer by layer. Do not strike the package violently.
- During unpacking, check whether the product and its accessories have any damage, corrosion, or bump on the surface.
- Check the quantity of the product and its accessories and documents against the packing list.

Storage and Transportation



WARNING

- Large-scale or heavy equipment must be transported by qualified professionals using specialized hoisting equipment. Failure to comply may result in personal injuries or equipment damage.
- Before hoisting the equipment, ensure that components, such as the front cover and terminal blocks, are secured firmly with screws. Loosely-connected components may fall off and result in personal injury or equipment damage.
- Never stand or stay below the equipment when the equipment is being hoisted by the hoisting equipment.
- When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply may result in personal injuries or equipment damage.



CAUTION

- Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage.
- When handling the product by hand, grab the product case tightly to avoid dropping the product and causing injuries.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply may result in equipment damage.
- Avoid storage and transportation in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storing the product for more than 3 months. When the product needs to be stored for an extended period, take more strict protection and necessary inspection.
- Package the product strictly before transporting it, and use an enclosed container for long-distance transportation.
- Never transport the equipment with other equipment or materials that may harm or have negative impacts on this equipment.

Installation**DANGER**

- Installation must be carried out by technicians who have received relevant training on electrical equipment and have sufficient electrical expertise. Non-professionals are not allowed to operate the equipment.

**WARNING**

- Read through the guide and safety instructions before installation.
- Do not install the product in places with strong electric or magnetic fields.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply may result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in electric shocks.
- When installing the equipment (such as the control cabinet) in a closed environment (such as a cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or fire.
- Do not modify the product.
- Do not loosen the fixing bolts of the product parts and components.
- When installing the equipment (such as the control cabinet) in a cabinet or final assembly, make sure that the enclosure of the cabinet or final assembly provides adequate fire prevention, electrical protection, and mechanical protection conforming to relevant IEC standards and local laws and regulations.
- Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction.
- Install the product on an incombustible object, such as metal, and do not touch or attach the product to combustibles. Failure to comply may result in fire accident.

**CAUTION**

- Cover the top of the equipment (such as the control cabinet) with cloth or paper during installation to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment and causing faults. After installation, remove the cloth or paper on top of the equipment to prevent over-temperature caused by poor ventilation due to blocked ventilation holes.

Wiring**DANGER**

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- Before wiring, cut off all the power supplies of the equipment. Wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. After waiting for the designated time, measure the DC voltage in the main circuit to ensure the DC voltage is within the safe voltage range. Failure to comply may result in electric shocks.
- Do not perform wiring, remove the equipment cover, or touch the circuit board with power ON. Failure to comply may result in electric shocks.
- Check that the equipment is grounded properly. Failure to comply may result in electric shocks.

**WARNING**

- Do not connect the input power supply to the output end of the equipment. Failure to comply may result in equipment damage or even a fire.
- When connecting a drive to a motor, check that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation.
- Cables used for wiring must meet cross sectional area and shielding requirements. The shield of the cable must be reliably grounded at one end.
- Fix the terminal screws with the tightening torque specified in the user guide. Improper tightening torque may overheat or damage the connecting part, resulting in a fire.
- After wiring is done, check that all cables are connected properly and no screws, washers, or exposed cables are left inside the equipment. Failure to comply may result in electric shocks or equipment damage.

**CAUTION**

- During wiring, follow the proper electrostatic discharge (ESD) procedures and wear an anti-static wrist strap. Failure to comply may result in damage to the equipment or its internal circuits.
- Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding purpose. Failure to comply may result in equipment malfunction.

Power-on**DANGER**

- Before power-on, check that the equipment is installed properly with reliable wiring and the motor can be restarted.
- Check that the power supply meets equipment requirements before power-on to prevent equipment damage or fire accident.
- After power-on, do not open the cabinet door or protective cover of the equipment, touch any terminal, or disassemble any unit or component of the equipment. Failure to comply may result in electric shocks.

**WARNING**

- Perform a trial run after wiring and parameter setting to ensure the equipment operates safely. Failure to comply may result in physical injuries or equipment damage.
- Before power-on, check that the rated voltage of the equipment is consistent with that of the power supply. Failure to comply may result in fire.
- Before power-on, check that no one is near the equipment, motor, or machine. Failure to comply may result in physical injuries or even death.

Operation**DANGER**

- The equipment must be operated only by professionals. Failure to comply may result in death or personal injury.
- Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply may result in electric shocks.

**WARNING**

- Do not touch the equipment enclosure, fan, or resistor with bare hands. Failure to comply may result in personal injury.
- Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in a fire or equipment damage.

Maintenance



DANGER

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- Do not maintain the equipment while power is on. Failure to comply may result in electric shocks.
- Before maintenance, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.
- When a permanent magnet motor is used, do not touch the motor terminals immediately after power-off because the motor terminals can generate induced voltage during rotation even after the equipment power supply is off. Failure to comply may result in electric shocks.



WARNING

- Carry out daily and periodic inspection and maintenance on the equipment according to maintenance requirements and retain a maintenance record.

Repair



DANGER

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- Do not repair the equipment while power is on. Failure to comply may result in electric shocks.
- Before inspection and repair, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.



WARNING

- Submit the repair request according to the warranty agreement.
- When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply may result in death, personal injury or equipment damage.
- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Replace quick-wear parts of the equipment in according with the replacement instructions.
- Do not perform operations on damaged equipment. Failure to comply may result in death, personal injury, or severe equipment damage.
- After the equipment is replaced, check the wiring and set parameters again.

Disposal	
 WARNING	• Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, personal injuries, or even death. • Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.

Safety Sign

For safe equipment operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. See the following table for descriptions of the safety labels.

To ensure safe operation, comply with equipment-related safety labels. See the following table for descriptions of the safety labels.

Safety Sign	Description
	• Read through the safety instructions before operating the equipment. Failure to comply may result in equipment damage, physical injuries, or even death. • Do not touch the terminals or remove the cover with power ON or within 10 minutes after power-off. Failure to comply may result in electric shocks.

1.2 Special Precautions

To prevent accidents with the robot, be sure to set up relevant safety measures according to the specific situation. All operators must fully comply with the requirements.

1. Ensure a safety protection range that is greater than the maximum motion range of the robot. Set up comprehensive guard devices (such as fences) around the safety protection range, with an emergency stop device easily accessible to operators. Leave sufficient space (safety zone) around for the operator to avoid abnormal operations or emergency situations.
2. Ensure that the safety protection devices has only one entrance and is equipped with a safety latch. Manually remove the safety latch when closing or opening the entrance. Ensure that the safety devices (such as emergency stop buttons and safety latch) are working properly before accessing the safety protection devices.
3. The safety fences must be sturdy enough to withstand impacts and pressures from both internal and external sources. The safety fences must be fixed and immovable to prevent operators from easily dismantling or breaking them. The safety fences must also be free of sharp angles, edges, or spikes, and must not contain any potentially hazardous components.

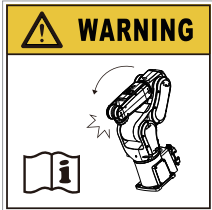
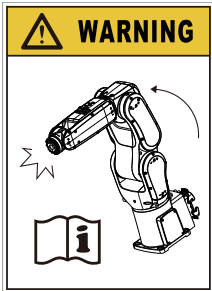
4. On the guard devices (fences), clearly display robot status, such as automatic running, teaching, and emergency stop, so that everyone onsite can easily see the status of the robot.

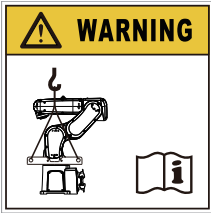
Before turning on or starting the robot, check all safety conditions to ensure that there are no people or obstructions within the robot's motion range.

1.3 Safety Signs

The following signs are stuck on the robot body. Pay attention that special dangers exist around the positions stuck with safety signs. For safe equipment operation and maintenance, comply with safety signs on the equipment. Do not damage or remove the safety signs.

Description of warning signs:

Safety Signs	Description
	To prevent the robot from tilting forward due to its center of gravity, which may cause equipment damage or personal injury, fasten the robot first and then remove the fastening screws of the base.
	To prevent the robot from tilting forward due to its center of gravity, which may cause equipment damage or personal injury, secure the robot to the platform.
	NEVER enter the action area during robot running. Otherwise, you may bump into the robot, and serious accidents may occur.

Safety Signs	Description
	If a lifting is required, please follow the lifting diagram, otherwise the robot may tilt and cause damage or injury to personnel. For lifting of the robot, see the manual.
	Do not touch the energized parts when the power is on. Failure to comply may result in an electric shock.

2 Product Information

2.1 Model Description

Note

- The maintenance instructions in this guide refer to IRS311-7 series models for Chinese and international markets.
- The product information in this guide is the information of standard models in a standard environment. For information about non-standard models or models in clean environment, contact the provider.

Models for Chinese market

IRS311-7-70TS5
① ② ③ ④ ⑤ ⑥ ⑦

Product family ① IRS: Inovance robot system	Arm length ④ 70: 717 mm 90: 911 mm	Cable length ⑦ 5: 5 m
Series ② 311: 6-axis robot (With drive-control integrated controller)	Installation method ⑤ T: Standard	-
Load ③ 7: 7 kg	Installation environment ⑥ S: Standard C: Cleanroom	

Models for international markets

IRS311-7-70TS-INT
① ② ③ ④ ⑤ ⑥ ⑦

① Product family IRS: Inovance robot system	④ Arm length 70: 717 mm 90: 911 mm	⑦ Version INT: International (With functional safety)
② Series 311: 6-axis robot (Drive and control integrated cabinet)	⑤ Installation method T: Standard	-
③ Load 7: 7 kg	⑥ Installation environment S: Standard	

2.2 Components

The mechanical system of the robot is composed of the base, swivel base, upper arm, elbow, linkage arm, forearm, wrist, and pipeline. With six joints driven by six motors, the robot can implement various forms of motion in the workspace to complete various tasks. The following figure shows each part of the robot.

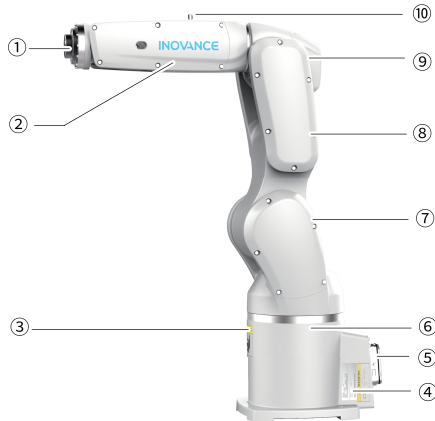


Table 2-1 Components

No.	Component	No.	Component
①	Wrist flange	⑥	Base
②	Forearm	⑦	Swivel base
③	Safety sign	⑧	Upper arm
④	Nameplate	⑨	Elbow
⑤	Heavy-duty connector	⑩	Air duct connector

3 Inspection and Maintenance

3.1 Maintenance Precautions

Before maintenance, read this guide and other related guides carefully to fully understand the methods of safe check and maintenance.



Danger

- Equipment installation, wiring, inspection, maintenance, or parts replacement must be performed by professionals.
 - Do not maintain the equipment after power-on. Failure to comply will result in an electric shock.
 - Do not remove any parts that are not covered in this guide. Follow the maintenance procedure strictly as described in this guide.
 - Check the motion of the robot after parts replacement outside the safety fence. Failure to comply may cause severe safety issues due to abnormal movement of the robot.
 - Make sure that the emergency stop switch and safety door switch work properly before operation. Otherwise, safety protection function will not work properly in emergency cases, causing serious injury or damage.
-



Warning

- Submit the repair request according to the warranty agreement.
 - Perform daily and periodic inspection and maintenance for the equipment according to maintenance requirements and keep a maintenance record.
 - When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
 - Replace quick-wear parts of the equipment according to the replacement guide.
 - Prevent foreign objects from entering the equipment and terminals during maintenance.
 - Open the equipment cover only when repair and maintenance.
 - After the equipment is replaced, perform wiring inspection and parameter settings again.
-

3.2 Schedule for Inspection and Maintenance

Inspection points are divided into five stages: 1-month, 3-month, 6-month, 12-month, and 36-month. The inspection points are added every stage. If the robot is operated for 250 hours or longer per month, the inspection points must be added every 250 hours, 750 hours, 1500 hours, and 3000 hours operation.

Check Item	Check Item					
	Daily Inspection	Monthly Inspection	3 months Inspection	6 months Inspection	12 months inspection	Overhaul (Replacement)
1 month (250 h)	✓	✓	-	-	-	-
2 months (500 h)	✓	✓	-	-	-	-
3 months (750 h)	✓	✓	✓	-	-	-
4 months (1000 h)	✓	✓	-	-	-	-
5 months (1250 h)	✓	✓	-	-	-	-
6 months (1500 h)	✓	✓	✓	✓	-	-
7 months (1750 h)	✓	✓	-	-	-	-
8 months (2000 h)	✓	✓	-	-	-	-
9 months (2250 h)	✓	✓	✓	-	-	-
10 months (2500 h)	✓	✓	-	-	-	-
11 months (2750 h)	✓	✓	-	-	-	-
12 months (3000 h)	✓	✓	✓	✓	✓	-
...	-	-	-	-	-	-
36 months (9000 h)	✓	✓	✓	✓	✓	✓
...	-	-	-	-	-	-

3.3 Inspection and Maintenance Items

Inspect and maintain the robot regularly for the robot to run more safely and efficiently. The target parts can be inspected and maintained daily, monthly, quarterly, semi-annually, and annually as needed.

The list of maintenance items lists the necessary maintenance items at each stage. In the rightmost column of the table, the maintenance personnel are divided into "Professionals", "Qualified Personnel", and "Manufacturer" (that is, Inovance). You can designate skilled personnel to carry out various maintenance operations.

1. Daily inspection and maintenance

Check Item	Check Measure
Visual inspection	• Check all joint gaps, oil filling ports, and drain ports for grease leakage. • Check robot exterior for any impact damage.
Screw tightening inspection	Check all screws for looseness throughout the robot and check whether the screw tightening torques meet the requirements.
Noise inspection	Check all transmission mechanisms for unusual sounds.
Joint transmission mechanism inspection	Check for table running and abnormal jittering of the transmission mechanisms.
Pipeline accessory inspection	Check whether the pipeline accessories are complete, worn and rusted.
Control inspection of all electrical components	Check whether the control buttons of all electrical components of the robot are normal.

2. Weekly inspection and maintenance

Check Item	Check Measure
Brake inspection	Check whether the brake of each axis of the robot is effective.
Motion range of each axis	• Check whether the motion range of each axis is within the normal angle range. • Check whether the zero point position of each axis is aligned.

3. Monthly inspection and maintenance

Check Item	Check Measure
Control cabinet heat dissipation inspection	Check whether the fan behind the control cabinet is ventilated smoothly. It is recommended to replace or maintain the fan once a month.

4. Inspection and maintenance every six months

Check Item	Check Measure
All wiring harnesses for each electrical component	• Check all cable connectors of the robot body for bending, corrosion and falling off. • Check the cables outside the control cabinet for bending, corrosion and falling off. • Check the cable of the teach pendant for bending, corrosion and falling off.

5. Inspection and maintenance every year

Check Item	Check Measure
Control cabinet DI/DO signal	Check whether the DI/DO signal response of the control cabinet is normal.
Reducer of each axis	• Check whether the lubrication of the reducer of each axis of the robot is normal and whether there is abnormal noise. • Check the wear iron powder concentration of lubricating grease of each axis reducer.
Cleaning of all electrical components	Check the cleanliness of all electrical components. Under normal circumstances, remove dust for all electrical components every year.
Control cabinet fan filter	Check the cleanliness of the filter of the control cabinet fan, and replace the filter once a year under normal circumstances.
Timing belt	Check whether the tension frequency of timing belt is within the standard range.

6. Inspection and maintenance every 1.5 years

Check Item	Check Measure
Battery inspection	Check the battery voltage. If the battery voltage is lower than 3.3 V or a battery capacity alarm is reported, replace the battery in time.



Caution

Due to the risk of screw thread stripping, inspect the torque wrench and hexagon screw-driver bit for wear before use and replace if necessary.

3.4 Inspection and Maintenance of Screws

Use hexagon screws (hereinafter referred to as screws) in places where mechanical strength is required. When assembling the robot, tighten the screws according to the tightening torque shown in the following table.

Table 3-1 Screw diagnosis part

No.	Diagnosis Part	No.	Diagnosis Part
1	Robot base mounting screws	6	J5 axis motor mounting screws
2	J1 axis motor mounting screws	7	J6 axis motor mounting screws
3	J2 axis motor mounting screws	8	Wrist parts mounting screws
4	J3 axis motor mounting screws	9	End load mounting screws
5	J4 axis motor mounting screws	-	-

When it is necessary to refasten these screws in some procedures in this guide (except special cases as noted), use a torque wrench so that the screws are fastened with the appropriate tightening torques as shown below.

Screw	Tightening torque
M2.5	1.0 N · m
M3	2.0 N · m
M4	4.0 N · m
M5	7.0 N · m
M6	13.0 N · m

Tighten the screws in the sequence shown below: The screws aligned on a circumference should be fastened in a crisscross pattern as shown in the figure below.

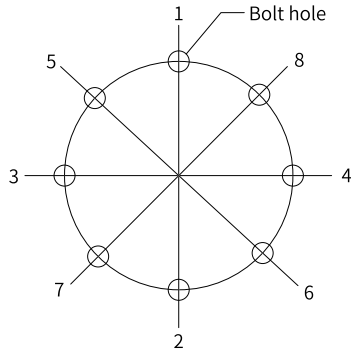


Figure 3-1 Tightening method

Do not fasten all screws securely at one time. Do not tighten the screw to the maximum torque value at a time. Tighten the screws slightly with a hexagonal wrench as shown in the preceding figure. Then tighten the screws to the torque values in the table above with a torque wrench.

3.5 Daily Control Cabinet Cable Inspection

No.	Check Item	Diagram/Illustration	Cycle
①	Check that the power output cable and encoder cable of the robot are properly connected to the control cabinet.		Daily
②	Check that the teach pendant cable is properly connected to the control cabinet.		Daily

No.	Check Item	Diagram/Illustration	Cycle
③	Check that the external power cable (L, N, and PE slots) is properly connected to the control cabinet.		Daily
④	Wipe off any acid, alkali, oil, or corrosive liquids with dust-free cloth or scouring pad.	All cables	Monthly

3.6 Oil Leakage Inspection

3.6.1 Daily Inspection

Check the following items each day when the system is running.

Inspection Item	Content
Oil leakage	Check for oil leakage at each joint. Wipe off any oil leaked.

3.6.2 Oil Leakage Inspection Parts

- Insert a dust-free cloth or scouring pad into the gap of each joint. Check for lubricating grease leakage at each joint. Wipe off any lubricating grease leaked.
- Depending on operating conditions and the surrounding environment, a small amount of lubricating grease may seep out from the outer side of the oil seal lip (minor adhesion). When this lubricating grease accumulates into droplets, it may drip under certain movements. Before operating the robot, wipe off any lubricating grease residue beneath the oil seal.
- If significant lubricating grease leakage is observed, contact the manufacturer for technical support.

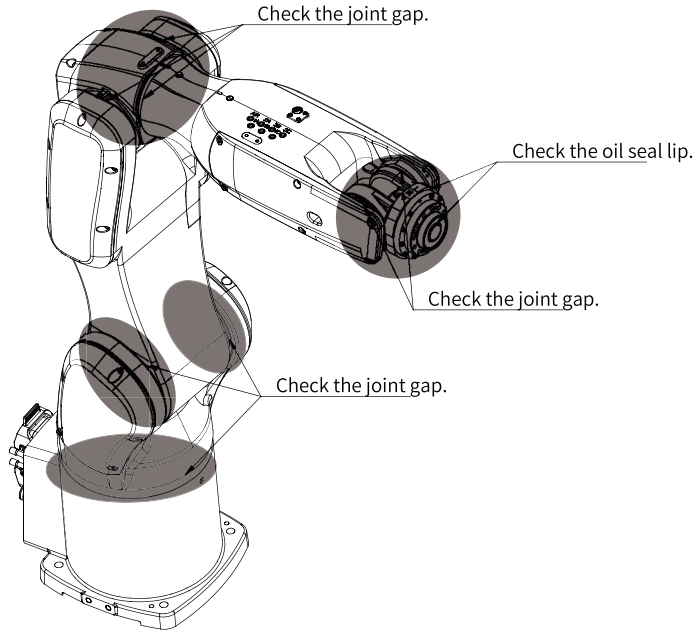


Figure 3-2 Oil Leakage Inspection Parts

**Caution**

- When opening the grease filling port, lubricating grease may be sprayed out at high temperature. Prepare plastic bags in advance and lay them under the oil filling port.
- Wear heat-resistant gloves, protective goggles, masks, and protective clothing as needed.
- If oil leakage persists after frequent wiping, see ["3.6.3 Lubricating Grease Leakage and Solution" on page 26](#) for handling.
- When reinstalling the screw plug into the oil filling port, check whether the tightening torque meets the standard torque value. The torque is 1.8 N·m for the M5 screw plug and 0.25 N·m for the M3 screw plug (only for the oil drain port of J3 axis).

3.6.3 Lubricating Grease Leakage and Solution

Problem	Problem Description	Cause Analysis	Solution
Oil seepage or leakage at gearbox	Oil leakage at joints	The robot has been used for an extended period, causing aging of sealing rubber parts or O-shaped seal rings.	Replace the sealing rubber parts or O-shaped sealing rings.
		Improper disassembly/reassembly operations may damage sealing rubber parts or O-shaped sealing rings.	
		Oil seal damage may be caused by foreign particles (such as dust) scratching the oil seal lip.	If the oil seal at the reducer is damaged (based on leakage position), replace the reducer. If the motor oil seal is damaged, replace the motor.
		Gaps exist on sealing surfaces.	Re-tighten mounting screws to ensure a tight fit between surfaces.
		Threadlocker LT518 on motor or reducer mounting surfaces becomes invalid.	Re-apply the threadlocker LT518.
		Combined sealing washers matching hexagon socket screw plugs at oil filling and draining ports of joints function improperly.	Replace with new hexagon socket screw plugs and matching combined sealing washers.
		Cracks on castings or oil chamber damage occurs due to collisions or other impacts.	Replace with new parts.

3.7 Maintenance of Robot Covers

3.7.1 Robot Enclosure Inspection and Tool Preparation

This section describes removal and installation steps of the enclosures necessary for maintenance.



Warning

- Power off the robot system by removing the power plug.
- Before performing any replacement procedure, turn off the robot system and related equipment, and then disconnect the power plug from the power source. Operating with the power ON may cause electric shock or malfunction of the robot system .
- Prevent foreign objects from entering the robot, connector and pins. Turning on the power when any foreign substances exist may cause electric shock or malfunction.

The tools required are described in the following table.

Name		Quantity
Tool	Torque wrench	1
	M4 hexagon screwdriver bit	1
Materials used	LT243 threadlocker	1

The following figure shows the robot covers for maintenance.

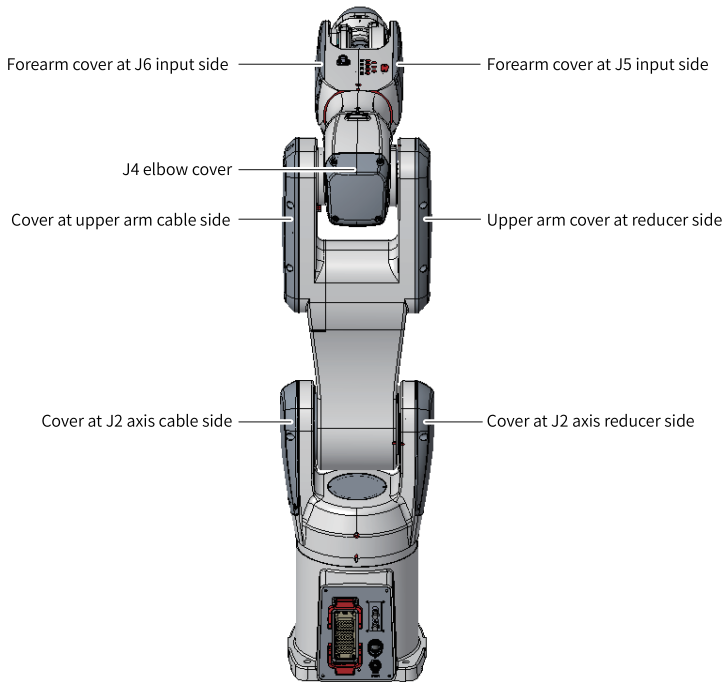


Figure 3-3 Robot enclosures for maintenance

3.7.2 J2 Reducer Cover and Cable Cover



- Do not remove the cover forcibly. Failure to comply may result in damage, break, and poor contact of the cable, causing electric shock or improper function of the robot system.
 - When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Failure to comply may result in damage, break, and poor contact of the cable, causing electric shock or improper function of the robot system. When routing the cables, check the cable locations after removing the cover. Be sure to place the cables back to their original locations.
 - Ensure that the gasket is installed properly when installing the cover. Do not damage the gasket during installation to ensure airtightness of the robot.
-

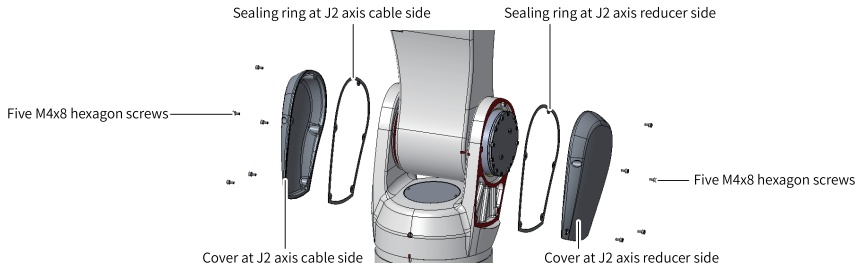


Figure 3-4 Replacing the J2 reducer cover and cable cover

Remove the J2 reducer cover and cable cover:

1. Remove five M4x8 hexagon screws from the J2 cable cover and reducer cover.
2. Remove the J2 reducer cover and cable cover.

Install the J2 reducer cover and cable cover:

1. Install the sealing ring at J2 axis reducer side to the J2 reducer cover.
2. Install the sealing ring at J2 axis cable side to the J2 cable cover.
3. Clean residual threadlocker from all screws. Apply fresh LT243 threadlocker to all screws.
4. Secure the J2 cable cover and J2 reducer cover using five M4x8 hexagon screws with a tightening torque of 2 N·m.



During installation, do not pinch or damage internal cables and sealing rings.

3.7.3 Reducer Cover and Cable Cover of the Upper Arm



Caution

- Do not remove the cover forcibly. Failure to comply may result in damage, break, and poor contact of the cable, causing electric shock or improper function of the robot system.
- When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Failure to comply may result in damage, break, and poor contact of the cable, causing electric shock or improper function of the robot system. When routing the cables, check the cable locations after removing the cover. Be sure to place the cables back to their original locations.
- Ensure that the gasket is installed properly when installing the cover. Do not damage the gasket during installation to ensure airtightness of the robot.

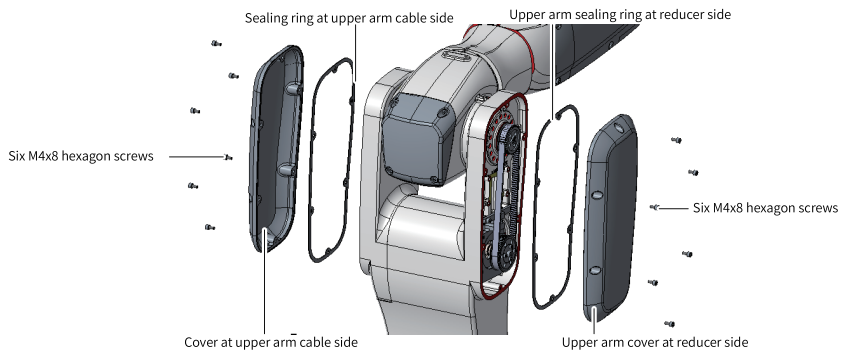


Figure 3-5 Replacing the reducer cover and cable cover of the upper arm

To remove the reducer cover and cable cover of the upper arm: Remove the six M4×8 hexagon screws from the covers, and then remove the covers.

1. Remove the six M4x8 hexagon screws from the cable cover and reducer cover of the upper arm.
2. Remove the cable cover and reducer cover of the upper arm.

Install the cable cover and reducer cover of the upper arm:

1. Install the sealing ring at upper arm reducer side to the reducer cover of the upper arm.
2. Install the sealing ring at upper arm cable side to the cable cover of the upper arm.
3. Clean residual threadlocker from all screws. Apply fresh LT243 threadlocker to all screws.
4. Secure the cable cover and reducer cover of the upper arm using six M4x8 hexagon screws with a tightening torque of 2 N·m.

**Caution**

During installation, do not pinch or damage internal cables and sealing rings.

3.7.4 J4 Elbow Cover

**Caution**

- Do not remove the cover forcibly. Failure to comply may result in damage, break, and poor contact of the cable, causing electric shock or improper function of the robot system.
- When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Failure to comply may result in damage, break, and poor contact of the cable, causing electric shock or improper function of the robot system. When routing the cables, check the cable locations after removing the cover. Be sure to place the cables back to their original locations.
- Ensure that the gasket is installed properly when installing the cover. Do not damage the gasket during installation to ensure airtightness of the robot.

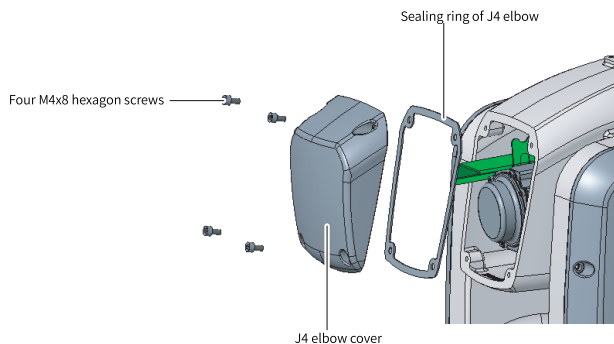


Figure 3-6 Replacing the J4 elbow cover

Removing the J4 elbow cover:

1. Remove four M4x8 hexagon screws from the J4 elbow cover.
2. Remove the J4 elbow cover.

Installing the J4 elbow cover:

1. Install the sealing ring of J4 elbow to the J4 elbow cover.

2. Clean residual threadlocker from all screws. Apply fresh LT243 threadlocker to all screws.
3. Secure the J4 elbow cover to the elbow using four M4x8 hexagon screws with a tightening torque of $2 \text{ N} \cdot \text{m}$.



Caution

During installation, do not pinch or damage internal cables and sealing rings.

3.7.5 J6 Input Side Cover and J5 Input Side Cover of the Forearm



Caution

- Do not remove the cover forcibly. Failure to comply may result in damage, break, and poor contact of the cable, causing electric shock or improper function of the robot system.
- When installing the cover, be careful not to get the cables caught in it or bend them forcibly to push into the cover. Failure to comply may result in damage, break, and poor contact of the cable, causing electric shock or improper function of the robot system. When routing the cables, observe the cable locations after removing the cover. Be sure to place the cables back to their original locations.
- Ensure that the gasket is installed properly when installing the cover. Do not damage the gasket during installation to ensure airtightness of the robot.

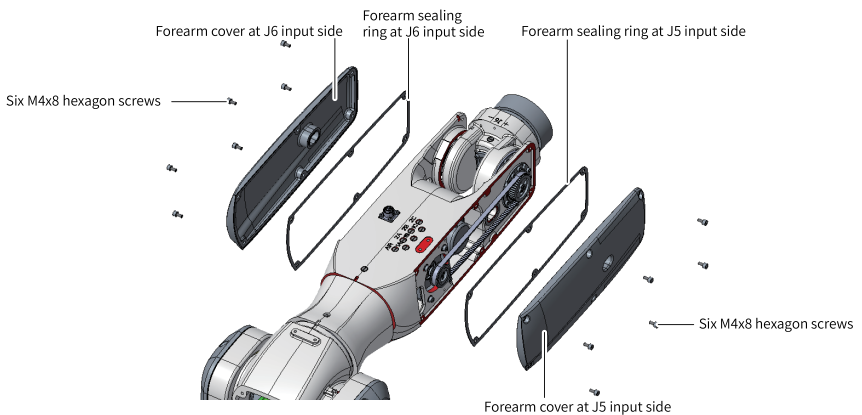


Figure 3-7 J6 input side cover and J5 input side cover of the forearm

Remove the J6 input side cover and J5 input side cover of the forearm:

1. Remove the six M4x8 hexagon screws from the J5 input side cover of the forearm.
2. Remove the six M4x8 hexagon screws from the J6 input side cover of the forearm.
3. Remove the J5 input side cover and J6 input side cover of the forearm.

Install the J6 input side cover and J5 input side cover of the forearm:

1. Install the sealing ring of J5 input side cover of the forearm to the J5 input side cover of the forearm.
2. Install the sealing ring of J6 input side cover of the forearm to the J6 input side cover of the forearm.
3. Clean residual threadlocker from all screws. Apply fresh LT243 threadlocker to all screws.
4. Secure the J5 and J6 input side covers of the forearm to the forearm using six M4x8 hexagon screws with a tightening torque of 2 N·m.



During installation, do not pinch or damage internal cables and sealing rings.

3.8 Maintenance and Replacement of Parts

3.8.1 J1 Axis



- Power off the robot system by removing the power plug.
 - Before performing any replacement procedure, turn off the robot system and related equipment, and then disconnect the power plug from the power source. Operating with the power ON may cause electric shock or malfunction of the robot system.
 - Always connect the AC power cable to the power plug. Do not connect it directly to the factory power supply.
-

**Caution**

- Do not apply excessive shock to the motor shaft during replacement. Failure to comply may shorten the service life or damage the motor or encoder.
 - Do not disassemble the encoder of the motor.
 - After parts such as motors and reducer have been replaced, the robot cannot operate properly because a mismatch exists between the zero point stored in each motor and its corresponding zero point stored in the robot system. After replacing the parts, it is necessary to match these zero points.
-

Replacing Motor Assembly of the J1 Axis

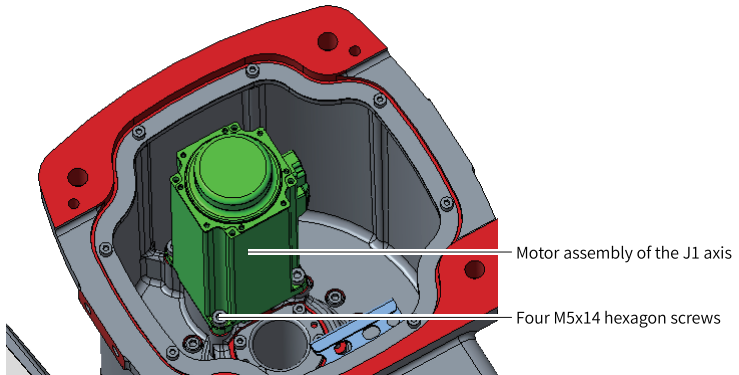
Name		Quantity
Maintenance part	Motor assembly of the J1 axis	1
	O-shaped sealing ring of the J1 axis	1
Tool	Hexagon wrench	1
	15-N·m torque wrench	1
	Circlip pliers	1
	Torque screwdriver for M4 and M5 hexagon screws	1
	Screwdriver sleeve for M4 and M5 hexagon screws	1
	Air gun	1
	Dust-free cloth or oil-absorbing sheet	Several
Materials used	DOWSIL TC-5625C heat-conducting silicone grease ^[1]	1

Note

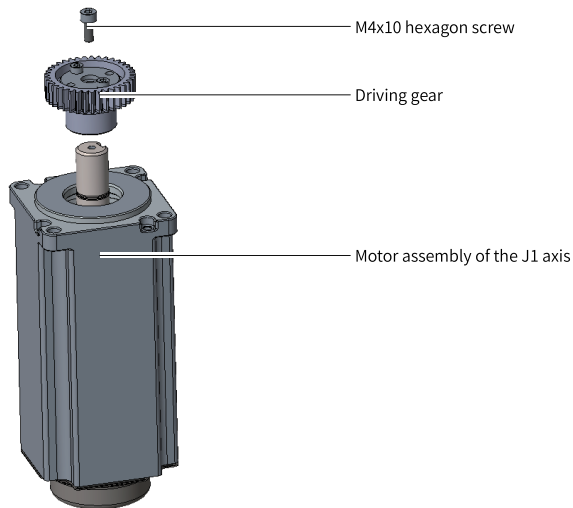
[1]: Product code: 24060017

• Removing the motor assembly of the J1 axis:

1. Switch off the control switch on the control cabinet and disconnect the heavy-duty cables from the robot.
2. Remove the power cable and encoder cable of the J1 axis motor.
3. Remove the four M5x14 hexagon screws from the J1 motor.



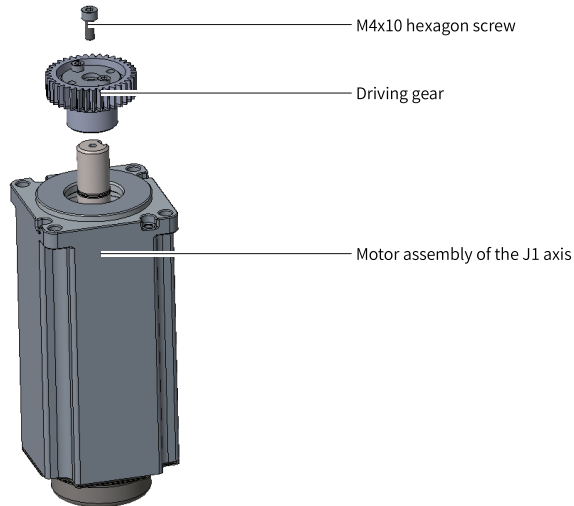
4. Before removing the motor, turn on the brake and keep the motor vertical to prevent gear impact damage and abnormal noise.
5. Remove the one M4x10 hexagon screw securing the J1 axis fixing gear shaft.
6. Use circlip pliers to remove the driving gear from the J1 motor.



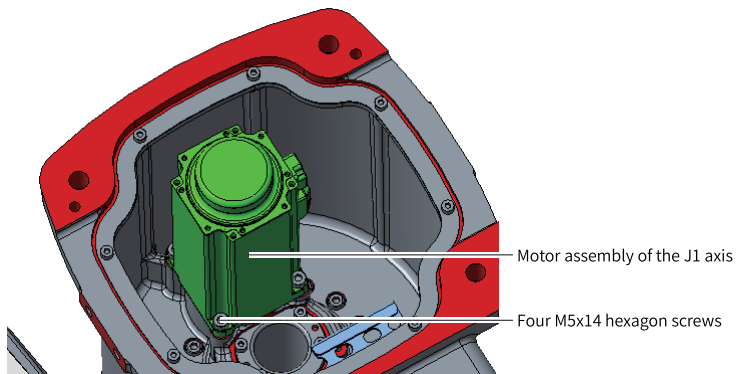
- **Installing the J1 axis motor assembly:**

1. Check the J1 motor for any damage or burrs, and clean the motor shaft with a dust-free cloth and anhydrous ethanol.
2. Clean critical areas of the drive gear (such as tooth tips and tooth profiles) using an air gun.
3. Align the driving gear boss downward with the keyway and install it onto the motor output shaft. Do not use impact methods for installation.

4. Apply a small amount of lubricating grease to the driving gear, and apply DOWSIL TC-5625C heat-conducting silicone grease on the motor end face.
5. Secure the J1 axis motor driving gear to the J1 motor using one M4x10 hexagon screw with a torque of $4 \text{ N} \cdot \text{m}$.



6. Secure the J1 axis motor assembly to the J1 axis motor mounting position using four M5x14 hexagon screws in two stages with a torque of $3 \text{ N} \cdot \text{m}$ and $7 \text{ N} \cdot \text{m}$ respectively.



7. Install the cables. For details, see ["3.11.3 Installing Cables Inside Robot" on page 74](#).
8. Power on the robot, reset the J1 axis encoder value, clear any alarms, and then capture the J1 axis zero point position.

Replacing the J1 axis reducer

For replacement of the reducer, please contact your local dealer.

Contact local dealers when you need to replace the reducer.

3.8.2 J2 Axis



Warning

- Power off the robot system by removing the power plug.
- Before performing any replacement procedure, turn off the robot system and related equipment, and then disconnect the power plug from the power source. Operating with the power ON may cause electric shock or malfunction of the robot system.
- Always connect the AC power cable to the power plug. Do not connect it directly to the factory power supply.



Caution

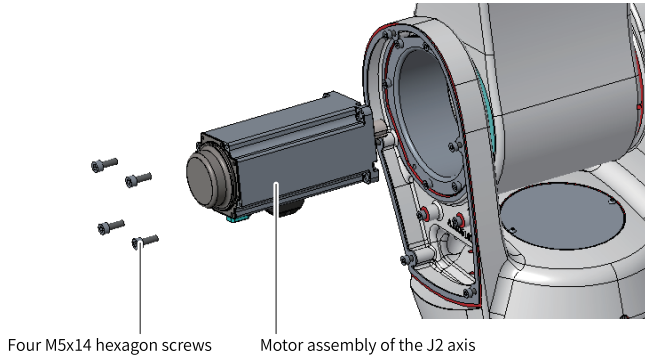
- Do not apply excessive shock to the motor shaft during replacement. Failure to comply may shorten the service life or damage the motor or encoder.
- Do not disassemble the encoder of the motor.
- After parts such as motors and reducer have been replaced, the robot cannot operate properly because a mismatch exists between the zero point stored in each motor and its corresponding zero point stored in the robot system. After replacing the parts, it is necessary to match these zero points.

Replacing Motor Assembly of the J2 Axis

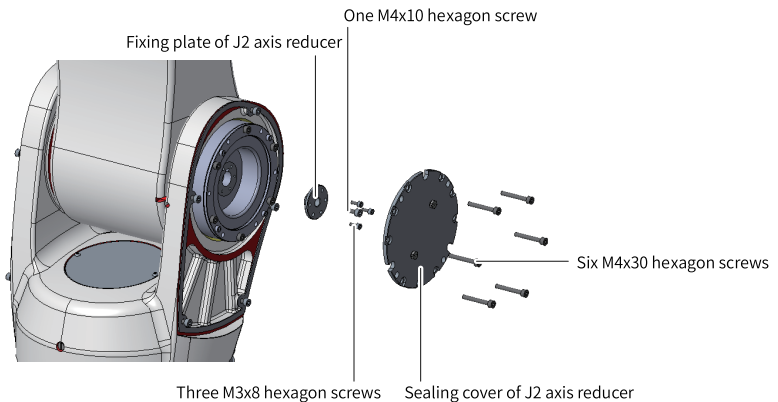
Name		Quantity
Maintenance part	Motor assembly of the J2 axis	1
	O-shaped sealing ring of the J2 axis	1
Tool	Hexagon wrench	1
	15-N · m torque wrench	1
	Torque screwdriver for M4 and M5 hexagon screws	1
	Screwdriver sleeve for M4 and M5 hexagon screws	1
	Dust-free cloth or oil-absorbing sheet	Several

- **Removing the motor assembly of the J2 axis:**

1. Switch off the control switch on the control cabinet and disconnect the heavy-duty cables from the robot.
2. Remove the J2 reducer cover and cable cover.
3. Remove the power cable and encoder cable of the J2 motor at the J2 cable side.
4. Remove the four M5x14 hexagon screws from the J2 axis motor assembly.



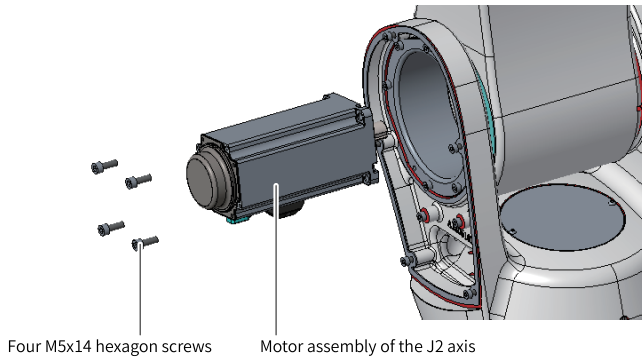
5. At the J2 axis reducer side, remove the six M4x30 hexagon screws on the J2 axis reducer sealing cover.
6. Remove one M4x10 hexagon screw and three M3x8 hexagon screws from the J2 axis reducer fixing plate.



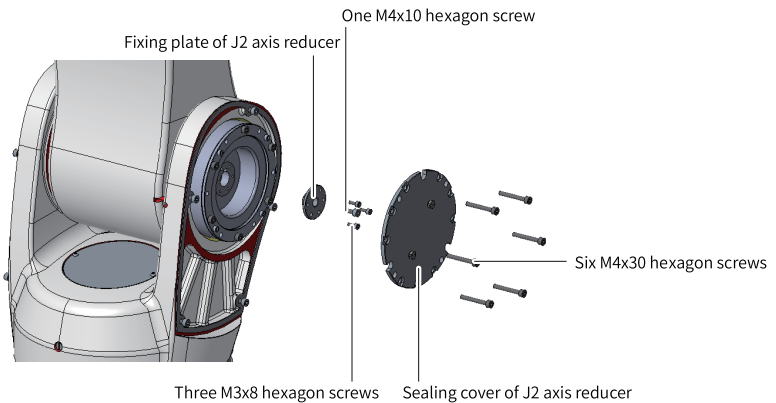
- **Installing the J2 axis motor assembly:**

1. Pay attention to the direction of the motor terminals and the coordination between the motor and the reducer.

- Secure the J2 axis motor assembly to the motor mounting position at J2 axis cable side using four M5x14 hexagon screws in three stages with a torque of 1 N·m, 4 N·m, and 7 N·m respectively.



- Secure the J2 axis reducer fixing plate to the corresponding position at the J2 axis reducer side using three M3x8 hexagon screws in two stages with a torque of 1 N·m and 2 N·m respectively.



- Secure the J2 axis reducer fixing plate with one M4x10 hexagon screw with a torque of 4 N·m.
- Install the J2 axis reducer sealing cover to the corresponding position at the J2 axis reducer side using six M4x30 hexagon screws in three stages with a torque of 1 N·m, 3 N·m, and 5.5 N·m respectively.
- Install the cables. For details, see ["3.11.3 Installing Cables Inside Robot" on page 74](#).
- Power on the robot, reset the J2 axis encoder value, clear any alarms, and then capture the J2 axis zero point position.
- Install the J2 reducer cover and cable cover.

Replacing the J2 axis reducer

For replacement of the reducer, please contact your local dealer.

Contact local dealers when you need to replace the reducer.

3.8.3 J3 Axis



Warning

- Power off the robot system by removing the power plug.
 - Before performing any replacement procedure, turn off the robot system and related equipment, and then disconnect the power plug from the power source. Operating with the power ON may cause electric shock or malfunction of the robot system.
 - Always connect the AC power cable to the power plug. Do not connect it directly to the factory power supply.
-



Caution

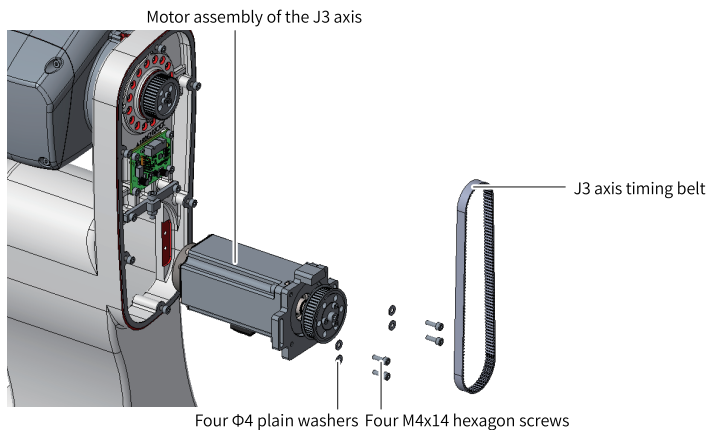
- Do not apply excessive shock to the motor shaft during replacement. Failure to comply may shorten the service life or damage the motor or encoder.
 - Do not disassemble the encoder of the motor.
 - After parts such as motors and reducer have been replaced, the robot cannot operate properly because a mismatch exists between the zero point stored in each motor and its corresponding zero point stored in the robot system. After replacing the parts, it is necessary to match these zero points.
-

Replacing Motor Assembly of the J3 Axis

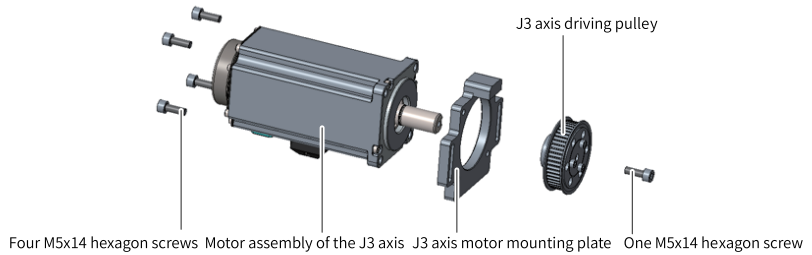
Name		Quantity
Maintenance part	Motor assembly of the J3 axis	1
	O-shaped sealing ring of the J3 axis	1
Tool	Hexagon wrench	1
	15-N·m torque wrench	1
	Tension meter	1
	Air gun	1
	Torque screwdriver for M4 and M5 hexagon screws	1
	Screwdriver sleeve for M4 and M5 hexagon screws	1
	Dust-free cloth or oil-absorbing sheet	Several

● Removing the motor assembly of the J3 axis:

1. Switch off the control switch on the control cabinet and disconnect the heavy-duty cables from the robot.
2. Remove the reducer cover of the upper arm to expose the internal structure.
3. Remove the power cable and encoder cable of the J3 motor.
4. Remove the J3 axis timing belt at the upper arm reducer side.
5. Remove the four M4x14 hexagon screws and plain washers from the J3 axis motor assembly, and remove the J3 axis motor assembly.

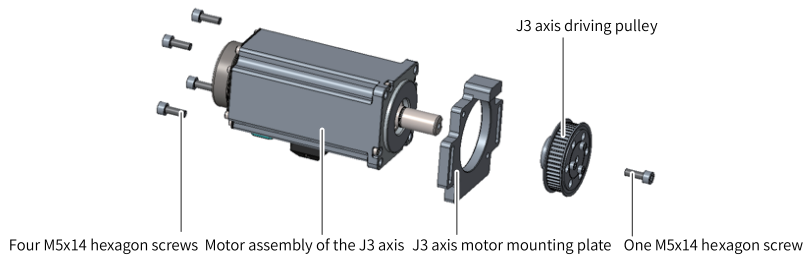


6. Remove the one M5x14 hexagon screw fixing the J3 axis driving pulley and remove the J3 axis driving pulley.
7. Remove the four M5x14 hexagon screws securing the J3 axis motor mounting plate and then remove the J3 axis motor mounting plate.



● **Installing the J3 axis motor assembly:**

1. Check the J3 motor for any damage or burrs, and clean the motor shaft with a dust-free cloth and anhydrous ethanol.
2. Clean the J3 axis driving pulley using an air gun.
3. Orient the J3 axis driving pulley with the processing holes facing outward, and then install it onto the motor output shaft. Do not use impact methods for installation.
4. Secure the driving pulley to the J3 axis motor assembly output shaft using one M5x14 hexagon screw, with a tightening torque of $7 \text{ N} \cdot \text{m}$.
5. Secure the J3 axis motor assembly to the J3 axis motor mounting plate using four M5x14 hexagon screws. Tighten each screw in three stages: first to $3 \text{ N} \cdot \text{m}$, $5 \text{ N} \cdot \text{m}$, and then to $7 \text{ N} \cdot \text{m}$.



6. Secure the J3 axis motor assembly to the J3 axis motor mounting position using four M4x14 hexagon screws and plain washers, with a tightening torque of $3 \text{ N} \cdot \text{m}$.
7. Install cables by referring to ["3.11.3 Installing Cables Inside Robot" on page 74](#).
8. Install the timing belt and adjust the frequency of J3 axis timing belt to 145 Hz to 160 Hz.

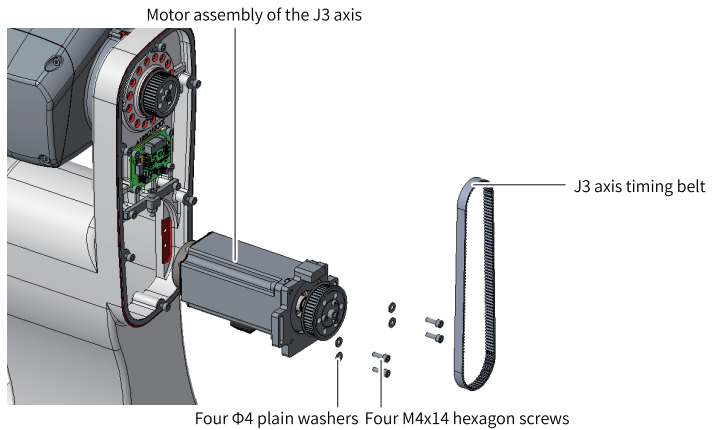
Note

Before testing the timing belt frequency with a tension meter, the following parameters must be set:

Measuring span: 200 mm

Timing belt unit mass: 2.4 g/m

Timing belt width: 10.0 mm/R



9. Power on the robot, reset the J3 axis encoder value, clear any alarms, and then capture the J3 axis zero point position.
10. Install the reducer cover of the upper arm.

Replacing the J3 axis reducer

For replacement of the reducer, please contact your local dealer.

Contact local dealers when you need to replace the reducer.

3.8.4 J4 Axis



Warning

- Power off the robot system by removing the power plug.
- Before performing any replacement procedure, turn off the robot system and related equipment, and then disconnect the power plug from the power source. Operating with the power ON may cause electric shock or malfunction of the robot system.
- Always connect the AC power cable to the power plug. Do not connect it directly to the factory power supply.



Caution

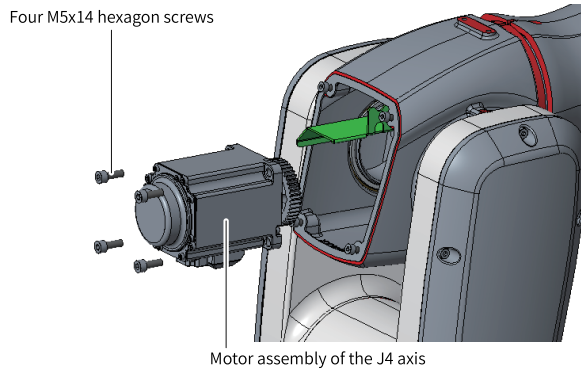
- Do not apply excessive shock to the motor shaft during replacement. Failure to comply may shorten the service life or damage the motor or encoder.
- Do not disassemble the encoder of the motor.
- After parts such as motors and reducer have been replaced, the robot cannot operate properly because a mismatch exists between the zero point stored in each motor and its corresponding zero point stored in the robot system. After replacing the parts, it is necessary to match these zero points.

Replacing Motor Assembly of the J4 Axis

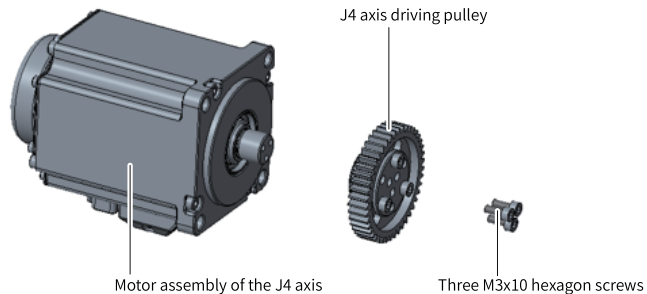
	Name	Quantity
Maintenance part	Motor assembly of the J4 axis	1
	O-shaped sealing ring of the J4 axis	1
Tool	Hexagon wrench	1
	15-N · m torque wrench	1
	Air gun	1
	Torque screwdriver for M4 and M5 hexagon screws	1
	Screwdriver sleeve for M4 and M5 hexagon screws	1
	Dust-free cloth or oil-absorbing sheet	Several

- **Removing the motor assembly of the J4 axis:**
 1. Switch off the control switch on the control cabinet and disconnect the heavy-duty cables from the robot.

2. Remove the J4 elbow cover to expose the internal structure.
3. Remove the power cable and encoder cable of the J4 motor.
4. Remove the four M5x14 hexagon screws, and remove the J4 axis motor assembly.

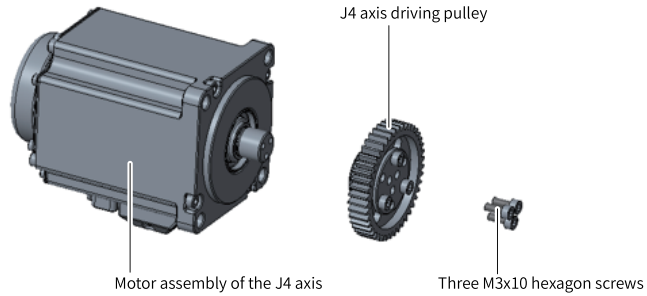


5. Remove the three M3x10 hexagon screws on the J4 axis driving pulley and remove the J4 axis driving pulley.

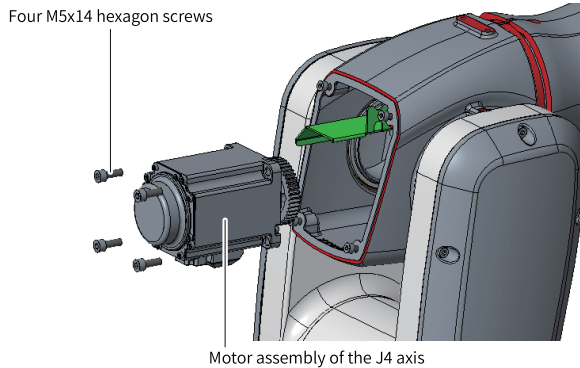


● **Installing the J4 axis motor assembly:**

1. Check the J4 motor for any damage or burrs, and clean the motor shaft with a dust-free cloth and anhydrous ethanol.
2. Clean critical areas of the J4 axis driving gear (such as tooth tips and tooth profiles) using an air gun.
3. Face the J4 axis driving gear boss downward and install it onto the motor output shaft. Do not use impact methods for installation.
4. Secure the J4 axis driving pulley shaft to the J4 motor using three M3x10 hexagon screws. Tighten each screw in two stages: first to 1 N·m, and then to 2 N·m.



5. Secure the J4 axis motor assembly to the J4 axis motor mounting plate at the elbow using four M5x14 hexagon screws. Tighten each screw in three stages: first to 3 N·m, 5 N·m, and then to 7 N·m.



6. Install the J4 motor cables. For details, see ["3.11.3 Installing Cables Inside Robot" on page 74](#).
7. Power on the robot, reset the J4 axis encoder value, clear any alarms, and then capture the J4 axis zero point position.
8. Install the J4 elbow cover.

Replacing the J4 axis reducer

For replacement of the reducer, please contact your local dealer.

Contact local dealers when you need to replace the reducer.

3.8.5 J5 Axis



Warning

- Power off the robot system by removing the power plug.
- Before performing any replacement procedure, turn off the robot system and related equipment, and then disconnect the power plug from the power source. Operating with the power ON may cause electric shock or malfunction of the robot system.
- Always connect the AC power cable to the power plug. Do not connect it directly to the factory power supply.



Caution

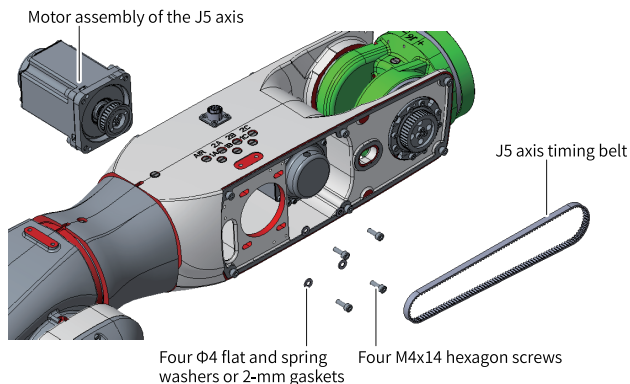
- Do not apply excessive shock to the motor shaft during replacement. Failure to comply may shorten the service life or damage the motor or encoder.
- Do not disassemble the encoder of the motor.
- After parts such as motors and reducer have been replaced, the robot cannot operate properly because a mismatch exists between the zero point stored in each motor and its corresponding zero point stored in the robot system. After replacing the parts, it is necessary to match these zero points.

Replacing Motor of the J5 Axis

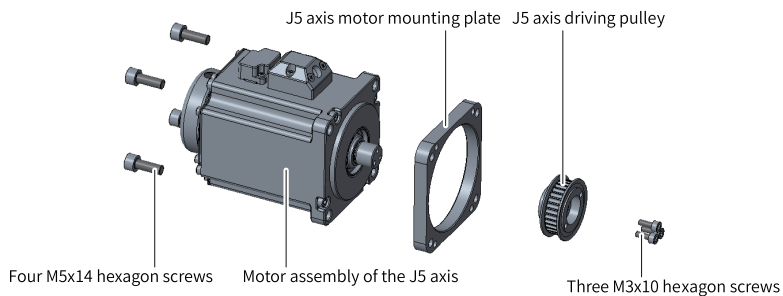
	Name	Quantity
Maintenance part	Motor assembly of the J5 axis	1
	O-shaped sealing ring of the J5 axis	1
Tool	Hexagon wrench	1
	15-N · m torque wrench	1
	Tension meter	1
	Air gun	1
	Torque screwdriver for M3, M4, and M5 hexagon screws	1
	Screwdriver sleeve for M3, M4, and M5 hexagon screws	1
	Dust-free cloth or oil-absorbing sheet	Several

- **Removing the J5 motor:**

1. Switch off the control switch on the control cabinet and disconnect the heavy-duty cables from the robot.
2. Remove the J5 input side cover of the forearm to expose the internal structure.
3. Remove the power cable and encoder cable of the J5 motor.
4. Remove the J5 axis timing belt at the J5 axis input side of the forearm.
5. Remove the four M4x14 hexagon screws and plain washers fixing the J5 axis motor assembly, and remove the J5 axis motor assembly.



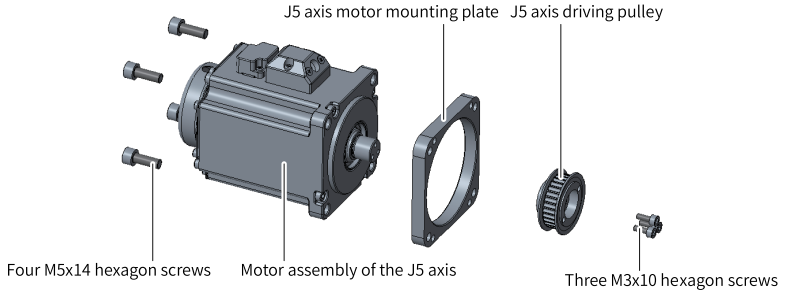
6. Remove the three M3x10 hexagon screws on the J5 axis driving pulley and remove the J5 axis driving pulley.
7. Remove the four M5x14 hexagon screws fixing the J5 axis motor mounting plate and then remove the J5 motor.



● Installing the J5 motor:

1. Check the J5 motor for any damage or burrs, and clean the motor shaft with a dust-free cloth and anhydrous ethanol.
2. Clean the J5 axis driving pulley using an air gun.
3. Orient the J5 axis driving pulley with the countersunk holes facing outward, and then install it onto the motor output shaft. Do not use impact methods for installation.

4. Secure the J5 axis driving pulley to the J5 motor using three M3x10 hexagon screws. Tighten each screw in two stages: first to 1 N·m, then to 2 N·m.
5. Secure the J5 axis motor mounting plate to the J5 motor using four M5x14 hexagon screws. Tighten each screw in two stages: first to 3 N·m, then to 7 N·m.



6. Secure the J5 axis motor assembly to the forearm J5 axis motor mounting position using four M4x14 hexagon screws and plain washers, with a tightening torque of 3 N·m.
7. Install cables by referring to ["3.11.3 Installing Cables Inside Robot" on page 74](#).
8. Install the timing belt and adjust the frequency of J5 axis timing belt to 90 Hz to 120 Hz.

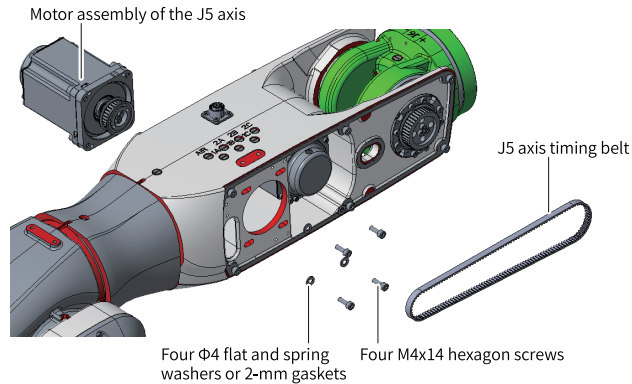
Note

Before testing the timing belt frequency with a tension meter, the following parameters must be set:

Measuring span: 200 mm

Timing belt unit mass: 2.4 g/m

Timing belt width: 10.0 mm/R



9. Power on the robot, reset the J5 axis encoder value, clear any alarms, and then capture the J5 axis zero point position.
10. Install the J5 input side cover of the forearm.

Replacing the J5 axis reducer

For replacement of the reducer, please contact your local dealer.

Contact local dealers when you need to replace the reducer.

Replacing the J5 axis timing belt

Replace the J5 axis timing belt according to methods described in this section.

3.8.6 J6 Axis



Warning

- Power off the robot system by removing the power plug.
 - Before performing any replacement procedure, turn off the robot system and related equipment, and then disconnect the power plug from the power source. Operating with the power ON may cause electric shock or malfunction of the robot system.
 - Always connect the AC power cable to the power plug. Do not connect it directly to the factory power supply.
-



Caution

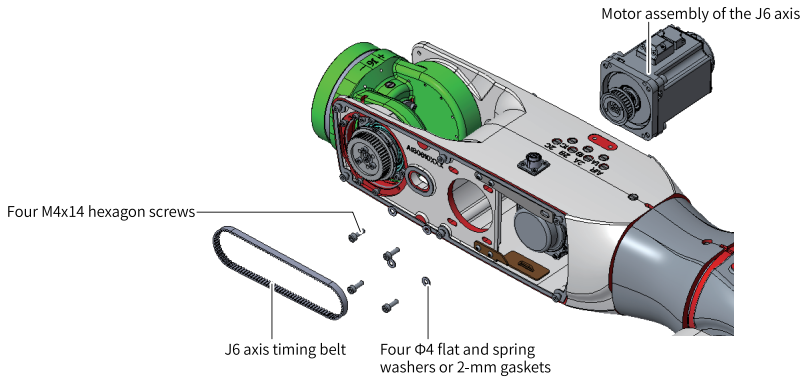
- Do not apply excessive shock to the motor shaft during replacement. Failure to comply may shorten the service life or damage the motor or encoder.
- Do not disassemble the encoder of the motor.
- After parts such as motors and reducer have been replaced, the robot cannot operate properly because a mismatch exists between the zero point stored in each motor and its corresponding zero point stored in the robot system. After replacing the parts, it is necessary to match these zero points.

Replacing Motor of the J6 Axis

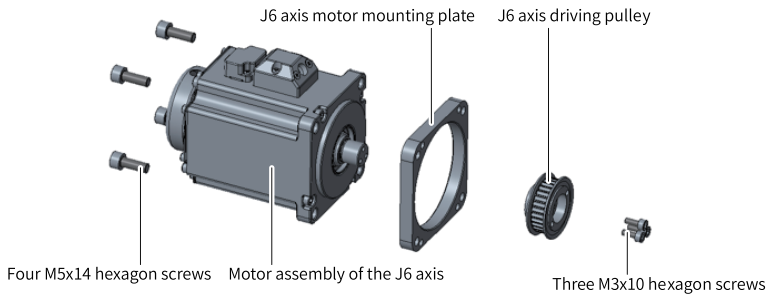
Name		Quantity
Maintenance part	Motor assembly of the J6 axis	1
	O-shaped sealing ring of the J6 axis	1
Tool	Hexagon wrench	1
	15-N·m torque wrench	1
	Tension meter	1
	Air gun	1
	Torque screwdriver for M3, M4, and M5 hexagon screws	1
	Screwdriver sleeve for M3, M4, and M5 hexagon screws	1
	Dust-free cloth or oil-absorbing sheet	Several

● Removing the J6 motor:

1. Switch off the control switch on the control cabinet and disconnect the heavy-duty cables from the robot.
2. Remove the J6 input side cover to expose the internal structure.
3. Remove the power cable and encoder cable of the J6 motor.
4. Remove the J6 axis timing belt at the J6 axis input side of the forearm.
5. Remove the four M4x14 hexagon screws and plain washers fixing the J6 axis motor assembly, and remove the J6 axis motor assembly.

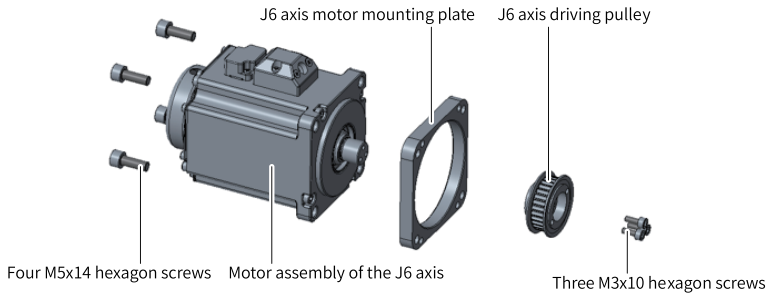


6. Remove the three M3x10 hexagon screws on the J6 axis driving pulley and remove the J6 axis driving pulley.
7. Remove the four M5x14 hexagon screws fixing the J6 axis motor mounting plate and then remove the J6 motor.



● Install the J6 motor:

1. Check the J6 motor for any damage or burrs, and clean the motor shaft with a dust-free cloth and anhydrous ethanol.
2. Clean the J6 axis driving pulley using an air gun.
3. Orient the J6 axis driving pulley with the countersunk holes facing outward, and then install it onto the motor output shaft. Do not use impact methods for installation.
4. Secure the J6 axis driving pulley to the J6 motor using three M3x10 hexagon screws. Tighten each screw in two stages: first to 1 N·m, then to 2 N·m.
5. Secure the J6 axis motor mounting plate to the J6 motor using four M5x14 hexagon screws. Tighten each screw in two stages: first to 3 N·m, then to 7 N·m.



6. Secure the J6 axis motor assembly to the forearm J6 axis motor mounting position using four M4x14 hexagon screws and plain washers, with a tightening torque of $3 \text{ N} \cdot \text{m}$.
7. Install the timing belt and adjust the frequency of J6 axis timing belt to 130 Hz to 160 Hz for the IRS311-7-70 model and to 160 Hz to 180 Hz for the IRS311-7-90 model.

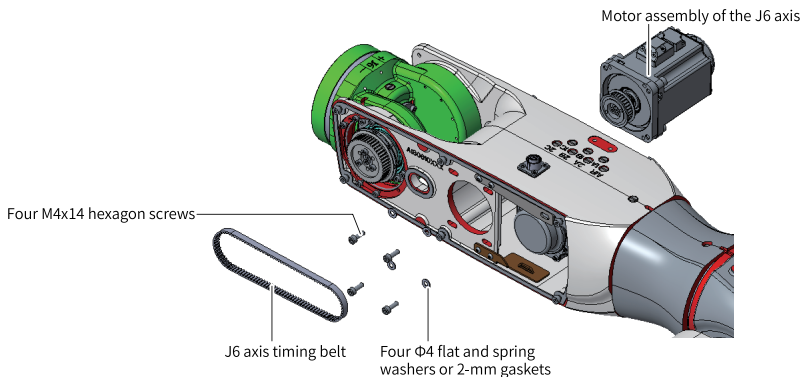
Note

Before testing the timing belt frequency with a tension meter, the following parameters must be set:

Measuring span: 200 mm

Timing belt unit mass: 2.4 g/m

Timing belt width: 10.0 mm/R



8. Install cables by referring to ["3.11.3 Installing Cables Inside Robot" on page 74](#).
9. Power on the robot, reset the J6 axis encoder value, clear any alarms, and then capture the J6 axis zero point position.
10. Install the J6 input side cover of the forearm.

Replacing the J6 axis reducer

For replacement of the reducer, please contact your local dealer.

Contact local dealers when you need to replace the reducer.

Replacing the J6 axis timing belt

For replacement of the J6 timing belt, see this section.

3.9 Replacement of Battery (Lithium Battery)

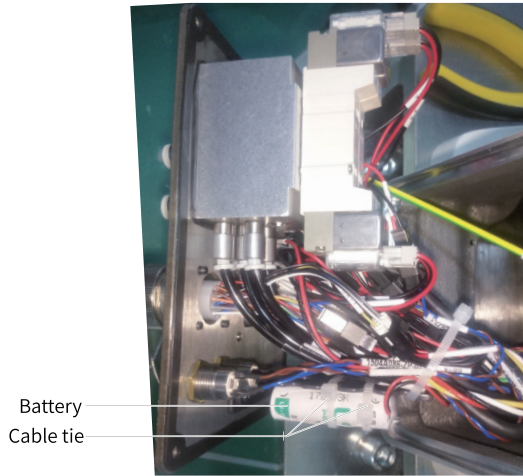


- Do not maintain the equipment after power-on. Failure to comply will result in an electric shock.
- If a lithium battery is used, avoid the following improper use; otherwise, severe safety issues may occur due to heat, leakage, explosion, or fire of the lithium battery.
 - Charging
 - Compression and deformation
 - Dismantlement
 - Short circuit
 - Improper battery connections
 - Heating
 - Throwing into fire
 - Soldering battery terminals
 - Forced discharging
- When disposing the battery, consult with the professional disposal services or comply with the local regulation.

To prevent loss of the home position, when replacing the battery, disassemble the back cover of the manipulator, take out the battery to be replaced, insert the new battery into the white 2P connector, and then pull out the old battery and fix it in the wire chamber. The replacement procedure is as follows:

Accessories	Code
Robot battery	98051002

1. Remove the four M4×8 inner hexagon screws on the rear cover of the base and remove the rear housing.
2. Cut the cable tie securing the battery to the cable board.
3. Secure the new battery to the cable board with a cable tie.



4. Connect the new battery to the empty white 2P cable end connector.
5. Remove the old battery.
6. Install the rear cover again.



Caution

If the zero point is lost due to failure to comply with the preceding steps, see ["3.10.2 Home Position Calibration Procedure" on page 56](#).

3.10 Zero Point Adjustment

3.10.1 Overview of Zero Point Adjustment

The zero point is the reference point and base point for the robot. When robot parts (such as the motor, reducer, timing belt, and cables) are replaced, the robot cannot position properly because a gap exists between the zero point stored in each motor and its corresponding zero point stored in the controller. Therefore, after the parts are replaced, zero point adjustment is required.

Note

After the calibration, the absolute accuracy of the robot may deviate from the default absolute accuracy at delivery.



- Install a safety fence for the system to prevent people from entering the action area of the system. Failure to comply will result in serious accidents.
 - Before operation, check that there is no person inside the safety fence. Do not enter the action area during system running. Failure to comply will result in serious safety problems.
 - Operating the robot system in teaching mode can ensure the safety of the operator to a certain extent, although the motion is limited (low speed and low power). However, severe safety issues may also occur when the robot moves unexpectedly.
-

3.10.2 Home Position Calibration Procedure

Both the PC teaching software and the hand-held teach pendant provide an operation interface for zero point calibration. The following describes the zero point calibration operations on the hand-held teach pendant. The operations on the PC teaching software are similar to those on the hand-held teach pendant.

When calibrating the home position using the teach pendant, calibrate J3 and J4 at the same time.

1. Log in to the user account.
 - a. On the main screen of the teach pendant, click the "User Settings" shortcut key to open the "User Settings" screen
 - b. Enter the password in the password input box and click the **Log In** button.

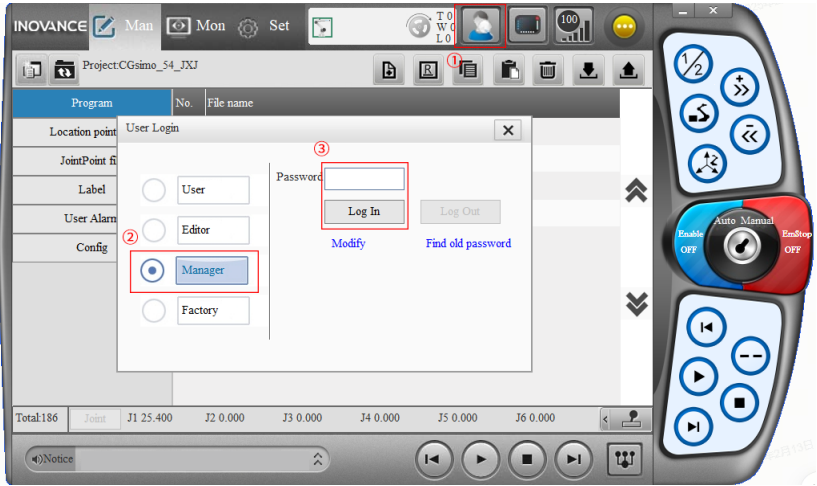


Figure 3-8 Screen of IRT80 series tech pendant

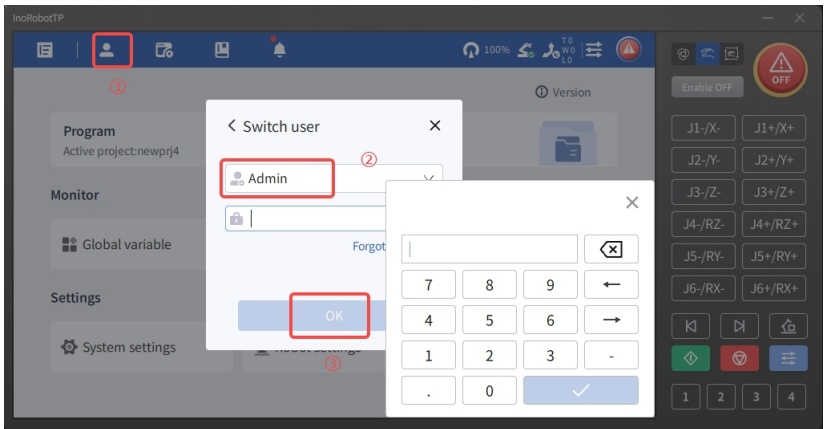


Figure 3-9 Screen of IRT200 series tech pendant

2. Go to the absolute zero setting interface.

On the main screen of the tech pendant, choose "Set" > "BasePos" > "ZeroPoint" to open the "ZeroPoint" screen.

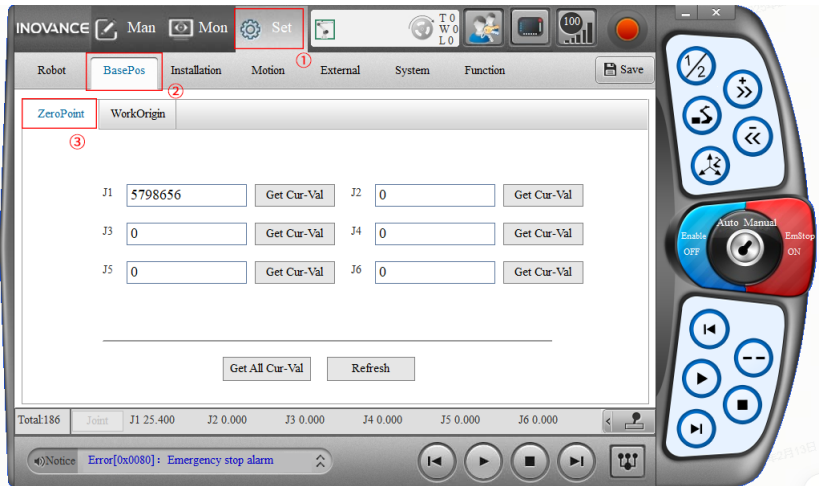


Figure 3-10 Screen of I RTP80 series tech pendant

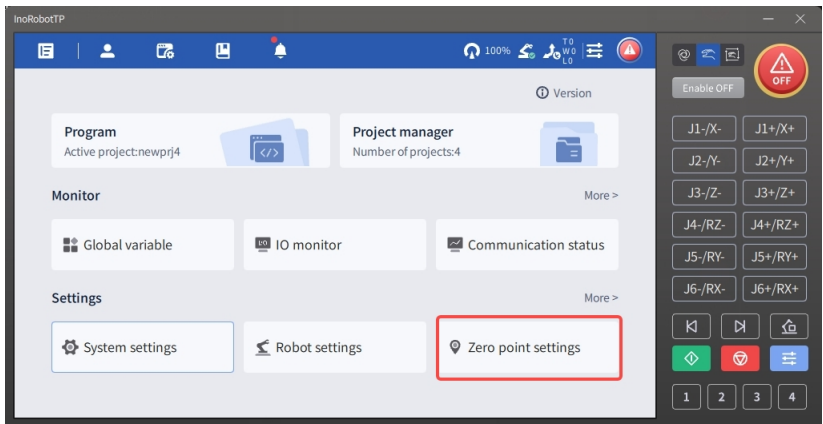


Figure 3-11 Screen of I RTP200 series tech pendant

3. Move each joint of the robot to the zero point.
 - a. Move the robot axes to their respective zero points on the hand-held or PC-based teach pendant. For details, see Teach Pendant User Guide.
 - b. Also, you can manually push the robot to the home position when the motor is not enabled.

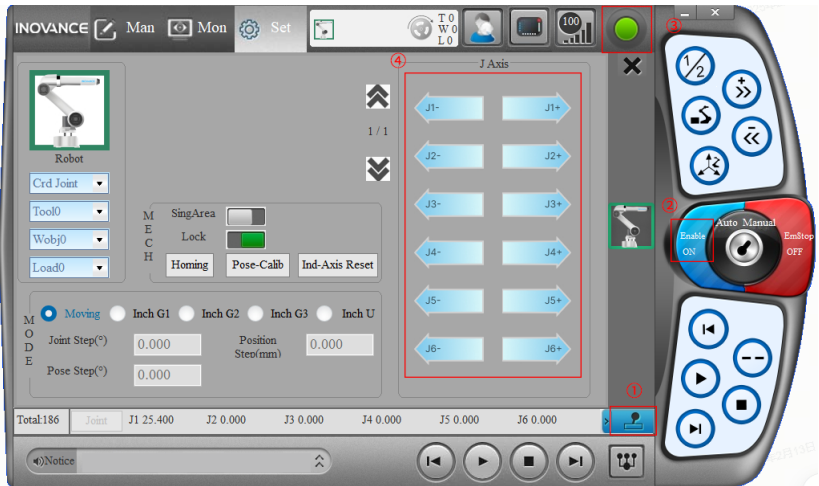


Figure 3-12 Screen of I RTP80 series tech pendant

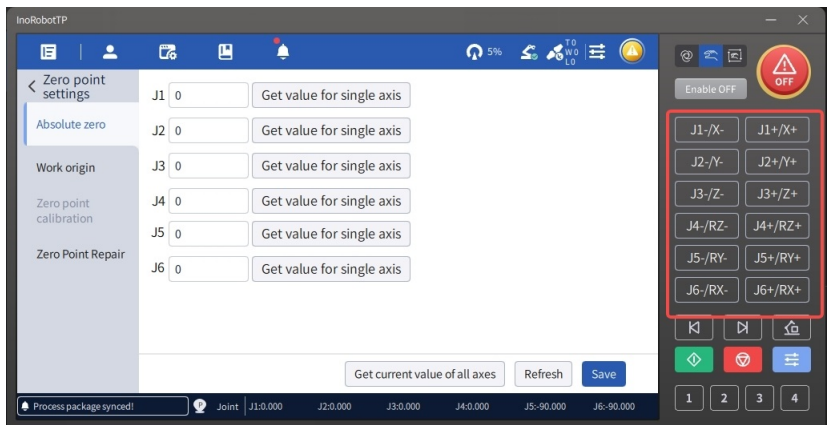


Figure 3-13 Screen of I RTP200 series tech pendant

4. Switch to the emergency stop state.

- a. Click the virtual emergency stop button on the PC-based teach pendant, or press the red "EmStop" button on the hand-held teach pendant.
- b. The status indicator in the upper right corner of the PC-based teach pendant (or the display of the hand-held teach pendant) indicates the emergency stop state (red).

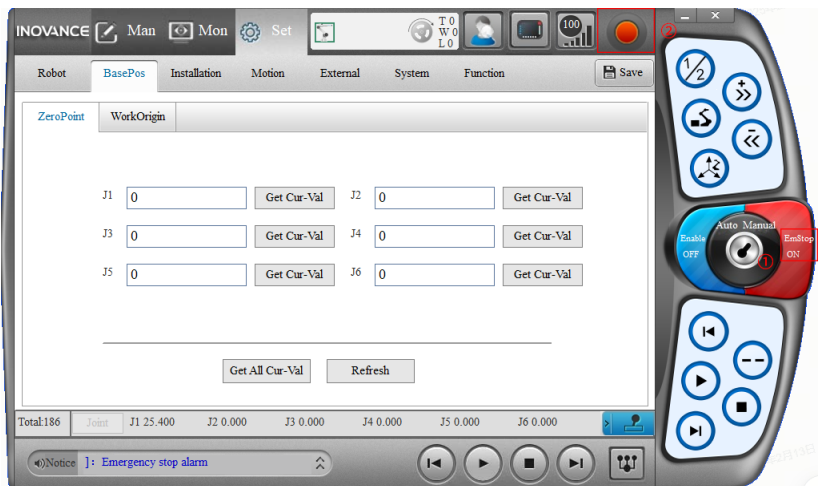


Figure 3-14 Screen of I RTP80 series tech pendant

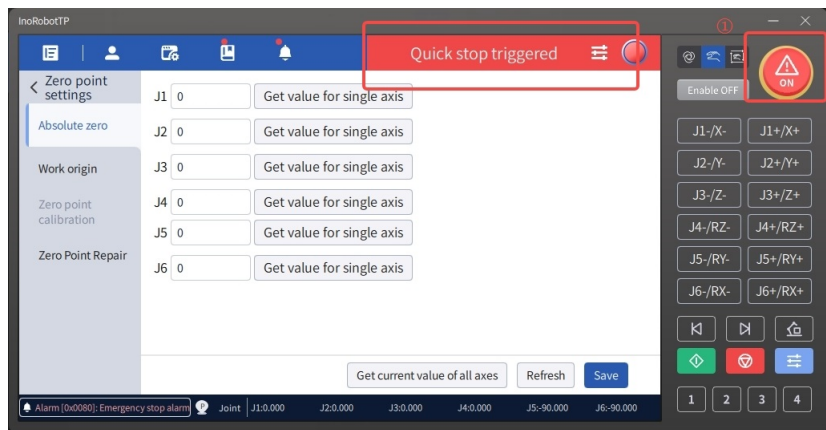


Figure 3-15 Screen of I RTP200 series tech pendant

5. Obtain and save the zero point information.
 - a. Click the "Get Cur" button when the robot moves to the zero point position to obtain the encoder pulses at the zero point position.
 - b. Click the **Save** button to complete the zero point calibration.

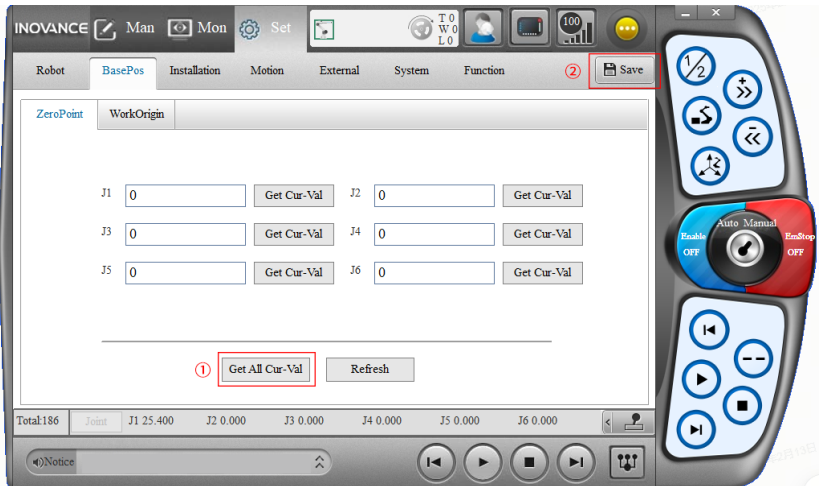


Figure 3-16 Screen of I RTP80 series tech pendant

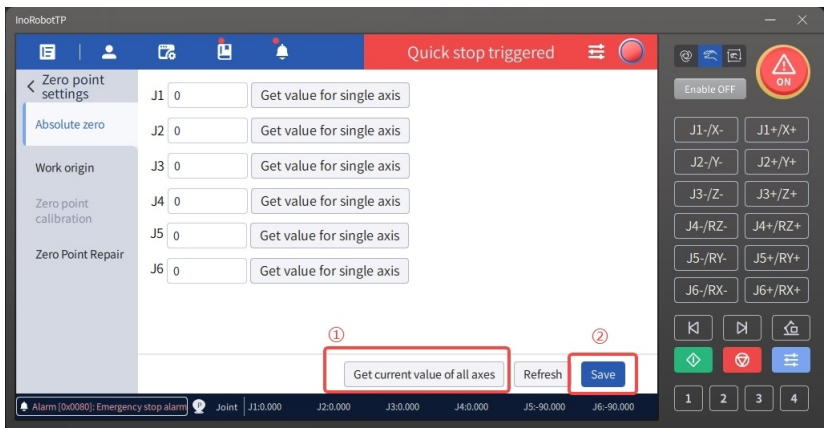


Figure 3-17 Screen of I RTP200 series tech pendant

3.10.3 Zero Point Position of Each Joint

Calibration tool

The calibration tool is used to calibrate the rotary axes of the robot manually, as shown in the figure below.

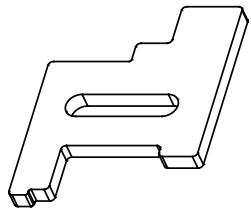


Figure 3-18 Calibration tool

Tool	Material Code	Applicable Model
Zero point calibration tool	01660016	IRS311-7

Calibration method of axes J1 to J6

Control the robot to move at a speed within 5% of the rated speed by using the teach pendant. Adjust J1 to J6 until the calibration tool fits snugly in the reference slot, as shown in the figure below.

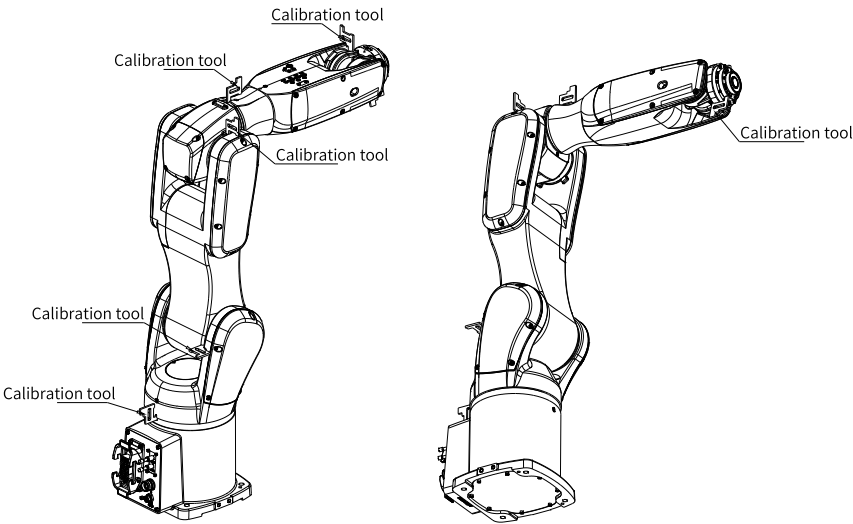


Figure 3-19 Calibration of axes J1 to J6

3.10.4Zero Calibration of Each Joint

The following figure shows the zero calibration effect of each joint.

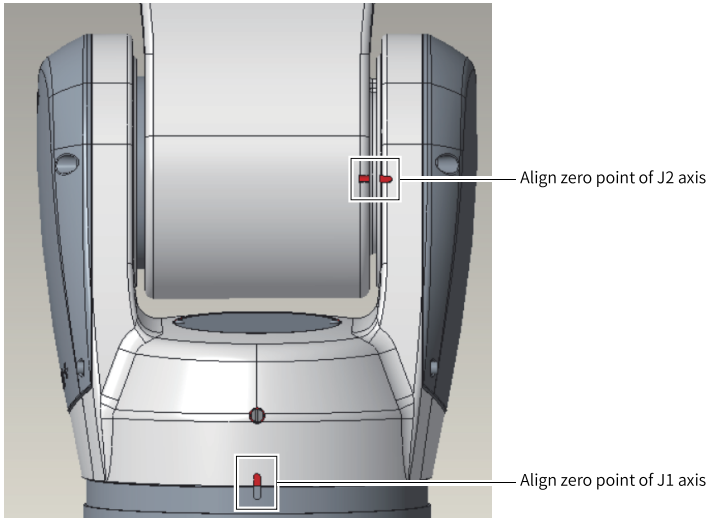


Figure 3-20 Zero calibration of axes J1 and J2

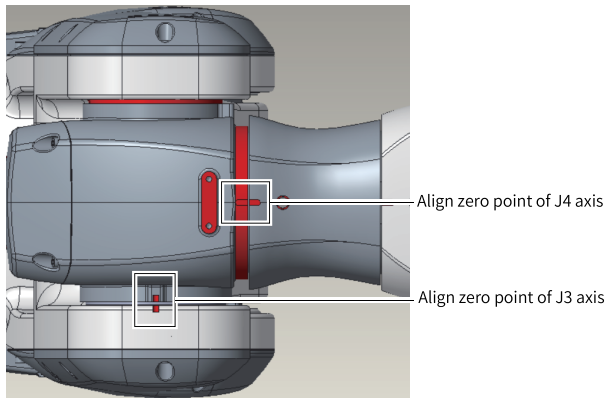


Figure 3-21 Zero calibration of axes J3 and J4

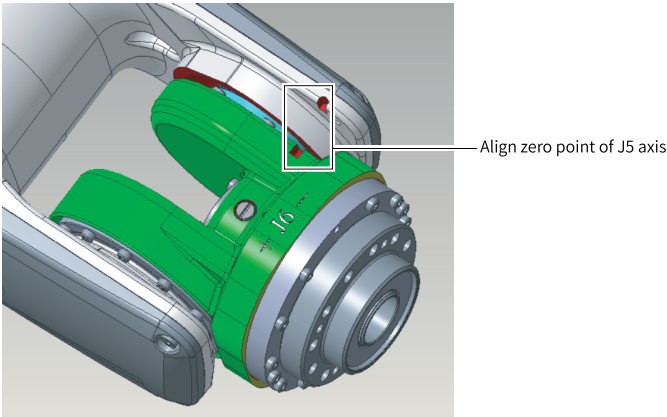


Figure 3-22 Zero calibration of axis J5

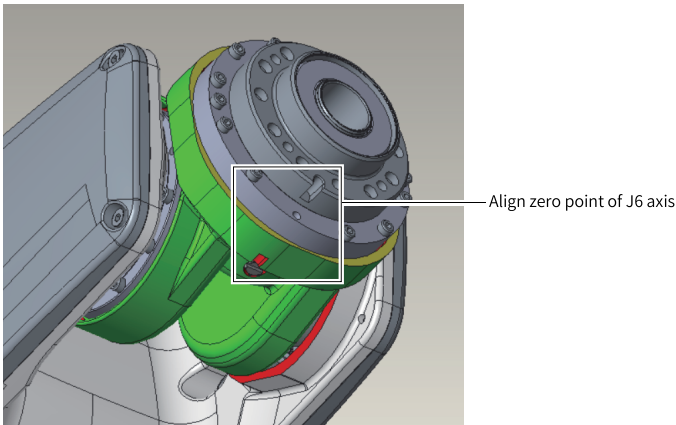


Figure 3-23 Zero calibration of axis J6

3.11 Cable Replacement

3.11.1List of Tools for Replacing Cables Inside Robot

Name	Quantity	Code	Remarks
Robot connection cable	1	1504LT65	IRS311-7-90TS5
Motor connection cable	1	1504LT75	IRS311-7-70TS5 IRS311-7-90TS5
Robot connection cable	1	1504LT62	IRS311-7-70TS5

Name	Quantity	Code	Remarks
Cable tie	Several	21080044	-
Optitemp RB 2-1KG Specific for cable lubrication (RoHS)	Several	24060150	-
Hexagon wrench	1	-	-
Phillips screwdriver	1	-	-
Diagonal pliers	1	-	-
Electronic scale	1		
Monkey spanner	1	-	-
LT243 threadlocker	1	-	-
LT5699 seal gum	1	-	-

3.11.2 Removing Cables Inside Robot

Preparation



Caution

- Photograph all cable routing before disassembly to ensure correct re-installation reference.
- Return all axes to their zero point positions before cable removal. Failure to comply may result in:
 - Crossed cable routing.
 - Reduced operational accuracy of the robot.
 - Inconsistent cable positioning, complicating absolute zero recalibration.



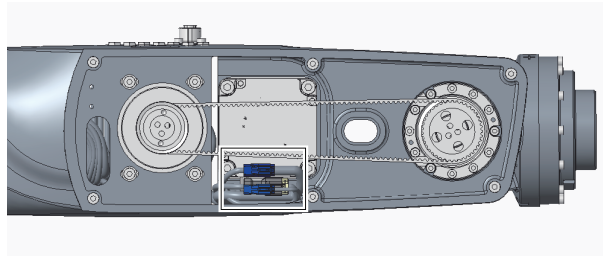
Danger

Before entering the operating area of the robot, turn off all the power and air pressure sources connected to the robot, and put up work-in-progress signs.

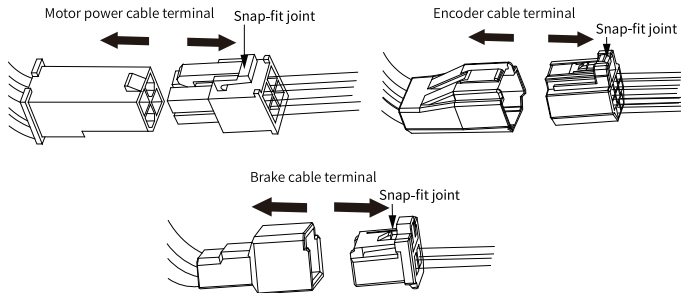
Removing procedure

1. Remove the J6 axis cable.
 - a. Remove the J6 input side cover of the forearm to expose the internal structure.

- b. Connect the J6 axis motor power cable, encoder cable, and brake cable according to the cable markings.

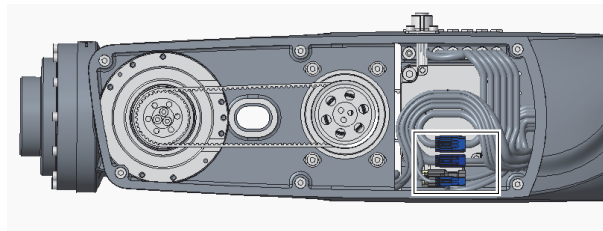


- c. Press the snap-fit joint and disconnect the connector in the direction indicated by the arrow and cut the cable ties.

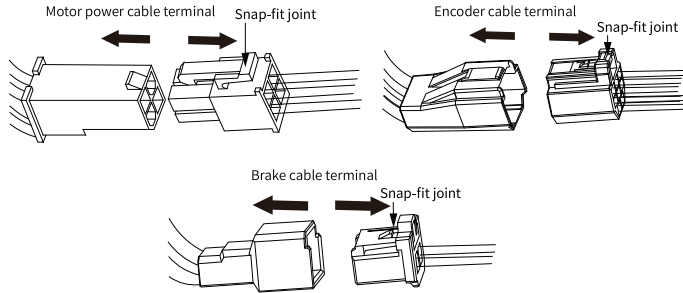


2. Remove the J5 axis cable.

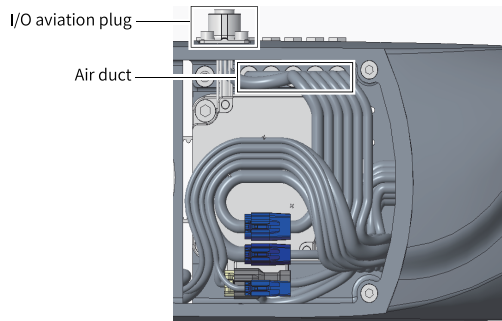
- a. Remove the J5 input side cover of the forearm to expose the internal structure.
- b. Connect the J5 axis motor power cable, encoder cable, and brake cable according to the cable markings.



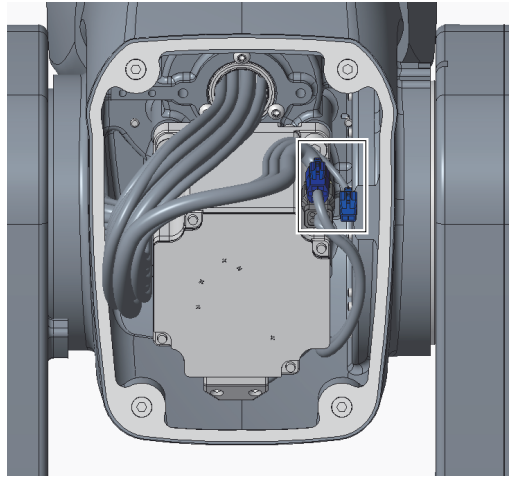
- c. Press the snap-fit joint and disconnect the connector in the direction indicated by the arrow and cut the cable ties.



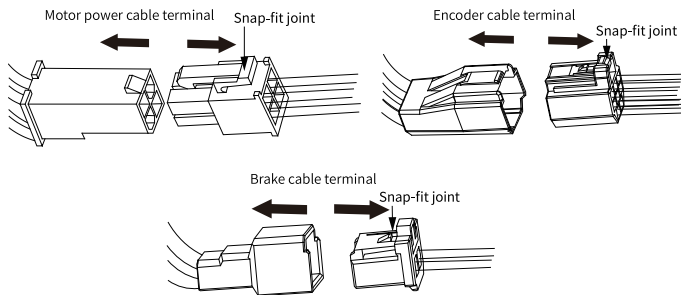
3. Remove the air ducts and I/O aviation plug base.
 - a. After removing the forearm input side cover, press the air duct connectors to detach the air ducts.
 - b. Locate the I/O aviation plug connector according to the label, disconnect the connector, and cut the cable ties.
 - c. Use a screwdriver to remove the I/O aviation plug, and then take out the disconnected I/O aviation plug cable from the robot.



4. Remove the J4 axis cable.
 - a. Remove the J4 elbow cover to expose the internal structure.
 - b. Connect the J4 axis motor power cable, encoder cable, and brake cable according to the cable markings.

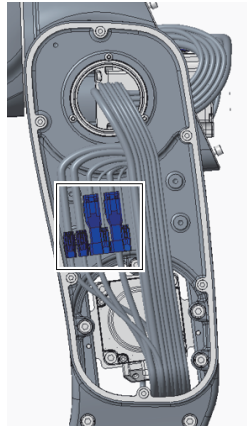


- c. Press the snap-fit joint and disconnect the connector in the direction indicated by the arrow and cut the cable ties.

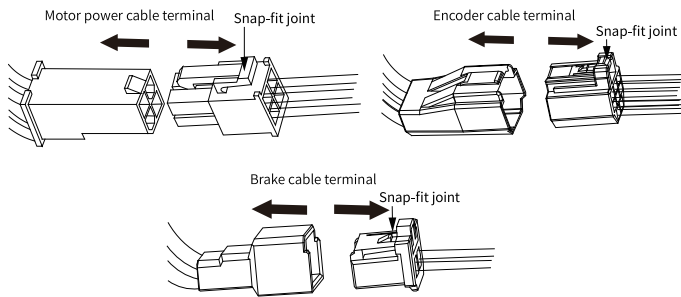


5. Remove the J2 and J3 axis cables.

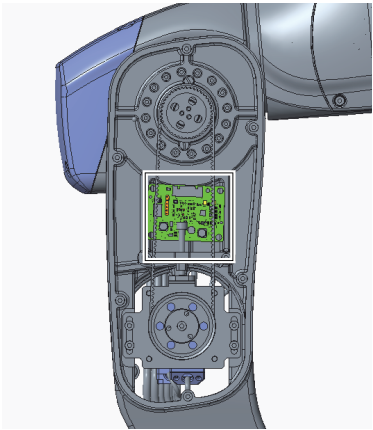
- a. Remove the cable cover of the upper arm to expose the internal structure.
- b. Connect the J2 axis motor power cable, encoder cable, and brake cable according to the cable markings.
- c. Connect the J3 axis motor power cable, encoder cable, and brake cable according to the cable markings.



- d. Press the snap-fit joint and disconnect the connector in the direction indicated by the arrow and cut the cable ties.

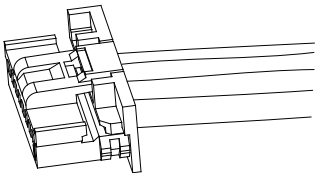


6. Remove the gyroscope cable.
- a. Remove the reducer cover of the upper arm to expose the internal structure.
 - b. Locate the gyroscope cable connector on the motor pulley side.

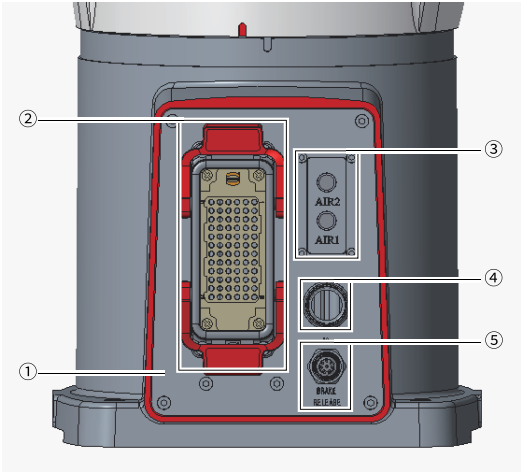


c. Disconnect the gyroscope cable connector and cut the cable tie.

Gyroscope terminal

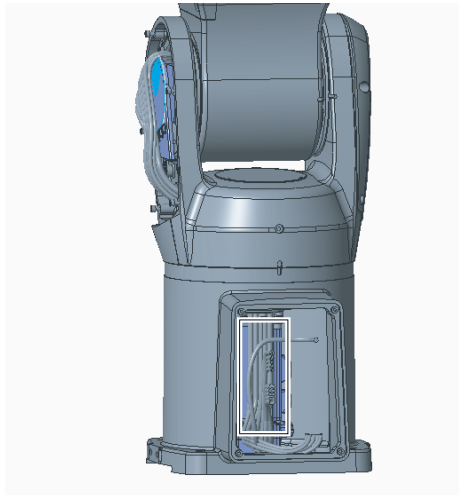


7. Remove the base cables.
- a. Use an Allen wrench to remove the screws on the cover, and then detach the base connector electrical cover.

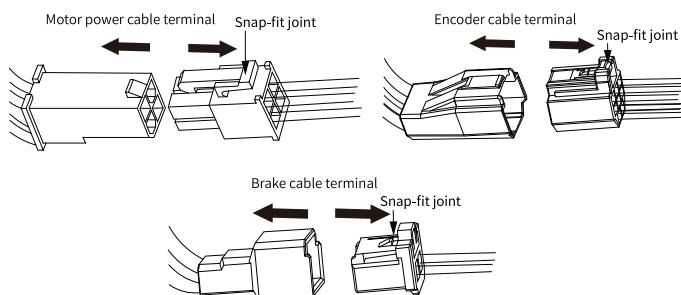


No.	Name
①	Electrical cover of the base connector
②	Heavy-duty connector
③	Circular brake aviation plug
④	I/O aviation plug
⑤	Air duct connector

- b. Use a Phillips screwdriver to remove the heavy-duty connector from the heavy-duty base.
 - c. Remove the circular brake aviation plug from the sheet metal.
 - d. Remove the connector of the I/O aviation plug.
 - e. Disconnect the grounding adapter cable terminal.
 - f. Remove the battery cable connector and remove the air dust from the air duct connector.
8. Remove the J1 axis cable.
- a. Remove the base connector electrical cover to expose the internal structure.
 - b. Connect the J1 axis motor power cable, encoder cable, and brake cable according to the cable markings.

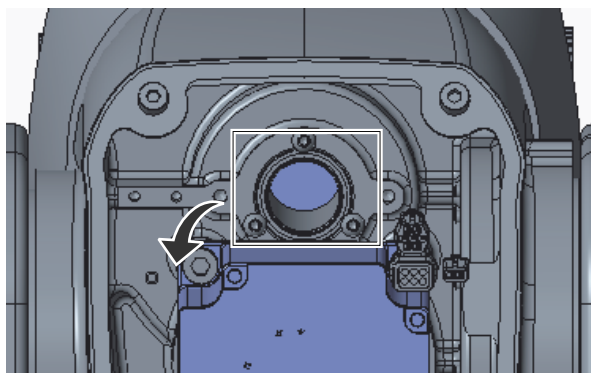


- c. Press the snap-fit joint and disconnect the connector in the direction indicated by the arrow and cut the cable ties.

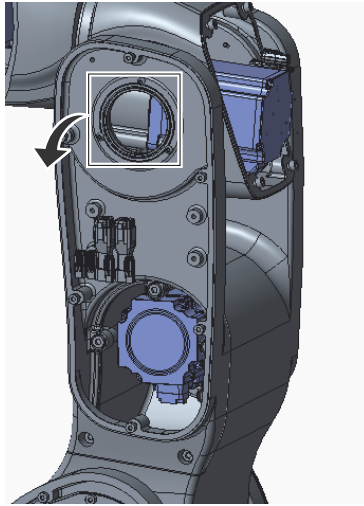


9. Remove all cables.

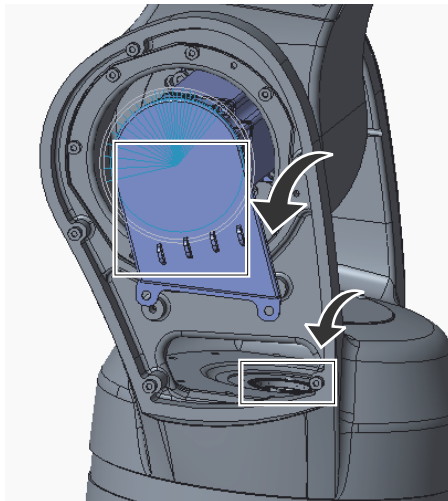
- a. Pull out the J5 axis cables, J6 axis cables, air ducts, and I/O adapter cables through the J4 axis elbow threaded hole in the direction shown in the figure.



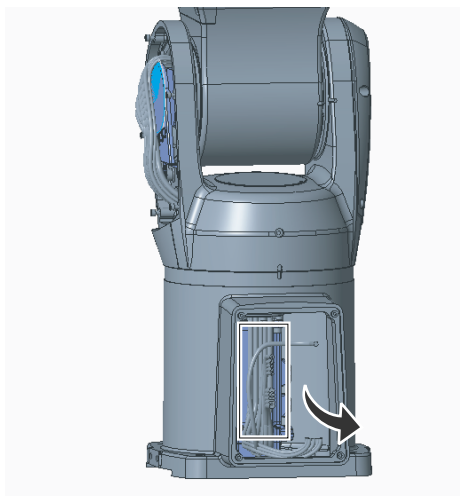
- b. Cut the cable ties and pull out the cables through the threaded hole at cable cover of the J3 upper arm in the direction shown in the figure.



- c. Extract the cables through the threaded hole at J2 axis swivel base and remove the cable ties.
- d. Pull down the cables through the threaded hole in the middle of J1 axis swivel base, fully extending them into the base cavity in the direction shown in the figure.



- e. Completely extract all cables from the base cavity in the direction shown in the figure.

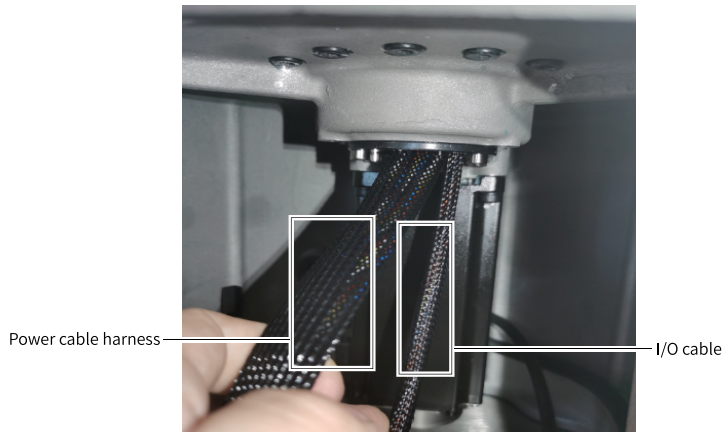


3.11.3 Installing Cables Inside Robot

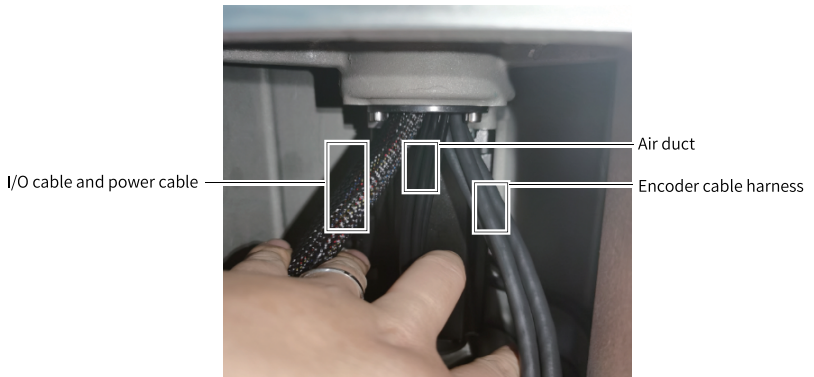
1. Reconnect the cables.
 - a. Prepare cables for replacement and tidy them up.
 - b. Wrap the cable connectors to avoid damage.



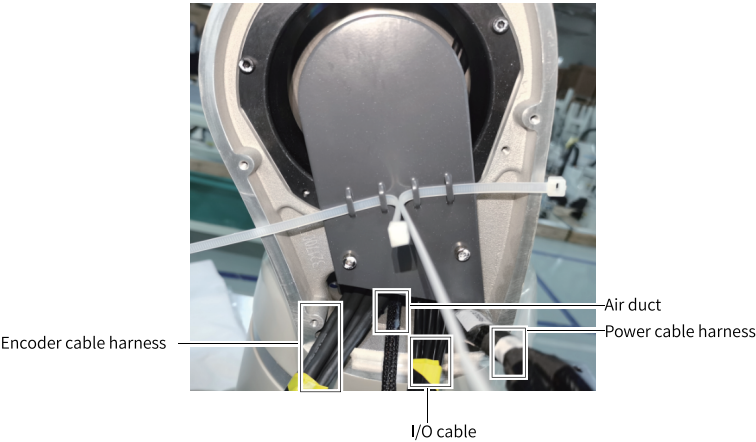
- c. Arrange the power cable and I/O flat cable on the left side in the threaded hole of the base from left to right, as shown in the figure.



- d. Pass the power cable and I/O cable harness through the threaded hole, and lead the I/O cable and then the power cable out from the swivel base in sequence.
- e. Arrange the encoder cable on the rightmost side of the base threaded hole, thread the encoder cable harness through the base threaded hole, and lead it out of the swivel base, as shown in the figure.
- f. Place the air duct between the power cable and encoder cable at the threaded hole, and pass it from the base threaded hole to the swivel base outlet hole, as shown in the figure.

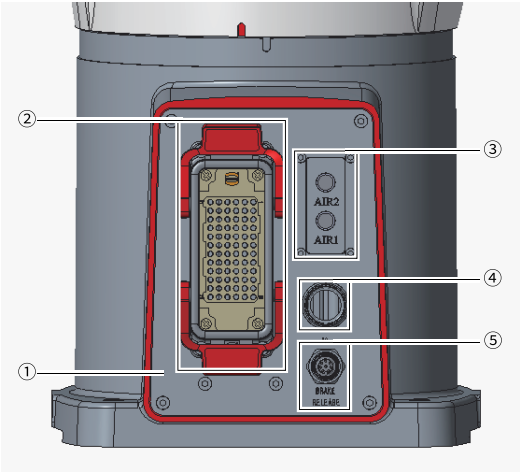


- g. Pull the cable from the middle threaded hole of the J1 axis swivel base to the side, as shown in the figure.

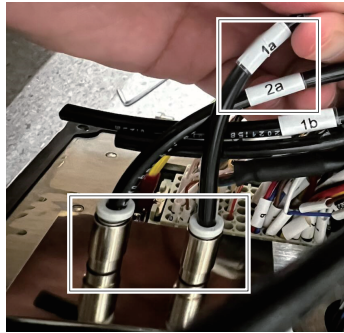


2. Install the base cover cable.

No.	Name
①	Base cable cover
②	Heavy-duty connector
③	Circular brake aviation plug
④	I/O aviation plug
⑤	Air duct connector



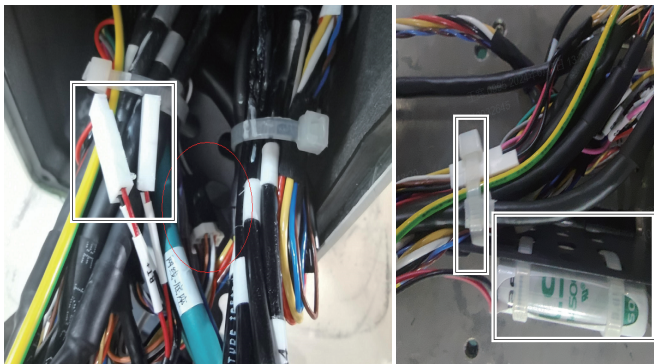
a. Insert the 2a and 1a air ducts into the air duct connector, as shown in the figure.



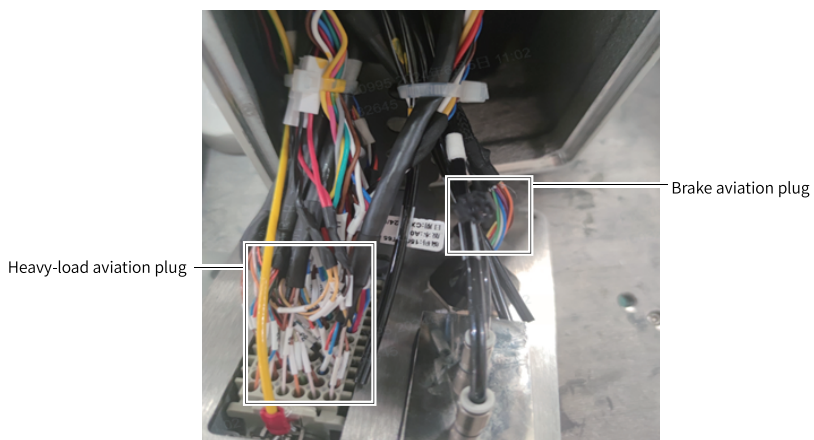
b. Use a Monkey wrench to install the I/O aviation plug on the base cable cover.



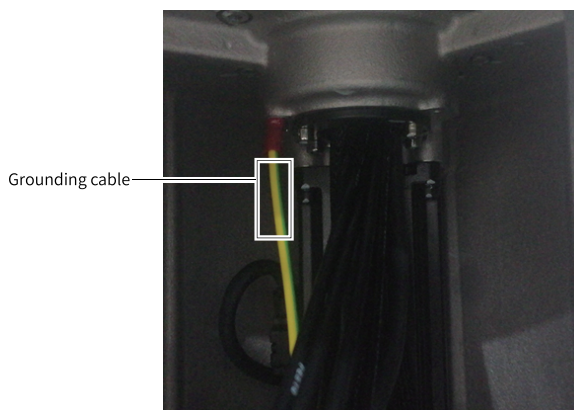
c. Connect the battery connector and secure it to the battery sheet metal with cable ties.



d. Install the heavy-duty aviation plug on the heavy-duty base and install the brake aviation plug on the base cable cover.

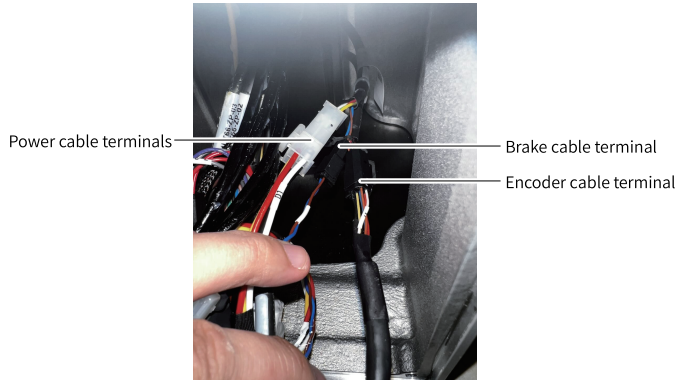


- e. Attach the grounding cable to the robot and connect the grounding adapter cable.

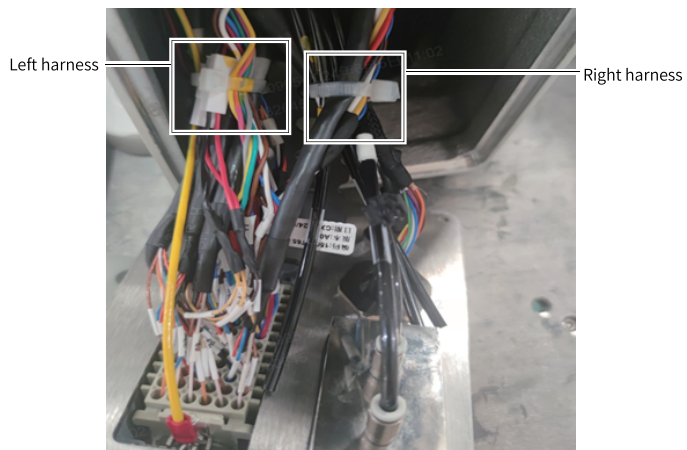


3. Install the J1 axis motor cable.

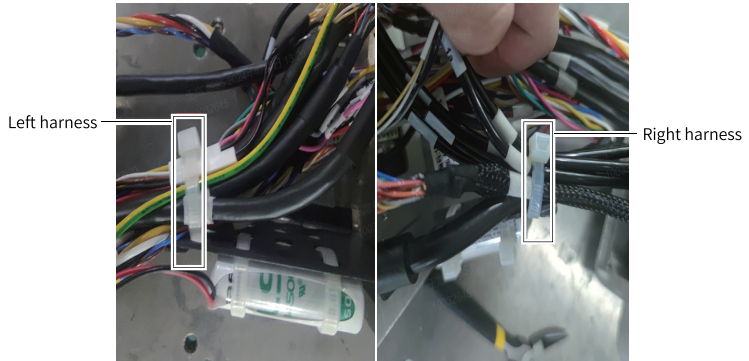
- a. Connect the power cable, encoder cable, and brake cable of J1 motor separately.



- b. Organize the J1 axis cables into two bundles: the left bundle includes the encoder cables, power cables, gyroscope cables, and grounding cables of axes J2 to J6, while the right bundle includes the encoder cable, power cable, air duct, and I/O cable of J1 axis.

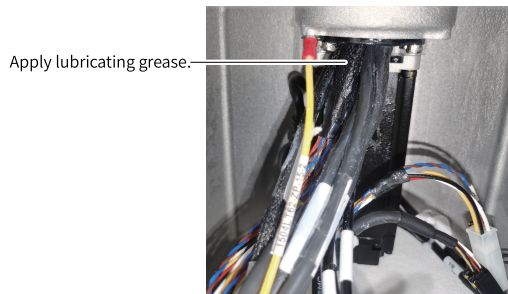


- c. Bundle the J1 axis cables: the left bundle must be tied together with the battery terminal at the designated binding points, and the right bundle must be tied according to the binding points. Cables without marked binding points must be straightened.



4. Apply lubricating grease to the J1 axis cables.

- a. Pull the cables downward from the threaded cable hole of J1 axis swivel base.
- b. After wearing gloves, apply cable lubricating grease RB2 of 7 g to each cable. Ensure that all cables at the threaded hole are fully lubricated.



- c. Pull the entire cable harness upward to align the J2 axis binding point with the cable binding point.



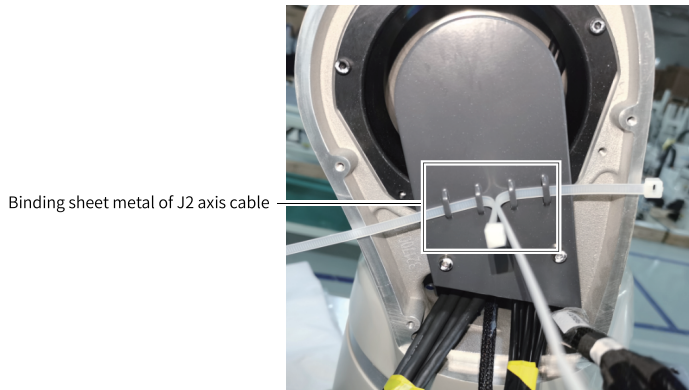
5. Install the electrical mounting sheet metal of J1 axis.

- a. Install the electrical mounting sheet metal of J1 axis with the base.
- b. Apply LT243 threadlocker to the base threaded holes for 3 to 4 times.
- c. Align four M4x8 hexagon screws with the mounting holes and then install them into the base with a torque of $2 \pm 0.2 \text{ N} \cdot \text{m}$.

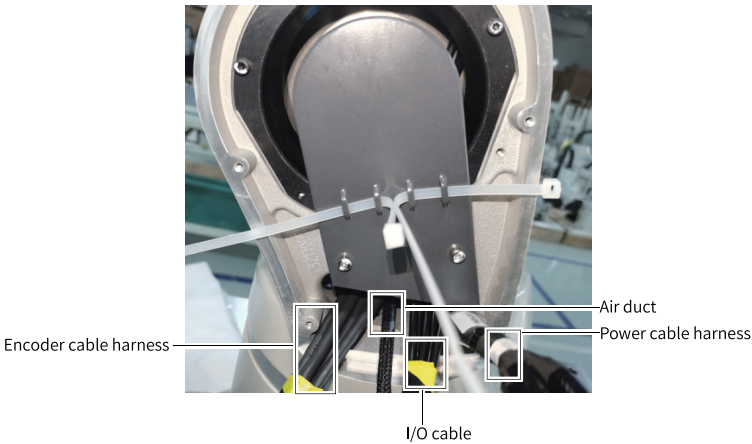


6. Install the J2 axis cables.

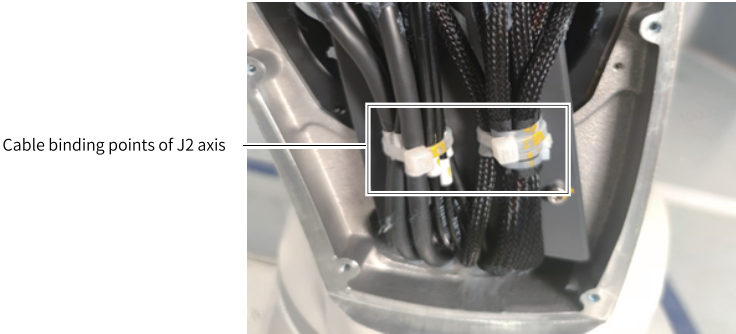
- a. Take two cable ties and pass them through the J2 axis cable binding sheet metal in advance.



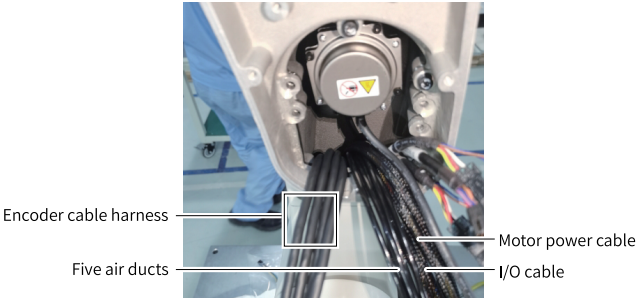
- b. Organize the cables at the swivel base cable outlet hole in order, from left to right: encoder cable, air duct, I/O cable, and motor power cable.



- c. Adjust the binding points on the J2 axis cable side to align them horizontally with the cable tie positions.
- d. Use cable ties to secure the cables to the J2 axis cable binding sheet metal.



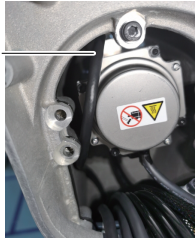
- e. Pass all cables through the J2 axis threaded hole into the upper arm interior, and then out through the threaded hole at the upper arm cable side.
- f. The cable exit order at the threaded hole at the upper arm cable side, from left to right, is: encoder cable, air duct, I/O cable, and motor power cable.



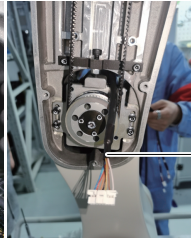
7. Install the gyroscope cable.

- a. Pass the gyroscope cable through the far-left J2 axis threaded hole and out from the upper arm reducer side.

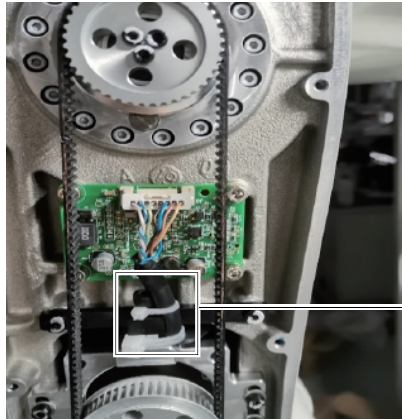
Thread the gyroscope cable into the J2 axis threaded hole.



Thread the gyroscope cable out of the J3 axis reducer side.

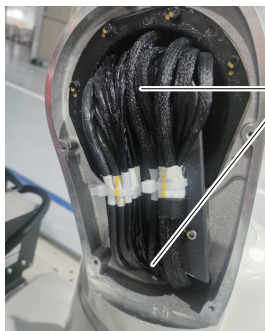


- b. Secure the gyroscope cable to the J3 axis tensioning mechanism using a cable tie, as shown in the figure below.



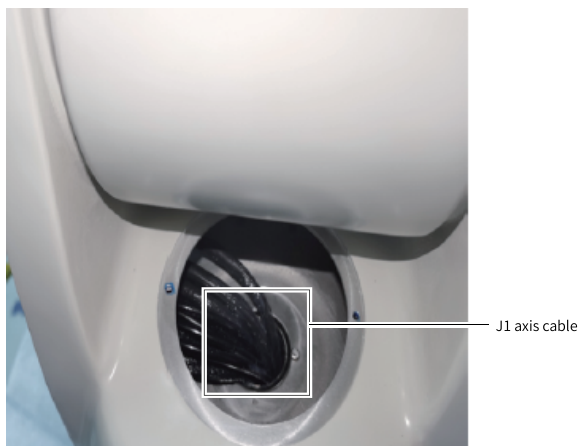
Binding point of gyroscope cable

8. Apply 4 g of cable lubricating grease RB2 to the cables at the J2 axis swivel base cable outlet hole.



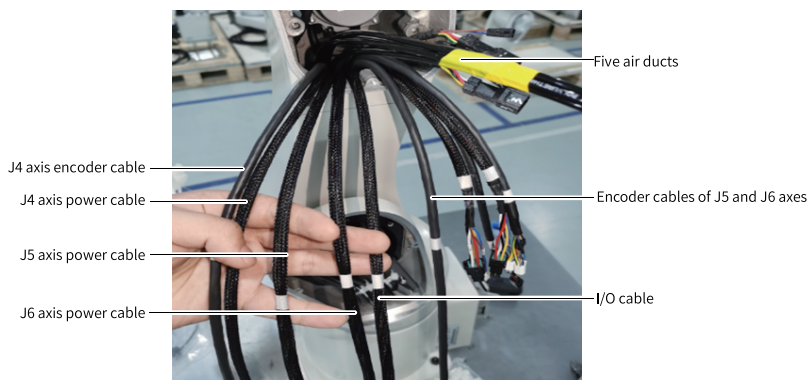
Lubrication position

9. Inside the inspection hole above the J1 axis swivel base, adjust the cable harness at the J1 axis threaded hole to ensure the cables do not press against the casting.

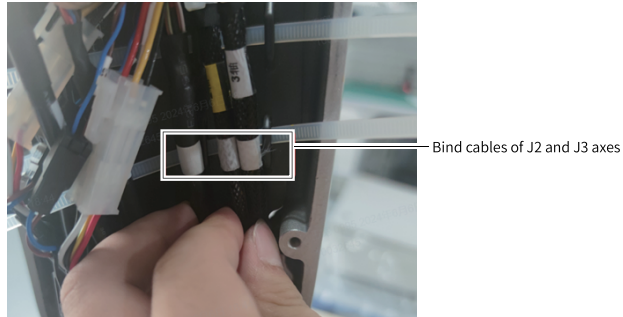


10. Install the J2 and J3 axis motor cables.

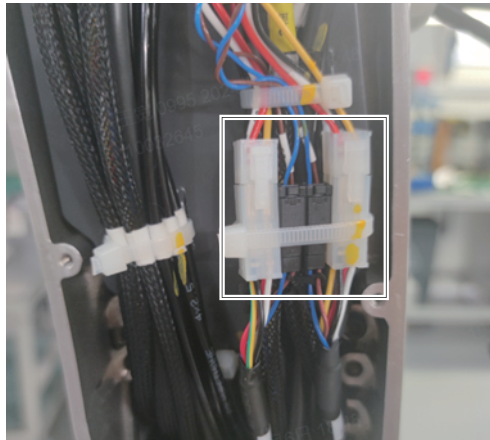
- a. Organize the cables on the upper arm cable side according to their markings, in the following left-to-right order: J4 axis encoder cable, J4 axis motor power cable, J5 axis power cable, J6 axis power cable, I/O aviation plug cable, 5 air ducts, and J5 and J6 axis encoder cables.



- b. Connect the J2 and J3 axis motor power cables, brake cables, and encoder cables according to the cable markings.
- c. Organize the connected J2 and J3 axis encoder and power cables, aligning the bundling points with the cable tie positions.



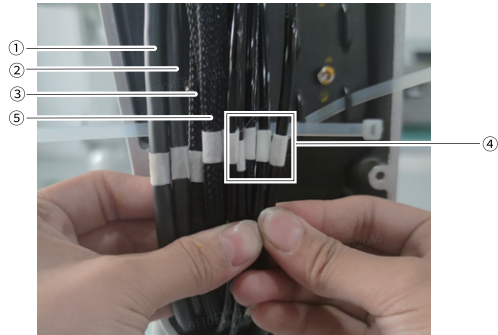
- d. The power cable terminals must be on both sides, the brake cable terminals in the middle, and the encoder terminals aligned without cross-tangling.



11. Apply lubricating grease to the elbow cables.

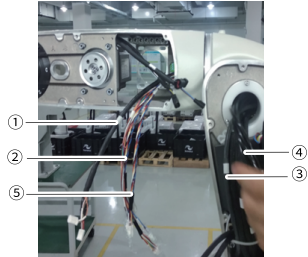
- a. Organize the J4, J5, and J6 axis cables and the I/O aviation plug cable in the left-to-right order as shown in the table below.

No.	Name
①	Power cable and encoder cable of J4 axis
②	Power cables of J5 and J6 axes
③	I/O aviation plug cable
④	Five air ducts
⑤	Encoder cables of J5 and J6 axes

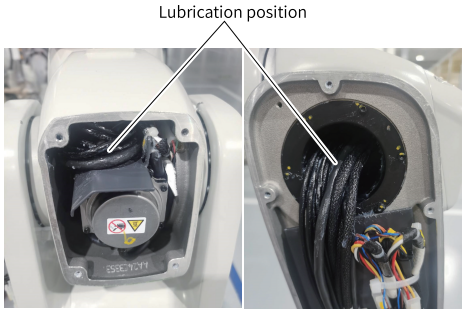


b. Arrange the J4, J5, and J6 axis cables and the I/O aviation plug cable from left to right in the order shown in the table below, and then pass them sequentially from the threaded hole at the upper arm cable side to the elbow.

No.	Name
①	Power cable and encoder cable of J4 axis
②	Power cables of J5 and J6 axes
③	I/O aviation plug cable
④	Five air ducts
⑤	Encoder cables of J5 and J6 axes

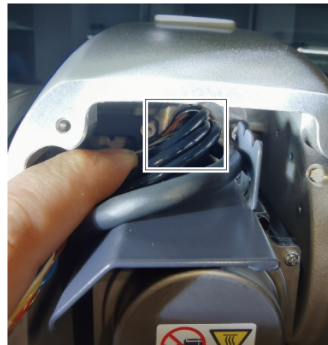
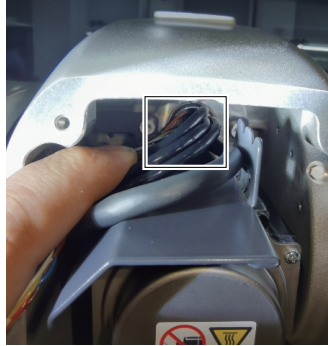


c. Apply 2 g of cable lubricating grease RB2 to the cable harness at the threaded hole between the upper arm and elbow evenly.

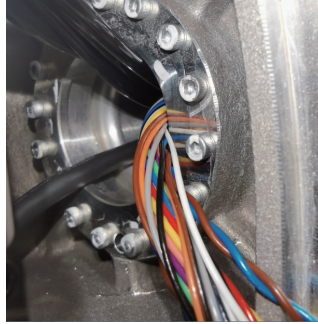


12. Install the J5 and J6 axis cables to the forearm.

- a. Pass the J5 axis power cable, J6 axis power cable, I/O aviation plug, and J5 and J6 axis encoder cables through the threaded hole where the elbow connects to the forearm.
- b. The cable harness routing positions during threading are as follows: J5 axis power cable: lower left corner of the threaded hole; J6 axis power cable: directly left side of the threaded hole; I/O aviation plug: upper left corner of the threaded hole; J5 and J6 axis encoder cables: lower right corner of the threaded hole.

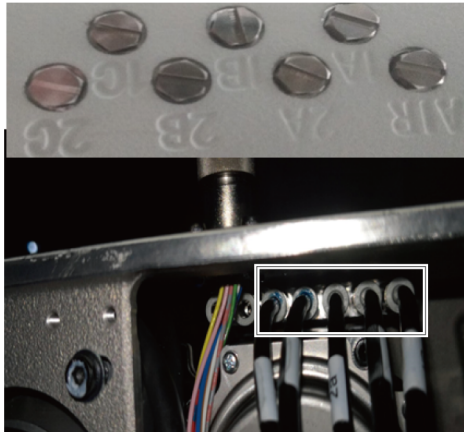


- c. Pass the air ducts through the threaded hole where the elbow connects to the forearm.
- d. Adjust the air ducts to be positioned at the upper right of the threaded hole.
- e. Adjust the cable harness positions before and after the threaded hole to ensure the exit positions match the threading arrangement.

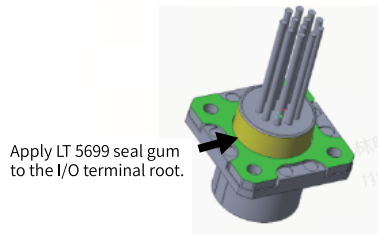


13. Install the forearm air ducts and J5 and J6 axis cables.

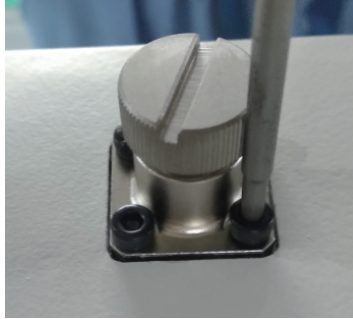
- a. Connect the air ducts to the corresponding forearm air duct connectors according to the markings (AIR, 1A, 2A, 1B, and 2B) and leave positions C1 and C2 uninstalled.



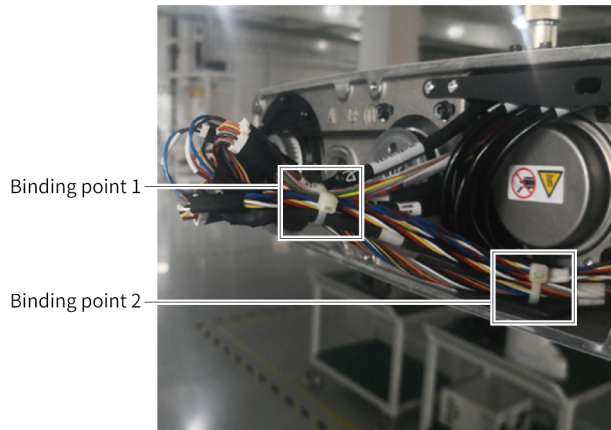
- b. Connect the J5 and J6 axis motor power cables, encoder cables, and brake cables according to the cable markings.
- c. After installing the I/O connector, connect the I/O aviation plug cable to the forearm I/O aviation connector.
- d. Apply a ring of LT5699 seal gum around the base of the I/O terminals.



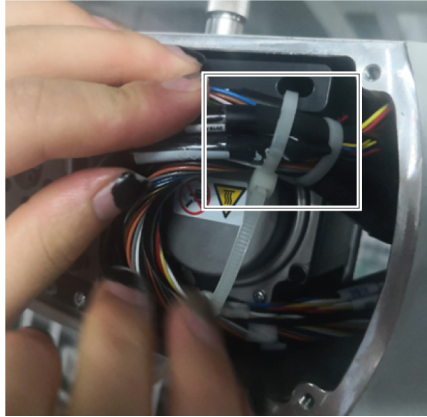
- e. Apply LT243 threadlocker to four M3x8 hexagon screws, and then tighten them diagonally with a torque of $1.5 \pm 0.2 \text{ N} \cdot \text{m}$.



- f. Organize and bind the forearm cables.
- g. Use cable ties to bind cables at Binding Point 1 and Binding Point 2. Ensure that the forearm cables are neatly arranged without crossing or tangling, as shown in the figure.



- h. After binding, fold the cable ends back toward the forearm and push them upward to avoid contact with the J4 axis threaded hole.
- i. Bind the cables to the J6 axis top cable sheet metal at the designated binding points using cable ties.



14. Install the elbow J4 axis motor cables.

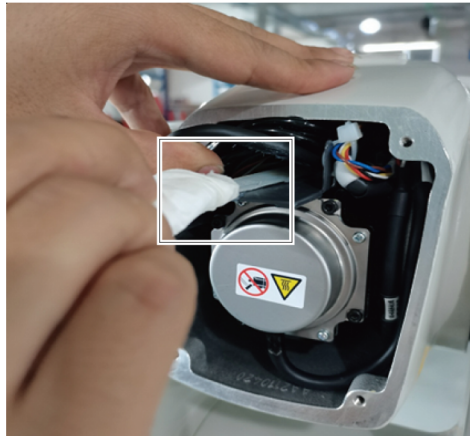
- a. Pass the J4 axis encoder cable and power cable from the threaded hole at upper arm cable side to the elbow, and then route them along the inner side above the motor.
- b. Adjust the J4 axis encoder cable and power cable to prevent contact with the casting.



- c. Connect the J4 axis motor power cables, encoder cables, and brake cables according to the cable markings.
- d. Bind the J4 axis encoder cable and power cable to the J4 axis sheet metal with a cable tie.
- e. Bend the J4 axis power cable and place it in the upper right area of the elbow. Then bend and bind the J4 axis encoder cable, placing it in the upper right space of the elbow to prevent the enclosure from pinching the internal cables.



- f. Bend the J4 axis encoder cable and power cable separately, and then insert them into the gap on the right side of the J4 motor.
- g. Apply 5 g of cable lubricating grease RB2 to the cables above the J4 axis elbow sheet metal, the cables outside the threaded hole, and the cables inside the threaded hole.



3.11.4 Replacing the Motor Cables

Replace the motor cables after removing and installing the motor according to section "Maintenance and Replacement of Parts" in sections ["3.8.1 J1 Axis" on page 33](#) to ["3.8.6 J6 Axis" on page 50](#).

After removing the connector with a screwdriver, replace the cable, insert the new cable into the motor connector, and securely lock the connector.

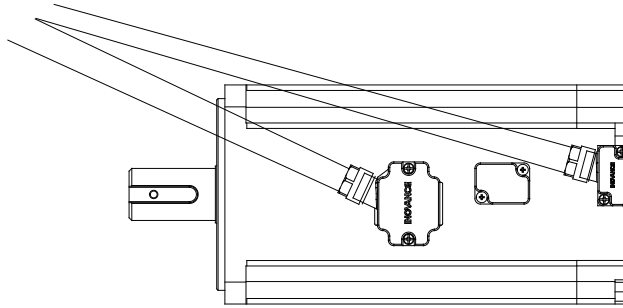


Figure 3-24 Replacing the motor cables

3.11.5 Checking the Internal Cables and Re-installing the Covers



Caution

- When the cable is slack, it may cause unnecessary friction during robot movement and lead to wire breakage. Ensure that the cables at the bending points are free from unnecessary squeezing or crossing.
- If the motor cable plug is not properly installed, it may result in poor electrical connection and robot malfunction.
- Bent air ducts with creases may cause the air ducts to fail to function normally.

Procedure

1. Ensure that all the cables and stamping parts are installed properly and all the cables are tied firmly.
2. Ensure that all plugs of the motor are screwed in place.
3. Ensure that no air duct is bent.

Install the enclosures according to the method described in ["3.7.1 Robot Enclosure Inspection and Tool Preparation" on page 27](#)[Maintenance of Robot Enclosure](#).



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