



IR-S20&GS20 Series SCARA Robots Maintenance Guide



Industrial
Automation



Intelligent
Elevator



New Energy
Vehicle



Industrial
Robot



Rail
Transit



Data code PS00015874A01

Preface

Introduction

The IR-S20 and GS20 series SCARA robots are designed for application in lithium battery industry, with a maximum payload of 20 kg and a Z-axis stroke of 420 mm. The J4 axis of the robot is driven by a harmonic reducer, and the J3 axis can be equipped with a plain shaft to increase the maximum stroke of Z-axis and the rigidity in the overturning direction when moving up and down under large eccentric loads. The robot features high inertia, strong rigidity and high precision.

This guide describes maintenance of the product.

More Data

Name	Data Code	Description
IR-S20 and GS20 Series SCARA Robot User Guide - Manipulator	PS00011394	Describes basic specifications, installation, and maintenance of IR-S20 and GS20 series SCARA robots.
IRCB500 Series Robot Controller User Guide	PS00003526	Describes the specifications, installation, wiring and more of the IRCB500 series high-protection controller.
IRP80 Series Teach Pendant User Guide	19012261	Describes the product information, wiring, and operation of the IRTP80 series teach pendant.
IR-20 and GS20 Series SCARA Robot Maintenance Guide (this guide)	PS00015874	Describes maintenance of the product.

Revision History

Date	Version	Description
April 2025	A01	• Updated "2.1 Model" on page 16. • Updated "3.1 Periodic Inspection" on page 19. • Updated "3.3 Replacing the Lubricating Grease" on page 22. • Updated "5.9.3 Installing Cables Inside Robot" on page 73.
November 2024	A00	Initial 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

**DANGER**

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

**WARNING**

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

**CAUTION**

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.
- Product illustrations in this guide are for reference only. Actual products may vary.
- 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

- Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking.
- Unpack the product layer by layer. Do not strike the package violently.
- Check the surfaces of the equipment and accessories for any damage, rust, and scratches.
- Check whether the package contents are consistent with the packing list before unpacking.

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 carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in personal 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.
- Pack the equipment strictly before transportation. Use a sealed box 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 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 a fire.
- Do not modify the product.
- Do not fiddle with the bolts used to fix equipment components or the bolts marked in red.
- When the equipment is installed in a cabinet or final assembly, a fireproof enclosure providing both electrical and mechanical protections must be provided. The IP rating must meet 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 with a piece of cloth or paper during installation. This is 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 the top of the equipment to prevent over-temperature caused by poor ventilation due to blocked ventilation holes.
- Resonance may occur when the equipment operating at a constant speed executes variable speed operations. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

Wiring**DANGER**

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by 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**

- Follow the proper electrostatic discharge (ESD) procedure and wear an anti-static wrist strap to perform wiring. Failure to comply may result in damage to the equipment or to the internal circuit of the product.
- Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment. 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.
- 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 accident.
- Before power-on, check that no one is near the equipment, motor, or machine. Failure to comply may result in death or personal injury.

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 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 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. The following table describes 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.

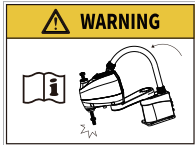
1. Ensure a safety protection range that is greater than the maximum motion range of the robot. Set up comprehensive guard devices (such as fences) around the safety protection range, with an emergency stop device easily accessible to operators. Leave sufficient space (safety zone) around for the operator 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 table describes the warning labels affixed on the robot body. Pay special attention that specific dangers exist around the positions where these labels are affixed. Comply with the cautions and warnings on the warning labels to operate and maintain the robot system safely. Do not damage or remove the warning labels.

The following table lists the warning labels.

Safety Signs	Name	Description
	Risk of electric shock	Indicates that if the operator ignores this label, it may lead to serious consequences such as equipment damage, electric shock, or even death.
	Risk of impact	Indicates that if the operator ignores this label, it may lead to serious consequences such as equipment impact and damage, injury, or even death.
	Risk of tipping	Indicates that if the operator ignores this label, it may lead to serious consequences such as equipment tilting, falling, and damage, or injury.

1.4 Emergency Movement and Emergency Stop

Emergency Movement

When the system is placed in emergency stop mode, push the arm or joint of the robot by hand.



Be aware of sagging due to the weight of the end effector during pressing of the brake release switch.

The following takes the IR-S20 series as an example to describe the procedure:

- J1: Rotate clockwise and counterclockwise by hand.
- J2: Rotate clockwise and counterclockwise by hand.
- J3: Move the joint down while pressing the brake release switch.
- J4: Push the joint to rotate clockwise and counterclockwise while pressing the brake release switch.

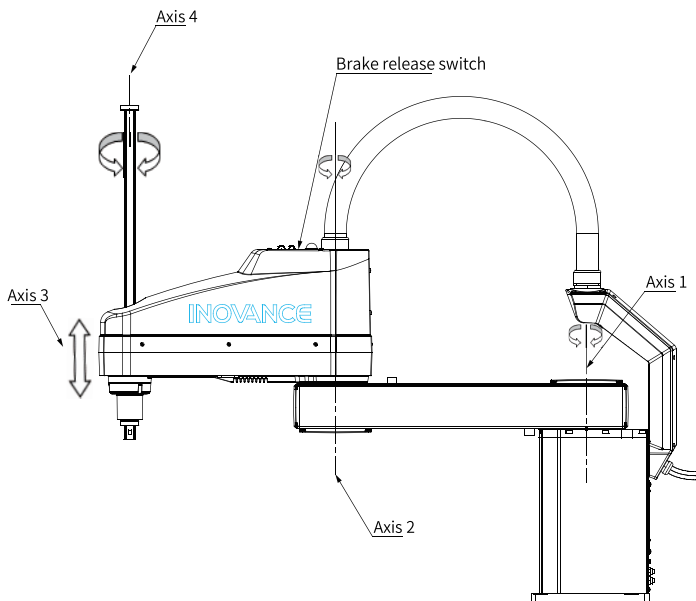


Figure 1-1 Position of the S20 brake contact switch

Emergency Stop

If the robot moves abnormally during operation or an emergency situation occurs, immediately press the emergency stop switch. When the switch is pressed, the power supply to the motor is cut off and the braking system stops the robot in the shortest distance.

Do not press the emergency stop switch unnecessarily while the robot is operating. On the one hand, this will shorten the life of the brakes due to the worn friction plates. On the other hand, this will disrupt the normal trajectory of the robot, which may result in an error in the execution of the motion. In severe cases, the robot may collide with a nearby object.

To stop the robot in non-emergency situations, press the stop button. In this case, the power supply to the motor is not cut off and the brakes do not work. The life of the brakes are not affected.



2 Description

2.1 Model

Note

- The maintenance instructions in this guide refer to IR-S4 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

IR-S 20-100Z42S5

① ② ③ ④ ⑤ ⑥ ⑦

① Product family INOVANCE Robot	④ Arm length 80: 800 mm 100: 1000 mm	⑦ Cable length 3: 3 m standard cable 5: 5 m standard cable 10: 10 m standard cable 15: 15 m standard cable
② Series S: SCARA robot GS: High-performance SCARA (equipped with a plain shaft)	⑤ Maximum travel of Z axis Z42: 420 mm	-
③ Load 20: Maximum load of 20 kg	⑥ Installation environment S: Standard P: High-protection	

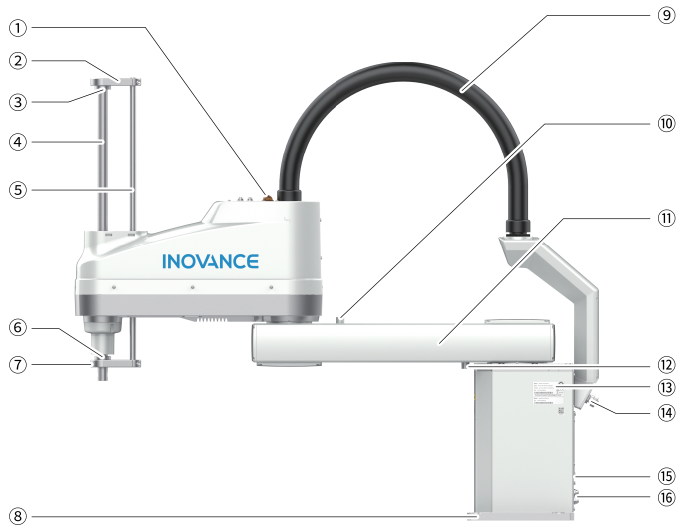
Models for international markets

IR-S 20-100Z42S - INT

① ② ③ ④ ⑤ ⑥ ⑦

① Product family INOVANCE Robot	④ Arm length 80: 800 mm 100: 1000 mm	⑦ Version INT: International (With functional safety)
② Series S: SCARA robot GS: High-performance SCARA (equipped with a plain shaft)	⑤ Maximum travel of Z axis Z42: 420 mm	-
③ Load 20: Maximum load of 20 kg	⑥ Installation environment S: Standard	

2.2 Components



No.	Description
①	State indicator
②	Upper bearing block (equipped for GS20)
③	Mechanical stop for J3 upper limit ring
④	J3 axis lead screw
⑤	Plain shaft (equipped for GS20)
⑥	Lower bearing block (equipped for GS20)
⑦	Mechanical stop for J3 lower limit ring
⑧	Base

No.	Description
⑨	Cable unit
⑩	J2 mechanical limit stop
⑪	J1 robot arm
⑫	J1 mechanical limit stop
⑬	Nameplate
⑭	Signal cable (left), power cable (right)
⑮	User connector (D-sub)
⑯	Air duct connector

3 Regular Inspection

3.1 Periodic Inspection

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.
Ball screw and spline (plain shaft)	Check the lubrication state of ball screw and spline, and replenish lubricating grease according to the recommended replacement cycle.

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.
Timing belt	Check whether the tension frequency of timing belt is within the standard range.

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.

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.

3.2 Tightening Robot Screws

Unless otherwise specified, tighten the hexagon screws according to the following torque.

Screw	Torque (N·m)
M2.5	1
M3	1.5
M4	3
M5	7
M6	13
M8	30
M10	75

Unless otherwise specified, tighten the set screws according to the following torque:

Screw	Torque (N·m)
M3	0.8
M4	2

Unless otherwise specified, tighten the cross screws according to the following torque:

Screw	Torque (N·m)
M4	1.5

Tighten the screws in the sequence shown below:

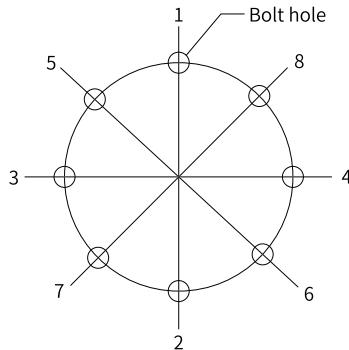


Figure 3-1 Tightening method

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 hexagon wrench as shown in the figure. Then tighten the screws to the torque values in the table above with a torque wrench.

3.3 Replacing the Lubricating Grease

Note

- Only apply the original lubricating grease to the reducer.
- Normally, the reducer does not need to be greased. However, under the extreme conditions (duty cycle, speed, and load), the grease needs to be replaced regularly.
- Replacing grease by non-professional personnel is not allowed. If maintenance is needed, contact Inovance after-sales maintenance personnel.

Before maintenance, it is necessary to clarify the parts configuration of the robot body. The type of lubricating grease used for reducers or ball screws varies from supplier to supplier. The specific types of lubricating greases used and their codes are listed in the table below.

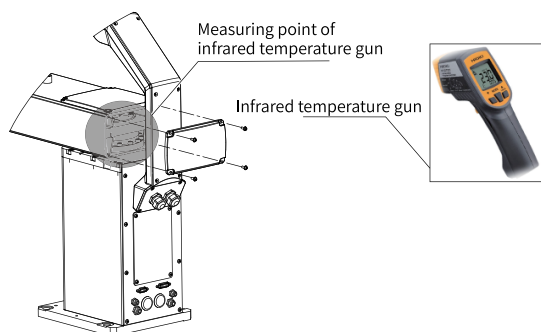
Table 3-1 Lubricating greases

Component	Lubricating Grease Type	Lubricating Grease Code
J1 axis reducer	Reducer lubricating grease	24060215
J2 axis reducer	Reducer lubricating grease	24060061
J4 axis reducer	Reducer lubricating grease	24060061
Lead screw	Lead screw lubricating grease	24100039

Due to the aging cycle of lubricating grease used for the RV reducer of heavy-load SCARA robots, it is necessary to regularly replace the lubricating grease to ensure the lubrication performance cycle of the reducer. The lubricating grease replacement cycle of the RV reducer is closely related to the actual working conditions and environment. The lubricating grease replacement cycles for SCARA robot RV joints are as follows.

Application Scenarios	Lubricating Grease Replacement Cycle
Reducer enclosure temperature lower than 40°C	12,000 h
Reducer enclosure temperature between 40°C and 55°C	8,000 h

It is recommended to use an industrial infrared thermometer to measure the temperature rise on the reducer enclosure. The temperature measurement point is as follows.



For the RV reducer joint working conditions, ensure that the reducer enclosure temperature and joint angle requirements are met. This can prevent the reducer from being damaged and the lifetime being shortened due to the temperature exceeding 60°C and the small angle operation of the reducer.

Reducer temperature

The high load and high utilization may cause the reducer temperature exceeding the allowable temperature. Make sure that the reducer is in a cooled state to prevent the surface temperature of the reducer from exceeding 60°C. If the surface temperature exceeds 60°C, it may cause product damage.

About the output rotation angle of the reducer

When the rotation angle is small (less than 10°), poor lubrication or concentrated load of internal parts may lead to a shorter rating life of the reducer.

The following table lists the S20 series robot joints that need to be regularly lubricated and the lubricating volume.

Lubricating Joint	Lubricating Volume
RV reducer of J1	189 mL (165 g)

Note

J2 and J4 axes of the S20 and GS20 series SCARA robots use maintenance-free harmonic wave reducers, that is, their lubricating grease does not need to be replaced.

Note

RV reducer lubricating grease replacement and refilling precautions

If the lubrication operation is incorrectly performed, the internal pressure of the lubrication chamber may suddenly increase, which may damage the seal and cause lubricating grease leakage and abnormal operation. Therefore, adhere to the following when performing lubrication operations:

- Before lubrication, open the oil drain port (remove the plug of the oil drain port).
- Provide lubricating grease slowly at a speed of 3.6 g/s (4 mL/s) or less gently. It is necessary to use an oil gun that can clearly add oil volume. In case of no oil gun, confirm the amount of lubricating grease by measuring the lubricating grease weight before and after oiling.
- If the oil supply is insufficient, use a precision regulator for gas supply to squeeze out the air in the chamber and then supply oil. Control the air pressure at 0.03 MPa or less by using a regulator.
- Only use the specified type of lubricating grease. If other types of lubricating grease are used, it may damage the reducer or cause other problems.
- After oiling, release the residual pressure in the lubricating grease chamber before installing the hexagon socket screw plugs. When installing hexagon socket screw plugs, it is necessary to install sealing gaskets to prevent the lubricating grease from leaking at the oil supply port and oil drain port.
- Check whether the exhaust valve is blocked by grease. If the exhaust valve contains grease, replace it with a new one.
- To prevent accidents caused by slipping, completely clean up excess lubricating grease on the ground and on the robot.

After the robot body is running, it is necessary to regularly replace the ball screw lubricating grease to ensure that the ball screw of the robot body can be well lubricated. The following table lists the recommended replacement part and cycle.

Table 3-2 Recommended lubricating grease replacement cycle for the ball screw of the robot body

Part	Replacement Cycle
Lead screw	3 months or running for 100 km

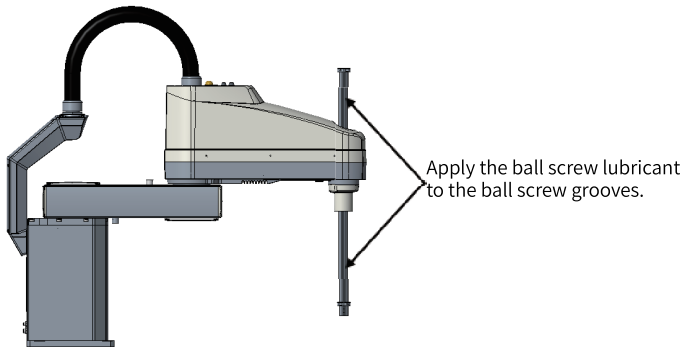


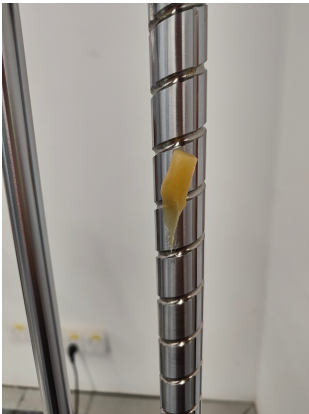
Figure 3-2 Ball screw maintenance by lubricating grease

The method of replacing the lead screw lubricating grease is as follows:

1. Use a clean dust-free cloth or scouring pad to wipe off the earlier lubricating grease on the lead screw.



2. Apply an appropriate amount of lubricating grease to the spiral groove and spline groove of the ball screw.



Note

If the GS20 series robot body is equipped with a plain shaft, it is necessary to apply a lubricating grease on the surface of the plain shaft.

The application effect for the ball screw is shown in the following figure.

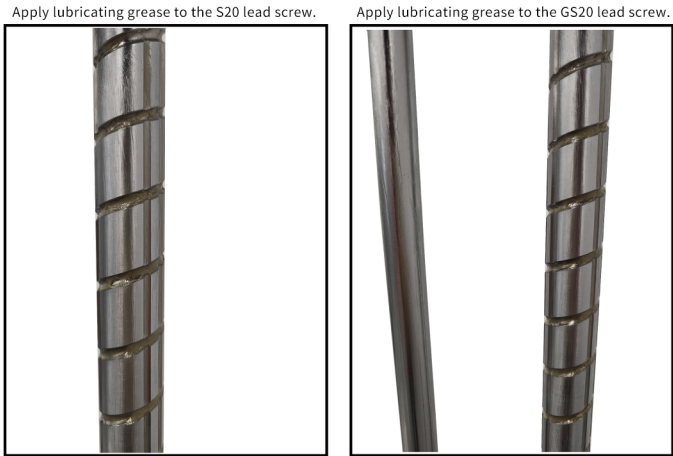


Figure 3-3 Lubrication effect

Note

If the lubricating grease gets into your eyes, mouth, or on your skin, follow the instructions below:

- Before maintenance, prepare the necessary tools and fixtures, lubricating grease, screws and other auxiliary materials for assembly and disassembly in advance.
- During maintenance, if you encounter special problems, you can take photos for record and contact our R&D personnel and production process personnel for help.
- For special operating conditions, such as those with fast operating rhythms, recording and regular lubrication are required. Consult our R&D personnel for specific maintenance cycles.

3.4 Monitoring RV Reducer Grease

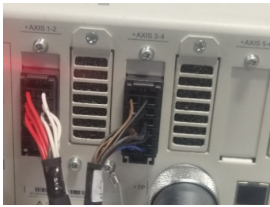
Type	No.	L10 Service Life Ratio	Monitoring Action	Judgment Criteria
L10 service life [1] ≥ 500 days	1	1/3	Monitor the iron powder concentration according to SOP.	Case 1: Do not replace the grease when iron powder concentration is < 0.05 . Case 2: Replace the grease when iron powder concentration is ≥ 0.05 . Case 3: Replace the reducer or the robot when iron powder concentration is ≥ 0.1 .
	2	1/2	1. Monitor the iron powder concentration according to SOP. 2. Replace the grease.	
	3	2/3	Monitor the iron powder concentration according to SOP.	
	4	4/5	Monitor the iron powder concentration according to SOP.	
	5	100%	Monitor the iron powder concentration according to SOP.	
L10 service life < 500 days	1	1/3	Monitor the iron powder concentration according to SOP.	
	2	1/2	1. Monitor the iron powder concentration according to SOP. 2. Replace the grease.	
	3	50% to 100% (monitoring the concentration once every two months)	Monitor the iron powder concentration according to SOP.	

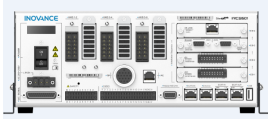
Note

[1]: The L10 service life of a reducer refers to the cumulative operating time at which the failure rate reaches a certain level, calculated based on the reducer's load torque and rotation amount. Before the displayed time is reached, failures may occur due to the end of the service life.

3.5 Maintenance of Control Cabinet Cables

The following table describes the inspection of control cabinet cables:

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
③	Check that the external power cable (Red for L, green for N, and yellow for PE respectively) is properly connected to the control cabinet.		Daily

No.	Check Item	Diagram/Illustration	Cycle
④	Check that the heavy-load connector of the control cabinet, aviation plug of the teach pendant, and the encoder cable are connected properly.		Daily
⑤	Wipe off any acid, alkali, oil, or corrosive liquids with dust-free cloth or scouring pad.	All cables	Daily

4 Enclosure Removal and Installation

Note

- During removal and re-installation of the enclosure, do not pull it forcibly. Failure to comply may result in cable damage, wire breaking, or poor contact, causing electric shock or system fault.
- After the maintenance is complete, install the removed enclosure back to its original position.
- If the enclosure fixing screws are missing, fix the enclosure with screws of the type and quantity shown below.
- Ensure that the enclosure is properly fixed. Otherwise, the enclosure may generate abnormal noise during robot running or even fall off, posing serious safety hazards.

4.1 Removing and Installing Plastic Covers of Forearm and Spline Nut

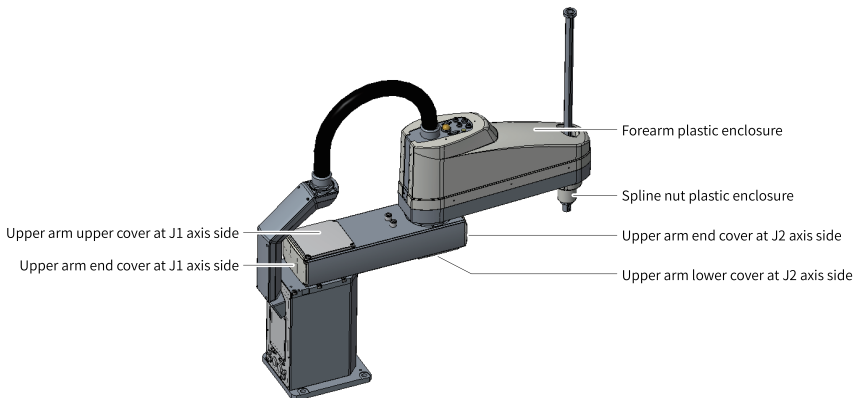


Figure 4-1 Position of robot plastic enclosure

Removing and installing the plastic enclosure of forearm

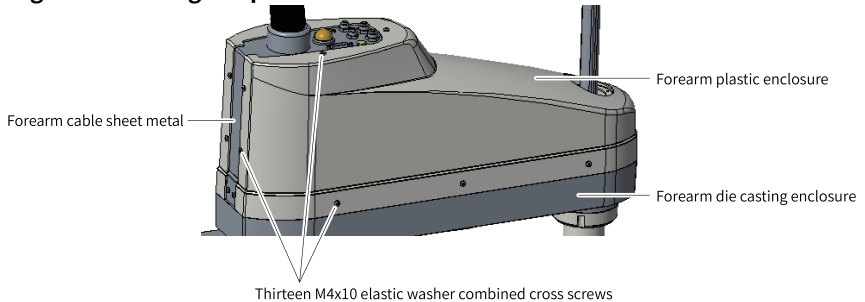


Figure 4-2 Robot forearm plastic enclosure and forearm assembly

- Removal:
 1. Loosen the 13 M4x10 elastic washer combined cross screws fixing the forearm plastic enclosure.
 2. Lift up and remove the forearm plastic enclosure.
- Installation:
 1. Fasten the forearm plastic enclosure, and then manually tighten the thirteen M4x10 elastic washer combined cross screws (locking torque: $0.6 \text{ N} \cdot \text{m}$) to ensure the alignment of the connecting holes between the forearm plastic enclosure and the forearm die-casting enclosure and prevent the plastic enclosure from generating internal tension.
 2. Align the six M4x10 elastic washer combined cross screws with screw holes at two sides on the plastic enclosure and forearm die-casting enclosure (lock the screws without tightening them).
 3. Align the seven M4x10 elastic washer combined cross screws with screw holes between the plastic enclosure and forearm cable sheet metal (lock the screws without tightening them).
 4. After all screws are aligned with thread holes, tighten all screws with a torque wrench with a torque of $0.6 \text{ N} \cdot \text{m}$.

Removing and installing the spline nut enclosure of forearm

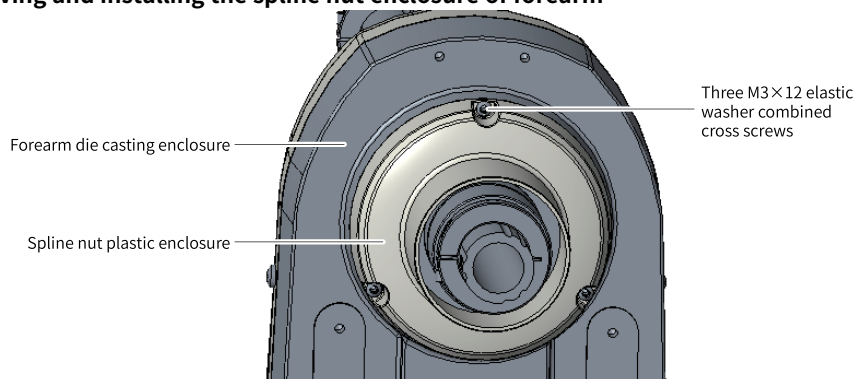


Figure 4-3 Robot forearm spline nut enclosure and forearm assembly

- Removal:
 1. Loosen the three M3x12 elastic washer combined cross screws between the spline nut plastic enclosure and forearm die-casting enclosure.
 2. Remove the spline nut plastic enclosure.
- Installation:

Fasten the spline nut plastic enclosure, and manually tighten the three M3x12 elastic washer combined cross screws with a torque of $0.4 \text{ N} \cdot \text{m}$.

4.2 Removing and Installing the Plastic Cover Enclosure of the Upper Arm

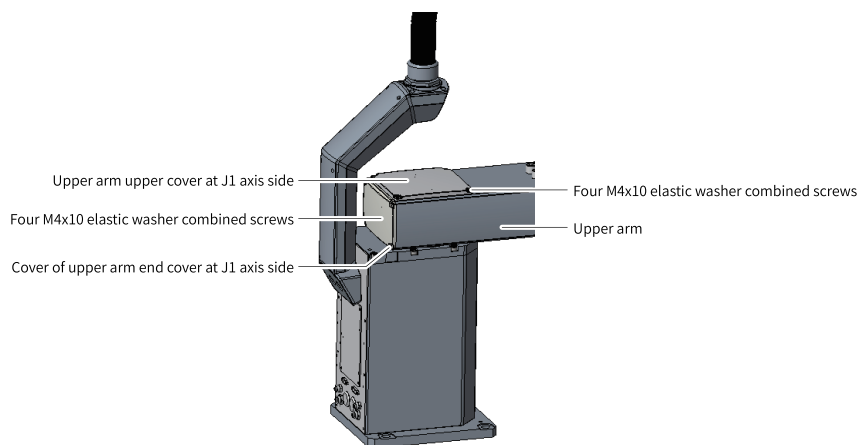


Figure 4-4 Plastic cover enclosure of the J1 axis upper arm

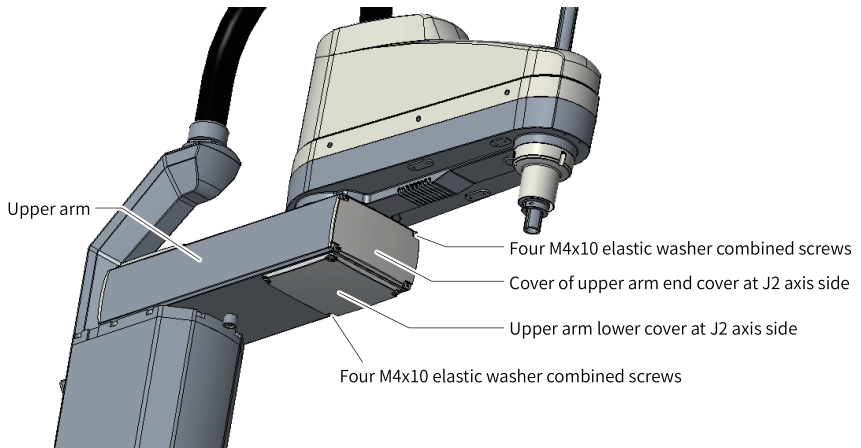


Figure 4-5 Plastic cover enclosure of the J2 axis upper arm

The upper arm end cover, upper cover, and lower cover of J1 and J2 axes are removed and installed in similar steps, as shown below.

- Removal:
 1. Loosen the four M4x10 elastic washer combined screws fixing the upper arm end cover enclosure (upper arm end cover, upper cover, or lower cover).
 2. Lift up and remove the upper arm end cover enclosure.
- Installation:

Fasten the upper arm end cover enclosure, and manually tighten the four M4x10 elastic washer combined screws with a torque of $0.6 \text{ N} \cdot \text{m}$.

5 Replacement and Maintenance

5.1 Maintaining the J1 Axis

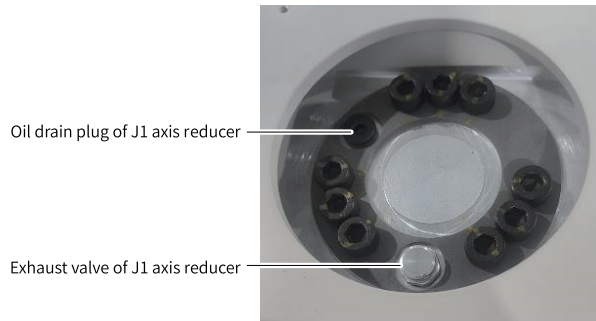
Name		Quantity
Maintenance part	J1 axis reducer	1
	J1 motor	1
Tool	Hexagon wrench	1
	Torque wrench (0 N·m to 25 N·m)	1
	Hexagon screwdriver bit	1
	Large Allen torque wrench (20 N·m to 250 N·m)	1
	Dust-free cloth or oil-absorbing sheet	Several
	Phillips screwdriver	1
	Hexagon Monkey spanner	1
	Filling pump	1
	Digital display grease gun	1
	M10x1 connector of inlet/outlet oil tube	2
	Grease collection bag (oil drain bucket)	Several
	Electronic scale	1
	M12x1.5 screw plug	1

Special reference tightening torques for screws:

Screw	Torque (N·m)
M10x30 and M10x25	60
M6x90, M6x30, M6x25, and M6x20	13
M10 exhaust valve (M6 hexagon socket)	7
M4 cross screw (plastic parts)	0.6

5.1.1 Replacing the Lubricating Grease for J1 Axis Reducer

- Remove the plastic upper cover of the upper arm on the J1 axis side. For details, see ["4.2 Removing and Installing the Plastic Cover Enclosure of the Upper Arm" on page 32](#)
 - Locate the J1 axis oil drain plug and J1 axis exhaust valve.
 - Check whether the exhaust valve is blocked by grease. If the exhaust valve contains grease, replace it with a new one.
- Use exhaust valve tooling and one M10x1 screw and gasket to block the hole. The torque of the M10x1 screw and gasket is $7 \pm 0.7 \text{ N} \cdot \text{m}$.



3. Remove the exhaust valve tooling from the filling hole on the motor side, and screw in the grease filling connector and tighten it.



Figure 5-1 Connecting grease filling pipe to grease filling port

4. After grease filling, screw out the grease filling connector, and install it into the grease filling hole with one M10x1 screw and gasket with a torque of $7 \pm 0.7 \text{ N} \cdot \text{m}$.



5. Oil discharge:

- a. Connect the air pump to the oil drain pipe, and drain the oil from the J1 axis reducer under a pressure of less than 0.03 MPa (rotate the upper arm to a large range of motion at a low speed to facilitate oil drain) until all the old grease of the J1 axis is drained.

- b. Collect the old grease into a bag or barrel, and weigh and record its weight.
6. Grease filling:
- a. Suck a proper amount of grease with a grease gun, connect the grease gun to the grease filling pipe, and remove the M12x1.5 screw mentioned in Step 3 at the exhaust valve opening.
 - b. Add grease to the J1 axis reducer under a pressure of less than 0.03 MPa slowly to the amount of grease drained in Step 4.
 - c. When filling grease, rotate the upper arm to a large range of motion at a low speed so that the grease can enter the grease cavity smoothly and be evenly dispersed in the grease cavity.

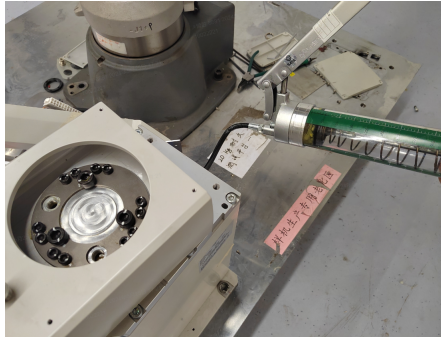


Figure 5-2 Apply grease to the RV reducer of J1 axis

7. Release the residual pressure in the grease reservoir:
- a. After injecting grease, block the sealing plug of the J1 axis grease filling port. To release the residual pressure in the grease reservoir, repeatedly move the J1 axis within $\pm 60^\circ$ for at least 5 minutes at a low speed (ensure the speed percentage is less than or equal to 10% when all parameters are set to their factory defaults).
 - b. Then, install the sealing plug on the oil drain port (do install the sealing gasket), install the exhaust valve in the exhaust valve hole, and clean excess residual grease with a dust-free cloth.

Note

- In case of environmental restrictions, for example, only half of the movement angle is allowed, make sure the robot also moves for at least twice the original time.
 - When the machine cannot be driven to run automatically due to conditions, the machine should be rotated manually.
-

8. See ["4.2 Removing and Installing the Plastic Cover Enclosure of the Upper Arm" on page 32](#) after replacing the grease.

5.1.2 Replacing the J1 Axis Reducer

1. Remove the upper arm at J1 axis side:
 - a. Take support and handling protection measures for forearm and upper arm assemblies except for the base, and remove the upper cover of the upper arm at the J1 axis side (see ["4.2 Removing and Installing the Plastic Cover Enclosure of the Upper Arm" on page 32](#)).
 - b. Loosen the three M10x25 hexagon screws and 12 M6x20 hexagon screws fixing the upper arm and the RV reducer (three M10x30 hexagon screws and 12 M6x25 hexagon screws when highly rigid upper arms are used), and remove the upper arm and forearm assemblies except for the base. See the figure below.

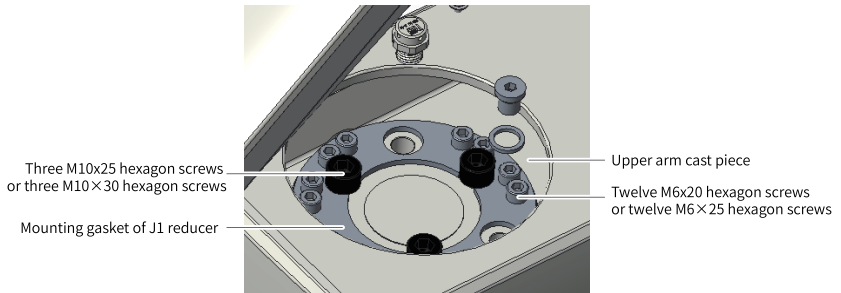


Figure 5-3 Screws connecting the upper arm and J1 axis reducer

Caution

1. Before disassembling the J1 axis RV reducer, ensure that the working space is sufficient, and provide proper support and handling protection for the upper arm and forearm assemblies (excluding the base that require complete removal).
2. During disassembly, check whether the handling and placement distance of the upper arm and forearm assemblies is shorter than that of the corrugated tube cables. If so, remove the corrugated tube cables at the forearm end before placement.

2. Clean the residual grease on the inside of the reducer the upper arm.
 - a. Take out sixteen M6x30 hexagon screws connected between the RV reducer and J1 axis base flange.
 - b. Install two M6x30 hexagon screws into two M6 threaded holes on the reducer (symmetrically distributed at 180 degrees, and screw in the screws slowly at both sides at the same time) and eject the J1 axis RV reducer.

- c. After the reducer is separated from the J1 axis base flange, slowly take out the J1 axis RV reducer. Clean the residual grease inside the reducer during the operation. See the figure below.

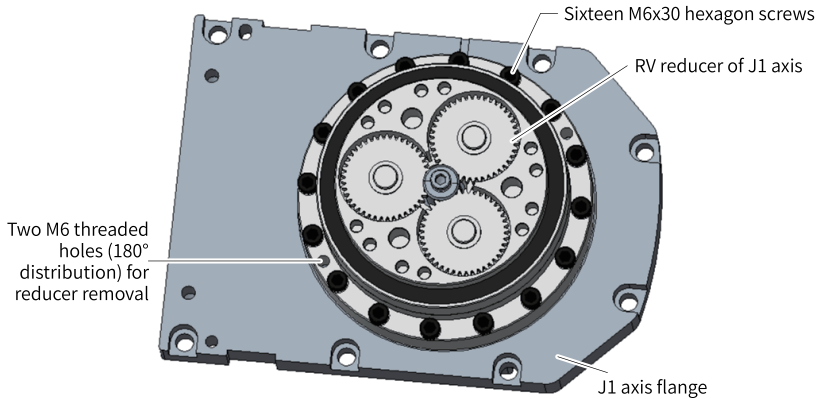


Figure 5-4 J1 axis base assembly

3. While clamping the flat cut on the input shaft of the reducer with a large Monkey wrench, perform the following steps:
 - a. Loosen and take out the M6x90 hexagon screw directly connecting the input shaft with the motor.
 - b. Remove the input shaft of RV reducer, and clean residual grease on the parts. See the figure below.

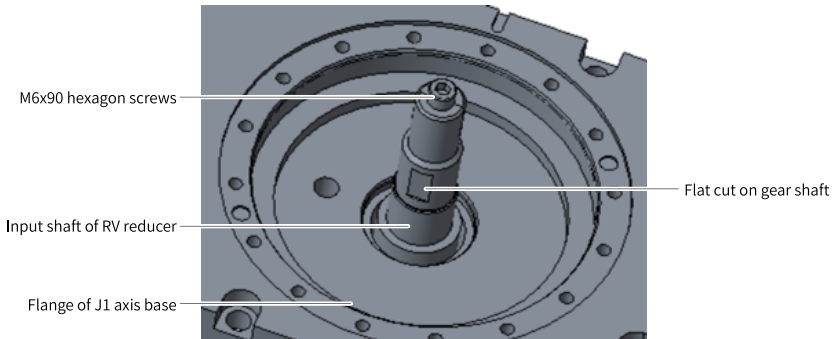


Figure 5-5 Removing the gear shaft of J1 axis RV reducer

4. When installing the J1 axis RV reducer, follow the reverse steps of the disassembly process for reassembly. Inject grease of about 175 mL (152 g) to the reducer. See the figure below.

**Caution**

When installing the reducer, apply plane gum to the output end face of the reducer, and apply a layer of gray plane seal gum to the contact surface between the reducer and the upper arm.

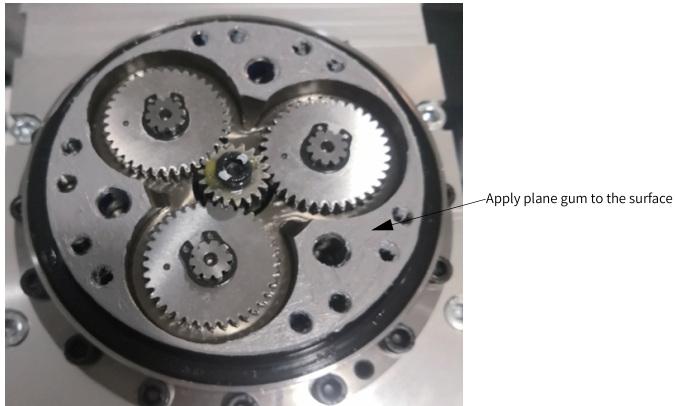


Figure 5-6 Applying plane gum

5.1.3 Replacing Motor of the J1 Axis

Note

The RV reducer of the J1 axis must be removed before the J1 axis motor can be replaced. Therefore, perform Step 3 of ["5.1.2 Replacing the J1 Axis Reducer" on page 37](#) before replacing the J1 axis motor.

1. Loosen the eight M8x20 hexagon screws between the J1 axis base flange and the base profile, and then remove the J1 motor base flange assembly. After removal, use a small Phillips screwdriver to disconnect the encoder cable and power cable between the J1 motor and the cables.

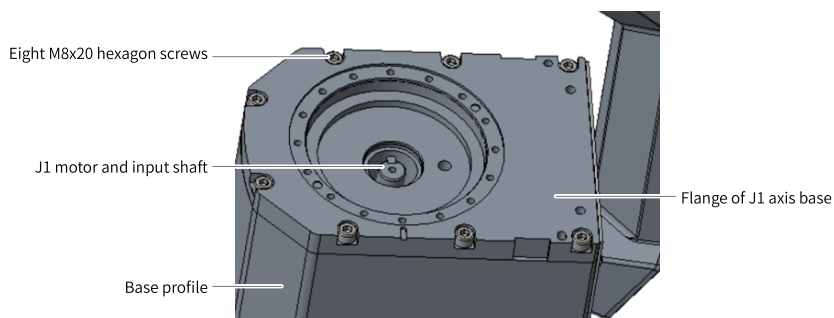


Figure 5-7 J1 motor base and flange assembly

2. Loosen the four M6x20 hexagon screws securing the motor to the J1 motor on the base plate, and then remove the J1 motor.

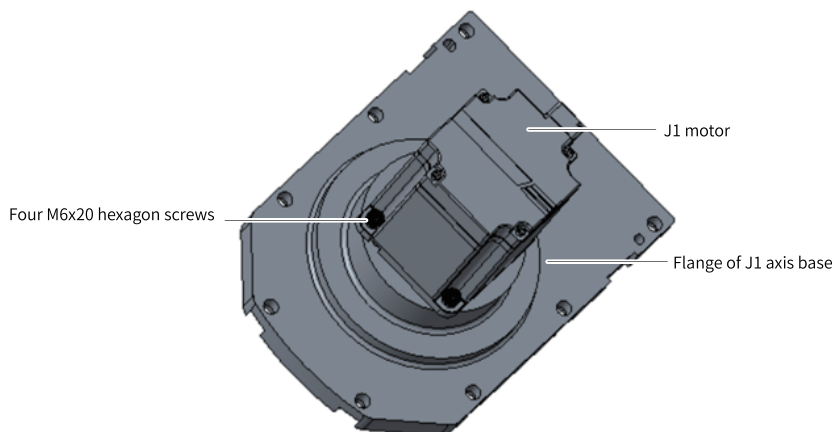


Figure 5-8 J1 motor and flange assembly

3. When installing the J1 motor, follow the reverse steps of the disassembly process for reassembly.

5.2 Maintaining the J2 Axis

	Name	Quantity
Maintenance part	J2 axis reducer	1
	O-shaped sealing ring	1
	J2 motor	1
Tool	Hexagon wrench	1
	Torque wrench (0 N·m to 30 N·m)	1
	Hexagon screwdriver bit	1
	Dust-free cloth or oil-absorbing sheet	Several
	Phillips screwdriver	1
	Depth gauge	1
	Tension meter	1
	Circlip pliers	1

Special reference tightening torques for screws:

Screw	Torque (N·m)
M5x20 hexagon screw (connecting the flange and forearm of the J2 motor)	8
M6x16 (connecting the waveform generator stopper and motor shaft)	3
M4x12 cross screw (fixing plastic parts)	0.6
M4x16 (on the locating ring)	4

5.2.1 Replacing the Lubricating Grease for J2 Axis Reducer

1. Remove the motor assembly of the J2 axis. Remove the J2 motor assembly from the forearm according to Steps 1-3 in ["5.2.2 Replacing Motor of the J2 Axis" on page 43](#).
2. Apply lubricating grease.
 - a. Apply a layer of lubricating grease evenly to the inner side and outer side of the waveform generator bearing.
 - b. Clean the old lubricating grease from the waveform generator and the circular/flex splines of the harmonic reducer, and apply new lubricating grease evenly to the surface of the waveform generator.
 - c. Inject lubricating grease to the grease gravity of the reduce (approx 162 mL, 140 g), the circular spline (approx. 58 mL, 50 g), and flexible spline (approx. 104 mL, 90 g) respectively.

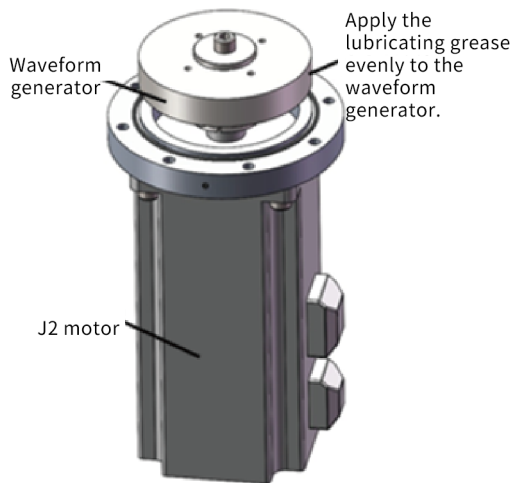


Figure 5-9 J2 axis motor assembly (including the reducer waveform generator)

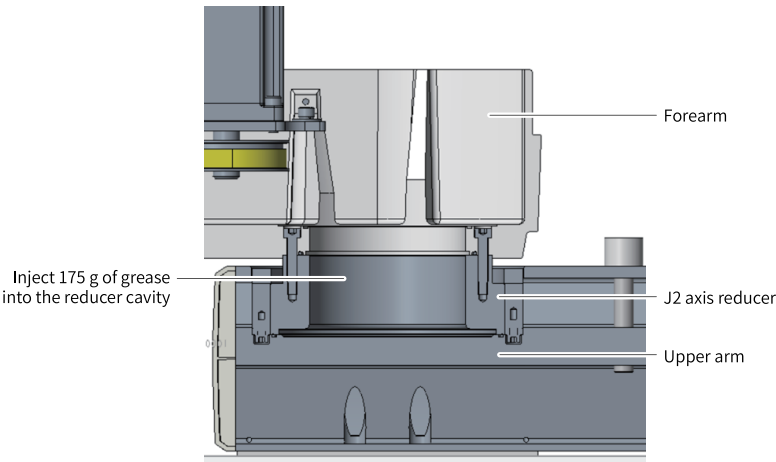


Figure 5-10 Grease cavity of J2 axis joint reducer

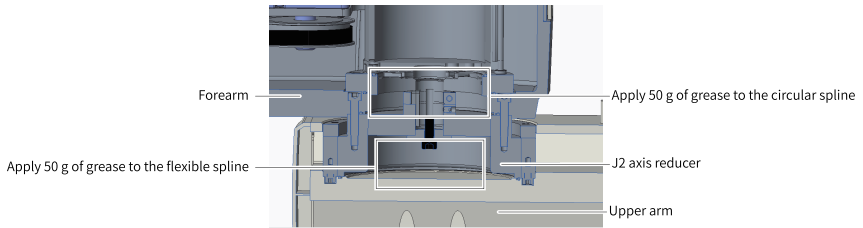


Figure 5-11 Grease cavity of J2 axis joint reducer

5.2.2 Replacing Motor of the J2 Axis

1. Remove the plastic enclosure of the forearm according to ["4.1 Removing and Installing Plastic Covers of Forearm and Spline Nut" on page 30](#).
 - a. Loosen the two M4x12 cross crews connecting the cable sheet metal of the forearm.
 - b. Remove the motor cable connectors of axes J2, J3, and J4, and remove the forearm cable sheet metal.

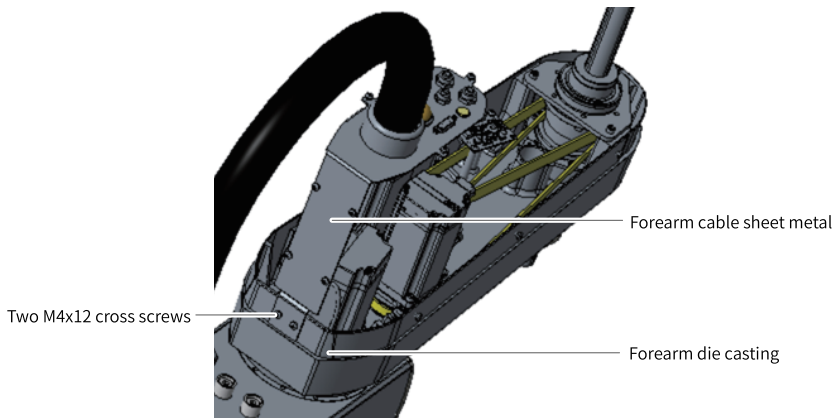


Figure 5-12 Forearm cable sheet metal and forearm assembly

2. Remove internal assemblies.
 - a. Loosen the eight M5x20 hexagon screws of the J2 axis motor flange. Loosen motors with interference when necessary.
 - b. Remove the J2 axis motor assembly (retain the O-shaped sealing ring between the J2 axis motor flange and the forearm), and clean the grease on the waveform generator.

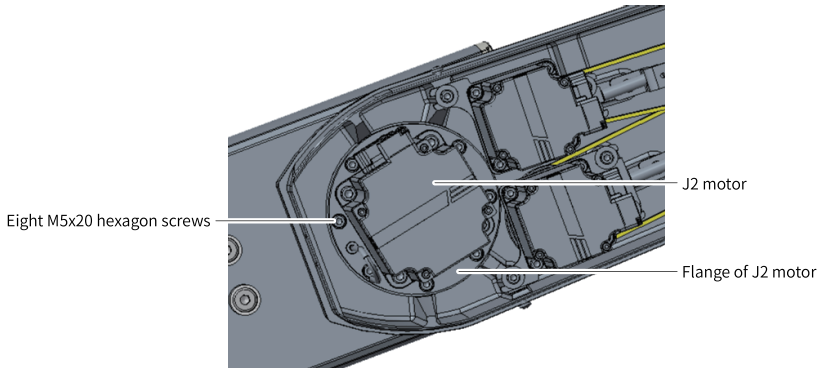


Figure 5-13 J2 motor and forearm assembly

3. Remove the motor assembly:

- a. Fix the gasket with circlip pliers, loosen the M6x16 hexagon screws, and remove the waveform generator baffle plate.
- b. Loosen the two M4x5 set screws, and remove the waveform generator.
- c. Loosen the M4x16 hexagon screw on the locating ring, and remove the locating ring.
- d. Loosen the four M6x16 hexagon screws, and remove the J2 axis motor flange.

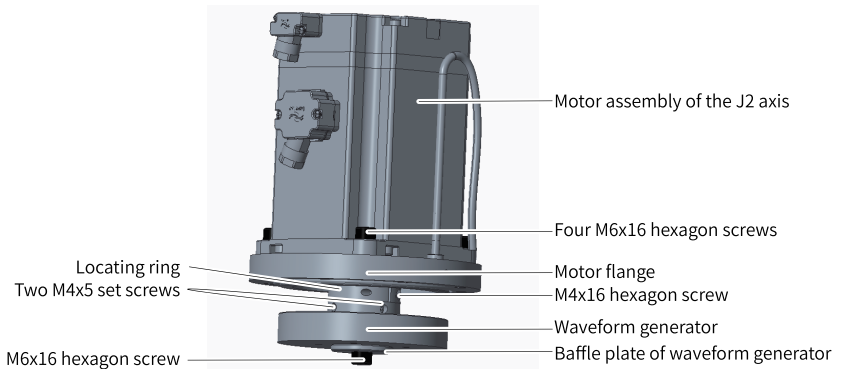


Figure 5-14 Motor assembly of the J2 axis

4. Take a new motor, clean the motor shaft until no foreign matters are visible, and install the locating ring. For the specific mounting height, contact Inovance technical support.
5. Install the motor flange, waveform generator, and waveform generator stopper in the reverse steps of disassembly to restore the J2 axis motor assembly according to ["Figure 5-13" on page 44](#).
6. Apply grease to the J2 axis motor assembly. For the grease amount, see ["5.2.1 Replacing the Lubricating Grease for J2 Axis Reducer" on page 41](#). Install other components in the

reverse steps of disassembly. Do not forget to install the O-shaped sealing ring of the J2 axis motor flange.

5.3 Maintaining the J3 Axis

	Name	Quantity
Maintenance part	J3 axis timing belt	1
	J3 motor	1
Tool	Hexagon wrench	1
	Torque wrench (0 N·m to 20 N·m)	1
	Hexagon screwdriver bit	1
	Dust-free cloth or oil-absorbing sheet	Several
	Phillips screwdriver	1
	Tension meter	1
	Circlip pliers	1

Special reference tightening torques for screws:

Screw	Torque (N·m)
M4x12 cross screw (fixing plastic parts)	0.6

5.3.1 Replacing the J3 Axis Timing Belt

1. Remove the plastic enclosure of the forearm according to ["4.1 Removing and Installing Plastic Covers of Forearm and Spline Nut" on page 30](#), and then loosen the three M4x12 cross crews connecting the cable sheet metal of the forearm.
2. Loosen the six M5x16 hexagon screws directly connecting the J3 axis motor assembly and J4 axis motor assembly with the forearm. Loosen two M8x50 hexagon screws of the timing belt tensioning sheet metal parts and the forearm, so that the J3 axis and J4 axis timing belts are loosened. Take off the gyroscope board with a Phillips screwdriver.

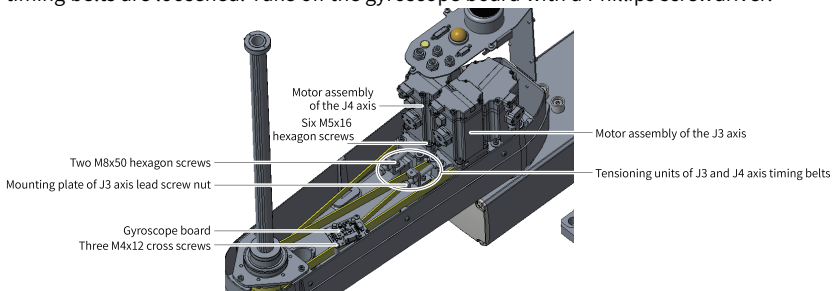


Figure 5-15 Motor assembly and forearm assembly of axes J3 and J4

3. Loosen the screw connected between the lead screw nut mounting plate and the forearm and the J3 axis motor assembly.

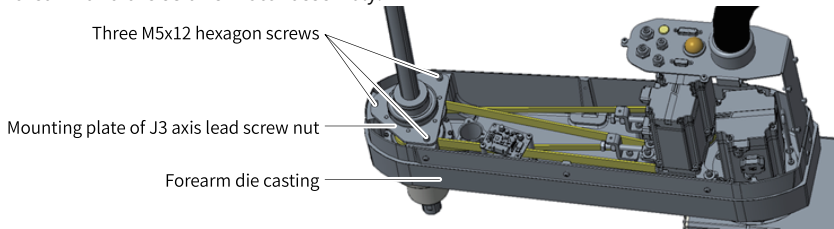


Figure 5-16 Mounting plate and forearm assembly of the J3 axis lead screw nut

4. Lift up the entire J3 axis screw lead nut assembly and J3 axis motor assembly, remove the old J3 axis timing belt, and replace it with a new J3 axis timing belt.

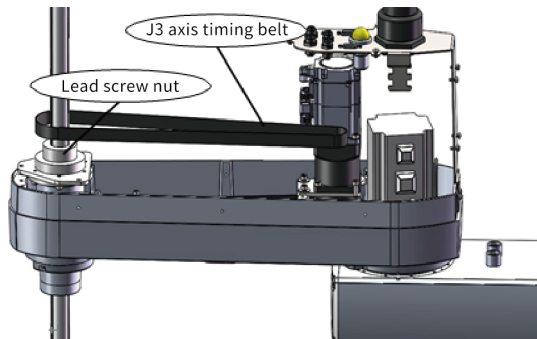


Figure 5-17 Replacing the J3 Axis Timing Belt

5. Install the J3 axis timing belt in the reverse steps of disassembly. The tension frequency of the J3 axis timing belt is 65 Hz to 75 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

5.3.2 Replacing Motor of the J3 Axis

1. Remove the plastic enclosure of the forearm according to ["4.1 Removing and Installing Plastic Covers of Forearm and Spline Nut" on page 30](#), and then loosen the two M4x10 cross crews connecting the cable sheet metal of the forearm.
2. Adjust the tension sheet metal of the J3 axis timing belt, loosen the three M5x16 elastic washer screws, and remove the J3 axis motor assembly.

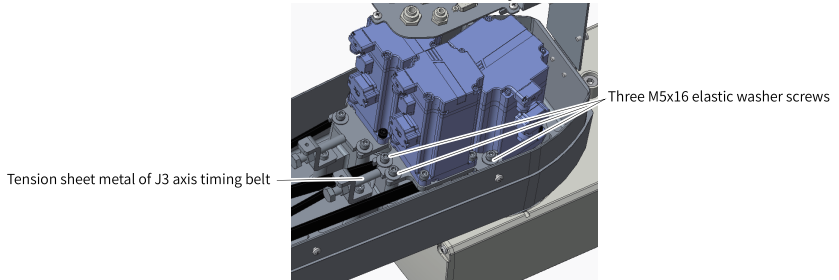


Figure 5-18 Tension sheet metal of J3 axis timing belt

3. Loosen the one M5x12 hexagon screw on the J3 axis motor assembly, loosen the four M4x16 hexagon screws, remove the limit block of the timing pulley and the motor of the J3 axis timing pulley.

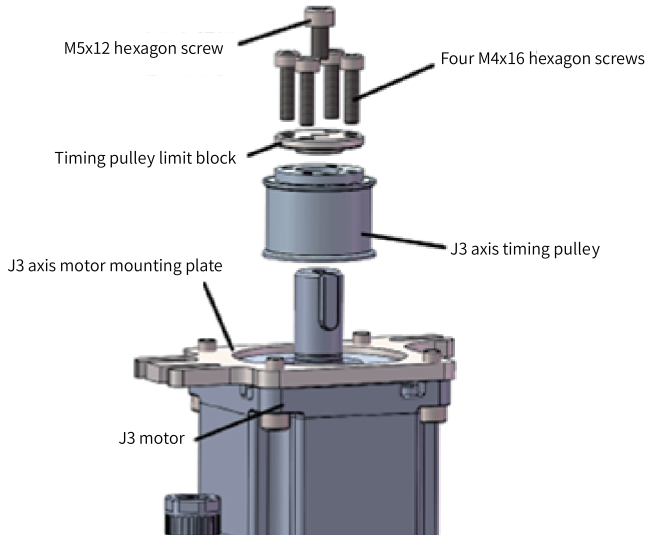


Figure 5-19 Motor assembly of the J3 axis

4. Remove the four M5x16 hexagon screws and the J3 axis motor mounting plate, and then remove the J3 axis motor.

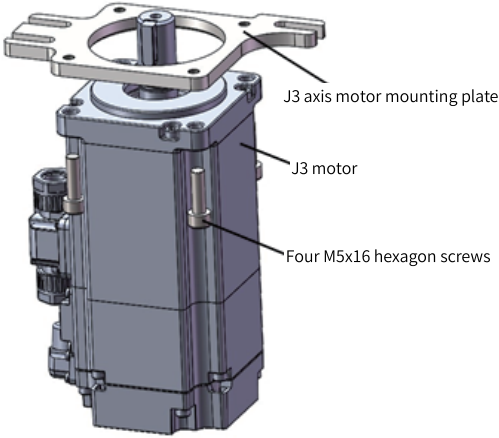


Figure 5-20 J3 axis motor mounting plate

5. Reassemble the J3 axis motor according to the reverse steps if the removal procedure.
See "[Tools List](#)" on [page 45](#) for the screw tightening torque and "[3.2 Tightening Robot Screws](#)" on [page 21](#) for the tightening method.

5.4 Maintaining the J4 Axis

Name		Quantity
Maintenance part	J4 axis timing belt	1
	O-shaped sealing ring	1
	J4 motor	1
Tool	Hexagon wrench	1
	Torque wrench (0 N·m to 20 N·m)	1
	Hexagon screwdriver bit	1
	Dust-free cloth or oil-absorbing sheet	Several
	Phillips screwdriver	1
	Tension meter	1

Special reference tightening torques for screws:

Screw	Torque (N·m)
M4x10 cross screw (fixing plastic parts)	0.6

5.4.1 Replacing the J4 Axis Timing Belt

1. Remove the plastic enclosure of the forearm according to ["4.1 Removing and Installing Plastic Covers of Forearm and Spline Nut" on page 30](#), and then loosen the three M4x10 cross crews connecting the cable sheet metal of the forearm.
2. Loosen the six M5x16 hexagon screws directly connecting the J3 axis motor assembly and J4 axis motor assembly with the forearm. Loosen two M8x50 hexagon screws of the timing belt tensioning sheet metal parts and the forearm, so that the J3 axis and J4 axis timing belts are loosened. Take off the gyroscope board with a Phillips screwdriver.

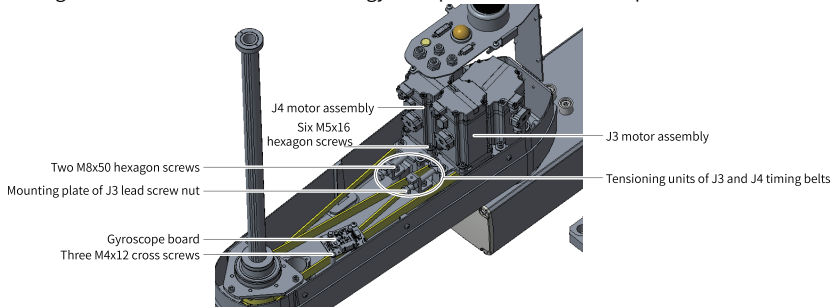


Figure 5-21 Motor assembly and forearm assembly of axes J3 and J4

3. Loosen the screw connected between the lead screw nut mounting plate and the forearm and the J3 axis motor assembly.

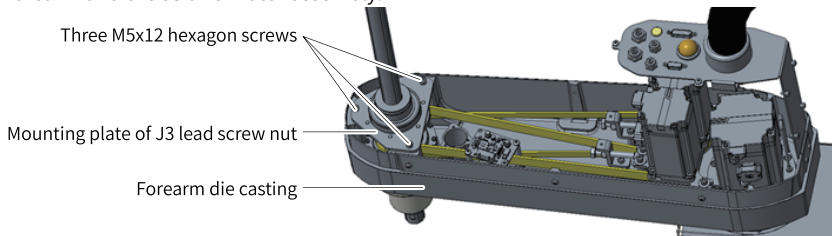


Figure 5-22 Mounting plate and forearm assembly of the J3 axis lead screw nut

4. Lift up the entire J3 axis screw lead nut assembly, J3 axis motor assembly, and J4 axis motor assembly, and remove the old J3 axis timing belt and J4 axis timing belt.

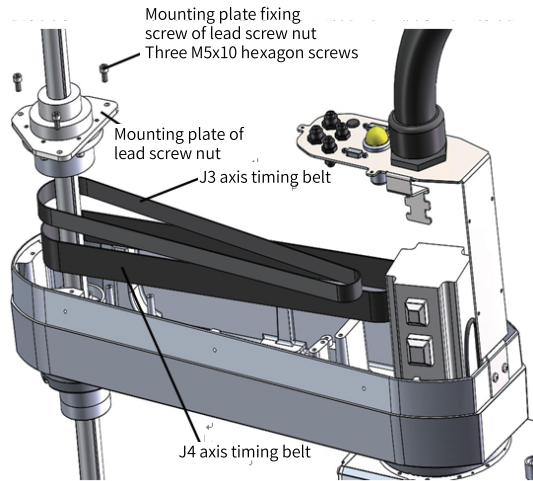


Figure 5-23 Replacing the J4 Axis Timing Belt

5. Install the J4 axis timing belt in the reverse steps of disassembly. The tension frequency of the J4 axis timing belt is 70 Hz to 80 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

5.4.2 Replacing Motor of the J4 Axis

1. Loosen and remove the plastic enclosure of the forearm according to ["4.1 Removing and Installing Plastic Covers of Forearm and Spline Nut"](#) on page 30, and then loosen the two M4x12 cross crews connecting the cable sheet metal of the forearm.
2. Adjust the tension sheet metal of the J4 axis timing belt, loosen the three M5x16 elastic washer screws, and remove the J4 axis motor assembly.

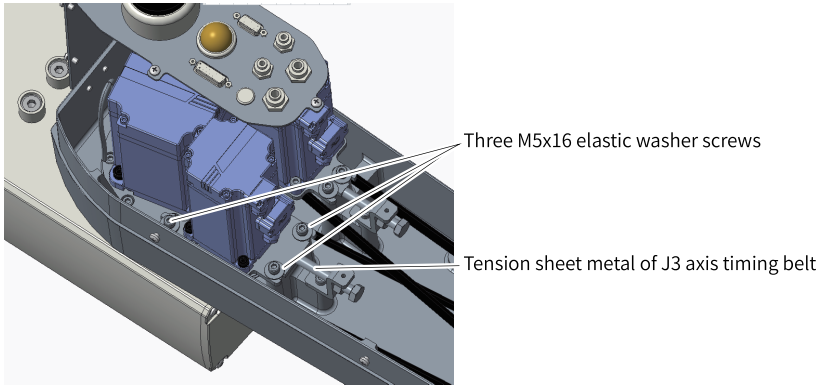


Figure 5-24 Tension sheet metal of J4 axis timing belt

3. Loosen the two M4x5 set screws from the J4 axis motor assembly, and remove the J4 axis timing pulley.

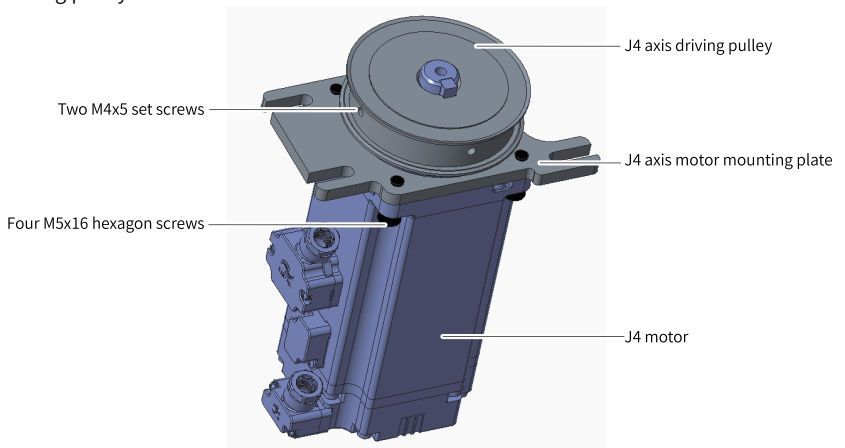


Figure 5-25 J4 axis motor assembly

4. Remove the four M5x16 hexagon screws and the J4 axis motor mounting plate, and then remove the J4 axis motor.

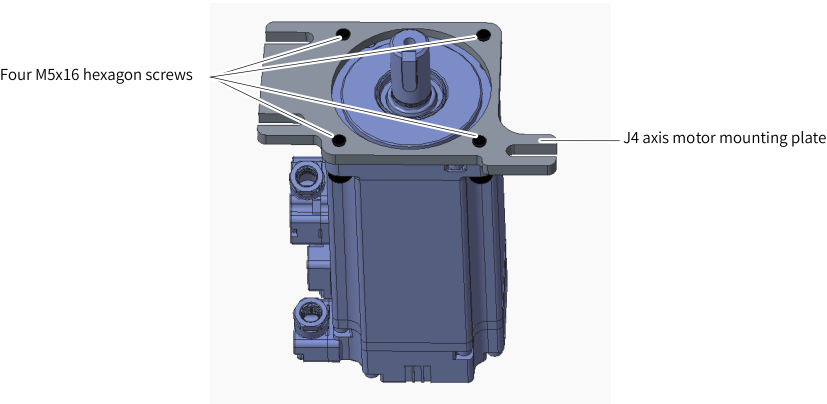


Figure 5-26 J4 axis motor assembly and motor mounting plate

5. Reassemble the J4 axis motor according to the reverse steps if the removal procedure, as shown in the following figure. See "[Tools List](#)" on [page 48](#) for the screw tightening torque and "[3.2 Tightening Robot Screws](#)" on [page 21](#) for the tightening method.

Note

The tension frequency of the J4 axis timing belt is 70 Hz to 80 Hz. The distance from the upper edge of the belt pulley to the upper edge of the mounting plate of the J4 axis must meet the requirements. For the specific instance, contact Inovance technical support.

5.5 Replacing the Spare Parts of Integrated Assembly of Ball Screw and J4 Axis Reducer

Name		Quantity
Maintenance part	Spare parts of integrated assembly of ball screw and J4 axis reducer	1
Tool	Hexagon wrench	1
	Torque wrench (0 N·m to 20 N·m)	1
	Hexagon screwdriver bit	1
	Dust-free cloth or oil-absorbing sheet	Several
	Phillips screwdriver	1
	Tension meter	1

Note

The spline of the lead screw and the linear nut must be used together and cannot be replaced separately.

Special reference tightening torques for screws:

Screw	Torque (N·m)
M4x8 cross screw (fixing plastic parts)	0.6



Figure 5-27 Integrated spare parts of ball screw and J4 axis reducer

Loosen the screw connected between the lead screw nut mounting plate and the forearm and the J3 axis motor assembly according to Step 3 in ["5.4.1 Replacing the J4 Axis Timing Belt" on page 49](#). Then replace the spare parts of J3 axis and J4 axis assembly.

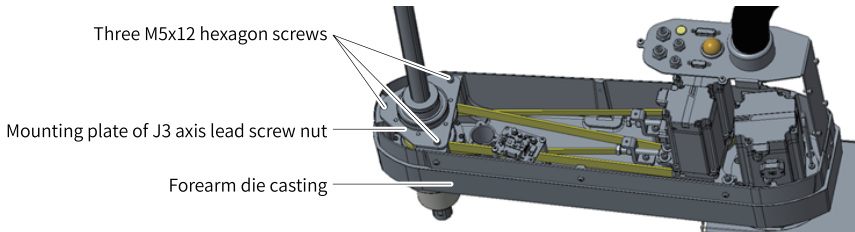


Figure 5-28 Mounting plate and forearm assembly of the J3 axis lead screw nut

1. Remove the upper and lower limit rings of the lead screw, extract the lead screw shaft upward with force, and remove the J3 axis lead screw nut assembly and the lead screw shaft assembly (to prevent the J3 axis lead screw shaft from being separated from the spline nut).

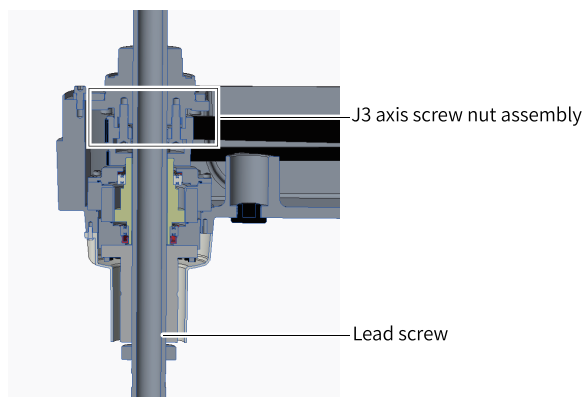


Figure 5-29 Removing the J3 axis lead screw nut and lead screw assembly

2. Remove twelve M3x30 hexagon screws connecting J4 axis harmonic reducer with the die casting of the forearm.

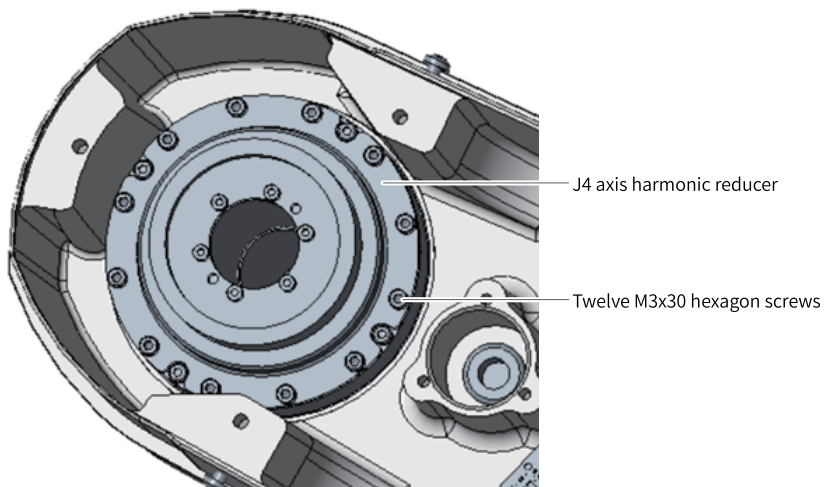


Figure 5-30 J4 axis reducer assembly and forearm assembly

3. Replace the J4 axis reducer and lead screw assembly according to the reverse steps of the disassembly process for reassembly.

5.6 Replacing and Maintaining the Battery



Warning

- Open the cover of the controller only when maintenance is needed. There are high-voltage parts inside the control cabinet, which may cause electric shock even when the power supply is off.
- Before part replacement, turn off the power supply of the control cabinet and related devices and unplug the power connector. Live working may cause electric shock or failure.
- Do not remove or install the motor connector while the power is still on. Failure to comply may result in abnormal action of the robot, which is dangerous. Operating with the power on may cause electric shock or malfunction.
- Turn off the main power and air supply to the robot when you receive a power failure notice.
- In the event of a sudden power outage, turn off the main power of the robot and remove the workpiece from the fixture before the power is restored.
- Do not remove or install the motor connector while the power is still on. Failure to comply may result in abnormal action of the robot, which is dangerous. Operating with the power on may cause electric shock or malfunction.
- Power off the robot system by removing the power plug. Always connect the AC power cable to the power plug. Do not connect it directly to the factory power supply.
- Before part replacement, turn off the power supply of the control cabinet and related devices and unplug the power connector. Live working may cause electric shock or failure.
- Pay full attention to the use of lithium batteries. In the following situations, it may cause heating, leakage, explosion, or fire, which is very dangerous. In addition, safety problems may occur.
 - Charge
 - Compression and deformation
 - Disassembly
 - Short circuit
 - Incorrect installation
 - Heating
 - Burning in fire
 - Welding
 - Forced discharge
- When disposing the battery, consult with the professional disposal services or comply with the local regulation.
- When disposing of the battery, insulate the battery even after use. Contact with other metals or battery terminals may cause a short circuit, resulting in heating, leakage, explosion, or fire.

If the lithium battery is exhausted, a warning voltage too low will occur when the controller is turned on (software startup). The position data of the motor will be lost. In this case, you need to calibrate the zero point of all joints.

The service life of the lithium battery is 1.5 years. Replace the lithium battery every 1.5 years even when the robot is always powered on.

Use the lithium battery specified by the Company. Connect the battery properly. Do not mistake the polarity.

To replace the battery, do as follows:

1. Remove the six M4x8 cross pan-head screws from the cable support arm cover of the base forearm and remove the base extension arm cover.

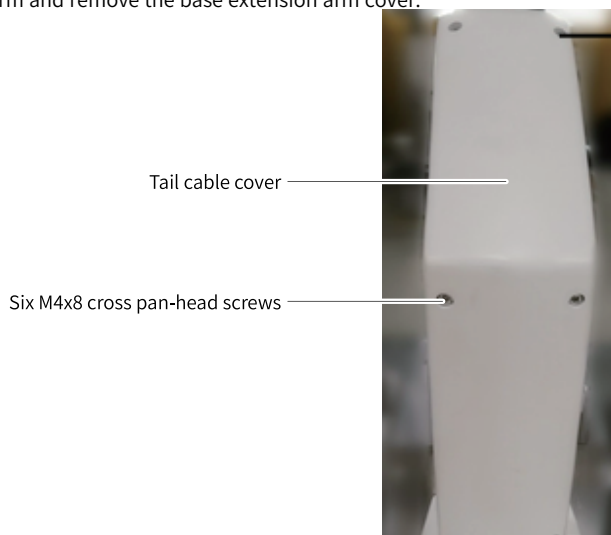


Figure 5-31 Forearm cable support cover

2. Cut the zip tie at the battery position as shown in the following figure, replace the battery, tie it with a zip tie, and arrange the cables and air ducts inside. Install the extension arm cover.



Figure 5-32 Position of battery on the forearm cable support

5.7 Zero Point Adjustment

5.7.1 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 zero point adjustment, 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 motion range of the system. Failure to comply may result in severe safety issues.
 - Before operation, ensure that there is no person within the safety fence. Do not enter the motion range during system running. Failure to comply may result in severe safety issues.
 - Operating the robot system in teach 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 performs unexpected actions.
-

5.7.2 Procedure of Zero Point Adjustment

Both the PC-based teach pendant and the hand-held teach pendant provide an operation interface for zero point adjustment. The following is an explanation using the PC-based teach pendant, with similar operations for the hand-held teach pendant.

Due to the strong correlation between the 4-axis robot's operation point coordinate and the accuracy of J2 axis, it is necessary to complete zero point adjustment of J2 axis before calculating the robot coordinates. The teach pendant provides a right/left wrist wizard. Follow the wizard to adjust the zero point.

When performing zero point adjustment using the teach pendant, adjust J4 and J3 at the same time.

1. Select a role and log in to the system.

- 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 "Log In".

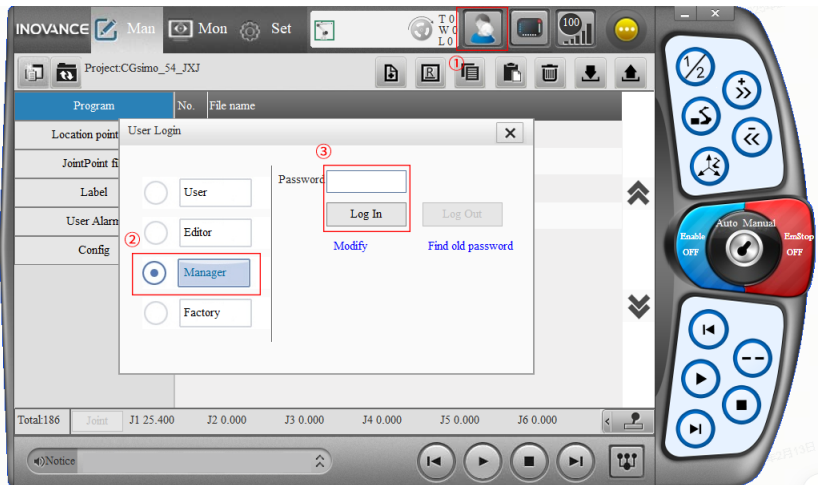


Figure 5-33 Screen of ITRP80 series tech pendant

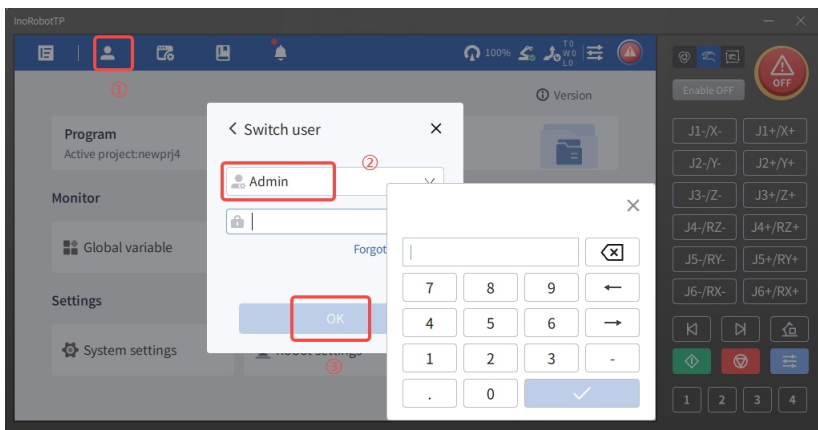


Figure 5-34 Screen of IRTP200 series tech pendant

2. Switch to the ZeroPoint setting screen.

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



Figure 5-35 Screen of IRTP80 tech pendant



Figure 5-36 Screen of IRT200 series tech pendant

3. Move each axis of the robot to the corresponding 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 a robot joint to the zero point when the motor is disabled.

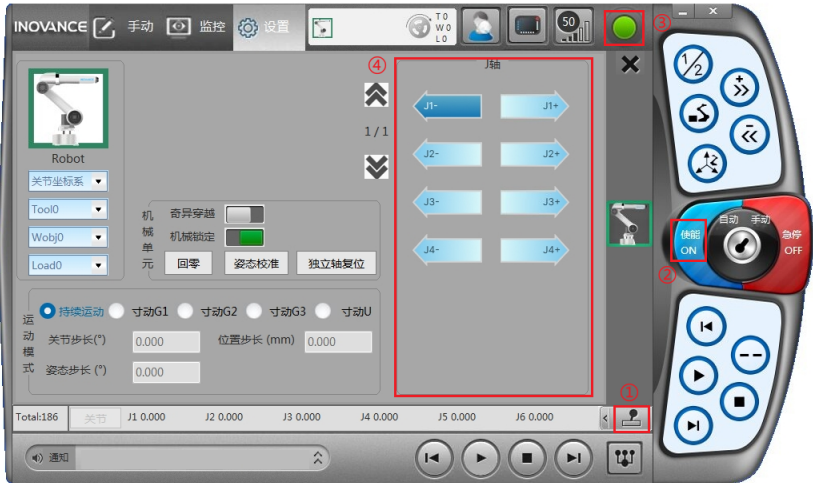


Figure 5-37 Screen of IRT80 series tech pendant



Figure 5-38 Screen of IRT200 series tech pendant

4. Switch to the emergency stop state.

- Click the virtual emergency stop button on the PC-based teach pendant, or press the red "EmStop" button on the hand-held teach pendant.
- 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 5-39 Screen of IRT80 series tech pendant



Figure 5-40 Screen of IRT200 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 "Save" to complete zero point adjustment.



Figure 5-41 Screen of IRT80 series tech pendant

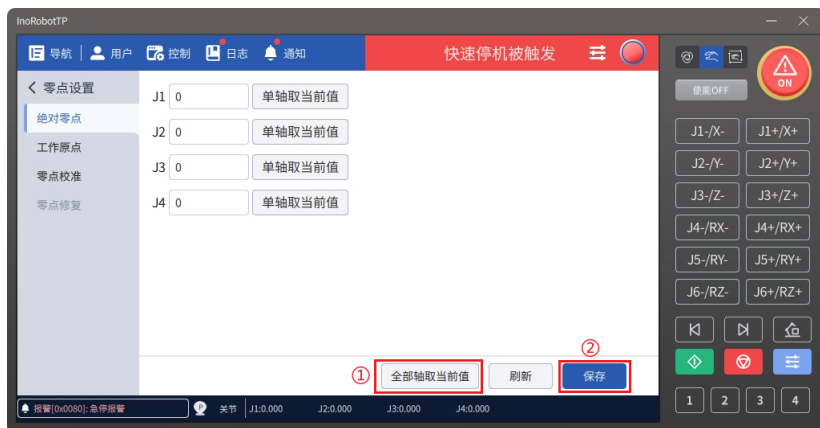


Figure 5-42 Screen of IRTP200 series tech pendant

5.7.3 Zero Point Position of Each Joint

1. The zero point of axis J1 is the position that overlaps with the X axis of the robot coordinate system.

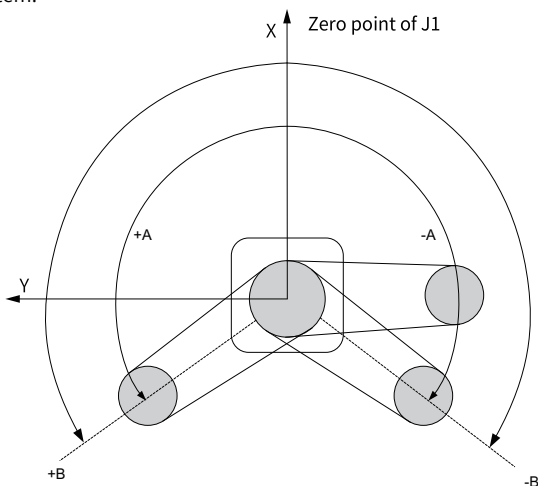


Figure 5-43 Zero point of axis J1

Model	Maximum Motion Range
IR-S20-80Z42S5	$\pm 132^\circ$
IR-S20-100Z42S5	
IR-GS20-80Z42S5	
IR-GS20-100Z42S5	

2. The zero point of axis J2 is the position that is parallel to the upper arm of the robot.

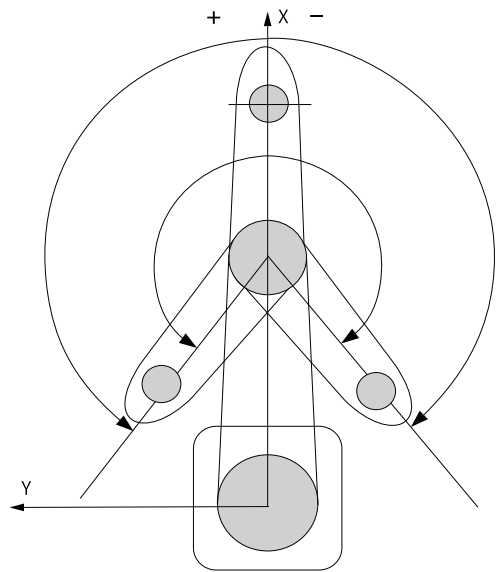
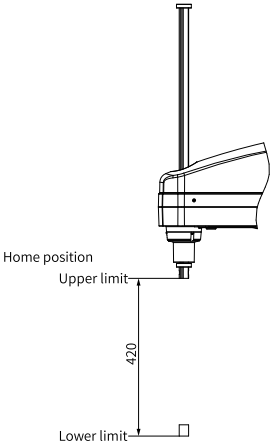


Figure 5-44 Zero point of axis J2

Model	Maximum Motion Range
IR-S20-80Z42S5	$\pm 152^{\circ}$
IR-S20-100Z42S5	
IR-GS20-80Z42S5	
IR-GS20-100Z42S5	

3. The 0 angle position of axis J3 is the upper limit position of the axis. When the axis J3 descends from the 0 angle position, it will definitely change to a negative angle value.



Model	Maximum Motion Range
IR-S20-80Z42S5	420 mm
IR-S20-100Z42S5	
IR-GS20-80Z42S5	
IR-GS20-100Z42S5	

4. Zero point of axis J4: Position where the flat surface on the shaft (or the slots of the upper and lower mechanical stops) faces towards the tip of the mechanical arm of the axis J2.

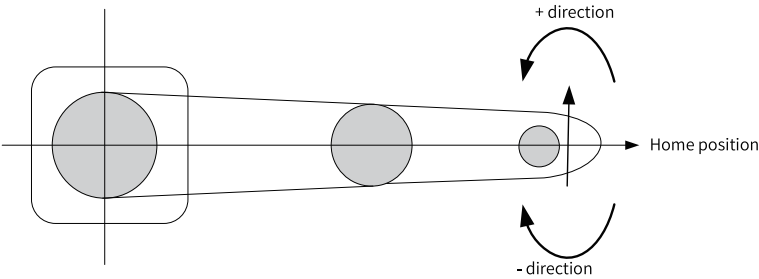


Figure 5-45 Zero point of axis J4

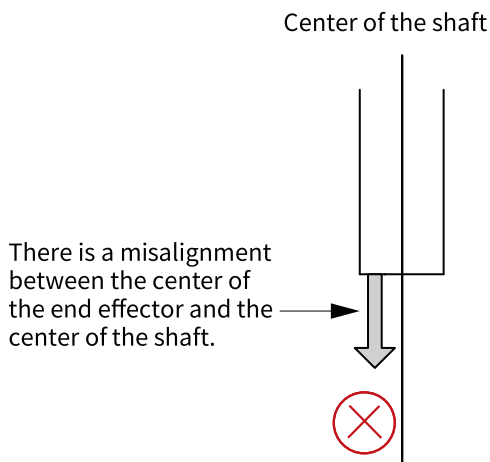
Model	Maximum Motion Range
IR-S20-80Z42S5	$\pm 360^\circ$
IR-S20-100Z42S5	
IR-GS20-80Z42S5	
IR-GS20-100Z42S5	

5.7.4 Zero Point Adjustment of J2 Axis

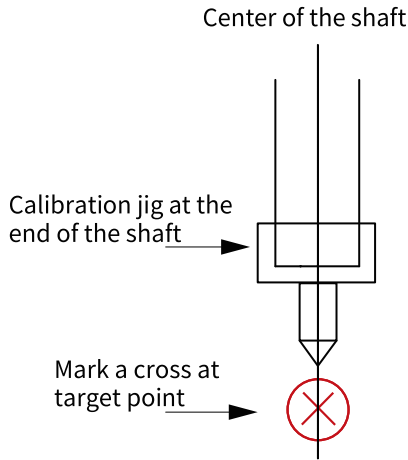
Due to the strong correlation between the 4-axis robot's operation point coordinate and the accuracy of J2 axis, it is necessary to complete zero point adjustment of J2 axis before calculating the robot coordinates. When adjusting the zero point of J2 axis in ["5.7.2 Procedure of Zero Point Adjustment" on page 58](#), refer to the right/left wrist wizard provided by the teach pendant.

Procedure of J2 axis zero point adjustment

1. The reference point for zero point adjustment is the center of the ball screw spline shaft. When the center of the end effector deviates from the center of the ball screw spline shaft, it is necessary to remove the end effector and adjust the zero point.



2. Make a zero point adjustment jig on the top side of the shaft to clarify the center of the shaft, as shown in the figure below. Specify a target position that can be easily recognized when the right/left wrist pose is changed, and then mark it with ×.



3. Adjust the zero point by using the right wrist or left wrist.
 - a. Adjust the robot end to the target point position using the right wrist (or left wrist) pose. On the teach pendant, go to "Set" > "BasePos" > "ZeroPoint", click the "Get Cur" button, and record the degree of J2 axis in current state as Enc1.
 - b. Manually adjust the robot end to the target point position using the left wrist (or right wrist) pose. On the teach pendant, go to "Set" > "BasePos" > "ZeroPoint", click the "Get Cur" button, and record the degree of J2 axis in current state as Enc2.
 - c. On the teach pendant, go to "Set" > "BasePos" > "ZeroPoint", click the "Default" button, and get the currently saved zero point info. Calculate $(Enc1+Enc2)/2$ and fill in the calculation result into the input box of J2 axis, and then click the Save button. The zero point position calibration of J2 axis is complete.
4. After removing the end effector and executing zero point adjustment, install the end effector and move the robot to the teaching point to verify whether there is a positional gap. If there is a positional gap, fine-tune the installation position of the end effector and teach the point again.

5.8 Wiring Diagrams

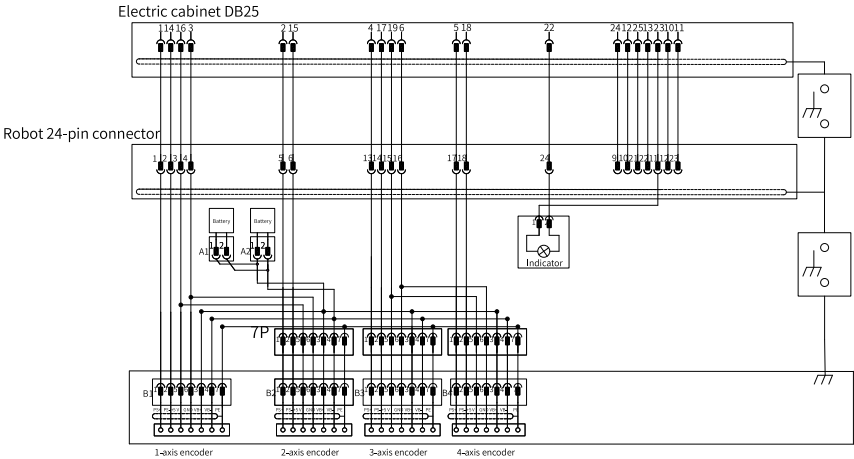


Figure 5-46 Robot electrical connection diagram (encoder connection)

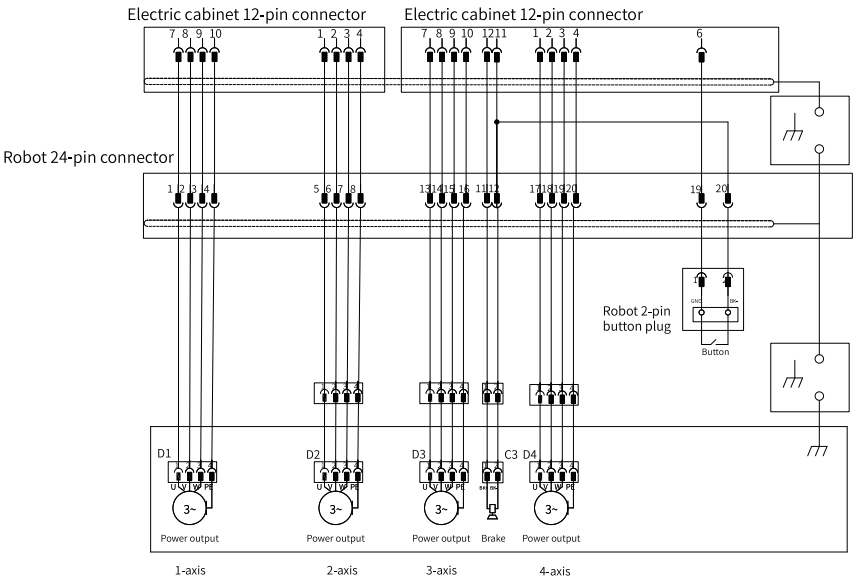


Figure 5-47 Robot electrical connection diagram (power cable connection)

5.9 Cable Replacement

5.9.1 List of Tools for Replacing Cables Inside Robot

Name	Quantity	Code	Remarks
Robot connection cable	1	1504RF14	IR-S20-100Z42S5
			IR-GS20-100Z42S5
	1	1504RF13	IR-S20-80Z42S5
			IR-GS20-80Z42S5
Hexagon wrench	-	-	-
Screwdriver	-	-	-
Diagonal pliers	-	-	-
Tie strap	-	-	-
Monkey spanner	-	-	-

5.9.2 Removing Cables Inside Robot

1. Preparation



Caution

Before removing the robot cables, adjust all axes to the zero position.

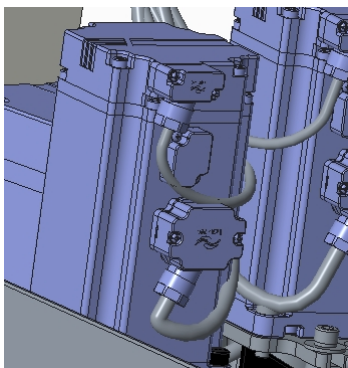


Danger

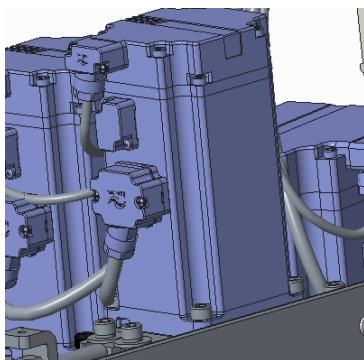
Before entering the operating area of the robot, turn off all the power and air pressure sources connected to the robot, and put up work-in-progress signs.

2. Remove the J4 axis cable.

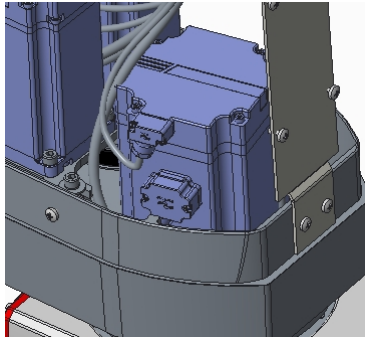
- Expose the internal structure according to ["4.1 Removing and Installing Plastic Covers of Forearm and Spline Nut" on page 30](#).
- Locate the motor cable and encoder cable of J4 axis, loosen the connector screw with a screwdriver, and unplug the connector. See the figure below.



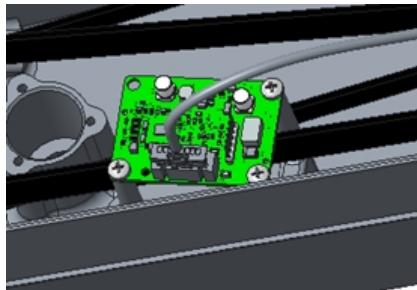
3. Remove the J3 axis cable.
 - a. Expose the internal structure according to ["4.1 Removing and Installing Plastic Covers of Forearm and Spline Nut" on page 30.](#)
 - b. Locate the motor cable and encoder cable of J3 axis, loosen the connector screw with a screwdriver, and unplug the connector. See the figure below.



4. Remove the J2 axis cable.
 - a. Expose the internal structure according to ["4.1 Removing and Installing Plastic Covers of Forearm and Spline Nut" on page 30.](#)
 - b. Locate the motor cable and encoder cable of J2 axis, loosen the connector screw with a screwdriver, and unplug the connector. See the figure below.



5. Remove the gyroscope cable.
 - a. Expose the internal structure according to ["4.1 Removing and Installing Plastic Covers of Forearm and Spline Nut" on page 30](#).
 - b. Locate the gyroscope cable connector, press the elastic piece of the cable plug with your finger, unplug the connector, and cut the cable tie. See the figure below.

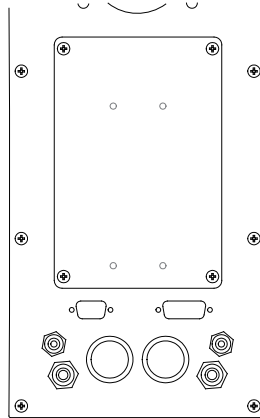


6. Remove the grounding cable.
 - a. Expose the internal structure according to ["4.1 Removing and Installing Plastic Covers of Forearm and Spline Nut" on page 30](#).
 - b. Locate the grounding cable ring, remove the grounding cable with an Allen wrench, and cut the cable tie. See the figure below.

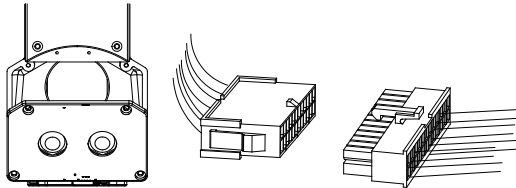


7. Remove the base cable and air duct.
 - a. Open the sheet metal cover of the base.

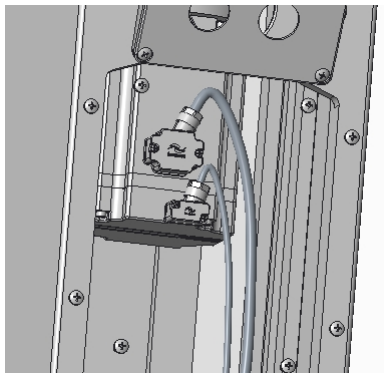
- b. Remove the air duct from the air duct connector, and use a screwdriver to remove the I/O connector. See the figure below.



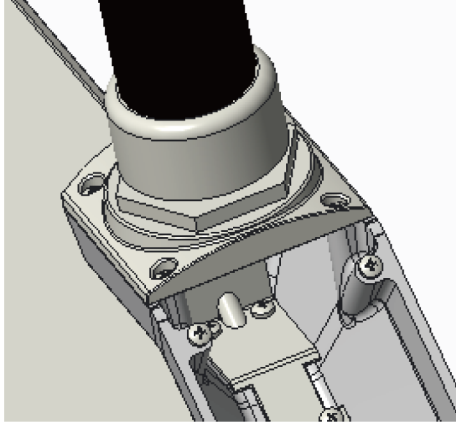
8. Disconnect the trailing cable, the robot connection cable, and the battery cable.
- a. Open the trailing cable sheet metal and locate the connector between the power cable and encoder cable.
- b. Press the snap-fit joint and unplug the connector. See the figure below.



9. Remove the J1 axis cable.
- Locate the motor cable and encoder cable of J2 axis, loosen the connector screw with a screwdriver, and unplug the connector. See the figure below.

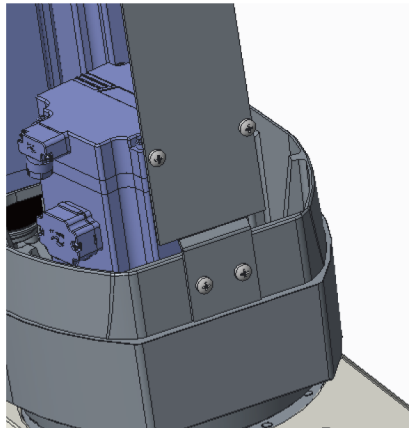


10. Cut the cable tie and remove the tail bellows mounting plate.
 - a. Cut the cable tie tied from the base to the bellows joint.
 - b. Use a screwdriver to remove the mounting plate at the tail of the bellows. See the figure below.



11. Remove the system cables.

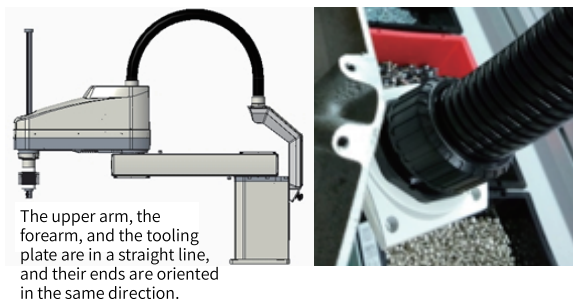
Use a screwdriver to remove the forearm sheet metal and then remove the system cable bundle. See the figure below.



5.9.3 Installing Cables Inside Robot

1. Reconnect the cables.

Adjust the robot posture, take the replacement cable, straighten it out, and install the tail sheet metal. See the figure below.



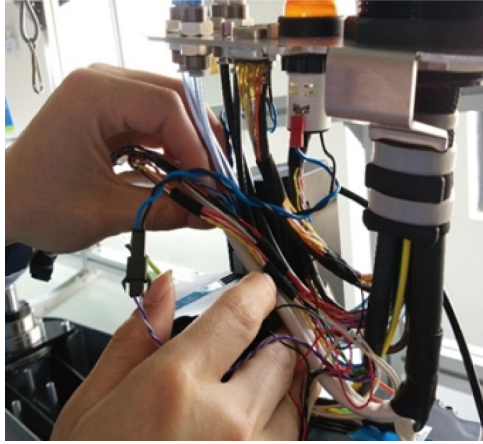
2. Install the forearm sheet metal.

- a. Apply flue to the threaded hole.
- b. Install the forearm sheet metal and fix it with two M4x10 pan head combined screws with torque of $1.5 \pm 0.2 \text{ N} \cdot \text{m}$. See the figure below.

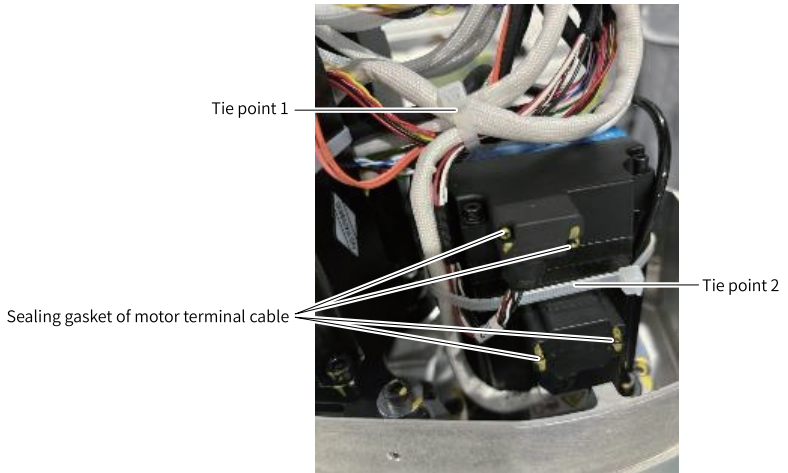


3. Arrange cables and install motor power cable and encoder cable.

- a. Group cables of the air duct, J2 axis, J3 axis, and J4 axis.

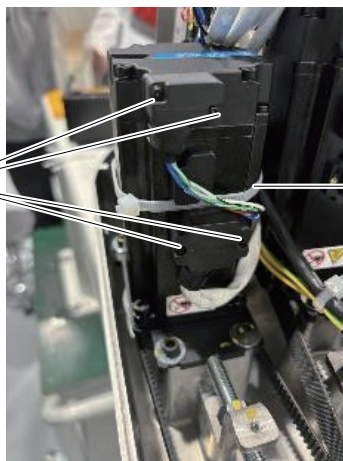


- b. Install the power cable terminal and encoder cable terminal of J2 motor and fix them with torque of $0.15 \text{ N} \cdot \text{m}$.
- c. Arrange the cable sealing gasket so that the gasket is flat and the screws are exposed. Bind the J2 axis motor power cable, encoder cable, and pressure relief pipe according to binding point 1 and binding point 2.



- d. Install the power cable terminal and encoder cable terminal of J4 motor and fix them with torque of $0.15 \text{ N} \cdot \text{m}$.
- e. Arrange the cable sealing gasket so that the gasket is flat and the screws are exposed. Bind the J4 axis motor power cable, encoder cable, and pressure relief pipe according to binding point 3.

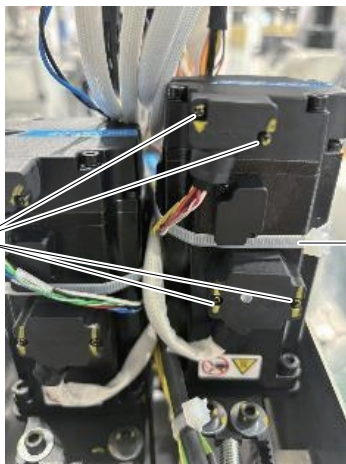
Sealing gasket of motor terminal cable



Tie point 3

- f. Install the power cable terminal and encoder cable terminal of J3 motor and fix them with torque of $0.15 \text{ N} \cdot \text{m}$.
- g. Arrange the cable sealing gasket so that the gasket is flat and the screws are exposed. Bind the J3 axis motor power cable, encoder cable, and pressure relief pipe according to binding point 4.

Sealing gasket of motor terminal cable



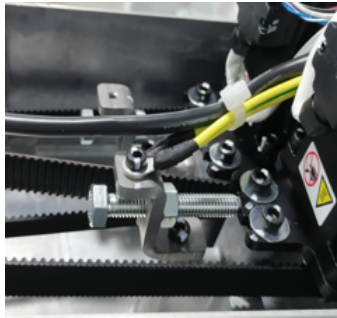
Tie point 4

- 4. Install the gyroscope cable.
 - a. Pass the gyroscope cable through the middle of J3 and J4 motors and connect the gyroscope connector.
 - b. Gently press the cable connector to clamp it. Do not touch the circuit board. Do not pull and insert it forcefully. See the figure below.



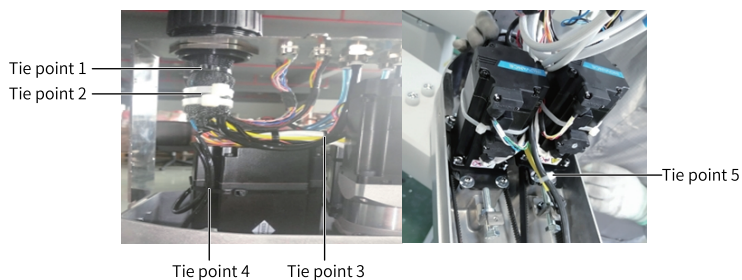
5. Installing the Grounding Cable

Install the grounding cable to the position shown in the figure, and tie it with a tie after fixing. See the figure below.



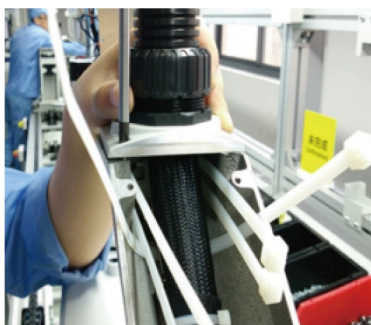
6. Tie the forearm cable:

- a. Binding point 1: Tie the cable harness separately with a tie.
- b. Binding point 2: Fix the harness to the sheet metal.
- c. Binding point 3: Tie the power cable and encoder cable of each axis together at the position shown in the figure.
- d. Binding point 4: Fix the exhaust pipe of J2 axis to the J2 motor with a cable tie as shown in the figure (note that the cable tie cannot crush the exhaust pipe).
- e. Binding point 5: Fix the gyroscope board cable and three grounding cables on the front motor with 4.8-mm cable ties (adjust the gyroscope board cable not to be too loose and not to sag and contact with the belt during cable binding). See the figure below.



7. Install the mounting plate of the tail bellows connector.

- a. Apply flue to the threaded hole.
- b. Align the bellows connector with the tail assembly, and fix them with four M4x8 pan-head screws with a torque of $1.5 \pm 0.2 \text{ N} \cdot \text{m}$. See the figure below.



8. Arrange the harness and thread it into the base.

Arrange the harness and thread the cable and air duct in to the base through the round hole. See the figure below.



9. Install the mounting plate of the tailing cable.

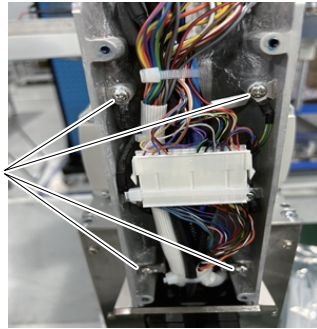
- a. Apply flue to the threaded hole.
- b. Install the mounting plate of the tailing cable and fix it with four M4x8 pan-head screws with a torque of $1.5 \pm 0.2 \text{ N} \cdot \text{m}$. See the figure below.

Four M4x8 fastening pan-head screws



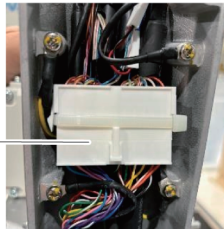
10. Fix the grounding cable with four M4x8 pan-head screws with a torque of $1.5 \pm 0.2 \text{ N} \cdot \text{m}$.

Four M4x8 cross recessed pan-head screws

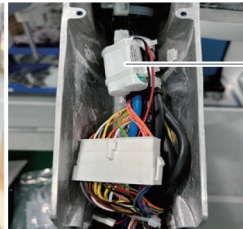


11. Connect the connection cables properly, as shown in the following figure.

Connector

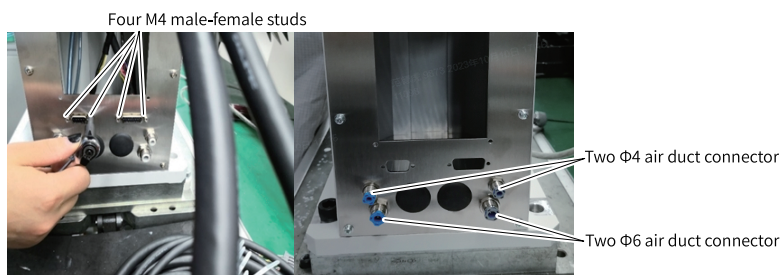


Connector



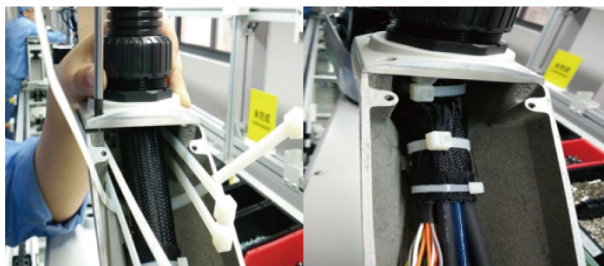
12. Install the base I/O cable and air duct.

- a. Install two DB connectors at the base, and lock the M4 male-female stud with a torque of $0.6 \text{ N} \cdot \text{m}$.
- b. Insert the blue air duct to the blue connector and the white air duct to the gray connector (distinguish the $\Phi 6$ and $\Phi 4$ ducts. Gently plug the ducts to ensure they are connected properly). See the figure below.



13. Bind the cable.

Bind the tailing cable according to the figure. See the figure below.



5.9.4 Checking the Internal Cables and Re-installing the Covers



Ensure that the cable is properly installed. When the cable is loose, it may break due to unnecessary friction with the robot during motion. Check that the air ducts are not bent excessively. Excessively bent air ducts cannot be used normally. Install the robot enclosures according to the maintenance method described in "[Enclosure Removal and Installation](#)" on page 30.

Install the covers according to the steps described in "[Enclosure Removal and Installation](#)" on page 30.



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