INOVANCE

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IR-S4&S7&S10 Series SCARA Robots

Maintenance Guide

Industrial Automation | Intelligent Elevator | New Energy Vehicle | Industrial Robot | Rail Transit

Data code PS00017525 A00

Preface

Introduction

This document describes the maintenance of the IR-S4, IR-S7, and IR-S10 series robots.

Audience

- Electrical engineers
- Mechanical engineers
- Hardware engineers

More Data

Name	Data Code	Description
IR-S4&S7&S10 Series SCARA Robot User Guide - Manipulator	PS00008454	This guide describes the specifications, installation, wiring and more of the IR-S4&S7&S10 series robots.
IR-S4&S7&S10 Series SCARA Robots Maintenance Guide	PS00017525	This guide describes the maintenance of the IR-S3/S4, S6/S7, and S10 series robots.

Revision History

Date	Version	Description
June 2024	A00	Initial release

Access to the Guide

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

- Do keyword search under Service and Support at *http://www.inovance.com*.
- Scan the QR code on the product with your smart phone.
- Scan the QR code below to install My Inovance app, where you can search for and download user guides.

Warranty Disclaimer

Inovance provides warranty service within the warranty period (as specified in your order) for faults or damage that occur during normal operation. Maintenance will be charged after the warranty expires.

Within the warranty period, maintenance will be charged for the following damage:

- Damage caused by operations not following the instructions in the user 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 (natural disaster, earthquake, and lightning strike)

The maintenance is charged according to the latest Price List of Inovance. If otherwise agreed upon, the terms and conditions in the agreement shall prevail.

For details, see Product Warranty Card.

Table of Contents

1 Safety

1.1 Safety Levels and Definitions

Safety Disclaimer

- This chapter presents essential safety instructions for a proper use of the equipment. Before operating the equipment, read through the guide and comprehend all the safety instructions. Failure to observe the safety instructions may result in death, personal injury, or equipment damage.
- "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.

In this manual, safety precautions are classified in three categories:

Indicates that failure to comply with the notice can result in death or severe personal injuries.

Indicates that failure to comply with the notice may result in death or severe personal injury.

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

1.2 Fundamental Safety Instructions

- Drawings in the guide are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
- The drawings in the guide are shown for illustration only and may be different from the product you purchased.
- Users 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

- Do not install the equipment if you find damage, rust, or signs of use on the equipment or accessories upon unpacking.
- Do not install the equipment if you find water seepage or missing or damaged components upon unpacking.
- Do not install the equipment if you find the packing list does not conform to the equipment you received.

- Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking.
- Unpack the package by following the package sequence. Do not hit the package with force.
- Check whether there is damage, rust, or injuries on the surface of the equipment and equipment accessories before unpacking.
- Check whether the package contents are consistent with the packing list before unpacking.

Storage and Transportation

- 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 the 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.

- 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 will result in equipment damage.
- Avoid storing or transporting the equipment 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

- The equipment must be operated only by professionals with electrical knowledge. Operations by others are prohibited.

- Read through the guide and safety instructions before installation.
- Do not install this equipment 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 will result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in an electric shock.
- 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 retrofit the equipment.
- 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 equipments with strong electromagnetic interference, such as a transformer, install a shielding equipment 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 combustible objects. Failure to comply can result in fire accident.

- 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 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

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Before wiring, cut off all the power supplies of the equipment, and wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. Measure the direct voltage of the main circuit and ensure that the voltage is within the safety range. Failure to comply will result in an electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board with power ON. Failure to comply will result in an electric shock.
- Check that the equipment is grounded properly. Failure to comply will result in an electric shock.

- Do not connect the input power supply to the output end of the equipment. Failure to comply will result in equipment damage or even a fire.
- When connecting a drive to the 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.
- Fasten screw terminals with the specified tightening torque. Insufficient or excessive torque may cause overheating, damage, and even a fire.
- After wiring, make sure that no screws are fallen and cables are exposed in the equipment. Failure to comply may result in an electric shock or equipment damage.

- 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 for grounding purpose. Failure to comply can result in equipment malfunction.

Power-on

- 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 a fire.
- Do not open the cabinet door or protective cover of the product, touch any wiring terminal of the product, or remove any part of the product with power on. Failure to comply can result in an electric shock.

- Perform a trial run after wiring and parameter setting to ensure the equipment operates safely. Failure to comply may result in personal 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 a fire. If the power supply voltage is used incorrectly, it will result in a fire.
- Before power-on, check that no one is near the equipment, motor, or other mechanical parts. Failure to comply may result in personal injuries or even death.

Operation

- The equipment must be operated only by professionals. Failure to comply can 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 can result in an electric shock.

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

Maintenance

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

- Perform routine and periodic inspection and maintenance on the equipment according to maintenance requirements and keep a maintenance record.

Repair

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Do not repair the equipment with power ON. Failure to comply can result in an electric shock.
- 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.

- Require for repair services according to the product warranty agreement.
- When the fuse is blown or the circuit breaker or earth leakage circuit breaker (ELCB) trips, wait as specified on the product warning sign before power-on or further operations. Failure to comply may result in personal injuries, equipment damage or even death.
- 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 instructions.
- Do not use 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 injury, or even death. • Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.

Safety Labels

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.

Safety Labels	Description
	• Read through the safety instructions before operating the equipment. Failure to comply may result in death, personal injuries, or equipment damage. • Do not touch the terminals or remove the cover with power ON or within 10 min after power-off. Failure to comply will result in an electric shock.

1.3 Special Reminder

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

1. Please ensure that the safety protection range of the robot is greater than the maximum motion range of the robot. Comprehensive safety protection devices (fences, etc.) must be installed on the periphery, and emergency stop devices must be installed within easy reach of the operator. Leave sufficient space (safe area) around for the operator to avoid abnormal operations or emergency situations.
2. The safety protection devices should only have one entrance and must be equipped with a safety latch. The safety latch must be manually removed when closing or opening the entrance. Please ensure that the safety devices (such as emergency stop buttons and safety latch) are working properly before accessing the safety protection device.
3. The safety fence must be strong enough to withstand both internal and external impacts and pressures. The position of the safety fence must be fixed to prevent operators from easily dismantling or breaking the safety fence. In addition, the safety fence must be free of any potential hazardous parts such as sharp corners, edges, or spikes.

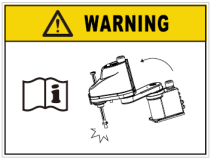
4. Clearly display the status information of the robot on the safety protection device (fence), such as automatic mode, teaching, emergency stop, etc., so that everyone can see the current status of the robot.

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

1.4 Safety Signs

The following signs are sticked on the robot body. Pay attention that special dangers exist around the positions sticked 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.
	NEVER enter the action area during robot running. Otherwise, you may bump into the robot, and serious accidents may occur.
	Do not touch the energized parts when the power is on. Failure to comply may result in an electric shock.

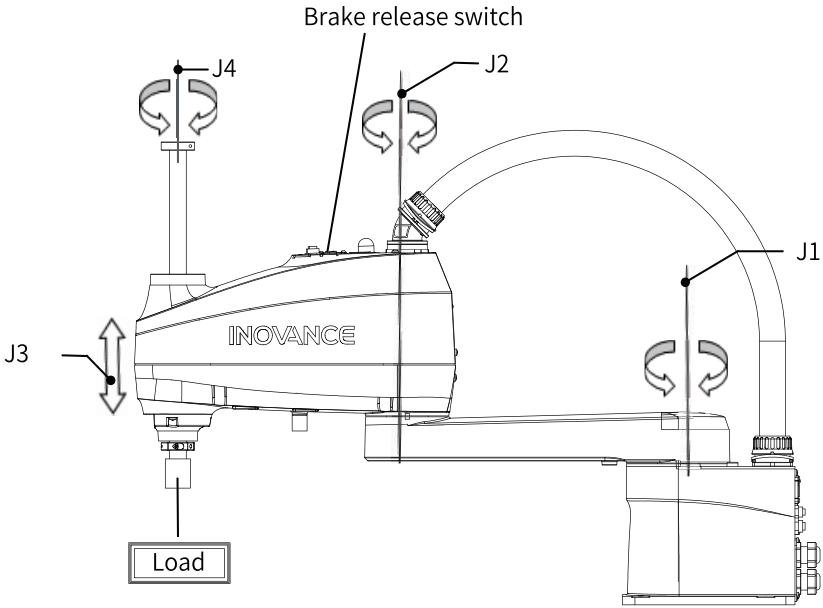
1.5 Emergency Movement and Emergency Stop

- **Emergency Movement**
  When the system is placed in emergency mode, push the arm or joint of the robot by hand as follows:
  - J1: Rotate clockwise and counterclockwise by hand.
  - J2: Rotate clockwise and counterclockwise by hand.
  - J3: Move the joint up/down while pressing the brake release switch.
  - J4: Push the joint to rotate clockwise and counterclockwise while pressing the brake release switch.

Warning

Be careful of the shaft falling while the brake release switch of J3 is pressed because the shaft may be lowered by the weight of an end effector.

The position of the brake release switch is shown below.



- **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.


Emergency stop
Stop button

2 IR-S4 Series SCARA Robots Maintenance Guide

2.1 Product Information

2.1.1 Model Description

IR- S 4 - 40 Z15 S 3
① ② ③ ④ ⑤ ⑥ ⑦

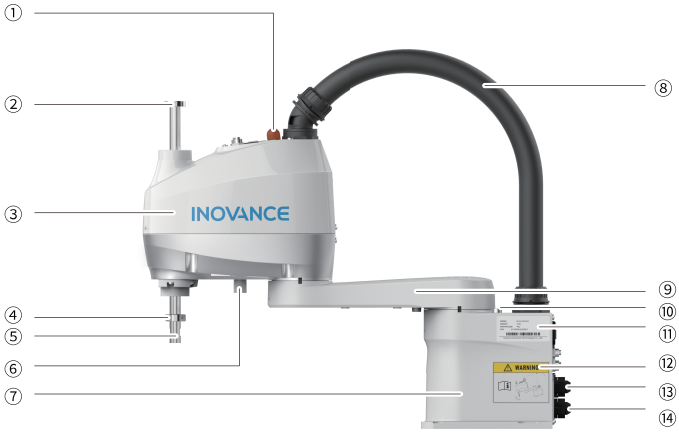
① **Product Family** INOVANCE Robot	④ **Arm Length** 40: 400 mm 50: 500 mm	⑦ **Cable Length** 0: No trailing cable 3: 3 m standard cable 5: 5 m standard cable G3: 3 m highly flexible cable
② **Series** S: SCARA robot R: 6-axis robot TS: Ceiling-mounted SCARA robot	⑤ **Max. Z-axis Stroke (Blank for models without lead screw)** Z15: Max. 150 mm stroke	-
③ **Payload** 4: 4 kg 7: 7 kg 10: 10 kg	⑥ **Installation Environment** C: Cleanroom S: Standard P: Protection	

Note

The product information in this guide is the information of standard models in a standard environment. For information about non-standard models or cleanroom models, contact the provider.

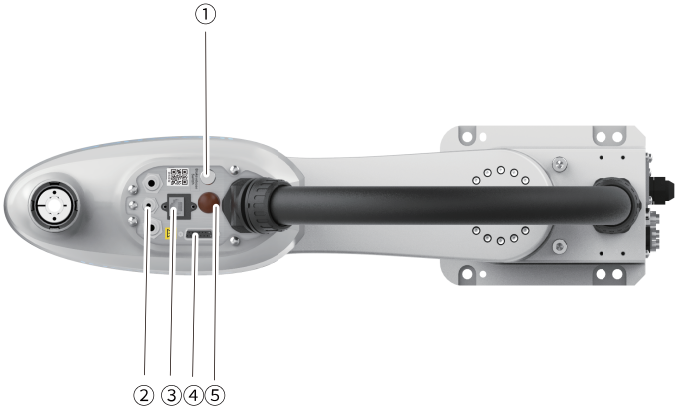
2.1.2 Components

Part 1



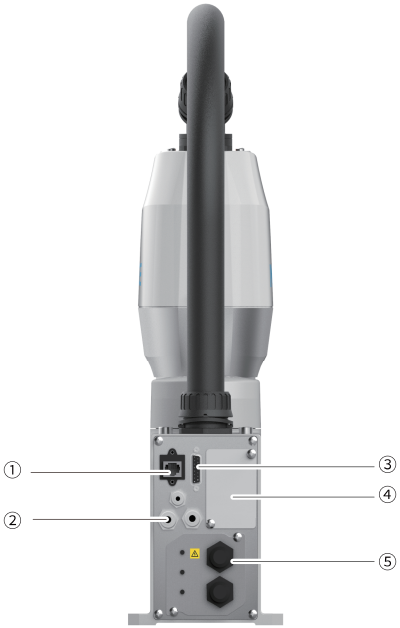
No.	Description
①	Run indicator
②	J3 upper mechanical stop
③	Arm 2
④	J3 lower mechanical stop
⑤	J3 lead screw
⑥	J2 mechanical stop
⑦	Base
⑧	Cable unit
⑨	Arm 1
⑩	J1 mechanical stop
⑪	Nameplate
⑫	Label
⑬	Power cable
⑭	Signal Cable

Part 2



No.	Description
①	Brake release switch
②	Air tube connector
③	Ethernet connector
④	DB15
⑤	Indicator

Part 3



No.	Description
①	Ethernet connector
②	Air tube connector
③	DB15
④	Battery cover
⑤	Trailing cable

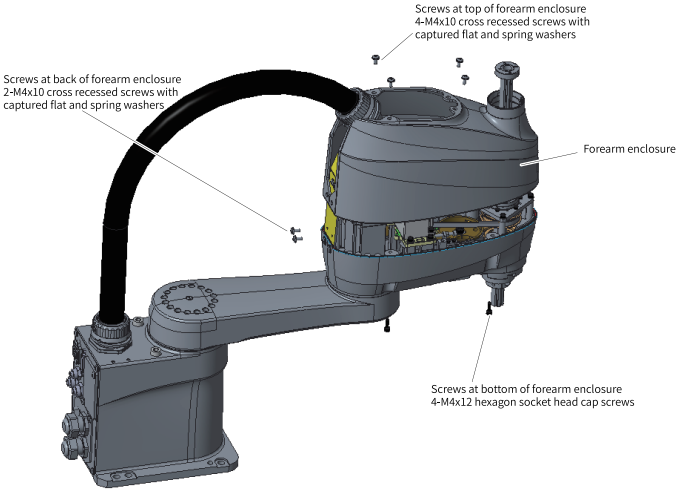
2.2 Enclosure Removal and Installation

Warning

- During removal and re-installation of the enclosure, do not pull it forcibly. Failure to comply will 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 in *"2.2.1 Removing and Installing the Enclosure of the Forearm" on page 21*.
- 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.

2.2.1 Removing and Installing the Enclosure of the Forearm

The following figure shows the removal and installation of the enclosure of the forearm.



Steps:

1. Remove the six cross recessed pan head screws on the top and back.

2. Remove the four hexagon socket head cap screws on the bottom.
3. Lift and remove the forearm enclosure. To install the enclosure, put back the enclosure and ensure that it fits properly with the forearm. Then tighten the 10 screws from the bottom to the top with a torque of 0.6 N·m.

2.2.2 Removing and Installing the Bottom Enclosure of Spline Nut

Warning

- When installing the spline nut, do not change the position of the limit ring at will.
- 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.

The following figure shows the removal and installation of the bottom enclosure of the spline nut.

To remove and install the bottom enclosure of the spline nut, do as follows:

Step 1: Remove the screws of the enclosure of the spline nut (4-M4×10 cross recessed screws with captured flat and spring washers).

Step 2: Remove the enclosure of the spline nut. When installing the enclosure, fix the screws with a torque of 0.6 N·m.

2.3 Regular Inspection

2.3.1 Regular Inspection Checklist

To make the robot run safely and efficiently, it needs to be inspected and maintained regularly. Maintenance can only be carried out after confirming the safety of the robot system. Only authorized personnel who have taken safety training should be allowed to perform the robot maintenance. Inspection points are divided into five stages: daily, monthly, quarterly, semi-annual, and annual. The inspection points are added every stage.

- Inspection while the power is OFF (robot is not operating)

Inspection Point	Inspection Place	Daily inspection	Monthly Inspection	Quarterly Inspection	Semi-annual Inspection	Annual Inspection
Check whether the screws are loose. If yes, tighten them.	Mounting screw of the end effector	✓	✓	✓	✓	✓
	Robot base mounting screws	✓	✓	✓	✓	✓
	Each joint	✓	✓	✓	✓	✓
	Screws around the axes	-	-	-	-	✓
	Screws securing the the motor, reducer, etc.	-	-	-	-	✓
Check whether the connector is loose. If yes, push it securely or tighten it.	Parts external to the robot (such as the connector board)	✓	✓	✓	✓	✓
	Robot cable unit	-	✓	✓	✓	✓
Check for scratches and remove dust.	Manipulator	✓	✓	✓	✓	✓
	External cables	-	✓	✓	✓	✓
Correct deformation and position offset.	Safeguard etc.	✓	✓	✓	✓	✓

Inspection Point	Inspection Place	Daily inspection	Monthly Inspection	Quarterly Inspection	Semi-annual Inspection	Annual Inspection
Check tension of the timing belt. Tighten it if necessary.	Inside arm #2	-	-	-	✓	✓
Check if the lubricating grease is sufficient for lubrication, and add an appropriate amount of lubricating grease as needed.	Ball screw spline	-	-	✓	✓	✓
Check whether there is dust at the outlet of fan of the robot controller. If yes, clean it.	-	-	-	✓	✓	✓

- Inspection while the power is ON (robot is not operating)

Inspection Point	Inspection Place	Daily inspection	Monthly Inspection	Quarterly Inspection	Semi-annual Inspection	Annual Inspection
Shake the cable gently by hand to check for wire breakage.	Parts external to the robot (such as the connector board)	-	-	-	✓	✓
Press each arm by hand in the enabled state to check whether the arms shake.	Each arm	-	-	-	-	✓
Check whether the fan of the robot controller works properly. If not, replace the controller.	Controller	-	-	✓	✓	✓

- Inspection while the power is ON (robot is operating)

Inspection Point	Inspection Place	Daily inspection	Monthly Inspection	Quarterly Inspection	Semi-annual Inspection	Annual Inspection
Check the motion range.	Each joint	-	-	-	-	✓
Check whether unusual sound or vibration occurs.	Manipulator	✓	✓	✓	✓	✓
Measure the accuracy repeatedly by a gauge.	Manipulator	-	-	-	-	✓

2.3.2 Screw Tightening Torque and Method

Otherwise specified, tighten the hexagon socket-head cap screws according to the following torque.

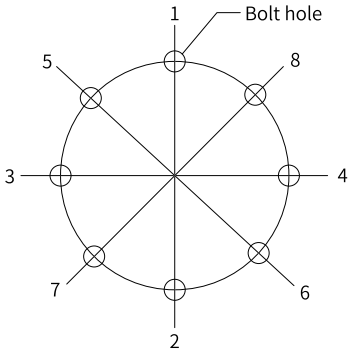
Caution

The tightening torque of the robot housing screws must not damage the housing.

The torque of the screws except those connected to the reducer is listed in the following table.

Screw	Torque (N·m)
M3	2
M4	3.5
M6	15
M8	30

Tighten the screws in the sequence shown below:



Do not tighten the screw to the maximum torque value at a time. Tighten the screws slightly with an Allen wrench as shown in the preceding figure. Then tighten the screws to the torque values in the table above with a torque wrench.

Otherwise specified, tighten the set screw according to the following torque:

Screw	Torque (N·m)
M4	1.8

2.3.3 Grease Refilling

The following table describes the grease refilling cycle:

Joint	Position	Cycle
J1	Reducer	When replacing the motor.
J2	Reducer	When replacing the motor.
J3	Ball screw spline	3 months

Cautions:

1. Only use original grease. See *"2.4.11 Parts List" on page 74* for the grease type.
2. It is strictly forbidden to deplete the grease of the ball screw spline, otherwise irreversible mechanical damage may occur.
3. Normally, the reducer does not require grease refilling. However, under the extreme conditions (duty cycle, speed, load), the grease needs to be refilled every 10,000 hours.

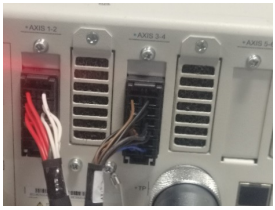
Note

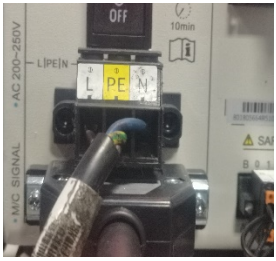
If grease gets into your eyes, mouth, or on your skin, follow the instructions below.

- If the grease gets into your eyes, flush them thoroughly with clean water, and then see a doctor immediately;
- If the grease gets into your mouth, wash out your mouth with water thoroughly; if swallowed, see a doctor immediately;
- If the grease gets on your skin, wash the area thoroughly with soap and water.

2.3.4 Controller Cable Inspection

The following table describes the inspection of controller cables:

No.	Item	Diagram	Cycle
①	Check that the power cable and encoder cable of the manipulator is properly connected to the controller.		Daily
②	Check that the teach pendant cable is properly connected to the controller.		Daily

No.	Item	Diagram	Cycle
③	Check that the external power cable (Red for L, green for N, and yellow for PE respectively) is properly connected to the controller.		Daily
④	Wipe off any acid, alkali, oil, or corrosive liquids with wiping paper or a dry cloth	All cables	Monthly

2.4 Replacement and Maintenance

2.4.1 J1 Maintenance

Tools list:

	Name	Quantity
Maintenance Parts	J1 motor	1
	J1 reducer	1
	Reducer grease	-
Tools	Hexagonal wrench	1
	Torque screwdriver (0 N·m to 10 N·m)	1
	Hexagon bit set	1
	LOCTITE 638 and 243	Several
	Oil-absorbing sheet	Several
	Wiping cloth	Several

Screw tightening torque reference:

Screw	Torque (N·m)
M3	2
M4	5

Note

- Recommended bit specifications: 3/4/5/6/8 mm diameter, 15 cm length; 1.5/2/2.5 mm diameter, 10 cm length
- Recommended cross screwdriver specifications: 5 mm diameter, 20 cm length; 3 mm diameter, 15 cm length

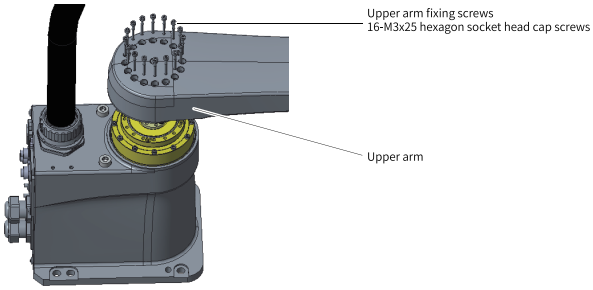
- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
- Do not remove the parts not mentioned in this document. Do not maintain any part with a method different from that described in this document.
- 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.
- After the motor is maintained, it is necessary to calibrate the zero point. Otherwise, the motor may encounter runaway after restart, posing serious safety hazards.

Warning

- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Prevent foreign objects from entering the equipment and terminals during maintenance.
- After the equipment is replaced, perform wiring inspection and parameter settings again.
- 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 motor and encoder. Failure to comply may result in motor failure due to misalignment during reassembly.

2.4.1.1 Maintaining the J1 Motor and Reducer

Step 1: Remove the upper arm and forearm by removing the forearm fastening screws (16-M3×25 socket head screws).

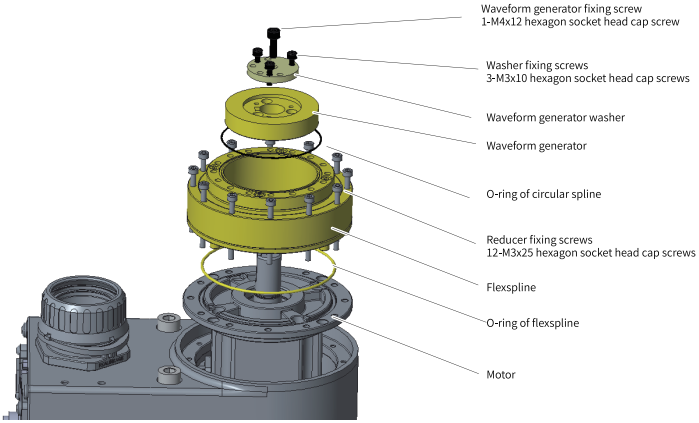


Note

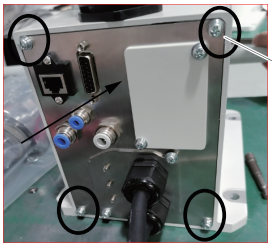
When removing the screws of the upper arm, hold the forearm to prevent the manipulator from tipping over due to an unstable center of gravity.

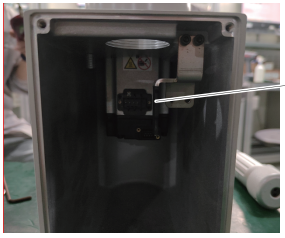
Step 2: Remove the waveform generator as follows: Remove the waveform generator fixing screws, clamp the washer with a circlip pliers, screw the M5 screw into the M5 hole in the middle of the washer, remove the waveform generator and then remove the washer fixing screws.

Step 3: Remove the reducer fixing screws, remove the O-ring of circular spline and then the flex spline, and replace the reducer with a new one. For the parts number, see *"2.4.11 Parts List" on page 74*.

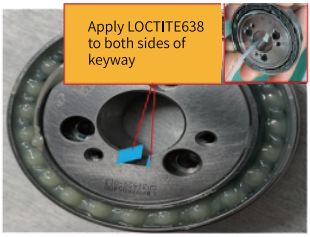


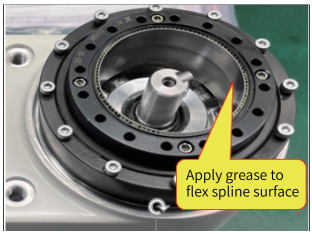
Step 4: Remove the O-ring of flex spline of the reducer, remove the sheet metal fixing screws on the base, remove the power cables and encoder cables of the J1 motor, remove the motor and replace it with a new one. For the parts number, see *"2.4.11 Parts List" on page 74*. To re-assemble, reverse the above steps. Note that the grease needs to be replaced after the motor and reducer are replaced. For replacement of the grease, see *"2.4.1.2 Replacing the Grease of J1 Reducer" on page 32*. (M3 screw tightening torque: 2 N · m, M4 screw tightening torque: 5 N · m. All reducer screws must be coated with LOCTITE 243 threadlocker).





To re-assemble, reverse the above steps. Note that the grease needs to be replaced after the motor and reducer are replaced. For replacement of the grease, see *"2.4.1.2 Replacing the Grease of J1 Reducer" on page 32*. In addition, apply LOCTITE 638 retaining compound to the keyway of the waveform generator and grease to the surface of the flex spline of the reducer. (M3 screw tightening torque: 2 N · m, M4 screw tightening torque: 5 N · m. All reducer screws must be coated with LOCTITE 243 threadlocker).





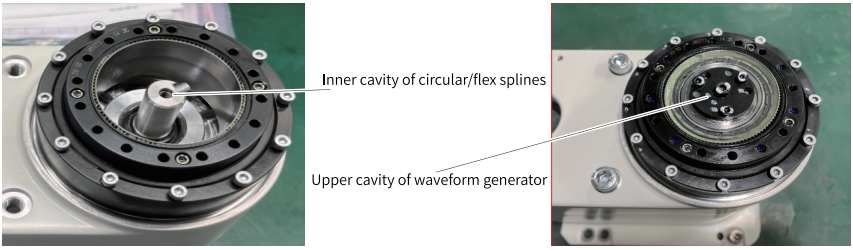
2.4.1.2 Replacing the Grease of J1 Reducer

Step 1: Remove the upper arm and forearm according to Step 1 of *"2.4.1.1 Maintaining the J1 Motor and Reducer" on page 30* (See the figure of Step 1 in *"2.4.1.1 Maintaining the J1 Motor and Reducer" on page 30*.)

Step 2: Remove the waveform generator according to Step 2 in *"2.4.1.1 Maintaining the J1 Motor and Reducer" on page 30*. Remove the circular spline and flexspline according to Step 3 in *"2.4.1.1 Maintaining the J1 Motor and Reducer" on page 30*.

Step 3: Apply grease to the waveform generator. Clean the old grease from the waveform generator and the circular/flex splines of the harmonic reducer and apply grease (H: SK-1A grease, X: SFB grease) evenly to the inner cavity of the circular/flex splines (approx. 31 ml, 28 g) and the upper cavity of the waveform generator (approx. 12 ml, 11 g). For the grease, see the parts list.

The following figure shows the lubrication of the waveform generator.



Step 4: Re-assemble the reducer. To re-assemble, reverse the above steps. (M3 screw tightening torque: 2 N·m, M4 screw tightening torque: 5 N·m. All reducer screws must be coated with LOCTITE 243 threadlocker).

2.4.2 J2 Maintenance

Tools list:

	Name	Quantity
Maintenance Parts	J2 motor	1
	J2 reducer	1
	Reducer grease	-
Tools	Hexagonal wrench	1
	Torque screwdriver (0 N·m to 10 N·m)	1
	Hexagon bit set	1
	LOCTITE 243 threadlocker	Several
	Oil-absorbing sheet	Several
	Wiping cloth	Several
	Phillips screwdriver	2

Note

- Recommended bit specifications: 3/4/5/6/8 mm diameter, 15 cm length; 1.5/2/2.5 mm diameter, 10 cm length
- Recommended cross screwdriver specifications: 5 mm diameter, 20 cm length; 3 mm diameter, 15 cm length

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
- Do not remove the parts not mentioned in this document. Do not maintain any part with a method different from that described in this document.
- 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.
- After the motor is maintained, it is necessary to calibrate the zero point. Otherwise, the motor may encounter runaway after restart, posing serious safety hazards.

Warning

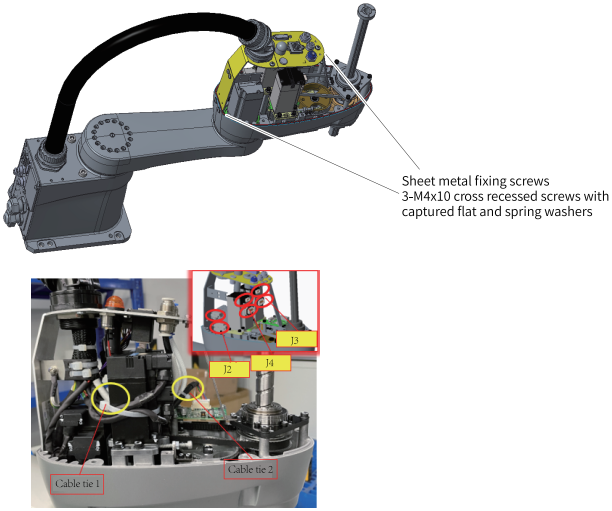
- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Prevent foreign objects from entering the equipment and terminals during maintenance.
- After the equipment is replaced, perform wiring inspection and parameter settings again.
- 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 motor and encoder. Failure to comply may result in motor failure due to misalignment during reassembly.

2.4.2.1 Maintaining the J2 Motor and Reducer

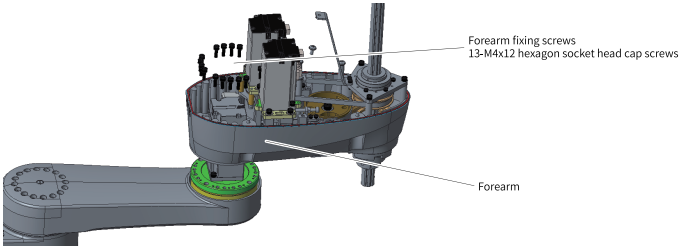
Step 1: Remove the forearm enclosure. Remove the enclosure according to *"2.2.1 Removing and Installing the Enclosure of the Forearm" on page 21* (See figure in *"2.2.1 Removing and Installing the Enclosure of the Forearm" on page 21*).

Step 2: Remove the sheet metal fixing screws. Remove the 3-M4×10 cross recessed screws with captured flat and spring washers on the back and top of the sheet metal part of the forearm, disconnect the power cables and encoder cables of the J2, J3, J4 motors and then remove the sheet metal part and the cables.

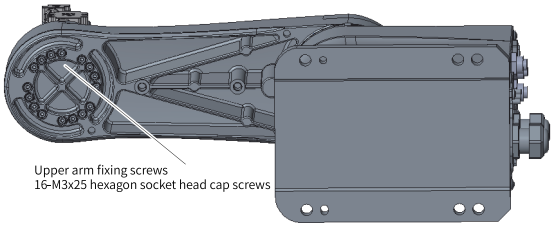
Remove the sheet metal fixing screws as shown below.



Step 3: Remove the forearm fixing screws and remove the forearm assembly. Remove the 13-M4×12 screws on the forearm and J2 assembly, and remove the forearm assembly.

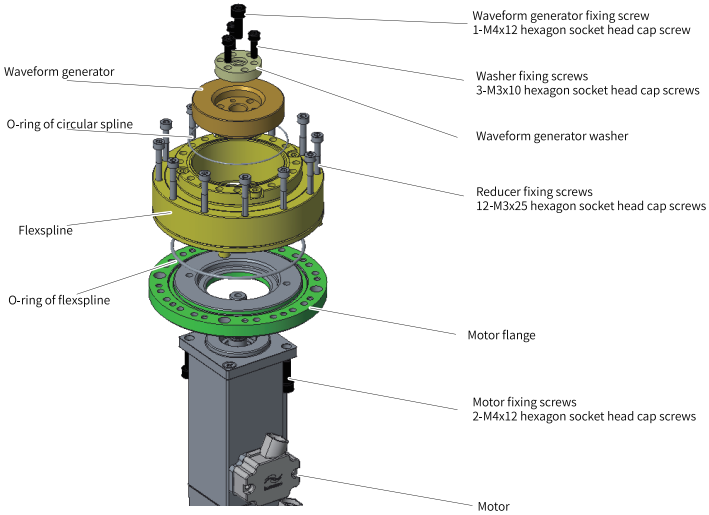


Step 4: Remove the the upper arm fixing screws and remove the J2 assembly.



Step 5: Remove the waveform generator fixing screws, clamp the washer with a circlip pliers, screw the M5 screw into the M5 hole in the middle of the washer, remove the waveform generator and then remove the washer fixing screws.

Step 6: Remove the reducer fixing screws, remove the reducer and the O-ring, then remove the motor fixing screws and replace the motor or reducer. For the motor and reducer, see *"2.4.11 Parts List" on page 74*.

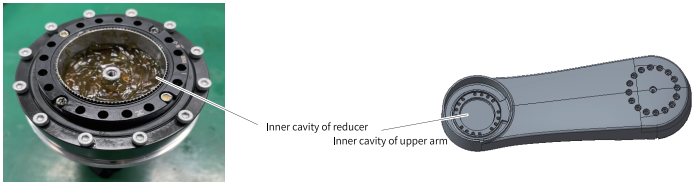


Step 7: Re-assemble the motor and reducer. To re-assemble the motor and reducer, reverse the above steps (M3 screw tightening torque: 2 N·m, M4 screw tightening torque: 5 N·m. All reducer screws must be coated with LOCTITE 243 threadlocker). Note that the O-ring must be restored. After the motor and reducer are replaced, the grease needs to be replaced. For replacement of the grease, see *"2.4.2.2 Replacing the Grease of J2 Reducer" on page 37*.

2.4.2.2 Replacing the Grease of J2 Reducer

Step 1: Remove the J2 motor assembly. Remove the J2 motor assembly and waveform generator according to Steps 1-5 in *"2.4.2.1 Maintaining the J2 Motor and Reducer" on page 35*.

Step 2: Clean the old grease from the waveform generator and the circular spline of the harmonic reducer, and apply grease (H: SK-2 grease, X: SFB grease) evenly to the inner cavity of the reducer (approx. 11.2 ml, 10 g) and the forearm (approx. 9 ml, 8 g). For grease types, see *"2.4.11 Parts List" on page 74*.



Step 3: Re-assemble the reducer. To re-assemble, reverse the above steps (M3 screw tightening torque: 2 N·m, M4 screw tightening torque: 5 N·m. All reducer screws must be coated with LOCTITE 243 threadlocker).

2.4.3 J3 Maintenance

Tools list:

	Name	Quantity
Maintenance Parts	J3 motor	1
	Brake	1
	Reducer grease	-
Tools	Hexagonal wrench	1
	Torque screwdriver (0 N·m to 10 N·m)	1
	Hexagon bit set	1
	Oil-absorbing sheet	Several
	Wiping cloth	Several
	Phillips screwdriver	2
	Tension meter	1

Screw tightening torque reference:

Screw	Torque (N·m)
M4	3.5
M3	1
M4 set screw	1.8N·m

Note

- Recommended bit specifications: 3/4/5/6/8 mm diameter, 15 cm length; 1.5/2/2.5 mm diameter, 10 cm length
- Recommended cross screwdriver specifications: 5 mm diameter, 20 cm length; 3 mm diameter, 15 cm length

Danger

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
- Do not remove the parts not mentioned in this document. Do not maintain any part with a method different from that described in this document.
- 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.
- After the motor is maintained, it is necessary to calibrate the zero point. Otherwise, the motor may encounter runaway after restart, posing serious safety hazards.

Warning

- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Prevent foreign objects from entering the equipment and terminals during maintenance.
- After the equipment is replaced, perform wiring inspection and parameter settings again.
- 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 motor and encoder. Failure to comply may result in motor failure due to misalignment during reassembly.

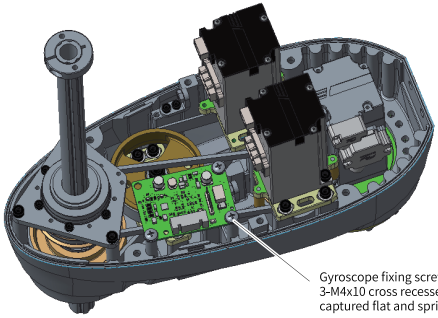
2.4.3.1 Maintaining the J3 Timing Belt, Brake and Motor

Step 1: Remove the enclosure, cables and sheet metal components of the forearm. Remove the enclosure according to *"2.2.1 Removing and Installing the Enclosure of the Forearm" on page 21* (See figure in *"2.2.1 Removing and Installing the Enclosure of the Forearm" on page 21*). Remove the cables and sheet metal components according

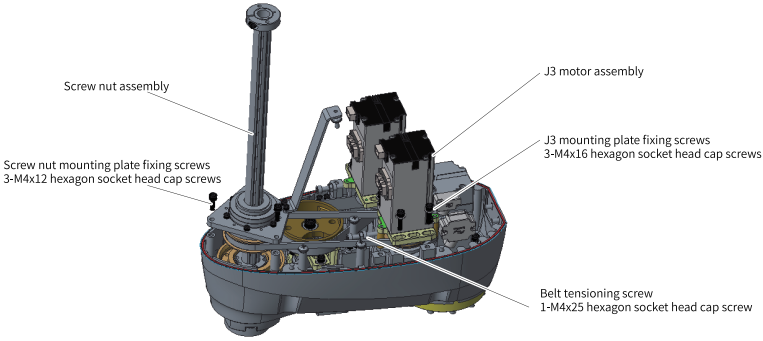
to Step 2 in *"2.4.2.1 Maintaining the J2 Motor and Reducer" on page 35* (See figure in *"2.2.1 Removing and Installing the Enclosure of the Forearm" on page 21*).

Step 2: Remove the gyroscope board. Remove the screws that fix the gyroscope board and then remove the gyroscope board.

Remove the gyroscope board as shown below.



Step 3: Remove the J3 belt tensioning screw, the screws fixing the J3 mounting plate and the screws fixing the screw nut mounting plate, remove the shaft and screw nut assembly (Note that the screw nut and shaft must not be separated) and then remove the J3 motor assembly.

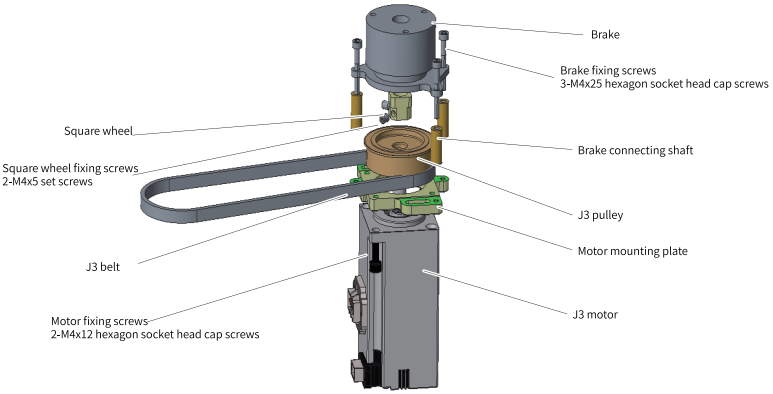


Step 4: Replace the J3 timing belt. Remove the J3 motor assembly, and remove the brake fixing screw, then remove the brake so you can replace the belt. Re-assemble the J3 (M4 screw tightening torque: 3.5 N·m and M3 screw tightening torque: 1 N·m) by reversing Steps 1, 2, and 3. Tighten the belt with the tension screw (Measure the belt with a tension meter to ensure the frequency is 90 Hz to 100 Hz).

Step 5: Replace the brake and motor. Remove the square wheel fixing screws, replace the square wheel and brake. (Note that the service life of the brake for emergency

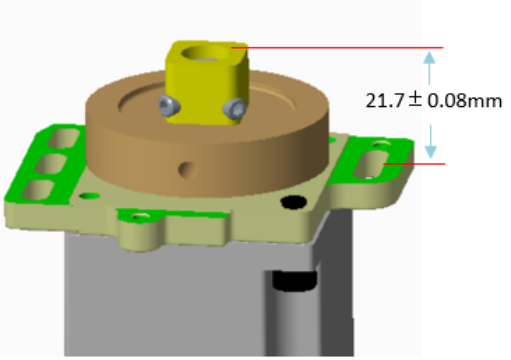
stop is 2,000 times. Replace the brake when the service life expires.) Remove the pulley fixing screws and the motor fixing screws and replace the motor.

Replace the J3 timing belt as shown below.



Step 6: Re-assemble the J3 timing belt. After replacing the motor and brake, install the pulley and the square wheel (Align two set screw holes with D-cut of the motor). Use a height scale to ensure that the top of the square wheel is 21.7 ± 0.08 mm from the motor mounting plate, and then lock the square wheel with M4×5 set screws. Then reinstall the J3 (M4×5 set screw tightening torque: 1.8 N·m, M4 screw: 3.5 N·m, M3 screw tightening torque: 1 N·m) by reversing the Steps 1 and 2. Tighten the belt with the tension screw (Measure the belt with a tension meter to ensure the frequency is 90 Hz to 100 Hz).

Tension the J3 timing belt as shown below.



2.4.4 J4 Maintenance

Tools list:

	Name	Quantity
Maintenance Parts	J4 motor	1
	Other timing belt	2
	Reducer grease	-
Tools	Hexagonal wrench	1
	Torque screwdriver (0 N·m to 10 N·m)	1
	Hexagon bit set	1
	Oil-absorbing sheet	Several
	Wiping cloth	Several
	Phillips screwdriver	2
	Tension meter	1

Screw tightening torque reference:

Screw	Torque (N·m)
M3	1.5
M4	3

Note

- Recommended bit specifications: 3/4/5/6/8 mm diameter, 15 cm length; 1.5/2/2.5 mm diameter, 10 cm length
- Recommended cross screwdriver specifications: 5 mm diameter, 20 cm length; 3 mm diameter, 15 cm length

Danger

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
- Do not remove the parts not mentioned in this document. Do not maintain any part with a method different from that described in this document.
- 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.
- After the motor is maintained, it is necessary to calibrate the zero point. Otherwise, the motor may encounter runaway after restart, posing serious safety hazards.

Warning

- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Prevent foreign objects from entering the equipment and terminals during maintenance.
- After the equipment is replaced, perform wiring inspection and parameter settings again.
- 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 motor and encoder. Failure to comply may result in motor failure due to misalignment during reassembly.

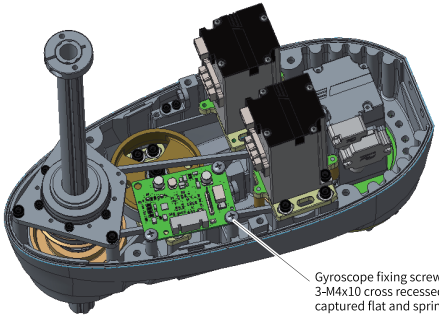
2.4.4.1 Maintaining the J4 Timing Belt

Step 1: Remove the enclosure, cables and sheet metal components of the forearm. Remove the enclosure according to *"2.2.1 Removing and Installing the Enclosure of the Forearm" on page 21* (See figure in *"2.2.1 Removing and Installing the Enclosure of the Forearm" on page 21*). Remove the cables and sheet metal components according

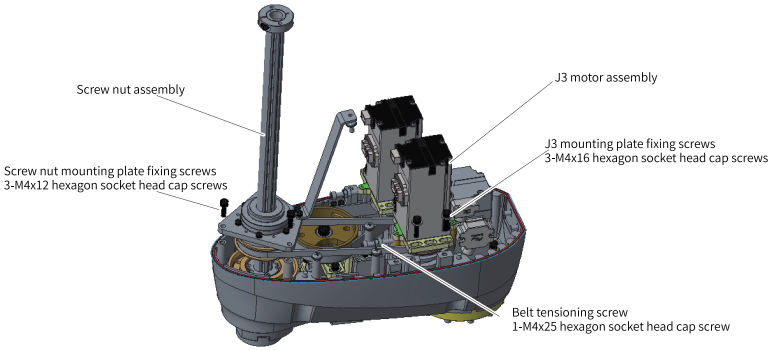
to Step 2 in *"2.4.2.1 Maintaining the J2 Motor and Reducer" on page 35* (See figure in *"2.2.1 Removing and Installing the Enclosure of the Forearm" on page 21*).

Step 2: Remove the gyroscope board. Remove the screws that fix the gyroscope board and then remove the gyroscope board.

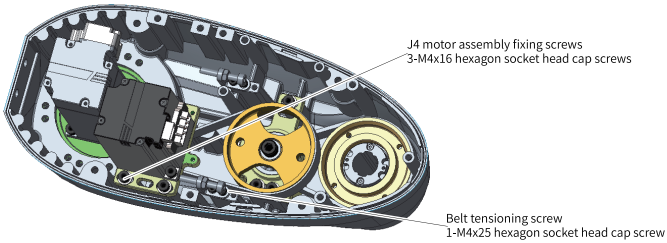
See the figure below.



Step 3: Remove the J3 belt tensioning screw, the screws fixing the J3 mounting plate and the screws fixing the screw nut mounting plate, remove the shaft and screw nut assembly (Note that the screw nut and shaft must not be separated) and then remove the J3 motor assembly.

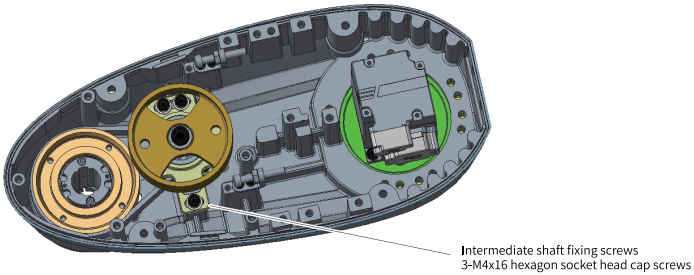


Step 4: Remove the J4 belt tensioning screw, the screws fixing the J4 assembly, remove the J4 motor assembly, and then replace the primary belt. The frequency is 260 Hz to 280 Hz.



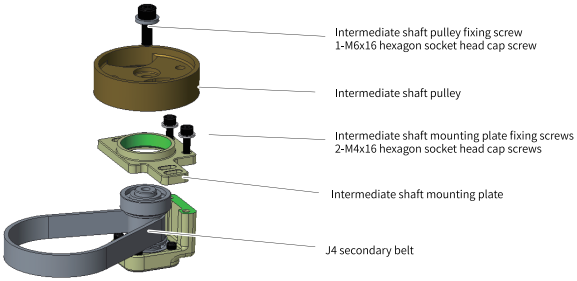
Step 5: Remove the intermediate shaft fixing nut and remove the intermediate shaft assembly.

Remove the J3 motor assembly as shown below.



Step 6: Remove the J4 motor assembly and the intermediate shaft assembly. Remove the pulley fixing screws of the intermediate shaft, the fixing screws of the intermediate shaft mounting plate, and replace the secondary belt. Then re-assemble the J4 by reversing the removal steps (M4 screw tightening torque: 3.5 N·m, M6 screw tightening torque: 15 N·m. The belt frequency is 380 Hz to 410 Hz.)

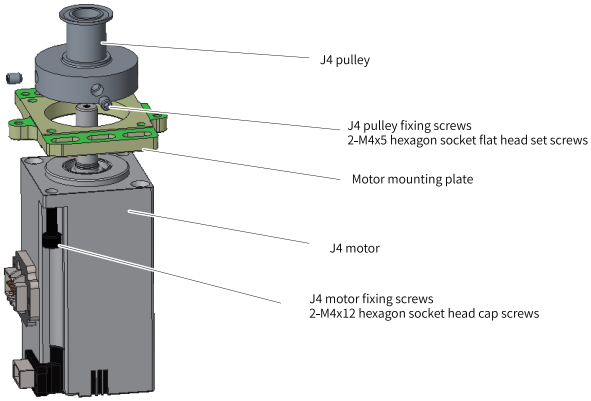
Remove the J4 motor assembly as shown below.



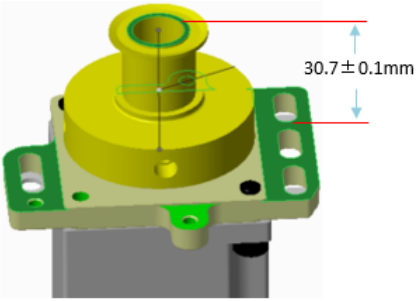
2.4.4.2 Maintaining the J4 Motor

Step 1: Remove the J4 motor assembly. Remove the J4 motor assembly according to Steps 1-4 in *"2.4.4.1 Maintaining the J4 Timing Belt" on page 43*.

Step 2: Replace the J4 motor. Remove the 2-M4×5 set screws, remove the J4 pulley, remove the J4 motor fixing screws, remove the J4 motor mounting plate, and then replace the motor.



Step 3: Re-assemble the J4 motor. To re-assemble the J4 motor, reverse the above steps. Note: Keep a distance of 30.7 ± 0.1 mm between the J4 pulley and the motor mounting plate, as shown below (M4×5 set screw tightening torque: 1.8 N·m, M4 screw tightening torque: 3.5 N·m).

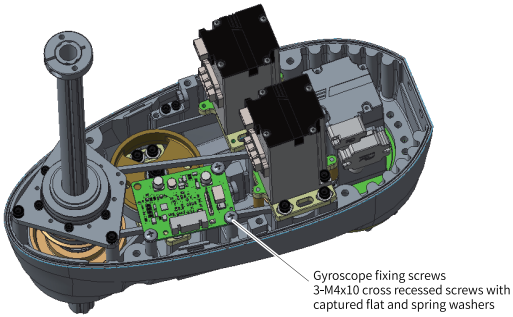


2.4.5 Maintaining the Ball Screw Spline

Step 1: Remove the enclosure, cables and sheet metal components of the forearm. Remove the enclosure according to *"2.2.1 Removing and Installing the Enclosure of the Forearm" on page 21* (See figure in *"2.2.1 Removing and Installing the Enclosure of the Forearm" on page 21*). Remove the cables and sheet metal components according

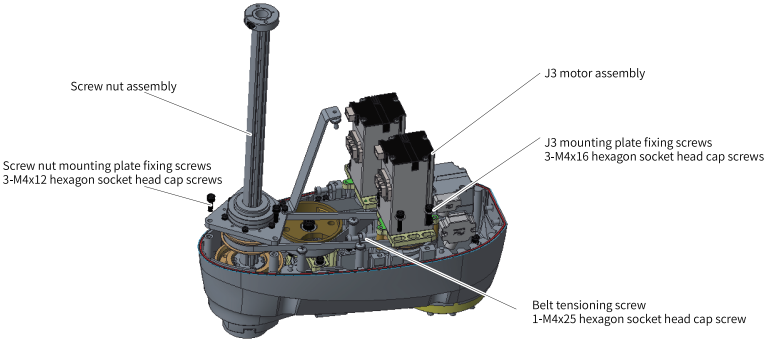
to Step 2 in *"2.4.2.1 Maintaining the J2 Motor and Reducer" on page 35* (See figure in *"2.2.1 Removing and Installing the Enclosure of the Forearm" on page 21*).

Step 2: Remove the gyroscope board. Remove the screws that fix the gyroscope board and then remove the gyroscope board.

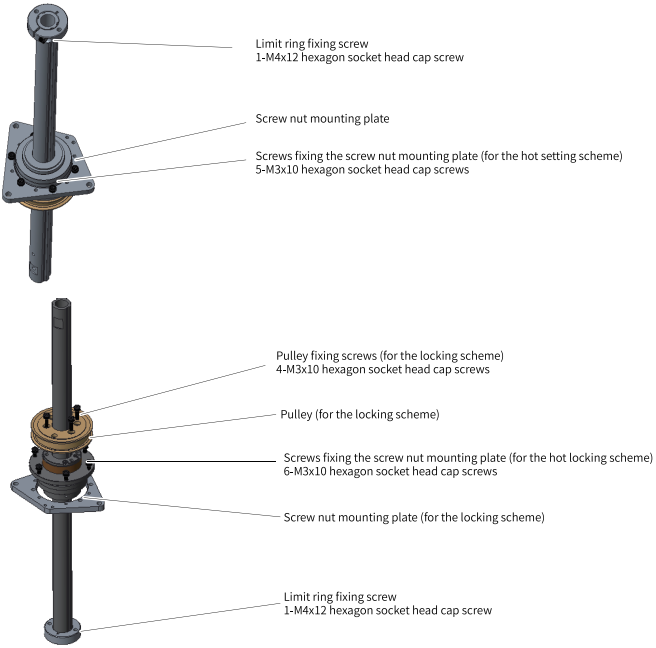


Step 3: Remove the J3 belt tensioning screw, the screws fixing the J3 mounting plate and the screws fixing the screw nut mounting plate, remove the shaft and screw nut assembly (Note that the screw nut and shaft must not be separated) and then remove the J3 motor assembly.

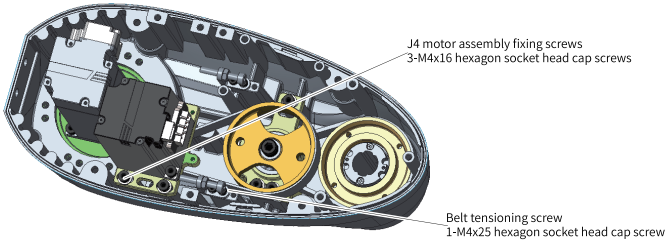
Remove the J4 motor, as shown below.



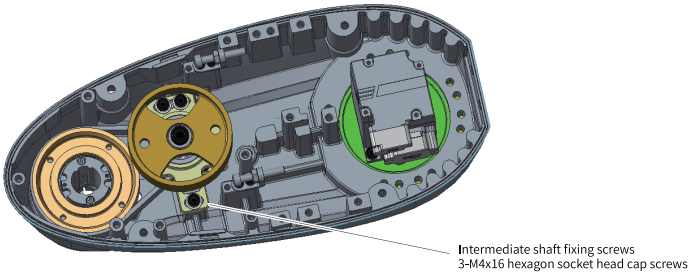
Step 4: Remove the screw nut mounting plate and replace the screw nut and shaft. Remove the screws fixing the screw nut mounting plate and the screws fixing the limit ring, remove the screw nut and shaft (Note that the screw nut and shaft must not be separated), and then replace the shaft and screw nut (Note: For the hot setting scheme, the pulley and screw nut are installed with interference fit, so the screw nut needs to be replaced together with the pulley; For the locking scheme, remove the pulley first and then the screw nut.)



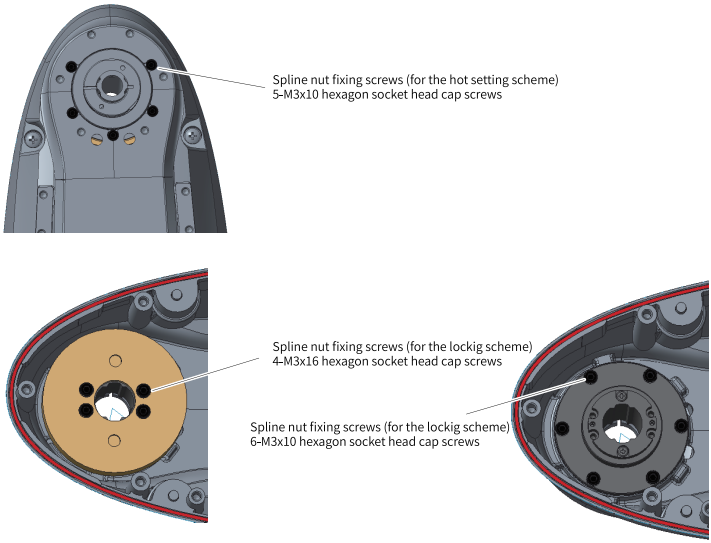
Step 5: Remove the J4 belt tensioning screw, the screws fixing the J4 assembly, and then remove the J4 motor assembly.



Step 6: Remove the screws fixing the intermediate shaft assembly and remove the intermediate shaft assembly.



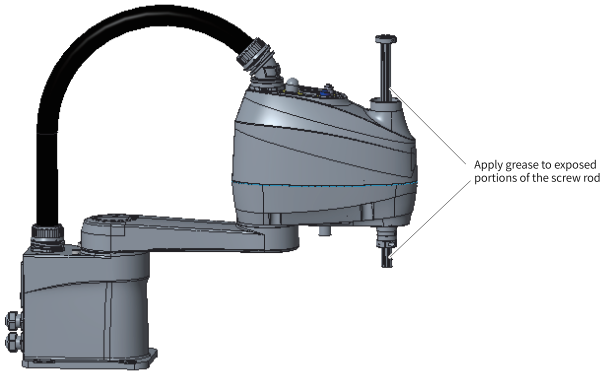
Step 7: Remove the screws fixing the spline nut, remove the spline nut assembly, and replace the spline nut (Note: For the hot setting scheme, the pulley and screw nut are installed with interference fit, so the screw nut needs to be replaced together with the pulley; For the locking scheme, remove the pulley first and then the screw nut.)



Step 8: Re-assemble the ball screw spline. To re-assemble the ball screw spline, reverse the above steps (M3 screw tightening torque: 2 N · m, M4 screw tightening torque: 3.5 N · m).

2.4.6 Maintaining the Ball Screw Spline

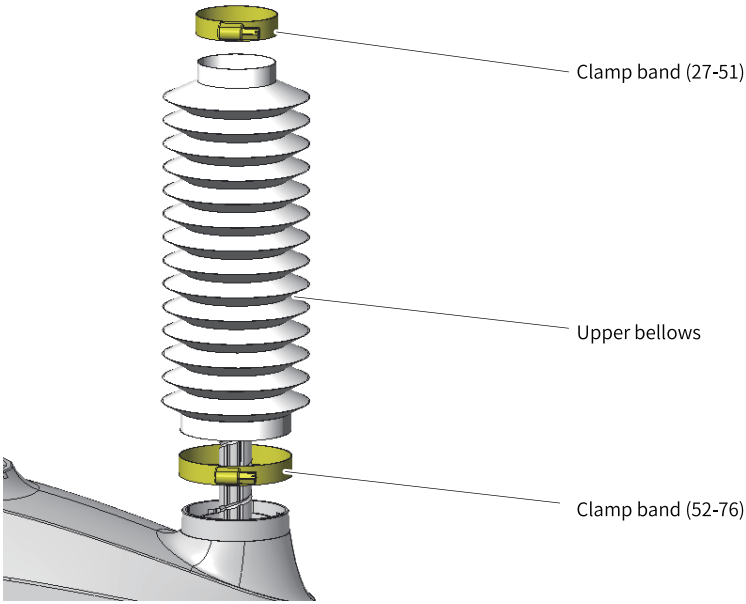
To lubricate the ball screw spline, do as follows:



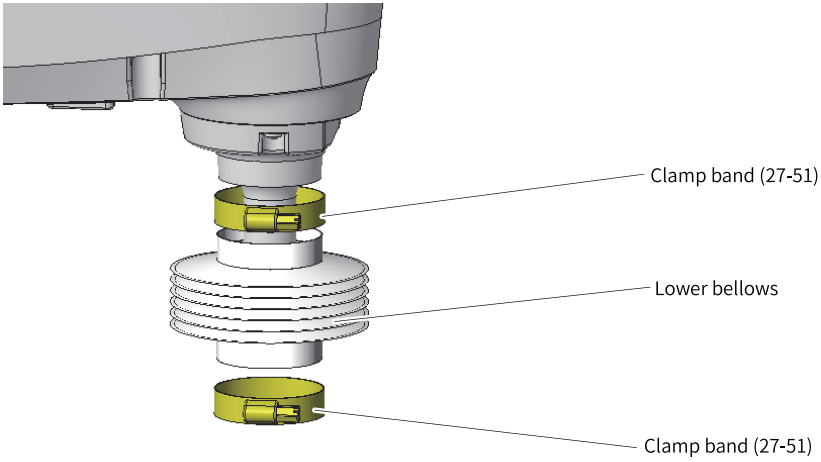
Clean the surface of the shaft with a clean cloth and apply grease (MUL TEMP LRL No.3) to the exposed portion of the shaft. Note that it is sufficient to continue to apply a thin layer of grease to the surface of the shaft, with a grease amount of 1 g. Excessive oil may splash onto processed products or equipment. The coating effect is shown in the following figure.

2.4.7 Replacing and Maintaining the Bellow of Cleanroom Model

Step 1: Remove the clamp band using a Phillips screwdriver and replace the upper bellow with a new one, then install the clamp band with a torque of 0.7 N·m.



Step 2: Remove the clamp band using a Phillips screwdriver and replace the lower bellow with a new one, then install the clamp band with a torque of 0.7 N · m.



2.4.8 Robot Cable Maintenance

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
- Do not remove the parts not mentioned in this document. Do not maintain any part with a method different from that described in this document.
- 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.

- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Prevent foreign objects from entering the equipment and terminals during maintenance.
- After the equipment is replaced, perform wiring inspection and parameter settings again.
- Connect the cables firmly. Do not lay heavy objects on the cables, or bend or pull the cables forcibly. Failure to comply will result in cable damage, wire breaking, or poor contact, causing electric shock or system fault.
- Wiring cables must meet diameter and shielding requirements. The shielding layer of the shielded cable must be reliably grounded at one end.
- Make the connections in correct sequence. Otherwise, the system may not work properly, which may cause safety hazards.
- After wiring, make sure there are no fallen screws and exposed cables inside the equipment.

2.4.8.1 Replacing the Cables Connected Between the Base and the Forearm

To replace the cables connected between the base and the forearm of the R-S4 series robots, follow the steps below.

Step 1: Turn on the robot controller.

Step 2: Hang a "Maintenance in process" sign. The "Maintenance in process" sign is used to prevent other operators from operating the robot.

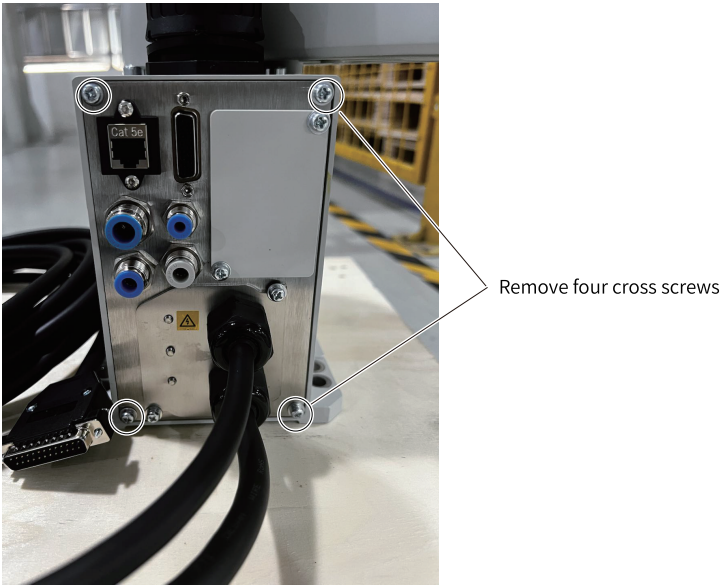
Step 3: Enter the safeguard system.

Step 4: Press the brake release switch to release the brake of J3, and then lower J3 to the lower limit. Ensure that sufficient space is left to prevent the end effector from colliding with peripheral devices.

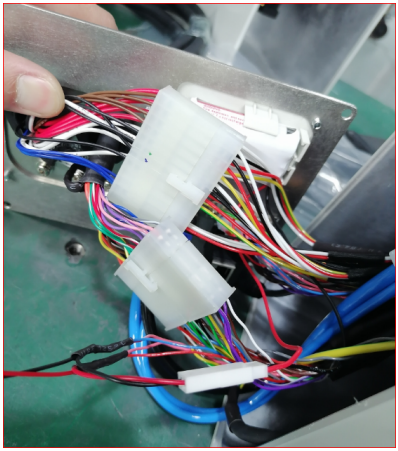
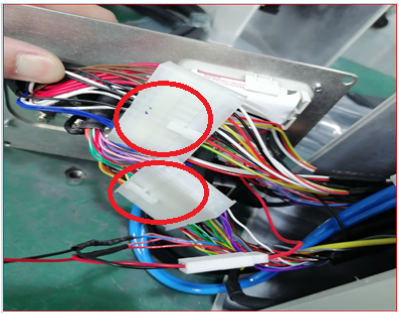
Step 5: Turn off the controller and disconnect the power and encoder cables connected to the controller.

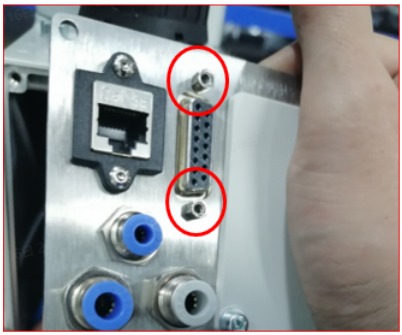
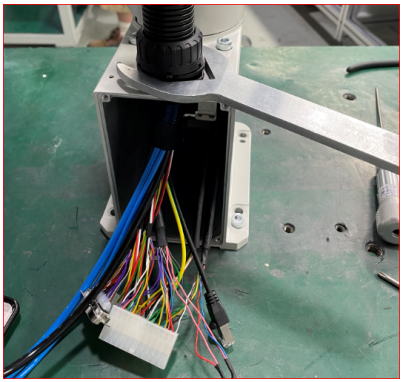
Step 6: Remove the four screws (4-M4×10 cross recessed pan head screws with captured flat and spring washers) from the front cover of the base and then remove the front cover.

Remove the front cover of the base, as shown below.

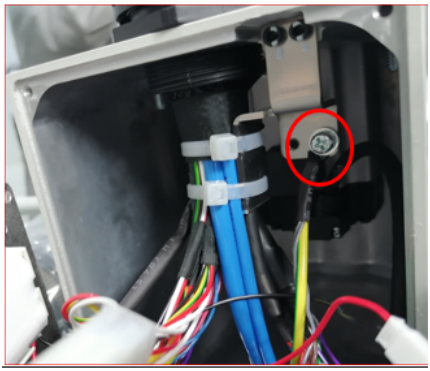
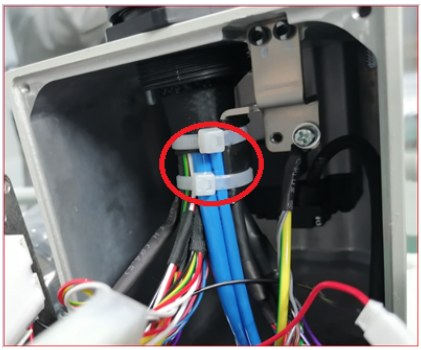


Step 7: Gently pull the internal cables out of the base, disconnect the power and encoder connectors connected to the base, disconnect the three air tubes and network cables connected to the cover of the base, disconnect the DB-15 connector, and then disconnect the grounding wire.

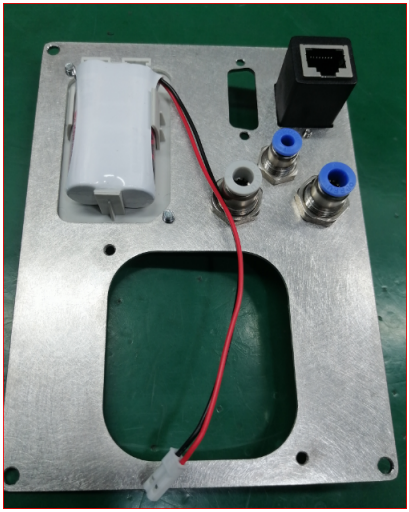
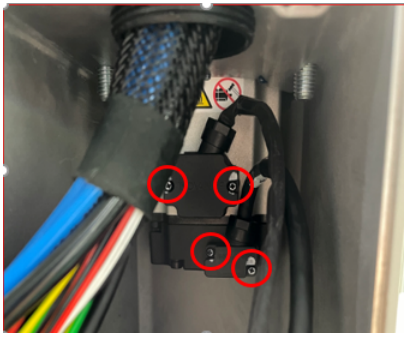
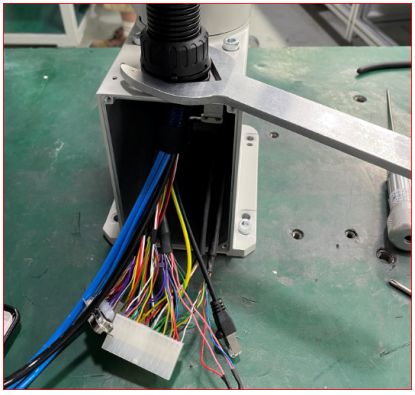
Step	Description	Diagram
①	Gently pull the internal cables out of the base	
②	Disconnect the power and encoder connectors	

Step	Description	Diagram
③	Disconnect the DB-15 connector	
④	Disconnect the network cable and air tube	

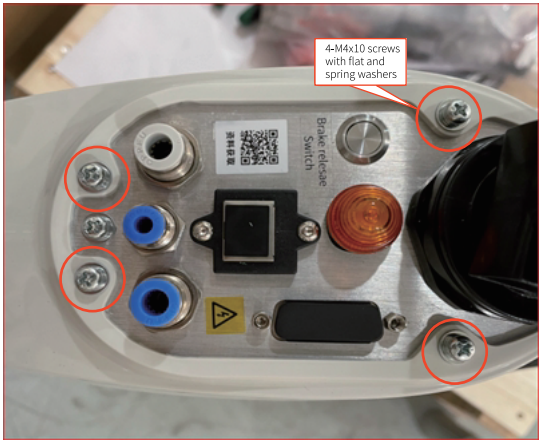
Step 8: Remove the grounding terminal fixed to the sheet metal inside the base and cut the cable tie.

Step	Description	Diagram
①	Remove Grounding terminal on the sheet metal inside the base	
②	Cut the cable tie	

Step 9: Remove the battery, disconnect the J1 encoder and power cable terminals, remove the bellows connector from the base, and lead the cables out of the base.

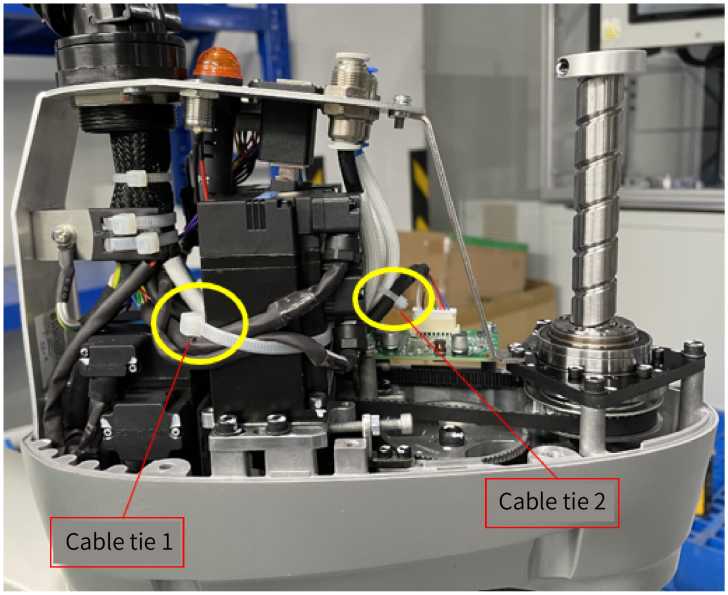
Step	Description	Diagram
①	Remove the battery	
②	Disconnect the J1 encoder and power cable terminals	
③	Remove the bellows connector from the base using a special tool provided	

Step 10: Remove the forearm enclosure.

Step	Description	Diagram
①	Top of the forearm enclosure	
②	Side screws	

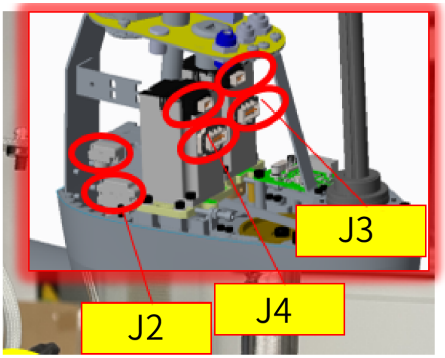
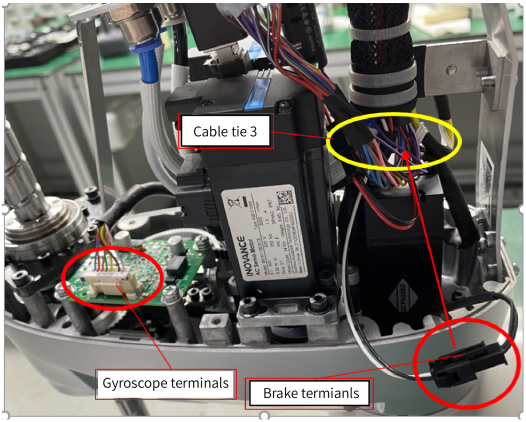
Step	Description	Diagram
③	Bottom screws	

Step 11: Cut the cable tie on the motor.



Step 12: Remove the screws (4-M2×8.5 cross recessed pan head screws) fixing the power and encoder connectors of J2, J3 and J4 using a Phillips screwdriver, and

gently remove the connectors from the male connector at the motor side. Be careful that the connector pins do not bend. Disconnect the brake button connector and the gyroscope terminals.

Step	Description	Diagram
①	Remove the screws (M2x8.5) fixing the power and encoder connectors of J2, J3 and J4 using a Phillips screwdriver	
②	Disconnect the brake button connector and the gyroscope terminals	

Step 13: Remove the screws (4-M4×8 cross recessed pan head screws) fixing the sheet metal of the forearm and remove the cables from the forearm.

Step 14: Remove the cables from the manipulator.

Step 15: Connect the power and encoder connectors connected to the controller and tighten the DB-25 connector of the encoder with a screwdriver.

2.4.8.2 Replacing the Cables Connected Between the Manipulator and Controller

This section describes how to replace the cable unit between the manipulator and the controller.

For the IR-S4 series robots, follow the steps below.

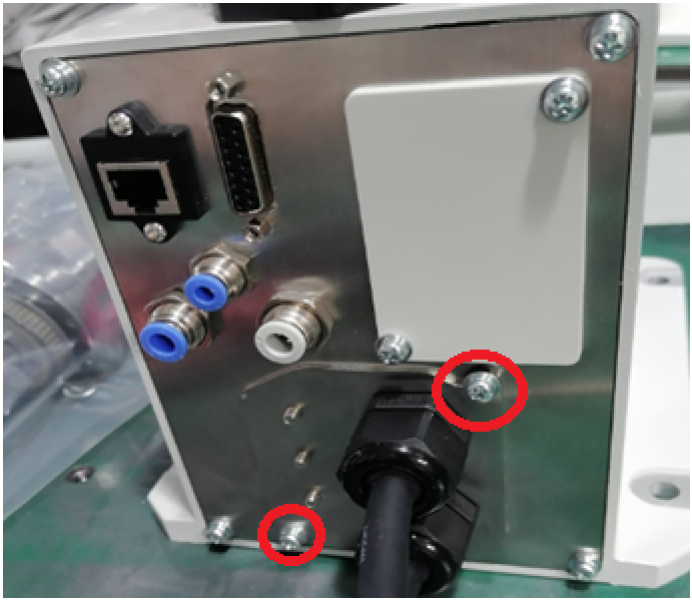
Step 1: Turn off the controller.

Step 2: Disconnect the power and encoder cables connected to the controller.

Step 3: Hang a "Maintenance in process" sign. The "Maintenance in process" sign is used to prevent other operators from operating the robot.

Step 4: Enter the safeguard system.

Step 5: Remove the two screws on the sheet metal of the trailing cable.



Step 6: Gently pull the trailing cable out of the base and disconnect the power and encoder connectors.

2.4.8.3 Replacing and Maintaining the Battery

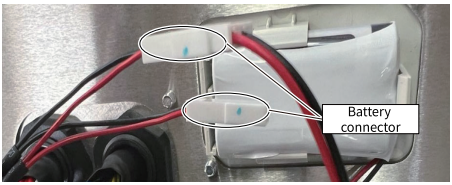
- Open the cover of the controller only when maintenance is needed. High voltage inside the controller poses a risk of electric shock even when the power is turned off.
- Before replacement, always turn off the power supply of the controller and related devices and remove the power plug. Operating with the power on may cause electric shock or malfunction.
- Do not remove or install the motor connector while the power is still on. Failure to comply may result in abnormal action of the manipulator, 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 manipulator, 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 replacement, always turn off the power supply of the controller and related devices and remove the power plug. Operating with the power on may cause electric shock or malfunction.
- 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.
  - Charging
  - Compression and deformation
  - Dismantling
  - Short circuit
  - Incorrect installation
  - Heating
  - Burning in fire
  - Soldering
  - 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.

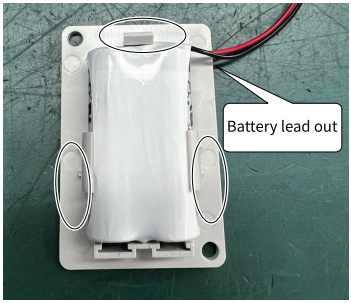
- If the lithium battery is exhausted, a warning voltage too low will occur when the controller is turned on (software startup) and the position data of the motor will be lost. In this case, you need to calibrate the origin of all joints.
- The service life of the lithium battery is 1.5 years. Replace 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:

Step 1: Return the robot to the zero point and cut off the power supply to the robot, then remove the battery cover at the rear of the base.

Step 2: Gently pull out the battery compartment, connect a new battery to the spare battery connector, then disconnect the old battery and secure the new battery to the compartment.





Step 3: Put back the battery compartment and fix it with two screws with a torque of 0.6 N·m.

2.4.9 Home Position Calibration

2.4.9.1 Description of Home Position Calibration

The home position is the reference point and base point for the robot. After parts (motors, reducer, timing belt, and cables etc.) have been replaced, the robot cannot execute the positioning properly because a mismatch exists between the home position stored in the motors and its corresponding home position stored in the controller. Therefore, home position calibration is required after the part replacement.

Note

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

Warning

- 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 performs unexpected actions.

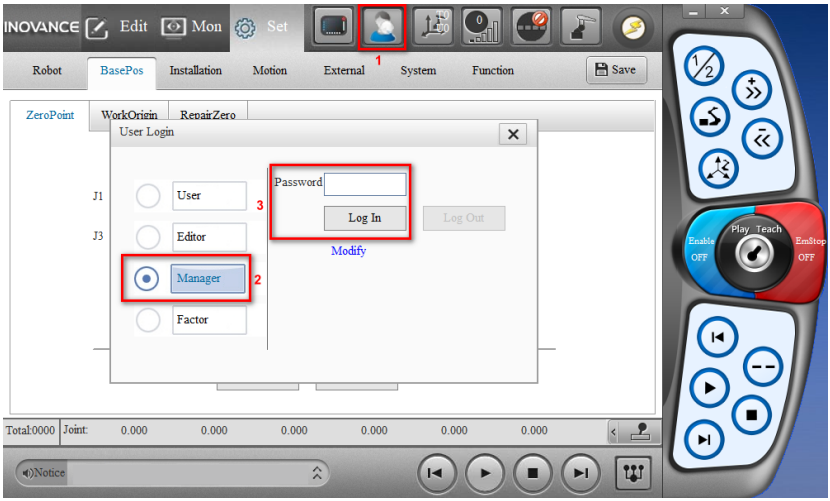
2.4.9.2 Home Position Calibration Procedure

Both the teaching software on PCs and the hand-held teach pendant provide an operation interface for home position calibration. The following takes the teaching software on PC as an example. The operations on the hand-held teach pendant are similar.

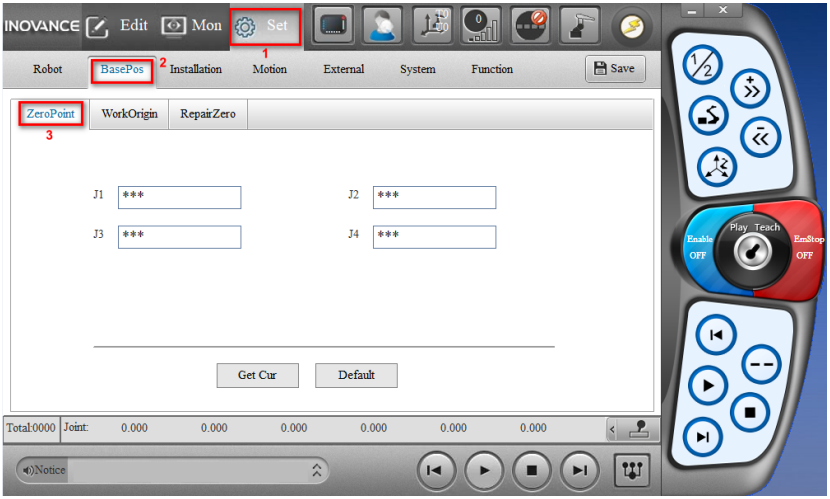
Due to the strong correlation between the coordinates of the robot's work points and the accuracy of J2, it is necessary to complete the home position calibration of J2 before calculating the robot coordinates. The teach pendant provides a right/left wrist rule wizard. Follow the wizard to calibrate the home position. For the adjustment method, see *"2.4.9.4 Home Position Calibration of J2" on page 70*.

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

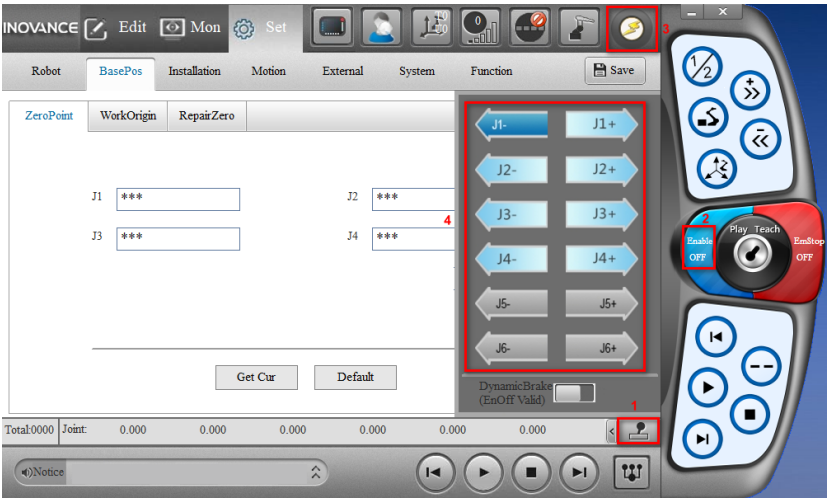
1. Log in to the user account.
   a. Click the shortcut key of user settings on the main interface of the PC teaching software or the hand-held teach pendant to open the user settings interface.
   b. Enter the password in the password input box and click the **log In** button.



2. Switch to the absolute zero setting interface.
   Choose **Set** > **BasePos** > **ZeroPoint** on the main interface of the teaching software or the hand-held teach pendant.

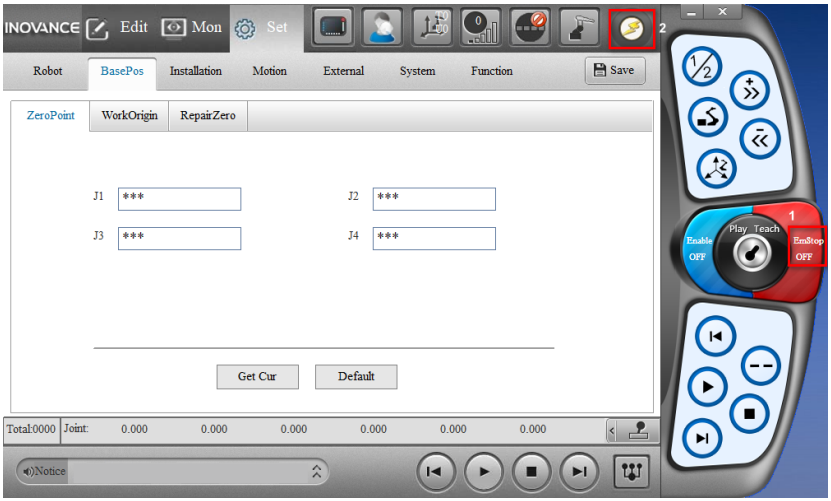


3. Move each joint of the robot to the home position.
   - Move the robot near the home position by using the joystick on the hand-held teach pendant or on the operation interface on the teaching software. See Teach Pendant User Guide.
   - Also, you can manually push the robot to the home position when the motor is not enabled.



4. Switch to the emergency stop state.
   a. Click the virtual emergency stop button on the PC teaching software or press the red emergency stop button on the hand-held teach pendant.

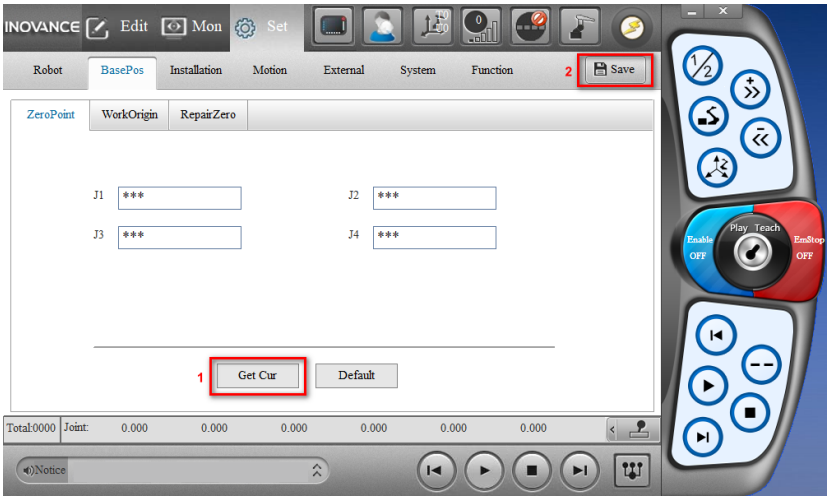
b. The status indicator on the upper right corner of the teaching software (or the display of the hand-held teach pendant) shows the emergency stop state (in red).



5. Obtain and save the home position information.

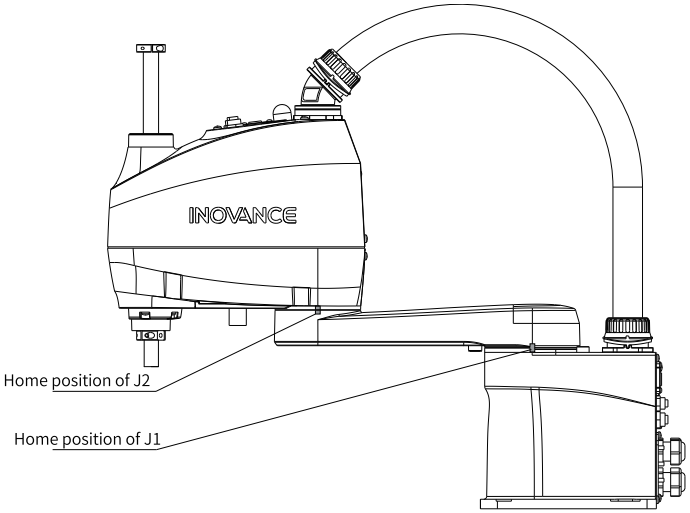
a. Click the **Get Cur** button when the robot moves to the home position to obtain the encoder pulses at the home position.

b. Click the **Save** button to complete the home position calibration.



2.4.9.3 Home Position of Each Joint

1. The following figure shows the home position of J1 and J2.



Model	J1 Max Motion Range	J2 Max Motion Range
IR-S4-40Z15S3	±132°	±141°

2. Home position of J3: Upper limit position in motion range.

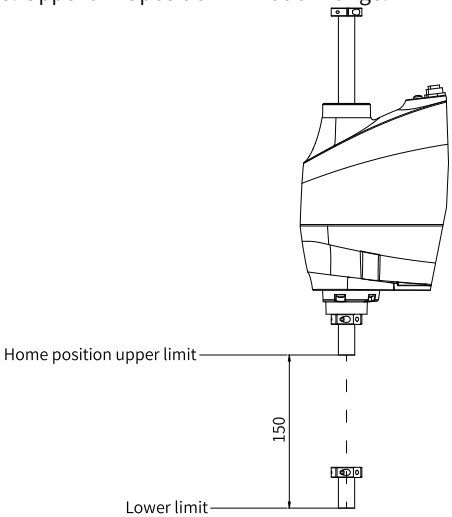


Figure 2-1

Model	Stroke of J3
IR-S4-40Z15S3	150 mm

3. Home position of J4: Position where the flat surface on the shaft (or the slots of the upper and lower mechanical stops) faces towards the tip of Arm #2.

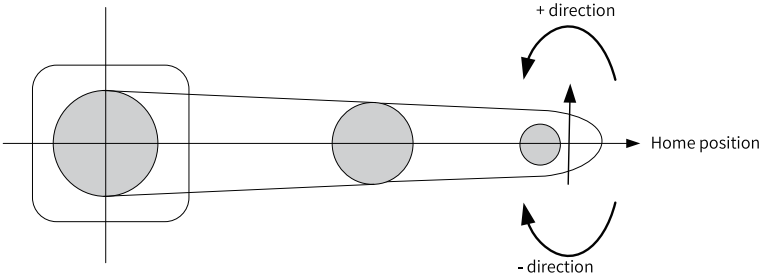


Figure 2-2

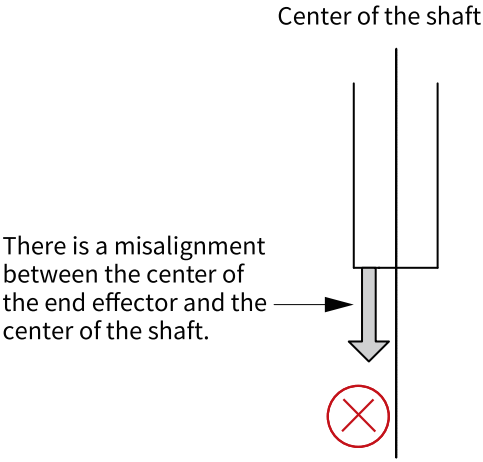
Model	J4 Max Motion Range
IR-S4-40Z15S3	±360°

2.4.9.4 Home Position Calibration of J2

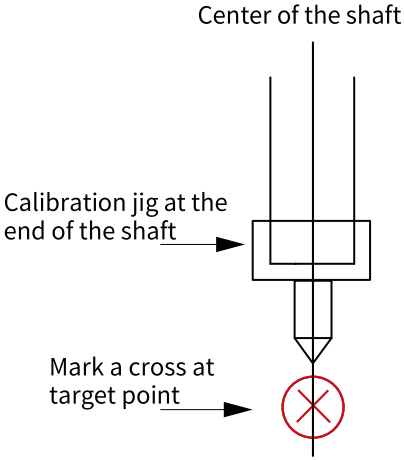
Due to the strong correlation between the coordinates of the robot's work points and the accuracy of J2, it is necessary to complete the home position calibration of J2 before calculating the robot coordinates. To calibrate the home position of J2, follow the wizard provided on the teach pendant for home position calibration using right/left wrist rule.

Calibration Procedure

1. The reference point for home position calibration 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 perform home position calibration.



2. Make a home position calibration jig (example) on the top side of the shaft to clarify the center of the shaft, as shown in the figure below. Make the position that can be easily recognized when changing the right/left wrist pose the target point, and mark it with X.



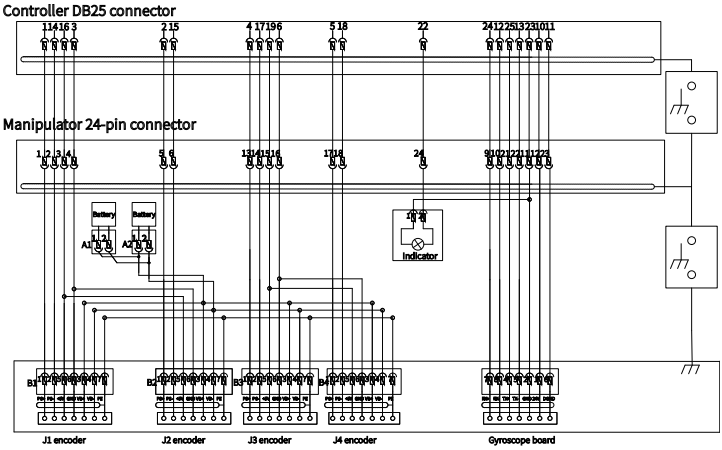
3. Perform home position calibration using the left/right wrist.
   a. Adjust the robot end to the target point position using the right wrist (or left wrist) pose. On the teach pendant, go to **Set** > **BasePos** > **ZeroPoint**, click the **Get Cur** button and record the degree of J2 in current state 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 in current state as Enc2.

c. On the teach pendant, go to **Set** > **BasePos** > **ZeroPoint**, click the **Default** button and get the currently saved home position info. Calculate (Enc1+Enc2)/2 and fill in the calculation result into the input box of J2, and then click the **Save** button. The home position calibration of J2 is complete.

4. After removing the end effector and executing the calibration, install the end effector and move the robot to the teaching point to verify whether is a a positional gap. If there is a positional gap, fine-tune the installation position of the end effector and teach the point again.

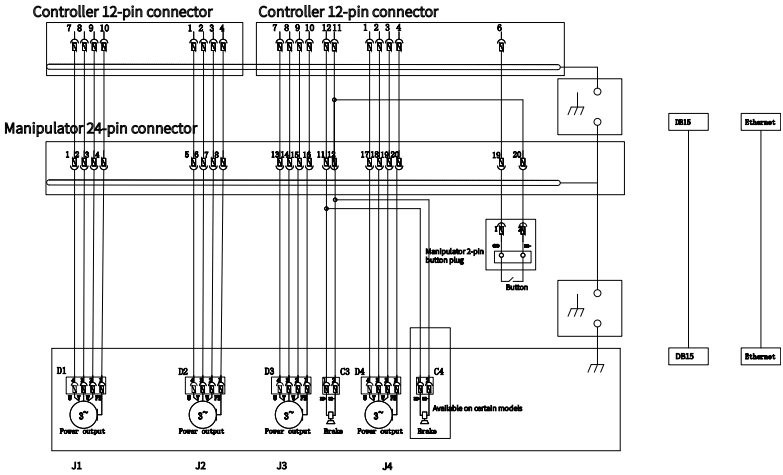
2.4.10Wiring Diagrams

The following figure shows the encoder cable connection.



Encoder Pin	7	1	2	5	6	3	4
Definition	Shield	PS+	PS-	5V	GND	BT+	BT-

The following figure shows the power cable connection.



Power Output Pin	1	2	3	4	1	2
Definition	U	V	W	PE	BK+	BK-

2.4.11Parts List

S4 series			
Parts Name		Parts Number	Maintenance Guide
AC servo motor	J1	01114669	"2.4.1.1 Maintaining the J1 Motor and Reducer" on page 30
	J2	01115498	"2.4.2.1 Maintaining the J2 Motor and Reducer" on page 35
	J3	01120393	"2.4.3.1 Maintaining the J3 Timing Belt, Brake and Motor" on page 39
	J4	01120393	"2.4.4.2 Maintaining the J4 Motor" on page 46
Reducer	J1	H: 72100615, X: 72100835	"2.4.1.1 Maintaining the J1 Motor and Reducer" on page 30
	J2	H: 72100613, X: 72100836	"2.4.2.1 Maintaining the J2 Motor and Reducer" on page 35
Timing belt	J3	72100564	"2.4.3.1 Maintaining the J3 Timing Belt, Brake and Motor" on page 39
	J4 primary belt	72100562	"2.4.4.1 Maintaining the J4 Timing Belt" on page 43
	J4 secondary belt	72100563	"2.4.4.1 Maintaining the J4 Timing Belt" on page 43
Ball screw spline		01792521	"2.4.5 Maintaining the Ball Screw Spline" on page 46

S4 series			
Parts Name		Parts Number	Maintenance Guide
Spare parts of ball screw spline (including sheave and screws)		98070252	-
Battery		71010029	*"2.4.8.3 Replacing and Maintaining the Battery" on page 63*
Grease	J1 reducer grease	H: 24060061 (SK-1A), X: 24060141 (SFB)	*"2.4.1.2 Replacing the Grease of J1 Reducer" on page 32*
	J2 reducer grease	H: 22010930 (SK-2), X: 24060141 (SFB)	*"2.4.2.2 Replacing the Grease of J2 Reducer" on page 37*
	Ball screw spline	24060125 MUL TEMP LRL No.3	*"2.4.6 Maintaining the Ball Screw Spline" on page 50*
Enclosure parts	Forearm enclosure	20212943	*"2.2.1 Removing and Installing the Enclosure of the Forearm" on page 21*
	Spline enclosure	20212944	*"2.2.2 Removing and Installing the Bottom Enclosure of Spline Nut" on page 22*
	Battery cover	20212945	-
	Limit post	20210329	-
Manipulator cable		1504D707	-
J3 brake and cables		1504D795	-
Upper bellows for cleanroom model		20422355	-
Upper bellows for cleanroom model		20422356	-

S4 series		
Parts Name	Parts Number	Maintenance Guide
Trailing cable of controller 1.0	1504D708: 3 m 1504D709: 5 m 1504D710: 10 m 1504D711: 15 m	-
Trailing cable of controller 2.0	1504PW06: 3 m 1504PW14: 5 m 1504PW15: 10 m 1504PW16: 15 m	-

3 IR-S7 Series SCARA Robots Maintenance Guide

3.1 Product Information

3.1.1 Model Description

IR- S 7 - 50 Z20 S 3
① ② ③ ④ ⑤ ⑥ ⑦

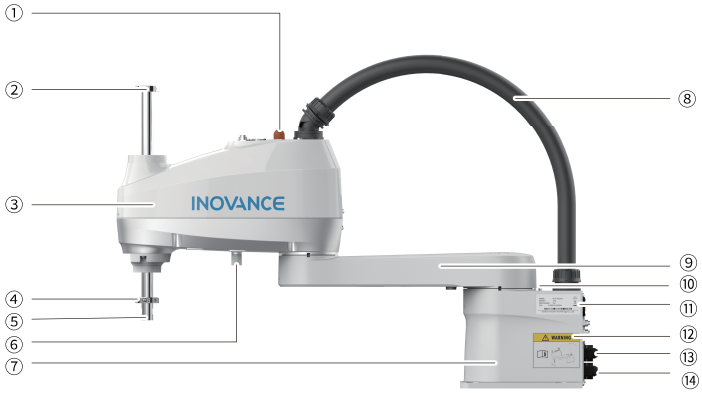
① **Product Family** INOVANCE Robot	④ **Arm Length** 50: 500 mm 60: 600 mm 70: 700 mm	⑦ **Cable Length** 0: No trailing cable 3: 3 m standard cable 5: 5 m standard cable G3: 3 m highly flexible cable
② **Series** S: SCARA robot R: 6-axis robot TS: Ceiling-mounted SCARA robot	⑤ **Max. Z-axis Stroke (Blank for models without lead screw)** Z20: Max. 200 mm stroke	-
③ **Payload** 4: 4 kg 7: 7 kg 10: 10 kg	⑥ **Installation Environment** C: Cleanroom S: Standard P: Protection	

Note

The product information in this guide is the information of standard models in a standard environment. For information about non-standard models or cleanroom models, contact the provider.

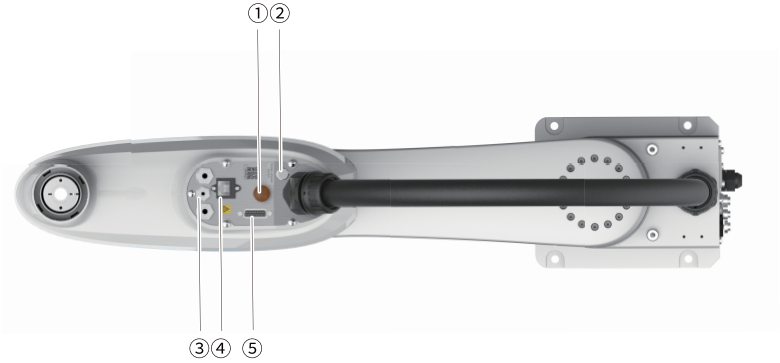
3.1.2 Components

Part 1



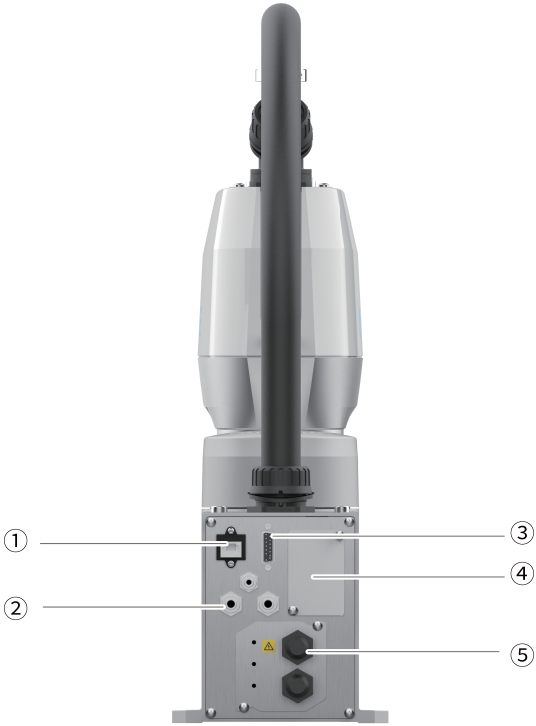
No.	Description
①	Run indicator
②	J3 upper mechanical stop
③	Arm 2
④	J3 lower mechanical stop
⑤	J3 lead screw
⑥	J2 mechanical stop
⑦	Base
⑧	Cable unit
⑨	Arm 1
⑩	J1 mechanical stop
⑪	Nameplate
⑫	Label
⑬	Power cable
⑭	Signal cable

Part 2



No.	Description
①	Indicator
②	Brake release switch
③	Air tube connector
④	Ethernet connector
⑤	DB15

Part 3



No.	Description
①	Ethernet connector
②	Air tube connector
③	DB15
④	Battery cover
⑤	Trailing cable

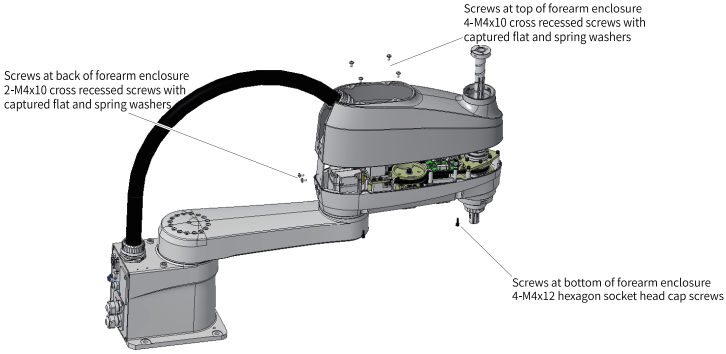
3.2 Enclosure Removal and Installation

Warning

- During removal and re-installation of the enclosure, do not pull it forcibly. Failure to comply will 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 in *"3.2.1 Removing and Installing the Enclosure of the Forearm" on page 81*.
- 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.

3.2.1 Removing and Installing the Enclosure of the Forearm

The following figure shows the removal and installation of the enclosure of the forearm.



Steps:

1. Remove the six cross recessed pan head screws on the top and back.
2. Remove the four hexagon socket head cap screws on the bottom.
3. Lift and remove the forearm enclosure. To install the enclosure, put back the enclosure and ensure that it fits properly with the forearm. Then tighten the ten screws from the bottom to the top with a torque of 0.6 N·m.

3.2.2 Removing and Installing the Bottom Enclosure of Spline Nut

The following figure shows the removal and installation of the bottom enclosure of the spline nut.

To remove and install the bottom enclosure of the spline nut, do as follows:

Step 1: Remove the screws of the enclosure of the spline nut (3-M4×10 cross recessed screws with captured flat and spring washers).

Step 2: Remove the enclosure of the spline nut. When installing the enclosure, fix the screws with a torque of 0.6 N·m.

3.3 Regular Inspection

3.3.1 Regular Inspection Checklist

To make the robot run safely and efficiently, it needs to be inspected and maintained regularly. Maintenance can only be carried out after confirming the safety of the robot system. Only authorized personnel who have taken safety training should be allowed to perform the robot maintenance. Inspection points are divided into five stages: daily, monthly, quarterly, semi-annual, and annual. The inspection points are added every stage.

- Inspection while the power is OFF (robot is not operating)

Inspection Point	Inspection Place	Daily inspection	Monthly Inspection	Quarterly Inspection	Semi-annual Inspection	Annual Inspection
Check whether the screws are loose. If yes, tighten them.	Mounting screw of the end effector	✓	✓	✓	✓	✓
	Robot base mounting screws	✓	✓	✓	✓	✓
	Each joint	✓	✓	✓	✓	✓
	Screws around the axes	-	-	-	-	✓
	Screws securing the the motor, reducer, etc.	-	-	-	-	✓
Check whether the connector is loose. If yes, push it securely or tighten it.	Parts external to the robot (such as the connector board)	✓	✓	✓	✓	✓
	Robot cable unit	-	✓	✓	✓	✓
Check for scratches and remove dust.	Manipulator	✓	✓	✓	✓	✓
	External cables	-	✓	✓	✓	✓
Correct deformation and position offset.	Safeguard etc.	✓	✓	✓	✓	✓
Check tension of the timing belt. Tighten it if necessary.	Inside arm #2	-	-	-	✓	✓

Inspection Point	Inspection Place	Daily inspection	Monthly Inspection	Quarterly Inspection	Semi-annual Inspection	Annual Inspection
Check if the lubricating grease is sufficient for lubrication, and add an appropriate amount of lubricating grease as needed.	Ball screw spline	-	-	✓	✓	✓
Check whether there is dust at the outlet of fan of the robot controller. If yes, clean it.	-	-	-	✓	✓	✓

- Inspection while the power is ON (robot is not operating)

Inspection Point	Inspection Place	Daily inspection	Monthly Inspection	Quarterly Inspection	Semi-annual Inspection	Annual Inspection
Shake the cable gently by hand to check for wire breakage.	Parts external to the robot (such as the connector board)	-	-	-	✓	✓
Press each arm by hand in the enabled state to check whether the arms shake.	Each arm	-	-	-	-	✓
Check whether the fan of the robot controller works properly. If not, replace the controller.	Controller	-	✓	✓	✓	✓

- Inspection while the power is ON (robot is operating)

Inspection Point	Inspection Place	Daily inspection	Monthly Inspection	Quarterly Inspection	Semi-annual Inspection	Annual Inspection
Check the motion range.	Each joint	-	-	-	-	✓
Check whether unusual sound or vibration occurs.	Manipulator	✓	✓	✓	✓	✓
Measure the accuracy repeatedly by a gauge.	Manipulator	-	-	-	-	✓

3.3.2 Screw Tightening Torque and Method

Otherwise specified, tighten the hexagon socket-head cap screws according to the following torque.

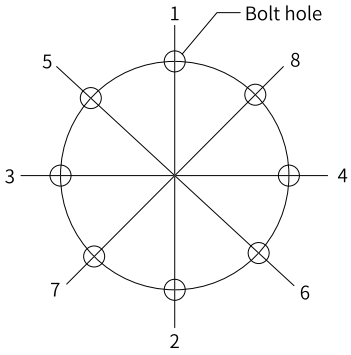
Caution

The tightening torque of the robot housing screws must not damage the housing.

The torque of the screws except those connected to the reducer is listed in the following table.

Screw	Torque (N·m)
M3	2
M4	3.5
M6	15
M8	30

Tighten the screws in the sequence shown below:



Do not tighten the screw to the maximum torque value at a time. Tighten the screws slightly with an Allen wrench as shown in the preceding figure. Then tighten the screws to the torque values in the table above with a torque wrench.

Otherwise specified, tighten the set screw according to the following torque:

Screw	Torque (N·m)
M3	0.8
M4	1.8

3.3.3 Grease Refilling

The following table describes the grease refilling cycle:

Joint	Position	Cycle
J1	Reducer	When replacing the motor.
J2	Reducer	When replacing the motor.
J3	Ball screw spline	3 months

Cautions:

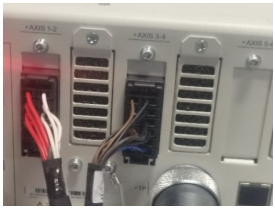
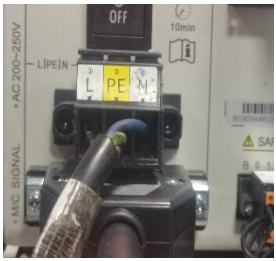
1. Only use original grease. See *"3.4.11 Parts List" on page 134* for the grease type.
2. It is strictly forbidden to deplete the grease of the ball screw spline, otherwise irreversible mechanical damage may occur.
3. Normally, the reducer does not require grease refilling. However, under the extreme conditions (duty cycle, speed, load), the grease needs to be refilled every 10,000 hours.

Note

- If the grease gets into your eyes, flush them thoroughly with clean water, and then see a doctor immediately;
- If the grease gets into your mouth, wash out your mouth with water thoroughly; if swallowed, see a doctor immediately;
- If the grease gets on your skin, wash the area thoroughly with soap and water.

3.3.4 Controller Cable Inspection

The following table describes the inspection of controller cables:

No.	Item	Diagram	Cycle
①	Check that the power cable of the manipulator is properly connected to the controller.		Daily
②	Check that the teach pendant cable is properly connected to the controller.		Daily
③	Check that the external power cable (Brown for L, blue for N, and yellowgreen for PE respectively) and the encoder cable are properly connected to the controller.		Daily
④	Wipe off any acid, alkali, oil, or corrosive liquids with wiping paper or a dry cloth	All cables	Monthly

3.4 Replacement and Maintenance

3.4.1 J1 Maintenance

Tools list:

	Name	Quantity
Maintenance Parts	J1 motor	1
	J1 reducer	1
	Reducer grease	-
Tools	Hexagonal wrench	1
	Torque screwdriver (0 N·m to 25 N·m)	1
	Hexagon bit set	1
	LOCTITE 638 and 243	Several
	Oil-absorbing sheet	Several
	Wiping cloth	Several

Screw tightening torque reference:

Screw	Torque (N·m)
M3	2
M4	5

Note

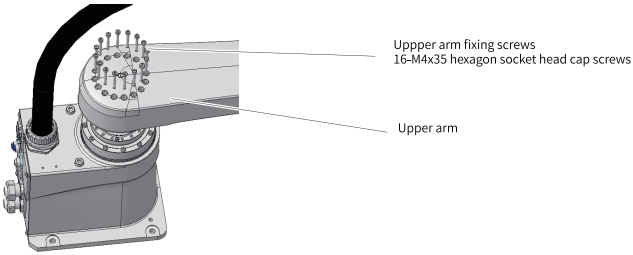
- Recommended bit specifications: 3/4/5/6/8 mm diameter, 15 cm length; 1.5/2/2.5 mm diameter, 10 cm length
- Recommended cross screwdriver specifications: 5 mm diameter, 20 cm length; 3 mm diameter, 15 cm length

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
- Do not remove the parts not mentioned in this document. Do not maintain any part with a method different from that described in this document.
- 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.
- After the motor is maintained, it is necessary to calibrate the zero point. Otherwise, the motor may encounter runaway after restart, posing serious safety hazards.

- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Prevent foreign objects from entering the equipment and terminals during maintenance.
- After the equipment is replaced, perform wiring inspection and parameter settings again.
- 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 motor and encoder. Failure to comply may result in motor failure due to misalignment during reassembly.

3.4.1.1 Maintaining the J1 Motor and Reducer

Step 1: Remove the upper arm and forearm by removing the forearm fastening screws (16-M4×35 socket head screws).

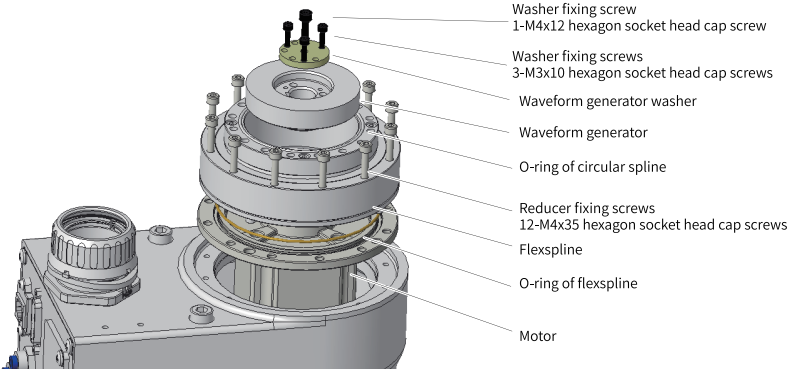


Note

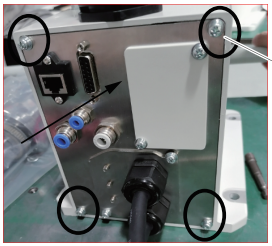
When removing the screws of the upper arm, hold the forearm to prevent the manipulator from tipping over due to an unstable center of gravity.

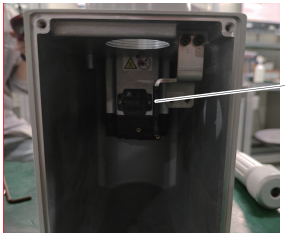
Step 2: Remove the waveform generator as follows: Remove the waveform generator fixing screws, clamp the washer with a circlip pliers, screw the M5 screw into the M5 hole in the middle of the washer, remove the waveform generator and then remove the washer fixing screws.

Step 3: Remove the reducer fixing screws, remove the O-ring of circular spline and then the flex spline, and replace the reducer with a new one. For the parts number, see *"3.4.11 Parts List" on page 134*.

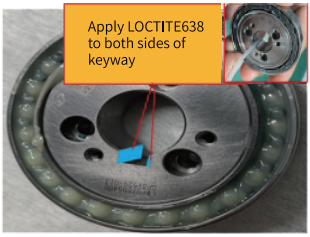


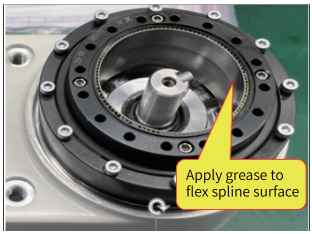
Step 4: Remove the sheet metal fixing screws on the base, disconnect the power cables and encoder cables of the J1 motor, remove the motor and replace it with a new one. For the parts number, see *"3.4.11 Parts List" on page 134*. To re-assemble, reverse the above steps. Note that the grease needs to be replaced after the motor and reducer are replaced. For replacement of the grease, see *"3.4.1.2 Replacing the Grease of J1 Reducer" on page 91* (M3 screw tightening torque: 2 N·m, M4 screw tightening torque: 5 N·m).





Step 5: To re-assemble, reverse the above steps. Note that the grease needs to be replaced after the motor and reducer are replaced. For replacement of the grease, see *"3.4.1.2 Replacing the Grease of J1 Reducer" on page 91*. In addition, apply LOCTITE 638 retaining compound to the keyway of the waveform generator and grease to the surface of the flex spline of the reducer (H: SK-1A grease, X: SFB grease). (M3 screw tightening torque: 2 N·m, M4 screw tightening torque: 5 N·m. All reducer screws must be coated with LOCTITE 243 threadlocker).



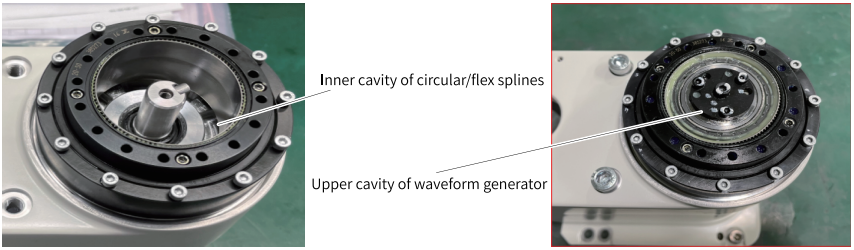


3.4.1.2 Replacing the Grease of J1 Reducer

Step 1: Remove the upper arm and forearm according to Step 1 in *"3.4.1.1 Maintaining the J1 Motor and Reducer" on page 89* (See the figure of Step 1 in *"3.4.1.1 Maintaining the J1 Motor and Reducer" on page 89*.)

Step 2: Remove the waveform generator according to Step 2 in *"3.4.1.1 Maintaining the J1 Motor and Reducer" on page 89*. Remove the circular spline and flexspline according to Step 3 in *"3.4.1.1 Maintaining the J1 Motor and Reducer" on page 89*.

Step 3: Apply grease to the waveform generator. Clean the old grease from the waveform generator and the circular/flex splines of the harmonic reducer, and apply grease (H: SK-1A grease, X: SFB grease) evenly to the inner cavity of the circular/flex splines (approx. 58.4 ml, 52 g) and upper cavity of the waveform generator (approx. 23.5 ml, 21 g).



Step 4: Re-assemble the reducer. To re-assemble, reverse the above steps (M3 screw tightening torque: 2 N·m, M4 screw tightening torque: 5 N·m. All reducer screws must be coated with LOCTITE 243 threadlocker).

3.4.2 J2 Maintenance

Tools list:

	Name	Quantity
Maintenance Parts	J2 motor	1
	J2 reducer	1
	Reducer grease	-
Tools	Hexagonal wrench	1
	Torque screwdriver (0 N·m to 10 N·m)	1
	Hexagon bit set	1
	LOCTITE 638 and 243	Several
	Oil-absorbing sheet	Several
	Wiping cloth	Several
	Phillips screwdriver	2

Note

- Recommended bit specifications: 3/4/5/6/8 mm diameter, 15 cm length; 1.5/2/2.5 mm diameter, 10 cm length
- Recommended cross screwdriver specifications: 5 mm diameter, 20 cm length; 3 mm diameter, 15 cm length

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
- Do not remove the parts not mentioned in this document. Do not maintain any part with a method different from that described in this document.
- 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.
- After the motor is maintained, it is necessary to calibrate the zero point. Otherwise, the motor may encounter runaway after restart, posing serious safety hazards.

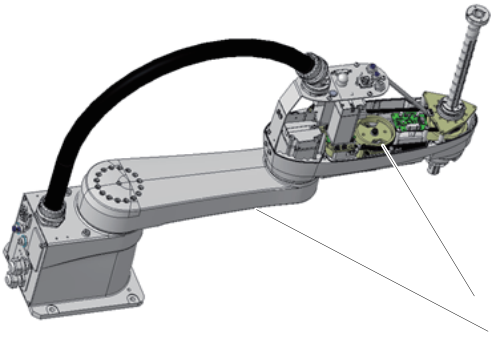
Warning

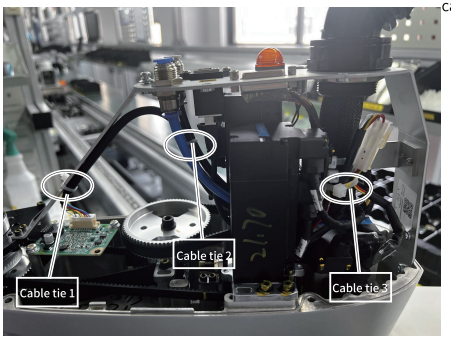
- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Prevent foreign objects from entering the equipment and terminals during maintenance.
- After the equipment is replaced, perform wiring inspection and parameter settings again.
- 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 motor and encoder. Failure to comply may result in motor failure due to misalignment during reassembly.

3.4.2.1 Maintaining the J2 Motor and Reducer

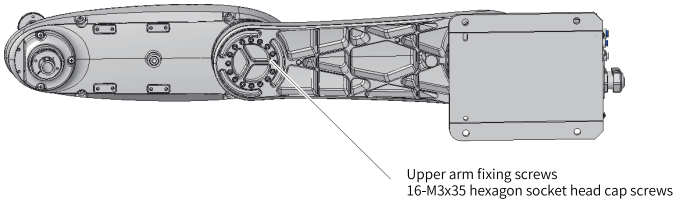
Step 1: Remove the forearm enclosure. Remove the enclosure according to *"3.2.1 Removing and Installing the Enclosure of the Forearm" on page 81* (see figure in *"3.2.1 Removing and Installing the Enclosure of the Forearm" on page 81*).

Step 2: Remove the sheet metal fixing screws. Remove the 3-M4×10 cross recessed screws with captured flat and spring washers on the back and top of the sheet metal part of the forearm, disconnect the power cables and encoder cables of the J2, J3, J4 motors and then remove the sheet metal part and the cables.



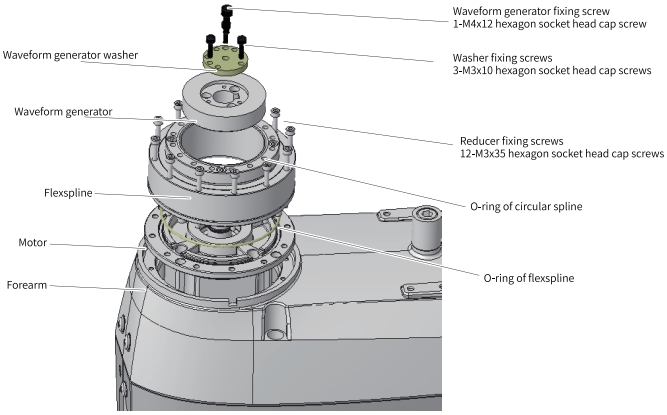


Step 3: Remove the the upper arm fixing screws and remove the J2 assembly.

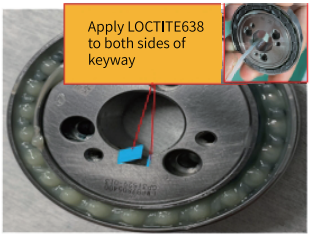


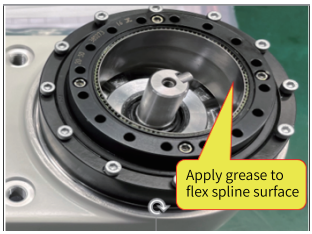
Step 4: Remove the waveform generator fixing screws, clamp the washer with a circlip pliers, screw the M5 screw into the M5 hole in the middle of the washer, remove the waveform generator and then remove the washer fixing screws.

Step 5: Remove the reducer fixing screws, remove the reducer and the O-ring, then remove the motor fixing screws and replace the motor or reducer. For the parts number, see *"3.4.11 Parts List" on page 134*.



Step 6: Re-assemble the J2 motor and reducer. To re-assemble, reverse the above steps. Note that the grease needs to be replaced after the motor and reducer are replaced. For replacement of the grease, see *"3.4.2.2 Replacing the Grease of J2 Reducer " on page 96*. In addition, apply LOCTITE 638 retaining compound to the keyway of the waveform generator and grease to the surface of the flex spline of the reducer (H: SK-1A grease, X: SFB grease). For the grease type, see the parts list (M3 screw tightening torque: 2 N·m, M4 screw tightening torque: 5 N·m. All reducer screws must be coated with LOCTITE 243 threadlocker).



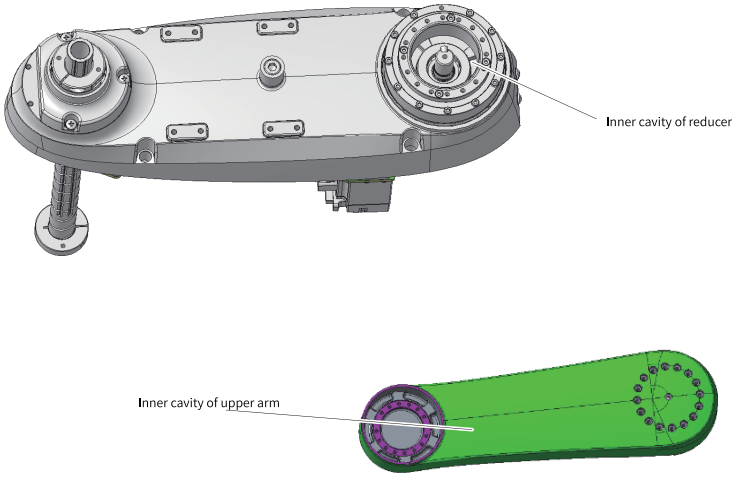


3.4.2.2 Replacing the Grease of J2 Reducer

Step 1: Remove the J2 motor assembly. Remove the J2 motor assembly and waveform generator according to Steps 1-5 in *"3.4.2.1 Maintaining the J2 Motor and Reducer" on page 94*.

Step 2: Clean the old grease from the waveform generator and the circular spline of the harmonic reducer, and apply grease (H: SK-1A grease, X: SFB grease) evenly to the

inner cavity of the reducer (approx. 20 ml, 18 g) and the forearm (approx. 12.3 ml, 11 g). For grease types, see *"3.4.11 Parts List" on page 134*.



Step 3: Re-assemble the reducer. To re-assemble, reverse the above steps (M3 screw tightening torque: 2 N·m, M4 screw tightening torque: 5 N·m. All reducer screws must be coated with a threadlocker).

3.4.3 J3 Maintenance

Tools list:

	Name	Quantity
Maintenance Parts	J1 motor	1
	Other timing belt	1
	Brake	1
	Reducer grease	-
Tools	Hexagonal wrench	1
	Torque screwdriver (0 N·m to 10 N·m)	1
	Hexagon bit set	1
	Oil-absorbing sheet	Several
	Wiping cloth	Several
	Phillips screwdriver	2
	Tension meter	1

Screw tightening torque reference:

Screw	Torque (N·m)
M4	3.5
M3	1
M4 set screw	1.8N·m

Note

- Recommended bit specifications: 3/4/5/6/8 mm diameter, 15 cm length; 1.5/2/2.5 mm diameter, 10 cm length
- Recommended cross screwdriver specifications: 5 mm diameter, 20 cm length; 3 mm diameter, 15 cm length

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
- Do not remove the parts not mentioned in this document. Do not maintain any part with a method different from that described in this document.
- 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.
- After the motor is maintained, it is necessary to calibrate the zero point. Otherwise, the motor may encounter runaway after restart, posing serious safety hazards.

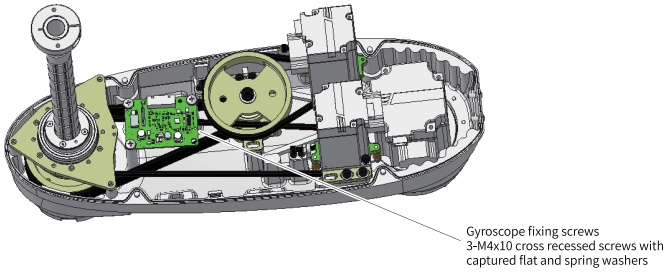
Warning

- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Prevent foreign objects from entering the equipment and terminals during maintenance.
- After the equipment is replaced, perform wiring inspection and parameter settings again.
- 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 motor and encoder. Failure to comply may result in motor failure due to misalignment during reassembly.

3.4.3.1 Maintaining the J3 Timing Belt

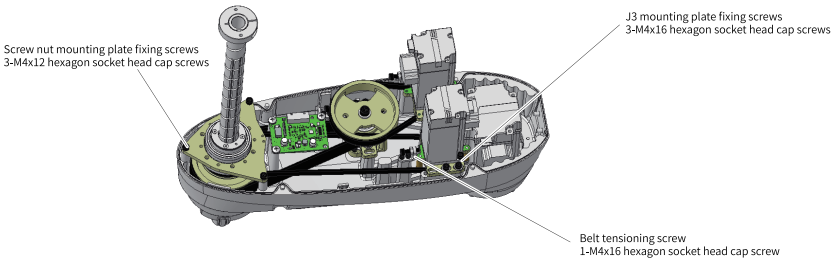
Step 1: Remove the enclosure, cables and sheet metal components of the forearm. Remove the enclosure according to *"3.2.1 Removing and Installing the Enclosure of the Forearm" on page 81* (See figure in *"3.2.1 Removing and Installing the Enclosure of the Forearm" on page 81*). Remove the cables and sheet metal components according to Step 2 in *"3.4.2.1 Maintaining the J2 Motor and Reducer" on page 94* (See figure in *"3.2.1 Removing and Installing the Enclosure of the Forearm" on page 81*).

Step 2: Remove the gyroscope board. Remove the screws that fix the gyroscope board and then remove the gyroscope board.



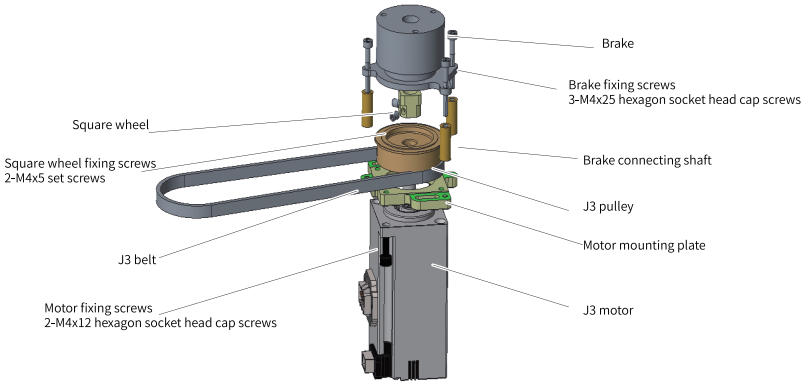
Step 3: Remove the J3 belt tensioning screw, the screws fixing the J3 mounting plate, the screws fixing the screw nut mounting plate, remove the shaft and screw nut

assembly first (Note that the screw nut and shaft must not be separated), and then remove the J3 motor assembly.



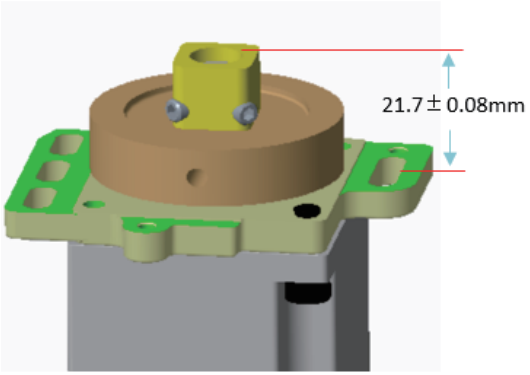
Step 4: Replace the J3 timing belt. Remove the J3 motor assembly, and remove the brake fixing screw, then remove the brake so you can replace the belt. Re-assemble the J3 (M4 screw tightening torque: 3.5 N·m and M3 screw tightening torque: 1 N·m) by reversing Steps 1, 2, and 3. Tighten the belt with the tension screw (Measure the belt with a tension meter to ensure the frequency is 110 Hz to 120 Hz).

Step 5: Replace the brake and motor. Remove the square wheel fixing screws, replace the square wheel and brake. (Note that the service life of the brake for emergency stop is 2,000 times. Replace the brake when the service life expires.) Remove the pulley fixing screws and the motor fixing screws and replace the motor.



Step 6: Re-assemble the J3 timing belt. After replacing the motor and brake, install the pulley and the square wheel (Align two set screw holes with D-cut of the motor). Use a height scale to ensure that the top of the square wheel is 21.7 ± 0.08 mm from the motor mounting plate, and then lock the square wheel with M4×5 set screws. Then reinstall the J3 (M4×5 set screw tightening torque: 1.8 N·m, M4 screw: 3.5 N·m, M3 screw tightening torque: 1 N·m) by reversing the Steps 1 and 2. Tighten the belt

with the tension screw (Measure the belt with a tension meter to ensure the frequency is 110 Hz to 120 Hz).



3.4.4 J4 Maintenance

Tools list:

	Name	Quantity
Maintenance Parts	J1 motor	1
	Other timing belt	2
	Reducer grease	-
Tools	Hexagonal wrench	1
	Torque screwdriver (0 N·m to 10 N·m)	1
	Hexagon bit set	1
	Oil-absorbing sheet	Several
	Wiping cloth	Several
	Phillips screwdriver	2
	Tension meter	1

Screw tightening torque reference:

Screw	Torque (N·m)
M3	1.5
M4	3

Note

- Recommended bit specifications: 3/4/5/6/8 mm diameter, 15 cm length; 1.5/2/2.5 mm diameter, 10 cm length
- Recommended cross screwdriver specifications: 5 mm diameter, 20 cm length; 3 mm diameter, 15 cm length

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
- Do not remove the parts not mentioned in this document. Do not maintain any part with a method different from that described in this document.
- 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.
- After the motor is maintained, it is necessary to calibrate the zero point. Otherwise, the motor may encounter runaway after restart, posing serious safety hazards.

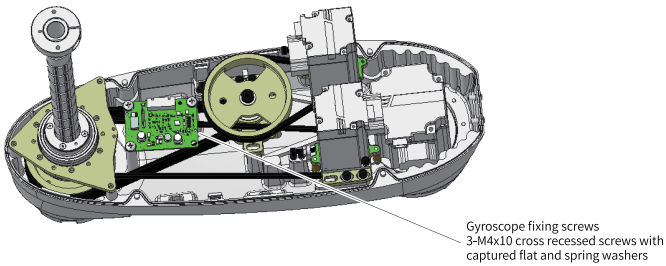
Warning

- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Prevent foreign objects from entering the equipment and terminals during maintenance.
- After the equipment is replaced, perform wiring inspection and parameter settings again.
- 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 motor and encoder. Failure to comply may result in motor failure due to misalignment during reassembly.

3.4.4.1 Maintaining the J4 Timing Belt

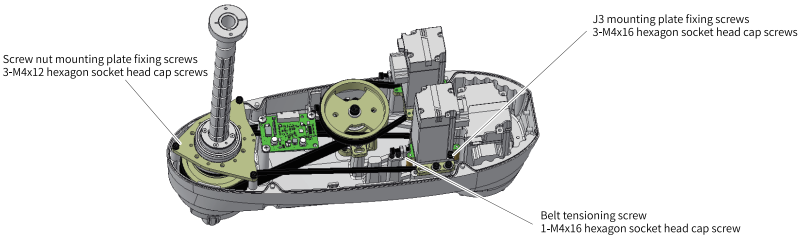
Step 1: Remove the enclosure, cables and sheet metal components of the forearm. Remove the enclosure according to *"3.2.1 Removing and Installing the Enclosure of the Forearm" on page 81* (See figure in *"3.2.1 Removing and Installing the Enclosure of the Forearm" on page 81*). Remove the cables and sheet metal components according to Step 2 in *"3.4.2.1 Maintaining the J2 Motor and Reducer" on page 94* (See figure in *"3.2.1 Removing and Installing the Enclosure of the Forearm" on page 81*).

Step 2: Remove the gyroscope board. Remove the screws that fix the gyroscope board and then remove the gyroscope board.

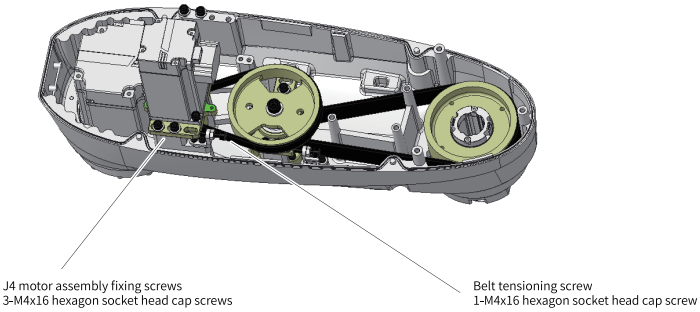


Step 3: Remove the J3 belt tensioning screw, the screws fixing the J3 mounting plate, the screws fixing the screw nut mounting plate, remove the shaft and screw nut

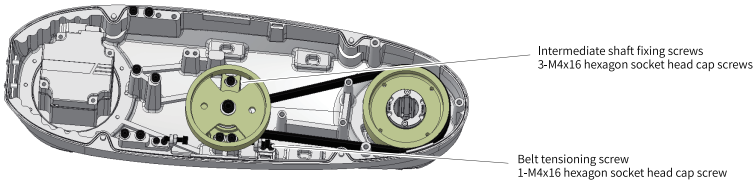
assembly (Note that the screw nut and shaft must not be separated), and then remove the J3 motor assembly.



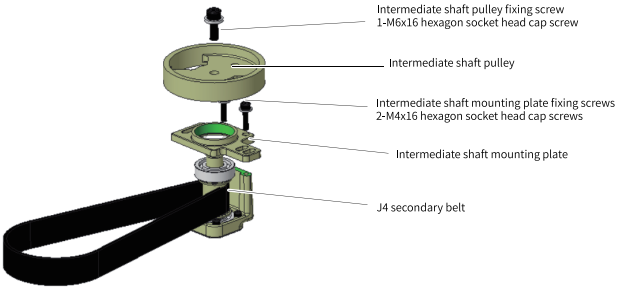
Step 4: Remove the J4 belt tensioning screw, the screws fixing the J4 assembly, remove the J4 motor assembly, and then replace the primary belt. The belt frequency is 395 Hz to 425 Hz.



Step 5: Remove the intermediate shaft fixing nut and remove the intermediate shaft assembly.



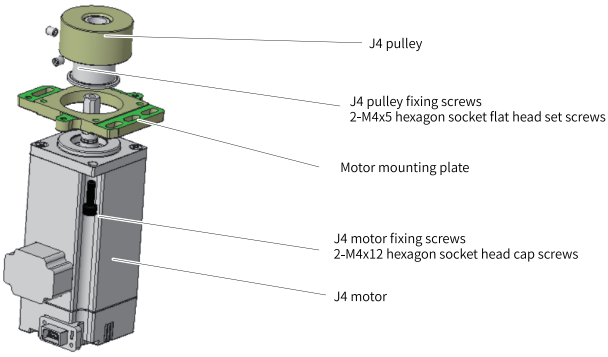
Step 6: Remove the J4 motor assembly and the intermediate shaft assembly. Remove the pulley fixing screws of the intermediate shaft, the fixing screws of the intermediate shaft mounting plate, remove the intermediate shaft mounting plate, and replace the secondary belt. The belt frequency is 125 Hz to 135 Hz. Then re-assemble the J4 by reversing the removal steps (M4 screw tightening torque: 3.5 N·m, M6 screw tightening torque: 15 N·m).



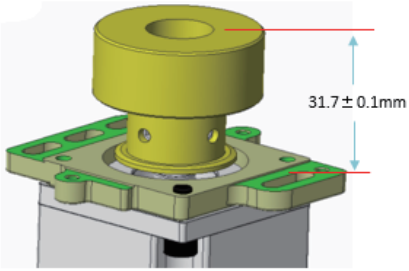
3.4.4.2 Maintaining the J4 Motor

Step 1: Remove the J4 motor assembly. Remove the J4 motor assembly according to Steps 1-4 in *"3.4.4.1 Maintaining the J4 Timing Belt" on page 103*.

Step 2: Replace the J4 motor. Remove the 2-M4×5 set screws, remove the J4 pulley, remove the J4 motor fixing screws, remove the J4 motor mounting plate, and then replace the motor.



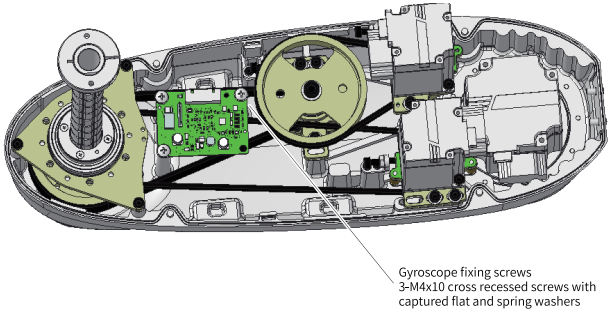
Step 3: Re-assemble the J4 motor. To re-assemble the J4 motor, reverse the above steps. Note: Keep a distance of 31.7 ± 0.1 mm between the J4 pulley and the motor mounting plate, as shown below (M4×5 set screw tightening torque: 1.8 N·m, M4 screw tightening torque: 3.5 N·m).



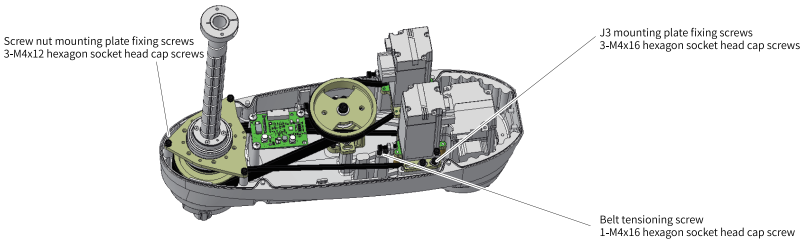
3.4.5 Maintaining the Ball Screw Spline

Step 1: Remove the enclosure, cables and sheet metal components of the forearm. Remove the enclosure according to *"3.2.1 Removing and Installing the Enclosure of the Forearm" on page 81* (See figure in *"3.2.1 Removing and Installing the Enclosure of the Forearm" on page 81*). Remove the cables and sheet metal components according to Step 2 in *"3.4.2.1 Maintaining the J2 Motor and Reducer" on page 94* (See figure in *"3.2.1 Removing and Installing the Enclosure of the Forearm" on page 81*).

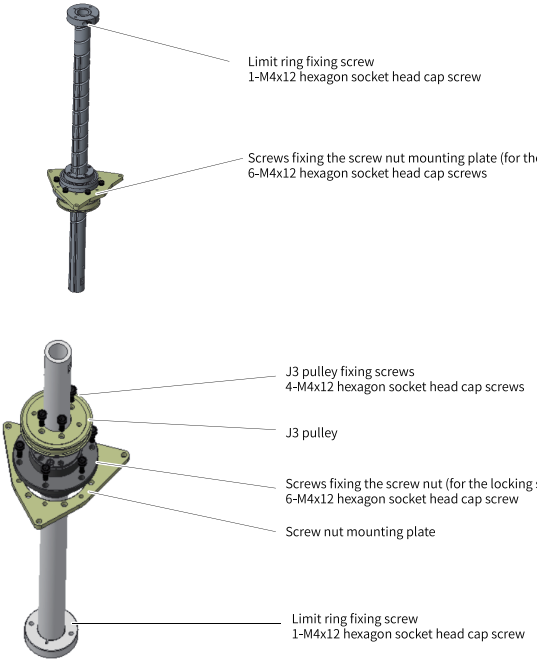
Step 2: Remove the gyroscope board. Remove the screws that fix the gyroscope board and then remove the gyroscope board.



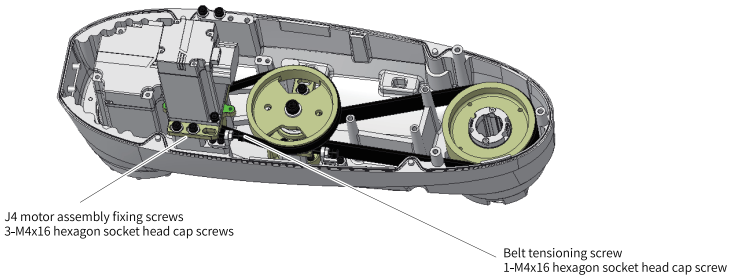
Step 3: Remove the belt tensioning screw of J3 shaft assembly, the screws fixing the J3 shaft mounting plate, and the screws fixing the screw nut mounting plate, and then remove the shaft and screw nut assembly first (Note that the screw nut and shaft must not be separated.)



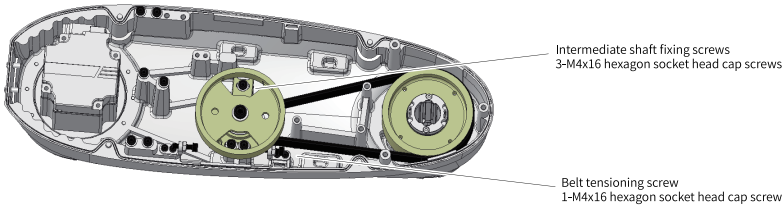
Step 4: Remove the screw nut mounting plate and replace the screw nut and shaft. Remove the screws fixing the screw nut mounting plate and the screws fixing the limit ring, remove the screw nut and shaft (Note that the screw nut and shaft must not be separated), and then replace the shaft and screw nut (Note: For the hot setting scheme, the pulley and screw nut are installed with interference fit, so the screw nut needs to be replaced together with the pulley; For the locking scheme, remove the pulley first and then the screw nut.)



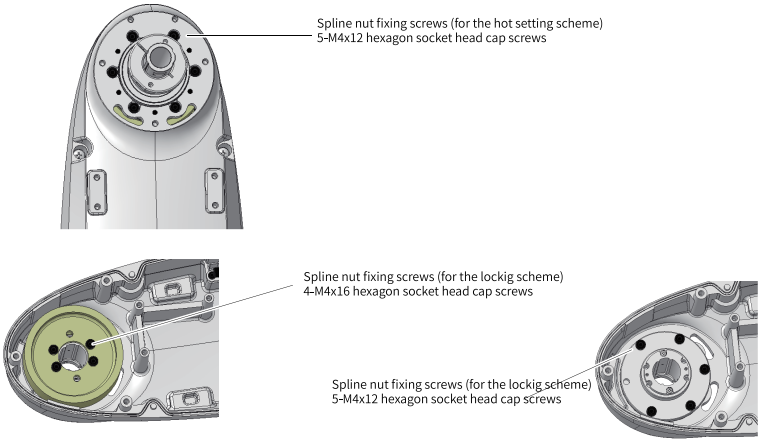
Step 5: Remove the belt tensioning screw of J4 shaft assembly, remove the screws fixing the J4 shaft assembly, and then take out the J4 motor assembly.



Step 6: Remove the screws fixing the intermediate shaft assembly and remove the intermediate shaft assembly.



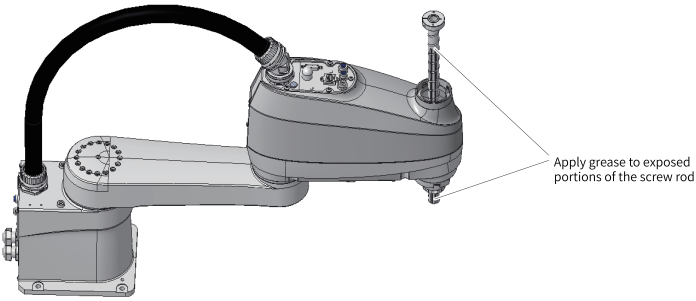
Step 7: Remove the screws fixing the spline nut, remove the spline nut assembly, and replace the spline nut (Note: For the hot setting scheme, the pulley and screw nut are installed with interference fit, so the screw nut needs to be replaced together with the pulley; For the locking scheme, remove the pulley first and then the screw nut.)



Step 8: Re-assemble the ball screw spline. To re-assemble the ball screw spline, reverse the above steps (M3 screw tightening torque: 2 N · m, M4 screw tightening torque: 3.5 N · m).

3.4.6 Maintaining the Ball Screw Spline

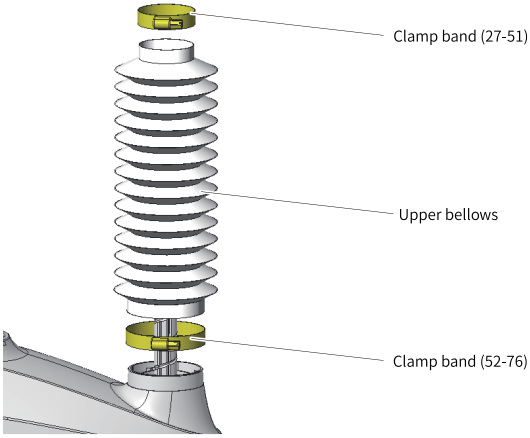
To lubricate the ball screw spline, do as follows:



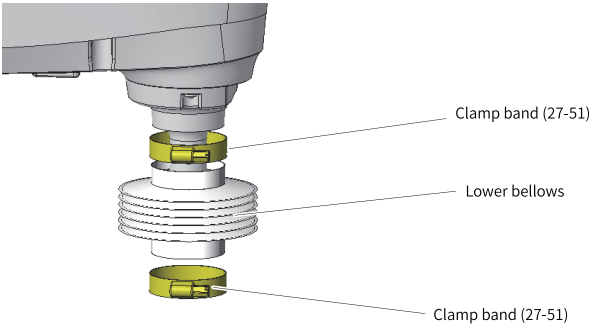
Clean the surface of the shaft with a clean cloth and apply grease (MUL TEMP LRL No.3) to the exposed portion of the shaft. Note that it is sufficient to continue to apply a thin layer of grease to the surface of the shaft, with a grease amount of 1 g. Excessive oil may splash onto processed products or equipment. The coating effect is shown in the following figure.

3.4.7 Replacing and Maintaining the Bellow of Cleanroom Model

Step 1: Remove the clamp band using a Phillips screwdriver and replace the upper bellow with a new one, then install the clamp band with a torque of 0.7 N · m.



Step 2: Remove the clamp band using a Phillips screwdriver and replace the lower bellow with a new one, then install the clamp band with a torque of 0.7 N · m.



3.4.8 Robot Cable Maintenance

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
- Do not remove the parts not mentioned in this document. Do not maintain any part with a method different from that described in this document.
- 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.

- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Prevent foreign objects from entering the equipment and terminals during maintenance.
- After the equipment is replaced, perform wiring inspection and parameter settings again.
- Connect the cables firmly. Do not lay heavy objects on the cables, or bend or pull the cables forcibly. Failure to comply will result in cable damage, wire breaking, or poor contact, causing electric shock or system fault.
- Wiring cables must meet diameter and shielding requirements. The shielding layer of the shielded cable must be reliably grounded at one end.
- Make the connections in correct sequence. Otherwise, the system may not work properly, which may cause safety hazards.
- After wiring, make sure there are no fallen screws and exposed cables inside the equipment.

3.4.8.1 Replacing the Cables Connected Between the Base and the Forearm

To replace the cables connected between the base and the forearm of the IR-S7 series robots, follow the steps below.

Step 1: Turn on the robot controller.

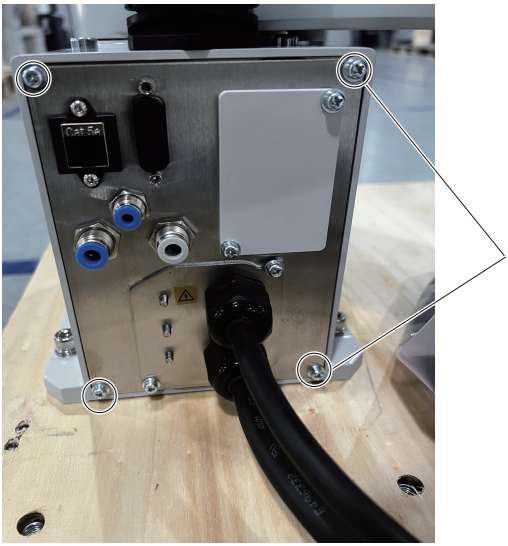
Step 2: Hang a "Maintenance in process" sign. The "Maintenance in process" sign is used to prevent other operators from operating the robot.

Step 3: Enter the safeguard system.

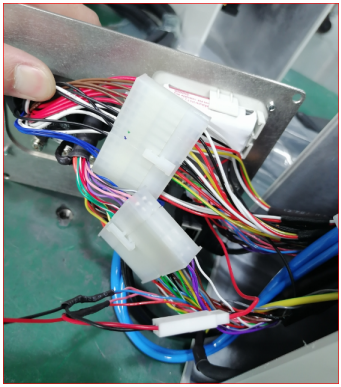
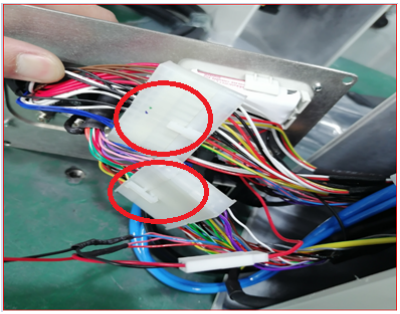
Step 4: Press the brake release switch to release the brake of J3, and then lower J3 to the lower limit. Ensure that sufficient space is left to prevent the end effector from colliding with peripheral devices.

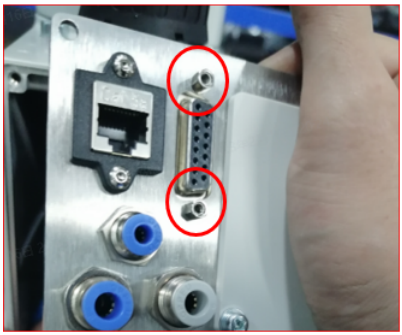
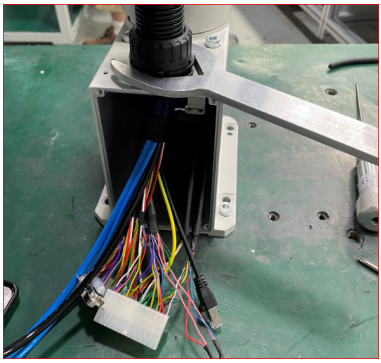
Step 5: Turn off the controller and disconnect the power and encoder cables connected to the controller.

Step 6: Remove the four screws (4-M4×10 cross recessed pan head screws with captured flat and spring washers) from the front cover of the base and then remove the front cover.

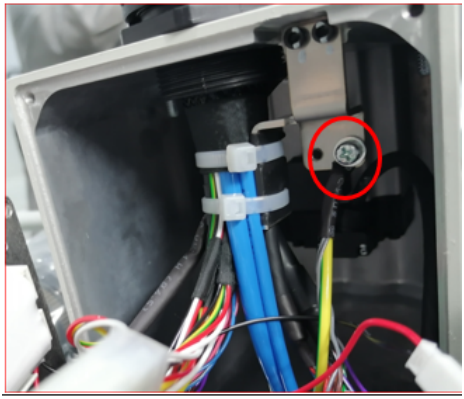
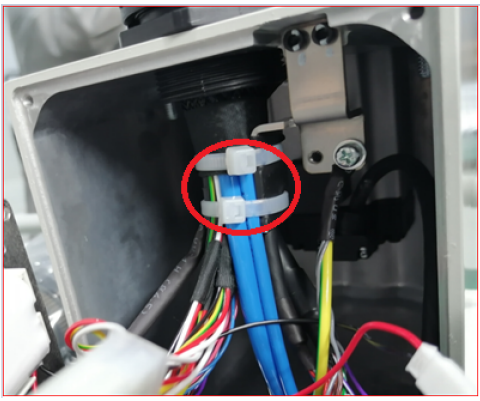


Step 7: Gently pull the internal cables out of the base, disconnect the power and encoder connectors connected to the base, disconnect the three air tubes and network cables connected to the cover of the base, disconnect the DB15 connector, and then disconnect the grounding wire.

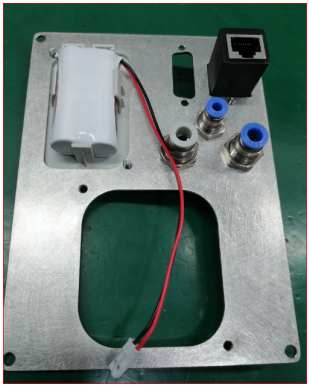
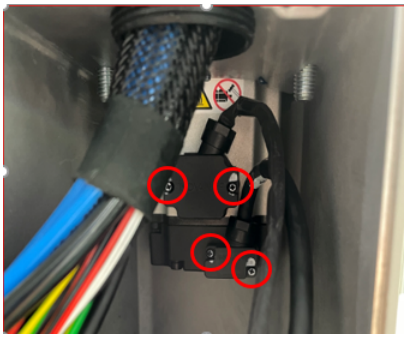
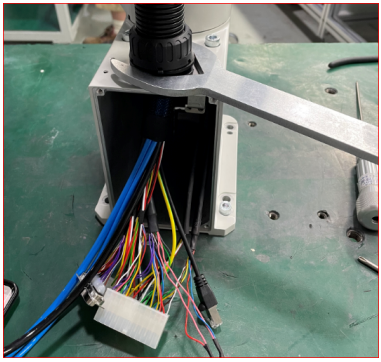
Step	Description	Diagram
①	Gently pull the internal cables out of the base	
②	Disconnect the power and encoder connectors	

Step	Description	Diagram
③	Disconnect the DB15 connector	
④	Disconnect the network cable and air tube	

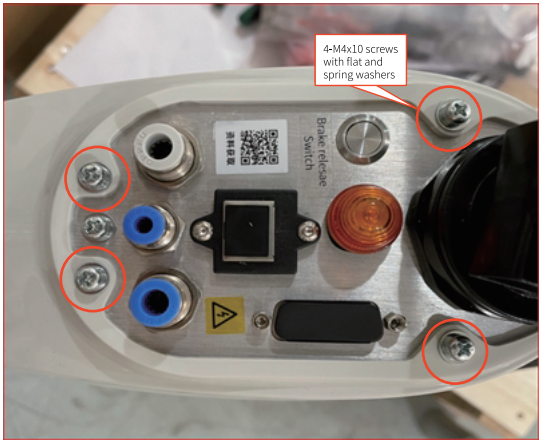
Step 8: Remove the grounding terminal fixed to the sheet metal inside the base and cut the cable tie.

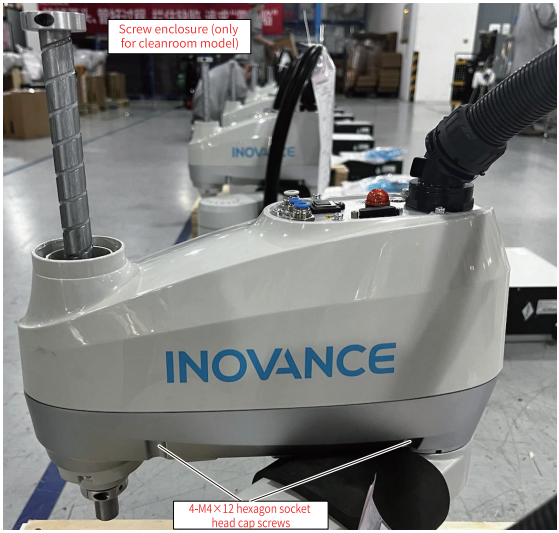
Step	Description	Diagram
①	Remove Grounding terminal on the sheet metal inside the base	
②	Cut the cable tie	

Step 9: Remove the battery, disconnect the J1 encoder and power cable terminals, remove the bellows connector from the base, and lead the cables out of the base.

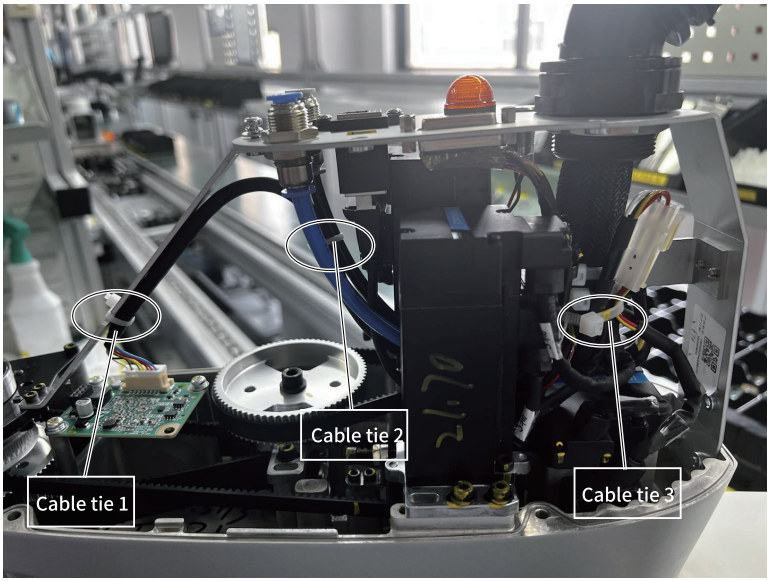
Step	Description	Diagram
①	Remove the battery	
②	Disconnect the J1 encoder and power cable terminals	
③	Remove the bellows connector from the base	

Step 10: Remove the forearm enclosure.

Step	Description	Diagram
①	Top of the forearm enclosure	
②	Side screws	

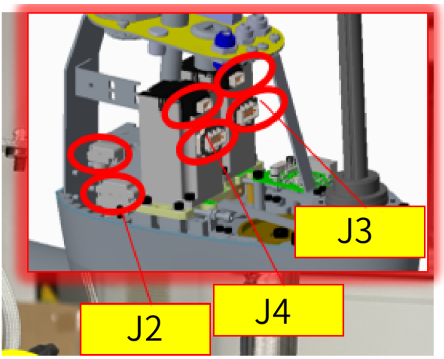
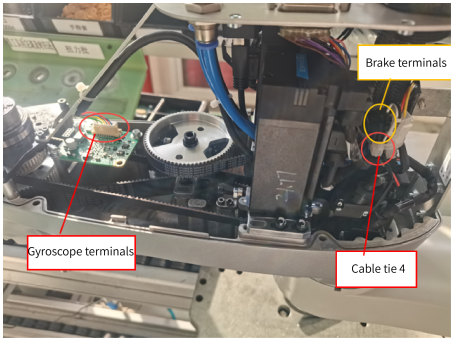
Step	Description	Diagram
③	Bottom screws	

Step 11: Cut the cable tie on the motor.



Step 12: Remove the screws (M2×8.5 cross recessed pan head screws) fixing the power and encoder connectors of J2, J3 and J4 using a Phillips screwdriver, and gently remove the connectors from the male connector at the motor side. Be careful

that the connector pins do not bend. Disconnect the brake button connector and the gyroscope terminals.

Step	Description	Diagram
①	Remove the screws (M2x8.5) fixing the power and encoder connectors of J2, J3 and J4 using a Phillips screwdriver	
②	Disconnect the brake button connector and the gyroscope terminals	

Step 13: Remove the screws (4-M4×8 cross recessed pan head screws) fixing the sheet metal of the forearm and remove the cables from the forearm.

Step 14: Remove the cables from the manipulator.

Step 15: Connect the power and encoder connectors connected to the controller and tighten the DB25 connector of the encoder with a screwdriver.

3.4.8.2 Replacing and Maintaining the Battery

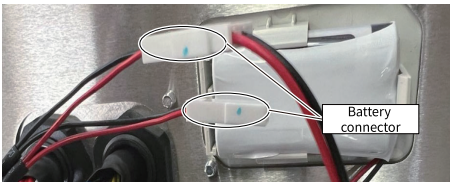
- Open the cover of the controller only when maintenance is needed. High voltage inside the controller poses a risk of electric shock even when the power is turned off.
- Before replacement, always turn off the power supply of the controller and related devices and remove the power plug. Operating with the power on may cause electric shock or malfunction.
- Do not remove or install the motor connector while the power is still on. Failure to comply may result in abnormal action of the manipulator, 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 manipulator, 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 replacement, always turn off the power supply of the controller and related devices and remove the power plug. Operating with the power on may cause electric shock or malfunction.
- 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.
  - Charging
  - Compression and deformation
  - Dismantling
  - Short circuit
  - Incorrect installation
  - Heating
  - Burning in fire
  - Soldering
  - 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.

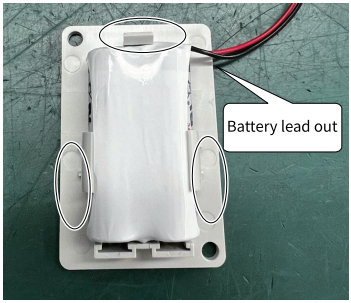
- If the lithium battery is exhausted, a warning voltage too low will occur when the controller is turned on (software startup) and the position data of the motor will be lost. In this case, you need to calibrate the origin of all joints.
- The service life of the lithium battery is 1.5 years. Replace 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:

Step 1: Return the robot to the zero point and cut off the power supply to the robot, then remove the battery cover at the rear of the base.

Step 2: Gently pull out the battery compartment, connect a new battery to the spare battery connector, then disconnect the old battery and secure the new battery to the compartment.





Step 3: Put back the battery compartment and fix it with two screws with a torque of 0.6 N·m.

3.4.8.3 Replacing the Cables Connected Between the Manipulator and Controller

This section describes how to replace the cable unit between the manipulator and the controller.

For the IR-S7 series robots, follow the steps below.

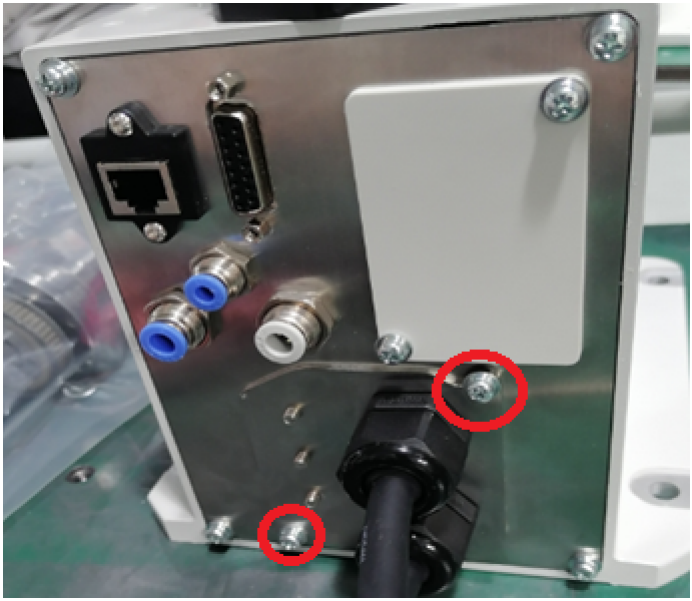
Step 1: Turn off the controller.

Step 2: Disconnect the power and encoder cables connected to the controller.

Step 3: Hang a "Maintenance in process" sign. The "Maintenance in process" sign is used to prevent other operators from operating the robot.

Step 4: Enter the safeguard system.

Step 5: Remove the two screws on the sheet metal of the trailing cable.



Step 6: Gently pull the trailing cable out of the base and disconnect the power and encoder connectors.

3.4.9 Home Position Calibration

3.4.9.1 Description of Home Position Calibration

The home position is the reference point and base point for the robot. After parts (motors, reducer, timing belt, and cables etc.) have been replaced, the robot cannot execute the positioning properly because a mismatch exists between the home position stored in the motors and its corresponding home position stored in the controller. Therefore, home position calibration is required after the part replacement.

Note

After home position 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 performs unexpected actions.

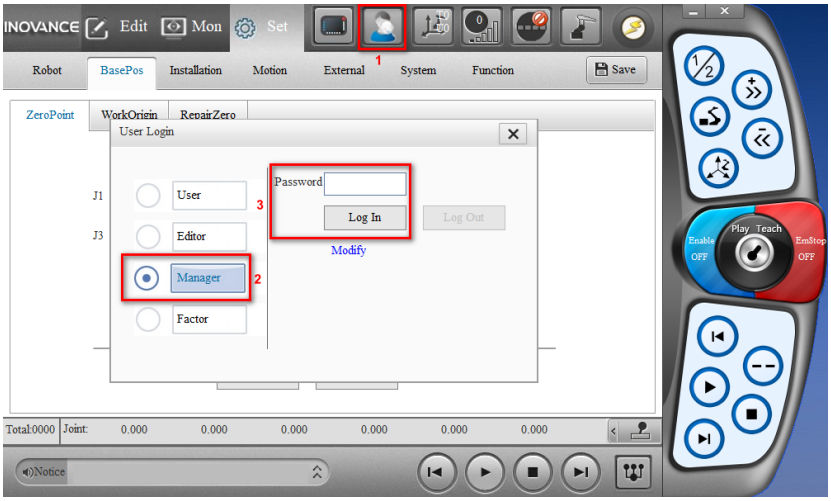
3.4.9.2 Home Position Calibration Procedure

Both the teaching software on PCs and the hand-held teach pendant provide an operation interface for home position calibration. The following takes the teaching software on PC as an example. The operations on the hand-held teach pendant are similar.

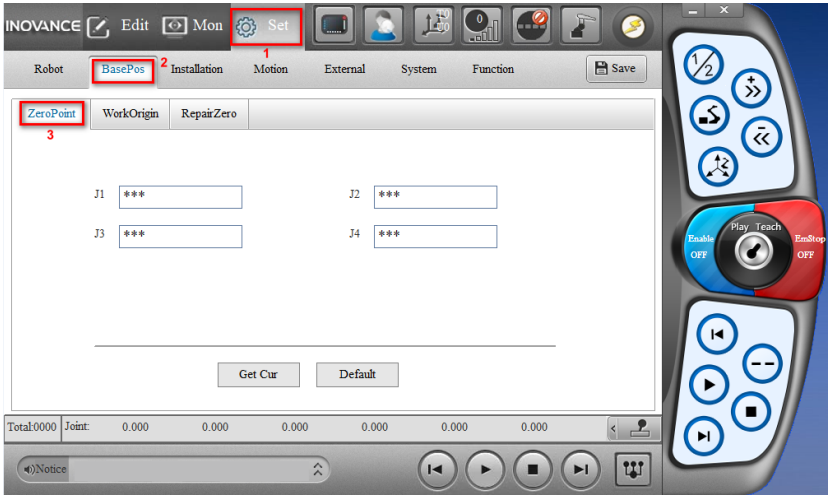
Due to the strong correlation between the coordinates of the robot's work points and the accuracy of J2, it is necessary to complete the home position calibration of J2 before calculating the robot coordinates. The teach pendant provides a right/left wrist rule wizard. Follow the wizard to calibrate the home position. For the adjustment method, see *"3.4.9.4 Home Position Calibration of J2" on page 130*.

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

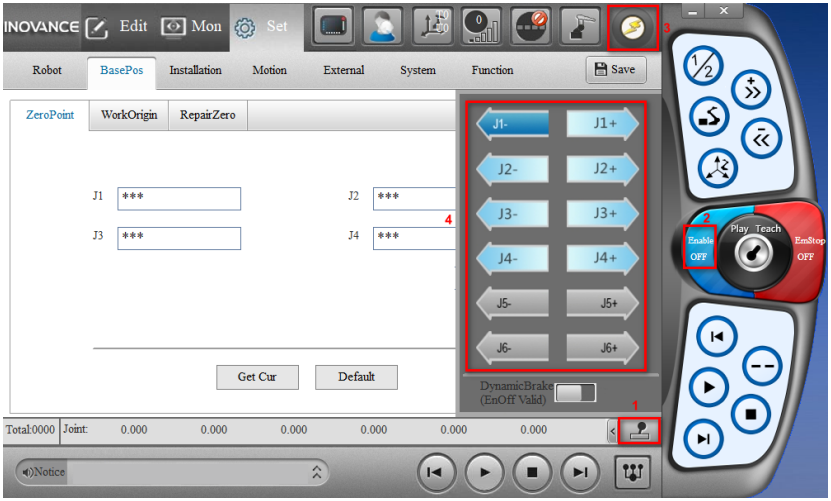
1. Log in to the user account.
   a. Click the shortcut key of user settings on the main interface of the PC teaching software or the hand-held teach pendant to open the user settings interface.
   b. Enter the password in the password input box and click the **log In** button.



2. Switch to the absolute zero setting interface.
   Choose **Set** > **BasePos** > **ZeroPoint** on the main interface of the teaching software or the hand-held teach pendant.



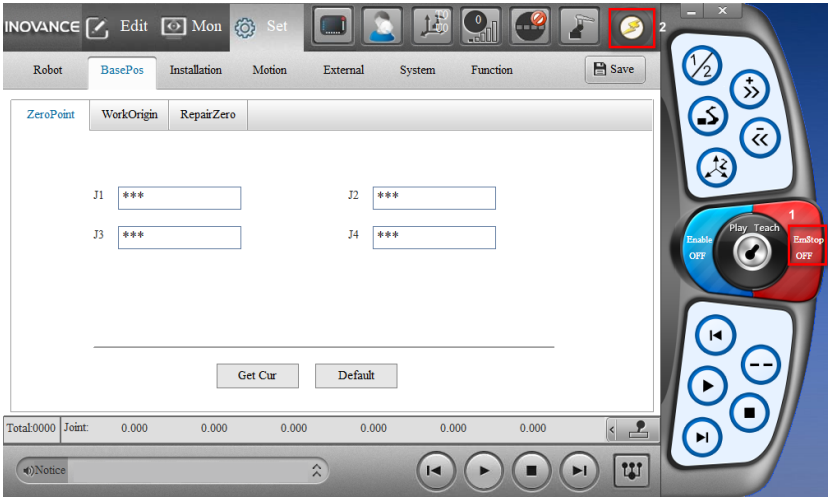
3. Move each joint of the robot to the home position.
   - Move the robot near the home position by using the joystick on the hand-held teach pendant or on the operation interface on the teaching software. See Teach Pendant User Guide.
   - Also, you can manually push the robot to the home position when the motor is not enabled.



4. Switch to the emergency stop state.

   a. Click the virtual emergency stop button on the PC teaching software or press the red emergency stop button on the hand-held teach pendant.

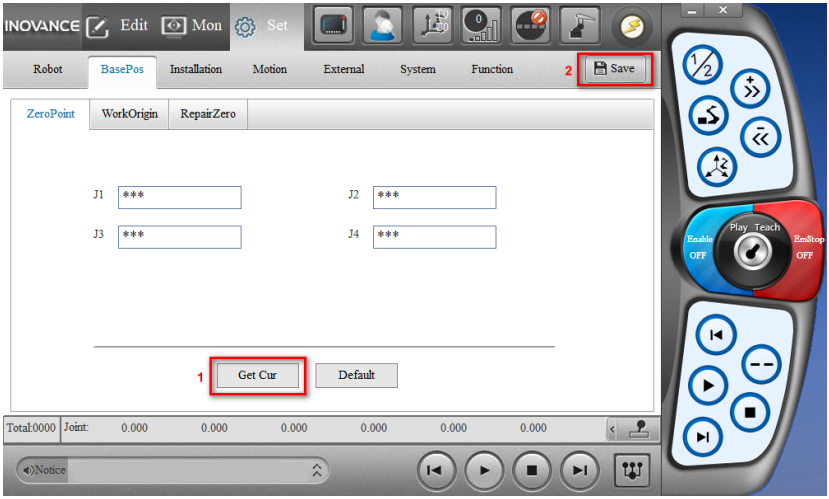
   b. The status indicator on the upper right corner of the teaching software (or the display of the hand-held teach pendant) shows the emergency stop state (in red).



5. Obtain and save the home position information.

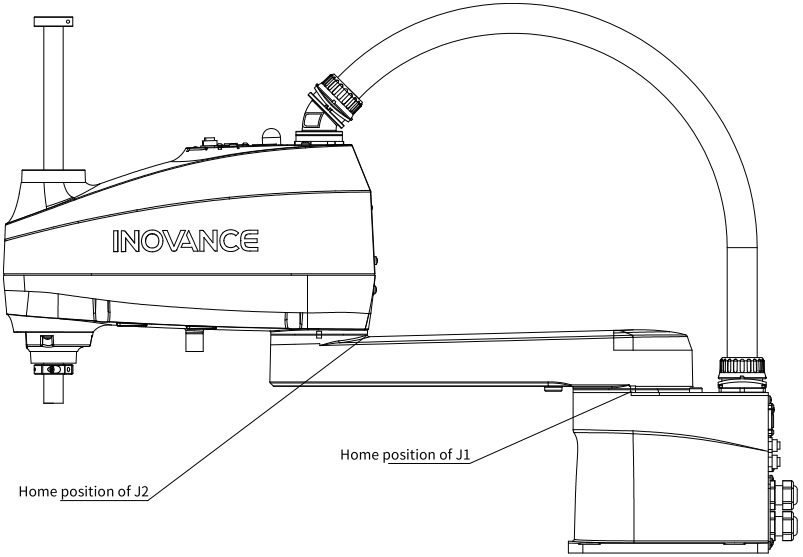
   a. Click the **Get Cur** button when the robot moves to the home position to obtain the encoder pulses at the home position.

   b. Click the **Save** button to complete the home position calibration.



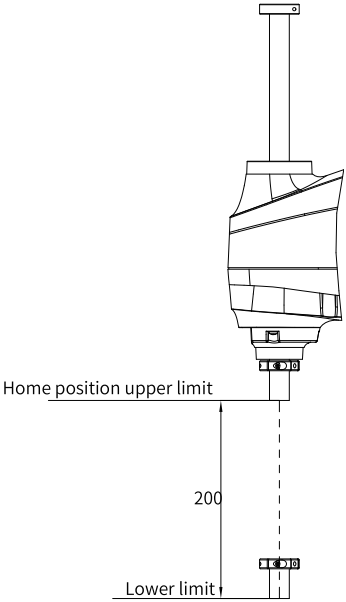
3.4.9.3 Home Position of Each Joint

1. The following figure shows the home position of J1 and J2.



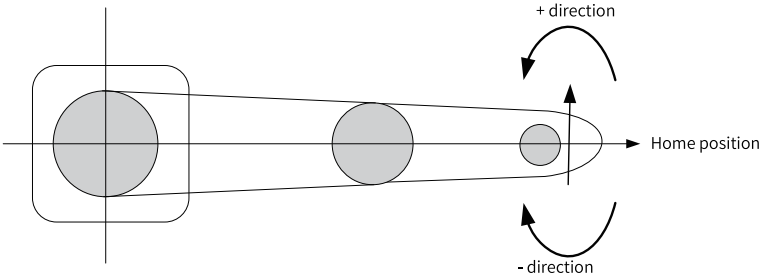
Model	J1 Max Motion Range	J2 Max Motion Range
IR-S7-50Z20S3	±132°	±150°

2. Home position of J3: Upper limit position in motion range.



Model	Stroke of J3
IR-S7-50Z20S3	200 mm

3. Home position of J4: Position where the flat surface on the shaft (or the slots of the upper and lower mechanical stops) faces towards the tip of Arm #2.



Model	J4 Max Motion Range
IR-S7-50Z20S3	±360°

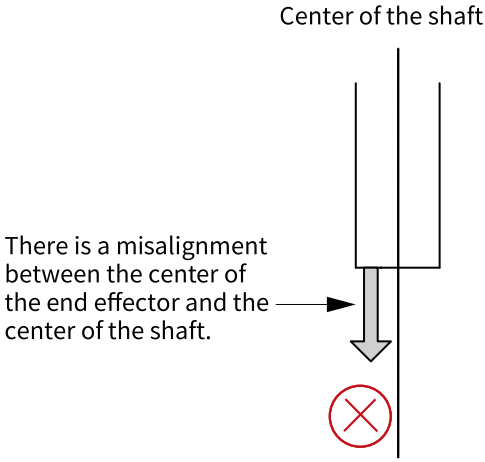
3.4.9.4 Home Position Calibration of J2

Due to the strong correlation between the coordinates of the robot's work points and the accuracy of J2, it is necessary to complete the home position calibration of J2

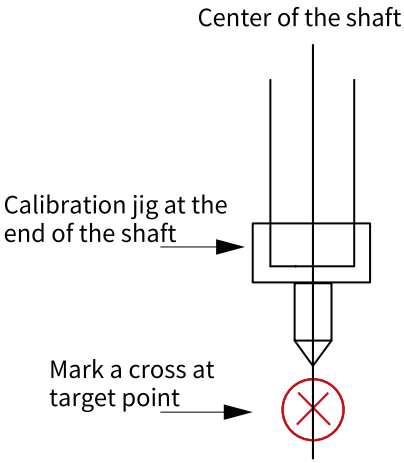
before calculating the robot coordinates. To calibrate the home position of J2, follow the wizard provided on the teach pendant for home position calibration using right/left wrist rule.

Calibration Procedure

1. The reference point for home position calibration 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 perform home position calibration.



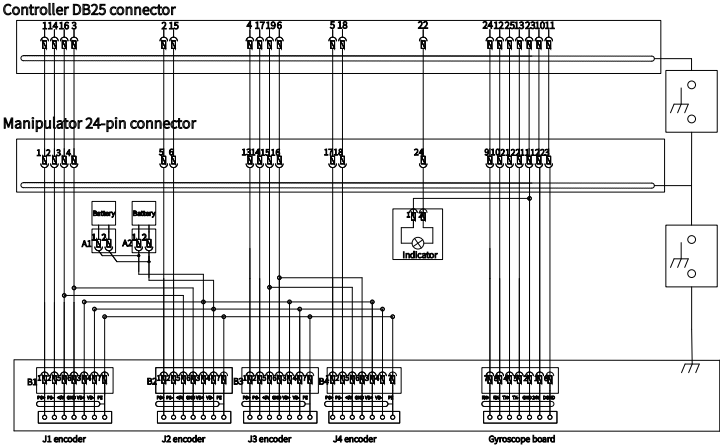
2. Make a home position calibration jig (example) on the top side of the shaft to clarify the center of the shaft, as shown in the figure below. Make the position that can be easily recognized when changing the right/left wrist pose the target point, and mark it with X.



3. Perform home position calibration using the left/right 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 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 in current state as Enc2.
   c. On the teach pendant, go to **Set** > **BasePos** > **ZeroPoint**, click the **Default** button and get the currently saved home position info. Calculate (Enc1+Enc2)/2 and fill in the calculation result into the input box of J2, and then click the **Save** button. The home position calibration of J2 is complete.
4. After removing the end effector and executing the calibration, install the end effector and move the robot to the teaching point to verify whether is a a positional gap. If there is a positional gap, fine-tune the installation position of the end effector and teach the point again.

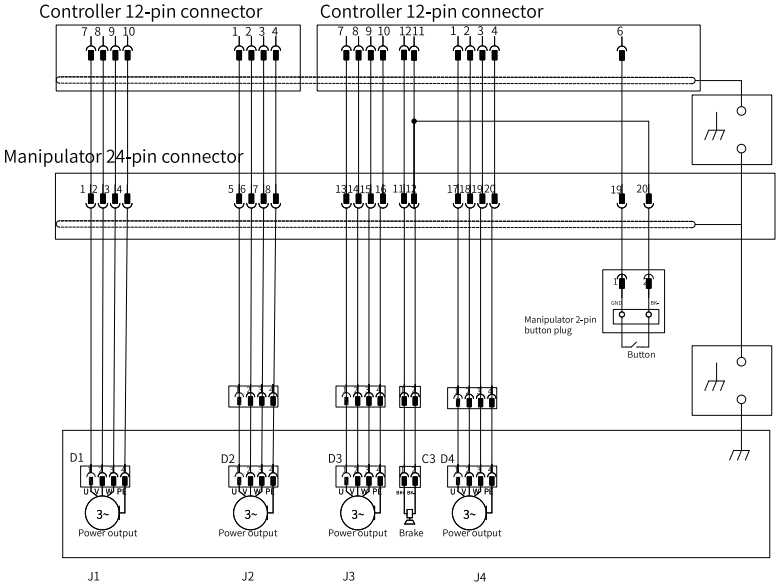
3.4.10Wiring Diagrams

The following figure shows the encoder cable connection.



Encoder Pin	7	1	2	3	4	5	6
Definition	Shield	PS+	PS	5V	GND	BT+	BT

The following figure shows the power cable connection.



Power Output Pin	1	2	3	4	1	2
Definition	U	V	W	PE	BK+	BK-

3.4.11Parts List

S7 Series			
Parts Name		Parts Number	Maintenance Guide
AC servo motor	J1	01115496	*"3.4.1.1 Maintaining the J1 Motor and Reducer" on page 89*
	J2	01115497	*"3.4.2.1 Maintaining the J2 Motor and Reducer" on page 94*
	J3	01115498	-
	J4	01115498	*"3.4.4.2 Maintaining the J4 Motor" on page 105*
Reducer	J1	H: 72100614, X: 72100841	*"3.4.1.1 Maintaining the J1 Motor and Reducer" on page 89*
	J2	H: 72100615, X: 72100835	*"3.4.2.1 Maintaining the J2 Motor and Reducer" on page 94*
Timing belt	J3	72100610	*"3.4.3.1 Maintaining the J3 Timing Belt" on page 99*
	J4 primary belt	22030050	*"3.4.4.1 Maintaining the J4 Timing Belt" on page 103*
	J4 secondary belt	72100609	*"3.4.4.1 Maintaining the J4 Timing Belt" on page 103*
Ball screw spline		01792522	*"3.4.5 Maintaining the Ball Screw Spline" on page 106*
Spare parts of ball screw spline (including sheave and screws)		98070253	*"3.4.5 Maintaining the Ball Screw Spline" on page 106*

S7 Series			
Parts Name		Parts Number	Maintenance Guide
Battery		71010029	*"3.4.8.2 Replacing and Maintaining the Battery" on page 122*
Grease	J1 reducer grease	H: 24060061 (SK-1A), X: 24060141 (SFB)	*"3.4.1.2 Replacing the Grease of J1 Reducer" on page 91*
	J2 reducer grease	H: 24060061 (SK-1A), X: 24060141 (SFB)	*"3.4.2.2 Replacing the Grease of J2 Reducer " on page 96*
	Ball screw spline	24060125 MUL TEMP LRL No.3	*"3.4.6 Maintaining the Ball Screw Spline" on page 109*
Enclosure parts	Forearm enclosure	20213087	*"3.2.1 Removing and Installing the Enclosure of the Forearm" on page 81*
	Spline enclosure	20213088	*"3.2.2 Removing and Installing the Bottom Enclosure of Spline Nut " on page 82*
	Battery cover	20212945	-
	Limit post	20210329	-
Manipulator cable		500 arm length: 1504DC33 600 arm length: 1504DC34 700 arm length: 1504DC35	-
J3 brake and cables		1504D795	-
Upper bellows for cleanroom model		20422357	*"3.4.7 Replacing and Maintaining the Bellow of Cleanroom Model " on page 111*

S7 Series		
Parts Name	Parts Number	Maintenance Guide
Upper bellows for cleanroom model	20422358	*"3.4.7 Replacing and Maintaining the Bellow of Cleanroom Model " on page 111*
Trailing cable of controller 1.0	1504D708: 3 m 1504D709: 5 m 1504D710: 10 m 1504D711: 15 m	-
Trailing cable of controller 2.0	1504PW06: 3 m 1504PW14: 5 m 1504PW15: 10 m	-

4 IR-S10 Series SCARA Robots Maintenance Guide

4.1 Product Information

4.1.1 Model Description

IR- S 10 - 80 Z20 S 3
① ② ③ ④ ⑤ ⑥⑦

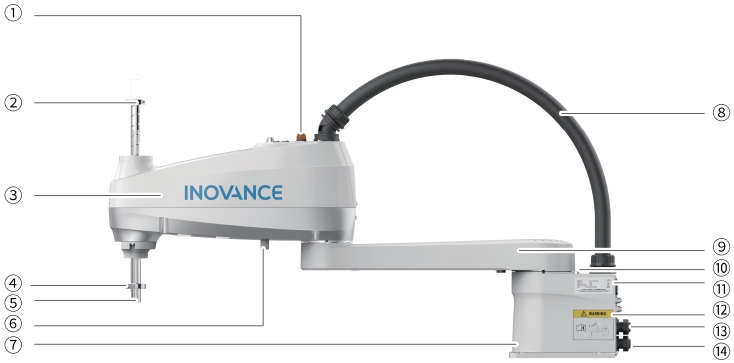
① **Product Family** INOVANCE Robot	④ **Arm Length** 60: 600 mm 70: 700 mm 80: 800 mm	⑦ **Cable Length** 0: No trailing cable 3: 3 m standard cable 5: 5 m standard cable G3: 3 m highly flexible cable
② **Series** S: SCARA robot R: 6-axis robot TS: Ceiling-mounted SCARA robot	⑤ **Max. Z-axis Stroke (Blank for models without lead screw)** Z20: Max. 200 mm stroke	-
③ **Payload** 4: 4 kg 7: 7 kg 10: 10 kg	⑥ **Installation Environment** C: Cleanroom S: Standard P: Protection	

Note

The product information in this guide is the information of standard models in a standard environment. For information about non-standard models or cleanroom models, contact the provider.

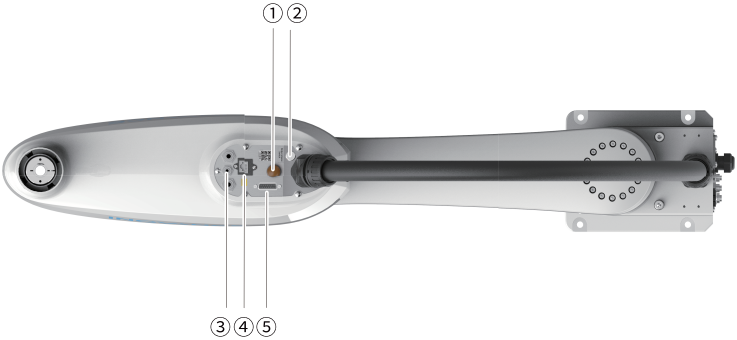
4.1.2 Components

Part 1



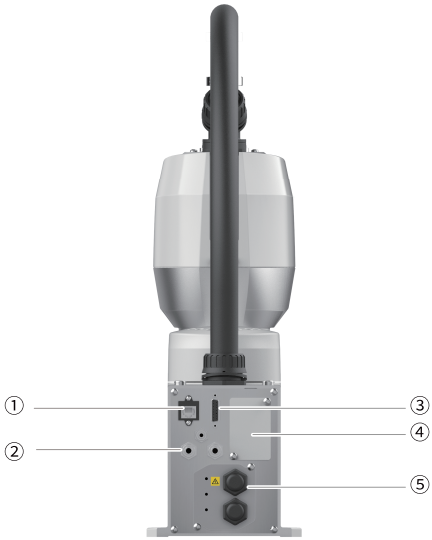
No.	Description
①	Run indicator
②	J3 upper mechanical stop
③	Arm 2
④	J3 lower mechanical stop
⑤	J3 lead screw
⑥	J2 mechanical stop
⑦	Base
⑧	Cable unit
⑨	Arm 1
⑩	J1 mechanical stop
⑪	Nameplate
⑫	Label
⑬	Power cable
⑭	Signal Cable

Part 2



No.	Description
①	Indicator
②	Brake release switch
③	Air tube connector
④	Ethernet connector
⑤	DB15

Part 3



No.	Description
①	Ethernet connector
②	Air tube connector
③	DB15
④	Battery cover
⑤	Trailing cable

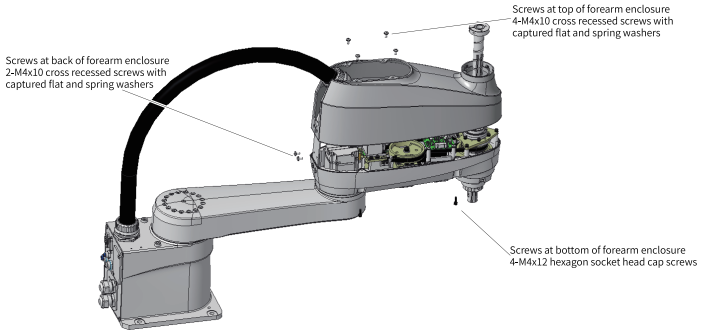
4.2 Enclosure Removal and Installation

Warning

- During removal and re-installation of the enclosure, do not pull it forcibly. Failure to comply will 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 in *"4.2.1 Removing and Installing the Enclosure of the Forearm" on page 140*.
- 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.

4.2.1 Removing and Installing the Enclosure of the Forearm

The following figure shows the removal and installation of the enclosure of the forearm.



Steps:

1. Remove the six cross recessed pan head screws on the top and back.
2. Remove the four hexagon socket head cap screws on the bottom.
3. Lift and remove the forearm enclosure. To install the enclosure, put back the enclosure and ensure that it fits properly with the forearm. Then tighten the 10 screws from the bottom to the top with a torque of 0.6 N·m.

4.2.2 Removing and Installing the Bottom Enclosure of Spline Nut

Warning

- When installing the spline nut, do not change the position of the limit ring at will.
- 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.

The following figure shows the removal and installation of the bottom enclosure of the spline nut.

Screws at bottom of spline nut enclosure
3-M4x10 cross recessed screws with captured flat and spring washers

To remove and install the bottom enclosure of the spline nut, do as follows:

Step 1: Remove the screws of the enclosure of the spline nut (3-M4×10 cross recessed screws with captured flat and spring washers).

Step 2: Remove the enclosure of the spline nut. When installing the enclosure, fix the screws with a torque of 0.6 N·m.

4.3 Regular Inspection

4.3.1 Regular Inspection Checklist

To make the robot run safely and efficiently, it needs to be inspected and maintained regularly. Maintenance can only be carried out after confirming the safety of the robot system. Only authorized personnel who have taken safety training should be allowed to perform the robot maintenance. Inspection points are divided into five stages: daily, monthly, quarterly, semi-annual, and annual. The inspection points are added every stage.

- Inspection while the power is OFF (robot is not operating)

Inspection Point	Inspection Place	Daily inspection	Monthly Inspection	Quarterly Inspection	Semi-annual Inspection	Annual Inspection
Check whether the screws are loose. If yes, tighten them.	Mounting screw of the end effector	✓	✓	✓	✓	✓
	Robot base mounting screws	✓	✓	✓	✓	✓
	Each joint	✓	✓	✓	✓	✓
	Screws around the axes	-	-	-	-	✓
	Screws securing the the motor, reducer, etc.	-	-	-	-	✓
Check whether the connector is loose. If yes, push it securely or tighten it.	Parts external to the robot (such as the connector board)	✓	✓	✓	✓	✓
	Robot cable unit	-	✓	✓	✓	✓
Check for scratches and remove dust.	Manipulator	✓	✓	✓	✓	✓
	External cables	-	✓	✓	✓	✓

Inspection Point	Inspection Place	Daily inspection	Monthly Inspection	Quarterly Inspection	Semi-annual Inspection	Annual Inspection
Correct deformation and position offset.	Safeguard etc.	✓	✓	✓	✓	✓
Check tension of the timing belt. Tighten it if necessary.	Inside arm #2	-	-	-	✓	✓
Check if the lubricating grease is sufficient for lubrication, and add an appropriate amount of lubricating grease as needed.	Ball screw spline	-	-	✓	✓	✓
Check whether there is dust at the outlet of fan of the robot controller. If yes, clean it.	-	-	-	✓	✓	✓

- Inspection while the power is ON (robot is not operating)

Inspection Point	Inspection Place	Daily inspection	Monthly Inspection	Quarterly Inspection	Semi-annual Inspection	Annual Inspection
Shake the cable gently by hand to check for wire breakage.	Parts external to the robot (such as the connector board)	-	-	-	✓	✓
Press each arm by hand in the enabled state to check whether the arms shake.	Each arm	-	-	-	-	✓
Check whether the fan of the robot controller works properly. If not, replace the controller.	Controller	-	✓	✓	✓	✓

- Inspection while the power is ON (robot is operating)

Inspection Point	Inspection Place	Daily inspection	Monthly Inspection	Quarterly Inspection	Semi-annual Inspection	Annual Inspection
Check the motion range.	Each joint	-	-	-	-	✓
Check whether unusual sound or vibration occurs.	Manipulator	✓	✓	✓	✓	✓
Measure the accuracy repeatedly by a gauge.	Manipulator	-	-	-	-	✓

4.3.2 Screw Tightening Torque and Method

Otherwise specified, tighten the hexagon socket-head cap screws according to the following torque.

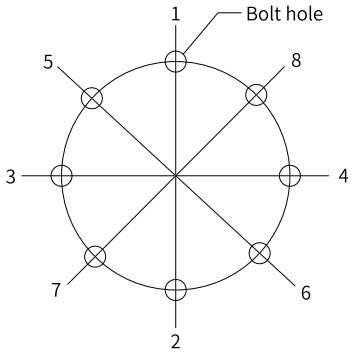
Caution

The tightening torque of the robot housing screws must not damage the housing.

The torque of the screws except those connected to the reducer is listed in the following table.

Screw	Torque (N·m)
M3	2
M4	3.5
M6	15
M8	30

Tighten the screws in the sequence shown below:



Do not tighten the screw to the maximum torque value at a time. Tighten the screws slightly with an Allen wrench as shown in the preceding figure. Then tighten the screws to the torque values in the table above with a torque wrench.

Otherwise specified, tighten the set screw according to the following torque:

Screw	Torque (N·m)
M4	1.8

4.3.3 Grease Refilling

The following table describes the grease refilling cycle:

Joint	Position	Cycle
J1	Reducer	When replacing the motor.
J2	Reducer	When replacing the motor.
J3	Ball screw spline	3 months

Cautions:

1. Only use original grease. See *"4.4.11 Parts List" on page 195* for the grease type.
2. It is strictly forbidden to deplete the grease of the ball screw spline, otherwise irreversible mechanical damage may occur.
3. Normally, the reducer does not require grease refilling. However, under the extreme conditions (duty cycle, speed, load), the grease needs to be refilled every 10,000 hours.

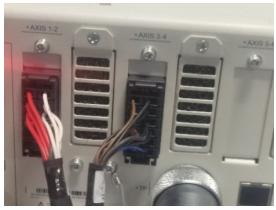
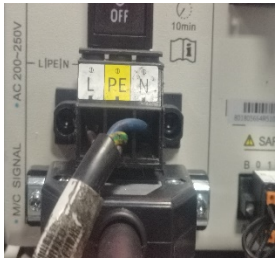
Note

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

1. If the grease gets into your eyes, flush them thoroughly with clean water, and then see a doctor immediately;
2. If the grease gets into your mouth, wash out your mouth with water thoroughly; if swallowed, see a doctor immediately;
3. If the grease gets on your skin, wash the area thoroughly with soap and water.

4.3.4 Controller Cable Inspection

The following table describes the inspection of controller cables:

No.	Item	Diagram	Cycle
①	Check that the power cable and encoder cable of the manipulator is properly connected to the controller.		Daily
②	Check that the teach pendant cable is properly connected to the controller.		Daily
③	Check that the external power cable (Red for L, green for N, and yellow for PE respectively) is properly connected to the controller.		Daily
④	Wipe off any acid, alkali, oil, or corrosive liquids with wiping paper or a dry cloth	All cables	Monthly

4.4 Replacement and Maintenance

4.4.1 J1 Maintenance

Tools list:

	Name	Quantity
Maintenance Parts	J1 motor	1
	J1 reducer	1
	Reducer grease	-
Tools	Hexagonal wrench	1
	Torque screwdriver (0 N·m to 10 N·m)	1
	Hexagon bit set	1
	LOCTITE 638 and 243	Several
	Oil-absorbing sheet	Several
	Wiping cloth	Several

Screw tightening torque reference:

Screw	Torque (N·m)
M3	2
M4	5

Note

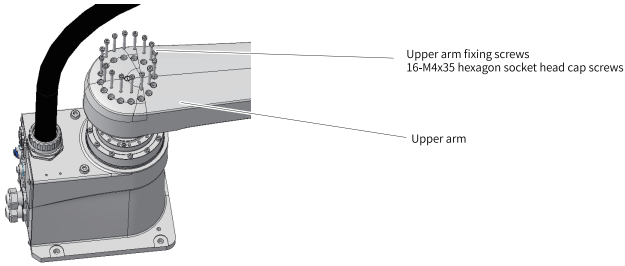
- Recommended bit specifications: 3/4/5/6/8 mm diameter, 15 cm length; 1.5/2/2.5 mm diameter, 10 cm length
- Recommended cross screwdriver specifications: 5 mm diameter, 20 cm length; 3 mm diameter, 15 cm length

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
- Do not remove the parts not mentioned in this document. Do not maintain any part with a method different from that described in this document.
- 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.
- After the motor is maintained, it is necessary to calibrate the zero point. Otherwise, the motor may encounter runaway after restart, posing serious safety hazards.

- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Prevent foreign objects from entering the equipment and terminals during maintenance.
- After the equipment is replaced, perform wiring inspection and parameter settings again.
- 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 motor and encoder. Failure to comply may result in motor failure due to misalignment during reassembly.

4.4.1.1 Maintaining the J1 Motor and Reducer

Step 1: Remove the upper arm and forearm by removing the forearm fastening screws (16-M4×35 socket head screws).

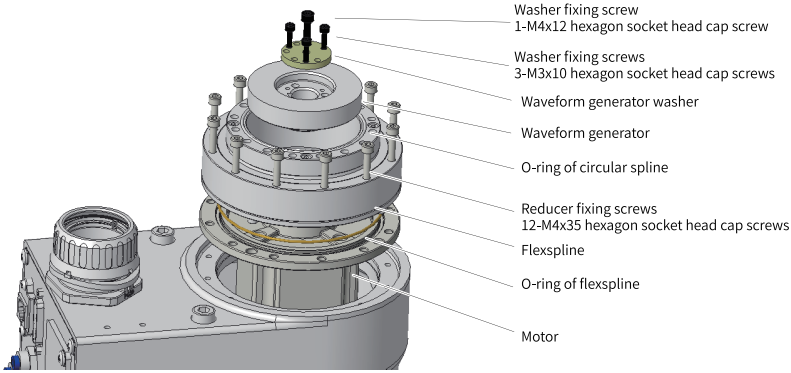


Note

When removing the screws of the upper arm, hold the forearm to prevent the manipulator from tipping over due to an unstable center of gravity.

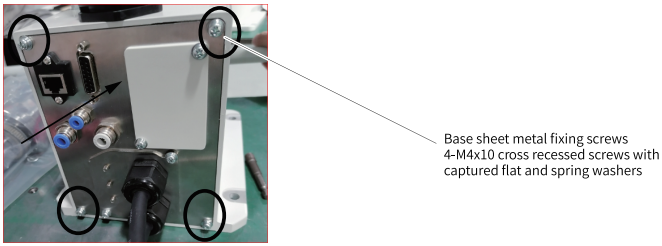
Step 2: Remove the waveform generator as follows: Remove the waveform generator fixing screws, clamp the washer with a circlip pliers, screw the M5 screw into the M5 hole in the middle of the washer, remove the waveform generator and then remove the washer fixing screws.

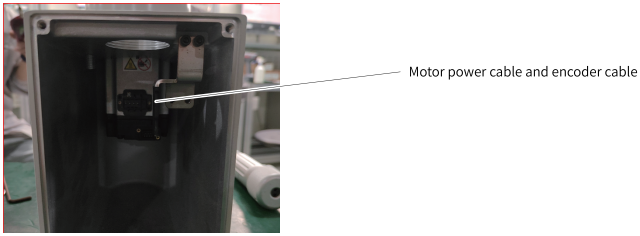
Step 3: Remove the reducer fixing screws, remove the O-ring of circular spline and then the flex spline, and replace the reducer with a new one. For the parts number, see *"4.4.11 Parts List" on page 195*.



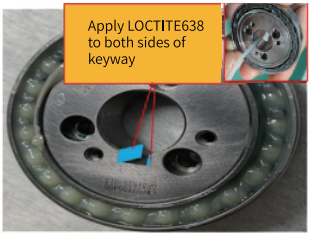
Step 4: Remove the sheet metal fixing screws on the base, disconnect the power cables and encoder cables of the J1 motor, remove the motor and replace it with a new one. For the parts number, see the parts list. To re-assemble, reverse the above steps. Note that the grease needs to be replaced after the motor and reducer are replaced. For replacement of the grease, see *"4.4.1.2 Replacing the Grease of J1*

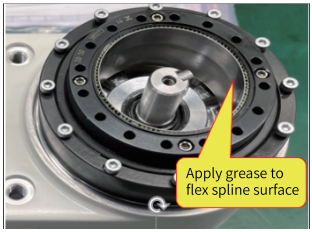
Reducer" on page 152 (M3 screw tightening torque: 2 N·m, M4 screw tightening torque: 5 N·m. All reducer screws must be coated with LOCTITE 243 threadlocker.)





Step 5: To re-assesmble, reverse the above steps. Note that the grease needs to be replaced after the motor and reducer are replaced. For replacement of the grease, see *"4.4.1.2 Replacing the Grease of J1 Reducer" on page 152*. In addition, apply LOCTITE 638 retaining compound to the keyway of the waveform generator and grease to the surface of the flex spline of the reducer (H: SK-1A grease, X: SFB grease). (M3 screw tightening torque: 2 N·m, M4 screw tightening torque: 5 N·m. All reducer screws must be coated with LOCTITE 243 threadlocker.)



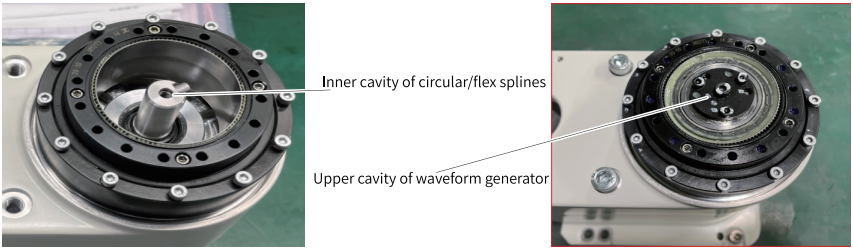


4.4.1.2 Replacing the Grease of J1 Reducer

Step 1: Remove the upper arm and forearm according to Step 1 in *"4.4.1.1 Maintaining the J1 Motor and Reducer" on page 149*.

Step 2: Remove the waveform generator according to Step 2 in *"4.4.1.1 Maintaining the J1 Motor and Reducer" on page 149*. Remove the circular spline and flexspline according to Step 3 in *"4.4.1.1 Maintaining the J1 Motor and Reducer" on page 149*.

Step 3: Apply grease to the waveform generator. Clean the old grease from the waveform generator and the circular/flex splines of the harmonic reducer, and apply grease (H: SK-1A grease, X: SFB grease) evenly on the inner cavity of the circular/flex splines (approx. 59 ml, 52 g) and the upper cavity of the waveform generator (approx. 24 ml, 21 g). For the grease types, see the parts list.



Step 4: To re-assemble, reverse the above steps (M3 screw tightening torque: 2 N·m, M4 screw tightening torque: 5 N·m. All reducer screws must be coated with LOCTITE 243 threadlocker).

4.4.2 J2 Maintenance

Tools list:

	Name	Quantity
Maintenance Parts	J2 motor	1
	J2 reducer	1
	Reducer grease	-
Tools	Hexagonal wrench	1
	Torque screwdriver (0 N·m to 10 N·m)	1
	Hexagon bit set	1
	LOCTITE 638 and 243	Several
	Oil-absorbing sheet	Several
	Wiping cloth	Several
	Phillips screwdriver	2

Note

- Recommended bit specifications: 3/4/5/6/8 mm diameter, 15 cm length; 1.5/2/2.5 mm diameter, 10 cm length
- Recommended cross screwdriver specifications: 5 mm diameter, 20 cm length; 3 mm diameter, 15 cm length

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
- Do not remove the parts not mentioned in this document. Do not maintain any part with a method different from that described in this document.
- 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.
- After the motor is maintained, it is necessary to calibrate the zero point. Otherwise, the motor may encounter runaway after restart, posing serious safety hazards.

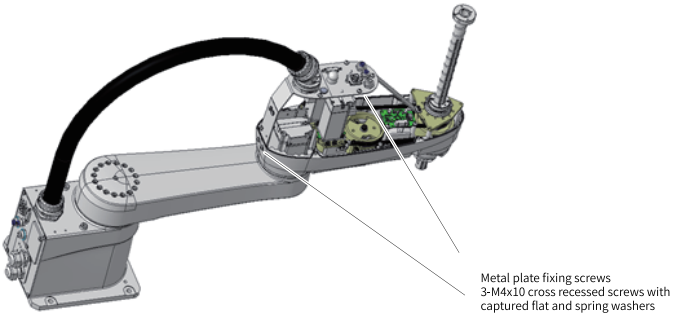
Warning

- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Prevent foreign objects from entering the equipment and terminals during maintenance.
- After the equipment is replaced, perform wiring inspection and parameter settings again.
- 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 motor and encoder. Failure to comply may result in motor failure due to misalignment during reassembly.

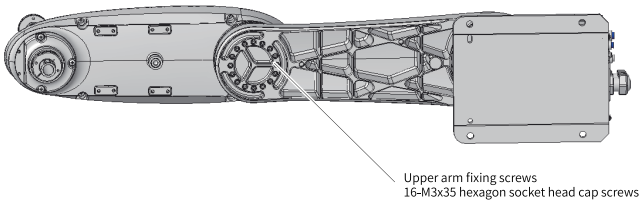
4.4.2.1 Maintaining the J2 Motor and Reducer

Step 1: Remove the forearm enclosure. Remove the enclosure according to *"4.2.1 Removing and Installing the Enclosure of the Forearm" on page 140* (See figure in *"4.2.1 Removing and Installing the Enclosure of the Forearm" on page 140*).

Step 2: Remove the sheet metal fixing screws. Remove the 3-M4×10 cross recessed screws with captured flat and spring washers on the back and top of the sheet metal part of the forearm, disconnect the power cables and encoder cables of the J2, J3, J4 motors and then remove the sheet metal parts and the cables.

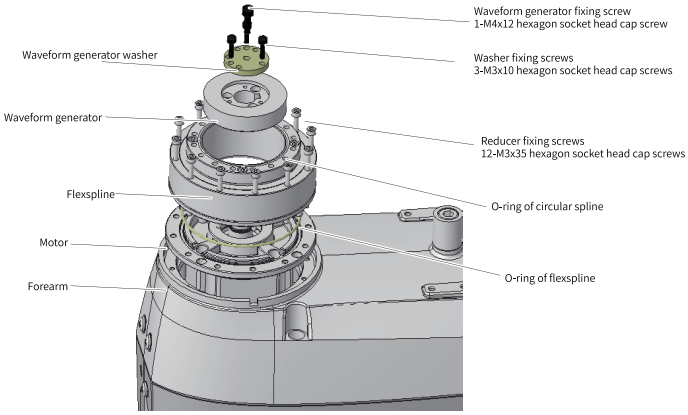


Step 3: Remove the the upper arm fixing screws and remove the J2 assembly.

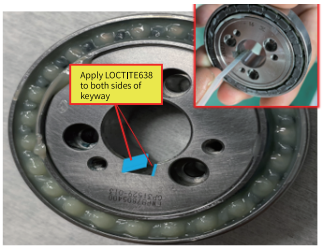


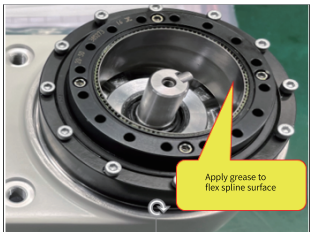
Step 4: Remove the waveform generator fixing screws, clamp the washer with a circlip pliers, screw the M5 screw into the M5 hole in the middle of the washer, remove the waveform generator and then remove the washer fixing screws.

Step 5: Remove the reducer fixing screws, remove the reducer and the O-ring, then remove the motor fixing screws and replace the motor or reducer. For the parts number, see *"4.4.11 Parts List" on page 195*.



Step 6: Re-assemble the J2 motor and reducer. To re-assemble, reverse the above steps. Note that the grease needs to be replaced after the motor and reducer are replaced. For replacement of the grease, see *"4.4.2.2 Replacing the Grease of J2 Reducer" on page 156*. In addition, apply LOCTITE 638 retaining compound to the keyway of the waveform generator and grease to the surface of the flex spline of the reducer. For the grease types, see *"4.4.11 Parts List" on page 195* (M3 screw tightening torque: 2 N·m, M4 screw tightening torque: 5 N·m. All reducer screws must be coated with LOCTITE 243 threadlocker.)

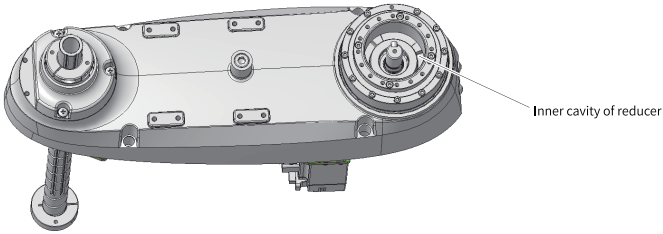


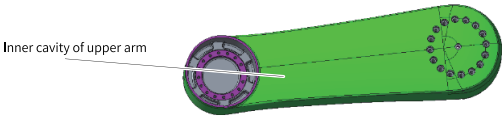


4.4.2.2 Replacing the Grease of J2 Reducer

Step 1: Remove the J2 motor assembly. Remove the J2 motor assembly and waveform generator according to Steps 1-5 in *"4.4.2.1 Maintaining the J2 Motor and Reducer" on page 154*.

Step 2: Clean the old grease from the waveform generator and the circular spline of the harmonic reducer, and apply grease (H: SK-1A grease, X: SFB grease) evenly to the inner cavity of the reducer (approx. 20 ml, 18 g) and the forearm (approx. 13 ml, 11 g). For grease types, see *"4.4.11 Parts List" on page 195*.





Step 3: Re-assemble the reducer. To re-assemble, reverse the above steps (M3 screw tightening torque: 2 N·m, M4 screw tightening torque: 5 N·m. All reducer screws must be coated with a threadlocker).

4.4.3 J3 Maintenance

Tools list:

	Name	Quantity
Maintenance Parts	J3 motor	1
	Other timing belt	1
	Reducer grease	-
Tools	Hexagonal wrench	1
	Torque screwdriver (0 N·m to 10 N·m)	1
	Hexagon bit set	1
	Oil-absorbing sheet	Several
	Wiping cloth	Several
	Phillips screwdriver	2
	Tension meter	1

Screw tightening torque reference:

Screw	Torque (N·m)
M4	3.5
M3	1
M4 set screw	1.8N·m

Note

- Recommended bit specifications: 3/4/5/6/8 mm diameter, 15 cm length; 1.5/2/2.5 mm diameter, 10 cm length
- Recommended cross screwdriver specifications: 5 mm diameter, 20 cm length; 3 mm diameter, 15 cm length

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
- Do not remove the parts not mentioned in this document. Do not maintain any part with a method different from that described in this document.
- 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.
- After the motor is maintained, it is necessary to calibrate the zero point. Otherwise, the motor may encounter runaway after restart, posing serious safety hazards.

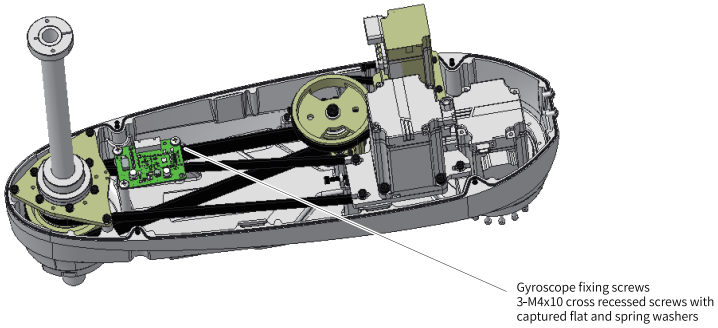
Warning

- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Prevent foreign objects from entering the equipment and terminals during maintenance.
- After the equipment is replaced, perform wiring inspection and parameter settings again.
- 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 motor and encoder. Failure to comply may result in motor failure due to misalignment during reassembly.

4.4.3.1 Maintaining the J3 Timing Belt

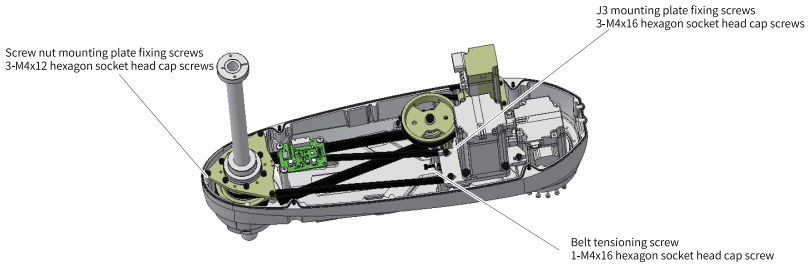
Step 1: Remove the enclosure, cables and sheet metal components of the forearm. Remove the enclosure according to *"4.2.1 Removing and Installing the Enclosure of the Forearm" on page 140* (See figure in *"4.2.1 Removing and Installing the Enclosure of the Forearm" on page 140*). Remove the cables and sheet metal components according to Step 2 in *"4.4.2.1 Maintaining the J2 Motor and Reducer" on page 154* (See figure in *"4.2.1 Removing and Installing the Enclosure of the Forearm" on page 140*).

Step 2: Remove the gyroscope board. Remove the screws that fix the gyroscope board and then remove the gyroscope board.



Step 3: Remove the J3 belt tensioning screw, the screws fixing the J3 mounting plate, the screws fixing the screw nut mounting plate, remove the shaft and screw nut

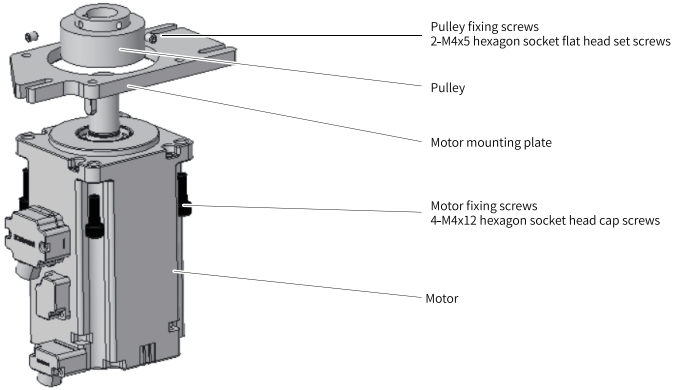
assembly (Note that the screw nut and shaft must not be separated), remove the J3 motor assembly and then replace the timing belt. Re-assemble the J3 (M4 screw tightening torque: 3.5 N·m and M3 screw tightening torque: 1 N·m) by reversing Steps 1 and 2. Tighten the belt with the tension screw (Measure the belt with a tension meter to ensure the frequency is 75 Hz to 85 Hz).



4.4.3.2 Maintaining the J3 Motor

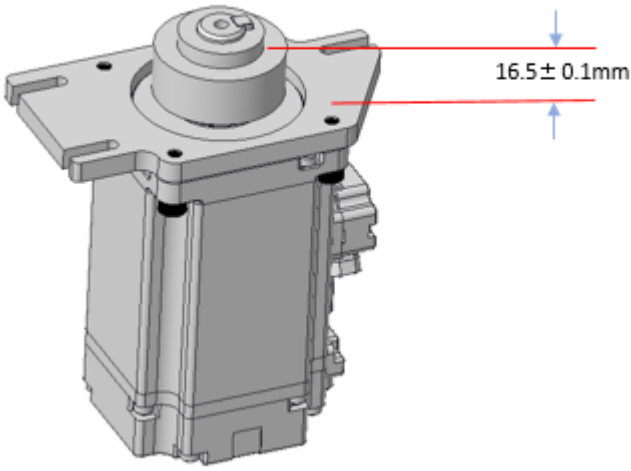
Step 1: Remove the J3 assembly according to Steps 1-4 in *"4.4.3.1 Maintaining the J3 Timing Belt" on page 159*.

Step 2: Remove the square wheel fixing screws and remove the square wheel, then remove the pulley fixing screws and the motor fixing screws and replace the motor.



Step 3: Re-assemble the J3 motor. After replacing the motor, install the pulley (Align two set screw holes with D-cut of the motor). Use a height scale to ensure that the top of the square wheel is 16.5 ± 0.1 mm from the motor mounting plate, and then lock the square wheel with M4×5 set screws. Then reinstall the J3 (M4×5 set screw tightening torque: 1.8 N·m, M4 screw: 3.5 N·m, M3 screw tightening torque: 1 N·m)

by reversing the Steps 1 and 2. Tighten the belt with the tension screw (Measure the belt with a tension meter to ensure the frequency is 75 Hz to 85 Hz).



4.4.4 J4 Maintenance

Tools list:

	Name	Quantity
Maintenance Parts	J4 motor	1
	Other timing belt	2
	Reducer grease	-
	Brake	1
Tools	Hexagonal wrench	1
	Torque screwdriver (0 N·m to 10 N·m)	1
	Hexagon bit set	1
	Oil-absorbing sheet	Several
	Wiping cloth	Several
	Phillips screwdriver	2
	Tension meter	1

Screw tightening torque reference:

Screw	Torque (N·m)
M3	1.5
M4	3

Note

- Recommended bit specifications: 3/4/5/6/8 mm diameter, 15 cm length; 1.5/2/2.5 mm diameter, 10 cm length
- Recommended cross screwdriver specifications: 5 mm diameter, 20 cm length; 3 mm diameter, 15 cm length

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
- Do not remove the parts not mentioned in this document. Do not maintain any part with a method different from that described in this document.
- 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.
- After the motor is maintained, it is necessary to calibrate the zero point. Otherwise, the motor may encounter runaway after restart, posing serious safety hazards.

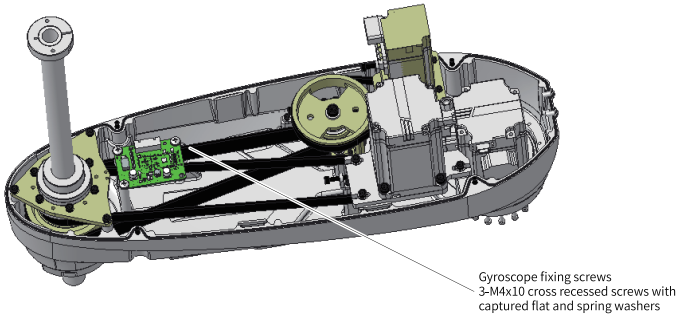
Warning

- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Prevent foreign objects from entering the equipment and terminals during maintenance.
- After the equipment is replaced, perform wiring inspection and parameter settings again.
- 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 motor and encoder. Failure to comply may result in motor failure due to misalignment during reassembly.

4.4.4.1 Maintaining the J4 Timing Belt

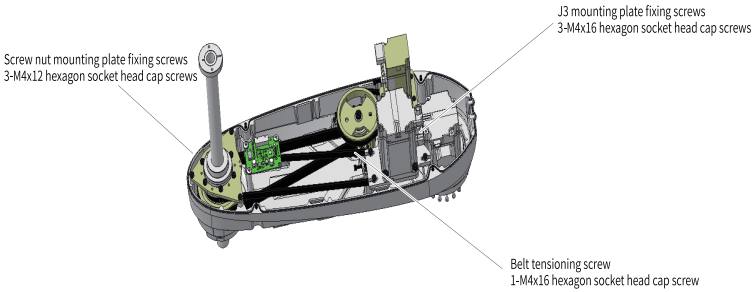
Step 1: Remove the enclosure, cables and sheet metal components of the forearm. Remove the enclosure according to *"4.2.1 Removing and Installing the Enclosure of the Forearm" on page 140* (See figure in *"4.2.1 Removing and Installing the Enclosure of the Forearm" on page 140*). Remove the cables and sheet metal components according to Step 2 in *"4.4.2.1 Maintaining the J2 Motor and Reducer" on page 154* (See figure in *"4.2.1 Removing and Installing the Enclosure of the Forearm" on page 140*).

Step 2: Remove the gyroscope board. Remove the screws that fix the gyroscope board and then remove the gyroscope board.

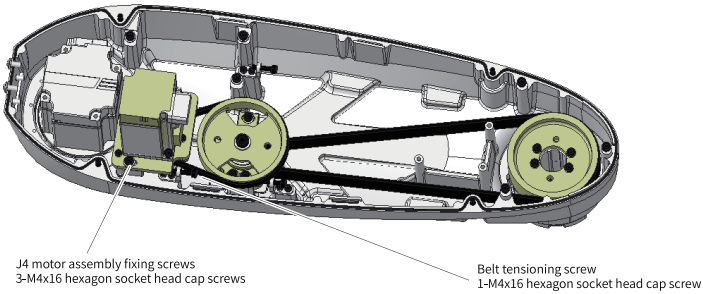


Step 3: Remove the J3 belt tensioning screw, the screws fixing the J3 mounting plate, the screws fixing the screw nut mounting plate, remove the shaft and screw nut

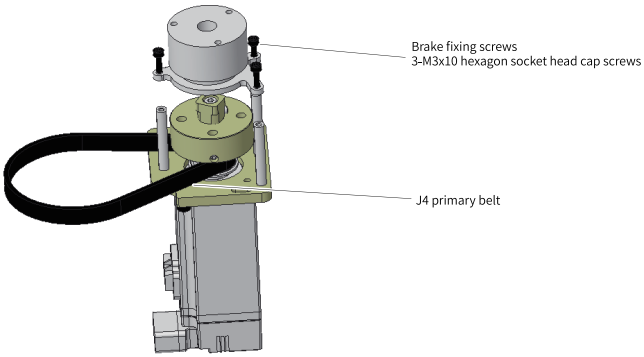
assembly (Note that the screw nut and shaft must not be separated), and then remove the J3 motor assembly.



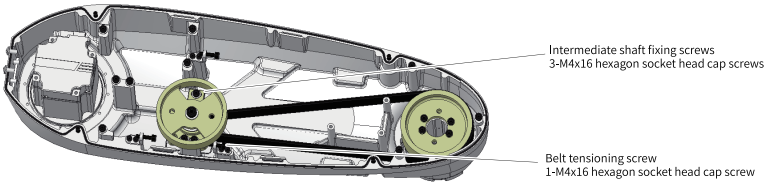
Step 4: Remove the J4 belt tensioning screw, the screws fixing the J4 assembly, and then remove the J4 motor assembly.



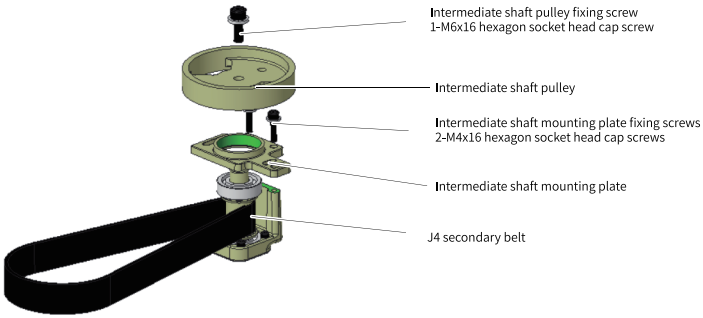
Step 5: Remove the brake fixing nut, remove the brake, and replace the J4 primary belt. Tighten the belt with the belt tensioning screws (395 Hz to 415 Hz).



Step 6: Remove the intermediate shaft fixing nut and remove the intermediate shaft assembly.



Step 7: Remove the J4 motor assembly and the intermediate shaft assembly. Remove the pulley fixing screws of the intermediate shaft, the fixing screws of the intermediate shaft mounting plate, remove the intermediate shaft mounting plate, and replace the secondary belt. Then re-assemble the J4 by reversing the removal steps (M4 screw tightening torque: 3.5 N · m, M6 screw tightening torque: 15 N · m). Tighten the belt with the belt tensioning screws (75 Hz to 85 Hz).

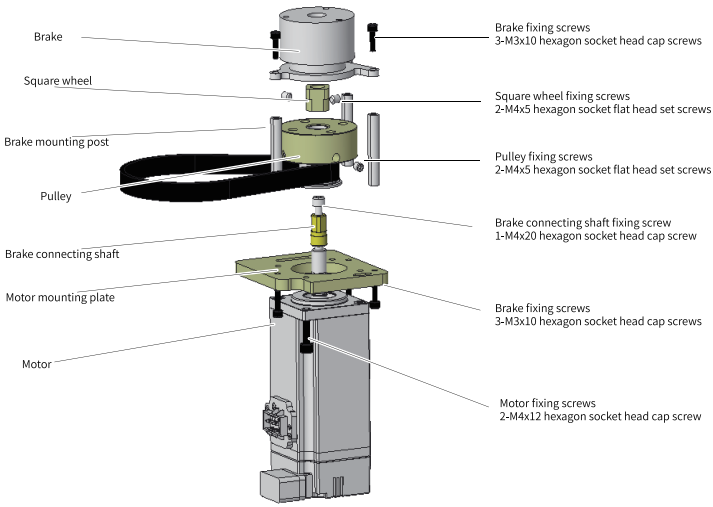


4.4.4.2 Maintaining the J4 Motor and Brake

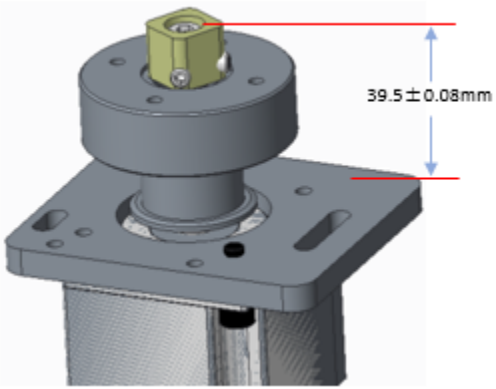
Step 1: Remove the J4 motor assembly. Remove the J4 motor assembly according to Steps 1-4 in *"4.4.4.1 Maintaining the J4 Timing Belt" on page 163*.

Step 2: Replace the J4 brake. Remove the brake fixing screws, remove the brake, remove the square wheel fixing screws and remove the square wheel, then replace the square wheel and brake.

Step 3: Replace the motor. Remove the screws fixing the brake connecting shaft while holding the brake connecting shaft using a wrench, and remove the brake connecting shaft. Remove the pulley fixing screw and remove the pulley. Then remove the motor fixing screws, remove the motor mounting plate, and replace the motor.



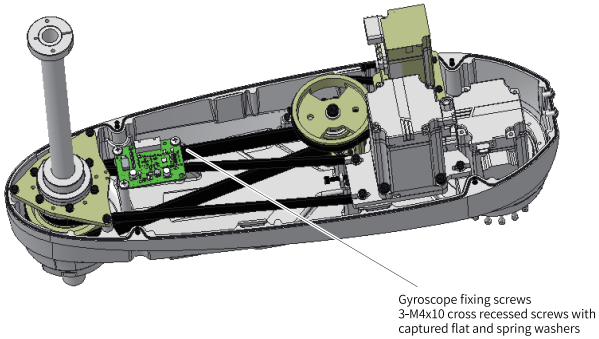
Step 4: Re-assemble the J4 motor and brake. After replacing the motor, align the set screw holes of the pulley with D-cut of the motor to pre-lock the pulley to the motor, and then lock the brake connecting shaft to the motor shaft (torque: 4 N·m). Then install the square wheel. Note that the distance between the square wheel and the motor mounting plate is 39.5 ± 0.08 mm, as shown below. Then push the upper face of the pulley up to contact with the square wheel, lock the pulley set screw, and then install the brake post, belt, and brake (M3 screw tightening torque: 1 N·m, M4×5 screw tightening torque: 1.8 N·m).



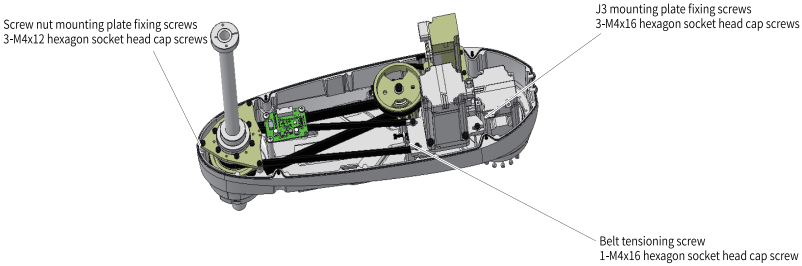
4.4.5 Maintaining the Ball Screw Spline

Step 1: Remove the enclosure, cables and sheet metal components of the forearm. Remove the enclosure according to *"4.2.1 Removing and Installing the Enclosure of the Forearm" on page 140* (See figure in *"4.2.1 Removing and Installing the Enclosure of the Forearm" on page 140*). Remove the cables and sheet metal components according to Step 2 in *"4.4.2.1 Maintaining the J2 Motor and Reducer" on page 154* (See figure in *"4.2.1 Removing and Installing the Enclosure of the Forearm" on page 140*).

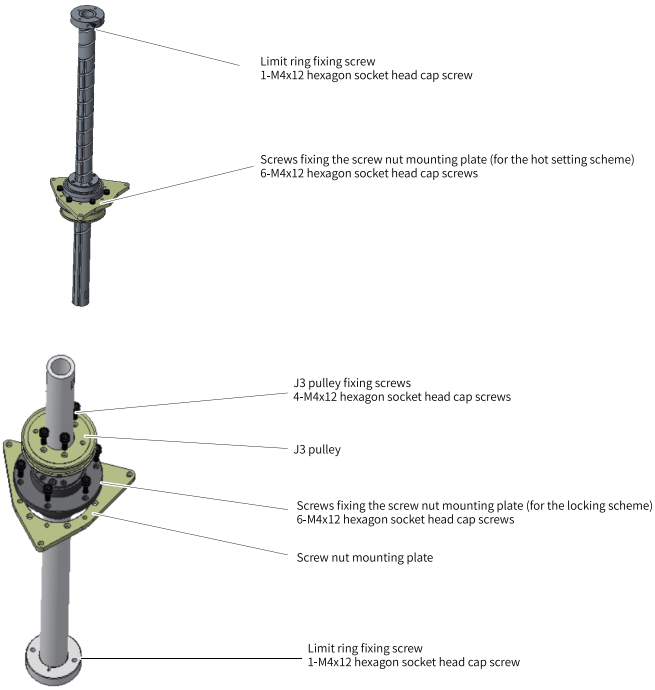
Step 2: Remove the gyroscope board. Remove the screws that fix the gyroscope board and then remove the gyroscope board.



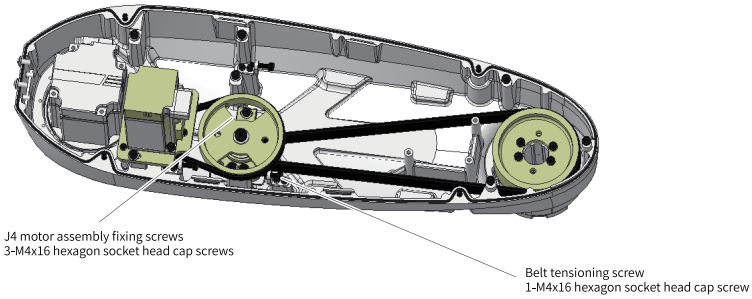
Step 3: Remove the J3 belt tensioning screw, the screws fixing the J3 mounting plate and the screws fixing the screw nut mounting plate, and remove the shaft and screw nut assembly (Note that the screw nut and shaft must not be separated.)



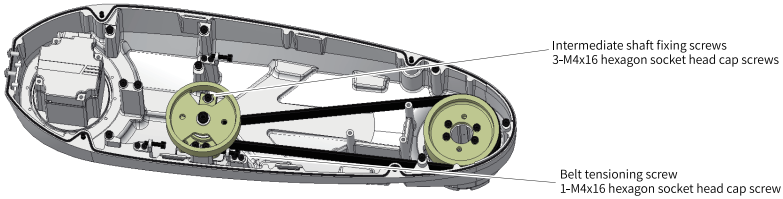
Step 4: Remove the screw nut mounting plate and replace the screw nut and shaft. Remove the screws fixing the screw nut mounting plate and the screws fixing the limit ring, remove the screw nut and shaft (Note that the screw nut and shaft must not be separated), and then replace the shaft and screw nut (Note: For the hot setting scheme, the pulley and screw nut are installed with interference fit, so the screw nut needs to be replaced together with the pulley; For the locking scheme, remove the pulley first and then the screw nut.)



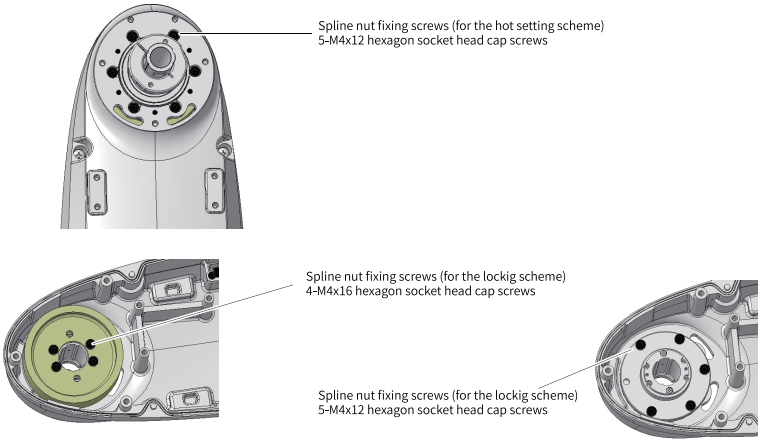
Step 5: Remove the J4 belt tensioning screw, the screws fixing the J4 assembly, and then remove the J4 motor assembly.



Step 6: Remove the screws fixing the intermediate shaft assembly and remove the intermediate shaft assembly.



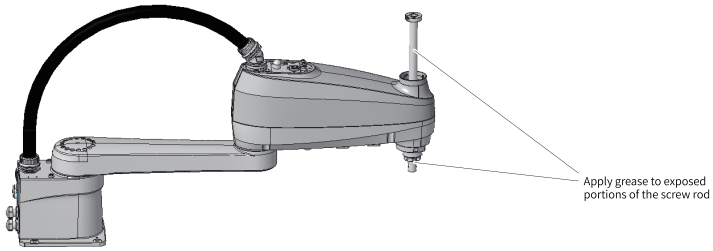
Step 7: Remove the screws fixing the spline nut, remove the spline nut assembly, and replace the spline nut (Note: For the hot setting scheme, the pulley and screw nut are installed with interference fit, so the screw nut needs to be replaced together with the pulley; For the locking scheme, remove the pulley first and then the screw nut.)



Step 8: Re-assemble the ball screw spline. To re-assemble the ball spline screw, reverse the above steps (M3 screw tightening torque: 2 N · m, M4 screw tightening torque: 3.5 N · m).

4.4.6 Maintaining the Ball Screw Spline

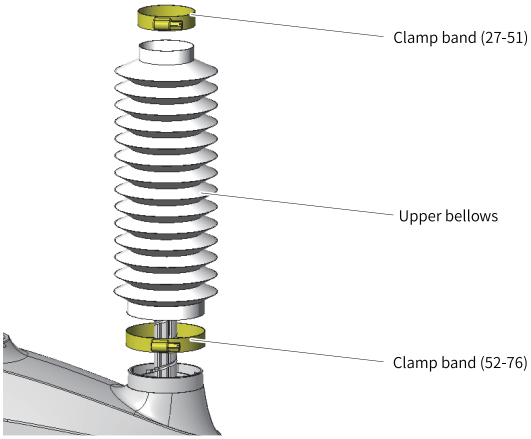
To lubricate the ball screw spline, do as follows:



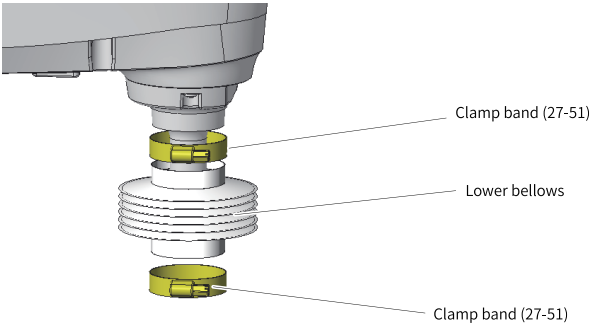
Clean the surface of the shaft with a clean cloth and apply grease (MUL TEMP LRL No.3) to the exposed portion of the shaft. Note that it is sufficient to continue to apply a thin layer of grease to the surface of the shaft, with a grease amount of 1 g. Excessive oil may splash onto processed products or equipment. The coating effect is shown in the following figure.

4.4.7 Replacing and Maintaining the Bellow of Cleanroom Model

Step 1: Remove the clamp band using a Phillips screwdriver and replace the upper bellow with a new one, then install the clamp band with a torque of 0.7 N·m.



Step 2: Remove the clamp band using a Phillips screwdriver and replace the lower bellow with a new one, then install the clamp band with a torque of 0.7 N · m.



4.4.8 Robot Cable Maintenance

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
- Do not remove the parts not mentioned in this document. Do not maintain any part with a method different from that described in this document.
- 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.

- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Prevent foreign objects from entering the equipment and terminals during maintenance.
- After the equipment is replaced, perform wiring inspection and parameter settings again.
- Connect the cables firmly. Do not lay heavy objects on the cables, or bend or pull the cables forcibly. Failure to comply will result in cable damage, wire breaking, or poor contact, causing electric shock or system fault.
- Wiring cables must meet diameter and shielding requirements. The shielding layer of the shielded cable must be reliably grounded at one end.
- Make the connections in correct sequence. Otherwise, the system may not work properly, which may cause safety hazards.
- After wiring, make sure there are no fallen screws and exposed cables inside the equipment.

4.4.8.1 Replacing the Cables Connected Between the Base and the Forearm

To replace the cables connected between the base and the forearm of the IR-S10 series robots, follow the steps below.

Step 1: Turn on the robot controller.

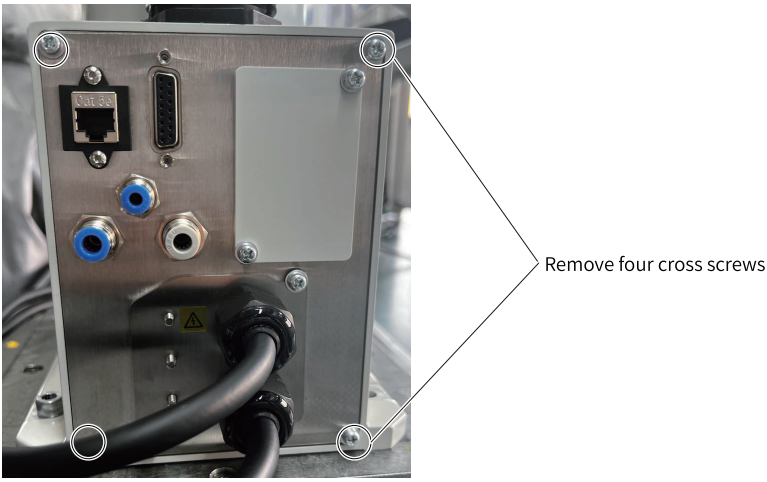
Step 2: Hang a "Maintenance in process" sign. The "Maintenance in process" sign is used to prevent other operators from operating the robot.

Step 3: Enter the safeguard system.

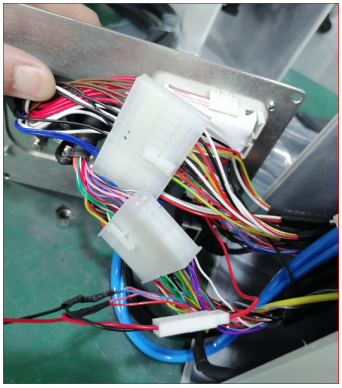
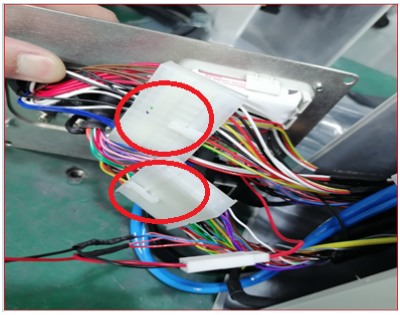
Step 4: Press the brake release switch to release the brake of J3, and then lower J3 to the lower limit. Ensure that sufficient space is left to prevent the end effector from colliding with peripheral devices.

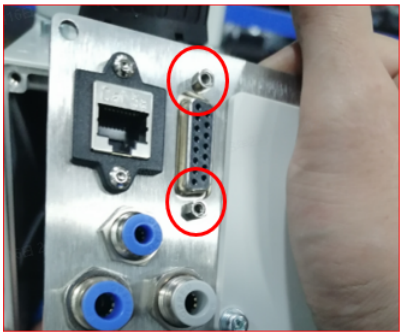
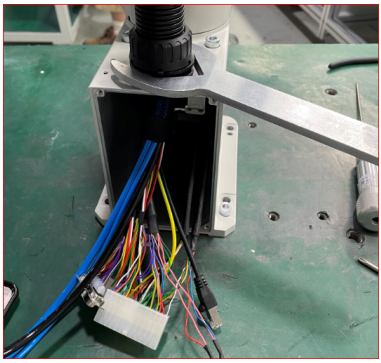
Step 5: Turn off the controller and disconnect the power and encoder cables connected to the controller.

Step 6: Remove the four screws (4-M4×10 cross recessed pan head screws with captured flat and spring washers) from the front cover of the base and then remove the front cover.

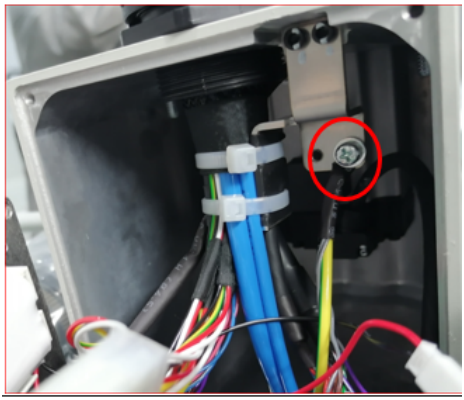
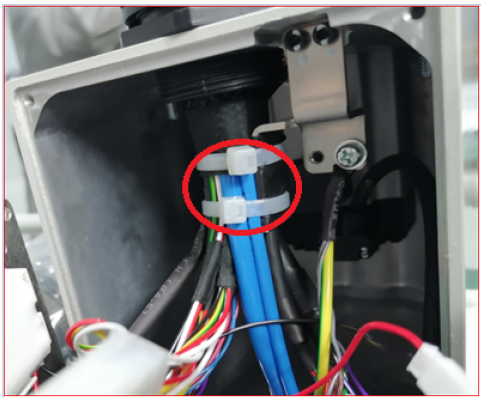


Step 7: Gently pull the internal cables out of the base, disconnect the power and encoder connectors connected to the base, disconnect the three air tubes and network cables connected to the cover of the base, disconnect the DB15 connector, and then disconnect the grounding wire.

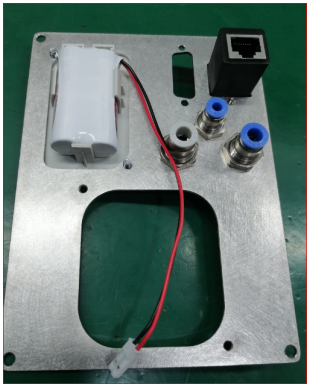
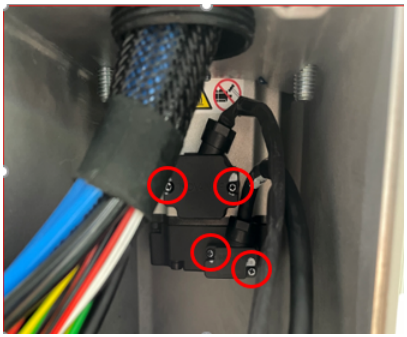
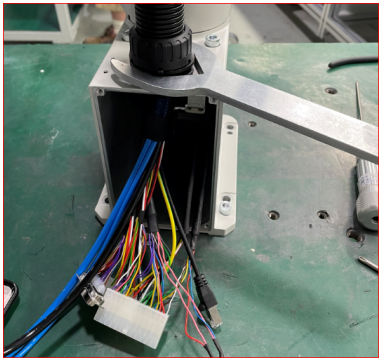
Step	Description	Diagram
①	Gently pull the internal cables out of the base	
②	Disconnect the power and encoder connectors	

Step	Description	Diagram
③	Disconnect the DB15 connector	
④	Disconnect the network cable and air tube	

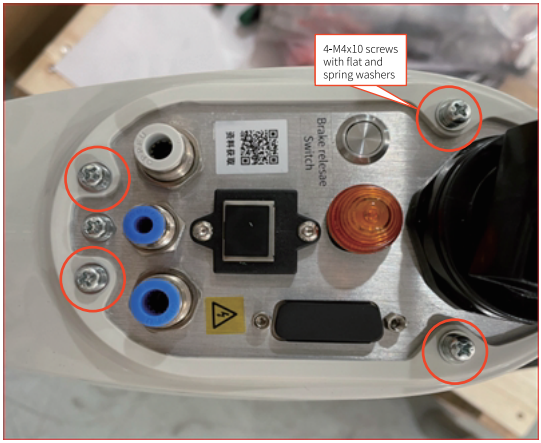
Step 8: Remove the grounding terminal fixed to the sheet metal inside the base and cut the cable tie.

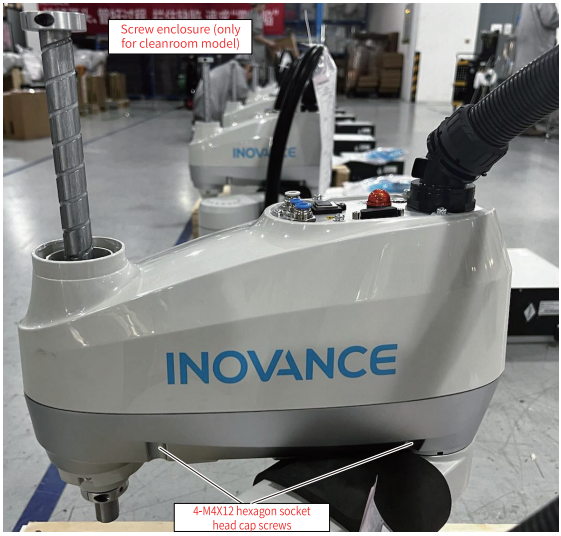
Step	Description	Diagram
①	Remove Grounding terminal on the sheet metal inside the base	
②	Cut the cable tie	

Step 9: Remove the battery, disconnect the J1 encoder and power cable terminals, remove the bellows connector from the base, and lead the cables out of the base.

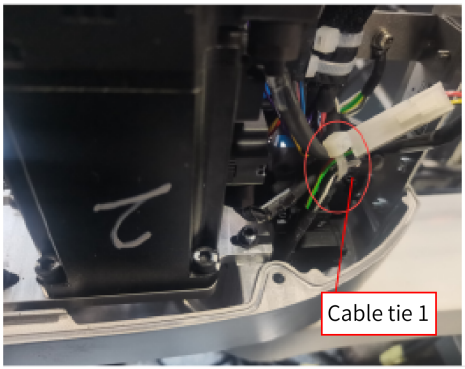
Step	Description	Diagram
①	Remove the battery	
②	Disconnect the J1 encoder and power cable terminals	
③	Remove the bellows connector from the base	

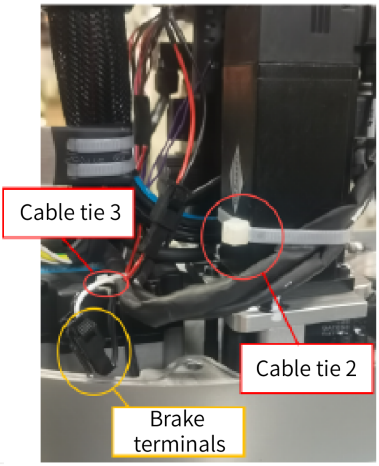
Step 10: Remove the forearm enclosure.

Step	Description	Diagram
①	Top of the forearm enclosure	
②	Side screws	

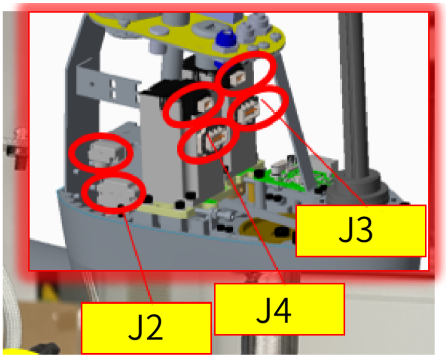
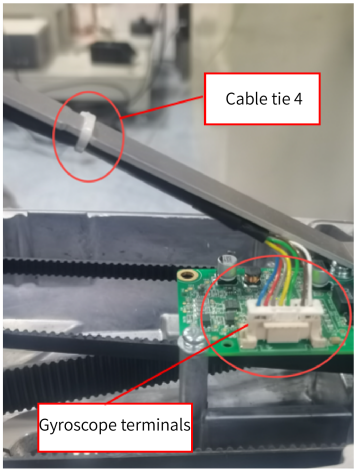
Step	Description	Diagram
③	Bottom screws	

Step 11: Cut the cable tie on the motor.





Step 12: Remove the screws (M2×8.5 cross recessed pan head screws) fixing the power and encoder connectors of J2, J3 and J4 using a Phillips screwdriver, and gently remove the connectors from the male connector at the motor side. Be careful that the connector pins do not bend. Disconnect the brake button connector and the gyroscope terminals.

Step	Description	Diagram
①	Remove the screws (M2x8.5) fixing the power and encoder connectors of J2, J3 and J4 using a Phillips screwdriver	
②	Disconnect the brake button connector and the gyroscope terminals	

Step 13: Remove the screws (4-M4×8 cross recessed pan head screws) fixing the sheet metal of the forearm and remove the cables from the forearm.

Step 14: Remove the cables from the manipulator.

Step 15: Connect the power and encoder connectors connected to the controller and tighten the DB25 connector of the encoder with a screwdriver.

4.4.8.2 Replacing the Cables Connected Between the Manipulator and Controller

This section describes how to replace the cable unit between the manipulator and the controller.

For the IR-S10 series robots, follow the steps below.

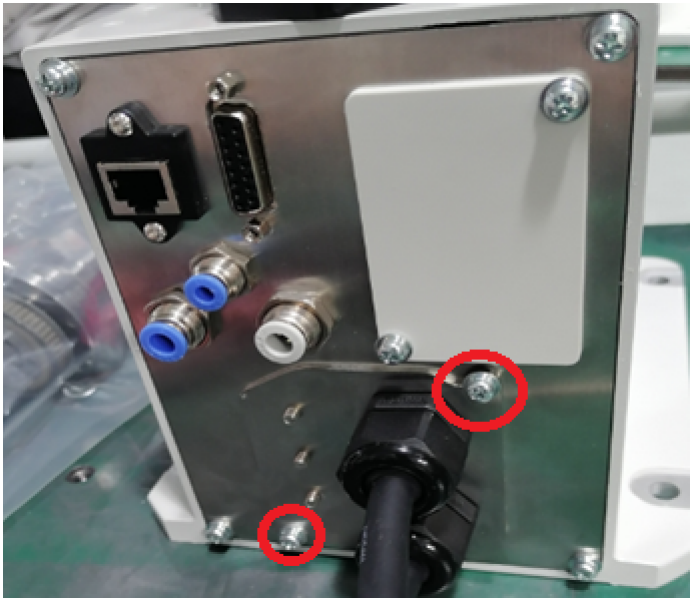
Step 1: Turn off the controller.

Step 2: Disconnect the power and encoder cables connected to the controller.

Step 3: Hang a "Maintenance in process" sign. The "Maintenance in process" sign is used to prevent other operators from operating the robot.

Step 4: Enter the safeguard system.

Step 5: Remove the two screws on the sheet metal of the trailing cable.



Step 6: Gently pull the trailing cable out of the base and disconnect the power and encoder connectors.

4.4.8.3 Replacing and Maintaining the Battery

- Open the cover of the controller only when maintenance is needed. High voltage inside the controller poses a risk of electric shock even when the power is turned off.
- Before replacement, always turn off the power supply of the controller and related devices and remove the power plug. Operating with the power on may cause electric shock or malfunction.
- Do not remove or install the motor connector while the power is still on. Failure to comply may result in abnormal action of the manipulator, 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 manipulator, 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 replacement, always turn off the power supply of the controller and related devices and remove the power plug. Operating with the power on may cause electric shock or malfunction.
- 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.
  - Charging
  - Compression and deformation
  - Dismantling
  - Short circuit
  - Incorrect installation
  - Heating
  - Burning in fire
  - Soldering
  - 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) and the position data of the motor will be lost. In this case, you need to calibrate the origin 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.

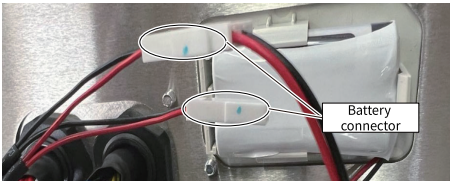
Note

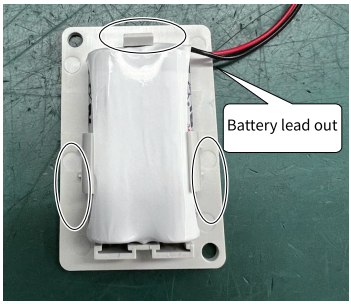
The battery pack includes two lithium batteries. Replace the batteries one by one. (When two batteries are removed at the same time, the position data of the motor are lost. In this case, you need to calibrate the origin of all joints.)

To replace the battery, do as follows:

Step 1: Return the robot to the zero point and cut off the power supply to the robot, then remove the battery cover at the rear of the base.

Step 2: Gently pull out the battery compartment, connect a new battery to the spare battery connector, then disconnect the old battery and secure the new battery to the compartment.





Step 3: Put back the battery compartment and fix it with two screws with a torque of 0.6 N·m.

4.4.9 Home Position Calibration

4.4.9.1 Description of Home Position Calibration

The home position is the reference point and base point for the robot. After parts (motors, reducer, timing belt, and cables etc.) have been replaced, the robot cannot execute the positioning properly because a mismatch exists between the home position stored in the motors and its corresponding home position stored in the controller. Therefore, home position calibration is required after the part replacement.

Note

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

Warning

- 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 performs unexpected actions.

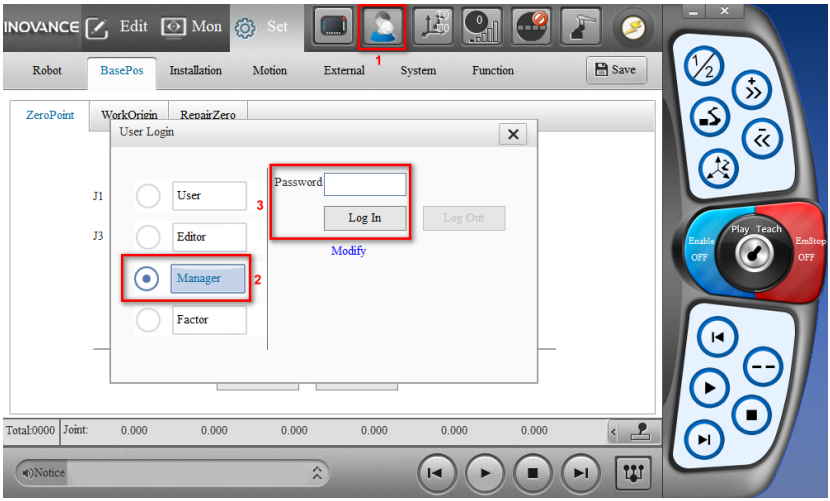
4.4.9.2 Home Position Calibration Procedure

Both the teaching software on PCs and the hand-held teach pendant provide an operation interface for home position calibration. The following takes the teaching software on PC as an example. The operations on the hand-held teach pendant are similar.

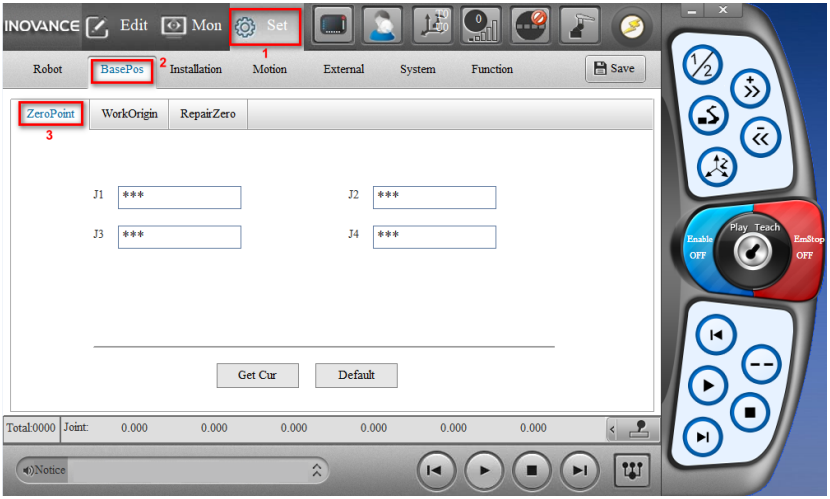
Due to the strong correlation between the coordinates of the robot's work points and the accuracy of J2, it is necessary to complete the home position calibration of J2 before calculating the robot coordinates. The teach pendant provides a right/left wrist rule wizard. Follow the wizard to calibrate the home position. For the adjustment method, see *"4.4.9.4 Home Position Calibration of J2" on page 191*.

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

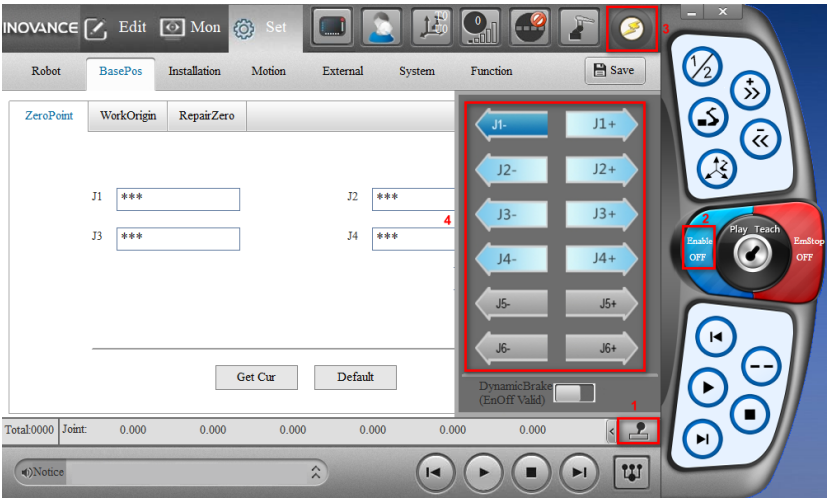
1. Log in to the user account.
   a. Click the shortcut key of user settings on the main interface of the PC teaching software or the hand-held teach pendant to open the user settings interface.
   b. Enter the password in the password input box and click the **log In** button.



2. Switch to the absolute zero setting interface.
   Choose **Set** > **BasePos** > **ZeroPoint** on the main interface of the teaching software or the hand-held teach pendant.

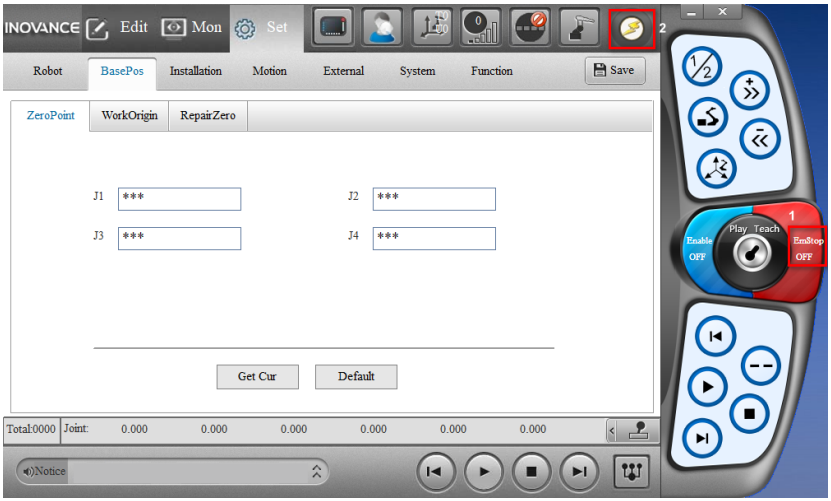


3. Move each joint of the robot to the home position.
   - Move the robot near the home position by using the joystick on the hand-held teach pendant or on the operation interface on the teaching software. See Teach Pendant User Guide.
   - Also, you can manually push the robot to the home position when the motor is not enabled.



4. Switch to the emergency stop state.
   a. Click the virtual emergency stop button on the PC teaching software or press the red emergency stop button on the hand-held teach pendant.

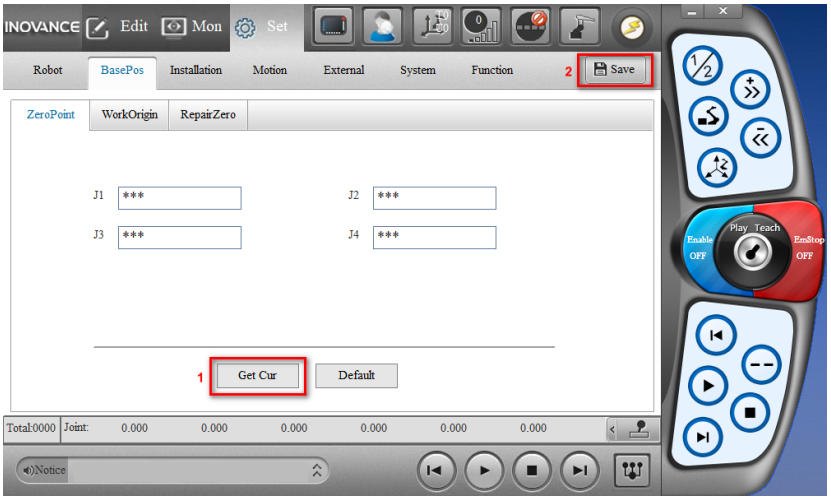
b. The status indicator on the upper right corner of the teaching software (or the display of the hand-held teach pendant) shows the emergency stop state (in red).



5. Obtain and save the home position information.

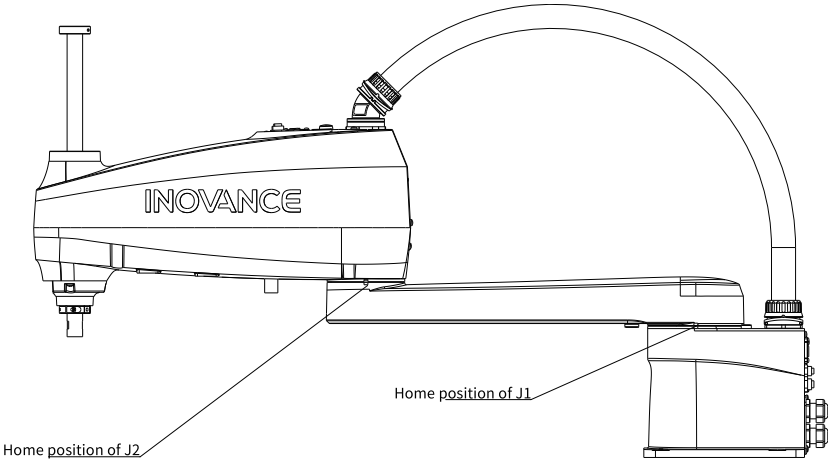
a. Click the **Get Cur** button when the robot moves to the home position to obtain the encoder pulses at the home position.

b. Click the **Save** button to complete the home position calibration.



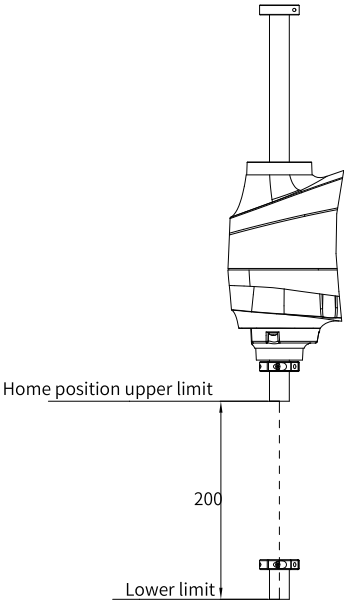
4.4.9.3 Home Position of Each Joint

1. The following figure shows the home position of J1 and J2.



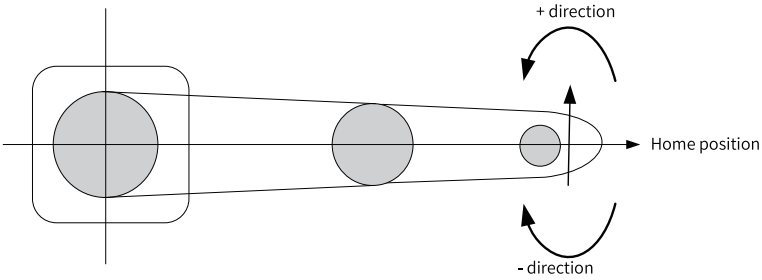
Model	J1 Max Motion Range	J2 Max Motion Range
IR-S10-80Z20S3	±132°	±150°

2. Home position of J3: Upper limit position in motion range.



Model	Stroke of J3
IR-S10-80Z20S3	200 mm

3. Home position of J4: Position where the flat surface on the shaft (or the slots of the upper and lower mechanical stops) faces towards the tip of Arm #2.



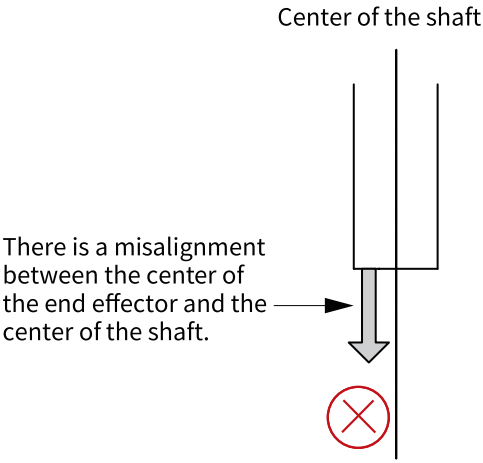
Model	J4 Max Motion Range
IR-S10-80Z20S3	±360°

4.4.9.4 Home Position Calibration of J2

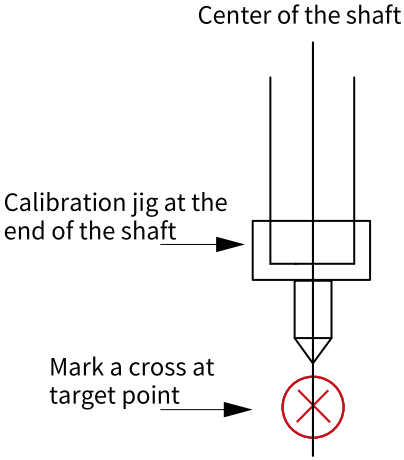
Due to the strong correlation between the coordinates of the robot's work points and the accuracy of J2, it is necessary to complete the home position calibration of J2 before calculating the robot coordinates. To calibrate the home position of J2, follow the wizard provided on the teach pendant for home position calibration using right/left wrist rule.

Calibration Procedure

1. The reference point for home position calibration 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 perform home position calibration.



2. Make a home position calibration jig (example) on the top side of the shaft to clarify the center of the shaft, as shown in the figure below. Make the position that can be easily recognized when changing the right/left wrist pose the target point, and mark it with X.



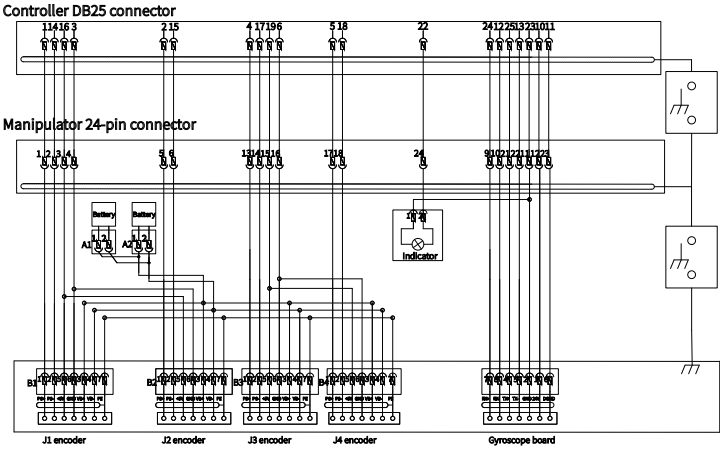
3. Perform home position calibration using the left/right wrist.
   a. Adjust the robot end to the target point position using the right wrist (or left wrist) pose. On the teach pendant, go to **Set** > **BasePos** > **ZeroPoint**, click the **Get Cur** button and record the degree of J2 in current state 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 in current state as Enc2.

c. On the teach pendant, go to **Set** > **BasePos** > **ZeroPoint**, click the **Default** button and get the currently saved home position info. Calculate (Enc1+Enc2)/2 and fill in the calculation result into the input box of J2, and then click the **Save** button. The home position calibration of J2 is complete.

4. After removing the end effector and executing the calibration, install the end effector and move the robot to the teaching point to verify whether is a a positional gap. If there is a positional gap, fine-tune the installation position of the end effector and teach the point again.

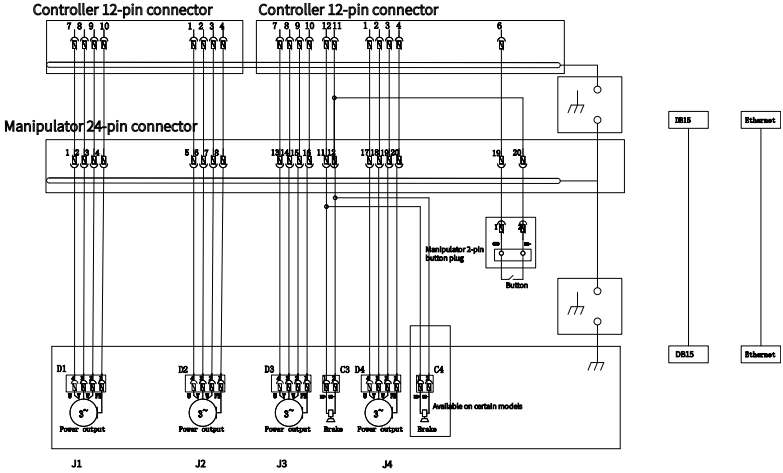
4.4.10Wiring Diagrams

The following figure shows the encoder cable connection.



Encoder Pin	7	1	2	5	6	3	4
Definition	Shield	PS+	PS-	5V	GND	BT+	BT-

The following figure shows the power cable connection.



Power Output Pin	1	2	3	4	1	2
Definition	U	V	W	PE	BK+	BK-

4.4.11Parts List

S10 Series			
Parts Name		Parts Number	Maintenance Guide
AC servo motor	J1	01115496	"4.4.1.1 Maintaining the J1 Motor and Reducer" on page 149
	J2	01115497	"4.4.2.1 Maintaining the J2 Motor and Reducer" on page 154
	J3	01112552	"4.4.3.2 Maintaining the J3 Motor" on page 160
	J4	01115498	"4.4.4.2 Maintaining the J4 Motor and Brake" on page 166
Reducer	J1	H: 72100614, X: 72100841	"4.4.1.1 Maintaining the J1 Motor and Reducer" on page 149
	J2	H: 72100615, X: 72100835	"4.4.2.1 Maintaining the J2 Motor and Reducer" on page 154
Timing belt	J3	72100748	"4.4.3.1 Maintaining the J3 Timing Belt" on page 159
	J4 primary belt	22030050	"4.4.4.1 Maintaining the J4 Timing Belt" on page 163
	J4 secondary belt	72100608	"4.4.4.1 Maintaining the J4 Timing Belt" on page 163
Ball screw spline		01791602	"4.4.5 Maintaining the Ball Screw Spline" on page 167

S10 Series			
Parts Name		Parts Number	Maintenance Guide
Spare parts of ball screw spline (including sheave and screws)		01791603	-
Battery		71010029	*"4.4.8.3 Replacing and Maintaining the Battery" on page 184*
Grease	J1 reducer grease	H: 24060061 (SK-1A), X: 24060141 (SFB)	*"4.4.1.2 Replacing the Grease of J1 Reducer" on page 152*
	J2 reducer grease	H: 24060061 (SK-1A), X: 24060141 (SFB)	*"4.4.2.2 Replacing the Grease of J2 Reducer" on page 156*
	Ball screw spline	24060125 MUL TEMP LRL No.3	*"4.4.6 Maintaining the Ball Screw Spline" on page 170*
Enclosure parts	Forearm enclosure	20213154	-
	Spline enclosure	20213088	-
	Battery cover	20212945	-
	Limit post	20210329	-
Manipulator cable		600 arm length: 1504DG24 700 arm length: 1504DG25 800 arm length: 1504DG26	-
J4 brake and cables		1504D795	-
Upper bellows for cleanroom model		20422357	-
Upper bellows for cleanroom model		20422358	-
		1504D708: 3 m 1504D709: 5 m 1504D710: 10 m 1504D711: 15 m	-
Trailing cable of controller 2.0		1504PW06: 3 m 1504PW14: 5 m 1504PW15: 10 m 1504PW16: 15 m	-

PS00017525A00

Shenzhen Inovance Technology Co., Ltd.

www.inovance.com

Add.: Inovance Headquarters Tower, High-tech Industrial Park,
Guanlan Street, Longhua New District,
Shenzhen 518000, P.R. China
Tel: (0755) 2979 9595 Fax: (0755) 2961 9897

Suzhou Inovance Technology Co., Ltd.

www.inovance.com

Add.: No.52, Tian'e Dang Road, Wuzhong District,
Suzhou 215104, P.R. China
Tel: (0512) 6637 6666 Fax: (0512) 6285 6720