



IR-S4&IR-S7&IR-S10 Series SCARA Robots Maintenance Guide



Industrial
Automation



Intelligent
Elevator



New Energy
Vehicle



Industrial
Robot



Rail
Transit



Data code PS00017525A01

Preface

Introduction

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

Note

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

Intended Audience

- Electrical engineers
- Mechanical engineers
- Hardware engineers

More Data

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

Revision History

Date	Version	Description
April 2025	A01	• Correct minor errors. • Updated "2.2.1 Periodic Inspection" on page 20. • Updated "2.4.10.2 Procedure of Zero Point Adjustment" on page 68.
June 2024	A00	Initial release.

Access to the Guide

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

- Visit www.inovance.com, go to Support > Download, search by keyword, and then download the PDF file.
- Scan the QR code on the product with your smart phone.

- Scan the QR code below to install the My Inovance app, where you can search for and download guides.



Warranty

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

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

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

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

For details, see the Product Warranty Card.

Table of Contents

Preface	1
1 Safety	6
1.1 Safety Precautions	6
1.2 Special Precautions	13
1.3 Safety Signs	14
1.4 Emergency Movement and Emergency Stop	14
2 IR-S4 Series SCARA Robot Maintenance Guide	17
2.1 Product Information	17
2.1.1 Model	17
2.1.2 Components	18
2.2 Regular Inspection	20
2.2.1 Periodic Inspection	20
2.2.2 Screw Tightening Torque and Method	22
2.2.3 Replacing the Lubricating Grease	23
2.2.4 Daily Control Cabinet Cable Inspection	24
2.3 Enclosure Removal and Installation	26
2.3.1 Removing and Installing the Enclosure of the Forearm	26
2.3.2 Removing and Installing the Bottom Enclosure of Spline Nut	27
2.4 Replacement and Maintenance	28
2.4.1 Maintaining the J1 Axis	28
2.4.1.1 Maintaining the J1 Motor and Reducer	30
2.4.1.2 Replacing the Lubricating Grease for J1 Axis Reducer	33
2.4.2 Maintaining the J2 Axis	35
2.4.2.1 Maintaining the J2 Motor and Reducer	36
2.4.2.2 Replacing the Lubricating Grease for J2 Axis Reducer	39
2.4.3 Maintaining the J3 Axis	40
2.4.3.1 Maintaining the J3 Axis Timing Belt, Brake, and Motor	41
2.4.4 Maintaining the J4 Axis	44
2.4.4.1 Maintaining the J4 Axis Timing Belt	46
2.4.4.2 Maintaining the J4 Motor	49
2.4.5 Maintaining the Ball Screw Spline	50
2.4.6 Maintaining the Ball Screw Spline	54
2.4.7 Replacing and Maintaining the Bellows of Cleanroom Model	55
2.4.8 Robot Cable Maintenance	57
2.4.8.1 Replacing the Cables Connected Between the Base and the Forearm	58
2.4.8.2 Replacing the Cables Connected Between the Robot and Control Cabinet	64
2.4.9 Replacing and Maintaining the Battery	66
2.4.10 Zero Point Adjustment	68

2.4.10.1 Overview of Zero Point Adjustment.	68
2.4.10.2 Procedure of Zero Point Adjustment.	68
2.4.10.3 Zero Point Position of Each Joint	73
2.4.10.4 Zero Point Adjustment of J2	75
2.4.11 Wiring Diagrams.	76
3 IR-S7 Series SCARA Robot Maintenance Guide	78
3.1 Product Information	78
3.1.1 Model	78
3.1.2 Components	79
3.2 Regular Inspection.	81
3.2.1 Periodic Inspection	81
3.2.2 Screw Tightening Torque and Method	83
3.2.3 Replacing the Lubricating Grease	84
3.2.4 Daily Control Cabinet Cable Inspection	85
3.3 Enclosure Removal and Installation	87
3.3.1 Removing and Installing the Enclosure of the Forearm	87
3.3.2 Removing and Installing the Bottom Enclosure of Spline Nut	88
3.4 Replacement and Maintenance	89
3.4.1 Maintaining the J1 Axis.	89
3.4.1.1 Maintaining the J1 Motor and Reducer.	90
3.4.1.2 Replacing the Lubricating Grease for J1 Axis Reducer	93
3.4.2 Maintaining the J2 Axis.	94
3.4.2.1 Maintaining the J2 Motor and Reducer.	96
3.4.2.2 Replacing the Lubricating Grease for J2 Axis Reducer	98
3.4.3 Maintaining the J3 Axis.	100
3.4.3.1 Maintaining the J3 Axis Timing Belt, Brake, and Motor.	101
3.4.4 Maintaining the J4 Axis.	104
3.4.4.1 Maintaining the J4 Axis Timing Belt.	106
3.4.4.2 Maintaining the J4 Motor	109
3.4.5 Maintaining the Ball Screw Spline	110
3.4.6 Maintaining the Ball Screw Spline	115
3.4.7 Replacing and Maintaining the Bellows of Cleanroom Model.	116
3.4.8 Robot Cable Maintenance	117
3.4.8.1 Replacing the Cables Connected Between the Base and the Forearm ...	118
3.4.8.2 Replacing the Cables Connected Between the Robot and Control Cabinet	126
3.4.9 Replacing and Maintaining the Battery.	127
3.4.10 Zero Point Adjustment	129
3.4.10.1 Overview of Zero Point Adjustment.	129
3.4.10.2 Procedure of Zero Point Adjustment.	129
3.4.10.3 Zero Point Position of Each Joint	134
3.4.10.4 Zero Point Adjustment of J2	136

3.4.11 Wiring Diagrams	138
4 IR-S10 Series SCARA Robot Maintenance Guide	140
4.1 Product Information	140
4.1.1 Model	140
4.1.2 Components	141
4.2 Regular Inspection	143
4.2.1 Periodic Inspection	143
4.2.2 Screw Tightening Torque and Method	145
4.2.3 Replacing the Lubricating Grease	146
4.2.4 Daily Control Cabinet Cable Inspection	146
4.3 Enclosure Removal and Installation	148
4.3.1 Removing and Installing the Enclosure of the Forearm	148
4.3.2 Removing and Installing the Bottom Enclosure of Spline Nut	149
4.4 Replacement and Maintenance	150
4.4.1 Maintaining the J1 Axis	150
4.4.1.1 Maintaining the J1 Motor and Reducer	152
4.4.1.2 Replacing the Lubricating Grease for J1 Axis Reducer	154
4.4.2 Maintaining the J2 Axis	156
4.4.2.1 Maintaining the J2 Motor and Reducer	157
4.4.2.2 Replacing the Lubricating Grease for J2 Axis Reducer	159
4.4.3 Maintaining the J3 Axis	161
4.4.3.1 Maintaining the J3 Axis Timing Belt	162
4.4.3.2 Maintaining the J3 Motor	164
4.4.4 Maintaining the J4 Axis	166
4.4.4.1 Maintaining the J4 Axis Timing Belt	167
4.4.4.2 Maintaining the Motor and Brake of J4 Axis	171
4.4.5 Maintaining the Ball Screw Spline	173
4.4.6 Maintaining the Ball Screw Spline	177
4.4.7 Replacing and Maintaining the Bellows of Cleanroom Model	178
4.4.8 Robot Cable Maintenance	180
4.4.8.1 Replacing the Cables Connected Between the Base and the Forearm ...	181
4.4.8.2 Replacing the Cables Connected Between the Robot and Control Cabinet	188
4.4.9 Replacing and Maintaining the Battery	189
4.4.10 Zero Point Adjustment	191
4.4.10.1 Overview of Zero Point Adjustment	191
4.4.10.2 Procedure of Zero Point Adjustment	191
4.4.10.3 Zero Point Position of Each Joint	196
4.4.10.4 Zero Point Adjustment of J2	198
4.4.11 Wiring Diagrams	199

1 Safety

1.1 Safety Precautions

Safety Disclaimer

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

Safety Levels and Definitions



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



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



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

Safety Precautions

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

Unpacking**WARNING**

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

**CAUTION**

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

Storage and Transportation



WARNING

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



CAUTION

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

Installation**DANGER**

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

**WARNING**

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

**CAUTION**

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

Wiring**DANGER**

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

**WARNING**

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

**CAUTION**

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

Power-on**DANGER**

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

**WARNING**

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

Operation**DANGER**

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

**WARNING**

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

Maintenance



DANGER

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



WARNING

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

Repair



DANGER

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



WARNING

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

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

Safety Sign

For safe equipment operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. The following table describes the safety labels.

To ensure safe operation, comply with equipment-related safety labels. The following table describes the safety labels.

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

1.2 Special Precautions

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

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

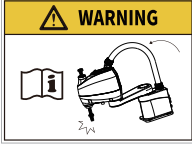
4. On the guard devices (fences), clearly display robot status, such as automatic running, teaching, and emergency stop, so that everyone onsite can easily see the status of the robot.

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

1.3 Safety Signs

The following table describes the warning labels affixed on the robot body. Pay special attention that specific dangers exist around the positions where these labels are affixed. Comply with the cautions and warnings on the warning labels to operate and maintain the robot system safely. Do not damage or remove the safety signs.

The following table lists the warning labels.

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

1.4 Emergency Movement and Emergency Stop

● Emergency Movement

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

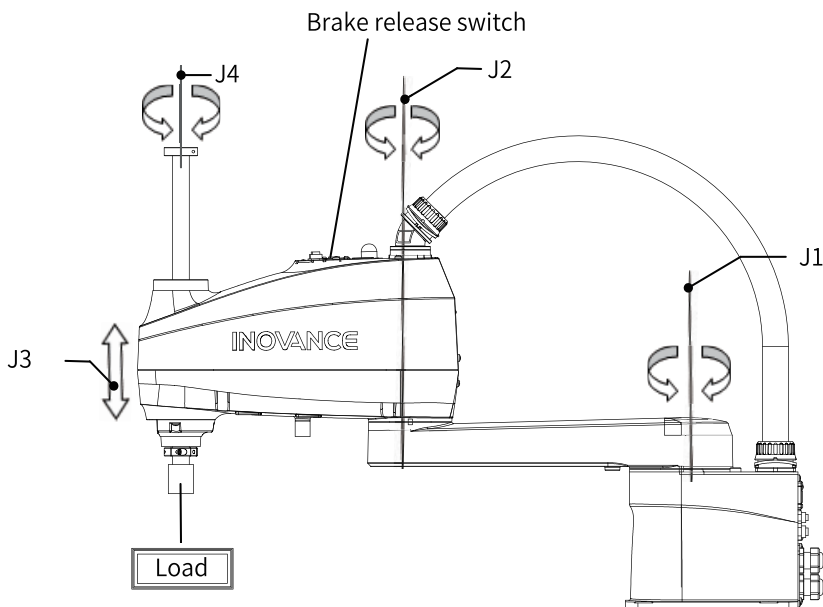
- J1: Rotate clockwise and counterclockwise by hand.
- J2: Rotate clockwise and counterclockwise by hand.
- J3: Move the joint up/down while pressing the brake release switch.
- J4: Push the joint to rotate clockwise and counterclockwise while pressing the brake release switch.



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.



2 IR-S4 Series SCARA Robot Maintenance Guide

2.1 Product Information

2.1.1 Model

Note

- The maintenance instructions in this guide refer to IR-S4 series models for Chinese and international markets.
- The product information in this guide is the information of standard models in a standard environment. For information about non-standard models or models in clean environment, contact the provider.

Models for Chinese market

IR- S 4 - 40 Z15 S 3
 ① ② ③ ④ ⑤ ⑥ ⑦

① Product family INOVANCE Robot	④ Arm length 40: 400 mm	⑦ Cable length 3: 3 m standard cable 5: 5 m standard cable G3: 3 m highly flexible cable
② Series S: SCARA robot	⑤ Maximum travel of Z axis (empty for models without a lead screw) Z15: 150 mm	-
③ Load 4: 4 kg	⑥ Installation environment C: Clean S: Standard P: High-protection	

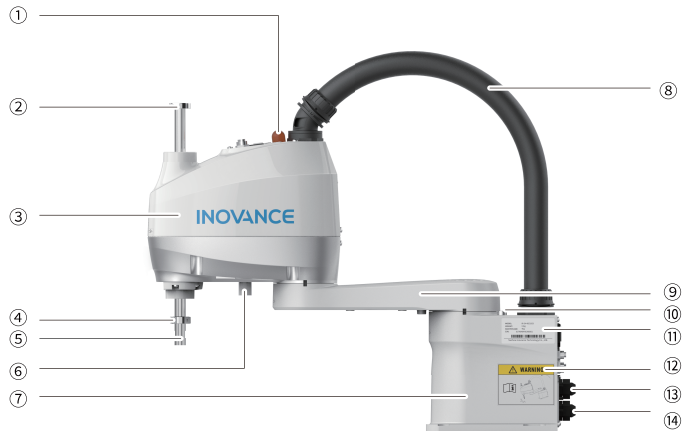
Models for international markets

IR- S 4 - 40 Z15 S-INT
 ① ② ③ ④ ⑤ ⑥ ⑦

① Product family INOVANCE Robot	④ Arm length 40: 400 mm	⑦ Version INT: International (With functional safety)
② Series S: SCARA robot	⑤ Maximum travel of Z axis Z15: 150 mm	-
③ Load 4: 4 kg	⑥ Installation environment S: Standard	

2.1.2 Components

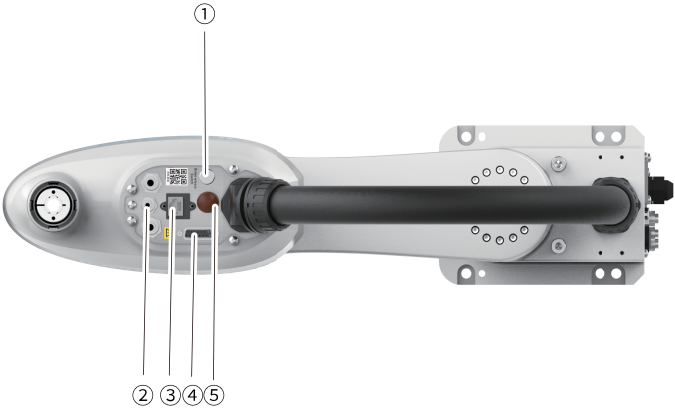
Part 1



No.	Description
①	State indicator
②	Mechanical stop for J3 upper limit
③	Arm 2
④	Mechanical stop for J3 lower limit
⑤	J3 axis lead screw
⑥	J2 mechanical limit stop
⑦	Base
⑧	Cable unit
⑨	Arm 1
⑩	J1 mechanical limit stop
⑪	Nameplate
⑫	Label

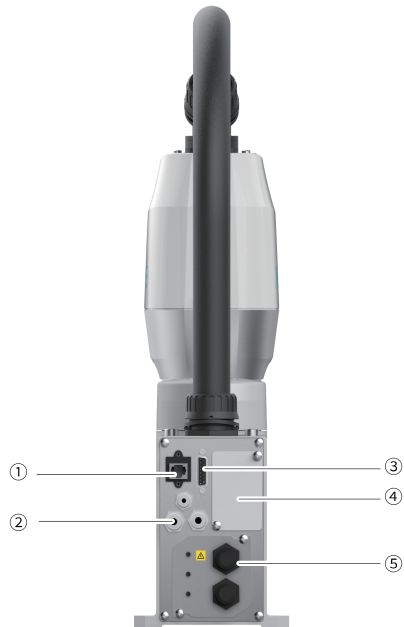
⑬	Power cable
⑭	Signal cable

Part 2



No.	Description
①	Brake button
②	Air duct connector
③	Network port
④	D-Sub 15Pin
⑤	Indicator

Part 3



No.	Description
①	Network port
②	Air duct connector
③	D-Sub 15Pin
④	Battery cover
⑤	Trailing cable

2.2 Regular Inspection

2.2.1 Periodic Inspection

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

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

1. Daily inspection and maintenance

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

2. Weekly inspection and maintenance

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

3. Monthly inspection and maintenance

Check Item	Check Measure
Control cabinet heat dissipation inspection	Check whether the fan behind the control cabinet is ventilated smoothly. It is recommended to replace or maintain the fan once a month.
Ball screw and spline (plain shaft)	Check the lubrication state of ball screw and spline, and replenish lubricating grease according to the recommended replacement cycle.

4. Inspection and maintenance every six months

Check Item	Check Measure
All wiring harnesses for each electrical component	• Check all cable connectors of the robot body for bending, corrosion and falling off. • Check the cables outside the control cabinet for bending, corrosion and falling off. • Check the cable of the teach pendant for bending, corrosion and falling off.
Timing belt	Check whether the tension frequency of timing belt is within the standard range.

5. Inspection and maintenance every year

Check Item	Check Measure
Control cabinet DI/DO signal	Check whether the DI/DO signal response of the control cabinet is normal.
Reducer of each axis	Check whether the lubrication of the reducer of each axis of the robot is normal and whether there is abnormal noise.
Cleaning of all electrical components	Check the cleanliness of all electrical components. Under normal circumstances, remove dust for all electrical components every year.
Control cabinet fan filter	Check the cleanliness of the filter of the control cabinet fan, and replace the filter once a year under normal circumstances.

6. Inspection and maintenance every 1.5 years

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

2.2.2 Screw Tightening Torque and Method

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

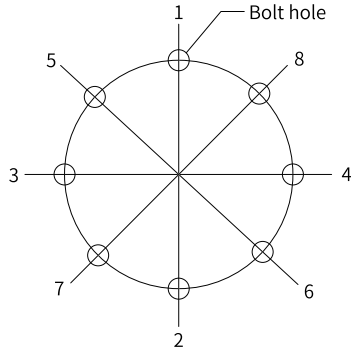


Caution

Except for torques of the screws of the robot enclosure and the connecting parts of the reducer, the torques of other screws are 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 fasten all screws securely at one time. Do not tighten the screw to the maximum torque value at a time. Tighten the screws slightly with a hexagon wrench as shown in the preceding figure. Then tighten the screws to the torque values in the table above with a torque wrench.

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

Screw	Torque (N·m)
M4	1.8

2.2.3 Replacing the Lubricating Grease

The following table describes the lubricating grease application cycle.

Position	Cycle
J1 axis reducer	When replacing the motor.
J2 axis reducer	When replacing the motor.
Ball screw and spline	Running for 100 km or every 3 months

Lubricating Grease Type	Lubricating Grease Code
Lubricating grease for J1 axis reducer	● H: 24060061 ● X: 24060141
Lubricating grease for J2 axis reducer	● H: 22010930 ● X: 24060141
Ball screw and spline	THK AFB-LF: 24100039

Cautions:

1. Only apply the original lubricating grease to the reducer and ball screw.
2. It is strictly forbidden to deplete the lubricating grease of the ball screw; otherwise, irreversible mechanical damage may occur.

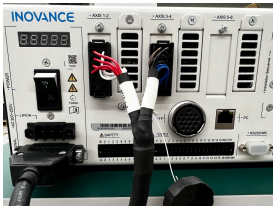
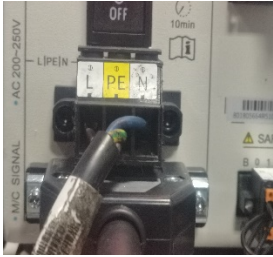


If the lubricating grease gets into your eyes, mouth, or on your skin, follow the instructions below:

- 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 lubricating grease gets on your skin, wash the area thoroughly with soap and water.
-

2.2.4 Daily Control Cabinet Cable Inspection

The following table describes the inspection of control cabinet cables:

No.	Check Item	Diagram/Illustration	Cycle
①	Check that the power output cable and encoder cable of the robot are properly connected to the control cabinet.		Daily
②	Check that the teach pendant cable is properly connected to the control cabinet.		Daily
③	Check that the external power cable (L, N, and PE slots) is properly connected to the control cabinet.		Daily
④	Wipe off any acid, alkali, oil, or corrosive liquids with dust-free cloth or scouring pad.	All cables	Monthly

2.3 Enclosure Removal and Installation

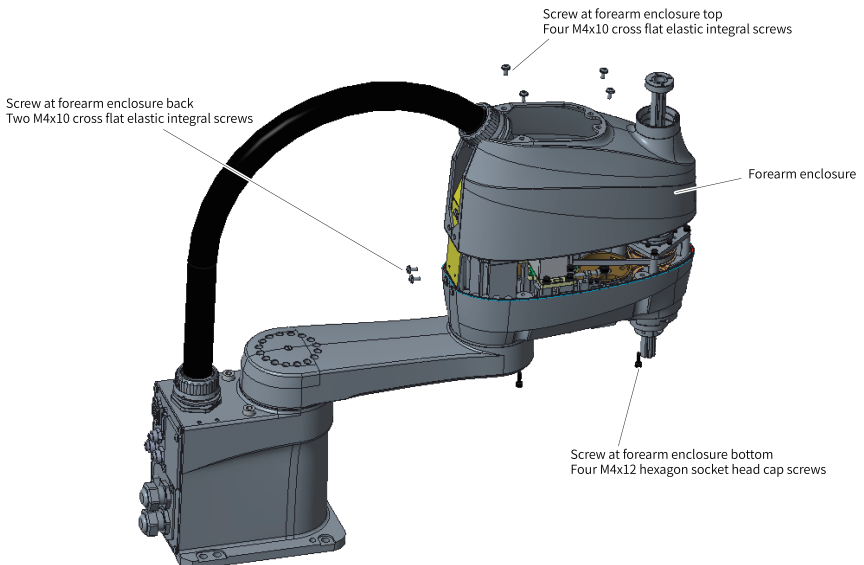


Caution

- During removal and re-installation of the enclosure, do not pull it forcibly. Failure to comply may result in cable damage, wire breaking, or poor contact, causing electric shock or system fault.
- After the maintenance is complete, install the removed enclosure back to its original position.
- If the enclosure fixing screws are missing, fix the enclosure with screws of the type and quantity shown in ["2.3.1 Removing and Installing the Enclosure of the Forearm" on page 26](#).
- 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.
- Before removing or installing the robot enclosure, power off the robot. Never remove or install the robot enclosure with power on.

2.3.1 Removing and Installing the Enclosure of the Forearm

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



Procedure:

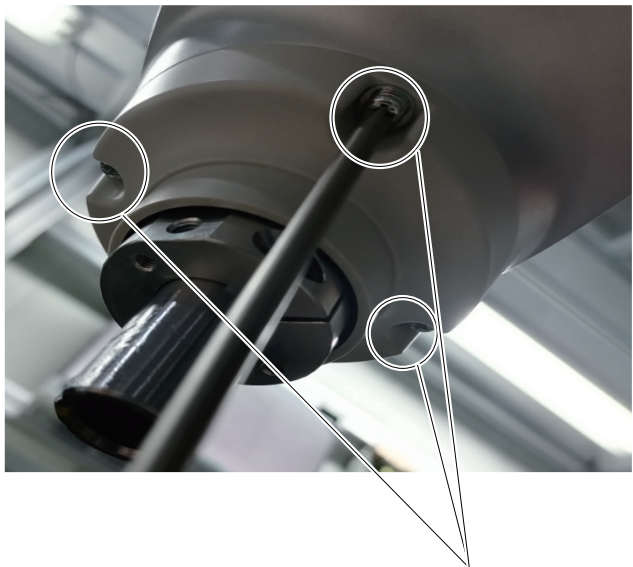
1. Remove the six M4x10 cross flat elastic integral screws on the top and back.
2. Remove the four M4x12 hexagon socket head cap screws on the bottom.
3. Lift up and remove the forearm enclosure.
4. To install the enclosure, put back the enclosure and ensure that it fits properly with the forearm. Then tighten the 10 screws from the bottom to the top with a torque of 0.6 N·m.

2.3.2 Removing and Installing the Bottom Enclosure of Spline Nut



- 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.



Screw at spline nut enclosure bottom
Four M4x10 cross flat elastic integral screws

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

1. Loosen four M4x10 cross flat elastic integral screws of the spline nut.
2. Remove the enclosure of the spline nut.
3. When installing the enclosure, fix the screws with a torque of $0.6\text{ N}\cdot\text{m}$.

2.4 Replacement and Maintenance

2.4.1 Maintaining the J1 Axis

Name		Quantity
Maintenance part	J1 motor	1
	O-shaped sealing ring	2
	J1 axis reducer	1
Tool	Hexagon wrench	1
	Torque wrench ($0\text{ N}\cdot\text{m}$ to $10\text{ N}\cdot\text{m}$)	1
	Hexagon screwdriver bit	1
	Dust-free cloth or oil-absorbing sheet	Several
	Phillips screwdriver	1

Name		Quantity
Material	LT243 threadlocker	1
	LT638 threadlocker	1
	Reducer lubricating grease ^[1]	1

Note

[1]: The codes of lubricating greases are:

- H lubricating grease: 24060061
- X lubricating grease: 24060141

Screw tightening torque reference:

Screw	Torque (N · m)
M3 hexagon socket head cap screw	2
M4 hexagon socket head cap screw	5

Note

- Recommended hexagon screwdriver 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**

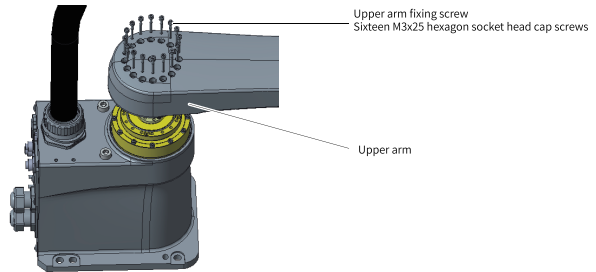
- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
 - Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
 - Do not remove any parts that are not covered in this guide. Follow the maintenance procedure strictly as described in this guide.
 - Check the motion of the robot after parts replacement outside the safety fence. Failure to comply may cause severe safety issues due to abnormal movement of the robot.
 - Make sure that the emergency stop switch and safety door switch work properly before operation. Otherwise, safety protection functions 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

1. Loosen the sixteen M3x25 hexagon socket head cap screws fixing the upper arm, and remove the upper arm and forearm.

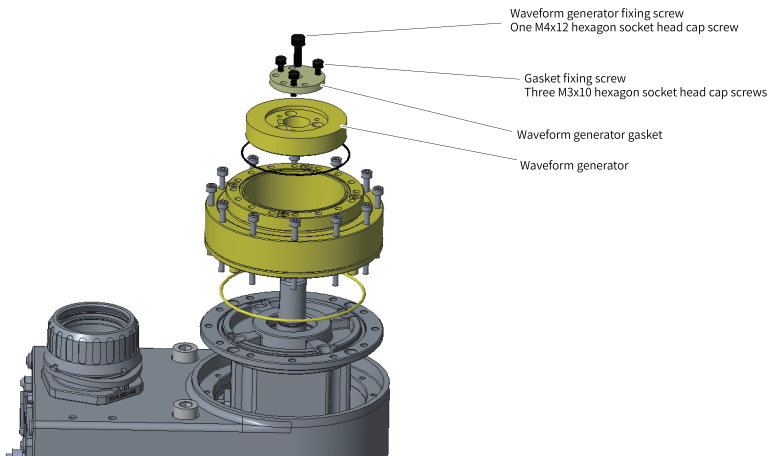


Note

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.

2. Remove the waveform generator:

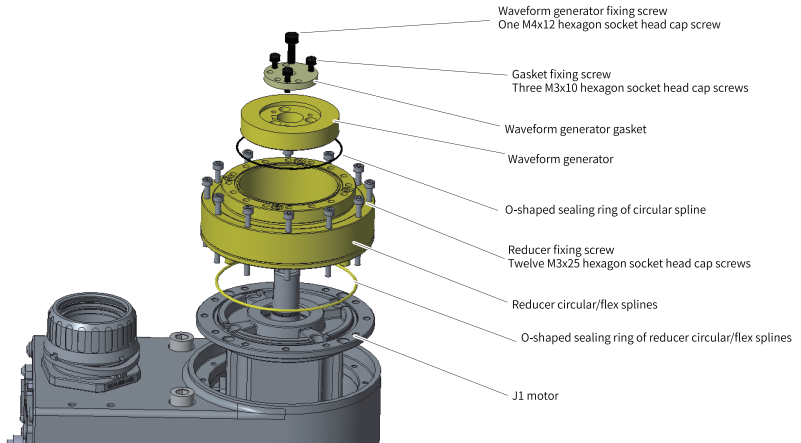
- a. Loosen the one M4x12 hexagon socket head cap screw securing the waveform generator, and clamp the gasket with circlip pliers.
- b. Screw M5 screw into the M5 hole in the middle of waveform generator gasket. Rotate the M5 screw and remove the waveform generator.
- c. After removing the waveform generator, loosen the three M3x10 hexagon socket head cap screws fixing the gasket.



3. Remove the reducer:

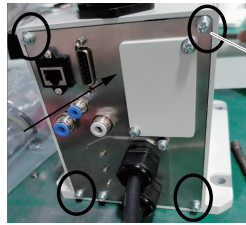
- a. Loosen the twelve M3x25 hexagon socket head cap screws fixing the reducer, and then remove the O-shaped sealing ring of the circular spline.

- b. Remove the reducer.
- c. Install a new reducer.



4. Remove the motor:

- a. Remove the O-shaped sealing rings of the circular/flex splines of the reducer, and loosen the four M4x10 cross flat elastic integral screws of the base sheet metal.
- b. Loosen the motor power cable and encoder cable of the J1 axis, remove the motor, and install a new one.
- c. After replacing the motor and reducer, apply new grease to the reducer according to ["2.4.1.2 Replacing the Lubricating Grease for J1 Axis Reducer" on page 33](#). The M3 screw tightening torque is 2 N·m, and the M4 screw tightening torque is 5 N·m. All reducer screws must be coated with LT243 threadlocker.



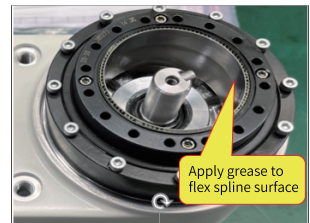
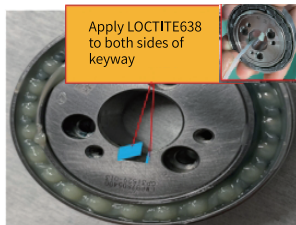
Base sheet metal fixing screw
Four M4x10 cross flat elastic integral screws



Motor power cable and encoder cable

5. Reassembly:

- a. 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 Lubricating Grease for J1 Axis Reducer" on page 33.](#)
- b. Apply the LT638 threadlocker to the keyway of the waveform generator and grease. The M3 screw tightening torque is 2 N·m, and the M4 screw tightening torque is 5 N·m. All reducer screws must be coated with LT243 threadlocker.



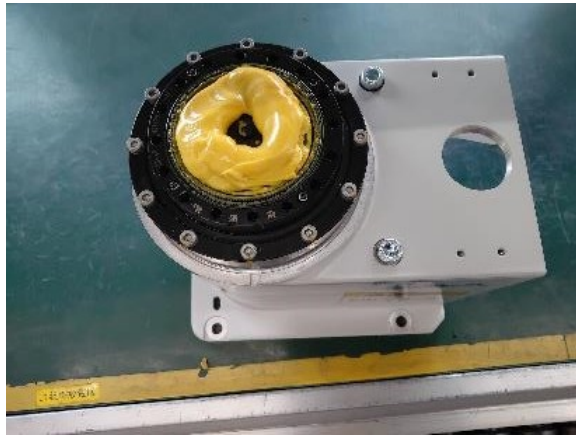
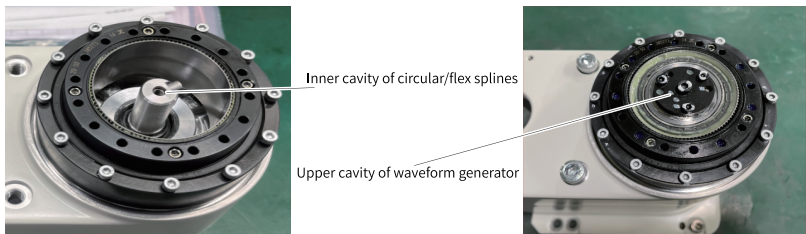
2.4.1.2 Replacing the Lubricating Grease for J1 Axis Reducer

1. Remove the upper arm and forearm:

For the IR-S4 series robot, remove the upper arm and forearm according to Step 1 in ["2.4.1.1 Maintaining the J1 Motor and Reducer" on page 30.](#)

2. Remove the waveform generator and the circular/flex splines of the reducer:

- a. Remove the waveform generator according to Step 2 in ["2.4.1.1 Maintaining the J1 Motor and Reducer" on page 30](#).
- b. Remove the circular/flex splines according to Step 3 in ["2.4.1.1 Maintaining the J1 Motor and Reducer" on page 30](#).
3. Apply lubricating grease to the waveform generator.
 - a. Clean old lubricating grease on the waveform generator and circular/flex splines of the reducer.
 - b. Apply lubricating 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), as shown in the following figure. For the grease code, see ["2.4.1.2 Replacing the Lubricating Grease for J1 Axis Reducer" on page 33](#).



4. Reassembly:

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 the LT243 threadlocker).
5. After reassembly, power on the robot, reset the J1 axis encoder value, clear any alarms, and then capture the J1 axis zero point position.

2.4.2 Maintaining the J2 Axis

	Name	Quantity
Maintenance part	J2 motor	1
	O-shaped sealing ring	2
	J2 axis reducer	1
Tool	Hexagon wrench	1
	Torque wrench (0 N·m to 10 N·m)	1
	Hexagon screwdriver bit	1
	Dust-free cloth or oil-absorbing sheet	Several
	Phillips screwdriver	2
Material	LT243 threadlocker	1
	LT638 threadlocker	1
	Reducer lubricating grease ^[1]	1

Note

[1]: The codes of lubricating greases are:

- H lubricating grease: 22010930
- X lubricating grease: 24060141

Note

- Recommended hexagon screwdriver 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 any parts that are not covered in this guide. Follow the maintenance procedure strictly as described in this guide.
 - Check the motion of the robot after parts replacement outside the safety fence. Failure to comply may cause severe safety issues due to abnormal movement of the robot.
 - Make sure that the emergency stop switch and safety door switch work properly before operation. Otherwise, safety protection functions 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.
-



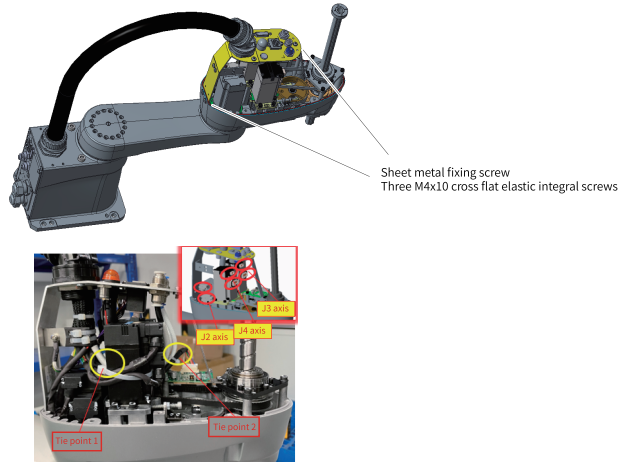
Warning

- 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

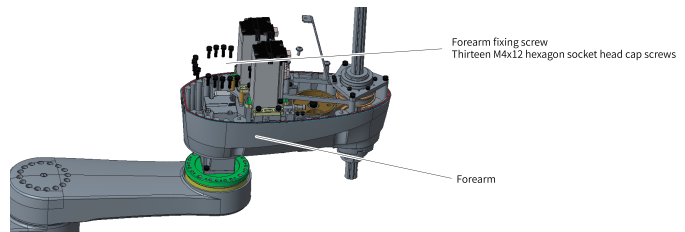
1. Remove the forearm enclosure. Remove the forearm enclosure according to ["2.3.1 Removing and Installing the Enclosure of the Forearm" on page 26](#).
2. Remove the cable sheet metal assembly:
 - a. Loosen the three M4x10 cross flat elastic integral screws on the top and back of the forearm sheet metal.

- b. Loosen the motor power cables and encoder cables of axes J2, J3, and J4, and move away the cable sheet metal assembly, as shown in the following figure.



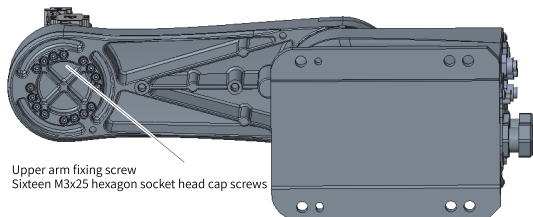
3. Remove the forearm assembly:

Loosen the thirteen M4x12 hexagon socket head cap screws fixing the forearm and J2 axis assembly, and remove the forearm assembly, as shown in the following figure.



4. Remove the J2 axis assembly:

Loosen the sixteen M3x25 hexagon socket head cap screws fixing the upper arm, and remove the J2 axis assembly.

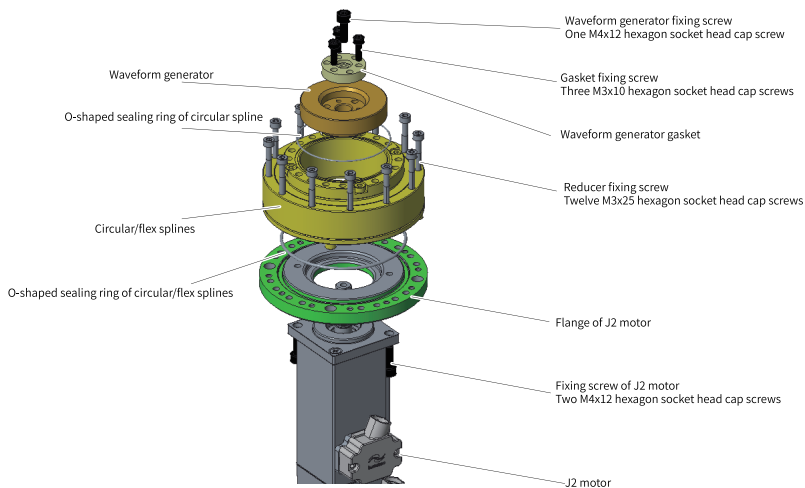


5. Remove the waveform generator:

- a. Loosen the one M4x12 hexagon socket head cap screw fixing the waveform generator, and clamp the gasket with circlip pliers.
- b. Screw M5 screw into the M5 hole in the middle of waveform generator gasket.
- c. Remove the waveform generator and loosen the three M3x10 hexagon socket head cap screws of the gasket.

6. Remove the motor and reducer:

- a. Loosen the twelve M3x25 hexagon socket head cap screws fixing the reducer, and then remove the O-shaped sealing rings of reducer and circular spline.
- b. Loosen the two M4x12 hexagon socket head cap screws fixing the J2 motor, and replace the motor or reducer, as shown in the following figure.



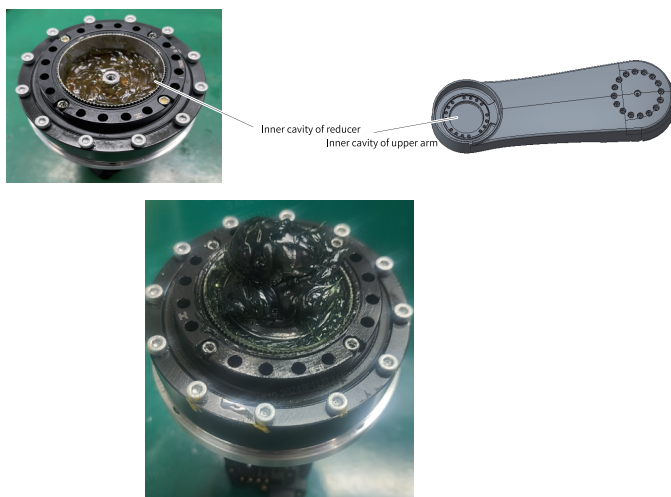
7. Reassembly:

- a. Re-assemble the components (including the O-shaped sealing rings) according to reverse steps of disassembly.

- b. After replacing the motor and reducer, apply new grease to them according to ["2.4.2.2 Replacing the Lubricating Grease for J2 Axis Reducer" on page 39](#). The M3 screw tightening torque is 2 N·m, and the M4 screw tightening torque is 5 N·m. All reducer screws must be coated with LT243 threadlocker.

2.4.2.2 Replacing the Lubricating Grease for J2 Axis Reducer

1. Remove the motor assembly of the J2 axis:
Remove the J2 motor assembly and waveform generator from the forearm according to Steps 1-6 in ["2.4.2.1 Maintaining the J2 Motor and Reducer" on page 36](#).
2. Apply lubricating grease to the waveform generator:
 - a. Clean old lubricating grease on the waveform generator and circular spline of the reducer.
 - b. 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 upper arm (approx. 9 mL, 8 g).



3. Reassembly:
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 the LT243 threadlocker).
4. After reassembly, power on the robot, reset the J2 axis encoder value, clear any alarms, and then capture the J2 axis zero point position.

2.4.3 Maintaining the J3 Axis

Name		Quantity
Maintenance part	J3 motor	1
	J3 axis brake	1
	Timing belt	1
Tool	Hexagon wrench	1
	Torque wrench (0 N·m to 10 N·m)	1
	Hexagon screwdriver bit	1
	Dust-free cloth or oil-absorbing sheet	Several
	Phillips screwdriver	2
	Tension meter	1
	Height gauge	1

Screw tightening torque reference:

Screw	Torque (N·m)
M4 hexagon socket head cap screw	3.5
M3 hexagon socket head cap screw	1
M4 hexagon set screw	1.8
M4 cross flat elastic integral screw	0.6

Note

- Recommended hexagon screwdriver 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

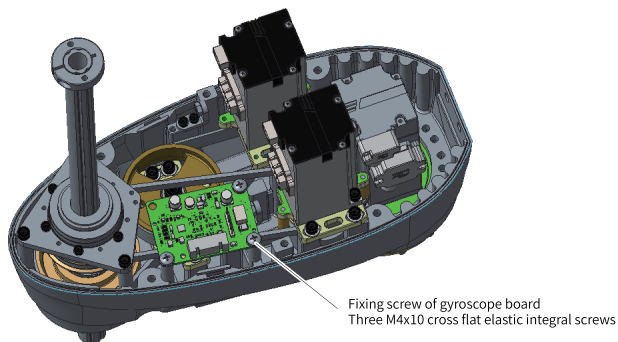
- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
 - Prevent foreign objects from entering the equipment and terminals during maintenance.
 - After the equipment is replaced, perform wiring 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 Axis Timing Belt, Brake, and Motor

1. Remove the enclosure, cables and sheet metal of the forearm:
 - a. Remove the forearm enclosure according to ["2.3.1 Removing and Installing the Enclosure of the Forearm" on page 26](#).
 - b. Remove the cables and sheet metal of the forearm according to Step 2 in ["2.4.2.1 Maintaining the J2 Motor and Reducer" on page 36](#).

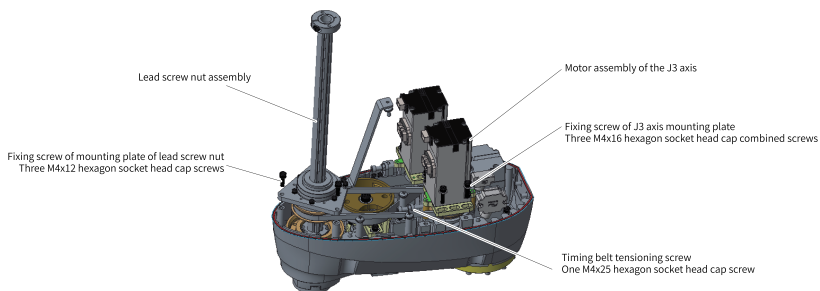
2. Remove the gyroscope board:

Loosen the three M4x10 cross flat elastic integral screws of the gyroscope board and then remove the gyroscope board, as shown in the following figure.



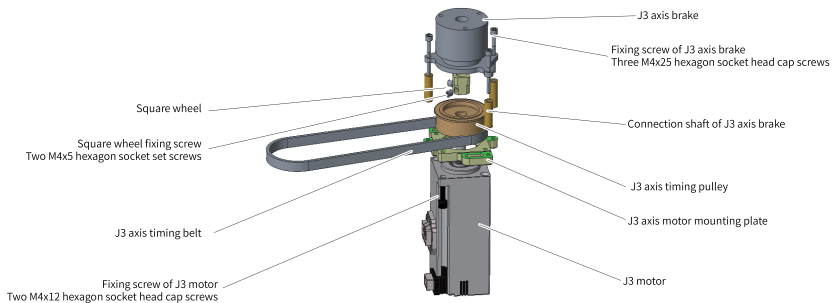
3. Remove the lead screw nut assembly and J3 axis motor assembly:

- a. Loosen the one M4x25 hexagon socket head cap screw securing the timing belt of the J3 axis assembly and then loosen the three M4x16 hexagon socket cap head combined screws fixing the mounting plate of the J3 axis.
- b. Loosen the three M4x12 hexagon socket head cap screws fixing the mounting plate of lead screw nut.
- c. Take out the lead screw nut assembly (do not separate the lead screw nut from the lead screw), and then take out the J3 axis motor assembly.



4. Replace the J3 axis timing belt:

- a. Take out the J3 axis motor assembly and unscrew the three M4x25 hexagon socket head cap screws fixing the brake.
 - b. Take out the J3 axis brake and replace the timing belt.
 - c. Re-assemble the J3 axis (M4 screw tightening torque: $3.5 \text{ N} \cdot \text{m}$ and M3 screw tightening torque: $1 \text{ N} \cdot \text{m}$) by reversing Steps 1, 2, and 3. Tighten the timing belt with the tension screw (Measure the belt with a tension meter to ensure the tension frequency is 90 Hz to 100 Hz).
5. Replace the brake and motor:
- a. Loosen the two M4x5 hexagon set screws fixing the square wheel and take out the square wheel.
 - b. Replace the square wheel and brake. (The service life of the brake for emergency stop is 2000 times. Replace the brake when the service life expires.)
 - c. Loosen the two M4x5 hexagon set screws fixing the timing pulley and the two M4x12 hexagon socket head cap screws fixing the J3 motor, and then replace the J3 motor, as shown in the following figure.



6. Reassembly:

- a. After replacing the motor and brake, install the timing pulley and square wheel (align the two screw holes with the motor flat position). Use a height gauge to ensure the distance from the square wheel top to the mounting plate. For the specific height, contact Inovance technical support.
- b. Attach the J3 axis timing pulley to the square wheel, and then lock the two M4x5 hexagon set screws on timing pulley to the motor flat position.
- c. Re-assemble the J3 axis (M4x5 screw tightening torque: $1.8 \text{ N} \cdot \text{m}$; M4 screw tightening torque: $3.5 \text{ N} \cdot \text{m}$; and M3 screw tightening torque: $1 \text{ N} \cdot \text{m}$) by reversing Steps 1 and 2.
- d. Tighten the timing belt with the screw (measure the timing belt with a tension meter to ensure the frequency is 90 Hz to 100 Hz).

Note

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

Measuring span: 200 mm

Timing belt unit mass: 2.4 g/m

Timing belt width: 10.0 mm/R

- After reassembly, power on the robot, reset the encoder values of axes J3 and J4 (which have a coupling structure), clear any alarms, and then capture the zero point positions of axes J3 and J4.

2.4.4 Maintaining the J4 Axis

Name		Quantity
Maintenance part	J4 motor	1
	Timing belt	2
Tool	Hexagon wrench	1
	Torque wrench (0 N·m to 10 N·m)	1
	Hexagon screwdriver bit	1
	Dust-free cloth or oil-absorbing sheet	Several
	Phillips screwdriver	2
	Tension meter	1
	Height gauge	1

Screw tightening torque reference:

Screw	Torque (N·m)
M3 hexagon socket head cap screw	1.5
M4 hexagon socket head cap screw	3

Note

- Recommended hexagon screwdriver 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.
-

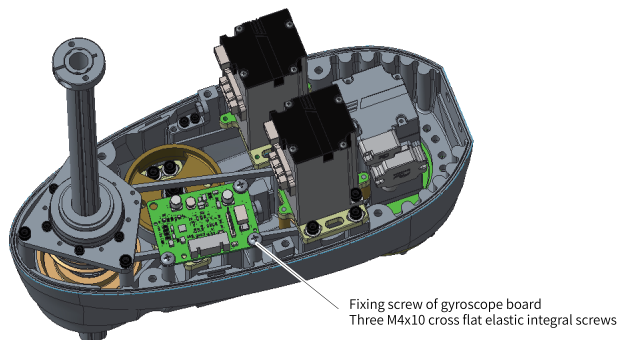
 Warning

- 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 Axis Timing Belt

1. Remove the enclosure, cables and sheet metal of the forearm:
 - a. Follow the instructions in ["2.3.1 Removing and Installing the Enclosure of the Forearm" on page 26.](#)
 - b. Remove the cables and sheet metal of the forearm according to Step 2 in ["2.4.2.1 Maintaining the J2 Motor and Reducer" on page 36.](#)
2. Remove the gyroscope board:

Remove the three M4x10 cross flat elastic integral screws that fix the gyroscope board and then remove the gyroscope board, as shown in the following figure.



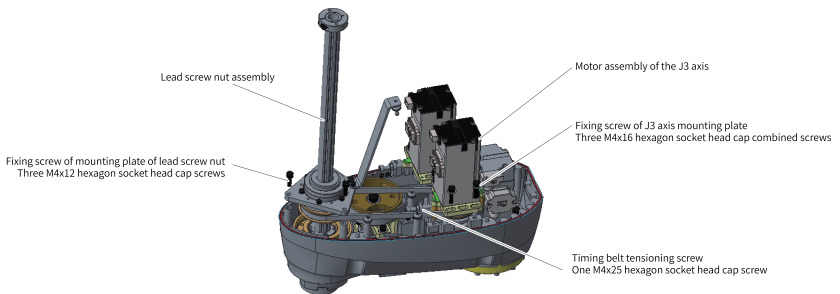
3. Disassemble the motor assembly of the J3 axis:



Caution

If you only need to remove the primary timing belt of the J4 axis, you do not need to remove the motor assembly of the J3 axis. If you need to remove the secondary timing belt of the J4 axis, you also need to remove the motor assembly of the J3 axis.

- a. Loosen the one M4x25 hexagon socket head cap screw securing the timing belt of the J3 axis assembly, and the three M4x16 hexagon socket cap head combined screws fixing the mounting plate of the J3 axis.
- b. Loosen the three M4x12 hexagon socket head cap screws fixing the mounting plate of lead screw nut.
- c. Take out the lead screw nut assembly (do not separate the lead screw nut from the lead screw), and then take out the J3 axis motor assembly, as shown in the following figure.



4. Disassemble the motor assembly of the J4 axis:
 - a. Loosen the one M4x25 hexagon socket head cap screw securing the timing belt of the J4 axis motor assembly, and loosen the three M4x16 hexagon socket cap head combined screws fixing the motor assembly of the J4 axis.
 - b. Take out the J4 axis motor assembly, and replace the primary timing belt with a tension frequency of 260 Hz to 280 Hz of the J4 axis, as shown in the following figure.

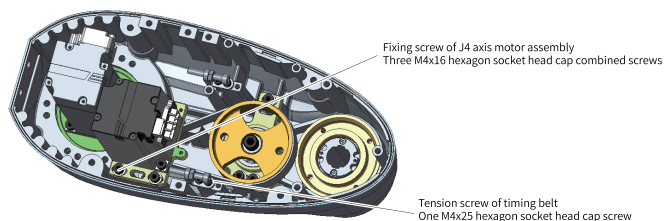
Note

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

Measuring span: 200 mm

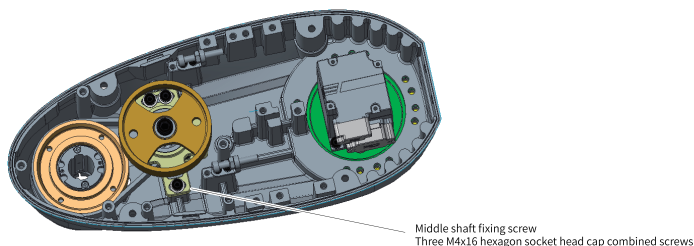
Timing belt unit mass: 2.4 g/m

Timing belt width: 10.0 mm/R



5. Loosen the middle shaft assembly:

Loosen the three M4x16 hexagon socket head cap combined screws fixing the middle shaft, and then remove the middle shaft assembly, as shown in the following figure.



6. Replace the secondary timing belt of J4 axis:

- Remove the J4 motor assembly and the intermediate shaft assembly.
- Loosen the one M6x16 combined cup head screw securing the middle shaft belt pulley, loosen the two M4x16 hexagon socket cap head combined screws fixing the mounting plate of the middle shaft, and replace the secondary timing belt of the J4 axis.
- Re-install the belt in the reverse steps of disassembly with M4 screws of torque $3.5 \text{ N} \cdot \text{m}$ or M6 screws of torque $15 \text{ N} \cdot \text{m}$. The tension frequency of the timing belt is 380 Hz to 410 Hz, as shown in the following figure.

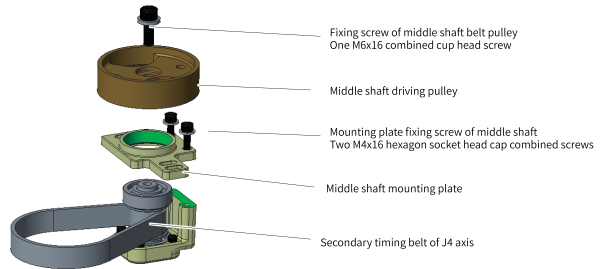
Note

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

Measuring span: 200 mm

Timing belt unit mass: 2.4 g/m

Timing belt width: 10.0 mm/R



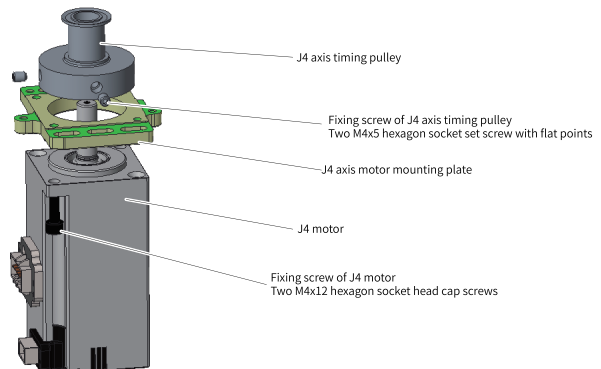
2.4.4.2 Maintaining the J4 Motor

1. Disassemble the motor assembly of the J4 axis:

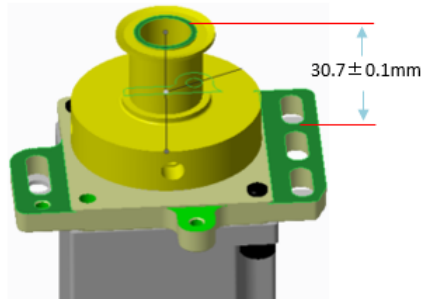
Remove the motor assembly of the J4 axis according to steps 1-4 in ["2.4.4.1 Maintaining the J4 Axis Timing Belt" on page 46](#).

2. Replace the J4 motor:

- a. Loosen the two M4x5 hexagon socket set screw with flat points and remove the J4 axis timing pulley.
- b. Loosen the two M4x12 hexagon socket head cap screws securing the J4 motor, remove the mounting plate of the J4 motor, and replace the motor, as shown in the following figure.



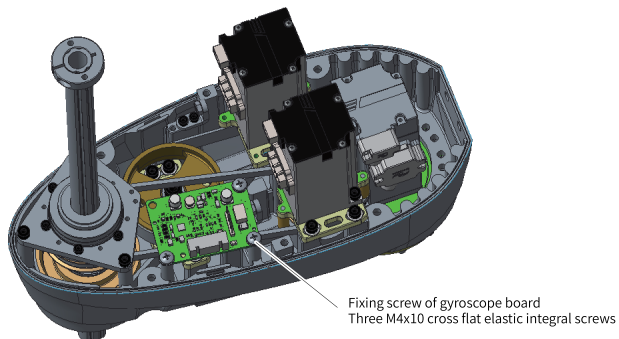
3. Reassemble the J4 motor in the reserve steps of the removal procedure, as shown in the following figure. The distance from the J4 axis belt pulley to the mounting plate of the J4 motor is 30.7 ± 0.1 mm (M4X5 screw torque: $1.8 \text{ N} \cdot \text{m}$; M4 screw torque: $3.5 \text{ N} \cdot \text{m}$).



4. After reassembly, power on the robot, reset the encoder values of axes J3 and J4 (which have a coupling structure), clear any alarms, and then capture the zero point positions of axes J3 and J4.

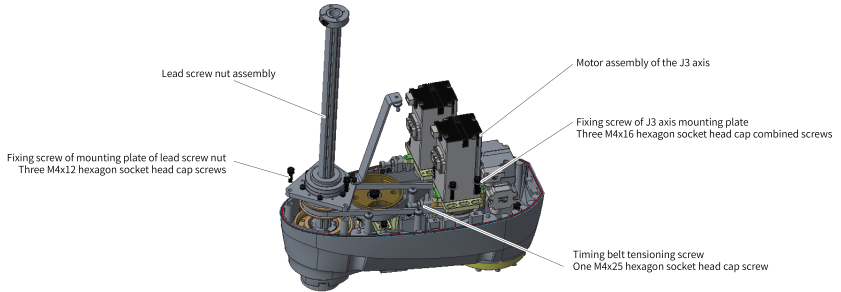
2.4.5 Maintaining the Ball Screw Spline

1. Remove the enclosure, cables and sheet metal of the forearm:
 - a. Remove the forearm enclosure according to ["2.3.1 Removing and Installing the Enclosure of the Forearm" on page 26](#).
 - b. Remove the cables and sheet metal of the forearm according to Step 2 in ["2.4.2.1 Maintaining the J2 Motor and Reducer" on page 36](#).
2. Remove the gyroscope board:
 - a. Loosen the three M4x10 cross flat elastic integral screws that fix the gyroscope board.
 - b. Remove the gyroscope cable and then remove the gyroscope board.



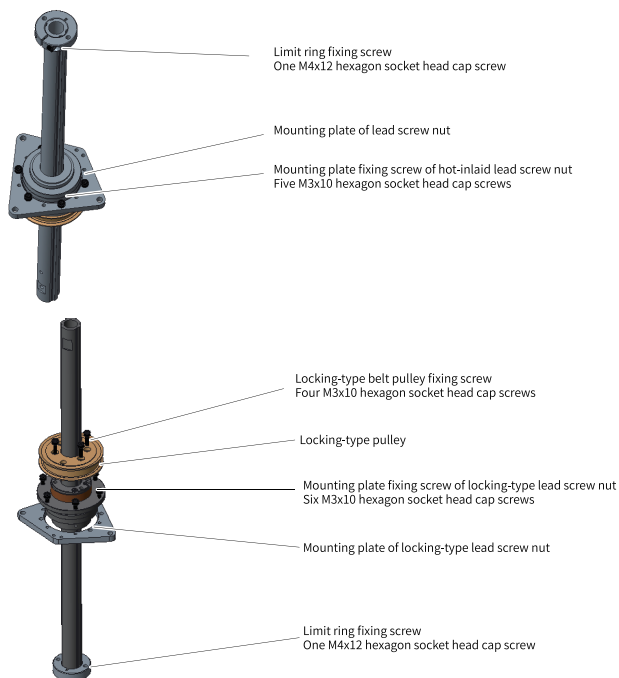
3. Remove the J3 motor:
 - a. Loosen the one M4x25 hexagon socket head cap screw securing the timing belt of the J3 axis assembly and then loosen the three M4x16 hexagon socket cap head combined screws fixing the mounting plate of the J3 axis.

- b. Loosen the three M4x12 hexagon socket head cap screws fixing the mounting plate of lead screw nut.
- c. Take out the lead screw nut assembly (do not separate the lead screw nut from the lead screw), and then take out the J3 axis motor assembly. See the figure below.



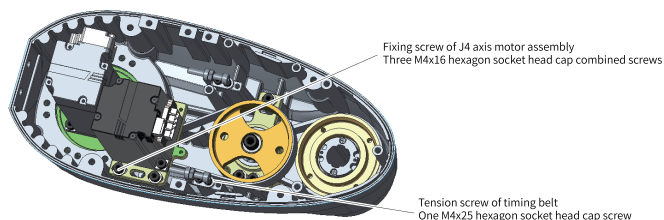
4. Remove and replace the lead screw.

- a. Loosen the five M3x10 hexagon socket head cap screws fixing the mounting plate of lead screw nut, and the one M4x12 hexagon socket head cap screw fixing the limit ring.
- b. Remove the lead screw nut and lead screw (do not separate the nut from the lead screw).
- c. Replace the lead screw and its nut (For the hot-inlaid scheme, the timing pulley and lead screw nut are installed with interference fit, so the lead screw nut needs to be replaced together with the timing pulley. For the locking scheme, remove the timing pulley first and then the lead screw nut).



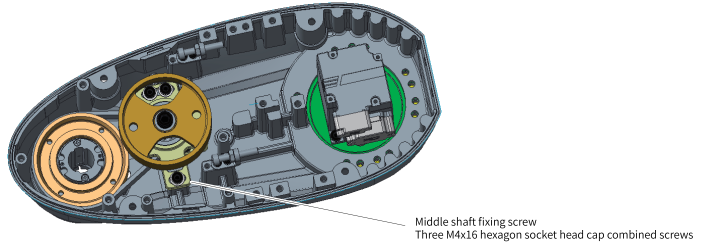
5. Disassemble the motor assembly of the J4 axis:

Loosen the one M4x25 hexagon socket head cap screw securing the timing belt of the J4 axis assembly, loosen the three M4x16 hexagon socket cap head combined screws fixing the motor assembly of the J4 axis, and then take out the J4 axis motor assembly.



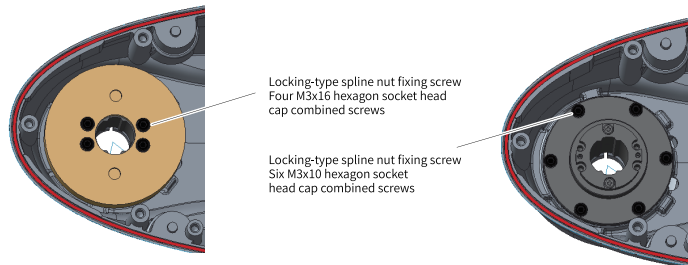
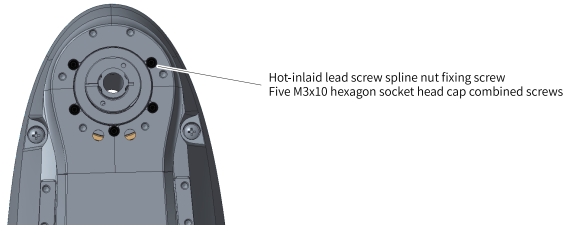
6. Loosen the middle shaft assembly:

Loosen the three M4x16 hexagon socket head cap combined screws fixing the middle shaft, and then remove the middle shaft assembly.



7. Remove and replace the spline nut:

- a. Loosen the five M3x10 hexagon socket head cap combined screws fixing the spline nut, and remove the spline nut assembly.
- b. Replace the spline nut (For the hot-inlaid scheme, the timing pulley and lead screw nut are installed with interference fit, so the lead screw nut needs to be replaced together with the timing pulley. For the locking scheme, remove the timing pulley first and then the spline nut).



8. Reassembly:

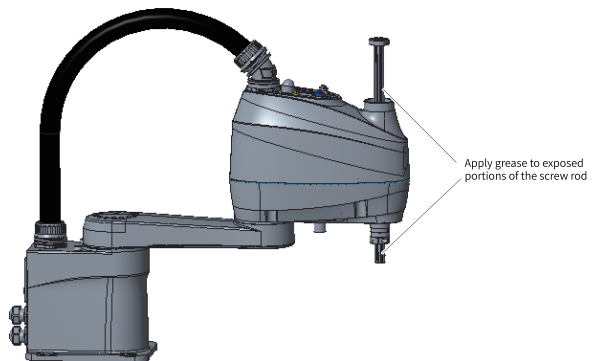
Re-install the ball screw spline in the reverse steps of disassembly. The M3 screw torque is $2 \text{ N} \cdot \text{m}$, the M4 screw torque is $3.5 \text{ N} \cdot \text{m}$, the frequency of J3 axis assembly timing belt is 75 Hz to 85 Hz, the frequency of the J4 axis primary timing belt is 265 Hz to 280 Hz, and the frequency of the J4 axis secondary timing belt is 380 Hz to 410 Hz.

 Caution

- When installing the lead screw into the spline, ensure that the cross-shaped mark on the lead screw aligns with the cross-shaped mark on the spline to prevent the spline ball bearings from falling out.
 - Tighten the lead screw mounting plate according to the specified torque requirements, and then adjust the tension of the timing belt.
 - The grease on the surface of the new lead screw spare part is anti-rust oil, which must be thoroughly wiped off with a dust-free cloth before reapplying lubricating grease.
 - After completing the assembly, since the J3 axis and J4 axis have a coupled structure, the zero point positions of both the J3 axis and J4 axis must be calibrated simultaneously.
-

2.4.6 Maintaining the Ball Screw Spline

1. Replace the lubricating grease of the ball screw spline as follows:



2. When replacing the lubricating grease of the ball screw spline, clean the surface of the screw rod shaft with a dust-free cloth or scouring pad.
3. Apply lubricating grease (THK AFB-LF, special grease for screw rod) to the exposed portion of the screw rod shaft. Note that it is sufficient to continue to apply a thin layer of grease to the surface of the screw rod shaft, with a grease amount of 1 g. Excessive grease may splash onto processed products or equipment. The coating effect is shown in the following figure.

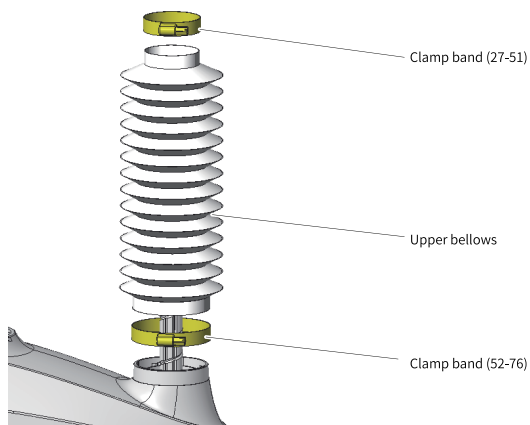


4. It is recommended to replace the lubricating grease of the screw rod every 100 km or every 3 months or in case of decolorization or drying of lubricating grease, as shown in the following figure.



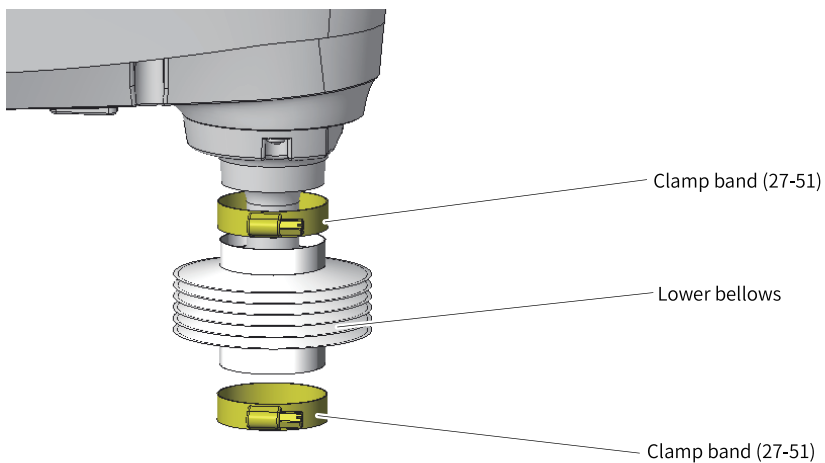
2.4.7 Replacing and Maintaining the Bellows of Cleanroom Model

1. Remove the upper bellows:
 - a. Use a Phillips screwdriver to remove the hose clamp.
 - b. Take out the upper bellows and replace with a new one.
 - c. Lock the upper bellows with a torque of $0.7 \text{ N} \cdot \text{m}$.



2. Remove the lower bellows:

- a. Use a Phillips screwdriver to remove the hose clamp.
- b. Take out the lower bellows and replace with a new one.
- c. Lock the upper bellows with a torque of $0.7 \text{ N} \cdot \text{m}$.



2.4.8 Robot Cable Maintenance



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.
-



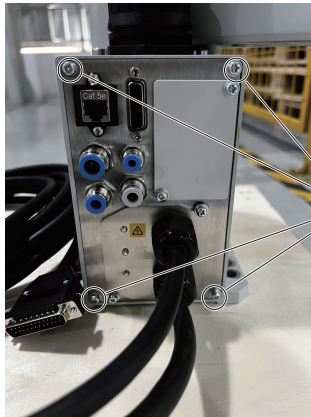
Warning

- 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.
 - 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

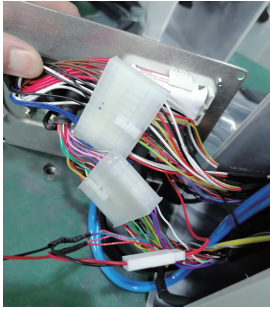
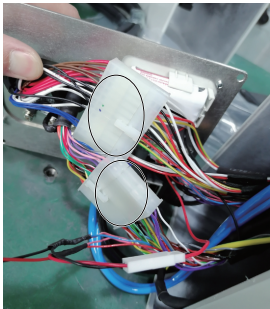
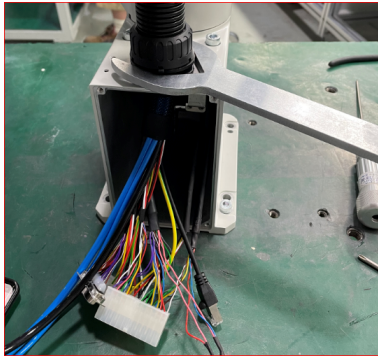
To replace the cables connected between the base and the forearm of the IR-S4 series robots, follow the steps below.

1. Power on the control cabinet.
2. Hang a "Maintenance in process" sign. The "Maintenance in process" sign is used to prevent other operators from operating the robot.
3. Enter the safeguard system.
4. Press the brake release switch to release the brake of J3 motor, and then lower the axis to the lower limit. Ensure that sufficient space is left to prevent the end effector from colliding with peripheral devices.
5. Power off the control cabinet and disconnect the power output and encoder cable connectors connected to the control cabinet.
6. Remove the four M4x10 cross flat elastic integral pan-head screws fixing the front cover of the base, and then remove the front cover, as shown in the following figure.

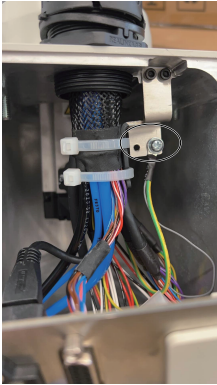


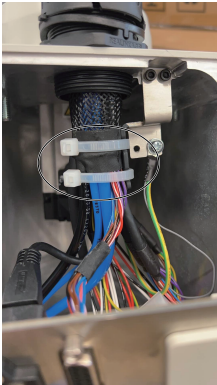
Four M4x10 cross flat elastic integral pan-head screws

7. Remove cables inside the base.

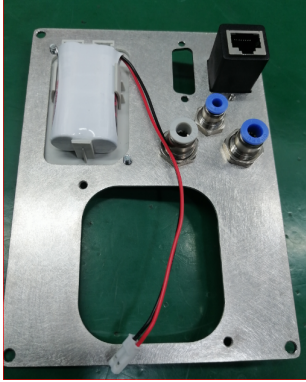
Step	Description	Illustration
①	Gently pull the internal cables out of the base	
②	Disconnect the power cable and encoder connectors.	
③	Loosen the 15-pin D-sub connector.	
④	Disconnect the three air ducts and network cables connected to the base cover.	

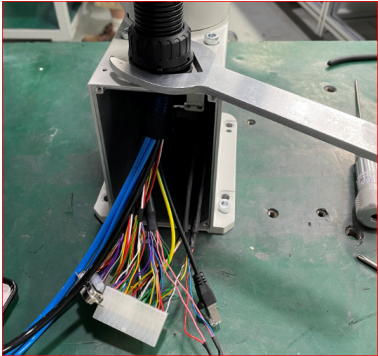
8. Cut the cable tie inside the base.

Step	Description	Illustration
①	Disconnect the grounding terminal on the sheet metal inside the base.	 A photograph showing the interior of a robot base. A bundle of multi-colored wires is visible, secured by a white cable tie. A metal bracket is attached to the sheet metal, and a grounding terminal is connected to it. The terminal is a small metal screw terminal.

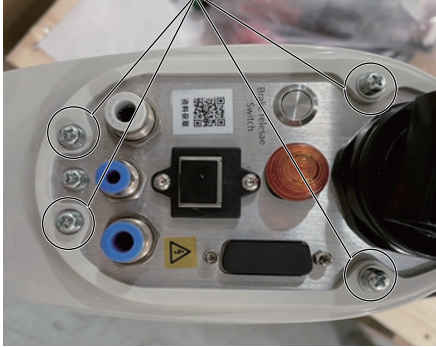
Step	Description	Illustration
②	Cut the cable tie.	 A photograph showing the interior of a robot base. A bundle of multi-colored wires is visible, secured by a white cable tie. A metal bracket is attached to the sheet metal, and a grounding terminal is connected to it. The terminal is a small metal screw terminal. A white circle highlights the cable tie, indicating it should be cut.

9. Remove the base bellows connector.

Step	Description	Illustration
①	Remove the battery	

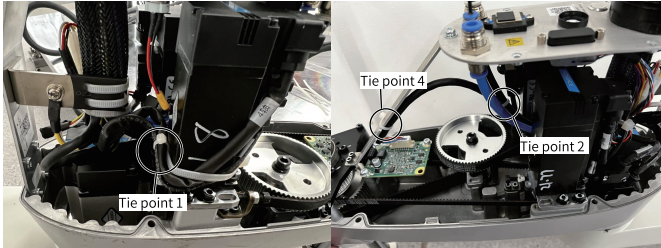
Step	Description	Illustration
②	Disconnect the encoder and power cable terminals of J1 axis.	
③	Remove the bellows connector from the base (use a hexagon wrench with the diameter of SW48 to pull out all terminal cables from the base, and apply threadlocker during re-assembly).	

10. Remove the forearm enclosure.

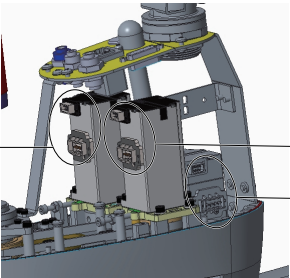
Step	Description	Illustration
①	Remove the four M4x10 spring washer and flat washer combined screws on the top of the forearm enclosure.	Four M4x10 spring washer and flat washer combined screws  A top-down view of the forearm enclosure. Four screws are circled with lines pointing to a common label above them. The enclosure has a QR code, a 'Reset Switch', and a warning symbol.
②	Remove the two screws on the back of the forearm.	 A back view of the forearm enclosure. Two screws are circled. The enclosure is mounted on a base.

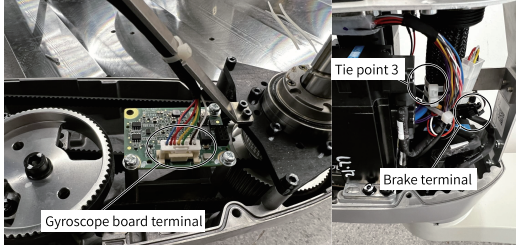
Step	Description	Illustration
③	Remove the four M4x12 hexagon screws on the bottom of the forearm.	 Lead screw enclosure (equipped for clean-type robots only) Four M4x12 hexagon screws

11. Cut the cable tie on the motor.



12. Remove the cable connector and gyroscope terminal.

Step	Description	Illustration
①	Use a Phillips screwdriver to loosen the four M2x8.5 cross pan-head screws fixing the four pins of power cable and encoder cable connectors of axes J2, J3, and J4.	 J4 axis connector J3 axis connector J2 axis connector

Step	Description	Illustration
②	Disconnect the brake button connector and the gyroscope terminals	

13. Remove the two M4x8 cross pan-head screws fixing the forearm sheet metal and remove the cables from the forearm, as shown in the following figure.



14. Remove the cables from the robot.

15. Re-install the cables in reverse steps of disassembly.

2.4.8.2 Replacing the Cables Connected Between the Robot and Control Cabinet

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

1. Power off the control cabinet.
2. Disconnect the power and encoder cable connectors connected to the control cabinet.
3. Hang a "Maintenance in process" sign. The "Maintenance in process" sign is used to prevent other operators from operating the robot.
4. Enter the safeguard system.
5. Remove the two M4x8 cross screws on the sheet metal of the trailing cable.



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

2.4.9 Replacing and Maintaining the Battery



Warning

- 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 zero point of all joints.
- The service life of the lithium battery is 1.5 years. Replace the lithium battery every 1.5 years even when the robot is always powered on. Use the lithium battery specified by the Company. Connect the battery properly. Do not mistake the polarity.

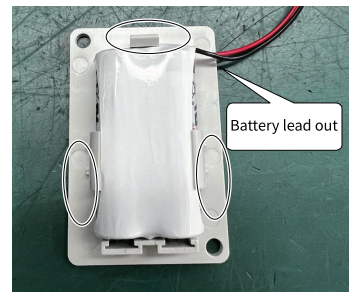
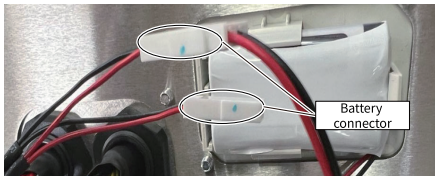
To replace the battery, do as follows:

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



2. Replacing the battery

- a. Gently take out the battery box and find another battery plug.
- b. Insert a new battery and then remove the old battery.
- c. Install the new battery to the battery box.



3. Put back the battery box and fix it with two screws with a torque of $0.6 \text{ N} \cdot \text{m}$.

2.4.10 Zero Point Adjustment

2.4.10.1 Overview of Zero Point Adjustment

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

Note

After zero point adjustment, the absolute accuracy of the robot may deviate from the default absolute accuracy at delivery.



Caution

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

2.4.10.2 Procedure of Zero Point Adjustment

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

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

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

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

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

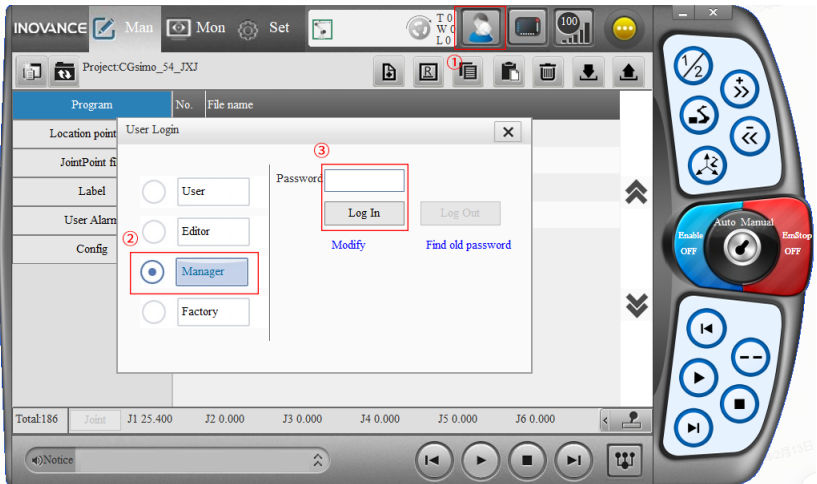


Figure 2-1 Screen of IRTP80 series tech pendant

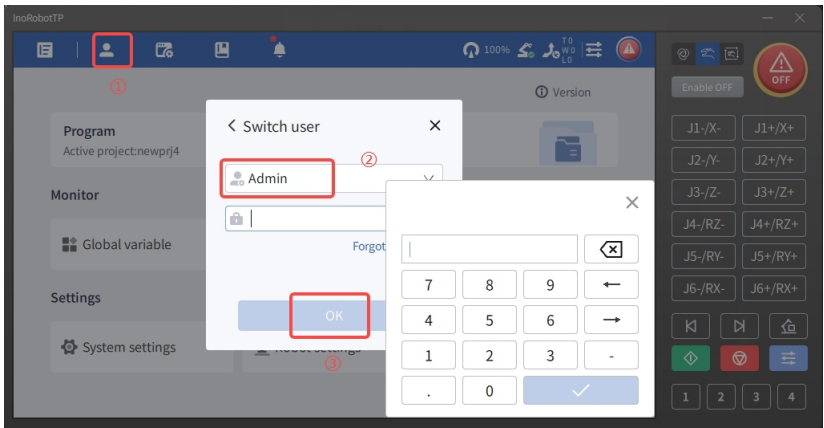


Figure 2-2 Screen of IRTP200 series tech pendant

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



Figure 2-3 Screen of IRT80 tech pendant



Figure 2-4 Screen of IRT200 series tech pendant

3. Move each axis of the robot to the corresponding zero point.
 - a. Move the robot axes to their respective zero points on the hand-held or PC-based teach pendant. For details, see Teach Pendant User Guide.
 - b. Also, you can manually push a robot joint to the zero point when the motor is disabled.

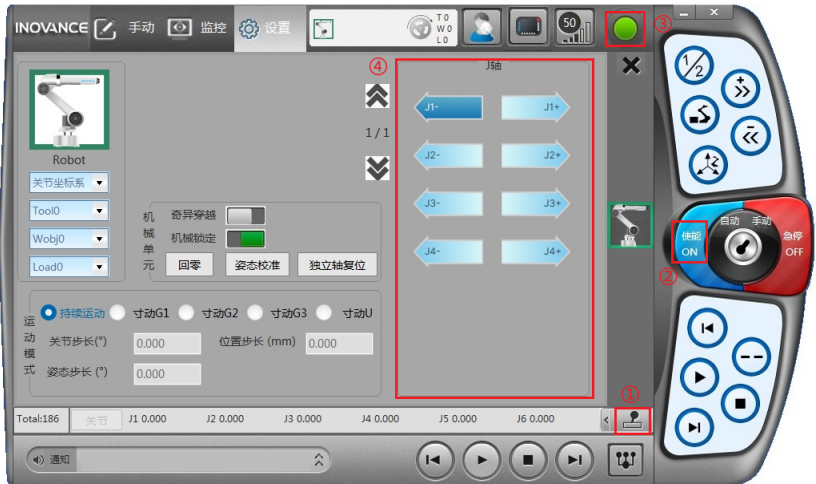


Figure 2-5 Screen of IRTP80 series tech pendant



Figure 2-6 Screen of IRTP200 series tech pendant

4. Switch to the emergency stop state.

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



Figure 2-7 Screen of IRT80 series tech pendant



Figure 2-8 Screen of IRT200 series tech pendant

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



Figure 2-9 Screen of IRTP80 series tech pendant



Figure 2-10 Screen of IRTP200 series tech pendant

2.4.10.3 Zero Point Position of Each Joint

1. The recesses of zero points of axes J1 and J2 are aligned together, as shown in the figure below.

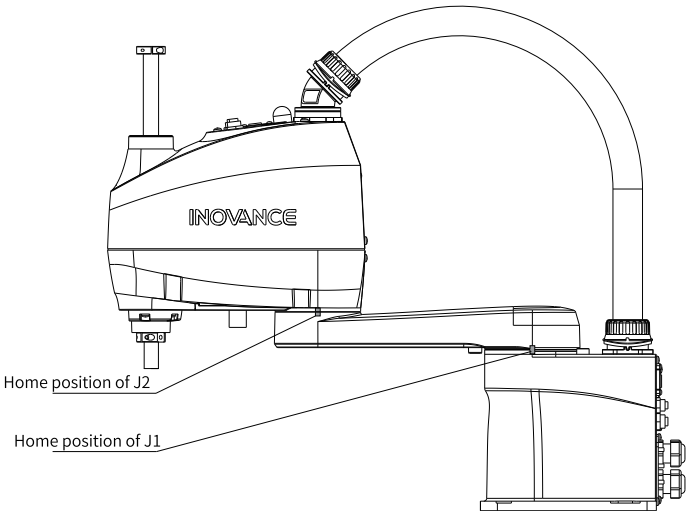


Figure 2-11 Zero points of axes J1 and J2

Model	J1 Max Motion Range	J2 Max Motion Range
IR-S4-40Z15S3	$\pm 132^\circ$	$\pm 141^\circ$

2. The zero point of J3 axis is the upper limit position of J3 axis.

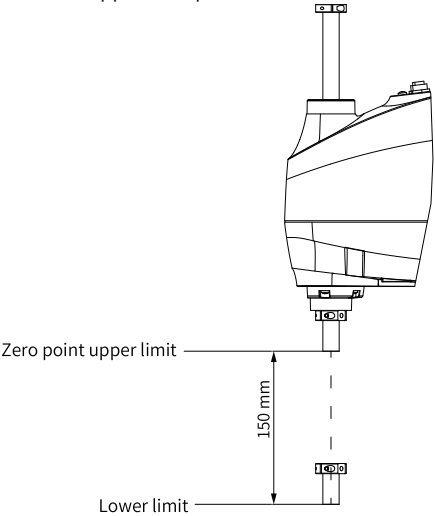


Figure 2-12 Zero point of axis J3

Model	J3 Travel
IR-S4-40Z15S3	150 mm

3. The zero point of J4 axis is the position where the plane of the axis (or the slot of the upper or lower mechanical limit stop) is facing toward the top of arm 2.

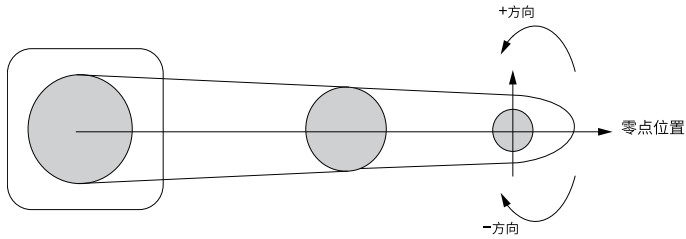


Figure 2-13 Zero point of axis J4

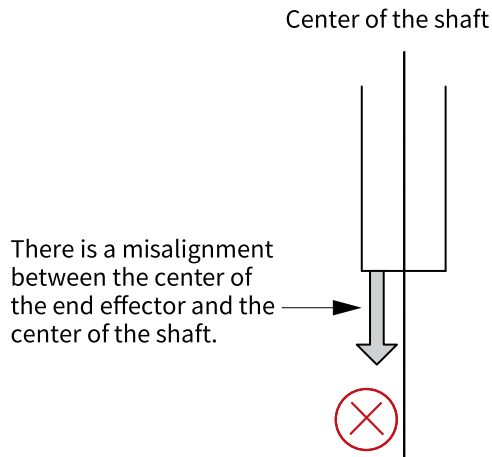
Model	J4 Max Motion Range
IR-S4-40Z15S3	$\pm 360^\circ$

2.4.10.4 Zero Point Adjustment of J2

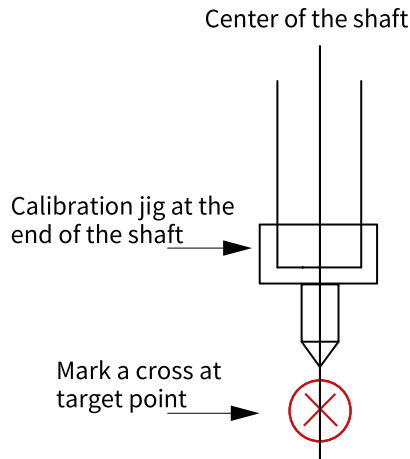
Due to the strong correlation between the coordinates of the robot's work points and the accuracy of J2, it is necessary to complete the zero point position calibration of J2 before calculating the robot coordinates. When adjusting the zero point of J2 in ["2.4.10.2 Procedure of Zero Point Adjustment" on page 68](#), refer to the right/left wrist wizard provided by the teach pendant.

Procedure of J2 zero point adjustment

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



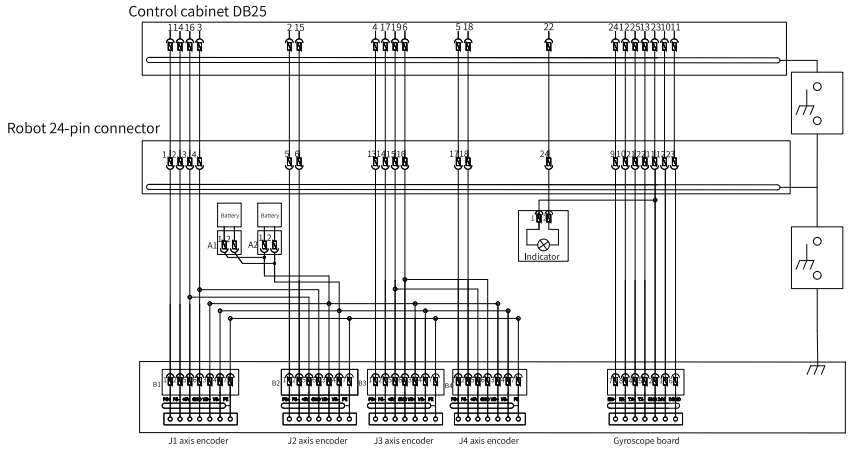
2. Make a zero point adjustment jig on the top side of the shaft to clarify the center of the shaft, as shown in the figure below. Specify a target position that can be easily recognized when the right/left wrist pose is changed, and then mark it with ×.



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

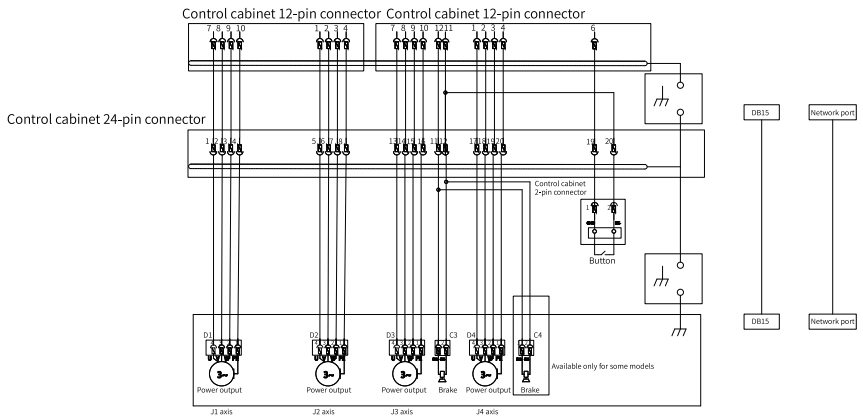
2.4.11Wiring Diagrams

The following figure shows the encoder cable connection.



Encoder Pin	7	1	2	5	6	3	4
Definitions	Shielding	PS+	PS−	5 V	GND	BT+	BT−

The following figure shows the power cable connection.



Power Output Pin	1	2	3	4	1	2
Definitions	U	V	W	PE	BK+	BK–

3 IR-S7 Series SCARA Robot Maintenance Guide

3.1 Product Information

3.1.1 Model

Note

- The maintenance instructions in this guide refer to IR-S7 series models for Chinese and international markets.
- The product information in this guide is the information of standard models in a standard environment. For information about non-standard models or models in clean environment, contact the provider.

Models for Chinese market

IR- S 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 3: 3 m standard cable 5: 5 m standard cable G3: 3 m highly flexible cable
② Series S: SCARA robot	⑤ Maximum travel of Z axis (empty for models without a lead screw) Z20: 200 mm	-
③ Load 7: 7 kg	⑥ Installation environment C: Clean S: Standard P: High-protection	

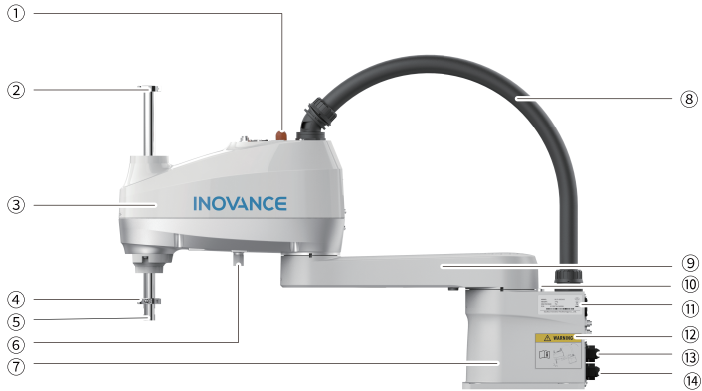
Models for international markets

IR- S 7- 60 Z20 S-INT
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 Version INT: International (With functional safety)
② Series S: SCARA robot	⑤ Maximum travel of Z axis Z20: 200 mm	-
③ Load 7: 7 kg	⑥ Installation environment S: Standard	

3.1.2 Components

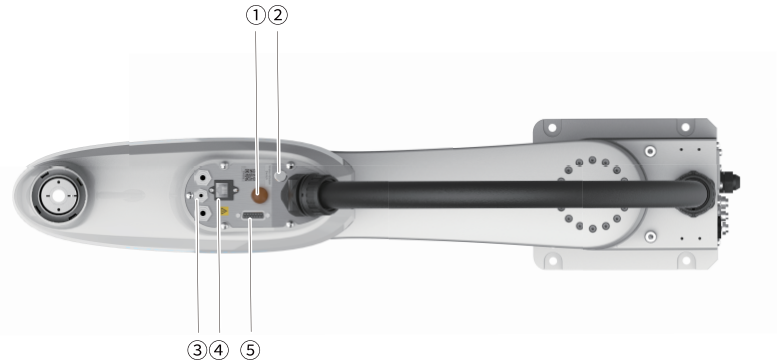
Part 1



No.	Description
①	State indicator
②	Mechanical stop for J3 upper limit
③	Arm 2
④	Mechanical stop for J3 lower limit
⑤	J3 lead screw shaft
⑥	J2 mechanical limit stop
⑦	Base
⑧	Cable unit
⑨	Arm 1
⑩	J1 mechanical limit stop
⑪	Nameplate
⑫	Label

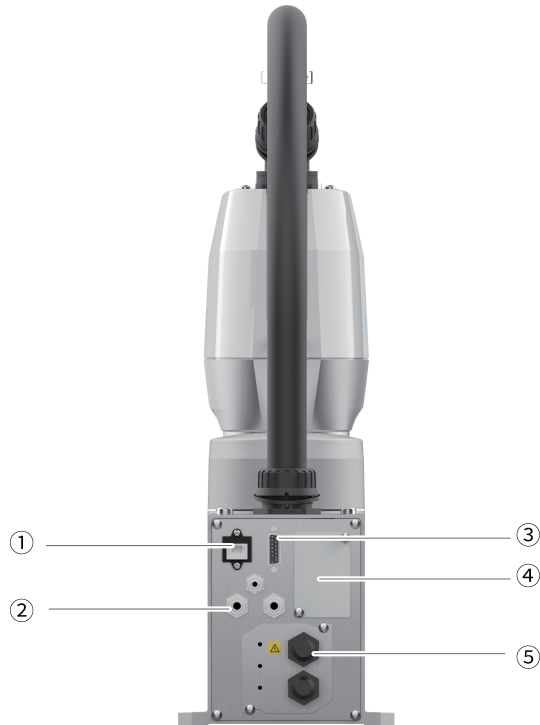
No.	Description
⑬	Power cable
⑭	Signal cable

Part 2



No.	Description
①	Indicator
②	Brake button
③	Air duct connector
④	Network port
⑤	D-Sub 15Pin

Part 3



No.	Description
①	Network port
②	Air duct connector
③	D-Sub 15Pin
④	Battery cover
⑤	Trailing cable

3.2 Regular Inspection

3.2.1 Periodic Inspection

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

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

1. Daily inspection and maintenance

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

2. Weekly inspection and maintenance

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

3. Monthly inspection and maintenance

Check Item	Check Measure
Control cabinet heat dissipation inspection	Check whether the fan behind the control cabinet is ventilated smoothly. It is recommended to replace or maintain the fan once a month.
Ball screw and spline (plain shaft)	Check the lubrication state of ball screw and spline, and replenish lubricating grease according to the recommended replacement cycle.

4. Inspection and maintenance every six months

Check Item	Check Measure
All wiring harnesses for each electrical component	• Check all cable connectors of the robot body for bending, corrosion and falling off. • Check the cables outside the control cabinet for bending, corrosion and falling off. • Check the cable of the teach pendant for bending, corrosion and falling off.
Timing belt	Check whether the tension frequency of timing belt is within the standard range.

5. Inspection and maintenance every year

Check Item	Check Measure
Control cabinet DI/DO signal	Check whether the DI/DO signal response of the control cabinet is normal.
Reducer of each axis	Check whether the lubrication of the reducer of each axis of the robot is normal and whether there is abnormal noise.
Cleaning of all electrical components	Check the cleanliness of all electrical components. Under normal circumstances, remove dust for all electrical components every year.
Control cabinet fan filter	Check the cleanliness of the filter of the control cabinet fan, and replace the filter once a year under normal circumstances.

6. Inspection and maintenance every 1.5 years

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

3.2.2 Screw Tightening Torque and Method

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

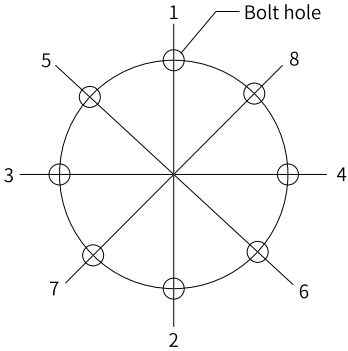


Caution

Except for torques of the screws of the robot enclosure and the connecting parts of the reducer, the torques of other screws are 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 fasten all screws securely at one time. Do not tighten the screw to the maximum torque value at a time. Tighten the screws slightly with a hexagon wrench as shown in the preceding figure. Then tighten the screws to the torque values in the table above with a torque wrench.

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

Screw	Torque (N·m)
M3	0.8
M4	1.8

3.2.3 Replacing the Lubricating Grease

The following table describes the lubricating grease application cycle.

Position	Cycle
J1 axis reducer	When replacing the motor.
J2 axis reducer	When replacing the motor.
Ball screw and spline	100 km or every 3 months

Lubricating Grease Type	Lubricating Grease Code
Lubricating grease for J1 axis reducer	● H: 24060061 ● X: 24060141
Lubricating grease for J2 axis reducer	● H: 24060061 ● X: 24060141
Ball screw and spline	THK AFB-LF: 24100039

Cautions:

1. Only apply the original lubricating grease to the reducer and ball screw.
2. It is strictly forbidden to deplete the lubricating grease of the ball screw; otherwise, irreversible mechanical damage may occur.



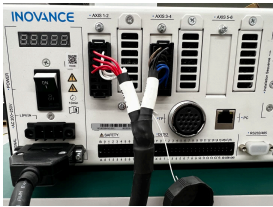
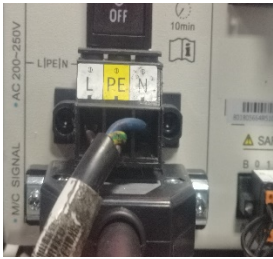
Caution

If the lubricating 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 lubricating grease gets on your skin, wash the area thoroughly with soap and water.

3.2.4 Daily Control Cabinet Cable Inspection

The following table describes the inspection of control cabinet cables:

No.	Check Item	Diagram/Illustration	Cycle
①	Check that the power output cable and encoder cable of the robot are properly connected to the control cabinet.		Daily
②	Check that the teach pendant cable is properly connected to the control cabinet.		Daily
③	Check that the external power cable (L, N, and PE slots) is properly connected to the control cabinet.		Daily
④	Wipe off any acid, alkali, oil, or corrosive liquids with dust-free cloth or scouring pad.	All cables	Monthly

3.3 Enclosure Removal and Installation

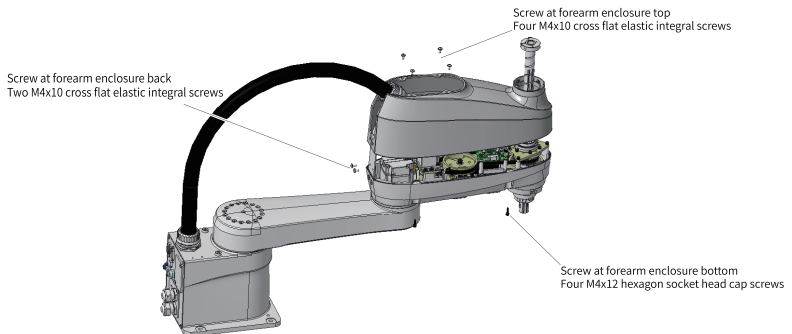


Caution

- During removal and re-installation of the enclosure, do not pull it forcibly. Failure to comply may result in cable damage, wire breaking, or poor contact, causing electric shock or system fault.
- After the maintenance is complete, install the removed enclosure back to its original position.
- If the enclosure fixing screws are missing, fix the enclosure with screws of the type and quantity shown in ["2.3.1 Removing and Installing the Enclosure of the Forearm" on page 26](#).
- 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.
- Before removing or installing the robot enclosure, power off the robot. Never remove or install the robot enclosure with power on.

3.3.1 Removing and Installing the Enclosure of the Forearm

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



Removing and Installing the Enclosure of the Forearm

Follow the following steps to remove and install the forearm enclosure:

1. Remove the six M4x10 cross flat elastic integral screws on the top and back.
2. Remove the four M4x12 hexagon socket head cap screws on the bottom.

3. Lift up and remove the forearm enclosure.
4. 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.

3.3.2 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.



Screw at spline nut enclosure bottom
Three M4x10 cross flat elastic integral screws

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

1. Loosen three M4x10 cross flat elastic integral screws of the spline nut.
2. Remove the enclosure of the spline nut.
3. When installing the enclosure, fix the screws with a torque of 0.6 N·m.

3.4 Replacement and Maintenance

3.4.1 Maintaining the J1 Axis

	Name	Quantity
Maintenance part	J1 motor	1
	O-shaped sealing ring	2
	J1 axis reducer	1
Tool	Hexagon wrench	1
	Torque wrench (0 N·m to 25 N·m)	1
	Hexagon screwdriver bit	1
	Dust-free cloth or oil-absorbing sheet	Several
	Phillips screwdriver	1
Material	LT243 threadlocker	1
	LT638 threadlocker	1
	Reducer lubricating grease ^[1]	1

Note

[1]: The codes of lubricating greases are:

- H lubricating grease: 24060061
- X lubricating grease: 24060141

Screw tightening torque reference:

Screw	Torque (N·m)
M3 hexagon socket head cap screw	2
M4 hexagon socket head cap screw	5

Note

- Recommended hexagon screwdriver 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**

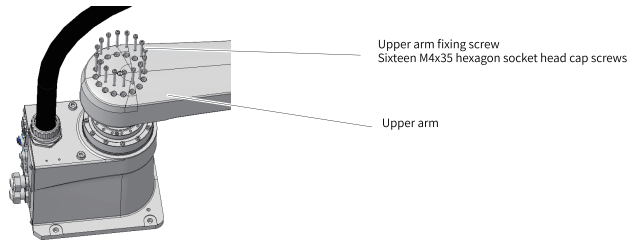
- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
 - Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
 - Do not remove any parts that are not covered in this guide. Follow the maintenance procedure strictly as described in this guide.
 - Check the motion of the robot after parts replacement outside the safety fence. Failure to comply may cause severe safety issues due to abnormal movement of the robot.
 - Make sure that the emergency stop switch and safety door switch work properly before operation. Otherwise, safety protection functions 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.
-

3.4.1.1 Maintaining the J1 Motor and Reducer

1. Remove the upper arm and forearm:
Loosen the sixteen M4x35 hexagon socket head cap screws fixing the upper arm, and remove the upper arm and forearm.

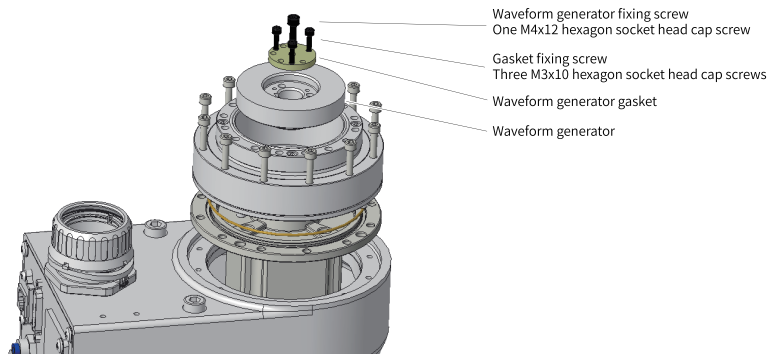


Note

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.

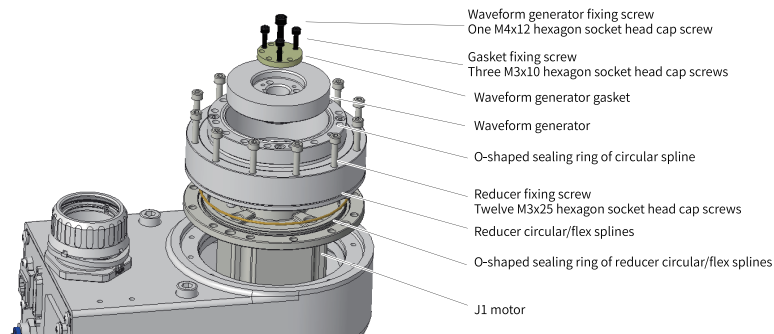
2. Remove the waveform generator:

- a. Loosen the one M4x12 hexagon socket head cap screw securing the waveform generator, and clamp the gasket with circlip pliers.
- b. Screw M5 screw into the M5 hole in the middle of waveform generator gasket. Rotate the M5 screw and remove the waveform generator.
- c. Remove the waveform generator and loosen the three M3x10 hexagon socket head cap screws fixing the gasket.



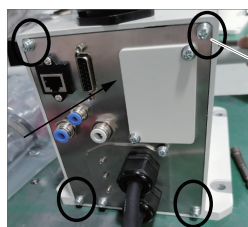
3. Remove and replace the reducer:

- a. Loosen the twelve M4x35 hexagon socket head cap screws fixing the reducer, and then remove the O-shaped sealing ring of the circular spline.
- b. Remove the reducer.
- c. Install a new one.

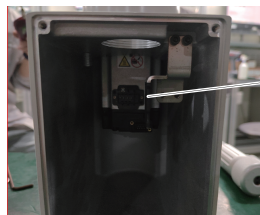


4. Remove and replace the J1 motor:

- Remove the O-shaped sealing rings of the circular/flex splines of the reducer, and loosen the four M4x10 cross flat elastic integral screws fixing the base sheet metal.
- Loosen the motor power cable and encoder cable of the J1 axis, remove the J1 motor, and install a new one.
- After replacing the motor and reducer of the J1 axis, apply new grease to the reducer according to ["3.4.1.2 Replacing the Lubricating Grease for J1 Axis Reducer" on page 93](#). The M3 screw tightening torque is 2 N·m, and the M4 screw tightening torque is 5 N·m.



Base sheet metal fixing screw
Four M4x10 cross flat elastic integral screws

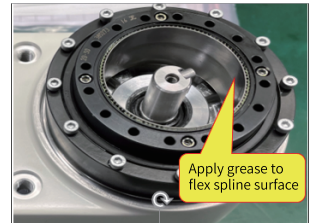
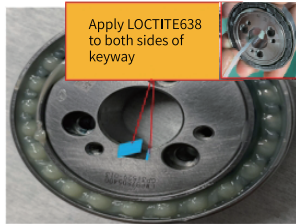


Power cable and encoder cable of J1 motor

5. Reassembly:

- Re-assemble the components according to reverse steps of disassembly.
- After replacing the motor and reducer of the J1 axis, apply new grease to the reducer.

- c. Apply the LT638 threadlocker to the keyway of the waveform generator and grease (H: SK-1A grease; X: SFB grease) to the surface of the circular/flex splines of the reducer. Fix the M3 screw with tightening torque of $2 \text{ N} \cdot \text{m}$, and the M4 screw with tightening torque of $5 \text{ N} \cdot \text{m}$. All reducer screws must be coated with LT243 threadlocker.



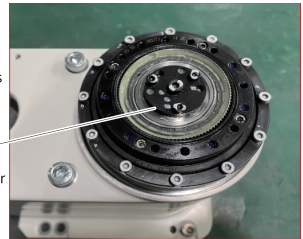
3.4.1.2 Replacing the Lubricating Grease for J1 Axis Reducer

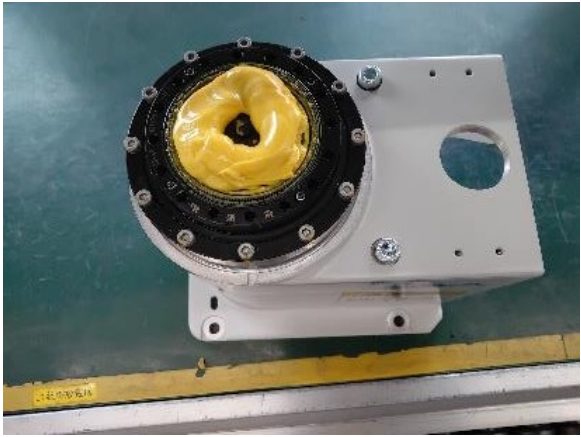
1. Remove the upper arm and forearm:
Remove the upper arm and forearm according to Step 1 in ["3.4.1.1 Maintaining the J1 Motor and Reducer" on page 90](#).
2. Remove the waveform generator and the circular/flex splines of the reducer:
 - a. Remove the waveform generator according to Step 2 in ["3.4.1.1 Maintaining the J1 Motor and Reducer" on page 90](#).
 - b. Remove the circular/flex splines according to Step 3 in ["3.4.1.1 Maintaining the J1 Motor and Reducer" on page 90](#).
3. Apply lubricating grease to the waveform generator.
 - a. Clean old lubricating grease on the waveform generator and circular/flex splines of the reducer.
 - b. Apply lubricating 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 the upper cavity of the waveform generator (approx. 23.5 mL, 21 g) of the reducer.



Inner cavity of circular/flex splines

Upper cavity of waveform generator





4. Reassembly:

Reverse the above steps (M3 screw tightening torque: $2 \text{ N} \cdot \text{m}$; M4 screw tightening torque: $5 \text{ N} \cdot \text{m}$. All reducer screws must be coated with the LT243 threadlocker).

5. After reassembly, power on the robot, reset the J1 axis encoder value, clear any alarms, and then capture the J1 axis zero point position.

3.4.2 Maintaining the J2 Axis

	Name	Quantity
Maintenance part	J2 motor	1
	O-shaped sealing ring	2
	J2 axis reducer	1
Tool	Hexagon wrench	1
	Torque wrench ($0 \text{ N} \cdot \text{m}$ to $10 \text{ N} \cdot \text{m}$)	1
	Hexagon screwdriver bit	1
	Dust-free cloth or oil-absorbing sheet	Several
	Phillips screwdriver	2
Material	LT243 threadlocker	1
	LT638 threadlocker	1
	Reducer lubricating grease ^[1]	1

Note

[1]: The codes of lubricating greases are:

- H lubricating grease: 22010930
 - X lubricating grease: 24060141
-

Note

- Recommended hexagon screwdriver 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

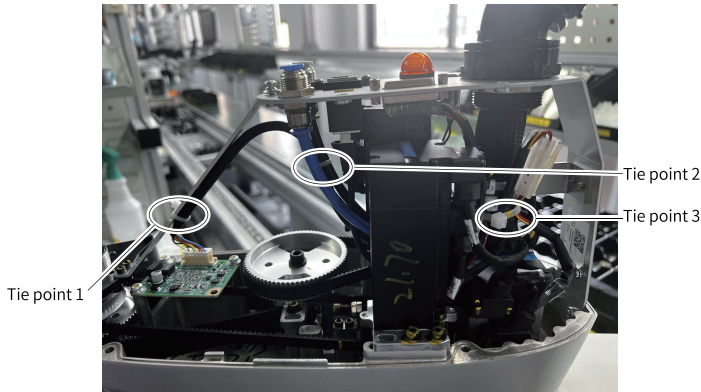
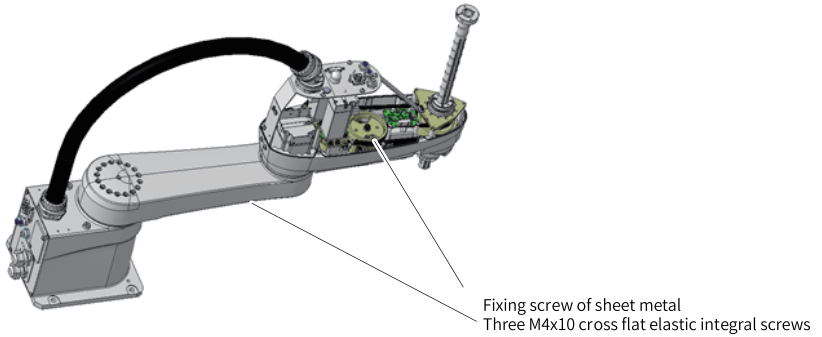
- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
 - Do not install or remove the motor connector while it is energized. Failure to comply may cause abnormal movements of the robot and pose serious safety hazards. Operating with the power on may cause electric shock.
 - Do not remove any parts that are not covered in this guide. Follow the maintenance procedure strictly as described in this guide.
 - Check the motion of the robot after parts replacement outside the safety fence. Failure to comply may cause severe safety issues due to abnormal movement of the robot.
 - Make sure that the emergency stop switch and safety door switch work properly before operation. Otherwise, safety protection functions 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.
-

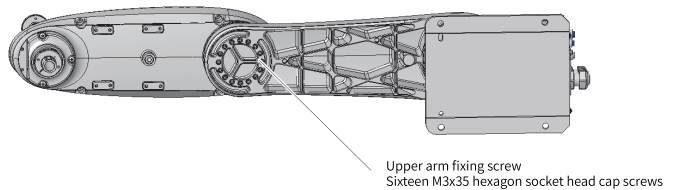
3.4.2.1 Maintaining the J2 Motor and Reducer

1. Remove the forearm enclosure:
Remove the forearm enclosure according to ["3.3.1 Removing and Installing the Enclosure of the Forearm" on page 87](#).
2. Remove the sheet metal assembly:
 - a. Loosen the three M4x10 cross flat elastic integral screws on the top and back of the forearm sheet metal.
 - b. Loosen the motor power cables and encoder cables of axes J2, J3, and J4, and move away the cable sheet metal assembly.



3. Remove the J2 axis assembly:

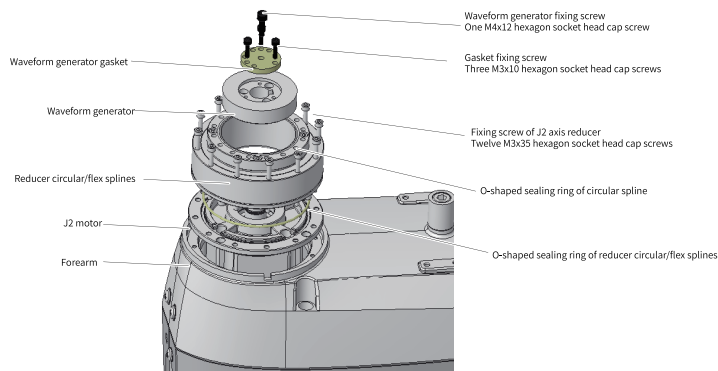
Loosen the sixteen M3x35 hexagon socket head cap screws fixing the upper arm, and remove the J2 axis assembly.



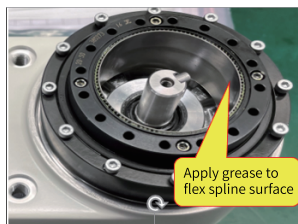
4. Remove the waveform generator:

- a. Loosen the one M4x12 hexagon socket head cap screw fixing the waveform generator, and clamp the gasket with circlip pliers.
- b. Screw M5 screw into the M5 hole in the middle of waveform generator gasket.

- c. Remove the waveform generator and loosen the three M3x10 hexagon socket head cap screws fixing the gasket.
5. Remove the J2 motor and reducer:
 - a. Loosen the twelve M3x35 hexagon socket head cap screws fixing the J2 axis reducer, and then remove the O-shaped sealing rings of reducer and circular spline.
 - b. Loosen the screw fixing the J2 motor, and replace the motor or reducer.



6. Reassembly:
 - a. 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 Lubricating Grease for J2 Axis Reducer" on page 98](#).
 - b. Apply the LT638 threadlocker to the keyway of the waveform generator and grease (H: SK-1A grease; X: SFB grease) to the surface of the circular/flex splines of the reducer. For the grease types, see the list of parts. The M3 screw tightening torque is $2 \text{ N} \cdot \text{m}$, and the M4 screw tightening torque is $5 \text{ N} \cdot \text{m}$. All reducer screws must be coated with LT243 threadlocker.



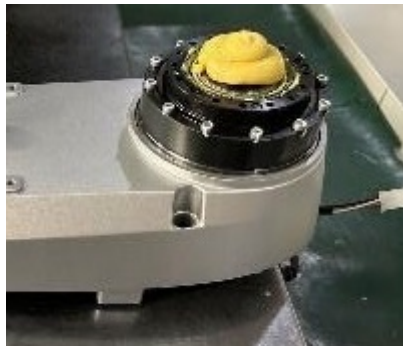
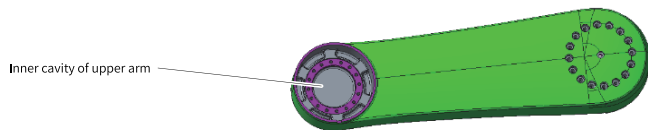
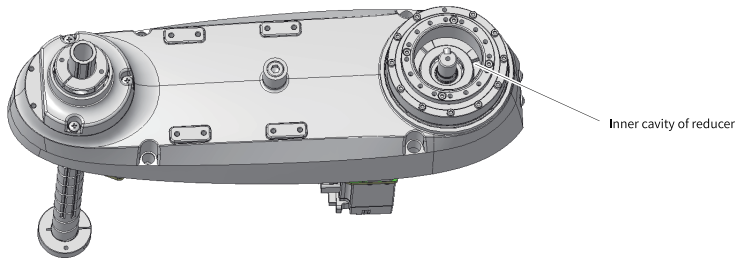
3.4.2.2 Replacing the Lubricating Grease for J2 Axis Reducer

1. Remove the motor assembly of the J2 axis:

Remove the J2 motor assembly and waveform generator from the forearm of the IR-S7 series robot according to Steps 1-5 in ["3.4.2.1 Maintaining the J2 Motor and Reducer" on page 96](#).

2. Apply lubricating grease to the waveform generator:

- a. Clean old lubricating grease on the waveform generator and circular/flex splines of the reducer.
- b. Apply grease (H: SK-1A grease, X: SFB grease) evenly to the inner cavity of the reducer (approx. 20 mL, 18 g) and the upper arm (approx. 12.3 mL, 11 g).



3. Reassembly:

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 the LT243 threadlocker).

4. After reassembly, power on the robot, reset the J2 axis encoder value, clear any alarms, and then capture the J2 axis zero point position.

3.4.3 Maintaining the J3 Axis

Name		Quantity
Maintenance part	J3 motor	1
	Timing belt	1
	Brake	1
Tool	Hexagon wrench	1
	Torque wrench (0 N·m to 10 N·m)	1
	Hexagon screwdriver bit	1
	Dust-free cloth or oil-absorbing sheet	Several
	Phillips screwdriver	2
	Tension meter	1
	Height gauge	1

Screw tightening torque reference:

Screw	Torque (N·m)
M4 hexagon socket head cap screw	3.5
M3 hexagon socket head cap screw	1
M4 hexagon set screw	1.8
M4 cross flat elastic integral screw	0.6

Note

- Recommended hexagon screwdriver 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

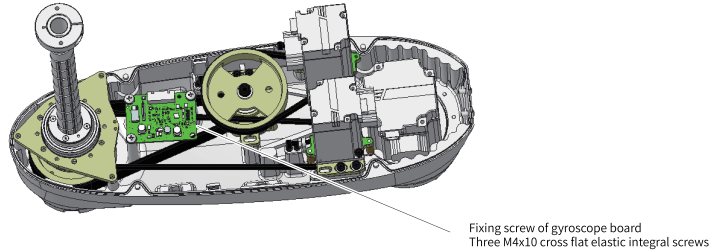
- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
 - Prevent foreign objects from entering the equipment and terminals during maintenance.
 - After the equipment is replaced, perform wiring 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.
-

3.4.3.1 Maintaining the J3 Axis Timing Belt, Brake, and Motor

1. Remove the enclosure, cables and sheet metal of the forearm:
 - a. Remove the forearm enclosure according to ["3.3.1 Removing and Installing the Enclosure of the Forearm" on page 87](#).
 - b. Remove the cables and sheet metal of the forearm according to Step 2 in ["3.4.2.1 Maintaining the J2 Motor and Reducer" on page 96](#).

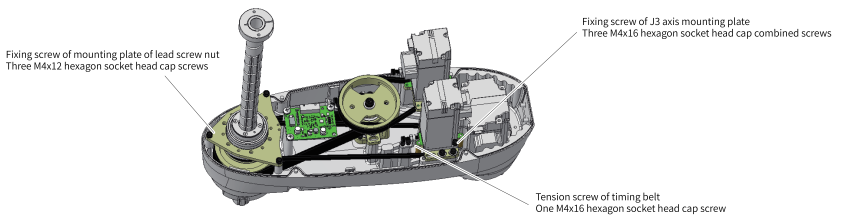
2. Remove the gyroscope board:

Remove the three M4x10 cross flat elastic integral screws that fix the gyroscope board and then remove the gyroscope board.



3. Disassemble the motor assembly of the J3 axis:

- a. Loosen the one M4x16 hexagon socket head cap screw securing the timing belt of the J3 axis and then loosen the three M4x16 hexagon socket cap head combined screws fixing the mounting plate of the J3 axis.
- b. Loosen the three M4x12 hexagon socket head cap screws fixing the mounting plate of lead screw nut.
- c. Take out the lead screw nut assembly (do not separate the lead screw nut from the lead screw), and then take out the J3 axis motor assembly.



4. Replace the J3 axis timing belt:

- a. Take out the J3 axis motor assembly and unscrew the three M4x25 hexagon socket head cap screws fixing the brake.
- b. Take out the brake and replace the timing belt.
- c. Re-assemble the J3 axis (M4 screw tightening torque: 3.5 N·m and M3 screw tightening torque: 1 N·m) by reversing Steps 1, 2, and 3.
- d. Tighten the timing belt with the tension screw (measure the timing belt with a tension meter to ensure the frequency is 110 Hz to 120 Hz).

Note

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

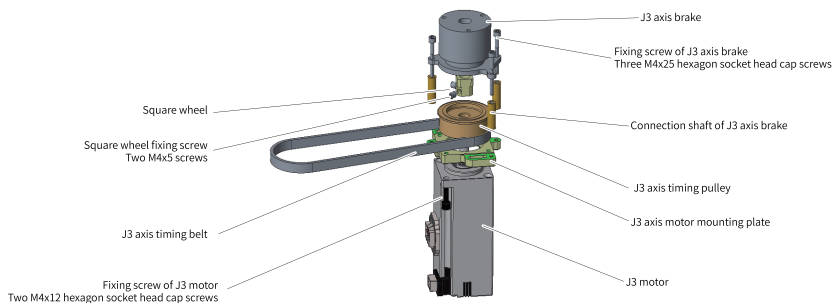
Measuring span: 200 mm

Timing belt unit mass: 2.4 g/m

Timing belt width: 10.0 mm/R

5. Replace the J3 axis brake and J3 axis motor:

- a. Loosen the two M4x5 screws fixing the square wheel and take out the square wheel.
- b. Replace the square wheel and J3 axis brake. (The service life of the brake for emergency stop is 2000 times. Replace the brake when the service life expires.)
- c. Loosen the two M4x5 hexagon set screws fixing the timing pulley and the two M4x12 hexagon socket head cap screws fixing the J3 motor, and then replace the J3 motor.



6. Reassembly:

- a. After replacing the motor and brake of J3 axis, install the timing pulley and square wheel, and align the two M4 set screw holes with the motor flat position.
- b. Use a height gauge to ensure the distance from the square wheel top to the mounting plate. For the specific height, contact Inovance technical support.
- c. Attach the J3 axis timing pulley to the square wheel, and then lock the two M4x5 hexagon set screws on timing pulley to the motor flat position.
- d. Re-assemble the J3 axis (M4x5 screw tightening torque: $1.8 \text{ N} \cdot \text{m}$; M4 screw tightening torque: $3.5 \text{ N} \cdot \text{m}$; and M3 screw tightening torque: $1 \text{ N} \cdot \text{m}$) by reversing Steps 1 and 2.
- e. Tighten the timing belt with the screw (measure the timing belt with a tension meter to ensure the frequency is 110 Hz to 120 Hz).

Note

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

Measuring span: 200 mm

Timing belt unit mass: 2.4 g/m

Timing belt width: 10.0 mm/R

- After reassembly, power on the robot, reset the encoder values of axes J3 and J4 (which have a coupling structure), clear any alarms, and then capture the zero point positions of axes J3 and J4.

3.4.4 Maintaining the J4 Axis

Name		Quantity
Maintenance part	J4 motor	1
	Timing belt	2
Tool	Hexagon wrench	1
	Torque wrench (0 N·m to 10 N·m)	1
	Hexagon screwdriver bit	1
	Dust-free cloth or oil-absorbing sheet	Several
	Phillips screwdriver	2
	Tension meter	1
	Height gauge	1

Screw tightening torque reference:

Screw	Torque (N·m)
M4 hexagon socket head cap screw	3
M3 hexagon socket head cap screw	1.5

Note

- Recommended hexagon screwdriver 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.
-

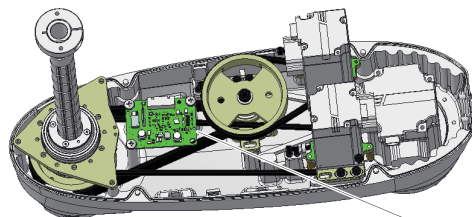


- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Prevent foreign objects from entering the equipment and terminals during maintenance.
- After the equipment is replaced, perform wiring inspection 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 Axis Timing Belt

1. Remove the enclosure, cables and sheet metal of the forearm:
 - a. Remove the forearm enclosure according to ["3.3.1 Removing and Installing the Enclosure of the Forearm" on page 87](#).
 - b. Remove the cables and sheet metal of the forearm according to Step 2 in ["3.4.2.1 Maintaining the J2 Motor and Reducer" on page 96](#).
2. Remove the gyroscope board:

Remove the three M4x10 cross flat elastic integral screws that fix the gyroscope board and then remove the gyroscope board.



Fixing screw of gyroscope board
Three M4x10 cross flat elastic integral screws

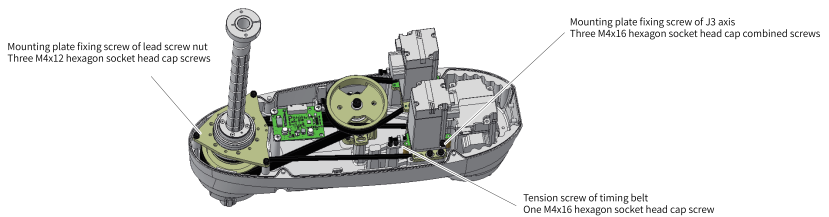
3. Disassemble the motor assembly of the J3 axis:



Caution

If you only need to remove the primary timing belt of the J4 axis, you do not need to remove the motor assembly of the J3 axis. If you need to remove the secondary timing belt of the J4 axis, you also need to remove the motor assembly of the J3 axis.

- a. Loosen the one M4x16 hexagon socket head cap screw securing the timing belt of the J3 axis motor assembly, and then loosen the three M4x16 hexagon socket cap head combined screws fixing the mounting plate of the J3 axis.
- b. Loosen the three M4x12 hexagon socket head cap screws fixing the mounting plate of the lead screw nut and remove the lead screw nut assembly (note that the screw nut and shaft must not be separated).
- c. Remove the motor assembly of the J3 axis.



4. Disassemble the motor assembly of the J4 axis:

- a. Loosen the one M4x16 hexagon socket head cap screw securing the timing belt of the J4 axis motor assembly, and loosen the three M4x16 hexagon socket cap head combined screws fixing the motor assembly of the J4 axis.
- b. Take out the J4 axis motor assembly, and replace the primary timing belt with a tension frequency of 395 Hz to 425 Hz of the J4 axis.

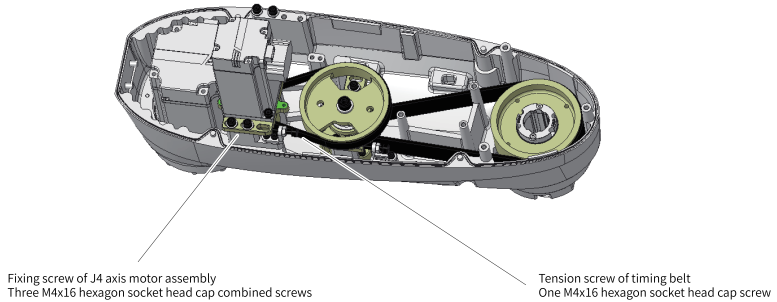
Note

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

Measuring span: 200 mm

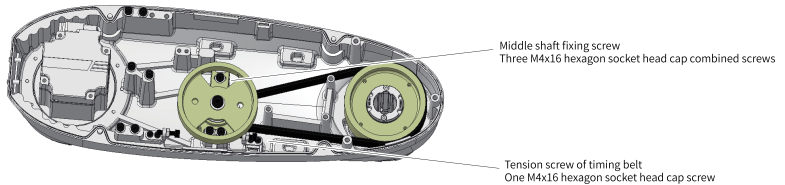
Timing belt unit mass: 2.4 g/m

Timing belt width: 10.0 mm/R



5. Remove the middle shaft assembly:

Loosen the three M4x16 hexagon socket head cap combined screws fixing the middle shaft, and then remove the middle shaft assembly.



6. Replace the secondary timing belt of J4 axis:

- Loosen the one M6x16 hexagon socket head cap screw securing the middle shaft timing pulley and then loosen the two M4x16 hexagon socket cap head combined screws fixing the mounting plate of the middle shaft.
- Remove the mounting plate of the middle shaft. Replace the secondary timing belt of J4 axis and secure the belt with tension screws to ensure that the tension frequency of the belt is 125 Hz to 135 Hz.

Note

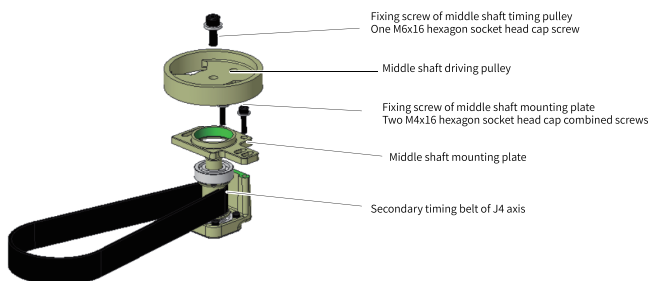
Before testing the timing belt frequency with a tension meter, the following parameters must be set:

Measuring span: 200 mm

Timing belt unit mass: 2.4 g/m

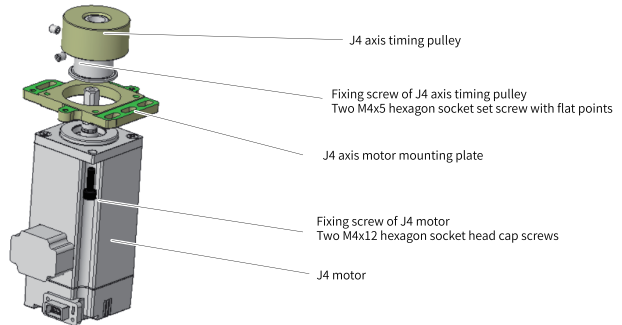
Timing belt width: 10.0 mm/R

- c. Re-install the belt in the reverse steps of disassembly with M4 screws of torque 3.5 N · m or M6 screws of torque 15 N · m.



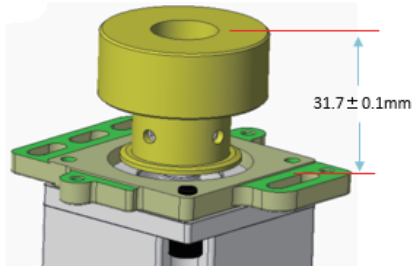
3.4.4.2 Maintaining the J4 Motor

1. Remove the motor assembly of the J4 axis.
Remove the motor assembly of the J4 axis according to steps 1-4 in ["3.4.4.1 Maintaining the J4 Axis Timing Belt" on page 106](#).
2. Replace the J4 motor:
 - a. Loosen the two M4x5 hexagon socket set screw with flat points and remove the J4 axis timing pulley.
 - b. Loosen the two M4x12 hexagon socket head cap screws from the J4 motor.
 - c. Remove the mounting plate of the J4 motor and replace the J4 motor.



3. Reassembly:

- a. Reassemble the J4 motor in the reserve steps of the removal procedure (M4X5 screw torque: $1.8 \text{ N} \cdot \text{m}$; M4 screw torque: $3.5 \text{ N} \cdot \text{m}$).
- b. The distance from the J4 axis belt pulley to the mounting plate of the J4 motor is $31.7 \pm 0.1 \text{ mm}$. See the figure below.



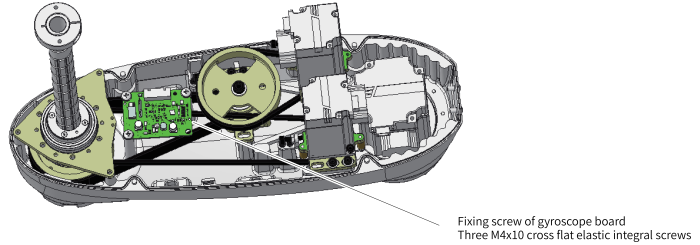
4. After reassembly, power on the robot, reset the encoder values of axes J3 and J4 (which have a coupling structure), clear any alarms, and then capture the zero point positions of axes J3 and J4.

3.4.5 Maintaining the Ball Screw Spline

1. Remove the enclosure, cables and sheet metal of the forearm:
 - a. Remove the forearm enclosure according to ["3.3.1 Removing and Installing the Enclosure of the Forearm" on page 87](#).
 - b. Remove the cables and sheet metal of the forearm according to Step 2 in ["3.4.2.1 Maintaining the J2 Motor and Reducer" on page 96](#).

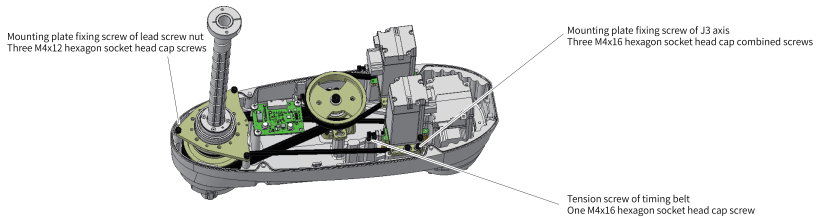
2. Remove the gyroscope board:

- a. Loosen the three M4x10 cross flat elastic integral screws fixing the gyroscope board.
- b. Remove the gyroscope cable and then remove the gyroscope board.



3. Take out the lead screw nut assembly:

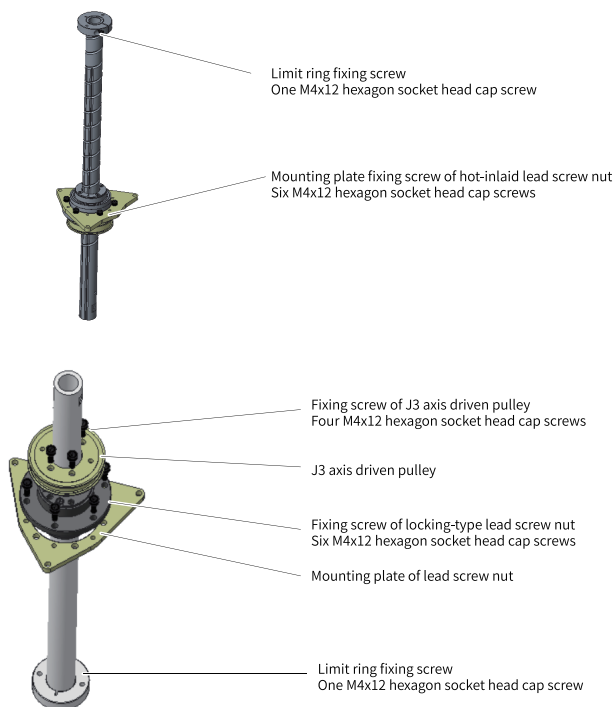
- a. Loosen the one M4x16 hexagon socket head cap screw securing the timing belt of the J3 axis assembly and then loosen the three M4x16 hexagon socket cap head combined screws fixing the mounting plate of the J3 axis.
- b. Loosen the three M4x12 hexagon socket head cap screws securing the mounting plate of lead screw nut.
- c. Take out the lead screw nut assembly (do not separate the lead screw nut from the lead screw).



4. Replace the lead screw assembly:

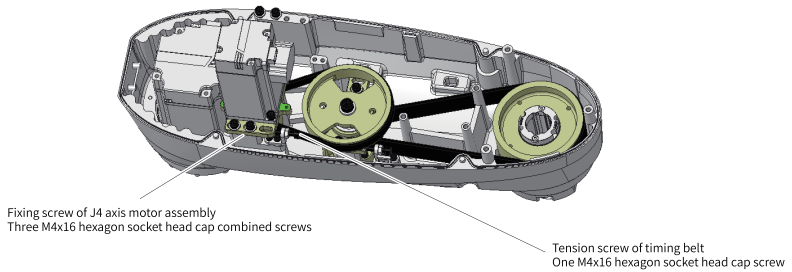
- a. Loosen the six M4x12 hexagon socket head cap screws fixing the mounting plate of lead screw nut, and the one M4x12 hexagon socket head cap screw fixing the limit ring.
- b. Remove the lead screw nut and lead screw (do not separate the nut from the lead screw).

- c. Replace the lead screw and its nut (For the hot-inlaid scheme, the timing pulley and lead screw nut are installed with interference fit, so the lead screw nut needs to be replaced together with the timing pulley. For the locking scheme, remove the timing pulley first and then the lead screw nut).



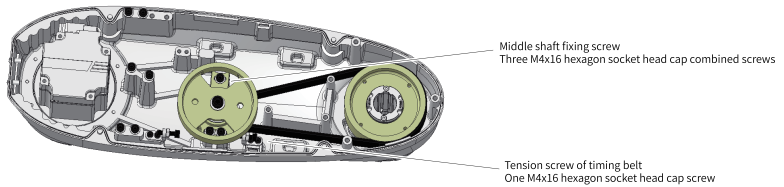
5. Remove the motor assembly of the J4 axis:

Loosen the one M4x16 hexagon socket head cap screw securing the timing belt of the J4 axis motor assembly, loosen the three M4x16 hexagon socket cap head combined screws fixing the motor assembly of the J4 axis, and then take out the J4 axis motor assembly.



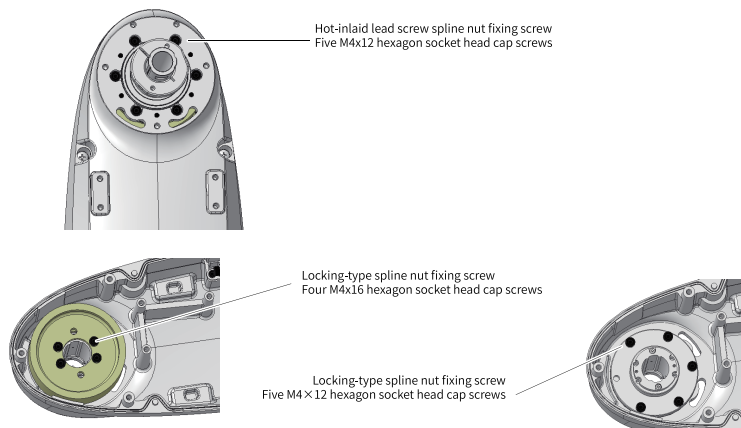
6. Remove the middle shaft assembly:

Loosen the three M4x16 hexagon socket head cap combined screws fixing the middle shaft, and then remove the middle shaft assembly.



7. Replace the spline nut:

- a. Loosen the five M4x12 hexagon socket head cap screws fixing the spline nut, and remove the spline nut assembly.
- b. Replace the spline nut (For the hot-inlaid scheme, the timing pulley and lead screw nut are installed with interference fit, so the lead screw nut needs to be replaced together with the timing pulley. For the locking scheme, remove the timing pulley first and then the spline nut).



8. Reassembly:

Re-install the ball screw spline in the reverse steps of disassembly. The M3 screw torque is $2\text{ N}\cdot\text{m}$, the M4 screw torque is $3.5\text{ N}\cdot\text{m}$, the frequency of J3 axis assembly timing belt is 110 Hz to 120 Hz, the frequency of the J4 axis primary timing belt is 395 Hz to 425 Hz, and the frequency of the J4 axis secondary timing belt is 125 Hz to 135 Hz.

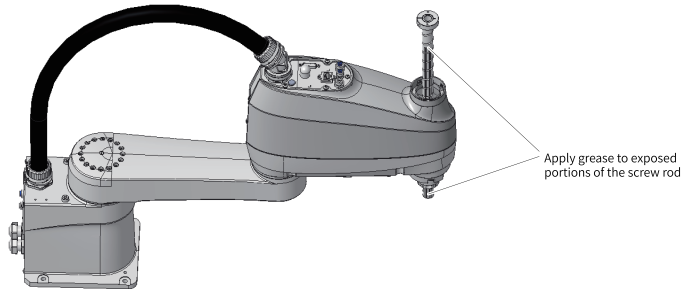


Caution

- When installing the lead screw into the spline, ensure that the cross-shaped mark on the lead screw aligns with the cross-shaped mark on the spline to prevent the spline ball bearings from falling out.
 - Tighten the lead screw mounting plate according to the specified torque requirements, and then adjust the tension of the timing belt.
 - The grease on the surface of the new lead screw spare part is anti-rust oil, which must be thoroughly wiped off with a dust-free cloth before reapplying lubricating grease.
 - After completing the assembly, since the J3 axis and J4 axis have a coupled structure, the zero point positions of both the J3 axis and J4 axis must be calibrated simultaneously.
-

3.4.6 Maintaining the Ball Screw Spline

1. Before replacing the lubricating grease of the ball screw spline, clean the surface of the screw rod shaft with a clean dust-free cloth or scouring pad.



2. Apply lubricating grease (THK AFB-LF, special grease for screw rod) to the exposed portion of the screw rod shaft. Note that it is sufficient to continue to apply a thin layer of grease to the surface of the screw rod shaft, with a grease amount of 1 g. Excessive grease may splash onto processed products or equipment. The coating effect is shown in the following figure.

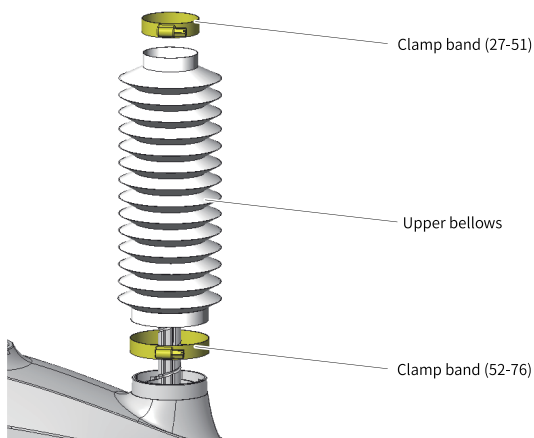


3. It is recommended to replace the lubricating grease of the screw rod every 100 km or every 3 months or in case of decolorization or drying of lubricating grease, as shown in the following figure.

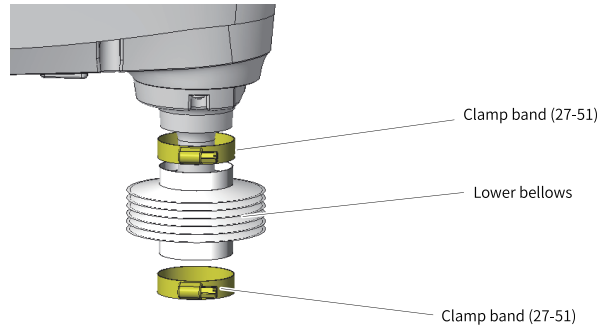


3.4.7 Replacing and Maintaining the Bellows of Cleanroom Model

1. Replace the upper bellows:
 - a. Use a Phillips screwdriver to remove the hose clamp and then remove the upper bellows.
 - b. Install a new upper bellows and lock the upper bellows with a torque of $0.7 \text{ N} \cdot \text{m}$.



2. Replace the lower bellows:
 - a. Use a Phillips screwdriver to remove the hose clamp and then remove the lower bellows.
 - b. Install a new lower bellows and lock the lower bellows with a torque of $0.7 \text{ N} \cdot \text{m}$.



3.4.8 Robot Cable Maintenance



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.
-



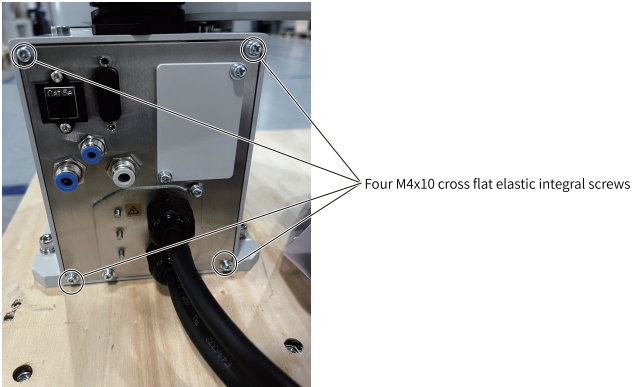
Warning

- 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.
 - 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.
-

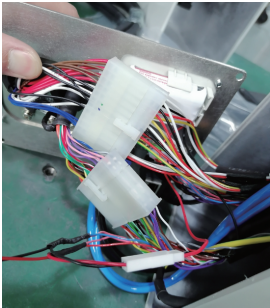
3.4.8.1 Replacing the Cables Connected Between the Base and the Forearm

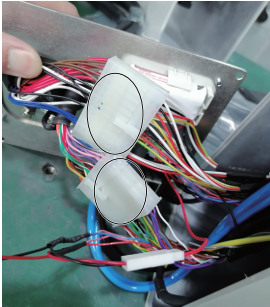
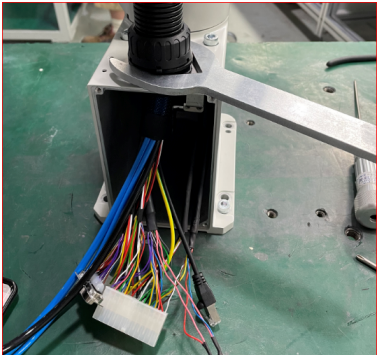
To replace the cables connected between the base and the forearm of the IR-S7 series robots, follow the steps below.

1. Power on the control cabinet.
2. Hang a "Maintenance in process" sign. The "Maintenance in process" sign is used to prevent other operators from operating the robot.
3. Enter the safeguard system.
4. Press the brake release switch to release the brake of J3 motor, and then lower the axis to the lower limit. Ensure that sufficient space is left to prevent the end effector from colliding with peripheral devices.
5. Power off the control cabinet and disconnect the power output and encoder cable connectors connected to the control cabinet.
6. Remove the four M4x10 cross flat elastic integral screws fixing the front cover of the base, and then remove the front cover, as shown in the following figure.

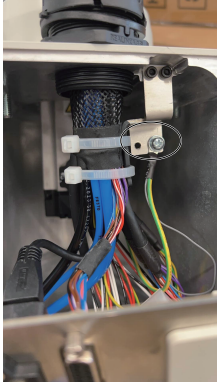
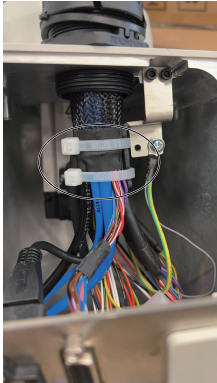


7. Remove cables inside the base.

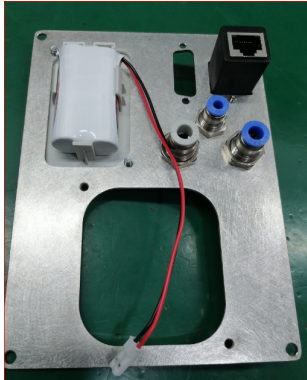
Step	Description	Illustration
①	Gently pull the internal cables out of the base.	

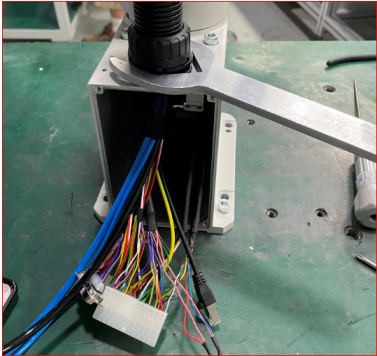
Step	Description	Illustration
②	Disconnect the power cable and encoder cable connectors from the base.	
③	Loosen the 15-pin D-sub connector.	
④	Disconnect the three air ducts and network cables connected to the base cover.	

8. Cut the cable tie inside the base.

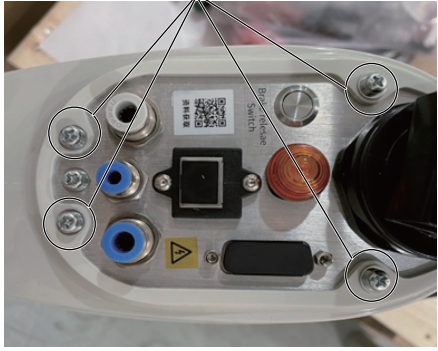
Step	Description	Illustration
①	Disconnect the grounding terminal on the sheet metal inside the base.	
②	Cut the cable tie.	

9. Remove the base bellows connector.

Step	Description	Illustration
①	Remove the battery	

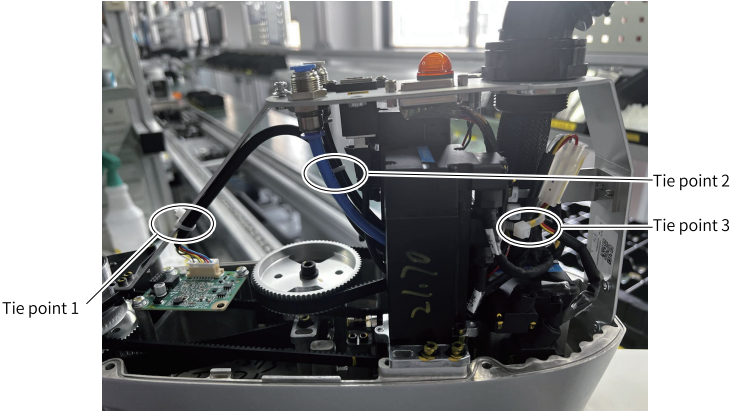
Step	Description	Illustration
②	Disconnect the encoder and power cable terminals of J1 axis.	
③	Remove the bellows connector from the base (use a hexagon wrench with the diameter of SW48 to pull out all terminal cables from the base, and apply threadlocker during re-assembly).	

10. Remove the forearm enclosure.

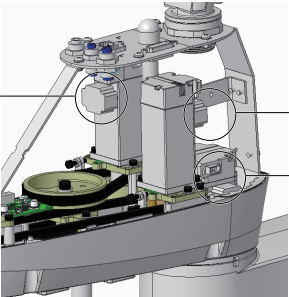
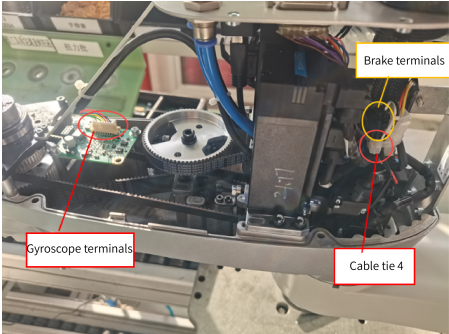
Step	Description	Illustration
①	Remove the four M4x10 screws on the top of the forearm enclosure.	Four M4x10 spring washer and flat washer combined screws  A close-up photograph of the top surface of a white robotic forearm enclosure. Four screws are highlighted with circles and lines pointing to them from the text above. The enclosure has various components including a QR code, a 'Break Release Switch', a red emergency stop button, and a yellow warning triangle.
②	Remove the two screws on the back of the forearm.	 A photograph showing the back of the white robotic forearm. Two screws are visible on the upper part of the back plate, which are the ones to be removed according to the step description.

Step	Description	Illustration
③	Remove the four M4x12 hexagon screws on the bottom of the forearm.	 Lead screw enclosure (equipped for clean-type robots only) Four M4x12 hexagon screws

11. Cut the cable tie on the motor.



12. Remove the cable connector and gyroscope terminal.

Step	Description	Illustration
①	Use a Phillips screwdriver to loosen the M2x8.5 cross pan-head screws fixing the four pins of the power cable and encoder cable connectors of axes J2, J3, and J4. Gently remove the connectors from the male connector at the motor side. Be careful that the connector pins do not bend.	
②	Disconnect the brake button connector and the gyroscope terminals	

13. Remove the two M4x8 cross pan-head screws fixing the forearm sheet metal and remove the cables from the forearm, as shown in the following figure.



14. Remove the cables from the robot.

15. Re-install the cables in reverse steps of disassembly.

3.4.8.2 Replacing the Cables Connected Between the Robot and Control Cabinet

This section describes how to replace the cable unit between the IR-S7 series robot and the control cabinet.

1. Power off the control cabinet.
2. Disconnect the power and encoder cable connectors connected to the control cabinet.
3. Hang a "Maintenance in process" sign. The "Maintenance in process" sign is used to prevent other operators from operating the robot.
4. Enter the safeguard system.
5. Remove the two M4x8 cross screws on the sheet metal of the trailing cable.



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

3.4.9 Replacing and Maintaining the Battery



Warning

- 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 zero point of all joints.
- The service life of the lithium battery is 1.5 years. Replace the lithium battery every 1.5 years even when the robot is always powered on. Use the lithium battery specified by the Company. Connect the battery properly. Do not mistake the polarity.

To replace the battery, do as follows:

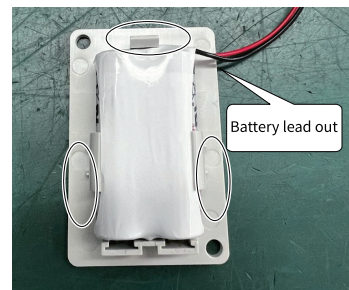
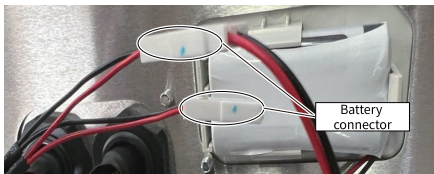
1. Preparations:

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



2. Replace the battery:

- Gently take out the battery box and find another battery plug.
- Insert a new battery and then remove the old battery.
- Install the new battery to the battery box.



3. Install the battery box:

Put back the battery box and lock it with two M4x8 cross screws with a torque of 0.6 N·m.

3.4.10 Zero Point Adjustment

3.4.10.1 Overview of Zero Point Adjustment

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

Note

After zero point adjustment, the absolute accuracy of the robot may deviate from the default absolute accuracy at delivery.



Caution

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

3.4.10.2 Procedure of Zero Point Adjustment

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

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

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

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

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

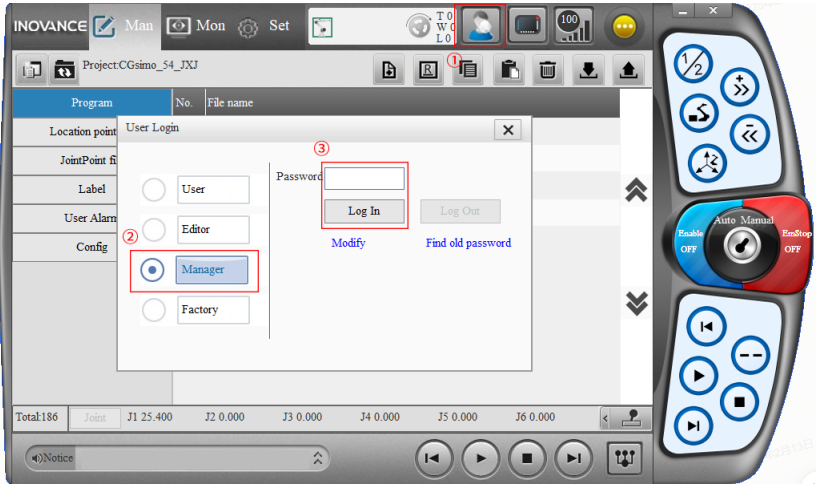


Figure 3-1 Screen of IRTP80 series tech pendant

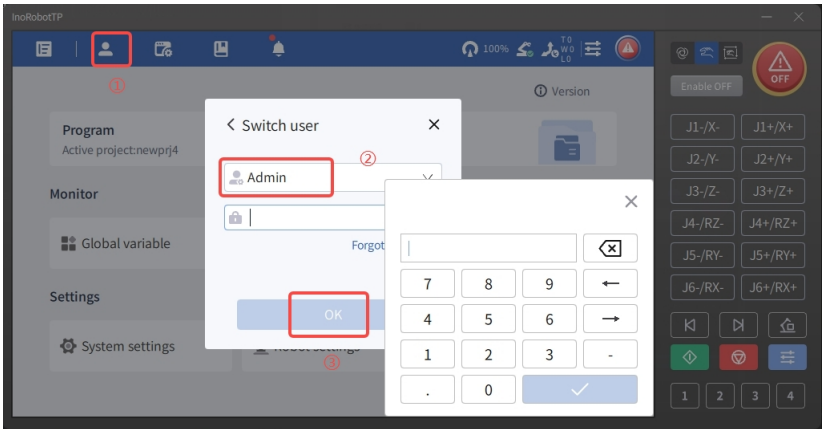


Figure 3-2 Screen of IRTP200 series tech pendant

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

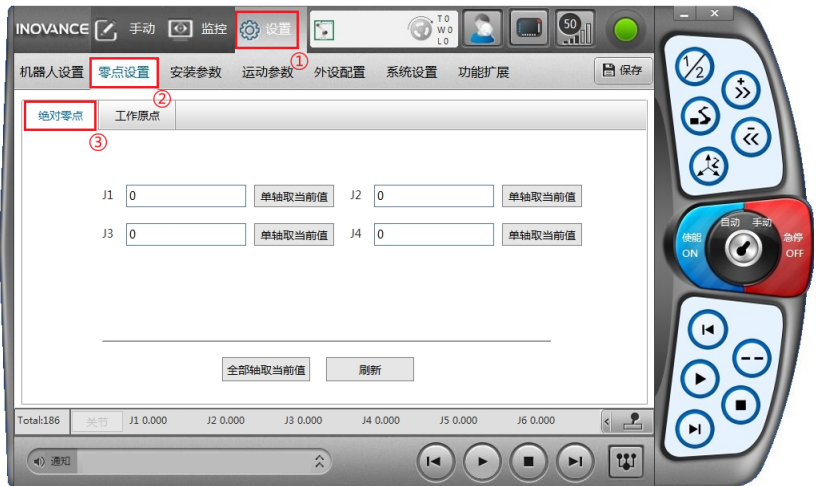


Figure 3-3 Screen of IRTP80 tech pendant



Figure 3-4 Screen of IRTP200 series tech pendant

3. Move each axis of the robot to the corresponding zero point.
 - a. Move the robot axes to their respective zero points on the hand-held or PC-based teach pendant. For details, see Teach Pendant User Guide.
 - b. Also, you can manually push a robot joint to the zero point when the motor is disabled.

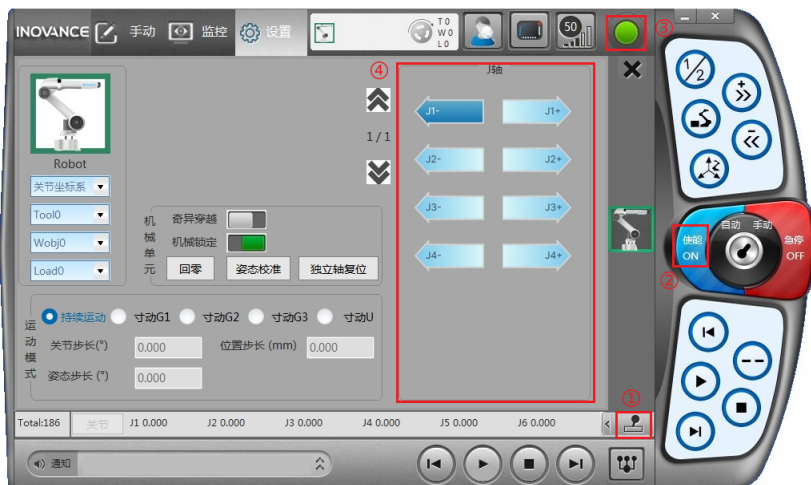


Figure 3-5 Screen of IRTP80 series tech pendant

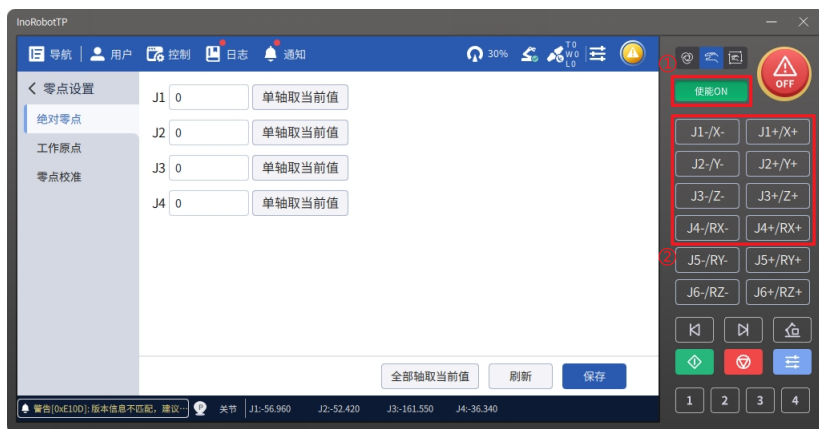


Figure 3-6 Screen of IRTP200 series tech pendant

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



Figure 3-7 Screen of IRTP80 series tech pendant



Figure 3-8 Screen of IRTP200 series tech pendant

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



Figure 3-9 Screen of IRTP80 series tech pendant



Figure 3-10 Screen of IRTP200 series tech pendant

3.4.10.3 Zero Point Position of Each Joint

1. The recesses of zero points of axes J1 and J2 are aligned together, as shown in the figure below.

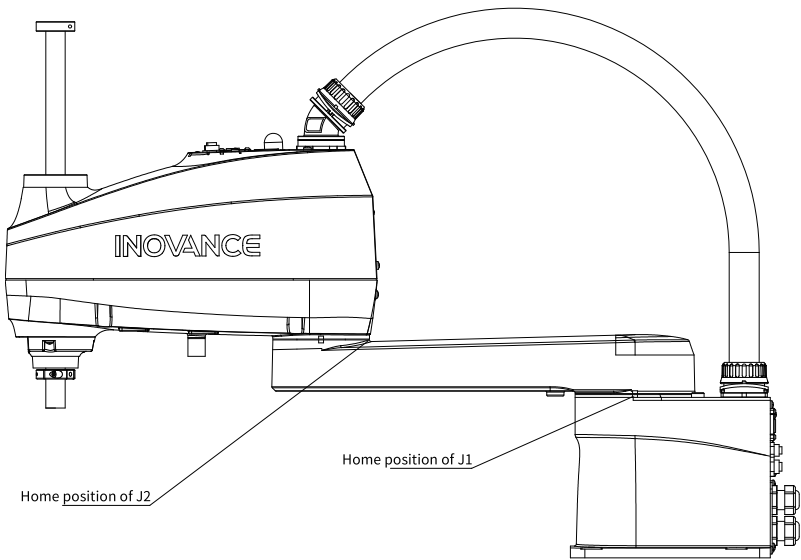


Figure 3-11 Zero points of axes J1 and J2

Model	J1 Max Motion Range	J2 Max Motion Range
IR-S7-50Z20S3	$\pm 132^\circ$	$\pm 150^\circ$

2. The zero point of J3 axis is the upper limit position of J3 axis.

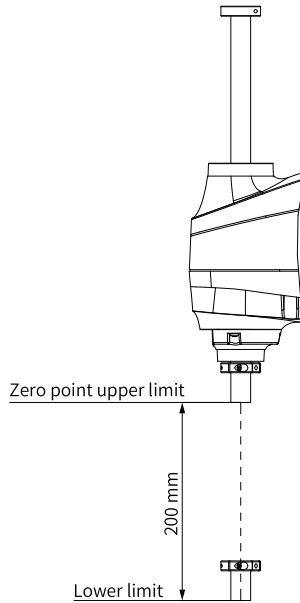


Figure 3-12 Zero point of axis J3

Model	J3 Travel
IR-S7-50Z20S3	200 mm

3. The zero point of J4 axis is the position where the plane of the axis (or the slot of the upper or lower mechanical limit stop) is facing toward the top of arm 2.

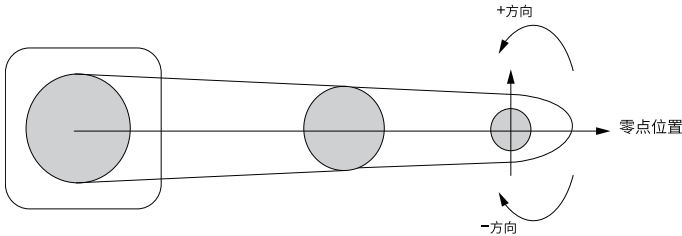


Figure 3-13 Zero point of axis J4

Model	J4 Max Motion Range
IR-S7-50Z20S3	$\pm 360^\circ$

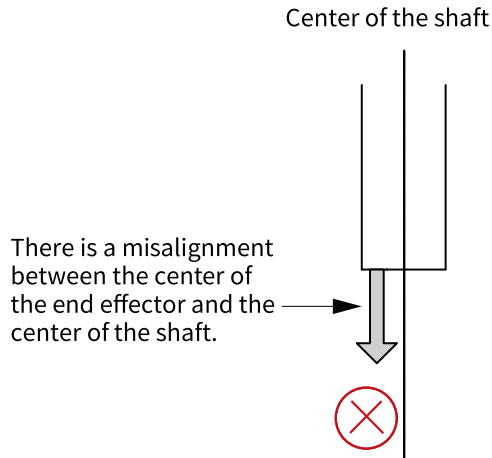
3.4.10.4 Zero Point Adjustment of J2

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 zero point position calibration of J2 before

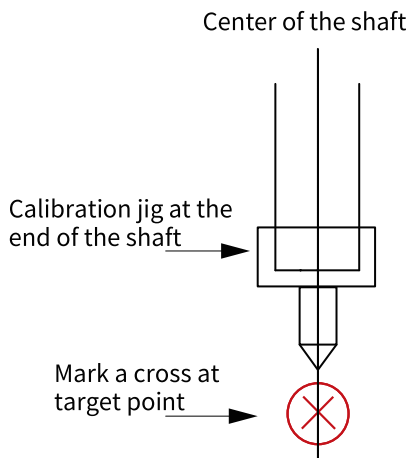
calculating the robot coordinates. When adjusting the zero point of J2 in "[3.4.10.2 Procedure of Zero Point Adjustment](#)" on [page 129](#), refer to the right/left wrist wizard provided by the teach pendant.

Procedure of J2 zero point adjustment

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



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

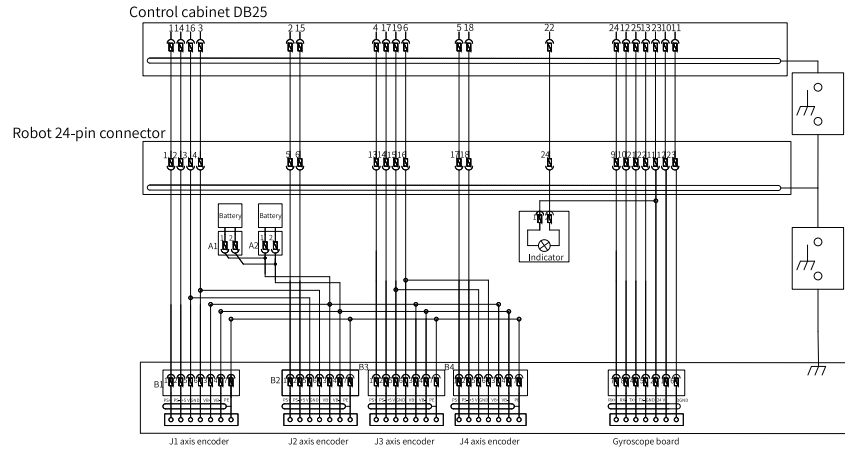


3. Adjust the zero point by using the right wrist or left wrist.

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

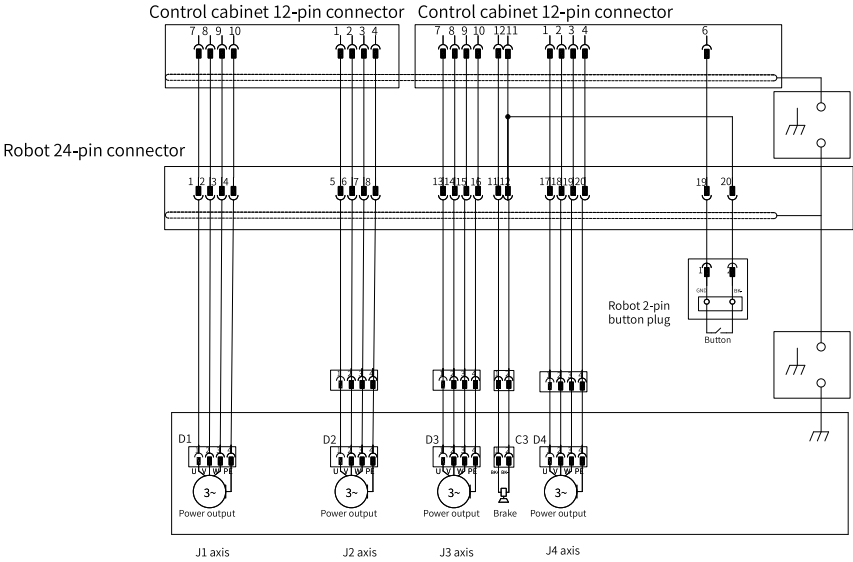
3.4.11Wiring Diagrams

The following figure shows the encoder cable connection.



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

The following figure shows the power cable connection.



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

4 IR-S10 Series SCARA Robot Maintenance Guide

4.1 Product Information

4.1.1 Model

Note

- The maintenance instructions in this guide refer to IR-S10 series models for Chinese and international markets.
- The product information in this guide is the information of standard models in a standard environment. For information about non-standard models or models in clean environment, contact the provider.

Models for Chinese market

IR- S 10 - 80 Z20 S 3
① ② ③ ④ ⑤ ⑥ ⑦

① Product family INOVANCE Robot	④ Arm length 60: 600 mm 70: 700 mm 80: 800 mm	⑦ Cable length 3: 3 m standard cable 5: 5 m standard cable G3: 3 m highly flexible cable
② Series S: SCARA robot	⑤ Maximum travel of Z axis (empty for models without a lead screw) Z20: 200 mm	-
③ Load 10: 10 kg	⑥ Installation environment C: Clean S: Standard P: High-protection	

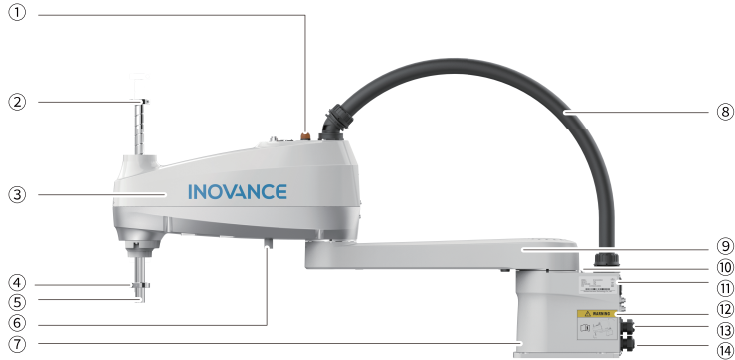
Models for international markets

IR- S 10 - 80 Z20 S-INT
① ② ③ ④ ⑤ ⑥ ⑦

① Product family INOVANCE Robot	④ Arm length 60: 600 mm 70: 700 mm 80: 800 mm	⑦ Functional safety INT: International (With functional safety)
② Series S: SCARA robot	⑤ Maximum travel of Z axis Z20: 200 mm	-
③ Load 10: 10 kg	⑥ Installation environment S: Standard	

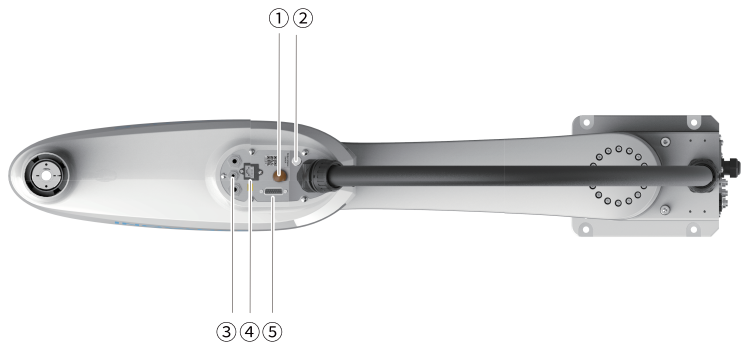
4.1.2 Components

Part 1



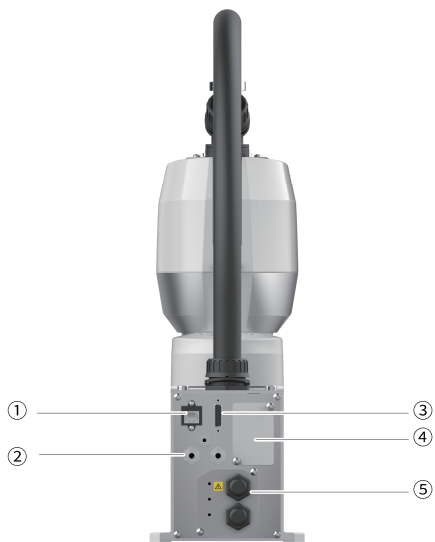
No.	Description
①	State indicator
②	Mechanical stop for J3 upper limit
③	Arm 2
④	Mechanical stop for J3 lower limit
⑤	J3 lead screw shaft
⑥	J2 mechanical limit stop
⑦	Base
⑧	Cable unit
⑨	Arm 1
⑩	J1 mechanical limit stop
⑪	Nameplate
⑫	Label
⑬	Power cable
⑭	Signal cable

Part 2



No.	Description
①	Indicator
②	Brake button
③	Air duct connector
④	Network port
⑤	D-Sub 15Pin

Part 3



No.	Description
①	Network port
②	Air duct connector
③	D-Sub 15Pin
④	Battery cover
⑤	Trailing cable

4.2 Regular Inspection

4.2.1 Periodic Inspection

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

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

1. Daily inspection and maintenance

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

2. Weekly inspection and maintenance

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

3. Monthly inspection and maintenance

Check Item	Check Measure
Control cabinet heat dissipation inspection	Check whether the fan behind the control cabinet is ventilated smoothly. It is recommended to replace or maintain the fan once a month.
Ball screw and spline (plain shaft)	Check the lubrication state of ball screw and spline, and replenish lubricating grease according to the recommended replacement cycle.

4. Inspection and maintenance every six months

Check Item	Check Measure
All wiring harnesses for each electrical component	• Check all cable connectors of the robot body for bending, corrosion and falling off. • Check the cables outside the control cabinet for bending, corrosion and falling off. • Check the cable of the teach pendant for bending, corrosion and falling off.
Timing belt	Check whether the tension frequency of timing belt is within the standard range.

5. Inspection and maintenance every year

Check Item	Check Measure
Control cabinet DI/DO signal	Check whether the DI/DO signal response of the control cabinet is normal.
Reducer of each axis	Check whether the lubrication of the reducer of each axis of the robot is normal and whether there is abnormal noise.
Cleaning of all electrical components	Check the cleanliness of all electrical components. Under normal circumstances, remove dust for all electrical components every year.
Control cabinet fan filter	Check the cleanliness of the filter of the control cabinet fan, and replace the filter once a year under normal circumstances.

6. Inspection and maintenance every 1.5 years

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

4.2.2 Screw Tightening Torque and Method

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

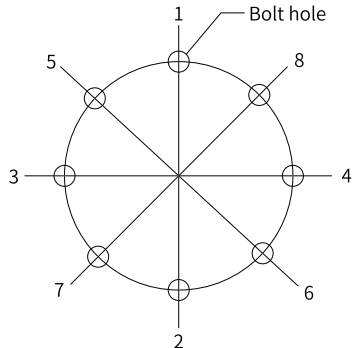


Caution

Except for torques of the screws of the robot enclosure and the connecting parts of the reducer, the torques of other screws are 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 fasten all screws securely at one time. Do not tighten the screw to the maximum torque value at a time. Tighten the screws slightly with a hexagon wrench as shown in the preceding figure. Then tighten the screws to the torque values in the table above with a torque wrench.

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

Screw	Torque (N·m)
M4	1.8

4.2.3 Replacing the Lubricating Grease

The following table describes the lubricating grease application cycle.

Position	Cycle
J1 axis reducer	When replacing the motor.
J2 axis reducer	When replacing the motor.
Ball screw and spline	Running for 100 km or every 3 months

Lubricating Grease Type	Lubricating Grease Code
Lubricating grease for J1 axis reducer	● H: 24060061 ● X: 24060141
Lubricating grease for J2 axis reducer	● H: 24060061 ● X: 24060141
Ball screw and spline	THK AFB-LF: 24100039

Cautions:

1. Only apply the original lubricating grease to the reducer and ball screw.
2. It is strictly forbidden to deplete the lubricating grease of the ball screw; otherwise, irreversible mechanical damage may occur.

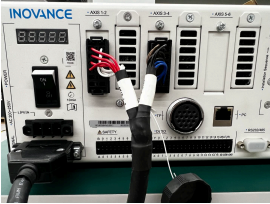


If the lubricating grease gets into your eyes, mouth, or on your skin, follow the instructions below:

- 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 lubricating grease gets on your skin, wash the area thoroughly with soap and water.

4.2.4 Daily Control Cabinet Cable Inspection

The following table describes the inspection of control cabinet cables:

No.	Check Item	Diagram/Illustration	Cycle
①	Check that the power output cable and encoder cable of the robot are properly connected to the control cabinet.		Daily
②	Check that the teach pendant cable is properly connected to the control cabinet.		Daily
③	Check that the external power cable (L, N, and PE slots) is properly connected to the control cabinet.		Daily
④	Wipe off any acid, alkali, oil, or corrosive liquids with dust-free cloth or scouring pad.	All cables	Monthly

4.3 Enclosure Removal and Installation

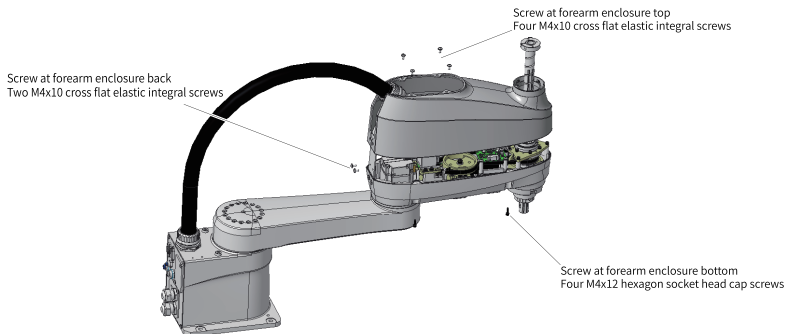


Caution

- During removal and re-installation of the enclosure, do not pull it forcibly. Failure to comply may result in cable damage, wire breaking, or poor contact, causing electric shock or system fault.
- After the maintenance is complete, install the removed enclosure back to its original position.
- If the enclosure fixing screws are missing, fix the enclosure with screws of the type and quantity shown in ["2.3.1 Removing and Installing the Enclosure of the Forearm" on page 26](#).
- 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.
- Before removing or installing the robot enclosure, power off the robot. Never remove or install the robot enclosure with power on.

4.3.1 Removing and Installing the Enclosure of the Forearm

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



Removing and Installing the Enclosure of the Forearm

Follow the following steps to remove and install the forearm enclosure:

1. Remove the six M4x10 cross flat elastic integral screws on the top and back.
2. Remove the four M4x12 hexagon socket head cap screws on the bottom.

3. Lift up and remove the forearm enclosure.
4. 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.

4.3.2 Removing and Installing the Bottom Enclosure of Spline Nut



- 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.



Screw at spline nut enclosure bottom
Three M4x10 cross flat elastic integral screws

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

1. Loosen three M4x10 cross flat elastic integral screws of the spline nut.
2. Remove the enclosure of the spline nut.
3. When installing the enclosure, fix the screws with a torque of $0.6 \text{ N} \cdot \text{m}$.

4.4 Replacement and Maintenance

4.4.1 Maintaining the J1 Axis

Name		Quantity
Maintenance part	J1 motor	1
	O-shaped sealing ring	2
	J1 axis reducer	1
Tool	Hexagon wrench	1
	Torque wrench ($0 \text{ N} \cdot \text{m}$ to $10 \text{ N} \cdot \text{m}$)	1
	Hexagon screwdriver bit	1
	Phillips screwdriver	1
	Dust-free cloth or oil-absorbing sheet	Several
Material	LT243 threadlocker	1
	LT638 threadlocker	1
	Reducer lubricating grease ^[1]	1

Note

[1]: The codes of lubricating greases are:

- H lubricating grease: 24060061
 - X lubricating grease: 24060141
-

Screw tightening torque reference:

Screw	Torque ($\text{N} \cdot \text{m}$)
M3 hexagon socket head cap screw	2
M4 hexagon socket head cap screw	5

Note

- Recommended hexagon screwdriver 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 any parts that are not covered in this guide. Follow the maintenance procedure strictly as described in this guide.
 - Check the motion of the robot after parts replacement outside the safety fence. Failure to comply may cause severe safety issues due to abnormal movement of the robot.
 - Make sure that the emergency stop switch and safety door switch work properly before operation. Otherwise, safety protection functions 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.
-



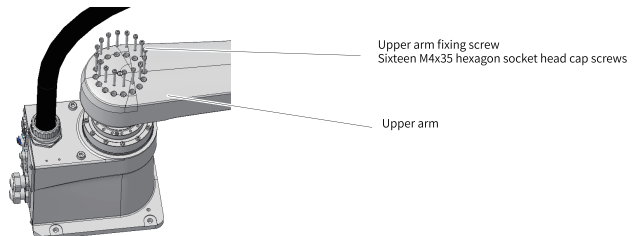
Warning

- 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.
-

4.4.1.1 Maintaining the J1 Motor and Reducer

1. Remove the upper arm and forearm:

Loosen the sixteen M4x35 hexagon socket head cap screws fixing the upper arm, and remove the upper arm and forearm.



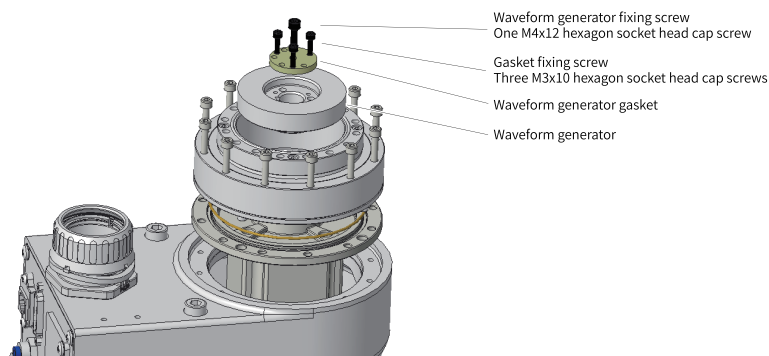
Note

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.

2. Remove the waveform generator:

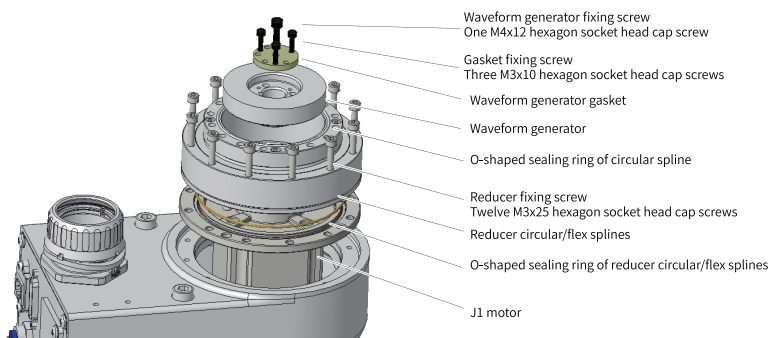
- a. After removing the waveform generator, loosen the one M4x12 hexagon socket head cap screw fixing the waveform generator.
- b. Clamp the gasket with circlip pliers. Screw M5 screw into the M5 hole in the middle of waveform generator gasket. Rotate the M5 screw and remove the waveform generator.

- c. Remove the waveform generator and loosen the three M3x10 hexagon socket head cap screws fixing the gasket.



3. Remove and replace the reducer:

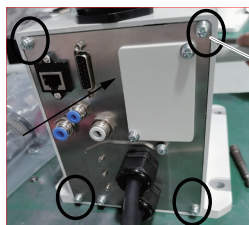
- Loosen the twelve M4x35 hexagon socket head cap screws fixing the reducer, and then remove the O-shaped sealing ring of the circular spline.
- Remove the reducer.
- Install a new one.



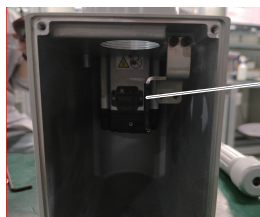
4. Remove and replace the J1 motor:

- Remove the O-shaped sealing rings of the circular/flex splines of the reducer, and loosen the four M4x10 cross flat elastic integral screws fixing the base sheet metal.
- Loosen the motor power cable and encoder cable of the J1 axis, remove the J1 motor, and install a new one.
- After replacing the motor and reducer of the J1 axis, apply new grease to the reducer according to ["3.4.1.2 Replacing the Lubricating Grease for J1 Axis Reducer"](#)

on page 93. The M3 screw tightening torque is $2 \text{ N} \cdot \text{m}$, and the M4 screw tightening torque is $5 \text{ N} \cdot \text{m}$.



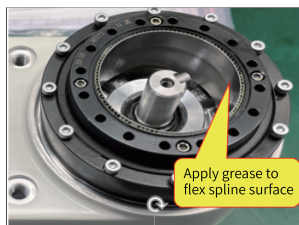
Base sheet metal fixing screw
Four M4x10 cross flat elastic integral screws



Power cable and encoder cable of J1 motor

5. Reassembly:

- Re-assemble the components according to reverse steps of disassembly.
- After replacing the motor and reducer of the J1 axis, apply new grease to the reducer according to ["3.4.1.2 Replacing the Lubricating Grease for J1 Axis Reducer" on page 93](#).
- Apply the LT638 threadlocker to the keyway of the waveform generator and grease (H: SK-1A grease; X: SFB grease) to the surface of the circular/flex splines of the reducer. Fix the M3 screw with tightening torque of $2 \text{ N} \cdot \text{m}$, and the M4 screw with tightening torque of $5 \text{ N} \cdot \text{m}$. All reducer screws must be coated with LT243 threadlocker.

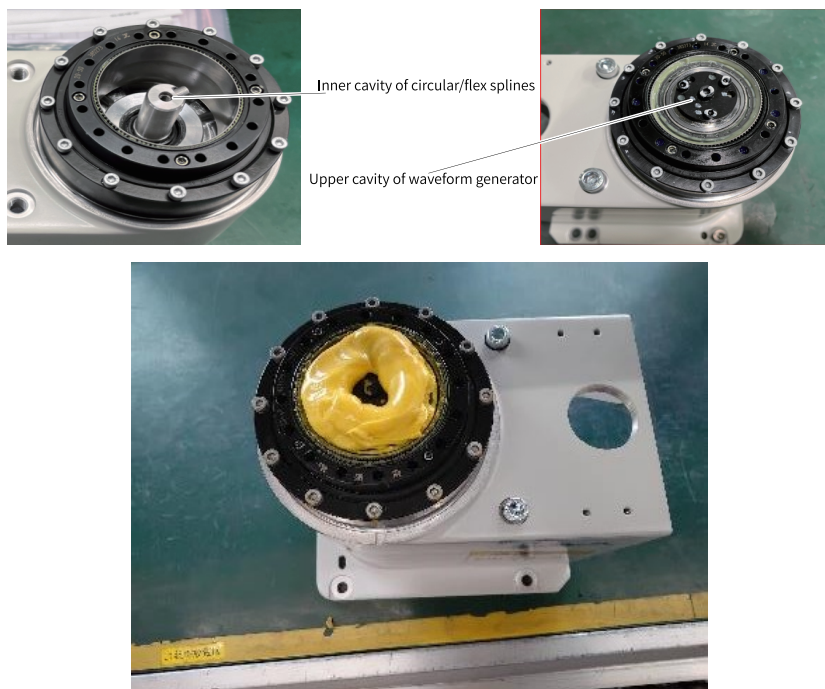


4.4.1.2 Replacing the Lubricating Grease for J1 Axis Reducer

- Remove the upper arm and forearm:

Remove the upper arm and forearm according to Step 1 in ["4.4.1.1 Maintaining the J1 Motor and Reducer" on page 152](#).

2. Remove the waveform generator and the circular/flex splines of the reducer:
 - a. Remove the waveform generator according to Step 2 in ["4.4.1.1 Maintaining the J1 Motor and Reducer" on page 152](#).
 - b. Remove the circular/flex splines according to Step 3 in ["4.4.1.1 Maintaining the J1 Motor and Reducer" on page 152](#).
3. Apply lubricating grease to the waveform generator.
 - a. Clean old lubricating grease on the waveform generator and circular/flex splines of the reducer.
 - b. Apply lubricating grease (H: SK-1A grease, X: SFB grease) evenly to 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) of the reducer.



4. Reassembly:

Reverse the above steps (M3 screw tightening torque: $2 \text{ N} \cdot \text{m}$; M4 screw tightening torque: $5 \text{ N} \cdot \text{m}$. All reducer screws must be coated with the LT243 threadlocker).
5. After reassembly, power on the robot, reset the J1 axis encoder value, clear any alarms, and then capture the J1 axis zero point position.

4.4.2 Maintaining the J2 Axis

	Name	Quantity
Maintenance part	J2 motor	1
	O-shaped sealing ring	2
	J2 axis reducer	1
Tool	Hexagon wrench	1
	Torque wrench (0 N·m to 10 N·m)	1
	Hexagon screwdriver bit	1
	Dust-free cloth or oil-absorbing sheet	Several
	Phillips screwdriver	2
Material	LT243 threadlocker	1
	LT638 threadlocker	1
	Reducer lubricating grease ^[1]	1

Note

[1]: The codes of lubricating greases are:

- H lubricating grease: 24060061
- X lubricating grease: 24060141

Note

- Recommended hexagon screwdriver 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 any parts that are not covered in this guide. Follow the maintenance procedure strictly as described in this guide.
 - Check the motion of the robot after parts replacement outside the safety fence. Failure to comply may cause severe safety issues due to abnormal movement of the robot.
 - Make sure that the emergency stop switch and safety door switch work properly before operation. Otherwise, safety protection functions 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.
-



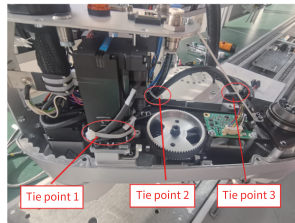
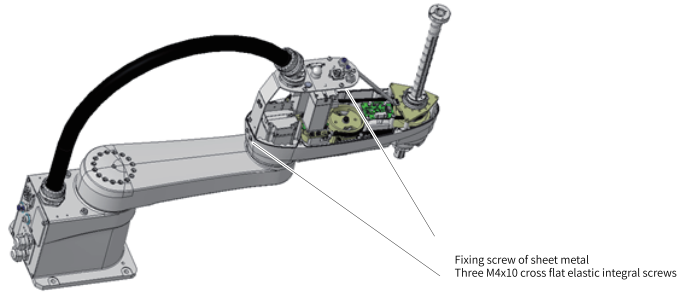
Warning

- 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.
-

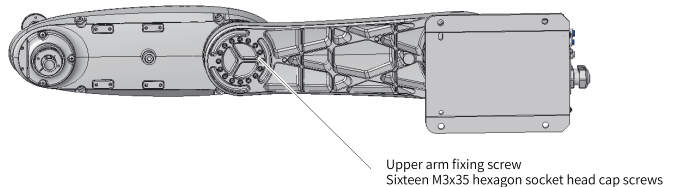
4.4.2.1 Maintaining the J2 Motor and Reducer

1. Remove the forearm enclosure:
Remove the forearm enclosure according to ["4.3.1 Removing and Installing the Enclosure of the Forearm" on page 148](#).
2. Remove the cable sheet metal assembly:

- a. Remove the three M4x10 cross flat elastic integral screws on the top and back of the forearm sheet metal.
- b. Loosen the motor power cables and encoder cables of axes J2, J3, and J4, and move away the cable sheet metal assembly.

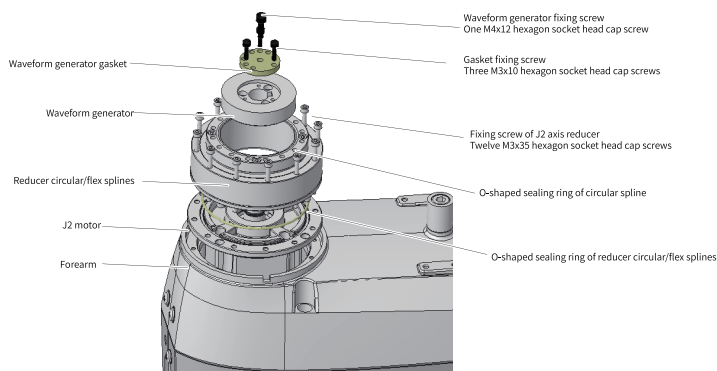


3. Remove the J2 axis assembly:
Loosen the sixteen M3x35 hexagon socket head cap screws fixing the upper arm, and remove the J2 axis assembly.

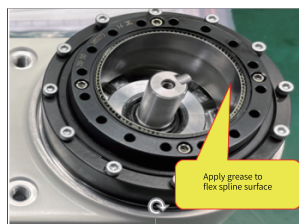
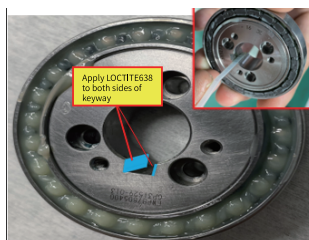


4. Remove the waveform generator:
 - a. Loosen the one M4x12 hexagon socket head cap screw fixing the waveform generator, and clamp the gasket with circlip pliers.
 - b. Screw M5 screw into the M5 hole in the middle of waveform generator gasket.

- c. Remove the waveform generator and loosen the three M3x10 hexagon socket head cap screws fixing the gasket.
5. Remove the J2 motor and reducer:
 - a. Loosen the twelve M3x35 hexagon socket head cap screws fixing the J2 axis reducer, and then remove the O-shaped sealing rings of reducer and circular spline.
 - b. Loosen the screw fixing the J2 motor, and replace the motor or reducer.



6. Reassembly:
 - a. 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 Lubricating Grease for J2 Axis Reducer"](#) on page 159.
 - b. Apply the LT638 threadlocker to the keyway of the waveform generator and grease (H: SK-1A grease; X: SFB grease) to the surface of the circular/flex splines of the reducer.
 - c. The M3 screw tightening torque is 2 N·m, and the M4 screw tightening torque is 5 N·m. All reducer screws must be coated with LT243 threadlocker.



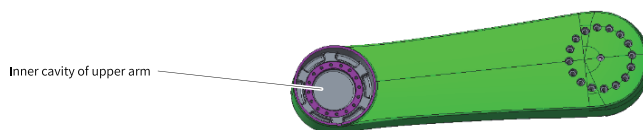
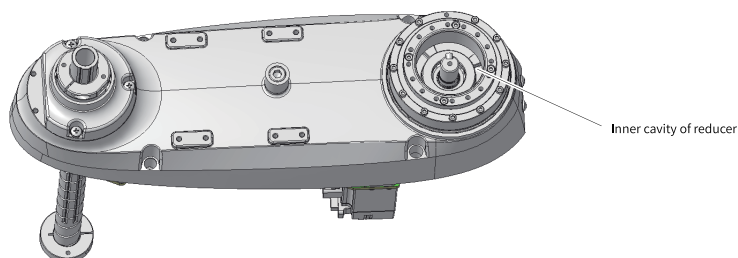
4.4.2.2 Replacing the Lubricating Grease for J2 Axis Reducer

1. Remove the motor assembly of the J2 axis:

Remove the J2 motor assembly and waveform generator from the forearm of the IR-S10 series robot according to Steps 1-6 in ["3.4.2.1 Maintaining the J2 Motor and Reducer" on page 96](#).

2. Apply lubricating grease to the waveform generator:

- a. Clean old lubricating grease on the waveform generator and circular/flex splines of the reducer.
- b. Apply grease (H: SK-1A grease, X: SFB grease) evenly to the inner cavity of the reducer (approx. 20 mL, 18 g) and the upper arm (approx. 12.3 mL, 11 g).



3. Reassembly:

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 the LT243 threadlocker).

4. After reassembly, power on the robot, reset the J1 axis encoder value, clear any alarms, and then capture the J1 axis zero point position.

4.4.3 Maintaining the J3 Axis

Tools list:

Name		Quantity
Maintenance part	J3 motor	1
	Timing belt	1
Tool	Hexagon wrench	1
	Torque wrench (0 N·m to 10 N·m)	1
	Hexagon screwdriver bit	1
	Dust-free cloth or oil-absorbing sheet	Several
	Phillips screwdriver	2
	Tension meter	1
	Height gauge	1

Screw tightening torque reference:

Screw	Torque (N·m)
M4 hexagon socket head cap screw	3.5
M3 hexagon socket head cap screw	1
M4 hexagon set screw	1.8
M4 cross flat elastic integral screw	0.6

Note

- Recommended hexagon screwdriver 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**

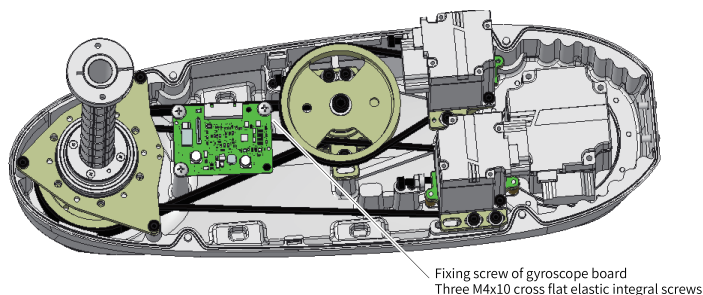
- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
 - Prevent foreign objects from entering the equipment and terminals during maintenance.
 - After the equipment is replaced, perform wiring 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.
-

4.4.3.1 Maintaining the J3 Axis Timing Belt

1. Remove the enclosure, cables and sheet metal of the forearm:
 - a. Remove the forearm enclosure according to ["4.3.1 Removing and Installing the Enclosure of the Forearm" on page 148.](#)
 - b. Remove the cables and sheet metal of the forearm according to Step 2 in ["4.4.2.1 Maintaining the J2 Motor and Reducer" on page 157.](#)

2. Remove the gyroscope board:

Remove the three M4x10 cross flat elastic integral screws that fix the gyroscope board and then remove the gyroscope board.



3. Replace the J3 axis timing belt:

- Loosen the one M4x16 hexagon socket head cap screw securing the timing belt of the J3 axis assembly and then loosen the three M4x16 hexagon socket head combined screws fixing the mounting plate of the J3 axis.
- Loosen the three M4x12 hexagon socket head cap screws fixing the mounting plate of the lead screw nut and remove the lead screw nut assembly (note that the screw nut and shaft must not be separated).
- Take out the J3 motor assembly and then replace the timing belt.
- Re-assemble the J3 (M4 screw tightening torque: $3.5 \text{ N} \cdot \text{m}$ and M3 screw tightening torque: $1 \text{ N} \cdot \text{m}$) by reversing Steps 1 and 2.
- Tighten the timing belt with the tension screw (measure the timing belt with a tension meter to ensure the frequency is 75 Hz to 85 Hz).

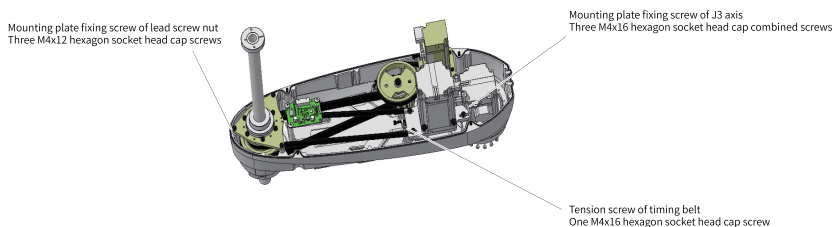
Note

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

Measuring span: 200 mm

Timing belt unit mass: 2.4 g/m

Timing belt width: 10.0 mm/R



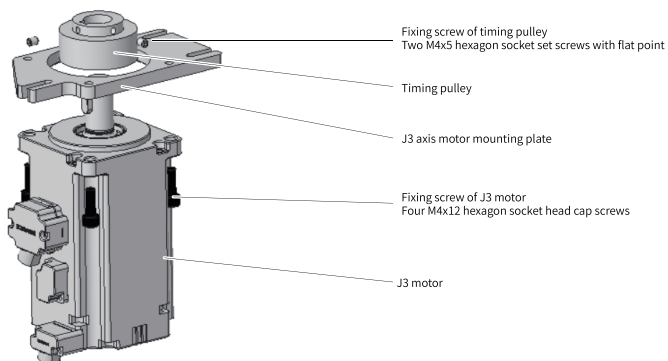
4.4.3.2 Maintaining the J3 Motor

1. Remove the J3 motor:

Take out the J3 axis motor assembly according to steps 1-4 in ["4.4.3.1 Maintaining the J3 Axis Timing Belt" on page 162.](#)

2. Replace the J3 axis brake and J3 axis motor:

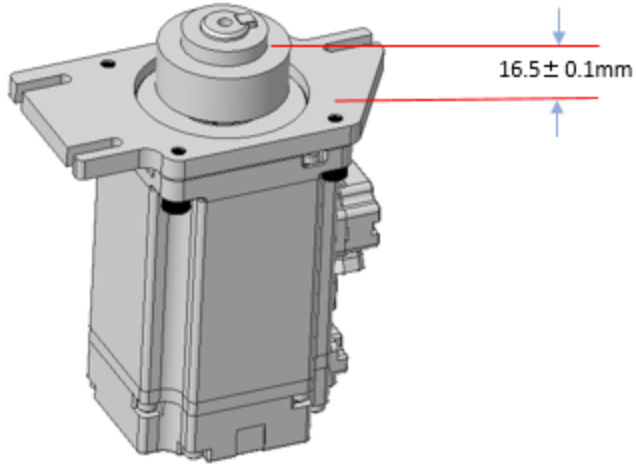
- Loosen the two M4x5 screws fixing the square wheel and take out the square wheel.
- Replace the square wheel and J3 axis brake. (The service life of the brake for emergency stop is 2000 times. Replace the brake when the service life expires.)
- Loosen the two M4x5 hexagon socket head set screws fixing the timing pulley and the four M4x12 hexagon socket head cap screws fixing the J3 motor, and then replace the J3 motor.



3. Reassembly:

- After replacing the motor, install the timing pulley and align the two set screw holes with the motor flat position.
- Use a height gauge to ensure that the top of the square wheel is 16.5 ± 0.1 mm from the mounting plate.

- c. Attach the J3 axis timing pulley to the square wheel, and then lock the two M4x5 hexagon set screws on timing pulley to the flat position of J3 motor.
- d. Re-assemble the J3 (m4x5 screw tightening torque: $1.8 \text{ N} \cdot \text{m}$; M4 screw tightening torque: $3.5 \text{ N} \cdot \text{m}$; and M3 screw tightening torque: $1 \text{ N} \cdot \text{m}$) by reversing Steps 1 and 2.
- e. Tighten the timing belt with the tension screw (measure the timing belt with a tension meter to ensure the frequency is 75 Hz to 85 Hz).



4. After reassembly, power on the robot, reset the encoder values of axes J3 and J4 (which have a coupling structure), clear any alarms, and then capture the zero point positions of axes J3 and J4.

4.4.4 Maintaining the J4 Axis

	Name	Quantity
Maintenance part	J4 motor	1
	Timing belt	2
	Brake	1
Tool	Hexagon wrench	1
	Torque wrench (0 N·m to 10 N·m)	1
	Hexagon screwdriver bit	1
	Dust-free cloth or oil-absorbing sheet	Several
	Phillips screwdriver	2
	Tension meter	1
	Height gauge	1

Screw tightening torque reference:

Screw	Torque (N·m)
M4 hexagon socket head cap screw	3
M3 hexagon socket head cap screw	1.5

Note

- Recommended hexagon screwdriver 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

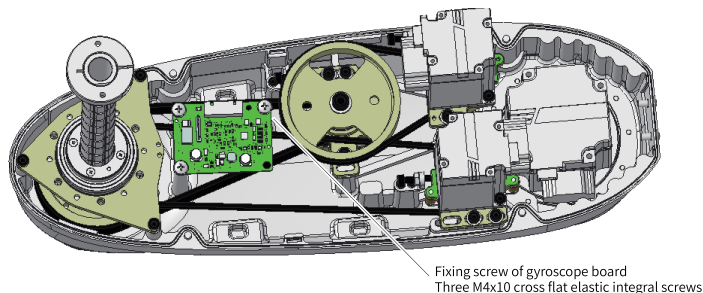
- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
 - Prevent foreign objects from entering the equipment and terminals during maintenance.
 - After the equipment is replaced, perform wiring 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.
-

4.4.4.1 Maintaining the J4 Axis Timing Belt

1. Remove the enclosure, cables and sheet metal of the forearm.
 - a. Remove the forearm enclosure according to ["4.3.1 Removing and Installing the Enclosure of the Forearm" on page 148.](#)
 - b. Remove the cables and sheet metal of the forearm according to Step 2 in ["4.4.2.1 Maintaining the J2 Motor and Reducer" on page 157.](#)

2. Remove the gyroscope board:

Remove the three M4x10 cross flat elastic integral screws that fix the gyroscope board and then remove the gyroscope board.



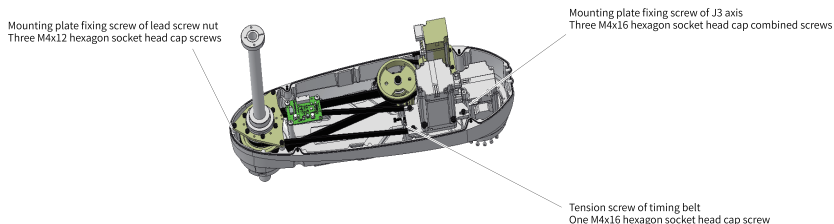
3. Disassemble the motor assembly of the J3 axis:



Caution

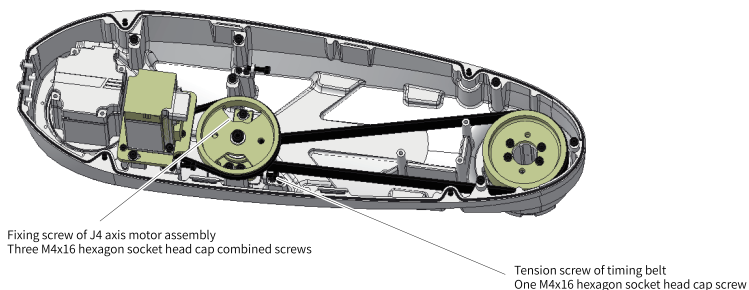
If you only need to remove the primary timing belt of the J4 axis, you do not need to remove the motor assembly of the J3 axis. If you need to remove the secondary timing belt of the J4 axis, you also need to remove the motor assembly of the J3 axis.

- a. Loosen the one M4x16 hexagon socket head cap screw securing the timing belt of the J3 axis assembly and then loosen the three M4x16 hexagon socket head combined screws fixing the mounting plate of the J3 axis.
- b. Loosen the three M4x12 hexagon socket head cap screws fixing the mounting plate of the lead screw nut and remove the lead screw nut assembly (note that the screw nut and shaft must not be separated).
- c. Remove the motor assembly of the J3 axis.



4. Disassemble the motor assembly of the J4 axis:

- a. Loosen the one M4x16 hexagon socket head cap screw securing the timing belt of the J4 axis assembly and then loosen the three M4x16 hexagon socket cap head combined screws fixing the motor assembly of the J4 axis.
- b. Remove the motor assembly of the J4 axis.



5. Replace the primary timing belt of J4 axis:

- a. Loosen the three M3x10 hexagon socket head cap screws fixing the J4 axis brake and remove the brake.
- b. Replace the primary timing belt of J4 axis and secure the belt with tension screws to ensure that the tension frequency of the belt is 395 Hz to 415 Hz.

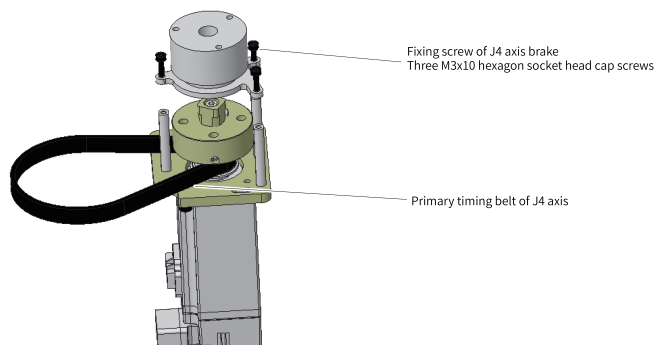
Note

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

Measuring span: 200 mm

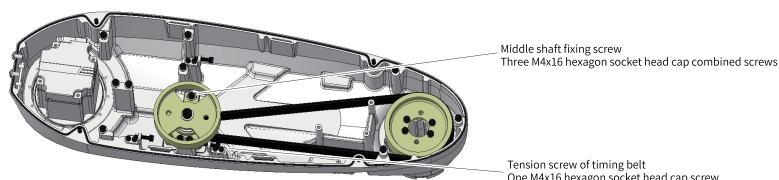
Timing belt unit mass: 2.4 g/m

Timing belt width: 10.0 mm/R



6. Remove the middle shaft assembly:

Loosen the three M4x16 hexagon socket head cap combined screws fixing the middle shaft, and then remove the middle shaft assembly.



7. Replace the secondary timing belt of J4 axis:

- a. Loosen the one M6x16 hexagon socket head cap screw securing the middle shaft belt pulley and then loosen the two M4x16 hexagon socket cap head combined screws fixing the mounting plate of the middle shaft.
- b. Remove the mounting plate of the middle shaft. Replace the secondary timing belt of J4 axis and secure the belt with tension screws to ensure that the tension frequency of the belt is 75 Hz to 85 Hz.

Note

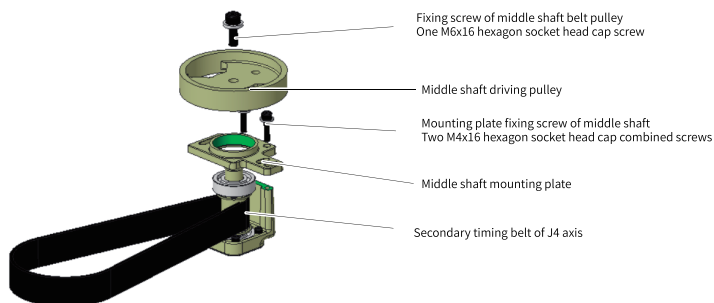
Before testing the timing belt frequency with a tension meter, the following parameters must be set:

Measuring span: 200 mm

Timing belt unit mass: 2.4 g/m

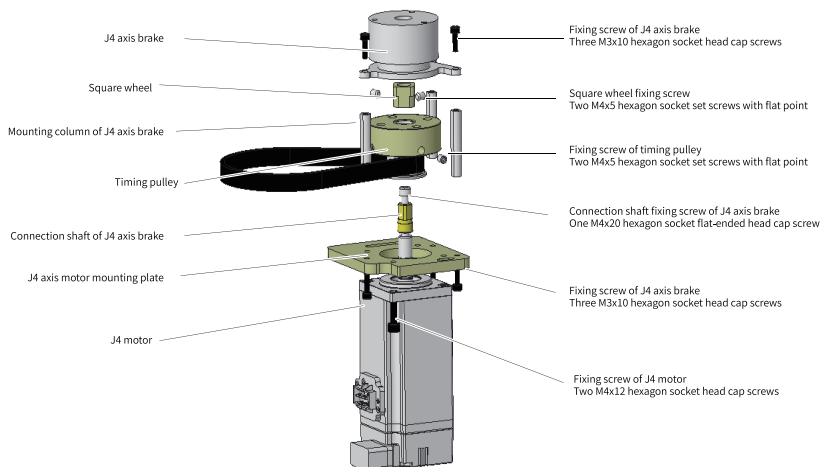
Timing belt width: 10.0 mm/R

- c. Re-install the belt in the reverse steps of disassembly with M4 screws of torque 3.5 N·m or M6 screws of torque 15 N·m.



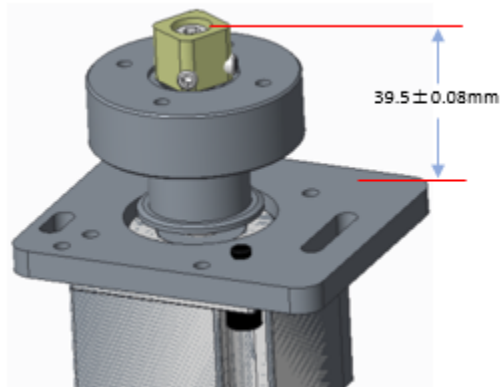
4.4.4.2 Maintaining the Motor and Brake of J4 Axis

1. Remove the motor assembly of the J4 axis.
Remove the motor assembly of the J4 axis according to steps 1-4 in ["4.4.4.1 Maintaining the J4 Axis Timing Belt" on page 167](#).
2. Replace the J4 axis brake:
 - a. Loosen the three M3x10 hexagon socket head cap screws fixing the J4 axis brake and remove the J4 axis brake.
 - b. Loosen the two M4x5 hexagon socket set screws with flat points fixing the square wheel, and remove the square wheel.
 - c. Replace the square wheel and J4 axis brake.
3. Replace the motor:
 - a. Clamp the connecting shaft of J4 axis brake with a wrench. Loosen the one M4x20 hexagon socket flat-ended head cap screw fixing the connecting shaft of J4 axis brake.
 - b. Remove the connection shaft of J4 axis brake.
 - c. Loosen the two M4x5 hexagon socket set screws with flat points fixing the square wheel of the timing pulley, and remove the timing pulley.
 - d. Loosen the two M4x12 hexagon socket head cap screws fixing the J4 motor and remove the motor mounting plate.
 - e. Replace the motor.



4. Re-assembly:

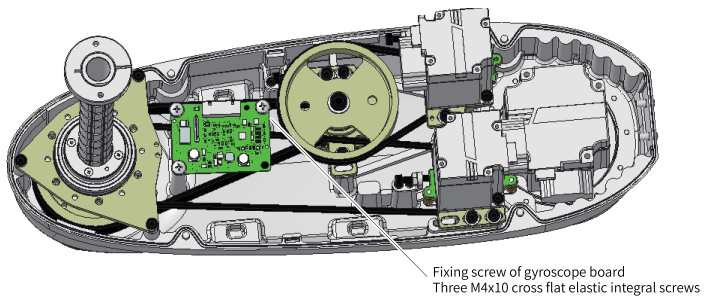
- After replacing the J4 motor, align the timing pulley fixing screw hole with the motor flat position, and install it on the motor for pre-locking.
- Install the connection shaft of J4 axis brake to the J4 axis motor shaft and lock it with a torque of $4 \text{ N} \cdot \text{m}$.
- Then install the square wheel. Note that the distance between the square wheel and the motor mounting plate is $39.5 \pm 0.08 \text{ mm}$.
- Push the upper end face of timing pulley upward to contact with the square wheel, and fasten the two M4x5 hexagon socket set screws with flat point of timing pulley.
- Install the J4 axis brake post, timing belt, and J4 axis brake with M3 screws of torque $1 \text{ N} \cdot \text{m}$ or M4x5 screws of torque $1.8 \text{ N} \cdot \text{m}$.



5. After reassembly, power on the robot, reset the encoder values of axes J3 and J4 (which have a coupling structure), clear any alarms, and then capture the zero point positions of axes J3 and J4.

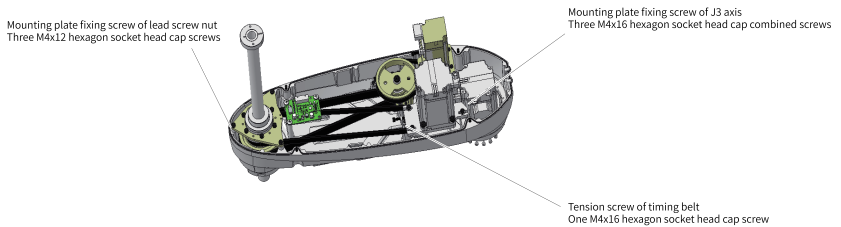
4.4.5 Maintaining the Ball Screw Spline

1. Remove the enclosure, cables and sheet metal of the forearm:
 - a. Remove the forearm enclosure according to ["4.3.1 Removing and Installing the Enclosure of the Forearm" on page 148.](#)
 - b. Remove the cables and sheet metal of the forearm according to Step 2 in ["4.4.2.1 Maintaining the J2 Motor and Reducer" on page 157.](#)
2. Remove the gyroscope board:
 - a. Loosen the three M4x10 cross flat elastic integral screws that fix the gyroscope board.
 - b. Remove the gyroscope cable and then remove the gyroscope board.



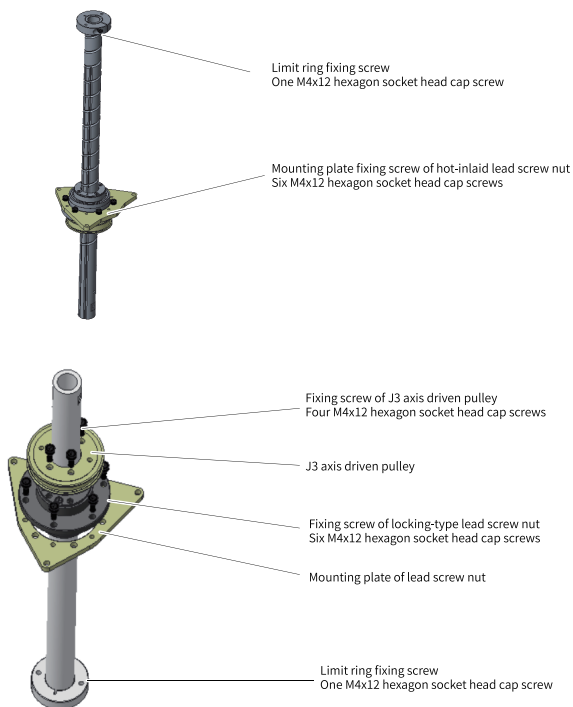
3. Take out the lead screw nut assembly:

- a. Loosen the one M4x16 hexagon socket head cap screw securing the timing belt of the J3 axis assembly and then loosen the three M4x16 hexagon socket cap head combined screws fixing the mounting plate of the J3 axis.
- b. Loosen the three M4x12 hexagon socket head cap screws securing the mounting plate of lead screw nut.
- c. Take out the lead screw nut assembly (do not separate the lead screw nut from the lead screw).



4. Replace the lead screw assembly:

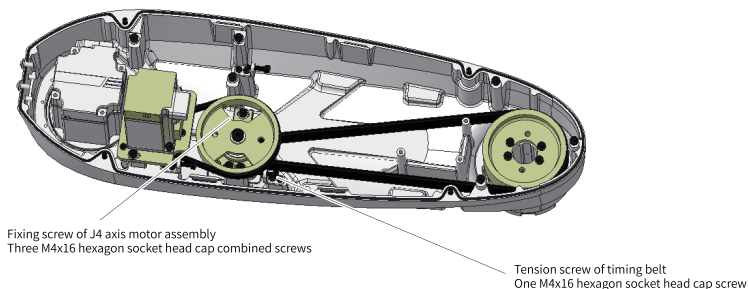
- a. Loosen the six M4x12 hexagon socket head cap screws fixing the mounting plate of lead screw nut, and the one M4x12 hexagon socket head cap screw fixing the limit ring.
- b. Remove the lead screw nut and lead screw (do not separate the nut from the lead screw).
- c. Replace the lead screw and its nut (For the hot-inlaid scheme, the belt pulley and lead screw nut are installed with interference fit, so the lead screw nut needs to be replaced together with the belt pulley. For the locking scheme, remove the belt pulley first and then the lead screw nut).



5. Remove the motor assembly of the J4 axis:

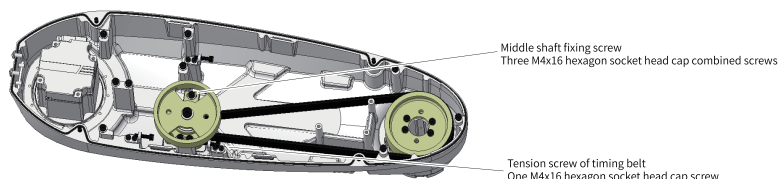
Loosen the one M4x16 hexagon socket head cap screw of the timing belt of J4 axis motor assembly.

Loosen the three M4x16 hexagon socket cap head combined screws fixing the J4 axis motor assembly, and remove the J4 axis motor assembly.



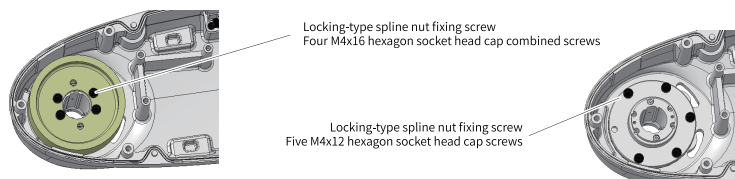
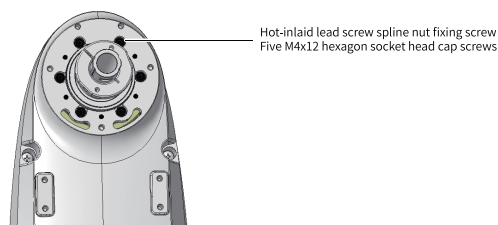
6. Remove the middle shaft assembly:

Loosen the three M4x16 hexagon socket head cap combined screws fixing the middle shaft assembly, and then remove the middle shaft assembly.



7. Replace the spline nut:

- Loosen the five M4x12 hexagon socket head cap screws fixing the spline nut, and remove the spline nut assembly.
- Replace the spline nut (For the hot-inlaid scheme, the belt pulley and lead screw nut are installed with interference fit, so the lead screw nut needs to be replaced together with the belt pulley. For the locking scheme, remove the belt pulley first and then the spline nut).



8. Reassembly:

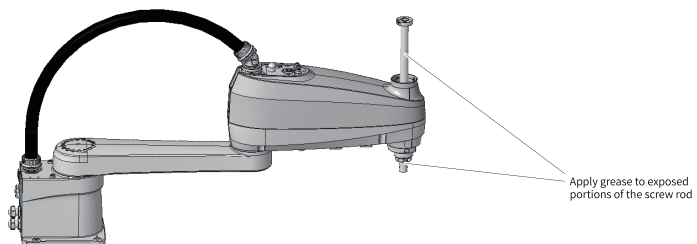
Re-install the ball screw spline in the reverse steps of disassembly. The M3 screw torque is $2 \text{ N} \cdot \text{m}$, the M4 screw torque is $3.5 \text{ N} \cdot \text{m}$, the frequency of the J4 axis primary timing belt is 395 Hz to 415 Hz, and the frequency of the J4 axis secondary timing belt is 75 Hz to 85 Hz.



- When installing the lead screw into the spline, ensure that the cross-shaped mark on the lead screw aligns with the cross-shaped mark on the spline to prevent the spline ball bearings from falling out.
- Tighten the lead screw mounting plate according to the specified torque requirements, and then adjust the tension of the timing belt.
- The grease on the surface of the new lead screw spare part is anti-rust oil, which must be thoroughly wiped off with a dust-free cloth before reapplying lubricating grease.
- After completing the assembly, since the J3 axis and J4 axis have a coupled structure, the zero point positions of both the J3 axis and J4 axis must be calibrated simultaneously.

4.4.6 Maintaining the Ball Screw Spline

1. Replace the lubricating grease of the ball screw spline as follows:



2. Clean the surface of the screw rod shaft with a clean dust-free cloth or scouring pad and apply lubricating grease (THK AFB-LF, special grease for screw rod) to the exposed portion of the screw rod shaft. Note that it is sufficient to continue to apply a thin layer of grease to the surface of the screw rod shaft, with a grease amount of 1 g. Excessive grease may splash onto processed products or equipment. The coating effect is shown in the following figure.

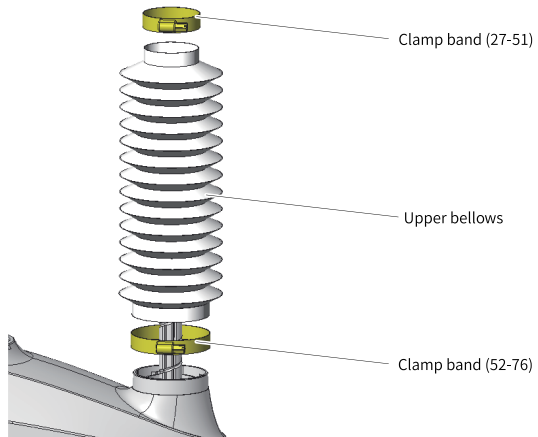


3. It is recommended to replace the lubricating grease of the screw rod every 100 km or every 3 months or in case of decolorization or drying of lubricating grease, as shown in the following figure.



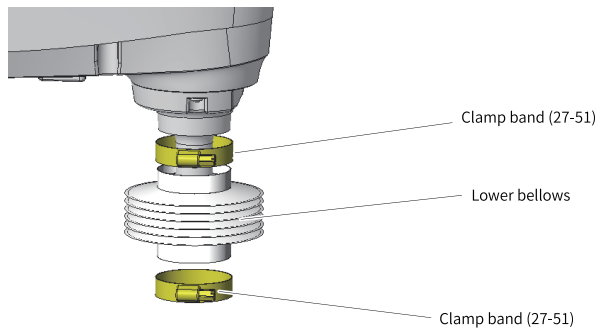
4.4.7 Replacing and Maintaining the Bellows of Cleanroom Model

1. Replace the upper bellows:
 - a. Use a Phillips screwdriver to remove the hose clamp and then remove the upper bellows.
 - b. Install a new upper bellows and lock the upper bellows with a torque of $0.7 \text{ N} \cdot \text{m}$.



2. Replace the lower bellows:

- a. Use a Phillips screwdriver to remove the hose clamp and then remove the lower bellows.
- b. Install a new lower bellows and lock the lower bellows with a torque of $0.7 \text{ N} \cdot \text{m}$.



4.4.8 Robot Cable Maintenance



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.
-



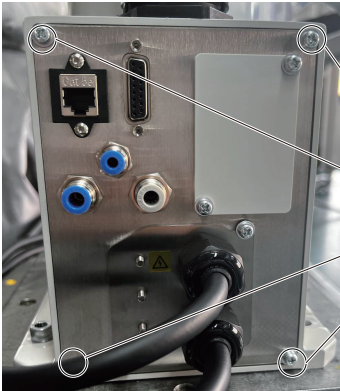
Warning

- 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.
 - 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.

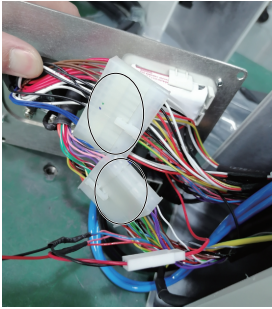
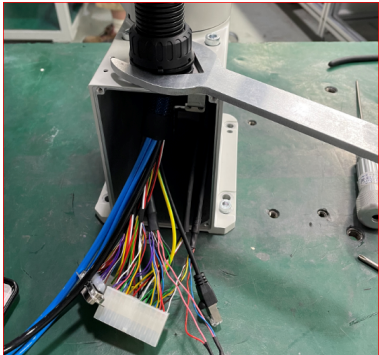
1. Power on the control cabinet.
2. Hang a "Maintenance in process" sign. The "Maintenance in process" sign is used to prevent other operators from operating the robot.
3. Enter the safeguard system.
4. Press the brake release switch to release the brake of J3 motor, and then lower the axis to the lower limit. Ensure that sufficient space is left to prevent the end effector from colliding with peripheral devices.
5. Power off the control cabinet and disconnect the power output and encoder cable connectors connected to the control cabinet.
6. Remove the four M4x10 cross flat elastic integral pan-head screws fixing the front cover of the base, and then remove the front cover.



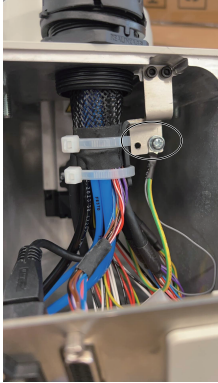
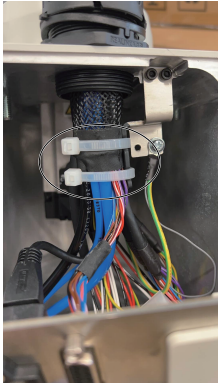
Four M4x10 cross flat elastic integral pan-head screws

7. Remove cables inside the base.

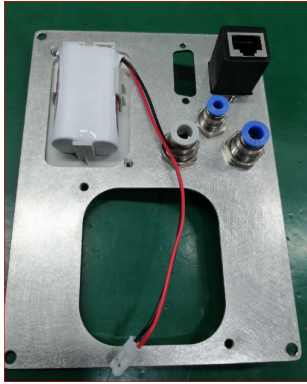
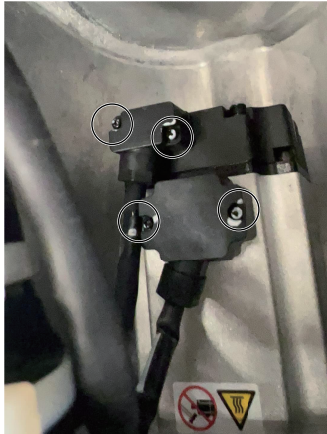
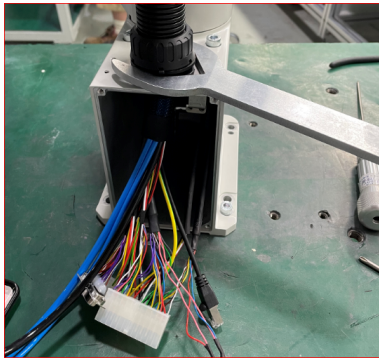
Step	Description	Illustration
①	Gently pull the internal cables out of the base.	

Step	Description	Illustration
②	Disconnect the power cable and encoder cable connectors.	
③	Loosen the 15-pin D-sub connector.	
④	Disconnect the three air ducts and network cables connected to the base cover.	

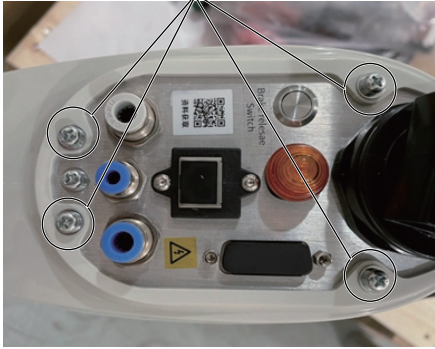
8. Cut the cable tie inside the base.

Step	Description	Illustration
①	Disconnect the grounding terminal on the sheet metal inside the base.	
②	Cut the cable tie.	

9. Remove the base bellows connector.

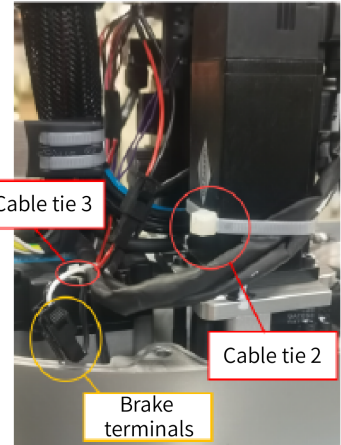
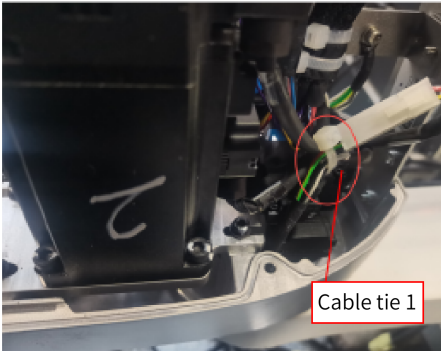
Step	Description	Illustration
①	Remove the battery	
②	Disconnect the encoder and power cable terminals of J1 axis.	
③	Remove the bellows connector from the base (use a hexagon wrench with the diameter of SW48 to pull out all terminal cables from the base, and apply threadlocker during re-assembly).	

10. Remove the forearm enclosure.

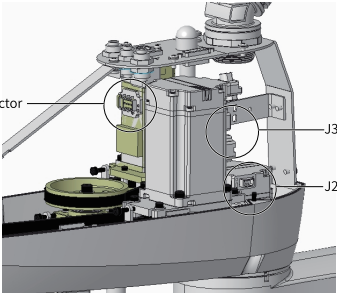
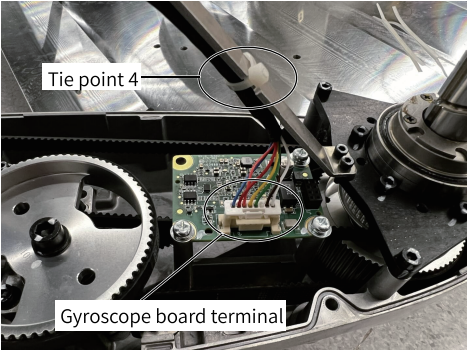
Step	Description	Illustration
①	Remove the four M4x10 screws on the top of the forearm enclosure.	Four M4x10 spring washer and flat washer combined screws  A close-up photograph of the top surface of a white robotic forearm enclosure. Four screws are highlighted with circles and lines pointing to a text label above them. The surface also features a QR code, a 'Break Release Switch' with a red button, a yellow triangular warning symbol, and a black rectangular component.
②	Remove the two screws on the back of the forearm.	 A photograph showing the back of the white robotic forearm. Two screws are highlighted with circles. The forearm is mounted on a grey base.

Step	Description	Illustration
③	Remove the four M4x12 hexagon screws on the bottom of the forearm.	 Lead screw enclosure (equipped for clean-type robots only) INOVANCE Four M4x12 hexagon screws

11. Cut the cable tie on the motor.



12. Remove the cable connector and gyroscope terminal.

Step	Description	Illustration
①	Use a Phillips screwdriver to loosen the M2x8.5 cross pan-head screws fixing the four pins of the power cable and encoder cable connectors of axes J2, J3, and J4. Carefully remove the connectors from the male connector at the motor side. Be careful that the connector pins do not bend.	 A 3D perspective diagram of the robot arm's internal assembly. It shows three specific cable connectors labeled 'J2 axis connector', 'J3 axis connector', and 'J4 axis connector'. These connectors are shown being detached from their respective motor-side male connectors. The diagram highlights the location of these connectors within the arm's structure.
②	Disconnect the brake button connector and the gyroscope terminals	 A close-up photograph of the robot arm's internal components. It shows a green circuit board with various components. A label 'Gyroscope board terminal' points to a specific connection point on the board. Another label 'Tie point 4' points to a white plastic tie point where a cable is secured. The background shows metallic parts of the robot arm.

13. Remove the two M4x8 cross pan-head screws fixing the forearm sheet metal and remove the cables from the forearm.



14. Remove the cables from the robot.
15. Re-install the cables in reverse steps of disassembly.

4.4.8.2 Replacing the Cables Connected Between the Robot and Control Cabinet

This section describes how to replace the cable unit between the robot and the control cabinet.

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

1. Power off the control cabinet.
2. Disconnect the power and encoder cable connectors connected to the control cabinet.
3. Hang a "Maintenance in process" sign. The "Maintenance in process" sign is used to prevent other operators from operating the robot.
4. Enter the safeguard system.
5. Remove the two M4x8 cross screws on the sheet metal of the trailing cable.



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

4.4.9 Replacing and Maintaining the Battery



Warning

- 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 zero point of all joints.
- The service life of the lithium battery is 1.5 years. Replace the lithium battery every 1.5 years even when the robot is always powered on. Use the lithium battery specified by the Company. Connect the battery properly. Do not mistake the polarity.

To replace the battery, do as follows:

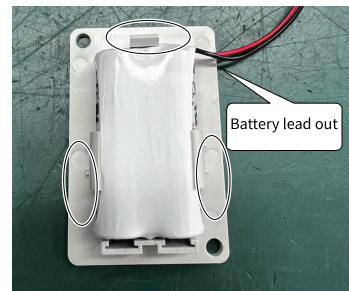
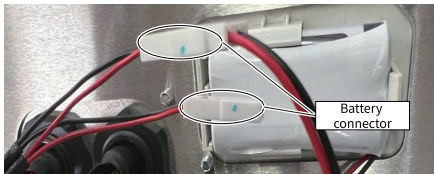
1. Preparations:

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



2. Replace the battery:

- Gently take out the battery box and find another battery plug.
- Insert a new battery and then remove the old battery.
- Install the new battery to the battery box.



3. Install the battery box:

Put back the battery box and fix it with two screws with a torque of $0.6 \text{ N} \cdot \text{m}$.

4.4.10 Zero Point Adjustment

4.4.10.1 Overview of Zero Point Adjustment

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

Note

After zero point adjustment, the absolute accuracy of the robot may deviate from the default absolute accuracy at delivery.



Caution

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

4.4.10.2 Procedure of Zero Point Adjustment

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

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

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

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

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

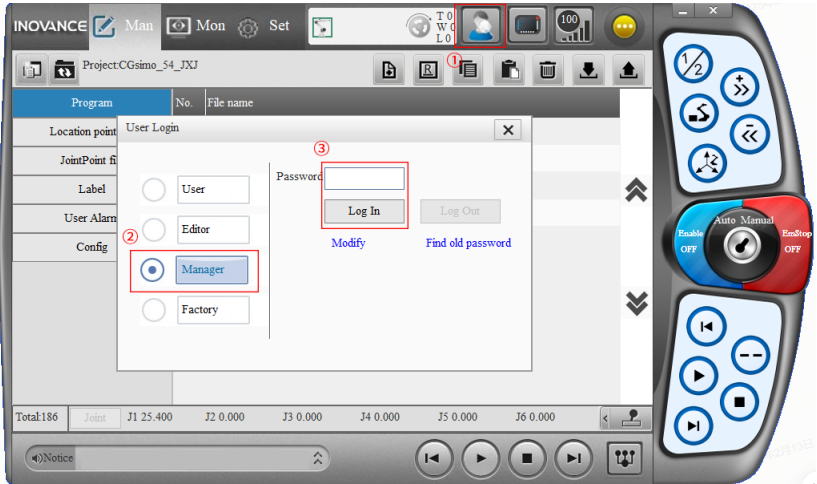


Figure 4-1 Screen of IRTP80 series tech pendant

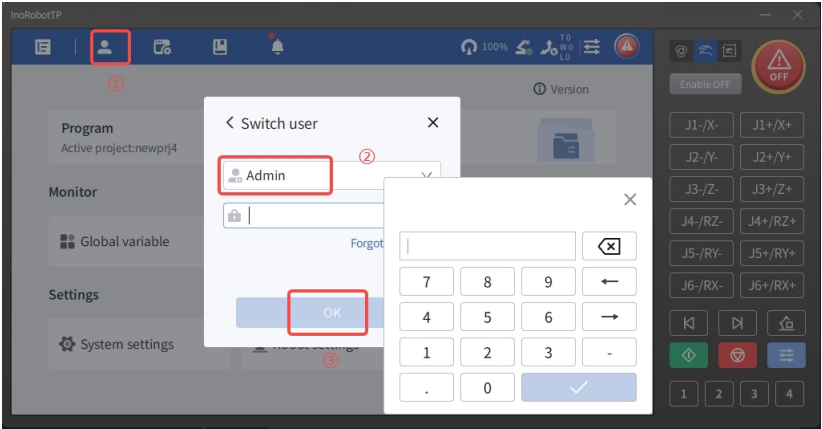


Figure 4-2 Screen of IRTP200 series tech pendant

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



Figure 4-3 Screen of IRTP80 tech pendant



Figure 4-4 Screen of IRTP200 series tech pendant

3. Move each axis of the robot to the corresponding zero point.
 - a. Move the robot axes to their respective zero points on the hand-held or PC-based teach pendant. For details, see Teach Pendant User Guide.
 - b. Also, you can manually push a robot joint to the zero point when the motor is disabled.

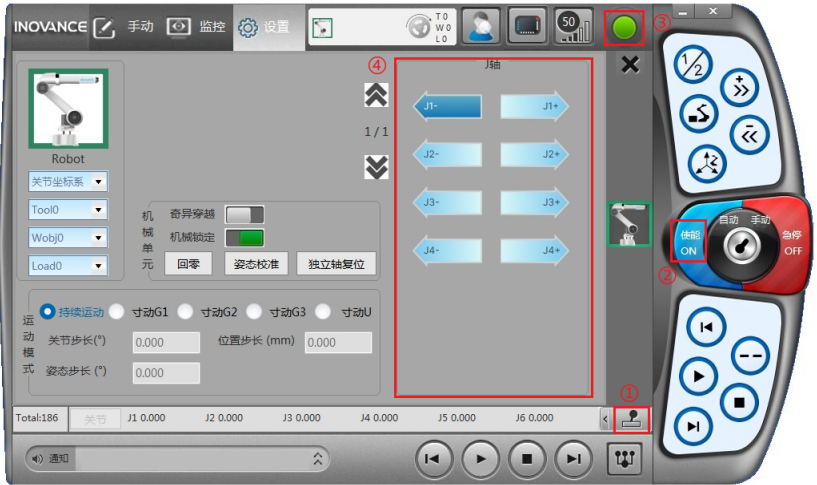


Figure 4-5 Screen of IRT80 series tech pendant



Figure 4-6 Screen of IRT200 series tech pendant

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



Figure 4-7 Screen of IRTP80 series tech pendant



Figure 4-8 Screen of IRTP200 series tech pendant

5. Obtain and save the zero point information.

- a. Click the "Get Cur" button when the robot moves to the zero point position to obtain the encoder pulses at the zero point position.
- b. Click "Save" to complete zero point adjustment.



Figure 4-9 Screen of IRT80 series tech pendant



Figure 4-10 Screen of IRT200 series tech pendant

4.4.10.3 Zero Point Position of Each Joint

1. The recesses of zero points of axes J1 and J2 are aligned together, as shown in the figure below.

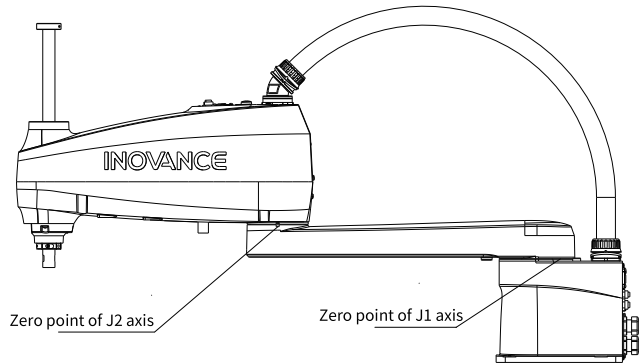


Figure 4-11 Zero points of axes J1 and J2

Model	J1 Max Motion Range	J2 Max Motion Range
IR-S10-80Z20S3	$\pm 132^\circ$	$\pm 150^\circ$

2. The zero point of J3 axis is the upper limit position of J3 axis.

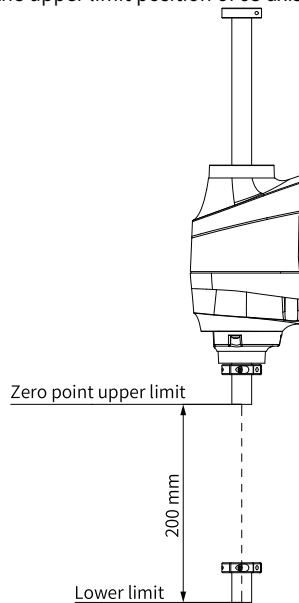


Figure 4-12 Zero point of axis J3

Model	J3 Travel
IR-S10-80Z20S3	200 mm

3. The zero point of J4 axis is the position where the plane of the axis (or the slot of the upper or lower mechanical limit stop) is facing toward the top of arm 2.

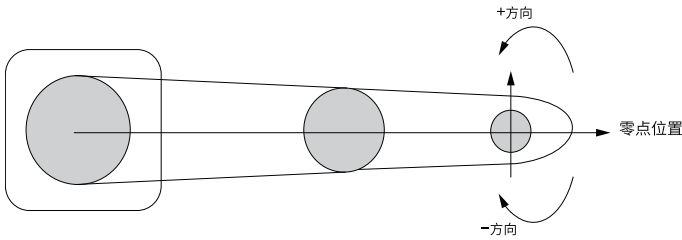


Figure 4-13 Zero point of axis J4

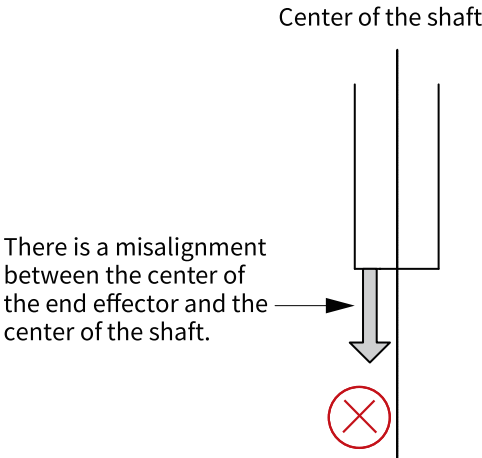
Model	J4 Max Motion Range
IR-S10-80Z20S3	±360°

4.4.10.4 Zero Point Adjustment of J2

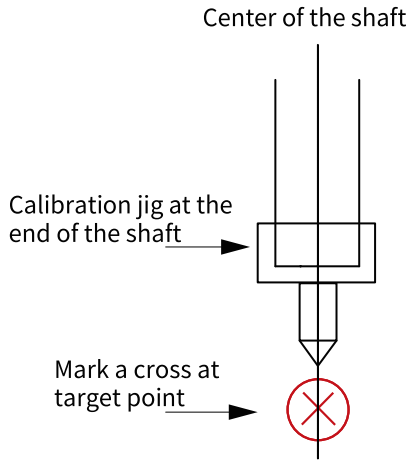
Due to the strong correlation between the coordinates of the robot's work points and the accuracy of J2, it is necessary to complete the zero point position calibration of J2 before calculating the robot coordinates. When adjusting the zero point of J2 in ["4.4.10.2 Procedure of Zero Point Adjustment" on page 191](#), refer to the right/left wrist wizard provided by the teach pendant.

Procedure of J2 zero point adjustment

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



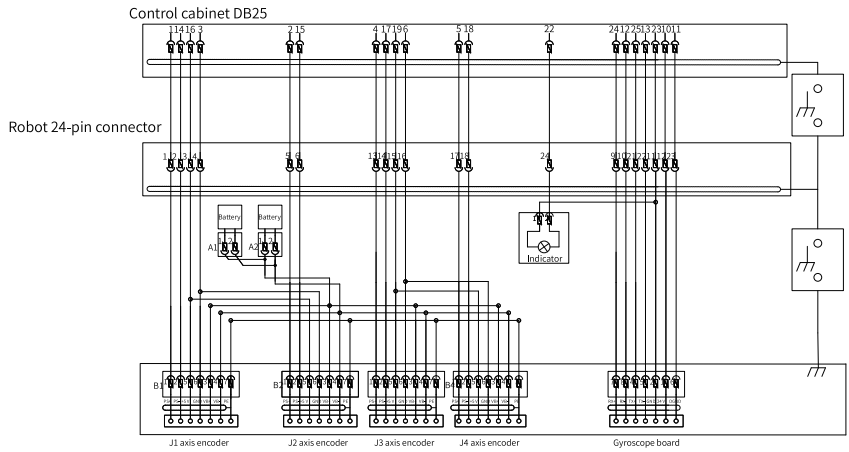
2. Make a zero point adjustment jig on the top side of the shaft to clarify the center of the shaft, as shown in the figure below. Specify a target position that can be easily recognized when the right/left wrist pose is changed, and then mark it with ×.



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

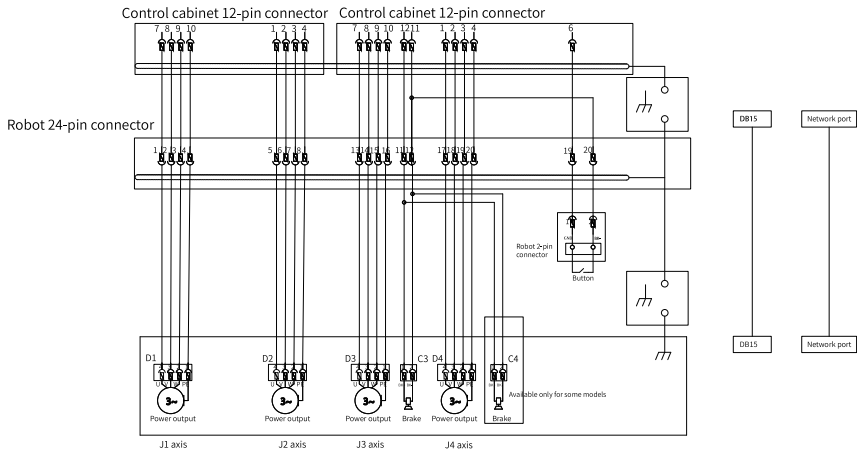
4.4.11Wiring Diagrams

The following figure shows the encoder cable connection.



Encoder Pin	7	1	2	5	6	3	4
Definitions	Shielding	PS+	PS-	5 V	GND	BT+	BT-

The following figure shows the power cable connection.



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



PS00017525A01

Copyright © Shenzhen Inovance Technology Co., Ltd.

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, 215104,
Suzhou City, Jiangsu Province, P.R. China

Tel: (0512) 6637 6666

Fax: (0512) 6285 6720