



IR-S4&S7&S10 Series SCARA Robot User Guide - Manipulator



Industrial
Automation



Intelligent
Elevator



New Energy
Vehicle



Industrial
Robot



Rail
Transit

>>>

Data code PS00008454 A01

Safety Instructions

Safety Precautions

- This section describes the safety precautions that help you use this product correctly. Before using this product, read the user guide thoroughly and correctly understand the related safety precautions. Failure to comply with the safety instructions may result in death, severe personal injuries, or equipment damage.
- "CAUTION", "WARNING", and "DANGER" items in the guide only indicate some of the precautions that need to be followed; they just supplement the safety precautions.
- Use this equipment 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 use.

Safety Levels and Definitions

**DANGER**

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

**WARNING**

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

**CAUTION**

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

General Safety Instructions

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

Unpacking

**WARNING**

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

 **CAUTION**

- Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking.
- Unpack the package by following the package sequence. Do not hit the package with force.
- Check whether there are damage, rust, or injuries on the surface of the equipment or equipment accessories.
- Check whether the number of packing materials is consistent with 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 the equipment components such as the front cover and terminal blocks are secured firmly with screws. Loosely-connected components may fall off and result in personal injuries or equipment damage.
- Never stand or stay below the equipment when the equipment is lifted by hoisting equipment.
- When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply may result in personal injuries or equipment damage.

 **CAUTION**

- Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in personal injuries.
- Store and transport this product in strict accordance with the storage and transportation requirements. Failure to comply may result in damage to the product.
- Avoid transporting the equipment in environments such as water splashing, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storing the equipment for more than three months. Long-term storage requires stricter protection and necessary inspections.
- 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**

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

WARNING

- Read through the guide and safety instructions before installation.
- Do not install this equipment in places with strong electric or magnetic fields.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply will result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in an electric shock.
- When installing the equipment in a closed environment (such as a cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or a fire.
- Do not retrofit the equipment.
- Do not fiddle with the bolts used to fix equipment components or the bolts marked in red.
- When this equipment is installed in a cabinet or final equipment, protection measures such as a fireproof enclosure, electrical enclosure, or mechanical enclosure must be provided. The IP rating must meet IEC standards and local laws and regulations.
- Before installing equipments with strong electromagnetic interference, such as a transformer, install a shielding equipment for the equipment to prevent malfunction.
- Install the equipment onto flame retardant materials, such as metal. Keep the equipment away from combustible objects. Failure to comply will result in a fire.

CAUTION

- Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment and causing faults. After installation, remove the cloth or paper for effective ventilation and cooling.
- Resonance may occur when the equipment operating at a constant speed executes variable speed operations. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

Wiring**DANGER**

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Before wiring, cut off all equipment power supplies. Wait as specified on the product warning sign before further operations because residual voltage exists after power-off. Measure the DC voltage of the main circuit and make sure that it is below the safety voltage. Failure to comply will result in an electric shock.
- Never perform wiring at power-on. Failure to comply will result in an electric shock.
- Check that the equipment is grounded properly. Failure to comply can result in electric shock.

 **WARNING**

- Do not connect the input power supply to the output end of the equipment. Failure to comply can result in equipment damage or even a fire.
- When connecting a drive with the motor, make sure that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation.
- Cables used for wiring must meet cross sectional area and shielding requirements. The shield of the cable must be reliably grounded at one end.
- Fasten screw terminals with the specified tightening torque. Insufficient or excessive torque may cause overheating, damage, and even a fire.
- After wiring, make sure that no screws are fallen and cables are exposed in the equipment. Failure to comply may result in an electric shock or equipment damage.

 **CAUTION**

- Follow the proper electrostatic discharge (ESD) procedure and wear an anti-static wrist strap to perform wiring. Failure to comply may result in damage to the equipment or to the internal circuit of the product.
- Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding purpose. Failure to comply will 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.
- Before power-on, make sure that the power supply meets product requirements to prevent product damage or even a fire.
- After power-on, do not open the cabinet door or protective cover of the equipment. Do not touch any terminals, or remove any part of the equipment at power-on. Failure to comply will result in an electric shock.

 **WARNING**

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

Operation

 **DANGER**

- The equipment must be operated only by professionals. Failure to comply will result in death or personal injuries.
- Do not touch any terminals or remove any part of the equipment during operation. Failure to comply will result in an electric shock.

WARNING

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

Maintenance**DANGER**

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not maintain the equipment with power ON. Failure to comply will result in an electric shock.
- Before maintenance, cut off all equipment power supplies and wait as specified on the product warning sign.
- In case of a permanent magnet motor, do not touch the motor terminals even after power-off because there is still induced voltage generated during rotation. Failure to comply will result in an electric shock.

WARNING

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

Repair**DANGER**

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not repair the equipment with power ON. Failure to comply will result in an electric shock.
- Before inspection and repair, cut off all equipment power supplies and wait as specified on the product warning sign.

WARNING

- Require for repair services according to the product warranty agreement.
- When the fuse is blown or the circuit breaker or earth leakage circuit breaker (ELCB) trips, wait as specified on the product warning sign before power-on or further operations. Failure to comply may result in personal injuries, equipment damage or even death.
- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Replace quick-wear parts of the equipment according to the replacement instructions.
- Do not operate damaged equipment. Failure to comply may result in worse damage.
- After the equipment is replaced, check the wiring and set parameters again.

| Disposal |
|---|
|  WARNING |
| <ul style="list-style-type: none"> • 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 Labels

To ensure safe operations, comply with safety signs on the device, and do not damage or remove the safety labels. The following table describes the meaning of the safety labels.

| Safety label | Description |
|---|---|
|  | <ul style="list-style-type: none"> • Read through the safety instructions before operating the equipment. Failure to comply may result in death, personal injuries, or equipment damage. • Do not touch the terminals or remove the cover with power ON or within 10 min after power-off. Failure to comply will result in an electric shock. |
|  | <ul style="list-style-type: none"> • To prevent the robot from tilting forward due to its center of gravity, which may cause equipment damage or personal injury, fasten the robot first and then remove the fastening screws of the base. |
|  | <ul style="list-style-type: none"> • Do not touch the energized parts when the power is on. Failure to comply may result in an electric shock. |
|  | <ul style="list-style-type: none"> • NEVER enter the action area during robot running. Otherwise, you may bump into the robot, and serious accidents may occur. |

1 IR-S4 Series SCARA Robot User Guide - Manipulator

1.1 Preface

Introduction

With a maximum payload of 4 kg and a Z-axis stroke of 150 mm, the robot can be widely used in loading and unloading, precision assembly, handling, dispensing, gluing, screw tightening, labeling, material insertion, and sorting. The robot can be used in high-load occasions, such as handling of large parts, machine loading and unloading, machine assembly, industrial parts transfer, and other occasions. It is suitable for new energy, 3C and food packaging industries.

This guide describes the basic specifications, installation, and maintenance of the product.

Audience

Mechanical engineers

Electrical engineers

System engineer

More Documents

| Data Name | Data Code | Description |
|--|------------|---|
| IRCB500 Series Robot Controller User Guide | PS00001641 | This guide describes the specifications, installation, wiring and more of the IRCB500 series controller. |
| IRP80 Series Teach Pendant User Guide | 19010502 | This guide describes the basic information, cable connection, operations and more of the IRTP80 series teach pendant. |

Revision History

| Date | Version | Description |
|----------------|---------|--|
| August 2023 | A01 | <ul style="list-style-type: none">• Updated technical data including rated load, manipulator weight, and cycle time.• Modified the outline dimensions |
| September 2022 | A00 | First release. |

Document Acquisition

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

- Visit <http://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.

Warranty

Inovance provides warranty service within the warranty period (as specified in your order) for any fault or damage that is not caused by improper operation of the user. You will be charged for any repair work after the warranty period expires.

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

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

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

For details, see the Product Warranty Card.

1.2 Product Information

1.2.1 Nameplate and Model Number

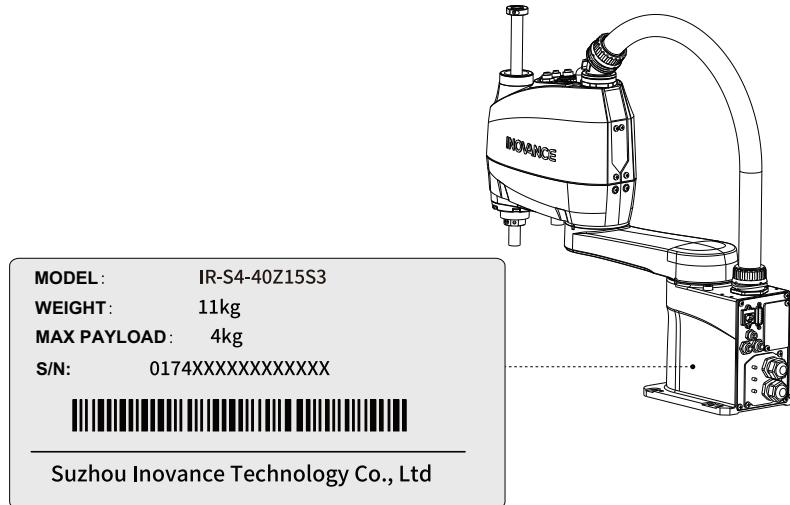


Figure 1-1 Nameplate



Do not wipe the robot hard with alcohol or benzene, as this may cause the gloss of the painted surface to deteriorate.

IR- S 4 - 40 Z15S3
① ② ③ ④ ⑤ ⑥⑦

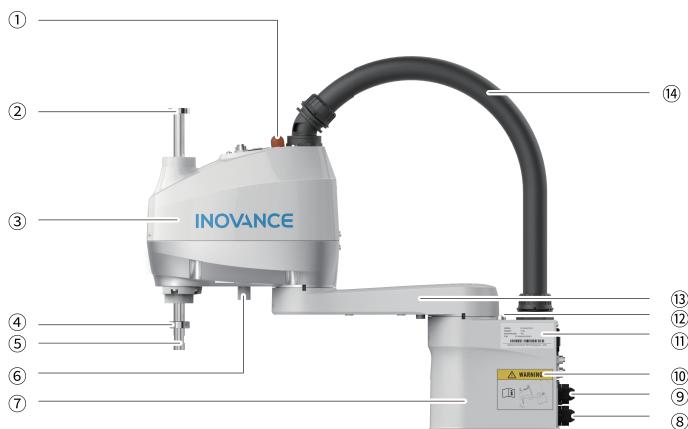
Figure 1-2 Model number

| | | |
|--|--|--|
| ① Family INOVANCE Robot | ④ Arm Length 40: 400 mm 50: 500 mm | ⑦ Cable Length 0: No drag cable 3: 3 m standard cable 5: 5 m standard cable G3: 3 m highly flexible cable |
| ② Serial Number S: SCARA robot R: 6-axis robot TS: Ceiling-mounted SCARA robot | ⑤ Max. Z-axis Stroke (empty for models without lead screw) Z15: Max. 150 mm stroke | - |
| ③ Load 4: 4 kg 7: 7 kg | ⑥ Mounting Mode C: Cleanroom S: Standard P: Protection | - |

Note

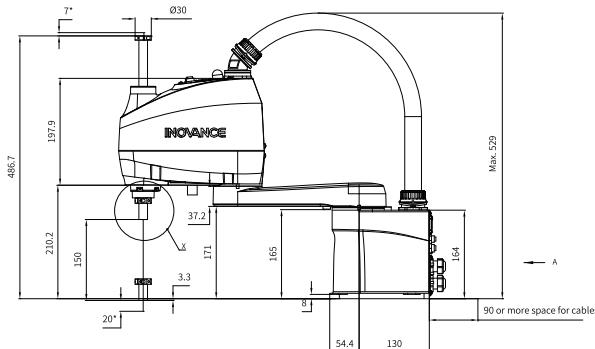
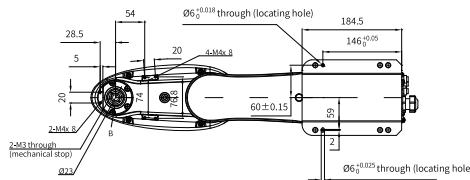
The product information in this guide is the information of standard models in a standard environment. For information about non-standard models or cleanroom models, contact the provider.

1.2.2 Components

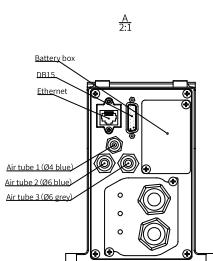
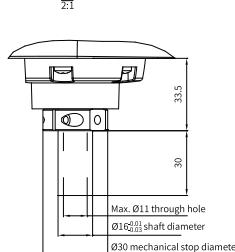
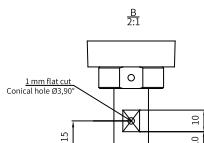
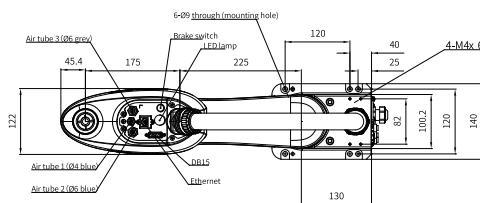


| No. | Description |
|-----|--------------------------|
| 1 | Run indicator |
| 2 | J3 upper mechanical stop |
| 3 | Arm 2 |
| 4 | J3 lower mechanical stop |
| 5 | J3 lead screw |
| 6 | J2 mechanical stop |
| 7 | Base |
| 8 | Signal Cable |
| 9 | Power cable |
| 10 | Label |
| 11 | Nameplate |
| 12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

1.2.3 Dimensions



(*) indicates the stroke margin by mechanical stop.



1.2.4 Specifications

| Item | | IR-S4-40Z15S3 |
|--------------------------------|------------------------------------|-------------------------|
| Arm length | Arm 1 + Arm 2 | 400 mm |
| | Arm 1 | 225 mm |
| | Arm 2 | 175 mm |
| Max. speed | J1 + J2 | 7200 mm/s |
| | J3 | 1300 mm/s |
| | J4 | 2600°/s |
| Repeatability | J1 + J2 | ±0.01 mm |
| | J3 | ±0.01 mm |
| | J4 | ±0.01° |
| Handling capacity (load) | Rated | 2 kg |
| | Maximum | 4 kg |
| Allowable inertia moment of J4 | Rated | 0.005 kg·m ² |
| | Maximum | 0.05 kg·m ² |
| Mounting hole | | 120x120 mm (4-ø9 mm) |
| Axis Diameter | | Ø16mm |
| Weight (excluding cables) | | 12 kg |
| Press-in force of J3 | | 100 N |
| Signal line | | 15 (15pin: D-sub) |
| | | CAT5E |
| Air tube | | 2x Ø6 mm, 0.59 Mpa |
| | | 1x Ø4 mm, 0.59 Mpa |
| Environmental conditions | Ambient temperature ^[1] | 5°C to 40°C |
| | Relative humidity | 10% to 80% RH |
| Noise level ^[2] | | Laeq=70 dB(A) |
| Maximum Motion Range | J1 | ±132° |
| | J2 | ±141° |
| | J3 | 150 mm |
| | J4 | ±360° |
| Cycle time ^[3] | | 0.342s |

[1] When used in a low-temperature environment approximating the lowest allowable temperature, or when idle for a long period of time due to holidays and nighttime, it is recommended to warm up the product for 10 minutes before operating it.

[2] Measured in front of the robot at a distance of 1000 mm from its operating area and at least 50 mm above the base mounting surface with four joints operating at 100% speed and acceleration and rated load, with a duty cycle of 50%.

[3] Time required for a robot to move a 1 kg payload between two points 300 mm apart at a height of 25 mm.

1.3 Preparation

1.3.1 Requirements Installation Personnel

Ensure that the installation personnel have obtained mechanics knowledge or received mechanics training in advance to understand various dangers and risks in the installation process.

The installation personnel must be familiar with all the installation requirements and related technical documents.

Non-professionals are strictly prohibited from product installation, wiring, maintenance, inspection and part replacement.

1.3.2 Requirements on Installation Environment

General environmental requirements

Set up the robot system in an environment that complies with the following conditions in order to maximize and maintain the performance of the equipment and to use it safely.

Table 1-1 Environmental conditions

| Item | Requirement |
|---|--|
| Operating temperature and humidity | 5°C to 40°C, 10% to 80%RH, non-condensing |
| Storage temperature and humidity | -10°C to 55°C, ≤80%RH, non-condensing |
| Transportation temperature and humidity | -10°C to 55°C, ≤80%RH, non-condensing |
| EFT/B immunity | 2 kV or less |
| Static immunity | 6 kV or less |
| Environment | <ul style="list-style-type: none">• Install indoors• Keep away from direct sunlight• Keep away from dust, oil smoke, salt, iron filings• Keep away from flammable and corrosive liquids and gases• Keep away from water• Avoid places with shocks or vibrations• Keep away from sources of electrical interference |

Special environmental requirements

- The surface of the robot provides certain protection. However, contact your provider and confirm in advance if the robot may come into contact with special liquid or gas during use.
- There may be condensation inside the robot if it is used in an environment with large changes in temperature and humidity. Please consult your provider.
- If you want to use the robot to handle food directly, please consult your provider in advance to avoid contamination of the food by the robot.



Caution

Do not wipe the robot hard with alcohol or benzene, as this may cause the gloss of the painted surface to deteriorate.

1.3.3 Requirements on Mounting Stand

You need to make a stand for fixing the robot. The shape and size of the stand vary depending on the purpose of the robot system. Requirements on the stand are listed as follows for your reference during design.

- The stand supports not only the weight of the robot, but also the dynamic forces generated by the robot when it moves at maximum acceleration. Ensure that the stand has sufficient bearing capacity by using the transverse beam and other reinforcement materials.
- The torque and reaction force generated by the robot action are described in the table below:

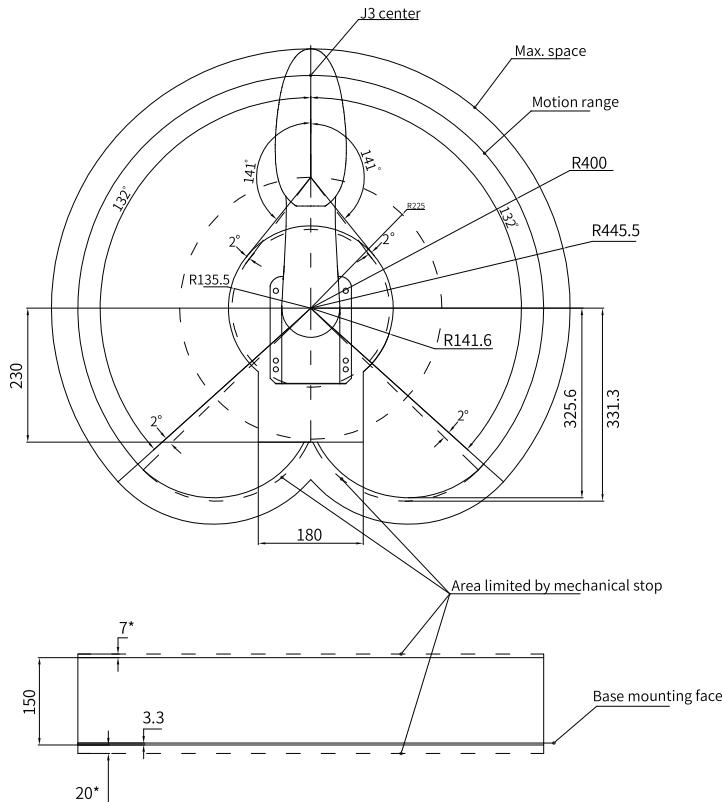
| Type | Size |
|--|---------|
| Maximum torque in horizontal plane | 250 N·m |
| Maximum reaction force in horizontal direction | 1000 N |
| Maximum reaction force in vertical direction | 1000 N |

- The threaded holes on the stand for mounting the manipulator are M12. Use screws conforming to the strength of GB/T 3098.1 class 10.9 or 12.9. For details about the dimensions, see ["1.2.3 Dimensions" on page 12](#).
- The plate for the robot mounting face should be 20 mm thick or more and made of steel to reduce vibration. The surface roughness of the steel plate should be 25 μm or less.
- Fix the stand firmly on the ground or wall.
- Keep the Z-axis of the robot perpendicular to the horizontal plane during installation.

- When using a level for height adjustment of the stand, use screws with a diameter larger than M8.
- When cutting holes in the stand for passing cables, ensure that the diameter of the holes is not less than 60 mm.
- Take the storage space of the controller into account when designing the stand. Please see the user guide of the controller for detailed data.

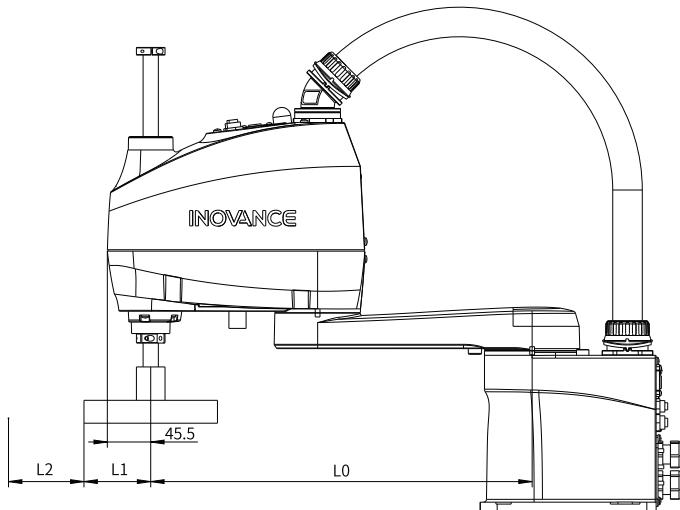
1.3.4 Requirements on Installation Space

Motion range of standard model (mm)



Maximum range

The "maximum range" is the range where the robot arm may cause interference. When an end effector with a radius of 45.5 mm or more is mounted, set the maximum range to the length of the two robot arms plus the radius of the end effector.



- L0: Length of the robot arms
- L1: Radius of the end effector
- L2: Safety space

The safety distance should be greater than $L0+L1+L2$.

1.3.5 Installation Tools

Table 1-2 Installation tools

| Tool | Quantity (PCS) |
|---------------------------|----------------|
| M8 outer hexagon wrench | 1 |
| Scissors or utility knife | 1 |
| Protective gloves | 1 |
| Safety shoes | 1 |
| Hoisting sling | 1 |

1.4 Unpacking and Handling

1.4.1 Notes



Caution

Check whether the packing is intact and whether there is damage, water seepage, damp, and deformation.

Unpack the package by following the package sequence. Do not hit the package with force.

Check whether there are damage, rust, or injuries on the surface of the equipment or equipment accessories.

Check whether the number of packing materials is consistent with the packing list.



Warning

Do not install the equipment if you find damage, rust, or indications of use on the equipment or accessories.

Do not install the equipment if you find water seepage, component missing or damage upon unpacking.

Do not install the equipment if you find the packing list does not conform to the equipment you received.

Unpack the packing box according to the direction instructed.



Danger

Only qualified personnel are allowed to carry out transportation including rigger operation, hoisting by crane, and forklift driving.



Warning

- Transport the equipment with a hoist or forklift with the original package.
- Wear personal protective equipment (PPE) during transportation with a hoist or forklift. Prohibit any personnel to stand or stay in the transportation route.
- Stabilize the equipment with hands when hoisting it. Unstable hoisting may result in the equipment falling over. This may cause severe bodily injury or equipment damage.



Caution

- Store and transport this equipment based on the storage and transportation requirements for humidity and temperature.
- Avoid transporting the equipment in environments such as water splashing, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- Never transport this equipment with other equipment or materials that may harm or have negative impacts on this equipment.
- If condensation occurs on the device during transportation or storage, remove the condensation before turning on the power.

1.4.2 Unpacking

Unpacking procedure:

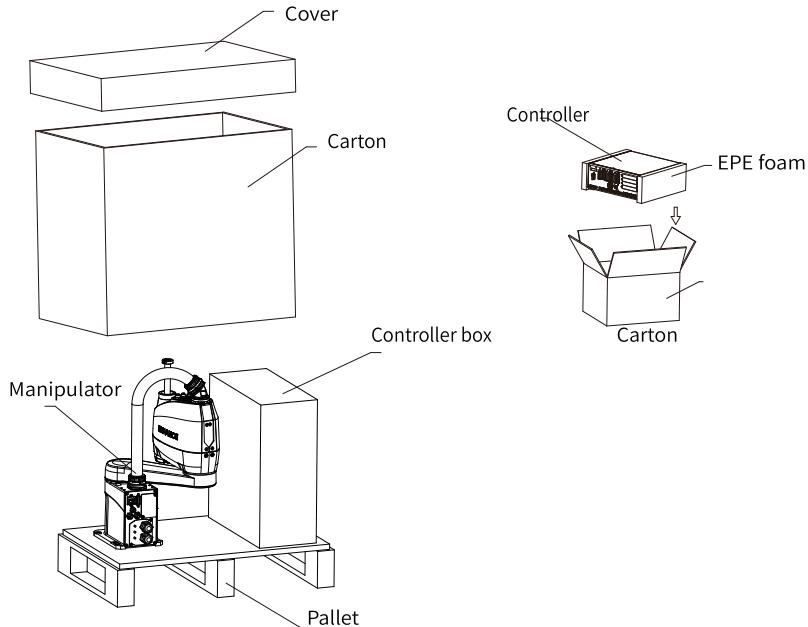
1. Unpack the carton.

Cut the PET tape using scissors or a utility knife, and remove the cover of the carton and the paper corner protectors. Move the carton from bottom to top and remove it.



Caution

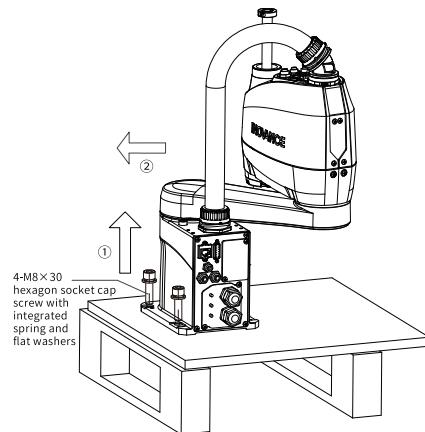
Wear gloves to prevent scratches.



2. Remove the manipulator from the pallet.

Remove bolts connecting the manipulator and the pallet using the M8 outer hexagon wrench.

Take out the manipulator by lifting it from bottom to top, and moving it horizontally.



 **Caution**

- Stabilize the robot when removing the bolts fixing the manipulator to avoid bodily injury or equipment damage caused by titling of the equipment due to unstable center of gravity.
- To repack the robot, reverse the steps above.
- Take out the robot carefully to avoid collision.

1.4.3 Handling

Pre-Handling Preparation

1. For a newly shipped robot, move it in the posture as it was delivered.
2. If you want to relocate a robot that is already in use, do the following before moving it:
 - Disconnect all power supplies of the equipment.
 - Disconnect the power and signal cables from the controller
 - Remove the bolts fixing the robot to the base and then remove the robot from the installation base.
 - Secure the robot to the transportation equipment.

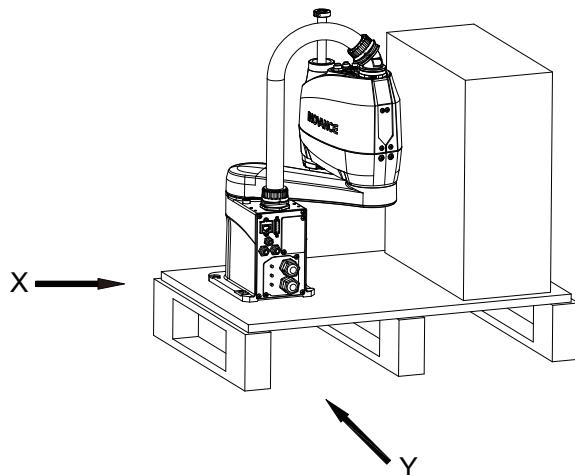
Handling Procedure

Transportation by hands

When transporting the robot, fix the robot on the transportation equipment or support the second robotic arm and the bottom of the base with hands. At least two people are required for the operation.

Handling with forklift

Secure the robot to a pallet or base plate with sufficient load capacity with bolts. Insert the fork of the forklift into the pallet to transport it together with the robot. Transport the robot slowly to prevent it from titling or falling over.



Note

- The robot is located on one side of the pallet. Therefore, when inserting the fork from the Y direction, pay attention to the counterweight on the other side to prevent the robot from falling over.
- Do not pull the cables of the robot to avoid possible damages.

1.5 Installation

1.5.1 Installation Precautions



Danger

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Install a safety fence for the system. Failure to comply will result in serious accidents.
- Reserve sufficient space between the equipment and surrounding buildings, structural parts, and devices. Failure to comply may cause serious injury or major damage.
- Fix the robot body before turning on the power or operating the system. Otherwise, the robot body may fall over and cause serious injury or major damage.

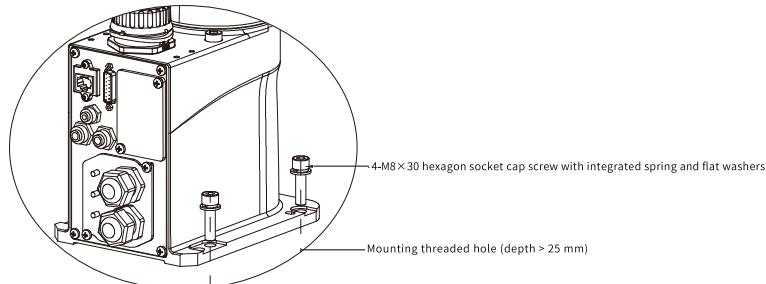


Warning

- Do not modify the equipment.
- Do not install this equipment in places with strong electric or magnetic fields.
- When removing the mounting screws of the robot body, hold the robot to prevent it from toppling over.
- For the tabletop mounting, at least two people are required for the operation.

1.5.2 Installing Manipulator

Secure the robot base to the stand with four M8x30 screws conforming to the strength of GB/T 3098.1 class 10.9 or 12.9, as shown below.



Check that the screws are tightened referring to the following recommended torque.

| Nominal Screw Diameter (10.9 or higher) | Installation Torque |
|---|---------------------|
| M8 | 30 N·m |

1.5.3 Installing End Effector

Users need to make their own end effectors. Before attaching an end effector, observe the following guidelines.



- Perform wiring and air tubing of the chuck only when the power supply is disconnected and the workpiece is not placed. If the emergency stop switch is pressed when the power is still connected, the workpiece may be released, resulting in damage to the robot system and workpiece.
- Pay attention to the interference area of the end effector during system layout design. After the end effector is installed, the end effector or workpiece may come into contact with the manipulator during motion due to the outer diameter of the end effector, the size of the workpiece, or the position of the robot arm, which may cause damage to the robot system and the workpiece.

Design your own end effector mounting method with reference to the following dimensions. The weight of the end effector should not exceed 4 kg, as shown in the figure below.

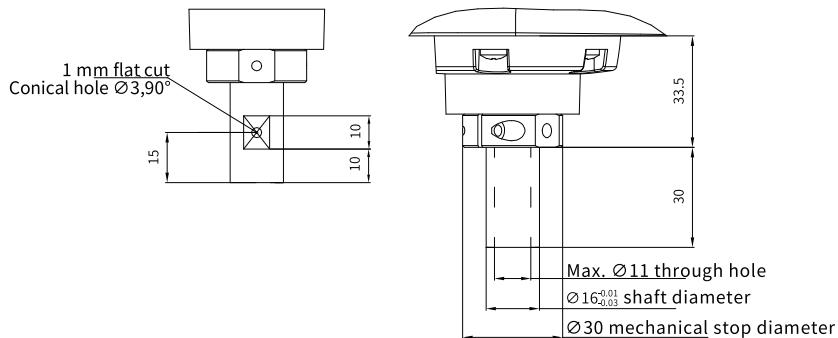


Figure 1-3 End effector mounting dimensions (in mm)

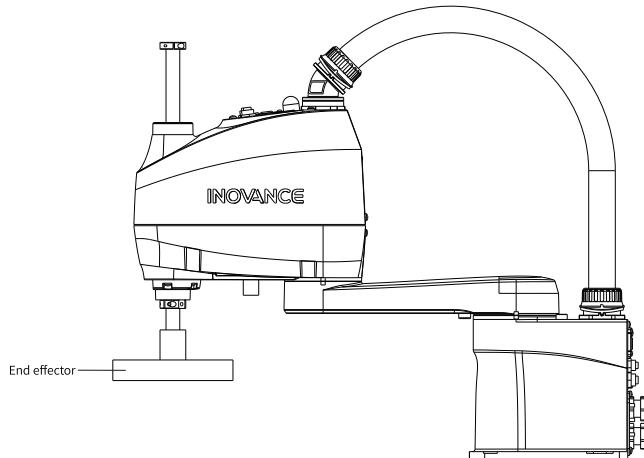


Figure 1-4 Installing the end effector

To move J3 up or down when installing the end-effector, turn on the power of the controller and move the joint up/down or rotate the joint while pressing the brake release switch. This switch is a momentary type switch that releases the brake only during the time it is pressed.

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

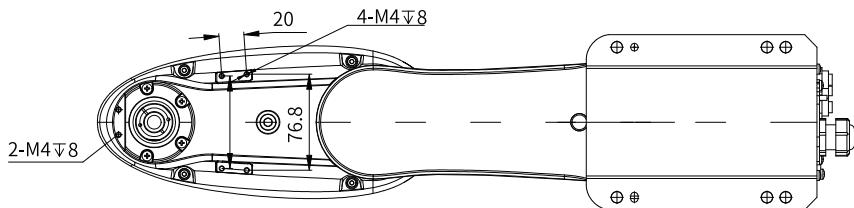
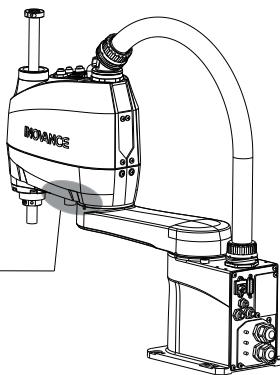
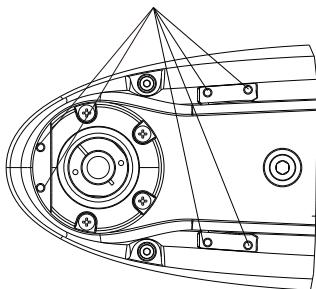
Note

To avoid contact between the end effector and the robot due to the outer diameter of the end effector, the size of the workpiece, or the position of the robot arm, stop operating the robot when installing the end effector. Pay attention to the interference area of the end effector during system layout design. See the maximum area in ["1.3.4 Requirements on Installation Space" on page 16](#).

1.5.4 Installing Camera and Pneumatic Valve

The robot provides mounting holes for the camera and pneumatic valve at the bottom of the second arm, as shown in the following figure.

Camera/pneumatic valve mounting position



1.5.5 Cable Connection



Danger

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Cut off the power before wiring. Failure to comply will result in electric shock or system fault.
- Before wiring, cut off all equipment power supplies. Residual voltage exists after power cut-off. Therefore, wait at least 10 minutes before further operations.
- Ensure that the safety input signals, such as the emergency stop switch and safety door switch are connected correctly before wiring. Otherwise, the safety protection will not work properly in emergency cases, causing serious injury or damage.
- Make sure that the equipment is well grounded. Failure to comply will result in an electric shock.
- During wiring, follow the proper electrostatic discharge (ESD) procedure, and wear an antistatic wrist strap. Failure to comply will damage the equipment or the internal circuits of the equipment.



Warning

- Connect the cables securely. 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.

Connect the power cable and signal cable to the controller.

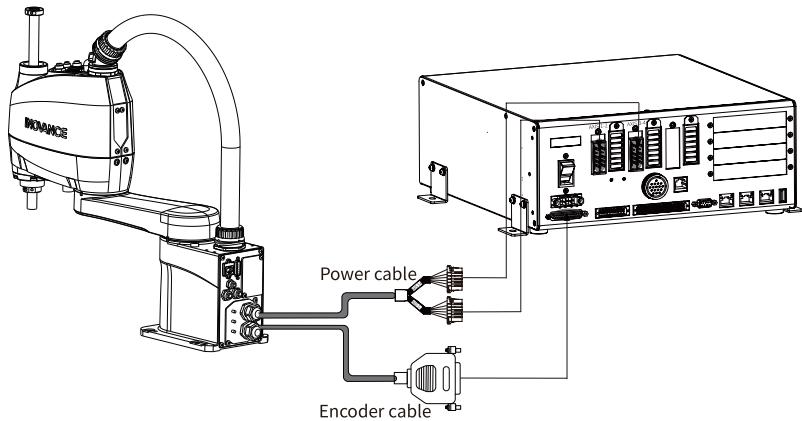
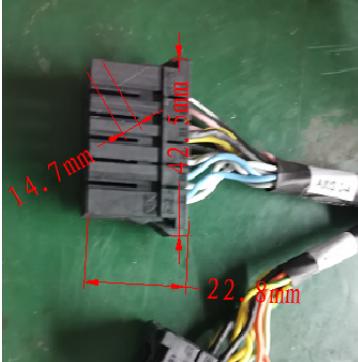
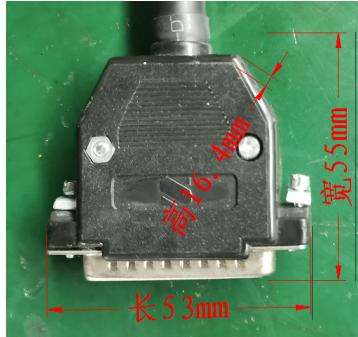
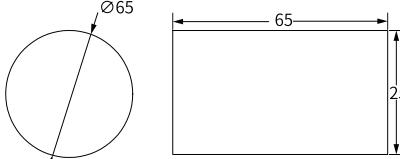
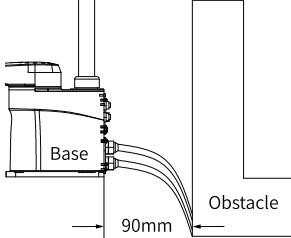


Figure 1-5 Cable connection

Table 1-3 Cable hole dimensions (IRCB500 drive-control integrated controller)

| Name | Power Cable Connector (Controller Side) | Encoder Cable Connector (Controller Side) |
|------------|---|--|
| Dimensions | 42.5 mm x 22.8 mm x 14.7 mm (L x W x H)  | 53 mm x 55 mm x 16.4 mm (L x W x H)  |

Recommended minimum hole size and reserved space for cables (red frame is recommended size).

| Hole size (round hole & square hole) (mm) | Space reserved for the manipulator cable (connector size+cable bending radius) |
|---|---|
|  |  |

1.5.6 Wiring and Tubing



Danger

Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.

Wiring (Electrical Wires)



Warning

Current higher than 0.5 A is not allowed.

| Model | Allowable current | Number of cores | Diameter | Remarks |
|-------|-------------------|-----------------|----------|-------------------------------------|
| DB15 | 0.5 A | 15 | 24AWG | Wire connector provided as standard |

Note

Use connectors with the same pin number on both ends of the cable. The robot is shipped with wiring ready for the user.

Communication cable requirements

Use the Cat5 shielded twisted pair cable for external and built-in network cables, with a maximum communication rate of 1000 bit/s, which can meet the communication requirements of industrial cameras and other devices.

Tubing (Air Tubes)

Note

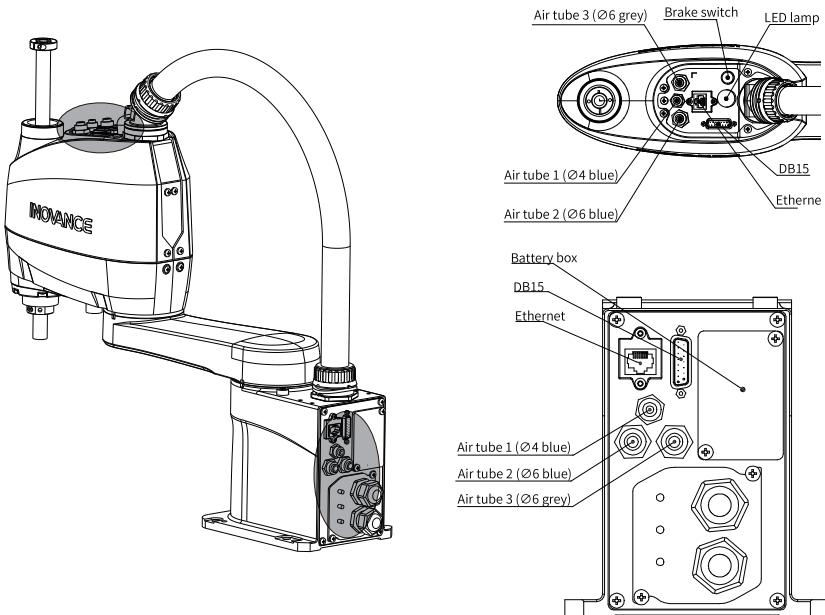
Both ends of the air tubes are equipped with ø6 mm and ø4 mm (outer diameter) fittings.

| Pressure resistance | Quantity | Dimensions (outer diameter) |
|-----------------------------------|----------|-----------------------------|
| 0.59 MPa (6 kgf/cm ²) | 2 | ø6 mm |
| 0.59 MPa (6 kgf/cm ²) | 1 | ø4 mm |

ø6 straight-through air tube fittings: two at the base and two at the forearm.

ø4 straight-through air tube fittings, one at the base and one at the forearm.

The air tube fittings are distinguished by color, as shown in the following figure.



1.6 Motion Range

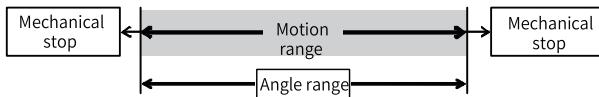
1.6.1 Method for Setting the Motion Range

Note

The default motion range at delivery is the maximum motion range of the robot.

To improve layout efficiency and to take into account the maximum safe range of motion of the robot, the following motion range setting methods are provided:

- Setting by angle range (for all joints)
- Setting by mechanical stops (for J1 to J3)



1.6.2 Motion Range Setting by Angle Range

1.6.2.1 Description of Angle Range

The basic unit of robot motion is degree. The motion limit (motion range) of the robot is set based on the angle lower limit and angle upper limit (angle range) of each joint.

The motion angle is determined by the encoder output pulse value of the servo motor, and the angle range must be set within the mechanical stop range.

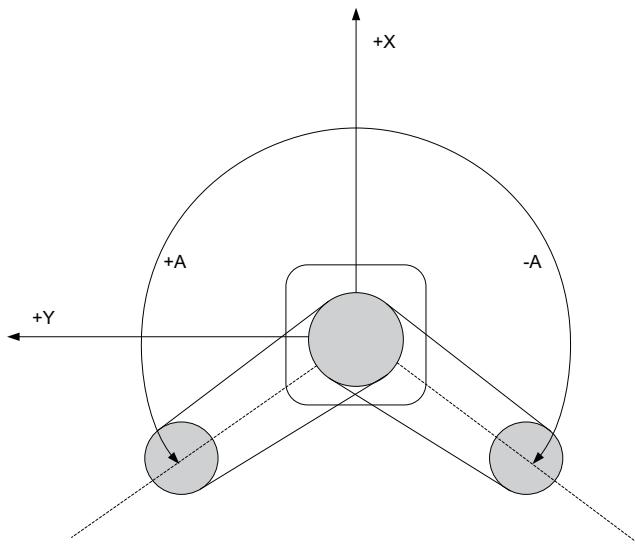
Once the robot receives an operating command, it checks whether the target position specified by the command is within the angle range before operating. If the target position is beyond the set angle range, an error occurs and the robot does not move.

Note

You can set the angle range by choosing Set > Motion > AxisPara > AxisLimit on the teach pendant.

1.6.2.2 Maximum angle range of joint 1

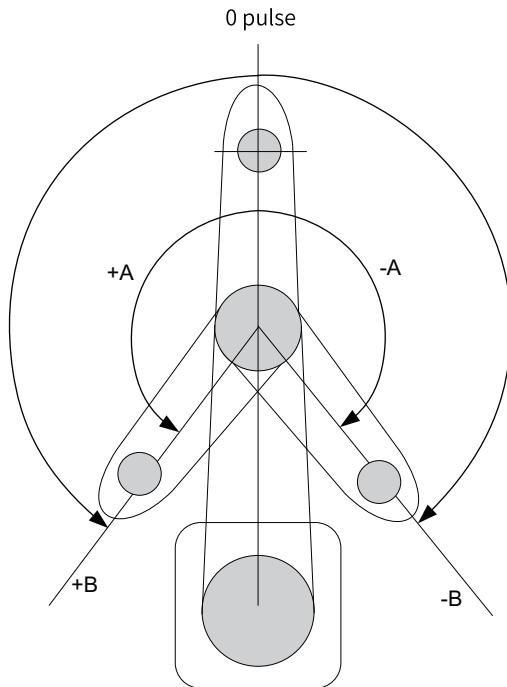
The 0 angle position of J1 refers to the position where the first arm points to the positive direction of the X coordinate axis. From the 0 pulse position, the clockwise angle is positive (+), and the counterclockwise angle is negative (-).



| Model | Maximum Motion Range |
|---------------|----------------------|
| IR-S4-40Z15S3 | $\pm 132^\circ$ |

1.6.2.3 Maximum angle range of joint 2

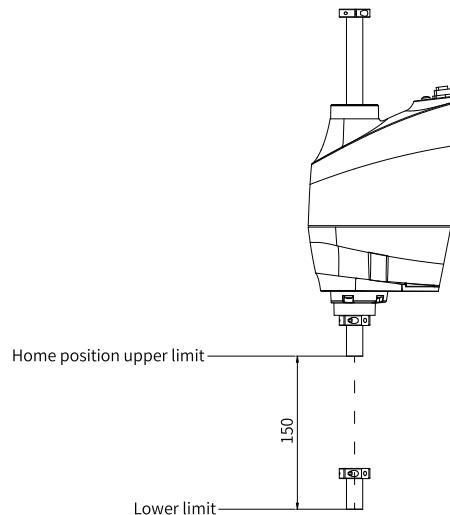
The 0 angle position of J2 refers to the position where the second arm is perpendicular to the first arm. (This is true regardless of the direction of the first arm.) From the 0 angle position, the clockwise angle is positive (+), and the counterclockwise angle is negative (-).



| Model | Maximum Motion Range |
|---------------|----------------------|
| IR-S4-40Z15S3 | $\pm 141^\circ$ |

1.6.2.4 Maximum Stroke of Joint 3

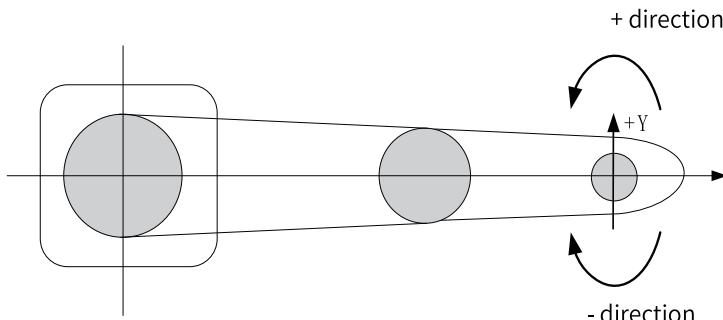
The 0 angle position of J3 is the upper limit position of the axis. When J3 descends from the 0 angle position, it will definitely change to a negative angle value.



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

1.6.2.5 Maximum angle range of joint 4

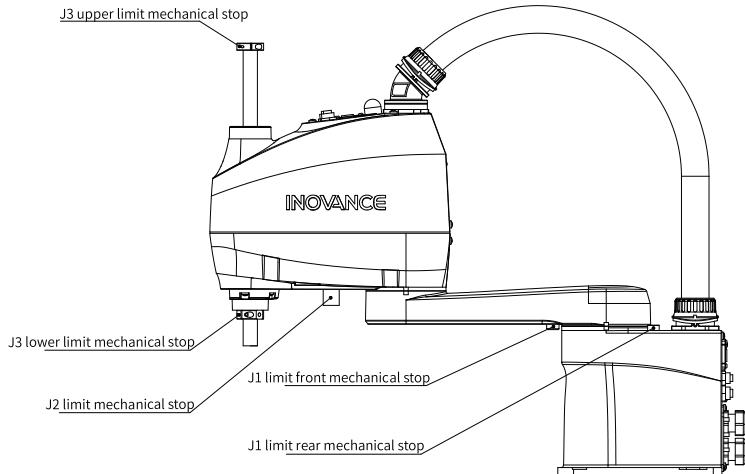
The 0 angle position of J4 is the position where the plane at the top of the axis faces in the direction of the top of the second robot arm. (This is true regardless of the direction of the second arm.) From the 0 angle position, the clockwise angle is positive (+), and the counterclockwise angle is negative (-).



| Model | Maximum Motion Range |
|---------------|----------------------|
| IR-S4-40Z15S3 | $\pm 360^\circ$ |

1.6.3 Description of Mechanical Stops

The robot has mechanical stops at J1, J2 and J3, except J4, and all these mechanical stops are not adjustable. The motion range set by mechanical stops at J1 and J2 is the extreme motion range. The up and down motion range of the mechanical stop at J3 is set by the internal program.



1.6.4 Standard Motion Range

The "motion range" refers to the situation at the standard (maximum) specifications. When motor of each joint is excited, the center of the lowest point of J3 moves in the areas shown in the figure.

"Area limited by mechanical stop" refers to the area where the center of the lowest point of J3 can be moved when the motor of each joint is not excited. "Mechanical stop" mechanically sets the absolute motion range beyond which motion is not allowed.

"Maximum space" is the area that contains the farthest reach of the arms. When an end effector with a radius of 45.5 mm or more is mounted, set the maximum space to the length of the two robot arms plus the radius of the end effector. The motion range is shown below.

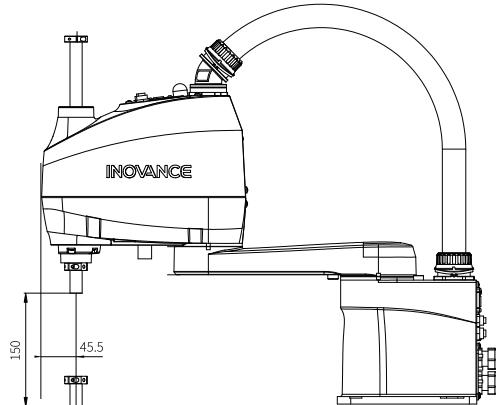


Figure 1-6 Motion range of end effector (unit: mm)

1.7 Maintenance

1.7.1 Safety Instructions for Maintenance and Repair

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



Danger

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not maintain the equipment after power-on. Failure to comply will result in an 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

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

1.7.2 Periodic Inspection Items

Perform periodic inspection on items that are difficult to check during operation. Clear the dust especially metal powders on the surface of the drive to prevent the dust from entering the equipment. Clear the greasy dirt from the cooling fan of the equipment.

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

| Inspec tion Point | Inspec tion Place | Daily In spec tion | Month ly Inspec tion | Quarter ly Inspec tion | Semi- annual Inspec tion | Annual Inspec tion | Maintenance Personnel | | |
|---|---|-----------------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|-----------------------|--------------------------------|----------------------|
| | | | | | | | Profes sionals | Quali fied Person nel | Manu factur er |
| Check wheth er the bolts are loose. If yes, tighten them. | End effec tor mount ing screw | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Robot mount ing bolts | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Each joint | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Bolts aroun d the axes | | | | | ✓ | | ✓ | ✓ |
| | Bolts secur ing the motor, reduc er, etc. | | | | | ✓ | | ✓ | ✓ |
| Check wheth er the connec tor is loose. If yes, push it secure ly or tighten it. | External con nec tors on the robot (on the con nector plates etc.) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Robot cable unit | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

| Inspec tion Point | Inspec tion Place | Daily In spec tion | Month ly Inspec tion | Quarter ly Inspec tion | Semi- annual Inspec tion | Annual Inspec tion | Maintenance Personnel | | |
|---|-------------------------|-----------------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|-----------------------|--------------------------------|----------------------|
| | | | | | | | Profes sionals | Quali fied Person nel | Manu factur er |
| Check for exter nal defects and remove dust. | Whole | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Exter nal cables | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Check for bends or improp er loca tion. Repair or place it proper ly if neces sary. | Safe guard etc. | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Check tension of timing belt. Tight en it if neces sary. | Inside arm #2 | | | | ✓ | ✓ | ✓ | ✓ | ✓ |

| Inspec tion Point | Inspec tion Place | Daily In spec tion | Month ly Inspec tion | Quarter ly Inspec tion | Semi- annual Inspec tion | Annual Inspec tion | Maintenance Personnel | | |
|--|--|-----------------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|-----------------------|--------------------------------|----------------------|
| | | | | | | | Profes sionals | Quali fied Person nel | Manu factur er |
| Check if the lubricating grease is sufficient for lubrication, and add an appropriate amount of lubricating grease as need ed. | Ball screw | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Spline | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Polish ed rod lubri cation inspec tion place | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| | | | | | | | | | |

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

| Inspec tion Point | Inspec tion Place | Daily Inspec tion | Month ly Inspec tion | Quar terly Inspec tion | Semi- annual Inspec tion | Annual Inspec tion | Maintenance Personnel | | |
|---|--|-------------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|-----------------------|--------------------------------|----------------------|
| | | | | | | | Profes sionals | Quali fied Person nel | Manu factur er |
| Shake the cable gently by hand to check for wire break age. | Exter nal cables (includ ing cable units of the robot) | | | | ✓ | ✓ | | ✓ | ✓ |
| Press each arm by hand in the ena bled state to check wheth er the arms shake. | Each joint | | | | | ✓ | | ✓ | ✓ |

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

| Inspec tion Point | Inspec tion Place | Daily Inspec tion | Month ly Inspec tion | Quar terly Inspec tion | Semi- annual Inspec tion | Annual Inspec tion | Maintenance Personnel | | |
|--|-------------------------|-------------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|-----------------------|--------------------------------|----------------------|
| | | | | | | | Profes sionals | Quali fied Person nel | Manu factur er |
| Check the motion range. | Each joint | | | | | ✓ | | ✓ | ✓ |
| Check whether unusual sound or vibration occurs. | Whole | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Measure the accuracy repeatedly by a gauge. | Whole | | | | | ✓ | | ✓ | ✓ |

1.7.3 Component Replacement

1.7.3.1 Note

- Be sure to cut off the power supply before installing or removing the motor connector; otherwise it may cause abnormal action of the robot or electric shock.
- Do not maintain the equipment after power-on. Failure to comply will result in an electric shock.
- Prevent foreign objects from entering the equipment and terminals during maintenance.

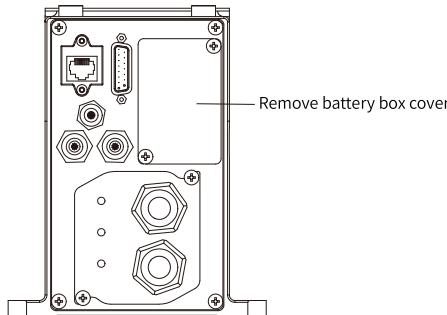
1.7.3.2 Replacing Battery

Warning

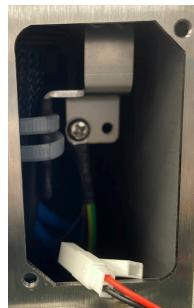
- Do not maintain the equipment after power-on. Failure to comply will result in an electric shock.
- When disposing the battery, consult with the professional disposal services or comply with the local regulation.
- Be sure to use lithium batteries correctly, the wrong way of use may lead to lithium battery heat, leakage, explosion or even fire, resulting in serious damage to personal and property safety.
- Do not charge the lithium battery.
- Do not pressurize or deform the lithium battery.
- Do not disassemble the lithium battery.
- Do not short-circuit or misconnect the lithium battery.
- Do not heat the lithium battery.
- Do not put the lithium battery into fire.
- Do not solder the battery terminals.
- Do not force discharge the lithium battery.

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

1. Remove the two M4x8 screws from the battery box cover.



2. Connect the new battery to the empty white 2P cable end connector.



3. Remove the old battery.
4. Fix the new battery on the battery box cover, and then secure the cover to the base with the M4*8 screws.

Note

If the home position is lost due to failure to comply with the preceding steps, see ["1.7.4.1 Description of Home Position Calibration" on page 46](#).

1.7.3.3 Replacing Cable

1. Loosen the fixing screw with a cross wrench, rotate the cable board by a certain angle and then take out the cable board.
2. Replace the damaged cable.
3. Rotate the cable board to the fixing hole and tighten the screw.

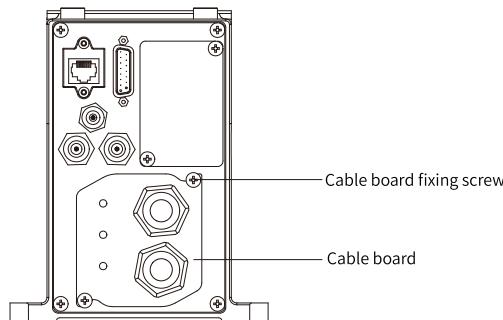


Figure 1-7 Base cable board

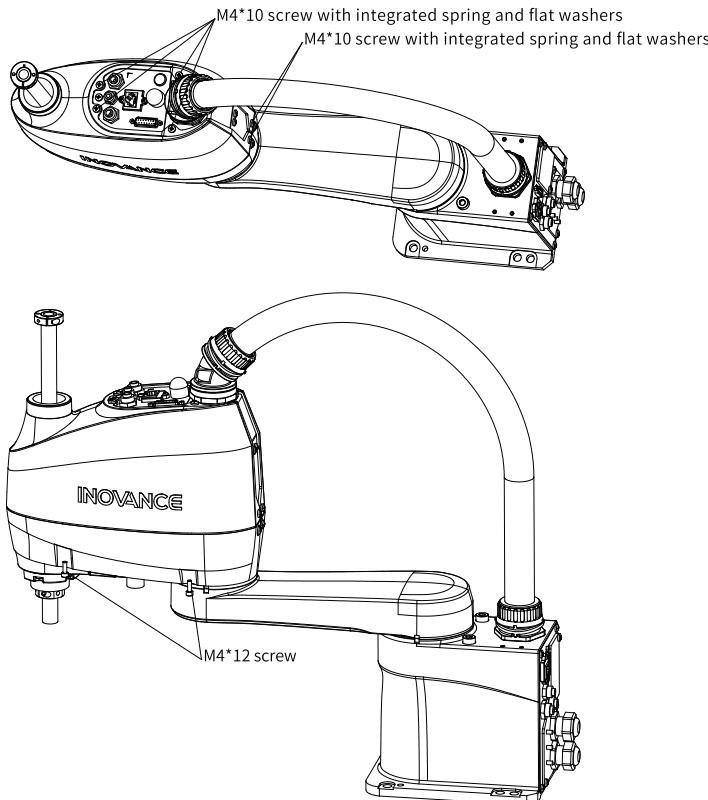
Caution

- Do not pull the cable board forcibly. Failure to comply will result in cable damage, wire breaking, or poor contact, causing electric shock or system fault.
- After removing the cable board, ensure that the cables are correctly connected during cable maintenance.

1.7.3.4 Replacing Enclosure

Removing the enclosure of the forearm

Remove the six M4*10 screws on the enclosure and sheet metal, and then remove the four M4*12 screws connecting the enclosure and the forearm.



Installing the enclosure of the forearm

1. Install the enclosure onto the forearm. Pay attention to the positioning columns and holes between the enclosure and the forearm to ensure that the mounting surface of the enclosure fits seamlessly with the mounting surface of the forearm and sheet metal.
2. Install the six M4*10 screws on the enclosure and sheet metal, with a torque of 0.6 N.m.
3. Install the four M4*12 screws connecting the enclosure to the forearm, with a torque of 0.6 N.m.

1.7.4 Home Position Calibration

1.7.4.1 Description of Home Position Calibration

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

Note

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



Warning

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

1.7.4.2 Home Position of Each Joint

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

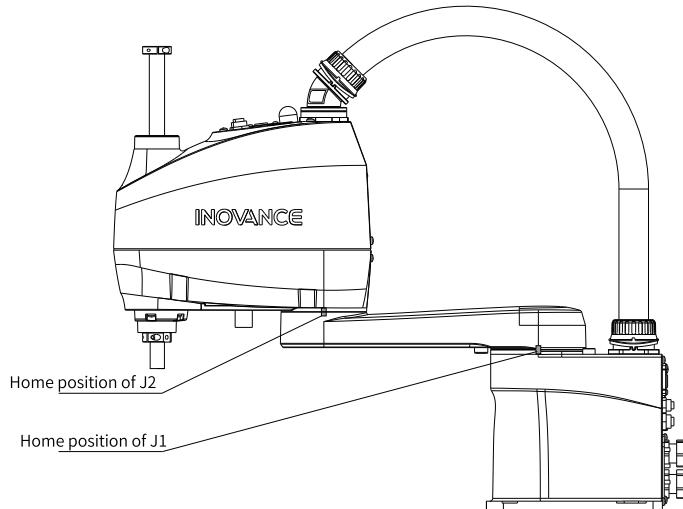


Figure 1-8 Home position of J1/J2

2. Home position of J3: The upper limit position of the J3.

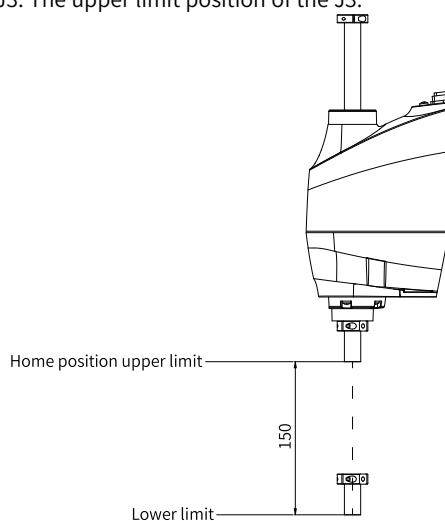


Figure 1-9 Home position of J3

3. Home position of J4: The position where the plane of the axis (or the slots of the upper and lower mechanical stops) faces the direction of the top of the second robot arm.

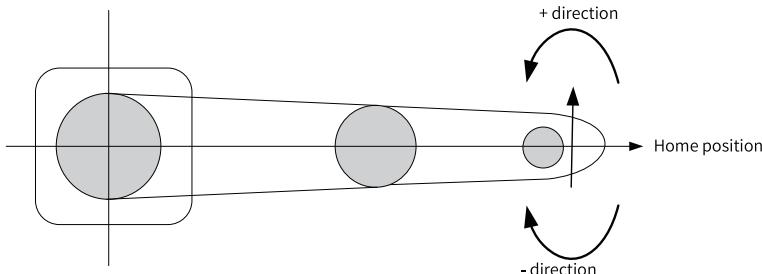


Figure 1-10 Home position of J4

1.7.4.3 Home Position Calibration of Joints 1 and 2

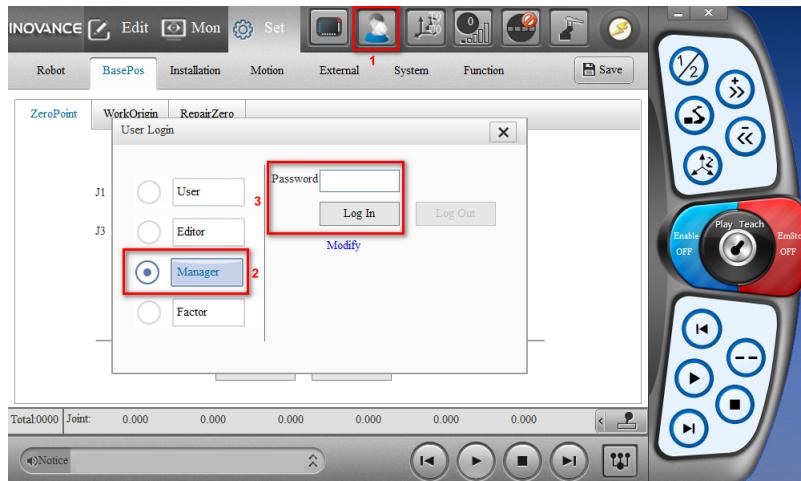
Both the teaching software on PCs and the hand-held teach pendant provide an operation interface for home position calibration. The following takes the teaching software on PC as an example. The operations on the hand-held teach pendant are similar.

Due to the strong correlation between the coordinates of the robot's work points and the accuracy of J2, it is necessary to complete the home position calibration of J2 before calculating the robot coordinates. The teach pendant provides a right/left wrist rule wizard. Follow the wizard to calibrate the home position.

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

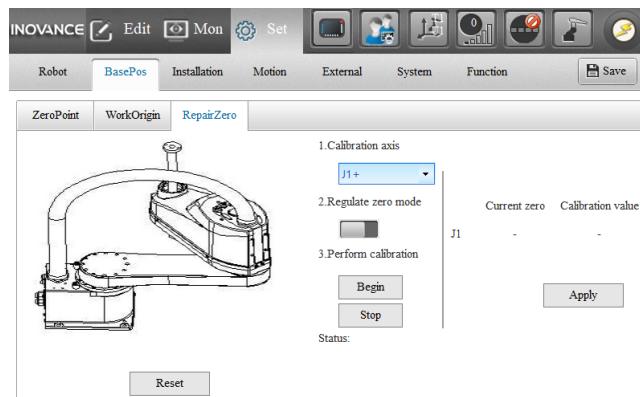
1. Log in to the user account.

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



2. Switch to the calibration interface.

Choose **Set > BasePos > RepairZero** on the main interface of the teaching software or the hand-held teach pendant.



3. Choose the calibration axis.

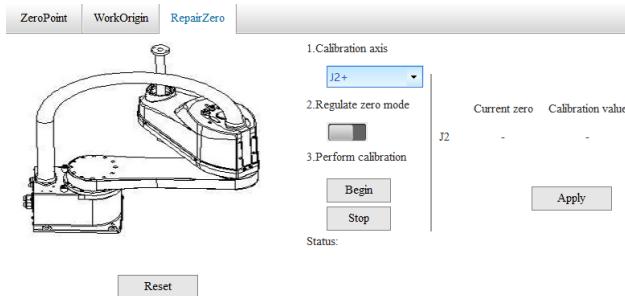
Choose the axis you want to calibrate from the **Calibration axis** drop-down list.

- The zeroing motion direction of all axes is positive.
- Caution: When switched to zeroing mode, the robot servo will be automatically enabled.
- If the multi-turn value of the encoder exceeds 2000, a warning pops up and emergency stop is triggered. In this case, you need to restart the controller and perform calibration again.

4. Perform calibration.

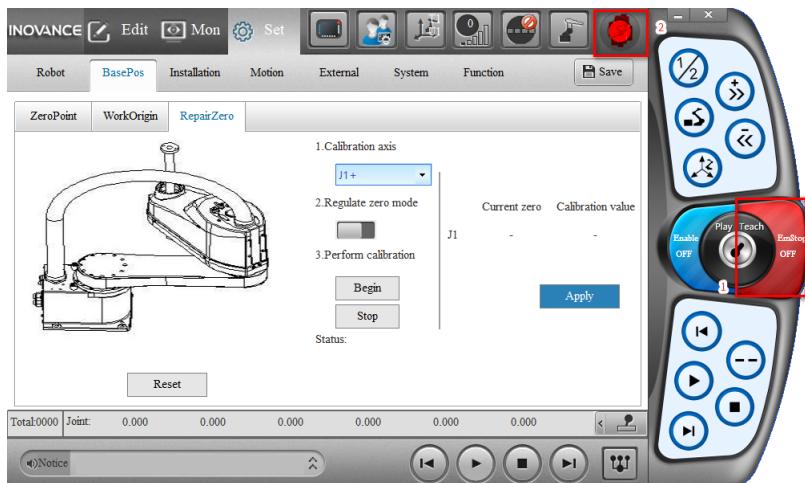
For example, select J2+ axis and click **Begin** to start calibration.

When the calibration is complete, the calibration value is updated.



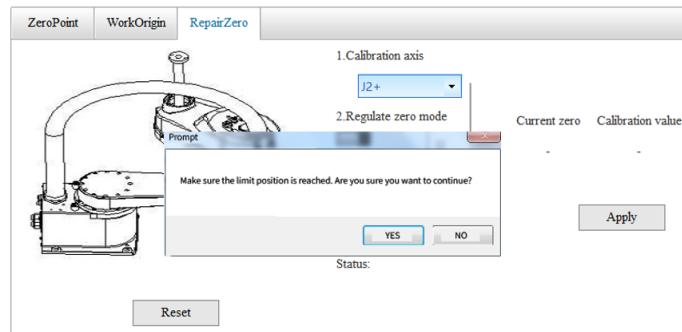
5. Switch to the emergency stop state.

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

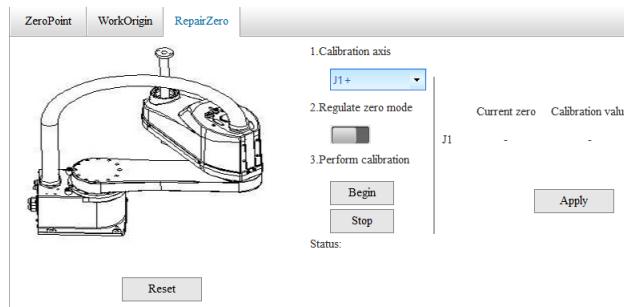


6. Update the zero point.

- Click **Apply**.



b. In the pop-up dialog, click **Yes**. The "Current zero" is replaced by "Calibration value".



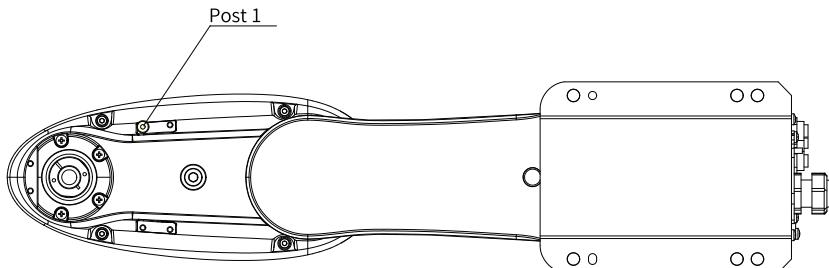
7. Check the zero point.

After updating the system zero point, check the result.

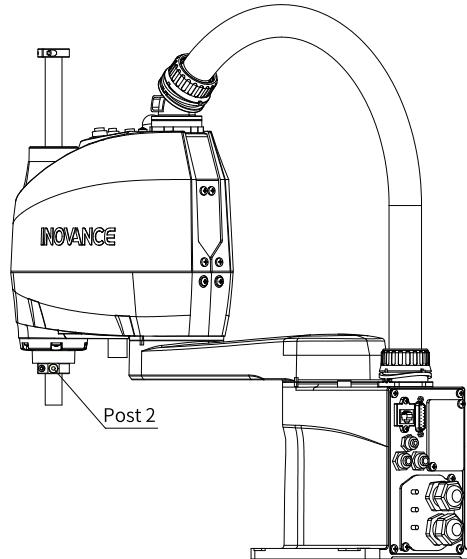
Recommended method: Teach a point, change the left and right hand parameters, and then observe the deviation of the center of the lead screw moving to that point.

1.7.4.4 Home Position Calibration of Joints 3 and 4

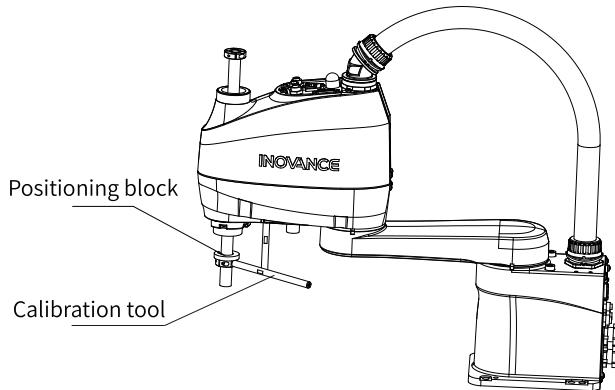
1. Fix the threaded end of the post 1 to the M4 threaded hole at the bottom of the forearm, as shown in the following figure:



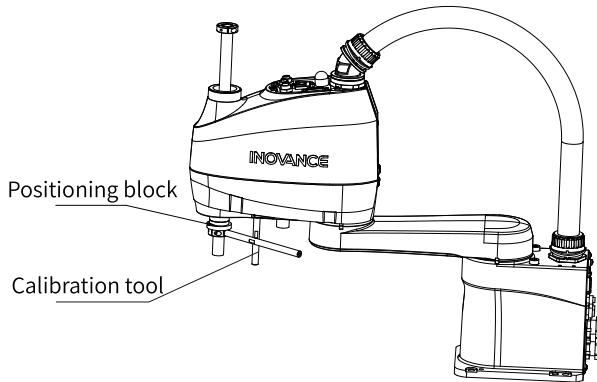
2. Fix the threaded end of the post 2 to the M5 threaded hole of the limit ring of the lead screw, as shown in the following figure:



3. Rotate the post 2 in the positive direction until it contacts the post 1. Then, assemble the positioning block onto the lead screw, as shown in the following figure:



4. Press the brake button and push the lead screw upwards until the positioning block contacts the lower end of the spline nut, as shown in the following figure. For other operations, refer to the automatic calibration steps. Select "J3J4+" when selecting the calibration axes to complete the calibration.



1.7.5 Options

| Name | Code | Description | Diagram (in mm) |
|---------------------------------|----------|--|---|
| Protective cover for lead screw | 20212980 | Mounted on the manipulator to protect the lead screw | / |
| Calibration tool | 32020626 | Used to calibrate the home position of J3 and J4 | <p>Technical drawing of Post 1 calibration tool. Dimensions shown: height 3.465, diameter 3.2, width 70, and a 120° angle.</p> |
| | 32020627 | | <p>Technical drawing of Post 2 calibration tool. Dimensions shown: height 3.465, diameter 3.2, width 145, and a 120° angle.</p> |
| | 32040084 | Positioning block | <p>Technical drawing of the positioning block. Dimensions shown: height 16.2, width 30, and a 7 ± 0.05 mm slot.</p> |

2 IR-S7 Series SCARA Robot User Guide - Manipulator

2.1 Preface

Introduction

With a maximum payload of 7 kg and a Z-axis stroke of 200 mm, the robot can be widely used in loading and unloading, precision assembly, handling, dispensing, gluing, screw tightening, labeling, material insertion, and sorting. The robot can be used in high-load occasions, such as handling of large parts, machine loading and unloading, machine assembly, industrial parts transfer, and other occasions. It is suitable for new energy, 3C and food packaging industries.

This guide describes the basic specifications, installation, and maintenance of the product.

Audience

Mechanical engineers

Electrical engineers

System engineer

More Documents

| Data Name | Data Code | Description |
|--|------------|---|
| IRCB500 Series Robot Controller User Guide | PS00001641 | This guide describes the specifications, installation, wiring and more of the IRCB500 series controller. |
| IRP80 Series Teach Pendant User Guide | 19010502 | This guide describes the basic information, cable connection, operations and more of the IRTP80 series teach pendant. |

Revision History

| Date | Version | Description |
|---------------|---------|--|
| August 2023 | A01 | <ul style="list-style-type: none">• Updated technical data including rated load, manipulator weight, and cycle time.• Modified the outline dimensions |
| November 2022 | A00 | First release. |

Document Acquisition

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

- Visit <http://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.

Warranty

Inovance provides warranty service within the warranty period (as specified in your order) for any fault or damage that is not caused by improper operation of the user. You will be charged for any repair work after the warranty period expires.

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

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

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

For details, see the Product Warranty Card.

2.2 Product Information

2.2.1 Nameplate and Model Number

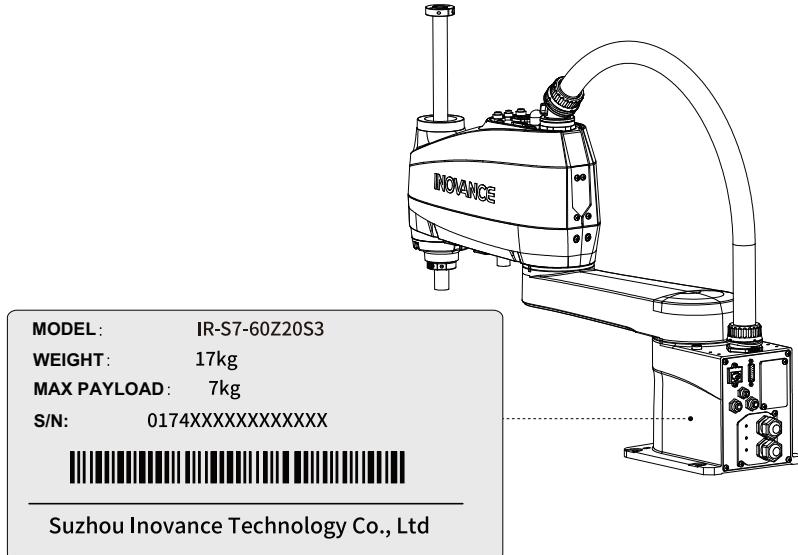


Figure 2-1 Nameplate



Do not wipe the robot hard with alcohol or benzene, as this may cause the gloss of the painted surface to deteriorate.

IR- S 7 - 50 Z20S3
① ② ③ ④ ⑤ ⑥⑦

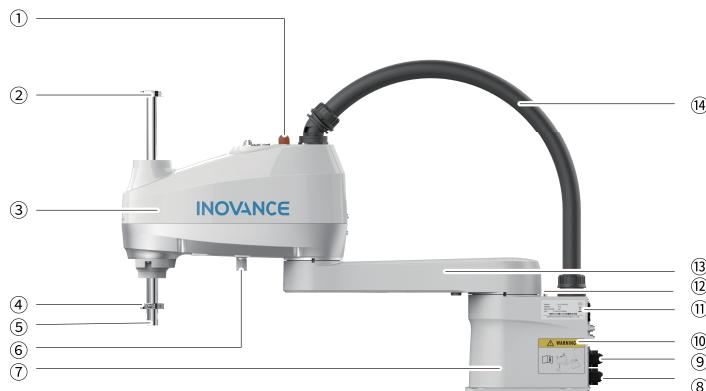
Figure 2-2 Model number

| | | |
|--|--|--|
| ① Family INOVANCE Robot | ④ Arm Length 50: 500 mm 60: 600 mm 70: 700 mm | ⑦ Cable Length 0: No drag cable 3: 3 m standard cable 5: 5 m standard cable G3: 3 m highly flexible cable |
| ② Serial Number S: SCARA robot R: 6-axis robot TS: Ceiling-mounted SCARA robot | ⑤ Max. Z-axis Stroke (empty for models without lead screw) Z20: Max. 200 mm stroke | - |
| ③ Load 4: 4 kg 7: 7 kg 10: 10 kg | ⑥ Mounting Mode C: Cleanroom S: Standard P: Protection | - |

Note

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

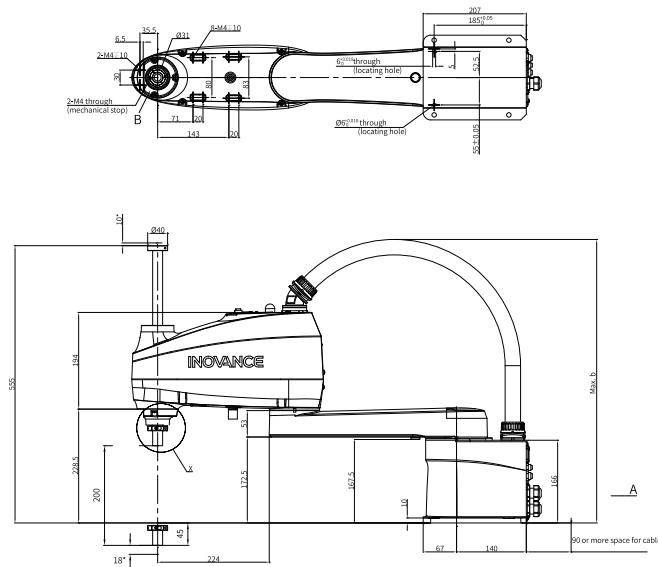
2.2.2 Components



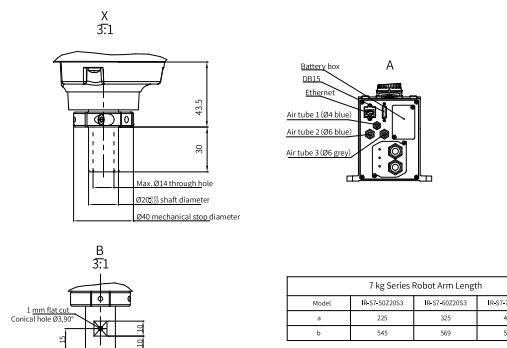
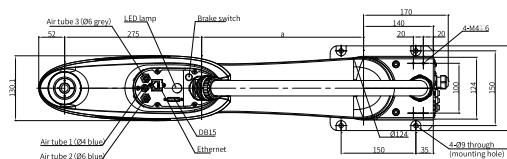
| No. | Description |
|-----|--------------------------|
| 1 | Run indicator |
| 2 | J3 upper mechanical stop |

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

2.2.3 Dimensions



(*) indicates the stroke margin by mechanical stop



2.2.4 Specifications

| Item | | IR-S7-50Z20S3 | IR-S7-60Z20S3 | IR-S7-70Z20S3 |
|--------------------------------|-------------------------|--|------------------------|------------------------|
| Arm length | Arm 1 + Arm 2 | 500 mm | 600 mm | 700 mm |
| | Arm 1 | 225 mm | 325 mm | 425 mm |
| | Arm 2 | 275 mm | 275 mm | 275 mm |
| Max. speed*1 | J1 + J2 | 7120 mm/s | 7850 mm/s | 8590 mm/s |
| | J3 | 1600 mm/s | 1600 mm/s | 1600 mm/s |
| | J4 | 2000°/s | 2000°/s | 2000°/s |
| Repeatability | J1 + J2 | ±0.02 mm | ±0.02 mm | ±0.02 mm |
| | J3 | ±0.01 mm | ±0.01 mm | ±0.01 mm |
| | J4 | ±0.01° | ±0.01° | ±0.01° |
| Handling capacity (load) | Rated | 3 kg | 3 kg | 3 kg |
| | Maximum | 7 kg | 7 kg | 7 kg |
| Allowable inertia moment of J4 | Rated | 0.01 kg.m ² | 0.01 kg.m ² | 0.01 kg.m ² |
| | Maximum | 0.12 kg.m ² | 0.12 kg.m ² | 0.12 kg.m ² |
| Mounting hole | | 150x150 mm (4-ø9 mm) | | |
| Weight (excluding cables) | | 17 kg | 17.5 kg | 19 kg |
| Press-in force of J3 | | 150 N | 150 N | 150 N |
| Signal line | | 15 (15pin: D-sub) CAT5E | | |
| Air tube | | 2x Ø6 mm, 0.59 Mpa 1x Ø4 mm, 0.59 Mpa | | |
| Environmental conditions | Ambient temperature [1] | 5°C to 40°C | | |
| | Relative humidity | 10% to 80% RH | | |
| Noise level [2] | | Laeq=70 dB(A) | | |
| Maximum Motion Range | J1 | ±132° | ±132° | ±132° |
| | J2 | ±150° | ±150° | ±150° |
| | J3 | 200 mm | 200 mm | 200 mm |
| | J4 | ±360° | ±360° | ±360° |
| Cycle time*1 [3] | | 0.351s | 0.360s | 0.375s |

[1] When used in a low-temperature environment approximating the lowest allowable temperature, or when idle for a long period of time due to holidays and nighttime, it is recommended to warm up the product for 10 minutes before operating it.

[2] Measured in front of the robot at a distance of 1000 mm from its operating area and at least 50 mm above the base mounting surface with four joints operating at 100% speed and acceleration and rated load, with a duty cycle of 50%.

[3] Time required for a robot to move a 2 kg payload between two points 300 mm apart at a height of 25 mm.

2.3 Preparation

2.3.1 Requirements Installation Personnel

Ensure that the installation personnel have obtained mechanics knowledge or received mechanics training in advance to understand various dangers and risks in the installation process.

The installation personnel must be familiar with all the installation requirements and related technical documents.

Non-professionals are strictly prohibited from product installation, wiring, maintenance, inspection and part replacement.

2.3.2 Requirements on Installation Environment

General environmental requirements

Set up the robot system in an environment that complies with the following conditions in order to maximize and maintain the performance of the equipment and to use it safely.

Table 2-1 Environmental conditions

| Item | Requirement |
|---|--|
| Operating temperature and humidity | 5°C to 40°C, 10% to 80%RH, non-condensing |
| Storage temperature and humidity | -10°C to 55°C, ≤80%RH, non-condensing |
| Transportation temperature and humidity | -10°C to 55°C, ≤80%RH, non-condensing |
| EFT/B immunity | 2 kV or less |
| Static immunity | 6 kV or less |
| Environment | <ul style="list-style-type: none"> • Install indoors • Keep away from direct sunlight • Keep away from dust, oil smoke, salt, iron filings • Keep away from flammable and corrosive liquids and gases • Keep away from water • Avoid places with shocks or vibrations • Keep away from sources of electrical interference |

Special environmental requirements

- The surface of the robot provides certain protection. However, contact your provider and confirm in advance if the robot may come into contact with special liquid or gas during use.
- There may be condensation inside the robot if it is used in an environment with large changes in temperature and humidity. Please consult your provider.
- If you want to use the robot to handle food directly, please consult your provider in advance to avoid contamination of the food by the robot.



Caution

Do not wipe the robot hard with alcohol or benzene, as this may cause the gloss of the painted surface to deteriorate.

2.3.3 Requirements on Mounting Stand

You need to make a stand for fixing the robot. The shape and size of the stand vary depending on the purpose of the robot system. Requirements on the stand are listed as follows for your reference during design.

- The stand supports not only the weight of the robot, but also the dynamic forces generated by the robot when it moves at maximum acceleration. Ensure that the stand has sufficient bearing capacity by using the transverse beam and other reinforcement materials.
- The torque and reaction force generated by the robot action are described in the table below:

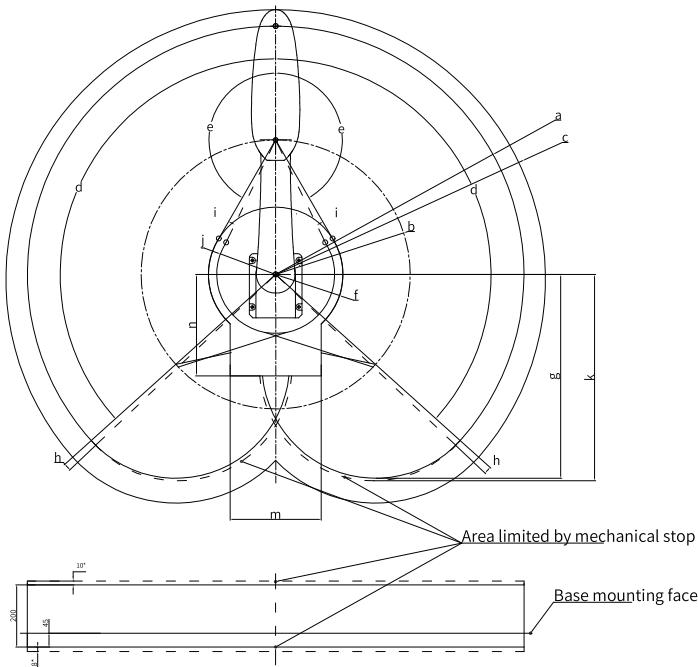
| Type | Size |
|--|---------|
| Maximum torque in horizontal plane | 350 N·m |
| Maximum reaction force in horizontal direction | 1700 N |
| Maximum reaction force in vertical direction | 1500 N |

- The threaded holes on the stand for mounting the manipulator are M12. Use screws conforming to the strength of GB/T 3098.1 class 10.9 or 12.9. For details about the dimensions, see ["2.2.3 Dimensions" on page 59](#).
- The plate for the robot mounting face should be 20 mm thick or more and made of steel to reduce vibration. The surface roughness of the steel plate should be 25 μm or less.
- Fix the stand firmly on the ground or wall.
- Keep the Z-axis of the robot perpendicular to the horizontal plane during installation.

- When using a level for height adjustment of the stand, use screws with a diameter larger than M8.
- When cutting holes in the stand for passing cables, ensure that the diameter of the holes is not less than 60 mm.
- Take the storage space of the controller into account when designing the stand. Please see the user guide of the controller for detailed data.

2.3.4 Requirements on Installation Space

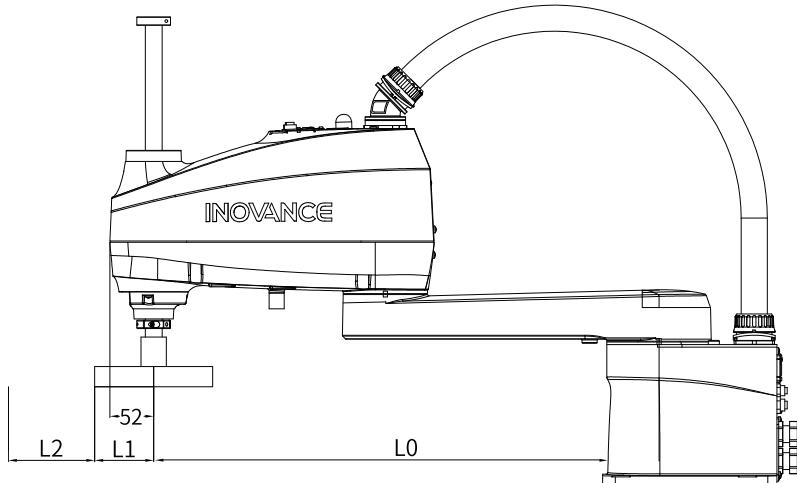
Motion range of standard model (mm)



| Motion range of 7 kg series robots with different arm lengths | | | |
|---|---------------|---------------|---------------|
| Model | IR-S7-50Z20S3 | IR-S7-60Z20S3 | IR-S7-70Z20S3 |
| a. Length of arm 1 + length of arm 2 (mm) | 500 | 600 | 700 |
| b. Length of arm 1 (mm) | 225 | 325 | 425 |
| c. Maximum motion range (mm) | 552 | 652 | 752 |
| d. Motion range of J1 (°) | | 132 | |
| e. Motion range of J2 (°) | | 150 | |
| f. Motion range (mm) | 138.1 | 162.6 | 232 |
| g. Rear motion range (mm) | 425.6 | 492.5 | 559.4 |
| h. Angle of mechanical stop position of J1 (°) | | 1 | |
| i. Angle of mechanical stop position of J2 (°) | 1 | 3 | 4 |
| j. Range of mechanical stop position (mm) | 134.2 | 148.3 | 214.8 |
| k. Range of rear mechanical stop position (mm) | 428.5 | 496.7 | 564.9 |
| m. Motion range (mm) | 240 | 220 | 220 |
| n. Motion range (mm) | | 245 | |

Maximum range

The "maximum range" is the range where the robot arm may cause interference. When an end effector with a radius of 52 mm or more is mounted, set the maximum range to the length of the two robot arms plus the radius of the end effector.



- L0: Length of the robot arms
- L1: Radius of the end effector
- L2: Safety space

The safety distance should be greater than $L0+L1+L2$.

2.3.5 Installation Tools

Table 2-2 Installation tools

| Tool | Quantity (PCS) |
|---------------------------|----------------|
| M8 outer hexagon wrench | 1 |
| Scissors or utility knife | 1 |
| Nail hammer | 1 |
| Straight screwdriver | 1 |
| Protective gloves | 1 |
| Safety shoes | 1 |
| Hoisting sling | 1 |
| Forklift | 1 |

2.4 Unpacking and Handling

2.4.1 Notes



Caution

Check whether the packing is intact and whether there is damage, water seepage, damp, and deformation.

Unpack the package by following the package sequence. Do not hit the package with force.

Check whether there are damage, rust, or injuries on the surface of the equipment or equipment accessories.

Check whether the number of packing materials is consistent with the packing list.



Warning

Do not install the equipment if you find damage, rust, or indications of use on the equipment or accessories.

Do not install the equipment if you find water seepage, component missing or damage upon unpacking.

Do not install the equipment if you find the packing list does not conform to the equipment you received.

Unpack the packing box according to the direction instructed.

 **Danger**

Only qualified personnel are allowed to carry out transportation including rigger operation, hoisting by crane, and forklift driving.

 **Warning**

- Transport the equipment with a hoist or forklift with the original package.
- Wear personal protective equipment (PPE) during transportation with a hoist or forklift. Prohibit any personnel to stand or stay in the transportation route.
- Stabilize the equipment with hands when hoisting it. Unstable hoisting may result in the equipment falling over. This may cause severe bodily injury or equipment damage.

 **Caution**

- Store and transport this equipment based on the storage and transportation requirements for humidity and temperature.
- Avoid transporting the equipment in environments such as water splashing, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- Never transport this equipment with other equipment or materials that may harm or have negative impacts on this equipment.
- If condensation occurs on the device during transportation or storage, remove the condensation before turning on the power.

2.4.2 Unpacking

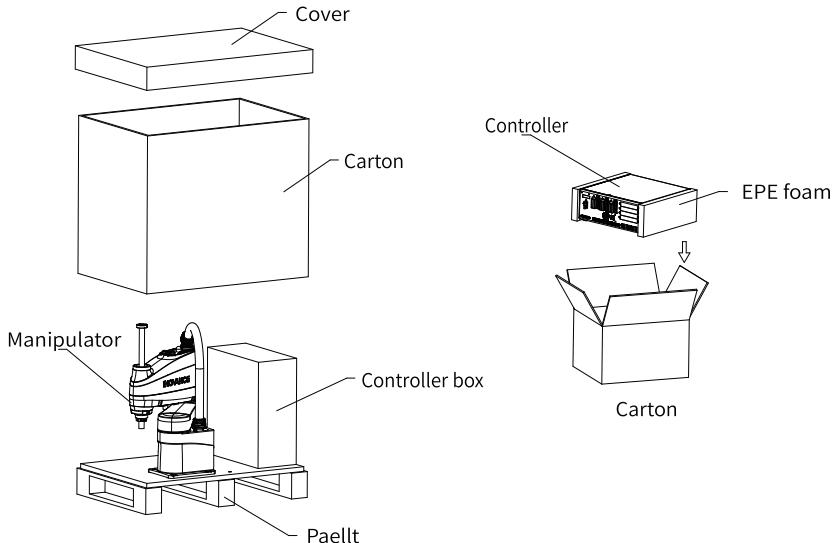
Unpacking procedure:

1. Unpack the carton.

Cut the PET tape using scissors or a utility knife, and remove the cover of the carton and the paper corner protectors. Move the carton from bottom to top and remove it.

 **Caution**

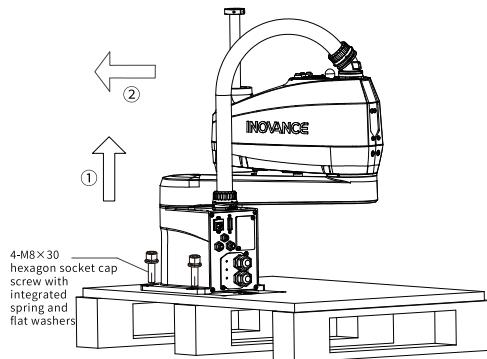
Wear gloves to prevent scratches.



2. Remove the manipulator from the pallet.

Remove bolts connecting the manipulator and the pallet using the M8 outer hexagon wrench.

Take out the manipulator by lifting it from bottom to top, and moving it horizontally.



 **Caution**

- Stabilize the robot when removing the bolts fixing the manipulator to avoid bodily injury or equipment damage caused by titling of the equipment due to unstable center of gravity.
- To repack the robot, reverse the steps above.
- Take out the robot carefully to avoid collision.

2.4.3 Handling

Pre-Handling Preparation

1. For a newly shipped robot, move it in the posture as it was delivered.
2. If you want to relocate a robot that is already in use, do the following before moving it:
 - Disconnect all power supplies of the equipment.
 - Disconnect the power and signal cables from the controller
 - Remove the bolts fixing the robot to the base and then remove the robot from the installation base.
 - Secure the robot to the transportation equipment.

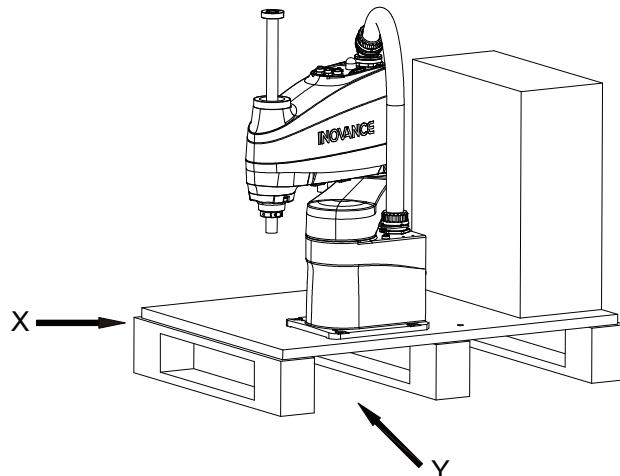
Handling Procedure

Transportation by hands

When transporting the robot, fix the robot on the transportation equipment or support the second robotic arm and the bottom of the base with hands. At least two people are required for the operation.

Handling with forklift

Secure the robot to a pallet or base plate with sufficient load capacity with bolts. Insert the fork of the forklift into the pallet to transport it together with the robot. Transport the robot slowly to prevent it from titling or falling over.



Note

- The robot is located on one side of the pallet. Therefore, when inserting the fork from the Y direction, pay attention to the counterweight on the other side to prevent the robot from falling over.
- Do not pull the cables of the robot to avoid possible damages.

2.5 Installation

2.5.1 Installation Precautions

Danger

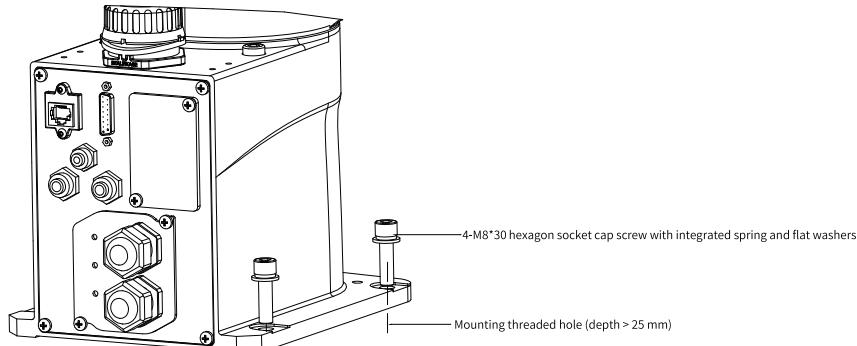
- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Install a safety fence for the system. Failure to comply will result in serious accidents.
- Reserve sufficient space between the equipment and surrounding buildings, structural parts, and devices. Failure to comply may cause serious injury or major damage.
- Fix the robot body before turning on the power or operating the system. Otherwise, the robot body may fall over and cause serious injury or major damage.

Warning

- Do not modify the equipment.
- Do not install this equipment in places with strong electric or magnetic fields.
- When removing the mounting screws of the robot body, hold the robot to prevent it from toppling over.
- For the tabletop mounting, at least two people are required for the operation.

2.5.2 Installing Manipulator

Secure the robot base to the stand with four M8x30 screws conforming to the strength of GB/T 3098.1 class 10.9 or 12.9, as shown below.

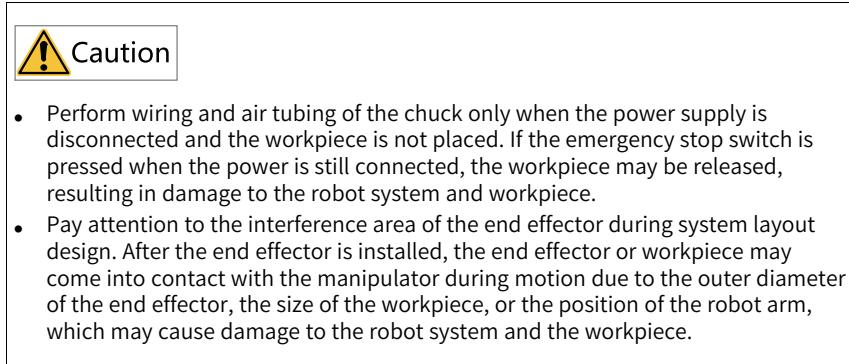


Check that the screws are tightened referring to the following recommended torque.

| Nominal Screw Diameter (10.9 or higher) | Installation Torque |
|---|---------------------|
| M8 | 30 N·m |

2.5.3 Installing End Effector

Users need to make their own end effectors. Before attaching an end effector, observe the following guidelines.



Design your own end effector mounting method with reference to the following dimensions. The weight of the end effector should not exceed 7 kg, as shown in the figure below.

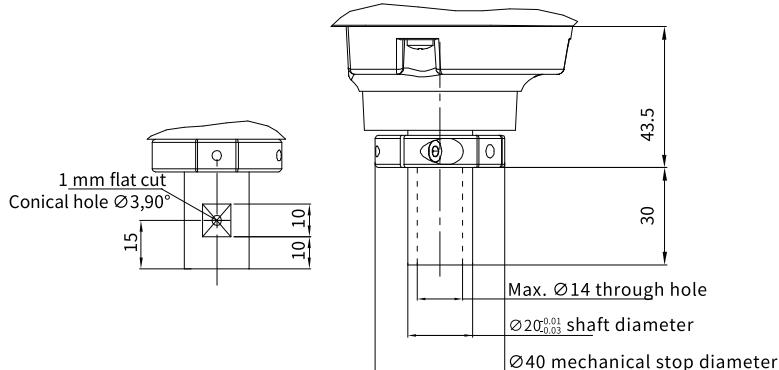


Figure 2-3 End effector mounting dimensions (in mm)

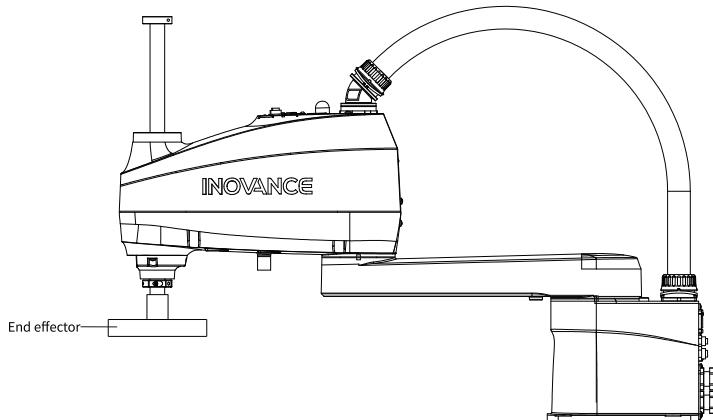


Figure 2-4 Installing the end effector

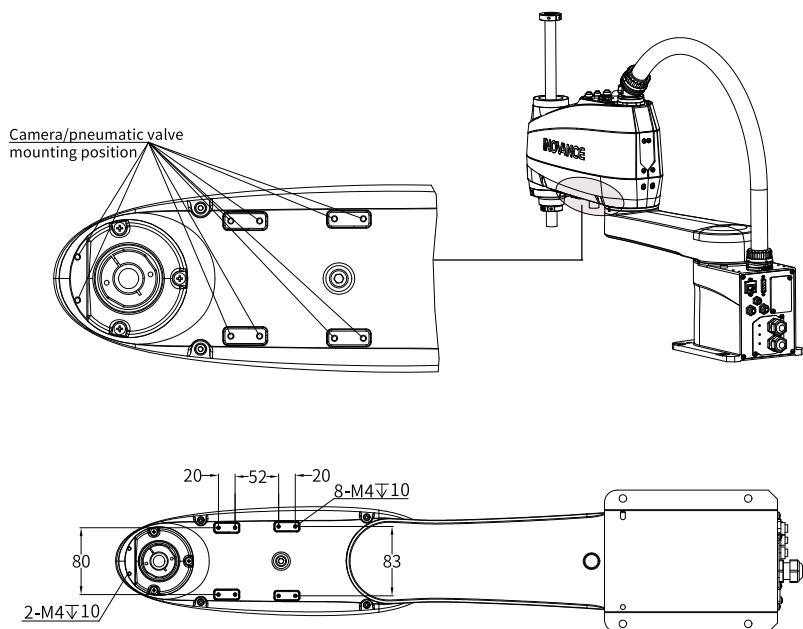
To move J3 up or down when installing the end-effector, turn on the power of the controller and move the joint up/down or rotate the joint while pressing the brake release switch. This switch is a momentary type switch that releases the brake only during the time it is pressed.

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

Note To avoid contact between the end effector and the robot due to the outer diameter of the end effector, the size of the workpiece, or the position of the robot arm, stop operating the robot when installing the end effector. Pay attention to the interference area of the end effector during system layout design. See the maximum area in ["2.3.4 Requirements on Installation Space" on page 64](#).

2.5.4 Installing Camera and Pneumatic Valve

The robot provides mounting holes for the camera and pneumatic valve at the bottom of the second arm, as shown in the following figure.



2.5.5 Cable Connection



Danger

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Cut off the power before wiring. Failure to comply will result in electric shock or system fault.
- Before wiring, cut off all equipment power supplies. Residual voltage exists after power cut-off. Therefore, wait at least 10 minutes before further operations.
- Ensure that the safety input signals, such as the emergency stop switch and safety door switch are connected correctly before wiring. Otherwise, the safety protection will not work properly in emergency cases, causing serious injury or damage.
- Make sure that the equipment is well grounded. Failure to comply will result in an electric shock.
- During wiring, follow the proper electrostatic discharge (ESD) procedure, and wear an antistatic wrist strap. Failure to comply will damage the equipment or the internal circuits of the equipment.



Warning

- Connect the cables securely. 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.

Connect the power cable and signal cable to the controller.

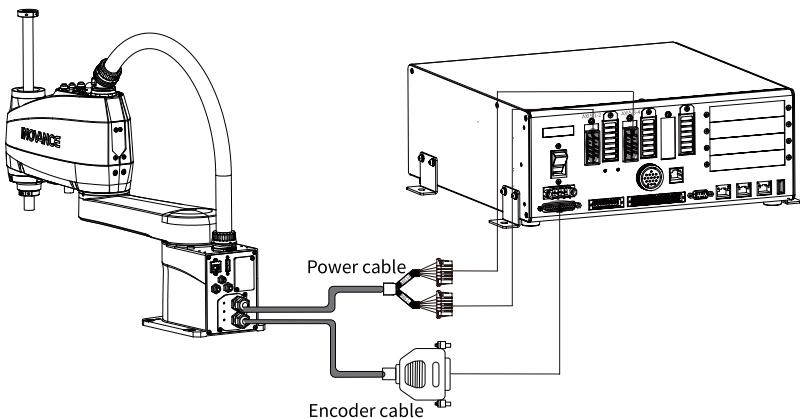
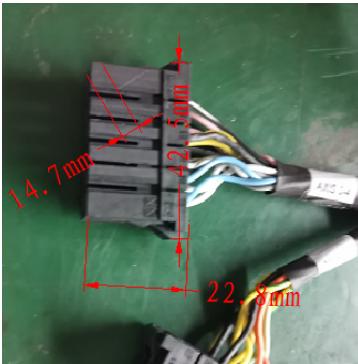
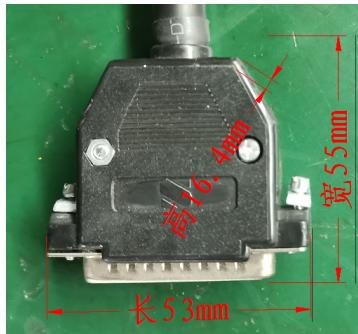
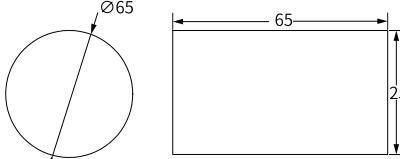
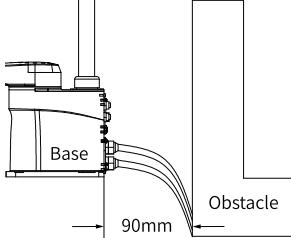


Figure 2-5 Cable connection

Table 2-3 Cable hole dimensions (IRCB500 drive-control integrated controller)

| Name | Power Cable Connector (Controller Side) | Encoder Cable Connector (Controller Side) |
|------------|---|--|
| Dimensions | 42.5 mm x 22.8 mm x 14.7 mm (L x W x H)  | 53 mm x 55 mm x 16.4 mm (L x W x H)  |

Recommended minimum hole size and reserved space for cables (red frame is recommended size).

| Hole size (round hole & square hole) (mm) | Space reserved for the manipulator cable (connector size+cable bending radius) |
|---|---|
|  |  |

2.5.6 Wiring and Tubing



Danger

Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.

Wiring (Electrical Wires)



Warning

Current higher than 0.5 A is not allowed.

| Model | Allowable current | Number of cores | Diameter | Remarks |
|-------|-------------------|-----------------|----------|-------------------------------------|
| DB15 | 0.5 A | 15 | 24AWG | Wire connector provided as standard |

Note

Use connectors with the same pin number on both ends of the cable. The robot is shipped with wiring ready for the user.

Communication cable requirements

Use the Cat5 shielded twisted pair cable for external and built-in network cables, with a maximum communication rate of 1000 bit/s, which can meet the communication requirements of industrial cameras and other devices.

Tubing (Air Tubes)

Note

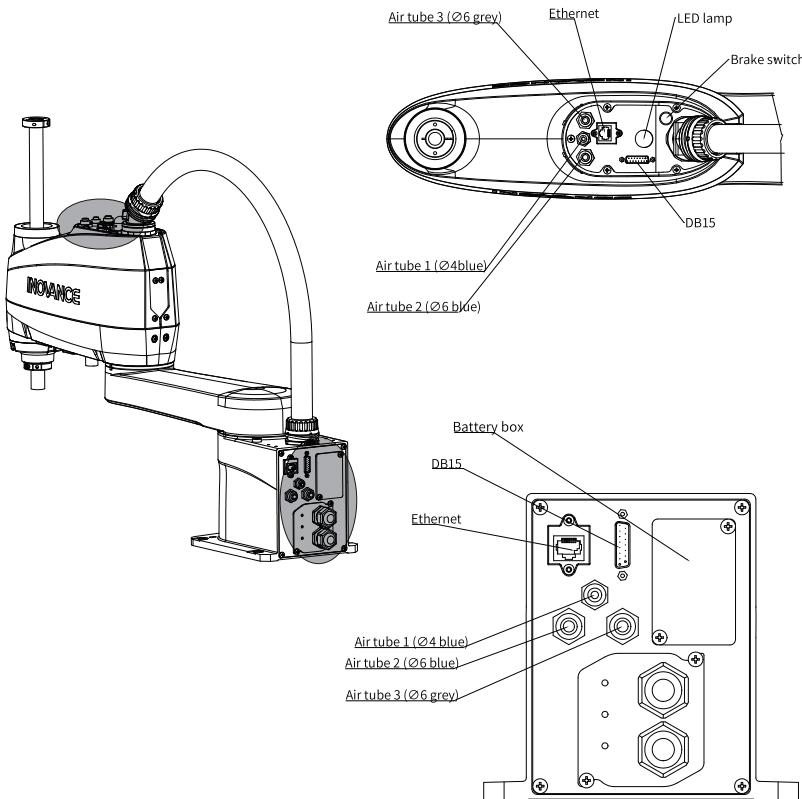
Both ends of the air tubes are equipped with ø6 mm and ø4 mm (outer diameter) fittings.

| Pressure resistance | Quantity | Dimensions (outer diameter) |
|-----------------------------------|----------|-----------------------------|
| 0.59 MPa (6 kgf/cm ²) | 2 | ø6 mm |
| 0.59 MPa (6 kgf/cm ²) | 1 | ø4 mm |

ø6 straight-through air tube fittings: two at the base and two at the forearm.

ø4 straight-through air tube fittings, one at the base and one at the forearm.

The air tube fittings are distinguished by color, as shown in the following figure.



2.6 Motion Range

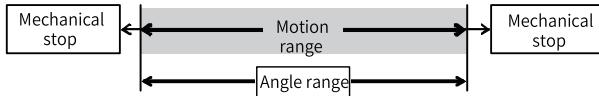
2.6.1 Method for Setting the Motion Range

Note

The default motion range at delivery is the maximum motion range of the robot.

To improve layout efficiency and to take into account the maximum safe range of motion of the robot, the following motion range setting methods are provided:

- Setting by angle range (for all joints)
- Setting by mechanical stops (for J1 to J3)



2.6.2 Motion Range Setting by Angle Range

2.6.2.1 Description of Angle Range

The basic unit of robot motion is degree. The motion limit (motion range) of the robot is set based on the angle lower limit and angle upper limit (angle range) of each joint.

The motion angle is determined by the encoder output pulse value of the servo motor, and the angle range must be set within the mechanical stop range.

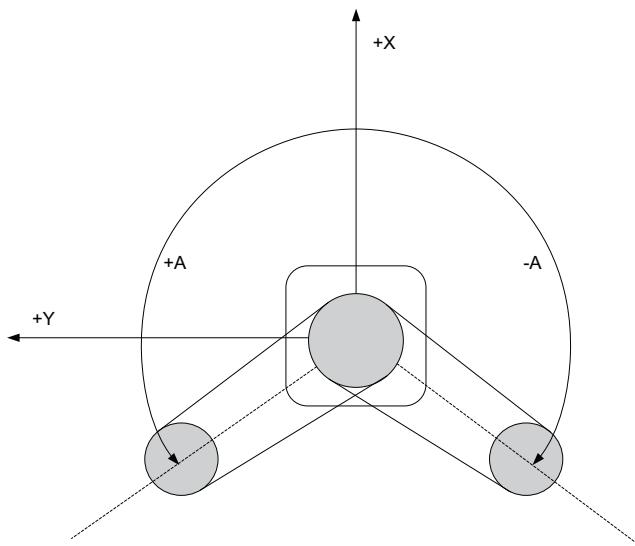
Once the robot receives an operating command, it checks whether the target position specified by the command is within the angle range before operating. If the target position is beyond the set angle range, an error occurs and the robot does not move.

Note

You can set the angle range by choosing Set > Motion > AxisPara > AxisLimit on the teach pendant.

2.6.2.2 Maximum angle range of joint 1

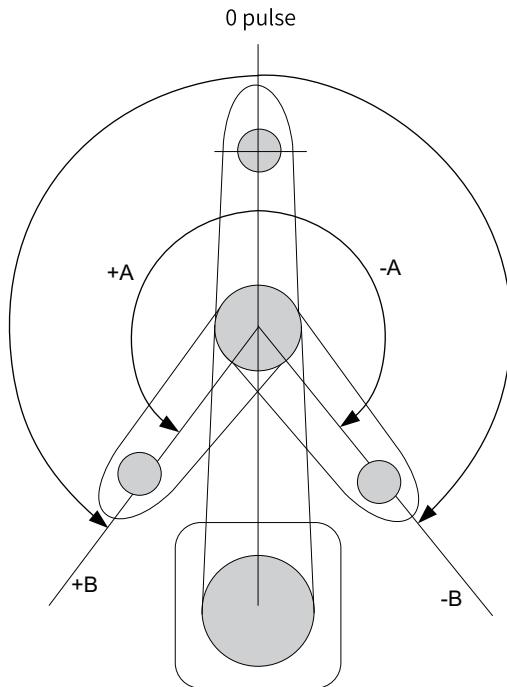
The 0 angle position of J1 refers to the position where the first arm points to the positive direction of the X coordinate axis. From the 0 pulse position, the clockwise angle is positive (+), and the counterclockwise angle is negative (-).



| Model | Maximum Motion Range |
|---------------|----------------------|
| IR-S7-50Z20S3 | $\pm 132^\circ$ |
| IR-S7-60Z20S3 | |
| IR-S7-70Z20S3 | |

2.6.2.3 Maximum angle range of joint 2

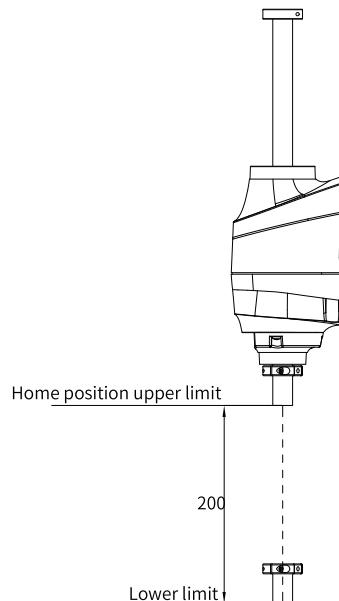
The 0 angle position of J2 refers to the position where the second arm is perpendicular to the first arm. (This is true regardless of the direction of the first arm.) From the 0 angle position, the clockwise angle is positive (+), and the counterclockwise angle is negative (-).



| Model | Maximum Motion Range |
|---------------|----------------------|
| IR-S7-50Z20S3 | $\pm 150^\circ$ |
| IR-S7-60Z20S3 | |
| IR-S7-70Z20S3 | |

2.6.2.4 Maximum Stroke of Joint 3

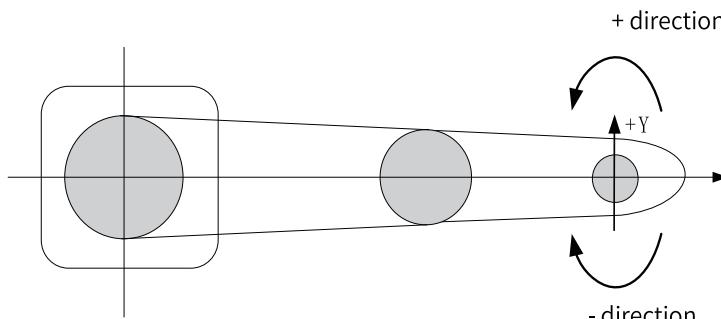
The 0 angle position of J3 is the upper limit position of the axis. When J3 descends from the 0 angle position, it will definitely change to a negative angle value.



| Model | Stroke of J3 |
|---------------|--------------|
| IR-S7-50Z20S3 | 200 mm |
| IR-S7-60Z20S3 | |
| IR-S7-70Z20S3 | |

2.6.2.5 Maximum angle range of joint 4

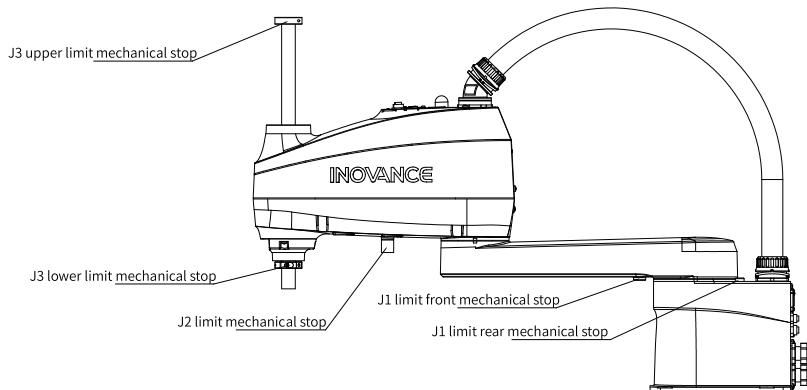
The 0 angle position of J4 is the position where the plane at the top of the axis faces in the direction of the top of the second robot arm. (This is true regardless of the direction of the second arm.) From the 0 angle position, the clockwise angle is positive (+), and the counterclockwise angle is negative (-).



| Model | Maximum Motion Range |
|---------------|----------------------|
| IR-S7-50Z20S3 | $\pm 360^\circ$ |
| IR-S7-60Z20S3 | |
| IR-S7-70Z20S3 | |

2.6.3 Description of Mechanical Stops

The robot has mechanical stops at J1, J2 and J3, except J4, and all these mechanical stops are not adjustable. The motion range set by mechanical stops at J1 and J2 is the extreme motion range. The up and down motion range of the mechanical stop at J3 is set by the internal program.



2.6.4 Standard Motion Range

The "motion range" refers to the situation at the standard (maximum) specifications. When motor of each joint is excited, the center of the lowest point of J3 moves in the areas shown in the figure.

"Area limited by mechanical stop" refers to the area where the center of the lowest point of J3 can be moved when the motor of each joint is not excited. "Mechanical stop" mechanically sets the absolute motion range beyond which motion is not allowed.

"Maximum space" is the area that contains the farthest reach of the arms. When an end effector with a radius of 52 mm or more is mounted, set the maximum space to the length of the two robot arms plus the radius of the end effector. The motion range is shown below.

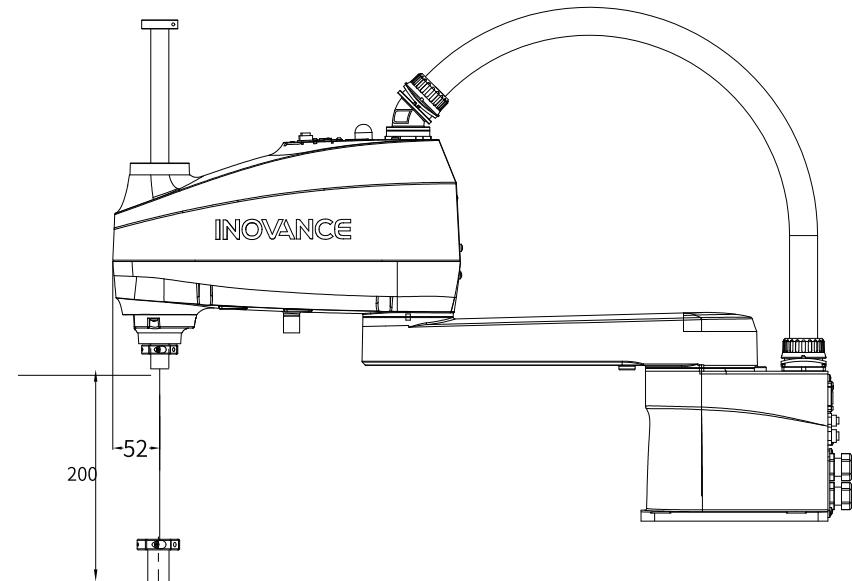


Figure 2-6 Motion range of end effector (unit: mm)

2.7 Maintenance

2.7.1 Safety Instructions for Maintenance and Repair

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



Danger

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not maintain the equipment after power-on. Failure to comply will result in an 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

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

2.7.2 Periodic Inspection Items

Perform periodic inspection on items that are difficult to check during operation. Clear the dust especially metal powders on the surface of the drive to prevent the dust from entering the equipment. Clear the greasy dirt from the cooling fan of the equipment.

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

| Inspec tion Point | Inspec tion Place | Daily In spec tion | Month ly Inspec tion | Quarter ly Inspec tion | Semi- annual Inspec tion | Annual Inspec tion | Maintenance Personnel | | |
|---|---|-----------------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|-----------------------|--------------------------------|----------------------|
| | | | | | | | Profes sionals | Quali fied Person nel | Manu factur er |
| Check wheth er the bolts are loose. If yes, tighten them. | End effec tor mount ing screw | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Robot mount ing bolts | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Each joint | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Bolts aroun d the axes | | | | | ✓ | | ✓ | ✓ |
| | Bolts secur ing the motor, reduc er, etc. | | | | | ✓ | | ✓ | ✓ |
| Check wheth er the connec tor is loose. If yes, push it secure ly or tighten it. | External con nec tors on the robot (on the con nector plates etc.) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Robot cable unit | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

| Inspec tion Point | Inspec tion Place | Daily In spec tion | Month ly Inspec tion | Quarter ly Inspec tion | Semi- annual Inspec tion | Annual Inspec tion | Maintenance Personnel | | |
|---|-------------------------|-----------------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|-----------------------|--------------------------------|----------------------|
| | | | | | | | Profes sionals | Quali fied Person nel | Manu factur er |
| Check for exter nal defects and remove dust. | Whole | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Exter nal cables | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Check for bends or improp er loca tion. Repair or place it proper ly if neces sary. | Safe guard etc. | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Check tension of timing belt. Tight en it if neces sary. | Inside arm #2 | | | | ✓ | ✓ | ✓ | ✓ | ✓ |

| Inspec tion Point | Inspec tion Place | Daily In spec tion | Month ly Inspec tion | Quarter ly Inspec tion | Semi- annual Inspec tion | Annual Inspec tion | Maintenance Personnel | | |
|--|--|-----------------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|-----------------------|--------------------------------|----------------------|
| | | | | | | | Profes sionals | Quali fied Person nel | Manu factur er |
| Check if the lubricating grease is sufficient for lubrication, and add an appropriate amount of lubricating grease as need ed. | Ball screw | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Spline | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Polish ed rod lubri cation inspec tion place | | | | | | | | |
| | | | | | ✓ | ✓ | ✓ | ✓ | ✓ |

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

| Inspec tion Point | Inspec tion Place | Daily Inspec tion | Month ly Inspec tion | Quar terly Inspec tion | Semi- annual Inspec tion | Annual Inspec tion | Maintenance Personnel | | |
|---|--|-------------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|-----------------------|--------------------------------|----------------------|
| | | | | | | | Profes sionals | Quali fied Person nel | Manu factur er |
| Shake the cable gently by hand to check for wire break age. | Exter nal cables (includ ing cable units of the robot) | | | | ✓ | ✓ | | ✓ | ✓ |
| Press each arm by hand in the ena bled state to check wheth er the arms shake. | Each joint | | | | | ✓ | | ✓ | ✓ |

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

| Inspec tion Point | Inspec tion Place | Daily Inspec tion | Month ly Inspec tion | Quar terly Inspec tion | Semi- annual Inspec tion | Annual Inspec tion | Maintenance Personnel | | |
|--|-------------------------|-------------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|-----------------------|--------------------------------|----------------------|
| | | | | | | | Profes sionals | Quali fied Person nel | Manu factur er |
| Check the motion range. | Each joint | | | | | ✓ | | ✓ | ✓ |
| Check whether unusual sound or vibration occurs. | Whole | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Measure the accuracy repeatedly by a gauge. | Whole | | | | | ✓ | | ✓ | ✓ |

2.7.3 Component Replacement

2.7.3.1 Note

- Be sure to cut off the power supply before installing or removing the motor connector; otherwise it may cause abnormal action of the robot or electric shock.
- Do not maintain the equipment after power-on. Failure to comply will result in an electric shock.
- Prevent foreign objects from entering the equipment and terminals during maintenance.

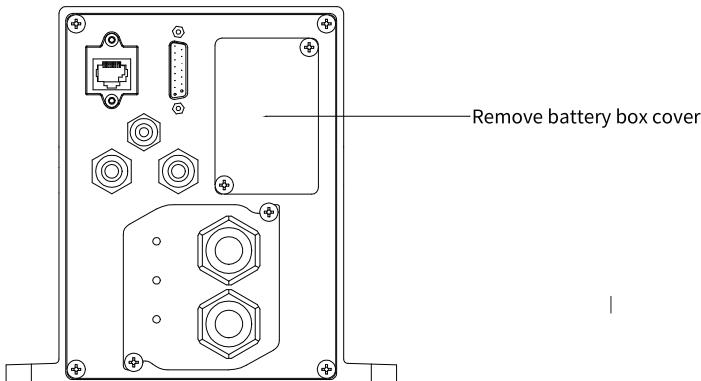
2.7.3.2 Replacing Battery

Warning

- Do not maintain the equipment after power-on. Failure to comply will result in an electric shock.
- When disposing the battery, consult with the professional disposal services or comply with the local regulation.
- Be sure to use lithium batteries correctly, the wrong way of use may lead to lithium battery heat, leakage, explosion or even fire, resulting in serious damage to personal and property safety.
- Do not charge the lithium battery.
- Do not pressurize or deform the lithium battery.
- Do not disassemble the lithium battery.
- Do not short-circuit or misconnect the lithium battery.
- Do not heat the lithium battery.
- Do not put the lithium battery into fire.
- Do not solder the battery terminals.
- Do not force discharge the lithium battery.

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

1. Remove the two M4x8 screws from the battery box cover.



2. Connect the new battery to the empty white 2P cable end connector.



3. Remove the old battery.
4. Fix the new battery on the battery box cover, and then secure the cover to the base with the M4*8 screws.

Note

If the home position is lost due to failure to comply with the preceding steps, see ["2.7.4.1 Description of Home Position Calibration" on page 95](#).

2.7.3.3 Replacing Cable

1. Loosen the fixing screw with a cross wrench, rotate the cable board by a certain angle and then take out the cable board.
2. Replace the damaged cable.
3. Rotate the cable board to the fixing hole and tighten the screw.

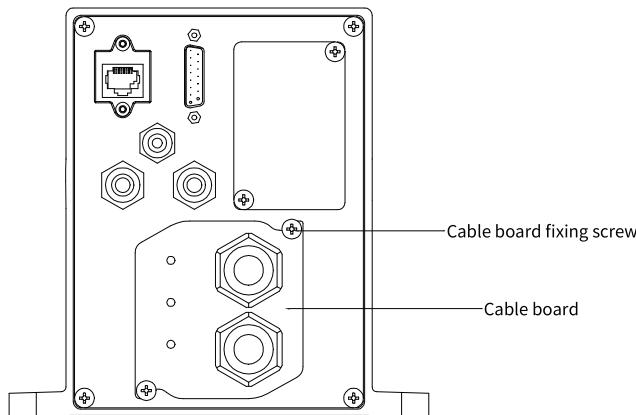


Figure 2-7 Base cable board

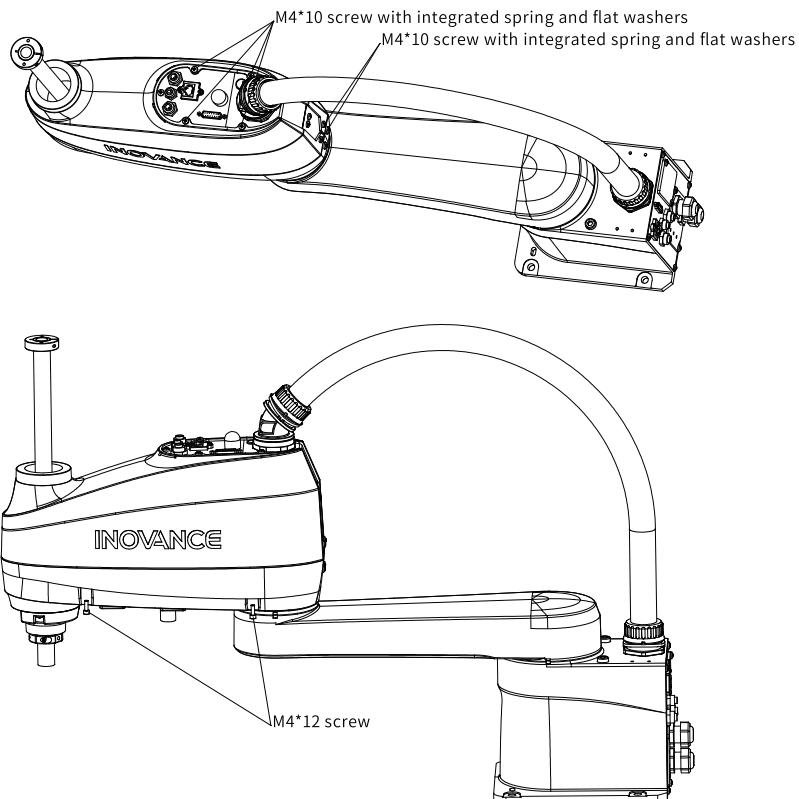
Caution

- Do not pull the cable board forcibly. Failure to comply will result in cable damage, wire breaking, or poor contact, causing electric shock or system fault.
- After removing the cable board, ensure that the cables are correctly connected during cable maintenance.

2.7.3.4 Replacing Enclosure

Removing the enclosure of the forearm

Remove the six M4*10 screws on the enclosure and sheet metal, and then remove the four M4*12 screws connecting the enclosure and the forearm.



Installing the enclosure of the forearm

1. Install the enclosure onto the forearm. Pay attention to the positioning columns and holes between the enclosure and the forearm to ensure that the mounting surface of the enclosure fits seamlessly with the mounting surface of the forearm and sheet metal.
2. Install the six M4*10 screws on the enclosure and sheet metal with a torque of 0.6 N.m.
3. Install the four M4*12 screws connecting the enclosure to the forearm, with a torque of 0.6 N.m.

2.7.4 Home Position Calibration

2.7.4.1 Description of Home Position Calibration

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

Note

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



Warning

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

2.7.4.2 Home Position of Each Joint

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

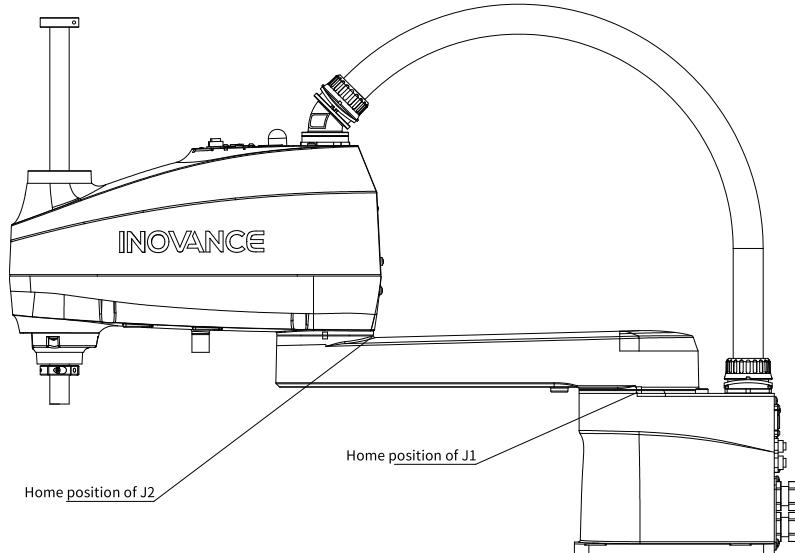


Figure 2-8 Home position of J1/J2

2. Home position of J3: The upper limit position of the J3.

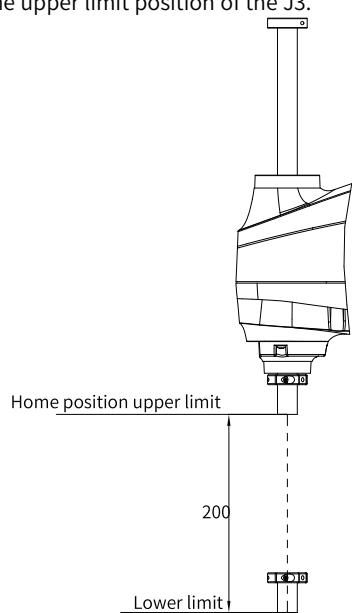


Figure 2-9 Home position of J3

3. Home position of J4: The position where the plane of the axis (or the slots of the upper and lower mechanical stops) faces the direction of the top of the second robot arm.

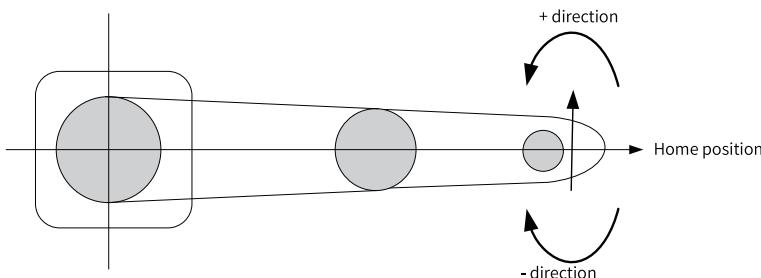


Figure 2-10 Home position of J4

2.7.4.3 Home Position Calibration of Joints 1 and 2

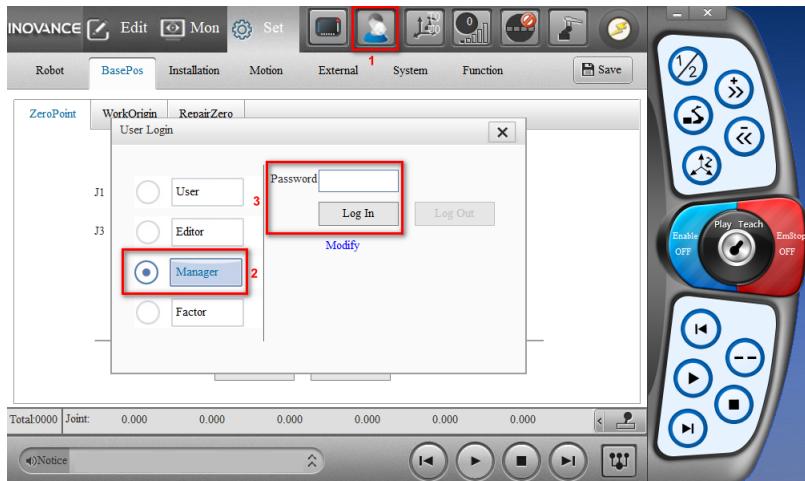
Both the teaching software on PCs and the hand-held teach pendant provide an operation interface for home position calibration. The following takes the teaching software on PC as an example. The operations on the hand-held teach pendant are similar.

Due to the strong correlation between the coordinates of the robot's work points and the accuracy of J2, it is necessary to complete the home position calibration of J2 before calculating the robot coordinates. The teach pendant provides a right/left wrist rule wizard. Follow the wizard to calibrate the home position.

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

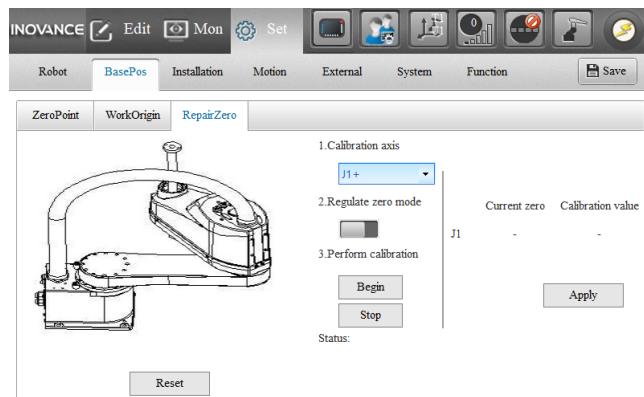
1. Log in to the user account.

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



2. Switch to the calibration interface.

Choose **Set > BasePos > RepairZero** on the main interface of the teaching software or the hand-held teach pendant.



3. Choose the calibration axis.

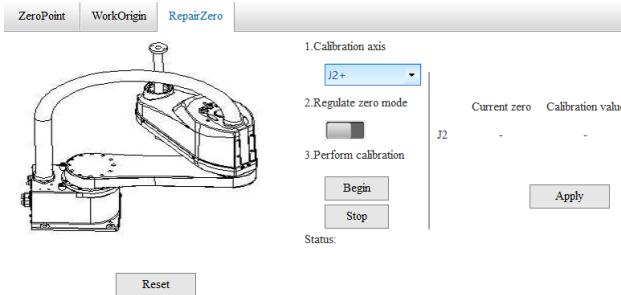
Choose the axis you want to calibrate from the **Calibration axis** drop-down list.

- The zeroing motion direction of all axes is positive.
- Caution: When switched to zeroing mode, the robot servo will be automatically enabled.
- If the multi-turn value of the encoder exceeds 2000, a warning pops up and emergency stop is triggered. In this case, you need to restart the controller and perform calibration again.

4. Perform calibration.

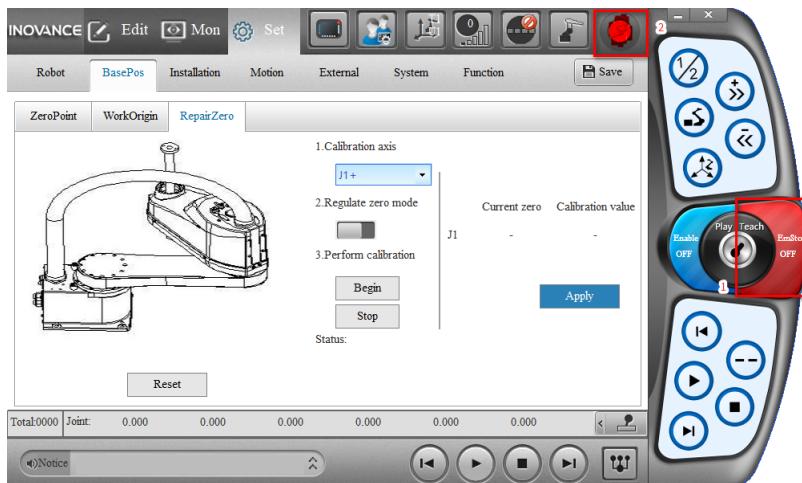
For example, select J2+ axis and click **Begin** to start calibration.

When the calibration is complete, the calibration value is updated.



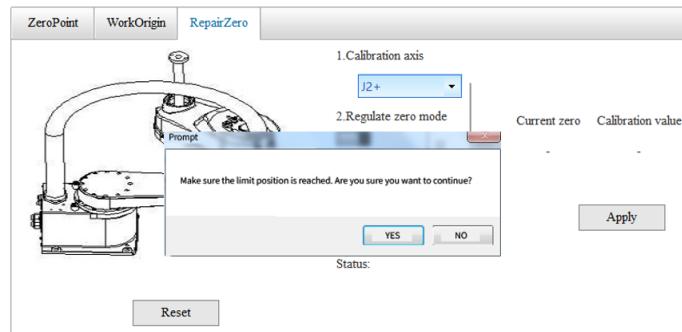
5. Switch to the emergency stop state.

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

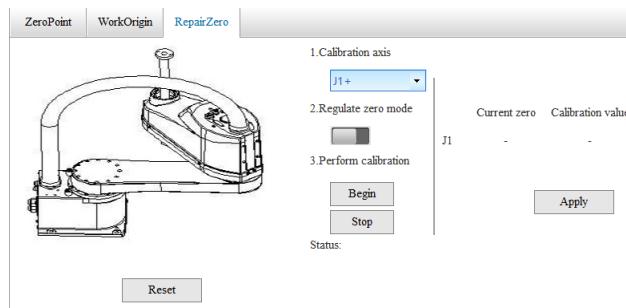


6. Update the zero point.

- Click **Apply**.



b. In the pop-up dialog, click **Yes**. The "Current zero" is replaced by "Calibration value".



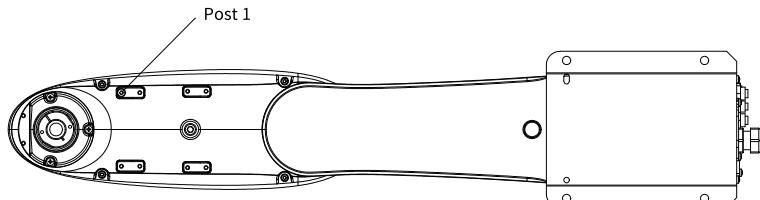
7. Check the zero point.

After updating the system zero point, check the result.

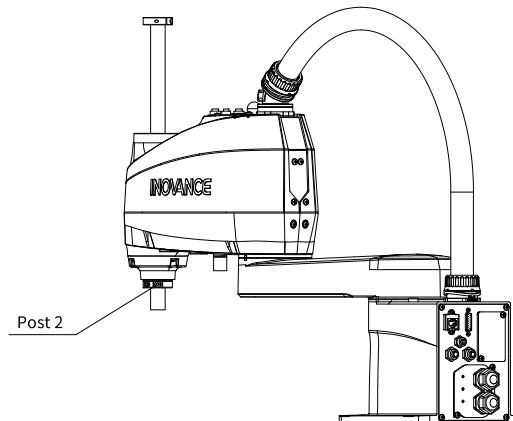
Recommended method: Teach a point, change the left and right hand parameters, and then observe the deviation of the center of the lead screw moving to that point.

2.7.4.4 Home Position Calibration of Joints 3 and 4

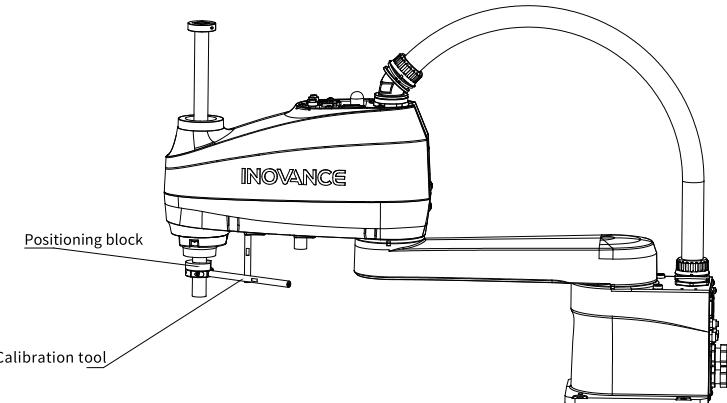
1. Fix the threaded end of the post 1 to the M4 threaded hole at the bottom of the forearm, as shown in the following figure:



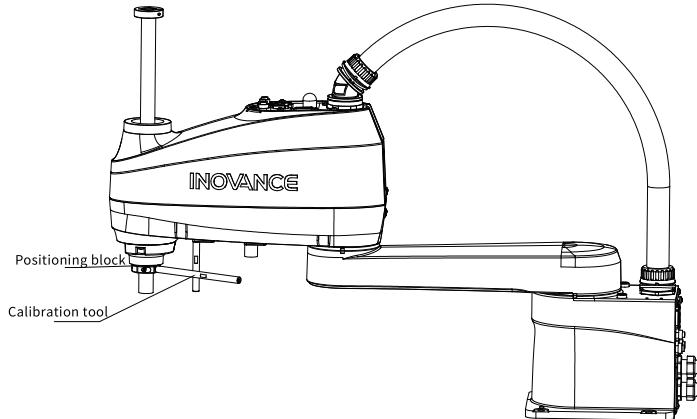
2. Fix the threaded end of the post 2 to the M5 threaded hole of the limit ring of the lead screw, as shown in the following figure:



3. Rotate the post 2 in the positive direction until it contacts the post 1. Then, assemble the positioning block onto the lead screw, as shown in the following figure:



4. Press the brake button and push the lead screw upwards until the positioning block contacts the lower end of the spline nut, as shown in the following figure. For other operations, refer to the automatic calibration steps. Select "J3J4+" when selecting the calibration axes to complete the calibration.



2.7.5 Options

| Name | | Code | Description | Diagram (in mm) |
|---------------------------------|--------|----------|--|-----------------|
| Protective cover for lead screw | | 20212980 | Mounted on the manipulator to protect the lead screw | / |
| Calibration tool | Post 1 | 32020626 | Used to calibrate the home position of J3 and J4 | |
| | Post 2 | 32020627 | | |
| Positioning block | | 32040084 | | |

3 IR-S10 Series SCARA Robot User Guide - Manipulator

3.1 Preface

Introduction

With a maximum payload of 10 kg and a Z-axis stroke of 200 mm, the robot can be widely used in loading and unloading, precision assembly, handling, dispensing, gluing, screw tightening, labeling, material insertion, and sorting. The robot can be used in high-load occasions, such as handling of large parts, machine loading and unloading, machine assembly, industrial parts transfer, and other occasions. It is suitable for new energy, 3C and food packaging industries.

This guide describes the basic specifications, installation, and maintenance of the product.

Audience

Mechanical engineers

Electrical engineers

System engineer

More Documents

| Data Name | Data Code | Description |
|--|------------|---|
| IRCB500 Series Robot Controller User Guide | PS00001641 | This guide describes the specifications, installation, wiring and more of the IRCB500 series controller. |
| IRP80 Series Teach Pendant User Guide | 19010502 | This guide describes the basic information, cable connection, operations and more of the IRTP80 series teach pendant. |

Revision History

| Date | Version | Description |
|---------------|---------|---|
| August 2023 | A01 | <ul style="list-style-type: none"> Updated technical data including rated load, manipulator weight, and cycle time. Modified the outline dimensions |
| December 2022 | A00 | First release. |

Document Acquisition

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

- Visit <http://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.

Warranty

Inovance provides warranty service within the warranty period (as specified in your order) for any fault or damage that is not caused by improper operation of the user. You will be charged for any repair work after the warranty period expires.

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

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

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

For details, see the Product Warranty Card.

3.2 Product Information

3.2.1 Nameplate and Model Number

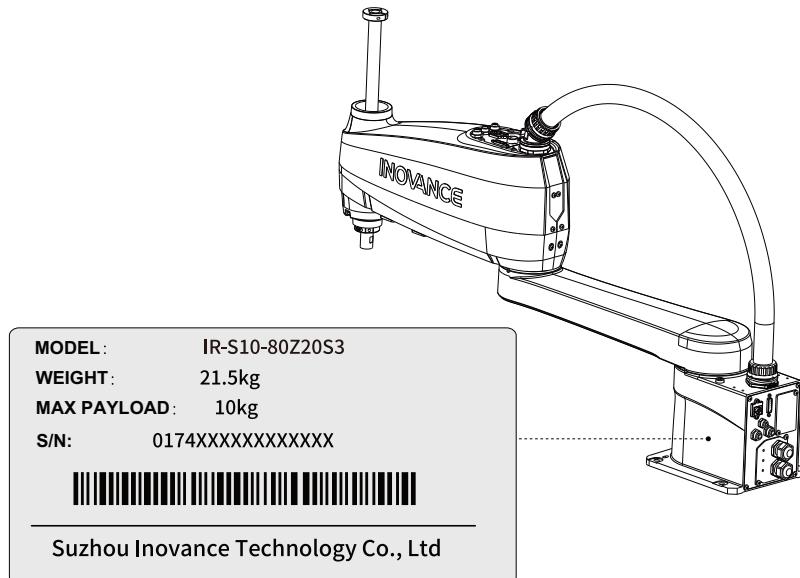


Figure 3-1 Nameplate



Do not wipe the robot hard with alcohol or benzene, as this may cause the gloss of the painted surface to deteriorate.

IR- S 10 - 80 Z20S3
① ② ③ ④ ⑤ ⑥⑦

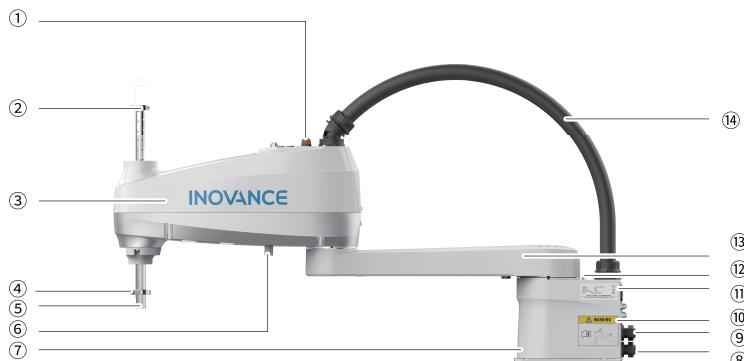
Figure 3-2 Model number

| | | |
|--|--|--|
| ① Family INOVANCE Robot | ④ Arm Length 60: 600 mm 70: 700 mm 80: 800 mm | ⑦ Cable Length 0: No drag cable 3: 3 m standard cable 5: 5 m standard cable G3: 3 m highly flexible cable |
| ② Serial Number S: SCARA robot R: 6-axis robot TS: Ceiling-mounted SCARA robot | ⑤ Max. Z-axis Stroke (empty for models without lead screw) Z20: Max. 200 mm stroke | - |
| ③ Load 4: 4 kg 7: 7 kg 10: 10 kg | ⑥ Mounting Mode C: Cleanroom S: Standard P: Protection | - |

Note

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

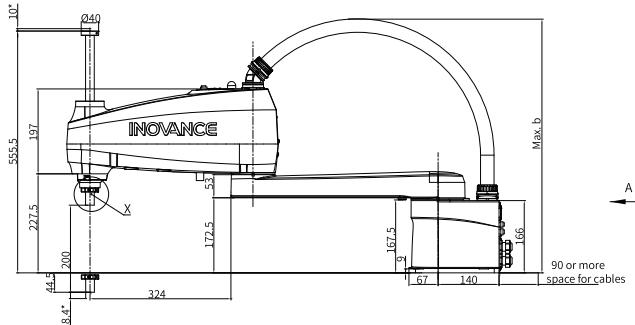
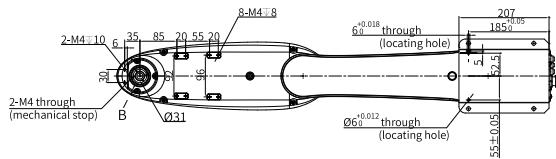
3.2.2 Components



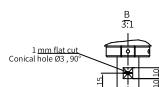
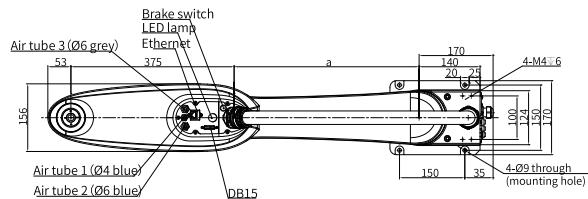
| No. | Description |
|-----|--------------------------|
| 1 | Run indicator |
| 2 | J3 upper mechanical stop |
| 3 | Arm 2 |

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

3.2.3 Dimensions



(*) indicates the stroke margin by mechanical stop.



| IR-S10-Series Robot Arm Length | | | |
|--------------------------------|----------------|----------------|----------------|
| Model | IR-S10-60220S3 | IR-S10-70220S3 | IR-S10-80220S3 |
| a | 225 | 325 | 425 |
| b | 545 | 569 | 599 |

3.2.4 Specifications

| Item | | IR-S10-60Z20S3 | IR-S10-70Z20S3 | IR-S10-80Z20S3 |
|--------------------------------|------------------------------------|--|------------------------|------------------------|
| Arm length | Arm 1 + Arm 2 | 600 mm | 700 mm | 800 mm |
| | Arm 1 | 225 mm | 325 mm | 425 mm |
| | Arm 2 | 375 mm | 375 mm | 375 mm |
| Max. speed*1 | J1 + J2 | 9100 mm/s | 9800 mm/s | 10500 mm/s |
| | J3 | 1600 mm/s | 1600 mm/s | 1600 mm/s |
| | J4 | 2700°/s | 2700°/s | 2700°/s |
| Repeatability | J1 + J2 | ±0.02 mm | ±0.02 mm | ±0.025 mm |
| | J3 | ±0.01 mm | ±0.01 mm | ±0.01 mm |
| | J4 | ±0.01° | ±0.01° | ±0.01° |
| Handling capacity (load) | Rated | 5 kg | 5 kg | 5 kg |
| | Maximum | 10 kg | 10 kg | 10 kg |
| Allowable inertia moment of J4 | Rated | 0.02 kg.m ² | 0.02 kg.m ² | 0.02 kg.m ² |
| | Maximum | 0.3 kg.m ² | 0.3 kg.m ² | 0.3 kg.m ² |
| Mounting hole | | 150x150 mm (4-ø9 mm) | | |
| Weight (excluding cables) | | 18.5 kg | 19 kg | 20.5 kg |
| Press-in force of J3 | | 200 N | 200 N | 200 N |
| Signal line | | 15 (15pin: D-sub) CAT5E | | |
| Air tube | | 2x Ø6 mm, 0.59 Mpa 1x Ø4 mm, 0.59 Mpa | | |
| Environmental conditions | Ambient temperature ^[1] | 5°C to 40°C | | |
| | Relative humidity | 10% to 80% RH | | |
| Noise level ^[2] | | Laeq=70 dB(A) | | |
| Maximum Motion Range | J1 | ±132° | ±132° | ±132° |
| | J2 | ±150° | ±150° | ±150° |
| | J3 | 200 mm | 200 mm | 200 mm |
| | J4 | ±360° | ±360° | ±360° |
| Cycle time*1 ^[3] | | 0.361s | 0.386s | 0.416s |

[1] When used in a low-temperature environment approximating the lowest allowable temperature, or when idle for a long period of time due to holidays and nighttime, it is recommended to warm up the product for 10 minutes before operating it.

[2] Measured in front of the robot at a distance of 1000 mm from its operating area and at least 50 mm above the base mounting surface with four joints operating at 100% speed and acceleration and rated load, with a duty cycle of 50%.

[3] Time required for a robot to move a 2 kg payload between two points 300 mm apart at a height of 25 mm.

3.3 Preparation

3.3.1 Requirements Installation Personnel

Ensure that the installation personnel have obtained mechanics knowledge or received mechanics training in advance to understand various dangers and risks in the installation process.

The installation personnel must be familiar with all the installation requirements and related technical documents.

Non-professionals are strictly prohibited from product installation, wiring, maintenance, inspection and part replacement.

3.3.2 Requirements on Installation Environment

General environmental requirements

Set up the robot system in an environment that complies with the following conditions in order to maximize and maintain the performance of the equipment and to use it safely.

Table 3-1 Environmental conditions

| Item | Requirement |
|---|--|
| Operating temperature and humidity | 5°C to 40°C, 10% to 80%RH, non-condensing |
| Storage temperature and humidity | -10°C to 55°C, ≤80%RH, non-condensing |
| Transportation temperature and humidity | -10°C to 55°C, ≤80%RH, non-condensing |
| EFT/B immunity | 2 kV or less |
| Static immunity | 6 kV or less |
| Environment | <ul style="list-style-type: none">• Install indoors• Keep away from direct sunlight• Keep away from dust, oil smoke, salt, iron filings• Keep away from flammable and corrosive liquids and gases• Keep away from water• Avoid places with shocks or vibrations• Keep away from sources of electrical interference |

Special environmental requirements

- The surface of the robot provides certain protection. However, contact your provider and confirm in advance if the robot may come into contact with special liquid or gas during use.
- There may be condensation inside the robot if it is used in an environment with large changes in temperature and humidity. Please consult your provider.
- If you want to use the robot to handle food directly, please consult your provider in advance to avoid contamination of the food by the robot.



Caution

Do not wipe the robot hard with alcohol or benzene, as this may cause the gloss of the painted surface to deteriorate.

3.3.3 Requirements on Mounting Stand

You need to make a stand for fixing the robot. The shape and size of the stand vary depending on the purpose of the robot system. Requirements on the stand are listed as follows for your reference during design.

- The stand supports not only the weight of the robot, but also the dynamic forces generated by the robot when it moves at maximum acceleration. Ensure that the stand has sufficient bearing capacity by using the transverse beam and other reinforcement materials.
- The torque and reaction force generated by the robot action are described in the table below:

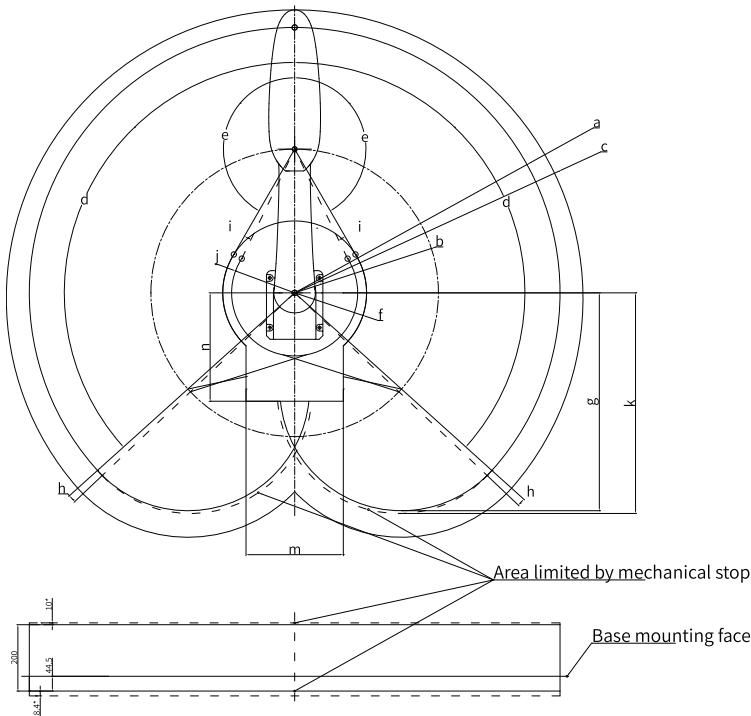
| Type | Size |
|--|---------|
| Maximum torque in horizontal plane | 550 N·m |
| Maximum reaction force in horizontal direction | 3200 N |
| Maximum reaction force in vertical direction | 1500 N |

- The threaded holes on the stand for mounting the manipulator are M12. Use screws conforming to the strength of GB/T 3098.1 class 10.9 or 12.9. For details about the dimensions, see ["3.2.3 Dimensions" on page 108](#).
- The plate for the robot mounting face should be 20 mm thick or more and made of steel to reduce vibration. The surface roughness of the steel plate should be 25 μm or less.
- Fix the stand firmly on the ground or wall.
- Keep the Z-axis of the robot perpendicular to the horizontal plane during installation.

- When using a level for height adjustment of the stand, use screws with a diameter larger than M8.
- When cutting holes in the stand for passing cables, ensure that the diameter of the holes is not less than 60 mm.
- Take the storage space of the controller into account when designing the stand. Please see the user guide of the controller for detailed data.

3.3.4 Requirements on Installation Space

Motion range of standard model (mm)

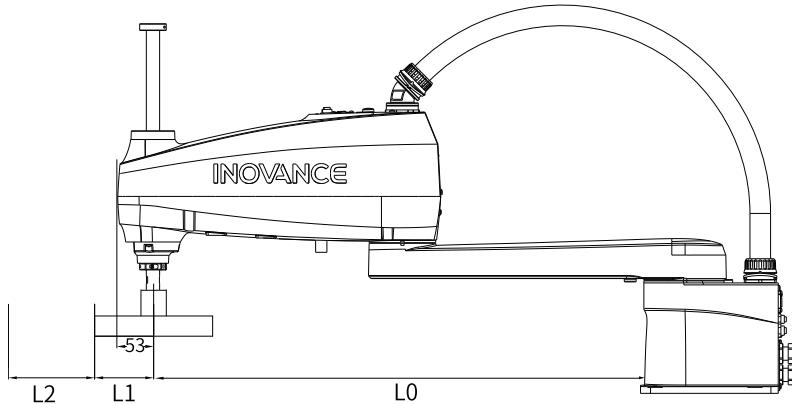


Motion range of IR-S10 series robots with different arm lengths

| Model | IR-S10-60Z20S3 | IR-S10-70Z20S3 | IR-S10-80Z20S3 |
|--|----------------|----------------|----------------|
| a. Length of arm 1 + length of arm 2 (mm) | 600 | 700 | 800 |
| b. Length of arm 1 (mm) | 225 | 335 | 425 |
| c. Maximum motion range (mm) | 653 | 753 | 853 |
| d. Motion range of J1 (°) | | 132 | |
| e. Motion range of J2 (°) | | 150 | |
| f. Motion range | 212.4 | 187.5 | 212.6 |
| g. Rear motion range | 525.6 | 592.5 | 659.4 |
| h. Angle of mechanical stop position of J1 (°) | | 1 | |
| i. Angle of mechanical stop position of J2 (°) | 1 | 3 | 4 |
| j. Range of mechanical stop position | 208.9 | 170.5 | 186 |
| k. Range of rear mechanical stop position | 528.5 | 596.7 | 664.9 |
| m. Motion range | 420 | 330 | 320 |
| n. Motion range | | 300 | |

Maximum range

The "maximum range" is the range where the robot arm may cause interference. When an end effector with a radius of 52 mm or more is mounted, set the maximum range to the length of the two robot arms plus the radius of the end effector.



- L0: Length of the robot arms
- L1: Radius of the end effector
- L2: Safety space

The safety distance should be greater than $L0+L1+L2$.

3.3.5 Installation Tools

Table 3-2 Installation tools

| Tool | Quantity (PCS) |
|---------------------------|----------------|
| M8 outer hexagon wrench | 1 |
| Scissors or utility knife | 1 |
| Nail hammer | 1 |
| Straight screwdriver | 1 |
| Protective gloves | 1 |
| Safety shoes | 1 |
| Hoisting sling | 1 |
| Forklift | 1 |

3.4 Unpacking and Handling

3.4.1 Notes



Caution

Check whether the packing is intact and whether there is damage, water seepage, damp, and deformation.

Unpack the package by following the package sequence. Do not hit the package with force.

Check whether there are damage, rust, or injuries on the surface of the equipment or equipment accessories.

Check whether the number of packing materials is consistent with the packing list.



Warning

Do not install the equipment if you find damage, rust, or indications of use on the equipment or accessories.

Do not install the equipment if you find water seepage, component missing or damage upon unpacking.

Do not install the equipment if you find the packing list does not conform to the equipment you received.

Unpack the packing box according to the direction instructed.



Danger

Only qualified personnel are allowed to carry out transportation including rigger operation, hoisting by crane, and forklift driving.



Warning

- Transport the equipment with a hoist or forklift with the original package.
- Wear personal protective equipment (PPE) during transportation with a hoist or forklift. Prohibit any personnel to stand or stay in the transportation route.
- Stabilize the equipment with hands when hoisting it. Unstable hoisting may result in the equipment falling over. This may cause severe bodily injury or equipment damage.



Caution

- Store and transport this equipment based on the storage and transportation requirements for humidity and temperature.
- Avoid transporting the equipment in environments such as water splashing, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- Never transport this equipment with other equipment or materials that may harm or have negative impacts on this equipment.
- If condensation occurs on the device during transportation or storage, remove the condensation before turning on the power.

3.4.2 Unpacking

Unpacking procedure:

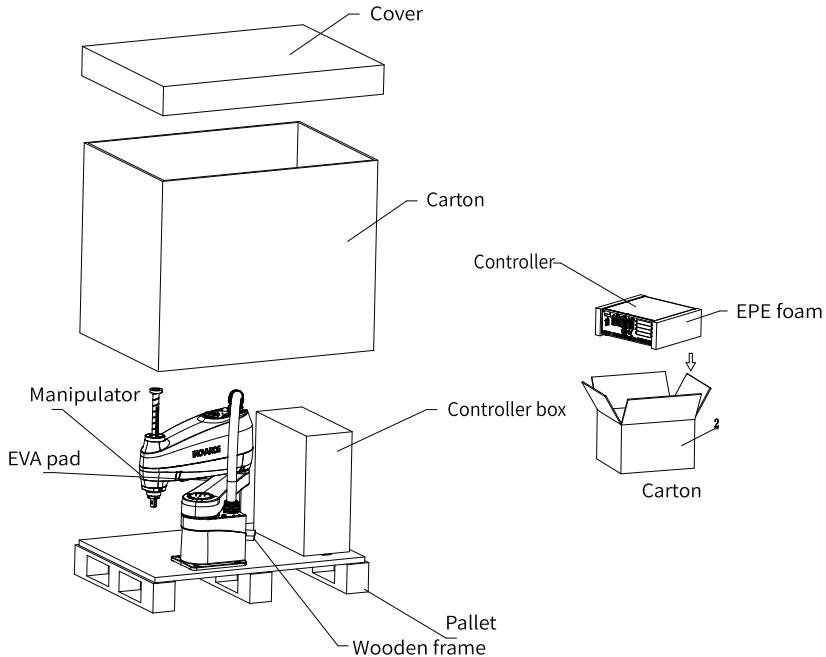
1. Unpack the carton.

Cut the PET tape using scissors or a utility knife, and remove the cover of the carton and the paper corner protectors. Move the carton from bottom to top and remove it.



Caution

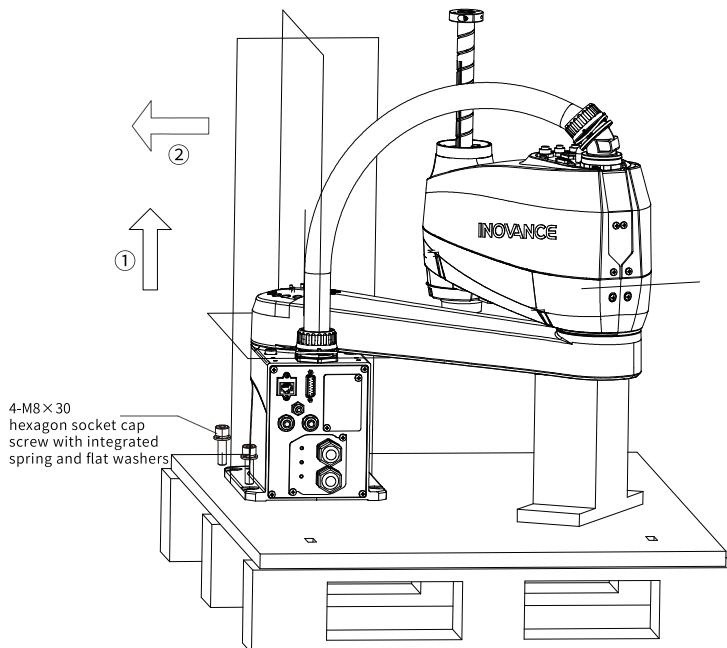
Wear gloves to prevent scratches.



2. Remove the manipulator from the pallet.

Remove bolts connecting the manipulator and the pallet using the M8 outer hexagon wrench.

Take out the manipulator by lifting it from bottom to top, and moving it horizontally. See .



Caution

- Stabilize the robot when removing the bolts fixing the manipulator to avoid bodily injury or equipment damage caused by titling of the equipment due to unstable center of gravity.
- To repack the robot, reverse the steps above.
- Take out the robot carefully to avoid collision.

3.4.3 Handling

Pre-Handling Preparation

1. For a newly shipped robot, move it in the posture as it was delivered.
2. If you want to relocate a robot that is already in use, do the following before moving it:
 - Disconnect all power supplies of the equipment.
 - Disconnect the power and signal cables from the controller
 - Remove the bolts fixing the robot to the base and then remove the robot from the installation base.

- Secure the robot to the transportation equipment.

Handling Procedure

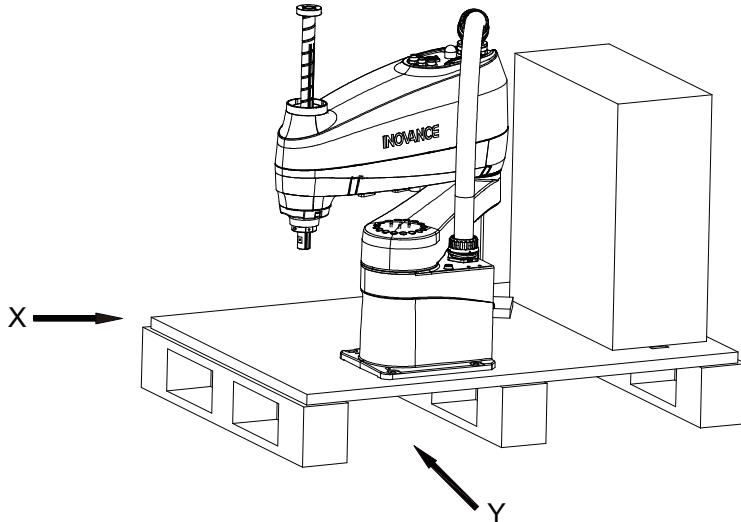
Transportation by hands

When transporting the robot, fix the robot on the transportation equipment or support the second robotic arm and the bottom of the base with hands. At least two people are required for the operation.

Handling with forklift

Secure the robot to a pallet or base plate with sufficient load capacity with bolts. Insert the fork of the forklift into the pallet to transport it together with the robot.

Transport the robot slowly to prevent it from titling or falling over.



Note

- The robot is located on one side of the pallet. Therefore, when inserting the fork from the Y direction, pay attention to the counterweight on the other side to prevent the robot from falling over.
- Do not pull the cables of the robot to avoid possible damages.

3.5 Installation

3.5.1 Installation Precautions

Danger

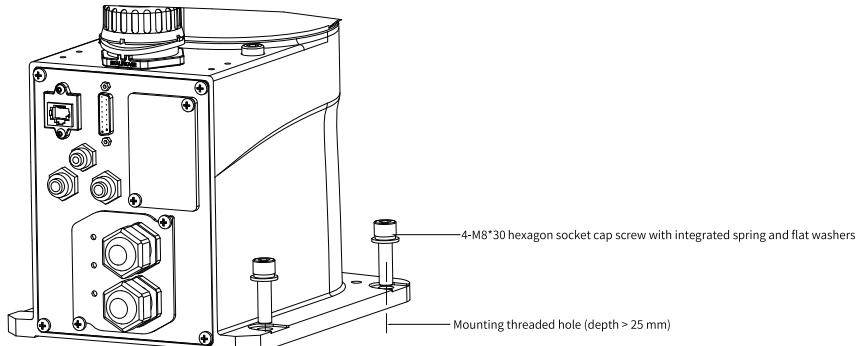
- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Install a safety fence for the system. Failure to comply will result in serious accidents.
- Reserve sufficient space between the equipment and surrounding buildings, structural parts, and devices. Failure to comply may cause serious injury or major damage.
- Fix the robot body before turning on the power or operating the system. Otherwise, the robot body may fall over and cause serious injury or major damage.

Warning

- Do not modify the equipment.
- Do not install this equipment in places with strong electric or magnetic fields.
- When removing the mounting screws of the robot body, hold the robot to prevent it from toppling over.
- For the tabletop mounting, at least two people are required for the operation.

3.5.2 Installing Manipulator

Secure the robot base to the stand with four M8x30 screws conforming to the strength of GB/T 3098.1 class 10.9 or 12.9, as shown below.

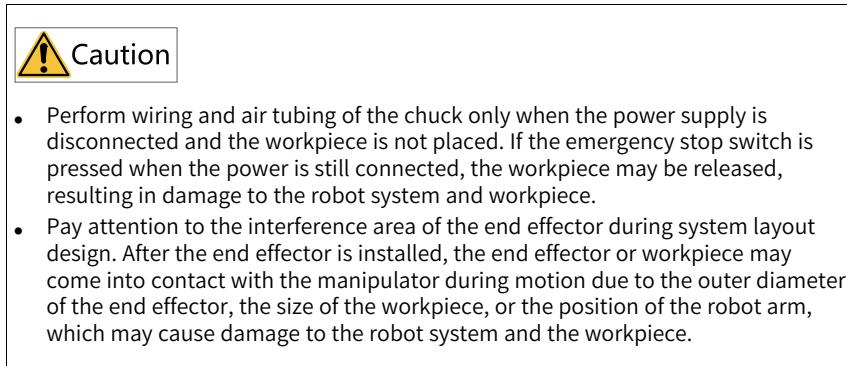


Check that the screws are tightened referring to the following recommended torque.

| Nominal Screw Diameter (10.9 or higher) | Installation Torque |
|---|---------------------|
| M8 | 30 N·m |

3.5.3 Installing End Effector

Users need to make their own end effectors. Before attaching an end effector, observe the following guidelines.



Design your own end effector mounting method with reference to the following dimensions. The weight of the end effector should not exceed 7 kg, as shown in the figure below.

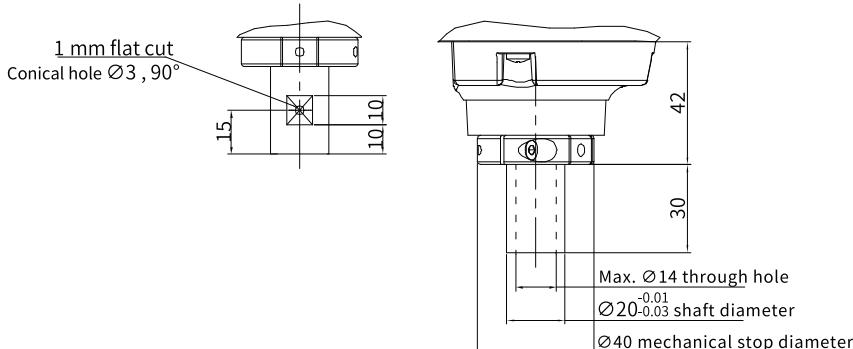


Figure 3-3 End effector mounting dimensions (in mm)

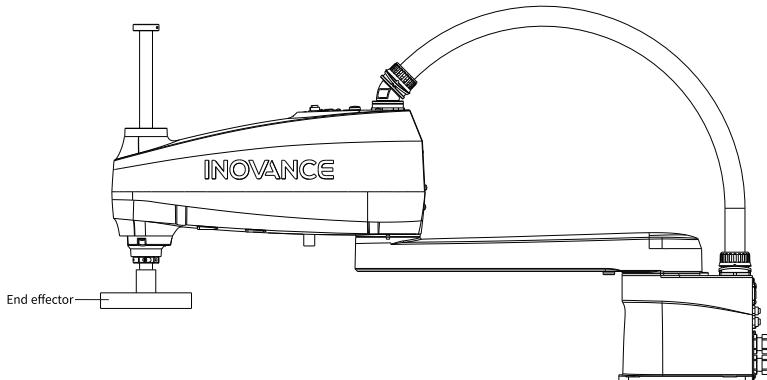


Figure 3-4 Installing the end effector

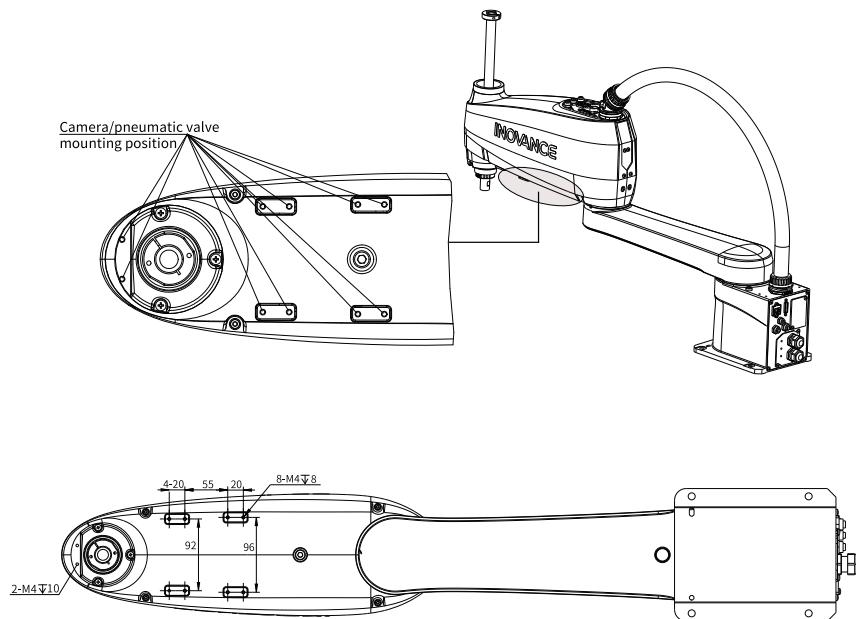
To move J3 up or down when installing the end-effector, turn on the power of the controller and move the joint up/down or rotate the joint while pressing the brake release switch. This switch is a momentary type switch that releases the brake only during the time it is pressed.

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

Note To avoid contact between the end effector and the robot due to the outer diameter of the end effector, the size of the workpiece, or the position of the robot arm, stop operating the robot when installing the end effector. Pay attention to the interference area of the end effector during system layout design. See the maximum area in ["3.3.4 Requirements on Installation Space" on page 113](#).

3.5.4 Installing Camera and Pneumatic Valve

The robot provides mounting holes for the camera and pneumatic valve at the bottom of the second arm, as shown in the following figure.



3.5.5 Cable Connection

 **Danger**

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals.
- Cut off the power before wiring. Failure to comply will result in electric shock or system fault.
- Before wiring, cut off all equipment power supplies. Residual voltage exists after power cut-off. Therefore, wait at least 10 minutes before further operations.
- Ensure that the safety input signals, such as the emergency stop switch and safety door switch are connected correctly before wiring. Otherwise, the safety protection will not work properly in emergency cases, causing serious injury or damage.
- Make sure that the equipment is well grounded. Failure to comply will result in an electric shock.
- During wiring, follow the proper electrostatic discharge (ESD) procedure, and wear an antistatic wrist strap. Failure to comply will damage the equipment or the internal circuits of the equipment.

 **Warning**

- Connect the cables securely. 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.

Connect the power cable and signal cable to the controller.

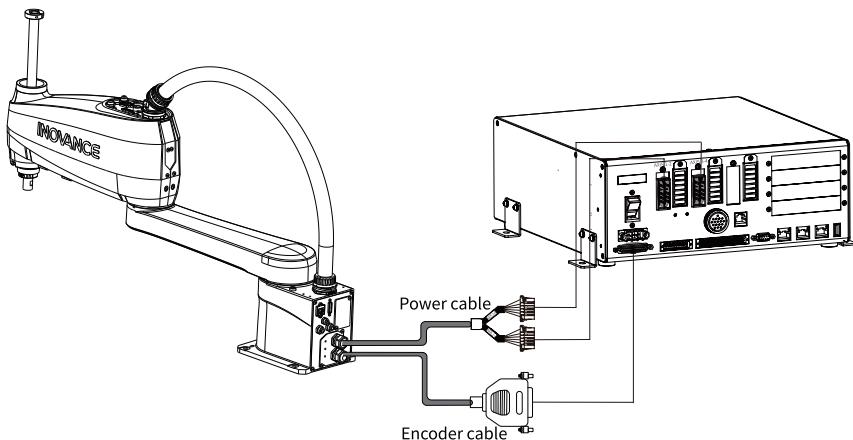
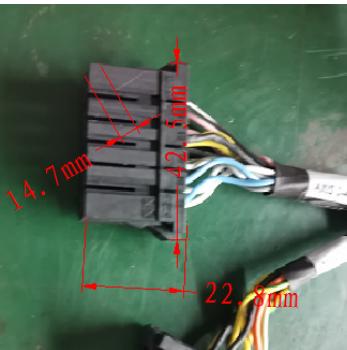
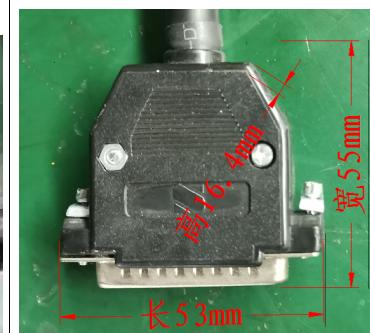
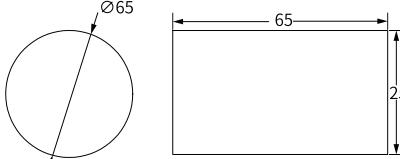
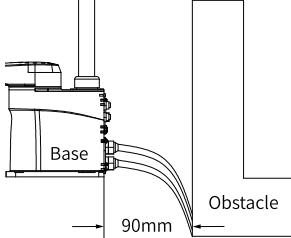


Figure 3-5 Cable connection

Table 3-3 Cable hole dimensions (IRCB500 drive-control integrated controller)

| Name | Power Cable Connector (Controller Side) | Encoder Cable Connector (Controller Side) |
|------------|---|--|
| Dimensions | 42.5 mm x 22.8 mm x 14.7 mm (L x W x H)  | 53 mm x 55 mm x 16.4 mm (L x W x H)  |

Recommended minimum hole size and reserved space for cables (red frame is recommended size).

| Hole size (round hole & square hole) (mm) | Space reserved for the manipulator cable (connector size+cable bending radius) |
|---|---|
|  |  |

3.5.6 Wiring and Tubing



Danger

Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.

Wiring (Electrical Wires)



Warning

Current higher than 0.5 A is not allowed.

| Model | Allowable current | Number of cores | Diameter | Remarks |
|-------|-------------------|-----------------|----------|-------------------------------------|
| DB15 | 0.5 A | 15 | 24AWG | Wire connector provided as standard |

Note

Use connectors with the same pin number on both ends of the cable. The robot is shipped with wiring ready for the user.

Communication cable requirements

Use the Cat5 shielded twisted pair cable for external and built-in network cables, with a maximum communication rate of 1000 bit/s, which can meet the communication requirements of industrial cameras and other devices.

Tubing (Air Tubes)

Note

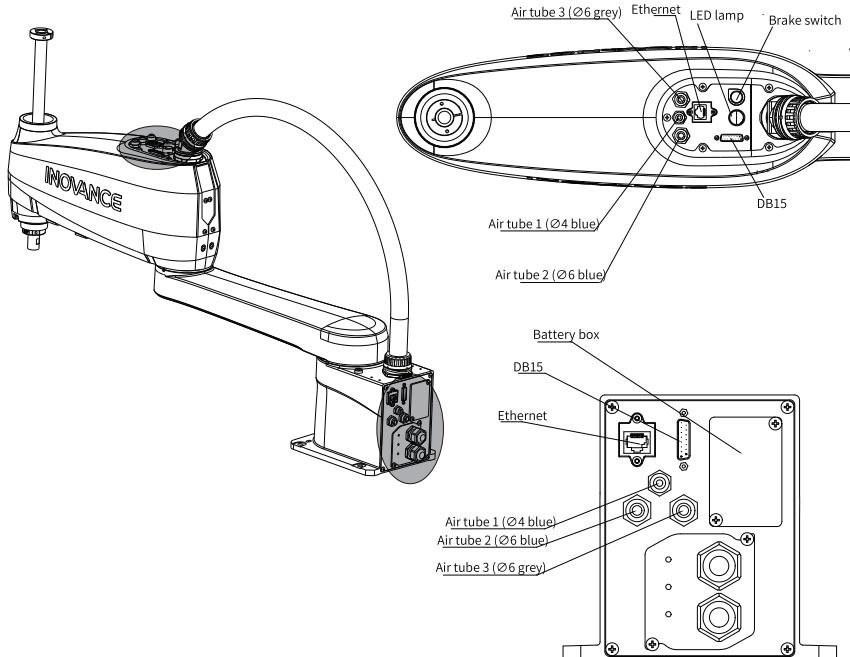
Both ends of the air tubes are equipped with $\varnothing 6$ mm and $\varnothing 4$ mm (outer diameter) fittings.

| Pressure resistance | Quantity | Dimensions (outer diameter) |
|-----------------------------------|----------|-----------------------------|
| 0.59 MPa (6 kgf/cm ²) | 2 | $\varnothing 6$ mm |
| 0.59 MPa (6 kgf/cm ²) | 1 | $\varnothing 4$ mm |

$\varnothing 6$ straight-through air tube fittings: two at the base and two at the forearm.

$\varnothing 4$ straight-through air tube fittings, one at the base and one at the forearm.

The air tube fittings are distinguished by color, as shown in the following figure.



3.6 Motion Range

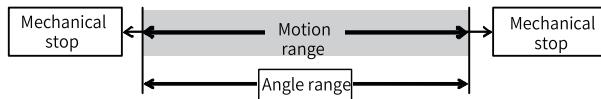
3.6.1 Method for Setting the Motion Range

Note

The default motion range at delivery is the maximum motion range of the robot.

To improve layout efficiency and to take into account the maximum safe range of motion of the robot, the following motion range setting methods are provided:

- Setting by angle range (for all joints)
- Setting by mechanical stops (for J1 to J3)



3.6.2 Motion Range Setting by Angle Range

3.6.2.1 Description of Angle Range

The basic unit of robot motion is degree. The motion limit (motion range) of the robot is set based on the angle lower limit and angle upper limit (angle range) of each joint.

The motion angle is determined by the encoder output pulse value of the servo motor, and the angle range must be set within the mechanical stop range.

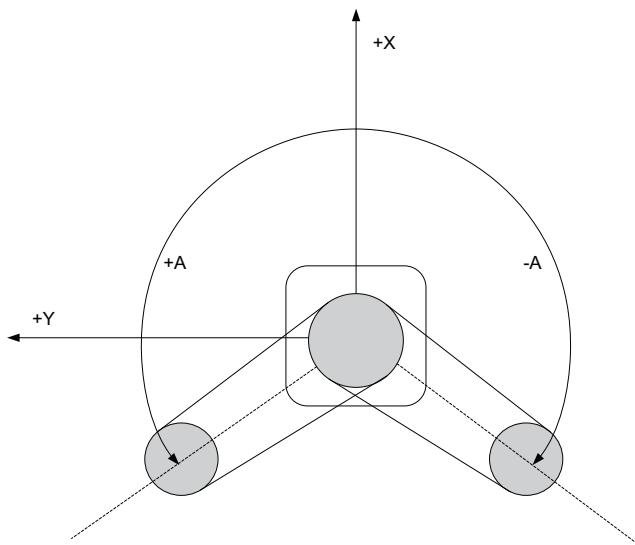
Once the robot receives an operating command, it checks whether the target position specified by the command is within the angle range before operating. If the target position is beyond the set angle range, an error occurs and the robot does not move.

Note

You can set the angle range by choosing Set > Motion > AxisPara > AxisLimit on the teach pendant.

3.6.2.2 Maximum angle range of joint 1

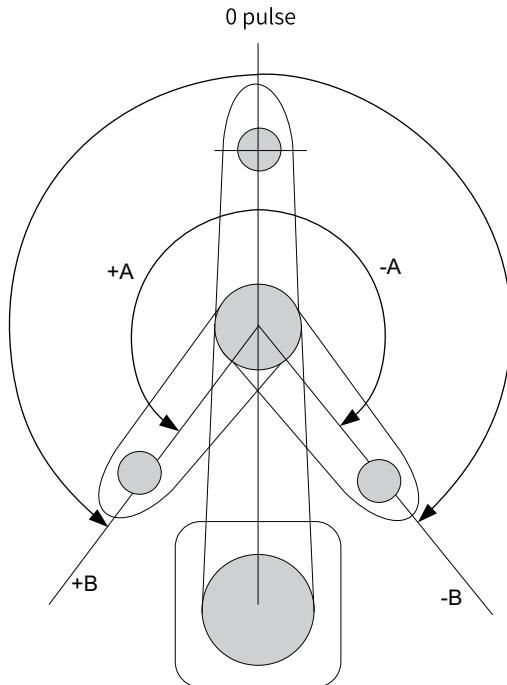
The 0 angle position of J1 refers to the position where the first arm points to the positive direction of the X coordinate axis. From the 0 pulse position, the clockwise angle is positive (+), and the counterclockwise angle is negative (-).



| Model | Maximum Motion Range |
|----------------|----------------------|
| IR-S10-60Z20S3 | $\pm 132^\circ$ |
| IR-S10-70Z20S3 | |
| IR-S10-80Z20S3 | |

3.6.2.3 Maximum angle range of joint 2

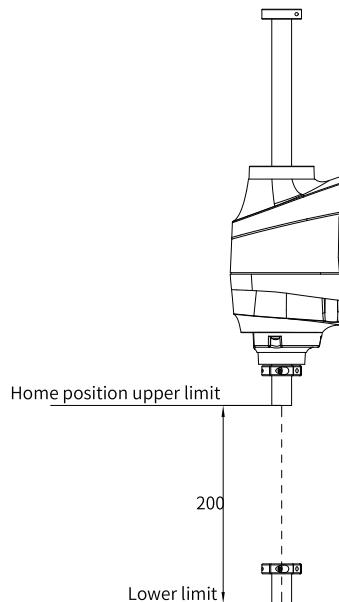
The 0 angle position of J2 refers to the position where the second arm is perpendicular to the first arm. (This is true regardless of the direction of the first arm.) From the 0 angle position, the clockwise angle is positive (+), and the counterclockwise angle is negative (-).



| Model | Maximum Motion Range |
|----------------|----------------------|
| IR-S10-60Z20S3 | $\pm 150^\circ$ |
| IR-S10-70Z20S3 | |
| IR-S10-80Z20S3 | |

3.6.2.4 Maximum Stroke of Joint 3

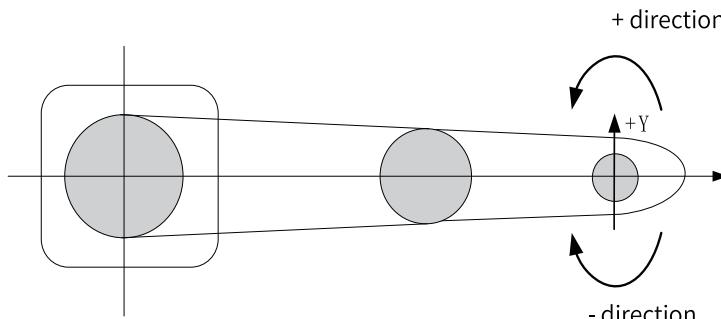
The 0 angle position of J3 is the upper limit position of the axis. When J3 descends from the 0 angle position, it will definitely change to a negative angle value.



| Model | Stroke of J3 |
|----------------|--------------|
| IR-S10-60Z20S3 | 200 mm |
| IR-S10-70Z20S3 | |
| IR-S10-80Z20S3 | |

3.6.2.5 Maximum angle range of joint 4

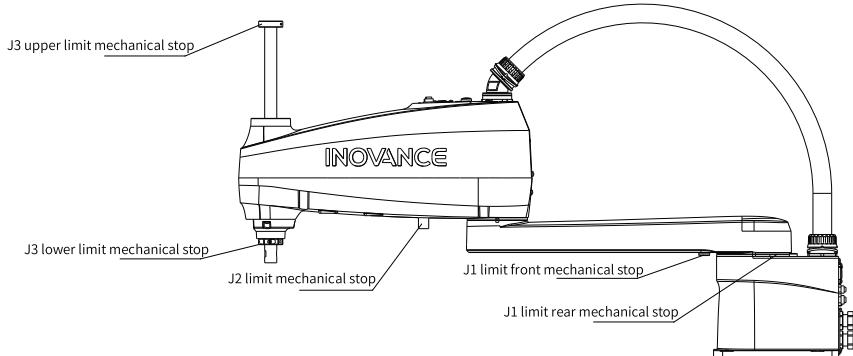
The 0 angle position of J4 is the position where the plane at the top of the axis faces in the direction of the top of the second robot arm. (This is true regardless of the direction of the second arm.) From the 0 angle position, the clockwise angle is positive (+), and the counterclockwise angle is negative (-).



| Model | Maximum Motion Range |
|----------------|----------------------|
| IR-S10-60Z20S3 | $\pm 360^\circ$ |
| IR-S10-70Z20S3 | |
| IR-S10-80Z20S3 | |

3.6.3 Description of Mechanical Stops

The robot has mechanical stops at J1, J2 and J3, except J4, and all these mechanical stops are not adjustable. The motion range set by mechanical stops at J1 and J2 is the extreme motion range. The up and down motion range of the mechanical stop at J3 is set by the internal program.



3.6.4 Standard Motion Range

The "motion range" refers to the situation at the standard (maximum) specifications. When motor of each joint is excited, the center of the lowest point of J3 moves in the areas shown in the figure.

"Area limited by mechanical stop" refers to the area where the center of the lowest point of J3 can be moved when the motor of each joint is not excited. "Mechanical stop" mechanically sets the absolute motion range beyond which motion is not allowed.

"Maximum space" is the area that contains the farthest reach of the arms. When an end effector with a radius of 53 mm or more is mounted, set the maximum space to the length of the two robot arms plus the radius of the end effector. The motion range is shown below.

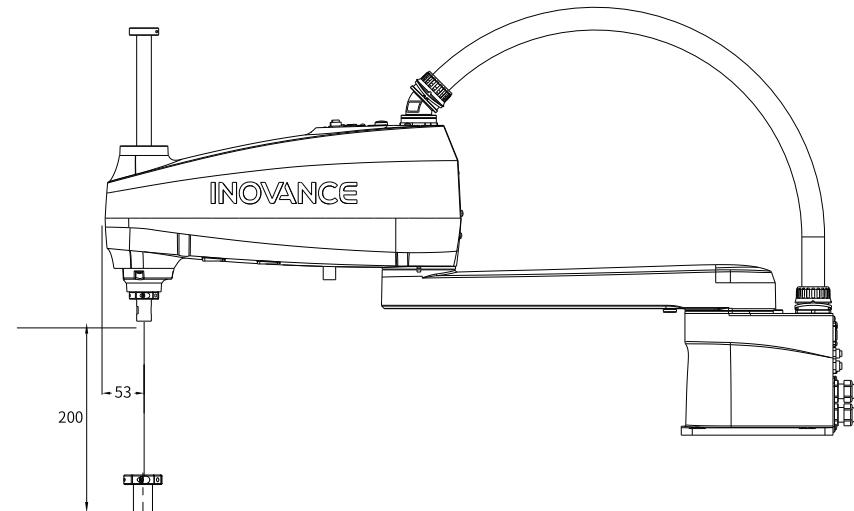


Figure 3-6 Motion range of end effector (unit: mm)

3.7 Maintenance

3.7.1 Safety Instructions for Maintenance and Repair

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



Danger

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not maintain the equipment after power-on. Failure to comply will result in an 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

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

3.7.2 Periodic Inspection Items

Perform periodic inspection on items that are difficult to check during operation. Clear the dust especially metal powders on the surface of the drive to prevent the dust from entering the equipment. Clear the greasy dirt from the cooling fan of the equipment.

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

| Inspec tion Point | Inspec tion Place | Daily In spec tion | Month ly Inspec tion | Quarter ly Inspec tion | Semi- annual Inspec tion | Annual Inspec tion | Maintenance Personnel | | |
|---|---|-----------------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|-----------------------|--------------------------------|----------------------|
| | | | | | | | Profes sionals | Quali fied Person nel | Manu factur er |
| Check wheth er the bolts are loose. If yes, tighten them. | End effec tor mount ing screw | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Robot mount ing bolts | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Each joint | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Bolts aroun d the axes | | | | | ✓ | | ✓ | ✓ |
| | Bolts secur ing the motor, reduc er, etc. | | | | | ✓ | | ✓ | ✓ |
| Check wheth er the connec tor is loose. If yes, push it secure ly or tighten it. | External con nec tors on the robot (on the con nector plates etc.) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Robot cable unit | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

| Inspec tion Point | Inspec tion Place | Daily In spec tion | Month ly Inspec tion | Quarter ly Inspec tion | Semi- annual Inspec tion | Annual Inspec tion | Maintenance Personnel | | |
|---|-------------------------|-----------------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|-----------------------|--------------------------------|----------------------|
| | | | | | | | Profes sionals | Quali fied Person nel | Manu factur er |
| Check for exter nal defects and remove dust. | Whole | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Exter nal cables | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Check for bends or improp er loca tion. Repair or place it proper ly if neces sary. | Safe guard etc. | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Check tension of timing belt. Tight en it if neces sary. | Inside arm #2 | | | | ✓ | ✓ | ✓ | ✓ | ✓ |

| Inspec tion Point | Inspec tion Place | Daily In spec tion | Month ly Inspec tion | Quarter ly Inspec tion | Semi- annual Inspec tion | Annual Inspec tion | Maintenance Personnel | | |
|--|--|-----------------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|-----------------------|--------------------------------|----------------------|
| | | | | | | | Profes sionals | Quali fied Person nel | Manu factur er |
| Check if the lubri cating grease is suffi cient for lubrica tion, and add an appro priate amoun t of lubri cating grease as need ed. | Ball screw | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Spline | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Polish ed rod lubri cation inspec tion place | | | | ✓ | ✓ | ✓ | ✓ | ✓ |

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

| Inspec tion Point | Inspec tion Place | Daily Inspec tion | Month ly Inspec tion | Quar terly Inspec tion | Semi- annual Inspec tion | Annual Inspec tion | Maintenance Personnel | | |
|---|--|-------------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|-----------------------|--------------------------------|----------------------|
| | | | | | | | Profes sionals | Quali fied Person nel | Manu factur er |
| Shake the cable gently by hand to check for wire break age. | Exter nal cables (includ ing cable units of the robot) | | | | ✓ | ✓ | | ✓ | ✓ |
| Press each arm by hand in the ena bled state to check wheth er the arms shake. | Each joint | | | | | ✓ | | ✓ | ✓ |

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

| Inspec tion Point | Inspec tion Place | Daily Inspec tion | Month ly Inspec tion | Quar terly Inspec tion | Semi- annual Inspec tion | Annual Inspec tion | Maintenance Personnel | | |
|--|-------------------------|-------------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|-----------------------|--------------------------------|----------------------|
| | | | | | | | Profes sionals | Quali fied Person nel | Manu factur er |
| Check the motion range. | Each joint | | | | | ✓ | | ✓ | ✓ |
| Check whether unusual sound or vibration occurs. | Whole | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Measure the accuracy repeatedly by a gauge. | Whole | | | | | ✓ | | ✓ | ✓ |

3.7.3 Component Replacement

3.7.3.1 Note

- Be sure to cut off the power supply before installing or removing the motor connector; otherwise it may cause abnormal action of the robot or electric shock.
- Do not maintain the equipment after power-on. Failure to comply will result in an electric shock.
- Prevent foreign objects from entering the equipment and terminals during maintenance.

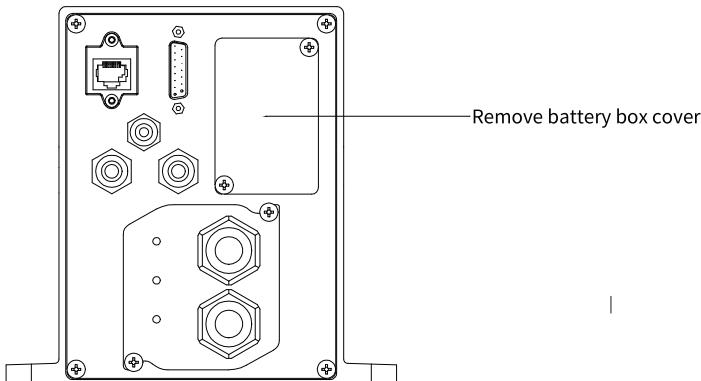
3.7.3.2 Replacing Battery

Warning

- Do not maintain the equipment after power-on. Failure to comply will result in an electric shock.
- When disposing the battery, consult with the professional disposal services or comply with the local regulation.
- Be sure to use lithium batteries correctly, the wrong way of use may lead to lithium battery heat, leakage, explosion or even fire, resulting in serious damage to personal and property safety.
- Do not charge the lithium battery.
- Do not pressurize or deform the lithium battery.
- Do not disassemble the lithium battery.
- Do not short-circuit or misconnect the lithium battery.
- Do not heat the lithium battery.
- Do not put the lithium battery into fire.
- Do not solder the battery terminals.
- Do not force discharge the lithium battery.

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

1. Remove the two M4x8 screws from the battery box cover.



2. Connect the new battery to the empty white 2P cable end connector.



3. Remove the old battery.
4. Fix the new battery on the battery box cover, and then secure the cover to the base with the M4*8 screws.

Note

If the home position is lost due to failure to comply with the preceding steps, see ["3.7.4.1 Description of Home Position Calibration" on page 143](#).

3.7.3.3 Replacing Cable

1. Loosen the fixing screw with a cross wrench, rotate the cable board by a certain angle and then take out the cable board.
2. Replace the damaged cable.
3. Rotate the cable board to the fixing hole and tighten the screw.

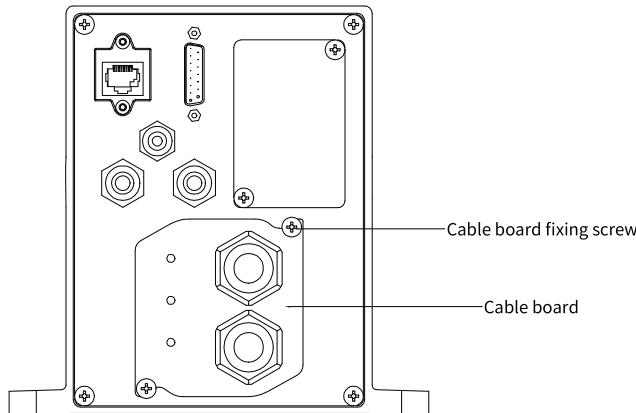


Figure 3-7 Base cable board

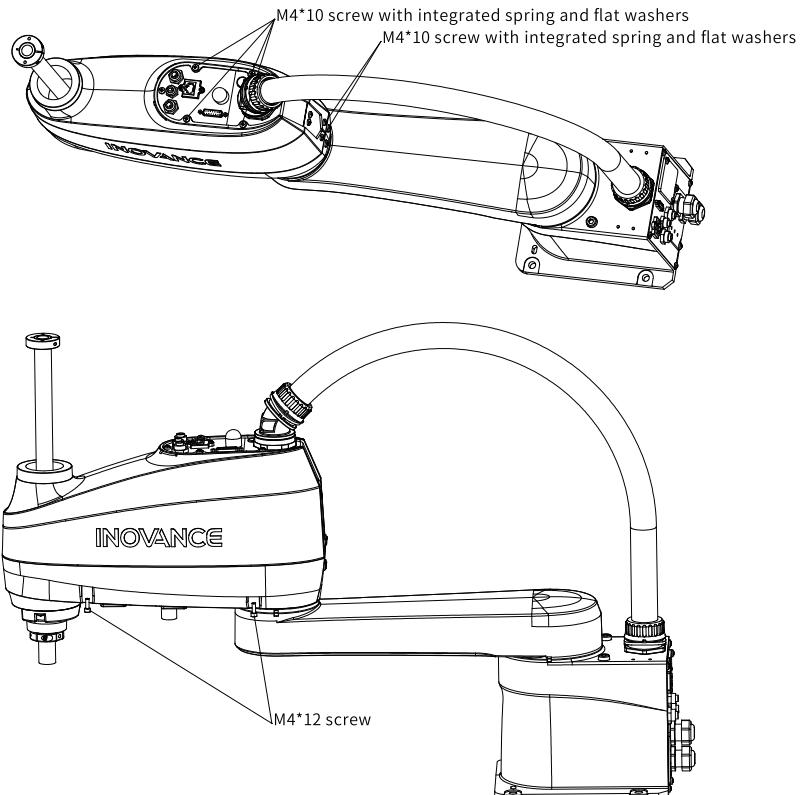
Caution

- Do not pull the cable board forcibly. Failure to comply will result in cable damage, wire breaking, or poor contact, causing electric shock or system fault.
- After removing the cable board, ensure that the cables are correctly connected during cable maintenance.

3.7.3.4 Replacing Enclosure

Removing the enclosure of the forearm

Remove the six M4*10 screws on the enclosure and sheet metal, and then remove the four M4*12 screws connecting the enclosure and the forearm.



Installing the enclosure of the forearm

1. Install the enclosure onto the forearm. Pay attention to the positioning columns and holes between the enclosure and the forearm to ensure that the mounting surface of the enclosure fits seamlessly with the mounting surface of the forearm and sheet metal.
2. Install the six M4*10 screws on the enclosure and sheet metal with a torque of 0.6 N.m.
3. Install the four M4*12 screws connecting the enclosure to the forearm, with a torque of 0.6 N.m.

3.7.4 Home Position Calibration

3.7.4.1 Description of Home Position Calibration

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

Note

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



Warning

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

3.7.4.2 Home Position of Each Joint

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

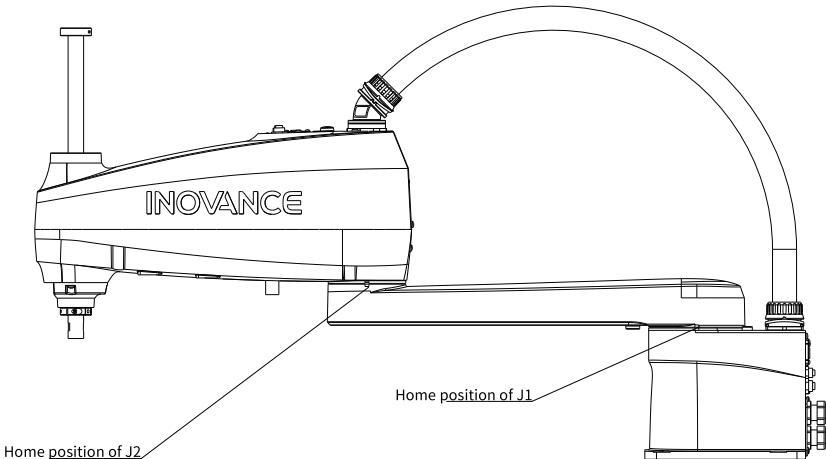


Figure 3-8 Home position of J1/J2

2. Home position of J3: The upper limit position of the J3.

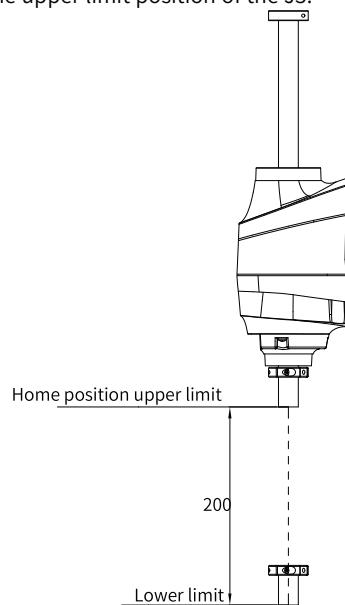


Figure 3-9 Home position of J3

3. Home position of J4: The position where the plane of the axis (or the slots of the upper and lower mechanical stops) faces the direction of the top of the second robot arm.

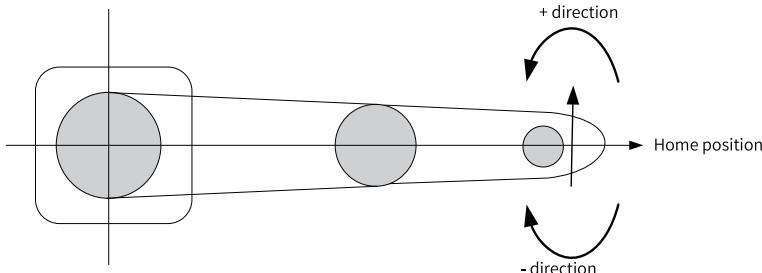


Figure 3-10 Home position of J4

3.7.4.3 Home Position Calibration of Joints 1 and 2

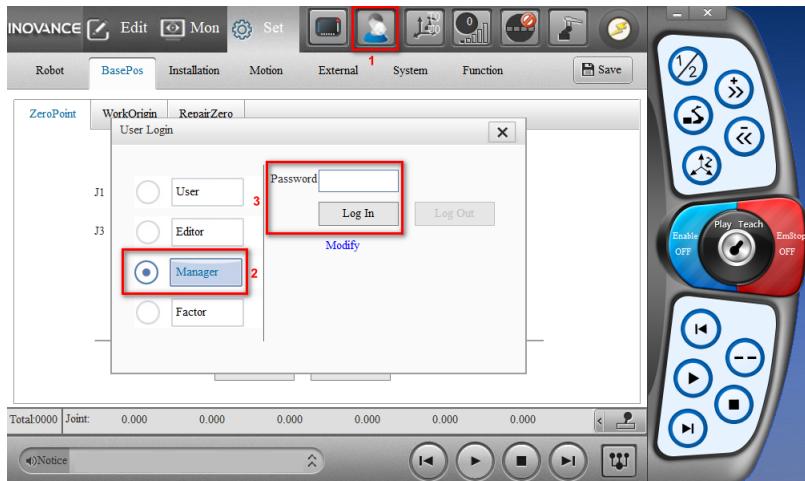
Both the teaching software on PCs and the hand-held teach pendant provide an operation interface for home position calibration. The following takes the teaching software on PC as an example. The operations on the hand-held teach pendant are similar.

Due to the strong correlation between the coordinates of the robot's work points and the accuracy of J2, it is necessary to complete the home position calibration of J2 before calculating the robot coordinates. The teach pendant provides a right/left wrist rule wizard. Follow the wizard to calibrate the home position.

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

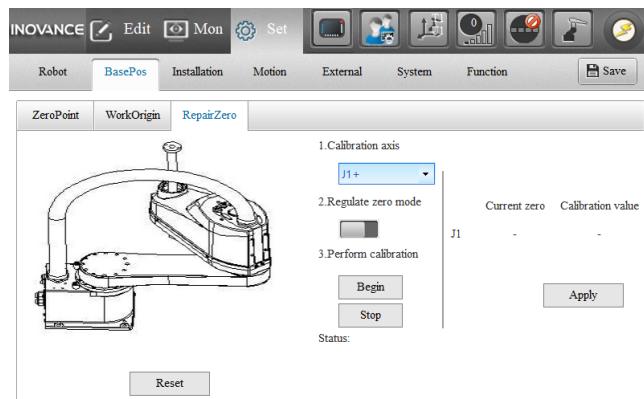
1. Log in to the user account.

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



2. Switch to the calibration interface.

Choose **Set > BasePos > RepairZero** on the main interface of the teaching software or the hand-held teach pendant.



3. Choose the calibration axis.

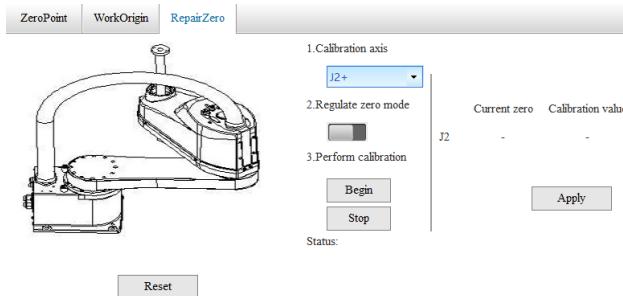
Choose the axis you want to calibrate from the **Calibration axis** drop-down list.

- The zeroing motion direction of all axes is positive.
- Caution: When switched to zeroing mode, the robot servo will be automatically enabled.
- If the multi-turn value of the encoder exceeds 2000, a warning pops up and emergency stop is triggered. In this case, you need to restart the controller and perform calibration again.

4. Perform calibration.

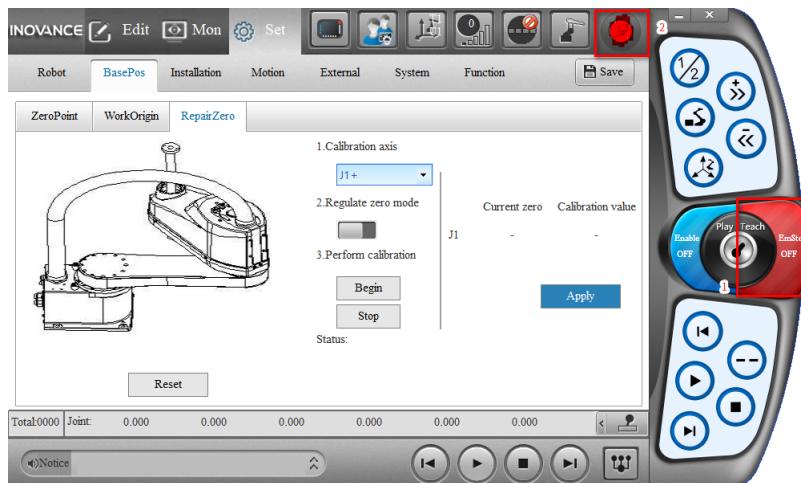
For example, select J2+ axis and click **Begin** to start calibration.

When the calibration is complete, the calibration value is updated.



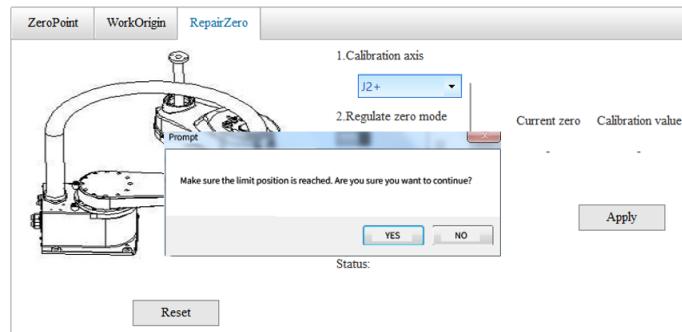
5. Switch to the emergency stop state.

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

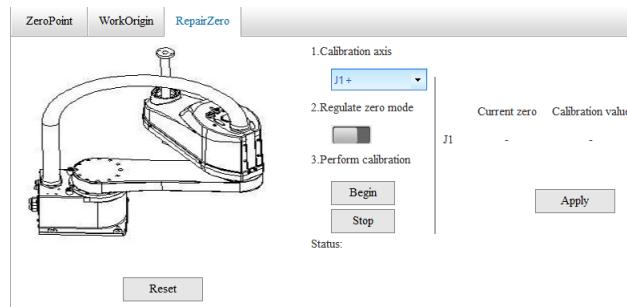


6. Update the zero point.

- Click **Apply**.



b. In the pop-up dialog, click **Yes**. The "Current zero" is replaced by "Calibration value".



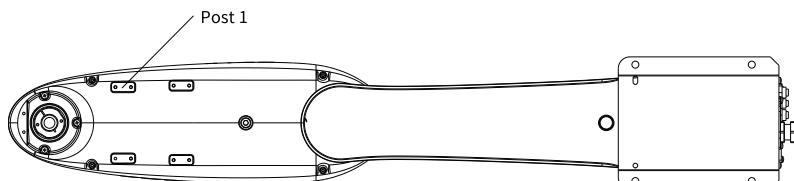
7. Check the zero point.

After updating the system zero point, check the result.

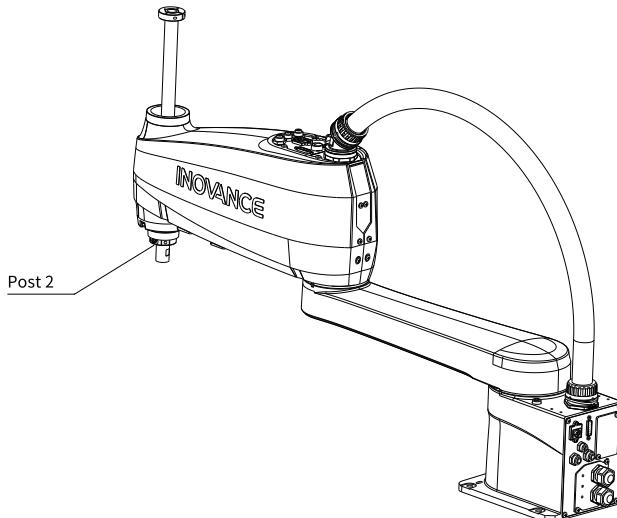
Recommended method: Teach a point, change the left and right hand parameters, and then observe the deviation of the center of the lead screw moving to that point.

3.7.4.4 Home Position Calibration of Joints 3 and 4

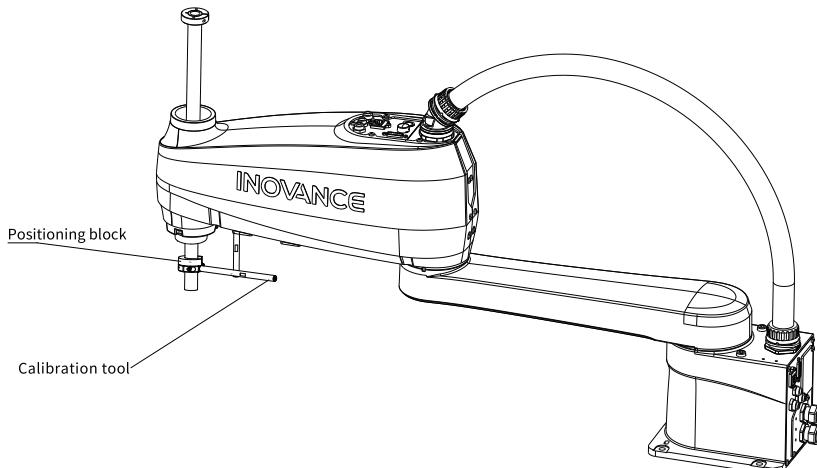
1. Fix the threaded end of the post 1 to the M4 threaded hole at the bottom of the forearm, as shown in the following figure:



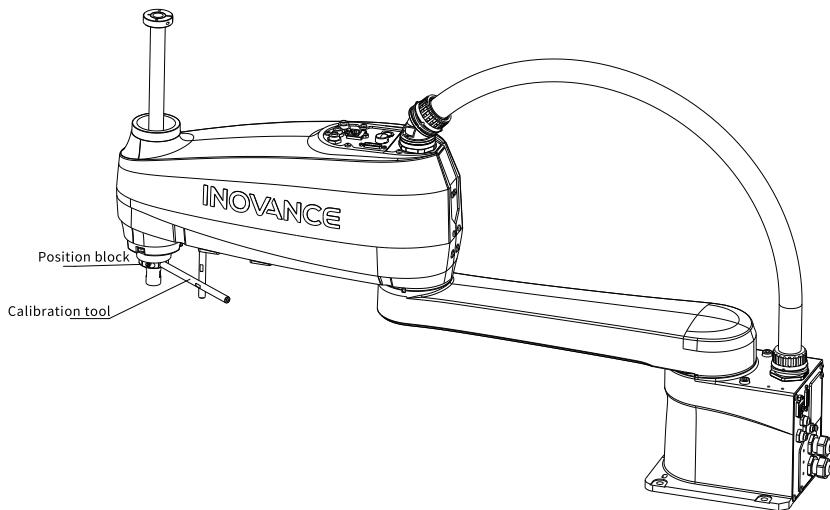
2. Fix the threaded end of the post 2 to the M5 threaded hole of the limit ring of the lead screw, as shown in the following figure:



3. Rotate the post 2 in the positive direction until it contacts the post 1. Then, assemble the positioning block onto the lead screw, as shown in the following figure:



4. Press the brake button and push the lead screw upwards until the positioning block contacts the lower end of the spline nut, as shown in the following figure. For other operations, refer to the automatic calibration steps. Select "J3J4+" when selecting the calibration axes to complete the calibration.



3.7.5 Options

| Name | | Code | Description | Diagram (in mm) |
|---------------------------------|-------------------|----------|--|-----------------|
| Protective cover for lead screw | | 20212980 | Mounted on the manipulator to protect the lead screw | / |
| Calibration tool | Post 1 | 32020626 | Used to calibrate the home position of J3 and J4 | |
| | Post 2 | 32020627 | | |
| | Positioning block | 32040084 | | |



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