



IR-R4 Series 6-Axis Robot

User Guide - Mechanical



Industrial
Automation



Intelligent
Elevator



New Energy
Vehicle



Industrial
Robot



Rail
Transit



Data code PS00008776 A01

Preface

Introduction

The IR-R4 series robot is a supplement to the 6-axis robot lineup for applications requiring a 4 kg payload capacity. With a compact and lightweight design, this robot can handle a maximum load of 4 kg. It finds extensive use in handling, loading, and unloading tasks in the 3C industry, as well as in handling tasks in the photovoltaic industry. Moreover, it is adaptable to grinding, assembly, and gluing tasks. Its compact structure and versatile installation facilitate a condensed arrangement of work units, empowering users to enhance productivity and efficiency.

More Documents

Doc Name	Data Code	Description
IRCB500 Series Robot Control Cabinet User Guide	PS00001641	Describes the specifications, installation, and wiring of the IRCB500 series control cabinet
IRTP80 Series Teach Pendant User Guide	19012261	Describes the product information, wiring, and operation of the IRTP80 series teach pendant

Revision History

Date	Version	Description
September 2023	A01	Corrected the warranty statement
April 2023	A00	First release

Access to the Guide

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

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



Warranty

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

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

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

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

For details, see the Product Warranty Card.

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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



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



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



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



- 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 shavings, 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.

Special Reminder

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

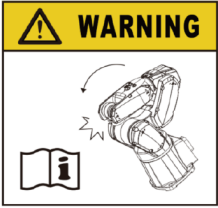
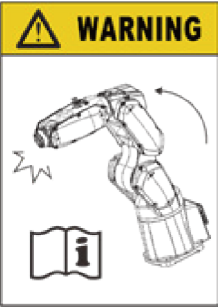
1. Please ensure that the safety protection range of the robot is greater than the maximum motion range of the robot. Comprehensive safety protection devices (fences, etc.) must be installed on the periphery, and emergency stop devices must be installed within easy reach of the operator. Leave sufficient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

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

Safety Signs

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

Description of warning signs:

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

Safety Signs	Description
	<p>Do not touch the energized parts when the power is on. Failure to comply may result in an electric shock.</p>
	<p>If a lifting is required, please follow the lifting diagram, otherwise the robot may tilt and cause damage or injury to personnel. See the user guide for information on lifting the robot.</p>

1 Product Information

1.1 Nameplate and Model Number

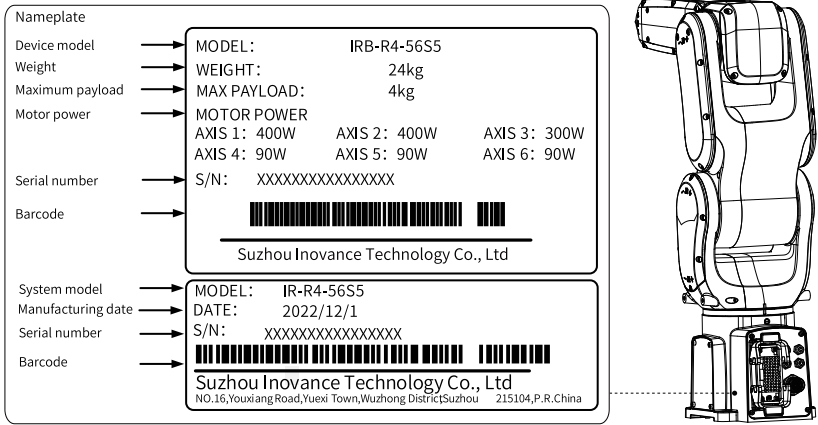


Figure 1-1 Nameplate

Note

Before use, make sure that the serial number of the robot manipulator is consistent with that of the robot controller. Otherwise, the robot system may not work properly.

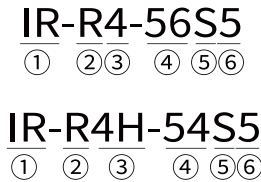


Figure 1-2 Model naming rules

① Product family INOVANCE Robot	③ Payload 4: 4 kg 4H: 4 kg (hollow wrist)	⑤ Installation mode C: Clean S: Standard P: High-protection
② Series S: SCARA robot R: 6-axis robot TS: Ceiling-mounted SCARA robot	④ Arm length 54: 545.7 mm 56: 560.6 mm	⑥ Cable length 0: No drag chain cable 3: 3 m standard cable 5: 5 m standard cable G3: 3 m highly-flexible cable

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 Components

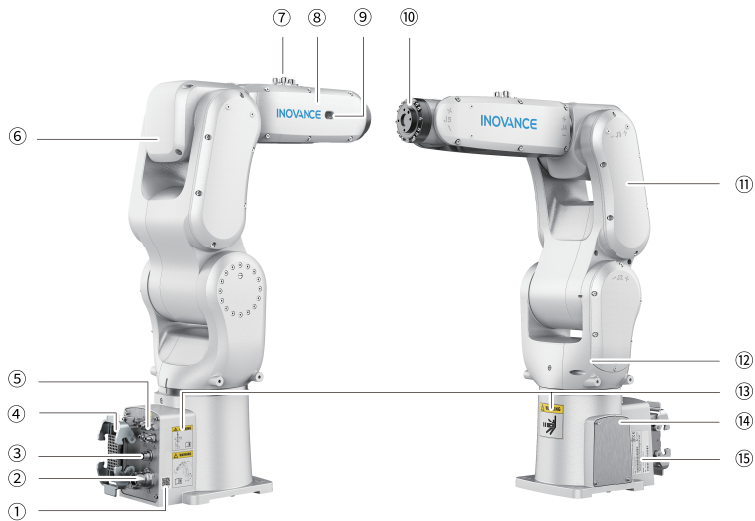


Table 1-1 Components

No.	Component	No.	Component
①	QR code	⑨	Hollow wrist (for standard models only)
②	19-pin I/O aviation connector	⑩	Wrist flange
③	Network cable connector	⑪	Upper arm
④	Heavy-duty connector	⑫	Swivel base
⑤	Air tube connector	⑬	Warning label
⑥	Elbow	⑭	Base
⑦	12-pin I/O aviation connector	⑮	Nameplate
⑧	Forearm	-	-

Note

Standard models are equipped with a hollow wrist, while customized models do not include a hollow wrist.

1.3 Rotation Directions

The following figure illustrates the rotation direction of each axis.

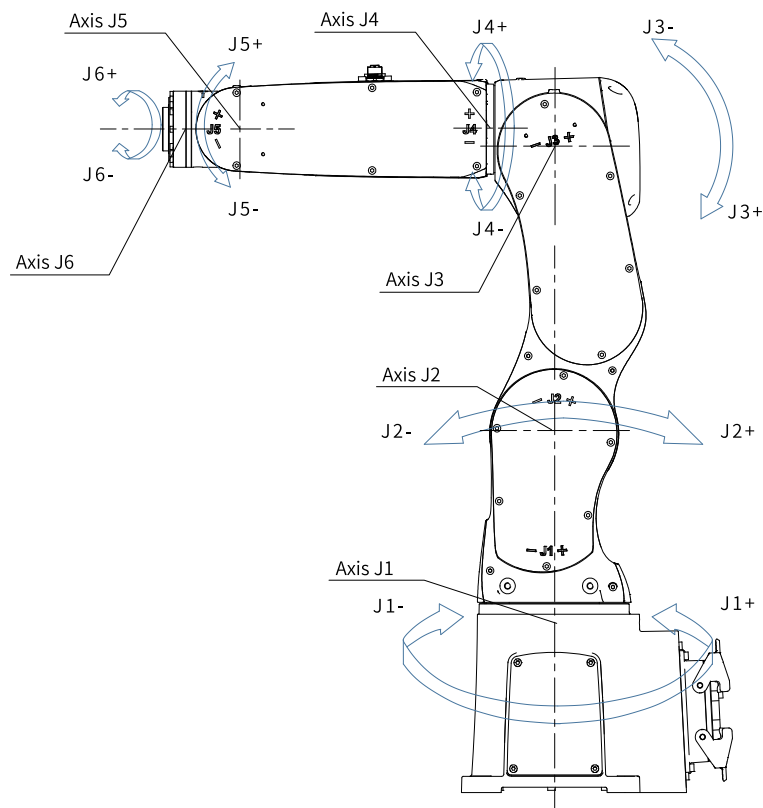


Figure 1-3 Axis rotation directions

1.4 Outline Dimensions

IR-R4-56S5 dimensions

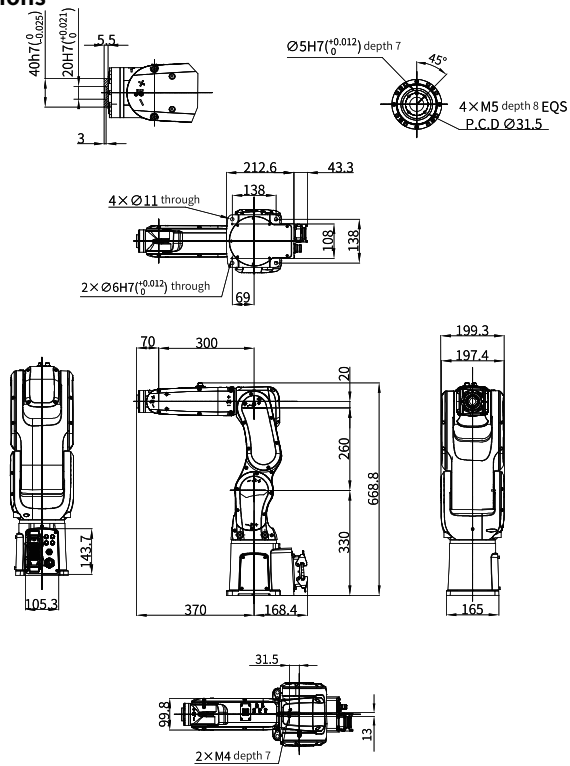


Figure 1-4 IR-R4-56S5 dimensions (unit: mm)

IR-R4H-54S5 dimensions

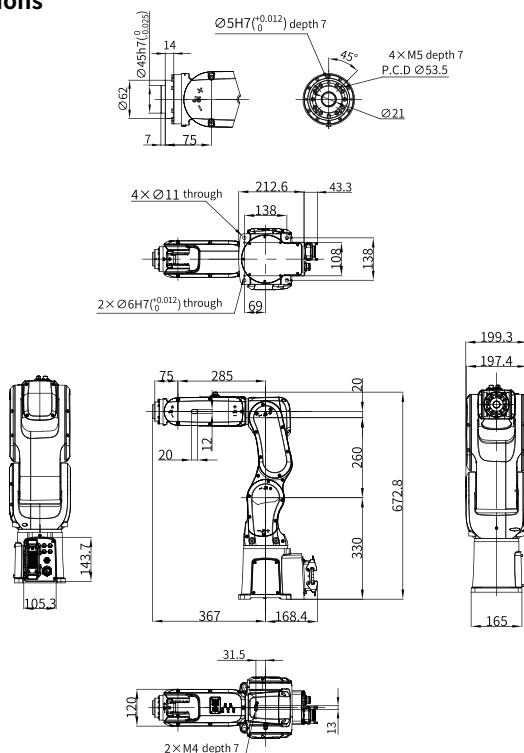


Figure 1-5 IR-R4H-54S5 dimensions (unit: mm)

1.5 Specifications

Model	IR-R4-56S5	IR-R4H-54S5
Structural style	Vertical multi-axis cascading structure	
Number of axes	6	
Maximum reach	560.6 mm	545.7 mm
Absolute positioning accuracy	± 0.3 mm	
Repeat positioning accuracy	± 0.01 mm	± 0.02 mm
Standard cycle time	0.37s (25 mm - 300 mm - 25 mm, 1 kg)	
Maximum payload	4 kg	
Rated payload	2 kg	

Model		IR-R4-56S5	IR-R4H-54S5
Motion speed	J1	450°/s	
	J2	460°/s	
	J3	520°/s	
	J4	560°/s	
	J5	560°/s	
	J6	900°/s	
Operating area	J1	−170° to +170°	
	J2	−120° to +110°	
	J3	−69° to +205°	−65° to +195°
	J4	−190° to +190°	
	J5	−120° to +120°	
	J6	−360° to +360°	
Allowable wrist torque	J4	8.86 N·m	
	J5	8.86 N·m	
	J6	4.9 N·m	
Maximum allowable wrist inertia	J4	0.2 kg·m ²	
	J5	0.2 kg·m ²	
	J6	0.067 kg·m ²	
Applicable environment	Ambient temperature	0°C to 45°C	
	Ambient humidity	5% to 95% (non-condensing)	
	Maximum temperature gradient	1.5°C/min	
Noise level		≤ 75 dB	≤ 80 dB
IP rating		Standard IP40, optional IP67	
Body weight		24 kg	24.5 kg
Base mounting dimensions		138 mm x 138 mm-4xφ11	
End flange dimensions		4xM5 depth 8+1xφ5H7 depth 7-φ31.5 mm	4xM5 depth 7+1xφ5H7 depth 7-φ53.5 mm; hollow hole diameter: 21 mm

1.6 Operating Area



Caution

- Ensure a safety protection range that is greater than the maximum operating area of the robot. Set up comprehensive guard devices (such as fences) around the safety protection range, with an emergency stop device easily accessible to operators.
- On the guard devices (fences), clearly display robot status, such as automatic running, teaching, and emergency stop, so that on-site personnel can easily see the status of the robot.
- The safety fences must be sturdy enough to withstand impacts and pressures from both internal and external sources. The safety fences must be fixed and immovable to prevent operators from easily dismantling or breaking them. The safety fences must also be free of sharp angles, edges, or spikes, and must not contain any potentially hazardous components.

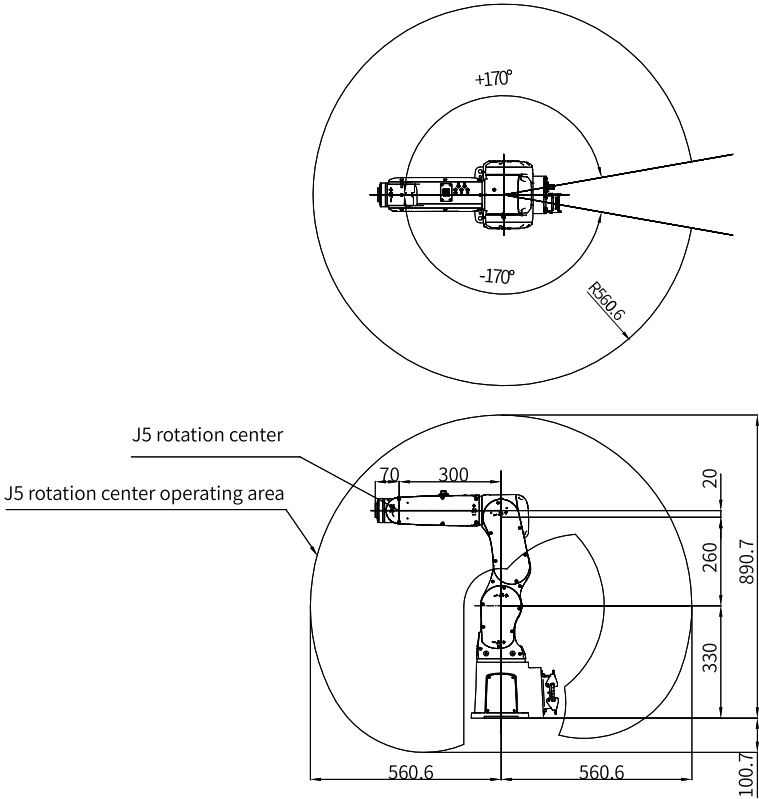


Figure 1-6 IR-R4-56S5 robot operating area (unit: mm)

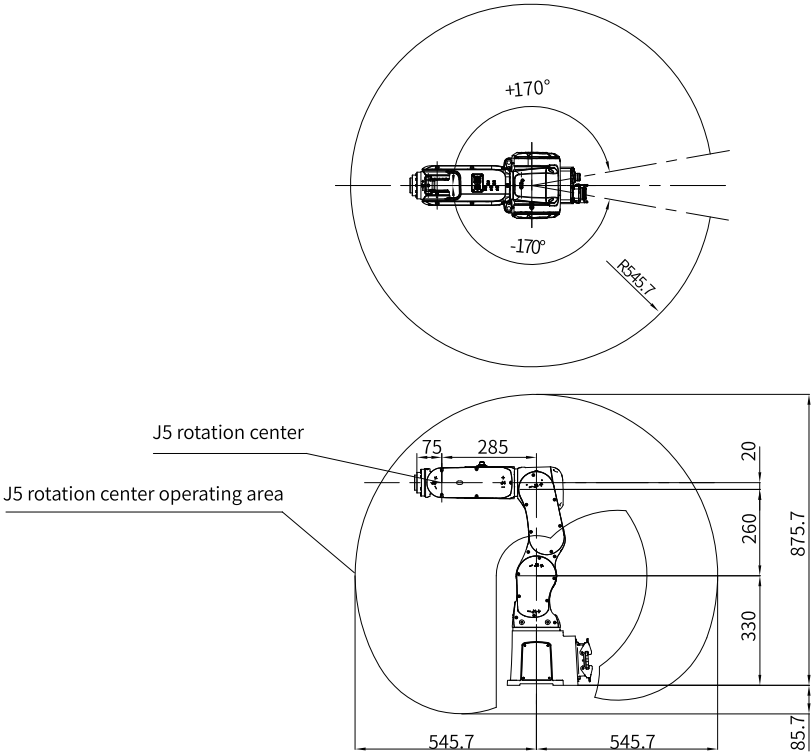


Figure 1-7 IR-R4H-54S5 robot operating area (unit: mm)

1.7 Maximum Load of the Wrist Flange

The IR-R4-56S5 and IR-R4H-54S5 models each support a maximum payload of 4 kg. The torque and maximum inertia should meet the following requirements. External force (other than gravity) applied to the robot should not exceed the range in the table below.

Wrist Load Condition		IR-R4-56S5 and IR-R4H-54S5
Allowable torque (N · m)	J4	8.86
	J5	8.86
	J6	4.9
Allowable inertia (kg · m ²)	J4	0.2
	J5	0.2
	J6	0.067

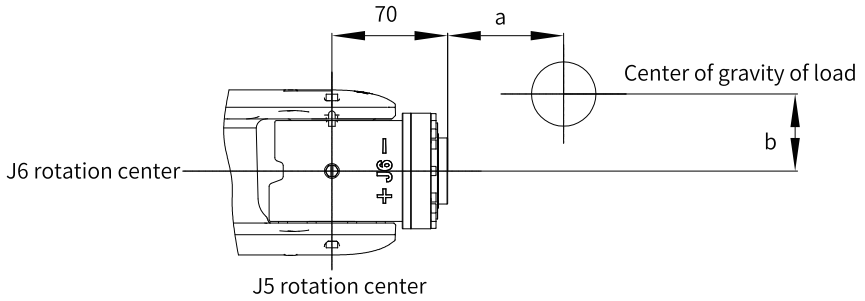


Figure 1-8 Distance to the rotation center of the J5/J6 axis of IR-R4-56S5

Note

- Distance to the rotation center of the J5 axis: $a + 70$ (mm)
- Distance to the rotation center of the J6 axis: b (mm)

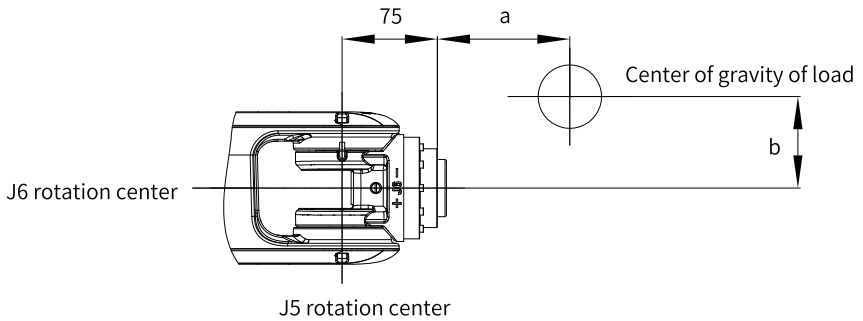


Figure 1-9 Distance to the rotation center of the J5/J6 axis of IR-R4H-54S5

Note

- Distance to the rotation center of the J5 axis: $a + 75$ (mm)
- Distance to the rotation center of the J6 axis: b (mm)

1.8 Wrist Load Curve

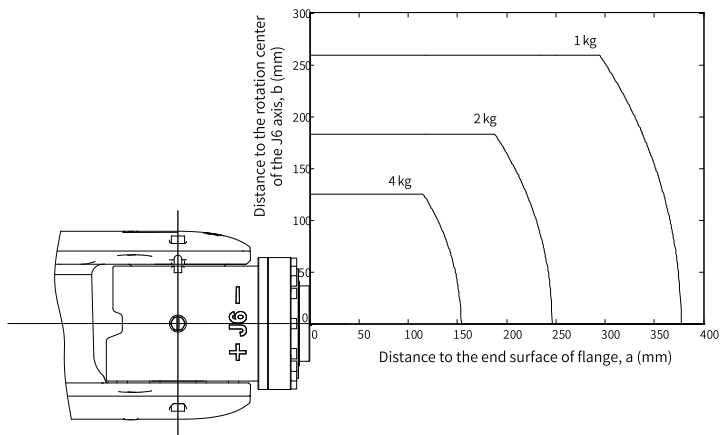


Figure 1-10 IR-R4-56S5 wrist load curve

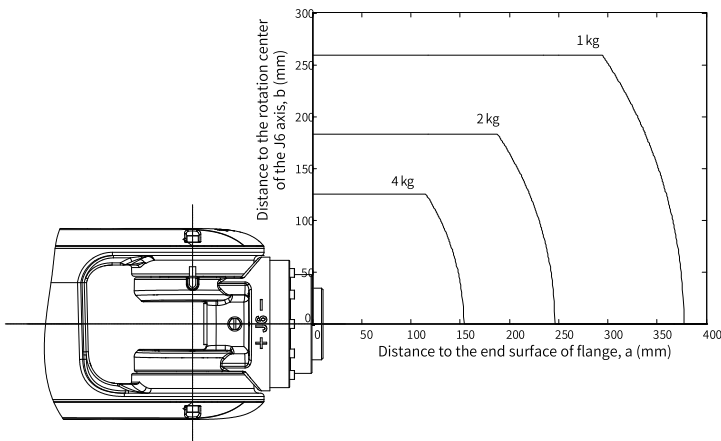


Figure 1-11 IR-R4H-54S5 wrist load curve

2 Preparation Before Installation

2.1 Requirements on 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.

2.2 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	Operating temperature: 0°C to 45°C (air temperature change rate less than 1.5°C/min) Humidity: 5% to 95%RH (non-condensing)
Storage temperature and humidity	Storage temperature: -10°C to +55°C Humidity: Max. 95%RH (non-condensing)
Transportation temperature and humidity	Temperature: -10°C to +55°C Humidity: Max. 95%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 ◆Keep away from shocks or vibrations ◆Keep away from sources of electrical interference



Caution

The robot is not suitable for use in harsh environments such as explosive spraying operations. Contact your provider if the robot needs to be used in an environment that does not meet the preceding conditions.

The EMC test is performed according to IEC 61800-3:2017.

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 Installation Base Table Requirements

You need to make a base table to fix the robot. The shape and size of the base table vary depending on the purpose of the robot system. You may refer to the following requirements when designing a base table.

- The base table supports not only the weight of the robot, but also the dynamic forces produced by the robot when it moves at maximum acceleration. Ensure that the base table has sufficient bearing capacity by reinforcing it with materials like connecting beams.
- Use M10 threaded holes on the base table to mount the robot. Use screws with a strength equivalent to Grade 12.9 specified in GB/T 3098.1.
- To dampen vibrations, use a steel plate with a thickness of over 30 mm, a surface roughness of 25 μm , and a flatness of less than 0.2 as the robot mounting surface.
- Fix the base table firmly on the ground.
- Keep the Z-axis of the robot perpendicular to the horizontal plane during installation.

- Reserve enough space for the robot control cabinet in the base table design. For space requirements of control cabinets, see relevant control cabinet user guides.
- Consider the following torques and reaction forces produced by movements of the robot.

Table 2-2 Maximum force and torque on the robot

Series	Torque in the Vertical Plane, M_k (N · m)	Vertical Force, F_v (N)	Torque in the Horizontal Plane, M_r (N · m)	Horizontal Force, F_o (N)
IR-R4-56S5/IR-R4H-54S5	500	1000	500	1200

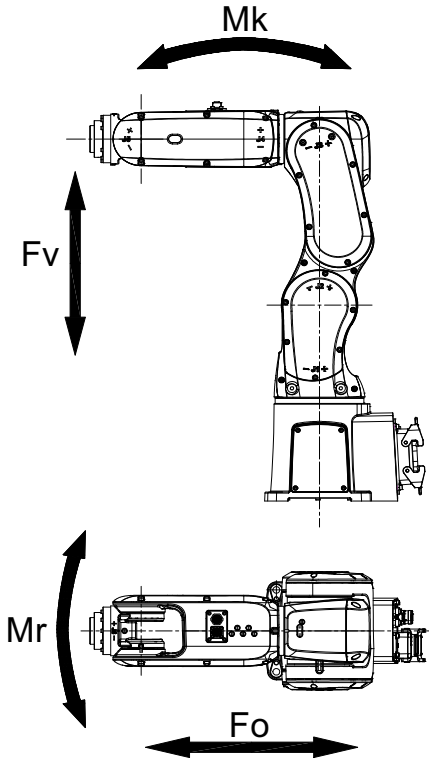


Figure 2-1 Forces and torques on the robot

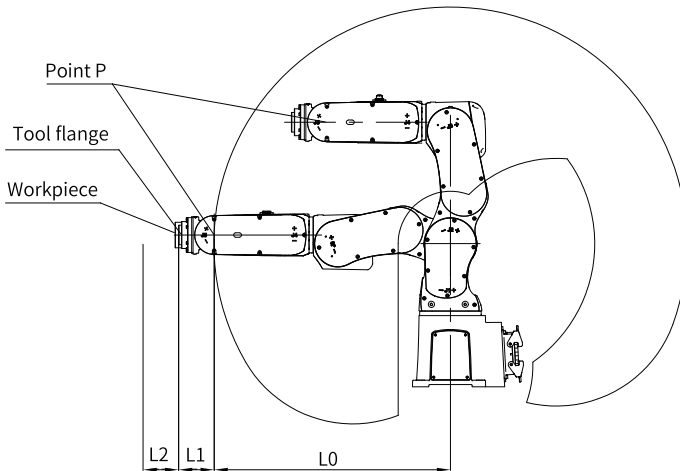
2.4 Installation Clearance Requirements

2.4.1 Safety Fence Range



Caution

- The safety protection range of the robot is greater than the maximum motion range of the robot. Comprehensive safety protection devices (fences, etc.) must be installed on the periphery, and emergency stop devices must be installed within easy reach of the operator.
 - Clearly display the status information of the robot on the safety protection device (fence), such as automatic mode, teaching, emergency stop, etc., so that personnel outside the safety fence can see the current status of the robot.
 - The safety fence must be strong enough to withstand both internal and external impacts and forces. The position of the safety fence must be fixed to prevent operators from easily dismantling or breaking the safety fence. In addition, the safety fence must be free of any potential hazardous parts such as sharp corners, edges, or spikes.
-



- L0: Operating area of the robot
- L1: Total length of the wrist, tool flange, and workpiece
- L2: Safety margin, where $L2 > 100 \text{ mm}$

2.4.2 Installation Space

1. In addition to the space required for the robot body, control cabinet, and peripherals, ensure the following minimum required spaces:
 - Space for teaching
 - Space for maintenance and inspection (for mounting fixtures)
 - Space for cables
2. The minimum bending radius of power cables and signal cables is 170 mm. When installing the robot, pay attention to the distance from obstacles. Reserve enough space for cable bending radius to avoid cable damage or breakage caused by extreme bending. For details, see ["4.5.3 Cable Hole Dimensions" on page 46](#).
3. Reserve at least 100 mm between the boundary of the operating area and the safety barrier.

2.5 Installation Tools

Table 2–3 Installation tools

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

3 Unpacking and Handling

3.1 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.

3.2 Unpacking

1. Remove the outer carton.

Cut the PET straps on the carton with scissors or a utility knife. Remove the carton cover and the paper corner protectors. Lift the carton vertically to remove it.

Note

Wear gloves to prevent scratches.

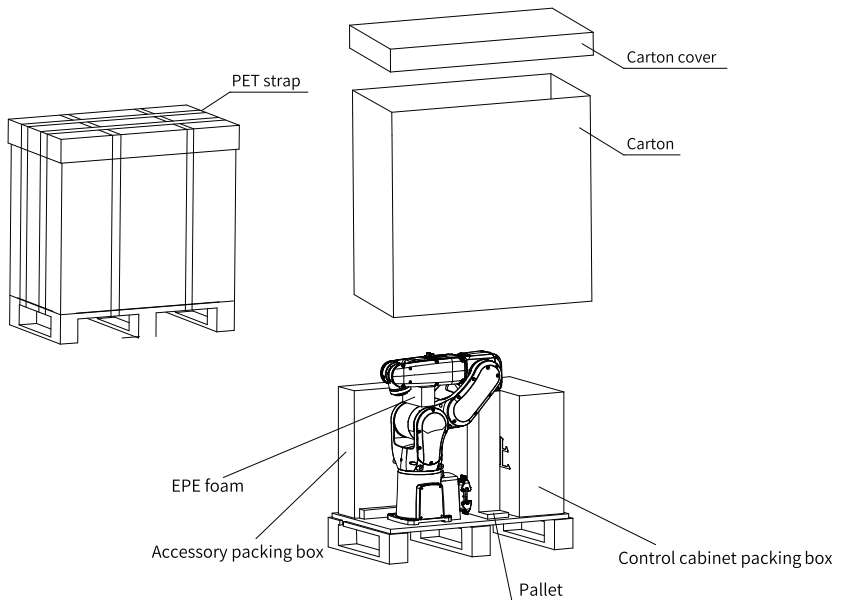
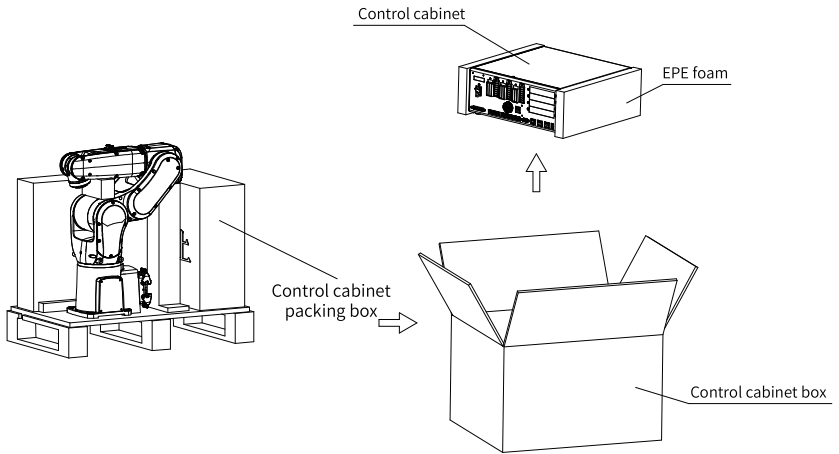


Figure 3-1 Removing the outer carton

2. Unpack the control cabinet.

- Cut the packing straps securing the control cabinet and accessory packing boxes with scissors.
- Remove the accessory packing box from the pallet. Then, transfer the control cabinet packing box from the pallet to an open area, ensuring to follow the orientation instructions on the box.
- Cut the sealing tape on the control cabinet packing box with scissors, and then open the box.
- Remove the expanded polyethylene (EPE) foam from the sides of the control cabinet. Grip the holes on the sides of the control cabinet or hold the bottom to remove the control cabinet from the packing box. Transfer the control cabinet to the desired location.



3. Remove the bolts securing the robot body.
Remove the bolts (M8x80) securing the robot body on the pallet by using an M8 outer hexagon wrench.

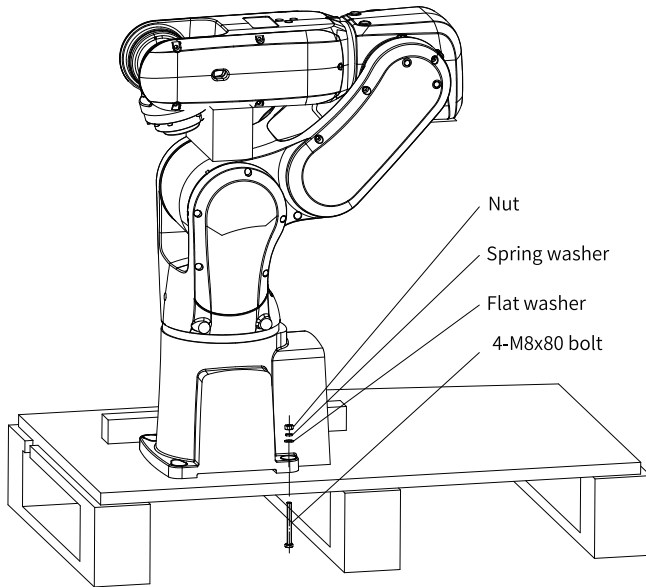


Figure 3-2 Packing of the robot

4. Take out the robot body.
Lift the robot vertically and then move it horizontally to remove it from the pallet. Avoid interference between the bottom of the robot body and the top of the fixtures. Then, transfer the robot body to the desired location.

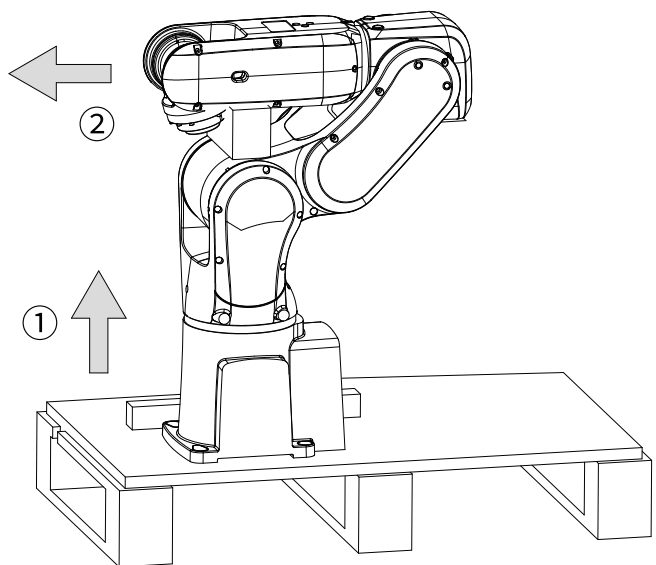


Figure 3-3 Taking out the robot body

Note

- Take out the robot carefully to avoid collision.
- To repack the robot, reverse the steps above. Please wear protective gloves to prevent scratches and work carefully to prevent damaging the machine.

3.3 Post-Unpacking Inspection

Check the products and accessories against the packing list after unpacking.

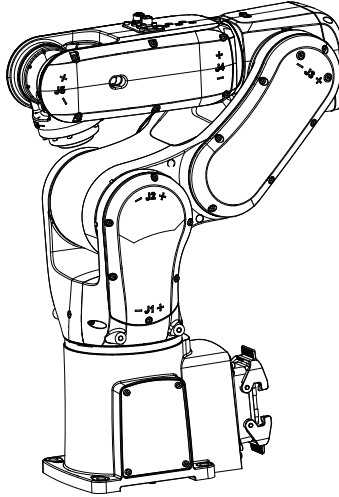
Table 3-1 Packing list

Material Name	Quantity (PCS)
Robot manipulator	1
Robot controller	1
Product Warranty Card	1
Controller cable connection kit	1
Connecting cable between manipulator and controller	1
Hexagon socket screw M10*35	4
Spring washer (GB/T93-1987)-10	4
Washer (GB/T97.1-2002)-10	4

3.4 Handling

Preparation before handling

1. If the robot is newly manufactured, keep it in the same posture as it was in the factory, as shown in the following figure.



Angles of the axes:

J1	J2	J3	J4	J5	J6
0°	+55°	-55°	0°	-105°	0°

2. If the robot has been used and needs to be moved to another location, complete the following steps before handling:
 - Disconnect power to all devices.
 - Unplug power and signal cables connected to the control cabinet.
 - Unscrew the base mounting screws and remove the robot from the mounting base.
 - Secure the robot to the handling equipment.
 - Adjust the robot to the posture for handling.

Handling procedure

Note

- The equipment is heavy and manual handling is strictly prohibited.
- Wear safety shoes for handling and at least two people are required.
- Wear protective equipment and ensure that the lifting area is safe enough to avoid collision hazards.



Warning

- Care should be taken when handling the robot with a crane or forklift. When placing the robot on the ground, avoid any strong collision between the robot mounting face and the ground.
- Before handling the robot, remove the end effector and the pallet. When it is necessary to handle the robot with the pallet, observe the following precautions.
 - The installation of the end effector and base does not cause a change in the overall center of gravity position of the robot. Ensure the balance of the robot when handling it.
 - The end-effector may oscillate due to vibration during transportation and excessive loads may be applied to the robot.
 - When handling the robot with the pallet installed, lift the pallet rather than the robot directly.

Handling with a crane

In principle, use a crane to move and transport the robot.

1. Adjust the robot to the same posture as it was in the factory, as shown in the following figure. Set up screw mounting holes for the handling sheet metal on the robot body, fix the handling sheet metal to the robot body using M6x12 screws, and then lift the robot with four steel slings. It is recommended that the steel sling length be 1 m, with a total weight capacity of at least 50 kg. Use rubber hoses or similar protection at contact points between the steel sling and the robot body.

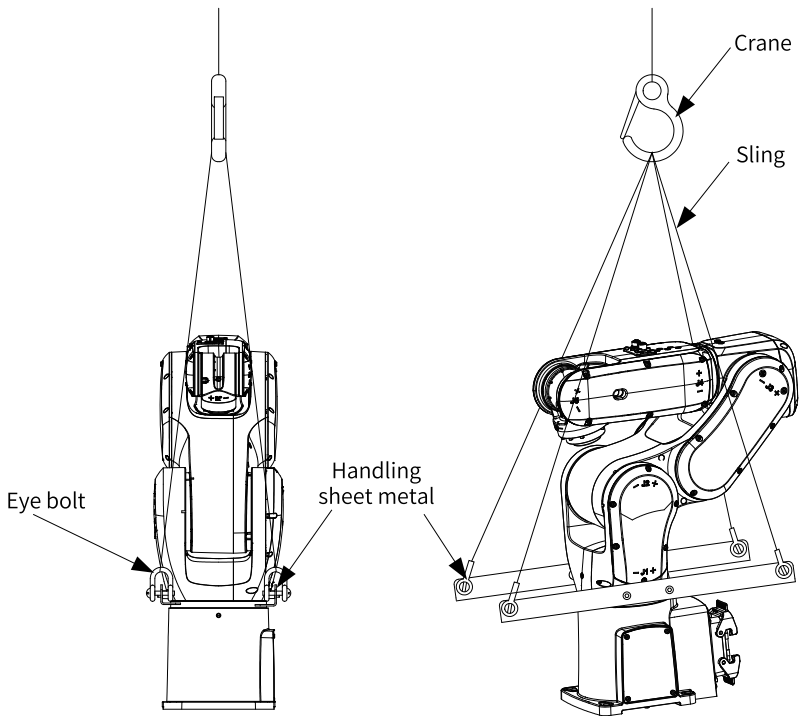


Figure 3-4 Lifting the robot

2. Use four steel slings to lift the robot. Ensure that the robot is balanced before moving the crane.
3. Two people should work together for the handling. One person should gently hold the robot body to prevent shaking and collision, while the other operates the crane to slowly lift the robot body and move it to the mounting platform.

Handling with a forklift

When handling the robot using a forklift, secure the robot onto its original pallet or a baseplate with sufficient load-carrying capacity with screws. Insert the fork of the forklift under the pallet or baseplate and lift the robot together with the pallet or baseplate.

Transport the robot slowly and carefully to prevent it from toppling or tilting over.

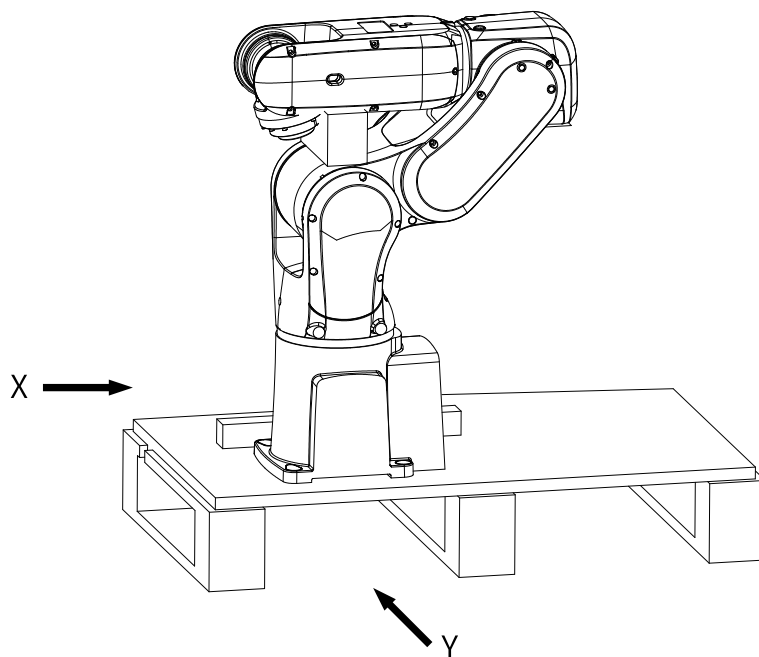


Figure 3-5 Handling the robot with a forklift

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.

4 Installation

4.1 Installation precautions

**Danger**

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed 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 manipulator before turning on the power or operating the system. Otherwise, the manipulator may fall over and cause serious injury or major damage.

Note

- Do not modify the equipment.
- Do not install this equipment in places with strong electric or magnetic fields.
- Remove the mounting screws of the manipulator and adjust the robot to its transport posture.
- For the tabletop mounting, at least two people are required for the operation.

4.2 Installing the Robot Body

Follow the following steps to install the robot body:

1. Disconnect power to all devices.
2. Clean the surface onto which the robot is to be mounted.

Note

To dampen vibrations, use a steel plate with a thickness of over 30 mm and a surface roughness of below 25 μm as the robot mounting surface.

3. Move the robot near the mounting surface.
4. Align the robot base with the two locating pin holes.
5. Install the two locating pins.

6. Install four spring washers and four flat washers, and tighten them with four M10x35 hexagon socket cap head screws (tightening torque: 75 N·m). Use screws with a strength equivalent to Grade 12.9 specified in GB/T 3098.1.

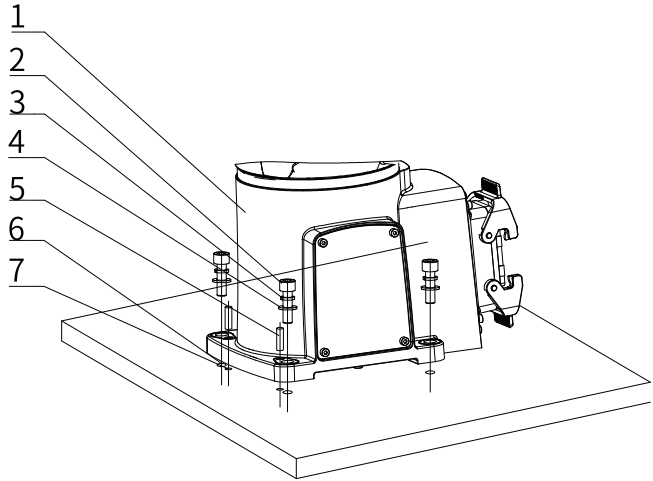


Figure 4-1 Installing the base

No.	Component
1	Robot base
2	M10x35 hexagon screw of Grade 12.9 specified in GB/T 70.1-2000 (4 pcs)
3	Spring washer in compliance with GB/T 93-1987 10 (4 pcs)
4	Flat washer in compliance with GB/T 97.1-1985 10 (4 pcs)
5	Φ6x32 parallel pin in compliance with GB/T 119.1-2000 (2 pcs)
6	Threaded mounting holes (depth: > 20 mm)
7	Mounting pin holes (depth: > 20 mm)

4.3 Installing an End Effector

Customers shall prepare end effectors. Observe the following precautions when installing an end effector.



Caution

- 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.

Use M5 screws (Grade 12.9) to attach the end effectors to the wrist flange.

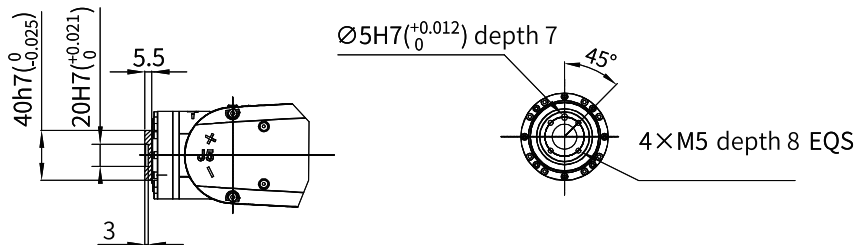


Figure 4-2 IR-R4-56S5 wrist flange

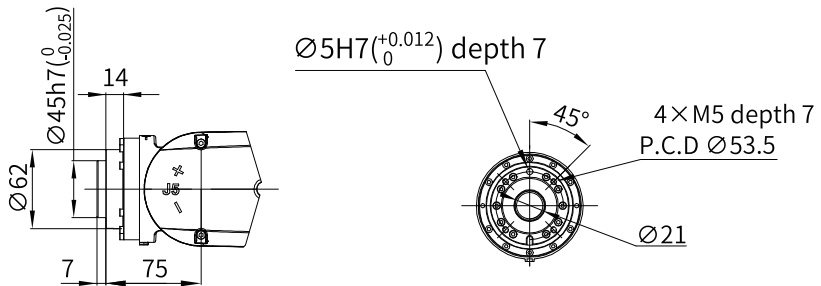


Figure 4-3 IR-R4H-54S5 wrist flange

4.4 Installing the Pneumatic Valve and Other Auxiliary Accessories

Connectors are provided on the upper arm, forearm, and upper end of the elbow to install the pneumatic valve and other auxiliary accessories. The following figure shows the specifications and dimensions of these connectors.

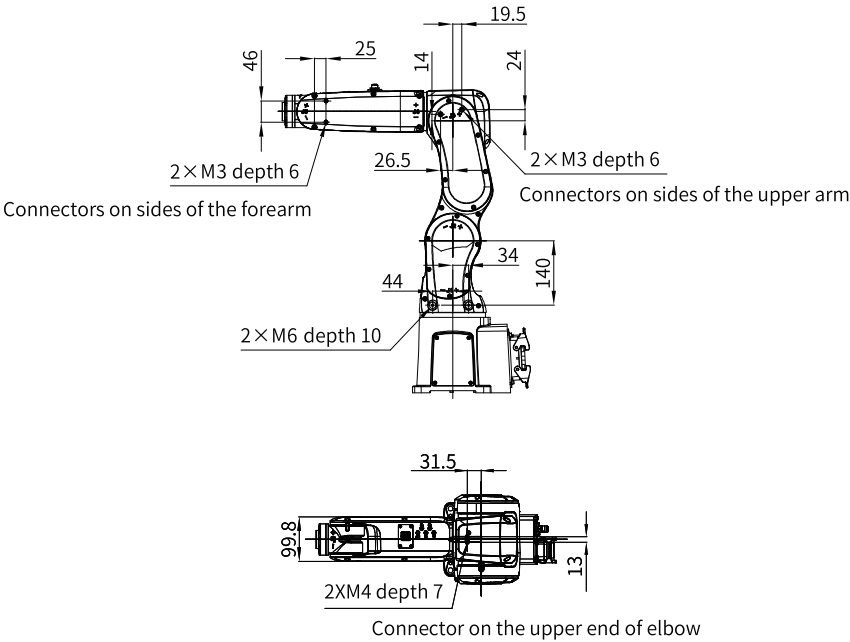


Figure 4-4 Auxiliary accessory mounting positions on IR-R4-56S5 (unit: mm)

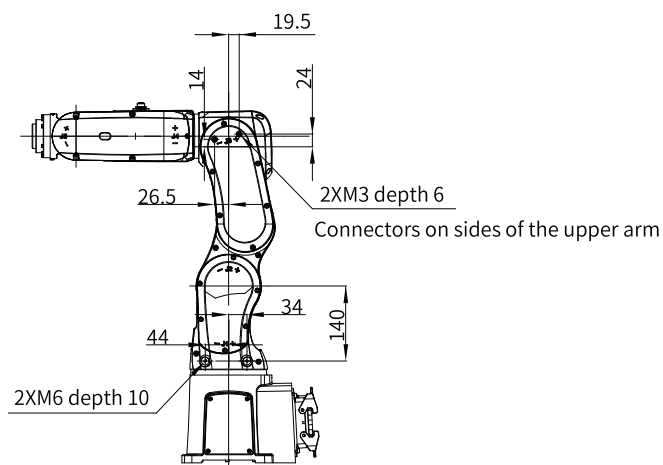


Figure 4-5 Auxiliary accessory mounting positions on IR-R4H-54S5 (unit: mm)

4.5 Connecting Cables

4.5.1 Connecting the Power Cable and Signal Cable



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.

Connection method:

1. Connect the heavy-duty connector for the user cable to the heavy-duty connector on the robot base.
2. Connect the power connector and signal connector of the user cables to the electric control cabinet.
3. Connect the safety terminals in the accessory kit to the corresponding terminals in the control cabinet.

4. Connect the power terminals in the accessory kit and then plug them into the power connectors of the control cabinet. Check that the L/PE/N sequence of the cable is correct.

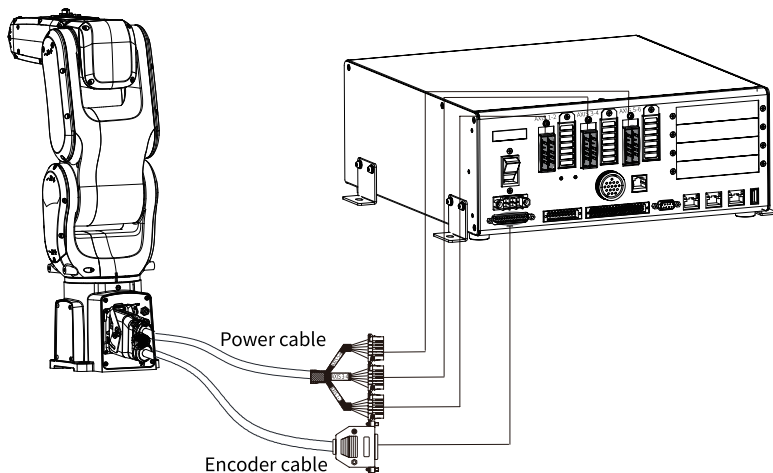
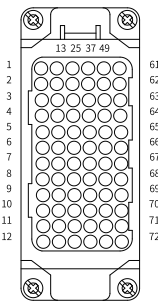


Figure 4-6 Power cable and encoder cable connection

4.5.2 Definition of Heavy-Duty Connector

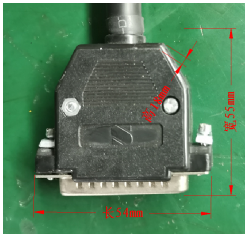
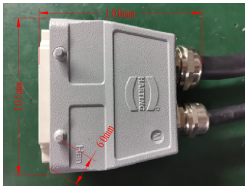
Table 4-1 Pin definition

Connector Pin Layout	Pin No.	Definition	Pin No.	Definition	Pin No.	Definition	Pin No.	Definition
	1	1U	21	23FG	41	4BK-	61	6U
	2	1V	22	14GND	42	56BK+	62	6V
	3	1 W	23	2PS-	43	-	63	6 W
	4	1PE	24	2PS+	44	GND	64	6PE
	5	1BK-	25	3U	45	56FG	65	6BK-
	6	0V	26	3V	46	23GND	66	-
	7	-	27	3 W	47	4PS-	67	-
	8	-	28	3PE	48	4PS+	68	B-
	9	1FG	29	3BK-	49	5U	69	A-
	10	14VCC	30	34BK+	50	5V	70	56GND
	11	1PS-	31	-	51	5 W	71	6PS-
	12	1PS+	32	0V	52	5PE	72	6PS+
	13	2U	33	4FG	53	5BK-	-	-
	14	2V	34	23VCC	54	-	-	-
	15	2 W	35	3PS-	55	-	-	-
	16	2PE	36	3PS+	56	B+	-	-
	17	2BK-	37	4U	57	A+	-	-
	18	12BK+	38	4V	58	56VCC	-	-
	19	-	39	4 W	59	5PS-	-	-
	20	24V	40	4PE	60	5PS+	-	-

4.5.3 Cable Hole Dimensions

When cutting cable holes on the base table, refer to the following connector dimensions.

Table 4-2 Cable hole dimensions

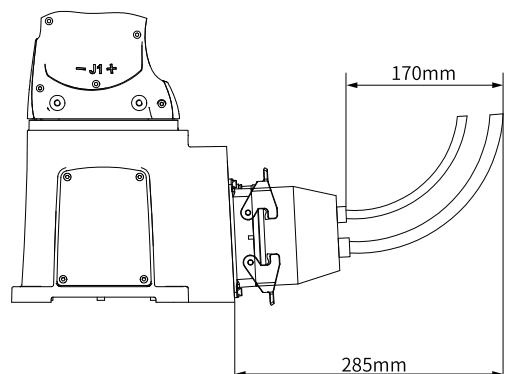
Name	Power Cable Connector (Cabinet Side)	Encoder Cable Connector (Cabinet Side)	Heavy-duty Connector (Robot Side)
Dimensions			
	40 mm x 22 mm x 15 mm (L x W x H)	54 mm x 55 mm x 18 mm (L x W x H)	105 mm x 100 mm x 60 mm (L x W x H)



Caution

- During cable connection, reserve a margin for cables at turns and do not pull the cables tight. The bending radius of a cable is about 10 times its diameter (170 mm).
- Do not bind the redundant power cables into a bundle of coils (two coils are acceptable) stacked together. Otherwise, cables may be damaged due to overheating.
- Connect the male heavy-duty connector straight to the female connector to avoid damaging the guide pin or contact.
- Never violently connect heavy-duty connectors (male and female) to avoid pin displacement or bending.
- The clips on the heavy-duty connectors are only used to fasten the connectors.

Reserved space (connector size+cable bending radius) for cables on the robot side: 285 mm. The bending radius of cables is approximately 170 mm, as shown in the following figure.



Opening size: the size of the opening reserved on the housing or sheet metal for the robot plug to pass through, as shown in the following figure.

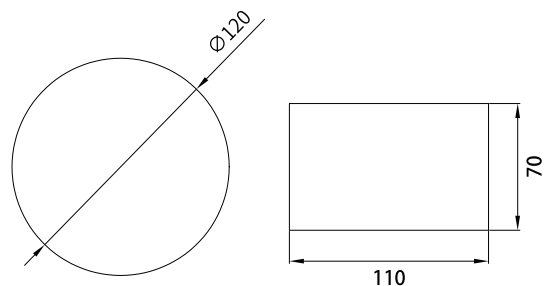


Figure 4-7 Opening size (unit: mm)

4.6 User Wiring and Tubing

4.6.1 Wiring (Cables)

- Perform wiring and air tubing of the chuck only when the power supply is disconnected and the workpiece is not placed.
- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.

Available cables are built in the robot body. The following table describes the specifications of signal cables.

Rated Voltage	Allowable Current	Number of Lines	Nominal Cross-sectional Area of Conductor	Remarks
30 VAC/VDC	0.5 A	12	26 AWG	Signal cable



Warning

Current higher than 0.5 A is not allowed.

The following table describes the specifications of connectors.

Cable	Code
12-pin aviation connector on the forearm	15050817
5 m 19-pin I/O cable on the base	1504B978
Network cable	1504NN47

4.6.2 Tubing (Air Tubes)

User tubing (air tubes)

The following table describes the specifications of air tubes.

Max Operating Pressure	Qty	Specifications (Outer Dia x Inner Dia)
0.59 MPa (6 kgf/cm ²)	4	Φ4 mm x Φ2.5 mm

Note

The IR-R4-56S5 standard model does not come with a network port, while the IR-R4-56S5 optional model and the IR-R4H-54S5 standard model come with a network port.

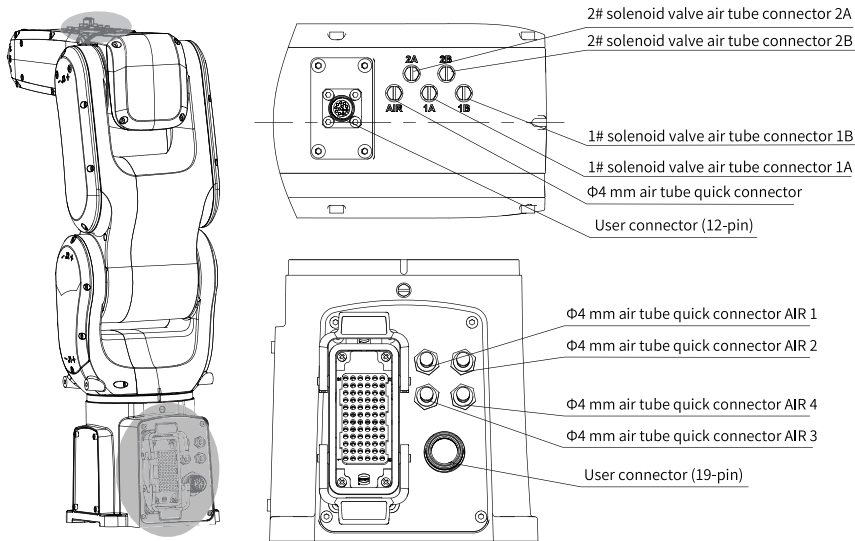


Figure 4-8 User wiring/tubing connectors of the standard model

The IR-R4-56S5 standard model does not come with a network port.

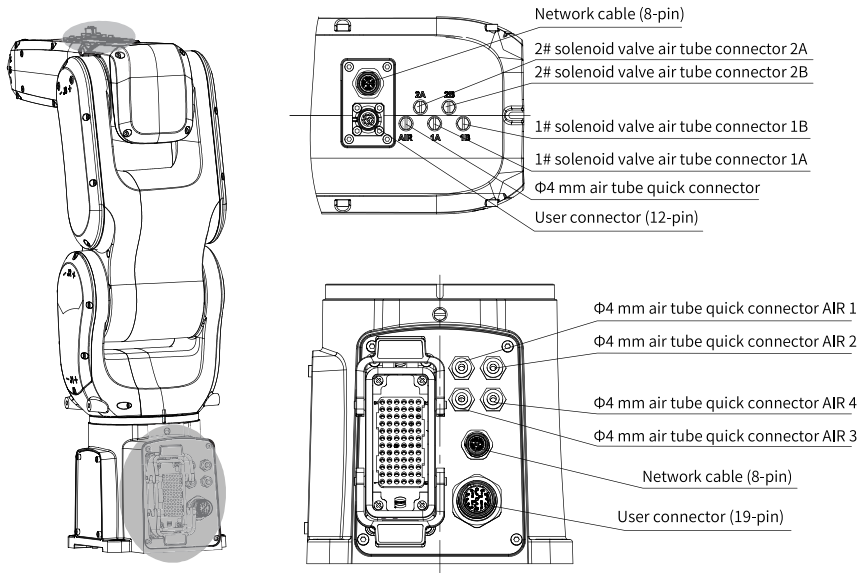


Figure 4-9 User wiring/tubing connectors of the optional model

The IR-R4-56S5 optional model and the IR-R4H-54S5 standard model come with a network port.

Air tubes for the optional model

The optional model can include a solenoid valve, which supports one $\Phi 4$ mm straight-through line and the conversion of up to two $\Phi 4$ mm input lines to four $\Phi 4$ mm output lines.

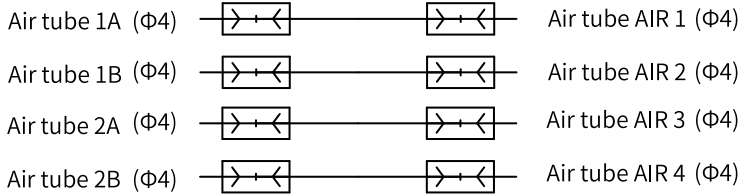


Figure 4-10 Air circuit connection for the standard model

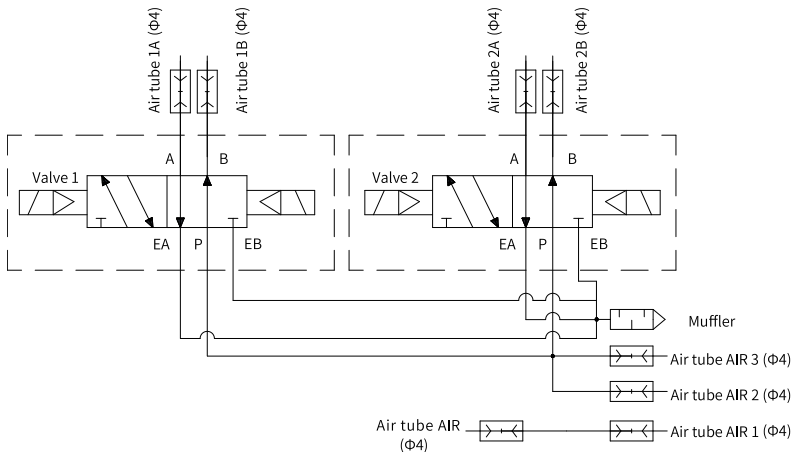


Figure 4-11 Air circuit connection with a solenoid valve for the optional model

4.6.3 Robot Aviation Connector Pins

I/O aviation connector

The robot provides a 12-pin aviation connector on the forearm top and a 19-pin aviation connector on the base. The two connectors are interconnected by a special cable inside the robot body.

Connection of the two aviation connectors:

- Pins 1 to 12 of the 19-pin connector are directly connected to pins 1 to 12 of the 12-pin connector.
- Pins 13 to 19 of the 19-pin connector are connected to the reserved solenoid valve connector.

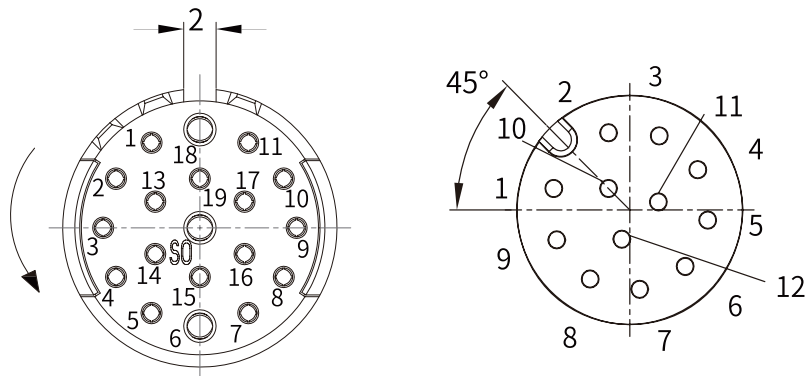


Figure 4-12 Arrangement of pins on the 19-pin and 12-pin connectors

Network cable aviation connector for the optional model

Network cable aviation connectors are available for the optional model. The connectors are installed on the electrical mounting plate of the base and the forearm.

Technical data of the network cable aviation connector:

Number of pins	8
Rated current (40°C)	0.5 A
Rated voltage	30 VAC, 30 VDC
Network cable type	CAT5A
I/O cable type	CAT6A
I/O cable size	0.14 mm ² (26 AWG)

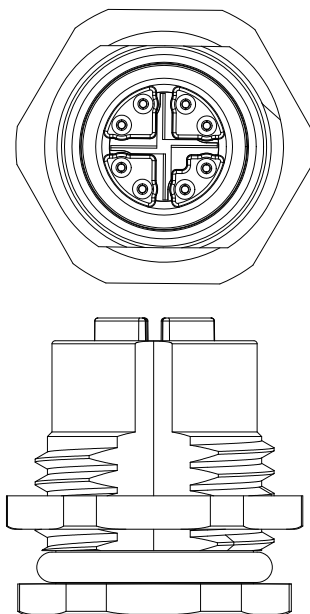


Figure 4-13 Pins of the network cable aviation connector

5 Operating Area

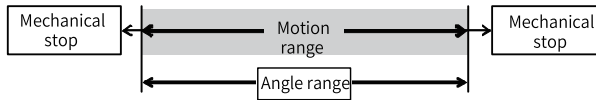
5.1 Method for Setting the Motion Range

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)



5.2 Setting Operating Area By Using Angle Range

5.2.1 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.

5.2.2 Maximum Angle Range of J1

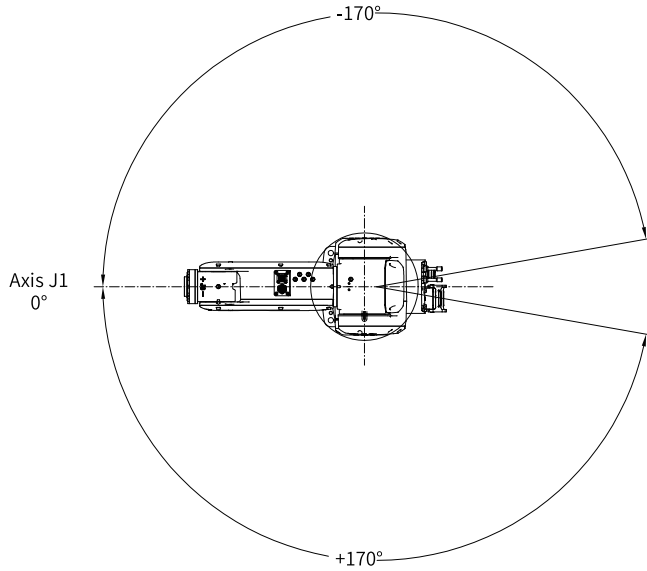


Figure 5-1 Maximum angle range of J1

5.2.3 Maximum Angle Range of J2

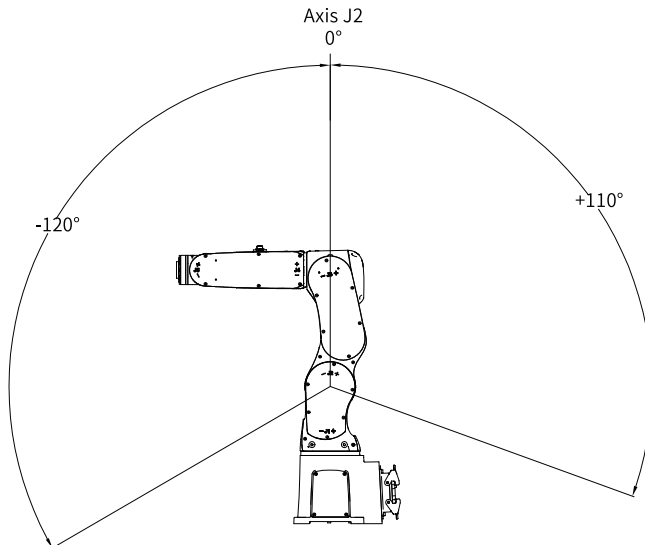


Figure 5-2 Maximum angle range of J2

5.2.4 Maximum Angle Range of J3

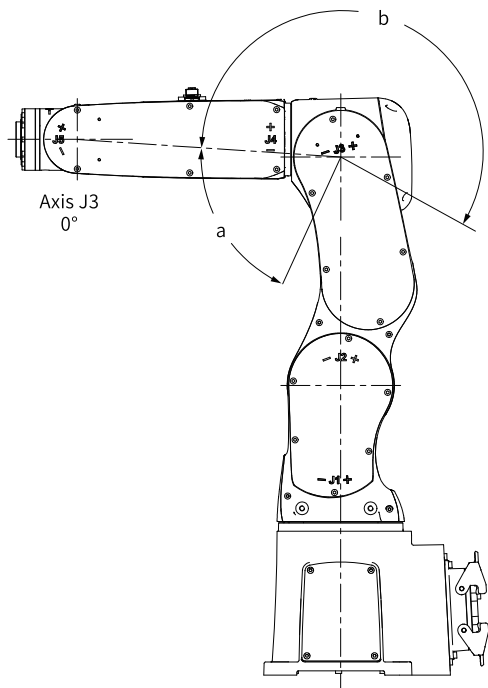


Figure 5-3 Maximum angle range of J3

Model	Max Angle Range a	Max Angle Range b
IR-R4-56S5	−69°	+205°
IR-R4H-54S5	−65°	+195°

5.2.5 Maximum Angle Range of J4

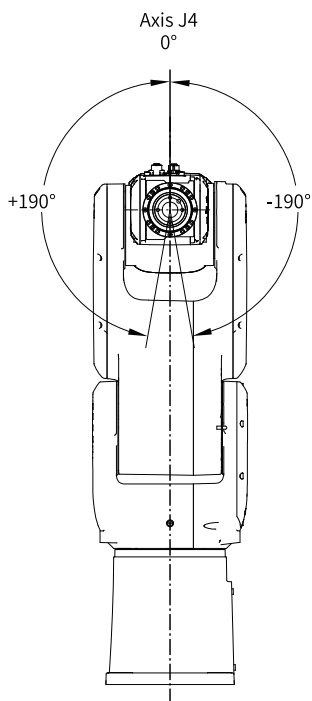


Figure 5-4 Maximum angle range of J4

5.2.6 Maximum Angle Range of J5

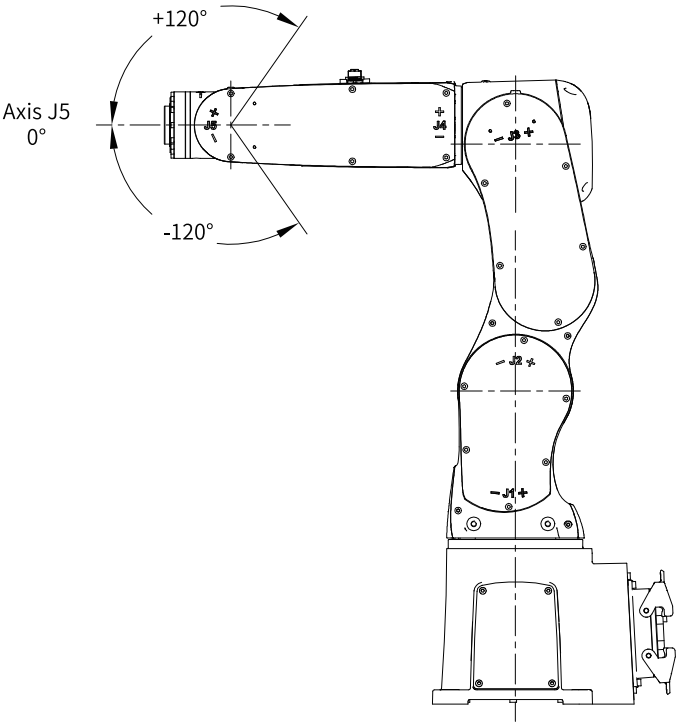


Figure 5-5 Maximum angle range of J5

5.2.7 Maximum Angle Range of J6

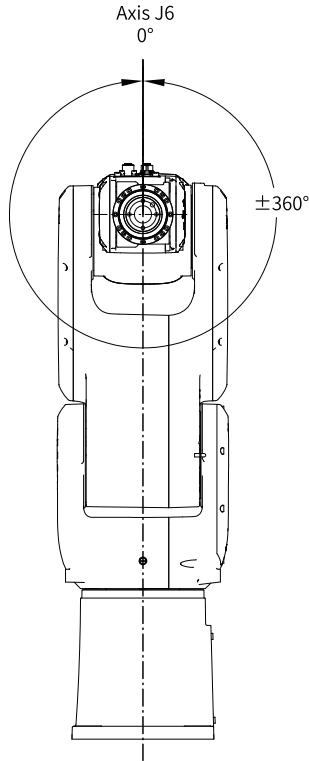


Figure 5-6 Maximum angle range of J6

5.3 Mechanical Limit Stops

As shown in the following figure, the IR-R4-56S5 and IR-R4H-54S5 models have mechanical stops at axes J1 and J3, while mechanical limits are achieved at axes J2 and J5 through the enclosure. Set angle ranges must not exceed the angle ranges allowed by the mechanical stops.

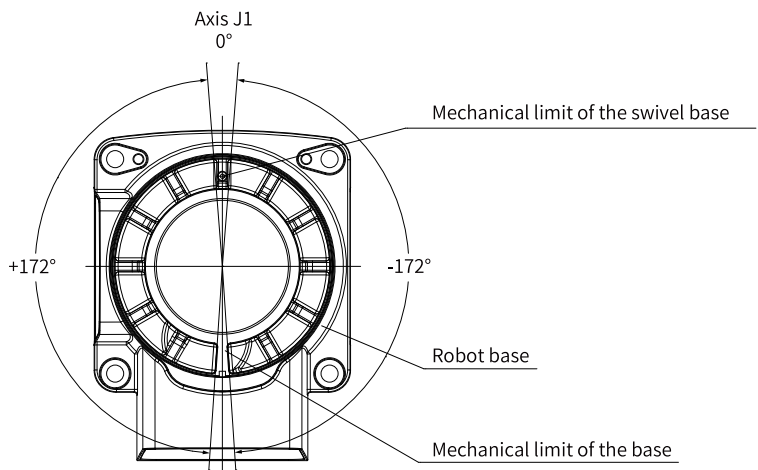


Figure 5-7 Mechanical limit stops for J1

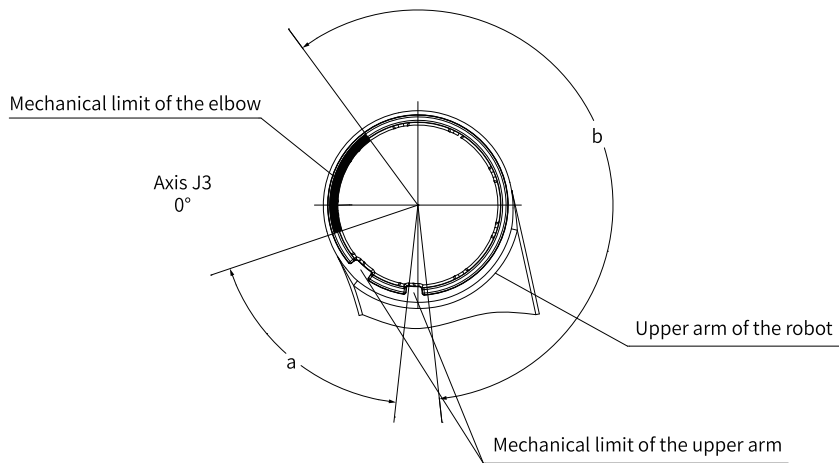


Figure 5-8 Mechanical limit stops for J3

Table 5-1 Angle range limit for J3

Model	Angle Range Limit a	Angle Range Limit b
IR-R4-56S5	-71°	+206.5°
IR-R4H-54S5	-67°	+197°

6 Maintenance

6.1 Description

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 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.

6.2 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)

Inspection Point	Inspection Place	Routine Inspection	Monthly Inspection	Quarterly Inspection	Semi-annual Inspection	Annual Inspection	Maintenance Personnel		
							Professionals	Qualified Personnel	Manufacturer
Check whether the bolts are loose. If yes, tighten them.	End effector mounting screw	✓	✓	✓	✓	✓	✓	✓	✓
	Robot mounting bolts	✓	✓	✓	✓	✓	✓	✓	✓
	Locking bolts of each arm	✓	✓	✓	✓	✓	✓	✓	✓
	Bolts around the axes					✓		✓	✓
	Bolts securing the motor, reducer, etc.					✓		✓	✓

Inspection Point	Inspection Place	Routine Inspection	Monthly Inspection	Quarterly Inspection	Semi-annual Inspection	Annual Inspection	Maintenance Personnel		
							Professionals	Qualified Personnel	Manufacturer
Check whether the connector is loose. If yes, push it securely or tighten it.	External connectors on the manipulator (on the connector plate etc.)	✓	✓	✓	✓	✓	✓	✓	✓
	Robot cable unit		✓	✓	✓	✓	✓	✓	✓
Check for external defects and remove dust.	Whole	✓	✓	✓	✓	✓	✓	✓	✓
	External cables		✓	✓	✓	✓	✓	✓	✓
Check for bends or improper location. Repair or place it properly if necessary.	Safety guard etc.	✓	✓	✓	✓	✓	✓	✓	✓

Inspection Point	Inspection Place	Routine Inspection	Monthly Inspection	Quarterly Inspection	Semi-annual Inspection	Annual Inspection	Maintenance Personnel		
							Professionals	Qualified Personnel	Manufacturer
Check tension of the timing belt. Tighten it if necessary.	Inside arms 5 and 6				✓	✓	✓	✓	✓
Battery	Battery	Replace the battery every 1.5 years. When the battery is low, the servo will report an alarm, and the teach pendant will display "Servo drive reports an alarm". You can choose Mon > Servo to check the servo alarm code.					✓	✓	✓

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

Inspection Point	Inspection Place	Routine Inspection	Monthly Inspection	Quarterly Inspection	Semi-annual Inspection	Annual Inspection	Maintenance Personnel		
							Professionals	Qualified Personnel	Manufacturer
Shake the cable gently by hand to check for wire breakage.	External cables (including cable units of the robot)				✓	✓		✓	✓
Press each arm by hand in the enabled state to check whether the arms shake.	Each joint					✓		✓	✓

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

Inspection Point	Inspection Place	Routine Inspection	Monthly Inspection	Quarterly Inspection	Semi-annual Inspection	Annual Inspection	Maintenance Personnel		
							Professionals	Qualified Personnel	Manufacturer
Check the motion range.	Each joint					✓		✓	✓
Check whether unusual sound or vibration occurs.	Whole	✓	✓	✓	✓	✓	✓	✓	✓
Measure the accuracy repeatedly by a gauge.	Whole					✓		✓	✓

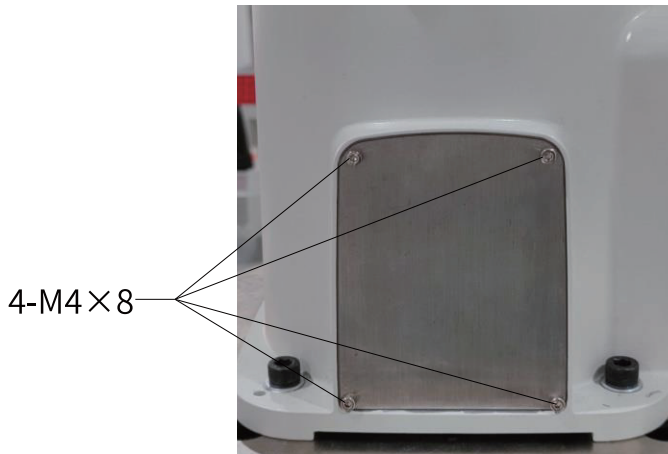
6.3 Components Replacement

6.3.1 Battery (Lithium Battery) Replacement



- Do not perform equipment maintenance or servicing while power is on. Failure to comply will result in an electric shock.
- When disposing of waste batteries, consult a professional disposal company or follow relevant local regulations.
- Use lithium batteries correctly. Incorrect usage may result in overheating, leakage, explosion, or fire, causing severe risks to personal and property safety.
 - Charging lithium batteries is prohibited.
 - Applying pressure to deform lithium batteries is prohibited.
 - Disassembling lithium batteries is prohibited.
 - Short-circuiting or incorrect connections to lithium batteries are prohibited.
 - Heating lithium batteries is prohibited.
 - Disposing of lithium batteries in fire is prohibited.
 - Welding battery terminals is prohibited.
 - Forcing discharge of lithium batteries is prohibited.

Step 1: Remove the screws (4-M4x8) on the back cover and remove the back cover.



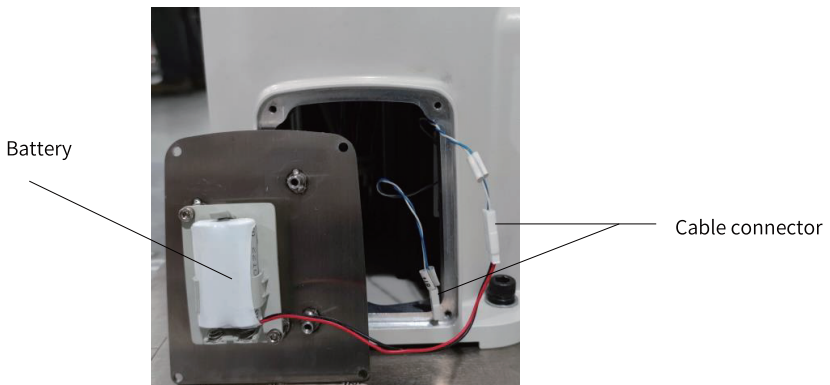
Step 2: Remove the battery.

Note

- When limiting the operating area for safety reasons, consider both the angle ranges and mechanical stops.
 - The default operating area at delivery is the maximum operating area of the robot.
-

Detailed procedure:

- Cut the zip tie securing the battery to the cable plate.
- Tie the new battery onto the cable plate with a zip tie.
- Connect the terminal of the new battery to the empty white 2P connector.
- Remove the used battery.



Note

Failure to comply with the procedure described above may cause loss of zero points. For details, see ["6.4.1 Description of Home Position Calibration" on page 69](#).

6.4 Zero Point Adjustment

6.4.1 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**

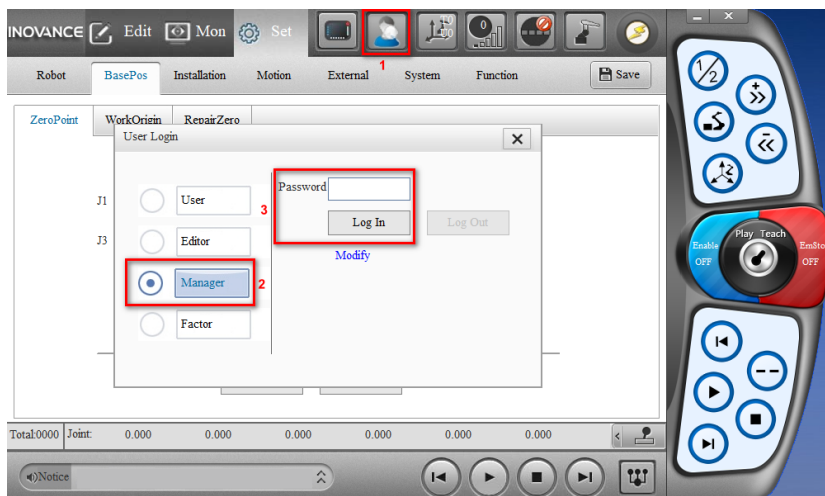
- Install a safety fence for the system to prevent people from entering the action area of the system. Failure to comply will result in serious accidents.
- Before operation, check that there is no person inside the safety fence. Do not enter the action area during system running. Failure to comply will 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.

6.4.2 Procedure of Zero Point Adjustment

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

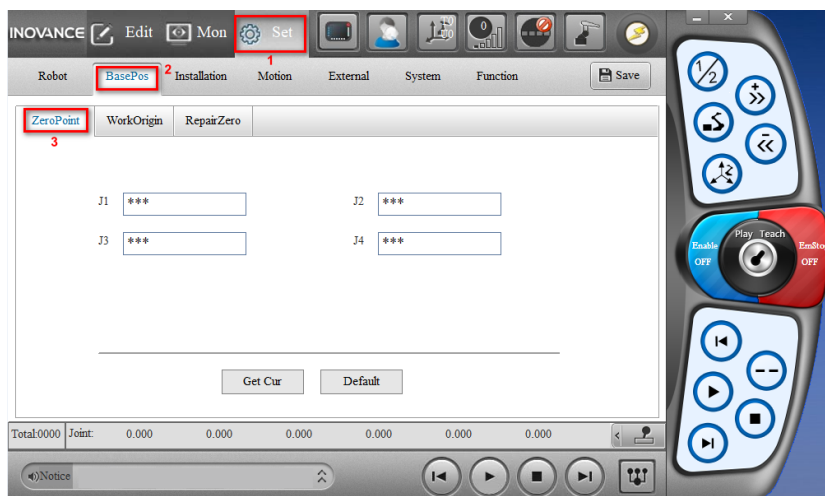
When performing zero point adjustment using the teach pendant, adjust Axes J4 and J3 at the same time.

1. Select a role and log in to the system.
 - a. On the main screen of the PC-based or hand-held teach pendant, click the user icon to open the "User Login" screen.
 - b. Enter the password in the password input box and click "Log In".



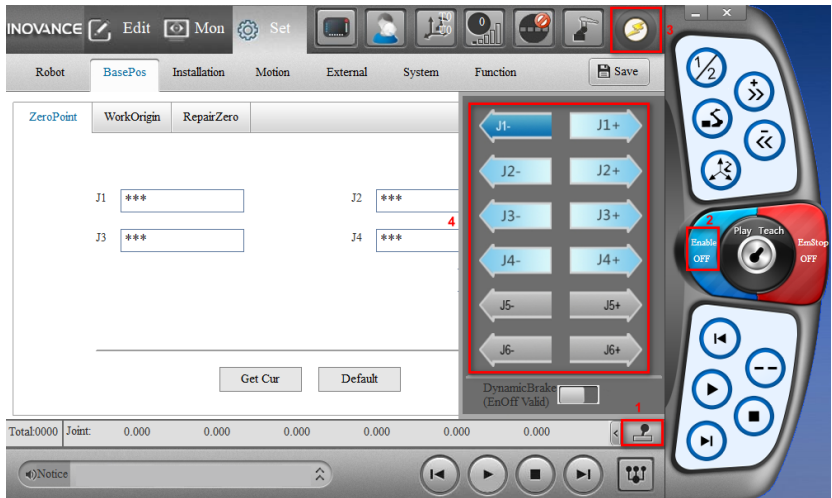
2. Switch to the ZeroPoint setting screen.

On the main screen of the PC-based or hand-held teach pendant, choose "Set" > "BasePos" > "ZeroPoint" to open the "ZeroPoint" screen.



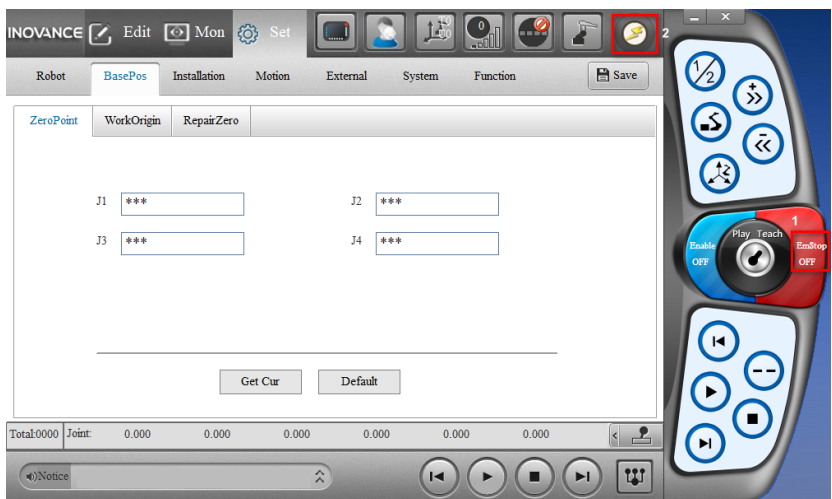
3. Move each axis of the robot to the corresponding zero point.

- Move the robot axes to their respective zero points by using the joystick on the hand-held teach pendant or the operation interface of the PC-based teach pendant. For details, see the Teach Pendant Software Guide/Programming Guide.
- For the zero point of each axis, see ["6.4.3 Zero Point of Each Axis" on page 73](#). Calibrate the zero points using the calibration tool.



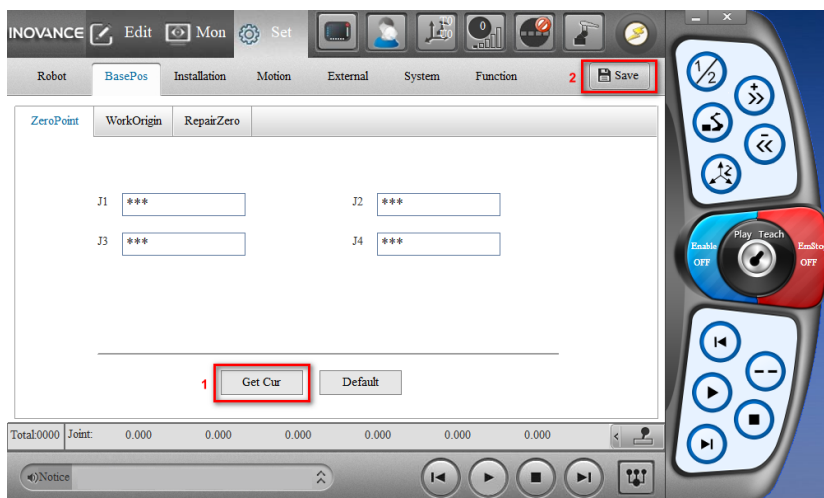
4. Switch to the emergency stop state.

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



5. Obtain and save the zero point information.

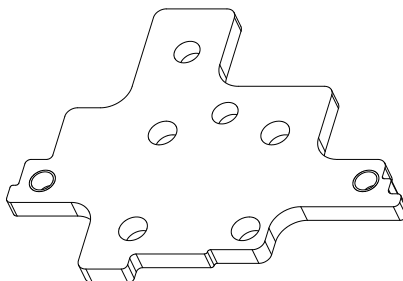
- When the robot axes are at their zero points, click "Get Cur" to obtain the encoder pulses.
- Click "Save" to complete zero point adjustment.



6.4.3 Zero Point of Each Axis

- **Calibration tool**

The calibration tool is used to calibrate the rotary axes of the robot manually.



- **Calibration of axes J1 to J6**

During calibration, control the robot to move at the lowest speed by using the teach pendant. Adjust axes J1 to J5 until the calibration tools fit snugly in the reference slots. J6 should be aligned with a taper pin, and the $\varnothing 5 \times 14$ taper pin should just touch the screw of the reducer, as shown in the following figure.

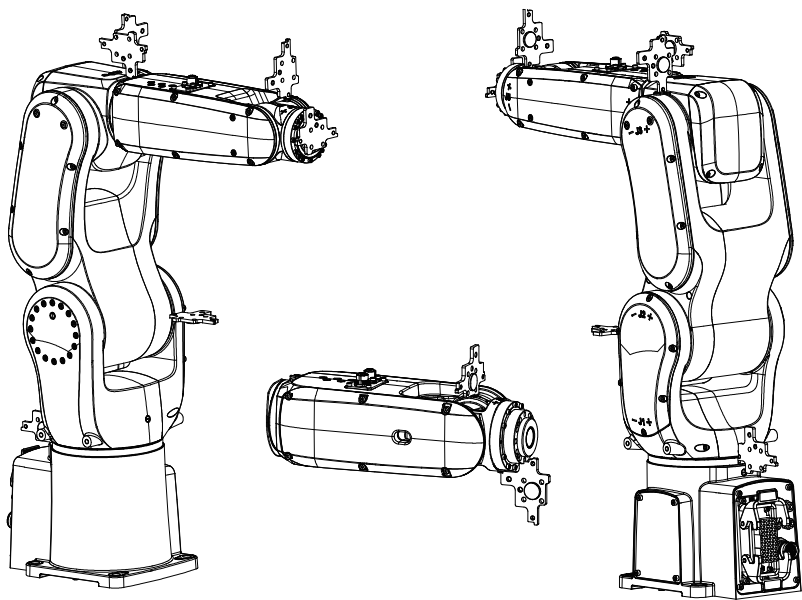


Figure 6-1 Calibration of axes J1 to J6

6.5 Options

Option	Description	Specifications	Code
Base I/O cable	Connects the body of the IR-R4 series 6-axis robot to an electric cabinet	5 m	1504B978
Forearm 90° I/O aviation connector	Connects a cable to the aviation connector on the forearm of the IR-R4 series 6-axis robot	12-pin	15050817
Network cable accessory	Connects a cable to the network port of the IR-R4 series 6-axis robot	CAT5	1504NN47



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