INOVANCE

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IR-R25&R16-INT Series 6-Axis Robot

User Guide - Manipulator

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

Data code PS00019449A01

Legal Information

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The contents are subject to change without notice due to product upgrade.

Waste Disposal

The storage, use, and disposal of this product (including optional accessories) must comply with local laws and regulations.

Qualified Personnel

The product/system described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel can identify the risks of the product/system and prevent possible dangers.

Proper Use of the Product

Proper transportation, storage, assembly, installation, commissioning, operation, and maintenance are required to ensure the safe operation of the product without any problems. The required ambient conditions must be met. All operations must follow the guidelines provided in this documentation.

Preface

Introduction

Inovance IR-R25 and IR-R16 series robots serve as a mid-payload complement within the 6-axis robot portfolio. They are primarily designed for applications such as material handling, machine tool loading/unloading, machining, polishing, assembly, and testing, and are widely used in the lithium battery, silicon crystal, and die casting industries. They support automatic loading/unloading, workobject flipping and transferring between processes for various workobjects including disks, long shafts, irregular shapes, metal plates. Their compact structure and flexible mounting capabilities allow for compact workstation layouts, helping users expand production capacity and achieve high-efficiency manufacturing.

This guide describes the installation and wiring of the product, including pre-installation preparation, unpacking and handling, mechanical installation, and electrical installation.

More Data

Data Name	Data Code	Description
IRCB501-INT High-Protection Series Robot Controller User Guide	PS00017685	This guide describes the specifications, installation, and wiring of the IRCB501 series high-protection controller.
IRTP80 Series Teach Pendent User Guide	19012261	This guide describes the basic information, cable connection, and operations of the IRTP80 series teach pendant.
IR-R25&R16-INT Series 6-Axis Robot User Guide - Manipulator (This guide)	PS00019449	This guide describes the installation and wiring of the product, including pre-installation preparation, unpacking and handling, mechanical installation, and electrical installation.

Revision History

Revision Date	Version	Revision
February 2026	A01	**Addition** • Added *" Anti-rust Requirements" on page 31*. • Added *" Transportation Protection" on page 46*. • Added *"8.2 Schedule for Inspection and Maintenance" on page 75*. **Update** • Updated the appearance drawings related to PI2.0. • Updated *"2.1 Model and Nameplate" on page 20*. • Updated *"2.2 Components" on page 21*. • Updated *"6.4.3 Terminal Assignment of the Heavy-Duty Connector" on page 59*. • Updated *"8.3 Regular Inspection Items" on page 75*.
April 2025	A00	First release.

Access to the Guide

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

- Visit *https://www.inovance.com/global*, and choose Service&Support > Support > Documentation Download.
- Scan the QR code on the product with your smart phone.
- Scan the QR code below to install My Inovance app, where you can search for and download user guides.

Warranty Disclaimer

Inovance provides warranty service within the warranty period (as specified in your order) for any fault or damage that is caused by proper operation of the user. Maintenance will be charged 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 unusual voltage
- Damage caused by unintended use of the product
- Damage caused by use beyond the specified scope of application of the product
- Damage or secondary damage caused by force majeure (natural disaster, earthquake, and lightning strike)

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

For details, see Product Warranty Card.

Table of Contents

Legal Information 1
Preface 2
1 Basic Safety Instructions 8
1.1 Safety Precautions 8
1.2 Special Precautions 15
1.3 Safety Signs 16
1.4 Industrial Information Security 18
2 Product Information 20
2.1 Model and Nameplate 20
2.2 Components 21
2.3 Rotation Directions 21
2.4 Outline Dimensions 23
2.5 Specifications 24
2.6 Motion Range 26
2.7 Maximum Load of Wrist Flange 28
3 Preparation 30
3.1 Installation Personnel Requirements 30
3.2 Installation Environment Requirements 30
3.3 Anti-rust Requirements 31
3.3.1 Usage Specifications 31
3.3.2 Maintenance 33
3.4 Installation Base Table Requirements 34
3.5 Installation Space Requirements 36
3.6 Installation Tool Preparations 37
4 Unpacking, Storage, and Handling 38
4.1 Precautions for Unpacking 38
4.2 Unpacking Procedure 38
4.3 Check After Unpacking 39
4.4 Precautions for Handling 40
4.5 Pre-Handling Preparation 41
4.6 Handling Procedure 42
5 Transportation Protection 46
5.1 Bill of Materials 46

5.2 Packaging Guide 47
5.2.1 Packaging Posture 47
5.2.2 Packaging Procedure 49
6 Installation 53
6.1 Precautions for Installation 53
6.2 Installing the Robot Body 53
6.3 Installing an End Effector 54
6.4 Cable Connection 56
6.4.1 Robot Interface 56
6.4.2 Connecting Power Cable and Signal Cable 57
6.4.3 Terminal Assignment of the Heavy-Duty Connector 59
6.4.4 Cable Hole Dimensions 60
6.5 Wiring and Tubing 63
6.5.1 Wiring (Cables) 63
6.5.2 Tubing (Air Ducts) 63
6.5.3 Robot Aviation Connector Pins 64
7 Motion Range 66
7.1 Method for Setting the Motion Range 66
7.2 Motion Range Setting by Angle Range 67
7.2.1 Maximum Angle Range of J1 67
7.2.2 Maximum Angle Range of J2 68
7.2.3 Maximum Angle Range of J3 69
7.2.4 Maximum Angle Range of J4 70
7.2.5 Maximum Angle Range of J5 71
7.2.6 Maximum Angle Range of J6 72
7.3 Mechanical Limit Stops 72
8 Inspection and Maintenance 74
8.1 Maintenance Precautions 74
8.2 Schedule for Inspection and Maintenance 75
8.3 Regular Inspection Items 75
8.4 Applying Lubricating Grease 78
8.5 Grease Seepage Inspection 79
8.5.1 Daily Inspection 79
8.5.2 Grease Seepage Inspection Points 79
8.5.3 Lubricating Grease Leakage and Solution 81
8.6 Battery (Lithium Battery) Replacement 82
8.7 Zero Point Calibration 84
8.7.1 Overview 84
8.7.2 Zero Point Calibration Procedure 85

8.7.3 Zero Point Position of Each Joint 88
8.8 Optional Components 90
8.8.1 Options 90
8.8.2 Protection Against Dust and Liquid 90
8.8.3 Forklifts and Transports Sheet Metal Workpieces 90
9 Certification and Standard Compliance 92
10 Service and Support 94

1 Basic Safety Instructions

1.1 Safety Precautions

Safety Disclaimer

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

Safety Levels and Definitions



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



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



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

Safety Precautions

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

Unpacking
 • Do not install the product when you find that the product and its accessories have any damage or corrosion or they have been used. • Do not install the product when there is water inside the product or any of its parts is missing or damaged. • Do not install the product when the product name is inconsistent with that in the packing list.
 • Before unpacking, check whether the package is intact, without damage, water seepage, damp, and deformation. • Unpack the product layer by layer. Do not strike the package violently. • During unpacking, check whether the product and its accessories have any damage, corrosion, or bump on the surface. • Check the quantity of the product and its accessories and documents against the packing list.

Storage and Transportation



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



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

Installation



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



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



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

Wiring



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



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



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

Power-on



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



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

Operation



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



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

Maintenance



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



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

Repair



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



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

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

Safety Sign

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

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

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

1.2 Special Precautions

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

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

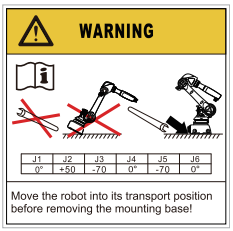
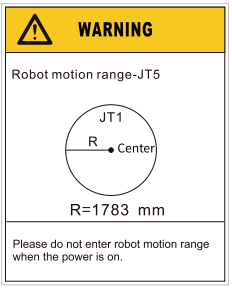
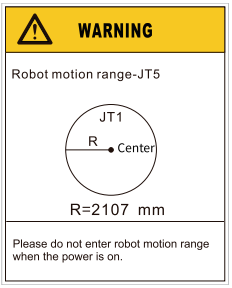
4. On the guard devices (fences), clearly display robot status, such as automatic running, teaching, and emergency stop, so that everyone onsite can easily see the status of the robot.

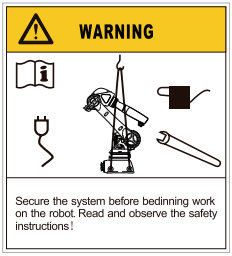
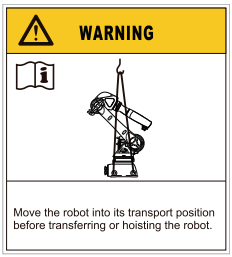
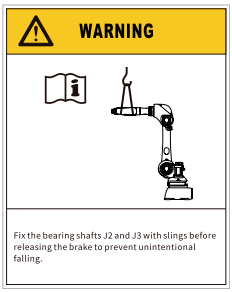
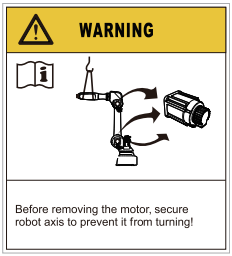
Before turning on or starting the robot, check all safety conditions to ensure that there are no people or obstructions within the robot's motion range.

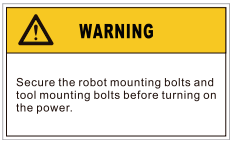
1.3 Safety Signs

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

The following table lists the warning labels.

Safety Signs	Safety Instructions
	Set the robot to its transport position before removing the mounting base.
 	When the robot is powered on, it is prohibited to enter its working radius area to prevent personal injury.

	Before starting work on the robot, read and observe the safety instructions to ensure the safety of the system.
	When lifting the robot with the eye bolts, use slings that prevent the robot from rotating and tilting.
	The J2 and J3 axes are gravity bearing axes. Secure them with a sling before releasing the brake to prevent falling and injury.
	Before removing the motor, secure the robot axes to prevent them from rotating.

	Secure the robot mounting bolts and tool mounting bolts before turning on the power.
	No stepping!
	Do not touch the energized parts during power-on. Failure to comply may result in electric shocks.

1.4 Industrial Information Security

This product provides an interface to connect to the network and transmit data through the network interface. To protect factories, systems, machines, and networks from cyber attacks, appropriate industrial information security protection mechanisms need to be implemented to ensure the safe operation of factories, systems, machines, and networks.

The customer is responsible for providing and continuously ensuring a secure connection between the product and the customer's network or any other network, to prevent unauthorized access to their factory, systems, machines, and networks. The system or machine may only be connected to the corporate network or the Internet when a secure connection is established and proper security measures are in place (for example, using antivirus software and installing firewalls).

INOVANCE continuously develops and improves its products and solutions to enhance safety. It is strongly recommended that you update your products promptly and always use the latest product versions.



Malware (such as viruses, Trojans, and worms) can bring the device into an unsafe operating state, resulting in death, serious injury, and property damage. Observe the following precautions strictly:

- Always use the latest software version. If the product version is no longer supported or the latest program version is not applied, customers are at increased risk of cyberattacks.
- Implement and maintain appropriate security measures (including but not limited to deploying anti-virus software, firewall, WAF, IPS/IDS, situational awareness system, ID verification, and data encryption) to prevent files in the removable storage device from being damaged by malware and to protect products, networks, systems, and interfaces from unauthorized access, disruption, intrusion, data leakage, or information theft.
- Check all safety-related interfaces and settings after commissioning.

2 Product Information

2.1 Model and Nameplate

IR ① - R ② 25 ③ - 178 ④ S ⑤ - INT ⑥

① **Product family** INOVANCE Robot	③ **Load** 16: 16 kg 25: 25 kg	⑤ **Mounting method** S: Standard
② **Series** S: SCARA robot R: 6-axis robot TS: Ceiling-mounted SCARA robot	④ **Arm length** 210: 2107 mm 178: 1783 mm	⑥ **Version** INT: International (with functional safety)

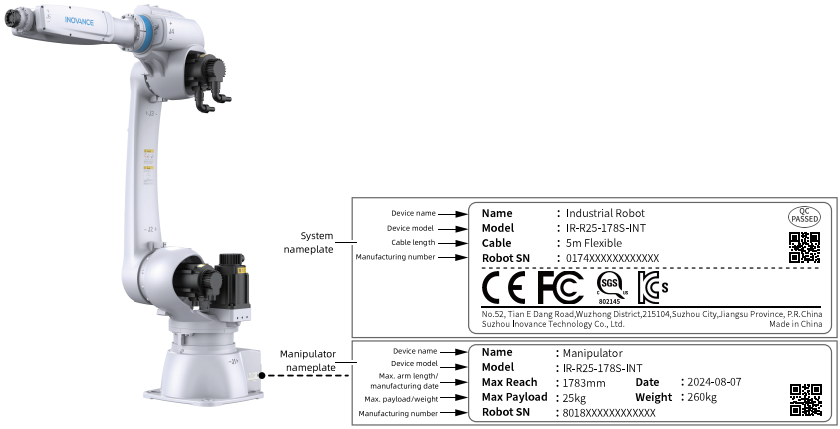


Figure 2-1 Nameplate

Note

- Before use, make sure that the system manufacturing numbers of the robot body and control cabinet are consistent. Otherwise, the robot may not work properly.
- 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 Components

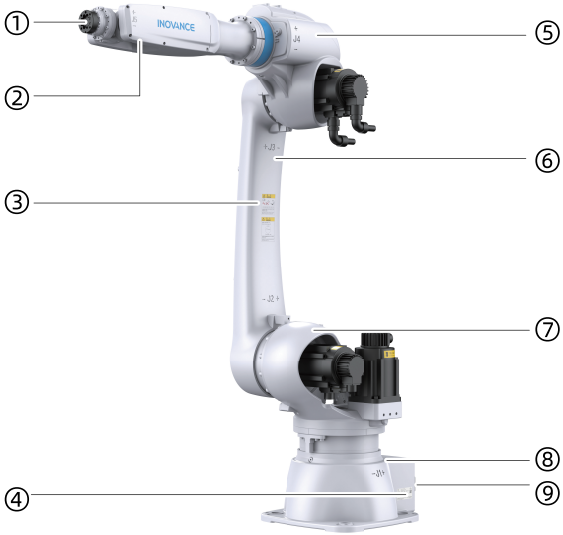


Table 2–1 Component description

No.	Name	No.	Name
①	Wrist flange	⑥	Base
②	Forearm	⑦	Swivel base
③	Safety sign	⑧	Upper arm
④	Nameplate	⑨	Elbow
⑤	Heavy-duty connector	-	

2.3 Rotation Directions

The following figure illustrates the rotation direction of each axis.

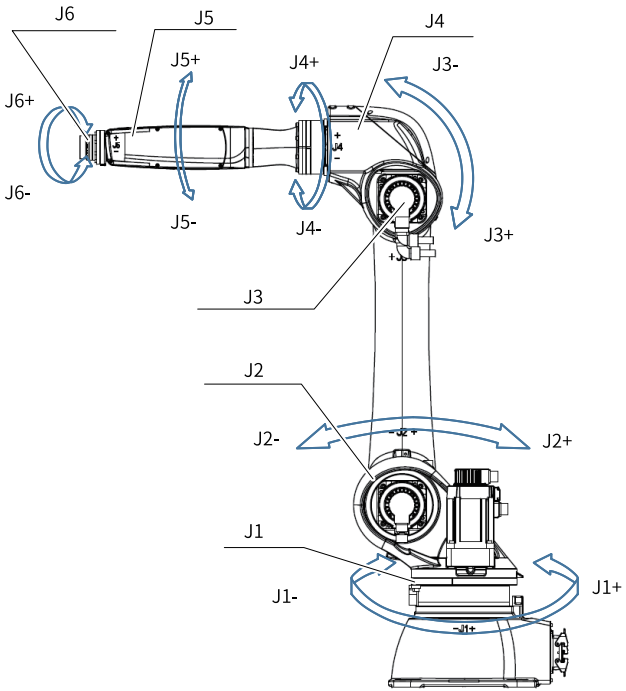


Figure 2-2 Axis rotation directions

2.4 Outline Dimensions

IR-R25-178S-INT outline dimensions

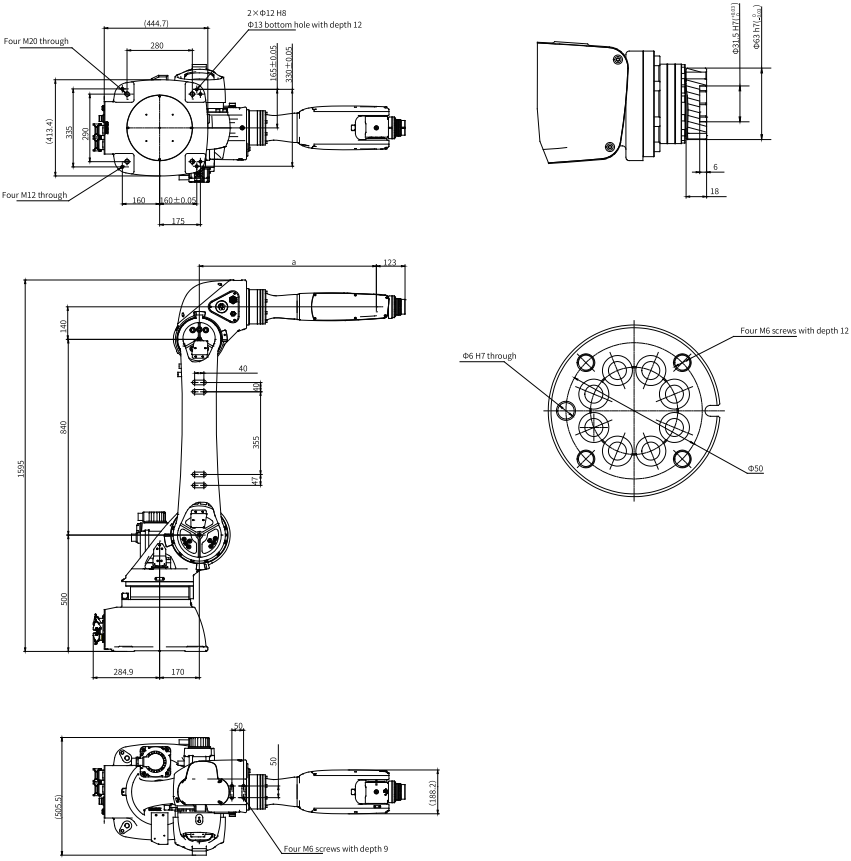


Figure 2-3 IR-R25-178S-INT outline dimensions (unit: mm)

IR-R16-210S-INT outline dimensions

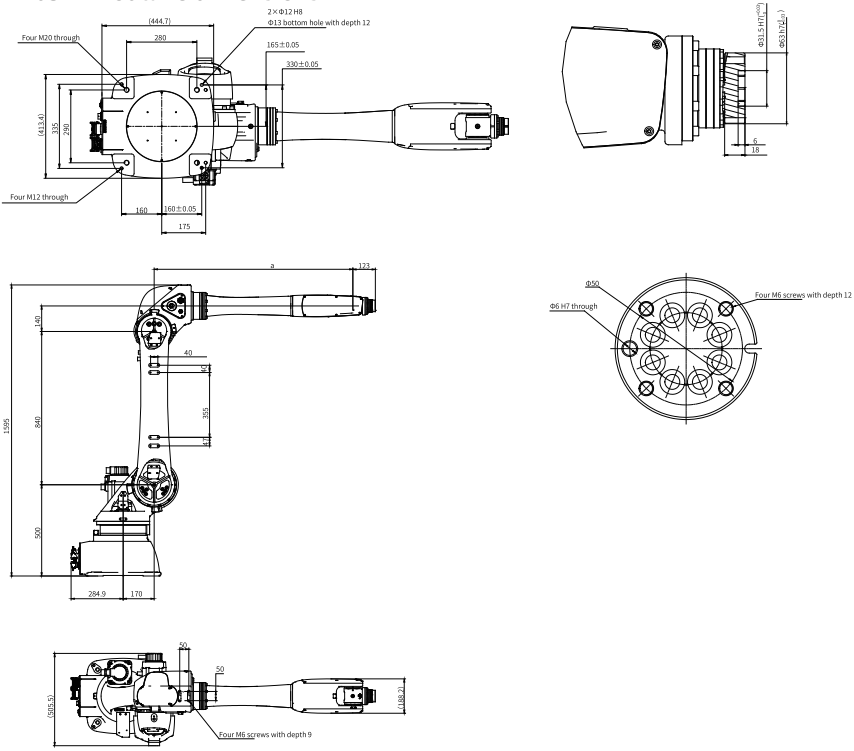


Figure 2-4 IR-R16-210S-INT outline dimensions (unit: mm)

2.5 Specifications

Model		IR-R25-178S-INT	IR-R16-210S-INT
Structure	Structure	Vertical multi-joint serial structure	Vertical multi-joint serial structure
Number of axes	Number of axes	6 axes	6 axes
Maximum reach	Maximum reach	1783 mm	2107 mm
Repeatability	Repeatability	±0.03 mm	±0.03 mm
Maximum wrist load	Maximum wrist load	25 kg	16 kg
IP rating	IP rating	Body: IP65, wrist: IP67	Body: IP65, wrist: IP67

Model		IR-R25-178S-INT	IR-R16-210S-INT
Maximum speed	J1 axis	190°/s	190°/s
	J2 axis	175°/s	175°/s
	J3 axis	200°/s	200°/s
	J4 axis	400°/s	400°/s
	J5 axis	360°/s	360°/s
	J6 axis	610°/s	610°/s
Maximum motion range	J1 axis	±170°	±170°
	J2 axis	-155° to +80°	-155° to +80°
	J3 axis	-75° to +160°	-75° to +160°
	J4 axis	±180°	±180°
	J5 axis	±140°	±140°
	J6 axis	±360°	±360°
Allowed wrist load torque	J4 axis	50 N·m	25 N·m
	J5 axis	50 N·m	25 N·m
	J6 axis	30 N·m	12 N·m
Allowed wrist load inertia	J4 axis	2.2 kg·m²	0.78 kg·m²
	J5 axis	2.2 kg·m²	0.78 kg·m²
	J6 axis	1.5 kg·m²	0.3 kg·m²
User interface	Wiring	18x signal, 30 V, 0.5 A	18x signal, 30 V, 0.5 A
	Air line	Air tube: Φ8 mm x 1 Pressure resistance: 0.59 MPa	Air tube: Φ8 mm x 1 Pressure resistance: 0.59 MPa
Ambient condition	Ambient temperature[1]	0°C to 45°C	0°C to 45°C
	Ambient humidity	5% to 95% RH (without condensation)	5% to 95% RH (without condensation)
	Maximum temperature gradient	1.5°C/min	1.5°C/min
Manipulator weight	Manipulator weight	255 kg	260 kg
Input power (average power consumption)	Input power (average power consumption)	5 kVA (1 kW)	5 kVA (1 kW)
Matching controller	Matching controller	IRCB501-6ND-INT	IRCB501-6ND-INT
Mounting method	Mounting method	Floor-mounted	Floor-mounted
Noise level	Noise level[2]	$L_{Aeq} \leq 80$ dB(A)	$L_{Aeq} \leq 80$ dB(A)

Model		IR-R25-178S-INT	IR-R16-210S-INT
Robot base mounting dimensions	Robot base mounting dimensions	290 mm x 280 mm (4 x Φ20 mm)	290 mm x 280 mm (4 x Φ20 mm)
Certification	CE certification, cSGSus certification, FCC certification, and functional safety certification (only supported by "-INT" controller and requires a functional safety expansion card), KCs certification.		

Note

[1] Ambient temperature: In low temperatures close to the minimum allowed temperature in the product specifications, or after a long time of unuse during holidays or nights, it is recommended to preheat the robot for 10 minutes before operation.

[2] Noise level: 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 six joints operating at 100% speed and acceleration, with a duty cycle of 50%.

2.6 Motion Range



- 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.

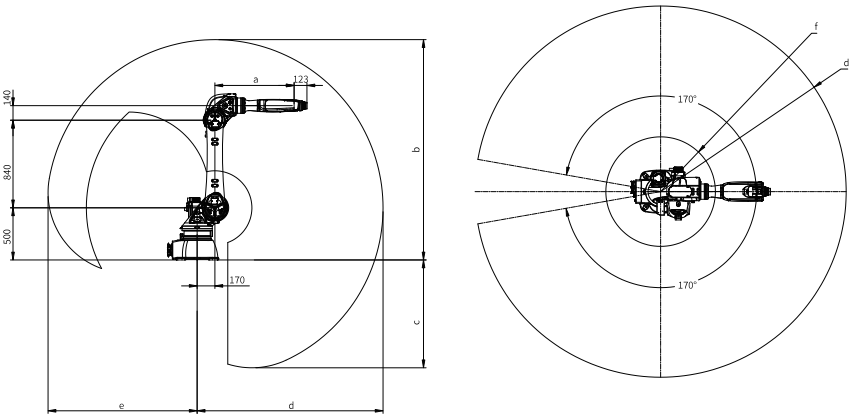


Figure 2-5 IR-R25-178S-INT robot motion range (unit: mm)

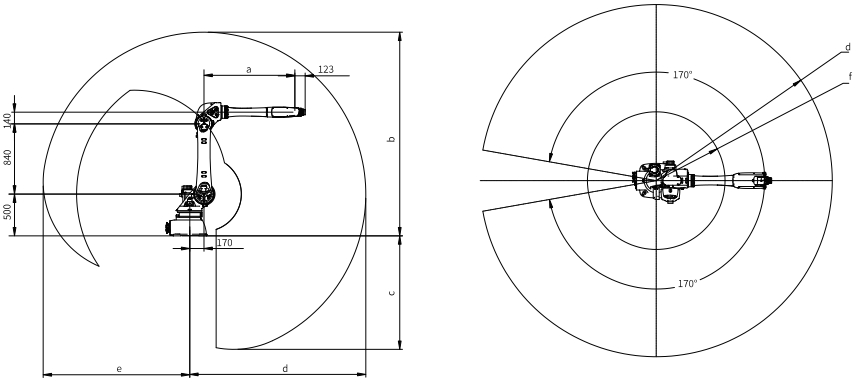


Figure 2-6 IR-R16-210S-INT robot motion range (unit: mm)

Name	IR-R25-178S-INT	IR-R16-210S-INT
a: Length from J3 to J5	760 mm	1088 mm
b: Height from the highest point to the base installation plane	2113 mm	2437 mm
c: Height from the lowest point to the base installation plane	1034 mm	1358 mm
d: Maximum reach	1783 mm	2107 mm
e: Maximum working radius limited by J1 rotation angle	1430 mm	1754 mm
f: Minimum unreachable working radius limited by J3 rotation angle	525 mm	617.5 mm

2.7 Maximum Load of Wrist Flange

The IR-R25 and IR-R16 models support a maximum load of 25 kg and 16 kg respectively. The allowed wrist torque and 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-R25-178S-INT	IR-R16-210S-INT
Allowed wrist torque (N·m)	J4 axis	50	25
	J5 axis	50	25
	J6 axis	30	12
Allowed wrist inertia (kg·m²)	J4 axis	2.2	0.78
	J5 axis	2.2	0.78
	J6 axis	1.5	0.3

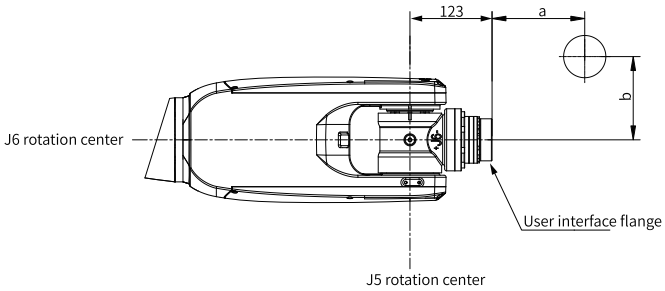


Figure 2-7 Distance to the rotation center of the J5/J6 axis

Note

- Distance to the rotation center of J5: a + 123 (mm)
- Distance to the rotation center of J6: b (mm)

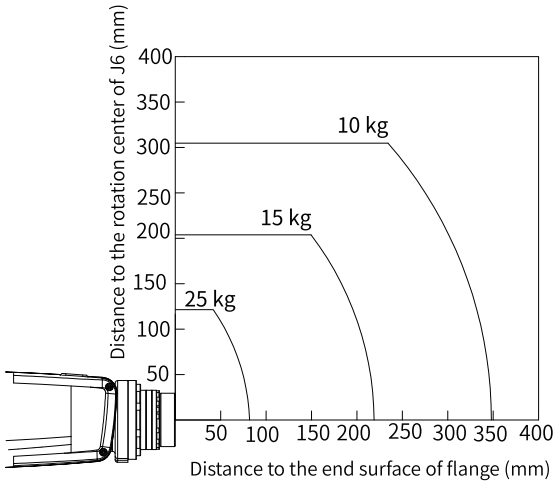


Figure 2-8 Wrist load curve of IR-R25

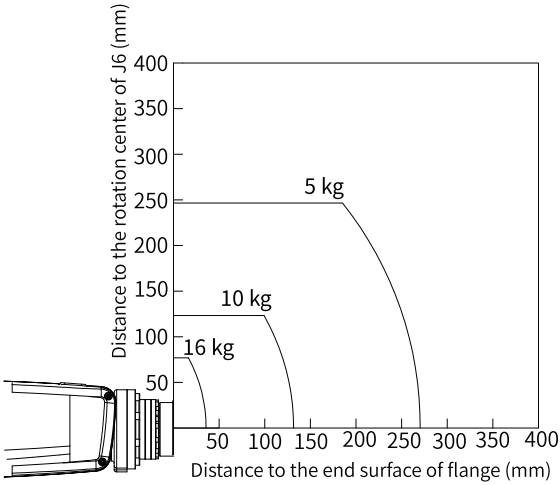


Figure 2-9 Wrist load curve of IR-R16

3 Preparation

3.1 Installation Personnel Requirements

- 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 the installation requirements and relevant technical information.
- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by professionals

3.2 Installation Environment Requirements

General environment requirements

Set up the robot system in accordance with the following environment requirements to maximize and maintain the performance of the robot and to use it safely.

Table 3–1 Ambient condition

Item	Requirement
Ambient temperature and humidity	Operating temperature range: 0°C to 45°C Air temperature change rate less than 1.5°C/min Humidity range: 5% RH to 95% RH, non-condensing
Storage temperature and humidity	Temperature range: -10°C to +55°C Humidity range: Up to 95% RH, non-condensing
Transportation temperature/ humidity	Temperature range: -10°C to +55°C Humidity range: Up to 95% RH, non-condensing
Electrical fast transient/burst immunity	2 kV or less
Static immunity	6 kV or less
Environment	• Indoor • Keep away from direct sunlight. • Keep away from dust, oil smoke, salt, and iron filings. • Keep away from flammable and corrosive liquids and gases. • Keep away from water. • Keep away from shocks and vibrations. • Keep away from sources of electrical interference.



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 environment 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. Consult your provider.
- If you want to use the robot to handle food directly, consult your provider in advance to avoid contamination of the food by the robot.



Do not wipe the robot hard with alcohol or benzene. Otherwise, the coated surface may lose gloss.

3.3 Anti-rust Requirements

3.3.1 Usage Specifications

Environmental control specifications

- Ensure the robot's operating environment temperature and humidity are within the equipment's allowable range, typically 0 ℃ to 45 ℃ for temperature and 20% RH to 80% RH for humidity.
- Avoid exposing the robot to corrosive gases or liquids such as acids, alkalis, or salt spray. Use a robot with a higher protection rating (e.g., IP67) and install physical protection if exposure is unavoidable due to process requirements (e.g., in electroplating or painting workshops). Regularly inspect for rust formation. If rust spots are found, remove the rust promptly and apply anti-rust oil[1].

- When there is continuous water splashing or other liquids that are prone to cause rust in the working environment, install physical protection to prevent liquids from splashing onto the robot. Also, regularly inspect for rust formation. If rust spots are found, remove the rust promptly and apply anti-rust oil.
- Keep floors clean. Clean up accumulated water and oil spills promptly to prevent increased humidity or corrosive gas formation due to evaporation.

Note

[1]: Contact the original manufacturer for the models of rust removers and anti-rust oils.

Daily operation specifications

- Before powering on, visually check the robot body, cables, and wrist area for obvious signs of water stains, oil contamination, or corrosion.
- Never touch the polished axis arm of the robot directly with bare hands. Hand sweat is one of the main causes of rust. Always wear clean gloves during operation.
- Gently wipe dust, oil, and cutting fluid from the robot surface (especially the wrist flange) using a dry, clean non-woven or cotton cloth.
- Standard models must not be washed with water. For IP67 optional models, add anti-rust agent to the water before washing. Immediately dry the robot after washing and apply anti-rust oil.

Emergency handling

- If the robot is splashed by any liquid (water, oil, chemical agent), stop it immediately. Perform thorough cleaning according to the cleaning steps in *"3.3.2 Maintenance" on page 33*, and reapply anti-rust oil after drying.
- If the robot is scheduled to be out of service for more than 48 hours, perform special preservation and anti-rust treatment. For specific operations, see *"3.3.2 Maintenance" on page 33*.

3.3.2 Maintenance

No.	Scenario	Detailed operations
1	Cleaning	1. Stop and power off the robot to ensure safety. 2. Perform initial dust removal: Use a soft brush or dry compressed air (pressure below 0.3 MPa) to remove dust from gaps and hard-to-reach areas. 3. Wipe down: Use a clean cloth dipped in a dedicated metal cleaner[1] to wipe the robot surface[2]. 4. Ensure thorough drying: Use a dry non-woven cloth to completely dry the surface, ensuring no moisture remains.
2	Applying anti-rust oil	1. Apply anti-rust oil to all exposed metal surfaces, especially the J6 axis end flange. 2. Spray a small amount of anti-rust oil onto a non-woven cloth, then evenly apply it to the metal surface to form a very thin oil film. Avoid excessive application that leads to dripping or runs.
3	Anti-rust and preservation treatments for long-term shutdown	1. Comprehensive cleaning and drying: Thoroughly clean and dry the robot according to the cleaning procedure. 2. Application of anti-rust oil: Apply anti-rust oil to all exposed metal surfaces. 3. Protection and storage: Proceed with the following operational precautions: • Move each axis of the robot to the standard parking posture to minimize structural stress. • Completely cover the robot with a dust cover or plastic film. Ensure an adequate amount of desiccant is placed inside the covering and inspect it periodically. • Power on and run the robot periodically for a certain duration to allow electrical components to generate heat and disperse moisture.

Note

[1]: Contact the original manufacturer for the models of rust removers.



[2]: It is strictly prohibited to use corrosive solvents such as strong acids, strong alkalis, and anhydrous ethanol to wipe the robot surface.

3.4 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 M16 threaded holes on the base table to mount the robot. Use screws with a strength equivalent to the performance level of Grade 12.9 specified in GB/T 3098.1.
- To dampen vibrations, use a steel plate with a thickness over 30 mm, a surface roughness of 25 μm, and a flatness below 0.2 mm 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 the user guide of the robot control cabinet.
- Consider the following torques and reaction forces produced by movements of the robot.

Table 3–2 Maximum force and torque on the robot

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)
4532	4447	1048	1461.8

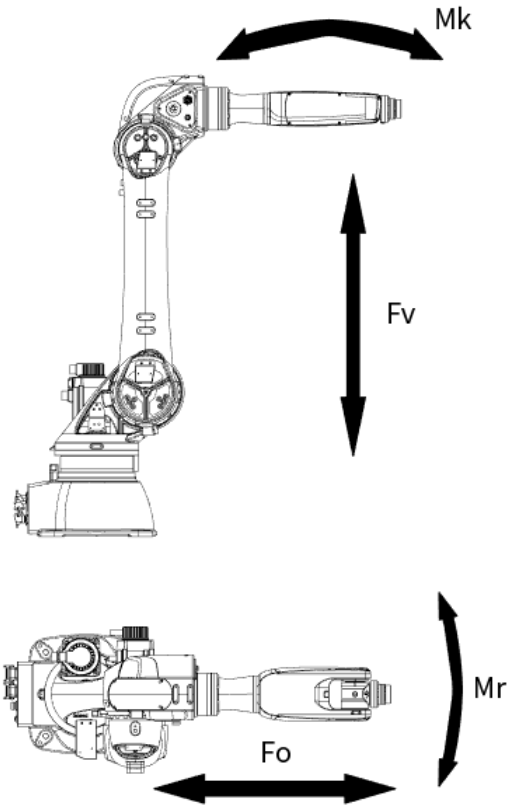


Figure 3-1 Forces and torques on the robot

CAUTION

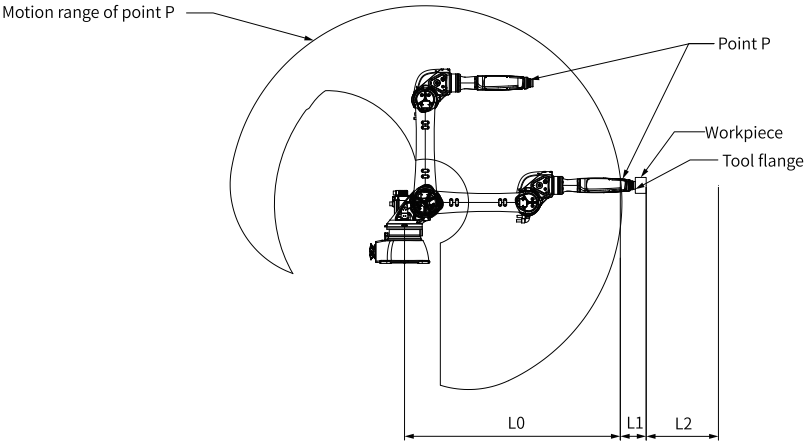
- When the robot is operated by combinations other than the above ones, it may be damaged.
- Installation and construction (welding and anchor bolts) shall be arranged by customers.
- Ensure that the flatness of the robot mounting surface is within 0.5 mm and the inclination angle is within 0.5°. The poor flatness of the robot base installation may lead to the damage of the base or the robot cannot work at its full performance.

3.5 Installation Space Requirements

Safety Fence Range

CAUTION

- Ensure a safety protection range that is greater than the maximum motion range of the robot. Set up comprehensive guard devices (such as fences) around the safety protection range, with an emergency stop device easily accessible to operators.
- On the guard devices (fences), clearly display robot status, such as automatic running, teaching, and emergency stop, so that personnel outside the safety fences 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.



- L0: Motion range of the robot
- L1: Total length of the wrist, tool flange, and workpiece
- L2: Safety space
- The safety distance of the safety fence should be greater than L0 + L1 + L2.

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 cords and signal cables is 230 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 *"6.4.4 Cable Hole Dimensions" on page 60*.
3. Reserve at least 200 mm between the boundary of the motion range and the safety fence.

Installation Dimensions

For the specific installation dimensions, see *"2.4 Outline Dimensions" on page 23*.

3.6 Installation Tool Preparations

Table 3–3 Preparation of tools

Tool	Quantity (pcs)
M16 outer hexagon wrench	1
Scissors or utility knife	1
Claw bar	1
Straight screwdriver	1
Protective gloves	1
Anti-smash shoes	1
Lifting rope	1
Forklift	1

4 Unpacking, Storage, and Handling

4.1 Precautions for Unpacking

CAUTION

- Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking.
- Unpack the product layer by layer. Do not strike the package violently.
- Check the surfaces of the equipment and accessories for any damage, rust, and scratches.
- Check the equipment, accessories, and materials in the package against the packing list.
- Do not install the equipment if any damage, rust, or sign of use is found on the equipment or accessories.
- Do not install the equipment if water seepage or component missing or damage is found upon unpacking.
- Do not install the equipment if the packing list does not conform to the equipment received.
- Unpack the packing box according to the direction instructed.

4.2 Unpacking Procedure

1. Wear protective gloves before operation, and use a claw bar to remove the top access cover and four side plates of the case.

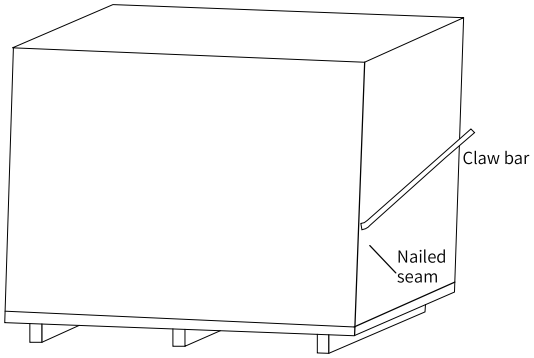


Figure 4-1 Outer carton structure

Note

Use a claw bar for unpacking, which is more secure.

2. Remove the plastic bags that cover the surface of the robot body and controller. Then, use a wrench to loosen the bolts fixing the robot body and packaging bottom board and the bolts fixing the controller and packaging bottom board.

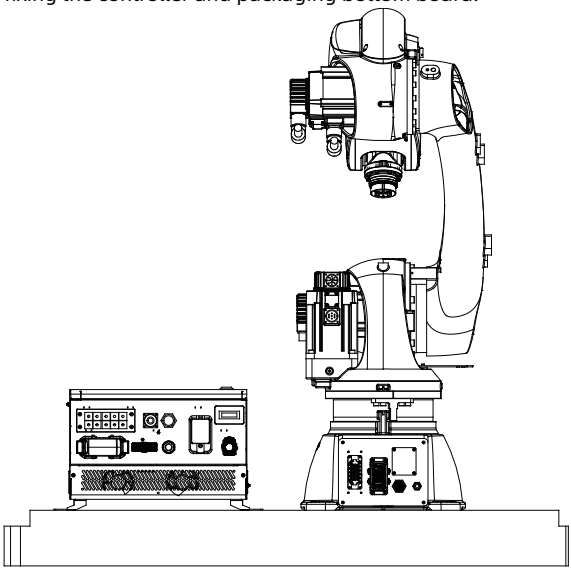


Figure 4-2 Packing of the robot

3. Transport the product to the installation site according to the handling procedure.

4.3 Check After Unpacking

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

Table 4–1 Packing list

Part Name	Quantity (pcs)
Robot body	1
Robot controller	1
Inovance Product Warranty Card	1
Cable set	1
M16x50 hexagon screws (Grade 12.9 in GB/T 70.1-2000)	4

Part Name	Quantity (pcs)
Spring washer (GB/T 93-1987)-16	4
Plain washer (GB/T 97.1-1985)-16	4
Eye bolt M12	4
Packing list	1

4.4 Precautions for Handling

Danger

Allow only qualified personnel to carry out transportation including rigger operation, hoisting by crane, and forklift driving.

Warning

- Transport the equipment with a crane or forklift with the original package.
- Wear personal protective equipment (PPE) during transportation with a crane or forklift. Prohibit any personnel from standing or staying around the transportation route.
- Keep the equipment balance when hoisting the equipment. Otherwise, the equipment may fall, resulting in serious injury or damage.

Caution

- Store and transport this equipment based on the storage and transportation requirements for humidity and temperature.
- Avoid storage and transportation in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Pack the equipment properly before transportation by vehicle. Use an enclosed box for long-distance transportation.
- Never transport the equipment with devices or materials that may damage or have negative impacts on the equipment.
- If condensation occurs on the device during transportation or storage, remove the condensation before turning on the power.

4.5 Pre-Handling Preparation

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.

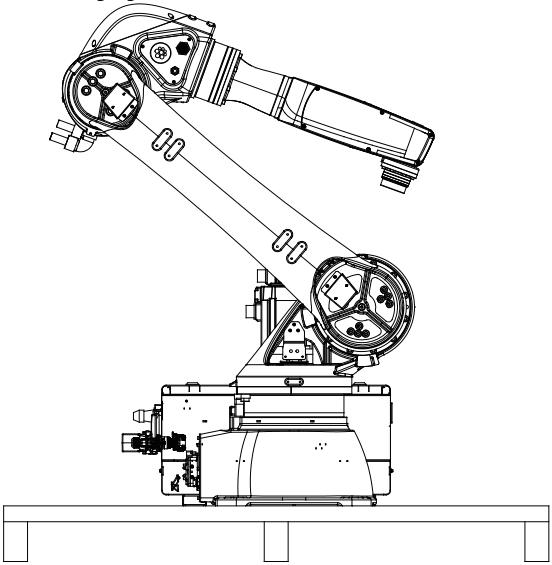


Figure 4-3 Robot posture at delivery

2. If the robot has been used and needs to be moved to another location, complete the following steps before handling:

   a. Adjust the robot to the posture for handling.
   b. Disconnect power to all devices.
   c. Unplug power and signal cables connected to the controller.
   d. Unscrew the base mounting screws and remove the robot from the mounting base.
   e. Secure the robot to the handling equipment.

4.6 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

- Take care when lifting 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 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. Set up the robot in the factory posture as shown in the figure below, then install four eye bolts (M16) on the swivel base, and lift it with four steel slings. It is recommended that the steel sling length be 2 m, with a total weight capacity of at least 500 kg. Use rubber hoses or similar protection at contact points between the steel sling and the robot body.

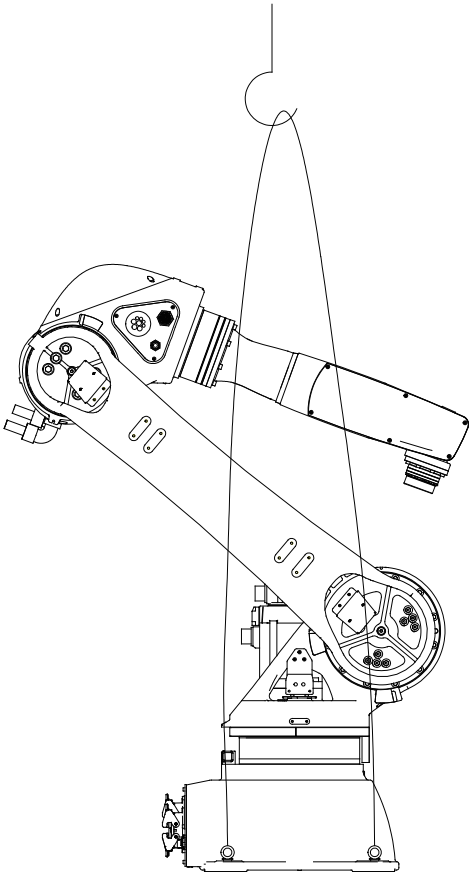


Figure 4-4 Lifting the robot

2. Use four steel slings to lift the robot. Ensure that the robot is balanced before moving the crane.
3. Move the robot independently or collaboratively, provided that the operation requirements of the crane are met.

Handling with a forklift

When handling the robot using a forklift, use bolts to secure the robot onto its original pallet or use screws to secure it on a baseplate with sufficient load-carrying capacity, and lift the robot together with the pallet or baseplate.

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

- **Handling the controller and robot body**

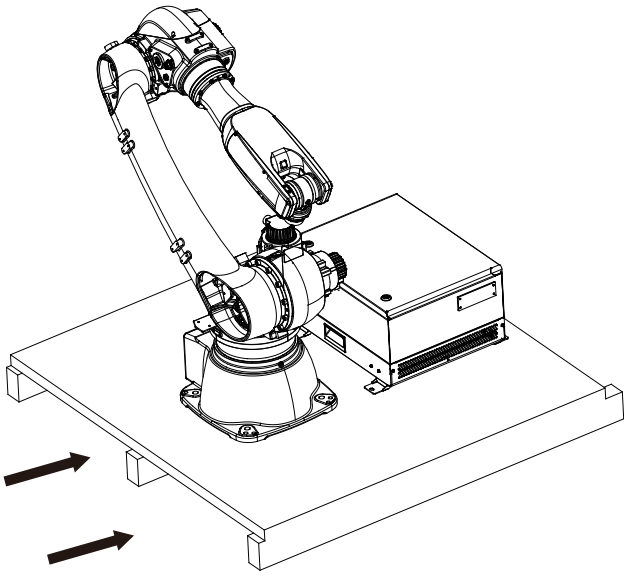


Figure 4-5 Handling the robot with a forklift

Note

When the factory pallet is used and the robot is located on one side of the pallet, apply a counterweight on the other side upon forklift insertion, to prevent the robot from tipping over.

- **Handling the robot body (handling options)**

Option	Code	Description
Forklifting tools x 4	20080072	Tools used by the forklift to transport the robot body fixed on the base

1. Install four forklifting tools at the four M12 threaded holes on the robot base according to the posture, as shown in the following figure. Forklift load capacity ≥ 500 kg, fork width ≤ 150 mm.

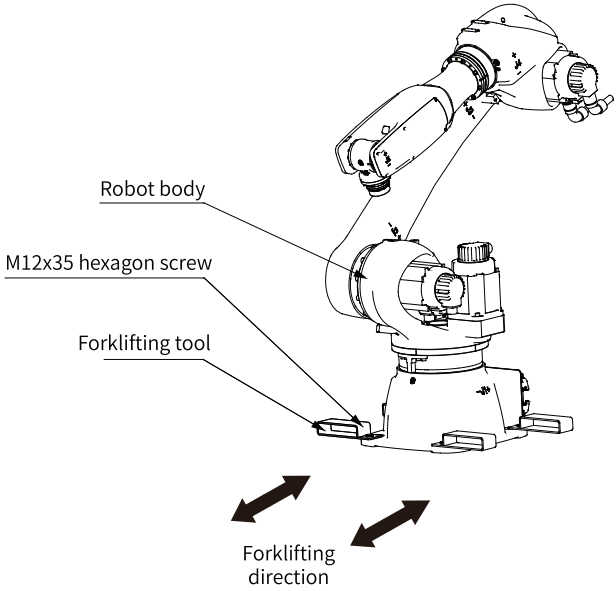


Figure 4-6 Forklift diagram

2. Ensure that the robot body is balanced before moving the forklift, so that it does not tip or tilt. Do not approach the forklift during transportation. Slowly raise the robot body and transport it to the installation base table.

5 Transportation Protection

5.1 Bill of Materials

The recommended bill of materials is as follows:

Name	Material	Size	Quantity	Description
Bubble wrap	LLDPE	-	Several	For protecting cable plugs
Hexagon socket screw	-	M8×80 M12×120	4 pieces each	For robot individual packaging. Use original factory-configured bolts.
Iron nail	Iron	-	Several	-
Desiccant	Montmorillonite/Silica gel desiccant	-	8 packets	30 g/packet
PE bag	LDPE	-	3 pieces/1 piece	Use the bag based on the product size: For packaging loose parts For packaging robot body/ cables
Nylon tie	NYLON 66	Length: 150 mm	4 pieces	-
Packing strap	PET	Width: 16 mm, thickness: 0.6 mm	8 m to 10 m	-
Industrial tape	BOPP	60 mm	Several	-
Carton box	K=K	-	2 pieces	1 piece for controller 1 piece for accessories
Compression-resistant carton	2A	-	1 piece	Select size as per equipment packaging requirements.
Wooden pallet	Plywood	-	1 piece	-
Plywood	Plywood	-	2 pieces	-
Wooden crate	Plywood	-	1 piece	Sheet material
Iron corner protector	Iron	-	8 pieces	-

CAUTION

Materials such as PE bags must comply with the laws and regulations of the destination country. Inovance packaging materials must meet the REACH certification requirements.

5.2 Packaging Guide

5.2.1 Packaging Posture

Transport Pose

Before transporting the robot, it must be placed in the transport pose. Angle of each joint:

Robot series	Axis	Angle
IR-R25&R16 Series	J1 axis	0°
	J2 axis	+50°
	J3 axis	-70°
	J4 axis	0°
	J5 axis	-70°
	J6 axis	0°

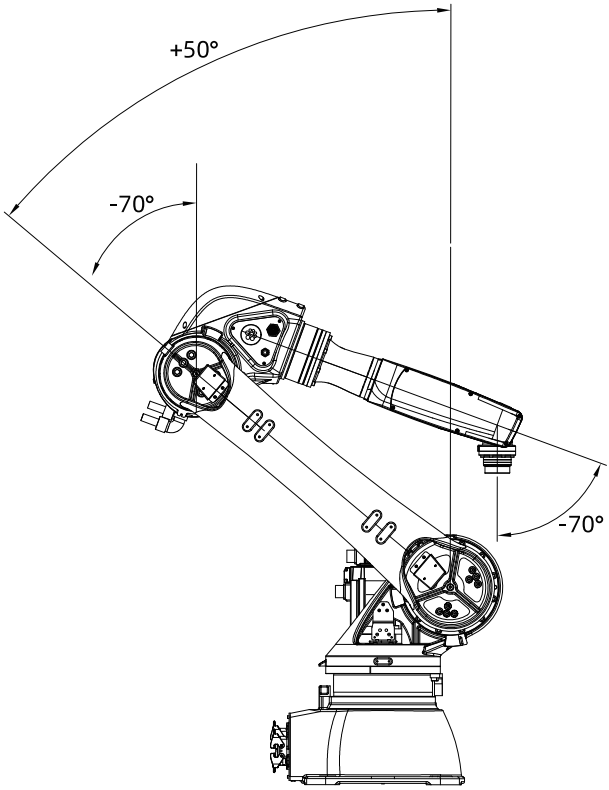


Figure 5-1 IR-R25&R16 Series

Package dimensions

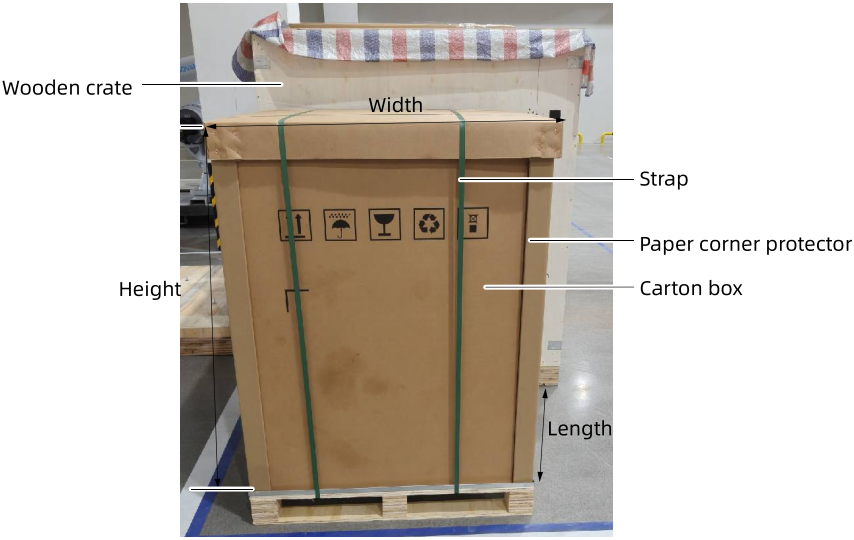
Wooden crate is used for packaging the international sales model of floor-mounted 6-axis robot, and carton box is used for packaging the domestic (China market) sales model.

Table 5–1 Package dimensions of carton box for IR-R25&R16 series robot (unit: mm)

Robot system	Arm length	Height	Width	Length
IR-R25&R16 Series	1783	1375	1375	1420
	2107			

Table 5–2 Package dimensions of wooden crate for IR-25&R16 series robot (unit: mm)

Robot system	Arm length	Height	Width	Length
IR-R25&R16 Series	1783	1375	1330	1420
	2107			



Note

The factory dimensions (robot + controller) above are for customer reference only.

5.2.2 Packaging Procedure

Due to their large motion range, multiple joints, and high flexibility, floor-mounted 6-axis robots should be packaged separately to ensure transportation safety and reliability. It is not recommended to package them together with the customer's automation equipment.

- **Package the robot in carton box**

  1. Place the robot body into a plastic bag (enclosing the robot body from the bottom up), and then secure it to the pallet using bolts.
  2. Place 4 packets of desiccant inside the plastic bag and ensure the bag opening is properly sealed.
  3. Use plywood to completely seal the 2 process holes for packaging, ensuring a tight seal.
  4. Place the controller into a plastic bag (enclosing the controller from bottom top), then secure it to the pallet using bolts.
  5. Place 4 packets of desiccant inside the plastic bag, and ensure the bag opening is properly sealed.
  6. Place cables and other accessories into a carton box, then use PET strapping to secure the carton box to the top of the controller.

7. Cover the final assembly with the main carton box and close the carton box cover. Use PET strapping to seal the carton box in a cross pattern. Package one product per carton.

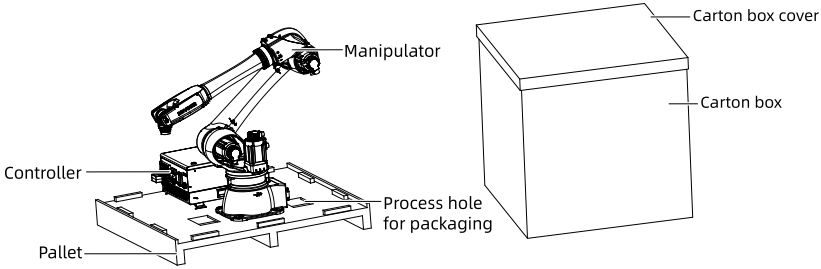


Figure 5-2 IR-R25&R16 series robot packaging (carton box)

- **Package the robot in wooden crate**

1. Use bolts to secure and tighten the robot arm to the wooden pallet.
2. Lay a PE bag first at the cardboard position, then place the controller and desiccant in the bag. Use bolts to lightly press and secure the controller to the wooden pallet, then tighten them.
3. Reserve puncture points on the PE bag for wrapping and sealing the controller.
4. Place the accessories in a carton box, thread the packing straps through the two square holes in the cardboard base, and tighten the straps.
5. Secure 4 packets of desiccant inside the packaging bag of the robot body to ensure no significant displacement.

Note

Place the desiccant inside the bag at the opening, ensuring it is clearly visible and easily accessible to the customer.

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6. Select a shrinkable plastic bag matching the outer diameter of the robot arm, axially slide the bag onto the arm until it reaches the end, and squeeze out the air from the bag to ensure a tight seal.
7. Use sealing tape to lightly bundle and secure the two adjacent plastic bags, confirming the completion of the inner packaging operation.
8. Use a pneumatic nail gun and iron nails to secure adjacent side plates, and side plates to the baseplate, at their joint areas. Nail spacing must be ≤ 100 mm.
9. All nails must be driven only into the pre-defined joint areas of the wooden plates, except for the iron corners.

10. After completing the side plate fixing process, place the cover plate flat on top of the side plates as shown in the diagram, and use a pneumatic nail gun to secure the cover plate to the side plates at the joint (nail spacing ≤ 100 mm). Use a pneumatic nail gun and iron nails to secure the side plates to the beam with iron nails at their joint areas.
11. The waterproof membrane shall be installed externally on the outer surface of the cover plate, with its edge overlapping the cover plate by ≥ 30 mm.
12. Install the sheet iron corner protector centered on the side panel junction edge, with one piece each at the top and bottom of each edge (top/bottom corner protectors aligned with the centerline of the junction edge).
13. Secure using nails, with 2 fixing points per corner protector (symmetrically arranged, spacing ≥ 50 mm).
14. Install the A4 laminated information card centered on all four sides of the component (centered over the edge, allowable deviation ≤ 3 mm). Use double-sided adhesive or staples (spacing ≤ 100 mm) to ensure the information card is flat and free of warping.

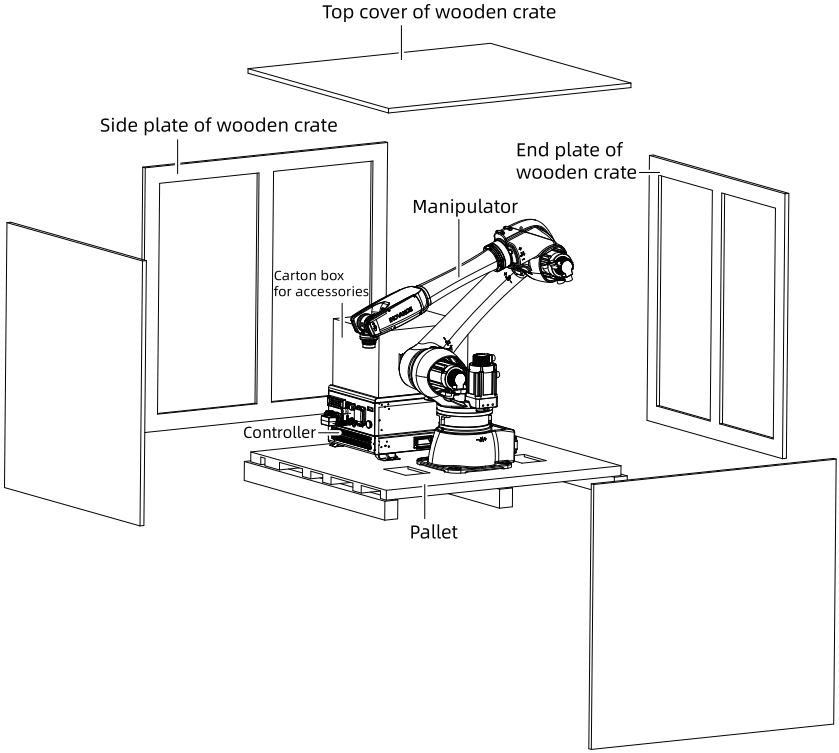


Figure 5-3 IR-R25&R16 series robot packaging (wooden crate)



Figure 5-4 Physical packaging

CAUTION

- Place the product together with desiccant into a plastic bag. Fold the bag flat and seal the opening with transparent adhesive tape.
- Place the product in a carton box and protect both ends of the product with polyethylene foam.
- Attach the guide, zero point information attachment, etc., to the inner side of the carton box.
- Place desiccant and cover with a PE bag to prevent dust and rust.
- Prevent collisions and scratches throughout the entire process.
- Secondary transportation with any load (tooling or gripper) is not recommended.

6 Installation

6.1 Precautions for Installation

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.

6.2 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 over 30 mm and a surface roughness below 25 μm as the robot mounting surface.

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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 plain washers, and tighten them with four M16x50 hexagon screws (tightening torque: 220 N·m).

Note

Use screws with a strength equivalent to the performance level of Grade 12.9 specified in GB/T 3098.1.

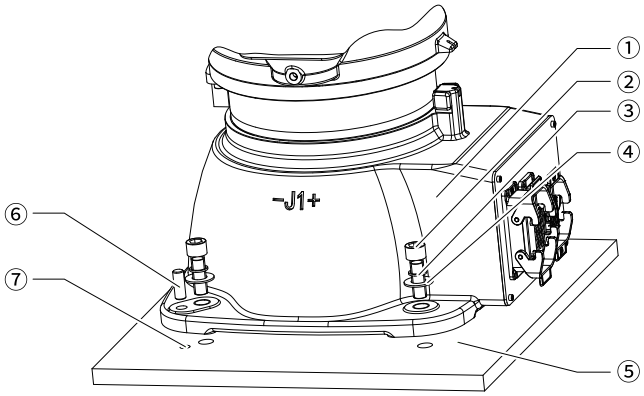


Figure 6-1 Installing the base

No.	Component
①	Robot base
②	Four M16x50 hexagon screws (Grade 12.9 in GB/T 70.1-2000)
③	Four spring washers (GB/T 93-1987)-16
④	Four plain washers (GB/T 97.1-1985)-16
⑤	Threaded mounting holes (depth: > 20 mm)
⑥	Two Φ12x32 parallel pins with internal threads (GB/T 120.2-2000)
⑦	Mounting pin holes (depth: > 20 mm)

6.3 Installing an End Effector

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

Caution

- Perform installation only when the power supply is disconnected and the workobject is not placed. If the emergency stop switch is pressed when the power is still connected, the workobject may be released at this time, which may cause damage to the robot system and workobject.
- Pay attention to the interference area of the end effector during system layout design. After the end effector is installed, the end effector or workobject may come into contact with the robot body during motion due to the outer diameter of the end effector, the size of the workobject, or the position of the robot arm, which may cause damage to the robot system and the workobject.

Use M6 screws (Grade 12.9) to attach the end effectors to the wrist flange.

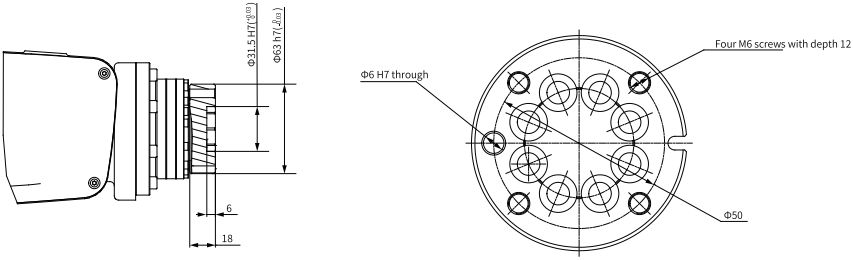


Figure 6-2 Wrist flange

6.4 Cable Connection

6.4.1 Robot Interface

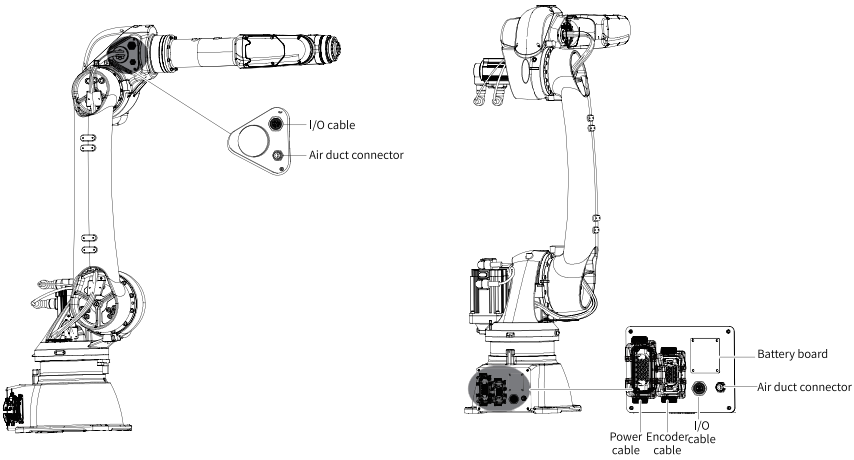


Figure 6-3 Robot interface diagram

6.4.2 Connecting 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.

Connecting method:

- Connect the heavy-duty connector of the user cable to the heavy-duty connector of the robot base.
- Connect the power connector and signal connector of the user cables to the controller.

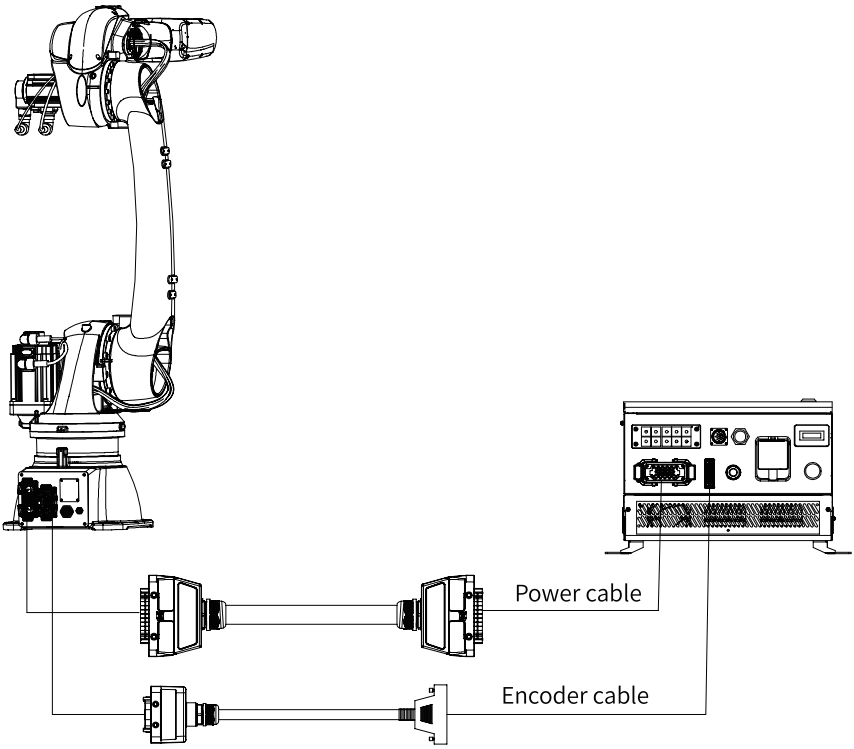


Figure 6-4 Connecting the power and encoder cables

6.4.3 Terminal Assignment of the Heavy-Duty Connector

Table 6–1 Power cable connector

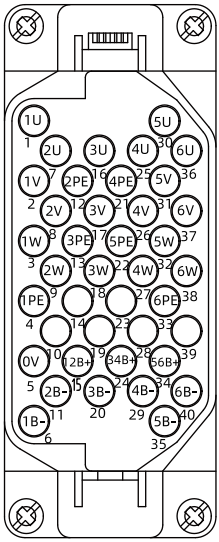
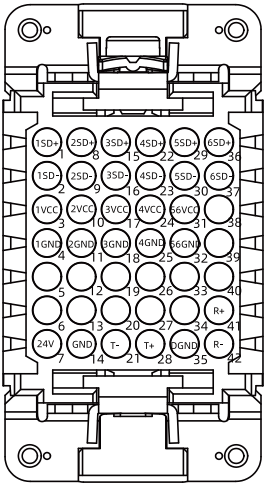
Connector pin layout	No.	Assignment	Description	No.	Assignment	Description
	1	U1	Motor output phase	25	U4	Motor output phase
	2	V1	Motor output phase	26	V4	Motor output phase
	3	W1	Motor output phase	27	W4	Motor output phase
	4	PE	Enclosure GND	21	PE	Enclosure GND
	7	U2	Motor output phase	30	U5	Motor output phase
	8	V2	Motor output phase	31	V5	Motor output phase
	9	W2	Motor output phase	32	W5	Motor output phase
	12	PE	Enclosure GND	22	PE	Enclosure GND
	16	U3	Motor output phase	36	U6	Motor output phase
	17	V3	Motor output phase	37	V6	Motor output phase
	18	W3	Motor output phase	38	W6	Motor output phase
	13	PE	Enclosure GND	33	PE	Enclosure GND
	6	BK1-	Brake 1	15	BK12+	Brake power supply
	11	BK2-	Brake 2	24	BK34+	Brake power supply
	20	BK3-	Brake 3	34	BK56+	Brake power supply
	29	BK4-	Brake 4	5	GND	Manual brake release
	35	BK5-	Brake 5	-	-	-
	40	BK6-	Brake 6	-	-	-

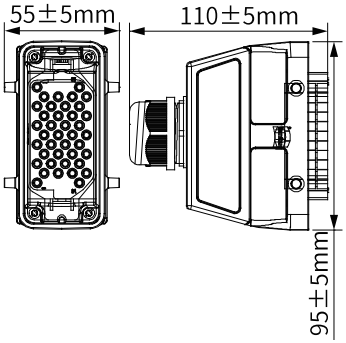
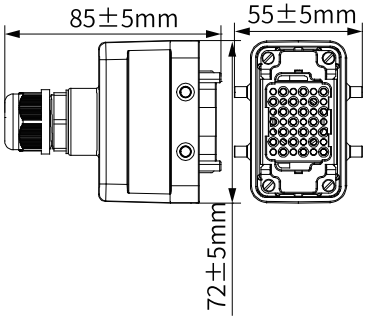
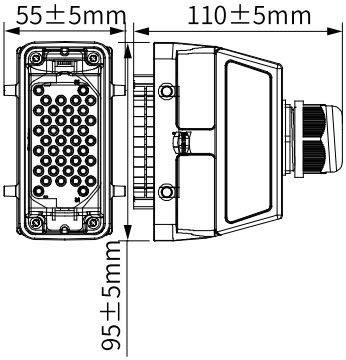
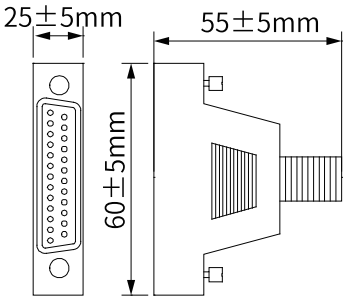
Table 6-2 Power cable connector of the robot body

Connector pin layout	Pin No.	Assignment
	1	J1: PS+
	2	J1: PS-
	3	J1: VCC
	4	J1: GND
	8	J2: PS+
	9	J2: PS-
	10	J2: VCC
	11	J2: GND
	15	J3: PS+
	16	J3: PS-
	17	J3: VCC
	18	J3: GND
	22	J4: PS+
	23	J4: PS-
	24	J4: VCC
	25	J4: GND
	29	J5: PS+
	30	J5: PS-
	31	J5 & J6: VCC
	32	J5 & J6: GND
	36	J6: PS+
	37	J6: PS-
	41	R+
	42	R-
	35	DGND
	28	T+
	21	T-
	14	GND
	7	24V

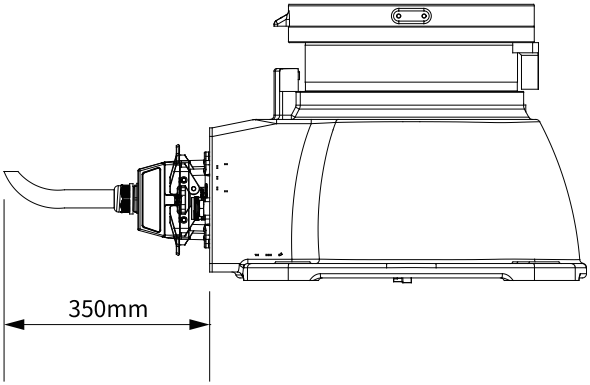
6.4.4 Cable Hole Dimensions

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

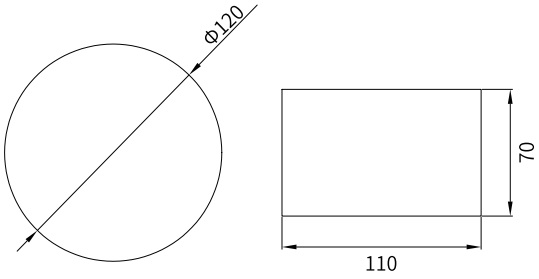
Table 6–3 Cable hole dimensions

Name	Power Cable Connector	Encoder Cable Connector
Robot Body Side		
	105 mm x 95 mm x 55 mm (L x W x H)	85 mm x 72 mm x 55 mm (L x W x H)
Control Cabinet Side		
	105 mm x 95 mm x 55 mm (L x W x H)	55 mm x 60 mm x 25 mm (L x W x H)

Reserved space (connector size + cable bending radius) for cables on the robot side is 350 mm, as shown in the following figure.



Recommended cable hole dimensions (round hole and square hole) are shown in the following figure (unit: mm).



WARNING

- 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 (350 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.

6.5 Wiring and Tubing

6.5.1 Wiring (Cables)

Note

Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed 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	18	25 AWG	Twisted pair



Current higher than 0.5 A is not allowed.

The specifications of the connector are described in the following table.

Model	Code
19-pin male aviation connector	15050930
19-pin male aviation connector (90°), with cable	15051215
I/O cable (5 m)	1504B978

6.5.2 Tubing (Air Ducts)

The following table describes the specifications of air ducts.

Max Operating Pressure	Quantity	Specifications (Outer Diameter x Inner Diameter)
0.59 MPa (6 kgf/cm²)	1	Φ 8 mm x Φ 5.7 mm

6.5.3 Robot Aviation Connector Pins

The robot provides a 19-pin aviation connector and a 19-pin aviation connector at the elbow joint and the base respectively. The two connectors are connected by cables routed inside the robot body.

The connector on the elbow joint is a 90° elbow aviation connector (without wire), and the connector on the base is a straight aviation connector (with wire). The connection between the 19-pin aviation connector on the base and that at the elbow joint (top of the forearm) is described as follows:

- Pins other than pin M of the two connectors are directly connected internally as user I/Os, and the pin functions can be customized.
- Pin M is connected to the shield.

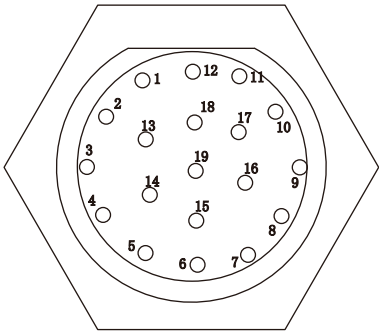


Figure 6-5 Distribution of I/O aviation connector pins

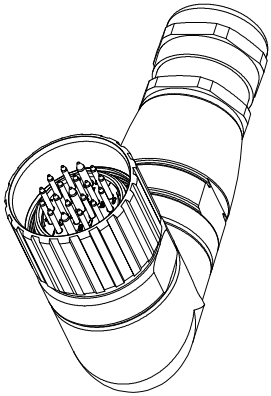


Figure 6-6 Aviation connector at the elbow joint

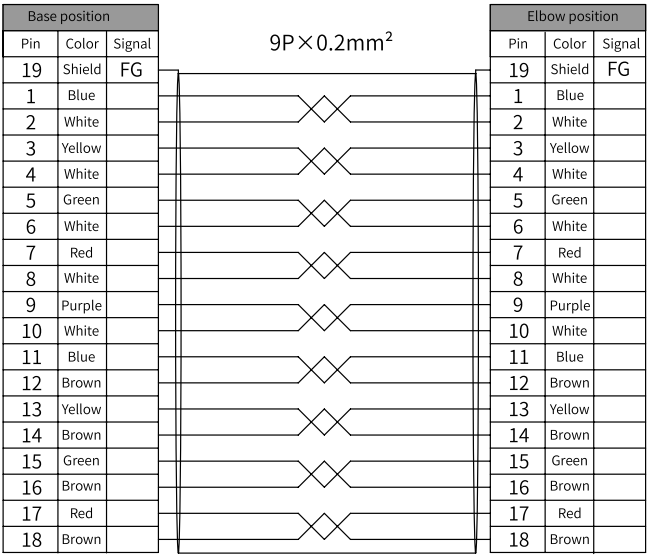


Figure 6-7 Internal structure of I/O aviation connector

7 Motion Range

7.1 Method for Setting the Motion Range



- When limiting the motion range for safety reasons, consider both the angle range and mechanical stop at the same time.
- The default motion range at delivery is the maximum motion range of the robot.
- To prevent premature wear of joint reducer bearings and gears due to insufficient oil film, avoid prolonged repetitive motion of joints within a small angular range of less than 10°.
- If the actual operating conditions require prolonged operation within an angle of less than 10°, it is recommended to cycle the mechanical joint once per hour, moving each joint more than 50° to ensure effective lubrication and extend service life.

Set the motion range based on the following:

- **Angle range (all joints)**
  The basic unit of the robot motion is degree. Set the robot motion limit (motion range) based on the upper and lower angle limits (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 limits corresponding to the set value of the mechanical stop.

  Once the robot receives a motion command, it checks whether the target position specified by the command is within the angle range before initiating the movement. If the target position is beyond the set angle range, an error occurs and no action will be taken.



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

- **Mechanical stop**
  Use the mechanical stops to mechanically set an absolute motion area, preventing any movement beyond them.

If you need to limit the motion range for safety reasons or to improve layout efficiency, set it according to *"7.3 Mechanical Limit Stops" on page 72*.

7.2 Motion Range Setting by Angle Range

7.2.1 Maximum Angle Range of J1

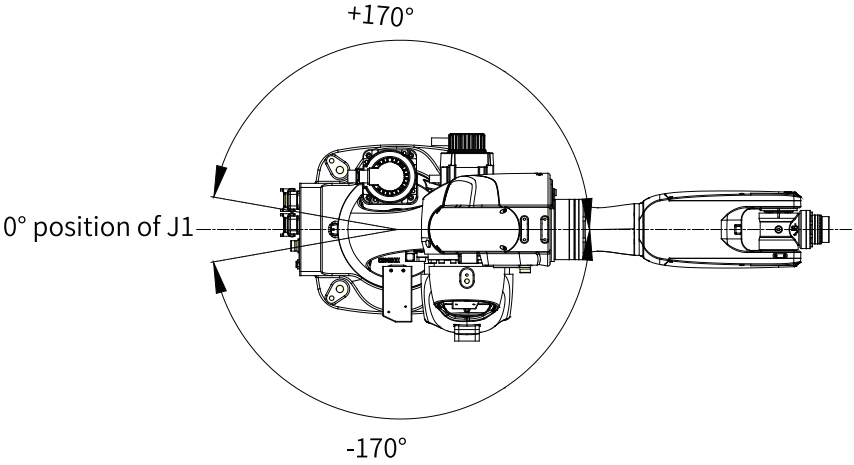


Figure 7-1 Maximum Angle Range of J1

7.2.2 Maximum Angle Range of J2

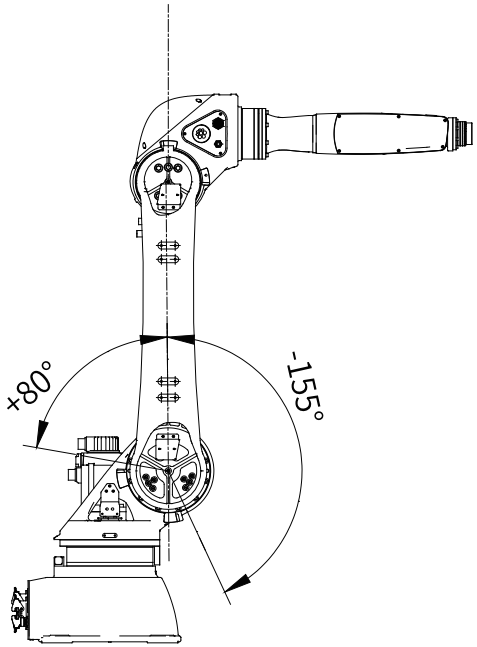


Figure 7-2 Maximum angle range of J2

7.2.3 Maximum Angle Range of J3

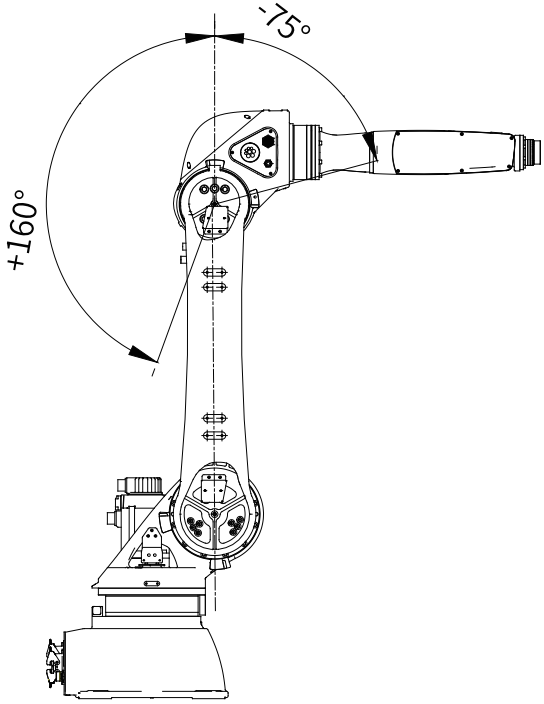


Figure 7-3 Maximum angle range of J3

7.2.4 Maximum Angle Range of J4

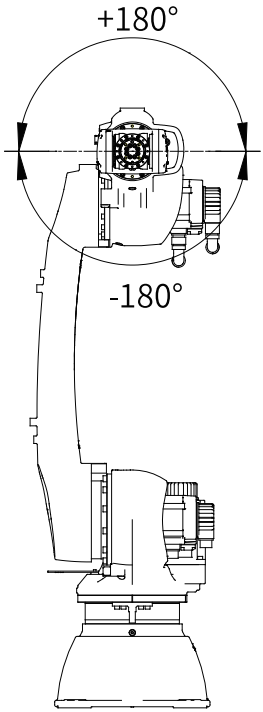


Figure 7-4 Maximum angle range of J4

7.2.5 Maximum Angle Range of J5

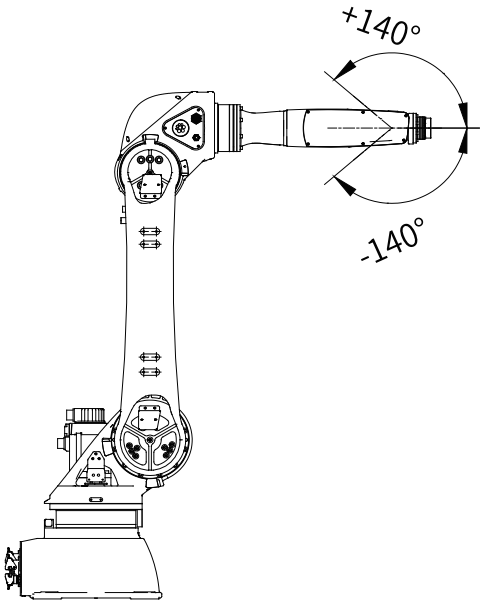


Figure 7-5 Maximum angle range of J5

7.2.6 Maximum Angle Range of J6

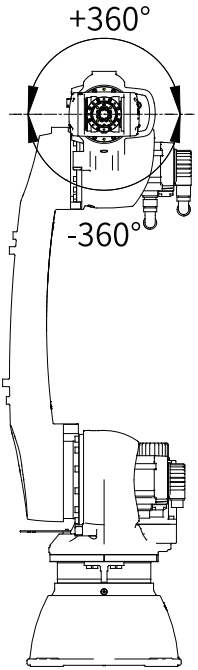


Figure 7-6 Maximum angle range of J6

7.3 Mechanical Limit Stops

As shown in the following figure, the IR-R25 and IR-R16 models have mechanical stops at J2 and J3. Set angle ranges must not exceed the angle ranges allowed by the mechanical stops.

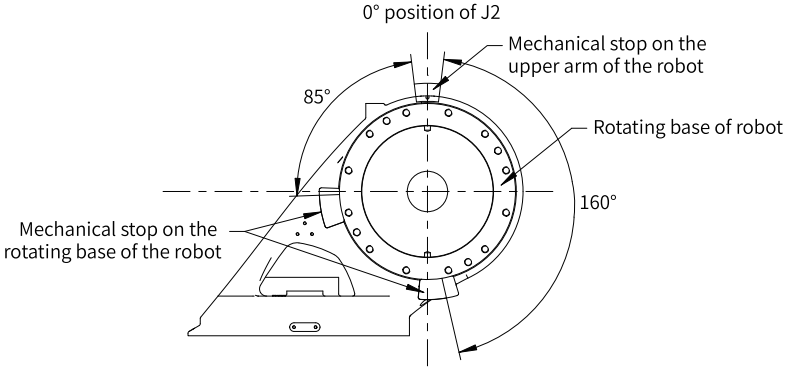


Figure 7-7 Mechanical limit stops for J2

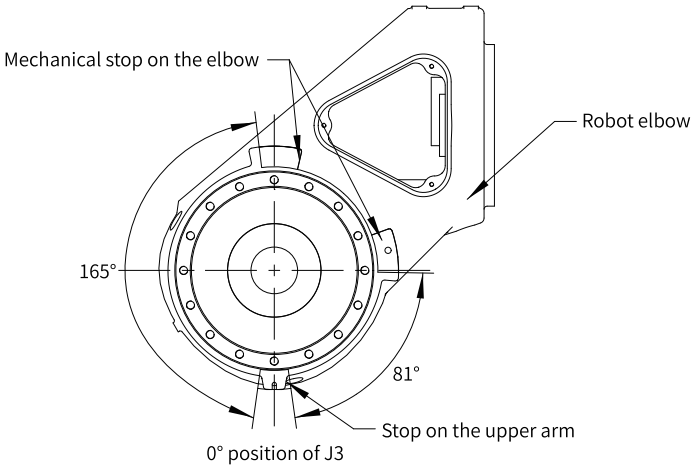


Figure 7-8 Mechanical limit stops for J3

8 Inspection and Maintenance

8.1 Maintenance Precautions

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

Note

- Equipment installation, wiring, inspection, maintenance, 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 any parts that are not covered in this guide. Follow the maintenance procedure strictly as described in this guide.
- Check the motion of the robot after parts replacement outside the safety fence. Failure to comply may cause severe safety issues due to abnormal movement of the robot.
- Make sure that the emergency stop switch and safety door switch work properly before operation. Otherwise, safety protection function will not work properly in emergency cases, causing serious injury or damage.



- Submit the repair request according to the 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.

8.2 Schedule for Inspection and Maintenance

Inspection points are divided into five stages: daily, monthly, quarterly, biannual, and annual. The inspection points are added every stage. If the robot is operated for 250 hours or longer per month, the inspection points must be added every 250 hours, 750 hours, 1500 hours, and 3000 hours operation.

Inspection item	Inspection item					
	Daily inspection	Monthly inspection	Quarterly inspection	Biannual inspection	Annual inspection	Overhaul (Replacement)
1 month (250 h)	Yes	Yes	-	-	-	-
2 months (500 h)	Yes	Yes	-	-	-	-
3 months (750 h)	Yes	Yes	Yes	-	-	-
4 months (1000 h)	Yes	Yes	-	-	-	-
5 months (1250 h)	Yes	Yes	-	-	-	-
6 months (1500 h)	Yes	Yes	Yes	Yes	-	-
7 months (1750 h)	Yes	Yes	-	-	-	-
8 months (2000 h)	Yes	Yes	-	-	-	-
9 months (2250 h)	Yes	Yes	Yes	-	-	-
10 months (2500 h)	Yes	Yes	-	-	-	-
11 months (2750 h)	Yes	Yes	-	-	-	-
12 months (3000 h)	Yes	Yes	Yes	Yes	Yes	-
...	-	-	-	-	-	-
36 months (9000 h)	Yes	Yes	Yes	Yes	Yes	Yes
...	-	-	-	-	-	-

8.3 Regular Inspection Items

In order to ensure the robot operates more safely and efficiently, regular inspections and maintenance are required. Based on the parts to be inspected and maintained, it can be

categorized into daily inspection, weekly inspection, monthly inspection, biannual inspection, annual inspection, as well as inspections before and during shutdown.

1. Daily inspection and maintenance

Inspection item	Inspection point
Visual inspection	• Check all joint gaps, oil filling ports, and drain ports for grease leakage. • Check robot exterior for any impact damage.
Screw tightening inspection	Check all screws for looseness throughout the robot and check whether the screw tightening torques meet the requirements.
Abnormal noise inspection	Check all transmission mechanisms for abnormal noise.
Joint transmission mechanism inspection	Check for unstable running and abnormal jittering in all transmission mechanisms.
Pipeline accessory inspection	Check whether the pipeline accessories are complete, worn and rusted.
Electrical component control inspection	Check whether the control buttons of all electrical components of the robot are normal.
Grease seepage inspection	Check for grease seepage at each joint. Wipe clean any grease seepage present.
Rust prevention inspection	Visually check for any water stains, contaminants, or rust spots.

2. Weekly inspection and maintenance

Inspection item	Inspection point
Brake inspection	Check whether the brake of each axis of the robot is effective.
Axis motion range inspection	• Check whether the motion range of each axis is within the normal angle range. • Check whether the zero point position of each axis is aligned.

3. Monthly inspection and maintenance

Inspection item	Inspection point
Controller heat dissipation inspection	Check that the rear controller fan is providing adequate airflow. It is recommended to replace or maintain the fan once a month.

4. Biannual inspection and maintenance

Inspection item	Inspection point
All wiring harnesses for each electrical component	• Check all cable connectors of the robot body for bending, corrosion and falling off. • Check the cables outside the controller for bending, corrosion and falling off. • Check the cables of the teach pendant for bending, corrosion and falling off.
Routine cleaning and maintenance	Check and, if necessary, apply anti-rust oil.

5. Annual inspection and maintenance

Inspection item	Inspection point
Controller DI/DO signals	Check whether the DI/DO signal response of the controller is normal.
Axis reducer	• Check whether the lubrication for each axis reducer is normal and whether there is abnormal noise. • Check the iron powder concentration in the lubricating grease of each axis reducer.
Electrical components cleanliness	Check the cleanliness of all electrical components. Under normal circumstances, remove dust for all electrical components annually.
Controller fan filter cotton	Check the cleanliness of the controller fan filter cotton, and replace the filter cotton annually under normal circumstances.
Synchronous belt	Check whether the tensioning frequency of the synchronous belts is within the standard range.
Routine cleaning and maintenance	Check and, if necessary, apply anti-rust oil.

6. Inspection and maintenance every 1.5 years

Inspection item	Inspection point
Battery inspection	Check the battery voltage. If the battery voltage is below 3.1 V or the software issues a battery level alarm, replace the battery promptly.

7. Inspection and maintenance every 2 years

Inspection item	Inspection point
In-depth inspection and maintenance	Perform a comprehensive inspection of concealed areas and perform professional anti-rust treatment on key components.

8. Inspection and maintenance before and during shutdown

Inspection item	Inspection point
Long-term shutdown maintenance	Perform comprehensive cleaning, anti-rust, and preservation treatments.

CAUTION

Improper use of tools can cause screw thread stripping. Inspect the torque wrench and hexagon screwdriver bit for wear before use, and replace them if necessary.

8.4 Applying Lubricating Grease

Replace the lubricating grease of the reducer or wrist every 2.5 years or every 10,000 operating hours (whichever is earlier). If the standard concentration value is exceeded, replace the grease or reducer. Contact the service center of Inovance.

Note

Lubricating grease of reducers of J1 to J4 of the IR-R25 and IR-R16 series robots must be replaced. The J5 and J6 use a harmonic reducer and thus lubricating grease replacement is not required.

CAUTION

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

Note

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

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

8.5 Grease Seepage Inspection

8.5.1 Daily Inspection

Check the following items each day when the system is running.

Inspection Item	Content
Grease seepage	Check for grease seepage at each joint. Wipe off any grease seeped.

8.5.2 Grease Seepage Inspection Points

- Insert a dust-free cloth or scouring pad into the gap of each joint. Check for grease seepage at each joint. Wipe off any grease seeped.
- Depending on operating conditions and the surrounding environment, a small amount of grease may seep out from the outer side of the oil seal lip (minor adhesion). When this grease accumulates into droplets, it may drip under certain movements. Before operating the robot, wipe off any grease residue beneath the oil seal.
- In the case of excessive seepage, change the grease or oil.
- When opening the lubrication grease supply/drain port, take care to prevent grease splashing.
- If the operating temperature becomes excessively high, internal pressure in the grease chamber may rise. In such cases, after operation, open the filler port once to restore normal internal pressure.

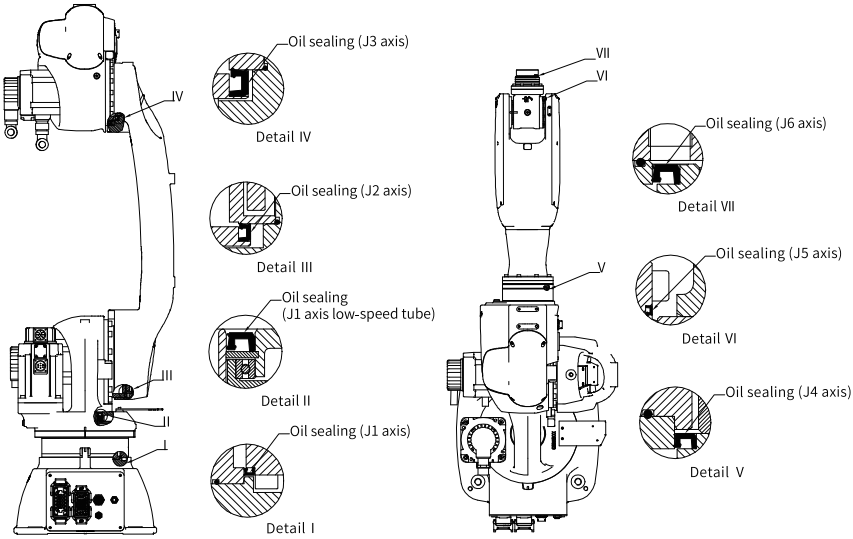


Figure 8-1 Grease seepage inspection points

CAUTION

- When opening the oil filling port, lubricating grease may be sprayed out at high temperature. Prepare plastic bags in advance and lay them under the oil filling port.
- Wear heat-resistant gloves, protective goggles, masks, and protective clothing as needed.
- If oil leakage persists after frequent wiping, see *"8.5.3 Lubricating Grease Leakage and Solution" on page 81* for handling.
- When reinstalling the screw plug into the oil filler port, check whether the tightening torque meets the standard torque value. The torque of the M10 screw plug is 7 N·m.

8.5.3 Lubricating Grease Leakage and Solution

Problem	Problem Description	Cause Analysis	Solution
Grease seepage or leakage at gearbox	Grease leakage at joints	The robot has been used for an extended period, causing aging of sealing rubber parts.	Replace the sealing rubber parts or O-rings.
		Improper disassembly/ reassembly operations may damage sealing rubber parts.	
		Oil seal damage may be caused by foreign particles (such as dust) scratching the oil seal lip.	If the oil seal at the reducer is damaged (based on leakage position), replace the reducer. If the motor oil seal is damaged, replace the motor.
		Gaps exist on sealing surfaces.	Re-tighten mounting screws to ensure a tight fit between surfaces.
		Threadlocker LT5699 on motor or reducer mounting surfaces becomes invalid.	Re-apply the threadlocker LT5699.
		The hexagon socket screw plugs do not match the combined sealing washers.	Replace with new hexagon socket screw plugs and matching combined sealing washers.
		Cracks on castings or oil chamber damage occurs due to collisions or other impacts.	Replace with new parts.

8.6 Battery (Lithium Battery) Replacement



- 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 zero points, after removing the battery supporting plate cover at the rear of the robot body, first insert a new battery into the white 2P connector. Secure the new battery in the wiring compartment, and then remove the used battery. The replacement steps are as follows:

Table 8–1 Replacing the battery

Step	Illustration
1. Turn off all power supplies.	
2. Loosen four M4 screws and remove the battery supporting plate.	

Step	Illustration
3. Insert a new battery, remove the used battery, and then fix the new battery to the supporting sheet metal.	
4. Install the battery supporting board in the reverse direction of Step 1.	

Note

Failure to comply with the procedure described above may cause loss of zero points. For details, see *"8.7.2 Zero Point Calibration Procedure" on page 85*.

8.7 Zero Point Calibration

8.7.1 Overview

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

Note

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



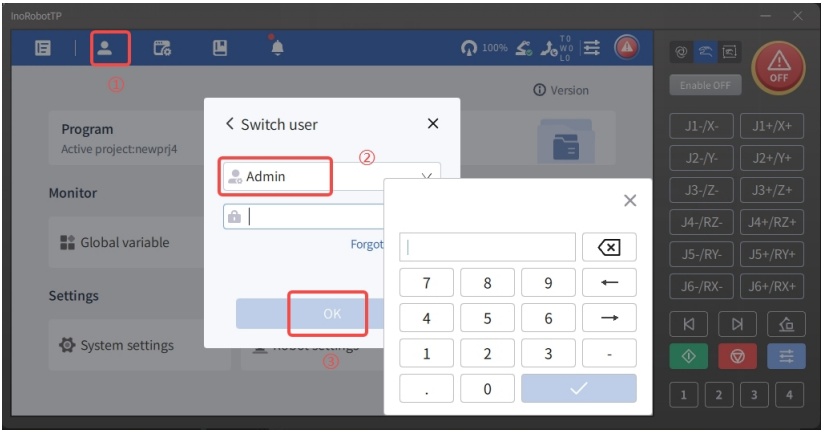
- Install a safety fence for the system to prevent people from entering the motion range of the system. Failure to comply may result in severe safety issues.
- Before operation, ensure that there is no person within the safety fence. Do not enter the motion range during system running. Failure to comply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

8.7.2 Zero Point Calibration Procedure

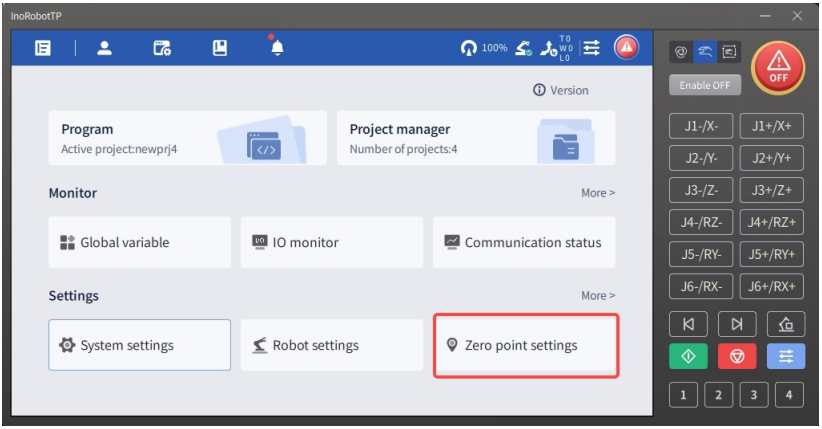
Both the PC-based teach pendant software (InoRobotTP) and the hand-held teach pendant provide an operation interface for zero point calibration. The following describes the zero point calibration operations on the InoRobotTP software. The operations on the hand-held teach pendant are similar.

When calibrating the zero point using the teach pendant, calibrate J3 and J4 at the same time.

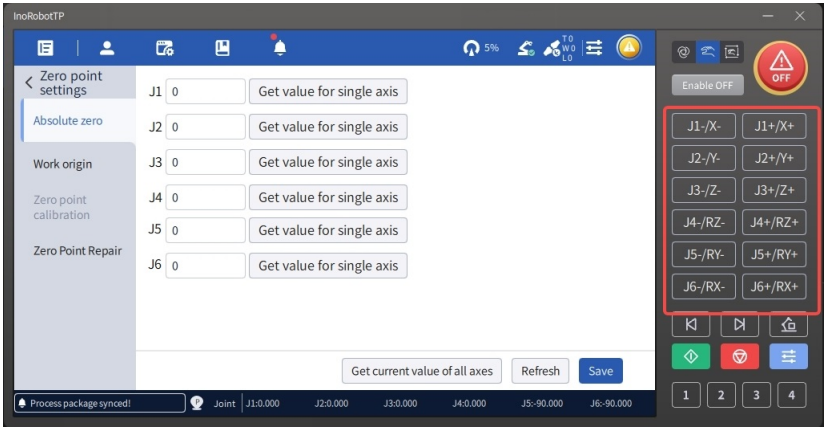
1. Log in to the user account.
   a. Click the "User" shortcut key on the InoRobotTP main interface to open the user mode setting interface.
   b. Enter the password in the password input box and click the "OK" button.



2. Go to the absolute zero setting interface.
   Choose "Settings" > "Zero point settings" > "Absolute zero" on the InoRobotTP main interface.



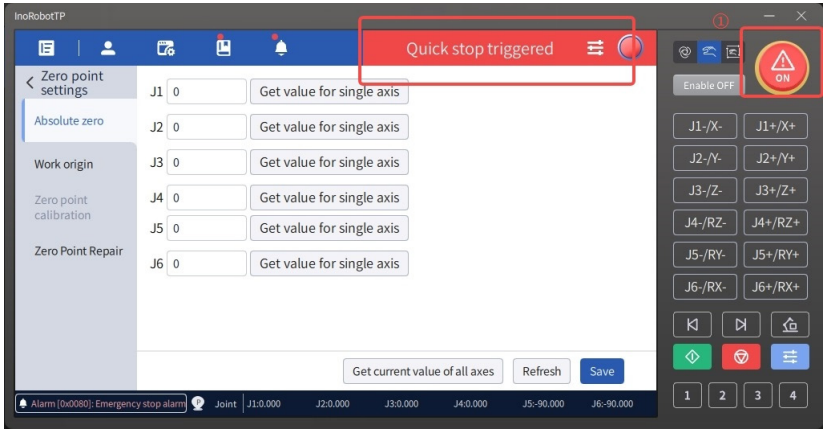
3. Move each joint of the robot to the zero point.
   - You can use the hand-held teach pendant or the InoRobotTP software to move the robot to the position near the zero point. See the "IR-TP200 Series Industrial Robot Teach Pendant User guide".
   - Also, you can manually push the robot to the position near the zero point when the robot is not enabled.



4. Switch to the emergency stop state.

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

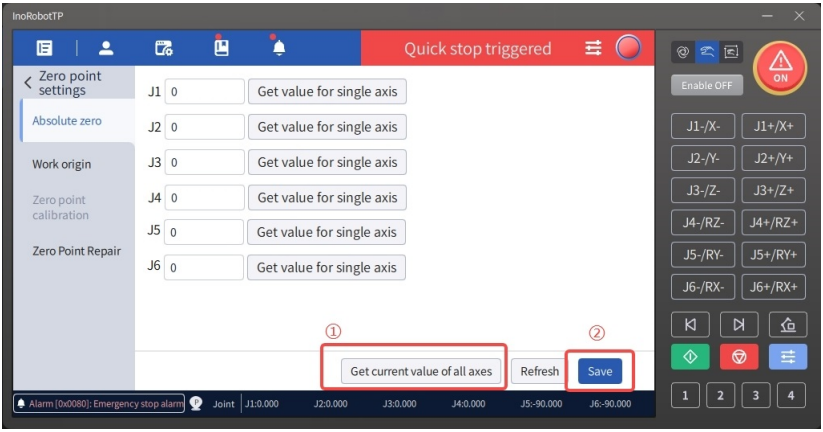
   b. The status indicator on the upper right corner of the InoRobotTP (or the hand-held teach pendant) shows the emergency stop state (in red).



5. Obtain and save the zero point information.

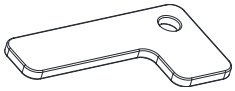
   a. When the robot is at the zero point position, click the "Get current values for all axes" button to obtain the encoder pulse counts.

   b. Click the "Save" button to complete the zero point calibration.



8.7.3 Zero Point Position of Each Joint

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



- **Calibration method of J1 to J6**
  During calibration, control the robot to move at the lowest speed by using the teach pendant. Adjust J1 to J6 until the calibration tool fits snugly in the reference slot, as shown in the figure below.

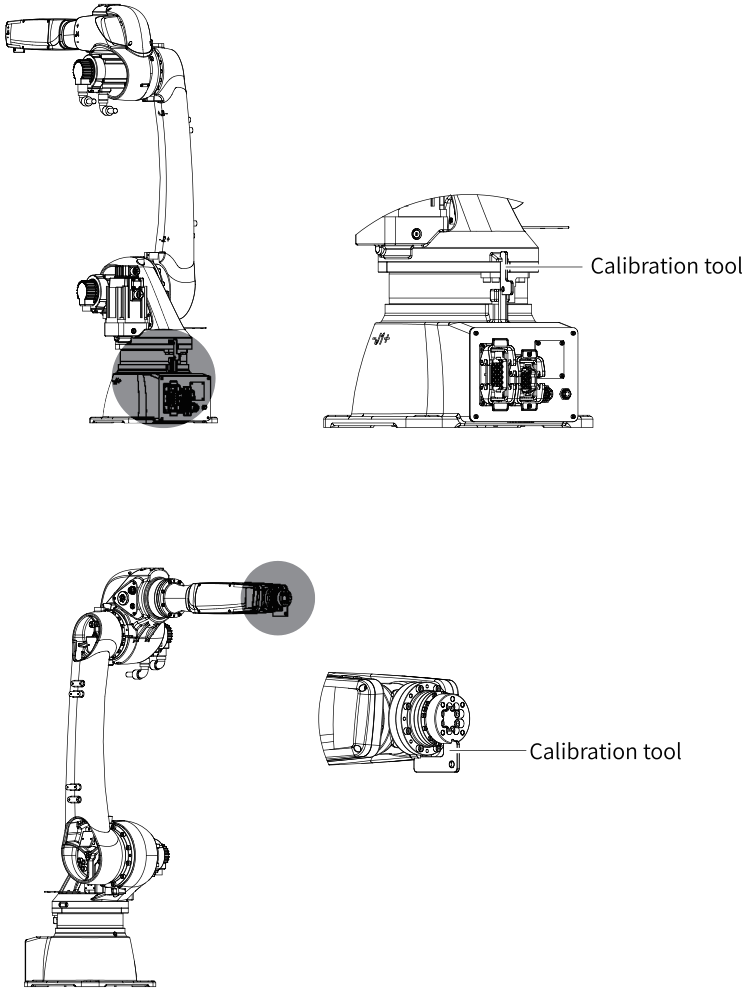


Figure 8-2 Calibration of J1 to J6

8.8 Optional Components

8.8.1 Options

Option	Description	Specifications	Code
I/O cable	Connecting the body of the IR-R25 and IR-R16 series 6-axis robots to a controller	5 m	1504B978
I/O male aviation connector (90°)	Connecting a cable to the aviation connector on the forearm of the IR-R25 and IR-R16 series 6-axis robots	19 pins	15050930
Forklifting tool	Forklifts and transports sheet metal workpieces	4	20080072
Zero point calibration tool	Used to calibrate the J1 to J6 of the robot manually	-	01660015

8.8.2 Protection Against Dust and Liquid

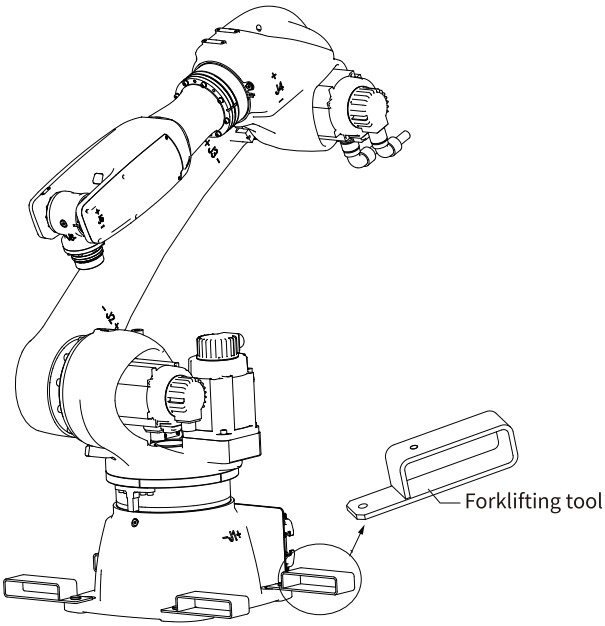
Dust-proof and liquid-proof are properties for robots to withstand use in harsh environments.

Note: Contact Inovance for technical support about whether the dust-proof and liquid-proof performance matches the customer's use environment.

Component	Standard	Optional for Dust-proof and Liquid-proof
Screw	Dyed black steel screw	FR-coated screw Stainless steel screw
Washer	Dyed black washer	Black chromate film washer
Cover	-	J2 cover
EE connector	Non-dust-proof connector	Dust-proof connector
Others	-	Sealing ring

8.8.3 Forklifts and Transports Sheet Metal Workpieces

Inovance robots are equipped with forklift and transport sheet metals for robot handling convenience.


Forklifting tool

9 Certification and Standard Compliance

Third-party certification

Certification mark	Certification	Description	Directive
	CE	The product complies with the LVD, MD, EMC, and RoHS directives and is labeled with the CE mark.	• EN 60204-1:2018 • EN ISO 10218-1:2011 • EN ISO 12100:2010 • EN 61000-6-2:2019 • EN 61000-6-4:2019 • ISO 13849-1:2023 • EN ISO 13849-1:2015
	SGS-TUV Saar	This product is certified by SGS-TUV Saar for functional safety.	
	cSGSus	This product is certified by SGS North America of Nationally Recognized Test Laboratory (NRTL).	• UL 1740,4th Ed., Jan. 26,2018 • NFPA 79 2021 Edition, Dated Oct. 25, 2020 • CAN/CSA Z434-14 (R2019), Reaffirmed 2019
	FCC	This product has passed the Federal Communications Commission (FCC) EMC testing and carries the FCC mark.	-
	KCs	This product is verified by Korea Occupational Safety and Health Agency (KOSHA) in terms of special equipment, labor protection supplies, and guard devices and carries the KCs mark.	-

Note

The preceding certification standards only apply to standard models of products. For specific certification information about customized products, consult Inovance technical personnel.

Declaration of conformity with EU directives

Inovance robots have been certified by the following directives and meet basic requirements of the CE-MD, CE-LVD, CE-EMC, and RoHS directives.

Machinery Directive (MD)	2006/42/EC
Low Voltage Directive (LVD)	2014/35/EU
Electromagnetic Compatibility (EMC)	2014/30/EU
ROHS Directive	2011/65/EU Amended by (EU)2015/863
Applicable Harmonized Standards	• EN 60204-1:2018 • EN ISO 10218-1:2011 • EN ISO 12100:2010 • EN 61000-6-2:2019 • EN 61000-6-4:2019 • ISO 13849-1:2023 • EN ISO 13849-1:2015

10 Service and Support

Should you encounter a safety accident during the use or operation of the product, or face challenges in operating and maintaining the equipment, which remain unresolved after the relevant documentation is consulted, we provide multiple channels to ensure prompt resolution:

- Channel #1: Contact service@inovance.com.
- Channel #2: Visit https://www.inovance.com/global to access document downloads, after-sales support, spare parts ordering, repair applications, and authenticity verification services.
- Channel #3: Download My Inovance app (https://zshc-eu.inovance.com/download-pc/) where you can access products info and documentation, and query product parameters.

We are committed to providing you with quick and professional technical support, and we look forward to your satisfaction and trust.

PS00019449A01

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