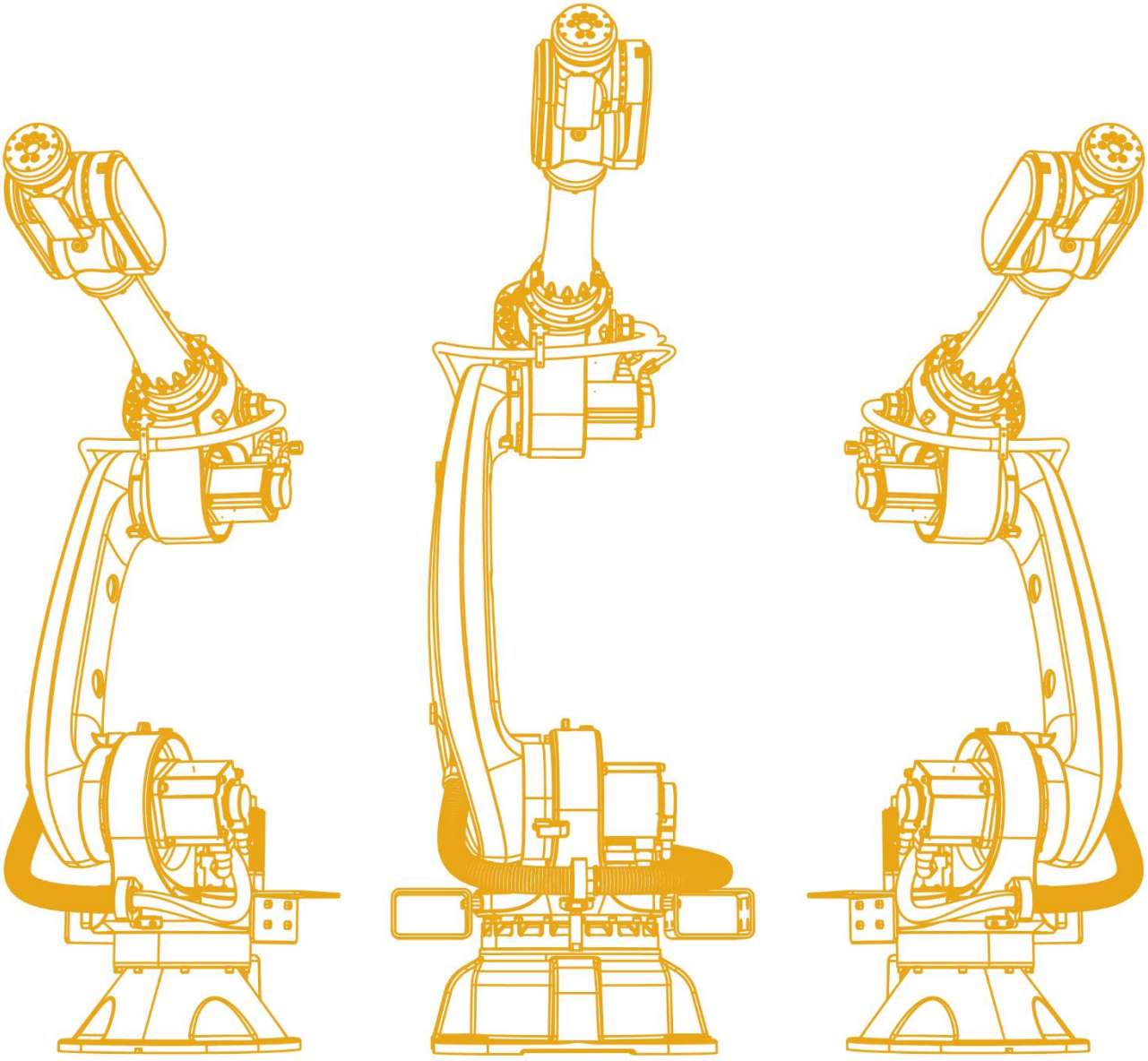
XINJE

Manual of Heavy Load Industrial Robot Manipulator

RX3-A620-3100/ RX3-A635-2700

RX3-A650-2260/ RX3-A650-2700

RX3-A680-2260/ RX3-A680-2560



Introduction

About this manual

This manual is designed to help technicians install and operate load-bearing industrial robots quickly, accurately, and safely, while familiarizing them with relevant precautions and performing regular maintenance on the manipulators.

Operational prerequisites

Before operating the robot, please carefully read the general safety instructions and precautions. Users must understand safety knowledge and basic operation knowledge before operating the robot.

Refer to the following when necessary:

- RX3H-S Series Control Cabinet User Manual (RC06 20250625 1.0) -2025.6.30
- XR Universal Robot System V4.0 User Manual (RC04 20250620 1.0) -2025.6.20
- XR System Warning and Error Codes (RC07 20250620 1.0) -2025.6.20
- XR Universal Robot System V4.0 Instruction Manual (RC05 20250627 1.0) -2025.6.27

Target groups

- operation staff
- Product Technical Staff
- Technical service personnel
- robot instructor

Scope of application

This manual is applicable to the following robot models:

Model name	handle weight
RX3-A620-3100	20kg
RX3-A635-2700	35kg
RX3-A650-2260/ RX3-A650-2700	50kg
RX3-A680-2260/ RX3-A680-2560	80kg

Common logo meanings

The symbols and their meanings in the manual are detailed in Table 1 below.

Table 1 Identifiers used in this article

sign	meaning
	Failure to follow the instructions may result in accidents, leading to serious or fatal injuries.
	Failure to follow the instructions may result in accidents causing moderate or minor injuries, or may only lead to material losses.
	Important environmental conditions and instructions, or quick actions
	Refer to other documents and instructions for additional information or more detailed operating instructions.

Manual

This manual may be updated or revised. Please check the Download Center on our company website regularly to get the latest version.

Our company website: https://www.xinje.com

Revision History

Revision history records each document update. The latest version includes all previous document updates.

Table 2 Document Revision History

edition	release time	Revision Notes
V1.0.0	2025.2	First official release

Document ID and version

The document number and version information are shown in Table 3.

Table 3 Document Information

Document Name	Manual of Medium Load Industrial Robot Manipulator
Document ID	RX3-C19-2502-100
Document Version	V1.0.0

Declaration of applicable safety standards

The requirements of industrial robot system design are shown in Table 4.

Table 4 Declaration of applicable safety standards

Standard	Explain
ISO 10218-1	**Industrial robots-Safety requirements:** Part 1: Robots (Note: Content complies with ANSI/RIAR.15.06-2012, Part 1)
61000-6-2	**Electromagnetic Compatibility (EMC):** Section 6-2: Basic Professional Standards; Anti-jamming in Industrial Environments
61000-6-4 + A1	**Electromagnetic Compatibility (EMC):** Section 6-4: General Standards; Radiation Interference in Industrial Environments

General safety instructions

Thank you for purchasing our company's operator. This manual outlines essential safety guidelines for proper operation. Before using the equipment, please thoroughly review the manual and ensure you understand all instructions before commencing operation.

For detailed information on the operator's functions, users should refer to the relevant manual to fully understand its specifications.

Safety Precautions

Generally, the manipulator cannot perform tasks individually. Only by installing end-effectors and assembling peripheral devices and systems can the manipulator operate effectively.

When considering its safety, the manipulator should not be considered in isolation, but in the context of the system.

When operating the manipulator, appropriate safety measures must be taken for the safety fence.

Warnings, Notes, and Tips

This manual includes precautions to ensure the personal safety of operators and prevent damage to the operating machine. According to their importance in terms of safety, they are described as 'Warnings' and 'Caution' in the text, while supplementary instructions are labeled as 'Tips'.

Before using the manipulator, the user must read the matters described in these "Warnings", "Caution" and "Tips" carefully.

 Warning	If the operation is not performed correctly, it may result in death or serious injury to the operator or other workers.
 Instruction	If the operation is not performed correctly, it may cause minor injuries to the operator or other workers, or damage the equipment.

General Precautions

	■ When connecting or disconnecting peripheral devices (e.g., safety barriers) and signals from the operator console, always ensure the console is powered off to prevent incorrect connections. ■ Do not use the manipulator under the following conditions. Otherwise, it may cause damage to the manipulator and peripheral devices, and even result in injuries or fatalities to the operator: ● Use in combustible environments ● Use in explosive environments ● Use in environments with high radiation levels ● Use in water or high humidity environments ● For the purpose of transporting persons or animals. ● Use as a tripod (e.g., to climb on the manipulator or hang from below) ■ Operators of the manipulator must wear the safety equipment listed below before commencing work: ● Workwear suitable for job content ● safety shoe ● safety helmet
	Personnel performing programming and maintenance tasks must receive appropriate training through the company's relevant training programs.

Precautions during installation

	■ When handling and installing the manipulator, strictly follow the methods specified in our company's manual. Incorrect operation may result in the manipulator tipping over, potentially causing injuries or fatalities to personnel. ■ When operating the manipulator for the first time after installation, start at a low speed, gradually increase the speed, and check for any abnormalities.

Precautions during operation

	■ When operating the manipulator, ensure no personnel are inside the safety barrier before commencing work. Additionally, inspect for potential hazards. If hazards are identified, eliminate them before proceeding. ■ When operating the teaching device, it is essential to remove gloves before proceeding, as wearing gloves may lead to operational errors.
	Program and system variable information can be saved on storage media such as memory cards. To prevent data loss due to unexpected incidents, users are advised to back up their data regularly.

Programming Notes

 Warning	■ Programming should be performed outside the safety fence whenever possible. If it is necessary to work inside the safety fence due to unavoidable circumstances, the following precautions must be observed: ● Examine the security fence thoroughly and ensure there are no hazards before entering. ● Ensure the emergency stop button is always accessible. ● The manipulator should be operated at low speed. ● Operations should be performed only after confirming the system's status to prevent operators from being exposed to hazards caused by remote control commands or actions on peripheral devices. ■ Operators of the manipulator must wear the safety equipment listed below before commencing work: ● Workwear suitable for job content ● safety shoe ● safety helmet ■ Programming should be performed outside the safety fence whenever possible. If it is necessary to work inside the safety fence due to unavoidable circumstances, the following precautions must be observed: ● Examine the security fence thoroughly and ensure there are no hazards before entering. ● Ensure the emergency stop button is always accessible. ● The manipulator should be operated at low speed. ● The operator should confirm the status of the entire system before performing any operations, to avoid putting the operator in danger due to remote control commands or actions on peripheral devices.
 Attention	After programming is completed, the system must undergo test operation according to the prescribed procedures, during which operators must work outside the safety fence.
 Instruction	Personnel performing programming and maintenance tasks must complete the company's relevant training.

Precautions for Maintenance Operations

 Warning	■ When powering on equipment, certain maintenance tasks carry electric shock risks. All maintenance operations should be performed with the control unit and system power disconnected whenever possible. Designated maintenance personnel must be assigned as required. During maintenance, ensure no other personnel are energized. Even when power must be activated for operations, always press the emergency stop button before proceeding. ■ If you need to replace parts, please contact our company.

	■ Customers replacing parts independently may cause unexpected accidents, resulting in damaged operating machinery and injuries to workers. ■ When entering the security fence, thoroughly inspect the entire system to confirm there are no hazards before proceeding. If dangerous conditions necessitate entry, maintain full awareness of the system status and exercise extreme caution. ■ When replacing components, always use parts designated by our company. Using non-designated parts may cause damage to the manipulator. When disassembling the motor and brake, measures such as crane lifting should be taken before disassembly to prevent the operating arm from falling. When performing maintenance operations, if it is necessary to move the manipulator due to unavoidable circumstances, the following precautions should be observed: ● Ensure the escape route remains unobstructed. Operate only after fully understanding the system's functionality to prevent the control unit and peripheral devices from blocking the exit. ● Always be aware of potential hazards around you and stay prepared to press the emergency stop button when needed. ■ When handling heavy components such as mobile motors and reducers, auxiliary equipment like cranes should be used to prevent excessive physical strain on workers. Additionally, incorrect operations must be avoided to prevent potential injuries or fatalities. ■ Be careful not to fall because of the lubricant spilled on the ground. ■ During operation, do not place any body part on any component of the machine, and climbing on the machine is strictly prohibited to avoid unnecessary personal injury or adverse effects on the equipment. ■ The following parts may become hot and require attention. When it is necessary to touch the device due to fever, protective equipment such as heat-resistant gloves should be prepared: ● servo motor ● decelerator ● Nearby components of the motor/reducer ● Inside the control cabinet ■ When replacing components, disassembled parts (e.g., screws) must be properly reinstalled. If insufficient parts are found or surplus parts remain, recheck and reinstall them correctly. ■ When performing maintenance on pneumatic or hydraulic systems, ensure the internal pressure is fully released to zero before proceeding. ■ After component replacement, conduct test operations strictly according to the specified procedures. During this process, operators must work outside the safety barrier. ■ After maintenance operations, thoroughly clean up all lubricants, debris, and water scattered on the ground around the control panel and within the safety fence. ■ When replacing components, prevent dust and other foreign matter from entering the machine's interior. ■ Personnel performing maintenance and repair operations must undergo training and pass relevant assessments provided by our company. When maintenance is performed, appropriate lighting should be provided, but

	care should be taken not to make the lighting a source of new hazards. ■ Please refer to this manual for regular maintenance. Failure to perform regular maintenance may reduce the service life of the manipulator and potentially lead to accidents.

Safety precaution

Before operating the manipulator and peripheral devices, as well as the entire manipulator system, it is essential to thoroughly study the safety precautions for both operators and the system. Figure 1 illustrates the safety workflow diagram for industrial robots.

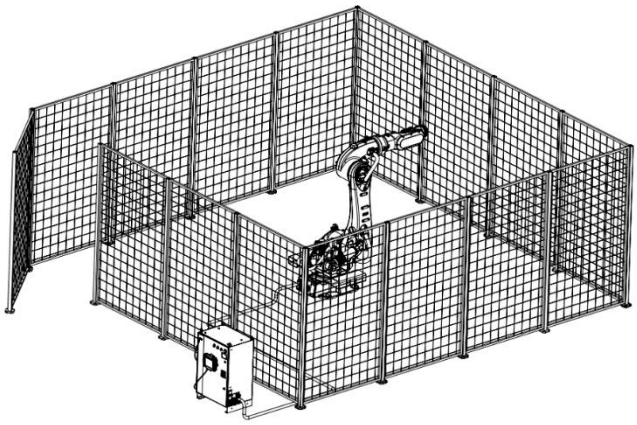


Figure 1 Schematic diagram of industrial robot safety operation

Operator definition

The operators of the machine are mainly divided into three types: operators, trainers, and maintenance engineers. The required qualifications for these roles are as follows:

console operator

- Turn the power on/off for the manipulator;
- Start the operator program through the operation panel;
- No right to work inside the security fence.

Demonstrator

- The operator has the function of;
- The operation machine can be operated and demonstrated inside the safety fence.

service engineer

- The instructor is responsible for demonstrating the procedures.
- The operation machine can be maintained (including repair, adjustment, replacement, etc.).

Safety of workers

When operating, programming, or maintaining the manipulator, operators, trainers, and maintenance engineers must prioritize safety and should wear at least the following protective gear:

- Workwear suitable for job content
- safety shoe
- safety helmet

When using automatic system, we must try to ensure the safety of the operator. It is very dangerous to enter the operation range of the machine, so we should take measures to prevent the operator from entering the operation range of the machine.

The following are general precautions. Please take appropriate measures to ensure the safety of workers:

- Operators of the machine control system must complete company training and pass relevant certification.
- During equipment operation, even if the control panel appears to be inactive, it may still be in a ready-to-action state while awaiting a startup signal. This state should be considered as the control panel being operational. To ensure operator safety, the operational status should be confirmed through visual indicators such as alarm lights or audible signals.
- Safety barriers and safety doors must be installed around the system to ensure that workers cannot enter the barriers without opening the safety doors. The safety doors should be equipped with interlock switches and safety latches to prevent the operating machine from starting when the workers open the safety doors.
- All peripheral devices should be electrically grounded.
- Peripheral devices should be placed outside the operating range as much as possible.
- The range of operation of manipulator should be marked by drawing lines on the floor, so that the operator can know the range of operation of manipulator including the manipulator equipped with manipulator tools.
- A floor switch or photoelectric switch should be installed to trigger an alarm via a buzzer and light when a worker approaches the machine's operational range, stopping the machine to ensure worker safety.
- A lock should be installed as needed, and the power supply to the control unit must not be activated by anyone other than the authorized operator.
- When debugging a peripheral device individually, always disconnect the power supply of the host computer.

Operator safety

Operators are not authorized to perform work within the safety barrier:

- When the operator is not in use, disconnect the power supply to the control cabinet or press the emergency stop button.
- The operator system should be operated outside the safety fence.
- To prevent unauthorized personnel from entering the operational area or operators from accessing hazardous zones, protective barriers and safety doors should be installed.
- The emergency stop button should be placed within the operator's reach.

Instruction	The operator control unit is designed to connect an external emergency stop button. Pressing this button will halt the operator.

The instructor's safety

When performing manipulator teaching tasks, you may need to enter the manipulator's operational range. In such cases, extra caution is required:

- Always perform operations outside the operational range unless necessary.
- Before performing the demonstration task, ensure the manipulator or peripheral device is in a safe condition.
- When it is necessary to enter the operating range for teaching operations under unavoidable circumstances, the position and status of safety devices (such as emergency stop buttons and emergency auto-shutdown switches of teaching devices) should be confirmed in advance.
- The instructor should pay special attention to prevent other personnel from entering the operational range of the manipulator.
- Before starting the manipulator, ensure there are no personnel or abnormalities within its operational range before proceeding.
- After the demonstration, make sure to follow these steps to test the operation:

Step 1、At low speed, execute at least one loop per step to confirm no exceptions.

Step 2、Run continuously at low speed for at least one cycle to confirm no abnormalities.

Step 3、Run at medium speed for at least one cycle to confirm no abnormalities.

Step 4、Run one cycle at the operating speed and confirm no abnormalities.

Step 5、Run the program in automatic mode.

- The instructor must move to the safety fence when the machine is running automatically.

Safety of maintenance engineer

To ensure the safety of maintenance engineers, the following matters should be fully considered:

- Do not enter the operational range of the manipulator during operation.
- Maintenance should be performed with the control device powered off whenever possible. The main circuit breaker must be secured with locks or similar measures to prevent unauthorized access to the power supply.
- When it is unavoidable to enter the working range of the manipulator during power-on, the emergency stop button of the control cabinet or teaching device must be pressed before entry. Additionally, the operator should display a "Maintenance in Progress" sign to remind other personnel not to operate the manipulator arbitrarily.
- Before performing maintenance operations, ensure the manipulator or peripheral equipment is in a safe condition.
- Do not operate automatically when someone is present within the range of motion.
- When working near walls and equipment, or when several workers are in close proximity, care should be taken not to block the escape routes of other workers.
- When the machine tool is equipped with cutting tools, or when other movable tools such as conveyor belts are present, special attention must be paid to the operation of these devices.
- A person familiar with the machine system and able to detect hazards should be positioned near the control panel or control box during operation, ensuring the emergency stop button is always accessible.
- When replacing components or reassembling, care should be taken to avoid foreign body adhesion or contamination.
- When inspecting the internal components of the control device, such as units or printed circuit boards, always disconnect the main circuit breaker's power supply before any operation to prevent electric shock.
- Always use parts specified by our company when replacing components.
- When restarting the manipulator system after maintenance work, ensure that no one is present within the manipulator's operational range and that both the manipulator and peripheral devices are in normal condition.

Peripheral device security

Program-related considerations

- To detect hazardous conditions, limit switches or similar detection devices should be used. The operation machine should be stopped as needed based on the signals from these devices.
- When other manipulators or peripheral devices malfunction, even if the manipulator itself is functioning normally, appropriate measures should be taken, such as halting the operation.
- If the system is operated synchronously with peripheral equipment, special attention should be paid to avoid mutual interference.
- In order to control the status of all the equipment in the system, the operator can interlock the operator and the peripheral equipment, and stop the operation of the operator according to the need.

Mechanical-related precautions

- The operator console system should be kept clean and used in an environment free from grease, water, dust, etc.
- Do not use cutting fluids and cleaning agents with unknown properties.
- Limit switches and mechanical brakes should be used to restrict the operation of the manipulator, to avoid collisions between the manipulator and peripheral equipment.
- No additional user cables or hoses shall be installed inside the operator console.
- When installing cables or other external components on the operator console, ensure they do not obstruct the machine's movement.
- For models with exposed cables inside the control unit, do not modify the exposed cable sections to obstruct their operation.
- When installing external devices on the manipulator, special attention should be paid to avoid interference with other parts of the manipulator.
- Frequent power-off operations on manipulators during motion, such as using emergency stop buttons, may cause malfunctions.

Mechanical safety of manipulator

Precautions during operation

When operating the manipulator with slow feed, the operator should remain highly alert and respond promptly to any issues that may arise.

Precautions for the procedure

When the action ranges of multiple manipulators overlap, special attention should be paid to avoid interference between them.

Make sure to set the specified working origin in the program of the manipulator, and create a program that starts and ends from the working origin, so that the end of the manipulator's operation can be clearly seen from the outside.

Institutional considerations

The operating machine should be kept clean and used in an environment free from grease, water, dust, etc.

Safety of end Effector

When controlling all kinds of transmission devices (pneumatic, hydraulic, electric), the time difference between the command and the actual action should be considered fully after issuing the command, and the control should have a certain flexibility.

The detection unit should be installed on the end effector to monitor its status and control the manipulator's movements.

Contents

1 Overview and Basic Composition of the Operator Machine

1.1 Overview of Industrial Robots

Industrial robots are composed of the following components:

- operator machine
- control cabinet
- demonstrator
- Connection (power supply) cables, etc.

Figure 11 shows an example of an industrial robot system, where:

1. Operator	2. Control Cabinet
3. Demonstrator	4. Connection (power supply) cable

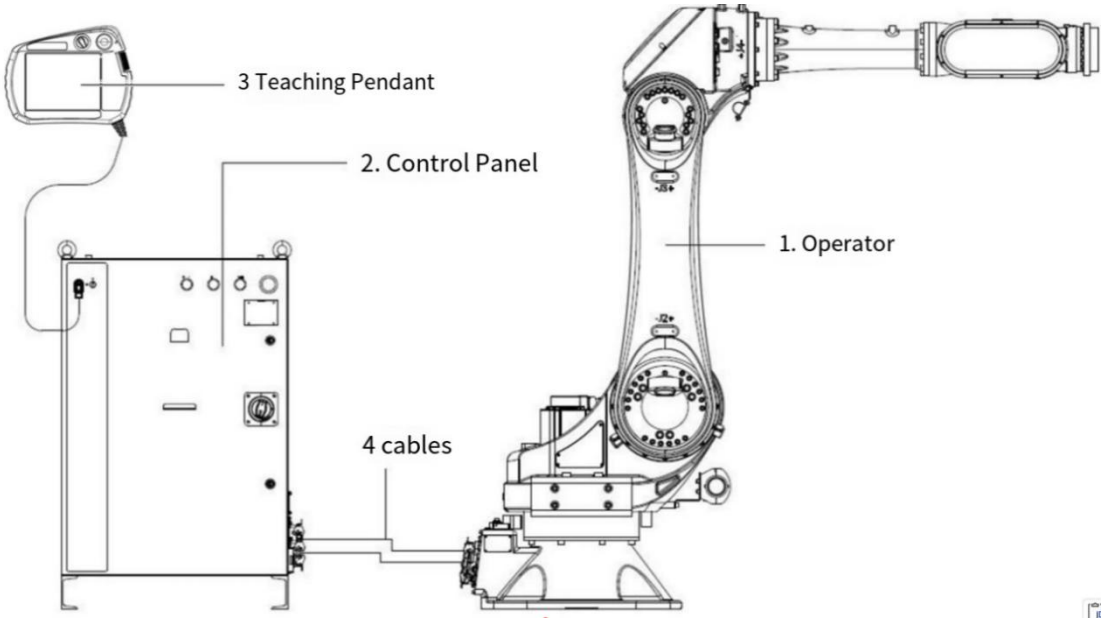


Figure 11: Composition of the load robot system

1.2 Basic constitution

The manipulator, also known as the robot body, is the mechanism in a robotic system designed to grasp or move objects (tools or workpieces). This manipulator is a six-degree-of-freedom serial industrial robot, comprising three swing axes and three rotational axes.

The robot manipulator and its parts are shown in FIG. 12-FIG. 16.

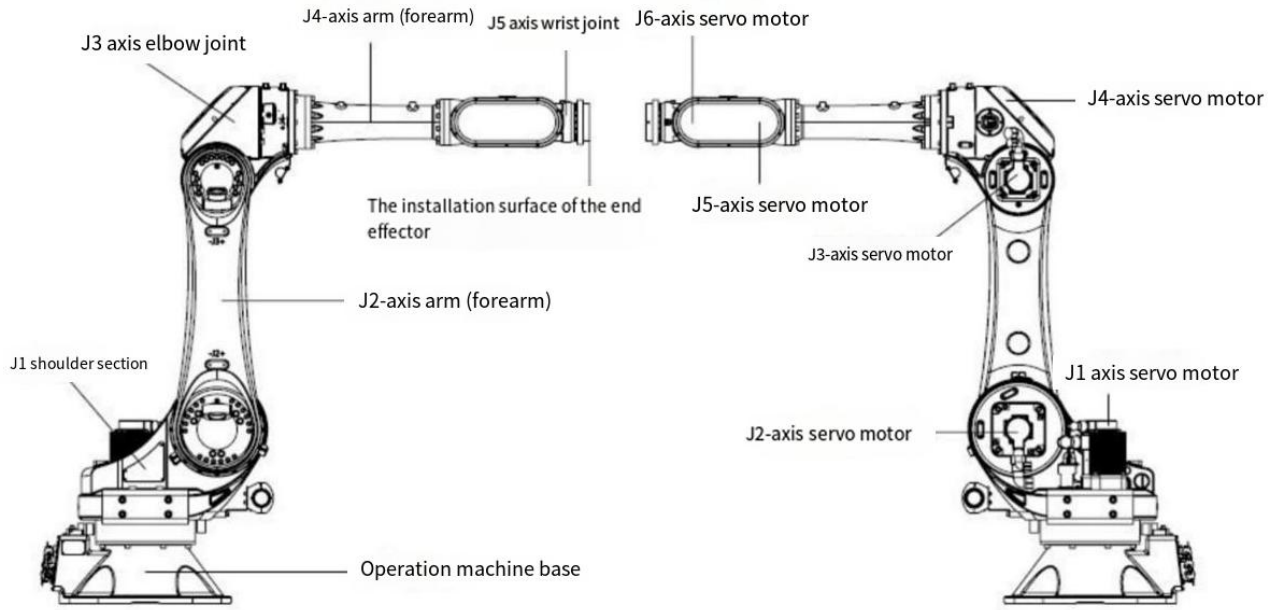


Figure 12: Robot body and its components of RX3-A650-2260/RX3-A680-2260

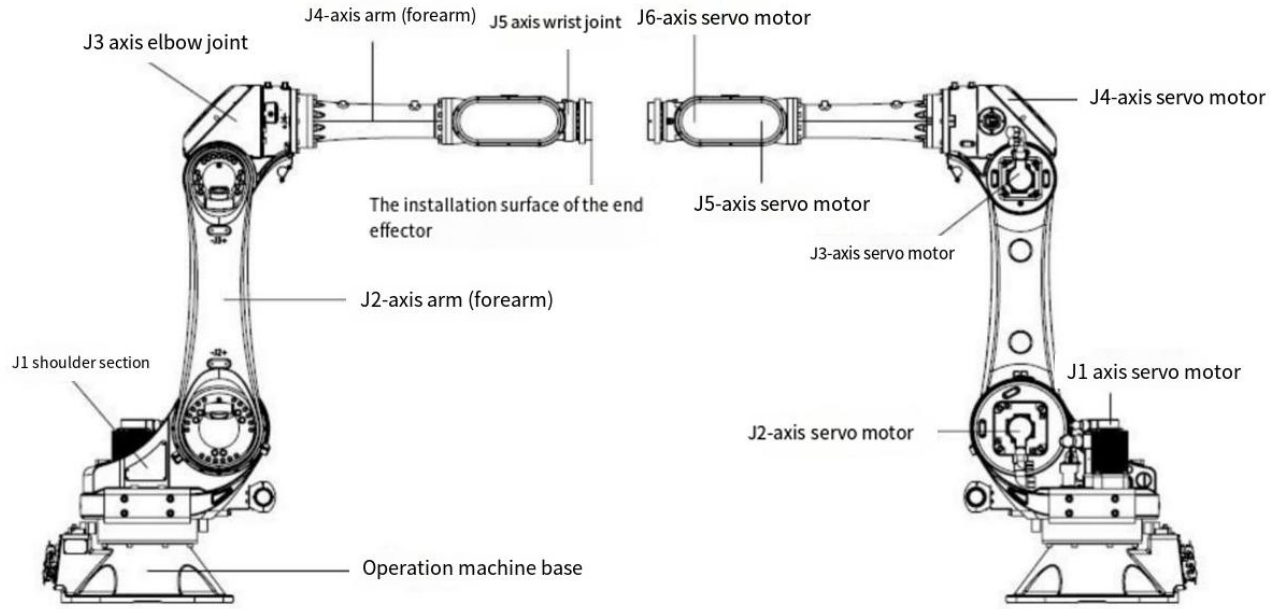


Figure 13: RX3-A680-2560 Robot Body and Its Components

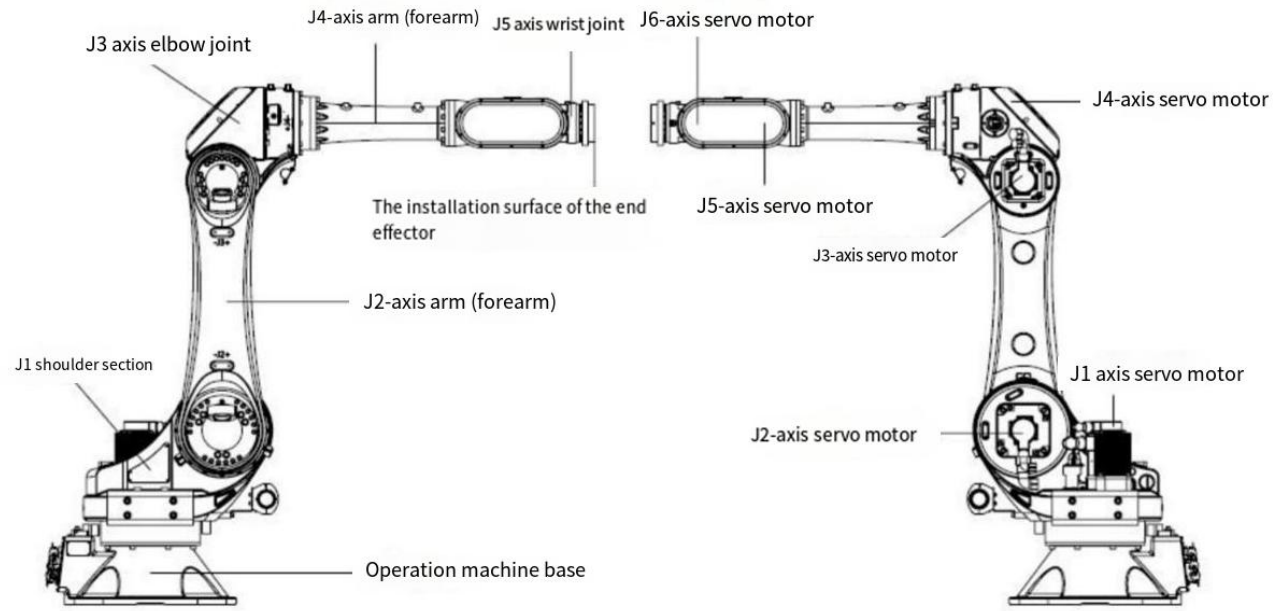


Figure 14: Robot Body and Its Components of RX3-A650-2700

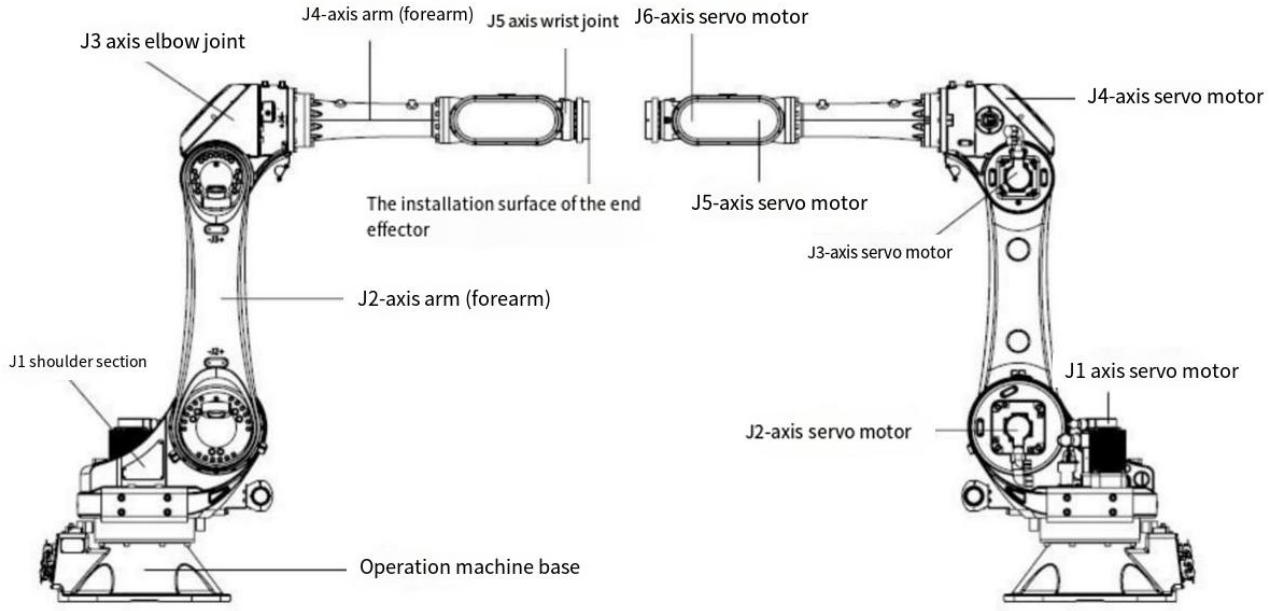


Figure 15: Robot Body and Its Components of RX3-A635-2700

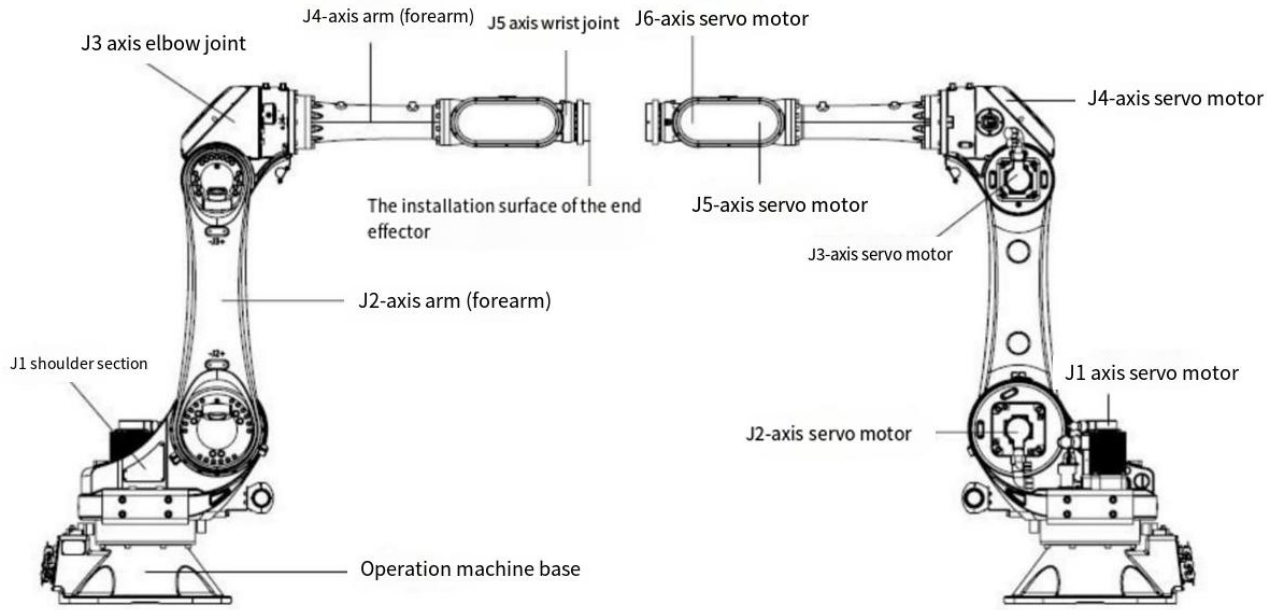


Figure 16: Main body and components of the RX3-A620-3100 robot

1.3 Basic specifications

The basic specifications of the robot are shown in Table 11 and Table 12.

Table 11 Basic Specifications of Robots

Parameter		**Explain**
coordinate form		Six-degree-of-freedom articulated robot
Control axis count		6 axes (J1, J2, J3, J4, J5, J6)
way to install		Ground installation, hoisting, wall installation
Range of motion (upper/lower limit)	**J1***	-170°~170°
	J2	-190°~10°
	J3	-200°~75°
	J4	-350°~350°
	J5	-125°~125°
	J6	-360°~360°
handle weight	Wrist area	■ 20kg（RX3-A620-3100） ■ 35kg（RX3-A635-2700） ■ 50kg（RX3-A650-2260/RX3-A650-2700） ■ 80kg（RX3-A680-2260/RX3-A680-2560）
	elbow	20kg
Drive mode		Use AC servo motor for electrical servo drive

Parameter	Explain
repeated positioning accuracy	■ ±0.03mm（RX3-A620-3100/RX3-A635-2700） ■ ±0.06mm（RX3-A650/2260/RX3-A650-2700/RX3-A680-2260/RX3-A680-2560）
noise	70dB
IP protection level of robot	IP54 (wrist protection: IP67)
Installation conditions	■ Ambient temperature: 5° C to 45° C ■ Humidity: within 95% at constant temperature, no condensation ■ Maximum height: below 1000 meters ■ No corrosive, flammable, or explosive gases should be present

Table 12 Maximum Motion Speed and Mass of the Robot

parameter		RX3-A620-3100	RX3-A635-2700	RX3-A650-2260	RX3-A650-2700	RX3-A680-2260	RX3-A680-2560
maximum action speed	J1	185°/s	185°/s	185°/s	155°/s	185°/s	155°/s
	J2	180°/s	180°/s	175°/s	145°/s	145°/s	145°/s
	J3	180°/s	180°/s	180°/s	180°/s	180°/s	185°/s
	J4	310°/s	310°/s	310°/s	310°/s	310°/s	310°/s
	J5	375°/s	375°/s	395°/s	395°/s	270°/s	270°/s
	J6	470°/s	470°/s	465°/s	465°/s	465°/s	465°/s
robotic quality		550kg	545kg	570kg	745kg	570kg	730kg

Warning

The "*" specification states that removing the mechanical limit of the J1 axis allows its movement range to extend from-185° to 185°.

1.4 Product naming rules

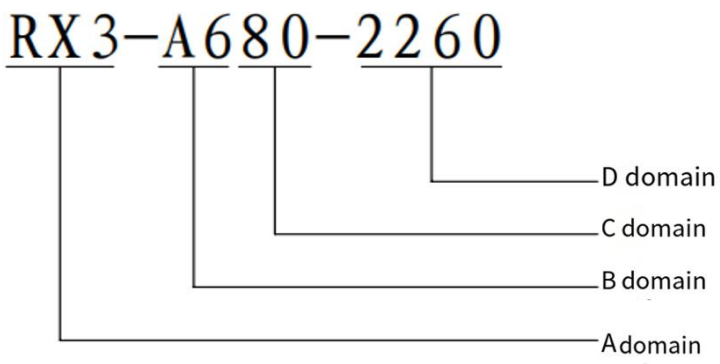


Figure 17 Schematic diagram of product naming rules

land within certain boundaries	meaning	Domain value	explain
A land within certain boundaries	product line	RX3	This indicates that the product belongs to the xinje RX3 product series.
B land within certain boundaries	type	A6	This indicates that the product model is a six-axis robot.
C land within certain boundaries	wrist load	8	indicates the robot wrist load does not exceed 8kg
D land within certain boundaries	armspan	2260	The robot arm span is 2260mm

Table 13 Product Naming Rule Explanation

1.5 Environmental requirements

The operating environment requirements for the manipulator are shown in Table 14.

Table 14 Operational Environment Requirements for Manipulators

<table>
<tr><th>parameter</th><th colspan="2">explain</th></tr>
<tr><td rowspan="3">temperature</td><td>minimum temperature</td><td>5℃</td></tr>
<tr><td>maximum temperature</td><td>45℃</td></tr>
<tr><td colspan="2"> 

When operating in environments below 10°C, preheat the machine for several minutes before use to prevent lubricant viscosity changes that may trigger robot alarms or performance degradation.</td></tr>
<tr><td>humidity</td><td colspan="2">The installation environment requirements for the operator console shall not exceed the humidity level specified in the document "IEC 60721-3-3-2002 Classification of environmental conditions", which is not higher than 95%.</td></tr>
<tr><td>above sea level</td><td colspan="2">The operating machine should not operate at altitudes exceeding 1,000 meters. Within the altitude range of 1,000 to 4,000 meters, the operating machine must be used at reduced capacity.</td></tr>
<tr><td>vibration strength</td><td colspan="2">The robotic manipulator should be used in an environment free of vibration whenever possible, with an ambient vibration limit frequency of 22Hz and an amplitude not exceeding 0.15mm.</td></tr>
<tr><td>special environmental requirements</td><td colspan="2">This operator is prohibited from use in flammable, explosive, or corrosive environments.</td></tr>
</table>

2 Definition and Meaning of Operator Machine Identification

2.1 Operator safety sign

A safety label for the manipulator is prominently displayed on the back of its arm (see Figure 21).

Figure 21 Safety Markings on the Operator

Danger	Failure to comply with this regulation may easily or potentially lead to unnecessary personal injury or even fatalities!

2.2 Operator nameplate

The nameplate of the manipulator can be observed on its base, which contains information such as the corresponding model, version number, weight, serial number, and production date, as shown in Figure 22.

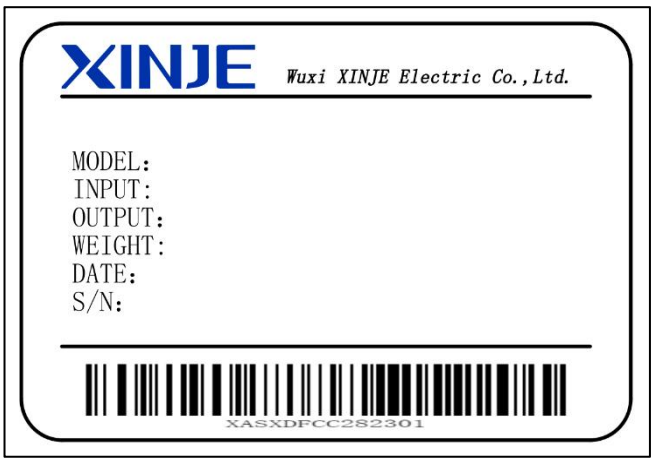


Figure 22 Robot nameplate

2.3 Axis direction labels of manipulator

On the connection parts of the 1st to 6th axes of the manipulator for rotation or swing, there are positive and negative direction indicators for motion, as shown in Figures 23 to 27, which indicate the motion direction of each axis. The number "J1" in the indicator represents one axis (other axes are represented by corresponding numbers), with "+" indicating positive motion direction and "-" indicating negative motion direction.

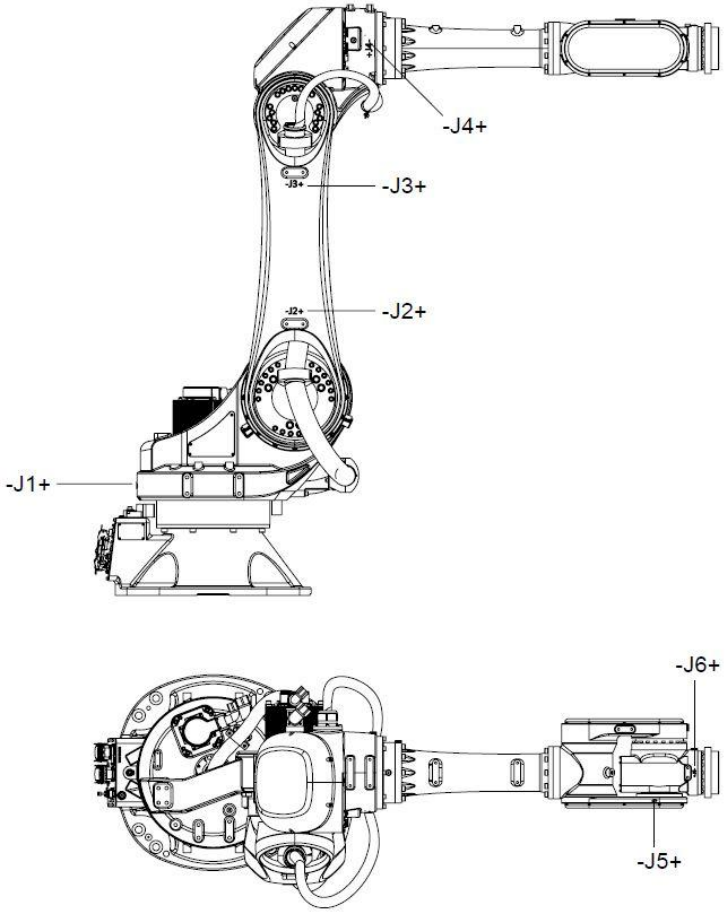


Figure 23 Axis Direction Labels on the RX3-A650-2260/RX3-A680-2260 Operating Machine

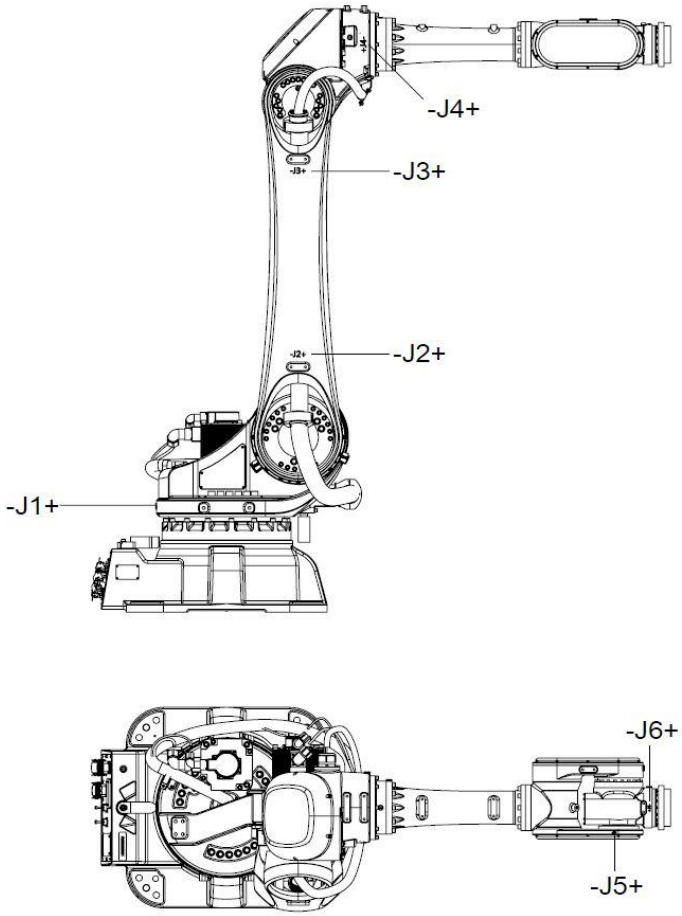


Figure 24: Axis Direction Indicators on the RX3-A680-2560 Manipulator

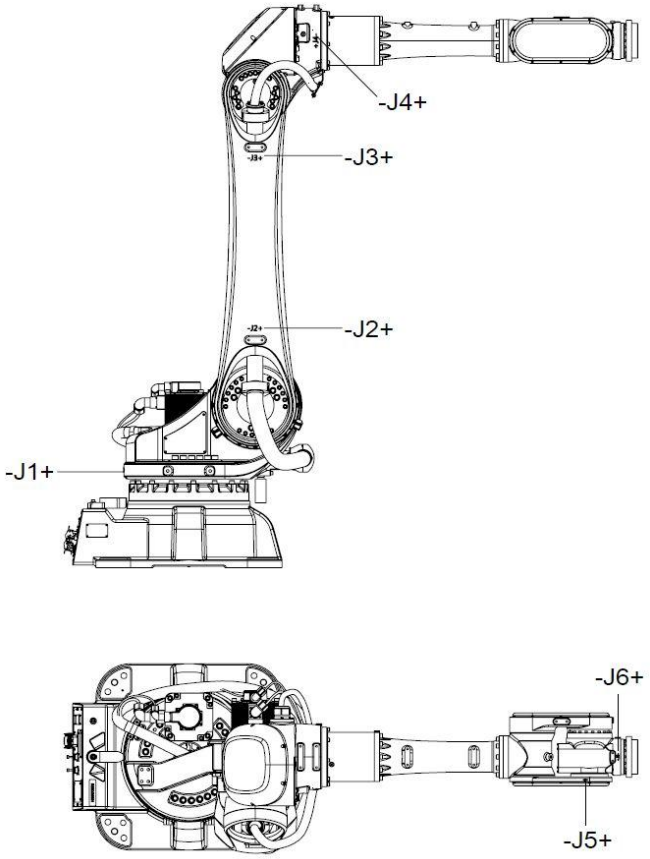


Figure 25: Axis Direction Indicators on the RX3-A650-2700 Manipulator

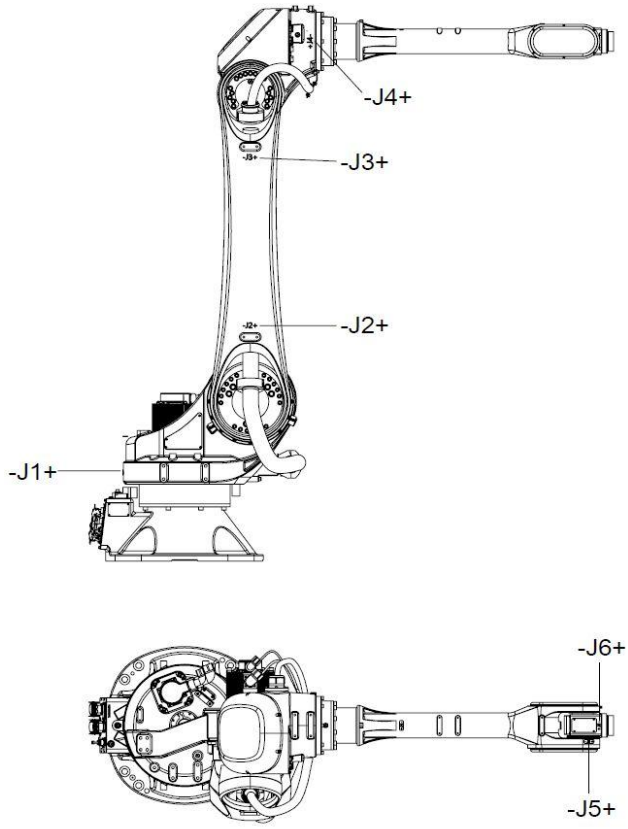


Figure 26: Axis Direction Indicators on the RX3-A635-2700 Operator

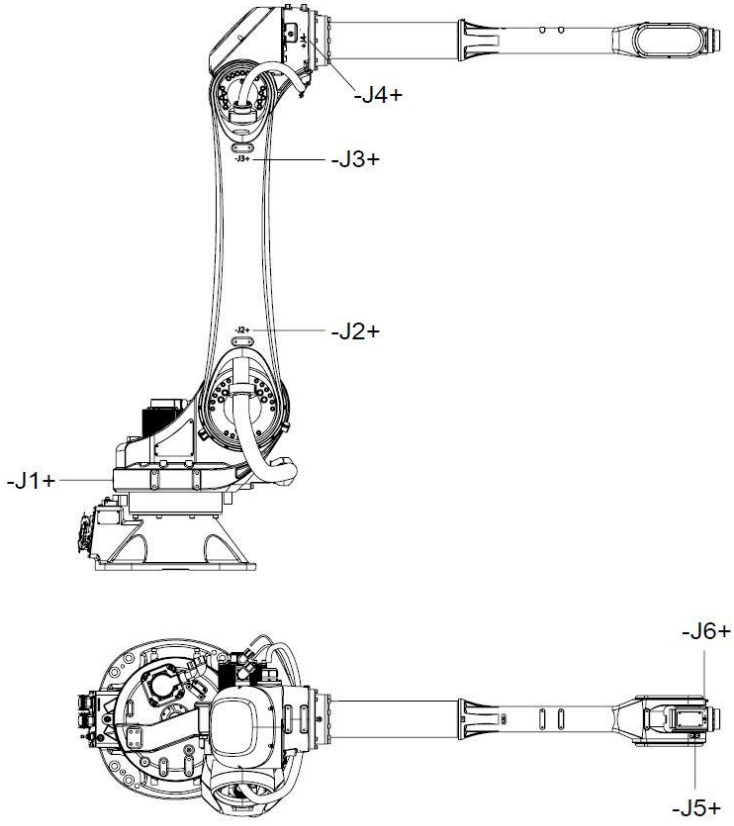


Figure 27: Axis Direction Indicators on the RX3-A620-3100 Manipulator

3 Preparations for installing the operator

3.1 Inspection item

The following items must be strictly followed before installing the manipulator:

- Ensure that installation personnel must complete the company's relevant training and can only perform installation work in compliance with international and local laws and regulations.
- After unpacking, ensure the manipulator is free from dents or damage.
- Ensure that the support brackets, lifting ring screws, and other components are installed on the operating machine as required.
- Ensure the operating machine installation environment complies with the requirements specified in Section 1.4 of this manual.
- Ensure that the installation site of the manipulator can withstand the pressure or tension caused by the manipulator and its load.

3.2 Installation tools and required connectors

Installing the manipulator may require tools (additional tools may be needed depending on the installation method).

- Set of internal hex wrenches
- monkey wrench
- Torque wrenches of various specifications

The following connectors may be required for installing the manipulator (additional connectors may be needed depending on the installation).

- A certain quantity of M20 or other size specifications cylindrical hex head screws with appropriate length and strength grade 12.9.
- Several chemical bolts with appropriate length and strength grade not less than 4.8.
- Several F20 or other specifications of cartridge cases.
- Multiple cylindrical pins with diameters of 12mm or 20mm, etc. See Section 4.2 of this manual for details.

4 Operator machine installation

4.1 Technical specifications

The forces and moments acting on the foundation during the operation of the manipulator are shown in Table 41. When installing the manipulator, the strength of the foundation installation surface must be fully considered. Additionally, the installation ground slope of the manipulator should be less than 5°.

Table 41 Force of the Manipulator on the Foundation

loadtype	**force/torque/mass**
Vertical force Fz	■ 18.1 kN (in operation) ■ 22.8 kN (emergency stop)
Horizontal force Fxy	■ 15 kN (in operation) ■ 20 kN (emergency stop)
overturning moment Mxy	■ 20.9 kNm (in operation) ■ 38.8 kNm (Emergency Stop)
Rotating torque Mz	■ 9.3 kNm (in operation) ■ 15.7 kNm (Emergency Stop)
total load mass	■ 20kg（RX3-A620-3100） ■ 35kg（RX3-A635-2700） ■ 50kg（RX3-A650-2260/RX3-A650-2700） ■ 80kg（RX3-A680-2260/RX3-A680-2560）

The dimensions of the operator base are shown in Figures 41 and 42.

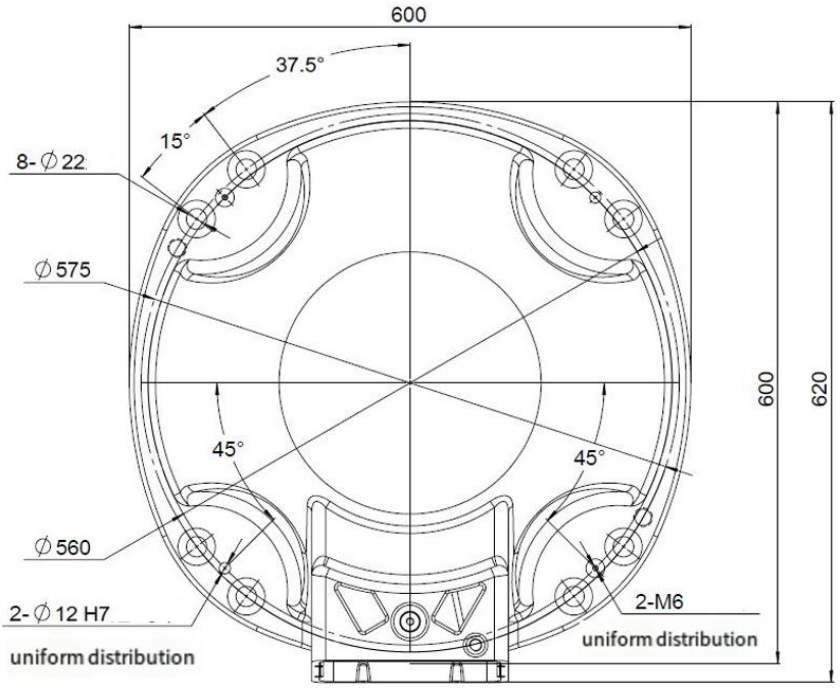


Figure 41: Interface dimensions of the base for RX3-A650-2260/RX3-A680-2260/RX3-A635-2700/RX3-A620-3100 operation consoles

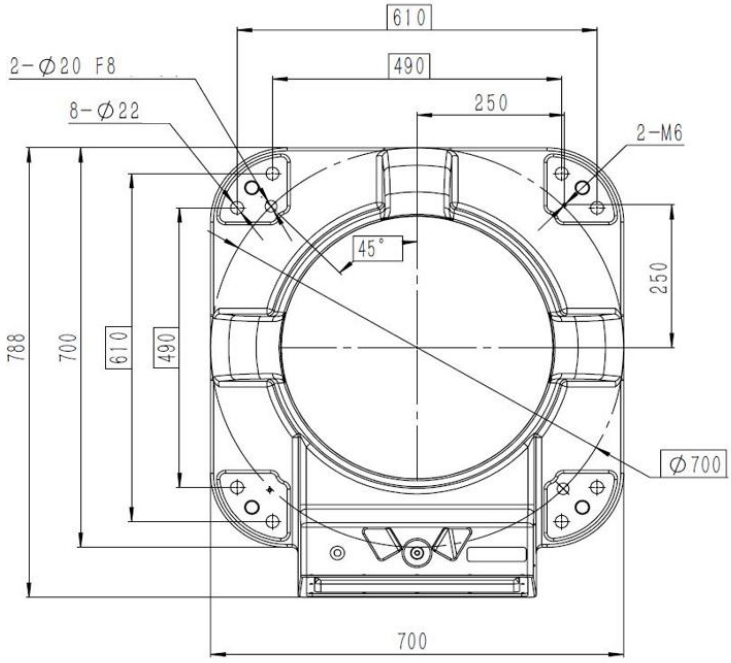


Figure 42: Interface dimensions of the RX3-A650-2700/RX3-A680-2560 operator base

4.2 Fixed form

4.2.1 The mounting methods for RX3-A650-2260, RX3-A680-2260, RX3-A635-2700, and RX3-A620-3100

The RX3-A650-2260, RX3-A680-2260, RX3-A635-2700, and RX3-A620-3100 operation consoles offer two mounting options:

- ground fix
- Support fixation

Instruction	■ The specific fixation method should be selected according to the environment used by the user. ■ The strength of chemical bolts is influenced by the strength of concrete. When installing chemical bolts, it is essential to refer to the manufacturer's design guidelines and ensure full consideration of safety before use.

The required parts and their specifications for fixed manipulators are shown in Table 42.

Table 42 Components Required for Operating Machine Fixation

Component Name	remarks	ground fix	Support fixation
clamp screw	M20x40 (12.9 grade) 4 pieces (8 pieces for bracket fixation)	○	○
chemical bolt	M20 (not less than 4.8 grade) 8 pieces	○	○
robotic fixation plate	Thickness: 25mm, 1 piece	○	
keysets	4 pieces, 25 mm thick		○

Instruction	■ There should be no insulating material between the robot fixed plate and the operating machine, concrete and the installation bracket. ■ The part is required for items marked with "○". ■ The bracket must be securely installed on the ground, with a strength no less than that of the robot mounting plate fixed to the ground in Method 1.

Ground fix

Fixed steps:

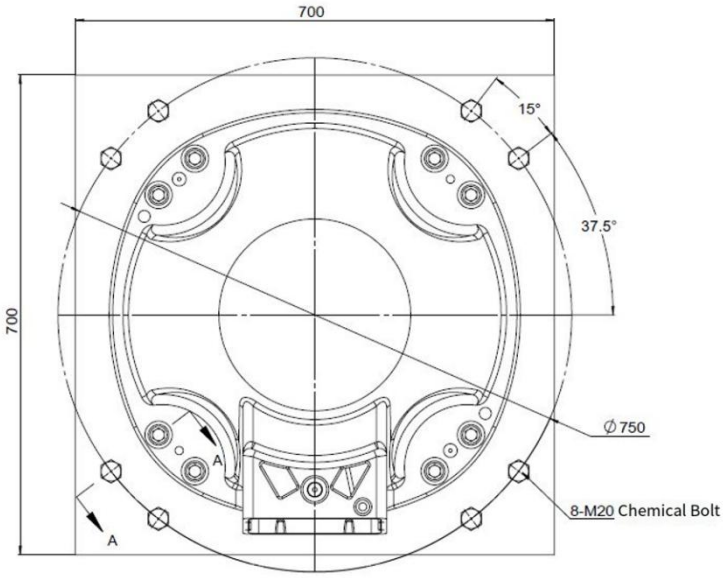
Step1、As shown in Figure 43, install M20 chemical bolts (minimum strength grade 4.8) on concrete foundations. Strictly follow the manufacturer's instructions for installation.

Step2、The robot mounting plate is securely fastened to the installation plane using eight M20 chemical bolts (with a minimum strength grade of 4.8) and M20 flat washers.

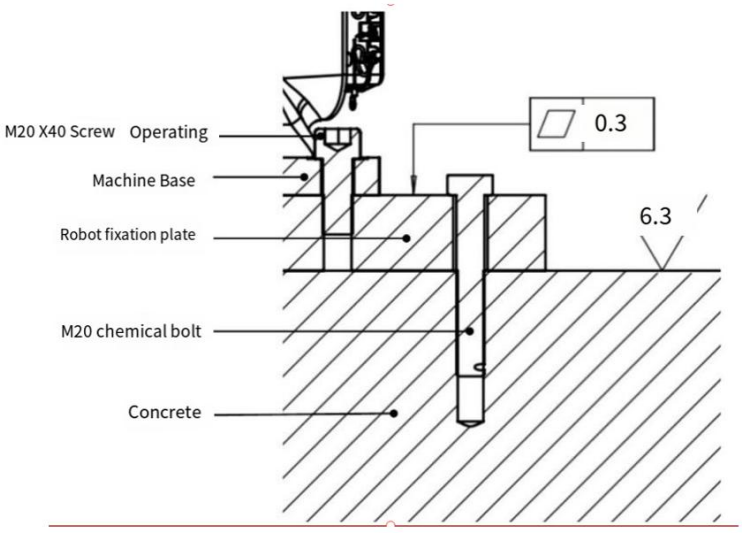
Step3、In the handling position (refer to Chapter 9), position the manipulator above the robot mounting plate, then adjust its orientation to align the Φ22 through-hole of the base with the M20 threaded hole on the plate.

Step4、Check that the base is tightly fitted to the mounting plate without any wobbling. Secure the manipulator base to the mounting plate using 8 M20x40 bolts (grade 12.9).

Instruction	The surface of the fixed plate must meet specific flatness requirements, with the installation surface flatness within 0.3.



(a)



(b)

Figure 43 Schematic diagram of ground fixation of the manipulator

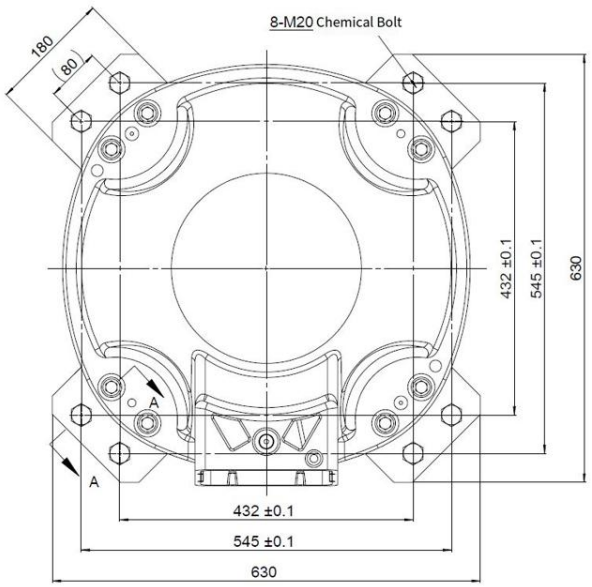
Support fixation

Fixed steps:

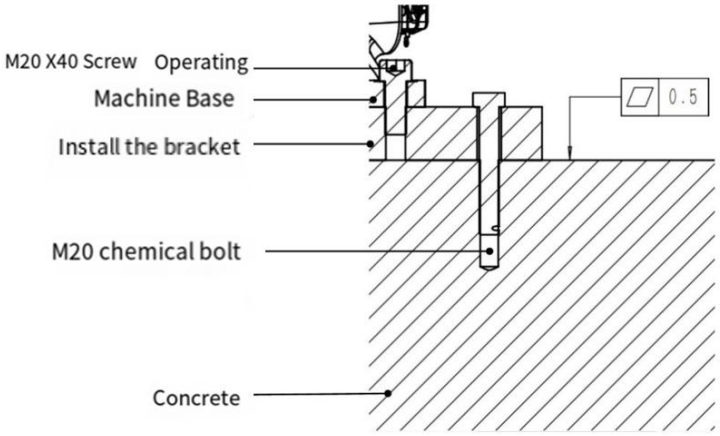
Step1、Use 8 M20 chemical bolts (minimum strength grade 4.8) to secure the 4 mounting brackets, as shown in Figure 44.

Step2、In the handling position, move the manipulator to the top of the mounting bracket, adjust its orientation to align the Φ22 through-hole of the base with the M20 threaded hole of the bracket.

Step3、Check whether the base is tightly attached to the mounting bracket surface without any wobbling. Secure the operating machine base to the bracket using 8 M20x40 bolts (strength grade 12.9). The bracket installation surface must meet specified flatness requirements.



(a)



(b)

Figure 44 Schematic diagram of manipulator bracket fixation

Instruction	The bracket mounting surface must meet specific flatness requirements, with a flatness tolerance of ≤0.5.

Warning	■ The M20 fixing screw for the fixed manipulator must be at least 40mm long, as insufficient length may result in improper fixation and other accidents. ■ When installing the overhead crane, extend the fixing screws to 45mm and ensure the mounting plate is at least 30mm thick.

4.2.2 Fixing methods for RX3-A650-2700 and RX3-A680-2560

The RX3-A650-2700 and RX3-A680-2560 operation consoles offer two mounting options:

- ground fix
- Support fixation

Instruction	■ The specific fixation method should be selected according to the environment used by the user. ■ The strength of chemical bolts is influenced by the strength of concrete. When installing chemical bolts, it is essential to refer to the manufacturer's design guidelines and ensure full consideration of safety before use.

The required parts and their specifications for fixed manipulators are shown in Table 42.

Table 43 Components Required for Operating Machine Fixation

Component Name	**remarks**	**ground fix**	**Support fixation**
clamp screw	M20x65 (12.9 grade) – 8 pieces	○	○
chemical bolt	M20 (not less than 4.8 grade) 12 pieces	○	○
robotic fixation plate	30 mm thick, 1 piece	○	
keysets	30 mm thick, 4 pieces		○

Instruction	■ There should be no insulating material between the robot fixed plate and the operating machine, concrete and the installation bracket. ■ The part is required for items marked with "○". ■ The bracket must be securely installed on the ground, with a strength no less than that of the robot mounting plate fixed to the ground in Method 1.

Ground fix

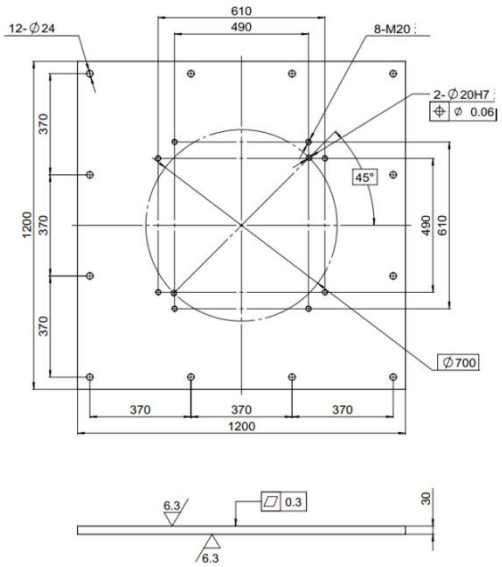
Fixed steps:

Step1、As shown in Figure 45, install M20 chemical bolts (minimum strength grade 4.8) on concrete foundations with a minimum thickness of 190mm. Strictly follow the manufacturer's instructions for installation.

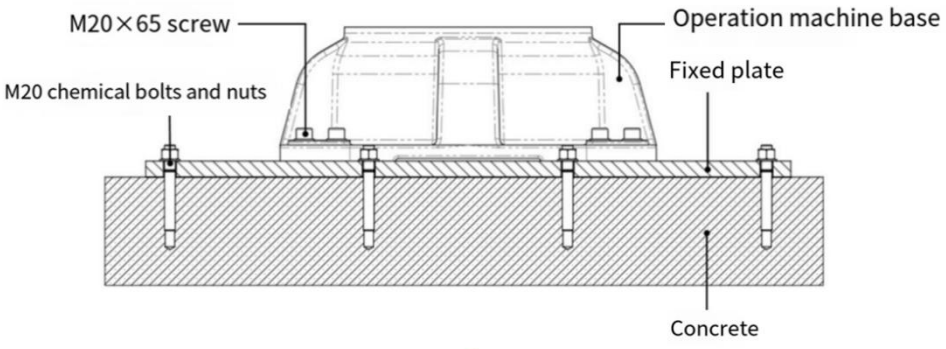
Step2、The robot mounting plate is securely fastened to the installation plane using eight M20 chemical bolts (with a minimum strength grade of 4.8) and M20 flat washers.

Step3、In the handling position (refer to Chapter 9), position the manipulator above the robot mounting plate, then adjust its orientation to align the Φ22 through-hole of the base with the M20 threaded hole on the plate.

Step4、Check that the base is tightly fitted to the mounting plate without any wobbling. Secure the manipulator base to the mounting plate using 8 M20x65 bolts (grade 12.9).



(a) Fixed plate dimensions



(b) Ground fixed cross-section diagram

Figure 45 Schematic diagram of ground fixation of the manipulator

Instruction	The surface of the fixed plate must meet specified roughness and flatness requirements, with the installation surface flatness within 0.3, as shown in Figure 45.

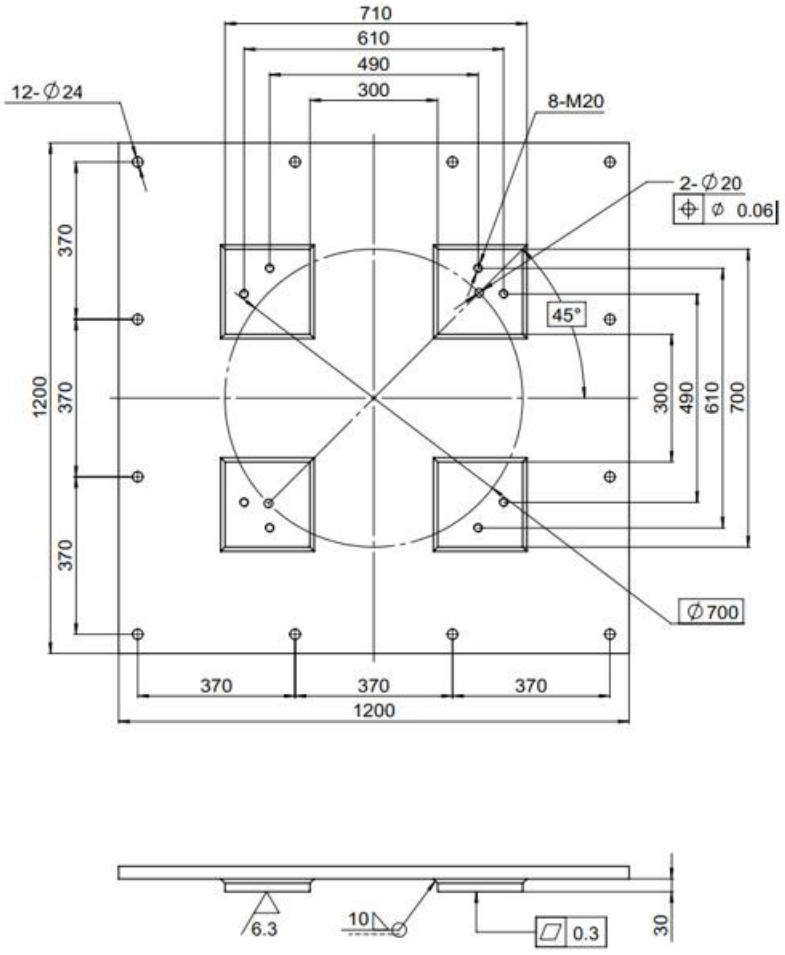
Support fixation

Fixed steps:

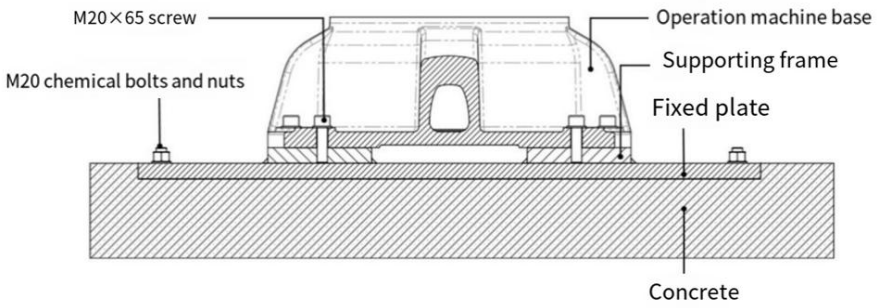
Step1、As shown in Figure 46, four mounting brackets (inner side) are welded to the robot base plate, which should be embedded in the concrete.

Step2、In the handling position, move the manipulator to the top of the mounting bracket, adjust its orientation to align the Φ22 through-hole of the base with the M20 threaded hole of the bracket.

Step3、Check that the base is tightly flush with the mounting bracket surface without any wobbling. Secure the manipulator base to the bracket using 8 M20x65 bolts (grade 12.9).



(a) Dimensions of the stent fixation plane layout



(b) Cross-sectional view of the stent fixation

Figure 46 Schematic diagram of manipulator bracket fixation

Instruction	The bracket mounting surface must meet specified flatness requirements, with a flatness tolerance of ≤0.3 as shown in Figure 46.

Warning	■ The M20 fixing screw for the operator console must be at least 60mm long, as insufficient length may result in improper fixation and other issues. ■ When installing the overhead unit, extend the mounting screw to 70mm and ensure the installation plate is at least 40mm thick.

5 Operator machine electrical connection

5.1 Operator machine electrical interface type

The operator console base features aviation connectors, heavy-duty connectors, IO interfaces, and air hose fittings (for φ10 air hose connections), with all components illustrated in Figures 51 and 52.

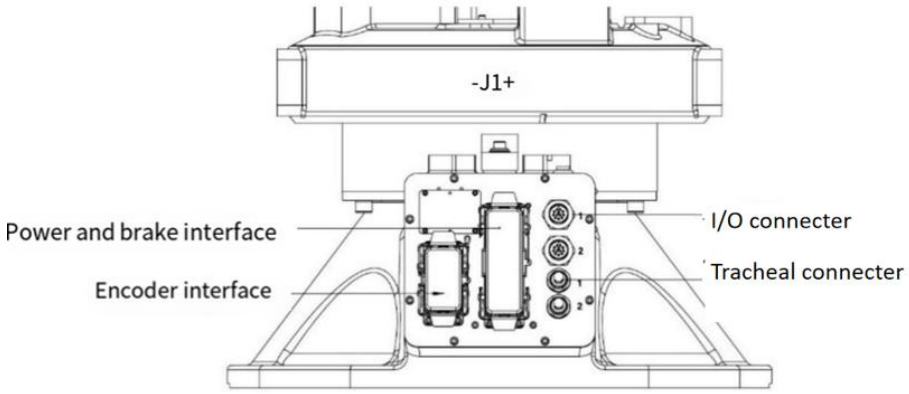


Figure 51 Electrical interfaces of the operating console base for models RX3-A650-2260/RX3-A680-2260/RX3-A635-2700/RX3-A620-3100

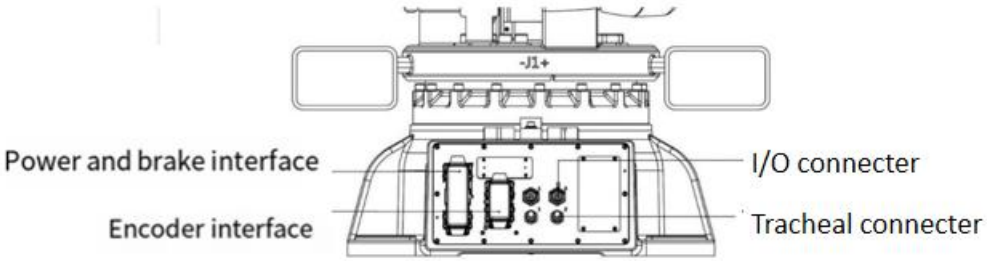


Figure 52 Electrical Interface of the RX3-A650-2700/RX3-A680-2560 Operator Base

The manipulator's forearm features an IO interface and a pneumatic tube interface (for φ10 pneumatic tubing), as shown in Figure 53.

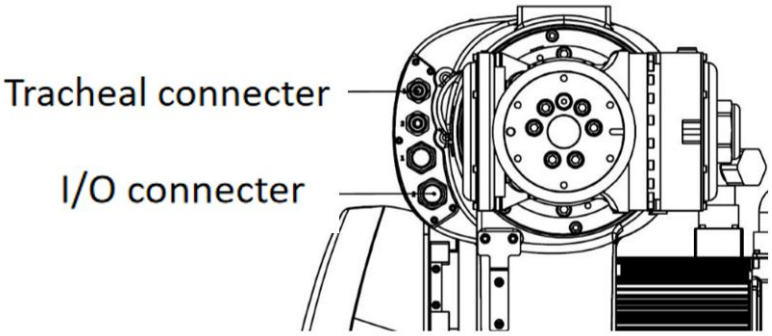


Figure 53 Electrical Interface of the Manipulator Arm

5.2 Operator interface definition

Power line overload interface definition

The schematic diagram of the heavy-load interface for the load-bearing manipulator's power line is shown in Figure 54, with definitions as specified in Table 51.

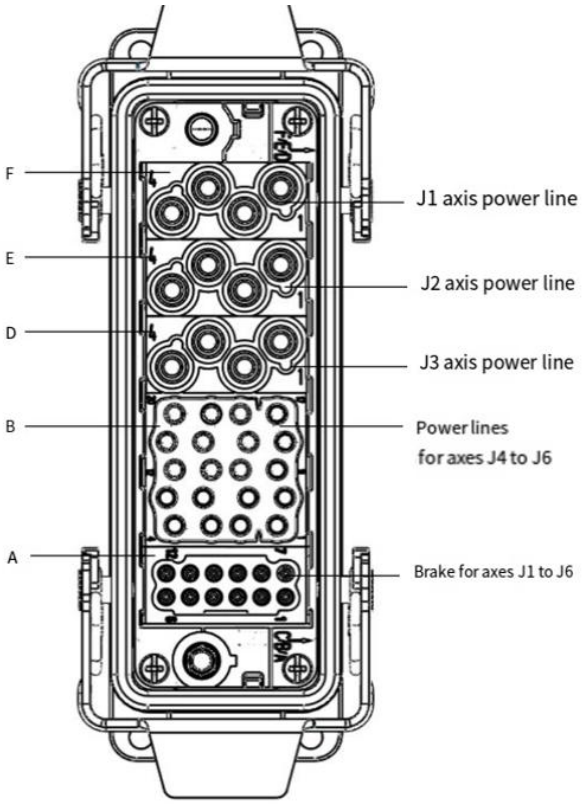


Figure 54: Load Manipulator Dynamic Heavy Load Connector

Table 51 Definition of Power and Brake Interface Pins

Signal name	Track number	Pin number	Signal name	Track number	Pin number	Signal name	Track number	Pin number
U1	Axis 1	F1	U4	4-axis	B17	BK1+	Axis 1	A1

V1	Axis 1	F2	V4	4-axis	B18	BK1-	Axis 1	A2
W1	Axis 1	F3	W4	4-axis	B19	BK2+	2 axes	A3
PE1	Axis 1	F4	PE4	4-axis	B20	BK2-	2 axes	A4
U2	2 axes	E1	U5	5-axis	B13	BK3+	3-axis	A5
V2	2 axes	E2	V5	5-axis	B14	BK3-	3-axis	A6
W2	2 axes	E3	W5	5-axis	B15	BK4+	4-axis	A7
PE2	2 axes	E4	PE5	5-axis	B16	BK4-	4-axis	A8
U3	3-axis	D1	U6	6-axis	B9	BK5+	5-axis	A9
V3	3-axis	D2	V6	6-axis	B10	BK5-	5-axis	A10
W3	3-axis	D3	W6	6-axis	B11	BK6+	6-axis	A11
PE3	3-axis	D4	PE6	6-axis	B12	BK6-	6-axis	A12

Definition of Encoder Wire Overload Interface

The schematic diagram of the overload interface for the load-carrying manipulator encoder is shown in Figure 55, with definitions as specified in Table 52.

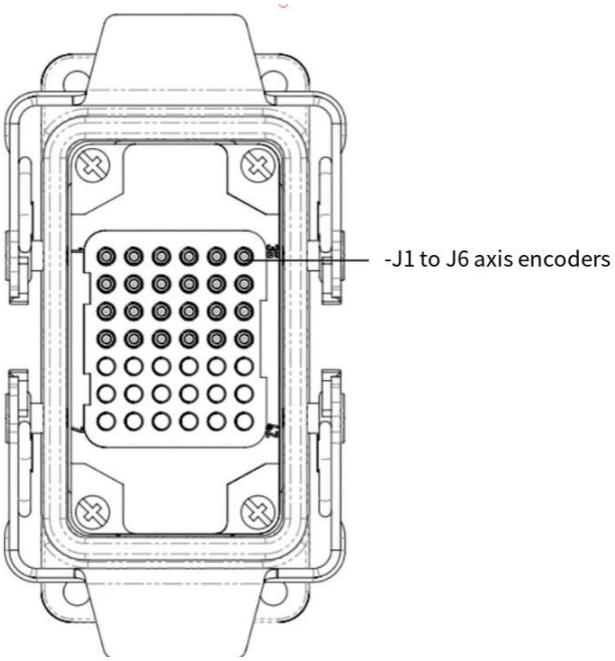


Figure 55: Heavy-load Connector for Load Manipulator Encoder

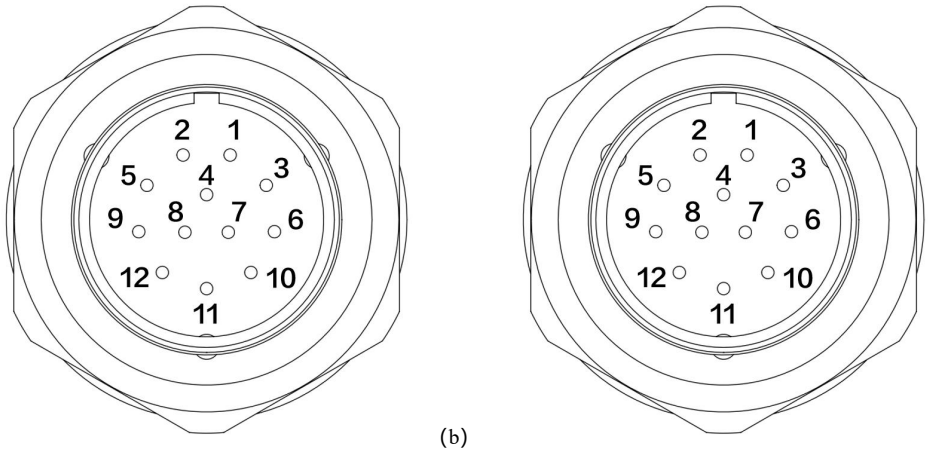
Table 52 Encoder Overload Interface Definition Table

Signal name	**Track number**	**Pin number**	**Signal name**	**Track number**	**Pin number**
J1_PS-	Axis 1	1	J4_PS-	4-axis	22
J1_PS+	Axis 1	2	J4_PS+	4-axis	23
J1_0V	Axis 1	3	J4_0V	4-axis	24

J1_5V	Axis 1	4	J4_5V	4-axis	25
J2_PS-	2 axes	8	J5_PS-	5-axis	29
J2_PS+	2 axes	9	J5_PS+	5-axis	30
J2_0V	2 axes	10	J5_0V	5-axis	31
J2_5V	2 axes	11	J5_5V	5-axis	32
J3_PS-	3-axis	15	J6_PS-	6-axis	36
J3_PS+	3-axis	16	J6_PS+	6-axis	37
J3_0V	3-axis	17	J6_0V	6-axis	38
J3_5V	3-axis	18	J6_5V	6-axis	39

User IO interface definition

The IO interface on the base of the load-operated manipulator is connected to the IO interface on the forearm, which can be used as needed. The interface configurations for both the base and forearm are shown in Figure 56, with their corresponding relationships detailed in Table 53. The IO connector on the base is the Weipu SA2015-P12B, while the one on the forearm is the Weipu SA2015-S12B. Refer to the relevant manuals to select the appropriate connector type.



(b)

Figure 56 shows the IO port interfaces of the manipulator base (left) and the manipulator arm (right).

Table 53 User IO Interface Definition Table

1 IO		**2-channel IO**	
Pin number (base)	**Pin number (forearm)**	**Pin number (base)**	**Pin number (forearm)**
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6

7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10
11	11	11	11
12	12	12	12

6 Operator Machine and Accessories Compatibility and Connection

6.1 Examples of attachment types

The auxiliary equipment of the manipulator mainly includes mechanical grippers (as shown in Figure 61), hydraulic/pneumatic suction cups (as shown in Figure 62), welding guns and welding machines (as shown in Figure 63), infrared recognition devices, visual recognition devices, cutting machines, and other specialized equipment.

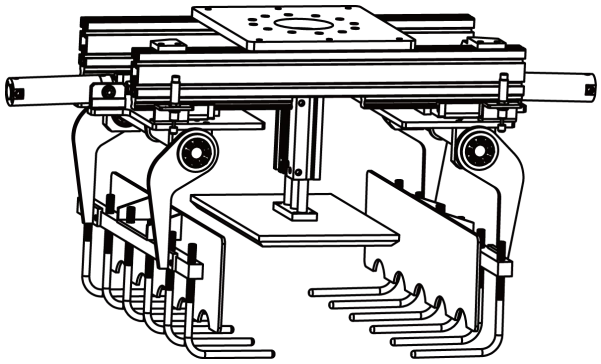


Figure 61 Industrial robot gripper

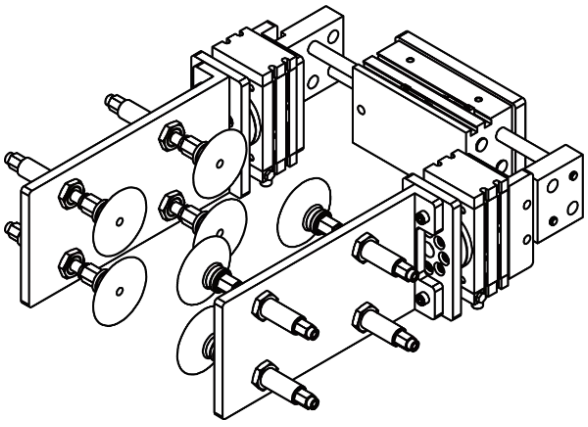


Figure 62: Industrial robot suction cup

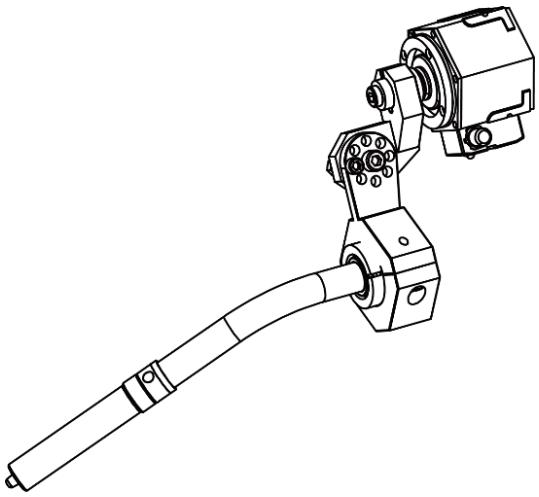


Figure 63 Arc welding gun for industrial robot

6.2 Attended mode

Operator machine connected with accessories

The connection and load of external accessories to the operator are similar to those of the operator itself. These accessories can be directly or indirectly connected to the operator via flanges, as detailed in Section 7.7 of this manual.

Operator console connected to control cabinet

As described in Section 5.2 of this manual, the overload connector on the operator body is connected to the control cabinet via an overload cable, with both ends of the cable used to connect the operator and the control cabinet (see Figure 64).

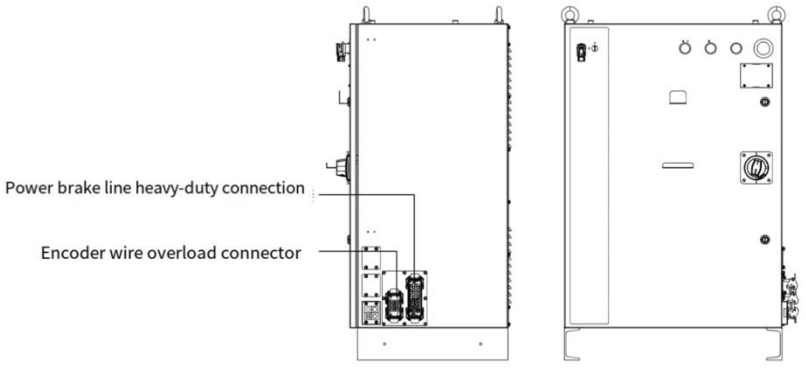


Figure 64: Definition of Control Cabinet Cable Connectors

7 Performance parameters of the manipulator

7.1 Basic specifications

For the basic specifications of the operator, refer to Section 1.3 in this manual.

7.2 Motion direction of each axis

The motion directions of a 6-DOF industrial robot manipulator are illustrated in Figures 71-73.

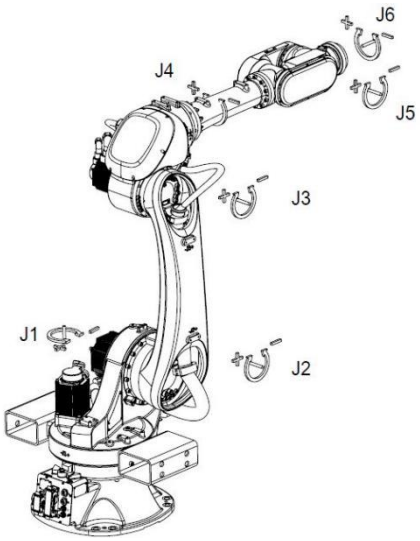


Figure 71: Movement Directions of Each Axis on the RX3-A650-2260/RX3-A680-2260 Manipulator

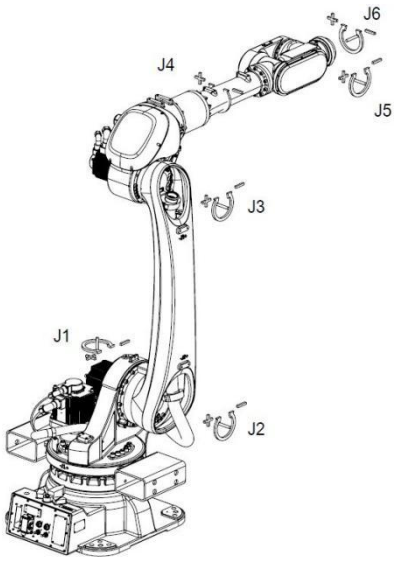


Figure 72: Movement Directions of Each Axis in the RX3-A650-2700/RX3-A680-2560 Manipulator

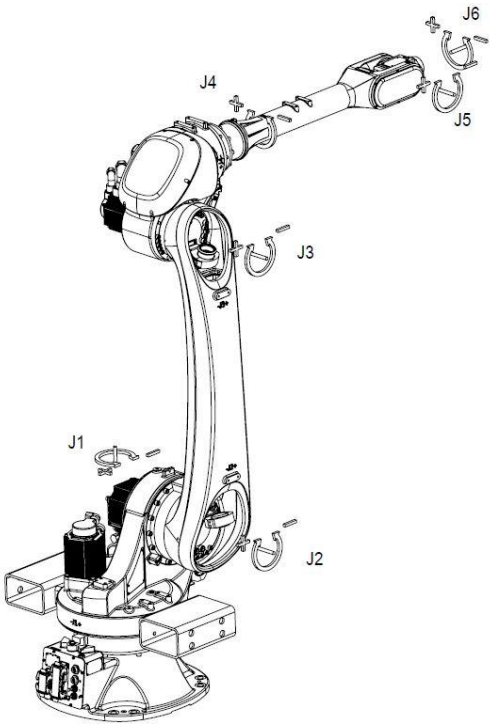


Figure 73: Movement directions of each axis on the RX3-A635-2700/RX3-A620-3100 manipulator

7.3 Dimensions and operating ranges of each axis

The motion range of each axis of the manipulator is shown in Table 71.

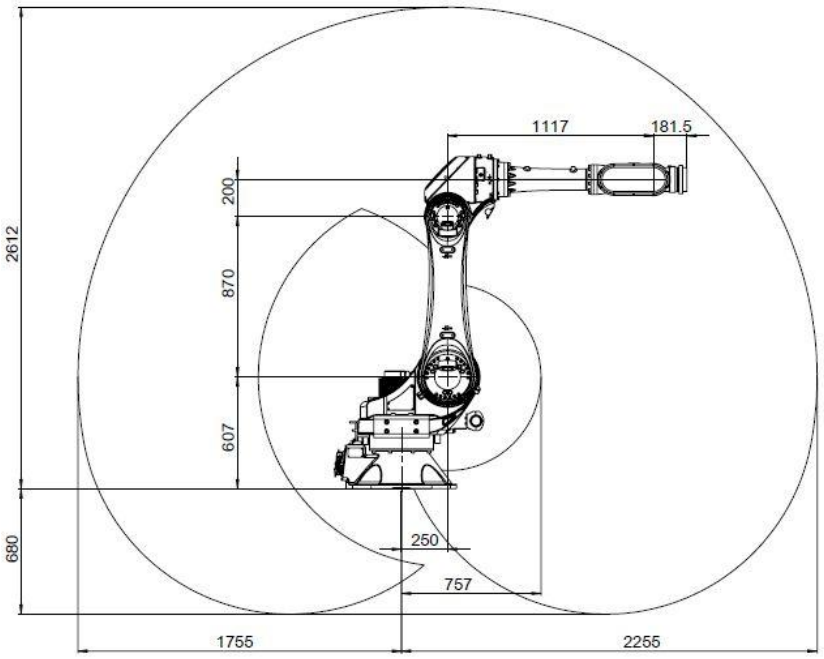
Table 71: Range of Motion for Each Axis of the Manipulator

Track number	**range of movement (°)**
J1*	-170 ~ +170
J2	-190 ~ +10
J3	-200 ~ +75
J4	-350 ~ +350
J5	-125 ~ +125
J6	-360 ~ +360

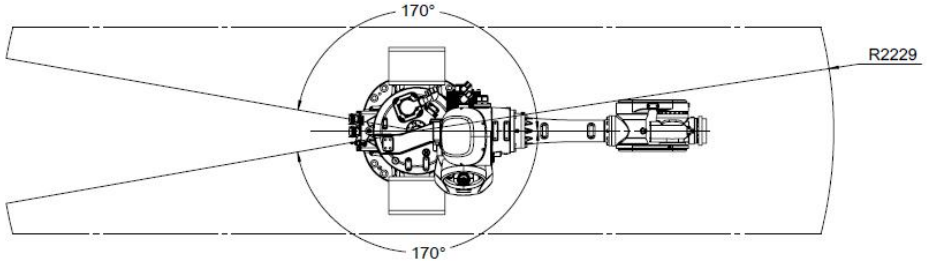
Instruction	"*": When the J1-axis mechanical limit is removed, the range of motion is-185° to 185°.

The range of motion diagram of the manipulator is shown in Figures 74 to 78.

When installing peripheral devices, ensure they do not interfere with the robot's main body or operational range. Unit: mm.

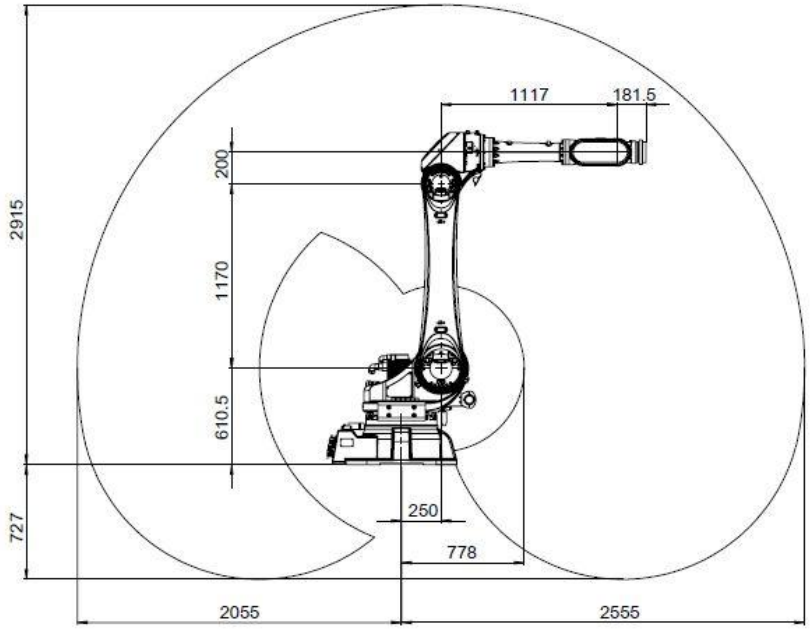


(a)

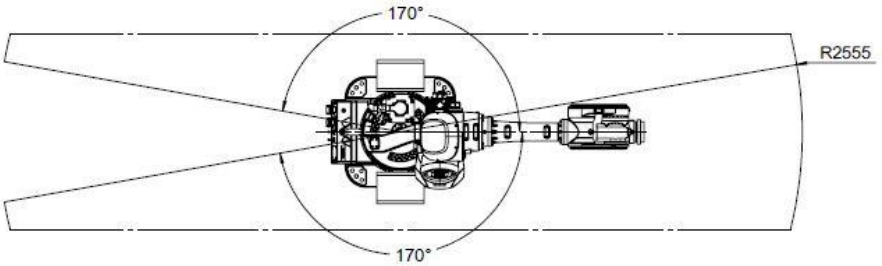


(b)

Figure 74: Operating Range of RX3-A650-2260/RX3-A680-2260 Operators

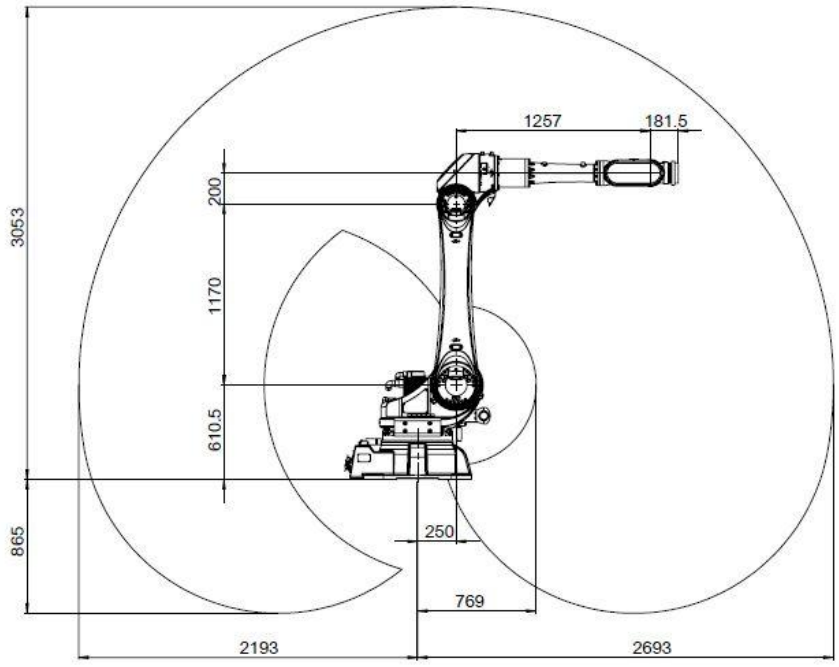


(a)

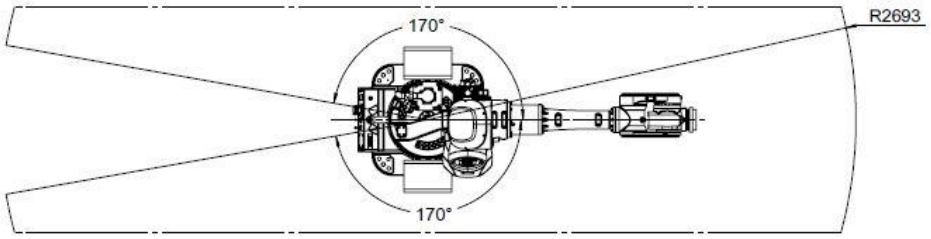


(b)

Figure 75: Operating Range of RX3-A680-2560 Manipulator

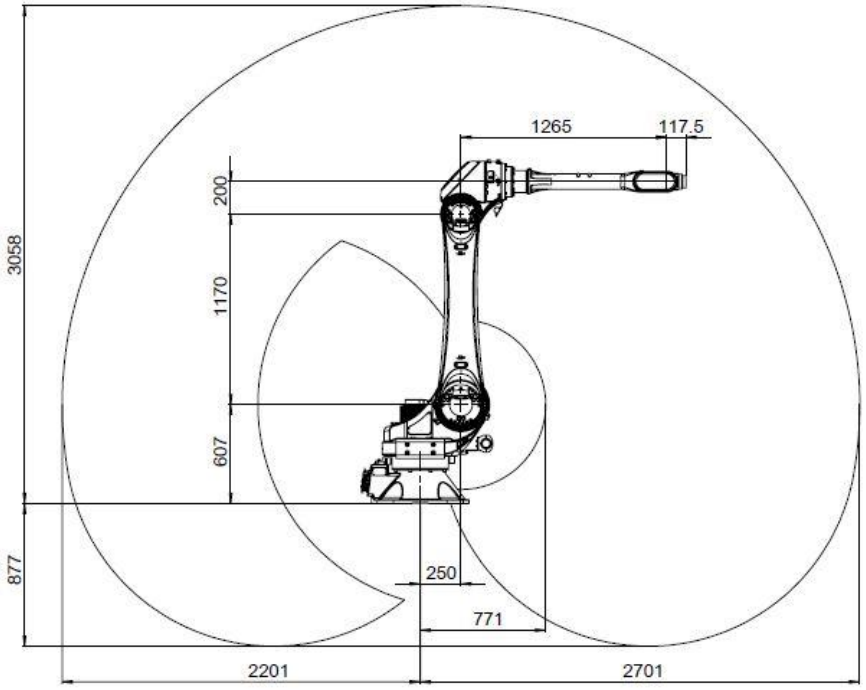


(a)

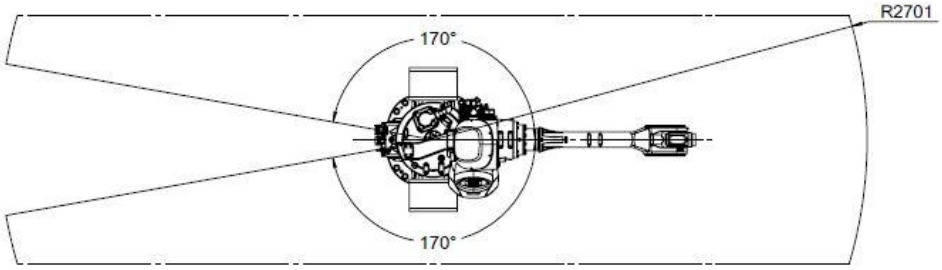


(b)

Figure 76: Operating Range of RX3-A650-2700 Manipulator

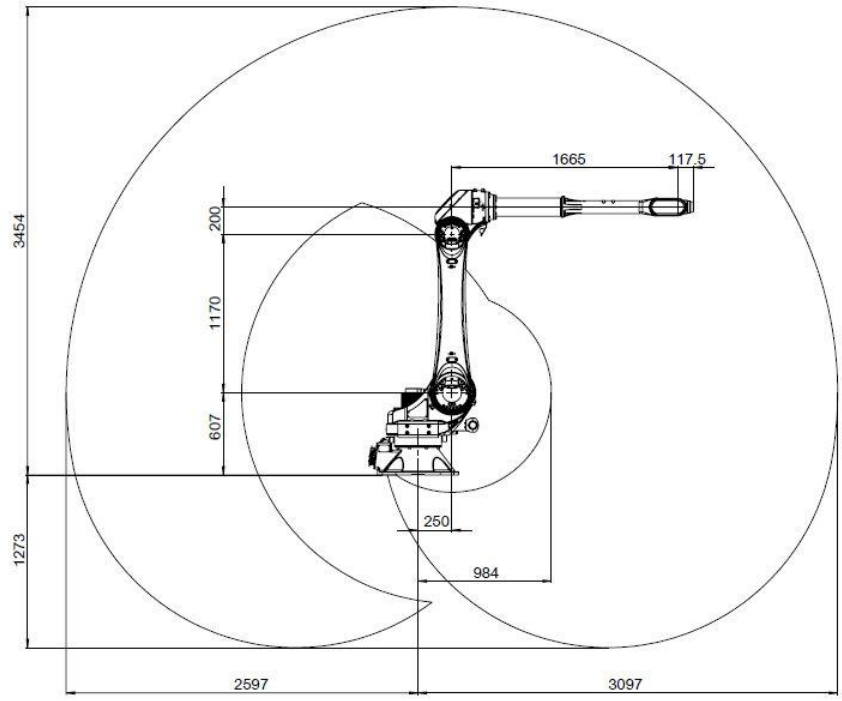


(a)

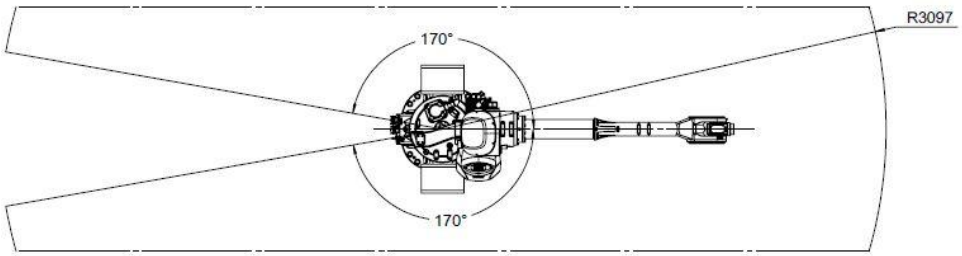


(b)

Figure 77: Operating Range of RX3-A635-2700 Manipulator



(a)



(b)

Figure 78: Operating Range of RX3-A620-3100 Manipulator

7.4 Mechanical limit

Each axis is equipped with a zero point and a range of motion. Unless the origin position is lost due to servo system abnormalities or system errors, the robot is controlled to operate within its range of motion. Additionally, to further ensure safety, some axes are fitted with mechanical brakes to limit the range of motion.

Attention	Do not modify the mechanical brake, as this may cause the robot to fail to stop properly.

Figures 79 to 711 illustrate the mechanical brake position.

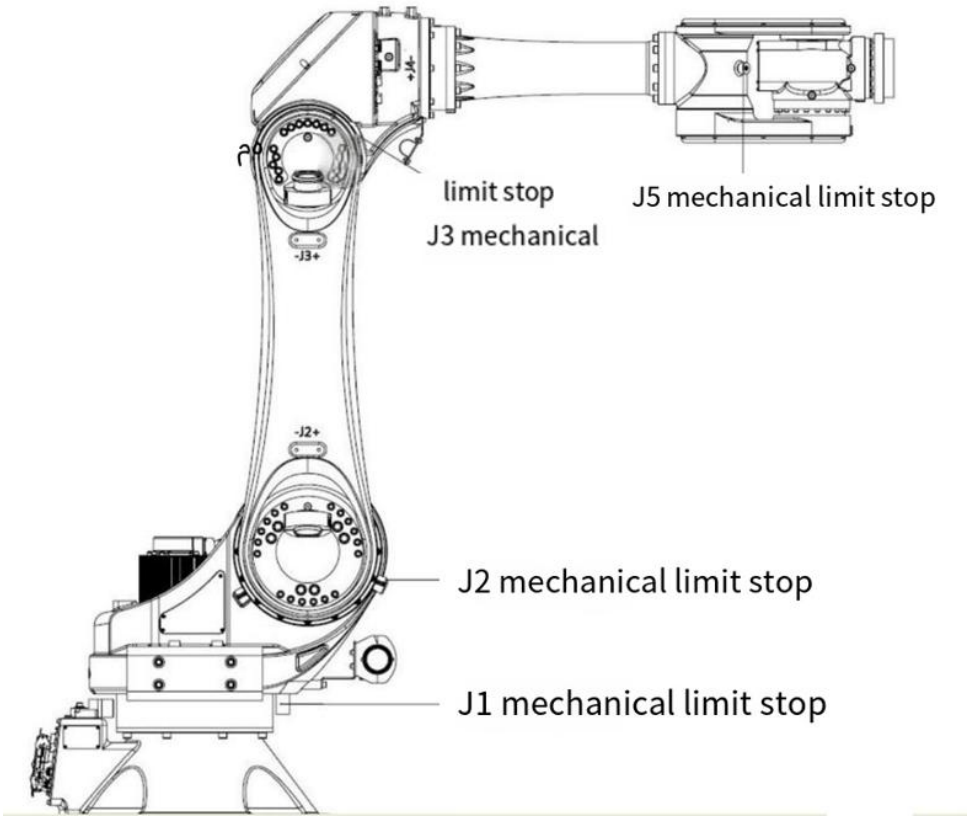


Figure 79 Mechanical Brake on RX3-A650-2260/RX3-A680-2260 Operator

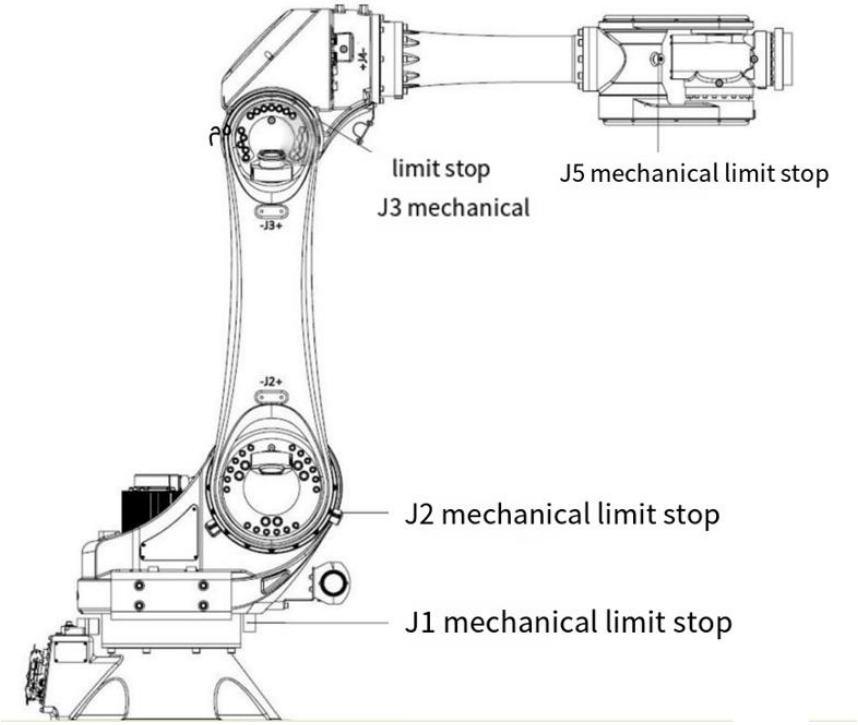


Figure 7: Mechanical Brake on RX3-A650-2700/RX3-A680-2560 Operator

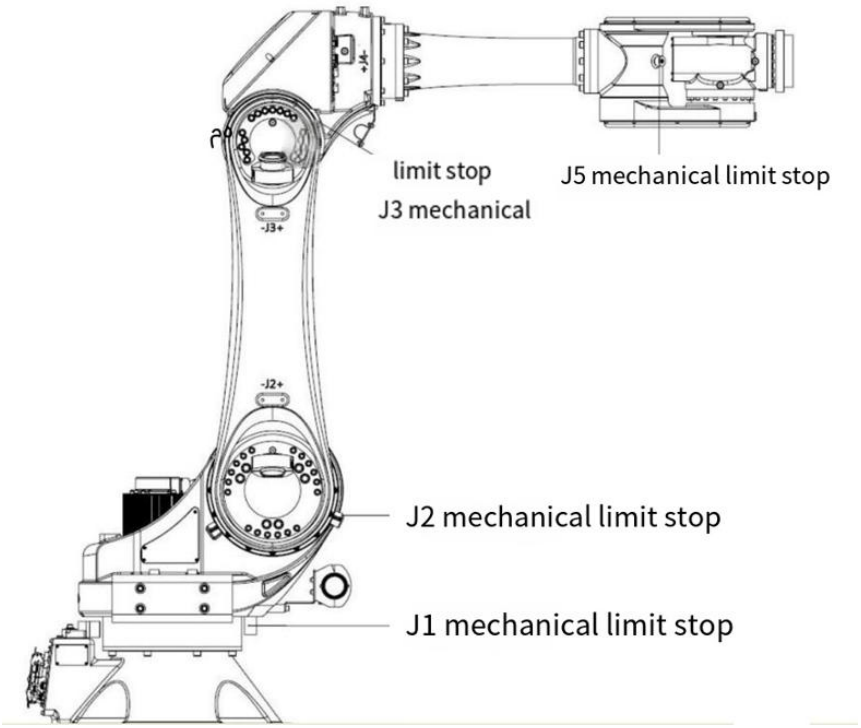


Figure 7: Mechanical Brake on RX3-A635-2700/RX3-A620-3100 Operator

7.5 Velocity of each axis

The maximum angular velocity of each axis of the manipulator is as shown in Table 72.

Table 72 Maximum Angular Velocity of Each Axis of the Manipulator

parameter		**RX3-A620-3100**	**RX3-A635-2700**	**RX3-A650-2260**	**RX3-A650-2700**	**RX3-A680-2260**	**RX3-A680-2560**
maximum action speed	J1	185°/s	185°/s	185°/s	155°/s	185°/s	155°/s
	J2	180°/s	180°/s	175°/s	145°/s	145°/s	145°/s
	J3	180°/s	180°/s	180°/s	180°/s	180°/s	185°/s
	J4	310°/s	310°/s	310°/s	310°/s	310°/s	310°/s
	J5	375°/s	375°/s	395°/s	395°/s	270°/s	270°/s
	J6	470°/s	470°/s	465°/s	465°/s	465°/s	465°/s

7.6 Flange size

The specifications and connection dimensions of the output flange for the load-bearing manipulator, along with schematic diagrams, are detailed in Table 73, Table 74, Figure 712, and Figure 713. For screw tightening force, refer to Appendix B: Table of Screw Strength and Tightening Torque (Nm).

Table 73: Specifications of Mechanical Interface for Output of RX3-A650-2260/RX3-A680-2260/RX3-A650-2700/RX3-A680-2560 Operators

parameter	**short-cut process**
Positioning circle diameter	35mm or 130mm
thread hole pitch circle diameter	115mm
screw grade	12.9 magnitude
Screw diameter	M8
Number of screws	6
dowel	8mm
Screw standard	GB/T 70.1-2000

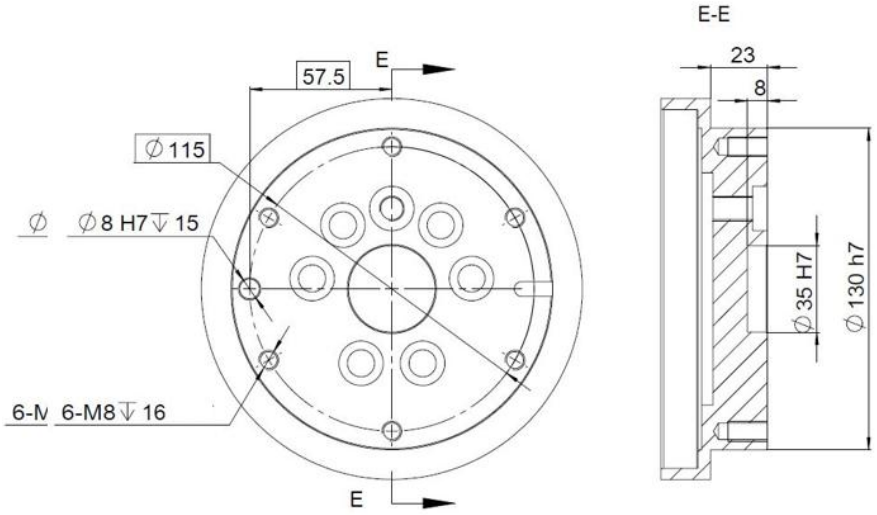


Figure 712: Schematic Diagram of Flange Dimensions for the Wrist of the RX3-A650-2260/RX3-A680-2260/RX3-A650-2700/RX3-A680-2560 Manipulator

Warning	When installing the fixture, the screws and positioning pins must be properly sized to match the depth of the threaded hole and pin hole. The installation length must not exceed 16mm for the threaded hole or 15mm for the pin hole, as exceeding these limits may damage the manipulator's wrist.

Table 74: Specifications of Mechanical Interface for Output of RX3-A635-2700/RX3-A620-3100 Operators

Parameter	**Short-cut Process**
Positioning circle diameter	18mm or 75mm
thread hole pitch circle diameter	45mm
screw grade	12.9 magnitude
Screw diameter	M6

Parameter	Short-cut Process
Number of screws	6
dowel	4mm
Screw standard	GB/T 70.1-2000

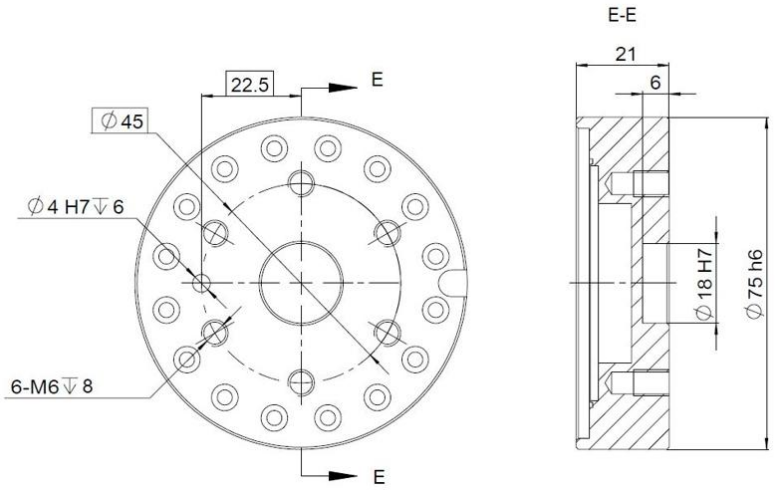


Figure 713 Schematic diagram of flange dimensions for the wrist of the RX3-A635-2700/RX3-A620-3100 operating console

Warning	When installing the fixture, the screws and positioning pins must be properly sized to match the depth of the threaded hole and pin hole. Installation length exceeding 8mm for the threaded hole or 6mm for the pin hole is strictly prohibited, as it may damage the manipulator's wrist.

7.7 Load and Installation Method

Method of calculating moment of inertia

Inertia torque refers to the rotational difficulty of the load (fixture end + workpiece) when the robot joint starts rotating (inertia). Inertia torque increases with the load weight and eccentricity. Since this also increases the load on the joint, ensure the inertia torque is within the allowable range.

The torque M (N·m) and inertial moment I (kg·m²) can be calculated when the load (fixture tip + workpiece) volume is small using the following formula.

$$M(N \cdot m) = m(kg) \times L(m) \times g(m/s^2)$$

$$I(kgm^2) = m(kg) \times L^2(m)$$

where m is the load weight (kg), L is the load centrifugal force (m), and g is the gravitational acceleration (m/s²).

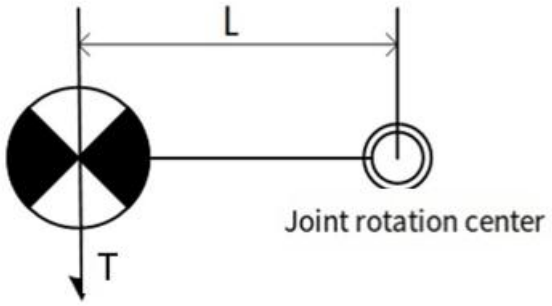
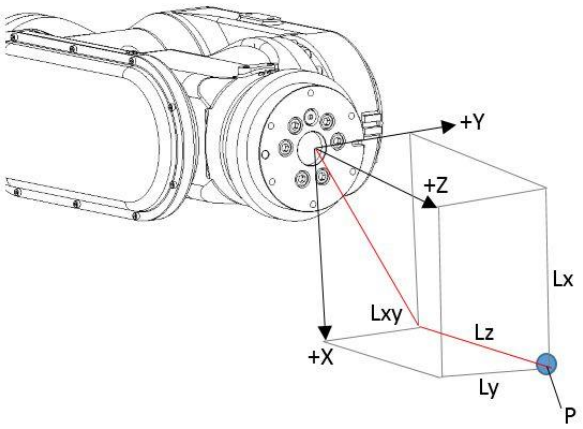


Figure 714 Schematic diagram of load centrifugal rate

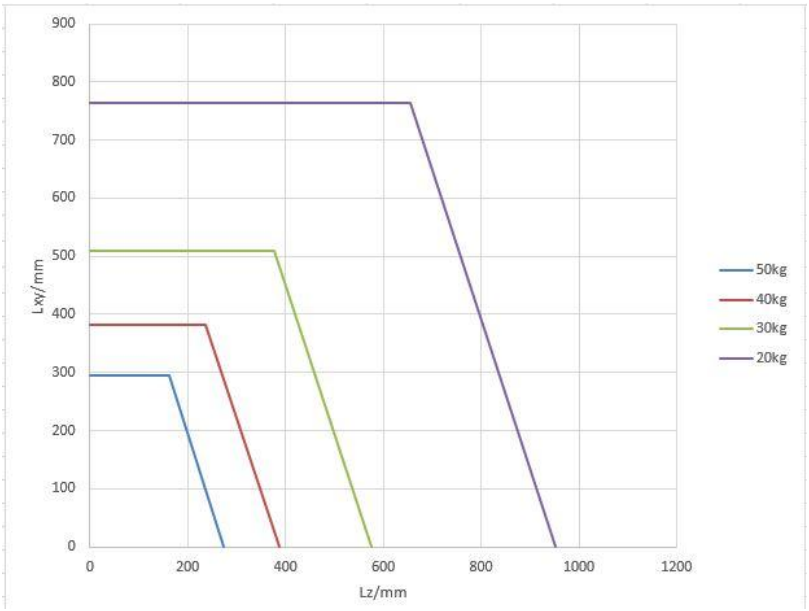
Installation of the wrist load for the RX3-A650-2260/RX3-A650-2700 operator

When installing the load on the wrist of the RX3-A650-2260/RX3-A650-2700 operator, the following precautions should be observed:

- For loads with a mass not exceeding 50kg, the centroid positions Lxy and Lz must fall within the range of the corresponding wire frames shown in Figure 715(b). Figure 715(a) defines the meanings of Lxy and Lz: Lxy represents the distance from the flange plane projection of the load's centroid to the origin, while Lz denotes the distance from the flange axis projection of the load's centroid to the origin.
- The wrist torque is limited to 222Nm for 4-axis, 222Nm for 5-axis, and 145Nm for 6-axis configurations.
- The 4-axis system permits a load moment of inertia below 28 kgm², the 5-axis system permits below 28 kgm², and the 6-axis system permits below 22 kgm².



(a)



(b)

Figure 715 Schematic diagram of the center of mass position of wrist load for RX3-A650-2260/RX3-A650-2700

The load torque and load inertia of the manipulator are shown in Table 75.

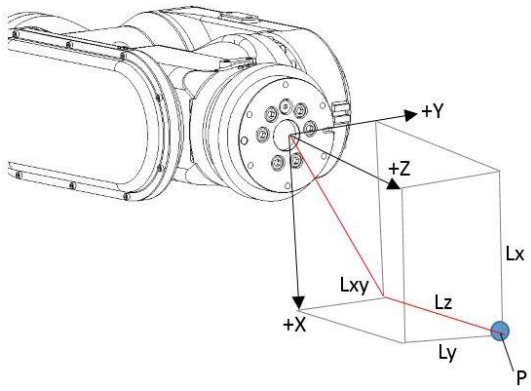
Table 75 Data on Operating Machine Load Torque and Load Moment of Inertia

Operator model	**axle**	**load troque**	**rotating inertia of load**
Wrist load 50kg		Nm	Kgm2
RX3-A650-2260 RX3-A650-2700	J4	222	28
	J5	222	28
	J6	145	22

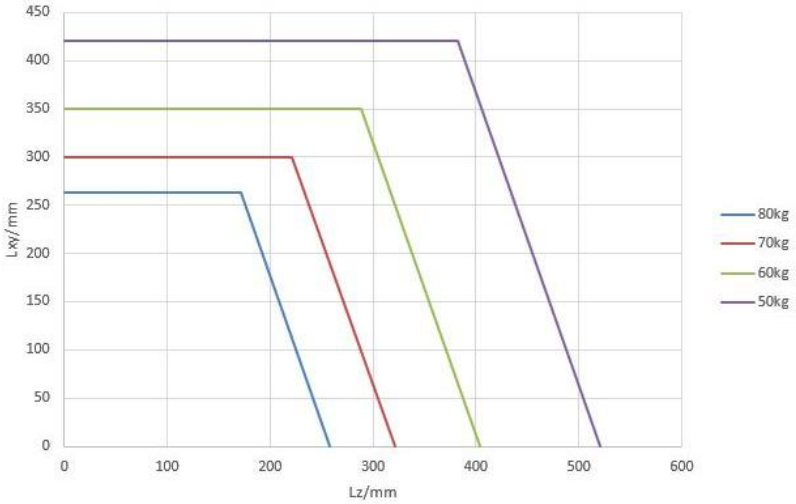
Installation of the wrist load for the RX3-A680-2260/RX3-A680-2560 operator

When installing the load on the wrist of the RX3-A680-2260/RX3-A680-2560 operator, the following precautions should be observed:

- For loads with a mass not exceeding 80kg, the centroid positions Lxy and Lz must fall within the range of the corresponding wire frames shown in Figure 716(b). Figure 716(a) defines these positions: Lxy represents the distance from the flange plane projection of the load's centroid to the origin, while Lz denotes the distance from the flange axis projection of the load's centroid to the origin.
- The wrist torque is limited to 344Nm for 4-axis, 344Nm for 5-axis, and 206Nm for 6-axis configurations.
- The load's rotational inertia should be less than 30 kgm² for 4-axis, 5-axis, and 6-axis configurations respectively.



(a)



(b)

Figure 716 Schematic diagram of the center of mass position of the wrist load for RX3-A680-2260/RX3-A680-2560

The load torque and load inertia of the manipulator are shown in Table 76.

Table 76 Data on Operating Machine Load Torque and Load Moment of Inertia

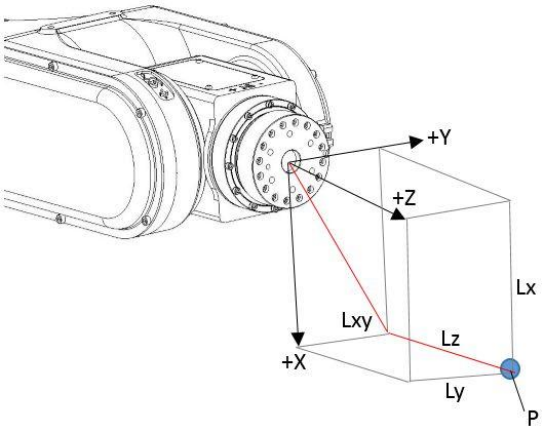
Operator model	**axle**	**load troque**	**rotating inertia of load**
Wrist load capacity: 80kg		Nm	Kgm2
RX3-A680-2260 **RX3-A680-2560**	J4	344	30
	J5	344	30
	J6	206	20

Installation of Load on the Wrist of RX3-A635-2700 Operator

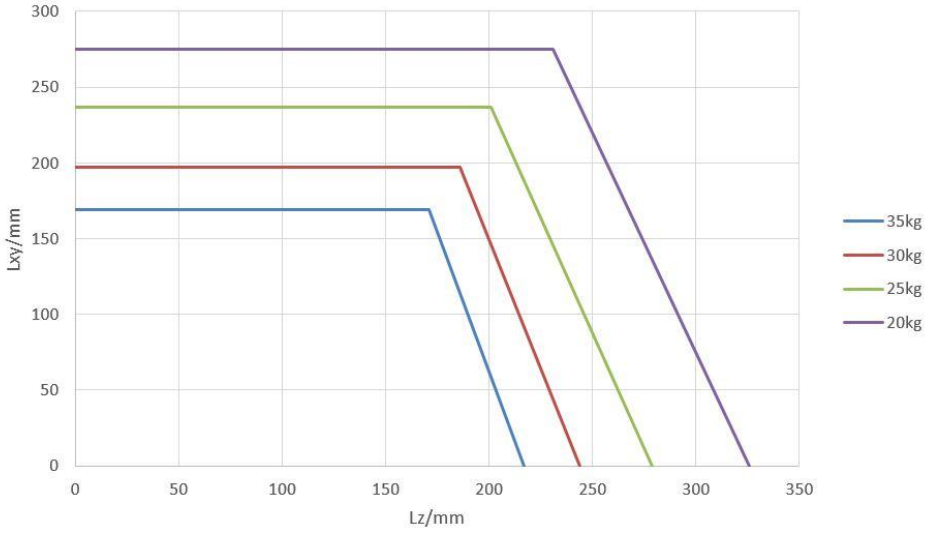
When installing the load on the wrist of the RX3-A635-2700 operator, note the following:

- For loads with a mass not exceeding 35kg, the centroid positions Lxy and Lz must fall within the range of the corresponding wire frames shown in Figure 717(b). Figure 717(a) defines the meanings of Lxy and Lz: Lxy represents the distance from the flange plane projection of the load's centroid to the origin, while Lz denotes the distance from the flange axis projection of the load's centroid to the origin.

- The wrist torque is limited to 131Nm for 4-axis, 131Nm for 5-axis, and 58Nm for 6-axis configurations.
- The 4-axis system allows a load moment of inertia below 4 kgm², the 5-axis system below 4 kgm², and the 6-axis system below 1.5 kgm².



(a)



(b)

Figure 717 Schematic diagram of the center of mass position of the wrist load for the RX3-A635-2700

The load torque and load inertia of the manipulator are shown in Table 77.

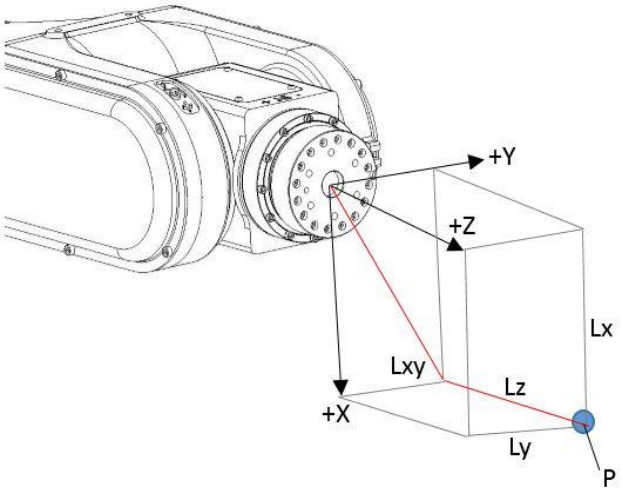
Table 77 Data on Operating Machine Load Torque and Load Moment of Inertia

Operator model	**axle**	**load troque**	**rotating inertia of load**
Wrist load 35kg		Nm	Kgm2
RX3-A635-2700	J4	131	4
	J5	131	4
	J6	58	1.5

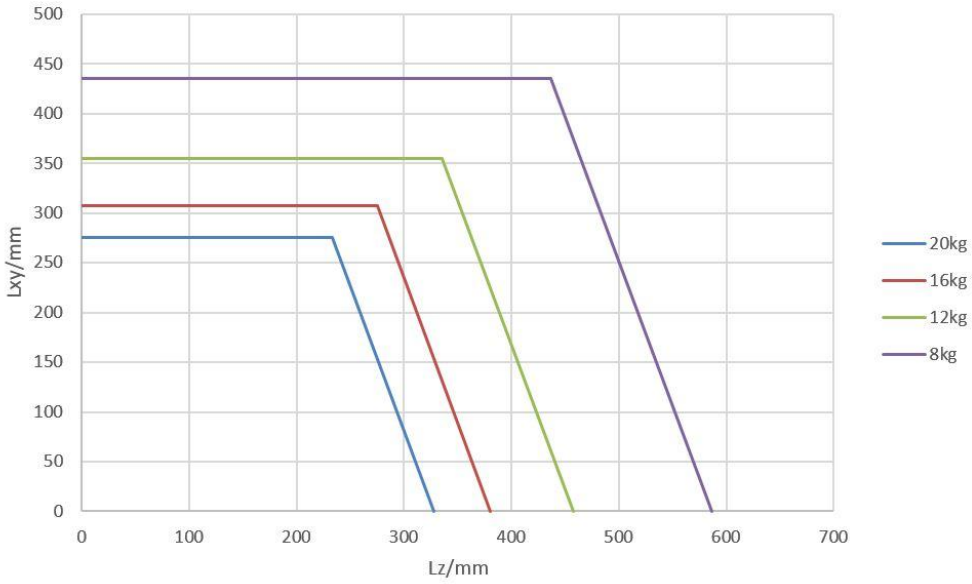
Installation of Load on the Wrist of RX3-A620-3100 Operating Machine

When installing the load on the wrist of the RX3-A620-3100 operator, note the following:

- For loads with a mass not exceeding 20kg, the centroid positions Lxy and Lz must fall within the range of the corresponding wire frames shown in Figure 718(b). Figure 718(a) defines these positions: Lxy represents the distance from the flange plane projection of the load's centroid to the origin, while Lz denotes the distance from the flange axis projection of the load's centroid to the origin.
- The wrist torque is limited to 131Nm for 4-axis, 131Nm for 5-axis, and 58Nm for 6-axis configurations.
- The 4-axis system allows a load moment of inertia below 4 kgm², the 5-axis system below 4 kgm², and the 6-axis system below 1.5 kgm².



(a)



(b)

Figure 718 Schematic diagram of the center of mass position of the wrist load for the RX3-A620-3100

The load torque and load inertia of the manipulator are shown in Table 78.

Table 78 Data on Operating Machine Load Torque and Load Moment of Inertia

Operator model	**axle**	**load troque**	**rotating inertia of load**
Wrist load 20kg		Nm	Kgm2
RX3-A620-3100	J4	131	4

Operator model	axle	load troque	rotating inertia of load
	J5	131	4
	J6	58	1.5

Installation of 3-axis elbow equipment for the manipulator

During the installation of the load on the operator's elbow, note the following:

- External devices with a weight not exceeding 20 kg can be installed on the elbow of the manipulator.
- The load center of gravity at the elbow must be located within the 80mm×60mm area marked by the installation screw in Figure 719.
- The height of the center of mass is not more than 60 mm from the installation surface.

The specifications and dimensions of the equipment mounting holes on the operator's elbow are shown in Figure 719.

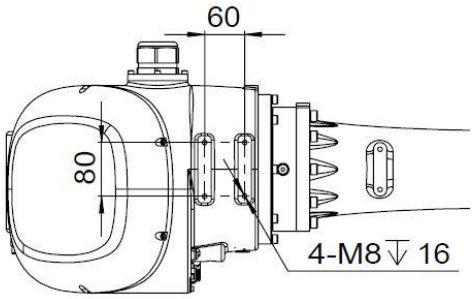


Figure 719 Schematic diagram of the load interface dimensions for the manipulator elbow

Warning	■ When installing the equipment, ensure reliable installation. Use 12.9-grade screws with the specified torque and apply thread sealant to the threads. Failure to do so may cause loosening or even fracture during long-term operation, potentially leading to accidents. ■ It is absolutely forbidden to add any additional machining holes or screw holes to the main body of the manipulator, as this may adversely affect its safety and functionality. ■ When installing equipment, the screws used must fully consider the depth of the threaded hole. Installation length exceeding the threaded hole depth (16mm) is prohibited, as it may damage the operating arm. ■ The load center of gravity at the elbow must not exceed the specified limit. Otherwise, the manipulator may trigger an alarm, malfunction, or experience reduced service life. ■ When installing equipment at the operating arm's elbow, ensure it does not interfere with the main body or cables. Additionally, avoid bundling external cables or air hoses with the main body's cables, as this may cause the main body's cables to break, leading to unforeseen severe failures and consequences.

Installation locations of other parts of the operator

To facilitate cable fixation on the manipulator, additional reserved areas are provided as follows:

fixed position of manipulator forearm

The installation hole specifications and dimensions of the manipulator's forearm are shown in Figures 720 and 721.

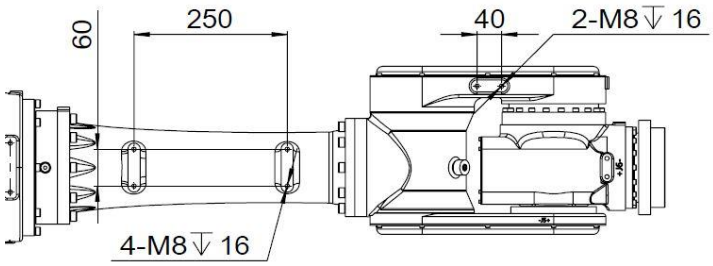


Figure 7: Interface dimensions of the manipulator arm for the 20

RX3-A650-2260/RX3-A680-2260/RX3-A650-2700/RX3-A680-2560 manipulators

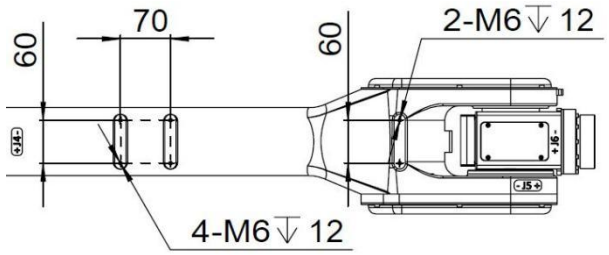


Figure 721: Interface dimensions of the forearm for the RX3-A635-2700/RX3-A620-3100 manipulator

fixed position of the manipulator arm

The installation hole specifications and dimensions of the operator arm are shown in Figures 722 and 723.

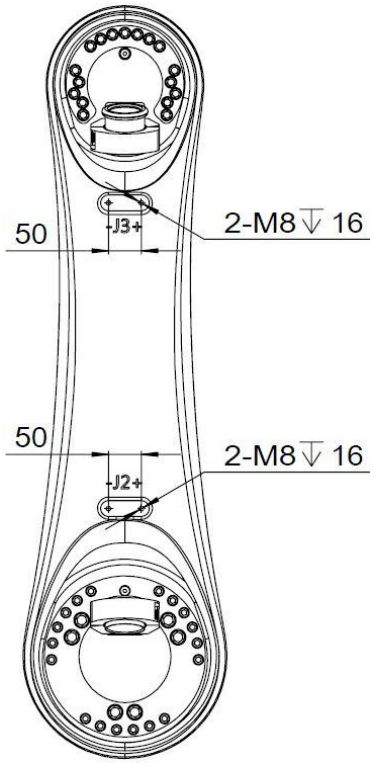


Figure 722: Interface dimensions of the main arm for RX3-A650-2260/RX3-A680-2260 manipulators

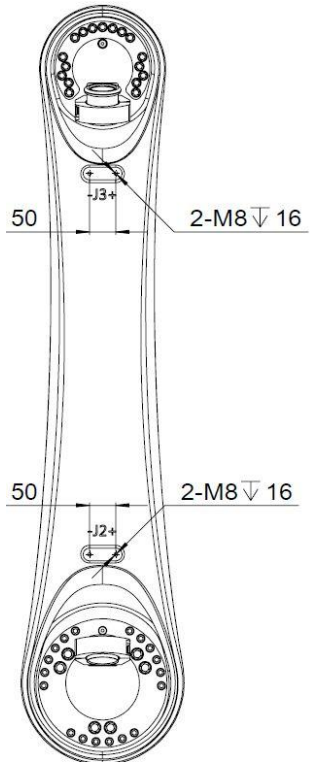


Figure 723: Interface dimensions of the operating arm for RX3-A680-2560/RX3-A650-2700/RX3-A635-2700/RX3-A620-3100 manipulators

Fixed position of the shoulder of the manipulator

The installation hole specifications and dimensions on the operator's shoulder are shown in Figures 724 and 725.

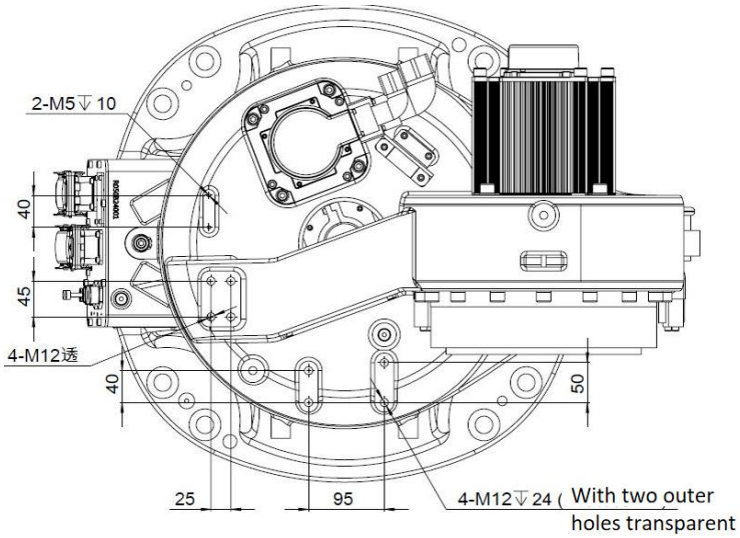


Figure 724: Shoulder Interface Dimensions of RX3-A650-2260/RX3-A680-2260/RX3-A635-2700/RX3-A620-3100 Operating Units

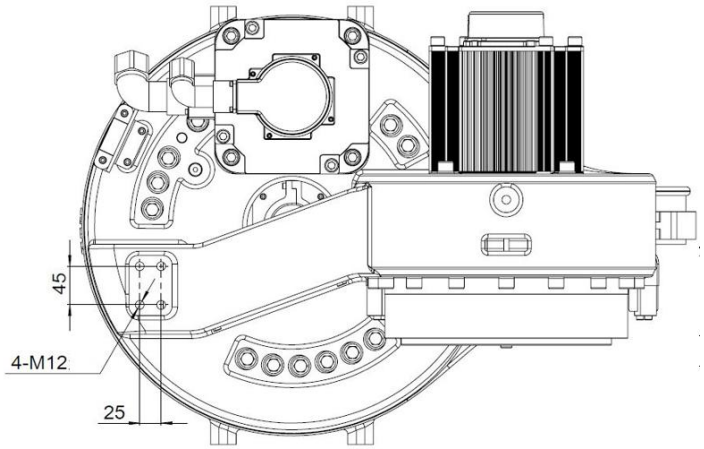


Figure 725: Shoulder Interface Dimensions of RX3-A650-2700/RX3-A680-2560 Operating Units

Warning	When installing equipment, the screws must be properly sized according to the thread hole depth. Exceeding the recommended installation length is strictly prohibited, as it may damage internal components or cables of the manipulator.

The above components are designed for cable fixation. If equipment installation is required, ensure:

- Forearm load + wrist load <80kg (RX3-A680-2260/RX3-A680-2560)
- Forearm load + wrist load <50kg (RX3-A650-2260/RX3-A650-2700)
- Forearm load + wrist load <35kg (RX3-A635-2700)
- Forearm load + wrist load <20kg (RX3-A620-3100)
- Shoulder load + upper arm load + elbow load <20kg

When installing the equipment, ensure reliable installation. Use 12.9-grade screws with the specified torque and apply thread sealant to the threads. Failure to do so may cause loosening or even fracture during long-term operation, potentially leading to accidents.

8 Calibration of each axis of load operating machine

8.1 Summary

This chapter introduces the situation of the manipulator needs to be calibrated and the zero point calibration method under different requirements.

8.2 When to calibrate

The operator must recalibrate when any of the following conditions occur:

- There have been some repairs such as motor replacement or pulley disassembly.
- The encoder battery has been replaced.
- The motor encoder wire is loose or reinstalled.
- The manipulator has experienced a strong collision.
- The control cabinet or system (e.g., industrial PC) has been replaced.

8.3 Calibrate axis positions

The calibration positions of each axis on the manipulator are shown in Figures 81 to 85. Except for the J2 axis calibrated at-90°, all other axes are set to 0°.

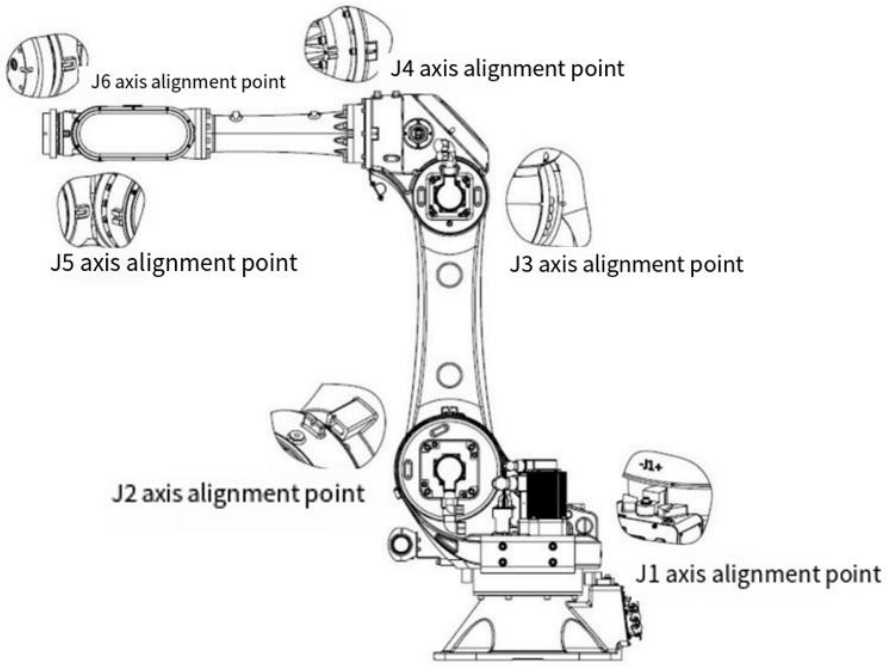


Figure 81 Schematic diagram of zero points for each axis of RX3-A650-2260/RX3-A680-2260

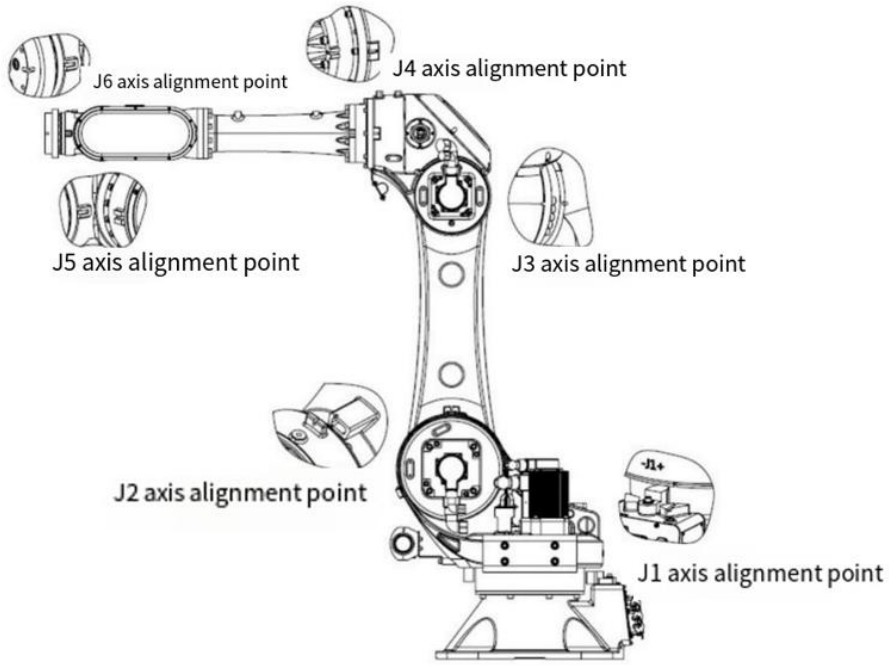


Figure 82: Zero Point Diagram of Each Axis for RX3-A650-2700

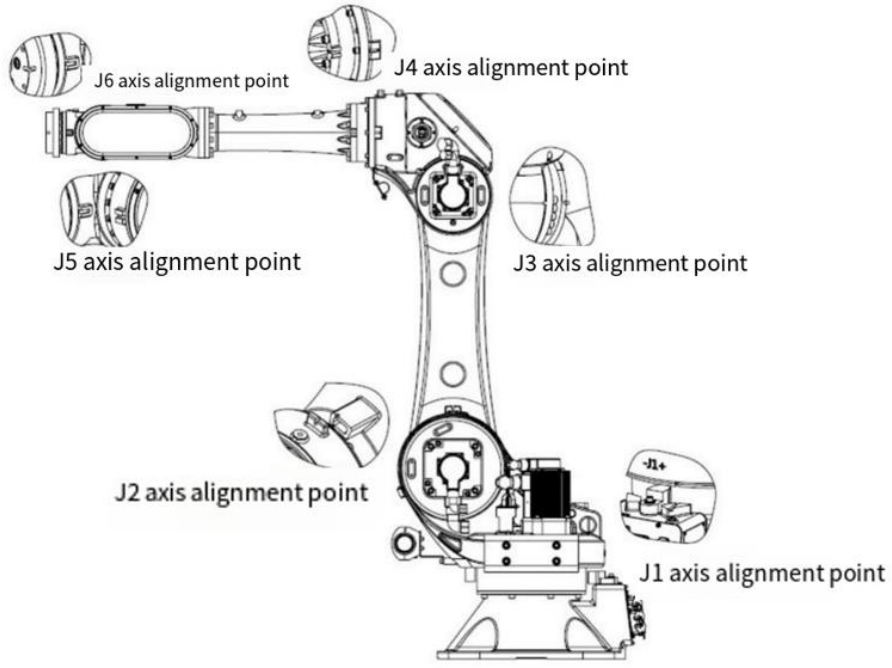


Figure 83: Zero Point Diagram of Each Axis for RX3-A680-2560

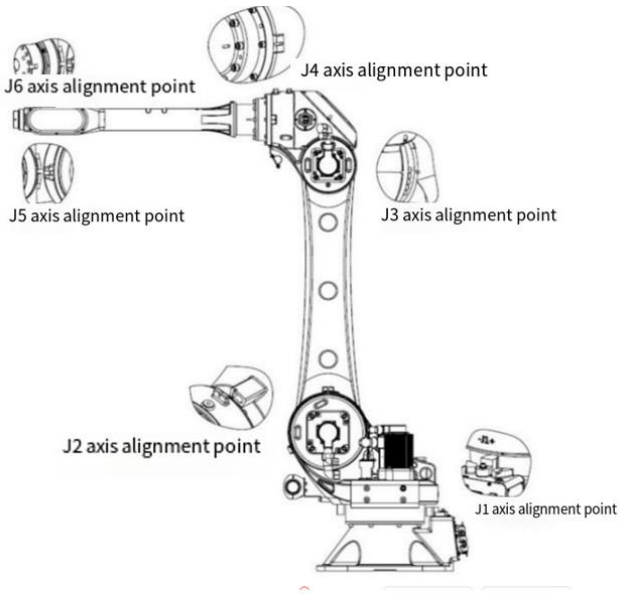


Figure 84: Schematic diagram of zero points for each axis of RX3-A635-2700

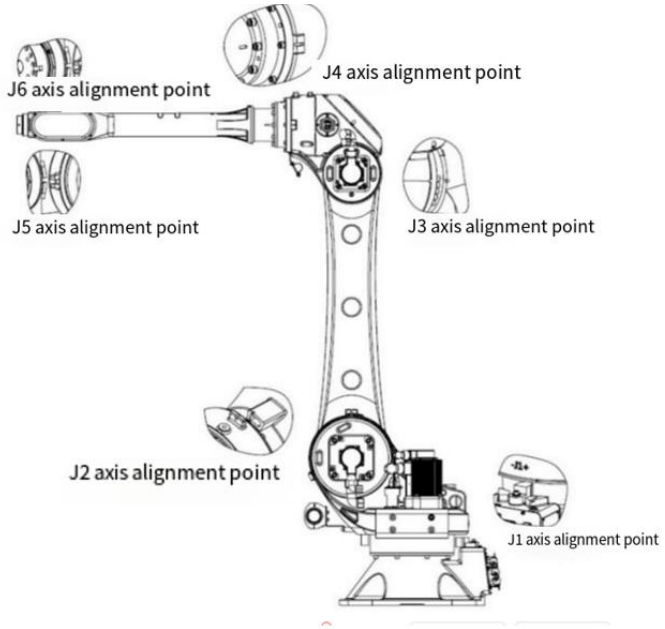


Figure 85: Zero Point Diagram of Each Axis for RX3-A620-3100

Attention	■ Robot calibration must always be carried out under the same temperature condition to avoid the error caused by thermal expansion and contraction. ■ The calibration of industrial robot must be carried out from J1 axis to J6 axis in sequence.

Calibration with High Repeatability and Precision

During operation, the manipulator only requires high repeatability positioning accuracy, with no specific path positioning precision requirements. As shown in Figure 81, the zero points of each axis are aligned visually, as illustrated in Figure 86.

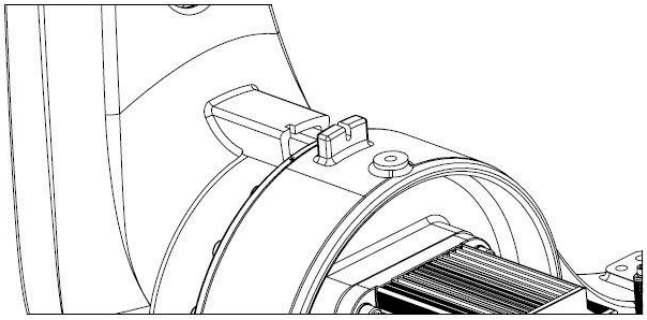


Figure 86 shows the zero-point calibration method for visual inspection of the load

Warning	During the calibration process, the speed should be minimized, and the operator must not enter the robot's operational range. After each stop, verify that the zero mark on the axis is properly aligned.

Calibration of Path Positioning Accuracy with Rough Requirements

When a rough requirement for path positioning accuracy is needed, calibration blocks are used for calibration, as shown in Figure 87.

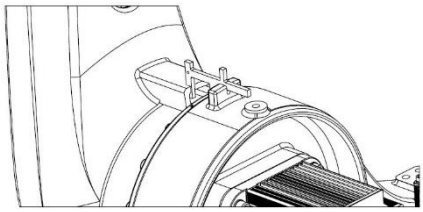


Figure 87 Zero Point Calibration Block Calibration Method

Warning	During the calibration process, the speed should be minimized, and the operator must not enter the robot's operational range. After each stop, verify that the zero mark on the axis is properly aligned.
Attention	For calibrating the manipulator using calibration blocks, first visually check that the calibration slots are properly aligned. Reduce the manipulator's speed to the lowest manual setting, then fine-tune the axis position. After multiple adjustments, insert the calibration block into both calibration slots simultaneously, as shown in Figure 87.

Calibration for High Path Positioning Accuracy

When the manipulator requires high path positioning accuracy, precise calibration and compensation of each axis' angles and lengths are necessary. For this purpose, contact our company to use specialized equipment for calibration.

9 Transport and handling of heavy load manipulators

Attention	When handling the manipulator, install the matching lifting bracket. Improper handling methods may cause damage to the manipulator. The manipulator's posture during handling should follow the description in Chapter 9.1 of this manual. The precautions for handling the manipulator are shown in Figure 9.1.

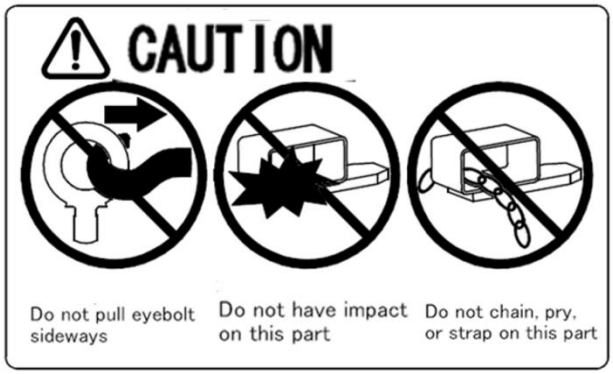


Figure 91 Precautions for the manipulator during handling

When handling robots, the following precautions should be observed:

- Do not pull the sling ring screw to the side.
- Do not use the clamping force of forklift crane to impact the transport components.
- Do not hang chains or similar items on the transported components.

9.1 Handling attitude

The attitude of the manipulator with load from 1 to 6 axes is shown in Figure 92 to Figure 96 and Table 91 to Table 95.

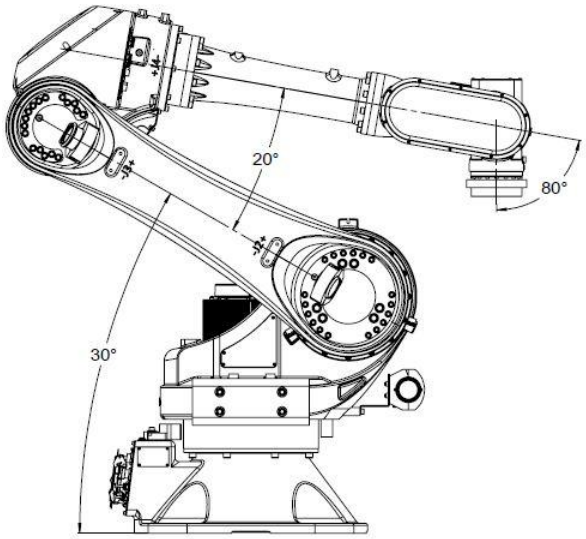


Figure 92: Manipulator Pose Diagram for RX3-A650-2260/RX3-A680-2260

Table 91: Angular Values of Each Axis During Robot Handling for RX3-A650-2260/RX3-A680-2260

A1	**A2**	**A3**	**A4**	**A5**	**A6**
0	-60°	160°	0	80°	0

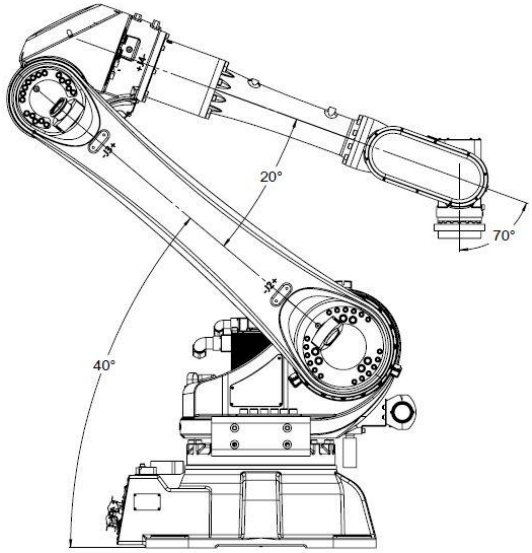


Figure 93: Manipulator Pose Diagram of RX3-A650-2700

Table 92: Angular Values of Each Axis During Robot Handling for RX3-A650-2700

A1	**A2**	**A3**	**A4**	**A5**	**A6**
0	-50°	160°	0	70°	0

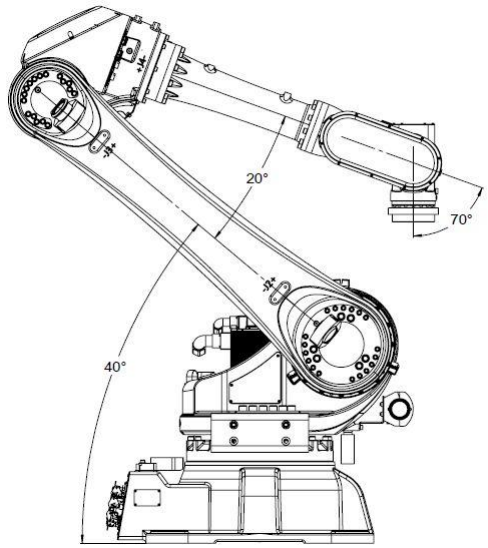


Figure 94: Manipulator Pose Diagram of RX3-A680-2560

Table 93: Angular Values of Each Axis During Robot Handling for RX3-A680-2560

A1	**A2**	**A3**	**A4**	**A5**	**A6**
0	-50°	160°	0	70°	0

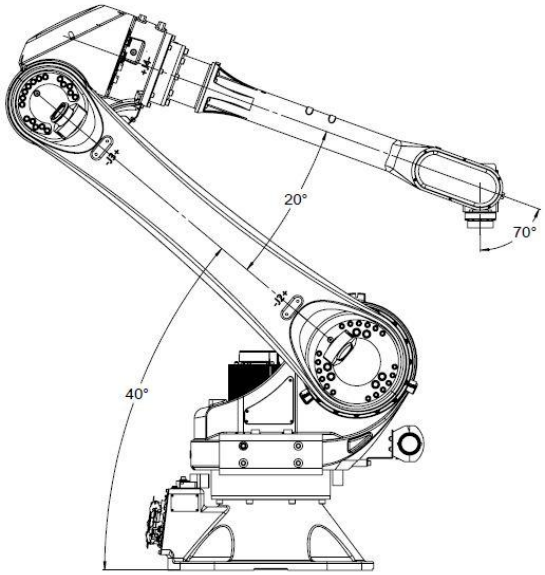


Figure 95: Manipulator Pose Diagram of RX3-A635-2700

Table 94: Angular Values of Each Axis During Robot Handling for RX3-A635-2700

A1	**A2**	**A3**	**A4**	**A5**	**A6**
0	-50°	160°	0	70°	0

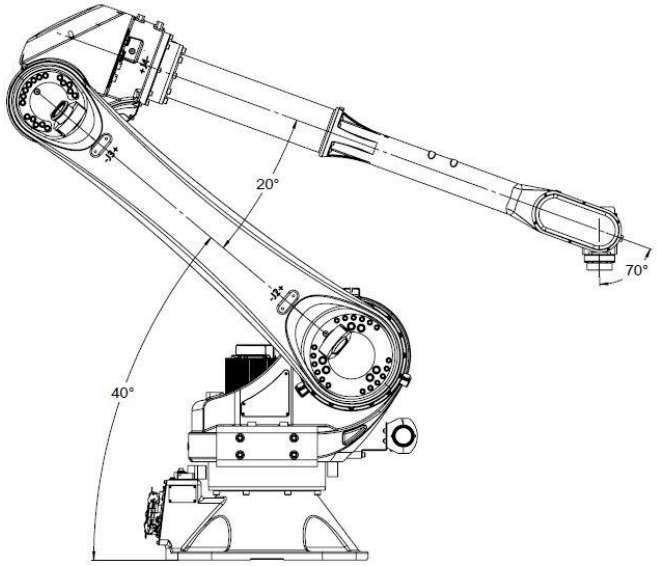


Figure 96: Manipulator Pose Diagram of RX3-A620-3100

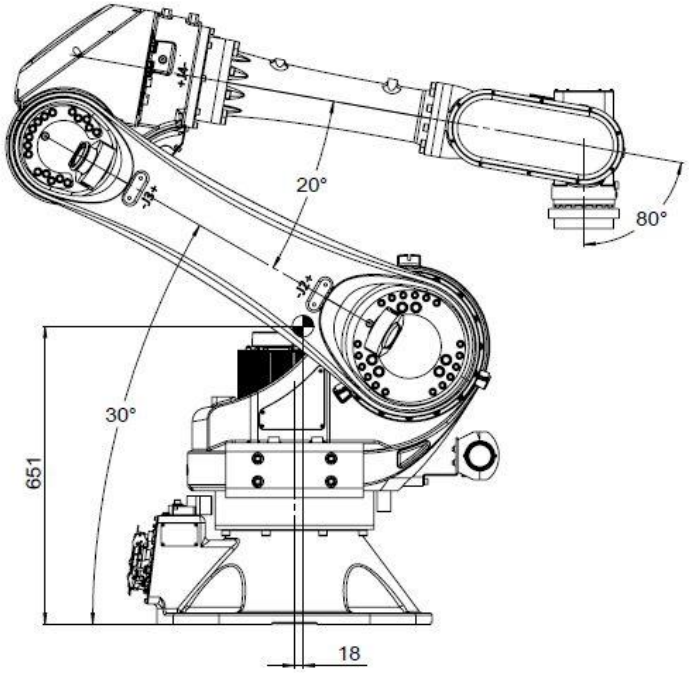
Table 95: Angular Values of Each Axis During Robot Handling for RX3-A620-3100

A1	**A2**	**A3**	**A4**	**A5**	**A6**
0	-50°	160°	0	70°	0

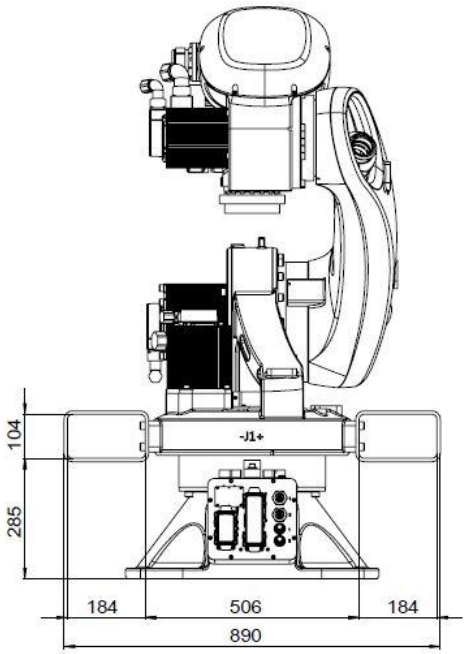
The manipulator must be handled strictly according to the table posture, otherwise it may tip over due to unstable center of gravity.

9.2 **Handling size**

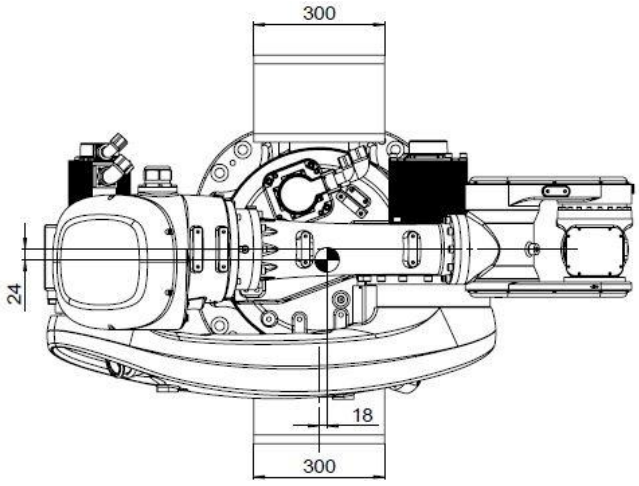
The dimensions of the manipulator's three-view drawings during handling are shown in Figures 97 to 911 (note that actual measurements may be slightly larger than those in the drawings).



(a)

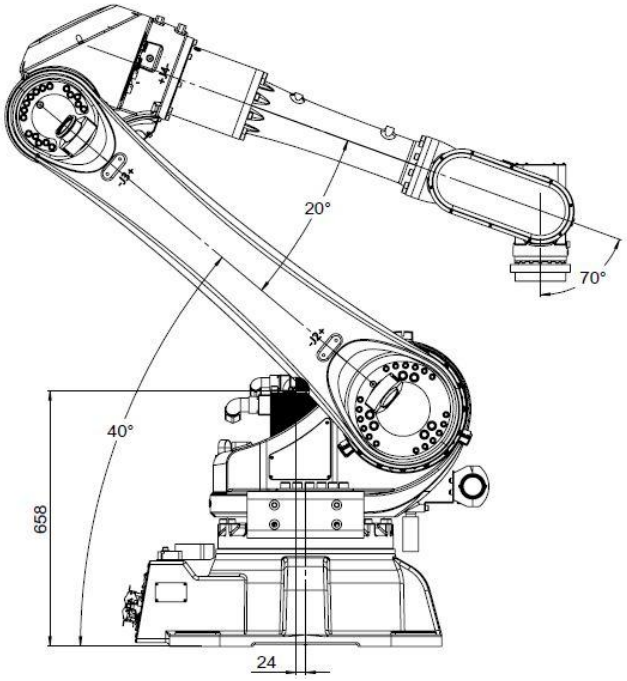


(b)

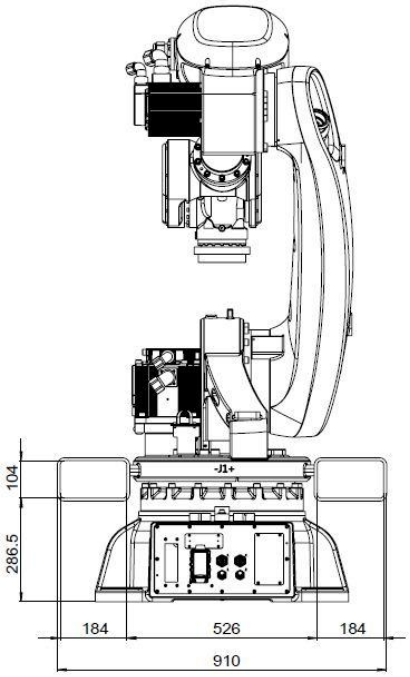


(c)

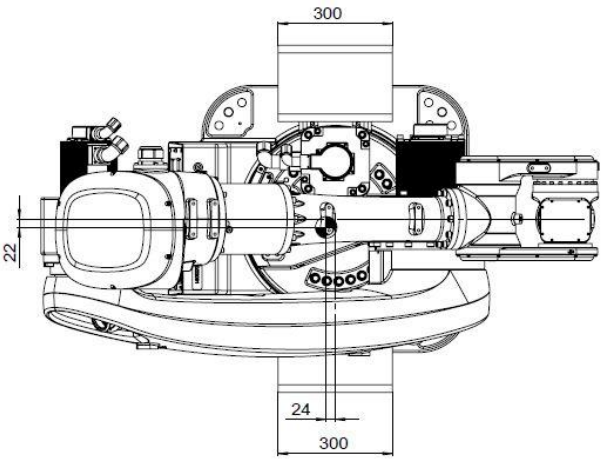
Figure 97: Operating dimensions of the RX3-A650-2260/RX3-A680-2260 handling machine



(a)

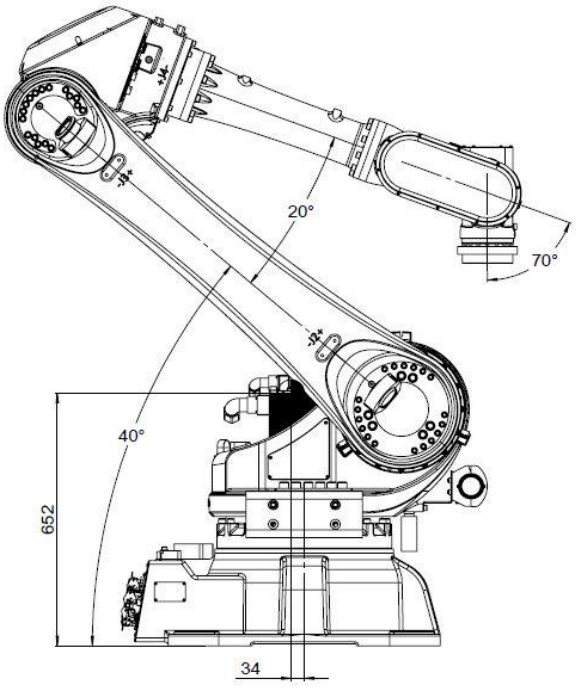


(b)

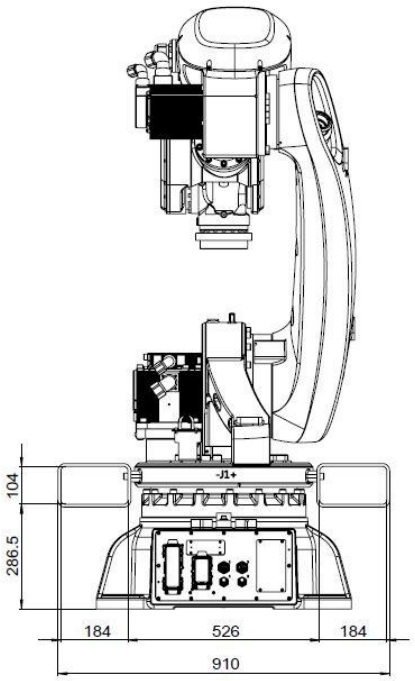


(c)

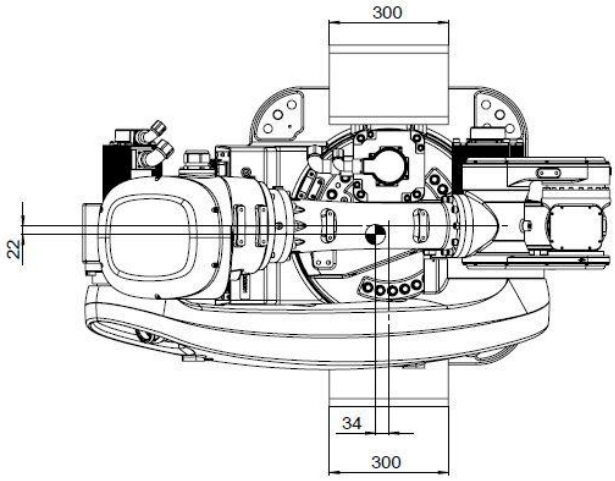
Figure 98: Operating Machine Dimensions for RX3-A650-2700 During Handling



(a)

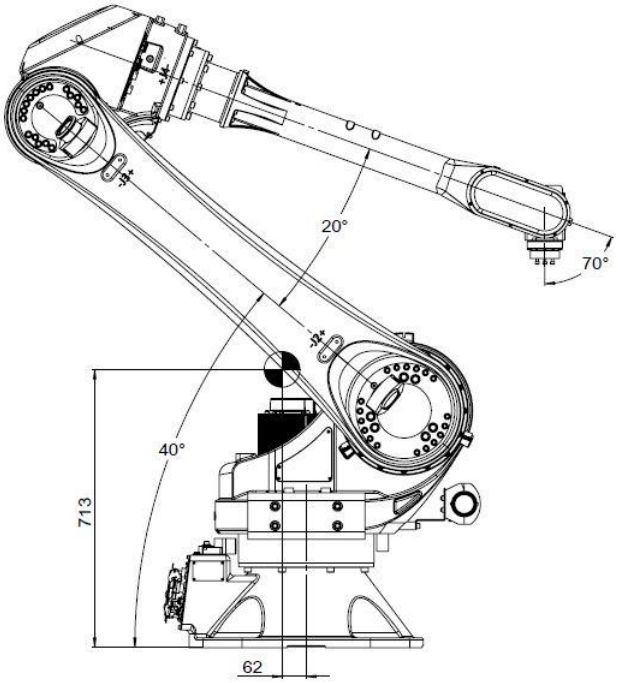


(b)

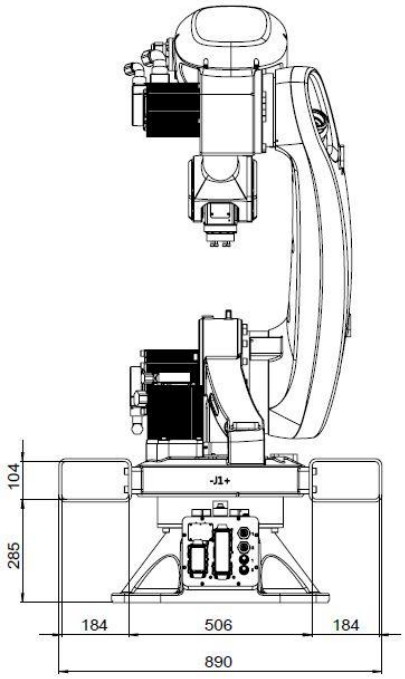


(c)

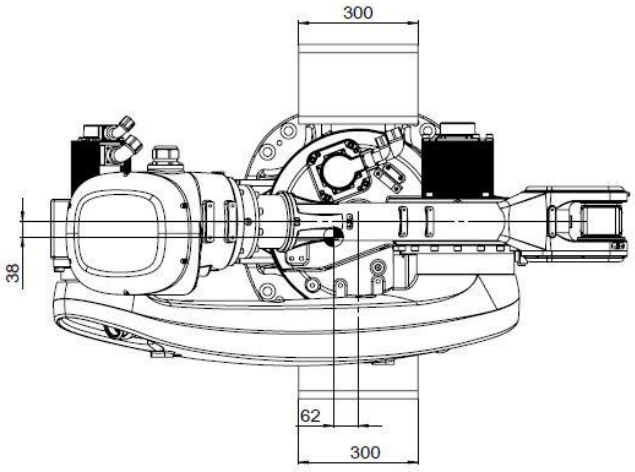
Figure 99: Operating dimensions of the RX3-A680-2560 handling machine



(a)

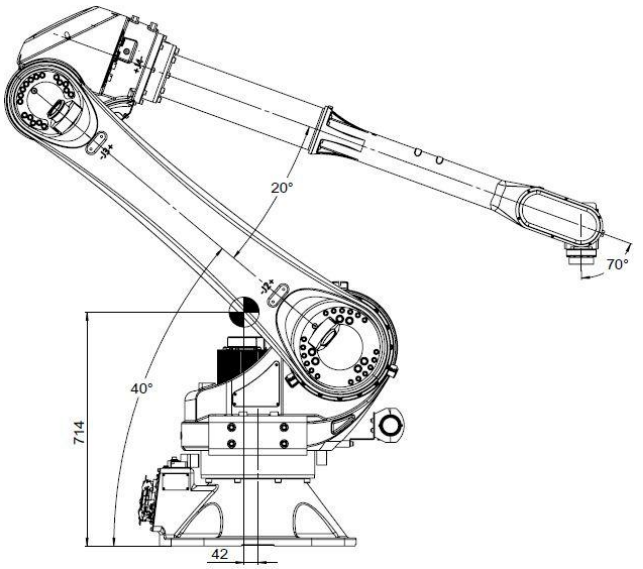


(b)

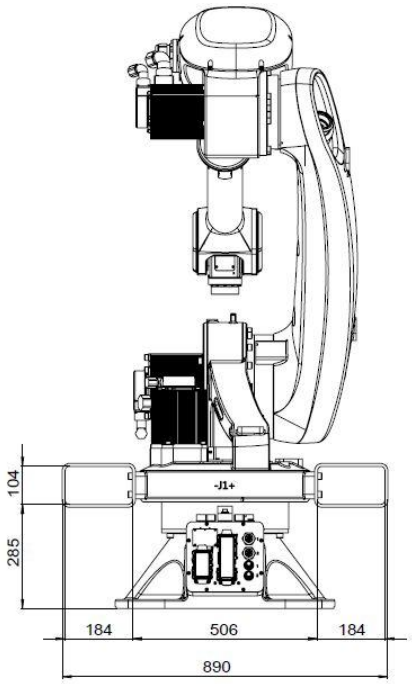


(c)

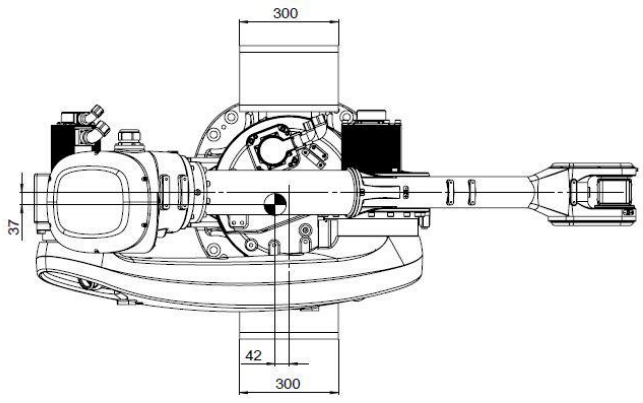
Figure 910: Dimensions of the manipulator for handling RX3-A635-2700



(a)



(b)



(c)

Figure 911: Dimensions of the manipulator for handling the RX3-A620-3100

9.3 Forklift handling

The forklift handling schematic is shown in Figures 912 and 913. The forklift must meet the weight requirements of the manipulator.

- The total weight of the RX3-A650-2260 manipulator and its handling device is approximately 595 kg.
- The total weight of the RX3-A680-2260 manipulator and its handling device is approximately 600 kg.
- The total weight of the RX3-A680-2560 manipulator and its handling device is approximately 755 kg.
- The total weight of the RX3-A650-2700 manipulator and its handling device is approximately 770 kg.
- The total weight of the RX3-A635-2700 manipulator and its handling device is approximately 570 kg.
- The total weight of the RX3-A620-3100 manipulator and its handling device is approximately 575 kg.

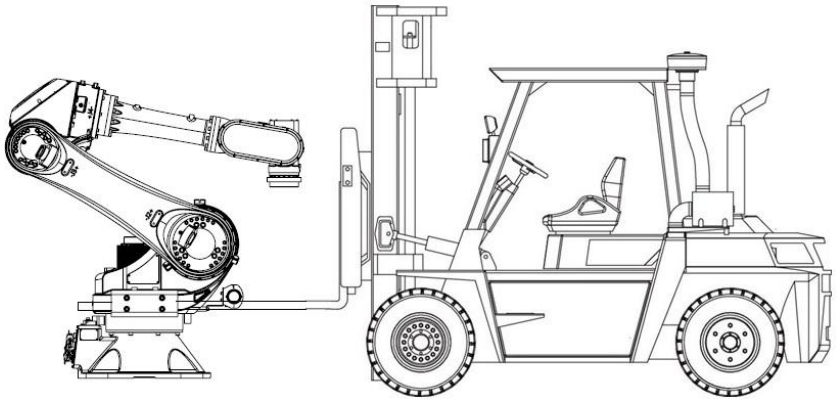


Figure 9: Forklift handling diagram for models RX3-A650-2260, RX3-A680-2260, RX3-A635-2700, and RX3-A620-3100

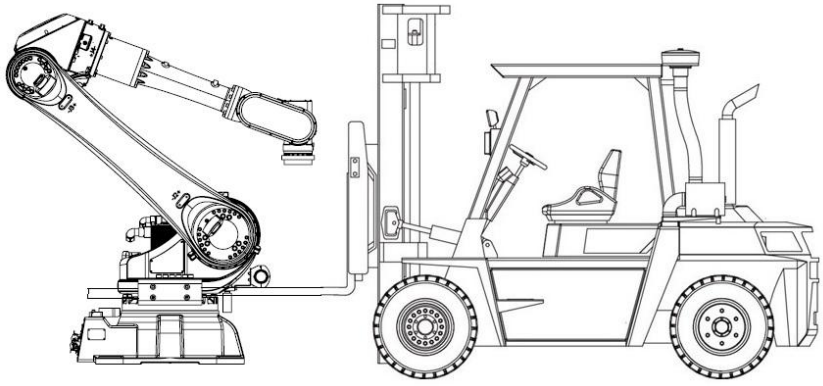


Figure 9: Schematic diagram of forklift handling for RX3-A650-2700/RX3-A680-2560 models

Attention	When handling the manipulator, install the matching transport bracket. Improper handling methods may cause damage to the manipulator. The manipulator's posture during handling shall comply with the description in Section 9.1 of this manual.

9.4 **Ring lifting**

The schematic diagram of the manipulator using lifting rings is shown in Figures 914 and 915. The lifting device must meet the weight requirements of the manipulator.

- The total weight of the RX3-A650-2260 manipulator and its handling device is approximately 595 kg.
- The total weight of the RX3-A680-2260 manipulator and its handling device is approximately 600 kg.
- The total weight of the RX3-A680-2560 manipulator and its handling device is approximately 755 kg.
- The total weight of the RX3-A650-2700 manipulator and its handling device is approximately 770 kg.
- The total weight of the RX3-A635-2700 manipulator and its handling device is approximately 570 kg.
- The total weight of the RX3-A620-3100 manipulator and its handling device is approximately 575 kg.

The lifting ring is made of 20 or 25 grade steel. The lifting ring specifications for the RX3-A650-2260/RX3-A680-2260/RX3-A635-2700/RX3-A620-3100 manipulators are M12, while those for the RX3-A650-2700/RX3-A680-2560 manipulators are M24.

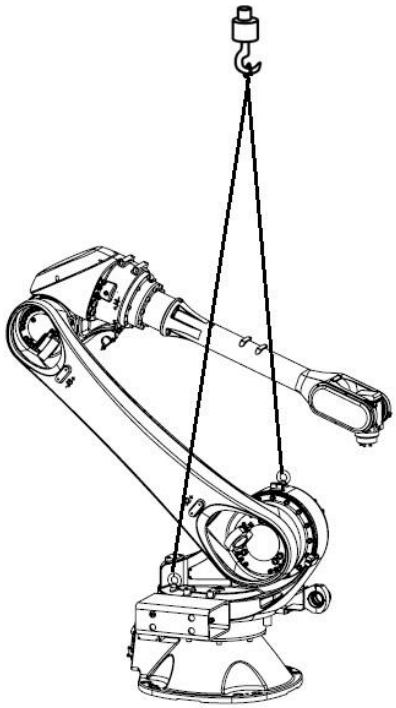


Figure 914 Schematic diagram of sling handling for RX3-A650-2260/RX3-A680-2260/RX3-A635-2700/RX3-A620-3100

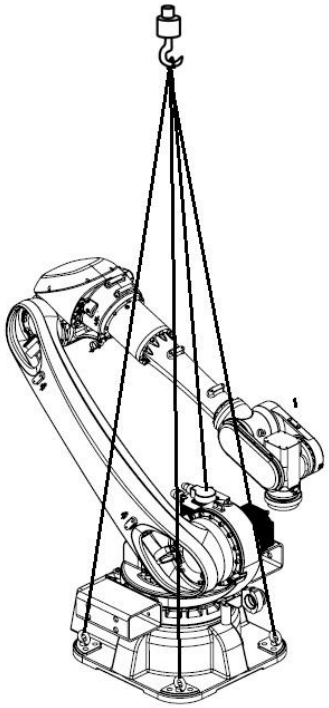


Figure 9: Schematic diagram of sling handling for RX3-A650-2700/RX3-A680-2560

Attention	■ When the manipulator is handled by lifting ring, a soft object is inserted between the lifting rope and the manipulator to prevent the rope from scratching the manipulator. ■ The manipulator may tip over when handled with lifting rings. Exercise extreme caution to maintain its stability during handling. ■ Do not pull the rings sideways to avoid damaging the manipulator and causing unexpected malfunctions.

10 General rules of maintenance

This manual provides guidelines for preventive maintenance of the manipulator. For a complete industrial robot system, the following should also be included:

- Control cabinet maintenance—refer to the Control Cabinet Maintenance Manual.
- End effector maintenance – refer to the manual.

	■ No maintenance work should be performed before reading the Safety Guidelines and Safety Precautions, and maintenance work should only be performed by properly trained technicians. ■ The primary objective of preventive maintenance is to ensure the optimal utilization of the operator system. Each scheduled and properly executed routine maintenance should contribute to achieving this goal. If routine maintenance fails to reduce equipment downtime, it constitutes unnecessary maintenance and represents a waste of resources. ■ Robot systems are designed to operate under highly demanding conditions with minimal maintenance requirements. Nevertheless, routine inspections and periodic maintenance must be performed according to specified intervals. ■ The time interval in the maintenance table is the recommended value. The actual time interval required by the maintenance operation machine may vary depending on factors such as the machine's working environment. ■ When performing routine maintenance, it is essential to keep numerous preventive measures in mind to avoid introducing additional errors or hazards into the system. ■ For well-functioning equipment, do not perform more maintenance than required. ■ All surfaces should be wiped clean before starting the maintenance procedure. ■ To prevent unnecessary contamination from dust and other debris, the exterior of the control cabinet door and the operation machine cover should be cleaned thoroughly before opening them.

11 Maintenance Project

11.1 Maintenance overhaul

During daily operation of the machine, the following items should be inspected as shown in Table 111.

Table 111 Daily Maintenance Items for the Operator

Order number	Inspection item	Check the key points
1	vibration, sound, motor heating	Are there any abnormal vibrations or noises on the shafts, and is the motor temperature abnormally high?
2	Presence or absence of positional accuracy changes	Check if the current startup position differs from the last one and if the stop position is off.
3	peripheral action confirmation	Verify that the actions of the controller and peripheral devices match the instructions

11.2 First maintenance

The following items for inspection and maintenance shall be performed when the operator console has been in operation for 320 hours or 1 month (whichever is shorter), as shown in Table 112.

Table 112 First Maintenance Items for the Operator

Order number	Inspection item	Check the key points
1	Check for any abnormal damage to the operator cable and its sheath, and ensure the motor connector is not loose.	Inspect the cable moving parts of the manipulator to check for damage, localized bending or twisting; examine whether the cable sheath is damaged; verify if the motor connector is loose (Note 1)
2	Tighten the main external bolts	Torque wrench to tighten the end effector mounting bolts and external main bolts (Note 2)
3	Clean all parts of the operating machine	Clean and maintain all parts of the manipulator, and inspect for any damage (Note 3).
4	Is the end effector cable damaged?	Check for cable damage and sheath damage
5	Is the synchronous belt worn?	Check for wear, elongation, or breakage of the synchronization belt (Note 4)
6	Check whether the limit rubber blocks at the J1, J2, J3, and J5 shafts are damaged.	Check whether the limit rubber block has issues such as loosening, impact damage, or aging.

Note 1:

maintenance area

- Remove the internal cables and cable sheaths from the operator console base (requires removal of the electrical panel).
- The cable and cable sheath inside the main body of the J1 shaft and the arm of the manipulator.
- Operator cable, grounding terminal, user cable connector.

Confirmation items

- Inspect the circuit sheath for cracks or wear. Replace it if damaged.
- Check if the grease on the cables inside the J1 shaft and the main arm has worn off. If it's about to run out, replenish it.
- Check if the wiring is worn. If the internal wires are visible, replace them.
- Circular connector: Turn it by hand to check for looseness.
- Square heavy load: Check if the control lever is detached.
- Ground terminal: Check for looseness.

Note 2:

Fastening area

- The installation bolts of the end effector and the operation machine fixing bolts are tightened.
- External connection screws of the manipulator, especially those connecting the shafts to the reducer or gearbox.
- For the tightening torque, refer to the recommended values in the appendix of this manual.

Note 3:

About cleaning

- Regular cleaning should be performed for areas requiring cleaning, dust accumulation on surfaces, and buildup of splashes.
- Special attention must be paid to the cleanliness of the J5-axis rotation area of the wrist, with timely removal of debris.
- Check for oil leakage from the reducer or gearbox.
- If oil is still visible after one day of wiping it off, there may be a leak.

Note 4:

On Synchronization Belt Maintenance

- After removing the operator cover plate, inspect the timing belt for wear or damage. For removal instructions, refer to Section 12.5 of this manual.
- Observe whether white hair is produced on the inner side of the synchronous belt, whether the side of the belt is worn, whether the teeth of the belt are crushed, whether the belt body is broken, whether the belt body is elongated (pre-tightening force decreased) and so on.

11.3 **Maintenance routine**

960 hours (3 months) of regular maintenance

The operator must perform the following inspection and maintenance items every 960 hours of operation or every 3 months (whichever is shorter), as shown in Table 113.

Table 113 Maintenance Items for 960 Hours (3 Months) of the Operator

order number	inspection item	Check the key points
1	Clean the ventilation port of the control cabinet	Remove the accumulated dust from the ventilation outlet of the control cabinet.
2	Clean the operator	Remove dirt, debris, dust, and cuttings that have accumulated.

1920 hours (6 months) of scheduled maintenance

The operator must perform the following inspection and maintenance items every 1920 hours of operation or 6 months (whichever is shorter), as shown in Table 114.

Table 114 Operation Machine 1920-hour (6-month) Maintenance Items

order number	inspection item	Check the key points
1	Check for damage to the operator cable and its sheath	See Chapter 11.2
2	Is the synchronous belt worn?	Check for wear, elongation, or breakage of the synchronization belt

3840 hours (1 year) of scheduled maintenance

The operator must perform the following inspection and maintenance items every 3,840 hours of operation or 1 year (whichever is shorter), as shown in Table 115.

Table 115 Maintenance Items for 3840 Hours (1 Year) of the Operator

order number	inspection item	Check the key points
1	Check for damage to the operator cable and its sheath	See Chapter 11.2
2	Tighten the main external bolts	See Chapter 11.2
3	Clean all parts of the operating machine	See Chapter 11.2
4	Is the end effector cable damaged?	See Chapter 11.2
5	Change the sync belt	See Chapter 11.2
6	Is the J1 shaft limit rubber block damaged?	See Chapter 11.2

7860 hours (2 years) of scheduled maintenance

The operator must perform the following inspection and maintenance items every 2 years or 7,860 hours (whichever comes first), as shown in Table 116.

Table 116 Maintenance Items for 7860 Hours (2 Years) of the Operator

order number	inspection item	Check the key points
1	Replace the battery	See Chapter 12.3

11,520 hours (3 years) of scheduled maintenance

The operator must perform the following inspection and maintenance items every 3 years or 11,520 hours (whichever comes first), as shown in Table 117.

Table 117 Operation Machine 11520-hour (3-year) Maintenance Items

order number	inspection item	Check the key points
1	Change the sync belt	See Chapter 11.2

15,360 hours (4 years) of scheduled maintenance

The operator must perform the following inspection and maintenance items every 4 years or 15,360 hours (whichever comes first), as shown in Table 118.

Table 118 Maintenance Items for 15360 Hours (4 Years) of the Operator

order number	inspection item	Check the key points
1	Replace the internal cables of the manipulator	To replace the operator cable, contact our company

19,200 hours (5 years) of scheduled maintenance

The operator must perform a major overhaul every 5 years or 19,200 hours (whichever comes first), during which many components need to be replaced. Please contact our company for details as shown in Table 119.

Table 119 Operation Machine 19200 Hours (5 Years) Maintenance Items

order number	inspection item	Check the key points
1	main overhaul of operator machine	Contact our company

12 Project maintenance process

12.1 Cleaning manipulator

To ensure long-term operation of the robot, the manipulator should be cleaned periodically every 960 hours or 3 months (whichever is shorter).

Cleaning steps:

Step1、Adjust the robot to calibration state.

Step2、To prevent hazards, disconnect the power, hydraulic, and pneumatic supplies to the robot.

Step3、Clean the manipulator using a vacuum cleaner or wipe it with a cloth.

Step4、Ensure all safety conditions are met before proceeding with the manipulator.

Warning	■ The use of water jets on the operating machine is prohibited, especially at joints, seals, or cable entry/exit points. ■ Do not use compressed air to clean the manipulator. ■ Do not remove any protective devices of the manipulator. ■ Solvent cleaning of the operating machine is prohibited.

12.2 Maintenance cable

To ensure long-term operation of the robot, the manipulator cables should be inspected every 1920 hours or 6 months (whichever comes first), as shown in the cable layout diagrams (Figures 121-123).

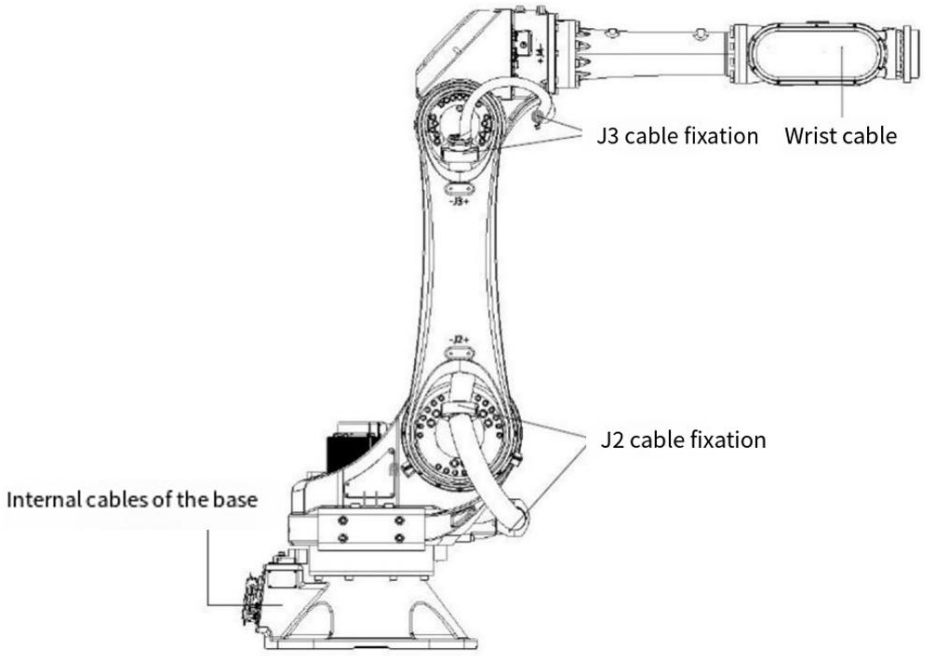


Figure 121: Schematic diagram of cable layout for RX3-A650-2260/RX3-A680-2260 operator console

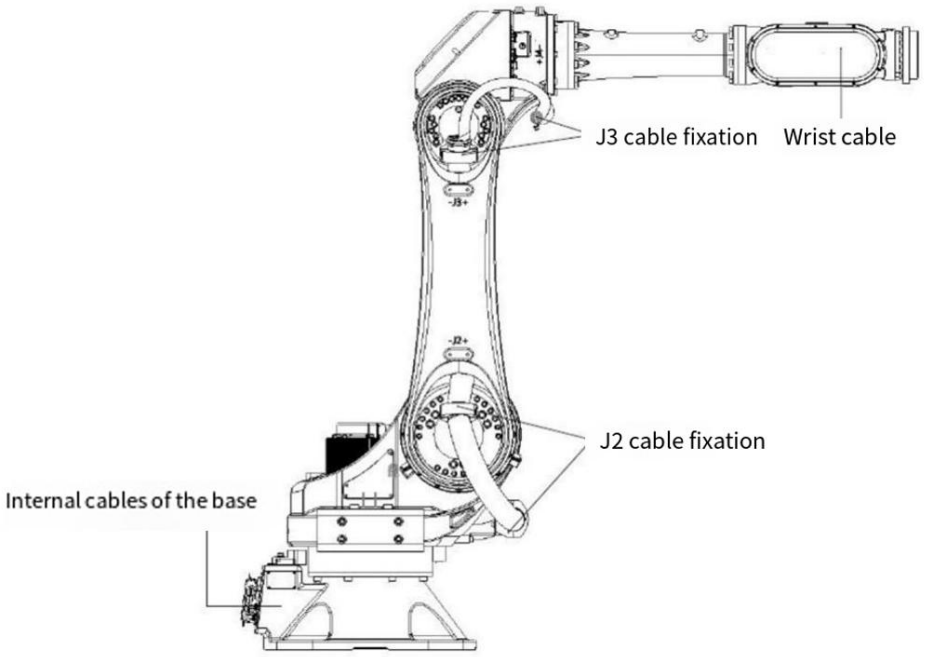


Figure 122: Cable Layout Diagram of RX3-A650-2700/RX3-A680-2560 Operator Console

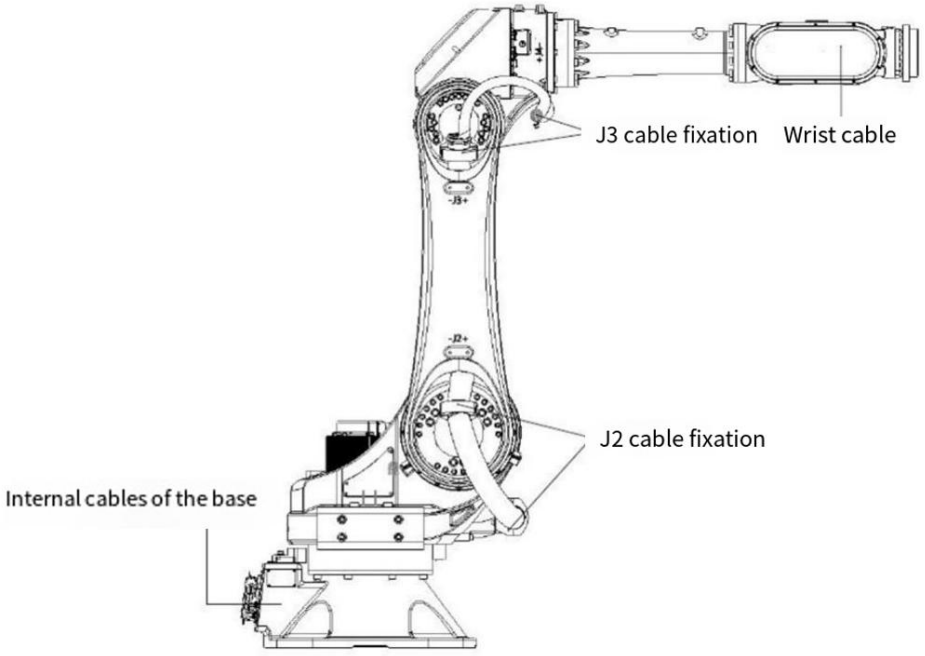


Figure 123: Schematic diagram of cable layout for RX3-A635-2700/RX3-A620-3100 operator console

Repair the external cable.

Maintenance steps:

Step1、Adjust the robot's J1 to J6 axes to 0°,0°,90°,0°,0°, and 0°.

Step2、To prevent hazards, disconnect the power, hydraulic, and pneumatic systems connected to the manipulator.

Step3、Examine all external cables visually for signs of wear or damage.

Step4、Check all cable connectors for integrity.

Step5、Check all stents and restraints are properly secured to the operating table.

Step6、Check for wear or damage at the cable and bracket fixation points.

Step7、If cracks, wear, or damage are found, contact our company immediately for replacement.

Inspection of internal cables in the base

Maintenance steps:

Step1、Remove the electrical panel as shown in Figure 124 or Figure 125, then unplug the internal cables from the base.

Step2、Check whether the stent has securely fixed the cable to the operating machine.

Step3、Check for wear or damage at the cable and bracket fixation points.

Step4、Check the internal cables for wear or damage.

Step5、If cracks, wear, or damage are found, contact our company immediately for replacement.

Step6、Check if the grease on the surface of the internal cable has disappeared.

Step7、If the grease on the cable surface disappears, it should be replenished promptly.

Step8、Insert the cable into the base while maintaining the U-shape as shown in Figures 124 and 125.

Step9、Install the electrical mounting panel and apply sealant to the interface between the panel and the base casting.

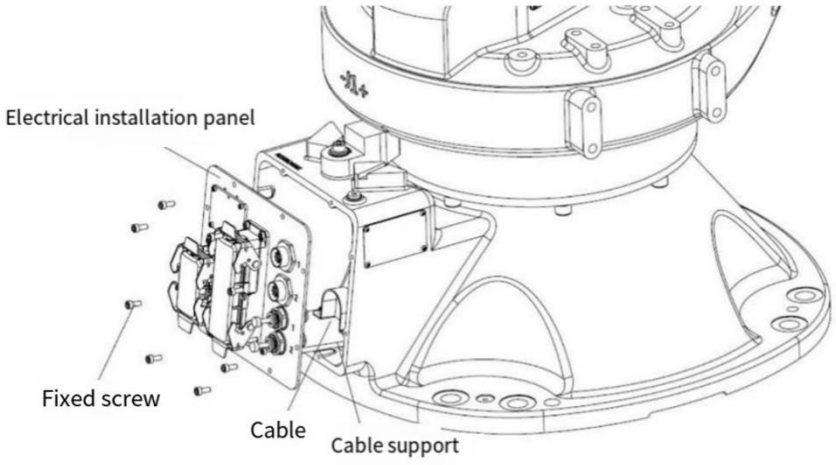


Figure 124: Internal cable layout of the RX3-A650-2260/RX3-A680-2260/RX3-A635-2700/RX3-A620-3100 bases

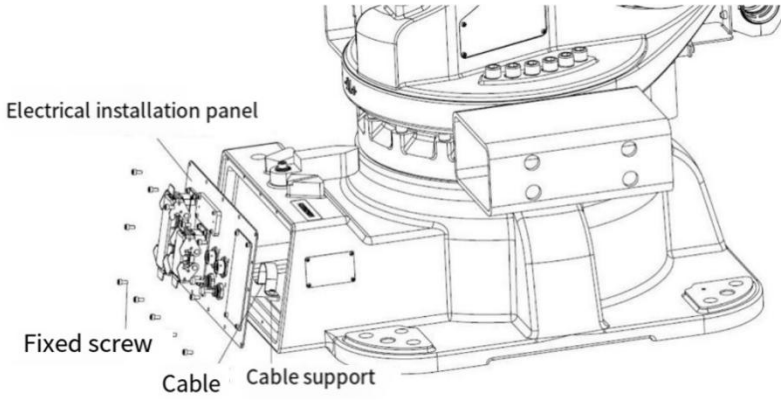
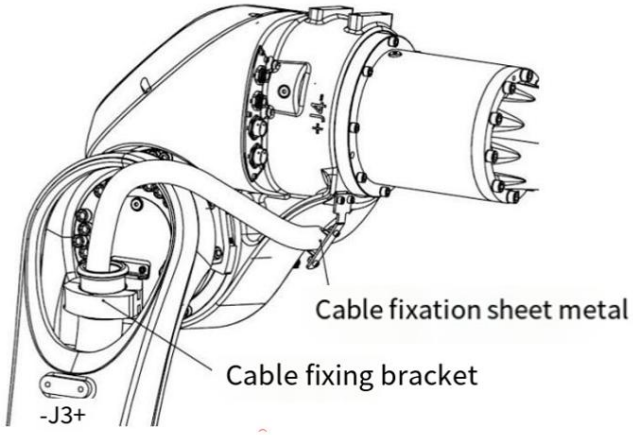
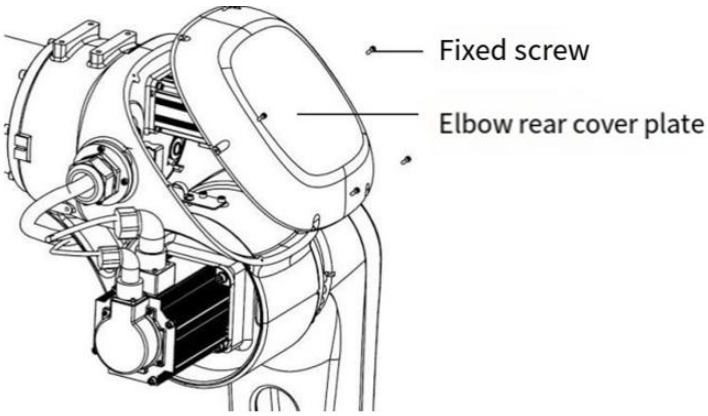


Figure 125: Internal Cable Harness of RX3-A650-2700/RX3-A680-2560 Base

Repair the internal cable in the elbow



(a)



(b)

Figure 126 Internal cable of the elbow

Maintenance steps:

Step1、Remove the rear elbow cover, cable mounting bracket, and cable mounting sheet metal as shown in Figure 126.

Step2、Remove the cable and verify its secure connection to the mounting plate.

Step3、Check for wear or damage at the cable and bracket fixation points.

Step4、Check the internal cables for wear or damage.

Step5、If cracks, wear, or damage are found, contact our company immediately for replacement.

Step6、Check if the grease on the surface of the internal cable has disappeared.

Step7、If the grease on the cable surface disappears, it should be replenished promptly.

Step8、Insert the cable into the elbow.

Step9、Install the cable fixing seat, cable fixing sheet metal and elbow rear cover plate.

Repair the internal cables in the wrist area

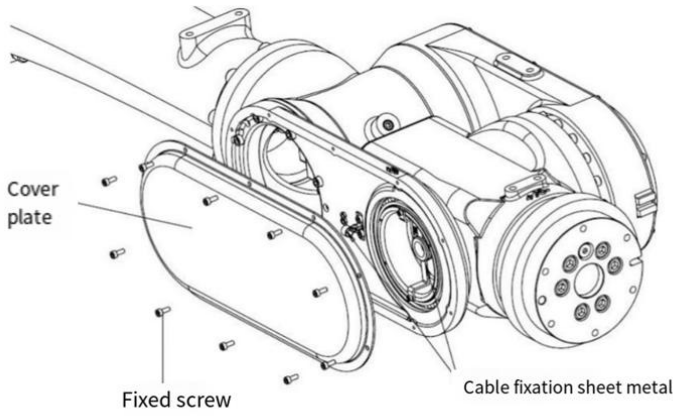


Figure 127 Internal cable of the wrist for RX3-A650-2260/RX3-A680-2260/RX3-A650-2700/RX3-A680-2560

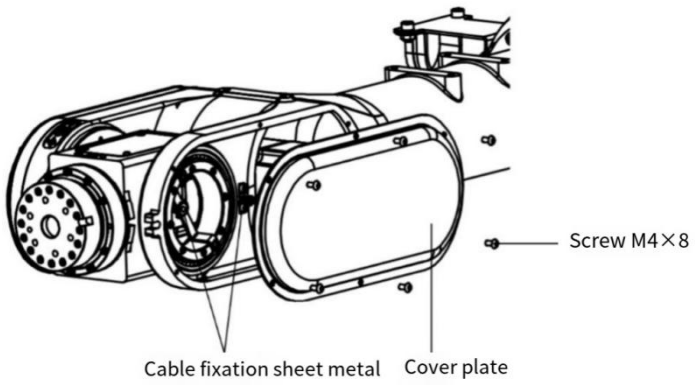


Figure 128 RX3-A635-2700/RX3-A620-3100 internal wrist cable

Maintenance steps:

Step1、Remove the cover plate as shown in Figure 127 or Figure 128.

Step2、Check for wear or damage at the cable shaft fixation point.

Step3、Check the internal cables for wear or damage.

Step4、If cracks, wear, or damage are found, contact our company immediately for replacement.

Step5、Check if the grease on the surface of the internal cable has disappeared.

Step6、If the grease on the cable surface disappears, it should be replenished promptly.

Step7、Install the cover plate and apply sealant to the interface between the cover plate and the forearm.

Warning	Please entrust the replacement of internal cables in the manipulator to our service department. Using non-compliant cables may cause the robot to malfunction.

12.3 **Replace the battery**

The position data of each axis in the manipulator is stored in the encoder battery. The battery should be replaced promptly after 7860 hours of operation or 2 years (whichever comes first).

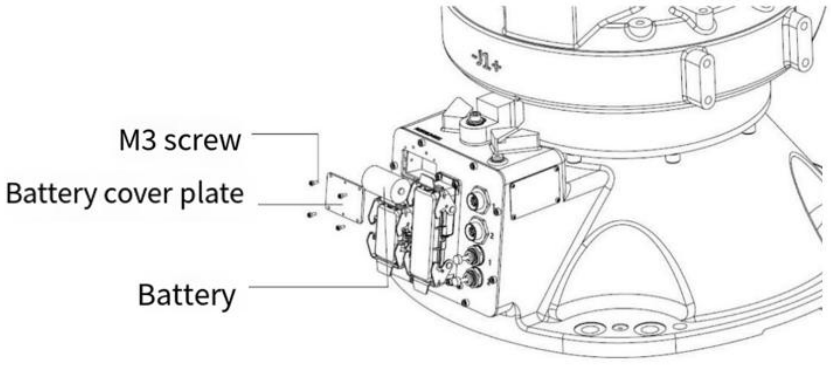


Figure 129: Battery Replacement for RX3-A650-2260/RX3-A680-2260/RX3-A635-2700/RX3-A620-3100

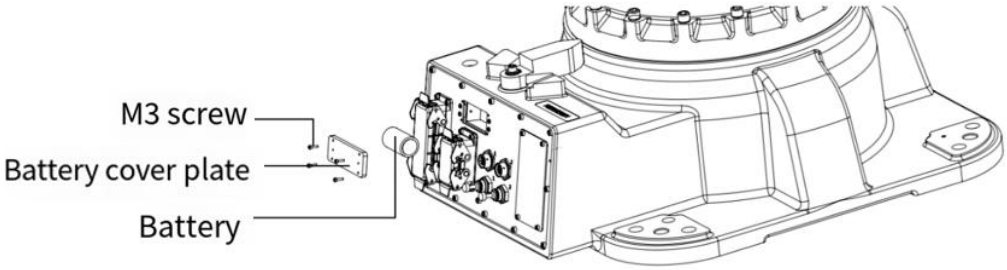


Figure 1210 RX3-A650-2700/RX3-A680-2560 Battery Replacement

Step to change:

Step1、Adjust the robot to calibration state.

Step2、To prevent hazards, disconnect the power, hydraulic, and pneumatic supplies to the robot.

Step3、Remove the battery cover plate from the electrical installation panel, as shown in Figure 129 or Figure 1210.

Step4、Remove the old battery from the battery compartment and insert the new one, ensuring correct polarity.

Step5、After all safety conditions are met, proceed with the operation machine calibration and testing.

12.4 **Replace the grease**

The internal grease in the reducer from J1 to J6 axes of the operator machine should be replaced every 11,520 hours or 3 years, whichever comes first.

For the type and amount of grease, refer to Tables 121 to 123.

Table 121: Grease Models and Amounts for RX3-A650-2260/RX3-A680-2260 Operators

Operator model	**Replace the grease component**	**Lubricant quantity**	**Lubricant type**
RX3-A650-2260 RX3-A680-2260	J1 shaft reducer	2800g	VIGOGREASE RE0
	J2 shaft reducer	1585g	
	J3 shaft reducer	1200g	
	J4 shaft reducer	700g	
	J5 shaft reducer	210g	
	J6 shaft reducer	225g	

Table 122: Grease Models and Amounts for RX3-A650-2700/RX3-A680-2560 Operators

Operator model	Replace the grease component	Lubricant quantity	Lubricant type
RX3-A650-2700 RX3-A680-2560	J1 shaft reducer	4300g	VIGOGREASE RE0
	J2 shaft reducer	1585g	
	J3 shaft reducer	1200g	
	J4 shaft reducer	700g	
	J5 shaft reducer	210g	
	J6 shaft reducer	225g	

Table 123: Grease Models and Amounts for RX3-A635-2700/RX3-A620-3100 Operators

Operator model	Replace the grease component	Lubricant quantity	Lubricant type
RX3-A635-2700 RX3-A620-3100	J1 shaft reducer	2800g	VIGOGREASE RE0
	J2 shaft reducer	1585g	
	J3 shaft reducer	1200g	
	J4 shaft reducer	700g	

Refer to Table 124 for the manipulator posture when changing grease.

Table 124 Lubricant Replacement Attitude for Manipulator

Replace the grease component	J1	J2	J3	J4	J5	J6
J1 shaft reducer	0°	0°	90°	wantonly	wantonly	wantonly
J2 shaft reducer	0°	0°	90°	wantonly	wantonly	wantonly
J3 shaft reducer	0°	0°	-90°	wantonly	wantonly	wantonly
J4 shaft reducer	0°	0°	-90°	0°	wantonly	wantonly
J5 shaft reducer	0°	0°	-90°	0°	0°	wantonly
J6 shaft reducer	0°	0°	-90°	0°	0°	0°

- The reducer oil temperature may exceed 90° C. Replace it after cooling.
- Wear gloves to prevent allergic reactions.
- Slowly open the drain port carefully to prevent oil splashing.

Replace the grease in the J1 shaft reducer

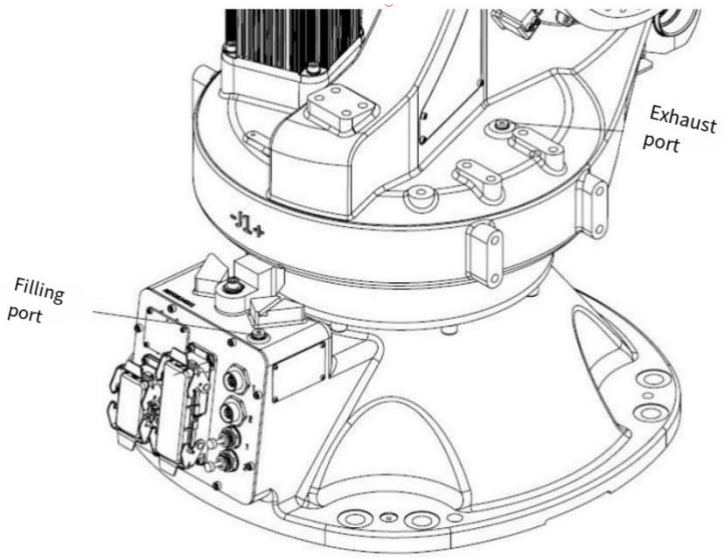


Figure 1211: Replacement of the J1 shaft reducer grease for the models RX3-A650-2260, RX3-A680-2260, RX3-A635-2700, and RX3-A620-3100

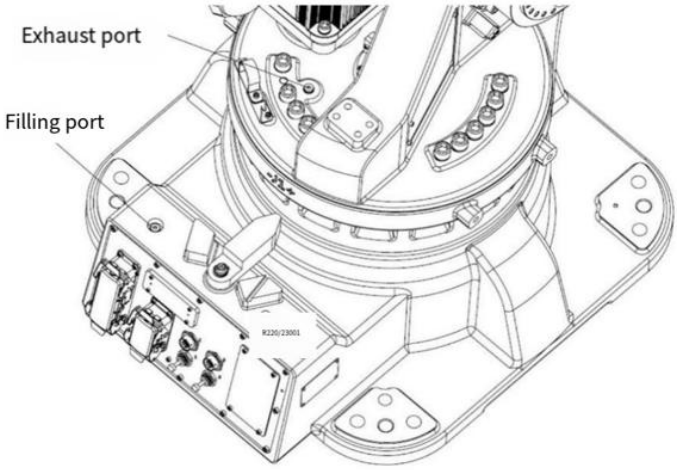


Figure 12: Replacement of the J1 shaft reducer grease for the RX3-A650-2700/RX3-A680-2560 models

Step to change:

Step1、Operate the manipulator to achieve the posture shown in Table 124.

Step2、To prevent hazards, disconnect the power, hydraulic, and pneumatic supplies to the robot.

Step3、The oil collection tank for collecting waste oil should be placed near the oil drain port.

Step4、Remove the M10x1 plug from the oil drain port, as shown in Figure 1211 (or Figure 1212).

Step5、Install the oil drain pipe to ensure waste oil flows into the oil collection tank.

Step6、Remove the M10x1 plug from the grease inlet, install the oil nozzle, and manually apply grease using a grease gun until fresh grease is discharged through the drain port.

Step7、As shown in Table 125, release the pressure of the internal grease in the reducer.

Step8、Measure the oil discharge and injection volume, ensuring they are equal. If the discharge is less than the injection, vent the excess through the oil port. If the discharge exceeds the injection, add the missing volume through the oil port.

Step9、Remove the oil injection nozzle from the grease outlet, install M10x1 plugs on both the grease outlet and injection port, and seal with tape or sealant.

Warning	When applying grease to the reducer's interior through the grease inlet, use a manual pump with a flow rate below 8g/s and pressure under 0.3MPa. To ensure proper drainage of old grease, pause after initial application until no residual grease is discharged from the outlet before resuming. Excessive grease flow may cause instantaneous pressure buildup, potentially damaging the motor's oil seal and allowing grease to enter the motor.

Replace the grease in the J2 shaft reducer

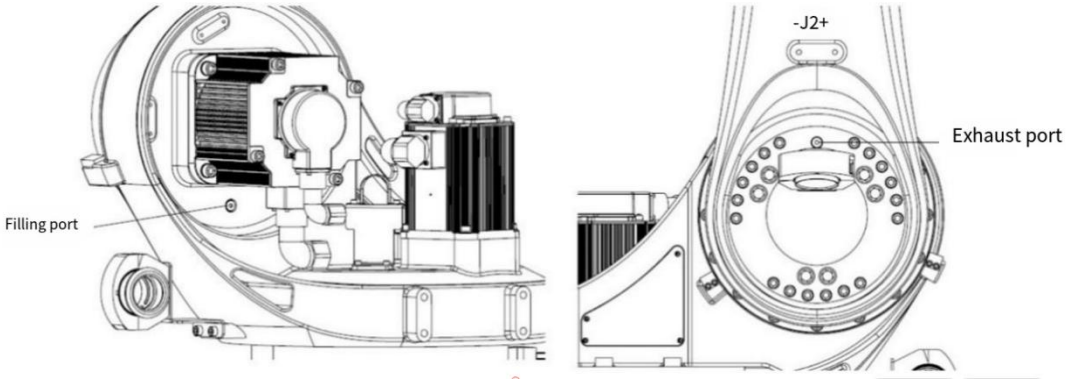


Figure 1213: Lubricant Replacement for J2 Shaft Reducer

Step to change:

Step1、Operate the manipulator to achieve the posture shown in Table 124.

Step2、To prevent hazards, disconnect the power, hydraulic, and pneumatic supplies to the robot.

Step3、The oil collection tank for collecting waste oil should be placed near the oil drain port.

Step4、Remove the M10x1 plug from the drain port, as shown in Figure 1213.

Step5、Install the oil drain pipe to ensure waste oil flows into the oil collection tank.

Step6、Remove the M10x1 plug from the grease inlet, install the oil nozzle, and manually apply grease using a grease gun until fresh grease is discharged through the drain port.

Step7、As shown in Table 125, release the pressure of the internal grease in the reducer.

Step8、Measure the amount of oil discharged and the amount injected, ensuring they are equal. If the discharge is less than the injection, inflate the oil injection port to release the excess. If the discharge exceeds the injection, add the missing amount through the oil discharge port.

Step9、Remove the oil injection nozzle from the grease outlet, install M10x1 plugs on both the grease outlet and injection port, and seal with tape or sealant.

Attention	When applying grease to the reducer's interior through the grease inlet, use a manual pump with a flow rate below 8g/s and pressure under 0.3MPa. To ensure proper drainage of old grease, pause after initial application until no residual grease is discharged from the outlet before resuming. Excessive grease flow may cause instantaneous pressure buildup, potentially damaging the motor's oil seal and allowing grease to enter the motor.

Replace the grease in the J3 shaft reducer

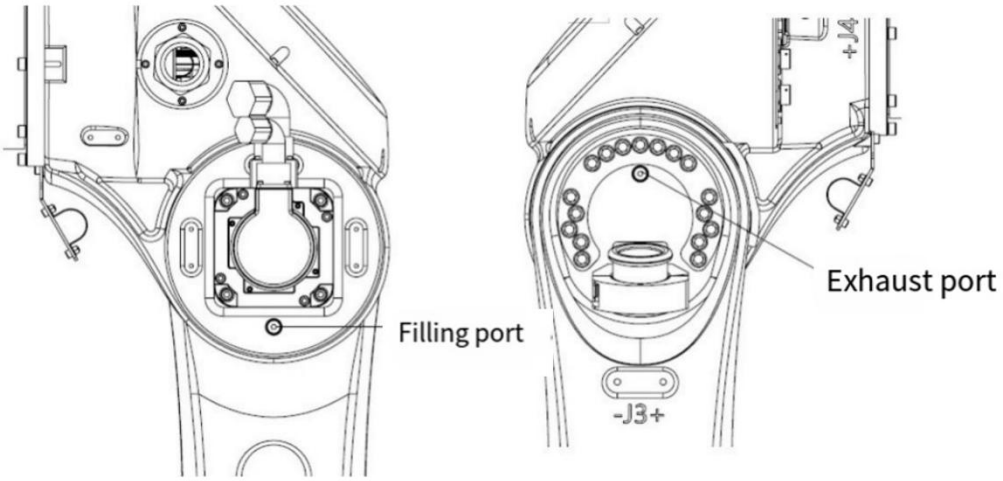


Figure 1214: Lubricant Replacement for J3 Shaft Reducer

Step to change:

Step1、Operate the manipulator to achieve the posture shown in Table 124.

Step2、To prevent hazards, disconnect the power, hydraulic, and pneumatic supplies to the robot.

Step3、The oil collection tank for collecting waste oil should be placed near the oil drain port.

Step4、Remove the M10x1 plug from the drain port as shown in Figure 1214.

Step5、Install the oil drain pipe to ensure waste oil flows into the oil collection tank.

Step6、Remove the M10x1 plug from the grease inlet, install the oil nozzle, and manually apply grease using a grease gun until fresh grease is discharged through the drain port.

Step7、As shown in Table 125, release the pressure of the internal grease in the reducer.

Step8、Measure the amount of oil discharged and the amount injected, ensuring they are equal. If the discharge is less than the injection, inflate the oil injection port to release the excess. If the discharge exceeds the injection, add the missing amount through the oil discharge port.

Step9、Remove the oil injection nozzle from the grease outlet, install M10x1 plugs on both the grease outlet and injection port, and seal with tape or sealant.

Attention	When applying grease to the reducer's interior through the grease inlet, use a manual pump with a flow rate below 8g/s and pressure under 0.3MPa. To ensure proper drainage of old grease, pause after initial application until no residual grease is discharged from the outlet before resuming. Excessive grease flow may cause instantaneous pressure buildup, potentially damaging the motor's oil seal and allowing grease to enter the motor.

Replace the grease in the J4 shaft reducer

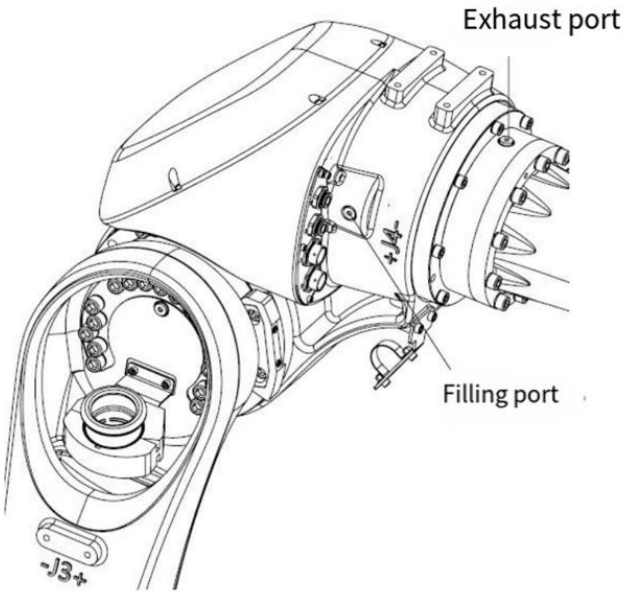


Figure 1215: Lubricant Replacement for J4 Shaft Reducer

Step to change:

Step1、Operate the manipulator to achieve the posture shown in Table 124.

Step2、To prevent hazards, disconnect the power, hydraulic, and pneumatic supplies to the robot.

Step3、The oil collection tank for collecting waste oil should be placed near the oil drain port.

Step4、Remove the M10x1 plug from the drain port as shown in Figure 1215.

Step5、Install the oil drain pipe to ensure waste oil flows into the oil collection tank.

Step6、Remove the M10x1 plug from the grease inlet, install the oil nozzle, and manually apply grease using a grease gun until fresh grease is discharged through the drain port.

Step7、As shown in Table 125, release the pressure of the internal grease in the reducer.

Step8、Measure the amount of oil discharged and the amount injected, ensuring they are equal. If the discharge is less than the injection, inflate the oil injection port to release the excess. If the discharge exceeds the injection, add the missing amount through the oil discharge port.

Step2、Remove the oil injection nozzle from the grease outlet, install M10x1 plugs on both the grease outlet and injection port, and seal with tape or sealant.

Attention	When applying grease to the reducer's interior through the grease inlet, use a manual pump with a flow rate below 8g/s and pressure under 0.3MPa. To ensure proper drainage of old grease, pause after initial application until no residual grease is discharged from the outlet before resuming. Excessive grease flow may cause instantaneous pressure buildup, potentially damaging the motor's oil seal and allowing grease to enter the motor.

Replace the grease in the J5 shaft reducer

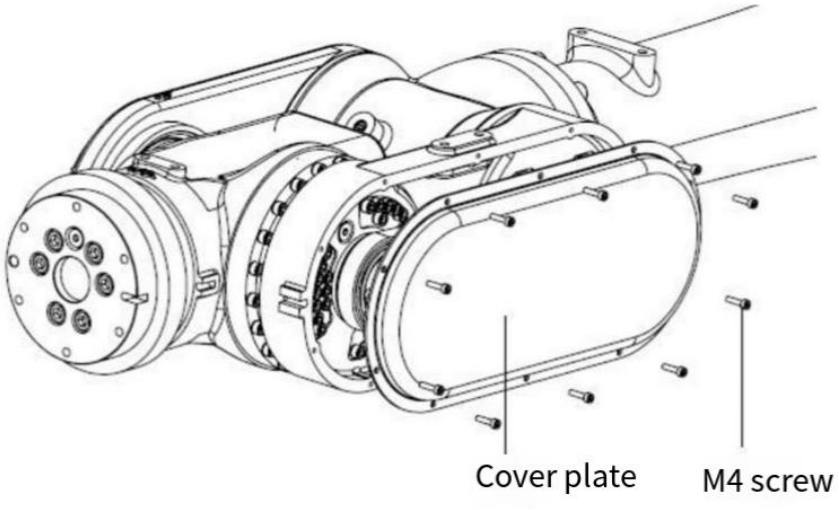


Figure 1216: J5 shaft cover plate removal

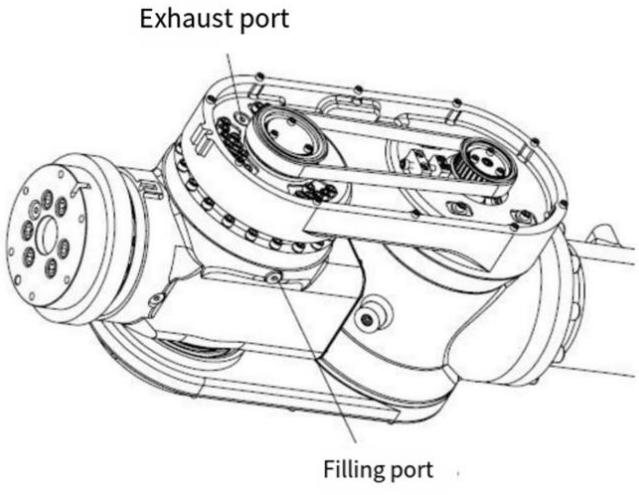


Figure 1217: Lubricant Replacement for J5 Shaft Reducer

Step to change:

Step1、Operate the manipulator to achieve the posture shown in Table 124.

Step2、To prevent hazards, disconnect the power, hydraulic, and pneumatic supplies to the robot.

Step3、Remove the M4 screw from the J5 shaft cover plate as shown in Figure 1216.

Step4、The oil collection tank for collecting waste oil should be placed near the oil drain port.

Step5、Remove the M10x1 plug from the drain port as shown in Figure 1217.

Step6、Install the oil drain pipe to ensure waste oil flows into the oil collection tank.

Step7、Remove the M10x1 plug from the grease inlet, install the oil nozzle, and manually apply grease using a grease gun until fresh grease is discharged through the drain port.

Step8、As shown in Table 125, release the pressure of the internal grease in the reducer.

Step8、Measure the amount of oil discharged and the amount injected, ensuring they are equal. If the discharge is less than the injection, inflate the oil injection port to release the excess. If the discharge exceeds the injection, add the missing amount through the oil discharge port.

Step9、Remove the oil injection nozzle from the grease outlet, install M10x1 plugs on both the grease outlet and injection port, and seal with tape or sealant.

Attention	When applying grease to the reducer's interior through the grease inlet, use a manual pump with a flow rate below 8g/s and pressure under 0.3MPa. To ensure proper drainage of old grease, pause after initial application until no residual grease is discharged from the outlet before resuming. Excessive grease flow may cause instantaneous pressure buildup, potentially damaging the motor's oil seal and allowing grease to enter the motor.

Replace the grease in the J6 shaft reducer

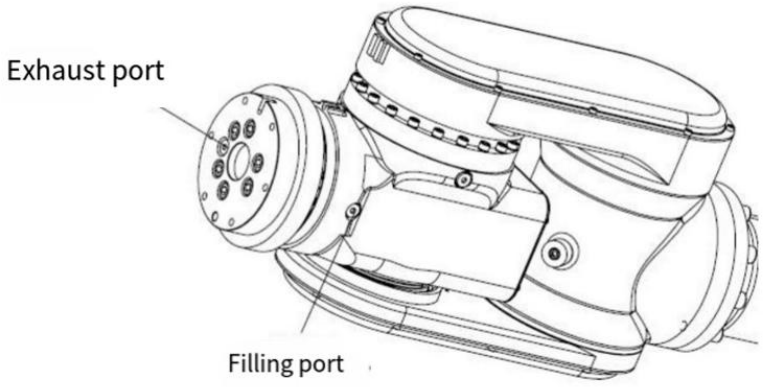


Figure 1218: Lubricant Replacement for J6 Shaft Reducer

Step to change:

Step1、Operate the manipulator to achieve the posture shown in Table 124.

Step2、To prevent hazards, disconnect the power, hydraulic, and pneumatic supplies to the robot.

Step3、The oil collection tank for collecting waste oil should be placed near the oil drain port.

Step4、Remove the M10x1 plug from the drain port as shown in Figure 1218.

Step5、Install the oil drain pipe to ensure waste oil flows into the oil collection tank.

Step6、Remove the M10x1 plug from the grease inlet, install the oil nozzle, and apply grease manually using a grease gun until fresh grease is discharged through the drain port.

Step7、As shown in Table 125, release the pressure of the internal grease in the reducer.

Step8、Measure the amount of oil discharged and the amount injected, ensuring they are equal. If the discharge is less than the injection, inflate the oil injection port to release the excess. If the discharge exceeds the injection, add the missing amount through the oil discharge port.

Step9、Remove the oil injection nozzle from the grease outlet, install M10x1 plugs on both the grease outlet and injection port, and seal with tape or sealant.

Attention	When applying grease to the reducer's interior through the grease inlet, use a manual pump with a flow rate below 8g/s and pressure under 0.3MPa. To ensure proper drainage of old grease, pause after initial application until no residual grease is discharged from the outlet before resuming. Excessive grease flow may cause instantaneous pressure buildup, potentially damaging the motor's oil seal and allowing grease to enter the motor.

Release the grease pressure inside the reducer

When releasing the internal grease pressure in the reducer, install a recovery device at the drain port to prevent the discharged grease from splashing and polluting the environment.

Table 125 Pressure Release in Reducer and Gearbox

Replace the grease component	**Action angle**	**actuation time**	**premise**
J1 shaft reducer	>90°	10 minutes	Install a plug or oil injector at the grease outlet, and do not install a sealing screw at the drain port.
J2 shaft reducer	>90°	10 minutes	
J3 shaft reducer	>90°	10 minutes	
J4 shaft reducer	>90°	10 minutes	
J5 shaft reducer	>90°	10 minutes	
J6 shaft reducer	>90°	10 minutes	

Attention	If the oil supply is wrong, the pressure in the reducer or gearbox will rise sharply, which will destroy the sealing ring and other internal parts, and then cause oil leakage or malfunction. Be sure to follow these precautions: ■ Before fat supply, the sealing screw of the fat discharge port must be removed. ■ Use the manual pump to slowly administer the fat. ■ Use the specified grease. ■ After fat infusion, release internal pressure according to step 125 in Table 1, then install the sealing screw.

	■ Thoroughly remove all grease from floors and control panels to prevent slips.

12.5 **Change the sync belt**

The J5 shaft synchronous belt must be replaced after 11,520 hours of operation or 3 years (whichever comes first).

For synchronous belt models, see Table 126:

Table 126 Model of Manipulator Synchronous Belt

Operator model	**synchronous belt position**	**synchronous belt type**
RX3-A650-2260 RX3-A650-2700	internal J5 axis of forearm	GT3，625-5GT-15
RX3-A680-2260 RX3-A680-2560	internal J5 axis of forearm	GT3，655-5GT-15
RX3-A635-2700 RX3-A620-3100	internal J5 axis of forearm	GT3，475-5MGT-9

Refer to Table 127 for the manipulator attitude when replacing the synchronous belt.

Table 127 Synchronous Belt Attitude for Manipulator Replacement

J1	**J2**	**J3**	**J4**	**J5**	**J6**
wantonly	-90°	0°	0°	0°	wantonly

Replace the J5 shaft synchronous belt

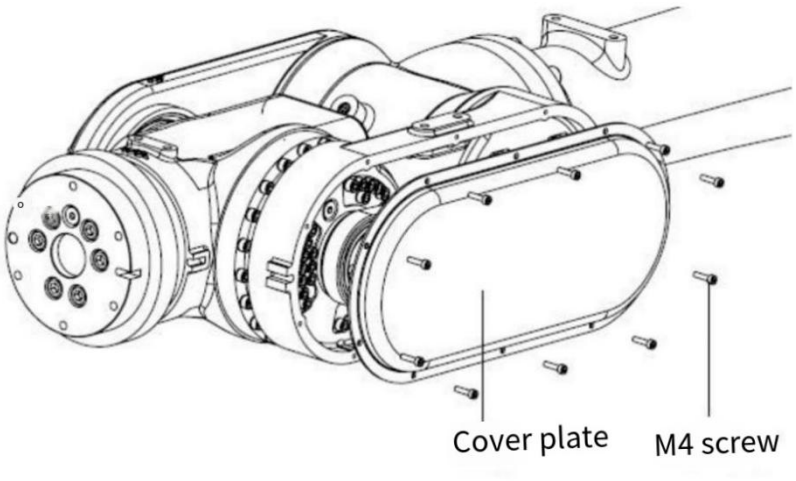


Figure 1219: Dismantling cover plate for RX3-A650-2260/RX3-A650-2700

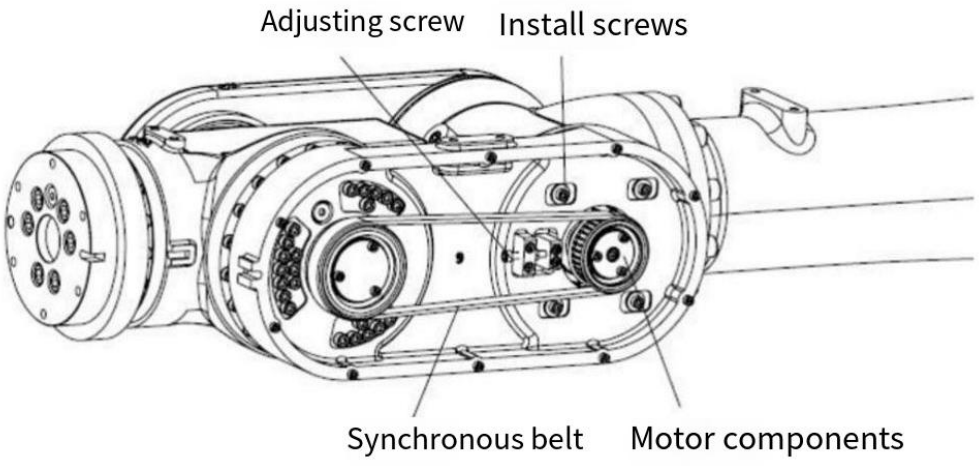


Figure 1220 RX3-A650-2260/RX3-A650-2700 Synchronous Belt Disassembly

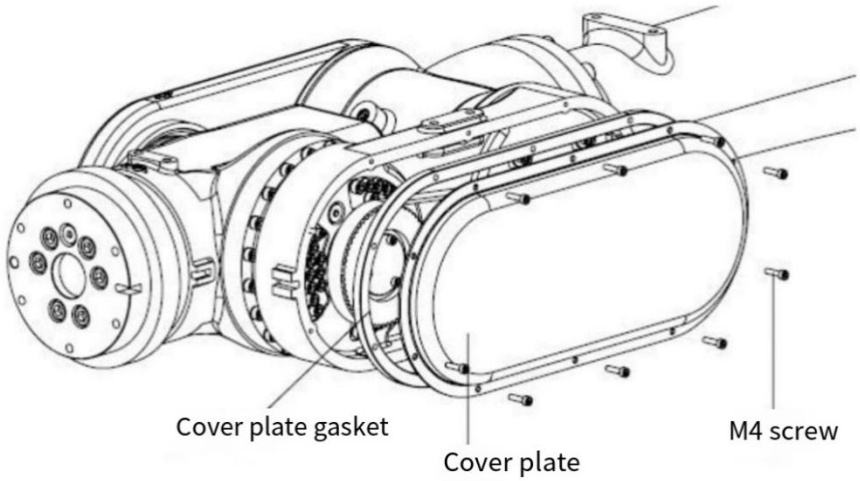


Figure 1221: Dismantling cover plate for RX3-A680-2260/RX3-A680-2560

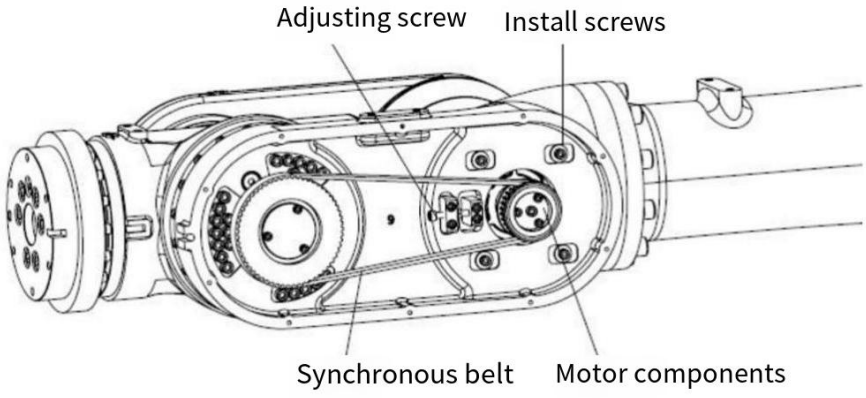


Figure 1222 RX3-A680-2260/RX3-A680-2560 Disassembly of Synchronous Belt

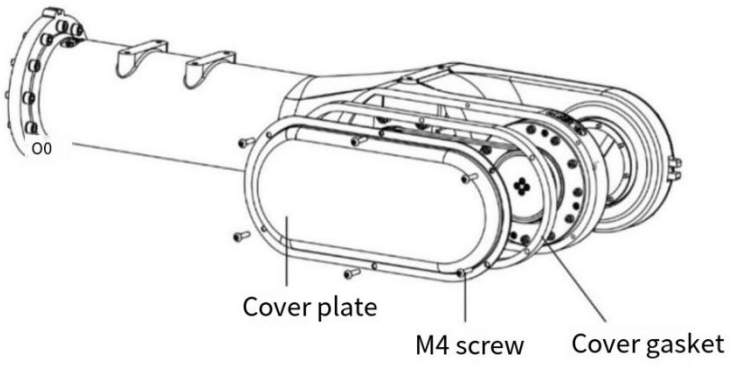


Figure 1223: Dismantling cover plates for RX3-A635-2700/RX3-A620-3100

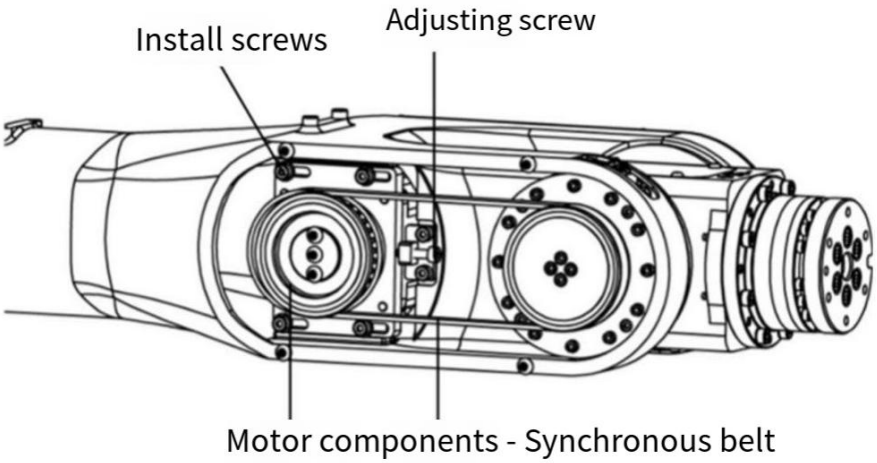


Figure 1224: Disassembly of Synchronous Belt for RX3-A635-2700/RX3-A620-3100

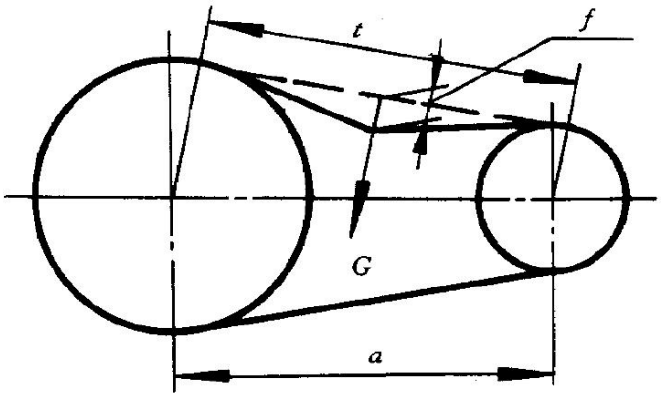


Figure 1225 Synchronization Belt Installation Deflection

Step to change:

Step1、Move the manipulator to the position shown in Table 127.

Step2、Cut off the power supply to the control device.

Step3、Remove the operator cover plate and M4 fastening screws as shown in Figure 1219 (or Figure 1221, or Figure 1223).

Step4、Loosen the adjustment screw of the synchronous belt.

Step5、Remove the four M5 mounting screws from the motor base (or four M4 screws for RX3-A635-2700/RX3-A620-3100 models), as shown in Figure 1220 (or Figure 1222 or Figure 1224).

Step6、Remove the old synchronous belt from the motor pulley assembly and install a new one.

Step7、For initial installation, use M5 mounting screws for the motor base (M4 screws are required for RX3-A635-2700/RX3-A620-3100 models).

Step8、Install the adjustment screw on the hex wrench to set the synchronous belt tension to the appropriate level. The synchronous belt frequency for the J5 shaft of RX3-A650-2260/RX3-A650-2700 operator ranges from 101Hz to 105Hz, while that for the J5 shaft of RX3-A680-2260/RX3-A680-2560 operator is 104Hz to 109Hz. For the J5 shaft of RX3-A635-2700/RX3-A620-3100 operator, the frequency is 116Hz to 122Hz.

Step9、The motor bracket screws are installed with specified torque (M5 screws for RX3-A635-2700/RX3-A620-3100 models, M4 screws for other types).

Step10、Install the operator cover plate and apply sealant to the joint.

Step11、The calibration of the J5 axis of the manipulator is carried out.

 Warning	After replacing the synchronous belt, calibrate the J5 axis of the manipulator. Refer to Chapter 8 of this manual for details.

13 Common Faults and Solutions

The fault of the operator is sometimes caused by many different reasons, and it is often difficult to find out the real reason. If the wrong method is used, the fault may be worsened. Therefore, it is very important to find out the real reason by analyzing the fault in detail.

Generate vibrations or abnormal noises

The causes and corrective actions for vibration or abnormal noise in the operator console are listed in Table 131. If the cause cannot be identified or the appropriate action is uncertain, please contact our company.

Table 131 Causes and Countermeasures for Vibration or Abnormal Noise in the Operator

Hitch	Fault classification	Possible causes of failure	Treatment measure
generate vibration Abnormal noise	■ When the manipulator operates, its base lifts off the workshop base. ■ There is a gap between the base and the pedestal. ■ The connecting screws between the base and the pedestal are loose.	Base fixation: ■ This may be because the operator's base is not securely fastened to the workshop foundation. ■ This may occur due to loose screws, insufficient flatness of the base, or foreign object inclusion, causing the base to float off the workshop foundation during operation, resulting in vibration from the impact.	■ When the screw is loose, tighten it with a torque wrench to the appropriate torque. ■ Adjust the flatness of the base to meet the specified tolerance requirements. ■ Confirm the presence of foreign bodies. If any are found, remove them. ■ You may consult our company.
	Vibration of workshop base during operation of the manipulator	Workshop base: ■ This may occur because the workshop base is not fully secured to the foundation, causing vibrations during operation or movement. ■ The deformation and vibration of the workshop base may result from insufficient rigidity, where reaction forces and torques generated during the manipulator's movement cause structural deformation.	■ Complete fixing of workshop base with corresponding method ■ Processing Workshop Base, Improving Its Rigidity ■ The difficult-to-machine workshop base can mitigate vibrations by altering the motion program. ■ You may consult our company.

Hitch	Fault classification	Possible causes of failure	Treatment measure
generate vibration Abnormal noise	■ vibration occurring at a specific posture during motion ■ No vibration occurs when the motion speed is reduced ■ Significant vibration during acceleration and deceleration ■ multiple axis vibration	■ Vibration may occur due to the manipulator load exceeding the allowable limit. ■ Vibration may occur due to the excessive rigidity of the motion program on the manipulator. ■ Vibration may occur due to inappropriate acceleration.	■ Check if the operator's load exceeds the allowed limit, reduce the load, or change the action program ■ Vibrations in specific areas can be mitigated by reducing speed, decreasing acceleration, or modifying the movement sequence.
	■ Vibration occurs after the manipulator collides or after prolonged operation under overload conditions. ■ Long-term lack of grease replacement has caused vibration	■ Excessive external forces may be applied to the mechanical transmission system due to collisions or overloads, resulting in damage to the gear surfaces or rolling surfaces of gears, bearings, or reducers, or in spalling due to fatigue. ■ This may result from foreign bodies being embedded in the gears, bearings, or internal components of the reducer, leading to damage of the gear surfaces or rolling surfaces of the gears, bearings, or reducer. ■ This may result from prolonged use without lubricant replacement, causing fatigue-induced spalling of gear surfaces or rolling surfaces in gears, bearings, and reducers. ■ The aforementioned causes may lead to periodic vibrations or abnormal noises.	■ Move the manipulator along a single axis to identify the axis generating vibration and noise. ■ For gear, bearing, or reducer replacement, please contact our company. ■ Do not operate the machine under overload conditions ■ If you need to replace the grease, please contact our company. ■ You may consult our company.

Hitch	Fault classification	Possible causes of failure	Treatment measure
generate vibration Abnormal noise	Reasons that cannot be determined by the mechanical component	■ A malfunction in the control device's circuitry may cause the command to fail transmission to the motor, or the motor data to be improperly relayed to the control unit, resulting in the manipulator vibrating. ■ A malfunction in the pulse encoder caused the motor's position to fail transmission to the control unit, resulting in the manipulator vibrating. ■ The main part of the motor malfunctions, failing to deliver its original performance and causing the manipulator to vibrate. ■ Internal motor cables in the manipulator are damaged and will break, preventing the correct transmission of command values to the motor and control system, resulting in manipulator vibration. ■ The voltage drops below the specified level, causing the operating machine to vibrate. ■ Incorrect motion control parameters were entered, causing the manipulator to vibrate.	■ For control device failures, refer to the control device manual. ■ Replace the motor with a vibration-resistant one and check for vibration. ■ Check for damage to the operator console cables, the cables between the console and control cabinet, and the internal control device cables. Replace any damaged cables. ■ Check if the cable connector has good contact. If contact is poor or loose, tighten it or take appropriate measures to ensure good contact. ■ Check if the action control parameters are correct. If there are errors, enter the correct parameters again. ■ You may consult our company.
	The mechanical motion near the manipulator is closely related to the vibration of the robot	■ Mechanical and Electrical Noise from the Operating Machine ■ When no proper grounding connection is established, electrical noise may interfere with the grounding system, causing operational commands to be disrupted and resulting in equipment vibration. ■ When the grounding wire connection location is inappropriate, it may cause unstable grounding, resulting in vibration of the operating machine due to electrical noise interference.	■ Ensure proper connection of the ground wire to prevent electrical noise from interfering with the control unit. ■ You may consult our company.

Hitch	Fault classification	Possible causes of failure	Treatment measure
generate vibration Abnormal noise	■ Abnormal noise occurs after grease replacement ■ Abnormal noise occurs during robot operation after prolonged shutdown ■ Abnormal noise occurs during low-speed operation	The operator may hear abnormal noise when the machine is running at low speed after a recent replacement or during a restart after prolonged shutdown.	Observe the operation of the manipulator for 1-2 days. Typically, abnormal noises will disappear.

operator shaking

Table 132 details the causes and corrective actions for operator machine shaking. If the cause cannot be identified or the appropriate action is uncertain, please contact our company.

Table 132 Causes and Countermeasures of Manipulator Vibration

Hitch	Fault classification	Possible causes of failure	Treatment measure
operator shaking	■ After disconnecting the power supply of the manipulator, some components can be manually shaken. ■ There is a gap in the connection surface of the manipulator.	■ Loose bolts on the operating machine ■ Possible due to overload, collision, or other factors, some connecting bolts on the manipulator may loosen and cause shaking.	For each shaft, check whether the bolts in the following areas are loose. If loose, tighten them with a torque wrench to the appropriate torque. ■ motor fixing bolt ■ reducer housing fixing bolt ■ output shaft fixing bolt of reducer ■ base fixing bolt ■ Fixation bolts between the arms ■ shell fixing bolt ■ end effector fastening bolt
	Cut off the power supply to the manipulator, confirm that the screws are tightened, and then shake the entire head of the manipulator by hand.	Internal gear wear or damage in the manipulator may result in significant backlash due to overload, impact, or other factors.	If internal gears need replacement, please contact our company.

motor overheating

The causes and corrective measures for motor overheating are listed in Table 133. If the cause cannot be identified or the appropriate action is uncertain, please contact our company.

Table 133 Causes and Solutions for Motor Overheating

Hitch	Fault classification	Possible causes of failure	Treatment measure
motor overheating	■ The operating machine's installation environment temperature has risen, causing the motor to overheat. ■ The motor overheats after the cover plate is installed. ■ Motor overheating occurs after modifying the operator's action program and load conditions.	ambient temperature ： ■ An increase in ambient temperature or installation of the motor cover plate may impair motor heat dissipation, resulting in motor overheating. ■ Load action: ■ The motor current may exceed its rated value due to load or operational procedures.	■ Reducing ambient temperature can effectively prevent motor overheating ■ Enhancing ventilation around the motor, i.e., improving its heat dissipation, can effectively prevent motor overheating. ■ When a heat source is located near the motor, installing a radiation-shielding panel can effectively prevent motor overheating. ■ By slowing down the motor's operation and reducing the load, the average current value decreases, preventing the motor from overheating. ■ You may consult our company.
	Motor overheating after modifying the manipulator's motion control parameters	controlling parameter ： Inappropriate input parameters may cause the robot to accelerate or decelerate improperly, resulting in increased average motor current and motor overheating.	■ Enter the appropriate parameters according to the relevant instructions ■ You may consult our company.
	Motor overheating when not meeting the above classification criteria	Operator machine malfunction: The motor may overheat due to excessive load caused by a malfunction in the manipulator's mechanical system. Motor fault: ■ A potential issue is a faulty motor brake, causing the motor to remain in a braking state continuously. This results in excessive load on the motor, leading to overheating. ■ A malfunction in the motor's main component may prevent it from functioning properly, causing excessive current to flow through the motor and resulting in overheating.	■ Refer to vibration, abnormal noise, and loose items to identify mechanical failures. ■ Check whether the brake releases when the motor is powered on and started. ■ After replacing the motor, the motor overheating issue was resolved. This situation is confirmed as abnormal. ■ You may consult our company.

Grease leakage

The causes and corrective actions for grease leakage are listed in Table 134. If the cause cannot be identified or the appropriate procedure is uncertain, please contact our company.

Table 134 Causes and Solutions for Grease Leakage

Hitch	Fault classification	Possible causes of failure	Treatment measure
Grease leakage	The lubricating grease is leaking from the mechanical components.	Poor sealing: ■ The casting may have developed cracks due to excessive external force generated by the collision, resulting in grease leakage. ■ The grease leakage may be caused by damaged O-rings during disassembly and reassembly. ■ This may be due to dust intrusion, oil seal abrasion, or grease leakage. ■ The grease leakage may be due to poor sealing between the cover plate and the casting.	■ For emergency measures in cases of casting cracks, sealant may be used to plug the grease. However, considering the potential for further crack propagation, the component should be replaced as soon as possible. ■ You may consult our company.

operator shaft drop

The causes and corrective measures for the dropping of the operating shaft are listed in Table 135. If the cause cannot be determined or the appropriate action is uncertain, please contact our company.

Table 135 Causes and Handling Measures for Shaft Drop of the Operator

hitch	fault classification	Possible causes of failure	treatment measure
operator shaft drop	■ Complete brake failure, rapid shaft drop ■ After the brake engages, the shaft drops slowly.	■ The brake may remain continuously energized due to a faulty brake drive relay, resulting in failure to function as a brake. ■ The braking effect may be reduced due to brake wear or damage to the brake body. ■ The brake may slip due to lubricating oil or grease entering the motor interior.	■ Check if the brake drive relay is damaged. If so, replace the relay. ■ Replace the motor if the brake is worn, the brake body is damaged, or grease has entered the motor. ■ You may consult our company.

offset

The causes and solutions for position offset are shown in Table 136. If the cause cannot be determined or the solution is uncertain, please contact our company.

Table 136 Causes and Measures for Position Deviation

Hitch	**Fault Classification**	**Possible causes of failure**	**Treatment measure**
offset	■ The manipulator deviates from the taught position ■ The repeatability accuracy of the manipulator exceeds the permissible limit	mechanical breakdown ： ■ The instability in positioning accuracy may result from mechanical system abnormalities, loose screws, or other malfunctions. ■ After initial misalignment, the repositioning accuracy remains stable, though excessive loads from collisions may cause sliding between the base surface, shaft castings, and the reducer connection surfaces. ■ possibly caused by a motor encoder malfunction	■ If the positioning accuracy is unstable, check for vibrations, abnormal noise, or shaking to identify mechanical issues. ■ When the positioning accuracy is stable, modify the teaching program. If collisions no longer occur, there will be no positional offset. ■ Replace the motor or encoder if an error occurs. ■ You may consult our company.
	Positioning is only for specific peripheral device offsets	Peripheral device position offset: The peripheral device may be displaced from the manipulator due to external force.	■ Change the peripheral device location ■ Modify the teaching program ■ You may consult our company.
	The position offset occurred after changing the parameter	parameter ： The loss of the manipulator's origin may result from modifying the calibration data.	■ Re-enter the previously correct calibration data ■ If the calibration data is uncertain, recalibrate the manipulator. ■ You may consult our company.

14 Storage Condition

14.1 Long-term storage environmental conditions for the manipulator

Table 141 Long-term storage environmental conditions for the operating machine

parameter	**numeric value**
minimum ambient temperature	-25℃
maximum ambient temperature	55℃
Maximum ambient temperature (storage time less than 24 hours)	70℃
maximum ambient humidity	Less than 95% at constant temperature, no condensation
maximum vibration condition	Frequency 22Hz, amplitude 0.15mm

14.2 Storage precautions for the manipulator

For long-term storage of the operator's console, in addition to complying with the requirements specified in Section 1.5 of this manual, the following precautions must be observed:

- Before long-term storage, the manipulator should be positioned in a handling posture and placed on a level surface. Refer to Chapter 9 of this manual for details.
- When the manipulator is not in use for an extended period, all power sources should be disconnected, the heavy-load connector on the main unit removed, and the protective cover for the heavy-load connector closed.
- The main body of the manipulator should be protected by external protective covers such as paper or wooden packaging boxes to avoid prolonged exposure to light or contact with water, oil, corrosive liquids, etc.
- The surface of the operating machine should be cleaned regularly by dust and dirt removal, and the specific cleaning cycle depends on the storage environment of the operating machine.
- When the storage period ends and the manipulator is put back into use, it must be inspected in accordance with Chapter 3.1 of this manual.

Appendix A Periodic Maintenance Schedule for the Operator

Note: (indicates maintenance required.

Schedule A: Periodic Maintenance Schedule for Load Operators

Maintenance Project	servicing time	First maintenance in 320 hours	3 months 960 hours	6 months 1920 hours	9 months and 2880 hours	1 year 3840 hours	15 months and 4800 hours	18 months and 5760 hours	21 months and 6720 hours	2 years and 7,680 hours	27 months and 8,640 hours	30 months, 9,600 hours	33 months 10,560 hours	3 years and 11,520 hours	39 months 12,480 hours	42 months 13,440 hours	45 months 14,400 hours	4 years and 15,360 hours	51 months and 16,320 hours	54 months 17,280 hours	57 months 18,240 hours	5 years, 19,200 hours
Clean the operator	0.5h	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Clean the ventilation port of the control cabinet	0.1h	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Is the synchronous belt worn?	0.5h	O		O	O	O		O		O		O		O		O		O		O		O
Is the operator's cable damaged?	3h	O		O	O	O		O		O		O		O		O		O		O		O
Is the cable sheath of the operator damaged?	2h	O		O	O	O		O		O		O		O		O		O		O		O
Check for damage to the cables connecting the demonstrator, control cabinet, and operating machine.	0.2h	O			O	O				O				O				O				O
Check if connectors such as the motor are loose.	0.2h	O			O	O				O				O				O				O
Tightening of the screw on the end effector	0.2h	O			O	O				O				O				O				O
Tightening of external main screws	1h	O			O	O				O				O				O				O
Is the end effector cable	0.2h	O			O	O				O				O				O				O

Maintenance Project	servicing time	First maintenance in 320 hours	3 months 960 hours	6 months 1920 hours	9 months and 2880 hours	1 year 3840 hours	15 months and 4800 hours	18 months and 5760 hours	21 months and 6720 hours	2 years and 7,680 hours	27 months and 8,640 hours	30 months, 9,600 hours	33 months 10,560 hours	3 years and 11,520 hours	39 months 12,480 hours	42 months 13,440 hours	45 months 14,400 hours	4 years and 15,360 hours	51 months and 16,320 hours	54 months 17,280 hours	57 months 18,240 hours	5 years, 19,200 hours
damaged?																						
Is the limit block damaged?	0.1h	O			O	O				O				O				O				O
Change the sync belt	1h					O				O				O				O				O
Replace the battery	0.5h									O								O				
Replace the internal cables of the manipulator	8h																	O				
main overhaul of operator machine																						O

Appendix B Table of Screw Strength and Tightening Torque (Nm)

Appendix B1: Carbon Steel Screw Strength and Tightening Torque Table (Nm)

performance grade / thread specification	8.8 magnitude	10.9 magnitude	12.9 magnitude
M3	1.2	1.6	2.0
M4	2.8	3.7	4.4
M5	5.6	7.5	9
M6	9.5	12.5	15
M8	23	31	36
M10	45	60	70
M12	78	104	125
M14	113	165	195
M16	195	250	305
M20	370	500	600

Appendix B2: Stainless Steel Screw Strength and Tightening Torque Table (Nm)

thread specification	Stainless steel A4-80	Stainless steel A2-70 and A4-70	Stainless steel A2-50
M3	1.0	0.8	0.4
M4	2.4	1.9	0.9
M5	4.8	3.8	1.9
M6	8.0	6.4	3.1
M8	19.5	15.5	7.5
M10	38.5	30.5	15.0
M12	66.0	52.0	25.5
M14	106.0	84.0	41.0
M16	165.0	130.0	64.0
M20	320.0	253.0	125.0
M24	557.0	441.0	217.0
M30	1107.0	876.0	-

Instruction

- All screws must be tightened with appropriate torque.
- Unless the torque is specified in the text, select the appropriate tightening torque according to the screw's performance grade.
- Remove screws and foreign bodies from threaded holes.
- Torque is suitable for lightly lubricated screws.
- The screw should be tightened evenly and symmetrically in a stepwise manner.
- Apply thread sealant to the screw engagement areas as required for reducer and other moving parts installation.

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