AUCTECH

H Series Robots

Mechanical Operation and Maintenance Manual

V2. 0

Guangzhou Auctech Automation Technology Ltd

Directory

Content

Introductory

Foreword.

Thank you for purchasing our robots from your company.

This manual introduces the H series industrial robots mechanical operation and maintenance manual composition and the function of each part and the demonstrator, servo drive fault code description and processing countermeasures, etc. It is a basic manual for users to quickly learn and use.

Before using the robot, read this manual and other related manuals carefully, and be sure to understand and familiarize yourself with the contents explained in the manuals.

Addressee

This manual is intended for users of industrial robots, please make sure that the user has a basic knowledge of industrial robots.

Illustrate

The following illustrations may appear in this specification and the meanings they represent are as follows:

icon	instructions
 Danger	Indicates a highly dangerous situation that could result in death or serious injury to the user if handled incorrectly.
 Caution	Indicates a situation where handling errors could result in death or serious injury to the user.
 Attention	Indicates a situation where incorrect handling could result in minor injuries to the user or property damage.
 Importance	Indicates other significant circumstances.

1 Surety

Industrial robots comply with current safety technology regulations. Nevertheless, non-compliance may result in personal injury and damage to the robot or other equipment.

The use of industrial robots is permitted only when the robot is in perfect condition, as specified and in a safety-conscious manner. The robot must be used in accordance with these instructions and faults that pose a safety hazard must be removed in a timely manner.

Guangzhou Auctech Automation Technology Ltd. is committed to providing reliable safety information, but assumes no responsibility for it. Even if everything is done in accordance with the safety instructions, there is no guarantee that the robot will not cause personal injury and property damage.

1.1 Robot safety information

Before installation, operation, maintenance, or overhaul, be sure to read this book and the accompanying documents and use this product correctly. Use this product only when you have full knowledge of the equipment, safety information, and all precautions.

1.1.1 Safety precautions for adjustment, operation, and preservation operations

(1) Operators are required to wear overalls, helmets, safety shoes, etc.

(2) When the power is turned on, make sure that there are no workers within the robot's operating range.

(3) When the robot is in automatic mode, no personnel are allowed to enter the range of motion of the robot.

(4) The power supply must be cut off before entering the robot's range of action to carry out the work, and the demonstrator must be carried with you to avoid misuse by others.

(5) If inspection, maintenance, or other work must be carried out while the power is on, two people should work in a team, one in a position that allows the emergency stop button to be pressed immediately, and the other in a position that allows the robot to operate within its range of motion, so that the robot can remain vigilant and work quickly. The other

(2) Other operators performed the operation.

(3) A different programme was started due to an abnormality in peripheral equipment, etc. and a programme error.

(4) Abnormal operation due to noise, malfunction, defect, etc.

(5) Misuse.

(6) The action was intended to be executed with low-speed regeneration, but a high-speed action was executed instead.

(7) Workpieces handled by the robot fall off and fall apart.

(8) Sudden loss of control when the workpiece is in a clamped, interlocked standby stop.

(9) An adjacent or behind robot performs the action.

The above are just a few examples, and there are many other forms of "unexpected situations". In most cases, it is not possible to "stop" or "escape" a robot that moves suddenly, so the following best practices should be implemented to avoid such accidents.

	Be careful. Do not approach the robot.
	When the robot is not in use, take measures such as "pressing the emergency stop button" or "cutting off the power supply" to prevent the robot from operating.
	During robot operation, have a monitor (third party) who can immediately press the emergency stop button to monitor the safety situation.
	During robot action, work should be carried out in a posture that allows the emergency stop button to be pressed immediately.

In order to comply with these principles, the latter caveats must be fully understood and effectively followed.

1.1.2 Safety countermeasures for the robot body

The robot shall be designed to remove unnecessary protrusions or sharp parts, use materials adapted to the operating environment, and adopt fail-safe structures that are not susceptible to damage or accidents during operation.

In addition, it should be equipped with a malfunction detection stop function and an emergency stop function when the robot is in use, as well as an interlock function that prevents the robot from becoming dangerous when an abnormality occurs in the peripheral equipment, etc., to ensure safe operation.

It is prohibited to operate the robot with safety functions or guards de-activated or removed.

It is prohibited to dismantle the robot's balancing device without reliable auxiliary tooling.

When installing incidental machines on end-effector and robotic arms, the size and number of bolts specified in this book should be strictly adhered to, and tightened to the specified torque using a torque spanner.
In addition, rusted or fouled bolts must not be used.
Out-of-specification tightening and imperfect methods can loosen bolts and lead to major accidents.

When designing and manufacturing the end-effector, control it within the load tolerance of the robot's wrist area.

A fail-safe structure shall be adopted so that even if the power supply to the end-effector or the supply of compressed air is cut off, no accident occurs in which the handle is released or flies out, and the edge or protruding part shall be handled so as to prevent any damage to people or objects.

It is strictly prohibited to supply electricity, compressed air, or welding cooling water outside of the specifications, as this will affect the performance of the robot's movements and cause abnormal movements or malfunctions, damage, and other dangerous situations.

There is no perfect countermeasure for electromagnetic interference with current technology, although it is related to the type or intensity of the interference. When the robot is in operation, powered on, etc., observe the operating precautions. Data recorded may be lost due to electromagnetic waves, other noises, and defects in the substrate.

Therefore, please back up your programs or constants to an external storage medium such as a compact flash card.

When multiple operators are working on a large system and must talk at a distance from each other, correctly communicate intentions through the use of hand signals, etc.

Factors such as noise in the environment can prevent meaning from being conveyed correctly and lead to accidents.

When designing and manufacturing the end-effector, control it within the load tolerance of the robot's wrist area.

Industrial Robot Gesture Method (example)

Attention

Attention

Operators should also maintain an awareness of escape at all times during operations.

It must be ensured that immediate escape is possible in case of emergency.

Caution

Always be aware of the robot's movements and do not work with your back to the robot.

Slow reaction to the robot's movements can also lead to accidents.

Caution

When an abnormality is detected, the emergency stop button should be pressed immediately.

This provision must be thoroughly implemented.

Work regulations and checklists related to the starting method, operation method, and solution method in case of an abnormality of the robot should be prepared according to the installation site and the contents of the work. The work shall be performed in accordance with the work regulations.

Operation based solely on the memory and knowledge of the operator can lead to accidents due to forgetfulness and errors, etc.

When you do not need to move or operate the robot, turn off the power before performing the work.

When demonstrating, confirm the procedure number or step number before proceeding with the work.
Editing procedures and steps incorrectly can lead to accidents.

For completed programmes, use the store protection function to prevent accidental editing.

After the demonstration operation is completed, the robot's movements should be checked manually at low speed.
If immediately in automatic mode and running at 100% speed, accidents can occur due to programming errors and other factors.

At the end of the demonstration work, clean up the work and make sure that no tools have been forgotten. Oil contamination of the work area, forgotten tools, etc. can lead to accidents such as falls.

Ensuring safety starts with tidying up.

If you remove the motor without securing the arm, the arm may fall or move back and forth. Secure the arm first and then remove the motor.

1.2 Transfer, assignment, realisation of robots

When a robot is transferred, assigned, or sold, it is necessary to ensure that the operation manual, maintenance manual, and other types of documents attached to the robot are handed over to the new user.

When transferring, assigning, or selling abroad, the customer must be responsible for preparing operating and maintenance instructions in the appropriate language, modifying the display language, and ensuring compliance with local laws.

Incorrect operation or unsafe work by new users who have not read the instruction manual can lead to accidents.

When a robot is transferred, assigned, or sold abroad, the provisions of the contract at the time of the initial sale, if not specifically provided for, containing provisions relating to security, may not be inherited by the new owner.

Between the original customer and the new bearer, the contract must be renewed.

1.3 Abandonment of robots

Do not disassemble, heat, or incinerate the battery used for the control unit or robot body, as fire, rupture, or combustion may occur.

Do not disassemble the control unit's substrate, components, etc., and then dispose of them. Sharp parts such as Hacks or cuts, and electrical wires, etc., may cause injury.

After removing the cable and external wiring from the connector or terminal box, do not disassemble them further and then dispose of them. Otherwise, the conductors may cause hand or eye injuries.

When carrying out abandonment work, take sufficient care not to get pinched or injured.

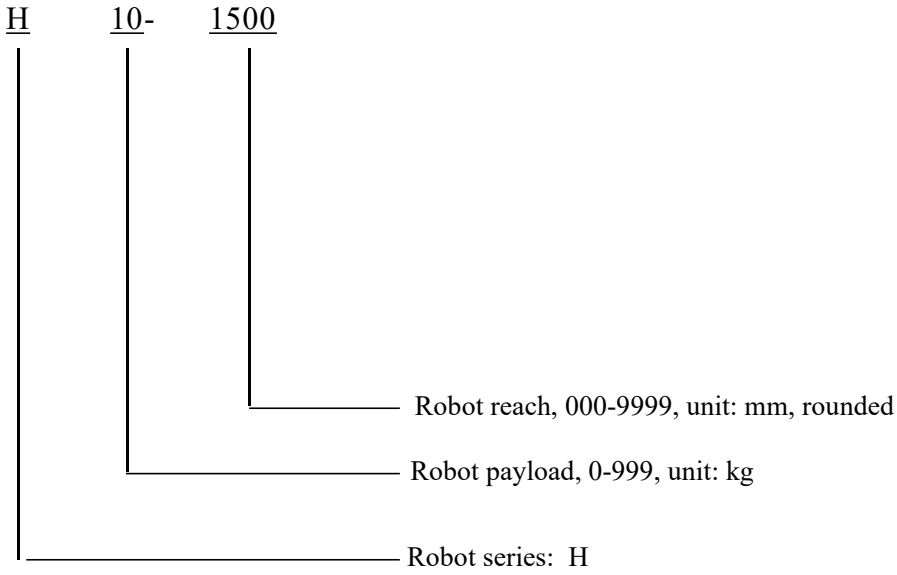
Waste products should be disposed of in a safe condition.

Please dispose of environmentally hazardous waste materials such as used batteries and used grease according to local environmental protection requirements to avoid environmental pollution.

2 Basic description

2.1 Model specificationdescription

The company's robot models are described below:



2.2 Components of the mechanical system

This section describes the components of the robot body:

Robot mechanical system refers to the mechanical body composition, the robot body is mainly composed of the base, big arm, small arm, wrist, balance cylinder, etc., and its relevant relationship is shown in Figure 2.1 Robot system composition diagram.

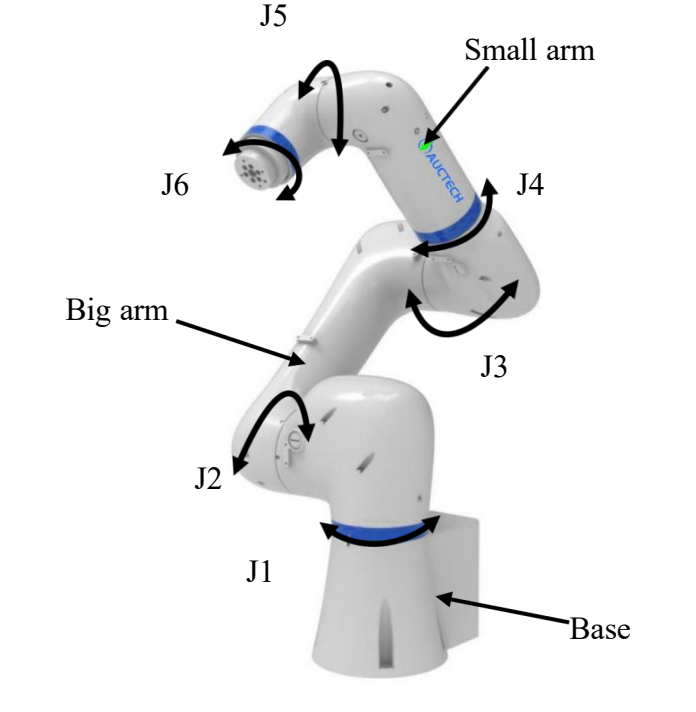


Figure 2.1 Robot Mechanical System Composition

2.3 Mechanical performance parameters

This section describes the performance parameters of the robot, such as the range of robot motion, speed, and reachable space.

2.3.1 Related performance parameters

Table 2.1 Robot performance parameters

Model number		H5-790	H7-890	H10-1500	H16-1200
Axis		6	6	6	6
Maximum load		5kg	7kg	10kg	16kg
Maximum radius of movement		785mm	885mm	1455mm	1155mm
Repeat Positioning Accuracy		±0.02mm	±0.02mm	±0.03mm	±0.03mm
Range of motion	J1	±360°	±360°	±360°	±360°
	J2	-240°/+60°	-240°/+60°	±360°	±360°

	J3	-60 /+240°	-60 /+240°	- 75°/ +255°	- 70°/ +250°
	J4	±360°	±360°	±360°	±360°
	J5	±360°	±360°	±360°	±360°
	J6	±360°	±360°	±360°	±360°
Maximum speed of operation	J1	3.49rad/s, 200°/s	4.18rad/s, 240°/s	4.18rad/s, 240°/S	4.18rad/s, 240°/S
	J2	3.49rad/s, 200°/s	3.66rad/s, 210°/s	4.36 rad/s, 250°/s	4.36rad/s, 240°/s
	J3	5.23rad/s, 300°/s	4.71rad/s, 270°/s	4.18rad/s, 240°/S	3.66rad/s, 210°/s
	J4	5.23rad/s, 300°/s	6.54rad/s, 375°/s	8.38rad/s, 480°/s	7.85rad/s, 450°/s
	J5	5.23rad/s, 300°/s	5.23rad/s, 300°/s	6.28rad/s, 360°/s	6.28rad/s, 360°/s
	J6	6.54rad/s, 375°/s	10.5rad/s, 600°/s	12.6rad/s, 720°/s	7.85rad/s, 450°/s
Applicable environment	temperature	0°~45°			
	humidity	20%～80%			
	other	Avoid contact with flammable, explosive or corrosive gases and liquids and keep away from electronic noise sources (plasma).			
Teach pendant cable length		8 meter			
Body-cabinet connection line length		3 meter			
Body protection level		IP67	IP67	IP67	IP67
Installation		Ground mounting, side mounting, upside down mounting			
Body weight		24kg	35kg	55kg	53.4kg

2.3.2 Working radius and range of motion

Table 2.2 H Series robot zero position

	zero point
J1	0°
J2	-90°.
J3	180°

J4	0°
J5	90°
J6	0°

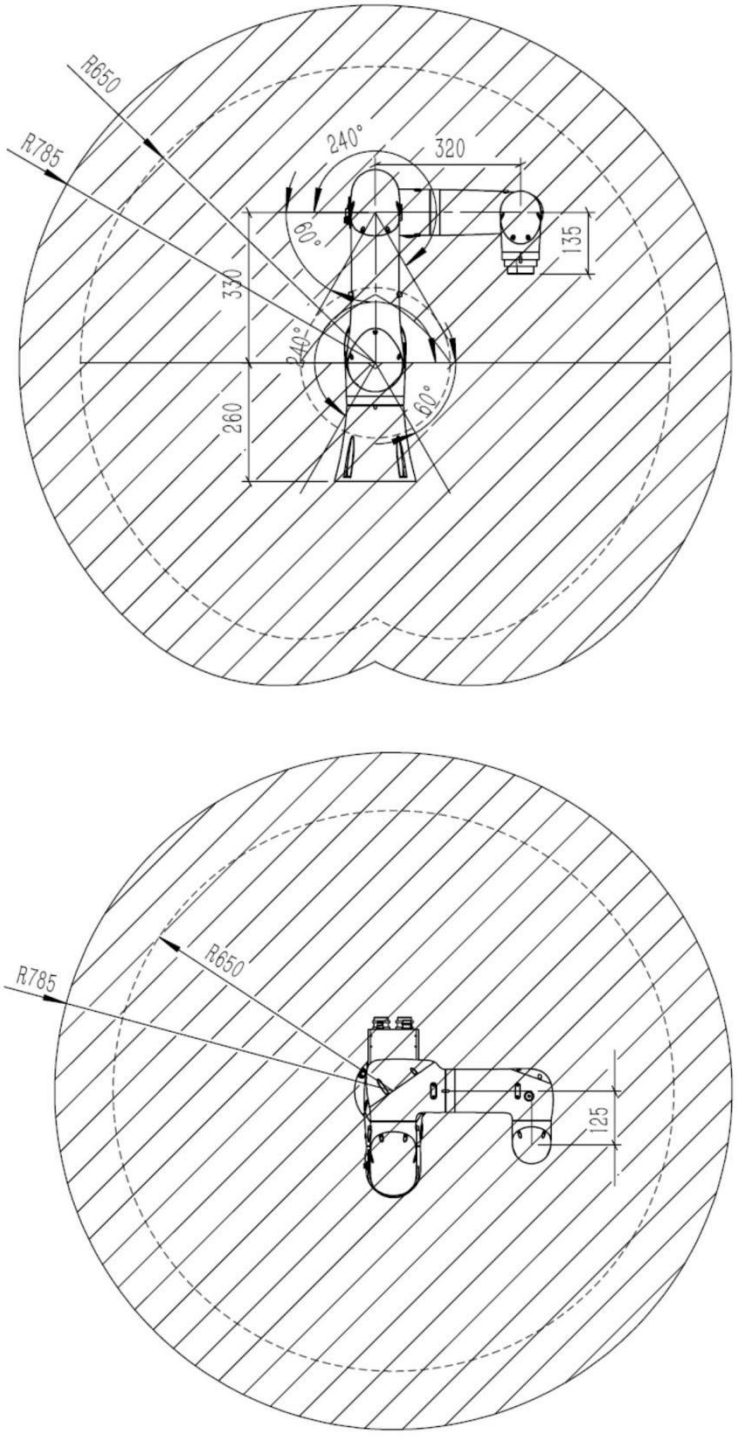


Figure 2.2 H5-790 robot workspace

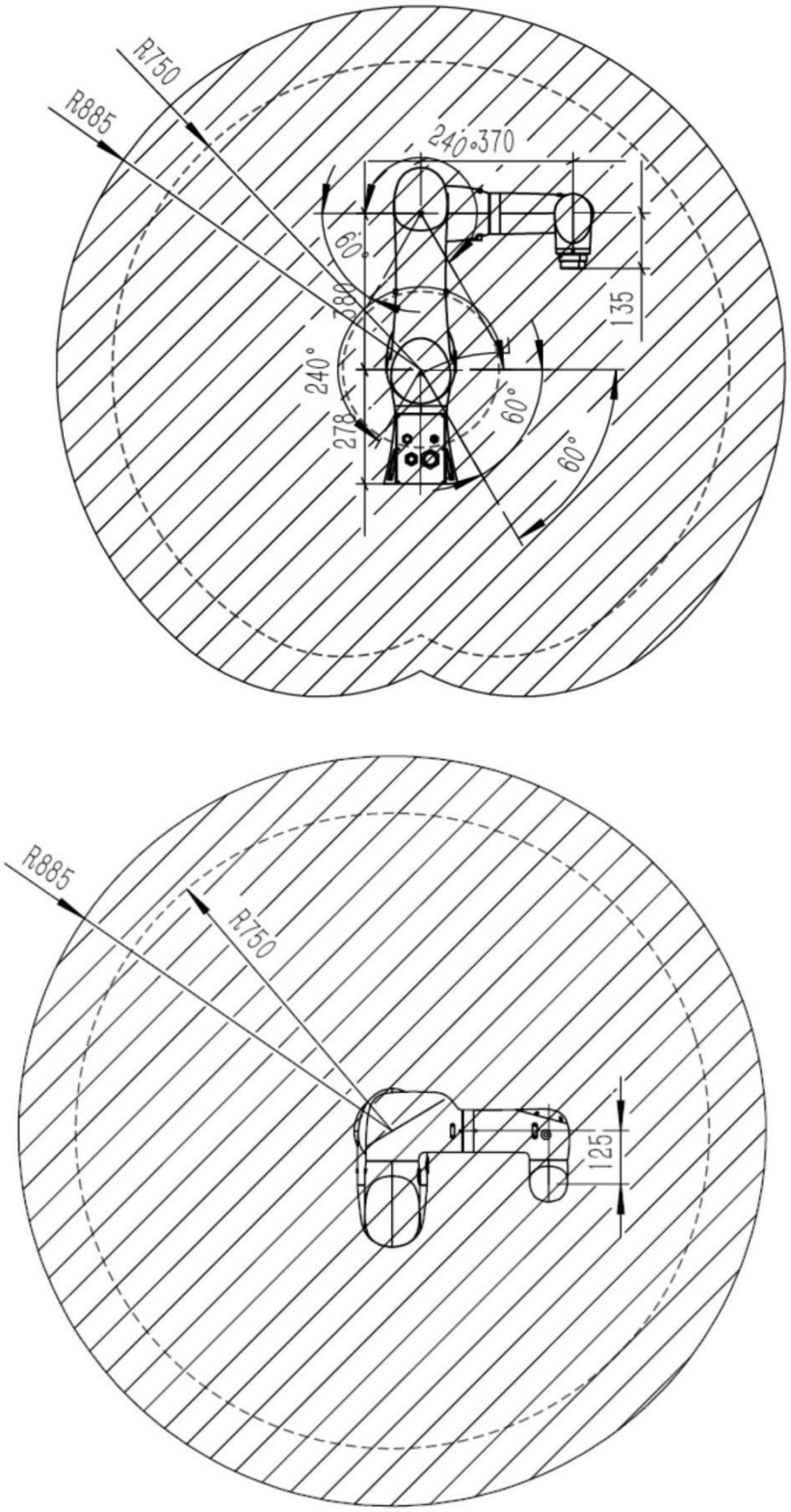


Figure 2.3 H7-890 robot workspace

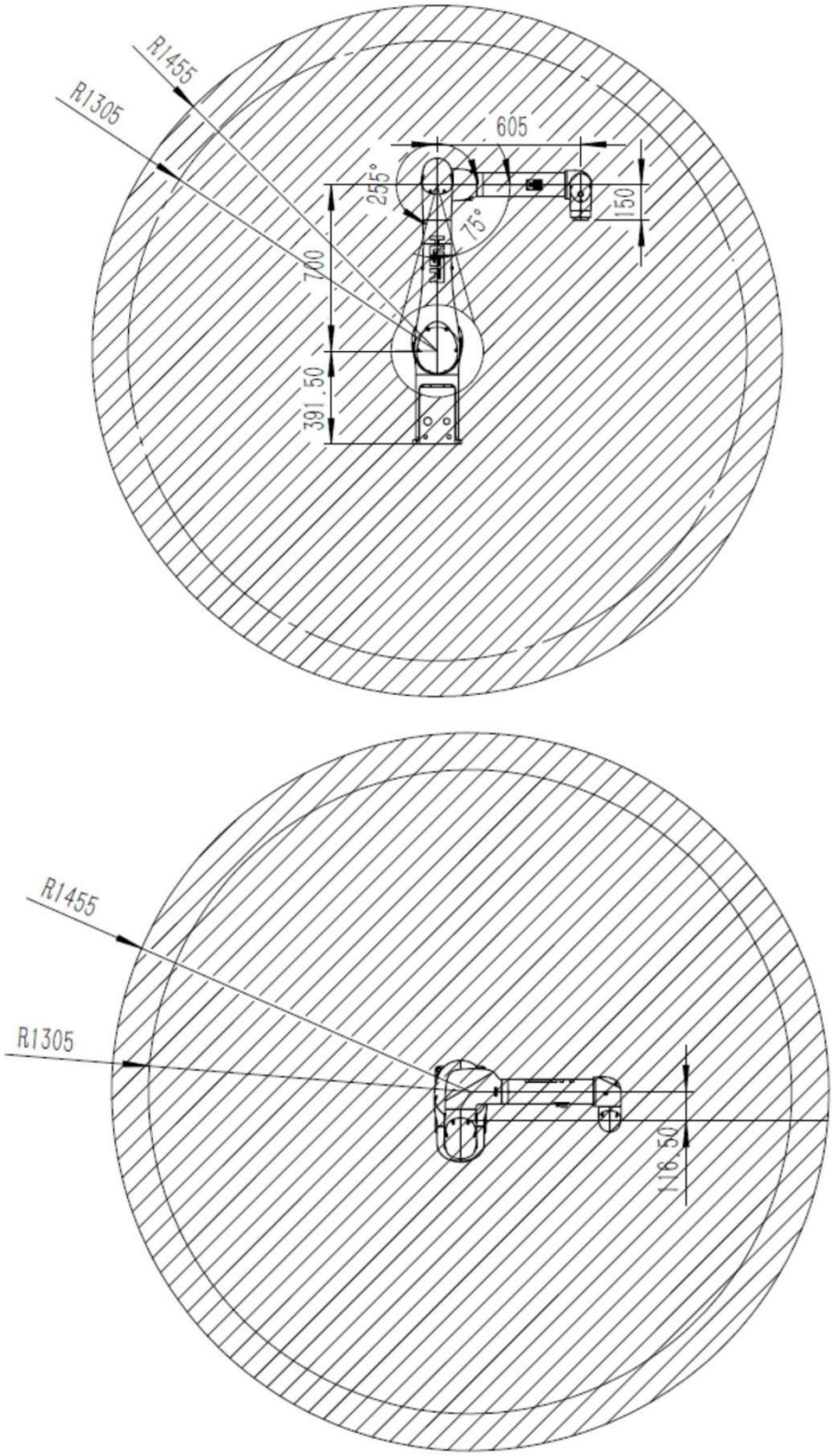


Figure 2.4 H10-1500 robot workspace

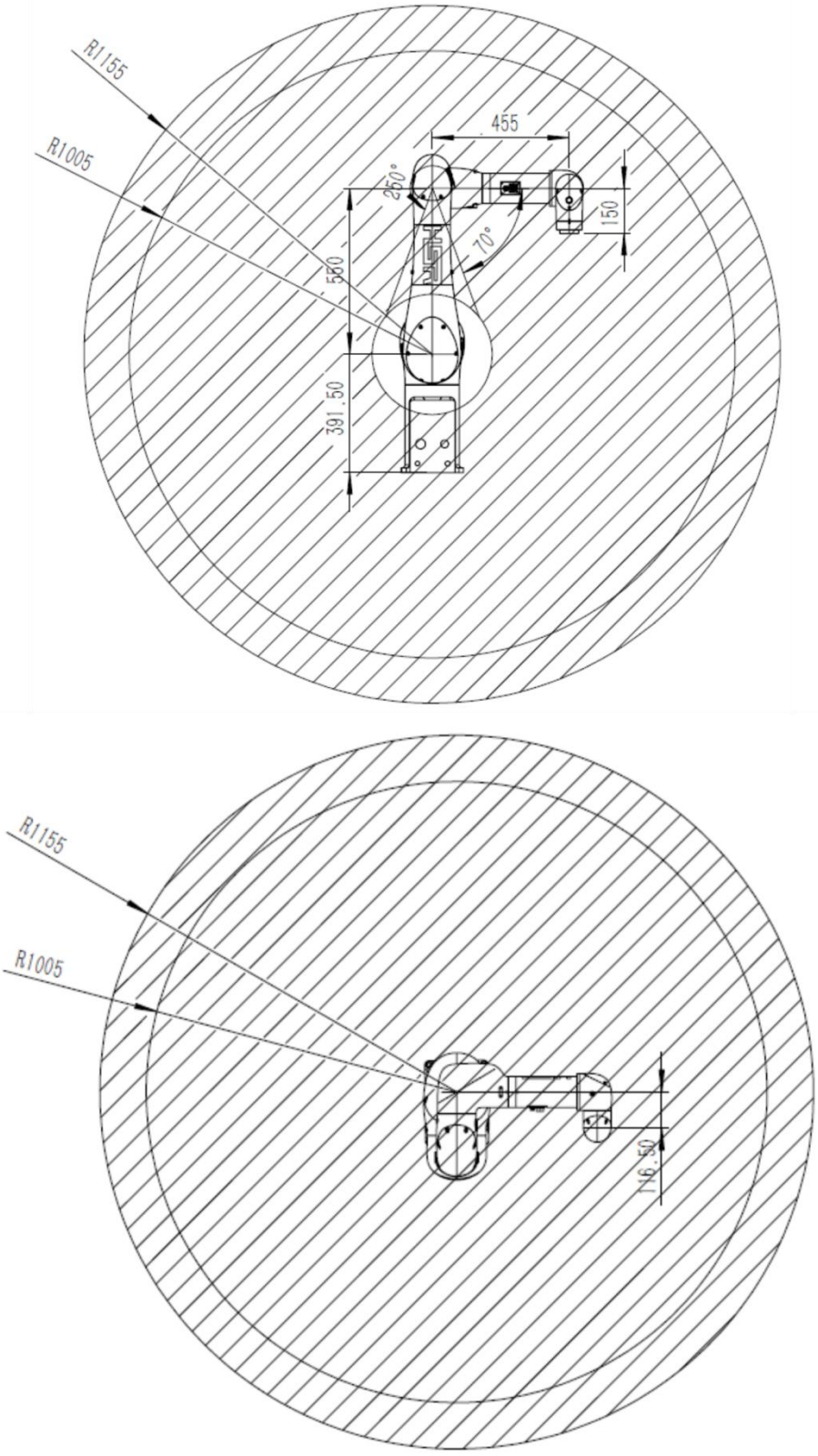


Figure 2.5 H16-1200 robot workspace

2.4 Handling and storage

This section describes robot unpacking, handling and related precautions; in principle, a cranes or forklift should be used for robot handling operations. Appropriate precautions should be taken when transporting and storing the H series industrial robots; they should be transported and stored within the temperature range of 0 °C to 45 °C and can withstand short-term transport and storage at temperatures of up to 70 °C for a period of no more than 24h. It should not be subject to strong bumps, vibrations, shocks and collisions and should take moisture-proof measures to avoid damage to electrical equipment.

2.4.1 Unpacking

Upon arrival, please confirm the contents of the box and whether the packaging is damaged.

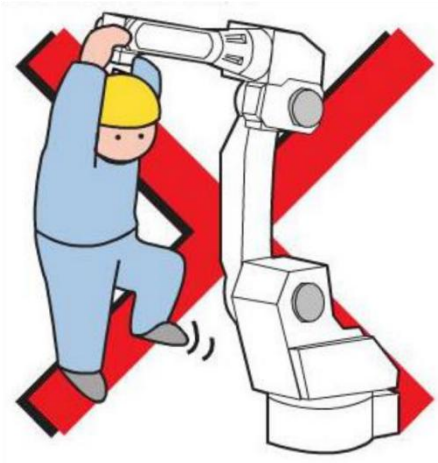
Be careful not to damage the robot during the unboxing process, and please do not forcefully wrench, suspend, or ride the robot after unboxing.

If the robot base fixing screws are to be removed after unpacking, take care to balance the robot by lifting it with an aerial trolley during the process to prevent it from tipping over.

注意

Attention

Do not forcefully wrench, suspend, or ride the robot.



Attention

The robot should be removed from the transport support frame before powering up for movement.

2.4.2 Portage

Manual handling

1） H5-790、H7-890 The robot body is lightweight, and manual handling is an option。

Attention

When transporting the robot, attach it to the conveyor or drag it to the bottom of the arm with your hand and pick it up by two or more people. When dragging the bottom of your arm, be careful not to pinch your fingers

Figure 2.6 Schematic diagram of handling

2）Forklift or cranes handling

The full range of H robots can be handled by forklifts or cranes.

Importance

The lifting weight is not more than 60kg (excluding handling fixtures and pallets), please choose a forklift or cranes with sufficient load-bearing capacity and a lifting rope with sufficient strength.

When handling the robot, be sure to avoid exposing the robot to excessive shock and vibration.

When transporting the robot with a forklift or cranes, remove obstacles and other obstacles in advance to ensure that the robot is safely transported to the installation position.

Caution

When using a cranes or forklift to move a robot, the robot body must never be supported manually.

Qualified workers are required to carry out handling operations such as rope driving, cranes lifting, or forklift driving. If the work is carried out by unqualified workers, it can cause serious injury or major damage, which is very dangerous.

When lifting the robot, make sure the robot is balanced. Unstable lifting can lead to serious injury or major damage due to the robot falling, which is very dangerous.

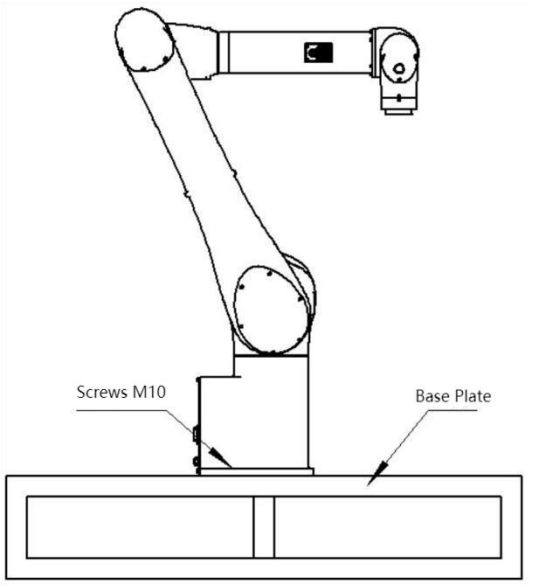


Figure 2.7 Handling with a forklift

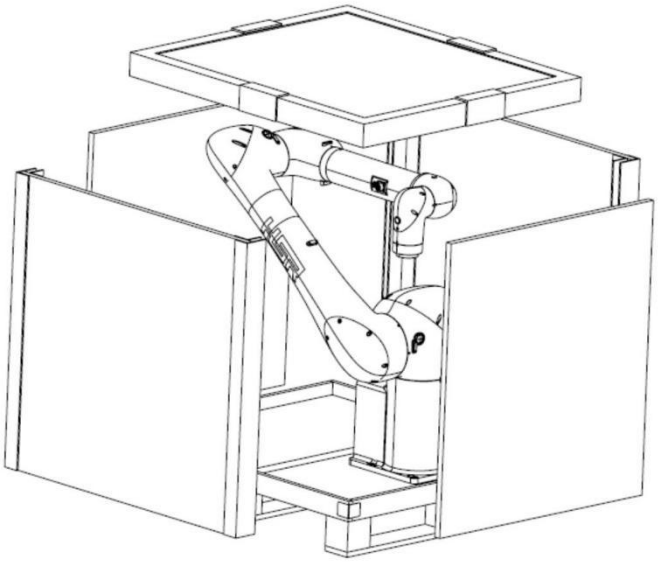


Figure 2.8 Schematic diagram of H Series packing attitude

Packing attitude angle of each model:

H5-790（0, -133, 223, 0, 90, 0）; H7-890（0, -133, 223, 0, 90, 0）

H10-1500（0, -151, 241, 0, 90, 0）; H16-1200（0, -133, 223, 0, 90, 0）

2.4.3 Transport and storage environment

1) Below 1000m above sea level; Keep away from places with large electromagnetic interference; Keep away from places with high levels of radiation

2) Long-term transportation and storage environment needs to be in the temperature range of -25 °C to +55 °C, and the temperature is up to 70 °C, and the time shall not exceed 24 hours. Measures should be taken to prevent moisture, vibration and shock to avoid damage to electrical equipment.

2.5 Mounting

This section describes robot installation and its precautions, robot installation examples, and installation environments.

Robots are used to set up safety fences, otherwise accidents such as personal injury and equipment damage may occur.

It is strictly prohibited to energise and operate the robot without fixing it, otherwise accidents such as equipment tipping, personal injury and equipment damage may occur.

Do not install or operate a robot with damaged or missing parts.

After setup, it is important that accessories and items placed on the robot are removed and personnel are kept away from the robot's maximum range of motion before initial power-up.

2.5.1 Security fence

In order to avoid personnel injury and equipment damage during the operation of the robot, please be sure to set up a safety area, and set the robot to slow down or even stop running when people are detected.

2.5.2 Installation environment

The installation of the robot is important for its functioning. The robot installation environment is as follows:

(1) The flatness of the mounting surface is within 0.5mm;

(2) Ambient temperature 0 ° to 45 °;

(3) Ambient humidity 20% to 80% without condensation;

(4) The altitude of the installation site does not exceed 1000m above sea level;

(5) The pollution level is 3;

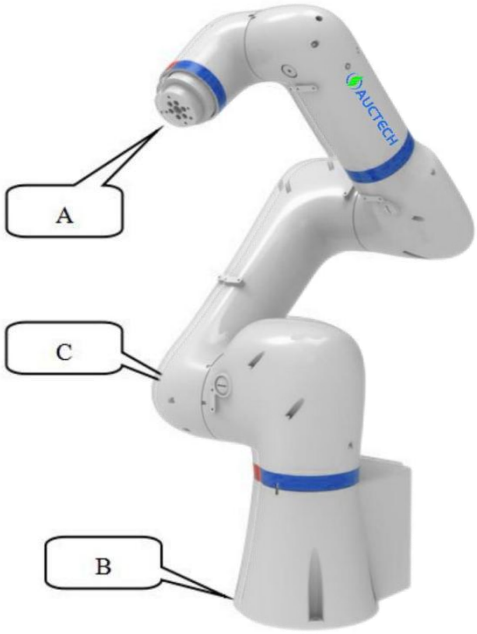
(6) Where flammable and corrosive liquids and gases are not present;

(7) Stay away from places with large sources of electrical noise;

(8) Places not subject to large shocks and vibrations.

2.5.3 Robot mounting and fixing dimensions

1) H5-790, H7-890 installation and fixed dimensions



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3） Figure 2.9 Robot installation size distribution diagram

A	End flange mounting dimensions, Figure 2.10
B	Robot base plate installation dimensions, Figure 2.11
C	Auxiliary equipment installation area, the maximum installation load is 1.0kg, Figure 2.12

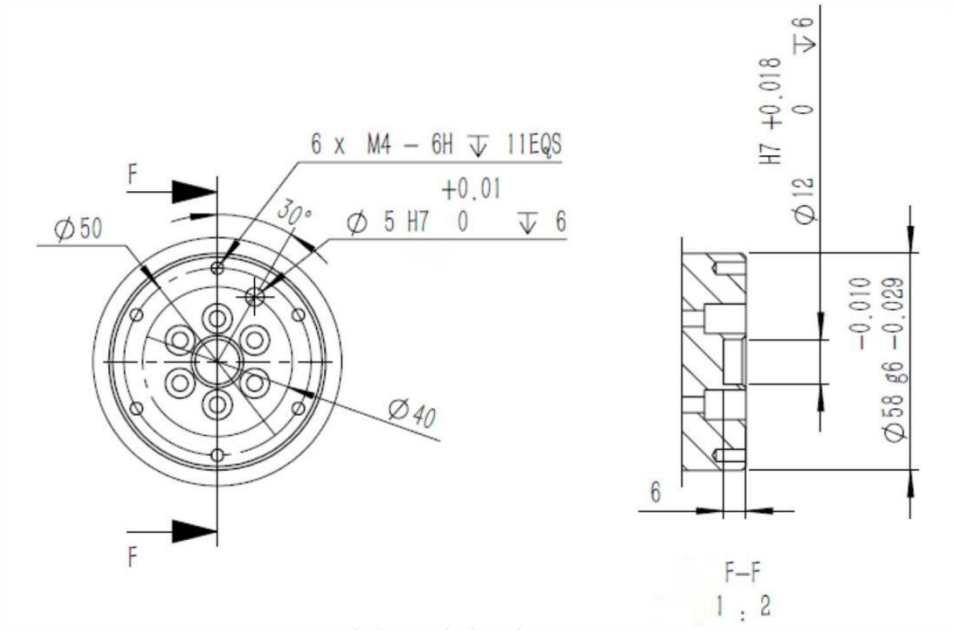


Figure 2.10 End flange dimensions of H5-790 and H7-890

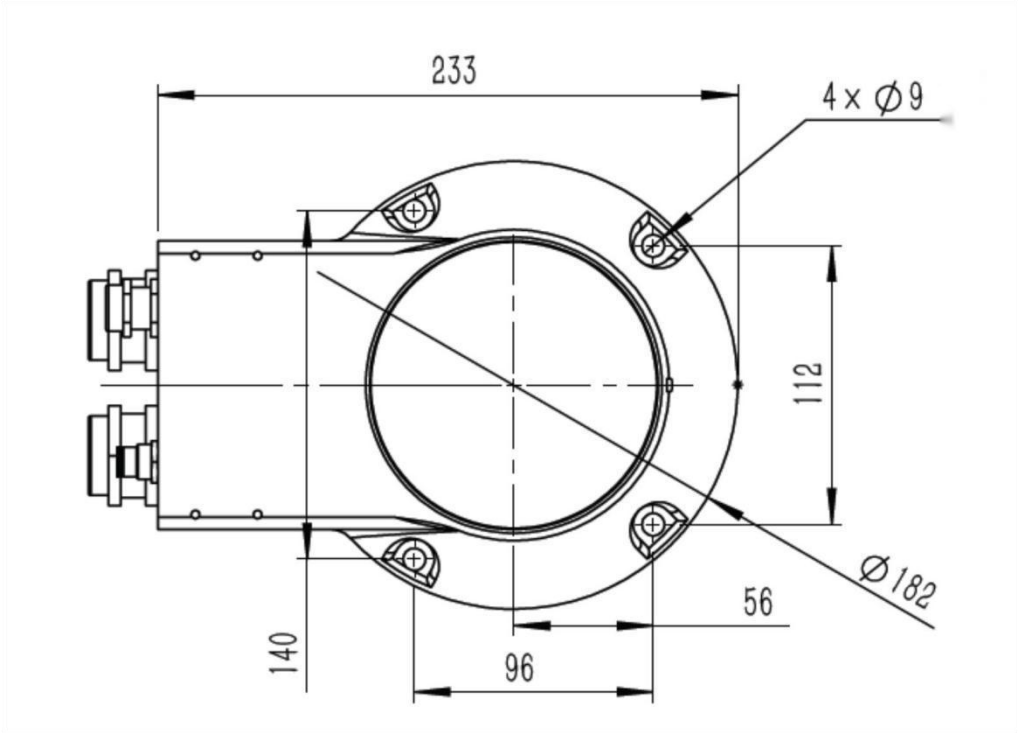
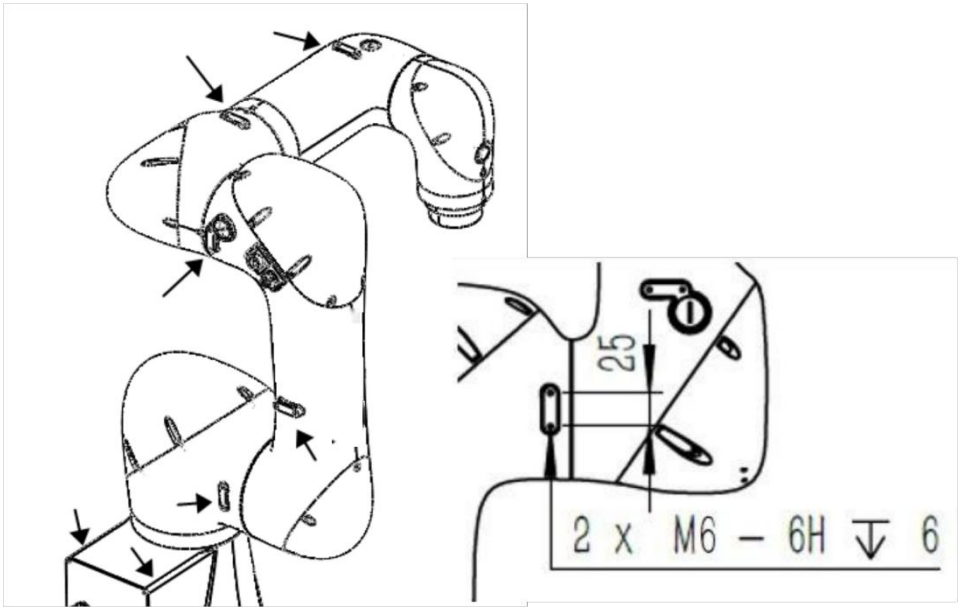


Figure 2.11 Base dimensions of H5-790 and H7-890



H10-1500, H16-1200 installation and fixed dimensions

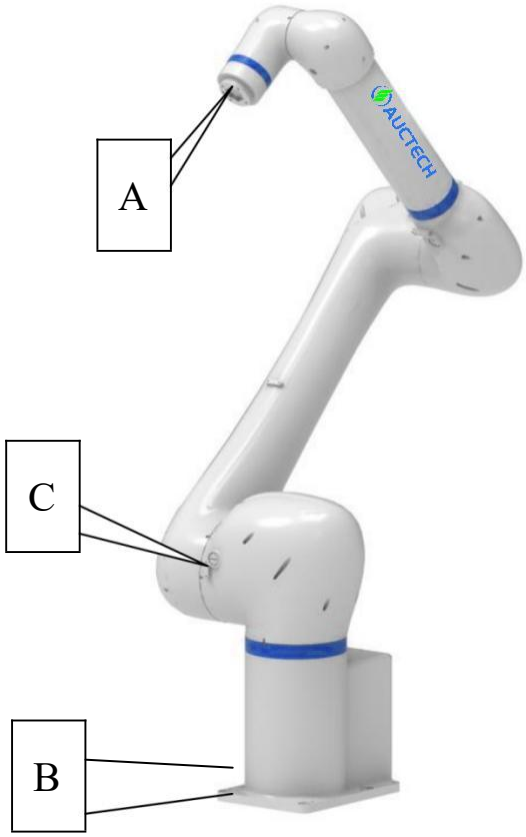


Figure 2.13 Robot installation size distribution diagram

A	End flange mounting dimensions, Figure 2.14
B	Robot base mounting dimensions, Figure 2.15
C	Auxiliary equipment installation area, the maximum installation load is 1.0kg, Figure 2.16

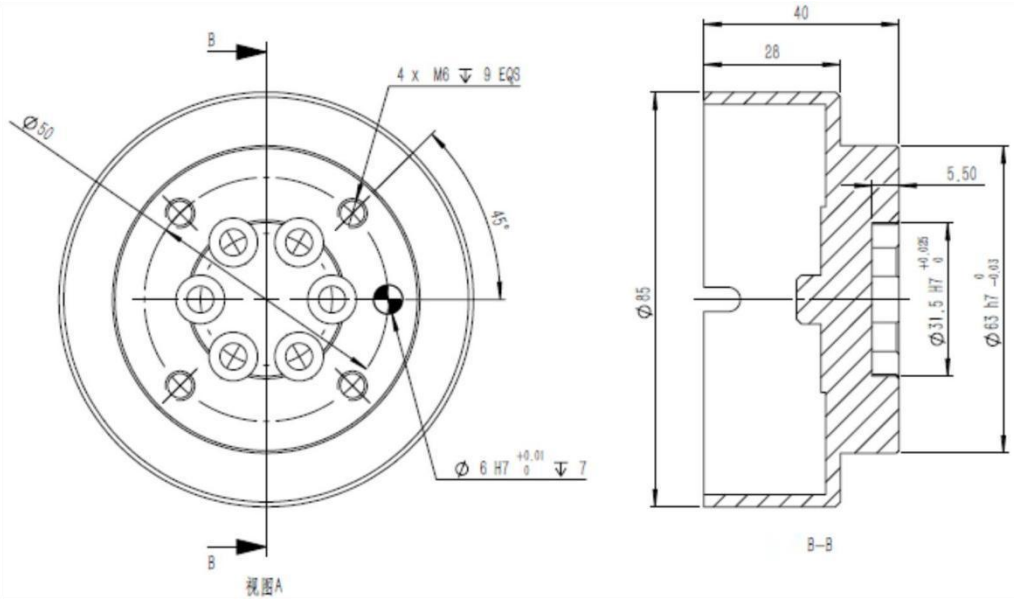


Fig. 2.14 End flange dimensions of H10-1500 and H16-1200

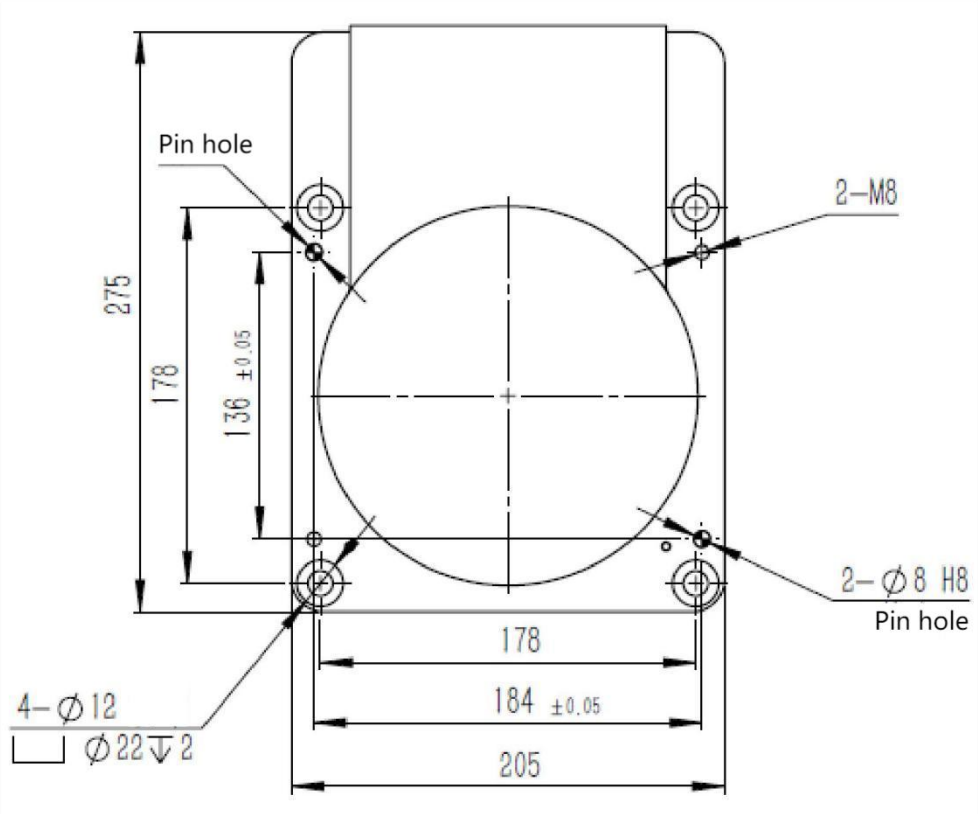


Figure 2.15 Base dimensions of H10-1500 and H16-1200

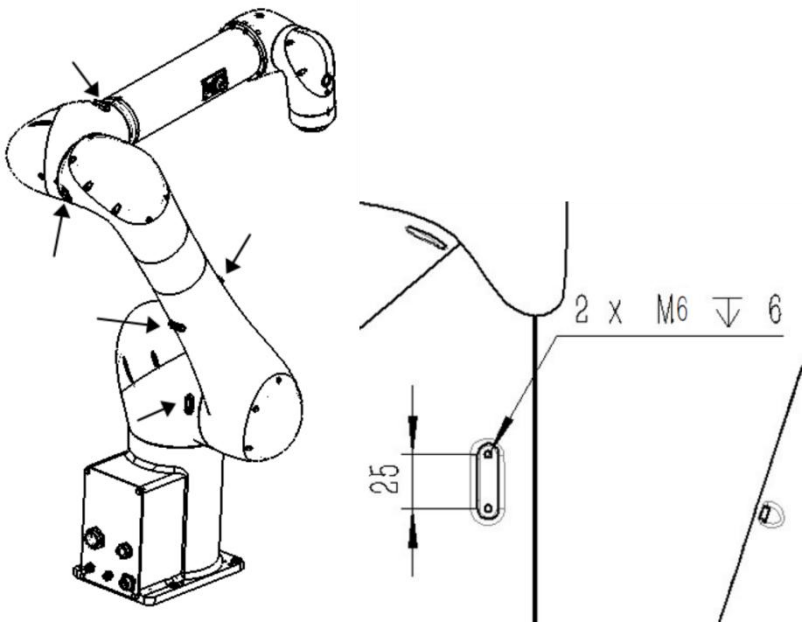


Figure 2.16 Installation area of H10-1500 and H16-1200 auxiliary equipment

2.5.4 Installation

The robot base can be mounted directly on the floor or through a pedestal.

Danger

When the robot accelerates and decelerates, a large reaction force is generated in all directions ofthe base. Therefore, when installing the robot, it should be ensured that the robot must be mounted firmly and securely, otherwise it may cause the robot to roll over, resulting in significant personal property damage.

When the robot base is mounted directly on the floor:

As shown in Figure 2.17, the robot can be fixed directly to the ground by means of ground bolts or by fixing to a thick iron plate embedded in the soil mix.

Danger

When the robot accelerates and decelerates, a large reaction force is generated in all directions of the base. Therefore, when installing the robot, it should be ensured that the robot must be mounted firmly and securely, otherwise it may cause the robot to roll over, resulting in significant personal property damage.

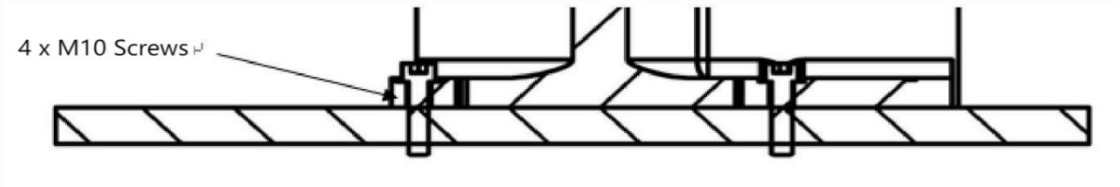


Figure 2.17 Robot mounted directly on the ground

First of all, the base plate is fixed to the ground, and the base plate must have sufficient strength and rigidity. The base of the robot should be fixed to the base plate with suitable screws through the four mounting holes on it (H5/607 uses M8 screws; H10/616 uses M10 screws). When choosing an upside-down installation, it is necessary to attach it to a ceiling or wall with sufficient strength, and to consider a safety device to prevent falling just in case. Otherwise, accidents such as personal injury and equipment damage may occur.

2.6 Allowable values for robot loads

This section focuses on robot loads. When selecting a robot, if the associated load, torque, or inertia exceeds the permissible values, please select a robot with a higher load or consult us.

Refer to section 2.5.3 for dimensions of mounting equipment on the robot body.

The mounting load on the front of the robot wrist is affected by the allowable weight of the wrist, the allowable load torque value, and the allowable moment of inertia value, which varies depending on the actual load moment of inertia.

Wrist loads should be strictly controlled within each tolerance value. If the robot is used with wrist loads outside the permissible values, normal operation cannot be guaranteed and damage to the robot drive parts may occur.

(1) Allowable robot handling weight

Table 2.3 Allowable handling weights

Robot Model	H5-790	H7-890	H10-1500	H16-1200
Allowable handling weight	5 KG	7KG	10KG	16KG

（2）Maximum permissible static load torque of the robot

Table 2.4 Allowable maximum static load torque

Robot Model		H5-790	H7-890	H10-1500	H16-1200
Allowable maximum static load torque	J6	10Nm	11.08Nm	15Nm	19.2Nm
	J5	16.5Nm	18.9Nm	31Nm	37.92Nm
	J4	11Nm	37.8Nm	23Nm	46.4Nm

（3）Maximum permissible moment of inertia of the robot

Table 2.5 Allowable maximum moment of inertia

Robot Model		H5-790	H7-890	H10-1500	H16-1200
Allowable maximum moment of inertia	J6	0.15kgm²	0.37kgm²	0.45kgm²	0.45kgm²
	J5	0.58kgm²	0.54kgm²	1.04kgm²	0.92kgm²
	J4	0.31kgm²	2.08kgm²	0.59kgm²	1.43kgm²

（4）Robot Load Diagram

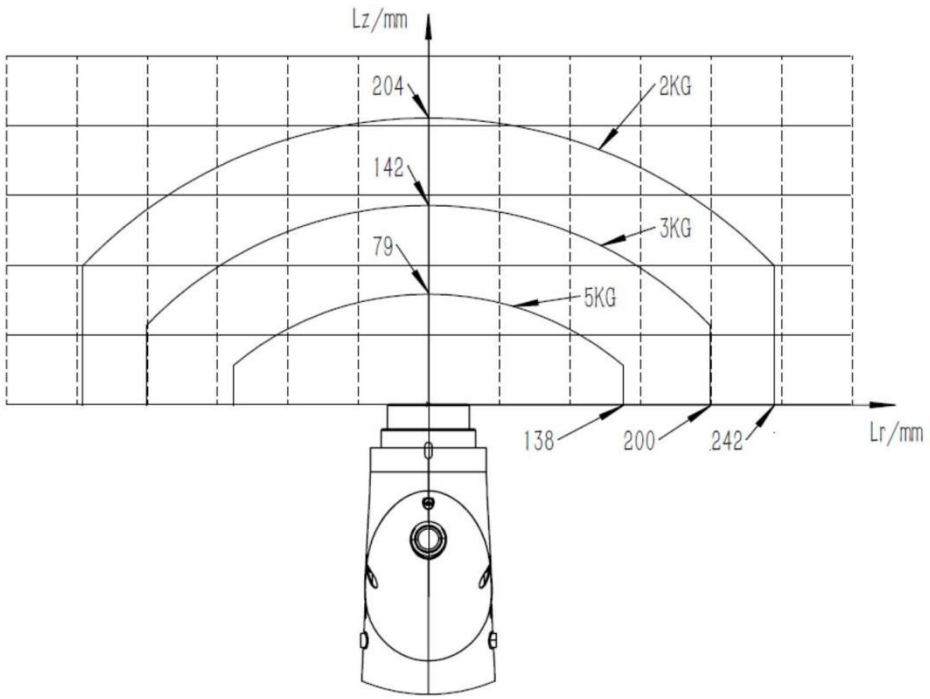


Figure 2.18 H5-790 load curve

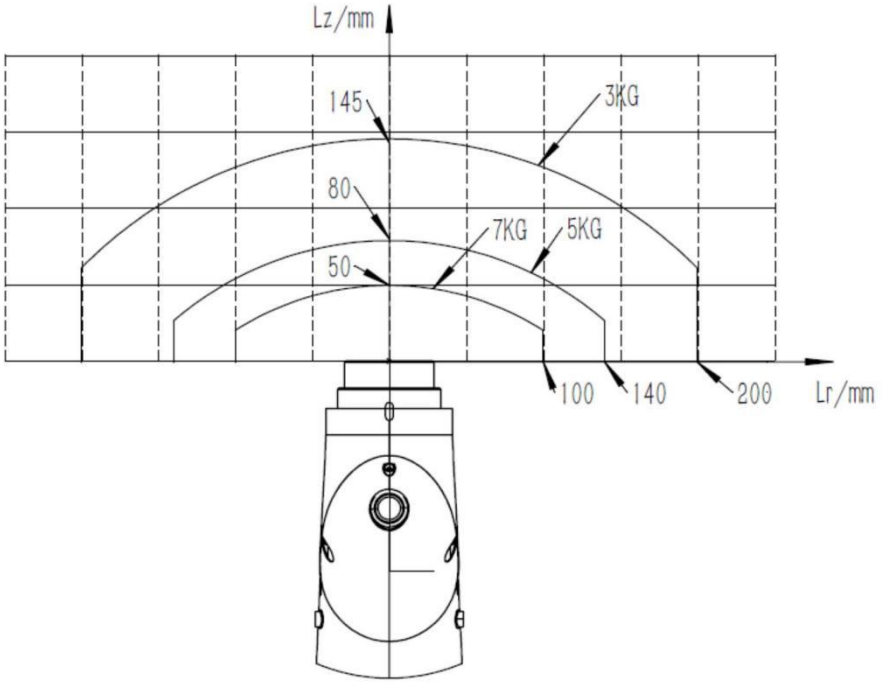


Figure 2.19 H7-890 load curve

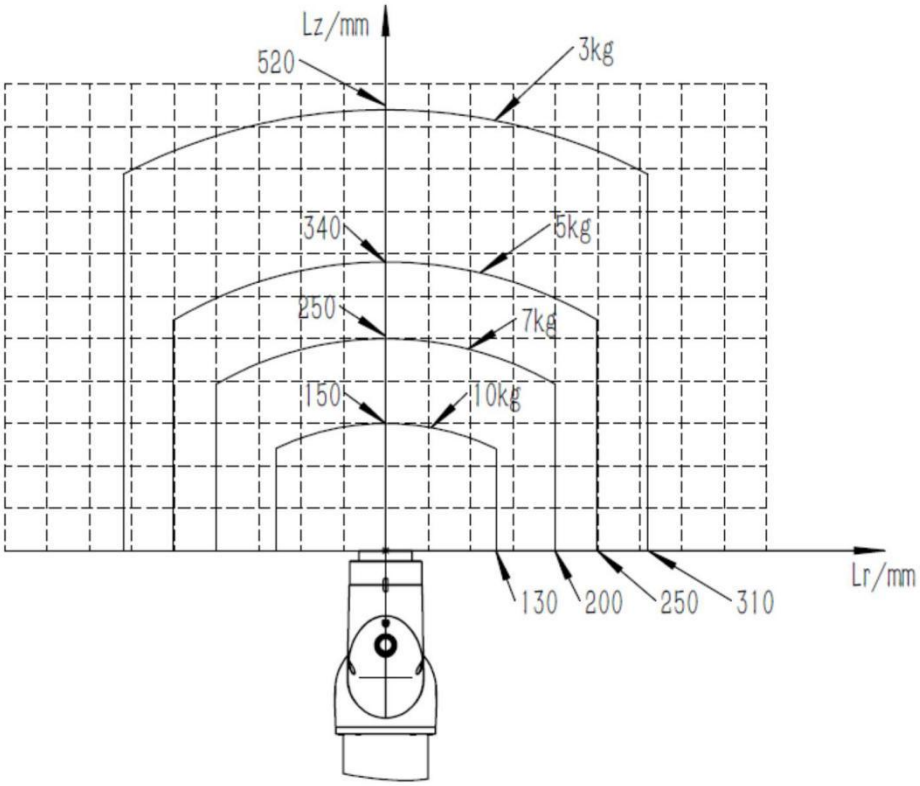


Figure 2.20 H10-1500 load curve

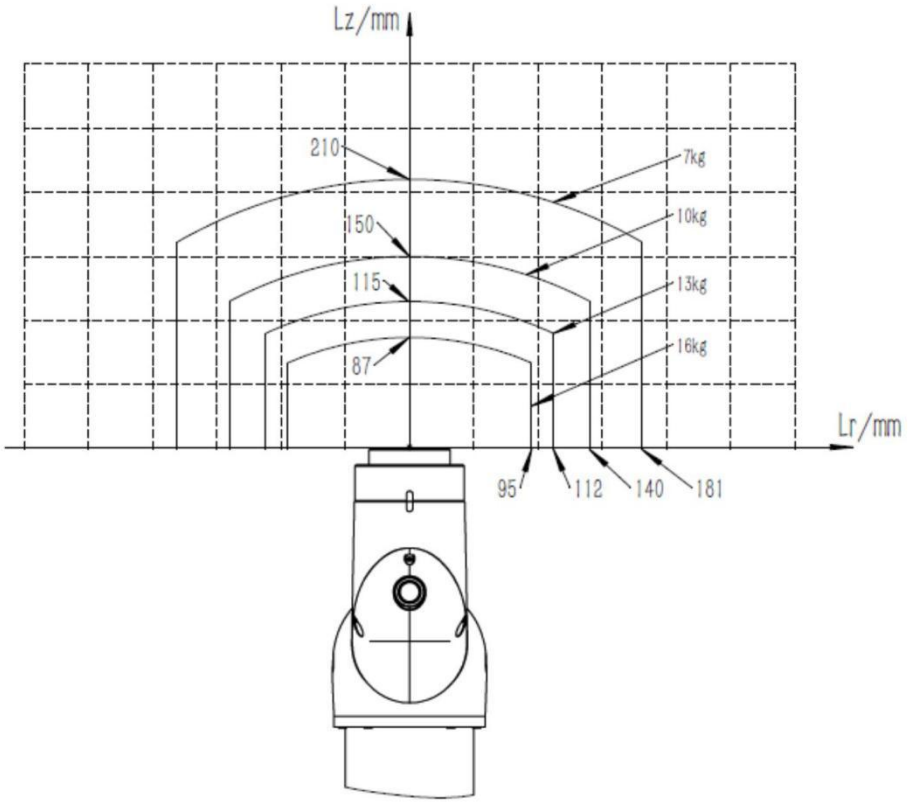


Figure 2.21 H16-1200 load curve

Note: Z-direction is the end flange axial direction.

2.7 Electrical connection

This section focuses on the preparation of the electrical connection of the robot, including the connection between the robot body and the control cabinet, the grounding of the robot body, the external I/O and trachea description of the robot, etc.

2.7.1 Connection of the body to the control cabinet

Attention

The nameplate number of the robot body must match the nameplate number of the control cabinet. Mismatching of the nameplate numbers will result in deviations in robot accuracy.

The robot body and the control cabinet are connected by a power coding line and a button wire. The power cable J1/J2 is connected to the electrical cabinet AXIS 1-2, the power cable J3/J4 is connected to the electrical cabinet AXIS 3-4, the power cable J5/J6 is connected

to the electrical cabinet AXIS 5-6, the encoder cable is connected to the ENC-A, and the button cable is connected as shown in Figure 2.26.

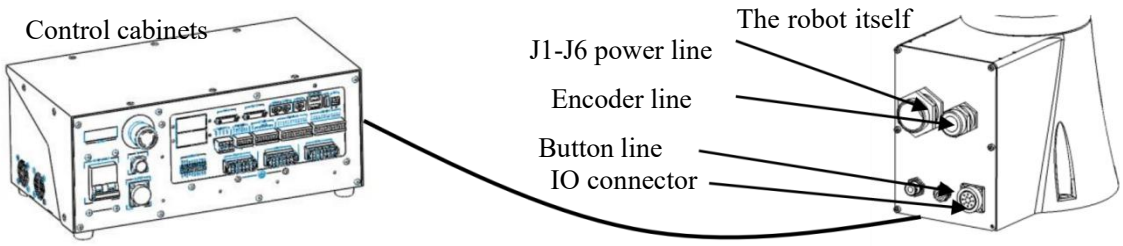


Figure 2.22 Schematic diagram of the connection between the robot and the control cabinet

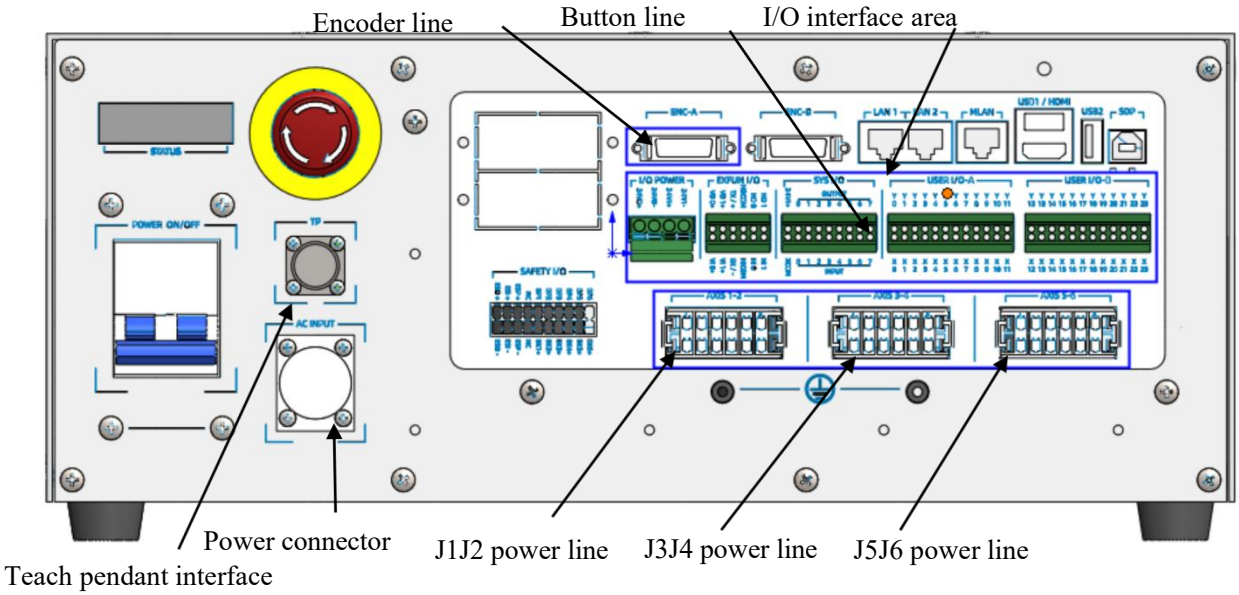


Figure 2.23 Schematic diagram of the connection position of the electrical cabinet panel

2.7.2 Description of the I/O interface area

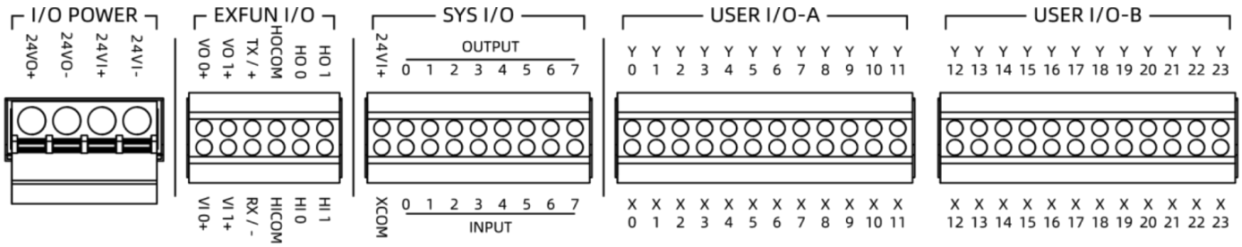
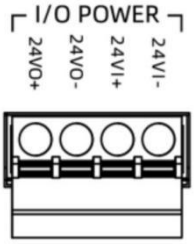
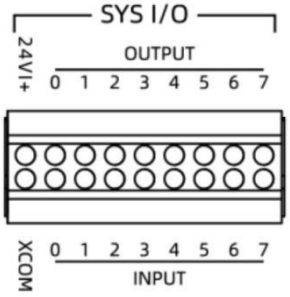


Figure 2.24 I/O interface area diagram

24V output input port definition：

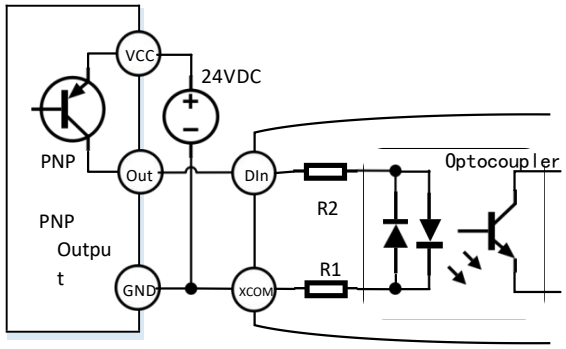
 I/O POWER	port	24VO+	24VO-	24VI+	24VI-
	definition	24V+ output	24V- output	24V+ input	24V- input

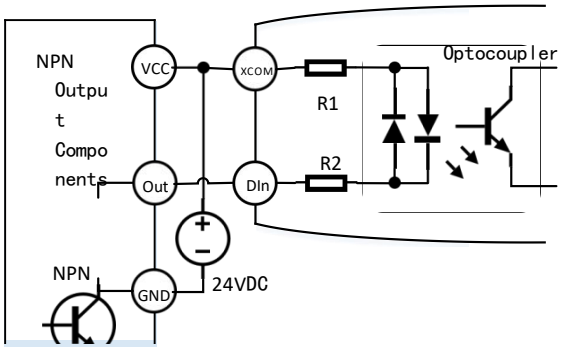
System I/O port definition：

 SYS I/O	port	24V I+	OUTPUT 0、1、6、7
	definition	24V+ input	System-specific numbers IO
	port	XCOM	INPUT 0、1、6、7
	definition	Enter the public side	System-specific numbers IO

*** Note: When the system is not occupied, DI0 and DO0 on the system start from the 0 of this port, for example, interface OUTPUT0 is DO0, Y0 and X0 are DO8 and DI8.**

For detailed interfacedescription, please refer to the user manual of the HRC-I series control cabinet, which is only explained here for the drag button instructions of the H Series models. The I/O POWER terminal defaults to 24VO+ shorting to 24VO-, 24VI+ shorting to 24VI-, I/O POWER 24VI+ is connected to SYS I/O 24VI+, the input mode can only use NPN or PNP input, the two input modes are as follows：

Example of PNP input		【Function description】Used to obtain the signal of PNP output device, note that the input port of the common XCOM can only be connected to NPN or PNP. 【Recommended wire】Copper core wire, core ≥ 0.5mm².

		【Wiring】The positive pole of the 24V DC power supply is connected to the VCC terminal of the PNP device; 24V DC power supply negative terminal, connected to XCOM terminal and GND terminal of PNP type device; DIn terminal, which connects the signal output of the PNP-type device.
Example of NPN input		【Functiondescription】Used to obtain the signal of NPN output device, note that the input port of the common XCOM can only be connected to NPN or PNP. 【Recommended wire】Copper core wire, core ≥ 0.3mm2. 【Wiring】24V DC power supply positive, connecting the XCOM terminal and the VCC terminal of NPN type device; 24V DC power supply negative terminal, connected to the GND terminal of NPN type device; DIn terminal, which connects the signal output of the NPN-type device.

2.7.3 Drag the button to wiring

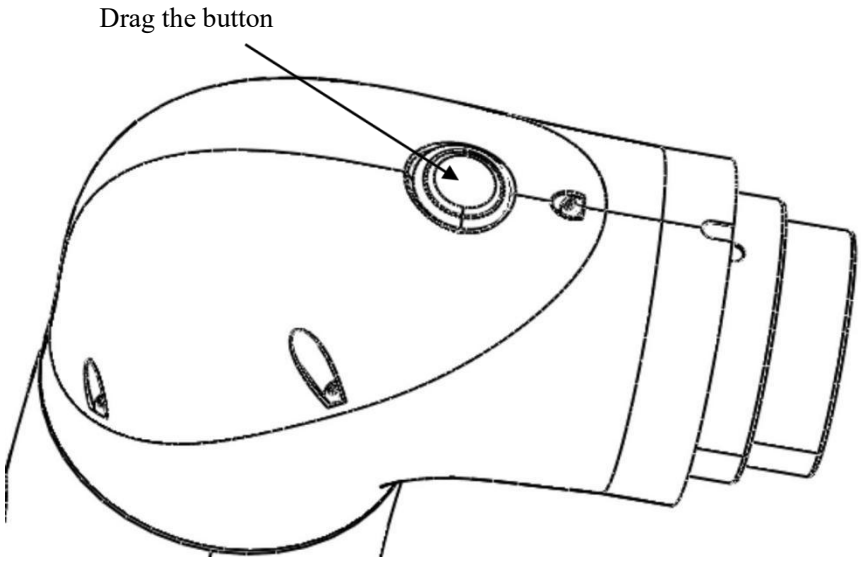


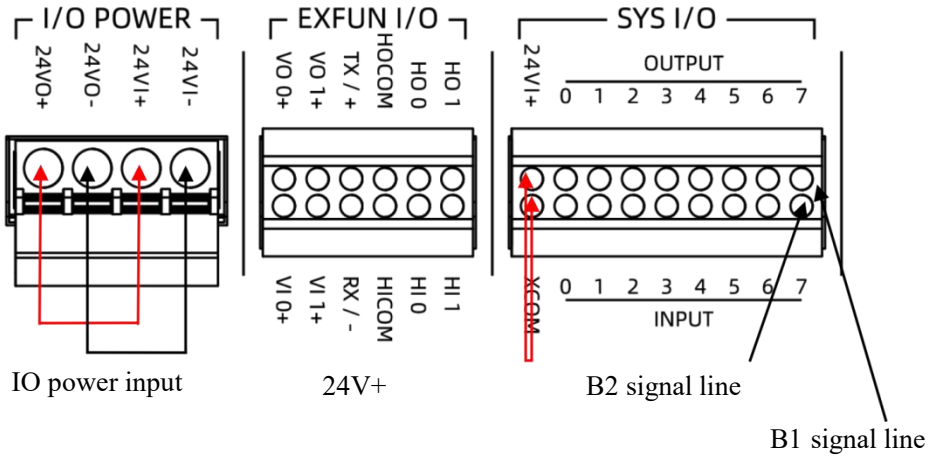
Figure 2.25 Schematic diagram of the position of the H Series buttons

Attention	Before using this function, you need to make sure that the cable of the electric cabinet drag button has been connected.

The IO input point of the H Series drag teach-in function system is DI7 by default, that is, when DI7 has input, it can take effect, and the signal line of the drag button is B1 and B2, and the loop is formed by the button closure. The following lists two wiring methods, and the default wiring method is 1 at the factory.

Wiring method 1 (factory default)：

NPN input is used, connected to 24V+ to XCOM terminal, signal line B1 is connected to DO7 of SYS I/O OUTPUT module (H system forcibly occupies output), signal line B2 is connected to DI7 of SYS I/O INPUT module, and the input signal can be generated by pressing the button.



Wiring method 2：

If PNP input is used, connect 24V- to XCOM terminal, signal line B1 to 24V+ of SYS I/O module, signal line B2 to DI7 of SYS I/O INPUT module, press the button and generate an input signal.

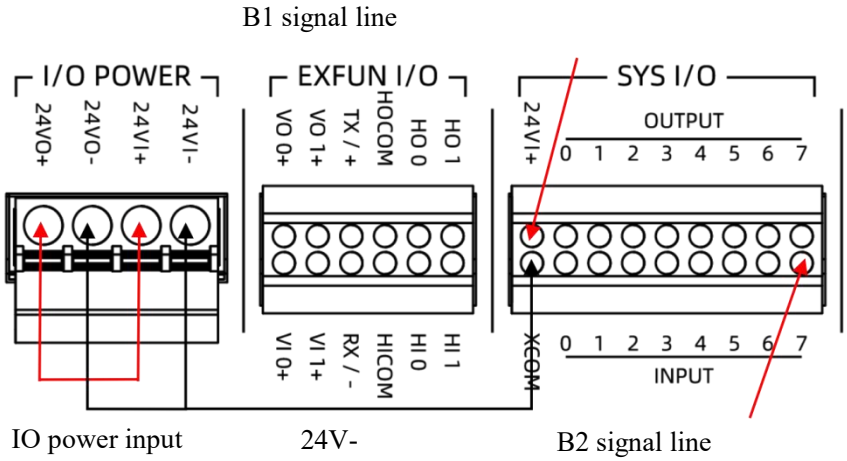


Figure 2.26 Schematic diagram of the wiring position of the H Series button

---

Attention

Before using this function, you need to make sure that the robot load number is set correctly, the drag function is turned on, and the load is identified, otherwise there is a risk of falling arm. (·For detailed operation, please be sure to read the " Robot Operation and Programming Manual" -9 dynamic function chapter)

Select the Configure → dynamics function → in the menu bar→ drag the teach-in settings→ drag function switch (on)

Press the drag button in the manual mode of the teach pendant, and the robot can enter the manual guidance mode. In this mode, the user can drag and guide the robot.。

2.7.4 Body grounding

There is an M4 grounding screw hole at the base of the robot for connecting the grounding terminal.

Attention

Before turning on the power supply of the control cabinet, please reliably ground the main body. If the ground wire is not connected, there is a risk of electric shock.

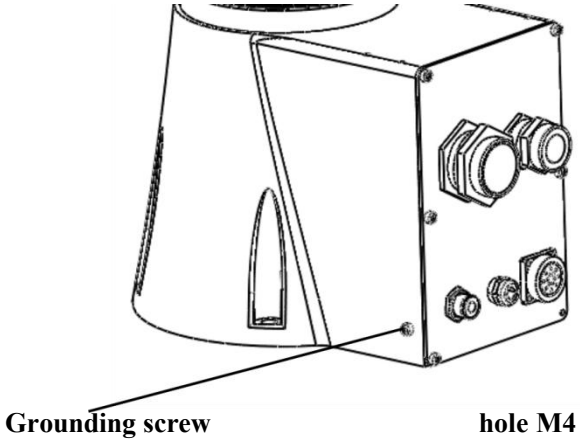


Figure 2.27 H5-790 and H7-890 robot grounding screw

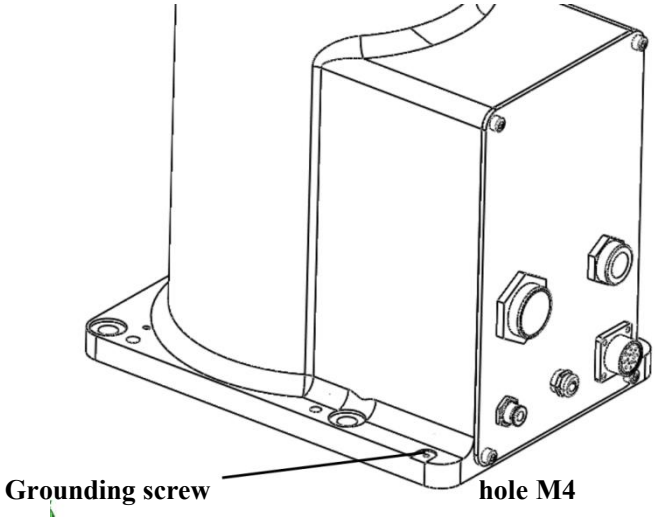


Figure 2.28 H10-1500 and H16-1200 robot grounding screw holes

2.7.5 External pipelines

The robot provides an electrical signal from the base to the forearm and tracheal access for the use of the end-effector.

IO provides corresponding joints for welding according to actual needs, and the models are WY16J10TE (10 cores) and WY20J12TE (12 cores)

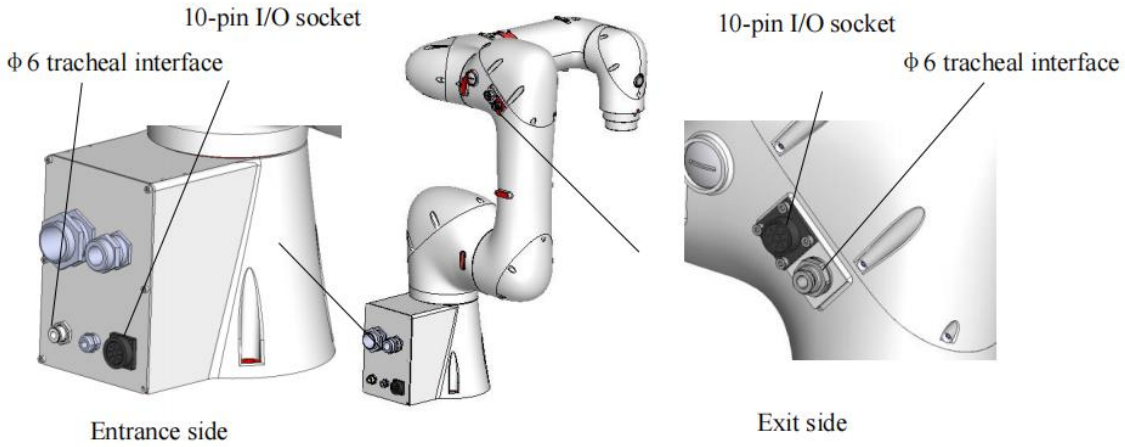


Figure 2.29 External circuits and gas circuits of H5-790 and H7-890 robots

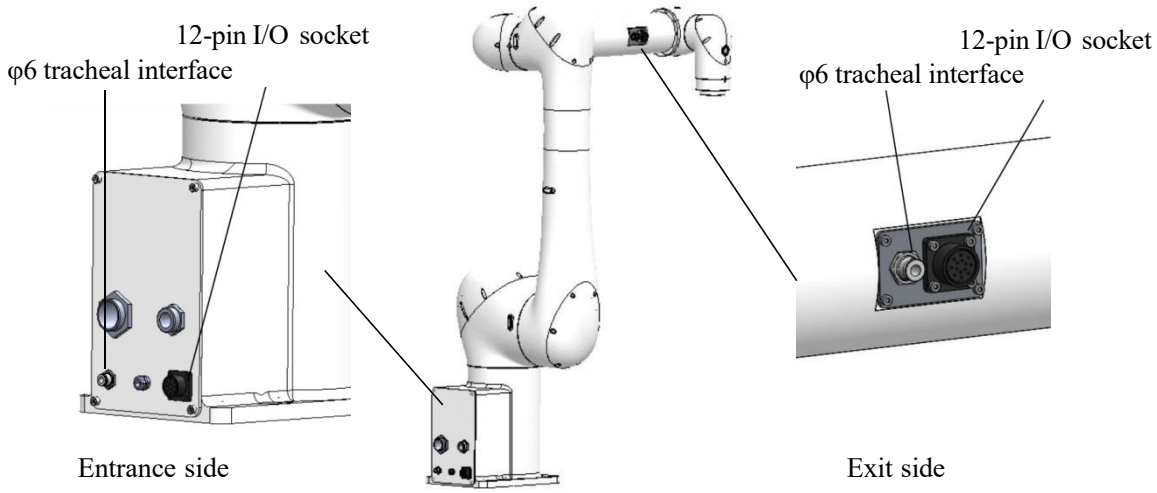


Figure 2.30 External circuits and gas circuits of H10-1500 and H16-1200 robots

3 Overhaul and maintenance

This chapter describes the overhaul and maintenance of the robot, and provides guidance to customers on the maintenance of the robot.

Maintenance inspections are necessary to maintain high performance of the robot over time.

Inspection is categorized into routine and periodic inspections, and inspectors must prepare an inspection plan and carry out inspections effectively. Refer to Table 3.1 for maintenance items.

Maintenance, overhaul and wiring operations must be disconnected from the power supply, otherwise there is a risk of electric shock, personal injury and other accidents. Please contact us for disassembly and repair.

If you need to disconnect the power supply for repair, overhaul, maintenance, or parts replacement, hang a "No power supply" sign on the primary power supply to prevent other workers from accidentally switching on the power supply.

Repair, overhaul, and maintenance operations must be carried out safely by confirming the safety of the surrounding area and securing access and places necessary to avoid danger.

The personnel who carry out maintenance and overhaul must be persons who have received special instruction or education for the period prescribed by law and are familiar with the contents.

3.1 Maintenance and inspection items and cycles

This section describes machine maintenance inspections, maintenance items and intervals.

Overhaul inspections are necessary to maintain high performance over time and to reduce malfunctions and ensure safety.

Inspection and maintenance is divided into daily maintenance and regular maintenance, the inspector must prepare the maintenance plan and effectively carry out the maintenance, the maintenance items and period refer to Table 3.1.

In addition, please contact us if you are not sure of the method of overhaul or adjustment.

Table 3.1 Maintenance inspection items and cycles

Maintenance area		maintenance interval						methodologies	Contents of overhaul treatment
		Everyday life	Interval 1000h	Interval 6000h	Interval 12000h	Interval 24000h	Interval 36000h		
1	origin marker	●						visual assessment	Is the zero point lost
2	External Cables	●						visual assessment	Detect for stains, damage
3	Overall appearance	●						visual assessment	Clean up dust and stains, and test all parts for Hacks.
4	Chassis bolts		●					spanners	Detection of missing, loose

5	Cover bolts		•					spanners	Detection of missing, loose
6	Main bolts		•					lever (on a machine)	Check for missing, loose
7	battery pack*1								Teachers display alarms
8	Reduction gears for each axis			•					Detecting any abnormalities (rattles, vibrations, etc.)
9	cord (computer)			•				visual assessment	Check for wear and tear, kinks
10	Terminal Fixture	•						Visual inspection, hand touch	Check for missing, loose

*1 Refer to section 3.5 for battery replacement.

3.2 Overhaul of main bolts

Table 3.2 Main screw Inspection Areas

No.	Inspection area	No.	Inspection area
1	For Robot Installation	5	For J4 shaft motor mounting
2	For J1 shaft motor mounting	6	For J5 shaft motor mounting
3	For J2 shaft motor mounting	7	For mounting of wrist parts
4	For J3 shaft motor mounting	8	For end-load mounting

screws must be tightened and replaced with a torque spanner to the correct torque before being fixed with paint, in addition, care should be taken that unloosened bolts are not tightened with more than the required torque.

3.3 Synchronous belt overhaul

Be sure to turn off the power before replacing the timing belt.

When performing replacement work, be careful not to apply excessive shock to the motor shaft. Failure to do so may result in a shorter or damaged life of the motor or code

If the parts of the robot (motor, reducer, timing belt, etc.) are replaced, there will be a deviation between the origin saved by the motor encoder and the origin saved on the controller side, and correct positioning will not be possible. Therefore, after the part replacement work, it is necessary to perform work to make the two origins consistent. The job of making the two origin positions consistent is called "zero point proofreading", and the method is described in section 3.6.

The replacement of the parts of the robot (motor, reducer, timing belt, etc.) must be carried out by professionals, otherwise the parts of the robot are likely to be damaged or the robot cannot work normally and stably. If you need to replace the robot parts, please consult our company or have the relevant trained professionals replace the relevant parts. This model does not have a synchronous wheel timing belt structure, so it does not need to be overhauled

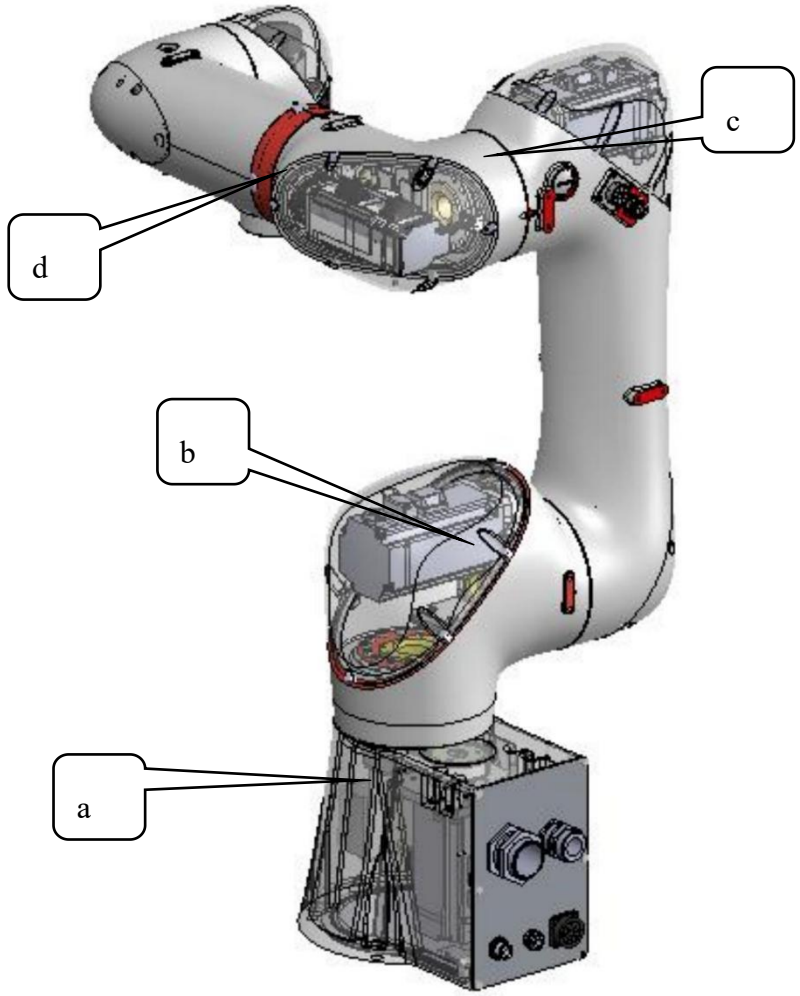


Figure 3.1 Schematic diagram of the position of the timing belt of the H Series robot

Area	H5-790	H7-890	H10-1500	H16-1200	note
a	258-3GT-9	258-3GT-9	360-5GT-10	360-5GT-10	J1
b	258-3GT-9	303-3GT-9	339-3GT-10	339-3GT-10	J2
c	195-3GT-6	195-3GT-6	258-3GT-9	258-3GT-9	J3
d	195-3GT-6	195-3GT-6	195-3GT-6	195-3GT-6	J4

3.4 Replace the lubricating oil

Measure the concentration of lubricating oil iron powder in the bevel gear every 20,000 hours or every 3 years (or every 10,000 hours or every 1.5 years for loading and unloading purposes). If it is necessary to change the lubricating oil if the standard value is exceeded, please contact our service center. Required Tools: lubricating oil iron powder concentration meter; Lubricating oil gun (with fuel supply confirmation and counting function)

Attention

When filling the lubricating oil, please use the brand model provided by our company, unless otherwise specified in the instructions.

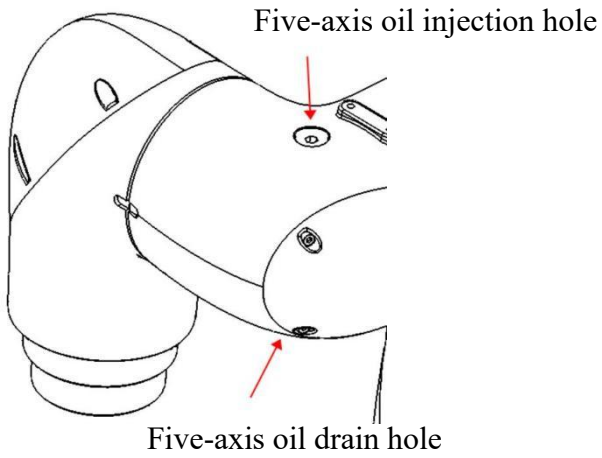


Fig.3.2 Schematic diagram of the location of the five-axis oil injection hole and oil drain hole of H Series robots

Replacement Steps:

(1) Remove the plugs ofthe oil inlet and drain port.

(2) Use the oil gun to fill 150ml of oil from the oil injection port, (the discharged lubricating oil is caught and installed with a waste oil drum)

Remove excess grease and install plugs.

3.5 Battery Replacement

Importance

Please return the robot to zero before replacing the battery to prevent the zero point loss of the mounting cover plate after replacing the battery, and be careful not to squeeze the cable

Importance

Battery life, the normal service life of the battery is 3 years, please check the battery usage regularly according to the requirements of the manual.

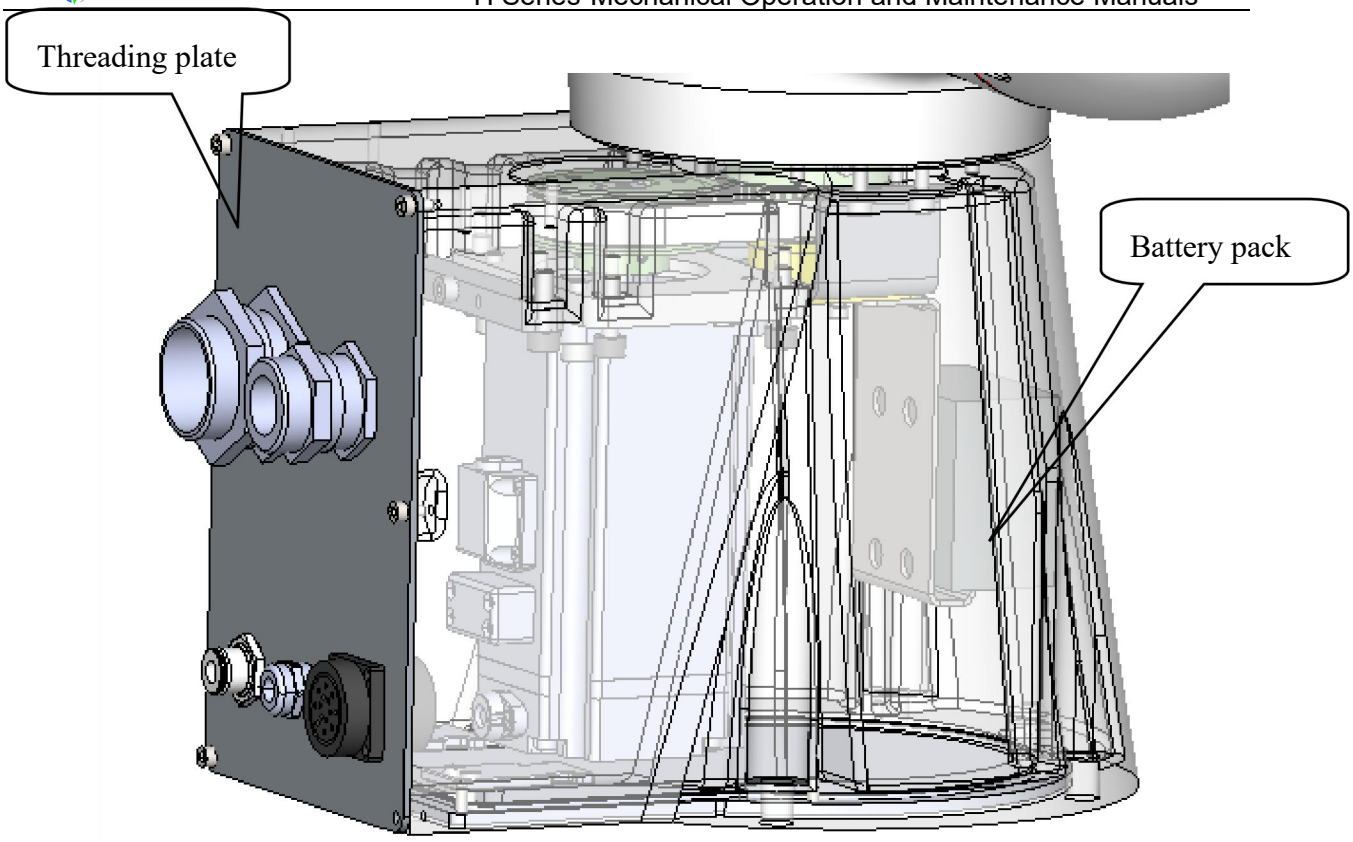


Figure 3.3 Schematic diagram of the battery position of H5-790 and H7-890 robots

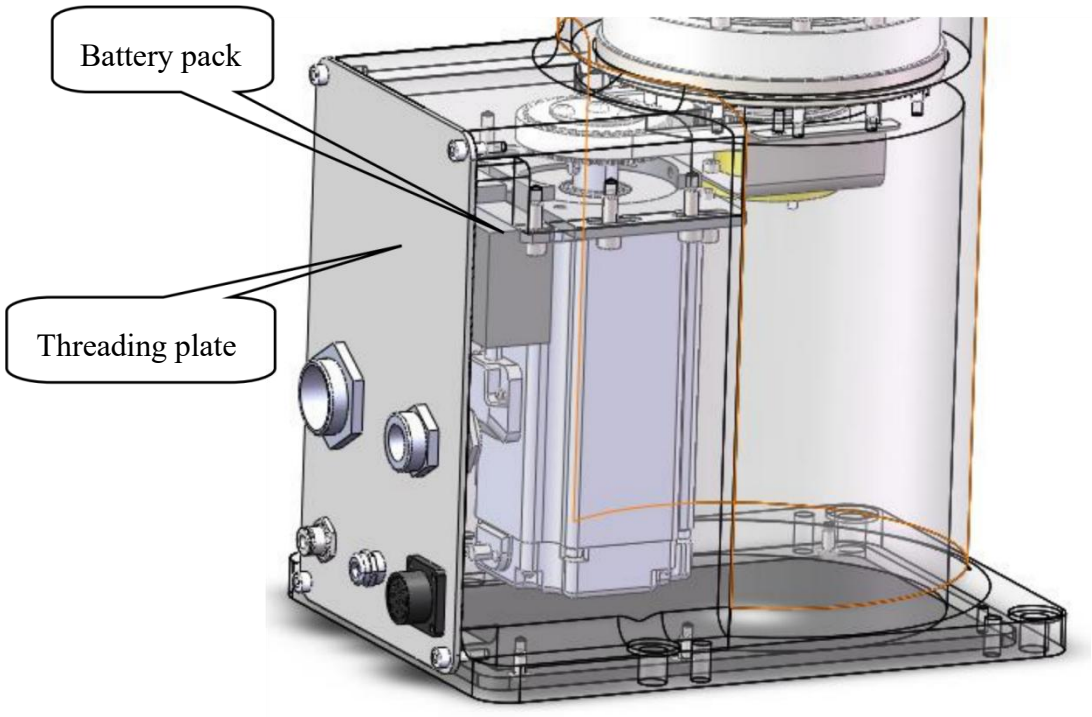


Figure 3.4 Schematic diagram of the battery position of H10-1500 and H16-1200 robots

Replacement Steps:

1) The origin of the robot returns to zero

2) Remove the robot threading plate, and the robot pad is placed on its side (note that H10-1500/616 does not require this step);

3) H5/ H7 disassemble the bottom plate, disassemble the fixing bracket screws, and take out the fixing bracket including the battery pack; H10/ H16 disassemble the threading plate and remove the battery pack.

4) Untie the cable tie and unplug the old battery;

5) Insert the new battery into the plug and fix it in its original position.

6) Reinstall the fixing bracket, install the bottom plate (threading plate), and re-fix the robot;

7) Turn on the robot to set its zero point.

If the robot does not return to the zero point before replacing the battery or the zero point of the robot is lost due to other reasons after replacing the battery, please refer to chapter 3.6 for proofreading.

3.5.1 Zero-point proofreading

Before the robot leaves the factory, it has done a good job of mechanical zero point calibration, and when the robot loses the zero point position due to failure, it is necessary to re-calibrate the mechanical zero point of the robot.

When calibrating at zero point, please adjust the speed to low speed

Attention

When calibrating zero, please pay attention to pressing your hands during the movement of the robot

Calibration Steps:

1) Initially adjust the robot to the zero point (by observing whether the notches at the zero point of each axis are aligned)

2) Turn the robot to low speed (minimum speed recommended)

3) Observe the notch by fine-tuning each axis of the robot until the calibration block is put into the notch, which is the zero point of the robot

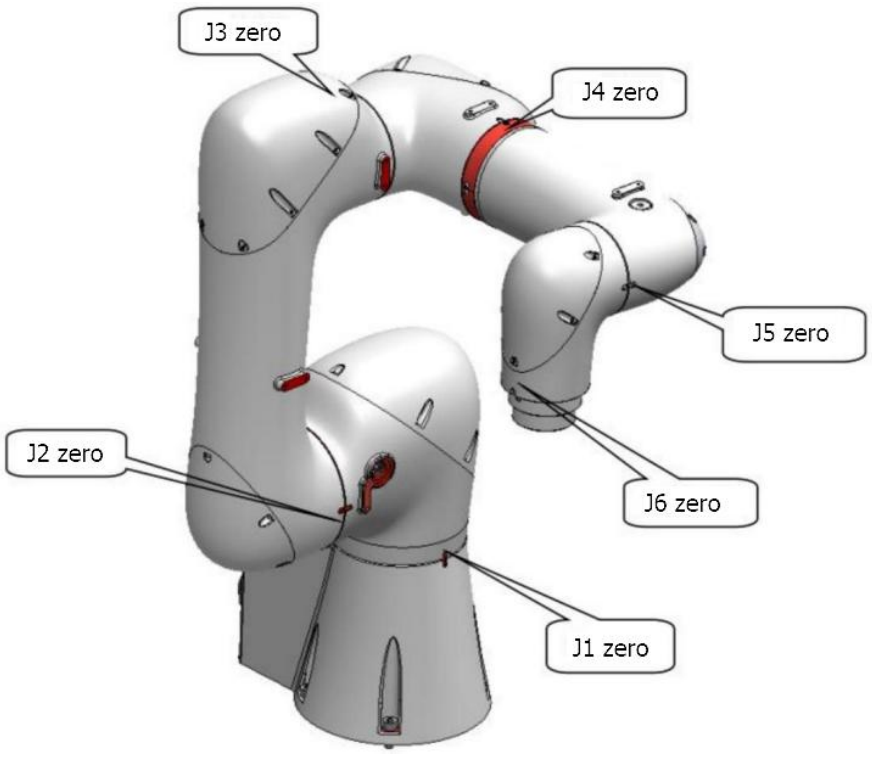


Figure 3.5 Schematic diagram of H Series robot zero calibration

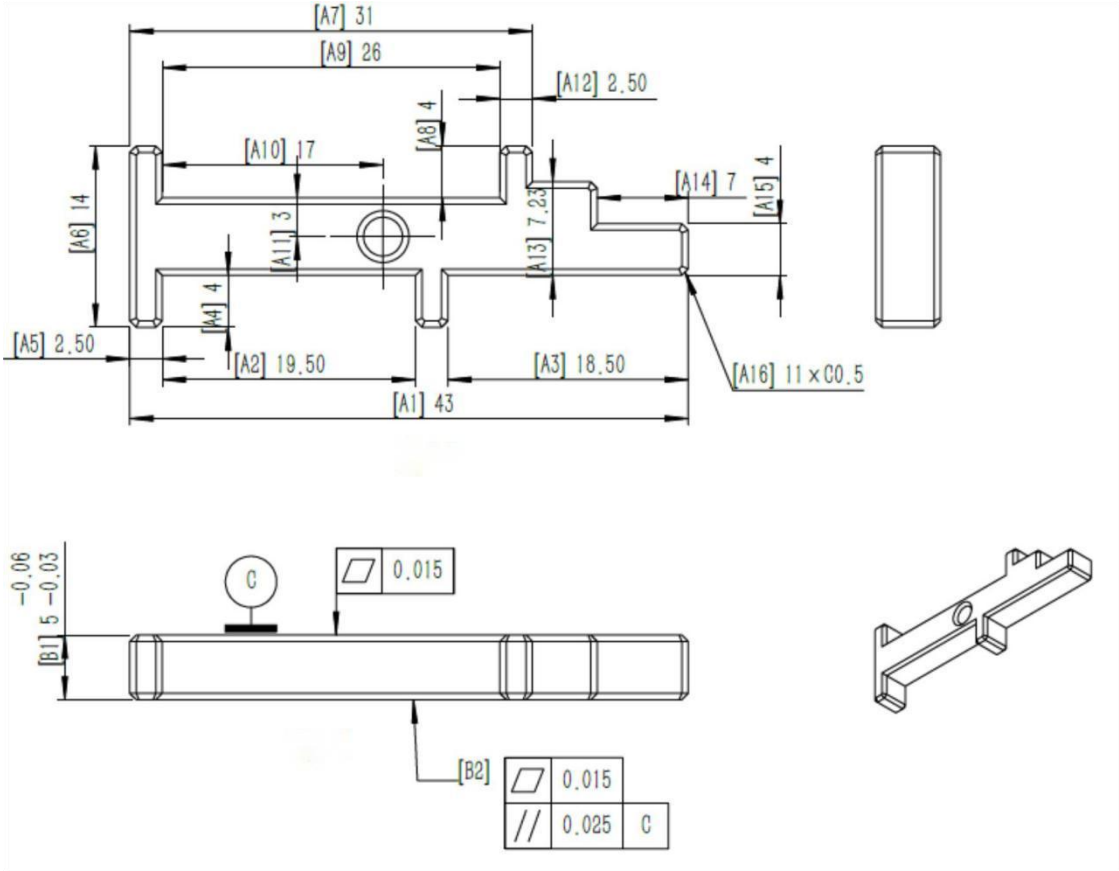


Figure 3.6 Calibration blocks

Zero position calibration procedure:

1）Oscillator manual T1/T2 mode runs the mechanical zero alignment of the axes of the robot body;

2）Select "Configuration->Demonstrator Configuration->User Group" in the main menu of the Demonstrator to log in as a Super user, and the user login interface is shown in Figure 3.11;

Figure 3.11 User login screen

3）In the main menu of the Teacher Demonstrator, select "Input Operation->Adjustment->Single-Axis Calibration or Calibration", click to input the initial position data of each axis as shown in Fig. 3.12, and then click "Save Calibration" button to save the data, and the single-axis calibration or axis calibration will take effect after the successful saving; whether the saving is successful or not will be shown in the status bar. After successful saving, the single-axis calibration or calibration will take effect; whether the saving is successful or not will be shown in the status bar.

Figure 3.12 Single Axis/Axis Zero Calibration Data

4）In the manual T1/T2 mode of the Teach pendant, run the robot body axes away from the mechanical zero position, select "Display->Variable List->JR Tab" in the main menu, select the JR[1] variable in the interface shown in Fig. 3.13, and click the "Modify" button, select the "Joint" coordinate, and change the value of axis 1~6 to "0,-90,180,0,0,0" respectively. Click "Modify" button, select "Joint" coordinate, change the value of axis 1~6 to "0,-90,180,0,90,0", and click "Move to Point" button to move the robot to the point. Click the "Move to Point" button to make each axis of the robot body automatically run to the zero position, so the zero position calibration operation is completed.

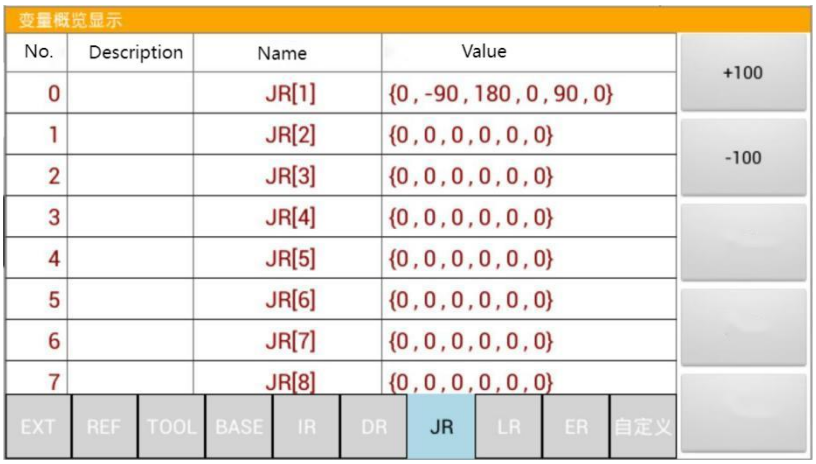


Figure 3.13 JR Joint Position Register Variable Table

4 Troubleshooting

4.1 Methods of investigating the cause of failure

The robot must be designed in such a way that even if an abnormal situation occurs, the abnormality can be detected immediately and operation stopped immediately. Even then, continued operation is absolutely prohibited because it is still in a dangerous state.

There are various scenarios of malfunctioning robots as follows:

(1) In the event of a malfunction, a malfunction that cannot be operated until repairs are completed.

(2) A fault that occurs and is left for a period of time before operation can be resumed.

(3) Even if a malfunction occurs, if the power supply is turned OFF, the malfunction can be operated again.

(4) Even if a fault occurs, the fault can be run again immediately.

(5) A malfunction that is not the robot itself, but a malfunction on the system side that causes the robot to act abnormally.

(6) A fault that causes abnormal operation on the system side due to a fault on the robot side.

Especially in the case of (2) (3) (4), the malfunction is sure to occur again. Moreover, in complex systems, the cause of a malfunction is often not easily found even by sophisticated engineers. Therefore, in the event of a malfunction, do not continue operation, but immediately contact a preservation operator who has received the required training and who will carry out the identification of the cause of the malfunction and repair. In addition, these elements should be included in the operating rules and a complete system should be established that can be practically implemented. Failure to do so may result in accidents.

If there is an abnormality in the movement or operation of the robot, it should be considered that the abnormality is caused by damage to a mechanical part if there is no abnormality in the control device. In order to troubleshoot a problem quickly, it is necessary to understand the phenomenon clearly and determine what parts are causing the abnormality.

Step 1 Which axis is abnormal?

The first thing to do is to find out which axis is abnormal. If there is no obvious abnormal action and it is difficult to judge, you should investigate whether there is a part that makes abnormal sound; whether there is a part that is abnormally hot; and whether there is a part that has a gap.

Step 2 Which component has a damaged condition?

After determining the shaft on which the abnormality occurs, investigate which part is the cause of the abnormality. One phenomenon may be caused by more than one component. The failure phenomena and causes are shown in Table 4.1 on the following page.

Step 3 Disposal of problematic parts:

After determining the part with the problem, proceed as shown in 4.3. Some problems can be handled by the user, but for problems that are difficult to handle, contact our service department.

4.2 Failure phenomenon and cause

As shown in Table 4.1, one malfunctioning phenomenon may be caused by several different components. Therefore, in order to determine which component is damaged, please refer to the contents shown hereafter.

Table 4.1 Fault phenomena and causes

Cause / Component / Faultdescription	speed reducer	electrical machinery
Overload **[Note 1]**	●	●
positional deviation	●	●
give rise to an unusual noise	●	●
Vibration in motion **[Note 2]**	●	●
Swaying when stopping **[Note 3]**		●
The shaft falls off naturally.	●	●
abnormal fever	●	●
Misoperation, loss of control		●

[Note 1]: Phenomenon that occurs when the load exceeds the rated specifications of the motor.

[Note 2]: Vibration phenomenon during action.

[Note 3]: The phenomenon of repeated shaking around the stop position several times during stopping.

4.3 Inspection methods and treatment of each component

4.3.1 Speed reducer

Damage to the speed reducer will cause vibration and abnormal sound. In addition, normal operation is impeded, resulting in overload, abnormal deviation, abnormal heat generation, and complete inability to operate and positional deviation.

(1) Inspection methods

Check the amount of iron powder in the grease in the reducer: If the amount of iron powder in the grease inheres to a concentration of 1,000ppm or more, there is a possibility of internal damage. (Measure the concentration of iron powder in the grease of the reducer every 5,000 hours of operation or every one year. If the standard value is exceeded, it is necessary to replace the grease or the gear head, so please contact our service department).

Check the running status of the reducer: Remove the reducer, turn the input end of the reduction by hand, and observe whether the reducer produces a jamming or abnormal sound.

Check the temperature of the reducer: when the temperature rises 10℃ compared with normal operation, it can be basically judged that the reducer has been damaged.

(2) Treatment

Please replace the reducer. Since replacing the gearbox is complicated, please contact our service department when replacement is required.

4.3.2 Electrical machinery

When the motor is abnormal, abnormal movements such as shaking during shutdown and vibration during operation will occur. In addition, abnormal heat and abnormal sound may occur. Since the phenomena that occur are the same as those that occur when the reducer is damaged, it is difficult to determine where the cause lies, so inspections of both the reducer and the balance cylinder parts should be conducted at the same time.

(1) Methodology of the survey

Check for abnormal sounds and abnormal heating.

(2) Treatment

Please replace the motor. Since replacing the motor is complicated, please contact our service department when replacement is required.

4.4 Sealant Applications

(1) Cleaning and drying of surfaces to be sealed

① Remove dust by blowing the surface to be sealed with gas.

② Degrease the mounting surface to be sealed, either with a cloth soaked in cleaning agent or by spraying cleaning agent directly.

③ Blow dry with gas.

(2) Apply sealant

① Make sure that the mounting surface is dry (free of residual cleaning agent, if any, wipe or blow dry it).

② Apply the sealant on the surface, the sealant is applied evenly, and the sealant must not have broken lines at the place to be sealed.

(3) fit together

① To prevent dust from falling on the part to which the sealant is applied, install the parts as soon as possible after the sealant is applied. Be careful not to touch the applied sealant. If the sealant is wiped off, reapply.

② After installing the parts, fasten it with screws and washers to bring the matching surfaces closer together.

③Do not lubricate without applying the sealant because the lubricant may leak without sealing measures. Lubrication should be performed after waiting at least 2 hours after applying the sealant.

4.5 Maintenance of the body harness

For parts such as one axis base to two axis seats, two axis seats to booms, booms to three axial seats, three axial seats to four-axis seats, four-axis seats to small arms, small arms to five-axis seats, five-axis seats to six-axis seats, etc., the range of wiring harness movement is relatively large.

If the wiring harness is rubbed against the mechanical body for a long time, resulting in the wire harness Hacking or about to break, this situation is not allowed in the work of the robot. If the above situation occurs, it is best to replace the wiring harness in advance (it can be replaced when it is not in production), and the replacement steps are:

1) Identify all the cables in the wiring harness to be replaced, and loosen the joints or connections of these cables;

2) Loosen the wire clamp used, remove the cable that needs to be replaced (mark the place where the wire bundle is fixed with the wire clamp), and gradually withdraw the cable from the body mechanism;

3) Intercept cables of the same length and the same specification, and mark them at the same position for the purpose of easy installation;

4) Thread all wiring harnesses into the body mechanism;

5) Install the penetrated wiring harness on the mechanical body (pay attention to the marked position);

6) Make all kinds of cable connectors and connect them in a fixed place.

5 Appendix

5.1 Robot Spare Parts Catalogue

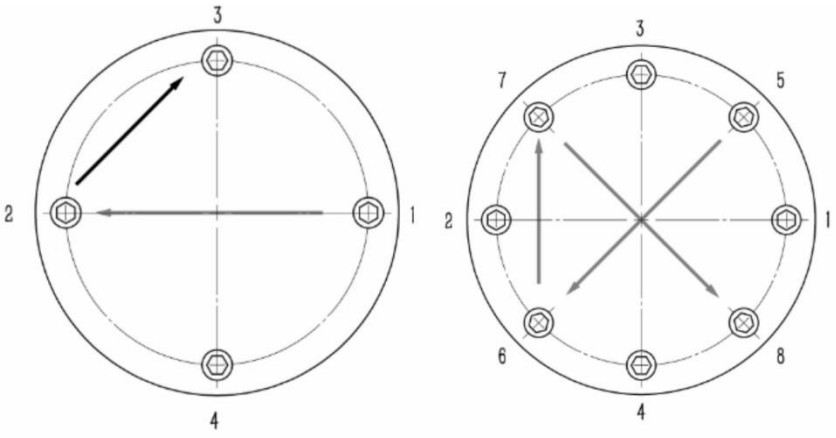
name (of a thing)	norm	serial number	unit (of measure)	Quantity/unit	References
Encoder Battery			piece	6	3.5
Wrist grease	Special grease for reducer				3.4
sealing glue	Loctite 5699				
thread glue	Loctite 243				

Note: For brands and specifications of special grease for gearboxes, please consult Robotics.

5.2 Screw tightening instructions

During maintenance and repair of the robot, screws should be tightened with a torque spanner according to the Hiss-Hoss method, and the torque for screw tightening should strictly refer to the data listed in Table 5.1.

Hiss-Hoss method: screws are tightened in the form of a Hiss-Hoss fastening, as shown below. Tightening should be carried out gradually in multiple stages. Initial tightening: about 30 per cent of the tightening torque, second tightening: about 80 per cent of the tightening torque, third tightening: 100 per cent of the tightening torque.



Screw installation and precautions:

(1) Observe the screws for satisfactory appearance before installation and collect the screws as required.

(2) When fastening screws, mark the screws to distinguish between fastened and unfastened screws, and mark the screws and fasteners after fastening.

(3) For the dismantling of the washers (spring washers and disc spring washers) after dismantling and fastening for many times, there is no elastic deformation force should be discarded, and the washers (spring washers and disc spring washers) for fixing the speed reducer should be discarded and replaced with new ones after dismantling for 2 times.

(4) screws should be discarded if the screw threads have been damaged after disassembly and repeated use.

(5) During the process of fastening parts with screws, if the screws are jammed by the screw holes and cannot be driven in further, the screws must be withdrawn and replaced with another one to prevent them from slipping or breaking.

Table 5.1 screw tightening torques

Norm	Screw grade 8.8		Screw grade 12.9	
	Standard torque value Nm	Torque range Nm	Standard torque valueNm	Torque range Nm
M3	1.2	1.1 to 1.5	2	1.6 to 2.2
M4	2.5	2.2 to 3.5	4.8	3.8 to 5.7
M5	5	3.2 to 4.4	9.3	8.4 to 10.2
M6	8	7.4 to 11.2	16	15-18
M8	20	16 to 26	42	35 to 53
M10	40	36-52	80	74-88
M12	75	61 to 94	129	120 to 138
M14	120	97 to 150	205	195 to 220
M16	200	170-230	380	320-425
M20	370	310 to 430	550	490 to 610

Note: If the screw connection is aluminium, the tightening torque is in accordance with the requirements of class 8.

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