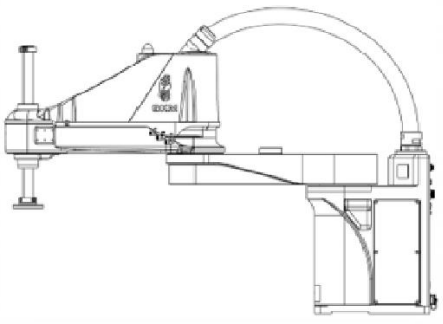
AH20 Robot

User Manual



User Manual

AH20-0850-0204-2000

AH20-0850-0204-4000

AH20-1050-0204-2000

AH20-1050-0204-4000

QKM Technology (Dongguan) Co., Ltd.

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Preface

Thank you for purchasing the robot produced by QKM!

This manual describes the matters needing attention for properly use of AH20 Robot.

Read this manual carefully before using AH20 Robot.

Please keep this manual properly for future reference.

Overview

This manual provides detailed information on product features, main components, installation guide, system debugging and technical specifications of AH20 Robot so that users can fully understand and properly use the robot.

Target readers

This manual is for the reference of:

Customer Engineer	Technical Support Engineer
Application Engineer	Installation and Debugging Engineer

Signs

The signs in this document clearly indicate any dangers, warnings, cautions and notes that may occur while users perform the operations described in this manual. Pay attention to the following signs when they appear in the document.

The signs appearing in this manual are shown in the following table:

Figures	Description
	It indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury.
	It indicates that a potentially dangerous situation would occur and cause personal injuries or equipment damage if it is not avoided.
	It indicates that an unpredictable situation would occur and cause equipment damage, performance degradation, data loss, etc. if it is not avoided.
	It gives the description on key information and operation tips.

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V1.0.1	November, 14, 2022	Modified the front pinout picture of the 9-pin header of the communication interface (RS-232) in section 4.3.4 Modified the picture description of the front pinout of the 9-core hole holder of the communication interface (RS-485) in Chapter 4.3.5

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Chapter 1 Safety Precautions

This chapter describes the safety precautions for using AH20 Robot. Please read this manual carefully before using the robot. Improper use of the robot may cause injuries to operators and damage to the system, and even cause personal deaths. Users shall strictly follow the safety precautions in this manual. QKM shall not be responsible for any personal and equipment losses caused by illegal operations.

Personnel who use AH20 Robot for system design, operation and maintenance shall be trained by QKM or relevant institutions or shall have the same professional skills. Personnel shall read this manual carefully before conducting operation, maintenance, teaching, programming and system development of AH20 Robot and use it in strict accordance with the safety precautions in this manual.

1.1 General safety

The safety precautions in this manual only serve as a supplement to safety specifications. Personnel using the robot shall also comply with local safety regulations or specifications.

Personnel who use this series of robots for system design and manufacturing shall observe the following safety rules:

- Use the robot and its component products in an environment that meets the design specifications, otherwise, the robot may fail.
    - Please use the robot within the specified operation environment. If it is

used beyond its specifications and load conditions, the service life of the robot would be shortened, or the robot would even be damaged.

- Users should ensure that the robot operates under safety conditions. There should be no objects around the robot, which may cause damage to it. As the robot may be scratched and bumped due to the motion of its movable mechanical parts, users should carry out risk assessment of the operation environment on site and set up special facilities for protection.
- To prevent personnel from entering the motion area of the robot by mistake, be sure to install a safety fence to stop personnel from entering the dangerous area.
- When the ambient temperature is close to 0°C, operate the robot at the speed of 10% or less for more than 10 minutes to preheat it; perform other operations after preheating the robot.
- Detergents with strong corrosion are not suitable for cleaning the robot. Anodized parts should not be cleaned by immersion.
- Non-professionals shall not repair faulty products without permission. Do not disassemble the electronic control cabinet arbitrarily. If the product fails, please contact QKM Customer Service.
- Personnel responsible for installation, operation and maintenance of QKM robot must receive rigorous training to understand all safety precautions and proper methods of operation and maintenance before operating and maintaining the robot.
- Users should carry out regular inspection and maintenance of the robot according to the manual and related requirements and timely replace damaged parts to ensure safe operation and service life of the robot.

- Before operating, maintaining and testing the robot, be sure to know the exact location of the E-stop device of the robot in the workplace and ensure that the E-stop button can be quickly pressed in case of an emergency.
- Do not plug or unplug the power and communication cables or press the E-stop button at will during normal operation of the robot.
- Users should follow the instructions marked on the robot to avoid entering dangerous working areas where personal injury and robot damage may be caused.
- If users request for transport, please adopt the standard packaging required by QKM.

1.2 Precautions for safe operation

- Shut off the power when installing and maintaining the robot to prevent accidents.
- Do not enter the work area of the robot after it is powered on to prevent danger.

Please observe the following safety rules when conducting installation, teaching and programming of the robot:

- Only qualified personnel through special training with correct understanding of precautions for operation safety and mastery of use of the robot can operate, maintain and repair the robot.
- Do not randomly change the hardware and software configuration of the robot, otherwise the robot may be damaged or users may be injured.

- The robot must be well grounded by connecting to the main ground wire of the factory to prevent static damage; maintenance tools must adopt special insulation tools.
- Confirm that the entire robot system is in a safe environment before performing daily inspection and regular maintenance of the robot.
- Do not plug or unplug the power and communication cables during normal operation of the robot.
- Regularly carry out training for operators on operating rules, industrial safety, safety instructions and environmental protection.
- Users should carry out daily check and regular maintenance of the robot according to the manual and related requirements and timely replace damaged parts to ensure safe operation and service life of the robot.
- If the robot and its components are scrapped and shall be discarded, please handle the industrial waste properly in accordance with relevant laws and regulations to protect the environment.

1.3 Safety signs

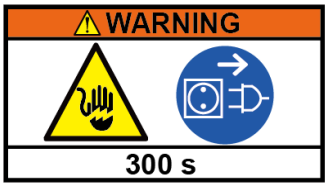
The main body of the robot is labeled with the following warning signs.

There are corresponding dangers and warnings near the location where the signs are labeled, so take sufficient care when operating.

In order to operate and maintain the robot system safely, be sure to observe the cautions and contents on the warning signs.

Table 1-1 Warning signs

No.	Labeling	Notes

1		A triangle sign for warning of high voltage
2		Grounding sign
3		Do not disassemble the robot to prevent failures.
4		A sign for protection from residual voltage

Chapter 2 Product Overview

2.1 Introduction

AH20 Robot is a SCARA robot (adopting a new generation of distributed controller) independently developed by QKM Technology (Dongguan) Co., Ltd. (hereinafter referred to as QKM). It is characterized by AIO design, no separate control cabinet, and with compact structure, greatly overthrowing the layout of traditional industrial robots with large control cabinet on equipment and even production lines. Like home appliances, it is plug-and-play, simple and easy to use, suitable for handling, sorting, loading and unloading in mobile phone, 3C, food and other industries.

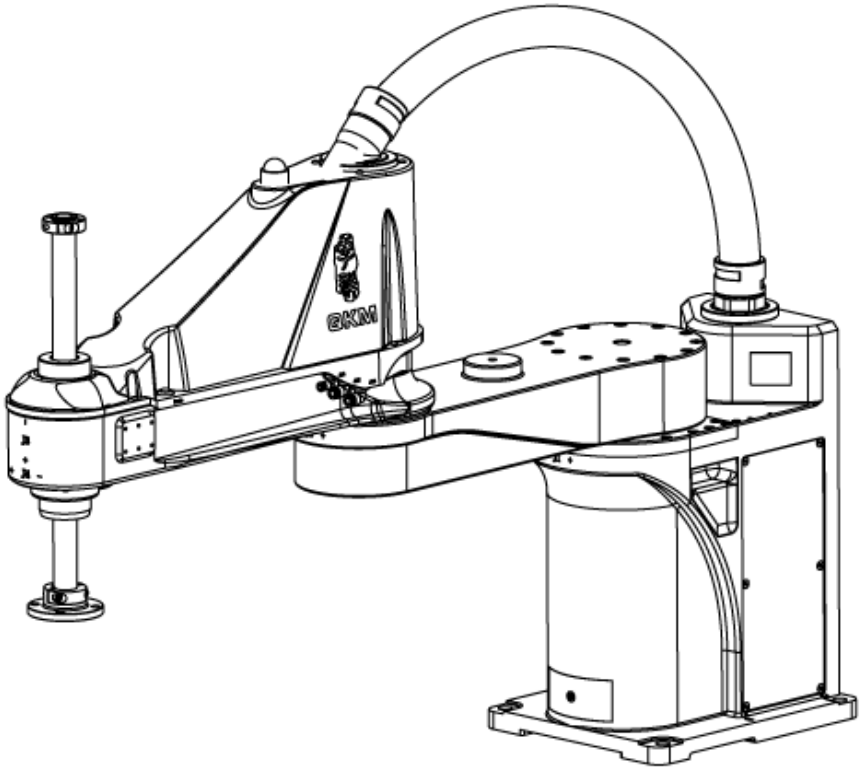


Figure 2-1 AH20 Robot (AH20-0850-0204-2000) appearance

2.2 Model implication

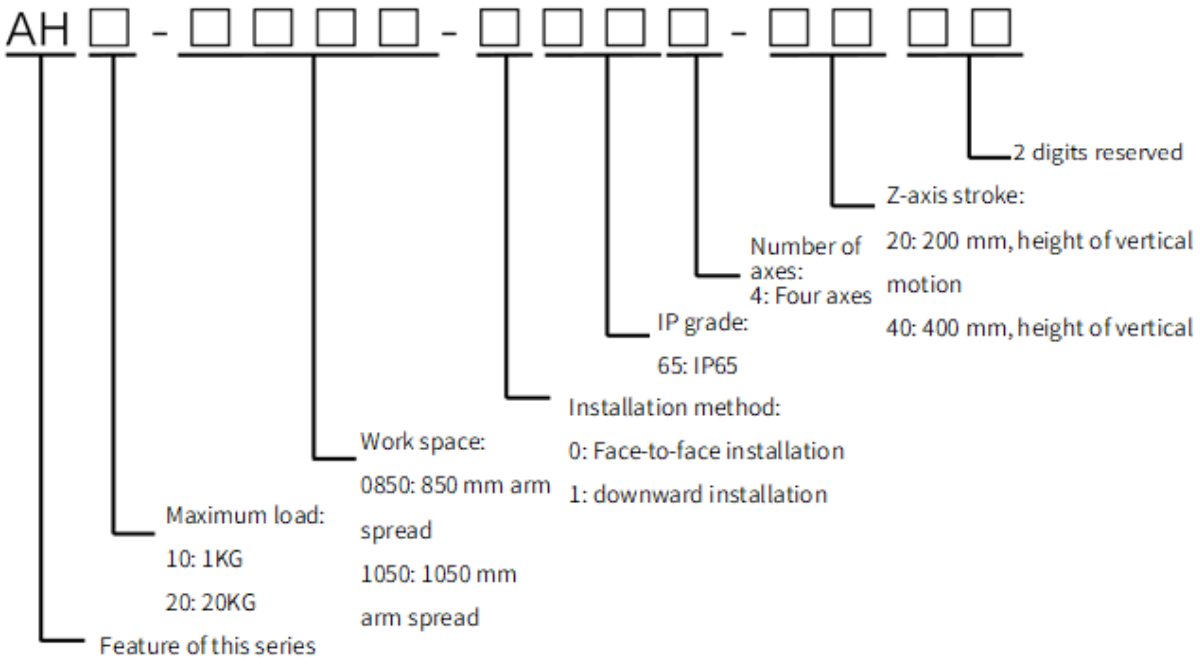


Figure 2-2 Model implication

Table 2-1 Model preview

Model Name	Rated load (kg)	Max. Load (kg)	Horizontal Work Space (mm)	Vertical Work Space (mm)	Installation	Protection Grade	Operating Environment
AH20-0850-0204-2000	10	20	850	200	Tabletop mounting	IP 65	Standards
AH20-0850-0204-4000				400			
AH20-1050-0204-2000			1050	200			
AH20-1050-0204-4000				400			

2.3 Product features

- Available in 850 mm and 1,050 mm arm lengths for flexible use by customers.
- AIO design without separate control cabinet for less space and easy installation. By adopting a new generation of distributed architecture control system, it is more stable, smoother and easier to use.
- Built-in controller improves electromagnetic compatibility (EMC/EMI) and system stability.
- High precision is perfectly fitting for high-precision laminating and assembly applications.

Chapter 3 Components and Functional Description

3.1 Introduction to main body

AH20 Robot is mainly composed of a base, a mechanical arm 1, a mechanical arm 2, a spline shaft, a terminal flange and a corrugated pipe (including cables). Its appearance and structure are shown in Figure 3-1.

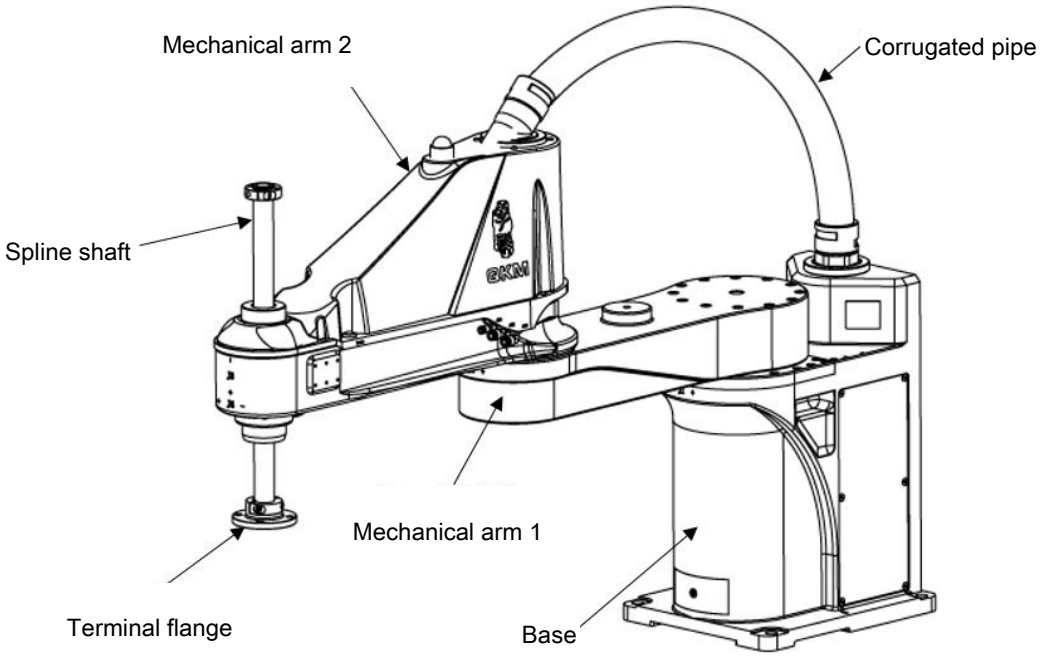


Figure 3-1 Composition of AH20 Robot (AH20-0850-0204-2000)

3.1.1 Base

The connector panel of power supply, communication and status display is arranged at the back of the AH20 Robot base. Four through-holes and two pin holes are provided at the installation location of the base for accurate fixation of the robot.

3.1.2 Mechanical arm 1

Casting design with light weight is used for improving the performance of the robot.

3.1.3 Mechanical arm 2

Three groups of motors are built in, with high-precision lifting and rotating shaft. Axis J3 and Axis J4 are driven by synchronous belt with high stability and reliability. Mechanical arm 2 is overall designed with compact structure.

As the spline screw shaft is exposed, foreign objects are prone to fall in and damage the screw. Prevent foreign objects from falling into the spline screw shaft.

3.1.4 Cable

AH6 Robot adopts torsion-resistant and high-flexibility cables, which can ensure smooth signal transmission of the robot.

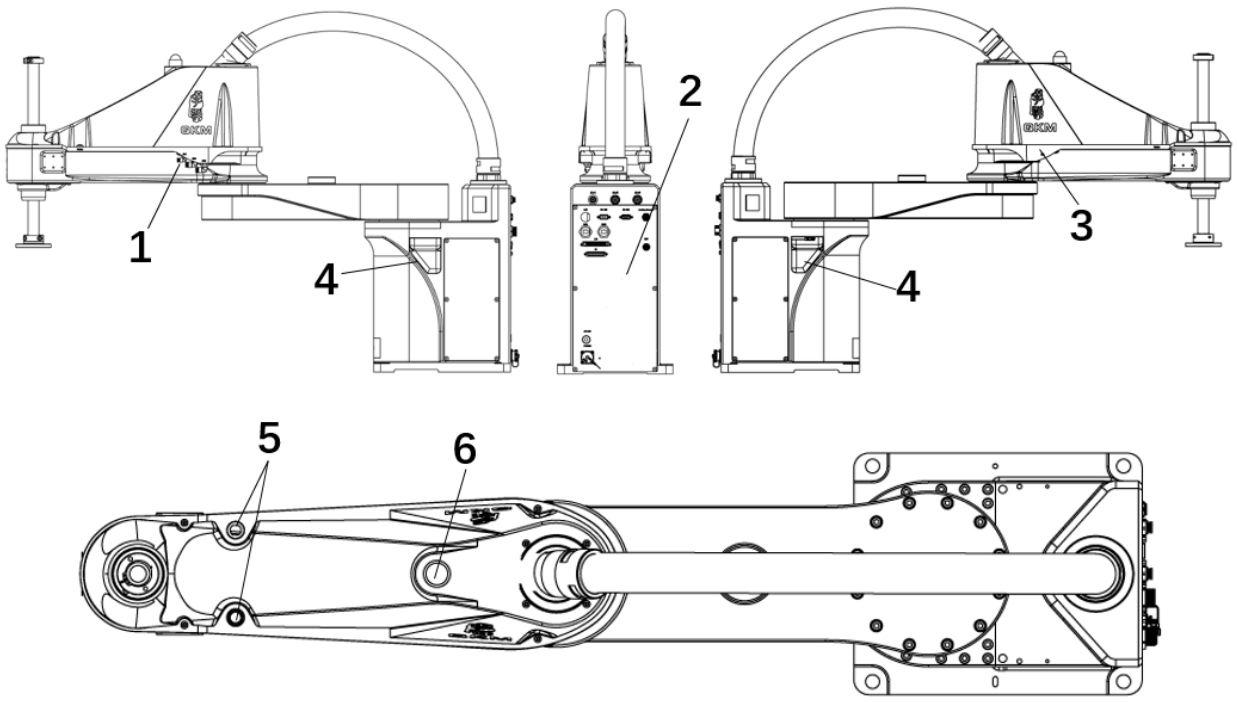


Figure 3-2 Main view of AH20 Robot

Table 3-1 Components of AH20 Robot

SN	Name	Description
1	Fast air pipe connector	Air1(Φ4 mm); Air2, Air3(Φ6 mm)
2	Electrical connector panel	For connecting power supply, Ethernet cables, etc.
3	I/O connector	19-core circular aviation plug
4	Grooved handrail	Convenient for users to handle the robot
5	Double brake button	"Brake" buttons used to release the J3/J4 axis brake
6	LED Indicators	It indicates the status of the robot. Refer to Section 4.2 for details.

The double brake buttons have the same functions and are independent of

each other. Pressing any button will work on the J3 and J4 axes at the same time. The brake buttons can be pressed only when the robot is in servo-off state.

NOTE For details on the electrical connector panel, please refer to Section 4.1 Introduction of connector panel.

3.2 Trajectory

Joint coordinate of robot control system: The posture of the robot is represented by rotation angle of each axis.

CAUTION The "+" and "-" indicating directions of the axes are applicable to the joint coordinate system.

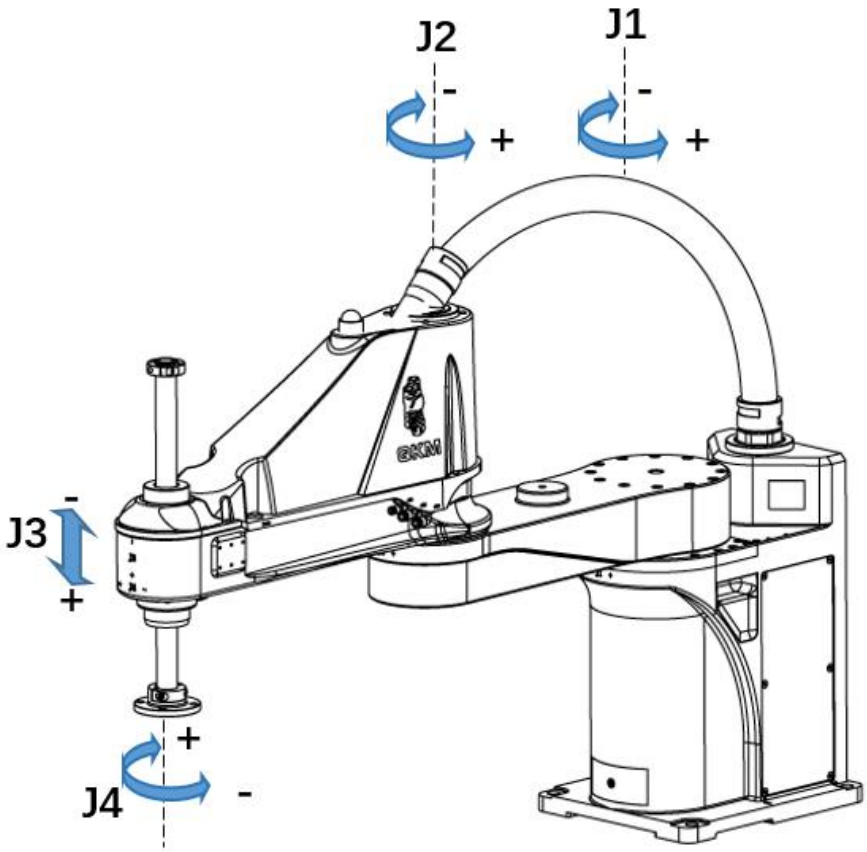


Figure 3-3 Trajectories of each axis

3.3 Horizontal work space

- AH20-0850-0204-2000/ AH20-0850-0204-4000

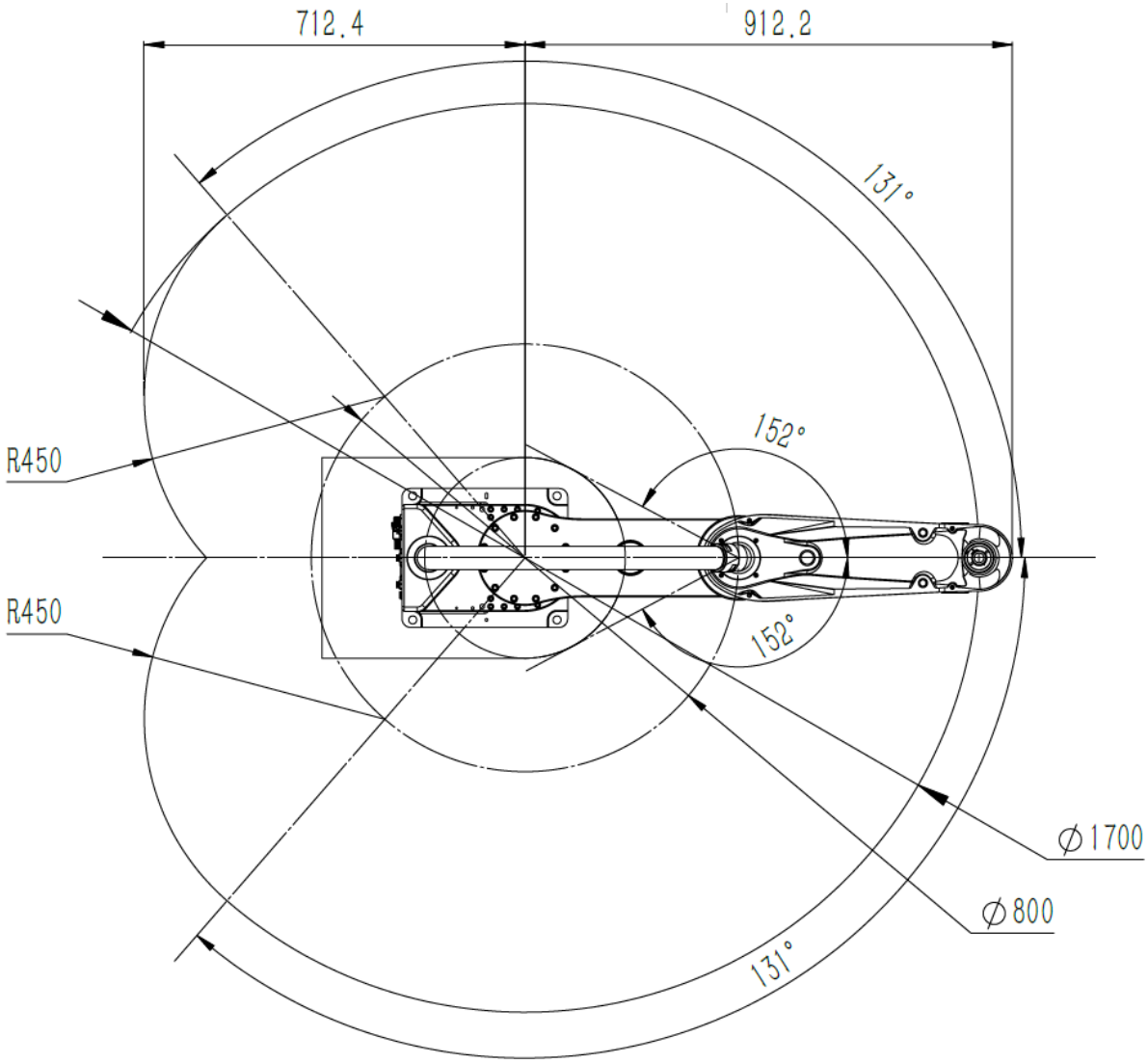


Figure 3-4 AH20-0850-0204-2000 / AH20-0850-0204-4000

- AH20-1050-0204-2000/ AH20-1050-0204-4000

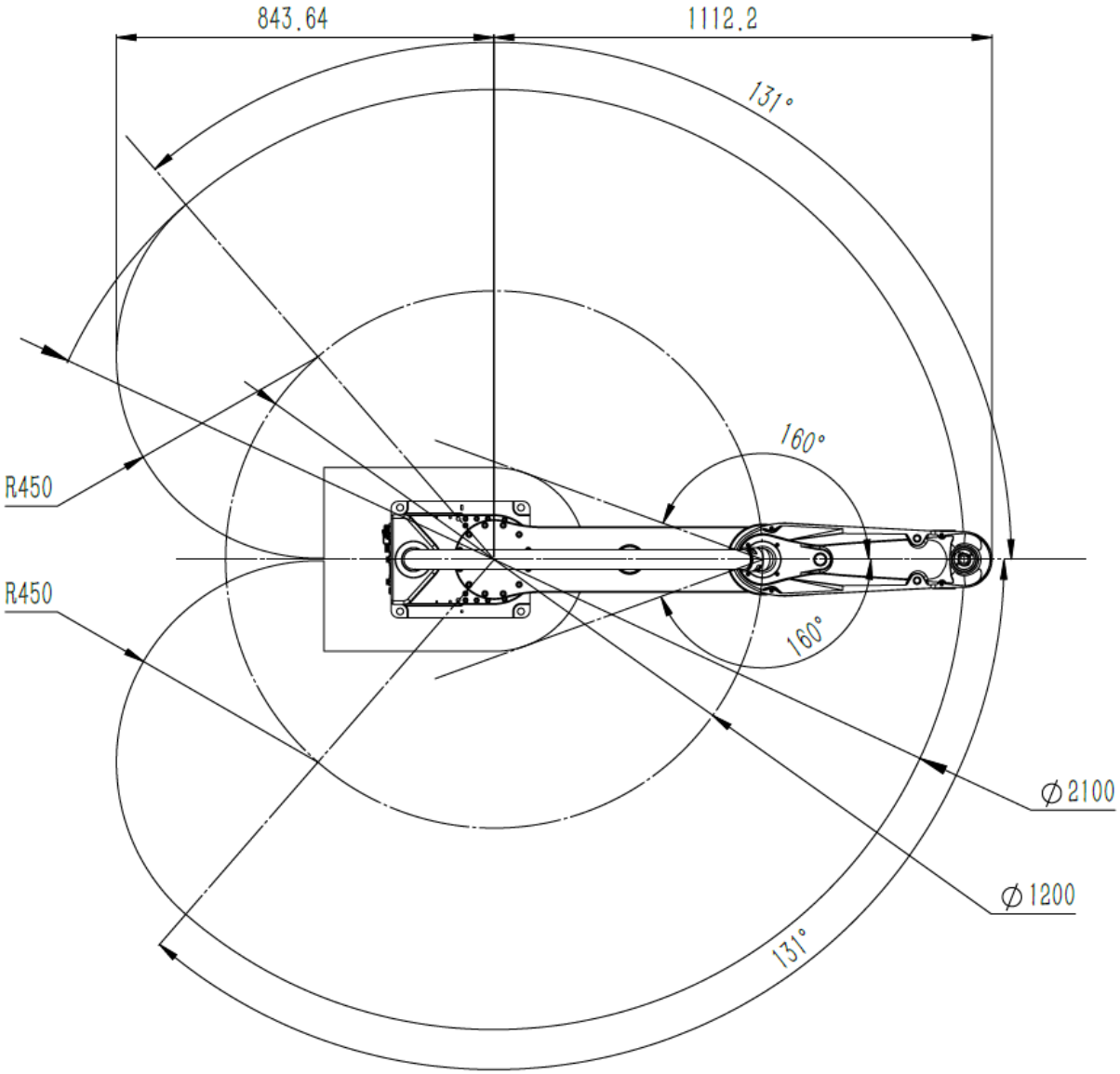


Figure 3-5 AH20-1050-0204-2000 / AH20-1050-0204-4000

3.4 Robot coordinate system

CAUTION

The "+" and "-" indicating directions of the axes are applicable to the cartesian coordinate system.

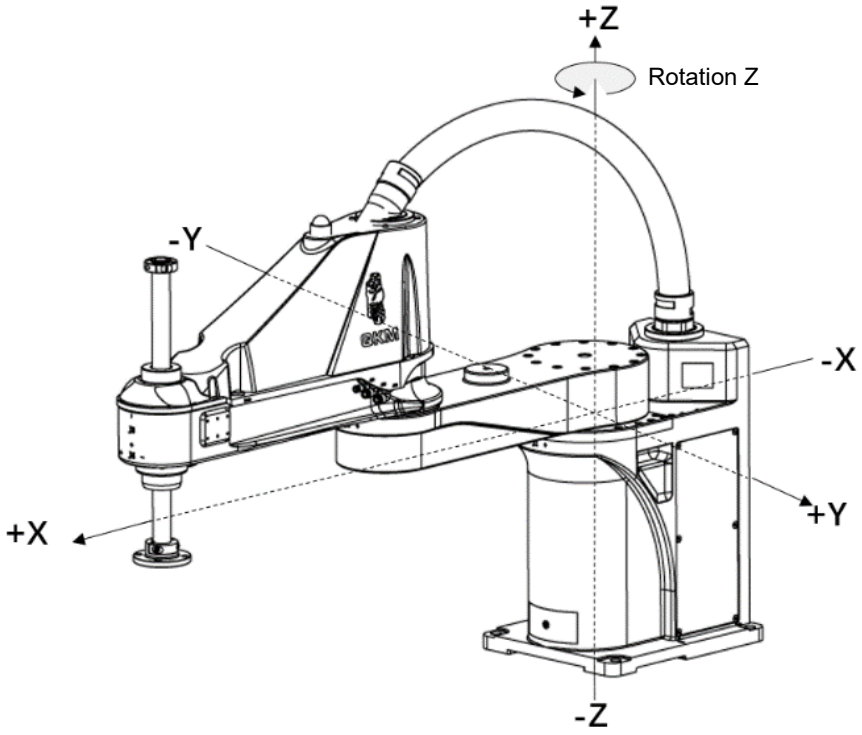


Figure 3-6 World coordinate system

3.5 Specification and dimension

3.5.1 Overall dimension

- AH20-0850-0204-2000

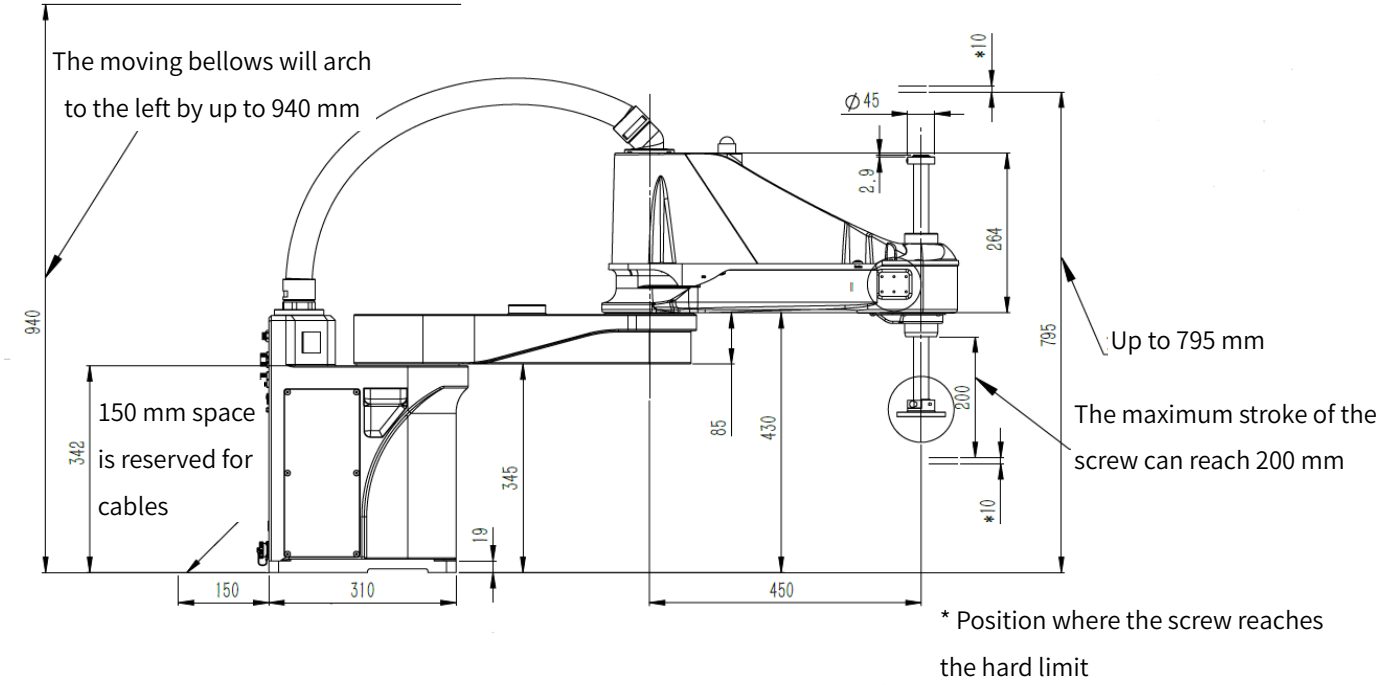


Figure 3-7 AH20-0850-0204-2000 dimensions (unit: mm)

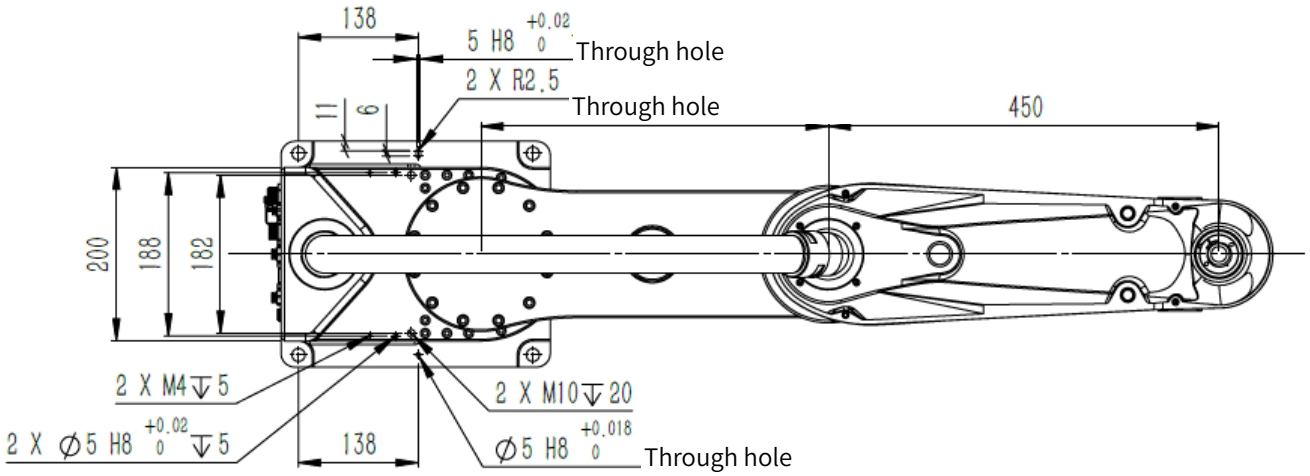


Figure 3-8 AH20-0850-0204-2000 dimensions (unit: mm)

- AH20-0850-0204-4000

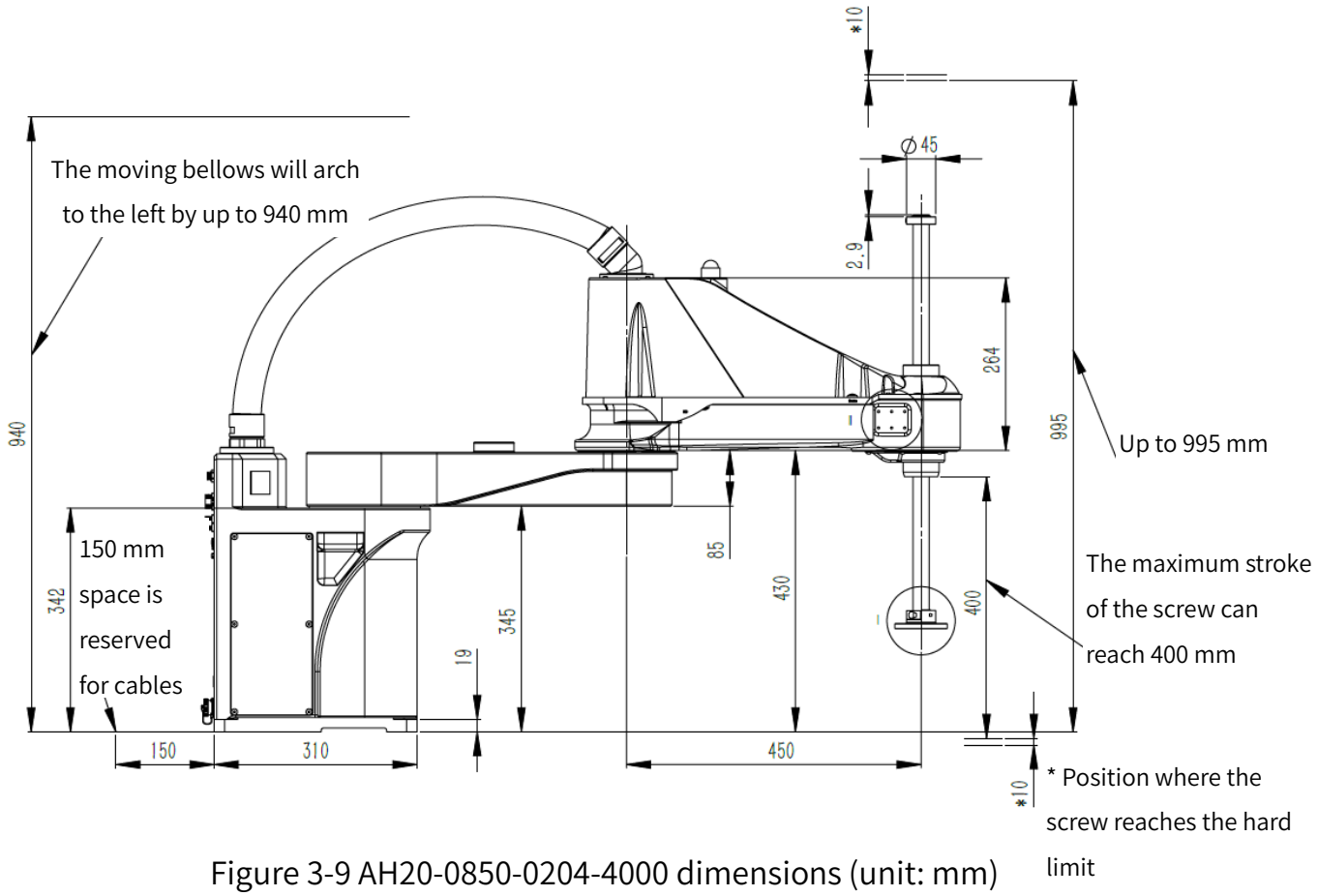


Figure 3-9 AH20-0850-0204-4000 dimensions (unit: mm)

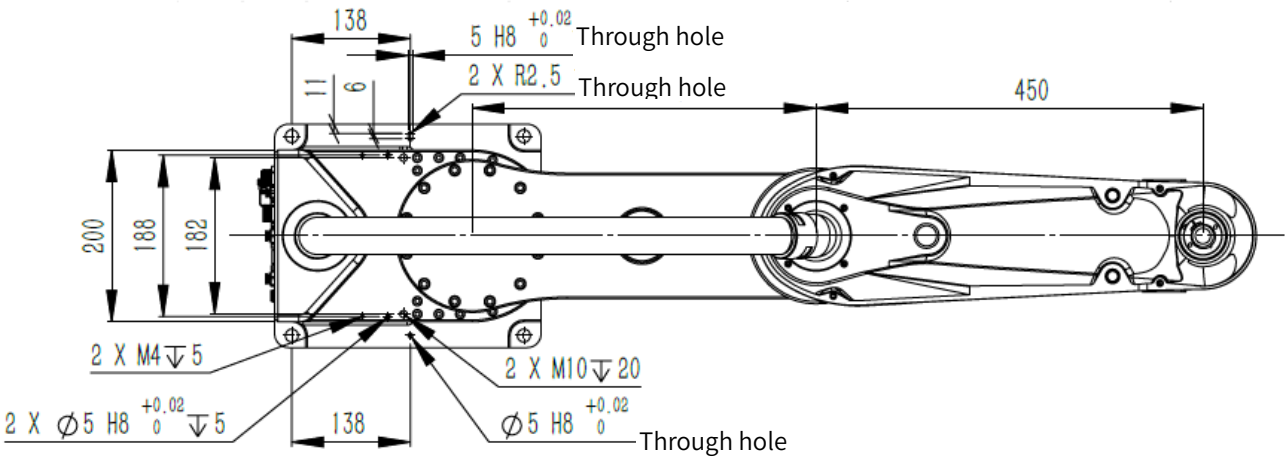


Figure 3-10 AH20-0850-0204-4000 dimensions (unit: mm)

- AH20-1050-0204-2000

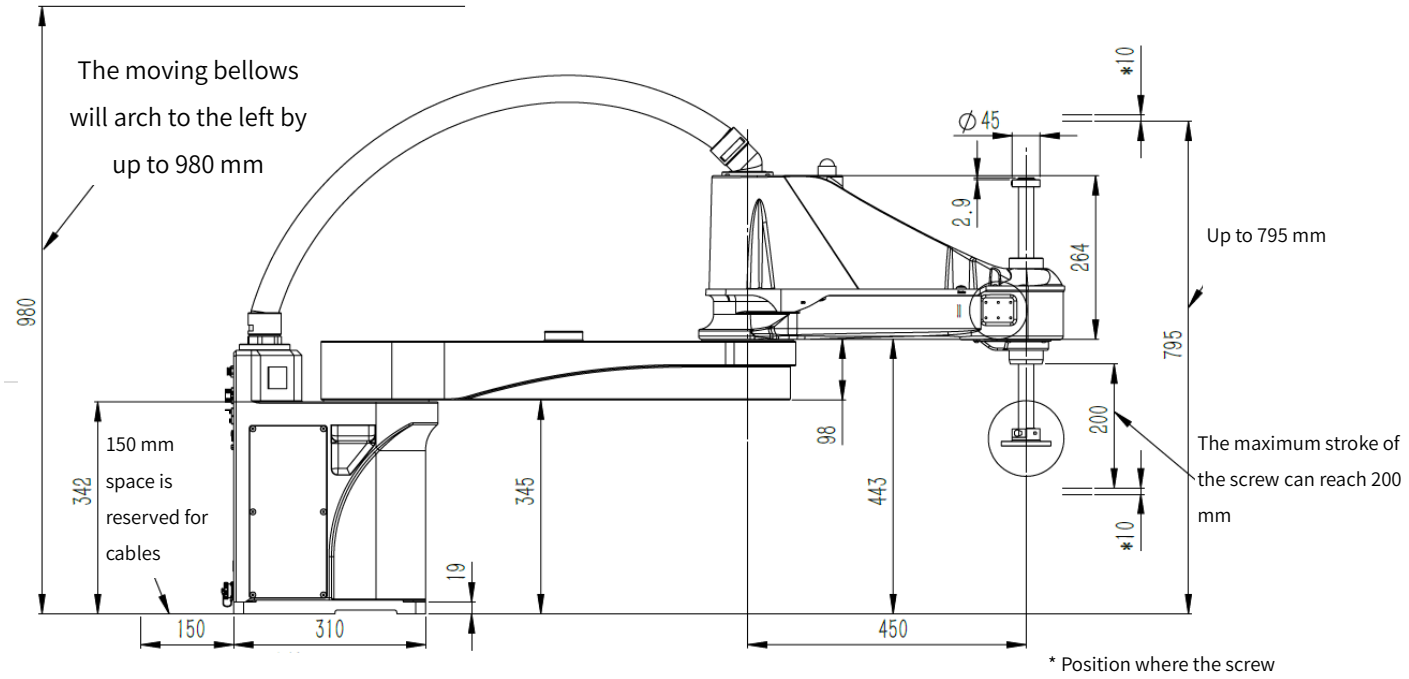


Figure 3-11 AH20-1050-0204-2000 dimensions (unit: mm)

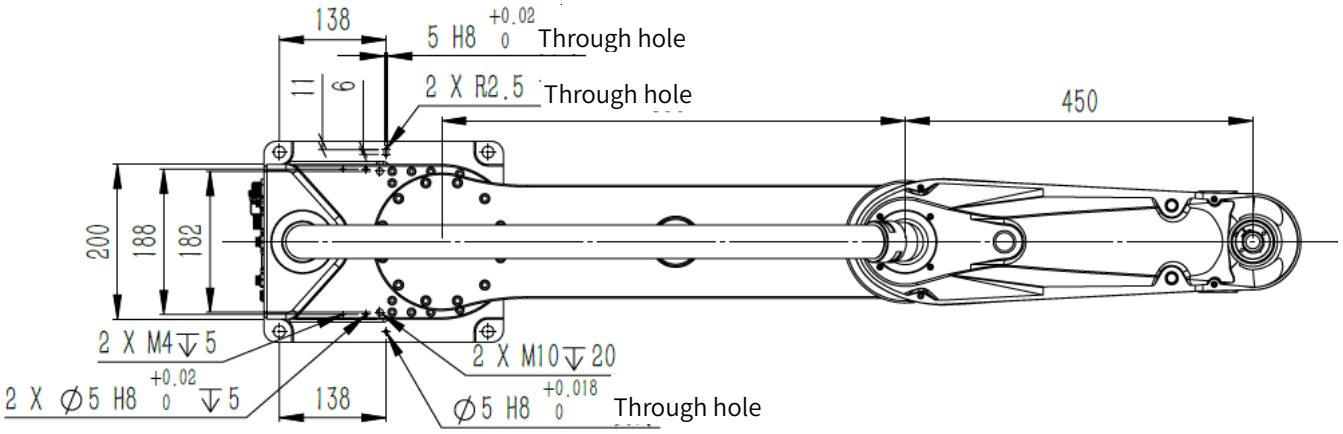


Figure 3-12 AH20-1050-0204-2000 dimensions (unit: mm)

- AH20-1050-0204-4000

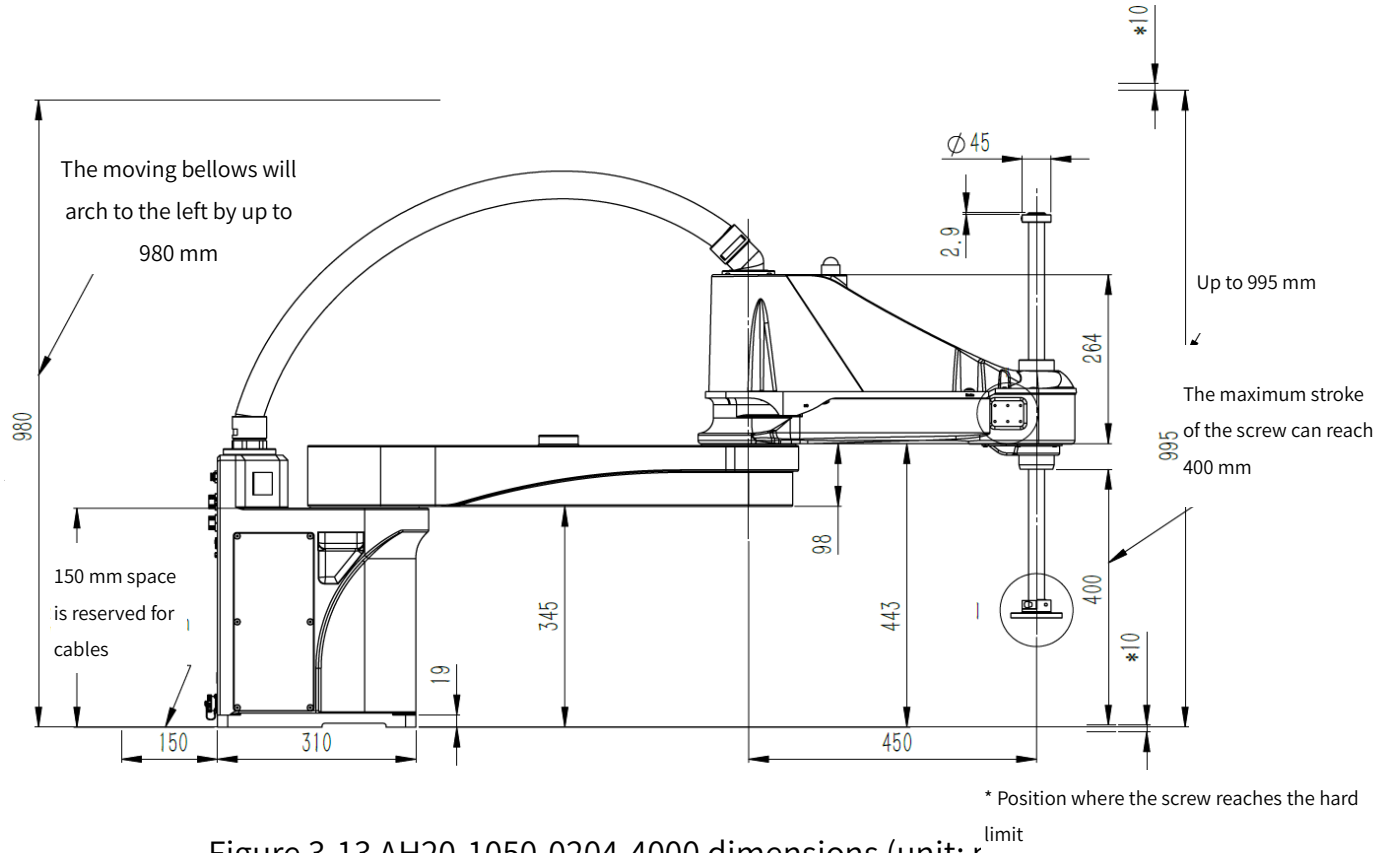


Figure 3-13 AH20-1050-0204-4000 dimensions (unit: mm)

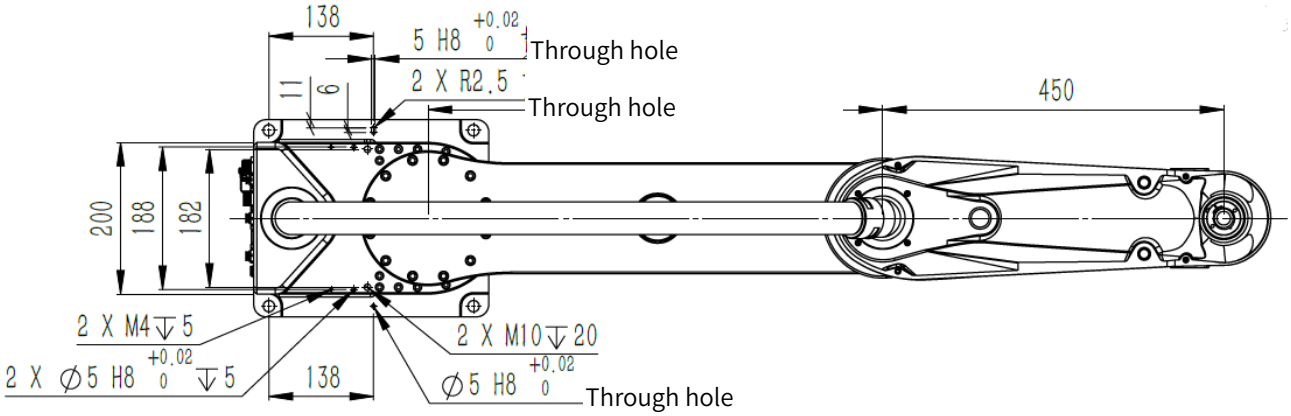


Figure 3-14 AH20-1050-0204-4000 dimensions (unit: mm)

3.5.2 Base dimensions

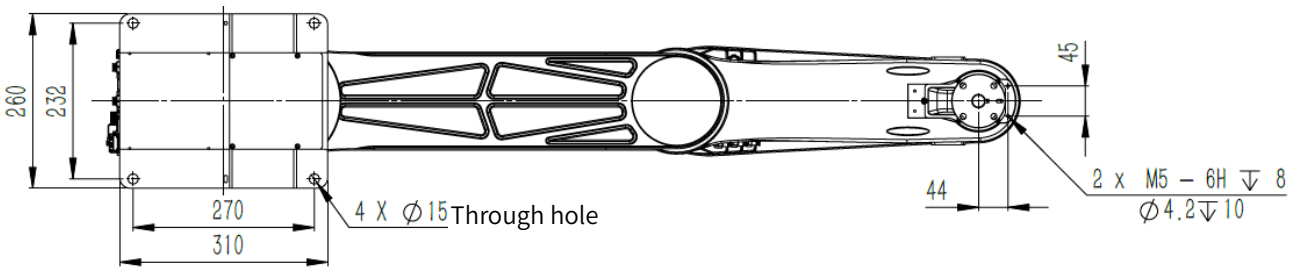


Figure 3-15 Product dimensions (Unit: mm)

3.5.3 Terminal flange dimensions

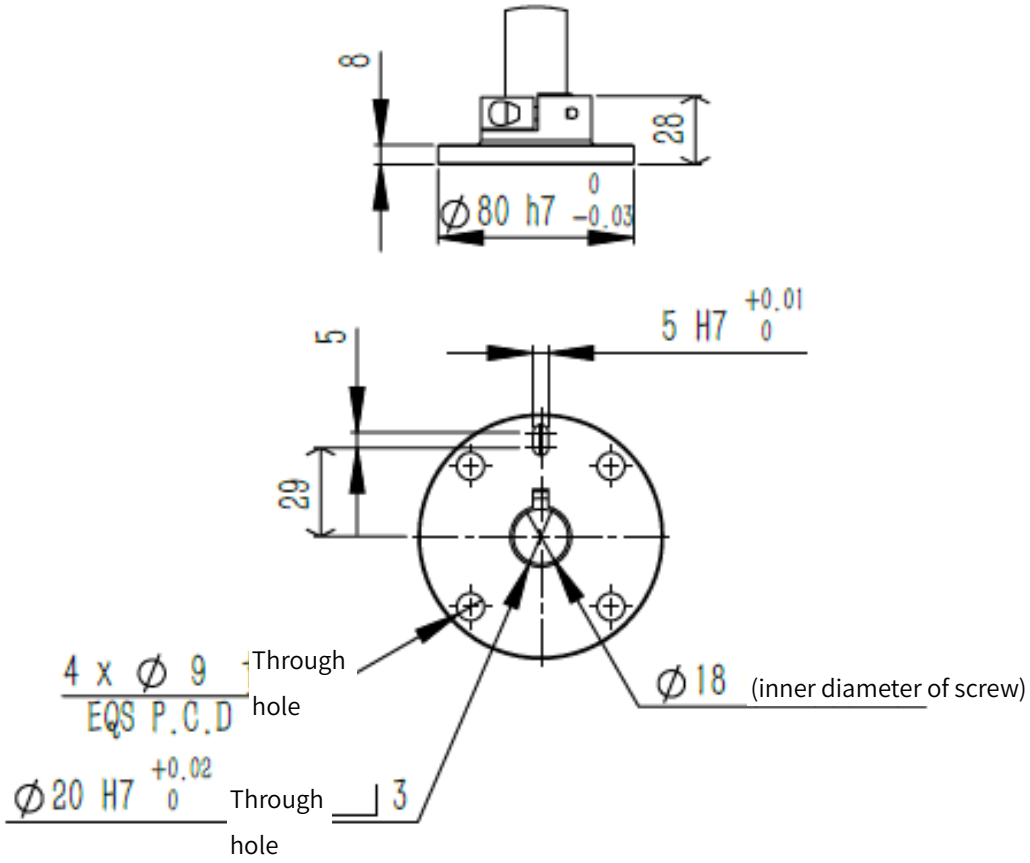


Figure 3-16 End flange installation dimensions (unit: mm)

3.6 Technical parameters

Table 3-8 Technical parameters of AH20 Robot

<table>
<tr><td colspan="2"></td><td colspan="2">AH20-0850</td><td colspan="2">AH20-1050</td></tr>
<tr><td colspan="2">Model Number</td><td>AH20-0850-0204-2000</td><td>AH20-0850-0204-4000</td><td>AH20-1050-0204-2000</td><td>AH20-1050-0204-4000</td></tr>
<tr><td rowspan="3">Arm length (mm)</td><td>Full arm length</td><td colspan="2">850</td><td colspan="2">1050</td></tr>
<tr><td>Axis A</td><td colspan="2">400</td><td colspan="2">600</td></tr>
<tr><td>Axis B</td><td colspan="2">450</td><td colspan="2">450</td></tr>
<tr><td rowspan="3">Maximum speed</td><td>Axis A + Axis B (mm/s)</td><td colspan="2">11000</td><td colspan="2">12250</td></tr>
<tr><td>Axis Z (mm/s)</td><td colspan="4">2400</td></tr>
<tr><td>Axis W (°/s)</td><td colspan="4">1600</td></tr>
<tr><td rowspan="4">Work space</td><td>J1 (°)</td><td colspan="4">±131</td></tr>
<tr><td>J2 (°)</td><td colspan="2">±152</td><td colspan="2">±152</td></tr>
<tr><td>J3 (mm)</td><td>200</td><td>400</td><td>200</td><td>400</td></tr>
<tr><td>J4 (°)</td><td colspan="4">±360</td></tr>
<tr><td rowspan="3">Repeated positioning accuracy</td><td>J1+J2 (mm)</td><td colspan="4">±0.025</td></tr>
<tr><td>J3 (mm)</td><td colspan="4">±0.01</td></tr>
<tr><td>J4 (°)</td><td colspan="4">±0.01</td></tr>
<tr><td colspan="2">Rated load (Kg)</td><td colspan="4">10</td></tr>
<tr><td colspan="2">Maximum load (Kg)</td><td colspan="4">20</td></tr>
<tr><td colspan="2">J4 rated moment of inertia (kg·m²)</td><td colspan="4">0.05</td></tr>
</table>

J4 maximum moment of inertia (kg·m²)	0.45	
Total weight (kg)	56	63

3.7 Environmental parameters

Install the robot system in an environment that meets the following conditions to exert/maintain the performance of the robot and to ensure safe use.

Table 3-9 Environmental parameters

Installation Environment	Notes
Ambient temperature	0 ~ 40°C
Ambient relative humidity	⩽ 90%, non-condensing
Ambient environment	Located indoors
	No flammable gas, dust or liquid
	No corrosive gas or substance
	Free from electromagnetic interference source, electrostatic discharge, etc. in the vicinity
Vibration	Free from influence by strong impact and vibration

The robot is not suitable for work in harsh environmental conditions. If used in a place that does not meet the above conditions, we welcome your inquiry.

- If used in an environment where temperature and humidity change greatly, fogging may be caused inside the mechanical arm.

- Do not use it in corrosive environments such as acids or alkalis, otherwise the normal use of the robot would be affected.

3.8 Electrical parameters

Table 3-10 Robot electrical parameters

Item	Parameter
Rated voltage	230 V a.c. 50/60 Hz
Rated Power	0.8 kW
Motor brake voltage	24 V d.c.
I/O connector	20-CH universal digital inputs, 6-CH high-speed inputs, 2-CH analog inputs, 18-CH universal digital outputs.
Communication connector	LAN, RTN1, RTN2, RS-232, RS-485
Noise level	⩽ 70dB

Chapter 4 Introduction to Electrical Connectors

4.1 External electrical connector

The electrical connectors of AH20 Robot mainly include air pipe connector, power connector, communication connector and user connector, etc., which are distributed on the base and mechanical arm 2, as shown in the figure.

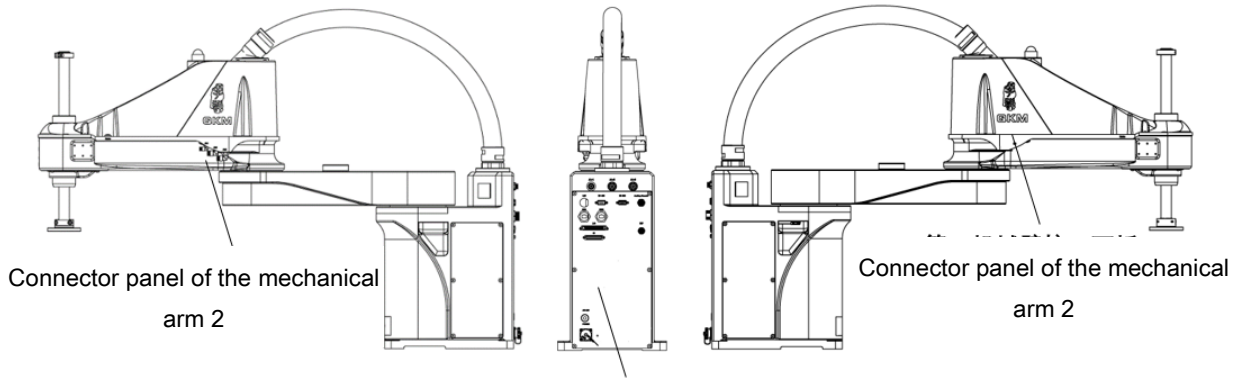


Figure 4-1 External connector panel

4.1.1 Connector panel of the mechanical arm 2

The mechanical arm 2 connectors are arranged on both sides of the arm in sequence, including the air pipe connector and the CS connector, which are hidden under the arm, showing a beautiful appearance and design without destroying the external streamline.

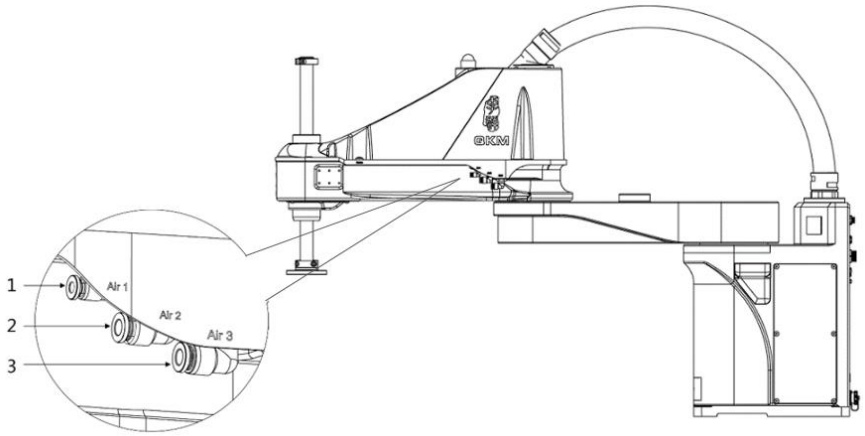


Figure 4-2 Air hole

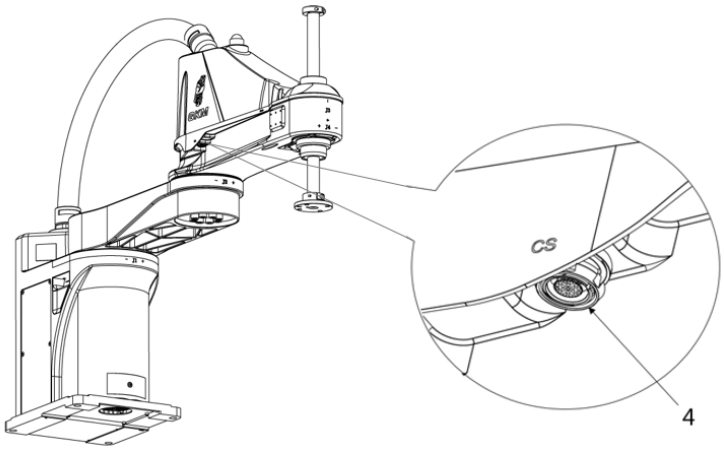


Figure 4-3 CS connector

Table 4-1 Introduction of connector panel

SN	Name	Description
1	Air pipe connector	Connected to Φ4 air pipe
2	Air pipe connector	Connected to Φ6 air pipe
3	Air pipe connector	Connected to Φ6 air pipe
4	CS connector	Customer signal connector

4.1.2 Base connector panel

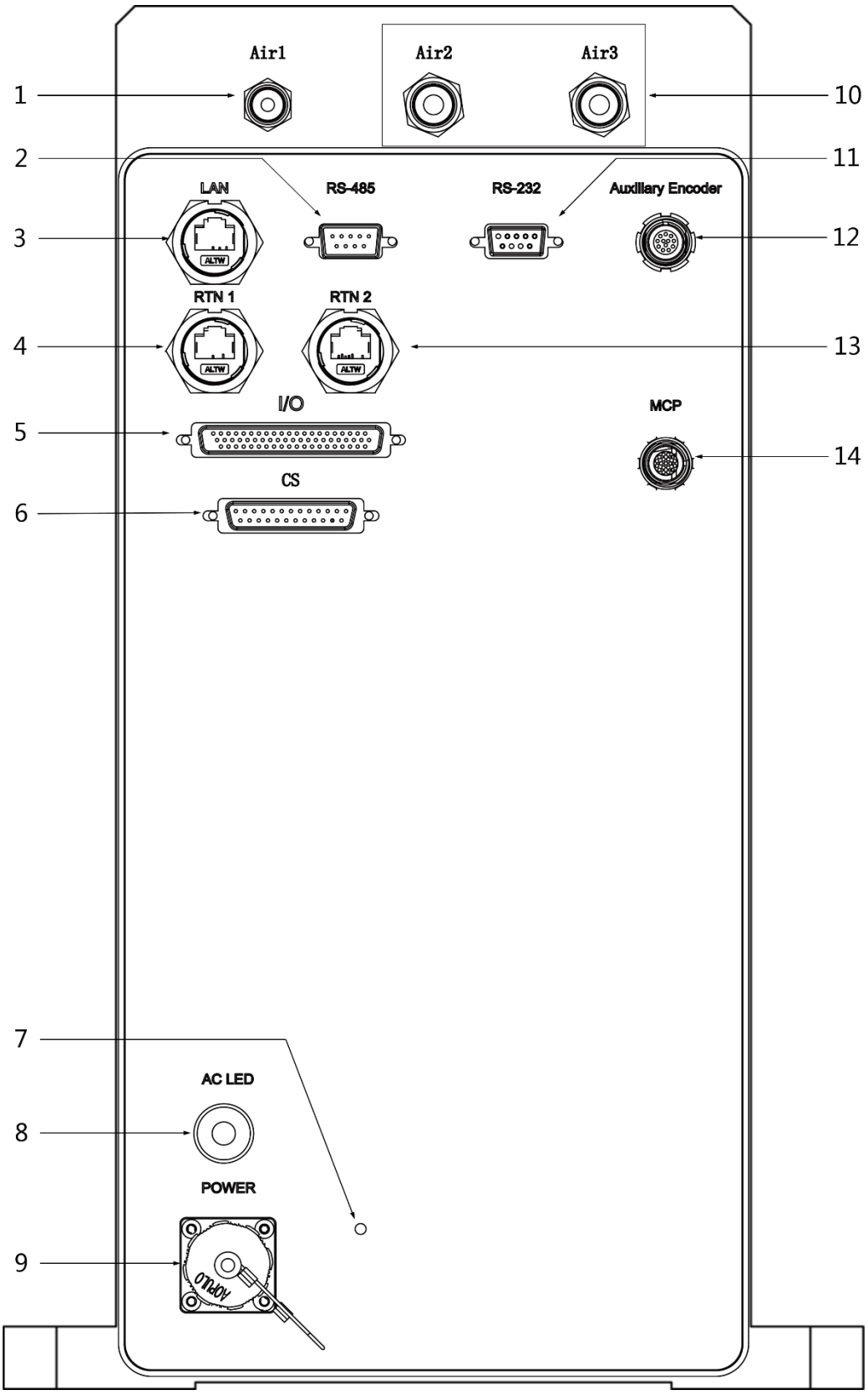


Figure 4-4 Schematic diagram of connector panel

Table 4-2 Introduction of connector panel

SN	Name	Description
1	Air1	Air pipe connector (white, Φ6)
2	RS-485	Communication connector
3	LAN	Ethernet connector (Ethernet communication)
4	RTN1	Real-time Ethernet connector 1 (extended function reserved connector)
5	I/O	Digital input/output connector
6	CS	Customer signal connector (customer signal)
7	Grounding screw hole	Common ground terminal for connecting the ground wire
8	AC LED	Main power indicator
9	POWER	Power connector
10	Air2	Air pipe connector (white, Φ6)
	Air3	Air pipe connector (white, Φ6)
11	RS-232	Communication connector
12	Auxiliary Encoder	Auxiliary encoder connector
13	RTN2	Real-time Ethernet connector 2 (extended function reserved connector)
14	MCP	E-stop component connector/MCP connector

4.2 Indicator description

AH20 Robot comprises AC LED on the base connector panel and system indicator on the mechanical arm 2. The status of the indicators is described below.

4.2.1 Main power indicator

Table 4-3 Description of power indicator status

State	Description
OFF	Indicates that the robot is not powered on.
ON (red)	Indicates that the robot is powered on.

4.2.2 System indicator (Mechanical arm 2)

The system indicator is located at the top of the mechanical arm 2 of the robot. It is a circular LED light, and it shows different colors when the robot works. The status of the system indicator is described below.

Table 4-4 Description of system indicator status

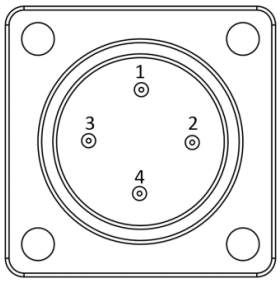
State	Description
OFF	Indicates that the robot is not in the servo state.
Flashing	Indicates that the robot system is starting or being servoed.
ON (green)	Indicates that the robot has entered the servo state.

4.3 Definition of connector pins

This section provides detailed functions and descriptions of pins on the power connector, each connector of the upper control cabinet and the CS connector on the mechanical arm 2. The operations must be performed in accordance with the descriptions of the pins.

4.3.1 Power connector (POWER)

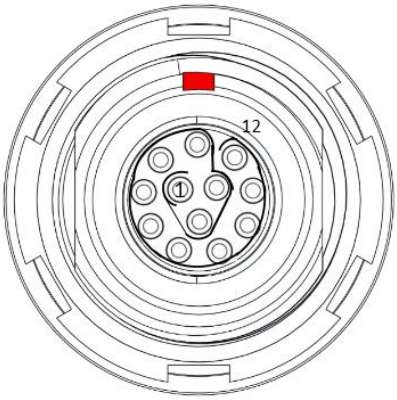
Table 4-5 Definition of power connector pins

Pin	Function	Description	230 V a.c. power connector
1	L	Live wire	 4-pin male front pinout
2	N	Neutral wire	
3	PE	Ground wire	
4	/	Idle	

4.3.2 Auxiliary encoder

Table 4-6 Definition of auxiliary encoder pins

Auxiliary Encoder				
Axis No.	Pin	Function	Description	
3-axis	01	Output +5 V d.c.	5 V d.c. output power	

	02	GND	Common ground	 12-pin female front pinout
	03	3A+	3-axis A +	
	04	3B+	3-axis B+	
	05	3Z+	3-axis Z+	
	06	F.G	Shielded wire	
Axis 4	07	Output +5 V d.c.	5 V d.c. output power	
	08	GND	Common ground	
	09	4A+	Axis 4 A +	
	10	4B+	Axis 4 B +	
	11	4Z+	Axis 4 Z +	
	12	F.G	Shielded wire	

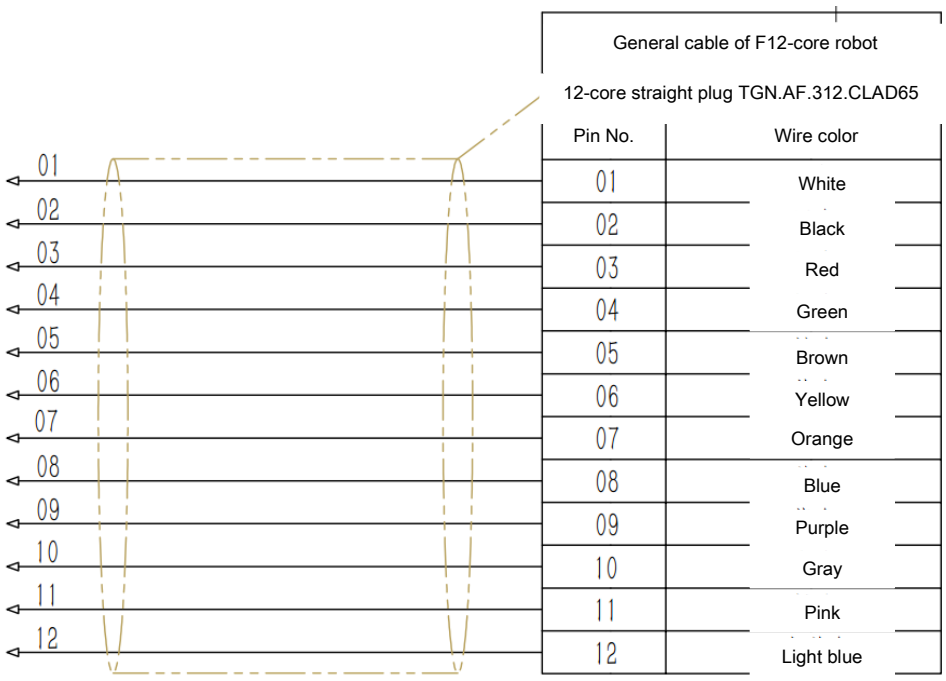


Figure 4-5 Auxiliary encoder

- The 5 V pin in the auxiliary encoder connector indicates a DC output power supply.
- Do not connect external power supply to the 5 V auxiliary encoder pin, otherwise the internal circuit of the robot will be burnt.
- The auxiliary encoder and main encoder on the same axis share 1-CH 5V power supply, with maximum continuous output current of 500 mA; typical overcurrent protection of 1 A lower limit: 0.75 A, upper limit: 1.25 A)

WARNING

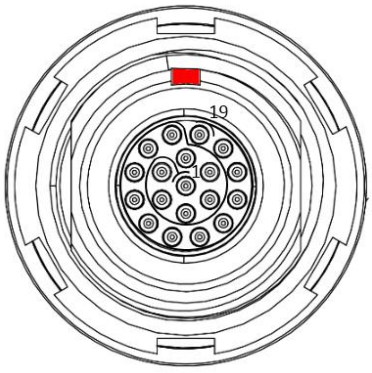
4.3.3 MCP connector (MCP/E-stop)

The MCP connector pins are defined as follows, where function 1 is enabled when an external manual control pendent (MCP) is connected, and function 2 is enabled under emergency conditions.

NOTE

- MCP/E-stop is classified as type 1

Table 4-7 Definition of MCP pins

MCP connector


19-pin female connector			
Pin	Function 1 (MCP)	Function 1 description	Function 2 (E-stop)
01	Auto/Manual 2	Auto/manual mode 2	/
02	Output 24 V d.c.	24 V d.c. output power	/
03	Auto/Manual 1	Auto/manual mode 1	/
04	Output 24 V d.c.	24 V d.c. output power	/
05	BI_D4+	2-CH data +	/
06	BI_D4-	2-CH data -	/
07	E-STOP_0	E-stop contact 0	E-STOP_0
08	GND	Common ground	GND
09	/	/	/
10	/	/	/
11	E-STOP_2	E-stop contact 2	E-STOP_2
12	GND	Common ground	/
13	GND	Common ground	GND
14	BI_D3+	Two-way data +	/
15	BI_D3-	Two-way data -	/
16	TX_D1+	Transmit data +	/
17	TX_D1-	Transmit data -	/

18	RX_D2+	Receive data +	/
19	RX_D2-	Receive data -	/

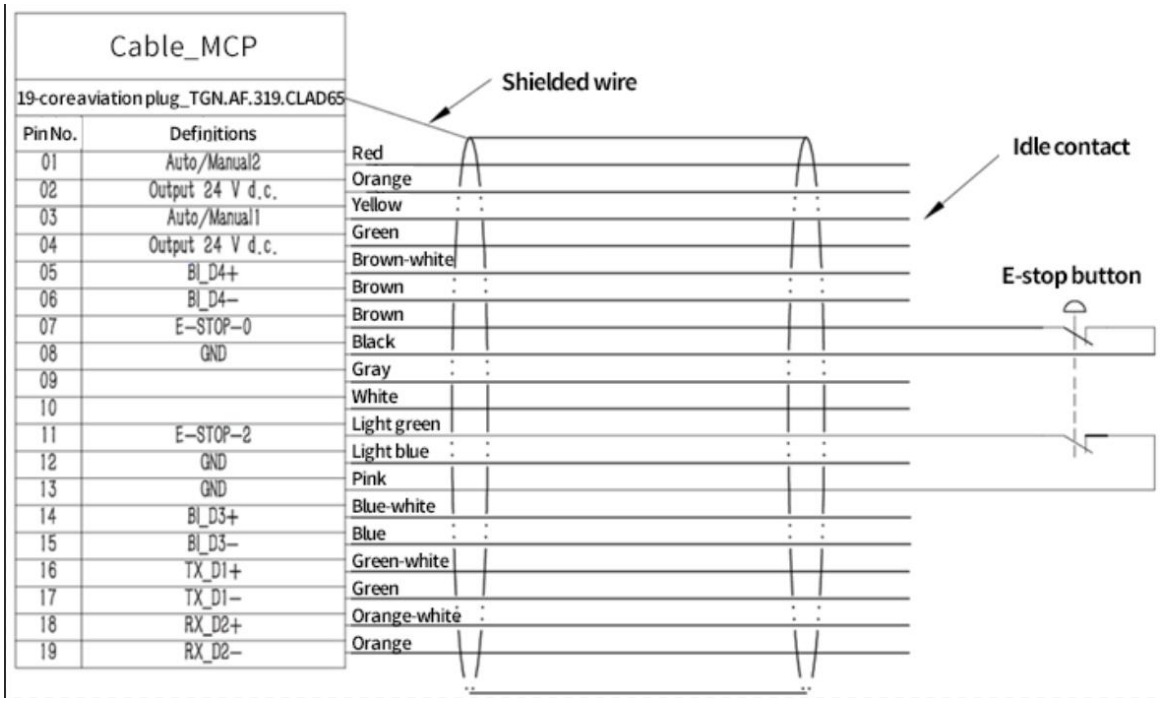
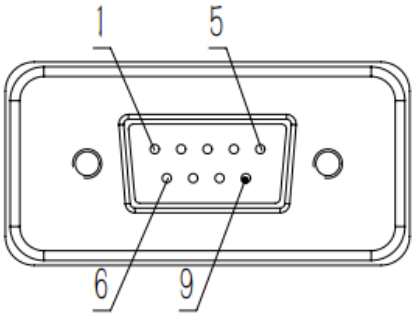


Figure 4-6 Wiring diagram of E-stop device

4.3.4 Communication connector (RS-232)

Table 4-8 Definition of RS-232 pins

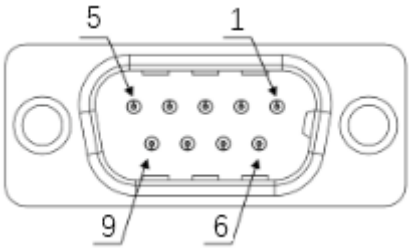
Definition of RS-232 pins			
Pin	Function	Description	
01	/	Unused	
02	RXD	Receive data	
03	TXD	Transmit data	
04	/	Unused	
05	GND	Ground terminal	9-pin male front pinout
06	/	Unused	

07	/	Unused	
08	/	Unused	
09	/	Unused	

4.3.5 Communication connector (RS-485)

Table 4-9 Definition of RS-485 pins

Definition of RS-485 pins			
Pin	Function	Description	
01	/	Unused	
02	/	Unused	
03	/	Unused	
04	/	Unused	
05	/	Unused	
06	/	Unused	
07	GND	Ground terminal	
08	RS485+	RS485+	
09	RS485-	RS485-	

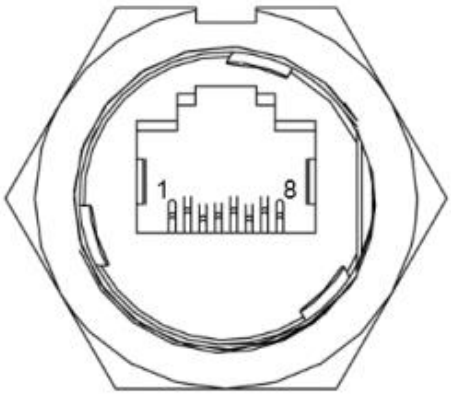


9-pin female front pinout

4.3.6 Ethernet connector (LAN/RTN1/RTN2)

Table 4-10 Definition of Ethernet connector pins

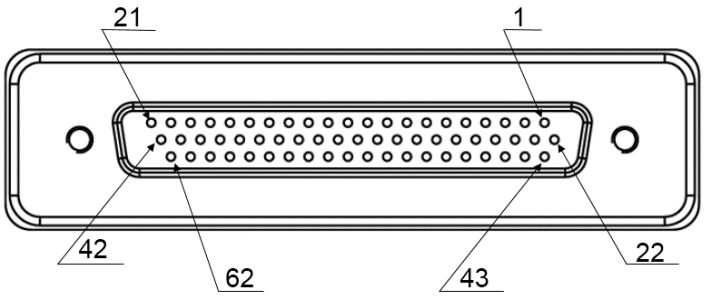
Ethernet connector			
Pin	Signal name	Description	

01	TX_D1+	Transmit data +	 8-core positive pinout
02	TX_D1-	Transmit data -	
03	RX_D2+	Receive data +	
04	BI_D3+	Two-way data +	
05	BI_D3-	Two-way data -	
06	RX_D2-	Receive data -	
07	BI_D4+	Two-way data +	
08	BI_D4-	Two-way data -	

4.3.7 Digital input/output connector (I/O)

For easy programming, each pin of the IO connector is defined with a corresponding number. The following provides the definition, function, corresponding signal code and description of each pin on the connector, as shown in Table 4-11.

Table 4-11 Definition of I/O connector pins

Definition of I/O connector pins			
 62-core female front pinout			
Pin	Function	Signal code	Description
01	E-DO_1	20101	General output 1
02	E-DO_2	20102	General output 2
03	Output 24 V d.c①	/	24 V d.c. output power
04	GND	/	Common ground
05	E-DO_3	20103	General output 3
06	E-DO_4	20104	General output 4
07	E-DO_5	20105	General output 5
08	E-DO_6	20106	General output 6
09	Output 24 V d.c①	/	24 V d.c. output power
10	GND	/	Common ground
11	E-DO_7	20107	General output 7
12	E-DO_8	20108	General output 8
13	E-DO_9	20109	General output 9

14	E-DO_10	20110	General output 10
15	Output 24 V d.c ①	/	24 V d.c. output power
16	GND	/	Common ground
17	E-DO_11	20111	General output 11
18	E-DO_12	20112	General output 12
19	E-DO_13	20113	General output 13
20	E-DO_14	20114	General output 14
21	Output 24 V d.c ①	/	24 V d.c. output power
22	GND	/	Common ground
23	E-DO_15	20115	General output 15
24	E-DO_16	20116	General output 16
25	E-DO_17	20117	General output 17
26	E-DO_18	20118	General output 18
27	Output 24 V d.c ①	/	24 V d.c. output power
28	GND	/	Common ground
29	E-HDI_1	30101	High speed input 1
30	E-HDI_2	30102	High speed input 2
31	E-HDI_3	30103	High speed input 3
32	E-HDI_4	30104	High speed input 4
33	HGND	/	High speed input common ground
34	E-DI_1	10101	General input 1
35	E-DI_2	10102	General input 2
36	E-DI_3	10103	General input 3
37	E-DI_4	10104	General input 4
38	E-DI_5	10105	General input 5
39	E-DI_6	10106	General input 6
40	E-DI_7	10107	General input 7
41	E-DI_8	10108	General input 8

42	GND	/	Common ground
43	E-DI_9	10109	General input 9
44	E-DI_10	10110	General input 10
45	E-DI_11	10111	General input 11
46	E-DI_12	10112	General input 12
47	E-DI_13	10113	General input 13
48	E-DI_14	10114	General input 14
49	E-DI_15	10115	General input 15
50	E-DI_16	10116	General input 16
51	E-DI_17	10117	General input 17
52	E-DI_18	10118	General input 18
53	E-DI_19	10119	General input 19
54	E-DI_20	10120	General input 20
55	GND	/	Common ground
56	E-HDI_5	30105	High speed input 5
57	E-HDI_6	30106	High speed input 6
58	HGND	/	High speed input common ground
59	Ain	60101	Analog input 1
60	AGND1	/	Analog input common ground 1
61	Ain2	60102	Analog input 2
62	AGND2	/	Analog input common ground 2

Note ①: The rated current of one-way 24V DC output power supply is 1A; The 24V DC output power supply cannot be connect to external devices, but can only be used for I/O output.

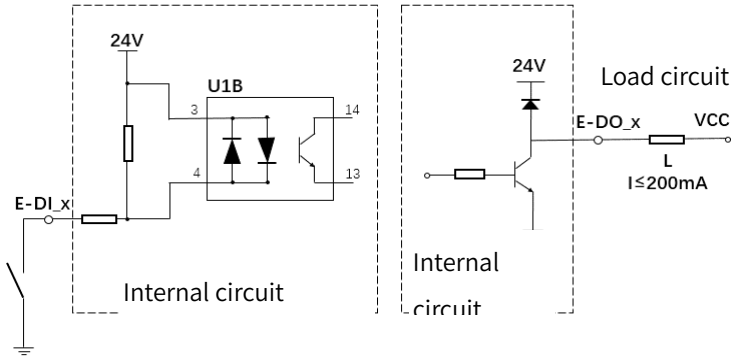


Figure 4-7 Diagram of input circuit (left) and output circuit (right)

CAUTION

1. DO indicates open-circuit output mode (NPN), with maximum frequency of 1 kHz, and maximum current of less than 200 mA;

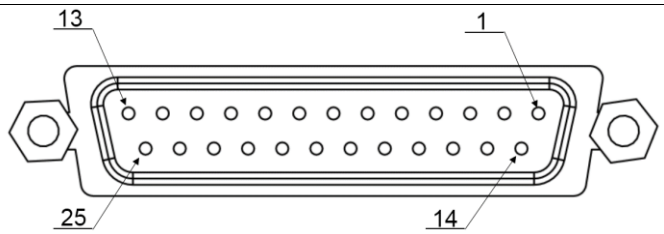
2. When the 24V DC output power supply of the I/O connector is used in conjunction with the DO, it serves as an active output to provide energy to the outside and can be connected to resistive, inductive and capacitive loads. However, the one-way 24V DC output power supply can be used in conjunction with up to 4-way DO at the same time, with maximum current of less than 1A, otherwise the internal protection circuit of the system would be burnt out due to overcurrent.

3. To ensure reliable and stable operation of the load, it should be connected to an external 24V power supply in conjunction with DO.

4.3.8 Base customer signal connector (CS)

Table 4-12 Definition of base CS connector pins

Definition of base CS connector pins



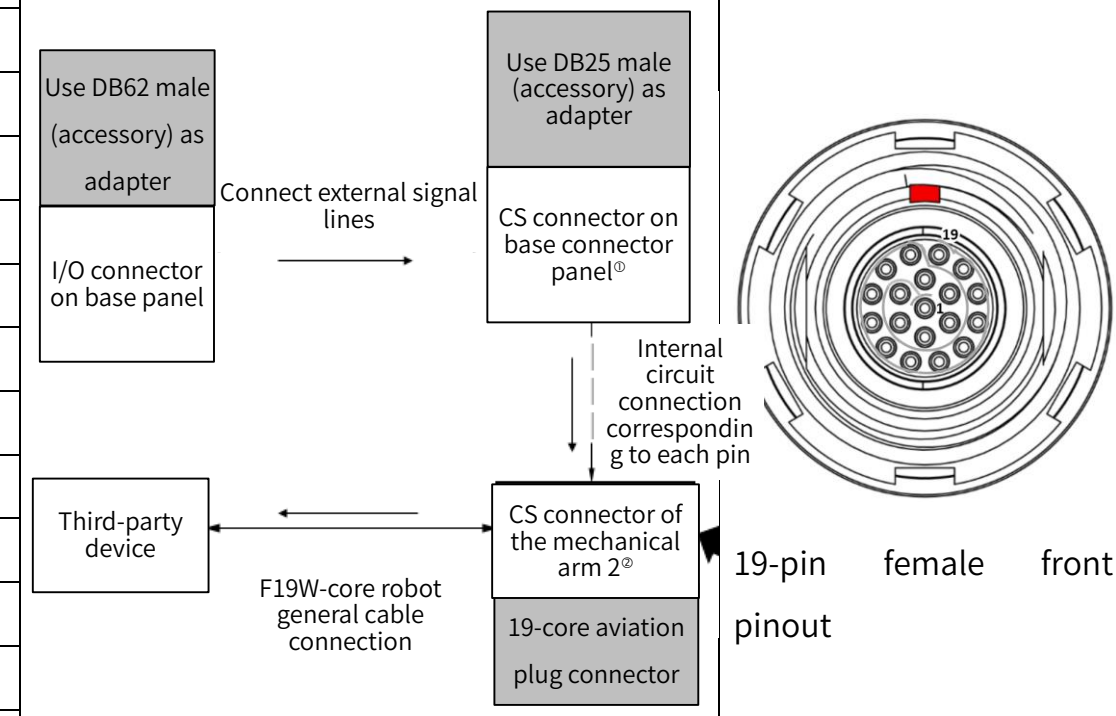
25-pin female front pinout

Pin	Description
01	Use DB62 male (accessory) as adapter I/O conncector on base panel Connection of external signal lines Use DB25 male (accessory) as adapter CS connector on base connector panel① Internal circuit connection corresponding to each pin Third-party device F19W-core robot general cable connection CS connector of the mechanical arm 2② 19-core aviation plug connector
02	
03	
04	
05	
06	
07	
08	
09	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19-25	Idle

4.3.9 Customer signal connector of the mechanical arm 2 (CS)

Table 4-13 Definition of the mechanical arm 2 CS connector pins

Definition of the mechanical arm 2 I/O connector pins		
Pins	Description	
01		
02		
03		
04		
05		
06		
07		
08		
09		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19	Idle	



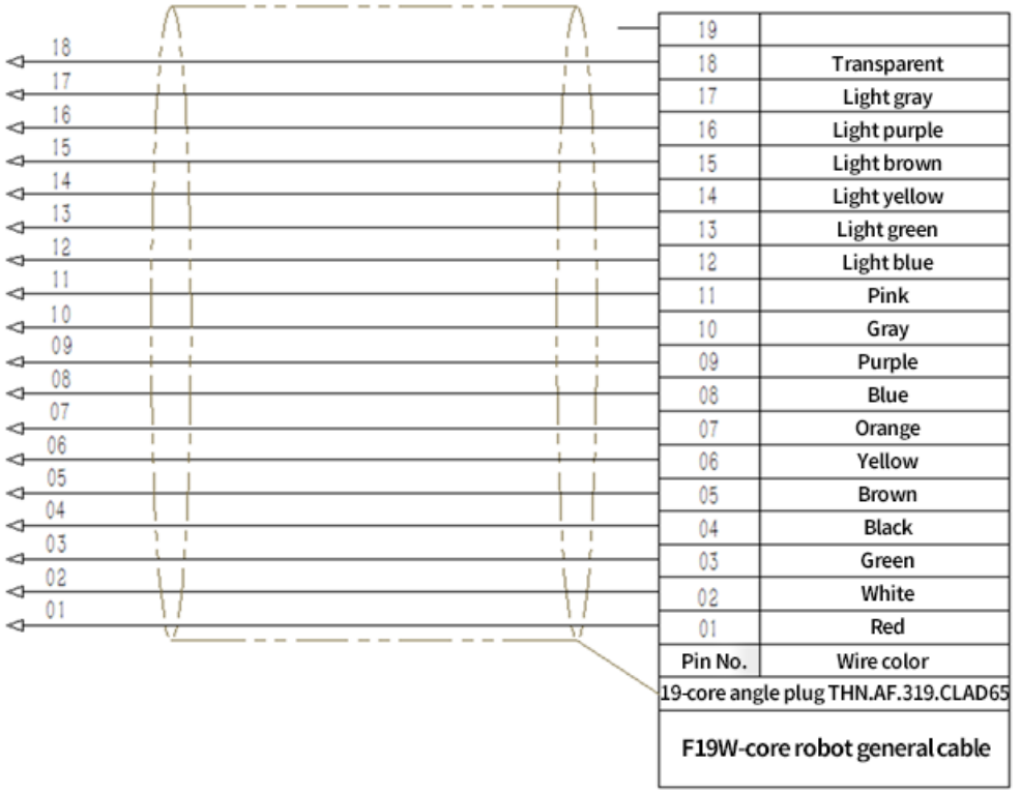


Figure 4-8 Wiring diagram of CS connector of F19W-core robot general cable

NOTE

1. Take the DB62 and DB25 male pins and plug housings out of the accessory box, solder and fabricate the I/O and CS cables as required according to the definition table of I/O connector pins;

2. When the robot is powered off, plug the fabricated I/O cable and CS cable into the corresponding sockets on the base connector panel, and use the straight screwdriver to tighten the fastening screws on the plug;

3. Take the universal two-joint cable out of the accessory box and insert it into the CS aviation plug socket on the two-joint connector panel. At this time, the universal cable is connected to the CS cable;

4. Short the pins that need to be freely distributed on the I/O cable to the CS cable (use an insulated sheathed terminal to prevent short-circuiting), then the I/O cable can be connected to the corresponding pins of the universal cable to achieve the free distribution of I/O.

Chapter 5 Product Installation

The installation of the robot is critical to its function. Special attention should be paid to the fixing of the base and the foundation needs to be able to withstand the impact load generated from the acceleration of the robot. Install this robot according to the following requirements.

5.1 Installation requirements

Users should design and produce the rack for fixing the robot by themselves. The shape and size of the rack may vary depending on the purpose of the robot system.

The rack must withstand the weight of the robot and the dynamic force produced when the robot acts at the maximum acceleration. More crosspieces should be installed to provide sufficient strength. The requirements for installing the rack are as follows.

- The bottom surface of the robot is parallel to the mounting surface.
- The area of the mounting surface is not less than that of the bottom surface of the robot.
- Fix the rack externally (on the ground) and ensure that it will not move.

The holes on the rack for installing the mechanical arm should be M12 threaded holes. When installing the mechanical arm, use bolts with a strength meeting ISO898-1 property class 10.9 or 12.9.

If 4040 square tube is used for welding, ground screws (not less than M12) should be used for fixation.

In order to suppress vibration, the installation panel of the mechanical arm should be iron plate with a thickness of 20 mm or more, a surface roughness of 25 μm or

less and a flatness of less than 0.5 mm.

CAUTION

- The poor accuracy of the installation surface would degrade the positioning accuracy of the robot.
- If the stiffness or stability of the rack is insufficient, or sheet metal is mounted on the rack, the robot would vibrate (resonate) during operation, which may adversely affect the operation.

To ensure enough space for installation of cables, a space of more than 150 mm must be reserved at the back of the base.

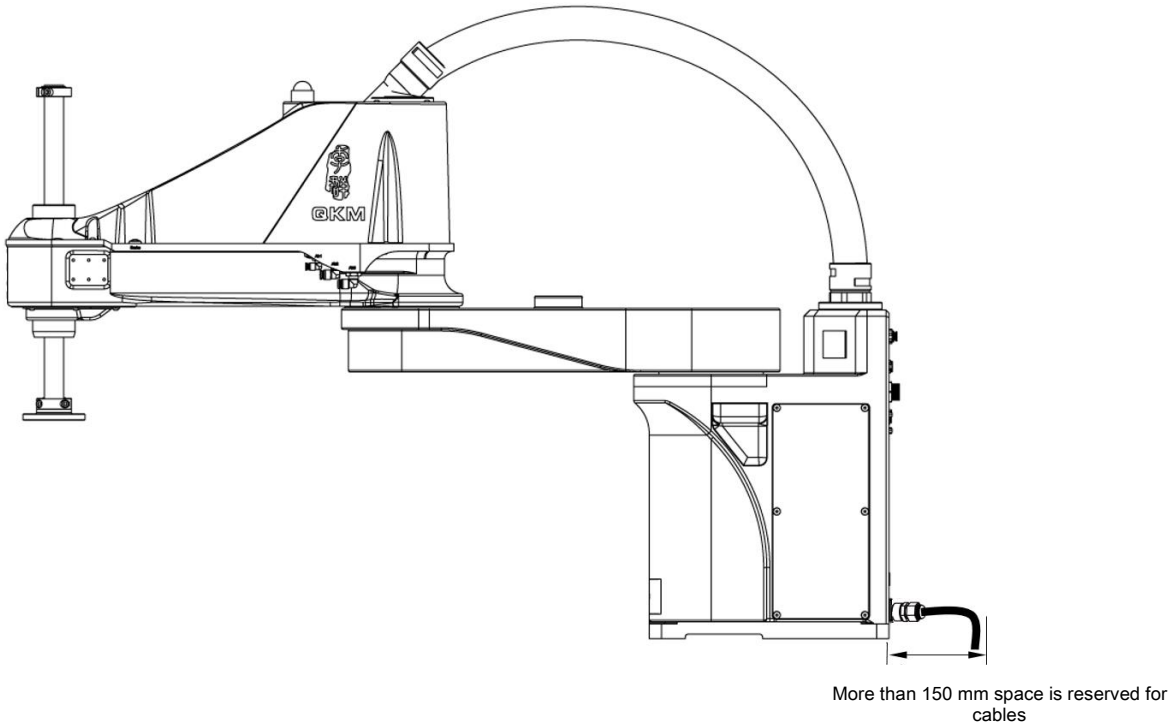


Figure 5-1 Reserved space at the back of the base

- Installation example

Fix the bottom plate on the ground with anchor bolts (M12 or more). The bottom plate must be sufficiently strong and rigid. The bottom plate with a thickness of 20mm or more is recommended.

Position and install the robot base through four instillation holes and two pin holes. Then use the hex bolts (M12*40), spring washers and flat washers to fix the robot base. To prevent the hex bolts from loosening during the operation of the robot, please follow the method described to tighten them.

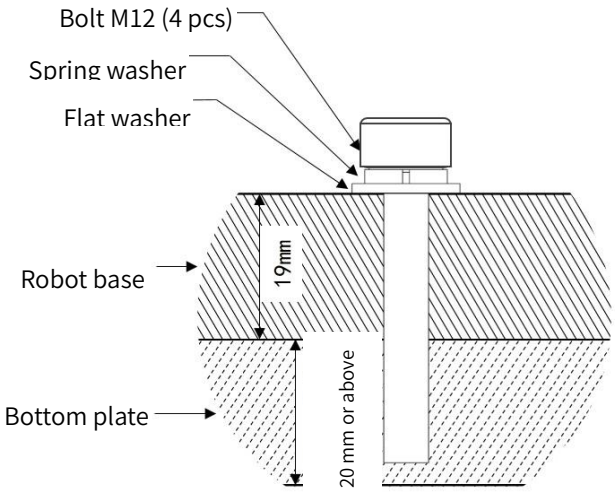


Figure 5-2 Installation diagram

5.2 Product confirmation

After unpacking, confirm the product components and status according to the packing list. The standard packing list should contain:

- AH20 Robot body
- Accessory box (containing user manual)

CAUTION In case of any damage or component incompletion after unpacking, please contact QKM or local office.

5.3 Installation site and environment

The installation of AH20 Robot shall meet the following conditions.

- The ambient temperature during transportation maintains at 0 ~ 40°C.

- In a dry place with low humidity. ⩽ 90% relative humidity, non-condensing.

- The site causes small vibration and impact to the robot (vibration of less than 0.5G)

- The robot must be installed away from flammable or corrosive liquids or gases and sources of electrical interference.

5.4 Installation of external parts

External equipment, such as vision camera, solenoid valve, etc. can be installed through the holes at the front end of the mechanical arm 2 of AH20 Robot. The installation dimensions for the fixing position are shown in Figure 5-3.

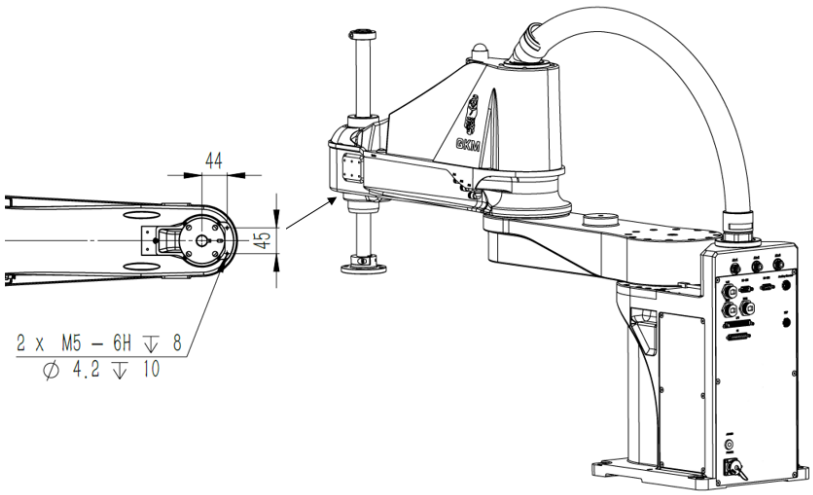


Figure 5-3 Installation position of external parts (unit: mm)

CAUTION

When the robot is powered on for the first time, check the rotation angle of the fourth axis. Return to zero before installing the tool to prevent the fourth axis from exceeding the soft limit position after power-on.

5.4.1 Installation of camera (optional)

Install the camera as shown in the figure. The figure only shows one installation method. You can install the camera as required. If you use the installation method as shown in the figure, M5 screw holes are available here, and you should prepare the screws by yourself.

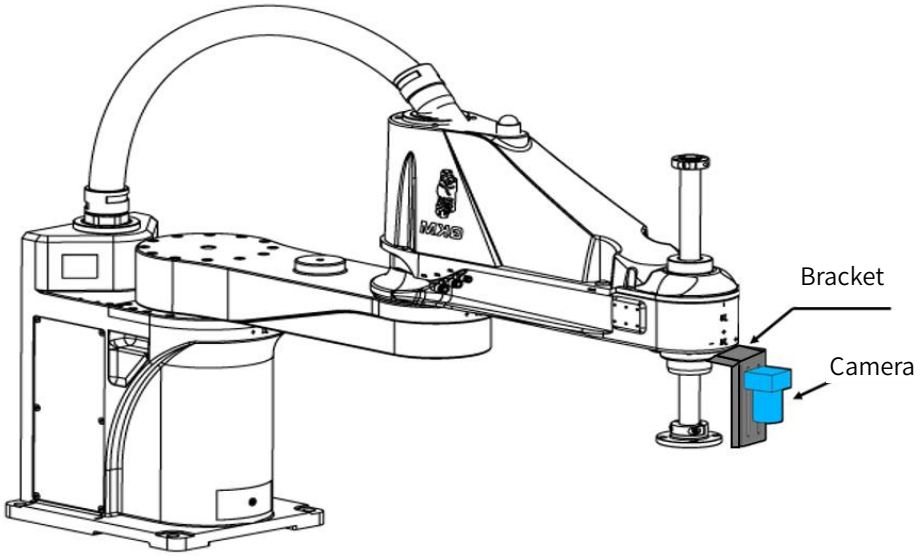


Figure 5-4 Camera installation diagram

5.5 Handling of robot

Use a forklift or the like to handle the robot in a packed state as far as possible. Comply with the following requirements when handling and unpacking the robot.

The installation should be performed by qualified personnel. Take care not to impact the equipment when unpacking.

CAUTION

- The robot should be lifted with crane or handled with forklift by professionals. Serious injuries or damage would be caused if the operation is performed by non-professionals.

- When lifting the robot, hold it by hand to ensure balance. If the lifting is unstable, serious injury or major damage may be caused due to the falling of the robot.
- The packing box of the robot should be placed vertically upwards. Handle it with care and prevent it from damage due to collision.
- Do not remove the fixing bolts, or the robot fixed on the handling pallet would roll over. Be careful to avoid clamping your hands or feet by the robot.
- The robot must be held by at least two persons with their hands when handling it with a forklift or a crane.

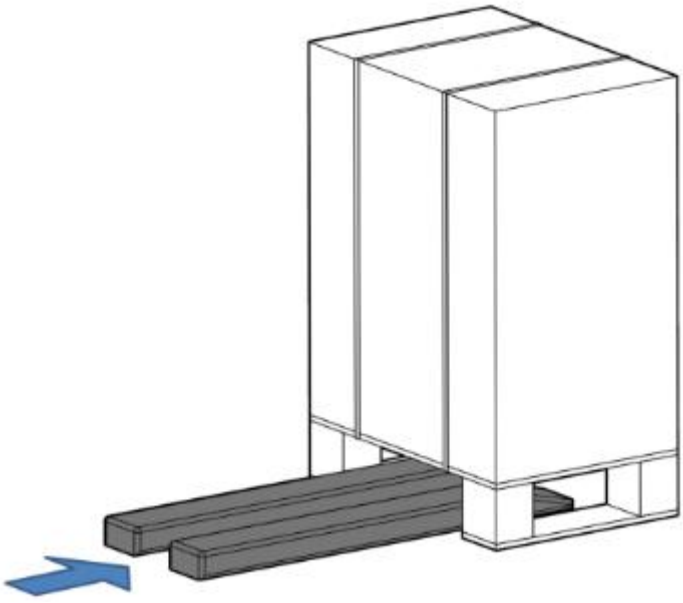
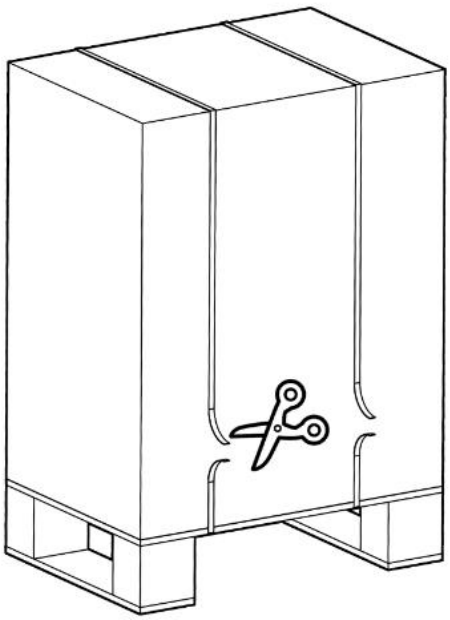


Figure 5-5 Schematic diagram of packaging and transportation

After transporting to the designated site, use an adjustable wrench to remove the self-tapping screws from the bottom side of the wooden box, then take out the wooden box upwards and store it properly.



NOTE The carton should be folded and stored for repeated use.

5.6 Base installation

Table 5-1 Tightening torque

Fixing bolt	Tightening torque
M12*40	100 N·m

Use bolts, elastic washers and flat washers to install the base. The dimensions and installation of the bolts and washers are shown in Figure 5-5.

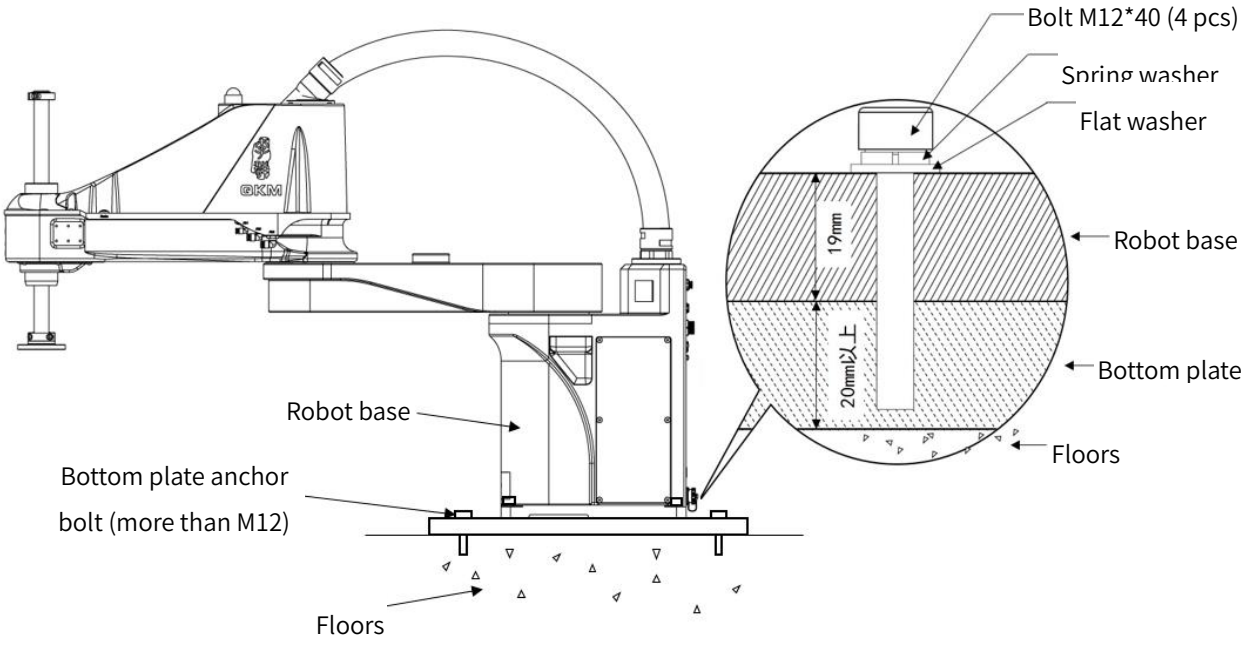


Figure 5-6 Install bolts on the base

CAUTION

- The base of the robot must be installed by at least two professionals. Pay full attention to avoid damage due to mechanical arm movement or to prevent hands or feet from being clamped.
- Fix the robot onto the rack with specified number of bolts meeting the requirement of tightening torque. The robot would tilt if failing to observe the rules.

5.7 5.7 Removal of fastener

Remove the fixed plate as shown in Figure 5-7 after installing the base.

Tools: 3# L hexagon wrench.

Removal steps:

Step 1 Use the 3# hexagon wrench to remove the four M4 screws from the fixed plate 1.

Step 2 Move the mechanical arm 2 with hand to separate the mechanical arm from the fixed plate 1.

Step 3 Hold the fixed plate 1 and use the 3# hexagon wrench to remove the two M4 screws from the fixed plate 1.

Step 4 Separate the fixed plate 1 from the fixed plate 2, remove the fixed plate 1 and properly store it.

Step 5 Use the 3# hexagon wrench to remove the two M4 screws from the fixed plate 2, remove the fixed plate 1 and properly store it.

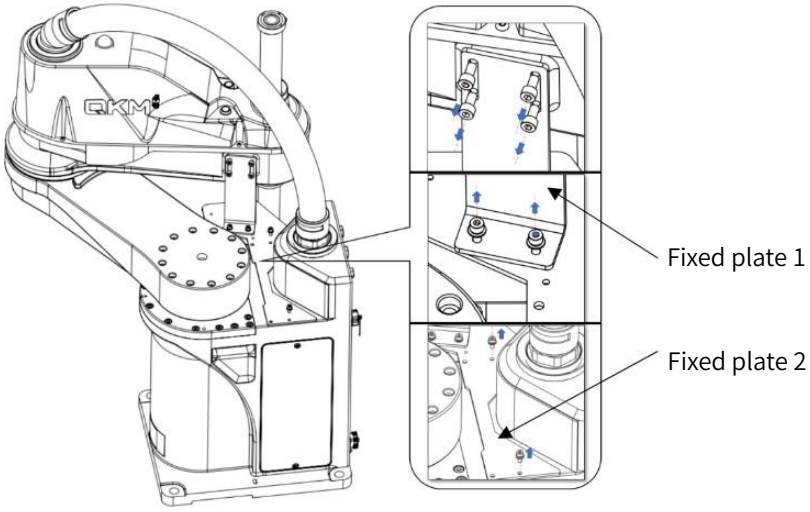


Figure 5-7 Diagram of removing the fixed plate

5.8 Ground protection

Each AH20 Robot is labeled with a "Ground Protection" sign and equipped with a ground terminal. Connect the ground terminal of the robot base to the external protective conductor.

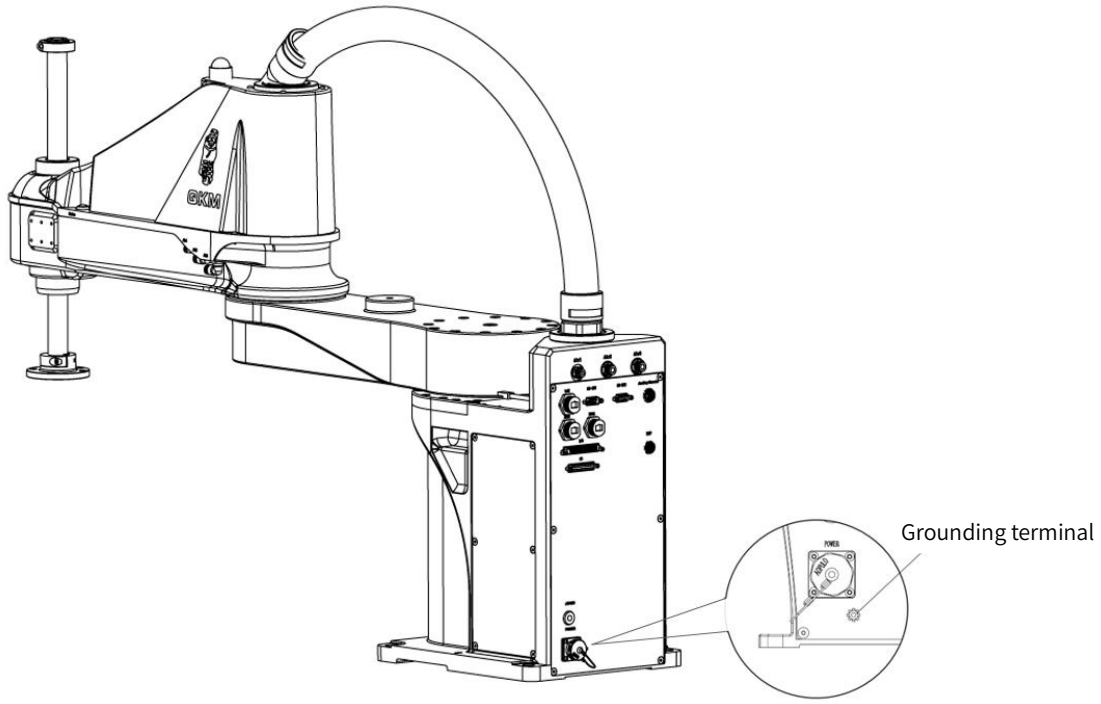


Figure 5-8 Grounding diagram

5.9 Installation of robot cable

- Connect the robot to other equipment when the robot is powered off.
- The bending or breaking of cable connector pins and cable damage may cause anomalies when connecting to the robot. Check whether the above conditions exist before connection.
- When cabling the robot, do not interfere with the motion of the robot. Interference would be caused in the area where the robot cable is located and load is applied at the front end of the robot. Do not regard it as the work area to avoid damage to the cable of the robot.

WARNING

Do not plug or unplug the cable connector when the robot is powered on, or the internal circuit may be burnt out.

5.9.1 Communication connection

AH20 Robot communicates via Ethernet.

Cable to be used: CAT5E network cable

Step 1 Install one end of the network cable to the "Ethernet" connector on the connector panel of the robot back.

Step 2 Insert the other end of the network cable into the PC or IPC port as shown in Figure 5-9.

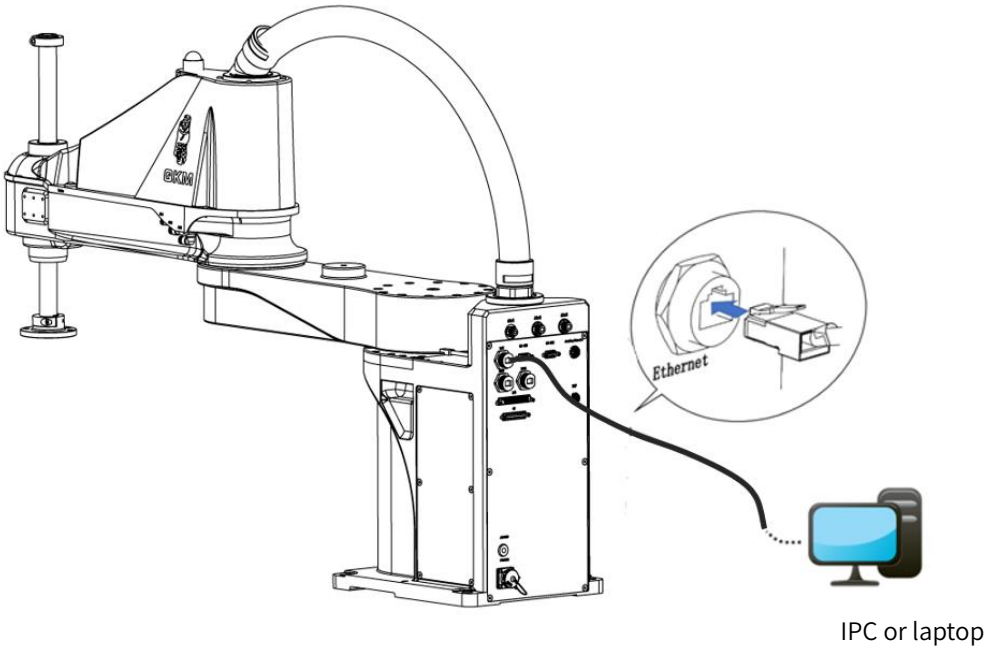


Figure 5-9 Schematic diagram of communication connection

5.9.2 Connection of E-stop device

AH20 Robot is provided with an E-stop device with cable.

Cable to be used: cable for E-stop device

NOTE If an MCP is purchased, you need to prepare the teach pendant, and then install and use the cables according to the MCP user manual.

The wiring steps are shown below:

Step 1 Take out the provided E-stop device and install its aviation plug at the "MCP" connector on the connector panel of the robot.

Step 2 Place the E-stop button box in a position that will allow easy operation by users.

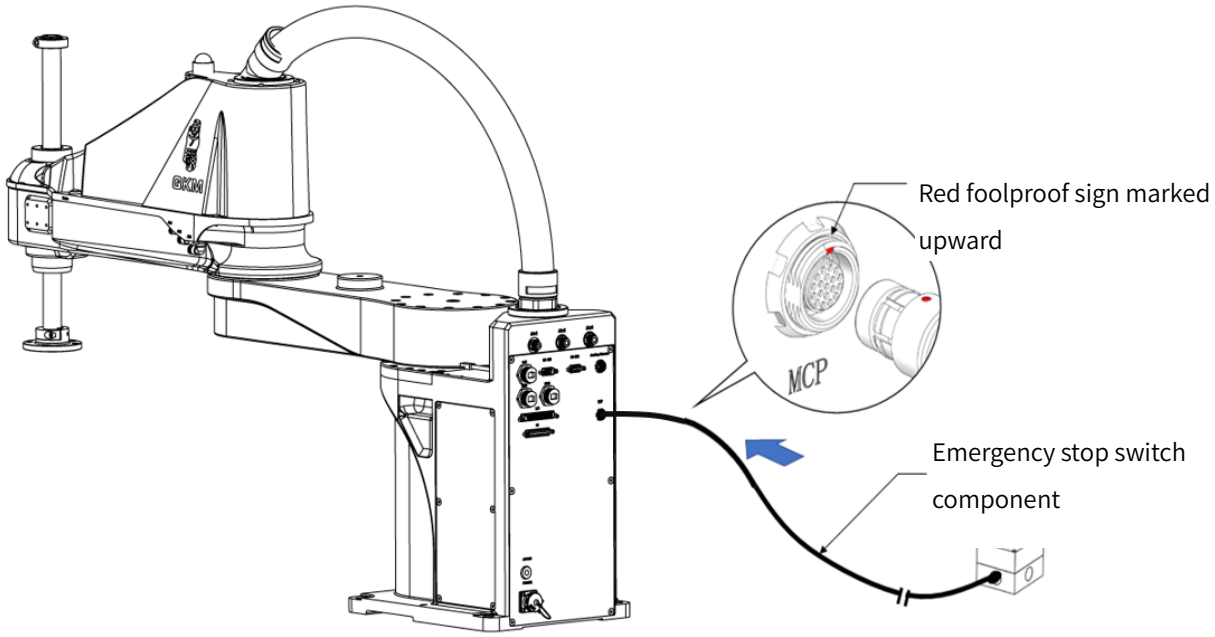


Figure 5-10 Schematic diagram of E-stop device connection

5.9.3 Power connection

AH20 Robot has achieved integrated design without power supply box for power connection, which is convenient for use.

Cable to be used: Power cable

The wiring steps are shown below:

Step 1 Take the power cable out of the accessory box. Install the aviation plug end of the power cable at the "POWER" connector of the robot.

Step 2 Tighten the screw cap of the aviation plug clockwise.

Step 3 Plug the other end of the power cable into the 230 V a.c. socket.

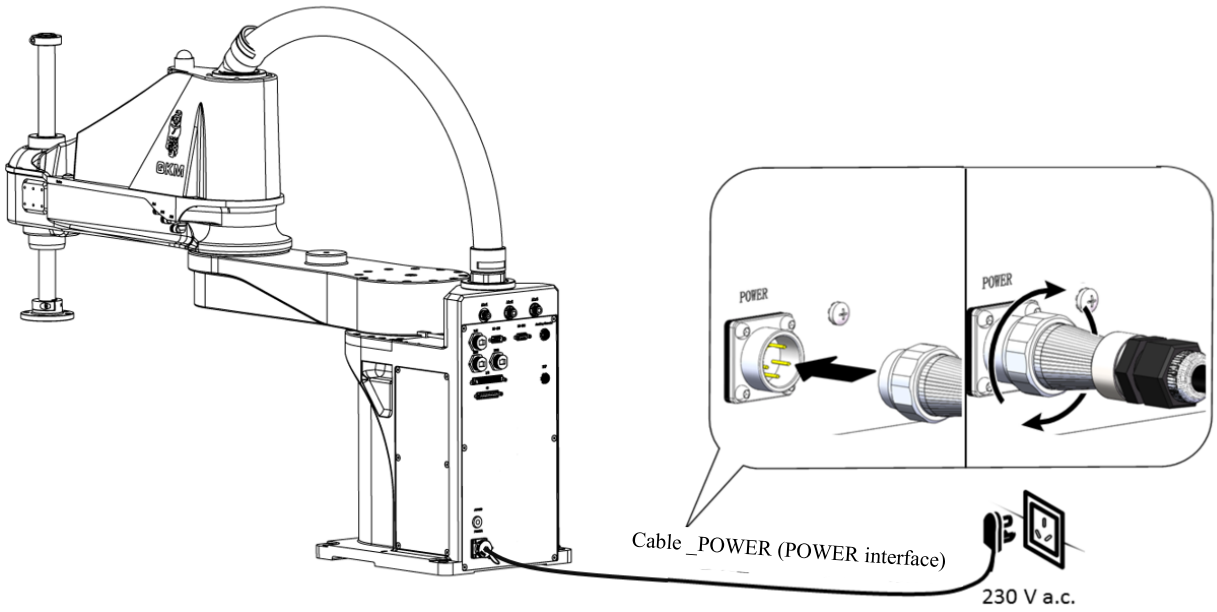


Figure 5-11 Connect the power supply

CAUTION

- It is dangerous to perform cable wiring while the robot is powered on. Before wiring, turn off the relevant

equipment that provides power supply and mark with warning signs, e.g "Do not turn on the power supply".

- Avoid poor contact and ensure that the screw cap of the power connector is rotated to the end without loosening.
- Provide 220 V a.c. power supply as required;
- Do not connect directly to the factory power supply. The connection of a servo plug to the factory power supply would cause failure in the robot system.

5.9.4 Check after installation

Users need to check whether the robot is in an operable state after installing the cables. The checks are as follows:

- Check whether the plugs at all cable connectors are loose or not.
- Make sure that the robot is in a safe work space and nobody is within the movable range of the robot.

5.9.5 Check before power-on

Ensure that:

1) each fastener of the robot is free from loose connection;

2) necessary protective devices have been properly installed and functioned well;

3) the voltage level of the energized electrical equipment is equal to that of the power supplied;

4) the power plug of the equipment is not shorted when checked with a multimeter before power-on;

5) all cable heads are correctly connected to buses and they are securely installed.

Check safety functions to ensure that:

1) the equipment is in a well-insulated environment;

2) the main power cable is grounded and the triangle plug is firmly inserted into the socket to prevent electric shock;

3) the E-stop button is connected to the robot.

Chapter 6 Robot Operation

AH10 Series Robot needs to be used in the ARM (Automation Resource Manager) programming environment. ARM is the software programming environment suitable for robots produced by QKM. Users can write programs based on the software and send instructions to control the robot. This chapter mainly introduces the prerequisites and installation of ARM, the functions and usage of macro language development interface, the functions of jog teach interface, servo power-on, speed adjustment, emergency stop and recovery, and robot power-off operation.

If an error is reported during the use of the robot, refer to the "QKM Robot Error Code Manual" for information on the abnormality. Users can download the latest version of the manual at our official website.

6.1 Prerequisites

1) Familiar with macro instructions.

QKM macro instructions indicate the robot secondary development language independently developed and defined by QKM based on the QKM motion control system, which is called Macro instruction set. Macro instructions can be used to automatically execute defined commands and perform functions such as complex operations, string processing, interactions between users and projects, etc.

2) Familiar with the mode of motion of the robot.

6.2 Programming environment installation

You can download QKMLink using the two methods as follows:

- Download the QKMLink installation package at the official website of QKM and install QKMLink.
- The ARM installation package has integrated QKMLink, so QKMLink will be installed automatically when ARM is installed.

In the application development of robots, the interactions of Windows with QKM robots or equipment system are required. QKMLink provides the interface for such interactions.

QKMLink is designed according to the QKM Protocol. The format of data from the interactions conforms to the protocol. Currently, QKMLink supports TCP communication and can be installed on Windows of different devices. Its interface supports C#, VB, C++ call and development.

QKMLink is an application software development component under Windows. Users use this component for software development to complete data interactions with Robot and other devices.

Requirements for download environment and memory:

1) Win7, Win8, Win10 systems;

2) Memory: 2G or more.

6.2.1 Installation steps

Step 1 Download an ARM installation package at the official website of QKM.

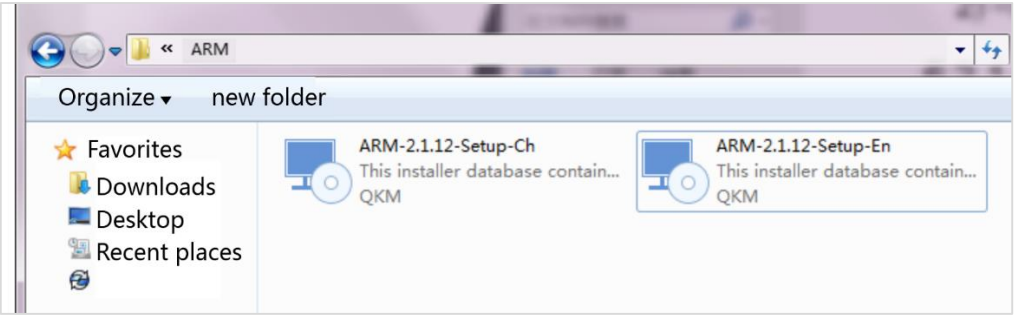


Figure 6-1 Installation package

Step 2 Double-click the left button to install the software.

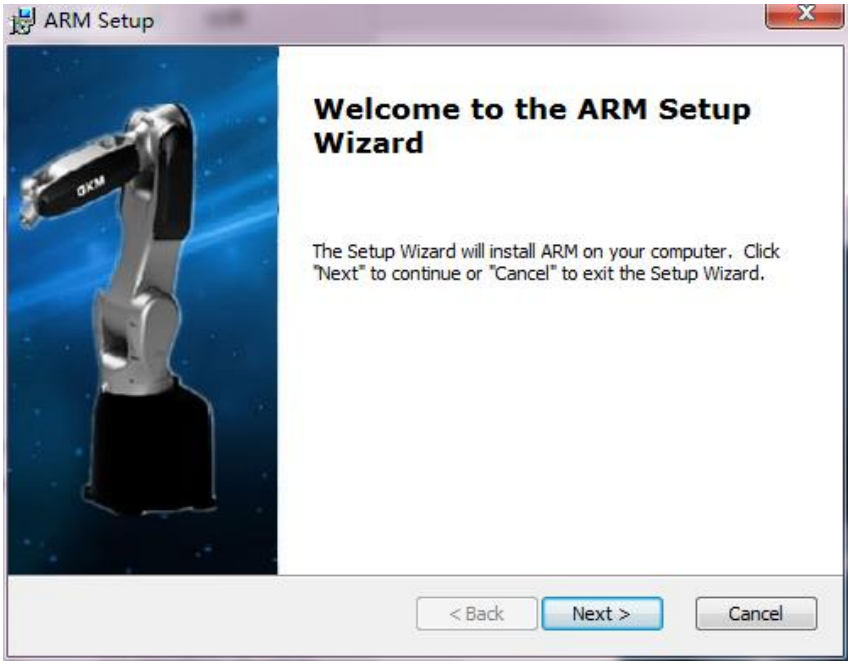


Figure 6-2 Start installation

Step 3 Click on "Next", as shown in Figure 2-3.

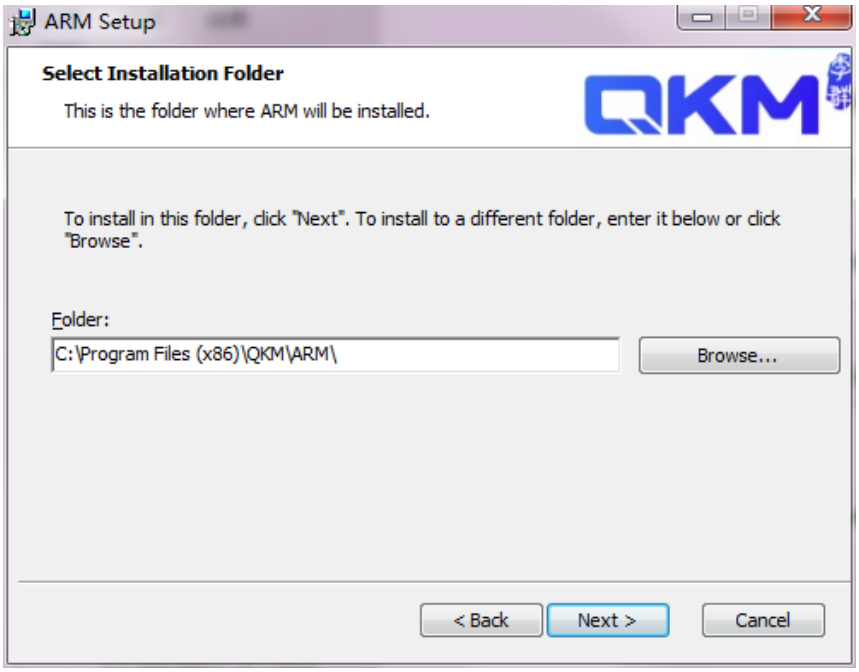


Figure 6-3 Choose installation path

Step 4 Choose the installation path and click on "Next".

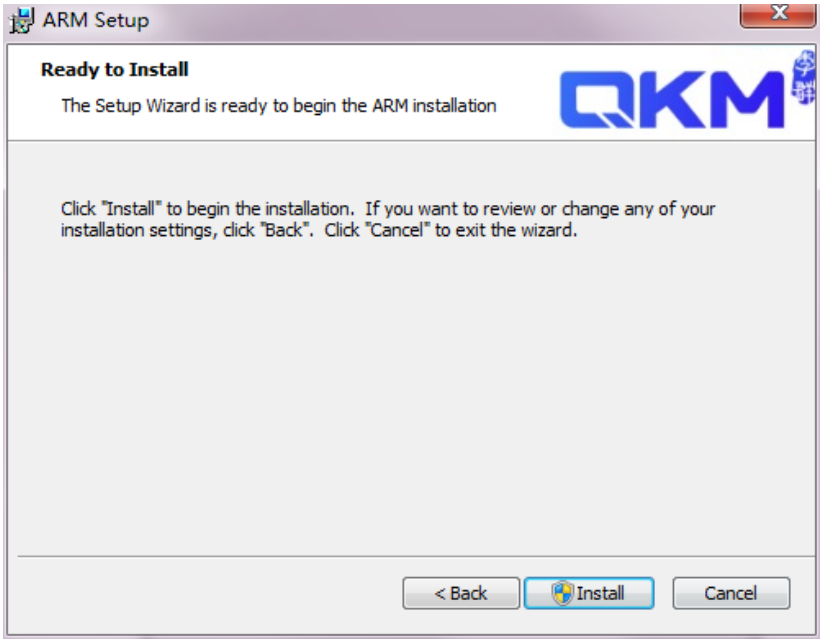


Figure 6-4 Successful installation

Step 5 Click on "Install" to complete the installation.

6.3 Open macro language development interface

步骤1 Double-click the installed ARM to open the ARM interface, and then

click <Mode> on the menu bar to switch to <Pallas> mode, as shown in Figure 6 5.

Figure 6-5 ARM interface

步骤2 On the interface of ARM in Pallas mode, click <Tools> on the menu bar and select <Macro language development interface>, as shown in Figure 6 6.

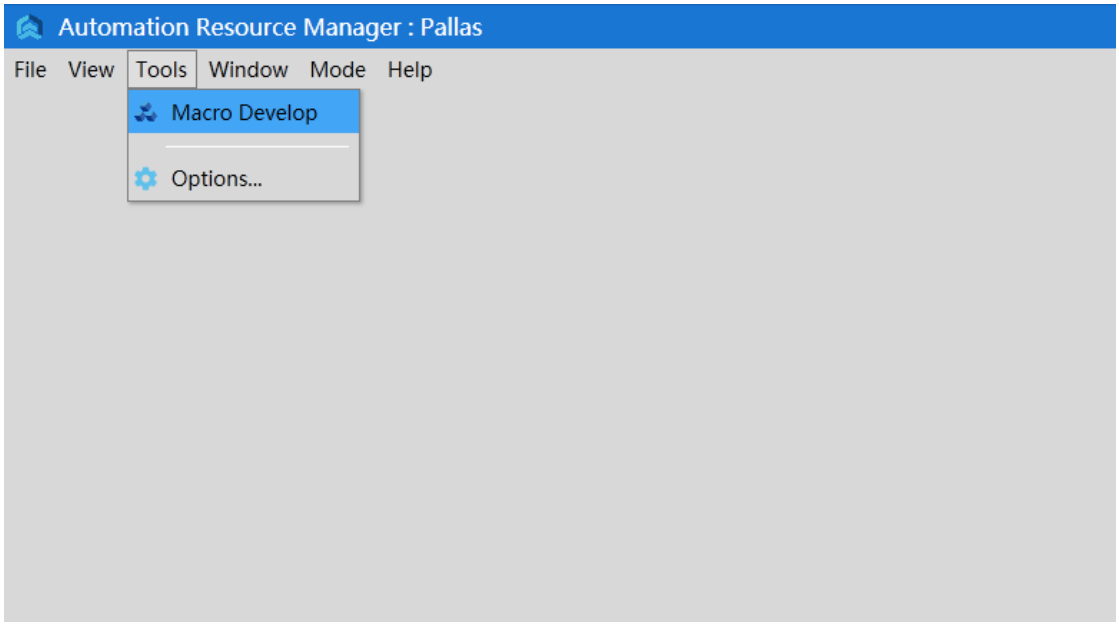


Figure 6-6 ARM interface

步骤3 The macro language development interface is shown in Figure 6 7.

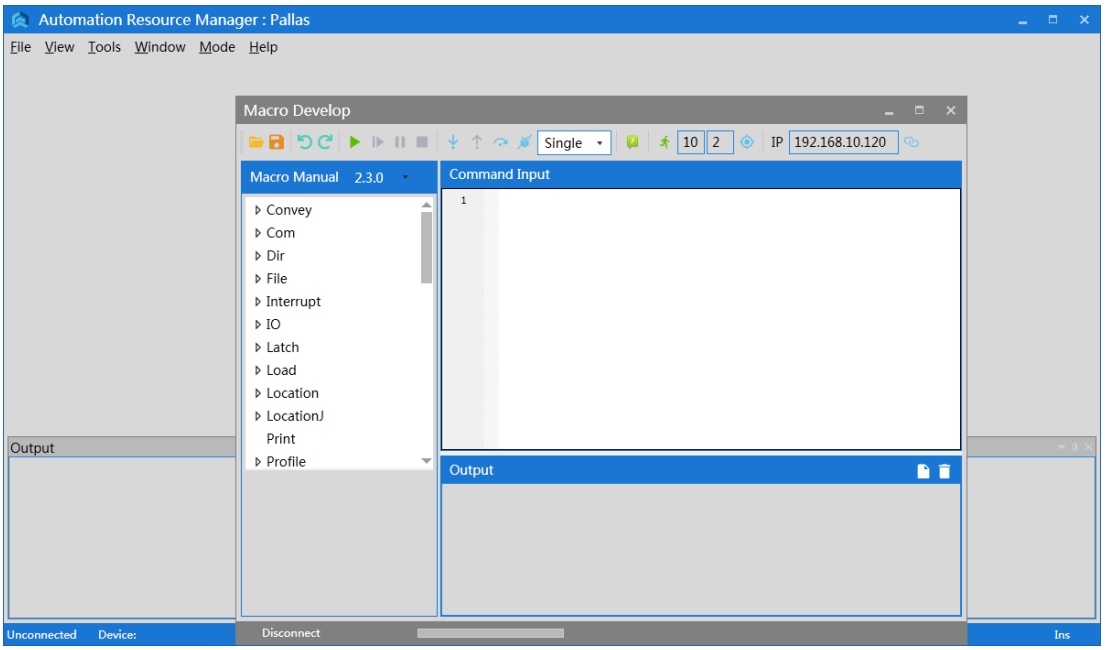


Figure 6-7 Macro language development interface

6.4 Functions of macro language development interface

NOTE

The macro language development interface is used in the installed ARM programming environment.

6.4.1 Interface

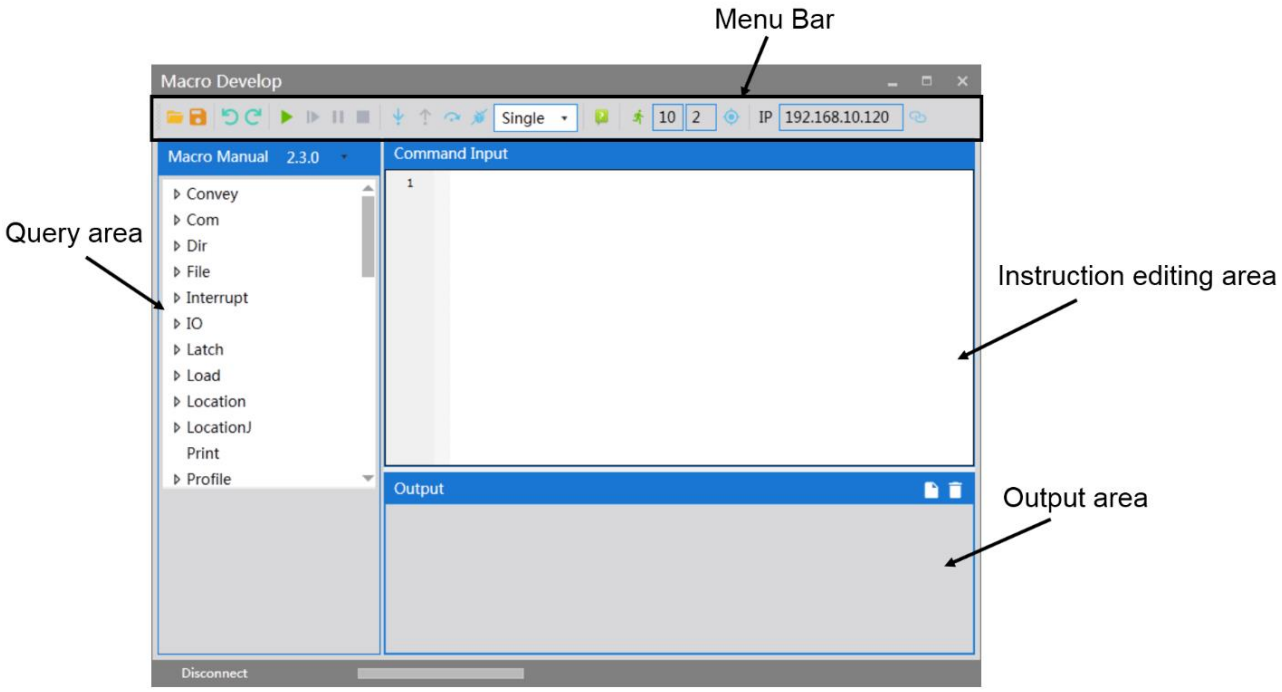


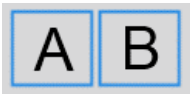
Figure 6-8 Macro language development interface

6.4.2 Menu bar

Figure 6-9 Menu bar of macro language development interface (ARM)

Table 6-1 Functions of tools on the macro language development interface

Introduction to menu bar on the macro language development interface (ARM)			
	Open		Save
	Undo		Resume
	Start (Note: Run all instructions in order.)		Continue

	Pause		Stop
	Single step		Previous
	Jump		Clear
	There are two options, i.e. "Single" and "Cycle". Click on the inverted triangle to select.		Hide and show
	A = Send A instructions for each batch; B = When the remaining B instructions in the previous batch are to be sent, the A instructions of the next batch starts to be sent. Purpose: To improve the speed of continuously sending instructions. Where, A and B are the numbers that need to be set by the user.		Send multiple: After the numbers of A and B are set, click here to start execution.
	Jog teach		Connect to robot: After entering the IP of the robot, click on this button to connect the robot.

IP	Enter the IP of the robot and establish communication with the robot.		

6.4.3 Introduction to user defined instruction editing area

Users can add common instructions to the < macro language development interface > interface through the user-defined instruction editing function according to their needs. After editing, the required instructions will be added to the right side of the interface for easy access next time. For example, add the command of "servo power on" in the interface:

Step 1 Click the arm software debugging environment, and then click < Tools > → < macro language development interface > to enter the debugging interface.

Step 2 Click the < add > button on the right to open the operation instruction dialog box. Type the instruction name "servo power on", the operation instruction content "robot. Powerenable 1,1" and the comment "robot servo motor power on" in the input box of the interface to edit the required instructions, as shown in Figure 6-10.

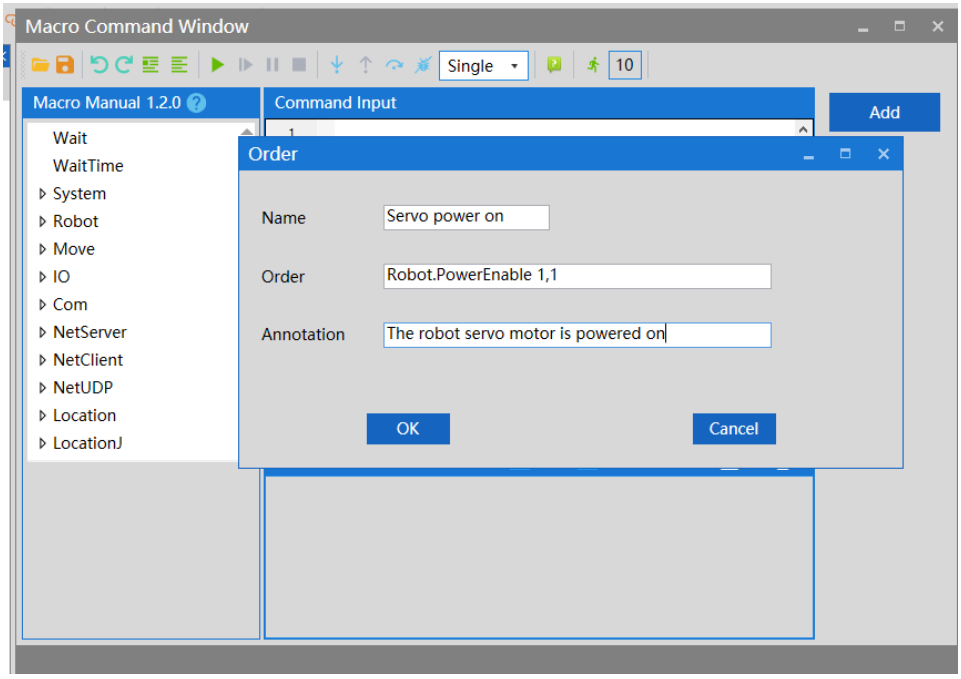


Figure 6-10 User defined editing interface (ARM)

Step 3 Click < OK >, and the command shortcut key < servo power on >, just added, will appear on the right side of the macro language development interface.

To call the command of "servo power on" again, the user can directly click the shortcut key of < servo power on > on the right side of < macro language development interface >, and the specific content of the command "robot. Powerenable 1,1" will be sent to the robot. The sent command and execution result can be seen in the < output > window, without manual input again.

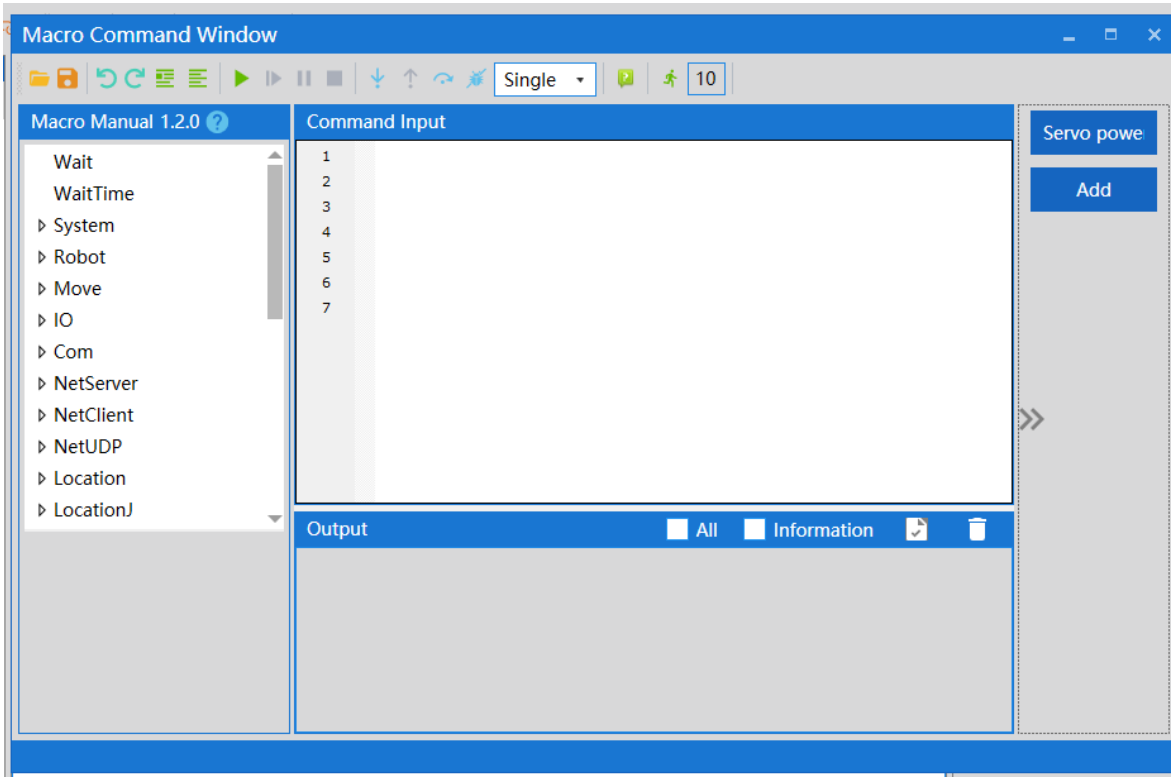


Figure 6-11 Interface after quick instruction call (ARM)

6.4.4 Establish IP communication

Step 1 Click the ARM debugging environment, then click <Tools> → <Macro language development interface> to enter the debugging interface.

Step 2 Click the IP address input field in the upper right corner, enter the default IP address (192.168.10.120) of the robot, and then click the <Connect> button on the right, as shown in Figure 6-12.

NOTE

- The IP addresses of the robot and the host computer must remain on the same network segment.
- The IP of the robot is 192.168.10.120, then that of the host computer can be set to 192.168.10.1, that is, the IP addresses of the two must be the same in the first three digits and different in the last digit.

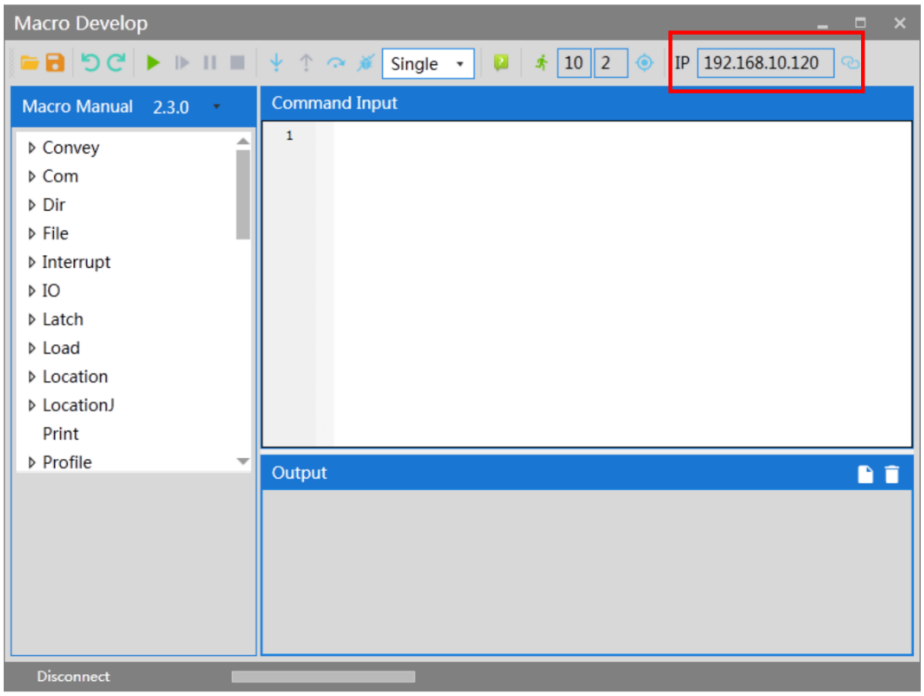


Figure 6-12 IP connection

1.1.1.1. Successful IP connection

The premise of successful IP connection is that the IP addresses of the robot and the host computer are on the same network segment. Upon successful connection, there is a prompt of "Successful connection: 192.168.10.120" in the lower left corner of the macro language development interface, as shown in Figure 6-13.

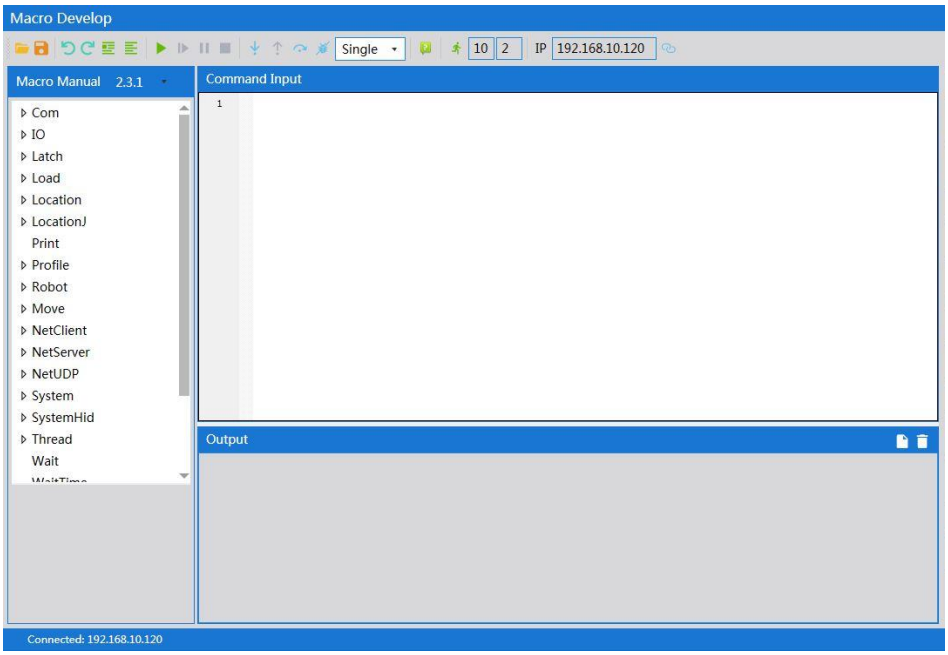


Figure 6-13 Successful connection

1.1.1.2. IP connection failure

The interface of IP connection failure is shown in Figure 6-14.

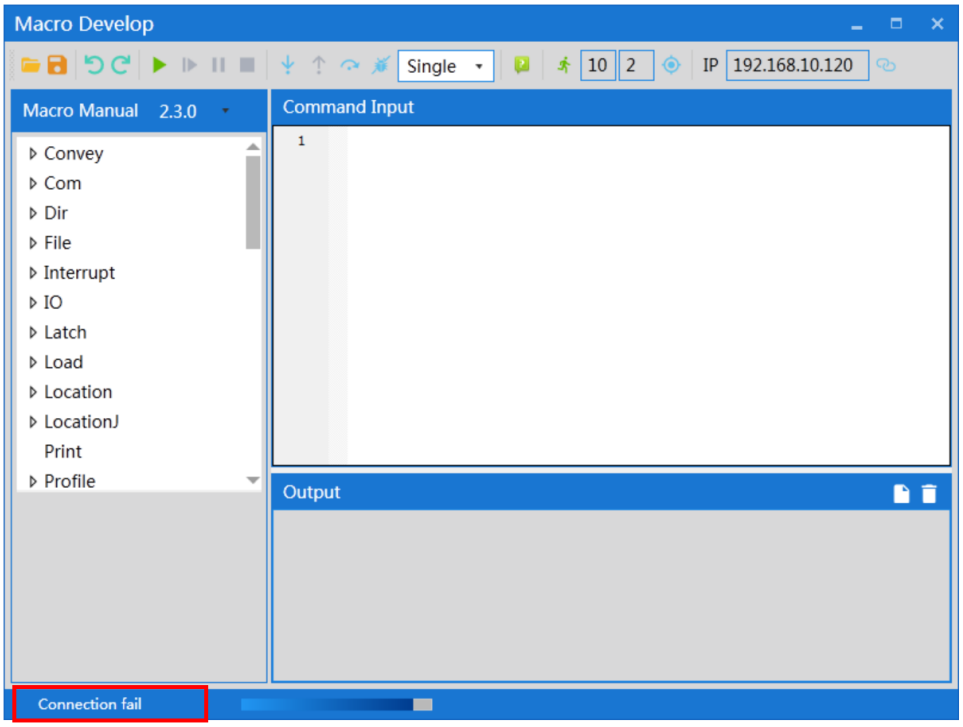


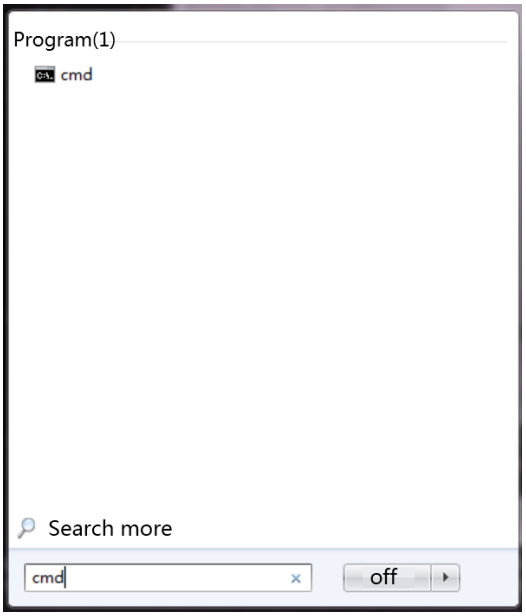
Figure 6-14 Connection failure

Solution to connection failure:

Step 1 Check whether the IP addresses of the host computer and the robot are on the same network segment;

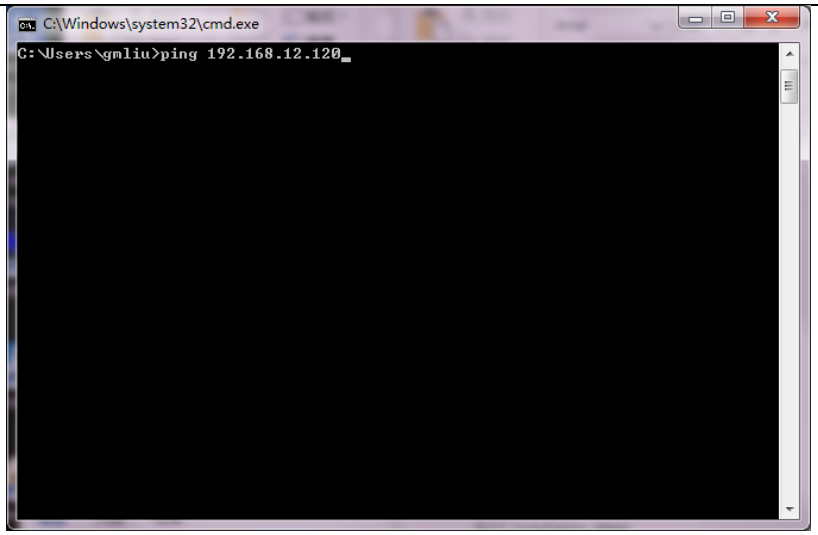
Step 2 Execute system search and run cmd as shown in the figure:

NOTE



Step 3 Directly input "ping" + IP after >. If the specific values of the parameters of byte, time and TIL are returned, it indicates that the network is connected as shown in the figure.

(Note: The IP in the figure is just an example. The correct IP is subject to the actual IP of the robot.)



Step 4 Re-enter the IP in the macro language development interface and connect the robot.

6.4.5 Query on description of macro language instructions

The macro language development interface includes a macro language manual, which lists the macro language instructions that need to be used during robot debugging. For details, please refer to the "QKM Robot Instruction Manual".

When you click a corresponding macro language instruction, the list automatically pops up a description of this instruction set, as shown in Figure 6-15.

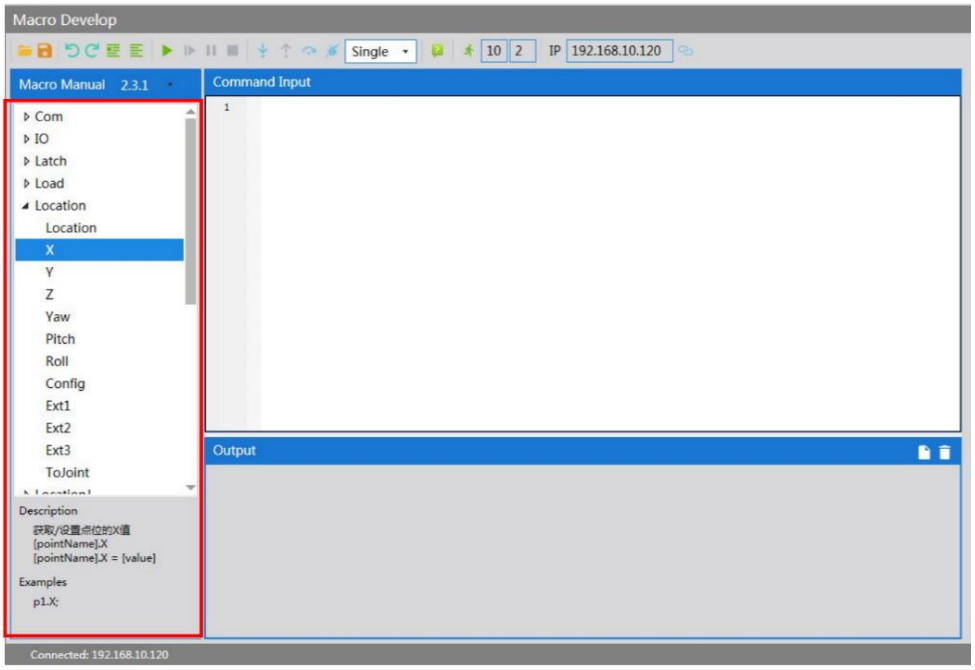


Figure 6-15 Macro language manual

6.4.6 Input instructions

The "instruction editing area" is the area where instructions are input and edited as shown in Figure 6-16.

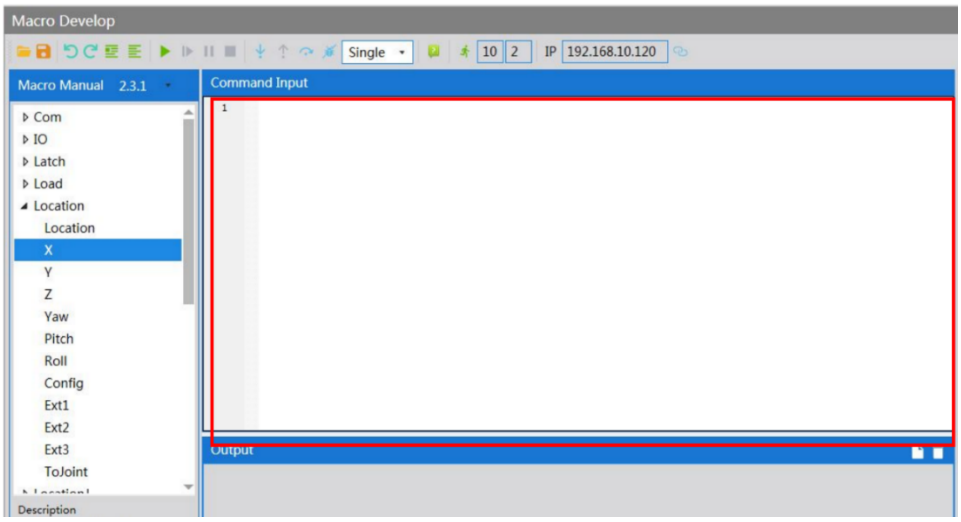


Figure 6-16 Input instructions

When inputting a single instruction, you can enter the first letter of the instruction. If you want to select an instruction, such as System, you can enter the capital letter "S" and the System instruction automatically pops up as shown in Figure 6 17.

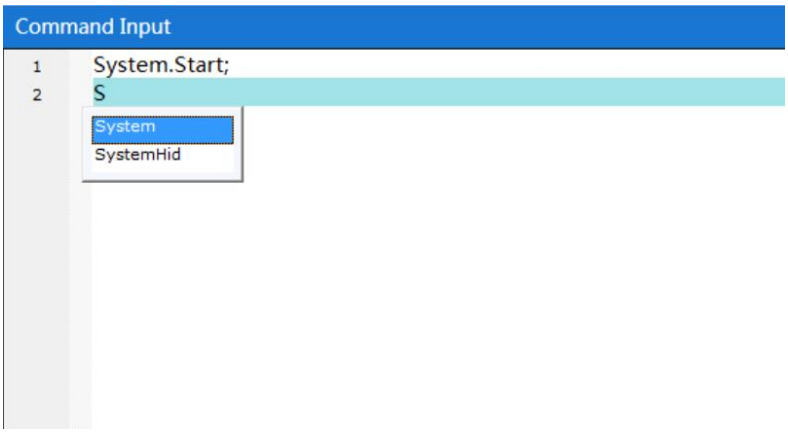


Figure 6-17 Input instructions

All instructions contained under the instruction set can be prompted automatically when you enter ".", as shown in Figure 6-18.

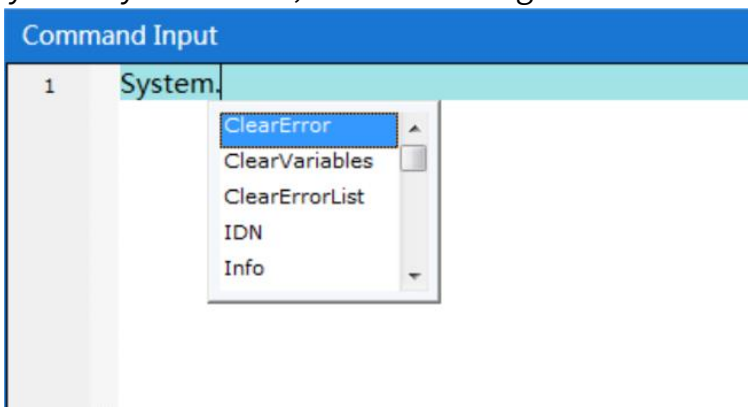


Figure 6-18 Input instructions

6.4.7 Run instructions

After editing the instructions, click on the <Run> button in the menu bar to run all the instructions in the "instruction editing area" one by one in sequence. The results are displayed in the "instruction output area", as shown in Figure 6-19.

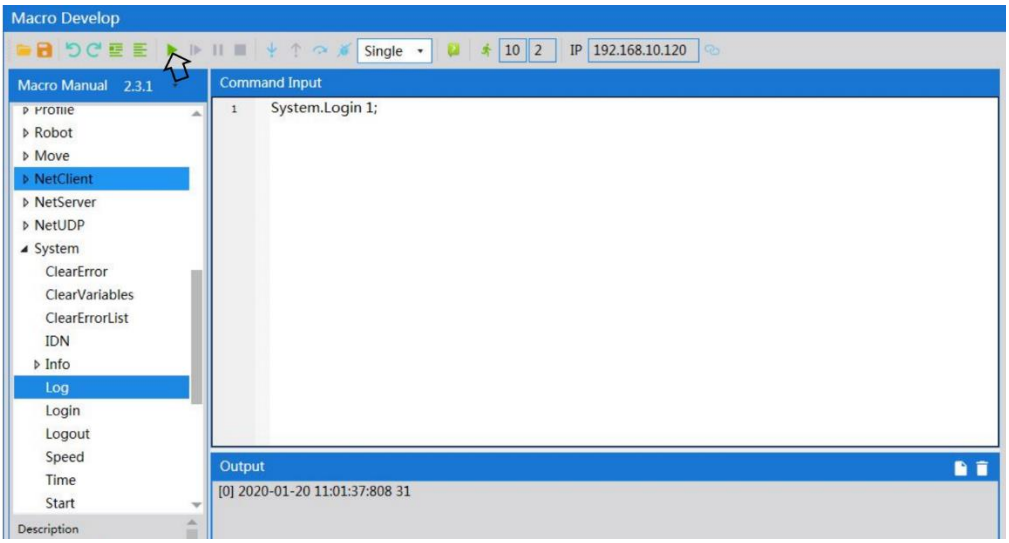


Figure 6-19 Run instructions

6.4.8 Breakpoint debugging

If you need to debug or run an instruction separately, you can locate it by adding a breakpoint before the instruction. Method of adding a breakpoint: Click the left mouse button at the position of instruction number before the instruction to add a breakpoint identifier, as shown in Figure 6-20.

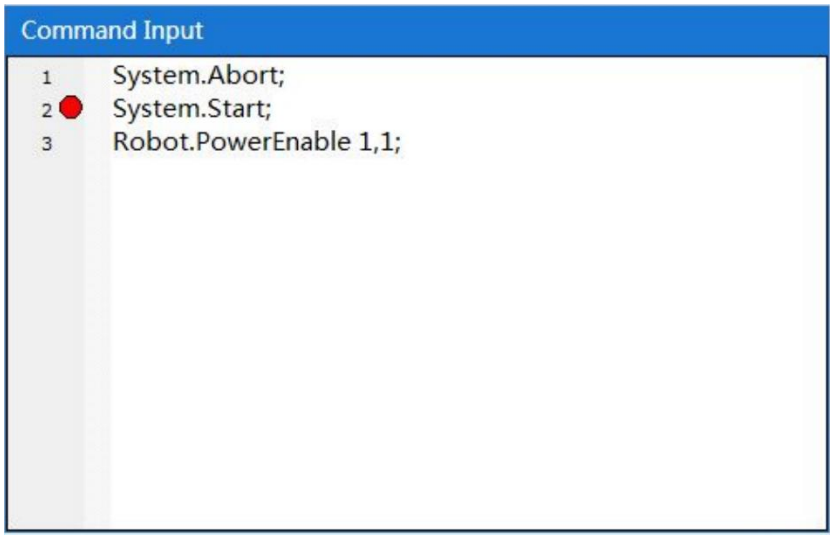


Figure 6-20 add a breakpoint

6.4.9 Output

The output after running is displayed as shown in Figure 6-21.

NOTE

The output interface contains the information of feedback from each instruction. If the instruction is successfully executed, the feedback result is displayed in black. If the instruction fails, the feedback result is displayed in red.

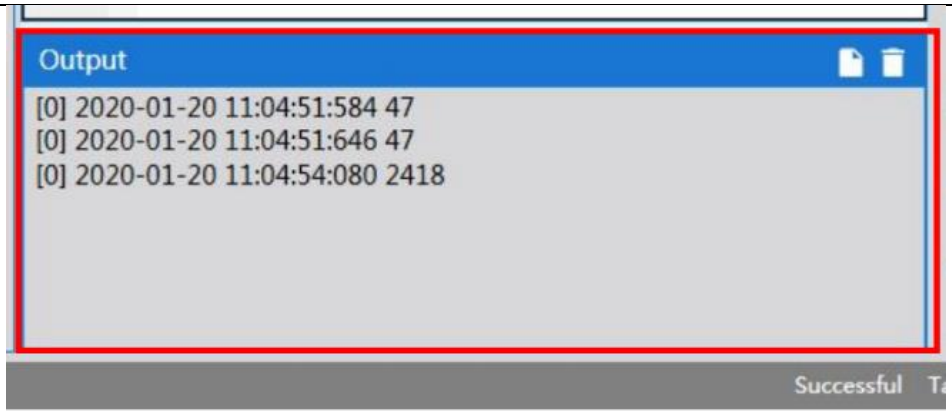


Figure 6-21 Output

6.4.10 Clear output

Click the <Clear> button in the upper right corner of the output area to complete the clear, as shown in Figure 6-22.

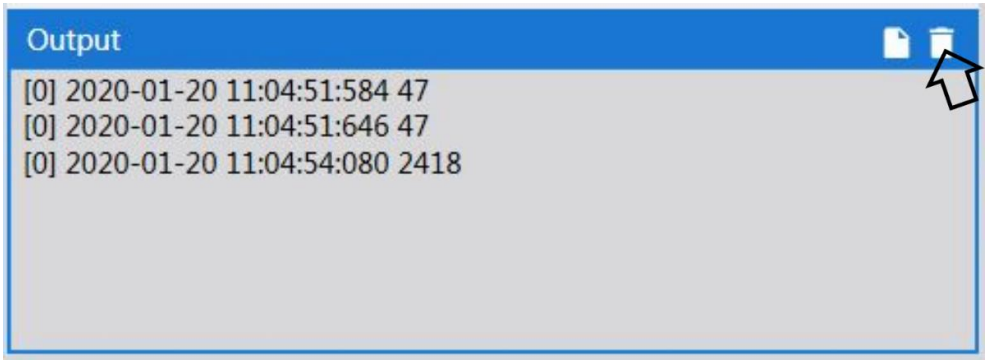


Figure 6-22 Clear output

6.4.11 Save output

If you need to save the output, you can click the <Save> button in the upper right corner of the output box to save it in the *.log format as shown in Figure

6-23.

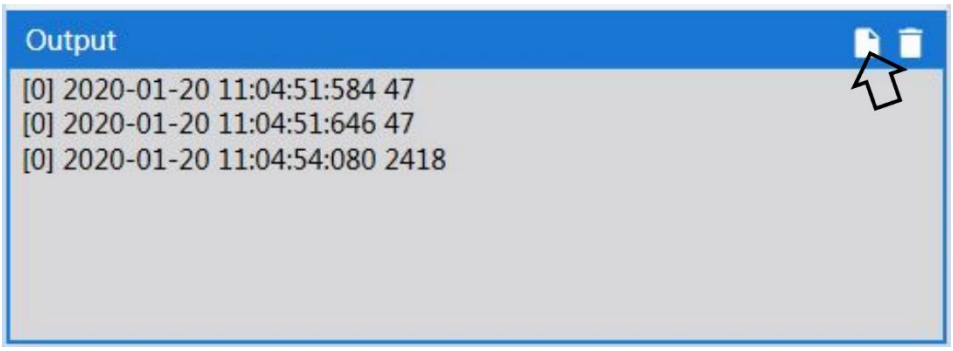


Figure 6-23 Save

6.5 Manual jog teach

On the ARM interface, click  to pop up the jog teach interface as shown in Figure 6-24.

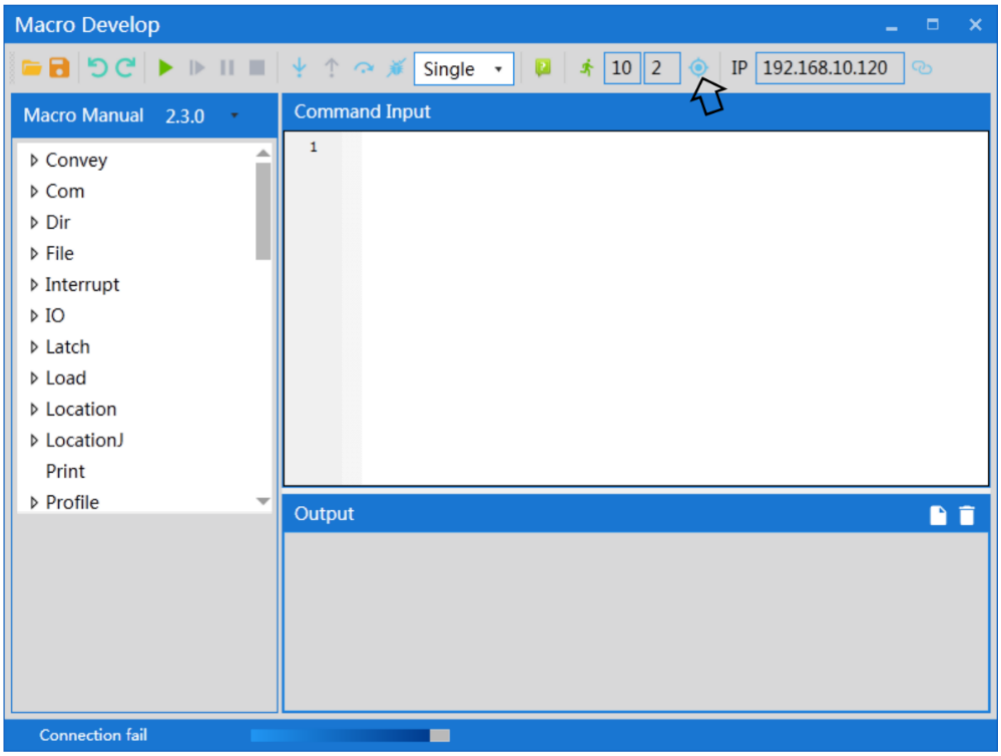


Figure 6-24 Jog teach

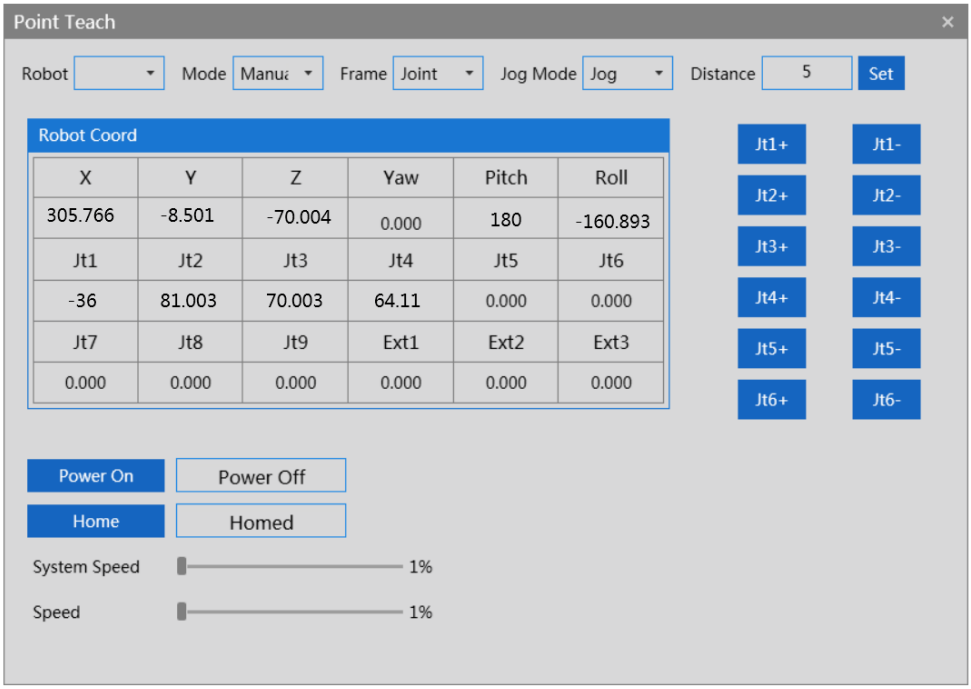
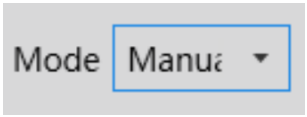
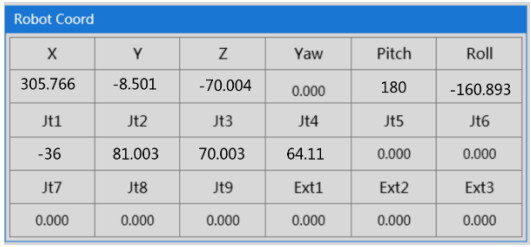
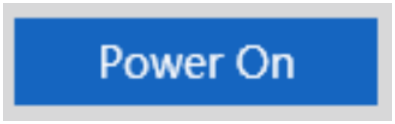


Figure 6-25 Teach interface

Table 6-2 Introduction to tools on the jog teach interface

Function	Diagram	Description
Select Robot		Click the drop-down menu after <Robot> and select the robot with corresponding number, such as Robot 1. For example,  .
Select Mode		You can select [Manual] or [Auto].
Coordinate		You can select [Joint] or [World].
Joint Mode		You can select [Jog] or [Inch] in this mode.
Inching distance		Manually enter the distance value for each inching.
Robot coordinate	 Coordinates of the robot when the [Joint] coordinate system is selected	The coordinate values of ends of the current robot in different coordinate systems include X, Y, Z, Yaw, Pitch, Roll; or Jt1, Jt2, Jt3, Jt4

Jog coordinate values	 Parameter values for coordinates of the robot when the [Joint] coordinate system is selected	If you need to control the motion of the robot separately, you can click <X +>, <X->, etc. to control the motion of the robot in the direction of X, etc.
Robot power-on		Click <Power> to power on the robot.
Home robot		Click <Home> to enable the robot to return to zero.
System Speed		You can adjust the operating speed of the entire system by percentage.
Speed		You can adjust the operating speed of the robot by percentage.

6.6 Servo power-on

NOTE

After the robot is powered on for the first time or restarted after a power-off, a <Unhome> button appears on the jog teach page, so the robot needs to return to zero after it is powered on via servo.

Method 1 (jog teach):

Click the <Home> button on the jog teach interface to enable the robot to return to zero.

Method 2 (send macro instruction):

Enter Robot.Home [robotIndex] in the instruction editing area on the macro language development interface to send a power-on instruction to the robot. (Where robotIndex is the index number of the online robot.)

```
For example, Robot.Home 1
        //the current robot at the first node is powered on
```

When controlling the motion of the robot through the ARM programming environment, you must first power on the robot via servo. The robot can be powered on using the two methods as follows.

Method 1 (jog teach):

Click the <Power> button on the jog teach interface to power on the robot via servo as shown in Figure 6-26.

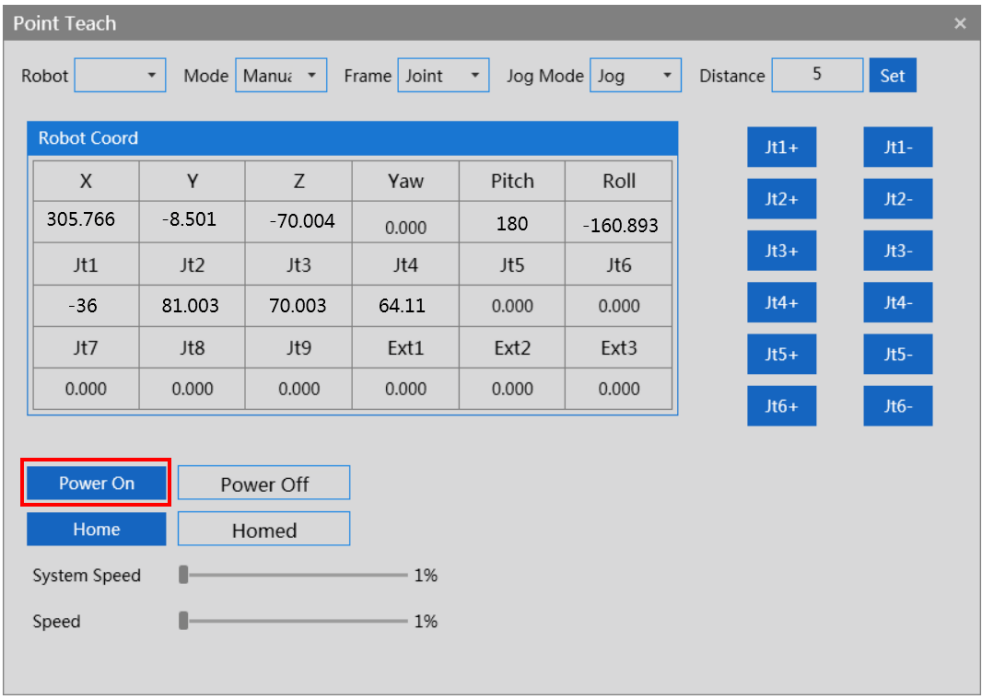


Figure 6-26 Power-on button interface

Method 2 (send macro instruction):

Prerequisites: ① Manual or auto mode; ② The control authority is 0/1 (set authority with System.LogIn).

Enter Robot. PowerEnable [robotIndex],1 in the instruction editing area on the macro language development interface to send a power-on instruction to the robot. (Where robotIndex is the index number of the online robot.)

```
For example, Robot.PowerEnable 1,1        //the robot at the first node is powered on
```

6.7 Speed adjustment

There are three speeds:

- System speed;
- Robot speed;
- Speed in robot motion parameters.

6.7.1 Adjustment of system speed

Under the control of the same controller, one or more robots cooperate with each other to complete one or more actions, forming a complete robot operating system including all devices participating in the motion (s). The system operates at a certain speed which is called system speed. The system speed can be adjusted using two methods:

Method 1 (jog teach):

When the robot is in the servo power-on state, click the <System speed> slider on the "Jog teach" interface and slide it to adjust the motion speed of the robot, as shown in Figure 6-27.

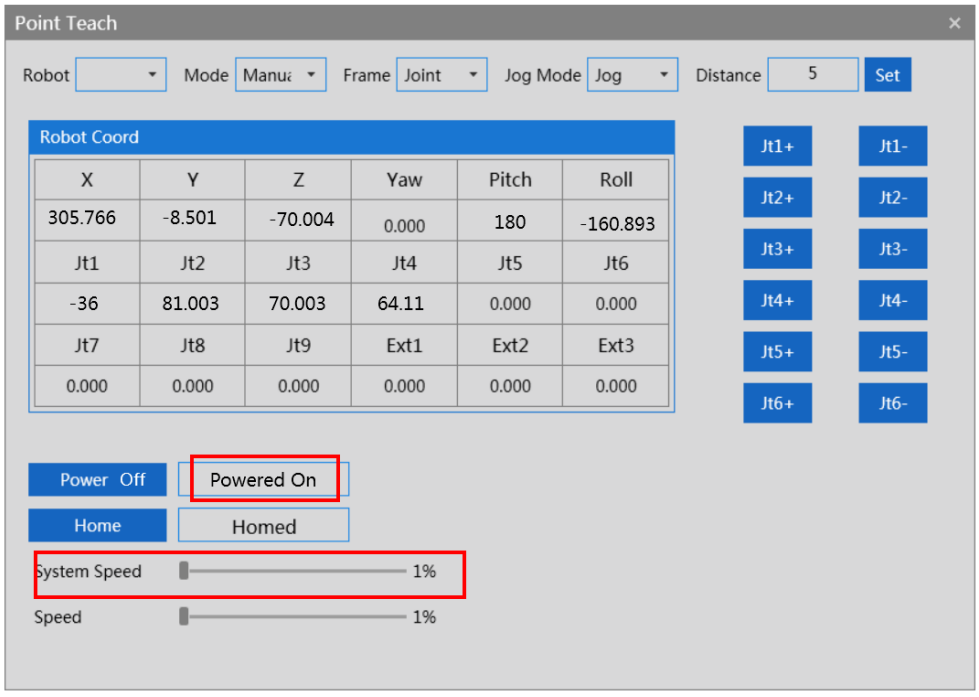


Figure 6-27 Adjustment of system speed

Method 2 (send macro instruction):

Enter System.Speed [value] in the instruction editing area on the macro language interface to send instructions to the robot. (Where value indicates the value of system speed of the robot and its type is double)

For example, System.Speed 50 // The speed of all robots in the node is set to 50.

6.7.2 Adjustment of robot speed

The speed of a single robot with regard to a complete motion trajectory can be adjusted with the two methods:

Method 1 (jog teach):

When the robot is in the servo power-on state, click the <Speed> slider on the "Jog teach" interface and slide it to adjust the motion speed of the robot, as shown in Figure 6-28.

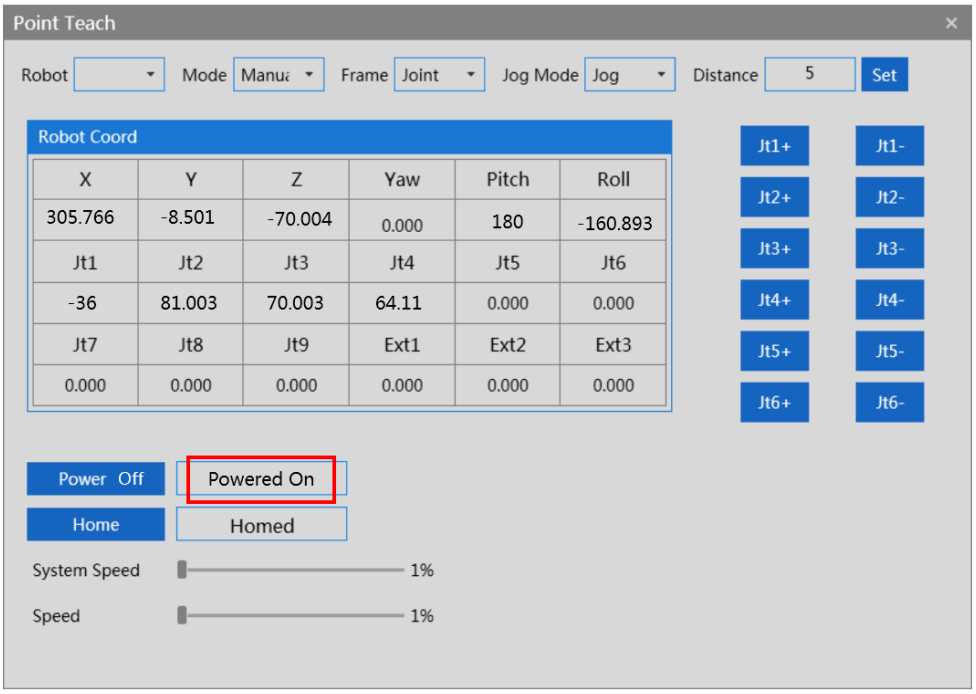


Figure 6-28 Speed adjustment

Method 2 (send macro instruction):

Prerequisites: (1) The robot is stopped; (2) The control authority is 0/1 (set authority with System.LogIn)

Enter Robot.Speed [robotIndex], [value] or Robot.Speed [robotIndex] in the instruction editing area on the macro language interface. (Where robotIndex is

the index number of the robot and its type is Integer; value is the speed value of the robot system, it is a global variable ranged from 0 to 100, and its type is double.)

```
Example 1: Robot.Speed 1,10    // Set the speed of the first robot to 10
```

```
Example 2: Robot.Speed 1        // Return to [ 0    10] Note: Set the speed of the first robot to 10
```

6.7.3 Speed adjustment during motion

Method of adjusting the speed of a certain point in the process of robot motion (send a macro instruction):

Step 1 Enter Profile [profileName] = [Speed, Speed2, Accel, Decel, AccelRamp, DecelRamp, InRange, Type] in the instruction editing area on the macro language interface to create a new name of robot speed and assign values to its parameters.

profileName is the name of objects for motion parameters. Speed / Speed2 / Accel / Decel / AccelRamp / DecelRamp / InRange / Type respectively represents the information on speed. For details about parameters, please refer to the "QKM Robot Instruction Manual". (If one of the parameters is not assigned a value, it is represented by "0" or a space.)

```
For example, Profile prof2 = 80,0,80,80,0.1,0.1    // Create an object named prof2 and assign a value to the parameter.
```

```
Profile prof3 = 80,80,80,0.1,0.1      // Create an object named prof3
                                         and assign a value to the
                                         parameter.
```

Prerequisite: The control authority is 0/1 (set authority with System.LogIn).

Step 2 Enter Profile.Set [robotIndex], [ProfileName] and send an instruction to the robot. (Where robotIndex is the index of the robot and its type is Integer; ProfileName is the name of the speed (variable) and its type is Profile)

```
For example, Profile.Set 1, prof2 // The instruction for assigning value to
                                     prof2 has been executed before, then set the Profile used
                                     during the motion of robot 1 to be prof2.
```

6.8 Emergency stop and recovery

6.8.1 Emergency stop

During the process of manual operation, an emergency stop needs to be performed when a collision or other unexpected conditions occur due to nonproficiency of the operator.Operation: Press the emergency stop button.

6.8.2 Recovery

After the emergency stop, some manual operations need to be performed to push the robot to a safe position, and then release the emergency stop button to restore the robot to its normal working state for safety.

The manual operations should be adjusted according to different scenarios. The robot may be stopped in an open area or stuck between obstacles. The handling methods are shown in Table 6-3. Ensure that the robot is in a safe position before releasing the emergency stop button to complete the recovery

on it after the emergency stop

Table 6-3 Handling methods

Robot position	Handling
In an open area	Manually operate the robot and move it to a safe position.
In the case where it is blocked between obstacles but the obstacles are easy to be moved away	Directly move away the obstacles around it, and then manually operate the robot to move it to a safe position.
In the case the obstacles around it are not easy to be moved away and it is difficult to manually operate the robot and move it to a safe position	Release the brake button and manually operate the robot to move it to a safe position.

6.9 Robot power-off

When it is necessary to stop or maintain the robot, it needs to be powered off with the two methods as follows:

Method 1 (jog teach):

Step 1 Click the OFF button on the jog teach interface as shown in Figure 6-29.

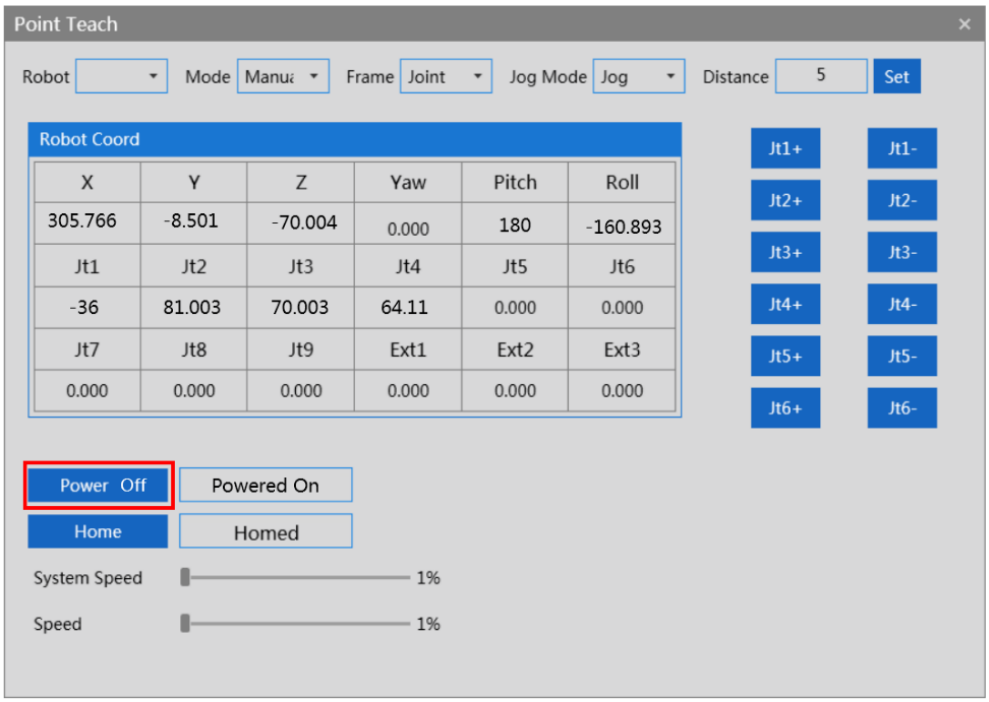


Figure 6-29 Interface of teaching in powered-on state

Step 2 Unplug the power cable from the robot (turn off the power switch before unplugging the power cable if there is a power switch on the robot).

Method 2 (send macro instruction):

Prerequisites: ① Manual or auto mode; ② The control authority is 0/1 (set authority with System.LogIn).

Step 1 Enter Robot.PowerEnable [robotIndex], 0 in the instruction editing area on the macro language development interface. (Where robotIndex is the index number of the online robot.)

For example, Robot.PowerEnable 1,0 // the robot at the first node is powered off

Step 2 Unplug the power cable from the robot (turn off the power switch before unplugging the power cable if there is a power switch on the robot).

Chapter 7 Technical Service

QKM is committed to providing you with technical information on machine motion and operation to help you remove faults and reply to your inquiry in detail. If your robot or equipment fails during use, you can contact our service department and provide information below as much as possible:

- Model and serial number of robot or equipment;
- Model and serial number of control system;
- Control system version number;
- Supporting software feature pack (optional);
- Existing applications;
- Other additional supporting products (vision, PLC, etc.);
- Description of the problem, duration and frequency of the fault, etc.

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- Other additional supporting products (vision, PLC, etc.);
- Description of the problem, duration and frequency of the fault, etc.

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