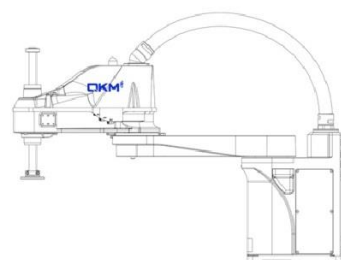


AH10 Robot

Maintenance Manual



Maintenance Manual

AH10 Series Robot

AH10-0600-0204-2000

AH10-0600-0204-4000

AH10-0700-0204-2000

AH10-0700-0204-4000

AH10-0800-0204-2000

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QKM Technology (Dongguan) Co., Ltd.

Preface

Thank you for purchasing the robot produced by QKM!

This manual describes the instructions to maintain the robot.

Refer to the contents of this manual for maintenance.

Please keep this manual properly for future reference

General

This manual provides detailed information on the routine maintenance and safety inspection of AH10 Series Robot, as well as the maintenance of its mechanical and electrical components, so that users can better use AH10 Series Robot.

Target reader

This manual applies to:





Customer engineer
Field mechanical engineer

Field electrical engineer
Maintenance Engineer

Signs & meanings

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

The signs in this manual are described in the table below:

Signs	Description
 DANGER	It indicates that a dangerous situation would occur and cause serious personal injuries or deaths if it is not avoided.
 WARNING	It indicates that a potentially dangerous situation would occur and cause personal injury or robot damage if it is not avoided.
 CAUTION	It indicates that an unpredictable situation would occur and cause robot damage, performance degradation, data loss, etc. if it is not avoided.
 NOTE	It gives the description on key information and operation tips.

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Caution

The contents of this document are subject to change at any time due to product upgrade or other reasons. QKM reserves the right to change the contents of maintenance and operation in this manual without prior notice. For the recent information on this product, please download the latest manual from our official website.

Trademark statement

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Disclaimer

Users need to be careful to maintain and operate the robot in a safe environment. QKM assumes no obligation and responsibility for incidental or consequential losses arisen therefrom.

QKM does not assume any direct, indirect, special or incidental loss or liability due to improper use of this product.

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Revision history

The version history contains the accumulated information on each update of the document, and the latest version of the document includes the updates in all previous versions of the document.

Version	Time	Change Content
V1.0	1/4/2022	The first version of the document was released.
V2.0	3/14/2022	The information on the replacement and maintenance of the 1-axis motor fan was changed, and that on the maintenance of the 1-axis motor fan was added in Section 5.1.
V2.1	9/28/2022	Modified the description of encoder battery maintenance in Section 5.4

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Chapter 1 Safety Precautions

1.1 Precautions for operation

The maintenance of the robot system must be performed by safety-trained personnel.

Safety-trained personnel are those who have received safety training (on knowledge, operation, teaching, etc. of industrial robots, knowledge related to inspection and other operations, and related laws and regulations) prescribed by each laws and regulations for workers engaged in services related to industrial robots.



- Make sure that there are no other persons within the safety fence before operating the robot system. Operators are safe when the robot always acts in the restricted state (low speed, low power).
-

Do not disassemble the parts that are not described in this manual or perform maintenance in a different way from that described. Improper disassembly or maintenance will disable the normal operation of the robot system and may cause serious safety problems.

1.2 Precautions for electrical safety







- Be sure to unplug the power cable and lock the power supply when the robot is not used.
 - Be sure to connect the AC power cable to the power plug when using the robot. Do not connect directly to the power supply from factory.
 - Be sure to make replacement after turning off the controller and the power of related equipment and unplugging the power plug. If the replacement is performed while the power is on, electric shock or malfunction may be caused.
 - Reliably connect the cable. Do not place heavy objects on the cable, or forcibly pull or clamp the cable. Failure to do so may result in cable damage, disconnection or poor contact, abnormal system operation or electric shock.
-

- Do not plug or unplug the cables on the interface panel while the robot is powered on.

1.3 Warning labels

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

Paste location	Labeling	Notes
A		A triangle sign for warning of high voltage
B		Grounding sign
C		Do not touch the screw shaft. Prevent the screw shaft from rusting to ensure the normal operation of the robot.
D		Non-professionals are not allowed to open it.

E		A sign for protection from residual voltage
F		Warning! Hot surface.
G		Beware of Collisions

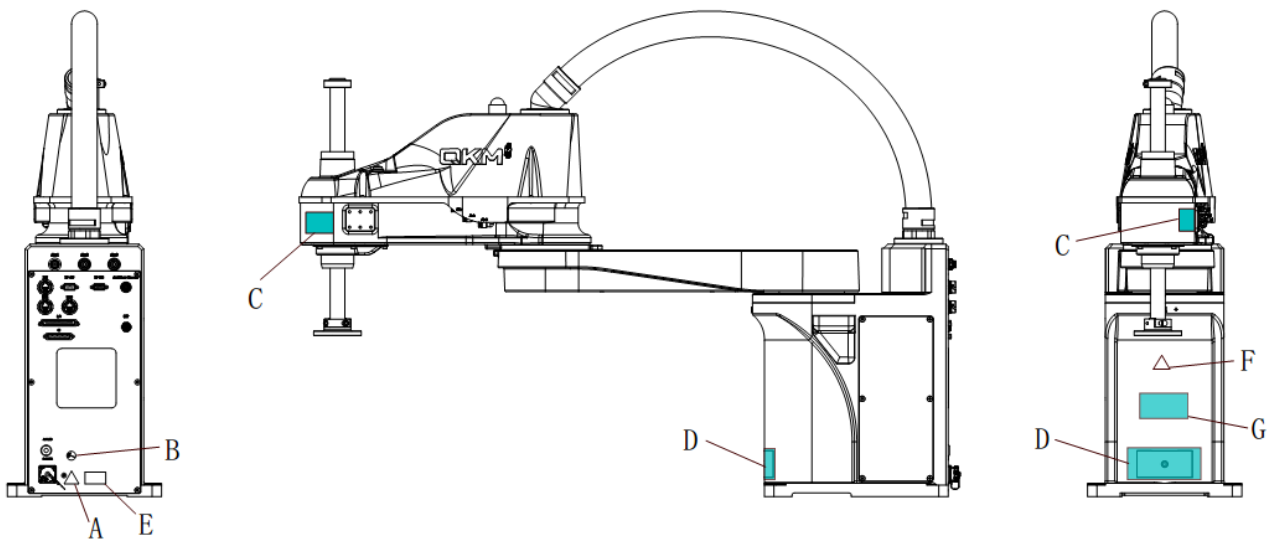


Figure 1-1 Position of warning sign

Chapter 2 Safety Maintenance

2.1 Use of robot in accordance with regulations

Do not use the robot illegally. QKM will not be liable for any losses due to illegal use by users. To ensure the service life of the robot, please regularly maintain it in accordance with the contents of this manual.

- Common situations involving illegal use:
 - beyond specified operating range
 - unsafe use of electricity
 - non-use of additional protective devices
 - beyond specified environmental requirements
 - overload
 - excessive moment of inertia

2.2 Safe area

Understand the safe area during operation of the robot. Users need to pay full attention to the safe area during use to avoid accidents caused by neglecting it.

- Work area

The work area refers to the range of working area of the robot determined by its

motion trajectories and guaranteed by protective devices.

- Protective area
 - The protective area must be larger than the work area, inside which protective devices need to be placed for warning and safe use.
 - Common isolated protective device: safety fence; common safety reminders: warning sign and slogan.
- Hazardous area
 - The dangerous area includes any position where the robot body and the robot arms may stay in their motion trajectories, which can be protected by isolated protective devices to avoid personal injury or property damage.
 - When the robot stops running, the robot arms will stop in the dangerous area.

2.3 Emergency stop device

In case of an abnormality in the robot, press the emergency stop device to ensure the safety of personnel and avoid damage to the robot and persons. The emergency stop device needs to be properly set in the industrial robot for convenient operation. Immediately press the device in the event of a dangerous or emergency situation.

- The following situation will occur when the device is pressed:
 - The robot will stop in the current state and enter the servo-off state.

- To re-start the robot, be sure to turn the emergency stop device to unlock it.
 - The emergency stop device is connected via the user interface.
-



The supporting equipment (such as jigs at the end of robot arms or other devices) of the robot may cause danger and must be connected to the emergency stop circuit of the robot.

2.4 Precautions for general safety



The robot may be damaged in the case of incomplete safety functions and protective devices. Do not use the robot when safety functions are disabled or protective devices are removed.

- Operational changes
 - After changing the composition of the robot, be sure to check whether it meets the necessary safety requirements and test all safety functions.
 - When starting a changed program, test it by reducing the system speed and then gradually increasing the speed.

- Fault occurrence

Steps for operation when a fault occurs:

- Turn off the control system of the robot to prevent any unexpected restart without permission.
 - Set up an obvious sign at the site where the fault occurs to indicate the fault.
-

- Record the fault.
- Resolve the fault and perform a function check.
- Putting into operation and putting back into operation

Before putting the equipment and devices into operation for the first time, be sure to check them to ensure that the equipment and devices are complete with perfect functions for safe operation and fault identification.

The following checks must be completed before putting into operation for the first time or putting back into operation:

- Check whether all protective devices have been properly installed and functioned well.
 - Check whether the electrical wires and cables are properly connected. If compressed air is used, check whether the corresponding air pipes are connected properly.
 - When teaching the robot, check whether its work area is reasonable and remove other objects from the work area.
- Stop running

Precautions when the robot stops running:

- Reduce the speed of the robot to ensure that the servo of the robot is shut off when the robot can be stopped.
- Recover materials and supplies related to the equipment and ensure that the equipment restores to the safe state for restart.
- Set up protective devices to indicate the current state of the equipment and prevent others from incorrectly operating it.

Chapter 3 Routine maintenance and safety inspection

3.1 Routine Inspection

1. Inspection of preparations for robot startup

Confirm whether the external supporting facilities of the robot are normal before use.

➤ Inspection of compressed air:

- Check whether air supply is normal and whether air pressure is stable.
- Check whether there are obvious impurities in compressed air and whether there is accumulated water in air pipe.
- Check whether the air pipes from the interface panels of the robot body and B-axis are properly connected to air supply.

➤ Inspection of cables:

- Check whether the cable at the Ethernet interface is loose.
- Check whether the connectors of wires and cables on the interface panel of the robot body are loose.

2. Start of the robot

- Check whether there are abnormal noises, vibrations, etc. in the robot when starting it.
- Check whether the movable cable and air distribution pipe are normal, and

whether they are entangled, pulled, etc.

3.2 Regular inspection

To keep the robot in good working condition, perform maintenance and checks on the following items. Be sure to cut off the power supply before performing maintenance and checks.

The cycle for routine inspection is based on the normal working conditions. For the normal working environment, please refer to the section of environment requirements in "AH10 Robot User Manual". The actual maintenance cycle depends on the operating frequency of the robot.

Table 3-1 Routine inspection and maintenance schedule

Check item	Maintenance cycle	Check content	Recommended maintenance method
Pipeline	Routine	Check whether the external lines are damaged, and whether they are entangled or pulled with each other.	In case of any damage, replace the cable lines; if they are entangled or pulled, re-lay the cables.
Emergency stop switch, external indicator light and button	Routine	Check whether the emergency stop switch and the power indicator light work normally, and whether the motor brake is effective.	If it is ineffective or does not work properly, replace the related component in time.
External screws of the robot	Routine	Check whether the screws of the joints, back plate, side plate, and base are loose or slipped.	If the screws are loose or fall off, tighten them in time. If the screw heads are worn or slipped, replace with new screws immediately.
Internal fan	3 Months	Check whether the fan operates normally or dust has accumulated on it.	Clean the dust on the surface of the fan with compressed air; if the fan fails to work, replace it.
Screw rod	3 months	Observe whether grease completely covers the screw.	If grease is inadequate, refer to Section 4.1 for adding grease.
Robot surface	3 months	Visually check whether there are impact marks or wear.	Wipe with clean cloth or touch up paint.

A-axis and B-axis hard limit	6 months	Check whether there is breakage or damage.	In case of any breakage or damage, replace it.
Timing pulley	6 Months	Check all timing pulleys and gears to see whether they are worn or fractured.	If worn or fractured, replace them in time.
Timing belt	6 Months	Check all timing belts to see whether they are worn or fractured.	If worn or fractured, replace them in time.

3.3 Cleaning and maintenance

The maintenance time of the robot mainly depends on the operating environment and frequency of the robot. The following recommended maintenance items are set under normal working conditions.



Make sure that the robot is in the power-off state before maintenance.

Table 3-2 Routine cleaning and maintenance schedule

Maintenance item	Maintenance cycle	Recommended maintenance method
Robot body	1 Month	Wipe dust off the surface with a clean cloth.
Spline screw shaft	3 ~ 6 months	Add lubricating grease.

The protection class of standard robot is IP20. It can be cleaned with a damp cloth rather than water. The protection class of protective robot is IP65. It can be cleaned with water.

Clean the robot with routine disinfectant and cleaning liquid. Do not use acidic cleaning liquid to perform routine maintenance on the robot.

3.4 Safety inspection

Safety system test cycle: generally six months, depending on the actual situation of the user site.

This is to ensure the safety and reliability of the robot. Make sure that the robot is in a low-power state and test any of the following switches and buttons. If any one of the test items fails, the robot must be restored to the normal working state before it continues to run.

Test items:

- Emergency stop switch provided by user to operate the robot.
- Emergency stop switch on the manual control pendant (if a manual control pendant is provided for users).
- Manual-automatic switch on the manual control pendant (if a manual control pendant is provided by user).
- Servo enable switch on the manual control pendant (if a manual control pendant is provided by user).

3.5 Handling of common exceptions

Table 3-3 Handling of common exceptions

Common exception	Possible Cause	Troubleshooting:
Abnormal emergency stop	Failure in robot emergency stop line.	<ul style="list-style-type: none"> • Check whether the emergency stop switch is triggered. • Check whether the emergency stop switch is damaged.

		<ul style="list-style-type: none"> • Replace the emergency stop switch.
Unable to connect robot.	<ul style="list-style-type: none"> • Failure in PC network settings. • Multiple problems in PC network card. • Ethernet interface is damaged. • Network cable is damaged. 	<ul style="list-style-type: none"> • Change the IP of the PC connected to the robot to be in the same network segment as the robot's IP, and then connect it. • Disable all other network cards in the PC except the network card connected to the robot. • Replace the Ethernet interface. • Replace with a network cable that has been verified to work normally.
RS-232 or RS-485 communication port fails in communication.	<ul style="list-style-type: none"> • Plug is not connected properly; • Interface is damaged. • Parameters are improperly configured. 	<ul style="list-style-type: none"> • Check whether the plug is properly plugged. • Reconfigure the parameters. • Replace the damaged plug.
Communication port fails.	Plug fails.	<ul style="list-style-type: none"> • Re-plug/unplug the network cable. • Replace with a network cable that can be normally used for testing.
I/O communication port fails.	I/O plug is damaged.	<ul style="list-style-type: none"> • Check whether the I/O line is properly connected. • Replace the I/O plug.

Chapter 4 Maintenance of Mechanical Components

4.1 Lubrication of spline screw shaft

4.1.1 Standard type

**NOTE**

- Grease usage: Check whether there is grease in the groove of the spline shaft; or wipe the surface of the shaft with dust-free paper and observe whether the dust-free paper is reflective on its surface. If no, the grease is used up.
 - The use of lubricating oil or grease can effectively extend the life of the robot.
-

Running out of lubricating oil may cause abnormal wear, noise, etc. Check the grease on the spline screw shaft regularly. If much lubricating grease is applied or grease is unevenly applied, grease dripping may occur.

There is a slight loss of grease at the part of the spline screw shaft exposed to the air. Under normal operating conditions, it is recommended that the spline screw shaft be filled with lubricating oil every 3~6 months. Select appropriate grease according to the information in Table 4-1.

Table 4-1 Selection of lubricating grease

Model Number	Suitable environment	Performance characteristics	Application part	Notes
THK AFC	Micro-vibration	Long life, resistance to micro-vibration	Spline screw shaft	Non-food industry
AZ food machinery grease	Micro-vibration	Stable, nonhazardous	Spline screw shaft	Food industry

Accessories: special oil brush, AFC grease or AZ food machinery grease and disposable protective gloves.



Figure 4-1 Special oil brush



NOTE

- QKM offers special oil brush and AFC grease.
- Keep special oil brush back in the bottle when it is not in use.

Step 1 Confirm that the robot is powered on and in servo-off state. After confirmation, wear disposable gloves and hold the end of the screw, then press the brake button and do not release it until the spline screw shaft is pushed down to the lowest end, as shown in Figure 4-2.

➤ Refer to Chapter 6 Robot Operation in "AH10 Series Robot User Manual" (latest edition).

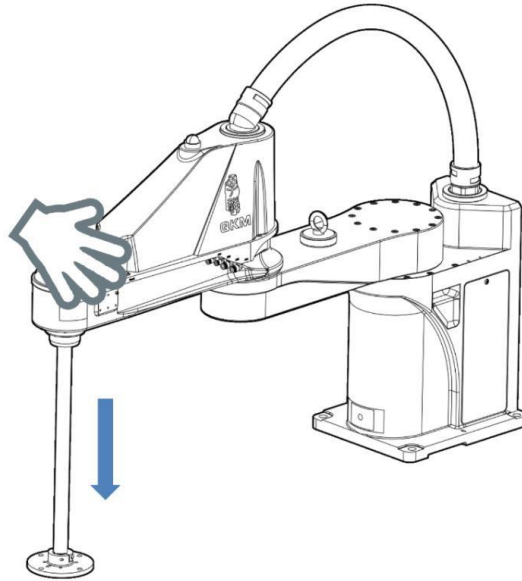


Figure 4-2 Push down spline screw shaft

Step 2 Wipe the old grease off the screw shaft with dust-free paper, and then use the special oil brush to evenly apply appropriate amount of grease on the screw to completely cover it, as shown in Figure 4-3

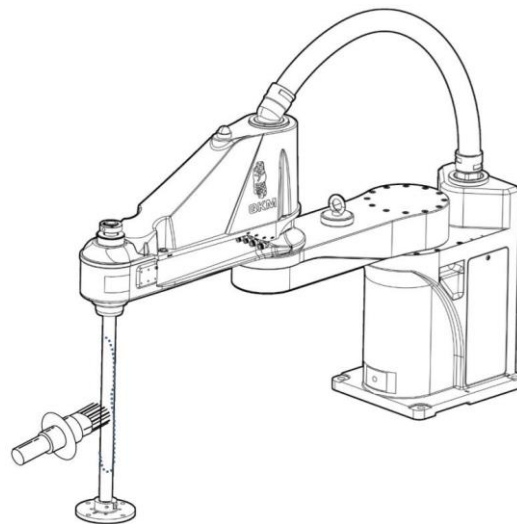


Figure 4-3 Apply lubricating grease

Step 3 Hold the end of the screw, then press the brake button and do not release it until the spline screw shaft is pushed up to the top, as shown in Figure 4-4

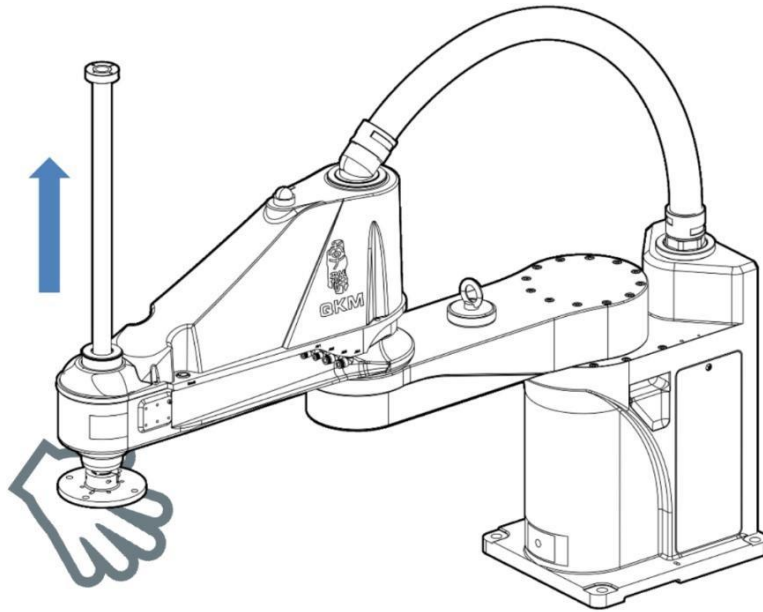


Figure 4-4 Push up spline screw shaft

Step 4 Wipe the old grease off the screw with dust-free paper, and then use the special oil brush to evenly apply appropriate amount of grease on the screw.

Step 5 Hold the end of the screw, then press the brake button, and push the screw up and down more than 5 times. Follow the above four steps to replenish grease twice. If the grease is evenly distributed on the surface of the screw, the replenishment is completed. Wipe the excess grease off the upper and lower gears of the screw with dust-free paper.

(Note: Hold the end of the screw before pressing the brake button to prevent the screw from sliding down.)

If grease gets into your eyes, mouth or is adhered to your skin, handle them as follows.



- If it gets into eyes, rinse carefully and thoroughly with water and seek medical advice immediately.
 - If it gets into mouth, do not induce vomiting if swallowed. Seek medical attention immediately.
 - If your mouth is soiled, rinse your mouth
-

thoroughly with water. If serious, seek immediate medical attention.

- If it is adhered to your skin, wash your hands with soap. Clean them.
 - If it is adhered to the wound on your skin, seek medical attention immediately.
-

4.1.2 Protective type

Remove the protective cover from the robot before replenishing grease onto the screw.

Accessories: Allen wrench, special oil brush, AFC grease or AZ food machinery grease and disposable protective gloves.

Step 1 Refer to Section 4.2 Removal of protective cover to remove the protective cover from the robot.

Step 2 Refer to Section 4.1.1 Standard robot to replace the grease on the screw rod of the robot.

4.2 Removal and installation of protective cover

Users can remove and install the protective cover of AH10 Robot (protective type) according to the needs of use, as shown in Figure 4-5.

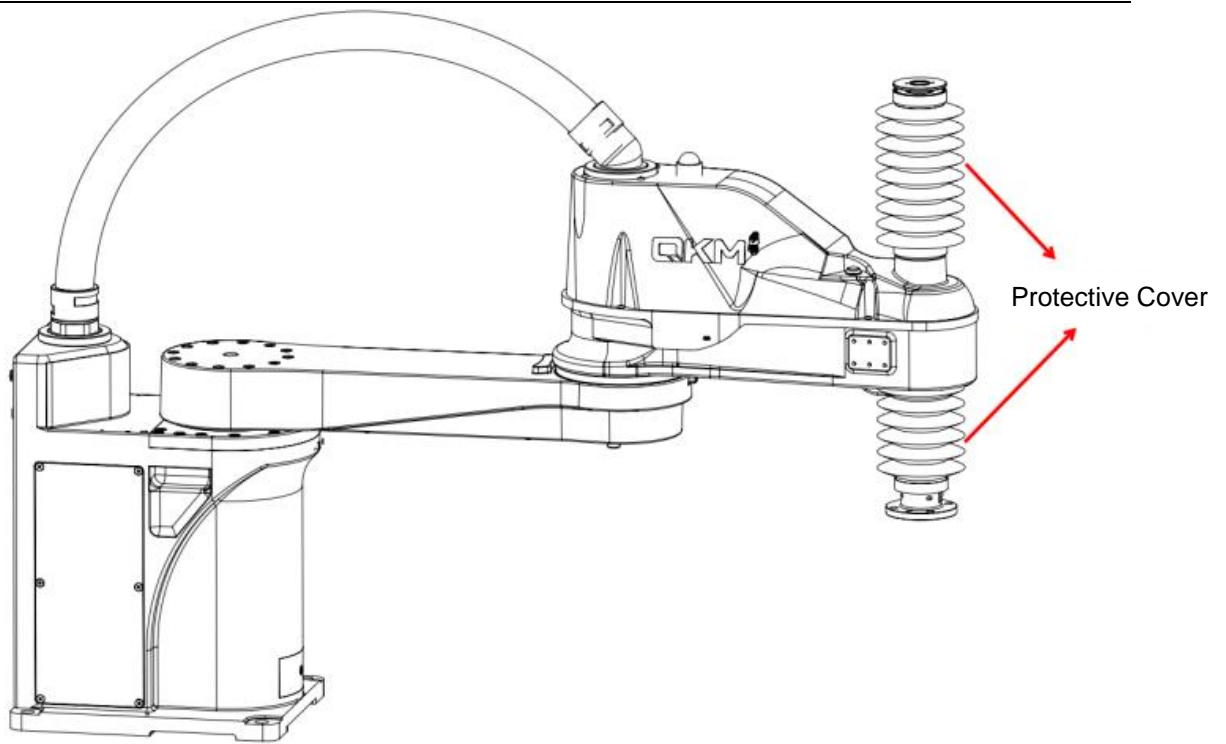


Figure 4-5 Protective cover

Accessories of protective cover

Accessories of protective cover	Name	Qty./PCS
Accessories of screw upper protective cover	Fasteners on the protective cover	1
	Hole circlip	1
	Coupling	2
	Telescopic protective cover	1
	Deep groove ball bearing	1
	Fixed cover	1
	Jackscrew	2
Accessories of screw lower protective cover	Connecting fastener	1
	Deep groove ball bearing	1
	Bearing fixing ring	1
	Hole circlip	1
	Telescopic protective cover	1

	Coupling	2
--	----------	---

4.2.1 Removal of protective cover

Removal tools and accessories: Allen wrench, straight screwdriver, protective gloves.

➤ Removal of upper protective cover:

Step 1 Use the straight screwdriver to loosen the two couplings of the upper protective cover.

Step 2 Use the Allen wrench to remove the screws from the connection between the fastener and the fixing ring on the protective cover.

Step 3 Remove the couplings, the protective cover and its bearing.

➤ Removal of lower protective cover:

Step 1 Use the straight screwdriver to loosen the two couplings of the lower protective cover.

Step 2 Use the Allen wrench to remove the loaded flange from the end of the screw. Do not drop the protective cover bearing and the flat key during removal.

Step 3 Remove the couplings, the protective cover and its bearing.

Step 4 Use the Allen wrench to remove the bearing fixing ring from the lower protective cover.



- Pay attention to some sharp parts of the couplings when removing them. Protect your hands from being scratched.
 - When removing the loaded flange from the end of the screw of the lower protective cover, loosen the
-

screws on both sides alternately. Do not unscrew all the screws from one side at a time. Loosen rather than remove the screws.

4.2.2 Installation of protective cover

Installation tools and accessories: Allen wrench, straight screwdriver, protective gloves.

➤ Installation of upper protective cover:

Step 1 Apply the couplings and the protective cover into the screw. Be sure to apply one coupling, the protective cover, and the other coupling in sequence.

Step 2 Lock the fastener on the protective cover and the fixing ring at the upper end of the screw with screws.

Step 3 Apply one end of the protective cover on the 2-axis housing and fasten it with a coupling. Apply the other end on the connecting fastener and fix it with a coupling.

➤ Installation of lower protective cover:

Step 1 Apply the couplings and the protective cover into the screw.

Step 2 Apply one end of the protective cover on the decorative shell of the 3-axis upper limit and fasten it with a coupling.

Step 3 Apply the bearing fixing ring and the deep groove ball bearing on the screw. Do not tighten the screws temporarily.

Step 4 Install the flange at the end of the screw. Note that you should put the flat key into the keyway first.

Step 5 After confirming that the flange is properly installed at the end of the screw, allow the deep groove ball bearing to come into contact with the

flange at the end, then the bearing fixing ring to come into contact with the deep groove ball bearing, and tighten the screws on the bearing fixing ring.

Step 6 Apply the protective cover on the bearing fixing ring and fasten it with a coupling.



- Pay attention to some sharp parts of the couplings when removing them. Protect your hands from being scratched.
 - When removing the loaded flange from the end of the screw of the lower protective cover, loosen the screws on both sides alternately. Do not unscrew all the screws from one side at a time. Loosen rather than remove the screws.
-

4.3 Cover



Be sure to make replacement after powering off the controller and unplugging the power plug from related devices, otherwise safety accidents and robot failures may occur.

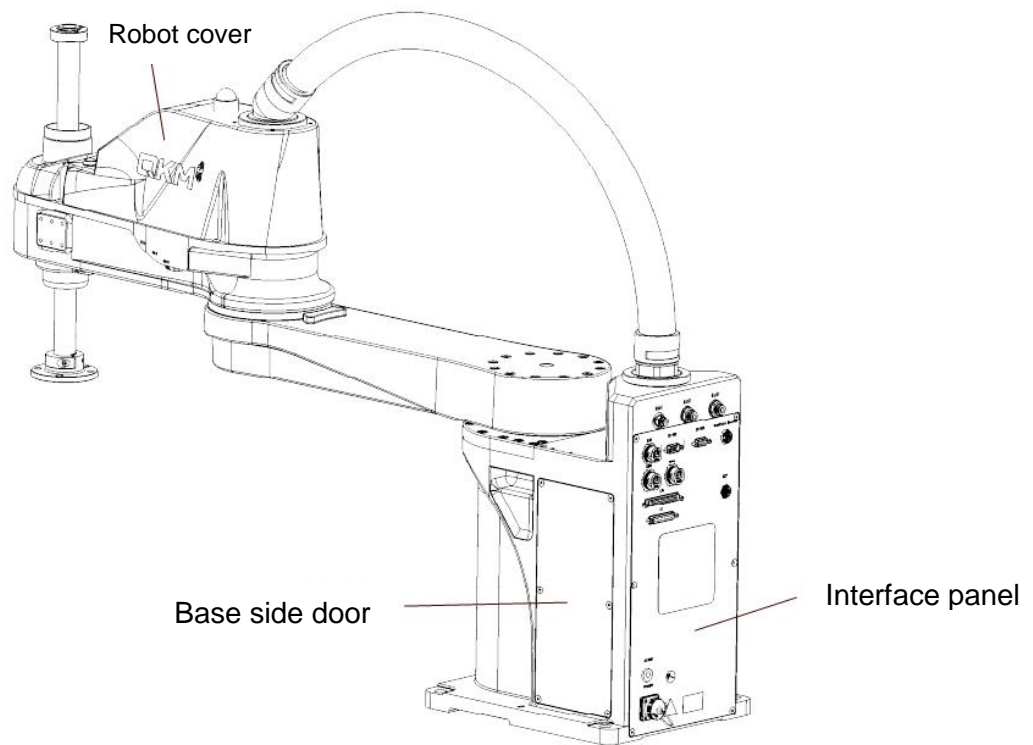


Figure 4-6 Diagram of robot covers

4.3.1 Robot cover

Tool: an Allen wrench.

Step 1 Lower the spline screw shaft to the lowest point.

Step 2 Use the M3 Allen wrench to remove the fastening screws from the robot cover, as shown in Figure 4-7.

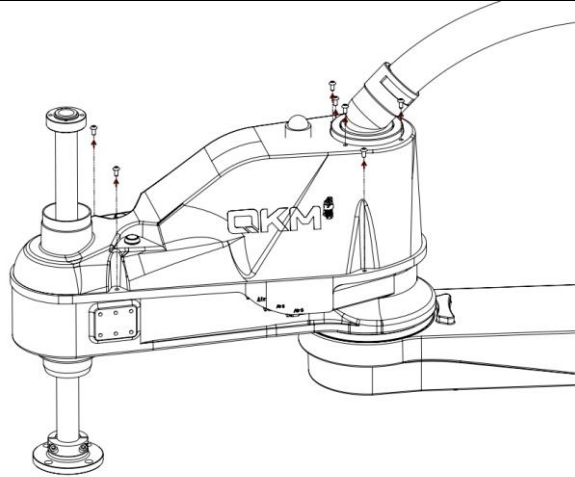


Figure 4-7 Remove the fastening screws from the cover

Step 3 Lift the robot cover, as shown in Figure 4-8

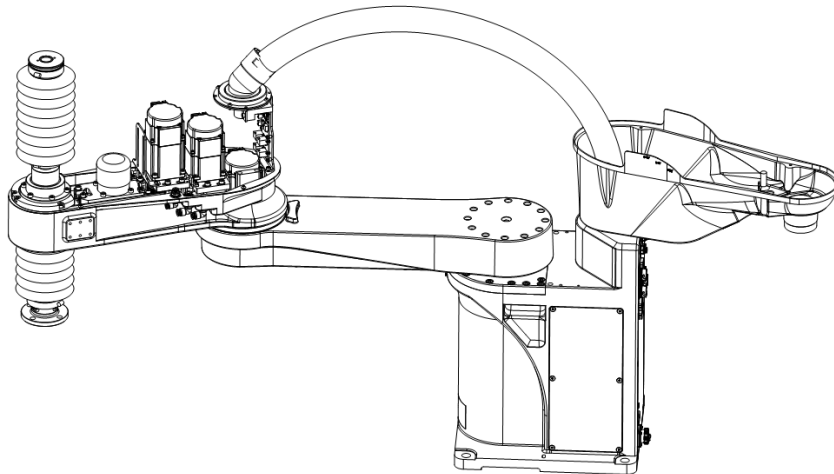


Figure 4-8 Lift the cover

4.3.2 Base side door

Tool: Allen wrench.

Step 1 Use the M3 Allen wrench to loosen the fastening screws on the side door of the base, as shown in Figure 4-9.

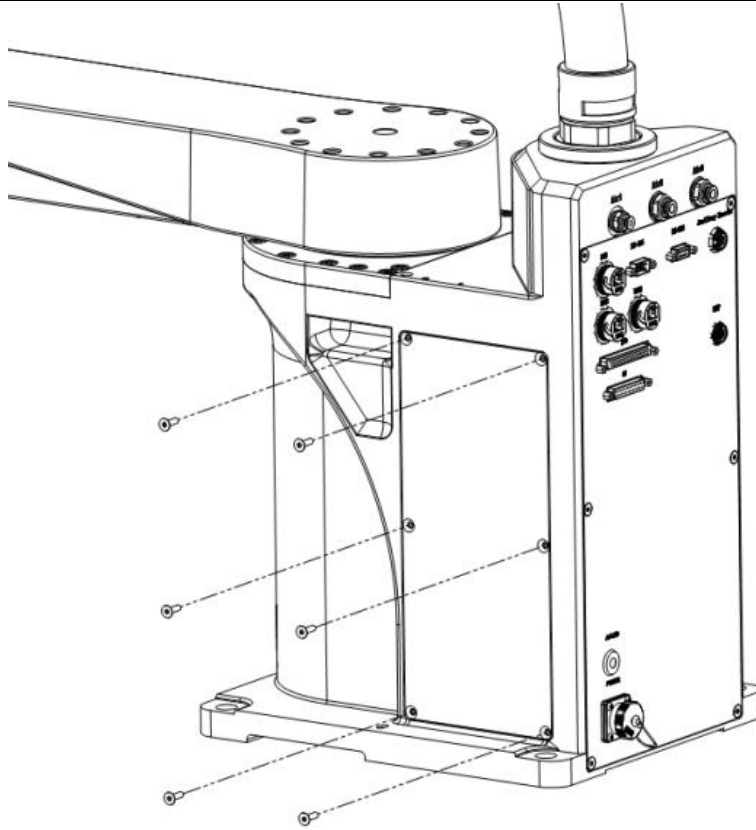


Figure 4-9 Removal of fastening screws

Step 2 Take out the side door of the base, as shown in Figure 4-10.

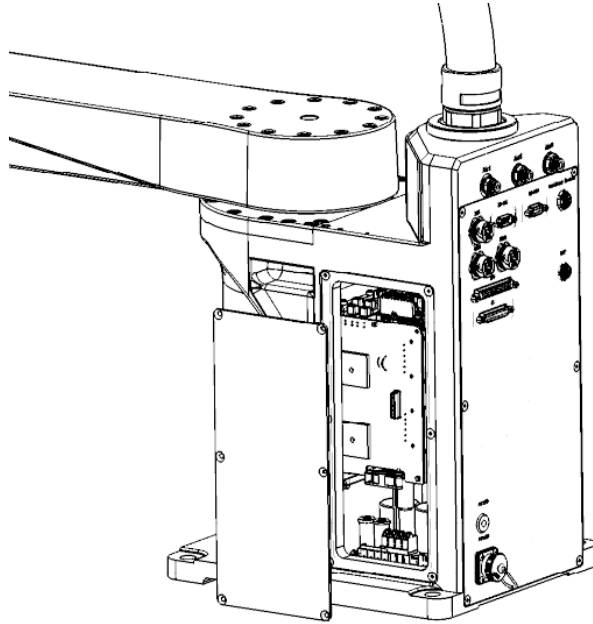


Figure 4-10 Take out the side door of the base

4.3.3 Interface panel

Tool: Allen wrench.

Step 1 Use the Allen wrench to remove the fastening screws from the interface panel, as shown in Figure 4-11.

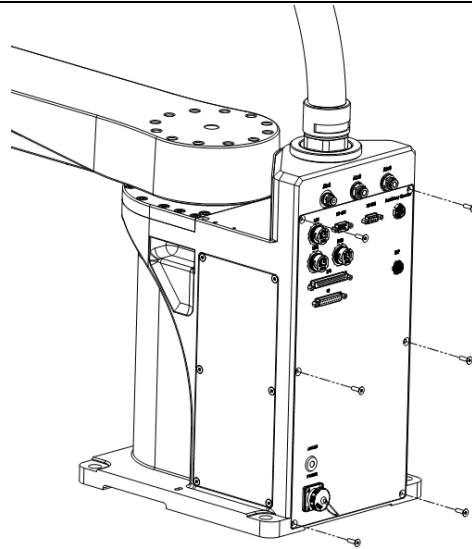


Figure 4-11 Remove the fastening screws from the interface panel

Step 2 Gently take the interface panel out by holding its upper end. Be careful not to break off the cables when taking it out, as shown in Figure 4-12.

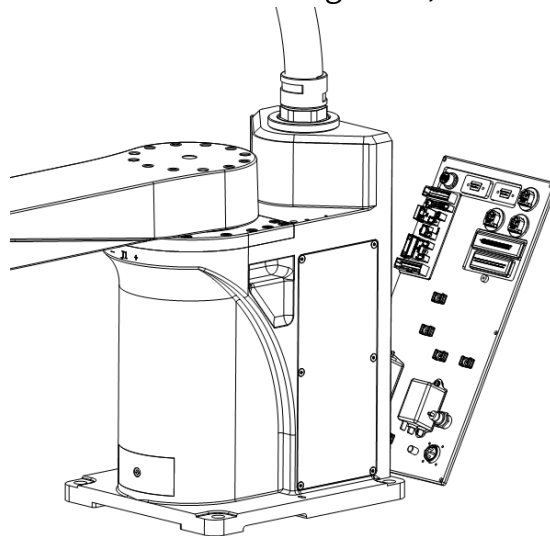


Figure 4-12 Open the interface panel



- Do not pull the interface panel by force. Failure to do so may result in cable damage, disconnection or poor contact, abnormal system operation or power outage.
 - When installing the interface panel, do not clasp the cables or forcibly bend them to press in.
-

4.4 Timing belt tension measurement

4.4.1 Measuring instrument

Instrument name: sonic belt tension meter

Brand: UNITTA

Screen



Figure 4-13 Appearance of the instrument

Press the "POWER" button, and the LCD will display the following interface:

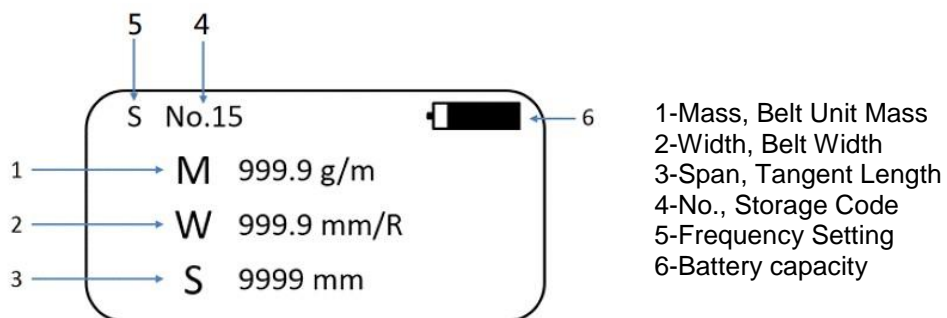


Figure 4-14 Introduction of the screen

In low-light conditions, the LCD backlight automatically turns on, and the screen shows the data used at the previous shutdown.

Function Key

Name	Notes
POWER	Power switch
MEASURE	Measuring key
MASS	Belt mass
WIDTH	Belt width
SPAN	Span
UP	Previous page
DOWN	Next page
RANGE	Range (key combination, 00, 01, 02, etc. are optional)
Hz	HZ
SELECT	Select key (set width is available)
0~8	Numeric key

- USB interface

The meter is equipped with a USB interface to connect to PC. The upper and lower limits of the measurements can be set via PC, and the data will be displayed directly on the PC screen upon measurement.

4.4.2 Parameter settings

Refer to the "U-508 Tension Meter User Manual" (the tension meter user manual

is available if requested by customer).

4.4.3 Measuring steps and display

The operation steps are as follows:

Step 1 Connect the slot on the probe to the groove on the meter and push it tightly. If you want to separate it, hold the slot on the probe and pull it out.

Step 2 Press the "POWER" button to turn on the sonic tension meter.

Step 3 Select the proper range (such as 00, 01, 02, etc.) via key combination according to the width, mass and span of the belt. If the measurement is conducted for the first time, measure the width, mass and span of the belt.

Step 4 Press the "MEASURE" button, and the green LED light starts flashing. Beat the belt to allow it to vibrate, then place the probe about 1 cm (0.4 inches) away from the belt rather than bring it into contact with the belt. The green LED light keeps flashing until the probe receives a signal, then the LED light automatically turns off and a graph appears on the screen.

Step 5 After the signal is received, the measured tension will be displayed, the meter will beep three times, and the LED light will flash to indicate that the measurement is completed. After reading the tension report, press the HZ button to keep the tension, frequency on the screen.

Step 6 Pull the belt to carry out measurement again.

Step 7 After measurement, press the "POWER" button again to turn off the sonic tension meter.



The red LED light will be on if failing to carry out measurements of the belt, or if measured frequency or calculated tension is beyond the range of the meter. At this point the measurements of either tension or frequency may be incorrect.

- Tension display

T= □□□□ Kgf/lbf/N

The measurement output values can be displayed in kilograms, pounds or newtons according to the following steps: When the power is off, press "0" and "9" buttons and the "POWER" button at the same time, the meter will turn on and display the current measurement unit, then you can select the desired unit by pressing the "SELECT" button. Press and hold the "POWER" button again until the meter is turned off, then turn on the meter for normal operation, all data entered must be in millimeters and grams.

The available output value is 99900 kg/lb/N.

- Frequency display

F= □□□□HZ

Press the "Hz" button and tension or frequency will be displayed on the screen.

- Measurement error

If neither calculated tension nor measured frequency is displayed, the red LED light will be on and an error message will be displayed on the LCD screen. Check the accuracy of the mass, width and span. Re-measure until tension or frequency values are displayed.

As auto-trigger function is available, it is not necessary to press the "MEASURE" button again.

After obtaining tension or frequency values, compare at least two additional data. If multiple measurement results are close to each other, it means that the measurements are correct.

More vibrations and measurement errors are prone to occur on the belt with too low tension. If a tension value cannot be obtained, the belt may be too weak to produce a clear frequency signal. In order to get an accurate tension value, the belt should be a little tensioned.



Frequencies are stored in the record, otherwise the red LED light of the meter will always be on.

4.4.4 Measuring results

Compare the results measured in Section 4.3.3 with the data in the table below. If they are not within the standard range, repeat the measurement in Section 4.3.3.

Belt tension measuring range:

Timing belt tension

Belt width (mm)	12	20
Recommended tension (N)	59	98
±10%	53.1~64.9	88.2~107.8

Tension meter settings

Belt width mm (W)	12	20
Belt mass g/m (M)	2.5	2.5
Span mm (S)	300	367

4.4.5 Characteristics

- Before measuring the installing tension of a new belt, turn it back and forth several times. Abnormal drive shaft or irregular belt teeth will affect the tension of the belt when it is running
- 5000 Hz maximum frequency
- Automatic shutdown if there is no operation within 5 minutes.
- Manual shutdown by pressing the power button for 1 ~ 2 seconds.
- Storage of 40 frequencies.
- Two 3A batteries installed behind the meter.

4.4.6 Cautions

- Avoid collision since any collision may cause damage to this product.
- Do not spill water, solvents or any other liquids on this product.
- Do not place this product in dusty environment.
- Keep this product away from heat.
- Do not use this product in areas with potential for sparks as this may cause explosions.
- Do not use this product outdoors during thunderstorms. Turn off the power and use it in a safe place, or you may be struck by lightning.
- The portable probe is of tubular structure. Do not bend the probe to an acute angle.

Chapter 5 Maintenance of Electrical Components



- Do not perform maintenance on the electrical components while the power is on. Failure to do so may cause abnormal action of the robot, which is very dangerous; and may also cause electric shock or malfunction.
 - Do not allow foreign objects to enter the inside of the mechanical arms and connecting terminals. If the power is turned on when a foreign object enters, electric shock or malfunction may be caused, which is very dangerous.
 - Electrical engineer or professional electrical operator shall perform maintenance operations, and wear protective equipment such as anti-static wrist strap to prevent the electrical components of the robot from damage.
-

5.1 Replacement and maintenance of 1-axis motor fan

5.1.1 Replacement of 1-axis motor fan

The position of the 1-axis motor fan is shown in Figure 5-1.

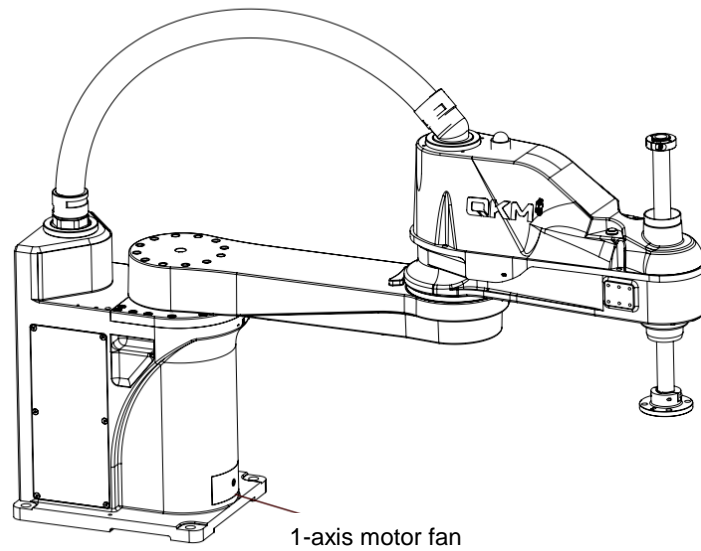


Figure 5-1 1-axis motor fan

Tools and accessories: Allen wrench, 1-axis motor fan assembly.

Step 1 Tear off the warning sign, as shown in Figure 5-2.

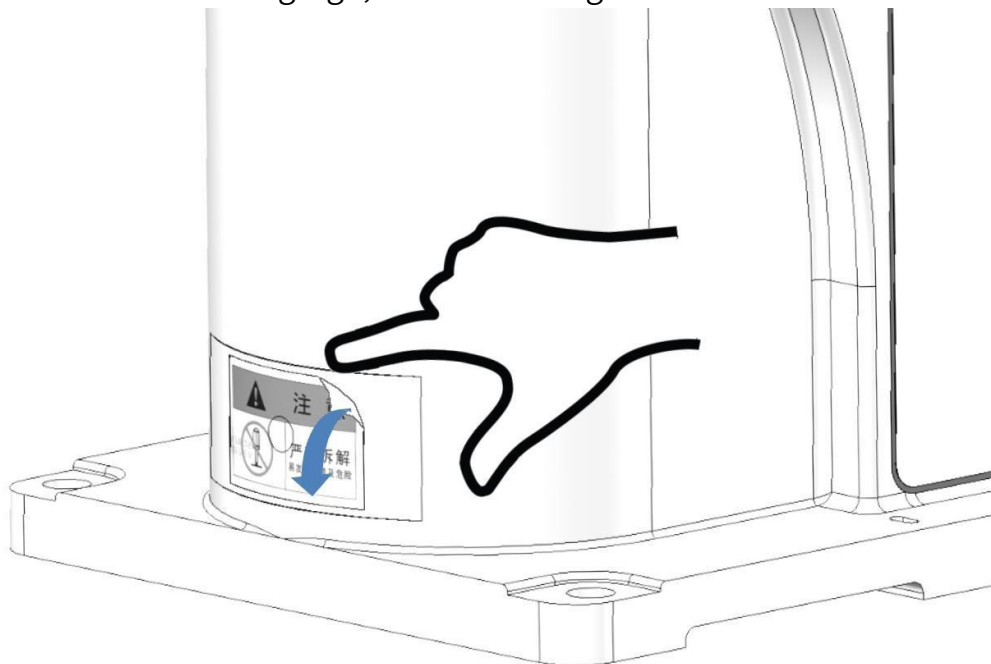


Figure 5-2 Tear off the warning sign

Step 2 Use the Allen wrench to remove the fastening screws from the protective cover and take out the protective cover, as shown in Figure 5-3.

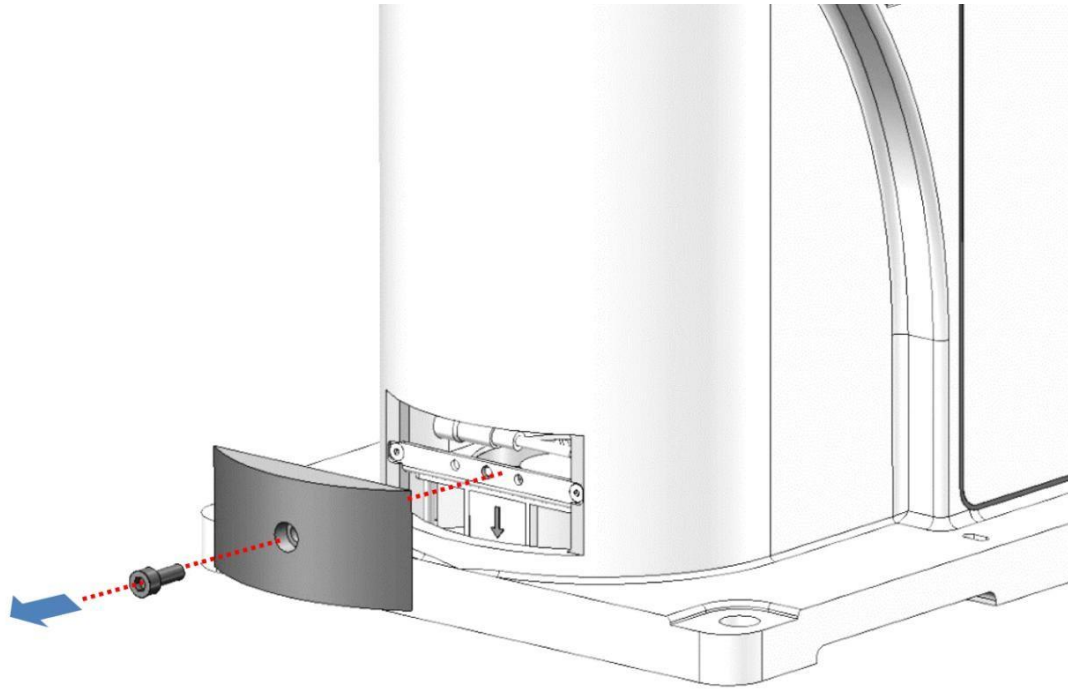


Figure 5-3 Take out the protective cover

Step 3 Use the Allen wrench to remove the fastening screws from the fan assembly, as shown in Figure 5-4.

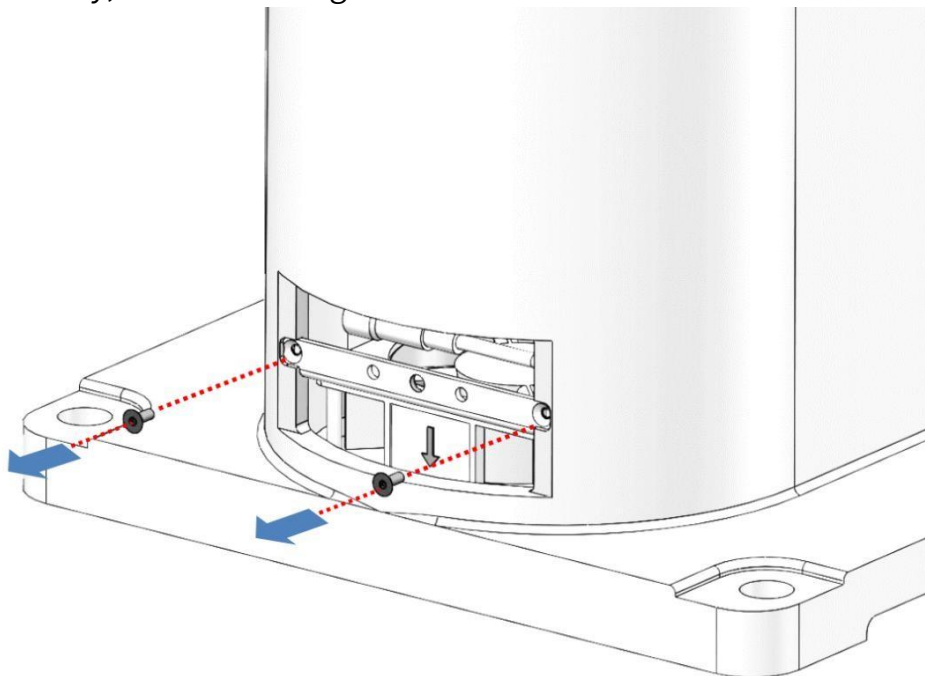


Figure 5-4 Remove the fan assembly

Step 4 Slightly lift the fan assembly and then pull it out, unscrew the waterproof connecting plug from the fan cable; then take out the fan

assembly to be replaced, as shown in Figure 5-5.

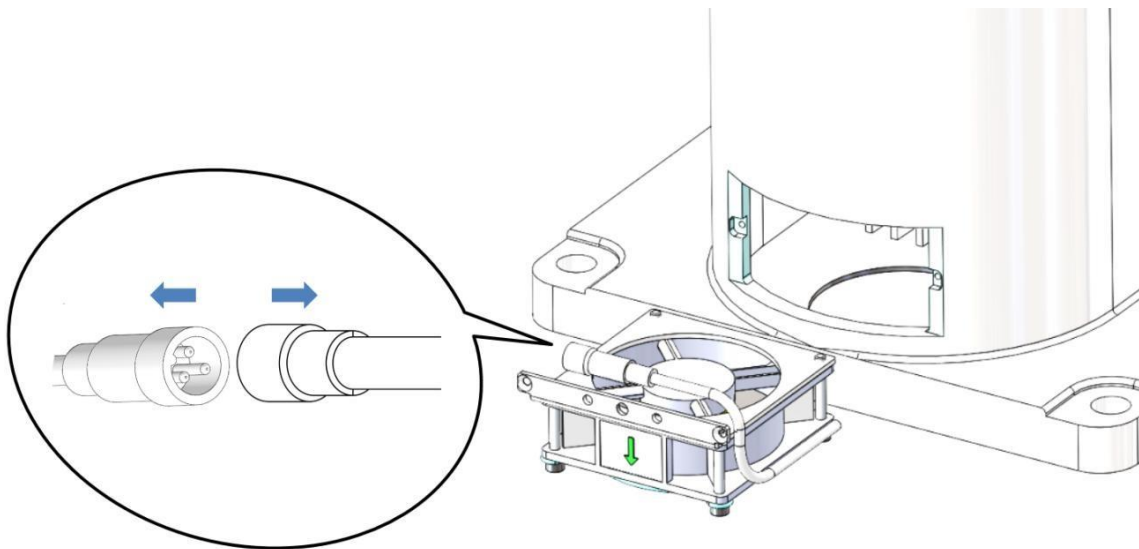


Figure 5-5 Take out the fan assembly

Step 5 Replace with a new fan assembly. After connecting the cable, place the fan assembly in the robot, tighten the fastening screws and install the protective cover.

Step 6 Replace with a new warning sign.

Notes:

- i. Do not lose the gasket used at the joint.
- ii. When placing the new fan assembly into the robot, do not press the connecting cable to prevent the cable skin from being damaged by fan blades.

5.1.2 Maintenance of 1-axis motor fan



NOTE

In order to reduce fan alarms and failures caused by dust accumulation and extend its service life, the 1-axis motor fan of AH10 Series Robot needs to be cleaned and maintained regularly.

Tools and accessories: Allen wrench, diagonal pliers, anti-static gloves.

Step 1 Remove the fan according to Steps 1~4 in Section 5.1. Replacement of 1-axis motor fan.

Step 2 Wipe the dust off the fan surface, blades, protective cover, and sheet metal fixing the fan with a clean cloth until they are clean.

Step 3 After cleaning, reinstall the fan on the base in the reverse order of its removal (note that the air outlet is downward).

- Power off the robot before maintaining or troubleshooting the fan.
- In the power-on state, visually check whether the fan rotates normally and aurally check whether there is any abnormal noise. In case of any abnormality, find out the cause and solve the fault.
- In the power-on state, connect the upper computer software ARM to the robot body with network cable for communication, and test whether the robot can be servoed and work normally with ARM. If the robot can work normally, it indicates that the test signals of all fans are normal. If the robot cannot work properly, find out the cause and solve the fault. The robot may be servoed to work after the alarm is cleared, or the cable may be in poor contact, or the fan is damaged and needs to be replaced.
- After power off, turn the fan with hand to test whether the resistance of the fan is normal. If the resistance is too large, replace the fan.
- Clean the dust on the blades with appropriate intensity. Wipe the dust off the surface with a clean cloth in a cyclic manner until it is clean.
- Make a fan inspection and maintenance record form and perform regular maintenance (as shown in the form below).



Fan Inspection and Maintenance Record Form

SN	Time of inspection	Inspected by	Check content	Notes
----	--------------------	--------------	---------------	-------

			Replacement	Cleaning	

5.2 Replacement and maintenance of 24V switching power module

5.2.1 Replacement of 24V power supply

Tools and accessories: cross screwdriver, 24V power supply, disposable protective gloves. The position of the 24V power supply is shown in Figure 5-6

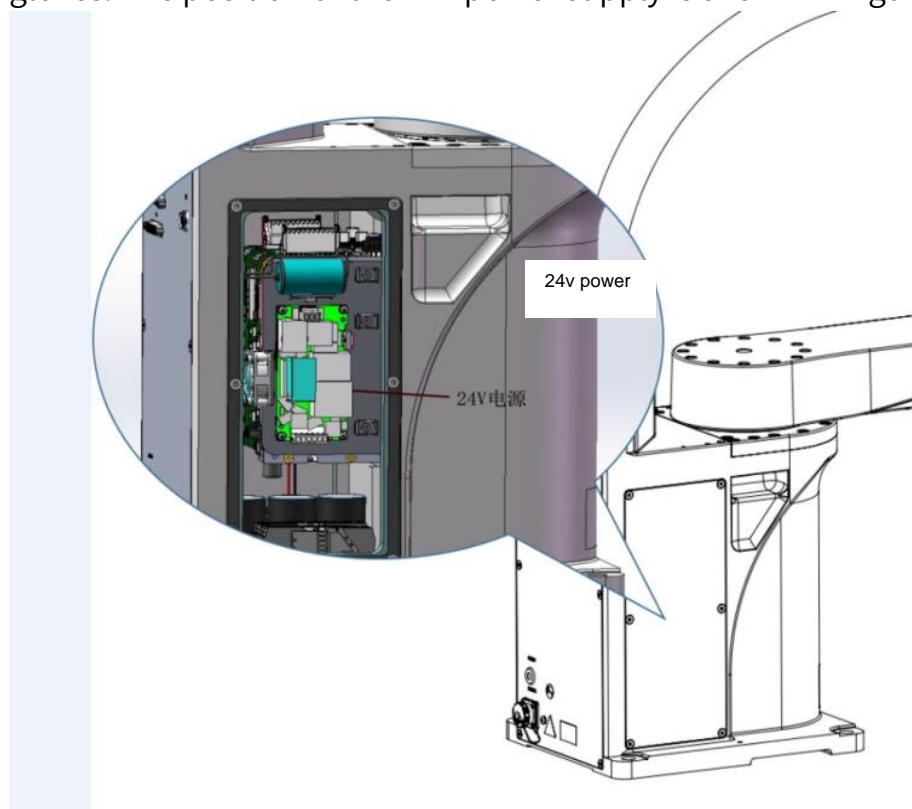


Figure 5-6 24V power module

Step 1 Refer to Section 4.2.2 Base side door to remove the base side door from

the robot.

Step 2 Refer to Section 4.2.3 Interface panel to remove the interface panel from the robot.

Step 3 Refer to Section 5.2.2 24V power module cooling fan to remove the fan.

Step 4 Unplug the 24V connector and the 220V connector from the power module.

Step 5 Use the cross screwdriver to remove the fastening screws from the power module, as shown in Figure 5-7.

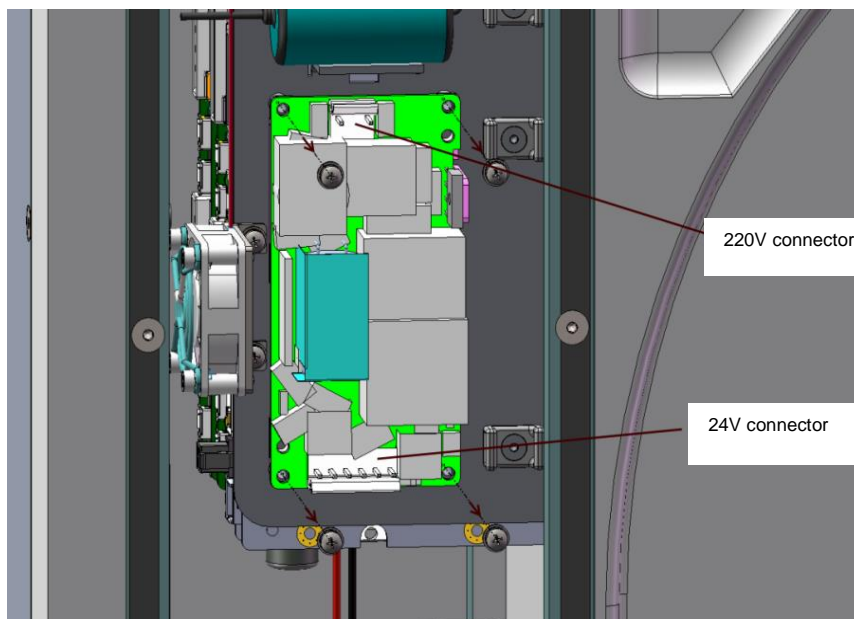


Figure 5-7 Removal of power module

Step 6 Replace the power module in the control cabinet with a new one, plug in the 24 V connector and the 220 V connector.

Step 7 Install the interface panel and base side door of the robot as they are.

Notes:

- i. The control cabinet is small inside, and the fan needs to be removed first.
- ii. Do not forcibly pull the cables in the control cabinet to prevent them from damage, disconnection or poor contact.
- iii. Keep the removed power module properly and do not discard it.

5.2.2 Replacement and maintenance of 24V power module cooling fan

The position of the power module cooling fan is shown in Figure 5-8.

Tools and accessories: Allen wrench, cross screwdriver, diagonal pliers, fan assembly, disposable protective gloves.

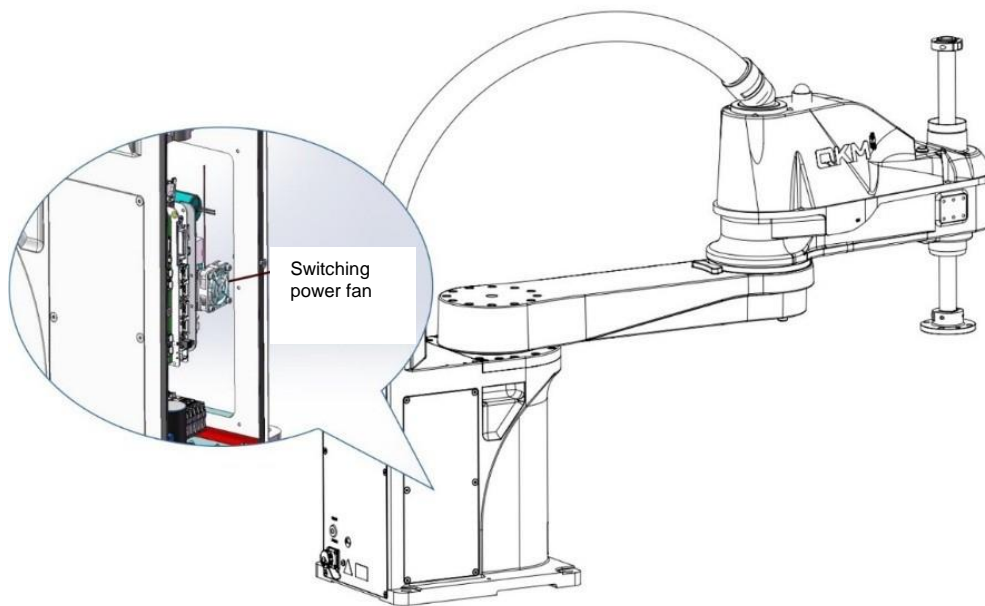


Figure 5-8 Power module cooling fan

Step 1 Refer to Section 4.2.2 Base side door to remove the base side door from the robot.

Step 2 Refer to Section 4.2.3 Interface panel to remove the interface panel from the robot.

Step 3 Use the diagonal pliers to remove the cable tie along the fan cable.

Step 4 Find the "Fan#2" connector on the interface panel, as shown in Figure 5-9, and pull out the connector.

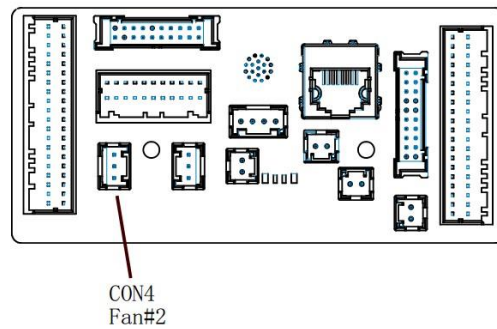


Figure 5-9 Position of the power fan connector

Step 5 Use 6 mm Allen wrench to remove the fastening screws from the power module cooling fan, as shown in Figure 5-10.

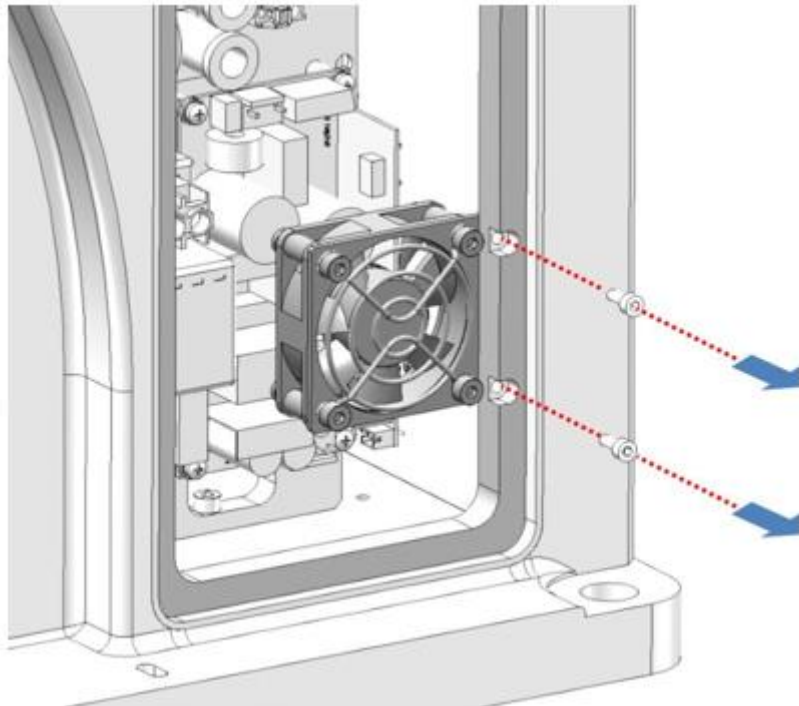


Figure 5-10 Remove the power module cooling fan

Step 6 Install a new fan assembly, plug in the fan connector, fix the fan cable with a cable tie.

Step 7 Install the interface panel and base side door of the robot as they are.

Notes:

- i. This cooling fan is installed in a hanging manner. Hold it during

installation and removal to prevent the fan assembly from falling into the control cabinet and damaging other cables.

ii. The control cabinet has a small space, so take care not to touch other connectors when removing the cable ties. Remove the old cable ties from the control cabinet. Do not leave sundries in the control cabinet.

iii. Do not forcibly pull the cables in the control cabinet to prevent them from damage, disconnection or poor contact.

5.3 Replacement and maintenance of QBUS module

5.3.1 Replacement of QBUS module

Tools and accessories: Allen wrench, straight screwdriver, cross screwdriver, diagonal pliers, disposable protective gloves. The position of the control card fan is shown in Figure 5-11.

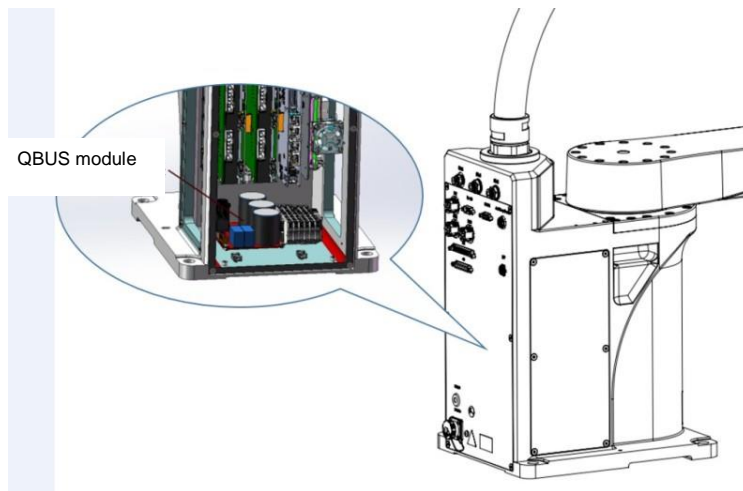


Figure 5-11 QBUS module

Step 1 Refer to Section 4.2.2 Base side door to remove the base side door from the robot.

Step 2 Use the straight screwdriver to remove the connection terminals.

Step 3 Use 6 mm Allen wrench to remove the cross recessed screws from the QBUS module, as shown in Figure 5-12.

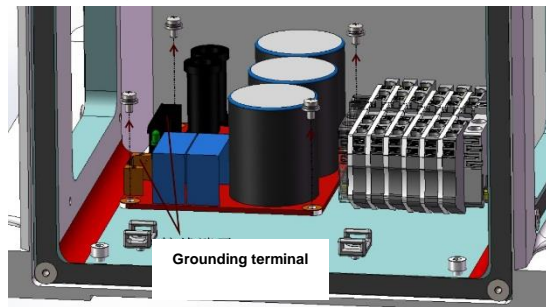


Figure 5-12 Remove the QBUS module

Step 4 Install a new QBUS module and connect to the connection terminals.

Step 5 Install the interface panel and base side door of the robot as they are.

Notes:

- The lower end of the QBUS module is close to the filter terminal block. Be careful not to hit other cables when removing the screws.
- When installing the connection terminals, make sure that the terminals are firmly connected.
- The QBUS module is located inside, so take care not to drop the screws into the control cabinet when installing or removing the QBUS module.
- Do not forcibly pull the cables in the control cabinet to prevent them from damage, disconnection or poor contact.

5.3.2 Replacement and maintenance of QBUS fuse

The position of the QBUS fuse is shown in Figure 5-13.

Tools and accessories: straight screwdriver, fuse, disposable protective gloves.

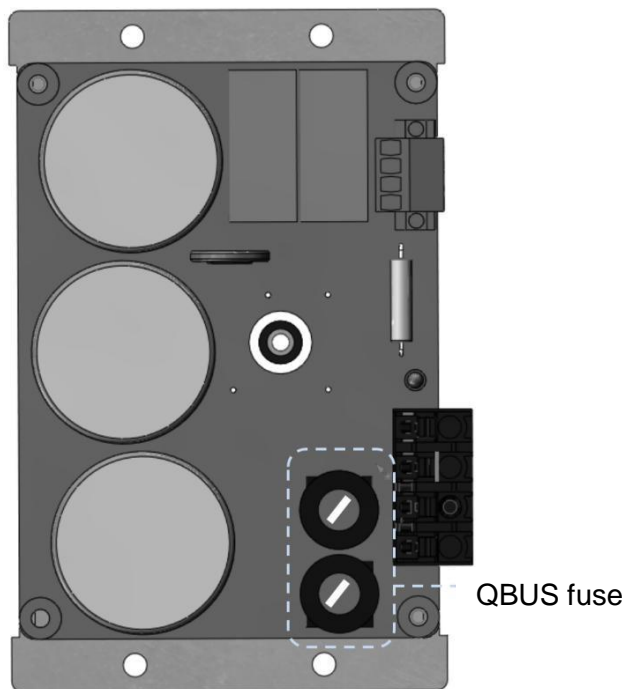


Figure 5-13 QBUS fuse

Step 1 Refer to Section 4.2.2 Base side door to remove the base side door from the robot.

Step 2 Refer to Section 5.3.1 Replace the QBUS to remove the QBUS.

Step 3 Turn the top cover of the fuse counterclockwise to remove the fuse.

Step 4 After installing a new fuse, tighten the top cover and install the base side door to restore the robot upon replacement.

5.4 Encoder battery

The encoder is equipped with a 3.6 V disposable Li-SOCl₂ battery with a normal voltage of not less than 3.6 V.

The encoder battery is located in the base of the robot. To replace it, the back panel and side door of the base need to be removed. The position of the encoder battery is shown in Figure 5-14.

- Replace the battery every 1.5 years under continuous operation condition of the robot; replace the battery once a year under non-continuous operation condition of the robot.

(Continuous operation: the robot runs 20h a day and 300 days a year)

- Replacement of the battery after it is depleted will affect production operation. It is recommended to make a preventive replacement.

Tools and accessories: Allen wrench, encoder battery assembly, disposable protective gloves.

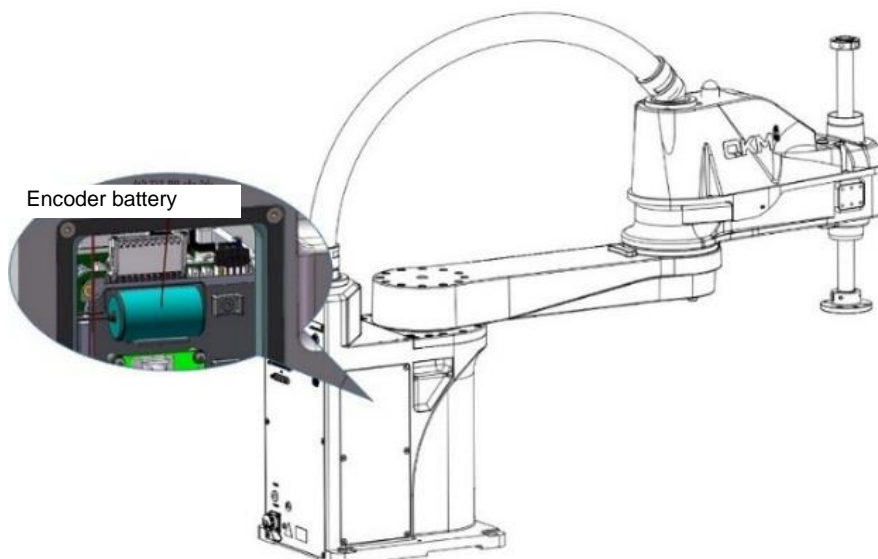


Figure 5-14 Encoder battery

Step 1 Refer to Section 4.2.2 Base side door to remove the base side door from the robot.

Step 2 Refer to Section 4.2.3 Interface panel to remove the interface panel from the robot.

Step 3 Find the interface for backup battery on the interface panel, and install a new encoder battery, as shown in Figure 5-15.

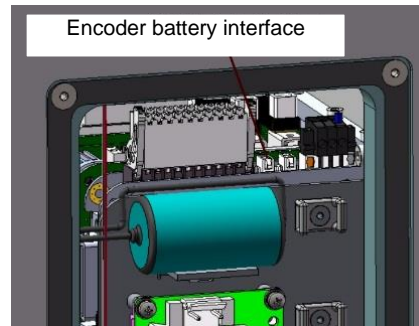


Figure 5-15 Position of encoder battery connector

Step 4 Use the diagonal pliers to cut off the cable tie of the encoder battery, install a new encoder battery, and fix it with a cable tie.

Step 5 Remove the cable tie along the cable, and pull out the connector of the old encoder battery. Fix the cable of the new encoder battery with a cable tie.

Step 6 Install the interface panel and base side door of the robot as they are.

Step 7 After the battery of the robot is replaced, power on the robot for 30 s and then power it off before it can be powered on for other operations. Otherwise, the new battery will be discharged excessively.

Notes:

- Be sure to take out the old encoder battery after the new encoder battery is completely connected. If the encoder is powered off, the robot will lose zero, and zero calibration is required.
- Remove the old cable ties from the control cabinet. Do not leave sundries in the control cabinet. Removed old batteries must be recycled at designated locations.

5.5 Replacement and maintenance of controller assembly

The controller is located in the robot base. To replace the controller, remove the back and side panels of the base. The position of the controller is shown in Figure 5-16.

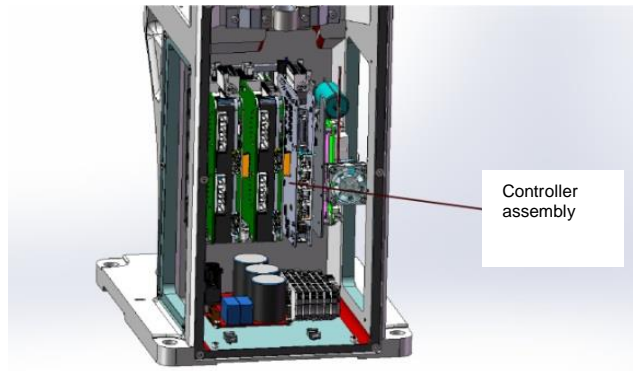


Figure 5-16 Position of controller assembly

Tools: Allen wrench, cable tie, diagonal pliers, controller assembly, anti-static gloves.



Back up the data before replacing the controller. After replacement, copy the configuration file of the old controller into the new controller to avoid parameter loss, and then re-calibrate the zero point of the robot. (In case of any problems that cannot be solved by yourself, contact QKM.)

Step 1 Refer to Section 4.2.2 Base side door to remove the base side door from the robot.

Step 2 Refer to Section 4.2.3 Interface panel to remove the interface panel from the robot.

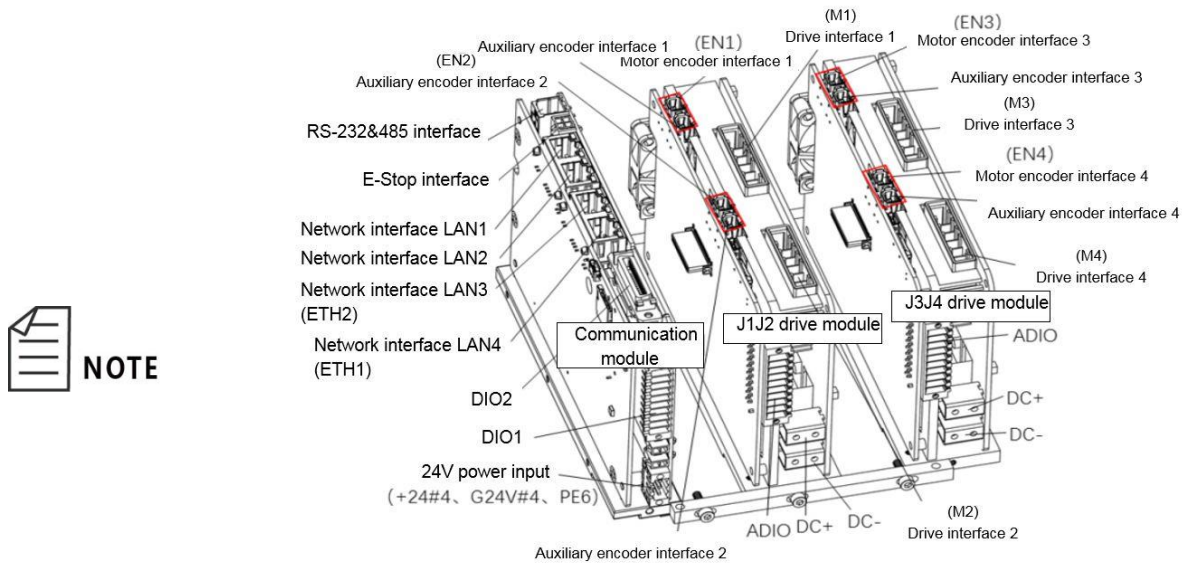
Step 3 Unplug all cables connected to the controller, unscrew the 4 M4*10

hexagon socket cap screws fixing the controller assembly, and then take out the controller assembly. It is shown in the figure.

Step 4 After removing the old control assembly, install a new controller assembly in the base and tighten the screws. Reconnect all the cables to the corresponding connectors of the new controller assembly.

At the time of installation, users shall check whether the interfaces match the line labels, as shown in Figure 5-17.

Avoid damage to the controller due to wrong connection. The line labels corresponding to each interface are shown below:



NOTE

Figure 5-17 Distribution of controller interfaces

Step 5 Restore the back and side panels of the base.

5.6 Replacement and maintenance of IO-free-distribution

PCBA

The IO-free-distribution PCBA is located on the interface panel in the base. To replace and maintain it, the base interface panel needs to be removed.

The position of the PCBA is shown in Figure 5-18.

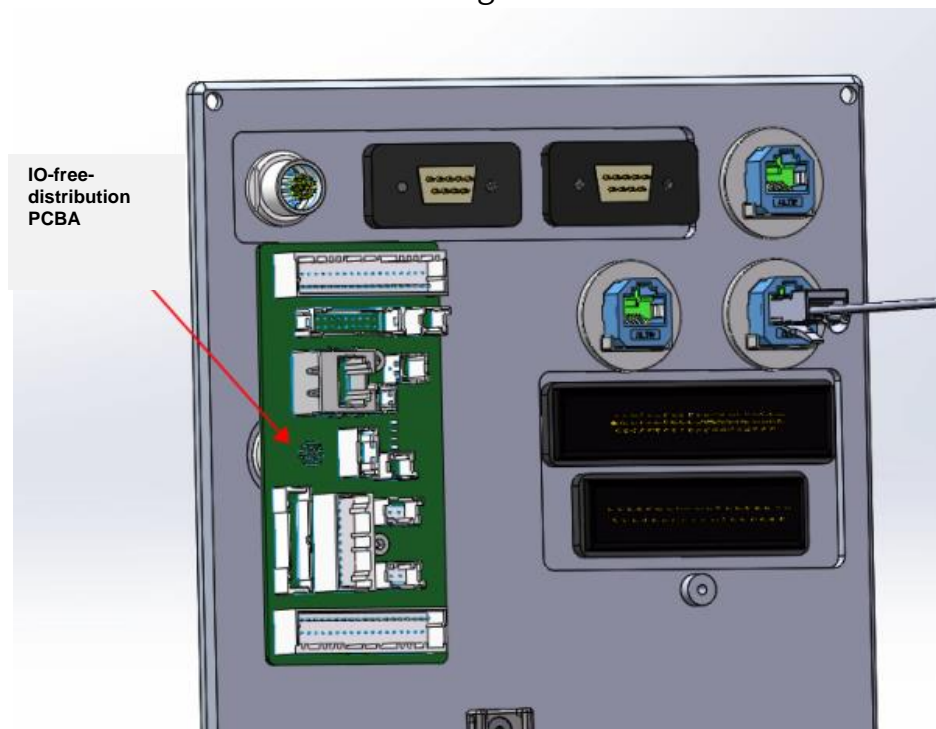


Figure 5-18 Position of the IO-free-distribution PCBA

Tools and accessories: Allen wrench, special assembly and disassembly tool for aviation plug, cable tie, diagonal pliers, anti-static gloves.

Step 1 Refer to Section 4.2.3 Interface panel to remove the interface panel from the robot.

Step 2 Unplug all cables connected to the IO-free-distribution PCBA.

Step 3 Use the Allen wrench to remove the fastening screws from the IO-free-distribution PCBA.

Step 4 Use the special assembly and disassembly tool for aviation plug to remove the IO-free-distribution PCBA.

Step 5 Install a new IO-free-distribution PCBA on the interface panel and lock it.

Step 6 Plug all cables into the corresponding interfaces on the new IO-free-distribution PCBA.

At the time of installation, users shall check whether the interfaces match the line labels, as shown in Figure 5-19.

Avoid damage to the controller cable due to wrong connection. The line labels corresponding to each interface are shown in the figure:

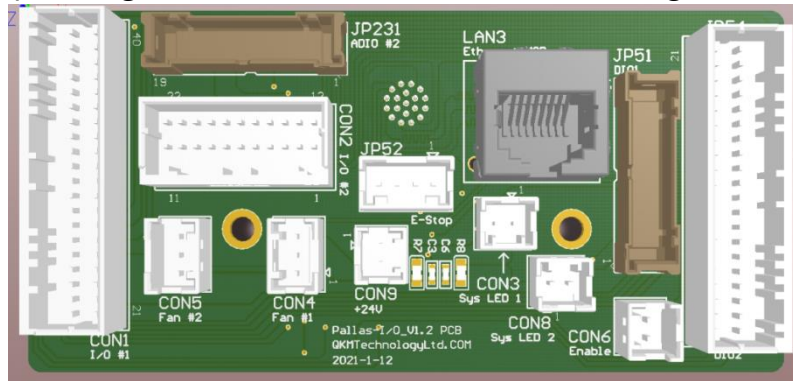


Figure 5-19 PCBA interfaces

Step 7 Install the base interface panel of the robot as it is.

5.7 Replacement and maintenance of surge suppressor

The surge suppressor is located on the interface panel of the robot. To replace it, it is required to remove the robot interface panel. The position of the surge suppressor is shown in Figure 5-20.

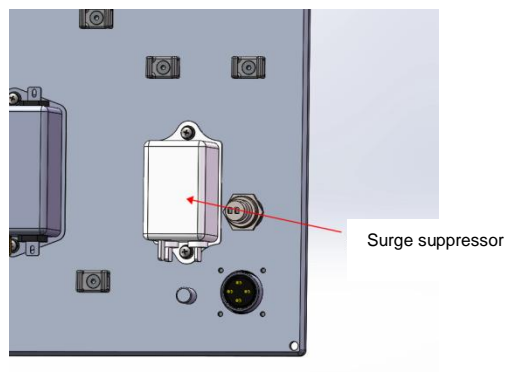


Figure 5-20 Position of the surge suppressor

Tools and accessories: cross screwdriver, cable tie, diagonal pliers, surge

suppressor, anti-static gloves.

Step 1 Refer to Section 4.2.3 Interface panel to remove the interface panel from the robot.

Step 2 Unplug all cables from the surge suppressor.

Step 3 Use the cross screwdriver to remove the surge suppressor.

Step 4 Install a new surge suppressor on the interface panel and lock the screws. Connect all cables to the new surge suppressor.

At the time of installation, users shall check whether the interfaces match the line labels as shown in Figure 5-21 and avoid damage to the controller due to wrong connection.

The line labels corresponding to each interface are shown below:

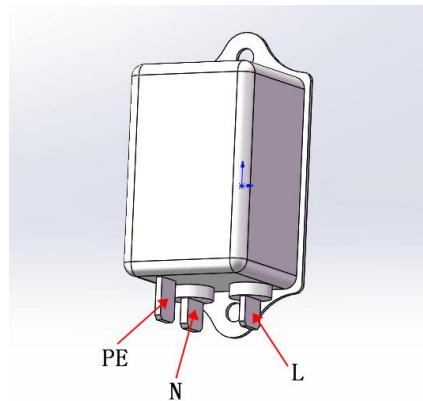


Figure 5-21 Interfaces of the surge suppressor

Step 5 Install the base interface panel of the robot as it is.

5.8 Replacement and maintenance of filter

The filter is located on the interface panel of the robot. To replace it, it is required to remove the robot interface panel first.

The position of the filter is shown in Figure 5-22

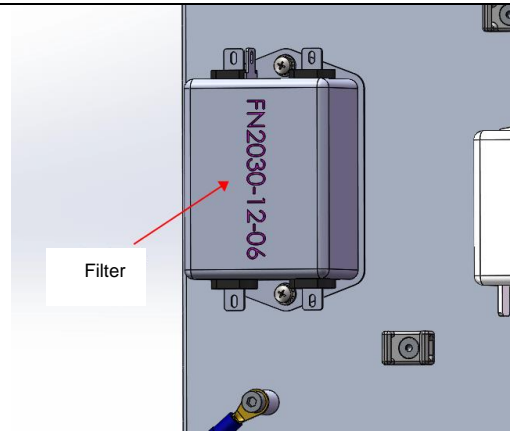


Figure 5-22 Position of the filter

Tools and accessories: cross screwdriver, cable tie, diagonal pliers, filter, anti-static gloves.

Step 1 Refer to Section 4.2.3 Interface panel to remove the interface panel from the robot.

Step 2 Unplug all cables connected to the filter.

Step 3 Use the cross screwdriver to remove the filter.

Step 4 Install a new filter on the interface panel and lock the screws.

Connect all cables to the new filter.

At the time of installation, users shall check whether the interfaces match the line labels, as shown in Figure 5-23.

Avoid damage to the controller due to wrong connection. The line labels corresponding to each interface are shown below:

 **NOTE**

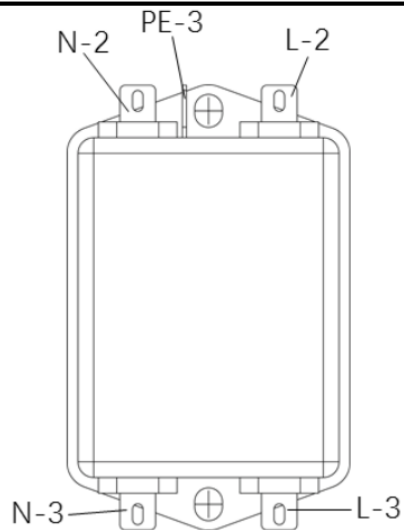


Figure 5-23 Interfaces of the filter

Step 5 Install the base interface panel of the robot as it is.

5.9 Replacement and maintenance of brake PCBA

The brake PCBA is located in the second joint of the robot. To replace it, open the second joint cover first.

The position of the brake PCBA is shown in Figure 5-24.

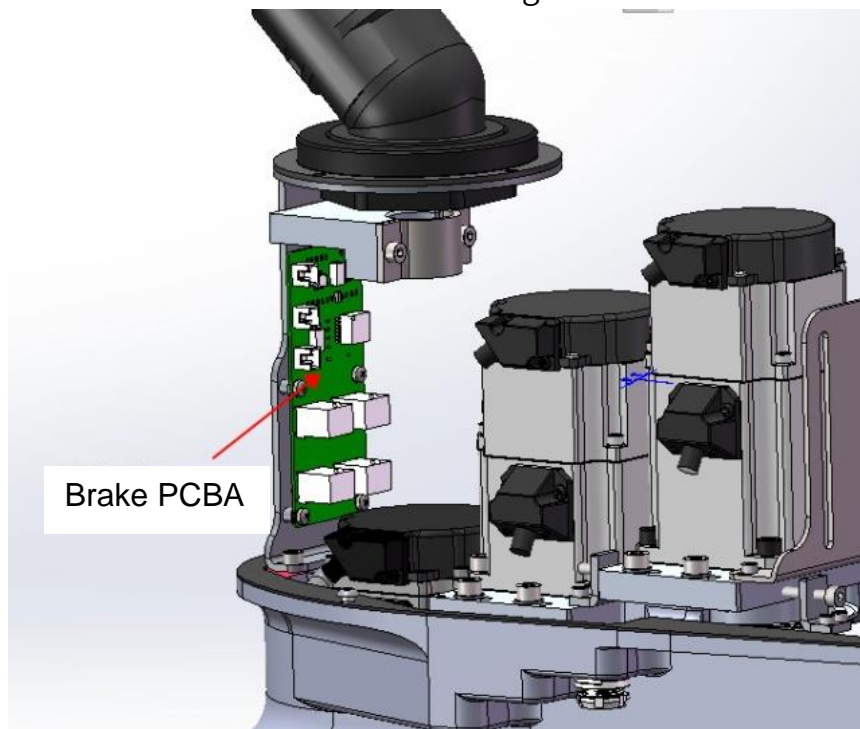


Figure 5-24 Position of the brake PCBA

Tools and accessories: Allen wrench, cable tie, diagonal pliers, brake PCBA, anti-static gloves.

Step 1 Refer to Section 4.2.1 Robot cover to remove the 2-axis cover from the robot.

Step 2 Unplug all cables connected to the brake PCBA.

Step 3 Use the Allen wrench to remove the brake PCBA.

Step 4 Install a new brake PCBA and tighten the screws, then connect all cables to the new brake PCBA.

At the time of installation, users shall check whether the interfaces match the line labels, as shown in Figure 5-25.

Avoid damage to the controller due to wrong connection. The line labels corresponding to each interface are shown below:

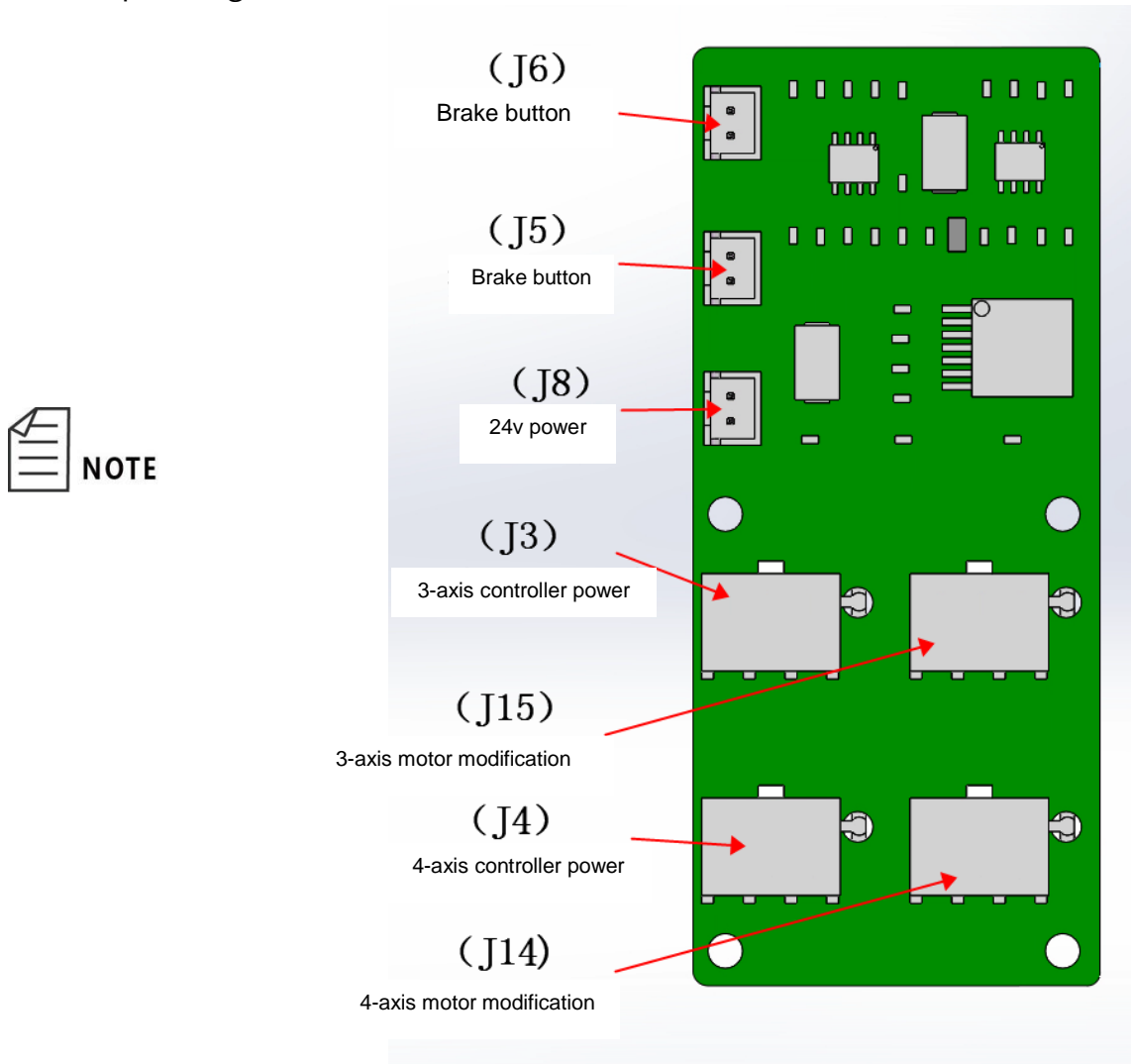


Figure 5-25 Interfaces of the brake PCBA

Step 5 Install the 2-axis cover on the robot as it is.



Providing excellent robot products and services for global manufacturing enterprises

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