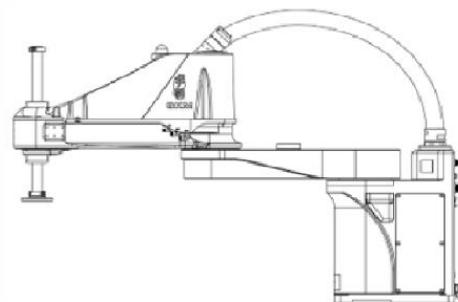


AH20 Robot

Maintenance Manual



Maintenance Manual

AH20 Robot

AH20-0850-0204-2000

AH20-0850-0204-4000

AH20-1050-0204-2000

AH20-1050-0204-4000

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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.

Overview

This manual provides detailed information on the routine maintenance and safety inspection of AH20 Robot, as well as the maintenance of mechanical and electrical components, so that users can better use AH20 Robot; this manual can serve as a reference for system integrators to design user workstation systems by using our AH20 Robot, and can also be used to guide system installation, commissioning and maintenance.

Target readers

This manual is for the reference of:

Electrical Engineer

Maintenance Engineer

Mechanical Engineer

Technical Support Engineer

Signs

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 injury or death 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 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

 is the trademark of QKM, and QKM possesses the ownership of the trademark.

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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V1.0.1	September 21, 2022	The description of encoder battery maintenance in Section 5.2 was modified.

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Chapter 1 Safety Precautions

Before starting maintenance on the robot, please read all the following 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 laws and regulations of relevant countries 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

The discontinuation, storage and waste disposal of the robot and related parts must be handled in accordance with relevant laws, regulations and standards to protect the environment.



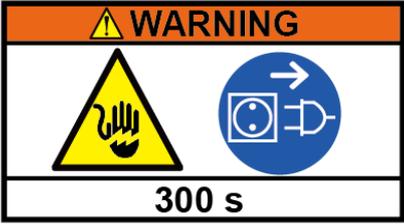
- Be sure to unplug the power cable and lock the power supply when the robot is not used.
 - Be sure to connect the AC power cable to the power plug when using the robot. Do not connect directly to the factory power supply.
 - Be sure to make replacement after turning off the controller and the related equipment and unplugging the power plug. If the replacement is performed while the power is on, it may cause electric shock or malfunction.
 - 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 connector panel while the robot is powered on.
-

1.3 Warning sign

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

SN	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

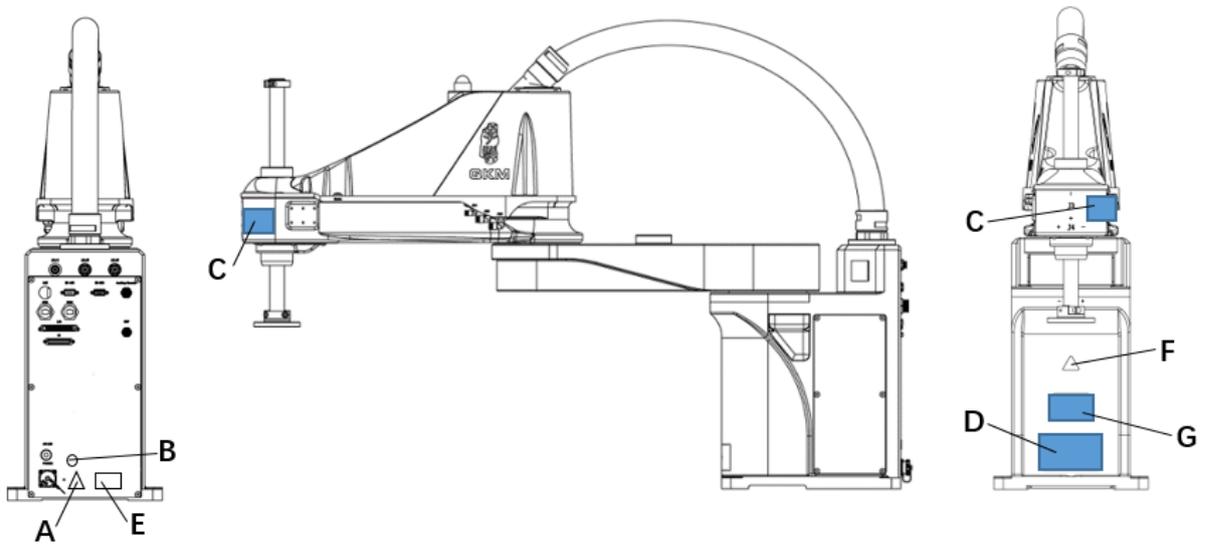


Figure 1-1 Position of warning sign

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:

- use beyond specified operating range;
- unsafe use of electricity;
- non-use of additional protective devices;
- use beyond specified environmental requirements;
- use under overload conditions;
- 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.

➤ Dangerous 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 E-stop device

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.



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 E-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 the safety performance of 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 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 connector panels of the robot body and mechanical arm 2 are properly connected to air supply.

➤ Inspection of cables:

- Check whether the cable at the Ethernet connector is loose.
- Check whether the connectors of cables on the connector 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 "AH20 Robot User Manual". The actual maintenance cycle depends on the operating frequency of the robot.

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 3-1 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 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:

- E-stop switch provided by user to operate the robot.
- E-stop switch on the manual control pendant (if user is provided with a manual control pendant).

- Manual-automatic switch on the manual control pendant (if user is provided with a manual control pendant).
- Servo enable switch on the manual control pendant (if user is provided with a manual control pendant).

3.5 Handling of common exceptions

Table 3-2 Handling of common exceptions

Common Exception	Possible Cause	Handling
Abnormal E-stop	Failure in robot E-stop line.	<ul style="list-style-type: none"> ● Ensure that the E-stop switch is not pressed. ● Check whether the E-stop switch is damaged. ● Replace the E-stop switch.
Unable to connect robot	Failure in PC network settings.	<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.
	Multiple network cards exist on the PC.	Disable all other network cards on the PC except the one connected to the robot.
	Ethernet connector or network cable is damaged.	<ul style="list-style-type: none"> ● Replace the Ethernet connector. ● Replace with another network cable.

RS-232 communication connector fails in communication	Connector is damaged or plug is not inserted properly.	<ul style="list-style-type: none"> ● Replace the damaged connector. ● Properly connect the plug.
	Improper parameter configuration.	Reconfigure parameters of communication connector.
I/O communication connector fails	I/O plug is damaged.	Check whether the I/O line is properly connected. Replace the I/O plug.
Fan failure alarm	<ul style="list-style-type: none"> • The plug of the fan assembly is not inserted properly. • The fan is damaged. 	<p>Check whether the fan cables are connected normally.</p> <p>Check whether the fan is damaged.</p> <p>Replace the fan assembly.</p>

Chapter 4 Maintenance of Mechanical Components

4.1 Lubrication of spline screw shaft

4.1.1 Standard robot



NOTE

- Grease usage: Check whether there is grease in the groove of the spline screw 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 grease may cause abnormal wear, noise, etc. Check the grease on the spline screw shaft regularly. If much lubricating grease is applied or the grease is unevenly applied, grease dripping may occur.

There will be 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 shaft	Non-food industry
AZ food machinery grease	Micro-vibration	Stable, nonhazardous	Spline 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 YAMABALA KY1106 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.

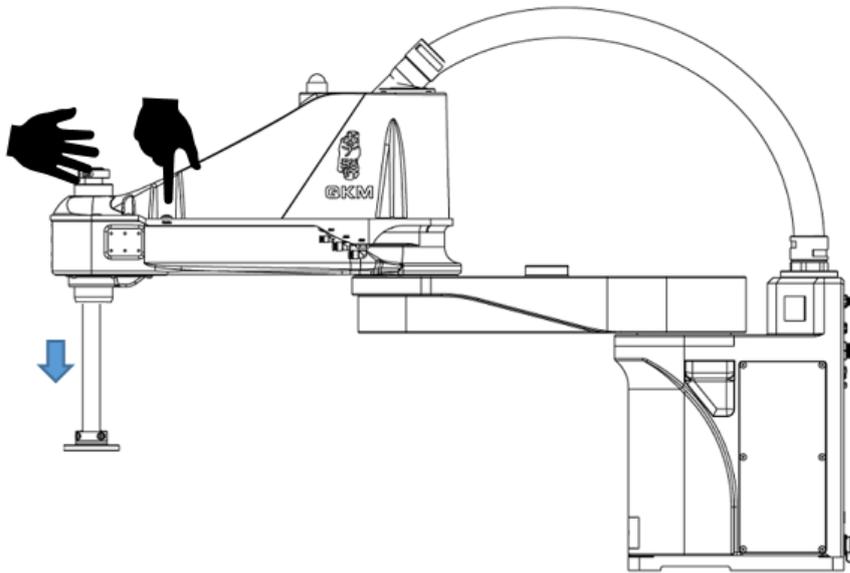


Figure 4-2 Push down the spline screw shaft

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

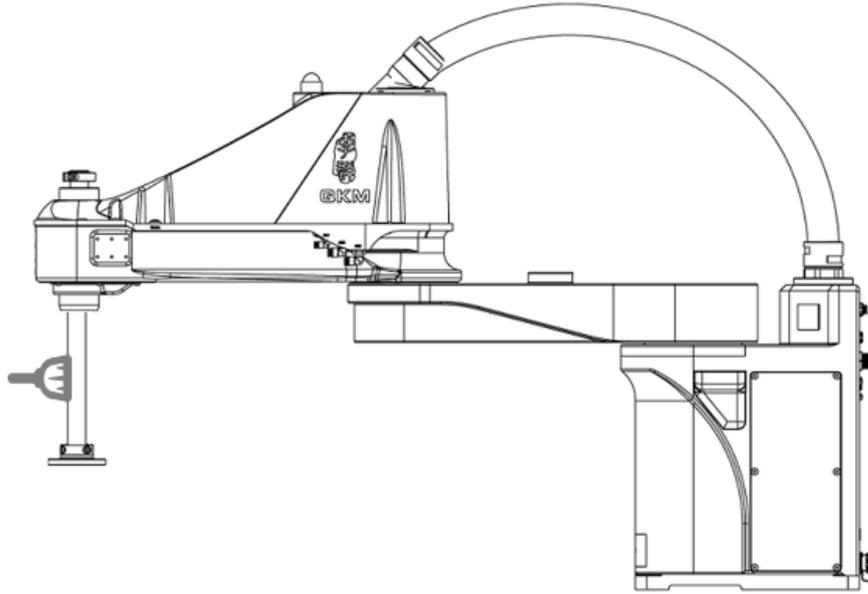


Figure 4-3 Apply lubricating grease

Step 3 Hold the end of the screw, then press the brake button and push the spline screw shaft up to the top, as shown in Figure 4-4.

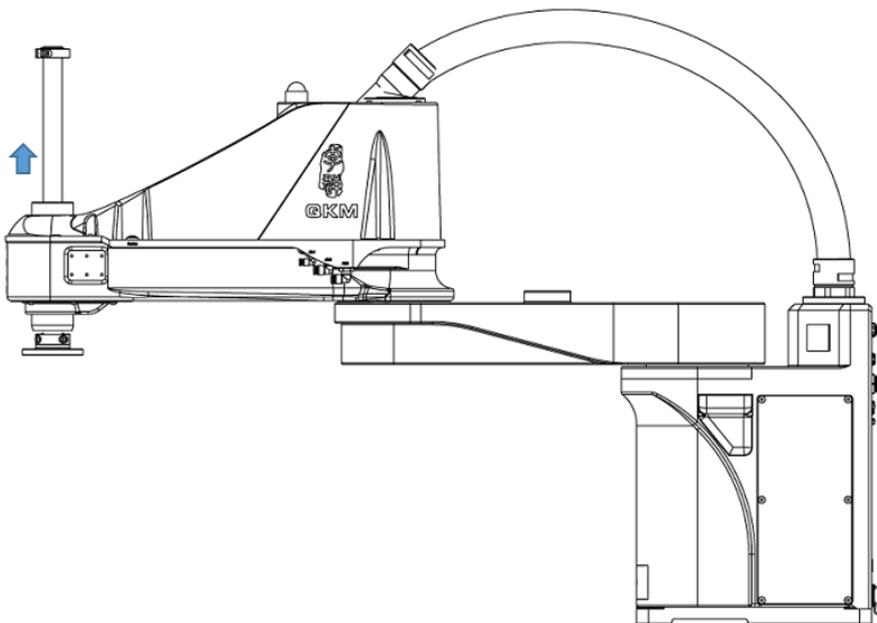


Figure 4-4 Push up the spline screw shaft

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.



Into the eyes: Rinse carefully and thoroughly with water and seek medical advice.

Into the mouth:

- Do not induce vomiting if swallowed. Seek medical attention immediately.
- If your mouth is soiled, rinse your mouth thoroughly with water.

Adhered to the Rinse with water and soap.

skin:

4.1.2 Protective robot

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 4.2.1 (*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 screws of the robot.

4.2 Removal and installation of 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
	Circlip for hole	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
	Circlip for hole	1
	Telescopic protective cover	1
	Coupling	2

4.2.1 Removal of protective cover

Material preparation before installation:

Table 4-2 Accessories

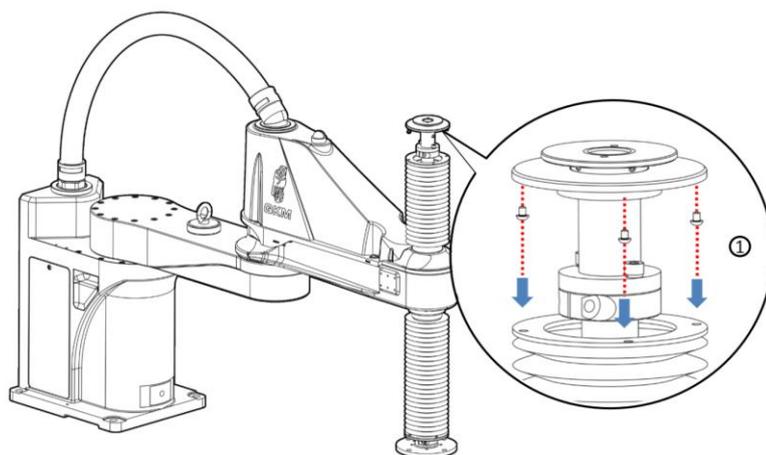
Tools	Qty
Allen wrench	1
Straight screwdriver	1
Protective gloves	1

The installation steps are as follows:

Step 1 Check whether the robot is equipped with a protective cover.

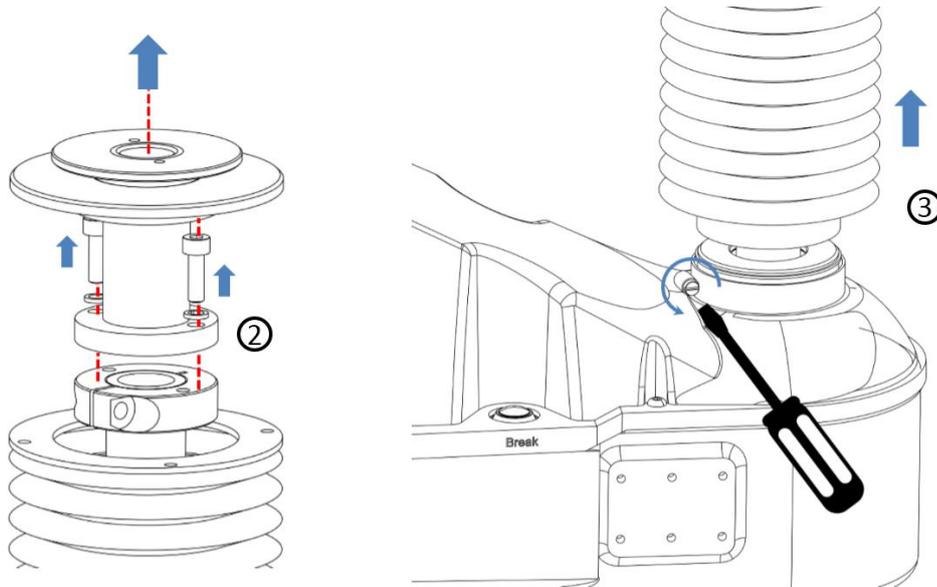
Step 2 Remove the protective cover at the upper end of the screw.

- ① Use 2.5 mm Allen wrench to remove the 4*M3 fastening screws from the protective cover at the top of the screw, as shown in the figure below.



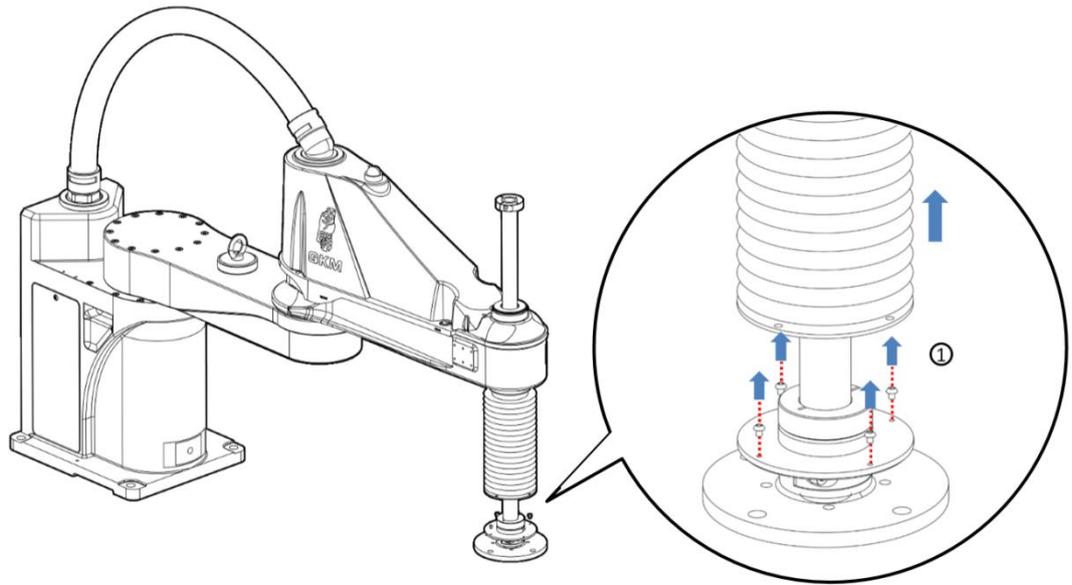
- ② Use 4 mm Allen wrench to remove the 2*M5 fastening screws from the extension rod assembly of the protective cover and properly place it.

- ③ Use the straight screwdriver to remove the fastening screws from the coupling at the bottom of the protective cover at the upper end of the screw; remove the protective cover and the coupling in upward direction and place them properly, as shown in the figure below.

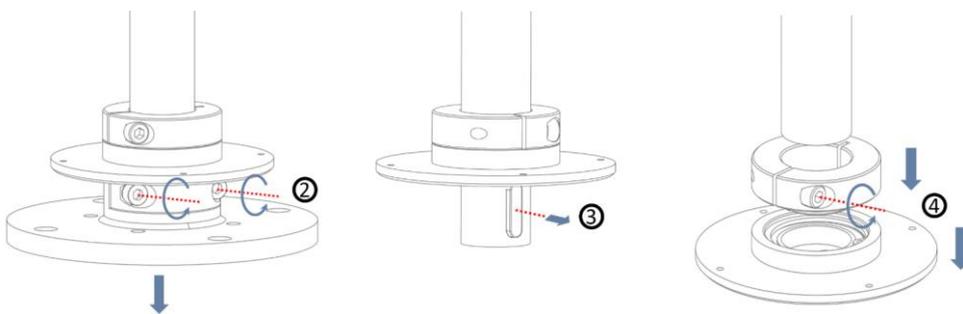


Step 3 Remove the protective cover at the lower part of the screw.

- ① Use 2.5 mm Allen wrench to remove the 4*M3 fastening screws from the protective cover at the bottom of the screw, as shown in the figure below.

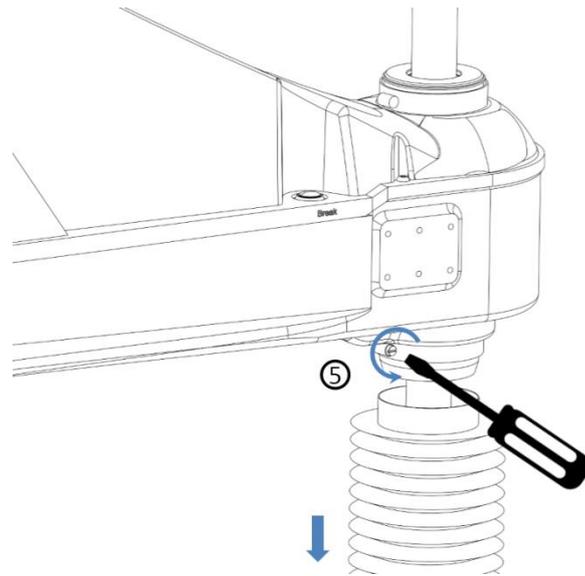


- ② Use 4 mm Allen wrench to loosen the 2*M5 fastening screws of the flange at the end of the screw, remove the end flange in downward direction and properly place it, as shown in the figure below.



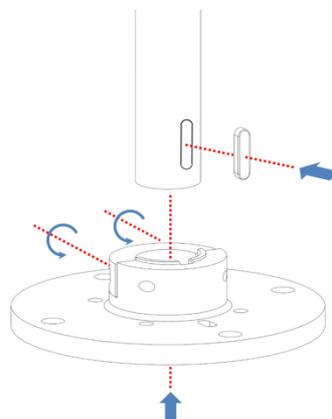
- ③ Use the flat-nose pliers to remove the flat key from the screw.
- ④ Use 4 mm Allen key to loosen the fastening screws of the bearing fixing ring, remove the bearing fixing ring and the connecting fastener in downward direction.
- ⑤ Use the straight screwdriver to remove the fastening screws from the

coupling at the top of the protective cover at the upper end of the screw, as shown in the figure below; remove the protective cover and the coupling in upward direction and place them properly.



Step 4 Reinstall the end flange.

Place the flat key into the keyway; install the flange by aligning with the keyway and push it up to the bottom of the screw to completely fit the flange, then use an Allen wrench to tighten the M5 screws with a torque of 10 N, as shown in the figure below.



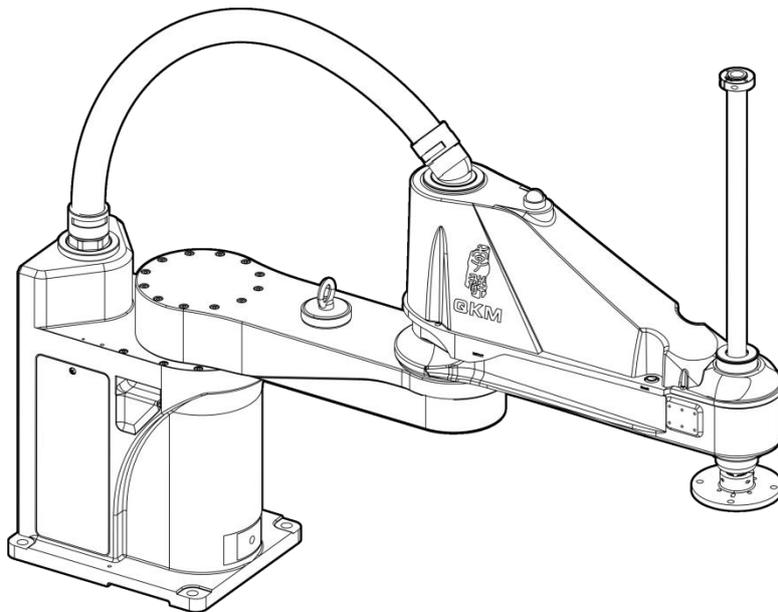
To tighten the fastening screws of the flange, pre-tighten the screws on one side, and then tighten the screws on the other



CAUTION

side, alternately perform the operation for 2 ~ 3 times until all the screws are tightened firmly; do not tighten up the fastening screws on one side at one time.

The robot whose protective cover has been removed is shown in the figure below.



Ensure that there are no other objects within the operating



CAUTION

range of the screw when it moves to the zero position to avoid accidents such as collision.

4.2.2 Installation of protective cover

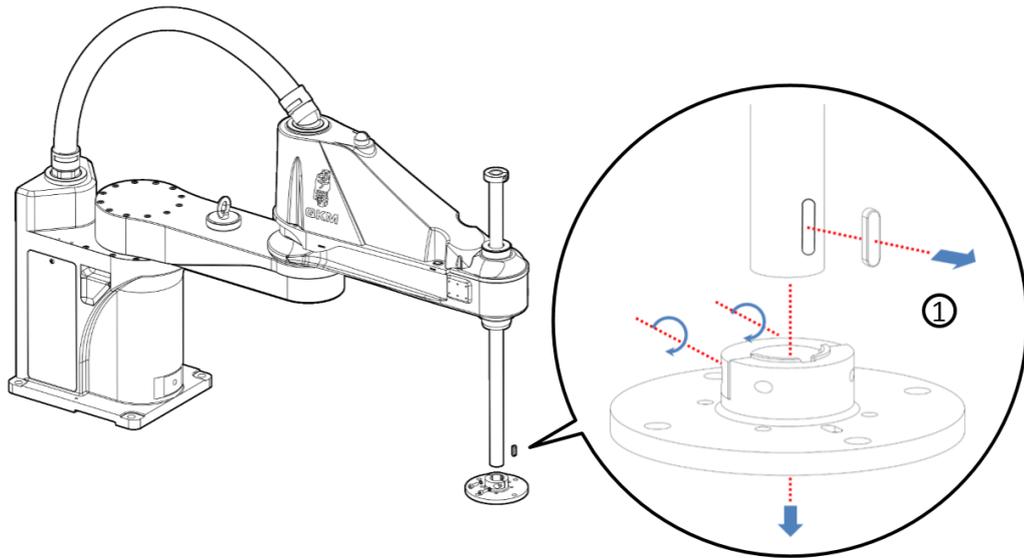
Preparation of accessories:

Table 4-3 Accessories

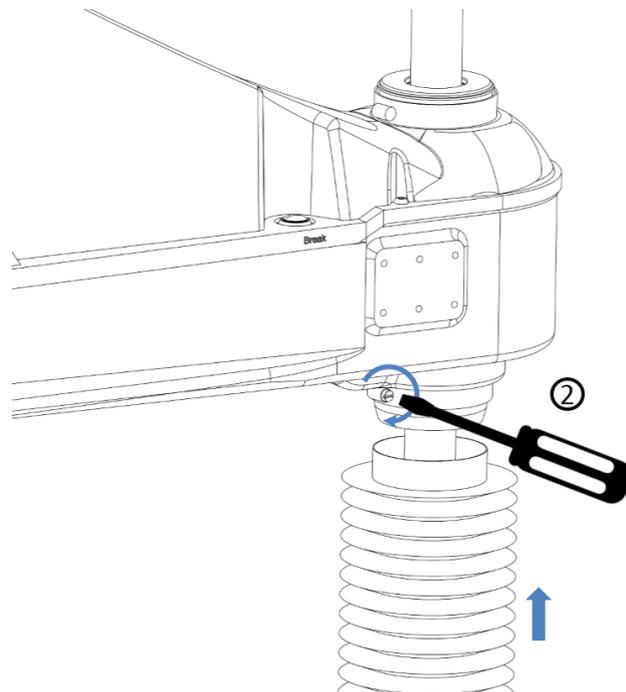
Tools	Qty
Spare parts	1 set
Allen wrench	1
Straight screwdriver	1
Protective gloves	1

Step 1 Install the protective cover at the lower end of the screw.

- ① Use 4 mm Allen wrench to loosen the fastening screws of the end flange, remove the flange in downward direction; use the flat-nose pliers to remove the flat key and properly place it, as shown in the figure below.

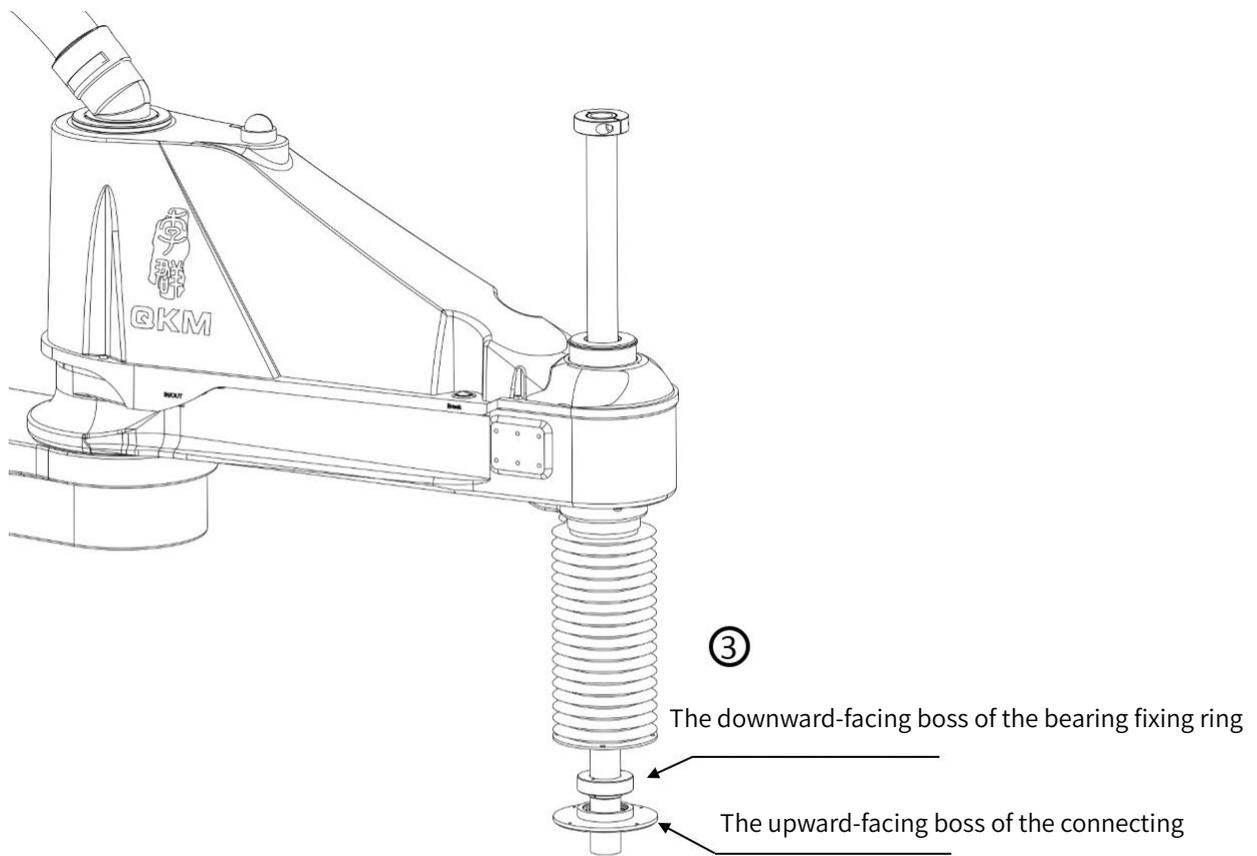


- ② Install the protective cover and the coupling, and tighten the fastening screws of the coupling after completely applying it to the top of the protective cover, as shown in the figure below.



- ③ Install the bearing fixing ring and the connecting fastener, loosen the fastening screws of the bearing fixing ring, apply it into the middle and upper part of the screw by placing its boss downward, and pre-tighten the screws; then apply it

into the connecting fastener by placing the boss of the connecting fastener upward, as shown in the figure below.

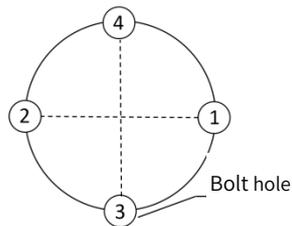


④ Install the end flange.

- i. Place the flat key into the keyway, then install the flange upward. Tighten the fastening screws of the flange after the bottom of the screw completely fits the contact surface of the flange.
- ii. Move the connecting fastener down along the screw until it is in full contact with the top of the flange.
- iii. Loosen the fastening screws of the bearing fixing ring and move the bearing fixing ring down along the screw until its boss contacts the

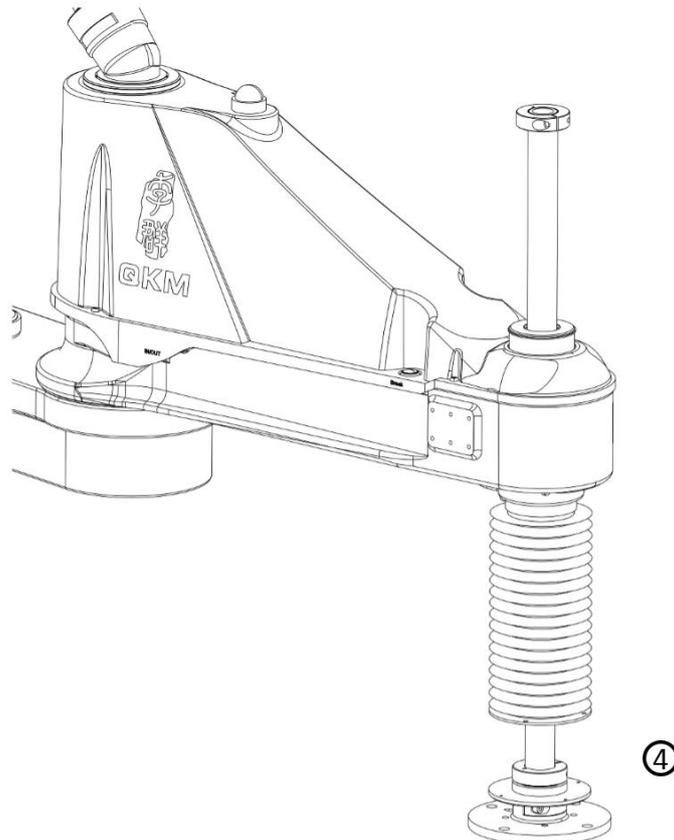
connecting fastener, then tighten the fastening screws of the bearing fixing ring.

- ⑤ Use 2.5 mm Allen key to install the protective cover and the connecting fastener.

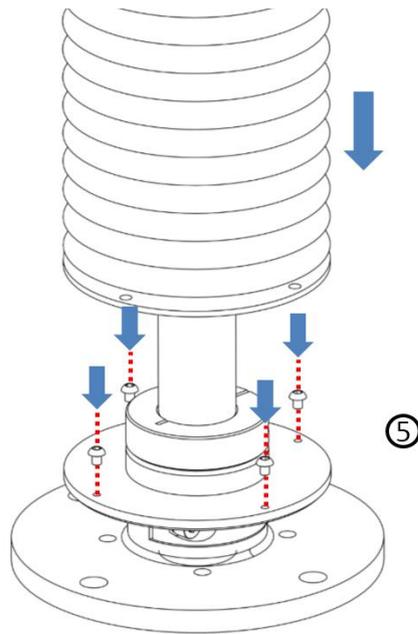


Do not screw in the bolt at one time when fixing.

Use an Allen wrench to tighten the bolt by 2 or 3 turns in accordance with the tightening sequence in the figure below.



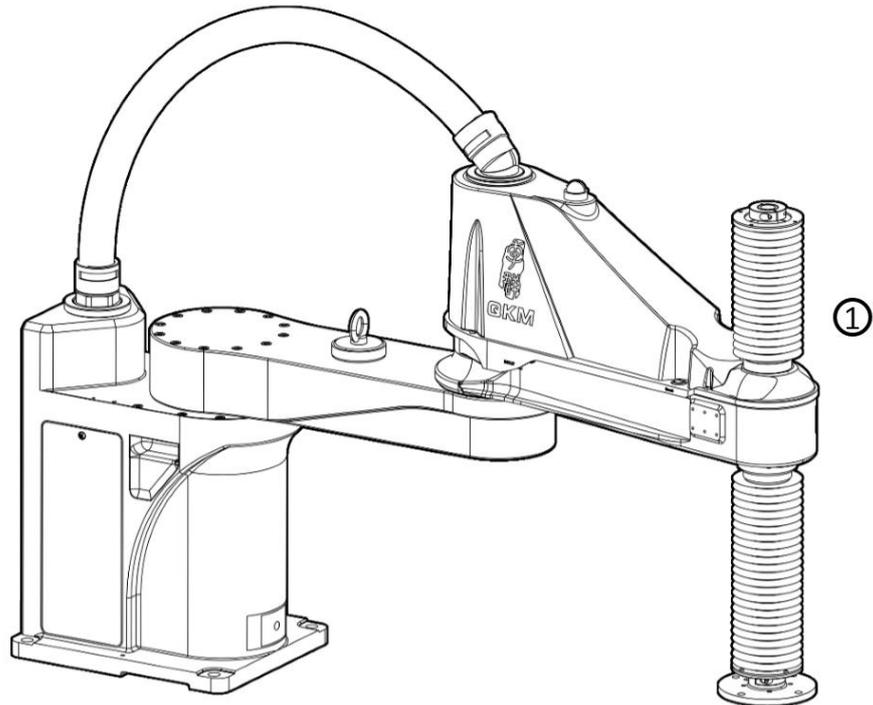
Install the end flange.



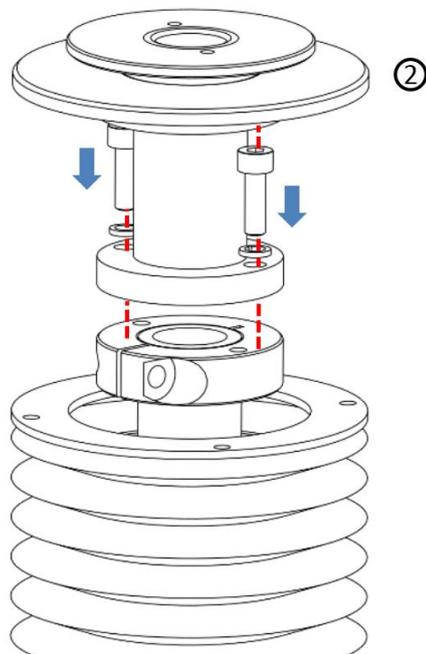
Install the protective cover.

Step 2 Install the protective cover at the upper end of the screw.

- ① Install the coupling and the protective cover, and tighten the fastening screws of the coupling after completely applying it to the bottom of the protective cover.

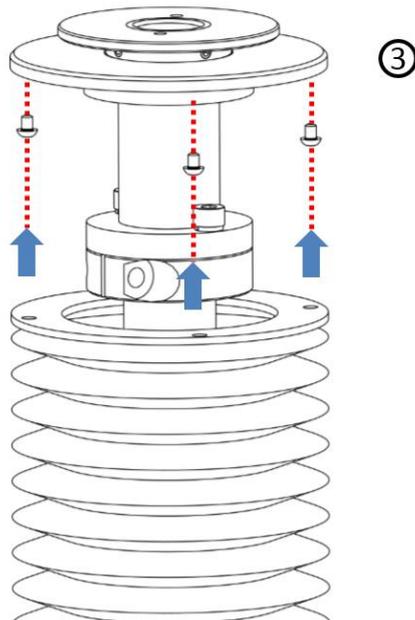


- ② Use 5 mm Allen wrench to install the extension rod assembly of the protective cover, as shown in the figure below.



- ③ Lock the protective cover in the protective cover extension rod assembly, and use 2.5 mm Allen wrench to install the protective cover and the protective

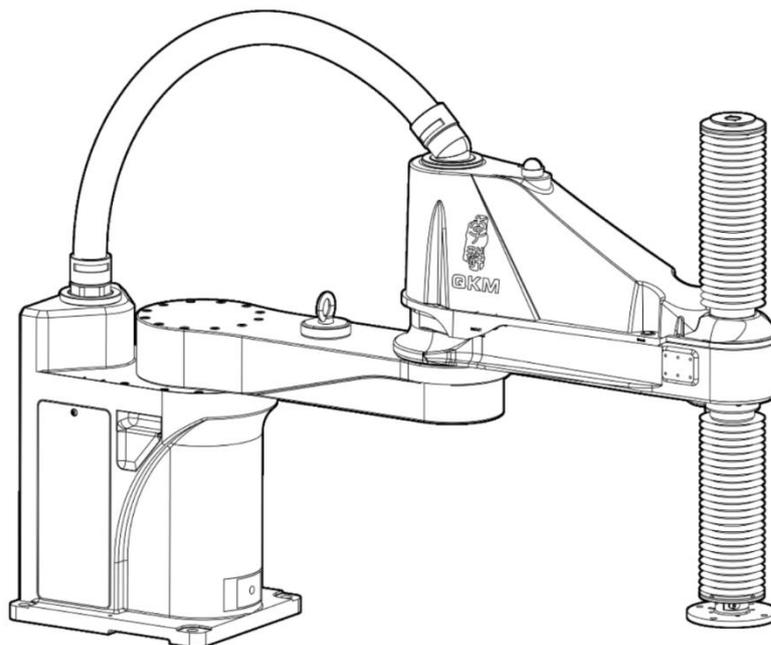
cover extension rod assembly, as shown in the figure below.



The robot equipped with the protective cover is shown in the figure below.



The Z-axis stroke of the robot equipped with the protective cover is reduced by 30 mm.



4.3 Cover



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

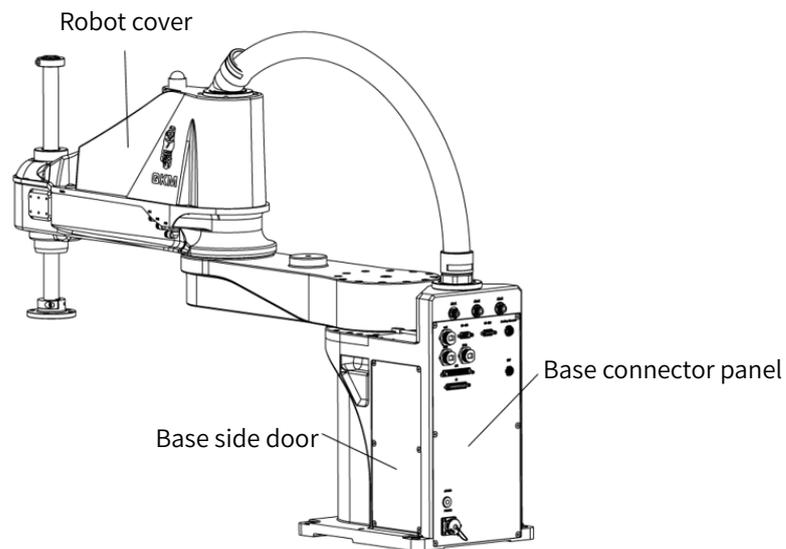


Figure 4-5 Diagram of robot covers

4.3.1 Robot cover

Tools: a set of Allen wrench, a straight screwdriver

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

Step 2 Use 2.5 mm Allen wrench to remove the fastening screws from the robot cover, as shown in Figure 4-6.

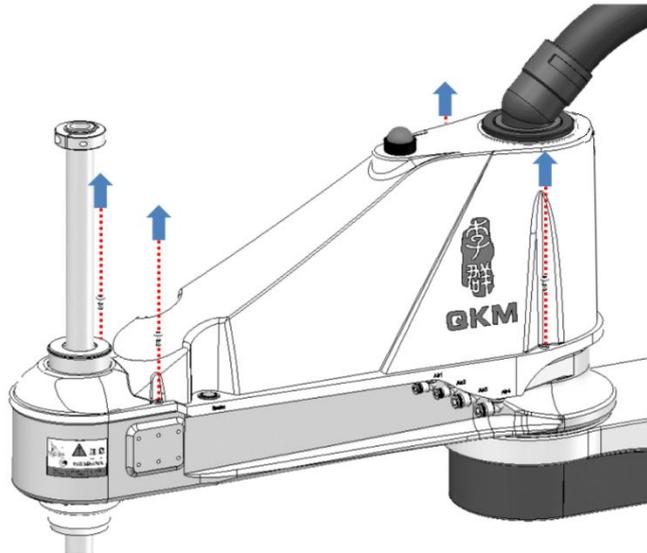


Figure 4-6 Removal of fastening screws

Step 3 Lift the robot cover as shown in Figure 4-7.

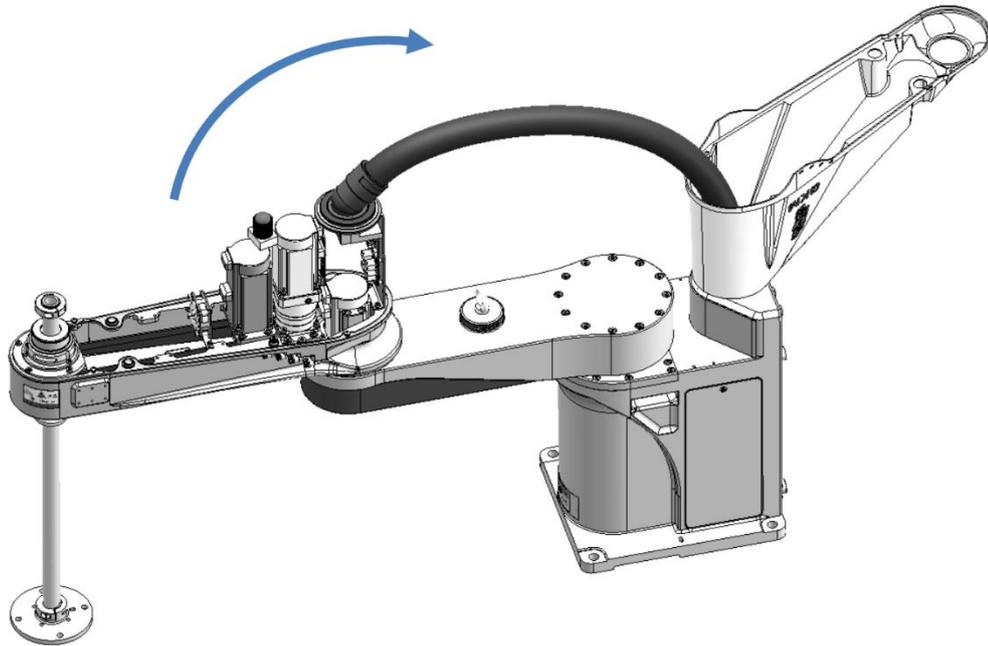


Figure 4-7 Lift the cover

4.3.2 Base side door

Tool: Allen wrench

Step 1 Use 2.5 mm Allen wrench to loosen the anti-off screws from the side door of the base, as shown in the figure.

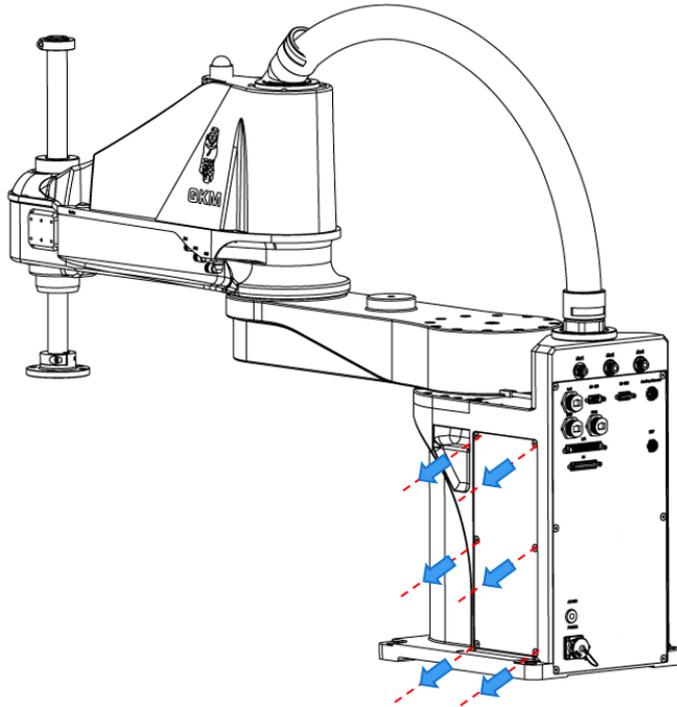


Figure 4-8 Removal of fastening screws

Step 2 Take out the side door of the base, as shown in Figure 4-9.

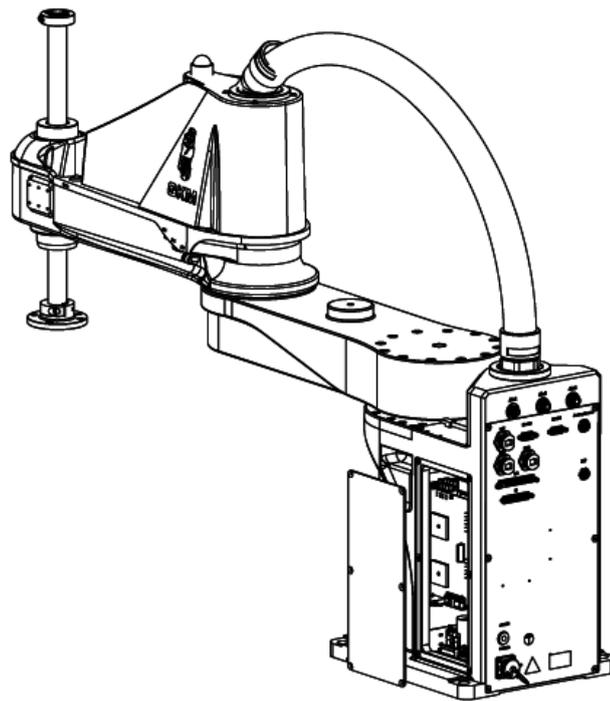


Figure 4-9 Take out the side door of the base

4.3.3 Connector panel

Tool: Allen wrench

Step 1 Use 2.5 mm Allen wrench to remove the fastening screws from the connector panel, as shown in Figure 4-10.

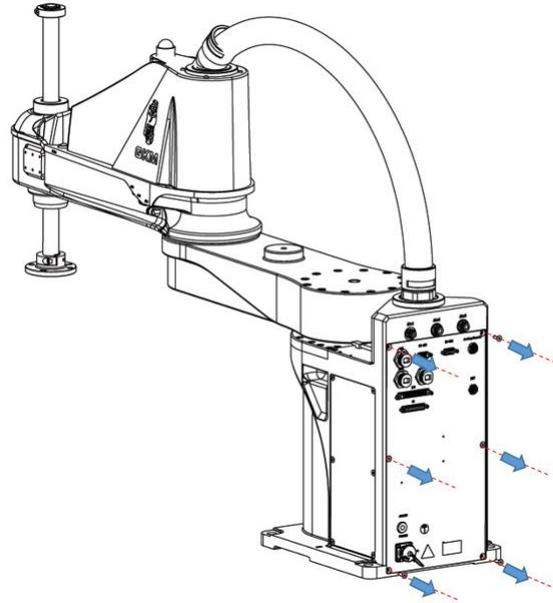


Figure 4-10 Remove the fastening screws from the connector panel

Step 2 Gently take the connector panel out by holding its upper end. Be careful not to break off the cables when taking it out, as shown in Figure 4-11.

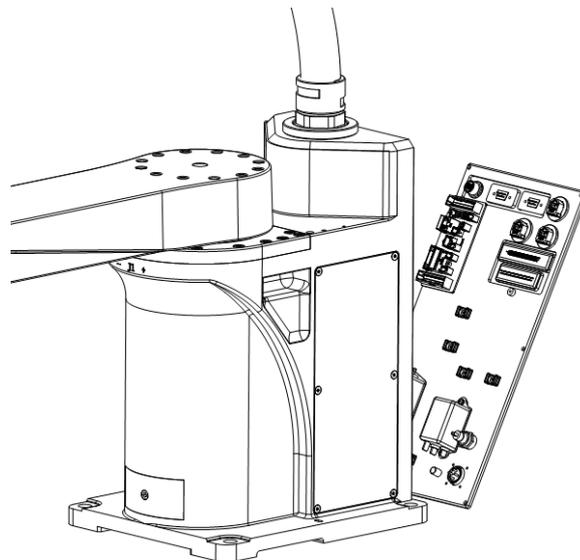


Figure 4-11 Open the connector panel



- Do not pull the connector 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 connector 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



Figure 4-12 Appearance of the instrument

- Screen

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

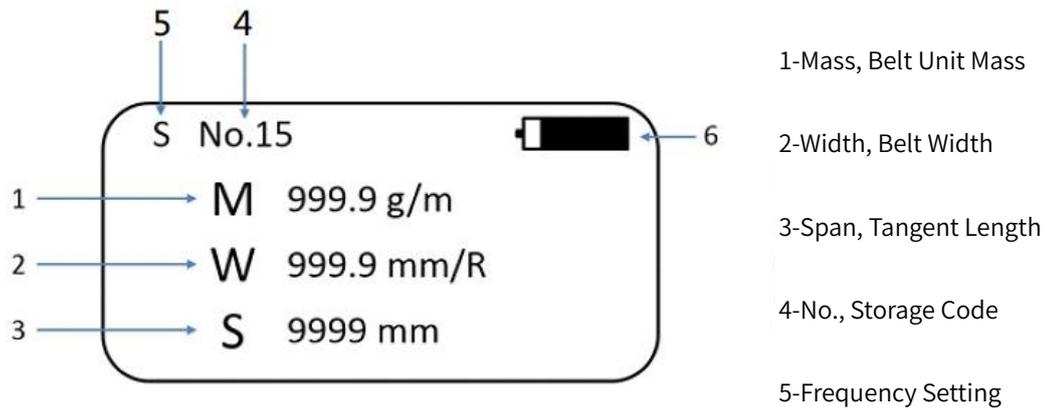


Figure 4-13 Introduction of the screen

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	Selection key (available to select set width)
0~8	Numeric key

- USB connector

The meter is equipped with a USB connector 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 setting

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 first.

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 curve 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 by following steps below: 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:

Table 4-4 Belt tension parameters

	Unit mass (g/m)	Width (mm)	Span (mm)	Standard tension $\pm 10\%/n$
--	--------------------	---------------	--------------	-------------------------------------

J3-axis drive belt	2.5	9	120	44
J4-axis primary drive belt	1.3	9	45	25
J4-axis secondary drive belt	1.3	20	75	100

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.
- 5,000 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.

4.4.5 Precautions

- 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 a 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

At the time of replacement, keep the removed components properly. To ensure that the appearance of the robot is not damaged, do not scratch the surface of the robot.



- 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 robot. If the power is turned on when there is a foreign object inside, electric shock or malfunction may be caused, which is very dangerous.
 - Maintenance operations should be done by electrical engineer or professional electrical operator, who should wear anti-static wrist strap or take other measures to prevent the electrical components of the robot from damage.
 - Do not forcibly pull the cables in the machine during
-

operation to prevent them from damage, disconnection or poor contact.

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 the figure.

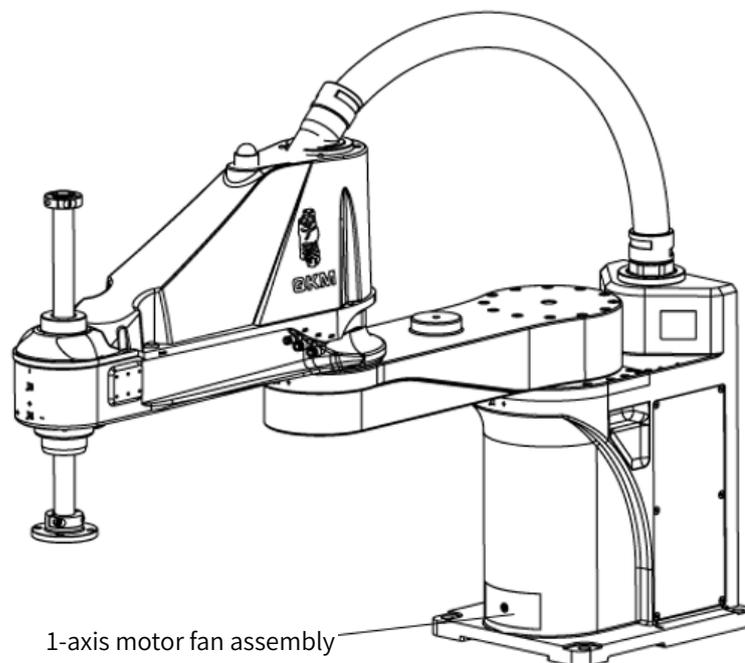


Figure 5-1 1-axis motor fan

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

Step 1 Tear off the warning sign, as shown in the figure.

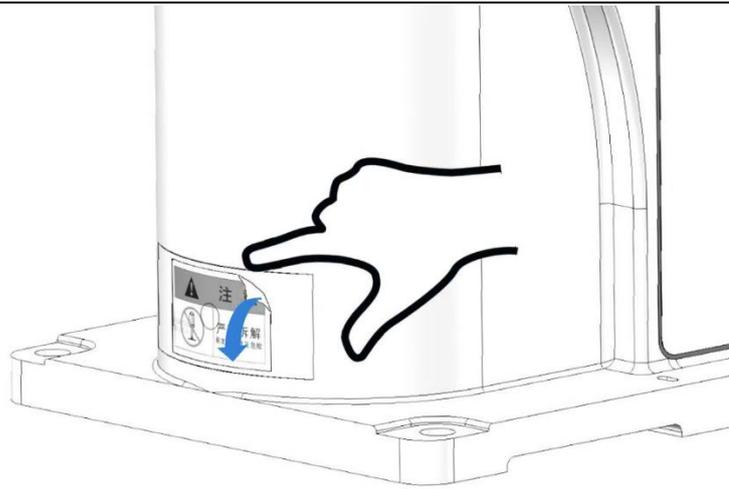


Figure 5-2 Tear off the warning sign

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

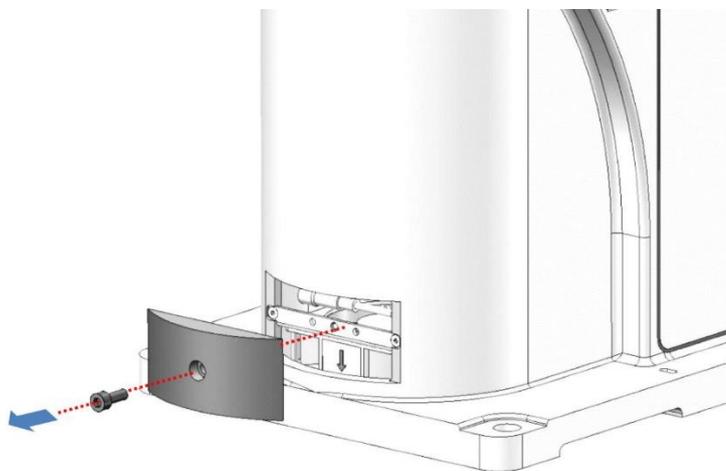


Figure 5-3 Take out the protective cover

Step 3 Use the Allen wrench to remove the fastening screws from the 1-axis fan assembly, as shown in the figure.

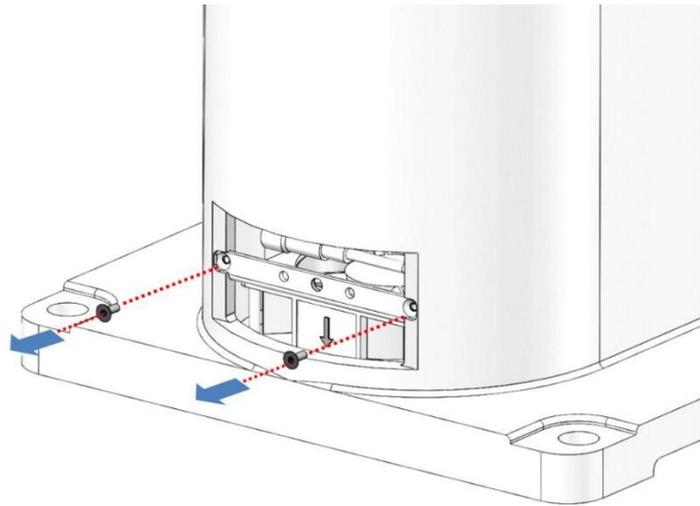


Figure 5-4 Remove the fan assembly

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 the figure.

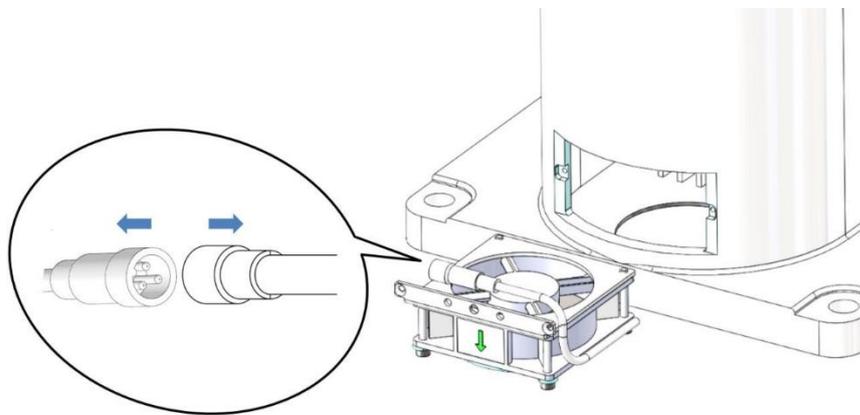


Figure 5-5 Take out the fan assembly

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 AH20 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 table and perform regular maintenance (as shown in the table below).

Table 5-1 Fan inspection and maintenance record

SN	Inspection time	Inspected by	Inspection content		Notes
			Replacement	Cleaning	

5.2 Replacement and maintenance of 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 5-6.

- 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, cable tie, diagonal pliers, encoder battery assembly, anti-static gloves.

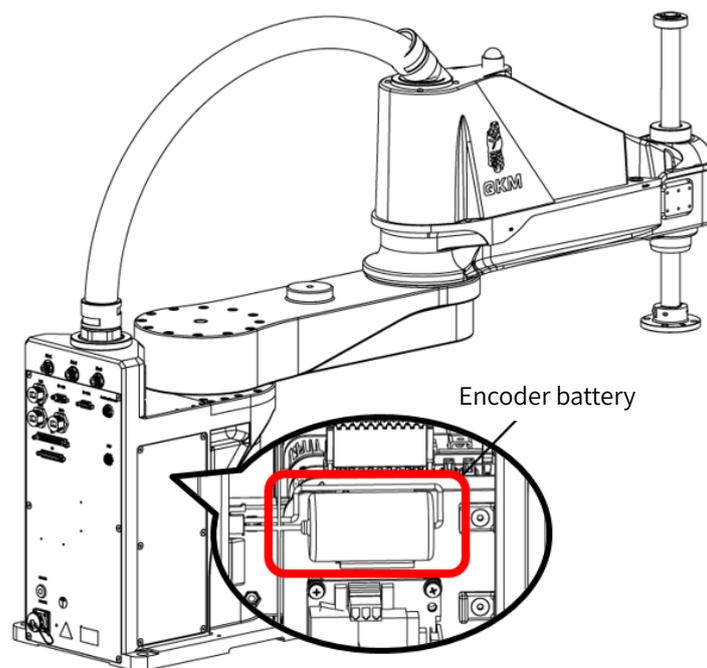


Figure 5-6 Encoder battery

Step 1 Refer to Section 4.3.2 to remove the base side door from the robot.

Step 2 Refer to Section 4.3.3 to remove the connector panel from the robot.

Step 3 Find the connector for backup battery on the connector panel, and install a new encoder battery, as shown in Figure 5-7.

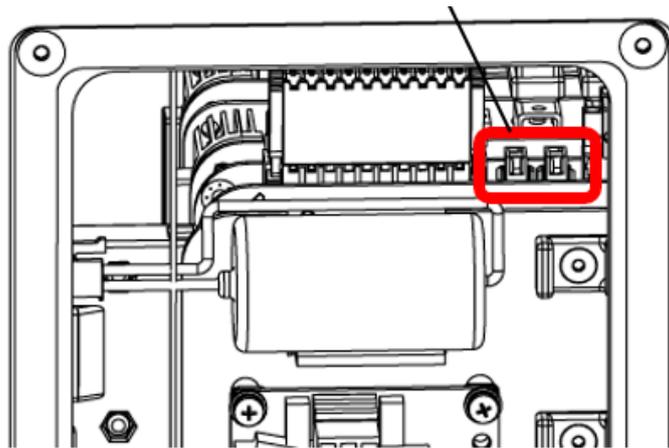


Figure 5-7 Position of encoder battery connector

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 connector 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.



- The robot will lose the zero point when the power supply for the encoder is interrupted. To avoid this, be sure to remove the old encoder battery after a new encoder

battery is fully connected.

- Remove the old cable ties from the electric control cabinet. Do not leave sundries in the electric control cabinet. Removed old batteries must be recycled at designated locations.
-

5.3 Replacement and maintenance of controller assembly

The controller is located in the robot base. To replace the controller, remove the back and side door of the base. The position of the controller is shown in Figure 5-8.

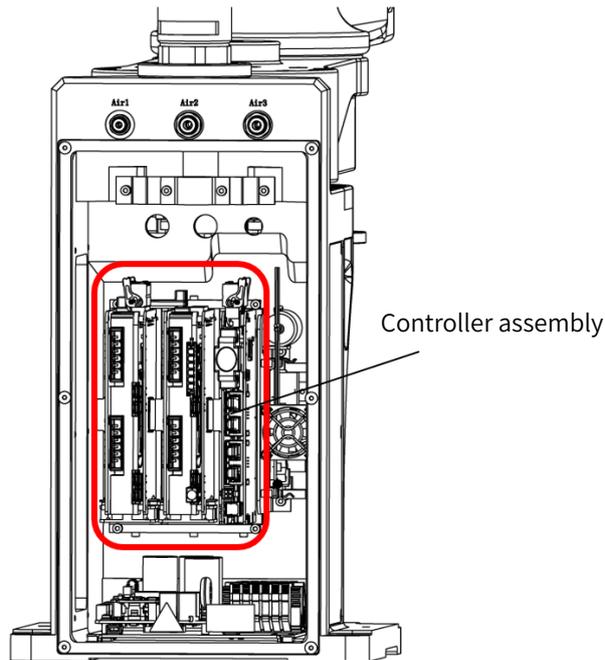


Figure 5-8 Controller assembly



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 which cannot be solved by yourself, contact QKM.)

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

Step 1 Refer to Section 4.3.2 (*Base side door*) to remove the base side door from the robot.

Step 2 Refer to Section 4.3.3 to remove the connector panel from the robot.

Step 3 Unplug all cables connected to the controller, unscrew the four M4*10 hexagon socket cap screws fixing the controller assembly, and then take out the controller assembly. It is shown in the figure. Remove the cables from old controller, unscrew the four M4*10 hexagon socket cap screws fixing the controller assembly, and then take out the controller assembly. It is shown in Figure 5-9.

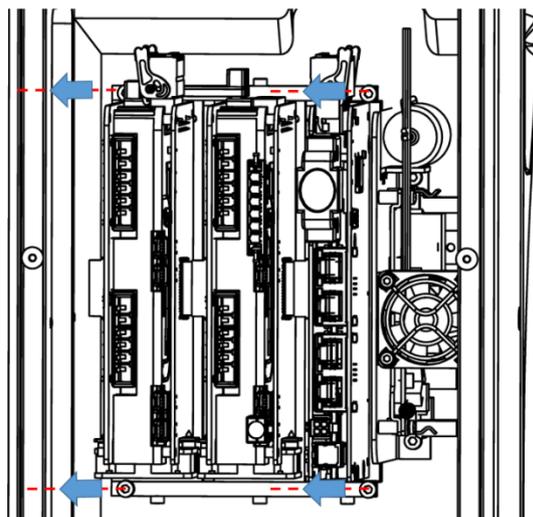
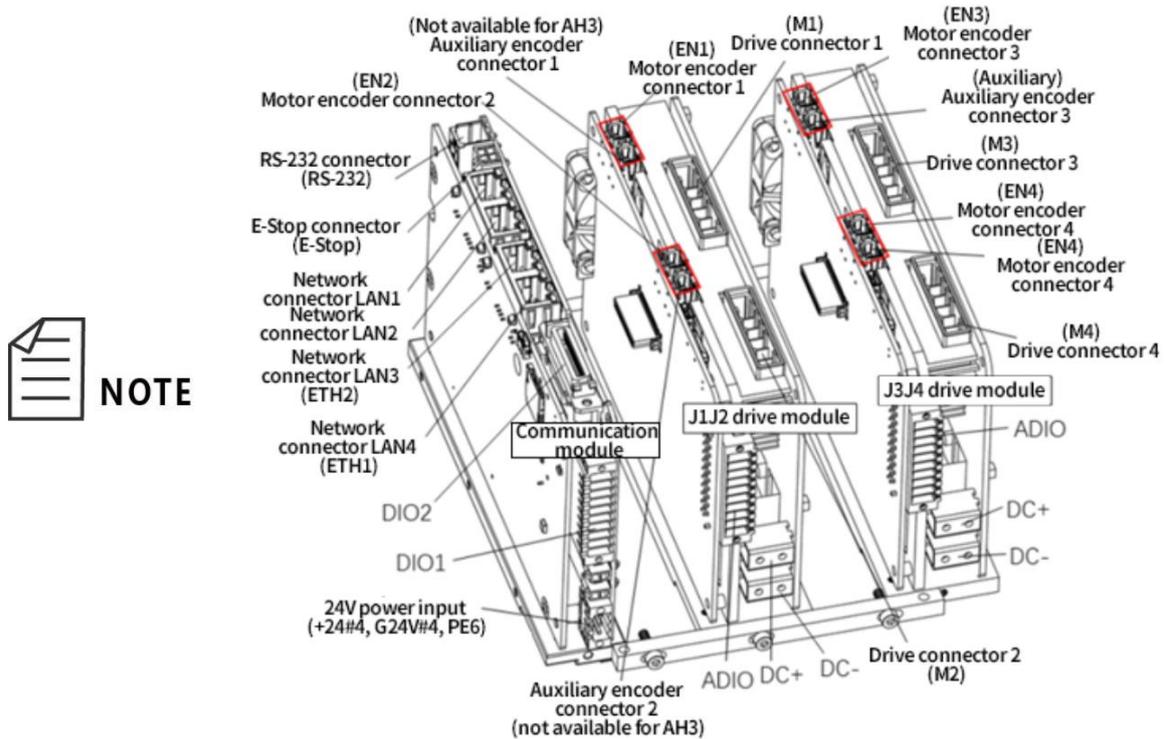


Figure 5-9 Remove the controller assembly

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 connectors match the line labels, as shown in the figure below.



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

5.4 Replacement and maintenance of IO-free-distribution PCBA

The IO-free-distribution PCBA is located on the connector panel of the base. To replace and maintain it, the base connector panel needs to be removed. The position of the IO-free-distribution PCBA is shown in Figure 5-10.

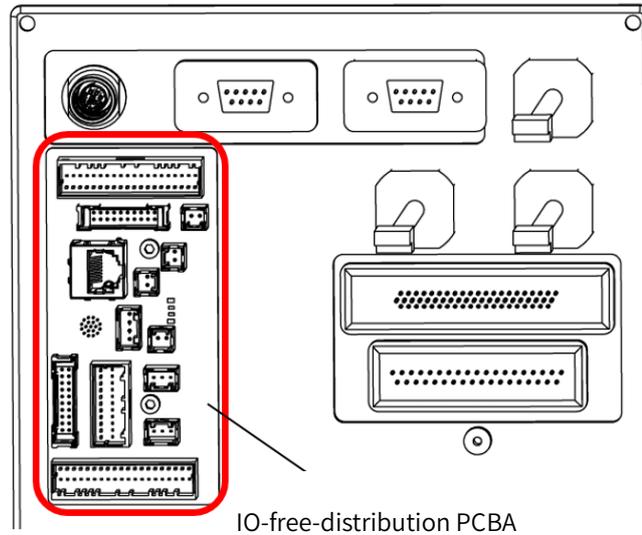


Figure 5-10 IO-free-distribution PCBA

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 4.3.3 (*Connector panel*) to remove the connector panel from the robot.

Step 2 Unplug all the 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.

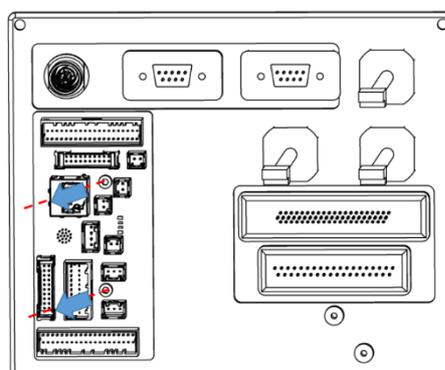


Figure 5-11 Removal of IO-free-distribution PCBA

Step 4 Use the special tool to loosen the nut and remove the IO-free-distribution PCBA. The position of the screw is shown in Figure 5-12.

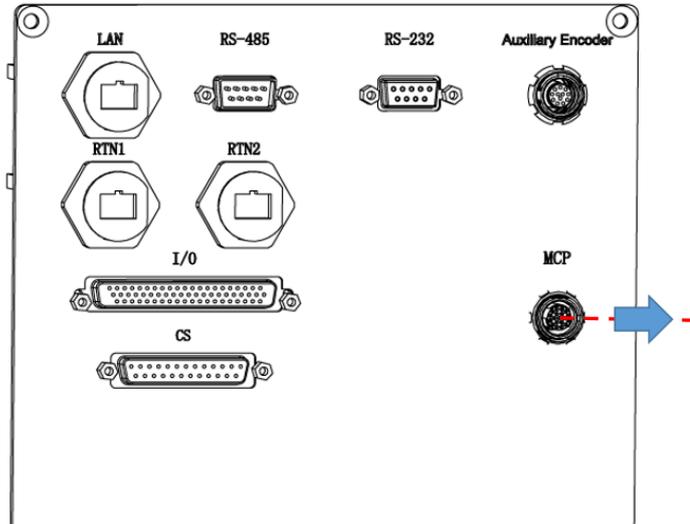


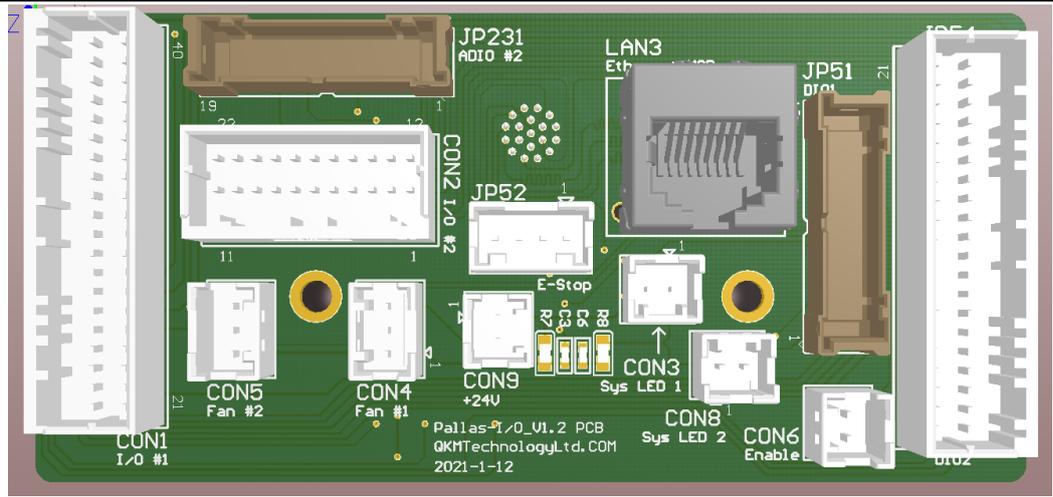
Figure 5-12 Removal of IO-free-distribution PCBA

Step 5 Install a new IO-free-distribution PCBA on the base connector panel and tighten the screws. Connect all the cables to the new IO-free-distribution PCBA.



NOTE

At the time of installation, users shall check whether the connectors match the line labels and avoid damage to the controller due to wrong connection. The line labels corresponding to each connector are shown below:



Step 6 Refer to Section 4.3.3 to reinstall the base panel on the robot.

5.5 Replacement and maintenance of surge suppressor

The surge suppressor is located on the connector panel of the robot. To replace it, it's required to remove the connector panel. The position of the surge suppressor is shown in Figure 5-13.

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

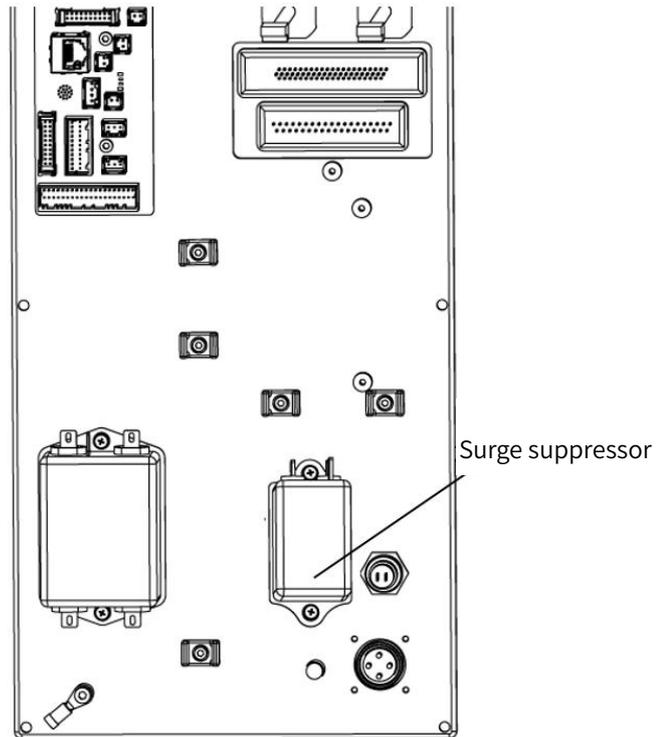


Figure 5-13 Surge suppressor

Step 1 Refer to Section 4.3.3 to remove the connector panel from the robot.

Step 2 Unplug all cables from the surge suppressor.

Step 3 Use the cross screwdriver to remove the screws from the surge suppressor, as shown in Figure 5-14.

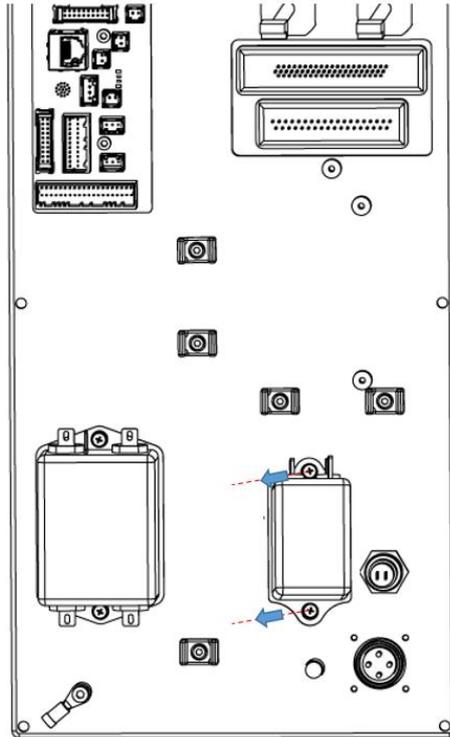
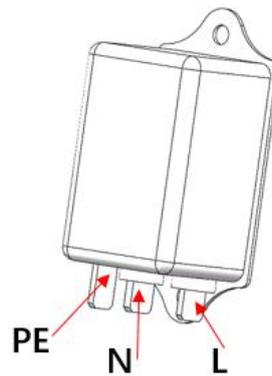


Figure 5-14 Removal of fastening screws

Step 4 Install a new surge suppressor on the part in the base and tighten the screws, then connect all the cables to the new surge suppressor.



At the time of installation, users shall check whether the connectors match the line labels and avoid damage to the controller due to wrong connection. The line labels corresponding to each connector are shown below:



Step 5 Refer to Section 5.3, 4.3.2 and 4.3.3 to restore the controller, side door and connector panel of the robot.

5.6 Replacement and maintenance of filter

The filter is located on the connector panel of the robot. To replace it, it's required to remove the connector panel of the robot. The position of the filter is shown in Figure 5-15.

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

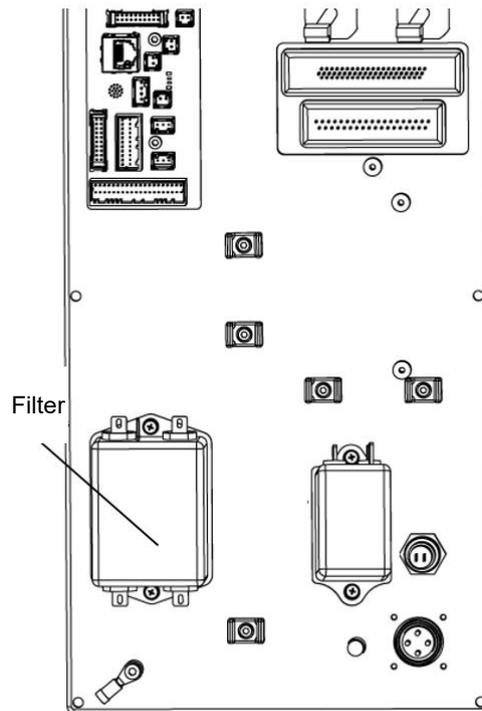


Figure 5-15 Filter

Step 1 Refer to Section 4.3.3 to remove the connector panel from the robot.

Step 2 Unplug all cables connected to the filter.

Step 3 Use the cross screwdriver to unscrew the fastening screws from the filter and remove them, as shown in Figure 5-16.

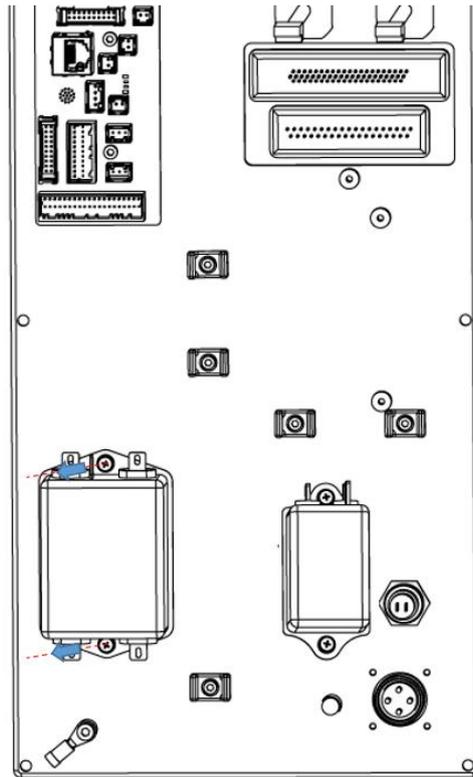


Figure 5-16 Removal of fastening screws

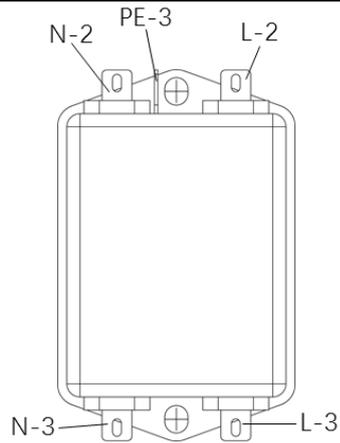
Step 4 Install a new filter on the connector panel and tighten the screws.

Connect all cables to the new filter.



NOTE

At the time of installation, users shall check whether the connectors match the line labels and avoid damage to the controller due to wrong connection. The line labels corresponding to each connector are shown below:



Step 5 Refer to Section 4.3.3 to restore the connector panel on the robot.

5.7 Replacement and maintenance of QBUS module

The QBUS module is located in the base of the robot. To replace it, the connector panel and side door of the robot need to be pulled out. The position of the QBUS module is shown in Figure 5-17.

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

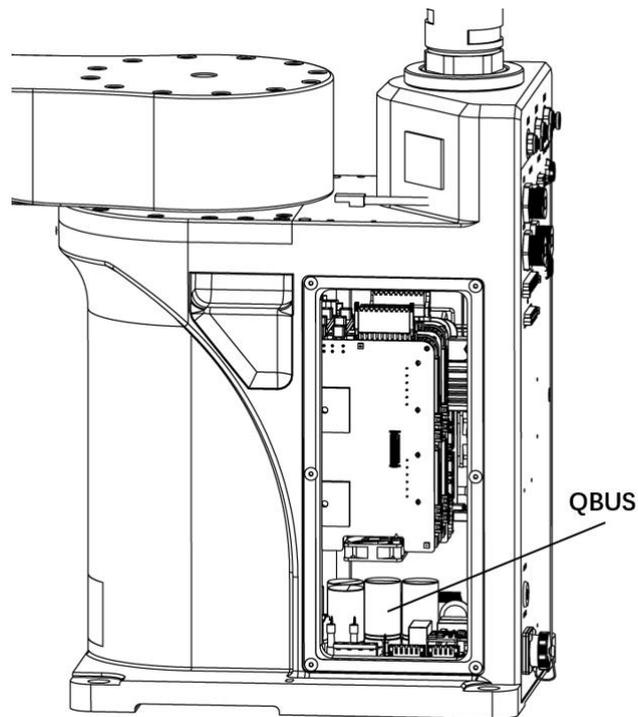


Figure 5-17 QBUS module

Step 1 Refer to Section 4.3.2 and 4.3.3 to remove the side door and connector panel from the robot.

Step 2 Refer to Section 5.3 to remove the controller assembly.

Step 3 Use the straight screwdriver to remove the terminals from the connector.
Unplug all the cables connected to the QBUS module.

Step 4 Use a cross screwdriver to remove the cross recessed screws from the QBUS module, as shown in Figure 5-18.

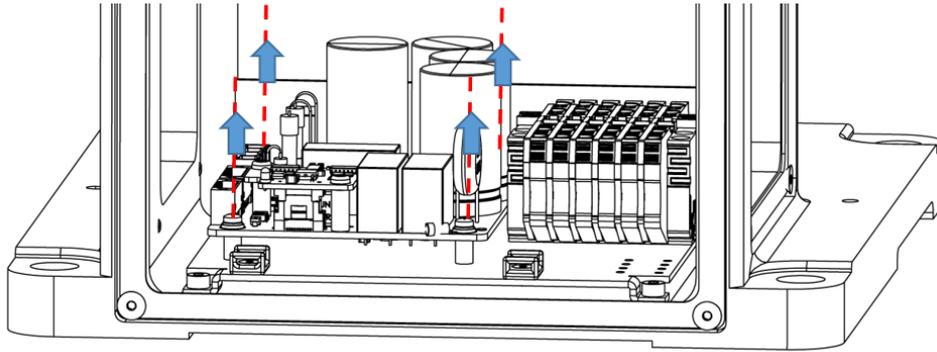


Figure 5-18 Removal of QBUS module

Step 5 Install a new QBUS module and connect to the connection terminals.

Step 6 Refer to Section 5.3, 4.3.2 and 4.3.3 to restore the controller, side door and connector panel of the robot.

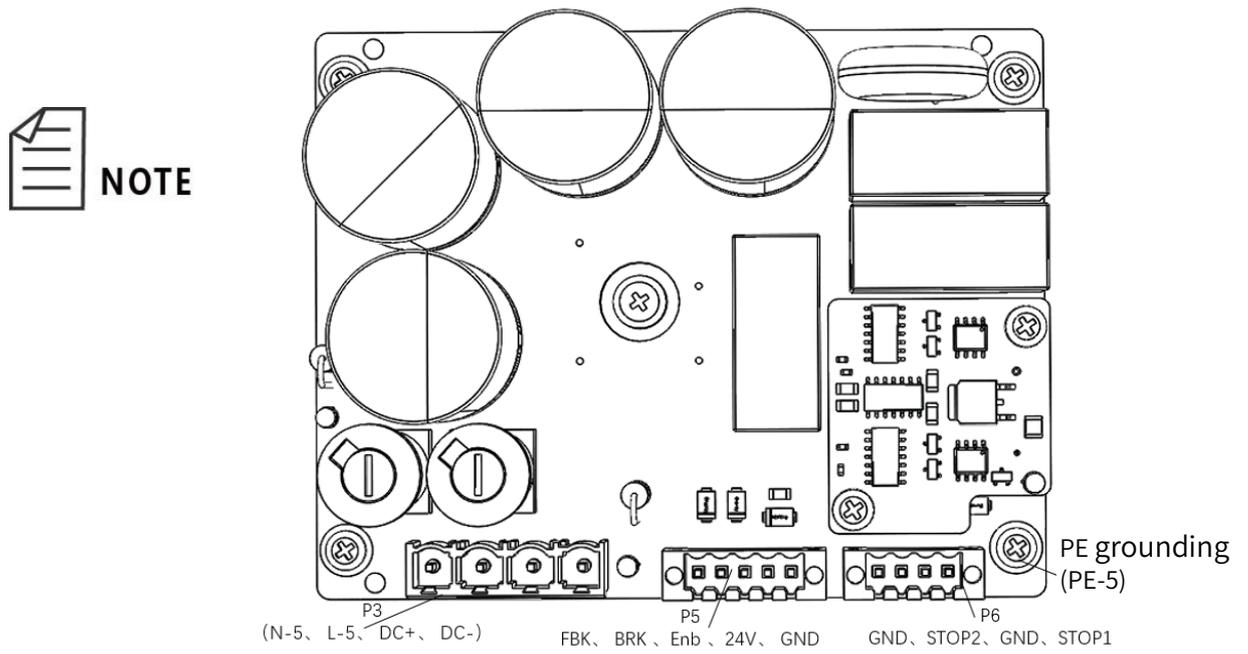
- The lower end of the QBUS module is close to the filter terminal block. Be careful not to hit other cables when removing the screws.
- When installing the connection terminals, make sure that the terminals are firmly connected.



CAUTION

- 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.

At the time of installation, users shall check whether the connectors match the line labels and avoid damage to the controller due to wrong connection. The line labels corresponding to each connector are shown below:



5.8 Replacement and maintenance of QBUS fuse

There are two QBUS fuses on the QBUS module, as shown in Figure 5-19.

Tools and accessories: straight screwdriver, fuse, anti-static gloves.

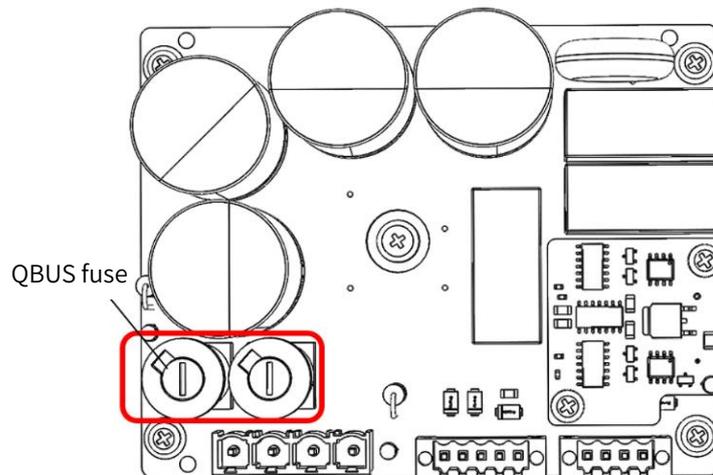


Figure 5-19 QBUS fuse

Step 1 Refer to Section 4.3.2 to remove the side door from the robot.

Step 2 Find the QBUS module, use the straight screwdriver to turn counterclockwise the fuse cover on the QBUS module, and take out the fuse.

Step 3 After installing a new fuse, tighten the cover and restore the robot after replacement.

The burning of the QBUS fuse indicates that the main circuits of the QBUS and the drive Cell may burn out.



Therefore, before replacing the fuse, check whether the 4 pins of N-5, L-5, DC+ and DC- of the QBUS are shorted out, and whether the DC+ and DC- pins of the drive Cell are shorted out or have low resistance (the normal resistance measured by the multimeter in power-off condition is in the MΩ range). In case of

a short circuit, replace the QBUS, and replace the drive Cell at the same time when possible. A careful troubleshooting is required before further operation. Do not power on after replacing the fuse separately without troubleshooting, as this may cause secondary damage.

5.9 Replacement and maintenance of 24 V switching power supply

The 24 V switching power supply is located in the base of the robot. To replace it, the base connector panel of the robot needs to be pulled out. The position of the 24 V switching power supply is shown in Figure 5-20.

Tools and accessories: cross screwdriver, diagonal pliers, 24 V switching power supply, anti-static gloves.

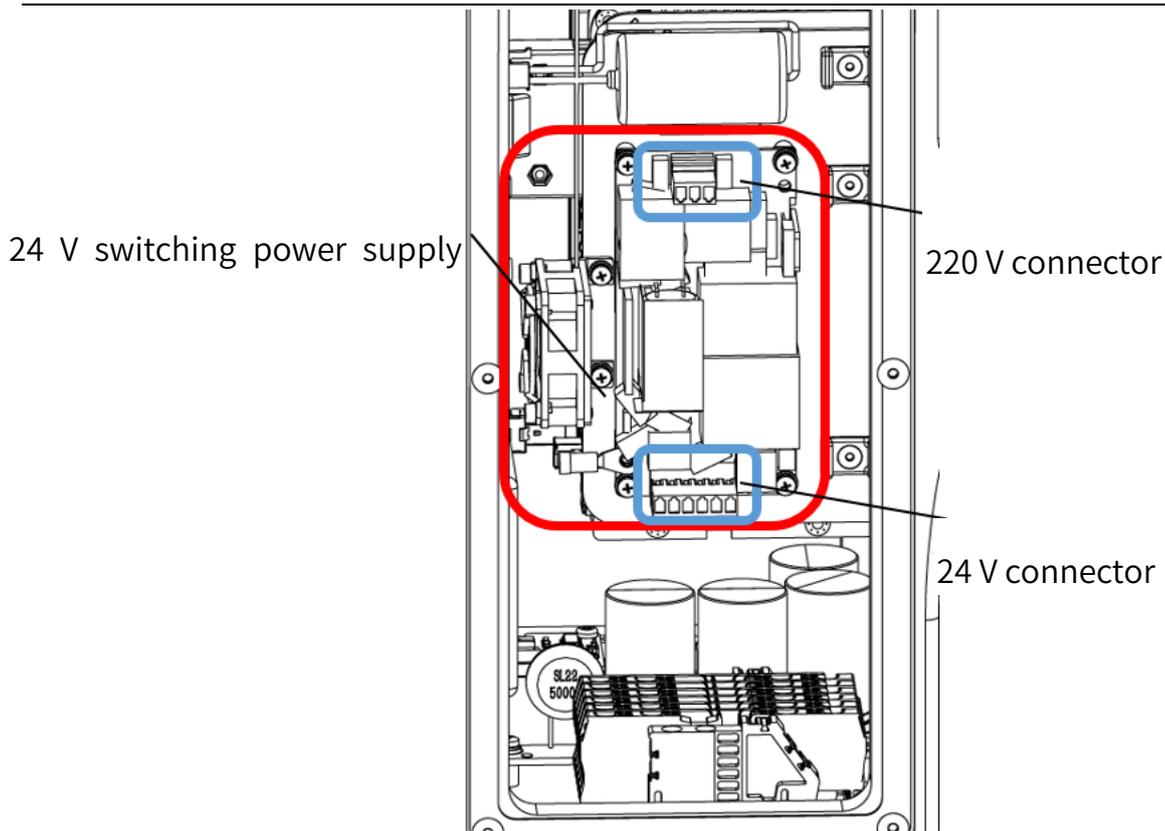


Figure 5-20 24 V switching power supply

Step 1 Refer to Section 4.3.2 and 4.3.3 to remove the side door and connector panel from the robot.

Step 2 Unplug the 24 V power plug and 220 V power plug from the switching power supply.

The line labels of the 24V power plug include + 24V # 1, G24, + 24V # 3 and G24 # 3.

**NOTE**

The line labels of the 220V power plug include L-4, N-4 and PE-4.

Step 3 Use the cross screwdriver to remove the combination screws from the

switching power supply and take out the switching power supply, as shown in Figure 5-21.

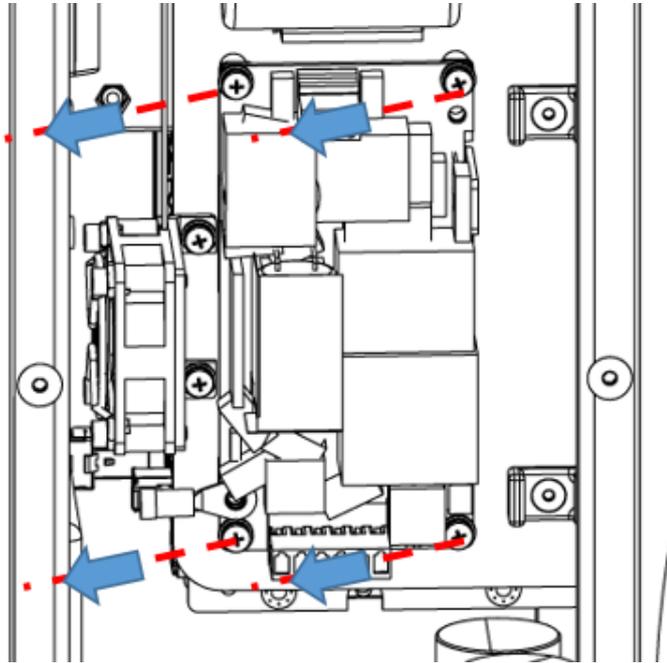


Figure 5-21 Removal of power module

Step 4 Install a new switching power supply on the bracket and tighten the screws. Connect the 24 V power plug and 220 V power plug to the new switching power supply.

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

5.10 Replacement and maintenance of 24 V switching power module cooling fan

The position of the power module cooling fan is shown in Figure 5-22.

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

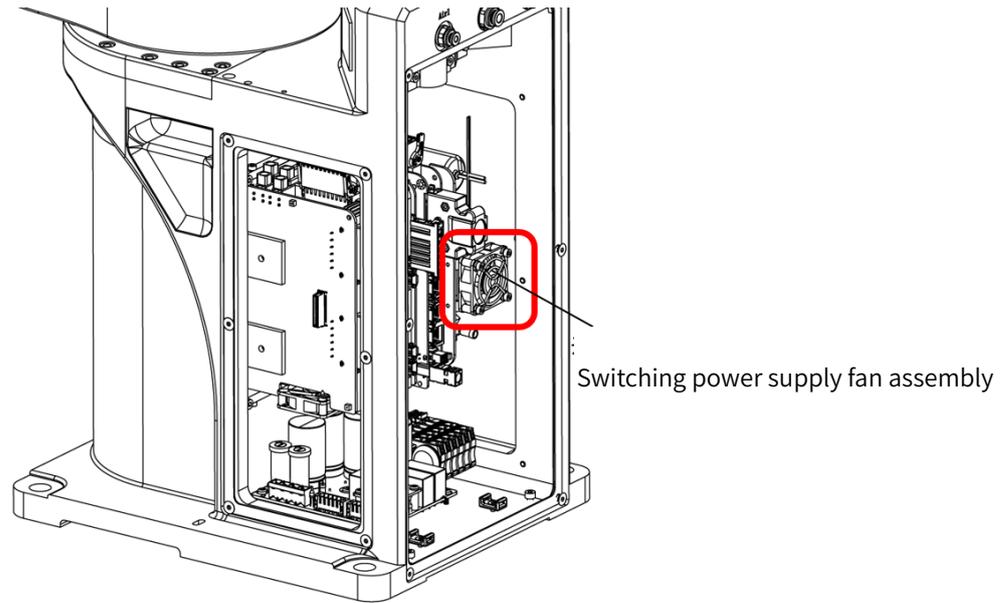


Figure 5-22 Switching power supply fan assembly

Step 1 Refer to Section 4.3.2 and 4.3.3 to remove the side door and connector panel from the robot.

Step 2 Use diagonal pliers to remove the cable tie along the fan cable.

Step 3 Refer to Section 5.4 Definition of pins on IO-free-distribution PCBA to locate the "Fan # 2" connector and gently pull the connector out.

Step 4 Use an Allen wrench to remove the fastening screws from the power module cooling fan, as shown in Figure 5-23.

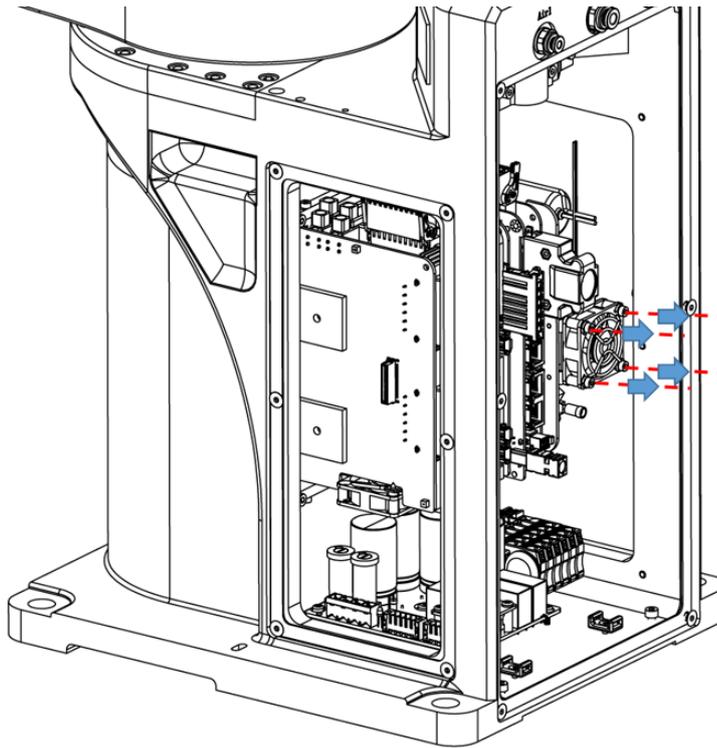


Figure 5-23 Remove the power module cooling fan

Step 5 Install a new fan assembly, plug in the fan connector, fix the fan cable with a cable tie. Connect the connector of the new fan assembly to the connector of the switch fan.

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



- 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.

- 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.

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

5.11 Replacement and maintenance of the fan assembly of the mechanical arm 2

The mechanical arm 2 fan is located in the second mechanical arm of the robot. To replace it, the mechanical arm 2 shell of the robot needs to be removed, as shown in the figure below.

Tools and accessories: 3# Allen wrench, fan, anti-static gloves.

Screw type: hexagon socket head cap screw (M4*20)

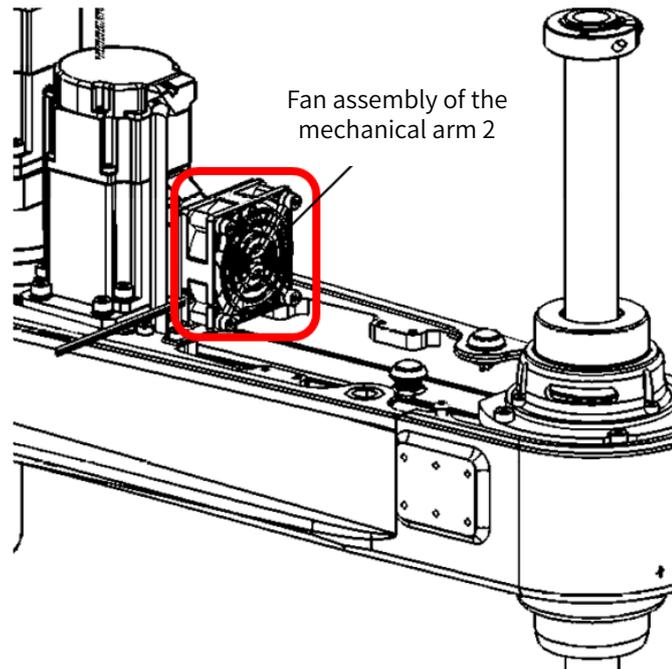


Figure 5-24 Fan assembly of the mechanical arm 2

Step 1 Refer to Section 4.5 to remove the screws from the mechanical arm 2 shell of the robot and gently pull out the second mechanical arm shell.

Step 2 Unplug all the cables connected to the fan of the mechanical arm 2.

Step 3 Use #3 Allen wrench to loosen the fastening screws on the fan of the mechanical arm 2 and remove them, as shown in the figure below.

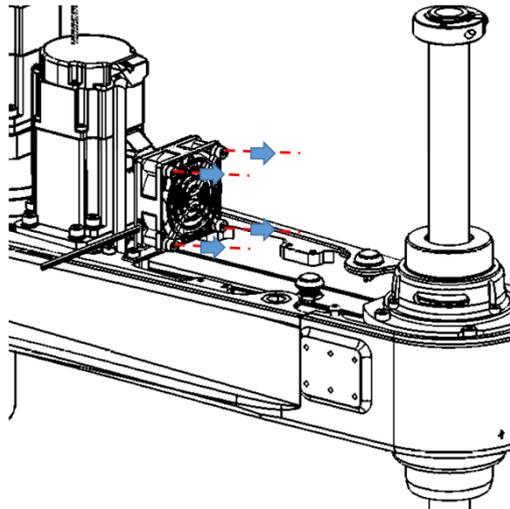


Figure 5-25 Removal of the fan from the mechanical arm 2

Step 4 Install a new fan in the original position and tighten the screws, then connect the fan cables.

5.12 Replacement and maintenance of brake PCBA

The brake PCBA is located in the mechanical arm 2 of the robot. To replace it, the mechanical arm 2 shell of the robot needs to be removed. The brake PCBA of the mechanical arm 2 is shown in Figure 5-26.

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

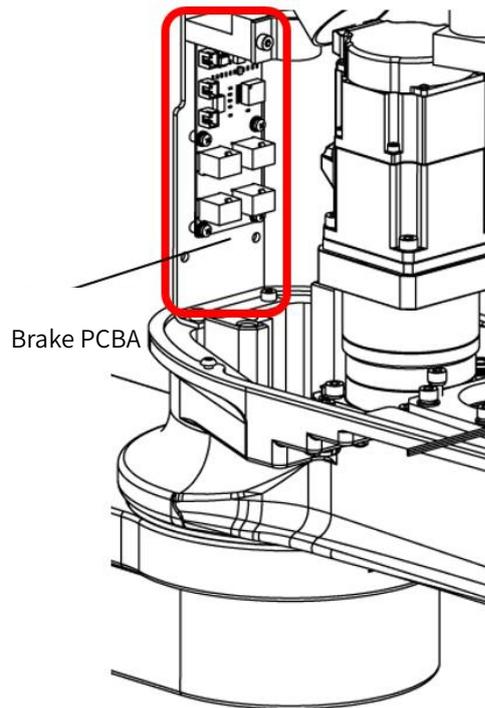


Figure 5-26 Brake PCBA of the mechanical arm 2

Step 1 Refer to Section 4.3.1 to remove the screws from the mechanical arm 2 shell of the robot and gently pull out the mechanical arm 2 shell.

Step 2 Unplug all cables connected to the brake PCBA.

Step 3 Use the cross screwdriver to unscrew the fastening screws from the brake PCBA and remove them, as shown in Figure 5-25.

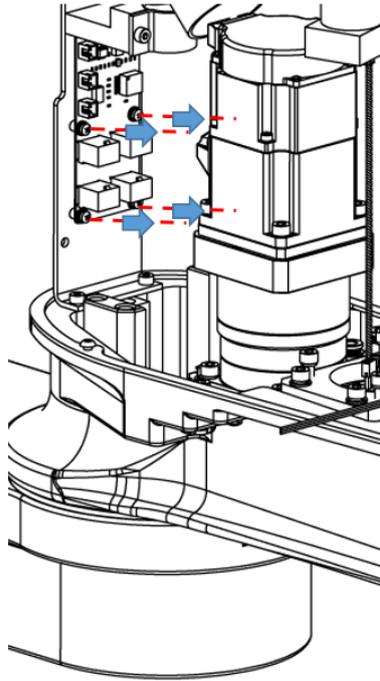


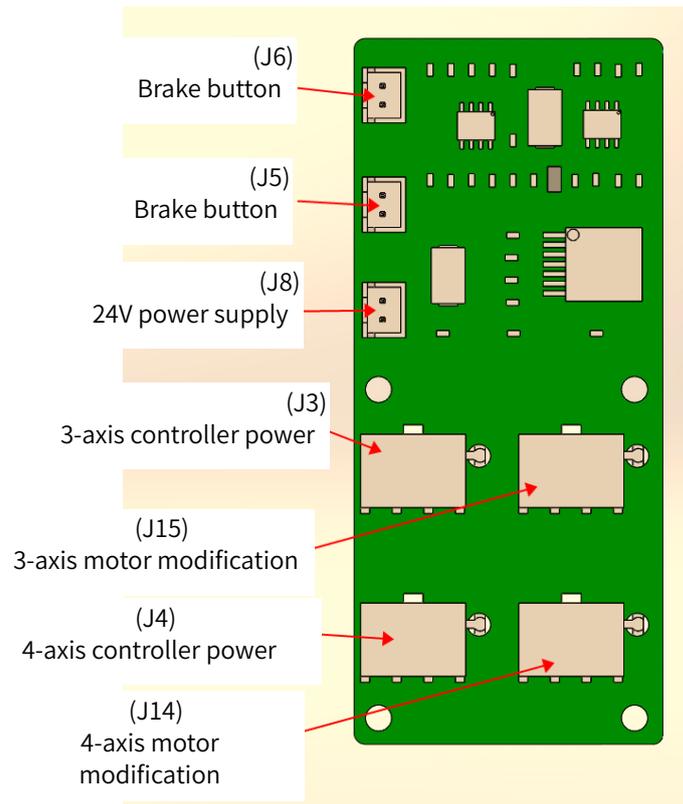
Figure 5-27 Removal of the brake PCBA from the mechanical arm 2

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



NOTE

At the time of installation, users shall check whether the connectors match the line labels and avoid damage to the controller due to wrong connection. The line labels corresponding to each connector are shown below:



Step 5 Reinstall the mechanical arm 2 shell of the robot.

Chapter 6 Technical service

6.1 Consulting and services

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 the robot (nameplate on the back of the robot base)
- Model and serial number of the control system (contact the production department for check according to serial number)
- Control system version (send System.Info Version, 1 via ARM and macro language interface for check)
- 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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