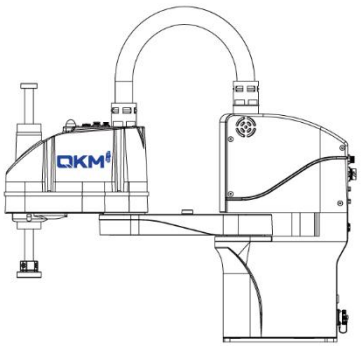
AH3 Robot

Maintenance Manual



QKM

Maintenance Manual

AH3 Robot

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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.
Keep this manual properly for future reference.

Overview

This manual provides detailed information on the routine maintenance and safety inspection of AH3 Robot, as well as the maintenance of mechanical and electrical components, so that users can better use AH3 Robot. This manual can serve as a reference for system integrators to design user workstation systems by using our AH3 Robot, and can also be used to guide system installation, commissioning and maintenance.

Readers

This manual applies to:

Electrical Engineer	Maintenance Engineer
Mechanical Engineer	Technical Support Engineer

Symbols and their 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:

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

Notice

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

QKM is the trademark of QKM Technology (Dongguan) Co., Ltd. QKM has been granted ownership of this 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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Version 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
V1.0.0	08-30-2019	The first version of the document was released.
V1.0.1	11-25-2019	• Robot pictures were updated. • The grease model was changed. • Section 3.3 Cleaning and replacement of dust-proof sponge was added. • Section 4.3 Replacement and maintenance of upper control cabinet fan was added.
V1.1.0	05-12-2020	• Section 4.3 Replacement and maintenance of controller fan was deleted. • Section 4.6 Removal and installation of the second mechanical arm shell was added. • Section 5.4 Replacement and maintenance of IO-free-distribution PCBA was added. • Section 5.10 Replacement and maintenance of brake PCBA of the second mechanical arm was added. • Chapter 5 Description of Electrical Interfaces and Cable Identification was added. 1. Section 5.1 Description of encoder battery interfaces and cable identification was added. 2. Section 5.3 Description of controller interfaces and cable identification was added. 3. Section 5.4 Description of IO-free-distribution PCBA interfaces and cable identification was added. 4. Section 5.5 Description of surge PCBA interfaces and cable identification was added. 5. Section 5.6 Description of filter interfaces and cable identification was added.

		6. Section 5.7 Description of QBUS module interfaces and cable identification was added. 7. Section 5.9 Description of 24V switching power supply interfaces and cable identification was added. 8. Section 5.10 Description of brake PCBA interfaces and cable identification was added.

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Chapter 1 Safety Precautions

Before starting maintenance on the robot, please read all the following precautions:

1.1 Safety responsibility

- 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 local laws and regulations for workers engaged in services related to industrial robots.

- Do not use the robot illegally. QKM will not be liable for any losses due to illegal use by users.

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

- Do not modify the robot without permission. QKM assumes no responsibility for any personal injury or machine damage caused by unauthorized changes to the robot.
- QKM is committed to providing safe and reliable information, but does not assume responsibility for it. Even if all operations are performed in accordance with the safety instructions, there is no guarantee that the robot will not cause any personal or property damage.

1.2 Safety Precautions

1.2.1 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.
- Make sure that there are no other people within the work area of the robot before operating the robot system.
- 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.
- Be sure to unplug the power cable when the robot is not used.
- Be sure to connect the cable_POWER to the power socket when using the robot. Do not connect directly to the main power supply from factory.
- Be sure to make replacement after turning off the power of the robot and unplugging the power plug. If the replacement is performed while the power is on, electric shock or equipment failure may be caused.
- Connect the cables properly. Do not place heavy objects on the cables, or forcibly pull or clamp the cables. Failure to do so may result in cable damage, disconnection or poor contact, abnormal system operation or electric shock to personnel.
- Do not plug or unplug the cables on the interface panel while the robot is powered on.

1.2.2 Precautions before robot operation

Setting up safe area

Understand the safe area before using 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, outside 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.

Setting emergency stop device

The robot needs to be equipped with an emergency stop device before running. In case of an abnormality in the robot, press the emergency stop button to ensure the safety of personnel and avoid damage to the robot.

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 robot will act as follows when the device is pressed:

- The robot will stop in the current state and enter the servo-off state.

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.

1.2.3 Precautions when operating

Before operating the robot for the first time, inspection is required to ensure that the equipment and its devices are complete with perfect functions for safe operation and fault identification.

Precautions when operating for the first time or operating again

- Ensure that all protective devices are properly installed and perfectly functioning, and that signs are set up to direct relevant operations.
- The robot has been correctly placed and secured in accordance with the manual.
- Make sure that the electrical wires and cables have been properly connected and the robot is grounded.
- If compressed air is used, check whether the corresponding air pipe is connected properly.
- When operating the robot, check whether its work area is reasonable and remove other objects from the work area.

- Do not plug or unplug the power wires or communication cables during normal operation of the robot.

1.2.4 Precautions when a fault occurs

When the robot fails, be sure to operate it in accordance with normal steps to prevent personnel injury and robot damage caused by incorrect operation.

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.

1.2.5 Precautions during maintenance

- Make sure there is no danger before entering the safety fence.
- Make sure that the robot or peripheral equipment is in a safe state before performing any maintenance.
- Maintenance personnel must wear work clothes, safety helmet, etc. when performing maintenance on the robot.
- To replace any components, please contact QKM; avoid damage to the robot or personal injury caused by unexpected situations from operations of users upon subjective judgment.
- After replacing related components, prevent foreign matter from adhering to or entering the robot.
- The parts (screws, etc.) removed shall be correctly installed in their original positions. In case of redundant or insufficient parts, please confirm again and install them correctly.
- When restarting the robot after maintenance, ensure that there are no people in the work area of the robot.
- If the maintenance needs to be performed while the power is on, one group of two workers is required. When one worker maintains the robot, the other worker shall be able to quickly press the emergency stop switch when the robot abnormally acts to prevent personal injury or equipment damage.
- After changing the composition of the robot, be sure to check whether it meets the necessary safety requirements and test all safety functions.

NOTE

Testing of safety functions:

- Emergency stop device of the robot
- External emergency stop device (input and output terminals)
- Confirmation device (in test mode)
- Personnel protective equipment
- All other safety-related input and output terminals used

- When restarting a changed program, test it by reducing the system speed (10% speed is recommended) and then gradually increasing the speed after confirming that there is no problem.
- After repairing and maintaining the robot, test the robot to ensure that the robot and its functions are complete.

1.2.6 Precautions for safe shutdown

Precautions when the robot stops running:

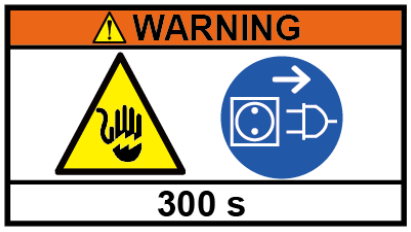
- Decrease the speed of the robot and then enable the robot to be servoed off. Turn off the power after the robot is servoed off.
- Recover materials and supplies related to the equipment and ensure that the equipment restores to the safe state for restart.
- Set up protective devices to indicate the current state of the equipment and prevent others from incorrectly operating it.
- The robot restarts at a recommended interval of about 300 s. Do not restart it immediately after turning off the power to avoid damage to the robot.
- The robot restarts at an interval of about 300 s. Do not restart it immediately after turning off the power to avoid damage to the robot.
- Before the robot starts again, check whether the emergency stop button is released to avoid the situation that the robot can not be servoed.

1.3 Safety signs

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

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

Table 1-1 Warning signs

No.	Label	Remark
1		A triangle sign for warning of high voltage
2		A grounding sign
3		A sign for protection from residual voltage
4	 **Attention:** Do not disassemble the robot to avoid failure and danger.	Do not disassemble the robot to prevent it from failures.

1.4 Waste disposal

The stoppage, 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.

Chapter 2 Routine Maintenance

Routine maintenance is a kind of preventive maintenance, which means that maintenance personnel periodically carry out inspection and maintenance during normal operation of equipment to ensure that the equipment is intact, tidy, clean, lubricated and safe meeting production requirements, and hidden faults can be timely found and removed.

Personnel responsible for maintaining QKM robots shall determine the maintenance cycle according to the contents of this manual, actual situation and working conditions in local place. They shall also perform routine inspection and maintenance of robots, and handle faults in a timely manner if they are found.

2.1 Regular maintenance and inspection

The routine maintenance and inspection cycles proposed in this manual are based on the following working conditions of the robot :

Working condition	Situation
Low load (A)	Works 8 hours a day under a load of 0 - 3 kg
	Works 16 hours a day under a load of 0 - 1 kg
High load (B)	Works 16 hours a day under a load of 1 - 3 kg
	Works 24 hours a day under a load of 0 – 3 kg

In order to maintain a good working state of the robot, prevent failures and ensure safety, users shall perform routine maintenance and inspection according to the following items; The cycle for routine inspection is based on the normal working conditions. For the normal working environment, please refer to the parameters of operating environment in "AH3 Robot User Manual". The actual maintenance cycle depends on the operating environment and frequency of the robot.

2.1.1 Inspection before power-on

Inspection item	Cycle (A / B)	Inspection method	Inspection standard	Exception handling
Air pipe and air pipe connector	Daily / Daily	Visually check whether they are damaged.	No damage	Replace with new components.
		Visually check whether they are seriously bent or blocked.	No bending or blockage.	Replace with new components.
Main exposed fastening screws and the like on the robot body	3 months / 1 month	Measure torque with torque wrench.	Screws on the side door panel of the upper control cabinet (1 N·m)	Tighten the screws according to the tightening torque
			Screws on the interface panel of the upper control cabinet (2 N·m)	
			Screws on the base interface panel (1.5 N·m)	
			Screws on the second mechanical arm shell (0.4 N·m)	
Wires and cables	3 months / 1 month	Visually check whether the connectors of wires and cables on the interface panel of the robot body are loose, and whether the wires and cables are twisted or tangled.	No loose, twists or tangles.	Properly connect.
Screw rod	3 months / 1 month	Visually check whether it is short of lubricating grease.	Grease is evenly applied.	Apply lubricating grease (refer to Section 4.1)
		Visually check whether it is rusted.	No rust.	Use rust remover and sandpaper (2000 # and finer) to remove rust.
Robot surface	3 months / 1 month	Visually check whether there are impact marks or wear.	No impact marks or wear.	Wipe with clean cloth or touch up paint.
Encoder battery	6 months / 3 months	Use the multimeter to measure whether the battery voltage is lower than 2.8V (refer to Section 5.1).	Not lower than 2.8V.	Replace the encoder battery (refer to Section 5.1).
The cycle (A / B) in this table is determined according to the above table.				

2.1.2 Inspection after power-on

Inspection item	Cycle (A / B)	Inspection method	Inspection standard	Exception handling
Emergency stop switch	Daily / Daily	Press the emergency stop button to check whether the servo is off.	Servo is off.	1. Ensure that the emergency stop switch is not pressed. 2. Check whether the emergency stop switch is damaged. 3. Replace the emergency stop switch.
Brake button	Daily / Daily	Check whether the motor brake is released by pressing the brake button (refer to Section4.1).	Press the brake button and the spline screw shaft can be pushed.	Contact QKM.
Screw rod	3 months / 1 month	Push up and down the screw rod according to Step 1 in Section 4.1 to check whether it is stuck.	No bending or sticking.	Contact QKM to replace with new components.
The cycle (A / B) in this table is determined according to the above table.				

Chapter 3 Handling of Common Exceptions

Common exceptions in mechanical and electrical components of AH3 Robot during installation and maintenance are shown in the table below. In case of an error code of the robot control system, refer to the "QKM Robot Error Code Manual" to check whether there is an exception in the system. If the exceptions described in the following table cannot be eliminated by mechanical ways, please contact QKM for technical support.

Table 3-1 Handling of common exceptions

Common Exception	Possible Cause	Handling
Robot is in emergency stop state.	Failure in robot emergency stop line.	• Ensure that the emergency stop switch is not pressed. • Check whether the emergency stop switch is damaged. • Replace the emergency stop switch.
Unable to connect robot.	Failure in PC network settings.	• 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 problems in PC network card.	Disable all other network cards in the PC except the network card connected to the robot.
	Ethernet interface or network cable is damaged.	• Replace the Ethernet interface. • Replace with another network cable.
RS-232 communication port fails in communication.	Interface is damaged or plug is not inserted properly.	• Replace the damaged interface. • Properly connect the plug.
	Improper parameter configuration.	Reconfigure parameters of communication interface.
I/O communication port fails.	I/O plug is damaged.	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

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 yes, 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 unevenly applied, grease dripping may occur.

There is a slight loss to 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 100 km (filled by 50 km for the first time). Select appropriate grease according to Table 4-1.

Table 4-1 Selection of lubricating grease

Model	Suitable Environment	Performance Characteristics	Application Part	Remark
YMABALA KY1106	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, YMABALA KY1106 grease and disposable protective glove.

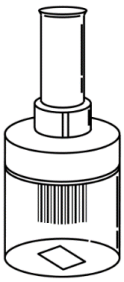


Figure 4-1 Special oil brush

NOTE

- QKM offers special oil brush and YMABALA KY1106 grease.
- Keep special oil brush back in the bottle when it is not in use.

Step 1 When the robot is powered on while no servo,wear disposable protective gloves, press and hold the brake button on the mechanical arm 2 of the robot, and push the spline screw shaft to the bottom, as shown in Figure 4-2.

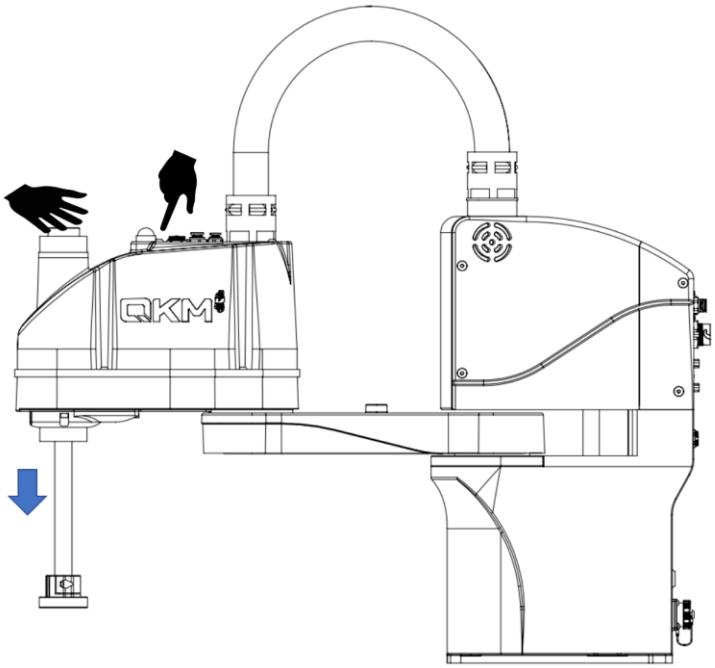


Figure 4-2 Push down spline screw shaft

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.

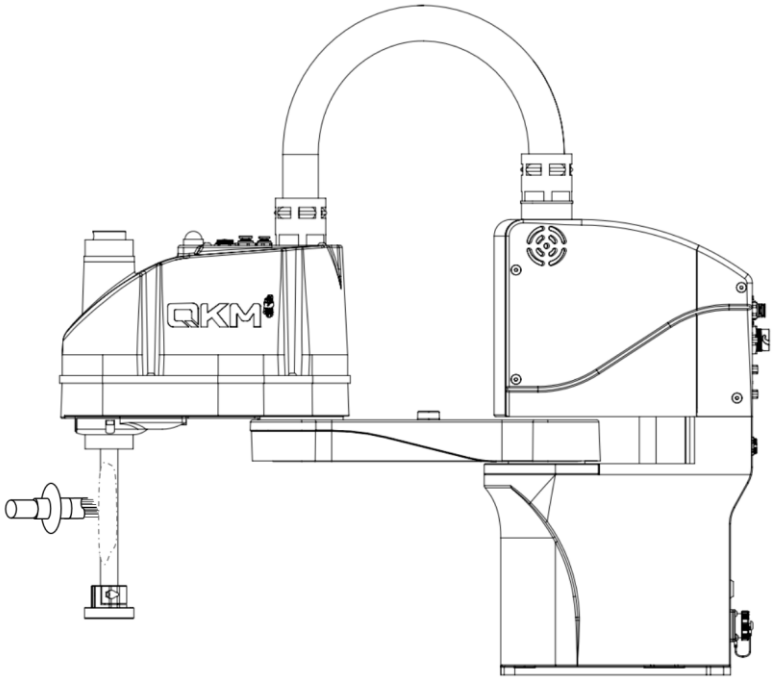


Figure 4-3 Apply lubricating grease

Step 3 Press and hold the brake button and push the spline screw shaft up to the top as shown in Figure 4-4.

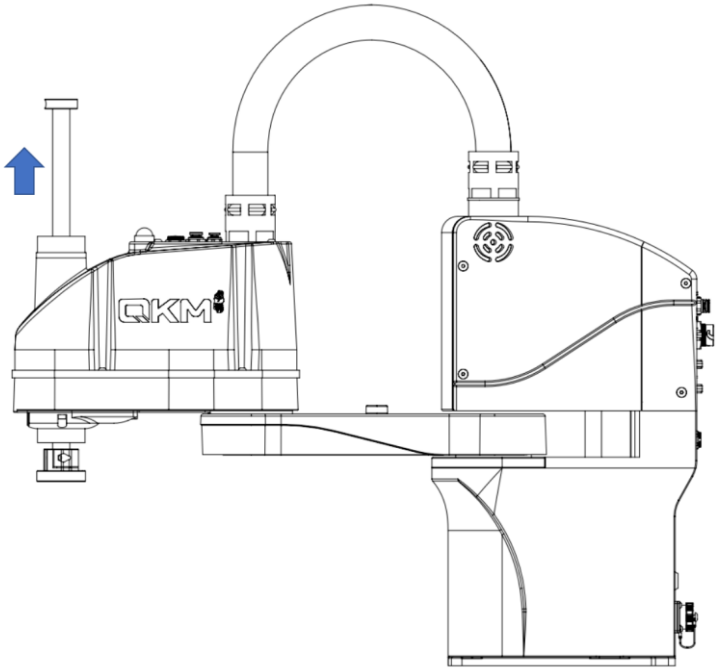


Figure 4-4 Push up spline screw shaft

Step 4 Apply an appropriate amount of grease on the upper part and spread it evenly. Push the spline screw shaft up and down in the same way to replenish grease twice. If the grease is evenly distributed on the surface of the screw shaft, the replenishment is completed. Wipe the excess grease off the upper and lower gears of the screw shaft with dust-free paper.

NOTICE

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 skin:	Rinse with water and soap.

4.2 Removal and installation of upper control cabinet side door panel

The side panel of the control cabinet of AH3 Robot can be removed and installed according to user requirements.

WARNING

Be sure to make replacement after powering off the robot and unplugging the power plug, otherwise electric shock or malfunction may be caused.

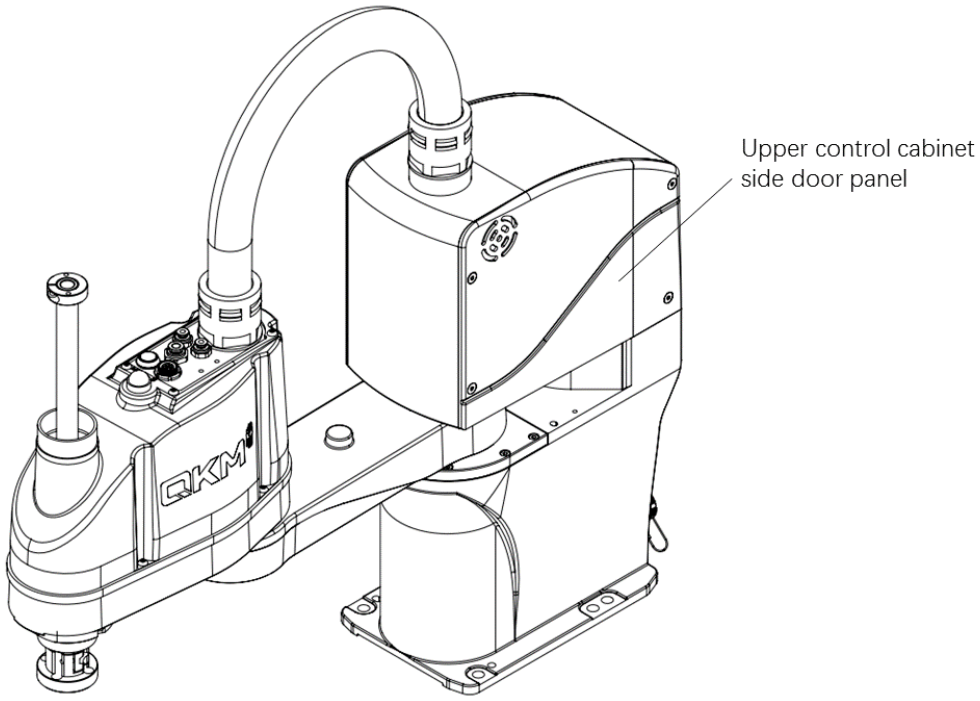


Figure 4-5 Upper control cabinet side door panel

➢ Removal

Tool: 2.5 mm Allen wrench.

Screw type: hexagon socket countersunk head screw (M4 * 12)

Step 1 Use 3 mm Allen wrench to remove the screws from the side door panel of the upper control cabinet of the robot, as shown in Figure 4-6.

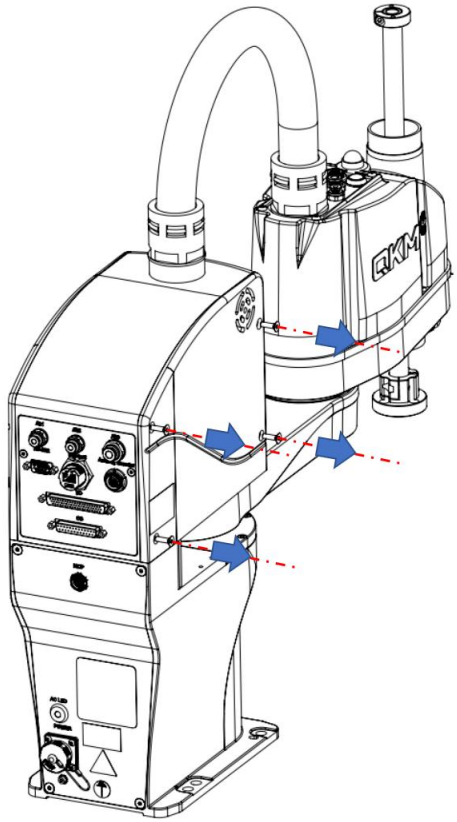


Figure 4-6 Removal of upper control cabinet side door panel

Step 2 Remove the screws and put them aside, and then gently remove the side door panel.

NOTICE

The door panels on the left and right sides of the control cabinet are removed in the same way. Users can remove the other side door panel in accordance with the above method.

➢ Installation

Tool: 2.5 mm Allen wrench, H3 * 50 torque wrench (1-5 N·m).

Screw type: hexagon socket countersunk head screw (M4 * 12)

Step 1 Arrange the wires and cables in the robot, insert the side panel directly into the slot and align with the screw holes on the robot base.

Step 2 Use 3 mm Allen wrench to tighten the screws on the side door panel of the robot (with a tightening torque of 1 N·m), as shown in in Figure 4-7.

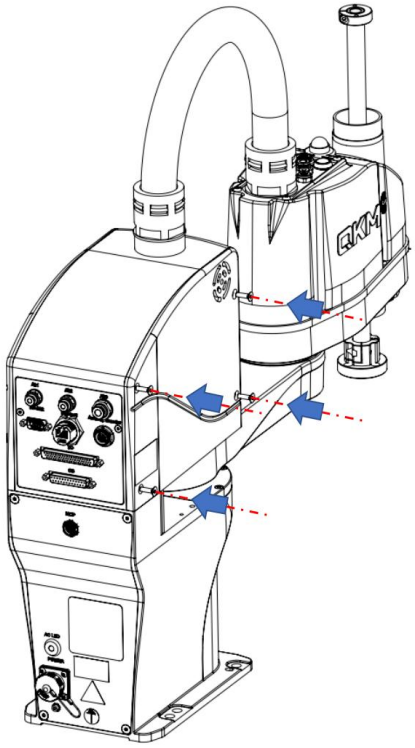


Figure 4-7 Installation of upper control cabinet side door panel

NOTICE

When installing the side door panel, do not clasp the cables or forcibly bend them to press in.

4.3 Cleaning and replacement of dust-proof sponge

Install a dust-proof sponge at the vent of the upper control cabinet of AH3 Robot. Regularly clean the dust-proof sponge when using the robot; if damaged, replace it timely.

Tools: 2.5 mm Allen wrench, H2.5 * 50 torque wrench (1-5 N·m).

Screw type: hexagon socket head cap screw (M3 * 6)

Step 1 Remove the side door panel from the upper control cabinet with reference to Section 4.2

Step 2 Use 2.5 mm Allen wrench to remove two screws from the metal plate, and remove the metal plate and dust-proof sponge, as shown in Figure 4-8.

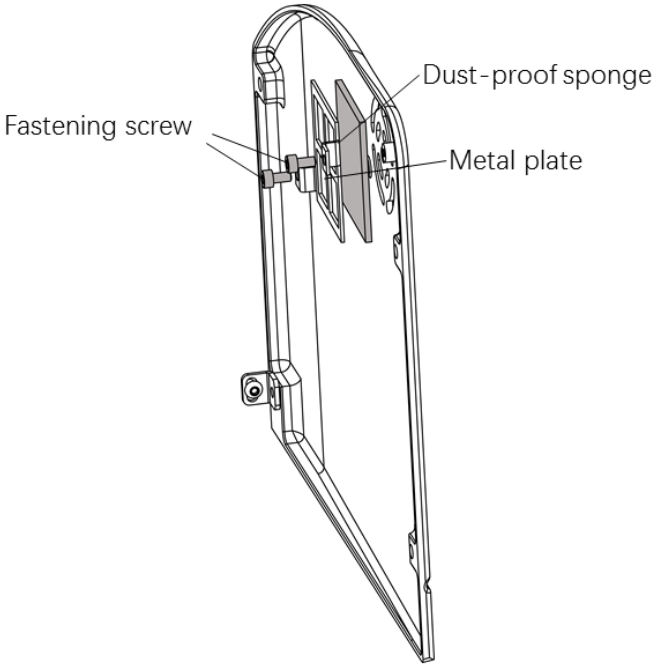


Figure 4-8 Dust-proof sponge

Step 3 Clean (or replace) the dust-proof sponge, then place it back to its original position and tighten the screws. (with a tightening torque of 1 N·m).

Step 4 Install the side panel of the upper control cabinet with reference to Section 4.2

NOTICE

The cleaning (or replacement) of the dust-proof sponge on both sides is the same. For cleaning (or replacement) on the other side, refer to the above steps.

4.4 Removal and installation of upper control cabinet interface panel

Users can remove and install the interface panel on the back of the upper control cabinet of AH3 Robot according to the needs of use.

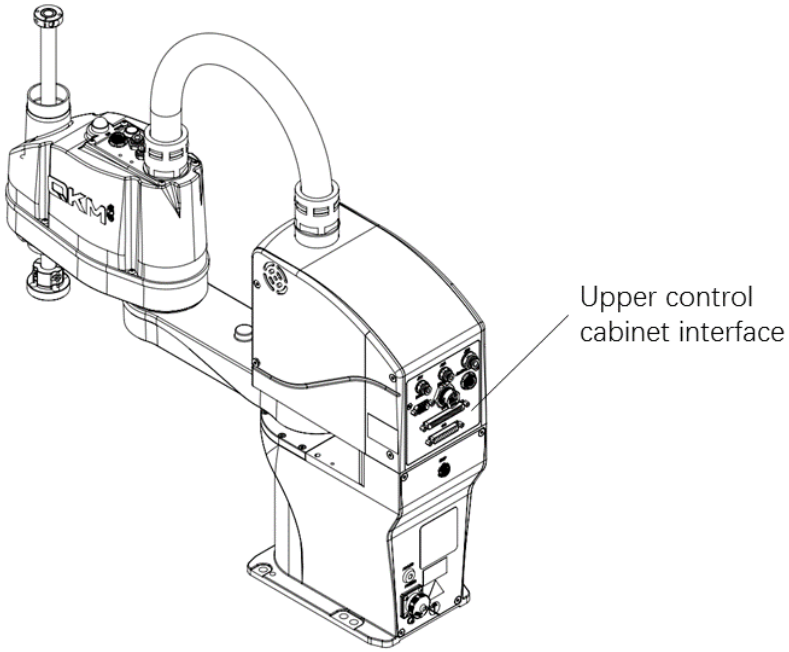


Figure 4-9 Upper control cabinet interface panel

- Removal

Tool: 2.5 mm Allen wrench.

Screw type: hexagon socket head cap screw (M3 * 6)

Step 1 Use 2.5 mm Allen wrench to remove the screws from the upper control cabinet interface panel of the robot, as shown in Figure 4-10.

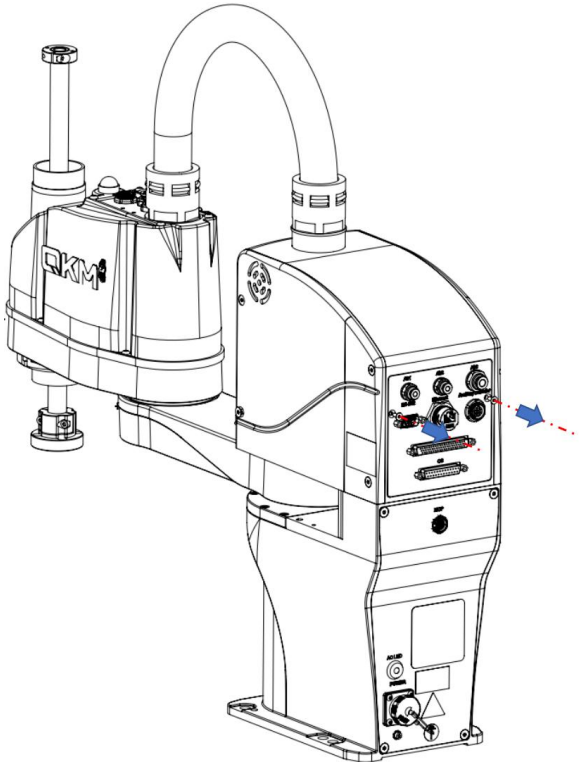


Figure 4-10 Removal of upper control cabinet interface panel

Step 2 Remove the upper control cabinet interface panel.

➢ Installation

Tools: 2.5 mm Allen wrench, H2.5 * 50 torque wrench (1-5 N·m).

Screw type: hexagon socket head cap screw (M3 * 6)

Step 1 Hold the upper control cabinet interface panel by aligning with the screw holes on the robot body

Step 2 Use 2.5 mm Allen wrench to tighten the screws on the upper control cabinet of the robot (with a tightening torque of 2N·m), as shown in Figure 4-11.

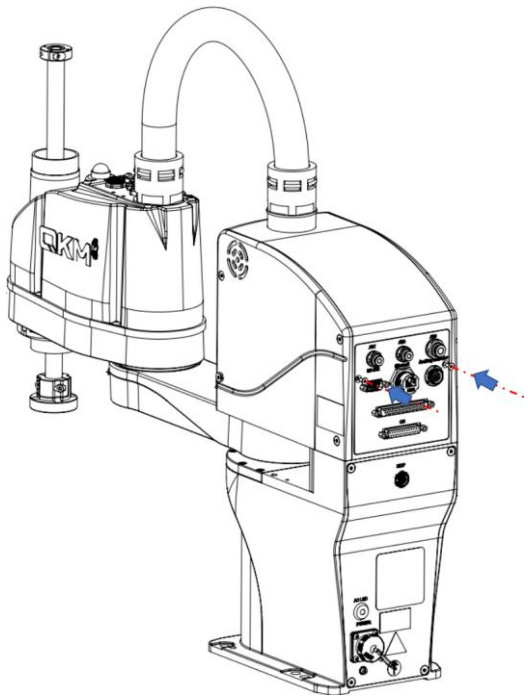


Figure 4-11 Installation of upper control cabinet interface panel

NOTICE When installing the upper control cabinet interface panel, do not clasp the cables or forcibly bend them to press in.

4.5 Removal and installation of base interface panel

Users can remove and install the base interface panel of AH3 Robot according to the needs of use.

NOTE At the time of removal and installation, set up a safety fence and warning signs around the robot to prevent other workers from incorrectly operating it.

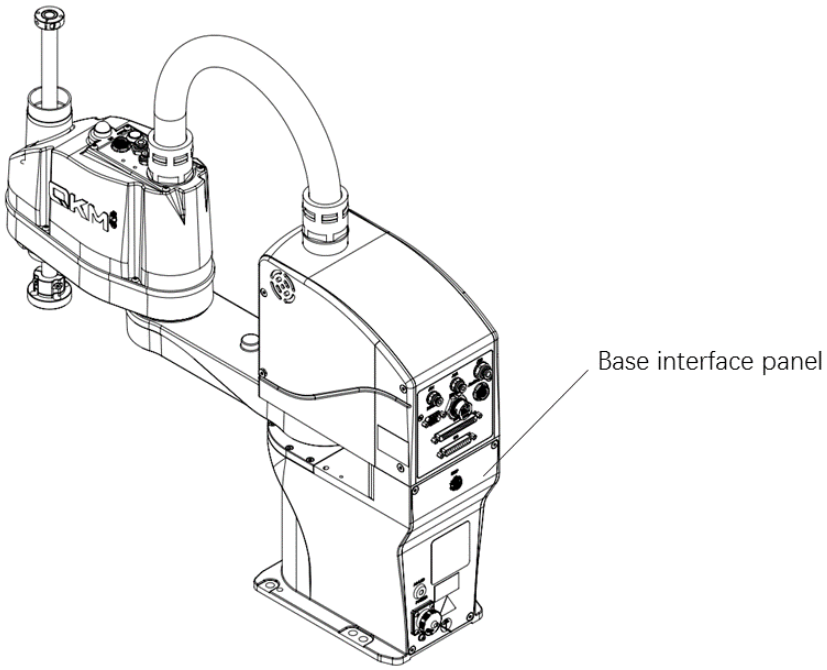


Figure 4-12 Base interface panel

- Removal

Tool: 2.5 mm Allen wrench.

Screw type: hexagon socket countersunk head screw (M4 * 8)

Step 1 Use 3 mm Allen wrench to remove screws from the base interface panel of the robot, as shown in Figure 4-13.

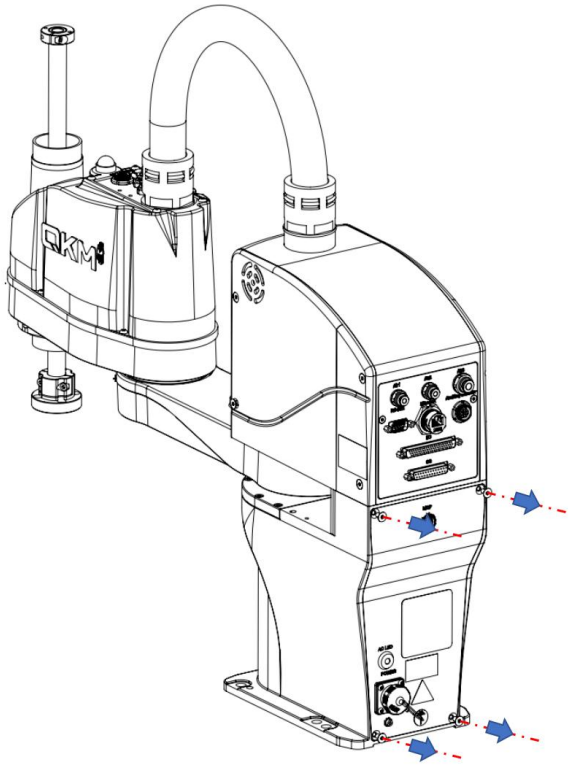


Figure 4-13 Removal of base interface panel

Step 2 Refer to Section 4.4 to remove the upper control cabinet interface panel, disconnect the 24V power connector and high-voltage DC power terminal on the controller in the upper control cabinet, and loosen the ground terminal, as shown in Figure 4-14.

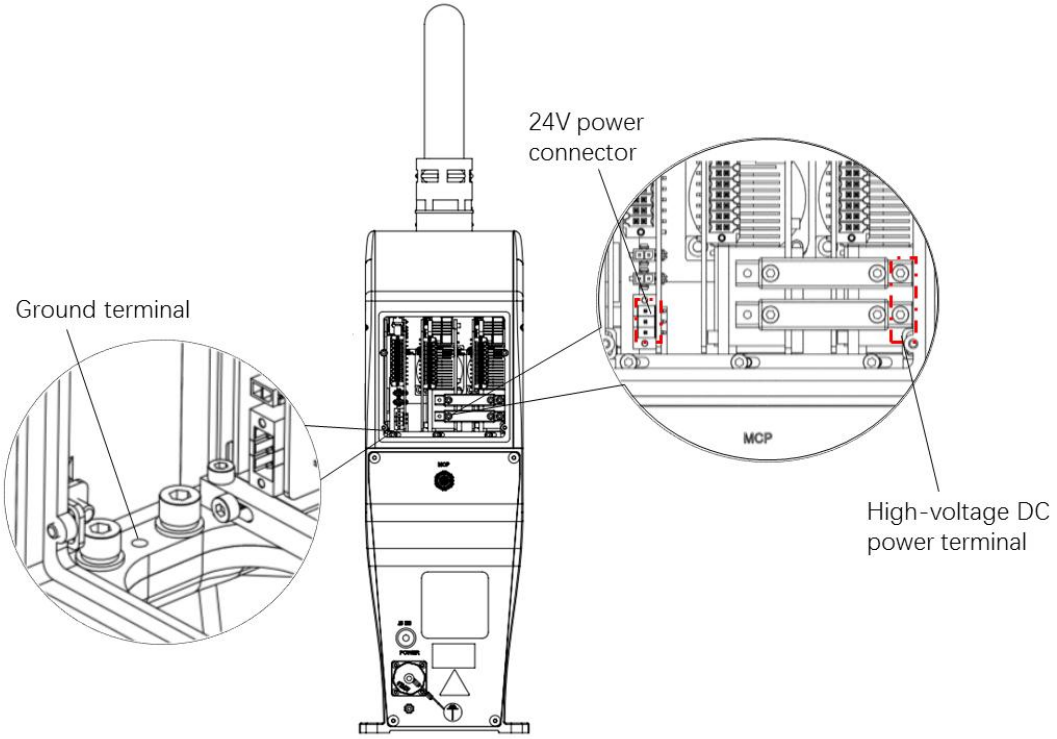


Figure 4-14 Disconnect connectors and related terminals in upper control cabinet

Step 3 Disconnect the connectors on the PCBA at the back of the base panel, avoid pulling on the cables, andgently pull them out of the base interface panel.

Step 4 Take out the base interface panel.

NOTICE

- The base interface panel is integrated with the internal electrical components. Pay attention to the overall weight when taking it out.
- When removing the base interface panel, do not forcibly pull it to avoid damage to the cables.

➢ Installation

Tools: 2.5 mm Allen wrench, H3 * 50 torque wrench (1-5 N m).

Screw type: hexagon socket countersunk head screw (M4 * 8)

Step 1 Arrange the wires and cables in the base, and connect the disconnected connectors and ground terminal on the controller in the upper control cabinet.

Step 2 Reinstall the disconnected connectors on the PCBA in the base.

Step 3 Hold the base interface panel by aligning with the screw holes on the robot body, and then use 3 mm Allen wrench to tighten the screws on the base

interface panel of the robot (with a tightening torque of 1.5 N·m) , as shown in Figure 4-15.

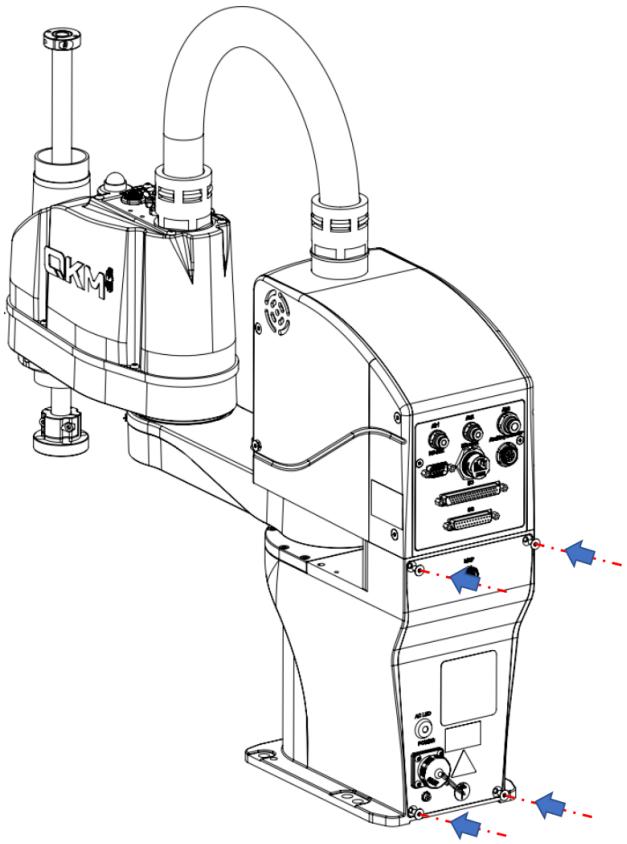


Figure 4-15 Installation of base interface panel

Step 4 Install the base interface panel as it is.

NOTICE

When installing the base interface panel, do not clasp the cables or forcibly bend them to press in.

4.6 Removal and installation of the second mechanical arm shell

Users can remove and install the second mechanical arm shell of AH3 Robot according to the needs of use.

NOTICE

At the time of removal and installation, set up a safety fence and warning signs around the robot to prevent other workers from improper operation.

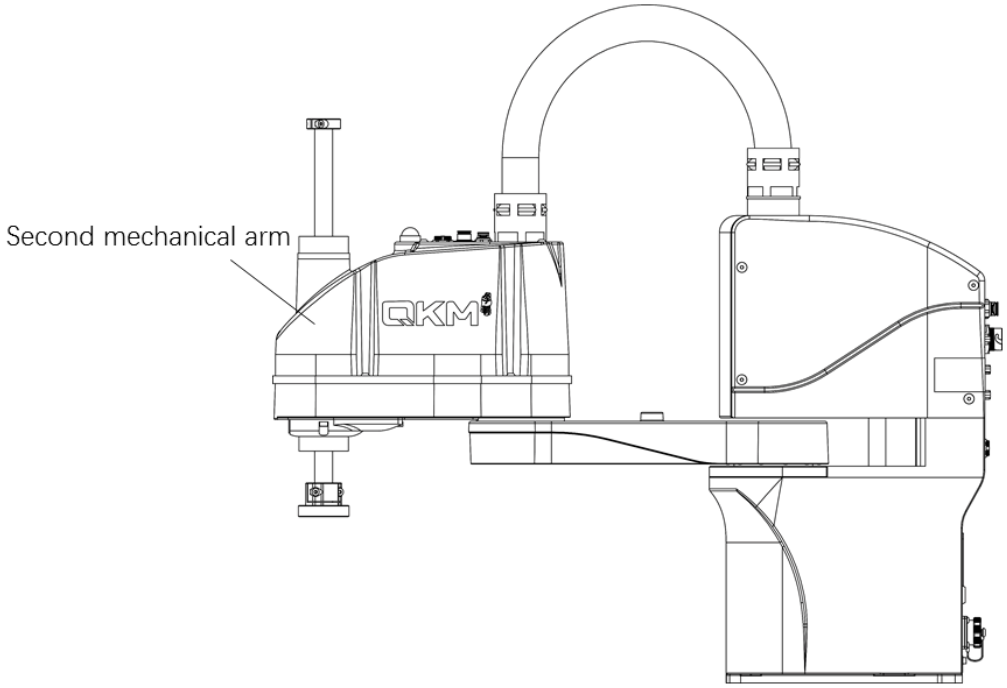


Figure 4-16 Second mechanical arm

- Removal

Tools: 2.5 mm Allen wrench, disposable protective gloves.

Screw type: hexagon socket button head screw (M4 * 8)

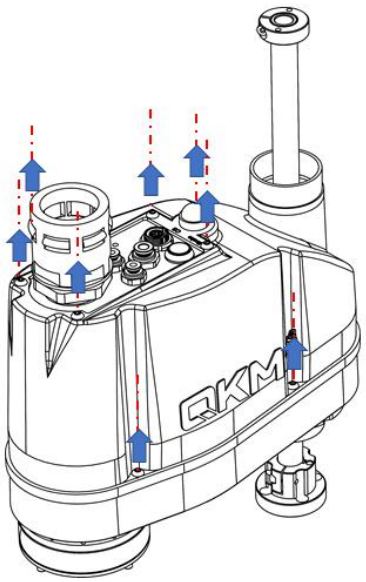


Figure 4-17 Removal of the second mechanical arm shell

Step 1 When the robot is powered on while no servo, wear disposable protective gloves, press and hold the brake button on the second mechanical arm of the robot, and push the spline screw shaft to the bottom, with reference to the steps in Section 4.1.

Step 2 Remove the screws and put them aside, and then gently pull the shell towards the bellows, as shown in. Figure 4-17.

Step 3 Disconnect the connector of the system indicator from the robot interface, and pull the shell to the other end in the direction of the bellows, as shown in Figure 4-18.

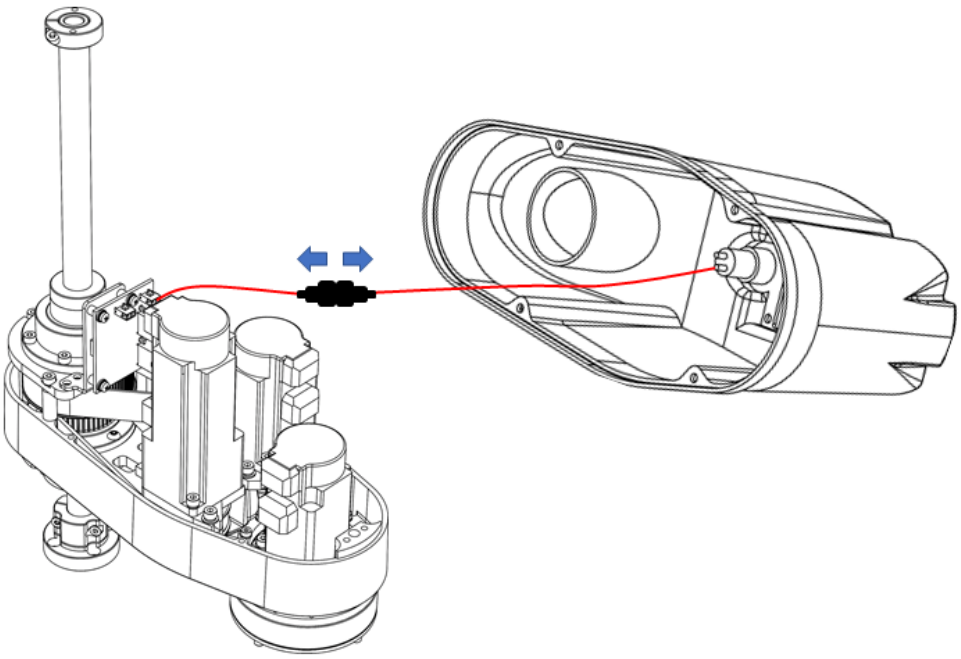


Figure 4-18 Connector of system indicator

➢ Installation

Tools: 2.5 mm Allen wrench, H2.5 * 50 torque wrench (1-5 N·m).

Screw type: hexagon socket button head screw (M4 * 8)

Step 1 Arrange the wires and cables in the robot, connect the system indicator to the interface, put the shell into the slot and align with the screw holes on the robot base.

Step 2 Use 3 mm Allen wrench to tighten the screws on the second mechanical arm shell of the robot (with a tightening torque of 0.4 N·m), as shown in Figure 4-19

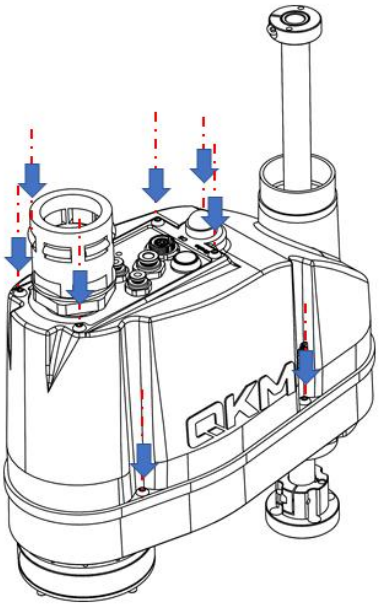


Figure 4-19 Installation of the second mechanical arm shell

NOTICE

When installing the second mechanical arm shell, do not clasp the cables or forcibly bend them to press in.

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, otherwise it 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 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 damage to electrical components of the robot.
- 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 encoder battery

The encoder battery is located in the upper control cabinet of the robot. To replace it, the side door panel of the upper control cabinet needs to be removed. The position of the encoder battery is shown in Figure 5-1.

Tools and accessories: 2.5 mm Allen wrench, cable tie, diagonal pliers, encoder battery, static protective gloves, multimeter.

Screw type: hexagon socket head cap screw (M3 * 6)

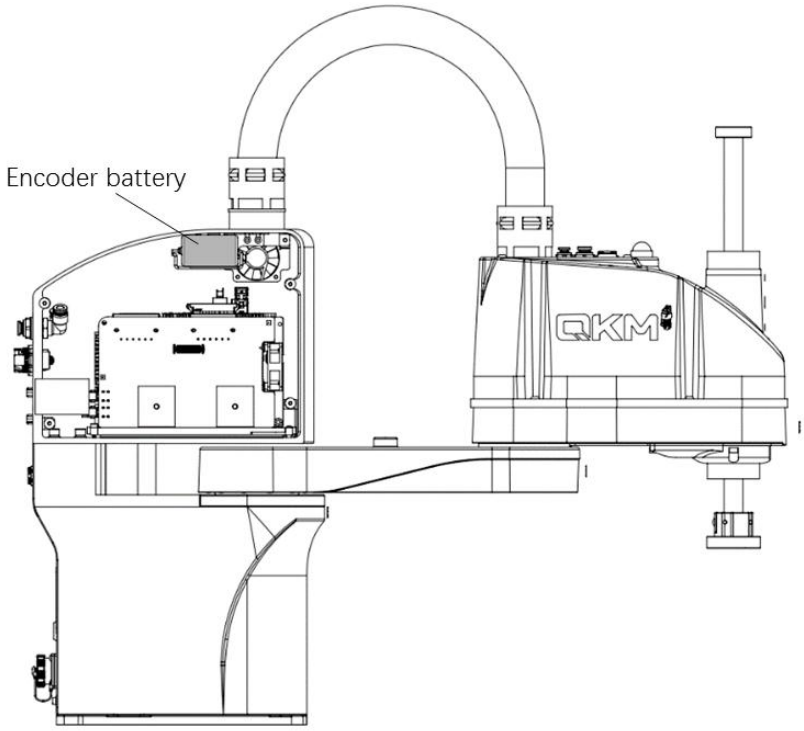


Figure 5-1 Encoder battery

Measurement of encoder battery voltage: Set the function switch of the multimeter to the voltage range position, insert the red and black probes into the backup interfaces of the encoder battery to display the residual voltage, as shown in.Figure 5-2.

Check whether the voltage of the encoder battery is lower than 2.8V. If yes, replace the encoder battery.

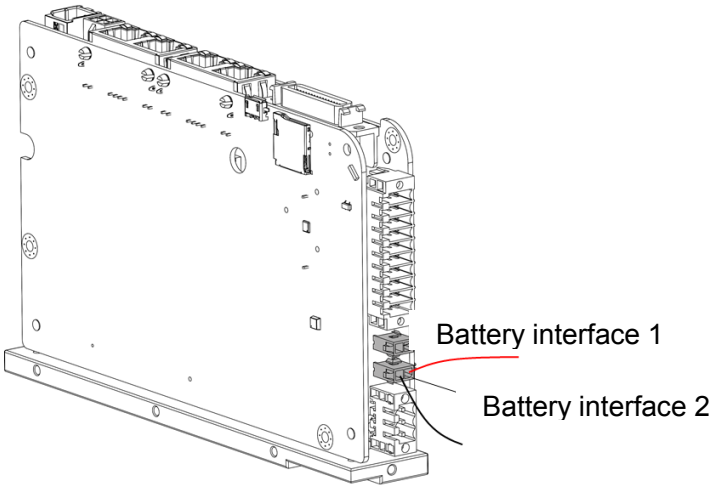


Figure 5-2 Measurement of encoder battery voltage

Step 1 Refer to Section 4.2 to remove the side door panel from the upper control cabinet of the robot.

Step 2 Remove the screws from the metal plate fixing the encoder battery and slowly pull out the battery assembly.

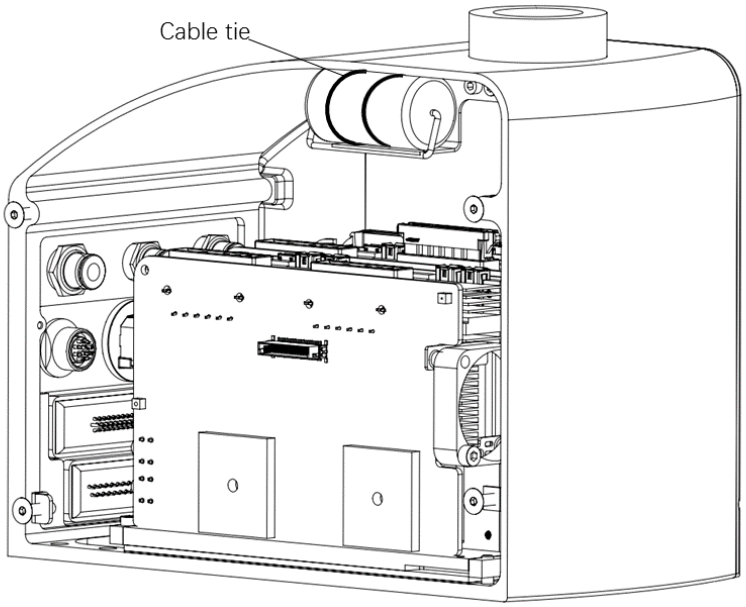


Figure 5-3 Cable tie for fixing battery assembly

Step 3 Remove the door panel on the other side with reference to Section 4.2 .

Step 4 Find the backup interface (battery interface 2) of the encoder battery on the controller communication module to connect a new encoder battery, and then disconnect the old encoder battery connector from the battery interface 1 on the controller communication module, as shown in Figure 5-2.

NOTICE

The robot will lose the zero point when 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.

Step 5 Take out the old encoder battery and replace it with a new one. Place the new encoder battery in the battery holder and tighten it with a cable tie.

Step 6 Install the battery holder as it is.

Step 7 Reinstall the side door panel of the upper control cabinet of the robot.

5.2 Replacement and maintenance of controller components

The controller is located in the upper control cabinet of the robot. To replace it, the side door panel of the upper control cabinet needs to be removed. The position of the controller is shown in Figure 5-4.

NOTICE

Back up 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: 2.5 mm Allen wrench, cable tie, diagonal pliers, controller, static protective gloves.

Screw type: hexagon socket head cap screw (M3 * 12), hexagon socket countersunk head screw (M4 * 12).

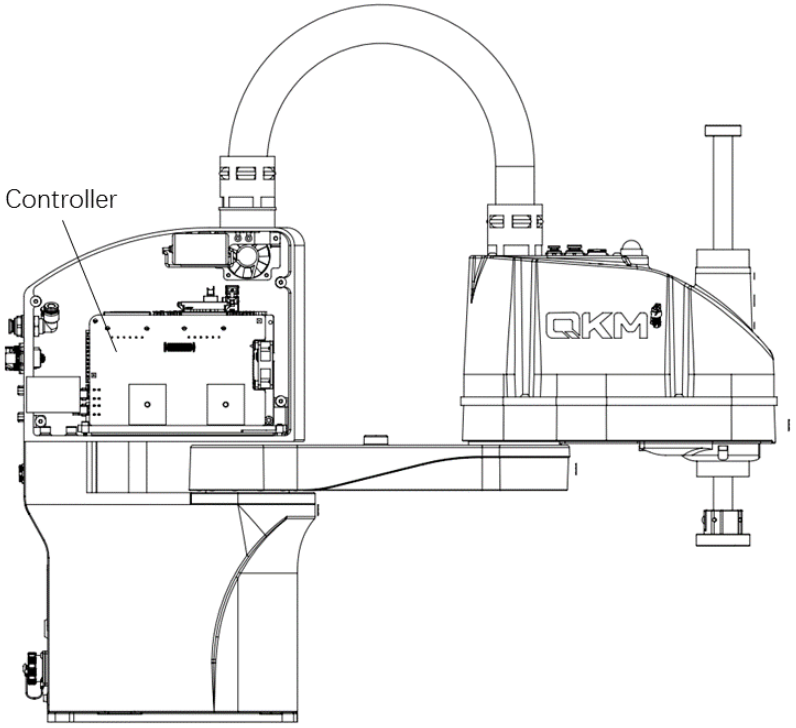


Figure 5-4 Controller

Step 1 Refer to Section 4.2 to remove the side door panel from the upper control cabinet of the robot.

Step 2 Unplug all cables connected to the old controller.

Step 3 Remove all screws (as shown in Figure 5-5and Figure 5-6) from the mounting part of the controller. Take the controller out of the upper control cabinet.

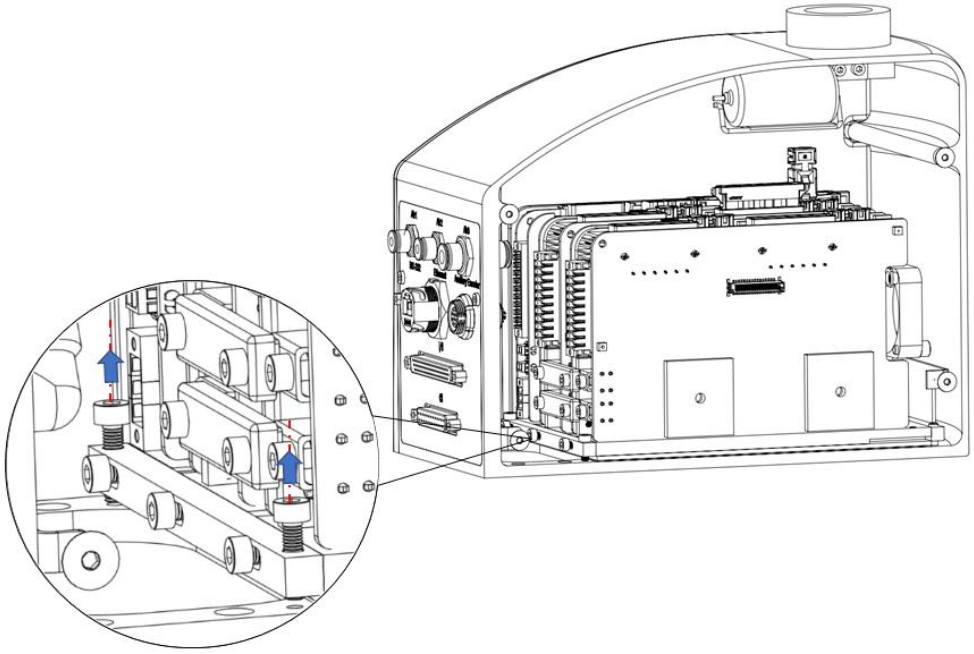


Figure 5-5 Removal of screws from controller fixing part

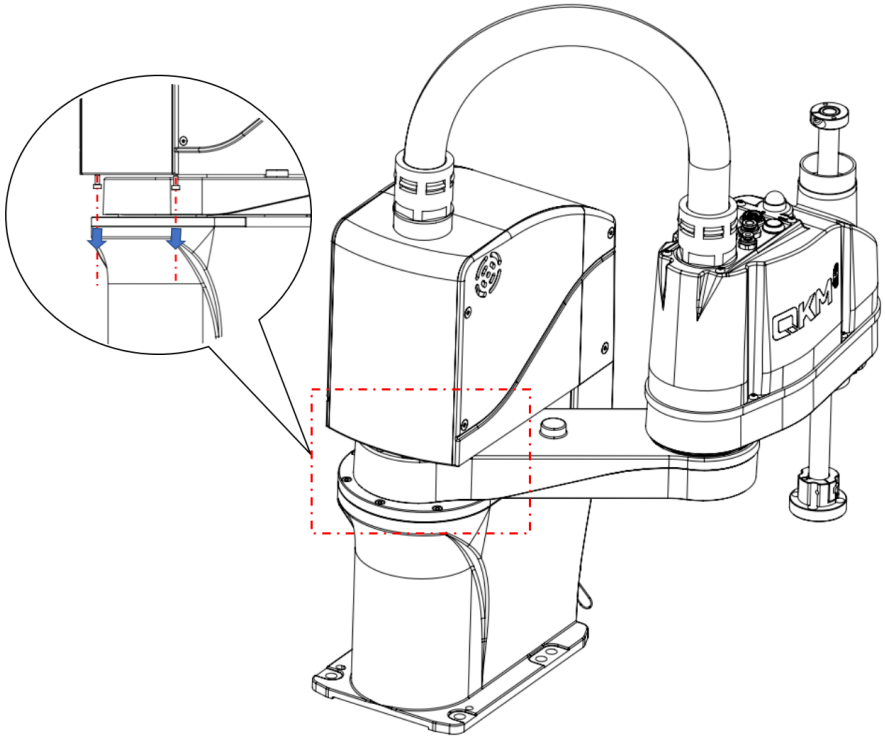
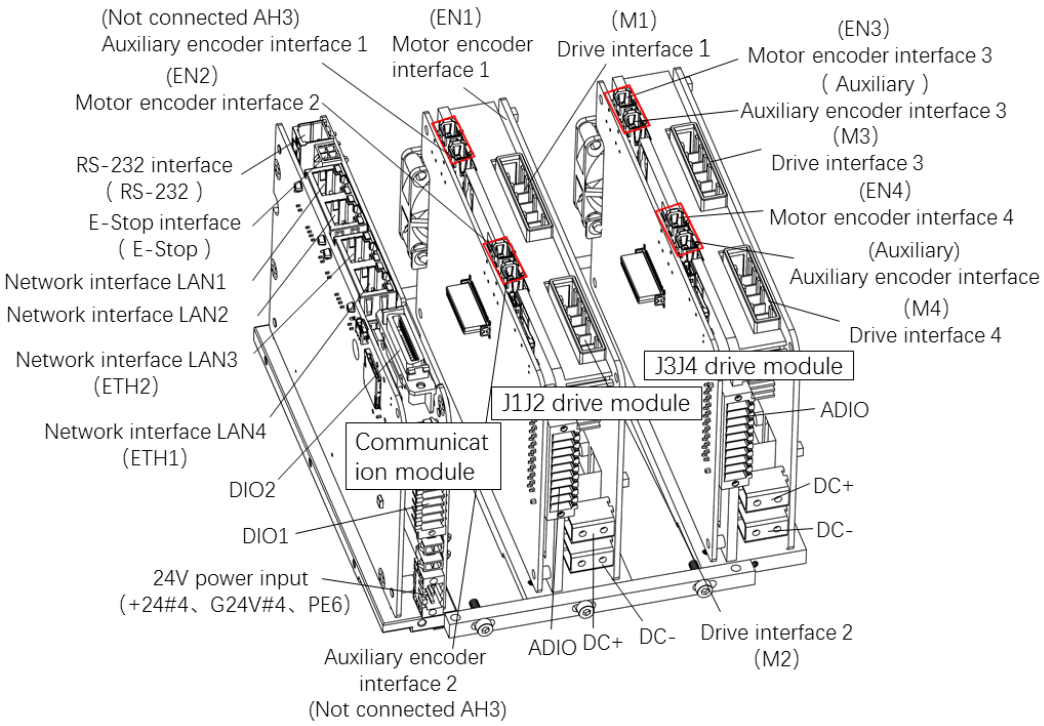


Figure 5-6 Removal of screws from the bottom of controller fixing part

Step 4 Remove the old controller, install a new controller in the upper control cabinet and tighten the screws, and then reconnect all cables to the new controller.

NOTE	At the time of installation, users shall check whether the interfaces match the line labels to avoid damage to the controller due to wrong connection. Line labels corresponding to each interface are shown in the figure below:



Step 5 Reinstall the upper control cabinet side door panel.

5.3 Replacement and maintenance of upper control cabinet fan

The upper control cabinet fan is located in the upper control cabinet. To replace and maintain it, the side door panel of the upper control cabinet needs to be removed. The position of the upper control cabinet fan is shown in Figure 5-7.

Tools and accessories: 2.5 mm Allen wrench, cable tie, diagonal pliers, controller fan, static protective gloves.

Screw type: hexagon socket head cap screw (M3 * 6)

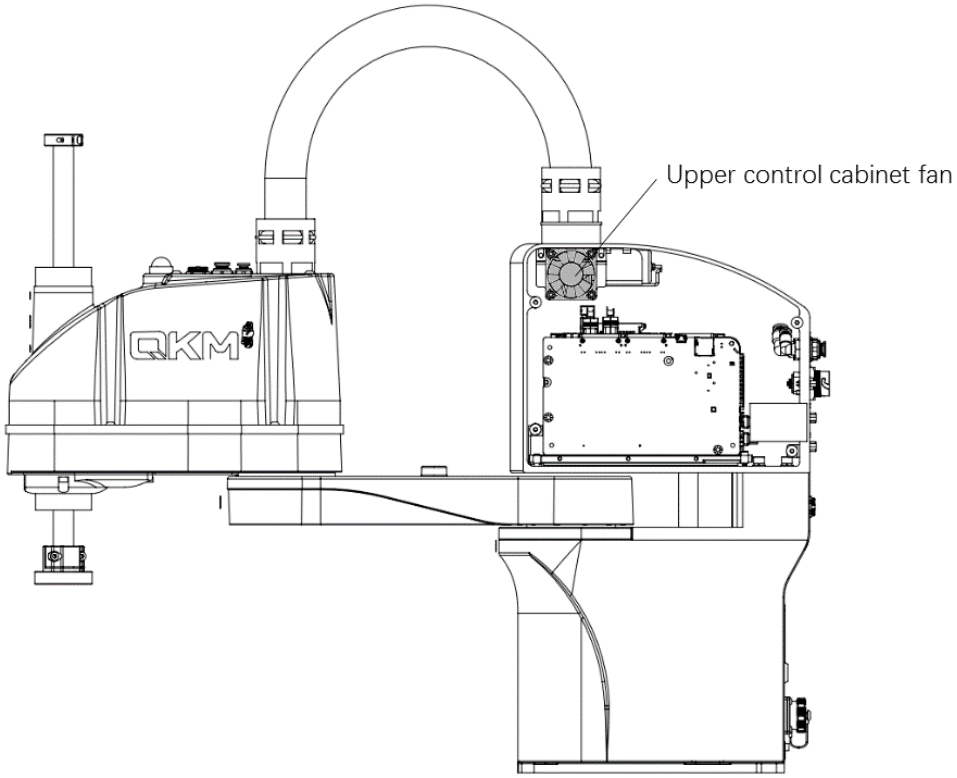


Figure 5-7 Upper control cabinet fan

Step 1 Refer to Section 4.2 to remove the side door panel from the upper control cabinet of the robot.

Step 2 Use 2.5 mm Allen wrench to loosen the screws and remove the fan module. The position of the screws is shown in Figure 5-8.

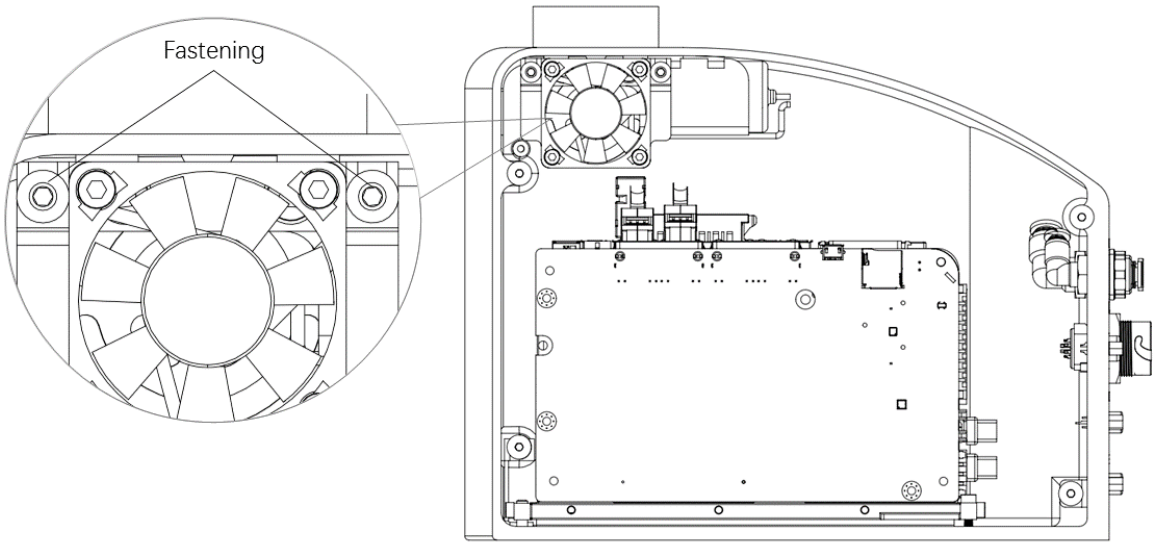


Figure 5-8 Removal of screws from fan

Step 3 Find the upper control cabinet fan plug on the PCBA behind the base, unplug the fan connector and remove the old fan module.

Step 4 Remove the old fan from the metal plate and install a new fan (note that the airflow direction is inward).

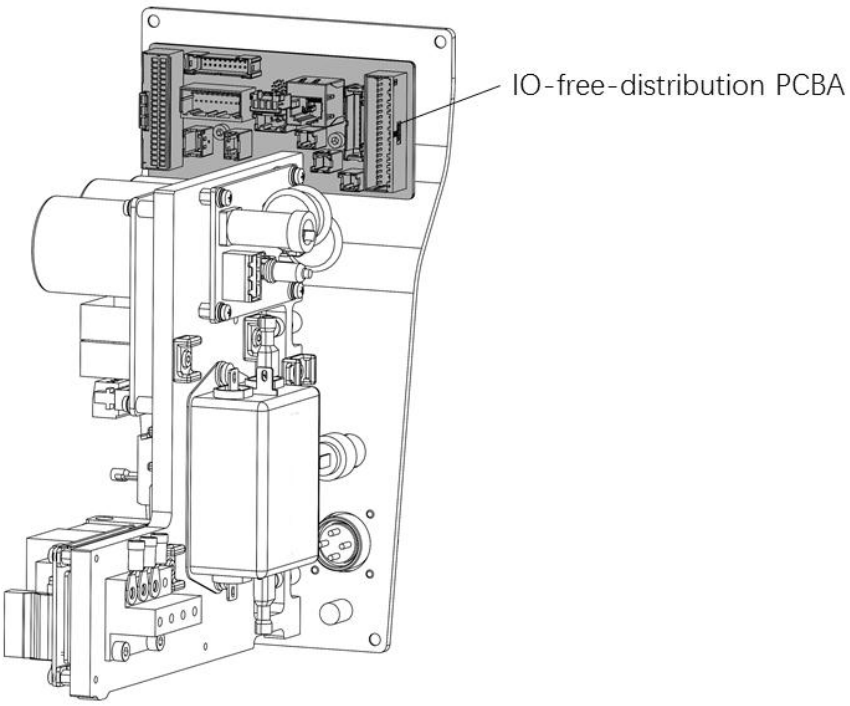
Step 5 Reinstall the new fan module and plug the fan connector.

Step 6 Reinstall the upper control cabinet side door panel.

5.4 Replacement and maintenance of IO-free-distribution PCBA

The IO-free-distribution PCBA is located in the base. To replace and maintain it, the base interface panel needs to be removed. The position of PCBA is shown in Figure 5-9.

Tools and accessories: 2.5 mm Allen wrench, diagonal pliers, cable tie,



special assembly and disassembly tool for aviation plug,

static protective gloves.

Screw type: hexagon socket head cap screw (M3 * 8)

Figure 5-9 IO-free-distribution PCBA

Step 1 Refer to Section 4.5 to remove screws from the base interface panel of the robot and gently pull out the base interface panel.

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

Step 3 Use 2.5mm Allen wrench to loosen the fastening screws on the IO-free-distribution PCBA and remove them. The position of the screws is shown in Figure 5-10.

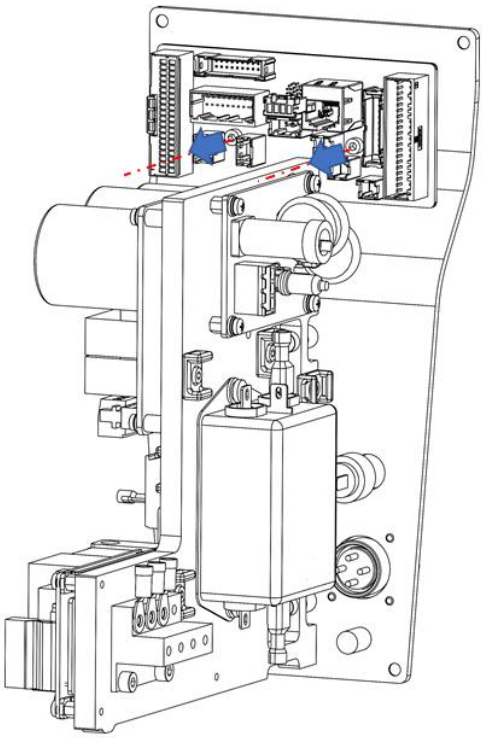


Figure 5-10 Removal of IO-free-distribution PCBA

Step 4 Use the special assembly and disassembly tool for aviation plug to loosen the nut and remove the IO-free-distribution PCBA. The position of the screws is shown in Figure 5-11.

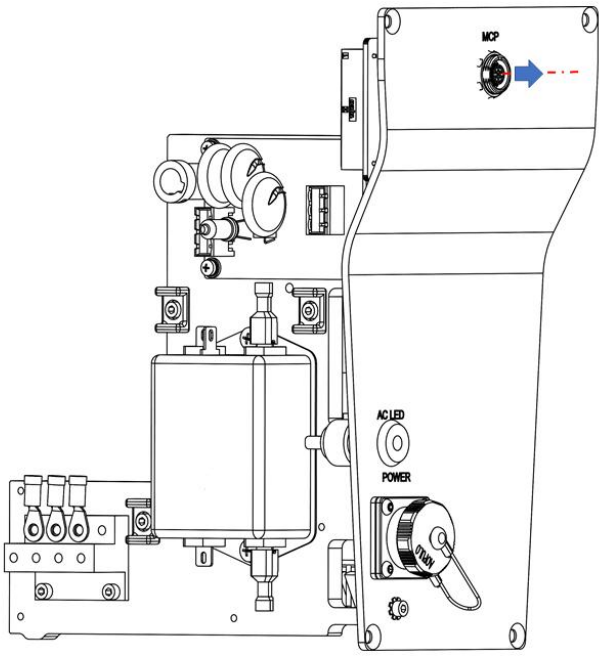
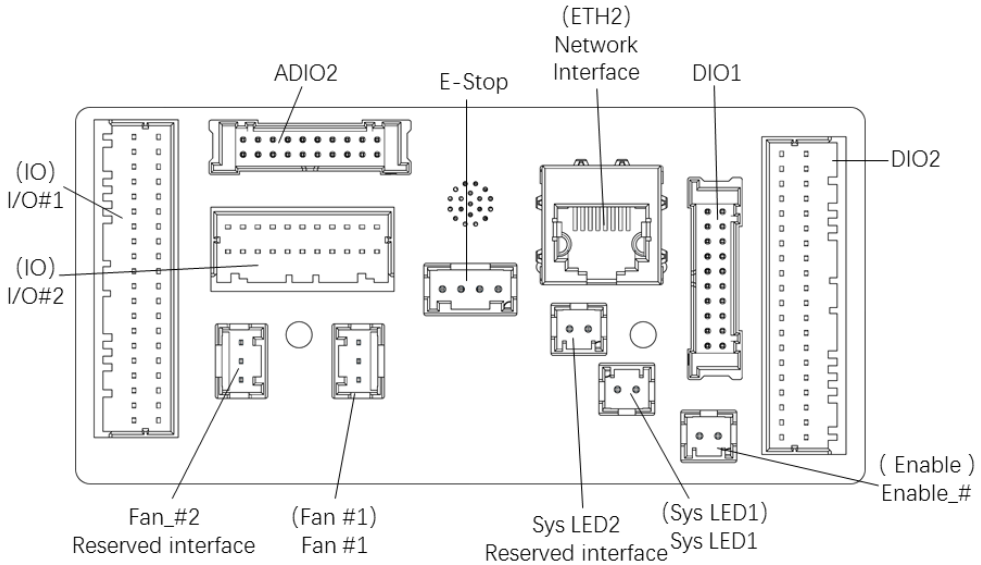


Figure 5-11 Removal of nut from IO-free-distribution PCBA

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

NOTE

At the time of installation, users shall check whether the interfaces match the line labels to avoid damage to the controller due to wrong connection. Line labels corresponding to each interface are shown in the figure below:



Step 6 Install the base interface panel of the robot as it is.

5.5 Replacement and maintenance of surge PCBA

The surge PCBA is located in the base of the robot. To replace it, the base interface panel of the robot needs to be removed. The position of the surge PCBA is shown in Figure 5-12

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

static protective gloves.

Screw type: cross recessed screw (M3 * 6), 304 stainless steel spring washer.

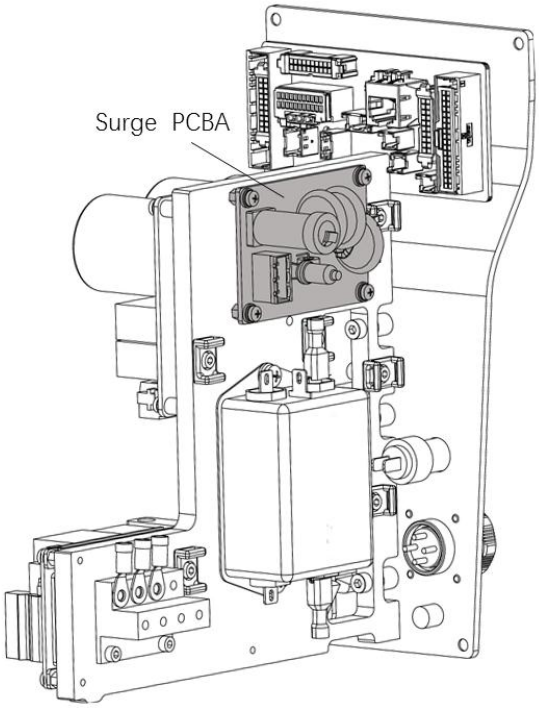


Figure 5-12 Surge PCBA

Step 1 Refer to Section 4.5 to remove the fastening screws from the base interface panel of the robot and gently pull out the base interface panel.

Step 2 Unplug all the cables connected to the surge PCBA.

Step 3 Use the cross screwdriver to unscrew the combination screws on the surge PCBA and remove them, as shown in Figure 5-13.

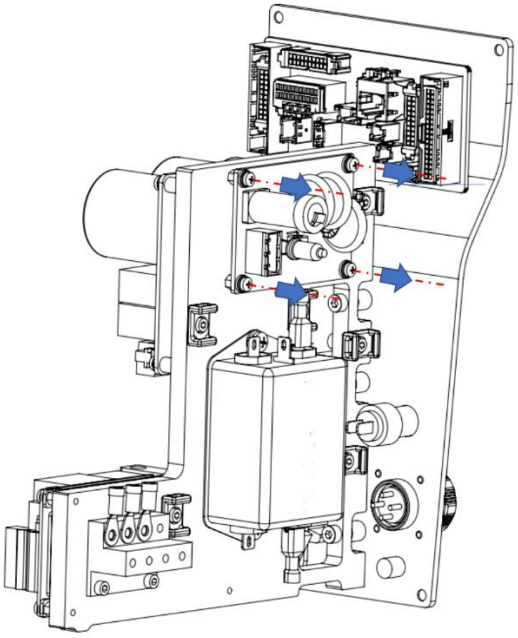


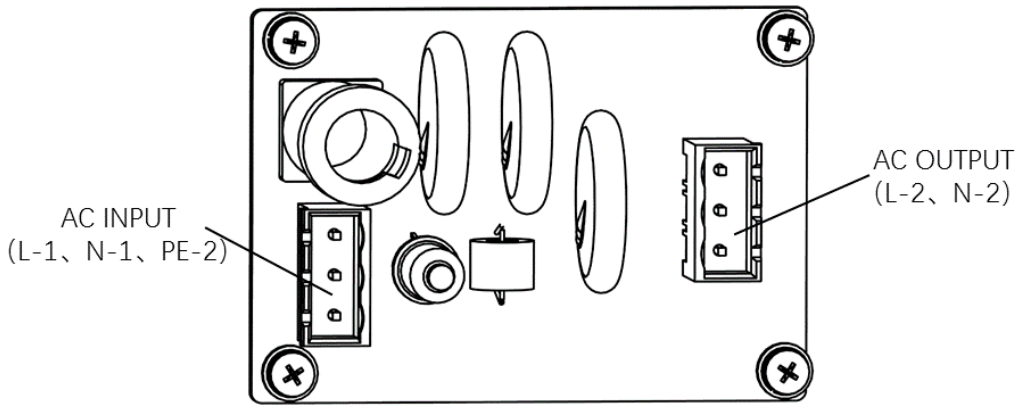
Figure 5-13 Removal of surge PCBA

Step 4 Install a new surge PCBA on the part in the base and tighten the screws, and

then connect all cables to the new surge PCBA.

NOTE

At the time of installation, users shall check whether the interfaces match the line labels to avoid damage to the controller due to wrong connection. Line labels corresponding to each interface are shown in the figure below:



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

5.6 Replacement and maintenance of filter

The filter is located in the base of the robot. To replace it, the base interface panel of the robot needs to be pulled out. The position of the filter is shown in Figure 5-14.

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

static protective gloves.

Screw type: cross recessed screw (M4 * 8), 304 stainless steel spring washer.

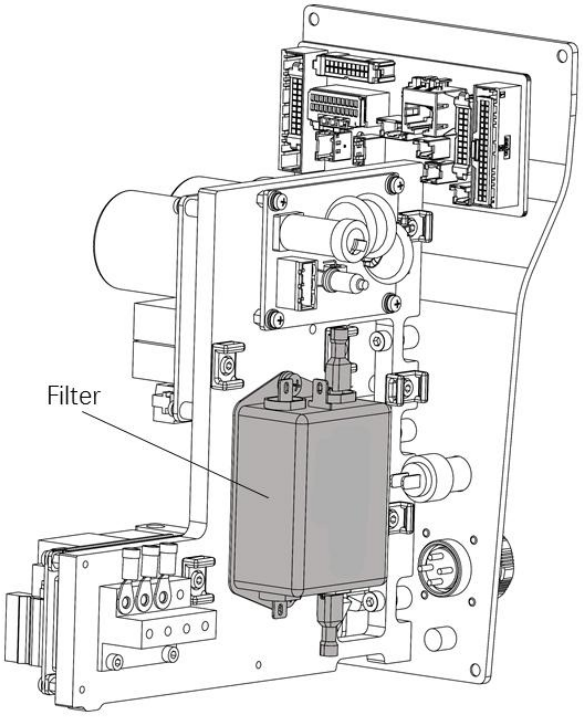


Figure 5-14 Filter

Step 1 Refer to Section 4.5 to remove the screws from the base interface panel of the robot and gently pull out the base interface panel.

Step 2 Unplug all cables connected to the filter.

Step 3 Use the cross screwdriver to loosen the combination screws on the filter and remove them, as shown in Figure 5-15.

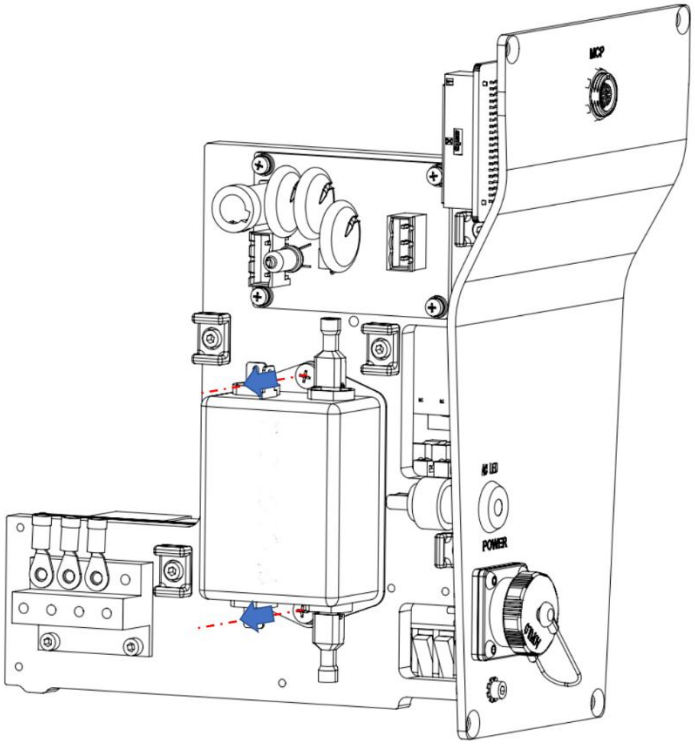
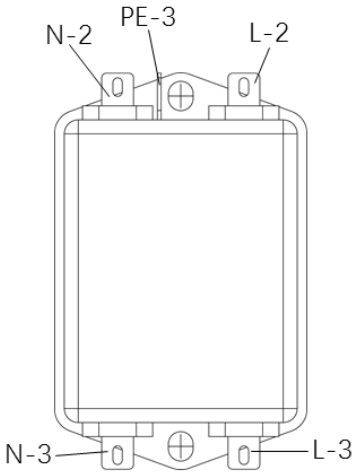


Figure 5-15 Removal of filter

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

NOTE

At the time of installation, users shall check whether the interfaces match the line labels to avoid damage to the controller due to wrong connection. Line labels corresponding to each interface are shown in the figure below:



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

5.7 Replacement and maintenance of QBUS module

The QBUS module is located in the base of the robot. To replace it, the base interface panel of the robot needs to be pulled out. The position of the QBUS module is shown in Figure 5-16.

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

Screw type: cross recessed round head screw (M3 * 6), 304 stainless steel spring washer.

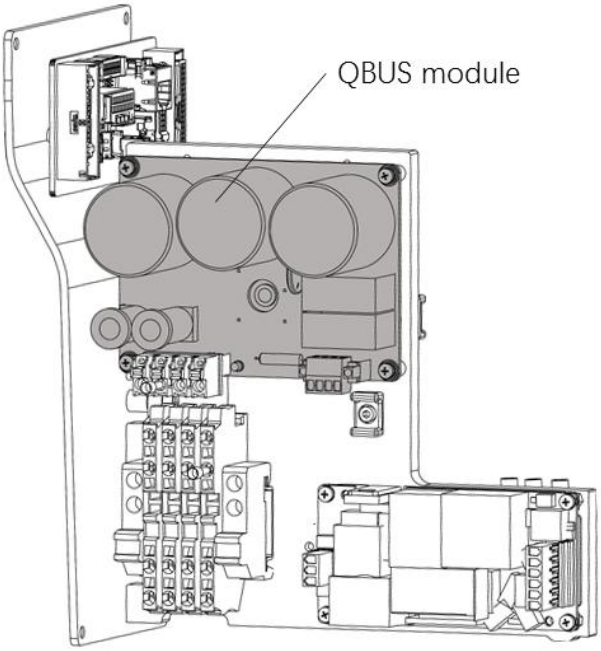


Figure 5-16 QBUS module

Step 1 Refer to Section 4.5 to remove screws from the base interface panel of the robot and gently pull out the base interface panel.

Step 2 Unplug all cables connected to the QBUS module.

Step 3 Use the cross screwdriver to loosen the combination screws on the QBUS module and remove them, as shown in Figure 5-17.

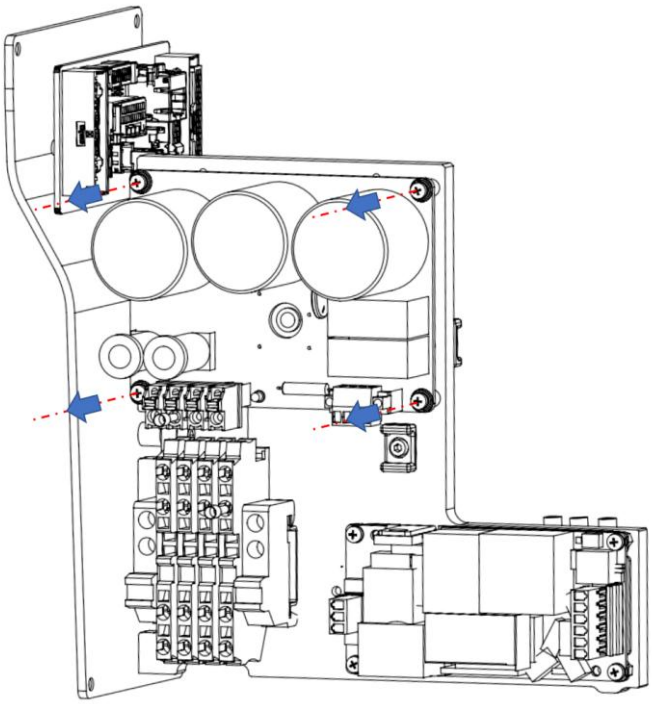
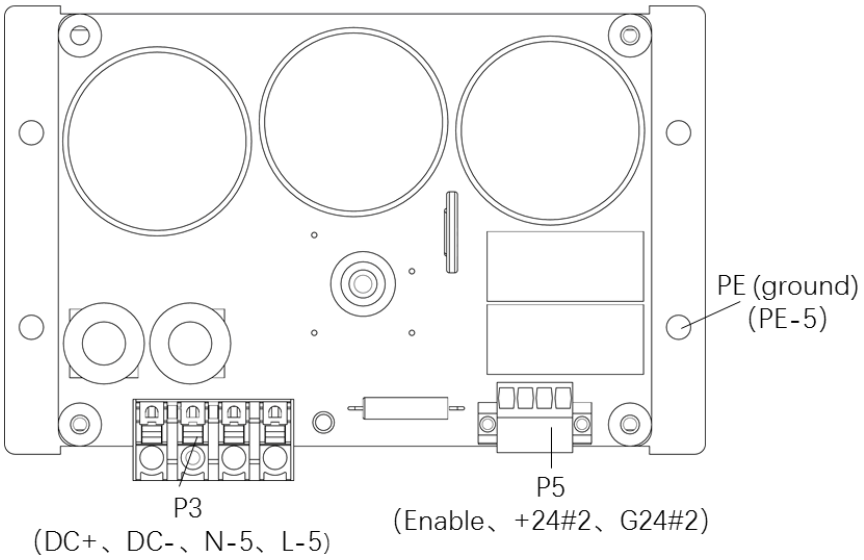


Figure 5-17 Removal of QBUS module

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

NOTE

At the time of installation, users shall check whether the interfaces match the line labels to avoid damage to the controller due to wrong connection. Line labels corresponding to each interface are shown in the figure below:



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

5.8 Replacement and maintenance of QBUS fuse

There are two QBUS fuses on the QBUS module, as shown in Figure 5-18.

Tools and accessories: straight screwdriver, 8A fuse, static protective gloves.

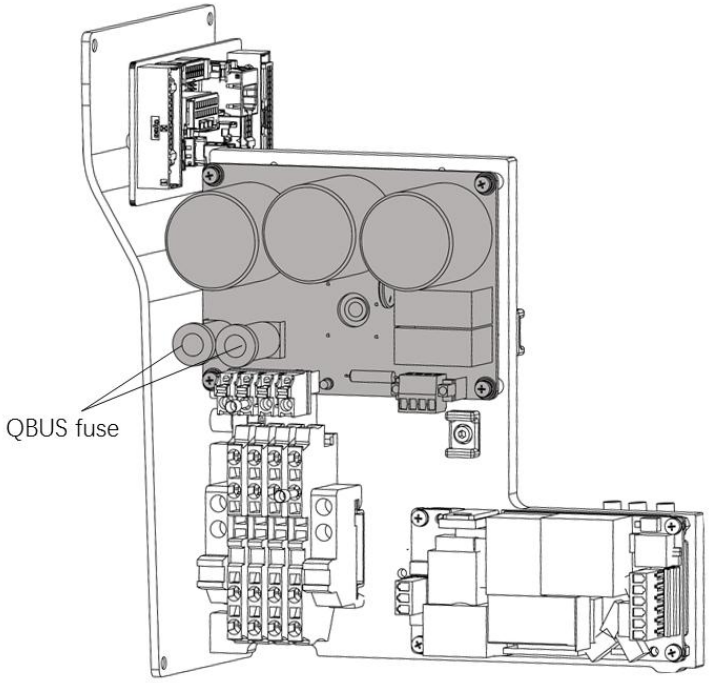


Figure 5-18 QBUS fuse

Step 1 Remove the base interface panel from the robot with reference to Section 4.5.

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.

5.9 Replacement and maintenance of 24V switching power supply

The position of the 24V switching power supply is shown in Figure 5-19.

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

Screw type: cross recessed round head screw (M3 * 6),

304 stainless steel spring washer.

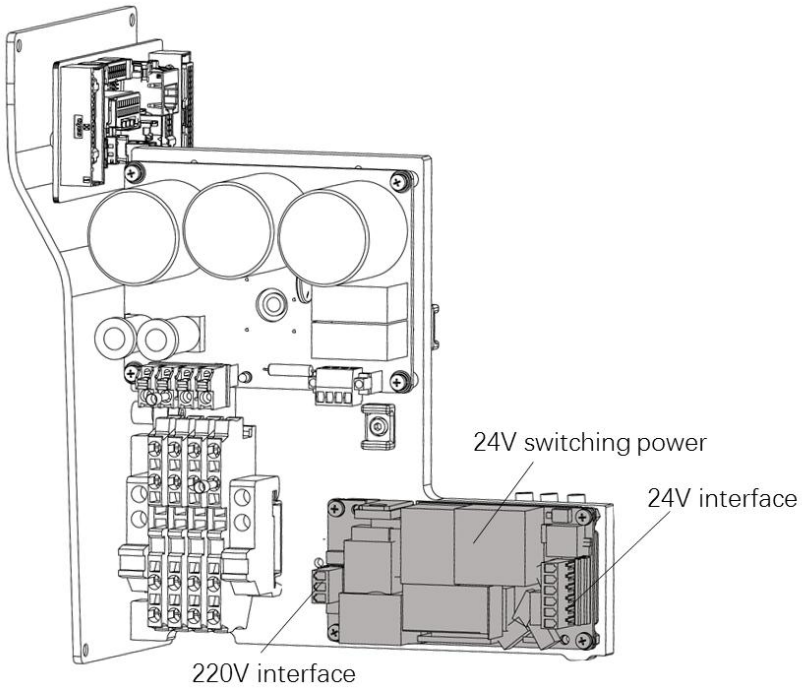


Figure 5-19 24V switching power supply

Step 1 Refer to Section 4.5 to remove the base interface panel of the robot and take it out.

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

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 5-20.

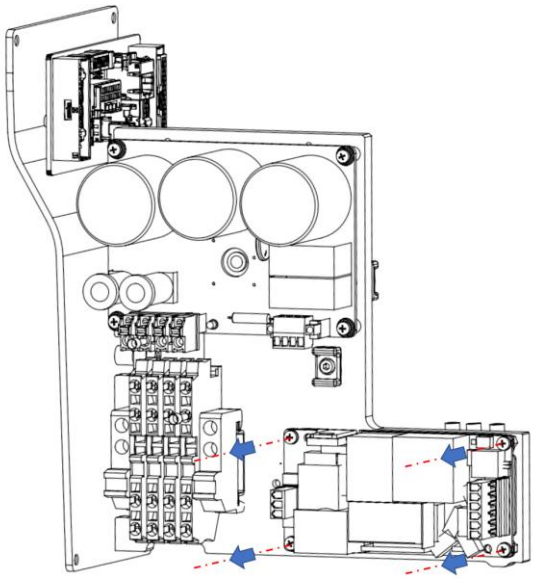


Figure 5-20 Removal of power module

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

NOTE

Line labels of the 24V power plug include + 24V # 1 and G24 # 1.

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

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

5.10 Replacement and maintenance of brake PCBA in the second mechanical arm

The brake PCBA in the second mechanical arm is located in the base of the robot. To replace it, the base interface panel of the robot needs to be pulled out. The position of the brake PCBA in the second mechanical arm is shown in Figure 5-21 .

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

Screw type: cross recessed screw (M3 * 6), 304 stainless steel spring washer.

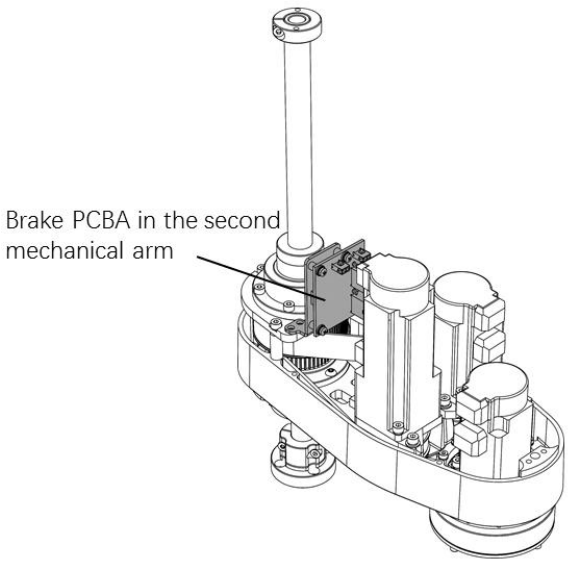


Figure 5-21 Brake PCBA in the second mechanical arm

Step 1 Refer to Section 4.6 to remove screws from the second mechanical arm shell of the robot and gently pull out the second mechanical arm shell.

Step 2 Unplug all cables connected to the brake PCBA in the second mechanical arm.

Step 3 Use the cross screwdriver to unscrew the combination screws on the brake PCBA in the second mechanical arm and remove them, as shown in Figure 5-22

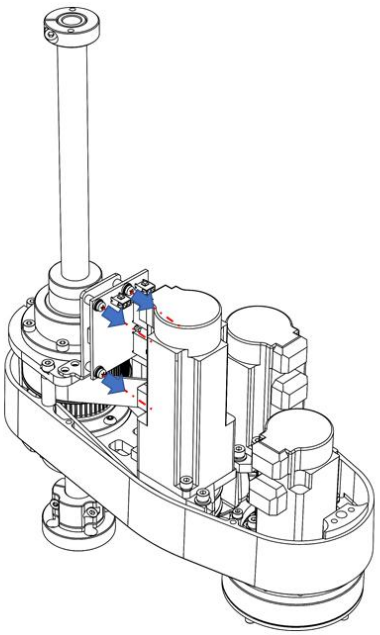
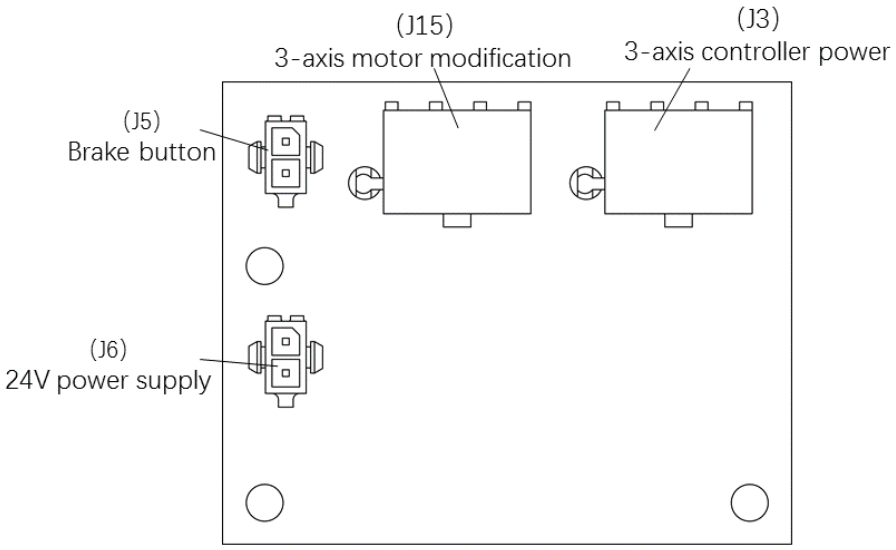


Figure 5-22 Removal of brake PCBA from the second mechanical arm

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

NOTE

At the time of installation, users shall check whether the interfaces match the line labels to avoid damage to the controller due to wrong connection. Line labels corresponding to each interface are shown in the figure below:



Step 5 Reinstall the second mechanical arm shell of the robot as it is.

Chapter 6 Technical Services

6.1 Consulting and services

QKM Technology Co., Ltd. is committed to providing you with technical information on machine motion and operation to help you clear faults and reply to your inquiry in detail. If your robot or equipment fails during use, you can contact our service department and provide as much information 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 (call 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 application(s)
- Other additional supporting products (vision, PLC, etc.)
- Problem description, duration and frequency of faults, etc.

Provide Superior Robot Products and Services to Global Manufacturers

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