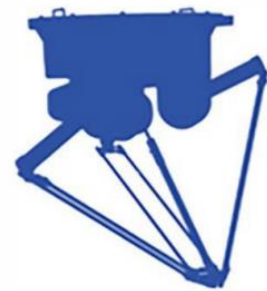


AP25X Robot

Maintenance Manual



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Robot Maintenance Manual

AP25X Robot

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Dongguan Liquan Automation Technology Co., LTD

QKM Technology (Dongguan) Co., Ltd.

Preface

Thank you for buying our robots

This manual records the things needed to use the robot correctly

Read this manual carefully before use

Please keep this manual safe for future reference

Summary

This manual describes in detail the daily maintenance of the robot and the handling of common abnormal conditions, so that users can better maintain the robot.

Target audience

This manual applies :

Client Engineer	Technical Support Engineer
Applications Engineer	Installation and Bring-up Engineer

Figure illustration

This diagram will clearly illustrate all hazards, warnings, notices and instructions that may occur when performing the work described in this manual. Please pay attention to the following diagrams in this manual.

The diagrams appearing in this manual are described in the following table:

Label	Description
 DANGER	Indicates that serious dangerous situations may occur, such as death or serious injury to personnel if not avoided.
 WARNING	It indicates that potential dangerous situations may occur, such as personnel injury and equipment damage if not avoided.
 NOTICE	Indicates that unpredictable situations may occur, such as failure to avoid equipment damage, performance degradation, data loss, etc.
 NOTE	Indicates key information and operational tips.

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1 Maintain Security

Industrial robots comply with current technical levels and existing safety regulations. Improper use may cause personal injury, damage to the robot system and other equipment.

Industrial robots are only allowed to be used in good technical condition and in accordance with regulations and safety awareness. Liqun Automation Technology Co., Ltd. shall not be liable for any losses caused by users' illegal use of industrial robots. In order to ensure the service life of robots, regular maintenance of robots shall be carried out according to the contents of this manual.

1.1 Related Personnel

Prior to the deployment of a robot, the personnel concerned must be informed of the manner and scale of the work and the possible risks. Regular instruction must be given to ensure the safety of the personnel during the operation of the robot.

Users must meet the following conditions:

- Must receive training in robotics.
- Have the knowledge and experience in this area, be familiar with the prescribed standards, and therefore be able to make a correct judgment on the work to be done, and be able to identify potential hazards



Only professionals are allowed to perform operations on the electrical and mechanical parts of the robot to avoid injury to the operator.

1.2 Safe Region

The use of robots needs to mark the safety area and pay attention at all times, so as not to cause accidents due to neglect of the safety area.

- Work space

The working area is determined by the motion trajectory of the robot, and the scope of the working area is ensured by the protective device.

- Protective areas

The protection area should be larger than the working area, and protective devices should be placed in the protection area for warning and attention to safety.

Common isolation protection devices are: guardrail; common warning protection devices are: warning signs and slogans.

- Danger area

The dangerous area includes any position that can be stayed in the movement trajectory of the robot body and the robot arm. The area can be protected by isolated protective devices to avoid loss of personnel or property.

When the robot stops running, the robotic arm stops in the dangerous area.

1.3 Emergency Stop Device

When the robot is abnormal, it is necessary to press the emergency stop device to ensure the safety of personnel and avoid damage to the robot and personnel.

The emergency stop device of the industrial robot shall be located in a position convenient for operation. The device must be pressed in case of danger or emergency.

What happens when you press the device:

- The robot and its supporting equipment will stop in their current state, and the robot is in a drop servo state.
- To restart the robot, rotate the emergency stop device to unlock it.
- The emergency stop device is connected through the user's interface. The emergency stop device is not included in the delivery scope of the robot.



Only professionals are allowed to perform operations on the electrical and mechanical parts of the robot to avoid injury to the operator.

1.4 Safety Signs

It is strictly prohibited to change or remove the nameplate, instructions, icons and markings related to robots and equipment.

The identification of the robot includes:

- Power nameplate
- Safety icon
- Cable markings

1.5 General Security Measures

- In the case of imperfect safety functions and protective devices, robots may cause loss of personnel or property. The use of robots is prohibited when safety functions are turned off or protective devices are removed.
- In the actual production and use of robots, if the ambient temperature is lower than 0°C, the robot needs to start up slowly. The heating action can be simply taught to run back and forth between two points, and the speed is between 30% and 60% of the rated speed for no less than 30 minutes.
- The changed program should be tested at a reduced system speed at startup, and then gradually increased.

1.5.1 Change the Operation

- After modifying the robot, it must be checked whether it meets the necessary safety requirements, and all safety functions must be tested for safety performance.
- The changed program should be tested at a reduced system speed at startup, and then gradually increased.

1.5.2 A failure Occurred

- Close the control system of the robot to prevent accidental restart without permission.
- Place a clear sign at the fault site to indicate the fault.
- Document the fault.
- Remove the fault and perform a functional check.

1.5.3 Put into operation and put back into operation

Equipment and devices must be checked before they are put into operation for the first time to ensure that they are complete and functional, can operate safely and can detect faults.

The contents to be checked before the first or re-operation are:

- All protective devices are properly installed and in good working order.
- Check whether the electrical cables are properly connected. If compressed air is used, check whether the corresponding air pipes are properly connected.
- Demonstrate whether the working area of the robot is reasonable and eliminate other objects in the working area.

1.5.4 Bring to Rest

Matters needing attention when the robot stops running:

- When the equipment is used again after a long power failure, battery abnormalities are likely to occur. Therefore, the robot should be kept at zero position as far as possible before the equipment is stopped for a long time.
- Slow down the robot and make sure that the robot can stop before it goes into servo.
- Recycle the equipment related materials to ensure that the equipment is restored to a safe restart state.
- Set up protective devices to indicate the current state of the equipment and prevent accidental operation by others.
- The recommended time interval for the robot to restart again is about 300s. Do not restart immediately after turning off the power supply to avoid damage to the robot.
- Before the robot restarts, check whether the emergency stop button is released to avoid the

robot not being able to go up to the servo.

2 Routine Maintenance

2.1 Routine Cleaning and Maintenance

2.1.1 Regular Maintenance and Repair

Daily maintenance is a kind of preventive maintenance, which means that maintenance personnel carry out periodic overhaul and maintenance work when the performance of the robot is normal, so as to ensure that the robot is in good condition and meets the production requirements, keep the robot in good condition, find and eliminate potential faults of the robot in time, and maintain neatness, cleanliness, lubrication and safety.

The personnel responsible for maintaining the QKM robot should formulate the maintenance cycle according to the contents of this manual, local actual conditions and working conditions, do a good job in daily inspection and maintenance of the robot, and deal with the faults in time.

To maintain optimal robot performance, prevent malfunctions, and ensure safety, users should perform daily maintenance and inspections according to the following guidelines. The scheduled maintenance intervals are based on standard operating conditions. For specific operational environments, please refer to the environmental parameters in the AP25X Robot User Manual. Actual maintenance schedules should be adjusted according to the robot's usage environment and frequency of operation.

2.1.2 Robotics Cleaning

After the robot is in a working state for a long time, dust or dirt will appear on its surface. Regular cleaning and maintenance of the robot are required. The maintenance cycle under general working conditions is shown in Table 2-1.

Maintain projects	Maintenance cycle	Recommended maintenance methods
Robot body	everyday	Use a clean cloth to wipe the surface dust
Globe joint	everyday	Use a pneumatic gun or clean cloth to remove impurities in the bushing and on the surface of the ball head
Mobile platform	everyday	Use a clean cloth to wipe the surface dust
Pipeline routes	everyday	Use a clean cloth to wipe the surface dust
Axis of rotation	everyday	Wipe the surface with a rinse or clean cloth. Be sure to wipe the water layer clean and add lubricating oil or grease
Motor cover	everyday	Use a clean cloth to wipe the surface dust

Table 2-1 Conventional cleaning and maintenance schedule

- Cleaning agent selection:

Sodium hydroxide cleaner

The cleaning of the robot can be performed using a neutral food machinery cleaner available at room temperature. All components of the robot can be cleaned and maintained for daily maintenance. Long-term frequent corrosive cleaning or exposure to sunlight may cause discoloration of the robot's material, but there will be no significant loss of material, so there is no need to worry about it.



Anodized parts are not suitable for immersion cleaning, and highly corrosive cleaning is not suitable for robot cleaning.

Water cleaner

After cleaning, there may be a small amount of water on the top of the robot, ball joint and moving platform. You can wipe away the excess water with clean cloth or dry it naturally or blow dry it.

2.1.3 Routine Inspection

In order to maintain the good working condition of the robot, please carry out maintenance and inspection according to the items in Table 2-2. When carrying out maintenance and inspection, please pay attention to disconnect the power supply first.



Please pay attention to anti-static operation during electrical operation, such as wearing anti-static wristbands and other measures to ensure that the internal parts of the robot are not damaged.

Check components or items	Maintenance projects	Detail	Maintenance frequency					
			Daily inspection	One month	Three months	Six months	Twelve months	24 months
J1, J2 and J3 axes	Motor and reducer foundation inspection	Loosen the brake on the base interface board, push up and down the active arm to feel whether there is any unsmooth operation or large resistance. If so, contact QKM.		√	√	√	√	√
J4 axis	Motor and reducer foundation inspection	Turn the moving platform to feel whether there is any difficulty in running or large resistance, or abnormal sound. If so, please contact QKM.		√	√	√	√	√
J1, J2, J3, shaft reducer installation screws	Check the retarder	Use an 12.0Nm torque wrench to check whether the reducer installation screws are loose. If so, contact QKM.				√	√	√
J4 shaft reducer installation screws	Check the retarder	Use a 2.5Nm torque wrench to check whether the reducer installation screws are loose. If so, contact QKM.				√	√	√
Master arm	Active arm examination	Check whether the screw is loose, whether there is impact or wear damage. If there is serious damage, replace the active arm.	√	√	√	√	√	√
From the lever arm	Check the lever arm	Check whether the carbon fiber rod has impact or wear damage. If the driven arm is damaged, replace the driven arm.	√	√	√	√	√	√
Motion platform	Check the motion platform	Use a clean cloth to wipe the surface dust, and confirm whether serious deformation, poor rotation, or oil leakage has occurred. If there is any abnormality, contact QKM.	√	√	√	√	√	√
Bulb	Ball joint inspection	Use a air gun or clean cloth to remove impurities from the surface of the ball head.	√	√	√	√	√	√

Bush	Lubrication system inspection	Use a pneumatic gun or clean cloth to remove impurities in the bushing. If the bushing is missing edges, cracks or severe wear, replace the bushing.	√	√	√	√	√	√
Spring	Spring inspection	Whether the spring is deformed or broken, if deformed or broken, please replace the spring.	√	√	√	√	√	√
Cell	Battery replacement	Check the battery usage date, must be replaced after two years.						√
Base interface board brake button	Check the brake function	1. Check that the shaft will not fall due to gravity when the motor is under servo or power off. 2. When the motor is powered off or the brake release switch is not enabled, the shaft drops. Please contact the manufacturer. 3. If the brake button cannot be released, contact the manufacturer.	√	√	√	√	√	√
Heavy haul lines	Visual inspection of the heavy load line	Check whether the cable is worn, broken, loose plug, etc.	√	√	√	√	√	√
Emergency stop switch	Check the emergency stop function	When the motor is energized, press the emergency stop switch and check whether the robot can stop normally.	√	√	√	√	√	√
Exit	Check the security door function	When the motor is energized, open the safety door and check whether the robot can stop normally.	√	√	√	√	√	√
External airway and connector of the robot	Connectivity check	Check whether there is damage, serious bending or gas blockage. If bending occurs, manually restore the air pipe to its original position.	√	√	√	√	√	√
Install the bracket bolt	Connectivity check	Use a hex wrench to check whether the installation bolts of the fixture are loose. If loosening occurs, tighten the screws according to the component lock torque.	√	√	√	√	√	√

Mounting bolts for the base and other structural parts	Connectivity check	Use a hex wrench to check whether the mounting bolts of the base and frame are loose. If loosening occurs, tighten the screws according to the component locking torque.	√	√	√	√	√	√
External robot cable	Connectivity check	Check whether the cable connector on the robot body interface panel is loose, tangled, pulled and so on. If loosening occurs, please lock it again.	√	√	√	√	√	√
Top cover locking bolt and sealing washer	Connectivity check	Use a torque wrench to check whether all screws are loose and whether the sealing washer is cracked. If the bolt is loose, retighten it; if the sealing washer is damaged, replace it.	√	√	√	√	√	√

Table 2-2 Schedule of routine maintenance items

2.2 Safety System Check

Make daily or monthly inspection forms according to the user's site conditions to ensure that the robot and its external equipment will be inspected within the specified time.

Security system test cycle: generally six months.

To ensure the safety and reliability of the robot, please confirm that the robot is in low power condition and test any of the following switches and buttons. If any of the tests fails, the robot must be repaired to a normal working state before continuing to run.

Scope of examination :

- Located at the emergency stop switch of the operable robot equipment provided by the user.
- Automatic and manual switching switch located on the demonstrator (if the user is equipped with the demonstrator).
- Servo enable switch located on the demonstrator (if the user is equipped with a demonstrator).

2.3 Contact the Customer Service

**NOTE**

When the robot needs to replace the parts, please contact Li Qun Automation for delivery.

Users are requested to contact Li Qun automated customer service in the following abnormal situations.

- Robot zero calibration

If the zero point is lost, it needs to be recovered through calibration.

Typically, the loss of zero point occurs as follows:

1. The robot encoder battery is loose or the encoder battery voltage is low.
2. During the configuration file import process, the robot has abnormal power failure and the zero point is lost.
3. When replacing the motor, reducer, active arm, rotating shaft and other parts, the zero point will be lost.

- Replacement of electrical components

If the robot needs to open the top cover to replace parts during operation, please contact Li Qun automation customer service.

3 Maintenance of Mechanical Parts



NOTICE

Safe operation status: The robot is in the power-off servo state; the robot is connected to the power supply and only manual operation of the robot is allowed.

When operating on the robot body, please wear protective gloves and other protective equipment to ensure personnel safety.

3.1 Check the Installation Bolts

The robot should be checked once in the first week after installation to avoid problems such as loose fixed screws.

After the initial inspection, check whether the installation screws of the robot are locked every six months or so.

- Prepare tools and accessories: torque wrench

Install downward, install upward

Install downward, install upward

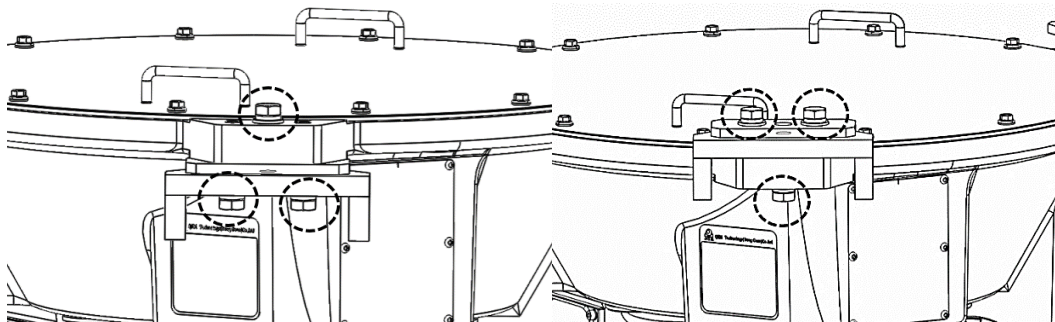


Figure 3-1 Installation method

Check the locking torque according to installation requirements during inspection. The torque of screws is shown in Table 3-1 according to the standard.

Standard	Name	Code name	Tighten torque (reference)
The metric system	Hex head bolt C grade M16×65	GB/T 5780-2000	190 Nm

Table 3-1 Locking screw torque reference standard

3.2 Replacement of the Lever Arm

The active arm, the driven arm and the moving platform are all connected and positioned by ball joints, and the spring is tightened between the ball joints at both ends of the driven arm. The spring is fastened in the slots at both ends of the spring connecting parts.

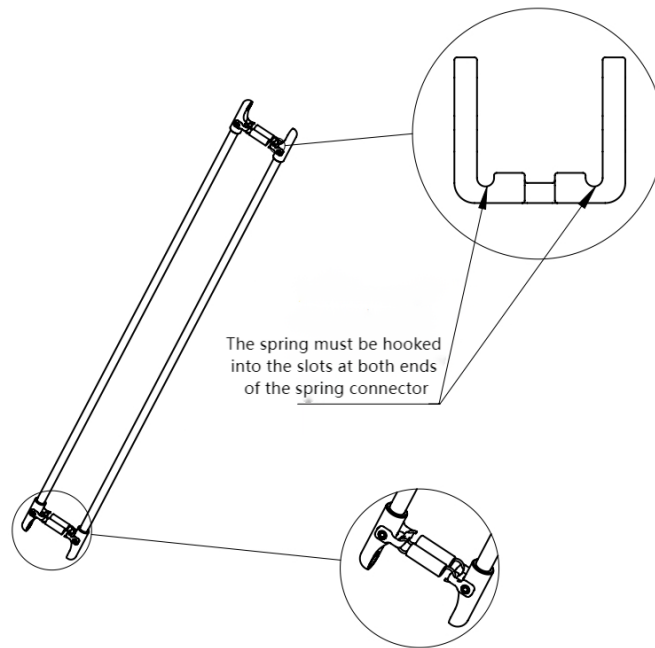


Figure 3-2 Spring buckle position

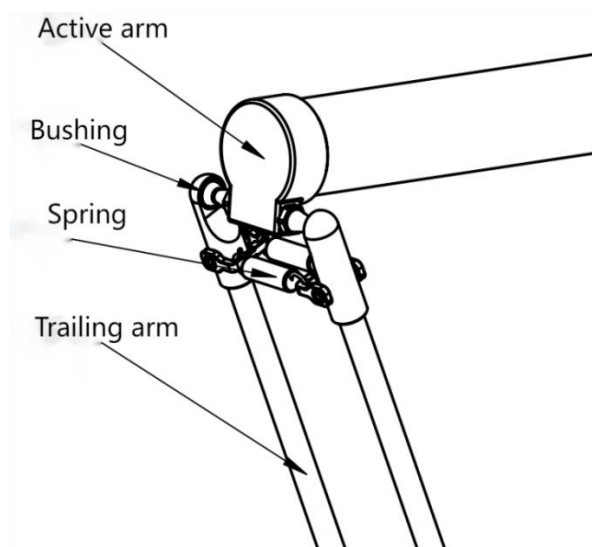


Figure 3-3 Shows the connection between active arm and passive arm

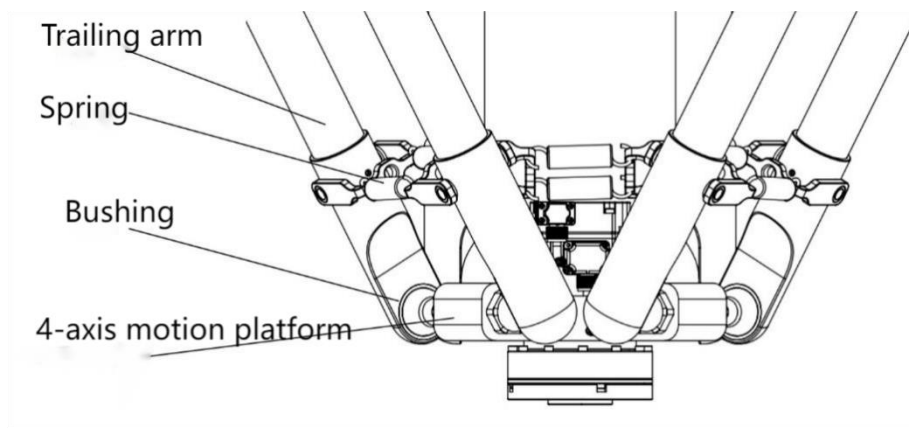


Figure 3-4 Shows the connection between the moving platform and the driven arm

- Prepare tools and accessories

Order number	Name of tool/adjuvant	Quantity	Remarks
1	From the arm assembly	3	/
2	paperboard	a surname	Place the follower arm

Table 3-2 Tools and accessories

- Operating steps

Step 1: Ensure the robot is in the lower servo position. Remove cables, air pipes, and other fixed components from the driven arm. After removing the end load from the moving platform and confirming safe operation, have two operators assist: one presses the Brake button (as shown in Figure 3-5), while the other pulls the moving platform to contact the ground or conveyor belt surface to prevent the platform's end from dropping after removing the driven arm. Finally, perform power-off procedures on the robot.



When the Brake key is pressed, the active arm, driven arm, moving platform and rotating shaft will slide under the action of their own gravity, so support measures should be taken.

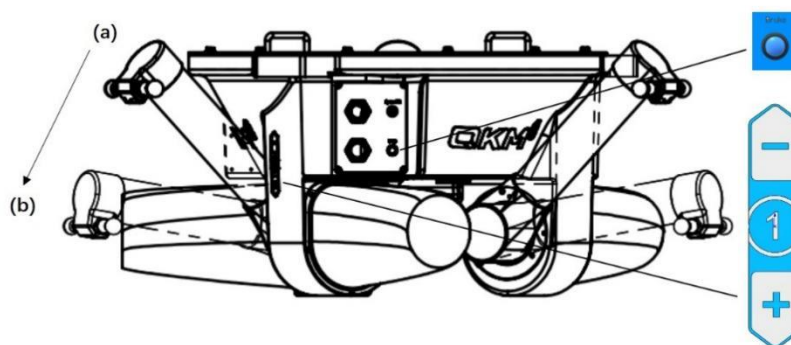


Figure 3-5 Adjust the position of the active arm

Step 2 Pull open the spring connected with the moving platform to separate the bushing from the ball head, as shown in Figure 3-6.

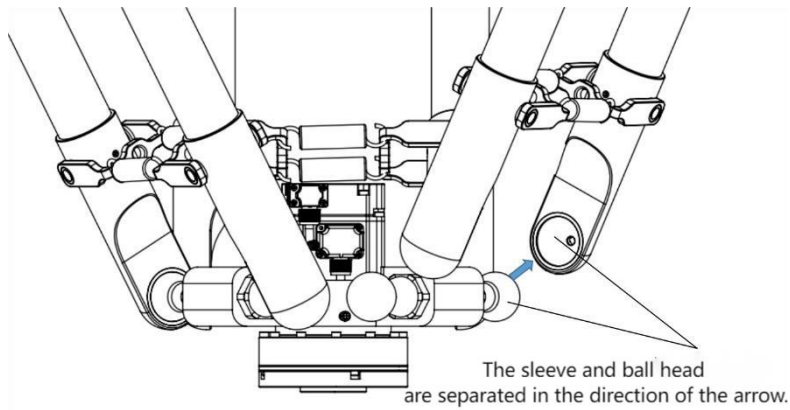


Figure 3-6 Schematic diagram of end disassembly of moving platform

Step 3 Pull out the spring connected to the active arm again, as shown in Figure 3-7, and then place the disassembled driven arm on the cardboard. At this time, pay attention to the moving platform to prevent it from falling suddenly.

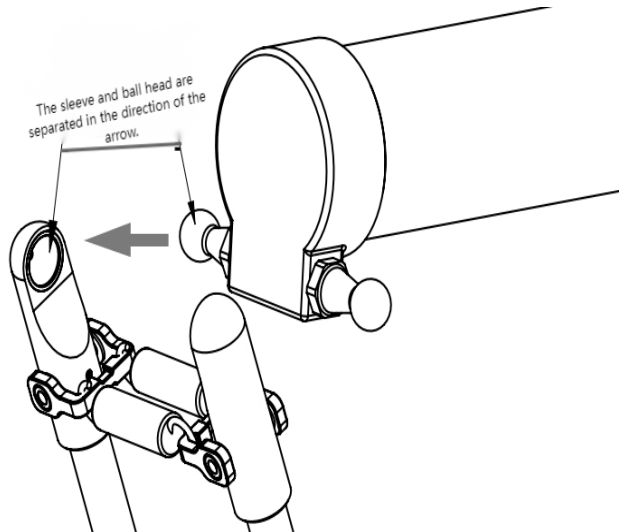


Figure 3-7 Schematic diagram of active arm end disassembly

Step 4 Install the new driven arm. Pull the spring at the connection end of the active arm by hand, and put the bushing on the ball head. After loosening the hand, the installation and connection between the driven arm and the end of the active arm are completed.

Step 5 After installing the active arm end, connect the moving platform end in the same way to complete the replacement of the driven arm.

3.3 Active arm Replacement

The replacement of the active arm should be carried out according to the following steps, and the zero point calibration should be performed after completion to ensure that the robot can work normally.

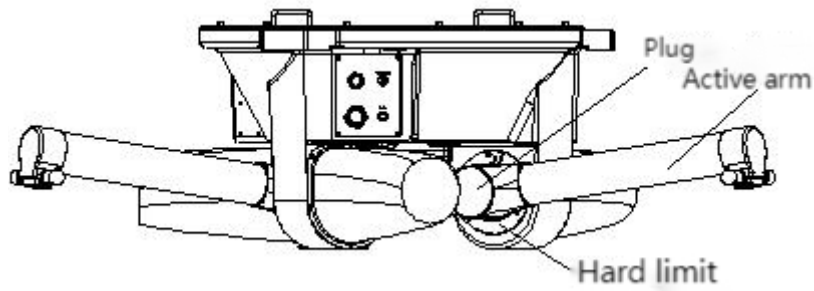


Figure 3-8 Schematic diagram of active arm after installation

● Prepare tools and accessories

Order number	Name of tool/adjuvant	Quantity	Remarks
1	Active arm assembly	3	/
2	2.5mm hex key	1	Remove the pipe plug fixing screw
3	1/2 square head ratchet wrench	1	Remove the active arm
4	H6 batch head	1	Remove the active arm
5	Air-laid paper	a surname	Clean surface stains
6	Letai 243 medium strength thread glue	a surname	Use during reassembly
7	Tension wrench	1	The torque is about 28N·m

Table 3-3 Tools and accessories

● Operating steps

Step 1 Ensure that the robot is in the lower servo state, and remove the cables and air tubes fixed on the active arm. If necessary, hold down the Brake button to manually adjust the three active arms to the appropriate position slowly. Then power off the robot.



When the Brake key is pressed, the active arm, driven arm, moving platform and rotating shaft will slide under the action of their own gravity, so support measures should be taken.

Step 2 Refer to step 1-3 in Section 3.2 and remove the follower arm.

Step 3 Remove the M4 top screw using a 2.5mm hex key (located on the cylindrical surface behind the active arm cleaning surface in Figure 3-9). Then remove the pipe plug and use a 1/2 square-head ratchet wrench with an H6 pneumatic wrench bit to remove the screws connecting the reducer. Remove the bolts securing the active arm and reducer,

then disassemble the active arm.

Step 4 Clean the stains on the surface of the reducer and the new active arm assembly with dust-free paper, as shown in Figure 3-9.



Figure 3-9 Schematic diagram of active arm assembly surface

Step 5 Lock the active arm screw. As shown in Figure 3-10, the locking torque is about 20 N·m, and the screw should be coated with Letai 243 medium strength thread glue, then cover the tube plug and lock the M4 set screw (the locking torque is about 0.8N·m).

Step 6 Refer to Chapter 3.11, use the zero point calibration function of ARM software to calibrate the zero point of the corresponding shaft group and complete the replacement of the active arm.

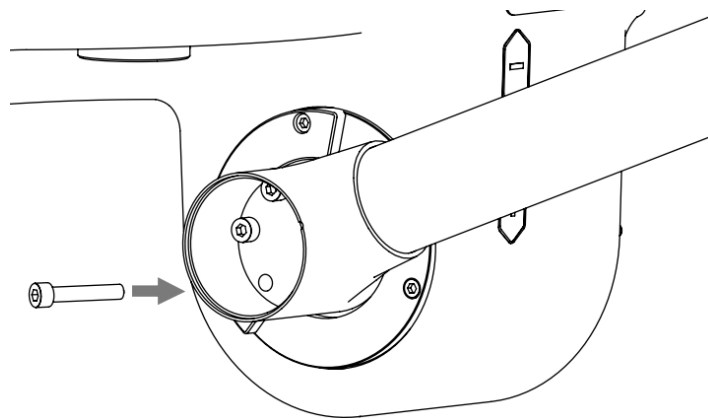


Figure 3-10 Installs the active arm to the reducer

3.1 Move the Platform and Replace it

The replacement of the moving platform should be carried out according to the following steps.

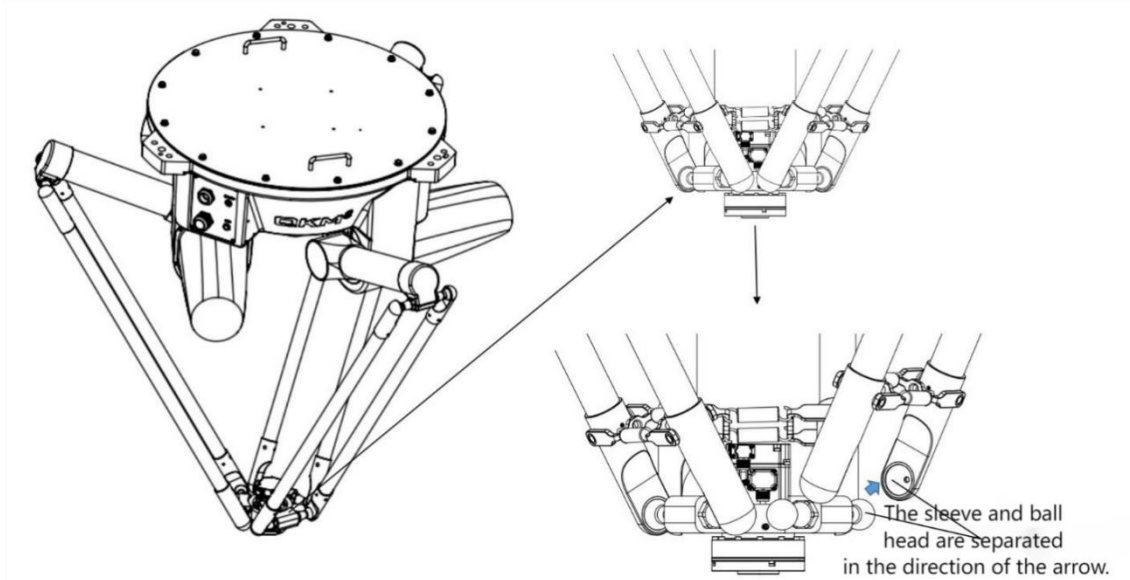


Figure 3-11 Schematic diagram of moving platform and universal joint

- No tools or fixtures are required to disassemble the moving platform
- Operating steps

Step 1 Ensure that the robot is in the lower servo state, remove the cables and air tubes fixed on the active arm and the passive arm. If necessary, hold down the Brake button to manually adjust the three active arms to the appropriate position slowly. Then power off the robot.



When the Brake key is pressed, the active arm, driven arm, moving platform and rotating shaft will slide under the action of their own gravity, so support measures should be taken.

Step 2 Remove the working fixture (claw, suction head, etc.) connected to the lower end of the moving platform.

Step 3 Release the ball joint at the connection end of the driven arm and the moving platform (refer to Figure 3-11 for the operation steps). At this time, the moving platform and the rotating shaft slide down under the action of its own gravity. Support measures should be taken to disassemble the three driven arm shafts in turn, and the removal of the moving platform is complete.

3.5 Lubricant Sleeve Replacement

Ball joint bushing plays a vital role in the precision of the robot, and regular replacement can make the robot in the best condition for a long time.

- Prepare tools and accessories

Order number	Name of tool/adjuvant	Quantity	Remarks
1	bush	a surname	/

2	Hexagonal cylindrical head screw M6x20	1	Remove the bushing
---	--	---	--------------------

Table 3-4 Tools and accessories

- Operating steps

Step 1. Confirm that the robot is in a power-off state.

Step 2 Refer to section 3.2 to remove the follower arm.

Step 3 Use the screw to screw into the threaded hole of the bushing, and continue to screw in to remove the ball joint bushing.

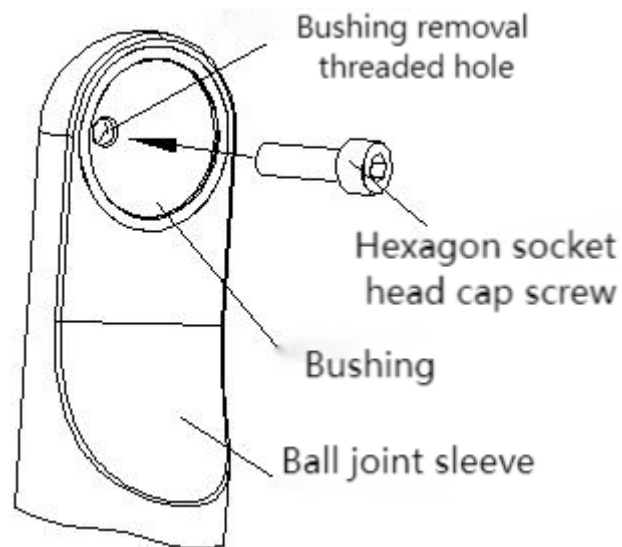


Figure 3-12 Correct removal of ball joint bushing

Step 4 Put the new bushing into the ball joint and press it lightly to level it. Make sure the bushing is in place without protruding from the ball joint.

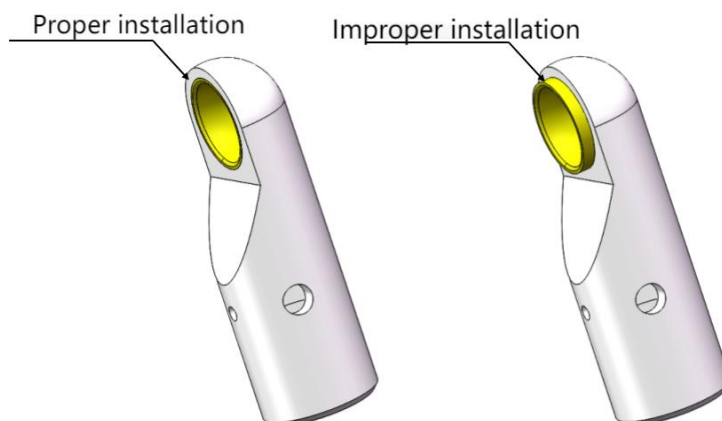


Figure 3-13 Correct installation of ball joint bushing

Step 5 Reinstall the driven arm and complete the replacement of the bushing.

3.6 Replace the Spring

- Prepare tools and accessories

Order number	Name of tool/adjuvant	Quantity	Remarks
1	spring	a surname	All spring models are AWT-14-60
2	Straight out card clamp	1	Remove the spring

Table 3-5 Tools and accessories

- Replacement steps:

Step 1. Confirm that the robot is in a power-off state.

Step 2 Remove the driven arm by referring to the chapter of replacing the driven arm.

Step 3 Use a straight out spring wrench to remove the spring along the opening direction of the spring hook and replace it with a new spring.

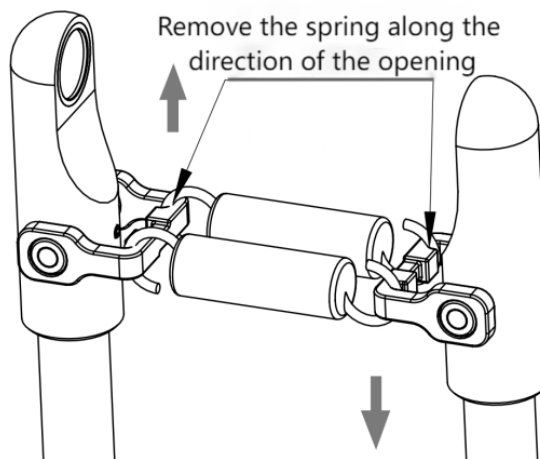


Figure 3-14 Take out the spring

Step 4 When replacing the spring, install it from the opening direction of the spring, and confirm that the spring model, quantity and position are consistent with those before replacement.

3.7 J1/J2/J3 Axis Motor Replacement

- Prepare tools and accessories

Order number	Name of tool/material	Quantity	Remarks
1	Any power-generating or power-driven machine	1	

2	2.5mm hex key	1	Remove the outer cover
3	diagonal pliers	1	
4	5mm hex wrench	1	Remove the reducer shaft clamps and screws
5	6mm hex wrench	1	Remove the motor fixing screw and reducer top screw
6	ribbon	2	
7	Letai 243 medium strength thread glue	a surname	Use during reassembly

Table 3-6 Tools and accessories

● Replacement steps:

Step 1 Remove 5 hexagonal flat head screws M4x10, remove the outer cover, as shown in Figure 3-15.

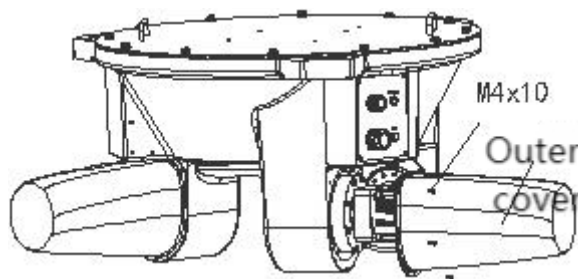


Figure 3-15 Remove the cover

Step 2 Disconnect the motor power line and encoder wire from the connector position.

Step 3 As shown in Figure 3-16, remove the top screw of the reducer. After removing the top screw, as shown in Figure 3-17, loosen the M6 nut on the reducer shaft clamp through the threaded hole. Note: If the threaded hole at the current position does not correspond to the reducer shaft clamp nut, hold down the Brake button to adjust the position of the reducer shaft clamp nut.

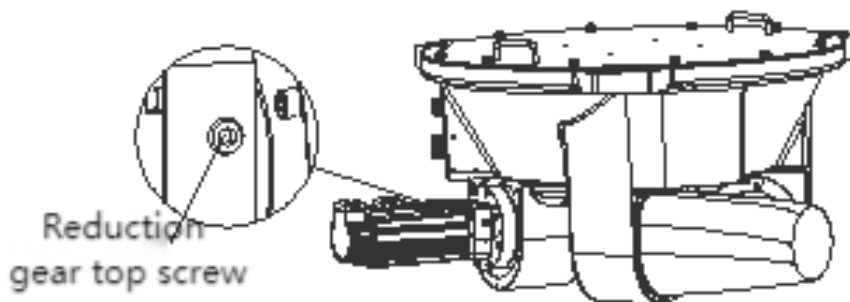


Figure 3-16 Remove the top screw of the reducer

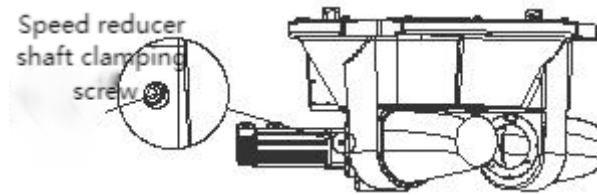


Figure 3-17 Loosen the screw of the reducer shaft clamp

Step 4 As shown in Figure 3-18, remove the four hexagonal cylindrical head screws M8x25 to remove the motor.

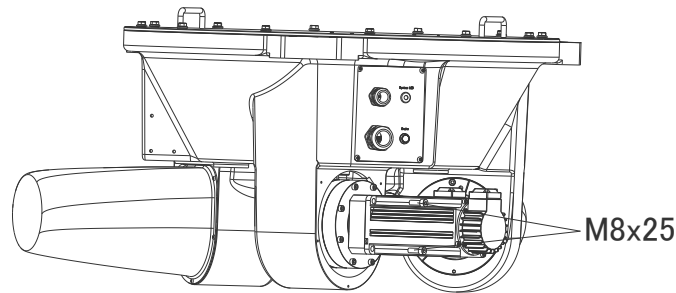


Figure 3-18 Remove the motor fixing screws

Step 5 Replace the motor with a new one. The cable orientation should follow Figure 3-19. First, tighten all four motor fixing screws (M8x25) with a torque of 20 N·m. Next, secure the reducer shaft clamps (M6) using 15 N·m torque. Finally, tighten the top screw of the reducer until it no longer protrudes from the surface. Apply thread locker when tightening screws to ensure proper sealing.

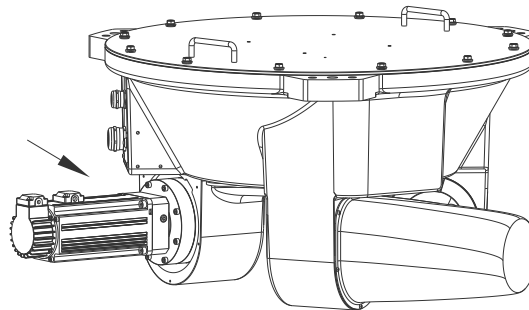


Figure 3-19 Motor cable orientation

Step 6 Reconnect the motor cable according to the line mark, fix the cable with a tie band, and install the cover.

Step 7 Refer to Chapter 3.11, use the zero point calibration function of ARM software to calibrate the zero point of the corresponding shaft group and complete the motor replacement.

3.8 J1/J2/J3 Shaft Reducer Replacement

- Prepare tools and accessories

Order number	Name of tool/adjuvant	Quantity	Remarks
1	reduction box	1	
2	2.5mm hex key	1	Remove the outer cover
3	diagonal pliers	1	
4	5mm hex wrench	1	Remove the reducer shaft clamp screw and reducer fixing screw
5	6mm hex wrench	1	Remove the motor fixing screw and reducer top screw
6	ribbon	2	
7	Letai 243 medium strength thread glue	a surname	Use during reassembly

Table 3-7 Tools and accessories

● Replacement steps:

Step 1 Remove the active arm according to step 1-3 of Section 3.3; remove the motor according to step 1-4 of Section 3.7.

Step 2 As shown in Figure 3-20, remove the reducer by removing 12 hexagonal cylindrical head screws M6x20.

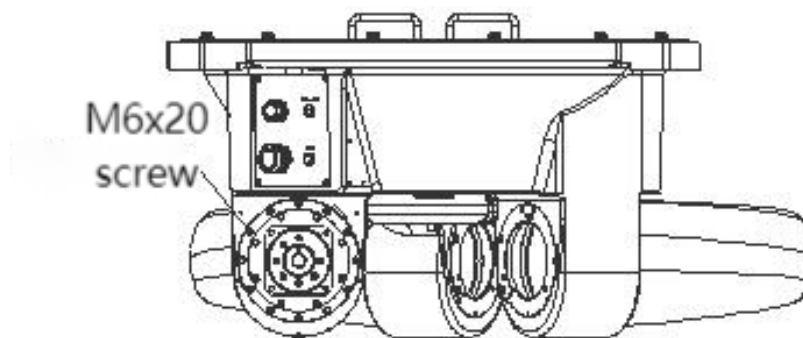


Figure 3-20 Speed reducer fixing screw

Step 3 Replace the new reducer. The direction of the top screw of the reducer is shown in Figure 3-21. Tighten 12 M6x20 screws with a locking torque of 12N·m. Thread glue should be applied when the screws are tightened.

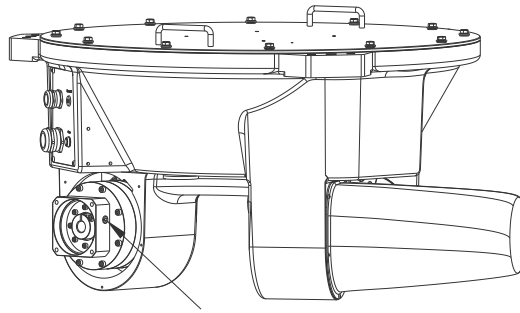


Figure 3-21 Shows the direction of the top screw of the reducer

Step 4 Install the active arm according to step 4-5 in Section 3.3, and install the motor and cover according to step 5-6 in Section 3.7.

Step 5 Refer to Chapter 3.11, use the zero point calibration function of ARM software to calibrate the zero point of the corresponding shaft group and complete the replacement of the reducer.

3.9 J4 Shaft Motor Replacement

- Prepare tools and accessories

Order number	Name of tool/adjuvant	Quantity	Remarks
1	J4 shaft motor	1	
3	diagonal pliers	1	
4	3mm hex wrench	2	Remove the motor fixing screw and wave generator screw
5	4mm hex wrench	1	Remove the wave generator screw
6	ribbon	a surname	
7	Letai 243 medium strength thread glue	a surname	Use during reassembly
8	M3x25 screws	2	
9	Noddy rubber gloves	1	Wear it throughout the operation process, and ensure that the replacement place is clean

Table 3-8 Tools and accessories

- Replacement steps:(Note: all the operation steps should wear dust-free rubber gloves to ensure a clean working environment)

Step 1 Use a slanted pliers to cut the fixing strap of the four-axis cable, and pay attention to the

fixing position of the strap.

Step 2 As shown in Figure 3-22, remove the four motor screws M5x14.

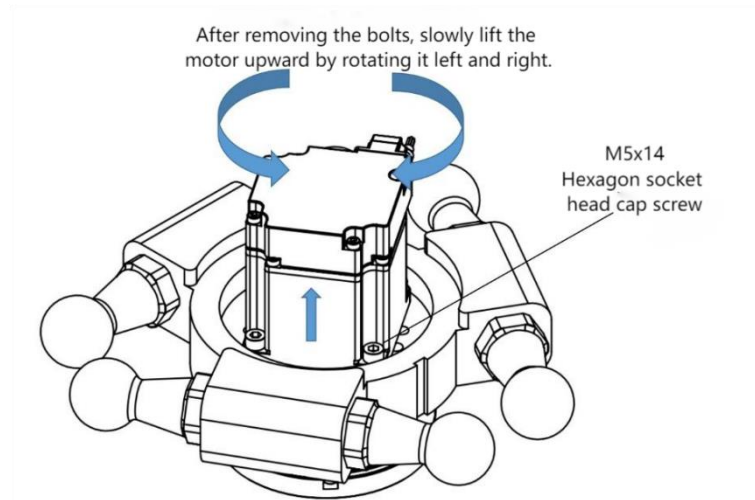


Figure 3-22 Motor fixing screw

Step 3 Disconnect the power line and encoder line of the motor at the position of the cable connector. Hold the motor, rotate it left and right and lift it slowly upward to remove the motor from the wave generator;

Step 4 As shown in Figure 3-23, remove the fixing screw of the wave generator; fix the 4mm hex key at the middle M5 screw, and then remove the two diagonal M4x16 screws with a 3mm hex key.

Step 5 As shown in Figure 3-24, remove the remaining mounting screws from the wave generator. Two M4x25mm screws are then inserted into the previously removed two M4x16 screws, with a depth of 3-5 turns. Secure a 3mm hex key at the three screw positions. Hold the 3mm hex key and use another 3mm hex key to remove the remaining M4x16 screws. Finally, use a 4mm hex key to remove the M5x14 screw.

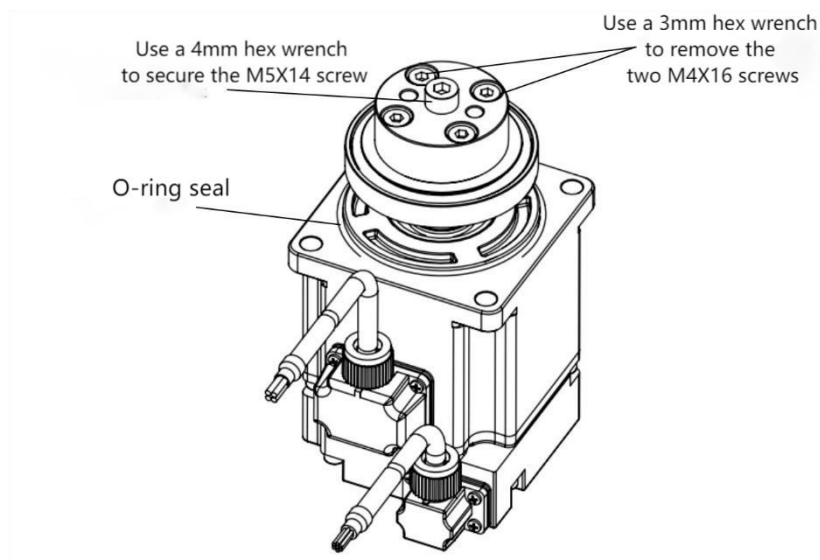


Figure 3-23 Shows the removal of the fixing screws of the reducer wave generator 1

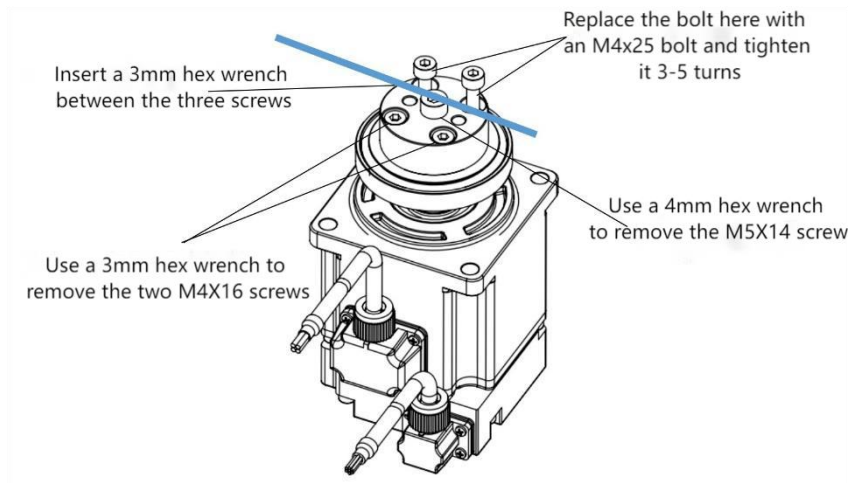


Figure 3-24 Removal of fixing screws of the reducer wave generator 2

Step 6 After replacing the new motor, install the wave generator into the motor shaft as shown in Figure 3-25, and pay attention to the orientation of the wave generator boss.

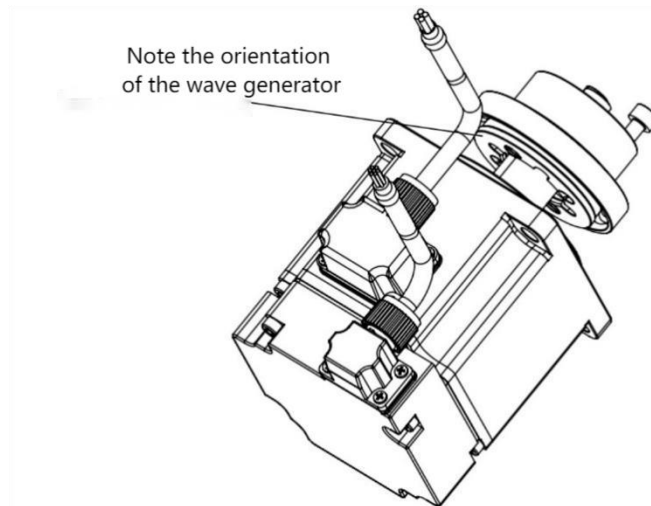


Figure 3-25 Remove the motor fixing screws

Step 7 Following the previous steps, first tighten the M5x14 screw with a torque of 10N·m.

Next, secure four M4x16 screws with a torque of 4N·m. Slowly rotate the motor and wave generator to press them into the reducer (make sure to include the O-ring). Finally, tighten four M5x14 motor screws with a torque of 10N·m. Note: Apply thread locker when tightening these screws.

Step 8 Reconnect the motor cable according to the line mark, and use a tie strap to fix the cable at the fixed place of the removed cable mark;

Step 9 Refer to Chapter 3.11, use the zero point calibration function of ARM software to calibrate the zero point of J4 axis and complete the replacement of J4 axis motor.

3.10 J4 Shaft Reducer Replacement

- Prepare tools and accessories

Order number	Name of tool/adjuvant	Quantity	Remarks
1	J4 shaft reducer	1	
2	2.5mm hex key	1	Remove the steel wheel of the reducer and the external fixing screw
4	3mm hex wrench	2	Remove the motor fixing screw and wave generator screw
5	4mm hex wrench	1	Remove the wave generator screw
6	Ribbon	a surname	
7	Letai 243 medium strength thread glue	a surname	Use during reassembly
8	M3x25 screws	2	
9	Noddy rubber gloves	1	Wear it throughout the operation process, and ensure that the replacement place is clean

Table 3-9 Tools and accessories

- Replacement steps:

Step 1 Remove the reducer wave generator according to step 1-7 of Chapter 3.9.

Step 2 As shown in Figure 3-26, remove the 16 M3x20 reducer fixing screws with a 2.5mm hex key to remove the reducer.

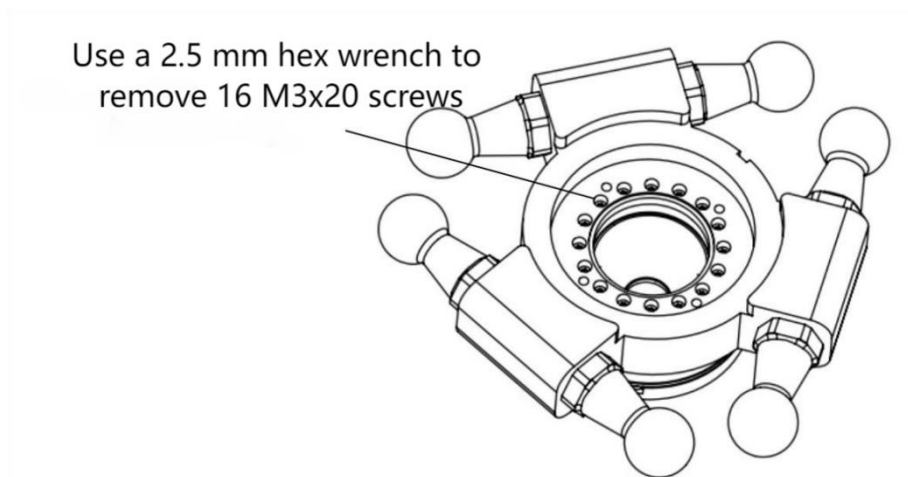


Figure 3-26 Remove the fixed screw of the reducer

Step 3 As shown in Figure 3-27, remove the end fixing plate by using a 2.5mm hex key to remove the 12 fixing screws of the M3x25 reducer.

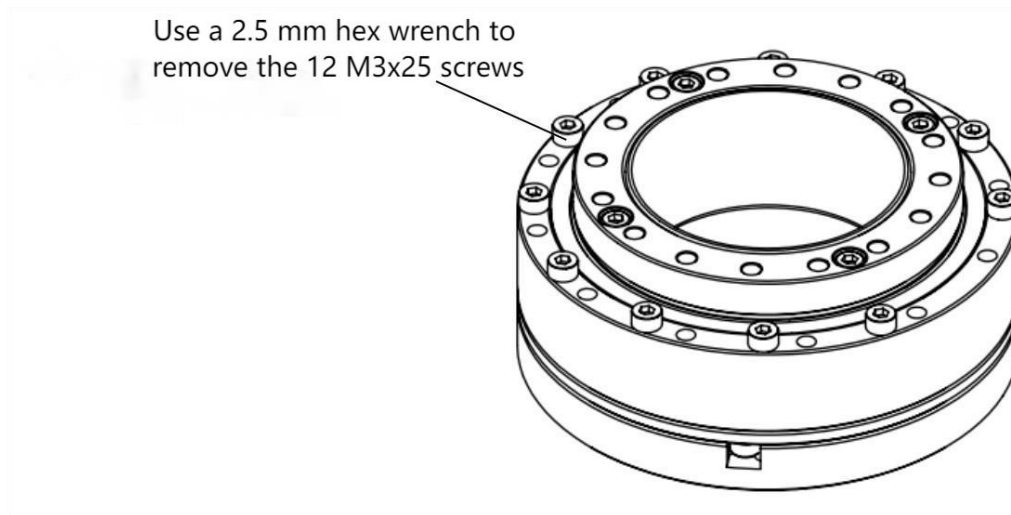


Figure 3-27 Remove the end fixing screw

Step 4 Replace the new reducer. As shown in Figure 3-28, check the O-ring and cross lock 12 M3x25 screws with a locking torque of 2.5N·m. The screws need to be coated with thread glue when locked.

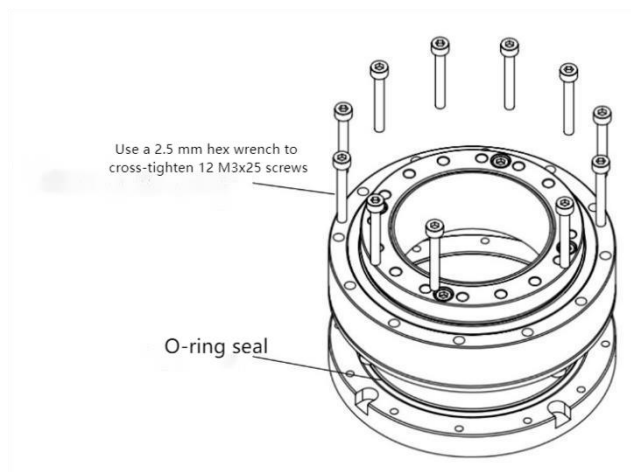


Figure 3-28 Fixed end fastener screw

Step 5 Before the reducer is transferred to the moving platform, grease is injected into the inner cavity of the reducer (note: the grease and the reducer are placed in the packaging box, do not add other types of grease), and the amount of grease is about 2/3 of the total volume of the inner cavity;

Step 6 Install the reducer into the moving platform as shown in Figure 3-29; pay attention to the O-ring seal, cross lock 16 M3x20 screws with a locking torque of 2.5N·m, and apply thread glue when locking the screws.

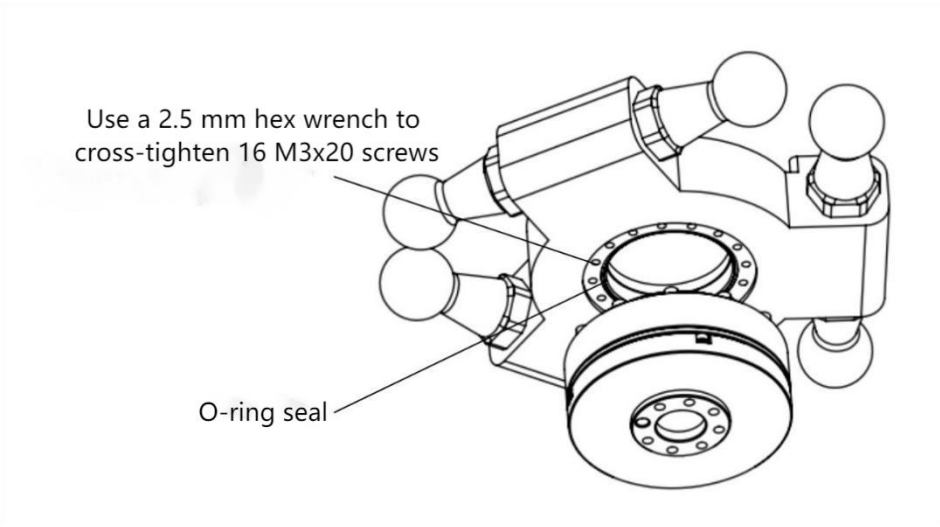


Figure 3-29 Shows the direction of the top screw of the reducer

- Step 7 Refers to step 1-7 in Chapter 3.9, and installs the motor and wave generator;
- Step 8 Refer to Chapter 3.11, use the zero point calibration function of ARM software to calibrate the zero point of J4 axis; complete the replacement of J4 reducer.

3.11 Zero Point Calibration

- Prepare tools

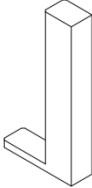
Order number	Tool name	Quantity	Rmarks
1	Four axis calibration fixture	1	Used to calibrate the zero point of the fourth axis (not standard, if needed, please contact QKM) 
2	computer	1	Install the ARM software

Table 3-10 List of tools

- Oerating steps

Step 1: Ensure that the robot is in the lower servo state. Press the Brake key on the interface panel and push the active arm to the negative direction of the current axis until the active arm is close to the upper side of the hard limit, as shown in Figure 3-30 for the calibration posture of the current axis.

**NOTE**

This attitude is the calibration attitude of the current axis and the zero point attitude of the non-current axis.

**WARNING**

When the Brake button is pressed, the active arm, driven arm, moving platform and rotating shaft will slide under the action of their own gravity. Support measures should be taken, and it is recommended that two people operate together.

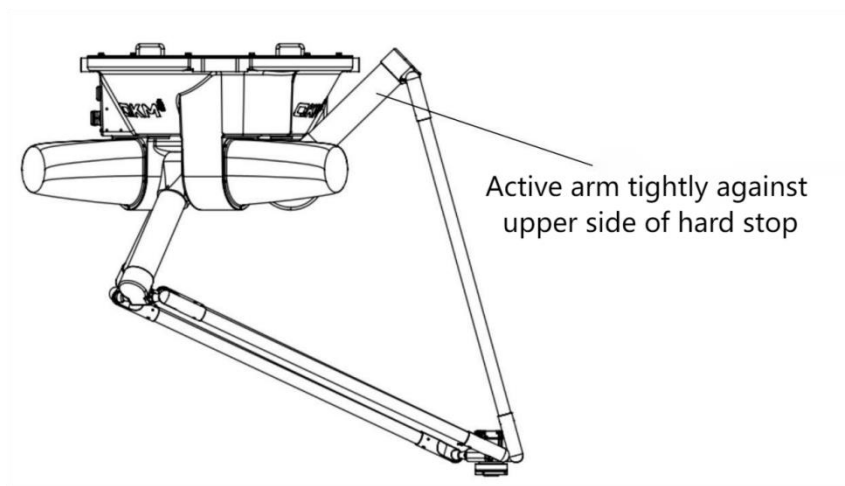


Figure 3-30 Calibration posture

Step 2 Open the ARM software. As shown in Figure 3-33, select the zero point calibration function under the menu bar tool option;

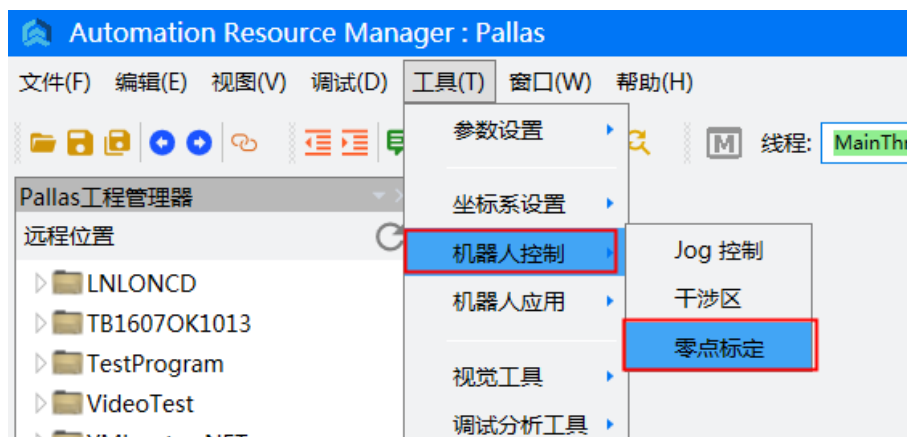


Figure 3-31 Calibration attitude

**NOTICE**

This operation is only supported when running in Macro mode

Step 3: As shown in Figure 3-32, select the robot model and choose coarse calibration mode.

Select the axis requiring zero-point recalibration. Click the "Get Encoder Value" button to obtain the current encoder value of the axis. Click the "Calculate" button to determine

the robot's current zero-point position. Finally, click "Save" to record the calculated zero-point data into the robot, completing the zero-point calibration for the specified axis.



Figure 3-32 Select robot model and calibration method



NOTE

The coarse calibration method refers to the zero point calibration by visually moving each joint of the robot to the zero point position, obtaining the encoder value, clicking the calculation and save button successively to complete the zero point calibration.

Step 3 Use the four-axis calibration fixture, as shown in the red area of Figure 3-33, and adjust the end flange to the J4 calibration posture: The two step surfaces of the fixture are respectively attached to the flat position of the rotating shaft of the moving platform and the flat position of the base of the moving platform, and the screw holes of the fixture are aligned with the slot of the rotating shaft of the moving platform.

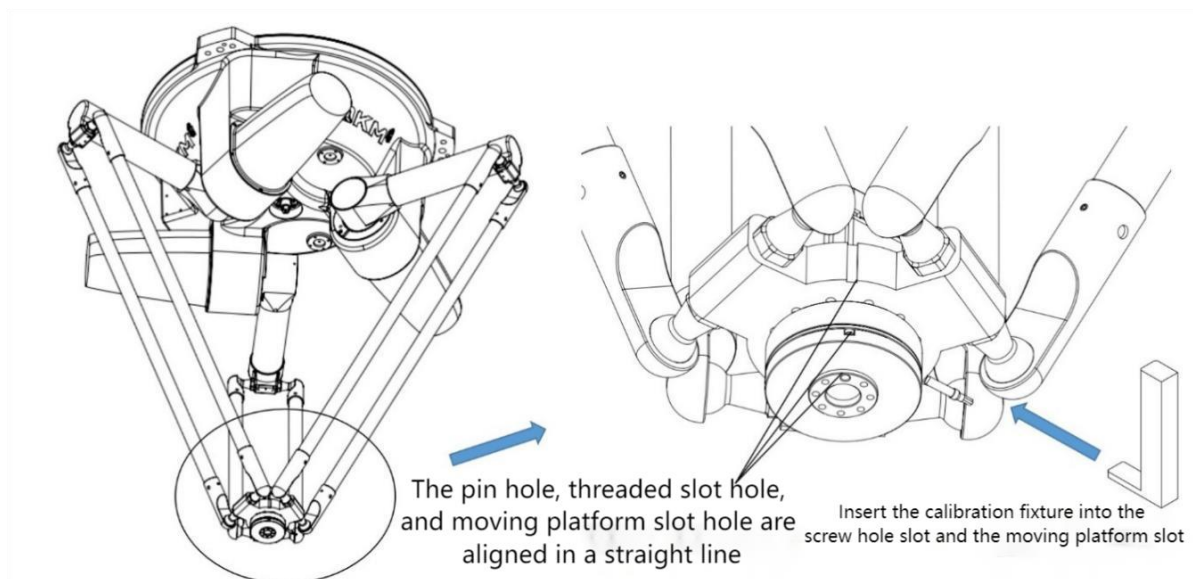


Figure 3-33 J4 calibration attitude

Step 4 Use ARM to complete J4 axis zero point calibration.

4 Electrical Components Maintenance

4.1 Encoder Battery Replacement

If the encoder battery is low or out of power, all zero point position data of the motor will be lost, and it is necessary to recalibrate all joints for zero point, which will affect the production work.

The service life of the encoder battery varies depending on the user's controller power-on time and the robot's installation environment. It is usually about 2 years (the controller is powered on for 24 hours a day). Compared with the controller when it is powered on, the battery power consumption will increase significantly when the controller is not connected to the power supply.

If a low voltage warning (alarm code "-6504") occurs, replace the battery even if it does not reach the above battery life.

If it's past the recommended replacement time, the battery may be exhausted.

If no low voltage warning (alarm code "-6504") occurs, there is no need to calibrate all joints. However, if the zero position is shifted after battery replacement, recalibrate the zero position.

Please be sure to use the encoder battery spare parts specified by our company.

Order number	Name of tool/adjuvant	Quantity	Remarks
1	Encoder battery assembly	1	/
2	2.5mm hex key	1	Remove the screws
3	ribbon	2	/

Table 4-1 Tools and accessories

Detection method of encoder battery voltage: Use the voltage range of the multimeter, and insert the red and black probes into the spare interface pin of the encoder battery, and the remaining voltage can be displayed. Check whether the voltage of the encoder battery is lower than 3.6V, if it is lower than 3.6V, then replace the encoder battery.

● Replacement steps

Step 1: Before replacement, first power off the robot. After 90 seconds of power-off, use a 2.5mm hex key to unscrew the battery. Secure the metal plate and cable using two M3x6 connection bolts. Remove the battery from the metal plate and install it. The encoder battery should be fixed on the mounting metal plate. Note: Incorrect! No reference source found.

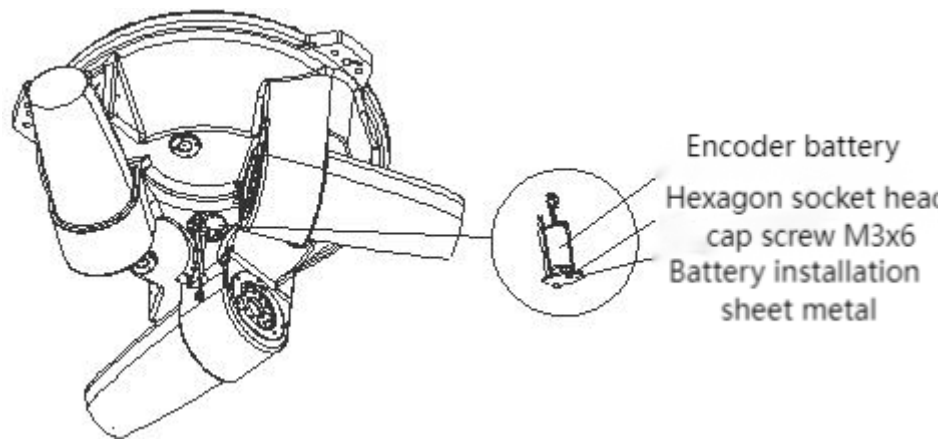


Figure 4-1 Encoder battery diagram

Step 2 Replace the battery.

- (1) Install the connector socket of the reformed new battery into the spare plug-in interface of the encoder battery connection line.
- (2) Confirm that the new battery plug is connected to the connector, then pull out the old battery plug and remove the old battery.
- (3) Fix the new battery to the battery mounting sheet metal with a cable tie.

Step 3 Install the battery and install the sheet metal, tighten the screws, and the battery replacement is complete.



NOTICE

The robot will lose the zero point when the power supply of the encoder is interrupted. In order to avoid this situation, when replacing the new encoder battery, the old encoder battery can only be removed after the new encoder battery is fully connected.

When the equipment is used again after a long power failure, battery abnormalities are likely to occur. Therefore, the robot should be kept in the zero position as far as possible before the equipment is stopped for a long time.

4.2 Replacement and Maintenance of brake plates

The brake plate is located in the base of the robot. If it needs to be replaced, the interface panel should be removed. The brake plate is shown in Figure 4-2 and Figure 4-6.

Prepare tools and accessories: cross screwdriver, slanting pliers, anti-static gloves

Screw type: Cross screw M3x6

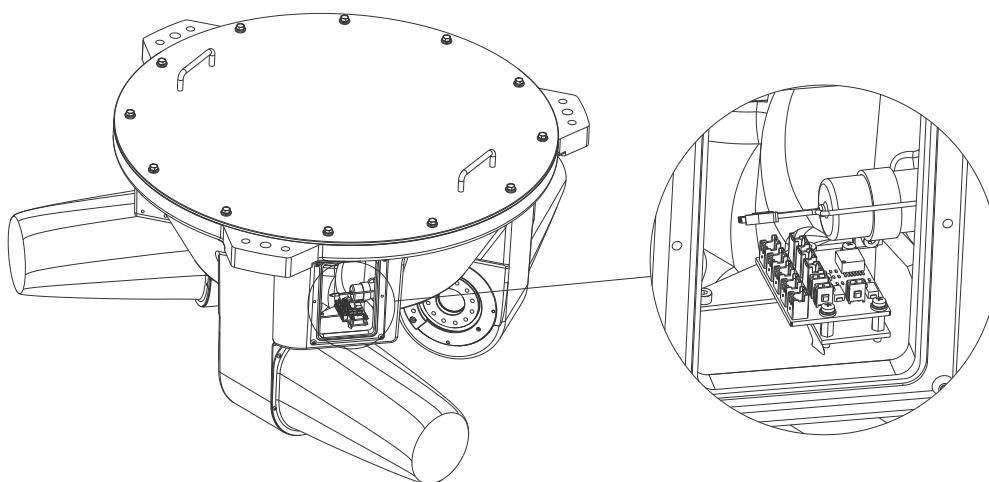


Figure 4-2 Schematic diagram of brake pad position

Step 1 Refer to step 4.1, Step 1, 2 and 3, and remove the interface panel.

Step 2 Remove all cables connected to the brake plate.

Step 3 Remove the three cross screws M3x6 that fix the brake plate with a cross screwdriver and remove them, as shown in Figure 4-3.

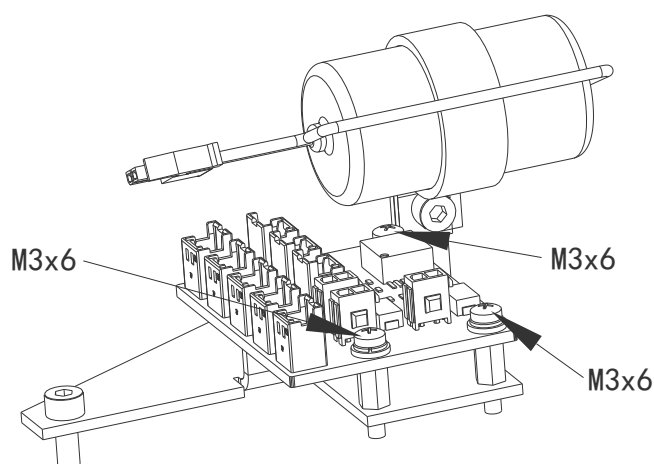


Figure 4-3 Remove the screws that fix the brake plate

Step 4 Remove the old brake plate, install the new brake plate and tighten the screws.

Step 5. Reinsert all cables into the brake plate and restore the cables.

Step 6 Restore the interface panel and tighten the screws.

Step 7 Since the brake pad is replaced, the encoder battery needs to be removed, so the zero point needs to be recalibrated after the replacement.

5 Environmental Protection

5.1 Environmental Conditions of Concern

The external environment will affect the operation performance of the robot in the environment, as well as the impact of the robot on environmental cleaning.

- The AP25X robot is designed for the following conditions:

1. All components of the robot, including cables, meet IP 54 requirements;
- 2, ambient temperature 0~45°C;
3. Relative humidity 10~80%, no condensation;
4. Alcohol, weak alkali and sodium hydroxide containing chlorine can be used as general cleaning agents to clean the robot

- The environmental protection of AP25X robot is as follows:

1. High level of surface coating and surface treatment technology, so that the robot in the cleaning process will not cause environmental impact;
2. The lubricant is used under multiple sealing conditions without leakage;
3. Self-lubrication performance of ball joint, no need to add lubricant;
- 4, high quality spring steel made springs, have excellent stability, will not rust;
5. Even if the robot parts are very small, they are connected tightly enough not to cause environmental pollution.

5.2 Clean Room Usage

The AP25X robot standard edition is configured for non-clean room use conditions. If you need clean room environment, please contact QKM for more information about model and environment selection.

5.3 Design Elements

The environmental requirements and cleaning needs of each component of the robot are as follows:

- Robot body:

The robot's body and most components are manufactured from aluminum alloy, effectively withstanding the load from high-pressure flushing. Similarly, the premium aluminum alloy material provides partial resistance to corrosive agents. The robot's polished surface facilitates effective cleaning of both detergents and fluids. The drive components—including motors and reducers—are fully sealed and protected within the robot's housing, achieving an IP 54 rating. All sealing materials comply with universal industrial cleanliness standards.

**NOTE**

As with most sealing materials, excessive cleaning, corrosive cleaning, and overpressure cleaning can lead to reduced sealing performance and failure earlier than designed.

- Active arm and driven arm:

The active and driven arms of the robot are mainly made of carbon fiber and aluminum alloy. The active and driven arms bonded with epoxy resin can withstand general cleaning conditions, such as caustic soda cleaning agent.

- Globe joint :

The ball joint is designed to be completely suitable for caustic soda cleaning and flushing cleaning. After cleaning, the surface cleaner can be wiped off and used without adding lubricant.

- Spring :

The lever arm is connected by a spring to make the ball joint play a more effective role. The spring has excellent corrosion resistance. The spring exposed to air is easy to be polluted by the environment, and the spring can be washed or even immersed in clean water.

- Motion platform:

The AP25X quad-axis robot's moving platform undergoes rigorous surface treatment, making it suitable for basic caustic soda and water spray cleaning. The AP25X tri-axis robot's moving platform also features deep anodizing treatment, enabling effective handling of caustic soda, water spray, and even immersion cleaning. All platforms are designed to meet fundamental standards for sealing, easy cleaning and drying, compatibility, and long service life.

6 Technical Service

Li Qun Automation Technology Co., Ltd. is committed to providing technical information support on machine movement and operation, helping you troubleshoot and provide detailed consultation. If your robot or equipment has a fault in use, please contact our service agency and provide the following information as far as possible:

- The model and serial number of the robot or equipment
- Control system model and serial number
- Control system version number
- Optional supporting software function packages
- Existing applications
- Other supporting additional product devices (vision, PLC, etc.)
- Problem description, fault duration and frequency, etc



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