JAKA

JAKA Robotics

Service Manual

Original Instructions (en)

File Version: 2.0

Robot: MiniCobo

Notice:

The definition of collaborative robots follows the ISO standards and relevant national standards to protect the safety of operators. We do not recommend applying the robots directly to cases when the operating object is a human. However, if there is a need for the robot to operate on a human, the robot needs to be equipped with a safe, reliable, fully tested and certified safety protection system to protect the human, provided that the personnel safety is fully assessed by the user or application developer.

We will regularly revise the user manual, and the content may be updated without notice. Please check the factual product information carefully before reading this manual.

This manual is applicable to all products and/or services manufactured or provided by JAKA (hereinafter collectively referred to as the “products"). The information contained in the user manual is provided "as is" and is subject to and interpreted in accordance with the laws of the People's Republic of China (excluding Hong Kong, Macau, and Taiwan). To the maximum extent permitted by law, this user manual does not constitute any form of express or implied representation or warranty of JAKA, neither constitute a guarantee of merchantability, suitability for specific purposes, achievement of expected results, or non infringement of the products. JAKA assumes no responsibility for any error or omission that may appear in this manual, or any accident or indirect injury arising from the use of this manual and the products described therein. Before installing and operating the product, read this manual carefully.

The pictures in this manual are for reference only.

If the robot body is transformed or disassembled, JAKA will not be responsible for after-sales services.

JAKA reminds users that they must use safety equipment when using and maintaining JAKA robots and must comply with the safety terms.

Programmers of JAKA robots and designers and debugging personnel of robot systems must be familiar with the way to program JAKA robots and install system applications.

About the Manual

This manual mainly includes service-related operations and troubleshooting.

This manual is aimed at users who have received basic mechanical and electrical training, which will be more helpful in the repair and operation of the JAKA robot.

More Information

For more product information, scan the QR code on the right to visit our official website: www.jakarobotics.com.

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1. Safety

1.1 Introduction

The robot has an advanced safety system. According to the special characteristics of the robot workspace, configure the safety system after ensuring the safety of all personnel and equipment around the robot. Applying the settings defined by the risk assessment is the first thing an integrator must do. For details on the security system, see “JAKA Hardware User Manual”.

1.2 Safety Instructions

Please strictly follow all safety instructions in this manual.

Maintenance and calibration must be conducted in accordance with the latest manual or receive professional training in JAKA.

Maintenance must be performed by an authorized system integrator or JAKA staff. When the Spare parts need to return to JAKA, please operate in accordance with this manual.

Please ensure the safety level specified for maintenance work, comply with valid national or regional work safety regulations, and all safety functions must be tested for operating properly.

The purpose of maintenance work is to ensure the system can run properly or to help it restore in case of system failure. Maintenance includes fault diagnosis and actual repairs.

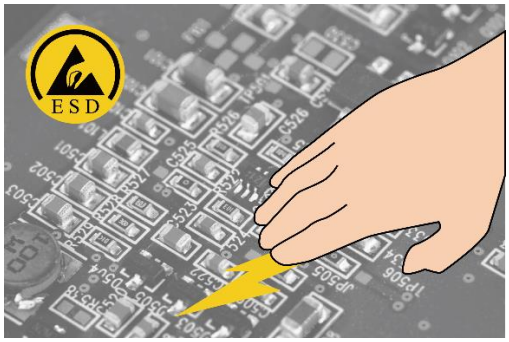
JAKA recommends the user does not attempt repair, adjustment, or make other interventions in the mechanical or electrical systems of the robot without first consulting a JAKA certified service engineer. Any unauthorized intervention voids the warranty. Service-related operations and troubleshooting should only be performed by qualified personnel.

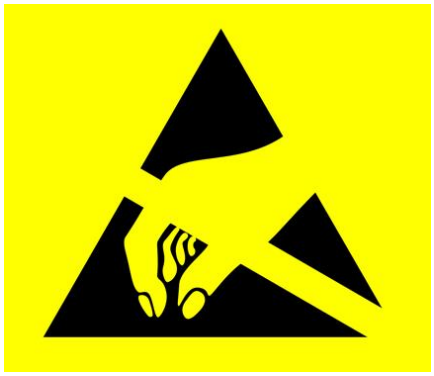
The following safety procedures and warnings must be followed when operating the robot or control cabinet:

Symbol	Description
	**WARNING** 1. Remove the main input cable from the bottom of the control cabinet to ensure that it is completely powered off. Disconnect other energy sources connected to the robot or the control cabinet. Take necessary precautions to prevent others from energizing the system during maintenance. 2. Check the grounding connection before restarting the system. 3. Observe the ESD regulations when disassembling the robot or the control cabinet. 4. Avoid disassembling the power supply system in the control cabinet. High voltage may remain in the power supply system for several hours after the control cabinet is powered down. 5. Avoid water or dust entering the robot or the control cabinet.

Symbol	Description
	**WARNING** 1. It is forbidden to modify any information in the software safety configuration. If the safety parameters are changed, the entire robot system should be considered as a new system, which means that all safety examination processes, such as risk assessment, must be updated. 2. Replace a failed component with a new one with the same component number or an equivalent approved by JAKA. 3. Reactivate all disabled safety measures immediately after the work is completed. 4. Record all maintenance operations and save them in technical documents related to the entire robot system.

1.3 Handling ESD Sensitive Parts





To prevent damage to components susceptible to static electricity, follow the instructions below in addition to normal measures such as turning off the power before removing the PCB.

Notice:

1. Before replacing ESD-sensitive parts, make sure to have an anti-static wristband and a spare anti-static bag.

2. Keep ESD sensitive parts in their original packaging. (a special antistatic bag) until the part is ready for replacement.

3. Bring an anti-static wristband to your wrist and connect one end of the wristband to a grounding point. This releases the static electricity from your body to the ground.

4. Handle ESD-sensitive parts by their edges: do not touch their pins. If you are removing a pluggable module, you should use the correct tool.

5. To prevent ESD-sensitive parts from being inadvertently touched by others, never place unprotected ESD-sensitive parts on a table.

6. Use extreme care with static-sensitive parts in cold weather or when using heating devices, as low humidity can increase static electricity.

1.4 Recommended Inspection Activities

To enable the robot to maintain high performance for a long term, maintenance inspection must be carried out. Refer to the following table for inspection activities.

1.4.1 Robot Inspection Activities

Period		Item	Key Points of Check	Scope
Monthly	Quarterly			
●		Joint lid and sealing ring	Check if the joint lid and sealing ring are damaged or deformed, replace it if necessary	All the joints
●		Robot cleaning	Clean up the robot arm with dry and clean cloth. remove accumulated splashes, dust, metal scraps, etc.	All the joints
●		Joint	Check if there's any grease leakage from the joints, and test free drive for each joint check if there's any abnormal sound or obstruction inside the joint	All the joints
●		Brake mechanism	Check if each joint is locked properly by the brake mechanism after the robot is powered off.	All the joints
●		End-effector	Check if the tool is properly mounted at the tool flange.	Joint 6
●		Robot base	Check if the fastening screws of the robot base are securely tightened	Robot base
	●	Robot connection cable	Check if the connector for robot connection cable (if any) is in good condition, and well connected, and whether the cable is severely worn or bent.	Robot base

1.4.2 Control Cabinet Inspection Activities

Period					Scope	Key points of Check	Inspection Method
Daily	Monthly	Quarterly	Half-yearly	Yearly			
●					Shell	No attached splashes,	Visual inspection and

Period					Scope	Key points of Check	Inspection Method
Daily	Monthly	Quarterly	Half-yearly	Yearly			
						dust, and other impurities	cleaning
	●				Dust Cover	No presence of dirt and blockages	Visual inspection, cleaning, and replacement
	●				Exhaust Fan	When the control cabinet starts up, the cooling fan operates normally	Visual inspection, cleaning, and replacement
		●			Wiring terminal	All terminal and wire should be connected properly	Visual inspection, tightening, and replacement
			●		Grounding	Control cabinet should be grounded properly, no leakage	Visual inspection, voltage measurement, and tightening
				●	Cables	Cables are in good condition, any damages, cracks, or false connection	Visually confirm tightening; when the cable is obviously damaged, please replace it

Note: Use a soft cloth to wipe off dust when cleaning. Do not use equipment such as blowers to blow away dust. The wind pressure will cause dust to enter the inside of the fan, and the blades will rotate at a speed above the specified one, which may cause the fan to malfunction or reduce its life. Use the vacuum cleaner only for the blade, and do not vacuum the rotating part and the main body.

1.4.3 Preventive Inspection Activities

Item	Key Points of Check	Period	Scope
Brake mechanism	Check if the brake is damaged or deformed, ensure the robot is powered off and well supported. Contact the JAKA technical service personnel for details.	Quarterly	All the joints

Item	Key Points of Check	Period	Scope
Encoder	Check the condition of the encoder inside joints, servo firmware R6189 and above required and with CAN tools. Contact JAKA technical service personnel for support.	Quarterly	All the joints
Reducer	Evaluate the worn of the reducer inside joints, all joints shall stay steady when the robot is enabled with collision protection disabled, and will not rotate when pushing each joint.	Half-yearly	All the joints
Screw	Check all the screws between the joints, and tighten all bolts if shifting or loosen inspected with proper torque. (Refer to 2.1.3 Tighten Screws for torque).	Half-yearly	All the joints
Joint cables	Check the condition of power cable and CAN wires between joints, open the joint lids, disconnect the power cable and CAN wires, measure the resistance of each cable (≤0.5 Ω) and the resistance with the joint housing (open circuit state).	Yearly	All the joints
Hard drive	Check the service life of the hard drive with the tools and procedure provided by JAKA, replace it in advance before the life cycle ends.	Yearly	Control cabinet
Control cabinet battery	Replace the battery annually if the control cabinet was never used such as a stock, or replace it every two years if the control cabinet is in operation.	Yearly	Control cabinet

Note:

1. In order to ensure long-term normal use of the product, periodic check shall be done;
2. Periodic check shall be thorough, including internal check and cleaning of the robot and control cabinet;
3. It is recommended for the authorized partners from JAKA to perform those preventive maintenance subjects.

1.5 Parts Replacement and Storage

When replacing the components of the robot, observe the following precautions to work safely.

Symbol	Description
	1. It is strictly prohibited to modify any product of the company. 2. Fire, failure and wrong action due to modification may cause personnel injury or damage to the machine. 3. Any loss caused by users' own modification of JAKA's products is not within the scope of

Symbol	Description
	the company's warranty.
	4. To prevent electric shock, when replacing components, turn off the circuit breaker in advance and cut off the main power supply.
	1. Cut off the main power supply and wait for 5 minutes before replacing the components. 2. Due to the residual charge in the substrate and the electrolytic capacitor, there is a risk of electric shock. 3. It is forbidden to operate with wet hands. 4. Electric shock will cause serious injury or death.
	1. The replacement must be carried out by specified operators. 2. Electric shock or being caught by the robot due to its accidental action will cause serious injury or death.
	1. There are a large number of connection interfaces between printing substrates. Be cautious when replacing components and avoid mistakes or omission of plugging. 2. If electric shock or fire is caused, it may cause serious injury or death.
	1. Do not damage the wiring or pull the interfaces during replacement to avoid damage. 2. Do not touch the electronic components of the printing substrates, and the contact part of the circuits and interfaces during replacement. Hold the edge of the printing substrates. 3. If accidentally touched, it may cause electric shock, resulting in serious injury or death.
	1. When the power supply must be turned on for once with the robot control cabinet opened to maintenance and inspection, do not expose the inside of the robot control cabinet directly to sunlight, searchlight and other strong light, otherwise it will lead to failure or wrong action.
	1. Before operation, operators should release static electricity in advance. 2. Tools like anti-static wristbands are very effective. 3. Direct touching of electrical components without any precautions may cause electrical components to malfunction.
	1. After the operation is completed, check if there is any gap or if any cable is clamped. After that, reinstall the control cabinet shell. If there is a gap, it may cause dirt, dust, etc. to enter the control cabinet, which will cause failure.

1.5.1 Robot System Cleaning

1. Power off the robot and the control cabinet.
2. Put on the anti-static wrist strap and protective gloves.
3. Dampen a microfiber cloth with the 75% rubbing alcohol solution.
4. Gently wipe exterior surfaces of the robot and control cabinet by the microfiber cloth.
5. Wait 5 minutes and then wipe the robot and control cabinet with a dry and clean microfiber cloth.
6. Ensure surfaces have completely dried before powering on the robot and the control cabinet after cleaning.

Notice:

1. All external surfaces of your robot system can be cleaned using the recommended solution, including all metal surfaces, plastics, and rubber.
2. Do not use corrosive cleaning agents to clean the robot system.
3. When cleaning, please be careful to avoid labels and warning signs, excessive cleaning will cause letters on labels to be blurred or faded.

1.5.2 Filter Cleaning

1. Cut off the power supply of the control cabinet.
2. Remove the nut of the filter housing.
3. Clean the dust stuck on the filter by blowing it out. Dust shall be blown out from the inside of the control cabinet during the cleaning. When there is dirt, it should be cleaned with warm water or neutral detergents. If it cannot be totally cleaned even in this way, it should be replaced.
4. When cleaning with warm water or neutral detergents, wait until the component is fully dried before installation.

1.5.3 Storage Conditions

1. Storage temperature: –10°C ~ 50°C (14~122°F)

For long-term storage, in order to maintain its reliability, it is recommended to keep the temperature within 25°C±10°C (59~95°F). Avoid such a sudden temperature change if possible (10°C/h (50°F) and above).

2. Storage humidity: 20%RH ~ 85%RH

For long-term storage, to maintain its reliability, it is recommended to keep the humidity within 45%~65%. Keep away from dew condensation or mildew.

3. Anti-static

It is easy to generate static when kept in extremely dry conditions. The shock of electrostatic discharge may damage the semiconductor. Please store it in an anti-static bag.

4. Other environmental conditions

Keep the components in an environment with less dust that will not produce toxic gases or dirt. Do not place heavy objects on it during storage.

1.6 Prohibited Environment

Do not use the robot in the following situations. Otherwise, it will not only adversely affect the robot and surrounding equipment, but may also cause serious injury to the operator:

1. Use in flammable environment;
2. Use in explosive environment;
3. Use in high radiation environment;
4. Use in water or high humidity conditions;
5. Use for the purpose of transporting people or animals;
6. Use when the robot is squeezed by external force;
7. Use in strong magnetic environment.

2. Robot Maintenance

The accuracy of the robot is divided into repeatability and absolute accuracy. Replacing the joint will reduce the absolute accuracy of the robot, and joint zero position will change, too.

➢ For scenarios that only require repeatability, such as handling, palletizing, dispensing, spot welding, etc., it's only necessary to run to the same fixed point every time, and the motor module can be replaced.

➢ For scenarios that require high absolute accuracy, it is not recommended to replace the joints. After the joints are replaced, the trajectory accuracy will be reduced, and the process requirements cannot be met. In this scenario, the robot needs to be returned to the factory for calibration with a laser tracker before the absolute accuracy can be restored. There are scenarios that require absolute accuracy, mainly the following scenarios:

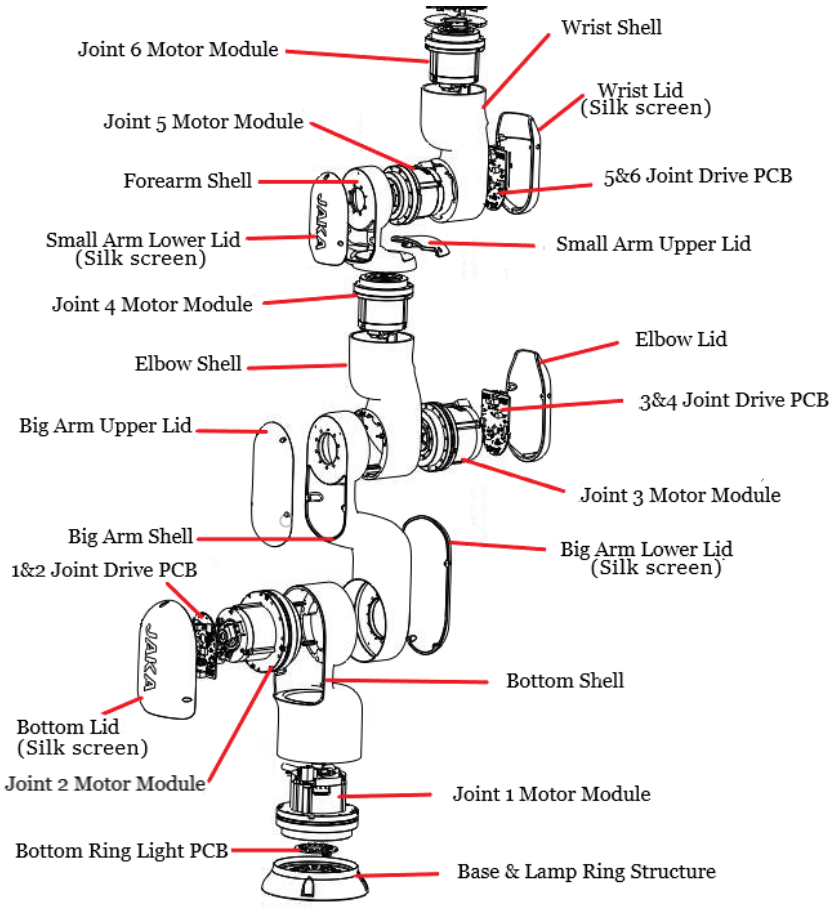
1) Offline programming scene (import mechanical model, automatically generate teaching track);

2) Vision (2D, 3D) is used for visual guidance, deviation correction and other scenes;

3) There are specific process requirements, such as linear gluing/soldering, long-distance linear perforation; arc gluing/soldering, etc., which all require absolute accuracy.

2.1 JAKA MiniCobo

2.1.1 MiniCobo Structure



2.1.2 Movement without Drive Power

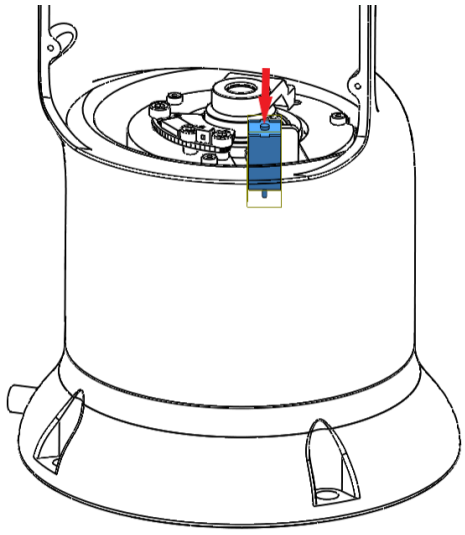
In emergency situations such as robot disable or without power supply, the following methods can be used to force the robot to move: after turning off the power of the robot body, remove the joint lid, hold the robot, and then release the brake manually (press the slider in the electromagnet to release the brake).

Notice:

1. Remove every dangerous fixture before releasing the brakes to prevent from danger.
2. If you want to release the brakes of any joint, please provide suitable mechanical support.
3. Ensure that no one is under the robotic arm when releasing the brakes.
4. Never turn joints unnecessarily.

Steps to release the brake:

1. Disable and power off the robot and power down the control cabinet.
2. Remove the lid from the joint. The electromagnets of joint one and joint two are located in the base lid, the electromagnets of joint three and joint four are located in the elbow lid, and the electromagnets of joint five and joint six are located in the wrist lid.
3. Press the slider of the electromagnet (as figure below). Some electromagnets are blocked by the driver board, so you need to remove the driver board before pressing the slider of the electromagnet.



4. Push the single joint to move to the desired position.
5. Before power on the robot, make sure that the electromagnet core is ejected and the joint lid is properly installed.

2.1.3 Tighten Screws

(1) Screw tightening torque

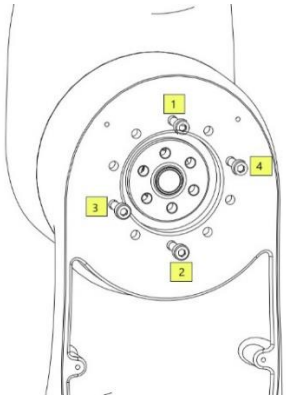
Position	Screw Specifications	Torque	Thread Locker
Base lid——Base shell	M2 x 6 mm* 3 pcs M2 x 0.24 in* 3 pcs	/	√
Big arm lower lid——Big arm shell	M2 x 6 mm* 4 pcs M2 x 0.24 in* 3 pcs	/	√
Big arm upper lid——Big arm shell	M2 x6 mm* 4 pcs M2 x 0.24 in* 3 pcs	/	√
Elbow lid——Elbow shell	M2 x 6 mm* 3 pcs M2 x 0.24 in* 3 pcs	/	√
Small arm lower lid——Small arm shell	M2 x 6 mm* 3 pcs M2 x 0.24 in* 3 pcs	/	√
Small arm upper lid——Small arm shell	M2 x 6 mm* 3 pcs M2 x 0.24 in* 3 pcs	/	√
Base——Joint 1 motor module	M3 x 10 mm* 16 pcs M3 x 0.40 mm* 16 pcs	2.4 Nm	√
Joint 1 motor module——Base shell	M3 x 25 mm* 12 pcs M3 x 0.98 mm* 12 pcs	2.4 Nm (21.24 lbf·in)	√
Joint 2 motor module——Base shell	M3 x 25 mm* 12 pcs M3 x 0.98 mm* 12 pcs	2.4 Nm (21.24 lbf·in)	√
Big arm shell——Joint 2 motor module	M3 x 10 mm* 16 pcs M3 x 0.40 mm* 16 pcs	2.4 Nm (21.24 lbf·in)	√
Joint 3 motor module——Elbow shell	M3x20mm* 8 pcs M3 x 0.79 mm* 8 pcs	2.4 Nm (21.24 lbf·in)	√
Big arm shell——Joint 3 motor module	M3 x 10 mm* 10 pcs M3 x 0.40 mm* 16 pcs	2.4 Nm (21.24 lbf·in)	√
Joint 4 motor module——Elbow shell	M3x20mm* 6 pcs M3 x 0.79 mm* 6 pcs	2.4 Nm (21.24 lbf·in)	√

Position	Screw Specifications	Torque	Thread Locker
Small arm shell——Joint 4 motor module	M3 x 10 mm* 8 pcs M3 x 0.40 mm* 8 pcs	2.4 Nm (21.24 lbf·in)	√
Small arm shell——Joint 5 motor module	M3 x 6 mm* 8 pcs M3 x 0.24 mm* 8 pcs	2.4 Nm (21.24 lbf·in)	√
Joint 5 motor module——Wrist shell	M3 x 20 mm* 6 pcs M3 x 0.79 mm* 6 pcs	2.4 Nm (21.24 lbf·in)	√
Joint 6 motor module——Wrist shell	M3 x 20 mm* 6 pcs M3 x 0.79 mm* 6 pcs	2.4 Nm (21.24 lbf·in)	√
Flange mounting plate——Joint 6 motor module	M3 x 6 mm* 8 pcs M3 x 0.24 mm* 8 pcs	2.4 Nm (21.24 lbf·in)	√
Flange——Flange mounting plate	M2 x 12 mm* 8 pcs M2 x 0.47 mm* 8 pcs	2.4 Nm (21.24 lbf·in)	√

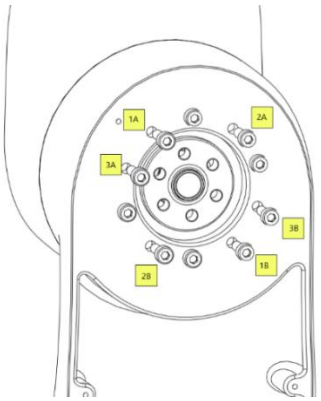
(2) Screw tightening order

To ensure all screws tightened with the equal force, you need to tighten them according to the following order: Take the tightening of joint 3 lid as an example, steps are as follows:

1. Ensure the joint direction, make two joints closer, and align mounting holes.
2. Insert hex screws according figure below. Tighten to 50% of target torque in order of 1-2-3-4.



3. Insert hex screws according figure below. Tighten to 50% of target torque in order of 1A-1B-2A-2B-3A-3B.



4. Tighten the screws again in the above order to the target torque. Refer to 2.1.3 Tighten Screws for screw torque specifications.

2.2 Lid Replacement

There are seven lids on MiniCobo, including base lid, big arm upper lid, big arm lower lid, elbow lid, small arm upper lid, small arm lower lid, and wrist lid. The replacement steps are almost same, so the following steps are taking base shell replacement as an example.

2.2.1 Preparation

(1) Tool

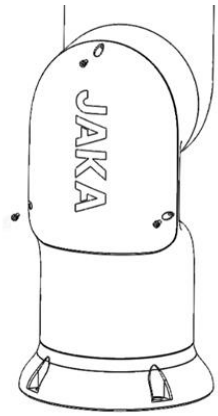
- 1.5 mm (0.06 in) Allen wrench: for disassembling and assembling screws on the lids.
- LOCTITE 243 thread locker: for fixing screws.

(2) Spare parts

No.	Name	Description
GS01.01	Joint lid set	J1-J6 Joint lids

2.2.2 Replacement

1. Prepare tools you need and wear anti-static bracelets.
2. Change the robot orientation to orientation that is easy to disassemble by JAKA Zu App.
3. Power off and disable the robot, power down the control cabinet and unplug the power.
4. Unscrew all screws by a 1.5 mm (0.06 in) Allen wrench.



5. Remove the lid and assemble the new one, spread thread locker on screws, align the screws and holes, and tighten screws.

WARNING

Be careful not to squeeze wires of electromagnet and encoder, which will result in wire broken and shell short circuit, and the JAKA Zu App will pop up error.

2.3 Driver Board Replacement

There are three driver boards in the MiniCobo, which locates under the base lid, elbow lid, and wrist lid respectively. Each driver board control two motors. The three driver boards are same according to hardware structure. There are DIP switch on the driver board, which can be change to the replaced joint.

2.3.1 Preparation

(1) Tool

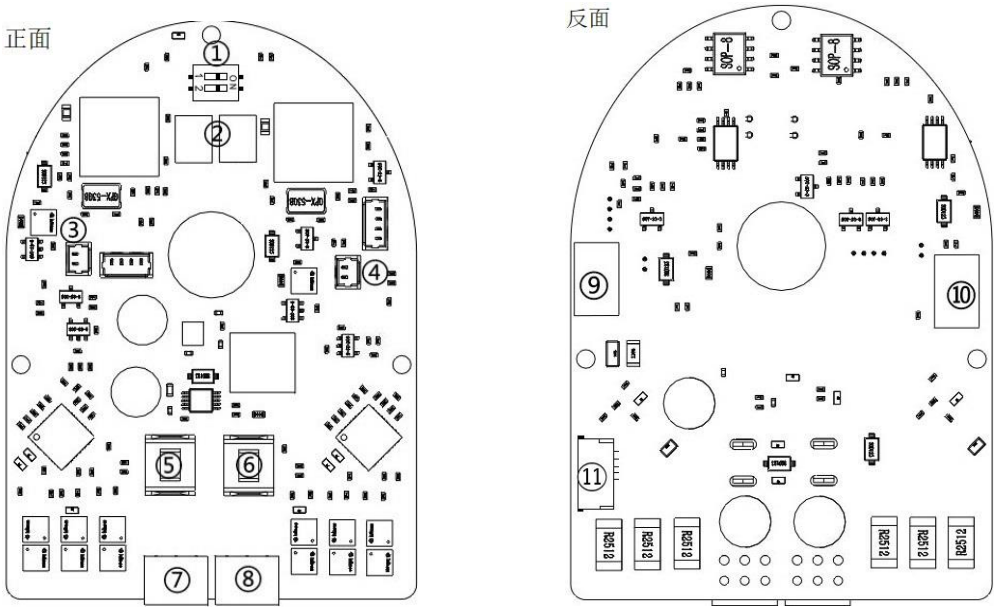
- 1.5 mm (0.06 in) Allen wrench: for disassembling and assembling screws on the lids.
- 3 mm (0.12 in) Phillips screwdriver: for disassembling and assembling screws and power terminals on the driver board.
- 1 mm (0.04 in) slotted screwdriver: for disassembling and assembling motor phase line on the driver board.

- Tweezer: for unplug the wire connectors on the driver board.
- Anti-static bracelet: for safe when disassembling and assembling the driver board.
- Thread locker: for fixing screws.
- Zip ties: for tying wires on the driver board.
- Diagonal pliers: for cutting zip ties.

(2) Spare parts

No.	Name	Description
03.01.15	Motor driver board	Driver board

2.3.2 Driver Board Interface Description



Front side Back side

1. DIP switch: switch it to the joint you want to replace. Set to “00” when you replace joint 1 or joint 2, which means that switch it to position closes to “1” and “2”.

Set to “01” when you replace joint 3 or joint 4, which means that put the first DIP switch close to “1”, and the second one close to “ON”.

Set to “10” when you replace joint 5 or joint 6, which means that put the first DIP switch close to “ON”, and the second one close to “2”.

2. CAN wire interfaces: There are two CAN wire interfaces and you don’t need to distinguish the order when you insert the CAN wires.

3. **Electromagnet interface 1**: It uses to connect electromagnet of joint 2, 3, and 5.

4. **Electromagnet interface 2**: It uses to connect electromagnet of joint 1, 4, and 6.

5. **+24V**: Interface of robot inner positive terminal of power cable. It connects red wires in the robot.

6. **GND**: Interface of robot inner negative terminal of power cable. It connects black wires in the robot.

7. **Motor phase line interface 1**: It uses to connect motor of joint 2, 3, and 5. The wiring sequence for the three motor phase lines is red, yellow, and blue from left to right.

8. **Motor phase line interface 2**: It uses to connect motor of joint 1, 4, and 6. The wiring sequence for the three motor phase lines is red, yellow, and blue from left to right.

9. **Encoder wire interface1**: It locates the back of driver board and uses to connect encoder of joint 1, 4, and 6.

10. **Encoder wire interface 2**: It locates the back of driver board and uses to connect encoder of joint 2, 3, and 5.

11. **Lamp ring structure wire interface**: It locates the back of driver board and only driver boards of joint 1 and joint 2 needs to connect lamp ring structure wire.

2.3.3 Replacement

1. Prepare tools you need and wear anti-static bracelets.

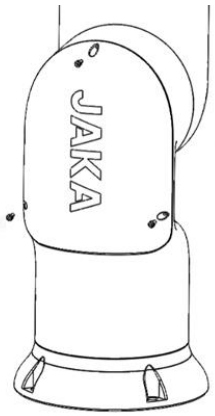
2. Change the robot orientation to the orientation that is easy to disassemble by the JAKA Zu App.

1) When robot malfunctions and cannot be control by the JAKA Zu App, refer to 2.1.2 Movement without Drive Power to move the robot to the position that is easy to disassemble.

2) You can detach the robot for the mounting plane and put it on a stable workbench, if necessary.

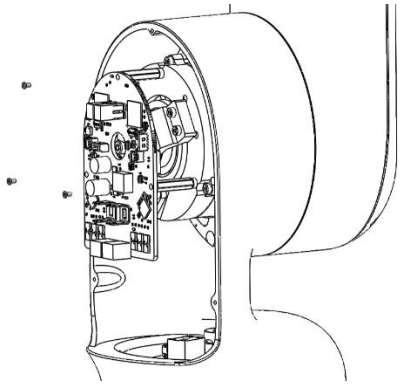
3. Power off and disable the robot, power down the control cabinet and unplug the power.

4. Unscrew all screws by a 1.5 mm (0.06 in) Allen wrench and remove the lid.

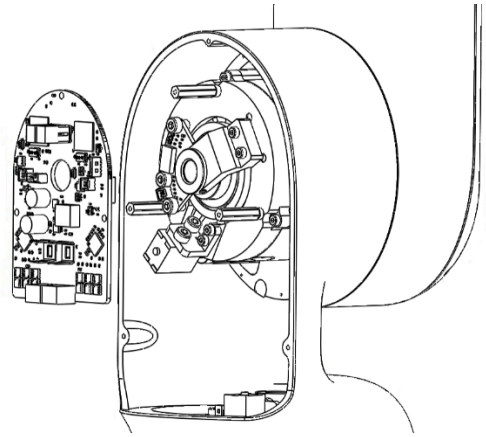


5. Unplug the wires on the driver board and cut the zip ties.

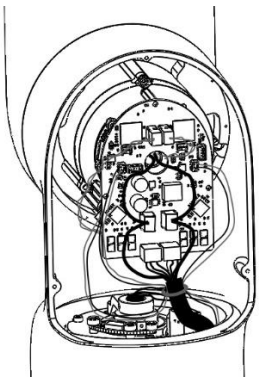
6. Remove three screws on the driver board and the driver board.



7. Switch the DIP switch on the new driver board, assemble the new driver board, and tighten three screws of the driver board.



8. Insert the wires on the driver board and tie them with zip ties.



9. You need to upgrade the firmware of the driver board, input parameters of driver board, and Z calibration after replacing the driver board. Refer to 3 Operations.

10. Check the zero position tags on the joints that controlled by this driver board, if they cannot be aligned, you need to calibrate the joints. Refer to 4 Calibration for joint calibration.

11. After completing the above steps, operate the robot to verify its function. Once confirmed that everything is in order, assemble the corresponding lid.

WARNING

1. Remember to wear anti-static bracelets when you replace the driver board to prevent static damage it.

2. If parameters of replaced driver board can be read when replacing the driver board, it is advisable to backup them. You can refer to “Method one: parameter backup” in 3.3 Write Parameters of Driver Board.

2.4 Electromagnet Replacement

MiniCobo has six electromagnets. The electromagnets of joint 1 and joint 2 are located in the base lid, the electromagnets of joint 3 and joint 4 are located in the elbow lid, and the electromagnets of joint 5 and joint 6 are located in the wrist lid. Some electromagnets are blocked by the driver board, so you need to remove the driver board first. The replacement steps of electromagnets are almost same, so the following steps are taking joint 2 electromagnet replacement as an example.

2.4.1 Preparation

(1) Tool

- 1.5 mm (0.06 in) Allen wrench: for disassembling and assembling screws on the lids and electromagnets.
- 3 mm (0.12 in) Phillips screwdriver: for disassembling and assembling screws and power terminals on the driver board.
- 1 mm (0.04 in) slotted screwdriver: for disassembling and assembling motor phase line on the driver board.
- Tweezer: for unplug the wire connectors on the driver board.
- Anti-static bracelet: for safe when disassembling and assembling the driver board.
- Diagonal pliers: for cutting zip ties.
- Zip ties: for tying wires on the driver board.
- Thread locker: for fixing screws.

(2) Spare parts

No.	Name	Description
GS01.02	Brake set	Electromagnet

2.4.2 Replacement

1. Prepare tools you need and wear anti-static bracelets.

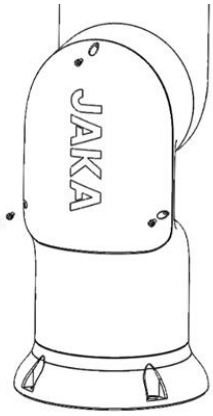
2. Change the robot orientation to orientation that is easy to disassemble by JAKA Zu App.

1) When robot malfunctions and cannot be control by App, refer to 2.1.2 Movement without Drive Power to move robot to position that is easy to disassemble.

2) You can detach the robot for the mounting plane and put it on a stable workbench, if necessary.

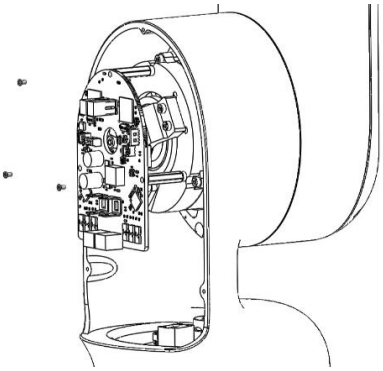
3. Power off and disable the robot, power down the control cabinet and unplug the power.

4. Unscrew all screws by 1.5 mm (0.06 in) Allen wrench and remove the lid.

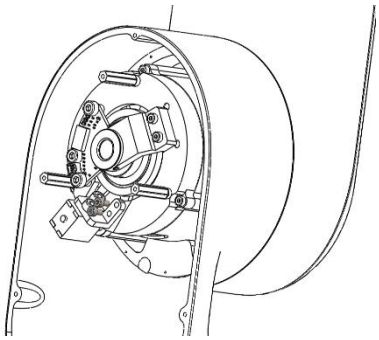


5. Unplug the wires on the driver board and cut the zip ties.

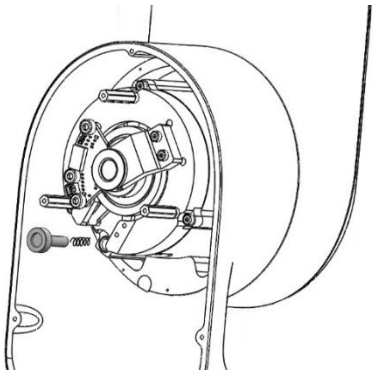
6. Remove three screws on the driver board and the driver board.



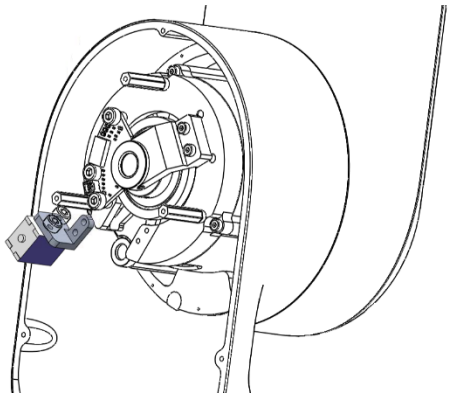
7. Remove two screws securing electromagnet by 1.5 mm (0.06 in) Allen wrench and remove electromagnet and its mounting base.



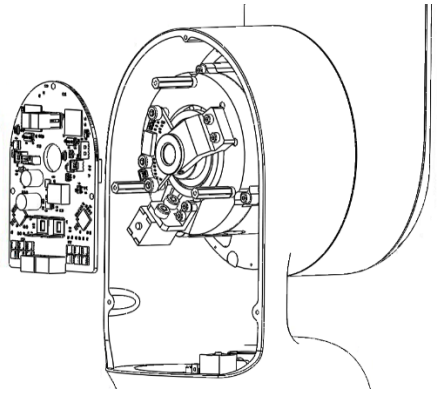
8. Its block and spring can be removed after removing electromagnet. Check whether block and spring are deformed, if they are, please change new one, if not, put them back. The small spring is prone to being lost, so be mindful to store it securely.



9. Place the new electromagnet on the brake guard, align the holes, and then tighten the two fixing screws. When tightening, adjust the ejector rod of the electromagnet to the center position of the block.



10. Put the driver board back and connect wires on it. Refer to 2.3 Driver Board Replacement.



11. Check the zero position tags on the joints that controlled by this driver board, if they cannot match , you need to calibrate joint. Refer to 4 Calibration for joint calibration.

12. After completing the above steps, operate the robot to verify its functionality. Once confirmed that everything is in order, assemble the corresponding lid.

2.5 Robot Base Replacement

2.5.1 Preparation

(1) Tool

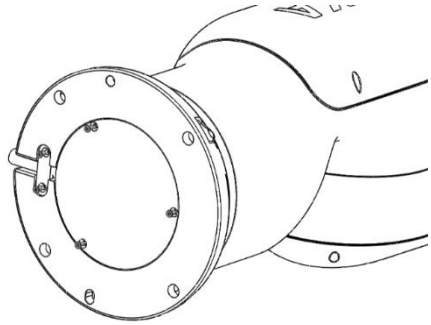
- 1.5 mm (0.06 in) Allen wrench: for disassembling and assembling screws fixing lamp ring structure board.
- 2.5 mm (0.10 in) Allen wrench: for disassembling and assembling screws on base.
- 3 mm (0.12 in) Phillips screwdriver: for disassembling and assembling screws and power terminals on the driver board.
- Torque wrench: for tighten base screws.
- Tweezer: for unplug the wire connectors on the driver board.
- Anti-static bracelet: for safe when disassembling and assembling the driver board.
- Thread locker: for fixing screws.
- Zip ties: for tying wires on the base.
- Diagonal pliers: for cutting zip ties.

(2) Spare parts

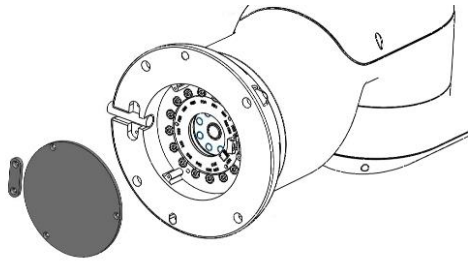
No.	Name	Description
0301.08	Base & lamp ring structure	Base & screws & zero position tag

2.5.2 Replacement

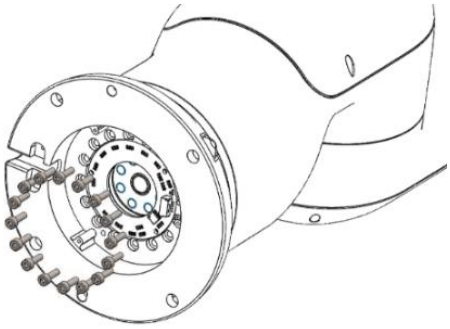
1. Prepare tools you need and wear anti-static bracelets.
2. You can detach the robot for the mounting plane and put it on a stable workbench, if necessary.
3. Power off and disable the robot, power down the control cabinet and unplug the power.
4. Unscrew the three screws securing white plate and two screws securing cable fastener by 3 mm (0.12 in) Phillips screwdriver.



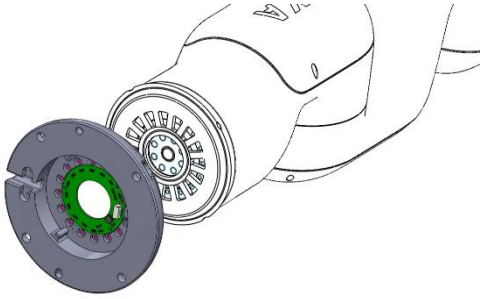
5. Remove white plate and the robot connection cable fastener.



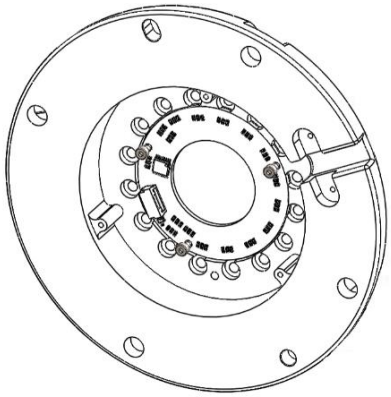
6. Cut zip ties by diagonal plier, and unplug the power wires, CAN wires, and lamp ring structure wires.
7. Unscrew 16 screws on base by 2.5 mm (0.10 in) Allen wrench.



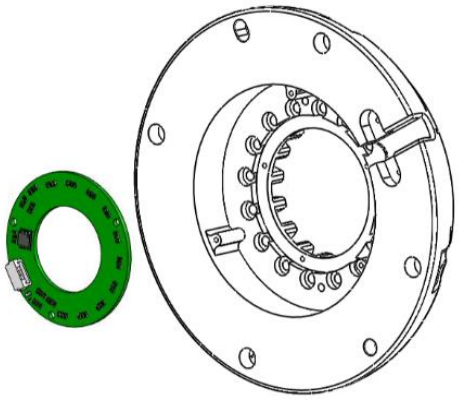
8. Gently rotate to remove the replaced base.



9. Unscrew 3 screws securing lamp ring structure on base by a 1.5 mm (0.06 in) Allen wrench.



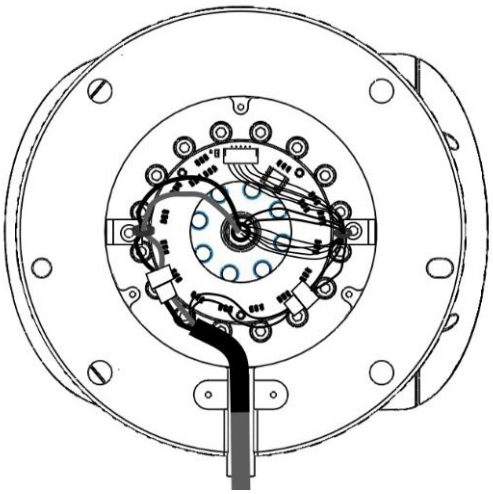
10. Remove lamp ring structure board, place it on the new base, and align holes to tighten three screws.



11. Install the new base on the robot, align screw holes, and tighten 16 screws.

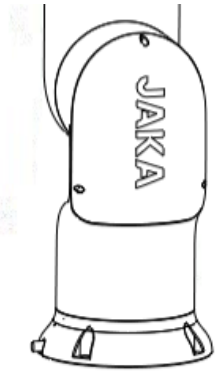
12. Insert terminals of power wires, lamp ring structure wires, and CAN wires on the lamp ring structure board.

13. Separate power wires, CAN wires, and encoder wires, adjust the wiring harness to a relatively relaxed state, and use zip tie to secure them onto the white cable clamps.



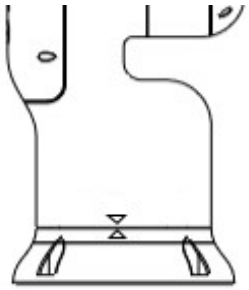
14. Put white plate and cable fastener back and tighten screws.

15. Power on and enable the robot, and move joint 6 of the robot to the calibration orientation. Since there is no zero position tag on the new flange, you can refer to the orientation in 4.1 MiniCobo Joint Calibration Orientation, and the relative position of the base cable interface and the base lid, and roughly move the joint 1 to the calibration orientation.



16. After joint 1 is in calibration orientation, refer to 4 Calibration to calibrate position of joint 1 to zero position.

17. After moving Joint 1 to 0°, affix the new zero position tag onto the base, considering that there are no zero position tag on the new base.



2.6 Flange Replacement

2.6.1 Preparation

(1) Tool

- 1.5 mm (0.06 in) Allen wrench: for disassembling and assembling screws fixing Flange and TIO board.
- Torque wrench: for tighten screws on flange.
- Tweezer: for unplug the wire connectors on the driver board.
- 14 mm (0.55 in) open-end wrench: for disassembling and assembling nuts securing FREE and POINT buttons.
- 11 mm (0.43 in) open-end wrench: for disassembling and assembling nuts securing TIO cable.
- Anti-static bracelet: for safe when disassembling and assembling the driver board.
- Thread locker: for fixing screws.

(2) Spare parts

No.	Name	Description
0301.07	Flange	Flange & screws & zero position tag

2.6.2 Replacement

1. Prepare tools you need and wear anti-static bracelets.

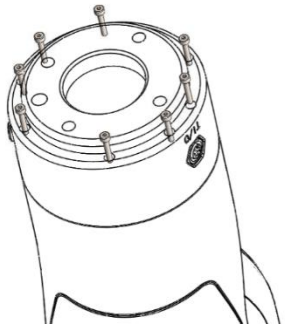
2. Change the robot orientation to orientation that is easy to disassemble by the JAKA Zu App.

1) When robot malfunctions and cannot be control by the JAKA Zu App, refer to 2.1.2 Movement without Drive Power to move robot to the position that is easy to disassemble.

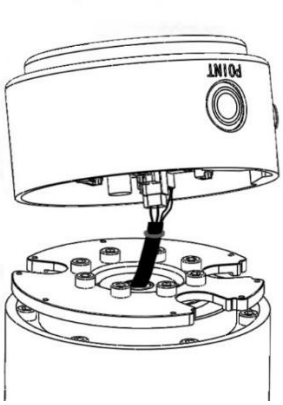
2) You can detach the robot for the mounting plane and put it on a stable workbench, if necessary.

3. Power off and disable the robot, power down the control cabinet and unplug the power.

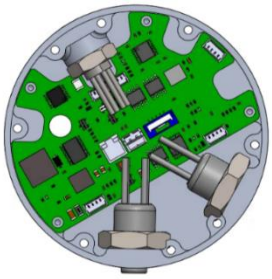
4. Unscrew 8 screws on flange by a 1.5 mm (0.06 in) Allen wrench.



5. Unplug terminals of CAN wires and power wires from the TIO board to remove flange.

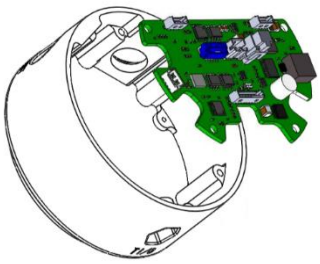


6. Remove nuts securing FREE and POINT buttons by a 14 mm (0.55 in) open-end wrench and remove nuts securing the TIO by a 11 mm (0.43 in) open-end wrench.



7. Unplug terminals of the TIO cable, FREE button, and POINT button from the TIO board.

8. Remove four screws securing the TIO board by a 1.5 mm (0.06 in) Allen wrench, and then remove the TIO board from the replaced flange.



9. Place the disassembled TIO board in the new flange, align screws and holes, and tighten four screws.

10. Put the TIO cable, FREE button, and POINT button back, insert terminals of FREE button, and POINT button wires on the TIO board, and screw nuts.

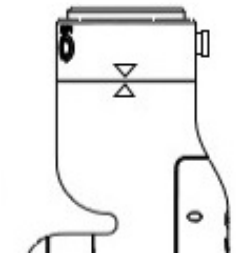
11. Insert the terminals of TIO wires on the TIO board.

12. Install the new flange on the robot, align screws and holes, and screw nuts.

13. Power on and enable the robot, and move joint 1 of the robot to the calibration orientation. Since there is no zero position tag on the new base, you can refer to the orientation in 4.1 MiniCobo Joint Calibration Orientation, and the relative position of the buttons on flange and TIO interface with wrist lid, and roughly move the joint 6 to the calibration orientation.

14. After joint 1 is in calibration orientation, refer to 4 Calibration to calibrate position of joint 6 to zero position.

15. After moving joint 6 to 0°, affix the new zero position tag onto the flange, considering that there are no zero position tag on the new flange.



2.7 TIO Cable Replacement

2.7.1 Preparation

(1) Tool

- 1.5 mm (0.06 in) Allen wrench: for disassembling and assembling screws securing flange and lids.
- Torque wrench: for tighten screws on flange.
- Tweezer: for unplug the wire connectors on the driver board.
- 3 mm (0.12 in) Phillips screwdriver: for disassembling and assembling screws and power terminals on the driver board.
- 1 mm (0.04 in) slotted screwdriver: for disassembling and assembling motor phase line on the driver board.
- Anti-static bracelet: for safe when disassembling and assembling the driver board.
- Thread locker: for fixing screws.
- Zip ties: for tying wires on the driver board and TIO wires.
- Diagonal pliers: for cutting zip ties.

(2) Spare parts

No.	Name	Description
GS01.03	Wire set	CAN wires & power wires

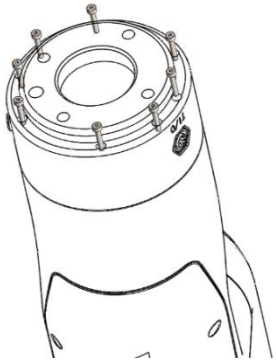
2.7.2 Replacement

1. Prepare tools you need and wear anti-static bracelets.
2. Change the robot orientation to orientation that is easy to disassemble by the JAKA Zu App.

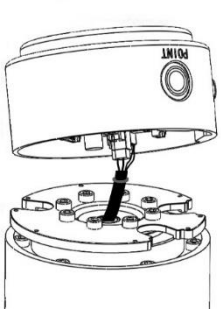
1) When robot malfunctions and cannot be control by the JAKA Zu App, refer to 2.1.2 Movement without Drive Power to move robot to the position that is easy to disassemble.

2) You can detach the robot for the mounting plane and put it on a stable workbench, if necessary.

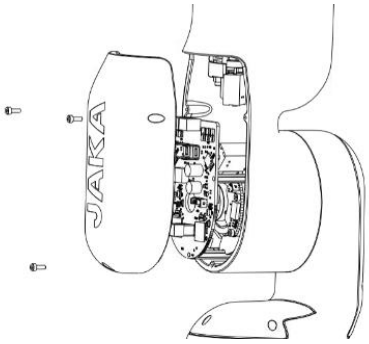
3. Power off and disable the robot, power down the control cabinet and unplug the power.
4. Unscrew 8 screws on flange by a 1.5 mm (0.06 in) Allen wrench.



5. Unplug terminals of CAN wires and power wires from TIO board by tweezer to remove flange.



6. Remove the wrist lid by a 1.5 mm (0.06 in) Allen wrench.



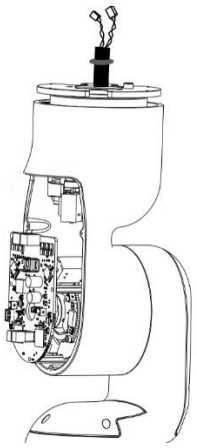
7. Remove red and black power wires and CAN wires on the driver board by a 3 mm (0.12 in) Phillips screwdriver.

8. Pull replaced TIO wires out of flange outward. Due to small hole of joint, so wires cannot be pulled out at once. It is recommended to pull out the wires one by one, starting with the power wires and leaving the CAN wires to be pulled out last.

9. Thread the new TIO wires into the hollow space of the joint 6 from the flange. During threading, it is advisable to start by threading the CAN wires, followed by individually threading the two power wires.

10. Insert terminals of red and black power wires and CAN wire on the driver board, and then put back wrist lid.

11. Tie a zip tie around the end of the black heat shrink tube at the flange to prevent wear on the wires. The length of reserved heat shrink tube should be between 2~4mm (0.08~0.16 in).



12. Insert terminals of TIO wires on the TIO board.
13. Install flange on the robot, align screws and holes, and tighten screws.

2.8 Base Wire Harness Replacement

2.8.1 Preparation

(1) Tool

- 1.5 mm (0.06 in) Allen wrench: for disassembling and assembling screws on the lids.
- 3 mm (0.12 in) Phillips screwdriver: for disassembling and assembling power terminals on driver board.
- Torque wrench: for tighten base screws.
- Tweezer: for unplug the wire connectors on the driver board.
- Anti-static bracelet: for safe when disassembling and assembling the driver board.
- Thread locker: for fixing screws.
- Zip ties: for tying wires on the driver board and TIO wires.
- Diagonal pliers: for cutting zip ties.

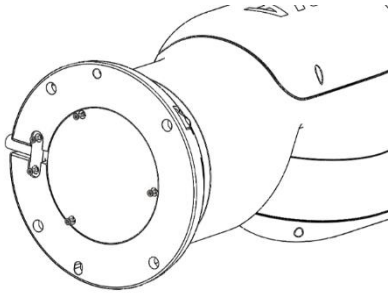
(2) Spare parts

No.	Name	Description
GS01.03	Wire set in the robot	CAN wires & power wires

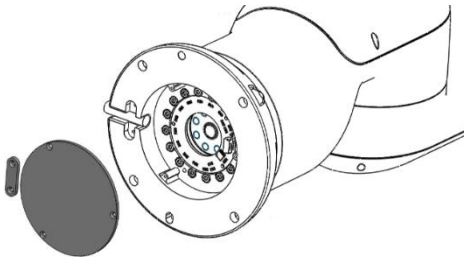
2.8.2 Replacement

1. Prepare tools you need and wear anti-static bracelets.
2. You can detach the robot for the mounting plane and put it on a stable workbench, if necessary.
3. Power off and disable the robot, power down the control cabinet and unplug the power.
4. Unscrew the three screws securing white plate and two screws securing cable fastener by a 3 mm (0.12

in) Phillips screwdriver.

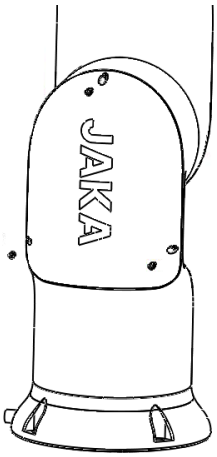


5. Remove the white plate and the cable fastener.



6. Cut zip ties by diagonal plier, and unplug the power wires, CAN wires, and lamp ring structure wires.

7. Unscrew three screws on the bottom lid by a 1.5 mm (0.06 in) Allen wrench, and remove the bottom lid.



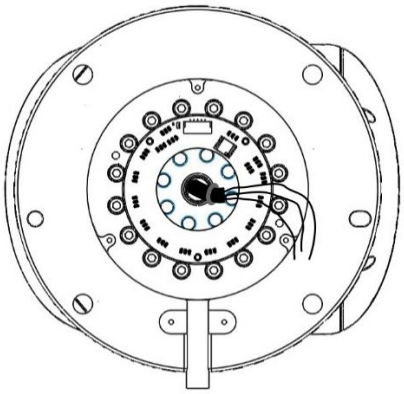
8. Remove red and black power wires connected to the driver board from the base wire harness by a 3 mm (0.12 in) Phillips screwdriver. Remove CAN wires and connectors of lamp ring structure wires connected to the driver board by the base wire harness.

9. Pull replaced base wire harness out of the robot base. Due to small hole of joint, so wires cannot be pulled out at once. It is recommended to pull out the wires according to the order of the power wires, the CAN wires, and lamp ring structure wires.

10. Thread the new TIO wires into the hollow space of the joint 6 from the flange. During threading, it is advisable to start by threading the CAN wires, followed by individually threading the two power wires.

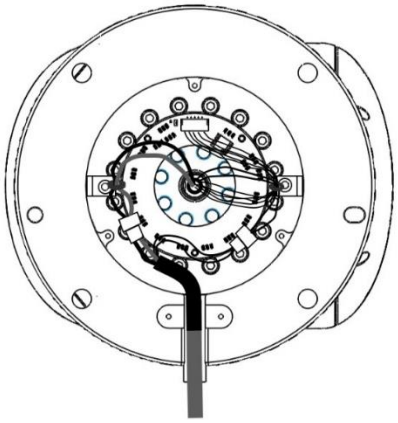
11. Insert terminals of red and black power wires, CAN wires, and light wires on the driver board, and then put them back in bottom lid.

12. Tie a zip tie around the end of the black heat shrink tube at the bottom of robot base. The length of reserved heat shrink tube should be between 2~4mm (0.08~0.16 in).



13. Insert terminals of power cables, lamp ring structure wires, and CAN wires on the lamp ring structure board.

14. Separate power wires, CAN wires, and encoder wires, adjust the wiring harness to a relatively relaxed state, and use zip tie to secure them onto the white cable clamps.



15. Put white plate and cable fastener back on robot base, align screw holes and tighten screws.

2.9 Joint Connection Wire Harness Replacement

There are joint 1~3 wire harness, joint 3~5 wire harness, TIO wire harness, and base wire harness in MiniCobo. The replacement of TIO wires and base wires are described in other chapters. The replacement steps of joint 1~3 wire harness and joint 3~5 wire harness are almost same. In this chapter, taking the replacement of joint 1~3 wire harness as an example. The replacement steps for the joint 3~5 wires are not reiterated in this manual.

2.9.1 Preparation

(1) Tool

- 1.5 mm (0.06 in) Allen wrench: for disassembling and assembling screws on the lids.
- 3 mm (0.12 in) Phillips screwdriver: for disassembling and assembling screws and power terminals on the

driver board.

- 1 mm (0.04 in) slotted screwdriver: for disassembling and assembling motor phase line on the driver board.
- Tweezer: for unplug the wire connectors on the driver board.
- Anti-static bracelet: for safe when disassembling and assembling the driver board.
- Thread locker: for fixing screws.
- Zip ties: for tying wires on the driver board.
- Diagonal pliers: for cutting zip ties.

(2) Spare parts

No.	Name	Description
GS01.03	Wire set in the robot	CAN wires & power wires

2.9.2 Replacement

1. Prepare tools you need and wear anti-static bracelets.

2. Change the robot orientation to orientation that is easy to disassemble by the JAKA Zu App. When replacing the robot internal wires, it is recommended to adjust the robot to a vertical orientation.

1) When robot malfunctions and cannot be control by the JAKA Zu App, refer to 2.1.2 Movement without Drive Power to move robot to position that is easy to disassemble.

2) You can detach the robot for the mounting plane and put it on a stable workbench, if necessary.

3. Power off and disable the robot, power down the control cabinet and unplug the power.

4. Remove base lid, big arm upper lid, big arm lower lid, and elbow lid with a 1.5 mm (0.06 in) Allen wrench, and then the joint 1~3 wire harness can be seen.

5. Remove red and black power wires and CAN wires connected to the driver board by a 3 mm (0.12 in) Phillips screwdriver.

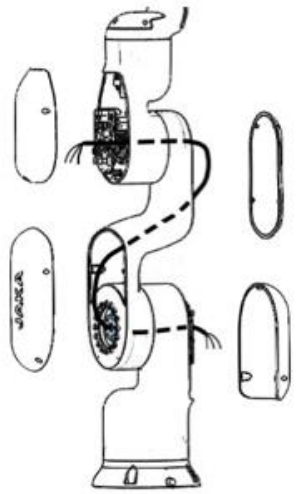
6. Pull old joint 1~3 wire harness out of the hollow space of joint 2 and joint 3. Due to small hole of joint, so

wires cannot be pulled out at once. It is recommended to pull out the cables one by one, starting with the power wires and leaving the CAN wires to be pulled out last.

7. Thread the new wires into the hollow space of the joint 2 and joint 3. During threading, it is advisable to start by threading the CAN wires, followed by individually threading the two power wires.

8. Connect power wires and CAN wires.

9. Put the base lid, big arm lower lid, big arm upper lid, and elbow lid back.



2.10 Motor Module Replacement

A motor module contains a joint motor, an encoder, a reducer, a rotor, and accessories. When any of the above components fails, the entire motor module is replaced by default. MiniCobo has three types motor modules, including the motor module for joint 1 and joint 2, the motor module for joint 3, and the motor module for joint 4, joint 5, and joint 6. The replacement steps of different types of motor modules are almost same, so the following steps are taking joint 2 motor module replacement as an example.

2.10.1 Preparation

(1) Tool

- 1.5 mm (0.06 in) Allen wrench: for disassembling and assembling screws on the lids and electromagnets.
- 2.5 mm (0.10 in) Allen wrench: for disassembling and assembling screws on motors and lids.
- 3 mm (0.12 in) Phillips screwdriver: for disassembling and assembling screws and power terminals on the driver board.
- 1 mm (0.04 in) slotted screwdriver: for disassembling and assembling motor phase line on the driver board.
- Torque wrench: for tighten screws of motors and lids and calibrate the torque.
- Tweezer: for unplug the wire connectors on the driver board.
- Anti-static bracelet: for safe when disassembling and assembling the driver board.
- Thread locker: for fixing screws.

- Zip ties: for tying wires on the driver board.
- Diagonal pliers: for cutting zip ties.

(2) Spare parts

No.	Name	Description
0301.01	Joint 1	Joint module + screws
0301.02	Joint 2	Joint module + screws
0301.03	Joint 3	Joint module + screws
0301.04	Joint 4	Joint module + screws
0301.05	Joint 5	Joint module + screws
0301.06	Joint 6	Joint module + screws

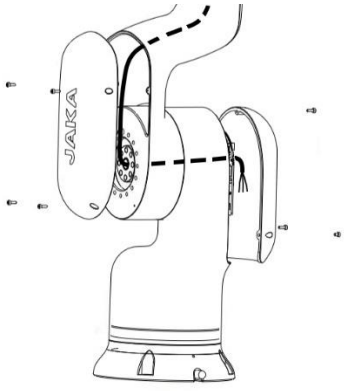
2.10.2 Replacement

1. Prepare tools you need and wear anti-static bracelets.

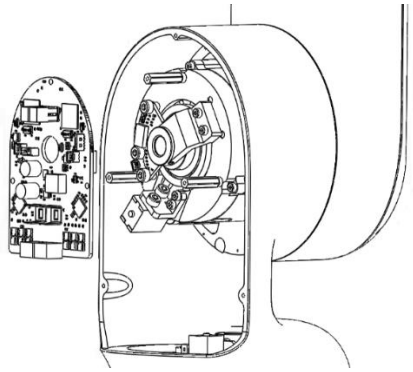
2. Before replacing the joint module, you need to detach the robot for the mounting plane and put it on a stable workbench.

3. Power off and disable the robot, power down the control cabinet and unplug the power.

4. Remove the base lid and the lower lid of big arm by a 1.5 mm (0.06 in) Allen wrench.

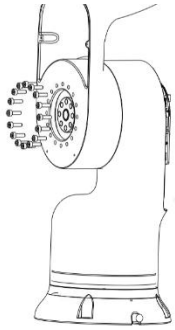


5. Remove wires from the driver board of base lid, three screws on the driver board, and the driver board.

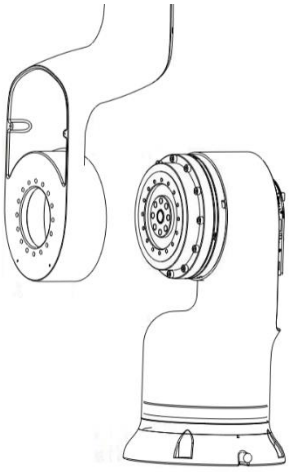


6. Pull the old wires of joint 1~3 out of the hollow space of joint 2. It is recommended to pull out the wires one by one, starting with the power wires and leaving the CAN wires to be pulled out last.

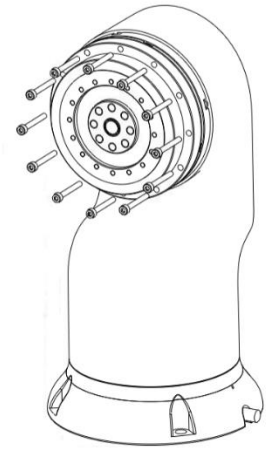
7. Unscrew 16 screws connected the shell in the lower lid of big arm by a 2.5 mm (0.10 in) Allen wrench.



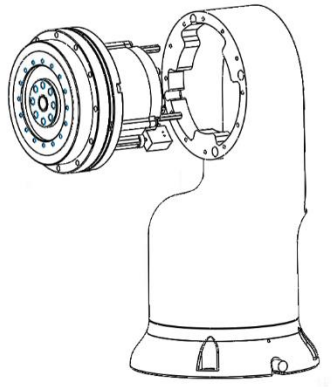
8. Separate the big arm shell and the base shell.



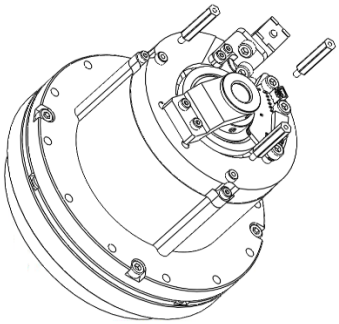
9. Remove 12 screws securing the motor module of the joint 2.



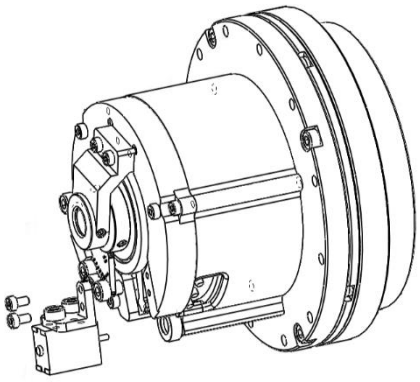
10. Take out the motor module of joint 2 from base shell, taking care not to damage the wires on the motor module when taking it out.



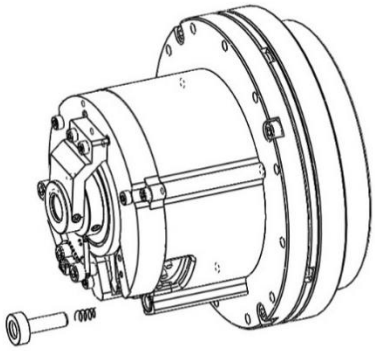
11. Remove three steel hex standoff spacers on the motor module of joint 2, and install the removed steel hex standoff spacers onto the new motor module.



12. Remove two screws secured electromagnet by a 1.5 mm (0.06 in) Allen wrench and remove electromagnet and its mounting base.



13. Remove the block and spring of the electromagnet. Check whether they are deformed, if they are, please change a new one, if not, put them back. The small spring is prone to being lost, so be mindful to store it securely.



14. Place the removed electromagnet on the new motor module, align the holes, and then tighten the two fixing screws. When tightening, adjust the ejector rod of the electromagnet to the center position of the block.

15. Put a new motor module of joint 2 in the base shell, align the holes, and tighten 12 screws secured the motor module.

16. Assemble big arm shell and base shell and screw 16 screws.

17. Thread the wires of joint 1~3 into the hollow space of the joint 2. During threading, it is advisable to start by threading the CAN wires, followed by individually threading the two power wires.

18. Put the driver board back and connect wires on it. Refer to 2.3 Driver Board Replacement for the operation steps.

19. Put the base lid and the big arm lower lid back.

20. Joint Z and zero calibration are needed after replacing a new motor module. Refer to 3.4 Z Calibration and 4 Calibration for the operation steps.

2.11 Shell Replacement

There are 5 shells in the MiniCobo, including base shell, big arm shell, elbow shell, small arm shell, and wrist shell, The replacement steps of different types of shells are almost same, so the following steps are taking big arm shell replacement as an example.

2.11.1 Preparation

(1) Tool

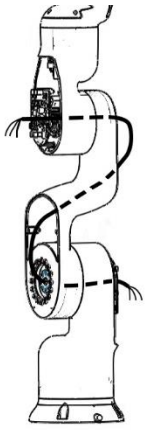
- 1.5 mm (0.06 in) Allen wrench: for disassembling and assembling screws on the lids and electromagnets.
- 2.5 mm (0.10 in) Allen wrench: for disassembling and assembling screws on motors and lids.
- 3 mm (0.12 in) Phillips screwdriver: for disassembling and assembling screws and power terminals on the driver board.
- 1 mm (0.04 in) slotted screwdriver: for disassembling and assembling motor phase line on the driver board.
- Torque wrench: for tighten screws of motors and lids and calibrate the torque.
- Tweezer: for unplug the wire connectors on the driver board.
- Anti-static bracelet: for safe when disassembling and assembling the driver board.
- Thread locker: for fixing screws.
- Zip ties: for tying wires on the driver board.
- Diagonal pliers: for cutting zip ties.

(2) Spare parts

No.	Name	Description
0301.10	Base shell	Shell + screws + packaging material
0301.11	Small arm shell	Shell + screws + packaging material
0301.12	Big arm shell	Shell + screws + packaging material
0301.13	Wrist shell	Shell + screws + packaging material
0301.14	Elbow shell	Shell + screws + packaging material

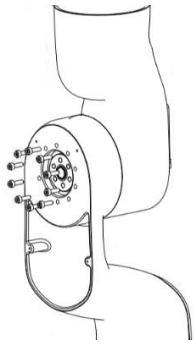
2.11.2 Replacement

1. Prepare tools you need and wear anti-static bracelets.
2. Before replacing the joint module, you need to detach the robot for the mounting plane and put it on a stable workbench.
3. Power off and disable the robot, power down the control cabinet and unplug the power.
4. Remove base lid, big arm lower lid, big arm upper lid, and elbow lid with a 1.5 mm (0.06 in) Allen wrench, and then the joint 1~3 wire harness can be seen.

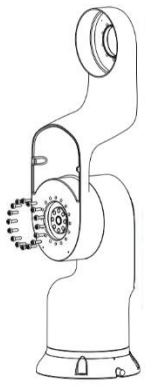


5. Remove the wire connectors connected on driver board from joint 1~3 wire harness and pull joint 1~3 wire harness out of the robot.

6. Unscrew 10 screws in the upper lid of big arm by a 2.5 mm (0.10 in) Allen wrench and separate elbow shell and big arm shell.



7. Unscrew 16 screws in the lower lid of big arm by a 2.5 mm (0.10 in) Allen wrench and separate big arm shell and base shell.



8. Assemble the new big arm shell and base shell and screw 16 screws by a 2.5 mm (0.10 in) Allen wrench.

9. Assemble the new big arm shell and elbow shell and screw 10 screws by a 2.5 mm (0.10 in) Allen wrench.

10. Thread the joint 1~3 wire harness into the big arm shell and thread both sides of the wires through the

hollow space of joint 2 and joint 3.

11. Connect the connectors of joint 1~3 wire harness to the driver boards.

12. Put the base lid, big arm lower lid, big arm upper lid, and elbow lid back, and tighten the screws.

13. Power on and enable the robot, and move the joint 2 and joint 3 of the robot to the calibration orientation. Since there is no zero position tag on the new shell, refer to the robot orientation in 4.1 MiniCobo Joint Calibration Orientation to move the robot joint 2 and joint 3 to calibration orientation roughly by visual estimation.

14. After joint 2 and joint 3 are in calibration orientation, refer to 4 Calibration to calibrate the orientation of joint 2 and joint 3 to the zero position.

15. After moving joint 2 and joint 3 to 0°, affix the new zero position tag onto them, considering that there is no zero position tag on the new shell.

3. Operations

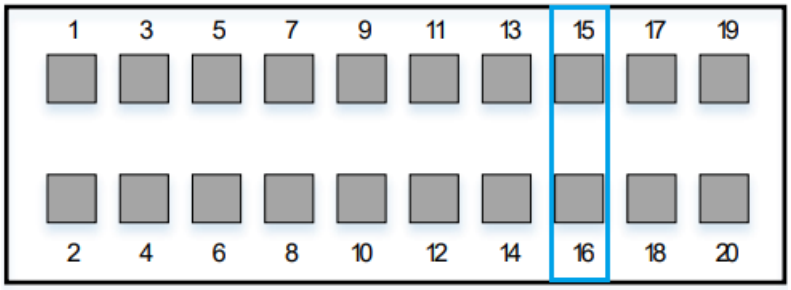
3.1 CAN Wire Connection

(1) Tool

- Computer: a computer installs JAKA Servo Upper Monitor.
- CAN Analyzer: used to connect the computer to the robot CAN bus.

(2) Connection

After the replacement of the driver board, you need to upgrade servo firmware, write parameters to the driver board, and Z calibration. Connect the CANH and CANL from the CAN Analyzer to the CAN bus. Steps are as follows: Interface number 15 and 16 of Minicab's integrated interface correspond to CAN_H and CAN_L channels, connecting CAN_H and CAN_L channels of CAN analyzer to number 15 and 16.



3.2 Driver Board Firmware Upgrade

Upgrade steps:

1. Connect to the same local area network as the control cabinet on the app.

2. Open the JAKA Zu APP and Click icon on the upper right corner to find the corresponding robot to connect, the Wi-Fi with the name of the control cabinet number in the device can be found.

3. Click【Settings】→【System Settings】→【Version Upgrade】to enter the servo upgrade interface, click the white box of "Please select the file" and upload the servo upgrade package (the name of the upgrade package cannot be modified, the original file name must be maintained), click the icon to upload the servo upgrade package.

4. During the upgrade process, the controller will be automatically powered on, the APP interface will pop up the upgrade progress window, wait for a few minutes, the controller will automatically restart, the upgrade is completed.

3.3 Write Parameters of Driver Board

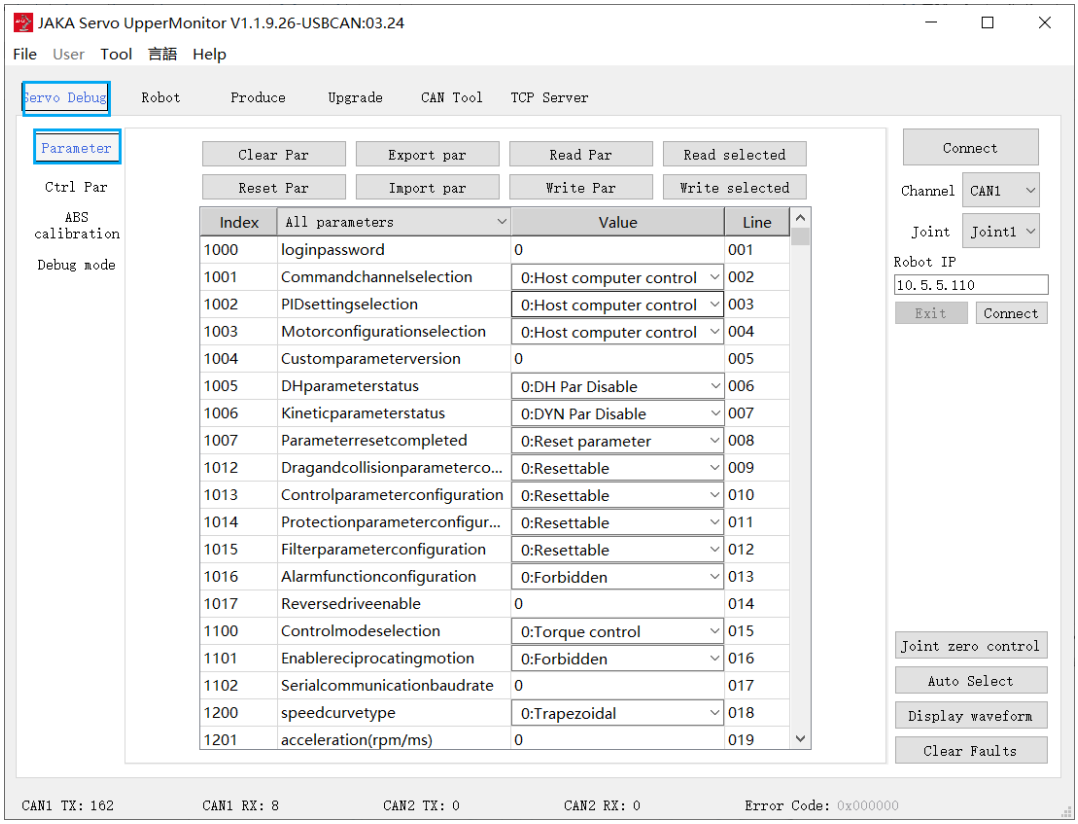
There are three driver boards in the MiniCobo, which means that every two joints share one driver board. After replacing the driver board, you need to rewrite parameters of two joint motors that controlled by the driver board replaced. There are two methods to write parameters. First, read and backup parameters from the original driver board, and then import the backup parameters into the new driver board. Second, according to the driver board parameter table below, manually select and write the corresponding parameters on the 【Produce】 page of the JAKA Servo Upper Monitor. For operators unfamiliar with servo parameters, it is recommended to prioritize first method for writing the driver board parameters.

Method one: backup parameters

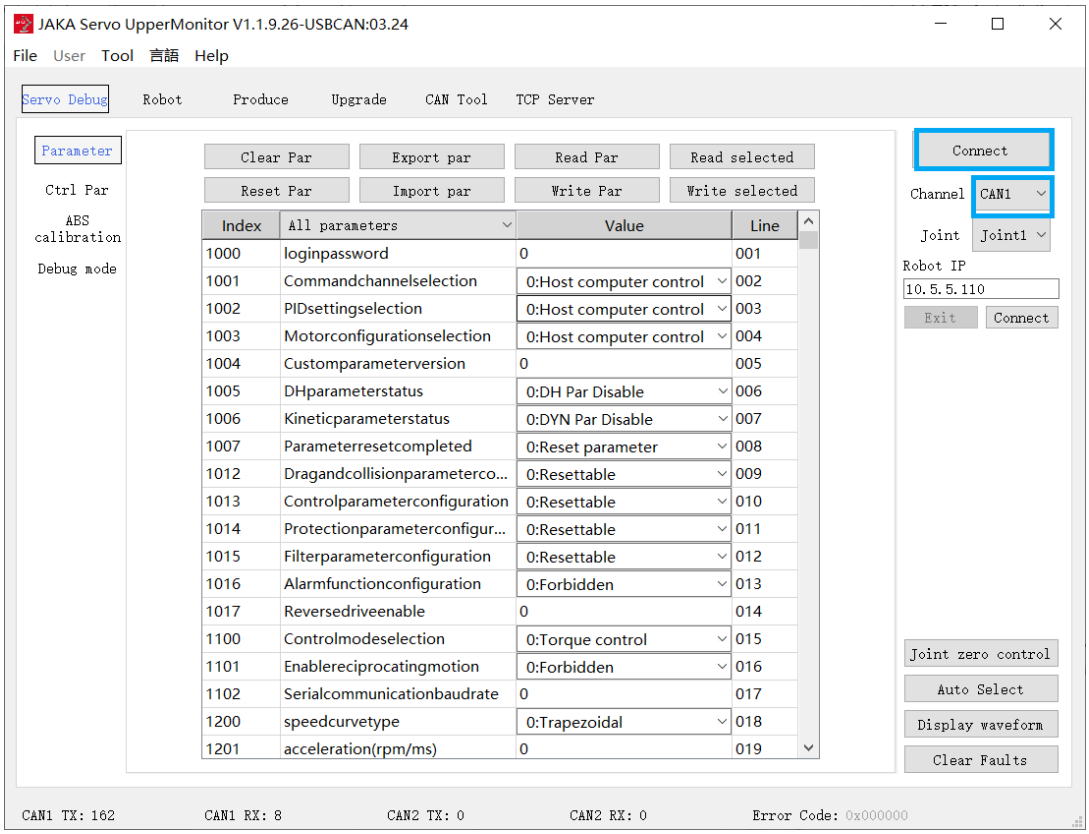
Steps:

1. Refer to 3.1 CAN Wire Connection, connect the CAN analyzer to the robot CAN bus.

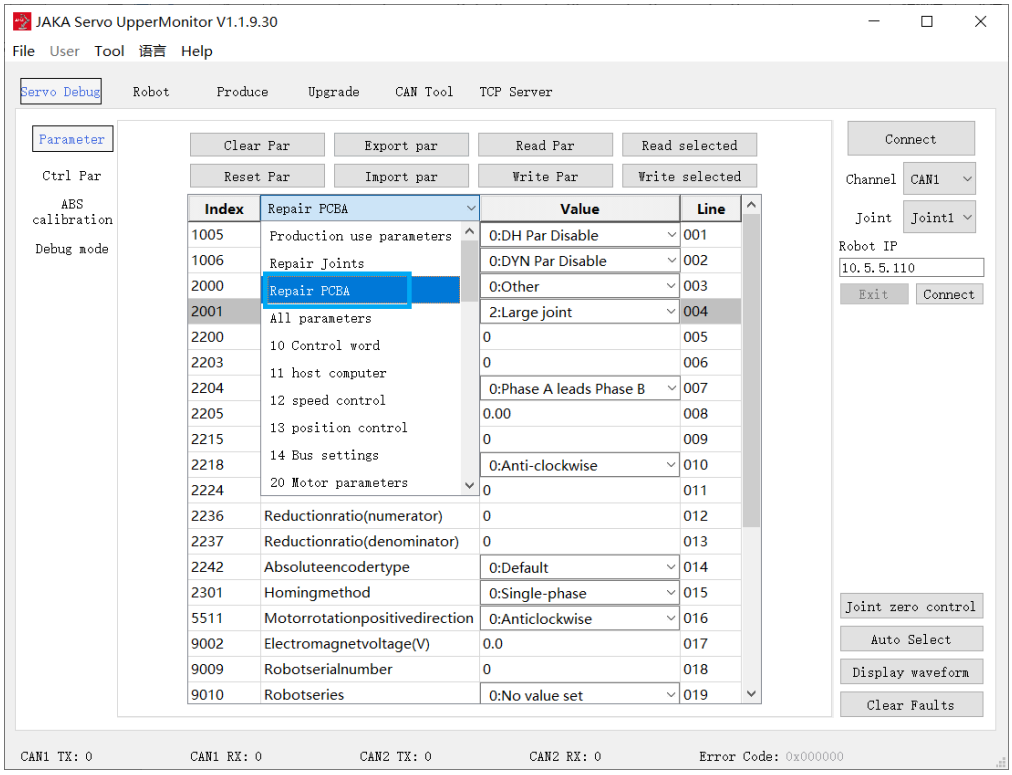
2. Open JAKA Servo Upper Monitor, go to 【Servo Debug】 interface, and click 【Parameter】 in the left menu bar.



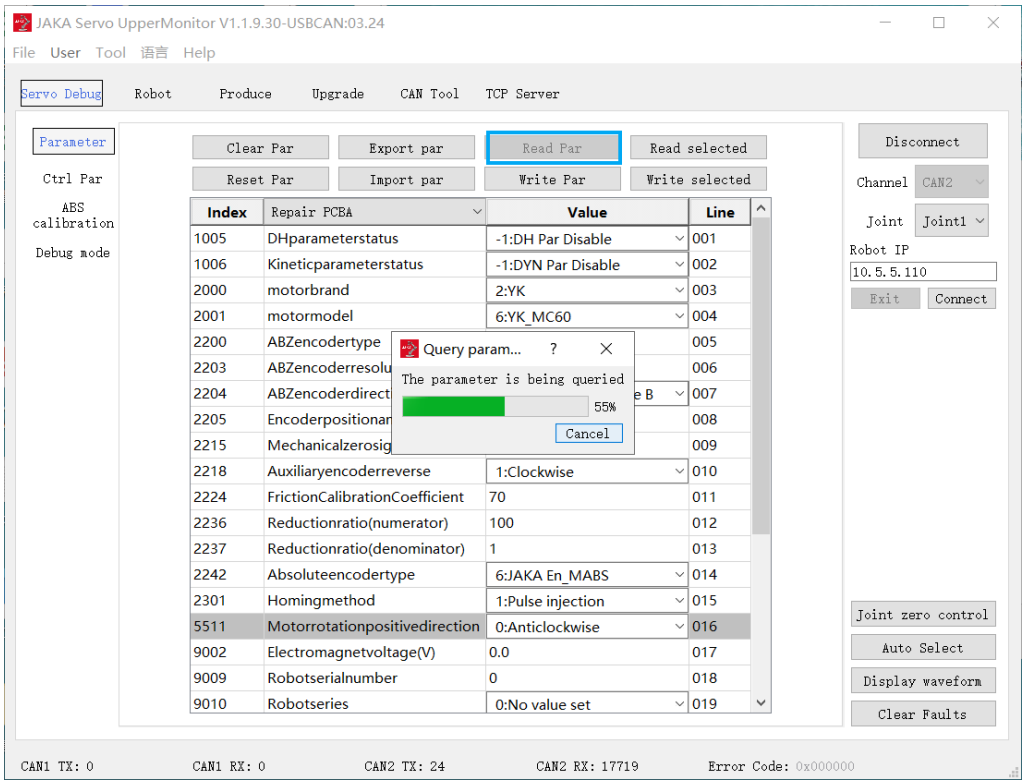
3. Power on the robot, select joint and CAN channel, and click 【Connect】.



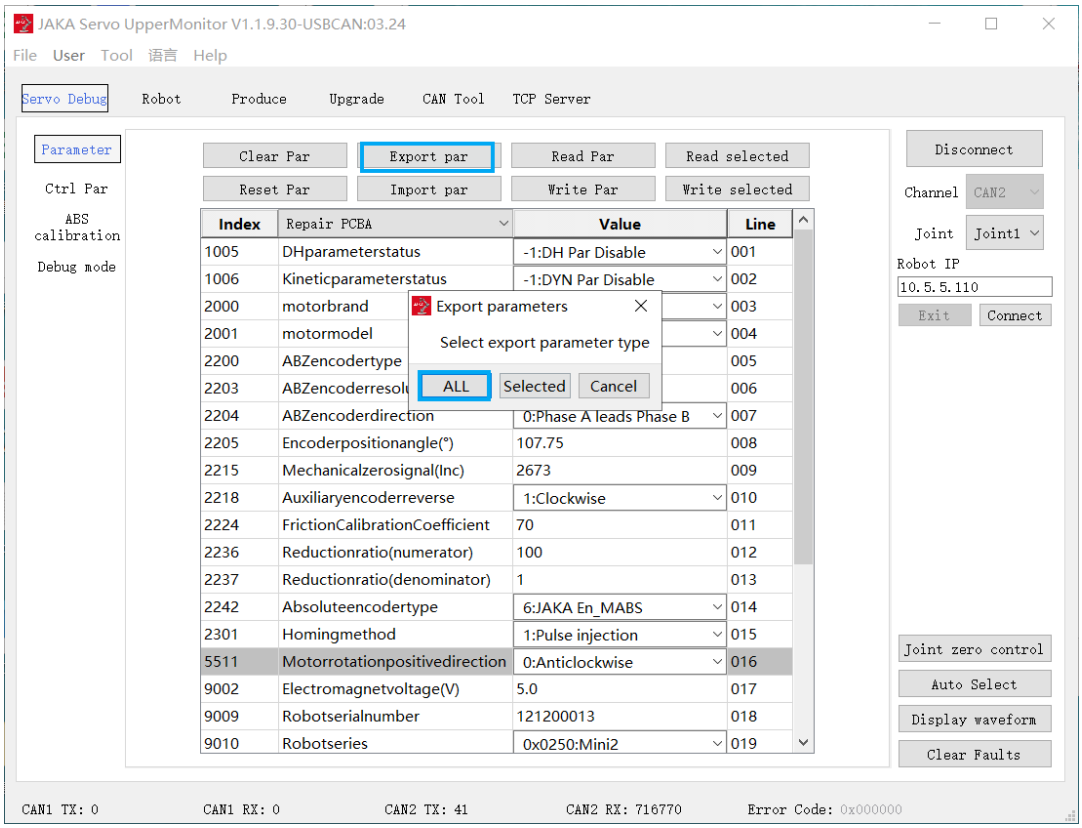
4. Switch the index to the “Repair PACB”.

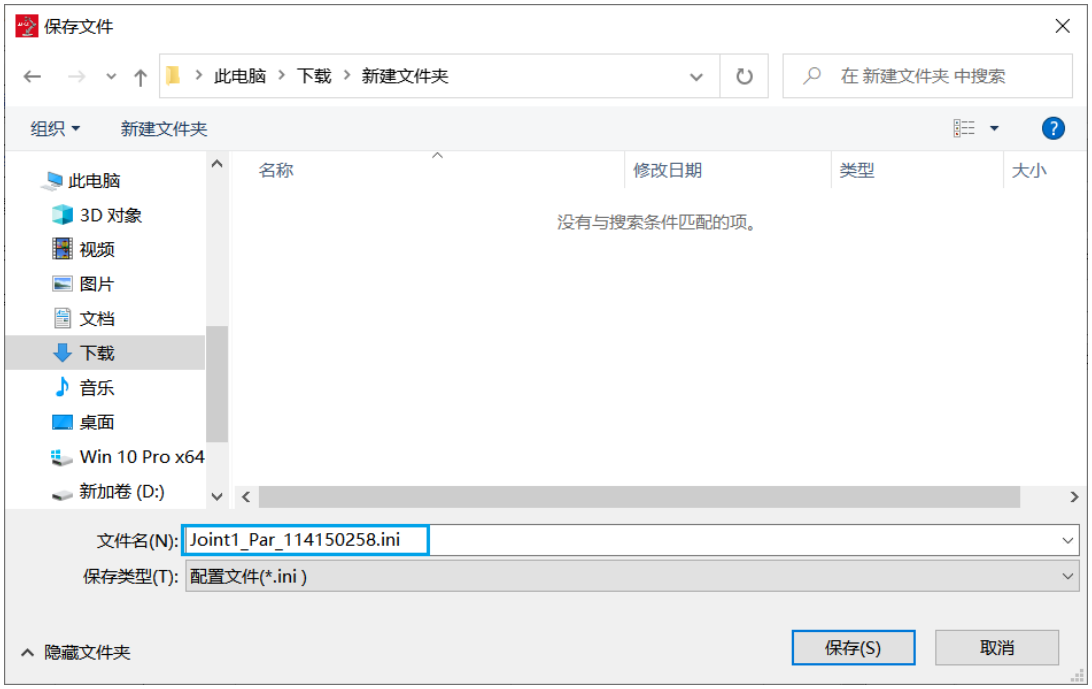


5. Click 【Read Par】, and wait for the parameter query to complete. In case of failure, try reading again.



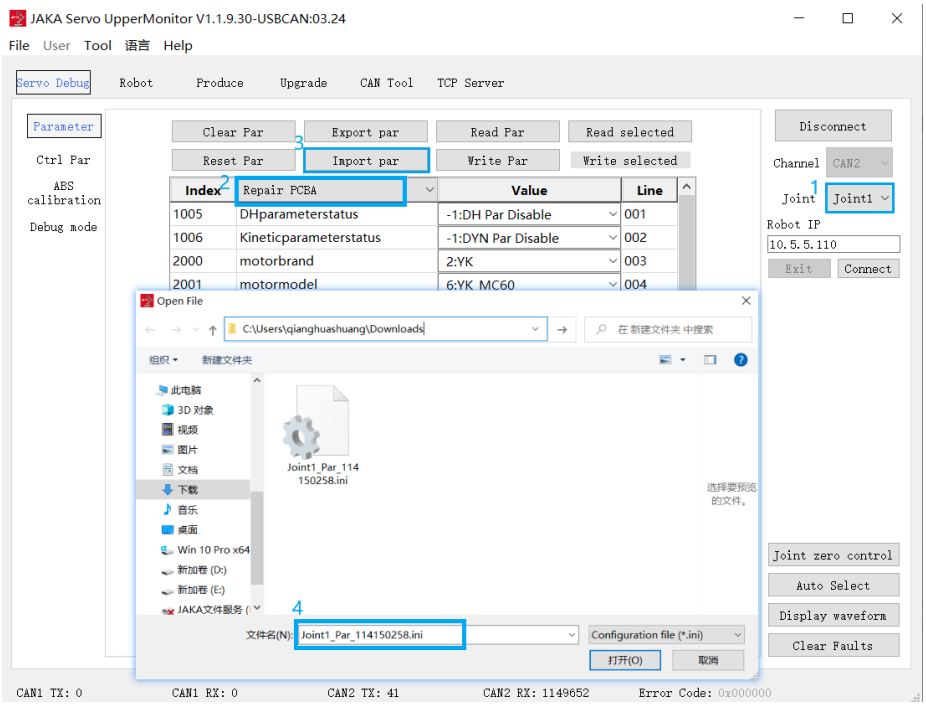
6. Click 【Export par】 and select 【ALL】 in the pop-up window, and then all parameters of driver board replacement will be backed up. The default file name is **Joint name_Par_Robot ID**. The exportation of the joint parameters is completed now. The backup steps of other joints are same as steps above.



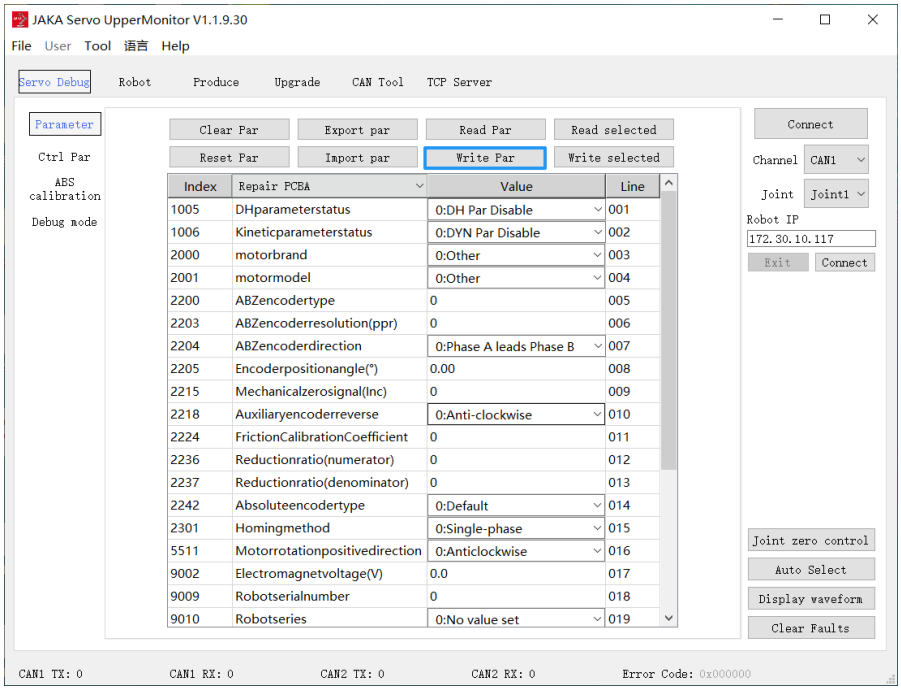


7. Power off the robot and replace the joint driver board. Note that the joint DIP switch needs to be consistent with the original driver board. Refer to 2.3 Driver Board Replacement and 3.2 Driver Board Firmware Upgrade for operation steps.

8. Select replaced joint, click 【Import par】, and select the backed up parameters before and export them.



9. Click 【Write Par】 after parameters are imported. Due to numerous parameters set at once, the software pops up two confirmation prompts. Simply select “OK”. After importing parameters of two joints controlled by the new driver board. You can perform the Z calibration.



WARNING

The driver board parameters of joint 1, joint 2, and joint 3 are same and the driver board parameters of joint 4, joint 5, and joint 6 are same. If the old driver board is damaged and unable to export parameters, read from other joints with the same parameters.

Method two: manually write

Refer to table below for joint parameters. Due to usage of the integration motor for Minicobo, there are two sets of parameters for the motors in the shipped robots. You can differentiate them based on the robot ID on the label. For driver board parameters where the ID is greater than MC14150799, refer to table one; for those less than or equal to MC14150799, refer to table two.

Table one:

Shared parameters of the joint 1-6	2203ABZ resolution:	3000
	2204ABZ encoder direction:	Phase A leads Phase B
	2236 Reduction ratio (numerator):	50
	2242ABS Type:	JAKA En_MABS
	2301 Homing method:	Pulse injection
	5511 Motor rotation positive direction	Clockwise
	9009 Robot serial number	Input the robot ID that can be found in the robot label
	9010 Robot series:	0x0150: MiniCobo
	Electromagnet voltage (V)	5.5
	2000 Motor brand:	2: YK
Shared parameters of the joint 1-3	2001 Motor model:	6：YK_MC60
Shared parameters of the joint 4-6	2001 Motor model:	7：YK_MC52

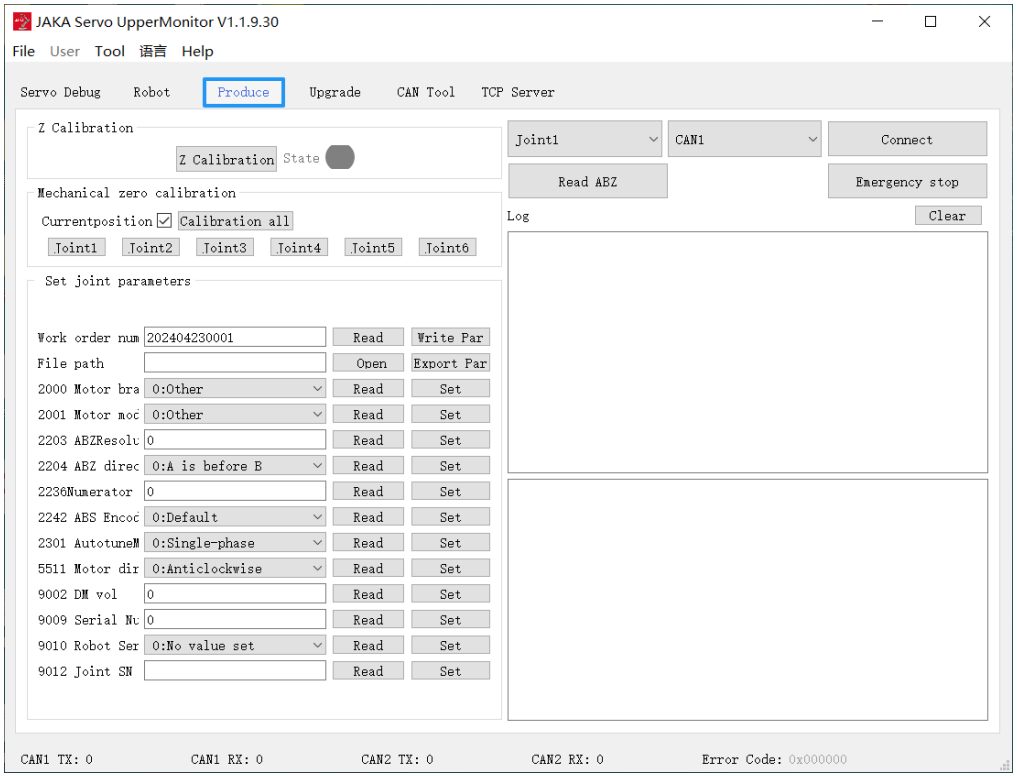
Table two:

Shared parameters of the joint 1-6	2203ABZ resolution:	3000
	2204ABZ encoder direction:	Phase A leads Phase B

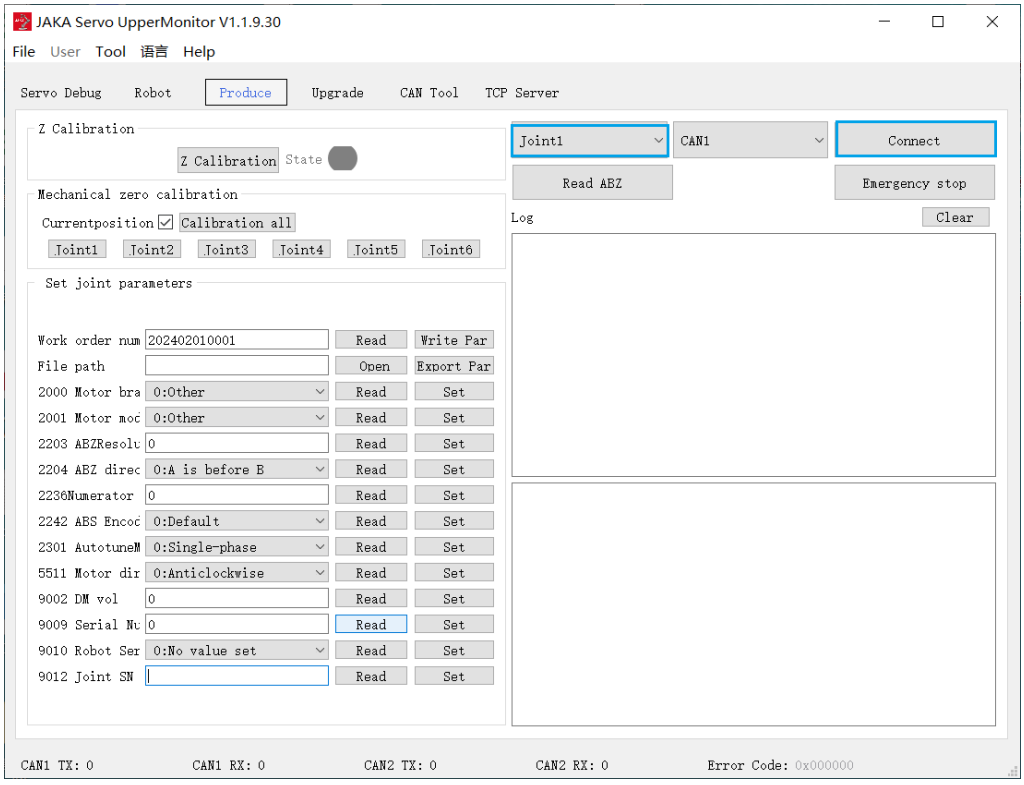
	2236 Reduction ratio (numerator):	50
	2242ABS Type:	JAKA En_MABS
	2301 Homing method:	Pulse injection
	5511 Motor rotation positive direction	Clockwise
	9009 Robot serial number	Input the robot ID that can be found in the robot label
	9010 Robot series:	0x0150: MiniCobo
	Electromagnet voltage (V)	5.5
Shared parameters of the joint 1-3	2000 Motor brand:	2
	2001 Motor model:	1
Shared parameters of the joint 4-6	2000 Motor brand:	3
	2001 Motor model:	1

Steps:

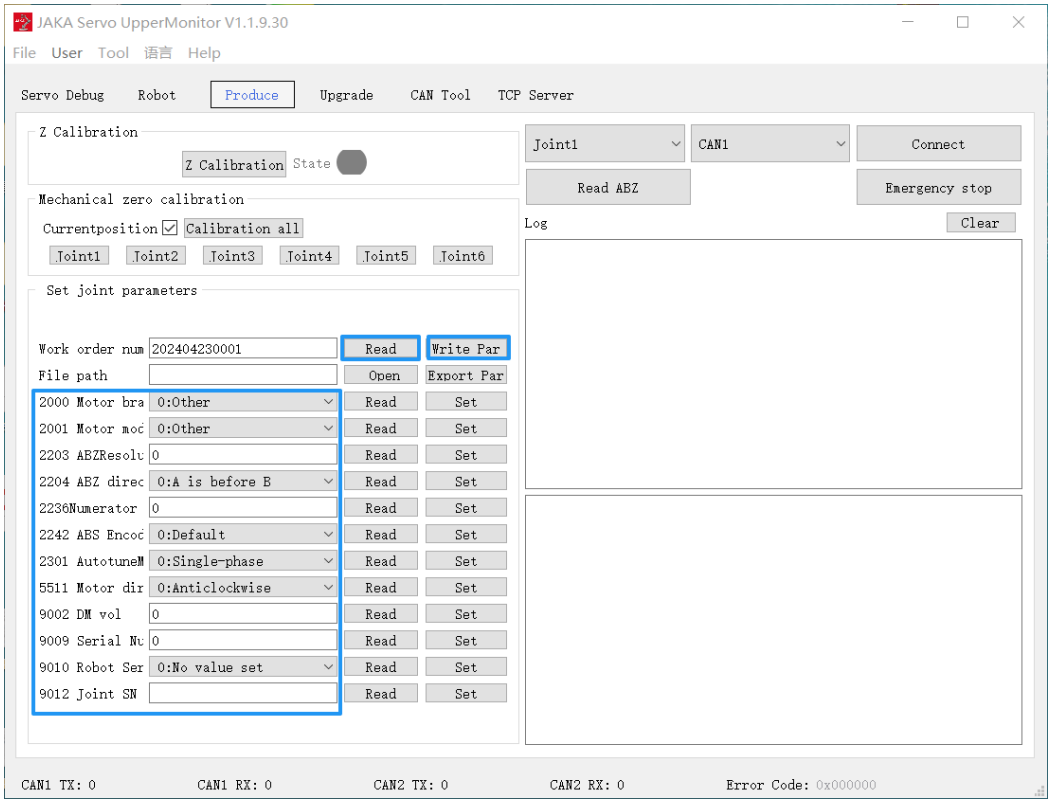
1. Refer to 3.1 CAN Wire Connection, connect the CAN analyzer to the robot CAN bus.
2. Open JAKA Servo Upper Monitor, and go to 【Produce】 interface.



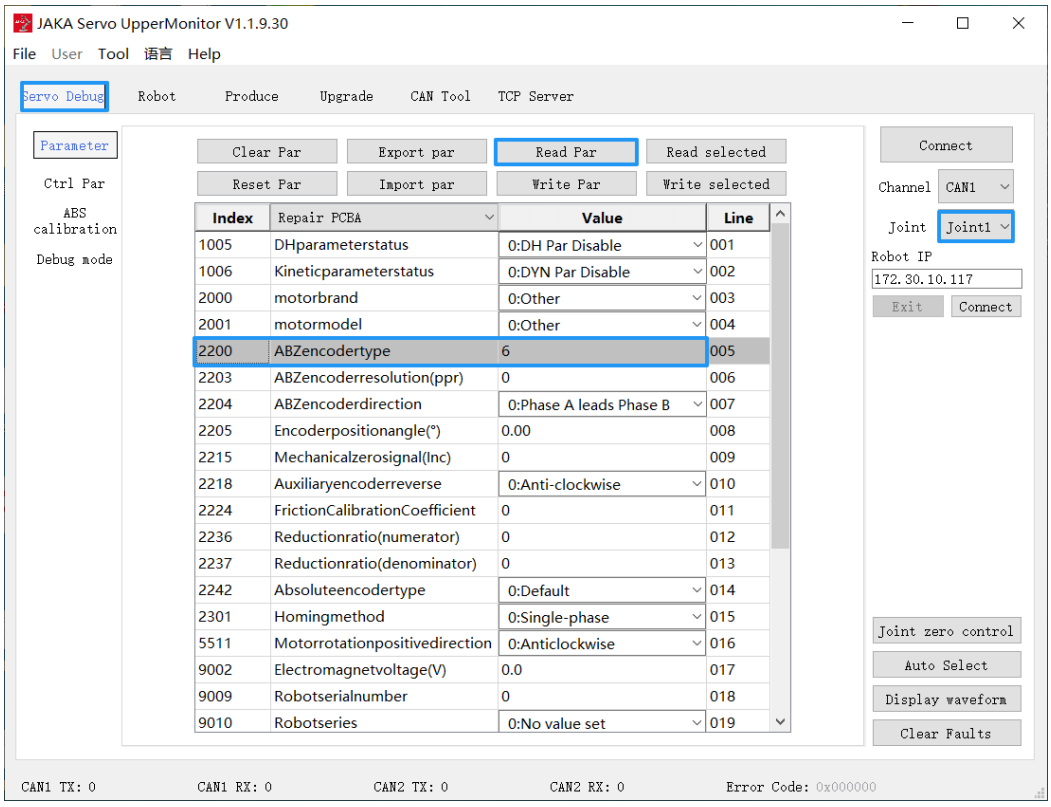
3. Power on the robot, select joint and channel, and click 【Connect】.



4. Click 【Read】 to read the parameters of current joint, modify parameters according to the parameter table, input the actual robot ID in “9009 Serial Number”, and click 【Write Par】.



5. After writing parameters in the 【Produce】 interface, go to 【Servo Debug】 interface, select joint, click 【Read Par】, check if the parameters of "00ABZ encoder type" is 6 after reading, if not, it should be modified to 6.



6. Power off the robot and re-power on the robot, and all steps for writing parameters of the driver board have been completed.

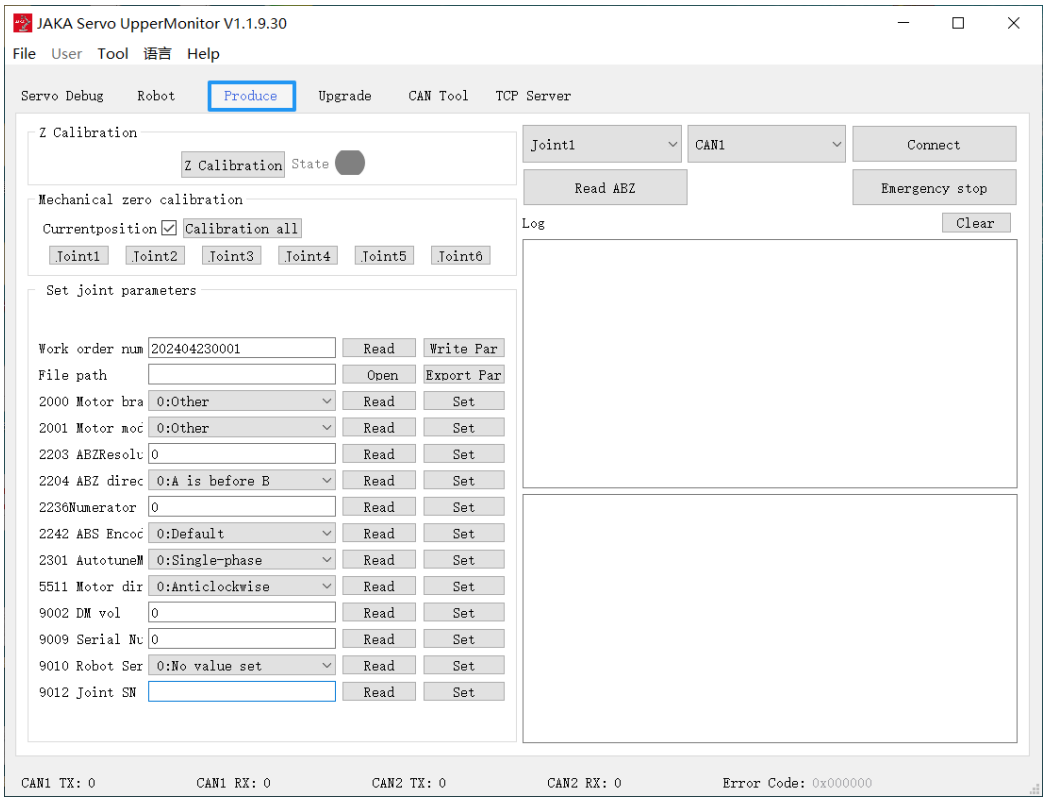
3.4 Z Calibration

You need to calibrate Z after replacing the driver board. Move the robot in the orientation that the angle of each joint is 0° to reduce the payload of each joint to minimum.

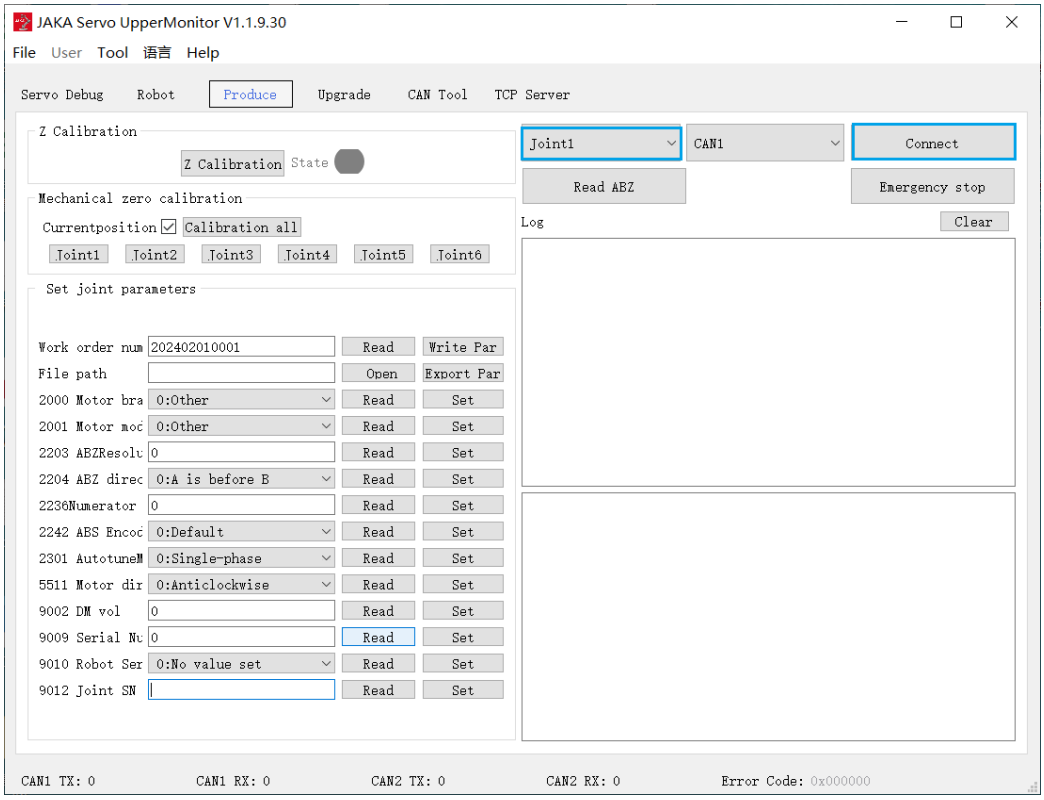
Steps:

1. Refer to 3.1 CAN Wire Connection, connect the CAN analyzer to the robot CAN bus.

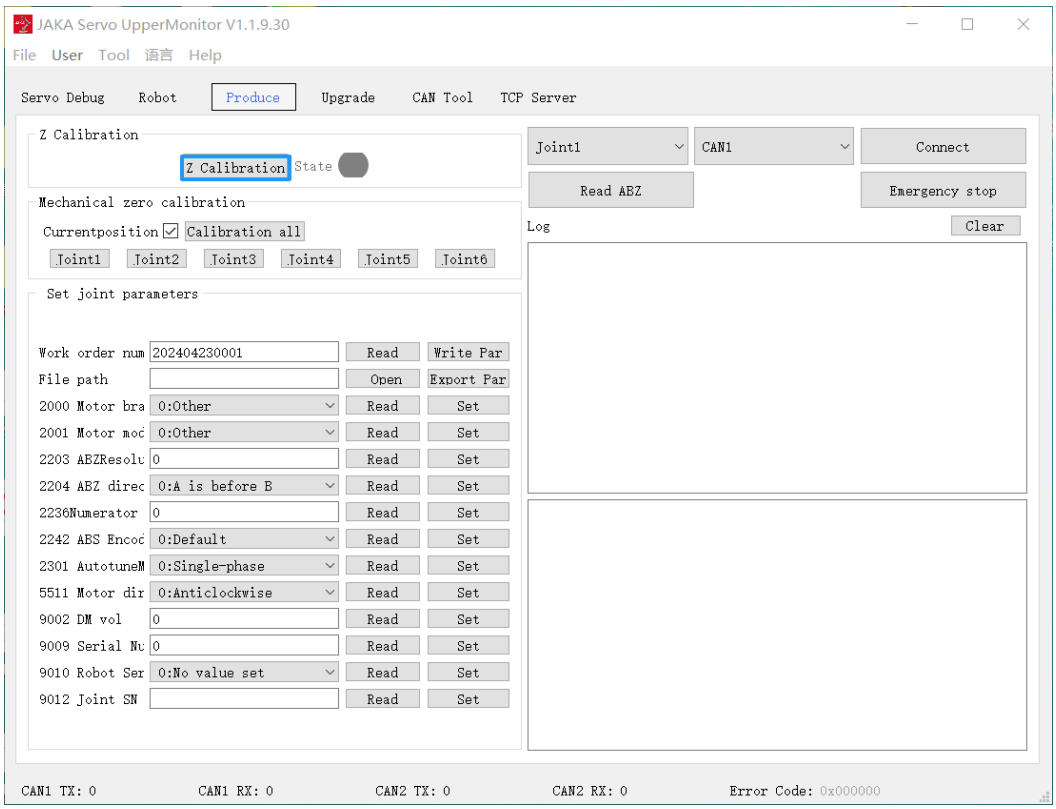
2. Open JAKA Servo Upper Monitor, and go to 【Produce】 interface.



3. Power on the robot, select the joint, and click 【Connect】.



4. Click 【Z Calibration】, if the JAKA Zu App pops up " Calibrate successfully", the Z calibration is finished. If you want to terminate the calibration process, please click the 【Emergency stop】 button to end the calibration.



4. Calibration

(1) When is manual calibration necessary?

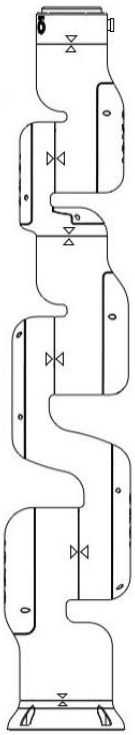
When the components of the robot such as motor module, robot shell are replaced, the joint zero position will lose, and the zero calibration is necessary. When calibrating the zero position, the order of performing multi-turn value calibration before joint calibration needs to be followed.

(2) How to know which joint should be calibrated?

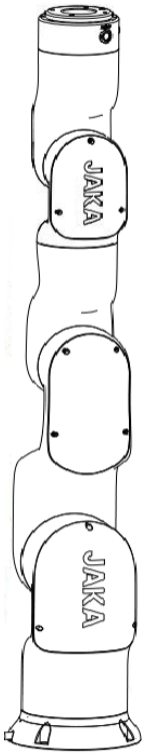
Modify angles of all joints to 0° in the manual operation interface of the JAKA Zu App and observe if the zero position tags on each joint are aligned, if not, the zero calibration should be performed.

4.1 MiniCobo Joint Calibration Orientation

The calibration orientation is as picture below. In this orientation, angles of all joints are 0°, and the robotic arm is in vertical position. In normal circumstances, when the joint returns to the zero position, you can refer to the zero position tags on each joint to judge whether the robot is in the zero position. But sometimes, it may wear out, get lost, or when replacing a new shell, flange, or base, the new ones may not have zero position tag. In such cases, you need to visually refer to the standard zero position in the picture below for a rough calibration of the joint zero position. You can adjust the angles of each joint by referencing the gaps in the robot connection cable at the robot base and the relative positions of each lid when the robot is in the standard zero position. For example, the base lid, big arm upper lid, and small arm upper lid are on the same side. The big arm lower lid, elbow lid, and wrist lid are on the same side.



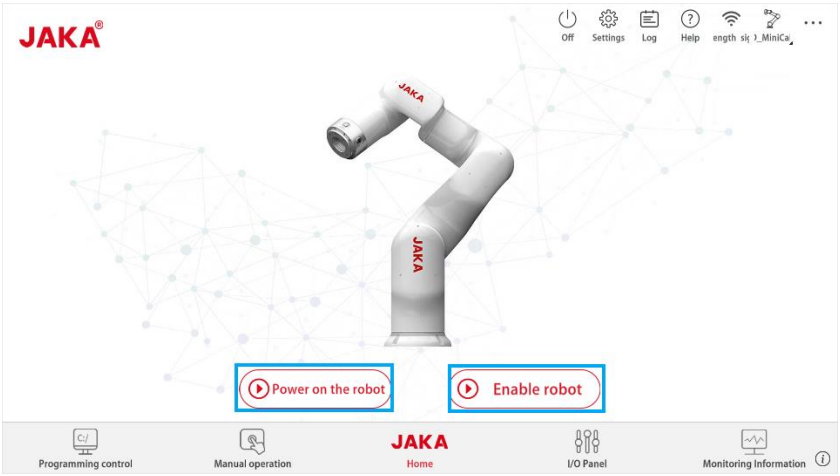
Main view



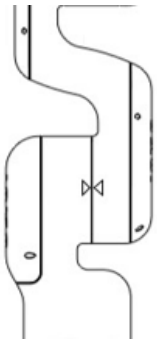
Side view

4.2 Joint Multi-Turn Value Calibration

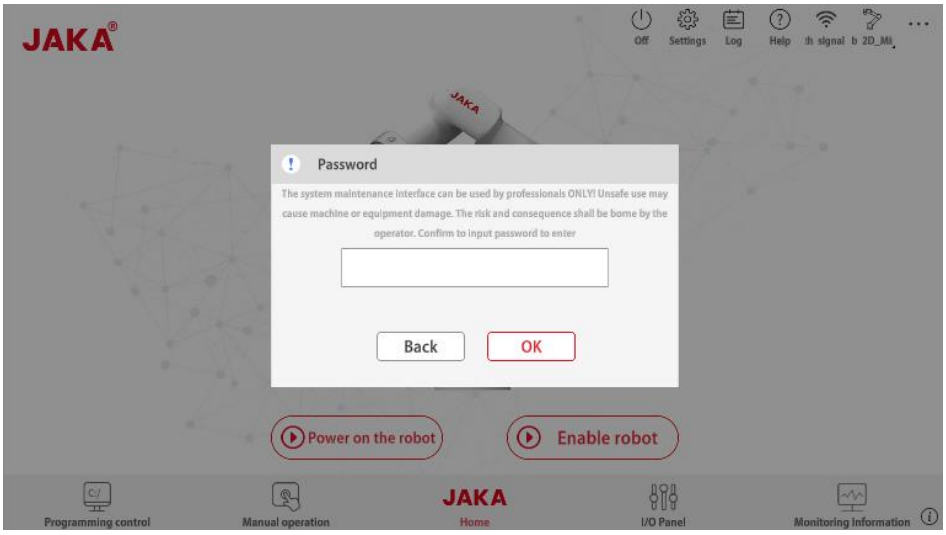
1. Power up the control cabinet, open the JAKA Zu App, connect the robot, power on the robot, and enable the robot.



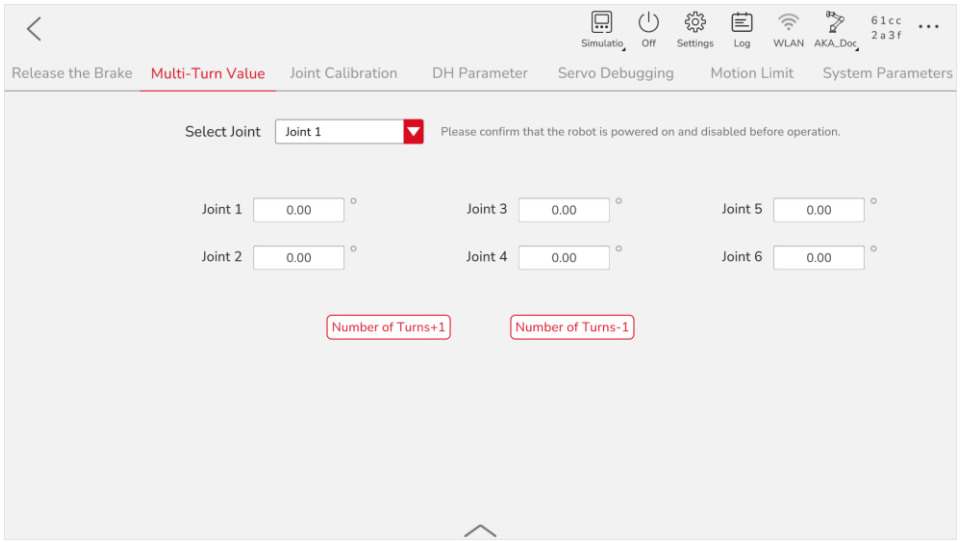
2. Control the robot to move in the 【Manual Operation】 interface until the zero position tags on the joint that need to be calibrated are aligned. Disable the robot.



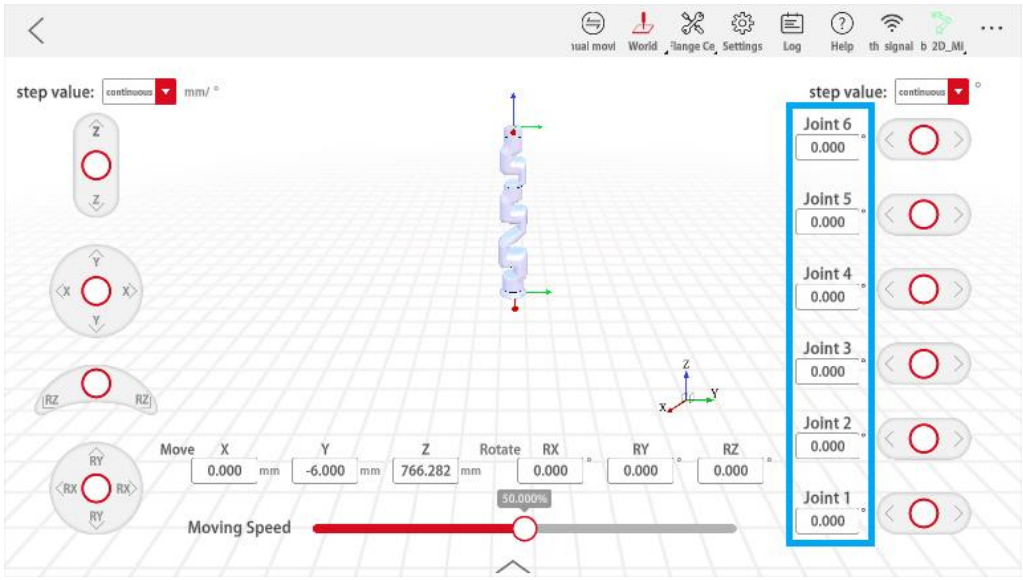
3. Continuously click the JAKA logo at the top left corner of the 【Homepage】, and enter the password "JAKAAMAZING" to go to the system maintenance interface.



4. Enter 【Multi-Turn Value】 interface, select the joint losing zero position, and add or reduce multi-turn value by the button of “Number of Turns+1” and “Number of Turns-1” to make its value stay within the range of ±7.2°.



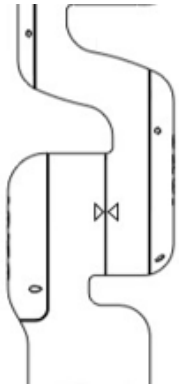
5. Return to the 【Homepage】, and enable the robot. Go to 【Manual Operation】 interface, modify the angle of the joint losing zero position to 0°. If the zero position tags of this joint are aligned, the zero calibration is successful. If there is still a deviation, please perform the steps of “Joint zero calibration” as below.



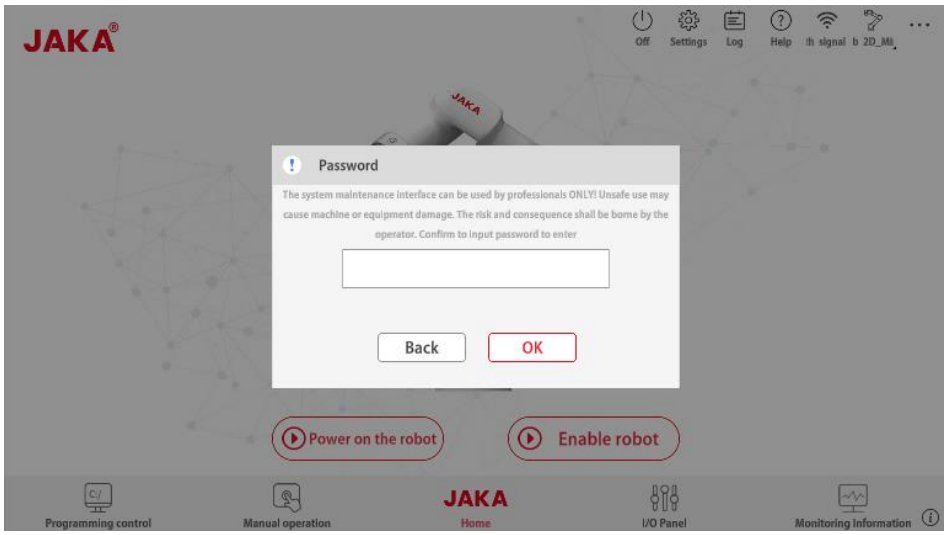
4.3 Joint Zero Calibration

1. Power up the control cabinet, open the JAKA Zu App, connect the robot, power on the robot, and enable the robot.

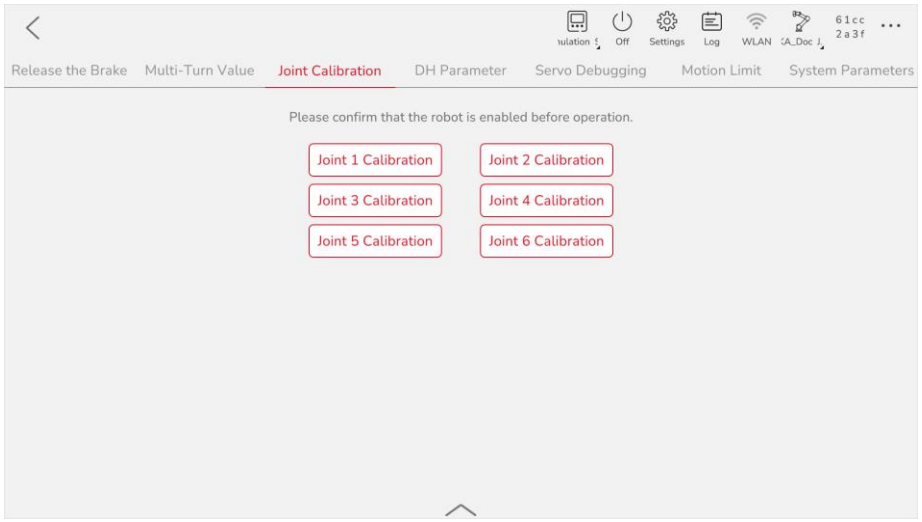
2. Control the robot to move in the 【Manual Operation】 interface until the zero position tags on the joint that need to be calibrated are aligned.



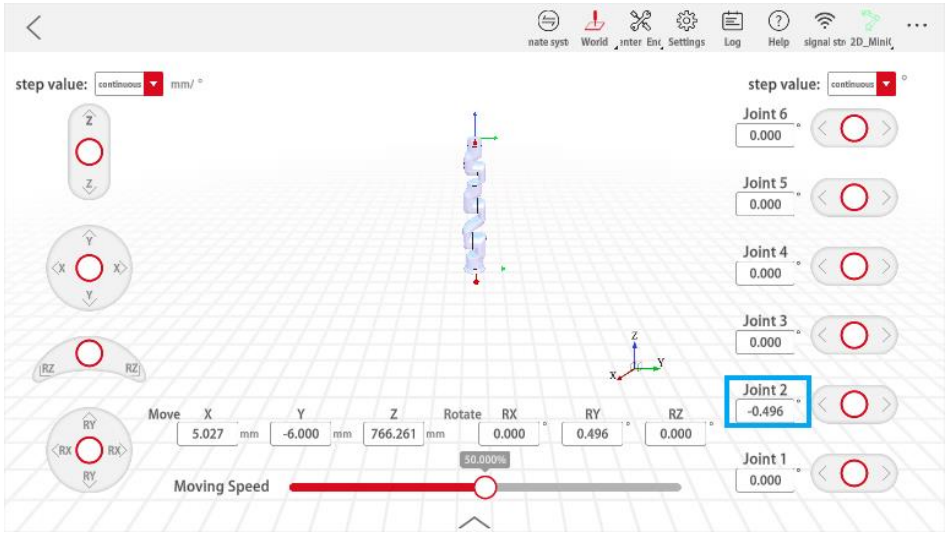
3. Continuously click the JAKA logo at the top left corner of the 【Homepage】, and enter the password “JAKAAMAZING” to go to the system maintenance interface.



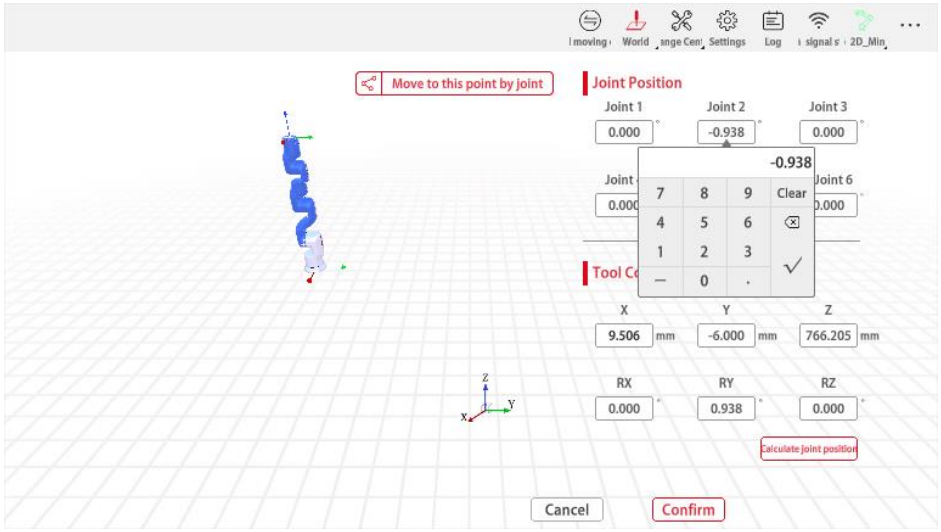
4. Enter 【Joint Calibration】 interface, click the calibration button of the joint losing zero position to calibrate.



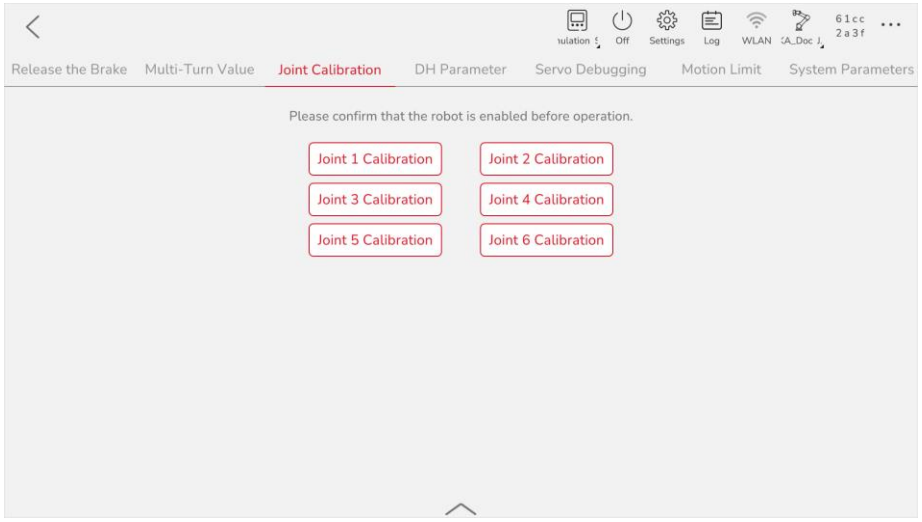
5. Go to 【Manual Operation】 interface and check the calibrated joint angle. If the angle is 0°, the calibration has been finished; if not, continue to calibrate by following steps below.



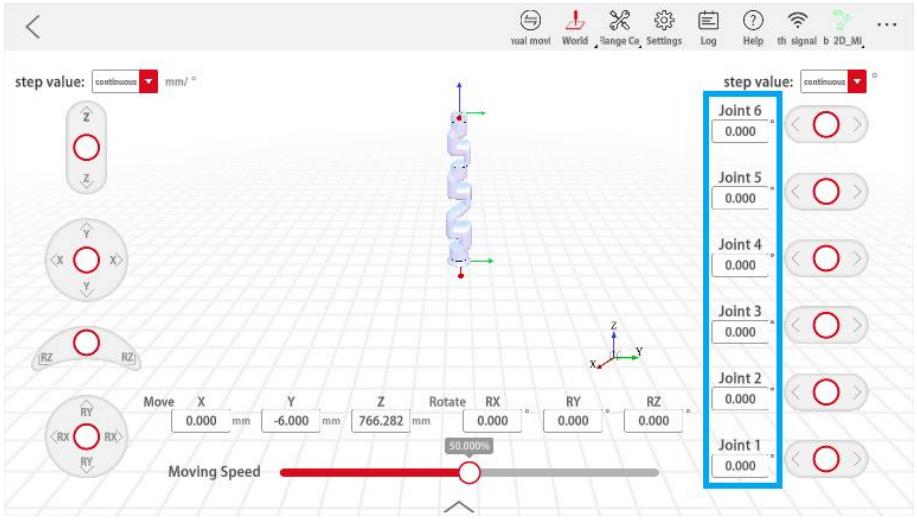
6. Click the text box of the calibrated joint to enter manually input joint angle interface, and input the twice of the displaced value of the calibrated joint. For example, if the displayed value is –0.469°, input –0.938°. Click “Move to the Point by MoveJ”.



7. Enter 【Joint Calibration】 interface, click the calibration button of the joint losing zero position to calibrate.



8. Go to 【Manual Operation】 interface, modify the angles of all joints to 0°. If the zero position tags of this joint are aligned, the zero calibration is successful. If there is still a deviation, please repeat the above operation to calibrate again.


World
Settings
Log
Help
step value:
continuous
mm/ °
step value:
continuous
Joint 6
0.000
Joint 5
0.000
Joint 4
0.000
Joint 3
0.000
Joint 2
0.000
Joint 1
0.000
Move
X
Y
Z
Rotate
RX
RY
RZ
0.000 mm
-6.000 mm
766.282 mm
0.000 °
0.000 °
0.000 °
50.000%
Moving Speed

5. Spare Part Lists

5.1 Spare Parts

No.	Name	Description
0301.01	Joint 1&2	Joint module + screws
0301.02	Joint 3	
0301.03	Joint 4&5&6	
0301.04	Flange	Flange & screws & zero position tag
0301.05	Base & lamp ring structure	Base & screws & zero position tag
0301.06	Base shell	Base shell & screws & zero position tag
0301.07	Small arm shell	Small arm shell & screws & zero position tag
0301.08	Big arm shell	Big arm shell & screws & zero position tag
0301.09	Wrist shell	Wrist shell & screws & zero position tag
0301.10	Elbow shell	Elbow shell & screws & zero position tag

5.2 General Spare Parts

5.2.1 Robot General Spare Parts

No.	Name	Description
GS01.01	Joint lid set	J1-J6 joint lids
GS01.02	Joint brake set	Electromagnet set
GS01.03	Wire set in the robot	CAN wires & power wires
GS01.04	Motor driver board	Driver board
GS01.05	TIO_driver board	Driver board

No.	Name	Description
GS01.06	Lamp ring structure driver board	Driver board
GS01.07	Robot connection cable	Robot connection cable

5.2.2 Control Cabinet General Spare Parts

No.	Name	Description
GSCB.32	Antenna	--
GSCB.33	Control cabinet terminal kit	Power input + emergency stop + user I/O
GSCB.34	Control stick	-
GSCB.53	Button cell	-
GSCB.54	Control cabinet jumpers of terminals	-
GS01.08	24V Power adapter	-
GSCB.06	Power cord (Chinese)	-
GSCB.07	Power cord (European)	
GSCB.08	Power cord (American)	
GSCB.09	Power cord (British)	
GSCB.10	Power cord (Japanese)	

6. Packaging and Shipping

Before packaging and shipping any robots or spare parts back to JAKA, please note the following:

Notice:

1. Remove external tools and electrical connections before shipment. JAKA may reject the shipment if the third-party product cannot be safely removed, or the required post-repair test is prohibited. JAKA assumes no responsibility for the return and exchange of third-party goods.

2. Before delivery, please confirm that robots, control cabinets, spare parts and other items have been packed according to the standard. Please return the product in its original packaging.

3. Software and firmware may be upgraded during maintenance. Therefore, after maintenance or replacement the robot, control cabinet or other parts, it is necessary to check the software version and upgrade it as needed.

4. Robots, control cabinets and components must be cleaned before shipment if they have been exposed to hazardous chemicals or materials or operated in an environment with hazardous chemicals or materials. If the robot, control cabinet, parts are found to be unable to be safely repaired, JAKA reserves the right to clean the robot, control cabinet and parts, or rejects them and sends them back at the customer's expense.

Packaging steps:

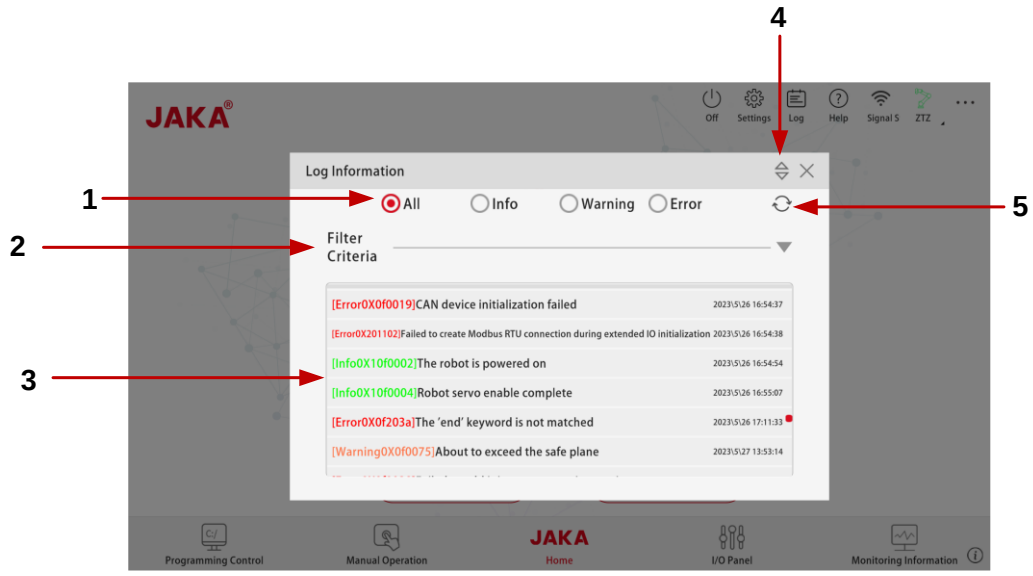
1. Adjust the robot to the packing posture:
Open the JAKA Zu App, connect the robot, click 【Settings】→【Safety Settings】→【Robot Pose】to enter robot pose setup interface, hold and press the “Move to target point” in the line of “Factory Pose”;

2. Disable and power off the robot, disconnect the power supply of the control cabinet and remove all connections;

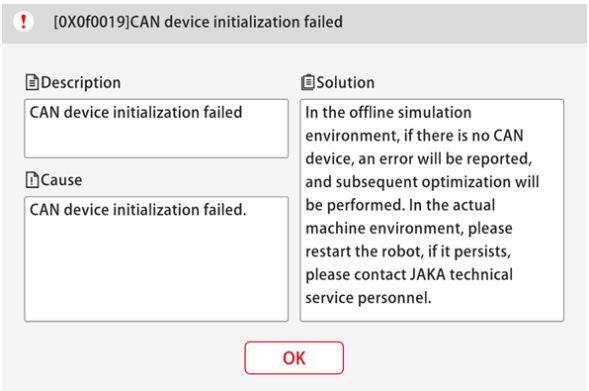
3. Put the robot and control cabinet into the original packing box to ensure that they are placed in the correct position.

7. Troubleshooting

Troubleshooting information can be seen in the log interface of JAKA Zu APP.



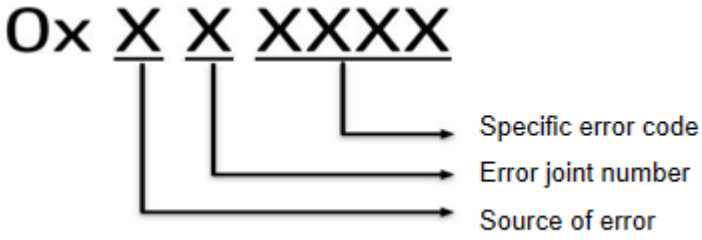
1. Select the log type (Information-green, Warning-orange, Error-red);
2. Find the specific faults by set the time and keyword;
3. Log display area: See the details by clicking the name of log;



4. Zoom in or zoom out the log information window;
5. Update the log information.

The error code can also be found in the JAKA document website, refer to [Event code and meaning | Docs (jaka.com)](#).

The meaning of the error code is as follow:



Source of Error:	**Error Joint Number:**
0: Controller	0-5: From joint 1 to joint 6
1: Servo	F: APP
F: APP	

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