ShenZhen Troy Intelligent Trading LTD.

MOD (Moying Omni-directional Dual-arm Collaborative Robot)

Two-arm omnidirectional mobile collaborative robot

User Manual V1.0

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一、Introduction

1.1 Target

This document is aimed at users of the MOD dual-arm omnidirectional mobile collaborative robot. It is intended to help users become familiar with this product and be able to use/maintain this product under the guidance of the manual.

1.2 Icon Description

Safety tips that must be followed!



The alert indicates that death or serious bodily harm is likely to result if precautions are not taken.



The alert indicates that death or serious bodily harm is likely to result if precautions are not taken.



This tip indicates that minor bodily injury may result if precautions are not taken.



This tip indicates that property damage may result if precautions are not taken.



This notice contains instructions for safety-related information or general safety measures and does not address individual hazards or individual precautions.

Tips: These tips make work easier or provide instructions for further information.



Tips used to facilitate work or provide supplemental information.

1.3 Concept list

Concept	Descriptions
MOD	Two-arm omnidirectional mobile collaborative robot
MON	Omnidirectional AGV
MRCS	Robots Control System
BMS	battery management system
MPC	Control system PC
PLC	programmable logic controller
SSD	Solid State Drive (electronic storage medium)
TCP	Tool Center Point

1.4 Document History

Versions	Issue Date	Descriptions	Hardware Version
1.0	2020/10/28	First edition	1.0

二、Product Description

2.1 Introductions



Picture 2 - 1: MOD dual-arm omnidirectional mobile collaborative robot

Composition:

1. Transport vehicles (MON omnidirectional AGV and middle frame)
2. Six-axis collaborative robotic arm
3. Robot head

Instruction:

The MOD dual-arm omnidirectional mobile collaborative robot (hereinafter referred to as: MOD) consists of a transport vehicle (MON omnidirectional AGV and middle frame) and a six-axis cooperative robotic arm (hereinafter referred to as: six-axis robotic arm) with a load of 3kg/5kg.

MOD can complete the tasks of multiple stations in the production line at the same time. It adopts the Mecanum wheel drive mode to realize omnidirectional movement, and can operate flexibly in a narrow space, effectively improving the site utilization rate and production efficiency. With a wealth of end fixtures and visual equipment, functions such as grasping, assembly, sorting, loading and unloading, moving, handling, and visual inspection can be realized, and are more accurate, stable and efficient. The dual-arm bionic design is closer to the human operation mode, and is suitable for a variety of typical workstations that require both hands to work at the same time.

The MOD can move in all directions through the transport vehicle and can achieve ±1mm ultra-high precision navigation and positioning. The transport vehicle can move autonomously with the help of software (MRCS: Moying Robots Control System) and can be completed by the remote control handle. (Please refer to Chapter 2.5 for details of the remote control handle)

The vehicle is designed to operate on a level, fixed surface that does not exceed an allowable slope.

MOD main features:

Typical operating time: 8h

Transport vehicle load capacity: 300kg/600kg

Six-axis robotic arm load capacity: 3kg/5kg

2.2 Transport vehicle

The transport vehicle uses a cast aluminum frame as the main body, with the following components:

- Drive assembly (Mecanum wheel)
- Automatic lifting and lowering charging pile components
- Power battery unit (drawer installation)
- Control unit
- Safety devices and communication units
- Lidar unit
- LED light strip unit
- Audio prompt unit
- Control panel components

Specific Identification:



Picture 2 - 2: Transport Vehicle - Front Side

1. Robot emergency stop button
2. Depth Camera Realsense
3. Lidar
4. Anti-collision strip
5. Mecanum Wheel



Picture 2 - 3: Transport vehicle - rear side

1. Robot emergency stop button

2. Depth Camera Realsense

3. Control panel components (from left to right: HDMI port, manual charging port, power off button, power on button, USB port, USB port)

4. Anti-collision strip

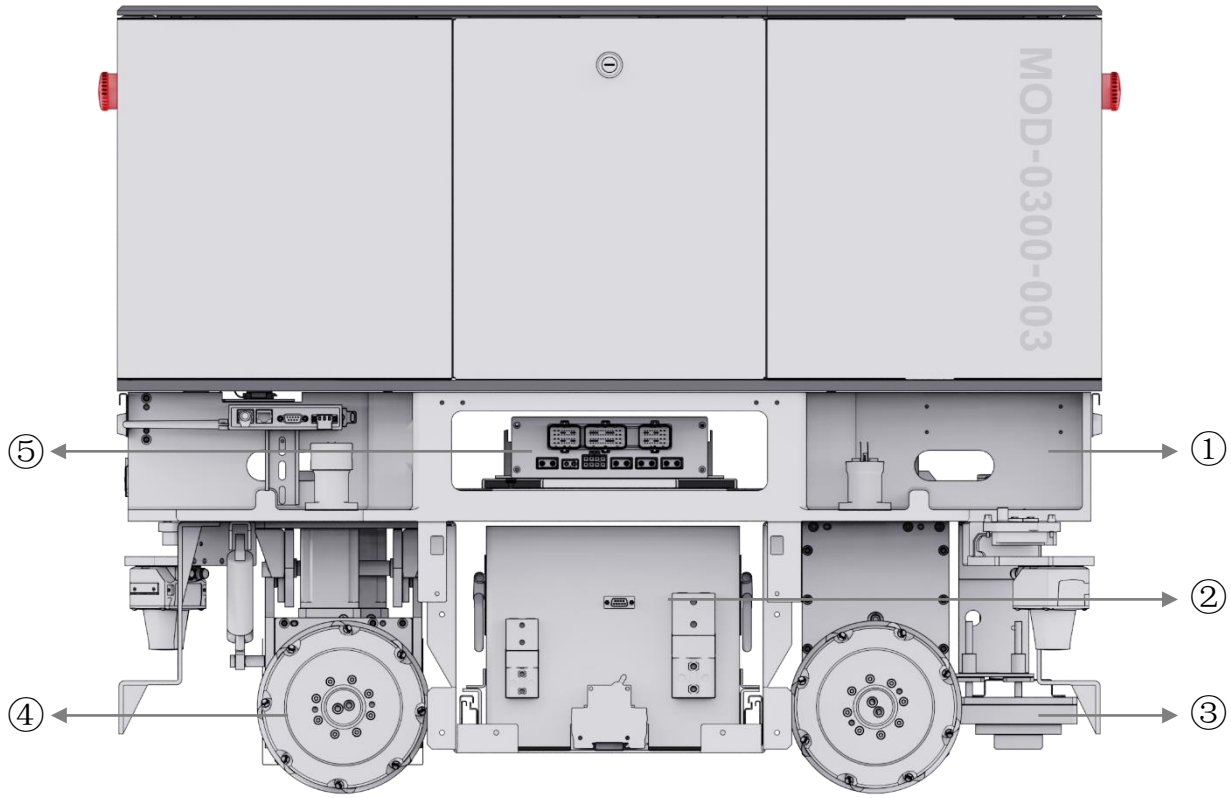
5. Mecanum Wheel

6. Lidar



Picture 2 - 4: Transport Vehicle - Left

1. Robot emergency stop button
2. Emergency stop button for transport vehicle
3. Lidar
4. Anti-collision strip
5. Mecanum Wheel
6. Side Door



Picture 2 - 5: Transport vehicle - right side, remove MON lower side panel

1. Cast aluminum frame

2. Power battery (drawer installation)

3. Automatic lifting and lowering charging pile components

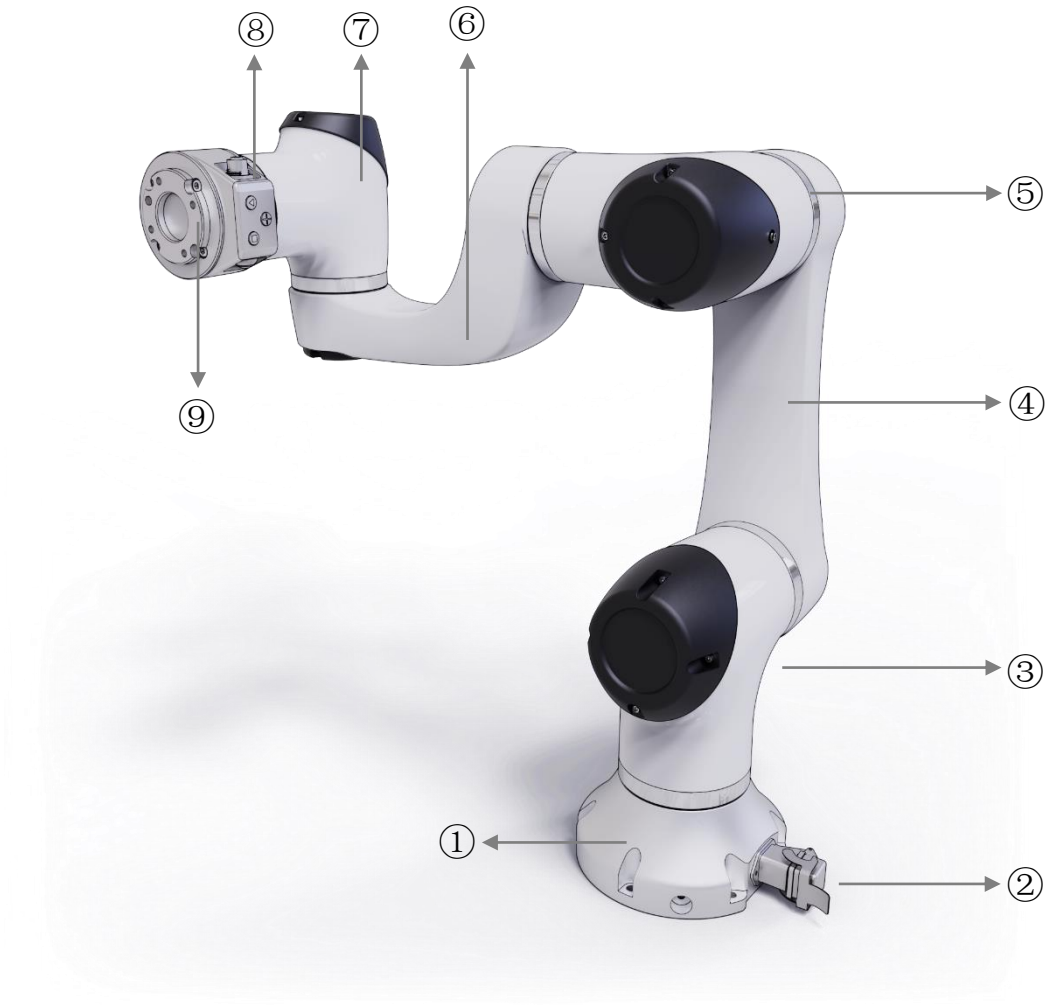
4. Drive assembly (Mecanum wheel)

5. Control unit

2.3 Six-axis collaborative robotic arm

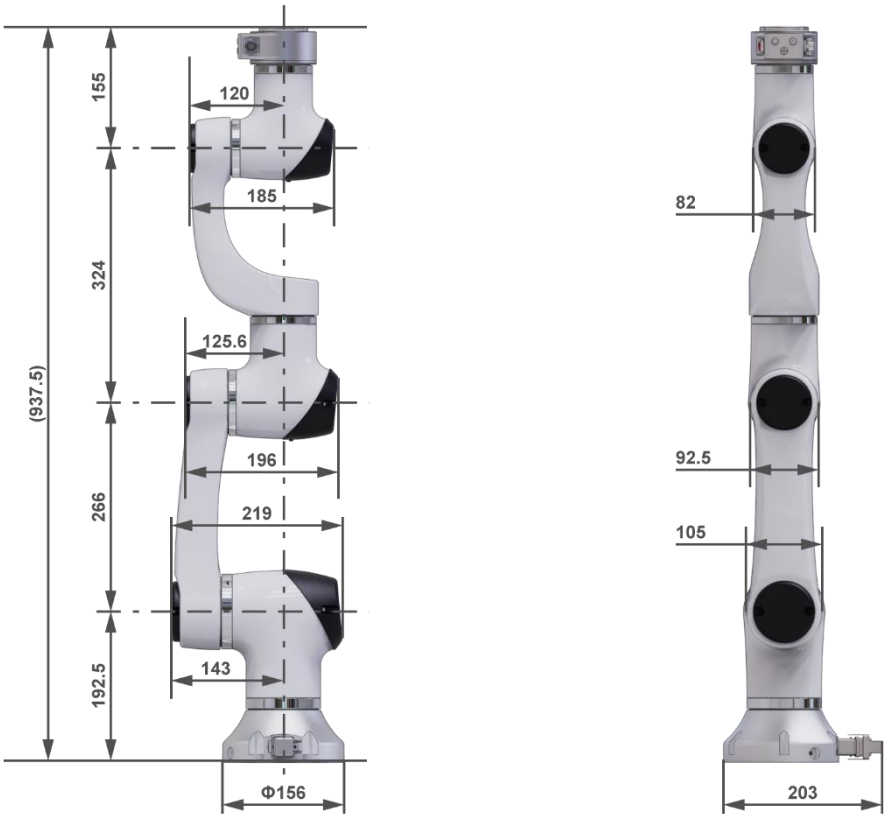
The collaborative robot arm matched with the MOD is the Elfin03/Elfin05 robot arm.

2.3.1 Elfin The name of each part of the robot arm

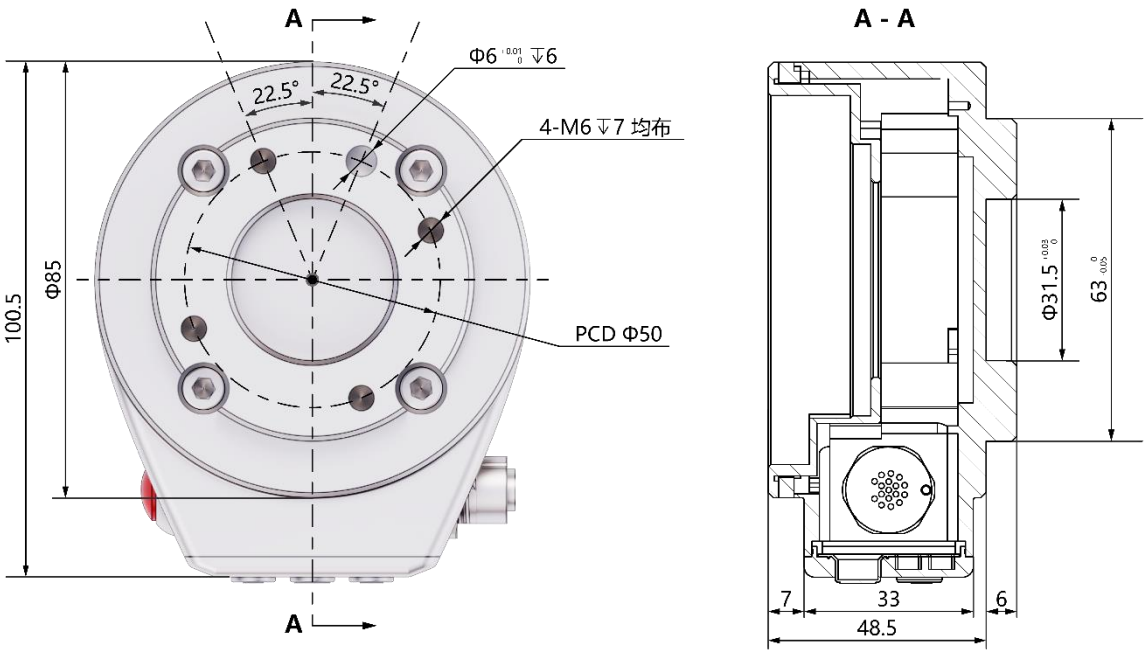


Picture 2 - 6: Elfin Robot arm

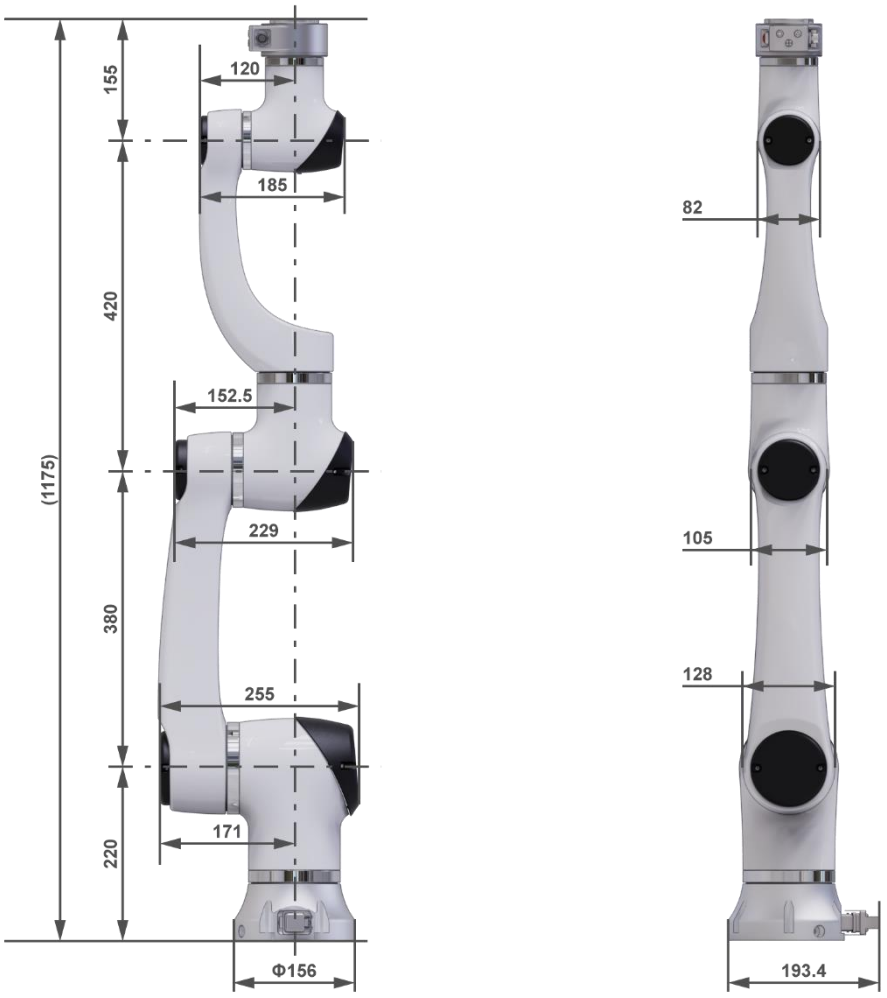
1. Pedestal
2. Communication and power cables
3. J1-J2 module
4. Lower arm
5. J3-J4 module
6. Upper Arm
7. J5-J6 module
8. Tool IO
9. Tool flange



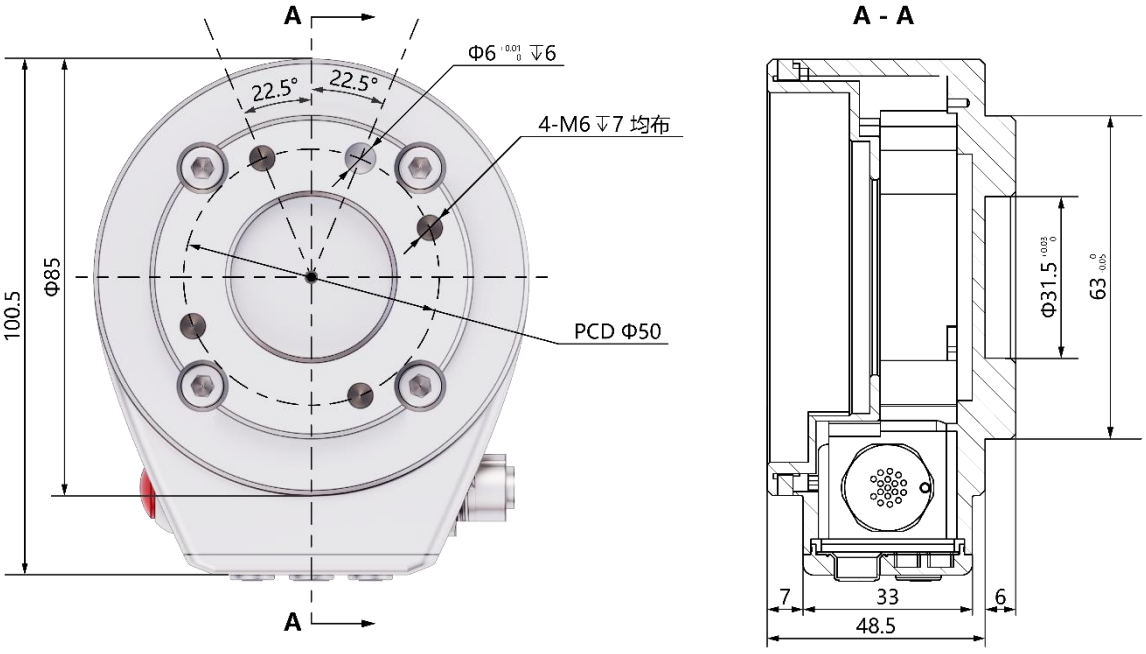
Picture 2 - 7：Elfin03 Dimensions



Picture 2 - 8：Elfin03 ending flange



Picture 2 - 9: Elfin05 Dimensions

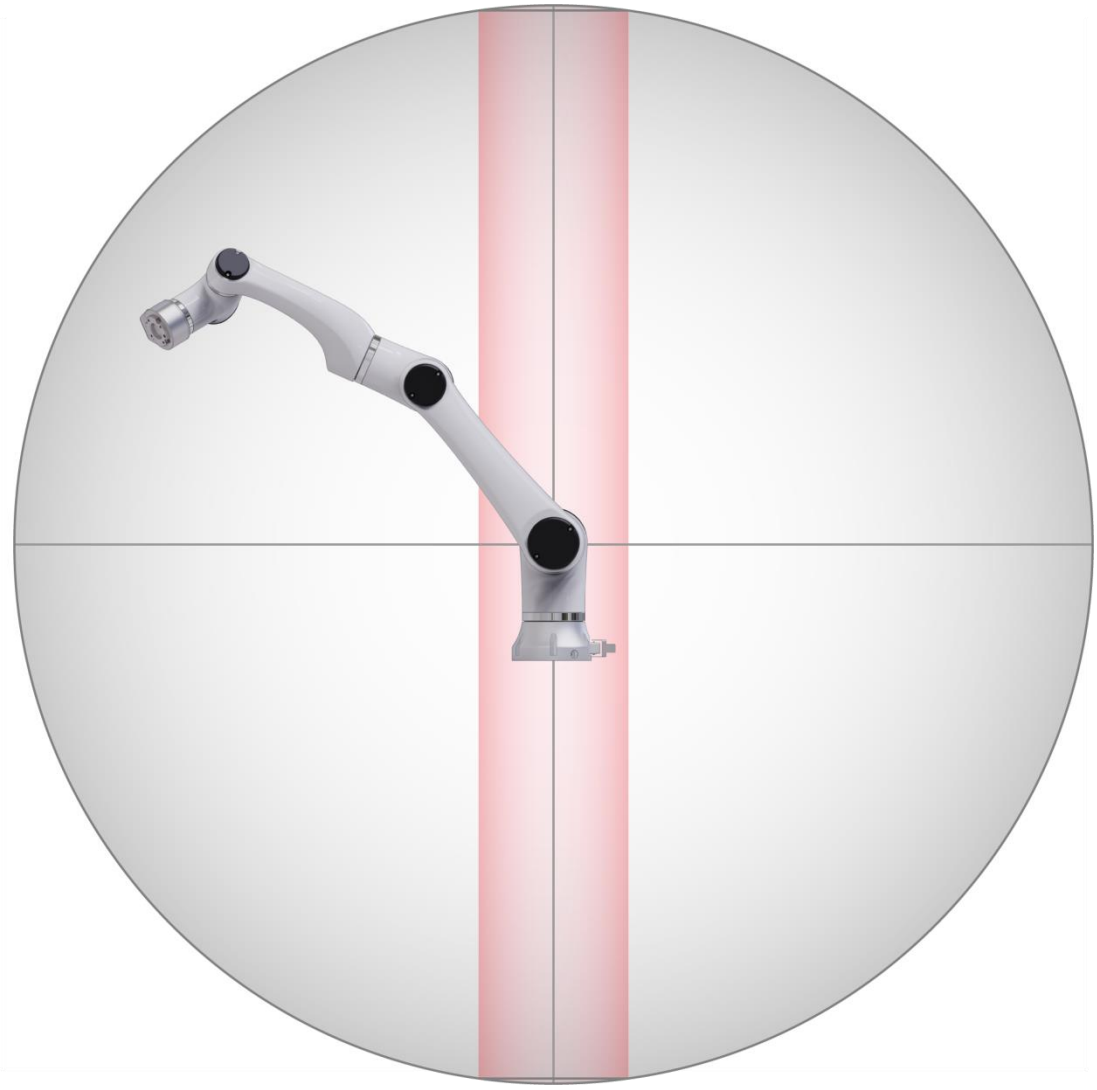


Picture 2 - 10: Elfin05 ending flange

2.3.2 Robot arm working area

The workspace of the robotic arm refers to the area within the specified range of the base joint (as shown in the figure below). Avoid moving the tool into the cylindrical space as much as possible, because this will cause the joint to move too fast when the tool is moving slowly, resulting in inefficiency of the robotic arm and difficult risk assessment.

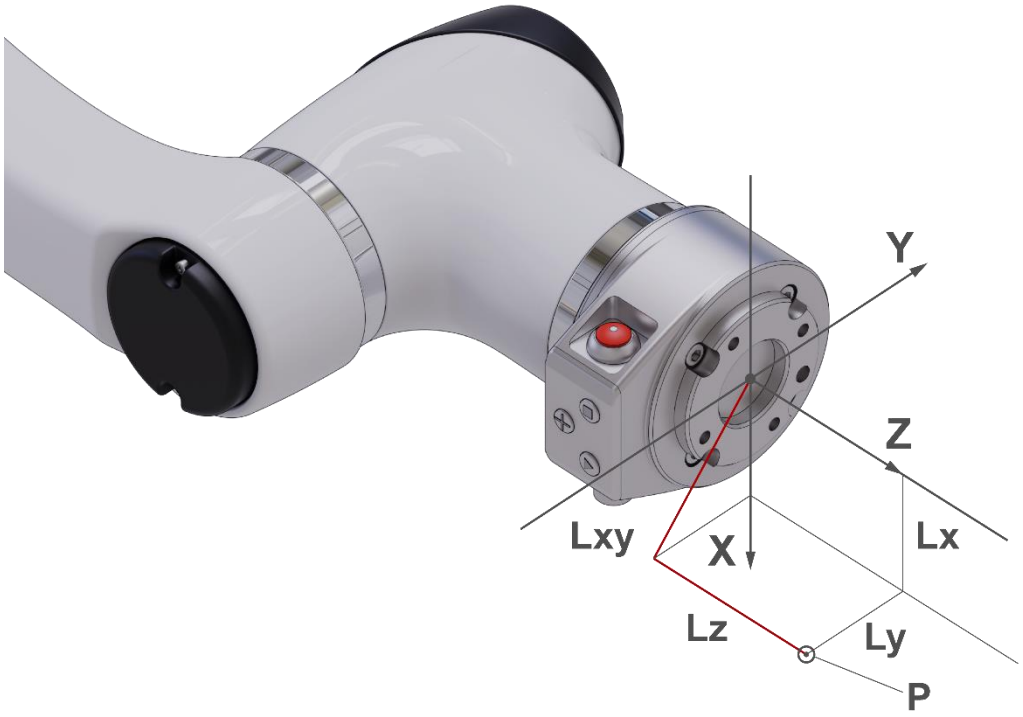
Model	Elfin03	Elfin05
Working radius (mm)	590	800



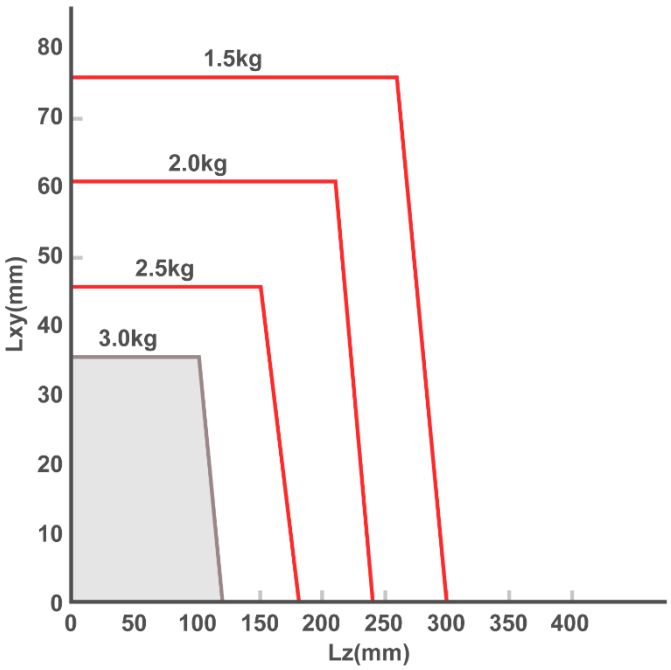
Picture 2 - 11: Elfin Working radius

2.3.3 Tool maximum payload range

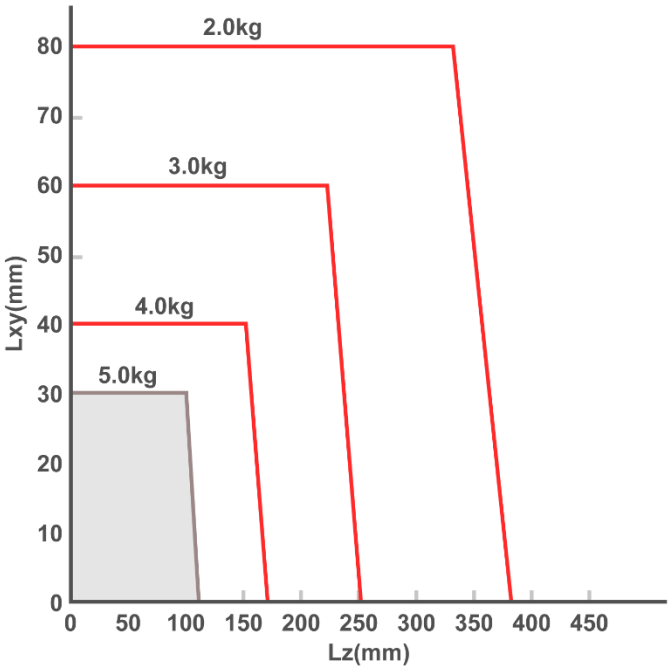
The distance between the center of gravity of the end load of the robot arm and the center of the mounting flange is different, and the maximum load allowed by the robot arm will also change accordingly. The relationship between the center of gravity distance and the maximum allowable load is as follows:



Picture 2 - 12: Elfin coordinate



Picture 2 - 13: Elfin03 The relationship between the maximum load and the distance from the center of gravity



Picture 2 - 14: Elfin05 The relationship between the maximum load and the distance from the center of gravity

2.3.4 End-of-arm tool

According to different task scenarios, different end clamps can be equipped:

- Welding gun
- Grinding components
- Biological experiment pipette components
- End suction cup tool
- Two-fingered claw
- …

2.4 Robot head

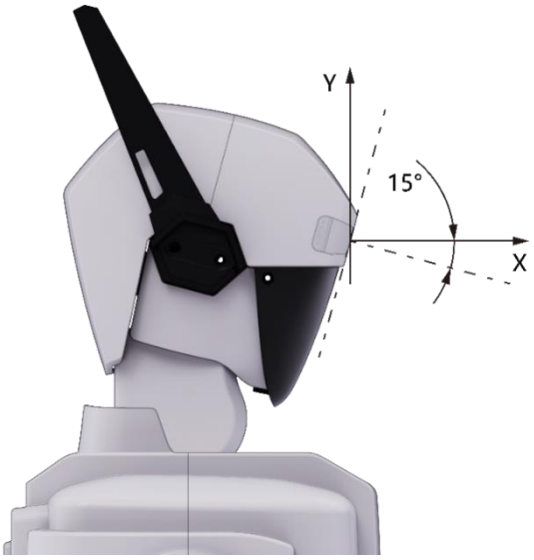
The dual-arm robot head has 2 degrees of freedom, which increases the visual range of the camera.

> 注意
>
> It is forbidden to twist and rotate the robot head manually, which may cause the zero point of the encoder of the robot head to be lost.

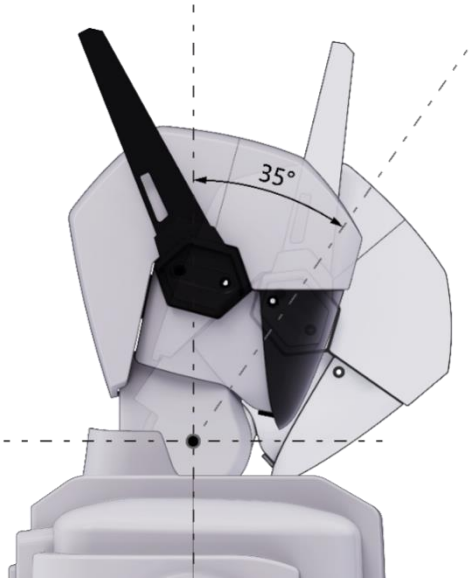
The main features of the robot head:

Horizontal rotation angle: 120°

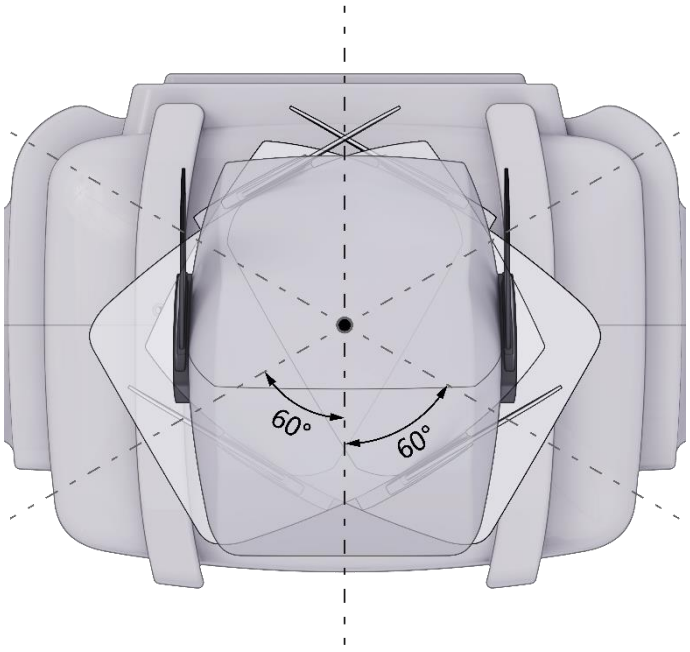
Vertical rotation angle: 35°



Picture 2 - 15: The angle between the camera and the horizontal plane by default



Picture 2 - 16: Head vertical rotation angle



Picture 2 - 17: The horizontal rotation angle of the head



Picture 2 - 18: Rotation in the horizontal direction

2.5 Robot switch:

The switch button is located on the rear panel of the robot. As shown in the figure, the green button is the power button, and the red button is the shutdown button.

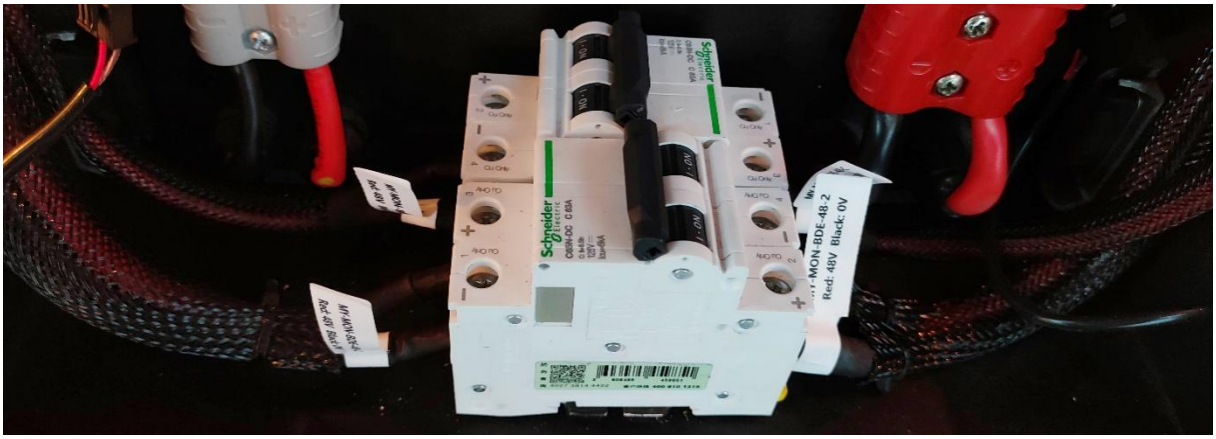


Picture 2 - 19: Robot panel

2.5.1 Boot

Press and hold the robot power button for 2s, and let go after the robot atmosphere light (the eight groups of light segments described in Chapter 6) lights up. When the ambient light is in the yellow breathing state, the machine is in the starting state; when the ambient light changes into the blue breathing state, after the robotic arm makes a sound, the robot is ready to start and can be controlled. (Please refer to Chapter 6 for specific lighting instructions)

When turning on the robot for the first time, the internal circuit breaker of the robot needs to be turned on and the battery is powered on. (Please refer to chapter 7.8 for circuit breaker location)



Picture 2 - 20: Circuit breaker location

2.5.2 Shut down

Press and hold the robot shutdown button for 2s, and let go when the robot's ambient light changes to a yellow breathing state.

注意

When the robot ambient light is not turned off, do not power off to avoid the loss of robot data.

2.6 Using the remote control handle

2.6.1 Remote control handle introduction

At present, the entire system of robots supports the use of wireless remote control handles to control the walking of robots. The handle model used is Logitech F710.

See photo:



Picture 2 - 21: Joypad

1. Direction keys
2. Left joystick
3. Right joystick
4. MODE button
5. MODE indicator
6. A key

2.6.2 How to use the remote control handle

1. Install the battery on the handle, and insert the USB wireless receiver of the handle (placed in the battery compartment behind the handle) into the USB port on the rear panel of the robot;

2. As shown in the figure below, dial the dial on the front of the handle to the X end;



Picture 2 - 22: handle dial

1. Press the MODE button to select the control mode, the handle has two control modes to choose from:

1) The MODE indicator light is on (use the direction buttons to control the movement)

Move: Hold down the A key and press any direction key at the same time, the robot will move in the direction corresponding to the key

Steering: Press and hold the A key while operating the right joystick to turn left and right

2) The MODE indicator is off (use the direction rocker to control the movement)

Move: Press and hold the A key while operating the left joystick, at this time the robot will move in the corresponding direction of the joystick

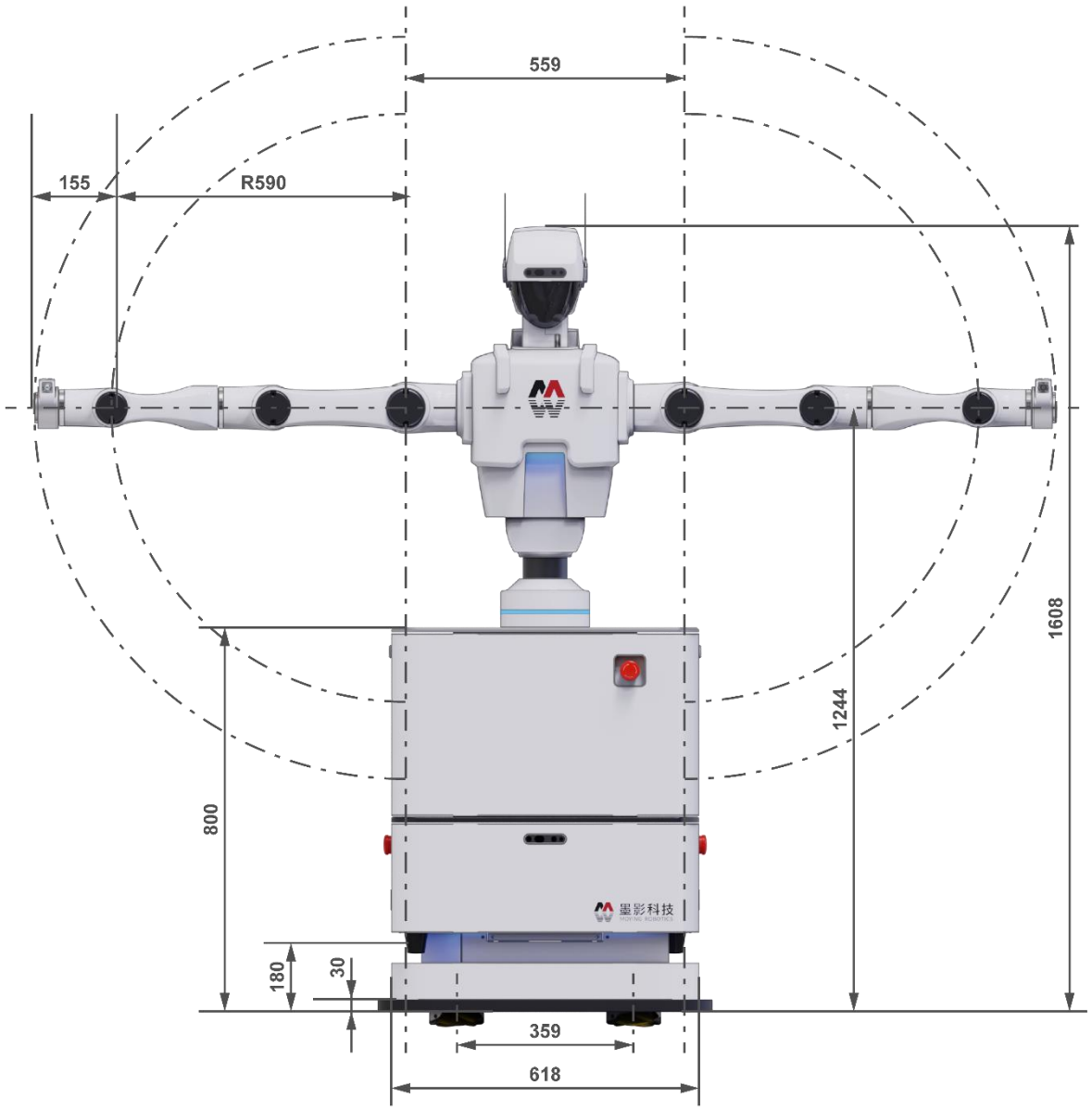
Steering: Press and hold the A key while operating the right joystick to turn left and right



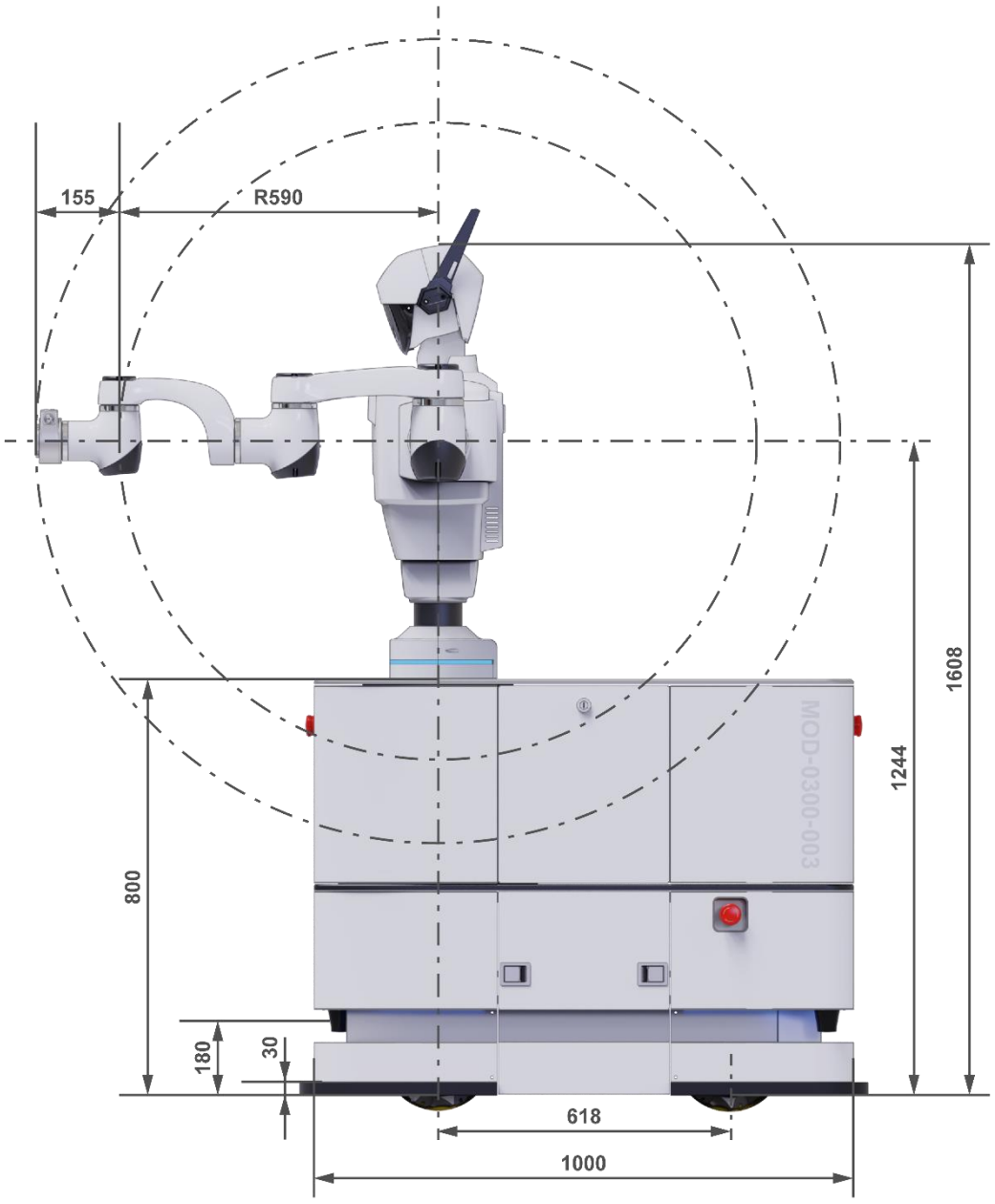
When the MODE indicator flashes, please check whether the USB wireless receiver is in good contact or whether there is a shield between it and the remote control handle.

三、Technical data

3.1 Base data



Picture 3 - 1：MOD Front（Match Elfin03）



Picture 3 - 2: MOD left side (Match Elfin03)

3.2 MOD Series main parameters

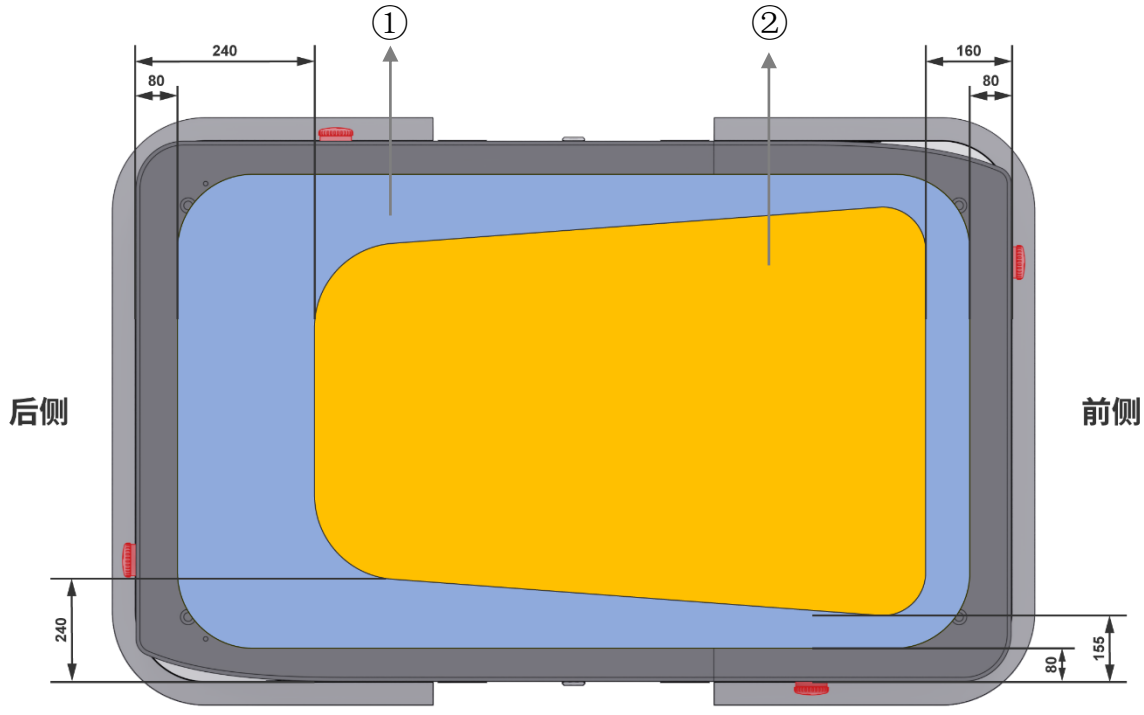
Parameter Type	MOD-0300 Parameters		Configuration
Basic parameters of the chassis	Dimensions (length x width x height)	1000x618x425 mm	Customizable
	Ground clearance	30mm	Standard
	Net, weight	≤160 kg	Customizable
	Load surface size (length x width)	900x580 mm	Customizable
	Max payload	300 kg	Customizable
Motion performance	Driving mode	全向	Standard
	Top driving speed	1.0 m/s	Standard
	Top traverse speed	0.56 m/s	Standard
	Top diagonal speed	0.56 m/s	Standard
	Maximum linear acceleration	0.5 m/s²	Standard
	Grade ability	≤ 3°	Standard
	Maximum obstacle height	10 mm	Standard
	Repeat accuracy	± 1 mm	Standard
Navigation	Lidar X2		Optional by brand
	Vision assistant		Customizable
Manipulator parameters	Degree of freedom of single manipulator	6	Standard
	payload of single arm	3/5 kg	Customizable
	Single robotic arm working range	590/800 mm	Varies due to options
	Repeat accuracy of robotic arm	± 0.05 mm	Varies due to options
	Maximum speed at the end	1 m/s	Varies due to options
	Number of robotic arms	2	Standard
	Robotic arm brand and specifications		Customizable
Robot torso & head parameters	Trunk lift		Customizable
	Torso rotation		Customizable
	Head freedom		Customizable

	Head camera (1-2)		Customizable
Overall parameters	Machine size	1000x618x1000 mm	Customizable
	Overall size	≤250 kg	Customizable
	Machine loading surface size (Length x width)	580x500 mm	Customizable
	Platform load of the whole machine	100 kg	Varies due to options

3.3 Back payload area

The following is a diagram of the load status of each area of the MON. The load of the vehicle is based on the distribution of the rack and the drive unit, and is closely related to the placement of the goods on the MON top plate. According to the simulation results, it is roughly shown that the farther the center of gravity of the goods is from the center of gravity of the AGV, the smaller the maximum bearing capacity.

The specific diagram as follows:



Picture 3 - 3: MON maximum load distribution diagram

1. Maximum load in the blue area: 150kg - Arm weight
2. Maximum load in the yellow area: 240kg - Arm weight

四、Safety related

4.1 Label

The following signs are affixed to the MOD



Picture 4 - 1: Front of the label

NO.	Description
1	Company LOGO



Picture 4 - 2: Side sign

NO.	Description
1	MOD-0300-003 Robot series code



Picture 4 - 3：Power battery sign

NO.	Description
1	 Power battery information nameplate
2	 Power battery warning language ● Do not charge in non-designated areas ● It is forbidden to reversely connect or short-circuit the positive and

	negative of the battery pack ● It is forbidden to knock, throw, step on and puncture the battery pack ● Non-professionals are not allowed to disassemble the battery pack, and disassemble without after-sale service ● Do not place the battery pack in high temperature, such as heating, near fire or sunlight exposure, etc. ● When charging, please use a special charger for the battery pack ● During the transportation of the battery pack, do not turn the battery upside down, handle it with care ● If the battery pack will not be used for a long time, please keep 40%~60% of the power in a cool and dry place. The battery should be charged with a charger every three months.
3	 Safety Warning Signs: High Voltage Danger

五、Packing and shipping

警告

叉车操作需由专业人员进行。

5.1 Packing

5.1.1 Packing material

Packaging materials include: wooden box pallets, wooden box frames, pearl cotton cushions, packaging elastic bands, slopes

5.1.2 Packing list

（see accessories box）

5.1.3 Packaging Precautions

- The end of the robotic arm is fixed to the top plate of the transport vehicle (refer to the software operation section for the attitude adjustment of the robotic arm) to prevent the loss of the origin. A rubber pad should be placed between the fixing block and the robotic arm.



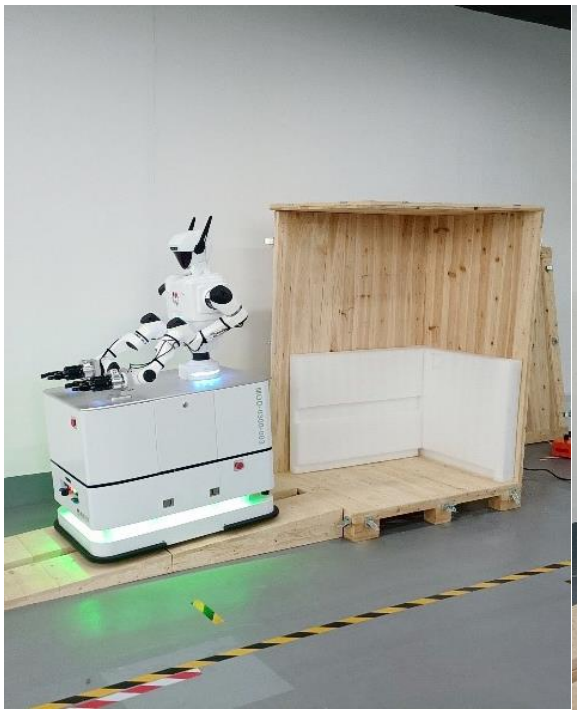
- For the wooden box, the front and one side hoardings need to be removed (the orientation is as shown in the figure below). The remaining two sides need to be pre-placed with foam, which can be fixed with an appropriate amount of double-sided tape. Avoid the three butterfly buckles on the front side of the pallet and place the ramp snugly against the pallet.




- Gently move the joystick of the remote control to align the robot with the slope, move slowly, and finally enter the wooden box, which roughly fits with the foam. If you need to manually adjust the position of the robot, you can press the emergency stop button of the transport vehicle (for the position of the emergency stop button, please refer to the description in Chapter 2.2 of this article), and then perform manual adjustment.

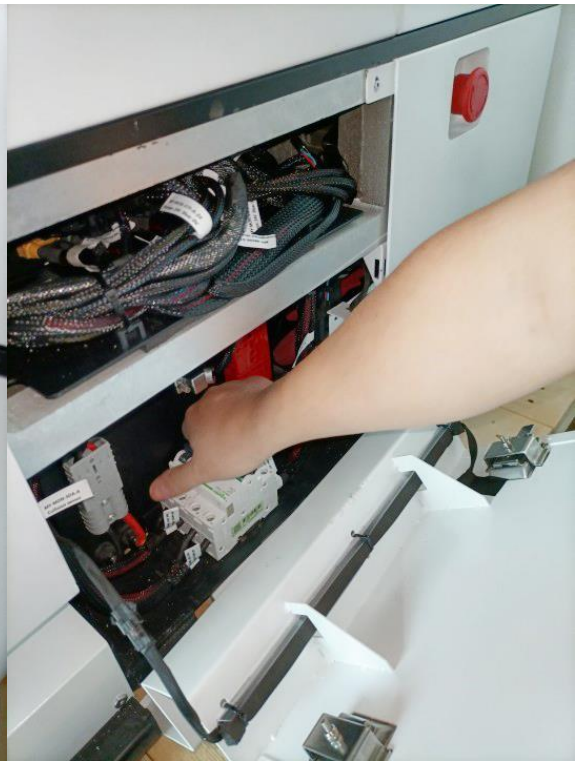
警告

During the movement of the robot, pay attention to observe the position of the robot, and be careful to prevent the wheels from falling off the slope. If the emergency stop of the transport vehicle is used to manually adjust the position,




- Pull out the remote control receiver (at the USB port on the control panel), press and hold the red power off button for 2s, and release it when the ambient atmosphere light strip turns yellow breathing light. When the ambient light is completely off, open the right door under the transport vehicle and turn off the circuit breaker device.





- Correctly place the foam, assemble the wooden box frame, and tuck the slope away.




- Use two 10m long packing tapes, each wrapping tape can be wrapped horizontally and vertically for two weeks.



The process is reversed when unpacking.

5.2 Transportation

If the customer has the needs of transporting robots, they should pay attention to the following matters:

- Transport vehicles need to have lift tail boards
- MOD Robot Packaging complies with the notice of appeal
- After packaging, it needs to be securely fixed in the transport vehicle
- The driver should be reminded to control the speed of the vehicle when passing the speed bump, let the car pass smoothly, and prevent the wooden box from shaking in the carriage

六、Light Instructions

6.1 Lighting action

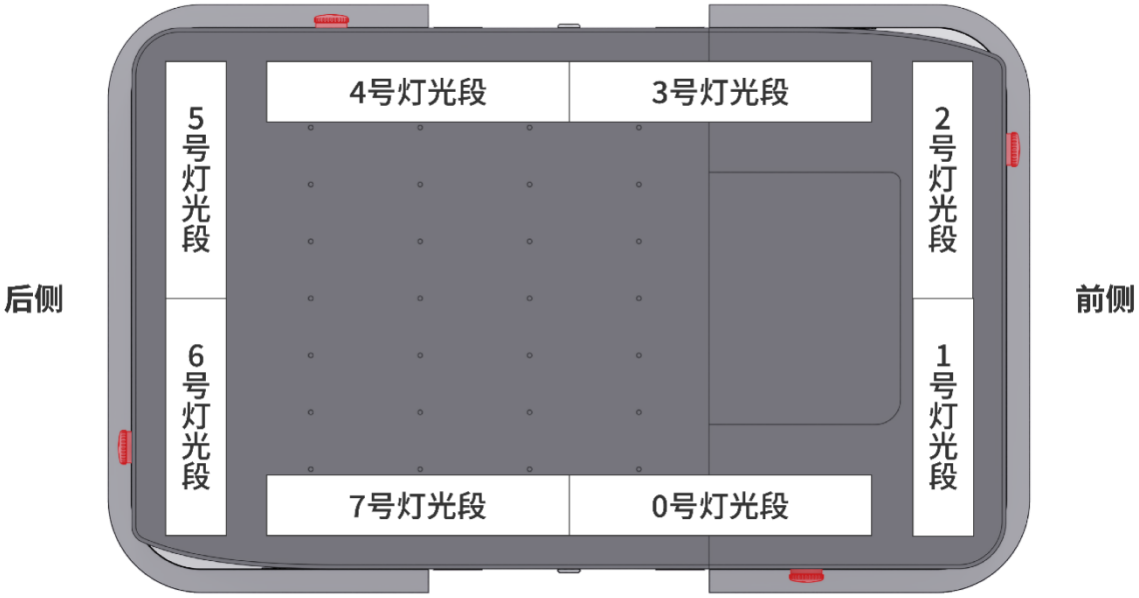
Action NO.	Action Name
0	Always Off
1	Always bright
2	breathe
3	flicker

6.2 Light Color

Color NO.	Color	
0	Off	
1	White	
2	Red	
3	green	
4	Blue	
5	Yellow	
6	Magenta	
7	blue	

6.3 Light status table

6.3.1 Lighting segment numbering regulations



Picture 6 - 1: Light segment number

6.3.2 Action table

NO.	Status	Sub-task	Color	Action
0	emergency stop		Red	flicker
1	System is starting		Yellow	breathe
2	standby mode		Blue	breathe
3	shutdown		Yellow	breathe
4	Moving	go ahead	Green	1, 2 segment flashing
		back	Green	5, 6 segment flashing
		shift left	Green	3, 4 segment flashing
		move right	Green	0 and 7 segments flicker
		Turn left	Green	2, 3, 6, 7 segments flashing
		Turn right	Green	0, 1, 4, 5 flashes
		composite state	Green	Corresponding action stacking
5	Low battery (<30%)		Magenta	breathe
6	Charging (≥30%)		White	breathe

Light instance:



Picture 6 - 2: Standby mode



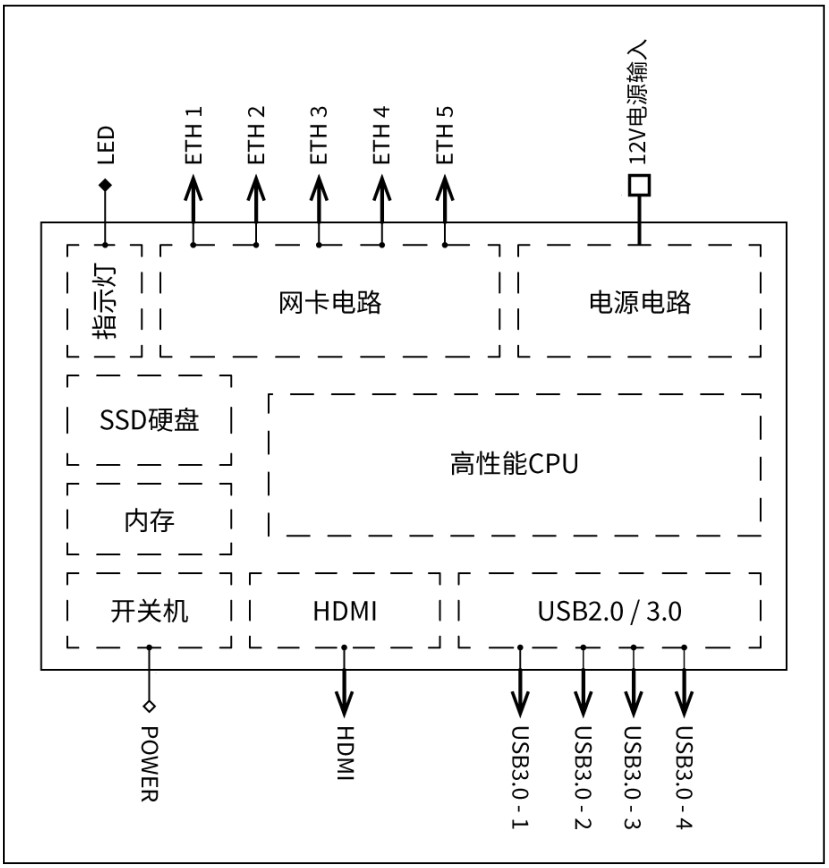
Picture 6 - 3: Emergency stop state

七、Electrical overview

Inside the robot is composed of many electrical equipment, including: 1. Industrial control computer, 2. Power controller, 3. Servo motor driver, 4. Power lithium battery, 5. Automatic charging device, 6. Industrial wireless network client, 7 .Lidar sensor, 8. Circuit breaker and DC contactor, 9. Emergency stop button, 10. Collaborative robotic arm, 11. Six-dimensional force sensor, 12. Electric gripper and other main equipment and other auxiliary equipment.

7.1 Industrial control computer

The high-performance industrial computer can satisfy the real-time control of the multi-dimensional motion planning of the robot, and the lower delay can ensure the high-precision operation of the robot. Powerful computing power can realize real-time capture and recognition of depth camera vision, and realize all machine vision-based applications. The configured high-speed network card makes the application based on network control more flexible.

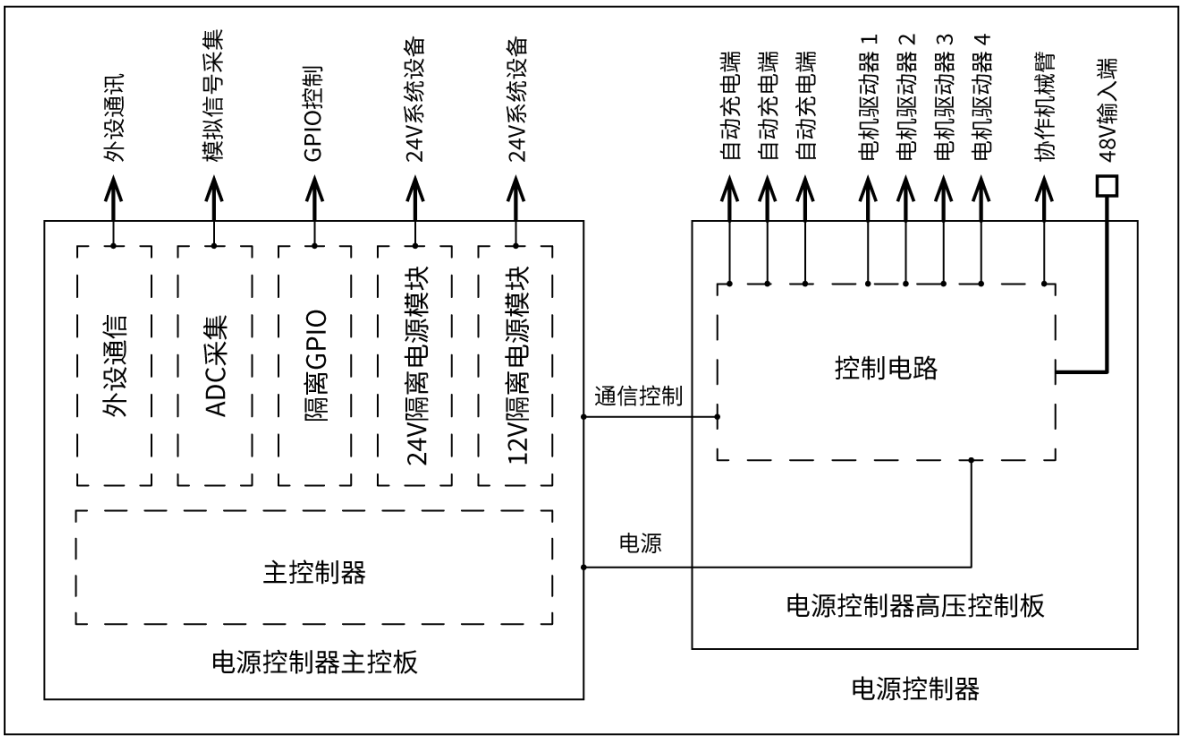


Picture 7 - 1: Industrial control computer peripheral layout block diagram

7.2 Power controller

The power controller acts as the power control center of the entire robot, and the complete electrical isolation design ensures electrical safety. It communicates with the comprehensive control computer through the high-speed USB interface to realize the control of the underlying power supply and the BMS information monitoring of the battery.

The isolated power modules have multiple protections for overheating, overvoltage, and overcurrent to ensure that when the electrical equipment fails, it can provide protection at the first time and improve safety. When the fault is removed, the power supply will automatically return to the normal state. The open GPIO interface can be directly controlled through the upper-layer software interface, which is more scalable.



Picture 7 - 2: Power Controller Electrical Block Diagram

7.3 Servo drive & motor

The motor driver is the core component of vehicle motion control. The drive adopts the low-latency and high-reliability EtherCAT bus as the communication carrier, which can realize very flexible motion control. The drive has multiple protection mechanisms, such as overload, overvoltage, overcurrent, overheating, motor IIt protection, emergency stop and other protection mechanisms to ensure the safety of the drive system. The maximum 3 times overload design improves the response speed of the robot's start and stop.

7.4 Power lithium battery

The power lithium battery uses lithium iron phosphate cells, which are safe and reliable. The capacity of 80AH provides longer working time. The BMS inside the battery can monitor the running status of the battery in real time, and upload the battery status information to the power control board in real time through the battery peripheral communication interface RS-485 to realize the real-time status monitoring of the battery. . If the battery pack is not used for a long time, please keep 40%~60% of the power in a cool and dry place. The battery is charged with a charger every three months to protect the long-term stability of the battery cells.

7.5 Automatic charging device

The automatic charging device is located directly below the front end of the robot. The automatic charging device is an electric lifting structure. There are 4 copper contacts at the bottom of the automatic charging device, which are 1: +48V, 2: Communication control signal, 3: Communication control signal, 4 : GND, there is a D-SUB connector socket at the top, defined as A1: +48V, A2: GND, 1: Lift control terminal (+24V when rising, 0V when falling) 2: Lift control terminal (when rising 0V, +24V when falling), 4: communication control signal 5: communication control signal. The automatic charging device can only be used with automatic charging piles. (Please refer to Chapter 8.2 for specific usage specifications)

7.6 Industrial Wireless Network Client

This industrial wireless network client supports IEEE 802.11a/b/g/n client, a variety of interfaces, equipped with 1 serial port and 2 Ethernet ports, based on client-side millisecond Turbo Roaming fast roaming, AeroMag flash matching technology, can easily Setup and deployment, 2x2 MIMO technology, Network Address Translation (NAT) for easy network setup, integrated and reliable antenna and power isolation protection design, providing 500 V isolation protection against external electrical interference, anti-vibration design.

7.6.1 Wireless network configuration

Before the robot is officially used, it is necessary to use the USB wireless network card shown in the figure below to configure the robot network to the wireless network of the actual use environment.



Picture 7 - 3: USB Wireless network card

Insert the USB wireless network card into the USB port on the rear panel of the robot, and use another computer to connect to the robot hotspot. The robot hotspot name is MoyingRobot, and the password is moying@robotics. After a successful connection, as shown in the figure:



Picture 7 - 4: Network connection success icon

7.6.2 Robot web client configuration

For specific instructions, please refer to "Robot Network Configuration Instructions"

7.6.3 Robot System IP Configuration

For specific instructions, please refer to "Robot Network Configuration Instructions"

7.7 2D Lidar sensors

Thanks to HDDM technology (HDDM = High Definition Distance Measurement), large-area monitoring of indoor and outdoor areas is ensured (even under the strong influence of ambient light, and for any surface). In a compact, rugged housing, the TiM571-9950101S01 provides accurate measurement data of the scanned surface to determine other information such as the object's structural size, shape, and more. Therefore, TiM571-9950101S01 can be flexibly used in various application situations in industrial environment and building automation. The integrated Ethernet interface enables simple execution and remote maintenance. Surfaces up to 1470 m² can be monitored with just one sensor High ambient

light immunity guaranteed by HDDM Low power consumption thanks to protection class IP 67 Low power consumption (standard 4 W) Compact dimensions with a maximum housing height of only is 86 mm. Scanning range of up to 25 m.

Overview of technical parameters:

Application field	Indoor/Outdoor
Measurement principle	HDDM+/HDDM
Integrated application	Measurement data output
Opening angle (horizontal direction)	270°
Angular resolution	1° /0.33°
Work area	0.05 m ... 25 m
Protection distance (when reflectance is 10%)	2 m ... 8 m
scanning frequency	15 Hz
Working temperature	-25 ° C ... +50 ° C 1)
serial	✔
USB	✔
Ethernet	✔
digital input	0
Switch output	1 (PNP, “SYNC”/“Device Ready（device ready）”)
weight	150 g / 250 g

7.8 Circuit breakers and DC contactors

The working current of the circuit breaker is 63A, which is used as the total current circuit breaker of the whole robot. When the total power consumption of the robot exceeds this value, the circuit breaker will be automatically disconnected. When the robot is powered on for the first time, please open the right door on the lower level of the transport vehicle and turn off the circuit breaker. Turn on the circuit breaker to the ON state. Please turn the circuit breaker to the OFF state when the robot is transported or left unused for a long time. This machine contains 2 DC contactors, which are located at the right front and the right rear respectively. The DC contactor located at the front is used to protect the disconnection of the exposed charging contacts of the automatic charging device, ensuring that the contacts are physically disconnected from the charging end of the battery under uncharged conditions, improving safety. The DC contactor located at the back end is used to protect the manual charging interface from the charging end

of the battery when it is not charged, so as to ensure that the manual charging interface is safe when it is not charged.

7.9 Emergency button

Emergency stop button is divided into chassis emergency stop button and mechanical arm emergency stop button. The chassis emergency stop button is located on the left and right sides of the lower layer of the transport vehicle, which is used for emergency stop control of the emergency stop chassis. The emergency stop button of the robotic arm is located at the front and rear of the upper layer of the transport vehicle, which is used to control the emergency stop of the robotic arm when it is out of control.

7.10 Cobot arms

The collaborative manipulator has high man-machine synergy, and stops immediately when it encounters resistance. EtherCAT communication integrated control, high torque density and low cogging force torque motor design and drive are perfectly matched to provide the robot with the best performance and stability.

Overview of technical parameters:

Parameter	Elfin03	Elfin05	Elfin10
product weight	17KG	23KG	40KG
maximum load	3KG	5KG	10KG
The scope of work	590mm	800mm	1000mm
Joint maximum speed	J1-J4 180° /S	J1-J4 180° /S	J1-J4 135° /S
	J5-J6 200° /S	J5-J6 200° /S	J5-J6 180° /S
Joint range	±360°		
Tool maximum speed	2m/s		
Repeatability	±0.05mm		
End I/O Interface	Digital Inputs: 3 Digital Outputs: 3 Analog Inputs: 2		
communication	TCP/IP、Modbus TCP、RS-485 series port		
I/O power	24V 2A		
External power input	200-240V AC 50-60Hz		
energy consumption	About 100W when running a typical program	About 180W when running a typical program	About 350W when running a typical program
Electric box I/O port	Digital Inputs: 16 Digital outputs: 16	Digital Inputs: 16 Digital outputs: 16	Digital Inputs: 16 Digital outputs: 16
	Analog Inputs: 2 Analog output: 2	Analog Inputs: 2 Analog output: 2	Analog Inputs: 2 Analog output: 2
Working temperature	0-50℃		
IP protection class	IP54/IP66		
Main material	Aluminum alloy		

7.11 Six-dimensional force sensor

The ROBOTIQ FT 300 force and torque sensor is designed for easy integration with collaborative robotic arms. The sensors are also designed for high performance precision force control tasks. Such as finishing, product testing, assembly and precise part insertion.

Overview of technical parameters of ROBOTIQ FT 300 torque sensor:

Specifications	FX FY FZ	MX MY MZ
Measuring range	±300 N	±30 Nm
Overload capacity	500%	500%
noise	0.1 N	0.005 Nm
Recommended Thresholds for Contact Detection	1 N	0.02Nm
Tool deflection at maximum measurable load	0.01 mm	0.17 deg
Data output rate (streaming mode)	100 Hz	100 Hz
letter of agreement	Modbus RTU/Data flow(RS-485)	Modbus RTU/Data flow(RS-485)

7.12 Electric gripper

The electric gripper is highly flexible, can adapt to the shape of the object to be clamped, and easily grip objects of different shapes. By calling the upper-layer software interface, it is convenient and quick to adapt the gripper to the project required by the developer.

Overview of technical parameters of ROBOTIQ two-finger gripper:

Specifications	2F-85	2F-140
Stroke (adjustable)	0 to 85 mm	0 to 140 mm
Clamping force (adjustable)	20 - 235 N	10 - 125 N
Conformable Grip Load	5 kg	2.5 kg
frictional grip load	5 kg	2.5 kg
closing speed	20 to 150 mm/s	30 to 250 mm/s
Location resolution	0.4 mm	0.6 mm
Fixture quality	0.9kg	1 kg
Protection class	IP40	IP40
Protocol	Modbus RTU (RS-232)	Modbus RTU (RS-232)

八、Charging equipment and how to use it

8.1 Manual charging

When using the manual charger to charge the robot, insert the two-pin aviation plug into the two-pin socket on the rear panel of the robot, and insert the aviation plug until the connector self-locking device is locked in place. Then insert the 220V/16A three-core AC plug into the 16A AC socket and connect it firmly, press the AC socket switch, the charger is powered on and starts to charge the power lithium battery. During the charging process, due to the large charging current (maximum 40A), it is normal for the DC output cable to heat up.

The robot cannot use the remote control handle to control the robot movement when the robot is charging.

The robot can be charged in the power-on state or in the power-off state. After the robot is fully charged, the charger will automatically turn off the charging function. At this time, the aviation plug can be unplugged from the robot, and the charger is still charging when the robot battery is not fully charged. If you need to unplug the DC charging plug, you need to turn off the AC socket first, make sure that the charger is disconnected from the 220V power supply, and then unplug the aviation plug plugged into the robot. When unplugging the DC aviation plug, you need to press down on the self-locking buckle above the plug and pull out the plug backwards. When charging the battery with a manual charger, it takes about 2 hours and 20 minutes to fully charge the battery from 1% to 100%.

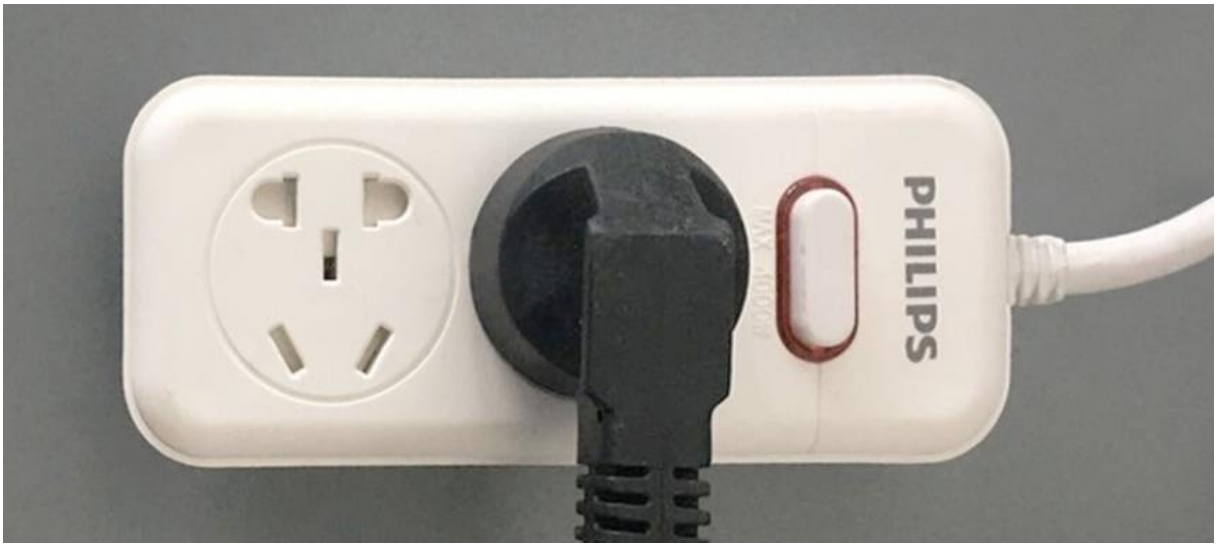
This design reference (EN 61851-1-2011) standard is designed and complies with the relevant specifications, and the equipment must be used in accordance with the requirements of the standard specification.

Manual charging operation process::

1. Prepare a 16A socket with a switch.



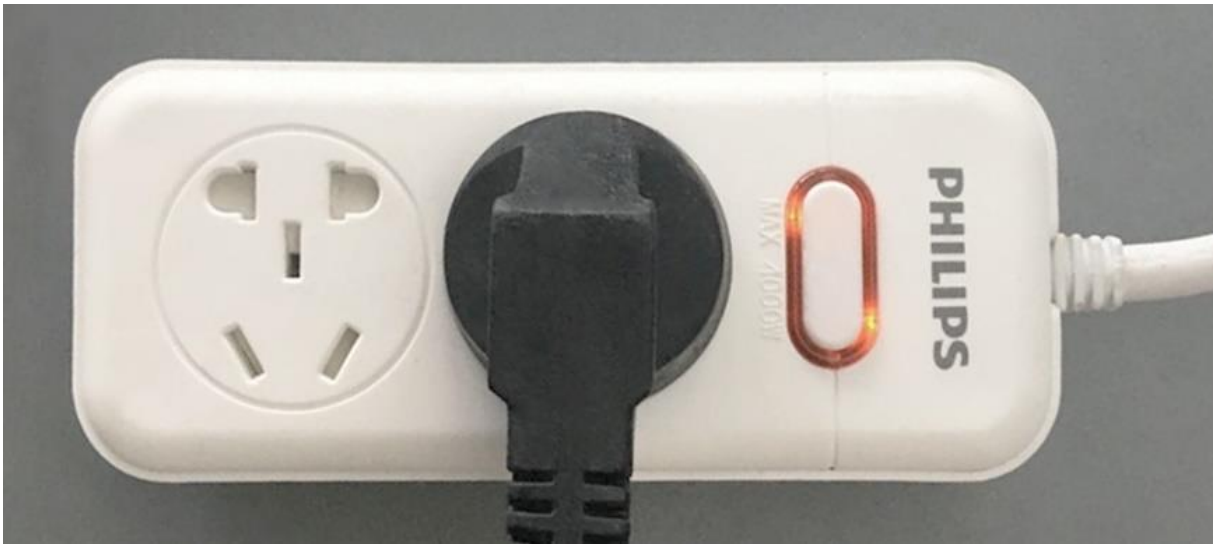
2. Insert the three-terminal AC plug of the charger into a 16A socket with a switch prepared in advance, the socket is off by default, as shown in the following figure:



3. Insert the charger's DC output aviation plug into the charging aviation socket on the rear panel of the robot, and pay attention to the direction of the plug and socket as shown in the figure below to ensure that the directions are consistent.



1. After confirming that the above steps are well connected, press the switch button of the AC socket, as shown in the following figure:



2. Please check the light indication on the charger panel for the specific charging status: when the charger is charging, the green light flashes; when the battery is fully charged, the green light is always on. When the battery is fully charged, disconnect the charger output to end charging.



1. The steps to remove the charger after fully charged are as follows:
2. Turn off the AC power outlet and unplug the AC plug of the charger.
3. Unplug the charging aviation plug at the rear of the robot. When unplugging the aviation plug, you need to press the self-locking shrapnel on the plug. When pressing the shrapnel, pull out the plug backward. Store the charger.
4. The above is the entire process of manual charging. When the robot is turned on, the charging process is the same as the above steps, and will not be described in detail here.

8.2 Automatic charging

The automatic charging device is located directly under the front of the robot. When using the automatic charging device to charge the robot, it is necessary to cooperate with the company's automatic charging pile.

When the automatic charging device charges the robot, the upper-layer ROS interface needs to be called to control the automatic charging device.

When using the automatic charging device to charge, the robot needs to be docked to the front of the charging pile within a distance of 10cm±2 from the charging pile, and the left and right error range is ±5mm. The charging control of the automatic charging device can only be carried out when the docking meets the above conditions, otherwise the docking is not charging. Controlling the automatic charging device when the pile is within the range of reliable charging will cause the automatic charging to fail.

No external force can be applied to the robot body during automatic charging. If the body is moved by external force, it will cause damage to the automatic charging device and the automatic charging pile.

When the battery is charged to 100%, the automatic charging device will automatically disconnect the charging and retract the lifting device to restore the robot automatic charging device to its original position.

This design reference (EN 61851-1-2011) standard is designed and complies with the relevant specifications, and the equipment must be used in accordance with the requirements of the standard specification.

8.3 Notes on the use of charging equipment

- The charger is a high-power power supply device. It must be used in accordance with (EN 61851-1-2011) specifications to avoid accidents caused by improper operation. Before using the charger, ensure that the 220V socket is connected to a leakage protection device, and the leakage protection device is grounded. Good to be safe.
- When using the charger, ensure that the power consumption meets the power consumption requirements of the charger, and avoid fire or personal injury caused by the power consumption accident caused by the mismatch of the power of the matching switches, sockets, and power cables.
- The charger is used indoors, avoid outdoor use.
- The charger cannot be used in a high temperature and high humidity environment.
- After the charger is found to be abnormal during use, it is forbidden to continue to use it, and it cannot be disassembled by itself.
- The charger usage process follows the above regulations and cannot be used as other battery chargers.

九、Mobile collaborative robot electrical components and parameters

MOD-0300-003 Equipment electrical and environmental parameters table

Device Name	Model	Rated Valtage(V)	Rated Current(A)	Temperature(℃)	Humidity (no condensation)	IP Class	Qty by one Robot
Industrial control computer		12V	10A	-40 to +85℃	5-85% RH	IP55	1
		24V	5A	-40to+85℃	5-85% RH	IP55	1
power controller	MY-PC-01	48V	60A	-40to+85℃	5-95% RH	IP55	1
Servo motor driver	FD-124S	48V	10A	-0to+40℃	5-95% RH	IP65	4
	FD-134S	48V	10A	-0to+40℃	5-95% RH	IP65	1
Servo Motor	SMC60S-0020-130MAK-5DSU	48V	5.7A	-40to+85℃	10-85% RH	IP65	5
	SMS80S-0075-30KAK-3DSU	48V	19A	-40to+85℃	10-85% RH	IP65	1
Collaborative robotic arm	Elfin3	48V	5A	-0to+50℃	5-95% RH	IP67	2
depth camera	D435	5V	1A	-40to+85℃	20-80% RH	IP64	3
2D lidar sensor	TiM571-9950101S01	24V	0.17A	-25to+50℃	5-95% RH	IP67	2
Industrial Wireless Client	AWK-1137C	24V	1A	-40to+75℃	5-95% RH	IP30	1
Upper control box	MY-PC-02	48V	10A	-40to+85℃	5-95% RH	IP55	1
automatic charging device	MY-ACT-01	48V	40A	-40to+85℃	20-80% RH	IP55	1
DC circuit breaker	C65N-DC	125V	63A	-30to+70℃	5-95% RH	IP55	1
DC contactor	DH100	500V	100A	-40to+85℃	20-95% RH	IP65	2
Normally closed emergency stop switch	ZB2-BE102C	240V	3A	-25to+70℃	10-85% RH	IP30	4
Normally open switch	ZB2-BE101C	240V	3A	-25to+70℃	10-85% RH	IP30	2
48V DC stabilized power supply	SD-500L-48	48V	10.5A	-20to+60℃	20~90% RH	IP30	1

MON-0300 Equipment electrical and environmental parameters table

Device Name	Model	Rated Valtage (V)	Rated Current (A)	Temperature(℃)	Humidity (无冷凝)	IP Class	Qty by one Robot
Industrial integrated		12V	10A	-40to+85℃	5-85% RH	IP55	1

computer							
power controller	MY-PC-01	48V	60A	-40to+85℃	5-95% RH	IP55	1
Servo motor driver	FD-124S	48V	10A	-0to+40℃	5-95% RH	IP65	4
servo motor	SMC60S-0020-30MAK-5DSU	48V	5.7A	-40to+85℃	10-85% RH	IP65	4
depth camera	D435	5V	1A	-40to+85℃	20-80% RH	IP64	2
2D lidar sensor	TiM571-9950101S01	24V	0.17A	-25to+50℃	5-95% RH	IP67	2
Industrial Wireless Client	AWK-1137C	24V	1A	-40to+75℃	5-95% RH	IP30	1
automatic charging device	MY-ACT-01	48V	40A	-40to+85℃	20-80% RH	IP55	1
DC circuit breaker	C65N-DC	125V	63A	-30to+70℃	5-95% RH	IP55	1
DC contactor	DH100	500V	100A	-40to+85℃	20-95% RH	IP65	2
Normally closed emergency stop switch	ZB2-BE102C	240V	3A	-25to+70℃	10-85% RH	IP30	2
Normally open switch	ZB2-BE101C	240V	3A	-25to+70℃	10-85% RH	IP30	2

十、Harness Label

All wire harness designs of the robot are designed with reference to the wire harness industry standard (QC/T29106-2002), and all wire harness designs meet the requirements of this standard.

Overview of Harness Label Parameters::

Harness Label	Harness function description
MY-MON-BDE-48-1	The label is the 48V power battery discharge output harness (red: +48V, black: 0V), which is connected from the battery discharge end to the DC

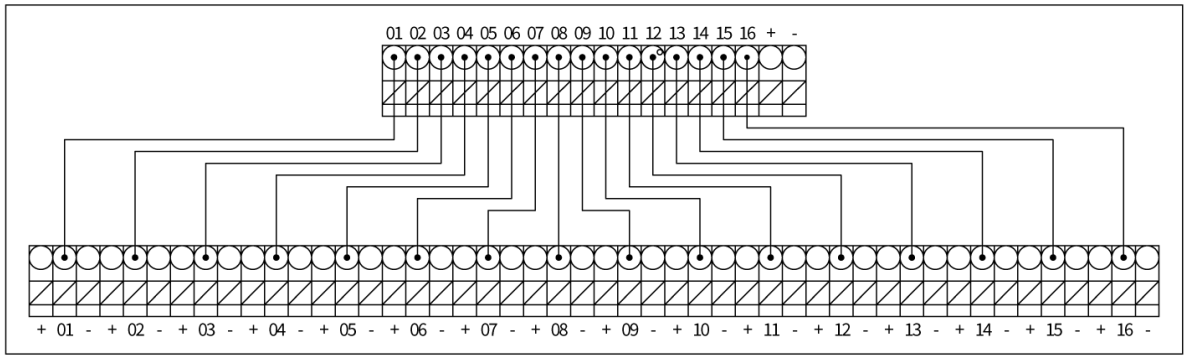
	circuit breaker input end
MY-MON-BDE-48-2	The label is a 48V power supply cable (red: +48V, black: 0V), which is connected to the power control power input terminal by the DC circuit breaker output terminal
MY-MON-BCE-48-C	This label is the 48V power battery charging input harness (red: +48V, black: 0V), the battery charging end is connected to the battery charging end of the power controller
MY-MON-BCE-48-A	The label is the 48V power battery automatic charging input harness (red: +48V, black: 0V), which is connected to the automatic charging end of the power controller by the contactor of the automatic charging device
MY-MON-BCE-48-M	The label is the 48V power battery manual charging input harness (red: +48V, black: 0V), which is connected to the manual charging end of the power controller by the manual charging contactor
MY-MON-TPO-48-1	The label is the mechanical arm 48V power input harness (red: +48V, black: 0V), which is connected by the power controller to the upper access panel power interface
MY-MON-TPO-48-2	The label is the 48V power input harness of the robot arm (red: +48V, black: 0V), which is connected from the upper access panel power interface to the upper control box 48V power port
MY-MON-MDR-48-F	The label is the front motor driver 48V power input harness (red: +48V, black: 0V), which is connected by the power controller to the front 2 motor driver power connectors
MY-MON-MDR-48-A	The label is the rear motor driver 48V power input harness (red: +48V, black: 0V), which is connected by the power controller to the rear 2 motor driver power connectors
MY-MON-GPI-08	The label is the GPIO input harness, which is connected by the power controller output to the upper access panel
MY-MON-GPO-08	The label is the GPIO output harness, which is connected by the power controller output to the upper access panel
MY-MON-STL-F	This label is the emergency stop switch signal harness, which is connected to the front emergency stop switch by the power controller control interface
MY-MON-STL-A	This label is the emergency stop switch signal harness, which is connected to the emergency stop switch by the power controller control interface.
MY-MON-STL-F-24	This label is the emergency stop enable power supply for the first 2 motor drivers of the chassis (brown: +24V, orange-silver: 0V)
MY-MON-STL-A-24	The wiring harness is the emergency stop enable power supply for the two motor drivers behind the chassis (brown: +24V, orange and silver: 0V)
MY-MON-SDA-F	This label is the signal harness of the front bumper strip, which is connected to the input port of the power controller by the bumper strip
MY-MON-SDA-A	The label is the rear bumper bar signal harness, which is connected to the power controller input port by the bumper bar
MY-MON-LDR-F	The label is the front lidar power output harness (red: +24V, black: 0V), which is connected to the front lidar power port by the power output interface of the power controller

MY-MON-LDR-A	The label is the rear lidar power output harness (red: +24V, black: 0V), which is connected to the front lidar power port by the power controller power output interface
MY-MON-WIR-24	This label is the wireless client power output harness (red and blue: +24V, black: 0V)
MY-MON-DAT-001	This label is the wireless client LAN port connecting the network communication data harness of the computer ETH5
MY-MON-DAT-002	This label is for the EtherCAT communication harness computer connection to chassis front left motor driver XIN port
MY-MON-DAT-003	The label is the XOUT terminal of the front left motor driver of the EtherCAT communication harness, and is connected to the XIN port of the front right motor driver
MY-MON-DAT-004	The label is the XOUT terminal of the right motor driver in front of the EtherCAT communication harness, and the XIN port of the left motor driver after connecting to
MY-MON-DAT-005	The label is the XOUT port of the left motor driver after the EtherCAT communication harness, and the XIN port of the right motor driver after connecting to
MY-MON-DAT-006	The label is the XOUT end of the right motor driver behind the EtherCAT communication harness, which is connected to the CAT port of the robotic arm
MY-MON-DAT-007	This label is the USB harness for the front depth camera to connect to the computer
MY-MON-DAT-008	This label is the USB harness for the rear depth camera connection to the computer
MY-MON-DAT-009	The label is a USB data cable, which is connected from the USB end of the computer to the USB end of the power controller
MY-MON-DAT-010	The label is the USB data cable, which is connected from the USB end of the computer to the USB end of the access panel (left)
MY-MON-DAT-011	The label is the USB data cable, which is connected from the USB end of the computer to the USB end of the access panel (right)
MY-MON-DAT-012	The label is a video data cable, which is connected from the DVI end of the computer to the HDMI port of the access panel
MY-MON-ADC-01	This label is the ADC analog signal acquisition interface, including 1-4 channels of AIN signals, which are connected to the ADC input end of the power supply controller by the docking terminal
MY-MON-ADC-02	This label is the ADC analog signal acquisition interface, including 5-8 channels of AIN signals, which are connected to the ADC input end of the power controller by the docking terminal

十一、Extension GPIO

The extended GPIO terminal block is located behind the right door of the upper compartment of the robot. The installation method of screwless wiring is convenient for

the connection of GPIO devices. The GPIO control is realized through the upper software interface, and the optocoupler isolation design is safer.

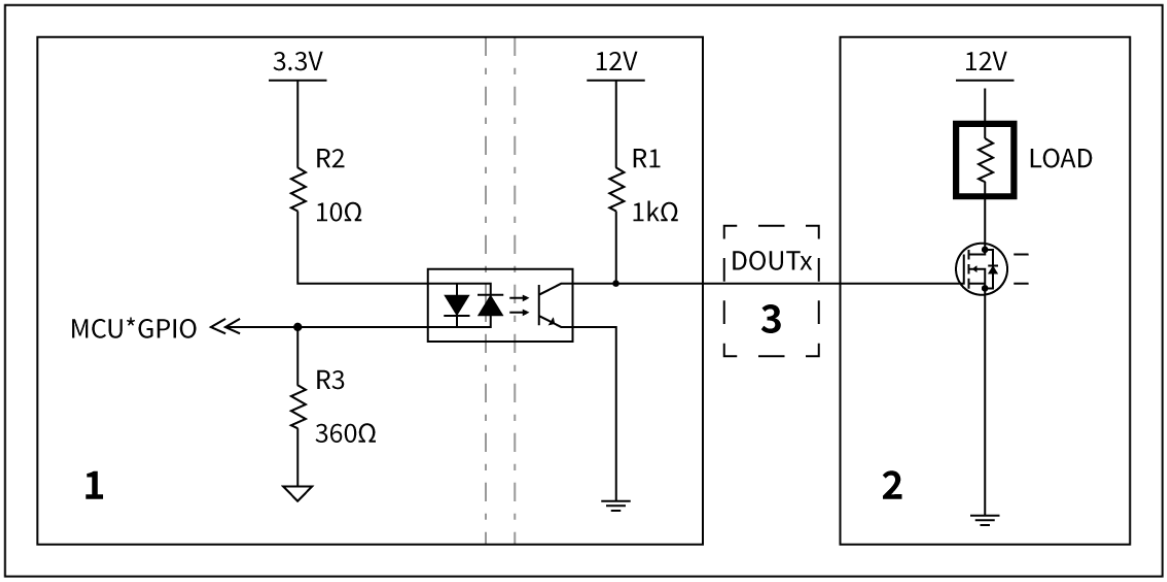


Picture 11 - 1: Terminal block diagram

Terminal block pin definition:

PIN NO.	Pin definition	Pin functions
1	DOUT1	Isolated digital IO output 1, output voltage 12V, drive current 10mA
2	DOUT2	Isolated digital IO output 2, output voltage 12V, drive current 10mA
3	DOUT3	Isolated digital IO output 3, output voltage 12V, drive current 10mA
4	DOUT4	Isolated digital IO output 4, output voltage 12V, drive current 10mA
5	DOUT5	Isolated digital IO output 5, output voltage 24V, drive current 10mA
6	DOUT6	Isolated digital IO output 6, output voltage 24V, drive current 10mA
7	DOUT7	Isolated digital IO output 7, output voltage 24V, drive current 10mA
8	DOUT8	Isolated digital IO output 8, output voltage 24V, drive current 10mA
9	DIN1	Isolated digital IO input 1, pull-up is valid, pull-up voltage is 12V~24V
10	DIN2	Isolated digital IO input 2, pull-up is valid, pull-up voltage is 12V~24V
11	DIN3	Isolated digital IO input 3, pull-up is valid, pull-up voltage is 12V~24V
12	DIN4	Isolated digital IO input 4, pull-up is valid, pull-up voltage is 12V~24V
13	DIN5	Isolated digital IO input 5, pull-down is valid, pull-down voltage is 0V
14	DIN6	Isolated digital IO input 6, pull-down is valid, pull-down voltage is 0V
15	DIN7	Isolated digital IO input 7, pull-down is valid, pull-down voltage is 0V
16	DIN8	Isolated digital IO input 8, pull-down is valid, pull-down voltage is 0V
+	+24V	Positive pole of DC 24V power supply
-	GND	DC power ground

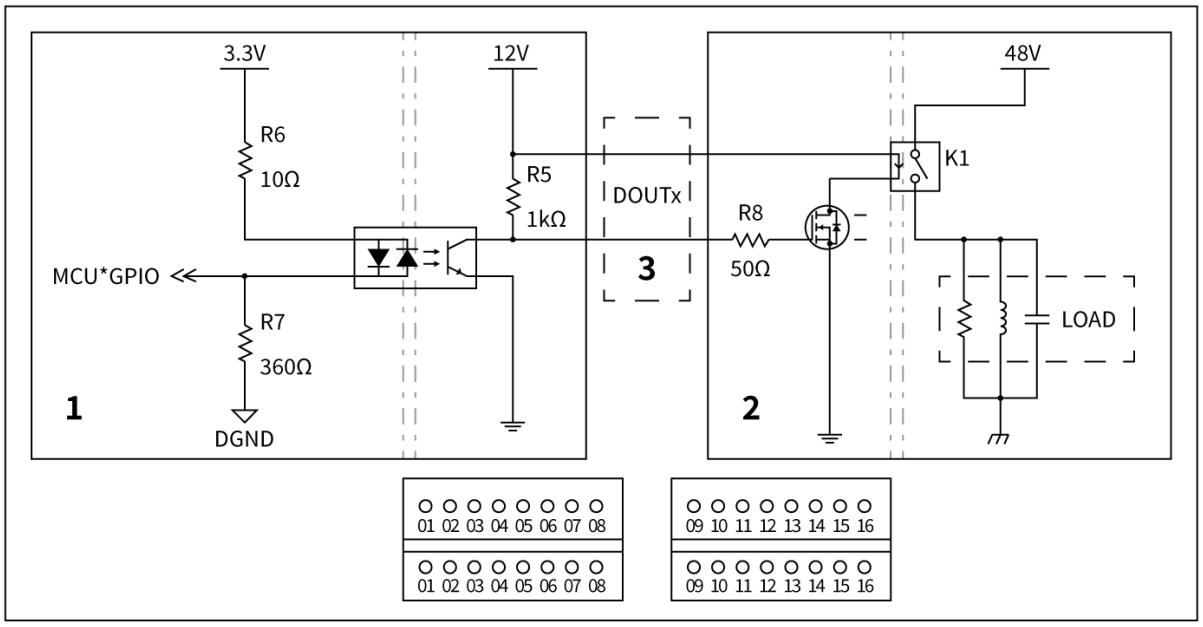
Isolated digital IO output driver connection diagram:



Picture 11 - 2: Schematic diagram of isolated digital IO output driving MOSFET

- The first part of the frame is the power controller
- Part of frame 2 is the MOSFET drive circuit
- Frame 3 is the GPIO terminal block

The above picture is the schematic diagram of the isolated digital IO output driving MOSFET. The driving load depends on the MOSFET selection. When the driving load is a 48V device, you cannot refer to this schematic design. In order to ensure the integrity of the electrical isolation, when it is necessary to drive and control a 48V device , refer to the following schematic design.



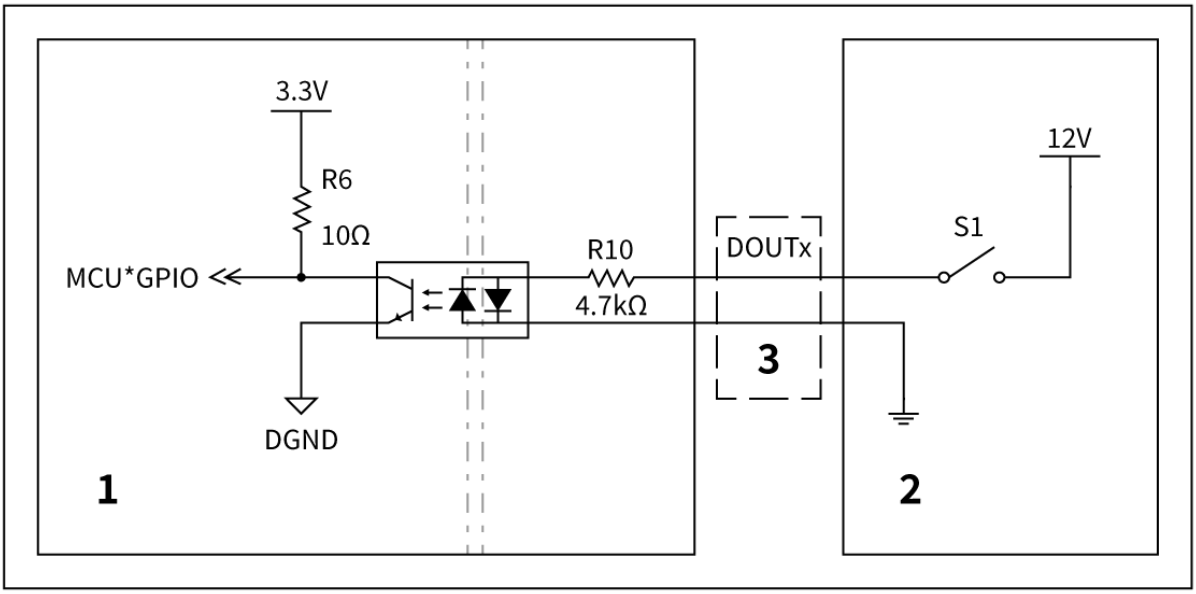
Picture 11 - 3: Schematic diagram of isolated digital IO output driving relay

- The first part of the frame is the power controller
- Part 2 of the frame is the MOSFET drive relay circuit, K1 is the relay, and LOAD can be resistive load, inductive load and capacitive load.

- Frame 3 is the GPIO terminal block

When using the isolated output IO drive device, you must refer to the above schematic design, and the IO drive load must be within the range of 10mA, otherwise it will cause failure to drive or directly cause damage to the drive optocoupler.

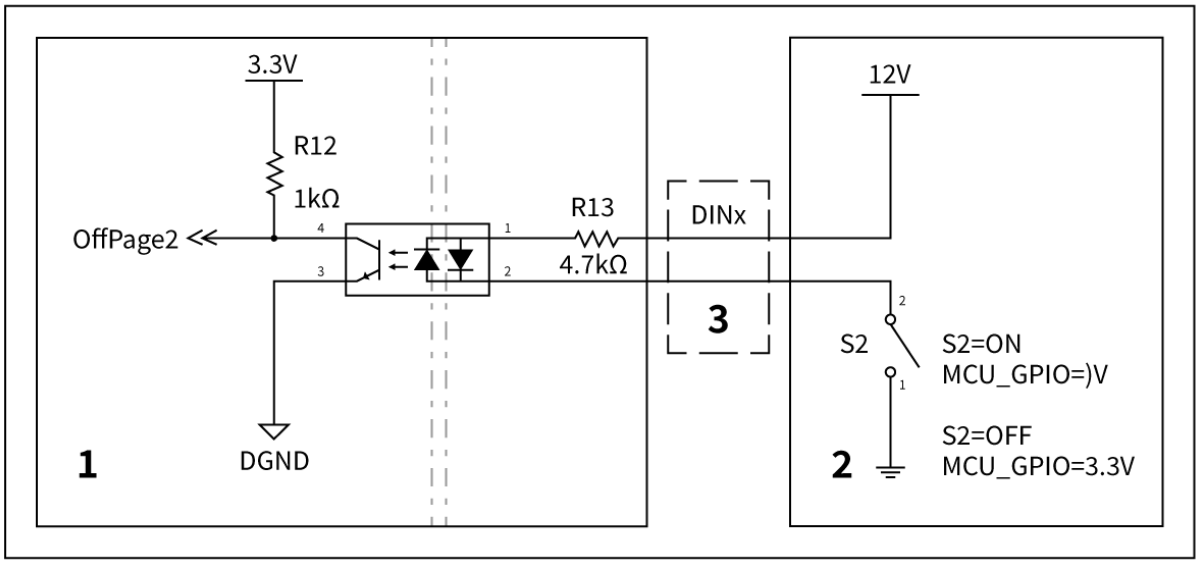
Isolated digital IO pull-up input connection diagram:



Picture 11 - 4: Schematic diagram of isolated digital IO pull-up input

- The first part of the frame is the power controller
- Frame 2 is the pull-up input diagram. S1 pin 2 is connected to the DIN pull-up pin of the terminal block, and pin 1 is connected to the +24V power supply. When S1 is closed, the MCU_GPIO terminal is low level. When S1 is disconnected, MCU_GPIO terminal is high level.
- Frame 3 is the GPIO terminal block

Digital isolated IO pull-down input connection diagram:



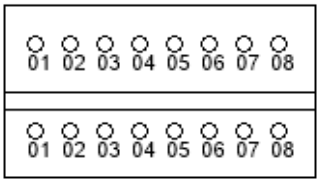
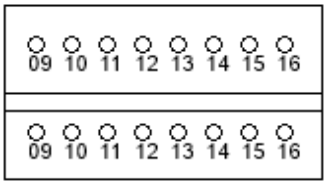
Picture 11 - 5: Schematic diagram of isolated digital IO pull-down input

- The first part of the frame is the power controller
- Frame 2 is the pull-up input diagram. S1 pin 2 is connected to the DIN pull-up pin of the terminal block, and pin 1 is connected to the to24V power ground. When S1 is closed, the MCU_GPIO terminal is low, and when S1 is separated, the MCU_GPIO terminal is high.
- Frame 3 is the GPIO terminal block

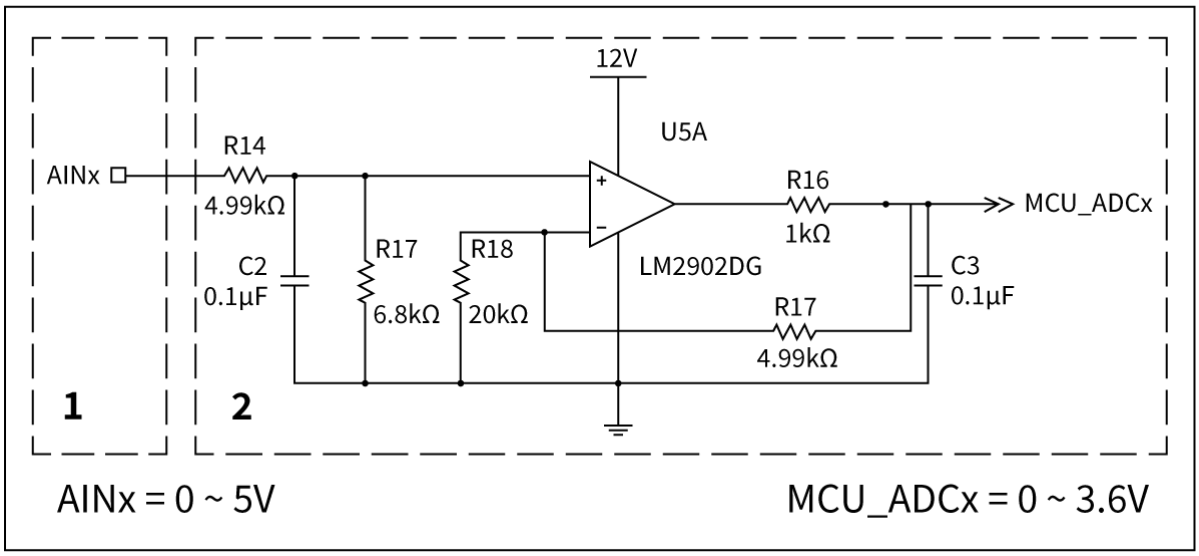
The pull-up and pull-down input of isolated digital IO is used with reference to the above schematic diagram. When the input signal source is other external power supply, attention must be paid to the integrity of the ground signal.

十二、ADC input acquisition

ADC input terminal definition:

	PIN NO.	PIN Definition	Pin Function
	01	AIN1	Analog input positive Voltage range: 0~5V
	03	AIN2	
	05	AIN3	
	07	AIN4	
	02\04\06\08	GND	analog input ground
	07	AIN5	Analog input positive Voltage range: 0~5V
	09	AIN6	
	11	AIN7	
	15	AIN8	
	10\12\14\16	GND	analog input ground

Schematic diagram of analog signal voltage processing:



Picture 12 - 1：电压变换处理电路

- The first part of the frame is the ADC input terminal
- The second part of the frame is the power controller
- When using an analog sensor, make sure that the output voltage of the sensor is within the voltage range of 0~5V. When the output voltage of the sensor is greater than 5V and connected to the AINx terminal, the output voltage of the MCU_ADCx terminal will increase accordingly. If the voltage at this point is greater than 3.6V, it will exceed the ADC input. The maximum voltage of the terminal will cause damage to the MCU.
- When it is necessary to collect voltage signals greater than 5V, an external voltage divider circuit needs to be designed, adjusted to the range of 0~5V, and then connected to the AINx input terminal.
- For ADC related interfaces, see ADC software interface calling and usage.

十三、Maintenance

13.1 Check list

> 注意
>
> Inspection and maintenance work is only permitted when the vehicle is unloaded.

Period	Tasks	Method
before boot	Check the vehicle for loose, defective or damaged parts.	Visually
before boot	Automatic charging: Check the contacts of the charging station for contamination or mechanical damage. Manual charging: Check the charging cable and plug for dirt or mechanical damage.	Visually
before boot	Clean up the dust on the emergency stop device to prevent it from hindering the emergency stop device from blocking and other abnormal conditions in an emergency.	cleaning cloth
after boot	Test the function of all emergency stop devices on the MOD while the vehicle is stationary or moving slowly (normal display includes: the light strip flashes red, the robot stops moving.)	hand press/visual
after boot	Check whether the wireless emergency stop function is normal.	hand press/visual
after boot	Check whether the light strip lights up normally and is consistent with the defined operating state.	Visually
after boot	Test the lidar obstacle avoidance function and check whether the MOD slows down or stops within a certain distance from the obstacle.	Visually

13.2 Maintenance list

> 注意
>
> Inspection and maintenance work is only permitted when the vehicle is unloaded.

Period	Tasks	Method
every 3 months	Check all rolls of the Mecanum wheel for wear or damage, and replace the rollers involved when wear or damage is identified on one or more rolls.	Visually
every 3 months	Check whether the state of all electrical interfaces of the drive battery is damaged, and replace the drive battery if it is in a	/

	bad state.	
every 6 months	Check if the sound is working properly	listening
every 6 months	Check if the fan of the MOD control box is working properly	Visually
1 year	Check all Mecanum wheels for wear or damage, replace the wheel when wear or damage is identified on one or more of the rollers	Visually
1 year	Check the drive battery for dirt and mechanical damage. Clean the drive battery if necessary. If damaged, replace the drive battery.	/
1 year	Clean the charging contacts and check for damage (use a copper brush).	/

13.3 Electrical maintenance

The electrical maintenance of the robot requires regular maintenance and maintenance. The electrical maintenance is mainly lithium battery maintenance and radar maintenance. Other electrical components do not need special maintenance and maintenance under non-fault conditions.

13.3.1 Lithium battery maintenance and replacement

Lithium batteries are energy supply equipment and require simple maintenance and maintenance on a daily basis. The main maintenance items are that extra charging and maintenance are required when the robot battery has not been used for a long time. One charge, (this is applicable when the remaining battery capacity is 100% before the robot is placed. The lower the remaining battery capacity, the shorter the charging time interval. If the robot is not used for a long time, please turn the DC circuit breaker to OFF to reduce the battery loss faster)。

13.3.2 Radar Maintenance

The radar itself does not need frequent maintenance. Only when working in a very dusty environment, the surface of the radar lens needs to be cleaned from time to time. The cleaning must be cleaned with a dust-free cloth to ensure no scratches on the lens surface. The cleaning force should be gentle, and after the cleaning is completed, test whether the radar enters the normal working state. Maintenance is not required as long as there is no foreign matter on the radar surface in a clean environment。

13.3.3 Electrical Routine Maintenance

Routine maintenance is the maintenance under the condition of no fault in daily use. The basic maintenance process is as follows:

1. Open the right door on the lower level of the transport vehicle, check each wire harness connector to see if it is loose, and tighten it if it is loose.

2. Check whether the charging and discharging DC breakers are faulty, switch from the ON state to the OFF state, and use a multimeter to measure whether the output poles are normally disconnected from the power supply. If the power supply cannot be disconnected, the circuit breaker is damaged and needs to be replaced by the same type of DC circuit breaker. , to ensure safe disconnection when the entire vehicle is powered off.

3. Check whether the battery charging & discharging Anderson plug is loose. If there is no looseness, it is not necessary to tighten it.

4. Check the DB9 interface of battery communication and communication to see if it is loose. Just tighten it if it is loose.

5. For the AGV upper wiring harness, it is not necessary to loosen and pull out the inspection if there is no fault.

The above 5 items are routine inspections of electrical wiring harnesses, DC circuit breakers, and BMS communication wiring harnesses under fault-free conditions.。

13.3.4 Fault clearing

Error Code	fault phenomenon	Description	Troubleshooting
0000	Robot doesn't turn on	Pressing the power button does not turn on	1. 1. Check that the DC circuit breaker is open. 2. 2. When the circuit breaker is turned on, use a multimeter to check whether the battery has electricity. The normal voltage is 48V. 3. 3. If the battery detects that there is power and the output does not turn on, check whether the 48V input terminal of the power controller is properly connected. 4. 4. None of the above, please call the company for maintenance。
0001	The robot does not start properly	After pressing the power button, the release robot cannot	The detection time of the robot's power button is 2 seconds. When the robot is powered on, the time to press the power

		start	button must be greater than or equal to 2 seconds.
		Press the power button, after the robot starts, the computer cannot enter the normal working mode	1. It takes time for the computer to start up. If the startup fails for a long time, you can use an HDMI cable to connect to the HDMI port on the access panel at the rear of the robot, and check on the monitor whether the computer is powered on normally. If the robot is turned on normally and still cannot control the robot, check the startup code to see if it starts. 2. If the startup code reports an error, check the relevant error-reporting nodes. 3. When the node reporting the error is a robotic arm, check whether the emergency stop button of the robotic arm has been pressed. If it is pressed, unscrew the emergency stop button and restart the node. 4. The above can not solve the problem, please call the company to deal with it。
0002	Robot cannot be turned off	The robot cannot turn off the robot by pressing the shutdown button	1. Press the power button for more than or equal to 2 seconds. 2. After pressing the power button for 2 seconds, the light strip turns yellow and shuts down within 10 seconds。
		Press the power button for 2 seconds to shut down	When this happens to the robot, you need to press the emergency stop button of the chassis, then open the door on the right side of the chassis, and turn off the circuit breaker。
0003	Chassis out of control	The chassis cannot be controlled with the remote control handle	1. Check whether the remote controller receiver is plugged into the robot's USB port. 2. Plug the receiver into the USB, check whether the battery of the remote controller has power, please replace the battery when the battery power is low. 3. When the robot is controlled by the remote controller, please follow the chapter on the remote controller. 4. If it is not a hardware fault, please check whether there is any bug in the

			software.
0004		The remote control handle communicates normally and cannot control the chassis	Check the color of the light strip to see if it is in an emergency stop state。
0005	The robotic arm cannot be started	The robot arm cannot be started normally, and the robot arm node of the startup code reports an error	1. Detect whether the emergency stop button of the manipulator is pressed. If it is pressed, unscrew the button and restart the manipulator. 2. When it is not a hardware failure, please check whether there is a bug in the software
0006	Electric gripper does not work	The electric gripper will not work after a period of use	1. Check whether the electric gripper cable is loose and whether the surface temperature of the electric gripper exceeds 50℃. When the temperature exceeds 50° C, please shut down and cool down to normal room temperature before use. If the fault persists. Please return it to the company for processing. 2. If it is not a hardware fault, please check whether there is any bug in the software.
0007	Six-dimensional force sensor does not work	Six-dimensional force sensor, unable to read data normally after startup	1. Check the sensor connection cable for looseness. 2. If it is not a hardware fault, please check whether there is any bug in the software.
0008	Unable to charge the robot	Plug in the charging plug to the robot charging interface and cannot charge	1. Check that the plug is seated properly. 2. Check if the charger is working properly. 3. Press the 220V socket switch again if the charger has no fault. 4. Press the socket switch to activate the charger and start charging the battery. 5. If the above is normal, it still cannot be charged, check whether the battery is abnormal.。