

Elephant Robotics User Manual

Catbot Collaborative Robot



Version 1.0

Language: English

Compiled in 2019/01

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目录

Overview of the manual.....	1
About the manual.....	1
Reading objects of the manual.....	1
How to use.....	1
Main contents of the manual.....	1
Before the official reading of the manual.....	2
1 Security.....	3
1.1 Introduction.....	3
1.2 Safety alert symbol description.....	3
1.3 Hazard identification.....	4
1.4 Safety Precautions.....	5
1.5 Label, nameplate introduction.....	7
1.5.1 Nameplate.....	7
1.5.2 Label.....	7
1.6 Avoid misuse.....	8
1.7 Emergency stop.....	8
1.7.1 Emergency button.....	8
1.7.2 Collision checking.....	9
1.8 Emergency stop configuration without power box.....	9
1.9 Urgent handling.....	10
2 About product.....	11
2.1 Overview of the robot system.....	11
2.2 Robot.....	12
2.2.1 Characteristics of the robot.....	12
2.2.2 Robot joint introduction.....	13
2.3 Scope of work.....	14
2.4 Active load.....	15
2.5 Technical Parameter Table.....	15
3 Environment and installation.....	17
3.1 Transportation and storage.....	17
3.2 Open box examination.....	17
3.3 Working environment and conditions.....	18
3.4 Installation.....	18
3.4.1 Installation requirements.....	18
3.4.2 Installation.....	18
3.5 Electrical connections.....	22
3.5.1 Cable connection.....	22
3.6 System startup debugging.....	23
3.7 Interface description.....	24
4 Maintenance.....	26
4.1 About the safety during maintenance.....	26
4.2 Maintenance plan.....	27
4.3 Who to contact.....	27
5 Repair.....	28

Overview of the manual

About the manual

Welcome to use Catbot collaborative robot and thanks for your purchase.

This manual describes the precautions for proper installation and use of the Catbot collaborative robot.

Please read this manual and other related manuals carefully before installing this robot system. After reading, please keep it in a safe place so that you can access it at any time.

Reading objects of the manual

This manual is targeted to:

- installer.
- Debugger.
- Maintenance staff.



Attention

Those who install/debug/maintain the Catbot collaborative robot must be trained in Elephant Robotics and have the mechanical and electronic knowledge required for the above work.

How to use

This manual should be used when doing the following works:

- Installation work: Move the robot to the working position and fix it to the base according to the installation instructions.
- Debugging: Debugging the robot to work status.
- Maintenance work: regular maintenance robot system to ensure its normal functioning. When the robot malfunctions due to environmental influences or improper operation of the user, or a certain component of the robot system exceeds the normal service life, the robot needs to be repaired.

Main contents of the manual

- Precautions for safe use of the robot.
- Mechanical, electrical installation and commissioning of the robot.
- Maintenance and repair of the robot.

Before the official reading of the manual

Before you officially read the manual, you need to know:

1. About the robot system

Unlike traditional industrial robots, the Catbot robotic system has a unique "All In One" technology. Completed a perfect slimming of the robot, to achieve the integration of cabinets. It can work safely with workers and independently complete the processes of loading, unloading, testing, testing and packaging in industrial manufacturing.

2. About product warranty

During the warranty period of the delivered product, the company will only repair the failures that occur when the robot is normally used. However, in the following cases, the customer will be charged for repairs (even during the warranty period):

- 1) Damage or malfunction caused by incorrect use and improper use of the manual.
- 2) Failure caused by unauthorized removal by the customer.
- 3) Damage caused by improper adjustment or unauthorized repair.
- 4) Damage caused by natural disasters such as earthquakes and floods.

Therefore, please operate the robot in strict accordance with the instructions in this manual and related manuals.

1. About help

For any questions or suggestions on the contents of the manual, you can query on the official website of the Elephant Robotics to submit the relevant information: <https://www.elephantrobotics.com>.

1 Security

1.1 Introduction

1, Introduction to this chapter

This chapter details general safety information for people who perform installation, maintenance, and repair work on the robots. Please read and understand the contents and precautions of this chapter before handling, installation and use.

As described in GB 11291.1-2011, whether it is a robot manufacturer, system integrator, or individual user, it is necessary to carry out hazard identification and risk assessment before using the robot. It is required to conduct a hazard analysis to identify any hazards that may arise; and for hazards identified in hazard identification, a risk assessment should be performed to maximize personal safety and property safety.

This chapter provides a basic guide to safe use by introducing different safety alert symbols and precautions.

2, Interpretation of related terms

1) Collaborative operation

A specially designed robot that works directly with people in a defined workspace.

2) Collaborative workspace

In the safety protection space of the robot work unit, the robot and the person can complete the task at the same time in the production activity.

1.2 Safety alert symbol description

As shown in Table 1-1, this section describes the safety alert symbols used in this manual. You can find the corresponding symbols described in this chapter in other chapters, please note the meaning of these symbols and their meanings.

Table1- 1 Safety Warning Symbol Table

 Danger	Danger: A dangerous situation that is likely to result in death or serious injury if not avoided.
---	---

 Warning	WARNING: Conditions that may cause a hazard that, if not avoided, could result in personal injury or serious damage to the equipment.
 Caution Electricity	Be careful of electric shock: It may cause dangerous use of electricity. If it is not avoided, it may cause personal injury or serious damage to equipment.
 Prohibited	Prohibited: Things that are not allowed to do.
 Attention	Caution: Important things to be noted.

1.3 Hazard identification

The safety of the collaborative robot is based on the premise of proper configuration and use of the robot, and even if all safety instructions are observed, the injury or damage caused by the operator may still occur. Therefore, it is very important to understand the safety hazards of robot use, which is beneficial to prevent problems before they occur.

Tables 1-2 to 1-4 below are common safety hazards that may exist in the context of using robots:

Table1- 2 Dangerous safety hazards

 Danger	
1	Personal injury or robot damage caused by incorrect operation during robot handling.
2	Personal injury or robot damage caused because the robot is not fixed as required, for example, the screw is not screwed or tightened, and the base is not enough to stably support the robot for high-speed movement, causing the robot to tip down.
3	Failure to perform proper safety function configuration of the robot, or installation of safety protection tools, etc., may cause the safety function of the robot to fail.

Table1- 3 Warning level security risks

 Warning	
1	Play around the robot, you may be hit by a running robot, or be tripped by an obstacle such as a cable to cause personal injury.
2	Unauthorized personnel change the security configuration parameters, causing the safety function to fail or danger.
3	Scratches and punctures caused by sharp surfaces such as other devices in the work environment or robot end effector.
4	The robot is a precision machine and pedaling may cause damage to the robot.
5	If the clamp is not in place or before the power supply of the robot is turned off or the gas source is turned off (it is not determined whether the end effector firmly holds the object without falling off due to loss of power). If the clamped object is not removed, it may cause danger, such as people being injured by crashing.
6	There is a risk of accidental movement of the robot. Under no circumstances should you stand under any axis of the robot!
7	The robot is a precision machine. If it is not placed smoothly during handling, it may cause vibration and may cause damage to the internal components of the robot.

Table1- 4 Potential safety hazards that may result in electric shock

 Caution Electricity	
1	Using a non-original cable may pose an unknown hazard.
2	Contact with liquids by electrical equipment may result in a risk of electric leakage.
3	There may be an electric shock hazard when the electrical connection is incorrect.
4	Be sure to handle replacement work after turning off the power to the controller and related equipment and unplugging the power cord. If the work is performed while the power is on, it may cause electric shock or malfunction.

1.4 Safety Precautions

In general, compared with ordinary machinery, robots have the characteristics of larger working range and faster speed, so they are accompanied by the dangers that ordinary machinery does not have. When installing, using, and maintaining the robot, please pay attention to the following items shown in Table 1-5 and Table 1-6 (the followings are some of the common precautions listed):

Table1- 5 Safety precautions on acts that need to be banned

 Prohibited	
1	It is forbidden to modify the robot or use non-original accessories.
2	Untrained non-professionals are prohibited from entering the robot work area at will, pressing any button or doing other operations at will.
3	The relevant personnel shall not maintain, repair or use the robot after being affected by drinking, taking drugs or stimulating drugs.

Table1- 6 General safety precautions

 Attention	
1	Anyone responsible for installing and maintaining the robot must read and follow these safety instructions.
2	Ensure that safety measures and robot safety configuration parameters are defined as required in the risk assessment to protect programmers, operators, and bystanders.
3	Production operators should not loosen long hair (long hair must be picked up) and wear a work cap, not wearing jewelry.
4	Operators operating in conjunction with the robot must be familiar with and understand the content and exact location of the various warning signs and warning symbols on the equipment and ensure that all warning signs and warning symbols are complete and clear, and that all safety devices are secured before opening and starting the equipment. And make sure the relevant accessories are normal and no one is in a dangerous location where the equipment is activated. When the robot runs abnormally, it should be stopped immediately and the situation must be reported it in time.
5	The operator must clarify the scope of operation, commissioning, maintenance and repair. The operator is not allowed to change the operating procedures and trials at will, and other personnel are not allowed to enter the collaborative operation space and danger zone.
6	When repairing work, operators must hang the warning sign to enter the collaborative operation space.
7	When the operator enters the safety zone of the equipment protected by the safety guard door, it shall be absolutely guaranteed that the safety guard door will always open when working in the area, and the door must be in an unlocked position.
8	When the operator is in production, it should be ensured that each starting device is normal and cannot be started at will.
9	When the maintenance and operation personnel perform maintenance on the

	equipment, the main power switch must be turned off to perform maintenance work.
10	No items should be stacked in the robot working area, and no debris should be placed in the control box.
11	After the operation is completed, the safety protection door should be closed immediately, and the various switches of gas and electricity should be closed according to the procedure, and the work site should be cleaned up.
12	Do not shake the robot and hang heavy objects on the robot.
13	No dangerous behaviors or games around the robot.
14	After installing the robot, make sure the robot is fixed on a stable surface for subsequent operations.
15	Make sure that the robot does not collide with itself or other objects during running.
16	If the robot is damaged, do not continue to use it.
17	Please use the robot within the robot's parameter range and service life, otherwise it will cause serious safety problems.
18	After the emergency stop state is canceled, and before the servo power is turned on, it is necessary to remove the obstacles and faults that cause the emergency stop, and then turn on the servo power.
19	Please pay attention to the rotating shaft of the robot to prevent the cable and the air tube from being entangled. Keep a distance from the shaft to prevent hair or clothing from getting entangled.

1.5 Label, nameplate introduction

1.5.1 Nameplate

There are two types of nameplates used in the robot system. The robot body and power box have different nameplates. The nameplate records some basic information about the product. It should be noted that the production number on the nameplate is unique. That is to say, each product has a unique ID, which is an important basis for distinguishing each product, and is also important information to be provided when applying for maintenance.

1.5.2 Label

Robots are high-precision equipment, and they are more dangerous than ordinary machines when they are unfamiliar or not in accordance with the manual. As shown in Figure 1-1, the labels are attached to the power box to remind the operator to read the relevant operating manual before use.



Figure 1- 1 Reading manual before the operation

The power box provides power to the entire robot system and must be operated correctly to prevent electric shock. As shown in Figure 1-2, A power-proof warning label is attached to the power box to remind the operator that there is a potential danger of electric shock to the power box, and it is required to be used correctly to prevent electric shock.



Figure 1- 2 Label to caution preventing electric shock

1.6 Avoid misuse

Please do not use the Catbot collaborative robot for the following purposes.

- Medical and life-critical applications.
- In environment that may cause an explosion.
- Used directly without risk assessment.
- Insufficient use of safety function levels.
- Inconsistent use of robot performance parameters.

1.7 Emergency stop

This section describes two types of emergency stop for robots:

- If you feel abnormal during the robot's motion, immediately press the emergency stop switch.
- When the force generated by the collision of the robot with the person or object is greater than the threshold, the robot detects the force generated by the collision, thereby stopping or moving to a certain position (collision return).

1.7.1 Emergency button

When the emergency stop button on the teach pendant is pressed, the drive will be stopped, the brake will start, the motor power will be turned off, and the electromagnetic brake will stop the robot's inertial motion, the robot will stop all

motion, the program running in Catbot RoboFlow will also be stopped.

However, during normal operation, do not press the emergency stop switch at will. If the emergency stop switch is pressed during the operation, the robot movement trajectory before stopping will be different from the trajectory during normal operation and may hit a peripheral device or the like.

When it is in an emergency stop state (normal), if the robot system is to be placed in an emergency stop state, press the emergency stop switch when the robot does not operate.

Before using the emergency stop switch, you need to know the followings:

- The emergency stop (E-STOP) switch can only be used to stop the robot in an emergency.
- To stop the robot running the program in a non-emergency situation, use the Pause or STOP command. The Pause and STOP commands will not turn off the motor. Therefore, the brake will not work.
- If user need to control the emergency stop of the robot and other equipment at the same time, you can use the external E-STOP double loop circuit (user need to short it when not in use).

1.7.2 Collision checking

During the operation of the robot, it is possible to touch people or objects. It can be protected by setting a protection threshold. The specific operation mode is as follows: When the force generated by the collision of the robot with the person or the object is greater than the threshold, the robot detects the force generated by the collision, thereby stopping or moving to a certain position (collision return).

Please note that when the protection threshold is set too high, a large force is required to stop the robot, which will reduce the sensitivity of the collision detection to a certain extent. When the protection threshold is set too low, the robot may stop when it is holding the load due to the excessive torque generated by its own motion. Please set the threshold of protection under guidance.

In addition, you can set the protection threshold for each movement and each movement of the robot, and set the two protection threshold directions including the X-Y plane (horizontal direction) and the Z plane (vertical direction).

1.8 Emergency stop configuration without power box

If users need to use robots without power boxes (e.g. without power boxes), besides DC 48V and DC 24V power supply, emergency stop buttons must be attached. Users can connect with the emergency shutdown circuit shown in

Figure 1-3.

The emergency stop button needs to control the DC 48V which is supplied to each joint motor of the robot body. By controlling the relay, the indirect control of the DC 48V can be realized.

 Warning	If the user does not use the power box without accessing the emergency stop button as required, if an abnormal situation occurs, such as a collision during the debugging process, the robot will not be stopped in time.
	If the user fails to use the emergency stop button of the power supply box or access the emergency stop button according to the normal use requirements, all losses will be borne by the user.

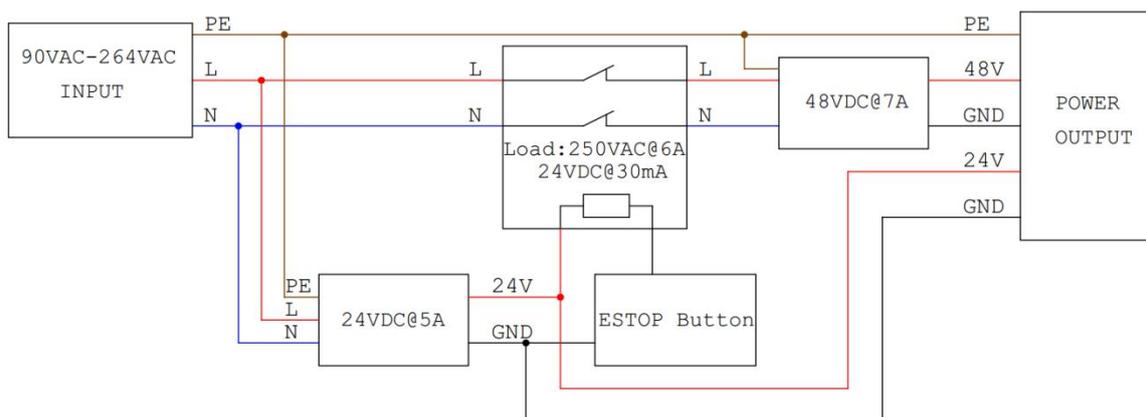


Figure 1- 3 Emergency Shutdown Circuit

1.9 Urgent handling

 Attention	If the software pops up with a fatal error message, please activate the emergency stop quickly, write down the condition that caused the error, and contact your supplier.
	In the event of a fire, use a carbon dioxide (CO ₂) fire extinguisher!

2 About product

2.1 Overview of the robot system

Catbot collaborative robot is the latest 6-axis robot from Elephant Robotics. It solves the problem that the robot controller needs another land occupation for the first time. And integrates the controller into the robot body to perfectly realize the cabinet integration.

Generally, a traditional robot consists of three major parts: a robot body, a teach pendant, and a controller. As shown in Figure 2-1, Catbot collaborative robot using the latest integrated design. On the basis of accomplishing the same function, the advantages of being convenient to carry, not subject to space limitation and flexible arrangement are added.

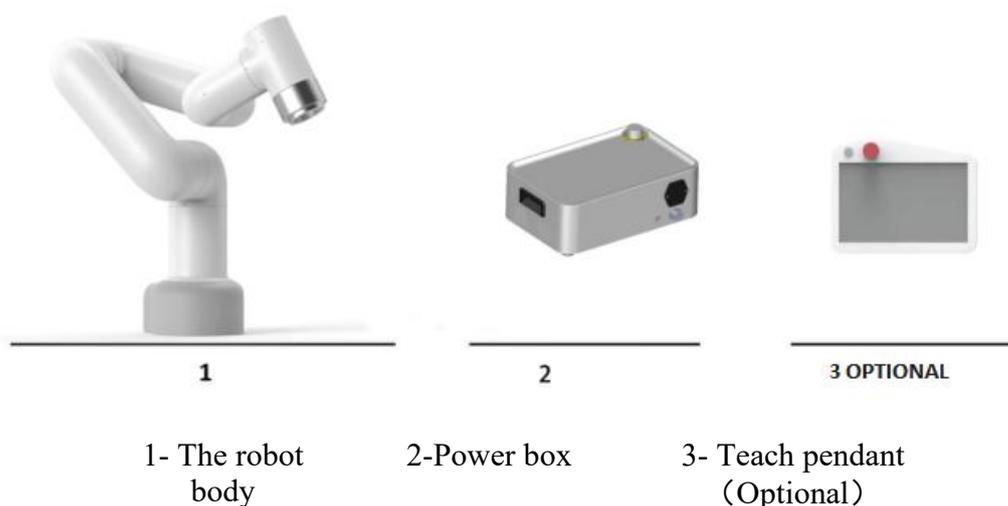


Figure 2- 1 Robot system

1. The robot body

The robot body is a mechanical body used to complete various tasks of the robot system, and mainly includes a robot casing, a driving device, a transmission unit, and an internal sensor. The main material of the robot casing is aluminum alloy.

The robot's principle of motion is a combination of rotational motions of six joints. Using kinematics and dynamics analysis, the algorithm is solved to achieve the desired motion at the end of the robot.

The Catbot collaborative robot integrates the controller into the body. The controller's structural realization of the robot control function is a key part of determining the function and level of the robot. The main component of the controller is the computer, which controls the overall motion of the robot.

2. Power box

The power box is used to supply power to the robot body. It is also equipped with an emergency stop knob for safe use.

3. Teach pendant (Optional)

The teach pendant is the main interface of human-computer interaction, and its internal part is composed of a touch screen display, a control circuit board and some components. The user can program and operate the robot by using the teach pendant.

As for Catbot collaborative robot, the teach pendant is an optional accessory. Even without the teach pendant, the user can connect the robot with other display devices or tablets or mobile phones to complete the robot motion control and programming operations.

Shortly, if the robot system is like a human, then the controller is like a human brain, controlling the robot body (like a human hand) to perform tasks, and the teach pendant is the human-machine interface that the robot system communicates with people.

2.2 Robot

2.2.1 Characteristics of the robot

The Catbot collaborative robot has the advantages of short deployment time, easy operation, safe use and convenient expansion of peripheral equipment, which can greatly shorten the deployment time of the factory for automation project transformation and reduce the total cost of deployment. The specific description is as follows:

1. Cabinet integration

The Catbot collaborative robot integrates the controller into the robot body for a high degree of integration. It has a modular design and a compact body. The weight is only 18kg. This design also greatly reduces the overall footprint of the robot system. And it can effectively simplify the installation steps of the robot and shorten the installation time.

The Catbot collaborative robot can be adapted to both the structured production floor and the installation requirements of shops or studios in non-industrial environments.

2. Voice control

In addition to the unique security and flexibility of the collaborative robot, the Catbot collaborative robot also adds human-machine voice interaction, which is also a manifestation of the development of robot AI, making voice programming a reality. The user can control the Catbot collaborative robot with voice commands to make it accurate to millimeters. Human-machine voice

interaction makes robot programming more interesting, and it is more convenient and time-saving.

When developing the Catbot operating system, we always insist on user-centricity. After many experimental adjustments, the Catbot operating system is easy to operate, and the user interface is simple and clear.

Even a novice can quickly get started programming.

3. Development platform

The Catbot collaborative robot is equipped with an open software platform. It supports users to develop or utilize third parties independently according to their own needs, and secondary development of robots.

The openness of the Catbot collaborative robot makes it easy to scale, enabling multiple functions and a wide range of applications.

4. Cloud programming

Cloud programming from Catbot collaborative robot allows anyone with innovative ideas to program robots with terminal devices or computers at all times and places. As the commander of the robot, the user controls the robot to implement his own innovative ideas.

5. Safe and reliable

Based on the efficient and exact collision detection algorithm, Catbot collaborative robot performs an emergency stop when a slight collision is detected, ensuring personnel safety without the need to install a guard rail. The intelligent and highly flexible Catbot collaborative robot can be adapted to both fine production and high-volume production processes.

2.2.2 Robot joint introduction

The Catbot collaborative robot is a robot with a load of 3kg and a range of 570mm. Its repeat positioning accuracy is $\pm 0.05\text{mm}$. It is used in independent work: for loading, unloading, testing, testing and packaging. Catbot collaborative robots work safely with workers.

The schematic diagram of the robot body is shown in Figure 2-2.

The mechanical body of the Catbot collaborative robot can be thought of as an open-chain multi-link mechanism. The start link is the base of the robot, the end link is connected to the end effector, and the adjacent links are connected by a joint. The Catbot collaborative robot is a 6-degree-of-freedom industrial robot consisting of 6 links and 6 joints (axes). When numbered, the base is called the link 0 and is not included in the six links. The link 1 is connected to the base by the joint 1, the link 2 is connected to the link 1 through the joint 2,

and so on.

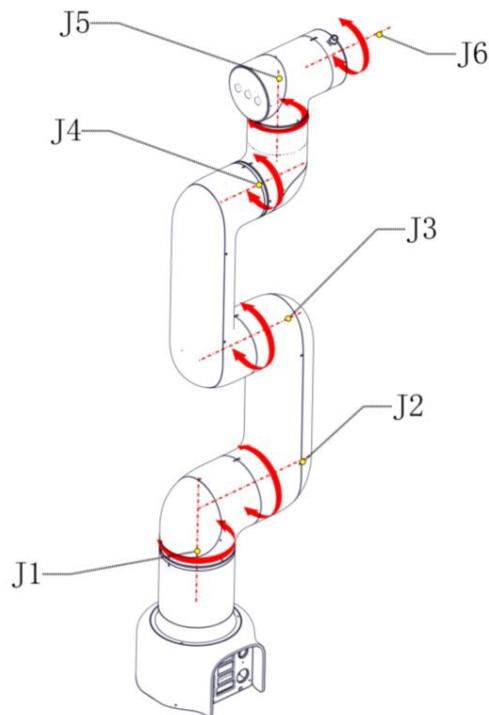


Figure 2- 2 Schematic diagram of the robot

The flange can be used to connect an end effector, such as an electric gripper or a pneumatic suction cup.

2.3 Scope of work

Table 2-2 shows the joint range data table for the Catbot collaborative robot. Please limit the actual range of the robot according to the range of motion of the robot before using the robot to avoid the consequences of insufficient arm length or collision.

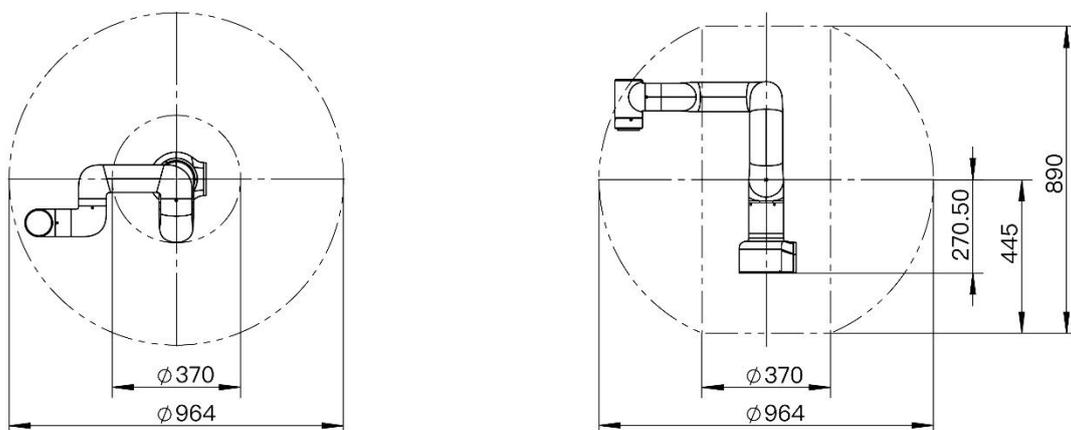


Figure 2- 3 Schematic diagram of the working space of the Catbot

2.4 Active load

The Catbot collaborative robot is rated at 3kg and can operate under loads of 3kg and below. As the load moves further and further away from the J6 flange position, its payload will become smaller and smaller.

2.5 Technical Parameter Table

The specifications parameters of the Catbot collaborative robot are shown in Table 2-2.

Table 2- 2 Technical Parameter

Catbot Robot	
Payload	3kg
Reach	600mm
Degrees of freedom	6
Working range	J1: $\pm 360^{\circ}$
	J2: $\pm 180^{\circ}$
	J3: $\pm 165^{\circ}$
	J4/J5/J6: $\pm 360^{\circ}$
Axis maximum speed	J1/J2/J3: 180° /sec
	J4/J5/J6: 225° /sec
Tool speed	1m/sec
Weight	18kg
Position repeatability	± 0.05 mm
Dimensions robot base	ϕ 150mm
I/O ports	Digital Input:12
	Digital Output:8
Tool I/O ports	Digital Input:3
	Digital Output:3
I/O power supply	24V 2A
Communication	TCP/IP
Programming mode	Graphical programming
IP classification	IP42
Power consumption	180W (Typical)
Materials	Aluminium alloy, PC, Rubber
Operating temperature range	0-50 $^{\circ}$ C
Power supply	DC 48V, 10.5A
	DC 24V, 4.5A

Collaboration operation	Test in accordance with: EN ISO 13849:2008 PL d EN ISO 10218-1: 2011-Clause 5.4.3
Noise	<70dB
Robot mounting	Any angle
Relative humidity	5%-95%
Interface and openness	SDK(Python, C++,Java),API,ROS
Power box	
Size (length × width × height)	297mm×200mm×128mm
Weight	6kg
Power supply	AC 220V, 50Hz
IP Rate	IP20
Teach Pendant(Optional)	
Size (L×W×H)	255mm×230mm×90mm
Weight	1.8kg
Screen resolution	1024×768
IP classification	IP20
Screen size	10.4"

3 Environment and installation

3.1 Transportation and storage

Since the robot is a precision device, please pay special attention to the protection of the device during transportation.

 Attention	Avoid applying external force to the robot's body and motor.
	When transporting the robot over long distances, it is necessary to fix it to the handling device to prevent the robot from tipping over. If necessary, use the packaging at the time of delivery.
	If the robot produces condensation during transportation/storage, turn the power on after removing condensation.

When transporting before installation, in principle, lifting equipment such as bridge crane should be used. Since the mass of the main body is not heavy, manual handling can also be considered without lifting equipment. Pay attention to safety when handling by hand, and take it with care to avoid damage to the equipment.

 Attention	Please use heavy lifting equipment such as driving as much as possible, and be careful of the people standing around to prevent the machine from rolling over.
	When carrying the Catbot collaborative robot manually, the number of personnel must not be less than two.
	The Catbot collaborative robot is a precision device, so avoid excessive vibration and shock when handling.
	The weight of the Catbot collaborative robot body is 15 kg.
	If the sling is used to lift the robot, in order to avoid the appearance damage of the robot, place a thick cloth in the place where the sling is in direct contact, and try to avoid the person standing under the robot body being lifted.
	The robot cable and power must be disconnected before handling.

The storage environment temperature of the robot is 0-50°C, and a special person shall be responsible for keeping it.

3.2 Open box examination

When the packing box is in place, please confirm that the robot package is intact. If there is any damage, please contact the logistics company and our company in time.

After unpacking, check the actual items in the box according to the list of items.

3.3 Working environment and conditions

Please set up the robot system in the environment that meets the requirements stated in table 3-1, in order to play / maintain the performance of the machine and use it safely.

Table 3- 1 Working environment and conditions

Temperature	0-50°C
Relative humidity	20%~70%
Indoor and outdoor requirements	Indoor
Other environmental requirements	<ul style="list-style-type: none"> - Avoid sun exposure. - Keep away from dust, oil smoke, salt, iron filings, etc.. - Keep away from flammable, corrosive liquids and gases. - Do not come into contact with water. - Do not transmit shocks, vibrations, etc. - Keep away from sources of strong electromagnetic interference.

3.4 Installation

3.4.1 Installation requirements

The actual weight of the Catbot collaborative robot is 18kg. Considering the movement of the robot, the center of gravity will move as the robot moves. Therefore, the robot needs to be fixed on a solid base to be used normally.

- The installation angles of the robot include vertical, inverted, side mounted angles, etc.
- Table 3-1 shows the installation environment.
- The installation position must not be less than the working range of the robot.

3.4.2 Installation

1. Interface size of robot base

The pedestal fixing hole is the interface that fixes the robot to other bases or planes. The specific hole size is shown in Figure 3-2. It is 4 through holes with a diameter of 6.5mm, which can be fixed with M6 bolts (M6 bolts and matching gaskets and nuts are installed in the package).

Table 3- 2 Specifications of robot base fixing screw

Bolt specification	M6
Bolt length	Select based on the thickness of the platform of the base mounting robot
Strength	12.9
Tightening torque	12Nm(recommended using a torque wrench for fastening)

The specific hole size is shown in Figure 3-1. Make sure that there is a corresponding threaded hole on the fixed base before installing.

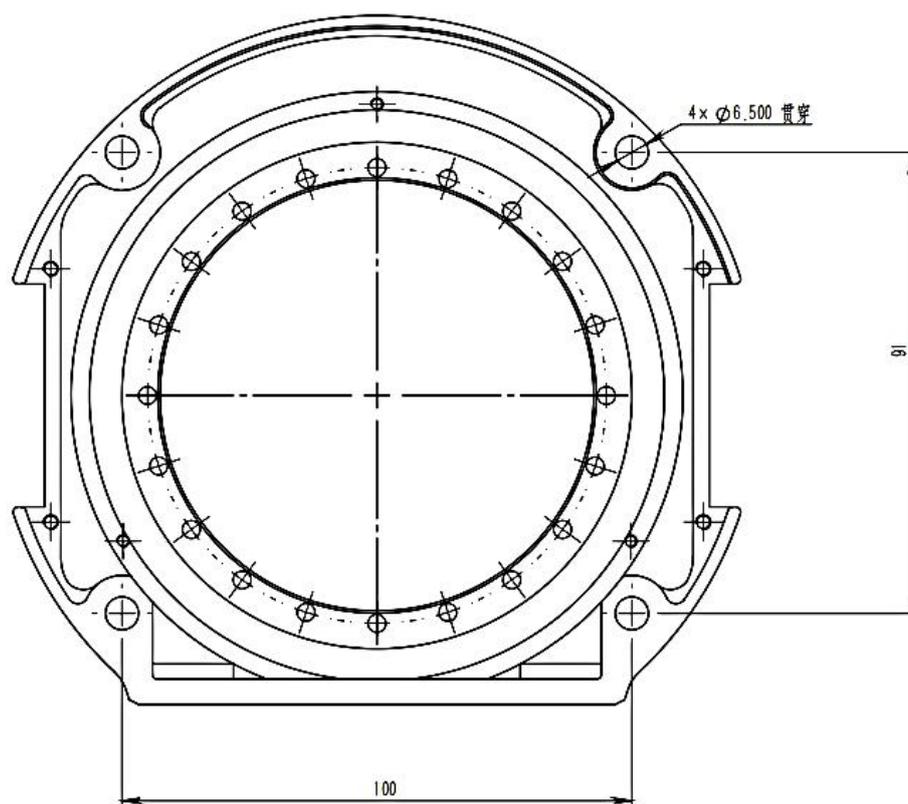


Figure 3- 1 The specific hole size

2. Mount the robot on the base

Before you officially install, please confirm:

- The environment to be installed complies with the requirements of Table 3-1.
- The installation position is not less than the working range of the robot, and there is enough space for installation, use, maintenance and repair.
- Place the stand in the proper position.
- Installation related tools are ready, such as screws, wrenches, etc.

After confirming the above, move the robot to the mounting surface of the base, adjust the position of the robot, and align the fixing hole of the robot base with the hole on the mounting surface of the base.

	<p>When adjusting the position of the robot on the mounting base, please avoid pushing the robot directly on the mounting surface of the base to avoid scratches.</p> <p>When manually moving the robot, please try to avoid applying external force to the weak part of the robot body to avoid unnecessary damage to the robot.</p>
Warning	

After aligning the holes, align the screws with the holes and tighten.

	<p>As long as the robot is not yet firmly mounted on the base, the robot may be in danger of falling over. Please keep the balance of the robot.</p>
Danger	

3. Place power box, teach pendant

Figure 3-2 shows the outline of the power supply box.

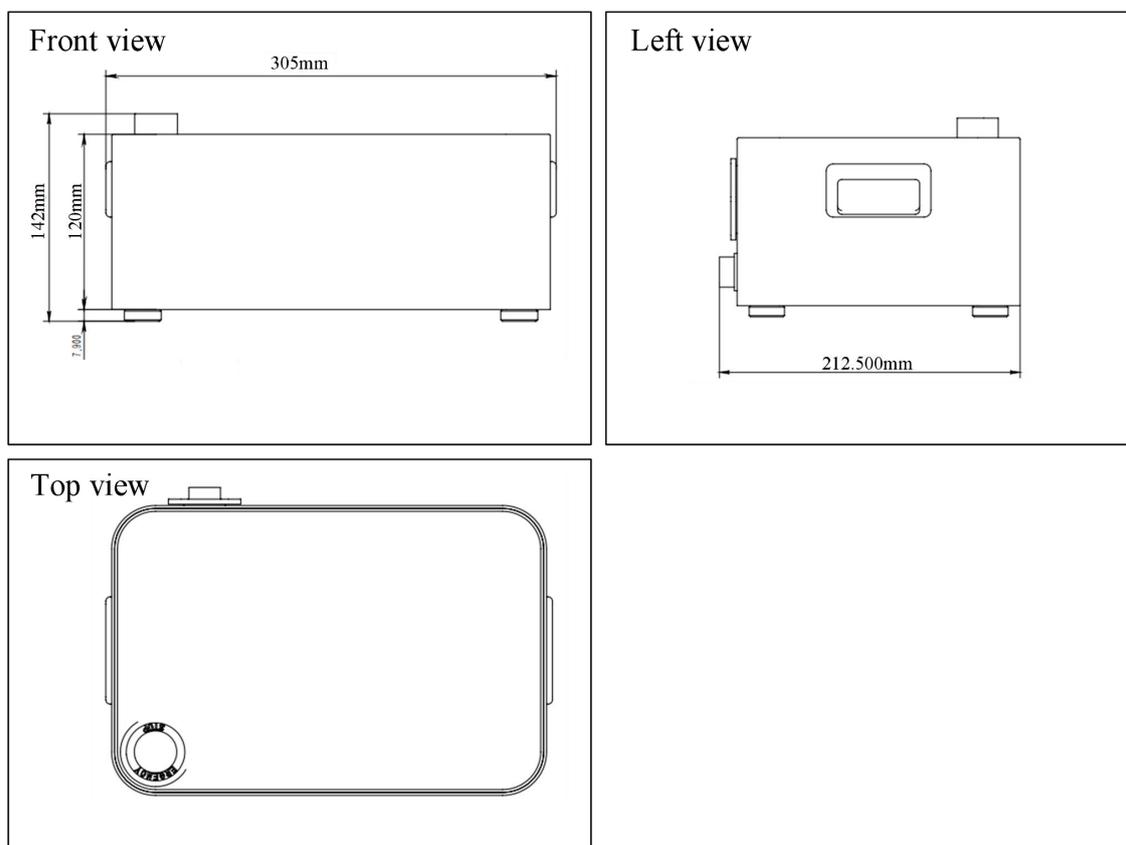


Figure 3- 2 Power box outline drawing

User needs to determine the placement based on the actual size of the power box and the cable orientation.

If the user purchases the teach pendant, the user can place it on the table or hang it on a self-installing hook.

	<p>When placing the power box, be careful not to keep its distance from the robot body beyond the length of the connecting cable.</p>
Attention	<p>Choose the placement position of the power box, try to avoid possible problems such as the controller being bumped or close to the wall not conducive to heat dissipation.</p>

Figure 3-3 shows the installation of the Catbot collaborative robot.



Figure 3- 3 Installation diagram

4. Install the end effector to the robot flange

The end effector is a device specially designed and installed at the mechanical interface for the robot to perform its tasks. For example, grippers, wrenches, welding torches, spray guns, etc.. The specific flange size is shown in Figure 3-4.

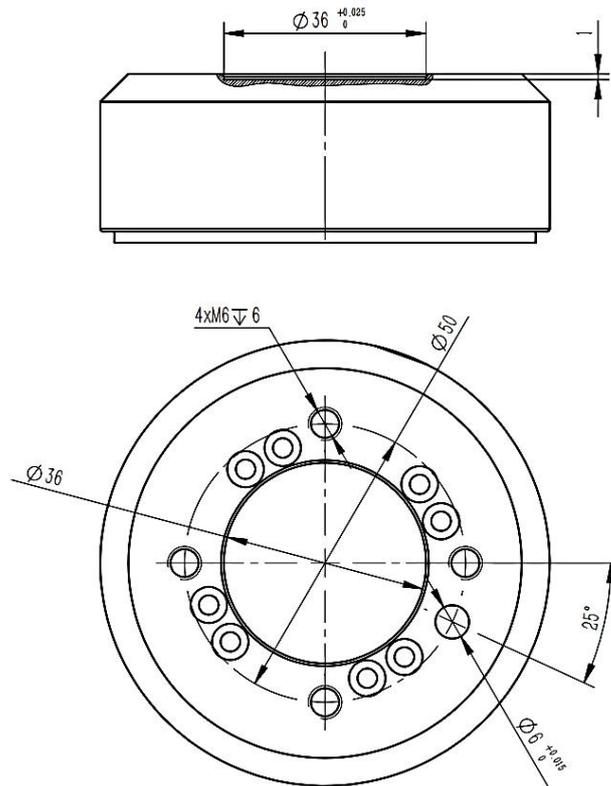


Figure 3- 4 Flange size

To install the end effector to the robot flange, there are two cases. One is that the end effector interface corresponds to the flange mechanical interface size; the other is to use the adapter that meets the size requirements of the connection interface for connection.

3.5 Electrical connections

3.5.1 Cable connection

There is only one main cable in the Catbot collaborative robot system. The specific information is shown in Table 3-2.

Table 3- 3 Main cables of the robot

Type	Connection	Length	Use description
Power cable	Power supply- Power box	2m	It supplies electricity to the entire robotic system.



Attention

The original cable must be used.

The cable interface is generally easy to damage. Do not use brute force or vigorously shake when plugging or unplugging. It is easy to cause the interface to loose or deform. Please insert and remove it carefully after alignment.

 Caution Electricity	<p>Be sure to make replacement after turning off the power to the controller and related equipment and unplugging the power cord. If the work is performed while the power is on, it may cause electric shock or malfunction.</p>
	<p>Be sure to connect the AC power cable to the power plug. Do not connect directly to the factory power supply. Turn off the power to the robot system by unplugging the power cord. It is extremely dangerous to work when the AC power cable is connected to the factory power supply, which may result in electric shock and malfunction of the robot system.</p>
	<p>Be careful not to bend the cable forcibly to avoid applying a load to the cable. Also, do not place heavy objects on the cable and forcibly bend or pull the cable. Failure to do so may result in damage to the cable, disconnection, or poor contact, electric shock or improper system operation.</p>
	<p>Before wiring, turn off the power of the controller and related devices and pull up the warning sign (do not turn on the power). Wiring under power-on conditions is extremely dangerous and may result in electric shock and malfunction of the robot system.</p>
	<p>Please ensure that the ground wire connection is reliable, otherwise it may cause fire or electric shock.</p>

3.6 System startup debugging

After the installation and connection work is completed, user need to plug in the power cord, turn on the power switch, press the system start button of the teach pendant. After that, user should observe whether the display button of the teach pendant is lit. If the light is on, it means the installation is successful, you can go to the next step. Otherwise user need to check if an important step is missing. If it is unsuccessful according to the manual, it may cause a malfunction during transportation. Do not disassemble the parts by yourself. Please contact a professional for disposal.

Robot system boot flow chart as shown in Figure 3-5. Please strictly follow the manual, otherwise the warranty will not be available if the robot is damaged due to improper operation.

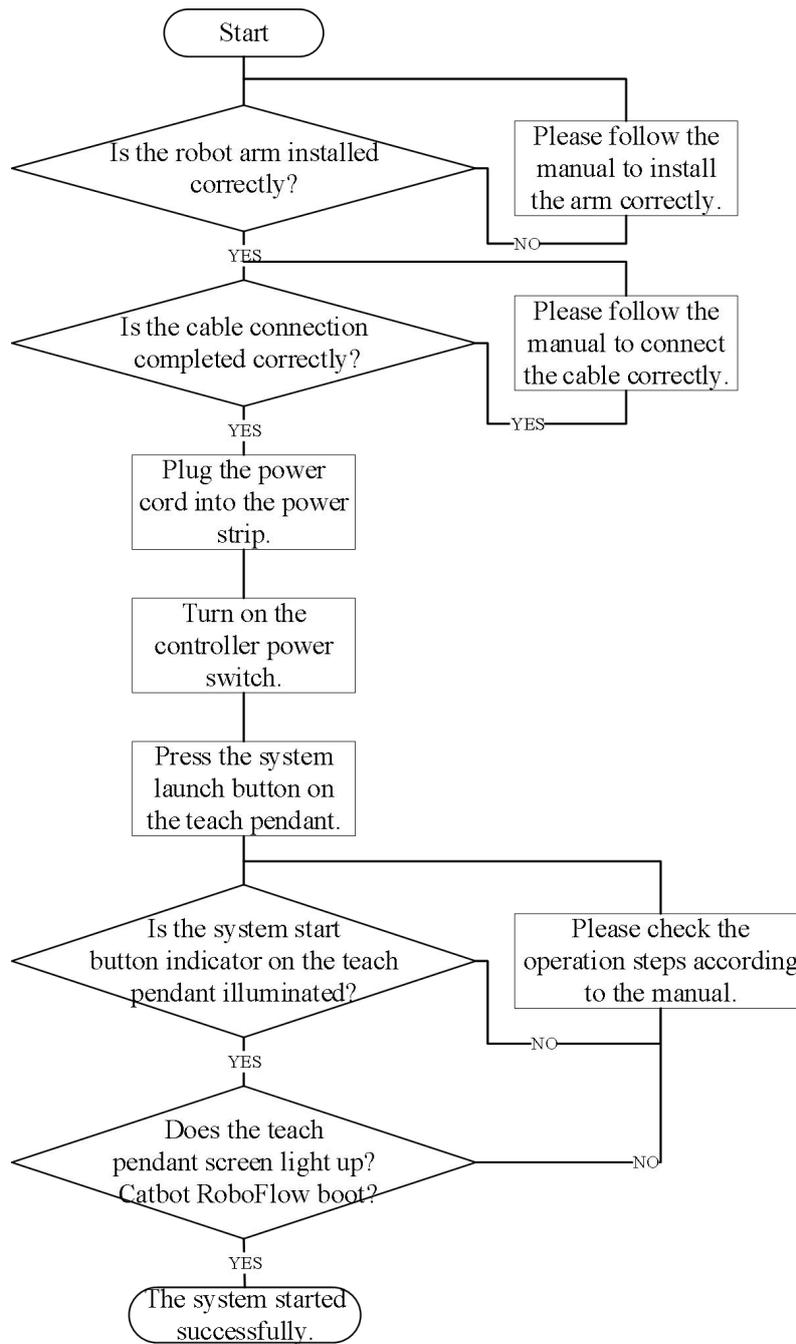


Figure 3- 5 Robot system boot flow chart

3.7 Interface description

Figure 3-6 shows the interface of the Catbot collaborative robot.

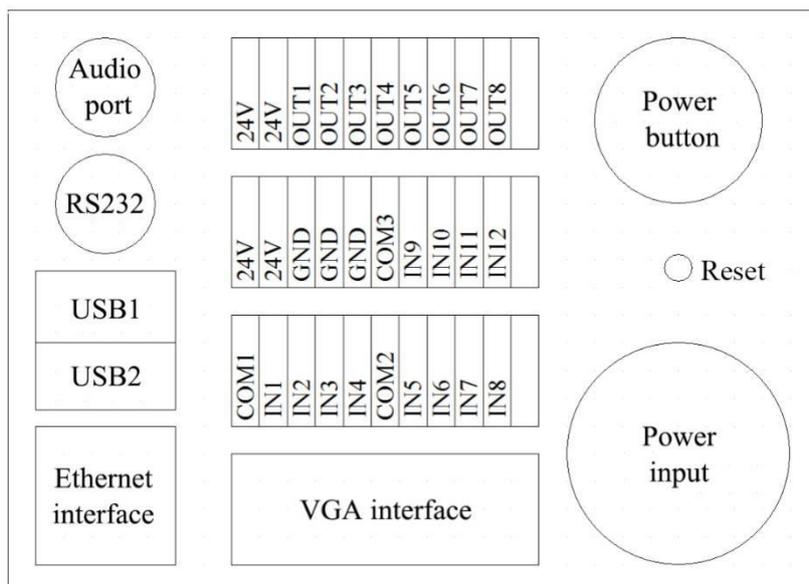


Figure 3- 6 Robot interface illustration

The Catbot collaborative robot provides three communication methods: USB communication, serial communication, and Ethernet communication.

The Catbot collaborative robot provides an audio interface and a VGA display interface for easy interaction, making it easier and convenient for users to use during operation. It is a very powerful collaborative robot assistant.

The Catbot collaborative robot provides eight digital input signals and eight digital output signals. It also provides an internal DC 24V power supply for easy integration with external equipment to form an automated control system.

4 Maintenance

4.1 About the safety during maintenance

When the robot has been running for a period of time, it is necessary to carry out necessary maintenance to ensure that the robot's function is normal.

- Be sure to perform robot maintenance by trained personnel.
- Personnel trained in safety refer to those that have been regulated by national laws and regulations.
- Personnel who are trained in the safety when engaged in industrial robot-related business (training on knowledge, operation, teaching, etc. of industrial robots, knowledge of business operations such as inspections, and related laws and regulations).
- The company's training is for those who have completed the installation training and maintenance training.

Before maintenance, please read “Safety on Maintenance”, this manual and related manuals, and perform maintenance based on a thorough understanding of safety maintenance methods.

 <p>Warning</p>	Do not change any information in the software security configuration (such as force limits). If the safety parameters change, the entire robot system should be considered a new system, which means that all safety audit processes, such as risk assessment, must be updated.
	Do not remove any parts unless otherwise stated in this manual. The maintenance steps shall be strictly adhered to according to the content. If wrong disassemble or maintenance is performed, not only will the robot system malfunction, but it may also cause serious safety problems.
	Be sure to check the robot movement after replacing the parts outside the safety fence. Otherwise, the robot before the action confirmation may perform unexpected actions and may cause serious safety problems.
	All disassembled robots need to be recalibrated.
	If you have not received training, keep away from the robot when the power is on. Also, do not enter the action area. Even if you see that the robot seems to stop moving, the robot that is powered on may accidentally operate and may cause serious safety problems.
	Before entering the normal operation, please confirm that the emergency stop switch and the safety guard switch are in normal operation. If the switch does not operate normally, the safety function cannot be performed in an emergency, which may result in serious injury or serious damage, which is very dangerous.



Caution Electricity

Be sure to perform maintenance, replacement, and wiring work after turning off the power to the controller and related equipment and unplugging the power cord. Failure to do so may result in electric shock or malfunction.

4.2 Maintenance plan

In order to keep the robot to maintain efficient performance over the long term, regular maintenance is required. The maintenance personnel must prepare an overhaul plan and strictly implement it. The maintenance plan for the Catbot collaborative robot is shown in Table 5-1.

Table 4- 1 Maintenance schedule

No.	Contents	Equipment	Routine	1 month	3 months	6 months	12 months	
1	Inspection	Robot appearance	√					
2		Cable interface		√				
3		Motor, reducer					√	
4		Cable harness	external		√			
5			internal				√	
6		Screw	surface		√			
7			internal				√	
8	Clean	Whole robot	√					
9	Replacement	Lubricating oil	Replace when the gear unit needs to be replaced.					
10		Battery	When the battery low warning appears.					

4.3 Who to contact

1. System integrator

You can directly contact the system integrator responsible for installing and commissioning the Catbot collaborative robot.

2. Supplier

You can contact the supplier of Elephant Robotics in your region. For specific supplier information, please visit the official website:

www.elephantrobotics.com.

3. Official website

You can check out on the official website of the Elephant Robotics (www.elephantrobotics.com) for more information.

5 Repair

When the robot malfunctions, do not continue to operate. Please immediately contact the operator who has received the prescribed training to perform fault analysis, so as to clearly grasp the phenomenon and determine what components are abnormal.

Matters on repair, inspection, adjustment, etc. of the robot must be carried out by an authorized system integrator or agent. Please contact a professional for disposal. Do not disassemble the robot at will. See section 4.3 for contact details.

When contacting, please prepare the following items in advance:

- Controller name, serial number.
- Robot name, serial number.
- Description of problem (preferably with pictures).