Agilebot

Product Manual

Mechanical Manual for GBT-C5A Series Robots

Product Manual

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V1.3

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The original language of this Publication is Chinese.

International standard units are adopted in all publications. GB means Chinese national standard.

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V1.3	Aug 01,2025	Release

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Safety instructions

GBT-C5A series collaborative robots can be used to operate tools, end-effectors or fixtures, or process and transport workpieces.

Meanwhile, the GBT-C5A series collaborative robots are provided with safety features. After thorough risk assessment, this series of robots can work without safety fences or with people.

Note: Human-computer collaborative operation should be a non-hazardous application. Namely, it has been proven after risk assessment that application scenarios, including tools/end-effectors, workpieces, obstacles and other machines, have no significant hazards or all risks are acceptable.

The robots must not be used in any application incompatible with the intended use, including but not limited to:

- Potential explosive environment

- Medical applications

- Applications without risk assessment

- Applications beyond product specifications

- Use as a climbing tool

- Operations beyond the allowed operating parameter range

Besides safety precautions in this chapter, this Manual contains other safety instructions, which must be followed as well. For safety issues uncovered in this Manual, please refer to the Safety Manual.

Definition of user

The operators are defined as follows:

➤ Operator

Perform power-on/off operation on the robot.

Start the robot program from the panel board.

➤ Robot Engineer

Operate the robot.

Perform teaching and programming debugging of the robot.

➤ Maintenance Engineer

Operate the robot.

Perform teaching of the robot.

Carry out maintenance (repair, adjustment, replacement) operations on the robot.

The user must receive professional training on the robot. When operating, programming and maintaining the robot, the operator, programmer and maintenance engineer must clearly give a safety warning and wear at least the following protective articles.

➤ Work clothes suitable for operations

➤ Safety shoes

➤ Safety helmets

➤ Goggles

Definition of safety signs

This Manual includes safety warnings to ensure personal safety of the users and avoid any damage to the machine tool and describes them with "Danger" and "Warning" in the main text based on their importance in safety.

In addition, relevant additional descriptions are described as "Caution".

Before use, the user must thoroughly read the precautions described in "Danger", "Warning" and "Caution".

Identification	Definition
⚠ Danger	It indicates dangerous situations possibly resulting in serious injury or death to the user during incorrect operation.
⚠ Warning	It indicates dangerous situations possibly resulting in mild or moderate personal injury or property damage during incorrect operation.
⚠ Caution	It provides additional descriptions outside the scope of danger or warning.

Please read this Manual carefully and keep it secure for easy reference at any time.

Robot training

The operator, robot engineer and maintenance engineer must receive the following operation and maintenance training.

> ➢ Fundamentals of robots
>
> ➢ Safety precautions for robots
>
> ➢ Jogging of robots
>
> ➢ Manual operation and teaching of robots
>
> ➢ Program creation, teaching and operation
>
> ➢ Auto run
>
> ➢ Composition and functionality of a robot
>
> ➢ Setting of coordinate system
>
> ➢ System backup and recovery
>
> ➢ Zero calibration
>
> ➢ Robot mounting method

We have robot training courses available. Please contact us for details.

⚠ Warning

The operator, robot engineer and maintenance engineer should receive training in accordance with the laws of the countries or regions where robots are mounted and operated. Those working inside the working range of the robot without training may be caught or collided by the robot body, posing the risk of serious injury or death.

Steps for robot axis operation in emergency and abnormal situations

When an emergency occurs, press the E-stop button on the control handle to immediately stop all motions of the robot. Emergency shutdown cannot be used as a risk reduction measure, but can be considered as a secondary protective device and is only used in emergency. Please stop the robot (if required) by other means under normal circumstances.

In such emergency situations as power failure or no power, two different methods can be adopted to forcibly move the robot joints:

1. Forcible manual drive: force the joints to rotate by pushing or pulling the robot arm. The brake of each joint is provided with a latch brake. The joint can rotate when the torque borne by the joint is higher than the safe torque of the friction clutch.

2. Manual release of the brake: Press the sliding rod to manually release the brake as shown in the figure below.

Slider for releasing the axis brake
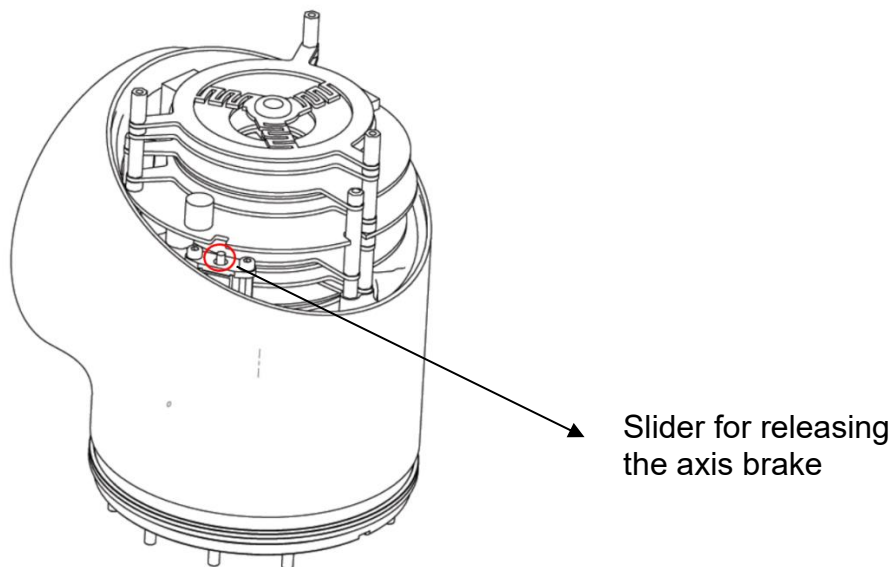
⚠️ Warning

When the E-stop button is pressed, the robot system may cut off the power supply of the robot. In this case, a slight downward movement of the robot under the action of gravity may pose a risk of injury or collision with the human body although the brake between the joints can lock the joints.

The forcible manual movement of the robot arm is only allowed in emergency situations and may damage the joint. So, it cannot be used as daily operation.

The robot joint may move under the action of gravity if the brake is manually released. Therefore, before the brake is manually released, it is necessary to effectively support the robot body and the tools or workpieces mounted on the robot.

Safety warning label

The robot body bears several safety and information labels, which contain important information related to the product. This information is very useful for all persons operating the robot system, e.g. during mounting, maintenance or operation.

The safety labels are only graphical and applicable to all languages.

> ⚠ Caution
>
> It is required to observe the safety and health signs on the product label. In addition, it is also necessary to comply with the supplementary safety information provided by the system builder or integrator.

Sign	Description
⚡	An electric shock may occur if the internally energized parts of the robot are touched when powered on.
✋	Keep your hands away from the robot, otherwise your hands or fingers may get stuck between robot axes.
♨	Beware of burns due to high surface temperature.

1 HANDLING AND MOUNTING

1.1 HANDLING

During transportation, please fix the robot in the packaging box according to the packing posture (as shown in Fig. 1.1). The data of each axis under the packing posture is shown in Table 1.1. The purpose is to avoid robot collisions or damages due to unexpected movements during transportation.

During transportation, it is necessary to fix the original package and ensure that the robot is stable.

When the robot is lifted, corresponding measures should be taken for positioning to avoid accidental movement, causing personal injury or robot damage on the site.
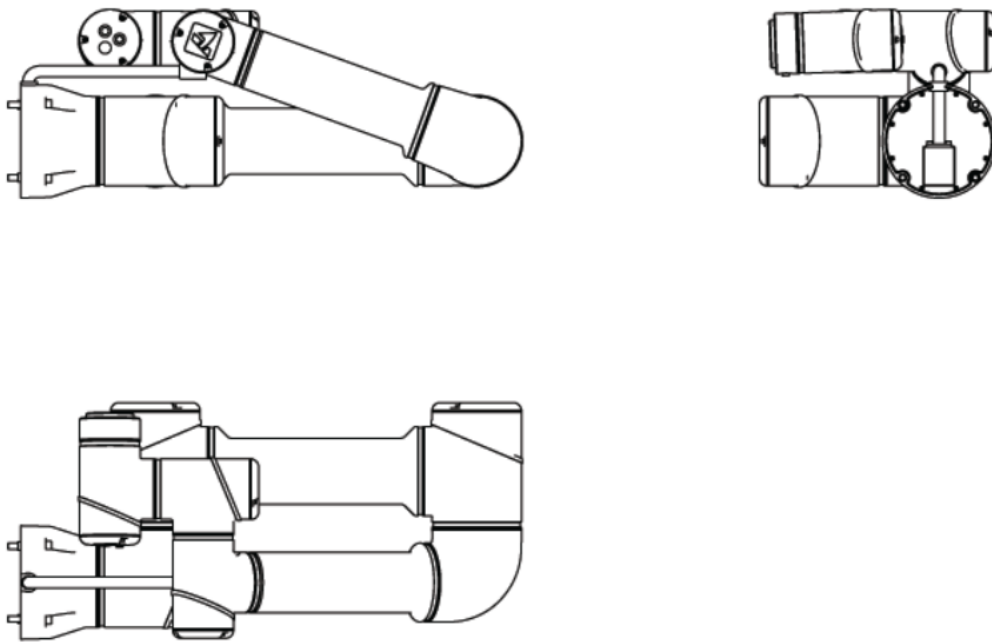
Fig. 1.1 Packing Posture

Axis No.	1	2	3	4	5	6
Angle/stroke	0°	90°	160°	110°	0°	0°

Table 1.1 Axis Data at Packing Posture

The weight of C5A series robot is shown in Fig. 1.2:

Robot model	Weight (excluding cables)
GBT-C5A	23 kg

Table 1.2 Weights of GBT-C5A Series Robots

⚠ Caution

The weight of this robot only refers to its body weight, excluding the weight of the controller.

Properly choose the pickup points when manually handling the robot. Unsuitable pickup points may easily result in finger pinching or other injuries as well as damage to the robot.

When a forklift is used, the robot must be firmly fixed on the forklift and must not shake or move relative to the forklift during transportation.

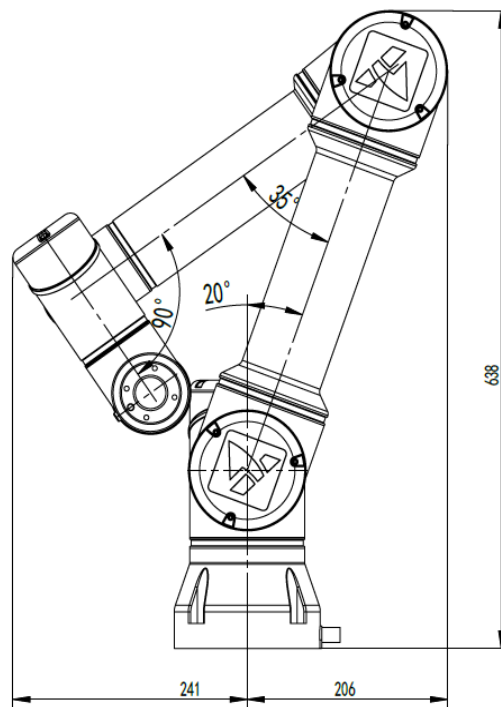The transport posture of the robot is shown in Fig. 1.2:
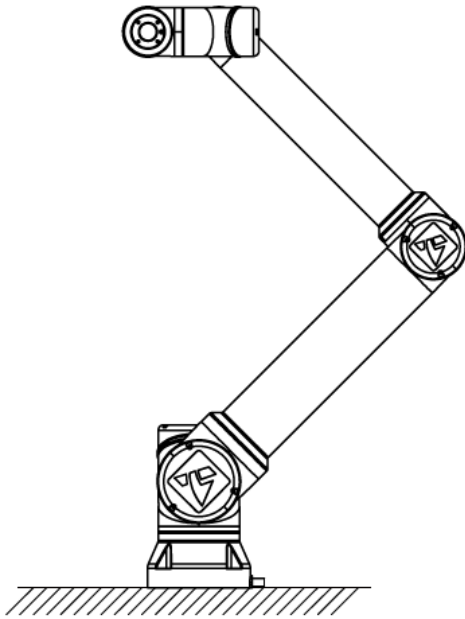

Fig. 1.2 Transport Posture

⚠ Caution

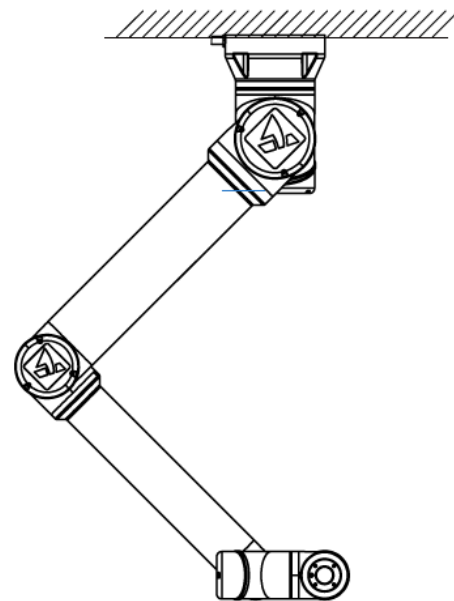The dimensional units for all measurements of the drawings in this section are in millimeters (mm).

Axis No.	1	2	3	4	5	6
Angle/stroke	0°	+20°	-65°	0°	-90°	0°

Table 1.3 Axis Data at Transport Posture

1.2 MOUNTING

1.Forward installation   2.Inverted installation
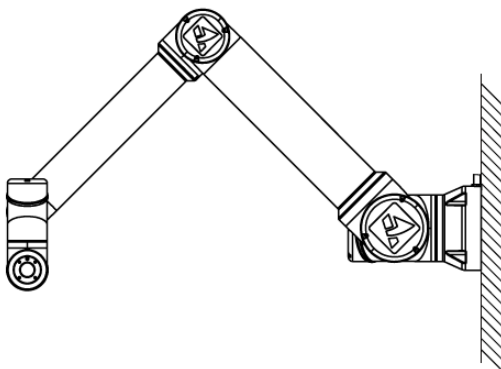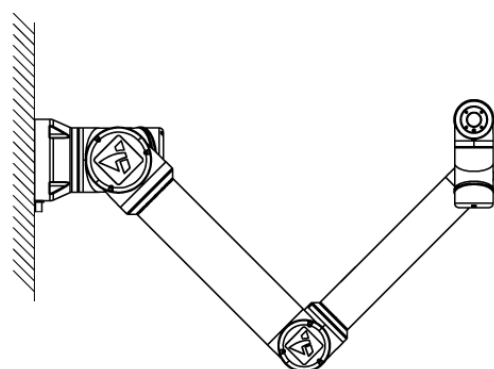
3.Side installation   4.Side installation

Refer to the direction of the base coordinate system during ground mounting. The moment direction is shown in Fig. 1.3. For other mounting forms, please consult Agilebot.

Mount the robot on a sturdy, vibration-free surface sufficient to bear at least 10 times the maximum moment of the base joint (≥1950Nm) and at least 5 times the weight of the robot arm (≥118kg).
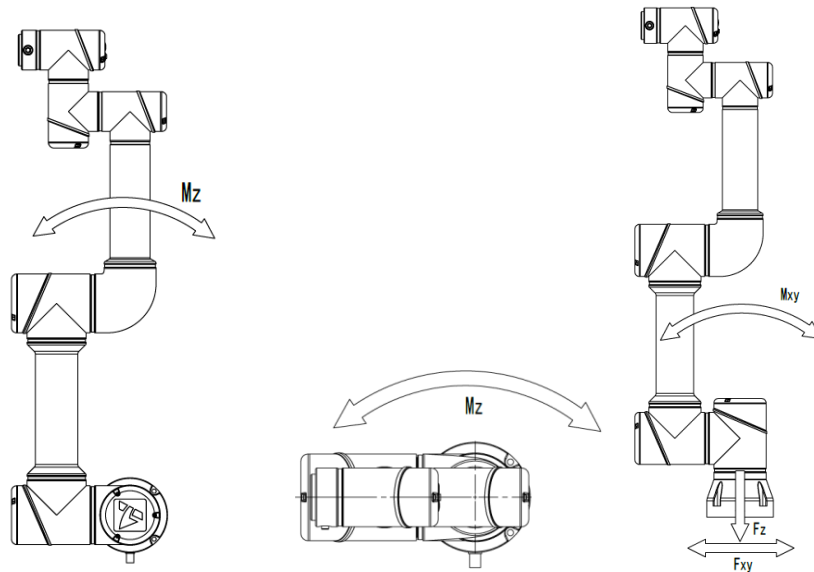
Fig. 1.3 Moment Directions of GBT-C5A

1.3 MOUNTING PREPARATION AND STEPS

1. Safety measures: gloves, work shoes and safety helmets

2. Tools: Allen wrench, mounting bolts, nuts and washers

3. Mounting the robot to the floor or base (see Fig. 1.4)

Screws fixing the robot to the
base or bottom plate
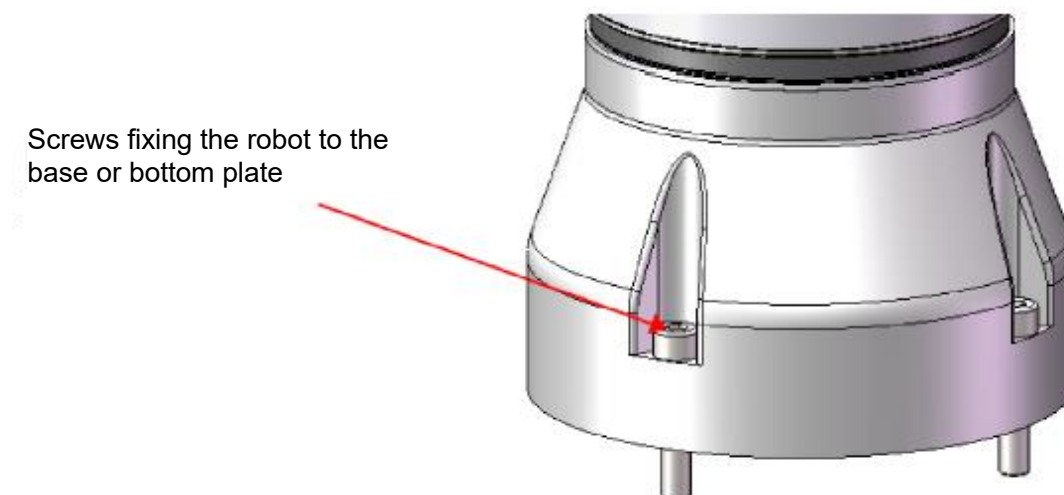
Fig. 1.4 Nuts Fixing Robot to Base or Bottom Plate

Parts required for mounting the robot:

S/N	Name	Number (pcs)
1	Hex socket cap screws M8X40	4

The mounting dimensions are shown in Fig. 1.5.
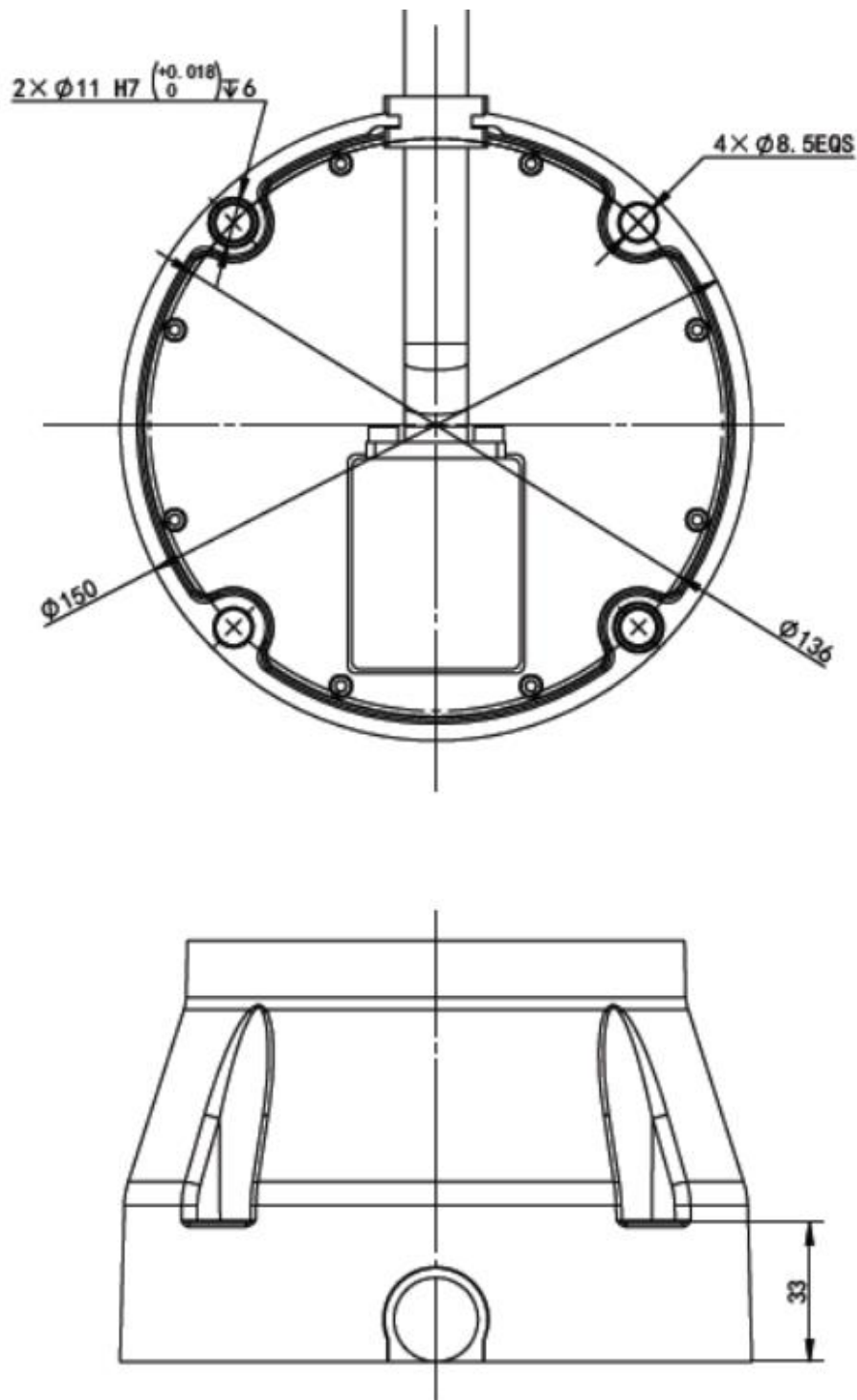
| ⚠ | Caution |

The dimensional units for all measurements of the drawings in this section are in millimeters (mm).

Fig. 1.5 Base Mounting Dimensions
Mechanical Manual for GBT-C5A Series Robots

Mounting requirements:

Mounting base required	Flatness requirements	≤0.2mm
	Inclination angle	Any angle
Storage conditions	Minimum environmental temperature	-20℃
	Maximum environmental temperature	60℃
Operating conditions	Minimum temperature	0℃
	Maximum temperature	50℃
Environmental conditions	Indoors; avoid direct sunlight, dust, salt, metal powder or other pollutants; stay away from flammable or other highly corrosive liquids and gases; avoid shock and vibration.	

⚠ Warning

Those designing or manufacturing the robot system with this product must read this Manual to understand basic precautions before work. Otherwise, it is very dangerous and may result in serious injury or significant damage.

Please use the robot system under the environmental conditions recorded in the Manual. This product is designed and manufactured firstly for the purpose of typical indoor environments. Operation in an environment unsatisfying the environmental conditions may not only shorten the service life, but also cause serious safety issues.

Please use the robot system within the specified specifications. Operation beyond the specifications may not only shorten the service life, but also cause serious safety issues.

When mounting the robot system, you must wear at least the following protective devices.

- Work clothes suitable for operations

- Safety helmets

- Safety shoes

⚠ Warning

Be sure to mount an emergency stop device so that the operator can immediately stop the system. Otherwise, it is very dangerous and may cause serious injury or significant damage to the robot system. Ensure that the E-stop switch of the wired handle can operate properly when safety doors and other emergency stop or safety input signals are connected to the controller connector.

Mount the robot in a position with sufficient space and ensure that the surrounding area of the end fixture or the workpiece does not collide with walls or safety guards when the robot moves the workpiece and is extending. A collision (if any) may cause serious personal injury or significant equipment damage.

Fix the robot firmly before power-on or operation. Otherwise, it is very dangerous - the robot may fall, resulting in serious injury or significant damage to the robotic arm system.

Before mounting and operation, please ensure that all components of the robot are in place and free from external defects. Missing or defective components may lead to improper operation of the robot. It is very dangerous and may cause serious injury or significant damage.

Never use the robot near the devices generating powerful electromagnetic forces. Otherwise, it may cause malfunction or defect of the robot.

Never use the robot in places subject to electromagnetic interference, electrostatic discharge or radio frequency interference risk. Otherwise, it may cause malfunction of the robot.

Never use the robot in places exposed to flammable gases, dust, gasoline or solvents that may explode or catch fire. Otherwise, it may cause serious accidents or fires involving injury (including death).

Never place your hands or fingers near the moving parts of the robot. Otherwise, it may cause hand pinching and other injuries.

Never mount the robot controller upside down or tilted.

⚠️ Warning

Make sure to connect the power cable to an electrical component that can be quickly disconnected. Never connect it directly to the main power supply of the factory or share the same electrical protector with other equipment at the first connection point.

Do not open the controller or robot cover except for maintenance. It is very dangerous when the controller cover is opened. Even if the main power is turned off, the internal high-voltage charging unit may cause electric shock as well.

Before connecting or disconnecting the cable, ensure that the power to the upper port of the connection point is turned off. It is very dangerous to connect or disconnect the cable in the power-on state. It may lead to electric shock or controller failure.

Ensure that the power supply is connected by a qualified operator.

The robot must be grounded properly or provided with a residual current protector to ensure safety according to field conditions.

Make sure to disconnect the power when opening the front cover of the controller. It is very dangerous to touch the power terminal inside the controller during power-on. It may cause electric shock or serious safety issues.

Make sure to mount the controller and connect its cable when mounting the robot. Prevent the connector from being impacted or loaded during cabling. Never forcefully pull the cable during connection.

Please make sure to turn off the power of the controller and related equipment and pull up the warning sign (e.g. no power-on) before wiring. It is very dangerous for wiring in the power-on state. It may lead to electric shock or robot system malfunction. (Wiring refers to all wiring actions related to the robot.)

⚠️ Caution

The corresponding robot S/N is indicated on the controller label. Connect the controller and the robot correctly. In case of a mistake in the connection relationship, not only the robot system may not function properly, but also it may cause safety issues.

According to the rigidity of the mounting platform, vibration (resonance) may occur during operation. In case of vibration, increase the rigidity of the platform or change the speed or acceleration and deceleration settings.

Please confirm that the pins are not bent before the connector is connected. If the pins are bent during connection, it may damage the connector or cause the robot system to malfunction.

2 CONNECTION TO CONTROLLER

The robot mopping cable must be inserted into the connector on the side of the control box. When starting the robot arm, be sure to tighten the clip at the connection between the cable and the electrical cabinet. The robot's power supply must be cut off when disconnecting the robot cable. As shown in the figure.

⚠ Warning

Before connecting the power of the controller, please connect the robot and the controller with a ground wire. Electric shock may occur if the ground wire is not connected.
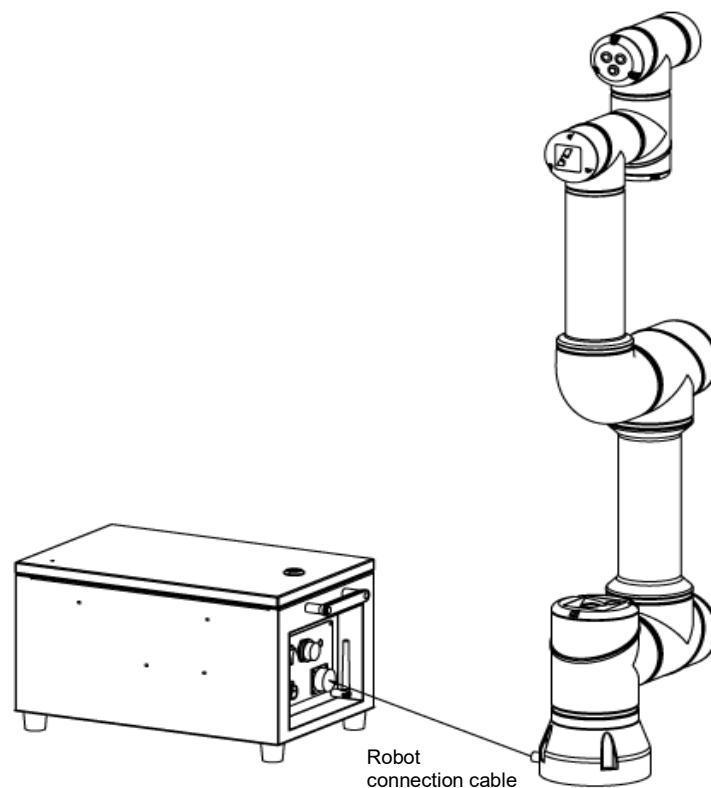
Robot
connection cable

Fig. 2.1 Diagram for Connection between GBT-C5A Robot and Controller

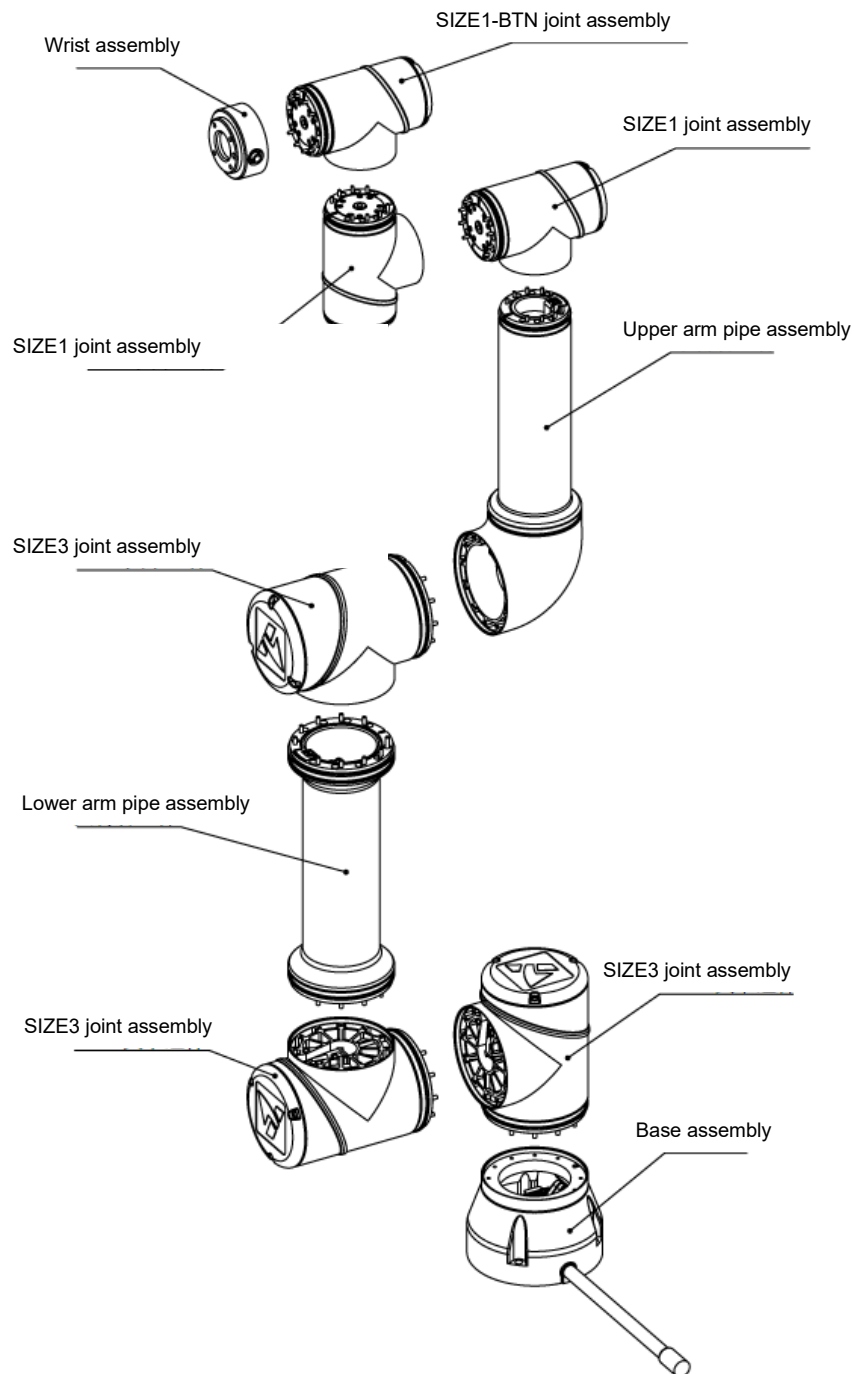# 3 BASIC SPECIFICATION

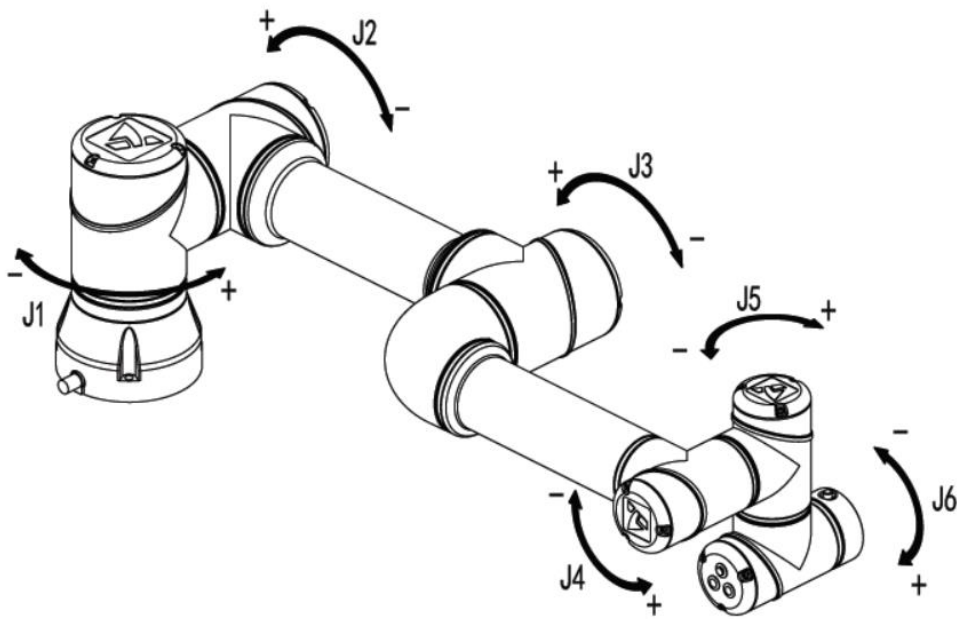## 3.1 COMPOSITION OF ROBOT

Fig. 3.1 Diagram for Robot Joints

Fig. 3.2 Various Motion Joints and Forward Motion Direction of GBT-C5A

The performance parameters of GBT-C5A series robot are shown in Fig. 3.1.

Model	GBT-C5A	
Basic specification		
Axes	6	
Reach	933mm	
Maximum payload	5kg	
Protection level	IP67	
Mounting method	Any angle	
Motion parameters[Note]		
Axis motion speed	1	180°/s
	2	180°/s
	3	180°/s
	4	180°/s
	5	180°/s
	6	180°/s
Axis movement range		±360°
		±360°
		−165°~165°
		±360°
		±360°
		±360°

Position repeatability	0.02mm

Note: The axis movement range refers to the movement of the main body in Cartesian space, and the movement range may be restricted by the tooling fixtures installed at the end.

Table 3.1 Performance Parameter Table

⚠️ Caution

1. Even when the robot is used within the specification range, certain action programs may shorten the lifespan of the gearbox or cause overheating alarms.

2. It is impossible to reach maximum speed of each axis at a short action distance.

3. In a low temperature of -5 ℃ or below, or after long-time stop under a low temperature (≤ -5 ℃), the robot may send out collision alarms or overcurrent alarms at the beginning of operation due to high impedance of the joint area, Therefore, it is recommended to warm up the motor for at least half an hour in advance.

4. Please consult our company for use the robot in the environments with high/low temperature, vibration, dust, high concentration of cutting oil, etc.

3.2 DIAGRAM FOR OVERALL DIMENSIONS AND ACTION RANGE

Fig. 3.3 Overall Dimensions of GBT-C5A Series

⚠ Caution

The dimensional units for all measurements of the drawings in this section are in millimeters (mm).

⚠ Caution

The workspace shown in this figure is the maximum space that can be theoretically reached. It may vary depending on the mounting method during actual operation. In practical application, please consider the impact of mounting method on the workspace.

Recommended Reach R850

Max.Working Range
R959.5

1693

178

847

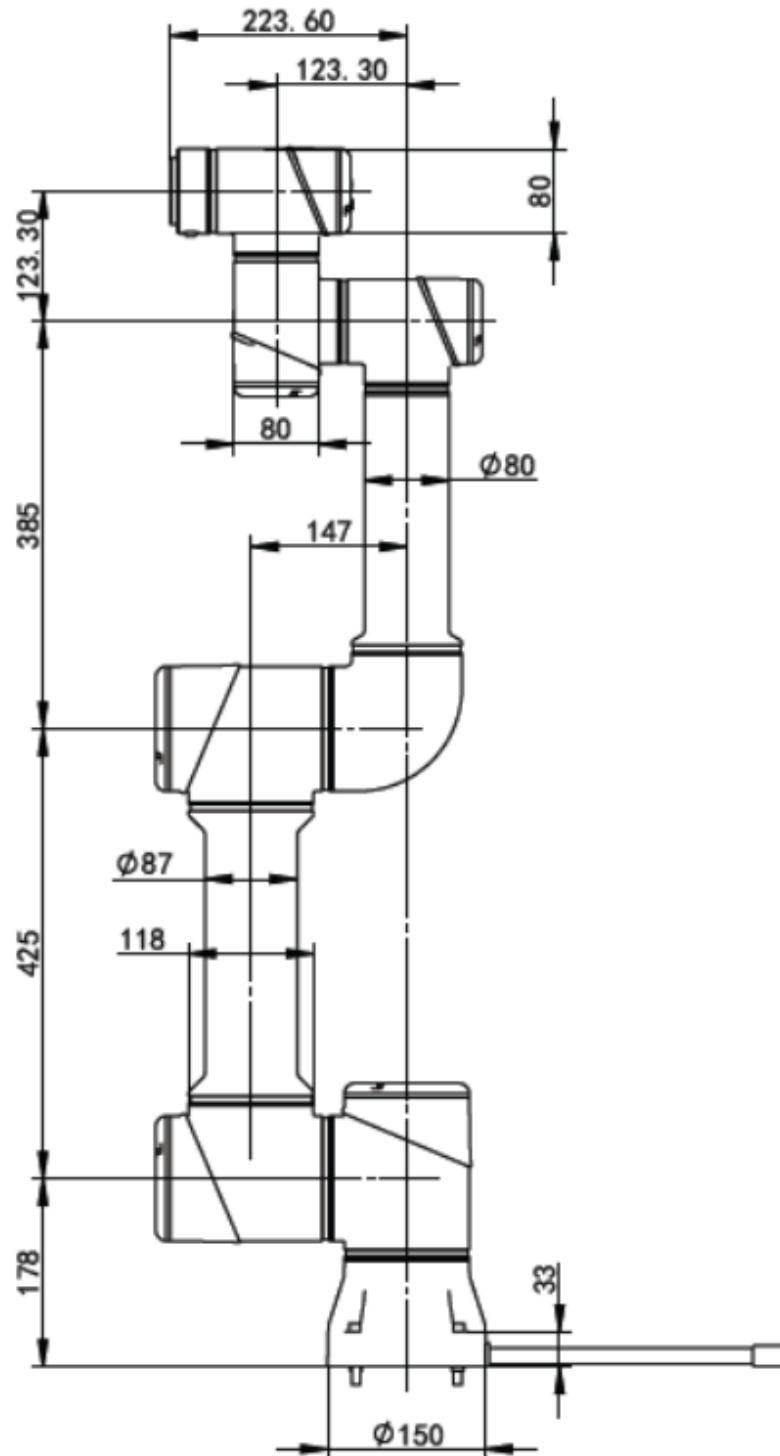Ø150

Recommended Reach
R850
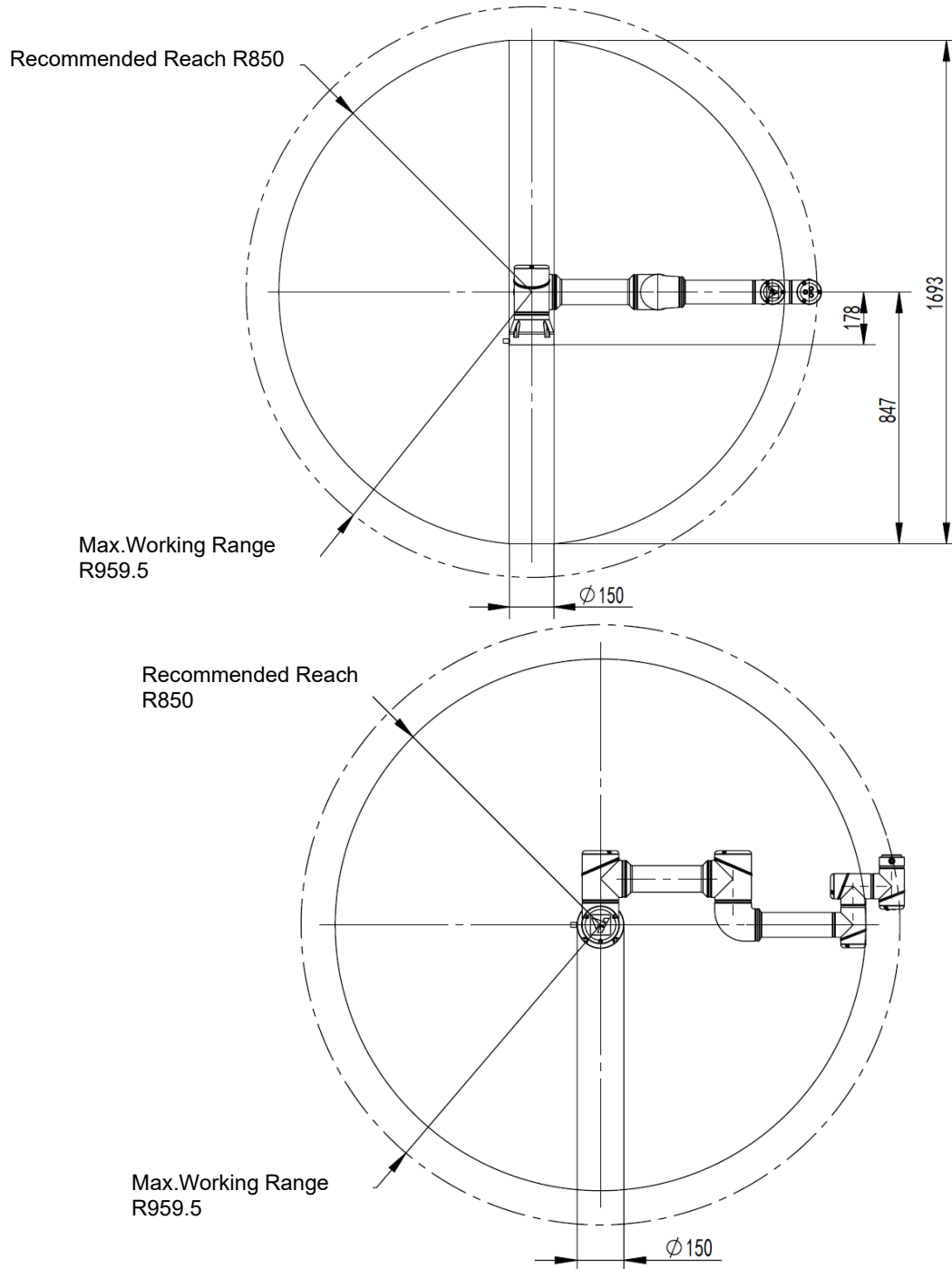
Max.Working Range
R959.5

Ø150

Fig. 3.4 Operating Space of GBT-C5A Series

⚠ Caution

The dimensional units for all measurements of the drawings in this section are in millimeters (mm).

3.3 WRIST PAYLOAD CONDITIONS

The payload of the robot must comply with the payload curve diagram. It is important to carefully confirm the mass and inertia of the payload before operation. Overload may lead to excessive operation of the motor, the gearbox and relevant structures. It may also affect their service life, seriously damage the robot and even cause injury.
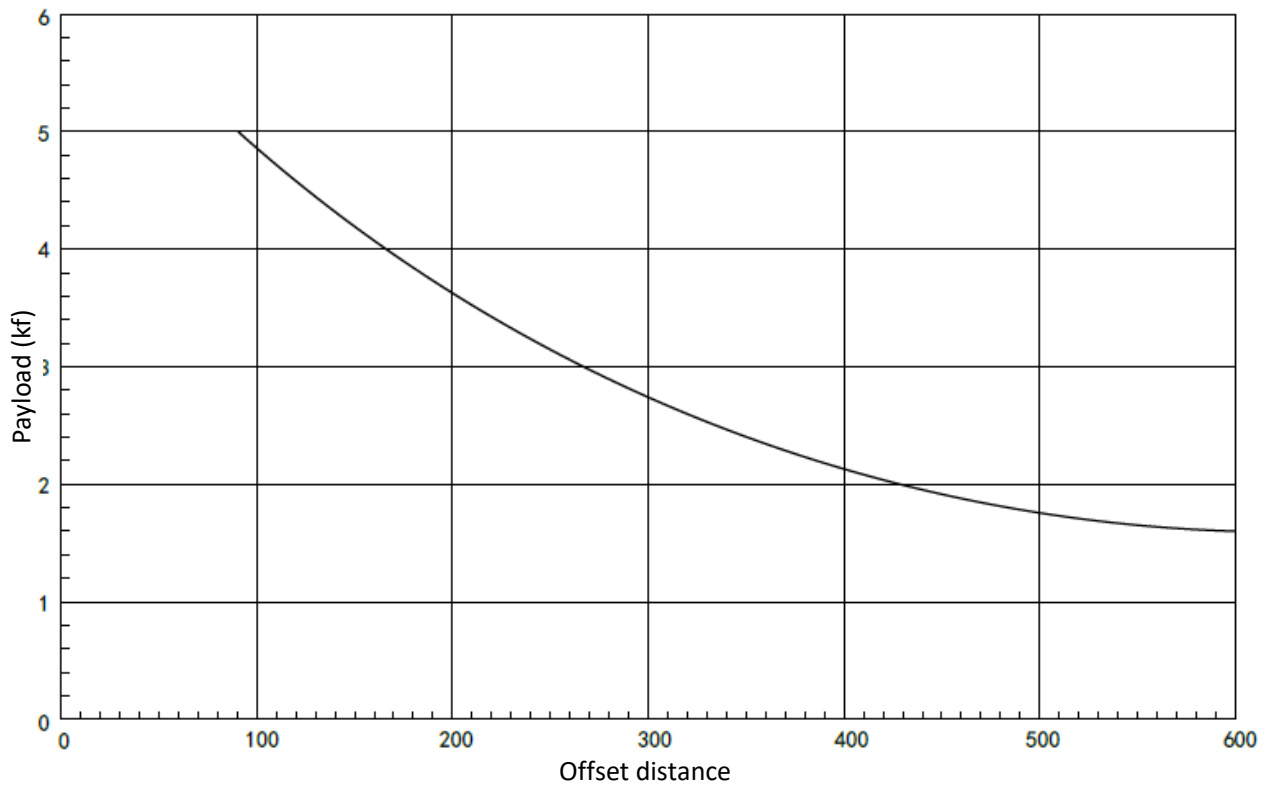

Fig. 3.6 Payload Curve of GBT-C5A

Note: The offset distance is the distance from the barycenter of the payload to the center point of the end flange face of the robot.

4 MOUNT THE DEVICE ONTO THE ROBOT

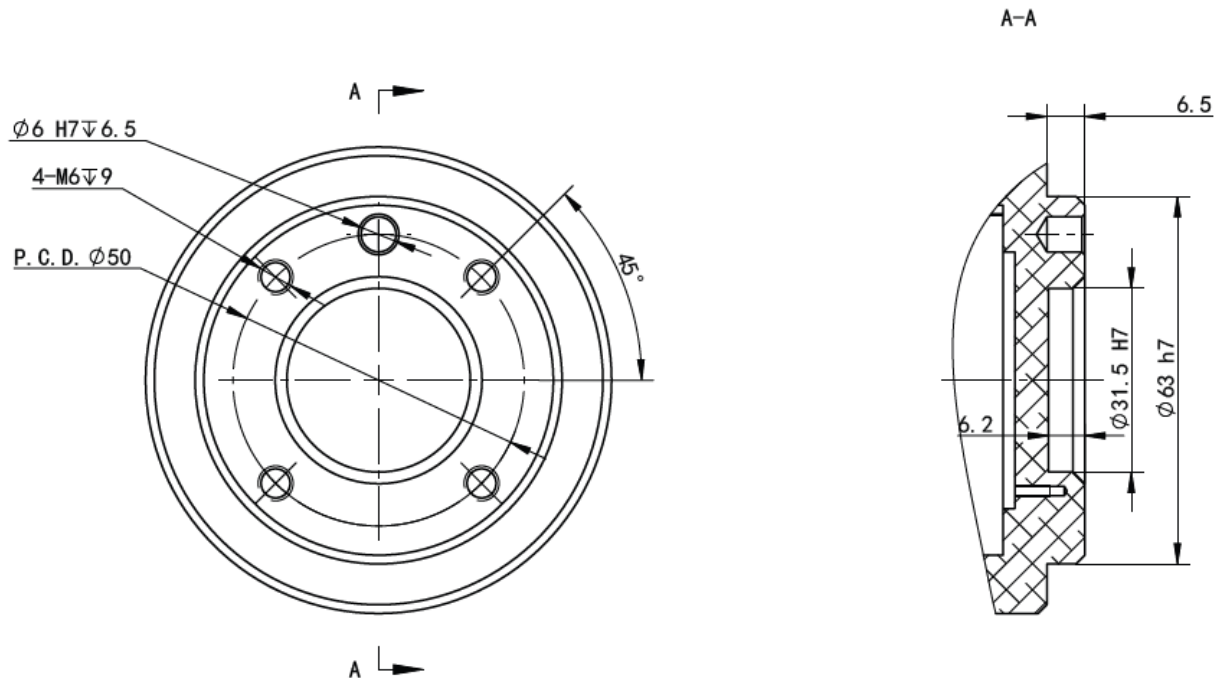## 4.1 MOUNT THE END-EFFECTOR TO THE FRONT END OF THE WRIST

Fig. 4.1 Dimensions of GBT-C5A

> ⚠️ **Caution**
>
> The dimensional units for all measurements of the drawings in this section are in millimeters (mm).

Parts required for mounting of end-effector

S/N	Name	Num
1	Hex socket cap screws M6X15	4
2	Parallel pins with internal thread	1

4.2 MOUNTING SURFACE

The required flatness of the mounting surface is ≤ 0.2mm.

> ⚠️ Caution
>
> 1. Never increase machining holes or screw holes on the robot body, for it may cause adverse effects on the safety and functionality of the robot.
>
> 2. Please note that the use of screw holes other than those shown in the following figure is not warranted. Do not fix to the robot other devices fixed with screws.
>
> 3. When mounting the device onto the robot, it is warned to avoid interference with the cables inside the mechanism. The interference (if any) may cause unexpected cable break within the mechanism.

4.3 ABOUT PAYLOAD SETTING

Summary of payload setting:

The payload setting is to set relevant information of the payload (weight, barycenter, etc.) mounted on the robot.

The following effects can be achieved by setting payload information appropriately.

> ➢ Improve motion performance. (reduced vibration, better cycle time, higher accuracy, etc.).
>
> ➢ Effectively utilize relevant dynamic functions. (Improve the collision detection function, gravity compensation function and other properties.)

If a greater error is found in payload information, it may lead to great vibration or incorrect detection of collisions. In order to more effectively use the robot, the user is recommended to appropriately set payload information of the devices arranged on robots, workpieces or arms.

The payload information can be set on the "Payload Setting Screen". 10 payloads can be set on this screen. Multiple payloads can be set in advance. Then, the payloads can be changed by simply switching their numbers. In addition, the payload number can be switched in the program through program instructions (see Section 3.8.5).

The robot can achieve optimal control accuracy and stability under corresponding payloads by selecting or adjusting internal control parameters for different payloads.

The payload is set in the following steps:

1. Successively click "Menu Button" → "System Setting" → "Basic Setting" → "Payload Setting" to enter the screen as shown in Fig. 2.38. The payload activated at default is set to [Payload: 0] and cannot be edited.

Fig. 2.38 Payload Parameter Interface

2. Click "New" and set a new payload. Click "Edit" to manually input payload data, as shown in Fig. 2.39. - ⊗ Cancel editing, - ✓ Save editing.

Fig. 2.39 Payload Parameter Interface

Among others, M (kg) is the mass of the payload, X (mm), Y (mm) and Z (mm) are the barycenter positions of the payload relative to the flange center as shown in Fig. 2.39, and Ix, Iy and Iz are the rotational inertia of the payload relative to X, Y and Z coordinates. When the payload of the robot is taken as a mass point, the moment of inertia Ix, Iy and Iz are written as 0.
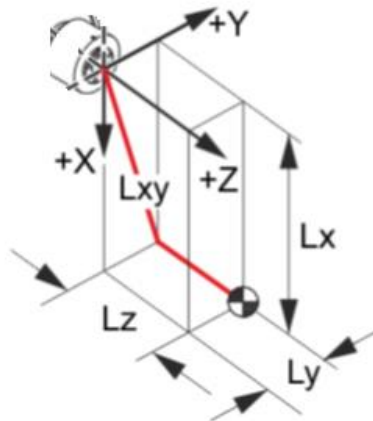
Fig. 2.40 Payload Position Reference

3. The setting of activated payload is shown in Fig. 2.40, with a "√" mark in front of the activated load.

4.3.1 Automatically measure the load

The automatic load measurement is an expansion of the original load setting function, and its location is at Load Setting/Automatic Measurement.

> ⚠ Caution
>
> It is recommended that when using the automatic measurement function, the load mass is greater than 20% of the robot's maximum load.

The steps are as follows:

1、Set the parameters and the 3rd axis.

Mass:

Unknown: Select this option when the specific value of the mass is unknown. It is recommended to choose this one in such a case;

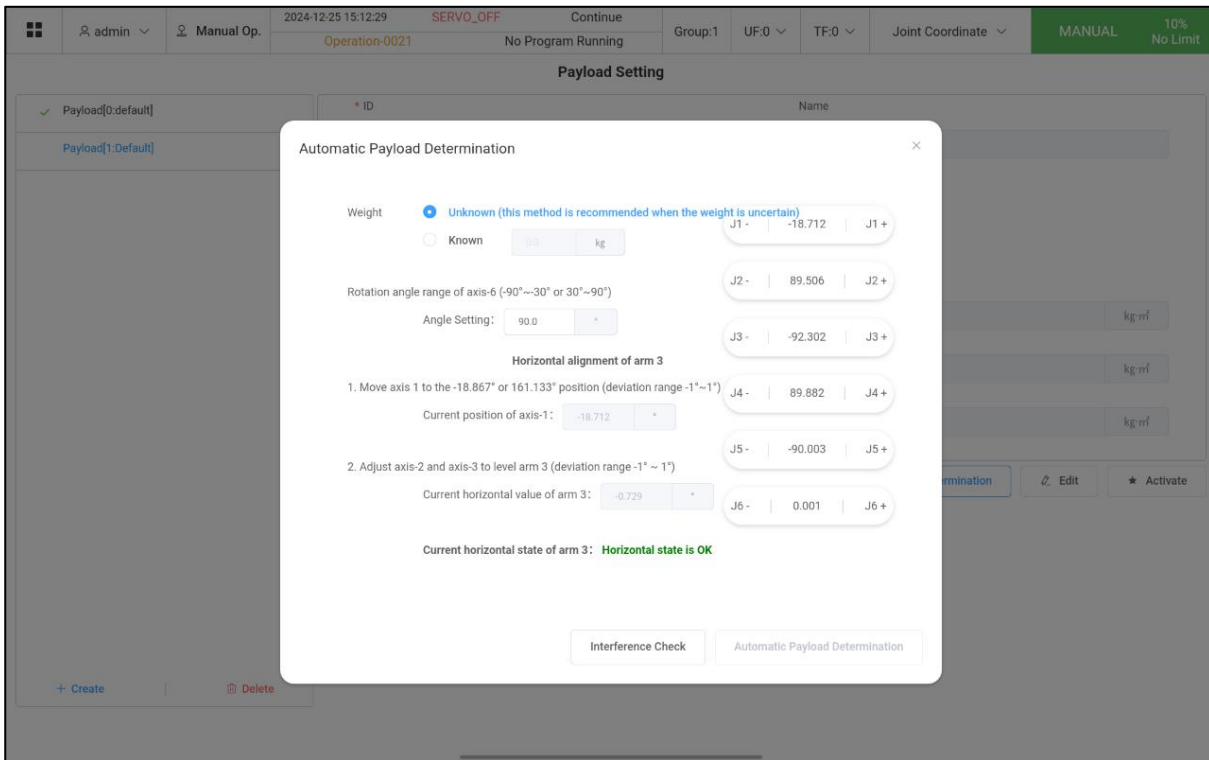Known: Select this option when the exact mass is known. The numerical value should be reserved to one decimal place, and there is no limit on the maximum value.

6-axis Angle:

Setting Range: -90° to -30° or 30° to 90°.

The numerical value should be reserved to one decimal place.

3-axis Horizontal Calibration (Teach the robot in manual mode):

Current Horizontal Value: Display the horizontal state of the forearm in real time. Taking the horizontal state as 0°, use the symbol "-" when it is downward and "+" when it is upward.

Current Horizontal State: When the horizontal value of the forearm is within the deviation range (currently it is -1° to 1°. Actually, a reasonable range will be given according to the results of research and development and

debugging), the horizontal state will display "Horizontal" and the 3-axis horizontal calibration is completed. Otherwise, it will display "Not Horizontal". If there is an angle installation setting, the angle value will be automatically compensated.

2、 Interference check
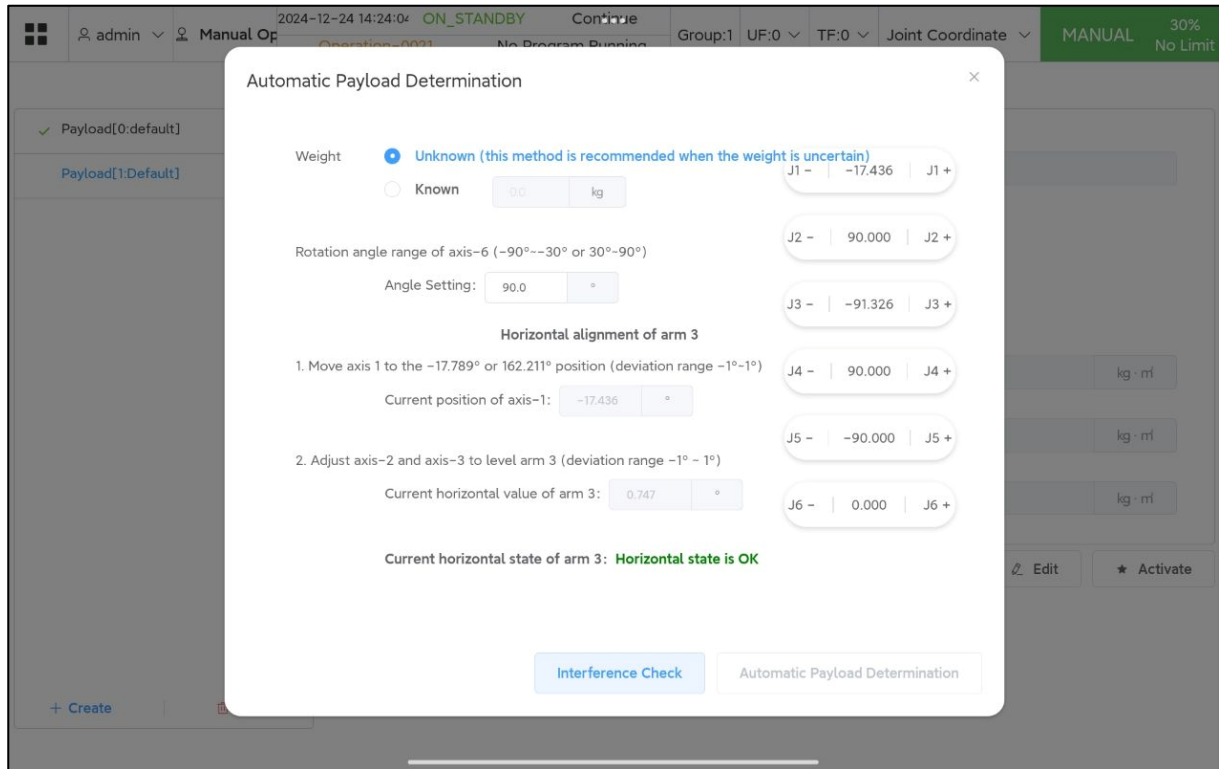
1）Interference Check: When the parameter settings are correct, the 3-axis is level, and in the manual mode, if all these conditions are met, the interference check option will be highlighted and can be clicked to proceed with the next operation (see the figure below). Otherwise, the interference check option will be displayed in grayscale and clicking on it will be ineffective.；
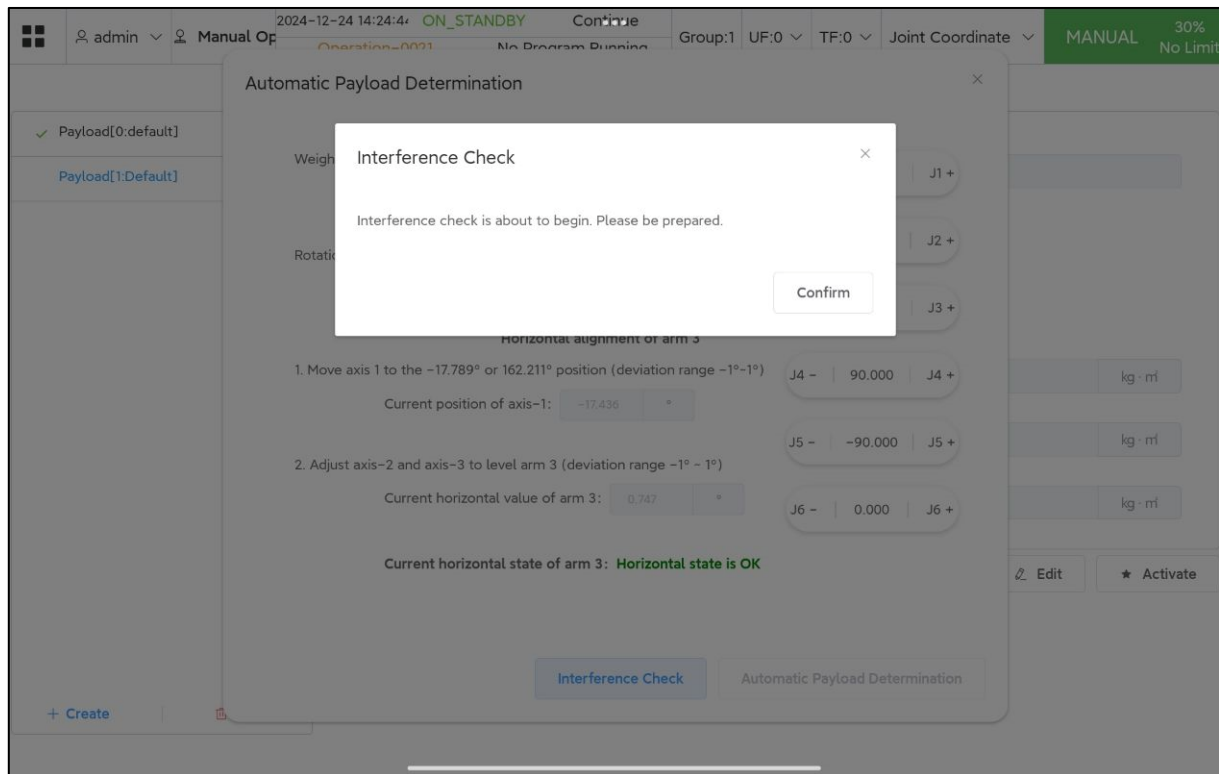
1）X: Click it to cancel the ongoing "Interference Check".

3）Confirm: After the conditions for program operation in the manual mode are met, this button will be highlighted (otherwise, it will be displayed in grayscale and cannot be executed). Then click this button, and the robot will automatically conduct the interference check at a speed of 10%.

> ⚠ Caution
>
> The running trajectories of the interference check and the automatic measurement are the same.
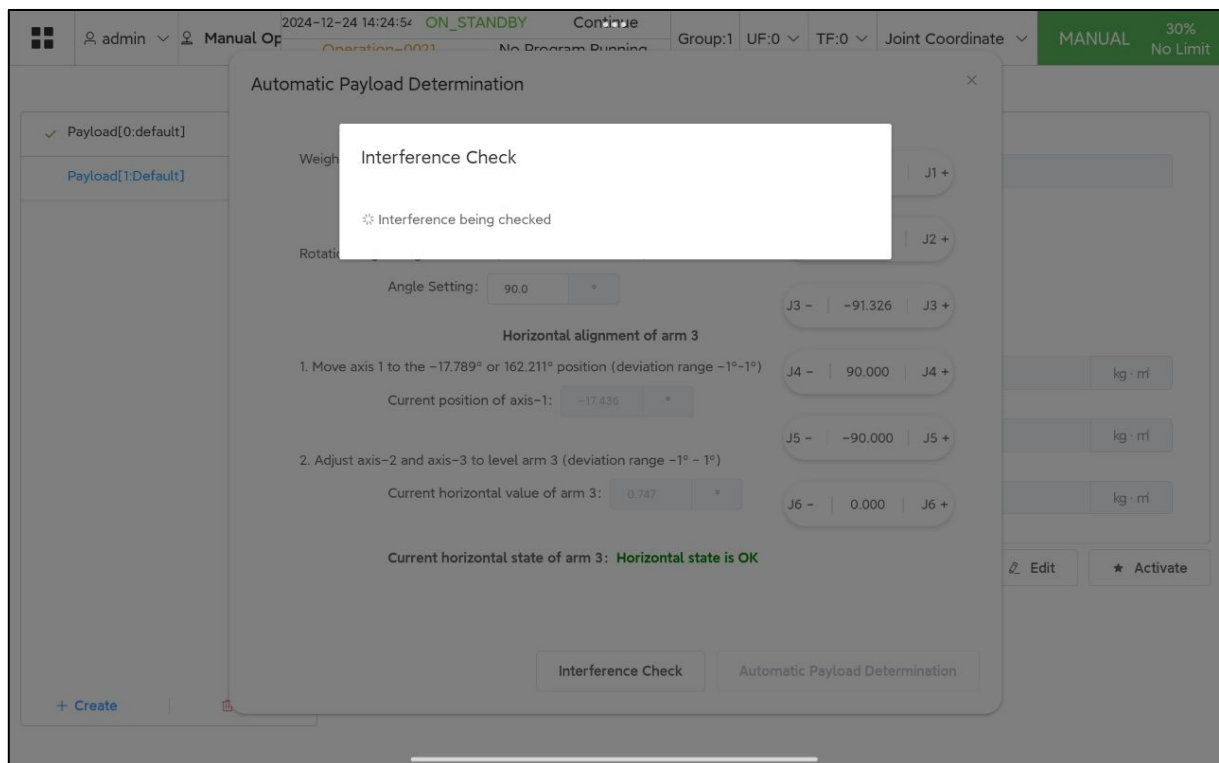
1）During the interference check: The robot moves slowly to conduct the interference check. During this process, the interference check can be stopped by pressing the emergency stop button.
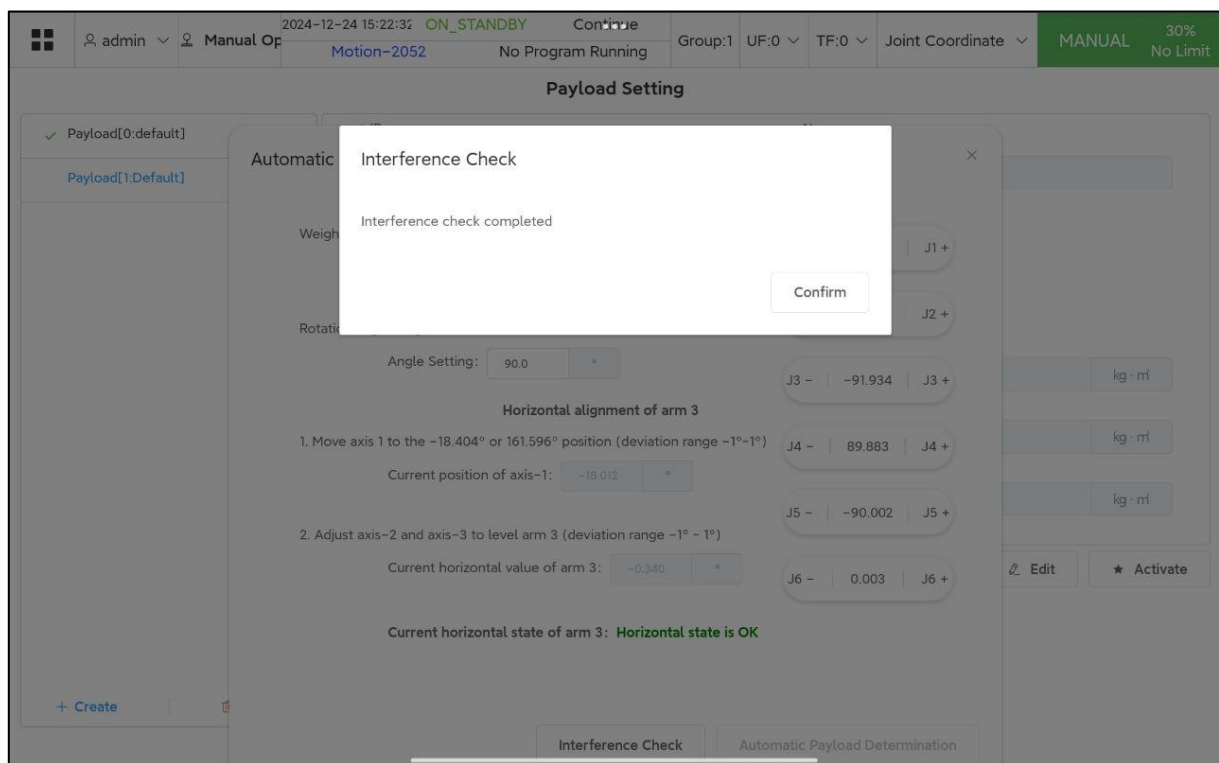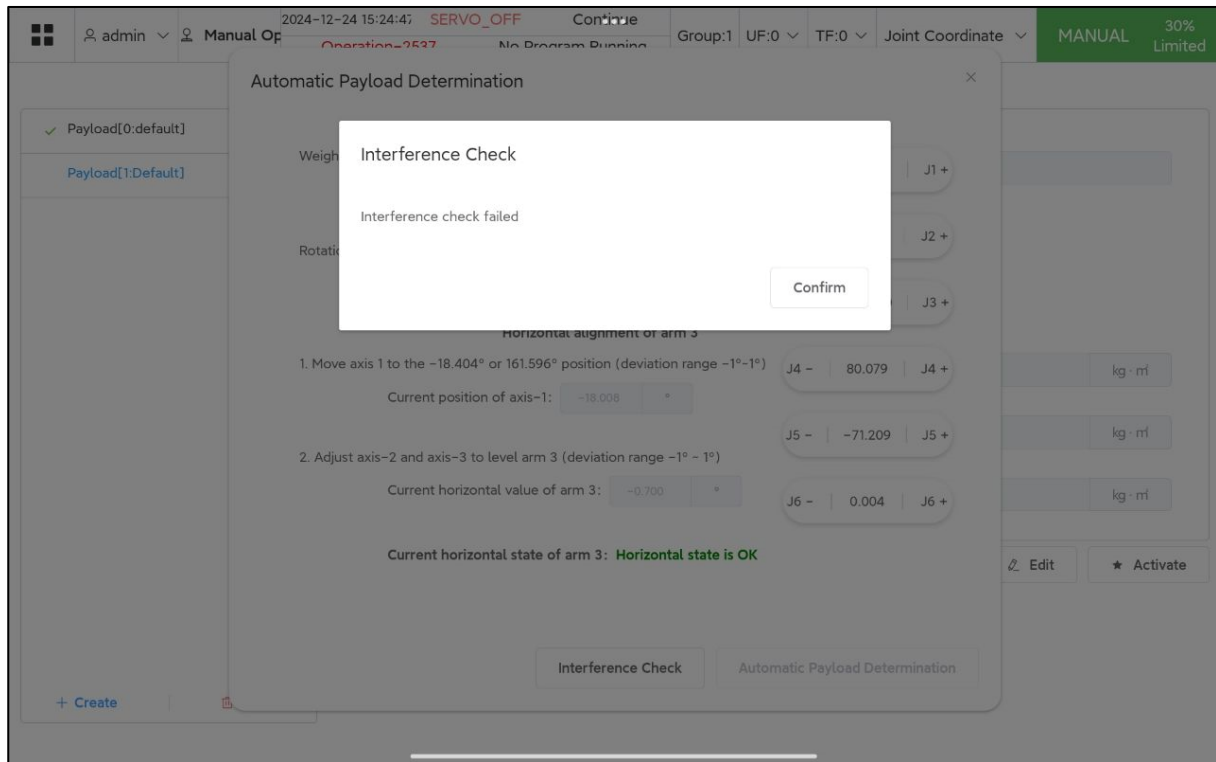
2）Confirm: The interference check is successful, with no interference. Click it and return to the previous interface.

Any interruption of the inspection actions during the interference check process is regarded as a failure of the interference check. Click it and return to the previous interface.

⚠️ Caution

When the interference check is completed, the robot will automatically reset to its initial position and posture.

3、Automatic measurement

1）Automatic measurement: If the most recent interference check is successful and there is no change in parameters (it is sufficient to state that writable parameters remain unchanged and read-only parameters are at the horizontal level), s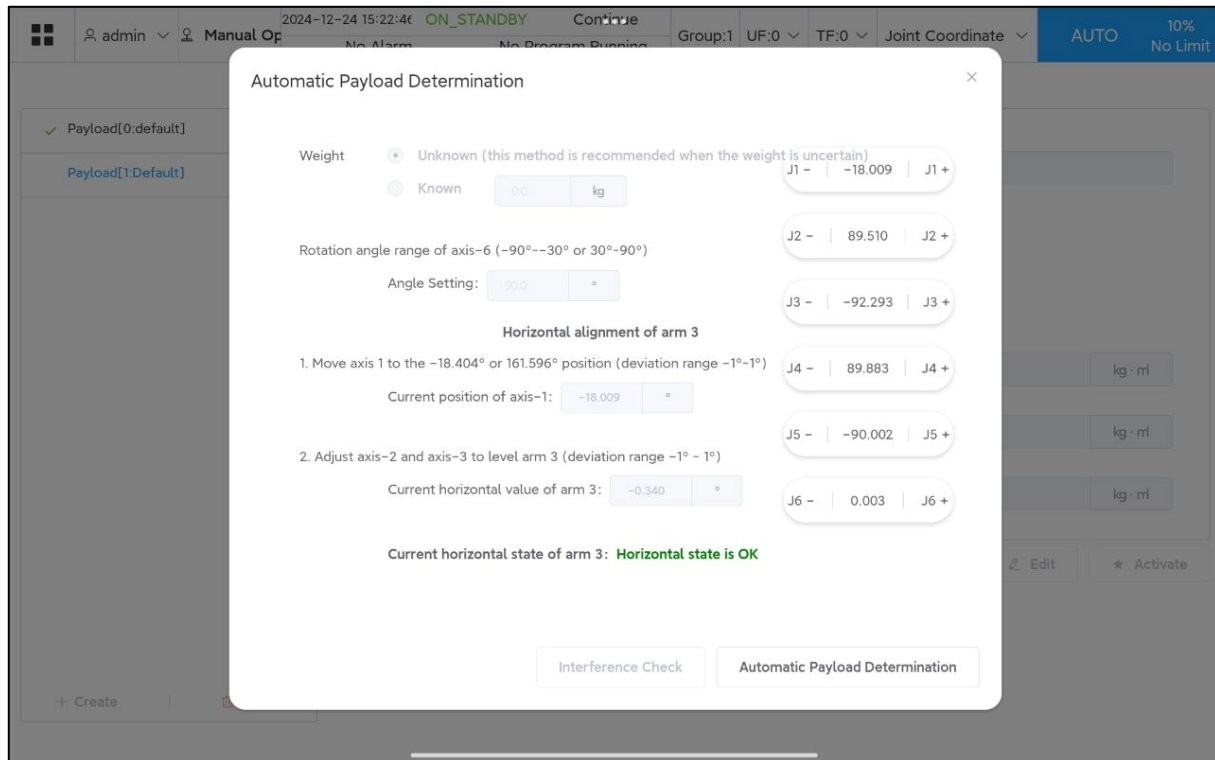witch to the automatic mode, and the automatic measurement option will be highlighted. Both the interference check and parameter settings will be locked and cannot be operated.

> ⚠️ Caution
>
> After the interference check is successful, if any configuration parameters are modified, the interference check needs to be carried out again. Otherwise, the automatic measurement in the automatic mode will not be highlighted and available either.

2）X: Click it to cancel the ongoing "Automatic Measurement".

3）Confirm: After the conditions for program operation in the automatic mode are met, click this button, and the robot will conduct the automatic load measurement.
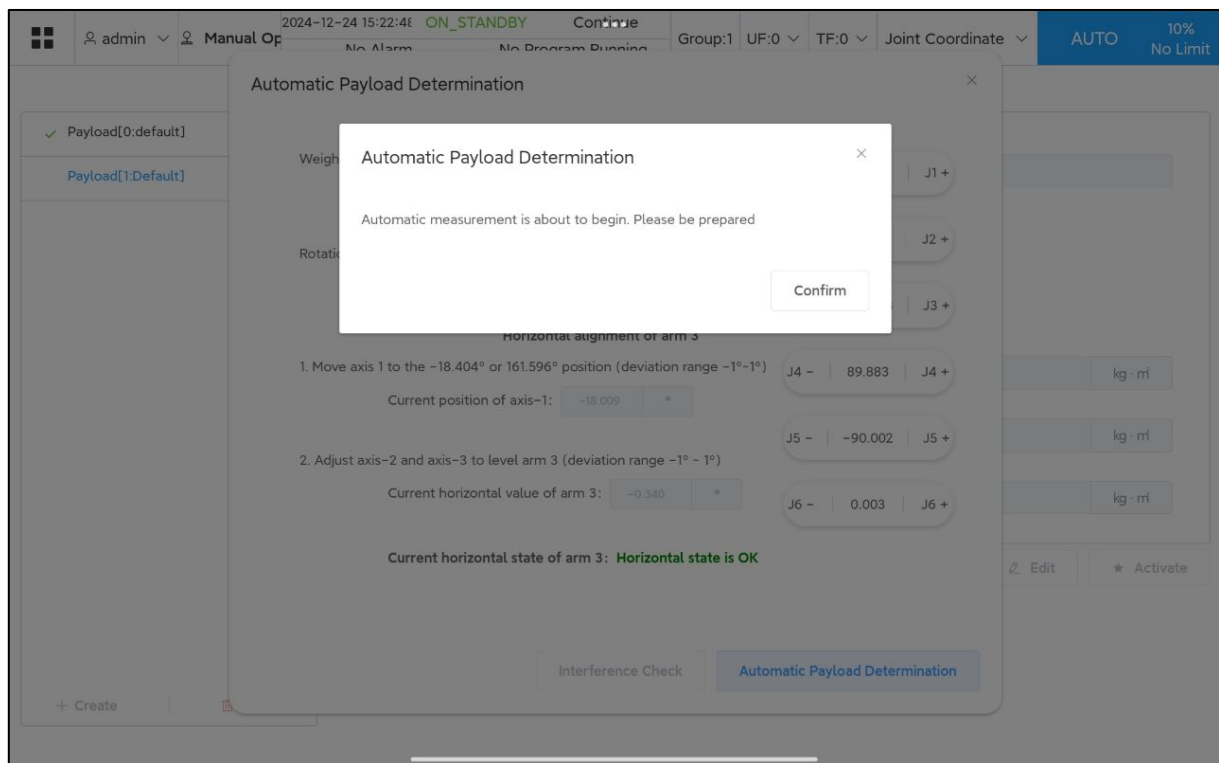
1）During the automatic measurement: The movement of the robot can be stopped in a timely manner by pressing the emergency stop button during this process.
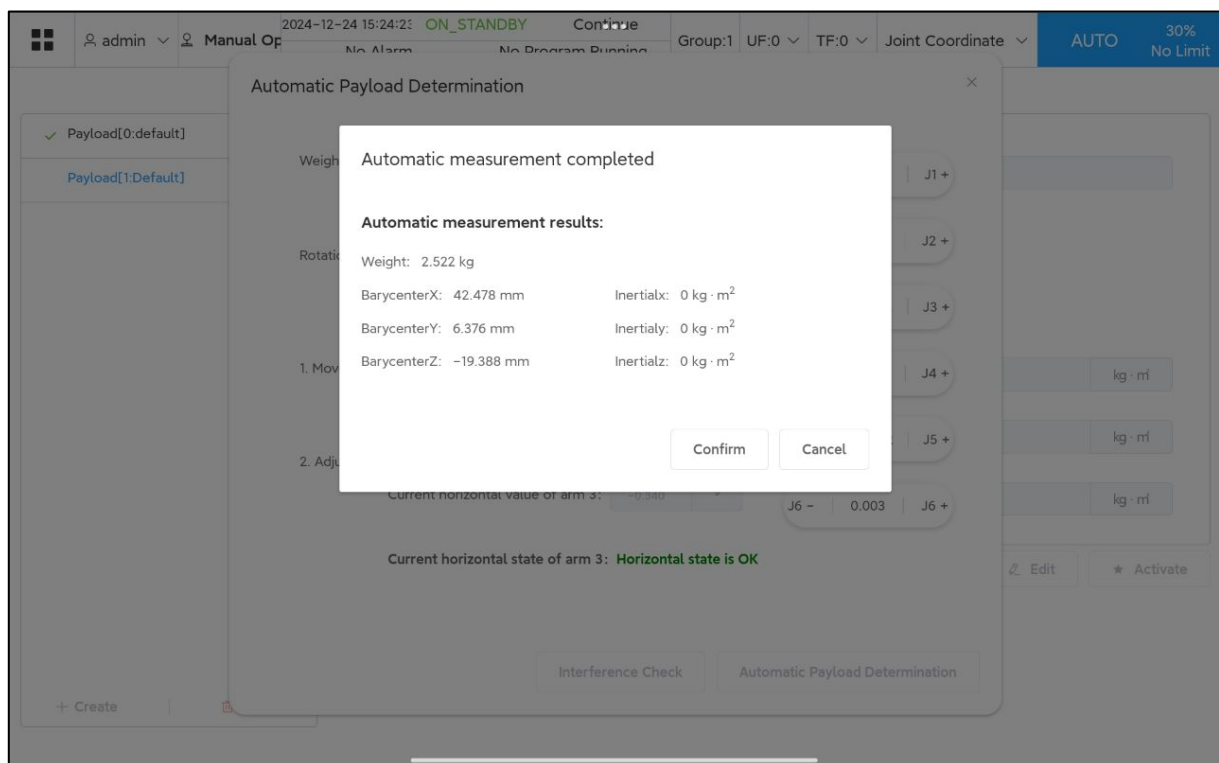
2）Save: Confirm that the result is correct, update the parameters to the load setting interface and save them.

3）Cancel: Ignore the measurement result.

⚠️ **Caution**

When the interference check is completed, the robot will automatically reset to its initial position and posture.
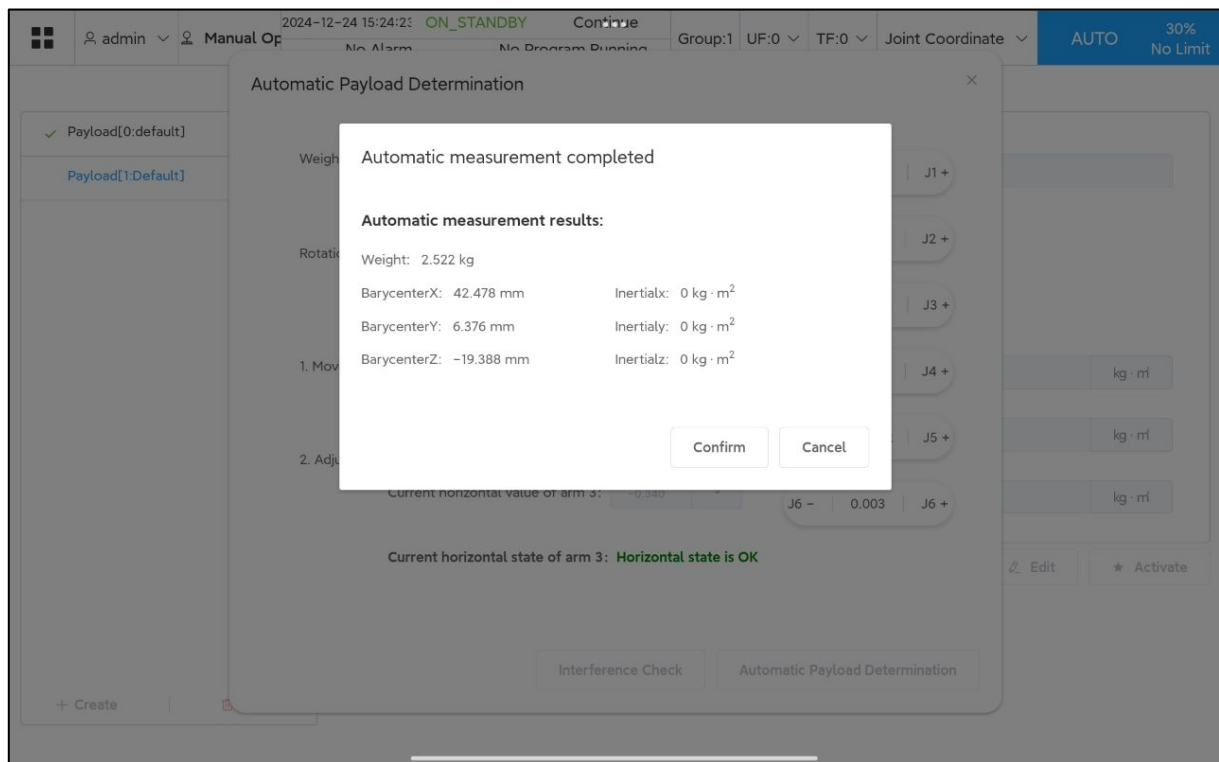
1）Confirm: Ignore the measurement result.

⚠️ **Caution**

If the automatic measurement fails, all the specific measurement result parameters will be displayed as 0.

---

1   The main interface for setting the load after the automatic measurement is completed

5 CABLING AND PIPING TO END-EFFECTOR

> ⚠ Warning
>
> ● Do not add cables or hoses inside the robot mechanism.
>
> ● When mounting cables outside the robot mechanism, take care not to obstruct the motion of the robot.
>
> ● Take care not to interfere with other parts when laying cables or air pipes on the robot during integration.
>
> ● Please cut off any excess part of the end-effector cable and insulate it, e.g. wrapping insulation tape.
>
> ● If it is impossible to prevent the end-effector or workpiece from being electrified, please try to route the end-effector cable as far away as possible from the end-effector or workpiece. Carry out insulation treatment between the cable and the end-effector or workpiece when the cable must be routed near the end-effector or workpiece.
>
> ● Perform daily inspection to confirm if the connector gets loose or the outer protective layer of the end-effector (manipulator) cable is damaged.
>
> ● Cable damage due to non-compliance with the above precautions may cause wrong actions of the end-effector and alarm/stop or incorrect actions of the robot. In addition, there is a risk of electric shock if exposed to damaged power cables.

5.1 ROBOT LIGHT

The robot itself is equipped with indicator lights, and the meanings indicated by their colors are as shown in the table below.
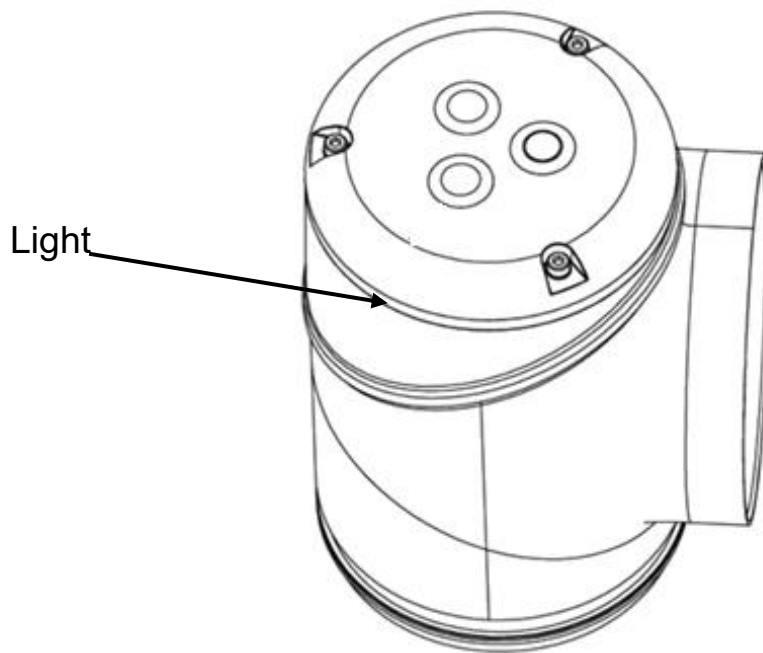
Light

Fig. 5.1 The light ring on the axis

Color	The light ring on the axis		
	steady light	Flash (once per second)	Flash (twice per second)
Blue		1.The Servo on process 2.The Servo off process	
White	Servo off, no fault, and the Cobot software is not connected.	Servo off, no fault, and the Cobot software is connected.	
Green	The program is running	The Servo on is completed.	
Yellow	Drag mode	1. The program is paused. 2. Type 2 stop.	
Red	1. Emergency stop 2. Alarm event level 5 - 10	The communication link of the main body is disconnected.	1. Alarm event level 11 2. Boot - up timeout
Off	The robot arm has no available power supply: 1.Failure 2.The system power is off.		

⚠ Caution

When the communication link of the robot body is disconnected and the arm communication is interrupted, the user can try to restart the control cabinet.

5.2 THE BUTTONS AT THE END CUP

The robot is equipped with three buttons at its end effector. The buttons are the drag button, the record position button, and the pause/resume button respectively, as shown in the following figure.

1 Record Position Button

3 Pause/Resume Button

2 Drag Button
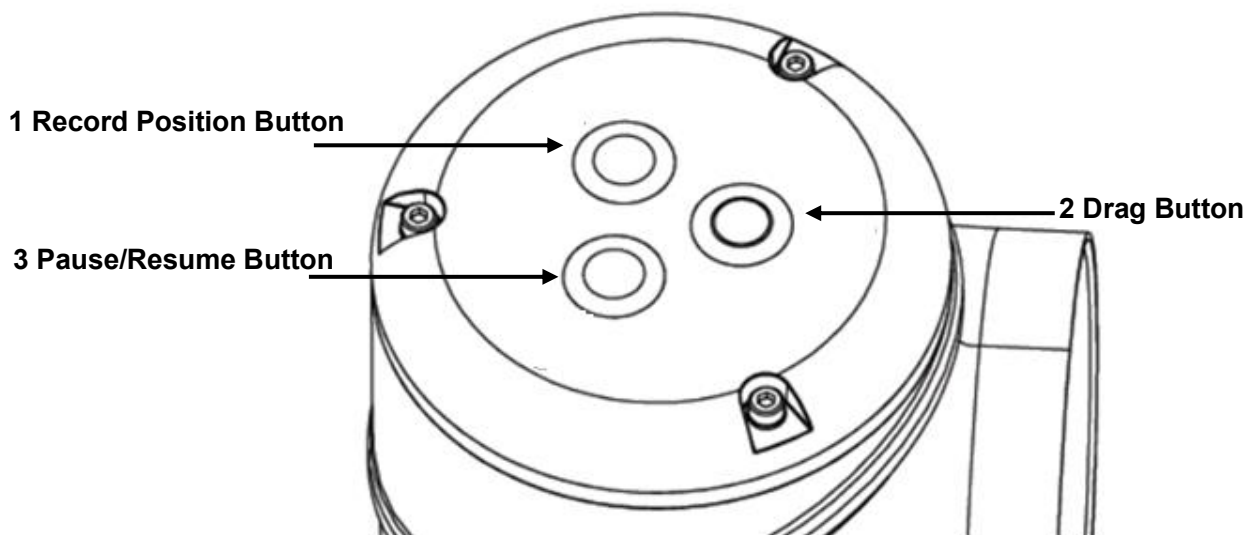
Fig. 5.2 Button Position Diagram

Record Position Button

The record position button needs to be used in conjunction with the robot operation software COBOT. When the record position button is pressed, the operation software will record the corresponding position (for specific operations, please refer to the collaborative robot system manual).

Drag Button

When the drag button is pressed, the robot enters the drag teaching mode. In this mode, users can directly drag the robot to the desired point.

Pause/Resume Button

In the manual mode, when the robot is running a program, pressing the pause/resume button can pause the robot's movement, and pressing it again can resume the movement.

> ⚠️ Warning
>
> For the use of the drag button, users are required to fully assess the possible risks. It is necessary to ensure that parameters such as the installation posture of the robot, the end effector load and the Tool Center Point (TCP) are correctly set. Otherwise, it may cause personal injury or equipment damage.
>
> For the use of the pause/resume button, users are required to fully assess the possible risks. The sudden start and stop of the robot may cause personal injury or equipment damage.

5.3 WRIST - TOOL I/O INTERFACE

There is a wrist - tool I/O interface at the tool flange, which provides power and control signals for the end - effector connected to the robot and receives input signals from external sensors.

wrist - tool I/O interface
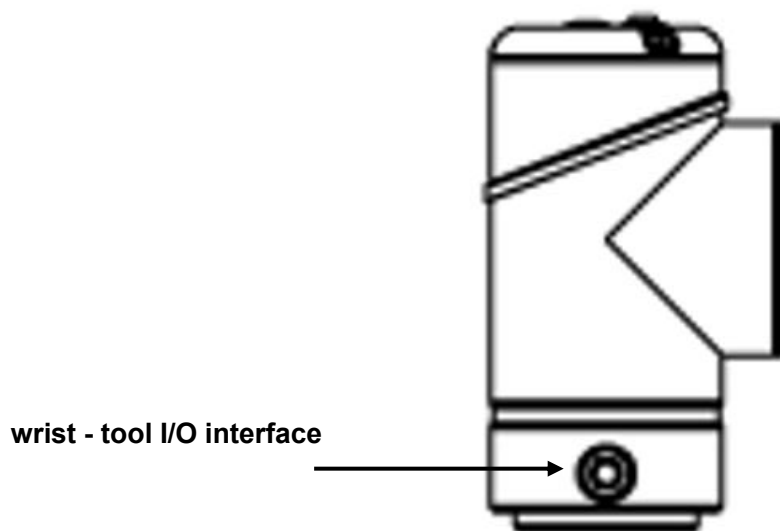
Fig. 5.3 Wrist - tool I/O interface

The M8 straight pin plug is an industrial cable suitable for this port, with a model of M8-P8A-MWA-* **-*. Its material, length and shielding XX can be chosen by the user. Eight wires inside the cable are in different colors, representing different functions. See Table 5.1.
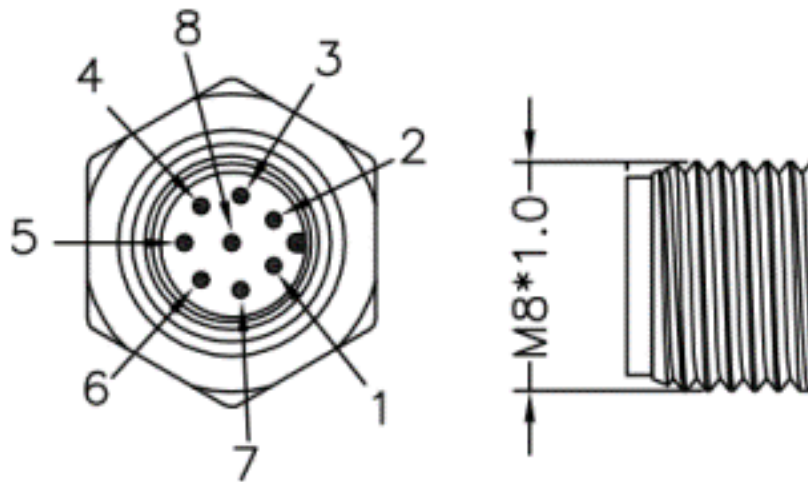
Fig.5.4 M8 straight pin plug

Definition of wrist I/O function		
Pin No.	Function	Description
1	24V	Input voltage 24V
2	GND	GND
3	DI1	Digital input 1
4	DI2	Digital input 2
5	DO1	Digital output 1
6	DO2	Digital output 2
7	AI1	Analog input 1
8	AI2	Analog input 2

Table 5.1 Definition of Wrist I/O Functions

6 MAINTENANCE AND REPAIR

It is possible to maintain the performance of the robot in a stable state through maintenance and repair.

> ⚠️ Warning
>
> The cumulative operating time of the GBT robot is assumed to be 3000h in a year. If the annual operating time is longer than 3000h, it is necessary to shorten the maintenance cycle according to the operating time. For example, the maintenance and repair cycle is shortened by half when the cumulative operating time is 6000h in a year.

6.1 MAINTENANCE AND REPAIR CONTENTS

Daily maintenance

Before daily maintenance, please read this chapter carefully to fully understand safe maintenance methods.

Only those who having passed robot system training of our company and the dealer are allowed to maintain the robot system.

> ⚠️ Warning
>
> ● Please use alcohol, liquid gasket and adhesive carefully according to respective instructions and the following descriptions. Improper use of alcohol, liquid gasket or adhesive may lead to fire or safety issues.
>
>   ➢ It is prohibited to keep alcohol, liquid gasket or adhesive near fire sources.
>
>   ➢ Perform indoor ventilation when using alcohol, liquid gasket or adhesive.
>
>   ➢ Please wear protective devices, such as masks, goggles and oil-resistant gloves.
>
>   ➢ Thoroughly clean with water and soap the alcohol, liquid gasket or adhesive flashed on the skin.
>
>   ➢ If alcohol, liquid gasket or adhesive is splashed into the eyes or mouth, thoroughly rinse the eyes or mouth with water and seek medical attention immediately.
>
> ● The robot may generate heat due to motor heating or similar reasons. Do not touch the robot before it cools down. In addition, ensure that the robot has cooled down and is not hot when touched. Then, perform teaching or maintenance.
>
> ● When performing robot maintenance, ensure a space of approximately 50cm around the robot.

6.2 REGULAR MAINTENANCE · REPAIR

Carry out maintenance and repair for the items below according to the shorter term of the specified period or cumulative operating time.

Robot Maintenance Schedule

Category	Inspection items	Interval	Contents
Inspection	Clean the body	3 months	Wipe away dirt and clear away accumulated splashes, dust, chips, etc.
Inspection	Bolt	3 months	Tighten all exposed bolts on the robot.
Inspection	Gap	3 months	Apply certain forces to the end tool in front, back, left, right, up and down directions and confirm that it doesn't shake.
Inspection	Robot cables	1 year	Confirm if they are worn
Inspection	Warning sign	1 year	Confirm if it is broken or lost
Category	Inspection items	Interval	Contents
Inspection	Secureness of end tools	3 months	Apply certain forces to the end tool in front, back, left, right, up and down directions and confirm that it doesn't shake.

7 ZERO CALIBRATION METHOD

7.1 SUMMARY

Zero calibration is an operation associating the angle of each robot joint with the pulse count.

The zero calibration operation is to obtain the pulse count corresponding to the zero position.

The "zero calibration" is completed before ex-factory. It is unnecessary to perform zero calibration in daily operations. However, zero calibration should be performed in the following situations.

If the encoder's multi-circle value is reset, the joint is replaced or the encoder is replaced, please contact us for high-precision calibration.

Zero calibration method

> ➢ General calibration method

> ➢ Direct writing method of zero encoding data

7.2 GENERAL CALIBRATION METHOD

The steps for general calibration method are as follows:

Select one or several axes and record their current readings as new zero data in the parameter file of the robot's Flash. The recording objects include main axis and additional axes of the robot (if any). It is possible to calibrate a single axis. (For example, if a user moves a robot to coincide the zero scale of a certain axis and then uses this function to achieve zero calibration of the robot.)

Perform zero calibration if the zero-calibration data of a specific axis is lost due to the replacement of pulse encoder, etc. Select the general calibration method and check multiple axes or a single axis for calibration. Check "complete" and click the "calibration" button to complete the calibration.
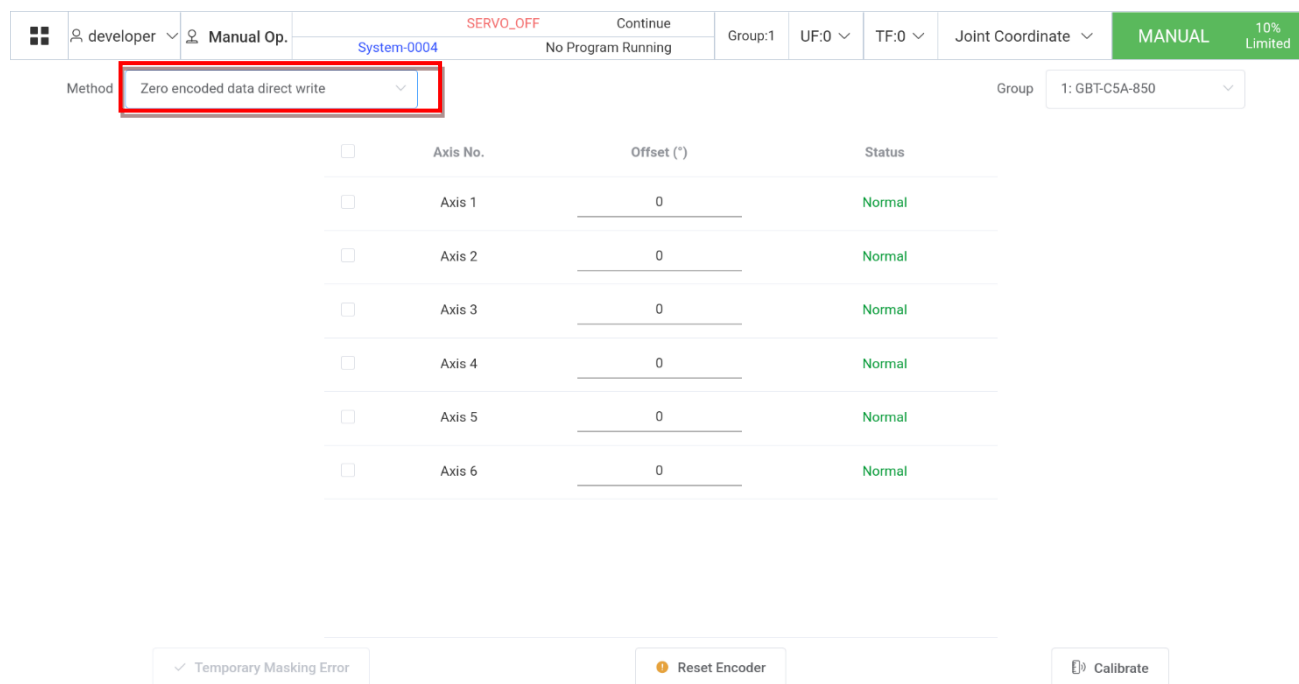
Fig. 7.1 Interface of General Calibration Method

7.3 DIRECT WRITING METHOD OF ZERO ENCODING DATA

As for the direct input encoder calibration, the zero calibration data can be directly entered into the system variables. This operation is used in the situations where zero calibration data is lost while pulse data is still maintained.

Fig. 7.2 Interface of Direct Writing Method

8 RESOLUTION OF COMMON FAULTS

A fault in the mechanism is sometimes caused by multiple different causes together. So, it is often difficult to thoroughly investigate them. In addition, incorrect measures (if taken) may actually lead to further deterioration of the fault. Therefore, it is important to analyze the fault in detail and clarify its true cause.

The solutions for common faults in the mechanism are shown in the following. Please contact us if you cannot find the reason and don't know how to take countermeasures.

Phenomenon	Description	Cause analysis	Solution
Vibration	The base is not firmly fixed to the ground.	The connection between the base and the ground gets loose due to frequent vibration during robot operation.	Reinforce the connection between the robot and the ground again.
	The robot vibrates significantly beyond a certain speed.	The routing program used by the robot poses a heavy payload on the robot hardware.	Adjust the programmed route of the robot.
	The robot vibrates significantly at a specific position.	The payload on the robot is probably too heavy.	Reduce the payload on the robot.
	The robot vibrates after collision or long overload.	Collision or overload causes damage to the joint structure or gearbox.	Replace the gearbox or repair the structure in the area causing vibration.
	The vibration of the robot may be related to other running machines around.	The operations of the robot and the machine around may resonate.	Change the distance between the robot and other machine.
	When turning off the robot, manually move the robot and find that it is shaking.	Overload or impact causes the screws on robot joints to get loose.	Check if the screws at each joint are loose (motor screws, gearbox screws and connecting screws). If loose, tighten them according to regulations.
Abnormal noise	The robot generates an abnormal noise when exceeding a certain speed.	The routing program used by the robot poses a heavy payload on the robot hardware.	Adjust the programmed route of the robot.
	The robot generates an abnormal noise at a specific position.	The payload on the robot is probably too heavy.	Reduce the payload on the robot.
	The robot generates an abnormal noise after collision or long overload.	Collision or overload causes damage to the joint structure or gearbox.	Replace the gearbox or repair the structure in the area causing vibration.
Motor overheating	The temperature rises in the operating environment of the robot or its heat dissipation is influenced for the servo motor is covered by some object.	The motor temperature rises due to an increase in environmental temperature or poor heat dissipation of the motor.	Reduce environmental temperature, enhance heat dissipation and remove coverings on the motor.

		The control program or payload of the robot has been changed.	The program or payload exceeds the acceptable range of the robot.	Adjust the program and reduce the payload.
		The parameters imported into the controller have changed, causing motor overheating.	The imported parameters don't match the model of the robot	Re-import correct parameters
Jiggling		When cutting off the power supply of the robot, press it with a hand to find some robot mechanisms jiggling. There is a gap on the connecting surface of the parts.	Probably, overload or collision causes connecting bolts of robot components to get loose.	For each axis, confirm whether the bolts in the following positions are loose. If loose, use anti-loosening adhesive and tighten them with appropriate torque. ·Fixing bolts on motor ·Fixing bolts on gearbox ·Fixing bolts on base ·Fixing bolts on arm ·Fixing bolts on cover ·Fixing bolts on end-effector
Grease leaking		Grease leaks from the mechanism.	[Poor sealing] It may be caused by cracked casting, damaged O-ring seal, broken oil seal, loose sealing bolts, etc. The cracked casting may be caused by excessive external force on the mechanism due to collision or other reasons. The broken oil seal may be caused by scratches on the lip of the oil seal due to the invasion of dust or other foreign objects. When the sealing bolt is loose, lubricating oil may leak out along the screw.	
Position offset		The robot moves in a position deviating from the teach position. Repetitive positioning accuracy is greater than the allowed value.	[Mechanical fault] Unstable accuracy of repetitive positioning may be caused by abnormal driving systems, loose bolts or other faults on the mechanical part. If the repetitive positioning accuracy is stable after certain offset, it may be due to the mechanical deformation caused by excessive payload in case of collision. It may be caused by an abnormal pulse encoder.	
		The position is only offsetting for specific peripheral devices.	[Position offset of peripheral device]	

		It may be because external forces acting on peripheral devices cause offsetting of relative positions.	52 / 54
	Position offset occurs after the variable is changed.	[Variable] It may be because the robot's origin is lost due to rewriting of zero calibration data.	

APPENDICE

LIST OF BOLT STRENGTHS AND TIGHTENING TORQUES

List of Recommended Screw Tightening Torques (Nm)

Specification	Base material of steel parts	Base material of aluminum parts
M3	2±0.18	1.57±0.18

Contact us

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