Dobot CR Series User Guide

Disclaimer

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Before using our product, please thoroughly read and understand the contents of this document and related technical documents that are published online, to ensure that the robot is used on the premise of fully understanding the robot and related knowledge. Please use this document with technical guidance from professionals. Even if follow this document or any other related instructions, damages or losses will be happening in the using process. Dobot shall not be considered as a guarantee regarding all security information contained in this document.

The user has the responsibility to make sure of following the relevant practical laws and regulations of the country, in order that there is no significant danger in the use of the robot.

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Preface

Scope of Application

Robot arm:

- DOBOT CR3
- DOBOT CR5
- DOBOT CR7
- DOBOT CR10
- DOBOT CR12
- DOBOT CR16

You can find the model of robot arm on the right-top corner of the nameplate on the robot base. The figure below takes CR5 as an example.

Controller:

- DOBOT CC162

You can find the model of controller on the right-top corner of the nameplate.

Purpose

This document introduces the functions, technical specifications and installation procedure of Dobot CR series robots, which is convenient for users to understand and use the robot.

Intended Audience

This document is intended for:

- Customer
- Sales Engineer
- Installation and Commissioning Engineer
- Technical Support Engineer

Change History

Date	Change Description
2023/06/08	Add CR7 and CR12 load curves
2023/04/27	Modify CR7 base installation dimensions
2022/12/05	Integrate CR3, CR5, CR7, CR10, CR12, CR16 hardware guides

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
⚠ DANGER	Indicates a hazard with a high level of risk which, if not avoided, could result in death or serious injury
⚠ WARNING	Indicates a hazard with a medium level or low level of risk which, if not avoided, could result in minor or moderate injury, robot damage
⚠ NOTICE	Indicates a potentially hazardous situation which, if not avoided, can result in equipment damage, data loss, or unanticipated result
📖 NOTE	Provides additional information to emphasize or supplement important points in the main text

Contents

1. Safety

1.1 Liability

1.1.1 Validity and Responsibility

The information in this document does not cover designing, installing and operating a complete robot system, nor does it cover all peripheral equipment that can affect the safety of the complete system. The complete system must be designed and installed in accordance with the safety requirements set forth in the standards and regulations of the country where the robot is installed.

The integrators of Dobot are responsible for ensuring that the applicable safety laws and regulations in the country concerned are observed and that any significant hazards in the complete robot application are eliminated. This includes, but is not limited to:

- Performing a risk assessment for the complete robot system.
- Adding safety machines and mechanisms based on the risk assessment.
- Setting up the appropriate safety settings in the software.
- Ensuring that the user will not modify any safety measures.
- Validating that the total robot system is designed and installed correctly.
- Specifying instructions for use.
- Marking relevant signs and contact information of the integrators on the robot.
- Archiving relevant technical files.

1.1.2 Limitation of Liability

Any safety information provided in this document should not be construed as a warranty, by Dobot. The robot may cause injury or damage even if all safety instructions are observed.

1.1.3 Intended Use

Dobot CR series robots are industrial robots only for general industrial use, such as processing or delivering products or parts through end tools.

Dobot CR series robots are equipped with special safety mechanisms including collision detection. These mechanisms are purposely designed for human-robot collaborative operation, but only intended for non-hazardous applications after risk assessment, where tools, commodities, environments and other machines have been demonstrated to be incapable of significant risk through application-specific risk assessments.

Any use or application deviating from intended use is deemed to be impermissible misuse, including, but is not limited to:

- Use in potentially explosive environments.
- Use in life critical applications.
- Use before performing a risk assessment.
- Use over-stated specifications.

• Use as a climbing aid.

1.2 Safety warning signs

The following safety warning signs may appear in this document, and their meanings are described as follows. The same safety warning signs are also used in the products.

Sign	Description
⚠️DANGER	Indicates a high degree of potential danger, which, if not avoided, will result in death or serious injury.
⚠️ELECTRICITY	May cause dangerous power consumption soon, which, if not avoided, will cause personal injury or serious damage to the equipment.
⚠️HOT or 高温小心烫伤 Careful scald at high temperature	May cause dangerous hot surfaces, which, if touched, may cause personal injury.
⚠️WARNING	Indicates a moderate or low potential hazard, which, if not avoided, may cause minor personal injury and damage to the equipment.
⚠️ATTENTION	Indicates a potential risk, which, if ignored, may result in damage to the robot arm, loss of data or unpredictable results
⚠️NOTICE	A situation that, if not avoided, can cause personal injury or damage to the equipment. For items marked with such signs, depending on the specific situation, there is sometimes a possibility of significant consequences

1.3 General safety

Follow the safety instructions below when starting and using the robot for the first time.

⚠️DANGER

- The robot system is electrical equipment. Non-professional technicians should not modify the circuit, otherwise, it may cause damage to devices or personal injury.
- Comply with the local laws and regulations when operating the robot. The security precautions in this document are only supplemental to the local laws and regulations.
- Use the robot in the specified environment scope. Exceeding the specifications or load conditions will shorten the service life of the robot, even damage it.

- Ensure that the robot is operated under the security conditions and there is no harmful object around the robot.

- Turning on or off the power continually may result in degraded performance of the main circuit components inside the controller. If turning on or off the power continually is required, please keep the frequency less than once per minute.

⚠ HOT

- The robot and the controller will generate heat during operation. Please do not operate or touch the robot when the robot is working or has just stopped working.

- Turn off the power and wait an hour for the robot to cool down.

- Do not put your fingers to where the control cabinet gets hot.

⚠ NOTICE

- The personnel responsible for installation, operation and maintenance of equipment must first receive strict training, understand various safety precautions, and master correct operation and maintenance methods before they can operate and maintain equipment.

- Personnel without professional training shall not disassemble and repair the equipment without authorization. If the device fails, please contact Dobot technical support engineer in time.

- Be sure to carry out daily inspections and regular maintenance, and replace faulty components in time to ensure the safe operation of the equipment.

- If the equipment is scrapped, please comply with relevant laws to properly handle industrial waste and protect the environment.

- In order to prevent personnel from accidentally entering the working space of the robot arm, be sure to set up safety fence to prevent personnel from entering the hazardous area.

- Before operating the robot, make sure that no one is inside the safety fence. When operating the robot, be sure to operate outside the safety fence.

- Do not expose the robot to permanent magnetic fields all the time. Strong magnetic fields can cause damage to the robot.

- Dobot assumes no responsibility for robot damage or personal injury caused by failure to follow product instructions or other improper operations.

- Use appropriate and reliable lifting equipment during handling operations such as lifting rings and bridge crane. According to the relevant regulations of various countries, it must be carried out by personnel with operating qualification certificates or personnel authorized by the company.

- Make sure that there are no obstacles within 2 meters of the robot during

transportation. Relevant personnel should stay away from the suspended robot.

- Dobot is not responsible for any damage caused during the transportation and handling of equipment.

- Make sure that the robot is in the packing posture before packaging, and the brakes on each axis are normal.

- Make sure that there are no obstacles around the packing area, so that the staff can leave in a timely manner in case of an emergency.

- When the robot is transported, the packaging needs to be fixed to ensure that the robot is stable.

- After removing the outer packaging, make sure that the robot maintains the original packing posture and the brakes of each axis are normal.

- During the commissioning process, make sure that no relevant personnel and equipment (include computer used for debugging) stay in the dangerous area of the machine.

- If necessary, wear corresponding safety protective equipment, such as safety helmets, safety shoes (with non-slip soles), face shields, protective glasses and gloves. Inappropriate clothing may cause personal injury.

- In order to prevent personnel from entering the working space of the robot arm by mistake, please set up safety barriers to prevent personnel from entering the hazardous area.

- Do not enter the working space of the manipulator at will during operating the robot, otherwise cause injury to the robot or yourself.

- The personnel responsible for installation, operation, and maintenance of the equipment must first undergo strict training, understand various safety precautions, and master the correct operation and maintenance methods before operating and maintaining the equipment.

- When an abnormality occurs in the mechanical arm, it is necessary to ensure that the machine is stopped and then checked.

- After the commissioning of the operator is completed, the test needs to be performed in the Manual mode first, and then it is automatically run after it is confirmed to be correct.

- If the controller needs to be restarted due to power failure, when restarting, the robot must be manually returned to the initial position of the automatic operation program before restarting the automatic operation.

- Before maintenance and wiring work, the power supply must be cut off, and the sign **No power supply** must be put on. Otherwise, electric shock and personal injury may result.

- Please observe the ESD regulations when disassembling the robot or controller.

- Avoid dismantling the power supply system in the controller. After the controller is turned off, its power supply system may still have high voltage for several hours.

- Please contact our technical support staff for the disassembly and repair of the robot.

- Maintenance and repair work must be carried out by designated personnel, otherwise electric shock and personal injury may result.

- If the brake is manually released, the robot may move because of the action of gravity. So, when manually releasing the brake, please ensure that the robot body and the tools or workpieces installed on the robot are effectively supported.

- In order to prevent electric shock, when replacing parts, please turn off the circuit breaker in advance and cut off the main power before proceeding.

- Turn off the main power supply for 5 minutes before replacing parts.

- The replacement operation must be performed by the specified operator.

- The robot is designed and tested according to the group I class A engineering medical robot standard. In order to reduce the radio interference in in light industry or family environment, please take protective measures.

- It is prohibited to operate the robot in strong radiation environment (such as RF source without shielding), otherwise, it could interference robot work.

⚠WARNING

- Before the operation, please wear protective clothing, such as antistatic uniform, protective gloves, and protective shoes.

- It is prohibited to modify or remove the nameplates, instructions, icons and marks on the robot and the related equipment.

- Before operating the equipment, please find and be familiar with the operation method of the emergency stop function to ensure that the robot arm can be stopped urgently in the case of sudden stress. The emergency stop function is Stop Category 1.

- Be careful when carrying or installing the robot. Please follow the instructions on the packing box to put down the robot gently and place it correctly in the direction of the arrow.

- Please use the matched cables when connecting a robot to internal or external equipment for personal security and equipment protection.

- Please ensure that the robot and tools are installed correctly.

- Please ensure that the robot has enough space to move freely.

- If the robot is damaged, do not continue to use it.

- Any impact will release a lot of kinetic energy, which is much higher than that under high speed and high load.

1.4 Personal safety

When operating the robot system, please strictly follow the general precautions listed below to ensure the personal safety of the operator.

⚠ WARNING

- Please comply with local laws or regulations with regard to the maximum weight one person is permitted to carry.

- Do not touch the terminal blocks or disassemble the equipment with the power ON. Otherwise, it may result in an electric shock.

- Please confirm that the equipment is well grounded, otherwise it will endanger personal safety.

- Do not touch the terminal blocks or remove the interval circuit components within 10 minutes after the power is shut off, so as to avoid an electric shock since there is residual capacitance inside the controller.

- Even if the power switch of the controller is already in the OFF status, touching the terminal blocks or removing the interval circuit components is not allowed, so as to avoid an electric shock since there is residual capacitance inside the controller.

- When working with robots, do not wear loose clothing or jewelry. When operating the robot, make sure that you have bundle your hair behind your head.

- If the robot appears to have stopped during the operation of the equipment, it may be because the robot is waiting for the start signal and is in the state of being about to move. In this case, the robot should also be considered to be in motion. Do not approach the robot.

1.5 Emergency

1.5.1 Emergency stop switch

After you press the emergency stop switch in emergencies, the robot will immediately stop all motions and be locked.

The emergency stop switch is not a safeguard. It is a complimentary protective measure and are not intended to prevent injury.

1.5.2 Emergency recovery

The emergency stop switch will be locked after you press it. To unlock the switch, you need to rotate the switch according to the mark on the switch.

⚠ WARNING

Please operate the robot to recover from the emergency only after the danger of the robot system is completely removed.

1.5.3 Forced joint movement

In the unlikely event of an emergency, you may need to move the robot joint/s when the robot power is either impossible or unwanted. In this case, you must push or pull the robot arm hard to move the joint.

⚠ WARNING

Moving the locked joints forcefully may cause joint damage. Please operate only in emergencies.

2. **Transportation**

You need to transport the robot in its packaging posture (set in the control software in reference to the user guide of the control software for details), and use the original packaging for transportation.

During transportation, ensure that the robot arm is stable and fixed by corresponding measures.

During transportation and long-term storage, ensure that the ambient temperature ranges from -20 °C to +55 °C, and the ambient humidity is no more than 95% without condensation.

When moving the robot from its packaging to the installation space, hold the robot arm in place until all mounting bolts are securely tightened at the base of the robot.

After transportation, store the original package in a dry place for repacking and transporting it in the future.

⚠WARNING

- Ensure that the operator is not unduly stressed on their back or other body parts when lifting the equipment, and use appropriate lifting equipment if necessary.

- Dobot shall not be held responsible for any damage caused by transportation of the equipment.

- Be sure to follow all installation instructions when installing the robot.

3. Product Introduction

3.1 Overview
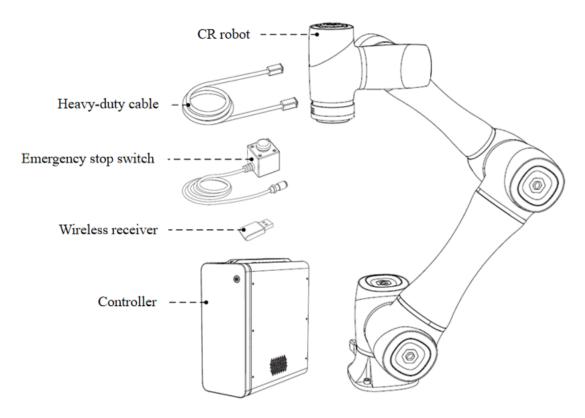
Figure 3.1　Robot overview

The main components of the robot system include:

- **CR robot:** six-axis robot arm, main moving parts.

- **Controller:** core computing and electrical components.

- **Emergency stop switch:** connected to the controller to realize the emergency stop function.

- **Wireless receiver:** plugged into the controller, so that the operating terminal can be connected to and control the robot via WiFi.

- **Heavy-duty cable**: connect the robot arm to the controller.

In addition, the system includes an **operating terminal** (tablet or PC) for installing the robot control software.

Pad   PC

Figure 3.2   Operation terminal

3.2   Robot arm

3.2.1   Composition

CR series robot arm includes 6 rotating motion joints, and two connecting rods (upper arm and forearm), as shown in Figure 3.3 (taking CR5 as an example). The robot arm is equipped with a heavy-duty interface on its base, buttons and indicator light on its end, and an aerial plug on its end flange side.
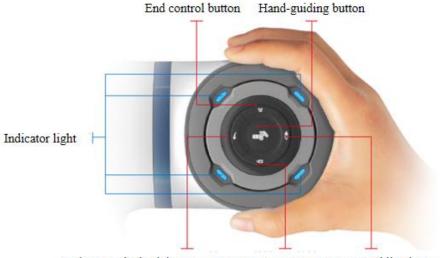
Figure 3.3   CR robot

3.2.2   End buttons and indicator lights

CR series robot arm is equipped with several buttons and indicator light on its end, as shown in Figure 3.4.

Figure 3.4   End buttons and indicator light

The definition of the indicator light is shown in Table 3.1.

Table 3.1   Definition of indicator lights

Color	Status	Definition
Blue light	Steady on	The robot arm has been started but not enabled
	Flash	Hand-guiding status (or the robot arm is starting/the robot arm and controller failed to be connected)
Green light	Steady on	The robot arm is enabled (not run projects)
	Flash	Automatic running (project is running)
Yellow light	Steady on	Trajectory recording
	Flash	Trajectory playback
Red light	Steady on	System error

The functions of the end button are shown below:

- **Hand-guiding button**: When the robot arm is in the enabled status (the indicator light is green and steady on), long press the button for 3 seconds and then release it, and the robot arm will enter the hand-guiding status (the indicator light flashes blue). After dragging the robot arm to the teaching point, press the end button again for a short time, and the robot arm will exit the hand-guiding status (the indicator light turns to green and steady on).

- **End control button**: Short-press the button to control the end tool. For specific functions, you need to configure in "Dobot+" page of the control software.

- **Enabling button**: When the robot arm is powered on and in the disabled status (the indicator light is blue and steady on), long press the button for 3 seconds and then release it, and the robot arm will enter the enabled status (the indicator light flashes blue). The

indicator light turns green after the robot arm is enabled successfully. Then long press the button for 6 seconds and release it, and the robot arm starts being disabled (the indicator light flashes green). The indicator light turns blue after the robot arm is disabled.

- **Trajectory recording button**: When the robot arm is in the enabled status (the indicator light is green and steady on), long press the button for 3 seconds and release it, and the robot arm will enter the trajectory recording status (the indicator light is yellow and steady on). After recording the trajectory, short-press the button again, and the robot arm will exit the trajectory recording status (the indicator light turns to green and steady on).

- **Trajectory playback button**: When the robot arm is in the enabled status (the indicator light is green and steady on), long press the button for 3 seconds and release it, and the robot arm enters the trajectory playback status (the indicator light flashes yellow) to play back the last recorded trajectory. Then short-press the button again, and the robot arm will exit the trajectory playback status (the indicator light turns to green and steady on).

3.3 Controller

CR series robot arms need to be used with a controller. Figure 3.5 shows the appearance of the controller. For details on its electrical interfaces, see *6 Electrical Features*.

Figure 3.5   Controller

After connecting the power supply and the robot arm, short press the power switch to turn on the controller and the robot arm. Then the blue light starts to flash. When the blue light is steady on, it indicates the controller is started successfully.

After the controller is started, long press the power switch for more than 3s and release it, then the controller and the robot arm will be powered off. When the blue light is off, it indicates the controller is powered off.

Above the general IO interface on the back of the controller are three indicator lights (green, yellow and red), which indicate the status of the main control board of the controller.

- Green light: power indicator, which is steady on after the power is turned on.

- Yellow light: communication indicator, which flashes when there is communication within the internal bus of the controller.

- Red light: running indicator, which flashes when the controller is running. When the main control board of the controller works normally, the controller will start running after being powered on, that is, the red light should be flashing at the same time when the green light is on.

3.4 Operation terminal

CR series robot arms support control through PC and App, as shown in Table 3.2. If you need to use WiFi for control, you need to plug the WiFi module into the controller.

Table 3.2 Operation terminal parameters

Terminal type	PC	Tablet (Android)	iPad
Operation system	Windows7/10/11	Android 10 and above	iOS 10 and above
Control software	DobotStudio Pro	Dobot CRStudio	Dobot CRStudio
Minimum configuration	CPU: Intel Core i3 Memory: 4GB Storage space: 256GB	CPU: 4-core Running memory: 2G Storage space: 32G	Storage space: 32G
Communication mode	LAN/WiFi	WiFi	WiFi

When purchasing CR series robot arms, you can ask for matching Android tablets; or use self-prepared operating terminal which meets the minimum configuration in Table 3.2. It is recommended to use Huawei C5 tablet.

4. **Product Features**

4.1 **Coordinate system**

4.1.1 **Joint coordinate system**

The joint coordinate system is determined based on all motion joints. All joints are rotating joints, as shown in Figure 4.1.
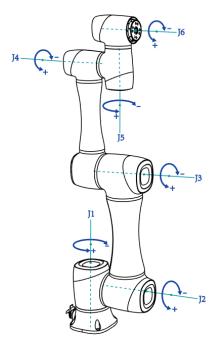
Figure 4.1 Joint coordinate system

4.1.2 **User coordinate system**

The user coordinate system is a movable coordinate system which is used for representing equipment like fixtures, workbenches. The origin and the orientations of axes can be defined based on the site requirements to measure point data within the workspace and arrange tasks conveniently. The default user coordinate system is determined based on the center point at the robot base, as shown in Figure 4.2.
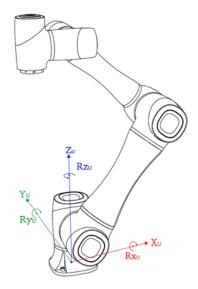
Figure 4.2   User coordinate system

4.1.3   **Tool coordinate system**

The tool coordinate system defines the tool center point (TCP) and tool posture, of which the origin and orientations vary with the position and angle of the workpiece at the end of robot. The default tool coordinate system is determined based on the center point of the end flange, as shown in Figure 4.3.
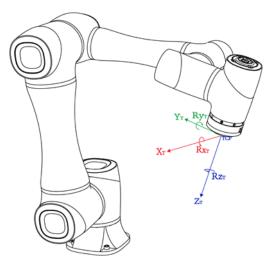
Figure 4.3   Tool coordinate system

4.2   **Home posture**

When the robot arm is in the vertical state shown in Figure 4.1, the angle of all joints is 0 degrees. This posture is called the home posture. The home-point stickers as shown in Figure 4.4 are attached to each joint of the robot arm. When the joint is 0 degree, the stickers on both sides of the joint will be aligned.

Figure 4.4   Home point sticker

If the home point of the robot arm changes due to the replacement of the transmission parts or the collision, you can move the robot arm to a state where all the home-point stickers of each joint are aligned, and then calibrate the home-point through the control software.

4.3 Singularity Point

4.3.1 Shoulder singularity

When the intersection of the J5 axis and the J6 axis of the robot arm is located in the plane formed by the J1 axis and the J2 axis, it will lead to singularity, as shown in Figure 4.5.
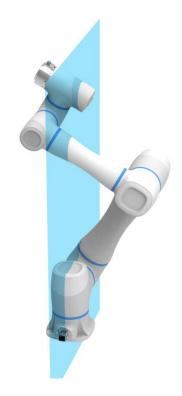
Figure 4.5   Shoulder singularity

4.3.2   **Elbow singularity**

When the upper arm and forearm are in the same line, it will lead to singularity, as shown in Figure 4.6.
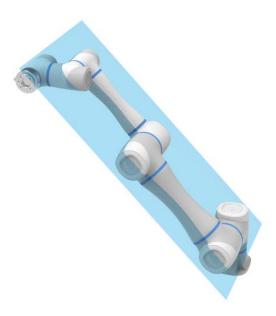
Figure 4.6   Elbow singularity

4.3.3   **Wrist singularity**

When the J4 axis and J6 axis are parallel, it will lead to singularity, as shown in Figure 4.7.

Figure 4.7   Wrist singularity

4.4   Braking time and braking distance

When the J1~J3 axes triggers an emergency stop at 100% speed, maximum load and maximum arm span, the braking time and braking distance of each joint are shown in the table below.

For the J1 axis, the test is performed by moving horizontally, namely, the rotation axis is perpendicular to the ground.

For the J2 and J3 axis tests, the robot follows a vertical trajectory, namely, the rotation axis is parallel to the ground, and triggers an emergency stop when the robot moves downward.

Table 4.1 only includes the data of some models for your reference.

Table 4.1   Braking time and Braking distance

Axis	Braking time/Braking distance			
	CR3	CR5	CR10	CR16
J1	122ms / 84.89mm	141ms / 179.39mm	114ms / 135.51mm	126ms / 144.58mm
J2	165ms / 83.97mm	161ms / 158.19mm	127ms / 177.88mm	127ms / 136.02mm
J3	98ms / 92.72mm	100ms / 180.99mm	126ms / 229.43mm	141ms / 199.45mm

5. Mechanical Specifications

All dimensions in this chapter are in millimeters (mm).

5.1 CR3 mechanical specifications

5.1.1 CR3 dimensions and working space

When selecting the installation position for the robot, you must consider the cylindrical space directly over and under the robot, and avoid moving the tool to the cylindrical space as much as possible. Because this will cause the joints to rotate too fast while the tool moves slowly, resulting in low working efficiency of the robot and difficult risk assessment.

Figure 5.1   CR3 dimensions and working space

5.1.2 CR3 base installation dimensions

Figure 5.2   CR3 base installation dimensions

5.1.3   **CR3 flange dimensions**

The end flanges of CR series robot arms are all in the same size. The flange design conforms to ISO 9409-1.

Figure 5.3   End flange dimensions

5.1.4   **CR3 load curve**

In the load curve, the coordinate origin is the center of the end flange, and X, Y represent the distance between the gravity center of load and the robot flange in X and Y directions. According to $r = \sqrt{X^2 + Y^2}$, the value **r** corresponds to the vertical coordinate X, Y[cm] of the load curve, and the abscissa Z[cm] represents the distance from the gravity center of the load to the robot flange in Z direction. You can determine the working condition of the robot according to the statistical results. For example, if the load is 2.8kg, X = 6cm, Y = 8cm, Z = 5cm, and you can get r = 10cm. The steps for judgement are as follows:

- According to $r = \sqrt{X^2 + Y^2}$, calculate r = 10cm.
- Select the corresponding curve according to the weight of the load. As the load is 2.8kg, you need to find the curve of 3kg correspondingly.
- Determine a point according to the r and Z coordinates, and compare the positional relationship between the point and the 3kg curve to judge the working condition. If the point is below the curve, the model is proper, otherwise you need to select other models.

Figure 5.4   CR3 load curve

5.2   **CR5 mechanical specifications**

5.2.1   **CR5 dimensions and working space**

When selecting the installation position for the robot, you must consider the cylindrical space directly over and under the robot, and avoid moving the tool to the cylindrical space as much as possible. Because this will cause the joints to rotate too fast while the tool moves slowly, resulting in low working efficiency of the robot and difficult risk assessment.
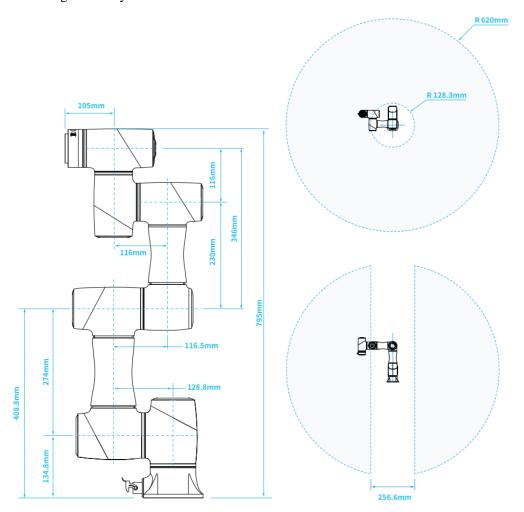
Figure 5.5   CR5 dimensions and working space

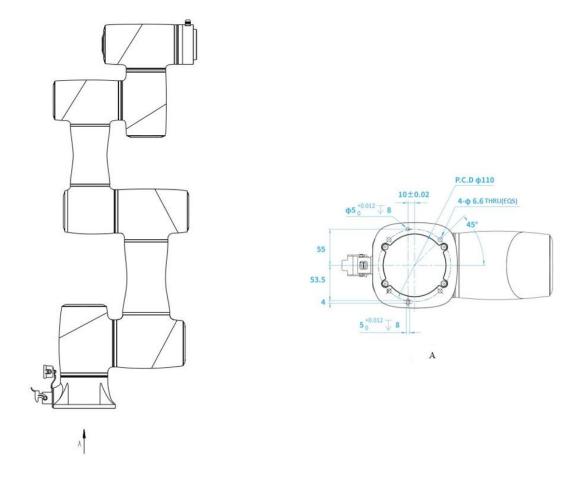## 5.2.2   **CR5 base installation dimensions**

Figure 5.6　CR5 base installation dimensions

5.2.3　**CR5 flange dimensions**

The end flanges of CR series robot arms are all in the same size. The flange design conforms to ISO 9409-1.
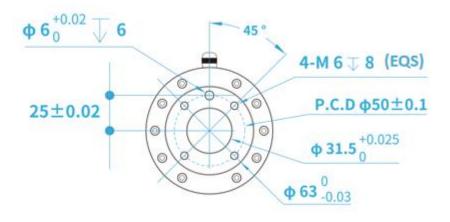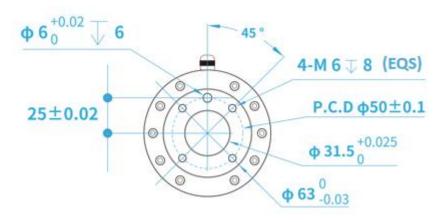

Figure 5.7　End flange dimensions

5.2.4　**CR5 load curve**

In the load curve, the coordinate origin is the center of the end flange, and X, Y represent the

distance between the gravity center of load and the robot flange in X and Y directions. According to $r = \sqrt{X^2 + Y^2}$, the value **r** corresponds to the vertical coordinate X, Y[cm] of the load curve, and the abscissa Z[cm] represents the distance from the gravity center of the load to the robot flange in Z direction. You can determine the working condition of the robot according to the statistical results. For example, if the load is 2.8kg, X = 6cm, Y = 8cm, Z = 5cm, and you can get r = 10cm. The steps for judgement are as follows:

- According to $r = \sqrt{X^2 + Y^2}$, calculate r = 10cm.

- Select the corresponding curve according to the weight of the load. As the load is 2.8kg, you need to find the curve of 3kg correspondingly.

- Determine a point according to the r and Z coordinates, and compare the positional relationship between the point and the 3kg curve to judge the working condition. If the point is below the curve, the model is proper, otherwise you need to select other models.

Figure 5.8   CR5 load curve

5.3   CR7 dimensions

5.3.1   CR7 product dimensions

When selecting the installation position for the robot, you must consider the cylindrical space directly over and under the robot, and avoid moving the tool to the cylindrical space as much as possible. Because this will cause the joints to rotate too fast while the tool moves slowly, resulting in low working efficiency of the robot and difficult risk assessment.

Figure 5.9   CR7 dimensions and working space

5.3.2   **CR7 base**
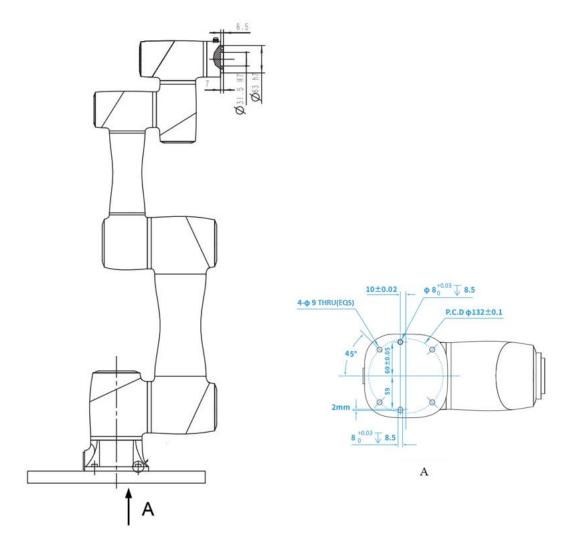
Figure 5.10   CR7 base installation dimensions

5.3.3   **CR7 end flange**

The end flanges of CR series robot arms are all in the same size. The flange design conforms to ISO 9409-1.
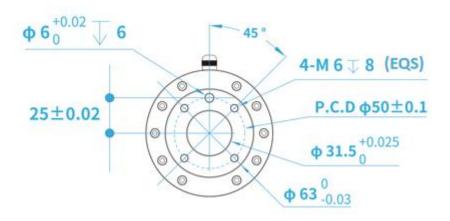
Figure 5.11   End flange dimensions

5.3.4　CR7 load curve

In the load curve, the coordinate origin is the center of the end flange, and X, Y represent the distance between the gravity center of load and the robot flange in X and Y directions. According to $r = \sqrt{X^2 + Y^2}$, the value **r** corresponds to the vertical coordinate X, Y[cm] of the load curve, and the abscissa Z[cm] represents the distance from the gravity center of the load to the robot flange in Z direction. You can determine the working condition of the robot according to the statistical results. For example, if the load is 2.8kg, X = 6cm, Y = 8cm, Z = 5cm, and you can get r = 10cm. The steps for judgement are as follows:

- According to $r = \sqrt{X^2 + Y^2}$, calculate r = 10cm.

- Select the corresponding curve according to the weight of the load. As the load is 2.8kg, you need to find the curve of 3kg correspondingly.

- Determine a point according to the r and Z coordinates, and compare the positional relationship between the point and the 3kg curve to judge the working condition. If the point is below the curve, the model is proper, otherwise you need to select other models.

Figure 5.12　CR7 load curve

5.4　CR10 mechanical specifications

5.4.1　CR10 dimensions and working range

When selecting the installation position for the robot, you must consider the cylindrical space directly over and under the robot, and avoid moving the tool to the cylindrical space as much as possible. Because this will cause the joints to rotate too fast while the tool moves slowly, resulting in low working efficiency of the robot and difficult risk assessment.
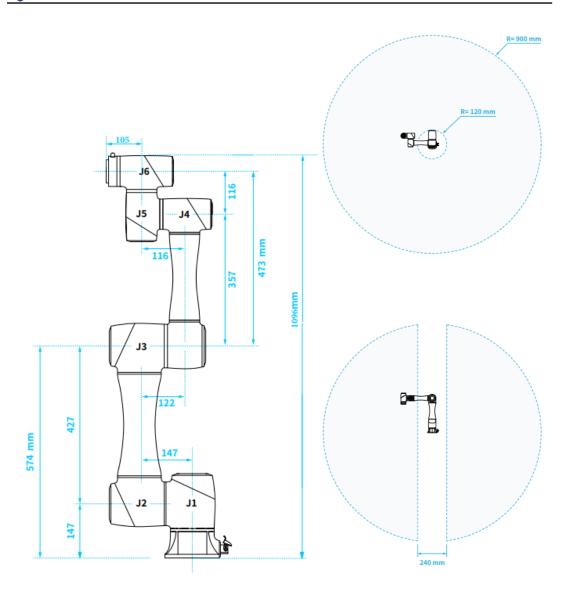
Figure 5.13   CR10 dimensions and working space

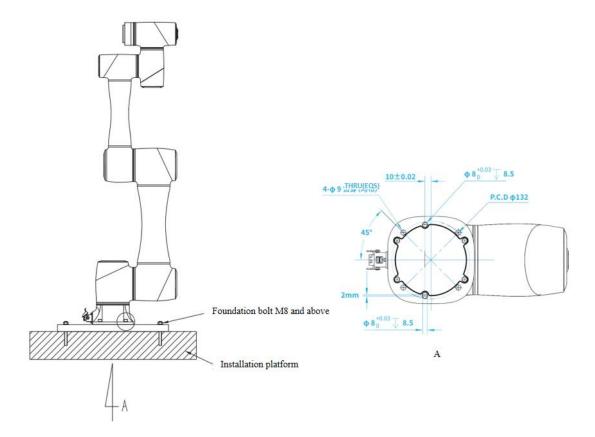5.4.2   **CR10 base installation dimensions**

Figure 5.14   CR10 base installation dimensions

5.4.3   **CR10 end flange dimensions**

The end flanges of CR series robot arms are all in the same size. The flange design conforms to ISO 9409-1.
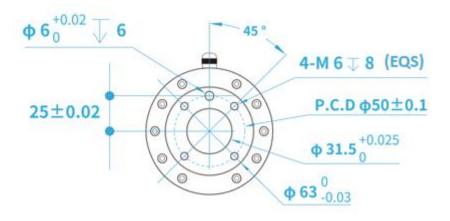
Figure 5.15   End flange dimensions

5.4.4 CR10 load curve

In the load curve, the coordinate origin is the center of the end flange, and X, Y represent the distance between the gravity center of load and the robot flange in X and Y directions. According to $r = \sqrt{X^2 + Y^2}$, the value **r** corresponds to the vertical coordinate X, Y[cm] of the load curve, and the abscissa Z[cm] represents the distance from the gravity center of the load to the robot flange in Z direction. You can determine the working condition of the robot according to the statistical results. For example, if the load is 3.8kg, X = 6cm, Y = 8cm, Z = 5cm, and you can get r = 10cm. The steps for judgement are as follows:

- According to $r = \sqrt{X^2 + Y^2}$, calculate r = 10cm.
- Select the corresponding curve according to the weight of the load. As the load is 3.8kg, you need to find the curve of 4kg correspondingly.
- Determine a point according to the r and Z coordinates, and compare the positional relationship between the point and the 4kg curve to judge the working condition. If the point is below the curve, the model is proper, otherwise you need to select other models.
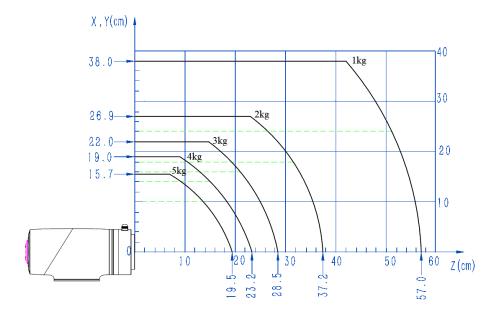

Figure 5.16   CR10 load curve

5.5 CR12 mechanical specifications

5.5.1 CR12 dimensions and working range

When selecting the installation position for the robot, you must consider the cylindrical space directly over and under the robot, and avoid moving the tool to the cylindrical space as much as possible. Because this will cause the joints to rotate too fast while the tool moves slowly, resulting in low working efficiency of the robot and difficult risk assessment.
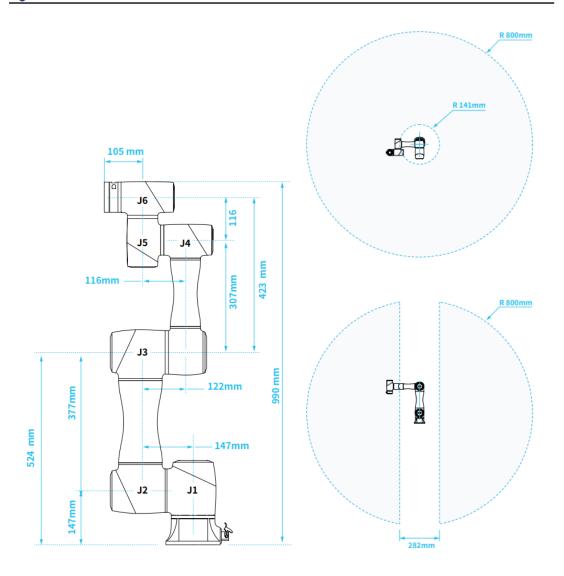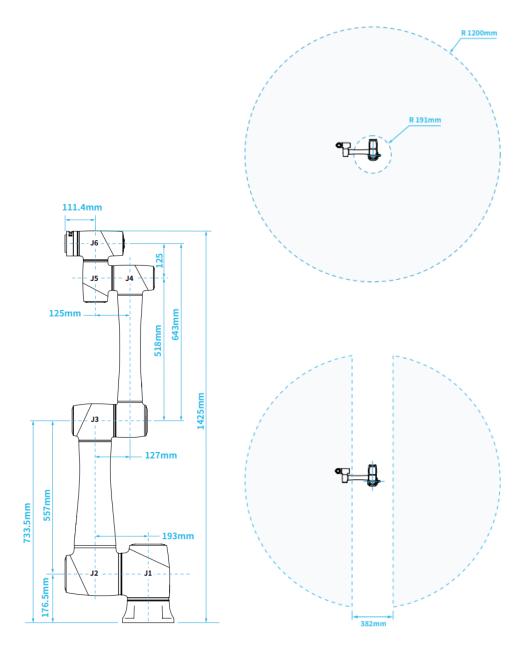
Figure 5.17   CR12 dimensions and working space

5.5.2   **CR12 base installation dimensions**
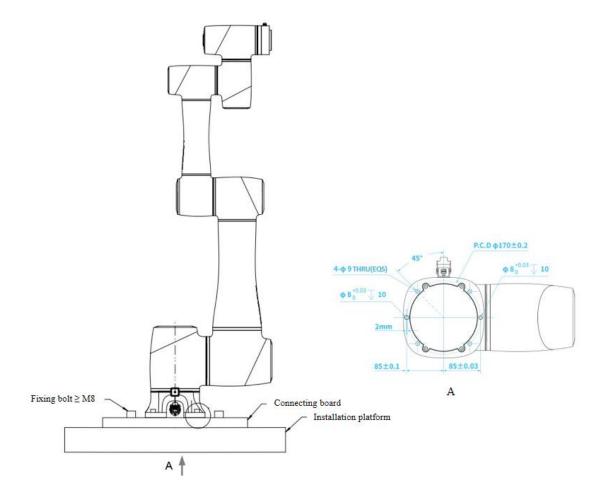
Figure 5.18　CR12 base installation dimensions

5.5.3　**CR12 end flange dimensions**

The end flanges of CR series robot arms are all in the same size. The flange design conforms to ISO 9409-1.
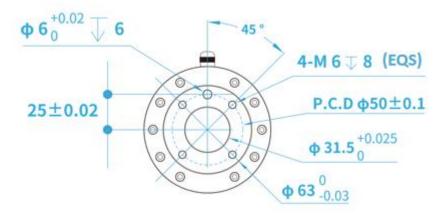
Figure 5.19　End flange dimensions

5.5.4 **CR12 load curve**

In the load curve, the coordinate origin is the center of the end flange, and X, Y represent the distance between the gravity center of load and the robot flange in X and Y directions. According to $r = \sqrt{X^2 + Y^2}$, the value **r** corresponds to the vertical coordinate X, Y[cm] of the load curve, and the abscissa Z[cm] represents the distance from the gravity center of the load to the robot flange in Z direction. You can determine the working condition of the robot according to the statistical results. For example, if the load is 3.8kg, X = 6cm, Y = 8cm, Z = 5cm, and you can get r = 10cm. The steps for judgement are as follows:

- According to $r = \sqrt{X^2 + Y^2}$, calculate r = 10cm.

- Select the corresponding curve according to the weight of the load. As the load is 3.8kg, you need to find the curve of 4kg correspondingly.

- Determine a point according to the r and Z coordinates, and compare the positional relationship between the point and the 4kg curve to judge the working condition. If the point is below the curve, the model is proper, otherwise you need to select other models.
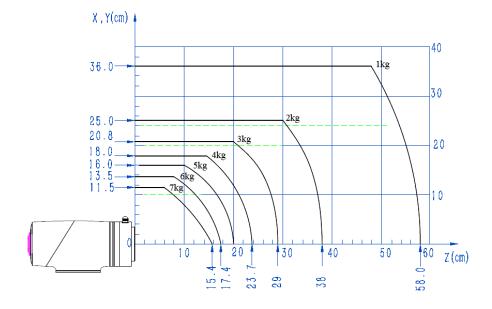

Figure 5.20   CR12 load curve

5.6 **CR16 mechanical specifications**

5.6.1 **CR16 dimensions and working space**

When selecting the installation position for the robot, you must consider the cylindrical space directly over and under the robot, and avoid moving the tool to the cylindrical space as much as possible. Because this will cause the joints to rotate too fast while the tool moves slowly, resulting in low working efficiency of the robot and difficult risk assessment.
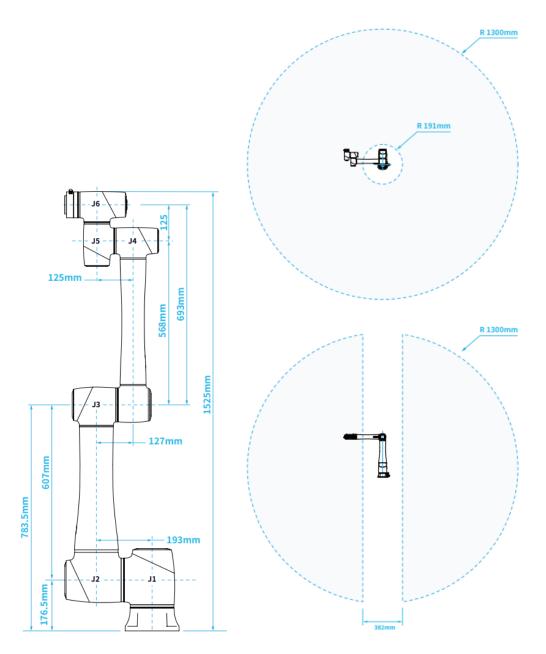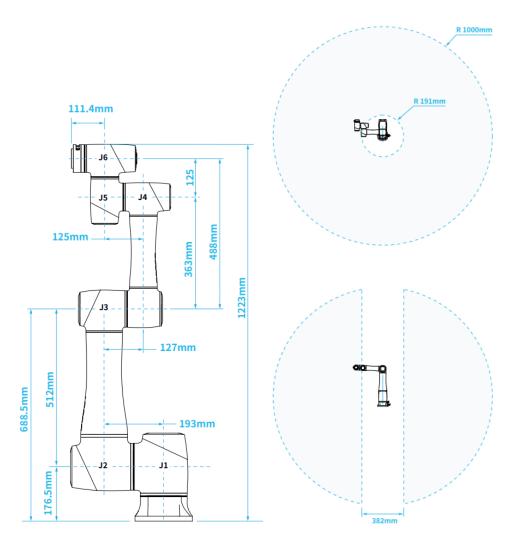
Figure 5.21　CR16 dimensions and working space
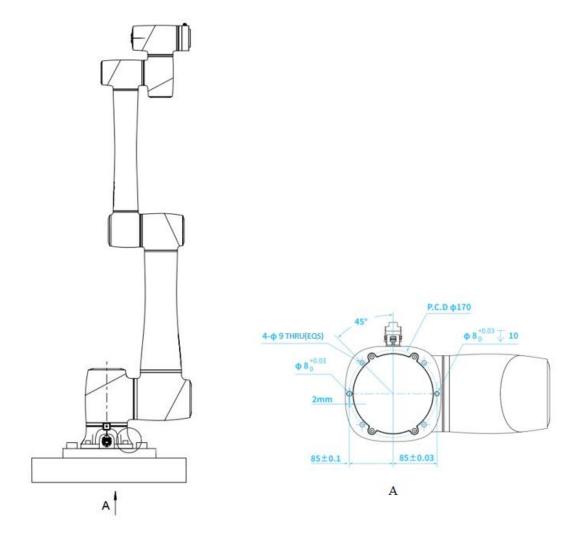
5.6.2　**CR16 base installation dimensions**
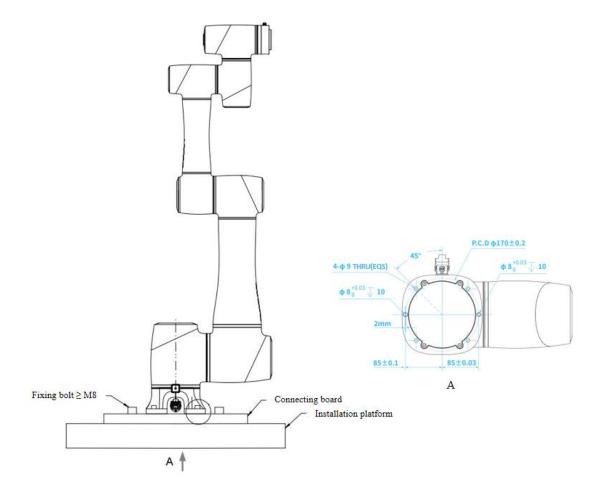
Figure 5.22   CR16 base installation dimensions

5.6.3   **CR16 end flange dimensions**

The end flanges of CR series robot arms are all in the same size. The flange design conforms to ISO 9409-1.
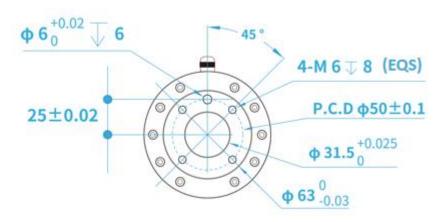
Figure 5.23   End flange dimensions

5.6.4 **CR16 load curve**

In the load curve, the coordinate origin is the center of the end flange, and X, Y represent the distance between the gravity center of load and the robot flange in X and Y directions. According to $r = \sqrt{X^2 + Y^2}$, the value **r** corresponds to the vertical coordinate X, Y[cm] of the load curve, and the abscissa Z[cm] represents the distance from the gravity center of the load to the robot flange in Z direction. You can determine the working condition of the robot according to the statistical results. For example, if the load is 3.8kg, X = 6cm, Y = 8cm, Z = 5cm, and you can get r = 10cm. The steps for judgement are as follows:

- According to $r = \sqrt{X^2 + Y^2}$, calculate r = 10cm.

- Select the corresponding curve according to the weight of the load. As the load is 3.8kg, you need to find the curve of 4kg correspondingly.

- Determine a point according to the r and Z coordinates, and compare the positional relationship between the point and the 4kg curve to judge the working condition. If the point is below the curve, the model is proper, otherwise you need to select other models.
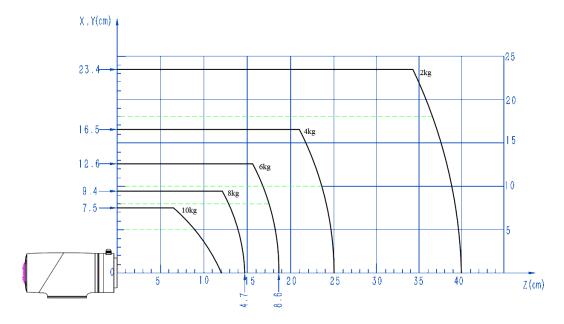

Figure 5.24　CR16 load curve

5.7　**Controller dimensions**

The dimensions of CC162 controller are shown in Figure 5.25.
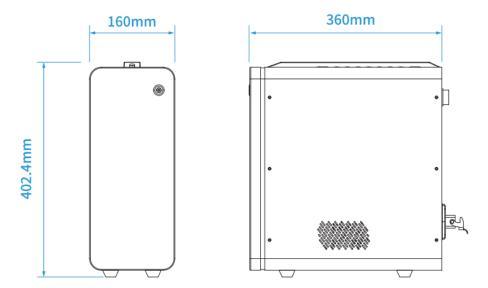
Figure 5.25   Controller dimensions

6. Electrical Features

6.1 Controller interface

6.1.1 Overview

The interfaces of the controller are shown in Figure 6.1.
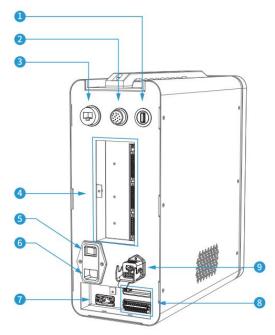
Figure 6.1   Controller electrical interfaces

Table 6.1   Interface panel description

No.	Description
1	USB interface For connecting to WiFi module
2	SmartPendant and emergency stop switch interface For connecting to SmartPendant (optional) or emergency stop switch
3	LAN interface (default address: 192.168.5.1) For connecting to PC (Used for debugging), or other external network equipment of TCP/IP or Modbus TCP protocol
4	General I/O interface See *6.1.2 General I/O interface panel*
5	Power switch of controller For powering on/off the controller
6	Power interface For accessing single-phase 1100/220V AC power supply

No.	Description
7	External DC 48V power supply reserved port
	For accessing AGV to supply 48V DC power to the robot
8	Safety I/O interface
	See *6.1.6 Safety I/O interface* for details
9	Heavy-duty connector interface
	For connecting to robot, powering robot and communication

6.1.2 General I/O interface panel

The robot controller contains an I/O interface panel for connecting to external equipment, such as air pump, PLC, etc. The I/O interface panel provide 32 digital inputs, 16 digital outputs (multiplex with 16 digital inputs), 2 analog outputs, and 2 analog inputs and an incremental encoder input.
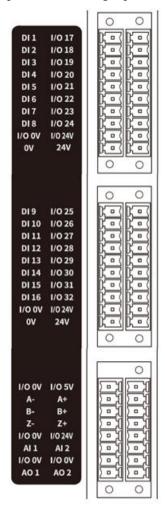
Figure 6.2   Controller I/O interface

Table 6.2 Pin definition

PIN	Name	Definition
1	DI1	Digital input 1
2	DI2	Digital input 2
3	DI3	Digital input 3
4	DI4	Digital input 4
5	DI5	Digital input 5
6	DI6	Digital input 6
7	DI7	Digital input 7
8	DI8	Digital input 8
9	I/O 0V	Ground for I/O interface
10	0V	Ground for internal DC24V power supply
11	I/O17	Digital input 17 /output 1
12	I/O18	Digital input 18 /output 2
13	I/O19	Digital input 19 /output 3
14	I/O20	Digital input 20/output 4
15	I/O21	Digital input 21/output 5
16	I/O22	Digital input 22/output 6
17	I/O23	Digital input 23/output 7
18	I/O24	Digital input 24/output 8
19	I/O 24V	Ground for I/O interface
20	24V	Ground for internal DC24V power supply
21	DI9	Digital input 9
22	DI10	Digital input 10
23	DI11	Digital input 11
24	DI12	Digital input 12
25	DI13	Digital input 13
26	DI14	Digital input 14
27	DI15	Digital input 15
28	DI16	Digital input 16

PIN	Name	Definition
29	I/O 0V	Ground for I/O interface
30	0V	Ground for internal DC24V power supply
31	I/O25	Digital input 25/output 9
32	I/O26	Digital input 26/output 10
33	I/O27	Digital input 27/output 11
34	I/O28	Digital input 28/output 12
35	I/O29	Digital input 29/output 13
36	I/O30	Digital input 30/output 14
37	I/O31	Digital input 31/output 15
38	I/O32	Digital input 32/output 16
39	I/O 24V	I / O interface DC 24V power input
40	24V	Internal DC 24V power output
41	I/O 0V	Ground for I/O interface
42	A-	Incremental Encoder ABZ Input
43	B-	
44	Z-	
50	A+	
51	B+	
52	Z+	
45	I/O 0V	Ground for I/O interface
46	AI 1	Analog input 1
47	I/O 0V	Ground for I/O interface
48	AO 1	Analog output 1
49	I/O 5V	Internal DC 5V power output
53	I/O 24V	I/O interface DC 24V power input
54	AI 2	Analog input 2
55	I/O 0V	Ground for I/O interface
56	AO 2	Analog output 2

6.1.3 **Digital I/O interface**

Digital I/O interfaces can be powered by internal 24V power supply, with total output current of 2A and 500mA maximum for each I/O output. When using the internal power supply, short-circuit 0V with I/O 0V or 24V with I/O 24V interfaces, as shown below.
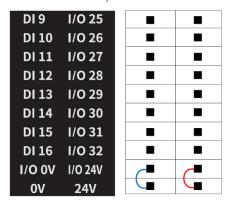
Figure 6.3   I/O using internal power supply

You can connect an external power supply if larger total output current (maximum: 4A) is required, as shown below.
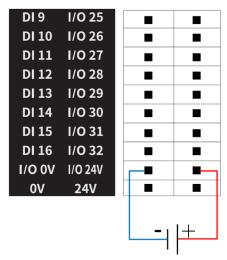
Figure 6.4   I/O connected to external power supply

The wiring of DI connected to a simple switch is shown below.
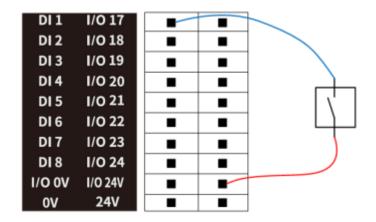
Figure 6.5   DI connected to PNP-type input

The wiring of DI connected to external DO is shown in Figure 6.6, which takes PNP-type DO without power supply as an example. If DO has its own power supply, you do not need to connect V+ cable.
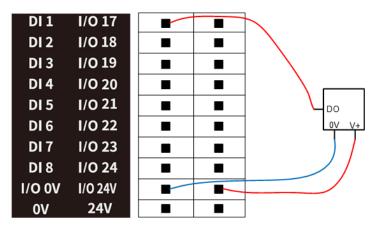
Figure 6.6   DI connected to PNP-type input

The wiring of DO connected to external load is shown in Figure 6.7.
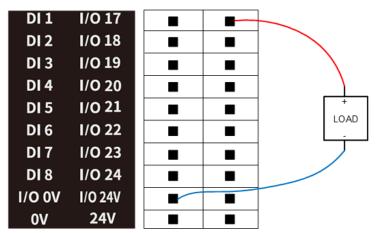
Figure 6.7   DO connected to external load

6.1.4   **Analog I/O interface**

The analog signal supports voltage (0~10V) or current (4~20mA) signal (default: voltage). If you need to adjust it to current signal, please contact Dobot technical support.

The wiring of AI interface connected to the tested object is shown in Figure 6.8.
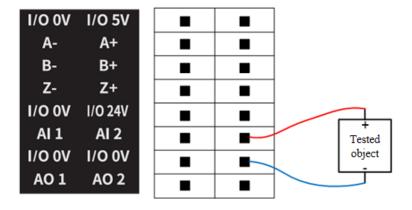
Figure 6.8   AI connected to tested object

The wiring of AO interface connected to the external load is shown in Figure 6.8.
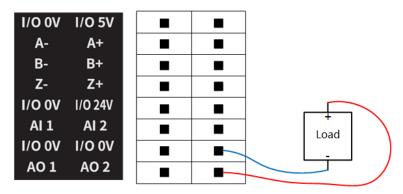
Figure 6.9   AO connected to external load

6.1.5   **Encoder I/O interface**

An encoder is a device that converts angular or linear displacement into electrical signals. Specifically, it converts displacement into periodic electrical signals and then converts electrical signals into count pluses. So the displacements can be measured by the number of pluses.

This section takes OMRON E6B2-CWZ1X as an example to describe how to connect it.

According to different color cables of the encoder, connect the 5V power cable to Pin49, 0V power cable to Pin41, and then connect each coded wiring in turn. If the ground wire is required, you can fix the cable shield on the controller using screws. There is no need to connect the ground wire unless in special circumstances (strong magnetic interference, etc.).

Table 6.3   Wiring color

Color	Description
Brown	I/O 5V
Blue	I/O 0V

Color	Description
Black	A+
White	B+
Orange	Z+
Black and red	A-
White and red	B-
Orange and red	Z-

6.1.6 **Safety I/O interface**

The safety I/O includes 20 interfaces: SI1~SI10, SO1~SO10.

SI02/SI03/SI04/SI05/SI10 interfaces can be configured to user emergency stop input, protective stop input, protective stop reset input, reduction mode input and automatic running input through control software. The above interfaces can be configured randomly (single/dual) and are not configured by factory default.

You can configure the SO03/SO05 interfaces through software as the emergency stop output, running state output, non-stop output and reduction mode output interfaces. These interfaces can be configured randomly (single channel) and are not configured by factory default. SO02, SO04 and SO10 are high level by default and can be connected to security peripherals.

Emergency stop interface

Emergency stop I/O is an emergency stop interface for you to connect to external emergency stop devices.

By default, the emergency stop input is the normally closed signal input of high level. Low level triggers the robot to enter the emergency stop status.

If you configure SI02 and SI03 as emergency stop I/O, the wiring of connecting one or multiple emergency stop switches is shown below (SO02 and SO04 are 24V).
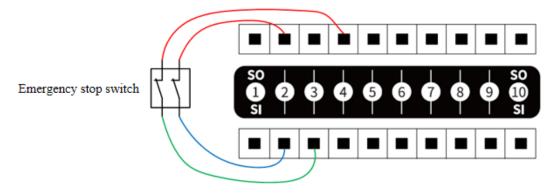
Figure 6.10   SI connected to an emergency stop switch
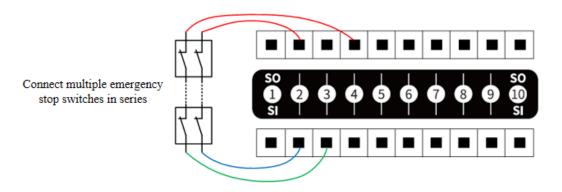
Figure 6.11   SI connected to multiple emergency stop switches

Protective stop interface

The protective stop interface is used for connecting external protective devices (such as safety gate, safety light curtains, etc.).

The protective stop input is the normally closed signal input of high power by default. Low level triggers the robot to enter protective stop state (pause state).

- When the protective stop reset interface is configured, the operation of the robot can be resumed only by restoring the protective stop input signal and triggering the protective stop reset input.
- When the protective stop reset interface is not configured, the operation of the robot can be resumed by restoring the protective stop input signal.

Protective stop reset interface

The protective stop reset interface is used to reset the protective stop state.

The default protective stop reset input is the normally open signal of high power, and rising edge triggers to reset the protective stop state.

If you configure SI04 and SI05 as protective stop input and SI10 as protective stop reset input, the wiring is shown below (SO02, SO04 and SO10 are 24V).
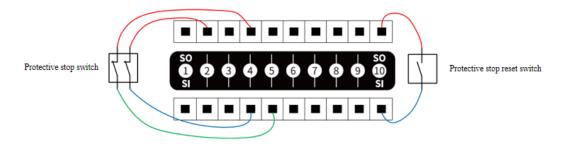
Figure 6.12 SI connected to protective stop device (with reset switch)

Reduction mode interface

Reduction mode interface is used to control the robot into reduction mode. In reduction mode, the motion parameters of the robot arm (joint speed, TCP speed) are limited within the range of the user-defined reduction mode.

The default input of reduction mode is the normally closed signal of high level, and low-level input triggers the robot to enter the reduction mode. If the high-level input is restored, the robot exits the reduction mode and enters the normal mode.
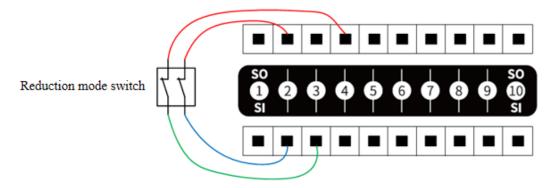
Figure 6.13 SI connected to reduction mode switch

Automatic operation confirmation interface

You need to confirm the automatic operation interface before the robot enters the automatic operation mode. The default automatic operation input is the normally open signal of high power, and rising edge triggers the robot to start the automatic mode confirmation.

If you configure SI04 and SI05 as automatic operation confirmation input, the wiring of connecting automatic operation confirmation switch is shown below (SO02 and SO04 are 24V).

Emergency stop state output interface

The emergency stop state output interface is used to confirm whether the robot enters the emergency stop state. In emergency stop state, the output voltage is low level, and in non-emergency stop state, the output voltage is high level.

If you configure SO03 as emergency stop state output, the wiring of connecting external load is shown below. The other end of the load can be connected to any 0V interface on the general I/O

interface panel. The figure below only shows an example.
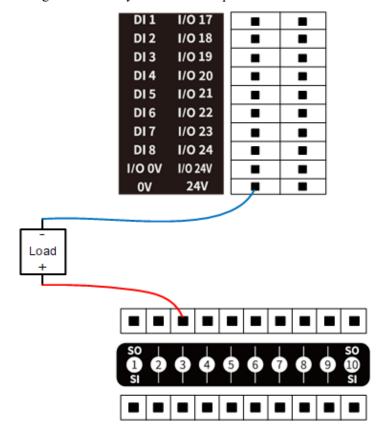
Figure 6.14 SO connected to external load

Running state output interface

The running state output interface is used to confirm whether the robot is in running state. The output voltage is low level in the running state, and high level in the non-running state.

Non-stop state output interface

The non-stop state output interface is used to check whether the script is running. The output voltage is low level when the script is running, and high level when the script is not running.

Reduction mode state interface

The reduction mode state output interface is used to check whether the robot enters the reduction mode. The output voltage is low level when the robot is in the reduction mode, and high level when the robot is in the normal mode.

📖NOTE

If the firmware version of the controller is lower than 3.5.4, the level definition of security output is opposite.
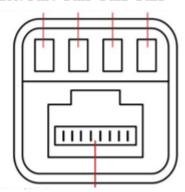
6.2 Robot interface

6.2.1 **Heavy-duty interface**

The heavy-duty connector of robot base is connected to the controller by overloading lines. It provides power supply and control signal for the robot. The pin distribution is shown below.

Power interface: Pin4 Pin3 Pin2 Pin1
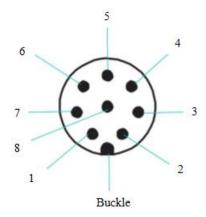
Communication interface: Pin8~Pin1

Pin		Name	Description
Power interface	Pin1	DC48V	DC48V +
	Pin2	DC48V	DC48V +
	Pin3	GND	DC48V -
	Pin4	GND	DC48V -
Communication interface	Pin1	TX+	Transmit data +
	Pin2	TX-	Transmit data -
	Pin3	RX+	Receive data +
	Pin6	RX-	Receive data -

6.2.2 **Tool I/O interface**
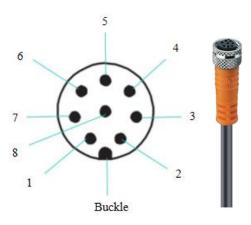
The end interface is an aerial plug located on the side of the end flange. The socket pins are distributed and defined as follows.

Pin	Name	Description
1	485A	485A
2	485B	485B
3	DI_2	Digital input 2
4	DI_1	Digital input 1
5	24V	24V output
6	DO_2	Digital output 2
7	DO_1	Digital output 1
8	GND	GND

The cable used in the tool I/O is the cable specified by Dobot (model: Lutronic FP-222460). The pin distribution and cable definition of the plug are shown as follows.

Pin	Wire color	Description
1	white	485A or analog input 1
2	brown	485B or analog input 2
3	green	Digital input 2
4	yellow	Digital input 1
5	grey	24V output
6	pink	Digital output 2
7	blue	Digital output 1
8	red	GND

Digital input/output:

The maximum current of 24V output of tool I/O is 2A (no more than 1s continuously), and the digital input is PNP type.

When using external simple switching circuit as the DI input source, the wiring is shown in Figure 6.15.
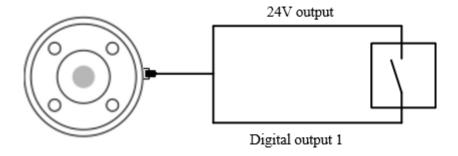
Figure 6.15   End DI wiring (simple switch)

When using the DO terminal of an external device as the DI input source, the wiring is shown in Figure 6.16, which takes a PNP-type DO without power supply as an example. If the DO has its own power supply, you do not need to connect the 24V cable.
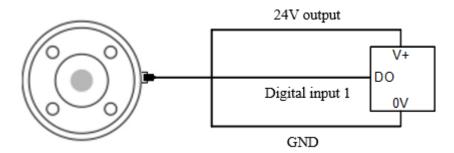
Figure 6.16   End DI wiring (PNP type DO)

The digital output of the tool I/O is NPN type, with the single output current no more than 400mA and the total output current no more than 400mA. The wiring is shown as follows.
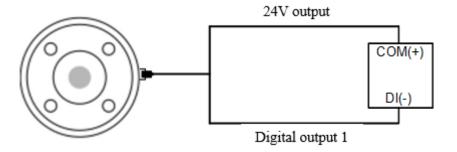
Figure 6.17   End DO wiring

Analog input

The wiring of analog I/O connected to the tested object is shown in Figure 6.18.
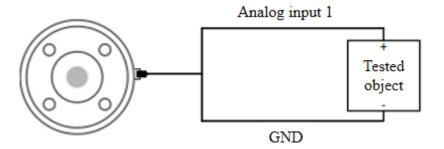
Figure 6.18   End AI wiring

7. Installation and Use

7.1 Installation environment

To maintain the performance of the controller and robot arm and ensure safe use, please place the controller and robot in an environment with the following conditions.

⚠ NOTICE

Please make sure that the installation environment meets the following conditions to avoid damage.

- Install indoors with good ventilation.

- Keep away from excessive vibration and shock.

- Keep away from direct sunlight.

- Keep away from dust, oily smoke, salinity, metal powder, corrosive gases, and other contaminants.

- Do not use in a closed environment. A closed environment may cause high temperature of the controller and shorten its service life.

- Keep away from flammable.

- Keep away from cutting and grinding fluids

- Keep away from sources of electromagnetic interference, such as large transformer, large electromagnetic contactor, electric welding machine, etc.

- When the robot is transported, ensure that the robot is stable and kept in proper place.

- When the robot is hoisted, be sure to take appropriate measures to locate the moving parts so as not to cause accidental movement and harm during hoisting and transportation.

- When moving the robot from the packing box to the mounting position, hold the robot until all bolts on the robot base are fastened.

- When the robot is installed, take corresponding measures to locate it. Be sure to use 4 hex bolts M6 (CR3)/M8 (Other models) (ISO898-1: 2013, property class: 12.9) with 20N•m torque to fix and tighten the robot base.

- When the robot is installed on the wall or upside down, be sure to take the anti-fall measures of the robot base.

- When the robot is installed, fix the robot on a sufficiently strong base, which needs to be able to fully withstand the reaction force of the robot acceleration and deceleration and the static weight of the robot and the workpiece.

7.2 Unpacking

When unpacking, please check the attached shipping list to ensure that all contents are included. If there is anything missing, please contact your supplier.

7.3 Robot installation

7.3.1 Robot arm installation

CR robot arm supports 360° installation at any angle. Figure 7.1 shows several typical installation postures.

Figure 7.1   CR robot installation posture

The installation platform of the robot arm should be stable enough to withstand at least 10 times the maximum torque of the J1 joint, and at least 5 times the weight of the robot arm.

If the robot arm is installed on a linear axis or a moving platform, the acceleration of the platform should be low, and high acceleration may trigger the robotic arm's collision detection mechanism and cause the robotic arm to stop.

Position the mounting holes on the installation platform according to the installation size of the robot base. Fix the robot arm base on the surface using bolts (4 M6 bolts for CR3, and 4 M8 bolts for other models). You can refer to *5 Mechanical Specifications* for the specific dimensions of the robot base.
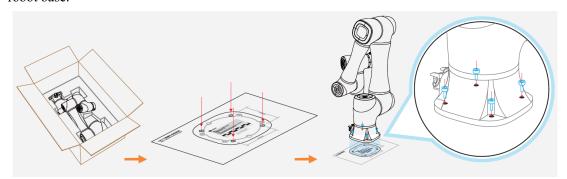
Figure 7.2   Base installation

7.3.2 Controller installation

Place the controller on a stable platform outside the working range of the robot arm, and reserve enough space for wiring and operation. Please leave at least 200 mm gap on the left and right sides and keep the vent unblocked to ensure enough space for heat dissipation. Place the control cabinet on a solid and flat plane outside the working space of the robotic arm, and reserve enough cable wiring space and operation space. A space of 200mm should be reserved on the left and right sides, and the trend will not be blocked to ensure sufficient heat dissipation space.
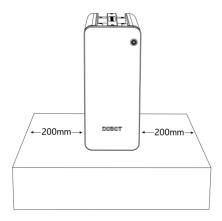
Figure 7.3   Controller installation space requirement

7.3.3   **End tool installation**

The end flange of the robot arm has four M6 threaded holes, which can fix the tool to the end of the robot arm. In order to accurately adjust the position of the tool, you can also use the reserved Φ6 positioning hole. The end flanges of CR series robot arms are in the same size. For detailed dimensions, refer to *5 Mechanical Specifications*.

7.4   **Wiring**
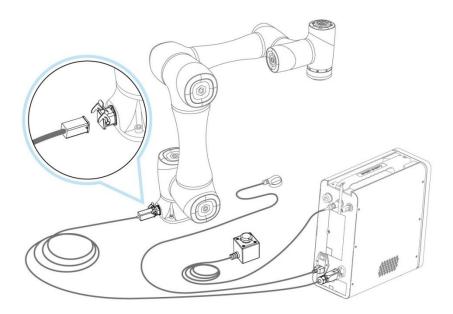
Figure 7.4   Wiring diagram

1. Connect the controller to robot arm through a heavy-duty cable. When you plug the heavy-duty connector into the heavy-duty socket, fix the buckle of the heavy-duty connector.

2. Plug the emergency stop switch cable to the emergency stop switch interface. When connecting, align the red point on the connector with the red point on the interface.

3. Plug the wireless receiver into the USB interface.

4. Plug one end of the power cable into the power interface of the controller, and the other end into main power socket.
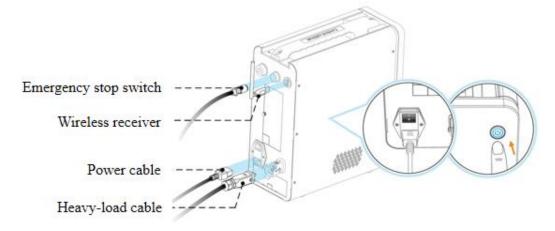
Figure 7.5 Controller wiring

⚠️NOTICE

- Set the specifications and installation method of external cables in compliance with local power distribution laws and regulations.

- Do not remove the controller by yourself, otherwise it may cause electricity leakage.

- Make sure the device is grounded.

- Do not bend the cable excessively, otherwise it may cause poor contact or cable breakage.

- Make sure the power outlet for the control system is disconnected when connecting an external device, otherwise it may cause an electric shock or device failure.

- Use supporting cables to protect device and personal safety.

- After wiring, ensure that there are no fallen screws or exposed cables in the device.

- Do not plug or remove the power cable or communication cable when the device is running normally.

- Power on the device only after connecting all the cables required.

- Ensure that the cables are connected correctly, otherwise, it may cause fault in internal modules or external devices.

- Before connecting, check whether there is breakage in the insulation and shield of the external cables.

7.5 Debugging

After turning on the external power supply, press the switch above the power interface to "|", and then short press the circular button in front of the controller. When the indicator lights at the end of the robot arm and on the controller turn blue, you can connect the robot arm, enable it and jog it for debugging through the operation terminal.

For specific operations, refer to *DobotStudio Pro User Guide* (for PC) or *Dobot CRStudio User Guide* (for App).

8. **Maintenance**

Maintenance and repairing must be performed in compliance with all safety instructions in this manual.

The purpose of maintenance and repairing is to ensure that the system is kept operational, or to return the system to an operational state in the event of a fault. Repairing includes troubleshooting in addition to the actual repair itself.

Repairing must be performed by an authorized system integrator or Dobot staff.

Robots or parts returned to Dobot should be as the following instructions.

- Remove all parts that do not belong to Dobot.

- Before returning to Dobot, please make a backup copy of the files. Dobot will not be responsible for the loss of programs, data or files stored in robot.

- The robot should move to the package point before returning to Dobot.

8.1 **Safety instructions**

The following safety procedures and warnings must be observed during the operation of the robot or controller:

- Replace faulty components using new components with the same model or equivalent components approved by Dobot.

- Reactivate all deactivated safety measures immediately after the repairing is completed.

- Record all repairs and save them in the technical document with the robot system.

- Remove the main input cables from the back of the controller to ensure that it is completely unpowered. Cut off any other power source connected to the robot or controller. Take necessary precautions to prevent other people from powering on the system during the repair period.

- Observe ESD regulations during the disassembly of the parts of the robot arm or controller.

- Avoid disassembling the power supply inside the controller. High voltage may remain inside the power supply for several hours after the controller has been powered off.

- Prevent water and dust from entering the robot arm or controller.

8.2 **Robot maintenance**

In order for the robot to maintain high performance for a long time, a maintenance inspection must be carried out. The personnel in charge of the maintenance must prepare a maintenance plan and carry out the maintenance. The maintenance items are shown below.

Table 8.1   Check items

Period	Maintenance	Maintenance essential

Daily	3 months	6 months	item	
√			Robot clean	Wipe off dirt, dust, cutting residue on the body with water or 10% alcohol
		√	Joint bolts	Check the torque of joint bolts based on the specified tightening torque table (Push aside the rubber to check)
	√		Tool mounting bolts	Check the torque based on the specified tightening torque table
√			Motor	Confirm abnormal heating or sound
√			Brake	Check whether the robot arm or end-effector will fall when the servo is powered off
	√		Reducer	Check abnormal vibration, noise, and oil leakage

The bolt tightening torque is shown in Table 8.2.

Table 8.2   Bolt tightening torque

Bolt size	Outer hexagonal bolt (joint)	Inner hexagonal bolt (12.9)	Hexagonal bolt (rear cover)
3 mm / 0.118 in	2 Nm	2.4 Nm	0.7 Nm
4 mm / 0.157 in	4 Nm	4.5 Nm	-
5 mm / 0.197 in	7.5 Nm	9 Nm	-
6 mm / 0.236 in	15 Nm	18 Nm	-
8 mm / 0.32 in	-	37 Nm	-

The tightening torques vary depending on the type of base metal or bolt. When it is not specified, please contact Dobot technical engineer.

In addition, maintenance is required every 20,000 hours of operation time or every 4 years (select the shorter of the two periods for maintenance). If you are not clear about the maintenance processes, please contact Dobot technical engineer.

9. **Certification**

Collaborative robot certification

Robot reliability certification

Functional safety certification

VERIFICATION OF COMPLIANCE Page: 1 of 2

No.:	SZFS2109000032BA	Issue No :1
Date of Issue:	20th Oct. 2021	Expiry Date: 20th Oct. 2026
Applicant:	Shenzhen Yuejiang Technology Co., Ltd.
	Room 1003, Building 2, Chongwen Park, Nanshan iPark, No.3370, Liuxian Blvd, Fuguang Community, Taoyuan Street, Nanshan District, Shenzhen, Guangdong, China
Manufacturer:	Same as applicant
Scope of certification:	EN ISO 13849-1:2015
	EN ISO 13849-2: 2012
Product Description:	CR-Series Collaborative Robot Safety System
Model No.:	DT-CR-6R030-00I; DT-CR-6R03S-00I; DT-CR-6R030-01I; DT-CR-6R03S-01I; DT-CR-6R050-00I; DT-CR-6R05S-00I; DT-CR-6R070-00I; DT-CR-6R07S-00I; DT-CR-6R100-00I; DT-CR-6R10S-00I; DT-CR-6R120-00I; DT-CR-6R12S-00I; DT-CR-6R160-00I; DT-CR-6R16S-00I.
Assessment Performed:	Assessed for compliance with the requirements of EN ISO 13849-1:2015 (PL=d, Cat 3)
Test Report Number(s):	SZFS210900003201

This Verification of Compliance has been granted to the applicant based on the results of tests, performed by Laboratory of SGS-CSTC Standards Technical Services Co., Ltd. on sample of the above-mentioned product in accordance with the provisions of the relevant specific standards.

Rocky Wang
Laboratory Manager
SGS CSTC

2021-10-20

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Member of SGS Group (Société Générale de Surveillance)

SGSPAPER
19947979

VERIFICATION OF COMPLIANCE

No.:	SHES2112024584MD
Applicant:	Shenzhen Yuejiang Technology Co., Ltd. Room 1003, Building 2, Chongwen Park, Nanshan iPark, No.3370, Liuxian Blvd, Fuguang Community, Taoyuan Street, Nanshan District, Shenzhen City, 518071, China
Manufacturer:	Same as applicant
Product Name:	DOBOT CR16, DOBOT CR16S, DOBOT CR12, DOBOT CR12S, DOBOT CR10, DOBOT CR10S, DOBOT CR7, DOBOT CR7S, DOBOT CR5, DOBOT CR5S, DOBOT CR3, DOBOT CR3S, DOBOT CR3L, DOBOT CR3LS
Product Description:	Collaborative robot
Model No.:	DT-CR-6R160-00I, DT-CR-6R16S-00I, DT-CR-6R120-00I, DT-CR-6R12S-00I, DT-CR-6R100-00I, DT-CR-6R10S-00I, DT-CR-6R070-00I, DT-CR-6R07S-00I, DT-CR-6R050-00I, DT-CR-6R05S-00I, DT-CR-6R030-00I, DT-CR-6R03S-00I, DT-CR-6R030-01I, DT-CR-6R03S-01I
Rating:	100-240 V~ 50/60 Hz
Protection against Electric Shock:	Class I
Additional Information (if any):	Collaborative robot tested with Power and force limiting by inherent design or control

Sufficient samples of the product have been tested and found to be in conformity with

Test Standard:	ISO/TS 15066:2016
as shown in the Test Report Number(s):	SHES2211202458471

This Verification of Compliance has been granted to the applicant based on the results of tests, performed by Laboratory of SGS-CSTC Standards Technical Services Co., Ltd. on sample of the above-mentioned product in accordance with the provisions of the relevant specific standards.

Andrew Zhai
Technical Manager
SGS-CSTC

2021-12-15

Safety-VOC-F05/ Rev.1.0/ 2021-11-29
Page 1 of 1

CE-MD certificate

VERIFICATION OF MD COMPLIANCE

No.:	SZFS2109000032MDC
Applicant:	Shenzhen Yuejiang Technology Co., Ltd.
	Room 1003, Building 2, Chongwen Park, Nanshan iPark, No.3370, Liuxian Blvd, Fuguang Community, Taoyuan Street, Nanshan District, Shenzhen, Guangdong, China
Manufacturer:	Same as applicant
Product Description:	CR-Series Collaborative Robot Safety System
Model No.:	DT-CR-6R030-00I; DT-CR-6R03S-00I; DT-CR-6R030-01I; DT-CR-6R03S-01I; DT-CR-6R050-00I; DT-CR-6R05S-00I; DT-CR-6R070-00I; DT-CR-6R07S-00I; DT-CR-6R100-00I; DT-CR-6R10S-00I; DT-CR-6R120-00I; DT-CR-6R12S-00I; DT-CR-6R160-00I; DT-CR-6R16S-00I

Sufficient samples of the product have been tested and found to be in conformity with

Test Standard:	EN ISO 12100:2010
	EN 60204-1:2018
	EN ISO 10218-1:2011
as shown in the Test Report Number(s)	SZFS210910003201
	SZFS210920003201

This Verification of MD Compliance has been granted to the applicant based on the results of tests, performed by Laboratory of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch on sample of the above-mentioned product in accordance with the provisions of the relevant specific standards and the Machinery Directive 2006/42/EC. The CE mark as shown below can be affixed, under the responsibility of the manufacturer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives. The affixing of the CE marking presumes in addition that the conditions in annexes III of the Directive are fulfilled.

Rocky Wang
Laboratory Manager
SGS-CSTC

2021-10-20

CE

SZE-VOC-F013 / V1.0

Effective Date :2020-02-26

SGSPAPER
19947981

CE-LVD certificate

SGS

VERIFICATION OF COMPLIANCE

No.:	LVD SZFS2109000032BA
Applicant:	Shenzhen Yuejiang Technology Co., Ltd.
	Room 1003, Building 2, Chongwen Park, Nanshan iPark, No.3370, Liuxian Blvd, Fuguang Community, Taoyuan Street, Nanshan District, Shenzhen, Guangdong, China
Manufacturer:	Same as applicant
Product Name:	CR-Series Collaborative Robot Safety System
Model No.:	DT-CR-6R030-00I; DT-CR-6R03S-00I; DT-CR-6R030-01I; DT-CR-6R03S-01I; DT-CR-6R050-00I; DT-CR-6R05S-00I; DT-CR-6R070-00I; DT-CR-6R07S-00I; DT-CR-6R100-00I; DT-CR-6R10S-00I; DT-CR-6R120-00I; DT-CR-6R12S-00I; DT-CR-6R160-00I; DT-CR-6R16S-00I.
Protection against Electric Shock:	Class I

Sufficient samples of the product have been tested and found to be in conformity with

Test Standard:	EN 60204-1:2018
Test Report Number(s):	SZFS210910003201

This Verification of Compliance has been granted to the applicant based on the results of tests, performed by Laboratory of SGS-CSTC Standards Technical Services Co., Ltd. on sample of the above-mentioned product in accordance with the provisions of the relevant harmonized standards under the Low Voltage Directive 2014/35/EU. The CE marking as shown below can be affixed, under the responsibility of the manufacturer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives. The affixing of the CE marking presumes in addition that the conditions in annexes III and IV of the Directive are fulfilled.

CE

Rocky Wang
Laboratory Technical Manager
SGS-CSTC

2021-10-20

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Member of SGS Group (Société Générale de Surveillance)

Safety-VOC-F005
Rev01/Effective Date :2020-12-11
Page 1 of 1

CE-RoHS certificate

NRTL certificate

CERTIFICATE OF COMPLIANCE

Certificate Number:	SGSNA/21/SH/00207
Contract Number:	800864
Certificate Project Number:	SH-CERT210401097
Certified Product:	DOBOT CR3, DOBOT CR5, DOBOT CR10, DOBOT CR16, DOBOT CC162
Trademarks:	DOBOT
Model(s):	DT-CR-6R030-00I, DT-CR-6R050-00I, DT-CR-6R100-00I, DT-CR-6R160-00I (Manipulator models),
	DT-CR-CC162-00I (Electrical cabinet model)
Technical Data:	DT-CR-6R030-00I: Input 48 VDC; FLA 4.4 A;
	DT-CR-6R050-00I: Input 48 VDC; FLA 6.3 A;
	DT-CR-6R100-00I: Input 48 VDC; FLA 9.4 A;
	DT-CR-6R160-00I: Input 48 VDC; FLA 8.4 A;
	DT-CR-CC162-00I: Input: 100-240 V 50/60 Hz Single phase; SCCR: 5 kA;
	Output: 48 VDC.
	DOBOT CR3; Payload 3 kg; Max. reach 620 mm;
	DOBOT CR5; Payload 5 kg; Max. reach 900 mm;
	DOBOT CR10; Payload 10 kg; Max. reach 1300 mm;
	DOBOT CR16; Payload 16 kg; Max. reach 1000 mm;
Certificate Holder:	Shenzhen Yuejiang Technology Co., Ltd.
	Room 1003, Building 2, Chongwen Park, Nanshan iPark, No.3370, Liuxian Blvd, Fuguang Community, Taoyuan Street, Nanshan District, Shenzhen City, 518071, China

This certificate supercedes previous certificates issued with the same certificate number. Certification is valid when products are indicated on the SGS directory of certified products at www.sgs.com or using the QR code below. The product is certified according to ISO/IEC Guide 17067, Conformity assessment - Fundamentals of product certification, System 3, and in accordance with:

ANSI/UL 1740, 4 Ed., Rev. June 20, 2019
CAN/CSA C22.2 No. 14-18
NFPA 79, 2018 Edition, 2018

Authorized by:

Jason Wei
Certifier

Effective date: 30 July 2021

Page 1 of 1

This certificate is issued by the company under its General Conditions for Certification Services accessible at https://www.sgs.com/en/terms-and-conditions. Attention is drawn to the limitations of liability defined therein and in the Test Report here above mentioned which findings are reflected in this Certificate. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

Certification Body

Consumer and Retail Services, a division of SGS North America Inc.
620 Old Peachtree Road, Ste. 100, Suwanee, GA 30024, USA
t +1 770 570 1800 f +1 770 277 1240 www.sgs.com

KCs certificate

자율안전확인 신고증명서
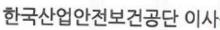
신청인	사업장명	Shenzhen Yuejiang Technology Co.,Ltd.	사업장관리번호	2021E220040
	사업자등록번호	021E220040	대표자 성명	Lui Peichao
	소재지	() Room 1003, Building2, Chang-yan Park, Nanshan Park, No.1(3 Luxian Blvd, Fuguang Community, Taoyuan Street, Nanshan District, Shenzhen China		

자율안전인증대상 기계 · 기구명		산업용로봇
형식(규격)	DT-CR-6R050-00I	용량(등급)
자율안전확인번호	21-AH2EQ-01042	
제조자	Shenzhen Yuejiang Technology Co.,Ltd.	
소재지	() Room 1003, Building2, Changwen Park, Nanshan Park, No.3370, Luxian Blvd, Fuguang Community, Taoyuan Street, Nanshan District, Shenzhen China	

용량(등급)란: 6 axis

「산업안전보건법」 제89조제1항 및 같은 법 시행규칙 제120조제3항에 따라
자율안전확인 신고증명서를 발급합니다.

2021년 06월 10일

한국산업안전보건공단 이사장

RCM certificate

GACA
Global Access Certification Australia Pty. Ltd.
960 Waverley Road, Wheelers Hill, Victoria 3150, Australia

Proof of RCM Compliance

Certificate No.: RCMP21261 001

Certificate holder:	Shenzhen Yuejiang Technology Co., Ltd. Room 1003, Building 2, Chongwen Park, Nanshan iPark, No. 3370, Liuxian Blvd, Fuguang Community, Taoyuan Street, Nanshan District, Shenzhen, Guangdong, China
Product Description:	Collaborative Robot (DOBOT CR3/ DOBOT CR5/ DOBOT CR10/ DOBOT CR16)
Brand Name:	DOBOT
Model Number:	DT-CR-6R030-00I, DT-CR-6R050-00I, DT-CR-6R100-00I, DT-CR-6R160-00I
Electrical Ratings:	48Vdc for Manipulator; 100-240Vac, 650W for controller

GACA approves that this Electrical Article as described above meets the requirements of the standard/regulation(s) listed below:

Complies with	**Standard/regulation(s)**
ACMA mandated	EN 301 489-1 V2.2.3, EN 301 489-17 V3.2.4, EN 55032: 2015, EN IEC 61000-6-4: 2019, EN IEC 61000-6-2: 2019, EN 300 328 V2.2.2, EN IEC 62311: 2020 (Test report: SZEM210200212501, SZEM210200212502, SZEM210200212503)
Electrical Safety	IEC 60204-1: 2005+A1: 2008, EN ISO 10218-1: 2011 (Test report: SZES200110054701, SZES200100054701)
EESS-National Equipment Database Registration	Above models is registered as level 1 product on https://equipment.erac.gov.au/Registration/EquipmentSearch.aspx?atn=public

Date of Registered:	10 May 2021
Date of Expiry:	20 September 2025

On behalf of GACA

10. Warranty

10.1 Product warranty

Without prejudice to any claim agreement that the user (customer) may reach with the distributor or retailer, the manufacturer shall guarantee the quality of the products to the customer in accordance with the terms and conditions below:

If defects caused by manufacturing and/or improper material occur in a new device and its components within 12 months (15 months at most if the shipping time is included) after the device is put into use, Dobot shall provide the necessary spare part, and the user (customer) shall offer personnel to replace the spare part, using another part that represents the latest technology level to replace or repairing the related part.

If the device defects are caused by improper handling and/or failure to follow the relevant information set out in the User Guide, the warranty is invalid.

This warranty does not apply to or extend to maintenance (e.g. installation, configuration, software download) performed by the authorized distributer or customer.

The user (customer) must provide the purchase receipt and the purchase date as valid evidence for the warranty. Claims under this warranty must be made within two months of the apparent failure to perform the product warranty.

The ownership of the equipment or components that are replaced or returned to Dobot shall remain with Dobot. Any other claims arising from or related to the equipment are not covered by this warranty.

Any items in this product warranty do not intend to limit or exclude the legal rights of the customer or to limit or exclude the liability of the manufacturer for the personnel casualty resulting from its negligence. The duration of this product warranty shall not be extended due to the services provided under the product warranty terms. Under the principle of not violating the warranty, Dobot reserves the right to charge customers for the replacement or maintenance. The foregoing does not imply a change in the burden of proof to the detriment of the client. If there are defects on the equipment, Dobot shall not be liable for any damage or loss arising therefrom, including but not limited to loss of production or damage to other production equipment.

10.2 Disclaimer

Dobot is committed to improve the reliability and performance of its products, and as such reserves the right to upgrade products without prior notice. Dobot strives to ensure the contents of the User Guide are precise and reliable, but takes no responsibility for any errors or missing information.

Appendix Technical Specifications

Appendix A   Robot technical specifications

Product		DOBOT CR3	DOBOT CR5	DOBOT CR7
Weight		16.5kg (36.4lb)	25kg (55.1lb)	24.5kg (54lb)
Maximum load		3kg (6.6lb)	5kg (11lb)	7kg (15.4lb)
Working radius		620mm (24.4in)	900mm (35.4in)	800mm (31.5in)
Full-load current		4.4A	6.3A	8.2A
Nominal voltage		DC 48V		
Maximum working speed		2m/s (78.7in/s)	3m/s (118.1in/s)	3m/s (118.1in/s)
Joint working range	J1	$\pm360°$		
	J2	$\pm360°$		
	J3	$\pm155°$	$\pm160°$	$\pm160°$
	J4	$\pm360°$		
	J5	$\pm360°$		
	J6	$\pm360°$		
Maximum joint speed	J1	180°/s	180°/s	180°/s
	J2	180°/s	180°/s	180°/s
	J3	180°/s		
	J4	180°/s		
	J5	180°/s		
	J6	180°/s		
Tool I/O	DI	2		
	DO	2		
	AI	2		
	RS485	ModBus_RTU (AI multiplexing)		
Repeatability		±0.02mm	±0.02mm	±0.02mm
IP rating		IP54		
Temperature range		0℃~45℃		
Typical power		120W	150W	150W

consumption			
Maximum power consumption	170W	300W	300W
Material	Aluminum alloy, ABS		
Operating altitude range	≤1000m		
Installation mode	Normal mounting, lifting, side mounting and mounting at any angle		
Safety standard	UL1740: 2018-Standard for Safety：Robot and Robotic Equipment; CSA Z434-14 (R2019) Industrial robots and robot systems NFPA 79:2018 Electrical Standard for Industrial Machinery EN ISO 10218-1:2011 Steel wire and wire products. General. Test methods EN 60204-1:2018 Safety of machinery. Electrical equipment of machines. General requirements; IEC 60204-1:2016 Safety of machinery. Electrical equipment of machines. General requirements; EN ISO 12100:2010 Safety of machinery. General principles for design. Risk assessment and risk reduction; ISO/TS 15066:2016 Robots and robotic devices-Collaborative robots; ISO 13849-1:2015 Safety of machinery-Safety-related parts of control systems -Part 1: General principles for design		
EMC Standard	EN IEC 61000-6-2:2019-Generic Standards-Immunity for industrial environments; EN IEC 61000-6-4:2019-Generic standards - Emission standard for industrial environments; EN IEC 61000-6-7:2014 Electromagnetic compatibility (EMC). Generic standards. Immunity requirements for equipment intended to perform functions in a safety-related system (functional safety) in industrial locations		

Product	DOBOT CR10	DOBOT CR12	DOBOT CR16
Weight	40kg (88.2lb)	39.5kg (87.1lb)	40kg (88.2lb)
Maximum load	10kg (22lb)	12kg (26.5lb)	16kg (35.3lb)
Working radius	1300mm (51.2in)	1200mm (47.2in)	1000mm (39.4in)
Full-load current	9.4A	9.4A	8.4A
Nominal voltage	DC 48V		
Maximum working speed	4m/s (157.5in/s)	4m/s (157.5in/s)	3m/s (118.1in/s)
Joint working	J1	±360°		
	J2	±360°		

range	J3	±160°
	J4	±360°
	J5	±360°
	J6	±360°
Maximum joint speed	J1	120°/s
	J2	120°/s
	J3	180°/s
	J4	180°/s
	J5	180°/s
	J6	180°/s
Tool I/O	DI	2
	DO	2
	AI	2
	RS485	ModBus_RTU ((AI multiplexing))
Repeatability		±0.03mm
IP rating		IP54
Temperature		0℃~45℃
Typical Power Supply		350W
Maximum power consumption		450W / 450W / 400W
Material		Aluminum alloy, ABS
Operating altitude range		≤1000m
Installation mode		Normal mounting, lifting, side mounting and mounting at any angle
Safety standard		UL1740: 2018-Standard for Safety：Robot and Robotic Equipment; CSA Z434-14 (R2019) Industrial robots and robot systems NFPA 79:2018 Electrical Standard for Industrial Machinery EN ISO 10218-1:2011 Steel wire and wire products. General. Test methods EN 60204-1:2018 Safety of machinery. Electrical equipment of machines. General requirements; IEC 60204-1:2016 Safety of machinery. Electrical equipment of machines. General requirements;

	EN ISO 12100:2010 Safety of machinery. General principles for design. Risk assessment and risk reduction;
	ISO/TS 15066:2016 Robots and robotic devices-Collaborative robots;
	ISO 13849-1:2015 Safety of machinery-Safety-related parts of control systems -Part 1: General principles for design
EMC Standard	EN IEC 61000-6-2:2019-Generic Standards-Immunity for industrial environments;
	EN IEC 61000-6-4:2019-Generic standards - Emission standard for industrial environments;
	EN IEC 61000-6-7:2014 Electromagnetic compatibility (EMC). Generic standards. Immunity requirements for equipment intended to perform functions in a safety-related system (functional safety) in industrial locations

Appendix B   Controller technical specifications

Product Name	DOBOT CC162
Product Model	DT-CR-6R162-00I
Axis Control	6 axes
Input Power	1 PHASE 100V~240V AC, 50/60 Hz
Output Power	48V DC, MAX nominal current: 12.5A, maximum current: 20A
I/O Interface	• 16 digital inputs • 16 digital inputs/outputs (multiplexing) • 2 analog outputs (voltage: 0V~10V, current: 4mA~20mA) • 2 analog inputs (voltage: 0V~10V, current: 4mA~20mA) • 1 incremental encoder ABZ input
Teaching Method	PC software, App (iOS/Android)
Programming Language	Script (Lua)/Blockly programming
Installation Method	Floor mounting
Environment	Temperature: 0℃~45℃ Humidity: ≤95%, no condensation
Protection Grade	IP20
Cooling Method	Forced air cooling
Safety Function	Emergency stop, external safety I/O interface reserved
Safety Standard	UL1740: 2018-Standard for Safety：Robot and Robotic Equipment; CSA Z434-14 (R2019) Industrial robots and robot systems NFPA 79:2018 Electrical Standard for Industrial Machinery EN ISO 10218-1:2011 Steel wire and wire products. General. Test methods EN 60204-1:2018 Safety of machinery. Electrical equipment of machines. General requirements; IEC 60204-1:2016 Safety of machinery. Electrical equipment of machines. General requirements; EN ISO 12100:2010 Safety of machinery. General principles for design. Risk assessment and risk reduction; ISO/TS 15066:2016 Robots and robotic devices-Collaborative robots; ISO 13849-1:2015 Safety of machinery-Safety-related parts of control systems -Part 1: General principles for design

EMC Standard	EN IEC 61000-6-2:2019-Generic Standards-Immunity for industrial environments;
	EN IEC 61000-6-4:2019-Generic standards - Emission standard for industrial environments;
	EN IEC 61000-6-7:2014 Electromagnetic compatibility (EMC). Generic standards. Immunity requirements for equipment intended to perform functions in a safety-related system (functional safety) in industrial locations

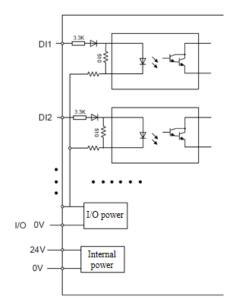## Appendix C   I/O simple circuit and specifications

Digital input

Figure C.1   Digital input simple internal circuit

Table C.1   Digital input technical specifications

Item	Specification
Input channel	16 channels
Connection method	Tube type pre-insulated terminal E0510
Input type	Optical coupling isolation input
Input voltage (DC)	24V±10%

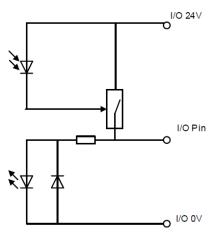**Multiplexed digital input/output interface**

Figure C.2   Multiplexed digital input/output simple circuit

Table C.2   Multiplexed digital input/output technical specifications

Item	Specification
Output channel	16 channels
Connection method	Tube type pre-insulated terminal E0510
Output type	High-side switch
Power supply (DC)	24V±10%
Load current of single channel	500mA
Output current	2A
Isolation method	Digital isolation

Analog input

The type of input can be adjusted through a DIP switch. "U" means voltage input, "I" means current input (default: voltage). The DIP switch is located inside the controller. If you need to adjust it, please contact Dobot technical support.
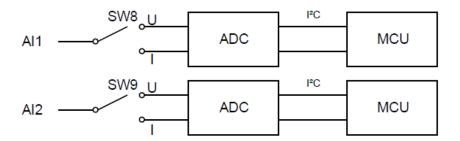

Figure C.3   Analog input simple circuit

Figure C.3   Analog input type

Analog input type	Range
Current input	Current: 4mA~20 mA
Voltage input	Voltage: ±10V

Analog output

The type of output can be adjusted through a DIP switch. "U" means voltage output, and "I" means current output (default: voltage).

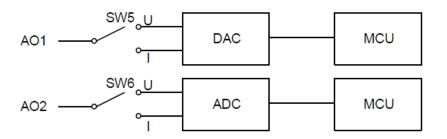The DIP switch is located inside the controller. If you need to adjust it, please contact Dobot technical support.

Figure C.4　Analog output simple circuit

Table C.4　DIP switch status and analog output type

DIP switch status	Analog output type	Range
ON	Current output	Current: 4mA~20mA
OFF	Voltage output	Voltage: 0V~10V