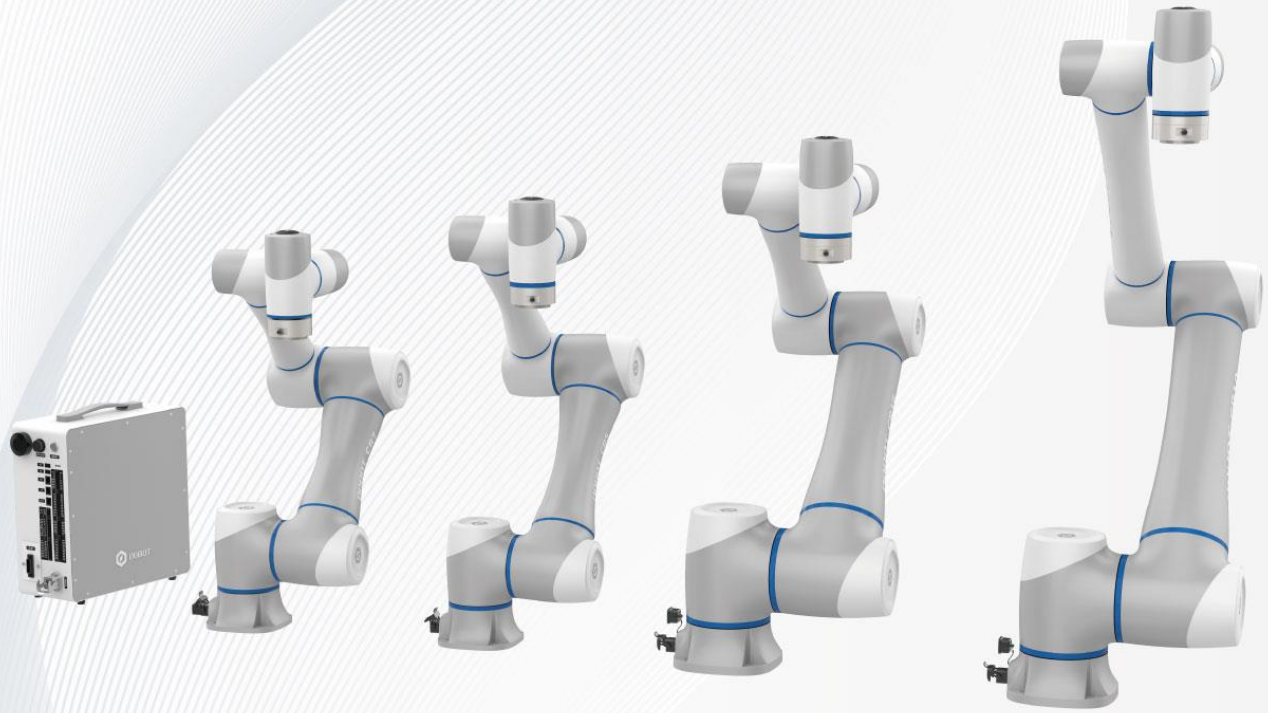
DOBOT

Dobot CR A Series User Guide



Issue: V1.3
Date: 2023-09-14
Shenzhen Yuejiang Technology Co., Ltd.|China

Disclaimer

To the maximum extent permitted by applicable law, the products described (including its hardware, software, and firmware, etc.) in this document are provided **AS IS**, which may have flaws, errors or faults. Dobot makes no warranties of any kind, express or implied, including but not limited to, merchantability, satisfaction of quality, fitness for a particular purpose and non-infringement of third party rights. In no event will Dobot be liable for any special, incidental, consequential or indirect damages resulting from the use of our products and documents.

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.

Shenzhen Yuejiang Technology Co., Ltd.

Address: Room 1003, Building 2, Chongwen Garden, Nanshan iPark, Liuxian Blvd, Nanshan District, Shenzhen, Guangdong Province, China

Website: www.dobot-robots.com

Preface

Scope of Application

Robot arm:

- DOBOT CR3A
- DOBOT CR5A
- DOBOT CR7A
- DOBOT CR10A
- DOBOT CR12A
- DOBOT CR16A
- DOBOT CR20A

You can find the model of robot arm on the right-top corner of the nameplate on the robot base. The figure below takes CR5A as an example.


DOBOT CR5A

中国·深圳市越疆科技股份有限公司
深圳市南山区桃源街道福光社区留仙大道3370号南山智园崇文园区2号楼1003
Shenzhen Yuejiang Technology Co.,Ltd.China
Room 1003, Building 2, Chongwen Park, Nanshan IPark,
No. 3370, Liuxian Blvd,Fuguang Community,Taoyuan Street,
Nanshan DIstrict, Shenzhen

型号/MODEL	DT-CR050A-0
重量/WEIGHT	25 kg
防护等级/ENCLOSURE TYPE	IP54
最大负载/MAX.PAYLOAD	5 kg
臂长/MAX.REACH	900 mm
额定电压/RATED VOLTAGE	DC 48V
满载电流/FULL LOAD CURRENT	6.3 A
最大关节电流/MAX.MOTOR FLA	3.2 A

6970632060397

Controller:

- DOBOT CC262
- DOBOT CC263

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


DOBOT CC262

中国·深圳市越疆科技股份有限公司
深圳市南山区桃源街道福光社区留仙大道3370号南山智园崇文园区2号楼1003
Shenzhen Yuejiang Technology Co.,Ltd.China
Room 1003, Building 2, Chongwen Park, Nanshan IPark,
No. 3370, Liuxian Blvd,Fuguang Community,Taoyuan Street,
Nanshan District, Shenzhen

型号/MODEL	DT-CC262-0A
重量/WEIGHT	9.5 kg
防护等级/ENCLOSURE TYPE	IP20
最大功率/MAXIMUM POWER	680W
输入电压/INPUT VOLTAGE	1PHASE，AC 100V~240V
输入频率/INPUT FREQUENCY	50/60 Hz
短路电流额定值/SCCR	100A

6970632060366

Purpose

This document introduces the functions, technical specifications and installation procedure of Dobot CR A 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	Issue	Change Description
2023/09/14	V1.3	• Modify CR20A & CC263 mechanical specifications • Added CR20A heavy-duty interface description
2023/08/24	V1.2	• Modify end buttons short/long press time (supported by controller V4.4.0 and above) • Modify control cabinet installation schematic • Add I/O interface factory default shorting instructions • Modify end flange dimensions • Modify emergency stop time and distance • Add CR20A contents
2023/07/19	V1.1	• Modify CR3/5/7 base installation dimensions • Modify the description of general safety • Modify the description of trajectory playback button • Update content styles
2023/05/16	V1.0	The first release

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

Symbol	Description
	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, including but not limited to building a proper safety circuit to achieve safe stop
- 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 A series robots are industrial robots only for general industrial use, such as processing or delivering products or parts through end tools.

Dobot CR A 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 	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.
- Please establish safety measures (such as guardrails, ropes or warning lines) near the operating area of the robot to ensure that personnel remain out of reach of the robot being operated or the robot about to start operation.
- Do not enter the safety range of the robot as determined by the risk assessment or touch the robot while the system is in operation.
- 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.

According to IEC 60204-1 and ISO 13850, the emergency stop switch is not a safeguard. It is a complimentary protective measure and 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. The alarm can be cleared through the software only after the emergency stop switch is unlocked. Then the robot arm can be powered on, enabled and resumed from the emergency status.

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

2. Transportation

You need to transport the robot in its packing 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

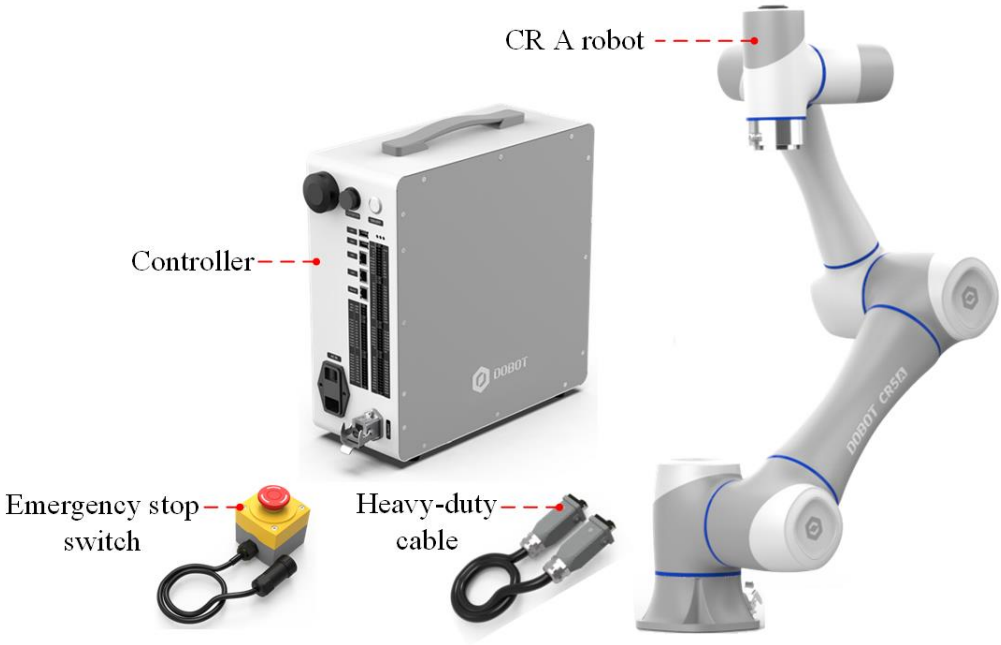


Figure 3.1 Robot overview

The main components of the robot system include:

- **CR A robot:** Six-axis robot arm, main moving parts.
- **Controller:** Core computing and electrical components, with IP54 protective cover (optional).
- **Emergency stop switch:** Connected to the controller to realize the emergency stop function.
- **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.

Figure 3.2 Operation terminal

3.2 Robot arm

3.2.1 Composition

CR A series robot arm includes 6 rotating motion joints, and two connecting rods (upper arm and forearm), as shown in Figure 3.3 and Figure 3.4(taking CR5A and CR20A as examples).

The robot arm is equipped with a heavy-duty interface on its base, models other than the CR20A are equipped with buttons and indicator lights on its end, and an aviation plug on the side of its end flange.

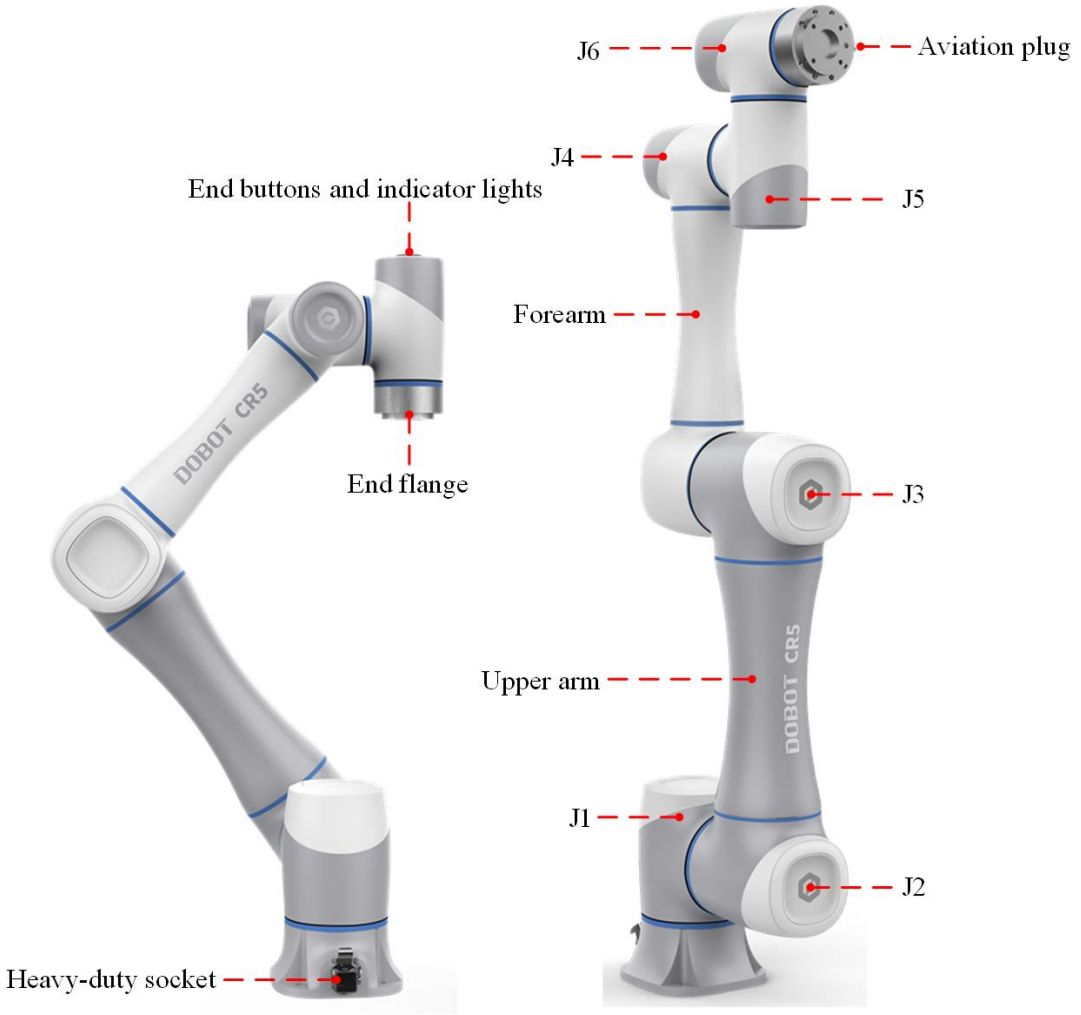


Figure 3.3 CR5A robot

The CR20A design differs in that there are two ring indicators, located on the J1 rear cover and on the side of its end flange; there is no keypad on the J6 rear cover, but is equipped with two buttons and two aviation plugs on the side of its end flange.

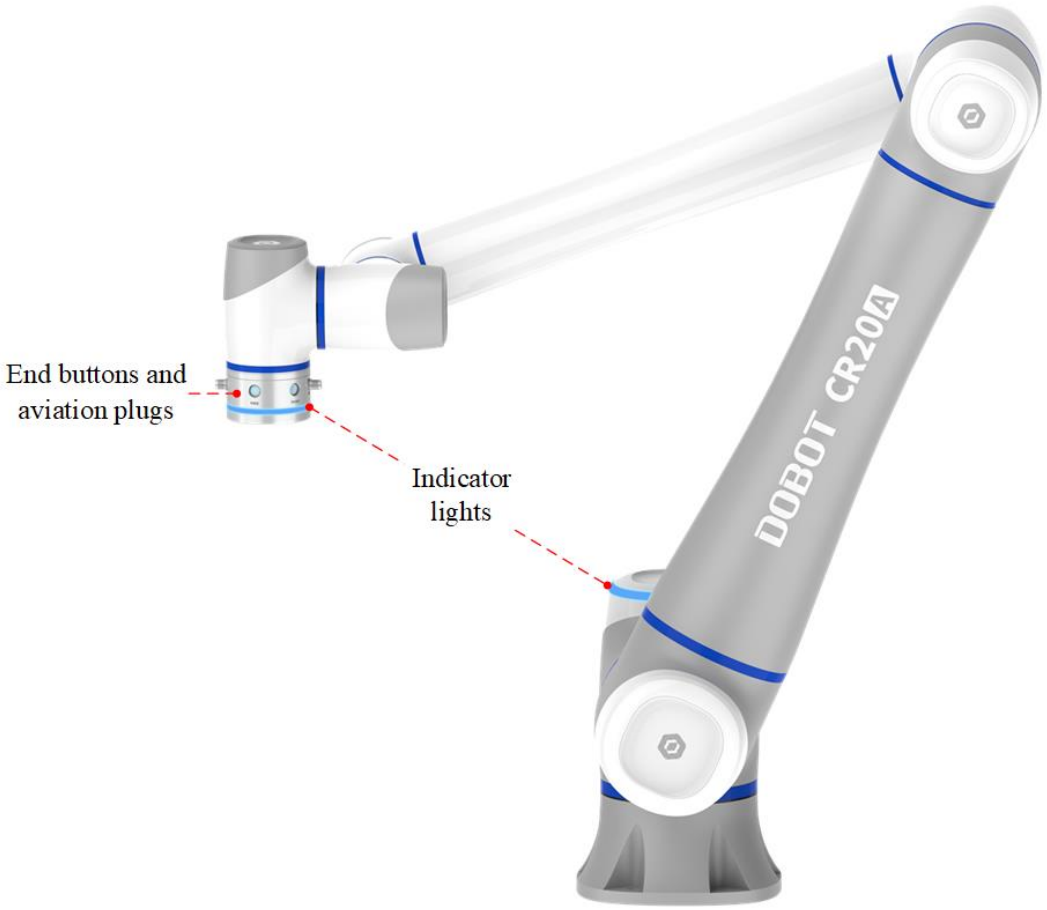


Figure 3.4 CR20A robot

3.2.2 End buttons and indicator lights

The end buttons and indicators of CR A series robot arms (except CR20A) are shown in Figure 3.5.

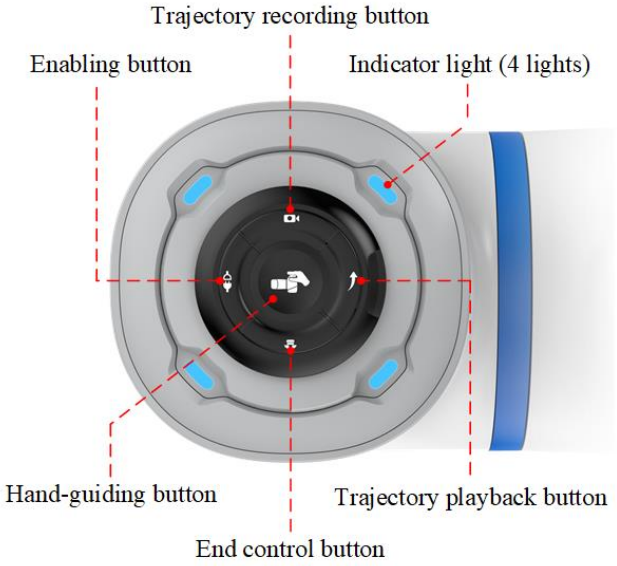


Figure 3.5 End buttons and indicator light (except CR20A)

The definition of the indicator lights 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
	Quick flash	The robot arm is starting.
Green light	Steady on	The robot arm is enabled (not running)
	Slow flash	Automatic running status (project debugging/running/pause, motion commands except TCP jog, trajectory playback)
	Quick flash	Single running status (Jog/Runto in software)/Drag mode/ Trajectory recording status
Red light	Slow flash	Joint brake switched on in disabled status
	Steady on	Alarm status
Yellow light	Steady on	Collision detected

NOTE

The quick flash frequency is 5Hz (0.2 sec/time), and slow flash frequency is 1.25Hz (0.8 sec/time).

The functions of the end button are shown below:

- **Hand-guiding button**: When the robot arm is in the enabled status, long press the button to enter the hand-guiding status. After dragging the robot arm to the teaching point, short-press the button and the robot arm will exit the hand-guiding status.
- **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, long press the button to enter the enabled status. Then short-press the button to disable robot arm.
- **Trajectory recording button**: When the robot arm is in the enabled status, long press the button to enter the trajectory recording status. After recording the trajectory, short-press the button, and the robot arm will exit the trajectory recording status.
- **Trajectory playback button**: When the robot arm is in the enabled status, long press the button to enter the trajectory playback status to play back the last trajectory recorded by **trajectory recording button**. Then short-press the button, and the robot arm will exit the trajectory playback status.

NOTE

- Short pressing is to release within 1.5s after pressing. Long pressing is to release within 1.5s~5s after pressing. Pressing for more than 5s and then releasing is an invalid operation.
- Some of the button functions are affected by the manual/automatic mode of the controller. See the instructions on mode switch in the DobotStudio Pro user guide for details.

The configuration of the end of CR20A is shown in Figure 3.6.

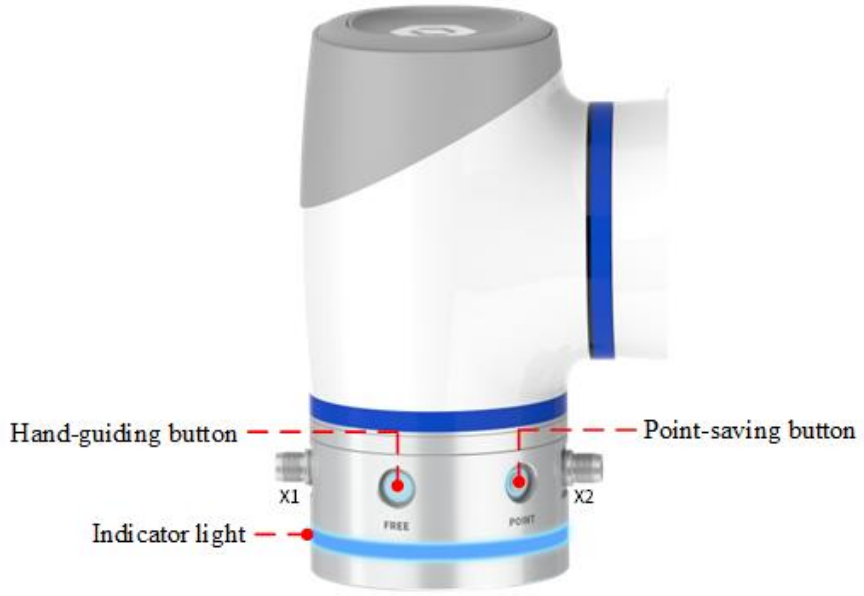


Figure 3.6 End buttons and indicator light (CR20A)

The indicators of CR20A have the same meaning as other models of CR A series robots. The functions of the buttons are described below.

- **Hand-guiding button (**silkscreen: FREE**):** When the robot arm is enabled, press and hold this button to enter the hand-guiding status, and release this button to exit the hand-guiding status.
- **Point-saving button (**silkscreen: POINT**):** When the robot arm is enabled, and DobotStudio Pro is connected to the robot arm and the point list is opened, short-press this button to save the current point of the robot arm.

3.3 Controller

CR A series robots need to be used with a controller.

The controller model of CR A series robot arms (except CR20A) is CC262, includes two models: AC power input and DC power input. They are common in the dimensions and functions, except for differences in input power components.

The controller model of CR20A robot arm is CC263, supports AC power input only and looks

similar to the CC262 with larger dimensions.

For details on its electrical interfaces and switches, see *6 Electrical Features*.

Figure 3.7 Controller appearance

3.4 Operation terminal

CR A series robot arms support control through PC and App, as shown in Table 3.2.

Table 3.2 Operation terminal parameters

Terminal type	PC	Tablet (Android)	iPad
Operation system	Windows7/10/11 64-bit	Android 10 and above	iOS 10 and above
Control software	DobotStudio Pro (V4.0 and above)		
Minimum configuration	CPU: Intel Core i3 Memory: 4G Storage space: 128GB Network card: Gigabit-NIC Display memory: 1G	CPU: 4-core Running memory: 2G Storage space: 32G Screen: 8-inch	iPad 5 and above
Communication mode	LAN/WiFi	WiFi	WiFi

When purchasing CR A series robot arms, you can ask for matching Android tablets; or use self-prepared operating terminal which is consistent with or higher than the recommended configuration in Table 3.2.

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.

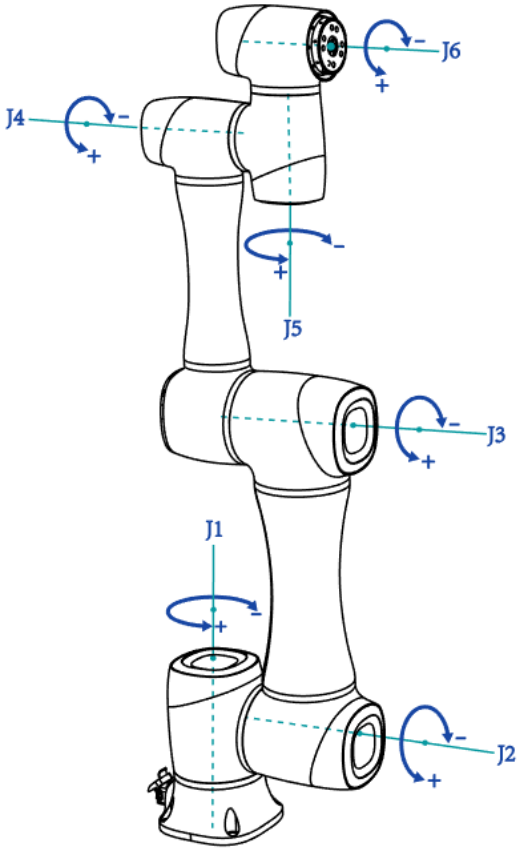


Figure 4.1 Joint coordinate system

4.1.2 User coordinate system

The user coordinate system is a custom workpiece or workbench coordinate system. The origin and the orientations of axes can be defined based on the site requirement to measure the points within the workspace and arrange tasks conveniently. The default user coordinate system is determined based on the center point of the robot base, and Y+ direction is the direction that the heavy-duty socket faces, as shown in Figure 4.2.

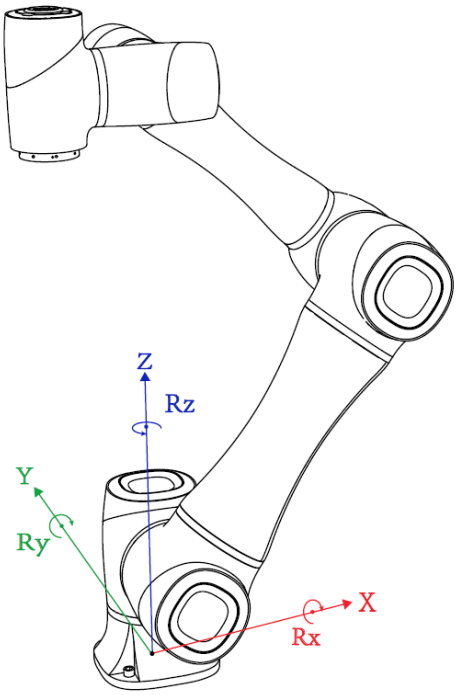


Figure 4.2 User coordinate system

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. The Y+ direction is the opposite direction of the aviation socket, as shown in Figure 4.3.

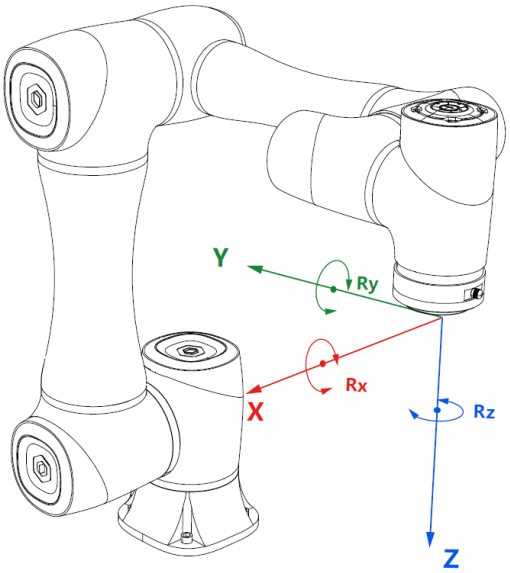


Figure 4.3 Tool coordinate system

4.2 Home posture

When the robot arm is in the vertical state shown in Figure 4.1, the angle of each joint is 0 degree. This posture is called the home posture. The home-posture stickers (transparent sticker with a blue line in the middle for alignment), 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 are aligned.

Figure 4.4 Home point sticker

If the home posture 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-posture stickers of each joint are aligned. Then calibrate the home posture 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.

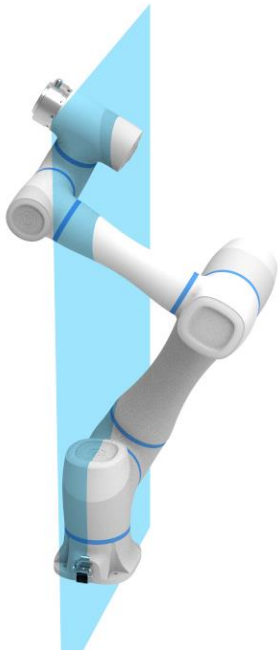


Figure 4.5 Shoulder singularity

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.

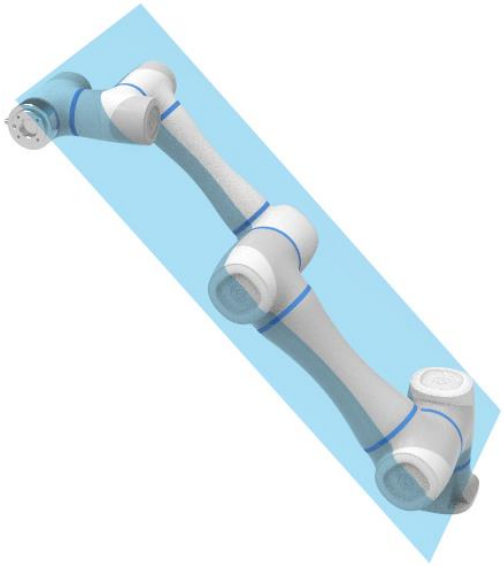


Figure 4.6 Elbow singularity

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.

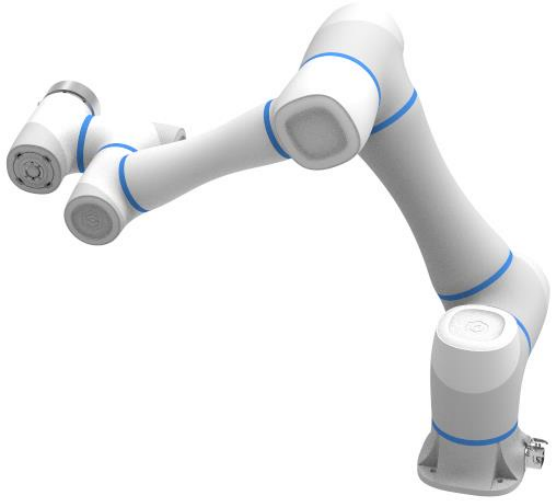


Figure 4.7 Wrist singularity

4.4 Emergency stop time and distance

When the J1~J3 axes trigger an emergency stop at 100% speed, maximum load and maximum arm span, the braking time and 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.

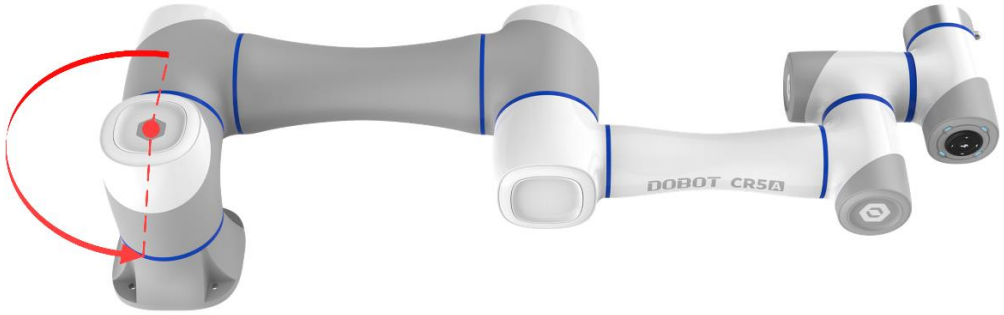


Figure 4.8 J1 Emergency stop test

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.

Figure 4.9 J2 Emergency stop test

Figure 4.10 J3 Emergency stop test

The table below includes the data of some models for your reference.

Table 4.1 Emergency stop time and distance

Axis	Braking time/distance			
	CR3A	CR5A	CR10A	CR20A
J1	209ms/160.58mm	351ms/389.94mm	306ms/420.46mm	448ms/836.23mm
J2	257ms/259.44mm	239ms/366.58mm	242ms/411.42mm	456ms/835.95mm
J3	270ms/187.42mm	248ms/205.14mm	252ms/293.75mm	272ms/338.54mm

5. Mechanical Specifications

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

5.1 CR3A mechanical specifications

5.1.1 CR3A 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 try to avoid moving the tool to the cylindrical space. 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.

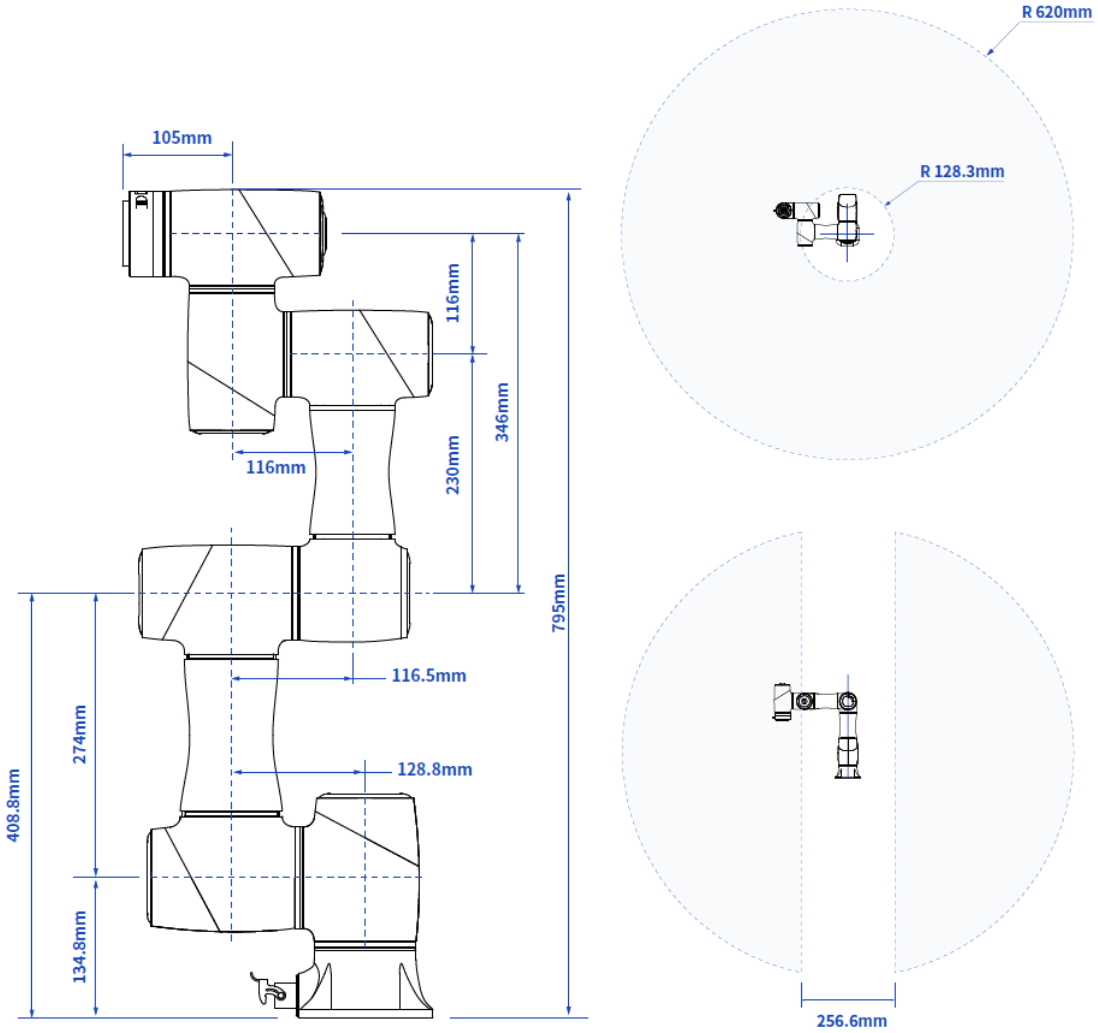


Figure 5.1 CR3A dimensions and working space

5.1.2 CR3A base installation dimensions

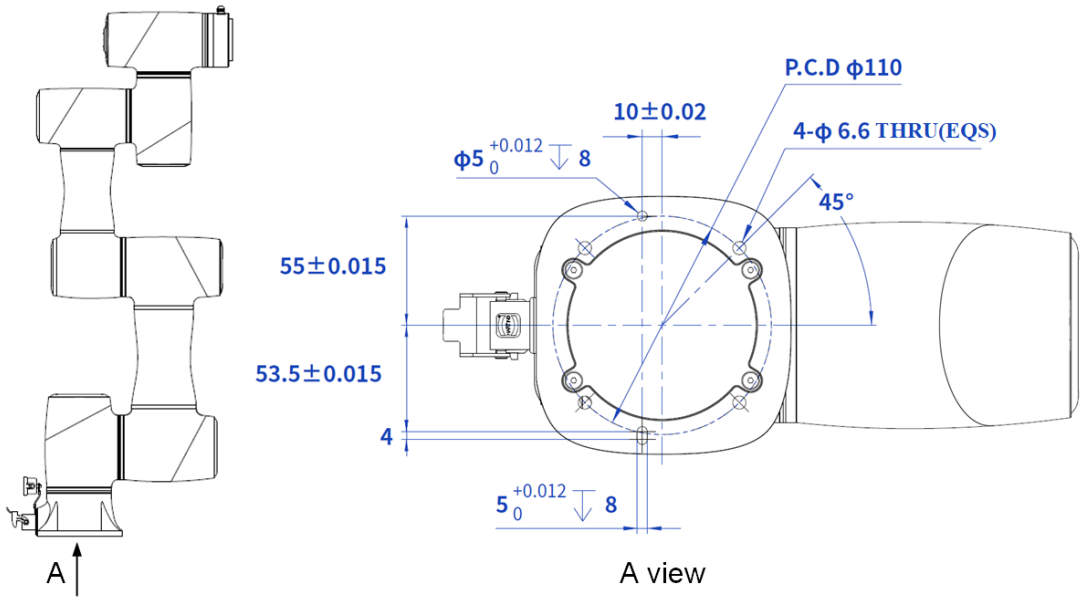


Figure 5.2 CR3A base installation dimensions

5.1.3 CR3A flange dimensions

The end flanges of CR A series robot arms (except CR20A) are all in the same size. The flange design conforms to ISO 9409-1.

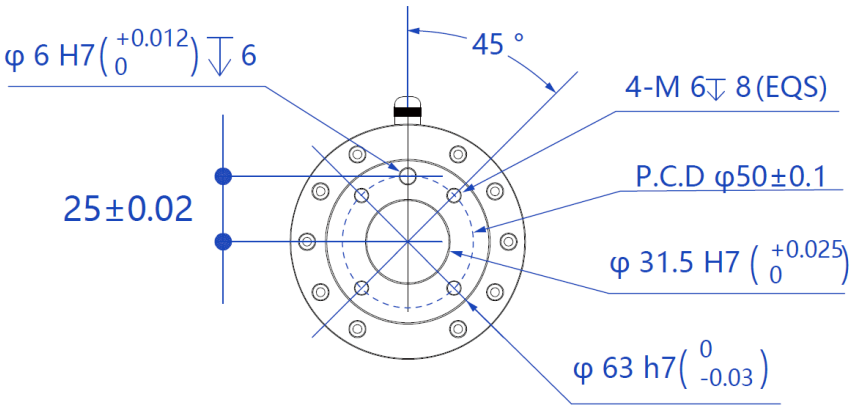


Figure 5.3 End flange dimensions

5.1.4 CR3A 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.

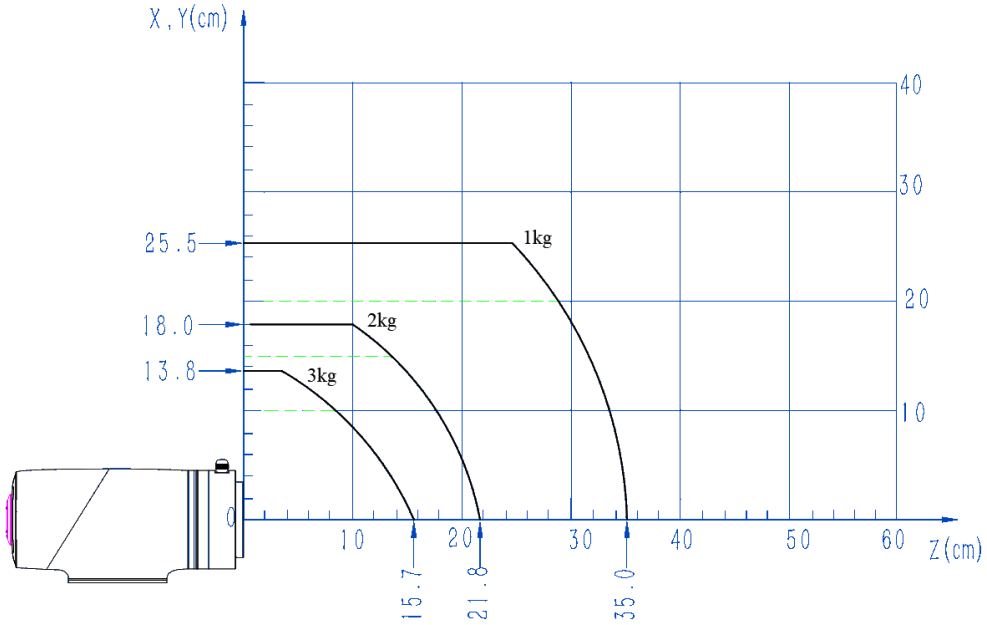


Figure 5.4 CR3A load curve

5.2 CR5A mechanical specifications

5.2.1 CR5A 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 try to avoid moving the tool to the cylindrical space. 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.

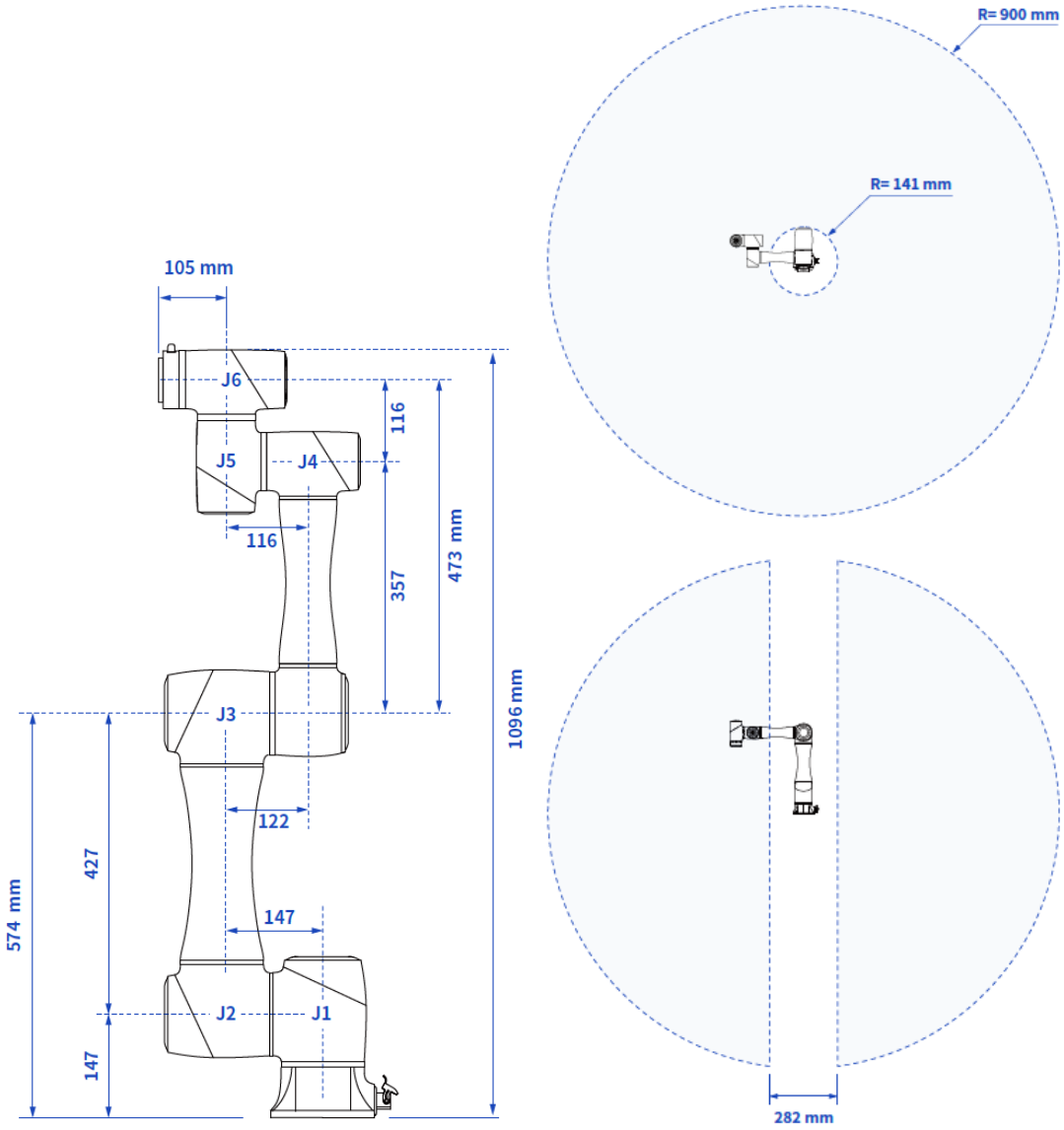


Figure 5.5 CR5A dimensions and working space

5.2.2 CR5A base installation dimensions

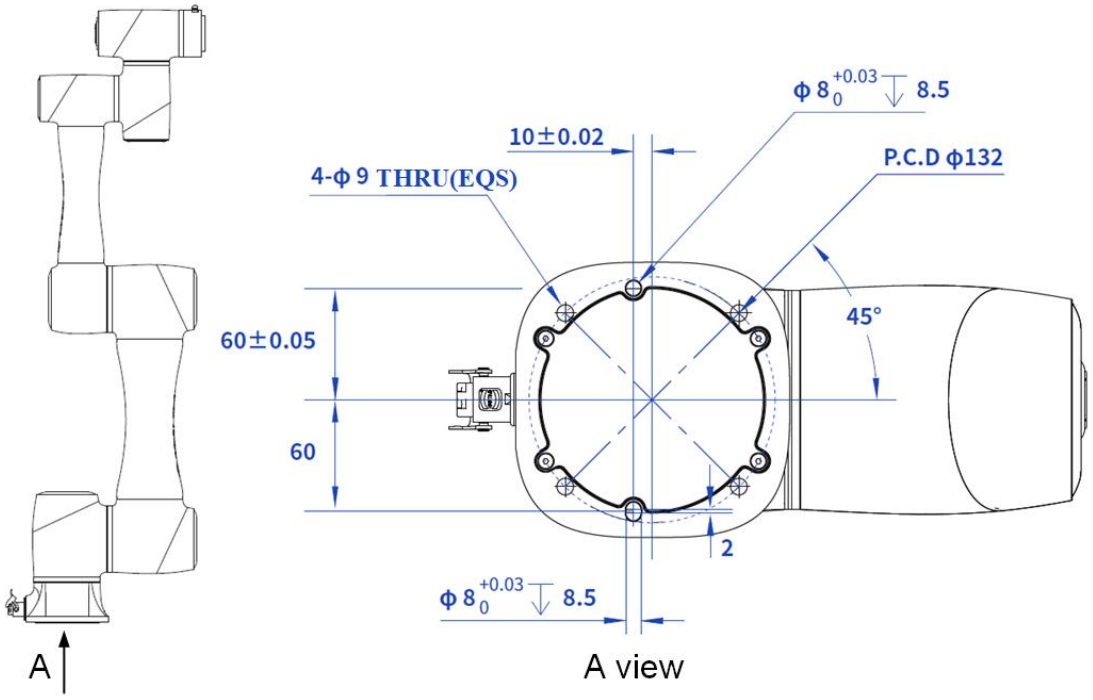


Figure 5.6 CR5A base installation dimensions

5.2.3 CR5A flange dimensions

The end flanges of CR A series robot arms (except CR20A) are all in the same size. The flange design conforms to ISO 9409-1.

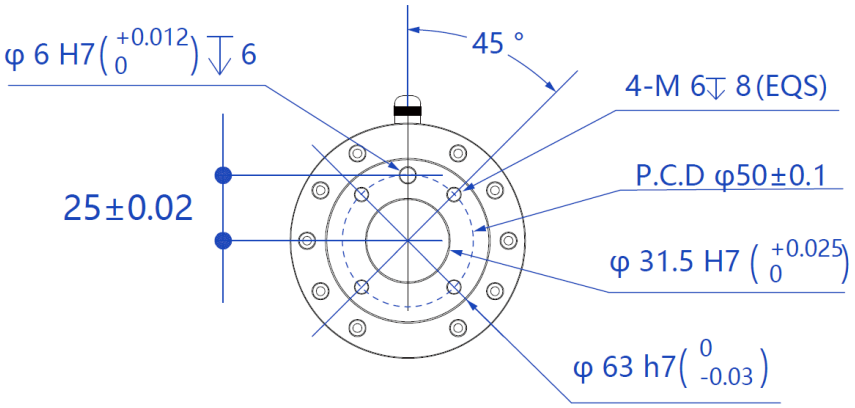


Figure 5.7 End flange dimensions

5.2.4 CR5A 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.

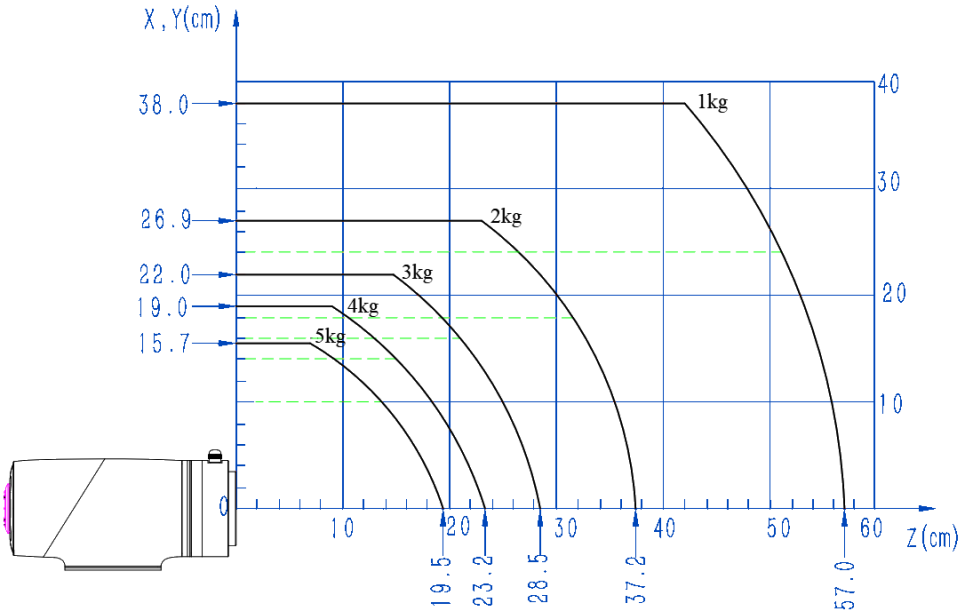


Figure 5.8 CR5A load curve

5.3 CR7A dimensions

5.3.1 CR7A 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 try to avoid moving the tool to the cylindrical space. 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.

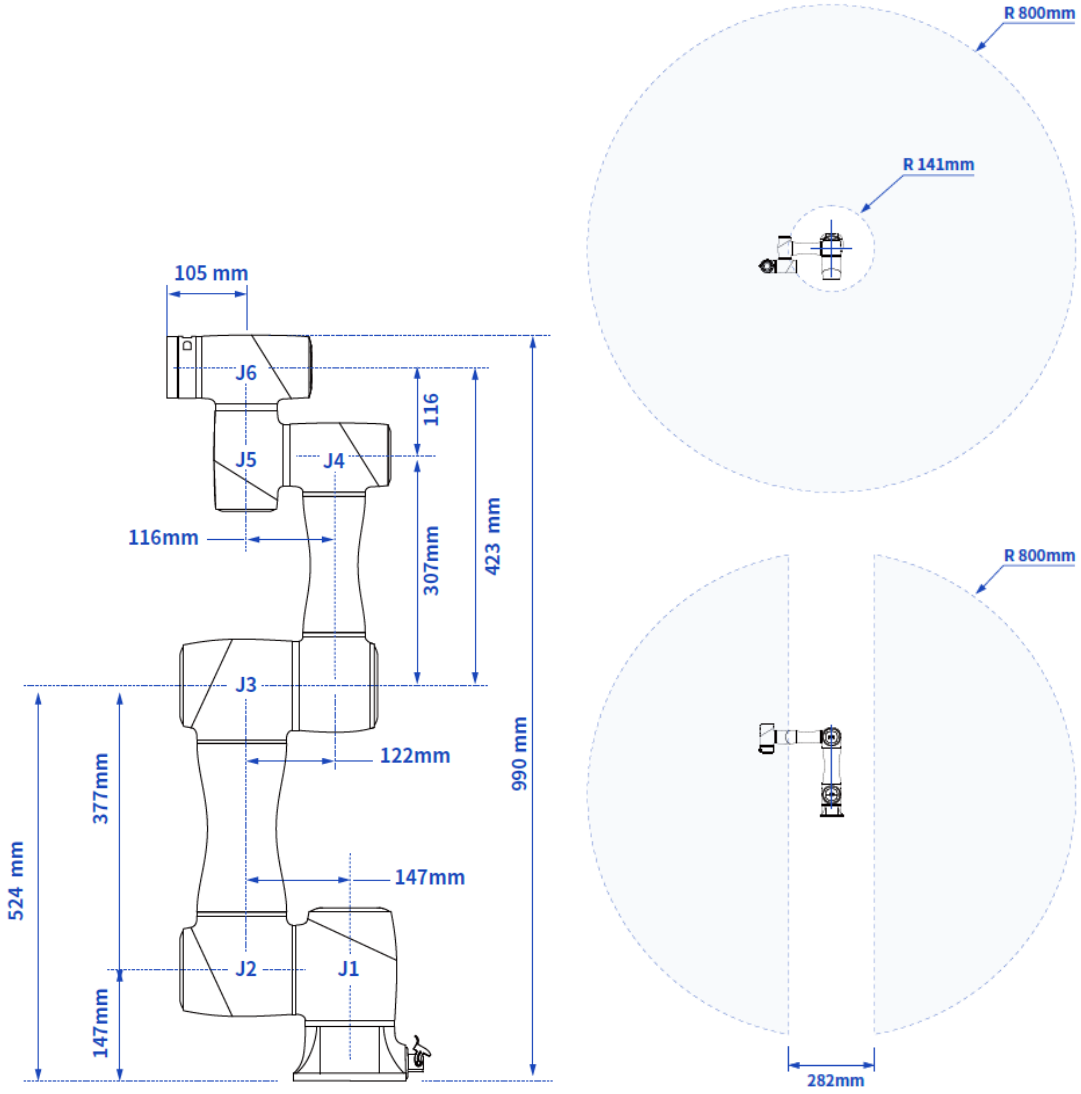


Figure 5.9 CR7A dimensions and working space

5.3.2 CR7A base installation dimensions

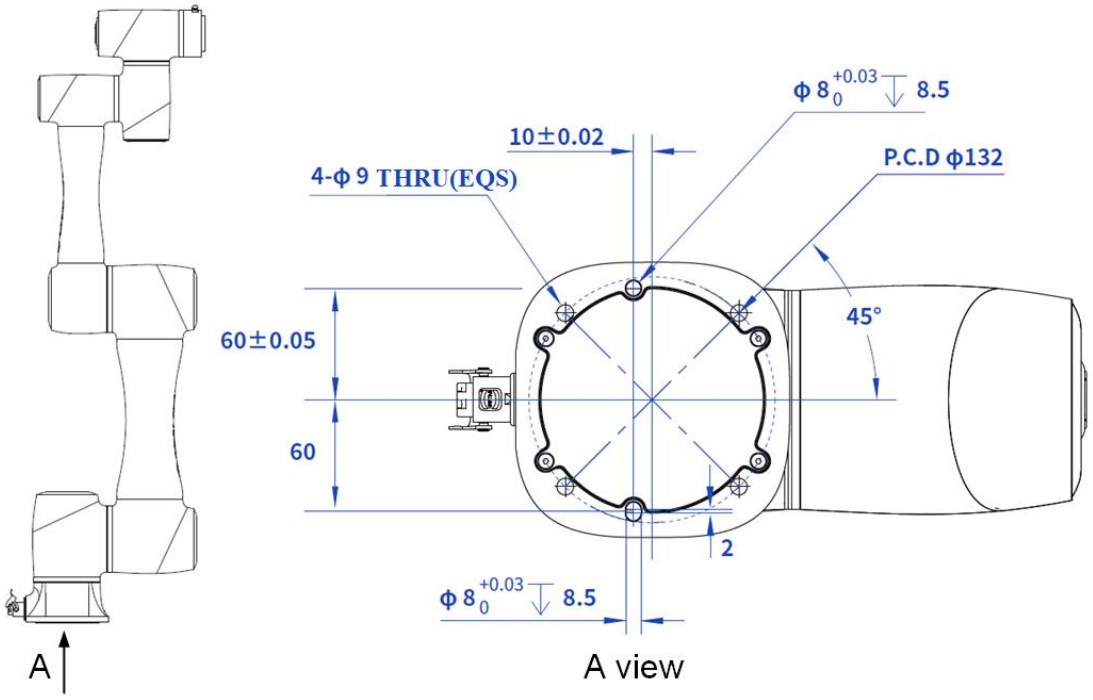


Figure 5.10 CR7A base installation dimensions

5.3.3 CR7A flange dimensions

The end flanges of CR A series robot arms (except CR20A) are all in the same size. The flange design conforms to ISO 9409-1.

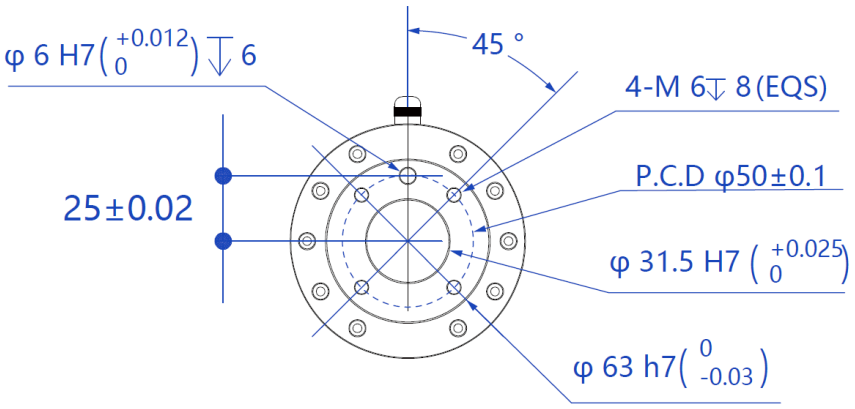


Figure 5.11 End flange dimensions

5.3.4 CR7A 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.

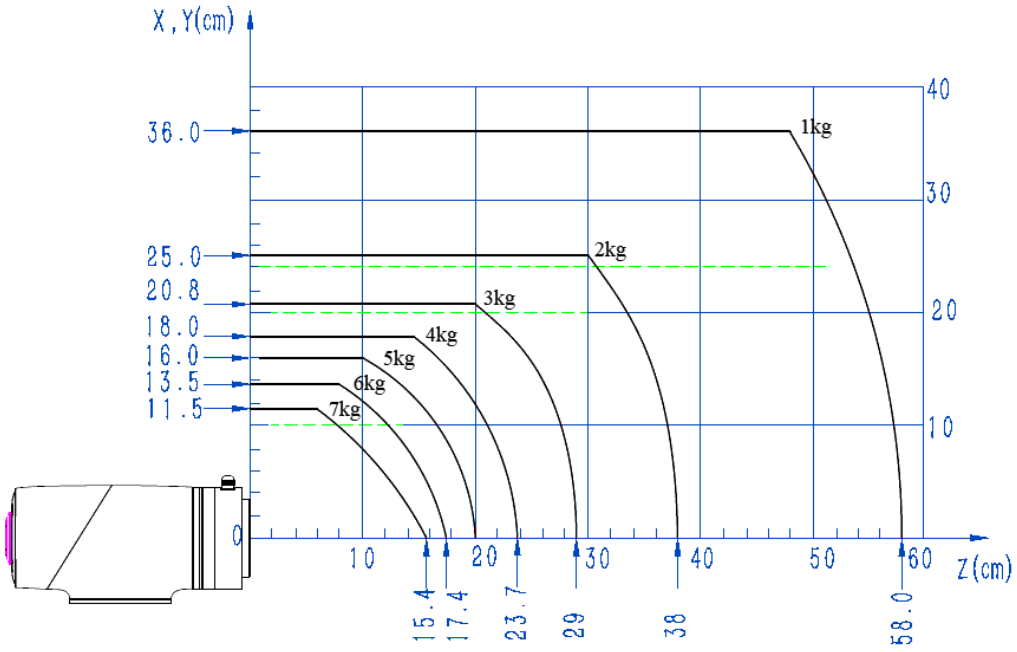


Figure 5.1 CR7A load curve

5.4 CR10A mechanical specifications

5.4.1 CR10A 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 try to avoid moving the tool to the cylindrical space. 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.

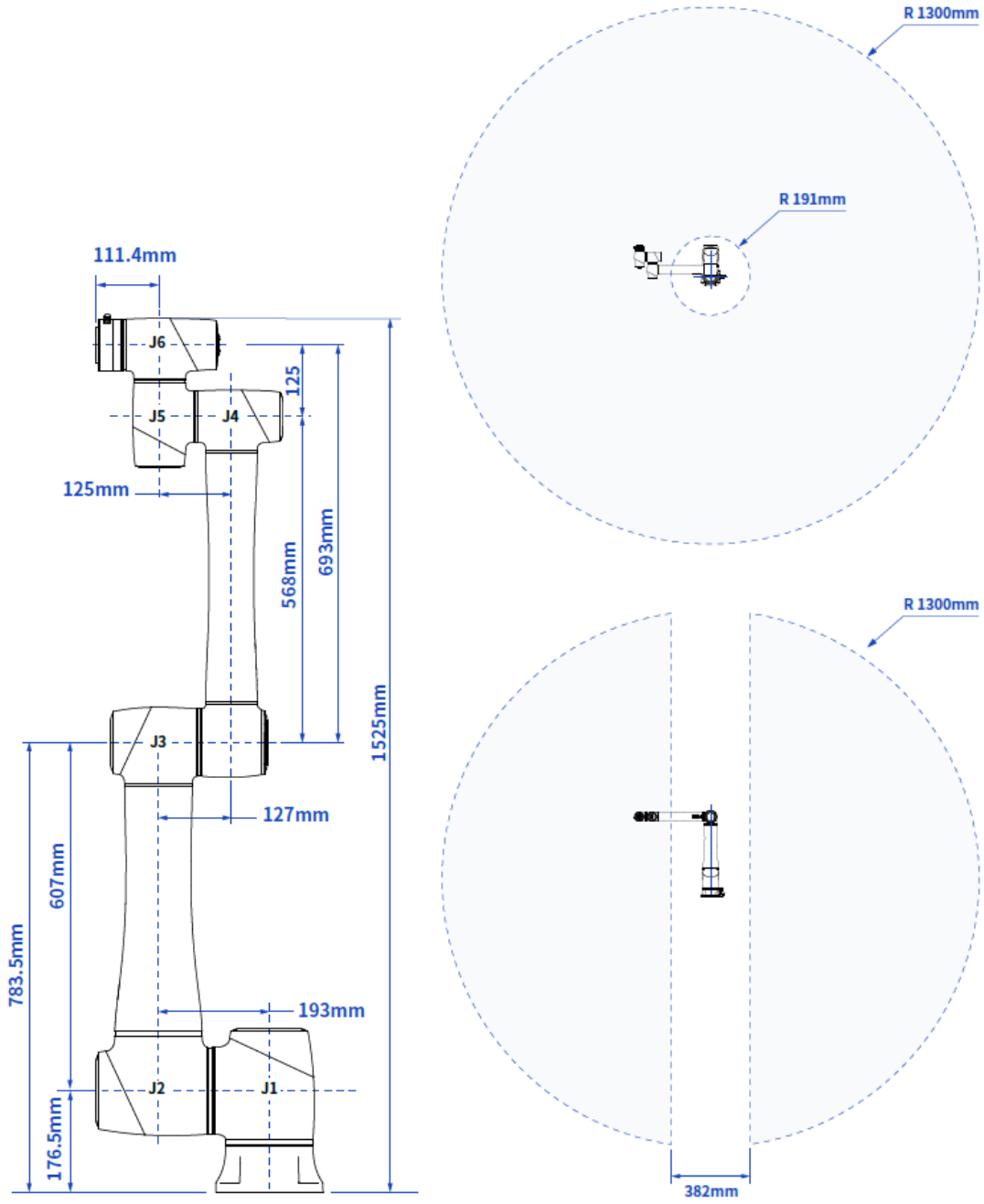


Figure 5.12 CR10A dimensions and working space

5.4.2 CR10A base installation dimensions

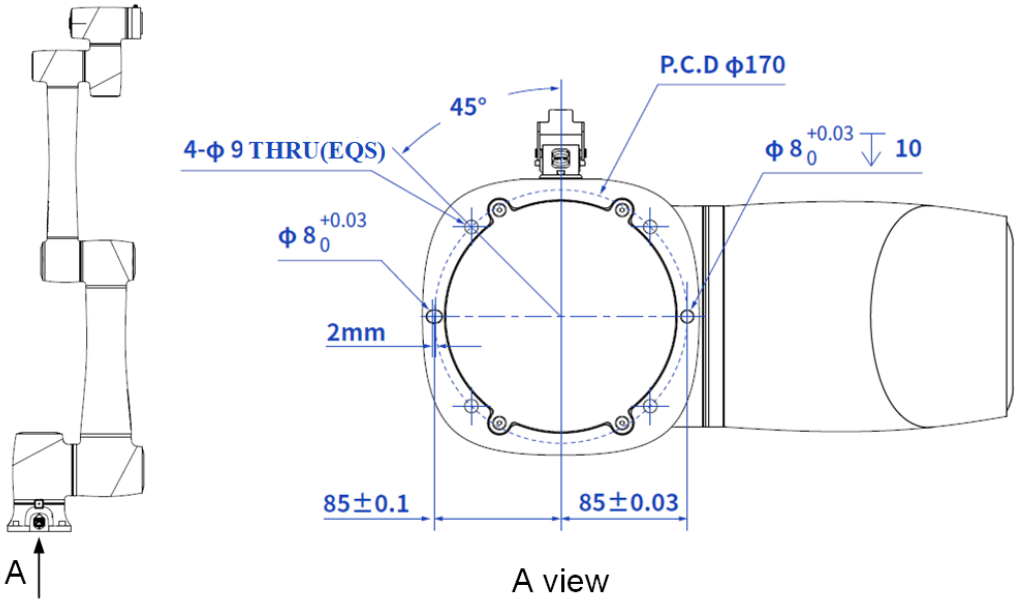


Figure 5.13 CR10A base installation dimensions

5.4.3 CR10A flange dimensions

The end flanges of CR A series robot arms (except CR20A) are all in the same size. The flange design conforms to ISO 9409-1.

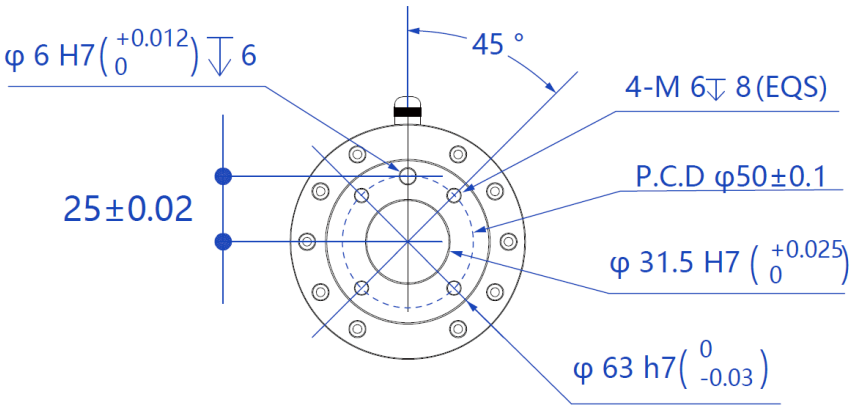


Figure 5.14 End flange dimensions

5.4.4 CR10A 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.

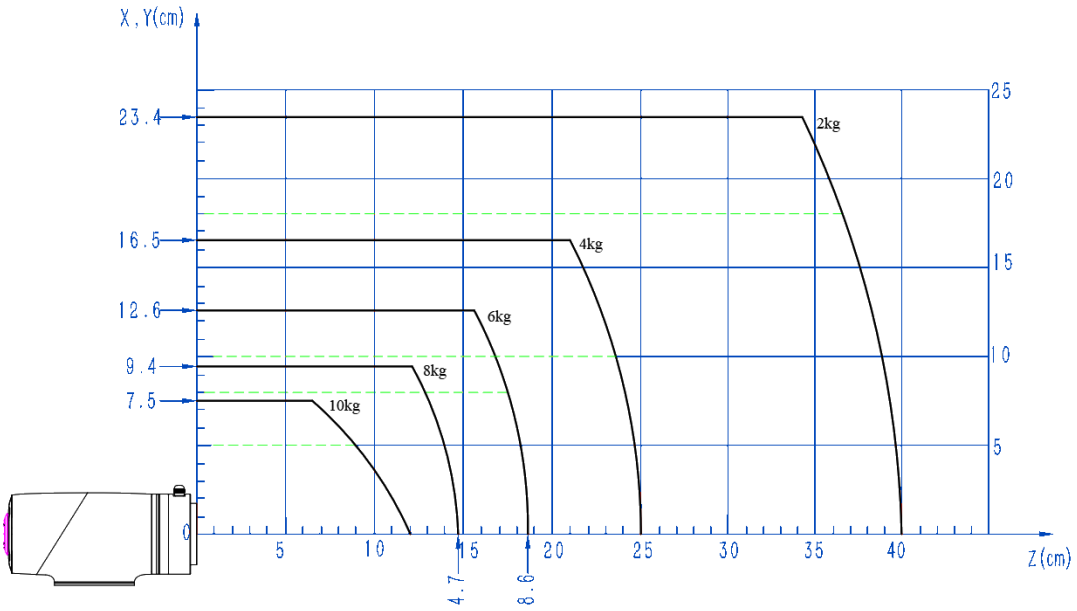


Figure 5.15 CR10A load curve

5.5 CR12A mechanical specifications

5.5.1 CR12A 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 try to avoid moving the tool to the cylindrical space. 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.

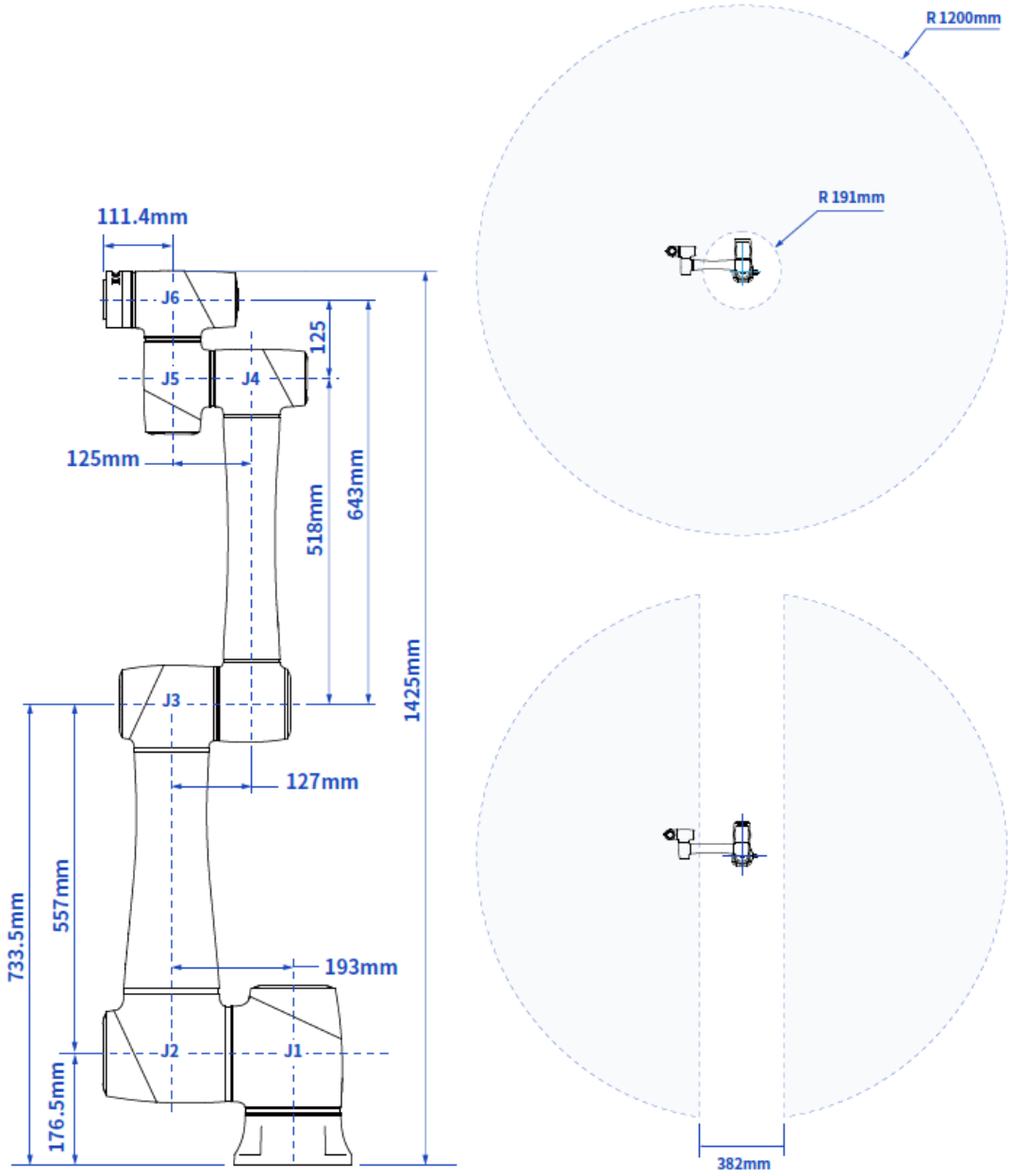


Figure 5.16 CR12A dimensions and working space

5.5.2 CR12A base installation dimensions

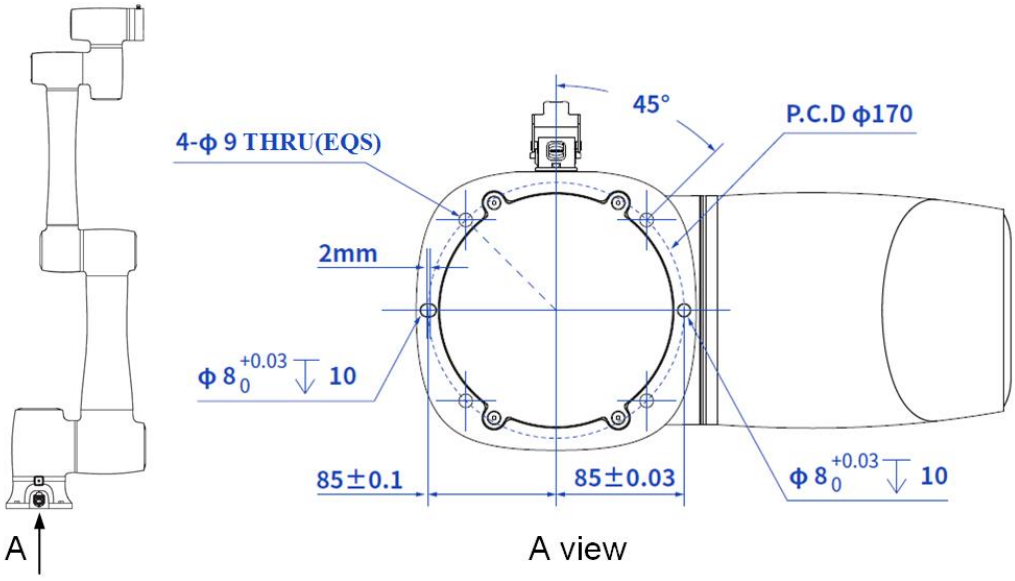


Figure 5.17 CR12A base installation dimensions

5.5.3 CR12A end flange dimensions

The end flanges of CR A series robot arms (except CR20A) are all in the same size. The flange design conforms to ISO 9409-1.

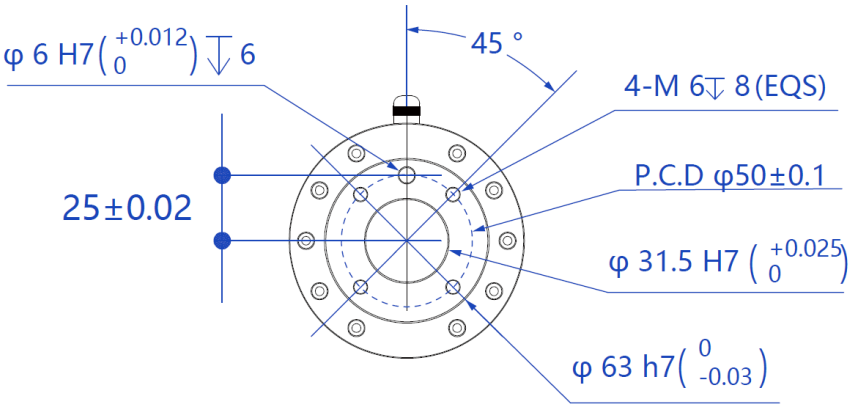


Figure 5.18 End flange dimensions

5.5.4 CR12A 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.

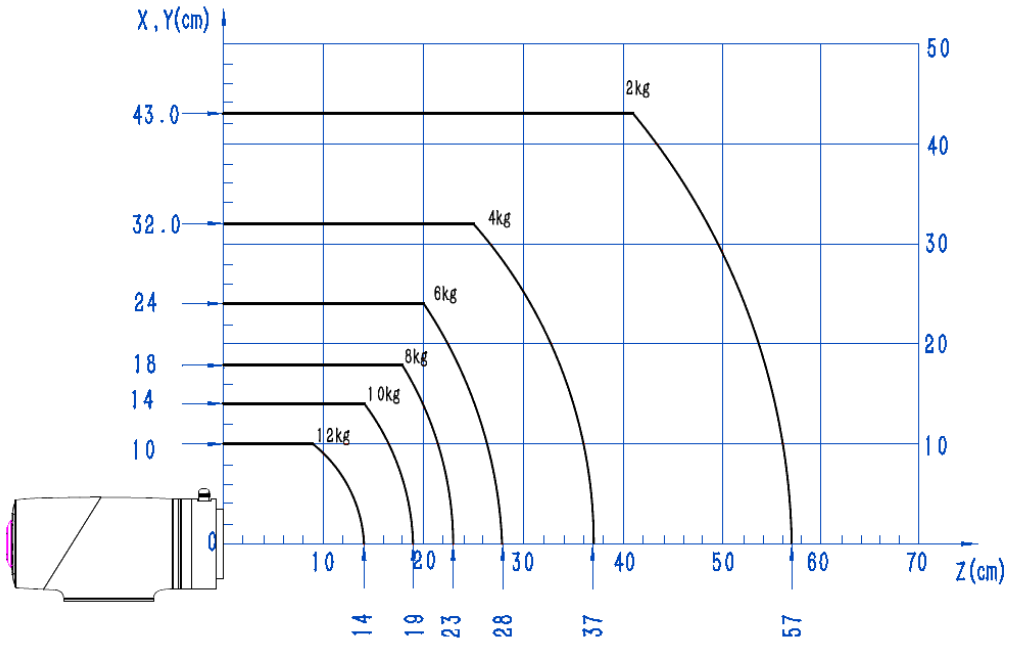


Figure 5.2 CR12A load curve

5.6 CR16A mechanical specifications

5.6.1 CR16A 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 try to avoid moving the tool to the cylindrical space. 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.

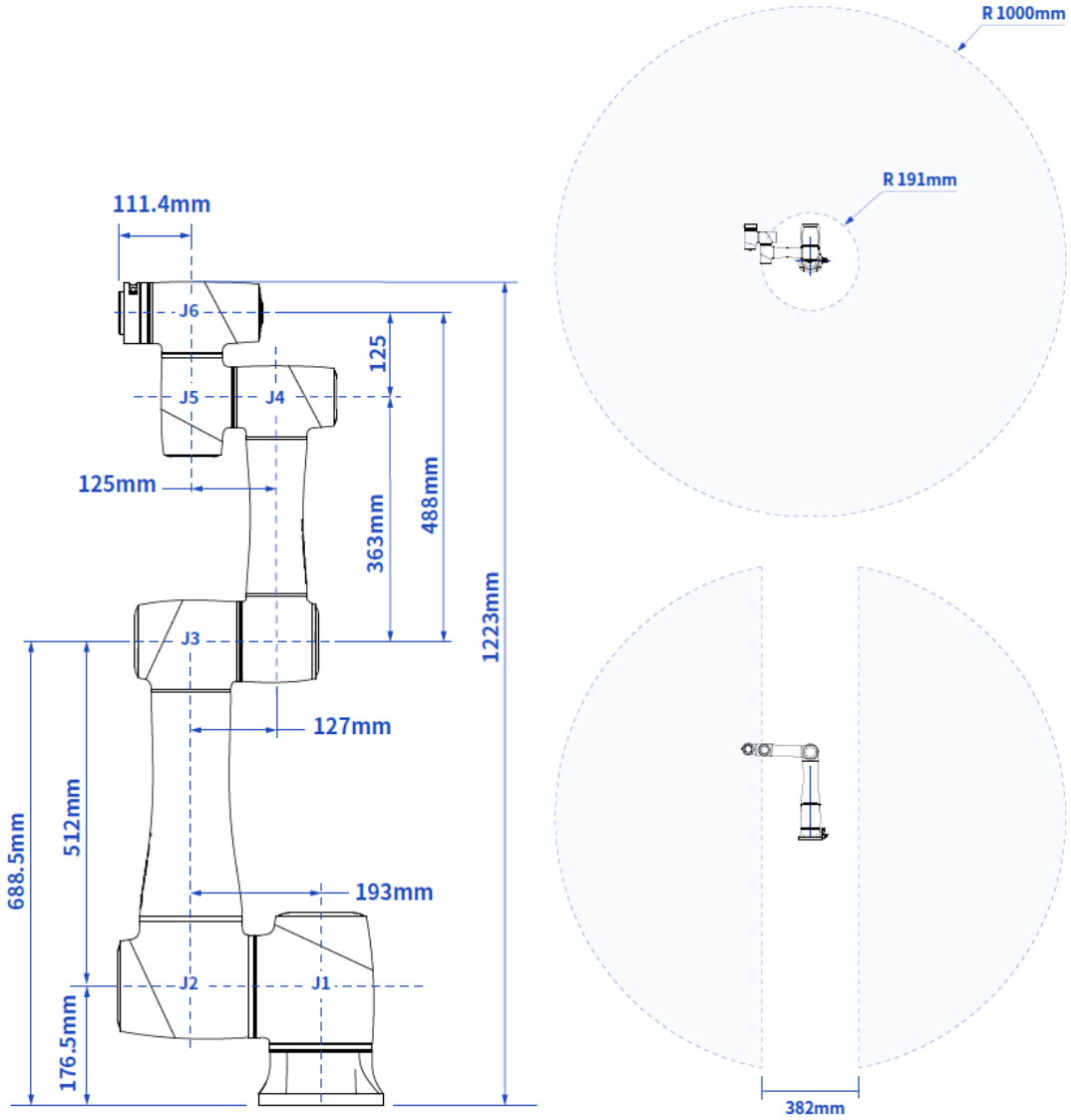


Figure 5.19 CR16A dimensions and working space

5.6.2 CR16A base installation dimensions

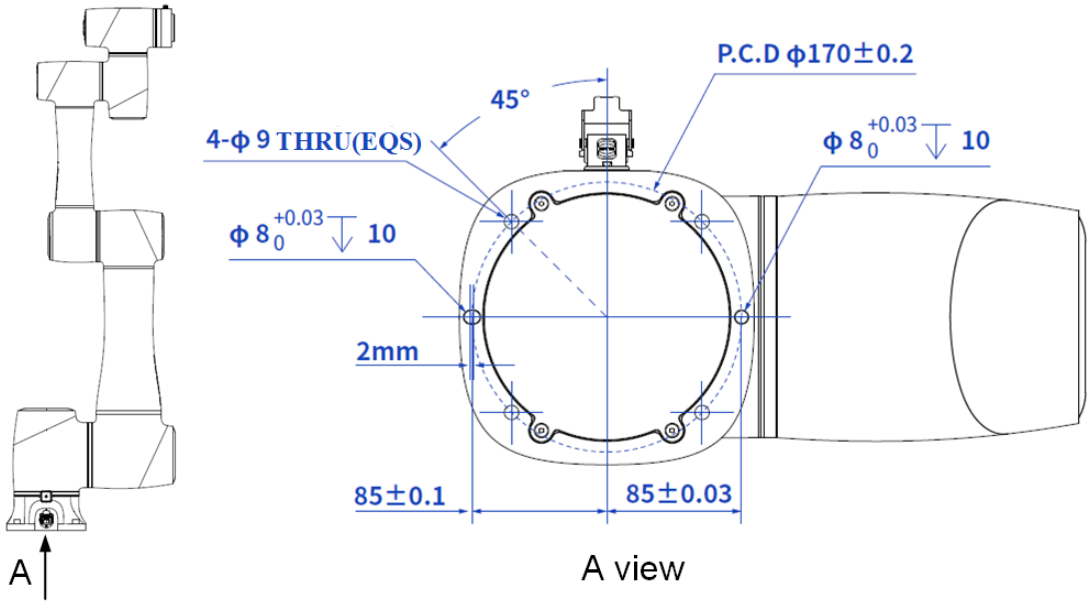


Figure 5.20 CR16A base installation dimensions

5.6.3 CR16A flange dimensions

The end flanges of CR A series robot arms (except CR20A) are all in the same size. The flange design conforms to ISO 9409-1.

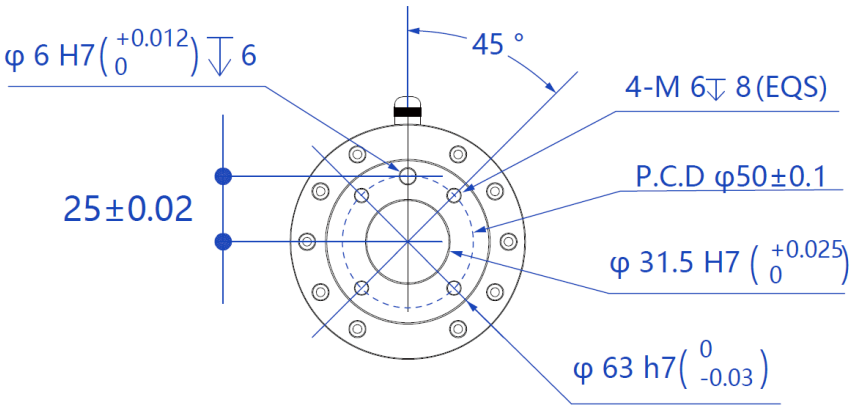


Figure 5.21 End flange dimensions

5.6.4 CR16A 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.

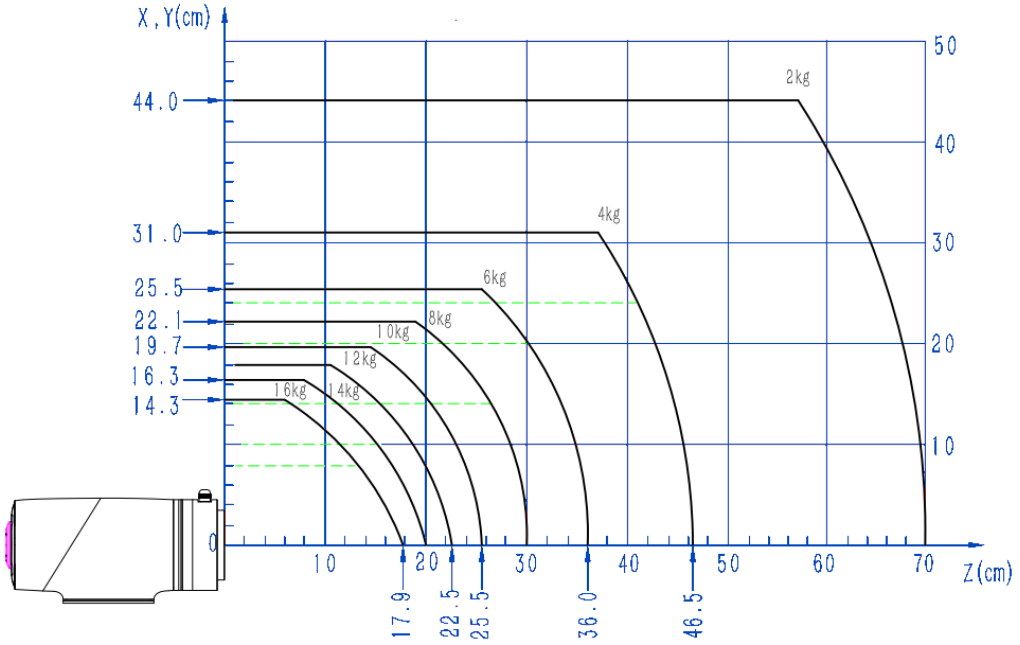


Figure 5.22 CR16A load curve

5.7 CR20A mechanical specifications

5.7.1 CR20A 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 try to avoid moving the tool to the cylindrical space. 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.

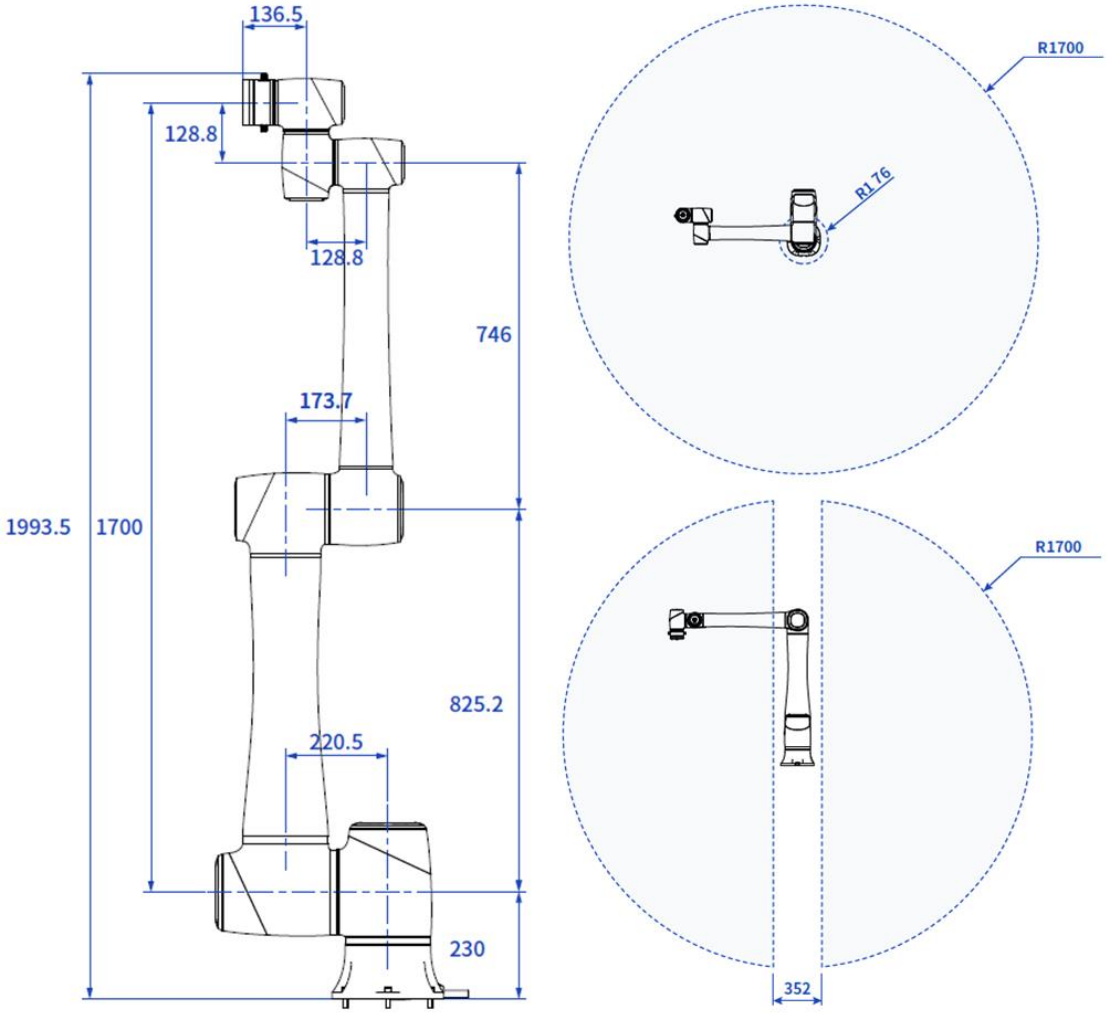


Figure 5.23 CR20A dimensions and working space

5.7.2 CR20A base installation dimensions

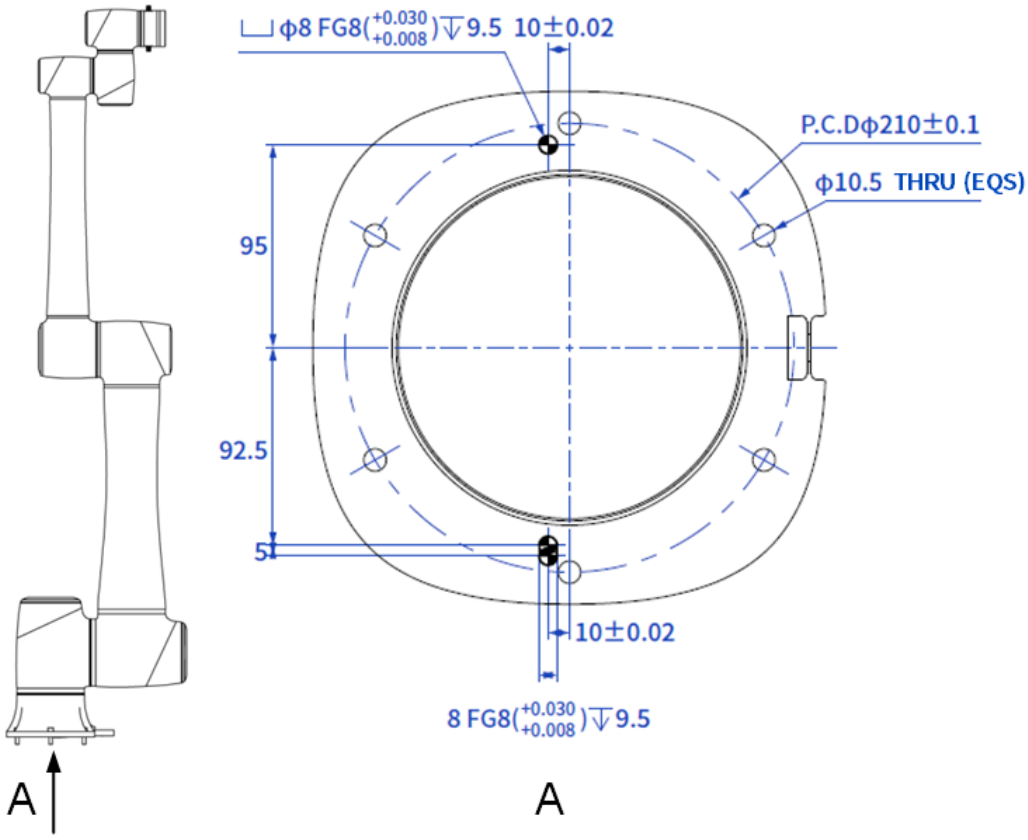


Figure 5.24 CR20A base installation dimensions

5.7.3 CR20A flange dimensions

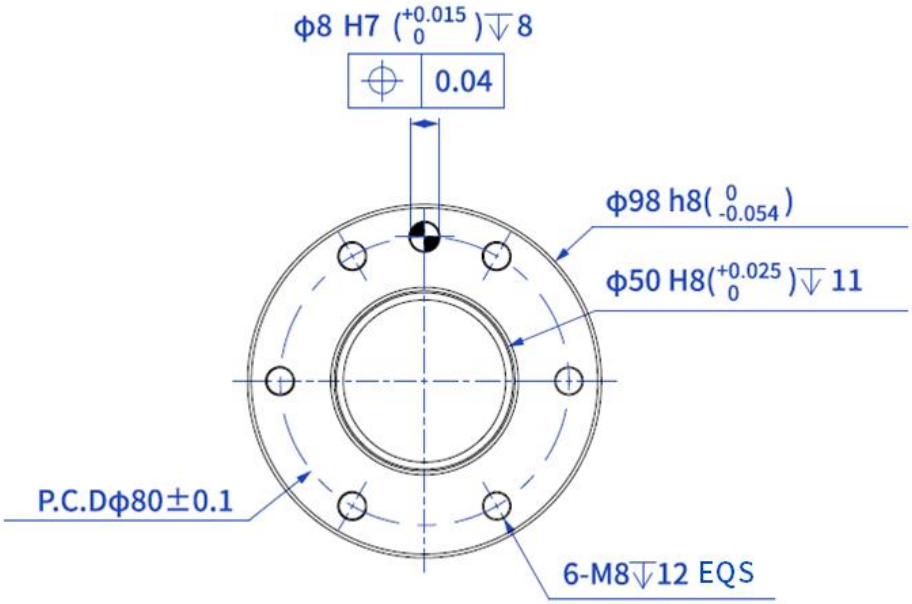


Figure 5.25 CR20A end flange dimensions

5.8 Controller dimensions

5.8.1 CC262 dimensions

The dimensions of CC262 controller are shown below. The right figure shows the length after the protective cover is installed. Other dimensions are the same as those of the controller without protective cover.

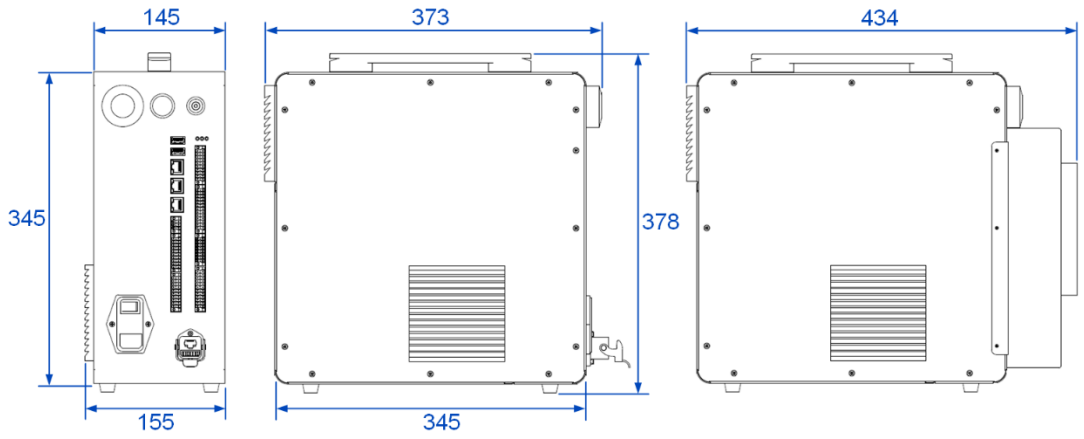


Figure 5.26 CC262 dimensions

5.8.2 CC263 dimensions

The dimensions of CC263 controller are shown below. The right figure shows the length after the protective cover is installed. Other dimensions are the same as those of the controller without protective cover.

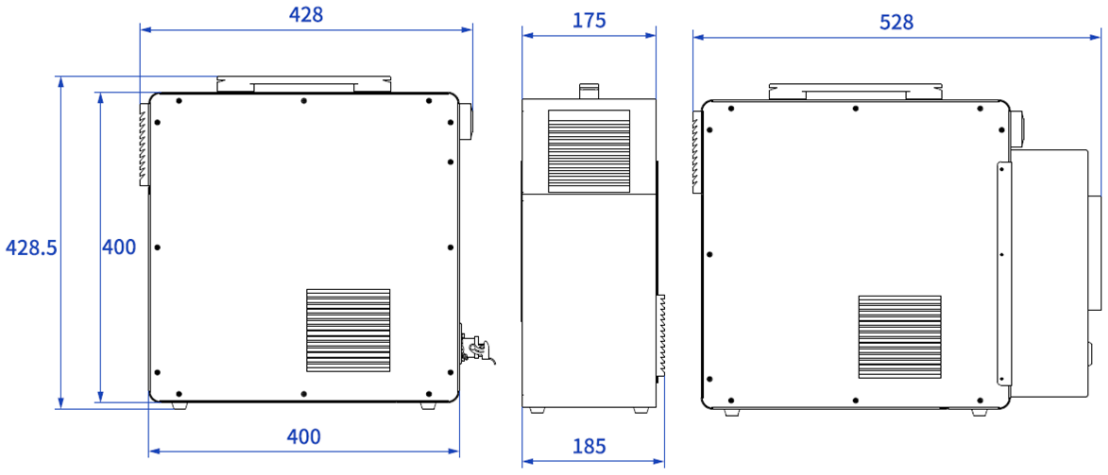


Figure 5.27 CC263 dimensions

6. Electrical Features

6.1 Controller interface

6.1.1 Overview

The electrical interfaces of the controller are all on the front side, as shown in the figure below. The interface distribution of CC263 is basically the same as that of the CC262 AC model, with only the power interface and switch modeling differing.

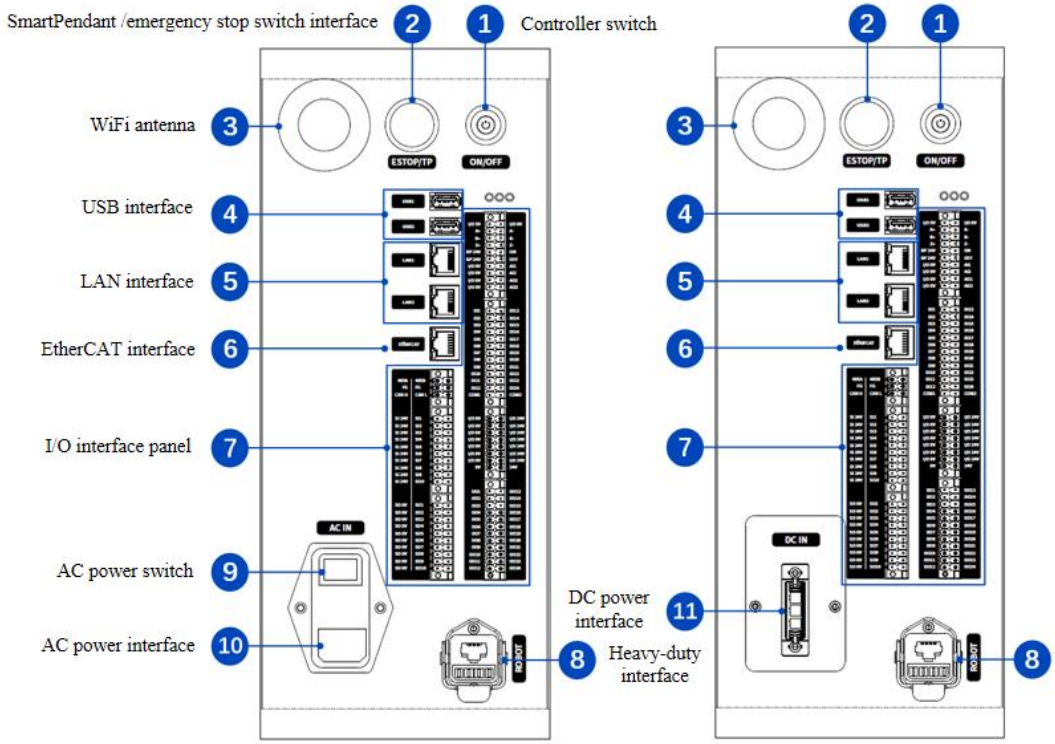


Figure 6.1 Controller electrical interfaces

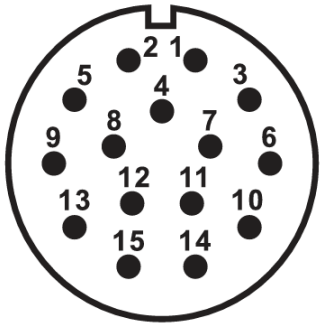
Table 6.1 Interface panel description

No.	Description
1	Controller switch After the controller is powered on, press the button for 0.5s and then release it, and the controller will be turned on and the button turns blue. When the controller is started, press the button for 3s and release it, and the controller will be turned off and the robot arm will be powered off, and the blue light will be off.
2	SmartPendant and emergency stop switch interface See *6.1.2 SmartPendant and emergency stop switch interface* for details.
3	WiFi antenna For connecting to PC or tablet through WiFi

No.	Description
4	USB interface For importing/exporting files
5	LAN interface, default address: • LAN1: 192.168.5.1 • LAN2: 192.168.200.1 For connecting to PC, or other external network equipment of TCP/IP or Modbus TCP protocol Only LAN1 IP address can be modified through DobotStudio Pro.
6	EtherCAT interface (reserved)
7	I/O interface panel See *6.1.3 I/O interface panel* for details.
8	Heavy-duty interface For connecting to robot, powering robot and communication
9	AC power switch For powering on/off controller
10	AC power interface For accessing single-phase 1100/220V AC power supply
11	DC power interface For accessing 30~60V DC power supply

6.1.2 SmartPendant and emergency stop switch interface

The interface is used to connect to specified SmartPendant or emergency stop switch, with pin definition shown below.



Pin	Definition
1	DC 24V
2	DC 0V
3	DC 24V

Pin	Definition
4	Emergency stop circuit 1 input (normally closed)
5	DC 24V
6	Emergency stop circuit 2 input (normally closed)
7~15	Communication of specified SmartPendant

6.1.3 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 provides 24 digital inputs, 24 digital outputs, 2 analog outputs, 2 analog inputs, 1 incremental encoder input, 1 RS485 interface, 1 CAN interface, 10 safety inputs and 10 safety outputs. **All interfaces with the same screen have common functions. You can select any available interface for wiring.** The interfaces connected by the green lines in the figure below are shorted by factory default.

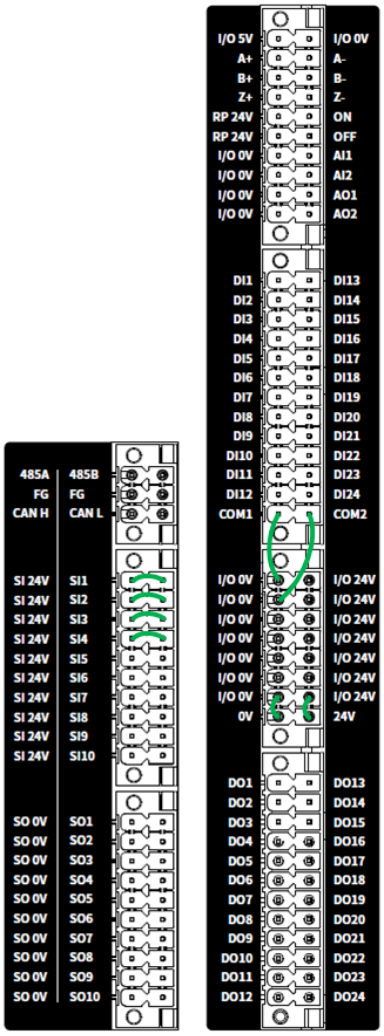


Figure 6.2 Controller I/O interface

Table 6.2 Pin definition

Screen	Definition
I/O 5V	Internal power source +5V
I/O 0V	Internal power source 0V
A+/A-	Pulse encoder interface. See *6.1.8 Encoder I/O interface* for details
B+/B-	
Z+/Z-	
RP 24V	Remote switch interface. See 6.1.7 Remote switch interface for details
ON	
OFF	
I/O 24V	I/O power +24V and 0V Internal power supply or external power supply can be realized through different wirings. See 6.1.4I/O interface power for details
I/O 0V	
AI1~AI2	Analog input/output interface. See *6.1.6 Analog I/O interface* for details.
AO1~AO2	
DI1~DI24	Digital input/output interface. See *6.1.5 Digital I/O interface* for details
DO1~DO24	
COM1~COM2	DI common ground for switching types of DI signal.
24V	Internal power source +24V and 0V
0V	
485A	RS485 interface. See *6.1.9 RS485 interface* for details
485B	
RG	For encoder, 485 and CAN grounding
CAN_H	CAN bus interface (reserved)
CAN_L	
SI 24V	Safety I/O power +24V and 0V
SO 0V	
SI1~SI10	Safety input/output interface. See *6.1.10 Safety I/O interface* for details
SO1~SO10	

6.1.4 I/O interface power

The I/O interface can be powered by internal and external 24V power supply, with a maximum of 500mA for each DO and a total output current of 3A. When using the internal power supply, short circuit 0V and 24V with the nearest I/O 0V and I/O 24V, as shown below.

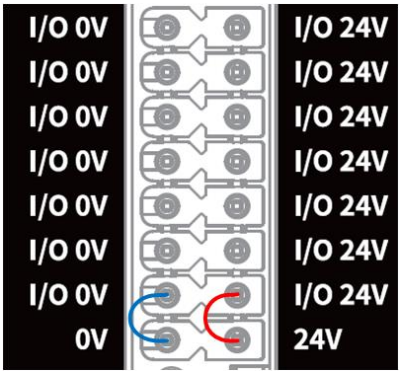


Figure 6.1 I/O connected to internal power supply

If a larger total output current (maximum 5A) is required, you can connect a 24V (±2%) power supply, as shown below. The external power supply and internal power supply are isolated and do not interfere with each other.

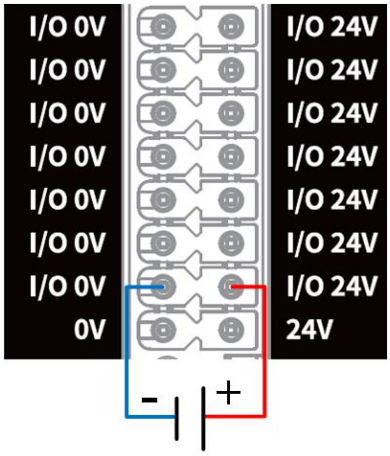


Figure 6.2 I/O connected to external power source

NOTE

The subsequent sections are based on the prerequisite that the I/O power supply has been connected, and will not describe I/O power supply wirings.

6.1.5 Digital I/O interface

The DI interface must be connected to the COM interface, and can switch signal types (PNP or NPN) through the COM interface. COM1 is used with DI1~DI2, and COM2 is used with DI13~DI24.

The wiring of DI connected to a simple switch is shown below. (left figure: PNP wiring, right figure: NPN wiring)

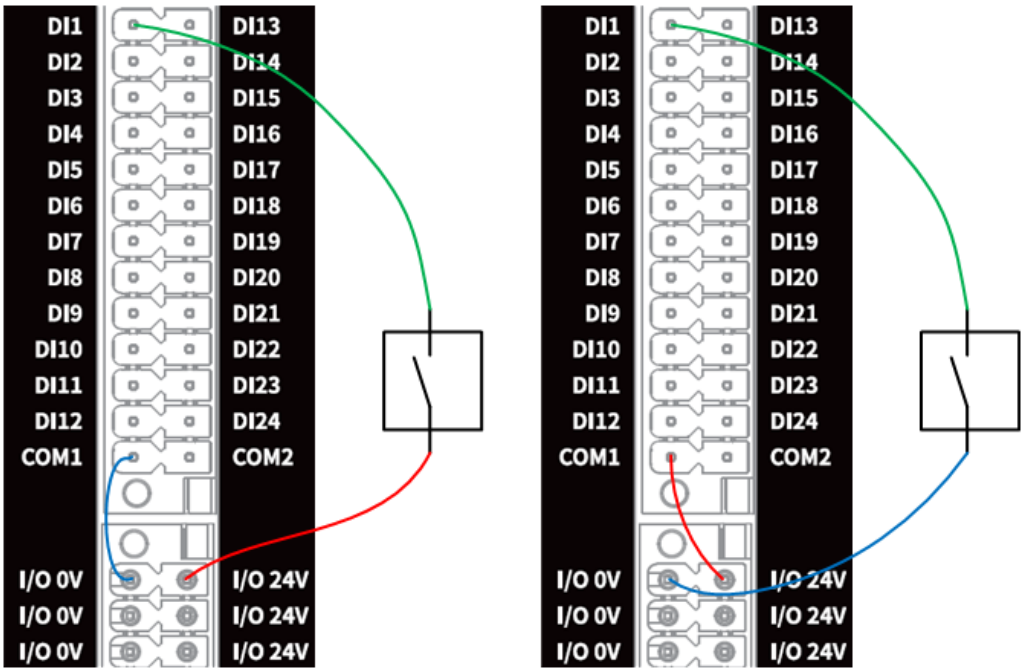


Figure 6.3 DI connected to simple switch

The wiring of DI connected to external PNP-type three-wire sensor is shown below. When the sensor is powered by the controller, short circuit the corresponding COM to I/O 0V (left figure below); when the sensor is powered by an external power supply, connect the COM to 0V of the external power supply (right figure below).

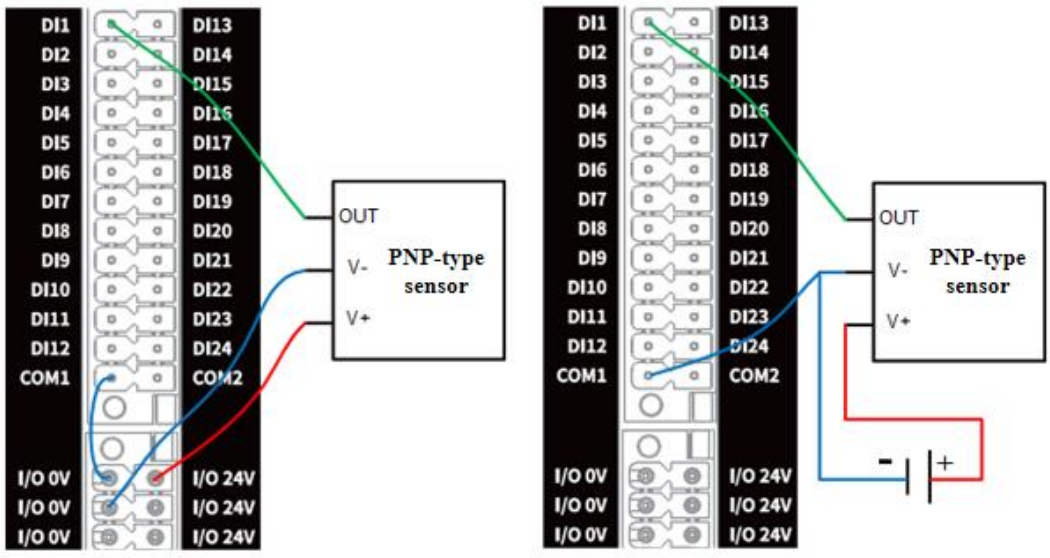


Figure 64 DI connected to PNP-type input

The wiring of DI connected to external NPN-type DO is shown below. When the external DO is powered by the controller, short circuit the corresponding COM to I/O 24V (left figure below); when the external DO is powered by an external power supply, connect the COM to 24V of the external power supply (right figure below).

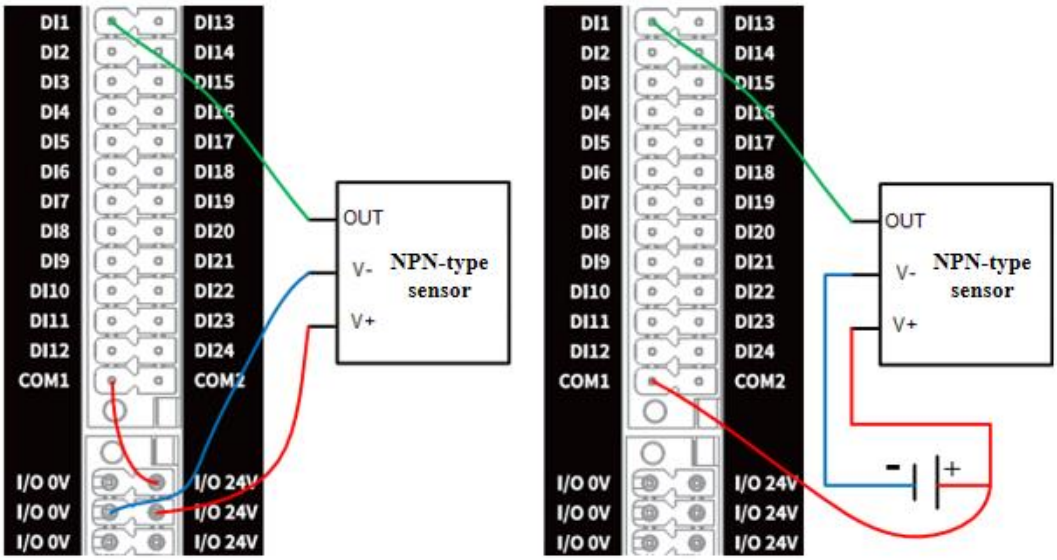


Figure 6.5 DI connected to NPN-type input

DO is PNP type by default, which can be configured to NPN type through the software. If the configuration of the upper computer is opposite with the load wiring (e.g. the upper computer is set to PNP type, and the load wiring is NPN type), the load cannot work normally.

The wiring of PNP-type DO connected to external load is shown below.

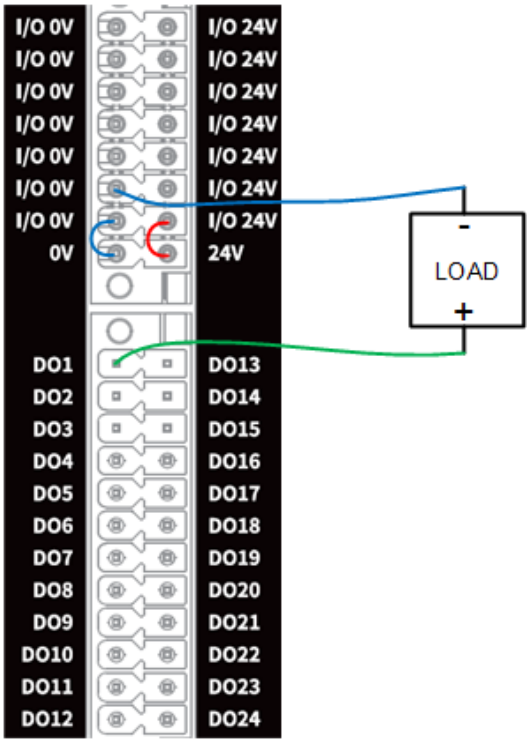


Figure 6.6 PNP-type DO connected to external load

The wiring of NPN-type DO connected to external load is shown below.

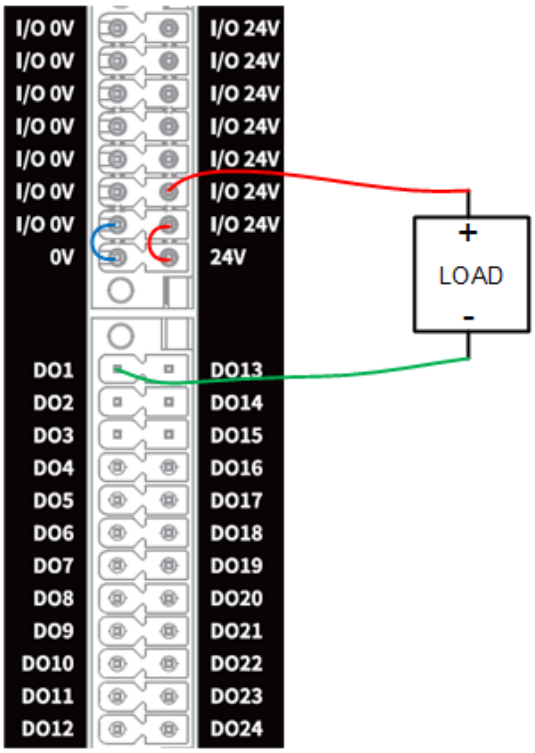


Figure 6.7 NPN-type DO connected to external load

6.1.6 Analog I/O interface

The analog signal supports voltage (0~10V) or current (4~20mA) signal (default: voltage). You can switch it to current signal through the software.

The wiring of AI interface connected to the tested object is shown below.

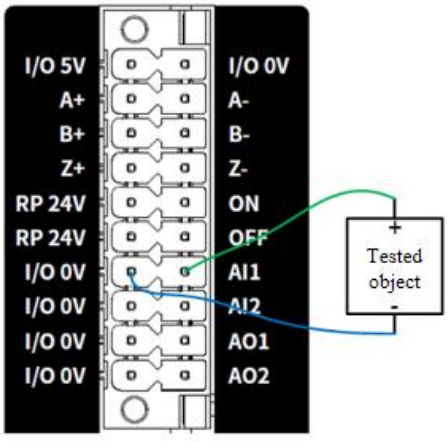


Figure 6.8 AI connected to tested object

The wiring of AO connected to external load is shown below.

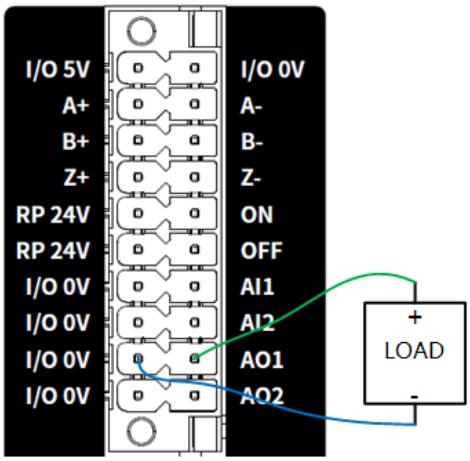


Figure 6.9 AO connected to external load

6.1.7 Remote switch interface

The remote switch interface is used to remotely control the controller to switch on/off. When the ON interface inputs in high level for 0.5s or more, the controller will be turned on. In the power-on status, when the OFF interface inputs in high level for 3s or more, the controller will be turned off. The wiring is shown below.

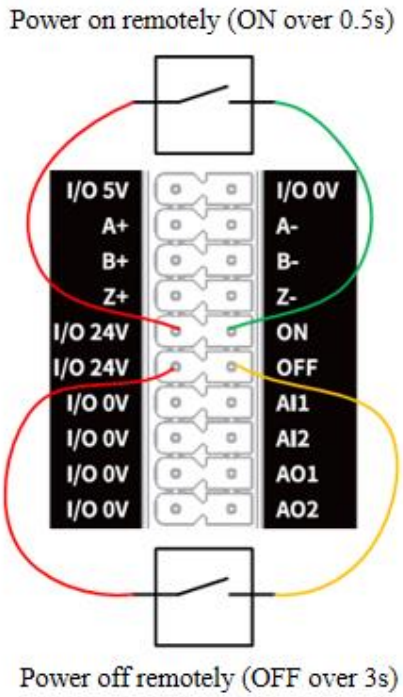


Figure 6.10 Remote switch interface wiring

6.1.8 Encoder I/O interface

An encoder is a device that converts angular or linear displacement into electrical signals. It

converts displacement into periodic electrical signals and then converts electrical signals into count pluses, so that the displacements can be measured by the number of pulses. The input signal in a specified format is supported.

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

According to different color cables of the encoder, connect each signal cable to the controller. Connect the 5V power cable to I/O 5V, 0V power cable to I/O 0V, and then connect each coded wiring in turn. If the ground wire is required, you can connect the cable shield to FG interface under RS485 interface. 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
Black	A+
White	B+
Orange	Z+
Black and red	A-
White and red	B-
Orange and red	Z-

6.1.9 RS485 interface

RS485 interface is mainly used for Modbus RTU communication. When connecting external devices (such as PLC), connect the 485A (or 485+) and 485B (or 485-) interfaces of both devices correspondingly, and connect the ground wire according to the actual condition, as shown below (taking double-ended grounding as an example).

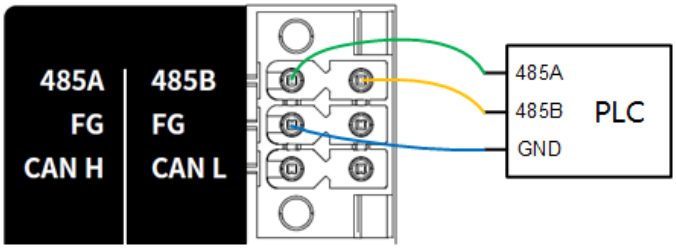


Figure 6.11 RS485 connected to PLC

6.1.10 Safety I/O interface

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

Safety input

SI1~SI10 interfaces are described below.

Screen	Definition
SI1, SI2	Emergency stop input
SI3, SI4	Protective stop input
SI5~SI10	You can configure in dual circuits to emergency stop input (no status output), protective stop reset input and reduced mode input through the software (no configuration by default).

Emergency stop input

The emergency stop input is an emergency stop interface 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. This function will trigger the emergency stop status output by default, which may lead to emergency stop self-locking in some circumstances. To avoid this case, you can modify the configurable SI interface to “User emergency stop input (no status output)” in the software, and use the corresponding interface as the user emergency stop input.

SI1 and SI2 are emergency stop inputs. The wiring for connecting one or more emergency stop switches is shown below.

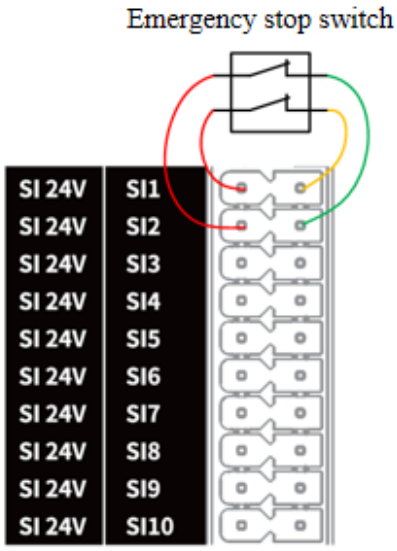


Figure 6.12 SI connected to one emergency stop switch

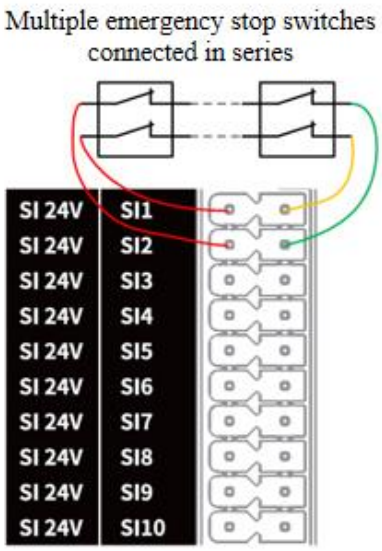


Figure 6.13 SI connected to multiple emergency stop switches

Protective stop input

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 level by default. Low level triggers the robot to enter the protective stop status (pause status).

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

Protective stop reset input

The protective stop reset input is used to reset the protective stop status.

The protective stop reset input is the normally open signal input of high level by default. The rising edge of both circuits triggers to reset the protective stop status.

SI3 and SI4 are protective stop inputs, and assume that you have set SI9 and SI10 to protective stop reset input, the wiring is shown below.

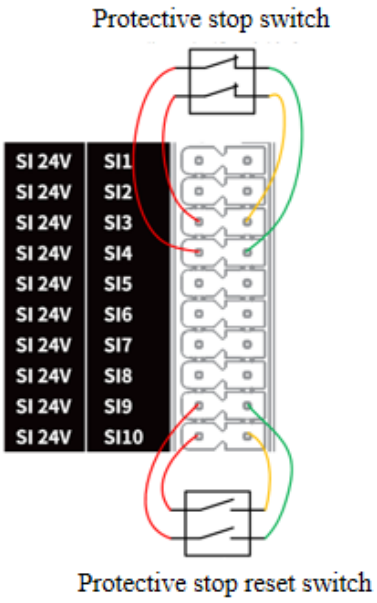


Figure 6.14 SI connected to protective stop device (with reset switch)

Reduced mode input

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

The default reduced mode input is the normally closed signal of high level, and low-level input triggers the robot to enter the reduced mode. If the high-level input is restored, the robot exits the reduced mode and enters the normal mode.

The wiring of connecting reduced mode switch is the same as that of connecting emergency stop switch or protective stop switch.

Safety output

SO1~SI10 interfaces are described below.

Screen	Definition
SO1, SO2	Emergency stop status output
SO3¬SO10	You can configure in dual circuits to protective stop status output, reduced mode status output, non-stop status output, running status output and initial posture status output through the software (no configuration by default).

Emergency stop status output

When the robot is in emergency stop status, the output voltage is low level, otherwise, the output voltage is high level.

SO1 and SO2 are Emergency stop status outputs, and the wiring of connecting external load is

shown below.

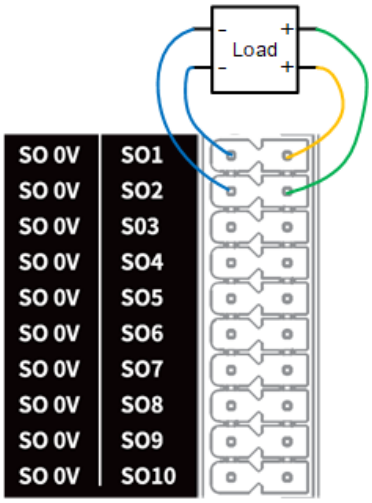


Figure 6.15 SO connected to external load

Protective stop status output

When the robot is in emergency stop status, the output voltage is low level, otherwise, the output voltage is high level.

Reduced mode status output

When the robot is in reduced mode, the output voltage is low level, otherwise, the output voltage is high level.

Non-stop status output

The output voltage is low level when the robot is in automatic running status (non-stop status), otherwise, the output voltage is high level. The status is judged by whether the robot is running the project, not whether the joints are moving. For example, if the project is running, and the program is waiting for the specified DI to turn ON, even if the robot arm is not moving, it is in non-stop status and outputs low level. When the project is in pause status, the robot arm is in stop status and outputs high level.

Running status output

If there is one or more joints of the robot moving more than 1°/s (except drag mode), it is in running status, and the output voltage is low level; otherwise, the output voltage is high level.

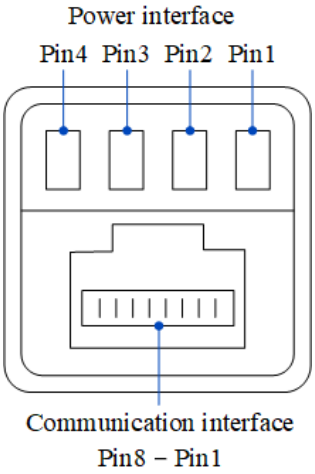
Initial posture status output

When the robot is in initial posture, the output voltage is high level, otherwise, the output voltage is low level. The initial posture is a user-defined posture, which can be set through the software.

6.2 Robot interface

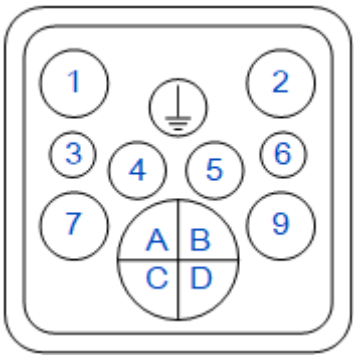
6.2.1 Heavy-duty interface

The heavy-duty interface of robot base is connected to the controller by overloading lines. It provides power supply and control signal for the robot. The CR A series (except CR20A) robotic arm heavy duty interface pinouts and definitions are as follows.



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

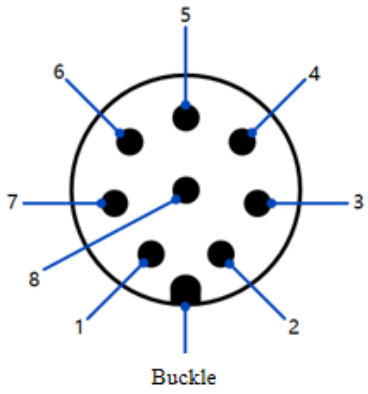
One end of the CR20A robotic arm heavy-duty cable is fixed to the robotic arm base, and the other end of the interface pinout and definition are as follows.



Pin	Name	Description
1	DC48V	DC48V +
2	DC48V	DC48V +
7	GND	DC48V -
9	GND	DC48V -
3	FG	Functional grounding
⏚	PE	Protective earthing
A	TX+	Send data +
B	TX-	Send data -
C	RX+	Receive data +
D	RX-	Receive data -

6.2.2 Tool I/O interface

The tool interface is an aviation plug located on the side of the end flange. The socket pins are distributed and defined as follows.



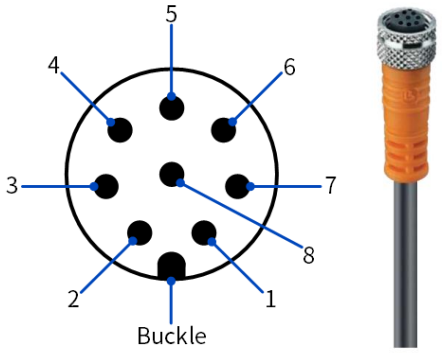
Pin	Name	Definition
1	485A/AI_1	485A or analog input 1
2	485B/AI_2	485B or analog input 2
3	DI_2	Digital input 2
4	D1_1	Digital input 1
5	24V	24V output, with nominal current of 1A and maximum current of 2A
6	DO_2	Digital output 2
7	DO_1	Digital output 1

8	GND	GND

NOTE

For CR20A, the X1 aviation socket pins are defined as shown above, and the AI/DI/DO of the X2 aviation socket are numbered consecutively after X1. For example, DI1 of X2 is DI3 and DI2 of X2 is DI4, and similarly for the cable pins below.

The cable used in the tool I/O is the cable specified by Dobot (model: SIGNAL 120108-06-014 (CR20A) / Lutronic FP-222460 (other CR A models)). The pin distribution and cable definition of the plug are shown as follows.



Pin	Color	Definition
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 tool digital input is PNP type. The wiring of connecting external simple switch circuit is shown below.

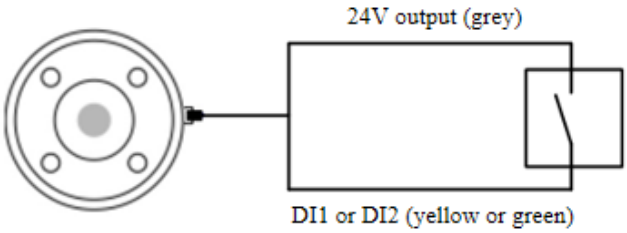


Figure 6.16 Tool DI connected to simple switch

When using PNP-type three-wire sensor as the DI input source, the wiring is shown below.

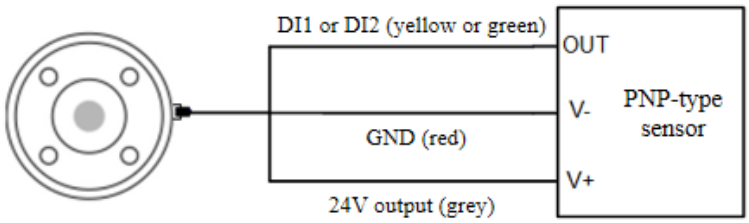


Figure 6.17 Tool DI connected to PNP-type sensor

The tool digital output is PNP type, powered by internal power supply, and the output current of the whole end is not greater than the maximum current of the 24V output as described before, with single DO output current ≤ 500mA. The wiring is shown below.

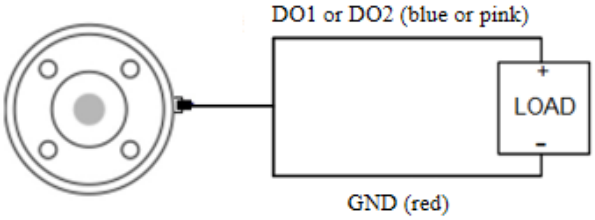


Figure 6.18 Tool DO wiring

Analog input

The wiring of tool analog input connected to the tested object is shown below.

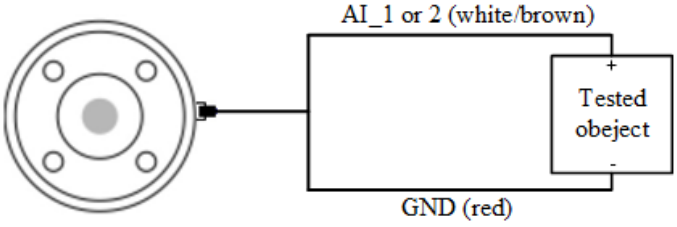


Figure 6.3 Tool AI wiring

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.

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 A robot arm supports 360° installation at any angle. The figure below shows several typical installation postures.

> NOTE
>
> The installation posture at the bottom of the figure is the standard mounting angle. When installing the robot in a non-standard mounting angle, you need to calibrate the mounting angle through the software after powering on the robot arm, See the user guide of the control software for details.

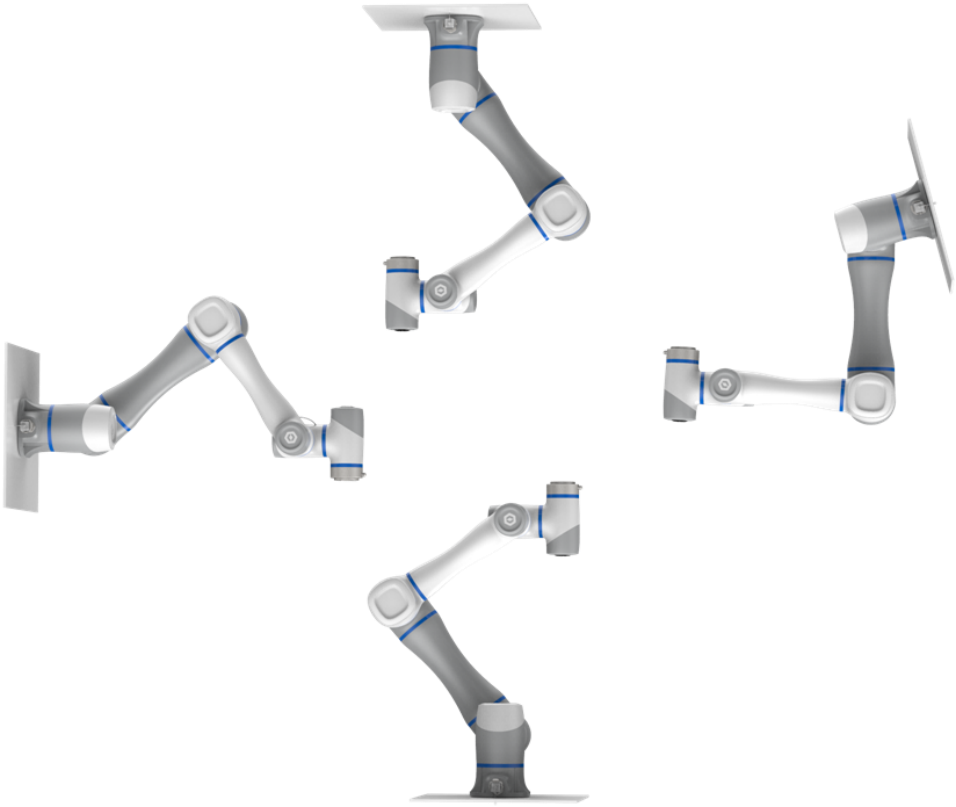


Figure 7.1 CR A robot installation posture

When installing the robot arm, position the mounting holes on the installation platform according to the installation size of the robot base. Fix the robot arm base on the platform using bolts. Be sure to observe the following during installation.

- When the robot is transported, ensure that the robot is stable and kept in proper place.
- When the robot is hoisted (CR20A comes with its own sling from the factory, if other models need to be lifted, users are requested to provide their own sling), 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 hex bolts (ISO898-1: 2013, property class: 12.9) to fix and tighten the robot base. The CR3A requires the use of 4 M6 bolts, the CR20A uses 6 M10 bolts, and the other models use 4 M8 bolts
- When the robot is installed on the wall or upside down, be sure to take the anti-fall measures of the robot base.
- 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. High acceleration may trigger the collision detection mechanism

of robot arm and cause the robot arm to stop.

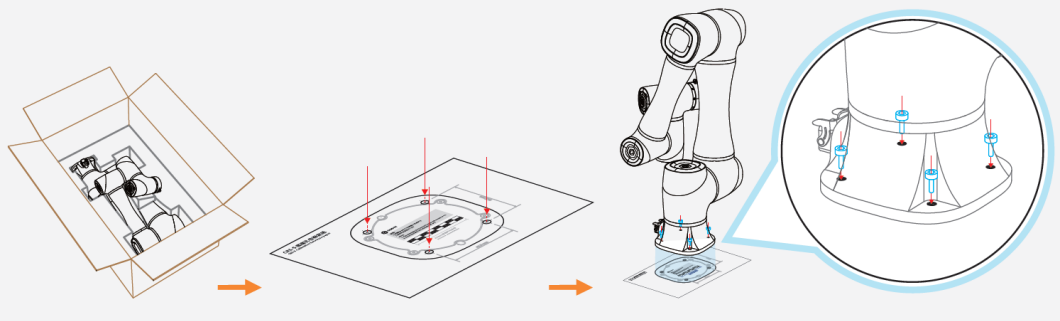


Figure 7.2 CR A robot installation posture

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. The controller supports vertical-type and horizontal-type installation. Please leave at least 200 mm gap on the corresponding side and keep the vent unblocked to ensure enough space for heat dissipation. Please leave 200 mm on the front side for cable wiring.

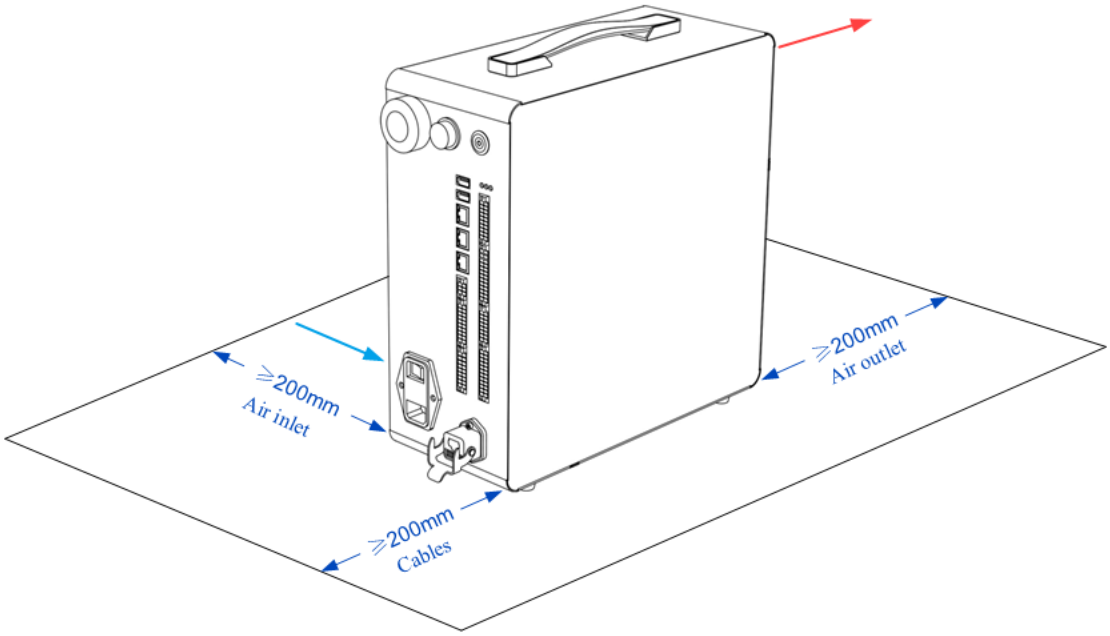


Figure 7.3 Vertical-type installation

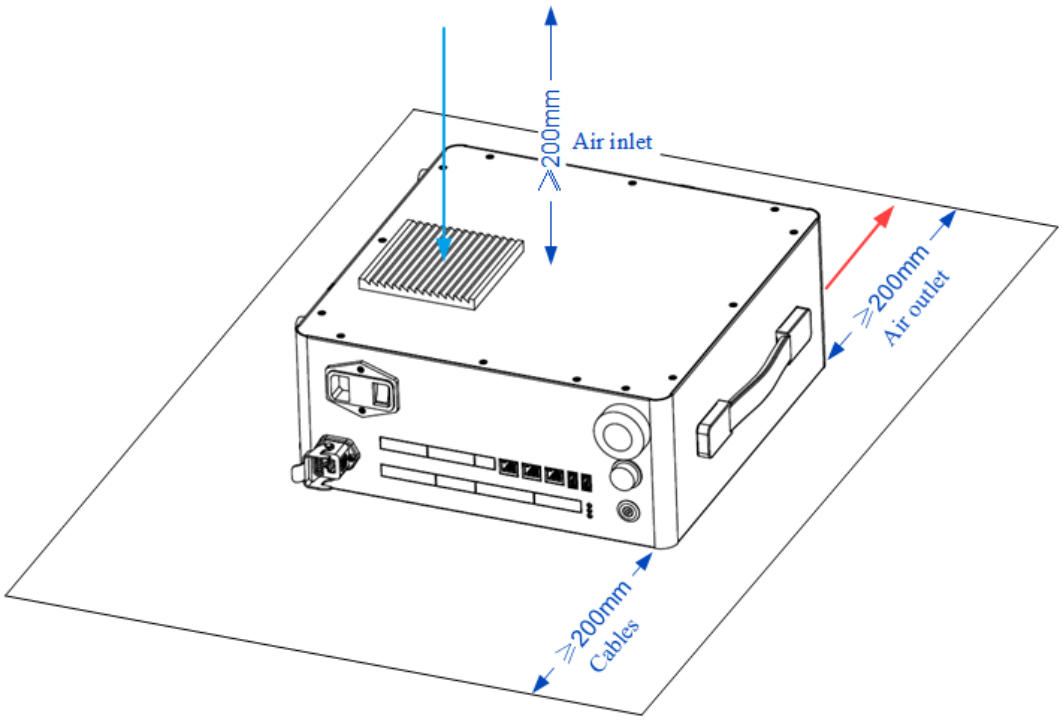


Figure 7.4 Horizontal-type installation

7.3.3 Protective cover installation (optional)

The controller can be equipped with a protective cover. After correct installation of the protective cover, the controller can reach IP54 protection level. The figure below shows the components of the protective cover.

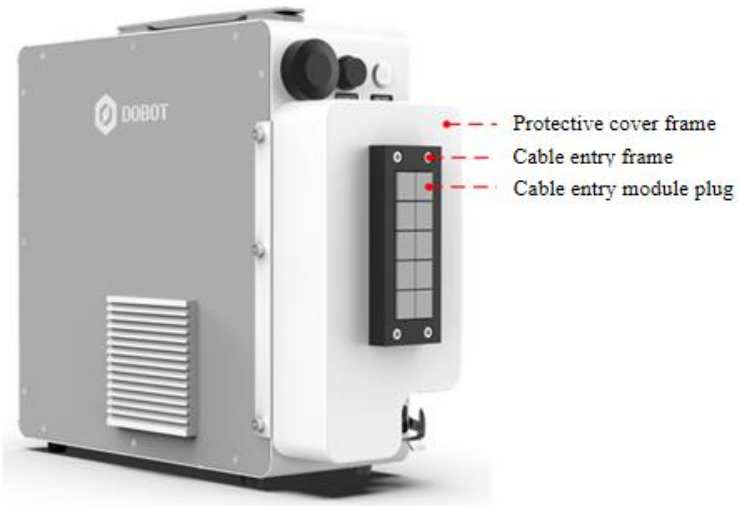


Figure 7.5 Protective cover

Before delivery, the cable entry plate (with modules and plugs) has been mounted on the protective cover frame.

1. Remove the four M4 bolts at the corners of the cable entry plate using inner hexagon

wrench, and remove the cable entry plate from the protective cover.

2. Loosen three M4 bolts on the side of the cable entry frame using M4 inner hexagon wrench to disassemble the cable entry plate and take out the cable entry module.

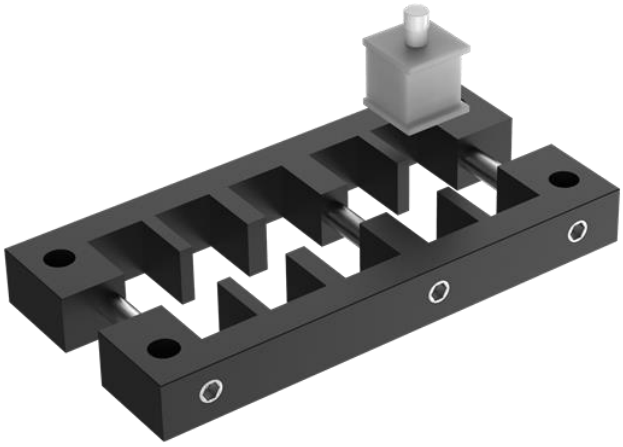


Figure 7.6 Cable entry plate

3. Select the appropriate module according to the cable diameter connected to the controller (If there is no suitable module among the modules pre-assembled on the cable-entry plate, you can select from the separate modules shipped with the protective cover). Take out the plug from the module, and embed the cable into the module.

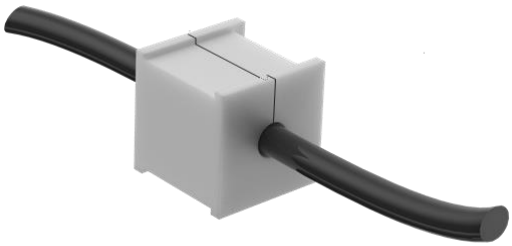


Figure 7.7 Cable entry module

4. Install the module back into the cable entry frame, and tighten 3 M4 bolts on the side of the frame.

> ⚠ NOTICE
>
> The module without embedded cable also needs to be installed back into the cable entry frame with the plug, otherwise, it cannot reach IP54 protection level.

5. Install the cable entry plate back into the protective cover frame, and fix it using 4 M4 bolts.
6. Connect the cable through the protective cover to the controller.
7. Remove 5 screws (3 on the left and 2 on the right) on both sides of the controller corresponding to the installation holes of the protective cover. For the installation position

of the protective cover, refer to the diagram at the beginning of this section.

8. Install the protective cover to the controller, and fix it using 5 M3 screws delivered with the protective cover.

7.3.4 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, and position it using pins. The end flanges of CR A series robot arms are all in the same size. For detailed dimensions, refer to *5 Mechanical Specifications*.

7.4 Wiring

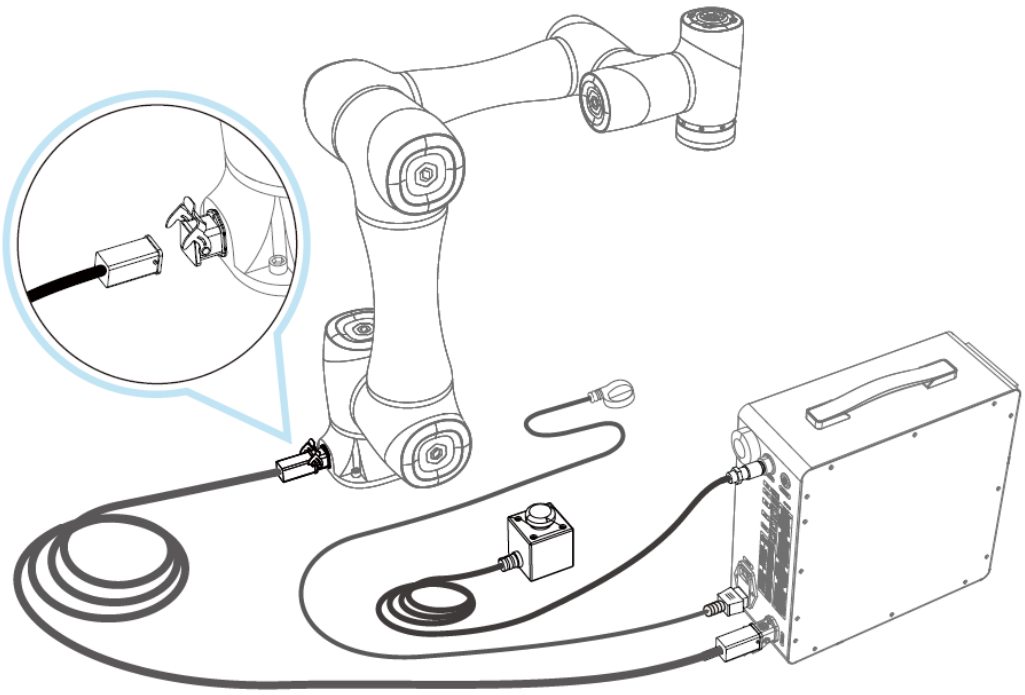


Figure 7.1 Wiring diagram

1. Connect the controller to robot arm through a heavy-duty cable. When you plug the heavy-duty connector into the heavy-duty socket, fasten the buckle of the heavy-duty connector.
2. Plug the emergency stop switch cable to the emergency stop switch interface. When connecting, align the white dot on the connector with the white dot on the interface, and rotate the blue plastic ring clockwise to fix.
3. Plug one end of the power cable into the power interface of the controller, and the other end into main power socket. (For DC controller, connect other end to 48V DC power. See the table below for terminal definitions).

Color	Label	Definition
Red	V+	48V power supply (positive)

Black	V-	Power supply (negative)
Yellow-green	PE	Protective grounding

NOTICE

- Set the specifications and installation method of external cables in compliance with local power distribution laws and regulations.
- Do not disassemble the robot 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 press the circular button for 0.5s on the front side of the controller. When the indicator lights both 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*.

When the robot arm is not in use, long press the circular button on the front side of the controller for 3s to switch it off when the robot arm is in stop status. Then press the switch on the top of the power interface to “O” to disconnect the power.

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 follow the instructions below:

- 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:

NOTICE

- 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 item	Maintenance essential
Daily	3 months	6 months		
√			Robot clean	Use a rag dipped in water, 10% ethanol, etc. to wipe any dust, dirt, oil, etc. visible on the robotic arm
		√	Joint bolts	Check the torque of exposed bolts based on the specified tightening torque table
	√		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
		√	Cables	Check that the connecting ends of power cables, heavy-duty cables, IO cables, etc. are secure and that the skin is not worn out

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.

9. Warranty

9.1 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.

9.2 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

Table 1 CR3/5/7A

Product		DOBOT CR3A	DOBOT CR5A	DOBOT CR7A
Weight		17.5kg (38.6lb)	25kg (55.1lb)	24kg (52.9lb)
Maximum load		3kg (6.6lb)	5kg (11lb)	7kg (15.4lb)
Working radius		620mm (24.4in)	900mm (35.4in)	800mm (31.5in)
Maximum linear speed		2m/s (78.7in/s)		
Joint working range	J1	±360°		
	J2	±360°		
	J3	±155°	±160°	±160°
	J4	±360°		
	J5	±360°		
	J6	±360°		
Maximum joint speed	J1	180°/s		
	J2	180°/s		
	J3	223°/s	180°/s	180°/s
	J4	223°/s		
	J5	223°/s		
	J6	223°/s		
Tool I/O	DI	2		
	DO	2		
	AI	2		
	RS485	Support (two AIs multiplexing)		
Repeatability		±0.02mm		
IP rating		IP54		
Noise		70dB(A)		
Temperature range		0℃~50℃		
Typical power		120W	150W	150W

consumption			
Installation mode	Any angle		
Cable length from robot to controller	5m (16.4 feet)		
Material	Aluminum alloy, ABS		

Table 2 CR10/12/16A

Product		DOBOT CR10A	DOBOT CR12A	DOBOT CR16A
Weight		40kg (88.2lb)	38.5kg (84.9lb)	38kg (83.8lb)
Maximum load		10kg (22lb)	12kg (26.5lb)	16kg (35.3lb)
Working radius		1300mm (51.2in)	1200mm (47.2in)	1000mm (39.4in)
Maximum linear speed		2m/s (78.7in/s)		
Joint working range	J1	±360°		
	J2	±360°		
	J3	±160°		
	J4	±360°		
	J5	±360°		
	J6	±360°		
Maximum joint speed	J1	150°/s		
	J2	150°/s		
	J3	180°/s		
	J4	223°/s		
	J5	223°/s		
	J6	223°/s		
Tool I/O	DI	2		
	DO	2		
	AI	2		
	RS485	Support (two AIs multiplexing)		
Repeatability		±0.03mm		
IP rating		IP54		

Noise	70dB(A)
Temperature	0℃~50℃
Typical Power Supply	350W
Installation mode	Any angle
Cable length from robot to controller	5m (16.4 feet)
Material	Aluminum alloy, ABS

Table 3 CR20A

Product		DOBOT CR20A
Weight		73kg (160.9lb)
Maximum load		20kg (44.1lb)
Working radius		1700mm (66.9in)
Maximum linear speed		2m/s (78.7in/s)
Joint working range	J1	±360°
	J2	±360°
	J3	±168°
	J4	±360°
	J5	±360°
	J6	±360°
Maximum joint speed	J1	120°/s
	J2	120°/s
	J3	150°/s
	J4	180°/s
	J5	180°/s
	J6	180°/s
Tool I/O	DI	4
	DO	4
	AI	4

	RS485	Support (four AIs multiplexing)
Repeatability		±0.1mm
IP rating		IP54
Noise		70dB(A)
Temperature		0℃~50℃
Typical Power Supply		5000W
Installation mode		Any angle
Cable length from robot to controller		6m (19.7 feet)
Material		Aluminum alloy, ABS

Appendix B Controller technical specifications

Product		DOBOT CC262		DOBOT CC263
		AC	DC	AC
Compatible Models		CR3A~CR16A		CR20A
Weight		9.5kg (20.9lb)	8.5kg (18.7lb)	14.5kg (32lb)
Input Power		100~240V, 47~63HZ	30~60V	100~240V, 47~63HZ
IO Power		24V, Max 3A, maximum 0.5A for each		
I/O Interface	DI	24 digital intputs (PNP or NPN)		
	DO	24 digital outputs (PNP or NPN)		
	AI	2 analog inputs, voltage/current mode: 0V~10V, 4mA~20mA		
	AO	2 analog outputs, voltage/current mode: 0V~10V, 4mA~20mA		
Remote switch on/off		Support		
Commu. interface	LAN	2 (for TCP/IP, Modbus TCP, Ethernet/IP communication)		
	USB	2 (for importing and exporting files)		
	RS485	1 (for RS485, Modbus RTU communication)		
	Encoder	1 (for ABZ incremental encoder)		
Environment		Temperature: 0℃~50℃ Humidity: ≤95%, no condensation		
Protection Grade		IP20 (IP54 optional)		
Cooling Method		Forced air cooling		
Teaching Method		PC software, App (Android), Teach pendant		

