# Dobot Nova 2S Hardware User Guide

Original Instructions

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SHENZHEN DOBOT CORP LTD | China

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

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# Preface

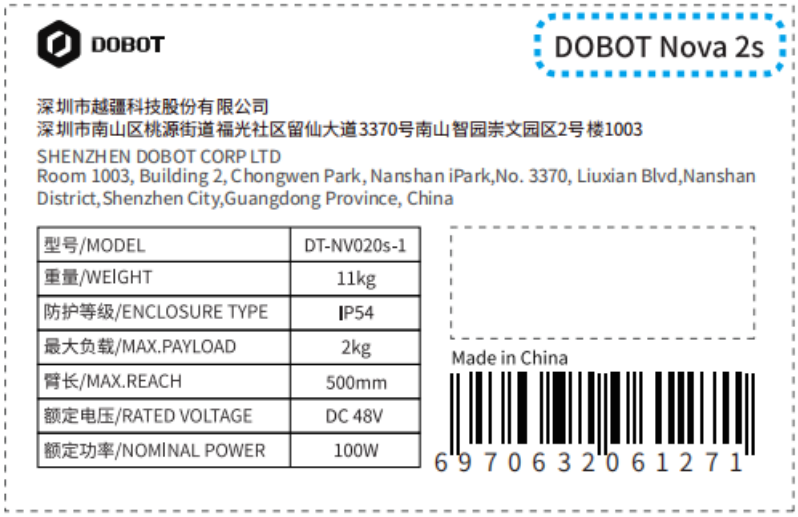
This document describes the functions, technical specifications, installation guide of Dobot Nova 2s collaborative robot, making it easy for users to fully understand and use it.

## Scope of application

**Robot arm:**

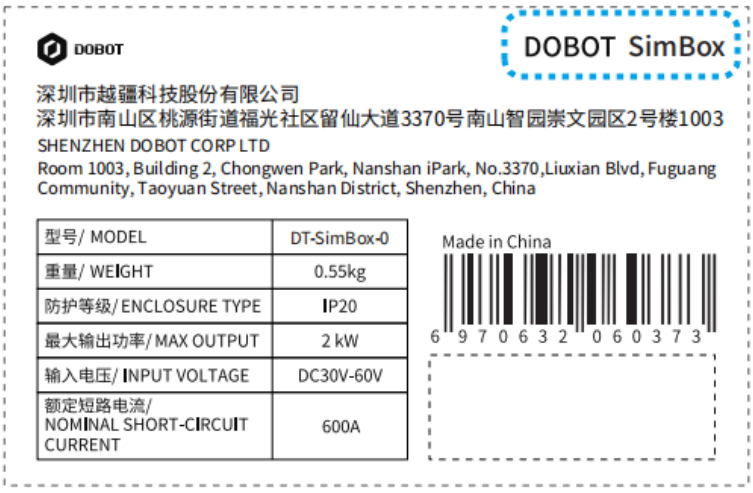
- DOBOT Nova 2s

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




**Controller:** DOBOT SimBox

You can find the model of the controller in the upper right corner of the nameplate on the controller.



## Important safety notice

The robot is a **semi-finished machinery**, so a risk assessment must be conducted after each installation. Please strictly adhere to all safety regulations outlined in Chapter 1.

## Intended audience

This document is intended for:

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

## Related documents

| Document | Description | Download link |
| --- | --- | --- |
| DobotStudio Pro User Guide | Explains how to use the robot control software, DobotStudio Pro. | Visit Dobot official website, click "Support > Download Center", and search by document name or filter by product series. |
| Dobot TCP_IP Remote Control Interface Guide | Describes how to use the secondary development interface based on TCP/IP protocol. In addition to the document, you can also access multi-language development DEMOs from Github. | |

## Revision history

| Date | Version | Revision history |
| --- | --- | --- |
| 2025/08/26 | 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 avoided, could result in minor or moderate injury, robot arm damage. |
| **NOTICE** | Indicates a potentially hazardous situation which, if not avoided, could result in robot arm damage, data loss, or unanticipated result. |
| **NOTE** | Provides additional information to emphasize or supplement important points in the main text. |

## How to use this guide

| Phase | Description | Reference section |
| --- | --- | --- |
| Safety Learning | Before installing and using the robot, read the safety section thoroughly and strictly follow the safety guidelines provided. | Safety |
| Product Understanding | Understand the components, features, and detailed technical specifications of the product. | Product Introduction<br>Product Characteristics<br>Appendix Technical Specifications |
| Planning | Space planning: Understand the mechanical specifications and installation environment requirements of the robot arm and controller, and plan the installation space by considering the end tool's mechanical specifications and installation method. | Mechanical Specifications<br>Installation environment |
| | Electrical planning: Read the relevant sections to understand the function and location of the robot's electrical interfaces, and plan the electrical connections and wiring. | Electrical Characteristics |
| Installation | Unpack the robot. | Unpacking |
| | Transport the robot arm and controller to their respective installation locations. | Transportation |
| | Install the robot arm, controller, and end tools in place. | Mechanical Specifications<br>Robot installation |

| Phase | Description | Reference section |
| --- | --- | --- |
| | Connect to the robot. | Electrical Characteristics<br>Cable connection |
| Power-on and Use | Power on the robot, then refer to *DobotStudio Pro User Guide* to configure and use the robot. | Power-on and debugging |
| Maintenance | Perform routine maintenance and care of the robot while strictly following the safety instructions. | Maintenance |
| Disposal | Follow the instructions in this document for deactivating and disposing of the robot. | Disposal and Environmental Protection |

# Contents



# 1. Safety

## 1.1 Responsibility

### 1.1.1 Responsibility and norms

The information in this document does not cover designing, installing and operating a complete robot system, nor does it cover all peripheral equipment that may 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 considered as a warranty from Dobot. The robot may cause injury or damage even if all safety instructions are observed.

### 1.1.3 Intended use

Dobot Nova 2s series robots are industrial robots only for general industrial use, such as processing or delivering products or parts through end tools.

Dobot Nova 2s series robots are equipped with special safety mechanisms including collision detection. These mechanisms are purposely designed for human-robot collaboration, but only intended for non-hazardous applications after risk assessment, where tools, goods, environment 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 Risk assessment

As the robot is a **semi-finished machinery**, the integrator is responsible for conducting a risk assessment of the overall system after integration. It is recommended that integrators perform a risk assessment based on ISO 12100 and ISO 10218-2 and refer to the Technical Specification ISO/TS 15066 for integration guidance.

The risk assessment should consider all workflows during the robot's entire lifecycle, including but not limited to:

- Teaching the robot during the setup and development process.
- Maintenance and repairs.
- Robot installation.

The risk assessment must be completed **before the robot is powered on for the first time**, including but not limited to confirming the safety function settings and evaluating whether additional emergency stop buttons or other protective measures are required.

When performing the risk assessment, the integrator should focus on the following safety functions:

- Collision detection sensitivity settings: Limiting the force applied during a collision between the robot and the operator.
- Robot and tool pose limitations: Reducing the risk of the robot and tools colliding with the operator, especially in specific body areas such as the head and neck.
- Speed limit: Limiting the robot's operating speed to reduce safety risks.

The integrator must set permissions and passwords to prevent unauthorized personnel from modifying the safety function configurations.

When conducting a risk assessment for collaborative robot applications, the integrator must consider potential collision risks caused by human error, including:

- The severity of potential collisions.
- The probability of potential collisions.
- The likelihood of avoiding potential collisions.

If the robot is installed in a non-collaborative application where its built-in safety functions cannot effectively eliminate safety risks (e.g., using hazardous tools), the integrator must consider adding additional protective measures (e.g., safety barriers or safety lasers) during the risk assessment.

The integrator must consider potential risks including but not limited to:

1. Cuts from sharp edges and points on the end tools or end effector connectors.
2. Cuts from sharp edges and points on obstacles in or near the robot's workspace.
3. Scrapes caused by contact with the robot.
4. Sprains or fractures resulting from collisions between heavy payloads on the robot's end and hard surfaces.
5. Consequences of loose bolts securing the robot or end tool.
6. Consequences of items falling off the end tool.
7. Consequences of incorrectly pressing the emergency stop button of other equipment.
8. Consequences of unauthorized changes to the safety function configurations.

## 1.3 Pre-use assessment

Before using the robot for the first time or after any modifications are made, testing must be conducted to ensure that all safety inputs and outputs are correctly connected and functioning properly:

1. Test whether the emergency stop button and user emergency stop input can trigger an emergency stop.
2. Test whether the protective stop input can halt the robot's motion. If a protective stop reset input is configured, test whether this input must be activated before the robot can resume operation.
3. If a reduced mode input is configured, test whether this input can switch the robot to reduced mode (reduced-speed operation).
4. Test whether the system connected to the emergency stop status output can detect the output change and respond accordingly.
5. If other safety outputs are configured, test whether the system connected to the corresponding output can detect the output change and respond accordingly.

## 1.4 Safety warning sign

The following safety warning signs may appear on the product, and their meanings are 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. |
| ⚠ **ELECTRICITY** | Indicates a potentially dangerous electrical situation that, if not avoided, could result in injury, death, or serious damage to the equipment. |
| ⚠ **HOT**   | May cause dangerous hot surface, if touched, may cause personal injury. |
| ⚠ **WARNING** | Indicates a hazard with a medium level or low level of risk which, if not avoided, could result in minor or moderate injury, robot arm damage. |
| ⚠ **NOTICE** | Indicates a potentially hazardous situation which, if not avoided, could result in robot arm damage, data loss, or unanticipated result. |
| ⚠ **CAUTION** | Indicates a situation that, if not avoided, could result in personnel injury or damage to the equipment.<br>For items marked with such signs, depending on the specific situation, there is sometimes a possibility of significant consequences |

## 1.5 General safety

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

**DANGER**

- The robot control system is an electrically powered device. Non-professionals should not modify the circuit, otherwise, it may result in robot damage or personal injury.
- Strictly comply with local laws and regulations when operating the robot. The safety precautions described in this document serve only as a supplement to local safety standards.
- Use the robot within the specified environmental conditions. Operating beyond the rated specifications and load conditions may shorten the robot's lifespan or even damage it.
- Ensure that the robot is operated under safe conditions and there is no harmful object around the robot.
- Avoid frequently powering the robot on and off, as this may degrade the performance of the main circuit components inside. If repeated power cycling is necessary, limit it to no more than once per minute.

**HOT**

- The robot and controller generate heat during operation. Do not operate or touch the robot while it is running or immediately after it stops.
- Turn off the power and wait one hour for the robot to cool down.
- Do not place your fingers on the heat generating area of the controller.

**NOTICE**

- Personnel responsible for installing, operating, and maintaining the equipment must undergo rigorous training, fully understand all safety precautions, and master proper operation and maintenance procedures before handling the equipment.
- Unauthorized personnel without professional training must not disassemble or repair the equipment. In case of a malfunction, contact Dobot's technical support engineer in time.
- Perform daily inspections and periodic maintenance, replacing faulty components promptly to ensure the safe operation of the equipment.
- If the equipment is scrapped, please comply with the relevant laws for the proper disposal of industrial waste to protect the environment.
- Establish safety measures (e.g., fences, ropes, or warning lines) near the robot’s operating area to ensure that personnel stay out of the robot's reach while it is in operation or about to start.
- Do not enter the robot’s safety zone defined by the risk assessment or touch the robot while the system is running.
- Do not expose the robot to a permanent magnetic field, as strong magnetic fields can cause damage.
- Dobot assumes no responsibility for robot damage or personal injury caused by improper operation or failure to follow the product’s instructions for use.
- Handling operations using lifting rings, cranes, or similar equipment must be conducted using appropriate and reliable lifting devices, and must be carried out by qualified personnel or those authorized by the company in accordance with local regulations.
- Make sure that there are no obstacles within 2 meters of the robot during the transportation, and personnel should stay away from the suspended robot.
- Dobot is not responsible for any damage caused during the transportation and handling of the equipment.
- Make sure that the robot is in the packing posture before packaging, and the brakes on each axis are normal.
- Make sure that the packing area is free of obstacles to allow staff to evacuate quickly in case of emergencies.
- Secure the packaging firmly during transport to keep the robot stable.
- After removing the outer packaging, make sure that the robot maintains its original packing posture and the brakes on each axis are normal.

- Make sure that the unpacking area is free of obstacles to allow staff to evacuate quickly in case of emergencies.
- During debugging, make sure that no personnel or other equipment (including computer used for debugging) is present in the hazardous area of the machine.
- Wear appropriate personal protective equipment when necessary, such as safety helmets, safety shoes (with non-slip soles), face shields, safety goggles, and gloves. Inappropriate clothing may cause personal injury.
- Do not enter the robot’s workspace while the robot is operating, as this may result in injury to the robot or operator.
- If an abnormality occurs with the robot, ensure that the system is stopped before conducting an inspection.
- After debugging, operators must first test the system in manual mode. Once this is confirmed to be correct, switch to automatic operation.
- If the controller needs to be restarted due to a power failure, the robot must be manually returned to the initial position of the automatic operation program before restarting automatic operation.
- Before performing maintenance, inspection, or wiring work, the power supply must be completely cut off, and a "No power supply" sign must be posted. Failure to do so may result in electric shock or personal injury.
- Observe ESD (Electrostatic Discharge) regulations when disassembling the robot or controller.
- Avoid disassembling the power supply system inside the controller. Even after the controller is turned off, high voltage may remain for several hours.
- For disassembly and repair of the robot, contact Dobot's technical support engineer.
- Maintenance and repair work must be carried out by designated personnel, otherwise electric shock or personal injury may result.
- If the brake is manually released, the robot may move due to gravity. Therefore, when manually releasing the brake, ensure proper support for the robot and any attached tools or workpieces.
- If the power supply must be turned on while the controller door is open for maintenance or inspection, avoid direct exposure of the controller interior to strong light sources such as sunlight or spotlights, as this may cause malfunctions or errors.
- To prevent electric shock, turn off the circuit breaker and disconnect the main power before replacing any components.
- Wait at least five minutes after disconnecting the main power before replacing components.
- Component replacement must be performed by authorized personnel.

- The robot is designed and tested according to industrial, scientific, and medical (ISM) equipment standards. In household and light industrial environments, the robot may cause radio interference, requiring protective measures.
- Do not operate the robot near strong radiation sources (e.g., unshielded RF sources), as this may interfere with normal operation.

**WARNING**

- Wear anti-static clothing and anti-static gloves before operating the equipment.
- It is prohibited to modify or remove the nameplate, instructions, icons, or labels on the equipment.
- Before operating the equipment, locate and be familiar with the emergency stop function to ensure that the robot can be stopped urgently in case of an emergency. The emergency stop function is classified as a Stop Category 1.
- Be careful when handling or installing the robot. Follow the instructions on the packaging box, place the robot gently, and position it according to the arrow markings to prevent damage.
- To ensure device and personal safety, use supplied cables.
- Make sure that both the robot and the tools are correctly and securely installed.
- Make sure that the robot has sufficient space to move freely.
- Do not continue using the robot if it is damaged.
- Any impact will release a large amount of kinetic energy, which can be much higher than during high-speed or high-load operations.

## 1.6 Personal safety

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

**WARNING**

- Comply with local laws or regulations with regard to the maximum weight one person is permitted to carry.
- Do not touch the wiring terminals or disassemble the equipment while it is powered on, as this may result in electric shock.
- Make sure that the equipment is properly grounded, otherwise, it may endanger personal safety.
- Do not touch the power terminals or disassemble internal components within 10 minutes of disconnecting the robot from the power supply, as residual voltage in the internal capacitors may cause electric shock.
- Even if the controller's power switch is already in the "OFF" status, do not touch or disassemble internal components, as residual voltage in the internal capacitors may cause electric shock.
- Do not wear loose clothing or jewelry when working with the robot. Tie your long hair back behind your head.
- If the robot appears to be stationary while the equipment is running, it may be in a standby state, waiting for a start signal. In such cases, the robot should still be considered active. Do not approach the robot.

## 1.7 Emergencies

### 1.7.1 Emergency stop device

In case of emergency, press the E-stop button to immediately halt all robot movements. According to IEC 60204-1 and ISO 13850, emergency stop devices are not safeguards. They serve as supplementary protective measures and are not intended to prevent injuries.

Based on the results of the risk assessment for your robot application, you can connect additional E-stop buttons. The E-stop button must comply with the IEC 60947-5-5 standard.

### 1.7.2 Emergency recovery

The E-stop button locks when pressed and must be rotated as indicated on the button to unlock it. After unlocking, the alarm can be cleared and the robot can be re-enabled via DobotStudio Pro to recover from the emergency status.

**WARNING**

Operate the robot arm to recover from emergency status only after the danger to the robot system has been completely eliminated.

### 1.7.3 Personnel rescue in emergency situations

In rare emergency cases, you may need to move the robot arm while in an emergency stop status to rescue a trapped person. In such cases, you can:

**Manually releasing the brakes**

Open DobotStudio Pro and navigate to **"Settings > Safety > Joint brake"** page, click **"Edit"**, hold the joint with your hand and turn on the switch of the joint you want to move, then click **"Save"**.

Once the brake is ON, you can drag the joint to rescue the trapped person.

**WARNING**

When switching on the "Joint brake" function, be sure to hold the joint with your hand to prevent it from falling.

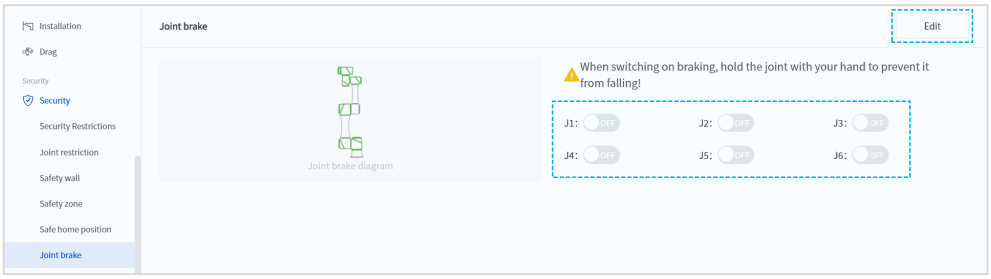



Figure 1.1 Manually release the brakes

**Removing the fixing screws from robot base**

Refer to Robot installation. After removing the fixing screws from the robot base, you can move the robot arm to free the trapped person.

**WARNING**

- Disconnect the robot from the power before removing the screws.
- Hold the robot throughout the process of removing the screws and moving the robot.

# 2. Product Introduction

## 2.1 Overview

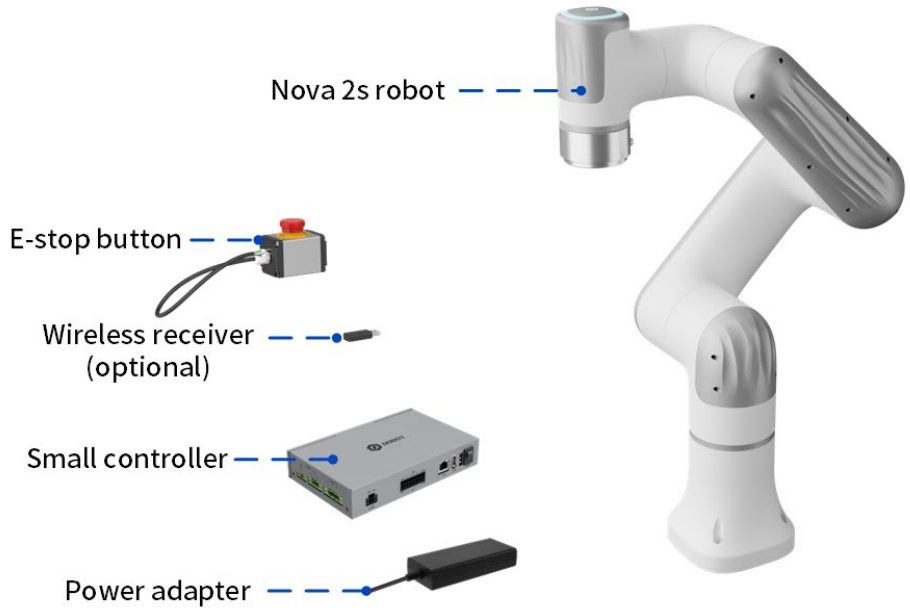



Figure 2.1 Robot system overview

The main components of the robot system include:

**Nova 2s Robot:** Six-axis robot arm, main moving parts.

**Small Controller (SimBox):** Core computing and electrical components.

**Power Adapter:** Connects the controller to the mains power supply and converts AC power into DC power suitable for the robot arm.

**E-Stop Button:** Connected to the controller to enable the emergency stop function.

**Wireless Receiver (Optional):** Plugs into the controller, enabling the operation terminal to connect to and control the robot via WiFi.

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


Figure 2.2 Operation terminal

## 2.2 Robot arm

### 2.2.1 Composition

As shown in Figure 2.3, the Nova 2s robot arm includes 6 rotary motion joints, and 2 connecting rods (upper arm and forearm). The robot's end is equipped with a hand-guiding button and an indicator light, while the tool flange side is fitted with an aviation connector.

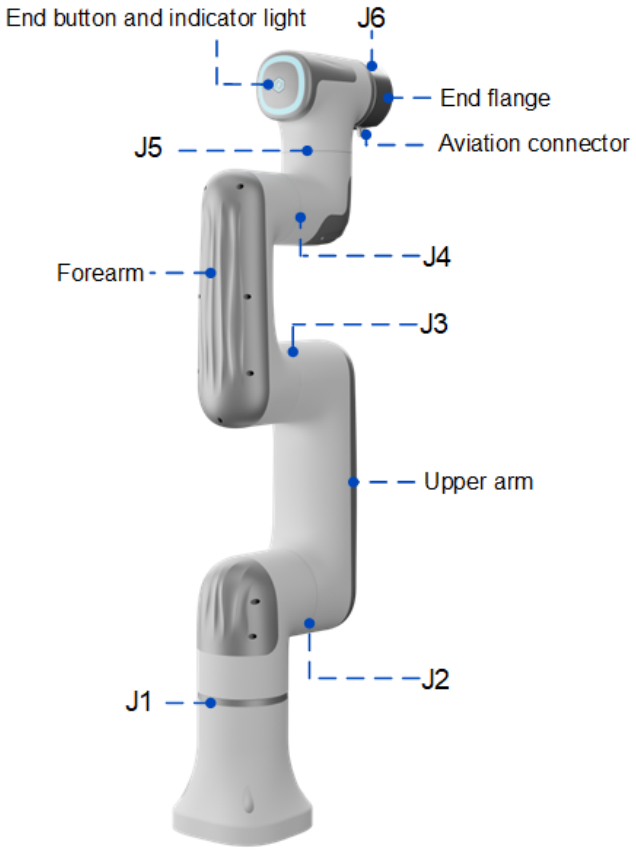



Figure 2.3 Nova 2s robot arm

### 2.2.2 End button and indicator light

The end of Nova 2s robot arm is equipped with a button and a ring of indicator light, as shown in Figure 2.4.

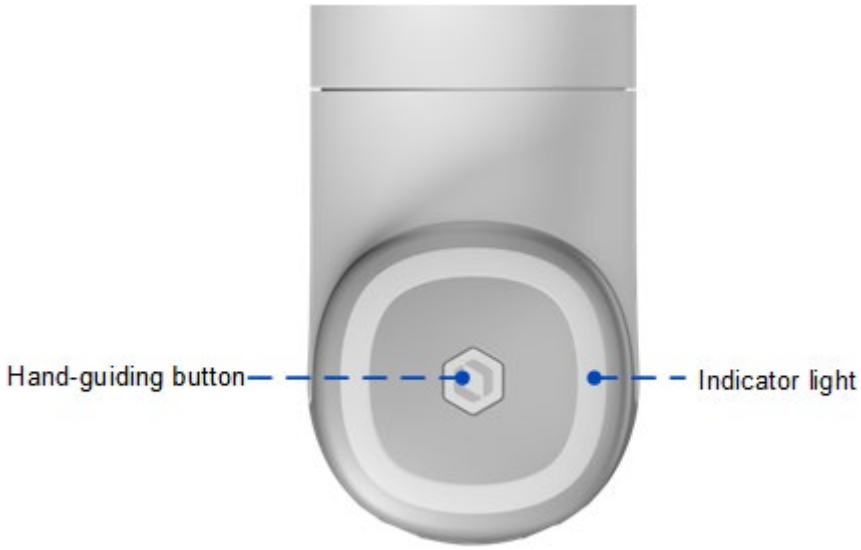



Figure 2.4 End button and indicator light

End indicator lights indicate the following statuses:

| Indicator color | Status | Description |
|---|---|---|
| Blue | Fast flashing | The robot is starting up |
| Blue | Steady on | The robot is powered on but not enabled |
| Green | Steady on | The robot is enabled but not running |
| Green | Slow flashing | Automatic running status (project debugging/running/pause, motion commands except TCP jog mode, trajectory playback) |
| Green | Fast flashing | Single running status (Jog / "RunTo" function in software) / Drag mode / Trajectory recording status |
| Red | Slow flashing | Joint brake switched on in disabled status |
| Red | Steady on | The robot is in alarm status |
| Yellow | Steady on | Collision detected |

> **NOTE**
>
> The quick flashing frequency is 5Hz (0.2s per cycle), and the slow flashing frequency is 1.25Hz (0.8s per cycle).

**The functions of hand-guiding button are shown below.**

When the robot is enabled, long-press the hand-guiding button for 3 seconds to enter drag teaching mode.

After dragging the robot to the teaching point, short-press the hand-guiding button to exit drag teaching mode.

## 2.3 Controller

The Dobot Nova 2s robot must be used in conjunction with a small controller (SimBox). The appearance of the SimBox is as shown in Figure 2.5, and detailed definitions of the electrical interfaces can be found in the Electrical Characteristics.

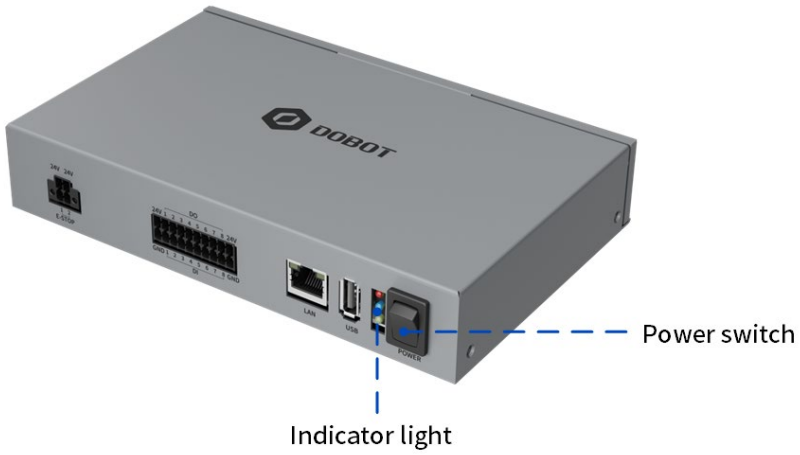



Figure 2.5 Small controller

After connecting the power supply to the robot, flip the power switch (rocker switch) upward to turn on the controller and power up the robot. The blue indicator light will start flashing. When the blue indicator is steady on, it means the controller has powered on.

With the controller powered on, flip the power switch downward to shut down the controller. The robot will power off, and the blue indicator light will turn off once shutdown is complete.

## 2.4 Operation terminal

The Dobot Nova 2s robot supports control via both PC and App, as shown in Table 2.1. To enable control via WiFi, the WiFi module must be plugged into the controller.

Table 2.1 Operation terminal specifications

| | | |
|---|---|---|
| **Terminal type** | PC | Tablet (Android) |
| **Operating system** | Windows 10 (64-bit) 1809 or above | Android 10 and above |
| **Control software** | DobotStudio Pro (V4.0 and above) | |
| **Recommended configuration** | CPU: 64-bit Intel or AMD processor (SSE4.2 or later, 2.9GHz or higher)<br>Memory: 16G<br>Storage: 128GB (at least 4GB available)<br>Network card: Gigabit-NIC<br>Graphics card: 4GB, DirectX12 support<br>Display: 1920x1080 or higher resolution | CPU: 4-core<br>RAM: 2GB<br>Storage: 32GB<br>Screen: 8-inch |
| **Communication mode** | LAN/WiFi | WiFi |

When purchasing a Dobot Nova 2s robot, you can request an optional Android tablet, or use self-prepared operation terminal as long as it meets or exceeds the recommended specifications in Table 2.1.

# 3. Product Characteristics

## 3.1 Coordinate system

### 3.1.1 Joint coordinate system

The joint coordinate system is determined based on all motion joints. All joints are rotational joints, as shown in Figure 3.1.

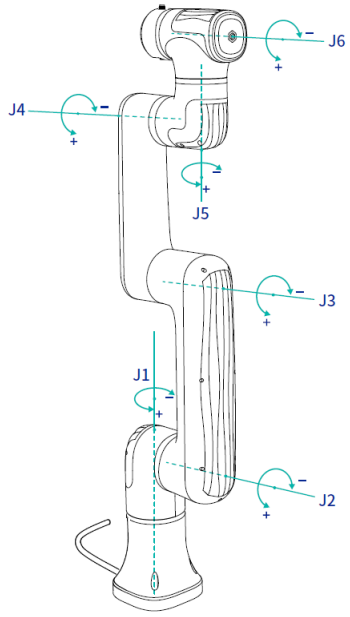



Figure 3.1 Joint coordinate system

### 3.1.2 User coordinate system

The user coordinate system is a user-defined coordinate system based on the workbench or workpiece. The origin and axis directions can be defined as needed to measure 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 routing direction of the heavy-duty cable, as shown in Figure 3.2.

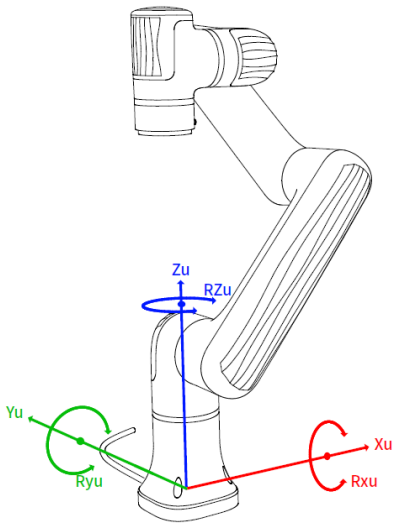



Figure 3.2 User coordinate system

### 3.1.3 Tool coordinate system

The tool coordinate system defines the position and posture of the Tool Center Point (TCP). Its origin and direction change dynamically based on the position and angle of the end tool. The default tool coordinate system is determined based on the center point of the end flange, with the Y+ direction facing opposite to the aviation connector, as shown in Figure 3.3.

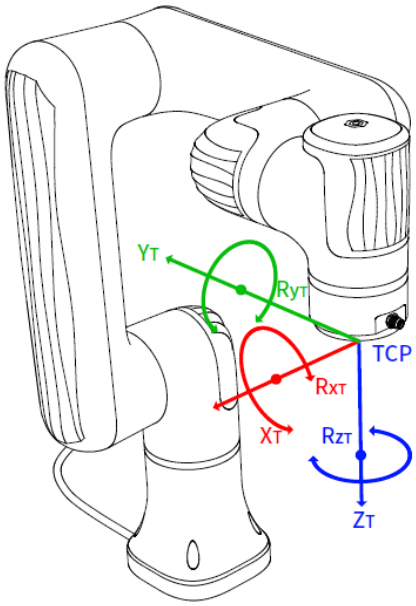



Figure 3.3 Tool coordinate system

## 3.2 Home posture

Each joint of the robot arm is marked with a home-posture sticker as shown in Figure 3.4. When a joint is at 0 degrees, the stickers on both sides of the joint will be perfectly aligned. When all joints are set to 0 degrees, the robot arm should be in a vertical posture, with the heavy-duty cable aligned parallel to the J2 axis and the aviation connector pointing straight upward.

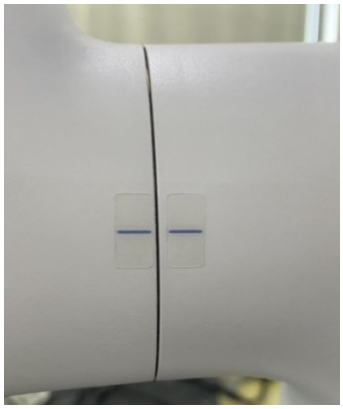


Figure 3.4 Home-posture sticker

If the home posture changes due to component replacement or 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 DobotStudio Pro.

## 3.3 Singularities

When the robot moves in a linear or arc trajectory and approaches certain specific postures, an alarm will be triggered, and the robot will stop movement. These postures are referred to as singular positions or singular points.

**NOTICE**

- Joint motion is not affected by singular positions.
- Avoid stopping the robot near a singularity using drag mode or joint motion and then attempting linear or arc motion.

The Dobot Nova 2s robot arm has three types of singularities, as described below.

### 3.3.1 Shoulder singularity

The singularity occurs when the intersection of the J5 and J6 axes is located in the plane formed by the J1 and J2 axes. This typically happens in the cylindrical space directly above or below the robot. Refer to the motion range in the Mechanical Specifications chapter for details about each model as shown in Figure 3.5.

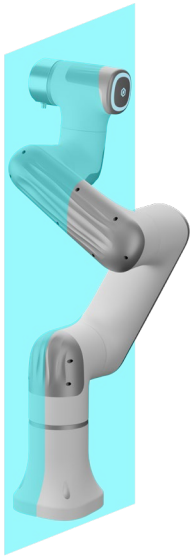


Figure 3.5 Shoulder singularity

### 3.3.2 Elbow singularity

The singularity occurs when J3=0°±2°, where the upper arm and forearm are parallel. as shown in Figure 3.6.

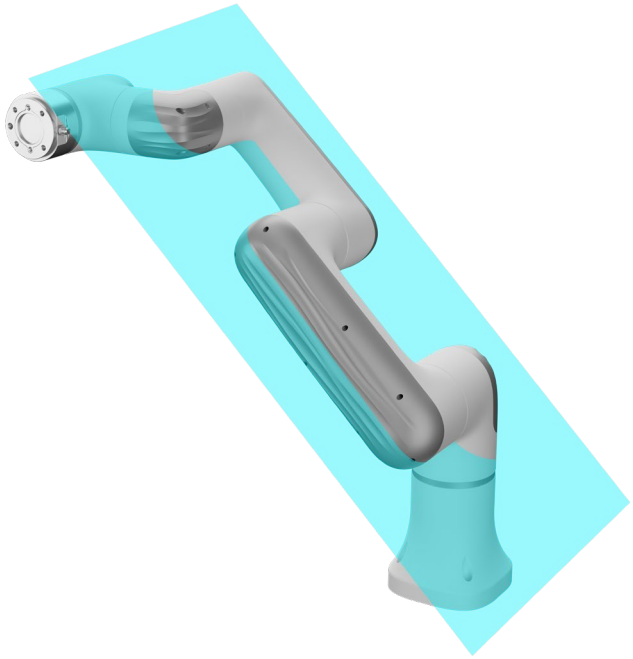


Figure 3.6 Elbow singularity

### 3.3.3 Wrist singularity

The singularity occurs when J5=0°±2°, where the J4 axis and J6 axis are parallel. as shown in Figure 3.7.

Figure 3.7 Wrist singularity

### 3.3.4 Recommendations for avoiding singularities

- Switch the motion type to joint motion when near a singularity.
- Add transition points in the trajectory to bypass the singularity.
- Adjust the installation posture of the robot to avoid singularities in the path. For example, switch from standard-angle mounting to hoisting or side mounting.
- Modify the length of the end tool.
- Adjust the installation angle of the end tool to bypass singularities in the path.

# 4. Mechanical Specifications

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

## 4.1 Nova 2s mechanical specifications

### 4.1.1 Nova 2s dimensions and workspace

When selecting the installation position for the robot, you must consider the cylindrical space directly above and below the robot, and try to avoid moving the tool into this cylindrical space. As doing so may cause the joints to rotate too fast even when the tool moves slowly, resulting in low work efficiency and making risk assessment more difficult.

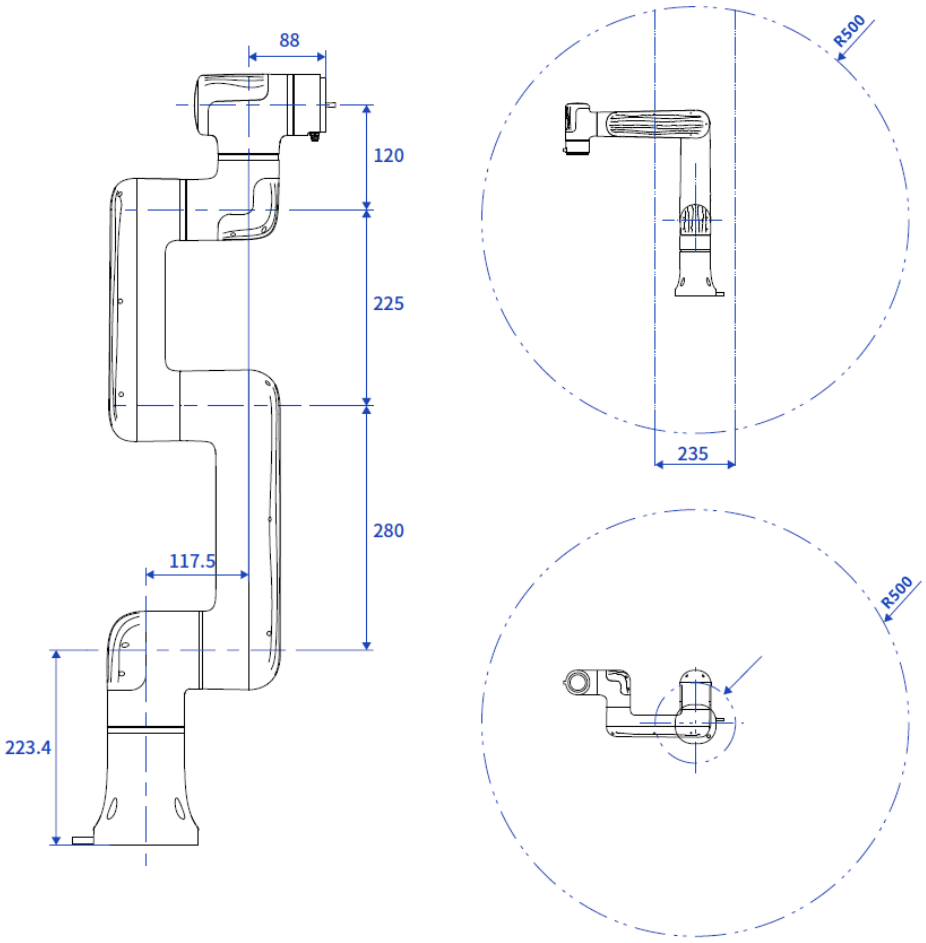



Figure 4.1 Nova 2s dimensions and workspace

### 4.1.2 Nova 2s base mounting dimensions

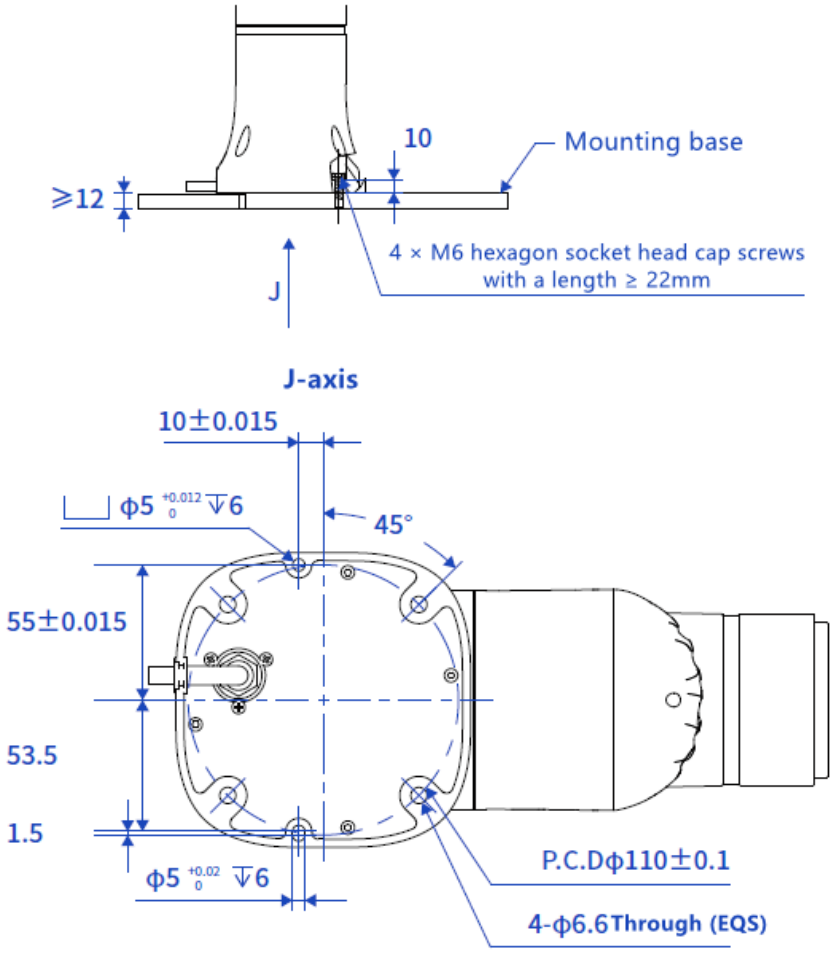



Figure 4.2 Nova 2s base mounting dimensions

### 4.1.3 Nova 2s end flange dimensions

The end flange dimensions of the Nova 2s robot are all identical. The flange design conforms to ISO 9409-1.

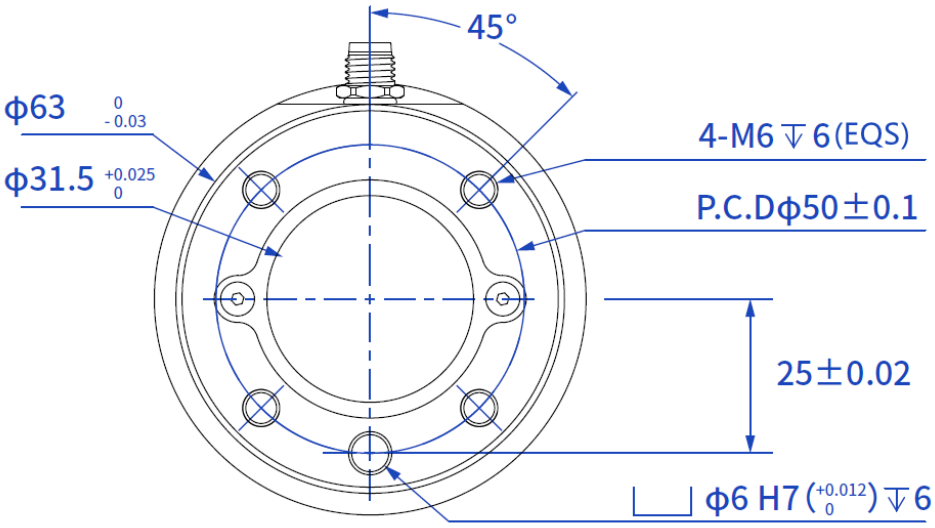



Figure 4.3 Nova 2s end flange dimensions

### 4.1.4 Nova 2s end load curve

The origin of the coordinate system for the end load curve is the center of the robot's end flange. X and Y represent the offset distance of the load's center of gravity from the flange center along the X and Y axes. The radial distance (r) is calculated as: $r = \sqrt{X^2 + Y^2}$. This r-value corresponds to the vertical axis (Y-axis) in the load curve graph, labeled as X, Y [cm]. The horizontal axis (X-axis) represents Z [cm], which is the distance from the load's center of gravity to the flange along the Z direction. You can evaluate the working condition of the robot according to the statistical results. For example, if the load is 1.5kg, X = 6cm, Y = 8cm, Z = 5cm, and you can get r = 10cm. The judgment steps are as follows:

- According to $r = \sqrt{X^2 + Y^2}$, calculate r = 10cm.
- Select the appropriate curve based on the load weight. Since 1.5kg is close to 1.5kg, use the 4kg curve as a reference.
- Locate the (r, Z) = (10cm, 5cm) point in the load curve graph and compare it with the 1.5kg curve. If the point is below the curve, the load is within the robot's operational range (selection valid). If the point is above the curve, the load exceeds the robot's limit (selection invalid). In this example, the point is below the curve, indicating that the selected load is acceptable, and the robot can operate safely under this condition.

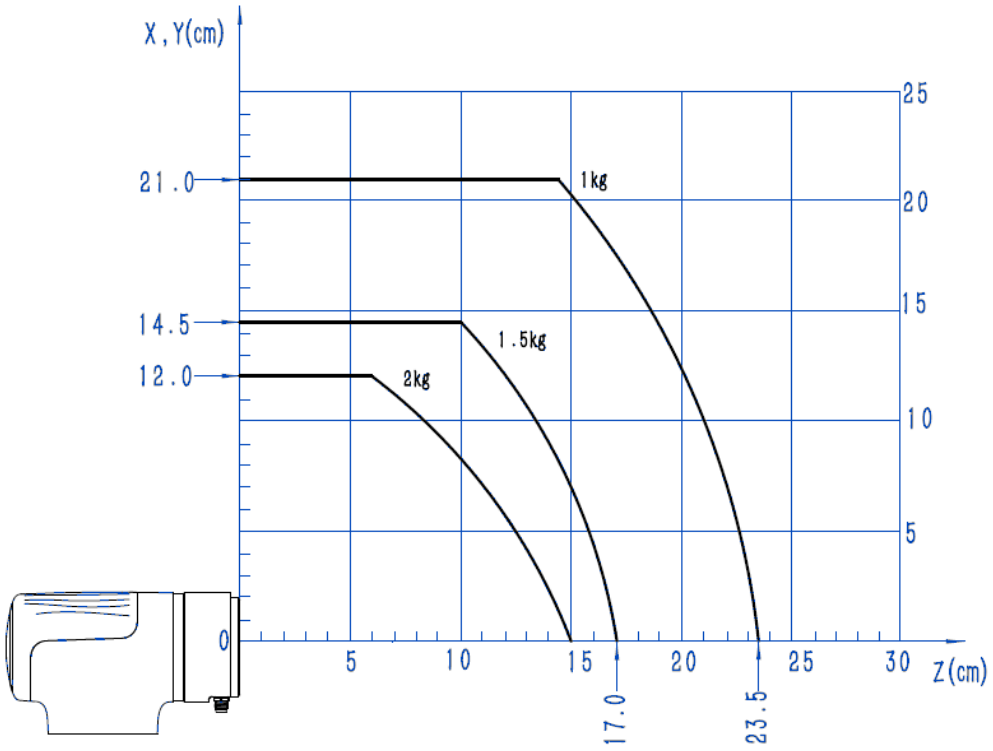



Figure 4.4 Nova 2s end load curve

## 4.2 Nova 2s controller dimensions

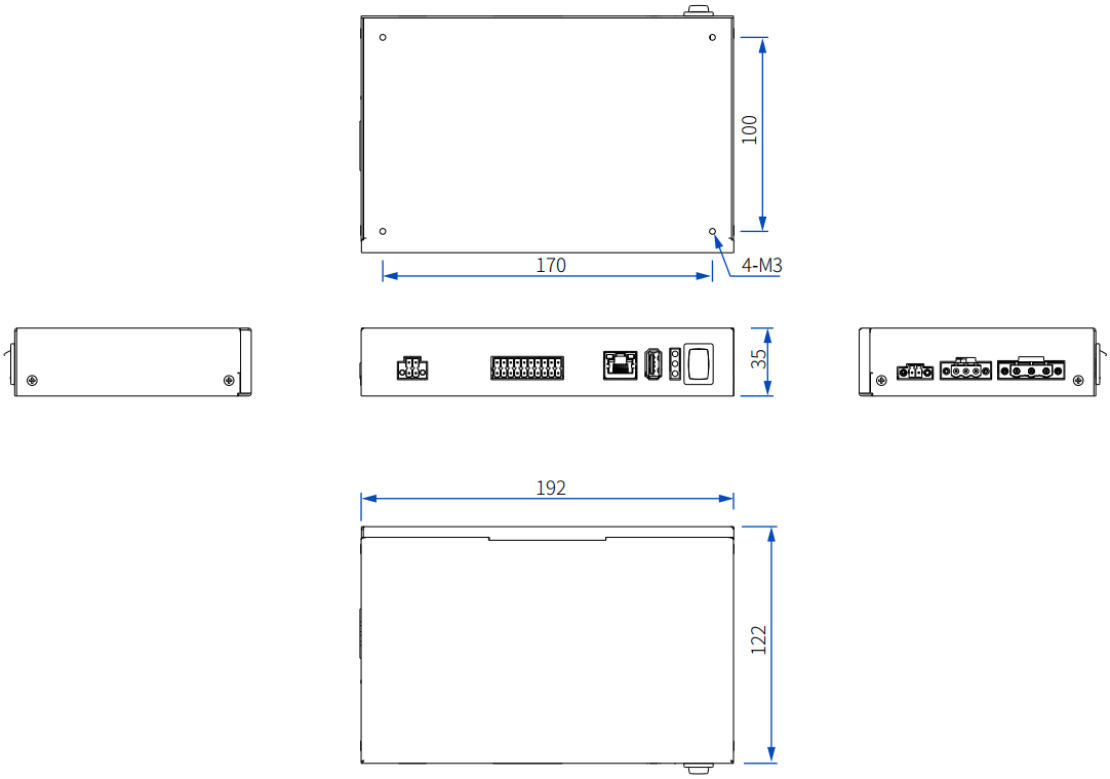



Figure 4.5 Nova 2s controller dimensions

# 5. Electrical Characteristics

## 5.1 Electrical warnings and precautions

When designing and installing robot applications, please strictly follow the warnings and precautions listed below.

**WARNING**

The following warnings must be observed when designing and installing safety signal-related functions, as failure to do so may result in the loss of safety functions and cause injury or death.

- Never connect safety signals to a non-safety PLC with an inappropriate safety level. Always separate safety signals from regular I/O signals.
- All safety signals must use a dual-channel redundant design, with both channels remaining independent. This ensures that if one channel fails, the safety function will still be maintained.

**WARNING: ELECTRICITY**

- Make sure that the equipment is protected from water ingress. If water gets into the equipment, disconnect the power and contact technical support. Do not reconnect the power until the issue is resolved.
- Only use the robot's original cables and avoid bending the cables.
- Make sure that the power supply connected to the controller is properly grounded and avoid leaving the grounding prong of the power plug floating.

**NOTICE**

- The robot has passed electromagnetic compatibility (EMC) tests according to relevant standards. Electromagnetic interference exceeding these standards may affect the robot's behavior. Extremely high signal levels or excessive exposure to electromagnetic fields may cause permanent damage to the robot. Dobot assumes no responsibility for any damage caused by EMC issues beyond the standards.
- The length of I/O cables used to connect the controller to other machinery or equipment should not exceed 30 meters unless confirmed feasible through on-site testing. If necessary, use shielded cables.

## 5.2 Controller interface

### 5.2.1 Overview

The following section uses the small controller (SimBox) paired with the Dobot Nova 2s robot as an example to introduce the interface layout of the controller.

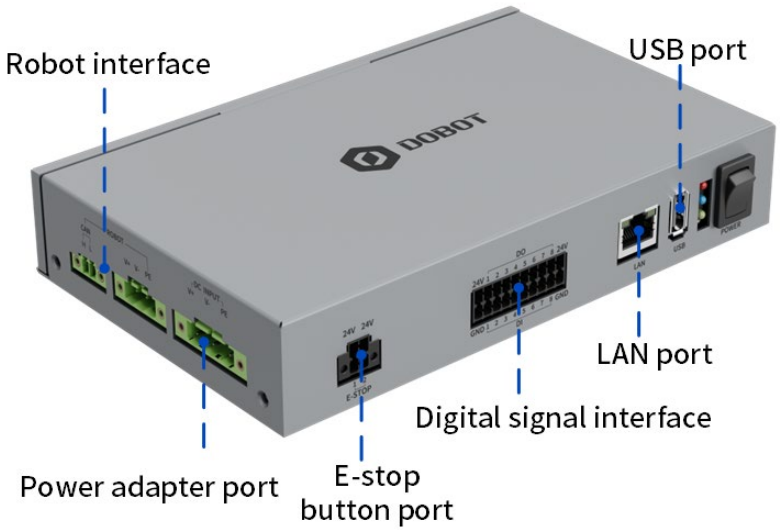



Figure 5.1 Controller interface description

### 5.2.2 Robot interface

Connects to the cable extending from the base of the robot, providing power to the robot and facilitating communication with it.

### 5.2.3 Power adapter port

Connects the power supply and grounding wires to deliver power and ensure proper grounding for the controller.

The robot has a rated voltage of 48V and can be powered using the attached power supply to connect the controller to the mains power, which converts AC power to DC power suitable for the robot's operation. If using a custom DC power supply, ensure that the voltage remains within the fluctuation range of 30VDC to 60VDC.

### 5.2.4 E-Stop button port

Connects to the E-stop button, which is used for emergency stop control of the robot.

The shipping list in the Nova 2s robot includes an E-stop button with pre-wired terminals. Simply align and plug it into the corresponding interface.

If you plan to use the built-in E-stop button, the wiring method is shown in the figure below.

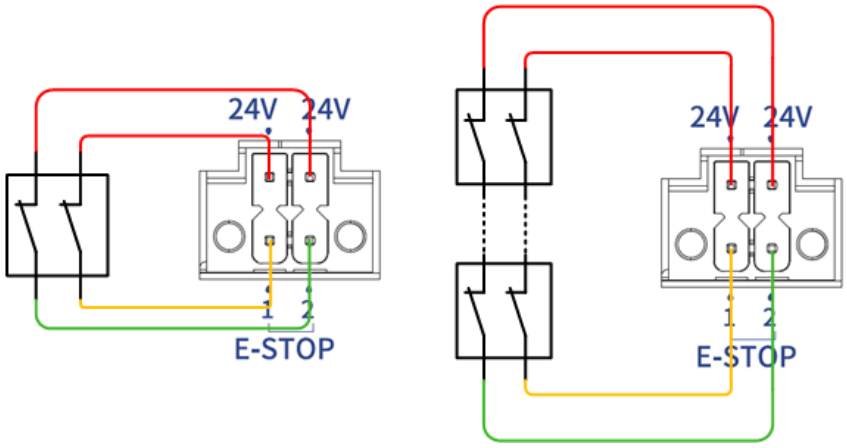



Figure 5.2 Connecting one or multiple E-stop buttons

### 5.2.5 Digital I/O interface

Eight channels of analog input/output interfaces, as shown in Figure 5.3, are used for digital signal input and output.

The digital signals are set to PNP type by default and can be configured to NPN type via the control software (DobotStudio Pro).

The I/O power supply is built-in, with a voltage of 24V. The total output current is up to 2A, and the maximum output for a single channel is 0.5A. External power supply is not supported.

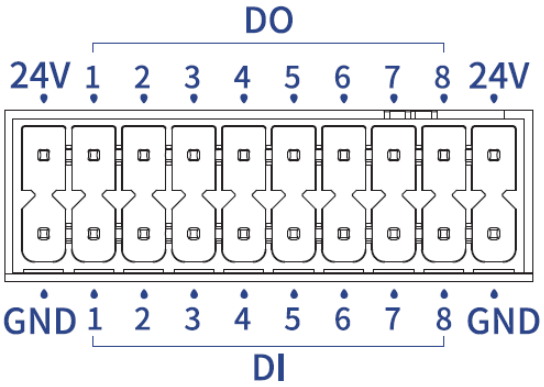



Figure 5.3 Digital signal interface

**DI wiring instruction**

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

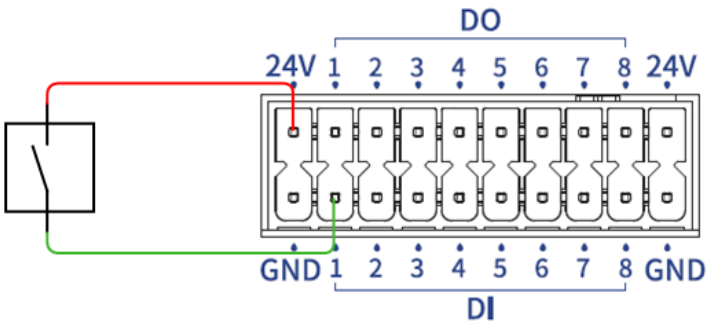



Figure 5.4 DI connected to simple switch

2. When using a three-wire sensor as the DI input source, the wiring is shown below. The sensor signal type (PNP/NPN) must match the signal type of the controller.

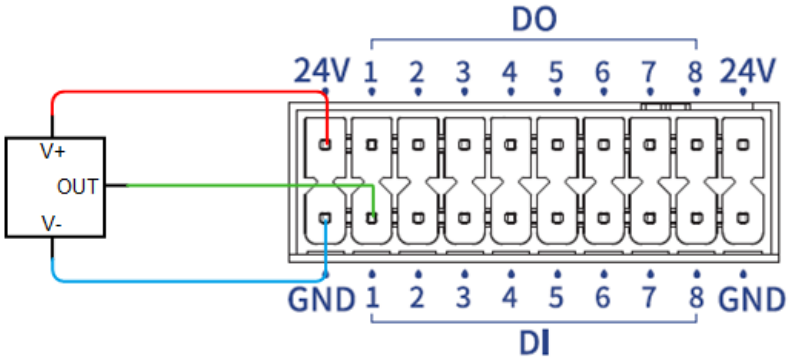



Figure 5.5 DI connected to a three-wire sensor

**DO wiring instruction**

For DO interface connected to external load, the wiring is shown below.

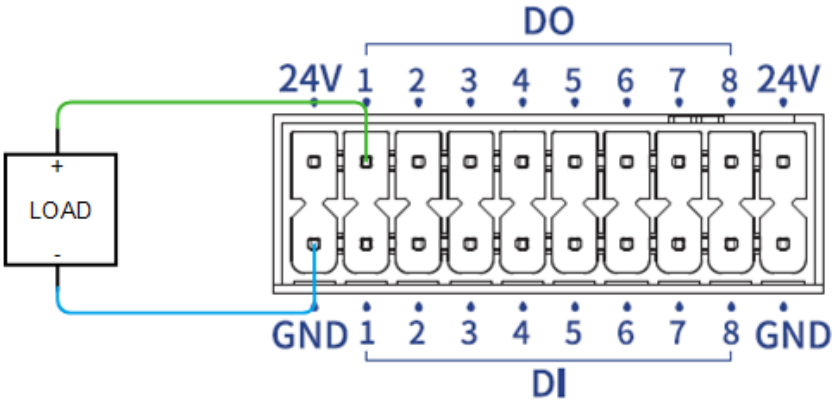



Figure 5.6 DO wiring

To ensure stable operation, it is recommended to maintain a minimum interval of 15ms between two DI signals or two DO signals.

### 5.2.6 LAN port

The small controller is equipped with one LAN interface for TCP/IP and Modbus TCP communication. The default IP address of the LAN interface is 192.168.5.1, which can be modified through the control software (DobotStudio Pro).

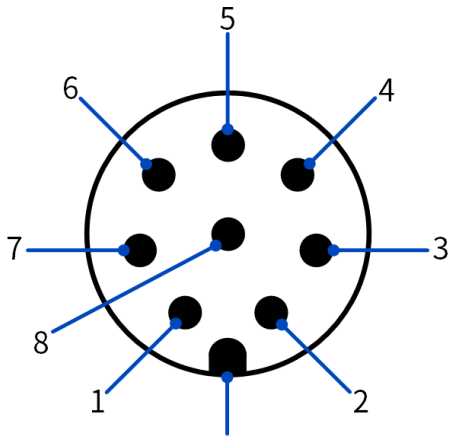
### 5.2.7 USB port

The small controller is equipped with one USB port, which can be used to connect a wireless receiver (optional accessory).

## 5.3 Interface on the robot end

The end interface is an aviation connector located on the side of the robot arm's end flange. The pin layout and definitions are as follows.

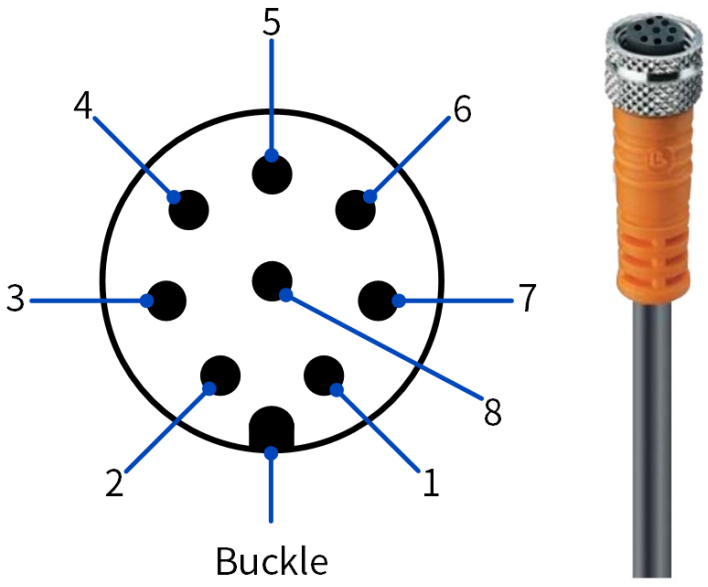



Buckle

| Pin | Name | Definition |
|---|---|---|
| 1 | 485A | 485A |
| 2 | 485B | 485B |
| 3 | DI_2 | Digital input 2 |
| 4 | D1_1 | Digital input 1 |
| 5 | 24V | 24V output |
| 6 | DO_2 | Digital output 2 |
| 7 | DO_1 | Digital output 1 |
| 8 | GND | GND |

The cable used for the tool I/O is specified by Dobot (model: Lutronic FP-222460). The pin layout and wiring definitions for the cable are as follows.




| Pin | Cable color | Definition |
|---|---|---|
| 1 | White | 485A |
| 2 | Brown | 485B |
| 3 | Green | Digital input 2 |
| 4 | Yellow | Digital input 1 |
| 5 | Gray | 24V output |
| 6 | Pink | Digital output 2 |
| 7 | Blue | Digital output 1 |
| 8 | Red | GND |

The 24V output of the tool I/O has a maximum current of 2A (duration not exceeding 1 second), and the digital input is of PNP type.

When using an external simple switch circuit as the DI input source, the wiring method is as follows.

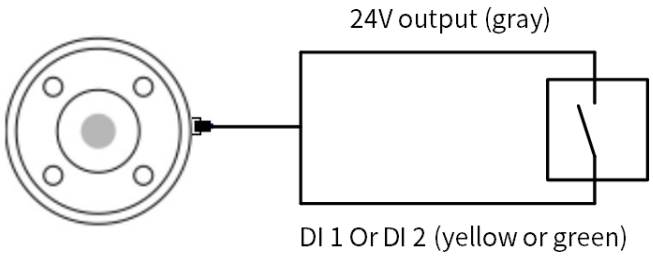



Figure 5.7 Tool DI connected to simple switch

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

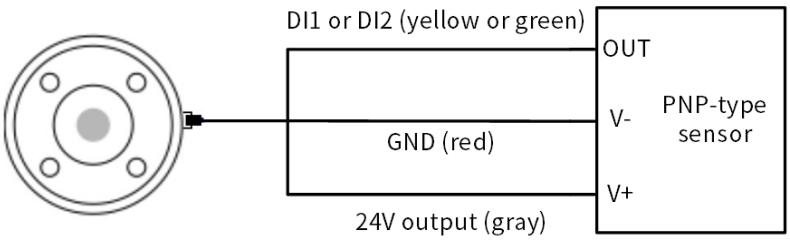



Figure 5.8 Tool DI connected to PNP-type sensor

The digital outputs of the tool I/O support both NPN and PNP types, which can be configured through the control software. If the software setting and the actual wiring method do not match (e.g., PNP is set in DobotStudio Pro, but the load wiring is NPN), the load will not work properly.

- When the digital output of the tool I/O is configured as NPN, the output current for a single channel is ≤400mA, and the total output current should not exceed 400mA. The wiring method is as follows:

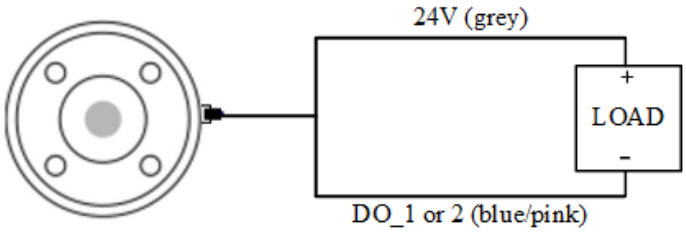



Figure 5.9 Tool DO wiring (NPN)

- The tool I/O digital output is PNP type, powered by the internal power supply, with the total output current at the end-effector not exceeding the maximum 24V output current as described before. The output current for a single DO channel should be ≤500mA. The wiring method is shown below.

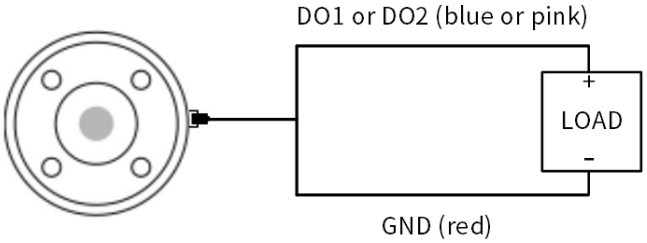



Figure 5.10 Tool DO wiring (PNP)

# 6. Transportation

## 6.1 Transportation precautions

The robot arm should be restored to its packing posture before transportation. This can be set in DobotStudio Pro (refer to *DobotStudio Pro User Guide* for details). Use the original packaging for transportation.

During transportation, ensure that the robot arm remains stable and is securely fastened.

During transportation and long-term storage, maintain an ambient temperature range of -20°C to +55°C, with humidity ≤95% and no condensation.

When removing the robot from its packaging and moving it to the installation position, hold the robot arm with your hand until all base mounting bolts are fully tightened.

After transportation, store the original packaging in a dry place for future repacking and transportation.

**WARNING**

- Ensure that operators do not strain their backs or other body parts while lifting the equipment. Use appropriate lifting equipment if necessary.
- Dobot assumes no responsibility for any damage incurred during transportation.
- Strictly follow the installation instructions when installing the robot.

## 6.2 Unpackaged transportation

When moving the robot arm from its packaging to the installation position or relocating it, follow these handling guidelines:

- If the robot arm is not in the packing posture, restore it to the packing posture first.
- When handling and installing the robot, hold the robot arm with your hand until all base mounting bolts are fully tightened.
- It is recommended to hold the J1 joint and the upper part of the upper arm for handling (if necessary, two people should carry it). **Do not lift the robot by grasping joints J3 – J6 or the forearm, as this may damage the internal structure.**

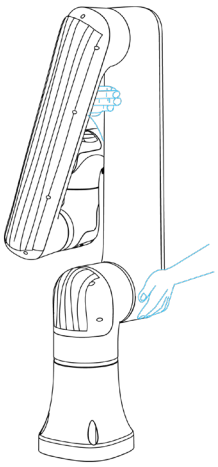


Figure 6.1 Handling the robot arm

# 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 arm in an environment that meets the following conditions.

**NOTICE**

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

- Install indoors with good ventilation.
- Keep away from excessive vibration and shock.
- Keep away from direct sunlight and radiant heat.
- Keep away from dust, oil mist, smoke, salinity, metal powder, corrosive gases, and other contaminants.
- Do not use in a closed environment. A closed environment may cause the controller to overheat and shorten its service life.
- Keep away from flammable.
- Keep away from cutting and grinding fluids.
- Keep away from sources of electromagnetic interference.

## 7.2 Unpacking

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

## 7.3 Robot installation

### 7.3.1 Installation platform requirements

- When installing the robot, it must be securely fixed to a stable base. The base should be able 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 movable platform, the acceleration of the platform should be low, as high acceleration may trigger the robot's collision detection mechanism, causing it to stop.
- If the connection cable between the robot and the controller needs to pass through a cable hole on the installation surface, the diameter of the cable hole should be no less than 30 mm.
- The Nova 2s robot supports both bottom cable routing and side cable routing.

For side cable routing, the recommended distance between the cable routing hole and the robot base should be no less than 120mm (Calculated using L+8D, where L = 40 mm, the length of the Ethernet cable's RJ45 connector; D = 9.1 mm, the diameter of the cable)

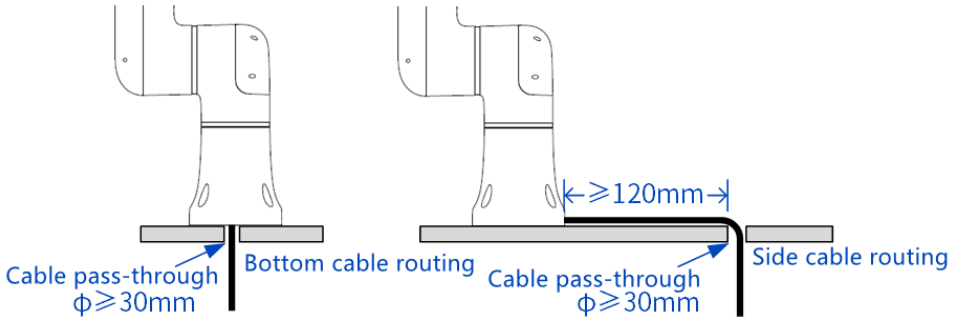



Figure 7.1 Nova 2s connection cable routing

### 7.3.2 Robot installation

The Nova 2s robot support 360° mounting at any angle. The figure below shows several typical installation postures.

> **NOTE**
>
> The installation angle on the far left is the standard mounting angle. When installing the robot in a non-standard mounting angle, you need to calibrate the mounting angle through DobotStudio Pro after power-on. For details, refer to *DobotStudio Pro User Guide*.

Figure 7.2 Nova 2s robot installation posture

When installing the robot, position the mounting holes on the installation platform according to the base dimension. Then, secure the robot base to the platform using bolts. The specific dimensions of the robot base can be referenced from Mechanical Specifications. Be sure to observe the following during installation.

- During transportation, ensure that the robot is stable and properly secured in its position.
- When moving the robot arm from its packaging to the installation position, hold the robot with your hand until all bolts on the base are tightened.
- During installation, ensure the robot is properly aligned and positioned. The robot base must be secured to the platform using 4 hex bolts M6 (ISO898-1: 2013, property class: 12.9) and tightened with a torque of 20 N•m.
- For wall-mounted or upside-down installations, safety measures must be taken to prevent the robot base from falling.

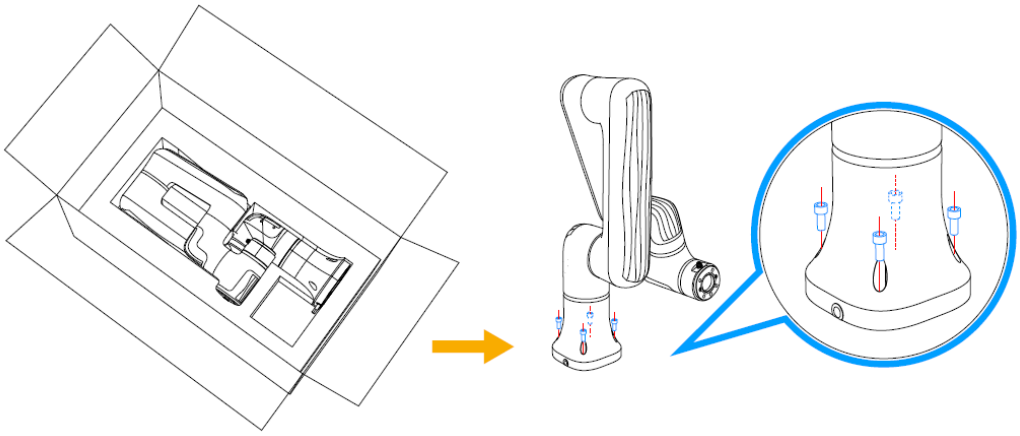


Figure 7.3 Base installation

### 7.3.3 Controller installation

The controller supports both horizontal and vertical installation. A minimum clearance of 50 mm should be maintained on all sides outside the mounting surface to ensure adequate heat dissipation.

**Horizontal installation**

① Install the fixed metal plate (You should prepare it yourself) at the bottom on both sides of the controller;

② Place the controller horizontally on a flat and stable mounting surface;

③ Then, use four M3x8 screws to fix it on mounting surface.

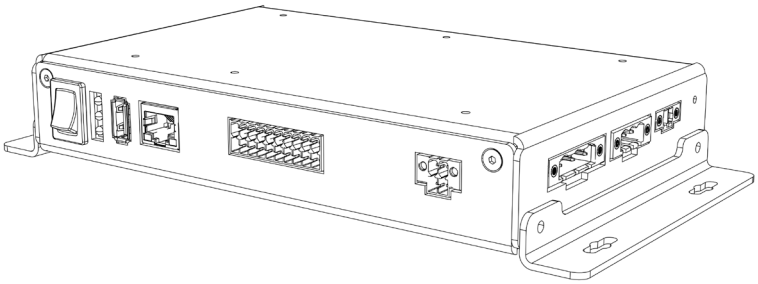


Figure 7.4 Controller installation

### 7.3.4 Tool installation

The robot's end flange is equipped with four M6 threaded holes, which can fix the tool to the end of the robot arm. To ensure precise alignment of the tool, the reserved Φ6 positioning holes can be used. The detailed dimensions of the end flange for the Nova 2s robot can be found in the Mechanical Specifications.

## 7.4 Cable connection

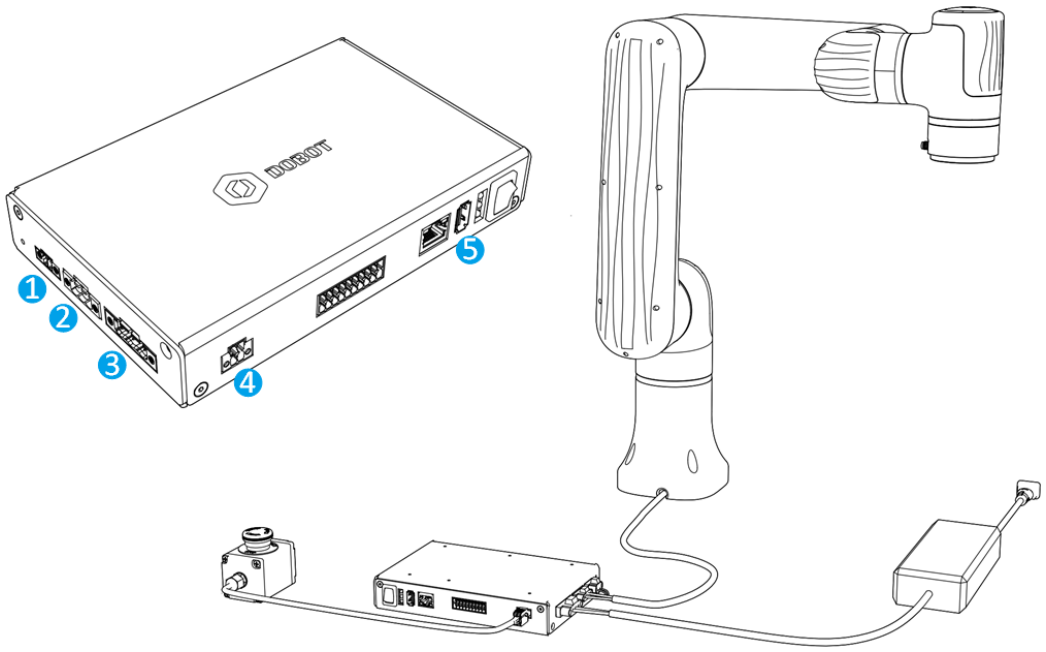



Figure 7.5 Cable connection

| | |
|---|---|
| **Step 1** | **Connect to robot**<br>Connect the cables extending from the robot base to the robot interface on the controller.<br>: Connect the communication cable terminal of the robot to the CAN interface (①) on the controller, and connect the power cable terminal of the robot to the power interface (②) on the controller. Then, tighten the screws on the cable terminals. |
| **Step 2** | **Connect to the power adapter**<br>Connect the terminals of the power adapter to the V+, V-, and PE ports of the power interface (③) on the controller. |
| **Step 3** | **Connect to E-stop button**<br>Connect the E-stop button to the emergency stop interface (④) on the controller, and tighten the screws on the terminal. |
| **Step 4** | **Connect to mains power**<br>Plug the power adapter into the mains power outlet.<br>: Complete all wiring and ensure all connections are correct before turning on the power. |
| **Step 5** | **(Optional) Connect the wireless receiver**<br>Connect the wireless receiver to the USB port of the controller (⑤). |

**NOTICE**

- The specifications and installation method of the external cables should comply with local laws and regulations.
- Do not disassemble the robot by yourself, as this may result in electrical leakage.
- Make sure that the device is properly grounded.
- Do not bend the cable excessively, otherwise it may cause poor connections or cable breakage.
- Before connecting external devices, make sure the power outlet of the control system is disconnected. If not disconnected, may result in electric shock or device failure.
- To ensure device and personal safety, use supplied cables.
- After wiring, make sure that there are no loose screws or exposed cables inside the device.
- During normal operation, do not plug or remove the power cables and communication cables.
- The device must be fully wired before powering it on.
- Make sure that the cables are connected correctly to avoid damage to internal modules or external devices.
- Before connecting, check that the insulation and shielding of external cables are not damaged.
- After connecting the robot power (②) cable and the controller power (③) cable, additional protective measures must be applied to ensure that wires and terminals are not exposed directly. Furthermore, the terminals must not be subjected to direct mechanical stress.

## 7.5 Power-on and debugging

After turning on the external power supply, press the power button on the controller. Once the indicator lights on both the robot arm's end-effector and the controller turn solid blue, you can connect to the robot using the operation terminal, enable it, and jog it for debugging.

For detailed operation instructions, refer to *DobotStudio Pro User Guide*.

# 8. Maintenance

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

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 when operating the robot arm or controller:

**NOTICE**

- Replace faulty components with new components of the same model or equivalent components approved by Dobot.
- Reactivate all deactivated safety measures immediately after completing maintenance work.
- Record all repairs and save them in the technical document associated with the robot system.
- Remove the main input cable from the back of the robot to ensure it is fully powered off. Take necessary precautions to prevent others from reconnecting the system power during maintenance.
- Observe ESD regulations when disassembling the robot.
- Prevent water or dust from entering the interior of the robot.

## 8.2 Robot maintenance

To ensure the robot maintains high performance over the long term, regular maintenance checks must be conducted. The personnel in charge of the maintenance must develop a maintenance plan and carry out the necessary tasks. The inspection items are listed in the table below.

Table 8.1 Inspection items

| Period | | | Inspection item | Inspection details |
|---|---|---|---|---|
| Daily | 3 months | 6 months | | |
| √ | | | Robot cleaning | Use a cloth dampened with water or 10% ethanol to wipe off any visible dust, dirt, or oil stains on the robot arm. |
| | | √ | Joint bolts | Refer to the bolt tightening torque table and check the torque of exposed bolts at each joint. |
| | √ | | Tool mounting bolts | Check that the tool is securely connected to the end flange. |
| √ | | | Joint module | Check that there is no abnormal noise or vibration from the joints when the robot is running. After running, touch the joint housing to check for excessive heat. |
| √ | | | Brake | Check that no part of the robot's joints or tool falls down when the robot is disabled. |
| | | √ | Cables | Inspect power cables, heavy-duty cables, and IO cables to ensure stable connections and check for wear or damage on the cable sheathing. |
| | √ | | E-stop button | Press the emergency stop switch when the robot is running and observe whether the robot stops immediately. |
| | √ | | Controller cleaning | Remove the side panel of the controller with the power disconnected, and clean any accumulated dust inside. |

The bolt tightening torques are shown in Table 8.2.

Table 8.2 Screw tightening torques

| Nominal thread diameter | Outer hexagonal bolt (joint) | Inner hexagonal bolt (12.9) | Inner hexagonal bolt (rear cover) |
|---|---|---|---|
| 3 mm | 2 Nm | 2.4 Nm | 0.7 Nm |
| 4 mm | 4 Nm | 4.5 Nm | - |
| 5 mm | 7.5 Nm | 9 Nm | - |
| 6 mm | 15 Nm | 18 Nm | - |
| 8 mm | - | 37 Nm | - |

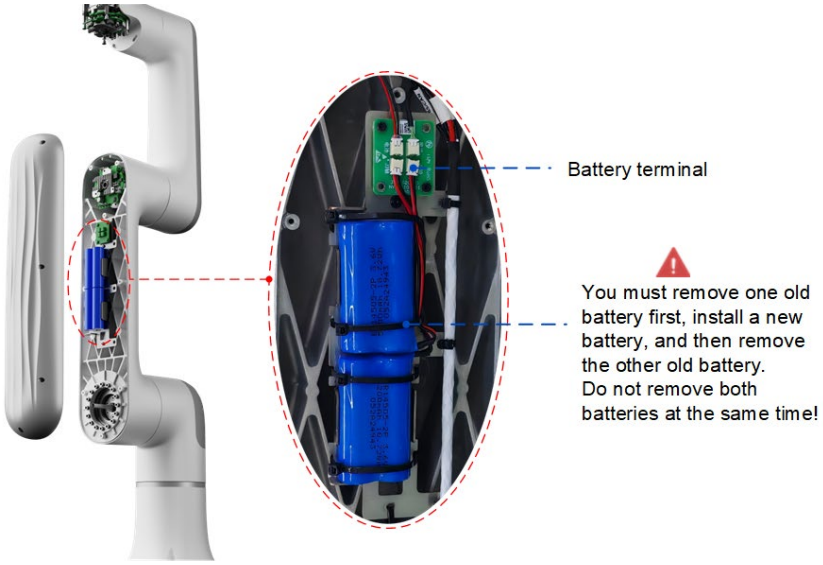
The tightening torques vary depending on the type of bolt or base material. If not listed in the table, please contact Dobot technical support engineer.

## 8.3 Battery replacement

The Nova 2s forearm is equipped with a dual-battery module. If a low-voltage alarm occurs during the operation of the robot, the dual-battery module can be replaced by following the steps below.

1. **Safety preparation**
   - Disable the robot
   - Long-press the power button on the controller for 3 seconds to power off
2. **Open the battery compartment**

   Remove the housing of the forearm (screw specification: M2.5×6) to locate the dual battery module (highlighted in the red oval area below).



### 3. Step-by-step battery replacement

① Disconnect the terminal of one old battery → Cut the securing cable tie → Remove the old battery

② Secure the new battery with a cable tie → Connect the terminal of the new battery

③ Repeat the above steps to replace the other old battery

④ After replacing the batteries, reattach the forearm housing

**NOTICE**

- Anti-static gloves must be worn during the battery replacement process.
- One old battery must be removed and replaced with a new one before removing the other old battery. Do not remove both batteries simultaneously, as this may result in the loss of the robot's zero position data.
- Do not mix old and new batteries.

### 4. Verification

① After turning on the external power supply, press the power button on the controller.

② When the blue indicator on the robot end and controller is steady on, reconnect the robot using DobotStudio Pro.

③ Verify the zero position data.

# 9. Disposal and Environment Protection

Dobot robots must be disposed of in accordance with the applicable national laws, regulations and standards.

The following symbol indicates that the product must not be disposed of as general waste.

# 10. Warranty

## 10.1 Product warranty

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

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

## 10.2 Disclaimer

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

# Appendix Technical Specifications

## Appendix A Robot technical specifications

| Product name | | Nova 2s |
|---|---|---|
| Weight | | 11 kg |
| | | 24.3 lb |
| Rated load | | 2 kg |
| | | 4.4 lb |
| Working radius | | 500 mm |
| | | 19.7 inch |
| Max working speed | | 1.3 m/s |
| | | 51.2 inch/s |
| Joint working range | J1 | ±360° |
| | J2 | ±150° |
| | J3 | ±150° |
| | J4 | ±152° |
| | J5 | ±360° |
| | J6 | ±360° |
| Max joint speed | J1 | 135°/s |
| | J2 | 135°/s |
| | J3 | 135°/s |
| | J4 | 135°/s |
| | J5 | 135°/s |
| | J6 | 135°/s |
| Tool IO | DI | 2 |
| | DO | 2 |
| | RS485 | Support |
| Repeatability | | ±0.05mm |
| IP rating | | IP54 |

| | |
|---|---|
| **Noise** | 65dB(A) |
| **Ambient temperature** | 0℃ – 50℃ |
| **Typical power consumption** | 100W |
| **Maximum power consumption** | 250W |
| **Installation mode** | Any angle |
| **Cable length①** | 3m (optional: 1.5m) |
| | 118.1 inch<br>(optional 59.06 inches) |
| **Material** | Aluminum alloy, ABS |

① : Cable length from robot to controller

## Appendix B Controller technical specifications

| Product name | | Controller (SimBox) |
|---|---|---|
| Compatible robot models | | Nova 2s |
| Size | | 192 mm x 122 mm x 35 mm |
| | | 7.56 x 4.80 x 1.38 inch |
| Weight | | 0.8 kg |
| | | 1.76 lb |
| Input power | | 30 – 60V DC |
| I/O input | | 24V, Max 2A, Max 0.5A for each |
| I/O interface | DI | 8 (NPN or PNP) |
| | DO | 8 (NPN or PNP) |
| Communication interface | LAN | 1, for TCP/IP, Modbus TCP communication |
| | USB | 1, for connecting the USB wireless module |
| Ambient temperature | | 0 – 50℃ |
| Ambient humidity | | ≤ 95%, non-condensing |
| IP rating | | IP20 |
| Cooling method | | Passive cooling |
| Teaching method | | PC, APP (Android) |