Copyright © ShenZhen Yuejiang Technology Co., Ltd 2021. All rights reserved.

No part of this document may be reproduced or transmitted in any form or by any means without prior written consent of Yuejiang Technology Co., Ltd.

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. Yuejiang 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 Yuejiang 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 robotic arm is used on the premise of fully understanding the robotic arm 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 happen in the using process, Dobot shall not be considered as a guarantee regarding to all security information contained in this document.

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 robotic arm.
Preface

Purpose

This Document describes the functions, technical specifications, installation guide and system commissioning of Magician Lite, making it easy for users to fully understand and use it.

Intended Audience

This document is intended for:

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

Change History

<table>
<thead>
<tr>
<th>Date</th>
<th>Change Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020/01/11</td>
<td>The first release</td>
</tr>
<tr>
<td>2020/04/14</td>
<td>Add power box security</td>
</tr>
</tbody>
</table>

Symbol Convention

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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![DANGER]</td>
<td>Indicates a hazard with a high level of risk which, if not avoided, could result in death or serious injury</td>
</tr>
<tr>
<td>![WARNING]</td>
<td>Indicates a hazard with a medium level or low level of risk which, if not avoided, could result in minor or moderate injury, robotic arm damage</td>
</tr>
<tr>
<td>![NOTICE]</td>
<td>Indicates a potentially hazardous situation which, if not avoided, can result in robotic arm damage, data loss, or unanticipated result</td>
</tr>
<tr>
<td>![NOTE]</td>
<td>Provides additional information to emphasize or supplement important points in the main text</td>
</tr>
</tbody>
</table>
Contents

1. Security Precautions ........................................................................................................... 1
   1.1 General Security ........................................................................................................ 1
   1.2 Power Box Security ................................................................................................... 2
   1.3 Precautions ................................................................................................................ 2

2. Quick Start ......................................................................................................................... 4
   2.1 Connecting Cables to Magician Lite ......................................................................... 4
   2.2 Installing the DobotStudio ....................................................................................... 7
      2.2.1 System Requirements ....................................................................................... 7
      2.2.2 Obtaining the DobotStudio Package .............................................................. 7
      2.2.3 Installing the DobotStudio ............................................................................. 7
      2.2.4 Verifying the Installation ............................................................................... 9
   2.3 Powering On/Off Magician Lite .............................................................................. 10
   2.4 Getting Started ......................................................................................................... 11

3. Introduction ....................................................................................................................... 17
   3.1 Overview .................................................................................................................. 17
   3.2 Appearance and Constitute ..................................................................................... 17
   3.3 Working Principle .................................................................................................... 18
      3.3.1 Workspace ....................................................................................................... 18
      3.3.2 Coordinate System ......................................................................................... 19
      3.3.3 Motion Mode ................................................................................................... 20
   3.4 Technical Specifications .......................................................................................... 23
      3.4.1 Technical Parameters ...................................................................................... 23
      3.4.2 Sizes ................................................................................................................ 25

4. Interface Description ....................................................................................................... 26
   4.1 Magician Lite Interface Description ...................................................................... 26
   4.2 Magic Box Interface Description .......................................................................... 27
   4.3 Power Box Interface ................................................................................................ 27
   4.4 Multiplexed I/O Interface Description ................................................................... 28

5. Operation ......................................................................................................................... 34
   5.1 Introduction to the DobotStudio ............................................................................ 34
      5.1.1 Function Modules ............................................................................................ 34
      5.1.2 Common Areas of DobotStudio Page .................................................................. 35
   5.2 Homing ..................................................................................................................... 37
   5.3 Performing Teaching & Playback Tasks .................................................................. 38
      5.3.1 Installing a Suction Cup Kit ........................................................................... 38
      5.3.2 Installing a Gripper Kit .................................................................................. 40
      5.3.3 Teaching & Playback Page .............................................................................. 41
      5.3.4 ARC Motion Mode ........................................................................................ 44
      5.3.5 Teaching & Playback Example ....................................................................... 47
   5.4 Working in Offline Mode ........................................................................................... 52
   5.5 Writing and Drawing .................................................................................................. 54
      5.5.1 Installing a Writing and drawing kit ................................................................. 54
5.5.2 Connecting the DobotStudio ................................................................. 56
5.5.3 Importing Image Files and Setting Writing Parameters ................ 57
5.5.4 Adjust the Position of the Pen Nib ..................................................... 62
5.6 Operating Blockly ................................................................................. 65
5.7 Scripting ................................................................................................. 66
1. Security Precautions

This topic describes the security precautions that should be noticed when using this product. Please read this document carefully before using the robotic arm for the first time. This product needs to be carried out in an environment meeting design specifications, you cannot remold the product without authorization, otherwise, it could lead to product failure, and even personal injury, electric shock, fire, etc. The installation personnel, operators, teaching personnel, and programmers must read this document carefully and use the robotic arm strictly according to the regulations of this document strictly.

1.1 General Security

⚠️ DANGER

The robotic arm is electrical equipment. Non-professional technicians cannot modify the wire, otherwise, it is vulnerable to injury the device or the person.

The following security rules should be followed when using the robotic arm.

- You should comply with local laws and regulations when operating the robotic arm. The security precautions in this document are only supplemental to local laws and regulations.

- The DANGER, WARNING, and NOTICE marks in this document are only supplemental to the security precautions.

- Please use the robotic arm in the specified environment scope. If not, exceeding the specifications and load conditions will shorten the service life of the product even damage the equipment.

- Before operating and maintaining the robotic arm, the personnel responsible for the installation, operation, and maintenance must be trained to understand the various security precautions and to master the correct methods of operation and maintenance.

- Highly corrosive cleaning is not suited to cleaning the robotic arm. The anodized components are not suitable for immersion cleaning.

- People cannot repair and disassemble the robotic arm without professional training. If there is a problem with the robotic arm, please contact Dobot technical support engineer in time.

- Please comply with the relevant laws to deal with the product which is scrapped, and protect the environment.

- There are small parts in the packing box, Please keep them away from children, to avoid any accidents.

- DO NOT let children play with the robotic arm alone. All processes need to be monitored while running. After processes have finished, please turn off the equipment promptly.

- DO NOT put hands into the workspace of the robotic arm while running, to avoid bruising or pinching.

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

- Commissioning of the incomplete machine is prohibited until it has been installed in a machine and the whole machine complies with the provisions of the Machinery Directive (2006/42/EC).
- It is prohibited to modify or remove the nameplates, instructions, icons, and marks on the robotic arm and the related equipment.
- Please refer to Magician Lite Quick Start along with the packing box before using it.

### 1.2 Power Box Security

The following basic precautions should be followed when using this product.

- Read all the instructions before using the product.
- To reduce the risk of injury, close supervision is necessary when the product is used near children.
- Do not put fingers or hands into the product.
- Do not expose power box to rain or snow.
- Use of a power supply or charger not recommended or sold by power pack manufacturer may result in a risk of fire or injury to persons.
- Do not use the power box in excess of its output rating. Overload outputs above rating may result in a risk of fire or injury to persons.
- Do not use the power box that is damaged or modified. Damaged or modified batteries may exhibit unpredictable behavior resulting in fire, explosion or risk of injury.
- Do not disassemble the power box. Take it to a qualified service person when service or repair is required. Incorrect reassembly may result in a risk of fire or injury to persons.
- Do not expose a power pack to fire or excessive temperature. Exposure to fire or temperature above 100°C may cause explosion. The temperature of 100°C can be replaced by the temperature of 212°F.
- Have servicing performed by a qualified repair person using only identical replacement parts. This will ensure that the safety of the product is maintained.
- Switch off the power box when not in use.

### 1.3 Precautions

- Magician Lite was calibrated at the factory. By default, the coordinate of J1 axis is 0° after Magician Lite moving to the default homing point, i.e. The forearm is in the middle of the front of the base of Magician Lite.
- If the LED indicator turns red after starting up, it indicates that the Magician Lite is at a limited position. Please make the Magician Lite in the workspace.
- Magician Lite will move slowly to the specific position when shutdown. DO NOT put hands into the workspace of Magician Lite while running, to avoid bruising or pinching. Only once the LED indicator completely turns off, Magician Lite can be powered down.
• If the Magician Lite coordinate reading is abnormal during use, please press the forearm unlock button to correct the reading.

• Please turn off Magician Lite completely first before connecting or disconnecting external equipment, such as infrared sensor, color sensor, etc. Otherwise, it causes damage to your device.
2. Quick Start

This topic briefly describes how to operate the Magician Lite with the software DobotStudio, allowing you to quickly know and use Magician Lite. Figure 2.1 shows the process of getting started with Magician Lite.

![Diagram of Quick Start Process]

Figure 2.1 The process of getting started with Magician Lite

2.1 Connecting Cables to Magician Lite

- When not used with Magic Box, connect directly to Magician Lite.

   **Step 1** Connect Magician Lite to your computer with USB cable, as shown in Figure 2.2.
Step 2  Connect power adapter to power interface on Magician Lite, as shown in Figure 2.3.

• When used with Magic Box, connect Magic Box and Magician Lite.

Step 1  Connect Magician Lite and Magic Box with 4PIN power cable and 10PIN communication cable. 4Pin power cable is connected to **12V** power interface, 10Pin communication cable is connected to **Communication1** interface.
Figure 2.4 Connect Magician Lite and Magic Box

**Step 2** Connect Magic Box and your computer with USB cable.

Figure 2.5 Connect Magician Lite to the electrical outlet

**Step 3** Connect power adaptor to Magic Box.
2.2 Installing the DobotStudio

You can control Magician Lite and Magic Box by DobotStudio (V1.9.1 and above) to implement functions such as Teaching & Playback, fully programmable applications. This topic introduces Teaching & Playback.

2.2.1 System Requirements

The DobotStudio supports the following Windows versions:
- Windows 7, Windows 8, and Windows 10 (This manual is explained based on this version)

2.2.2 Obtaining the DobotStudio Package

Before using Magician Lite, download the Windows DobotStudio package from https://www.dobot.cc/downloadcenter/dobot-magician-lite.html#most-download.

2.2.3 Installing the DobotStudio

Prerequisites
- The DobotStudio package has been obtained.

Procedure

Step 1
Unpack the DobotStudio package to a destination directory.
For example, this directory is Installation Directory\DobotStudio. You can install the DobotStudio to another location based on site requirements.

Step 2
In the installation directory double-click DobotStudioSetup.exe. The Select Setup Language dialog box is displayed, as shown in Figure 2.7.
Step 4  Choose a setup language such as **English**, as shown in Figure 2.8. You can also select **Chinese** if needed.

Step 5  Click **OK** to follow the on-screen instructions to continue with the installation.

During the installation, the Driver Installation dialog box is displayed, two drivers need to be installed, as shown in Figure 2.9.

Step 6  Click **Next** to install the first driver, and then click **INSTALL** to install the second driver.
When the drivers are installed successfully, the **Completing the Device Driver Installation Wizard** dialog box is displayed. Click **Finish**, as shown in Figure 2.10.

![Completing the Device Driver Installation Wizard](image)

Figure 2.10  The Completing the Device Driver Installation Wizard dialog box

**Step 7** Click **Next** to continue to install the DobotStudio by following the prompts on the **Setup – DobotStudio** dialog box.

When the installation is complete, the **Completing the DobotStudio Setup Wizard** dialog box is displayed. Click **Finish**, as shown in Figure 2.11.

![Completing the DobotStudio Setup Wizard](image)

Figure 2.11  The Completing the DobotStudio Setup Wizard dialog box

### 2.2.4 Verifying the Installation

#### 2.2.4.1 Verifying the DobotStudio

If the DobotStudio is launched and runs properly by double-clicking the desktop shortcut to this program, it means that it is installed successfully.
2.2.4.2 Verifying the Dobot Driver

If an available COM port is displayed on the upper left corner of the DobotStudio page after the robotic arm is powered on, as shown in Figure 2.12, the robotic arm driver is installed successfully.

![Figure 2.12](image)

Figure 2.12 An available COM port is displayed

If no COM port is available, check whether the robotic arm driver is successfully installed by following the steps below.

**Step 1** Connect Magician Lite to your computer with the supplied USB cable.

**Step 2** Press the power button to apply power.

**Step 3** Launch the Device Manager window to locate the Ports (COM & LPT) section. If the item USB Serial Device (COM8) is displayed, it means the robotic arm driver is installed successfully.

![Figure 2.13](image)

Figure 2.13 The robotic arm driver in the Device Manager window

2.3 Powering On/Off Magician Lite

- **Power on:** Press power button on Magician Lite or Magic Box, as shown in Figure 2.14. Once Magician Lite is powered on, all the stepper motors lock, and a short beep sound will be heard, the LED indicator turns green. Now Magician Lite is ready to use.
NOTICE

If the LED indicator is red after powering on Magician Lite, it means that Magician Lite reaches its limited position. To go back to the workspace, press and hold the unlock button on the Forearm to move Magician Lite to another desired position. After releasing the button, the LED indicator turns green.

- **Power off**: When the LED indicator is green, press the power button to turn off Magician Lite. In this case, the Forearm moves slowly to the Rear Arm while the angle between them becomes small. Finally, the two arms reach a specific position.

WARNING

Watch your hand during the shutdown process.

### 2.4 Getting Started

This topic describes how to use Magician Lite to complete the teaching & playback function by saving three points in the MOVJ mode, allowing you to get the basic knowledge of the usage of the robotic arm.

**Prerequisites**
• The DobotStudio has been installed. For details, please refer to 2.2 Installing the DobotStudio.

• Magician Lite is powered on. For details, please refer to 2.3 Powering On/Off Magician Lite.

**Procedure**

**Step 1**
Double-click the desktop shortcut of the DobotStudio.
The DobotStudio page is displayed as shown in Figure 2.15.

![Figure 2.15 The DobotStudio page](image)

**Step 2**
Click **Connect** on the DobotStudio page, as shown in Figure 2.16. Select **Magician Lite** in device type box (if using Magic Box, you need to select **Magic Box+Magician Lite**) and click **Connect**.

![Figure 2.16 Click Connect](image)
Step 3 Use DobotStudio to accomplish a teaching & playback task.

1. Click **Teaching & Playback**, as shown in Figure 2.17.

![Click Teaching & Playback figure]

Figure 2.17  Click Teaching & Playback

2. Select **PTP Point > MOVJ** mode in the Save Point area, as shown in Figure 2.18.

![Select MOVJ motion mode figure]

Figure 2.18  Select MOVJ motion mode

3. Press and hold the unlock button on the Forearm to move the robotic arm to a
position such as a point A, and then release the button.  
In this case, the DobotStudio will save the Cartesian coordinate of point A, as shown in Figure 2.19.

![Figure 2.19 The Cartesian coordinate of the point A](image)

**NOTE:**

Apart from hand-guided teaching, you can accomplish a teaching task by jogging Magician Lite in the Cartesian or Joint coordinate system, as shown in Figure 2.20.

![Figure 2.20 Jog Magician Lite in the Cartesian or Joint coordinate system](image)

4. Move the robotic arm to the other two locations such as points B and C by referring to the method of creating point A above, as shown in Figure 2.21. The robotic arm will save the Cartesian coordinates corresponding to these two points.
5. Enter 3 in the **Loop** text box.

The robotic arm will repeat the sequence of movements three times, as shown in Figure 2.22.

6. Click **Start** to perform the motions taught above, as shown in Figure 2.23. The robotic arm will stop after playing back the steps for three times.
7. Click ☑️ to exit the Teaching & Playback page, as shown in Figure 2.24.
3. Introduction

3.1 Overview

Magician Lite is a multifunctional desktop robotic arm for practical training education, supporting teaching and playback, blockly graphics programming, script, etc. It also supports secondary development by various extensible I/O interfaces provided by Magic Box, which really makes your creativity and imagination increase without any limitation.

Magician Lite features an external controller called “Magic Box” that separates motion control algorithm and user tasks to allow more convenience for programming and creating. Magician Lite supports offline function, 2 controllable power interfaces with 12V, 2 multi-function communication interfaces, 6 universal IO interfaces, 2 stepper motor interfaces and several I2C interfaces are available. Users can expand a wide range of sensors and related accessories to achieve more possibilities.

Power Box is a separate power accessory, which contains 2 12V out interfaces to supply power for Magician Lite and Magic Box. It is also convenient to carry and operate.

![The appearance of Magician Lite](image)

Figure 3.1 The appearance of Magician Lite

3.2 Appearance and Constitute

Magician Lite consists of Base, Rear Arm, Forearm, and end-effector, etc. Figure 3.2 shows the appearance.
3.3 Working Principle

This topic describes the workspace, principle, size and technical specifications of Magician Lite.

3.3.1 Workspace

Figure 3.3 and Figure 3.4 shows the workspace.
3.3.2 Coordinate System

Magician Lite has two types of coordinate systems, the joint one and the Cartesian one, as shown in Figure 3.5 and Figure 3.6 respectively.
Joint coordinate system: The coordinates are determined by the motion joints.

- If the end-effector with servo is installed, such as suction cup kit, gripper kit, Magician Lite contains four joints: J1, J2, J3, and J4, which are all the rotating joints. The positive direction of these joints is counter-clockwise.

Cartesian coordinate system: The coordinates are determined by the base.

- The origin is the center of the three motors (Rear Arm, Forearm, base).
- The direction of the X-axis is perpendicular to the base forward.
- The direction of the Y-axis is perpendicular to the base leftward.
- The direction of the Z-axis is vertical upward, which is based on the right-hand rule.
- The R-axis is the attitude of the servo center relative to the origin of the robotic arm, of which the positive direction is counter-clockwise. The R-axis only exists once the end-effector with servo is installed.

3.3.3 Motion Mode

The motion modes of Magician Lite include Jogging, Point to Point (PTP), ARC.

3.3.3.1 Jogging Mode

Jogging mode is the mode that jogging Magician Lite to a point in Cartesian coordinate system or Joint coordinate system when teaching.

⚠️ NOTE

This topic describes jogging mode by the GUI operation of DobotStudio.

- Cartesian coordinate system mode
  - Click X+, X- and Magician Lite will move along X-axis in a negative or positive direction.
  - Click Y+, Y- and Magician Lite will move along Y-axis in a negative or positive
direction.

- Click **Z+**, **Z-** and Magician Lite will move along Z-axis in a negative or positive direction.
- Click **R+**, **R-** and Magician Lite will rotate along R-axis in a positive or negative direction.

⚠️ **NOTICE**

If the end-effector with servo is installed on the Magician Lite, the R-axis will move together with Y-axis, to make sure that the terminal posture relative to the origin stays constant.

- **Joint coordinate system mode**
  - Click **J1+**, **J1-** and control the base motor to rotate in the negative or positive direction.
  - Click **J2+**, **J2-** and control the Rear Arm motor to rotate in the negative or positive direction.
  - Click **J3+**, **J3-** and control the Forearm motor to rotate in the negative or positive direction.
  - Click **J4+**, **J4-** and control the servo to rotate in the negative or positive direction.

### 3.3.3.2 Point to Point (PTP)

PTP mode supports MOVJ, MOVL, and JUMP, which means point to point movement. The trajectory of playback depends on the motion mode.

- **MOVJ**: Joint movement. From point A to point B, each joint will run from an initial angle to its target angle, regardless of the trajectory, as shown in Figure 3.7.

![Figure 3.7 MOVL/MOVJ mode](image)

- **MOVL**: Rectilinear movement. The joints will perform a straight line trajectory from point A to point B, as shown in Figure 3.7.
- **JUMP**: From point A to point B, the joints will move in MOVJ mode, of which the trajectory looks like a door, as shown in Figure 3.8.
  1. Move up the lifting Height in MOVJ mode.
2. Move horizontally to a point that is above B by height.
3. Move down to point B.

![Figure 3.8 JUMP mode](image)

### 3.3.3.3 ARC

The trajectory of ARC mode is an arc, which is determined by three points (the current point, any point and the end point on the arc), as shown in Figure 3.9.

⚠️ **NOTICE**

In ARC mode, it is necessary to confirm the three points with other motion modes, and the three points cannot be in a line.

![Figure 3.9 ARC mode](image)

### 3.3.3.4 Application Scenarios

The application scenario depends on the trajectory in motion mode, as shown in Table 3.1.

<table>
<thead>
<tr>
<th>Motion mode</th>
<th>Application scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOVL</td>
<td>If the trajectory of playback is required as a straight line, you can choose MOVL</td>
</tr>
</tbody>
</table>
### Motion mode and Application scenario

<table>
<thead>
<tr>
<th>Mode</th>
<th>Application scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOVJ</td>
<td>If the trajectory of playback is not required but high speed is required, you can choose MOVJ</td>
</tr>
<tr>
<td>JUMP</td>
<td>If the movement of two points is required to lift upwards by amount of height, such as sucking up, grabbing, you can choose JUMP</td>
</tr>
<tr>
<td>ARC</td>
<td>If the trajectory of playback is required as an arc, such as dispensing, you can choose ARC</td>
</tr>
</tbody>
</table>

### 3.4 Technical Specifications

#### 3.4.1 Technical Parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Magician Lite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum payload</td>
<td>250g</td>
</tr>
<tr>
<td>Maximum reach</td>
<td>340mm</td>
</tr>
<tr>
<td>Motion range</td>
<td></td>
</tr>
<tr>
<td>J1</td>
<td>-135°~135°</td>
</tr>
<tr>
<td>J2</td>
<td>-5°~80°</td>
</tr>
<tr>
<td>J3</td>
<td>-10°~85°</td>
</tr>
<tr>
<td>J4</td>
<td>-145°~145°</td>
</tr>
<tr>
<td>Repeated positioning accuracy</td>
<td>±0.2 mm</td>
</tr>
<tr>
<td>Power supply</td>
<td>100V~240V AC, 50/60Hz</td>
</tr>
<tr>
<td>Power in</td>
<td>12V/5A DC</td>
</tr>
<tr>
<td>Power</td>
<td>60W Max</td>
</tr>
<tr>
<td>Communication</td>
<td>USB, 10PIN Communication Interface</td>
</tr>
<tr>
<td>Software</td>
<td>DobotStudio/DobotScratch</td>
</tr>
<tr>
<td>Working temperature</td>
<td>-5°C~+45°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Magic Box</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control chip</td>
<td>ARM 32-bit Cortex-M4</td>
</tr>
<tr>
<td>Frequency</td>
<td>168 MHz</td>
</tr>
</tbody>
</table>
### Power Box technical parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Power Box</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum voltage</td>
<td>12V/1A DC</td>
</tr>
<tr>
<td>Power in</td>
<td>12V/5A DC</td>
</tr>
<tr>
<td>Power out</td>
<td>12V/3A DC</td>
</tr>
<tr>
<td>Rated capacity</td>
<td>2500mAH</td>
</tr>
<tr>
<td>Minimum capacity</td>
<td>2400mAH</td>
</tr>
<tr>
<td>Working temperature</td>
<td>0℃~40℃</td>
</tr>
<tr>
<td>Size</td>
<td>95 mm×80 mm×28.5 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Power supply (100V~240V AC, 50/60Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power in</td>
<td>12V/5A DC</td>
</tr>
<tr>
<td>Working Temperature</td>
<td>-5℃ - 45℃</td>
</tr>
<tr>
<td>Capacity</td>
<td>60W Max</td>
</tr>
<tr>
<td>Communication mode</td>
<td>USB virtual serial/serial/Bluetooth</td>
</tr>
<tr>
<td>Program language</td>
<td>MicroPython</td>
</tr>
<tr>
<td>Software</td>
<td>DobotStudio/DobotScratch</td>
</tr>
<tr>
<td>Weight</td>
<td>98g</td>
</tr>
<tr>
<td>Size</td>
<td>95 mm×80 mm×21.5 mm</td>
</tr>
<tr>
<td>Power interface</td>
<td>4 PIN, 12V/3A DC</td>
</tr>
<tr>
<td>Multifunctional</td>
<td>10PIN, Serial port communication interface</td>
</tr>
<tr>
<td>Communication Interface</td>
<td></td>
</tr>
<tr>
<td>General I/O expand</td>
<td>Green Port, 4PIN, 3.3V/5V-IO, 5V/1A-VCC, Multiplexing Interface</td>
</tr>
<tr>
<td>interface</td>
<td>Self-define I/O, AD, PWM output, 12C etc.</td>
</tr>
<tr>
<td>Stepper motor expand</td>
<td>Yellow port, 4PIN, 12V 1A</td>
</tr>
<tr>
<td>Interface</td>
<td></td>
</tr>
<tr>
<td>12V power interface</td>
<td>Red port, 2PIN, 12V, 3A max</td>
</tr>
<tr>
<td>PWM</td>
<td>Value range: 20Hz~100KHz</td>
</tr>
<tr>
<td>ADC</td>
<td>Value range: 0V~5V</td>
</tr>
<tr>
<td></td>
<td>Accuracy: 12bit</td>
</tr>
</tbody>
</table>
### Sizes

Figure 3.10 shows the size of Magician Lite and Figure 3.11 shows the size of the end mounting hole.

![Figure 3.10 Size of Magician Lite](image)

![Figure 3.11 Size of end mounting hole](image)
4. Interface Description

4.1 Magician Lite Interface Description

The interfaces of Magician Lite are located on the back of the base. Figure 4.1 shows the interfaces on the back of the base, and Table 4.1 lists the description.

![Figure 4.1 Interfaces in the base](image)

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1   | Power switch  
|     | Short press: Power on Magician Lite  
|     | Long press(>3s): Power off Magician Lite |
| 2   | Key  
|     | • Short press: Start running playback program in offline mode, for the details about offline mode, please refer to 5.4 Working in Offline Mode  
|     | • Long press(>2s): Start homing procedure, for the details about homing, please refer to 5.2 Homing |
| 3   | Power interface  
|     | Connect to power adaptor |
| 4   | 12V power interface: To supply power to Magician Lite |
| 5   | USB: Connect Magician Lite and your PC |
| 6   | 10PIN communication interface  
|     | Serial communication |

The LED indicator is located on the base, Table 4.2 lists the status description.
### 4.2 Magic Box Interface Description

The Magic Box interface consists of 24 I/O multiplexing interfaces as well as communication interfaces that connect sliding rail, conveyor belts, Joystick, sensors, and more. As shown in the figure below.

![Magic Box Interfaces](image)

**Figure 4.2 Magic Box interfaces**

### 4.3 Power Box Interface
### Interface Description

#### Power Box interface description

![Power Box interface](image)

**Table 4.3** Power Box LED description

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flashing</td>
<td>In discharge</td>
</tr>
<tr>
<td>Water lights</td>
<td>Charging</td>
</tr>
<tr>
<td>All on</td>
<td>Charging complete</td>
</tr>
<tr>
<td>Turn off after all flashing</td>
<td>Low battery, automatic shutdown</td>
</tr>
<tr>
<td>The inside and outside lights flash alternately</td>
<td>The temperature of the Power Box is too high or too low. At this time, the Power Box needs to be left for a period of time until the temperature is within the working temperature range</td>
</tr>
</tbody>
</table>

#### 4.4 Multiplexed I/O Interface Description

The addresses of the I/O interfaces in Magic Box are unified. Most of I/O interfaces have multiple functions, to control the peripheral equipment.

Figure 4.4 shows the communication interface on Magic Box, Table 4.4 lists the multiplexed I/O description.
### Interface Description

#### Communication Interface 1

![Communication Interface 1](image1.png)

#### Communication Interface 2

![Communication Interface 2](image2.png)

### Table 4.4 Magic Box multiplexed I/O description

<table>
<thead>
<tr>
<th>Interface</th>
<th>Pin</th>
<th>Description</th>
<th>Level Output</th>
<th>PWM</th>
<th>Level Input</th>
<th>ADC</th>
<th>Whether Pulling</th>
</tr>
</thead>
<tbody>
<tr>
<td>EIO1</td>
<td>undefined</td>
<td>General I/O interface</td>
<td>3.3V_10mA output</td>
<td>-</td>
<td>3.3V/5V_10mA input</td>
<td>-</td>
<td>No pulling</td>
</tr>
<tr>
<td>EIO2</td>
<td>GND</td>
<td>Ground</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Reset</td>
<td>GND</td>
<td>General I/O interface</td>
<td>3.3V_10mA output</td>
<td>-</td>
<td>3.3V_10mA input</td>
<td>-</td>
<td>Pull up 430R to 3.3V</td>
</tr>
<tr>
<td>EIO3</td>
<td>EIO3</td>
<td>General I/O</td>
<td>3.3V_10mA output</td>
<td>-</td>
<td>3.3V_10mA</td>
<td>-</td>
<td>Pull up</td>
</tr>
<tr>
<td>Interface</td>
<td>Pin</td>
<td>Description</td>
<td>Level Output</td>
<td>PWM</td>
<td>Level Input</td>
<td>ADC</td>
<td>Whether Pulling</td>
</tr>
<tr>
<td>-----------</td>
<td>-----</td>
<td>-------------</td>
<td>--------------</td>
<td>-----</td>
<td>-------------</td>
<td>-----</td>
<td>-----------------</td>
</tr>
<tr>
<td>EIO4</td>
<td></td>
<td>General I/O interface</td>
<td>3.3V_10mA Output</td>
<td>-</td>
<td>3.3V/5V_10mA input</td>
<td>-</td>
<td>No pulling</td>
</tr>
<tr>
<td>EIO5</td>
<td></td>
<td>General I/O interface</td>
<td>3.3V_10mA Output</td>
<td>-</td>
<td>3.3V/5V_10mA input</td>
<td>-</td>
<td>No pulling</td>
</tr>
<tr>
<td>5V</td>
<td></td>
<td>power</td>
<td>5V/1A Output</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>GND</td>
<td></td>
<td>ground</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>undefined</td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>GND</td>
<td></td>
<td>ground</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>EIO6</td>
<td></td>
<td>General I/O interface</td>
<td>3.3V_10mA Output</td>
<td>-</td>
<td>3.3V/5V_10mA input</td>
<td>-</td>
<td>No pulling</td>
</tr>
<tr>
<td>EIO7</td>
<td></td>
<td>General I/O interface</td>
<td>3.3V_10mA Output</td>
<td>-</td>
<td>3.3V/5V_10mA input</td>
<td>-</td>
<td>No pulling</td>
</tr>
<tr>
<td>Reset</td>
<td></td>
<td>Firmware reset</td>
<td>3.3V_10mA Output</td>
<td>-</td>
<td>3.3V_10mA input</td>
<td>-</td>
<td>Pull up 430R to 3.3V</td>
</tr>
<tr>
<td>EIO8</td>
<td></td>
<td>General I/O interface</td>
<td>3.3V_10mA Output</td>
<td>-</td>
<td>3.3V_10mA input</td>
<td>-</td>
<td>Pull up 10K to 3.3V</td>
</tr>
<tr>
<td>EIO9</td>
<td></td>
<td>General I/O interface</td>
<td>3.3V_10mA Output</td>
<td>-</td>
<td>3.3V/5V_10mA input</td>
<td>-</td>
<td>No pulling</td>
</tr>
<tr>
<td>EIO10</td>
<td></td>
<td>General I/O interface</td>
<td>3.3V_10mA Output</td>
<td>-</td>
<td>3.3V/5V_10mA input</td>
<td>-</td>
<td>No pulling</td>
</tr>
<tr>
<td>5V</td>
<td></td>
<td>power</td>
<td>5V/1A Output</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>GND</td>
<td></td>
<td>ground</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
### Interface Description

#### Figure 4.6 Peripheral interface

#### Table 4.5 Peripheral multiplexed I/O description

<table>
<thead>
<tr>
<th>Interface</th>
<th>Pin</th>
<th>Description</th>
<th>Level Output</th>
<th>PWM</th>
<th>Level Input</th>
<th>ADC</th>
<th>Whether Pulling</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW1</td>
<td>EIO12</td>
<td>Controlled power</td>
<td>8V~12.6V _3A output</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>GND</td>
<td>Ground</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SW2</td>
<td>EIO11</td>
<td>Controlled power</td>
<td>8V~12.6V _3A output</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>GND</td>
<td>Ground</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>STP1</td>
<td>2_1A</td>
<td></td>
<td>8V~12.6V /0.9A output</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2_1B</td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2_2A</td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>2_2B</td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
## Interface Description

<table>
<thead>
<tr>
<th>Interface</th>
<th>Pin</th>
<th>Description</th>
<th>Level Output</th>
<th>PWM</th>
<th>Level Input</th>
<th>ADC</th>
<th>Whether Pulling</th>
</tr>
</thead>
<tbody>
<tr>
<td>STP2</td>
<td>1_1A</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1_1B</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1_2A</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>1_2B</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Port1</td>
<td>GND</td>
<td>Ground</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>5V</td>
<td>Power</td>
<td>5V/1A</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>EIO16</td>
<td>General I/O interface</td>
<td>3.3V_10mA output</td>
<td>√</td>
<td>3.3V_10mA input</td>
<td>-</td>
<td>Pull up 51K to 3.3V</td>
</tr>
<tr>
<td></td>
<td>EIO15</td>
<td>General I/O interface</td>
<td>3.3V_10mA output</td>
<td>-</td>
<td>3.3V_10mA input</td>
<td>-</td>
<td>Pull up 51K to 3.3V</td>
</tr>
<tr>
<td>Port2</td>
<td>GND</td>
<td>Ground</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>5V</td>
<td>Power</td>
<td>5V/1A</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>EIO13</td>
<td>General I/O interface</td>
<td>3.3V_10mA output</td>
<td>√</td>
<td>3.3V_10mA input</td>
<td>-</td>
<td>Pull up 51K to 3.3V</td>
</tr>
<tr>
<td></td>
<td>EIO14</td>
<td>General I/O interface</td>
<td>3.3V_10mA output</td>
<td>-</td>
<td>3.3V_10mA input</td>
<td>-</td>
<td>Pull up 51K to 3.3V</td>
</tr>
<tr>
<td>Port3</td>
<td>GND</td>
<td>Ground</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>5V</td>
<td>Power</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>EIO23</td>
<td>General I/O interface</td>
<td>3.3V_10mA output</td>
<td>√</td>
<td>3.3V_10mA input</td>
<td>-</td>
<td>No pulling</td>
</tr>
<tr>
<td></td>
<td>EIO24</td>
<td>General I/O interface</td>
<td>3.3V_10mA output</td>
<td>-</td>
<td>3.3V_10mA input</td>
<td>√</td>
<td>No pulling</td>
</tr>
<tr>
<td>Port4</td>
<td>GND</td>
<td>Ground</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>5V</td>
<td>Power</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>EIO21</td>
<td>General I/O interface</td>
<td>3.3V_10mA output</td>
<td>√</td>
<td>3.3V_10mA input</td>
<td>-</td>
<td>No pulling</td>
</tr>
<tr>
<td>Interface</td>
<td>Pin</td>
<td>Description</td>
<td>Level Output</td>
<td>PWM</td>
<td>Level Input</td>
<td>ADC</td>
<td>Whether Pulling</td>
</tr>
<tr>
<td>-----------</td>
<td>-----</td>
<td>-------------</td>
<td>--------------</td>
<td>-----</td>
<td>-------------</td>
<td>-----</td>
<td>-----------------</td>
</tr>
<tr>
<td>Port5</td>
<td>EIO22</td>
<td>General I/O interface</td>
<td>3.3V_10mA output</td>
<td>-</td>
<td>3.3V_10mA input</td>
<td>√</td>
<td>No pulling</td>
</tr>
<tr>
<td></td>
<td>GND</td>
<td>Ground</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>5V</td>
<td>Power</td>
<td>5V/1A output</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>EIO20</td>
<td>General I/O interface</td>
<td>3.3V_10mA output</td>
<td>√</td>
<td>3.3V_10mA input</td>
<td>-</td>
<td>Pull up 51K to 3.3V</td>
</tr>
<tr>
<td></td>
<td>EIO19</td>
<td>General I/O interface</td>
<td>3.3V_10mA output</td>
<td>√</td>
<td>3.3V_10mA input</td>
<td>-</td>
<td>Pull up 51K to 3.3V</td>
</tr>
<tr>
<td>Port6</td>
<td>EIO18</td>
<td>General I/O interface</td>
<td>3.3V_10mA output</td>
<td>√</td>
<td>3.3V_10mA input</td>
<td>-</td>
<td>Pull up 51K to 3.3V</td>
</tr>
<tr>
<td></td>
<td>EIO17</td>
<td>General I/O interface</td>
<td>3.3V_10mA output</td>
<td>√</td>
<td>3.3V_10mA input</td>
<td>-</td>
<td>Pull up 51K to 3.3V</td>
</tr>
</tbody>
</table>
5. Operation

5.1 Introduction to the DobotStudio

5.1.1 Function Modules

You can use the DobotStudio to control the Magician Lite to accomplish multiple functions such as **Teaching & Playback**, **Write & Draw**, **Blockly** graphics programming, and **Script** control, as shown in Figure 5.1. For details, refer to Table 5.1.

![Function Modules on DobotStudio Page](image)

**Figure 5.1** The function modules on the DobotStudio page

<table>
<thead>
<tr>
<th>Function Modules</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching &amp; Playback</td>
<td>Teach Magician Lite how to move and then record the movement to make Magician Lite accomplish the recorded movements</td>
</tr>
<tr>
<td>Write &amp; Draw</td>
<td>Control Magician Lite to write, draw, or engrave an object using a laser</td>
</tr>
<tr>
<td>Blockly</td>
<td>Use <strong>Blockly</strong> to program Magician Lite in a graphics programming environment. It allows the users to drag and drop the blocks onto a workplace to generate execute code just as intuitive and easy as a block puzzle</td>
</tr>
<tr>
<td>Script</td>
<td>Control Magician Lite using the script commands</td>
</tr>
<tr>
<td>Add More</td>
<td>Add more custom functions to manipulate Magician Lite</td>
</tr>
</tbody>
</table>

You can also set the Magician Lite by clicking **Setting** on the DobotStudio page as shown in Figure 5.2. For details, please refer to Table 5.2.
Figure 5.2 The General Setting page

Table 5.2 The General Setting page

<table>
<thead>
<tr>
<th>Items</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Set a device name and collision detection</td>
</tr>
<tr>
<td>Update</td>
<td>Set firmware detection frequency and view the current firmware, software version</td>
</tr>
<tr>
<td>Firmware</td>
<td>Upgrade firmware&lt;br&gt; DobotStudio displays different firmware when connecting different devices. When connecting Magician Lite, firmware shows <strong>Magician Lite firmware</strong>. You can click <strong>Confirm</strong> to upgrade firmware.</td>
</tr>
<tr>
<td>Jog</td>
<td>Set the jogging speed ratio</td>
</tr>
<tr>
<td>Playback</td>
<td>Set speed ratio, Jump parameters, handhold teaching, and LostStepParam.</td>
</tr>
<tr>
<td>Write Draw</td>
<td>Set the Write &amp; Draw function, such as speed ratio, pen up offset and pen down position.</td>
</tr>
</tbody>
</table>

### 5.1.2 Common Areas of DobotStudio Page

The DobotStudio offers the following common areas shared by all the function modules to control the robotic arm.

- You can select the liner rail or an end-effector on the DobotStudio page, as shown in Figure 5.3.
Figure 5.3  The linear rail and end-effector drop-down list

Table 5.3  The linear rail and end-effector drop-down list

<table>
<thead>
<tr>
<th>Items</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear rail</td>
<td>When Magic Box+Magician Lite is connected to a linear rail, click this item</td>
</tr>
<tr>
<td></td>
<td>to enable the rail</td>
</tr>
<tr>
<td>End-effector</td>
<td>When the end-effector is a suction cup kit, gripper kit, or writing and</td>
</tr>
<tr>
<td>drop-down list</td>
<td>drawing kit, select the corresponding kit in this list</td>
</tr>
</tbody>
</table>

- You can also perform other operations on the DobotStudio page such as Setting, Home, Emergency Stop, and viewing the versions, as shown in Figure 5.4.

Table 5.4  Setting, Home, Emergency Stop, and viewing the versions

<table>
<thead>
<tr>
<th>Items</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting</td>
<td>Set the robotic arm such as firmware upgrade, sensor and base setup. For</td>
</tr>
<tr>
<td></td>
<td>details, please refer to Table 5.2</td>
</tr>
<tr>
<td>Home</td>
<td>Set Magician Lite back to its home position</td>
</tr>
<tr>
<td></td>
<td>When the robotic arm loses step, please press the button on forearm to</td>
</tr>
<tr>
<td></td>
<td>restore encoder value</td>
</tr>
<tr>
<td>Emergency</td>
<td>Stop the robotic arm if an emergency occurs</td>
</tr>
<tr>
<td>Stop</td>
<td></td>
</tr>
<tr>
<td></td>
<td>View the version information such as DobotStudio version, firmware version,</td>
</tr>
<tr>
<td></td>
<td>and hardware version</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Switch system language</td>
</tr>
</tbody>
</table>

With the **Operation Panel** on the **DobotStudio** page, you can teach the robotic arm to perform a specific task such as jogging the robotic arm in the Cartesian or joint coordinate system, or controlling a gripper or suction cup, as shown in Figure 5.5. For details, please refer to Table 5.5.
Figure 5.5  Setting the Operation Panel

Table 5.5  Setting the Operation Panel

<table>
<thead>
<tr>
<th>Items</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coordinate jogging</td>
<td>Jog Magician Lite by clicking X (X+/−), Y (Y+/−), Z (Z+/−), or R (R+/−) in the Cartesian coordinate system</td>
</tr>
<tr>
<td>Joint jogging</td>
<td>Jog Magician Lite by clicking J1+/−, J2+/−, J3+/−, or J4+/− in the Joint coordinate system</td>
</tr>
</tbody>
</table>
| Linear control      | When the linear rail is enabled (refer to Table 5.3), click L+/− to move the robotic arm along the rail.  
                                      Value range: 0 mm - 1000 mm  
                                      **NOTE**  
                                      The rail function is only available when connecting Magic Box + Magician Lite  |
| Gripper control     | When the end-effector is chosen as a **Gripper**, you can set the gripper to open, close, or disable in the **Gripper** drop-down box |
| Suction cup control | When the end-effector is chosen as a **Suction Cup**, select **SuctionCup** to power on the air pump.  
                                      If unselected, the air pump is powered off |
| Jogging speed control | Set the jogging speed percentage  
                                      Default value: 50%  
                                      Value range: 1% - 100%  |

5.2  Homing

Magician Lite has been calibrated before being shipped out. When Magician Lite backs to the homing position, which will not calibrate accuracy, If Magician Lite has been hit or the motor has lost a step, leading data abnormal, you need to press the button on forearm to restore encoder value.
Prerequisites

- Magician Lite has been powered on.
- Magician Lite has been connected to DobotStudio successfully.

Procedure

Click **Home** on the DobotStudio page, as shown in Figure 5.6.

⚠ **NOTICE**

- Please remove the end-effector from Magician Lite before homing.
- Please ensure that there are no obstacles in the workspace during homing.

Magician Lite will rotate to the default homing point automatically and the LED indicator on the base turns blue and is blinking. After the homing is successful, there is a beep sound and the LED indicator turns green.

Also, the homing point can be user-defined, you can select a saved point on the **Teaching&Playback** page and right-click **SetHome** to set this saved point as the homing point, as shown in Figure 5.7.

5.3 Performing Teaching & Playback Tasks

This topic introduces how to perform a teaching & playback task to suck or grab a small cube. Because a suction cup kit or a gripper kit is required, we will explain them first.

5.3.1 Installing a Suction Cup Kit

Magician Lite has built-in air pump with suction cup as the default end-effector, as shown in
Figure 5.8.

![Image of a suction cup kit]

**Figure 5.8** A suction cup kit

**Procedure**

**Step 1** Insert a suction cup kit into the end’s port, hear a sound indicating that the suction cup is fixed and complete, as shown in Figure 5.9.

![Image of installing a suction cup kit]

**Figure 5.9** Install a suction cup kit

**Step 2** Connect the air pump’s air tube to the air tube connector of the suction cup kit, as shown in Figure 5.10.
5.3.2 Installing a Gripper Kit

An air pump should be used with the gripper kit, as shown in Figure 5.11, to open or close the gripper.

Install the gripper kit to Magician Lite in the same way as the suction cup kit is installed. For details, please refer to 5.3.1 Installing a Suction Cup Kit. Figure 5.12 shows the effect of the gripper kit installation.
5.3.3 **Teaching & Playback Page**

The **Teaching & Playback** page is shown in Figure 5.13 when connect to Magic Box+Magician Lite. To access it, select **Connect > Teaching & Playback** on the DobotStudio page.

- You can switch mode between **Easy** and **Pro** modes, set loop, speed ratio, as shown in Figure 5.14.
Table 5.6  Set Easy/Pro, Loop, Speed ratio

<table>
<thead>
<tr>
<th>Items</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy/Pro</td>
<td>Click this slider to switch between <strong>Easy</strong> and <strong>Pro</strong> modes. The default is the <strong>Easy</strong> mode. Apart from all the functions in the <strong>Easy</strong> mode, the <strong>Pro</strong> mode offers multiple features such as the offline mode and multiplexed I/O interface.</td>
</tr>
<tr>
<td><strong>NOTE</strong></td>
<td>The <strong>Pro</strong> mode is only available when connecting Magic Box + Magician Lite.</td>
</tr>
<tr>
<td>Loop</td>
<td>Set the loop that the robotic arm plays back the recorded steps. Default value: 1. Value range: 1 - 999999</td>
</tr>
<tr>
<td>Speed</td>
<td>Set the speed ratio when doing playback. Default value: 50%. Value range: 0% - 100%</td>
</tr>
<tr>
<td>Exit</td>
<td>Exit the current <strong>Teaching &amp; Playback</strong> page to return to the <strong>DobotStudio</strong> page</td>
</tr>
</tbody>
</table>

- In both **Easy** and **Pro** modes, you can save points, set the motion mode and the pause time for a save point, as shown in Figure 5.15.

![Figure 5.15  Set the save points, motion modes and pause time](image)

Table 5.7  Set the save points, motion modes, and pause time

<table>
<thead>
<tr>
<th>Items</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>+Point</td>
<td>Click to create a new save point in the Save points list</td>
</tr>
<tr>
<td>Move mode</td>
<td>Choose a PTP (point to point) Point mode or ARC Point mode. In the PTP Point mode, you can select MOVJ, MOVL, or JUMP mode while the ARC Point mode requires a second point <strong>cirPoint</strong> and a finish point <strong>toPoint</strong> as well as the start point set via the PTP Point mode.</td>
</tr>
<tr>
<td>Pause time</td>
<td>Set the pause time for a saving point</td>
</tr>
</tbody>
</table>
• In both Easy and Pro modes, you can edit a highlighted save point such as copy, paste, cut, switch between motion modes, modify name and coordinates, as shown in Figure 5.16.

Figure 5.16 The Save points list

<table>
<thead>
<tr>
<th>Items</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A right-click mouse operation</td>
<td>In the right-click popup menu you can edit a highlighted save point such as copy, paste, cut, insert, and delete, as shown in Figure 5.16</td>
</tr>
<tr>
<td>A double-click mouse operation</td>
<td>Double-clicking a cell to modify its value</td>
</tr>
</tbody>
</table>

• Pro mode: To enter the Pro mode from the current Easy mode, click the Easy/Pro slider, as shown in Figure 5.17. Apart from all the functions in the default Easy mode, the Pro mode allows the robotic arm to run a save point each time, detect lost-steps, work in offline mode, and perform the multiplexed I/O interface. For details, refer to Table 5.9.
Figure 5.17  The Pro mode of the Teaching & Playback function

Table 5.9  The Pro mode of the Teaching & Playback function

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>StepRun</strong>: run a save point each time in the Save points list. Before clicking <strong>StepRun</strong>, please select a saved point</td>
</tr>
<tr>
<td>2</td>
<td><strong>Download</strong>: download the Save points list to Magician Lite or Magic Box for working in offline mode. For details, see 5.4 <em>Working in Offline Mode</em></td>
</tr>
</tbody>
</table>
| 3   | **Check Lost Step**: Magician Lite detects if lost-steps occur in its movements. The default threshold is 8°. Value range: 8°~15°. You can set the threshold by selecting **Setting > Playback > LostStepParam**  
If **Check Lost Step** is selected, the robotic arm detects if the stepper motors lose steps when moving. If unselected, no detection is performed  
If Magician Lite detects lost-steps, it stops working, and its LED indicator turns red. In this case, click **Home** to get a correct reference position |
| 4   | **Multiplexed I/O interface**: control Magician Lite via the I/O interfaces such as turning on or off the air pump |

### 5.3.4  ARC Motion Mode

**Application Scenarios**

The ARC motion mode requires three points in an arc to complete the arc movement process. In the ARC motion mode, only the second point and end point are saved while the start point is determined by the other modes.

**Prerequisites**

Magician Lite has been powered on and connected to your computer.
Notice

Note the following rules when saving points to prevent the robotic arm from working outside its normal workspace.

- Any two points cannot coincide.
- The three points cannot be in the same straight line.
- The arc trajectory cannot exceed the Magician Lite normal workspace.

For example, the points A, B, and C are on the arc. Point A is the start point; Point B is the second point; Point C is the endpoint, as shown in Figure 5.18.

![Figure 5.18 The arc trajectory](image)

Step 1  Click Teaching & Playback
The Teaching & Playback page is displayed.

Step 2  Save the start point A.
1. Select MOVJ motion mode in the Save Point area.
2. Click ![display operation panel](image) to display the Operation Panel, as shown in Figure 5.19.

![Figure 5.19 Display the Operation Panel](image)
3. Set the jogging speed percentage to **50** on the **Operation Panel**.

4. Jog Magician Lite in the Cartesian or Joint coordinate system to move the robotic arm to a location called position A.

5. Click **+Point** to save the coordinate corresponding to the position A, as shown in Figure 5.20.

![Figure 5.20 Save the start position A](image)

**Step 3** Save the second point B and the endpoint C.

1. Select **cirPoint** to save the second point in the Save Point area.

2. Jogging Magician Lite in the Cartesian or Joint coordinate system to move the robotic arm to the second position B as required.

3. Click **+Point** to save the coordinate corresponding to the position B. In this case, the DobotStudio automatically changes the motion mode to **toPoint** to get ready to save the end position.

4. Jogging Magician lite in the Cartesian or Joint coordinate system to move the robotic arm to the end position C as needed.

5. Click **+Point** to save the coordinates corresponding to the positions B and C, as shown in Figure 5.21.

![Figure 5.21 Save the second position B and the end position C](image)
Step 3  Set the percentage of speed for playback, such as 50.
Step 4  Set Loop to 2.
Step 5  Click Start. Magician Lite performs the sequence of ARC trajectory as taught from its memory system, moving from positions A through C, as shown in Figure 5.22.

![Figure 5.22: Move the small cube in the ARC motion mode](image)

### 5.3.5  Teaching & Playback Example

#### Application Scenarios

You can use the Teaching & Playback function module to manipulate Magician Lite to accomplish different tasks such as transportation or intelligent sort. This topic introduces how to move small cubes from position A to B in the JUMP motion mode.

#### Prerequisites

- Magician Lite has been powered on and connected to your computer.
- A suction cup kit has been installed. For details, see 5.3.1 Installing a Suction Cup Kit.

#### Procedure

Step 1  Choose SuctionCup as the end-effector on the DobotStudio page, as shown in Figure 5.23.
Step 2  Click Teaching & Playback.
The Teaching & Playback page is displayed.

Step 3  Save the start point A.
1. Put a small cube on the work surface near the suction cup kit.
2. Select the MOVJ motion mode in the Save Point area.
3. Click to display the Operation Panel, as shown in Figure 5.24.

4. Set the jogging speed percentage to 50 on the Operation Panel.
5. Jog Magician Lite in the Cartesian or Joint coordinate system to move the suction cup close enough to the small cube for picking-up. For example, the suction cup reaches this location called position A.

6. Select SuctionCup on the Operation Panel to turn on the air pump to pick up the small cube.

7. Set the PauseTime to 1 second in the Save Point area.

8. Click +Point to save the coordinate corresponding to the position A, as shown in Figure 5.26.
Step 4  Save the endpoint B.

1. Select the JUMP motion mode in the saving point area.

   **NOTE**

   To change the jogging speed percentage, drag the speed slider.

2. Set the lifting height (JumpHeight) and the maximum lifting height (Z Limit) by selecting Setting > Playback > JumpParam, as shown in Figure 5.27.

![Figure 5.27 Jump parameters](image)

3. Jogging Magician Lite in the Cartesian or Joint coordinate system to move the small cube to the end position B as required.

4. Unselect SuctionCup to turn off the air pump to release the small cube.

5. Click +Point to save the coordinate corresponding to the position B, as shown in Figure 5.28.
Step 5  Set the percentage of speed for playback, such as 50.

![Playback Setting](image)

**Figure 5.28** Save the end position B

**Figure 5.29** Set the speed ratio of the playback

**Table 5.10** Set the Playback

<table>
<thead>
<tr>
<th>Items</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SpeedRatioParam</td>
<td>Set speed ratio of Magician Lite and linear rail</td>
</tr>
<tr>
<td>JumpParam</td>
<td>Set the Jump height and Z limit, which are required in the JUMP motion mode</td>
</tr>
<tr>
<td>Handhold Teaching</td>
<td>Enable or disable handhold teaching. Automatically saves a point when releasing the unlock button or pressing this button</td>
</tr>
</tbody>
</table>
### 5.4 Working in Offline Mode

Magician Lite and Magic Box support offline mode, they download a saving list and perform it without keeping the USB connection. We will take Magic box as an example in this chapter.

#### Prerequisites
- Magic Box+Magician Lite has been powered on.
- Magic Box+Magician Lite has been connected to the DobotStudio.
- The points have been saved.

#### Procedure

**Step 1** Click the Easy/Pro slider to enter the Pro mode on the Teaching & Playback page.

**Step 2** Click Download.

The Question dialog box is displayed, asking if you want Magician Lite to automatically go back to its homing point before performing the save points in the offline mode, as shown in Figure 5.31.
Step 3  Click OK.

The Name dialog box is displayed, input the name of download save points, and click Download as shown in Figure 5.32.

Step 4  Disconnect the DobotStudio from Magic Box+Magician Lite or the USB cable between Magic Box and your computer.

Step 5  Find the download save points in the path PlayBack in Magic Box, click the OK button on Magic Box to perform downloaded save points

⚠️NOTICE
When connecting only Magician Lite, Save points are downloaded to Magician Lite, you have to disconnect the DobotStudio from Magician Lite or the USB cable between Magician Lite and your computer, and then press the button Key on the base of Magician Lite to perform the downloaded save points.

5.5 Writing and Drawing

Figure 5.33 shows the process of writing and drawing.

![Diagram](image)

Figure 5.33 The process of writing and draw

5.5.1 Installing a Writing and drawing kit

A writing and drawing kit consists of a pen and a pen holder. For detailed steps, see below.

**Step 1** Install a pen in the pen holder.

**Step 2** Insert the writing and drawing kit to the end of Magician Lite, hear a sound indicating that the writing and drawing kit is fixed and complete, as shown in Figure 5.34.
NOTE

- When using the pen for the first time, unscrew the suction tube inside the pen, and then replace it with the ink tube that came with the box. After replacement, keep the pen straight down for 2 minutes to use it. As shown in Figure 5.35.

Figure 5.35 Change ink-straw

- If you want to absorb ink, please remove pen-cap and rotate suction tube to absorb ink as shown in Figure 5.36.

Figure 5.36 Absorb ink
Step 3 Position a sheet of paper on the work surface within the workspace of Magician Lite.

5.5.2 Connecting the DobotStudio

Step 1 Launch the DobotStudio, and select device type and COM port (take Magician Lite as an example), and then click Connect as shown in Figure 5.37.

![Figure 5.37 Connect Magician Lite](image)

Step 2 Click Write & Draw, as shown in Figure 5.38.

![Figure 5.38 Click Write & Draw](image)

Step 3 Choose Pen as the end-effector on the Write & Draw page, as shown in Figure 5.39.
5.5.3 Importing Image Files and Setting Writing Parameters

When performing a write & draw task, a built-in or custom image file is required. Only a PLT or SVG image can be used. The built-in file is located in the directory `Installation Directory \DobotStudio\config\prefab\system\source`.

Prerequisites

A PLT or SVG image file has been created.

Procedure

Step 1 Click **Write & Draw** on the **DobotStudio** page, as shown in Figure 5.40.
Step 2 Import an image file using one of the following methods.

**NOTICE**

The imported image should be placed within the annular area on the **Write & Draw** page, as shown in Figure 5.41. If not, the robotic arm reaches its limited position and cannot draw or write. In this case, the image is highlighted with a red border, as shown in Figure 5.42.

- **Figure 5.41** The PLT or SVG image is located within the annular area

- **Figure 5.42** The PLT or SVG image is located outside the annular area

- **Click** **Open** on the **Write & Draw** page to import a built-in PLT or SVG image file from the DobotStudio installation directory `InstallationDirectory\DobotStudio\config\prefab\system\source`, as shown in Figure 5.43. You can also import your custom PLT or SVG image file.
Figure 5.43  Open a PLT or SVG system image file
- Click a shape in the **Input Shapes** area, as shown in Figure 5.44.

![Figure 5.44 Insert a system image file](image)

- Click **Input Texts** on the **Write & Draw** page to input texts, and set its style, and then click **OK** to display the text on the annular area, as shown in Figure 5.45.

![Figure 5.45 Input text](image)

- Click **Open** to import an image file such as BMP, JPEG, or PNG to convert this image to its corresponding SVG file that the DobotStudio supports, as shown in Figure 5.46. Once this image is imported, the **SVG Converter** dialog box is displayed, as shown in Figure 5.47. In this dialog box, drag the slider to set the black and white threshold, and click **Convert Bitmap To SVG** to perform the conversion, and then click **Plot to Main Scene** to display the converted SVG file on the annular area of the **Write & Draw** page.
Figure 5.46 Import an image

![Image](Image.png)

Figure 5.47 Convert an image to SVG

**NOTICE**

After image is converted to SVG, if there are single colors and fewer lines in the image, you need to adjust threshold, otherwise, the image can not be uploaded to DobotStudio.

![Image](Image.png)

Figure 5.48 Error tip
Step 3  Set the writing parameters.

1. Click **Setting** on the **Write & Draw** page, as shown in Figure 5.49.

![Figure 5.49 Click Setting](image)

2. Click **Write & Draw** to set **ArmSpeedRatio** (%), **PenUpOffset** (mm), **PenDown** (mm), as shown in Figure 5.50.

![Figure 5.50 Setting the parameters of the Write & Draw function](image)

5.5.4 Adjust the Position of the Pen Nib

Procedure

**Step 1**  Raise and lower the position of the pen nib.

Press and hold the unlock button on the Forearm to move Magician Lite to raise and
lower the pen nib until it slightly squeezes the paper. You can also jog the robotic arm in the Cartesian or Joint coordinate system to slowly pull the Z axis down to a suitable vertical position for writing, as shown in Figure 5.51.

![Figure 5.51 Adjust the position of the pen nib](image)

**NOTE**

The point marked by a red box, as shown in Figure 5.52, corresponds to the position of the writing and drawing kit of Magician Lite. This point changes its position only within the annular area when the robotic arm moves.

![Figure 5.52 The point corresponding to the laser kit of the robotic arm](image)

**Step 2**  
Click **AutoZ** on the **Write & Draw** page to obtain and save the current value of the Z axis.
Once this step is complete, the next time you start to write, directly import a PLT or SVG image file without adjusting the position of the pen nib, and click **SyncPos**, and then click **Start** to start writing on the paper, as shown in Figure 5.53.

![Figure 5.53 Lock the height of writing](image)

**NOTE**

The value of the Z axis is the **PenDown** parameter. This parameter can be set by selecting **Setting > Write Draw > PenDown** on the **Write & Draw** page, as shown in Figure 5.54. If the effect of writing is not satisfactory, slightly raise and lower the height of the writing and drawing kit or directly change the value of **PenDown**.

![Figure 5.54 The PenDown parameter](image)

**Step 3**  Click **SyncPos**.

Magician Lite automatically moves above the position (**PenDown**) of the start point.
5.6 Operating Blockly

Blockly is a programming platform for Magician Lite based on Google Blockly. You can program through the puzzle format, which is straightforward and easy to understand.

Prerequisites

- Magic Box + Magician Lite has been powered on.
- Magic Box + Magician Lite has been connected to DobotStudio successfully.

Procedure

Step 1  Click Blockly on the DobotStudio page.

The Blockly page is displayed.

Step 2  Drag the blockly module on the left pane of the Blockly page to program, as shown in Figure 5.55.

Table 5.11 lists the description of blockly module.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The selection area of blockly module, including logistic, loop, math, and Dobot API. You can program by dragging them to the window</td>
</tr>
<tr>
<td>2</td>
<td>The window of blockly programming</td>
</tr>
</tbody>
</table>
The demo in Figure 5.55 is described as follows.

1. Set the end-effector as **Gripper**.
2. Set the loop number as 3 and make the Z-axis move back and forth 3 times.
3. Set the pause time as 3.

**Step 3** Click **Save** on the **Blockly** page.

The Saving Blockly file page is displayed.

**Step 4** Input the user-defined name and the saving path, and click **Save**. The default path of the programming file is `Installation directory/DobotStudio/config/bystore`. Please replace the path based on site requirements.

**Step 5** Click **Start** on the **Blockly** page, and Magician Lite will move according to the program.

**NOTE**

You can also click **Download** to download Blockly file to Magic Box to perform in offline mode, for the details, please refer to 5.4 Working in Offline Mode.

### 5.7 Scripting

You can control Magician Lite over scripting. Magic Box supports various API, such as velocity setting, motion mode setting, and I/O configuration, which can be called by users during secondary development.


**Prerequisites**

- Magic Box + Magician Lite has been powered on.
- Magic Box + Magician Lite has been connected to DobotStudio successfully.

**Procedure**

**Step 1** Click **Script** on the **DobotStudio** page.

The **Script** page is displayed.

**Step 2** Write a script.

You can call the interface by double-clicking on the left pane of the **Script** page, the corresponding interface will be displayed on the middle pane, as shown in Figure 5.56. You can also click ![icon](https://www.dobot.cc/downloadcenter/dobot-magician-lite.html?sub_cat=187#sub-download) icon on the corresponding interface to view the way
how to set the parameters. The scripting examples (including Jog, PTP) can refer to
Installation directory/DobotStudio/config/ststore/.

Figure 5.56  Write a script

**Step 3**  
Click **Save** on the **Script** page.  
The Saving Script File page is displayed.

**Step 4**  
Input the user-defined name and the saving path, and click **Save**.  
The default path of the script is **Installation directory/DobotStudio/config/ststore**.  
Please replace the path based on site requirements.

**Step 5**  
Click **Start**, and Magician Lite will move according to the script file.  
The running log will be displayed on the lower pane of the **Script** page for checking.