UFACTORY

UFACTORY xARM

XARM VACUUM GRIPPER USER MANUAL

SHENZHEN UFACTORY CO., LTD

V.1.6.1

Table

1. General Presentation

1. 1. xArm Vacuum Gripper Introduction
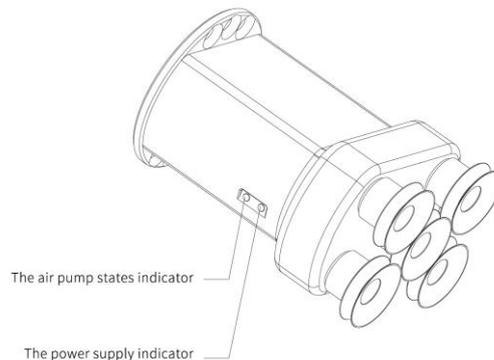
The vacuum gripper is ideal for picking up even workpieces less than 5 Kg. The vacuum gripper is equipped with 5 suction cups, which can be partially selected for use according to the size of the object surface, and the unused suction cup needs to be sealed.

Note:

If the surface of the object is not smooth, there will be air leakage from the suction cup which makes the object fail to be picked up firmly.

Indicator status: When the vacuum gripper is powered on, the power supply indicator near the vacuum gripper is constantly red. When the vacuum gripper is on, the IO status indicator is constantly green.

1.2. **Setup and Control**

The vacuum gripper is powered and controlled directly via a single connection cable that carries a 24V DC supply and IO control.

1.3. **Safety**

Warning

The operator must have read and understood all of the instructions in the following manual before handling the xArm Vacuum Gripper.

Caution

The term "operator" refers to anyone responsible for any of the following operations on the vacuum gripper:

- Installation
- Control
- Maintenance
- Inspection
- Calibration
- Programming
- Decommissioning

This documentation explains the various components of the vacuum gripper and general operations regarding the whole life-cycle of the product from installation to operation and decommissioning.

The drawings and photos in this documentation are representative examples and differences may exist between them and the delivered product.

1.3.1. Warning

Caution

Any use of the vacuum gripper in noncompliance of these warnings is inappropriate and may cause injury or damage.

Warning

● The vacuum gripper needs to be properly secured before operating the robot.

● Do not install or operate a vacuum gripper that is damaged or lacking parts.

● Never supply the vacuum gripper with an alternative current (AC) source.

● Make sure all cord sets are always secured at both ends,vacuum gripper end & robot end

● Always satisfy the recommended keying for electrical connections.

● Be sure no one is in the robot and/or vacuum gripper path before initializing the robot's routine.

● Always satisfy the vacuum gripper payload.

● Do not use the vacuum gripper on people or animals.

1.3.2.   **Risk Assessment and Final Application**

The vacuum gripper is meant to be used on an industrial robot. The robot, vacuum gripper and any other equipment used in the final application must be evaluated with a risk assessment. The robot integrator must ensure that all local safety measures and regulations are respected. Depending on the application, there may be risks that need additional protection/safety measures, for example, the work-piece the vacuum gripper is manipulating may be inherently dangerous to the operator.

1.3.3.   **Intended Use**

The vacuum gripper is designed for grasping and temporarily securing or holding objects.

Caution

The vacuum gripper is NOT intended for applying force against objects or surfaces.

The product is intended for installation on a robot or other automated machinery and equipment.

Info

Always comply with local and/or national laws, regulations and directives on automation safety and general machine safety.

The unit may be used only within the range of its technical data. Any

other use of the product is deemed improper and unintended use.

UFACTORY will not be liable for any damages resulting from any

improper or unintended use.

2. Installation

The following subsections will guide you through the installation and general setup of xArm Vacuum Gripper.

(1) The Scope of Delivery Section

(2) The Mechanical Installation Section

(3) The Electrical Setup Section

Warning

Before installing:

Read and understand the safety instructions related to the xArm Vacuum Gripper.

Verify your package according to the Scope of delivery and your order info.

Have the required parts, equipment and tools listed in the requirements readily available.

Installing:

Satisfy the environmental conditions.

Do not operate the xArm Vacuum Gripper, or even turn on the power supply, before it is firmly anchored and the danger zone is cleared.

2.1. Scope of Delivery

2.1.1. General Kit

A Vacuum Gripper Kit generally includes these items:

xArm vacuum gripper

Cross countersunk head screws M6*8 (2)

M5 sealing plugs (5)

DP-6 suction cup (5)

DP-15 suction cup (5)

DP-30 suction cup (5)

DP-30 Suction Cup (5)   DP-15 Suction Cup (5)

DP-6 Suction Cup (5)   M5 Sealing plugs (5)

Vacuum Gripper   Cross Screws Head Screws M6*8 (2)
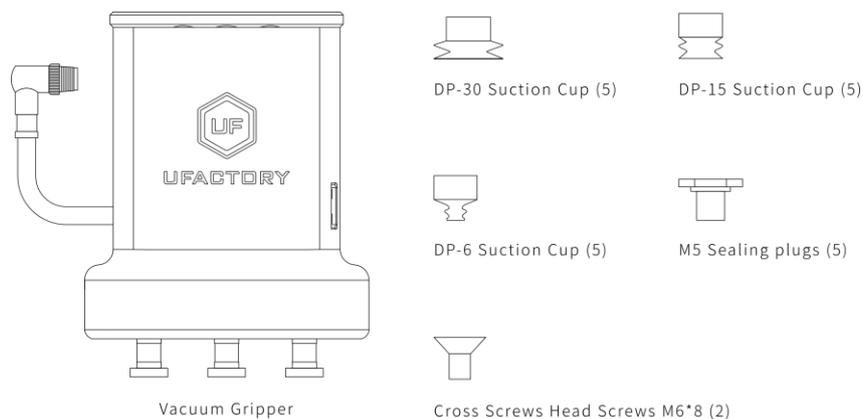
2.2. Mechanical Installation

xArm Vacuum Gripper installation steps:

1. Move the robotic arm to a safe position. Avoid collision with the robotic arm mounting surface or other equipment;

2. Power off the robotic arm by pressing the emergency stop button on the control box;

3. Fix the vacuum gripper on the end of the robotic arm with 2 M6 bolts;

4. Connect the robotic arm and the vacuum gripper with the vacuum gripper connection cable.

The End of the xArm

Cross Countersunk Head Screws M6*8

xArm Vacuum Gripper

Vacuum Gripper Connection Cable
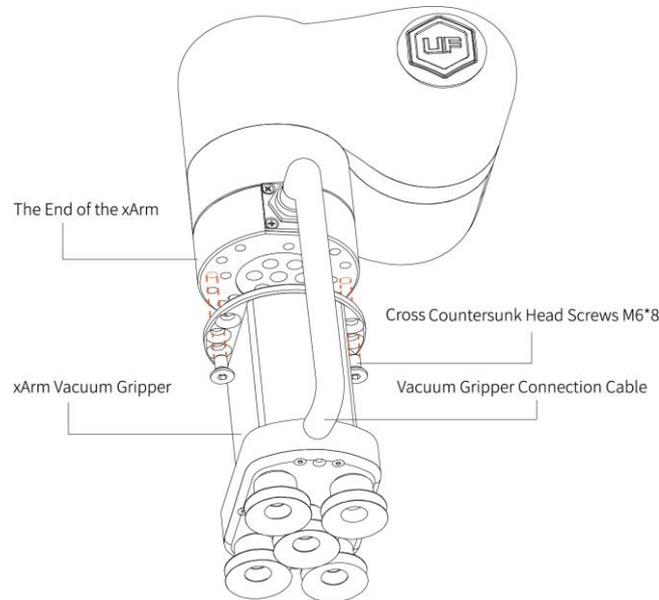
Note:

1. When turning on the vacuum gripper connection cable, be sure to power off the robotic arm, to set the emergency stop button in the pressed state, and to ensure that power indicator of the robotic arm is off, as to avoid robotic arm failure caused by hot-plugging;

2. Due to the length limitation of the vacuum gripper connection cable, the vacuum gripper interface and the tool IO interface must be in the same direction;

3. When connecting the vacuum gripper and the robotic arm, be sure to align the positioning holes on the two ends of the interface. The male pins of the connecting cable are relatively thin to avoid bending the male pins during disassembly.

2.3. Electrical Setup

Power and communication are established with the xArm Vacuum Gripper via a single vacuum gripper connection cable. The vacuum gripper connection cable provides a 24V power supply to the xArm Vacuum Gripper and enables IO communication to the robot control box.

Warning

Power must be off before connecting the xArm Vacuum Gripper and the robotic arm via the vacuum gripper connection cable.

2.3.1. Pinout Interface

The xArm Vacuum Gripper is connected to the tool end of the robotic arm via a 12 pin connector.
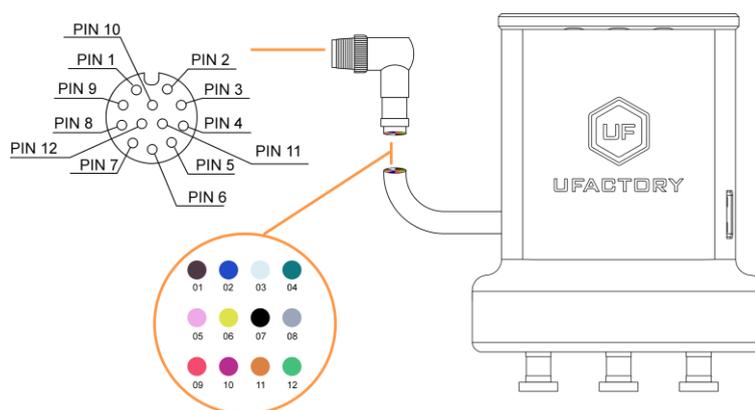
Pin sequence	Function

1	24V
2	24V
3	GND
4	GND
5	485-A(no use)
6	485-B(no use)
7	Digital Input 0
8	Digital Input 1
9	Digital Output 0
10	Digital Output 1(no use)
11	No Connect(no use)
12	No Connect(no use)

3.   Control

3.1. Use xArm Studio to Control xArm Vacuum Gripper

1. Set up xArm Vacuum Gripper

● Enter [Settings]-[End Effector]

Select the end effector: xArm Vacuum Gripper
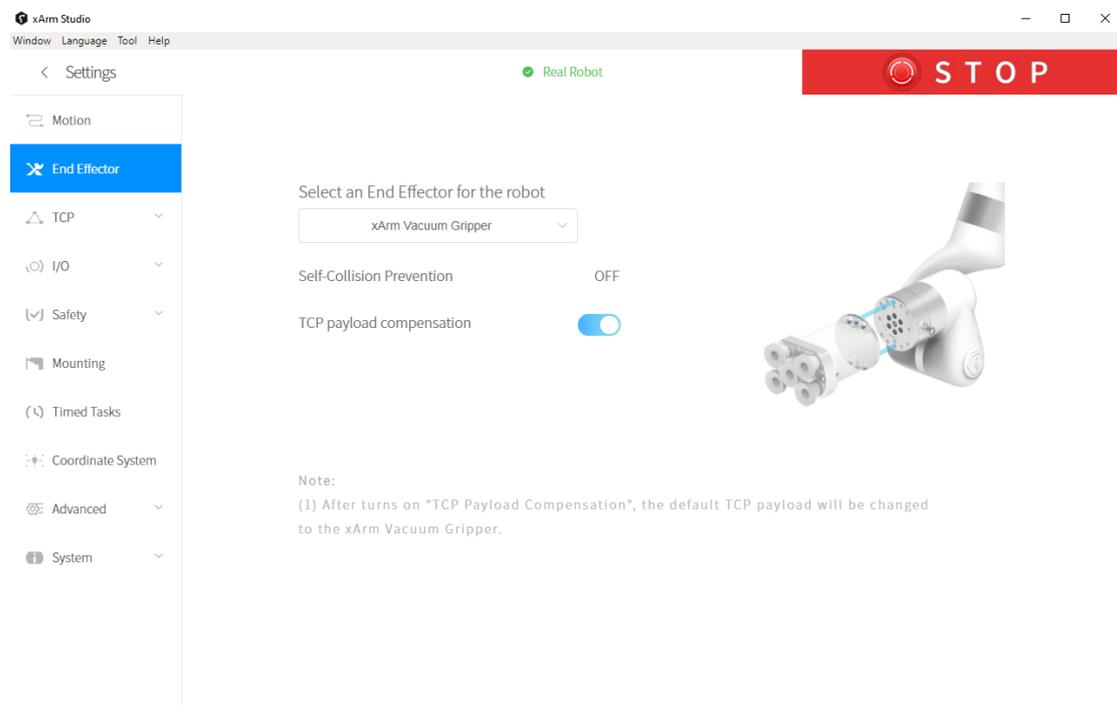
1. The self-collision prevention model of the vacuum gripper can be turned on by clicking the button.

2. When "TCP payload compensation" is turned on, the default TCP payload will be changed to the TCP payload parameter of the vacuum gripper.

2. Control xArm Vacuum Gripper

- Control the vacuum gripper in the live control

Control Method:

1) By clicking the [Open]/[Close] button, you can control the opening and closing of

the vacuum gripper.
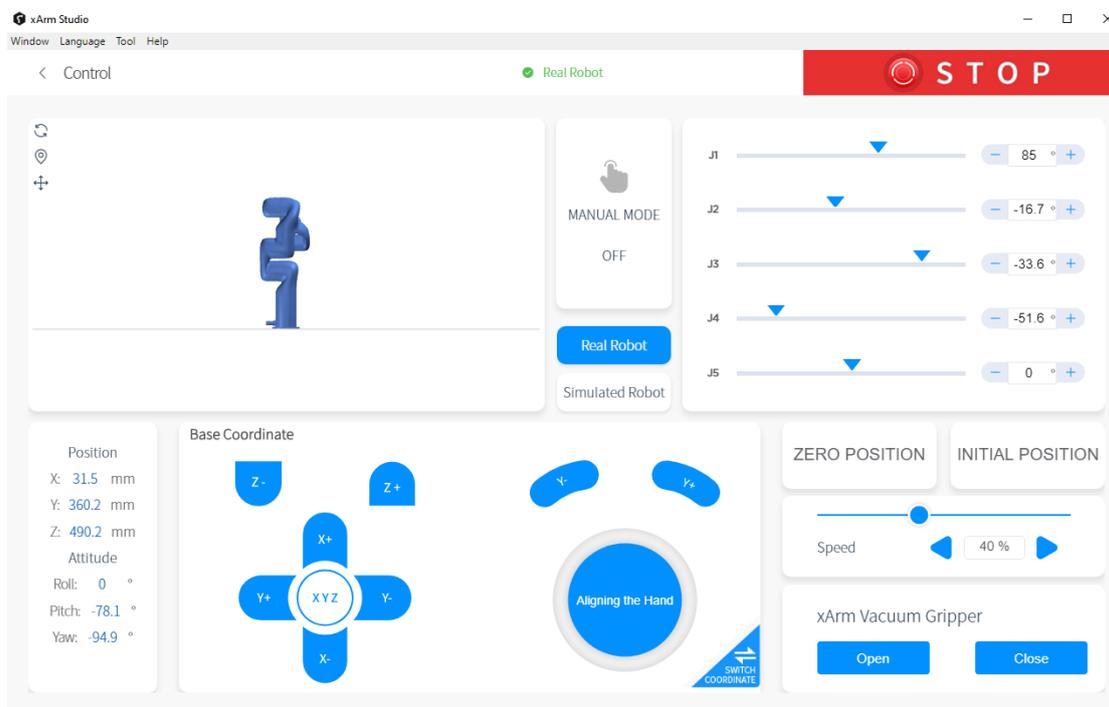
- Control the vacuum gripper through Blockly

xArm Vacuum Gripper.Blockly
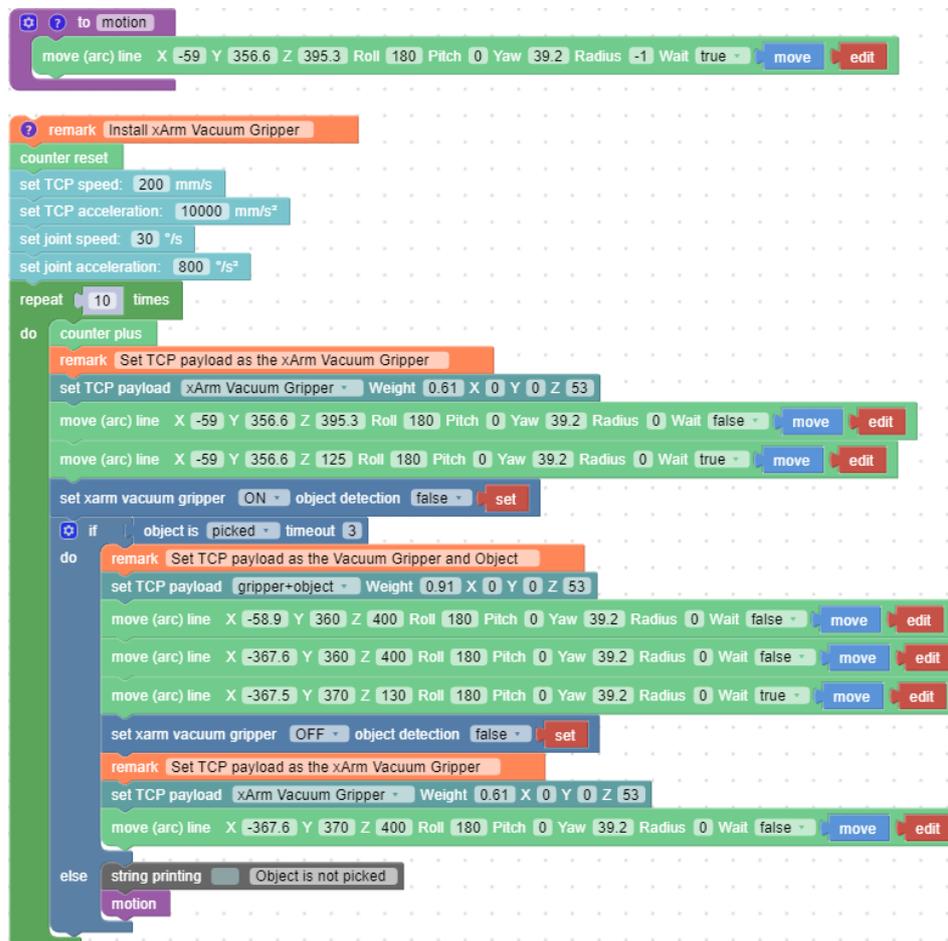
The role of this program: execute this program to control the vacuum gripper to suck the target object at the specified position, and then place the target object at the target position.

Note:

1) When the vacuum gripper is installed on the robotic arm, the TCP Payload of the vacuum gripper should be set in the Blockly program. When the total weight of the vacuum gripper changes after the object is sucked, a new TCP Payload needs to be set.

3.2. Use Python-SDK to Control xArm Vacuum Gripper

The interface of controling vacuum gripper：

```
arm.set_vacuum_gripper(True, wait=False)      #open the vacuum gripper
```

```
arm.set_vacuum_gripper(False, wait=False)     #close the vacuum gripper
```

The download link of the Python-SDK:

https://github.com/xArm-Developer/xArm-Python-SDK

3.3. Use ROS-SDK to Control xArm Vacuum Gripper

Please refer to Section 5.7.8 in the ReadMe file attached to the ROS package to control the vacuum gripper.

xArm ROS-SDK link :

https://github.com/xArm-Developer/xarm_ros

3.4. Use Modbus-TCP Communication Protocol to Control   xArm Vacuum Gripper

This section mainly explains how to control the xArm Vacuum Gripper by using the Modbus-TCP protocol through xArm control box.

3.4.1.   **Modbus-TCP Communication Format**

Modbus-TCP:

Modbus protocol is an application layer message transmission protocol, including three message types: ASCII, RTU, and TCP. The standard Modbus protocol physical layer interface includes RS232, RS422, RS485 and Ethernet interfaces, and adopts master / slave communication.

Modbus TCP Communication Process:

1. Establish a TCP connection

2. Prepare Modbus messages

3. Use the send command to send a message

4. Waiting for a response under the same connection

5. Use the recv command to read the message and complete a data exchange

6. When the communication task ends, close the TCP connection

Parameter:

　　Default TCP Port: 502　　Protocol: 0x00 0x02

On the problem of users using communication protocols to organize data in big endian and little endian:

In this article, data analysis is big-endian analysis.

3.4.2. Control of the xArm Vacuum Gripper

● **Open/Close the vacuum gripper**

Open the Vacuum Gripper	00 01 00 02 00 08 7F 09 0A 15 00 80 80 43
	00 01 00 02 00 08 7F 09 0A 15 00 00 00 44
Close the Vacuum Gripper	00 01 00 02 00 08 7F 09 0A 15 00 00 80 43
	00 01 00 02 00 08 7F 09 0A 15 00 80 00 44

Please refer to the table below for specific parameters.

IO control on the End-effector				
Register: 127 (0x7F)				
Request				
Modbus TCP Header	Transaction Identifier	2 Bytes	u16	0x00,0x01
	Protocol	2 Bytes	u16	0x00,0x02
	Length	2 Bytes	u16	0x00,0x08
	Register	1 Byte	u8	0x7F
Parameters	Host ID	1 Byte	u8	0x09
	Address	2 Bytes	u16	0x0A,0x15
	Parameters1(Open 0) Data: 256.0: Close 0 257.0: Open 0 512.0: Close 1 514.0: Open 1	4 Bytes	fp32	0x00,0x80,0x80,0x43
Response				
Modbus TCP Header	Transaction Identifier	2 Bytes	u16	0x00,0x01
	Protocol	2 Bytes	u16	0x00,0x02
	Length	2 Bytes	u16	0x00,0x02
	Register	1 Byte	u8	0x7F
Parameters	State	1 Byte	u8	0x00

● **Get the status of the vacuum gripper**

The steps to obtain the vacuum gripper status are shown in the following

table:

Get Status (Request Commands)	00 01 00 02 00 04 80 09 0A 14
Get Status (Response Commands) (The vacuum gripper picked up the object)	00 01 00 02 00 06 80 00 00 00 00 01
Get Status (Response Commands) (The vacuum gripper does not pick up the object)	00 01 00 02 00 06 80 00 00 00 00 00

Please refer to the table below for specific parameters.

Get the input of the end digital quantity				
Register: 128 (0x80)				
Request				
Modbus TCP Header	Transaction Identifier	2	u16	0x00,0x01
	Protocol	2	u16	0x00,0x02
	Length	2	u16	0x00,0x04
	Register	1 Byte	u8	0x80
Parameters	Host ID	1 Byte	u8	0x09
	Address	2	u16	0x0A, 0x14
Response				
Modbus TCP Header	Transaction Identifier	2	u16	0x00,0x01
	Protocol	2	u16	0x00,0x02
	Length	2	u16	0x00,0x06
	Register	1 Byte	u8	0x80
Parameters	State	1 Byte	u8	0x00
	Parameters1 (0) The end byte indicates the input status. The digit of 0 corresponds to input 0 and the digit of 1 corresponds to input 1.	4 Bytes	u8*4	0x00,0x00,0x00,0x00

4. xArm Vacuum Gripper Technical Specifications

Vacuum Gripper	
Rated Supply Voltage	24V DC
Absolute Maximum Supply Voltage	28V DC
Quiescent Current(mA)	30mA
Peak Current(mA)	400mA
Vacuum	78%
Vacuum Flow (L/min)	> 5.6L/min
Weight (g)	610 g
Dimensions (L*W*H)	122.5 * 91.6 * 75mm
Payload (kg)	≤5kg
Noise Level (30cm away)	< 60dB
Communication Mode	Digital IO
State Indicator	Power, Working State
Feedback	Air Pressure (Low or Normal)

5.　**After-sales Service**

1. After-sales policy:

For the detailed after-sales policy of the product, see the official website:

https://store-ufactory-cc.myshopify.com/pages/warranty-returns

1.　The general process of after-sales service is:

(1) Contact UFACTORY technical support (support@ufactory.cc) to confirm whether

the product needs to repair and which part should be sent back to UFACTORY.

(2) After the bill of lading on UPS, we will send the invoice and label to you by mail.

You need to make an appointment with the local UPS and then send the product to

us.

(3) UFACTORY　will check the product warranty status according to the after-sales

policy.

(4) Generally, the process takes around 1-2 weeks except for shipment.

Note:

1. Please keep the original packaging materials of the product. When you need to

send the product back to get repaired, please pack the product with the original

box to protect the product during the transportation.