DH-ROBOTICS

Product Operation Manual

Rotating Electric Gripper
RGI Series

This document is the operation manual for the RGI series product, applicable to the following models:

Applicable models	Maximum clamping force	Stroke
RGI-100-14	100 N	14 mm
RGI-100-22	100 N	22 mm
RGI-100-30	100 N	30 mm
RGIC-100-35	100 N	35 mm
RGI-35-14	35 N	14 mm
RGI-35-12	35 N	12 mm
RGIC-35-12	35 N	12 mm

| Catalog |

1. Overview of gripper

RGI series are servo-rotating parallel electric grippers, and the number represents the maximum opening and closing stroke of the grippers. The grippers are equipped with a pair of parallel fingertips that run symmetrically during movement and can be rotated infinitely according to demand. The main structure of the grippers is a smooth rectangular structure with 4 mounting holes to meet the different installation conditions of the equipment. It is also equipped with an 8-core communication interface. And has the following characteristics:

Controllable force position, speed and angle: The clamping grippers can be programmed to adjust the **clamping position, clamping force value, operating speed** and **rotation angle,** and can **be combined in any combination.**

Multiple communication modes: The gripper is controlled by the standard **modbus-RTU** protocol and **IO mode**. Other communication protocols such as USB, EtherCAT, CAN, TCP/IP, etc. can be transferred through protocol converters.

Clamping judgment: The clamping process is a combination of force control and position control.

Clamping feedback: The status of the grippers can be read by programming or judged by the indicator on the gripper body.

ingertip can be customized: the fingertips' can be replaced according to the real-time situation, suitable for precision machining, parts assembly and other fields.

The clamping gripper can be connected to the mainstream robots and industrial controllers PLC and IPC on the market, with built-in drives, and can control the clamping grippers by simply wiring them in use. Can be used in the following scenarios but not limited to:

Clamping gripper application scenario

- ✓ Loading and unloading of machine tools;
- ✓ Workpiece gripping and handling;
- ✓ Package gripping;
- ✓ Laboratory pipetting;
- ✓ New retail industry;
- ✓ Teaching and research;
- ✓ ……

1.1 Definition of indicator light

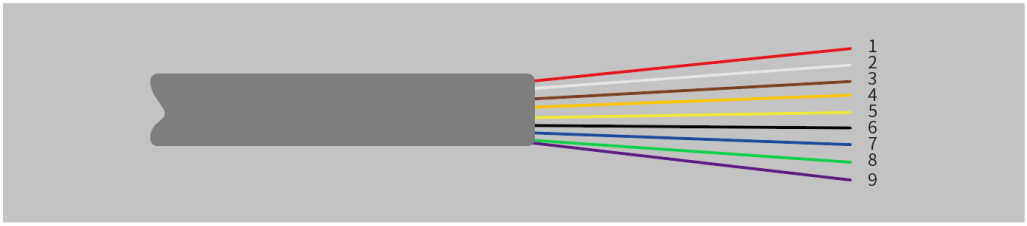
The gripper provide real-time feedback on the status of the gripper, which can be read by command or judged by the color of the indicator. There are two indicators on the RGI, indicating the clamping status and the rotation status, respectively:

Indicator light color description

- **Uninitialized state:** red light blinks, other lights are not lit.
- **Initialization completion status:** The blue light is always on, indicating that it is in an operable state.
- **Command status received:** The blue light blinks once, indicating that the command is being executed.
- **Clamped object status:** green light is always on, other lights are not on.
- **Object drop status:** Green light flashes.

1.2 Line sequence definition

The definition of the line sequence on the gripper, as shown in Figure 1.1



Serial Number	Cable Line	Definition	Description
1	Red	24V	Power supply 24V DC positive
2	White	INPUT1	IO mode digital input 1
3	Brown	INPUT2	IO mode digital input 2
4	Orange	OUTPUTI	IO mode digital output 1
5	Yellow	OUTPUT2	IO mode digital output 2
6	Black	GND	Power supply DC negative
7	Blue	485_B	T/R+ Communication line positive, T/R+
8	Green	485_A	T/R- Communication line negative, T/R-
9	Braided thread	PGND	rotect Ground

Fig. 1.1 Cable line marking diagram

Note: Please distinguish the line sequence according to the line label, if the line label is lost, off, forgotten, etc., please contact our staff, with the determination of the line sequence. If you do not contact our staff, due to the wrong line sequence, resulting in damage to the grippers, the consequences will be self-responsible.

2. Modbus-RTU control

The gripper command is controlled by the standard Modbus-RTU . Please refer to **2.3.1 Command Format** for some descriptions of Modbus-RTU commands (Modbus-RTU is the standard communication format on the market, widely used in industry, please refer to the web for detailed format); please refer to **2.1.1 Debugging Software Installation and Wiring** for specific wiring methods; please refer to **2.3.3 Detailed explanation of the commands** for specific communication register address description.

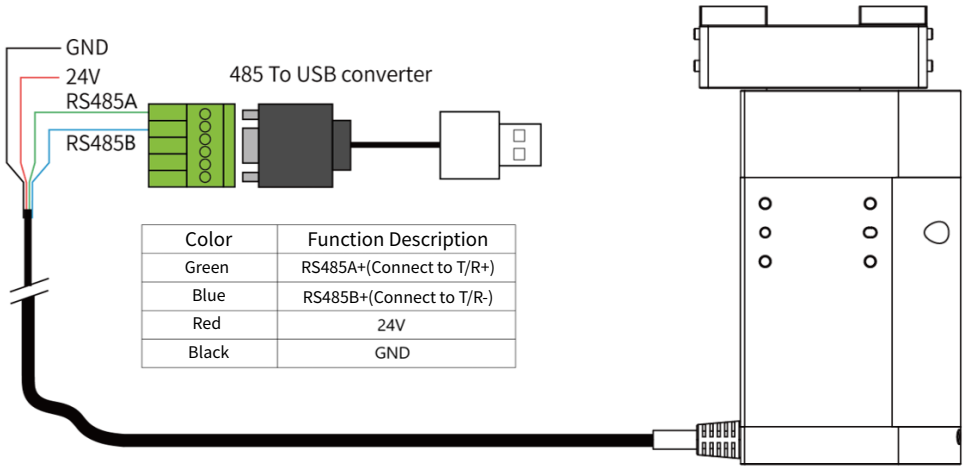
2.1 RS485 debugging software description

The debugging software is specially designed for controlling and setting debugging parameters of the clamping grippers on the computer side. As the computer side generally does not have RS485 interface, it is necessary to use the USB to 485 module to convert the interface to USB interface, so that the grippers can be easily debugged and controlled on the computer side.

2.1.1 Debugging software installation and wiring

The connection is made through the debugging software, which is essentially controlled through the RS485 interface. The specific connection needs to connect **24V, GND, 485_A(T/R+,485+) , 485_B(T/R-,485-)** at the gripper end for a total of 4 wires, the power supply is 24V DC regulated power supply, and the USB socket of the module is plugged into the USB port of the computer. **Wiring definitions are different for different series, please follow the instructions of the specific grippers for wiring,** as follows:

485A access 485 to USB module T/R+.
485B access 485 to USB Module T/R-.
24V access the positive terminal of 24V DC regulated power supply.
GND access the negative terminal of 24V DC regulated power supply



Color	Function Description
Green	RS485A+(Connect to T/R+)
Blue	RS485B+(Connect to T/R-)
Red	24V
Black	GND

Figure 2.1 Diagram of RS485 connection method

Wiring instructions

① When the device (computer) has RS485 interface, the communication can be directly connected to RS485+ and RS485- communication cable instead of through USB to 485 module
② Through this way of wiring, you can use other serial debugging software (such as Modbus Poll, etc.) for debugging

The software can be downloaded from the official website, and the software **installation process ntegrates software and drivers,** both of which are installed together.
It is recommended to check the **Create shortcut box during** the installation process.

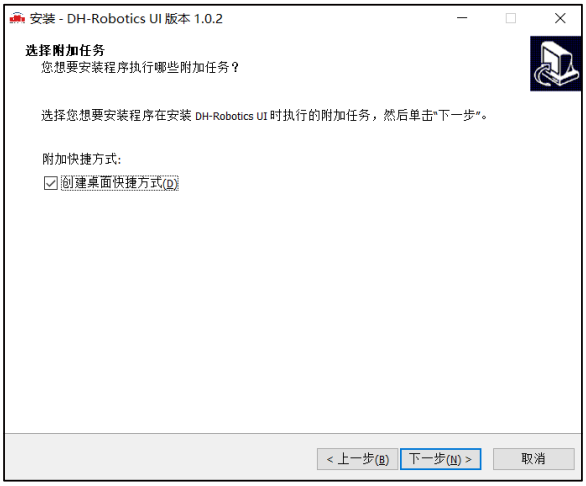


Figure 2.2(a) Software installation interface

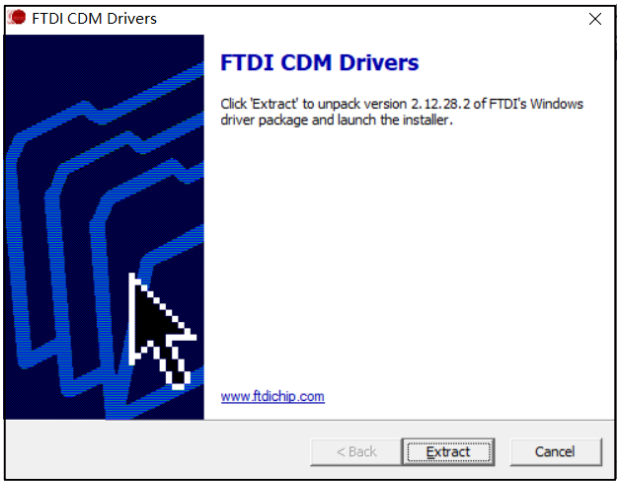


Figure 2.2(b) Driver installation interface

2.1.2 Instructions for using the debugging software

Before use, you need to follow the instructions **(see 2.1.1 Debugging Software Installation and Wiring)** to connect the corresponding wiring.

Open the software, the software will automatically identify the serial port, automatically identify the baud rate of the clamp claw, ID number and other information for automatic connection. The following figure shows:

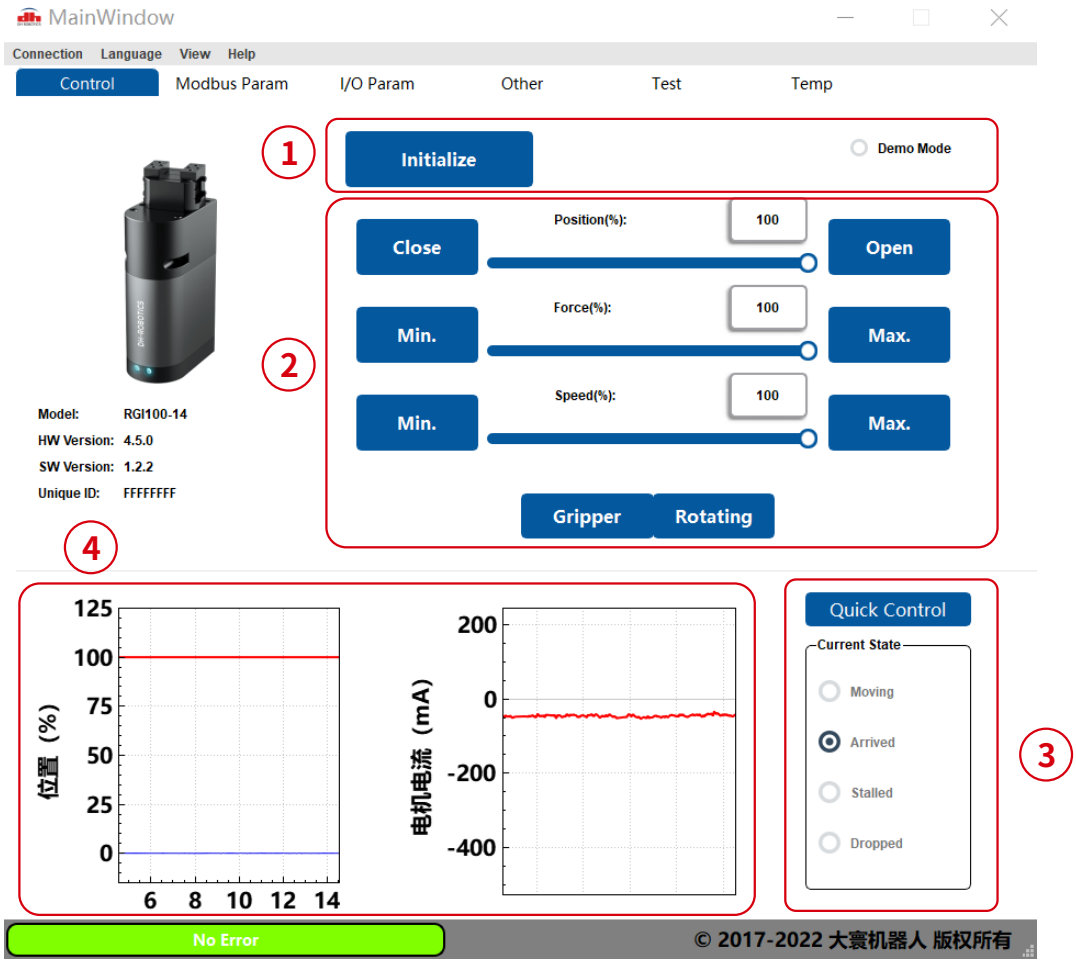


Figure 2.3 Main control interface

Specific interface descriptions are shown below:

Interface Description

① **Initialization and demonstration mode:** The gripper need to be initialized for zero calibration before operation, and the demonstration mode is a cyclic program.
② **Control interface:** You can control the position, force value and speed.
③ **Current status:** real-time display of the clamping status of the gripper.
④ **Real-time graph of position and current:** Real-time display of position and current. The current indicates the current of the internal motor, not the actual current consumed by the clamping grippers. The current real-time graph can reflect the stability of clamping force.
⑤ **Parameter setting:** you can configure parameters for modbus-RTU, such as baud rate, parity bits, etc.; IO mode is to configure parameters related to IO mode;

The clamping gripper body uses Modbus-RTU for communication, and can read and write data to the internal register, and can read and write data to the clamping gripper data at View-[Register], including control, feedback, user parameters, etc.

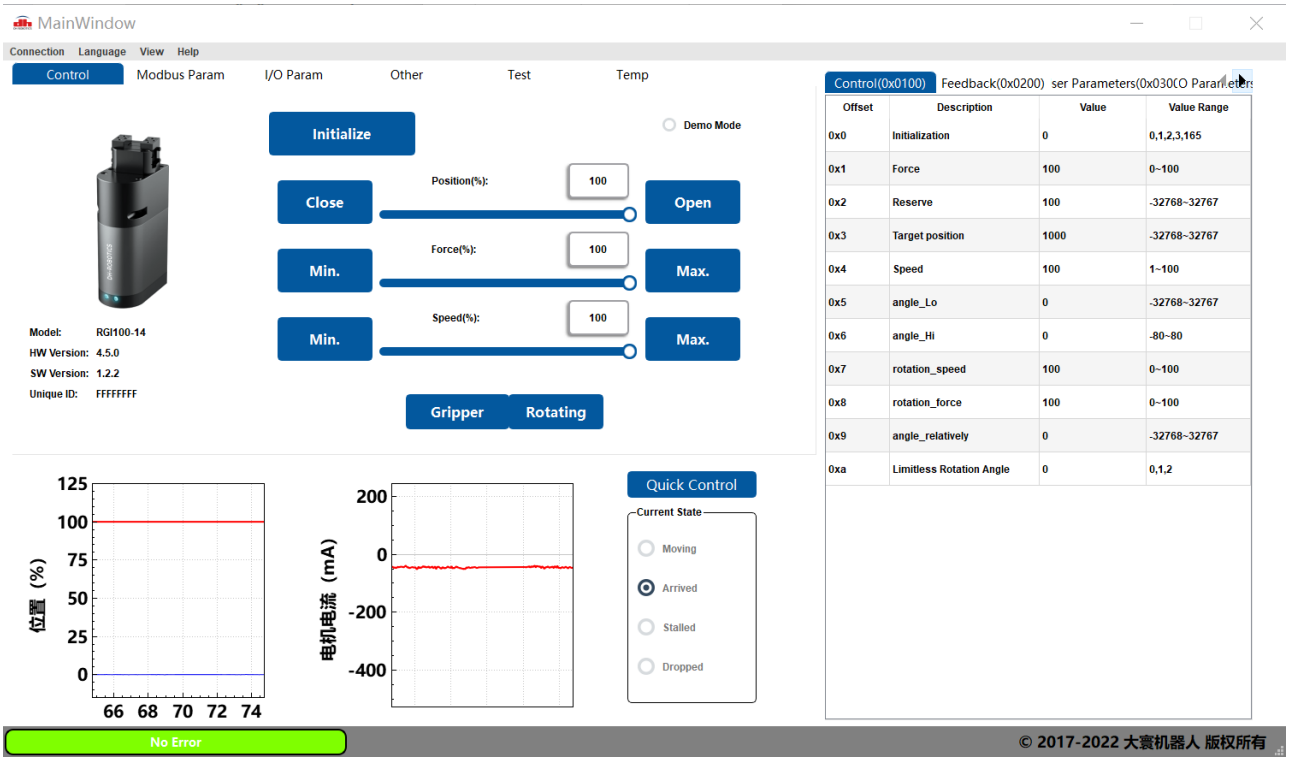


Figure 2.4 Register Control

You can set and configure the clamping gripper I/O parameters at [I/O Parameters], **and when the parameters are modified, please note that you can save them by clicking the Save button.**
The following figure shows the operation of opening IO mode:

Figure 2.5 Open IO mode

The steps for switching IO are shown below:

Switching IO mode steps

① **Open IO mode:** Open IO mode first.
② **Configuration of 4 groups of IO parameters:** 4 groups of parameters for the gripper, including position and force setting
③ **Save:** Click the Save button to write the parameters to the internal Flash registers, and reboot to control.
④ **Restart:** After restart, the gripper will be initialized automatically and the status light will change to blue. That is, the switch to IO mode is successful, you can control the grippers according to the INPUT signal, and the operation status will be fed back through OUTPUT.

Attention

① IO mode and 485 mode control are in conflict.
② In this software, after the gripper open IO mode, the 485 mode is restricted, and it is not possible to operate and control the grippers in the software.
③ IO mode is turned on without affecting the 485 communication function
④ IO and 485 communication, can be controlled at the same time, following the principle of **'first send first response, second send later response'**

2.2 RS485 default configuration

Clamp gripper ID: 1
Baud rate: 115200
Data bits: 8
Stop bit: 1
Checksum bit: No checksum bit

2.3 Instruction Description

2.3.1 Command Format

The grippers use the standard **Modbus-RTU protocol** and support 03, 04, 06 and 10 function codes.

When the grippers are controlled, the 03 and 06 function codes are generally used to read and control the grippers. 03 function code and 06 function code are read and write single registers, and the control nstruction consists of five parts: address code (1 byte), function code (1 byte), start address (2 bytes), data (2 bytes), and check code (2 bytes). Let's take the initialization instruction 01 06 01 00 00 01 49 F6 as an example, as shown in Table 2.1.

Address Code	Function Code	Register Address	Register Data	CRC Checksum
01	06	01 00	00 01	49 F6

Table 2.1 Command Format

Address code: indicates the ID number of the gripper. It can be modified in the device ID, the default is 1. 01 means the modbus ID of the gripper is 01.

Function code: Describe the read/write operation to the gripper, whether to read data to the gripper or to write data to the gripper, common function codes are 03 (read holding register), 06 (write holding register). The initialization instruction function code is 06, which means ready to write.

Register address: the address corresponding to the gripper function. The initialization instruction address is 0x0100.

Register data: Write data to the specific register address so as to control the read data. The initialization instruction is to write 01 to represent for initialization.

CRC check code: to ensure that the terminal device does not respond to the data that changes during transmission, to ensure the safety and efficiency of the system. 16-bit cyclic hyperactive method is used for CRC check, and according to the conversion of the previous data, the CRC check code of the initialization instruction is 49 F6.

If you need to read multiple register addresses or write register addresses, you can use the 04 (0x) and 10 (0x) function codes to read and write to the gripper consecutive register addresses, please refer to the modbus-RTU standard protocol **www.ip33.com/crc**.html for the specific control instruction format.

2.3.2 Command Overview

The command consists of **a basic control address table** and a **parameter configuration address table.**

Basic control address table: contains initialization, force value, position, speed, angle and their corresponding feedback commands, which are the main control commands. As shown in Table 2.2.

Parameter configuration table: contains the parameter configuration of the gripper, including the modbus-RTU related configuration and IO related configuration that can be written. It should be noted that after configuring the required parameters, it needs to be saved by writing to Flash at 0x0300. As shown in Table 2.3.

Function	Modbus address high byte	Modbus address low byte	Description	Write	Read
nitializing the gripper	0x01	0x00	Re-calibration of grippers and return to zero	The initialization function of the gripper of different series may vary, refer to 2.3.3.1 for details	0: not in the initialization process; 1: initialization completed; 2: initialization in progress
Force		0x01	Setting of subsequent gripper clamping force	20-100, percentage	Read the current set force
Reserved		0x02	—	—	—
Position		0x03	Movement to the designated position	0-1000, thousandths ratio	Read the current set position
Speed		0x04	Set subsequent clamping speed	1-100, percentage	Read the current set speed

Function	Modbus address high byte	Modbus address low byte	Description	Write	Read
Absolute angle low	0x01	0x05	Rotate to the absolute specified angle	-32768-32767, Angle value	Read the current set angle
Absolute angle high		0x06	Rotate to the absolute specified angle (high position)	-160-160, number of low angle overflows	The angle value is: low data + high data * 32768 **Note: Do not write to this address without special circumstances, the unit rotates 32768°**
Rotation peed		0x07	Set subsequent rotation speed value	1-100, percentage	Reads the current set spin speed
Rotational force value		0x08	Set subsequent rotation force value	20-100, percentage	Reads the current set torque
Relative rotation angle		0x09	Rotation relative rotation angle value	-32768-32767, Angle value	Read the current setting value and set to 0 after executing the rotation action
Initialization status feedback	0x02	0x00	Feedback on the current initialization status of the gripper	--This Modbus address is read only	0: not initialized; 1: initialization successful; 2, initialization in progress
Clamping status feedback		0x01	Feedback on the current gripping status of the gripper	--This Modbus address is read only	0: in motion, 1: arriving at position; 2: clamping object; 3: object falling
Location Feedback		0x02	Feedback of current gripper position information	--This Modbus address is read only	Retrieve the current **real-time location**
Error/ Warning/ Message Feedback		0x05	Feedback information such as the current error code of the gripper	--This Modbus address is read only	0: no problem; 04 overheating;08 overload; 11 overspeed
Rotation angle feedback		0x08	Feedback current rotation **real-time angle**	--This Modbus address is read only	Read the current **real-time angle**
Rotation angle feedback **(high)**		0x09	Feedback current rotation **real-time angle (high)**	--This Modbus address is read only	Read the current real-time angle height
Rotation initialization status feedback		0x0A	Feedback rotation initialization state	--This Modbus address is read only	0: not initialized; 1: initialization successful; 2, initialization in progress
Rotation status feedback		0x0B	Feedback rotation status	--This Modbus address is read only	0: in motion, 1: reached position; 2: blocked rotation; 3: blocking stall **(need to rotate blocking stall configuration)**

Table 2.2 Base control address table

Function	Modbus address high byte	Modbus address low byte	Description	Write	Read
Write to save	0x03	0x00	Write to flash	0: default, 1: write all parameters to flash	Write to flash operation, default read returns 0
Initialization direction		0x01	Configure gripper initialization direction	0: open; 1: close (default: 0)	Read the current setpoint
Device ID		0x02	Configure gripper Modbus ID	1-255 (default: 1)	Read the current setpoint
Baud rate		0x03	Configure gripper Modbus baud rate	0-5:115200, 57600, 38400, 19200, 9600, 4800 (default:0)	Read the current setpoint
Stop bit		0x04	Configure gripper Modbus stop bit	0: 1 stop bit; 1: 2 stop bits (default: 0)	Read the current setpoint
Check digit		0x05	Configure gripper Modbus check bits	0: no parity; 1: odd parity; 2: even parity (default: 0)	Read the current setpoint
IO Parameter Test	0x04	0x00	Direct control of 4 groups of IO functions	1;2;3;4	--This Modbus address is only written to
IO Mode Switch		0x02	Turn on the IO function switch	0: off, 1: on (default: 0 off)	Read the current setting value
IO Parameter Configura-tion		0x05-0x10	Four sets of IO parameters	**INPUT 1 is 0.** Execution position 1, force value 1, speed 1 **INPUT 1 is 1.** Execution position 2, force value 2, speed 2 **INPUT 2 is 0:** Execution rotation angle1 Rotation speed1 Rotation force value1 **INPUT 2 for 1:** Execution rotation angle2 Rotation speed2 Rotation force value2	Read the current setpoint
Rotation Stop	0x05	0x02	Stop rotation during gripper operation	Write 1: Spin Stop	Read the current setpoint
Automatic Initialization		0x04	Automatic power-up initialization configuration	0: No initialization at power-up; 1: Automatic initialization at power-up (0: default)	Read the current setting value (need to write 01 at 0x300, valid for re-powering)
Rotary blocking and stopping configuration		0x05	Rotary blocking and stopping configuration	0: rotating blocking non-stop; 1: rotating blocking stopping (0: default)	Read the current setpoint

Rotary

Reset rotation angle	0x05	0x06	Resetting the multi-turn rotation of the infinite rotation axis	**Write 01:** Reset the rotation angle to within ±360°.Write to A5: actual rotation to initialized position (0°) and reset rotation a ngle to 0°	Read the current setpoint

Table 2.3 Parameter configuration address table

2.3.3 Command Details

2.3.3.1 Initializing the gripper

This command is related to the initialization of the grippers at 0x0100. Details of the specific initialization commands are shown in Table 2.4 below.

Function	Address	Description	Write to		Read
Initia-lizing the gripper	0x0100	Recalibration gripper and return to zero position	RGI35 Series0x01: Clamp and rotate back to zero (find unidirectional position); 0x02: Clamp back to zero position (find unidirectional position); 0x03: Rotate back to zero only 0xA5: Recalibration initialization, the	RGI100 series 0x01: Clamping unidirectional return to zero (related to return to zero direction setting), rotating return to zero 0x02: Clamping open return to zero (return to zero direction returns to open), rotating return to zero 0x03: Clamping closed return to zero (return to zero direction returns to closed), rotating return to zero 0x04: Clamping recalibration 0x05: Clamping open return to zero 0x06: Clamping closed return to zero 0x07: Rotating counterclockwise return to zero 0x00xA5: Recalibration initialization (rotation first, then clamping)	0: not in the initialization process; 1: In the initialization process; 2: Initialization in progress

Table 2.4 Initialization Instructions

The grippers need to be initialized before RS485 connection control, for re-calibrating the grippers and returning to zero position, please do not control during the gripper initialization. Depending on the gripper model, the initialization time is about 0.5-3 seconds, please control after the initialization is finished. 0x01 and 0xA5 are functionally different, as follows:

0x01: Writing 0x01 will perform a unidirectional initialization based on the value of the **2.3.3.17 Initialization\l - _2.3.3.17_初始化方向** Direction register to find the maximum position or minimum position (i.e. unidirectional limit bit), after which the position percentage is calculated based on the saved total travel value (see 0xA5). If the initialization direction is open and the current position of the grippers is also open, the gripper is visually initialized with no action.

0xA5: After sending 0xA5, the grippers perform a close to open action, regardless of the gripper's position and state.

Note:

1.The initialization process of the 0xA5 instruction is looking for the maximum and minimum positions. If the maximum or minimum position is blocked during this process, the wrong stroke will be recognized, for example, the 0 position in Figure 2.6 will be recognized as the width of the clamped object.

2.After the customer replaces the fingertip, 0xA5 initialization is required and saved.

3..0x01 instruction is to control the initialization of the grippers in one direction, and the stroke is the stroke saved after the last 0xA5 initialization.

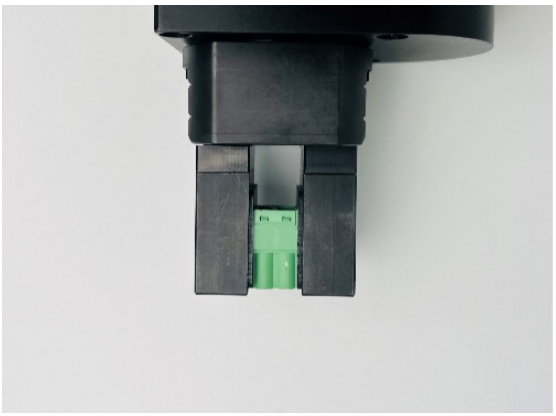


Figure 2.6 Example of error initialization

The initial specific execution initialization command is shown below:

Execute initialization successfully (write operation):

Send：01 06 01 00 00 01 49 F6

Return：01 06 01 00 00 01 49 F6

Fully initialized (write operation):

Send：01 06 01 00 00 A5 48 4D **Send save command after initialization, see 2.3.3.16 Write save**

Return：01 06 01 00 00 A5 48 4D，**use 0x01 function code again, the trip will be consistent with A5**

2.3.3.2 Force values

The command is related to the gripper force value and the address is 0x0101. The details of the grip force command are shown in Table 2.5 below.

Function	Address	Description	Write to	Read
Power Value	0x0101	Set force value	20-100, percentage (Default force value 100%)	Read the current set force value

Table 2.5 Force command

The force values range from 20 to 100 (%) and correspond to the hexadecimal data 00 14 - 00 64. Once you set the force value, the grippers will move in position to grip or hold open the target object with the set force value. As an example of setting and reading a 30% closure force:

Set 30% force value (write operation):

Send：01 06 01 01 00 1E 59 FE

Return：01 06 01 01 00 1E 59 FE

Read the current set force (read operation):

Send：01 03 01 01 00 01 D4 36

Return：01 03 02 xx xx crc1 crc2

2.3.3.3 Position

This command is the command related to setting the position of the gripper at 0x0103. Details of the specific position commands are shown in Table 2.6 below.

Function	Address	Description	Write to	Read
Position	0x0103	Set gripper position	0-1000, thousandths ratio	Read the current set position

Table 2.6 Position commands

The position value range is 0-1000 (‰), corresponding to the hexadecimal data 00 00 - 03 E8 , you can read the real-time position at 0x0202 address, please refer to **2.3.3.11 Position feedback.** To set and read position 500 (‰) as an example:

Set 500 position (write operation):
Send：01 06 01 03 01 F4 78 21
Return：01 06 01 03 01 F4 78 21

Read the current set position (read operation):
Send：01 03 01 03 00 01 75 F6
Return：01 03 02 xx xx crc1 crc2
Read the current real-time position (read operation):
Send：01 03 02 02 00 01 24 72
Return：01 03 02 xx xx crc1 crc2

2.3.3.4 Speed

This command is the gripper setting speed related command at 0x0104. Details of the specific speed commands are shown in Table 2.7 below.

Function	Address	Description	Write to	Read
Speed	0x0104	Running at set speed	1-100, percentage	Read the current set speed

Table 2.7 Speed commands

The speed value range is 1-100 (%), corresponding to the hexadecimal data 00 01 - 00 64 , recognizing a speed of 100%. To set and read 50 (%) closed force as an example:

et 50% speed (write operation):
Send：01 06 01 04 00 32 48 22
Return：01 06 01 04 00 32 48 22

Read current speed (read operation):
Send：01 03 01 04 00 01 C4 37
Return：01 03 02 xx xx crc1 crc2

2.3.3.5 Absolute angle low & high

his command is the command related to setting the absolute angle of rotation for the grippers, an d the address is 0x0105-0x0106. Details of the specific rotation angle commands are shown in Table 2.8 below.

unction	ddress	Description	Write	Read
Absolute angle low	0x0105	Run to absolute rotation angle	-32768-32767, Angle value	Read the current set rotation angle
Absolute angle high	0x0106	Run to absolute rotation angle	-160-160, number of low angle overflows	The angle value is: low data + high data * 32768 Note: Do not write to this address without special circumstances, the unit rotates 32768°

Table 2.8 Absolute angle low command

The rotation angle low value range is -32768-32767 (angle), corresponding to hexadecimal data 0x80 00-0x7FFF.

The high value of the rotation angle ranges from -160 to 160 (number of overflows), corresponding to hexadecimal data 0x FF60-0x00A0.

Add the relative rotation angle, **this angle is the absolute rotation angle, it is the accumulated rotation angle of the gripper from the start-up, when the accumulated rotation angle exceeds the low range, the absolute rotation angle high plus 1.**

When it is necessary to read real-time absolute angle, please refer to 2**.3.3.13 Rotation angle real-time feedback.**

The maximum value is: -160*32768~160*32767, when this value is exceeded, the absolute rotation angle automatically resets the rotation angle and resets the external axis position to the position within 1 turn: when the position before the reset is greater than 0 degrees: 0~360, when the position before the reset is less than 0 degrees: -360~0. If you need to clear the absolute angle accumulated value manually, please refer to 2.3.3.25 Reset Rotation angle.

Absolute rotation angle and relative rotation angle difference

- **Absolute rotation angle:**for the accumulated rotation angle, starting from the initialization position of the power on (angle 0° start), clockwise rotation accumulated count, counterclockwise rotation accumulated subtraction. The maximum value is: -160*32768~160*32767, when exceed this value, the absolute rotation **high automatically clears.**
- **Relative rotation angle:** Use the current gripper position as a reference for rotation. Set to 0 when rotation is completed. **for clockwise or counterclockwise rotation of relative angle.**

Absolute rotation angle and relative rotation angle connection

- **The absolute rotation is affected by the relative rotation angle:** when the relative rotation angle is rotated, the absolute rotation angle will be accumulated or subtracted according to the value of the relative angle.

To set and read 180 degrees as an example:
Set the absolute rotation angle of 180 degrees (write operation):
Send：01 06 01 05 00 B4 98 40
Return：01 06 01 05 00 B4 98 40
Read the currently set absolute angle (read operation):
Send：01 03 01 05 00 01 95 F7
Return：01 03 02 xx xx crc1 crc2

Attention

·The gripper use the inverse code representation to indicate positive and negative.

The rotation angle is positive and the inverse of the positive number is the same as its original code.
Example: 360° corresponds to the inverse code of 168(0x).
Rotate 360° angle command is: 01 06 01 05 01 68 98 49
The rotation angle is negative, and the inverse code of negative numbers is to invert the positive numbers bit by bit and add 1 to the sign bit.
Example: -360° corresponds to the inverse code FE98 (0x).
The rotation-360° angle command is: 01 06 01 05 FE 98 D9 FD

2.3.3.6 Rotation speed

This command is the command related to setting the rotation speed of the gripper at 0x0107. The details of specific rotation speed commands are shown in Table 2.9 below.

Function	Address	Description	Write	Read
Rotation speed	0x0107	Runs at set rotation speed	1-100, percentage	Read the current set rotation speed

Table 2.9 Rotational speed command

The rotation speed value ranges from 1 to 100 (%), corresponding to the hexadecimal data 00 01 - 00 64. The default rotation speed is 50%. To set and read 50 (%) rotation speed as an example:

Set 50% rotation speed (write operation):
Send：01 06 01 07 00 32 B8 22
Return：01 06 01 07 00 32 B8 22

Read the current rotation speed (read operation):
Send：01 03 01 07 00 01 34 37
Return：01 03 02 xx xx crc1 crc2

2.3.3.7 Rotational forces

This command is the command related to setting the rotational force of the gripper at 0x0108. Details of the specific rotational force commands are shown in Table 2.10 below.

Function	Address	Description	Write to	Read
Rotational force	0x0108	Operation with set rotational force	20-100, percentage	Read the current set rotation force

Table 2.10 Rotational force command

The value of the rotational force ranges from 20 to 100 (%), corresponding to the hexadecimal data 00 14 - 00 64, and the default is 100%. When you set the rotational force value, the gripper will rotate with the set rotational force value during the rotational movement.

As an example of setting 50% rotational force:
Set 50% rotational force value (write operation):
Send：01 06 01 08 00 32 88 21
Return：01 06 01 08 00 32 88 21

ead the current set rotational force (read operation):
Send：01 03 01 08 00 01 04 34
Return：01 03 02 xx xx crc1 crc2

2.3.3.8 Relative rotation angle

This command is the command related to setting the relative rotation angle of the gripper at 0x0109. Details of the specific rotational force commands are shown in Table 2.11 below.

Function	Address	Description	Write to	Read
Relative rotation angle	0x0109	Rotation relative rotation angle	-32768-32767, Angle value	Read the current setting value and set to 0 after executing the rotation action

Table 2.11 Rotational force command

The relative rotation angle range is -32768-32767 (angle), corresponding to the hexadecimal data 0x8 000-0x7FFF. When the relative rotation angle is set, the gripper will rotate according to the set angle and set to 0 after the rotation.

Absolute rotation angle and relative rotation angle difference

- **Relative rotation angle:** Use the current gripper position as a reference for rotation. After the rotation is completed, set to 0. **Use to rotate the relative angle clockwise or counterclockwise.**
- **Absolute rotation angle:** It is the accumulated rotation angle, starting from the initialization position of power on (angle 0°), the accumulated plus number of clockwise rotation and the accumulated minus number of counterclockwise rotation. The maximum value is: -160*32768~ 160*32767, when exceed this value, **the absolute rotation high automatically clears.**

Absolute rotation angle and relative rotation angle connection

- **The absolute rotation is affected by the relative rotation angle:** when the relative rotation angle is rotated, the absolute rotation angle will be accumulated or subtracted according to the value of the relative angle.

As an example of setting a 50° relative rotation angle:
Set 50° relative rotation angle (write operation):
Send：01 06 01 09 00 32 D9 E1
Return：01 06 01 09 00 32 D9 E1

Read the current set relative rotation angle (read operation):
Send：01 03 01 09 00 01 55 F4
Return：01 03 02 xx xx crc1 crc2

Attention

·The clamping grippers use the inverse code representation to indicate positive and negative.

The rotation angle is positive and the inverse of the positive number is the same as its original code.
Example: 360° corresponds to the inverse code of 168(0x).
Rotate 360° angle command is: 01 06 01 05 01 68 98 49
The rotation angle is negative, and the inverse code of negative numbers is to invert the positive numbers bit by bit and add 1 to the sign bit.
Example: -360° corresponds to the inverse code FE98 (0x).
The rotation-360° angle command is: 01 06 01 05 FE 98 D9 FD

2.3.3.9 Initializing state feedback

This command is the command related to the initialization status feedback of the gripper reading at 0x0200. The details of the specific initialization status feedback are shown in Table 2.12 below.

Function	Address	Description	Write	Read
Initialization status feedback	0x0200	Feedback on the current initialization status of the gripper	Cannot write	0: not initialized; 1: initialized successfully

Table 2.12 Initialization Status Feedback

The initialization status feedback can be used to obtain whether or not initialization has been performed. Specific read instructions are shown below:

Read initialization status (read operation):
Send：01 03 02 00 00 01 85 B2
Return：01 03 02 00 00 B8 44 (current uninitialized state)

2.3.3.10 Clamping status feedback

This command is related to the gripper clamping status feedback, address is 0x0201. The specific clamping status feedback details are shown in Table 2.13 below.

Function	Address	Description	Write	Read
Clamping status feedback	0x0201	0: in motion, 1: arriving at position; 2: clamping object; 3: object falling	Cannot write	00;01;02;03

Table 2.13 Initialization Status Feedback

The clamping status feedback is used to read the current status of the gripper, which can be divided into 4 states as follows

Feedback status description

The different returned command data, representing different states of the gripper, as follows:
·00 : The gripper is in motion.
·01 : The gripper stops moving and the gripper do not detect a clamped object.
·02 : The gripper stops moving, and the gripper detects a clamped object.
·03 : After the gripper detect the clamped object, the object is found to fall.

注：如果夹爪在到达指定位置前夹住物体，那么此时也认为夹爪已经夹住物体（反馈为：02）。

Read clamping status feedback (read operation):
Send：01 03 02 01 00 01 D4 72
Return：01 03 02 00 02 39 85 (Return 02 represents clamped objects)

2.3.3.11 Position Feedback

This command is a real-time feedback command for the gripper position at 0x0202. Details of the specific position feedback are shown in Table 2.14 below.

Function	Address	Description	Write	Read
Location Feedback	0x0202	Feedback of current gripper position in real time	Cannot write	Read the current real-time location

able 2.14 Position Feedback

Position feedback can be used to read the current real time position of the gripper. The specific reading instructions are shown below:

Read position status (read operation):
Send：01 03 02 02 00 01 24 72
Return：01 03 02 xx xx crc1 crc2

2.3.3.12 Errors/warnings/messages/feedback

This command is the gripper feedback error/warning/information/feedback command at 0x0205. The specific position feedback is detailed in Table 2.15 below.

Function	Address	Description	Write	Read
Errors/warnings/ messages/feedback	0x0205	Feedback information such as the current error code of the grippers	Cannot write	0: no problem;04 overheating; 08 overload;11 overspeed

Table 2.15 Error Feedback

The gripper feedback error/warning/information/feedback command can be used to read the current gripper status, including whether the temperature is too high, whether the operating speed is too fast, and whether the torque is overloaded. The specific read commands are shown below:

Read position status (read operation):
Send：01 03 02 05 00 01 95 B3
Return：01 03 02 xx xx crc1 crc2

2.3.3.13 Real-time feedback of rotation angle

This command is a real time feedback angle related command for gripper rotation angle, address is 0x0208. The details of specific rotation angle feedback are shown in Table 2.16 below.

Function	Address	Description	Write	Read
Rotation angle feedback	0x0208	Feedback the current gripper rotation real-time angle	Cannot write	Read the current rotation real-time angle
Rotation angle feedback	0x0209	Feedback the current gripper rotation real -time angle (high position)	Cannot write	Read the current rotation real-time angle (high)

Table 2.16 Rotation angle feedback

Rotation angle feedback can be used to read the current gripper rotation real-time angle, the angle value is: low data + high data * 32768. the specific reading instructions are shown below:

Read the real-time value of the rotation angle (read operation):
Send：01 03 02 08 00 01 04 70
Return：01 03 02 xx xx crc1 crc2

2.3.3.14 Rotation initialization state feedback

This command is related to the feedback of the gripper rotation initialization status, address 0x020A. The details of the specific rotation initialization status feedback are shown in Table 2.17 below.

Function	Address	Description	Write	Read
Rotation initialization status feedback	0x020A	Feedback on current gripper rotation initialization status	Cannot write	0: not initialized; 1: initialized successfully; 2: being initialized

Table 2.17 Rotation initialization state feedback

The rotation initialization status feedback can be used to read the current gripper rotation initialization status. The specific read command is shown below:

Read the rotation initialization status (read operation):
Send：01 03 02 0A 00 01 A5 B0
Return：01 03 02 xx xx crc1 crc2

2.3.3.15 Rotation status feedback

This command is related to the gripper rotation status feedback, address is 0x020B. The detailed description of the specific rotation status feedback is shown in Table 2.18 below.

Function	Address	Description	Write to	Read
Rotation status feedback	0x020B	Feedback on current gripper rotation status	Cannot write	0: in motion, 1: reached position; 2: blocked rotation;

Table 2.18 Clamp gripper rotation status

The rotation status feedback can be used to read the current gripper rotation status. The specific reading instructions are shown below:

Read the rotation status (read operation):
Send：01 03 02 0B 00 01 F4 70
Return：01 03 02 xx xx crc1 crc2

2.3.3.16 Write to save

This command is the command related to write and save configuration parameters for the grippers at 0x0300. The specific write and save details are shown in Table 2.19 below.

Function	Address	Description	Write	Read
Write to save	0x0300	Save manually configured parameters	0: default, 1: write all parameters to flash	Unreadable, returns 0 by default

Table 2.19 Write to save

Write Save can be used to save the IO configuration as well as the parameter configuration of RS485. The specific setup commands are shown below:

Write to save (write operation):
Send：01 06 03 00 00 01 48 4E
Return：01 06 03 00 00 01 48 4E

Attention

· -If IO configuration and RS485 parameters are configured for the grippers. The parameters must be saved by FLASH write in this command. (Note: The write operation will last 1-2 seconds, during which no other commands will be responded, so it is recommended not to use this command in real-time control)

2.3.3.17 Initialization direction

This command is related to setting the gripper initialization direction of the grippers at address 0x0301. Details of the specific set initialization direction commands are shown in Table 2.20 below.

Function	Address	Description	Write to	Read
Initialization direction	0x0301	Configuration initialization direction	0: open; 1: close; (default: 0)	Read the current setting value

Table 2.20 Initialization direction

The device ID can be used to configure the gripper initialization direction to open or close, the default is 0 open.
When a 0 is written, the grippers run to their maximum open position and are used as the initial starting point.
When a 1 is written, the grippers will run to the minimum closed position and serve as the initial starting point.

Set the initialization direction to off (write operation):
Send：01 06 03 01 00 01 19 8E
Return：01 06 03 01 00 01 19 8E

2.3.3.18 evice ID

This command is the command related to setting the gripper device ID for the grippers at 0x0302. Details of the specific set device ID commands are shown in Table 2.21 below.

Function	Address	Description	Write	Read
Device ID	0x0302	Configure gripper Modbus ID	1-247 (Default: 1)	Reading the gripper Modbus ID

Table 2.21 Device ID

Device ID can be used to configure the gripper Modbus ID, the default is 1. When there are multiple devices using modbus-RTU protocol, multiple devices can be controlled simultaneously by changing the ID, the specific set gripper ID command is as follows:

Set the device ID to 1 (write operation):
Send：01 06 03 02 00 01 E9 8E
Return：01 06 03 02 00 01 E9 8E

2.3.3.19 Baud rate

This command is a clamp claw configuration baud rate related command with address 0x0303. Details of the specific baud rate configuration are shown in Table 2.22 below.

Function	Address	Description	Write	Read
Baud rate	0x0303	0-5：115200, 57600, 38400, 19200, 9600, 4800 (0：default)	0;1;2;3;4;5	Read Baud Rate

Table 2.22 Baud rate settings

The baud rate command can be used to modify the baud rate size, the default is 115200, the recommended default. The specific set baud rate command is as follows:

Set the gripper baud rate to 115200 (write operation):
Send：01 06 03 03 00 00 79 8E
Return：01 06 03 03 00 00 79 8E

2.3.3.20 Stop bits

This command is related to the stop bit configuration of the gripper, and the address is 0x0304. The details of setting the stop bit are shown in Table 2.23 below.

Function	Address	Description	Write	Read
Stop bit	0x0304	Configure gripper Modbus stop bit	0: 1 stop bit; 1: 2 stop bits	Read stop bit

Table 2.23 Stop Bit Settings

The Stop Bit command can be used to modify the number of stop bits, the default is 1 stop bit, and the default is recommended. The specific set stop bit command is as follows:

Set the gripper stop bit to 1 (write operation):
Send：01 06 03 04 00 00 C8 4F
Return ：01 06 03 04 00 00 C8 4F

2.3.3.21 Checksum bits

This command is the command related to the configuration of the check digit for the gripper, and the address is 0x0305. The details of setting the checksum bit are shown in Table 2.24 below.

Function	Address	Description	Write	Read
Check digit	0x0305	Configure gripper Modbus check bits	0: no parity; 1: odd parity; 2: even parity;	Read parity bits

Table 2.24 Check Bit Settings

The parity bit command can be used to modify the parity bit, the default is no parity bit, and the default is recommended. The specific set parity bit command is as follows:

et the gripper parity bit to no parity (write operation):
Send ：01 06 03 05 00 00 99 8F
Return：01 06 03 05 00 00 99 8F

2.3.3.22 IO parameter testing

This command controls the 4 sets of set IO parameters of the grippers via modbus-RTU protocol for the gripper at address 0x0400. Details of the specific IO control are shown in Table 2.25 below.

Function	Address	Description	Write	Read
IO parameter testing	0x0400	Control 4 groups of IOs by sending data	1;2;3;4	Read IO control

Table 2.25 IO control

IIO parameter test can be used to directly run the set 4 groups of IO parameters, even if the power is off, the force position and speed of the 4 groups of IO parameters will not change, so the device can be executed to the running state as soon as possible. Specific IO control commands are shown below:

Set the grippers to the first group IO state (write operation):
Send：01 06 04 00 00 01 49 3A
Return：01 06 04 00 00 01 49 3A

Attention

·f you need to use modbus-RTU to control 4 groups of IO parameters, you need to turn off the IO mode switch.

2.3.3.23 IO mode switch

This command is related to setting IO mode switch, address is 0x0402. The details of specific IO mode switches are shown in Table 2.26 below.

Function	Address	Description	Write	Read
IO mode switch	0x0402	Whether to turn on the IO function	0: off, 1: on	Read the set value

Table 2.26 IO mode switches

The IO mode switch is a switch used to turn on the IO mode or not, and has two states, 0 and 1. The corresponding control ranges for the two states are shown in Table 2.27 below.

Front-end switch status	Corresponding Status	modbus-RTU control	IO Control
0	IO mode off	Yes	No
1	IO mode on	No	Yes

Table 2.27 IO mode switch correspondence range

Set the IO mode switch to Off (write operation):
Send：01 06 04 02 00 00 29 3A
Return：01 06 04 02 00 00 29 3A

2.3.3.24 IO parameter configuration

This command configures 4 sets of IO parameter-related commands for the gripper at addresses 0x0405-0x0410. Details of the specific IO parameters configuration are shown in Table 2.28 below.

Function	High Byte	Low Byte	Description	Write to	Read
Group 1 IO parameter setting	0x04	0x05	Group 1 position	0-1000, thousandths ratio	Retrieve the current value
		0x06	Group 1 force value	20-100, percentage	
		0x07	Group 1 speed	1-100, percentage	
Group 2 IO parameter setting		0x08	Group 2 position	0-1000, thousandths ratio	
		0x09	Group 2 force values	20-100, percentage	
		0x0A	Group 2 speed	1-100, percentage	
Group 3IO parameter setting		0x0B	Group 1 rotation angle	-32768-32767, Angle value	
		0x0C	Group 1 rotational force value	20-100, percentage	
		0x0D	Group 1 rotation speed	1-100, percentage	
Group 4 IO parameter setting		0x0E	Group 2 rotation angle	-32768-32767, Angle value	
		0x0F	Group 2 rotational force values	20-100, percentage	
		0x10	Group 2 rotation speed	1-100, percentage	

Table 2.28 IO parameter configuration

IO parameter configuration can be used to configure IO parameters. As an example, set the first set of target position to 300, target force to 30% and target speed to 30%:

Set the first set of states in I/O mode (write operation):

Send：01 06 04 05 01 2C 98 B6 (target position 300)

Return：01 06 04 05 01 2C 98 B6

Send：01 06 04 06 00 1E E8 F3 (30% of target force value)

Return：01 06 04 06 00 1E E8 F3

Send：01 06 04 07 00 1E B9 33 (target speed 30%)

Return：01 06 04 07 00 1E B9 33

IO parameter addresses are continuous addresses, or the 0x10 function code can be used to configure four groups of IO parameters at once, as follows:

Four consecutive multi-address writes to four groups of states (write operations):

Send：01 10 0405 000C 18 03e8 0014 000A 0100 0014 0002 0000 0064 0005 0250 0064 000a 9f 44

Return：01 10 04 05 00 0C D1 3D

After the configuration, you need to let the 1st 2 IO parameters and 3rd 4 IO parameters cooperate with each other to achieve the effect of rotation control.

2.3.3.25 Rotation stop

This command can be used to stop the rotation angle during the operation of the gripper, and the specific control details are shown in Table 2.29 below.

Function	Address	Description	Write	Read
Stop rotation	0x0502	Stops rotation during gripper rotation	Write 1: Gripper stop	Read the current setpoint

Table 2.29 Stop command

This command is used to stop the rotation of the gripper, the rotation process is faster and the impulse is larger, in order to prevent the loss of electric gripper caused by the sudden stop during the rotation, the stopping process is a planning stop, the maximum duration will stop within 0.5S.

Note: This command is a new command added after software version 1.14

Set gripper stop (write operation):
Send ：01 06 05 02 00 01 E9 06
Return：01 06 05 02 00 01 E9 06

2.3.3.26 Automatic initialization

This command sets whether the gripper are automatically initialized or not. The specific control details are shown in Table 2.30 below.

Function	Address	Description	Write	Read
Automatic initialization	0x0504	Automatic power-up initialization configuration	0: No initialization at power-up; 1: Automatic initialization at power-up (0: default)	Read the current setting value (need to write 01 at 0x300, effective for re-powering)

Table 2.30 Automatic initialization

This command is used to set whether the grippers are automatically initialized after power is applied. After power on, the gripper will automatically send 01 initialize to initialize, you can check the explanation of 01 initialize in 2.3.3.1 Initializing the grippers.

Set the gripper to be initialized automatically (write operation):
Send：01 06 05 04 00 01 09 07
Return ：01 06 05 04 00 01 09 07

Send again ：01 06 03 00 00 01 48 4E
Return ：01 06 03 00 00 01 48 4E

2.3.3.27 Rotary blocking stop configuration

his command sets the rotation blocking stop configuration command for the gripper, and the specific control details are shown in Table 2.31 below.

Function	Address	Description	Write	Read
Rotary blocking and stopping configuration	0x0505	Rotary blocking and stopping configuration	0: rotating blocking non-stop; 1: rotating blocking stopping (0: default)	Read the current setting value (need to write 01 at 0x300 to save)

Table 2.31 Rotary blocking stop configuration

This command is used to set whether the gripper rotate and stop after blocking when they are powered on.

Set the gripper to stop after rotational blocking (write operation):
Send：01 06 05 05 00 01 58 C7
Return：01 06 05 05 00 01 58 C7

Send again：01 06 03 00 00 01 48 4E
Return：01 06 03 00 00 01 48 4E

2.3.3.28 eset rotation angle

This command is a manual reset absolute rotation angle command for the gripper, and the specific control details are shown in Table 2.32 below.

Function	Address	Description	Write	Read
Reset absolute rotation angle	0x0506	Resetting the multi-turn rotation of the infinite rotation axis	Write 01: Reset rotation angle within ±360°. Write to A5: actual rotation to initialized position (0°) and reset rotation angle to 0°	Read the current setting value

Table 2.32 Manual reset absolute rotation angle

Write 01: Reset the external axis position to the current position within 1 turn, the gripper do not move: when the position before reset is greater than 0 degrees: 0~360, when the position before reset is less than 0 degrees: -360~0

Write A5: Resets the external axis position to a position within 1 turn and the gripper move to 0°.

Write 01 to reset the absolute rotation angle of the gripper (write operation):
Send：01 06 05 06 00 01 A8 C7
Return：01 06 05 06 00 01 A8 C7
Write to A5 to reset the absolute rotation angle of the gripper (write operation):
Send：01 06 05 06 00 A5 A9 7C
Return：01 06 05 06 00 A5 A9 7C

2.3.3.29 Blocking detection time

This command is the detection time setting command for clamping gripper blocking and stopping, and the specific control details are shown in Table 2.33 below.

Function	Address	Description	Write	Read
Plugging detection time	0x0508	Set the detection time for blocking and stopping, i.e. how many milliseconds after blocking and stopping	0-255, default is 100	Read the current setting value

Table 2.33 Blocking detection time

In the specific blocking and stopping process, the stopping process is related to the gripper rotational force and gripper speed, and is generally not set. **Set the blocking detection time to more accurately stop the gripper after blocking, the unit is 10ms, the default is 100 which is 1s.**

The longer the detection time, the longer the time needed to block, the maximum is 2.5s.

The shorter the detection time, the shorter the time needed to block, the minimum is 0s, stop immediately

Set the blocking threshold level to 50 (write operation):
Send：01 06 05 08 00 32 89 05
Return：01 06 05 08 00 32 89 05
Saving parameters:
Send：01 06 03 00 00 01 48 4E
Return：01 06 03 00 00 01 48 4E

3. IO control

IO mode is a common control method in industry to control the gripper in the form of hardware wiring. When using IO control, you need to set the gripper to IO mode in advance and set the 4 groups of IO states of the gripper.

3.1 IO configuration

The 4 states of IO mode can be configured through the serial software, or the parameters of the gripper can be configured through our debugging software, please refer to the following diagram for the specific wiring and configuration methods:

Gripper signal definition	Control devices
Input 1	DO /D-Out / Digital Output
Input 2	DO /D-Out / Digital Output
Ouput 1	DI /D-In / Digital Input
Ouput 2	DI /D-In / Digital Input
24V	24V/24V+
0 V	0V/24V-/GND

Once the four sets of parameters are configured, the gripper can be controlled by setting the INPUT 1 and INPUT 2 pins status, and the gripper status can be obtained by detecting the output pins OUTPUT 1 and OUTPUT 2.

The specific configuration is shown in the following figure:

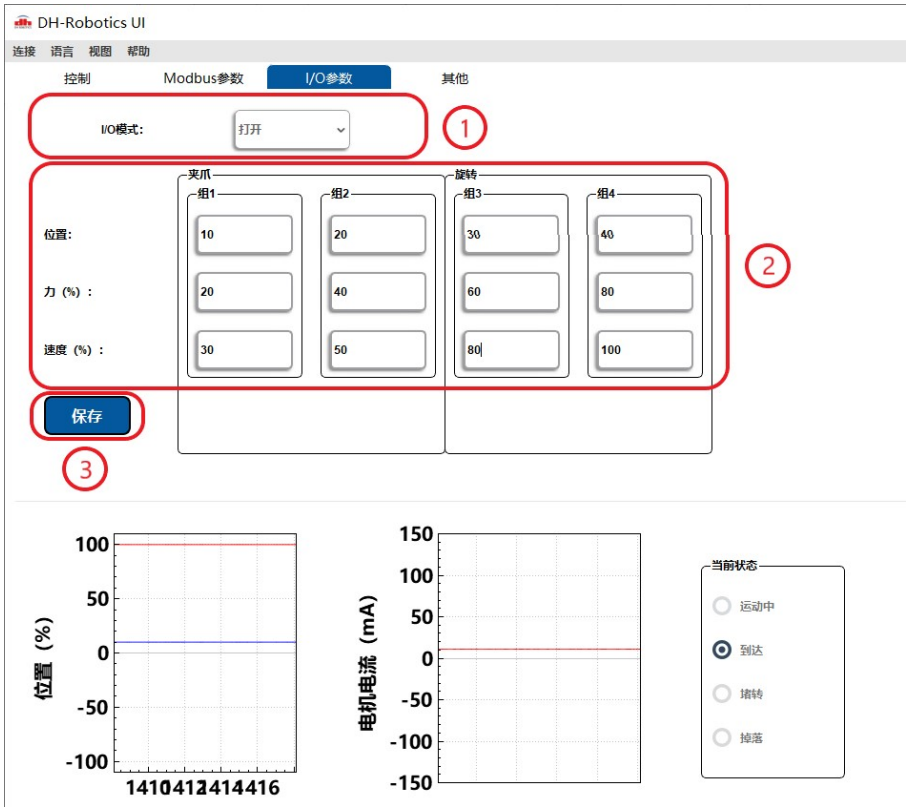


Figure 3.1 IO settings

Switching IO mode steps

① **Open IO mode:**Open IO mode first.
② **Configuration of 4 groups of IO parameters:**4 groups of parameters for gripper, including position, force and speed are set
③ **Save:**Click the Save button to write the parameters to the internal Flash registers and reboot to control.
④ **Restart:** After restarting, it is switched to IO mode successfully, you can control the grippers according to the INPUT signal, and the operation status will be fed back through

The gripper are controlled by setting the INPUT 1 and INPUT 2 pin states (0V and high resistance (off) states). The specific pin states correspond to those shown in Table 3.1(a) and Table 3.1(b).

Pins	Function	Input Status	I/O Status	Implementation content
INPUT 1	Control position	High resistance (disconnected)	0	Set position 1, set force value 1, set speed 1
		0V	1	Set position 2, set force value 2, set speed 2

Table 3.1(a) INPUT 1 Status Table

Pins	Function	Input Status	I/O Status	Implementation content
INPUT 2	Control position	High resistance (disconnected)	0	Rotation angle 1, rotation speed 1, rotation force value 1
		0V	1	Rotation angle 2, rotation speed 2, rotation force value 2

Table 3.1(b) INPUT 2 Status Table

The INPUT pin controls position and rotation, and the **two pins are sequential.** Both can be confirmed according to the actual situation whether the position is in place first and then rotate, or rotate first and then in place.

Note: The high resistance state, i.e., the resistance value is extremely high, corresponding to the disconnected suspended state without wiring, the same below.

The current status of the gripper can be obtained by detecting the output pins OUTPUT 1 and OUTPUT 2. OUTPUT 1 reflects the clamping status and OUTPUT 2 reflects the rotation status. During the operation of the gripper, four types of gripper states can be read. The details are shown in Table 3.2.

Pins	Function	Pin Status	I/O Status	Command content
OUTPUT 1	Control position	High resistance (disconnected)	0	Clamping in motion/dropping state
		0V	1	Clamping position in place / Clamping in progress

Pins	Function	Pin Status	I/O Status	Command content
OUTPUT 2	Control position	High resistance (disconnected)	0	In rotational motion
		0V	1	Rotation angle in place/rotation blocking

Table 3.2 OUTPUT1 OUTPUT2 Feedback status table

Attention

·The default input and output of digital IO are NPN type, and the input and output are valid for 0V. **(Low-level valid prohibits the connection of 24V, resulting in damage to the grippers at their own expense)**
·If you need to change the input and output to PNP type, that is, the input and output 24V effective **(high level effective prohibit ground or 0V, resulting in damage to the grippers of the consequences),** you need to communicate with our company in advance.

3.2 IO Usage

When the parameters are configured, 24V, GND, INPUT 1, INPUT 2, OUTPUT 1, OUTPUT 2 need to be connected on the hardware.

Connect the INPUT and OUPUT to the corresponding devices, confirm that the wiring is correct and restart, and the gripper will be initialized automatically. Then the gripper will be controlled according to the INPUT signal, and the operation status will be fed back through OUTPUT.

4. Gripper communication format details

4.1 Gripper wiring method

The gripper use the standard MODBUS-RTU communication protocol, RS-485 interface communication. he wiring method is half-duplex wiring, as shown in Figure 4.1.

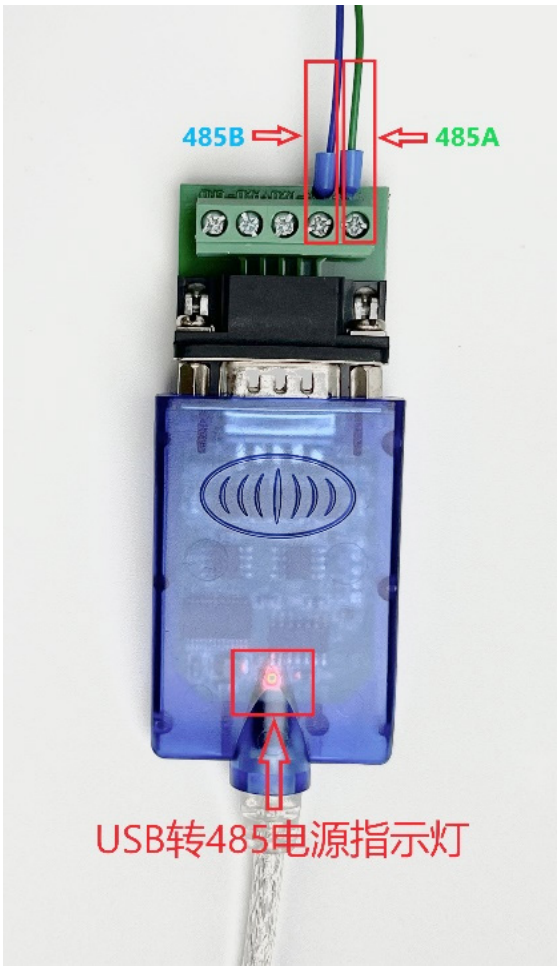


Figure 4.1 Wiring

USB to 485 module facing up, the **power indicator lights up red** after the USB to 485 module is powered on;

The upper interface at the right 2 interfaces for 485A/B line. **Demonstration gripper** color is **green A,** blue B. Please refer to the **line label for the** gripper signal line color definition.

4.2 Gripper communication format details

The default communication format of the gripper is: 115200 baud rate; data length 8; stop bit 1, no parity check. The communication format of the host computer and the gripper should be consistent. If inconsistency cannot be communicated, please modify the communication format of the host computer or the gripper, and restart the communication format of the gripper after modification. **Please refer to the corresponding gripper manual to modify the communication format of the gripper.**

4.2.1 Detailed explanation of 485 instruction 03 function code

The hardware adopts RS-485, master-slave half-duplex communication, the master calls the slave, the slave answers the communication mode

Note: All 485 commands are in hexadecimal; please refer to the command overview in the manual of the grippers for register addresses.

Gripper commonly used function code for 03; 06 two function codes, the following table 4.1 for 03 function code use profile.

Example instruction:**01 03 01 03 00 01 75F6** **03 Function code: Read register value**

1	2	3	4	5	6	7	8
ID	Function Code	Start register high byte	Start register low byte	Number of registers high byte	Number of regis-ters low byte	CRC check digit low byte	CRC check digit high byte
01	**03**	**01**	**03**	**00**	**01**	**75**	**F6**

Table 4.1 Introduction to the use of function codes

The first byte is the slave ID
The second byte is function code 03H
The 3rd and 4th bytes are the start registers
The 5th and 6th bytes are the number of registers to be read the current 0103 register is to be read;
The 7th and 8th bytes are CRC checksums

range (1 to 254);
to read the value in the register;
the start address of the register to be read;
00 01 means that only

Calculate the CRC16 checksum for bytes 1~6.

Example Instruction Description: The master reads the slave ID as 1 and returns the value of 0001 registers starting from 0103 register to the master.

Caution:

If the number of read registers is changed to 0002, it is to read two registers starting from 0103, 0103 and 0104. It should be noted that the number of reads is read in the order down, and it is not possible to read in jumps. For example, 0104 register and 0106 register, you need to pass two read instructions. Or the number of reads is changed to 0003 and the value of the three registers, 0104 0105 0106, is read. You cannot read 0104 and 0106 by one instruction alone.

Slave return command: **01 03 02 03 E8 B8FA**

1	2	3	4	5	6	7
ID	Function Code	BackTotal number of bytes	Register current data1	Register current data2	CRC check digit low byte	CRC check digit high byte
01	**03**	**02**	**03**	**E8**	**B8**	**FA**

Table 4.2 Introduction to the use of function codes

The first byte is the slave ID
The 2nd byte is function code 03H
The 3rd byte is the length of the returned data
The 4th and 5th bytes are the returned data content
The 6th and 7th bytes are CRC checksums

range (1 to 254);
Tthe master reads the value to return;
return of 2 bytes of data length;
Tthe returned data content is 03E8;
Calculate 1~6 byte CRC16 checksum.

Return Instruction Description:

The master sends a read command 0103 0103 0001 75F6 to the slave, and the slave returns a command 0103 02 03E8 B8FA to the master.
Explanation: The slave with ID 1 returns 2 bytes length data 03E8 (hexadecimal), which is converted to 1000 in decimal. 0103 register address represents the position register inside the gripper setting. The returned data represents that the current gripper is at position 1000.

4.2.2 Detailed explanation of 485 instruction 06 function code

Example instruction:0106 0103 03E8 7888 **06 Function code: Write a single register value**

1	2	3	4	5	6	7	8
ID	Function Code	Register address high byte	Register address low byte	Write data high byte	Write data low byte	CRC check digit low byte	CRC check digit high byte
01	**06**	**01**	**03**	**03**	**E8**	**78**	**88**

able 4.3 Introduction to the use of function codes

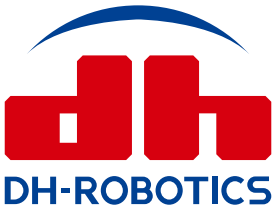
The first byte is the slave ID
The 2nd byte is function code 06H
The 3rd and 4th bytes are register addresses the data is written;
The 5th and 6th bytes are write data
The 7th and 8th bytes are CRC checksums

range (1 to 254);
the master writes the value to the slave register;
the address of the individual register to which;

03E8 is converted to 1000 in decimal;
Calculation of the CRC16 checksum for bytes 1 to 6;

Example command description:

The master writes data to the single register 0103 of the slave with ID 1. The written data is 03E8. 0103 is the position register, and this instruction indicates that the control gripper moves to position 1000.
Caution: Write data using function code 06, when the slave accepts it correctly, it will return the same command and check code, indicating that the command is accepted correctly. For example, the master sends: **0106 0103 03E8 788**
Return from station: **0106 0103 03E8 7888 .**



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