RGI-14 User Manual

Content

Revisions

Date	Version	Revised content
20200426	V1.0	First edition, write wiring instructions and command instructions
20200904	V2.0	Change some instructions , Update the description of IO mode

1 Specifications

RGI-14 is rotating parallel electric gripper, The number represents the Maximum stroke. The gripper is equipped with a pair of parallel fingertips, which runs symmetrically during the movement. The main structure of the gripper is a smooth rectangular structure with four installation positions, which can meet the different installation conditions of the equipment. It is equipped with an 8-core communication interface, as shown in Figure 1.1. It has the following characteristics:

Controllable force/position/speed/angle: the gripper can program and adjust the grip position, grip force ,grip speed and angle.

Multiple communication modes: The gripper supports Modbus RTU protocol and IO mode control. Other communication protocols such as Ethernet and PROFINET can be transferred through protocol converter.

grip judgment: the combination of force control and position control is adopted in the gripping process.

grip feedback: the state of the gripper can be read by programming, and can also be judged according to the indicator of the gripper.

Fingertips can be customized: fingertips can be replaced according to situation, which is suitable for precision machining, parts assembly and other fields.

Figure 1.1 RGI-14 gripper

1.1 performance parameter

The specific parameters of RGI-14 gripper are listed in Table 1.1

Table 1.1 A list of RGI-14 parameters

RGI-14 performance parameters.	
Grip force(one side)	10-65N.
Maximum open and close stroke.	14 mm.
Rotating torque.	0.25 N·m.
The rotation range.	Unlimited
Maximum rotation speed.	1500°/ s .
The repeated accuracy of the clamping position.	0.02mm
Rotating repeat accuracy.	0.02°
Open/Closed time	0.2/0.2S.
Weight.	0.8kg.
Protection level.	IP20.
Operating voltage.	24 V DC s 10%
Rated current.	1.1A.
Peak current.	2A.
The environment is recommended.	0 to 40°C,85% RH or less.
Communication protocol.	Modbus RTU (RS485), I/O.

In the actual gripping, You should take into account the grippining angle and gripping position.

The following right-angle coordinate system is established, and the corresponding directions of the X-axis, Y-axis, and Z-axis are shown in Figure 1.2 below. The force perpendicular to the gripped flat surface is used as Fz, the x-axis direction torque is Mx, the y-axis direction torque is My, and the z-axis direction torque is Mz . The RGI-14 torque table is shown in Table 1.2:

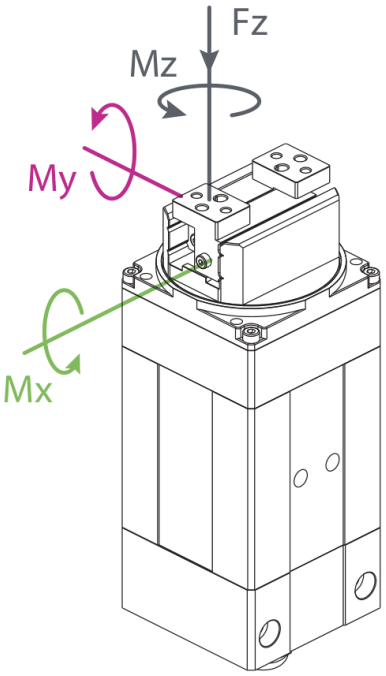


Figure 1.2 Torque diagram

Table 1.2 RGI-14 Torque Table .

RGI-14 Torque	
Maximum static load of Fz	150N
Maximum torque of x-axis	2 N m
Maximum torque of y-axis	1.5 N m
Maximum torque of z-axis	2.5 Nm

1.2 Hardware parameters.

The dimension drawing of RGI-14 gripper contain the specific size of the gripper, the mounting hole, as shown in Figure 1.3: .

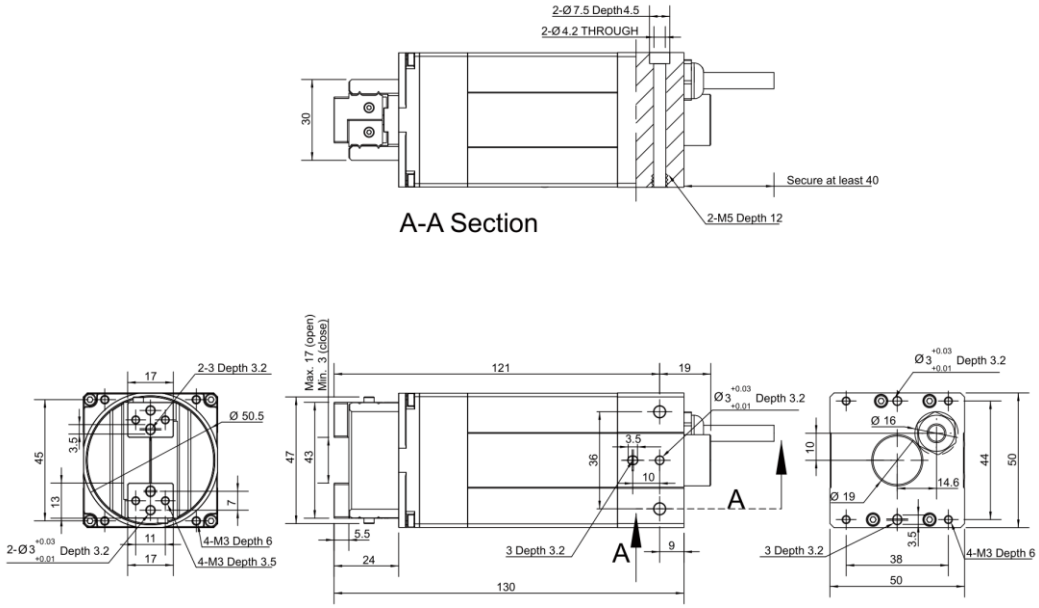


Figure 1.3 dimension of RGI-14 gripper

1.3 Indicator

The gripper can feed back the state of the gripper in real time. In addition to the command reading, it can also be judged on the color of the indicator :

Color description of indicator light

·**Uninitialized state:** Red light blinks, other lights are off.

·**Initialized State:** the blue light is always on, indicating that it is in the operable state.

·**Received command state**: the red light blink once quickly (because the blue light is always on at this time, the gripper indicator light will looks like a purple light).

·**Object Caught state:** green light is always on, other lights are off.

·**Object dropped state:** green light blinking.

1.4 Pinout Description

The pinout of the gripper is shown in Figure 1.4, and the pin description is shown in Table 1.3.

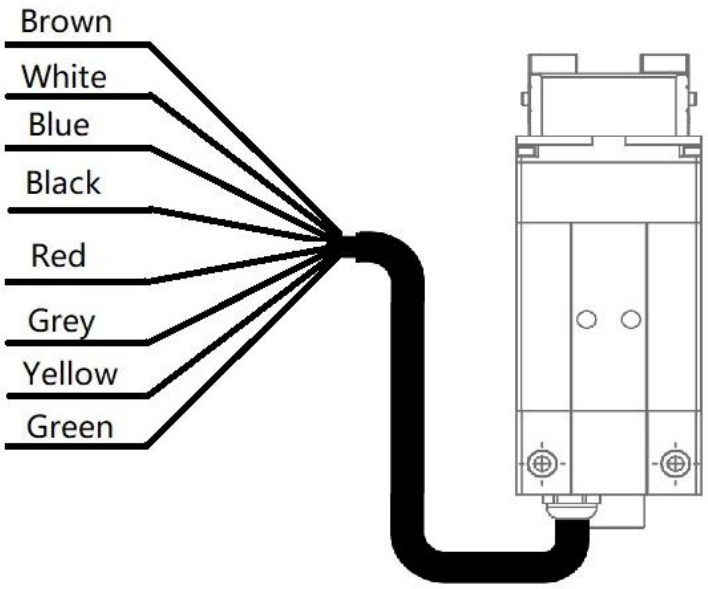


Figure1.4 The color of Pinout line

Table 1.3 Pinout Description

Wire color	Description
Brown	INPUT 2
White	INPUT 1
Blue	485_B
Black	485_A
Red	24 V
Grey/Pink	GND
Yellow	OUTPUT 1
Green	OUTPUT 2

2 Modbus-RTU Control

2.1 Wiring

Use the provided RS-485 to USB converter (see the schematic in Figure 1.1 below) to plug into a PC or other Controllers .

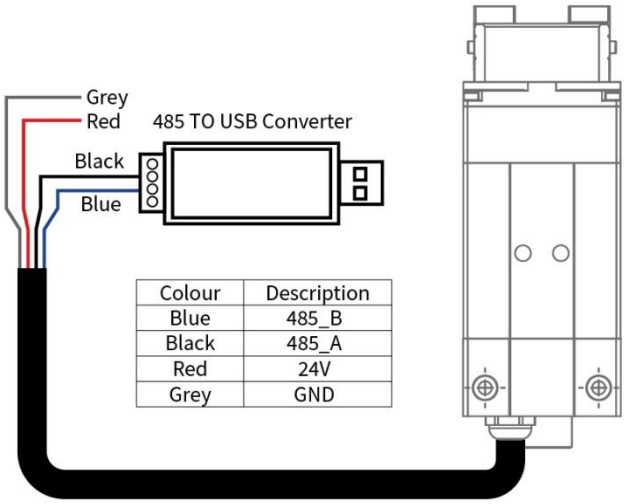


Figure 2.1 RS485 Connection

Warning

• **Note the line order before connecting:** Please note that the RGI power wire is red and gray wire is grey.

2.2 Default Communication Parameters

Slave Address : 1
Baud Rate : 115200
Data Bits : 8 bits
Stop Bits : 1 stop bit
Parity : None

2.3 Modbus-RTU Description

2.3.1 RTU Framing

This gripper uses the standard Modbus-RTU protocol.

In RTU mode, the first field is the device address. The allowable characters transmitted for all fields are hexadecimal 0 ... 9, A ... F. Networked devices monitor the network bus continuously, including during the silent intervals. When the first field (the address field) is received, each device decodes it to find out if it is the addressed device.

A typical message frame is shown in Table 2.1.

Table 2.1 RTU Framing (Function Code:0x06)

Slave Address	Function	Register address	Register data	CRC
01	06	01 00	00 01	49 F6

Slave Address: The Slave address of the gripper. The default is 1, you can also modify it through write different value to Slave Address register.

Function: The Function Code field tells the addressed slave what function to perform. Includes read or write registers function.

Register address: Specifies which registers reference to be written.

Register data: Specifies which value to be written. Each register (word - 16 bits) of the Modbus RTU protocol is composed of 2 bytes (8 bits) from the Gripper.

CRC: the CRC error-checking field contains a 16-bit value implemented as two eight-bit bytes. The CRC field is appended to the message as the last field in the frame. The low-order byte of the field is appended first, followed by the high-order byte. The CRC high-order byte is the last byte to be sent in the message.

2.3.2 Supported Modbus Function Code

This griper uses MODBUS- RTU. The following function codes are currently supported:

03 (HEX): Read Holding Registers

06 (HEX): Write Single Register

10 (HEX): Write Multiple Registers

2.3.3 Register Mapping

The gripper's Modbus-RTU registers consist of two types of registers: **the basic control registers** and **the configuration registers**.

Basic control registers: initialization, force setting, reference position, speed, and some states.

Configuration registers: gripper's parameter configuration. Includes Modbus communication parameters and I/O parameters.

Table 2.2 Basic Control register map

Function	high-byte	low-byte	Description	Write	Read
Initialization	0x01	0x00	Initialize the gripper	0x01：initialization；0xA5: Fully initialization	Current setting
Force		0x01	Gripper's force	20-100 (%)	Force currently set
Reserved		0x02	-	-	-
Position		0x03	Position	0-1000 (‰)	Reference position currently set
Speed		0x04	Speed	1-100 (%)	Speed currently set
Rotation angle		0x05	Rotate to the specified angle.	-32768-32767,angle value.	Read the current setting
Reserved		0x06	-	-	-
Rotation speed		0x07	Rotate at a set speed.	1-100%	Read the current setting.
Rotation force		0x08	Rotate at a set force.	20-100%	Read the current setting.
Initialization state	0x02	0x00	Initialization state of the gripper	Read Only	0：Not initialized；1：Initialized
Gripper state		0x01	Gripper state	Read Only	0：In motion; 1：Reach position； 2:object caught； 3：Object dropped
Position		0x02	gripper position	Read Only	Current actual position
Rotating angle feedback.		0x08.	Feedback on the current rotation angle.	Cannot be written.	Read the current value.
Rotating initialization state feedback.		0x0A.	Feedback rotation initialization state.	Cannot be written.	0:Not initialized;1:Initialized successfully.
Rotating state feedback.		0x0B.	Feedback rotation state.	Cannot be written.	0: In motion, 1 : reaching the position; 2: blocking; 3: blocked during reaching the specified position.

Table 2.3 Configuration register map

Function	High byte	Low bytes	Description	Write	Read
Save Parameter	0x03	0x00	Save all the parameters	0：default，1：Write all parameters to save	0
Initialization direction		0x01	Configure initialization direction	0: Open，1:Close (default: 0）	Current setting
Slave Address		0x02	Configure gripper Modbus address	0-255 (default: 1）	Current setting
Baud Rate		0x03	Configure gripper Modbus Baud rate	0-5：115200，57600，38400，19200，9600，4800（default :0）	Current setting
Stop Bits		0x04	Configure gripper Modbus stop bits	0：1 stop bit；1：2 stop bits（default: 0）	Current setting
Parity		0x05	Configure gripper Modbus Parity	0: None parity; 1: Odd parity; 2: Even parity (default: 0)	Current setting
I/O Parameters Test	0x04	0x00	Test I/O parameters	1；2；3；4	Current setting
I/O Mode Switch		0x02	I/O control switch	0：OFF，1：ON	Current setting
I/O Parameter Configuration		0x05-0x10	Four groups of I/O parameters	position 1，force 1，speed 1 to position 4，force 4，speed 4	Current setting

2.3.4 Register Description

2.3.4.1 Initialization

This register is used to initialize the gripper.

Write: If write 1 (0x01 hex) to this register, the gripper will be initialized (fingers move to the minimal or maximum position and rotation to find the 0 degree The initialization direction depends on the value of initialization direction register). If write 165 (0xA5 hex) to this register will fully initialize the gripper(find the minimal and maximum position).

Read: if gripper need to be initialized or have initialized, this register value is 0; and if gripper is in initializing process, this register value is 1.

The register address is 0x0100. The description of this register is shown in Table 2.4.

Table 2.4 Initialization

Function	Address	Description	Write	Read
Initialization	0x0100	Initialize the gripper	0x01：initialize；0xA5: Fully initialize	Current setting

The gripper needs to be initialized before control.

The sample command is as follows:

Initialize (write):

Send: 01 06 01 00 01 49 F6

Receive: 01 06 01 00 01 49 F6

Reinitialize(write):

Send:01 06 01 00 00 A5 48 4D

Receive: 01 06 01 00 00 A5 48 4D

2.3.4.2 Force

This register is used to set Force. It defines the current for the Gripper. If the current limit is exceeded, the fingers stop and trigger an object detection.

The address is 0x0101. The description of this register is shown in Table 2.5.

Table 2.5 Force

Function	Address	Description	Write	Read
Force	0x0101	Gripper's closing force	20-100 (%)	Force currently set

The force value range is 20-100, the corresponding value is 00 14–00 64(Hexadecimal).

Example:

Set 30% closing force (write):

Send: 01 06 01 01 1E 59 FE

Return: 01 06 01 01 1E 59 FE

Read the closing force currently set (read):

Send: 01 03 01 01 00 01 D4 36

Return: 01 03 02 xx xx crc1 crc2

2.3.4.3 Position

This register is used to set the reference position of gripper's fingers, then the fingers will move to the position immediately.

The address is 0x0103. The description of this register is shown in Table 2.6.

Table 2.6 Position

Function	Address	Description	Write	Read
Position	0x0103	Reference Position	0-1000 (‰)	Reference position currently set

The reference position value range is 0-1000 (‰), the corresponding value is 00 00 – 03 E8(Hexadecimal).

Example:

Set 500‰ position (write):

Send: 01 06 01 03 01 F4 78 21

Return: 01 06 01 03 01 F4 78 21

Read the reference position currently set(read):

Send: 01 03 01 03 00 01 75 F6

Return: 01 03 02 xx xx crc1 crc2

2.3.4.4 Speed

This register is used to set the Gripper closing and opening speed.

The address is 0x0104. The description of this register is shown in Table 2.7.

Table 2.7 Speed Instructions

Function	Address	Description	Write	Read
Speed	0x0104	Speed	1-100 (%)	Speed currently set

The speed value range is 1-100 ， The corresponding value is 00 01 – 00 64(Hexadecimal).

Example:

Set 50% speed (write):

Send: 01 06 01 04 00 32 48 22

Return: 01 06 01 04 00 32 48 22

Read the current speed (read):

Send: 01 03 01 04 00 01 C4 37

Return: 01 03 02 xx xx crc1 crc2

2.3.4.5 Rotation angle

This register is used to set the gripper angle of rotation.

The address is 0x0105. The description of this register is shown in Table 2.8.

Table 2.8 The angle of rotation

Function	Address	Description	Write	Read
Rotation angle	0x0105	Rotate to the specified angle.	-32768-32767	Read the current setting

The amgle of rotation is -32768-32767 ， The corresponding value is 0x0000 – 0xFFFF(Hexadecimal).

Example:

Set 180% angle (write):

Send: 01 06 01 05 00 B4 98 40

Return: 01 06 01 05 00 B4 98 40

Read the current angle (read):

Send: 01 03 01 05 00 01 95 F7

Return: 01 03 02 xx xx crc1 crc2

2.3.4.6 Rotation speed

This register is used to set the speedof rotation.
The address is 0x0107. The description of this register is shown in Table 2.9.

Table 2.9 The speed of rotation

Function	Address	Description	Write	Read
Rotation speed	0x0107	Rotate at a set speed.	1-100%	Read the current setting.

The speed of rotation is 1-100(%)，The corresponding value is 0x0001 –0x0064(Hexadecimal).
Example:

Set 50% rotation speed (write):

Send: 01 06 01 07 00 32 B8 22

Return: 01 06 01 05 00 B4 B8 22

Read the current speed (read):

Send: 01 03 01 07 00 01 34 37

Return: 01 03 02 xx xx crc1 crc2

2.3.4.7 Rotation force

This register is used to set the forceof rotation.
The address is 0x0108. The description of this register is shown in Table 2.10.

Table 2.9 The force of rotation

Function	Address	Description	Write	Read
Rotation force.	0x0108	Rotate at a set force	20-100%	Read the current setting.

The force of rotation is 20-100(%)，The corresponding value is 0x0014 –0x0064(Hexadecimal).
Example:

Set 50% force (write):

Send: 01 06 01 08 00 32 88 21

Return: 01 06 01 05 00 B4 88 21

Read the current force (read):

Send: 01 03 01 07 00 01 34 37

Return: 01 03 02 xx xx crc1 crc2

2.3.4.8 Initialization State

This register is used to store current initialization state of gripper, you can get the initialization state by reading this register.

The address is 0x0200. The description of this register is shown in Table 2.11.

Table 2.11 Initialization State

Function	Address	Description	Write	Read
Initialization State	0x0200	Initialization state of the gripper	Read Only	0：Not initialized； 1：Initialized

Example:

Read initialization state (read):

Send: 01 03 02 00 00 01 85 B2

Return: 01 03 02 00 00 B8 44

2.3.4.9 Gripper State

This register is used to store the Gripper state, you can get the state of gripper by reading this register.

And the address is 0x0201. The description of this register is shown in Table 2.12.

Table 2.12 Gripper State

Function	Address	Description	Write	Read
Gripper State	0x0201	the gripper state	Read Only	0：In motion; 1：Reached position； 2：Object caught； 3：Object dropped

States Description

Different values indicate different states of the gripper. The descriptions of states are as follows:

- 00: Fingers are in motion .
- 01: Fingers are at reference position. No object detected or object has been dropped.
- 02: Fingers have stopped due to an object detection.
- 03: Fingers are at reference positon due to object has been dropped after the gripper caught object.

Example:

Read gripper state (read):

Send: 01 03 02 01 00 01 D4 72

Return: 01 03 02 00 02 39 85(02: object caught)

2.3.4.10 Current Position

This register is used to store the Actual position of the Gripper.
The address is 0x0202. The description of this register is shown in Table 2.13.

Table 2.13 Current Position

Function	Address	Description	Write	Read
Current Position	0x0202	Gripper actual position	Read Only	Current actual position

Example:

Read actual position (read):

Send: 01 03 02 02 00 01 24 72

Return: 01 03 02 xx xx crc1 crc2

2.3.4.11 Rotating angle feedback

This register is used to store the Actual rotating angle of the Gripper.
The address is 0x0208. The description of this register is shown in Table 2.14.

Table 2.14 Rotating angle feedback.

Function	Address	Description	Write	Read
Rotating angle feedback.	0x0208.	Feedback on the current rotation angle.	Cannot be written.	Read the current value.

Example:

Read actual rotation angle (read):

Send: 01 03 02 08 00 01 04 70

Return: 01 03 02 xx xx crc1 crc2

2.3.4.12 Rotating initialization state feedback.

This register is used to store the Rotating initialization state feedback. of the Gripper.
The address is 0x020A. The description of this register is shown in Table 2.15.

Table 2.15 Rotating initialization state feedback.

Function	Address	Description	Write	Read
Rotating initialization state feedback.	0x020A.	Feedback rotation initialization state.	Cannot be written.	0:Not initialized;1:Initialized successfully.

Example:

Read actual Rotating initialization state feedback (read):

Send: 01 03 02 0A 00 01 A5 B0
Return: 01 03 02 xx xx crc1 crc2

2.3.4.13 Rotating state feedback.

This register is used to store the Rotating state feedback. of the Gripper.
The address is 0x020B. The description of this register is shown in Table 2.16.

Table 2.16 Rotating state feedback.

Function	Address	Description	Write	Read
Rotating state feedback.	0x020B.	Feedback rotation state.	Cannot be written.	0: In motion, 1 : reaching the position; 2: blocking; 3: had been blocked during reaching the specified position.

Example:
Read actual Rotating state feedback (read):
Send: 01 03 02 08 00 01 04 70
Return: 01 03 02 xx xx crc1 crc2

2.3.4.14 Save Parameter

This register is used to Save Parameter.
Write 1 to this register to save all parameter, If you modified the I/O or communication parameters.
The address is 0x0300. The description of this register is shown in Table 2.17.

Table 2.17 Save Parameter

Function	Address	Description	Write	Read
Save Parameter	0x0300	Save register's value to Flash	0：default， 1：Save all parameters	0

Example:
Save Parameter (Write):
Send: 01 06 03 00 00 01 48 4E
Return: 01 06 03 00 00 01 48 4E

NOTE
• The Saving process will take 1-2 seconds, and the gripper won't response to other command during this process. The gripper will response this command after saving process finished.

2.3.4.15 Initialization Direction

This register is used to set Initialization Direction of gripper.

The address is 0x0301. The description of this register is shown in Table 2.18.

Table 2.18 Baud Rate

Function	Address	Description	Write	Read
Baud Rate	0x0301	Configure initialization direction	0: Open，1:Close (default: 0）	Current setting

The value of this register is 0 by default.

If the register value is 0, when you send the initialization command, the gripper finger will open and find the maximum position.

If the register value is 1, when you send the initialization command, the gripper finger will close and find the minimal position.

Example:

Write 0 to initialization direction register:

Send: 01 06 03 01 00 00 D8 4E

Return: 01 06 03 01 00 00 D8 4E

2.3.4.16 Slave Address

This register is used to set Slave Address of gripper.

The address is 0x0302. The description of this register is shown in Table 2.19.

Table 2.19 Slave Address

Function	Address	Description	Write	Read
Slave Address	0x0302	Configure gripper Slave Address	0-255 (default: 1）	Current setting

The value of this register is 1 by default.

Example:

Set the Slave Address to 1 (write):

Send: 01 06 03 02 00 01 E9 8E

Return: 01 06 03 02 00 01 E9 8E

NOTE

• Please make sure that no other networked device has the same slave address as the gripper.

2.3.4.17 Baud Rate

This register is used to set Baud Rate of gripper.

The address is 0x0303. The description of this register is shown in Table 2.20.

Table 2.20 Baud Rate

Function	Address	Description	Write	Read
Baud Rate	0x0303	Configure gripper Modbus Baud rate	0-5：115200，57600，38400，19200，9600，4800（default: 0）	Current setting

The value of this register is 0 by default, corresponding to a baud rate of 115200.

Example:

Set gripper baud rate to115200 (write):

Send: 01 06 03 03 00 00 79 8E

Return: 01 06 03 03 00 00 79 8E

2.3.4.18 Stop Bits

This register is used to set Stop Bits of gripper.

The address is 0x0302. The description of this register is shown in Table 2.21.

Table 2.21 Stop bits settings

Function	Address	Description	Write	Read
Stop Bits	0x0304	Configure gripper Modbus stop bits	0：1 stop bit 1：2 stop bits （default: 0）	Current setting

The value of this register is 0 by default, corresponding to 1 stop bit.

Example:

Set the gripper stop bit to 1 stop bit (write):

Send: 01 06 03 04 00 00 C8 4F

Return: 01 06 03 04 00 00 C8 4F

2.3.4.19 Parity

This register is used to set Parity of gripper.

The address is 0x0305. The description of this register is shown in Table 2.22.

Table 2.22 Parity

Function	Address	Description	Write	Read
Parity	0x0305	Configure gripper Modbus Parity	0: None Parity 1: Odd Parity 2: Even Parity	Current setting

			(default : 0)	

The value of this register is 0 by default, corresponding to None Parity.

Example:

Set the gripper's Parity to None Parity (write):

Send: 01 06 03 05 00 00 99 8F

Return: 01 06 03 05 00 00 99 8F

2.3.4.20 Test I/O Parameters

This register is used to test the I/O Parameters.

The address is 0x0400. The description of this register is shown in Table 2.23.

Table 2.23 I/O Control

Function	Address	Description	Write	Read
Test I/O Parameters	0x0400	Test I/O Parameters	1；2；3；4	Current setting

This register can be used to directly test 4 groups of I/O parameters through Modbus-RTU to ensure that the I/O parameters are appropriate. For example, Write 1 to this register, the gripper will execute action with the first group of I/O parameter.

Example:

Control gripper by using first group of I/O parameter (write):

Send: 01 06 04 00 00 01 49 3A

Return: 01 06 04 00 00 01 49 3A

2.3.4.21 I/O Mode Switch

This register is used to turn I/O Control Mode ON or OFF.

The address is 0x0402. The description of this register is shown in Table 2.24

Table 2.24 I/O Mode Switch

Function	Address	Description	Write	Read
I/O Mode Switch	0x0402	I/O Control Switch	0：OFF，1：ON	Current setting

If you have written 1 to this register and have saved all parameters, the gripper will be initialized automatically after power on.

When the I/O Control Mode is turned on, the gripper can respond to Modbus-RTU commands and I/O, but I/O has priority.

The control method in different mode is shown in Table 2.252.

Table 2.25 Control method

Switch State	Description	Modbus-RTU	I/O
0	I/O control mode off	YES	No
1	I/O control mode on	YES	YES

Example:

Set the I/O control mode switch off (write):

Send: 01 06 04 02 00 00 29 3A

Return: 01 06 04 02 00 00 29 3A

NOTE

• If you just need to control the gripper through Modbus RTU, you should write 0 to this register and save all parameters to turn off the I/O control mode.

2.3.4.22 I/O Parameter Configuration

Those registers are used to Set the I/O Parameters.

The address is 0x0405-0x0410. The description of this register is shown in Table 2.26.

Table 2.26 I/O Parameter Configuration

Function	High-byte	Low bytes	Description	Write	Read
I/O Group 1	0x04	0x05	position 1	0-1000‰	Current setting
		0x06	force 1	20-100 %	
		0x07	speed 1	1-100 %	
I/O Group 2		0x08	position 2	0-1000‰	
		0x09	force 2	20-100 %	
		0x0A	speed 2	1-100 %	
I/O Group 3		0x0B	Rotation angle 1	-32768-32767	
		0x0C	Rotation speed 1	1-100 %	
		0x0D	Rotation force 1	20-100 %	
I/O Group 4		0x0E	Rotation angle 2	-32768-32767	
		0x0F	Rotation speed 2	1-100 %	
		0x10	Rotation force 2	20-100 %	

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

Example:

Set the first group of I/O parameter (write) :

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

Return: 01 06 04 05 01 2C 98 B6

Send: 01 06 04 06 00 1E E8 F3 (Force: 30%))

Return: 01 06 04 06 00 1E E8 F3

Send: 01 06 04 07 00 1E B9 33 (Speed: 30%)
Return: 01 06 04 07 00 1E B9 33

IO parameter address is continuous address, and four groups of IO parameters can be configured at one time by using the function code of 0x10, as follows:

Continuous multiple address write(write)[**Group 1:**1000 ‰ position;20%force;10%speed **Group 2:**100‰position;20%force;2%speed **Group 3:**0‰position;100%force;5%speed **Group 4:**592‰position;100%force;10%speed]:

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

3 I/O Control

The I/O mode is a common control method in industry.

The grippers will monitor the pin states of Input 1 and Input 2 (0V and high resistance states). Input 1 controls the **position** and Input 2 controls the **angle**.. You can control this gripper through changing the states of Input 1 and Input 2. As shown in Table 3.1(a) and. Table 3.1(b).

Table 3.1(a) Input 1 State

Pinout	Function	INPUT 1	Pin state	Perform action
INPUT 1	Position	High resistance	0	Target position 1,target force 1,target speed 1
		0V	1	Target position 2,Target Force 2,Target Speed 2

Table 3.1(b) Input 2 State

Pinout	Function	INPUT 1	Pin state	Perform action
INPUT 2	Rotation	High resistance	0	Rotation angle 1, rotation speed 1, rotation force 1
		0V	1	Rotation angle 2, rotation speed 2, rotation force 2

The input pin controls the position and rotation, and the **two pins have sequence**. According to the actual situation, they can confirm whether they move first and then rotate or rotate and then move.

You can also get the gripper state by detecting the states of Output1 and Output 2(0V and high resistance states). as shown in Table 3.2.

Table 3.2 Output1 Output2 State

I/O State (OUT1 OUT2)	State description
0 0	Fingers are in motion
1 0	Fingers are at reference position, No object detected or object has been dropped
0 1	Fingers have stopped due to an object detection

NOTE

• Please make sure that the I/O hardware type of the gripper is compatible with your controller's.

The four states of IO mode can be configured through Modbus RTU protocol of RS485, or the parameters of gripper can be configured through our debugging software. Please refer to the previous section for specific configuration mode. After the four groups of parameters are configured, the gripper can be controlled by setting the Input 1 and Input 2 pin states, and the grip state can be obtained by detecting the Output 1 and Output 2.

3.1 Wiring

In I/O control mode, there are six wires need to be connected, including Input 1, Input 2, 24 V, Output 2, Output 1, GND. Refer to Table 3.3 for specific line sequence and color.

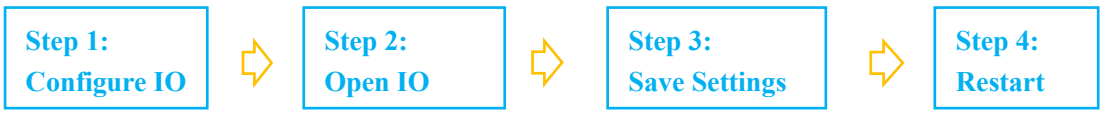
The gripper's Output pin should be connected to the Controller's Input pin. And the gripper's Input pin should be connected to the Controller's Output pin.

Table 3.3 wire Description

Wire color	Description
Brown	INPUT 2
White	INPUT 1
Blue	485_B
Black	485_A
Red	24 V
Grey/Pink	GND
Yellow	OUTPUT 1
Green	OUTPUT 2

3.2 I/O Usage

The diagram of IO operation steps is as follows:



3.2.1 Configure IO

Connect 24 V, GND and 485_ A and 485_ B. Then you can use **I/O Parameter Configuration** to configure four groups of IO parameters .It is recommended to use serial port debugging software at PC for configuration. IO parameters are configured as continuous address, and 12 groups of data including 0x0405-0x0410 need to be set.

You can configure the IO parameters of the gripper in two ways, as follows:

The first way:

Use the test software of the gripper for configuration. As shown in figures 3.1 (a) and 3.1 (b)

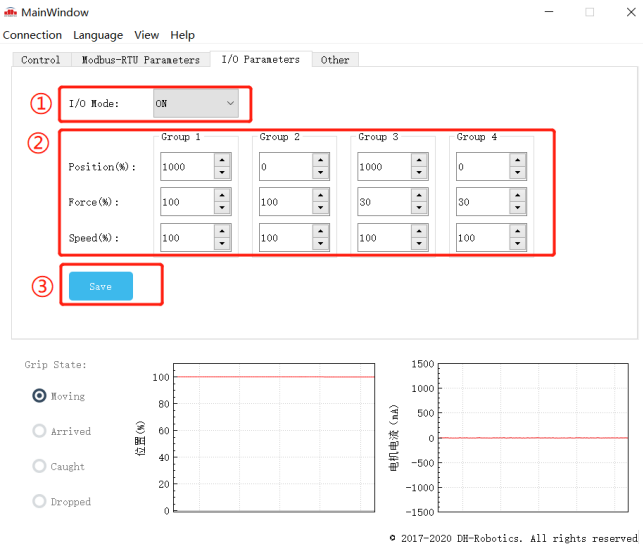


Figure 3.1 (a) graphical configuration

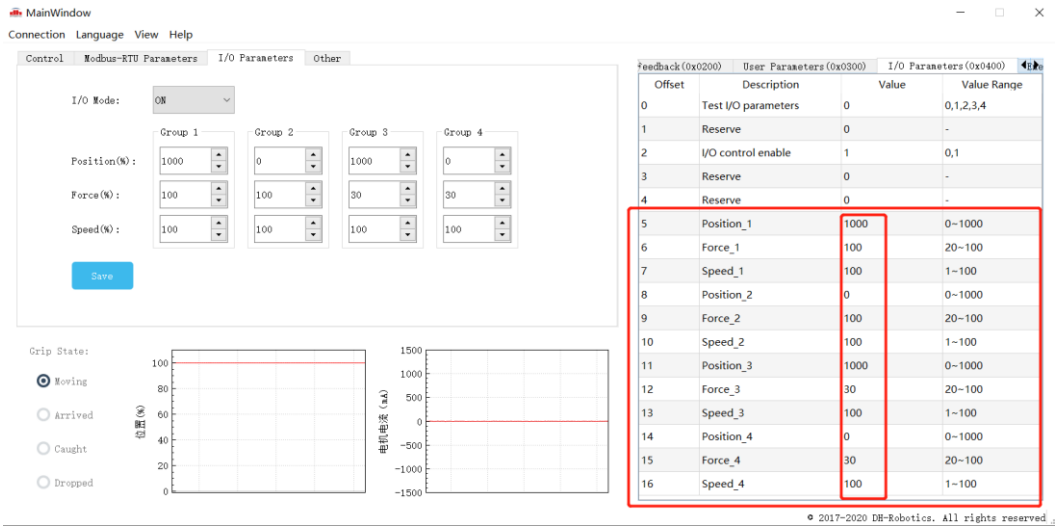


Figure 3.1 (b) test software register configuration

The second way:

You can use continuous multiple register write 10 (HEX):

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

Receive: 01 10 04 05 00 0C D1 3D

3.2.2 Open IO

Turn on the IO mode switch and write 01 at the register of 0x0402 to open it, as shown below: The specific instructions are as follows:

Send: 01 06 04 02 00 01 E8 FA

Return: 01 06 04 02 00 01 E8 FA

3.2.3 Save Settings

Save the configured parameters, and write 01 at the register of 0x300 for saving.
Send: 01 06 03 00 01 48 4e
Return: 01 06 03 00 01 48 4e

3.2.4. Restart

After power off, you can connect the input and output to the corresponding equipment, and power on after confirming that the wiring is correct. The gripper will be initialized automatically. Then the gripper is controlled according to the input signal, and the running state is feedback through output.