

Instruction Manual of JODELL Electric Parallel Gripper



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INTRODUCTION

Thank you for using JODELL electric parallel gripper.

JODELL electric parallel gripper specializes in the plug and play end electric servo gripping technology with high precision, high energy density and high reliability and is the best choice for the end gripping scheme.

Main Features	Scope of Application
● In-built drive control, integrated electromechanical control ● Compact size, large clamping force, power-off protection ● Precise force control, large stroke, adjustable scope ● 2-minute configuration, 3-minute use, real-time fault positioning ● Rapid networking ● Information feedback, industrial interconnection	● 3C electronics ● Automobile manufacturing ● Logistics ● Food ● Medical treatment ● Cosmetics ● Other

This manual is a general manual for JODELL electric parallel gripper and suitable for the electric parallel gripper products. This instruction describes the overall introduction, installation matters, communication protocol and control, networking description, debugging tools, fault handling and warranty issues, etc. For first-time users, please make sure to read this instruction carefully. For any doubts, please consult our technical support staff for assistance.

Precautions
◆ Since this is a general manual for serialized products and the legends in this instruction are for illustrative purposes only, which may differ from the products you have ordered. We are committed to the continuous improvement of products, the product functions will be constantly upgraded, the information provided is subject to change without notice, and you can make your own inquiries. ◆ For any other questions during use, please contact the regional agents or customer service center of the company. National service hotline: 0512-63667858, email: jodell-robots@jodell.cn

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TERMS AND ABBREVIATIONS

Term	Meaning
Electric gripper	JODELL electric parallel gripper, unless otherwise specified
Electric gripper	JODELL electric parallel gripper, unless otherwise specified

VERSION CHANGE RECORDS

Date	Changed version	Changed content
2024/05/08	V1.0	Initial release

CHAPTER 1 SAFETY MATTERS

To ensure that the users use this product safely and correctly and avoid causing injury to personnel, the safety matters are formulated hereby. Prior to using this product, please make sure to read the following safety matters carefully:

(1) The applicability of this product can be judged by the system designer or the specification formulator.

The conditions of use of this product are diverse, so the applicability can be judged by the system designer or the specification formulator. Please judge through analysis and testing when necessary.

Please build the system by referring to the latest product information, confirming the specification, and taking into account the possible malfunctions.

(2) The product should be used by the personnel with full knowledge and experience.

The products mentioned here may damage its safety in case of misoperation.

The operations such as assembly, operation, repair and maintenance of the mechanical device should be executed by a person with full knowledge and experience.

(3) Please use and disassemble the products after confirming that the machinery and device are safe.

- 1) Please use and maintain the machinery and device after taking precautions to prevent falling of moving objects and loss of control.
- 2) Please disassemble the product after confirming that the above safety measures have been taken and that the energy source and power supply to the device have been disconnected to guarantee system safety, and after confirming and understanding the individual precautions for the product on the device.
- 3) Please take precautions for accidental action and misoperation when restarting the machinery and device.

(4) Please consult us in advance while considering the safe countermeasures in the following conditions and environment.

- 1) Conditions or environments other than the specifications are documented clearly.
- 2) Used in atomic energy, railway, aerospace, space devices, ships, military, medical devices, food devices, fuel installations, safety devices, etc., as well as occasions other than the standard specification in the product manual.
- 3) Used in the occasions that may have major influence on people and property, especially the occasions with safety requirements.
- 4) When used for interlocking circuits, mechanical protection function against faults should be set for double interlocking. Regular inspections are also performed to confirm proper operation.

CHAPTER 2 OVERALL INTRODUCTION

JODELL electric parallel gripper is a special gripper designed for industrial automation application scenarios. Through the control of position, speed and force, the modular electric gripper can adapt to the objects of different shapes and sizes and achieve multi-purpose without replacing the end effector, which improves the gripping and operating ability of robots in various industries such as 3C electronics, automobile manufacturing, logistics, food, and medical care. Simple integration of hardware and software with collaborative robot arms and mainstream industrial robots enables “plug and play”, which is more convenient and faster than the traditional gripping solutions.

2.1 Operation Mode

The electric parallel gripper mainly works in two modes: inner support and outer clip.

(1) Inner support mode

This mode is suitable for grabbing objects within the stroke range of the fixture (the size of the clamping range can be designed according to the project, not limited to the stroke) (the shape of the object can be designed according to the project, not limited to the stroke), as shown in Figure 2.1.1.

(2) Outer clip mode

This mode is suitable for grabbing objects with irregular shapes or non-squeezable outer surface, as shown in Figure 2.1.2.

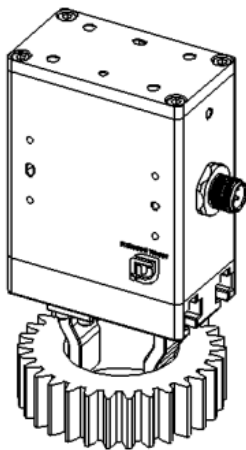


Figure 2.1.1 Inner support mode

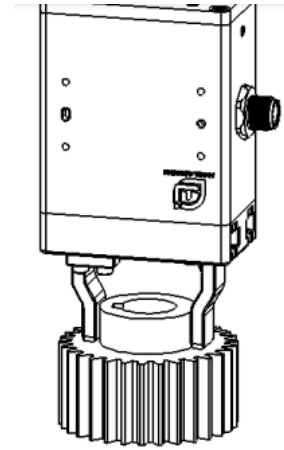


Figure 2.1.2 Outer clip mode

Whether the electric parallel gripper closes to create a sense of encirclement or fingertip grip will depend on:

- ① Operation mode;
- ② Geometrical shape and center of gravity of the parts;
- ③ Relative position of the object.

Therefore, grasping the same part with different “operation modes” may result in different grasping forces depending on the position and geometric shape of the part.

2.2 Basic Information

JODELL electric parallel gripper contains 3 series of products, featuring as follows:

Characteristics of electric parallel gripper: extra-large stroke, precise control, adjustable and controllable force position, grab feedback, drop detection and networking application;

EPG series: electric parallel gripper with high safety, mechanical self-locking mechanism and ultra-thin design to satisfy the side-by-side clamping of multiple workpieces;

EPG-HP series: high-precision electric parallel gripper with high density and high stiffness, suitable for application scenarios requiring high positioning accuracy and force control accuracy;

RG series: robot electric parallel gripper with standard robot interface directly adapted to the end of the cooperative robot.

CHAPTER 3 INSTALLATION MATTERS

Before installation, please carefully read the safety instructions for the electric gripper (Chapter 1 Safety Precautions). Do not turn on the power in advance before fixing the electric gripper.

3.1 Using Conditions

The operation, transportation and storage conditions for the electric gripper are:

- (1) Operating ambient temperature: $+5^{\circ}\text{C} - +40^{\circ}\text{C}$;
- (2) Operating ambient humidity: 20%-85% (no frost, no condensation);
- (3) Transportation and storage temperature: $-20^{\circ}\text{C} \sim +80^{\circ}\text{C}$;

Warning

The electric parallel gripper shall be kept away from vibration and shock, and shall be used in an environment free of dust, smoke or water, corrosive gases, liquids or explosive gases and strong electromagnetic interference sources. The cleanliness of the surface of the electric gripper may affect the friction against the object to be grasped. It is important to keep the electric gripper clean and away from sources of debris contamination and to carry out periodic maintenance according to the maintenance intervals recommended by the manufacturer.

3.2 Mechanical Connection

When the JODELL electric parallel gripper is used, the fixture with the electric gripper shall be linked and the hole location on the connecting end face shall be consistent with the hole location on the both side panels or bottom panel of the electric gripper; otherwise, a switching unit is required for switching. Ensure that the holes are secured using at least high-strength bolts.

The fingertips of the electric gripper can be designed and replaced according to different application scenarios and the size of the object clamped. Generally, when gripping objects by friction, the clamping force shall be greater than 10-20 times the weight of the object. A larger clamping force shall be reserved for eccentric clamping, precise positioning, and insufficient contact surface.

Installation instructions:

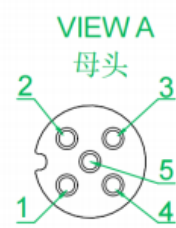
- (1) When fixing the main body, please use all the bolt holes on the same installation surface for fixing;
- (2) Tighten the bolts.

For each operation mode, the operator can control the force and speed of the fingers. Motion can be completed with just a “Go to target position” command. The electric parallel gripper is equipped with an internal controller that can adjust speed and force by sending control commands to the gripper according to the communication protocol described in Chapter 6. The fingers are mechanically designed to automatically adapt to the shape of the object.

3.3 Electrical Connection

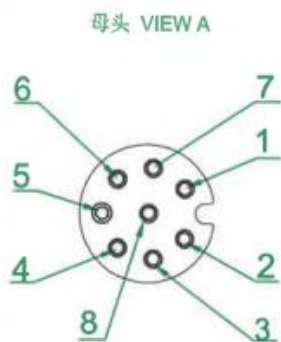
JODELL electric parallel gripper is powered by DC24V and supports Modbus communication control. Some models support Modbus communication control and I/O control.

Table 3.3.1 Definition of five-core wire sequence



SN	Cable	Function
1	Brown	DC24V
2	White	485A
3	Blue	DC0V
4	Black	485B
5	Gray	GND

Table 3.3.2 Definition of eight-core wire sequence



SN	Cable	Function
1	White	485A
2	Black	485B
3	Pink	OUT2
4	Yellow	OUT1
5	Brown	DC24V
6	Orange	IN2
7	Green	IN1
8	Blue	DC0V

3.3.1 IO signal input and output

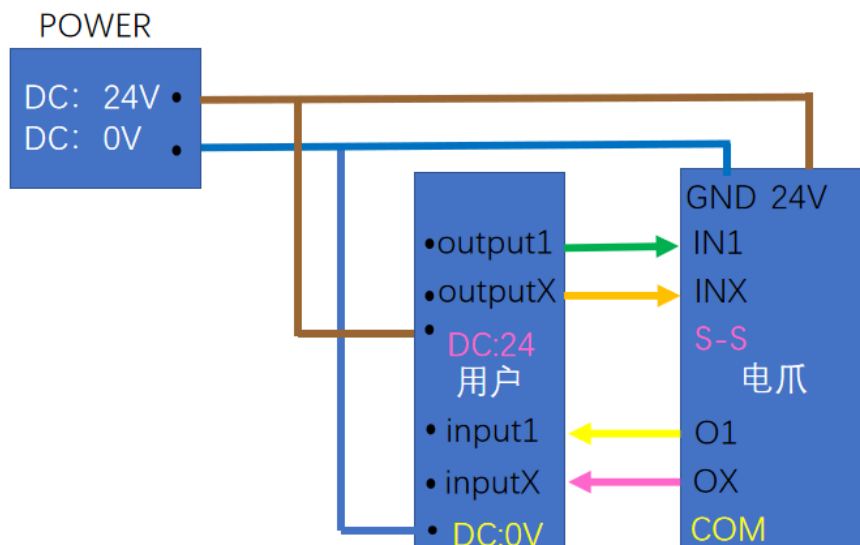
(Support IO control models only)

Current product models

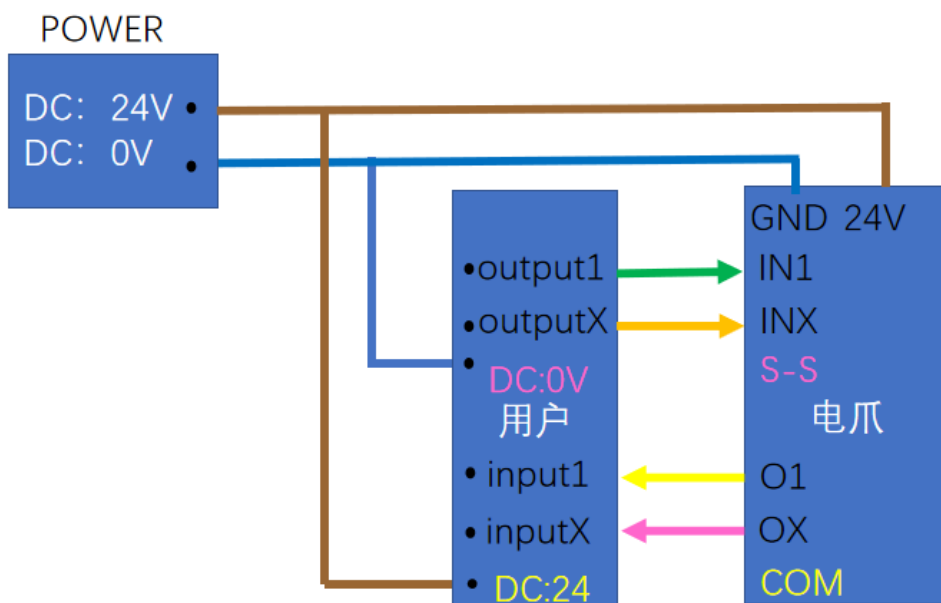
Note: both NPN and PNP below refer to the electric gripper.

- 1) IO input: support NPN and PNP connections.
- 2) IO output: support NPN and PNP connections, where the internal circuit is open drain output (the pull-up resistor shall be connected on the client signal side). **The maximum allowable filling current of open leakage output is 50 mA. It is recommended that the users use it in the range of 10~20mA.**

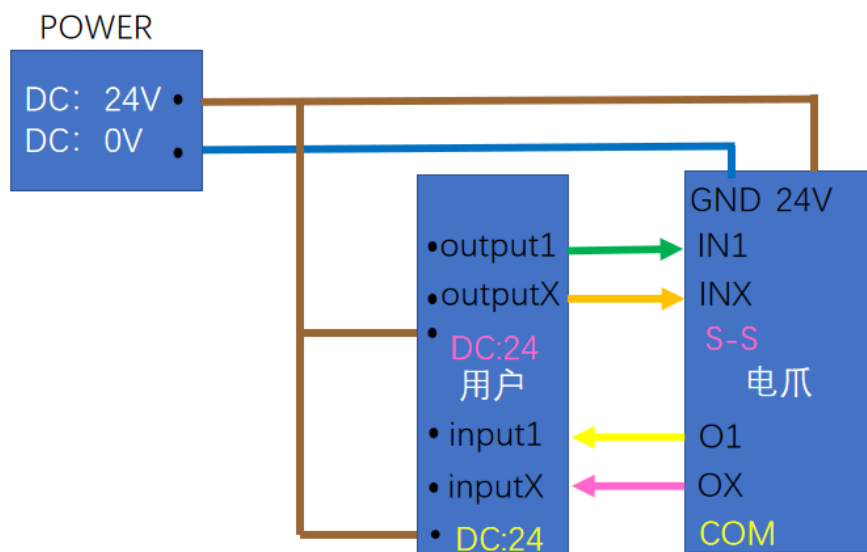
输入NPN/输出NPN型接线示意图(N/N)



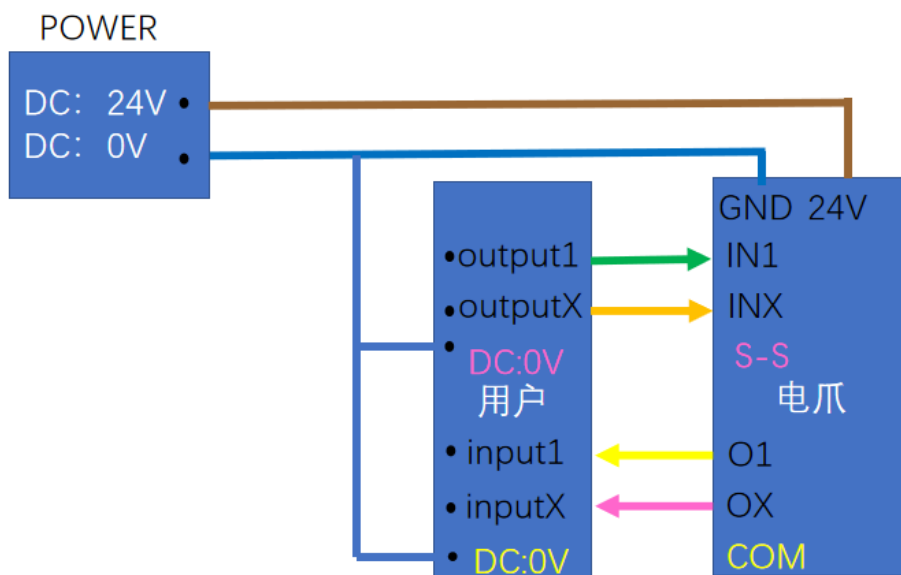
输入PNP/输出PNP型接线示意图(P/P)



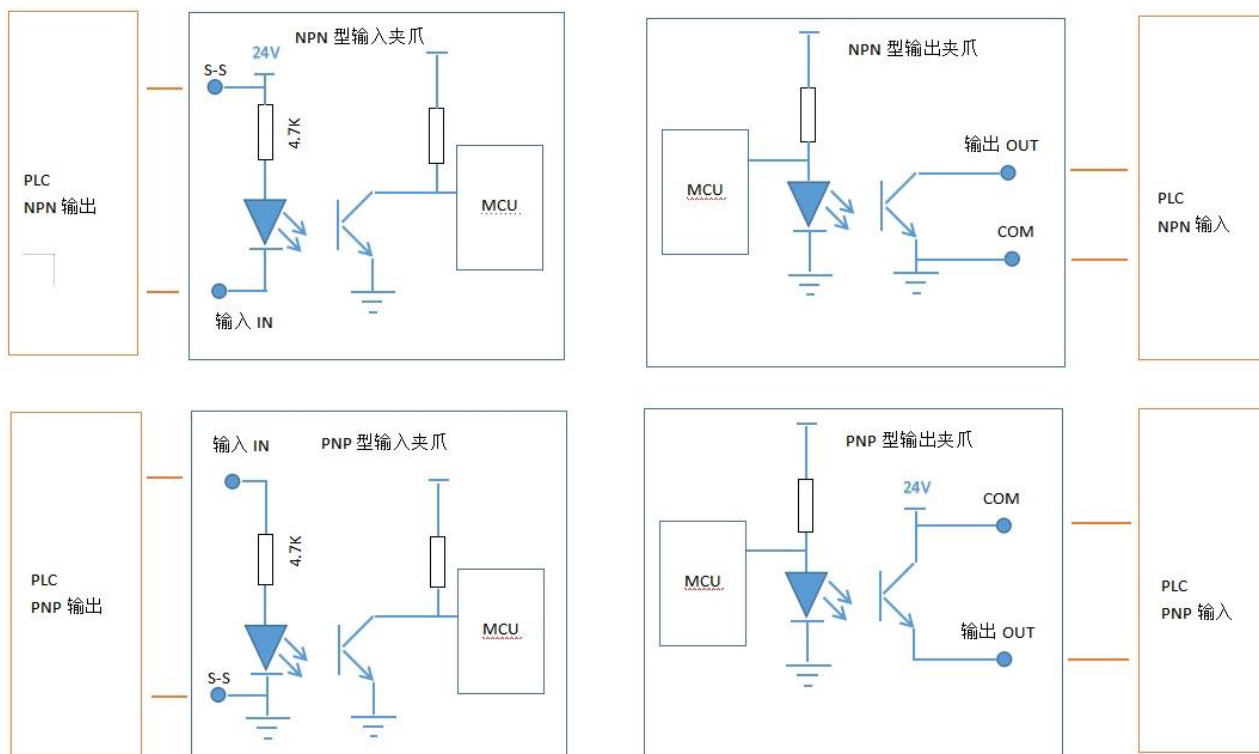
输入NPN/输出PNP型接线示意图(N/P)



输入PNP/输出NPN型接线示意图(P/N)



3) Sketch of internal IO circuit of electric gripper



Warning

Cables for this product requires the use of flexible clamping devices to ensure that the cable is fixed, maintain the appropriate degree of freedom, ensure that the cable is long enough for twist and tensile, and prevent the connection part of cable and the electric gripper connector from loosening and dropping during operation.

CHAPTER 4 COMMUNICATION AND CONTROL

4.1 General Specification

JODELL electric parallel gripper is connected using RS485 interface and controlled by Modbus RTU protocol. Some models support IO control. The electric gripper is used as the Modbus slave station in the communication network. In contrast, the upper computer, PLC or other modules that send the control commands to the electric gripper are used as the Modbus master station. This section is intended to provide configuration instructions for the Modbus master station.

For a general introduction to Modbus RTU and detailed information of the related CRC algorithm, please read the specifications and implementation guidelines related to Modbus.

4.2 Serial Port Setting

Table 4.1 describes the connection requirements of the JODELL electric parallel gripper controlled by Modbus RTU protocol.

Table 4.2.1 Connection requirements

Name	Data
Physical interface	RS-485
Baud rate	115200 bps (default)
Data bits	8 bits
Stop bit	1
Parity check	None
Data flow control	None
First address of the control register	0x03E8(1000)
First address of the status register	0x07D0(2000)

4.3 Command Frame Format

JODELL electric parallel gripper adopts the standard Modbus-RTU protocol, with the message format as follows:

Table 4.3.1 Message format

Device Address	Function Code	Data Format	CRC Check Code
1byte	1byte	N*1byte	2bytes

Device address: Slave address of JODELL electric parallel gripper in Modbus-RTU communication network, in the range of 1-247. This parameter can be modified.

Function code: JODELL electric parallel gripper supports function codes 0x03, 0x04, 0x06 and 0x10.

Data format: including register address for read/write data, data length, data, etc.

CRC check code: data frame CRC check code.

CHAPTER 5 DEBUGGING TOOLS

JODELL electric parallel gripper supports up to 8 groups of custom parameters, convenient for users to switch different working conditions. Users can debug configuration parameters in advance according to the field situation, for easy switching quickly. Users can send control commands to the electric gripper to modify register parameters for debugging according to the communication protocol described in Chapter 6, and can also use the debugging tools provided by the company for quick debugging. To facilitate the needs of different users, the company provides the corresponding debugging tools: dedicated upper computer software (PC version).

5.1 Dedicated Upper Computer Debugging Software (PC Version)

5.1.1 Instructions for use

Dedicated upper computer debugging software (PC version) is an installation-free software, users can directly open and use it, but the operating environment of PC shall meet the following requirements:

- (1) Windows 7 or higher version;
- (2) The main memory is at least 50MB;

As it is required to use the USB-to-485 module, corresponding drivers must be installed. For connection of DC power and the communication connection line, please refer to [3.3 Electrical Connection](#).

After completing the hardware wiring and software installation, you can use the dedicated upper computer debugging software (PC version) to debug the electric gripper, with the specific instructions as follows:

- (1) Open the special upper computer software for PC

The dedicated upper computer debugging software (PC version) is installation-free, which can be opened by double-clicking the software directly, with its interface as shown in Figure 5.1 below.



Figure 5.1.1 Main interface of special upper computer software for PC

(2) Open the serial port communication

When the debugging software is opened, the interface shown in Figure 5.1.1 appears. Select the corresponding product number to enter. In this manual, EPG electric parallel gripper is used, so EPG is selected to enter, as shown in Figure 5.1.2.

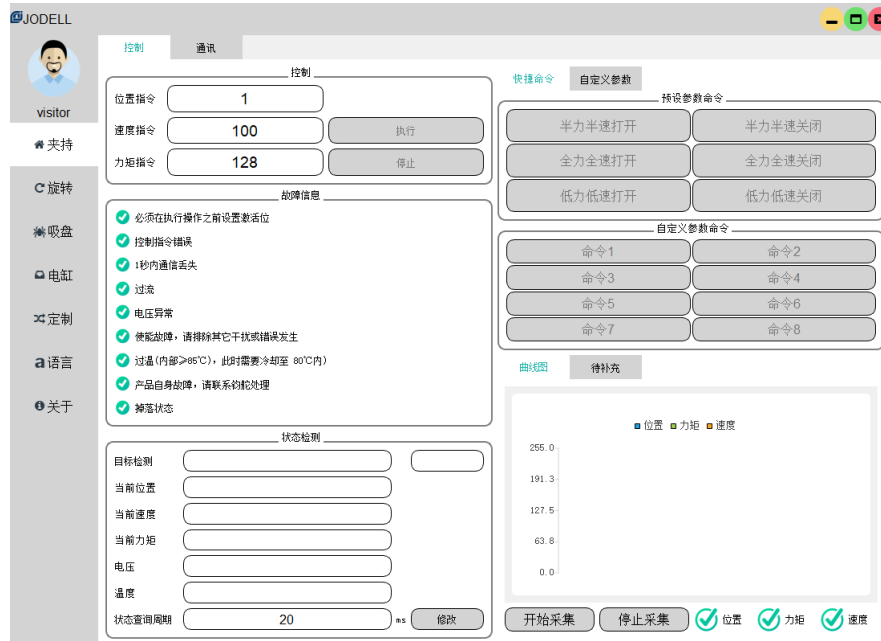


Figure 5.1.2 Debugging software interface

Determine whether the baud rate and serial number of the gripper are correct, and ensure that the serial port to be open is connected to the gripper from the drop-down list shown in Figure 5.1.3.



Figure 5.1.3 Open the serial port

(3) Activate the electric gripper

After the debugging software is successfully connected to the electric gripper, it is necessary to actively activate the electric gripper. Before activating the electric gripper, it is necessary to determine the ID number of the electric gripper, as shown in Figure 5.1.4. Read the ID according to the steps on the surface shown in the figure:

- ① As shown in Position 1 in the special function diagram, the range of ID number scanning can be determined by modifying the Position 2 in the Figure. Click Position 3 in the figure to scan;
- ② After scanning ID, the ID number of the electric gripper will appear at the position 4 in the figure;
- ③ Enter the same ID or the ID number to be changed in position 5, and click 6 to change the ID
- ④ When Position 7 in the figure shows that the ID is changed successfully, the ID change is now complete.

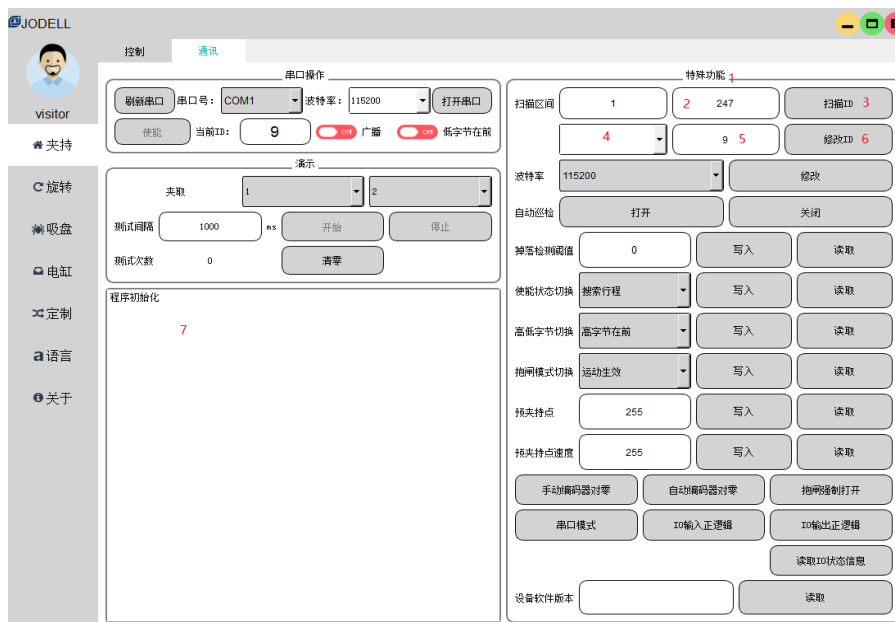


Figure 5.1.4 Modify ID

After successfully modifying the ID, click the enable button in the debugging software, and when the button becomes disabled and the electric gripper opens with fingers finally stopping the motion, it indicates successful enable or initialization. Special attention should be paid that every time the electric gripper is powered off and restarted, it needs to be enabled again to reset the position of the electric gripper, otherwise the electric gripper will have a position error message.

(4) Use of quick-build command, self-defined parameters of the debugging software

For ease of quick debugging, the dedicated upper computer debugging software (PC version) provides several kinds of quick commands for the users. The users can operate the electric gripper by clicking the quick command to carry out the corresponding actions. EPG series modular electric gripper provides up to 8 groups of customized parameters, so users can preset the parameters according to the actual process requirements to adapt to different working conditions. As shown in Figure 5.1.5, after entering a custom parameter, click the "Write" button behind it to send the custom parameter to the electric gripper. After the custom parameter is set, the user can click the custom parameter command to perform the corresponding operations.



Figure 5.1.5 Custom parameters and shortcut commands

(5) Status test

JODELL electric parallel gripper supports real-time status feedback, as shown in Figure 5.1. 6. The running status, motion curve and fault information can be quickly viewed through the special upper computer debugging software at the PC end.



Figure 5.1.6 Status detection

(6) Demo mode

To easily and quickly show the gripper function, the debugging software provides relevant demonstration function, as shown in Figure 5.1.7. Click Start to start demonstration. At this time, the upper computer software will send the selected data successively at the test time interval. The selected command can be taken and executed by selecting the value corresponding to the gripping in demo mode under the drop-down list. For example, selecting 1 and 2 corresponds to the shortcut commands half-force and half-speed opening and closing, and the rest are shown in Figure 5.1.7

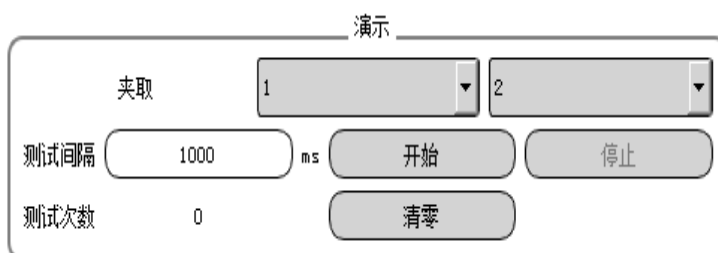




Figure 5.1.7 Demonstration mode

(7) Special functions

Other special functions are shown in Figure 5.1. 8. The debugging software supports baud rate modification and other functions to meet user requirements.

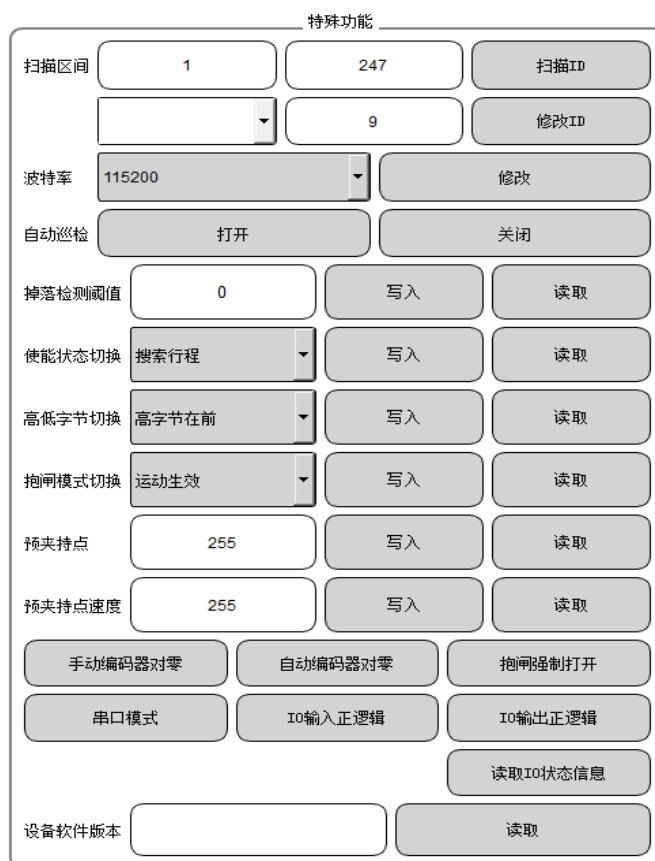


Figure 5.1.8 Special function illustration

CHAPTER 6 INSTRUCTIONS FOR MODBUS PROTOCOL

6.1 Electric Parallel Gripper Modbus Register

The electric gripper is abundant in read-write registers, including the control register, status feedback register and device register, to realize various functions. The table of control registers is as follows:

Table 6.1.1 Electric gripper Modbus register table

Address of control register	Instruction of control register	Address of status register	Instruction of status register
Low byte of 0x03E8	Control register	Low byte of 0x07D0	Gripper status
High byte of 0x03E8	Register without parameter control commands	Low byte of 0x07D1	Fault status
Low byte of 0x03E9	Reserved	High byte of 0x07D1	Position status
High byte of 0x03E9	Position setting register	Low byte of 0x07D2	Speed status
Low byte of 0x03EA	Speed setting register	High byte of 0x07D2	Force status (instant current)
High byte of 0x03EA	Force setting register	Low byte of 0x07D3	Bus voltage
Low byte of 0x03EB	Position setting of preset parameter 1	High byte of 0x07D3	Ambient temperature
High byte of 0x03EB	Speed setting of preset parameter 1		
Low byte of 0x03EC	Force setting of preset parameter 1		
High byte of 0x03EC			
Low byte of 0x03ED	Position setting of preset parameter 2		
High byte of 0x03ED	Speed setting of preset parameter 2		
Low byte of 0x03EE	Force setting of preset parameter 2		
High byte of 0x03EE			
Low byte of 0x03EF	Position setting of preset parameter 3		
High byte of 0x03EF	Speed setting of preset parameter 3		
Low byte of 0x03F0	Force setting of preset parameter 3		
High byte of 0x03F0			
Low byte of 0x03F1	Position setting of preset parameter 4		
High byte of 0x03F1	Speed setting of preset parameter 4		
Low byte of 0x03F2	Force setting of preset parameter 4		
High byte of 0x03F2			
Low byte of 0x03F3	Position setting of preset parameter 5		
High byte of 0x03F3	Speed setting of preset parameter 5		
Low byte of 0x03F4	Force setting of preset parameter 5		
High byte of 0x03F4			
Low byte of 0x03F5	Position setting of preset parameter 6		
High byte of 0x03F5	Speed setting of preset parameter 6		
Low byte of 0x03F6	Force setting of preset parameter 6		
High byte of 0x03F6			
Low byte of 0x03F7	Position setting of preset parameter 7		
High byte of 0x03F7	Speed setting of preset parameter 7		
Low byte of 0x03F8	Force setting of preset parameter 7		
High byte of 0x03F8			
Low byte of 0x03F9	Position setting of preset parameter 8		
High byte of 0x03F9	Speed setting of preset parameter 8		
Low byte of 0x03FA	Force setting of preset parameter 8		
High byte of 0x03FA			
Low byte of 0x03FB	Encoder zero setting		
High byte of 0x03FB			

Low byte of 0x03FC	Force open brake		
High byte of 0x03FC			
Low byte of 0x03FD	Control mode switching		
Low byte of 0x03FE	IO mode switching		

6.2 Instruction of Control Register (0x03E8)

6.2.1 Control register (low byte of 0x03E8)

This register is the main function register of the electric gripper, including the functions such as electric gripper enabling, mode switching and motion control etc.

Table 1 Description of control register

bit	Name	Function Description
0	rACT	The electric gripper shall be enabled before controlling. 0x0: stop the electric gripper, 0x1: enable the electric gripper Note: the rACT bit remains unchanged in any other operation. Clear the rACT bit to restart the electric gripper and clear all the fault status. When enabling, make sure that there are no obvious obstructions in the slide rail that could cause the stroke to be reduced
1	rMODE	Set the working mode of the electric parallel gripper 0x0: in the parameter control mode, and the position, speed and force parameters under the current command should be set. 0x1: In no input parameter control mode, reference register 0x03E8 high byte for fixed parameter reference mode.
2	Reserved	Reserved
3	rGTO: target position	Control the electric gripper to move according to the parameters set. 0x0: stop 0x1: move to the target position Note: in case that this bit is not set, this device only executes the enable command, not acting; When rMODE=0x0, the parameters are set by high byte of 0x03E9 and 0x03EA; When rMODE=0x1, the parameter is set by the parameter corresponding to the high byte of 0x03E8.
4	rATR:automatic inspection	This bit controls the electric gripper to open slowly, until all the motion shafts reach their mechanical limit. The electric gripper will send a fault signal after completing all the motions. Before executing other actions, this fault signal shall be cleared. This action executes all the commands except rACT, which can help to judge whether the electric gripper is normal. 0x0: normal 0x1: emergency automatic release Note: 1) This command must be set to 0x0 and then 0x1 before it can be executed. (2) Generally, it is operated only to check whether the gripper works properly or not after an emergency in the robotic arm or equipment, and the command is not executed in general.
5	rARD: automatic patrol inspection direction	rARD: moving direction of patrol inspection command. rARD bit shall be set before or at the same time as rATR bit, as the motion direction is required to be set when starting the automatic release 0x0: the patrol inspection direction is to close the electric gripper; 0x1: the patrol inspection direction is to open the electric gripper
6	Reserved	Reserved
7		

6.2.2 Register without parameter commands (high byte of 0x03E8)

This register is the parameter command of the master station when the electric gripper is in rMODE=0x1.

Table 6.2. 2 Description of parameterless instruction register

bit	Name	Function Description				
0-7	The parameter setting command under control mode without parameter entering. It is only valid in case of rMODE=0x1. 0x03EB-0x03FA shall be preset the format of the parameter is the same as 0x03E9 high byte and 0x03EA.	INSTRUCTION	Function	Position	Speed	Force
		0x0	Reserve	NA		
		0x1	Half-force half-speed open	0x00	0x80	0x80
		0x2	Half-force half-speed close	0xFF	0x80	0x80
		0x3	Full-force full-speed open	0x00	0xFF	0xFF
		0x4	Full-force full-speed close	0xFF	0xFF	0xFF
		0x5	Low-force low-speed open	0x00	0x00	0x00
		0x6	Low-force low-speed close	0xFF	0x00	0x00
		0x7	Reserve			
		0x8	Electric gripper parameter 1	Low byte of 0x03EB	High byte of 0x03EB	Low byte of 0x03EC
		0x9	Electric gripper parameter 2	Low byte of 0x03ED	High byte of 0x03ED	Low byte of 0x03EE
		0xA	Electric gripper parameter 3	Low byte of 0x03EF	High byte of 0x03EF	Low byte of 0x03F0
		0xB	Electric gripper parameter 4	Low byte of 0x03F1	High byte of 0x03F1	Low byte of 0x03F2
		0xC	Electric gripper parameter 5	Low byte of 0x03F3	High byte of 0x03F3	Low byte of 0x03F4
		0xD	Electric gripper parameter 6	Low byte of 0x03F5	High byte of 0x03F5	Low byte of 0x03F6
		0xE	Electric gripper parameter 7	Low byte of 0x03F7	High byte of 0x03F7	Low byte of 0x03F8
		0xF	Electric gripper parameter 8	Low byte of 0x03F9	High byte of 0x03F9	Low byte of 0x03FA

6.2.3 Dynamic position register (high byte of 0x03E9)

This register is the position parameter setting register in case of rMODE=0x0

Table 6.2.3 Location parameter register description

bit	Name	Function Description
0-7	Position parameter register	This register is used to set the target position of the gripper fingers. Positions 0x00 and 0xFF correspond to the fully open and fully closed mechanical loss limit Fully open: 0x00 Fully closed: 0xFF Note: 1. 0x00 represents fully open, 0xFF represents fully closed, with a linear relationship between the two fingers. 2. To avoid identification error of gripping state position, the gripping position shall be determined by combining the maximum stroke of the electric gripper and the object to be gripped. For example, for EPG50-060, assuming the size of the object to be gripped by the electric gripper to be 10mm, the maximum stroke of EPG50-060 electric gripper to be 50mm, the written value corresponding to the

		maximum position of EPG50-060 to be provided as 255 (fully closed) and the written value corresponding to the minimum position to be provided as 0 (fully open), the 10mm object can be gripped at the gripping position of 204 corresponding to EPG50-060 according to the corresponding proportional relationship. However, to ensure that the electric gripper can give regular feedback after gripping the object, it is necessary to set the position that is just enough to grip the object to more than 6 (2% of the maximum 255). Therefore, the gripping position here shall be set to above 210 before the electric gripper can give normal feedback.
--	--	---

6.2.4 Dynamic speed register (low byte of 0x03EA)

This register is the speed parameter setting register in case of rMODE=0x0

Table 6.2.4 Speed parameter register description

bit	Name	Function Description
0-7	Speed parameter register	This register is used to set the closing or opening speed of the gripper in real time, however, setting a speed may not initiate an action Lowest speed: 0x00, highest speed: 0xFF Note: 0x00 represents the lowest speed that can be controlled stably, and 0xFF represents the highest speed that can be controlled, varying linearly from each other.

6.2.5 Dynamic force register (high byte of 0x03EA)

This register is the force parameter setting register in case of rMODE=0x0

Table 6.2.5 Force parameter register description

bit	Name	Function Description
0-7	Force parameter register	Force setting determines the final grip of the gripper. This force will determine the maximum current sent to the motor. Minimum force: 0x00, maximum force: 0xFF Note: 0x00 represents the minimum force that can be controlled stably, and 0xFF represents the maximum force that can be controlled.

6.2.6 Preset position register (low bytes of 0x03EB, 0x03ED, 0x03EF, 0x03F1, 0x03F3, 0x03F5, 0x03F7 and 0x03F9)

This register is the position parameter setting register in case of rMODE=0x1

Table 6.2.6 Location parameter register description

bit	Name	Function Description
0-7	rPR	This register is used to set the target position of the gripper fingers. Positions 0x00 and 0xFF correspond to the fully open and fully closed mechanical loss limit Fully open: 0x00, fully closed: 0xFF Note: regardless of the variation between fingers, 0x00 is always fully open and 0xFF is fully closed, with a linear relationship between the two fingers.

6.2.7 Preset speed register (high byte of 0x03EB, 0x03ED, 0x03EF, 0x03F1, 0x03F3, 0x03F5, 0x03F7, 0x03F9)

This register is the speed parameter setting register in case of rMODE=0x1

Table 6.2.7 Speed parameter register description

bit	Name	Function Description
0-7	rSP	This register is used to set the closing or opening speed of the gripper in real time, however, setting a speed may not initiate an action Lowest speed: 0x00, highest speed: 0xFF Note: 0x00 represents the lowest speed that can be controlled stably, and 0xFF represents the highest speed that can be controlled, varying linearly from each other.

6.2.8 Preset force register (low byte of 0x03EC, 0x03EE, 0x03F0, 0x03F2, 0x03F4, 0x03F6, 0x03F8 and 0x03FA)

This register is the torque parameter setting register in case of rMODE= 0x1

Table 6.2.8 Force parameter register description

bit	Name	Function Description
0-7	rFC	Force setting determines the final grip of the gripper. This force will determine the maximum current sent to the motor. If the current limit is exceeded, the finger stops and triggers a target detection notification. Minimum force: 0x00, Maximum force: 0xFF Note: 0x00 represents the minimum force that can be controlled stably, and 0xFF represents the maximum force that can be controlled.

6.2.9 Encoder register (low byte of 0x03FB)

Table 6.2.9 Encoder register description

bit	Name	Function Description
0-7	Encoder register	This register is used for zero setting of the encoder Note: 0x01 represents encoder zero setting, 0x00: normal status

6.2.10 Brake register (low byte of 0x03FC)

Table 6.2.10 Brake register description

bit	Name	Function Description
0-7	Brake register	This register is used to set force open brake Note: 0x01 represents force open brake, 0x00: normal status

6.2.11 Control mode switch register (low byte of 0x03FD)

Table 6.2.11 Mode switching register description

bit	Name	Function Description
0-7	Switch register	This register is used for control mode switching (Support IO control models only) 0x55: IO mode control Other commands: Modbus-RTU communication control Note: in 0x55, the communication can only modify the register, but cannot control operation of the electric gripper, and it only supports IO combinations to control motion of the electric gripper.

6.2.12 IO mode switching register (low byte of 0x03FE)

Table 6.2.12 Mode switching register description

bit	Name	Function Description
0-7	IO status switch register	This register is used for switching the status of IO inputs and outputs (dedicated to IO control models) 0x00: IO status high level valid Other commands: IO status low level valid Note: The corresponding output status is also reversed regardless of switching to which input condition.

6.3 Instruction of Control Status Feedback Register (0x07D0)

6.3.1 Electric gripper status register (low byte of 0x07D0)

This register is the main function register of the electric gripper, including the functions such as electric gripper enabling, mode switching and motion control etc.

Table 6.3.1 Status register description

bit	Name	Function Description
-----	------	----------------------

0	gACT	gACT: show the enable status of the electric gripper, corresponding to rACT 0x0: The electric gripper is in resetting 0x1: The electric gripper is in enabling status
1	gDropSta	gDropSta: Displays the workpiece drop from the electric gripper 0x0: Normal 0x1: Workpiece drop
2	gMODE	Mode: operating mode 0x0: in the parameter control mode 0x1: in the control mode without input parameters
3	gGTO	Action status of electric gripper 0x0: stop (or in executing activation/patrol inspection) 0x1: go to the target position
4	gSTA	Return to the current status and action of the electric gripper 0x0: the electric gripper is in reset or patrol inspection status, if it has been activated, it needs to check the fault code 0x1: in activating 0x2: not used, reserved 0x3: activation completed
5		
6	gOBJ	Target detection, a built-in function, indicates whether an object is grasped or not, which is invalid when gGTO=0x0. 0x0: the finger is moving to the specified position. 0x1: when the finger is splayed, it has stopped due to contact with the object, indicating that the object has been supported in the inner support mode. 0x2: when the finger is closed, it has stopped due to contact with the object, indicating that the object has been clipped in the outer clip mode. 0x3: the finger has reached the specified position but no object has been detected, or the object has been lost or unclipped and dislodged. Note: in some cases, the object may be clamped but failed to be detected, probably because the clamped object is too thin to detect the change of force, so please ignore this register in this case.
7		

Example: When 0xB1 is returned, 0xB1 is converted to a binary number **10110001**

Red part: indicate target detection. 10 is converted to hexadecimal, i.e. 0x02. When the finger is closed, it has stopped due to contact with the object, indicating that the object has been clipped in the outer clip mode.

Yellow part: indicate the current status and action of the electric gripper. 11 is converted to hexadecimal, i.e. 0x03, representing that the activation is complete

Green part: it represents stop, if 0 is converted to hexadecimal, it will be 0x00 (or in executing activation/patrol inspection)

Blue part: indicate the working mode. 0 is converted to hexadecimal, i.e. 0x00, representing the parameter control mode

Purple part: it represents the enable status of the electric gripper, if 1 is converted to hexadecimal, it will be 0x01, representing that the electric gripper is in enabling status

6.3.2 Fault register (low byte of 0x07D1)

This register is the fault status register of the electric gripper, which is used for identifying different faults.

Table 6.3.2 Status register description

bit	Name	Function Description
0	Activation fault bit of electric gripper	The activation bit must be set before executing operations. 0x0: normal

		0x1: the motor is not activated
1	Control command fault bit	Control command error 0x0: normal 0x1: control command error When the control command is wrong or at fault, the blue light flashes quickly and the red light is always off
2	Communication fault bit	Communication loss within 1 second 0x0: normal 0x1: communication loss When the communication is lost, the blue light flashes slowly, and the red light is normally off
3	Overcurrent fault bit	Current abnormality 0x0: normal 0x1: current abnormality When current abnormality occurs, the blue light is normally off, and the red-light flashes quickly
4	Voltage abnormality fault bit	Voltage abnormality 0x0: normal 0x1: voltage abnormality, being lower than 20V or higher than 30V When voltage abnormality occurs, the blue light is normally off, and the red-light flashes slowly
5	Enabling fault bit	Enabling error status 0x0: normal 0x1: enabling fault bit When enabling fault occurs, the red and blue lights flash alternately
6	Overtemperature fault bit	Overtemperature (internal $\geq 85^{\circ}\text{C}$), at this time, it requires to cool to within 80°C 0x0: normal 0x1: Overtemperature fault When overtemperature fault occurs, the blue light is normally off, and the red light is normally on
7	Product self-fault bit	For product self-fault, please contact JODELL for handling 0x0: normal 0x1: product self-fault occurs When product self-fault occurs, the red and blue lights are always on.

6.3.3 Position status register (high byte of 0x07D1)

This register is the current position register of the electric gripper.

Table 6.3.3 Location status register description

bit	Name	Function Description
0-7	gPR	This register is used to display the current setting position, consistent with rPR. Positions 0x00 and 0xFF correspond to the fully open and fully closed mechanical loss limit Fully open: 0x00 Fully closed: 0xFF Note: regardless of the variation between fingers, 0 is always fully open and 255 is fully closed, with an almost-linear relationship between the two fingers.

6.3.4 Speed status register (low byte of 0x07D2)

This register is the current speed status register of the electric gripper.

Table 6.3.4 Speed status register description

bit	Name	Function Description
-----	------	----------------------

0-7	gSP	This register is used to display the current setting speed. Speeds 0x00 and 0xFF correspond to the lowest speed and the highest speed of finger movement of the electric gripper Lowest speed: 0x00 Highest speed: 0xFF Note: The finger speed is linear between 0x00 and 0xFF.
-----	-----	--

6.3.5 Force status register (high byte of 0x07D2)

This register is the current force status register of the electric gripper.

Table 6.3.5 Force status register description

bit	Name	Function Description
0-7	gCU	The value is the current value of the current motor, and this value is a per-unit value

6.3.6 Bus voltage register (low byte of 0x07D3)

This register stores the bus voltage detected by the controller, with unit of V.

Table 6.3.6 Bus voltage register description

bit	Name	Function Description
0-7	gBusVolt	The bus voltage occupies 1 byte, parsed as unsigned 8-bit data

6.3.7 Ambient temperature register (high byte of 0x07D3)

This register stores the ambient temperature detected by the controller.

Table 6.3.7 Ambient temperature register description

bit	Name	Function Description
0-7	gTemp	The ambient temperature occupies 1 byte, parsed as signed 8-bit data

6.4 Device Register (0x1388)

6.4.1 Software version register (0x138C)

Table 6.4.1 Software version register description

bit	Name	Function Description
0-7	Software version number	Software version number Major version number
0-7	Software version number	Software version number Sub-version number

6.4.2 Device ID register (low byte of 0x138D)

The device ID is the address identification of the device in the Modbus communication network, and the value can be modified via Modbus communication.

Table 6.4.2 Device ID register description

bit	Name	Function Description
0-7		Device ID (1 - 247)

6.4.3 Device communication configuration register (low byte of 0x138E)

The communication configuration parameters refer to the Modbus-RTU communication baud rate used by the device, as described below:

Table 6.4.3 Device ID register description

bit	Name	Function Description
0-7	Baud rate	0:115200 1:57600 2:38400 3:19200 4:9600 5:4800 (The default value is 0)

6.5 Modbus Function Code

6.5.1 Read hold register (FC03)

The function code 0x03 (FC03) is used to read the status of the hold register.

Examples of FC03 (0x03) reading functions:

Read register 0x03E8 (1000) and register 0x03E9 (1001).

The command entered are: 09 03 03 E8 00 02 45 33

Command	Description
09	Slave station address
03	Function code 03 (read hold register)
03E8	Address of the first register requested to be read
0002	Number of the registers requested to be read
4533	CRC check

The returned values are: 09 03 04 00 00 00 00 73 F3

Command	Description
09	Slave station address
03	Function code 03 (read hold register)
04	Number of data bytes (2 registers x 2 bytes = 4 bytes)
0000	Contents of the register 0x03E8 read
0000	Contents of the register 0x03E9 read
73F3	CRC check

6.5.2 Read input register (FC04)

The function code 04 (FC04) is used to read the status of the input register. These data feedback the current status, position, speed of the electric gripper as well as force of the electric gripper etc.

Examples of FC04 (0x04) reading functions:

Read register 0x07D0 (2000) and register 0x07D1 (2001), which contain the register status, object detection, fault status and position request.

The commands entered are: 09 04 07 D0 00 02 70 0E

Command	Description
09	Slave station address
04	Function code 04 (read input register)

07D0	Address of the first register requested to be read
0002	Number of the registers requested to be read
700E	CRC check

The returned values are: 09 04 04 00 00 00 04 73 87

Command	Description
09	Slave station address
04	Function code 04 (read input register)
04	Number of data bytes (2 registers x 2 bytes = 4 bytes)
0000	Contents of the register 07D0 read (according to section 6.3, the last 00 represents the gripper status)
0004	Contents of the register 07D1 read (according to section 6.3, 00 represents position, 04 represents the fault information)
7387	CRC check

6.5.3 Write single register (FC06)

The function code 0x06 (FC06) is used to modify the single register value. Examples of such data include action requests, speed and force etc.

Examples of FC06 (0x06) write functions:

Setting register 0x03E8 (1000) to request the setting of the enable state of EPG series modular electric gripper.

The command entered are: 09 06 03 E8 00 01 C9 32

Command	Description
09	Slave station address
06	Function code 06 (write single register)
03E8	Address of the register requested to be written
0001	Value written in register 03E8
C932	CRC check

Replies are: 09 06 03 E8 00 01 C9 32

Command	Description
09	Slave station address
06	Function code 06 (write single register)
03E8	Address of the register requested to be written
C932	CRC check

6.5.4 Write to multiple registers (FC16)

The function code 0x10 (FC16) is used to modify the values of several registers. Examples of such data include action requests, speed and force etc.

Examples of FC16 (0x10) write functions:

Setting registers 0x03E9 (1001) and 0x03EA (1002) to request setting the position, speed, and force of EPG series modular electric gripper.

The command entered are: 09 10 03 E9 00 02 04 60 E6 3C C8 EC 7C

Command	Description
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09	Slave station address
10	Function code 16 (write several registers)
03E9	Address of the first register requested to be written
0002	Number of the registers requested to be written
04	Number of data bytes (2 registers x 2 bytes = 4 bytes)
60E6	Value of the write register 0x03E9 (according to section 6.2, 60 represents the position)
3CC8	Value of the write register 0x03EA (according to section 6.2, 3C represents the torque, and C8 represents speed)
EC7C	CRC check

Replies are: 09 10 03 E9 00 02 91 30

Command	Description
09	Slave station address
10	Function code 16 (write several registers)
03E9	Address of the first register requested to be written
0002	Number of the registers requested to be written
9130	CRC check

CHAPTER 7 CONTROL INSTRUCTIONS AND EXAMPLES OF THE CLAMPING END

7.1 Control Mode and Examples including Parameters

First of all, the electric gripper is initialized, and then set the motion parameters continuously and detect the object position during the linkage process with the device, so as to realize orderly motion of the electric gripper.

Example: example of grasping an object at full-speed and full-force

Step 1: activate requests

Clear and set rACT=0, with requests: 09 10 03 E8 00 01 02 00 00 E5 B8

Command	Description
09	Slave station number
10	Function code 16 (write several registers)
03E8	Address of the first register requested to be written
0001	Number of the registers requested to be written
02	Number of data bytes (1 register x 2 bytes = 2 bytes)
0000	Content written into register 03E8
E5B8	CRC check

Replies: 09 10 03 E8 00 01 80 F1

Command	Description
09	Slave station number
10	Function code 16 (write several registers)
03E8	Address of the first register requested to be written
0001	Number of the registers requested to be written
80F1	CRC check

Set rACT=1, with requests: 09 10 03 E8 00 01 02 00 01 24 78

Command	Description
09	Slave station number
10	Function code 16 (write several registers)
03E8	Address of the first register requested to be written
0001	Number of the registers requested to be written
02	Number of data bytes (1 register x 2 bytes = 2 bytes)
0001	Content written into register 03E8
2478	CRC check

Replies: 09 10 03 E8 00 01 80 F1

Command	Description
09	Slave station number
10	Function code 16 (write several registers)
03E8	Address of the first register requested to be written

0001	Number of the registers requested to be written
80F1	CRC check

Step 2: read the activating status of the electric gripper until activation is completed

Requests: 09 04 07 D0 00 01 30 0F

Command	Description
09	Slave station number
04	Function code 04 (read input register)
07D0	Address of the first register requested to be read
0001	Number of the registers requested to be read
300F	CRC check

Reply (unfinished): 09 04 02 00 11 98 FD

Command	Description
09	Slave station number
04	Function code 04 (read input register)
02	Number of data bytes (1 register x 2 bytes = 2 bytes)
0011	Contents of the register 07D0 read (electric gripper status: 11)
98FD	CRC check

Replies (completed): 09 04 02 00 31 99 25

Command	Description
09	Slave station number
04	Function code 04 (read input register)
02	Number of data bytes (1 register x 2 bytes = 2 bytes)
0031	Contents of the register 07D0 read (electric gripper status: 31)
9925	CRC check

Step 3: Move the electric gripper to the target position with the device

Step 4: Close the electric gripper in full-speed and full-force

Requests: 09 10 03 E8 00 03 06 00 09 FF 00 FF FF 9E 95

Command	Description
09	Slave station address
10	Function code 16 (write several registers)
03E8	Address of the first register requested to be written
0003	Number of the registers requested to be written
06	Number of data bytes (3 registers x 2 bytes = 6 bytes)
0009	Content written into register 03E8 (activate request: 09)
FF00	Contents of the write register 03E9 (position: FF)
FFFF	Contents of the write register 03EA (speed: the second FF, force: the first FF)
9E95	CRC check

Replies: 09 10 03 E8 00 03 01 30

Command	Description
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09	Slave station number
10	Function code 16 (write several registers)
03E8	Address of the first register requested to be written
0003	Number of the registers requested to be written
0130	CRC check

Read the closing status of the electric gripper until it is completed

Requests: 09 04 07 D0 00 03 B1 CE

Command	Description
09	Slave station number
04	Function code 04 (read write register)
07D0	Address of the first register requested to be read
0003	Number of the registers requested to be read
B1CE	CRC check

Reply (unfinished): 09 04 06 00 39 89 00 01 00 B0 9A

Command	Description
09	Slave station number
04	Function code 04 (read write register)
06	Number of data bytes (3 registers x 2 bytes = 6 bytes)
0039	Contents of the register 07D0 read (electric gripper status: 39)
8900	Contents of the register 07D1 read (fault status: 00, current location: 89)
0100	Contents of the register 07D2 read (current speed: 00, current torque: 01)
B09A	CRC check

Reply in place (finished): 09 04 06 00 F1 FE 00 01 00 4A FE

Command	Description
09	Slave station number
04	Function code 04 (read write register)
06	Number of data bytes (3 registers x 2 bytes = 6 bytes)
00F1	Contents of the register 07D0 read (electric gripper status: F1)
FE00	Contents of the register 07D1 read (fault status: 00, current location: FE)
0100	Contents of the register 07D2 read (current speed: 00, current torque: 01)
4AFE	CRC check

Object clip reply (finished): 09 04 06 00 B1 AE 00 FE 00 1B C1

Command	Description
09	Slave station number
04	Function code 04 (read write register)
06	Number of data bytes (3 registers x 2 bytes = 6 bytes)
00B1	Contents of the register 07D0 read (electric gripper status: F1)
AE00	Contents of the register 07D1 read (fault status: 00, current location: AE)
FE00	Contents of the register 07D2 read (current speed: 00, current torque: FE)
1BC1	CRC check

Step 5: Move the electric gripper to the placement position with the device (device operation)

Step 6: Turn on the electric gripper at full speed with full force

Requests: 09 10 03 E8 00 03 06 00 09 00 00 FF FF AE 81

Command	Description
09	Slave station address
10	Function code 16 (write several registers)
03E8	Address of the first register requested to be written
0003	Number of the registers requested to be written
06	Number of data bytes (3 registers x 2 bytes = 6 bytes)
0009	Content written into register 03E8 (activate request: 09)
0000	Contents of the write register 03E9 (position: the first 00)
FFFF	Contents of the register 03EA (speed: the second FF, force: the first FF)
AE81	CRC check

Replies: 09 10 03 E8 00 03 01 30

Command	Description
09	Slave station number
10	Function code 16 (write several registers)
03E8	Address of the first register requested to be written
0003	Number of the registers requested to be written
0130	CRC check

Read the open status of the electric gripper until it is completed, requests: 09 04 07 D0 00 03 B1 CE

Command	Description
09	Slave station number
04	Function code 04 (read input register)
07D0	Address of the first register requested to be read
0003	Number of the registers requested to be read
B1CE	CRC check

Reply (unfinished): 09 04 06 00 39 89 00 01 00 B0 9A

Command	Description
09	Slave station number
04	Function code 04 (read write register)
06	Number of data bytes (3 registers x 2 bytes = 6 bytes)
0039	Contents of the register 07D0 read (electric gripper status: 39)
8900	Contents of the register 07D1 read (fault status: 00, current location: 89)
0100	Contents of the register 07D2 read (current speed: 00, current torque: 01)
B09A	CRC check

Reply in place (finished): 09 04 06 00 F1 00 00 01 00 7B 16

Command	Description
09	Slave station number
04	Function code 04 (read write register)

06	Number of data bytes (3 registers x 2 bytes = 6 bytes)
00F1	Contents of the register 07D0 read (electric gripper status: F1)
0000	Contents of the register 07D1 read (fault status: second 00, current location: first 00)
0100	Contents of the register 07D2 read (current speed: 00, current torque: 01)
7B16	CRC check

Object support reply (finished): 09 04 06 00 71 AE 00 FE 00 1B D0

Command	Description
09	Slave station number
04	Function code 04 (read write register)
06	Number of data bytes (3 registers x 2 bytes = 6 bytes)
0071	Contents of the register 07D0 read (electric gripper status: 71)
AE00	Contents of the register 07D1 read (fault status: 00, current location: AE)
FE00	Contents of the register 07D2 read (current speed: 00, current torque: FE)
1BD0	CRC check

7.2 Control Mode and Examples not including Parameters

In mode rMODE=0x1, the corresponding parameters must be pre-written and fixed in the hand according to Section 6.2. The remaining control modes are basically consistent.

Step 1: activate requests (clear and set rAct=0)

Requests: 09 10 03 E8 00 01 02 00 00 E5 B8

Command	Description
09	Slave station number
10	Function code 16 (write several registers)
03E8	Address of the first register requested to be written
0001	Number of the registers requested to be written
02	Number of data bytes (1 register x 2 bytes = 2 bytes)
0000	Content written into register 03E8
E5B8	CRC check

Replies: 09 10 03 E8 00 01 80 F1

Command	Description
09	Slave station number
10	Function code 16 (write several registers)
03E8	Address of the first register requested to be written
0001	Number of the registers requested to be written
80F1	CRC check

Set rACT=1, with requests: 09 10 03 E8 00 01 02 00 01 24 78

Command	Description
09	Slave station number
10	Function code 16 (write several registers)
03E8	Address of the first register requested to be written
0001	Number of the registers requested to be written

02	Number of data bytes (1 register x 2 bytes = 2 bytes)
0001	Content written into register 03E8
2478	CRC check

Replies: 09 10 03 E8 00 01 80 F1

Command	Description
09	Slave station number
10	Function code 16 (write several registers)
03E8	Address of the first register requested to be written
0001	Number of the registers requested to be written
80F1	CRC check

Step 2: read the activating status of the electric gripper until the activation is completed

Requests: 09 04 07 D0 00 01 30 0F

Command	Description
09	Slave station number
04	Function code 04 (read input register)
07D0	Address of the first register requested to be read
0001	Number of the registers requested to be read
300F	CRC check

Replies (uncompleted): 09 04 02 00 14 58 FE

Command	Description
09	Slave station number
04	Function code 04 (read input register)
02	Number of data bytes (1 register x 2 bytes = 2 bytes)
0014	Contents of the register 07D0 read (electric gripper status: 14)
58FE	CRC check

Replies (completed): 09 04 02 00 31 99 25

Command	Description
09	Slave station number
04	Function code 04 (read input register)
02	Number of data bytes (1 register x 2 bytes = 2 bytes)
0031	Contents of the register 07D0 read (electric gripper status: 31)
9925	CRC check

Step 3: Move the robot to the target position

Step 4: Close the electric gripper in full-speed and full-force

Requests: 09 10 03 E8 00 01 02 04 0B A6 BF

Command	Description
09	Slave station address
10	Function code 16 (write several registers)
03E8	Address of the first register requested to be written

0001	Number of the registers requested to be written
02	Number of data bytes (1 register x 2 bytes = 1 byte)
040B	Content written in register 03E8 (activation request: 0B, permanent reference number: 04, see section 6.2.2 for details)
A6BF	CRC check

Replies: 09 10 03 E8 00 01 80 F1

Command	Description
09	Slave station number
10	Function code 16 (write several registers)
03E8	Address of the first register requested to be written
0001	Number of the registers requested to be written
80F1	CRC check

Step 5: Read the closing status of the electric gripper until it is completed

Requests: 09 04 07 D0 00 03 B1 CE

Command	Description
09	Slave station number
04	Function code 04 (read input register)
07D0	Address of the first register requested to be read
0003	Number of the registers requested to be read
B1CE	CRC check

Reply (unfinished): 09 04 06 00 3D 89 00 01 00 41 5A

Command	Description
09	Slave station number
04	Function code 04 (read input register)
06	Number of data bytes (3 registers x 2 bytes = 6 bytes)
003D	Contents of the register 07D0 read (electric gripper status: 3D)
8900	Contents of the register 07D1 read (fault status: 00, current location: 89)
0100	Contents of the register 07D2 read (current speed: 00, current torque: 01)
415A	CRC check

Reply in place (finished): 09 04 06 00 F5 FE 00 01 00 BB 3E

Command	Description
09	Slave station number
04	Function code 04 (read input register)
06	Number of data bytes (3 registers x 2 bytes = 6 bytes)
00F5	Contents of the register 07D0 read (electric gripper status: F5)
FE00	Contents of the register 07D1 read (fault status: 00, current location: FE)
0100	Contents of the register 07D2 read (current speed: 00, current torque: 01)
BB3E	CRC check

Object clip reply (finished): 09 04 06 00 B5 AE 00 FE 00 EA 01

Command	Description
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09	Slave station number
04	Function code 04 (read input register)
06	Number of data bytes (3 registers x 2 bytes = 6 bytes)
00B5	Contents of the register 07D0 read (electric gripper status: B5)
AE00	Contents of the register 07D1 read (fault status: 00, current location: AE)
FE00	Contents of the register 07D2 read (current speed: 00, current torque: FE)
EA01	CRC check

Step 6: Move the robot to the placement position

Step 7: Open the electric gripper at full-speed and full-force

Requests: 09 10 03 E8 00 01 02 03 0B A4 8F

Command	Description
09	Slave station address
10	Function code 16 (write several registers)
03E8	Address of the first register requested to be written
0001	Number of the registers requested to be written
02	Number of data bytes (1 register x 2 bytes = 2 bytes)
030B	Content written into register 03E8 (activate request: 0B, fixed reference code: 03)
A48F	CRC check

Replies: 09 10 03 E8 00 01 80 F1

Command	Description
09	Slave station number
10	Function code 16 (write several registers)
03E8	Address of the first register requested to be written
0001	Number of the registers requested to be written
80F1	CRC check

Step 8: Read the open status of the electric gripper until it is completed

Requests: 09 04 07 D0 00 03 B1 CE

Command	Description
09	Slave station number
04	Function code 04 (read input register)
07D0	Address of the first register requested to be read
0003	Number of the registers requested to be read
B1CE	CRC check

Reply (unfinished): 09 04 06 00 3D 9A 00 01 00 45 DE

Command	Description
09	Slave station number
04	Function code 04 (read input register)
06	Number of data bytes (3 registers x 2 bytes = 6 bytes)
003D	Contents of the register 07D0 read (electric gripper status: 3D)
9A00	Contents of the register 07D1 read (fault status: 00, current location: 9A)

0100	Contents of the register 07D2 read (current speed: 00, current torque: 01)
45DE	CRC check

Reply in place (finished): 09 04 06 00 F5 00 00 01 00 8A D6

Command	Description
09	Slave station number
04	Function code 04 (read input register)
06	Number of data bytes (3 registers x 2 bytes = 6 bytes)
00F5	Contents of the register 07D0 read (electric gripper status: F5)
0004	Contents of the register 07D1 read (fault status: second 00, current location: first 00)
0100	Contents of the register 07D2 read (current speed: 00, current current: 01)
8AD6	CRC check

Object support reply (finished): 09 04 06 00 75 AE 00 FE 00 EA 10

Command	Description
09	Slave station number
04	Function code 04 (read input register)
06	Number of data bytes (3 registers x 2 bytes = 6 bytes)
0075	Contents of the register 07D0 read (electric gripper status: 75)
AE00	Contents of the register 07D1 read (fault status: 00, current location: AE)
FE00	Contents of the register 07D2 read (current speed: 00, current: FE)
EA10	CRC check

CHAPTER 8 IO CONTROL DESCRIPTION

This section shall describe the models supporting IO control correspondingly.

8.1 DI Input Control

DI2 input DI1 input	0	1
0	The electric gripper clears enabling, restoring to idle status	The electric gripper clears enabling, restoring to idle status
1	The electric gripper performs enabling/executes preset parameter 1 of the electric gripper	Execute preset parameter 2 of the electric gripper

Note: After initial power-on or clearing the enabling status, enabling command is performed for DI1=1, DI2=0, and the rest are for executing commands of the preset parameter 1. In the case of DI1=0, it indicates clearing the enabling command regardless of whether the DI2 is 1 or 0.

8.2 DO Output Feedback

DO2 output DO1 output	0	1
0	Workpieces detected in clamping by the electric gripper	Error status reported by the electric gripper
1	No workpieces detected in clamping by the electric gripper	The electric gripper is in regular operation

CHAPTER 9 NETWORKING DESCRIPTION

JODELL electric parallel gripper supports the networking control of up to 16 devices in the same network.

The electric grippers in the same networking communication network shall have different device IDs, so the users shall set IDs of each electric gripper during networking building, to guarantee normal networking functions. IDs of the electric gripper shall be modified by reading and writing the electric gripper ID register, or through assistance from the debugging software provided by the company.

It should be noted that multiple devices need to use the daisy-chain topology shown in the figure below when building a network, and any topology with branching relationships is not supported.



Daisy-chain topology

If the network power cable is long, guaranteeing that the power supply voltage and current are sufficient. If the communication cable is long, to guarantee stable communication, repeaters shall be increased to amplify the communication signal, and the end of the bus needs to be connected to the terminal 120Ω resistance.

During electric gripper control, the users can control all the electric grippers in the network through the broadcasting method to move synchronously, while status of each electric gripper is obtained by polling. The users can also send control commands to the specific slave station, to control a slave electric gripper to move separately.

When there are more slave devices and longer communication cables, the communication cycle for scheduling by the master needs to be increased appropriately.

CHAPTER 10 FAULT HANDLING

The faults of JODELL electric parallel gripper can be diagnosed conveniently and efficiently. The user can obtain the current status of the electric gripper and quickly identify the fault type through the LED indicators, fault feedback status words and other ways.

10.1 Fault Indicator Lights

JODELL electric parallel gripper is provided with red and blue LED indicators which can show the running status of Parallelism the electric gripper.

SN	Status of LED indicators	Meaning
1	The blue light is always on, and the red light is always off	Normal operation
2	The blue light flashes slowly (0.5Hz), and the red light is always off	Communication outage (no data communication within continuous 1s)
3	The blue light flashes quickly (1Hz), and the red light is always off	Control command error
4	The blue light is always off, and the red light is always on	Overtemperature fault
5	The blue light is always off, and the red light flashes slowly (0.5Hz)	Voltage abnormality
6	The blue light is always off, and the red light flashes quickly (1Hz)	Overcurrent fault
7	The red and blue lights flash alternately	Enabling fault
8	The red and blue lights are always on (pink)	Product self-fault

In addition to obtaining the electric gripper running status from the LED indicator status, the user can analyze the current gripper running status from the fault register status word by reading the fault register (6.3.2 Fault register).

10.2 Fault Handling

10.2.1 Communication outage

Fault phenomenon

Bit2 of the fault status word = 0x01, while the fault indicator status is: the blue light flashes slowly (0.5Hz), and the red light is always off.

Possible reasons and handling measures

Possible Reasons	Test Method	Handling Measures	Remarks
Communication line abnormalities	- Whether there is poor contact in the communication lines - Whether RS485A and RS485B are connected reversely	- Fasten the communication lines - Adjust the line sequence of RS485A and RS485B	The communication interruption in this case does not affect the electric gripper's response to the control command. This fault can be ignored if not required by the user.
The peripheral device does not send data to the electric gripper for more than 1s	Check whether the peripheral device can control the logic to send data to the electric gripper in real time	The peripheral device sends a request data package to the electric gripper periodically (>1Hz)	

10.2.2 Control command error

Fault phenomenon

Bit1 of the fault status word = 0x01, while the fault indicator status is: the blue light flashes quickly (1Hz), and the red light is always off.

Possible reasons and handling measures

Possible Reasons	Test Method	Handling Measures	Remarks
There are errors in the control commands sent by the peripheral device	Check for error in the control command sent, and send the correct command as referred to in Chapter 6.	Send correct control commands	

10.2.3 Overtemperature (overheating) faults

Fault phenomenon

Bit6 of the fault status word = 0x01, while the fault indicator status is: the blue light is always off, and the red light is always on.

Possible reasons and handling measures

Possible Reasons	Test Method	Handling Measures	Remarks
Too high external ambient temperature, or confined environment with too dense layout of heat generating device	- Detect whether the ambient temperature is higher than 45°C - Troubleshoot the heat generating device and its layout	- Add environmental heat dissipation device - Reasonably arrange the heat generating device	

10.2.4 Voltage abnormality

Fault phenomenon

Bit4 of the fault status word = 0x01, while the fault indicator status is: the blue light is always off, and the red-light flashes slowly (0.5Hz).

Possible reasons and handling measures

Possible Reasons	Test Method	Handling Measures	Remarks
The bus voltage is lower than 20V	Detect whether the DC voltage of the electric gripper is lower than 20V	Increase the output voltage of switching power supply to make the input bus voltage of the electric gripper sits in the range of 24V±10%	
The bus voltage is higher than 30V	Detect whether the DC voltage of the electric gripper is higher than 30V	Reduce the output voltage of switching power supply to make the input bus voltage of the electric gripper sits in the range of 24V±10%	

10.2.5 Overcurrent fault

Fault phenomenon

Bit3 of the fault status word = 0x01, while the fault indicator status is: the blue light is always off, and the red-light flashes quickly (1Hz).

Possible reasons and handling measures

Possible Reasons	Test Method	Handling Measures	Remarks
Short circuit	Check whether there are short circuits	Dispose of the places with short circuits	
Low current limiting value	Open the upper computer software, and check whether the setting value is too low	Increase the overcurrent limiting value	

10.2.6 Enabling fault at the clamping end

Fault phenomenon

Bit5 of the fault status word = 0x01, while the fault indicator status is: the red and blue lights flash alternately.

Possible reasons and handling measures

Possible Reasons	Test Method	Handling Measures	Remarks
After powering on, there are foreign matters in the slideway during enabling	Check whether there are foreign matters in the slideway	After clearing the foreign matters, resend the enabling command	

10.2.7 Product self-fault

Bit7 of the fault status word = 0x01, if there are fault within the product, please contact the official after-sales personnel or the relevant agent of JODELL.

CHAPTER 11 MAINTENANCE AND WARRANTY

11.1 Regular Inspections

This operation is not required for EPG-HP series

With stable performance, JODELL electric parallel gripper shall be maintained every 200W times or every 3 months (it is recommended to shorten the maintenance cycle appropriately in harsh field environment or at high working frequency). The user only needs to make periodic inspection to confirm no damage to external parts without disassembling the electric gripper. Inspection items:

- 1) Clean the palm slide regularly to prevent foreign objects from entering and causing damage to the main body of the electric gripper.
- 2) Regularly apply Mobilith SHC1500 grease to prevent the mutual wear of the main parts from resulting in reduced accuracy, as shown in Figure 11.1.
- 3) Check that the screw is not rusted or damaged; otherwise, replace it.



Figure 11.1 Schematic diagram of applying grease to electric gripper

11.2 Grease Maintenance Process

This operation is not required for EPG-HP series



Figure 11.2 Grease maintenance flow chart

- ① Directly perform the second step if the gripper does not have a brake; if the gripper is equipped with a brake, open it using the host computer software when the gripper is powered on (see Section 5.1 for the use of the host computer); do not forcefully pry the gear rack for the gripper equipped with a brake; to move the rack, please power it on
- ② For self-inspection, keep the electric gripper powered on and visually check that there are no particles or flocculent foreign bodies between the rack and guide rails. If there are foreign bodies, clean them up
- ③ Open the finger, as shown in mark 3 in Figure 11.2, to the maximum stroke using the host computer software (see section 5.1 for use of the host computer)
- ④ Apply lubricating grease Mobil SHC1500, as shown in mark 4 in Figure 11.2, in an even manner with a brush, covering all contact surfaces between the gear rack and the palm.
- ⑤ Close the finger, as shown in mark 5 in Figure 11.2, to the minimum stroke using the host computer software (see section 5.1 for use of the host computer)
- ⑥ Apply lubricating grease Mobil SHC1500, as shown in mark 6 in Figure 11.2, in an even manner with a brush, covering all contact surfaces between the gear rack and the palm
- ⑦ Wipe off excess grease, as shown in mark 7 in Figure 11.2, by driving the rack to run back and forth more than

5 times, and wiping off excess spilled grease with non-woven fabric (all excess spilled grease on the contact surface between the gear rack and the palm must be wiped off)

⑧ Conduct a self-inspection, as shown in mark 8 in Figure 11.2, to visually inspect the contact surface between the gear rack and the palm and apply oil evenly (after running back and forth on the contact surface, there should be no oil leakage, and there should be no foreign objects such as bristles between the gear rack and the palm)

11.3 Warranty Instruction

The warranty period of the electric parallel gripper is one year from the receipt of the product. Within the warranty period, the Company will maintain or replace the non-conforming products freely, where, nonconformance includes but not limited to the following conditions:

- (1) The electric gripper cannot be opened or closed.
- (2) The software of the electric gripper cannot be connected.
- (3) The electric gripper shakes abnormally.

11.4 Warning

In case of the following conditions, the warranty of the product will be invalid:

- ① The unit has been tampered with, repaired or damaged by unauthorized individuals and the warranty label has been removed;
- ② Except for the particular conditions described in these instructions for use, the device screws are removed and the device is opened;
- ③ The device serial number has been changed, erased or deleted, and the device unit has been misused, neglected or accidentally damaged.

In the above events, the Company shall not be liable for the unique, incidental or consequential damages. The Company is neither responsible for damages caused by the use of the product, nor is it responsible for performance failures of other items connected to the product, nor for operational problems on any system to which the product may belong. The above warranties replace all the other warranties, express, implied or statutory, including, but not limited to, the implied warranties of timeliness and fitness for a particular purpose.

Other statements:

The Company reserves the right to change the design or structure of any product within the business scope at any time, but is under no obligation to make any changes to the devices purchased before. This warranty does not cover faults due to the following reasons: improper use or installation, normal wear and tear, accidental problems, human error, natural accidents such as unavoidable catastrophes, or other problems occurring outside the scope of use and control of the product.