UFACTORY

Gripper User Manual

Please read this manual carefully before using it

V1.0

Content

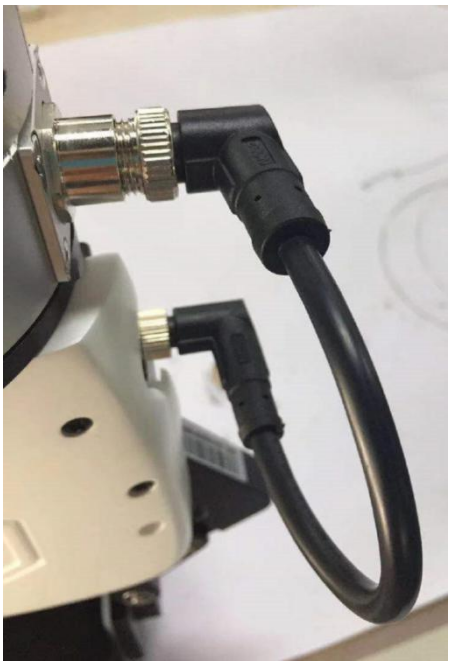
1. Gripper Mounting

Mounting process of the gripper:

1. Move the robotic arm to a safe position (avoid touching the mounting surface of the robotic arm or other equipment)
2. Turn off the power of the robotic arm (press the emergency stop button of the control box)
3. Secure the gripper to the end of the robotic arm with 2 M6 bolts
4. Connect the robotic arm to the gripper with a connecting wire

Note:

1. When connecting the wire of the gripper, the robotic arm must be powered off to avoid the failure caused by hot plugging.
2. Gripper interface needs to be in the same direction as end interface due to length limit of the gripper connecting wire
3. In addition, when connecting the gripper to the robotic arm by the connecting wire, pay attention to the positioning holes of the interface at both ends. As the male pin of the connecting line is thin, avoid bending the male pin when dismounting and mounting.

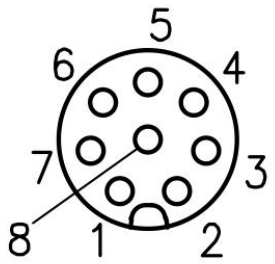


2. Gripper 3D File Download

Please click the following link to download the 3D file of the gripper
http://download.ufactory.cc/xarm/tool/xArm%20Gripper-17062019.STEP

3. Gripper Interface

No.	Color	Function
1	White	24V
2	Brown	24V
3	Green	GND
4	Yellow	GND
5	Grey	485-A
6	Pink	485-B
7	Blue	IN0 (Digital Input)
8	Red	IN1 (Digital Input)



4. Gripper Motion

The gripper is the robotic end-effector which can grip objects dynamically.
The range of the position value of the gripper is: -10 to 850. The larger the value is, the greater the opening degree of the gripper is. On the contrary, the smaller the value is, the smaller the opening degree of the gripper is. If the gripping is not tight enough, a negative value can be input.

5. Operating Gripper in xArm Studio

1. Open xArm Studio, in 【Settings】-【Tool Settings】 to mount the gripper and set the opening and closing speed.

2. Access to 【Real Time Control】, the drag bar controlling the motion of the gripper can be seen in the lower right corner, and the motion range of the gripper is -10~850.

3. Access to 【Blockly】 programming, drag the gripper commands to the work area in 【Accessories】-【Gripper】 of the code block, set the position and speed of the gripper, and

click 【Move】 to open and close the gripper.

6. Control Gripper with xArm-Python-SDK

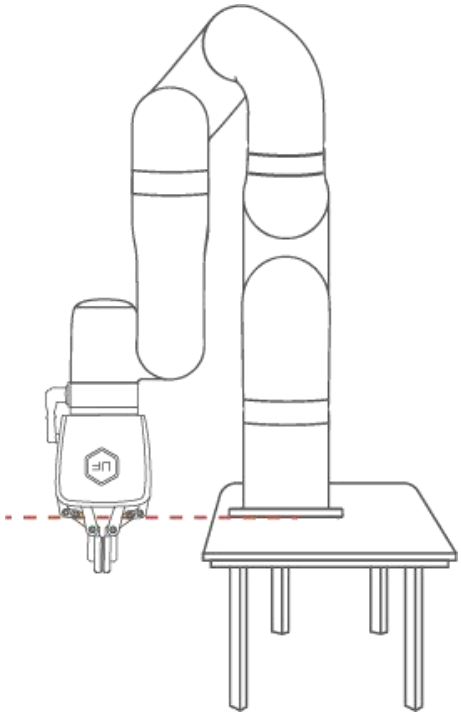
6.1.Movement process of the gripper:

1. First to enable the gripper
2. Set the modes of the gripper
3. Send positional commands
4. If the gripper reports an error, it is necessary to clean the error message before the gripper can resume normal operation

6.2.Robotic interface functions

Function	Interface function
Enable the gripper	set_gripper_enable
Set the modes of the gripper	set_gripper_mode
Set the position of the gripper	set_gripper_position
Set the speed of the gripper	set_gripper_speed
Get the position of the gripper	get_gripper_position
Get error code of the gripper	get_gripper_err_code
Clean error code of the gripper	clean_gripper_error
For detailed use of xArm-Python-SDK, please see the following link:https://github.com/xarm-developer/xarm-python-SDK/blob/dev/doc/API/xarm_API.md	

7. Notes for Use



1. The gripper of a robot with zero posture will exceed the mounting surface. Please adjust the robot to the posture suitable for mounting the gripper during mounting.
2. When planning the trajectory of a robot equipped with the gripper, safety evaluation must be carried out between positional commands to avoid collision with nearby equipment.
3. When planning the trajectory of a robot equipped with the gripper, safety evaluation must be carried out for zero return or whether zero return operation can be carried out.

8. Gripper Communication Protocol

8.1.Address description

The following communication address is the address written into the RAM of the gripper. If it needs to be written into EEPROM, perform an OR operation on the communication add -ress and 0x1000.

For example, write the operation mode of the gripper into EEPROM. The communication address (0x0101) needs to be changed to 0x1101

Send: 08 06 11 01 00 00 DD AF
Receive: 08 06 11 01 00 00 DD AF

8.1.1. Monitoring group

Communication address	Description
0x0000	Operating state
0x0001	Speed (r/min)
0x0002	Percentage of current
0x0003	Current (A)
0x0004	Command position (p)
0x0006	Motor position (p)
0x0008	Positional error (p)
0x000F	Current alarm code
0x0010	Current value when alarm occurs
0x0011	Speed value when alarm occurs
0x0012	Input voltage value when alarm occurs

8.1.2. Fn1xx control correlations

No.	Name	Setting range	Unit	Factory setting	Effective time	Communication address
Fn100	Enable the gripper	0-1	-	0	Immediately	0x0100
Fn101	Control mode	0-2 0: Position 1: Speed	-	0	Immediately	0x0101
Fn109	Failure reset	0-1	-	0	Immediately	0x0109

8.1.3. Fn2xx gain parameters

No.	Name	Setting range	Unit	Factory setting	Effective time	Communication address
Fn200	Position loop gain	10-20000	0.1Hz	200	Immediately	0x0200
Fn201	Position loop feedforward	0-1000	0.1%	200	Immediately	0x0201
Fn202	Position loop feedforward Filtering time	0-1000	1ms	5	Immediately	0x0202

Fn203	Speed loop gain	10-20000	0.1	100	Immediately	0x0203
Fn204	Speed loop integral	10-10000	0.1	300	Immediately	0x0204

8.1.4. Fn3xx position parameters

No.	Name	Setting range	Unit	Factory setting	Effective time	Communication address
Fn300	Position acceleration time	1-2000	ms	100	Effective after shutdown	0x0300
Fn301	Position deceleration time	1-2000	ms	100	Effective after shutdown	0x0301
Fn302	Position smoothing time	1-200	ms	10	Effective after shutdown	0x0302
Fn303	Position running speed	1-20000	r/min	1500	Immediately	0x0303
Fn308	Positional error alarm value	0x00000000-0xFFFFFFFF	Pulse	0x20000	Immediately	0x0308
Fn310	Positional command alarm value	0x00000000-0xFFFFFFFF	Pulse	0x20000	Immediately	0x030A

8.1.5. Fn4xx speed parameters

No.	Name	Setting range	Unit	Factory setting	Effective time	Communication address
Fn400	Speed command	-20000-20000	r/min	100	Immediately	0x0400
Fn403	Speed limit	0-20000	r/min	5000	Immediately	0x0403

8.1.6. Fn5xx torque parameters

No.	Name	Setting range	Unit	Factory setting	Effective time	Communication address
Fn505	Starting current amplitude limiting	5-100	-	16	Immediately	0x0505
Fn506	Holding current amplitude limiting	1-100	-	10	Immediately	0x0506
Fn507	Starting current Running time	100-30000	ms	1500	Immediately	0x0507

8.1.7. Fn6xx communication parameters

No.	Name	Setting range	Unit	Factory setting	Effective time	Communication address
Fn600	Communication address	1-255	-	8	Effective after power on	0x0600
Fn601	Communication rate	0:4800 1:9600 2:19200 8:921600 9:1M 10:1.5M 11:2M	bps	11	Effective after power on	0x0601
Fn602	Communication protocol	0: Modbus RTU 1: Customization		0	Immediately	0x0602
Fn609	Restore factory defaults	0-1	-	0	Effective after power on	0x0609

8.1.8. Fn7xx positional command group

No.	Name	Setting range	Unit	Factory setting	Effective time	Communication address
Fn700	Positional command	0x00000000-0xFFFFFFFF	pulse	0x00000000	Immediately	0x0700
Fn702	Positional feedback	0x00000000-0xFFFFFFFF	pulse	0x00000000	Read only	0x0702

Fn706	Molecule of electronic gear ratio	1-30000	-	100	Effective after shutdown	0x0706
Fn707	Denominator of electronic gear ratio	1-30000	-	100	Effective after shutdown	0x0707

8.1.9. Fn8xx motor parameters

No.	Name	Setting range	Unit	Factory setting	Effective time	Communication address
Fn800	Hardware version	-	-	10	Read only	0x0800
Fn801	Software version	-	-		Read only	0x0801
Fn804	Motor ID	0-999	-	100	Effective after power on	0x0804
Fn805	Rated power	1-2000	W	100	Effective after power on	0x0805
Fn806	Rated voltage	1-6000	0.01V	2400	Effective after power on	0x0806
Fn807	Rated current	1-2400	0.01A	800	Effective after power on	0x0807
Fn808	Maximum current	1-5000	0.01A	1650	Effective after power on	0x0808
Fn809	Rated rotating speed	1-6000	r/min	3000	Effective after power on	0x0809
Fn810	Maximum rotating speed	1-12000	r/min	6000	Effective after power on	0x080A
Fn811	Pole number	0-20	Pair	7	Effective after power on	0x080B
Fn816	Motor zero point	0x0000000-0xFFFFFFFF	Pulse	0	Immediately	0x0810
Fn823	Set the zero point of the gripper	0 - 1	-	0	Immediately	0x0817

8.2.Communication format description

The gripper defaults to the standard Modbus RTU protocol, with a default baud rate of 2 Mbps and an address of 8. The currently supported function codes are: 0x03/0x06/0x10. For example:

1. Write enabling the gripper. Address (0x0100)

Send: 08 06 01 00 00 01 49 6F
Receive: 08 06 01 00 00 01 49 6F

2. Write positional command being 100. Address (0x0700)

Send: 08 10 07 00 00 02 04 00 00 00 64 FA E8
Receive: 08 10 07 00 00 02 40 25

3. Read alarm code, address (0x000F)

Send: 08 03 00 0F 00 01 B4 90
Receive: 08 03 02 00 00 64 45

9. Alarm and Response

Alarm code	Description	Response
0x01	Invalid communication address	Check the communication address.
	Parameter write into read-only address	Check the property corresponding to the communication address.
0x02	Written value exceeds limit	Check the parameter range corresponding to the communication address.
	EEPROM cannot be written	Check the property corresponding to the communication address.
0x09	Current zero point bias error	Power on again. If it doesn't work after powering on for many times, replace the drive board
0x0B	Overcurrent protection	Check whether phase sequence is correct.
		Check whether motor type is correct.
		Check whether brake is normally opened.
		Check whether it is blocked.
		Whether the set control command changes greatly.
		Whether the zero point of the motor is correct.
0x0C	Motor phase sequence error	Check whether phase sequence is correct.
	Speed input value greater than overspeed	Reduce speed command

	value	
	Speed exceeds regulator too much	Reduce regulator gain
	Whether the zero point of the motor is correct	Set zero point
0x0D	Positional deviation is too large	Reduce positional command
		Increase positional filtering time
		Set positional deviation alarm value is too small (Fn308)
		Whether motor is blocked
		Increase positional gain appropriately
0x0E	Input positional command is too large	Whether it is not enabled
		Whether positional setting value is too large
0x14	Driver IC hardware alarm	Whether it is blocked
		Check the motor phase sequence
		Reduce regulator gain
0x15	Driver IC communication error	Hardware failure
0x19	Positional command exceeds limit	Whether positional command is too large
0x21	Driver overcurrent	
0x22	Motor overcurrent	
0x24	Driver type error	Reset drive type

10.Specification Parameter

Name	Description
Communication mode	RS-485
Communication protocol	Modbus RTU
Programmable parameters	Position, speed and force control
Status indication	Fault status, power
Feedback	Current, position
Rated supply voltage	24V DC
Absolute maximum supply voltage	28V DC
Static power consumption (minimum)	1.5W
Peak current	1.5A
Work scope	86mm
Maximum gripping weight	3kg