NRV-C2 Multi Channel Rotary Shear Valves

Shenzhen Keyto Fluid Technology Co., Ltd.

Contents

Contents ········ 1-2

1. Product Overview ········ 2

1.1 Main Features ········ 2

1.2 Words Definition ········ 2-4

1.3 Naming Rules ········ 5

1.4 Spec. Sheets ········ 6-7

1.5 Selective NRV-C2 rotary shear valve series ········ 8-14

1.6 Switching rotary shear valve dimensions ········ 15-21

2. Port definition ········ 22-23

3. Serial Communication Protocol ········ 23

3.1 Overview ········ 23

3.2 Communication Interface ········ 23

3.3 Serial Communication Protocol ········ 24

3.4 DT/OEM protocol ········ 24-32

3.5 Special Protocol ········ 33

3.6 Keyto Protocol ········ 34-40

3.7 MODBUS protocol ········ 40-45

3.8 CAN Communication protocol ········ 45-46

4. LED Instruction 47

5. Host Computer software 47-48

6. Common malfunctions and troubleshooting method 49

7. Surrounding conditions 50

8. Safety Precautions 51

1. **Product Overview**

The NRV-C2 series multi-channel rotary shear valves, developed independently by Keyto, are designed primarily for enabling multi-channel switching. This series offers a diverse range of models, each capable of withstanding various reagents across different working conditions, providing a consistently high level of reliability throughout their lifetime.

1.1 Main Features

- Keyto NRV-P1 series rotary shear valve is compatible in size and integrated with a controller to trigger the stepper motor by sending commands from the upper computer and switch the fluid pathways. Serial protocol can be RS232/RS485/CAN.
- Valve material PCTFE/PEEK/PVDF for easy maintenance, rotor material sapphire and stator material zirconium oxide for all kinds of corrosive medium.
- The rotation of the rotor relies on the planetary gearbox motor with high reliability.
- High-precision zirconia ceramic processing, strict inspection procedures, and unique sealing schemes ensure that the service life of the valve can reach 3,000,000 times of switching, without maintenance requirement.
- Good chemical resistance of wetted part materials. A variety of materials are available to ensure chemical compatibility.

1.2 Words Definition

Coefficient of variation Cv

Also known as flow coefficient(Kv in China, can be converted to Cv), Cv is a dimensionless parameter that represents a component's efficiency at allowing fluid flow. When actual designing and using a component, Cv needs to be converted to a flow rate reference with dimensions according to the application conditions.

$$C_v = q_v \sqrt{\frac{\rho \times \Delta P_0}{\rho_0 \times \Delta P}}$$

q_v - the flow rate when measured, expressed in gal/min

ρ_0 - the density of the water at $60^\circ F$, $\rho_0 = 1 g/cm^3$

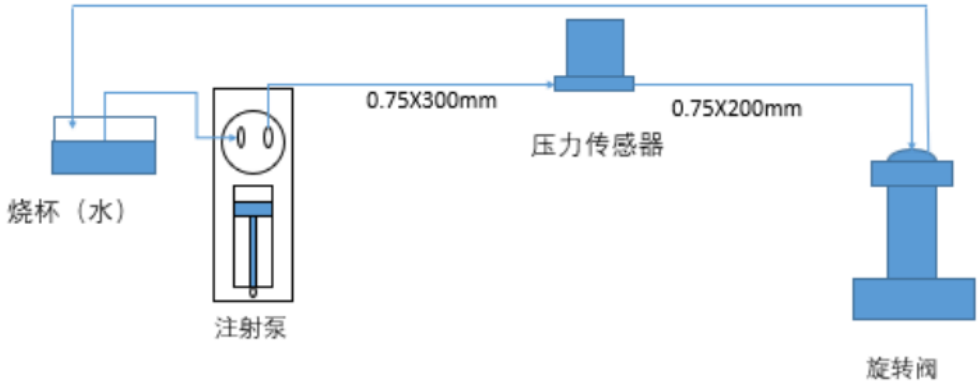
ΔP_0 - differential pressure before and after the measured component, $\Delta P_0 = 1 \mathrm{lbf/in^2 (psi)}$;

ρ , ΔP - the density of the medium and the differential pressure before and after the measured component.

Converted to the common dimension in China, then:

Cv = 0.03, indicating a flow rate of 5 ml/s at 25°C and 50 KPa.

As shown in the bellowing figure, under a specific liquid path, the rotary valve is switched to a certain channel, and the syringe pump injects pure water at a speed of 0.45mL/s. The piezoresistance at the point where the sensor of the liquid path system is located in a certain channel is measured. The piezoresistance range of many flow channels does not exceed 30kPa, and the piezoresistance ≤ 100kPa, which is considered qualified.



Note: Only ≥0.76mm orifice uses the following test method to evaluate the flow capacity.

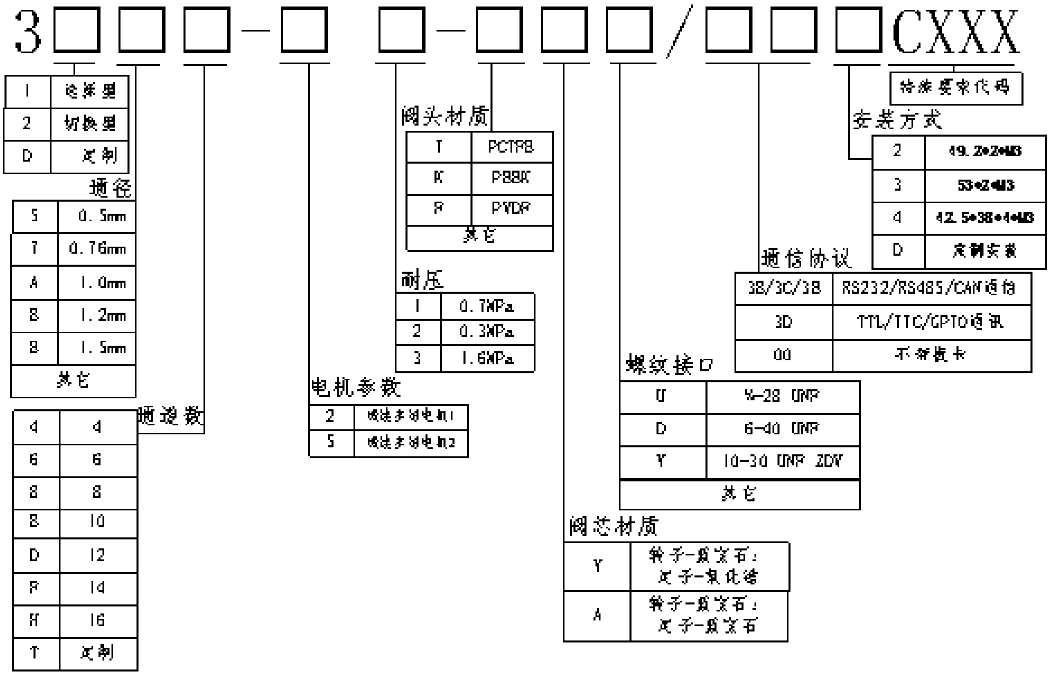
Maximum Response Time

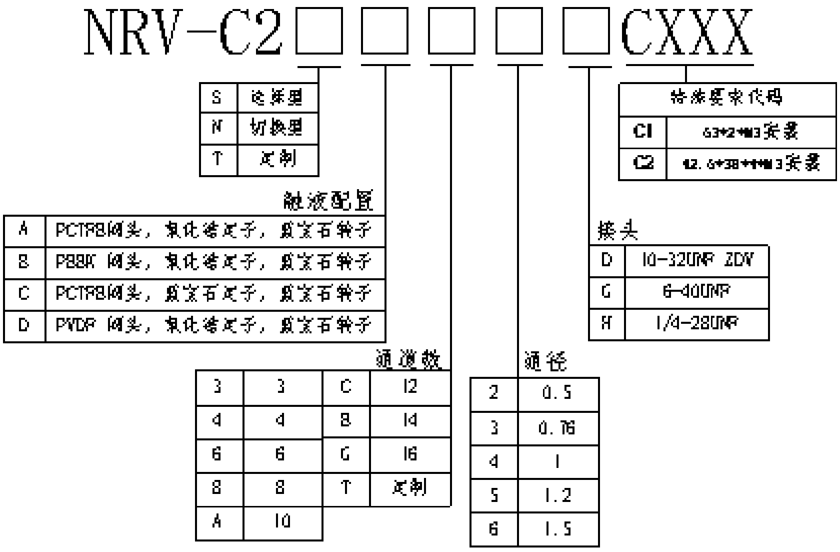
Inject air or water of 0.25MPa or maximum working differential pressure into the inlet, input the start signal to the rotary shear valve under test, make it rotate from any channel to the channel corresponding at 180°, and let the pressure sensor measure the pressure change of the outlet side of the rotary shear valve. Use an oscilloscope to identify the moment from when the signal is emitted until the pressure reaches its maximum value, and measure the time elapsed during this interval to calculate the time difference. Repeat this test multiple times, and then calculate the arithmetic average of these time differences. This average is known as the maximum response time, denoted as Tmax. The response time test for switching from one specified channel to another follows the same procedure.

Internal volume

It refers to the volume of the internal flow path from the inlet port to the outlet port when the rotary shear valve in closed state.

1.3 Naming Rules


3□□□-□ □-□□□/□□□CXXX
1 选择型
2 切换型
D 定制
通径
S 0.5mm
T 0.76mm
A 1.0mm
B 1.2mm
E 1.5mm
其它
通道数
4 4
6 6
8 8
B 10
D 12
F 14
H 16
T 定制
电机参数
2 减速步进电机1
5 减速步进电机2
阀头材质
T PCTFE
K PEEK
F PVDF
其它
耐压
1 0.7MPa
2 0.3MPa
3 1.6MPa
阀芯材质
Y 转子-蓝宝石；定子-氧化锆
A 转子-蓝宝石；定子-蓝宝石
螺纹接口
U ¼-28 UNF
D 6-40 UNF
Y 10-30 UNF ZDV
其它
通信协议
3B/3C/3E RS232/RS485/CAN通信
3D TTL/IIC/GPIO通讯
00 不带板卡
安装方式
2 49.2*2*M3
3 53*2*M3
4 42.5*38*4*M3
D 定制安装
特殊要求代码


NRV-C2□□□□□CXXX
S 选择型
N 切换型
T 定制
触液配置
A PCTFE阀头，氧化锆定子，蓝宝石转子
B PEEK 阀头，氧化锆定子，蓝宝石转子
C PCTFE阀头，蓝宝石定子，蓝宝石转子
D PVDF 阀头，氧化锆定子，蓝宝石转子
通道数
3 3
4 4
6 6
8 8
A 10
C 12
E 14
G 16
T 定制
通径
2 0.5
3 0.76
4 1
5 1.2
6 1.5
接头
D 10-32UNF ZDV
G 6-40UNF
H 1/4-28UNF
特殊要求代码
C1 63*2*M3安装
C2 42.6*38*4*M3安装

Note:

1. The above naming rules are only for explaining NRV-C2 series rotary shear valve rules.
2. The performance of Reducer Stepper Motor 1 and Reducer Stepper Motor 2 is identical, and they will no longer be differentiated after the second quarter of 2025.
3. RSV series under the 3C/3B/3E naming rules can actually use RS485, RS232 and CAN communication.

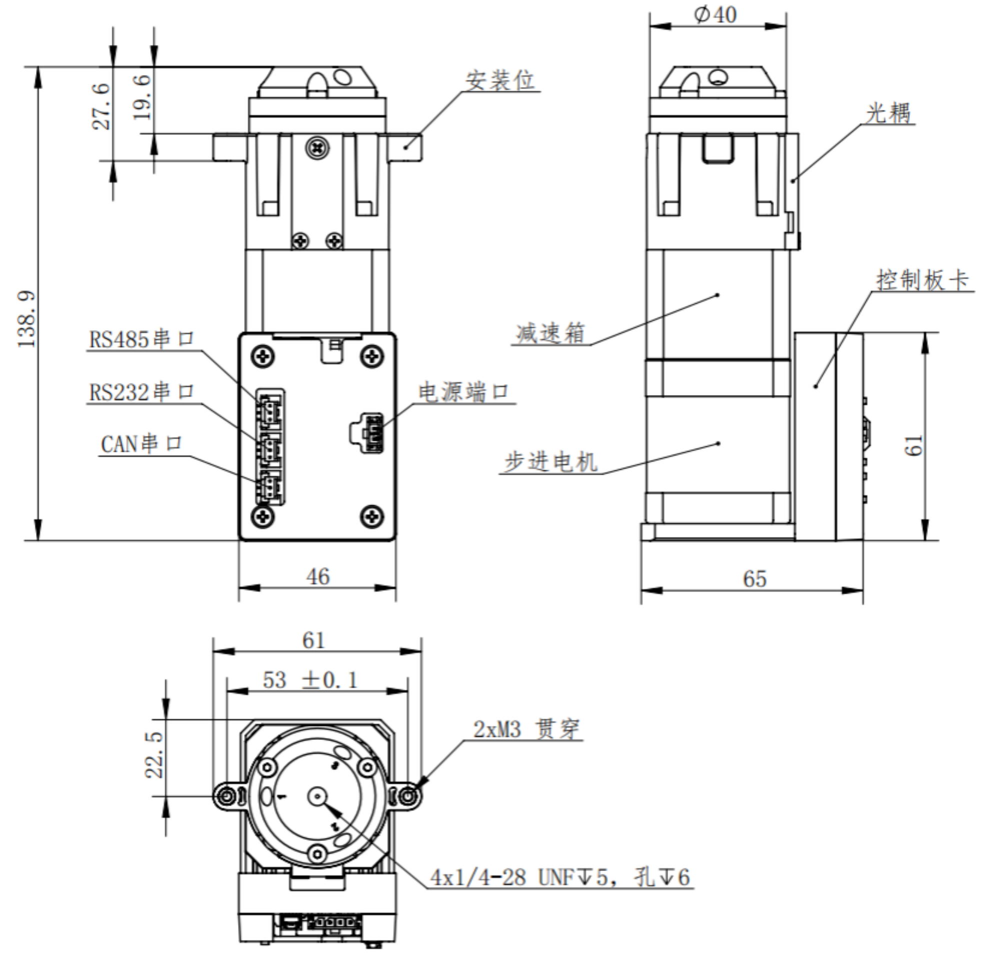
1.4 Spec Sheets

Item	Multi-ports Rotary Shear Valves
Port Numbers	N positions N+1 ports selection valve, 2 positions N ports selection valve
Wetted Material	4 options is available： • Valve material PCTFE, stator material zirconium oxide, rotor material sapphire, sealing material viton. • Valve material PEEK, stator material zirconium oxide, rotor material sapphire, sealing material viton. • Valve material PCTFE, stator and rotor material both sapphire, sealing material viton. • Valve material PVDF, stator material zirconium oxide, rotor material sapphire, sealing material viton.
Initial Positioning	The initial position is automatically detected after power on
Flow Path Diameter	0.5mm, 0.76mm, 1mm, 1.2mm, 1.5mm
Operating Environment Temperature	5℃~45℃
Relative Humidity	20%RH~80%RH，non-condensing
Medium Temperature	0-80℃，non-condensing
Storage Temperature	-20℃~50℃
Storage Humidity	
Atmospheric Pressure Range	
Interface	
Mounting Hole Thread	
Replaceable Parts	
Transposition Performance	Multi-position, random start
Lifetime	3,000,000 switches (in the case of DI water, the rotary valve randomly switches at a switching rate of 5 time/s)
CV	• 0.5mm Orifice: the maximum and minimum piezoresistance difference ≤30kPa, and both≤100kPa@0.45mL/s • 0.76mm Orifice: flow capacity > 10g/10s@90kPa • 1mm Orifice: flow capacity > 20g/10s@90kPa • 1.2mm Orifice: flow capacity > 25g/10s@90kPa • 1.5mm Orifice: flow capacity > 30g/10s@90kPa
Dead Volume（μl）	0
Switch Time	≤2.5s

Max. Driving Force/Torque	2.7N·M
Noise	≤65db and no sharp noise
Communication	RS232/RS485/CAN
Communication Rate	9600bps(adjustable)
Device Address Settings	Serial port settings
Device Parameter Settings	Serial port settings
Dimensions	Details at 2.3.1
Input Voltage	DC24V±10%
Maximum Power	48W
Atmospheric Pressure	0.7MPa
Leakage	≤2kPa/20s@gas
Motor Temperature Rise	≤30℃
Weight	< 0.90kg
Item	Multi-ports Rotary Shear Valves

1.5 Selective NRV-C2 rotary shear valve series dimensions

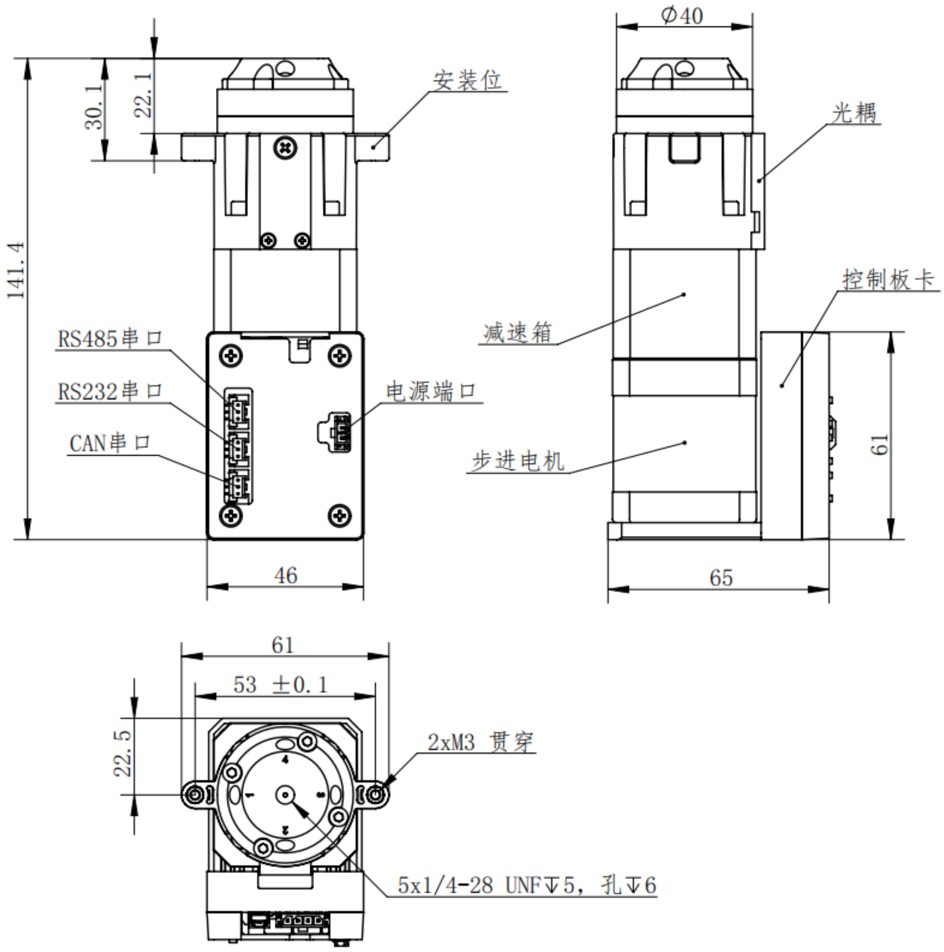
3 positions 4-port RSV


Ø40
27.6
19.6
安装位
光耦
138.9
控制板卡
RS485串口
减速箱
RS232串口
电源端口
CAN串口
步进电机
61
46
65
61
53 ±0.1
2xM3 贯穿
22.5
4x1/4-28 UNF↧5，孔↧6

Previous Naming Rule: 31B3-21-IYU/3C3

Current Naming Rule: NRV-C2SA35HC1

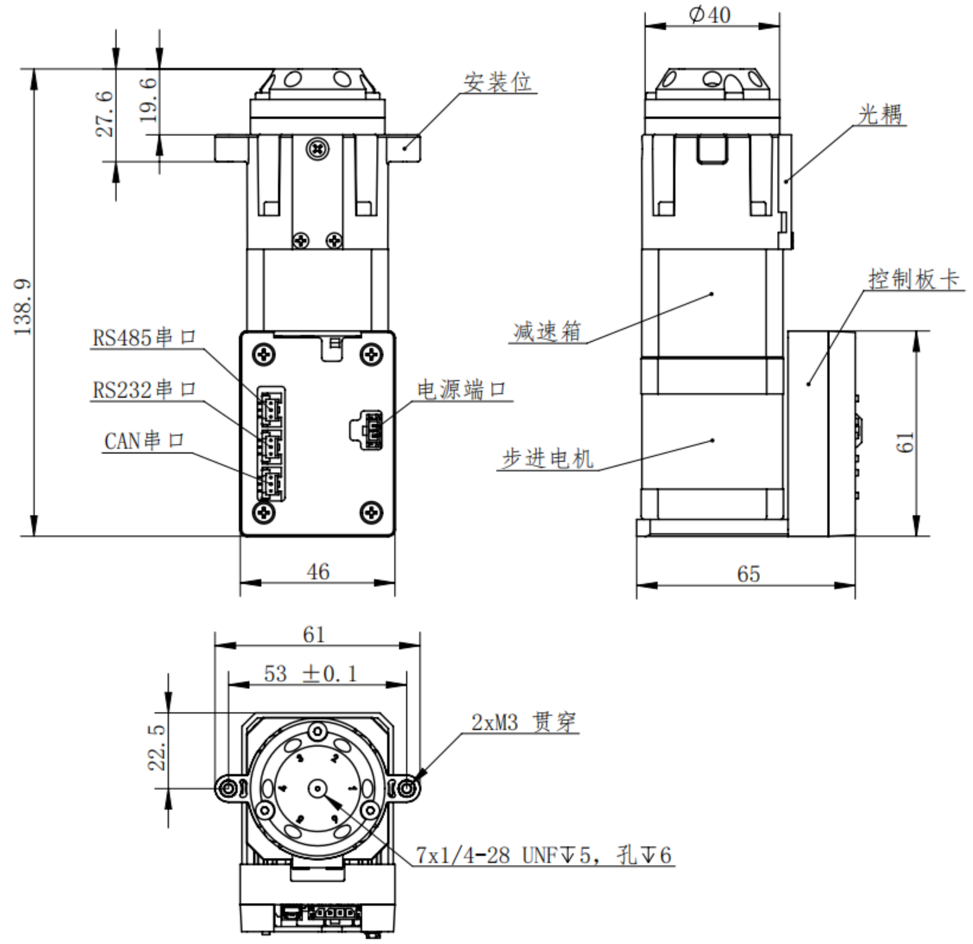
4 positions 5-port RSV


30.1
22.1
141.4
安装位
RS485串口
RS232串口
CAN串口
电源端口
46
Ø40
光耦
减速箱
控制板卡
步进电机
61
65
61
53 ±0.1
22.5
2xM3 贯穿
5x1/4-28 UNF↧5，孔↧6

Previous Naming Rule: 31B4-21-IYU/3C3

Current Naming Rule: NRV-C2SA45HC1

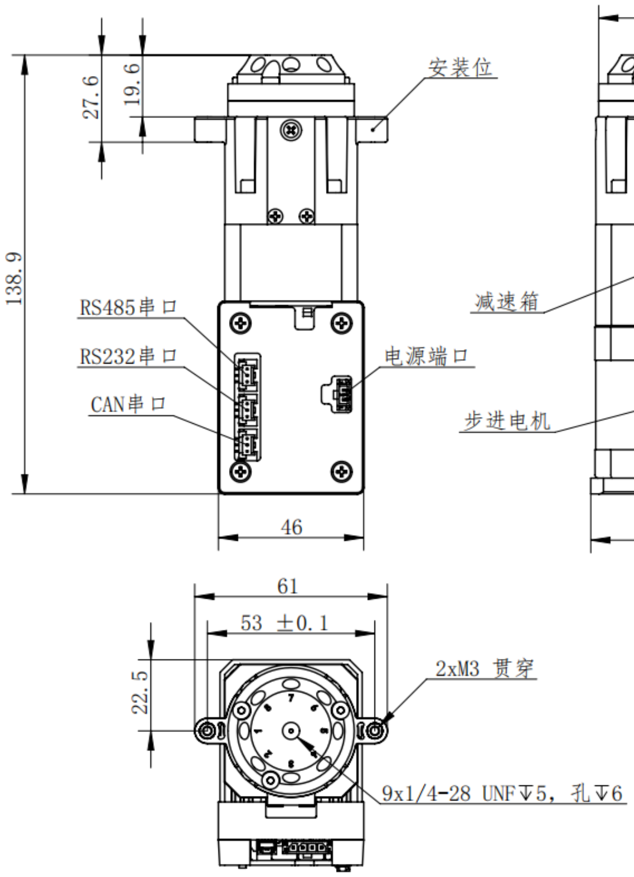
6 positions 7-port RSV


27.6
19.6
138.9
安装位
RS485串口
RS232串口
CAN串口
电源端口
46
Ø40
光耦
控制板卡
减速箱
步进电机
61
65
61
53 ±0.1
22.5
2xM3 贯穿
7x1/4-28 UNF↧5，孔↧6

Previous Naming Rule: 31B6-51-FYU/3C3

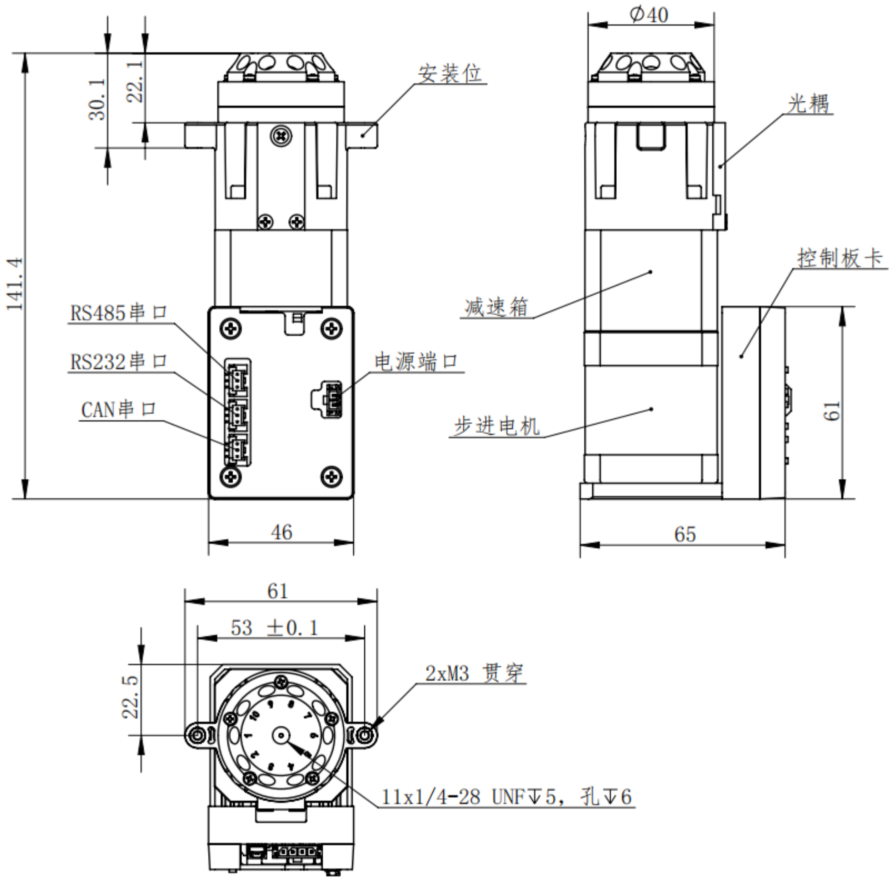
Current Naming Rule: NRV-C2SD65HC1

8 positions 9-port RSV


27.6
19.6
138.9
安装位
RS485串口
RS232串口
CAN串口
电源端口
46
Φ40
光耦
控制板卡
减速箱
步进电机
61
65
61
53 ±0.1
22.5
2xM3 贯穿
9x1/4-28 UNF↧5，孔↧6

Previous Naming Rule: 31B8-51-FYU/3C3
Current Naming Rule: NRV-C2SD85HC1

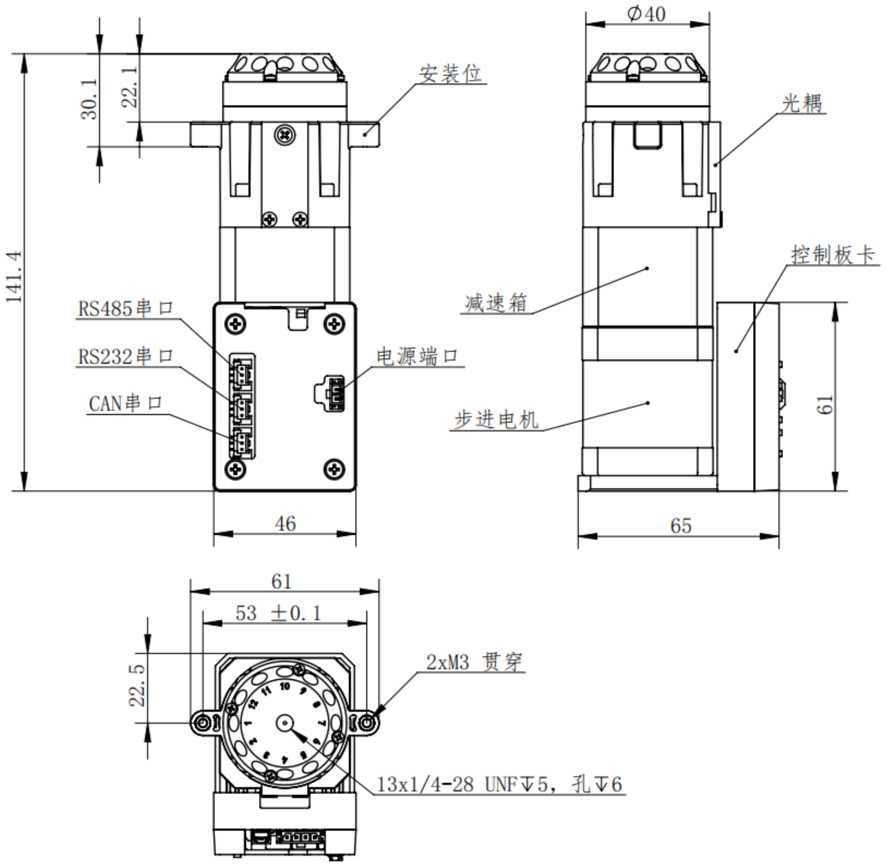
10 positions 11-port RSV


30.1
22.1
141.4
安装位
RS485串口
RS232串口
CAN串口
电源端口
46
Ø40
光耦
控制板卡
减速箱
步进电机
61
65
61
53 ±0.1
22.5
2xM3 贯穿
11x1/4-28 UNF↧5，孔↧6

Previous Naming Rule: 31BB-21-IYU/3C3

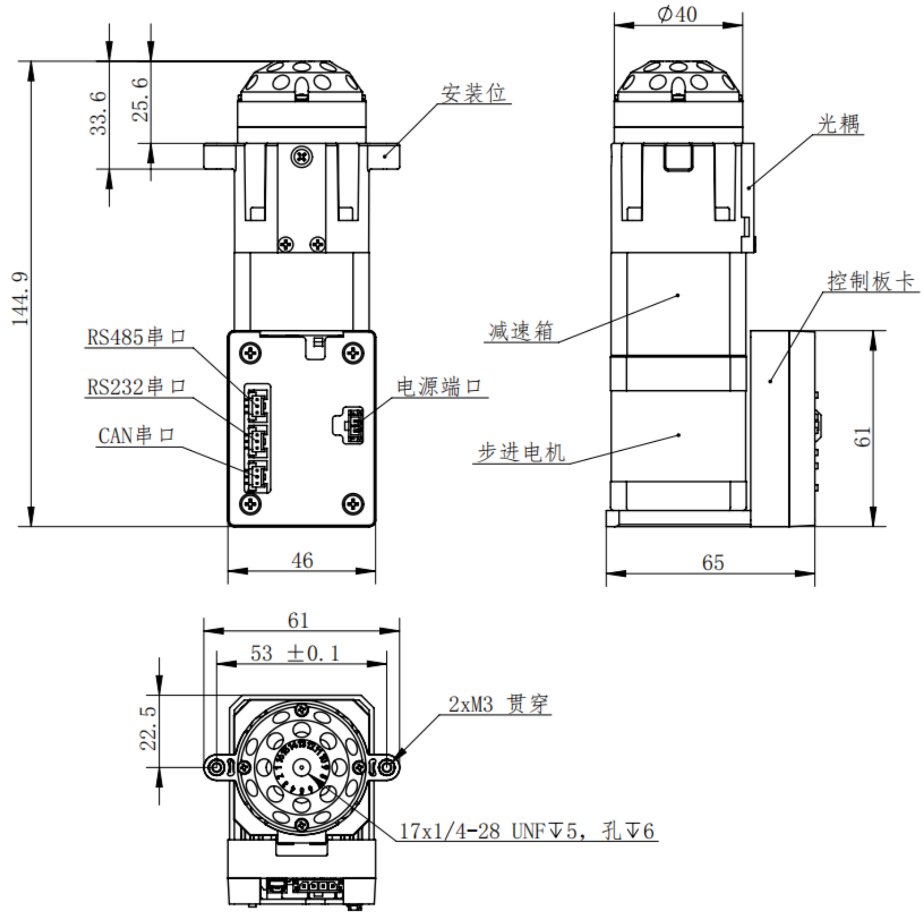
Current Naming Rule: NRV-C2SAA5HC1

12 positions 13-port RSV


30.1
22.1
141.4
安装位
RS485串口
RS232串口
CAN串口
电源端口
46
Φ40
光耦
控制板卡
减速箱
步进电机
61
65
61
53 ±0.1
22.5
2xM3 贯穿
13x1/4-28 UNF↧5，孔↧6

Previous Naming Rule: 31AD-51-FYU/3C3
Current Naming Rule: NRV-C2SDC5HC1

16 positions 17-port RSV

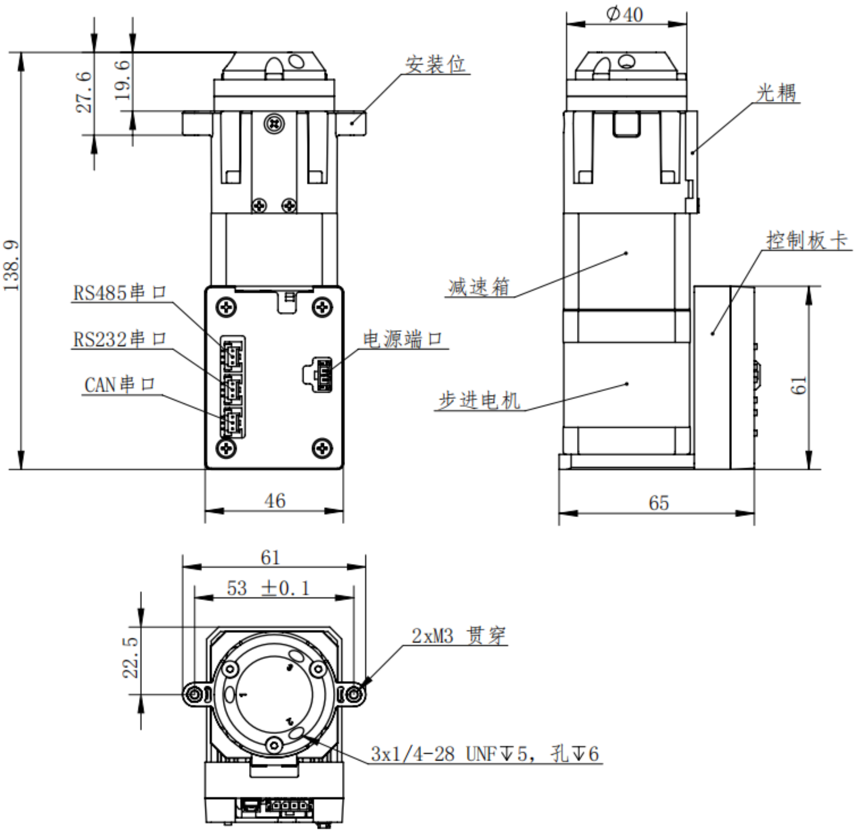

33.6
25.6
144.9
安装位
RS485串口
RS232串口
CAN串口
电源端口
46
Ø40
光耦
控制板卡
减速箱
步进电机
61
65
61
53 ±0.1
22.5
2xM3 贯穿
17x1/4-28 UNF↧5，孔↧6

Previous Naming Rule: 31AH-51-FYU/3C3

Current Naming Rule: NRV-C2SDG5HC1

1.6 Switching rotary shear valve dimensions

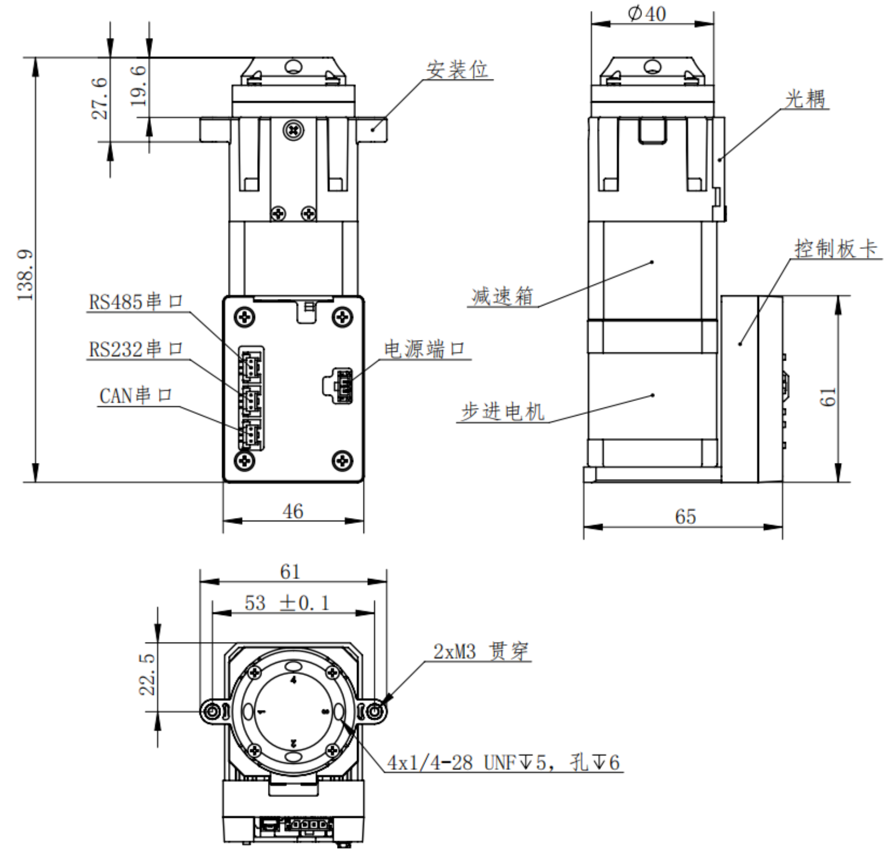
3 positions 3-port RSV


27.6
19.6
138.9
安装位
RS485串口
RS232串口
CAN串口
电源端口
46
Ø40
光耦
控制板卡
减速箱
步进电机
61
65
61
53 ±0.1
22.5
2xM3 贯穿
3x1/4-28 UNF↧5, 孔↧6

Previous Naming Rule: 32B3-21-KYU/3C3

Current Naming Rule: NRV-C2NB35HC1

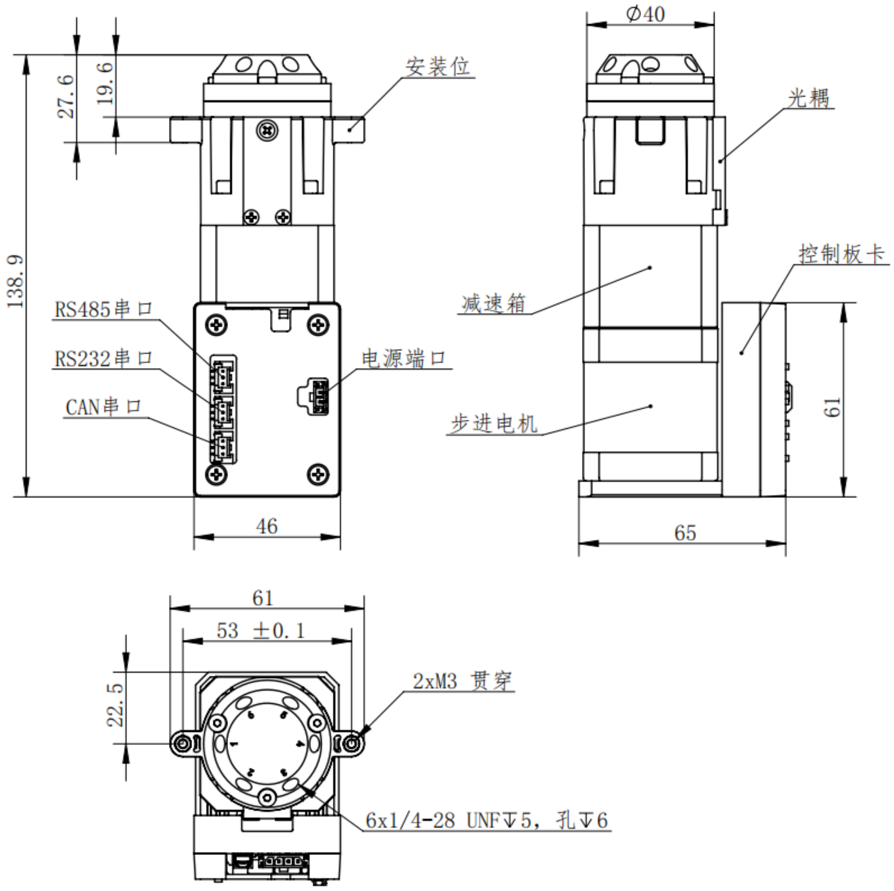
2 positions 4-port RSV


27.6
19.6
138.9
安装位
RS485串口
RS232串口
CAN串口
电源端口
46
Ø40
光耦
控制板卡
减速箱
步进电机
61
65
61
53 ±0.1
22.5
2xM3 贯穿
4x1/4-28 UNF↧5，孔↧6

Previous Naming Rule: 32B4-21-KYU/3C3

Current Naming Rule: NRV-C2NB45HC1

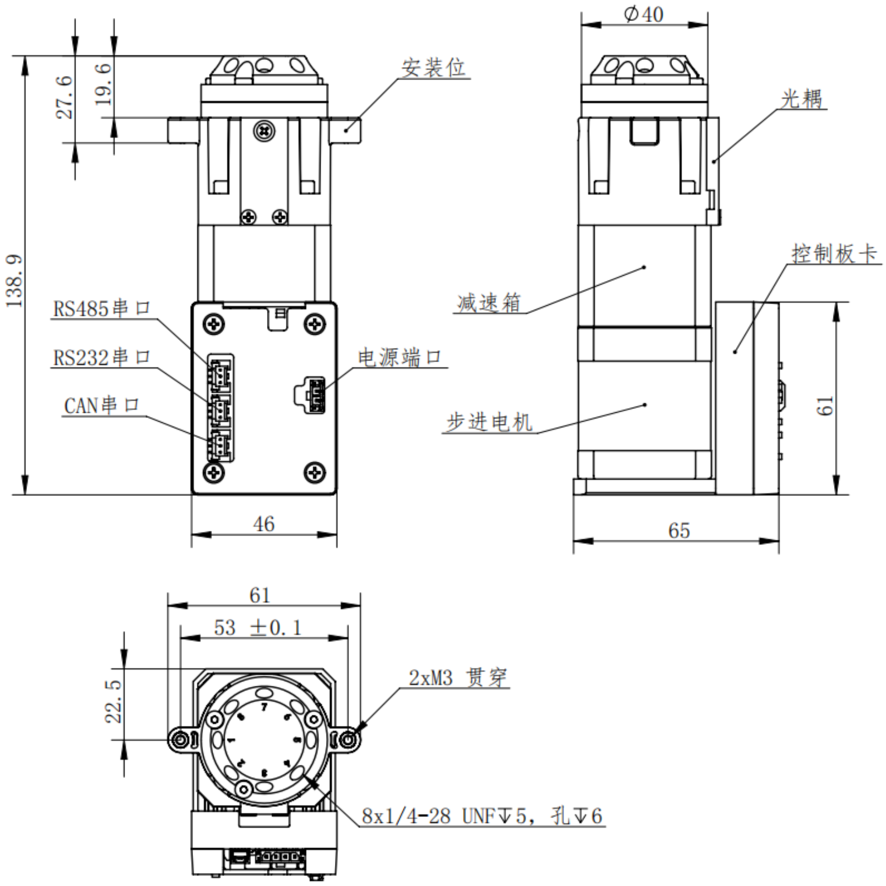
2 positions 6-port RSV


27.6
19.6
138.9
安装位
RS485串口
RS232串口
CAN串口
电源端口
46
Ø40
光耦
控制板卡
减速箱
步进电机
61
65
61
53 ±0.1
22.5
2xM3 贯穿
6x1/4-28 UNF↧5，孔↧6

Previous Naming Rule: 32B6-21-KYU/3C3

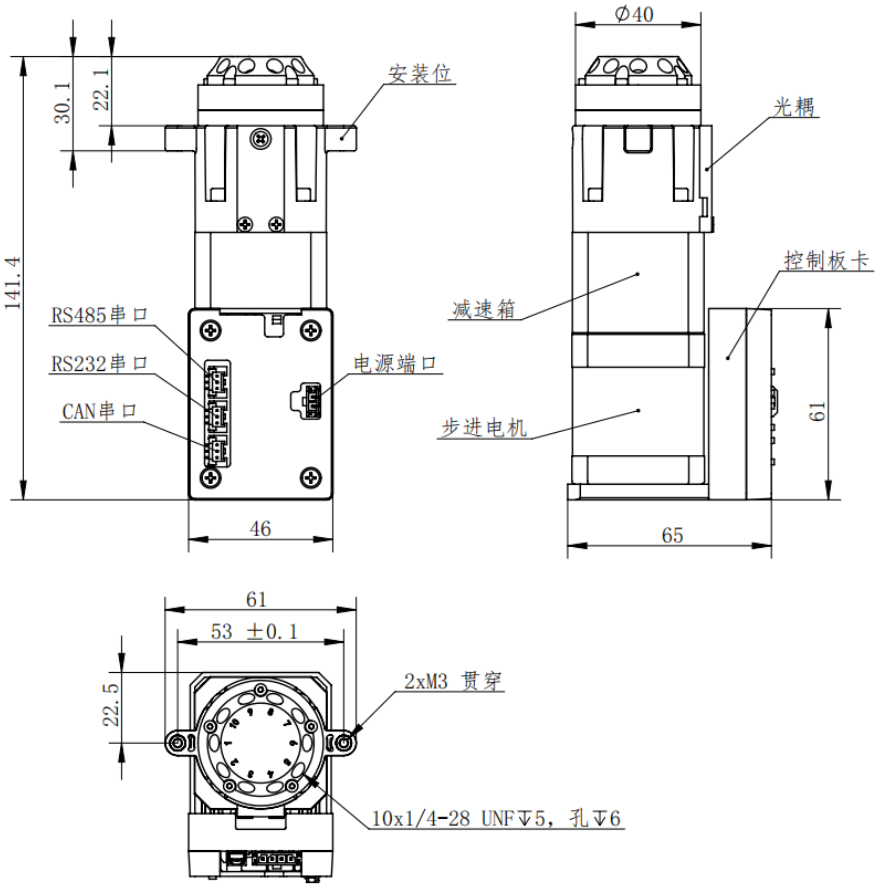
Current Naming Rule: NRV-C2NB65HC1

2 positions 8-port RSV


27.6
19.6
138.9
安装位
RS485串口
RS232串口
CAN串口
电源端口
46
⌀40
光耦
控制板卡
减速箱
步进电机
61
65
61
53 ±0.1
22.5
2xM3 贯穿
8x1/4-28 UNF↧5，孔↧6

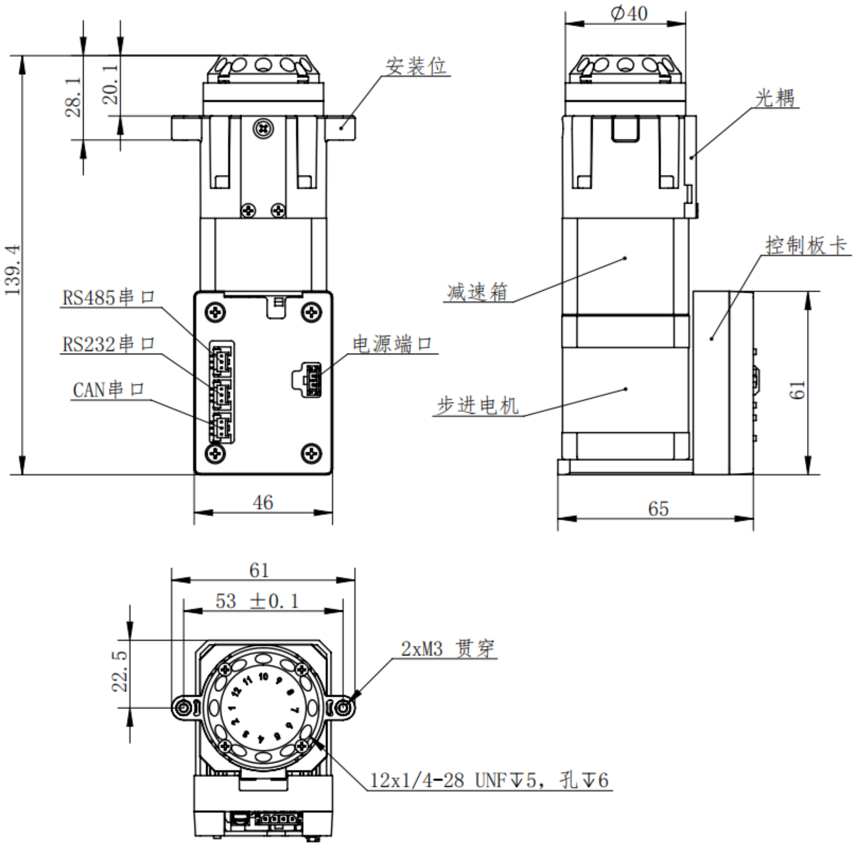
Previous Naming Rule: 32B8-21-KYU/3C3
Current Naming Rule: NRV-C2NB85HC1

2 positions 10-port RSV


30.1
22.1
141.4
安装位
RS485串口
RS232串口
CAN串口
电源端口
46
Ø40
光耦
控制板卡
减速箱
步进电机
61
65
61
53 ±0.1
22.5
2xM3 贯穿
10x1/4-28 UNF↧5，孔↧6

Previous Naming Rule: 32BB-21-KYU/3C3
Current Naming Rule: NRV-C2NBA5HC1

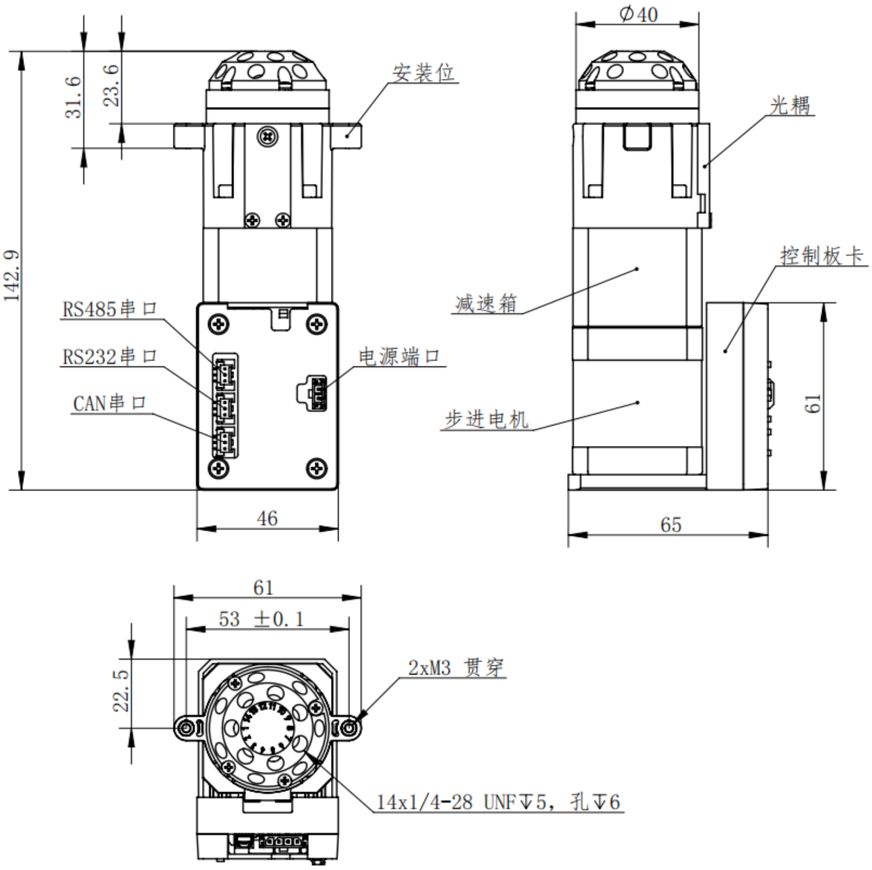
2 positions 12-port RSV


28.1
20.1
139.4
安装位
RS485串口
RS232串口
CAN串口
电源端口
46
Ø40
光耦
减速箱
控制板卡
步进电机
61
65
61
53 ±0.1
22.5
2xM3 贯穿
12x1/4-28 UNF↧5，孔↧6
1
2
3
4
5
6
7
8
9
10
11
12

Previous Naming Rule: 32AD-21-KYU/3C3

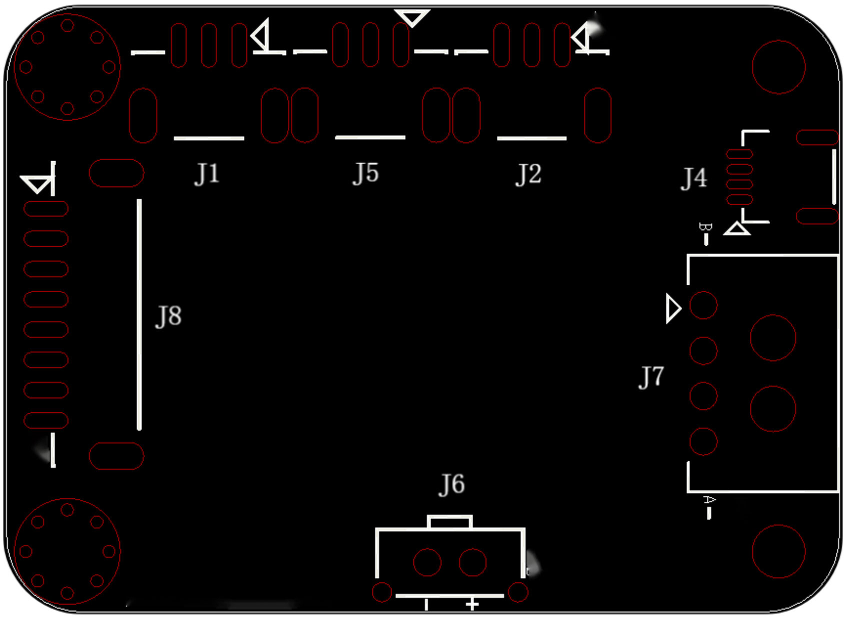
Current Naming Rule: NRV-C2NBC5HC1

2 positions 14-port RSV


31.6
23.6
142.9
安装位
Ø40
光耦
控制板卡
减速箱
RS485串口
RS232串口
CAN串口
电源端口
步进电机
61
46
65
61
53 ±0.1
22.5
2xM3 贯穿
14x1/4-28 UNF↧5, 孔↧6

Previous Naming Rule: 32AF-21-KYU/3C3
Current Naming Rule: NRV-C2NBE5HC1

2. **Port Definition**



Socket corresponding plug and terminal type

Number	Plug type	Terminal model	Plug
J1 J2 J5	JST PAP-03V-S	JST SPHD-001T-P0.5	AWG22-28
J8	JST PAP-08V-S		
J7	Molex 43645-0400	Molex 43030-0003/ Molex 43030-0001	AWG24-20
J6	Molex 43645-0200		
J4	JST NSHR-04V-S	JST SSHL-003T-P0.2	AWG28-32

Socket pin definition

Socket	Pin definition	Remarks
J6	1: 24V,in;2: GND	Red arrow indicates pin 1, voltage input
J7	1:B-;2:B+;3:A+;4:A-	Red arrow indicates pin 1, connect to the motor
J4	1:3.3V,out;2:GND;3:OW1;4:OW2	Red arrow indicates pin 1, connect to optocoupler board

J1	1:CANH;2:CANL;3:GND	Red arrow indicates pin 1, CAN
J2	1:485A;2:485B;3:GND	Red arrow indicates pin 1, 485
J5	1:232-TX,out;2:232-RX,in;3:GND	Red arrow indicates pin 1, 232
J8	1:5V,out;2:GND;3:A+;4:A-;5:B+;6:B-;7:Z+;8:Z-	Red arrow indicates pin 1, encoder

Optocoupler connection definition

Signal	Driver Board Socket	Optocoupler Board Socket	Remarks
3.3V	Pin 1 of J4	Pin 1 of J1	Driver board output, red
GND	Pin 2 of J4	Pin 2 of J1	Black
OW1	Pin 3 of J4	Pin 3 of J1	Brown
OW2	Pin 4 of J4	Pin 4 of J1	Blue

3. **Optocoupler connection definition**

3.1 Overview

The data transfer between rotary shear valve and the upper computer (computer, one-chip computer, PLC, etc.) is serial communication (such as RS-232/RS-485/CAN bus), and the following is a description of the communication format.

3.2 Communication Interface

Communication interface: RS-232/RS-485/CAN BUS
Baud rate: 9600(adjustable)
Check bit: None
Stop bit: 1

3.3 Serial Communication Protocol

Support：

- DT/OEM protocol
- Special protocol
- Keyto protocol
- MODBUS protocol

According to the different application of the customer to decide which communication method:

DT/OEM protocol: Supports up to 8 rotary shear valves controlled by one bus, suitable for systems where one bus controls both the syringe pumps and the rotary shear valves.

Special protocol: Supports one bus to control a maximum of one rotary shear valve, compatible with Special rotary shear valve.

Keyto protocol: Supports a maximum of 256 rotary shear valves controlled by one bus, consistent with the Keyto piston pump's protocol, suitable for systems where a bus controls both the Keyto piston pumps and rotary shear valves.

MODBUS protocol: Suitable for PLC users, controlled by MODBUS register.

The rotary shear valve automatically identifies all the preceding protocol formats based on the protocol format delivered for the first time when the user is powered on, and locks the protocol later. That is, the rotary valve receives only the protocols in the same format as those delivered for the first time.

3.4 DT/OEM Protocol

DT/OEM Protocol Overview

The rotary shear valve supports serial communication, including RS232 and RS485.

DT and OEM command characters are the same. When the rotary shear valve receives a string, it parses the string, verifies whether the address matches and syntax is correct, and returns the execution status of the first command. If multiple commands exist, you need to query the status to check whether subsequent commands are executed successfully.

DT Protocol

The protocol is based on RS232 and RS485 communication, the communication protocol has no check bits, and can easily use the serial debugging tool to send strings to control the rotary shear valve. Data is sent and received in ASCII characters for easy debugging. The communication protocol has the risk of data transmission error due to the absence of verification, resulting in execution and response errors. See DT protocol for details.

OEM protocol

The protocol is based on RS232 and RS485 communication, the communication protocol contains the communication serial number and check byte, which can effectively prevent data transmission errors. During operation, the controller polls the status of the rotary shear valve and analyzes the queried status to determine whether the rotary shear valve has completed the command or has an error. See OEM protocol for details.

DT Protocol Format

DT Protocol format of sending commands

No.	Function	Byte count	ASCII	HEX	Description
1	Start symbol	1	/	0x2F	Indicates the start identifier of a frame command
2	Device address	1			Control address of an ASCII character
2+n	Command string	n			ASCII command string, see Operation Command for details
3+n	Terminator	1	Carriage return character[CR]	0x0D	Indicates the end identifier of a frame command

DT Returns data protocol format

No.	Function	Byte count	ASCII	HEX	Description
1	Start symbol	1	/	0x2F	Indicates the start identifier of a frame command
2	Host address	1	0	0x30	Fixed host address
3	Status	1			The current status of the device is shown in Table 8
3+n	Data string	n			Return data ASCII string
4+n	Terminator	1	Terminator[ETX]	0x03	Represents the end identifier of the returned data of a frame
5+n		1	Carriage return character [CR]	0x0D	Indicates the start identifier of a frame command
6+n		1	Line break[LF]	0x0A	Fixed host address

For example: To initialize the rotary valve at address 1, send the command /1ZR carriage return [CR]

OEM Protocol Format

OEM Protocol format of sending commands

No.	Function	Byte count	ASCII	HEX	Description
1	Start symbol	1	Start symbol[STX]	0x02	Indicates the start identifier of a frame command
2	Device address	1			Control address of an ASCII character
3	Serial number	1			Reserve
2+n	Command string	n			ASCII command string, see Operation Command for details
3+n	Terminator	1	Terminator[ETX]	0x03	Indicates the end identifier of a frame command
4+n	Verify	1			X or check of the first 3+n command bytes

OEM Returns data protocol format

No.	Function	Byte count	ASCII	HEX	Description
1	Start symbol	1	Start symbol[STX]	0x02	Represents the start identifier of the returned data of a frame
2	Host address	1	0	0x30	Fixed host address
3	Status	1			The current status of the device is shown in Table 8
3+n	Data string	n			Return data ASCII string
4+n	Terminator	1	Terminator[ETX]	0x03	Indicates the end identifier of a frame command
5+n	Verify	1			Check for the first 4+n data bytes

DT/OEM Status Table

Status byte								Error code	Description
bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0		
0	1	x	0	0	0	0	0	0	Infallibility

0	1	x	0	0	0	0	1	1	Initialization error
0	1	x	0	0	0	1	0	2	Invalid command
0	1	x	0	0	0	1	1	3	Invalid operand
0	1	x	0	0	1	0	0	4	Invalid command sequence
0	1	x	0	0	1	1	0	6	Non-volatile memory error
0	1	x	0	0	1	1	1	7	The device is not initialized
0	1	x	0	1	0	1	0	10	Rotary shear valve overload
0	1	x	0	1	1	0	0	12	Internal error
0	1	x	0	1	1	1	1	15	Command buffer overflow

Bit7, bit6 and bit4 of the status byte are fixed as 0,1,0, bit5 indicates the current state of the rotary shear valve, when bit5 is 1, the rotary shear valve is idle, when bit5 is 0, the rotary shear valve is busy, and bit3 to bit0 indicates the wrong state of the rotary shear valve.

Command description

- All commands except report and query commands must end with the R command.
- A single command and command string can be executed sequentially, for example /1ZE2R\r, the rotary shear valve at address 1 is first initialized and then cut to channel 2.
- The rotary shear valve receives a maximum of 255 bytes. If the sent command or command string does not contain the R command at the end, the command or command string will be stored in the cache and not executed.
- After the command is executed, the rotary shear valve will enter the busy state until the command string is executed or the stop T command is received to exit the busy state. You can query the status by running the query Q command.
- After the rotary shear valve is powered on, it is automatically initialized to channel 1. If the rotary shear valve is used for the first time, you can query the status of the rotary valve through Q to switch channels.

Commands

<U>[n] System configuration

Rotary Shear Valve configuration

Command	Parameter	Parameter Range	Default value	Description
U		41		Set the baud rate of the serial port to 9600
		47		Set the baud rate of the serial port to 38400

All configurations configured using the U command take effect after being powered on and are automatically saved to the non-volatile memory.

Initialization Commands

Users can configure the coding direction of the rotary shear valve channel number according to different commands.

<Z>Initialize the valve in clockwise

Run this command to reset the valve. The port number of the valve starts from 1 in the clockwise direction, and subsequent valve cutting commands are executed according to this number. After the zero setting is complete, the command channel is 1 by default. If w parameter 1 is used to change the overset zero channel, the zero setting is the same as w zero setting.

<Y>Initialize the valve in counterclockwise

Run this command to reset the valve. The port number of the valve is numbered from 1 in the counterclockwise direction, and subsequent valve cutting commands are executed according to this number. After the zero setting is complete, the command channel is 1 by default. If w parameter 1 is used to change the overzero channel, the zero setting is the same as w zero setting.

<w>[n1] [n2] Initialize the rotary shear valve

Initialize the rotary shear valve

Command	Parameter	Parameter Range	Default value	Description
w	n1	1-X	1	After initialization, the channel is switched to this channel. X Maximum channel number
	n1	0-1	0	After initialization, valve channel coding direction: 0: clockwise encoding 1: encoding counterclockwise

Valve Control Commands

<I>[n] Clockwise switching channels

Clockwise switching channels

Command	Parameter	Parameter Range	Default value	Description
I	n	NA	NA	If no parameter is specified, the optimal path is switched to the input channel (channel 1 by default)
		1-X	Channel number	If with parameters: Number of the target channel Switch to the target channel clockwise

<O>[n] Counterclockwise switching channel

Counterclockwise switching channel

Command	Parameter	Parameter Range	Default value	Description
O	n	NA	NA	If no parameter is specified, the optimal path is switched to the input channel (channel 1 by default)
		1-X	Channel number	If with parameters: Number of the target channel Switch to the target channel counterclockwise

<E>[n] Optimal path switching channel

Optimal path switching channel

Command	Parameter	Parameter Range	Default value	Description
E	n	NA	NA	None Parameter: Optimal path switch valve to port E
	n	1-X	Channel number	With parameters: Number of the target channel

<B>[n] Optimal path switching channel

Optimal path switching channel

Command	Parameter	Parameter Range	Default value	Description
B	n	NA	NA	None Parameter: Optimal path switch valve to port B
	n	1-X	Channel number	With parameters: Number of the target channel

System Control Commands

<R> Execute command or string of commands

If there are unexecuted command strings in the command cache, when the command string ending with the R command string is received, the command string is stored in the cache and the command string in the cache is executed. When the command string stops executing due to the H command or T command, the command string with only the R command can be sent to continue the unfinished command string. When the execution of the delayed M command is in progress, sending the command string with only the R command will stop the execution of the delayed M command and continue to execute the subsequent commands.

<G>[n] Loop command or command string

Loop command or command string

Command	Parameter	Parameter Range	Default value	Description
G	n	0-48000		The number of times a command or command string is executed in a loop

The command or command string is executed repeatedly according to the specified number of times. When the number of cycles is 0, the command is executed continuously.

<g> The start symbol of a command or command string that loops

Execute the start symbol of the command or command string in a cycle. For example, send the ZgI2B3G5R command string, initialize the rotary shear valve, then switch the rotary shear valve clockwise to channel 2, and switch the optimal path to channel 3.

<M>[n] Delayed execution

Delayed execution

Command	Parameter	Parameter Range	Default value	Description
M	n	0-30000		Delayed execution time (ms)

This command can be used between the moving piston command and the switching valve port command. When the moving piston is finished, delay a certain time and then switch the valve port to reduce the pressure fluctuation; Delay process If the R command is received, the delay process can be terminated and subsequent command strings can be executed.

<T> Termination command

Stop valve switching, after stopping, you must reset to zero to allow the operation to continue

Termination command

<?>[n] Report rotary shear valve information

Report rotary shear valve information

Command	Parameter	Description
?	6	Report valve port
	23	Report firmware version
	29	Report current status

<&> Report firmware version

Same as the ? 23 command, report the firmware version in ASCII characters.

<Q> Report status

Same as the ? 29 command, report the status of the current rotary shear valve, see Table 8 status table.

Special Commands

<#> Set the address

This command is a special command used to set the address of a rotary shear valve without a dip switch. The setting takes effect immediately

Set the address

Command	Parameter Range	Description
#	1-15	Set address

Application Cases

Before sending an action command, run the Q command to query the current running status. The action command is sent only when the device is idle. The status returned by other non-Q commands cannot be used to identify the running or idle status of the device, but can only be used to handle exceptions.

DT Protocol

Execute a single command action

Host	ASCII Command	HEX Command	Remarks
Send	/1ZRCarriage return character[CR]	2F 31 5A 52 0D	Send clockwise valve and piston initialization commands.
Receive	/0@Terminator [ETX] Carriage return [CR] Newline [LF]	2F 30 40 03 0D 0A	Receive the response data of busy status.
Send	/1QR] Carriage return [CR]	2F 31 51 52 0D	Query running status.
Receive	/0@Terminator [ETX] Carriage return [CR] Newline [LF]	2F 30 60 03 0D	The current running status is found idle.

Executing Multiple Command Actions

Host	ASCII Command	HEX Command	Remarks
Send	/1ZI2B4R Carriage return [CR]	2F 31 5A 49 41 33 30 30 42 41 30 52 0D	The rotary shear valve first initializes the valve clockwise, then switches the valve clockwise to port 2, and then optimally switches the valve to port 4
Receive	/0@Terminator [ETX]Carriage return[CR] Newline[LF]	2F 30 40 03 0D 0A	The response data of the busy status was received. Procedure.

OEM Protocol

Host	HEX Command	Remarks
Send	02 31 30 5a 49 32 42 34 52 03 05	Send command: ZI2B4R.
Receive	02 30 40 03 71	Receive the response data of busy status.
Send	02 31 30 51 52 03 03	Query running status.
Receive	02 30 60 03 51	The current running status is found idle.

3.5 Special Protocol

Special Protocol Overview

The protocol has no address, so only one bus can control one device. The protocol is the simplest to use, sending P/+/-/M command to switch channels after the switch channel is completed automatically return the "\r" symbol. You do not need to query the status. However, in order to take into account the possibility of data loss in the communication, the user who does not receive a carriage return in more than 3 seconds needs to read the current channel through the query command 'S'.

Special Protocol Format

P,+,-,M Send \r automatically after the command action is completed

Command table (" \r "indicates newline characters)+

Protocol format

Command	Function	Return
P	Switches to the specified location with the optimal path	“*” : Executed successfully; “**\r” or “***\r: busy; “++\r”: the channel does not exist.
+	Switch counterclockwise to the specified position	
-	Switch clockwise to the specified position	
S	Example Query the current channel	Normal values are ASCII encoding in hexadecimal format: for example, channel 21: returns ASCII data. 15\r “ 63\r ” : power-on initialization optocoupler error. "42\r": Other errors.
E	Query status	"00\r *" : idle. "63\r" : power-on initialization optocoupler error. "42\r" : Other errors.
M	Resetting	"--\r" : there is an error status and cannot be reset. “*”: The command is executed successfully.
X	Set the baud rate for serial port communication X1: 9600 X2: 19200 X3: 38400 X4: 57600	“\r”: Setting successful. No reply: Unrecognizable baud rate.
Q	Reservation function	“01\r”
R	Get version	Current version: “107\r”

3.6 Keyto Protocol

Keyto Protocol Format

The communication adopts asynchronous serial communication mode, and the command and data frames adopt checksum, and the checksum is two bytes (2Byte). The commands and data in the communication are hexadecimal numbers, and the parameters are stored in small end mode.

The communication with the rotary valve adopts one-question with one-answer method. The main controller sends commands to the rotary valve, and the rotary valve receives and processes the commands and returns the answer data.

Keyto Send Command Protocol Format

Data Fields	Data type	Bytes numbers	Description
Frame Header	Uint8	1	Fixed value 0XAA, indicating the start of data
Address	Uint8	1	Communication address, each drive on each bus should be set to a unique address number in the range of 0-0xff. Communication is normal when the address matches, otherwise received commands will be ignored.
Command	Uint8	1	See command description
Data	int32	4	High byte first
Check	Uint8	1	An 8-bit checksum is calculated from the frame header to the end byte of the data area. The value obtained takes the last 8 bits of data.

Keyto Answer Command Protocol Format

Data Fields	Data type	Bytes numbers	Description
Frame Header	Uint8	1	Fixed value 0XAA, indicating the start of data
Address	Uint8	1	Communication address, each drive on each bus should be set to a unique address number. Communication is normal when the address matches, otherwise received commands will be ignored.
Command	int32	4	High byte first Set command: Data 0 indicates successful command setting, 1 indicates failure (such as exceeding the

			setting range) Control command: Data 0 indicates successful command execution, 1 indicates failure (such as the operation is not currently allowed) Query command: Data indicates the queried value.
Data	Uint8	1	An 8-bit checksum is calculated from the frame header to the end byte of the data area. The value obtained takes the last 8 bits of data.

Command Description

Please query whether the current system state is in idle state through command 0x90 before sending control and parameter setting commands, and allow sending control commands only when the system is in idle state.

Command List

Control Commands

Send Commands

Command Value	Function	Data range	Direction
0x01	Switch to the specified channel	1-x	X: the maximum value of the valve is different depending on the number of inaccessible channels, e.g. 10-way valve, data range 1-10. Function description: Control the rotary valve to move to the specified channel in the shortest path. Sending this command in the fault state or busy state will respond with a failure message.
0x02	Switch to the specified channel in counterclockwise direction	1-x	X: the maximum value of the valve is different depending on the number of inaccessible channels, e.g. 10-way valve, data range 1-10. Functional description: Control the rotary valve to move counterclockwise (i.e. the switching sequence is 1->10) to the specified channel. Sending this command in the fault state or busy state will respond with a failure message.
0x03	Switch to the specified channel in clockwise direction	1-x	X: Maximum value of the valve varies according to the number of inaccessible channels, e.g. 10-way valve, the data range is 1-10. Functional description: Control the rotary valve to move clockwise (i.e. the switching sequence is 10->1) to the

			specified channel. Sending this command in the fault state or busy state will respond with a failure message.
0x05	Set Zero	0	Controls the rotary valve automatically move to the zero optocoupler position automatically. Sending this command in a busy state will result in a failure message.
0x06	Stop	0	Immediate stopping of rotary valve movement regardless of current position.
0x07	Clear Error	0	Clear fault information.

Response data

Response data	Data range	Directions
	0,1	Original data: Command execution successful 1: Failure

Parameter Setting Commands

Keyto Protocol Parameter Settings Send Command Format

Command Value	Function	Data range	Default Value	Directions
0x51	Maximum speed	50-2000 (step/s)	500	Set the maximum speed during the motion process. The acceleration will stop when the acceleration reaches the set value. The unit of the command data is step/s.
0x52	Minimum speed	0-1000(step/s)	10	Set the minimum speed during the motion process. The acceleration curve starts from this speed and accelerates to the maximum speed. The deceleration curve will stop after decelerating to the set value. The command data unit is step/s.
0x53	Acceleration	50-10000(step/s)	2000	The number of steps added per second. The unit of this command data is step/s.
0x54	Deceleration	50-10000(step/s)	2000	The number of steps reduced per second. The unit of this command data is step/s.
0x55	Rated current	100-200	1800	Phase current when the motor is

		0(mA)		operating at maximum speed.
0x58	Set the maximum number of channels	1-0xFF	10	Maximum channel number setting, different parameters are set according to different devices.
0x6D	Set CAN baud rate (unit K)	100,125,250,500, 800,1000	500	Modify the CAN communication baud rate, save it through the EF command after the modification is completed, and it will take effect after restarting.
0x6E	Set serial port baud rate	9600,19200,38400,57600,115200	9600	Modify the communication baud rate and save it through the EF command after the modification is completed. It will take effect after restarting.
0x6F	Address	0-255	0	Drive address. After the address is modified, subsequent commands must use the modified address.
0xEF	Power-down saving all the parameter	123456	123456	The parameter value must be fixed to 0x1234, otherwise saving failed.
0xEE	Reset factory settings	123456	123456	The parameter value must be fixed to 0x1234, otherwise the factory reset failed.

Keyto protocol parameter setting response data format

Response data	Data range	Direction
	0,1	0: Setting successful 1: Setting failed When the parameter is wrong, the response will be set to failed.

Query Command

Send command parameter 0, the returned data will be different according to different command data, and the returned data range is the same as the parameter setting command.

Keyto protocol parameter setting query command format

Command Value	Function	Return data	Direction
0x90	Read the	0-0xffffffff	See 27 Status Table

	current status		
0x91	Maximum reading speed	50-2000(step/s)	
0x92	Minimum reading speed	0-2000(step/s)	
0x93	Reading acceleration	50-10000(step/s)	
0x94	Read deceleration	50-10000(step/s)	
0x95	Read rated current	100-2000(mA)	
0x98	Read the maximum number of channels	1-0xff	
0x99	Read the current channel position	1-x	X: The maximum value of the valve according to the number of blocked channels, for example, a 24-way valve, the data range is 1-24.
0xF0	Read Device ID	0-0xffffffff	Unique ID code of the device. This value is different for each drive.
0xF1	Read model	0-0xffffffff	The device model code is the device model, which can be used to distinguish different devices.
0xF2	Software version number	0-0xffffffff	Software version code.

Fig. State Table

0 idle state operational state, non-0 busy or error state, bit8-bit15 error code.

Keyto protocol status table

Bits	Definition	Return data
Bit0	Status	0: Idle, 1: Busy
Bit8-bit15	Fault	0: Normal, non-zero fault 1: Optocoupler error 2: Stall 3: Optocoupler count error 4: Driver initialization error 5: Switch channel optocoupler spacing error 6: Switch channel count error

Data Example

Control commands

(1) Switch to channel 5

Send data：AA 00 01 00 00 00 05 B0

Receive data：AA 00 00 00 00 00 AA

(2) Reset to zero

Send data：AA 00 05 00 00 00 00 AF

Receive data：AA 00 00 00 00 00 AA

(3) Stop

Send data：AA 00 06 00 00 00 00 B0

Receive data：AA 00 00 00 00 00 AA

(4) Troubleshooting

Send data：AA 00 07 00 00 00 00 B1

Receive data：AA 00 00 00 00 00 AA

Parameter setting commands

(1) Set the maximum speed to 1000

Send data：AA 00 51 00 00 03 E8 E6

Receive data：AA 00 00 00 00 00 AA

(2) Set the minimum speed to 100

Send data：AA 00 52 00 00 00 64 60

Receive data：AA 00 00 00 00 00 AA

(3) Set the acceleration to 2000

Send data：AA 00 53 00 00 07 D0 D4

Receive data：AA 00 00 00 00 00 AA

(4) Set the deceleration rate to 2000

Send data：AA 00 54 00 00 07 D0 D5

Receive data：AA 00 00 00 00 00 AA

(5) Set the rated current to 1500

Send data：AA 00 55 00 00 05 DC E0

Receive data：AA 00 00 00 00 00 AA

(6) Set the number of channels to 10

Send data：AA 00 58 00 00 00 0A 0C

Receive data：AA 00 00 00 00 00 AA

(7) Set the baud rate to 38400. Note that to send a power-down save command and power-off and restart after the setting is completed

Send data：AA 00 6E 00 00 96 00 AE

Receive data：AA 00 00 00 00 00 AA

(8) Set Address 2

Send data：AA 00 6F 00 00 00 02 1B

Receive data：AA 00 00 00 00 00 AA

(9) All parameters of power-down saving

Send data：AA 00 EF 00 01 E2 40 BC

Receive data：AA 00 00 00 00 00 AA

Query Command

(1) Query Status

Send data：AA 00 90 00 00 00 00 3A

Receive data：AA 00 00 00 00 00 AA

(2) Query maximum speed

Send data：AA 00 91 00 00 00 00 3B

Receive data：AA 00 00 00 03 E8 95

(3) Query minimum speed

Send data：AA 00 92 00 00 00 00 3C

Receive data：AA 00 00 00 00 C8 72

(4) Query acceleration

Send data：AA 00 93 00 00 00 00 3D

Receive data：AA 00 00 00 07 D0 81

(5) Query deceleration

Send data：AA 00 94 00 00 00 00 3E

Receive data：AA 00 00 00 07 D0 81

(6) Query rated current

Send data：AA 00 95 00 00 00 00 3F

Receive data：AA 00 00 00 05 DC 8B

(7) Query the number of channels 10

Send data：AA 00 98 00 00 00 00 42

Receive data：AA 00 00 00 00 0A B4

(8) Query the current channel number

Send data：AA 00 99 00 00 00 00 43

Receive data：AA 00 00 00 00 02 AC

3.7 MODBUS protocol

Overview

This protocol complies with the RTU mode in the subset protocol of the MODBUS protocol and the half-duplex working mode of RS232/RS485.

1. The data exchange between the communication machine (computer/data acquisition instrument) and the lower computer is transmitted in frames. The data in the data communication process is all processed as double-byte data. If the data identifier is a floating point number, write the decimal point that needs to be read to determine the size of the data.

2. The data in this protocol are encoded in hexadecimal, and each frame is checked through CRC16. The range of the check should include all bytes before the check byte, and the check polynomial is 0XA001.

3. The data block uses the little-endian mode, with the low byte of CRC16 in the front and the

high byte in the back.

4. Each communication is initiated by the communication machine (computer/data acquisition instrument), and the lower computer responds according to the command word sent by the communication. The communication machine sends a "command frame" and the corresponding lower computer returns a "response frame".

Protocol Format

Send command format

Read command format (0x03 function code) example

MODBUS protocol sending command format

Address	Function code	Register address (H)	Register address (L)	Number of data (H)	Number of data (L)	CRC16 (L)	CRC16 (H)
0x00	0x03	0x00	0x51	0x00	0x01	0xD4	0x0A

MODBUS protocol response command format

Address	Function code	Register address (H)	Register address (L)	Number of data (H)	Number of data (L)	CRC16 (L)
0x00	0x03	0x02	0x03	0xE8	0x85	0x3A

Write command format (0x06 function code) example

Address	Function code	Register address (H)	Register address (L)	Data (H)	Data (L)	CRC16 (L)	CRC16 (H)
0x00	0x06	0x00	0x51	0x07	0xD0	0xDA	0x66

Write command format reply format

Address	Function code	Register address (H)	Register address (L)	Data (H)	Data (L)	CRC16 (L)	CRC16 (H)
0x00	0x06	0x00	0x51	0x07	0xD0	0xDA	0x66

Command Description

Before sending control and parameter setting commands, please send command 0x0090 to query whether the current system status is idle. Only when the system is in idle state can control commands be sent.

Control command

Send command

MODBUS protocol control sending command format

Function code	Register Address	Data length	Data range	Directions
0x06	0x0001	2	1-Maximum Channel	Switch to the specified channel
0x06	0x0002	2	1-Maximum Channel	Switch to the specified channel in the positive directions.
0x06	0x0003	2	1-Maximum Channel	Switch to the specified channel in the opposite directions.
0x06	0x0005	2	0	Reset
0x06	0x0006	2	0	Stop now
0x06	0x0007	2	0	Clear error status

Response data

MODBUS protocol control response data format

Response data	Data range	Directions
	Original data, 1	Original data: Command execution successful 1: Failure

Parameter Setting Commands

MODBUS protocol parameter setting sending command format

Function code	Register Address	Function	Data range	Default value	Directions
0x06	0x0051	Maximum speed	50-2000(step /s)	500	Set the maximum speed during the motion process. The acceleration will stop when the acceleration reaches the set

					value. The unit of the command data is step/s.
0x06	0x0052	Minimum speed	0-1000(step/s)	10	Set the minimum speed during the motion process. The acceleration curve starts from this speed and accelerates to the maximum speed. The deceleration curve will stop after decelerating to the set value. The command data unit is step/s.
0x06	0x0053	Acceleration	50-10000(step/s)	2000	The number of steps added per second. The unit of this command data is step/s.
0x06	0x0054	Deceleration	50-10000(step/s)	2000	The number of steps reduced per second. The unit of this command data is step/s.
0x06	0x0055	Rated current	100-2000(mA)	1800	Phase current when the motor is operating at maximum speed.
0x06	0x0058	Set the maximum number of channels	1-0xFF	10	Maximum channel number setting, different parameters are set according to different devices.
0x06	0x006D	Set CAN baud rate (unit K)	100,125,250,500, 800,1000	500	Modify the CAN communication baud rate, save it through the EF command after the modification is completed, and it will take effect after restarting.
0x06	0x006E	Set serial port baud rate	0：9600 1：19200 2：28400 3：57600 4：115200	0	Modify the communication baud rate and save it through the EF command after the modification is completed. It will take effect after restarting.
0x06	0x006F	Address	0-255	0	Drive address. After the address is modified, subsequent commands must use the modified address.
0x06	0x00EF	Power-down saving all the parameter	0x1234	0x1234	0x1234，The parameter value must be fixed to 0x1234, otherwise saving failed.
0x06	0x00EE	Reset factory settings	0x1234	0x1234	0x1234，The parameter value must be fixed to 0x1234, otherwise the factory reset failed.

MODBUS protocol parameter setting response data format

Response data	Data range	Direction
	Original data,1	Original data: Setting successful 1: Setting failed When the parameter is wrong, the response will be "setting failed"

Query command

Send Command Parameters for 1, means read back one parameter. send Command Parameters for which number, means can read back the same quantity parameters. For example, if the register address is 0x0090, send the command parameter for 2 can read back of 0x0090 and 0x0091. If the register address is 0x0051, the maximum number to send Command Parameters is 9, and can read to the device address.

MODBUS Protocol Query command

Function code	Register Address	Function	Return data	Direction
0x03	0x0090	Read the current status	0-0xFFFF	Table 35 the status table
0x03	0x0091	Read the current channel	Current channel	
0x03	0x0051	Maximum reading speed	50-2000(step/s)	
0x03	0x0052	Minimum reading speed	0-2000(step/s)	
0x03	0x0053	Read acceleration	50-10000(step/s)	
0x03	0x0054	Read deceleration	50-10000(step/s)	
0x03	0x0055	Read rated current	100-2000(mA)	
0x03	0x0058	Read the maximum number of channels	1-0xff	
0x03	0x006D	CAN baud rate	100,125,250,500,800, 1000	
0x03	0x006E	Serial port baud rate	0：9600 1：19200 2：28400 3：57600 4：115200	
0x03	0x006F	Device Address	0-255	
0x03	0x00F0	ID Read Device ID	0-0xFFFF	Unique ID for each product.
0x03	0x00F1	Read model	0-0xFFFF	The code value is the

				model of the device, which can be used to distinguish different devices.
0x03	0x00F2	Read the version number	0-0xFFFF	Using BCD code to represent decimal.

Fig. Status table

MODBUS Protocol Status Table

bits	Definition	Return data
0	Status	0：Idle，1：Busy
1-7	Reserve	----
8	Driver chip failure	0: Normal，1: The driver chip work error, such as over-current, under-voltage, or over-temperature.
9	Optocoupler detection error	0: Normal，1: Optocoupler failure
10	Channel switching error	0: Normal，1: Channel Error
Others	Reserve	----

3.8 CAN Communication Protocol

communication interface

Communication Interface：CAN
Baud Rate：500k

protocol format

Send data format
Frame type: data frame
Message identifier type: Standard frame
SID：device address+0x200
DLC：Data length 8

Send data domain: The data length is fixed 8 bytes, including commands and communication data, the highest byte for the command, the lower 4 bytes for the data, in which the command and data are the same as the command and data in the serial communication.The data format is as follows.

Send data format of data area

DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7	DATA8
Command (same as serial communication command)	0	0	0	4 bytes of data (same as the serial communication data field)			

Return data format

Frame type: data frame

Message identifier type: Standard frame

SID： device address+0x100

DLC： Data length 4

Send data domain: The data length is fixed 4 bytes,in which the data format sames as the corresponding command and the return data in serial communication, and the data format is as follows.

Send data format of data area

DATA1	DATA2	DATA3	DATA4
Data (same as the serial communication data field)			

Data Example

Control Commands

(1) Switch to channel 5

Send data： SID=0X200 DLC=8 DATA=0X0100000000000005

Receive data： SID=0X100 DLC=4 DATA=0000000000

(2) Set the maximum speed to 1000

Send data： SID=0X200 DLC=8 DATA=0X5100000000000003E8

Receive data： SID=0X100 DLC=4 DATA=0X00000000

(3) Query the current channel

Send data： SID=0X200 DLC=8 DATA=0X9900000000000000

Receive data： SID=0X100 DLC=4 DATA=0X00000005

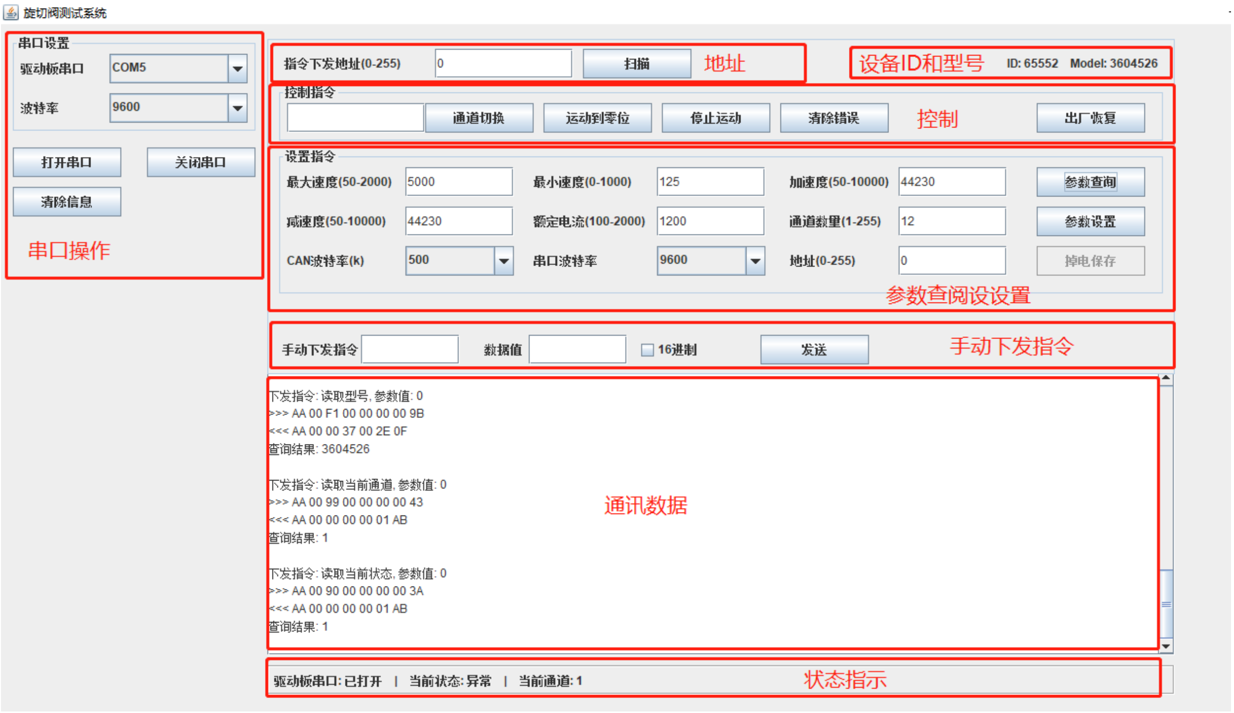
4. LED Instruction

1: LED Busy status LED constantly on.

LED status	Status light information
Constantly off	Idle
Constantly on	Busy
Flash 1 time	Optical coupler Reset error
Flash 2 times	Stall
Flash 3 times	Optical coupler counting error
Flash 4 times	Drive initialization error
Flash 5 times	Switch channel opticalcoupler spacing error
Flash 6 times	Switch channel counting error

5. Host Computer Software

The software interface of host computer is shown below.



旋切阀测试系统
串口设置
打开串口
关闭串口
清除信息
串口操作
扫描
地址
设备ID和型号
控制指令
通道切换
运动到零位
停止运动
清除错误
控制
出厂恢复
设置指令
参数查询
参数设置
掉电保存
参数查阅设设置
☐ 16进制
发送
手动下发指令
通讯数据
状态指示

驱动板串口 COM5
波特率 9600

指令下发地址(0-255) 0

ID: 65552 Model: 3604526

最大速度(50-2000) 5000
最小速度(0-1000) 125
加速度(50-10000) 44230
减速度(50-10000) 44230
额定电流(100-2000) 1200
通道数量(1-255) 12
CAN波特率(k) 500
串口波特率 9600
地址(0-255) 0

手动下发指令
数据值

```
下发指令: 读取型号, 参数值: 0
>>> AA 00 F1 00 00 00 00 9B
<<< AA 00 00 37 00 2E 0F
查询结果: 3604526

下发指令: 读取当前通道, 参数值: 0
>>> AA 00 99 00 00 00 00 43
<<< AA 00 00 00 00 01 AB
查询结果: 1

下发指令: 读取当前状态, 参数值: 0
>>> AA 00 90 00 00 00 00 3A
<<< AA 00 00 00 00 01 AB
查询结果: 1
```

驱动板串口: 已打开 | 当前状态: 异常 | 当前通道: 1

Description of each area

Functional Area	Description
Serial port operation	Used to modify PC serial port configuration, open and close serial port, and clear serial port data.
Address	Click the Scan button to automatically scan the device starting from address 0. You can also enter the address manually.
Equipment information	Model, ID, Display device model, device ID, and software version number.
Control	Used to send rotary valve control commands. Enter the channel number in the edit bar and click the channel switch button. The device will switch to the specified channel. Click Move to Zero and the device will reset to zero. Click the Restore Factory Settings button and the device will restore to factory settings.
Parameter query and setting	Used to query parameters, set parameters, and save parameters. After modifying the corresponding parameters, click Parameter Setting and the host computer will automatically send the modified parameter setting command to the drive.
Manually issue commands	Used to manually input commands and send data to the driver. 1: Command encoding is hexadecimal 2: The default encoding of numerical values is decimal. After selecting hexadecimal, the encoding format changes to hexadecimal.
Communication data	Display communication data in real time for easy viewing by users. Data can be copied by pressing Ctrl+C.
Status instruction	The queried status information will be displayed in the status indicator bar after clicking the query parameter, including the current channel number.

Control process

- Click to Open serial port.
- Enter the address if you know the device address, if not please click the Scan.
- Click Parameter Query and wait to complete, then check the query progress in the communication data area.
- Click Move to Zero and wait to complete.
- Enter the channel number which need to be switched in the control command bar, and click Channel Switch.

Parameter setting process

- Click to Query Parameter.
- Modify the corresponding parameters in the Setting Command Bar.
- Click Parameter Setting.

If you need power-down saving, please click the power-down saving button.

6. Common Malfunctions and Troubleshooting Method

Note: The following description is the troubleshooting method when the work is carried out under the working environment and rated conditions that meet the requirements.

	Malfunctions	Reason	Troubleshooting Method
1	Input commands don't work	The drive has reported error	Power-on Reset
2	Position inaccurate or not as entered	Input error	Refer to the specification and re-enter the correct command
		Signal interference	Check whether the serial port cable for good contact
		Poor contact of the motor wires	Tighten the motor cable house
		External resistance prevents rotation	Troubleshooting external disturbing forces
		Not upgraded to the latest version of the program	Upgrade program (consult engineer on whether an upgrade is required)
3	Liquid or gas line not working	Out of position	See item II in details
		Pipe connections, Pipe clogging	Remove foreign objects or replace connections and piping
		Crystallization in the valve	0.7MPaFlushing valves by air or water pressure maximum of 0.7 MPa.
4	Inaccurate test result	Fluid cross-contamination during valve rotation	It is happen on there is a large level difference between the valve and the hole passed during the rotation process.
		Pressure is not removed from the piping at the front and rear ends when the valve is turned.	For the sequential, ensures that channel switching after the front and rear elements of the rotary valve are completely stopped.
		Valve not cleaned	Cleaning valve before inject fluid for test every time.
		Leakage due to untightened fittings, damaged fittings, damaged piping	Replace good fittings and pipes, and recommend using a rubber gasket to improve sealing fittings.

7. Surrounding Conditions

Item	Unit	Value
Working Environment Temperature	Celsius	5℃~45℃
Operating Environment Humidity	RH%	20%RH~80%RH, non-condensing
Storage Temperature	Celsius	-20℃~50℃
Storage Humidity	RH%	20%RH~80%RH, non-condensing

8. Safety Precautions

For the personal safety of you and other users and to prevent damage caused by improper operation, please read the safety precautions carefully.

This manual uses the following symbols. Please fully understand what they represent before continuing.

⚠ Warning	Where the content with the mark is related to the safe use of the product and the personal safety of the user, it must be operated in strict accordance with the requirements, otherwise it may cause damage to the product or endanger the personal safety of the user.
⚠ Caution	The content with the mark is the part that users must pay attention to, otherwise it will cause product damage or other losses due to improper operation.

⚠ Caution
Confirm the specification: Please fully consider the use, fluid, environment and other conditions of use, and use within the scope of the specification to avoid damage to the product;
Material selection: For the media tolerance is not clear, first do the corresponding experiment to confirm the material, and then confirm whether the selected model is suitable;
The electromagnetic coil of this product has no waterproof function. If water or liquid drops accidentally splash on the solenoid valve during use, please wipe it as soon as possible to avoid water penetrating into the coil and causing short circuit. If you need to contact with water frequently, please configure waterproof protective devices;
Special fluorinated rubber and perfluorinated rubber are greatly affected by temperature, please avoid high frequency use at low temperatures;

⚠ Warning
1. Installation position: Do not put the inlet and outlet of the valve towards the position where the human body may contact, to avoid high pressure air impact on the human body after the solenoid valve is accidentally loosened;
2. Installation operation: The rotation of the coil assembly of this product will cause poor product performance. Do not use hands or tools to twist or rotate the proportional valve coil when installing this product;
3. Installation environment: Avoid using the solenoid valve near the heat source with high temperature;
4. Maintenance and repair: For abnormal occurrence, please contact the manufacturer first, do not directly disassemble and assemble, to avoid irreparable damage, and avoid failure to confirm the cause of the abnormal.

Keyto 星拓

Contact Us At

☎ Tel: 0755-29516669

✉ E-mail: info@keyto.com

Web: en.keyto.com

Add: 2 Yuandong East Road, Fuhai Street, Baoan District, Shenzhen

LinkedIn

YouTube

VERSION NUMBER 1.0