润泽流体 RUNZE FLUID

V 1.4

Smart SV-04 Selector valve Manual

南京润泽流体控制设备有限公司
NANJING RUNZE FLUID CONTROL EQUIPMENT CO.,LTD

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Chapter1 Getting Started

1.1 Company Profile

Nanjing Runze Fluid Control Equipment Co., Ltd. was established in 2014, We are a national high-tech enterprise focusing on R&D and production of fluid accessories for numerous analytical instruments. We engineer, manufacture and market differentiated standard products such as syringe pumps, multiport valves, peristaltic pumps, gastight syringes, plastic fittings, etc.. We persevere in providing our customers with best quality and service in the fields of environmental monitoring, biopharmaceuticals, medical equipment, industrial automation and laboratory instruments, etc.

RUNZE attracted experienced talents with strong capability on integrating software and hard-ware at electronic research, mechanical design, mold manufacturing. In past years, we have accumulated rich technical and practical experience that bring us honors of ISO9001, National High-tech Enterprise, Jiangsu Province Private Science and Technology Enterprise, 5A Bank Credit Assessment, 38 technical patents and multiple software copyright including 8 invention patents, 17 utility model patents, 13 design patents.

RUNZE Technology Center has a reliable EMC laboratory and a series of advanced processing equipment and testing instruments, such as imported white light interferometer, Keens plane rapid detector, five-axis machining center, high-precision nano-grinding machine, etc., Continuous and substantial investment in research and development, which enabled the company to obtain a huge advantage in the manufacture and sales of analytical instrument accessories.

Chapter2 Product Introduction

2.1 Product Features

(1) Name: The selector valve is an electric selector valve independently developed by RUNZE Fluid Control Equipment Co., Ltd., also known as electric rotary valve;

(2) Control: By receiving instructions from the Upper to control the operation of the stepper motor to make the rotor turn to the specified hole position to achieve the switching of the flow path. Serial communication protocol supports RS232/RS485/CAN.

(3) Corrosion Resistance: This type of selector valve adopts sapphire valve core, which can be applied to various corrosive liquid. The valve head are made of PCTFE (polychlorotrifluoroethylene) and PPS, maintenance-free;

(4) Valve Core Structure: The valve core adopts a multi-directional self-adaptive plane fitting method, which can extend the service life of the product effectively. (This structure has been applied for utility patent, patent number: CN204852471U)

(5) Motive Power: The rotation of the valve body adopts the imported NMB planetary gearbox motor as the power plant, which is extremely reliable.

(6) Orientation: The valve hole is positioned by optical encoder, which can effectively solve the problem of inaccurate positioning after the gearbox is worn down.

(7) Drive: The two-phase bipolar stepper drive module is a constant current drive chip, which can control the motor current with high efficiency. It has a built-in error detection circuit and error detection (TSD/ISD) signal output function;

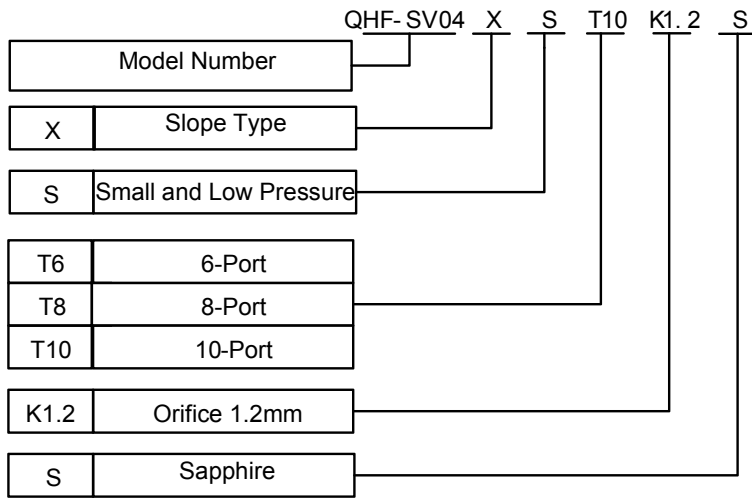**(8) Control Unit Interface:** XH terminal with 2.54mm pitch

(9) Usage: Widely used in the collection and distribution of fluid samples

(10) Application: Environmental testing devices, experimental analysis instruments, medical analyzers, chromatographic instruments, etc.

Before using the selector valve, please read the "Instruction Manual" carefully and follow the provisions in it.

2.2 Naming Rules

The model parameters are as follows:

QHF-SV04 X S T10 K1.2 S

Model Number	
X	Slope Type
S	Small and Low Pressure
T6	6-Port
T8	8-Port
T10	10-Port
K1.2	Orifice 1.2mm
S	Sapphire

Example:

slope type 10-port sapphire small and low pressure selector valve is named QHF-SV04-X-S-T10-K1.2-S

2.3 Product Specification

The SV-04 selector valve can be divided into 6-port, 8-port and 10-port, according to the number of ports, as shown in the figure below:
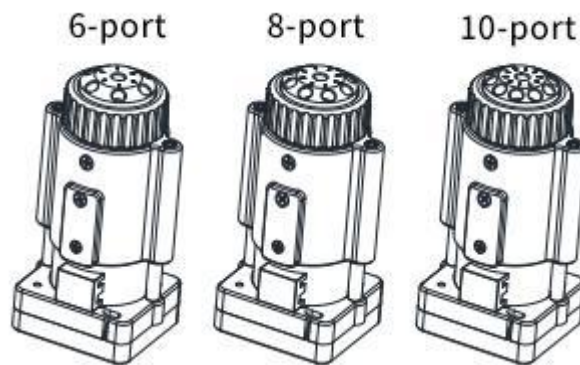
Figure 2-3

2.4 Product Structure

Labels: valve head, stator, rotor, holder, switch shaft, step motor, driver
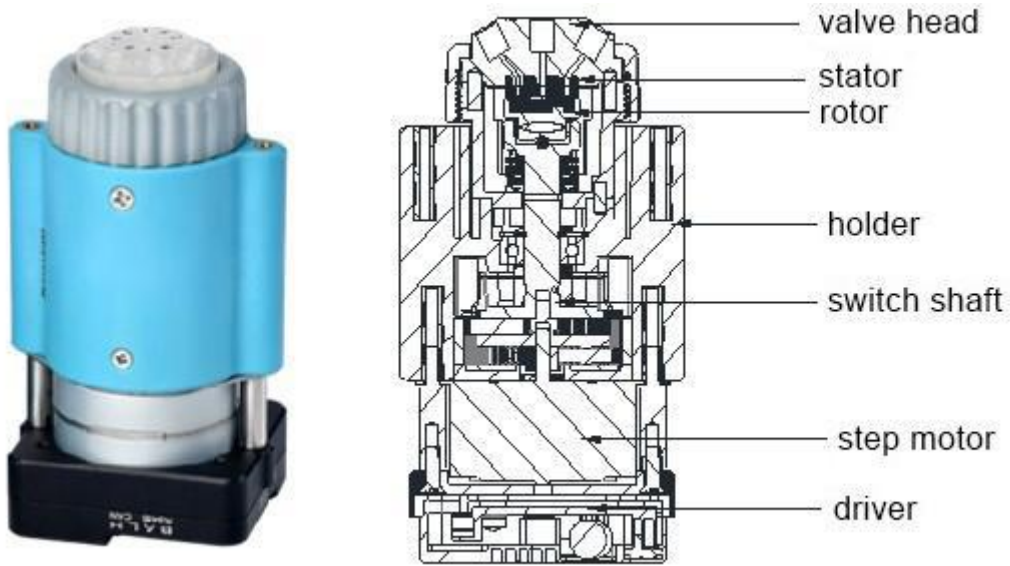
Figure 2-4

2.5 Structure Dimensions (unit: mm)

Dimensions: 63.7, 115.22, 92.4, 19.7, 59.5, φ44, φ32, 50.36, 53, 50.36, 27.36, 55.35, 2-M3 mounting hole

Figure 2-5

Note: 6 ports/8ports/10ports valve share the same dimension.

2.6 Technical Parameters

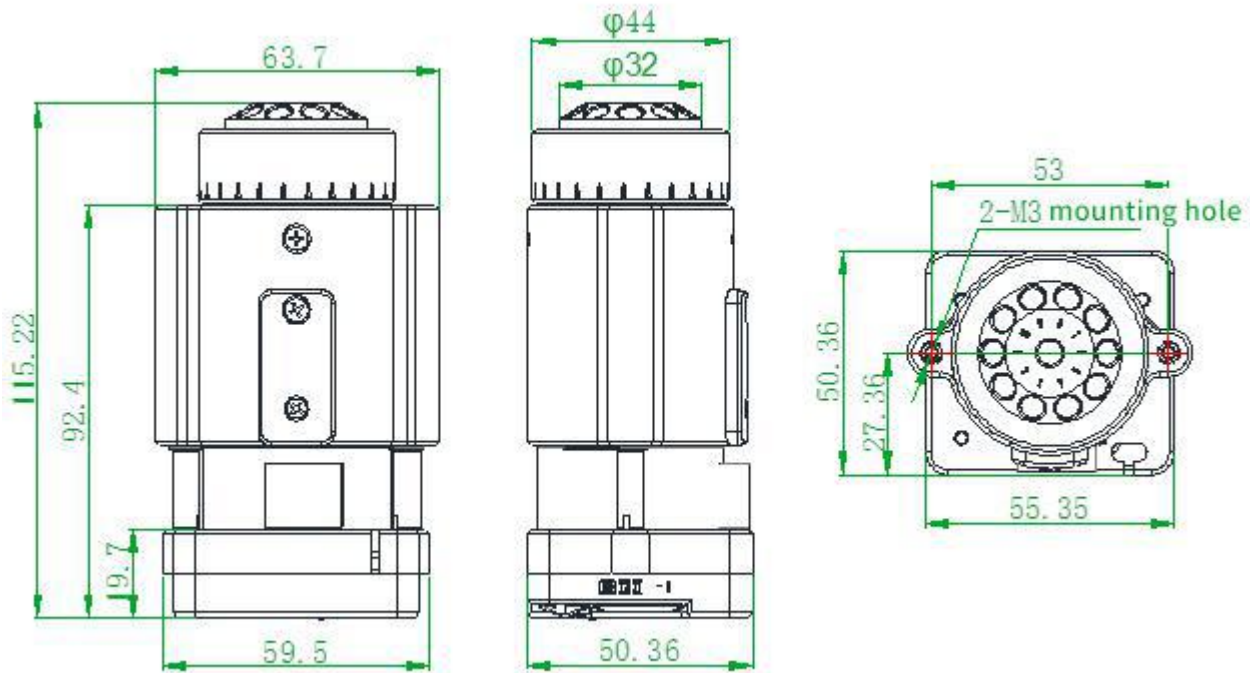| Description	Parameter	
Orifice	1.2mm	
Wetted material	PCTFE valve head, Sapphire rotor/stator	
Dead volume (Port to Port)	27.5μL	
Dead volume (Rotor groove)	5.41μL	
Pressure rating	0-0.5Mpa (air)	0-0.8Mpa (water)
Origin detection	Auto reset to initial position when powered on (this function can be opened or closed)	
Liquid temperature	0-150C°	
Connection	1/4-28UNF	
Replaceable parts	Stator replaceable, sealed rotor irreplaceable	
Transposition	Random start to any specific port	
Driver	Non-optional	
Valve switching time	≤4s/circle	
Max. torque	4N/m	
Communication	RS232/RS485/CAN	
Baud rate	RS232/RS485: 9600bps, 19200bps, 38400bps, 57600bps, 115200bps CAN: 100Kbps, 200Kbps, 500Kbps, 1Mbps	
Address & Parameter setting	Via communication	
Power supply	DC24V/1A	
Max. power	24W	
Operating temperature	0C°-50C°	
Operating humidity	<80% relative humidity, non-condensing	
Dimension (L*W*H)	63.7*50.4*115.2mm	
Net weigh	0.437kg	

Figure 2-6
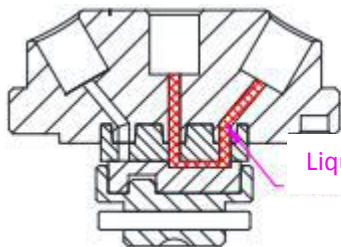
Figure 2-6-1 Dead volume (port to port)   **Figure 2-6-2 Rotor groove (sealed rotor)**
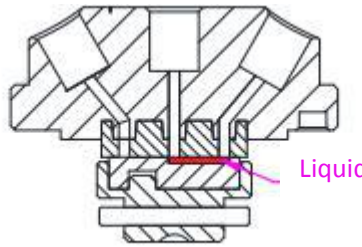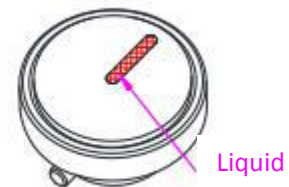
2.7 Flow Configuration

Center port is the common port and the valve can switch to any specific port by rotor. Flow configuration is shown in Figure 2-7.

| 6-port | 8-port | 10-port |

SV-04B Reset direction: CCW (Unchangeable)

SV-04B Reset position: between the port 1 and the port of the maximum number

2.8 Port Definition

Port	Description
+	DC24V positive
-	DC24V negative
TX	RS232 TX
RX	RS232 RX
GND	GND
H	CANH
L	CANL
A	RS485 A
B	RS485 B

Figure 2-8 Port Definition of Driver Board

Chapter 3 Description of Control Code

3.1 Overview

The data transmission between the selector valve and the Upper (computer, single-chip computer, PLC, etc.) adopts serial communication (e.g. RS-232/RS-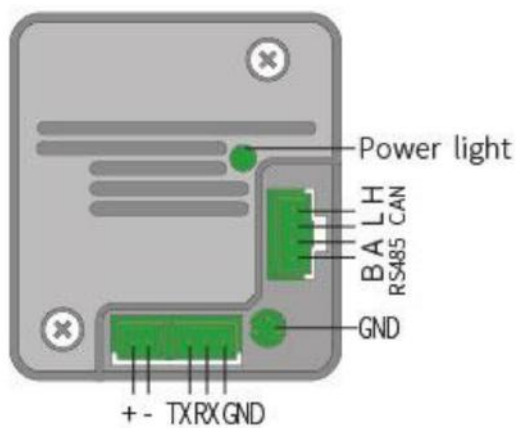485/CAN bus) and the following describes the communication format. The communication adopts asynchronous serial communication. Commands and data frames use sum check, and the sum check is two bytes (2Byte). Commands and data in communication are in hexadecimal, and parameters are stored in little-endian mode.

Communication interface: RS-232, RS-485, CAN bus;

Communication mode: two-way asynchronous, master-slave mode;

Baud rate: RS232, RS485: 9600bps, 19200bps, 38400bps, 57600bps, 115200bps

CAN: 100Kbps, 200Kbps, 500Kbps, 1Mbps

Data bit: 8 bit

Parity: no check

Response time: <1 second

3.2 Installation and Debugging

1. Installation and debugging tools, see 《Instructions for Debugging Tools》 for details.

2. Instructions for use, see 《Smart SV-04 Quick Use Guide》 for details.

3.3 Code Instructions

3.3.1 Control Command Format

a: Valve Parameter Setting Command (Factory Command)

b: Valve Parameter Query Command (Common Command)

c: Valve Action Command (Common Command)

Table 3-3-1 Send Command (Common Command)

Interpretation of 0xXX: 0x means hexadecimal, XX is a two-digit hexadecimal number. The value inputted into the software all should be XX.

The message frame of "Send Command" is 8 bytes, and the complete format is as follows:

FH (frame header)	Address code	Function code	Parameter		EOF (end of frame)	Sum check	
B0	B1	B2	B3	B4	B5	B6	B7
STX	ADDR	FUNC	1-8 bit	9-16 bit	ETX	Low byte	High byte

The 1st byte STX : Frame header (0XCC)

The 2nd byte ADDR : Address of slave device (0x00~0x7F)

Multicast Address (0x80~0xFE)

Broadcast Address (0xFF)

The 3rd byte FUNC : Function code

The 4th and 5th byte : Parameters corresponding to the function code

The 6th byte ETX : End of frame (0xDD)

The 7th and 8th byte : Cumulative sum check code from byte 1 to 6

Note: The above command format refers to the common command. In particular, if a password bit is added to the factory command and the parameter bit has also changed, from the original 2 bytes to 4 bytes, the command format is as follows:

The message frame of "Factory Command" is 14 bytes, and the format is as follows:

Table 3-3-2 Send Command (Factory Command)

FH (frame header)	Address code	Function code	Password	Parameter				EOF (end of frame)	Sum check	
B0	B1	B2	B3,B4, B5,B6	B7	B8	B9	B10	B11	B12	B13
STX	ADDR	FUNC	PWD	1-8 bit	9-16 bit	17-24 bit	25-32 bit	ETX	Low byte	High byte

Table 3-3-3 Response command

FH (frame header)	Address code	Status code	Parameter		EOF (end of frame)	Sum check	
B0	B1	B2	B3	B4	B5	B6	B7
STX	ADDR	STATUS	1-8 bit	9-16 bit	ETX	Low byte	High byte

Note: The send command and response command format of the common command are the same, and all the response command message frames are 8 bytes.

3.3.2 Command Format Instructions

Definition of frame header and end of frame B0, B5 (B11)

Name	Code	Remark
Frame header B0	0xCC	
End of frame B5 (B11)	0xDD	

Note: The send command and response command of the common command are the same. The frame header and end of frame are B0 and B5 respectively. Specially, the end of frame of factory command is B11.

Definition of address bit B1

Name	Abbreviation	Code B1	Remark
Address bit	Address	0xXX	

Note:

1.The send command and response command are the same.

2. The XX in "0xXX" means that it can be set, the factory default is 0x00, and the parameter value range is 0x00 ~ 0x7F.

Table 3-3-4 Control command instructions (B2～B10)

A: Valve Parameter Setting Command (Factory Command) (B2 ~ B10)

Code B2	Abbreviation	Password (B3 B4 B5 B6)	Parameter (B7 B8 B9 B10)
0x00	Set address	B3=0xFF B4=0xEE B5=0xBB B6=0xAA	B7=0xXX (B8=0x00 B9=0x00 B10=0x00) The value range of XX is 00 ~ 7F in V1.9 & above version, 00 ~ FF in version below V1.9, the default is 00.
0x01	Set RS232 baud rate	B3=0xFF B4=0xEE B5=0xBB B6=0xAA	Totally 5 baud rates: the factory default is 9600bps (B8=0x00 B9=0x00 B10=0x00) B7=0x00 corresponding baud rate is 9600bps B7=0x01 corresponding baud rate is 19200bps B7=0x02 corresponding baud rate is 38400bps B7=0x03 corresponding baud rate is 57600bps B7=0x04 corresponding baud rate is 115200bps
0x02	Set RS485 baud rate	B3=0xFF B4=0xEE B5=0xBB B6=0xAA	
0x03	Set CAN baud rate	B3=0xFF B4=0xEE B5=0xBB B6=0xAA	Totally 4 baud rates: the factory default is 100K (B8=0x00 B9=0x00 B10=0x00) B7=0x00 corresponding baud rate is 100Kbps B7=0x01 corresponding baud rate is 200Kbps B7=0x02 corresponding baud rate is 500Kbps B7=0x03 corresponding baud rate is 1Mbps

0x0E	Set automatic reset when power on	B3=0xFF B4=0xEE B5=0xBB B6=0xAA	B7=0x00 means non-automatic reset B7=0x01 means automatic reset Automatically reset to the position between port 1 and the port of the maximum number after power on (the factory default of selector valve is automatic reset).
0x10	Set CAN destination address	B3=0xFF B4=0xEE B5=0xBB B6=0xAA	B7=0xXX (B8=0x00 B9=0x00 B10=0x00) The value range of XX is 00 ~ FF, and the default is 00.
0x50	Set multicast channel 1 address	B3=0xFF B4=0xEE B5=0xBB B6=0xAA	B7=0xXX (B8=0x00 B9=0x00 B10=0x00) The value range of XX is 80 ~ FE, and the default is 00.
0x51	Set multicast channel 2 address	B3=0xFF B4=0xEE B5=0xBB B6=0xAA	B7=0xXX (B8=0x00 B9=0x00 B10=0x00) The value range of XX is 80 ~ FE, and the default is 00.
0x52	Set multicast channel 3 address	B3=0xFF B4=0xEE B5=0xBB B6=0xAA	B7=0xXX (B8=0x00 B9=0x00 B10=0x00) The value range of XX is 80 ~ FE, and the default is 00.
0x53	Set multicast channel 4 address	B3=0xFF B4=0xEE B5=0xBB B6=0xAA	B7=0xXX (B8=0x00 B9=0x00 B10=0x00) The value range of XX is 80 ~ FE, and the default is 00.
0xFC	Parameter lock	B3=0xFF B4=0xEE B5=0xBB B6=0xAA	All the parameters are 0x00.
0xFF	Restore factory setting	B3=0xFF B4=0xEE B5=0xBB B6=0xAA	All the parameters are 0x00.

Example: Use the 0x50/51/52/53 command to set the multicast address (only uses 0x50/51/52 commands in this example).

Use three RUNZE SV-04 selector valves with the same software version form. In RS485 communication mode, set their addresses into 00, 01, 02 and make a mark. Firstly, for the multicast channel 1 address of SV-04 whose address is 00, set the parameter 0x81 into 81 by command 0x50; for the multicast channel 3 , the parameter 0x83 is set into 83 by the command 0x52; Secondly, for the multicast channel 1 address of SV-04 whose address is 01, set the parameter 0x81 into 81 by command 0x50, for the multicast channel 2 address, the parameter 0x82 is set into 82 by the command 0x51; finally, for the multicast channel 2 address of SV-04 whose address is 02, set the parameter 0x82 into 82 by the command 0x51; for the multicast channel 3, the parameter 0x83 is set into 83 by the command 0x52. (See below table)

Item \ Device	Device1 (address 0)	Device2 (address 1)	Device3 (address 2)
Multicast address	81	81	
		82	82
	83		83
Broadcast address	FF	FF	FF

After the setting is completed, connect the three devices in parallel to the serial debugging tool, and use RUNZE debugging tool software MotorTest V0.8 to debug. Set the address into 0x81, the command into 0x44, and the parameter into 0x01. Click to send and then observe that the action of switching valve port is carried out on device 1 & device 2. Set the address into 0x82, the command into 0x44, and the parameter into 0x03. Click to send and then observe that the action of switching valve port is carried out on device 2 & device 3. Set the address into 0x83, the command into 0x44, and the parameter into 0x05. Click to send and then observe that the action of switching valve port is carried out on device 1 & device 3. Set the address into 0xFF, the command into 0x44, and the parameter into 0x03. Click to send and then observe that the action of switching valve port is carried out on all the devices.

The newly added command to set the multicast address greatly meets the needs of customer groups, making it easier and more convenient for customers. You can choose the device you want to control so that you can complete your work more efficiently and quickly during usage.

B: Valve Parameter Query Command (Common Command) (B2～B4)

Code B2	Abbreviation	Parameter B3 B4
0x20	Query address	The address ranges from 0x0000 to 0x007F. The default value is 00
Ox21	Query RS232 baud rate	Totally 5 baud rates: the factory default is 9600bps B3B4=0X0000 corresponding baud rate is 9600bps B3B4=0X0001 corresponding baud rate is 19200bps B3B4=0X0002 corresponding baud rate is 38400bps B3B4=0X0003 corresponding baud rate is 57600bps B3B4=0X0004 corresponding baud rate is 115200bps
0x22	Query RS485 baud rate	
0x23	Query CAN baud rate	Totally 4 baud rates: B3B4=0X0000 corresponding baud rate is 100Kbps B3B4=0X0001 corresponding baud rate is 200Kbps B3B4=0X0002 corresponding baud rate is 500Kbps B3B4=0X0003 corresponding baud rate is 1Mbps
0x2E	Query automatic reset when power on	B3=0x00 B4=0x00
0x30	Query CAN destination address	B3=0x00 B4=0x00
0x70	Query multicast channel 1 address	B3=0x00 B4=0x00
0x71	Query multicast channel 2 address	B3=0x00 B4=0x00

0x72	Query multicast channel 3 address	B3=0x00 B4=0x00
0x73	Query multicast channel 4 address	B3=0x00 B4=0x00
0x3E	Query current channel position	B3=0x00 B4=0x00
0x3F	Query current version	B3=0x01 B4=0x09, above is an example, if the response parameter is the same as above parameter, it means the current version is V1.9, see the version number on the label for details
0x4A	Query motor status	B3=0x00 B4=0x00

Note: After the V1.8 version, the software sub-version and the main version are merged into one command.

C: Valve Action Command (Common Command) (B2 ~ B4)

Code B2	Abbreviation	Parameter B3 B4
0x44	The motor rotates through the code disc, and selects the best path automatically	It depends on the actual number of valve channels. For example, for the selector valve with 10 channels, B3=0xXX B4=0x00, where the value range of XX is 01 ~ 0A.
0x45	Reset	B3=0x00 B4=0x00 The selector valve runs to the reset optocoupler and stops.
0x4F	Origin reset	B3=0x00 B4=0x00 The selector valve runs to the encoder origin position, which overlaps with reset position of the 0x45 command.
0xA4	Switch the port according to the required direction	According to the actual number of ports of the selector valve, the parameter cannot exceed the maximum number of ports of the current valve, and B3, B4 must be two adjacent ones. see the figure below for details.
0xB4	Switch between ports according the required direction	According to the actual number of ports of the selector valve, the parameter cannot exceed the maximum number of ports of the current valve, and B3, B4 must be two adjacent ones. see the figure below for details.
0x49	Stop forcibly	B3=0x00 B4=0x00

Example 1: 0x44: switch the port according to the required direction

(1) Origin: Rotor is at port 1

Target: CCW switch to port 4

Command: 0xA4

Parameter: 0x0304

After send commands, valve will CCW switch to port 4 (passing by port 3) as following picture:
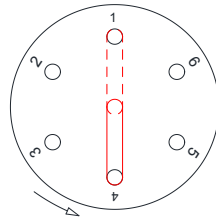
Figure 3-1

(2) Origin: Rotor is at port 1

Target: CW switch to port 4

Command: 0xA4

Parameter: 0x0504

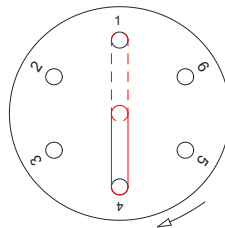After send commands, valve will CW switch to port 4 (passing by port 5) as following picture:

Figure 3-2

Example 2: 0xB4: Switch between ports according to the required direction

The current valve connected port is NO. 1

Target: run counterclockwise to between port 3 and port 4

Command: 0xB4

Parameter: 0x0304,

The valve will run counterclockwise through port 3 and stop between port 3 and port 4, as shown in Figure 3-3
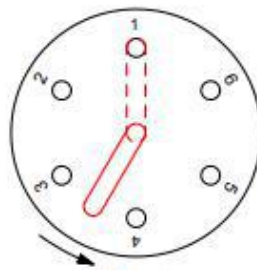

Figure3-3

Sum check (B6, B7)

Name	Abbreviation	Code B6，B7	Remark
Sum check	Sum check	0xXX 0xXX	Sum of header and end

Note: The sum check bit of the factory command is B12, B13

Response parameter description B2 B3 B4

Table 3-2-5 Response Parameter

Code B2	Description	Parameter description=B3 B4
0x00	Normal status	B3=0x00 B4=0x00 Example: when using the query command "0x3E", the parameter 0x01 0x00 ~ 0x0a 0x00 returned by B3, B4 means multi-channel 1-10 channels
0x01	Frame error	Parameter=0x00 0x00
0x02	Parameter error	Parameter =0x00 0x00
0x03	Optocoupler error	Parameter =0x00 0x00
0x04	Motor busy	Parameter =0x00 0x00
0x05	Motor stalled	Parameter =0x00 0x00
0x06	Unknown position	Parameter =0x00 0x00
0xFE	Task being executed	Parameter =0x00 0x00
0xFF	Unknown error	Parameter =0x00 0x00

Note:

(1) In 485 communication, when sending an action command, the byte B2 in the response frame is FE, indicating that the command is received and being executed.

(2) The code B2 in the response command indicates the current running status of the motor. Only when B2=0x00, the motor is in normal operation, and other parameters are shown in the above table, corresponding to different abnormal status respectively. In principle, the motor should be sent the 0X4A command to query the motor status at the end of the motor operation. Only when the parameter B2 in the response command is 00, other commands can be executed correctly.

Note: The code parameters of all the above commands are set in little-endian mode. Low data is stored in the low bit of the address and high data is stored in the high bit of the address.

3.4 SV04 CE Certification Recommended Circuit Diagram in Application

Since the SV04 selector valve can only exceed 500V in the surge test, if it is used in a harsh environment (such as high-voltage power, lightning strikes), then it is recommended that the user should add a surge protector to the power supply end of the SV04 to pass the 4th level (4KV).
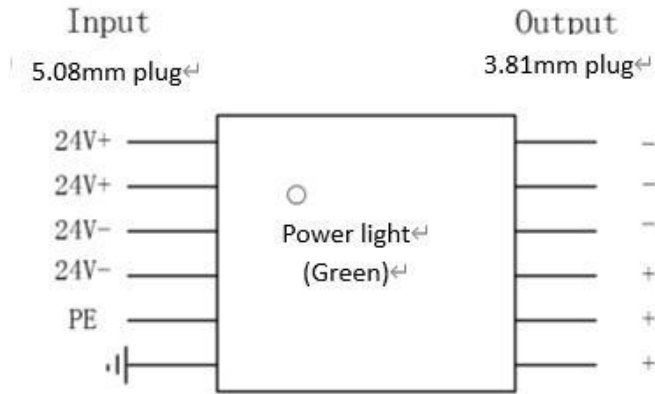
3.4.1 Schematic Diagram of Surge Protector

Figure 3-4-1

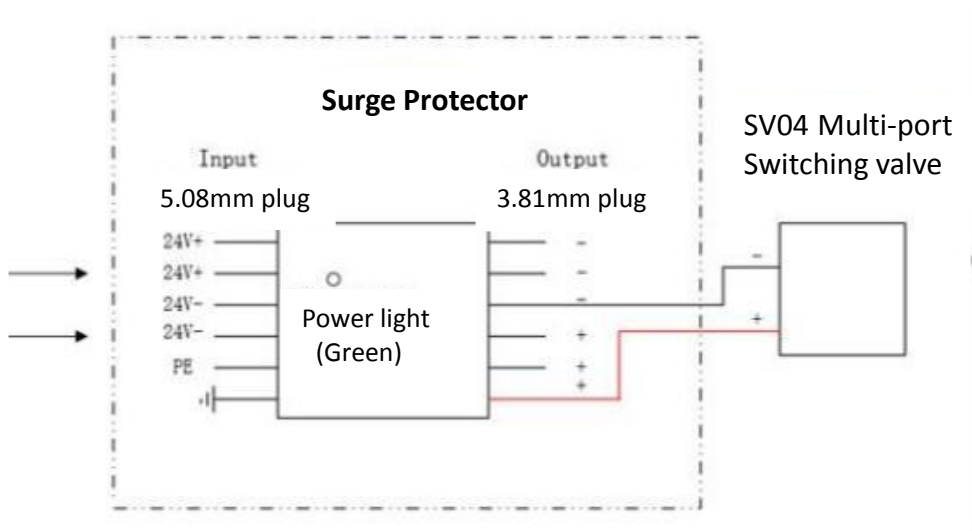### 3.4.2 The Wiring Diagram of Surge Protector & SV04

Figure 3-4-2

Chapter 4 Common Problems & Solutions

Phenomenon	Problem	Solution
Not working when power on	The working voltage is not in the acceptable range.	Check whether the voltage is within the acceptable range.
	The connection is loose or disconnected.	Check whether the connection is good.
	The working current is not in the acceptable range.	Check whether the current is within the acceptable range.
Not aspirate after switching	It is blocked by debris.	Remove the pump tube and clear the debris.
Liquid has bubbles.	The connection is not tight.	Replace suitable connectors.
No communication	The TX and RX lines of RS232 are connected reversely or phase A & B of RS485 are connected reversely.	Exchange the TX and RX line sequence of RS232 and exchange the phase A & B sequence of RS485.
The sent and received communications are consistent in RS232.	TX and RX are in short circuit.	Check whether there is short circuit, if yes, replace the cable.

Product safety precautions:

● Please ensure that the voltage matches with the standard voltage of the instrument.

● Please use the original serial cable of this product to connect to the power supply.

● The three communication methods (RS232, RS485, CAN bus) of this product are in non-isolated mode.

● Please cover the unused ports with suitable coned plugs when laid aside to avoid impurity substance and air.

● Do not disassemble the product parts at will. No warranty for tamper-evident label tearing.

● When operating the software, please refer to the operating instructions of the software and the communication protocol, and data input is not allowed to be fabricated without authorization.

● Discarding the instrument should be in accordance with the regulations on the disposal of equipment. For the waste after using the machine, please follow the national environmental protection requirements. Users should not throw away at will.

● When using CAN bus protocol to connect multiple devices, please refer to the connection method shown in Figure 4-1 below.
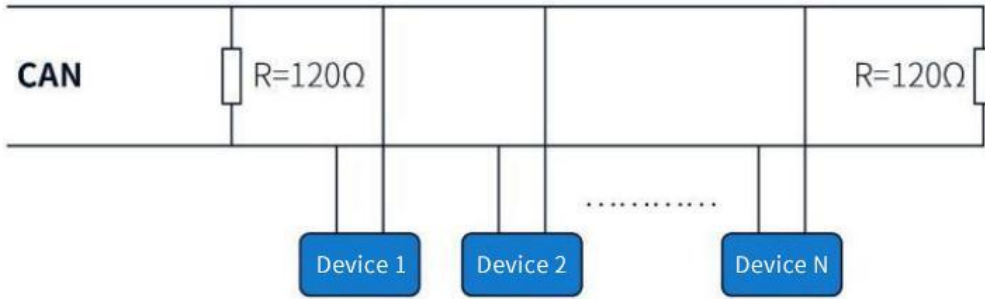
Figure 4-1

- When using RS485 protocol to connect multiple devices, please refer to the connection method shown in Figure 4-2 below (CAN resistance is removed)
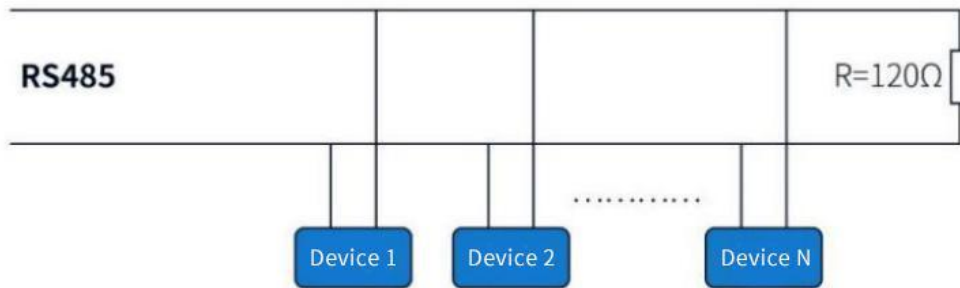

Figure 4-2

Chapter 5 Technical Service

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Official URL　　　　Alibaba Store URL　　　Aliexpress Store URL