PARKARN
INSTRUMENT CO.,LTD

USER MANUAL

PS500 Series Gas Mass Flow Controller

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Part I Installation

1.1 Mechanical installation

The external dimensions of PS500 series products are shown in the figure below, and the inlet and outlet of its flow channel are 1/4VCR connectors by default. If the user has other requirements, please explain when placing the order.

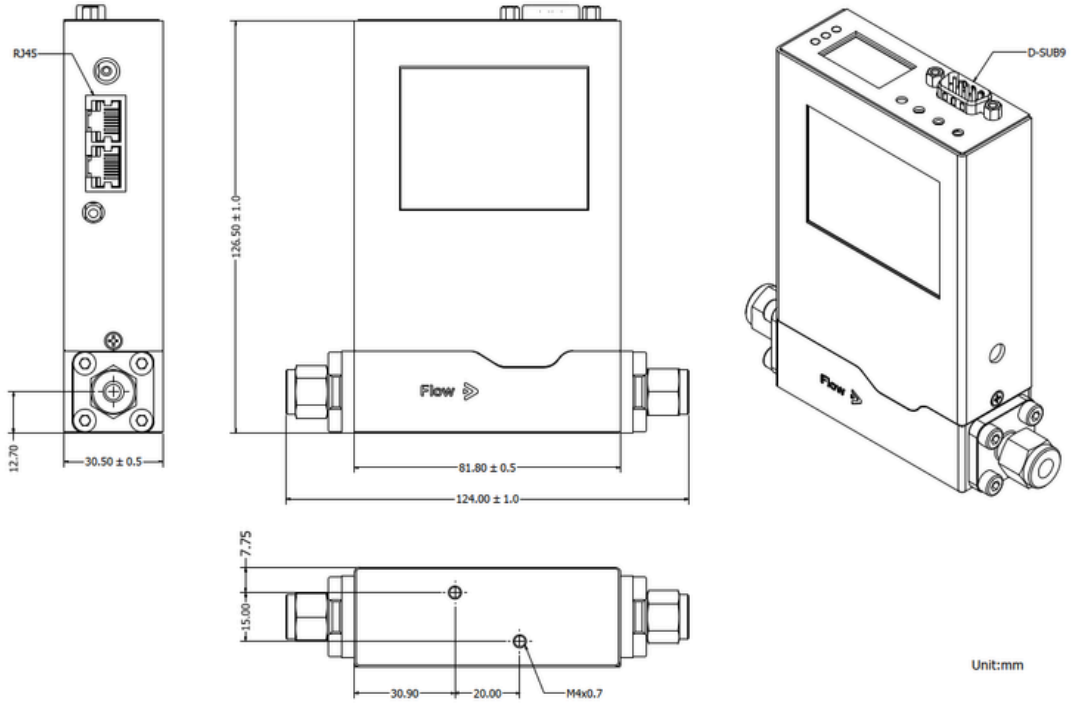

Figure S500 Series Product Appearance Dimensions

1.2 Electrical Installation

1.Power on

The power supply voltage of PS500 series products is 24V. The power supply can be connected in the following two ways to start the machine:

Through independent power supply interface

The user can start the machine by connecting the independent power supply interface through the standard DC24V power adapter, as shown in the figure:

Via D-SUB9 connector users can also turn on the machine according to the power supply through D-SUB9 connector.

Figure Connecting the power supply through the independent power supply interface.

2. Communication Mode

The default communication mode of PS500 series products includes RS-485 and 0~5V, which can be connected through the RJ45 interface or D-SUB9 interface configured by the product.

The line sequence is defined as follows:

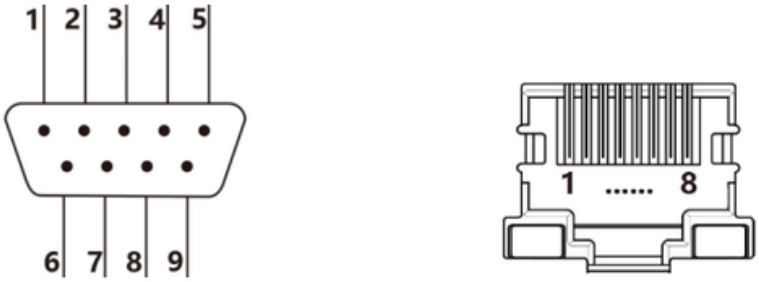

Figure D-SUB9 and RJ45 device end pin number

Table D-SUB9 Line sequence definition

D-SUB9 Equipment Side Pin No.	Line sequence definition
1	Please do not connect
2	Analog output
3	Power (DC24v)
4	Power supply ground
5	RS485-A
6	Analog Input
7	Analog ground
8	Analog ground
9	RS485-B

RJ45 Line Sequence definition

RJ45 Equipment Side Pin NO.	Line sequence definition
1	Power supply ground
2	Power supply ground
3	Please do not connect
4	RS485-B
5	RS485-A
6	Please do not connect
7	Please do not connect
8	Please do not connect

1.3 Installation Inspection

Before starting to operate PS500 series products, the following inspections must be carried out:

1) Check whether the piping is firmly connected and whether the air circuit leaks;
2) Check the integrity of process sequence and gas circuit components;
3) Check whether the wiring is firmly connected, and whether the size and form of control signal and power supply voltage are normal;
4) Check the gas type and rated pressure;
5) Inject dry inert gas for test run.

Part II Function Introduction

2.1 Starting up

PS500 series products are based on the company's proprietary intellectual property rights in high-end flow sensor chip technology, and can be turned on by turning on the power supply through the method described in "2.3 Electrical Installation" in this manual.

2.2 Feature List

Top screen	After power-on initialization	first line	Display MODBUS address
		Second line	The second line displays the instantaneous flow rate, and the number of digits after the decimal point depends on the range
		Third row	Display the flow unit, sccm or slpm
	in operation		1 The MODBUS address will vary depending on the actual position of the encoder 2. The flow unit and instantaneous flow will change accordingly based on actual switching
Screen	home page	Data refresh speed	0.2S
		Top Address	The actual address changes as the encoder position changes
		Intermediate data	Instantaneous flow rate, gas type, unit 1.Unit: sccm or slpm 2. Resolution: depending on the range
		lower left quarter	Cumulative time and cumulative flow 1. Cumulative time format: hours: minutes: seconds, days 2. Cumulative flow: Three decimal places. When the number is more than 999999.999, the unit changes from scc to sL, or sL to sm3
		Lower right corner	Set the flow value (valid for touching in the entire lower right corner white box) 1.When the unit is sccm, a keyboard with the unit of sccm pops up after touching, allowing you to enter the accuracy corresponding to the instantaneous flow rate." 2.When the unit is slpm, a keyboard with the unit of slpm pops up after touching, allowing you to enter the accuracy corresponding to the instantaneous flow rate." 3.In the keyboard interface, the return key indicates abandoning input, the check mark indicates confirming input, and the cross mark indicates backspacing. If you directly trigger the check key without entering a number, it also indicates abandoning input." 4.When the set value is more than the range set by the user, a failure reminder will appear, and the set value will remain at the last valid set value." 5. When the device supports analog signals (factory calibration and corresponding functions are enabled) and the user switches to the analog signal function, a setting failure prompt will appear
		upper right corner Setting	Click to enter the first level setting interface

	Level 1 setting	Upper left corner return	Return to Home Page 1.The home page is distinguished between sccm and slpm, and the returned home page interface should be consistent with the settings
		Upper right corner reset	Cumulative flow reset 1. After triggering, a confirmation dialog box will pop up, with Cancel as cancel and Clear as confirm
		Valve status	Control of full opening and closing of valves, and display of valve status 1. If both are gray, it indicates that the flow is under normal control 2. If All open is lit, it indicates that the valve is in the fully open state." 3. If All closed is lit, it indicates that the valve is fully closed 4. Click "All open" or "All closed". If the clicked icon is gray before clicking, it will light up and perform corresponding operations 5. If "All closed" is triggered, the set flow value on the homepage will become 0
		Gas Type	Gas switching 1. Eight fixed gases, each with a fixed relative coefficient (but depending on the actual calibration gas) 2. A user-defined coefficient with an input range of 0.833 - ∞ and a valid decimal place of 3; 3. When any of the 8 fixed gases is triggered, the corresponding icon illuminates. When returning to the home page, the gas type will follow the settings and the coefficient will also be switched accordingly; 4. When a user-defined icon is triggered, it will switch to the input interface A. Click return to return to the gas switching interface; B. Click the middle input box to pop up the keyboard, where you can enter a number of 0.833 - ∞. If it exceeds the limit, an error prompt will appear; C． Click Save to save this setting, otherwise the gas coefficient will switch to the last valid setting defined by the user;
		Factory reset	Restore factory (reverse operation of zero point calibration)
		Change Password	Change Password 1. After triggering, the user will enter the input interface of the old password. At this time, the trigger return or the number matching trigger under countless conditions indicates that the input is abandoned and the user will return to the level 1 setting interface 2. When the old password is incorrect, a prompt interface will pop up, and clicking Close will return to the old password input interface; When the old password is correct, enter the new password keyboard interface 3.When the return key or the checkmark key without input is triggered on the new password keyboard, the valve status will remain consistent with the actual working status when returning to the primary setting interface; The password is 1-4 digits, click Confirm and switch to the keyboard interface for repeating the password; 4. When the return key or the checkmark key without input is triggered under the repeated password, the valve status will remain consistent with the actual working status when returning to the primary setting interface; When the passwords are inconsistent twice, a corresponding prompt will appear. After closing the prompt, switch to the new password input interface; When the two passwords are consistent, a corresponding prompt will be given and the user will switch to the first level setting interface
		Range and unit（Enter the modify range and unit interface after triggering）	Return：Return to the first level setting interface 1. After returning, the valve state shall be consistent with the actual working state

			Range: Display and input of user range (input must be an integer) 1. Not factory range, user range is less than or equal to factory range 2. When the factory range is less than 1000 SCCM and the unit is switched to slpm, the touch keyboard does not respond; When the factory range is greater than 1000 SCCM, an integer must be entered in any unit, but when switching from SCCM to SLPM, it can be changed from an integer to a decimal 3. The keyboard operation mode is consistent with the flow setting mode
			Unit: Unit display switching 1. The left and right arrows switch between sccm and slpm 2. When switching units, the range flow value will be converted accordingly
			Save: Preservation 1.Save the set range and units to the system 2.If the range exceeds the factory range value, there will be an error prompt; If the setting is correct, a successful reminder will appear and you will return to the interface for setting the range
		Signal way (Enter the modify signal model interface after triggering)	Signal mode: signal mode display and switching 1.The left and right arrows switch signal modes, only within the type of signal mode the device has
			Save: 1. Save the set range and units to the system 2. Only the factory set signal can be saved successfully, for example, the analog voltage signal function must be turned on before switching to a 0-5V signal 3. If the setting is successful, there will be a success prompt and you will return to the interface for setting the signal method; If the setting fails, a failure reminder will appear and you will return to the interface for setting the signal method
Top indicator light、Key and coding switch	zero calibration	ZERO button	Zero calibration 1. Press and hold for 3 seconds (whether it is released or not) to perform the zero calibration function 2. The Alarm light on the top panel will give a corresponding reminder (later introduction)
	Address modification	MSD and LSD rotary encoders	Change address 1. MSD and LSD are the upper 4 bits and lower 4 bits of an 8-bit decimal address. The rotation range of each rotary encoder is 0-9, that is, the range represented is 00-99, which can be set to address 1-99 (0 address is not available) 2. After each change, the addresses displayed on the top and main screens will change accordingly, and the maximum delay time from rotation to display is 1 second; 3. Immediate effect upon change of address
	Baud rate modification	DATA RATE rotary encoder	change baud rate 1. Three baud rates: 960038400115200 2. The arrow on the knob needs to indicate one of the three baud rates mentioned above. If it is indicated at another position, an invalid baud rate will be generated 3. Effective immediately after changing the baud rate
	power indicator light	POWER light	always on after power on
	Data transmission indicator	TxRx light	1. Off when not communicating 2. Flashes during normal communication 3. Only receive but not send, always on 4. Send without receiving, always off
	Warning indicator	Alarm light	1. Normally off 2.EEPROM reading failure: ON for 0.5S, OFF for 0.5S 3. Zero point calibration successful: Always on first, then off after successful execution 4. Zero point calibration failed: First, it is normally on, flashing 8 times, and then off 5. Temperature abnormality: When the temperature is - 10 or 80, it will be on for two seconds and off for two seconds

			6. Cumulative flow overflow alarm: when the cumulative flow is greater than 999999.999m ³ On for three seconds, off for three seconds 7.When the set flow rate is greater than the maximum value, turn it on for 5S and turn it off for 5S. The set value is the last correct setting. When the set value is modified to be within the correct range, the alarm light turns off."

2.3 Communication Protocol

1.major parameter

communication interface	**RS485/RS232 Half duplex mode**
Baud rate	9600
data bit	8
Stop bit	1
verify	none
Communication data format	MODBUS RTU (default address 1)

2.Register list

Register address (hexadecimal)	Register content	data type	access type	remark
0x0003	Gas type	unsigned 16-bit integer	only read	
0x0004	Full range	unsigned 16-bit integer	only read	
0x0005	Flow unit	unsigned 16-bit integer	only read	
0x0014	flow decimal number	unsigned 16-bit integer	only read	
0x0015	temperature 16 bit	Signed 16 bit integer	only read	
0x0016	flow high 16 bit	unsigned 32-bit integer	only read	
0x0017	flow low 16 bit			
0x0018	accumulated flow high 32 bits	unsigned 64-bit integer	read/write	
0x0019				
0x001A	accumulated flow low 32 bits			
0x001B				
0x001C	accumulated flow unit 0: L; 1: m³	unsigned 16-bit integer	only read	
0x001D	accumulated flow days	unsigned 16-bit integer	only read	
0x001E	accumulated flow hours	unsigned 16-bit integer	only read	
0x001F	accumulated flow minutes	unsigned 16-bit integer	only read	

0x0020	accumulated flow seconds	unsigned 16-bit integer	only read	
0x0021	valve control mode 0: flow control mode 3: Valve proportional mode	unsigned 16-bit integer	read/write	Only applicable to PS500 series
0x0022	Set flow high 16 bit	unsigned 32-bit integer	read/write	
0x0023	Set flow low 16 bit significant digit 0.001			
0x0024	Set valve opening significant digit 0.01	unsigned 16-bit integer	read/write	
0x0025	zero calibration	unsigned 16-bit integer	only write	

3.Application example

Example 1- Host reads basic information

send to device：

device address	function code	register first address high bytes	register first address low bytes	Register length high bytes	Register length low bytes	CRC check low byte	CRC check high byte
0x01	0x03	0x00	0x03	0x00	0x03	0xF5	0xCB

return from device：

device address	function code	data bytes	gas type high byte	gas type low byte	full range high byte	full range low byte	device address
0x01	0x03	0x06	0x00	0x0D	0x00	0x64	0x01

flow unit high byte	flow unit low byte	CRC check low byte	CRC check high byte
0x00	0x0A	0xCD	0x6C

data analysis

① gas type:

0x000D (hexadecimal) = 13 (decimalism)

If you look at the code in the following table, you can see that 13 stands for nitrogen.

code (decimalism)	gas type	code (decimalism)	gas type
1	He	13	N2
2	CO	15	O2
4	Ar	25	CO2
7	H2	28	CH4
8	Air		

② flow unit:

0x000A (hexadecimal) = 10 (decimalism)

Refer to the following table code, we can see that 10 represents SCCM.

code (decimalism)	flow unit
10	SCCM
100	SLM

③ full range:

0x0064 (hexadecimal) = 100 (decimalism)

It is known that the full range of the device is 100 (if the flow unit is SCCM, the full flow is 100 SCCM; if the flow unit is SLM, the full flow is 100 SLM).

Example 2 – Host read temperature and flow

send to device:

device address	function code	register first address high bytes	register first address low bytes	Register length high bytes	Register length low bytes	CRC check low byte	CRC check high byte
0x01	0x03	0x00	0x14	0x00	0x04	0x04	0x0D

return from device:

device address	function code	data bytes	Decimal place high byte	Decimal place low byte	temperature high bytes	temperature low bytes
0x01	0x03	0x08	0x00	0x01	0x00	0xFD

flow data byte1	flow data byte2	flow data byte3	flow data byte4	CRC check low byte	CRC check high byte
0x00	0x00	0x30	0x39	0x3C	0xD1

data analysis

① temperature:

0x00FD (hexadecimal) = 253 (decimalism)

Divide by 10 to get the actual temperature = 253/10 = 25.3 (℃).

② flow data decimal places:

0x0001 (hexadecimal) = 1 (decimalism)

As can be seen from the following table, 1 indicates that flow data has three decimal places.

code (decimalism)	Baud rate
0	two decimal places
1	three decimal places
2	integer
3	one decimal place

③ flow:

0x00003039 (hexadecimal) = 12345 (decimalism)

Combined with flow data decimal places, the current flow is 12345 × 0.001 = 12.345

(if the flow unit is SCCM, the flow is 100 SCCM; if the flow unit is SLM, the flow is 100 SLM).

Example 3 – Host read cumulative flow

send to device:

device address	function code	register first address high bytes	register first address low bytes	Register length high bytes	Register length low bytes	CRC check low byte	CRC check high byte
0x01	0x03	0x00	0x18	0x00	0x09	0x05	0xCB

return from device:

device address	function code	data bytes	Cumulative flow data byte1	Cumulative flow data byte2	Cumulative flow data byte3	Cumulative flow data byte4	Cumulative flow data byte5
0x01	0x03	0x12	0x00	0x00	0x00	0x00	0x07

Cumulative flow data byte6	Cumulative flow data byte7	Cumulative flow data byte8	accumulated flow unit high type	accumulated flow unit low type	Cumulative flow days high type	Cumulative flow days low type	Cumulative flow hours high type
0x5B	0xCD	0x15	0x00	0x00	0x27	0x10	0x00

Cumulative flow hours low type	Cumulative flow minutes high type	Cumulative flow minutes low type	Cumulative flow seconds high type	Cumulative flow seconds low type	CRC check low byte	CRC check high byte
0x0A	0x00	0x32	0x00	0x1E	0x6E	0xF9

data analysis

① accumulated flow unit:

0x0000 (hexadecimal) = 0 (decimalism)

If you look in the Register list, 0 means L.

② cumulative flow:

0x000000000075BCD15 (hexadecimal) = 123456789 (decimalism)

Divide by 1000, and the actual cumulative flow is 123456.789.

(If the flow unit is L, the full flow is 123456.789 L;

If the flow unit is m3, the full flow is 123456.789 m3.)

③ cumulative time:

days

0x2710 (hexadecimal) = 10000 (decimalism)

hours

0x000A (hexadecimal) = 10 (decimalism)

minutes

0x0032 (hexadecimal) = 50 (decimalism)

seconds

0x001E (hexadecimal) = 30 (decimalism)

cumulative time is 10000 days, 10 hours, 50 minutes and 30 seconds.

Example 4 – Host clear cumulative flow
Send to device:

device address	function code	register first address high bytes	register first address low bytes	register number high type	register number low type	Modify data byte length	Data1 high type	data1 low type
0x01	0x10	0x00	0x18	0x00	0x04	0x08	0x00	0x00

data2 high type	data2 low type	data3 high type	data3 low type	data4 high type	data4 low type	CRC check low byte	CRC check high byte
0x00	0x00	0x00	0x00	0x00	0x00	0x96	0x5A

If the following data is returned, the operation succeeds

device address	function code	register first address high bytes	register first address low bytes	register number high type	register number low type	CRC check low byte	CRC check high byte
0x01	0x10	0x00	0x18	0x00	0x04	0x41	0xCD

Example 5 – Set flow on host (PS500 series only)
There are two methods for the host to set flow:
Method 1: Set the control mode and then the flow;
Method 2 (Recommended): Set the control mode and flow simultaneously.

Method 1 is as follows
First set control mode. send to device:

device address	function code	register first address high bytes	register first address low bytes	Register data high type	Register data low type	CRC check low byte	CRC check high byte
0x01	0x06	0x00	0x21	0x00	0x00	0xD9	0xC0

data analysis

0x0000 (hexadecimal) = 0 (decimal)

From the Register list, 0 indicates that the control mode is set to flow control mode.

Note: By default, the flow control mode is used by the host. If you do not need to change the flow control mode, skip this step and set the Flow mode directly. If you need to set flow multiple times and the control method is the same, perform this step only once.

If the following data is returned from device, the operation succeeds.

device address	function code	register first address high bytes	register first address low bytes	Register data high type	Register data low type	CRC check low byte	CRC check high byte
0x01	0x06	0x00	0x21	0x00	0x00	0xD9	0xC0

After the control method is determined, set the flow, send to device:

device address	function code	register first address high bytes	register first address low bytes	Register length high bytes	Register length low bytes	Modify data byte length
0x01	0x10	0x00	0x22	0x00	0x02	0x04

data1 high type	data1 low type	data2 high type	data2 low type	CRC check low byte	CRC check high byte
0x00	0x00	0x30	0x34	0x65	0xB9

data analysis

0x00003034 (hexadecimal) = 12340 (decimal)

Divide by 1000 to obtain the set target flow value:

12340 / 1000 = 12.34

- If the flow unit is SCCM, the target value is 12.34 SCCM
- If the flow unit is SLM, the target value is 12.34 SLM

If the following data is returned from device, the operation succeeds:

device address	function code	register first address high bytes	register first address low bytes	Register length high bytes	Register length low bytes	CRC check low byte	CRC check high byte
0x01	0x10	0x00	0x22	0x00	0x02	0xE1	0xC2

Method 2 is as follows:
send to device:

device address	function code	register first address high bytes	register first address low bytes	Register length high bytes	Register length low bytes	Modify data byte length	data1 high type
0x01	0x10	0x00	0x21	0x00	0x03	0x06	0x00

data1 low type	data2 high type	data2 low type	data3 high type	data3 low type	CRC check low byte	CRC check high byte
0x00	0x00	0x00	0x30	0x34	0xA3	0xF8

data analysis

① control mode:
0x0000 (hexadecimal) = 0 (decimalism)
From the Register list, 0 indicates that the control mode is set to flow control mode.

② Flow set:
0x00003034 (hexadecimal) = 12340 (decimalism)
Divide by 1000 to get the target flow value of set = 12340 / 1000 = 12.34
(If the flow unit is SCCM, the target value is 12.34 SCCM;
If the flow unit is SLM, the target value is 12.34 SLM.)

If the following data is returned from device, the operation succeeds.

device address	function code	register first address high bytes	register first address low bytes	Register length high bytes	Register length low bytes	CRC check low byte	CRC check high byte
0x01	0x10	0x00	0x21	0x00	0x03	0xD0	0x02

Example 6 – Host set valve opening (PS500 series only)
There are two methods for the host to set the valve opening:
Method 1: set control mode, then set ratio;
Method 2 (Recommended): control mode and ratio set simultaneously.

Method 1 is as follows
First set control mode, send to device:

device address	function code	register first address high bytes	register first address low bytes	Register data high type	Register data low type	CRC check low byte	CRC check high byte
0x01	0x06	0x00	0x21	0x00	0x03	0x99	0xC1

data analysis

0x0003 (hexadecimal) = 3 (decimal)
According to the Register list, 3 indicates that the proportional mode of control mode set is Valve.
Note: If you need to set different proportions for several consecutive times, perform this step only once.

If the following data is returned from device, the operation succeeds:

device address	function code	register first address high bytes	register first address low bytes	Register data high type	Register data low type	CRC check low byte	CRC check high byte
0x01	0x06	0x00	0x21	0x00	0x03	0x99	0xC1

After the control method is determined, the proportional set is carried out. Send to device:

device address	function code	register first address high bytes	register first address low bytes	Register data high type	Register data low type	CRC check low byte	CRC check high byte
0x01	0x06	0x00	0x24	0x04	0xD2	0x4B	0x5C

data analysis

0x04D2 (hexadecimal) = 1234 (decimalism)

Divide by 100 to get the target ratio of set = 1234/100 = 12.34 (%).
If the following data is returned from device, the operation succeeds.

device address	function code	register first address high bytes	register first address low bytes	Register data high type	Register data low type	CRC check low byte	CRC check high byte
0x01	0x06	0x00	0x24	0x04	0xD2	0x4B	0x5C

method 2 is as follows:
send to device:

device address	function code	register first address high bytes	register first address low bytes	Register length high bytes	Register length low bytes	Modify data byte length	data1 high type	data1 low type
0x01	0x10	0x00	0x21	0x00	0x04	0x08	0x00	0x03

data2 high type	data2 low type	data3 high type	data3 low type	data4 high type	data4 low type	CRC check low byte	CRC check high byte
0x00	0x00	0x00	0x00	0x04	0xD2	0x7B	0x9B

data analysis

① control mode:
0x0003 (hexadecimal) = 3 (decimalism)
According to the Register list, 3 indicates that the control mode set is proportional mode of Valve.

② Proportion set:
0x04D2 (hexadecimal) = 1234 (decimalism)

Divide by 100 to get proportion = 1234/100 = 12.34 (%).
If the following data is returned from device, the operation succeeds.

device address	function code	register first address high bytes	register first address low bytes	Register length high bytes	Register length low bytes	CRC check low byte	CRC check high byte
0x01	0x10	0x00	0x21	0x00	0x04	0x91	0xC0

Example 7 - Host read address (PS500 series only)
send to device:

device address	function code	register first address high bytes	register first address low bytes	Register length high bytes	Register length low bytes	CRC check low byte	CRC check high byte
0xFE	0x03	0x00	0x00	0x00	0x01	0x90	0x05

return from device：

device address	function code	data bytes	Address high type	Address low type	CRC check low byte	CRC check high byte
0xFE	0x03	0x02	0x00	0x01	0x6D	0x90

data analysis

0x0001(hexadecimal) = 1（decimalism）
Current address is 1.

Example 8- Host zero calibration
send to device：

device address	function code	register first address high bytes	register first address low bytes	register value high type	register value low type	CRC check low byte	CRC check high byte
0x01	0x06	0x00	0x25	0x00	0x01	0x59	0xC1

If the following data is returned from device, the operation succeeds.

device address	function code	register first address high bytes	register first address low bytes	Register value high type	Register value low type	CRC check low byte	CRC check high byte
0x01	0x06	0x00	0x25	0x00	0x01	0x59	0xC1

Example 9- Restore factory set
send to device：

device address	function code	register first address high bytes	register first address low bytes	Register value high type	Register value low type	CRC check low byte	CRC check high byte
0x01	0x06	0x00	0x25	0x00	0x02	0x19	0xC0

If the following data is returned from device, the operation succeeds.

device address	function code	register first address high bytes	register first address low bytes	Register value high type	Register value low type	CRC check low byte	CRC check high byte
0x01	0x06	0x00	0x25	0x00	0x02	0x19	0xC0

2.4 CRC Test algorithm (C language)

Method one:

```
unsigned short Crc16_Check(unsigned char *Pushdata, unsigned char length)
// The 16 bits of data returned are high first and low last.
{
   unsigned short Reg_Crc = 0xffff;
   unsigned char i, j;

   for(i = 0; i < length; i++)
   {
      Reg_Crc ^= *Pushdata++;
      for(j = 0; j < 8; j++)
      {
         if(Reg_Crc & 0x0001)
         {
            Reg_Crc = Reg_Crc >> 1 ^ 0xA001;
         }
         else
         {
            Reg_Crc >>= 1;
         }
      }
   }
   return (Reg_Crc);
}
```

Method Two:

```
const uint16_t crctalbeabs[] = {
   0x0000, 0xCC01, 0xD801, 0x1400, 0xF001, 0x3C00, 0x2800, 0xE401,
   0xA001, 0x6C00, 0x7800, 0xB401, 0x5000, 0x9C01, 0x8801, 0x4400 };
```

```
uint16_t crc16tablefast(uint8_t *ptr, uint16_t len)
// The 16 bits of data returned are high first and low last.

{   uint16_t crc = 0xffff;
    uint16_t i;
    uint8_t ch;

    for(i = 0; i < len; i++) {
        ch = *ptr++;
        crc = crctalbeabs[(ch ^ crc) & 15] ^ (crc >> 4);
        crc = crctalbeabs[((ch >> 4) ^ crc) & 15] ^ (crc >> 4);
    }

    return crc;
}
```

2.5 Power off

When removing the external connection line of this product, please power off first.

Part III Maintenance

3.1 Summary

There is no need for daily maintenance of this product, only occasional cleaning and recalibration. Please ensure that the product is clean, dry and free of corrosive gas, otherwise it will affect
the product performance and even cause product failure.
Please contact our company for more details.

3.2 Precautions

1） Media usage requirements

When using this product, the gas must be clean and dry, and dust, liquid and oil stains must be avoided. If necessary, a filter shall be installed in the gas circuit. If the outlet of this product is connected with a liquid source, a check valve must be installed at the outlet to prevent liquid backflow from damaging the product.

Warning:
If it is used to measure dangerous gases, please take precautions. Dangerous, flammable and explosive gases must be handled with great care to avoid safety accidents:
a) Before ventilation, the air tightness of installation and connection shall be strictly guaranteed and inspected;
b) If the dangerous gas is wet, please stop using it immediately;
c) Before removing from the system, the product should be thoroughly cleaned with dry conventional gas (such as nitrogen, air) or inert gas that is harmless to human body before disconnecting the gas circuit;
d) Do not use this product in explosive environment unless it has been effectively certified.

2) Valve port sealing problem
The solenoid valve of the gas mass flow controller is a regulating valve and cannot be used as a stop valve. If required, the user shall provide a stop valve. Especially when users use dangerous gas, they must add a stop valve at the inlet and outlet of the product to ensure the work safety.

Part IV Fault Diagnosis

4.1 Preliminary Inspection
1) Check whether the air source and the air path to the product are opened;
2) Ensure that the power supply and control signal are correctly transmitted to the electrical connector on the circuit board;
3) Check whether the communication line is connected correctly.

4.2 Fault Inspection
Please judge the fault according to the following table.

No.	Fault	Possible Causes	Solution
1	After startup, no air flow passes.	The air source is not turned on, and the air path is blocked	Connect the air source and open the air circuit
2	When not ventilated, the displayed value is not zero.	There is still gas flow	Check whether the stop valve is closed
		Power failure	Check power supply
		Zero deviation	Using the zero point calibration function
		Other faults	Please contact our company
3	Unable to control flow	Incorrect gas circuit connection	Check the gas circuit connection
		The pressure is not within the required range	Check the intake pressure
		Incorrect setting signal	Check the setting signal
		Circuit board issues	Please contact our company
		The controller is contaminated	Please contact our company
		Valve body damaged	Please contact our company
4	Unable to communicate	Power supply issues	Check the power supply
		Communication connection issues	Check the communication line connection
		Communication address conflict	Check communication address
		Incorrect baud rate setting	Check baud rate settings
		Other faults	※ Please contact our company

Warning:
Items marked with ※ must be handled by professional maintenance personnel of the company. If the fault is not in the above table or cannot be solved according to the above table, please contact our company.

Part V Guarantee and Service

5.1 Warranty

This product must be installed, used and maintained in strict accordance with the correct method under the normal working conditions specified in the manual.

The company provides the following warranty services for PS500 series products:

For new products, a 365-day free warranty service is provided from the date of shipment. For the repaired or replaced products, a 90-day free warranty service will be provided from the date of shipment or

the original warranty period will be extended.

Note that the following conditions do not apply to warranty terms:

1) Not the original product of the company;

2) The safety label of the product is torn;

3) The product is used in (or outside) abnormal environment specified in the manual, and any other circumstances that can be considered as abnormal use.

5.2 Product warranty

The company provides the following guarantees for PS500 series products:

1) During the warranty period, the product must be maintained and repaired by our company, otherwise, the product warranty is invalid.

2) Free maintenance within the 365-day warranty period.

3) The company will check the quality and function of each product before delivery (appearance inspection, gas leakage detection and flow calibration). The user is responsible for using this product in accordance with the provisions of this manual. The damage caused by incorrect use cannot be attributed to the company.

4) If the parts of the product fail due to material or process defects, our company can provide you with free replacement services.

5.3 Service

If you have any quality problems or need technical support, our product technical support engineers will help you solve problems in operation, software development, connection, gas mixing, etc.

In addition, we also provide product use training.

5.4 Disclaimers

The company is not responsible for the damage caused by the following conditions:

1) Product failure and damage caused by fire, natural disaster and other natural disasters;

2) Product failure and damage caused by misoperation or unreasonable use;

3) Failure and damage caused by operation or storage of products under unsuitable or harsh environment;

4) Product failure and damage caused by correct use in accordance with the product instructions;

5) Product failure and damage caused by impurity mixing;

6) Tear the safety label and change the product without authorization.

Appendix Common gas conversion coefficient

formula	code	conversion coefficient
N2	01	1
Air	02	1.001
O2	03	1.025
CO2	04	0.75
Ar	05	1.6
CH4	06	0.9
H2	07	3.9
He	08	4
CO	09	1.015
SiH4	10	0.685
NH3	11	0.91
N2O	12	0.751
BCl3	13	0.481
Cl2	14	0.841
NO	16	0.994
C3H6	69	0.453
C3H8	89	0.395
AsH3	35	0.755
BF3	48	0.575
B2H6	58	0.507
CCl4	101	0.342
CF4	63	0.469
C2H2	42	0.664
C2H4	38	0.679
C2H6	54	0.548
C3H4	68	0.478
C4H6	93	0.362
C4H8	104	0.331
C4H10	117	0.289
C5H12	240	0.244
C2H6O	136	0.439
C2N2	59	0.508
D2	39	2.449
F2	18	0.949
GeH4	43	0.638
HBr	19	0.987
HCl	27	0.998

HF	29	1.019
HI	17	0.972
H2S	22	0.89
Kr	15	1.388
Ne	25	1.562
NO2	26	0.789
PCl3	193	0.399
PH3	31	0.784
PF5	143	0.34
SiCl4	108	0.318
SiF4	88	0.39
SiH2Cl2	67	0.467
SiHCl3	147	0.381
SF6	110	0.297
SO2	32	1.218
WF6	121	0.24
Xe	70	1.369

Instructions for use of conversion coefficient:

The mass flow controller and mass flow meter products delivered by our company are calibrated with N2 by default.

If they are actually used for other gases, the reading shall be corrected by conversion coefficient. The method is to multiply the flow displayed by the product by the flow conversion coefficient. The conversion coefficient of some gases can be found in the company's operating instructions (as shown in the above table), and the conversion coefficient C of other gases can be

= H (S.ˇ + .ˇx K+ .ˇx K)/(!x &§
h = .ˇˇxˇ
ˇ2 2
!2 2

Φmix = 1 / ((q1 / Qmix)/C1 + (q2 / Qmix)/C2 + ... + (qm / Qmix)/Cn)

Where:
q1 ... qn - flow of corresponding gas
Qmix - flow of mixed gas
C1 ... Cn - conversion coefficient of corresponding gas

Thank you for using
PS500 Series Gas Mass Flow Controller

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PARKARN INSTUMENT CO.,LTD