USER MANUAL

PE Series Gas Mass Flow Controller

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Part I Installation

1.1 Mechanical installation

The external dimensions of PE series products are shown in the figure below. The inlet and outlet of E series products adopt G1/4 internal thread.

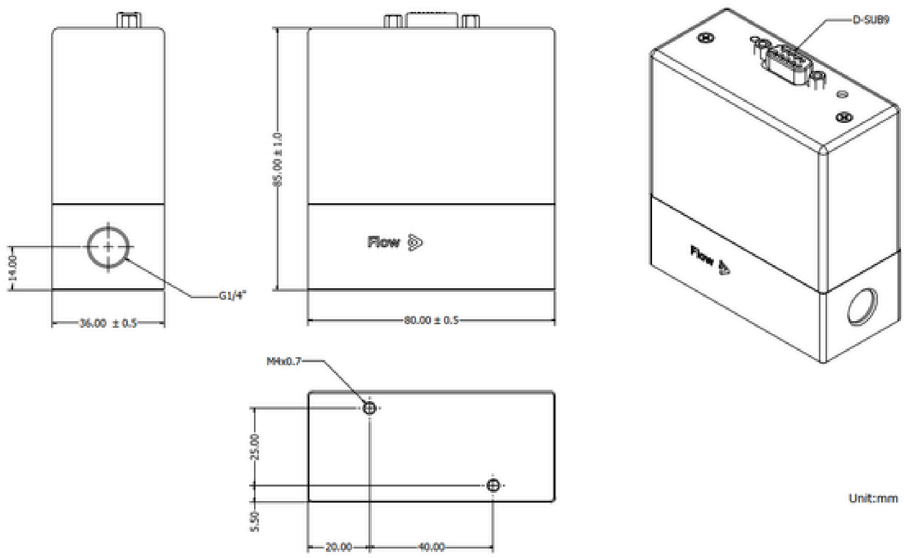

Figure PE Series Product Appearance Dimensions

1.2 Electrical Installation

PE series products adopt switching power supply mode and support DC ± 24V. D-SUB9 (line sequence arrangement is shown in the table) is used as the electrical connector by default. It supports 0~5V analog communication mode and RS485 serial communication mode (Modbus-RTU is used by default). Customers can customize the electrical connection mode according to actual needs.

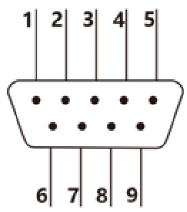

Figure D-SUB9 Pin No.

Table D-SUB9 Line sequence definition

D-SUB9 Equipment end Pin No.	Line sequence definition
1	Analog voltage output (0-5V)
2	RS485-A
3	Analog voltage input (0-5V)
4	Analog ground
5	RS485-B
6	Please do not connect
7	Please do not connect
8	Please do not connect
9	Positive pole of power supply (DC24V)

1.3 Installation Inspection

The following checks are required before starting to operate the mass flow controller/flowmeter:

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 control signal, power supply voltage size and form are normal.
4) Check the type of gas and rated pressure.
5) Inject dry inert gas for test run.

Part II Function Introduction

2.1 Power-up

The E series products are based on the high-end industrial MEMS sensor chip technology with independent intellectual property rights of the company, with a startup time of<1s and a response time of 0.5s (T98). Turn on the power supply through the method described in "2.3 Electrical installation" in this manual to realize the startup

2.2 Function list

Indicator status	Normal operation	The green light is always on
	Failed to read EEPROM	The red light is on for 0.5S and off for 0.5S (on and off alternately)
	Abnormal temperature sensor	The red light is on for 2 seconds and off for 2 seconds (turn on and off alternately)
	Start zeroing operation	Green light off, red light on
	Zeroing succeeded	Green light on, red light off
	Zeroing failed	The green light is off, the red light is on for 0.2 seconds, and off for 0.2 seconds

2.3 Communication protocol description

1) major parameter

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

2) Register list

Register address (hexadecimal)	Register content	data type	access type
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
0x0015	temperature 16 bit	Signed 16 bit integer	only read
0x0016	high flow 16 bit	unsigned 32-bit integer Significant digit 0.01	only read
0x0017	low flow 16 bit		

Register address (hexadecimal)	Register content	data type	access type
0x0018	accumulated flow high 32 bits	unsigned 64-bit integer	read/write
0x0019			
0x001A	Accumulated traffic low 32 bits		
0x001B			
0x001C	Cumulative 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
0x0022	Set flow high 16 bits	unsigned 32-bit integer Significant digit 0.01	read/write
0x0023	Set flow low 16 bits		
0x0024	Set valve opening	unsigned 16-bit integer Significant digit 0.01	read/write
0x0025	zero calibration	unsigned 16-bit integer	read/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
0x01	0x03	0x06	0x00	0x0D	0x00	0x64

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

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	0x15	0x00	0x01	0x95	0xCE

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	0x02	0xFF	0x85	0x38	0x17

data analysis

0xFF85(hexadecimal) = -123 (decimalism)

Divide by 10 to get the actual temperature = -123/10 = -12.3 (℃).

Example 3 – Host read 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	0x16	0x00	0x02	0x25	0xCF

return from device:

Device address	Function code	Data bytes	Flow data byte1	Flow data byte2	Flow data byte3	Flow data byte4	CRC check low byte	CRC check high byte
0x01	0x03	0x04	0x00	0x00	0x30	0x34	0xEF	0xE4

0x00003034(hexadecimal) = 12340 (decimalism)

Divide by 100 to get the actual flow = 12340/100 = 123.4

(If the flow unit is SCCM, then the flow is 123.4 SCCM; If the flow unit is SLM, the flow is 123.4SLM).

Example 4 – Host read cumulative flow

Send to device:

Device address	Function code	Register first address high bytes	Register first address low bytes	Register length high type	Register length low type	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	Cumulative flow unit high byte	Cumulative flow unit low byte	Cumulative flow day high byte	Cumulative flow day low byte	Cumulative flow hours high byte
0x5B	0xCD	0x15	0x00	0x00	0x27	0x10	0x00
Cumulative flow hours low byte	Cumulative flow minutes high byte	Cumulative flow minutes low byte	Cumulative flow seconds high byte	Cumulative flow seconds low byte	CRC check low byte	CRC check high byte	
0x0A	0x00	0x32	0x00	0x1E	0x6E	0xF9	

data analysis

① Cumulative flow unit:

0x0000 (hexadecimal) = 0 (decimalism)

Check the register list, we see that 0 represents L.

② Cumulative flow:

0x00000000075BCD15 (hexadecimal) = 123456789 (decimalism)

Divided by 1000, the actual cumulative flow is 123456.789 (If flow unit is L, cumulative flow is 123456.789 L; If the flow unit is m3, then cumulative 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 5 – The host zeroed out cumulative flow

send to device:

Device address	Function code	Register first address high bytes	Register first address low bytes	Register number high byte	Register number low byte	Modify data byte length	Data 1 high byte	Data 1 low byte
0x01	0x10	0x00	0x18	0x00	0x04	0x08	0x00	0x00

Data 2 high byte	Data 2 low byte	Data 3 high byte	Data 3 low byte	Data 4 high byte	Data 4 low byte	CRC Check low byte	CRC Check high byte
0x00	0x00	0x00	0x00	0x00	0x00	0x96	0x5A

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 number high type	Register number low type	CRC check low byte	CRC check high byte
0x01	0x10	0x00	0x18	0x00	0x04	0x41	0xCD

Example 6 – Host set flow

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 (decimalism)

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 type	Register length low type	Modify data byte length
0x01	0x10	0x00	0x22	0x00	0x02	0x04
Data1 high byte	Data1 low byte	Data2 high byte	Data2 low byte	CRC check low byte	CRC check high byte	
0x00	0x00	0x30	0x34	0x65	0xB9	

Data analysis

0x00003034 (hexadecimal) = 12340 (decimalism)

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 12.34SLM).

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 type	Register length low type	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 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 12.34SLM).

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 7- Host sets valve opening

There are two ways for the host to set the valve opening:

Method 1: First set the control mode, then set the ratio;

Method 2 (Recommended): Set the control mode and ratio at the same time.

Method 1 is as follows:

First set the control mode, send to device:

Device address	Function code	Register first address high bytes	Register first address low bytes	Register data high bytes	Register data low bytes	CRC check low byte	CRC check high byte
0x01	0x06	0x00	0x21	0x00	0x03	0x99	0xC1

data analysis

0x0003 (hexadecimal) = 3 (decimalism)

As shown in the register list, 3 proportional mode of control is set to Valve mode.

Note: If you need to set different ratios for multiple 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 bytes	Register data low bytes	CRC check low byte	CRC check high byte
0x01	0x06	0x00	0x21	0x00	0x03	0x99	0xC1

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

Device address	Function code	Register first address high bytes	Register first address low bytes	Register data high bytes	Register data low bytes	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 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 bytes	Register data low bytes	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 type	Register length low type	Modify data byte length	Data1 high byte	Data1 low byte
0x01	0x10	0x00	0x21	0x00	0x04	0x08	0x00	0x03

Data1 high byte	Data1 low byte	Data1 high byte	Data1 low byte	Data1 high byte	Data1 low byte	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)

As shown in the register list, 3 proportional mode of control is set to Valve mode.

② proportion set:

0x04D2 (hexadecimal) = 1234 (decimalism)

Divide by 100 to get the target ratio 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 length high type	Register length low type	CRC check low byte	CRC check high byte
0x01	0x10	0x00	0x21	0x00	0x04	0x91	0xC0

Example 8- Host read address

send to device:

Device address	Function code	Register first address high bytes	Register first address low bytes	Register length high type	Register length low type	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 byte	Address low byte	CRC check low byte	CRC check high byte
0xFE	0x03	0x02	0x00	0x01	0x6D	0x90

data analysis

0x0001 (hexadecimal) = 1(decimalism)

The current address is 1.

Example 9- Change the host address

send to device:

Device address	Function code	Register first address high bytes	Register first address low bytes	Register value high bytes	Register value low bytes	CRC check low byte	CRC check high byte
0xFE	0x06	0x00	0x00	0x00	0x02	0x1C	0x04

data analysis

0x0002 (hexadecimal) = 2 (decimalism)

This directive will change the address to 2. If the following data is returned from device, the operation succeeds (the modification takes effect immediately).

Device address	Function code	Register first address high bytes	Register first address low bytes	Register value high bytes	Register value low bytes	CRC check low byte	CRC check high byte
0xFE	0x06	0x00	0x00	0x00	0x02	0x1C	0x04

Example 10- Change the baud rate of the host

send to device:

Device address	Function code	Register first address high bytes	Register first address low bytes	Register value high bytes	Register value low bytes	CRC check low byte	CRC check high byte
0x01	0x06	0x00	0x01	0x00	0x08	0xD9	0xCC

data analysis

0x0008 (hexadecimal) = 8 (decimalism)

As you can see from the table below, this instruction will change the baud rate to 115200.

Code (decimalism)	Baud rate
1	4800
2	9600
3	14400
4	19200
5	38400
6	56000
7	57600
8	115200

If the following data is returned from device, the operation succeeds (the modification takes effect immediately).

Device address	Function code	Register first address high bytes	Register first address low bytes	Register value high bytes	Register value low bytes	CRC check low byte	CRC check high byte
0x01	0x06	0x00	0x01	0x00	0x08	0xD9	0xCC

Example 11- Host zero calibration

send to device:

Device address	Function code	Register first address high bytes	Register first address low bytes	Register value high bytes	Register value low bytes	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 bytes	Register value low bytes	CRC check low byte	CRC check high byte
0x01	0x06	0x00	0x25	0x00	0x01	0x59	0xC1

Example 12- Restore factory Settings

send to device:

Device address	Function code	Register first address high bytes	Register first address low bytes	Register value high bytes	Register value low bytes	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 bytes	Register value low bytes	CRC check low byte	CRC check high byte
0x01	0x06	0x00	0x25	0x00	0x02	0x19	0xC0

4. CRC test algorithm (C language)

Method One: unsigned short Crc16_Check(unsigned char *Push data,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 ^= *Push data++;
          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;
}
```

2.4 Turn off

When removing the external connecting wire of this product, please cut off the power first.

Part III Maintenance

3.1 summary

The product is used normally according to the requirements, and there is no need for daily maintenance of this product.
Please contact our company for more details.

3.2 Note

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 starting, no air flow passes through	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
		The flowmeter is contaminated	※Please contact our company
		The flowmeter has large drift	※Please contact our company
4	Unable to communicate	power problem	Check the power supply
		Communication connection problem	Check the communication line connection
		Address conflict	Check mailing address
		The baud rate is not set correctly	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 PE 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:

A. The product is changed, modified, in an abnormal environment (or beyond) specified in the manual and any other circumstances that can be considered as abnormal use;

B. Non-company original products.

5.2 Product warranty

The company provides the following guarantees for the production of E series products:

1) During the warranty period, the product must be maintained and repaired by our company to maintain the integrity of the product, 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 (joint 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) Unauthorized disassembly and modification of products.

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

$$C=\exp(-1.193+0.016\times h+0.025\times h2)/(\rho\times Cp)$$

$$h=43.86\times\lambda$$

Including: λ Is the thermal conductivity of the gas in the standard state (unit: W/m · K)

ρ Is the density of gas in standard state (unit: g/L)

Cp is the specific heat of gas at constant pressure (unit: cal/g · K)

Standard state: pressure - 101.325kPa (760mm Hg), temperature - 273.15K (0 ℃)

For mixed gases, calculate the conversion coefficient Cmix according to the following formula:

Cmix=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
PE Series Gas Mass Flow Controller

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