Product Manual

EDC-300 Series Mass Flow Controller

Biosflow (Zhengzhou) Electronic Technology Co., Ltd.

Contents

【Information before use 】

- Please be sure to carefully read and understand this manual before use;
- The company reserves the right not to be held liable for any losses or personal injuries resulting from failure to operate the product in accordance with this manual;
- Please keep this manual in a safe place for future reference during installation, maintenance, and troubleshooting;
- During operation, please carefully read all information marked with WARNING and CAUTION symbols.

【Warning】

- This product is suitable for use with flammable and explosive gases, but is not suitable for use in a flammable or explosive environment;
- Hazardous Gas Usage: When this product is used with hazardous gases, appropriate safety precautions must be taken;
- Confirm that the gas being used will not chemically react with the sealing materials;
- Gas Line Leak Check:During installation of this product, please inspect all gas line connections to ensure there are no gas leaks.;
- Do not exceed the maximum operating pressure of this product (refer to the manual for the maximum operating pressure);
- Do not open the product housing, replace components, or modify the product;
- The operating ambient temperature for this product is0~50℃;
- This product is not suitable for use with liquid media.

【Caution】

- This product is ready for use upon startup. However, to ensure accuracy, it must be warmed up for 15 to 30 minutes after powering on before use;
- Ensure that the operating pressure and differential pressure of the product are consistent with its specifications;
- Ensure the gas flow direction matches the arrow marking;
- Ensure that the signal type used matches the product's signal specifications;
- If the gas used is different from the calibration gas, confirm that it will not react with the product's sealing materials. Additionally, conversion must be performed using the conversion factors and formulas provided in the appendix of the manual.

1. Product Introduction

Gas Mass Flow Controllers (MFC) and Mass Flow Meters (MFM) are used for the precise control and measurement of gas mass flow. The measurement and control of gas mass flow are not affected by temperature or pressure variations.

MFC and MFM have important applications in scientific research and production in various fields such as semiconductor and integrated circuit technology, special materials science, chemical industry, petroleum industry, medicine, environmental protection and vacuum. Typical applications include: coating equipment, microelectronic process equipment such as diffusion furnaces, oxidation furnaces, epitaxial furnaces, CVD, plasma etching machines, sputtering stations, ion implanters, etc.; optical fiber melting, microreactors, gas mixing and distribution systems, bio-fermentation systems, petrochemical equipment, gas chromatographs and other analytical instruments.

2. Principle Principle

The core sensor of a thermal mass flow meter (MFM) utilizes the capillary thermal differential principle and consists of a stainless steel capillary tube with integrated heating and temperature-sensing elements. During MFM operation, a portion of the gas flows through the bypass sensor and is heated by the heating element. The gas flow creates an asymmetry in the temperature distribution, allowing the temperature difference between the two sensing elements to be measured. This temperature difference is proportional to the mass flow rate passing through the sensor. The main flow channel is perfectly split via a laminar flow element, ensuring a linear relationship between the sensor's output and the total mass flow rate.

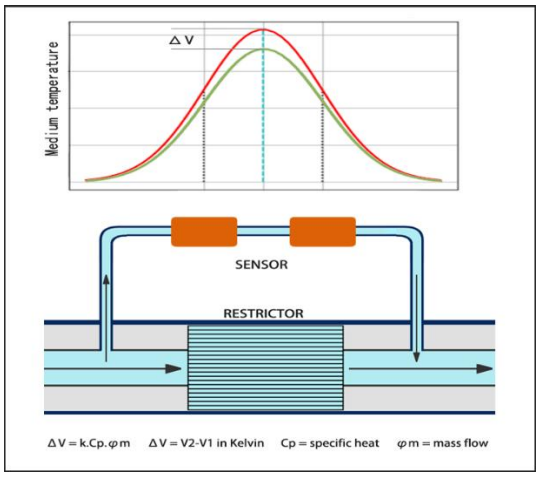


Figure 1 Sensor Operating Principle

A thermal mass flow controller (MFC) amplifies the sensor's output signal, compares it with the user's setpoint, and then uses a PID algorithm to control the valve opening, thereby regulating the flow and achieving closed-loop control of the mass flow.

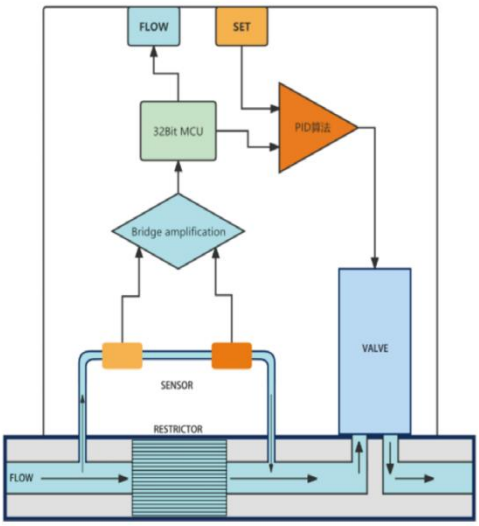


Figure 2 MFC Functional Block Diagram

3. Product Features

- EDC-300 series adopts a capillary thermal temperature difference sensor, which has high measurement accuracy, is not affected by temperature and pressure, and can be installed and used at any angle.
- The sensor and valve body are constructed from 316L stainless steel, making them suitable for use with toxic and corrosive gases;
- Features a digital measurement and control circuit for enhanced anti-interference capability and is compatible with analog signals of 0-5V or 4-20mA;
- The EDC-300 series is equipped with a proportional solenoid control valve, which provides very fast and stable control characteristics;
- EDC-300 series has passed CE and Rohs certification

4. Specifications

The following table shows the standard flow range (N2 calibrated) and operating pressure. For other specifications, please contact Biosfolw for customization.

Model	Max Full Scale	Min Full Scale	Withstand Pressure	Max Operating Pressure	Max Operating Differential presure
EDC-31x	10 SCCM	3 SCCM	1500 Psi/100 Bar	1500 Psi/100 Bar	150 Psi/10 Bar
EDC-32x	30 SLM	10 SCCM	1500 Psi/100 Bar	1500 Psi/100 Bar	150 Psi/10 Bar
EDC-33x	100 SLM	30 SLM	1500 Psi/100 Bar	1500 Psi/100 Bar	150 Psi/10 Bar
EDC-34x	200 SLM	100 SLM	450 Psi/30 Bar	150 Psi/10 Bar	150 Psi/10 Bar
EDC-35x	400 SLM	200 SLM	450 Psi/30 Bar	150 Psi/10 Bar	150 Psi/10 Bar
EDC-36x	1000 SLM	400 SLM	450 Psi/30 Bar	150 Psi/10 Bar	150 Psi/10 Bar
EDC-37x	1500 SLM	1000SLM	450 Psi/30 Bar	150 Psi/10 Bar	150 Psi/10 Bar

Note: SCCM (Standard milliliters per minute) and SLM (Standard liters per minute) are based on the default standard conditions (0°C, 101.3 kPa), and support (20°C, 101.3 kPa) or other standard conditions.

4.1 Performance Specifications

Parameter	Specification
Flow Accuracy	±0.8% F.S （<100 SLM） ±1% F.S（>100 SLM）
Repeatability	±0.2% F.S
Control Range	1%~100% F.S
Response Time	<0.8s
Temperature coefficient	Zero: <0.05% of F.S./℃. Span: <0.1% of S.P. /℃
Pressure coefficient	0.2% of S.P. / Bar
Operating temperature	0~50℃
Leakage rate	1x10-9 atm. cc/sec He
Warm-up time	5 min accuracy: ±5% F.S (30 min to achieve the best accuracy)

4.2 Electrical Parameters

Item	Parameters
Power Supply	+15～24 V dc
Max. Power Consumption	10W（MFC）；3W（MFM）
Analog Communication	0～5 V / 4～20mA
Digital Communication	RS-485（Modbus RTU Protocol）
Electrical Interface	9-pin D-connector (male)

4.3 Mechanical Parameters

Item	Description
Valve Type	Normally Closed (MFM is irrelevant)
Base Material	316L Stainless Steel
Seal Material	FKM, EPDM, NBR
Gas Port Connection	American / National Standard Ferrule or VCR Fitting

4.4 Dimensions (mm) and Weight (kg)

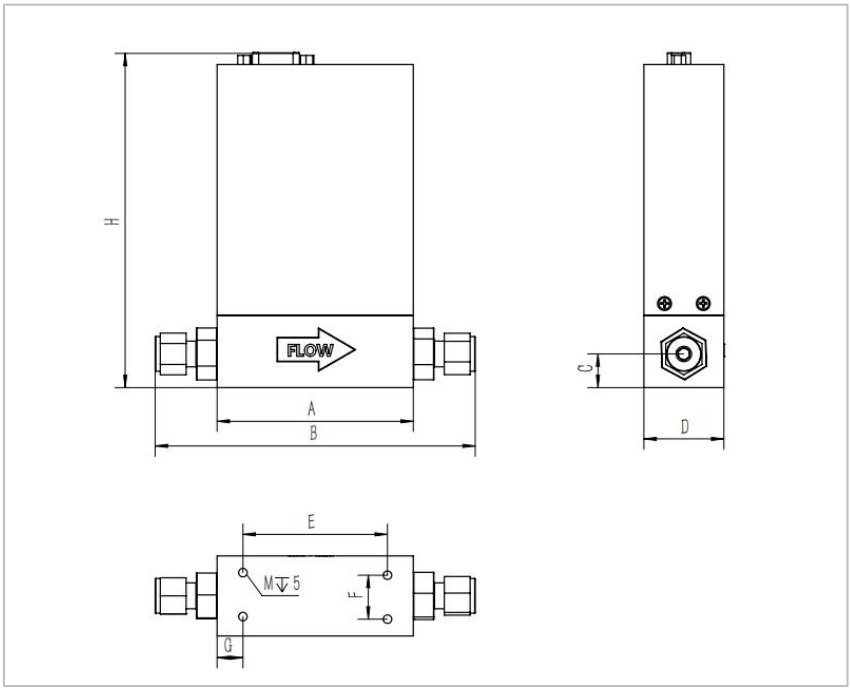


Figure 3 Dimension Drawing

Table 1 Model Size & Weight Corresponding Table

Model	A	B	C	D	H	E	F	G	M	Weight
EDC-310/1	76	124	13	31	125	56	16	10	M4	0.95
EDC-315/6	76	124	13	36	125	56	16	10	M4	0.95
EDC-320/1	76	124	13	31	125	56	16	10	M4	0.95
EDC-325/6	76	124	13	36	125	56	16	10	M4	0.95
EDC-33x	98.5	147	17	45	135	68	22	15.2	M4	1.8
EDC-34x	143	218	22	50	150	107	30	18	M4	3.3
EDC-35x	143	218	22	50	150	107	30	18	M4	3.3
EDC-36x	200	276	37	74	165	180	30	10	M6	5.5
EDC-37x	200	276	37	74	165	180	30	10	M6	5.5

4.5 Model and Configuration

Code	EDC-3x	0	1	5	6
Selection	Series	Controller	Flow Meter	Controller with Display	Flow Meter with Display

5. Electrical Connection

5.1 Analog Communication Connection Method

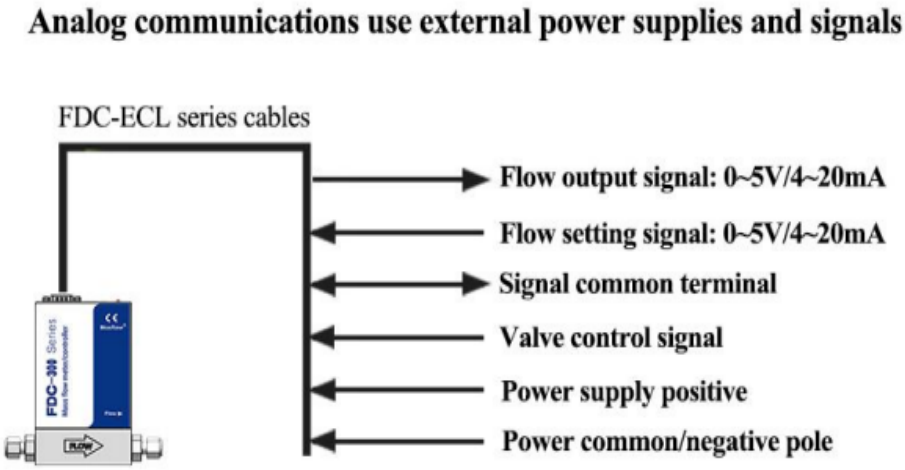


Figure 4 External Communication

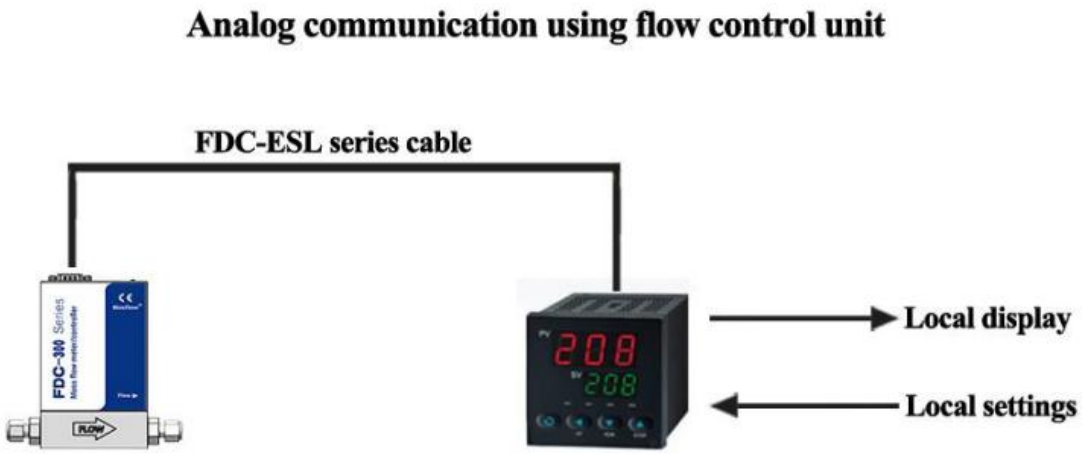
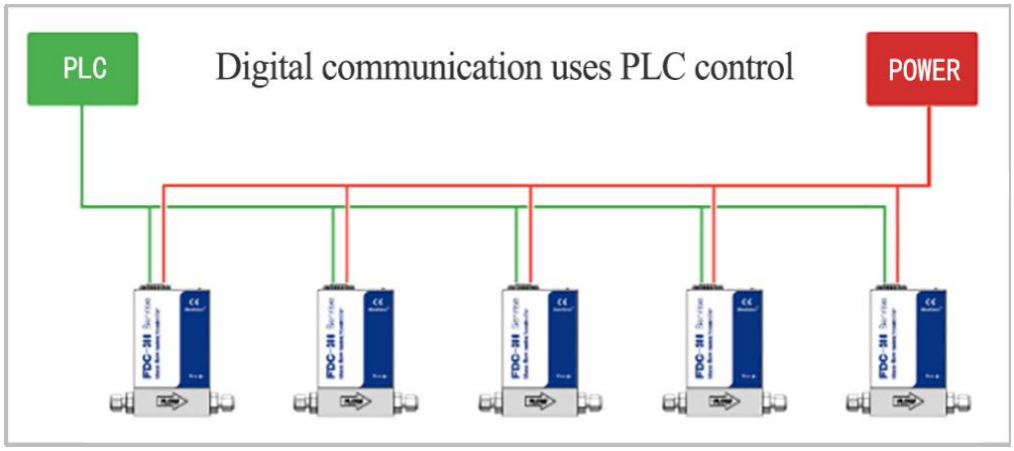


Figure 5 Connected to the Flow Control Unit

Table 2 DB9 Analog Communication Electrical Connection Pin Assignment

Pin No	Signal name
1	Chassis ground
2	Power supply positive[15～24V DC]
4	Input and output signal common terminal
5	Valve control (connected to positive power: cleaning; not connected or connected to negative power: normal control)
6	Flow feedback signal output
7	Negative power supply (power common terminal)
8	Flow setting signal input
Note: DB9 Male connector, other pins are not connected.	

5.2 Digital Communication Connection Method



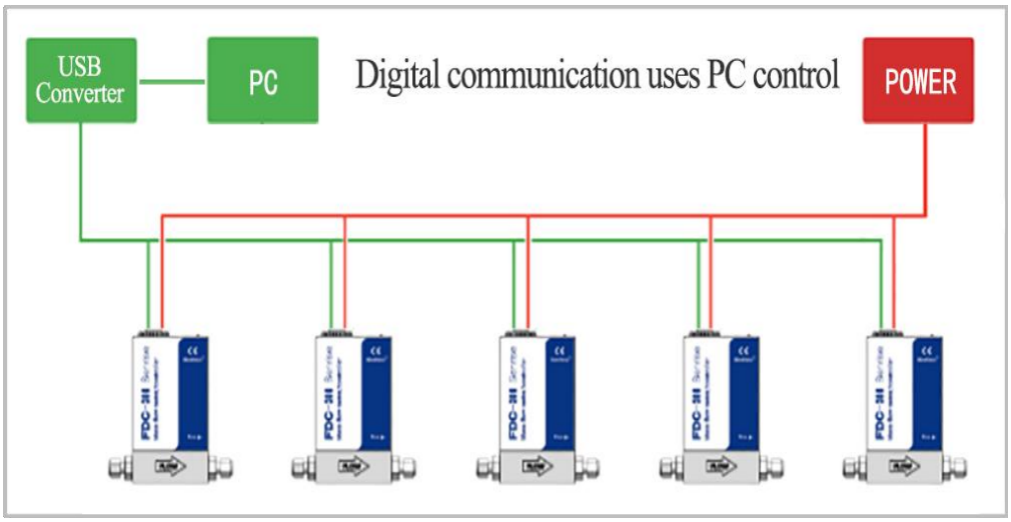


Table 3 DB9 Digital Communication Electrical Connection Pin Assignment

Pin No	Signal name
1	Chassis Ground
2	Power Positive [15~24V DC]
3	RS485 B-
7	Power Negative (Power Common Terminal)
9	RS485 A+
Note: DB9 Male connector. All other pins are not connected	

6. Install and use

6.1 Installation direction

The product can be installed at any angle. It is factory-calibrated in the horizontal position by default.If the actual installation position differs from the factory calibration position, zero offset may occur.In this case, adjust the zero point before operation.The air flow direction is indicated by the product arrow, which must be correctly connected into the pipeline.

6.2 Notes on Use

- The gas used must be dry, clean and non-polluting. Install a filter if necessary.
- If using easily liquefied or crystallized gas, install a check valve at the MFC outlet to prevent backflow damage to the equipment.

7. Function operation

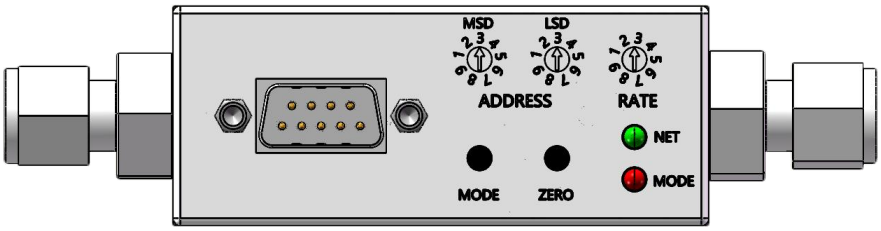


Figure 6 Top Peripheral Schematic

7.1 Peripheral description

- Button ZERO: Device Zero Adjustment；
- Button MODE: Switch between Digital and Analog Communication；
- Dual-color LED-MODE: Digital/Analog communication indication.Blue – Digital communication;Green – Analog communication.；
- Dual-color LED-NET: Communication abnormality / fault indication.；
- Knob ADDRESS-MSD: Set the tens digit of the communication address.；
- Knob ADDRESS-LSD: Set the units digit of the communication address；
- Knob RATE&CHECK: Set communication baud rate and parity bit.

7.2 Device Zero Adjustment

- Before performing zero adjustment, evacuate residual gas inside the MFC and ensure no gas leakage；
- Preheat fully for 15~30 min；
- Press and hold the ZERO button for about 3 seconds, release when the NET indicator flashes red at high frequency,Zero adjustment is completed when the flashing stops.

7.3 Communication Mode Switching

- Tap the MODE button to switch the communication mode；
- MODE-LED indication:Digital communication (blue), Analog communication (green)；
- Only one of digital communication or analog communication can be enabled at the same time.

7.4 Communication Address Setting

- Rotate the ADDRESS knob to the specified number；
- Communication address,MSD = tens digit, LSD = units digit,Communication address = MSD * 10 + LSD,Range: 1 ~ 99

7.5 Communication Baud Rate Setting

- Rotate the RATE&CHECK knob to the specified number;
- The corresponding relationship between digits and baud rate is shown in the table below:

Knob Digit	0	1	2	3	4	5	6	7	8	9
Baud Rate(bps)	9600	9600	19200	38400	9600	19200	38400	9600	19200	38400
Verify	NONE	NONE	NONE	NONE	ODD	ODD	ODD	EVEN	EVEN	EVEN

7.6 NET-LED Indicator Status Description

LED Indicator Status	Status Description
NET – Off	Communication failure or flow setting signal is zero
NET – Green steady on	The flow setting signal is valid
NET – Red high- frequency flashing	Performing device zeroing
NET – Red flashing 1 time/s	Sensor abnormality / Valve leakage
NET – Red flashing 2 times/s	Gas source abnormality
NET – Red flashing 3 times/s	abnormal power supply voltage

8. Troubleshooting

8.1 The device has no gas output and the feedback signal is zero

- Incorrect gas source or air flow direction;
- The control signal mode is inconsistent with the use signal;;
- Incorrect electrical connection of power supply or setting signal;
- Zero offset;
- Circuit board or sensor failure.

8.2 The setting signal is inconsistent with the feedback signal

- The use pressure is too low;
- The setting signal is inconsistent with the actual input signal;
- There is an error between the user output signal and the collected signal

8.3 No setting signal, feedback signal does not return to zero

- Zero offset;
- The valve is leaking.

8.4 Device cannot communicate

- Incorrect electrical connections;
- Correspondence addresses are incorrect or conflicting;
- The communication format or communication protocol is incorrect

8.5 Output flow is inaccurate

- Zero point deviation;;
- The standard temperature is inconsistent;
- The measuring range of the testing equipment is too large;
- Product failure.

9. Product Guarantee and Service

9.1 Warranty Description

- The warranty period for new products is one year after leaving the factory;
- The product warranty period after repair is 90 days;
- During the warranty period, repairs due to product quality problems are free of charge. Repair fees for products beyond the warranty period are charged according to the company's standards;
- If toxic or corrosive gases, or other contaminants are used in the product, please completely remove all residues and contaminants before maintenance, and notify our company personnel accordingly.

9.2 Not covered by warranty

- Product failures caused by the following reasons are not covered under warranty.
- Mechanical failures caused by product dropping or external impact;
- Damage to internal electronic components caused by incorrect electrical connections;
- Degradation of sealing materials caused by inconsistency between the gas used and the equipment parameters;
- Damage caused by gas pressure exceeding the equipment rating
- Blockage of precision internal components caused by unclean gas containing particles or other contaminants.
- Blockage of the gas flow path caused by gas crystallization as a result of failure to purge promptly after using easily crystallized gas.
- Unauthorized disassembly or modification of the product without the company’s permission.

9.3 Product Service

Our company provides free product operation instructions and technical support.

10. Contact Us

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Appendix A Communication Protocol

11.1 Introduction to Communication

- Physical layer connection: RS-485
- Standard Modbus-RTU Protocol
- Factory default communication format: Baud rate: 9600bps; Parity: None; Data bits: 8bps; Stop bits: 1bps;
- Factory default device address: 1;
- All floating-point numbers in this protocol are single-precision floating-point numbers conforming to the IEEE 754 encoding standard;

11.2 Register Address Description

Table 4 Flow Read/Write Memory Description

Register name	Register address	Register number	access type	Data element	Annotation
Communication test	0x01	1	Read only	U16	If the returned data is 0x0101, the communication test is successful.
Read flow rate(actual flow rate)	0x10	2	Read only	Float	The default unit is SCCM. Floating-point numbers are encoded according to the IEEE 754 standard, with the low byte preceding the high byte.
Read flow rate (percentage method)	0x16	1	Read only	U16	0-10000=0-100.00% ；
Set flow rate(actual flow rate)	0x20	2	Read and write	Float	The default unit for flow rate is SCCM. Floating-point numbers are encoded according to the IEEE 754 standard, with the least significant byte first and the most significant byte last. (Only one of the two flow rate setting methods may be selected.)
Set flow rate(percentage method)	0x26	1	Read and write	U16	0-10000=0-100.00% * full scale (You can only choose one of the two traffic setting methods)

Table 5 Communication Register Description

Register name	Register address	Register number	Access type	Data element	Annotation
Communication address	0x30	1	Read and write	U16	Address range 1-99.
Communication baud rate	0x31	1	Read and write	U16	Baud rate = sent value * 100; such as 96, corresponding baud rate is 9600 Bps.
Communication check bit	0x32	1	Read and write	U16	0: No parity; 1: Odd parity; 2: Even parity.

Table 6: Description of Other Registers

Register Name	Register Address	Register Count	Access Type	Data Type	Comments
Valve Control	0x2A	1	Read/Write	U16	0: Normal control; 2: Cleaning (full power open).Execute this operation only if cleaning function is required; default is normal control state.
Communication Mode	0x2D	1	Read/Write	U16	1: RS485 communication; 2: Analog communication.
Device Zero Calibration	0x41	1	Write Only	U16	Send 0xf0 to perform automatic zero calibration (ensure no gas passes through before executing this operation).
Total Flow	0x51	2	Read Only	U32	Default unit: smL (standard milliliter). Low byte first, high byte last.
Total Flow Clear	0x53	1	Write Only	U16	Send data: 0x01 to execute clear operation.

Warning Code	0x61	1	Read Only	U16	See Appendix 1: Warning Code Table for details.
Calibration Gas	0x80	5	Read Only	Char	Corresponding to ASCII code table.
Calibration Range	0x87	2	Read Only	Float	Default unit: SCCM (Standard Cubic Centimeters per Minute). Floating-point number is encoded in IEEE 754 format, low byte first, high byte last.

11.3 Core Register Examples

Note: The example data type is hexadecimal (16-bit)

11.3.1 Read actual traffic (default unit SCCM)

The host sends data:

Device address	Function code	Starting address high	Starting address low	High register count	Low register count	CRC high	CRC low
01	03	00	10	00	02	C5	CE

Data returned by the device: (For example, the return traffic is: 1000 SCCM)

Device address	Function code	Byte Count	Data1 High	Data 1 Low	Data 2 High	Data 2 Low	CRC Low	CRC Low
01	03	04	00	00	44	7A	48	D0

11.3.2 Read Flow Percentage （0~10000=0~100.00%）

Host sends data：

Device Address	Function Code	Starting Address High	Starting Address Low	Register Count High	Register Count Low	CRC Low	CRC Low
01	03	00	16	00	01	65	CE

Device returns data: (when the returned flow is 100% of full scale)

Device Address	Function Code	Byte Count	Data High	Data Low	CRC High	CRC Low
01	03	02	27	10	A2	78

11.3.3 Set the actual traffic volume (default unit: SCCM)

Note: Only one of the two options can be selected with Example 4.

Host sends data: (Set flow to 1000 SCCM)

Deviceaddress	Function code	Register address high	Register address low	High register count	Low register count	byte count	Data 1 High	Data 1 Low	Data 2 High	Data 2 Low	CRC high	CRC low
01	10	00	20	00	02	04	00	00	44	7A	43	54

Device returns data：

Device Address	Function Code	Starting Address High	Starting Address Low	Register Count High	Register Count Low	CRC High	CRC Low
01	10	00	20	00	02	40	02

11.3.4 Set Flow Percentage（0~10000=0~100.00%）

Note: Only one of the two options can be selected with Example 3.

Host sends data: (Set flow to 100% of full scale)

Device address	Function code	Register address high	Register address low	High register count	Low register count	byte count	Data High	Data Low	CRC high	CRC low
01	10	00	26	00	01	02	27	10	BB	6A

Device returns data：

Device Address	Function Code	Starting Address High	Starting Address Low	Register Count High	Register Count Low	CRC High	CRC Low
01	10	00	26	00	01	E0	02

11.3.5 Read Communication Address

Host sends data: (Example: Read communication address = 1)

Device Address	Device Address	Starting Address High	Starting Address Low	Register Count High	Register Count Low	CRC High	CRC Low
01	03	00	30	00	01	84	05

Device returns data：

Device Address	Function Code	Byte Count	Data High	Data Low	CRC High	CRC Low
01	03	02	00	01	79	84

11.3.6 Read Communication Baud Rate (bps = Read Data * 100)

Host sends data: (Example: Read baud rate = 9600, read data = 96 *100)

Device Address	Function Code	Starting Address High	Starting Address Low	Register Count High	Register Count Low	CRC High	CRC Low
01	03	00	31	00	01	D5	C5

Device returns data：

Device Address	Function Code	Byte Count	Data High	Data Low	CRC High	CRC Low
01	03	02	00	60	B8	C6

11.3.7 Read Communication Parity(0: No Parity; 1: Odd Parity; 2: Even Parity)

Host sends data: (Example: Read parity = No Parity)

Device Address	Function Code	Starting Address High	Starting Address Low	Register Count High	Register Count Low	CRC High	CRC Low
01	03	00	32	00	01	25	C5

Device Address	Function Code	Byte Count	Data High	Data Low	CRC High	CRC Low
01	03	02	00	00	B8	44

11.3.8 Fault Code List

Table 7 Fault Warning Code List

Fault Code	Fault Analysis	Troubleshooting
01	Sensor abnormality / Valve leakage	Zero adjustment after preheating with no gas flow
02	Air source abnormality	Check the air source