

**天武测控（江苏）有限公司**

ToYoTop Measure and Control (Jiangsu) Co., Ltd

[www.toyotop.net](http://www.toyotop.net)

# TP series mass flow controller/flow meter user manual



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## I. Main technical indicators

### Main indicators of flow controller/flow meter:

|                                                                        |                                          |                                        |
|------------------------------------------------------------------------|------------------------------------------|----------------------------------------|
| Traffic specifications:                                                | TPS                                      | 5mL/min - 5000mL/min                   |
|                                                                        | TP50                                     | 1L/min - 70L/min                       |
|                                                                        | TP150                                    | 50L/min - 150L/min                     |
|                                                                        | TP400                                    | 150L/min - 400L/min                    |
|                                                                        | TP1000                                   | 400L/min - 1000L/min                   |
|                                                                        | TPM                                      | 5mL/min - 200L/min                     |
|                                                                        | IGS                                      | 5mL/min - 5000mL/min                   |
| Control range:                                                         | TPS/TP50/TP150/TP400/TP1000/IGS          | 0.5% - 100% F.S                        |
|                                                                        | TPM                                      | 0% - 100% F.S                          |
| Accuracy:                                                              | TPS/TP50/TP150/TP400/TPM/IGS             | ±0.5%F.S                               |
|                                                                        | TP1000                                   | ±1%F.S                                 |
| Input and output signals                                               | Analog signal                            | 0-5V/0-10V/4-20mA/0-20mA               |
|                                                                        | Digit signal                             | RS485 (Modbus-RTU) /EtherCAT /ProfiNET |
| Linear:                                                                | ±0.5%F.S                                 |                                        |
| Repeatability precision:                                               | ±0.2%F.S                                 |                                        |
| Response time:                                                         | ?3Sec (software set)                     |                                        |
| Working pressure difference range:                                     | 0.05-0.8MPa                              |                                        |
| Maximum pressure resistance                                            | 30MPa                                    |                                        |
| Operating ambient temperature                                          | 5-55°                                    |                                        |
| Electrical connections                                                 | DB15/DB9/3Pin/8Pin/ network cable (RJ45) |                                        |
| Note: The above data are based on N2, working condition 20 ° and 1Atm. |                                          |                                        |

### Flow controller/flow meter operating conditions:

| Product line | Range ability | Normal pressure range | Conventional pipe size             | Minimum pressure difference |
|--------------|---------------|-----------------------|------------------------------------|-----------------------------|
| TPS          | 5mL-5000mL    | 4KPa-0.3MPa           | $\geq 3\text{mm } 1/8\text{inch}$  | 4KPa                        |
| TP50         | 5L-30L        | 0.1MPa-0.5MPa         | $\geq 3\text{mm } 1/8\text{inch}$  | 0.1MPa                      |
| TP50         | 30L-50L       | 0.1MPa-0.5MPa         | $\geq 6\text{mm } 1/4\text{inch}$  | 0.1MPa                      |
| TP50         | 50L-70L       | 0.1MPa-0.5MPa         | $\geq 8\text{mm } 1/8\text{inch}$  | 0.1MPa                      |
| TP150        | 50L-100L      | 0.1MPa-0.3MPa         | $\geq 10\text{mm } 3/8\text{inch}$ | 0.1MPa                      |
| TP150        | 100L-150L     | 0.2MPa-0.4MPa         | $\geq 10\text{mm } 3/8\text{inch}$ | 0.2MPa                      |
| TP400        | 150L-200L     | 0.05MPa-0.1MPa        | $\geq 12\text{mm } 1/2\text{inch}$ | 0.05MPa                     |
| TP400        | 200L-500L     | 0.1MPa-0.2MPa         | $\geq 12\text{mm } 1/2\text{inch}$ | 0.2MPa                      |
| TP1000       | 400L-600L     | 0.3MPa-0.8MPa         | $\geq 12\text{mm } 1/2\text{inch}$ | 0.3MPa                      |
| TP1000       | 600L-800L     | 0.35MPa-0.9MPa        | $\geq 12\text{mm } 1/2\text{inch}$ | 0.35MPa                     |
| TP1000       | 800L-1000L    | 0.4MPa-0.9MPa         | $\geq 12\text{mm } 1/2\text{inch}$ | 0.4MPa                      |
| TPM          | 5mL-200L      | $\leq 3\text{MPa}$    | /                                  | /                           |
| IGS          | 5mL-5000mL    | 4KPa-1MPa             | $\geq 3\text{mm } 1/8\text{inch}$  | 4KPa                        |

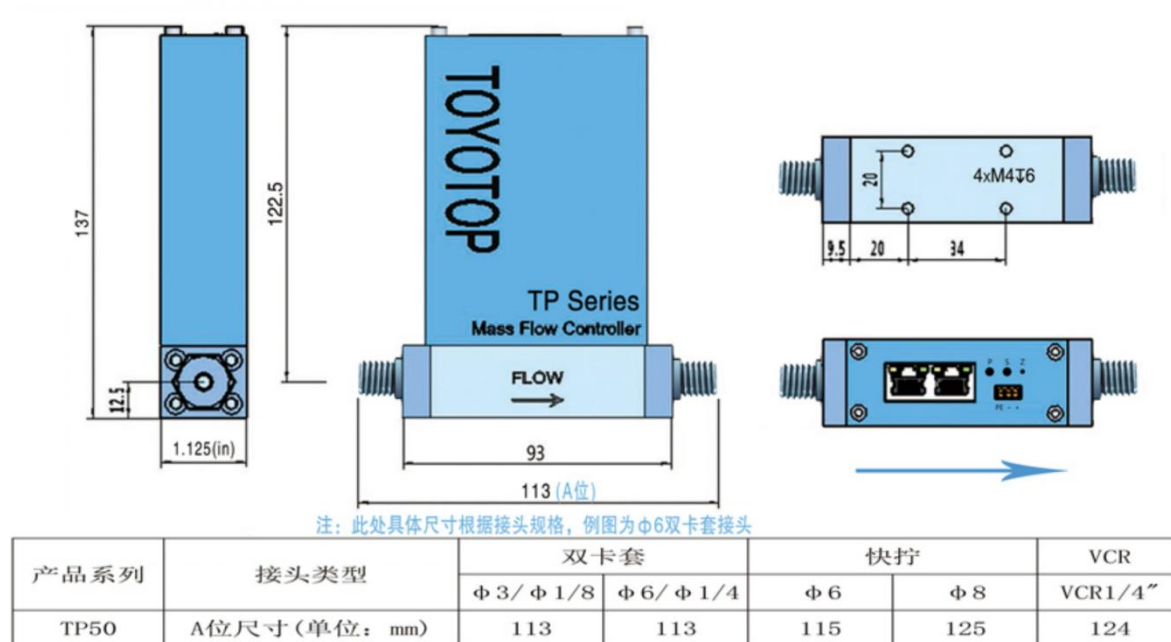
Note: This table is not absolute, and the performance varies depending on the

user's usage scenario. The TPM flow meter has no requirements for the pipeline.

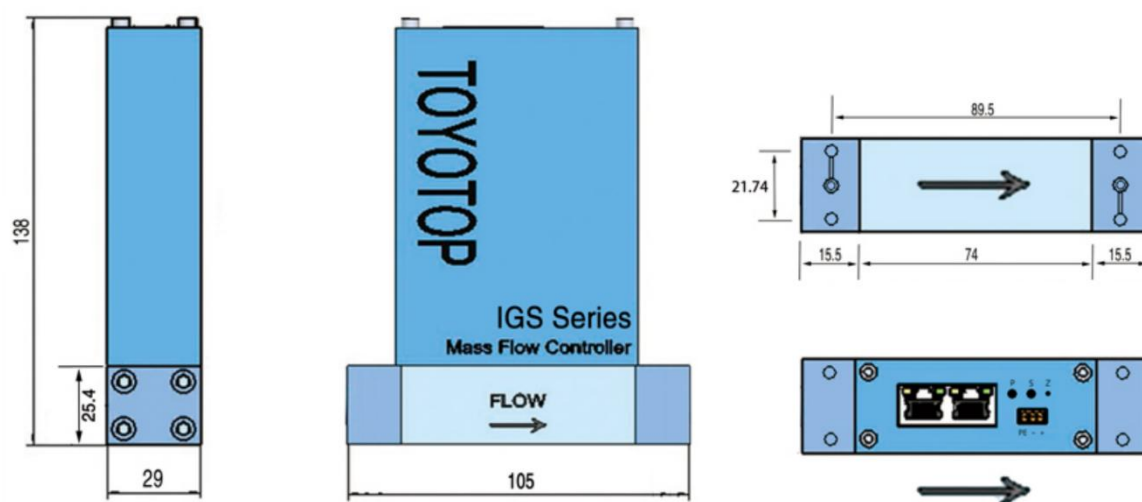
## 2. Installation size and pin definition

Shape and installation size of flow controller/flow meter

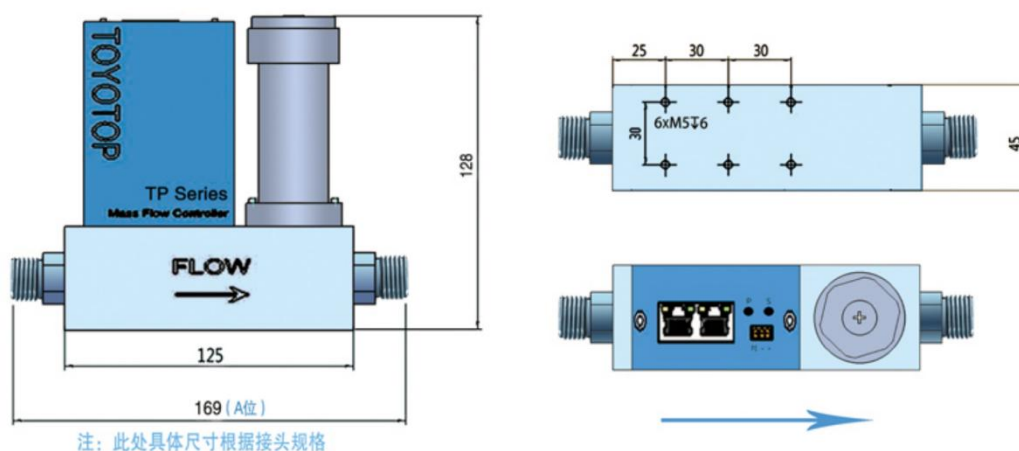
### 1. TPS/TP50 series



### 2. IGS series

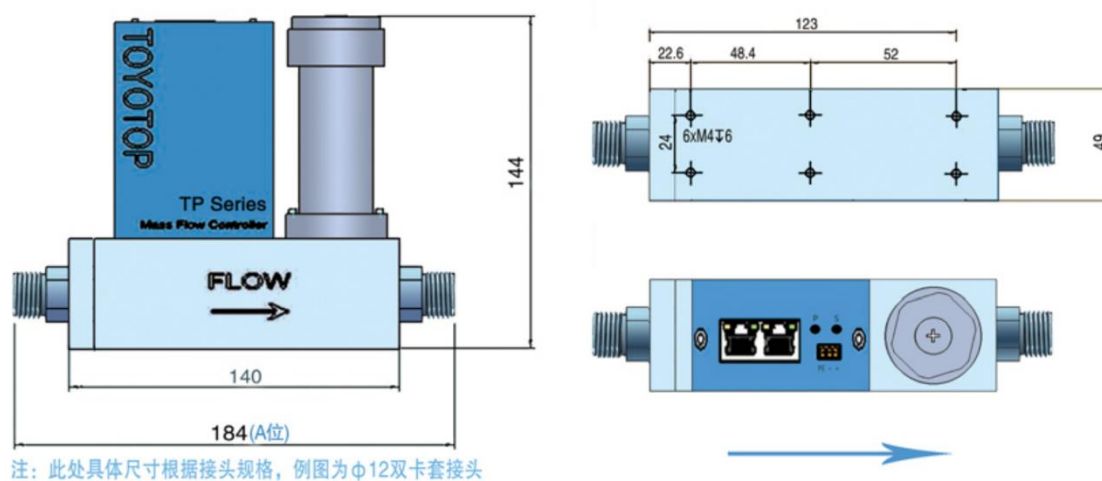


## 3. TP150 Series



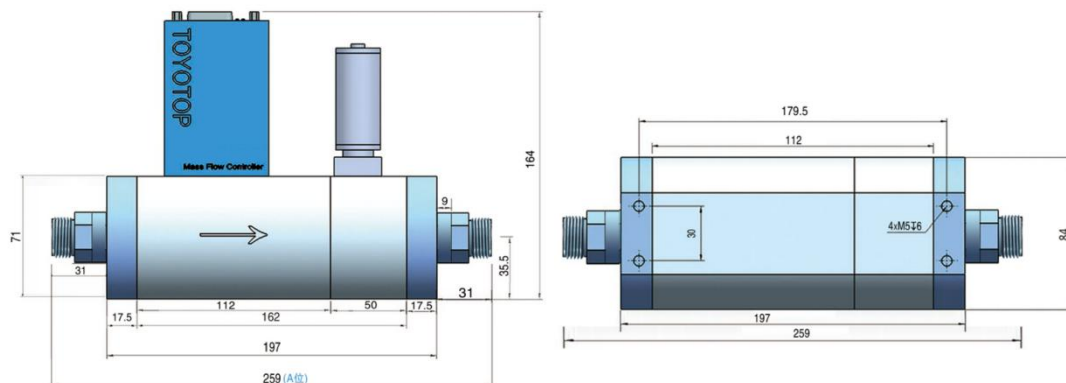
| 产品系列  | 接头类型         | 双卡套     |         |     |      |     |          |     |          | 快插  |     |     | 快拧  |
|-------|--------------|---------|---------|-----|------|-----|----------|-----|----------|-----|-----|-----|-----|
|       |              | φ3/φ1/8 | φ6/φ1/4 | φ8  | φ3/8 | φ10 | φ12/φ1/2 | φ14 | φ7/8(转接) | φ6  | φ8  | φ10 | φ6  |
| TP150 | A位尺寸(单位: mm) | 169     | 169     | 169 | 169  | 169 | 169      | 169 | 185      | 185 | 185 | 185 | 195 |

## 4. TP400 Series



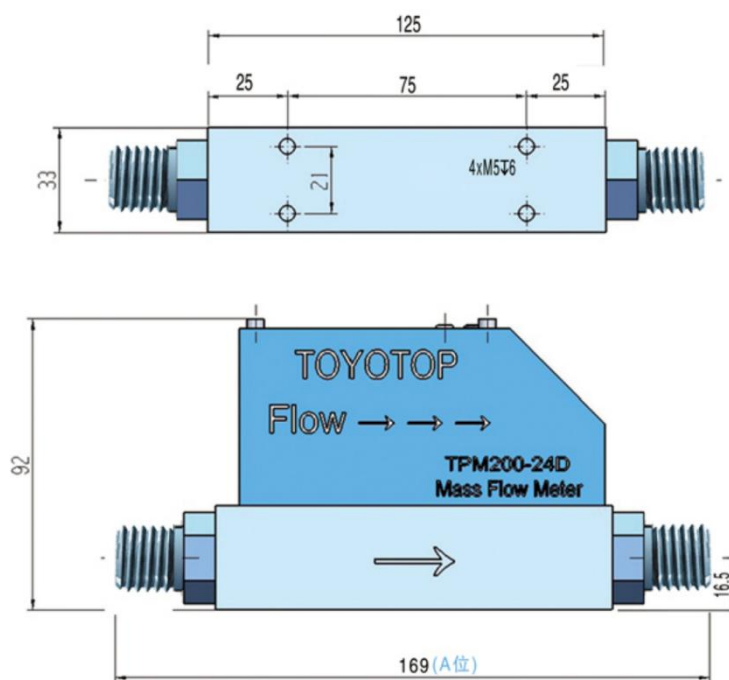
| 产品系列  | 接头类型         | 双卡套      |            |           |                    |           |            | 快插       |           |           |           |  |
|-------|--------------|----------|------------|-----------|--------------------|-----------|------------|----------|-----------|-----------|-----------|--|
|       |              | $\phi 8$ | $\phi 3/8$ | $\phi 10$ | $\phi 12/\phi 1/2$ | $\phi 14$ | $7/8$ (转接) | $\phi 8$ | $\phi 10$ | $\phi 12$ | $\phi 14$ |  |
| TP400 | A位尺寸(单位: mm) | 184      | 184        | 184       | 184                | 184       | 200        | 200      | 200       | 200       | 200       |  |

## 5. TP1000 Series



| 产品系列   | 接头类型         | 双卡套                |           |                 | 快插        |           |
|--------|--------------|--------------------|-----------|-----------------|-----------|-----------|
|        |              | $\phi 12/\phi 1/2$ | $\phi 14$ | $\phi 7/8$ (转接) | $\phi 12$ | $\phi 14$ |
| TP1000 | A位尺寸(单位: mm) | 241                | 241       | 257             | 257       | 257       |

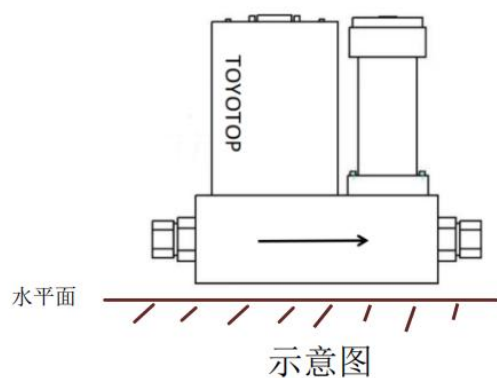
## 6. TPM series



| 产品系列 | 接头类型         | 双卡套               |                   |          |            |           |                    |           |                 | 快插       |          |           | 快拧       |
|------|--------------|-------------------|-------------------|----------|------------|-----------|--------------------|-----------|-----------------|----------|----------|-----------|----------|
|      |              | $\phi 3/\phi 1/8$ | $\phi 6/\phi 1/4$ | $\phi 8$ | $\phi 3/8$ | $\phi 10$ | $\phi 12/\phi 1/2$ | $\phi 14$ | $\phi 7/8$ (转接) | $\phi 6$ | $\phi 8$ | $\phi 10$ | $\phi 6$ |
| TPM  | A位尺寸(单位: mm) | 169               | 169               | 169      | 169        | 169       | 169                | 169       | 185             | 185      | 185      | 185       | 195      |

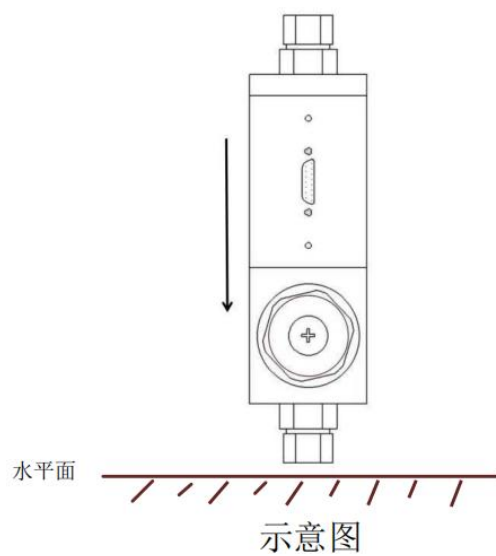
## Flow controller/flow meter installation direction

## 1. Horizontal installation



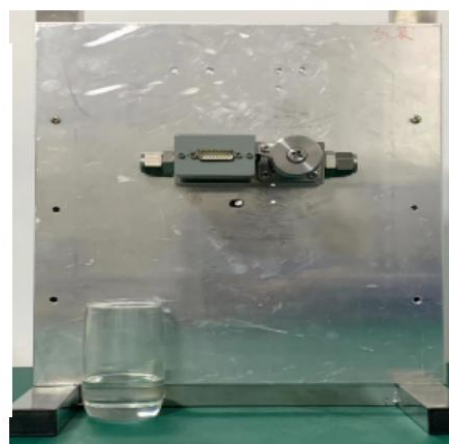
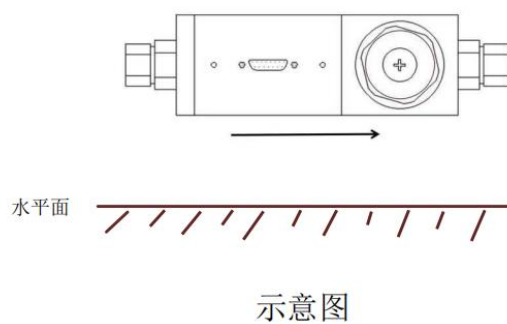
实物对照图

## 7. Vertical installation



实物对照图

## 3. side mount

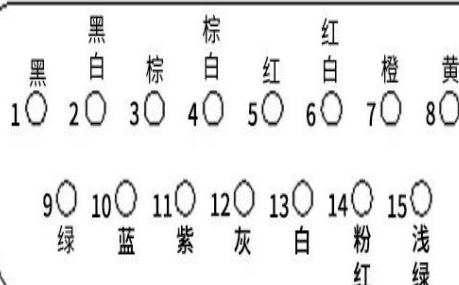


实物对照图

## Pin definitions for flow controller / flow meter

## 1. DB15, Pin definition

DB15公头



DB15母头



| Number of stitches | Def<br>ini<br>tio<br>n            |                    | Cable color       |
|--------------------|-----------------------------------|--------------------|-------------------|
| 1                  | Signal ground                     | Signal GND         | Black             |
| 2                  | Signal output (4-20mA)            | Signal OUT 4-20mA  | Black and white   |
| 3                  | Signal output (0-5V)              | Signal OUT 0-5V    | Palm              |
| 4                  | NC                                | NC                 | Brownish white    |
| 5                  | Positive power supply (+15V/+24V) | Power +(+15V/+24V) | Red               |
| 6                  | Negative power supply (-15V)      | Power - (-15V)     | Skewbald          |
| 7                  | Signal input (0-5V)               | Signal IN 0-5V     | Citrus si-nensis  |
| 8                  | Signal input (4-20mA)             | Signal IN 4-20mA   | Yellow            |
| 9                  | Power ground (0V)                 | Power GND (0V)     | Hispid ar-thraxon |
| 10                 | Signal ground                     | Signal GND         | Blue              |
| 11                 | Communication signal (A+)         | RS485 (A+)         | Purple            |
| 12                 | Communication signals (B-)        | RS485 (B-)         | Ash               |
| 13                 | NC                                | NC                 | White             |
| 14                 | The shell is hollow               | PE                 | Pink              |
| 15                 | NC                                | NC                 | Pale green        |

Note: This pin output specification applies to all flow controllers and flow meters using DB15 cables. 24 V power version connects to 5, 9.  $\pm 15V$  power version connects to 5, 6, 9.

## 2. DB9 pin definition

| Number of stitches | Def<br>ini<br>tio<br>n            |                    | Cable color |
|--------------------|-----------------------------------|--------------------|-------------|
| 1                  | Positive power supply (+15V/+24V) | Power +(+15V/+24V) | Black       |
| 2                  | The shell is out                  | PE                 | Palm        |
| 3                  | Negative power                    | Power - (-         | Red         |

### DB9公头

黑 棕 红 橙 黄  
1 2 3 4 5  
6 7 8 9  
绿 蓝 紫 灰

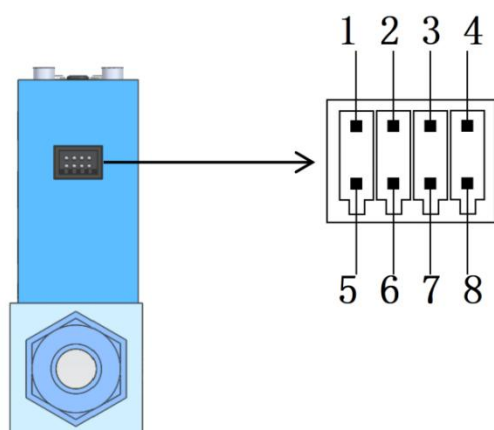
### DB9母头

黄 橙 红 棕 黑  
5 4 3 2 1  
9 8 7 6  
灰 紫 蓝 绿

|   |                            |                |                   |
|---|----------------------------|----------------|-------------------|
|   | supply (-15V)              | 15V)           |                   |
| 4 | Communication signals (B-) | RS485 (B-)     | Citrus si-nensis  |
| 5 | Communication signal (A+)  | RS485 (A+)     | Yellow            |
| 6 | Power ground (0V)          | Power GND (0V) | Hispid ar-thraxon |
| 7 | Analog signal ground       | Signal GND     | Blue              |
| 8 | Analog signal input        | Signal IN      | Purple            |
| 9 | Analog signal output       | Signal OUT     | Ash               |

Note: This pin output specification applies to all flow controllers and flow meters using DB9 cables. The type of analog signal is determined by selection. 24V power version connects 1, 6.  $\pm$  15V power version connects 1, 3, 6.

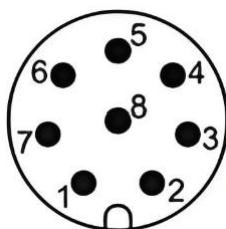
### 3. 8 Pin, pin definition



| Number of stitches | Defin<br>ition                |
|--------------------|-------------------------------|
| 1                  | 0VDC (negative power supply)  |
| 2                  | RS<br>485 ( B- )              |
| 3                  | RS<br>485 ( A+ )              |
| 4                  | 24VDC (positive power supply) |
| 5                  | Output<br>4-20mA              |
| 6                  | Output<br>0-5V                |
| 7                  | Signal public end<br>Scom     |
| 8                  | Signal public port<br>Scom    |

Note: The number of needles 2, 3, 5, 6, 7 can be customized according to user requirements. The above figure is the default definition

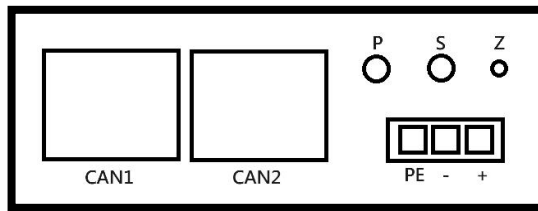
### 4. M8 aviation joint connection mode



| Number of stitches | Def<br>ini<br>tio<br>n             |                 | Cable color           |
|--------------------|------------------------------------|-----------------|-----------------------|
| 1                  | Communication<br>signal (A+)       | RS485 (A+)      | White                 |
| 2                  | Communication<br>signals (B-)      | RS485 (B-)      | Palm                  |
| 3                  | Analog signal<br>input             | Signal IN       | Hispid ar-<br>thraxon |
| 4                  | Analog signal<br>output            | Signal OUT      | Yellow                |
| 5                  | Analog signal<br>ground            | Signal GND      | Ash                   |
| 6                  | The shell is out                   | PE              | Powder                |
| 7                  | Power ground (0<br>V)              | Power GND ( 0V) | Blue                  |
| 8                  | Power supply po-<br>sitive (+ 24V) | Power + ( +24V) | Red                   |

Note: This pin output specification applies to all flow controllers and flow meters using M8 cables. The type of analog signal is determined by selection. Power is connected to pins 7 and 8; for the  $\pm 15V$  version, pin 7 is connected to 0V, pin 8 to +15V, and-

## 5. Network cable (RJ45) connection mode



| Number | Definition                    |
|--------|-------------------------------|
| CAN1   | EtherCAT IN                   |
| CAN2   | EtherCAT OUT                  |
| +      | 24VDC (positive power supply) |
| -      | 0VDC (negative power supply)  |
| PE     | PE (shell ground)             |
| P      | Power light                   |
| S      | Status indicator light        |
| Z      | The wither button             |

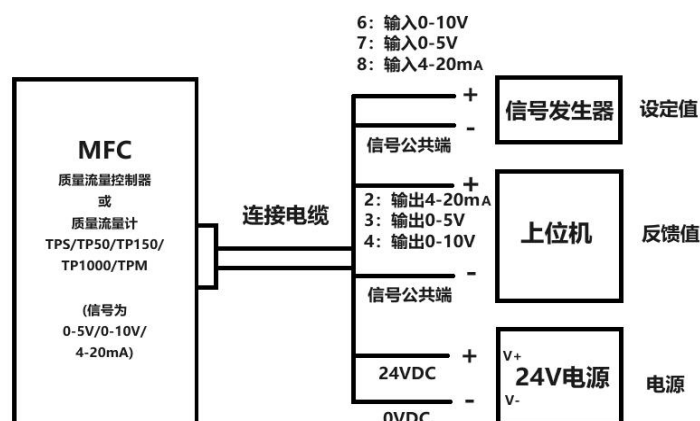
Note: The power supply wiring of the version without indicator light is different from that of the version with indicator light. Please pay attention to the distinction.

### 3. Wiring method

#### 1. Analog control wiring (0-5V/0-10V/4-20mA)

- ◆ High stability, high anti-interference ability +24V power supply;
- ◆ High stability, high anti-interference signal generator (0-5V/0-10V/4-20mA);
- ◆ Cable with strong anti-interference ability;
- ◆ The upper computer (secondary instrument, PLC, DCS, HMI...) is used to read analog signal (0-5V/0-10V/4-20mA).

Wiring method:



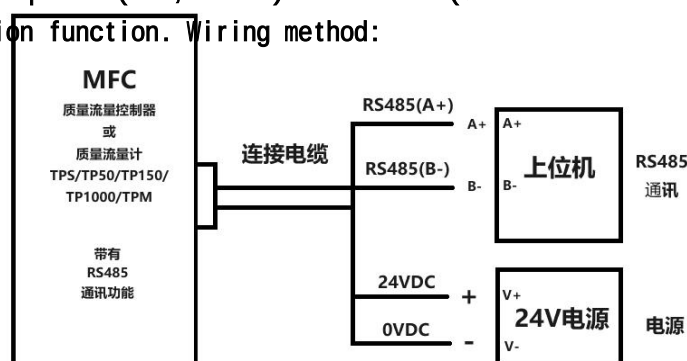
- ◆ Connect the positive terminal of the set flow signal to "input xx" and the negative terminal of the set flow signal to "signal common terminal".
- ◆ Connect the positive terminal of the upper computer to "output xxx" and the negative terminal of the upper computer to "signal common terminal".
- ◆ Connect the positive pole of the 24V power supply to "24VDC" and the negative pole of the 24V power supply to "0VDC". Note:

The signal public terminal does not need to be shorted to the power ground. Shorting will not damage the flow controller, but it will increase the interference of the input signal and affect the control stability.

Due to analog communication, especially voltage control at 0-5VDC, it is susceptible to the length of communication cables, external RF power sources, microwave signals, and electromagnetic interference. Therefore, when using voltage-based communication, it is recommended to use shielded connection cables and equipment similar to isolation transformers to prevent potential differences between analog and digital ranges at the system end.

#### 2. Communication control wiring method (RS485 Modbus-RTU)

- ◆ High stability, high anti-interference ability +24V power supply;
- ◆ Cable with strong anti-interference ability;
- ◆ The upper computer (PLC, PC...) has RS485 (Modbus-RTU) communication function. Wiring method:





- ◆ Connect the A+ of the upper computer RS485 to the RS485 (A+) of the device, and connect the B-of the upper computer RS485 to the RS485 (B-) of the device.
- ◆ Connect the positive pole of the 24V power supply to "24VDC" and the negative pole of the 24V power supply to "0VDC".
- ◆ The wiring method of analog signal is the same as the figure above.

pay attention to:

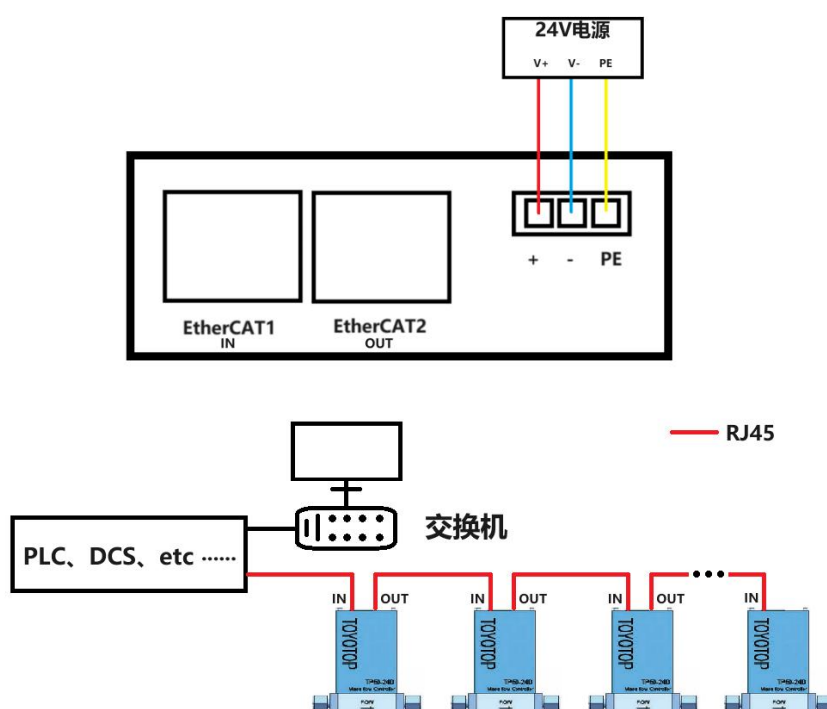
The RS485 (Modbus-RTU) version of TPS/TP50/TP150/TP1000 can output three types of analog signals: 0-5V, 0-10V, and 4-20mA simultaneously while communicating via 485. It also allows switching control modes through 485 communication, using the three types of analog signals for analog control.

Compared with analog control, communication control has many functions that cannot be realized by analog control. For information about communication protocol files and the use of TP series software, please refer to the relevant attachments.

### 3. EtherCAT Communication control wiring method (network cable RJ45)

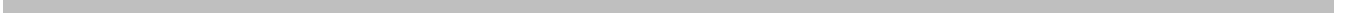
- ◆ High stability, high anti-interference ability +24V power supply;
- ◆ Network cable with strong anti-interference capability;
- ◆ The upper computer (PLC, PC...) has the function of network communication.

Wiring method:



- ◆ Connect the IN of the upper computer EtherCAT to the EtherCAT1 of the device, and connect the OUT of the upper computer EtherCAT to the EtherCAT2 of the device.
- ◆ Connect the positive pole of the 24V power supply to "24VDC" and the negative pole of the 24V power supply to "0VDC". Note:

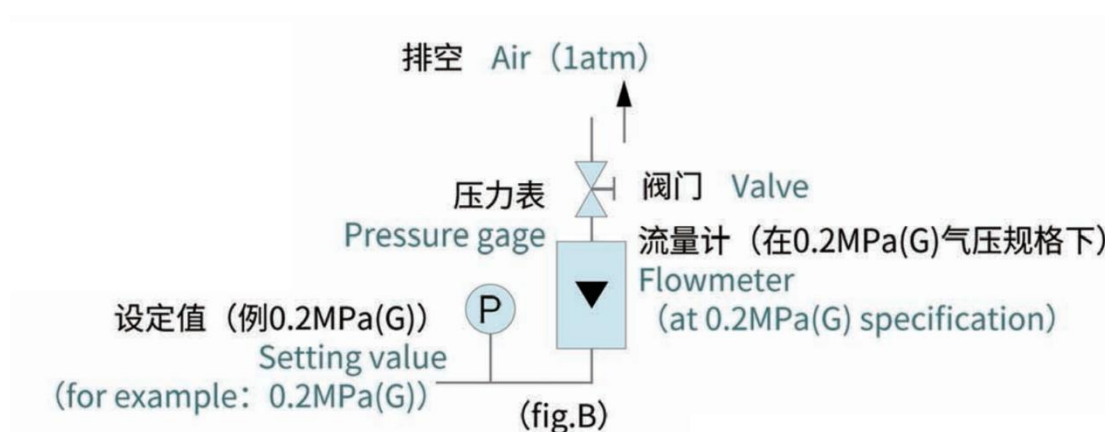
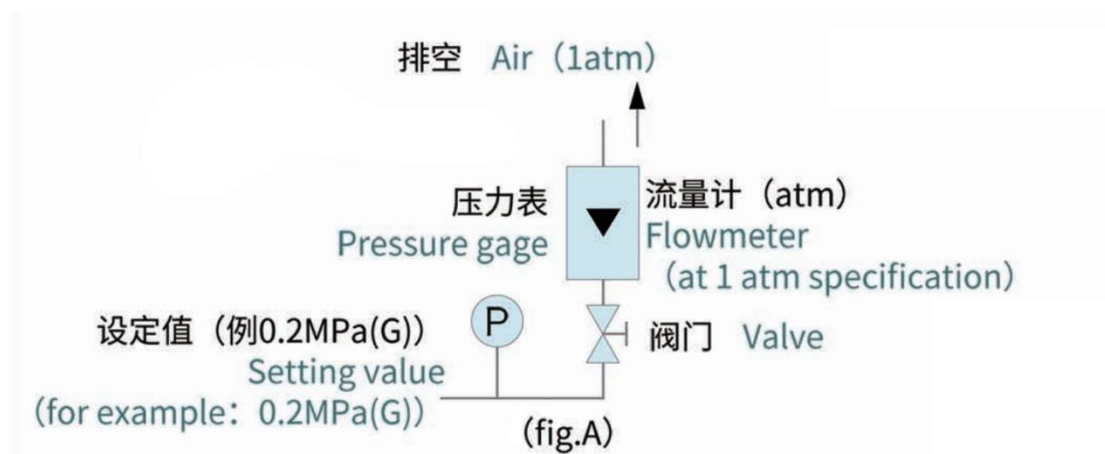
EtherCAT Versions of TP50/150/1000 generally do not have analog signals, and there are certain requirements for the anti-interference ability of network cables. (It is recommended to use: gold-plated contacts, 26AWG copper-clad aluminum wire core network cable, that is, Category 6 network cable.)



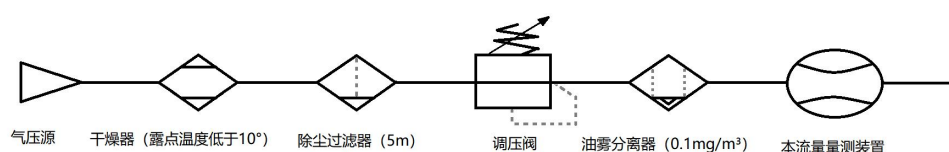
## 4. Pipeline connection

### 1. Mass flow controller/flow meter

- ◆ TPS/TP50/TP150/TP1000/TPM;
- ◆ Gas source processor, control the size of gas pressure;
- ◆ Barometer, observe real-time air pressure;
- ◆ Dry air source. Pipe connection mode:



Flow controller pipe connection



Flow meter piping connection

- ◆ Connect the devices in the order of the pictures;
- ◆ By observing the pressure gauge, adjust the gas source processor to adjust the pressure to the working range;
- ◆ The flow controller is set to the set value and can work normally.

#### pay attention to:

Most of the reasons for the failure of the instrument are caused by incorrect gas and pipeline connection. Please pay attention to the following conditions during installation:

#### ◆ For piping and installation

(1) The gas pipeline must be cleaned, especially after cutting the stainless steel pipeline for installation, or using sealant or raw belt for sealing, the pipeline must be blown clean with gas before connecting the flow controller, otherwise the impurities in the pipeline will blow into the flow controller.

(2) Try to use better quality gas pipe material, some gas pipes will produce corrosion due to the reaction of gas.

(3) Although it has been connected to the pipe, please try to use a fixed screw to fix the flow controller (there is an installation hole at the bottom, see the installation size for details), especially for the high flow controller.

(4) The pipe must conform to the gas flow, too small a pipe will cause greater pressure loss. (see flow controller/flow meter performance indicators for details)

(5) After the installation is complete, check whether there is a leak in the pipeline.

(6) Try to install a bypass system or have a backup flow controller so that the equipment will not be interrupted due to flow problems.

(7) The pipe joint of the flow controller is sealed with O-rings or flat gaskets to avoid excessive use of raw belt or liquid sealant that can affect the flow controller.

(8) Considering the impurities in the pipeline and the purity of the gas, we recommend that customers use a gas filter installed upstream of the flow controller, which is a protection for the flow controller and ensures the cleanliness of the product.

#### ◆ For the gas source

(1) If the air pressure exceeds the working condition, it may cause the flow controller/flow meter to fail to control effectively and cause personnel injury. Please confirm that the air pressure is within the working range before ventilation.

(2) The flow controller has certain requirements for the stability of air pressure. The air pressure gauge cannot have frequent and large fluctuations, and the instability of air pressure will lead to the decrease of control stability.

(3) The gas source must be dry; a damp gas source can cause the actual airflow to decrease (for example, if set at 100 L/min, the actual airflow is 80 L/min). In this case, connect the flow controller or flow meter to a dry gas source and purge for 5-10 minutes (blow out the moisture inside the equipment) to restore normal operation. A small amount of moisture entering the flow meter will not damage the flow controller or flow meter but may affect measurement

accuracy. If you cannot ensure that the gas source is dry, it is recommended to perform the purging operation daily.

## V. Operation and maintenance

### soak time:

As long as the power supply voltage and set signal are stable and the gas supply is not a problem, all TP series products are plug and play. However, for the consideration of measurement accuracy, it is recommended to use the thermal machine after 3-5 minutes.

### Maintenance and calibration checks:

If operated normally, the flow controller itself does not require routine maintenance. We recommend that it be calibrated regularly to determine whether the flow controller is operating within normal technical limits. The maintenance cycle depends on the error range and is determined by the customer.

### Taint and Clean:

According to different contamination conditions, on-site cleaning by the customer is also possible. We recommend using nitrogen or dry compressed air to blow through the flow controller. If the contamination is liquid, such as oil, pure alcohol can be used for cleaning. After cleaning with pure alcohol, please fully open valve 100% and blow with dry compressed air or nitrogen for 15 minutes.

**If the above operations are performed by the customer, please consult local sales and technical services.**

If the flow controller is completely contaminated inside, the internal flow splitter needs to be removed for cleaning. Depending on the contamination, it may need to be returned to the factory for repair.

If the flow controller housing is removed without authorization, the warranty will be invalid

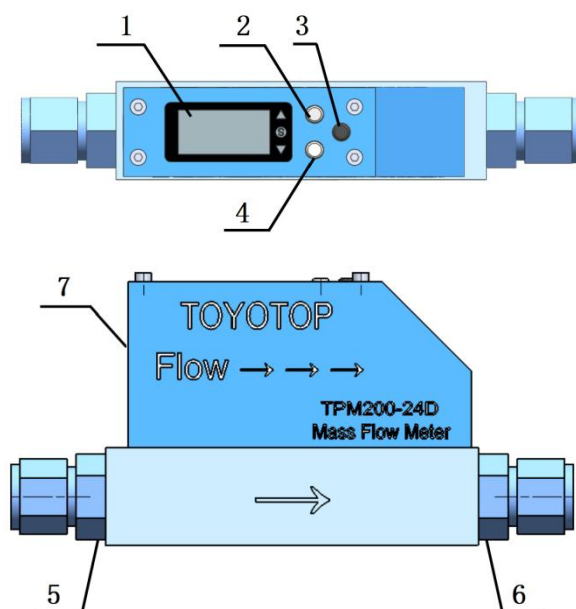
Please use a special tool

→ Before disassembly, ensure that the disassembly environment is clean, otherwise it is easy to cause secondary pollution

After installation and cleaning, please check for leakage.

## Six. TPM screen function

### ■ Product part name



- ◆ 1. Main display  
(traffic value display  
/ Parameter value display)
- ◆ 2. Up button (white  
button 1)
- ◆ 3. Set button (black  
button)
- ◆ 4. Down key (white  
button 2)
- ◆ 5. Air intake int-

erface

- ◆ 6. Air outlet
- ◆ 7. Power supply,  
input and output  
signals, RS485 te-  
rminals

## ■ Parameter setting content

| 1 Level menu | 2 Level menu                              | Three-level menu                                                                              |
|--------------|-------------------------------------------|-----------------------------------------------------------------------------------------------|
| CtrlPar      | SPD (response time)                       | 0/500*/1000/1500/2000 (ms)                                                                    |
|              | VOL (volume measurement standard)         | VOL<br>Default value: 1, parameter range: 0-5 resolution: 0.1                                 |
|              | FU (flow limit)                           | 0%~ 100% FR (L/min) (default value is the rated flow rate of the device FR;<br>Resolution: 1) |
|              | FL (flow limit)                           | 0%~100% FR (L/min)<br>(Default value 0; resolution: 1)                                        |
|              | DF (stiffness width)                      | 0~95% FR (L/min)<br>(Resolution: 1)                                                           |
|              | TC(temperature compensation)              | -10~10 (L/min)<br>(Default value: 0; Resolution: 0.1)                                         |
|              | ZM (cumulative flow power-off reset mode) | ON*/OFF<br>(Off: power off and reset; ON: power off and save the current value)               |
|              | SD (screen orientation reversal)          | Left is positive and RIGHT is negative                                                        |
|              | ZERO (calibration zero)                   | Y/N<br>(Y confirm; N cancel)                                                                  |
| CommPar      | ADDR(stop number)                         | 1*~247                                                                                        |
| RtnFact      | Y/N<br>(Y confirm; N cancel)              | Factory data reset                                                                            |
| AccuClr      | Y/N<br>(Y confirm; N cancel)              | Cumulative flow is zero                                                                       |

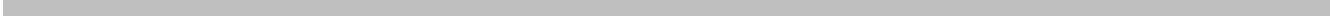
Note 1: There are three operation buttons in total: Set button (black button), set; Up button (white button 1), up flip / increase; Down button (white button 2), down flip / decrease.

2: \* is the default setting value.

3: At the initial moment, the instantaneous flow value and other information are displayed according to the default value. Press Up or Down to switch the instantaneous cumulative display mode on the same screen, and press Set for more than 2s to enter the parameter menu; under any level of menu, press Set for more than 2s to return to the previous level of menu.

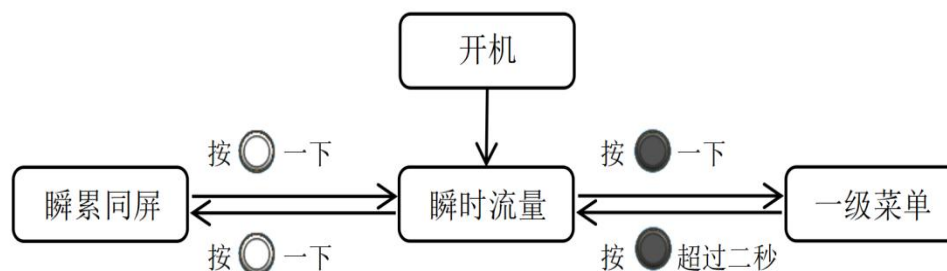
4: The lower limit of flow FL must be less than the upper limit of flow FU.

5: The default home page displays the instantaneous flow rate in the IN mode. LmtUp Upper limit alarm (NORMAL: normal, ALM: alarm), LmtLo Upper limit alarm (NORMAL: normal, ALM: alarm). Click the up or down key to switch to the instantaneous and cumulative flow display mode, where INST represents the instantaneous flow rate and ACCU represents the cumulative flow rate.

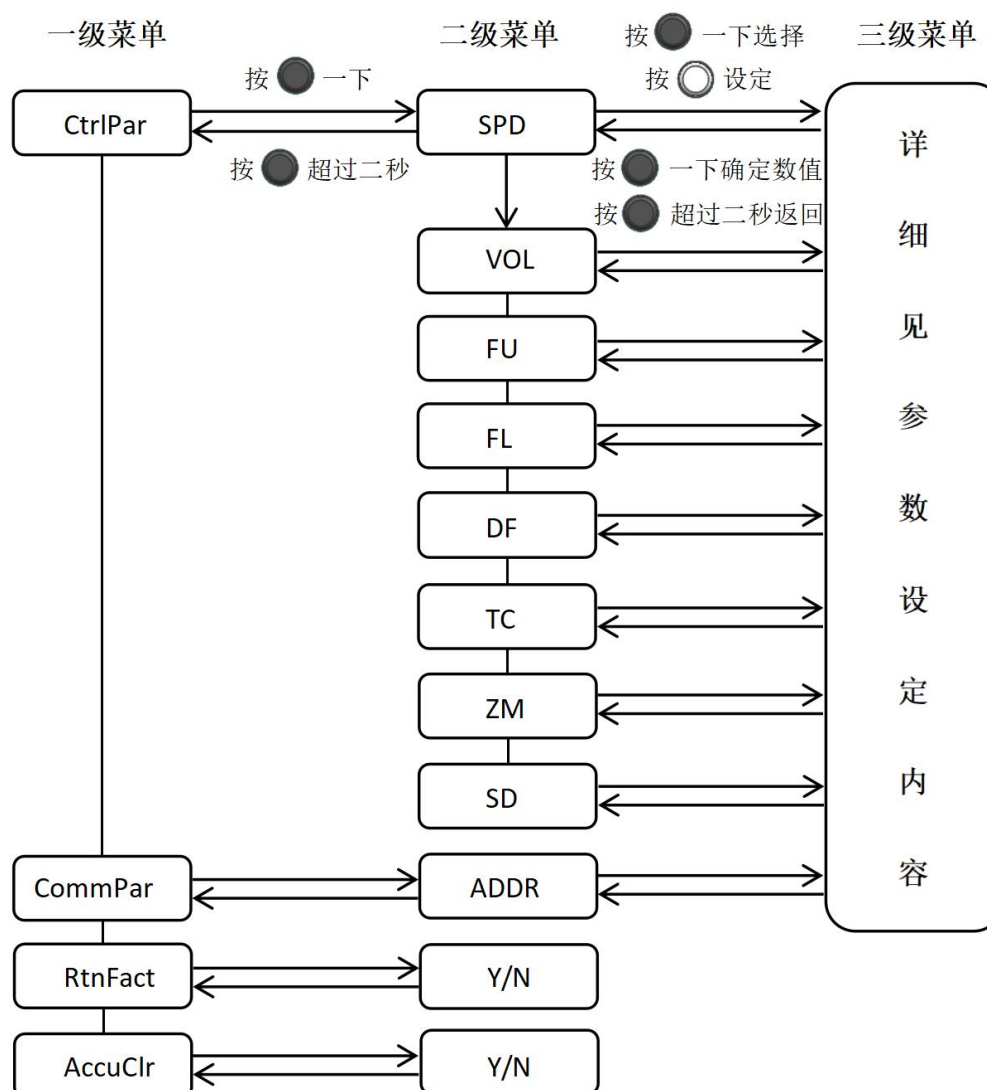


## ■ Parameter setting operation instructions

- To enter the first level menu, press under measurement mode (main page)
  - Press a key to enter the first level menu, and hold down for more than 2 seconds to return to the measurement mode (main page).
- Parameter setting method: When you find the preset or modified parameter,



- Level 2, 3 and 4 menu switching:



## ■ initialize

1. Unit setting: The VOL volume measurement standard of this body can be freely set between 0~ 5 (resolution 0.1). Move the cursor to the secondary menu **>VOL:** , press  Key select VOL and display **\*VOL:** At this point press  Key, which can increase (decrease) the value and display it **1.1atm** (Long press  You can increase or decrease the value continuously). Press  Key saves the set value and displays it **>VOL:** Then the save is successful.

2. Temperature compensation: The TC temperature compensation of this machine can be freely set before -10~ 10 (resolution 0. 1). Move the cursor to the secondary menu **>TC:** , press  The key is selected and TC is displayed **\*TC:** At this point press  Key, which can increase (decrease) the value and display it **0.0L/min** (Long press  You can continuously increase or decrease the value). Press  Key saves the set value and displays it **>TC:** Then the save is successful.

3. Response time setting: This machine provides four SPD response time options of 500\*/1000/1500/2000 (ms). Move the cursor to the secondary menu **>SPD:** , press  The key is selected and SPD is displayed **\*SPD:** At this point press  Key, to increase (decrease) the value, display **500ms** (Long press  You can continuously increase or decrease the value). Press  Key saves the set value and displays it **>SPD:** Then the save is successful.

## ■ Output mode setting

TPM supports three output modes: 0~ 5V output, 4~20MA output, and dual relay dry node output. 1.0~5V output: corresponding to instantaneous flow rate, users cannot change the corresponding value.

2.4~20MA output: corresponding instantaneous flow, users can not change the corresponding value.

3. Dual relay dry node output: on the screen in instantaneous flow display mode or instantaneous cumulative display mode (main page)

The bottom two lines will be displayed **LmtUp:** (Alarm upper limit) and **LmtLo:**

(Alarm lower limit)  instantaneous flow up and down

When the limit alarm  triggered, it is displayed When triggered, it displays

- The three options in the secondary menu are related to the output of the dual relay driver. **>FL:** node: **>FU:** (FU flow upper limit), (FL flow lower limit), **>DF:** (DF delay width).
- The parameter setting method of (FU flow upper limit), (FL flow lower limit) and (DF delay width) is similar to the initial setting. See the initial setting for details.
- (FU flow upper limit), (FL flow lower limit) The flow range L-H is referred to Figure 1.
-  Note! The FU flow upper limit must be greater than the FL flow lower limit, and the DF delay width should also take a proper value before it, otherwise it will cause abnormal alarm, serious injury to personnel and damage to other equipment.

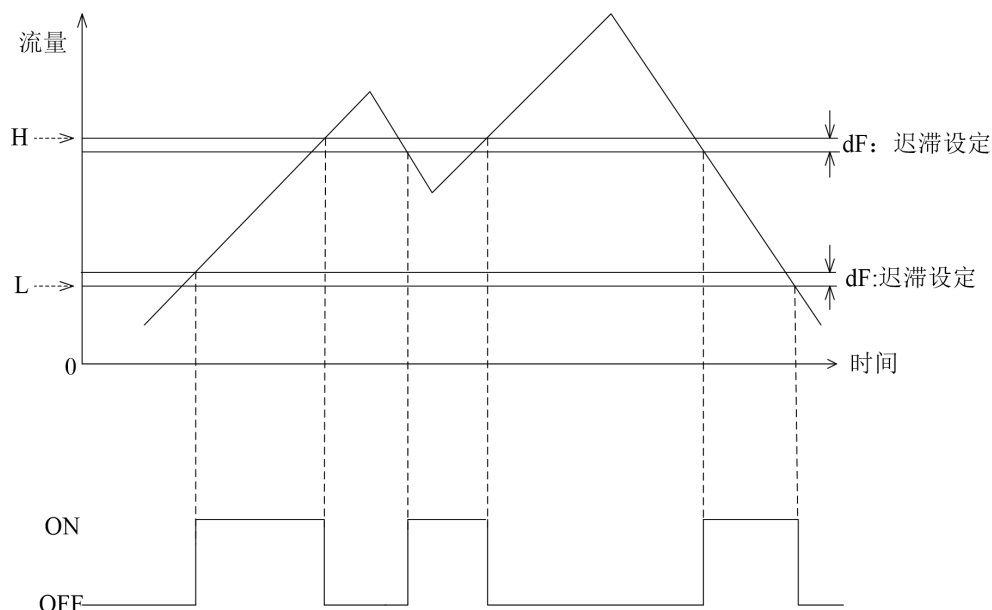


Figure 1 Schematic diagram of output window mode (low level overlimit)

## ■ Cumulative flow power failure reset setting

Select in the secondary menu **>ZM:** (ZM cumulative flow power-off reset

mode), select **ON** perhaps **OFF**. The parameter setting method of ON\*/OFF (ON keeps the current value after power failure, OFF clears the value after power failure) is similar to the initial setting. See the initial setting for details.

## ■ Screen orientation Settings

Select in the secondary menu **>SD:** (SD scr- **LEFT**aps **RIGHT** screen direction reversed), select (LEFT positive, RIGHT negative) The parameter setting method is similar to the initial setting. See the initial setting for details.

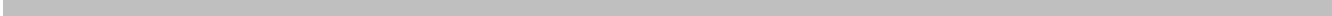
## ■ Equipment communication location setting

The communication position of TPM can be 1\*~247, which was previously freely selected.

1. Select in the primary menu **>CommPar** (ADDR station number), select

**>ADDR:** Change the station number. The parameter setting method is similar to the initial setting, see the initial setting for details.

- ⚠ Note! If you forget the station number, you can use TPM dedicated software to find the location of the device.



## ■ factory data reset

Select in the primary menu **>RtnFact** (Restore factory Settings), select **Y** perhaps **N** Y/N (Y yes, N no).

## ■ Manually reset the accumulated flow

Select in the primary menu **>AccuClr** (Restore factory Settings), select **Y** perhaps **N** Y/N (Y yes, N no).

## 7. RS485 Modbus-RTU communication protocol

This communication protocol is applicable to all TP series devices with RS485 (Mod busRTU)

1. Baud rate 9600bps, format N 81, address is set in the device menu 1~247;

2. Use RS485 (Mod busRTU) communication protocol function code 03H to read, 0x06H to write;

|                              |        |
|------------------------------|--------|
| 1 Location of communications | 1*~247 |
| 2 Communication rate         | 9600   |
| 3 Byte length                | 8      |
| 4 even-odd check             | NONE   |
| 5 stop bit                   | 1      |

### ● Read registers

| Device address | FC | Register address |    | Number of read registers |    | CRC verification |    |
|----------------|----|------------------|----|--------------------------|----|------------------|----|
| 01             | 03 | 10               | 00 | 00                       | 01 | 80               | CA |

- "01": address bit, indicating that the master device selects to communicate with the slave device with address 1.
- "03": Function code, indicating that the operation to be performed by the master device is to read the holding register of the slave device.
- "10 00 ": data bit, indicating the starting address of the register to be read. In this example, the starting address is 0x10 00 , or 4096.
- "0001": data bit, indicating the number of registers to be read. In this example, the number of registers to be read is 0x0001, that is, 1.
- "80 CA": Check bit, which is the cyclic redundancy check (CRC) code calculated based on the content of the message.

Therefore, the message means that the master device (address 1) sends a command to the slave device, asking to read the holding register of the slave device, starting address 4096, and the number of registers to be read is 4. The check bit is used to verify the integrity and accuracy of the message.

After the message is sent successfully, the device returns the message in the following format:

| Device address | FC | Number of data bytes | Two bytes of data |    | CRC verification |    |
|----------------|----|----------------------|-------------------|----|------------------|----|
| 01             | 03 | 02                   | 00                | 00 | 40               | C9 |

### ● Write registers

| Device address | FC | Register address |    | Read-in data |    | CRC verification |    |
|----------------|----|------------------|----|--------------|----|------------------|----|
| 01             | 06 | 10               | 03 | C3           | 50 | 2D               | C6 |

- "01": address bit, indicating that the master device selects to communicate with the slave device with address 1.
- "06": Function code, indicating that the operation to be performed by the

master device is to write into a single register.

8. "1003": data bit, indicating the address of the register to be written. In this example, the address of the register to be written is 0x1003, that is, 4099.

9. "C3 50": data bit, which indicates the value of the register to be written. In this example, the value to be written is 0xC350, that is, 50000.

10. "2D C6": Check bit, which is the cyclic Redundancy Check (CRC) code calculated based on the content of the message.

**Therefore, the message means that the master device (address 1) sends a command to the slave device to write into a single register of the slave device**

The register address is 4099 and the value written to the register is 50000. The check bit is used to verify the integrity and accuracy of the message.

1. **Bold red font in the communication protocol is the internal calibration data. If you need to change it, please consult technical service.**

| Memorizer    | Name                                           | Explain                                                                                                                                                                                                                                                                                                                    | Operate                                                                                                                                                                                                                           |
|--------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1000H        | Instantaneous flow value                       | <p>The selected product range is &gt; 600, X/10<br/> The selected product range is &gt; 60, X/100<br/> The selected product range is &gt; 6, X/1000<br/> The selected product range is less than or equal to 6, X/10000</p> <p><b>Write 0707H to calibrate the flow zero point (make sure to operate without flow)</b></p> | Read only (for example, if the product selection quantity is 100ml, then X/100, that is, the value read from this address is divided by 100, which is the actual instantaneous flow value)                                        |
| 1001H        | Factory data reset                             | <b>Write 5678H to restore factory Settings</b>                                                                                                                                                                                                                                                                             | Read-write                                                                                                                                                                                                                        |
| 1002H        | Device temperature value                       | Read as the device temperature value, X/10,<br><b>Write 1234H to clear the accumulated traffic</b>                                                                                                                                                                                                                         | Read-write                                                                                                                                                                                                                        |
| 1003H        | Set the flow rate                              | <p>The selected product range is more than 600, X*10<br/> The selected product range is &gt; 60, X*100<br/> The selected product range is &gt; 6, X*1000<br/> The selected range of the product is less than or equal to 6, X*10000</p>                                                                                    | Read and write (for example, if the product selection range is 100ml, then X*100, that is, the value written into the address is multiplied by 100. For example, if the flow rate is set to 50 ml, then write 5000 (50*100=5000)。 |
| <b>1006H</b> | <b>The calibration setting allows the lock</b> | <b>Write 5A5AH to unlock 1025H and 1026H</b>                                                                                                                                                                                                                                                                               | <b>Read-write</b>                                                                                                                                                                                                                 |
| 1007H        | Cumulative flow value (low)                    | (upper) * 65536 + (lower) (16-bit unsigned)                                                                                                                                                                                                                                                                                | Read only                                                                                                                                                                                                                         |
| 1008H        | Cumulative flow value (high)                   |                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                   |
| 1009H        | Response time                                  | *500、1000、1500、2000 mS                                                                                                                                                                                                                                                                                                     | Read-write                                                                                                                                                                                                                        |
| <b>100AH</b> | <b>Coefficient compensation K</b>              | <b>*1.00, 0.10~5.00, X/100</b>                                                                                                                                                                                                                                                                                             | <b>Read-write</b>                                                                                                                                                                                                                 |
| <b>100EH</b> | <b>Coefficient compensation</b>                | <b>*0,</b>                                                                                                                                                                                                                                                                                                                 | <b>Read-write</b>                                                                                                                                                                                                                 |

|       |                                               |                                                                                                                                                                                                                                                           |            |
|-------|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
|       | nsation B                                     | The product selection range is more than 600, -100.0~ 100.0 (L/min), X/10 product selection range>60, -10.00~ 10.00 (L/min), X/100 product selection range>6, -1.000~ 1. 000 (L/min), X/1000 product selection range <=6, -0.1000~0. 1000(L/min), X/10000 |            |
| 100FH | Power-off flow preservation mode              | *1,0 power off does not save, 1 power off saves                                                                                                                                                                                                           | Read-write |
| 1011H | Device address                                | *1, 1~147                                                                                                                                                                                                                                                 | Read-write |
| 1012H | Traffic control mode selection                | *0, 0 communication, 1 voltage, 2 current                                                                                                                                                                                                                 | Read-write |
| 1025H | Control the rate of ascent                    | *15,1~100,1 fastest, 100 slowest                                                                                                                                                                                                                          | Read-write |
| 1026H | Control the proportion of the speed reduction | *20,1~100,1 fastest, 100 slowest                                                                                                                                                                                                                          | Read-write |

## EtherCAT Communication protocol

1. **Bold red font in the communication protocol is internal calibration data. If you need to change it, please consult technical service.**

| Remote signal quantity (feedback value) |                                               | Remarks                                                                                                                                                                                                    |                                                                                                                                                                                                              |
|-----------------------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RD_FLOW_INST                            | Instantaneous delivery                        | The selected product range is >600, X/10<br>The selected product range is >60, X/100<br>The selected product range is >6, X/1000<br>The selected product range is less than or equal to 6, X/10000         | For example, if the product selection range is 1000ml, then X/10, that is, the value read at this address divided by 10, that is, the actual instantaneous flow value                                        |
| RD_FLOW_ADC                             | Zero point physical values                    | The zero point range is 6300 ± 200                                                                                                                                                                         | Used for zero calibration                                                                                                                                                                                    |
| RD_BOARD_TEMP                           | Device temperature value                      | Read as the device temperature value, X/10                                                                                                                                                                 |                                                                                                                                                                                                              |
| RD_FLOW_CALIB                           | Traffic calibration value                     | Read the calibrated range                                                                                                                                                                                  |                                                                                                                                                                                                              |
| RD_COMM_CTRV                            | Set the flow rate                             | The selected product range is >600, X*10<br>The selected product range is > 60, X*100<br>The selected product range is >6, X*1000<br>The selected range of the product is less than or equal to 6, X*10000 | For example, if the product selection range is 1000ml, then X*10, that is, the value written into the address is multiplied by 10. For example, if the flow rate is set to 50ml, then write 500 (50*10=500). |
| RD_SET_ENB                              | The calibration setting allows the lock       | Displays the current calibration setting that allows the lock value                                                                                                                                        |                                                                                                                                                                                                              |
| RD_CTRL_RISE                            | Control the rate of ascent                    | 1-100, 1 fastest, 100 slowest                                                                                                                                                                              |                                                                                                                                                                                                              |
| RD_CTRL_DEC                             | Control the proportion of the speed reduction | 1-100, 1 fastest, 100 slowest                                                                                                                                                                              |                                                                                                                                                                                                              |
| RD_FLOW_ACC                             | Cumulative flow value                         | Cumulative flow does not need to be converted                                                                                                                                                              |                                                                                                                                                                                                              |

| Remote adjustment (set value) |                   | Remarks                                                                                                                         |                                                                                      |
|-------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| WR_COMM_CTRV                  | Set the flow rate | The selected range of the product is >600, X*10<br>The selected product range is > 60, X*100<br>The selected product range is > | For example, if the product selection range is 1000ml, then X*10, that is, the value |

|              |                                         |                                                                                                                                                                |                                                                                                                                |
|--------------|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
|              |                                         | <p>6, X*1000</p> <p>The selected product range is less than or equal to 6, X*10000</p>                                                                         | <p>written into the address is multiplied by 10. For example, if the flow rate is set to 50ml, then write 500 (50*10=500).</p> |
| WR_SET_ENB   | The calibration setting allows the lock | <p>Enter 15420 to unlock the up/down speed. Enter 0 to lock (change)</p> <p>After that, be sure to lock it to prevent data changes caused by misoperation)</p> |                                                                                                                                |
| WR_CTRL_RISE | Lift velocity                           | 1-100,1 fastest, 100 slowest                                                                                                                                   |                                                                                                                                |
| WR_CTRL_DEC  | Descent speed                           | 1-100,1 is the fastest, 100 is the slowest                                                                                                                     |                                                                                                                                |
| WR_FLOW_CLR  | The cumulative flow is zero             | Enter 4660 and the cumulative flow is cleared                                                                                                                  |                                                                                                                                |
| WR_RST_FACT  | Factory data reset                      | Enter 22136 and restore factory Settings                                                                                                                       |                                                                                                                                |

## 9. TP series user software usage instructions

### ■ preparatory process

1. Use the RS485 converter to connect the device to the computer.
2. Unzip the "Tianwu Measurement and Control TP Series Dedicated Software," and open the "FlowMeter.exe" application. If the software displays an error upon opening, (as shown in Figure 1) right-click on "FlowMeter.exe," open "Properties," click "Compatibility," and select "Change High DPI Settings." Check "Replace High DPI Zoom Behavior." Choose "System (Enhanced)," and confirm. (as shown in Figure 2)

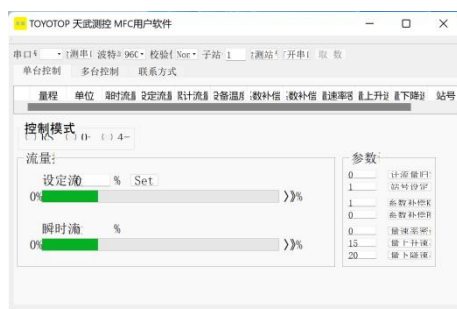


Figure 1 (abnormal display)

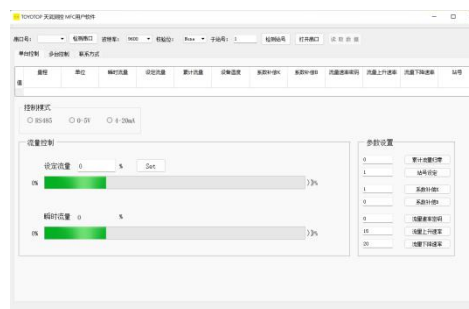
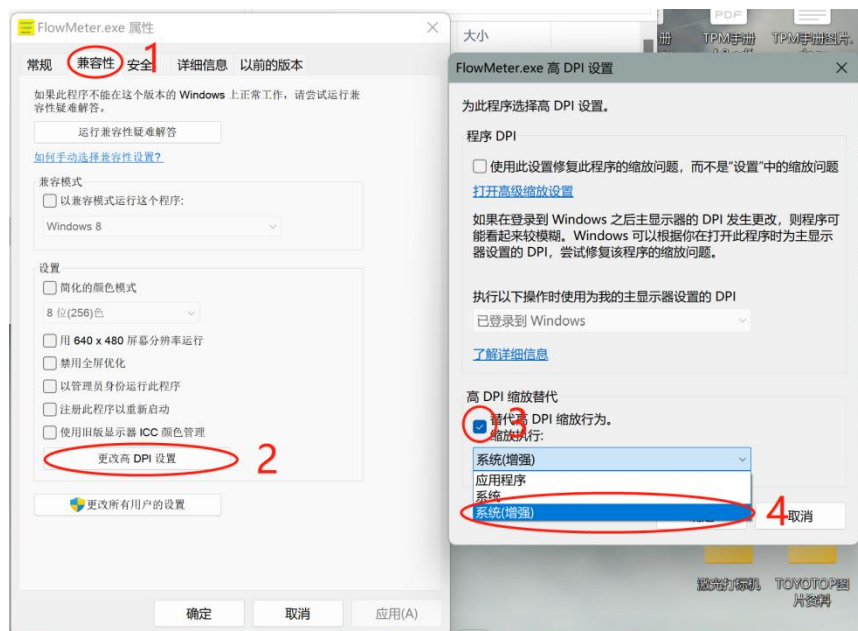


Figure 2 (normal display)

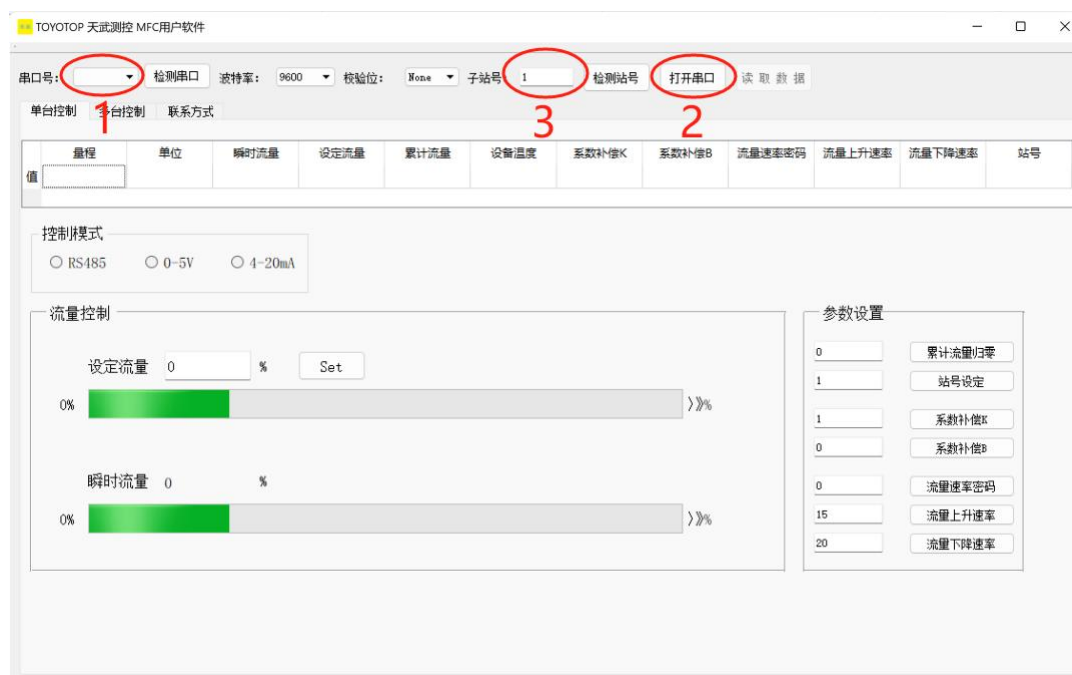


(Preparation process diagram)

## ■ direction for use

### 1. Connect the flow meter

1. **Serial port Settings:** Select serial port- "Open serial port" -Select station number (if you cannot find the serial port and station number, you can also use the detection function: Click "Test serial port" - "Open serial port" - "Test station number")



2. Read data: Click "Read data" (red represents abnormal communication, as shown in Figure 4; green represents normal communication, as shown in Figure 3).

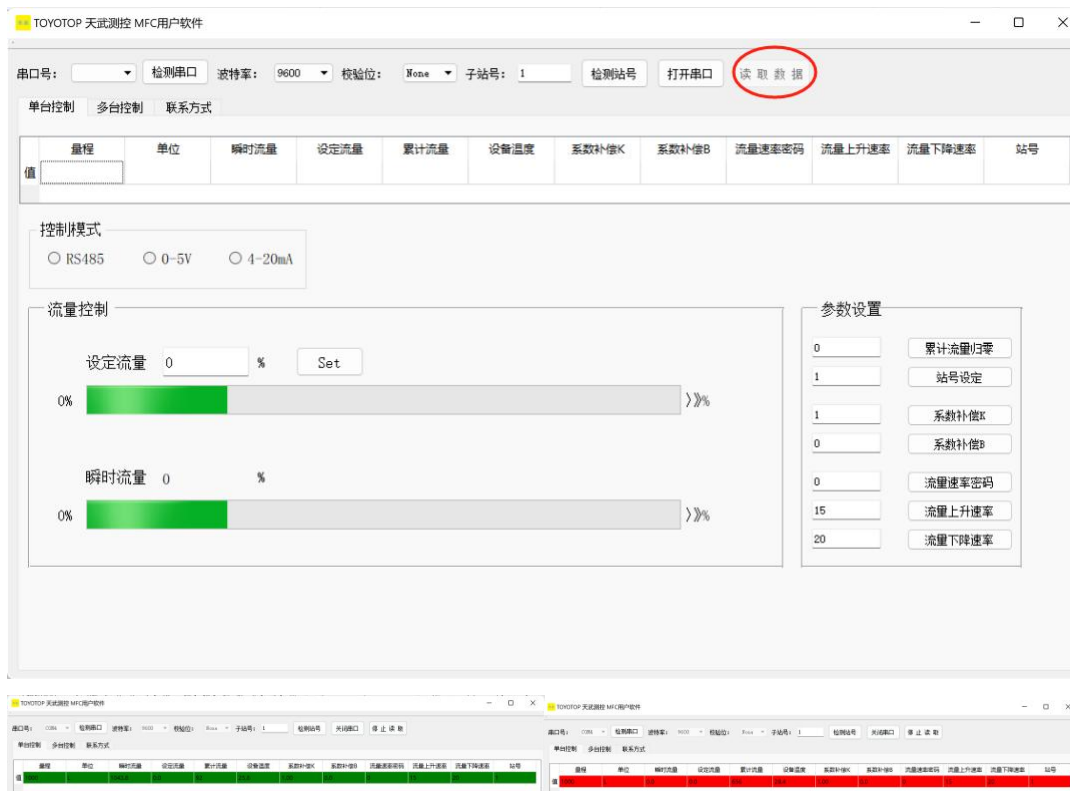
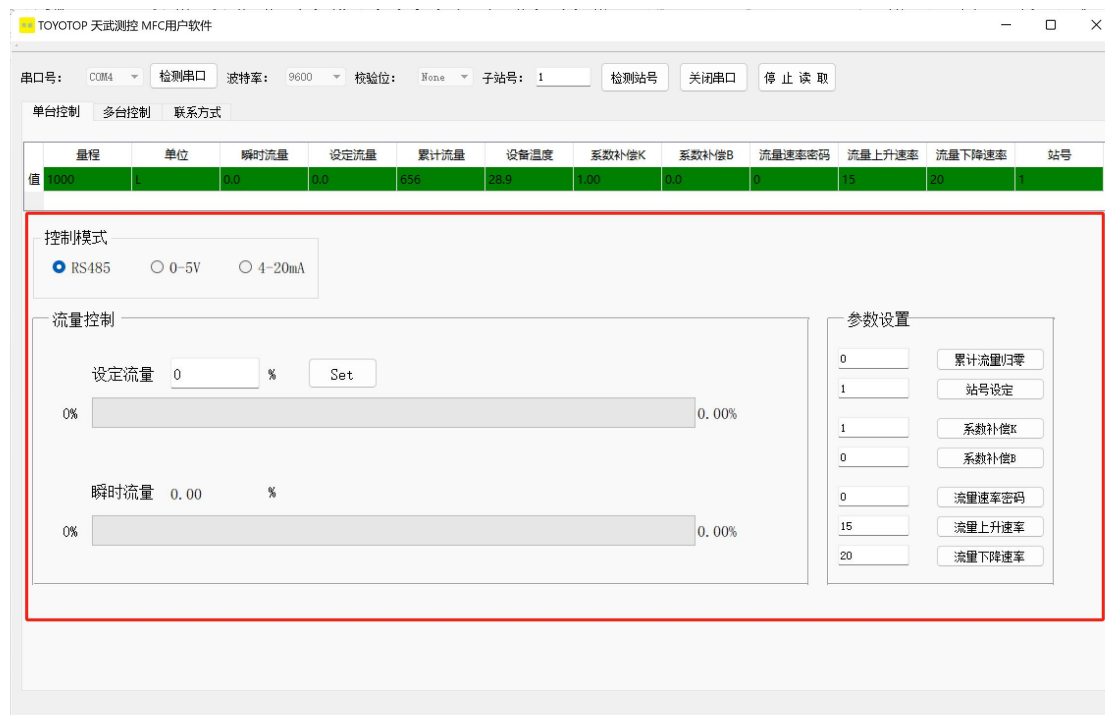


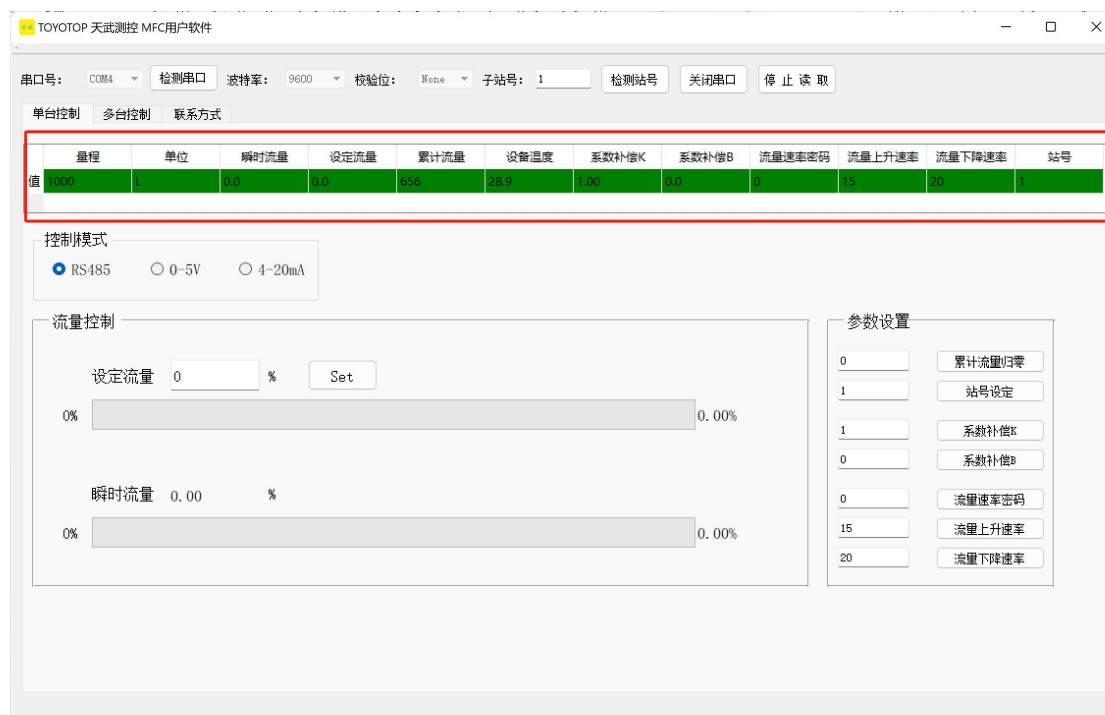
Figure 3 (green normal)

Figure 4 (red anomaly)

3. This area is the user area, where users can set parameters.

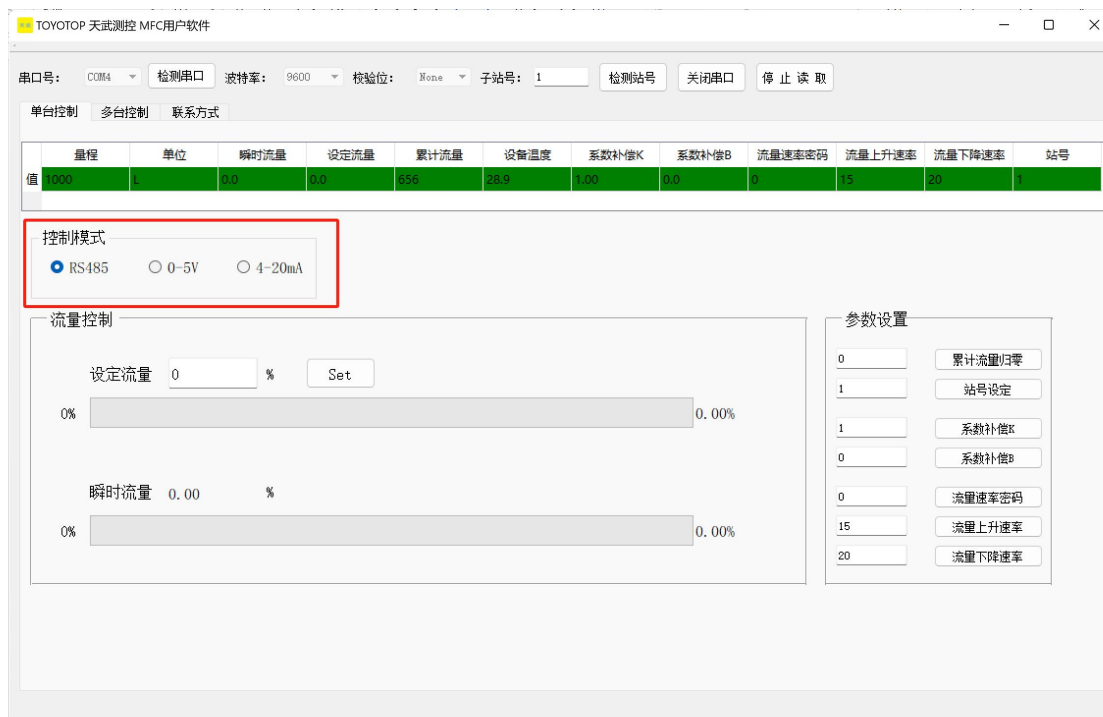


4. This area is the display area where the set parameters are displayed.



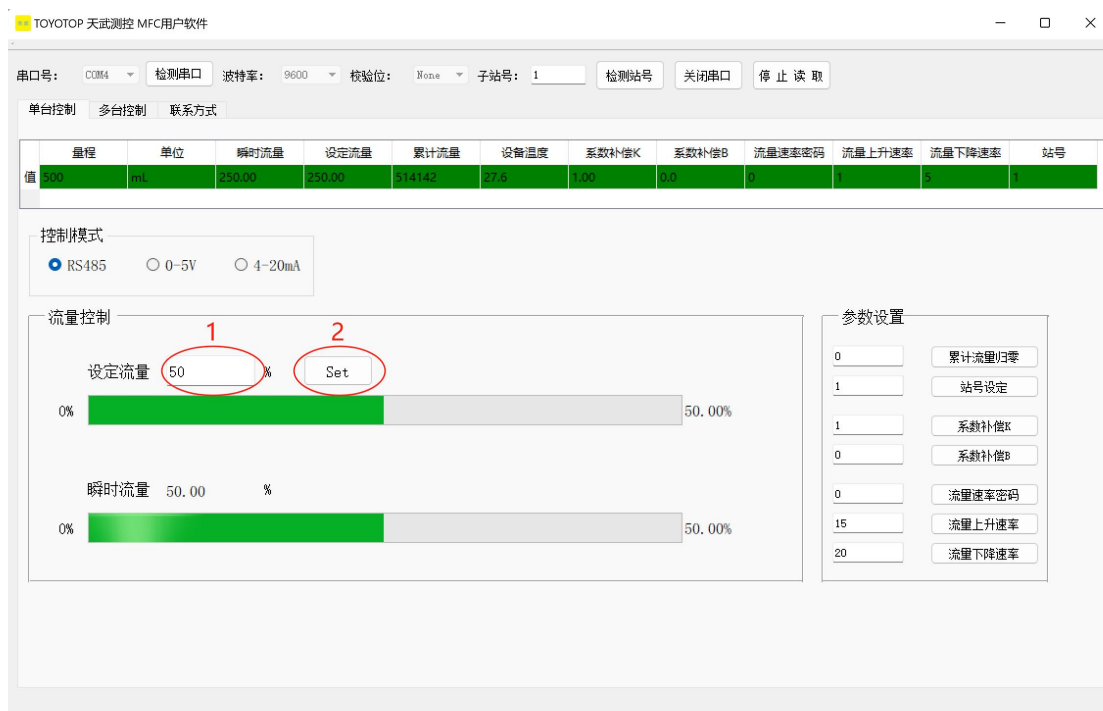
## ■ Use diagrams quickly

1. Determine the control mode of the flowmeter: there are three control modes in total: RS485 control, 0-5V control, and 4-20mA control. Only in the "RS485" control mode can the user software set the "flow control". (This function is both "read" and "set")

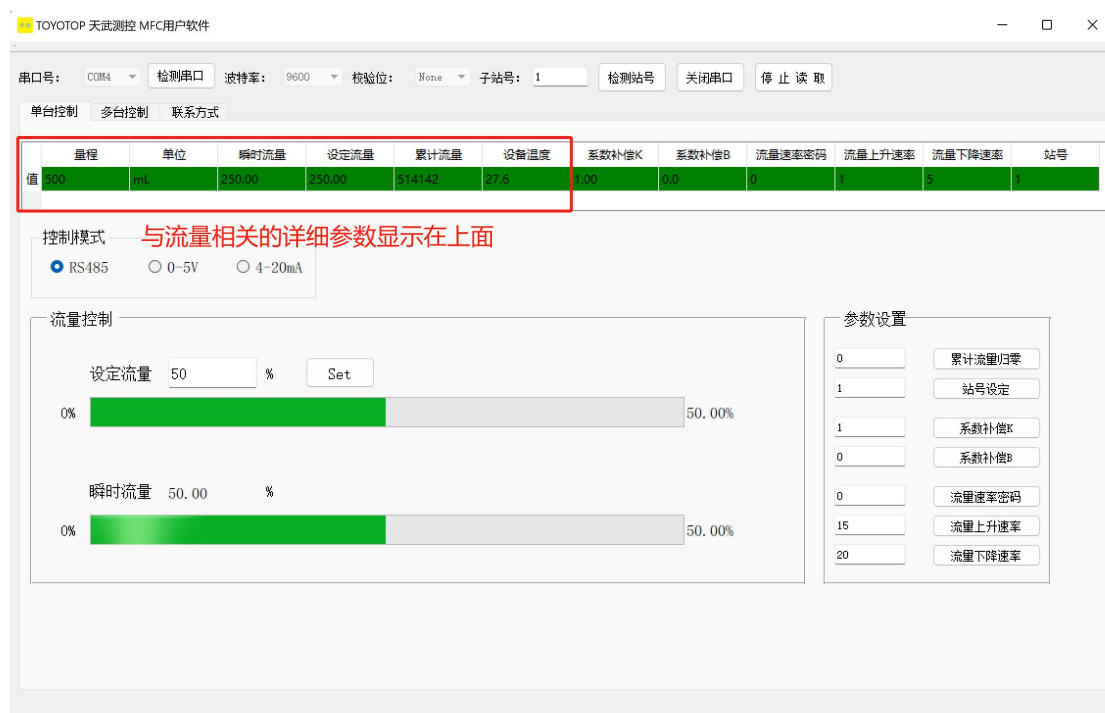
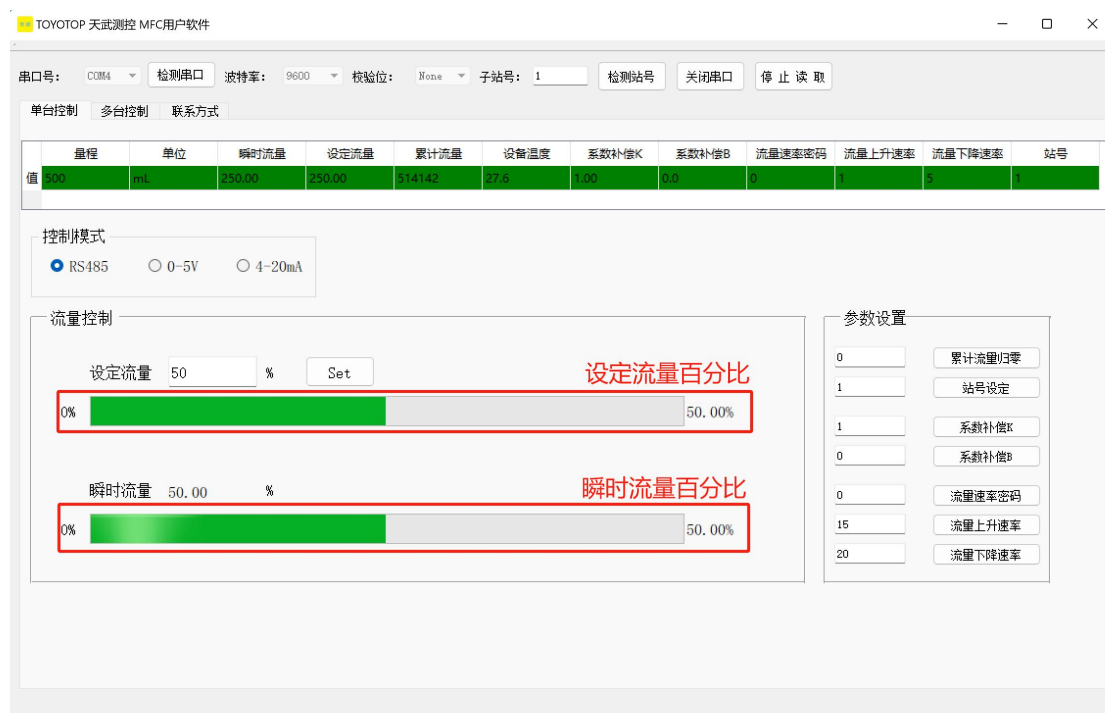


2. Set flow: Both "set flow" and "instantaneous flow" are set and displayed as percentages. In "set flow"

Enter the value and click "SET" to set. (If the setting is successful and the control is successful, the following "Instantaneous flow rate" will change.)



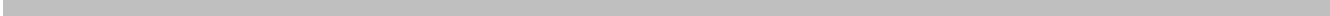
## 3. Check gas flow data:



4.Parameter Settings page Introduction: Parameter Settings are divided into two parts. One part does not require password input, and the other part requires password input as shown in the figure

5.Function introduction of parameter setting page:

| Parameter name                | Explain                                                                                                          |
|-------------------------------|------------------------------------------------------------------------------------------------------------------|
| Cumulative flow is zero       | Enter "1234" to reset the cumulative traffic                                                                     |
| Station number setting        | Set the station number of the product                                                                            |
| Coefficient co-compensation K | $Y = KX + B$ Set the value of K If set to 1.2, the flow will be multiplied by 1.2 times                          |
| Coefficient co-compensation B | $Y = KX + B$ Set the value of B If set to 1, the flow will be added by 1                                         |
| Traffic rate code             | Enter "5A5A" for the "Traffic Rate Password" to unlock the "Traffic Rise Rate" and "Traffic Drop Rate" Settings. |
| Rate of increase in traffic   | Change the rate of increase of control, range 1 to 100.1 is fastest and 100 is slowest                           |
| Rate of decline in traffic    | Change the rate at which control decreases, from 1 to 100.1 is the fastest and 100 is the slowest                |



## Multiple controls

1. Multi-control page introduction: Click "multi-control" to enter this page. The "multi-control" function can use up to 12 devices at the same time. The page is divided into three parts, "display parameters", "set parameters", and "enable devices".



2. Connect the device: "Select station number" - "device enabled" (red represents abnormal communication; green represents normal communication, as shown in Figure 5. Abnormal communication requires checking whether the serial port and station number are correct, and whether the station number conflicts)



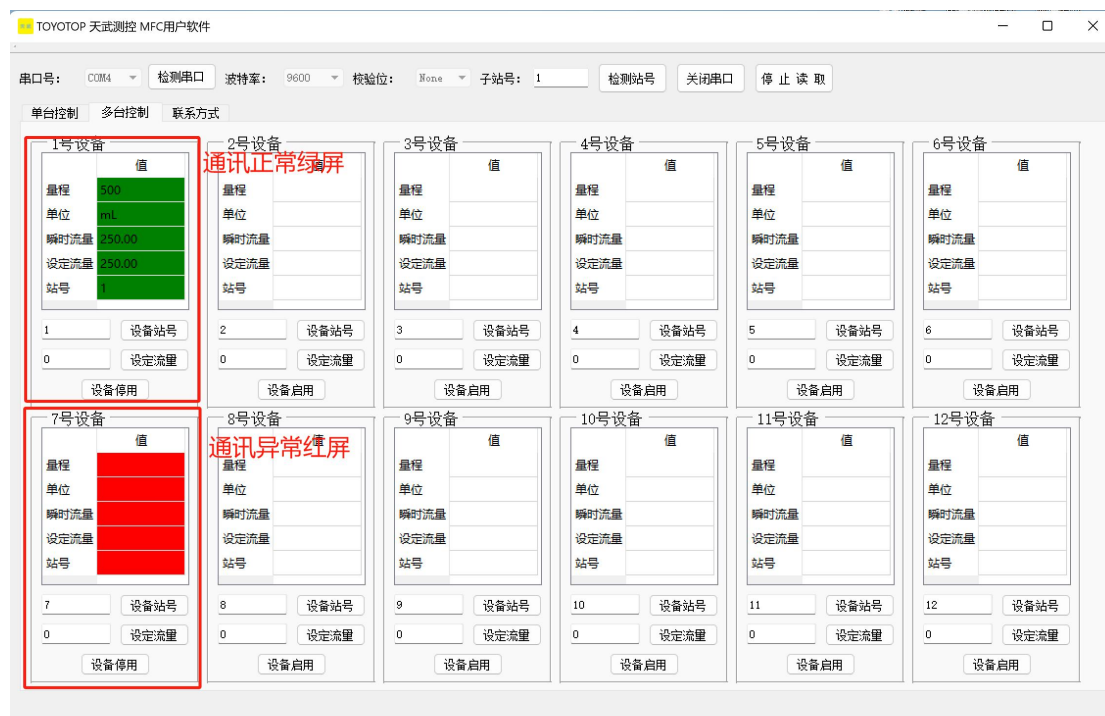


Figure 5 (green screen for normal communication; red screen for abnormal communication)

3. Set flow: The "set flow" under multiple controls is according to the real flow. For example, for a device with a range of 500ml, the "set flow" input is 250, which means setting 250ml.



**pay attention to!**

The more devices enabled under multiple controls, the slower the communication speed. In order to ensure the use experience, do not enable too many unused devices.

## X. Notes

1. The mass flow controller/flowmeter has certain requirements for the stability of the air source. The air pressure should not exceed the working range, and the air pressure should not have a large jump (such as 0.6MPa, suddenly jump to 0.3MPa)
2. This product belongs to the thermal gas mass flow controller/flowmeter, and has strict requirements for the installation direction. The product installed horizontally cannot be directly installed vertically, which will lead to changes in the control linearity and affect the measurement accuracy. Users should make clear the installation direction before selection.
3. The mass flow controller/flowmeter has certain requirements for the dryness of the gas source. If moisture enters the product and cannot be discharged, the measurement accuracy will decrease. With the accumulation of moisture, the overall gas flow will decrease (for example, set 100L/min, actual gas flow 80L/min).
4. The mass flow controller or flow meter has specific requirements for the effective diameter of the air pipe. If the maximum range is not reached despite appropriate air pressure, check if the air source and pipeline diameter meet the requirements. Many connectors have a very small effective diameter (for example, the air pipe switch valve, self-locking air compressor connector, or air compressor connector). The air pipe may appear to have a 12mm diameter, but its actual inner diameter is only 6mm.
5. The mass flow controller/flow meter should be installed in a position free of frequent vibration, which may cause the air flow to be unstable for a moment.
6. Without technical guidance from the manufacturer, removing the shell and valve is equivalent to giving up warranty.
7. This product has adaptive compensation for the change of temperature. It automatically compensates for the internal temperature to reduce the temperature drift and zero drift caused by temperature.
8. The quality flow controller of RS485 version can freely switch between analog control and communication control (analog control: 0-5V/0-10V/4-20ma; communication control: RS485 control) by connecting to the upper computer software
9. The RS485 version and the network cable version of the mass flow controller can freely adjust the reaction speed and increase/decrease the reaction time of the control gas by connecting to the upper computer software.

## XI. Fault diagnosis and handling

In the following table, some fault symptoms, possible causes and measures to be taken are listed. If the cause of the fault and the measures to be taken cannot be determined, please contact the local sales or technical service department.

**Note: Items marked with bold \* must be repaired by professional maintenance personnel**

| Order number | Problem statement                                                | Possible cause of failure                                                                                        | Processing method                                                                                                                  |
|--------------|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| 1            | After the set value is set, no air flows through                 | 1. The gas source is not open and the gas line is not open                                                       | Connect the air source and open the air line                                                                                       |
|              |                                                                  | 2. No set signal                                                                                                 | Check that the set value is correctly entered                                                                                      |
|              |                                                                  | 1. The set value wiring is incorrect                                                                             | Check the set value wiring (set value input, feedback value output)                                                                |
|              |                                                                  | 2. Inflow pressure is too high/low, and the pressure difference between inlet and outlet exceeds the rated value | Reduce/increase the input pressure appropriately, and reduce/increase the pressure difference                                      |
|              |                                                                  | 3. The filter screen is clogged                                                                                  | <b>* Replace the filter</b>                                                                                                        |
|              |                                                                  | 4. The regulating valve is faulty                                                                                | <b>Check whether the valve wire package is broken and repair the control valve</b>                                                 |
| 2            | If the machine is not ventilated, the flow detection is abnormal | 5. fault                                                                                                         | <b>* Repair circuit boards</b>                                                                                                     |
|              |                                                                  | 1. The regulating valve leaks air                                                                                | Power off, check whether the control valve leaks air                                                                               |
|              |                                                                  | 2. The installation direction is incorrect                                                                       | Check whether the installation direction is correct (the equipment installed horizontally cannot be directly installed vertically) |
|              |                                                                  | 3. wiring error                                                                                                  | Check wiring                                                                                                                       |
|              |                                                                  | 4. The inlet pressure is too high, and the pressure difference between the inlet and                             | Reduce the input pressure appropriately to reduce the pressure difference                                                          |

|   |                                                                |                                                                                                                     |                                                                                    |
|---|----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
|   |                                                                | outlet exceeds the rated value                                                                                      |                                                                                    |
|   |                                                                | 5. fault                                                                                                            | <b>* Repair circuit boards</b>                                                     |
| 3 | When the valve is closed, there is still a large flow of water | 1. The inlet pressure is too high, and the pressure difference between the inlet and outlet exceeds the rated value | Reduce the input pressure appropriately to reduce the pressure difference          |
|   |                                                                | 2. The set value wiring is incorrect                                                                                | Check the set value wiring                                                         |
|   |                                                                | 3. The set value control mode is incorrect                                                                          | Select the correct set point control mode (Communication control / 0-5V / 4-20 ma) |
|   |                                                                | 4. Pollution of control valve                                                                                       | <b>* Clean the valve and replace the seal</b>                                      |
|   |                                                                | 5. The regulating valve is faulty                                                                                   | <b>* Repair the control valve</b>                                                  |

|   |                                                                   |                                                                                                                                     |                                                                                                                                                                                                        |
|---|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4 | The flow display cannot reach the full scale value                | 1. The air pressure is below the quota                                                                                              | Increase the inlet pressure                                                                                                                                                                            |
|   |                                                                   | 2. The internal resistance of the gas source is too high                                                                            | Reduce the internal resistance of the gas source (when the flow rate is large, pay attention to open the valve, add thick pipe, and even parallel the gas cylinder to improve the gas supply capacity) |
|   |                                                                   | 3. The set value is incorrect                                                                                                       | Check whether the set value is correct                                                                                                                                                                 |
|   |                                                                   | 4. Pollution of control valve                                                                                                       | <b>* Clean the valve and replace the seal</b>                                                                                                                                                          |
|   |                                                                   | 5. The regulating valve is faulty                                                                                                   | <b>* Repair the control valve</b>                                                                                                                                                                      |
|   |                                                                   | 6. fault                                                                                                                            | <b>* Repair circuit boards</b>                                                                                                                                                                         |
| 5 | The airflow control is unstable and has large fluctuations        | 1. The intake air pressure exceeds the rated value or is unstable                                                                   | Check the inlet air pressure and stabilize the inlet air pressure                                                                                                                                      |
|   |                                                                   | 2. The internal resistance of the gas source is too high                                                                            | Reduce the internal resistance of the gas source (when the flow rate is large, pay attention to open the valve, thick pipe, and even parallel the gas cylinder to improve the gas supply capacity)     |
|   |                                                                   | 3. Pollution of control valve                                                                                                       | <b>* Clean the valve and replace the seal</b>                                                                                                                                                          |
|   |                                                                   | 4. The regulating valve is faulty                                                                                                   | <b>* Repair the control valve</b>                                                                                                                                                                      |
|   |                                                                   | 5. fault                                                                                                                            | <b>* Repair circuit board</b>                                                                                                                                                                          |
| 6 | The flow controller is disturbed when using high frequency source | 1. There is a problem with the connection of the ground wire and neutral wire in the power supply system or the grounding is faulty | Check the grounding system. The PE earth cannot be connected to the neutral line                                                                                                                       |
|   |                                                                   | 2. Signal reference end connection problem                                                                                          | Check the signal cable                                                                                                                                                                                 |

|   |                                                                                 |                                                                               |                                                                                                                                                                                                                                                                      |
|---|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   |                                                                                 | 3. Spatial interference                                                       | Proper shielding, away from the source of interference, choose shielding lines                                                                                                                                                                                       |
| 7 | Actual flow is not consistent with displayed flow                               | 1. The display range or unit does not match the controller                    | The display value and unit are converted according to the communication protocol                                                                                                                                                                                     |
|   |                                                                                 | 2. The controller channel is contaminated, causing the flow accuracy to shift | <b>* Clean the controller and recalibrate it</b>                                                                                                                                                                                                                     |
|   |                                                                                 | 3. The zero point of the flowmeter has a large deviation and is unstable      | <b>Replace the sensor and repair the circuit</b>                                                                                                                                                                                                                     |
| 8 | A large air flow passes through the channel, and the output has no flow display | 1. Controller contamination, sensor blockage                                  | <b>* Repair and replace the sensor. If there is dust in the air source, a filter should be installed in front of the channel. If special gases such as silane are used, attention should be paid to the sealing of the pipeline and the drying of the air source</b> |
|   |                                                                                 | 2. fault                                                                      | <b>* Repair circuit board</b>                                                                                                                                                                                                                                        |

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