# User Manual

## Miniature Turbine Flowmeter

U-002MLF-EN1

## Preface

- Thank you for purchasing our product.
- This manual is about the various functions of the product, wiring methods, setting methods, operating methods, troubleshooting methods, etc.
- Please read this manual carefully before operation, use this product correctly to avoid unnecessary losses due to incorrect operation.
- After you finish reading, please keep it in a place where it can be easily accessed at any time for reference during operation.

**Note**

- Modification of this manual's contents will not be notified as a result of some factors, such as function upgrading.
- We try our best to guarantee that the manual content is accurate, if you find something wrong or incorrect, please contact us.
- The content of this manual is strictly prohibited from reprinting or copying.

**Version**

U-002MLF-EN1

## Safety Precautions

For the safe operation of this product, please strictly follow the outlined safety precautions.

**About this manual**

- Please ensure the instrument operators have a careful reading of this manual.
- Prior to operation, please study this manual in detail to ensure a thorough comprehension of the device's functionality.
- This manual only describes the product's functions. The responsibility as to the device 's suitability for any specific purpose lies solely in the operator.

**Precautions for product protection, safety, and modification**

- For your safety and the normal operation of the product and its controlling systems, the guidelines and precautions specified in this manual are supposed to be fully observed. Operating the instrument in ways not specified in this manual may compromise its protective features. Our company shall not be liable for any malfunctions or accidents resulting from non-compliance with the precautions described.
- When equipped the product and its controlling systems with lightning protection or separate safety protection circuits, it needs to be implemented by other devices.
- If you need to replace components or fittings of the product, please use the model specified by the company.
- This product is not designed for use in systems directly related to personal safety, such as nuclear power facilities, radioactive equipment, railway systems, aviation equipment, marine equipment, and medical equipment. If applied, it is the user's responsibility to implement additional equipment or systems to ensure personal safety.
- Do not modify this product.
- The following safety symbols are used in this manual:

Hazard: Failure to take appropriate precautions may result in serious personal injury, product damage, or major property loss.

Warning: Pay special attention to critical information related to the product or specific sections of this user manual.

- Confirm whether the supply voltage is consistent with the rated voltage before operation.
- Do not use the instrument in a flammable and combustible or steam area.
- To prevent electric shock and operation errors, ensure proper grounding protection is in place.
- Thunder prevention engineering facilities must be well managed: the shared grounding network shall be grounded at the correct electric level, shielded, with wires properly routed, and an SPD surge protector applied as needed.
- Some internal components may carry high voltage. To avoid the risk of electric shock, do not open the front square panel unless it is being handled by trained personnel or maintenance staff authorized by our company.
- To avoid electric shock, disconnect the power before performing any checks.
- Check the condition of the terminal screws regularly. If loose, please tighten them before use.
- Unauthorized disassembly, modification, or repair of the product is not allowed, as it may lead to malfunctions, electric shock, or fire hazards.
- Wipe the product with a dry cotton cloth. Do not use alcohol, benzine, or other organic solvents, and avoid exposing the product to any liquids. If the product falls into the water, please cut off the power immediately to prevent leakage, electric shock, or fire hazards.

- Please check the grounding protection regularly. Do not operate the product if you think that the protection, such as grounding protection and fuses, is inadequate.
- Ventilation holes on the product housing must be kept clear to avoid malfunctions due to high temperatures, abnormal operation, shortened life, and fire.
- Please strictly follow the instructions in this manual; failure to do so may damage the product's protective devices.

- Do not use the instrument if it is found damaged or deformed upon opening the package.
- Prevent dust, wire end, iron fines, or other objects from entering the instrument during installation, as this may cause abnormal operation or failure.
- During operation, to modify the configuration, signal output, startup, stop, and operation safety shall be fully considered. Improper operation may lead to failure and even destruction of the instrument and control equipment.
- Each part of the instrument has a certain service life, which must be maintained and repaired on a regular basis for long-term use.
- If the product comes to the end of its service life, it should be disposed of as industrial waste as a way of environmental protection.
- Disconnect the instrument when it is not in use.
- If you find smoke from the product, smell odor, abnormal noise, etc., please turn off the power switch immediately and contact the company in time.

## Disclaimer

- The company does not make any guarantees for the terms beyond the scope of this product warranty.
- This company is not responsible for damage to the instrument, loss of parts, or unpredictable damage caused directly or indirectly by improper operation of the user.

| No. | Items | Quantity | Note |
|---|---|---|---|
| 1 | Miniature Turbine Flowmeter | 1 | |
| 2 | 5-pin Aviation Cable | 1 | |
| 3 | User Manual | 1 | |
| 4 | Certificate | 1 | |

After opening the box, please confirm the scope of delivery before starting the operation. If you find that the model and quantity are incorrect or there is physical damage to the product's appearance, please contact us.

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# 1 Introduction

## 1.1 Overview

The miniature turbine flowmeter features a simple structure, high accuracy, and ease of installation, maintenance, and operation. It enables real-time monitoring of both fluid flow and temperature within pipelines. The device supports flow and temperature outputs via (4–20) mA signals or RS485 communication, as well as alarm switch outputs. It also adopts an OLED display for real-time visualization of flow and temperature, providing an integrated monitoring solution for pipeline systems. It is widely used in industries such as petrochemicals, electric power, metallurgy, steel manufacturing, papermaking, food processing, water treatment, and battery production.

## 1.2 Measuring Principle

Inside the flowmeter's internal pipeline is a small magnetic impeller. When fluid passes through the pipeline, it strikes the impeller blades, causing the impeller to rotate. The angular velocity of the rotating impeller is proportional to the fluid flow rate. As the impeller spins, it triggers the Hall-effect sensor to generate a pulse frequency proportional to the flow. The transmitter converts this pulse frequency into an electrical signal. This signal is then transmitted to the display unit, which shows both the instantaneous and total flow rates of the fluid.

## 1.3 Features

- Integrated temperature and flow sensor for simultaneous monitoring of flow rate and temperature in the pipeline.
- Combined digital communication and analog signal output.
- Supports intelligent display and alarm contact output for both flow and temperature.
- Self-luminous OLED display with sharp and clear visuals.
- Separate design of the flowmeter's electronics and base for easy component replacement and maintenance.
- The flowmeter’s panel can be rotated 180° after removing four screws, allowing flexible adjustment of the display and cable outlet direction.
- 304 stainless steel base and aluminum alloy housing for anti-scaling and corrosion resistance.
- IP65-rated enclosure for use in harsh environments.

# 2 Technical Parameters

Table 1

| | | | | | |
|---|---|---|---|---|---|
| **Input** | | | | | |
| Measured variables | Flow velocity; temperature | | | | |
| Nominal diameter&flow range | Nominal diameter | DN10 | DN15 | DN20 | DN25 |
| | Flow range (L/min) | 3~20 | 10~100 | 12~120 | 16~160 |
| Temperature range | 0℃~100℃ | | | | |
| **Output** | | | | | |
| Transmitter output | Flow/temperature (4~20) mA, load resistance ≤500Ω | | | | |
| Alarm output | Flow/temperature alarm, PNP alarm contact, contact capacity: 24V/50mA | | | | |
| Communication | RS485 interface, MODBUS-RTU | | | | |
| **Electrical parameters** | | | | | |
| Power supply | 24VDC | | | | |
| Power consumption | ＜3W | | | | |
| Electrical interface | M12*1.5 aviation plug | | | | |
| **Performance parameters** | | | | | |
| Accuracy | Flow rate: 1.5 levels<br>Temperature: ±1℃ | | | | |
| Insulation resistance | 50MΩ at 100VDC | | | | |
| **Process conditions** | | | | | |
| Media | Liquid (water or water-soluble liquid such as ethylene glycol) | | | | |
| Viscosity | ≤68cst | | | | |
| Temperature | 0℃~100℃ | | | | |
| Pressure | See table 2 | | | | |
| **Environmental conditions** | | | | | |
| Environmental conditions | Temperature: -20℃~85℃; Humidity: <95%RH | | | | |
| Protection level | IP65 | | | | |

# 3 Structure and Dimensions

## 3.1 Dimensions

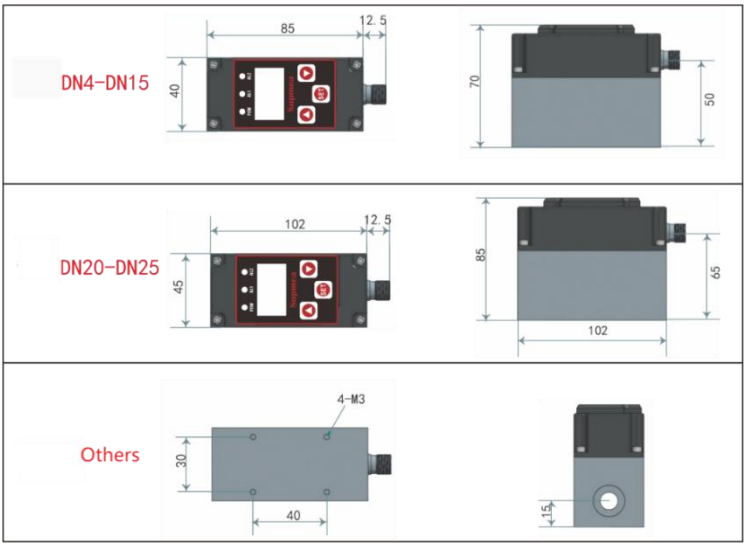



Fig.1 Dimensions (unit: mm)

## 3.2 Process connection

Table 2

| Pipe diameter | Threaded interface | Process pressure |
|---|---|---|
| DN10 | G 1/2 | 6.3MPa |
| DN15 | G 1/2 | 6.3MPa |
| DN20 | G 3/4 | 6.3MPa |
| DN25 | G 1 | 6.3MPa |

## 3.3 Material

Shell: Aluminum alloy

Base: 304

## 3.4 Weight

DN10: 820g DN15: 990g

DN20: 1310g DN25: 1310g

# 4 Installation

## 4.1 Installation Tips

**Note!**

Please inspect the packaging for any damage or signs of mishandling. If any damage is found, please report it specifically to both the courier and the manufacturer.

**Note!**

Please check the packing list to make sure the batch of goods that you have received is complete.

**Note!**

Please check the instrument nameplate, and confirm whether the delivered items are consistent with your order. Check whether the power supply indicated on the nameplate is correct. If not, please contact the manufacturer.

**Note!**

The installation diagram is only for reference; please refer to the actual product.

## 4.2 Pipe Design

**(1) Location**

① The flowmeter should be installed in a location that is convenient for maintenance, free from pipeline vibration, and not affected by strong electromagnetic interference or thermal radiation.

② For horizontal installation, the pipeline should be level, with a tilt of no more than 5°. For vertical installation, the deviation from vertical should also be less than 5°.

③ When installing the flowmeter on newly laid pipelines, it is recommended to first insert a short pipe section in place of the flowmeter. The actual flowmeter should only be installed after the pipeline has been thoroughly cleaned.

④ If the fluid contains impurities, a filter should be installed upstream of the flowmeter, and the pipeline should be regularly cleaned to remove sediment. If the measured liquid contains gas, a degasser should be installed upstream of the

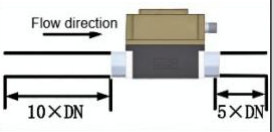
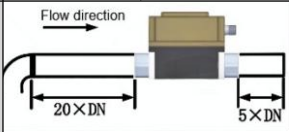
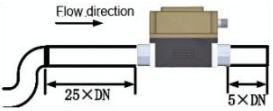
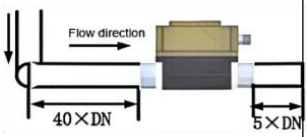
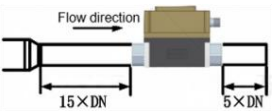
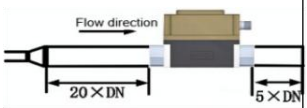
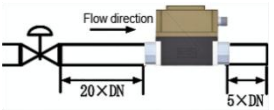
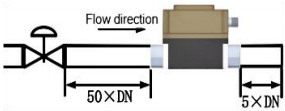
sensor. The outlets of both the filter and the degasser must lead to a safe discharge location.

⑤ When the flowmeter is installed outdoors, it should be protected from direct sunlight and rain.

**(2) Straight Pipe Requirements**

To ensure measurement accuracy, it is recommended that the upstream straight pipe section be at least 10 times the nominal pipe diameter (10 × DN). Where possible, doubling this length is advised to further improve accuracy. The downstream straight pipe section should be at least 5 times the pipe diameter (5× DN).

Table 3 Straight pipes requirements

| Inlet baffle Type | Installation conditions | | Outlet baffle Type | Installation conditions | |
|---|---|---|---|---|---|
| | Inlet | Outlet | | Inlet | Outlet |
| General |  | | 90° Elbow |  | |
| Two 90° elbows on the same plane |  | | Two 90° elbows on different planes |  | |
| Reducer |  | | Expander |  | |
| Fully opened valve |  | | Half opened valve |  | |

## 4.3 Installation Requirements

（1）Full pipe

The pipe must be completely filled with liquid. It is important to keep the pipe completely filled with liquid at all times, otherwise the flow display will be affected and may cause measurement errors.

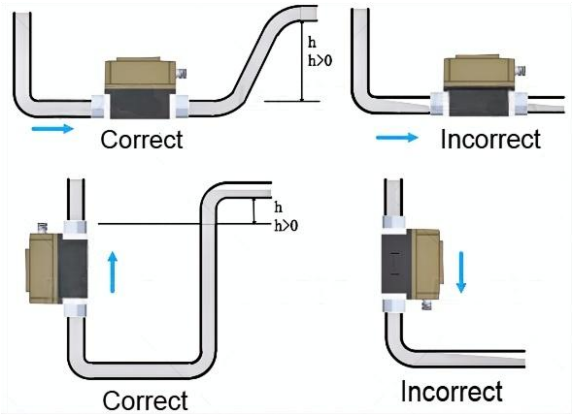



Fig.2

（2）Avoid bubbles

If air bubbles enter the measuring tube, the flow display will be affected and may cause measurement errors.

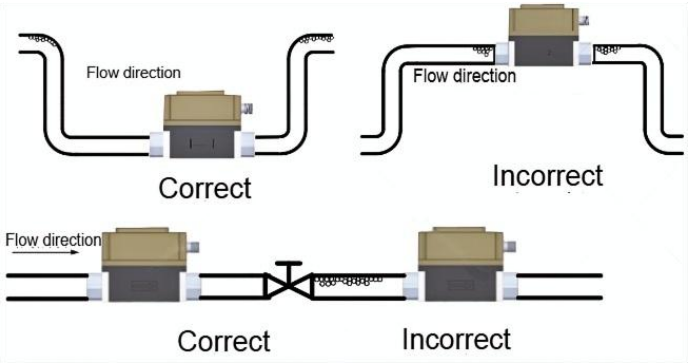



Fig.3

The following figure is a schematic diagram of flow meter installation:

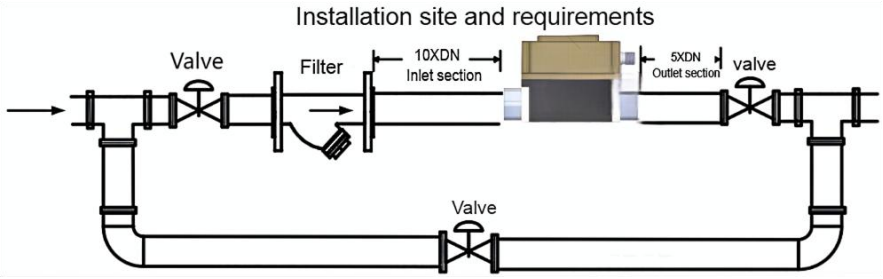



Fig.4

# 5 Electrical Connection

## 5.1 Terminals

The flowmeter wiring adopts a five-core waterproof aviation plug. OUT1, OUT2, and OUT3 support four outputs: flow alarm, temperature alarm, flow (4~20) mA output, and temperature (4~20) mA output; it also supports one RS485 communication output.

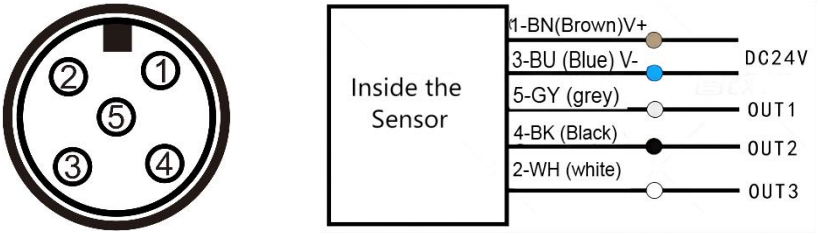



Fig.5 Aviation plug

Table 4

| No. | Color | Description |
|---|---|---|
| ① | brown | Positive power supply |
| ③ | blue | Negative pole of power supply |
| ⑤ (OUT1) | grey | ● Flow/temperature alarm output<br>● Flow/Temperature (4~20) mA output |
| ④ (OUT2) | black | ● Flow/temperature alarm output |
| ② (OUT3) | white | ● Flow/temperature alarm output<br>● Flow/Temperature (4~20) mA output |
| ⑤+② (RS485) | grey+white | RS485 communication output |

## 5.2 Wiring Diagram

**(1) Alarm + (4~20) mA output type**

- Channel 2 alarm PNP outputs, Channel 1 (4~20) mA output

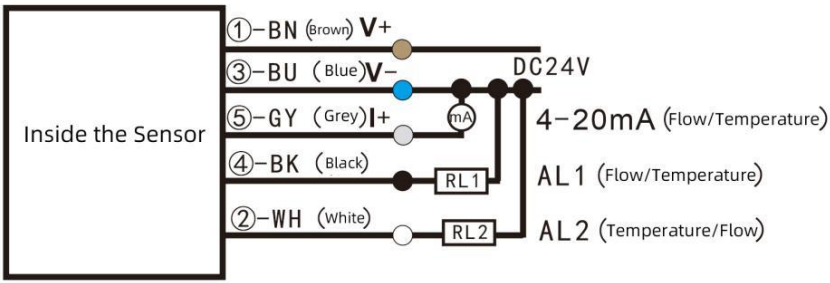



Fig.6

- Channel 1 alarm PNP output, Channel 2 (4~20) mA outputs

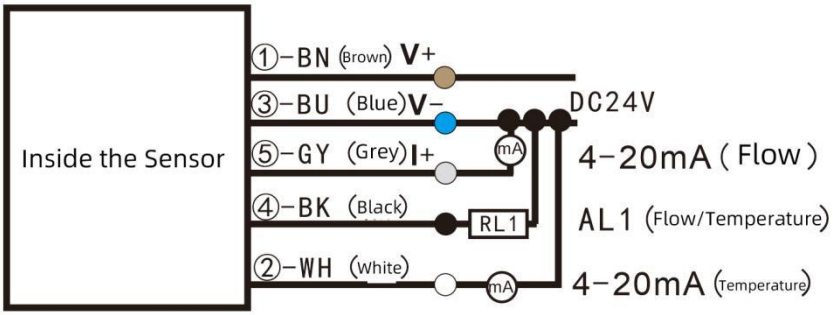



Fig.7

**(2) Alarm + RS485 output type**

- Channel 1 alarm PNP output, Channel 1 RS485 communication output

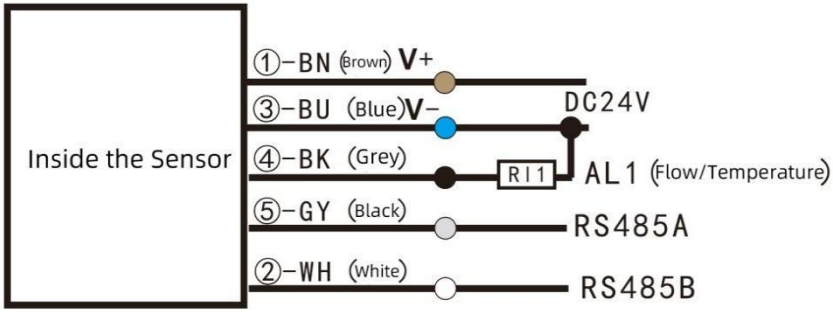



Fig.8

# 6 Operation

## 6.1 Panel Display

The turbine flowmeter features an OLED display that shows the current flow rate and temperature of the pipeline. Three buttons on the panel allow for quick configuration of upper and lower alarm limits for flow or temperature, as well as access to the setting menu.


Fig.9 Panel Display

## 6.2 Menu Description

Press [SET] on the display interface to enter the menu parameter interface. The "SET"(Settings) menu can be used to set the upper and lower limits of the alarm output. The "HGH"(Advanced) menu can be used to set the system configuration and general configuration.


Fig.10 Menu parameter interface

## 6.3 Set Alarm Upper and Lower Limits

The turbine flowmeter can be equipped with up to 2 alarm output channels(SPs), each of which can be freely configured with an alarm threshold value based on

either flow rate or temperature.

Example: SP1 (Channel 1 alarm) is configured for flow rate, and SP2 (Channel 1 alarm) for temperature.

Assuming that the upper limit for “SP1” (flow rate alarm on Channel 1) is set to 0100L/min, the alarm threshold can be set to 0100, and the “rP1” (reset value) to 12.0. Set the “OUT1” to “HNC” (Hysteresis Normally Open), meaning the alarm will be triggered when the flow rate exceeds 0100L/min, and cleared when it falls below 12.0L/min.


Fig.11 SP1 Setting

For “SP2” (alarm channel 2), if the upper limit for temperature alarm is set to 070.0℃, the alarm threshold can be set to 070.0, and the reset value to 069.0. Similarly, set the “OUT 2” to “HNC” (Hysteresis Normally Open), so the alarm will be triggered when the temperature exceeds 70℃ and the alarm is released when it is lower than 69℃.

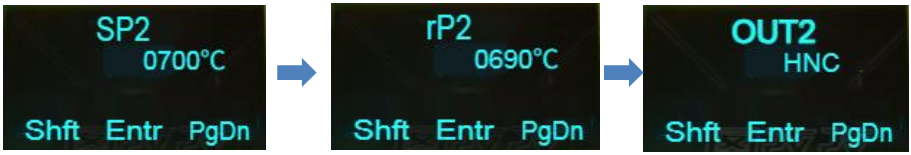



Fig.12 SP2 Setting

## 6.4 Configuration Settings

After entering the "HGH” (Advanced Menu), you need to enter the password to enter the configuration settings. The factory password is 0006.


Fig.13 Enter the advanced menu

Table 5 Configuration List

| Parameter | Name | Setting range | Description | Factory Preset |
|---|---|---|---|---|
| System | ADDR | 0~127 | Device communication address | 0001 |
| | Baud | 0~7 | 0: 1200;1:2400; 2: 4800; 3:9600; 4: 19200; 5: 38400; 6: 57600; 7: 115200 | 3 |
| System | FLTR | 0~1 (thousands) | 0: PNP; 1: NPN | 2 |
| | | 0~1 (hundreds) | reserved | |
| | | 0~4 (tens) | Temperature filter coefficient, interference filter adjustment | |
| | | 0~6 (units) | Flow filter coefficient, interference filter adjustment | |
| | 1OUL | 0~9999 | Set the value corresponding to 4mA output on Channel 1 (4-20mA). The unit depends on the currently selected physical quantity. | 0 |
| | 1OUH | 0~9999 | Set the value corresponding to 20mA output on Channel 1 (4-20mA). The unit depends on the currently selected physical parameter. | 200 |
| | Test | 0~9999 | Temperature correction (unit: °C, with one decimal point by default) | 0000 |
| | Fmul | 0~9999 | Flow correction (%) | 100 |

| Parameter | Name | Setting range | Description | Factory Preset |
|---|---|---|---|---|
| | | If the current reading is 1 m/s but the actual flow rate is 1.2 m/s, set the correction to 120. | | |
| | Lang | 0~1 | 0: English; 1: Chinese | Chinese |
| General configuration | SP1 | 0~9999 | Alarm value of the channel 1, the unit depends on the currently selected physical parameter. *[Note 1]* | 100 |
| | rP1 | 0~9999 | The reset value of channel 1, the unit depends on the currently selected physical parameter. *[Note 1]* | 95 |
| General configuration | OUT1 | 0~4 | The alarm function of channel 1<br>0: Off:<br>1: Hysteresis Normally Open<br>2: Hysteresis Normally Closed<br>3: Window always open<br>4: Window is always closed*[Note 1]* | 1 |
| | SP2 | 0~9999 | The alarm function of channel 2, the unit depends on the user selected physical parameter | 200 |
| | rP2 | 0~9999 | The reset value of channel 2, the unit depends on the user's current set physical parameter*[Note 1]* | 195 |

| Parameter | Name | Setting range | Description | Factory Preset |
|---|---|---|---|---|
| | OUT2 | 0~4 | The alarm function of channel 2<br>0: off<br>1: Hysteresis normally open<br>2: Hysteresis normally closed<br>3: Window always open<br>4: Window is always closed*[Note 1]* | 1 |
| | SEL1 | 0~1 | Alarm selection of channel 1<br>0: flow; 1: temperature | 0 |
| | SEL2 | 0~1 | Alarm selection of channel 2<br>0: flow; 1: temperature | 1 |
| | UNIT | 0~6 | Unit selection*[Note 2]* | 2 |
| | DIAM | 0~5 | Pipe diameter setting[*Note 2]* | Reserve |
| | ANL1 | 0~1 | First current selection<br>0: flow; 1: temperature | 0 |
| | ANL2 | 0~1 | Current set of channel 1<br>0: flow; 1: temperature | 1 |
| General configuration | TIM1 | 0~3 (thousands) | 0: Inverted display<br>2: Upright display | 2008 |
| | | 0~1 (hundreds) | Reserved | |
| | | 0~99 (tens, ones) | Main display interface display time (seconds) time = 1st digit x 10 + 0 digit | |
| | TIM2 | 0~99 | Main display interface screen off standby time (seconds) | 38 |
| | CTHz | 0~99 | Cut-off frequency (Hz) | 1 |

| Parameter | Name | Setting range | Description | Factory Preset |
|---|---|---|---|---|
| | LIGT | 0~99 | Brightness adjustment (%) | 10 |
| | PLUS | 0~9999 | According to different pipe diameters | Reserve |
| | TANL | 0~9999 | Set the value corresponding to 4mA output on Channel 2 (4-20mA). The unit depends on the currently selected physical quantity. | 0 |
| | TANH | 0~9999 | Set the value corresponding to 20mA output on Channel 2 (4-20mA). The unit depends on the currently selected physical quantity. | 1000 |

**【Note 1】Description of hysteresis and window function**

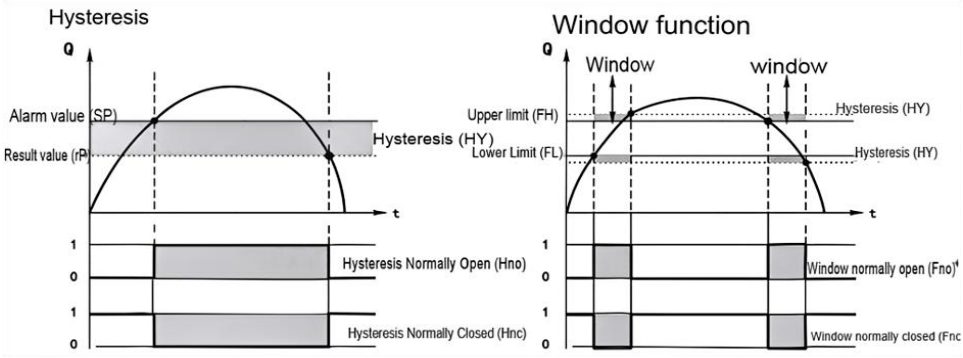



Fig.14

**【Note 2】Instructions for selecting units and pipe diameters**

Table 6 Units and pipe diameter selection

| Parameter | Unit | Description | Code |
|---|---|---|---|
| Units | m/s | Display flow rate in meters per second (3 decimal places) | 0000 |
| | % | Display flow rate percentage (1 decimal place) | 0001 |
| | L/min | Displays flow rate in litres per minute (no decimals) | 0002 |
| | $m^3$/min | Displays flow rate in cubic meters per minute (3 decimal places) | 0003 |
| | L/s | Display flow rate in liters per second (2 decimal places) | 0004 |
| | L/h | Displays flow rate in litres per hour (no decimals) | 0005 |
| | $m^3$ /h | Hourly flow rate (1 decimal place) | 0006 |
| Pipe diameter | DN6 | Pipe diameter DN6 | 0000 |
| | DN8 | Pipe diameter DN8 | 0001 |
| | DN10 | Pipe diameter DN10 | 0002 |
| | DN15 | Pipe diameter DN15 | 0003 |
| | DN20 | Pipe diameter DN20 | 0004 |
| | DN25 | Pipe diameter DN25 | 0005 |

# 7 Troubleshooting

The following table lists the common troubleshooting methods for turbine flowmeters. If the fault still cannot be solved, please contact our company.

Table 7

| Troubles | Possible causes | Troubleshooting |
|---|---|---|
| No alarm | Abnormal power supply | Check the power supply |
| | Incorrect wiring | Check whether the wiring is correct |
| | No medium flow | Check whether valves, etc. are open |
| The flow rate display is inaccurate | Inaccurate flow | Recalibrate the flowmeter |
| The display is dark | Abnormal power supply | Check the power supply |
| | The flowmeter is burned out | The flow sensor is burned out; replace the switch |
| The warning light is always on during debugging | Alarm contact setting error | Changing the alarm contact settings |
| The flowmeter is damaged shortly after operation | Lightning strike, induced high voltage | If struck by lightning, replace the instrument.<br>If there is induced high voltage around, please check whether the signal cable is laid together with the power cable. |

Maintenance:

1. The installed pipeline should be fully grounded to prevent lightning strikes, etc.;

2. Please clean the turbine regularly and remove foreign matters according to actual conditions.

3. When applied to areas near strong electromagnetic waves, please take protective anti-interference measures.

# Appendix A Flow Rate&Flow Velocity Reference Table

Table 8 Flow rate&flow velocity reference table

| Unit / Caliber | m/s | Flow rate% | L/min | $m^3$/ min | L/s | L/h | $m^3$ / h |
|---|---|---|---|---|---|---|---|
| DN8 | 1.0 | Calculate by range | 3.014 | / | / | 180.8 | 0.181 |
| DN10 | 1.0 | Calculate by range | 4.71 | / | 0.079 | 282.6 | 0.283 |
| DN15 | 1.0 | Calculate by range | 10.60 | / | 0.177 | 636 | 0.636 |
| DN20 | 1.0 | Calculate by range | 18.84 | / | 0.314 | 1230 | 1.13 |
| DN25 | 1.0 | Calculate by range | 29.44 | / | 0.491 | 1766 | 1.766 |
| Unit / Caliber | m/s | Flow rate% | L/min | $m^3$/ min | L/s | L/h | $m^3$ / h |
| DN8 | 2.0 | Calculate by range | 6.028 | / | / | 361.6 | 0.362 |
| DN10 | 2.0 | Calculate by range | 9.42 | / | 0.158 | 565.2 | 0.566 |
| DN15 | 2.0 | Calculate by range | 21.2 | / | 0.354 | 1272 | 1.272 |
| DN20 | 2.0 | Calculate by range | 37.68 | / | 0.628 | 2260 | 2.36 |
| DN25 | 2.0 | Calculate by range | 58.88 | / | 0.982 | 3532 | 3.532 |

# Appendix B Communication Protocol

## B.1 Overview

This protocol complies with the MODBUS communication protocol and adopts the RTU mode in the subset of the MODBUS protocol and the RS485 half-duplex working mode.

## B.2 Serial Data Format

Serial port settings: no parity, 8 data bits, 1 stop bit.

Example: 9600, N, 8, 1

Meaning: 9600bps, no parity, 8 data bits, 1 stop bit.

The serial port baud rates supported by this transmitter are: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200.

All data in the communication process is handled as 2-byte integer values. When the data represents a floating-point number, the actual value must be calculated based on the decimal point position, which is stored separately.

For example, when reading the flow value at address 39 (decimal), the number of decimal places is defined by the value at address 32. If the value at address 39 is 1000 and the value at address 32 is 3, the actual result is 1.000. The unit of measurement is determined by the value at address 16.

For PLCs or certain host systems, the register address may need to be incremented by 1 during data access. Whether this adjustment is necessary should be determined according to the actual field setup.

## B.3 Communication Format

（1）Read command format (03 function code) example

| Address | Function code | Data start (H) | Data start (L) | Number of data (H) | Number of data (L) | CRC16 Check(L) | CRC16 Check(H) |
|---|---|---|---|---|---|---|---|
| 0X01 | 0X03 | 0X00 | 0X00 | 0X00 | 0X01 | 0X84 | 0X0A |

B. Return read data format: Example

| Address | Function code | Data length | Data(H) | Data(L) | CRC16(L) | CRC16(H) |
|---|---|---|---|---|---|---|
| 0X01 | 0X03 | 0X02 | 0X00 | 0X01 | 0X79 | 0X84 |

（2）Write command format (06 function code) example

| Address | Function code | Data start (H) | Data start (L) | Data(H) | Data(L) | CRC16 (L) | CRC16 (H) |
|---|---|---|---|---|---|---|---|
| 0X01 | 0X06 | 0X00 | 0X00 | 0X00 | 0X02 | 0X08 | 0X0B |

B. Return read data format: Example

| Address | Function code | Data start (H) | Data start (L) | Data(H) | Data(L) | CRC16 (L) | CRC16 (H) |
|---|---|---|---|---|---|---|---|
| 0X01 | 0X06 | 0X00 | 0X00 | 0X00 | 0X02 | 0X08 | 0X0B |

（3）Abnormal response returned

| Address | Function code | Exception code | CRC16(L) | CRC16(H) |
|---|---|---|---|---|
| 0X01 | 0X80+Function code | 0x01 (illegal function)<br>0x02 (illegal data address)<br>0x03 (illegal data) | | |

**B.4 Supported Commands and Meaning of Command and Data**

Table 9 MODBUS-RTU protocol command list

| Decimal address | Symbol | Parameter | Code | Data | Description | General Presets |
|---|---|---|---|---|---|---|
| 0 | DE | Address | R03/W 06 | 16-bit integer | Device number, range 0~127 | 1 |
| 1 | BT | Baud rate | R03/W 06 | 16-bit integer | 0: 1200bps; 1: 2400bps;<br>2: 4800bps; 3: 9600bps<br>4: 19200bps; 5: 38400bps<br>6: 57600bps; 7: 115200bps | 3 |
| 2 | LV | Filter coefficient | R03/W 06 | 16-bit integer | Damping filter time constant,<br>Range: 0~6 | 2 |

| Decimal address | Symbol | Parameter | Code | Data | Description | General Presets |
|---|---|---|---|---|---|---|
| 3 | 1OUL | Flow transmission lower limit | R03/W 06 | 16-bit integer | 4mA corresponds to the flow value, Range: 0~1, the default unit is L/min, which ultimately depends on the user's currently flow unit setting | 0 |
| 4 | 1OUH | Flow rate transmission upper limit | R03/W 06 | 16-bit integer | 20mA corresponds to the flow value, Range: 0~9999, default unit is L/min, ultimately depends on the user's currently flow unit setting | 200 |
| 5 | 1Zql | Temperature set | R03/W 06 | 16-bit integer | Temperature offset, the instrument does not migrate to zero position in time when the sensor is at zero position, and the default contains one decimal point | 0 |
| 6 | 1RAO | Flow coefficient | R03/W0 6 | 16-bit integer | Flow rate ratio coefficient, range: 0~9.99 | 1.00 |
| 7 | lang | Language | R03/W 06 | 16-bit integer | Language selection, 0: English; 1: Chinese | 1 |
| 8 | SP1 | Channel 1 alarm value | R03/Wri te 06 | 16-bit integer | Alarm value of the first channel, range: | 110 |

| Decimal address | Symbol | Parameter | Code | Data | Description | General Presets |
|---|---|---|---|---|---|---|
| | | | | | -100~9999, the default unit is flow rate L/min, which ultimately depends on the user's current set physical quantity | |
| 9 | rP1 | Channel 1 reset value | R03/W 06 | 16-bit integer | The first reset value, range: -100~9999, the unit default flow rate L/min, ultimately depends on the user's current set physical quantity | 100 |
| 10 | OUT1 | Channel 1 alarm | R03/W 06 | 16-bit integer | The first alarm function 0: Disable alarm 1 : Hysteresis Normally Open 2: Hysteresis normally closed 3: Window always open 4: Window is always closed | 1 |
| 11 | SP2 | Channel 2 alarm value | R03/W 06 | 16-bit integer | The second alarm value, range: -100~9999, default temperature ℃, one decimal point, ultimately depends on the user's current set | 210 |

| Decimal address | Symbol | Parameter | Code | Data | Description | General Presets |
|---|---|---|---|---|---|---|
| | | | | | physical quantity | |
| 12 | rP2 | Channel 2 reset value | R 03/W 06 | 16-bit integer | The second reset value, range: -100~9999, default temperature ℃, one decimal point, ultimately depends on the user's current set physical quantity | 200 |
| 13 | OUT2 | Channel 2 alarm | R03/W 06 | 16-bit integer | Second alarm function 0: Disable alarm 1: Hysteresis Normally Open 2: Hysteresis normally closed 3: Window always open 4: Window is always closed | 0 |
| 14 | SP-1 | Channel 1 alarm | R03/W0 6 | 16-bit integer | First alarm selection, 0: Flow alarm 1: Temperature alarm | 0 |
| 15 | SP-2 | Channel 2 alarm | R03/W 06 | 16-bit integer | Second alarm selection, 0: Flow alarm 1: Temperature alarm | 0 |
| 16 | UNIT | Flow unit | R03/W 06 | 16-bit integer | Unit selection: 0: m/s; 1: %; 2: L/min; 3: $m^3$ /min; 4: L/s; 5: L/h; 6: $m^3$ /h | 0 |

| Decimal address | Symbol | Parameter | Code | Data | Description | General Presets |
|---|---|---|---|---|---|---|
| 17 | Pipe selection | Pipe diameter | OR 03 | 16-bit integer | 0: DN4; 1: DN6;<br>2: DN8; 3: DN10;<br>4: DN12; 5: DN15;<br>6: DN20; 7: DN25;<br>8: DN32; 9: DN40 | 6 |
| 18 | ANL1 | Channel 1 power supply | OR03 | 16-bit integer | First current selection<br>0: flow, 1: temperature | 0 |
| 19 | ANL2 | Channel 2 power supply | OR03 | 16-bit integer | Second current selection<br>0: flow, 1: temperature | 1 |
| 20 | TIM1 | Display time | R03/W 06 | 16-bit integer | The main interface displays time, range: 0~1000, unit: s | 8 |
| 21 | TIM2 | Standby time | R03/W 06 | 16-bit integer | Screen saver display time, range: 0~1000, unit: s | 38 |
| 22 | CTHZ | Cutoff frequency | R03/W 06 | 16-bit integer | Cut off small signal frequency value, range: 0~99, unit: Hz | 1 |
| 23 | LIGT | Brightness adjustment | R03/W0 6 | 16-bit integer | Screen brightness adjustment (%), 1~100 | 10 |
| 24 | PLUS | Pulse coefficient | OR03 | 16-bit integer | Set coefficients according to different pipe diameters | 75 |
| 25 | 2RL | Temperature Transmission Lower limit | R03/W 06 | 16-bit integer | 4mA corresponds to temperature value, unit:℃, default is one decimal point | 0 |

| Decimal address | Symbol | Parameter | Code | Data | Description | General Presets |
|---|---|---|---|---|---|---|
| 26 | 2RH | Temperature Transmission Upper limit | R03/W06 | 16-bit integer | 4mA corresponds to temperature value, unit:℃, default is one decimal point | 1000 |
| 32 | dot | Flow decimal point | OR03 | 16-bit integer | Flow decimal places, 0~3 | 1 |
| 39 | 1# | 1#Detection | OR03 | 16-bit integer | 1# detection value (instantaneous flow), the default unit is L/min, which is finally determined by the user's setting unit. | 0 |
| 40 | 2# | 2#Detection | OR03 | 16-bit integer | 2# detection value (instantaneous temperature), Unit:℃, default is one decimal point | 0 |

**B.5 Communication Example**

For example: read the flow value and temperature value of two devices:

Read device 1 flow: 01 03 00 27 00 01 34 01

Read device 1 temperature: 01 03 00 28 00 01 04 02

Read device 2 flow: 02 03 00 27 00 01 34 32

Read device 2 temperature: 02 03 00 28 00 01 04 31