YSQD Ultrasonic Doppler flowmeter User Manual

P lease read this manual carefully and use this product correctly.
P lease keep this manual properly for reference at any time.

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Catalogue

1 Manual Introduction

1.1 User Information

Thank you for choosing and using this product.

Please read the user manual carefully and follow the steps in the user manual. Keep the user manual properly after reading it.

This manual is intended for trained personnel with a technical background who have received professional training or have some theoretical and practical experience in instrumentation and control.

Understanding the safety information, warning messages, and correct technical operations described in this manual is critical to ensure the safety of personnel and products during installation, commissioning, operation, and maintenance.

This manual cannot cover all possible details, and it is impossible to describe all possible situations during installation, operation and maintenance or product use. If you need other information, or encounter some special problems that are not explained in this manual, you can contact us to solve your questions.

All or part of the products, services or features described in this manual may not be within your purchase or use scope. Unless otherwise agreed in the contract, the Company makes no express or implied warranty or guarantee for the content of this manual.

The product manual is copyrighted. Without the permission of the manufacturer, we reserve the right to pursue legal liability for any unauthorized competition by copying or partially copying the contents of the manual, adding content or distributing the contents of the manual.

Thank you again for choosing this product. Due to the improvement of the product, what you receive may not be completely consistent with the diagram in the user manual. We apologize for this.

1.2 Labeling notes

This manual introduces the relevant information and application specifications of this product, such as system principles, technical parameters, start-up, operation and maintenance, etc.

Please note the "Warning Text and Information Text" when reading this manual. Carefully reviewing the information can prevent hazards to the life or health of users and maintenance personnel, as well as property damage. These pieces of information will be marked with appropriate icons and provided alongside valuable tips, along with explanatory text. The terms used in this manual and the information on the product have the following meanings :

explain

The description is an explanation, explanation and supplement to certain specific contents in the operation of the product.

pay attention to

Note is an important message to remind users of the operation of the product, or parts of the manual that need to be paid special attention to.

warn

If the corresponding safety precautions are not observed, there may be a risk of injury to staff or minor damage to property.

danger

If the corresponding safety precautions are not observed, it may cause casualties to the staff or huge losses to the property.

1.3 Applicable personnel

If the product is operated incorrectly or if the warning information stated in the manual is not followed , serious injury to staff or property damage may result. Therefore , only appropriate personnel can operate this product.

A qualified person who understands the safety information appearing in this manual or noted on the product itself is :

- Professional instrumentation engineers familiar with the technology and safety of the product .
- Operators who have received operator position training and fully mastered the operation part of this manual .
- Operation and maintenance personnel who have received professional training according to established safety measures.

explain

After the installation and debugging of the equipment, the company will conduct relevant training and guidance for customers and related personnel, so that customers can use the product correctly and effectively.

1.4 Packaging and transportation

The scope of each part of the transport is determined by the valid contract listed in the documents attached to the transport.

When opening the packing box , please follow the relevant instructions on the packaging materials. After opening the box , please check the goods against the"Delivery List " in time. In addition , please check whether the appearance of the received items is deformed or damaged. Please keep the relevant documents well for use during installation and operation .

There is a copy of the "Shipment List " in the package. If you find that the contents shown in the shipment list are not consistent with the items in the box , please contact us in time.

Pay attention to

P lease keep the accessories properly , so as to avoid the inconvenience caused by the loss of accessories during maintenance.

1.5 Precautions

During the operation, maintenance and repair of this equipment, please follow the following general safety measures.

Ground the equipment correctly.

Proper grounding of the equipment can minimize the risk of electric shock.

Do not disassemble, assemble, debug, or insert or remove cables when the device is powered on. To prevent human electric shock and device damage, remove the power cable and discharge the electric energy of the internal circuit of the device before performing the operation.

Do not hold the circuit board bare-handed to avoid damage caused by static electricity.

Use protective equipment.

When working, please use high temperature gloves and other protective equipment as needed to avoid burns or cuts on the hands.

Failure to comply with safety measures or warnings for specific matters recorded in this user manual will violate the safety criteria for the design, manufacture and use of this product.

The Company shall not be liable for any of the above liabilities arising from the omission of the user.

1.6 Quality assurance

Thank you for using this product, our company will provide you with quality service.

During the warranty period and in accordance with the scope of warranty, our company will provide free maintenance services, including product repair within the warranty period, spare parts repair and replacement, technical support and routine field service, etc.

If the warranty period is exceeded or the following faults occur during the warranty period, it is considered as maintenance outside the warranty period, and our company can provide you with paid service for the product. The fault content includes but is not limited to :

- Damage caused by force majeure(earthquake, lightning, flood, etc.) ;
- Instrument damage caused by the failure of equipment to be reliably grounded separately as required ;
- natural wear;
- Damage caused by improper use (corrosion, fire, strong electricity, water in, strong electricity serial connection, etc.) ;
- Unauthorized modification of internal components of the product ;
- Without permission, modify the technical and functional parameters of the product ;
- Failure to store, use and maintain products in accordance with user manual and training regulations ;
- The product is not used according to the order definition;
- Manually remove product labels.

When the product parts reach the service life or are damaged, please dispose of them safely according to the requirements of local waste management and environmental regulations ; or return them to our company for disposal after packaging and marking.

Please refer to the terms of the purchase contract for specific warranty requirements.

2. Product overview

2.1 Overview

In the wastewater discharged from production processes, living facilities, and other emission sources, in addition to a certain amount of inorganic pollutants, there are also large amounts of organic pollutants. Once these pollutants enter the environment, a significant portion will settle through air deposition or even directly into nearby surface waters, causing varying degrees of pollution in most rivers, lakes, and urban reservoirs. This results in water bodies emitting foul odors, exhibiting abnormal colors, and impacting the entire ecosystem.

The company, drawing on years of experience in environmental monitoring instrument development, has developed a unique ultrasonic Doppler flow meter. This device integrates advanced flow measurement technology and IoT technology, merging water quality monitoring technology, mobile data communication technology, and data network technology into one. It intelligently monitors water parameters (flow rate, velocity, water level) and uploads the data to the system platform according to customizable protocols.

Controller unit: The controller unit uses a 2.8-inch industrial screen display, with a film button operation mode. This unit can collect flow meter data, display it, and transmit it externally. It can also set relevant parameters of the flow meter, such as pipe shape, cross-sectional area, water level reference, etc., as well as coefficient correction for measurement parameters.

Flow meter unit: used for measuring the flow rate of water in rivers, sewage pipe network, open channel and so on.

2.2 Product features

- It can be automatically detected for a long time, with small structure volume and strong environmental adaptability.
- 2.8 inch industrial screen, clear and intuitive display, stable and reliable.
- Wide voltage input, can support two power supply modes at the same time: 220 VAC and 24 VDC.
- RS-485 standard communication interface, default MODBUS standard protocol (accept non-standard customization).
- Supports 4-20mA output.
- The controller can be installed on the wall.
- The controller has built-in storage of 128 Mbit to store historical measurement data.
- Scalable to achieve 4G network data transmission (customized).

2.3 Application scenarios

- Water quality monitoring of pollution sources
- Water used in industrial production process
- Industrial and municipal sewage treatment

3 Product Introduction

3.1 controller

3.1.1 Product description

The controller is a field-friendly controller that connects to a Doppler flow meter, reads the data measured by the flow meter, and has a display for showing and interacting with it. The product is widely used in surface water, municipal sewage, industrial wastewater, sewage treatment, waterworks, industrial processes, aquaculture, and other industries.

3.1.2 Basic product parameters

Table 3.1 Basic specifications of products

specifications	detailed information
display screen	2.8"TFT color screen, resolution 240*320
communication interface	1 digital flow meter interface (24 VDC+ RS 485) 2 switch output (passive, maximum 24V1A) 1 RS 485 14-20 mA output 4G Internet of Things (optional customization)
SC	128Mbit
Electrical interface	4 PG9 waterproof connectors 1 USB-TypeC (reserved)
power requirement	100-240VAC50/60Hz ;9-36VDC
service temperature	-20℃~60℃
outline dimension	164 mm*146mm*101 mm
weight	1.5kg
way to install	wall mounting type

3.1.3 Product appearance

Figure 3.1 Controller appearance

3.1.4 Product size

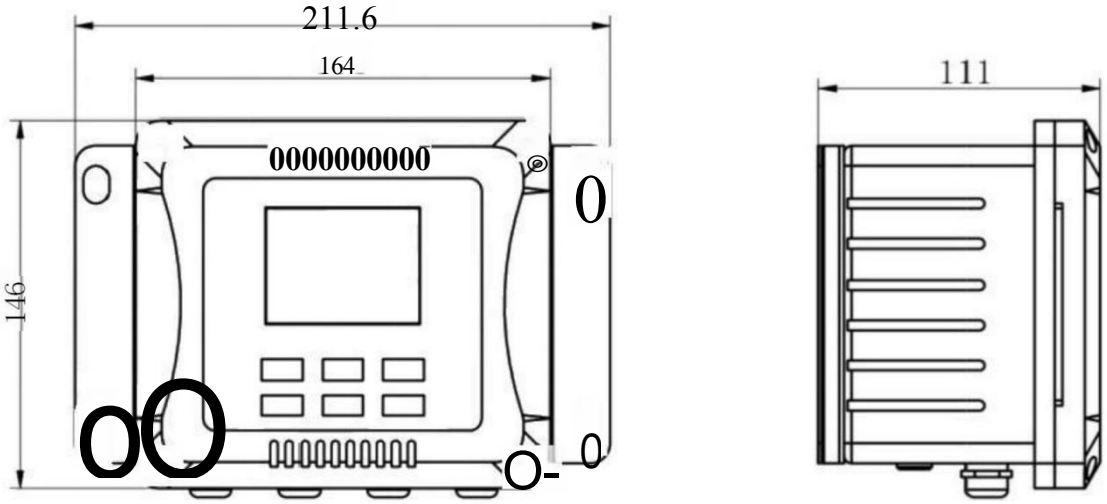


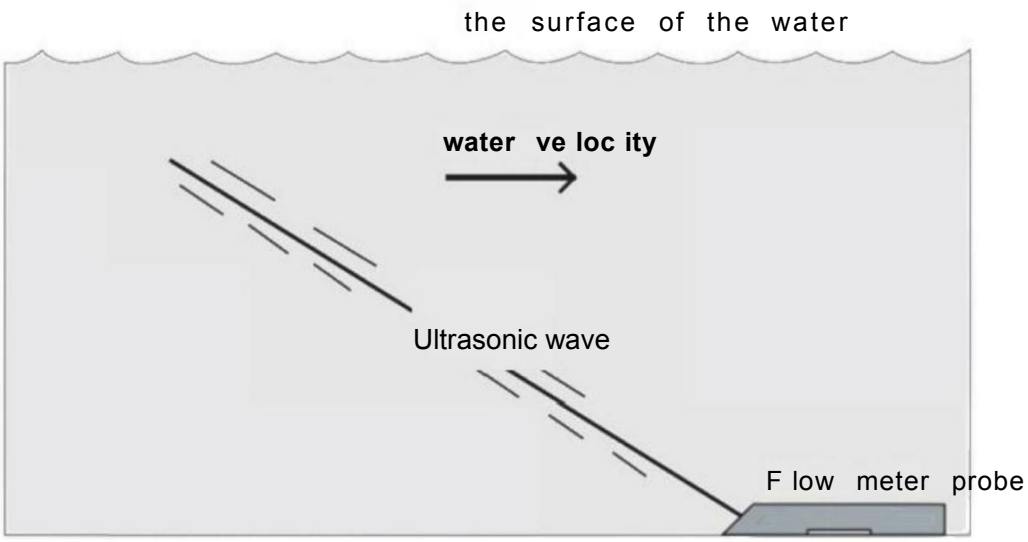
Figure 3.2 Controller size diagram

3.2 Ultrasonic Doppler flowmeter

3.2.1 Product description

The flow meter is packaged as an integrated unit, suitable for measuring water flow rates in various environments such as open channels, rivers, and pipelines. It employs ultrasonic detection technology, offering high measurement accuracy and stability with minimal environmental impact. The device has no moving parts, requires low maintenance, and boasts high operational reliability, making it the preferred choice for both online and portable measurements.

3.2.2 Measurement principle



F igure 3.2 Schemat ic d iagram of Dopp ler measurement

As shown in the figure above, the flow meter probe emits a beam of high-frequency ultrasound at an angle upward. When the ultrasound propagates through the fluid, it is reflected by moving impurities, causing a Doppler frequency shift in the reflected ultrasound. The magnitude of this frequency shift is proportional to the flow velocity. By monitoring the Doppler frequency shift △f, the fluids speed can be measured. The formula for calculating flow velocity is as follows :

$$V = \frac{\blacktriangle f * C}{2\mathrm{Cos}\alpha * f_0}$$

Where : C is the speed of sound in the fluid ;

F0 is the initial ultrasonic frequency;

α is the beam emission Angle;

△f is the ultrasonic frequency shift;

After obtaining the flow rate, the instantaneous flow rate (Q=V*S) can be calculated by combining the cross-sectional area of the channel.

3.2.3 Technical Features

Compared to traditional flow meters, Doppler flow meters feature an integrated packaging structure that is waterproof and pressure-resistant, with no wear. The sealed design ensures they are unaffected by external environments, resulting in low failure rates. Additionally, they have minimal impact on water flow conditions and are not affected by impurities or other debris in the water, preventing blockages that could render them inoperable. Utilizing the Doppler frequency shift principle, their detection accuracy reaches millimeter levels. This fundamentally addresses issues such as inaccurate measurements at low flow rates, easy clogging, susceptibility to corrosion, and frequent maintenance requirements. The following are its key features :

- Cross-sectional flow velocity measurement : streamlined small structure design, less impact on the flow state of the water section ;
- High measurement accuracy : Doppler frequency shift algorithm ensures stable measurement results and millimeter-level velocity resolution ;
- Functional diversity : in addition to measuring the flow rate, it can also detect the water depth and water temperature in real time ;
- Low power design : embedded software and hardware integration design, overall miniaturization packaging, overall low power consumption ;

● Wide application scenarios: turbidity greater than 20 NTU full pipe and non-full pipe flow as well as river channel velocity measurement can be measured;

● High protection level: IP68 protection level can be applied to various applications.

3.2.4 Basic product parameters

Table 3.2 Flowmeter specifications

specifications	detailed information
Flow velocity range	0.03m/s~10m/s
certainty of measurement	Relative error ±1%, absolute error ±0.010m/s
Water level range	(0~10)m
Water level accuracy	0.5%FS
Minimum water level height	0.02m
Temperature range	(0~60)℃
temperature measurement accuracy	±1℃
levels of protection	IP68
service voltage	(9~36)VDC
power	<0.4w
communication interface	RS485
response time	<ls

3.2.5 Product appearance

Figure 3.3 Flow meter appearance

3.2.6 Product s ize

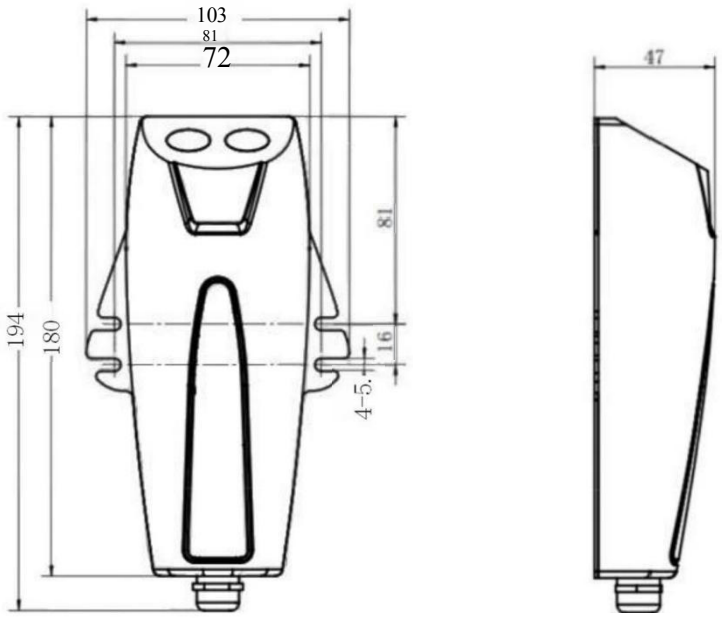


Figure 3.4 Flow meter s ize d iagram

4. Installation

4.1 Unpacking inspection

After receiving the instrument, check whether the packing wooden box is damaged.

After unpacking, check whether the instrument body is damaged and check whether the items on the delivery list are complete.

4.2 Installation requirements

4.2.1 Power supply

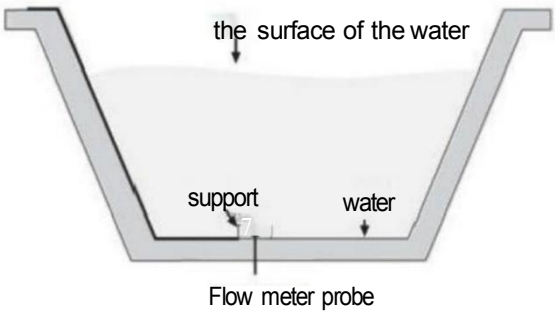
Single-phase AC: Power supply voltage: (100~240) VAC, with good grounding. The distribution cabinet should be equipped with at least one three-prong outlet, a 3P C10 air switch, and a lightning protection module, and it should be fixed at a height of 1.2 meters. For areas with unstable voltage and frequent power outages, it is recommended to use an AC voltage stabilizer that matches the power to protect the instruments.

Direct current : Power supply voltage : (9~36) VDC, the rated power is recommended not less than 24W.

4.2.2 Flowmeter installation point selection

The accuracy of flow rate measurement depends on the flow conditions and the location of the measurement point. The installation position of the flow meter is crucial; it should be chosen to ensure uniform water flow. To achieve better measurement results, the straight section above the water flow should be as long as possible. If possible, the upstream straight section length should exceed 10 times the width of the water flow, and the downstream straight section length should exceed 5 times the width of the water flow. If there are gates or pumps upstream, a straight section length of 30 times the water flow width should be maintained between the flow meter and the gates or pumps.

In the installation area , if there is no sediment , install the flow meter in the center of the bottom of the water flow. If there is sediment , install the flow meter above or on the side of the sediment. To prevent water flow from impacting the installation position of the flow meter , there is a base at the bottom of the flow meter , It is specially used to be fixed on the pipe, so that it is convenient for installation, maintenance and replacement.



F igure 4.1 Channe l insta llat ion d iagram

> Installation conditions and location within the channel

(1) In rivers and channels , as long as the lowest water level is more than 3 cm above the flow meter , it can be measured.

(2) The standard pressure resistance of the water level flowmeter is 200 kPa , and the maximum pressure resistance depth is 20m. If a larger depth test is required, it can be customized according to the requirements.

(3) Ultrasonic Doppler flowmeter is suitable for water quality with solid content not greater than 20 kg /m ³ .

(4) The ultrasonic Doppler flowmeter should be installed in a place where the water flow is stable. In most cases , the water flow is turbulent , and the measured velocity under turbulent conditions is unstable and the error is large.

(5) There should be a straight channel 20 times the width of the channel upstream and a straight channel 5 times the width of the channel downstream at the installation position of the ultrasonic Doppler flowmeter irrigation ditch.

Installation conditions and location in pipes or culverts

(1) The minimum water level should be more than 3 cm above the flow meter when

installed in the pipe , and the inner diameter of the pipe should be> 500 mm. Measurement is supported in the state of non-full pipe. The installation

position should be selected where the water flow is stable , with a straight channel larger than 20 times the inner diameter of the pipe upstream , and a straight channel 5 times the inner diameter of the pipe downstream.

(2) The installation should be in a place with stable water flow to ensure the

stability of the test , so as to avoid the fluctuation of the measured data or the measurement data being smaller than the actual one caused by turbulence.

(3) The condition of sediment and silt in the pipeline must also be considered , and the flow meter should avoid areas with silt. If avoidance is not possible , a

platform must be built to raise the testing height , preventing the impact of silt deposition . When fixed on the platform , compensation based on the actual water level height is required to calculate the actual flow rate. For points with a higher concentration of upstream debris or floating objects , a screen can be installed upstream to filter out debris and other floating items. The distance between the screen and the flow meter should be at least five times the pipe diameter .

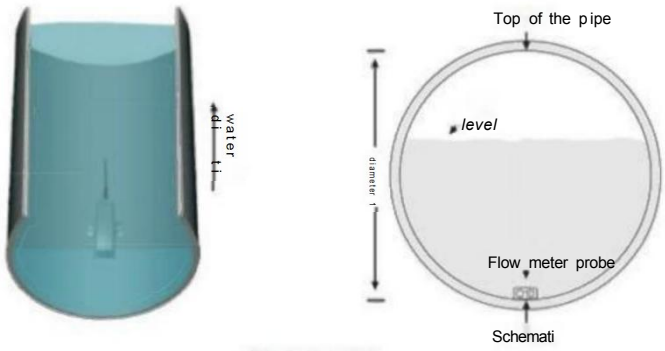


Figure 4.2 Schematic diagram of pipeline installation

Installation conditions and location in the river

(1) The flowmeter is installed in the center of the river, and the lowest water level should be more than 3 cm above the flowmeter before measurement.

(2) For wider rivers, such as natural streams, flood discharge channels of large reservoirs, ship channels under dams, and flood discharge channels of hydropower stations ; the flow velocity varies significantly from the banks to the center due to different locations and varying flow rates. In this case, it is generally necessary to collect flow velocity data at multiple points. At least three flow meters are required, one on each bank and one at the center (it is recommended that each flow meter cover a measurement range of no more than 6 m).

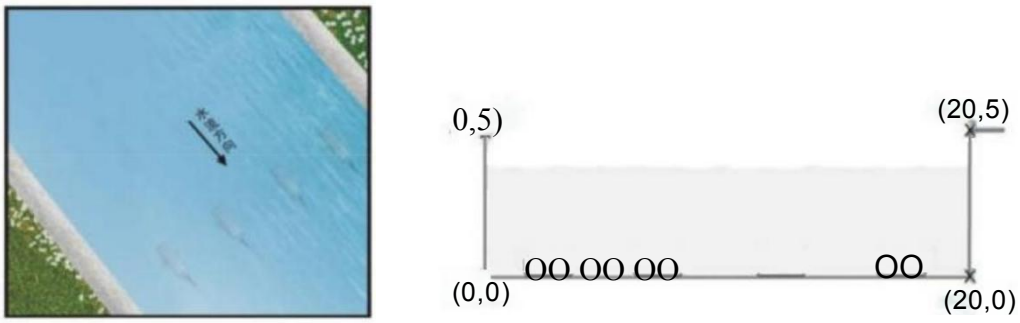
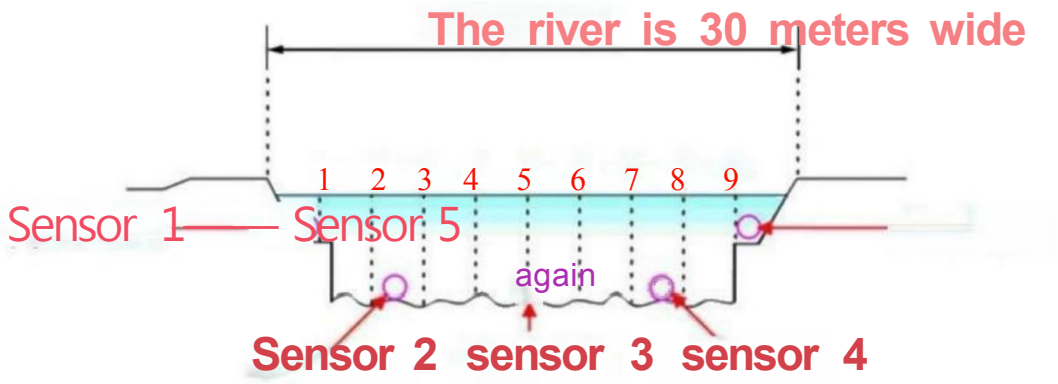


Figure 4.3 Schematic diagram of river installation

(3) For example, a 30-meter river channel is divided into 10 equal parts. After the equal width division of the river channel, a flow meter is installed on both sides and in the middle of the river channel. In order to increase the accuracy, ultrasonic flow meters can also be added and all connected to the same host.



(4) Ensure that the minimum water level at the installation point in the dry season is 3 cm higher than the flow meter.

(5) Before installation, it is necessary to survey the site and measure the points to see if they meet the installation conditions, so as to avoid difficulties in subsequent field installation.

① There was no place to install the support frame around the perimeter, so large machinery was used to build a fence in the water to help the construction.

② Open river channels with no support around.

③ The water level is very shallow and there are stones flowing through it.

4.3 Flow meter installation

4.3.1 Channel installation

(1) The flowmeter can be fixed in the channel by L-shaped bracket. The cable of the flowmeter must be protected with PVC, PE or galvanized pipe to prevent damage caused by water impact. If conditions permit, the protective pipe should be buried to prevent the cable from hanging garbage and other floating objects.

(2) In channels with silt and accumulation, the installation position of the flowmeter should be slightly higher than the bottom of the channel to prevent the sensor from being covered by accumulation to affect the flow measurement.

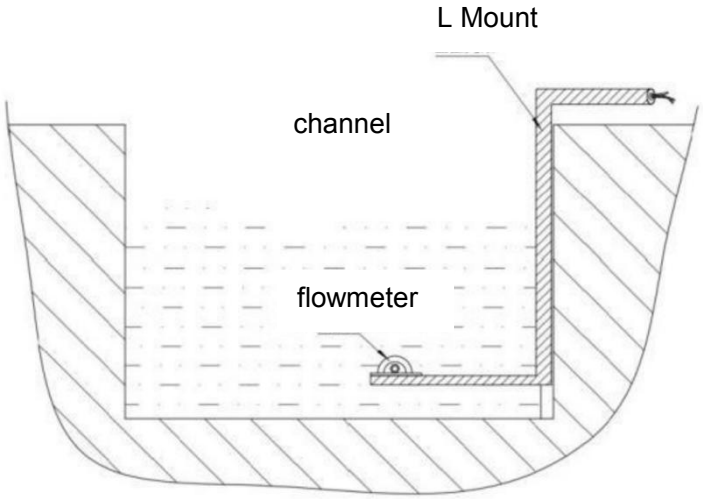


Figure 4.4 Channel installation diagram

4.3.2 Pipeline installation

If the pipe is installed inside, the pipe diameter should be greater than 500 mm,and the bracket should be installed centrally directly from the top of the pipe, and the flow meter should be fixed at the bottom of the pipe with a bracket. The bracket should be made in the shape of "L" to facilitate the flow of water in the relatively stable area inside the pipe, and the flow meter should face the direction of water flow.

F igure 4.5 P ipe insta llat ion

4.3.3 River installation

The river channel installation bracket and wiring are installed in the river channel, through the side bracket to install.

F igure 4.6 Schemat ic d iagram of river installation

Installation notes :

① The flowmeter needs to be fixed with a tightening ring to strengthen the fixation. In order to protect the flowmeter, a buffer pad should be placed between the tightening ring and the flowmeter. The buffer pad can be made of rubber material, and can be replaced by a tire inner tube.

② The communication cable that comes with the flow meter contains a vent pipe, so be sure not to bend it. After the communication cable is led out of the water surface, it can be connected to a regular cable, but at this point, the vent pipe opening should face downward to prevent water and foreign objects from entering or blocking the vent pipe. The cables for connecting the flowmeter to the 485or12VDC power supply must be shielded cables.

③ Prohibit dangerous behaviors such as pulling and shaking cables, hitting the flowmeter housing, using the connecting cable as a load-bearing line, and hanging heavy objects. The cable must be fixed firmly and cannot be shaken.

④ The power supply mode is 1 2VDC. It can be powered by battery, solar energy, 220 V mains to 1 2VDC and other ways. When using mains conversion, a linear conversion power supply is required to provide stable DC output.

4.3.4 Installation steps

(1) First install the fixed bracket to ensure that it can be stably and reliably fixed under the condition of twice the maximum flow rate.

(2) The flowmeter is fixed to the installation base.

(3) Flowmeter cable is wired through the pipe. All protective pipes should be fixed well. There should be at least one fixing buckle every 0.5 meters of protective pipes in the water, and the outlet behind the flowmeter should be specially protected and fixed.

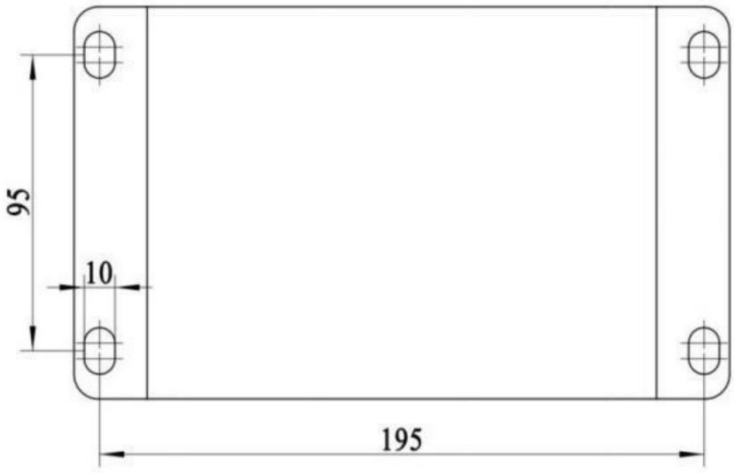
(4) Send instructions through the laptop to view the measurement data.

(5) If it is close to the actual flow rate, the 485 line can be connected to the "UTD" on site, computer, or other receiving equipment.

(6) Clean the garbage upstream of the flow meter.

4.4 Controller installation

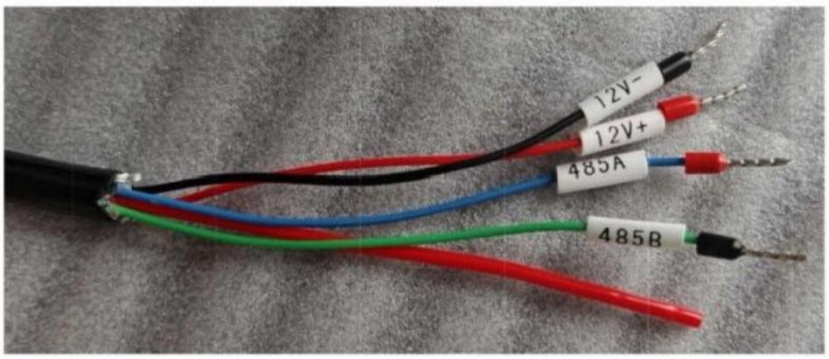
The controller is installed in a wall-mounted installation, and the installation hole diagram is shown below. The installation hole size is 10 mm, and it is recommended to use M8 screws for installation. The distribution of the installation hole is shown in the following figure :



F igure 4.7 Insta llat ion ho le d istr ibut ion locat ion diagram

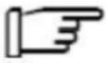
4.5 Line connection

4.5.1 Flow meter wiring definition



The flowmeter cable consists of four connecting wires and one gas guide tube.

Line sequence	pigment	use
1	red	Positive power supply (12V)
2	black	Negative power supply (12V)
3	blue	RS485-A
4	green	RS485-B
airway	red	Pressure sensors measure pressure



pay attention to

The cable color may vary due to batch reasons, and the cable based on the number tube mark.

4.5.2 Controller wiring definition

The controller has 4 cable interfaces and 1 USB interface, as shown in the figure below:

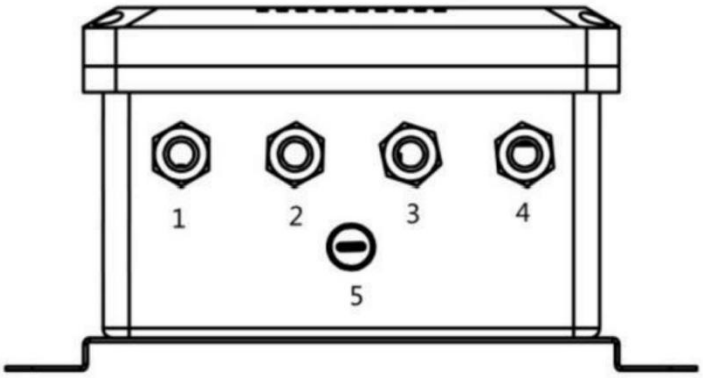


Figure 4.1 Controller interface distribution

The purpose of each interface is shown in the following table:

Table 4.1 Purpose of controller interface

number	name	use	Interface specifications
1	power input	For power input	PG9 (Cable outer diameter range 4~8 mm)
2	Flow meter interface	Power the flow meter and 485 communication	
3	Signal output 1	Customization: RS485 communication, 4-20 mA output and switch output can be connected	
4	Signal output 2		
5	USB joggle	obligate	USB-TypeC

The signal output has two reserved interfaces. If only one interface is used on site, the remaining interface should be blocked to prevent rain from entering the controller.

The internal wiring of the controller is defined as shown in the figure below:

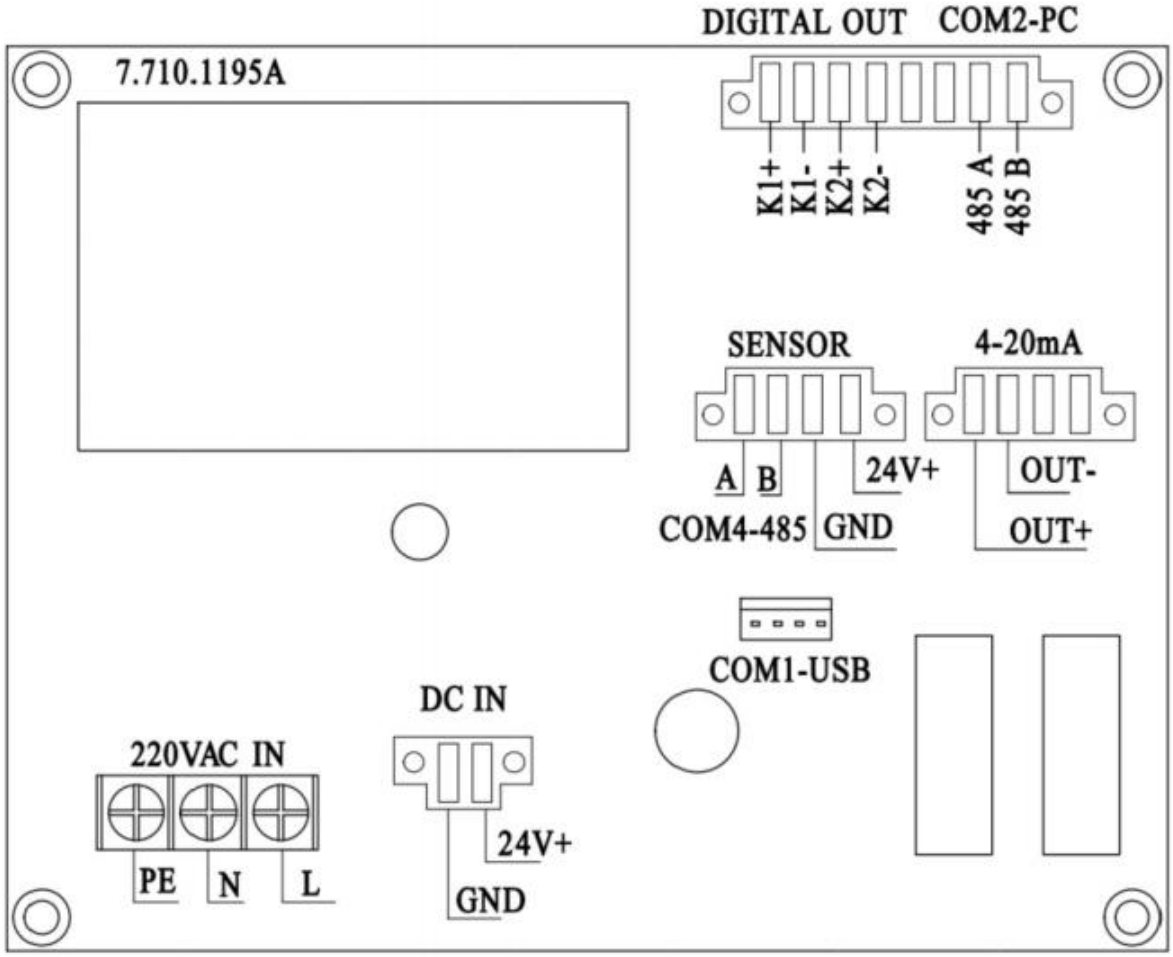


Figure 4.2 Schematic diagram of controller circuit board wiring

pay attention to

The AC terminal should be tightened and powered on after confirming that there is no short circuit.

After tightening the terminal, apply insulating sealant to prevent electric shock during operation and maintenance.

5. Equipment debugging

5.1 Flow rate calibration

The equipment has been calibrated before leaving the factory, and under normal circumstances, users do not need to modify the coefficient. When users find that the flow rate measurement is abnormal, they can check whether the flow rate calibration coefficient is abnormal.

5.2 Water level zero calibration

Water level zero calibration can be manually set or automatically calibrated. During automatic calibration, set the range according to the calibration water level. Click "zero adjustment" when there is no water, and click "calibration" when it is completely submerged in the bottom to complete the zero adjustment function.

5.3 Section type Settings

Click section type, there are three types to choose from, select the corresponding section according to the type of installation point.

(1) Circular section

The circular section is generally a pipe, which can be set according to the radius of the pipe, so that the flow rate can be automatically calculated according to the flow

rate. (The flow meter should be placed at the bottom of the pipe)

(2) Rectangular section

The rectangular section is a river or channel, etc., which can be set according to the width, so that the flow rate can be automatically calculated according to the velocity.

(3) Trapezoidal section

The trapezoidal section is for river or channel, etc., and can be set according to the bottom width and slope Angle to automatically calculate the flow rate according to the flow velocity.

6 Software operation

6.1 Software functions

- Collect the flow meter data and display it in real time on the interface.
- Set the parameters of flowmeter, pipe section area, measurement coefficient, etc.
- Measurement data can be exported through RS485 and 4-20mA output.
- Save historical data of flow rate, flow velocity and water level, and export the data to the computer through USB port.
- Accumulated flow can also be output proportionally by means of switch closure.

6.2 Menu structure

The operation interface of the analyzer adopts a simple and quick menu interface. The main interface includes the measurement component selection interface and the add parameter interface under the gear button. The organization structure of the whole menu is simple and clear, which is convenient for operation.

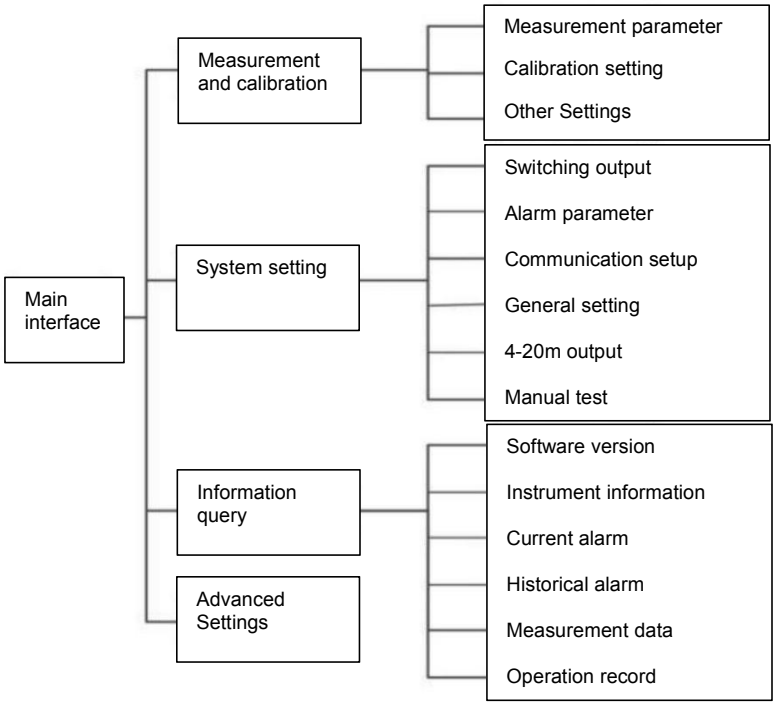


Figure 6.1 Menu structure diagram

6.3 Operation instructions

Table 6.1 Description of operating structure

key	operation declaration
	Left key, left and right page selection Under the main interface, you can quickly view the current alarm information
	Press the "up" key to flip through pages
	Right click and flip the page left and right to select Under the main interface, you can switch between the main and secondary screens
	Press the "down" key to flip through the pages
ESC	The "cancel" key cancels, exits and returns to the previous menu
ENTER	Press "Confirm" to enter the menu and select confirm

pay attention to

Due to software upgrades and other reasons, there may be slight differences between the actual interface of the analyzer and what is described in the user manual.

6.4 Startup interface

After the system is powered on, perform a self-check first. The self-check involves checking communication between the sensor and the controller. If the communication is successful, it will enter the main interface. If ommunication fails or if no sensor is

connected, you can press the "ESC" key to skip the self-check and directly enter the main interface, where you can modify the communication settings in the menu. Press "Enter" to initiate another self-check, or power off and restart the controller.

The main interface of the controller is shown in the figure below, which mainly includes the following information : device time, measurement parameter information (the following is an example of parameters of Doppler flowmeter, including flow rate, flow rate, cumulative flow rate, water level, water temperature, cross-sectional area), status prompt (N for normal measurement, F for fault, A for alarm).

2024.01.0120:00:00
Flow rate 0.000 m/s
Flow rate 0.00 m/h
Cumulative flow rate 0.04 m³
Water level 0.15 m
Water temperature 25.31℃
N ＜ alarm View the secondary screen ">"

Figure 6.2 Ma in interface d iagram

Click the "<" button to quickly enter the current alarm interface,click the "ESC" button to return to the main interface. Click the ">" button to view the secondary screen, and click the ">" button again to switch back to the main interface.

2024.01.0120:00:00
Cross- sectional area 0.00m³
N "<" View alarm View the secondaryscreen " > "

6.3 Secondary screen interface d iagram

6.5 Main menu

Under the main interface, press the "ENTER" key to enter the "main menu" interface.

The lower menu includes "measurement and calibration", "system Settings", "information query" and "advanced Settings". Select the menu by pressing the up, down, left and right keys, and press the "ENTER" key to enter. As shown in the following figure:

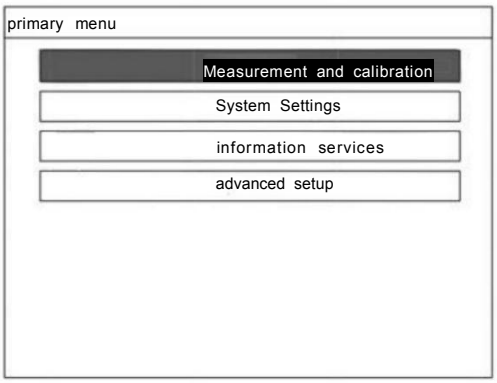


Figure 6.4 Main menu

6.6 Measurement and calibration

Select the "Measure and Calibrate" box by using the up and down keys, and click "ENTER" to enter the measure and Calibrate interface. Click "Doppler flowmeter", and the display menu includes "Measure Parameters", "Calibration Settings" and "Calibration Coefficient".

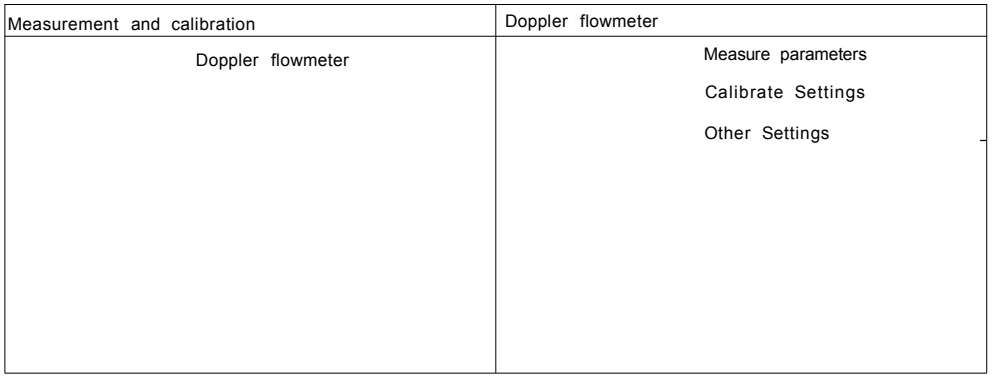


Figure 6.5 Measurement and calibration interface

6.6.1 Measurement parameters

Select the "measurement parameters" box with up and down keys to enter the detailed parameter setting interface. The menu includes "pipeline parameters", "unit Settings" and "water level offset".

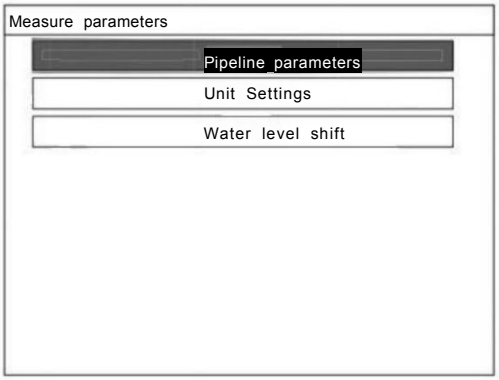


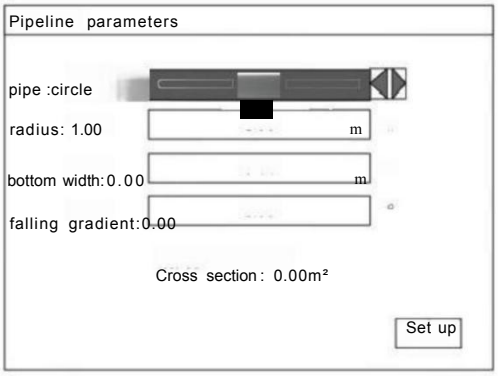
Figure 6.6 Measurement parameter interface

(1) Pipeline parameters

> Pipe shape: "round", "rectangular" and "trapezoidal" can be selected;> Pipe radius: can be freely set;

> Bottom width: can be set freely;

> Slope: can be set freely.

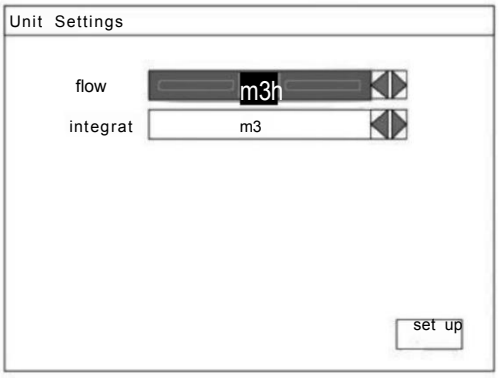


F igure 6.7 P ipe l ine parameter interface

(2) Unit setup

> The optional units of flow are m³/h, m³/s and L/s;

> The optional unit for cumulative flow is m³ and L.



F igure 6.8 Un it Sett ings interface

(3) Water level shift

In actual working conditions, the flow meter is installed at a certain height away from the bottom of the water, and this offset needs to be set in the equipment to correct the water level value.

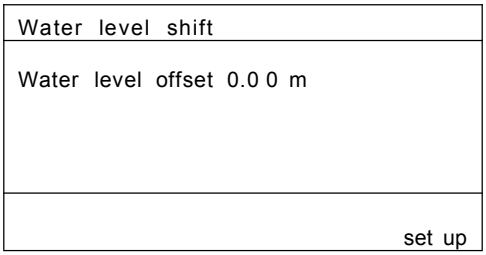


Figure 6.9 Water leve l offset interface

6.6.2 Calibration Settings

Select the "Calibration Settings" box by using the up and down keys to enter the calibration Settings interface. The lower menus are "Flow rate", "Flow", "Water level", "Water temperature", and "Cumulative flow".

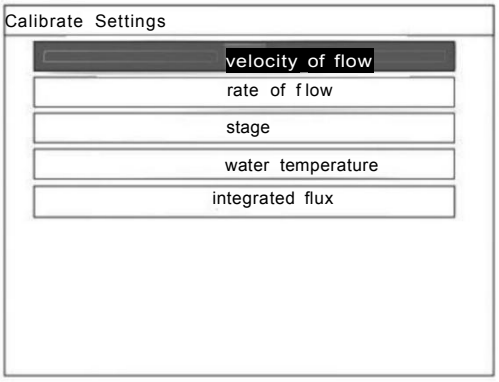


Figure 6.10 Calibration Settings screen

(1) Flow rate

Under the flow rate page, you can modify the zero coefficient b and range coefficient k of the flow rate. After modification, you need to select the "Set" button and click the "ENTER" key to complete the modification.

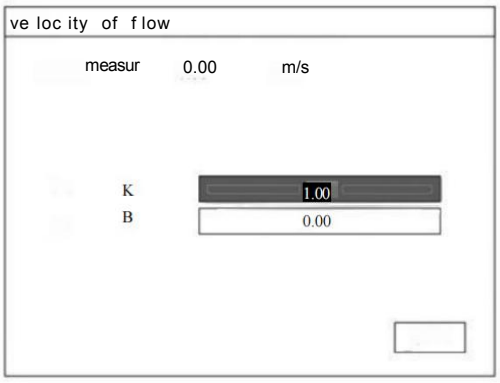


Figure 6.11 Velocity interface

（2） Traffic

In order to compensate for the flow error caused by the field condition, users can modify the flow coefficient k in the system. After modification, you need to select the "Set" button and click the "ENTER" key to complete the modification.

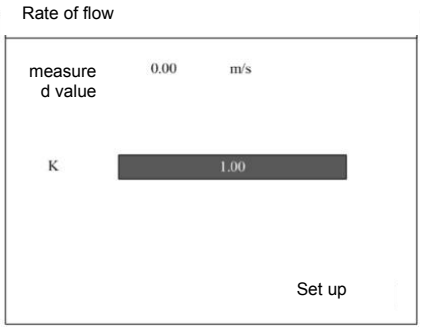


Figure 6.12 Flow interface

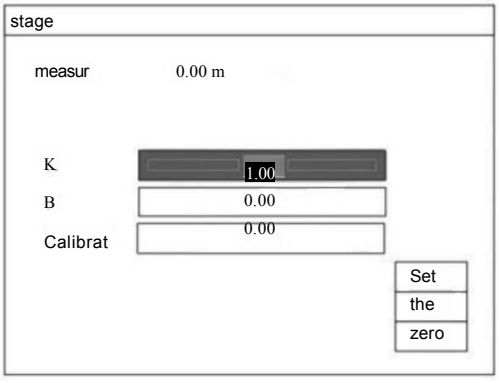
（3） Water level

Under the water level interface, the user can correct the measurement deviation of the water level sensor. Select the parameters to be modified by pressing the up anddown keys, and press the "Set" key to set the kb value under the current interface into the flowmeter.

If the user does not know what value to change the kb value to, it can also be corrected by using the "zero adjustment" and "calibration" buttons.

> Take the flowmeter out of the water and put it in the state of 0 water level. After the measured value is stable, select the "zero adjustment" button through the up and down keys, and press the "ENTER" key to perform the zero adjustment action.

Put the flowmeter into the water, and the depth of the water is recommended to be more than 1.5 meters. After the measurement value is stable, measure the water level value of the sensor with a tape measure, input the data into "calibration water level", select the "calibration" button by pressing the up and down keys, and execute the calibration action by pressing the "ENTER" key.



F igure 6.13 Water leve l interface

(4) Water temperature

The deviation of water temperature measurement can also be corrected by modifying the kb coefficient.

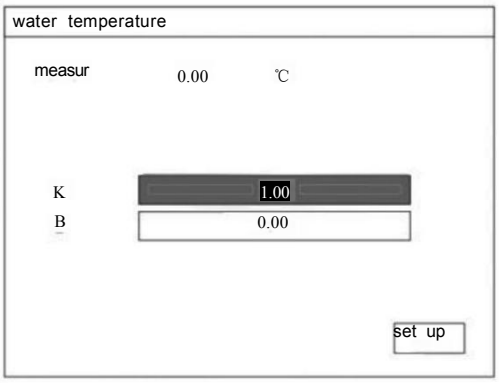


Figure 6.14 Water temperature interfac

(5) Cumulative traffic

Under the cumulative flow interface, users can modify the current cumulative flow value in m³. Inputting 0 will reset the flow to zero.

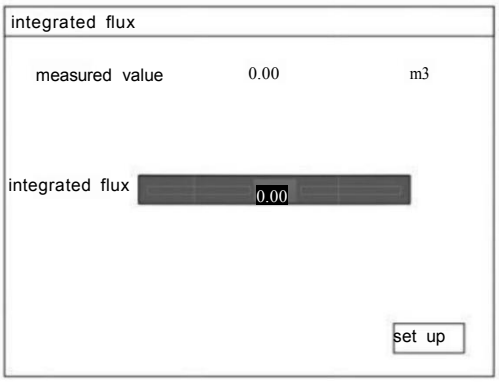


Figure 6.15 Cumulative flow interface

6.6.3 Other Settings

In other Settings, set the cumulative flow ratio output, for example, set it to 100 0m³. When the cumulative flow reaches 100 0m³, the corresponding relay will close for 5 seconds and then automatically disconnect. After that, the relay will act once every 1000m³.

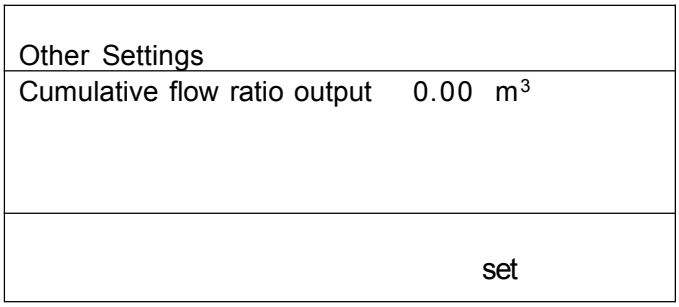


Figure 6.16 Other Settings screen

6.7 System Settings

In the main menu interface, select the "System Settings" box by using the up and down keys, and click the "ENTER" key to enter the system Settings sub-interface. There are 6 sub-items under the menu, as shown in the figure below.

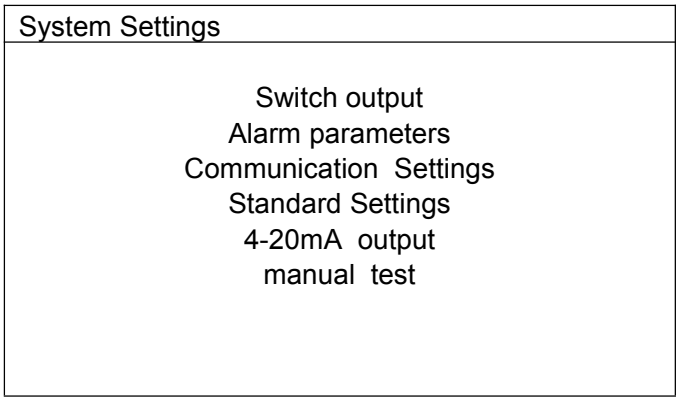
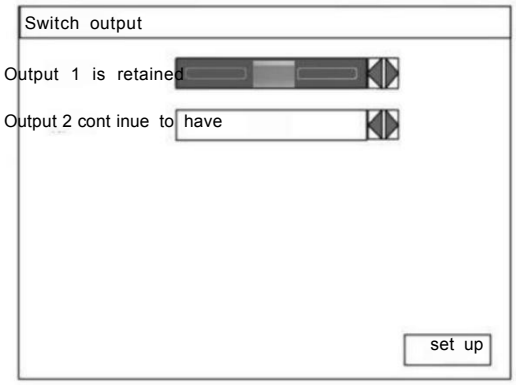


Figure 6.17 System Setting s screen

6.7.1 Switch output

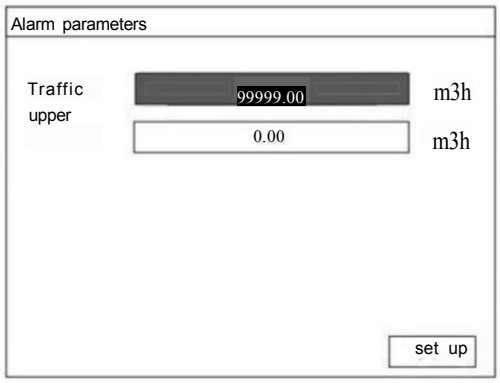
The switch output interface can be configured in four items: "low flow", "high flow", "cumulative flow ratio output", and "retain". The Settings can be selected by pressing the up and down keys, and executed by pressing the Settings key.



F igure 6. 18 Sw itch output interface

6.7.2 Alarm parameters

The upper and lower limits of the flow rate can be set. If the measured value exceeds the set range, an alarm will be triggered. If the alarm for low or high flow rate is configured in the switch output, the corresponding switch will close when the alarm is triggered.



F igure 6.19 A larm parameter interface

pay attent ion to

The upper l imit is set to be greater than the lower l imit.

6.7.3 Commun icat ion Sett ings

The controller has a total of 3 serial ports, among which COM1-USB is reserved port and can be expanded later. COM2-PC is the external data transmission serial port, which supports modbus protocol transmission. See Chapter 7.2 of this manual for details.

COM4-485 is the sensor communication port and needs to be configured according to the connected sensor.

The positions of each serial port on the circuit board are shown in Chapter 4.5.2 of this manual.When configured, select the serial port by pressing up and down keys, press "ENTER" to activate, and then use left and right direction keys to select the baud rate, whichcan be selected: 9600,.38400,57600, 115200, default is 57600. The device address is default 1.

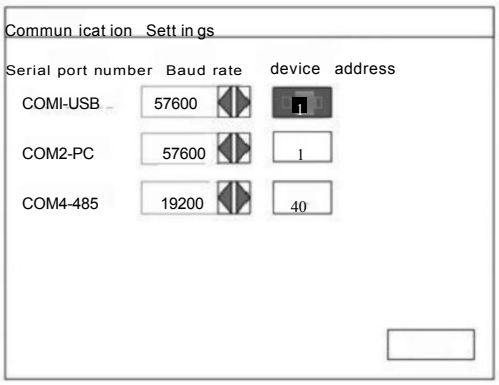
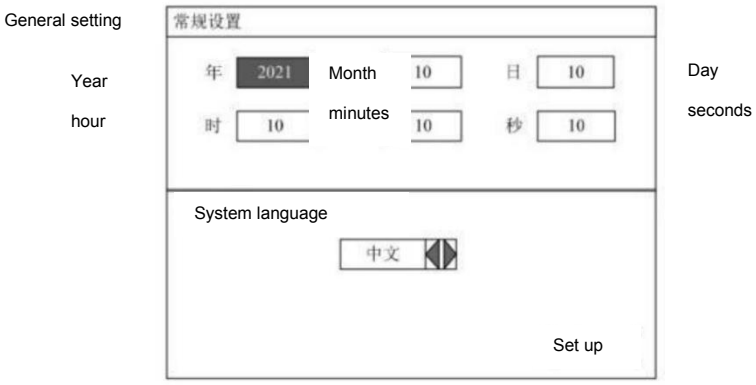


Figure 6.20 Commun icat ion Sett ings screen

6.7.4 Convent iona l Sett ings

The system time can be set to year, month, day, hour and minute. The 24-hour system is used, and the data type is integer. The range of data can be set as follows: year [2000,3000], month [1,12], day [1,31], hour [0,23], minute [0,59], and second [0,59].

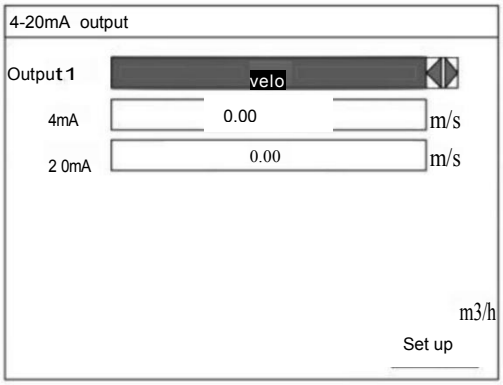
Language selection can be made in Simplified Chinese and English.



F igure 6.21 Convent iona l Sett ings interface

6.7.54-20mA output

The configuration items of 4-20mA output include flow rate, flow and retention. Decimals and two digits after the decimal point can be entered. When configured as flow rate, the unit is m/s; when configured as flow, the unit is m³/h.



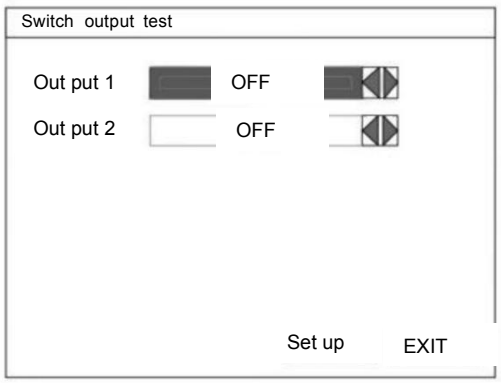
F igure 6.224-20 mA output interface

6.7.6 Manual testing

Manual Test The switch can be manually turned on or off, and the current value of 4-20 mA output can be set manually to verify that the device is working properly.

(1) Switch output test

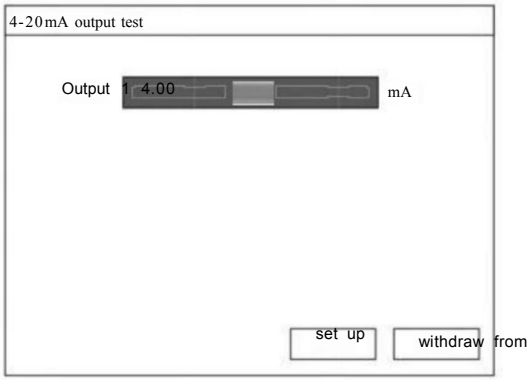
The status of each switch can be switched by the "←" and "→" keys. The status will take effect after clicking the "Set" button, and the status will be reset after clicking the "Exit" button.



F igure 6.23 Sw itch output test interface

(2) 4-20 mA output test interface

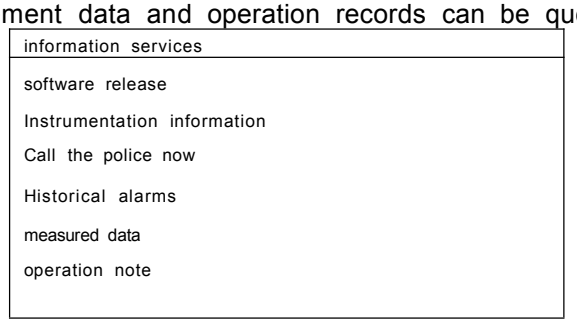
The current value can be manually set within the range of [4,20] mA. Click the "Set" button, 4-20 mA is forced to output according to the set value ; Click the "Exit" button to exit the manual test and reset the 4-20 mA output.



F igure 6.244-20 mA output test interface

6.8 Information query

The software version, instrument information, current alarm, historical alarm, measurement data and operation records can be queried.



F igure 6.28 Informat ion query interface

6.8.1 Software version

It can display the current controller software version and connected sensor software version.

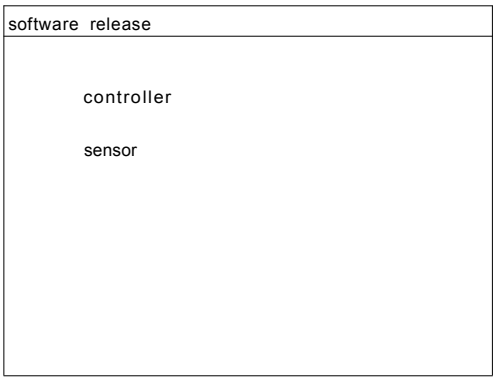


Figure 6.25 Software version interface

6.8.2 Instrument information

The current controller device number and connected sensor number can be displayed.

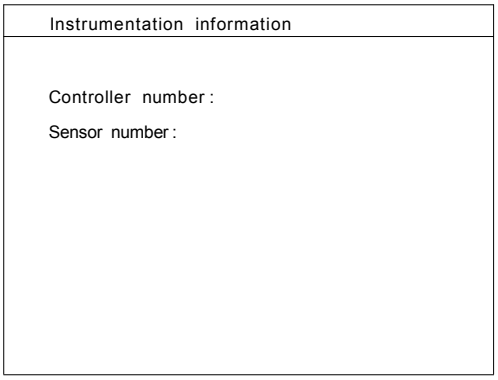


Figure 6.26 Instrument information interface

6.8.3 Current alarm

The current alarm only shows the current unrelieved alarm information, and both fault and alarm information are recorded here.

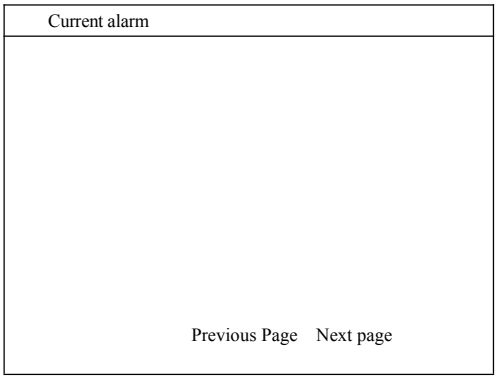


Figure 6.29 Current alarm interface

6.8.4 Historical alarm

The historical alarm includes the generation and release of alarms. The maximum number of records is 100. If more than 100 records are recorded, the earliest record will be deleted. Users can also manually clear the alarm records.

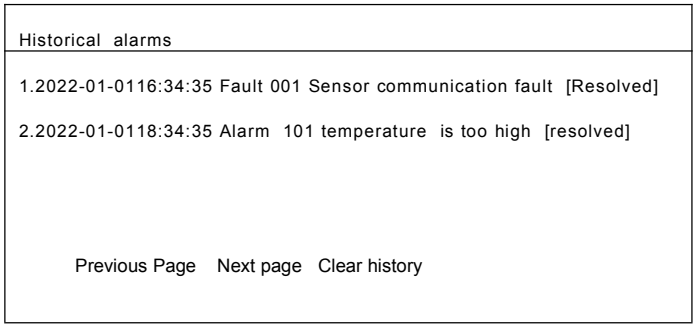


Figure 6.30 Historical alarm interface

6.8.5 Measurement data

The interface displays the recorded measurement data in the form of minute average data, and one hour data is one group. When exporting the data, you need to select how many groups of data to export, click the "Settings" button, and the data will be sent through COM1-USB serial port.

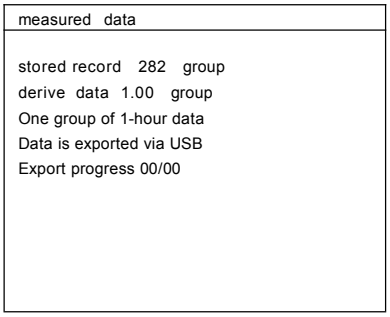


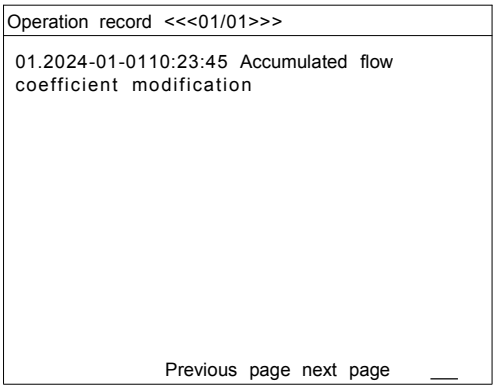
Figure 6.27 Measurement data interface

pay attention to

Data export is an extended function, and the actual situation may be inconsistent with the description of this manual as software upgrades occur. The exported data needs to be parsed by a dedicated tool.

6.8.6 Operation records

The operation log will record the important parameter modification actions, such as the modification of kb coefficient.



F igure 6.28 Operat ion record interface

pay attent ion to

Users cannot clear the measurement data and operation records. If you want to clear the data, you need to contact the manufacturer for technical support.

7 Communication protocol

7.1 Flow meter communication protocol

The communication mode of Doppler flowmeter is RS 485, and the communication protocol supports standard ModbusRtu format, as shown in detail below: baud rate support: 9600, 19200,38400,57600 and 115200 Data bits: 8 Stop bits: 1

parameter	Starting address of the register	Number of Register measure N	data class mould	autho rity	description	remarks
Flow velocity value	0x001A	2	float	R	m/s	
temperature	0x001C	2	float	R	degree Celsius	
Water level depth	0x001E	2	float	R	m	
measured discharge	0x0020	2	float	R	m3/s	Flow is related to section setting
integrated flux	0x0022	2	float	RWS	The default value is m³/h, which varies with the unit, and the data is saved once every 1 min	You can manually reset or set a pre-estimate for the debugging period
Peak Flow Rate price	0x0103	2	Float	RWS	Unit m/s, initial value is 5, range [1,10] can be set	The limit range of flow rate can be set

device address	0x010F	1	UINT16	RWS	Default 40; range [0,255]	Fixed address 255
485 baud rate	0x0110	1	UINT16	RWS	Default 1; Range [0, 3]; Meaning: 0=9600;1=19200;2=57600;3=115200; [Make sure to configure 57600 when upgrading remotely]	The default baud rate is 19200
Water level datum	0x0115	2	Float	RWS	Default 0; range [0,1000], unit: m	
discharge coefficient	0x0117	2	Float	RWS	Default 1, range [0.01,2]	
Low flow rate cut-off threshold	0x0119	2	Float	RWS	The default value is 0.05, unit: m/s, range [0,1], less than this threshold, the flow rate is 0	
flux unit	0x011B	1	UINT16	RWS	0: m3/h; 1: m3/s; 2: L/s; default 0	
integrated flux unit	0x011C	1	UINT16	RWS	0: m3; 1: L; default 0	
Pipeline type selection	0x0200	1	UINT16	RW	0: Circle; 1: Rectangle;	
				S	2: Trapezoid; default 0 circle	
Circular river radius	0x0201	2	Float	RW S	Unit m, default 1, range [0,10]	
Rectangular river width	0x0203	2	Float	RW S	Unit m, default 1, range [0,50]	
Trapezoidal channel width	0x0205	2	Float	RW S	Unit m, default 1, range [0,200]	
Trapezoidal channel Angle	0x0207	2	Float	RW S	The unit is °, the initial value is 30, and the range can be set as [0,90]	
Water level control command	0x0210	1	UINT16	W	Setting 1: zero adjustment (the device status becomes zero adjustment, and the measurement is automatically switched after zero adjustment);	

					Setting 2: Calibration (the device status becomes calibration, and the measurement is automatically switched after calibration)	Calibration requires setting the water level range first
Water level control command result	0x0211	1	UINT16	R	0: idle, 1: running; 2: running successfully; 3: running failed	
Water level compensation K	0x0212	2	Float	RW S	Default 1	The coefficient can be modified manually
Water level compensation B	0x0214	2	Float	RW S	The default is 0	
Water level range	0x0216	2	Float	RW S	Unit m, default 1, range [0,20]	Set up to calibrate the water level
Flow velocity calibration coefficient k	0x0230	2	Float	RW S	Default 1, range [0.01,2]	The coefficient can be modified manually
Flow velocity zero point coefficient b	0x0232	2	Float	RW S	Default 0, range [-5,5]	
Temperature calibration coefficient k	0x0270	2	Float	RW S	Default 1, range [0, 10]	The coefficient can be modified manually
Temperature zero point coefficient b	0x0272	2	Float	RW S	Default is 0, range [-10, 10]	

Protocol format: device address + function code + register address + number of registers + checksum data format is float type DC BA

Example of command: Device address is 40 (decimal)

parameter	Register address	Read the command	receiving order
velocity of flow	001A	2803001A0002 E235	28030425 F6 B93C DA4E Data analysis: 0.02
temperature	001C	2803001C00020234	28030400109541 EC 54 Data analysis: 18.63

Example of maximum flow velocity setting:

parameter	Register address	set up	protocol command
Maximum flow velocity value	0103	Set it to 5m/s	281001030002040000 A0404286

Maximum flow velocity value	0103	Set to 10m/s	2810010300020400002041 E286

Maximum flow rate reading protocol: Type float

parameter	Register address	Read the command	receiving order
Maximum flow velocity value	0103	280301030002320E	**2803040000 A0403B01 Data analysis: 5**

7.2 Controller protocol

The communication mode of the controller is RS 485, and the communication protocol supports standard ModbusRtu format, as detailed below: baud rate support: 9600, 19200, 38400, 57600 and 115200 Data bits: 8 stop bits: 1

parameter	The starting address of the register	Number of registers N	data type	authority	description
Flow velocity value	0x0000	2	float	R	m/s
sectional area	0x0002	2	float	R	m2
instantaneous delivery	0x0004	2	float	R	m3/h
depth of water	0x0006	2	float	R	m
temperature	0x0008	2	float	R	℃
integrated flux	0x000A	2	Float	R	m3
Switch operating modes	0xFFFF	1	Uint16	RW	0: Measurement mode 1: Maintenance mode

8. Maintenance

8.1 General maintenance

- Regularly check the whole system to see if the measurement data is normal.
- Regularly check all connections for leaks and corrosion.
- Regularly check all cables for damage.
- Check regularly whether the surface of the flowmeter is blocked by debris, and clean it regularly.

8.2 Long-term storage

When storing the instrument for a long time, please put the instrument into the instrument packaging box. When storing the instrument for a long time, pay attention to the humidity, temperature and corrosive environment used by the instrument, do not press, do not rain, do not expose to the sun.

Avoid placing the instrument near any potential power interference (such as pumps, microwaves, etc.), high energy magnetic fields or radio interference sources.