



Doppler Ultrasonic Flow Meter

User Manual



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1 Manual Introduction

1.1 User Notice

Thank you for choosing and using this product.

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

This manual is prepared for trained personnel with a certain technical foundation. They have received professional training or have certain theoretical and practical experience in the field of instrumentation and control.

It is very important to understand the safety information, warning information and correct technical operations described in this manual 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 when using the product. If you need additional 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 the scope of your purchase or use. Unless otherwise agreed in the contract, the company does not make any express or implied statements or warranties on the contents of this manual.

This product manual is protected by copyright. Without the manufacturer's permission, copying or partially copying the manual content, adding content, distributing the manual content, and using it for unfair competition, we will reserve the right to pursue legal liability.

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

1.2 Identification Notes

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

Special reminder: When reading this manual, please pay attention to the "warning text and information text".

Careful reading of the information can avoid danger to the life or health of users or maintenance personnel and property losses. These information will be marked with appropriate icons and some valuable tips will be provided next to them, with explanatory text attached. The terms used in this manual and the information on the product have the following meanings:



Instructions

Instructions are the description, explanation and supplement of certain specific contents in product operation.



Notice

Notes remind users of important information when operating the product, or parts of the manual that require special attention.



Warning

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



Danger

Failure to comply with the appropriate safety precautions may result in death or injury to personnel or significant property damage.

1.3 Applicable Personnel

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

Qualified personnel who understand the safety information that appears in this manual or is indicated on the product itself are:

- Professional instrumentation engineers who are familiar with the technology and safety of this product;
- Operators who have received operator training on the use of this product and fully understand the operating content of this manual;
- Operation and maintenance personnel who have received professional training according to the established safety measures.



Instructions

After installing and debugging the equipment, our company will provide relevant

training and guidance to customers and related personnel so that customers can use

this product correctly and effectively.

1.4 Packaging and Transportation

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

When opening the box, please follow the relevant instructions on the packaging material. After unpacking, please check the goods in time against the "Shipping List". In addition, please check

whether the appearance of the received items is deformed or damaged. Special reminder is to keep the relevant documents for use during installation and operation.

There is a copy of the "Shipping List" in the package. If you find that the content shown in the shipping list does not match the items in the box, please contact our company in time.

Notice



Please keep the accessories properly to avoid the inconvenience of extended repair time due to loss of accessories during repair.

1.5 Precautions

During the entire process of operating, maintaining, and repairing this equipment, please observe the following general safety measures.

- Ground the equipment properly.
- Grounding the equipment properly can minimize the risk of electric shock.
- Do not disassemble, assemble, debug, plug or unplug the connecting wires, etc. when the power is on, which may damage the instrument. To prevent electric shock to the human body and damage to the equipment, please remove the power cable and discharge the electrical energy in the internal circuit of the equipment before operating.
- Do not handle the circuit board with bare hands to avoid damage caused by static electricity.
- Use protective equipment.

Please use protective equipment such as high-temperature gloves as needed during operation to avoid burns or scratches on your hands.

If you neglect safety measures or fail to comply with the warnings on specific matters recorded in this user manual, you will violate the safety standards for the design, manufacture and use of this product.

The company is not responsible for any liability caused by the user's inaction.

1.6 Warranty

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

For damage within the warranty period and within the warranty scope, our company will provide free maintenance services, mainly including product maintenance, spare parts repair and replacement, technical support and regular on-site services within the warranty period.

If the following faults occur beyond the warranty period or within the warranty period, they are all out-of-warranty repairs. Our company can provide you with paid product services, including but not limited to:

- Damage caused by force majeure (earthquake, lightning strike, flood, etc.);
- Instrument damage caused by failure to reliably ground the equipment as required;
- Natural wear;
- Damage caused by improper use (corrosion, fire, strong electricity, water ingress, strong electricity in series, etc.);
- Unauthorized modification of internal components of the product;
- Unauthorized modification of technical and functional parameters of the product;
- Failure to store, use and maintain the product in accordance with the user manual and training regulations;
- Failure to use the product as defined in the order;

- Artificial removal of product labels.

When a product part reaches the end of its service life or is damaged, please dispose of it safely in accordance with local waste management and environmental regulations; or package and mark the part and return it to our company for processing.

For specific warranty requirements, please refer to the terms in the order contract

2 Product Overview

2.1 Overview

In addition to a certain amount of inorganic pollutants, various types of wastewater discharged from production processes, living facilities and other emission sources also contain a large amount of organic pollutants. After these pollutants enter the environment, a large part of them will be discharged into nearby surface water through air precipitation or even directly, causing most rivers, lakes, urban reservoirs, etc. to be polluted to varying degrees, causing the water to stink and have abnormal colors, which will affect the entire ecosystem.

Combining many years of experience in the development of environmental monitoring instruments, our company has developed a unique ultrasonic Doppler flowmeter, which integrates water quality monitoring technology, mobile data communication technology, data network technology, etc. with advanced flowmeter technology and Internet of Things technology as the core, and intelligently realizes the monitoring of water parameters (flow, flow rate, water level), and uploads data to the system platform according to customizable protocols.

Controller unit: The controller unit uses a 2.8-inch industrial screen display and a membrane keypad operation mode. The unit can collect flowmeter data, display it and transmit it to the outside. You can also set the relevant parameters of the flow meter, such as pipe shape, cross-sectional area, water level reference, etc., as well as coefficient correction of measurement parameters.

Flow meter unit: used to measure the flow rate and flow of water in rivers, sewage pipe networks, open channels, etc.

2.2 Features

- Capable of long-term automatic detection, small structure and strong environmental adaptability.
- 2.8-inch industrial screen, clear and intuitive display, stable and reliable.
- Wide voltage input, can support both 220VAC and 24VDC power supply modes.
- With RS-485 standard communication interface, default MODBUS standard protocol (accept non-standard customization).
- Support 4-20mA output.
- The controller can be wall-mounted.
- The controller has built-in storage of 128Mbit, which can store historical measurement data.
- Can be expanded to realize 4G network data transmission (need to be customized).

2.3 Applications

- Pollution source water quality monitoring
- Water used in industrial production processes
- Industrial and municipal wastewater treatment

3 Product Introduction

3.1 Controller

3.1.1 Product Description

The ZDMFA-01 controller is a controller that is easy to use on site. It can connect to the Doppler flowmeter, read the data measured by the flowmeter, and has a display screen for display and interaction. The product is widely used in surface water, municipal sewage, industrial wastewater, sewage treatment, water plants, industrial processes, aquaculture and other industries.

3.1.2 Basic parameters of the product

Table 3.1 Basic Product Specifications

Items	Details
Display	2.8" TFT color screen, resolution 240*320
Communication Interface	1-way digital flow meter interface (24VDC+RS485) 2-way switch outputs (passive, can withstand up to 24V1A) 1 RS485 1-way 4-20mA output 4G Internet of Things (optional customization)
Storage Capacity	128Mbit
Electrical interface	4个PG9 Waterproof Connector 1个USB-TypeC(Reserved)
Power Requirements	100-240VAC 50/60Hz;9-36VDC
Operating Temperature	-20°C~60°C
Dimensions	164mm*146mm*101mm
Weight	1.5kg
Installation	Wall-mounted

3.1.3 Product Appearance



Figure 3.1 Controller appearance

3.1.4 Product size

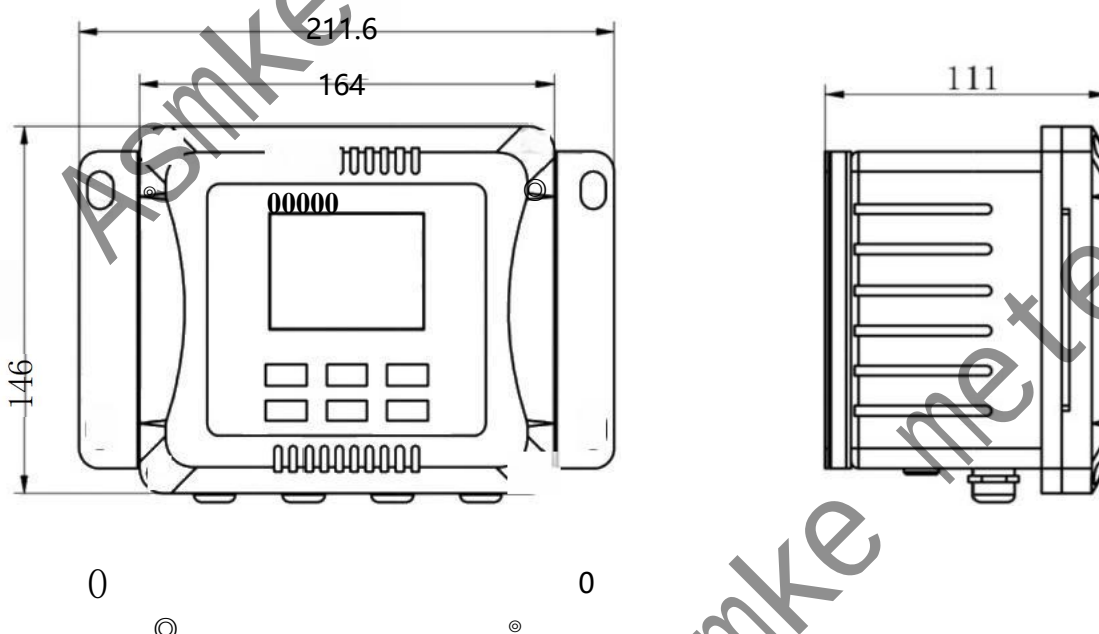


Figure 3.2 Controller dimensions

3.2 Ultrasonic Doppler Flow Meter

3.2.1 Product Description

The flow meter adopts an integrated package and is suitable for measuring water flow velocity in various environments such as open channels, rivers, and pipe networks. It adopts ultrasonic detection technology, has high measurement

accuracy, high stability, is less affected by environmental factors, has no rotating parts, has low maintenance frequency, and has high working reliability. It is the preferred product for online measurement and portable measurement.

3.2.2 Measuring Principle

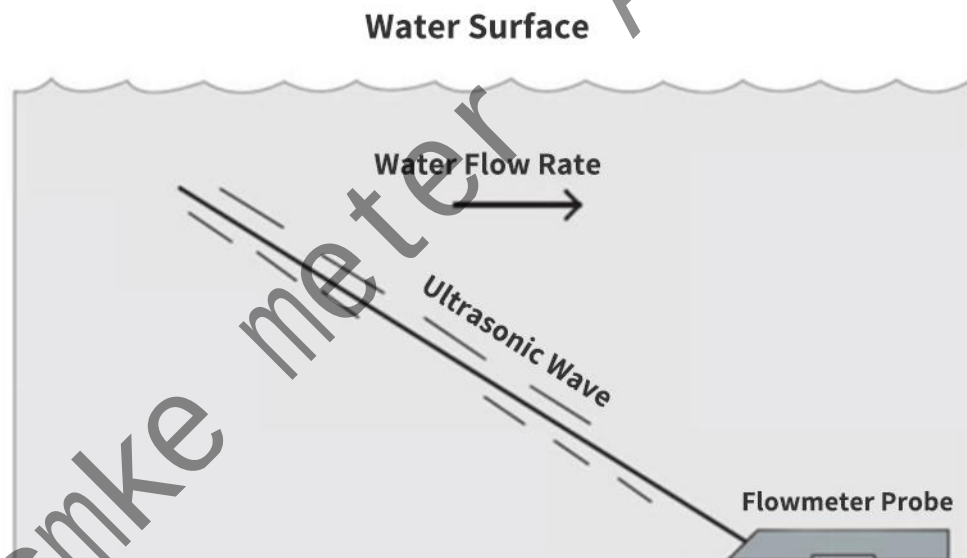


Figure 3.2 Doppler measurement principle diagram

As shown in the figure above, the flow meter probe emits a beam of high-frequency ultrasonic waves obliquely upward. When the ultrasonic waves propagate in the fluid, they are reflected by the flowing impurities. The reflected ultrasonic waves produce Doppler frequency shift, and the frequency shift is proportional to the flow velocity. By monitoring the Doppler frequency shift Δf , the velocity of the fluid can be measured. The flow velocity calculation formula is as follows:

$$V = \frac{\Delta f * C}{2 \cos \alpha * f_0}$$

in the formula: C is the sound velocity of ultrasound in the fluid;

f_0 is the initial ultrasound frequency;

α is the beam emission angle;

Δf is the ultrasound frequency shift;

After obtaining the flow velocity, the instantaneous flow rate ($Q=V*S$) can be calculated in combination with the cross-sectional area of the channel.

3.2.3 Technical features

Compared with traditional water flow meters, Doppler flow meters use an integrated packaging structure, which is waterproof, pressure-resistant, and wear-free. The closed structure is not affected by the external environment and has a low failure rate. At the same time, it has little effect on the water flow state, is not affected by impurities and other debris in the water flow, and will not fail to work due to blockage. Using the Doppler frequency shift principle, the detection accuracy reaches the millimeter level. It fundamentally solves various problems such as inaccurate low-flow measurement, easy clogging, easy corrosion, and frequent maintenance, and has the following characteristics:

- Cross-sectional flow velocity measurement: streamlined and compact structure design, with little impact on the flow state of the water section;
- High measurement accuracy: Doppler frequency shift algorithm ensures stable measurement results, with velocity resolution accurate to millimeter level.
- Functional diversity: In addition to measuring flow velocity, it can also detect water level depth and water temperature in real time.
- Low power consumption design: Embedded software and hardware integrated design, overall miniaturization packaging, and overall low power consumption.
- Wide application scenarios: full pipe and non-full pipe flow with turbidity greater than 20NTU, as well as river and channel flow velocity measurement are all possible.
- High protection level: Meets IP68 protection level and can be applied to various different applications.

3.2.4 Basic parameters of the product

Table 3.2 Flow Meter Specifications

Specification	Details
Flow Rate Range	0.03m/s~10m/s
Measurement Accuracy	Relative Error $\pm 1\%$, Absolute Error $\pm 0.010\text{m/s}$
Water Level Range	(0~10)m
Water Level Accuracy	0.5%FS
Minimum Water Level	0.02m
Temperature Measurement Range	(0~60) $^{\circ}\text{C}$

Temperature Measurement Accuracy	$\pm 1^{\circ}\text{C}$
Protection Level	IP68
Supply Voltage	(9~36)VDC
Power	<0.4w
Communication Interface	RS485
Response Time	<1s

3.2.5 Product Appearance



Figure 3.3 Flow meter appearance

3.2.6 Product Size

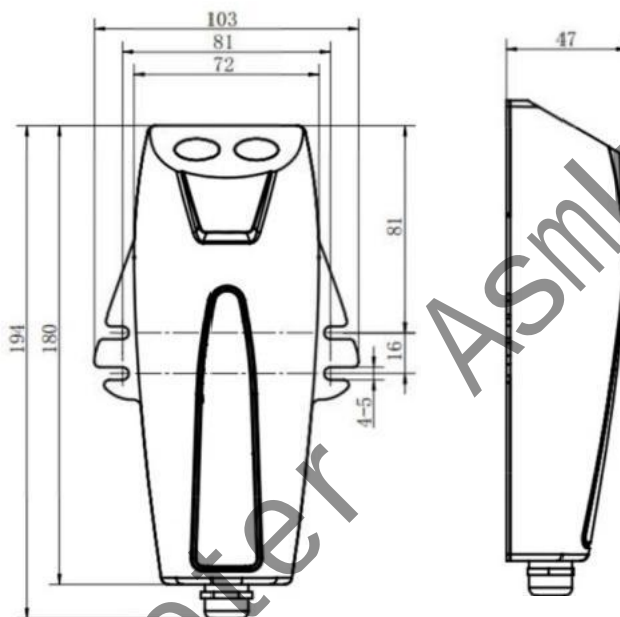


Figure 3.4 Flow Meter Dimension

4 Installation

4.1 Unboxing Inspection

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

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

4.2 Installation Requirements

4.2.1 Power Supply

Single-phase AC power: Power supply voltage: (100~240)VAC, should be well grounded. The power distribution cabinet is equipped with at least 1 three-hole socket, 3P C10 air switch, 1 lightning protection module, and the power distribution cabinet is 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 instrument.

DC power: Power supply voltage: (9~36)VDC, rated power is recommended to be no less than 24W.

4.2.2 Flow Meter Installation Point Selection

The accuracy of flow velocity measurement depends on the flow conditions and the location of the measurement point.

The installation location of the flow meter is very important. You should choose a location that can ensure uniform water flow. To ensure that you can obtain better measurement results, the direct flow section above the water flow should be as long as possible. If possible, the length of the upstream direct flow section should be more than 10 times the width of the water flow, and the length of the downstream direct flow section should be more than 5 times the width of the water flow. If there is a gate or water pump upstream, there should be a direct flow section length of 30 times the width of the water flow between the flow meter and the gate or water pump.

If there is no sediment in the installation area, install the flow meter in the center of the bottom of the water flow. If there is sediment, install the flow meter above or to the side of the sediment. In order to prevent the flow impact from changing the installation position of the flow meter, there is a base at the bottom of the flow meter, which is specially used to fix it on the pipeline, which is convenient for installation, maintenance and replacement.

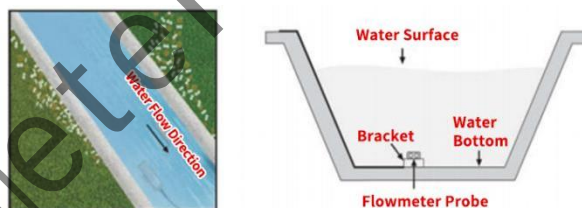


Figure 4.1 Channel installation diagram

Installation conditions and location in the channel

- (1) When measuring in rivers and channels, as long as the lowest water level is 3 cm above the flowmeter, the measurement can be performed.
- (2) The standard pressure resistance of the water level flowmeter is 200 kPa, and the maximum pressure resistance depth is 20 m. If a larger depth test is required, it can be customized according to demand.
- (3) Ultrasonic Doppler flowmeters are suitable for water with a solid content of no more than 20 kg/m³.
- (4) Ultrasonic Doppler flowmeters should be installed in places with stable water flow. In places where the water flow is not stable, it is turbulent in most cases. The flow velocity measured under turbulent conditions is unstable and the error is large.
- (5) There should be a straight channel 20 times the channel width upstream of the installation location of the ultrasonic Doppler flowmeter, and a straight channel 5 times the channel width downstream.

Installation conditions and location in pipelines or culverts

- (1) When installed in a pipeline, the minimum water level must be more than 3 cm above the flowmeter, and the inner diameter of the pipeline must be >500mm. It supports measurement when the pipe is not full. The installation location should be a place with stable water flow, with a straight channel larger than 20 times the inner diameter of the pipeline upstream and a straight channel 5 times the inner diameter of the pipeline downstream.
- (2) The installation should be carried out in a place with stable water flow to ensure the stability of the test. This is to avoid fluctuations in the measured data caused by turbulence or the measured data being smaller than the actual value.
- (3) At the same time, the sediment and silt in the pipeline should be considered, and the flowmeter should avoid the silt area. If it cannot be avoided, a platform should be built to raise the test height to avoid the impact of silt deposition. When fixed on the platform, compensation should be made according to the actual water level to calculate the actual flow. For points with a lot of garbage or floating objects coming from upstream, a grille can be built upstream to filter garbage and other floating objects. The distance between the grille and the flowmeter should be at least 5 times the inner diameter of the pipeline.

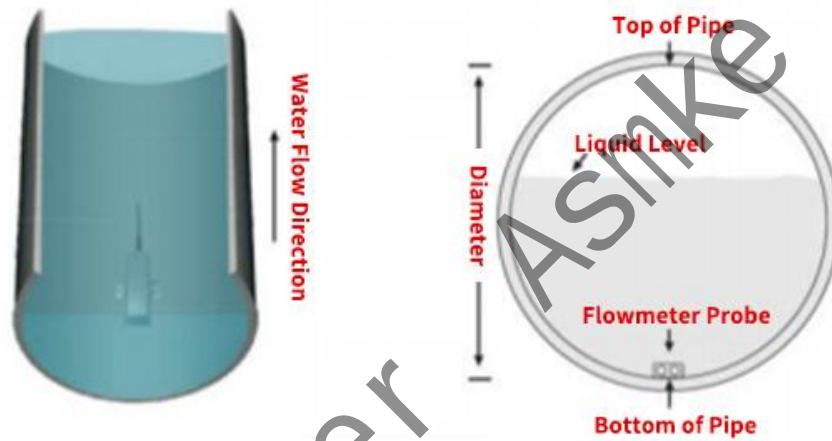


Figure 4.2 Schematic diagram of pipeline installation

Installation conditions and location in the river

(1) The flow meter is installed in the center of the river. The lowest water level must be 3 cm above the flow meter before it can be measured.

(2) For wider rivers, such as natural rivers, spillways of large reservoirs, ship channels under dams, and spillways of hydropower stations, the flow velocity from both banks to the center varies greatly because the flow velocity and flow rate are different at different locations. In this case, it is generally necessary to collect flow velocity data at multiple points. At least 3 flow meters are required, one on each side of the river bank and the center (it is recommended that the flow measurement coverage of a single flow meter should not exceed 6m wide).

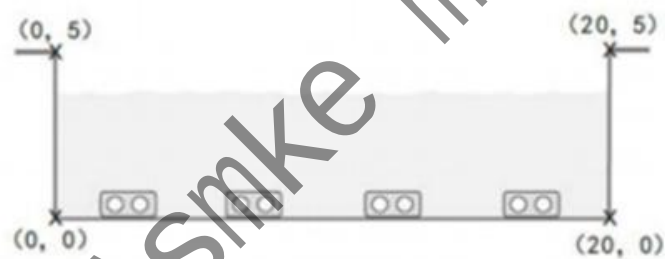
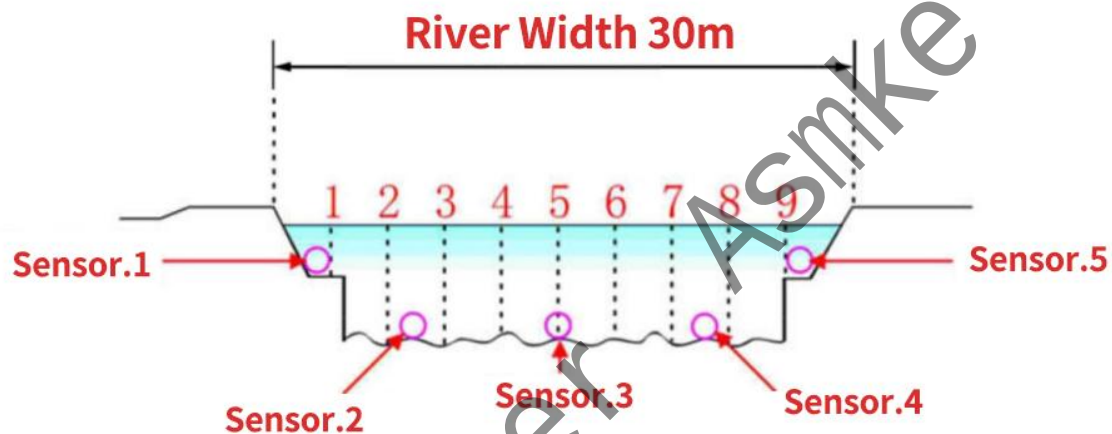


Figure 4.3 Schematic diagram of river channel installation

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



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

(5) Before installation, it is necessary to survey the on-site measurement point to see if the installation conditions are met to avoid difficulties in subsequent on-site installation.

- ① There is no place to install the bracket around, and finally large machinery is used to make enclosures in the water to help construction.
- ② An open river channel with no support around.
- ③ The water level is very shallow and there are stones flowing through.

4.3 Flow Meter installation

4.3.1 Channel Installation

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

(2) In channels with silt and sediment, the flow meter should be installed slightly higher than the bottom of the channel to prevent the sensor from being covered by sediment and affecting the flow measurement.

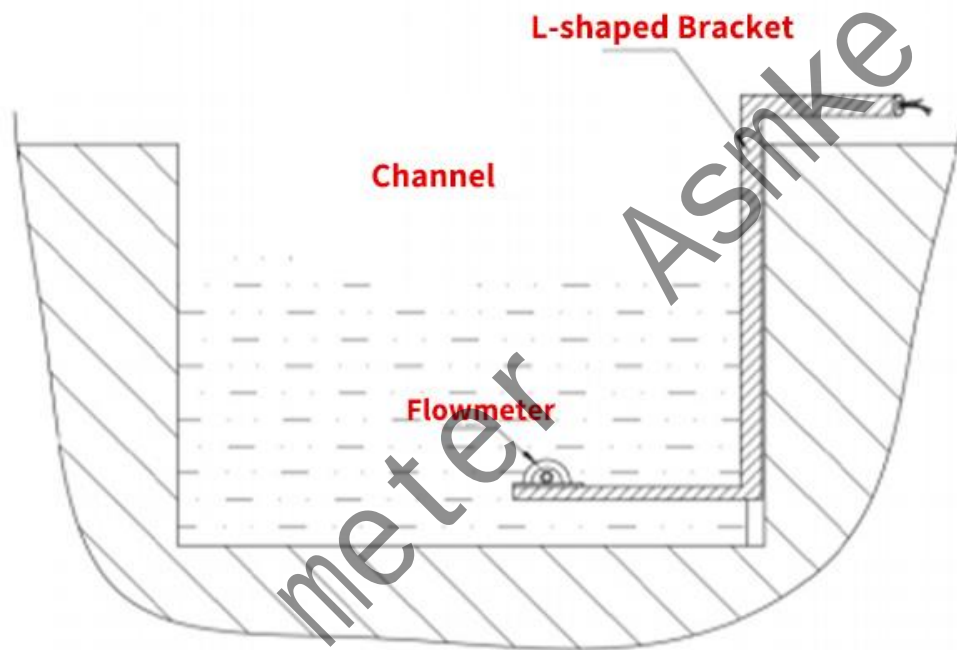


Figure 4.4 Channel installation diagram

4.3.2 Pipeline installation

If it is installed in a pipe, the pipe diameter should be greater than 500mm. Place the bracket directly from the top of the pipe and install it in the center. The flow meter is fixed to the bottom of the pipe with the bracket. The bracket is made into an "L" shape, which is convenient for going deep into the relatively stable water flow area in the pipe, and the flow meter is facing the water flow direction.



Figure 4.5 Pipeline installation

4.3.3 River channel installation

The river channel mounting bracket and wiring are installed in the river channel and installed through the side bracket.



Figure 4.6 Schematic diagram of river channel installation

Installation precautions:

- ① The flowmeter needs to be fixed to the mounting base with a clamp to strengthen the fixation. To protect the flowmeter, a buffer pad needs to be placed between the clamp and the flowmeter. The buffer pad can be made of rubber material, and can be replaced by a tire inner tube.
- ② The flowmeter has a section of communication cable with a ventilation tube, so be careful not to bend it. When the communication cable is led out of the water, it can be connected to an ordinary cable. At this time, the opening of the ventilation tube should be facing downward to prevent water and foreign objects from entering the ventilation tube or blocking the ventilation tube. The cable connecting the 485 or 12VDC power supply on the flowmeter must be connected with a shielded cable.
- ③ It is forbidden to pull or swing the cable, hit the flowmeter housing, use the connecting cable as a load-bearing line, hang heavy objects and other dangerous behaviors. The cable must be firmly fixed and cannot shake.
- ④ The power supply method is 12VDC direct current power supply. It can be powered by batteries, solar energy, 220V mains power to 12V DC, etc. When using AC power conversion, a linear conversion power supply is required to provide a stable DC output.

4.3.4 Installation Steps

(1) Install the fixing bracket first to ensure that it can be stably and reliably fixed under the condition of 2 times the maximum flow rate.

(2) Fix the flow meter to the mounting base.

(3) The flow meter cable is routed through the pipe. All protective tubes must be fixed. There must be at least one fixing buckle for every 0.5 meters of the protective tube in the water. The outlet at the back of the flow meter must be specially protected and fixed.

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

(5) If it is close to the actual flow rate, you can connect the 485 line to the on-site "UTD", computer, or other receiving device.

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

4.4 Controller Installation

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

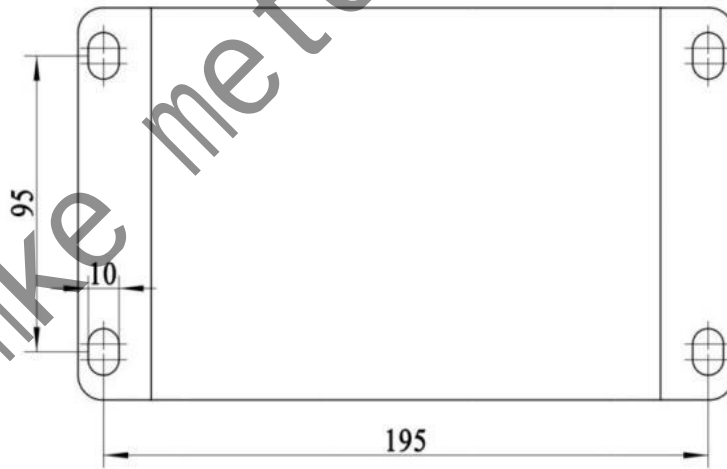
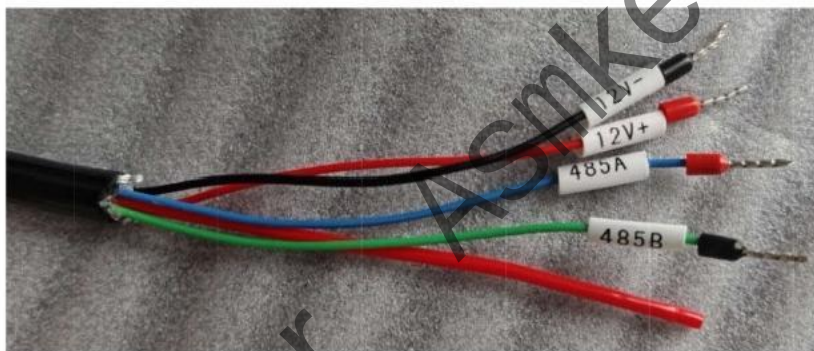


Figure 4.7 Mounting hole distribution diagram

4.5 Line Connection

4.5.1 Flow Meter Wiring Definition



The flow meter cable has 4 connecting wires and an air guide tube.

Line Sequence	Color	Usage
1	Red	Positive power supply(12V)
2	Black	Negative power supply (12V)
3	Blue	RS485-A
4	Green	RS485-B
Airway	Red	Pressure sensor to measure pressure



Notice

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

4.5.2 Controller Wiring Definition

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

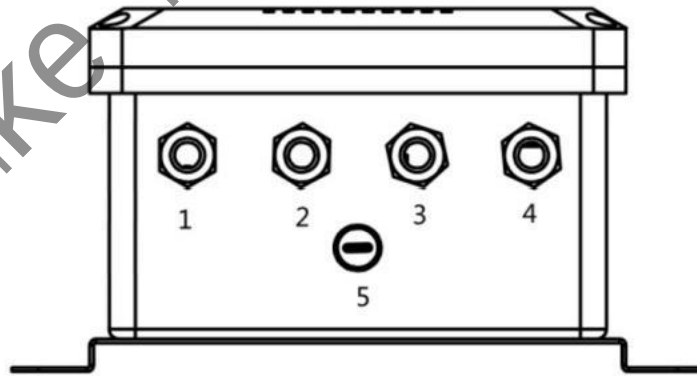


Figure 4.1 Controller interface distribution

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

Table 4.1 Controller interface usage

S/N	Item	Usage	Interface Specifications
1	Power Input	For Power Input	PG9 (cable outer diameter range 4~8mm)
2	Flow Meter Interface	Providing power supply and 485 communication for flow meter	
3	Signal Output 1	Customization: Can	
4	Signal Output 2	connect to RS485 communication, 4-20mA output and switch output	
5	USB Interface	Reserved	USB-Type C

There are 2 reserved interfaces for signal output. If only one interface is used on site, the remaining interface should be blocked to prevent rainwater from entering the controller.

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

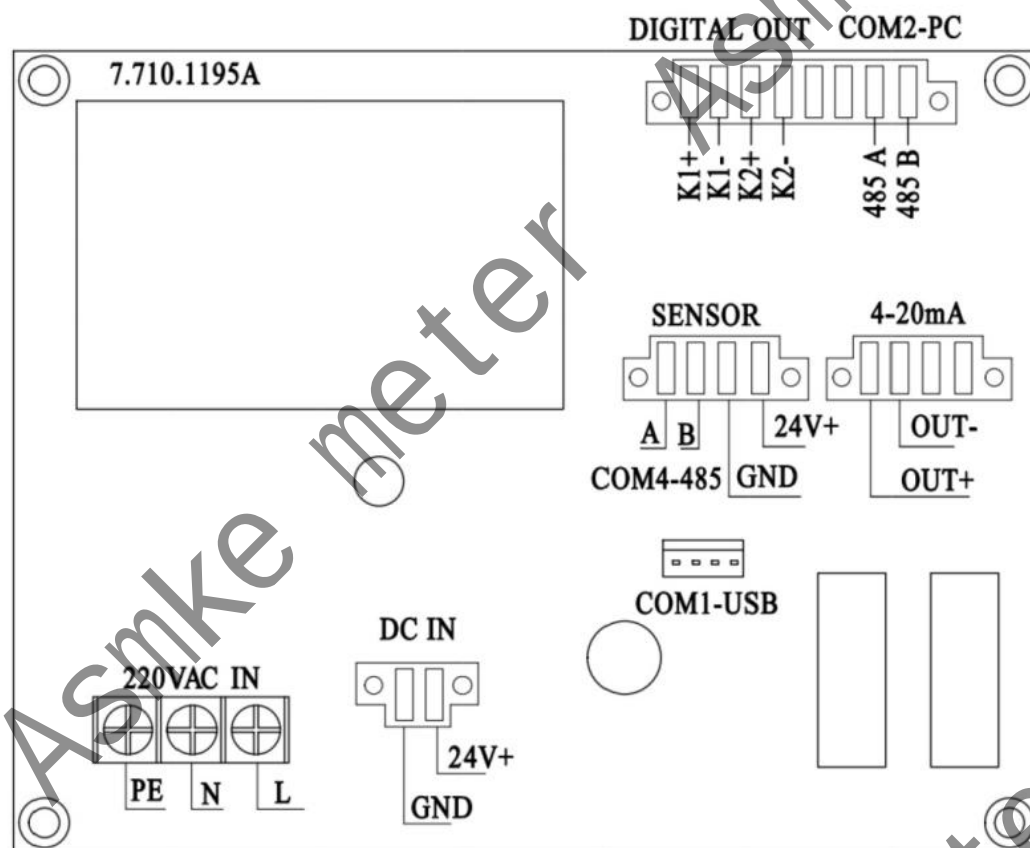
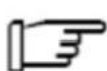


Figure 4.2 Schematic diagram of controller circuit board wiring



Notice

The AC power terminals must be tightened and powered on after confirming that there is no short circuit.

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

5 Equipment debugging

5.1 Flow rate calibration

The device has been zeroed and calibrated before leaving the factory. Under normal circumstances, the user does not need to modify the coefficient. If the user finds that the flow rate measurement is abnormal, the user can check whether the flow rate calibration coefficient is abnormal.

5.2 Water level zero calibration

Water level zero calibration can be set manually or automatically.

When performing automatic calibration, set the range according to the calibration water level, click "Zero" in the waterless state, and click "Calibrate" when it is completely submerged in water to complete the zero calibration function.

5.3 Section type settings

Click on the section type. There are 3 types to choose from. Select the corresponding section according to the type of installation point.

(1) Circular section

Circular sections are generally pipes. By setting according to the pipe radius, the flow rate can be automatically calculated based on the flow rate. (The flow meter needs to be placed at the bottom of the pipe)

(2) Rectangular section

Rectangular sections are rivers or channels. By setting according to the width, the flow rate can be automatically calculated based on the flow rate.

(3) Trapezoidal section

Trapezoidal sections are rivers or channels. By setting according to the bottom width and embankment slope angle, the flow rate can be automatically calculated based on the flow rate.

6 Software Operation

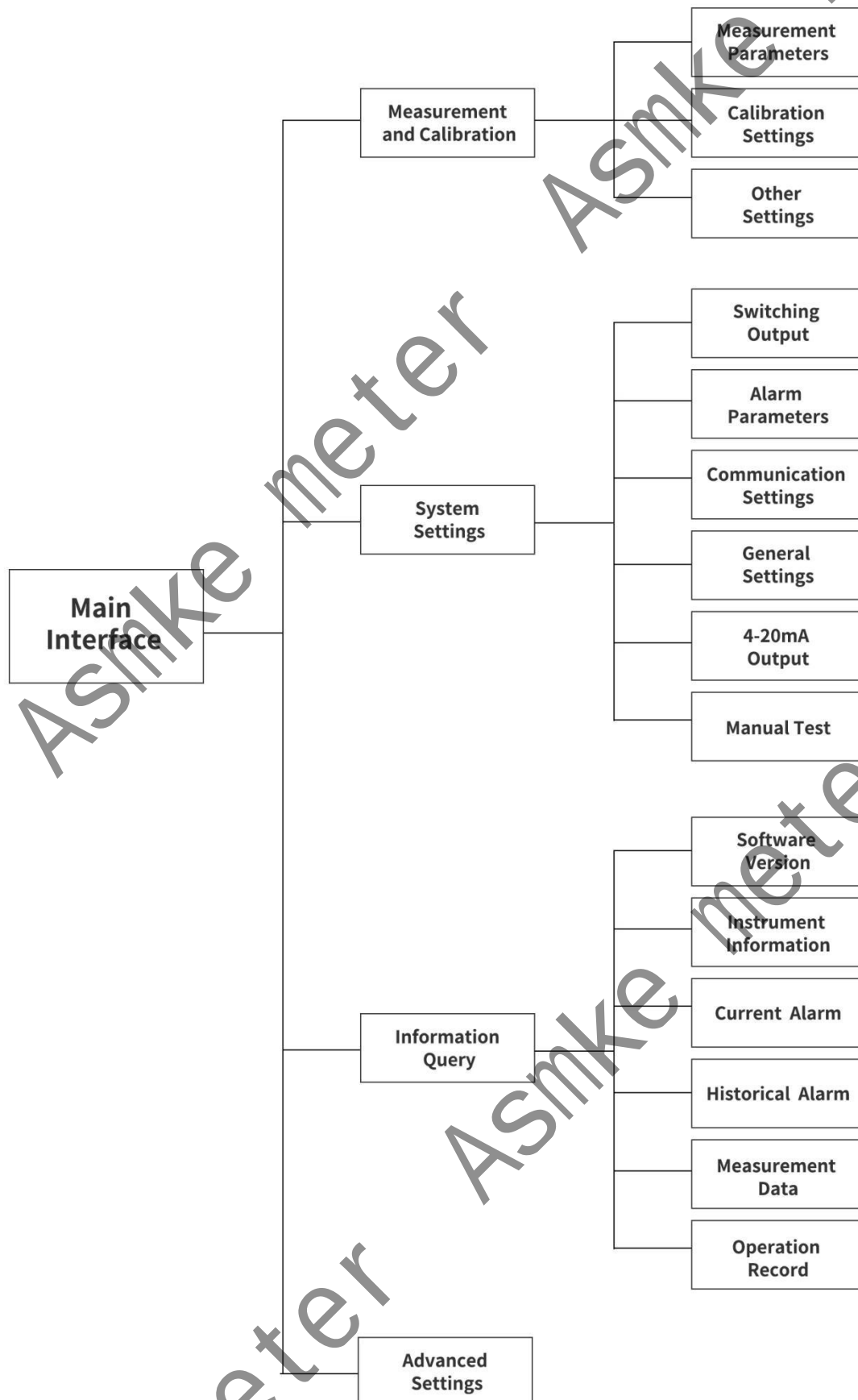
6.1 Software Features

- Collect flow meter data and display it in real time on the interface.
- Set flow meter parameters, pipe cross-sectional area, measurement coefficient, etc.
- The measurement data can be output externally via RS485 and 4-20mA.
- Save historical data of flow, flow velocity, water level and other measurement values, and export the data to a computer via the USB port.
- The accumulated flow can also be proportionally output by closing the switch.

6.2 Menu Structure

The analyzer's operating interface uses a simple and fast menu interface. The main interface includes the measurement component selection interface and the parameter addition interface under the gear button.

The entire menu organization structure is simple and clear, and easy to operate



6.3 Instructions

Table 1 Operation Structure Description

Button	Operating Instructions
	Button “左” : Left and right page selection In the main interface, you can quickly view the current alarm information.
	Button “上” : Page up and down selection
	Button “右” : Left and right page selection In the main interface, you can switch between the main and sub screens.
	Button “下”: Page up and down selection
	Button “取消” : Cancel, exit and return to the previous menu
	Button “确认”: Enter the menu. Select and Confirm

Note

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

6.4 Boot interface

After the system is powered on, it will first perform a self-test to check the communication with the sensor. If the communication is successful, it will enter the main interface. If the communication fails or the sensor is not connected, you can press the "ESC" key to skip the self-test and directly enter the main interface to modify the communication settings in the menu. Press "Enter" to initiate a self-test again, or power off and restart the controller.

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

2024.01.01 20:00:00		
流速	0.000	m/s
流量	0.00	m ³ /h
累积流量	0.04	m ³
水位	0.15	m
水温	25.31	°C
N	“<” 查看报警 查看副屏 “>”	

Main Interface Screenshot

Click the "<" button to quickly enter the current alarm interface, and 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.



Secondary Screen Interface

6.5 Main Menu

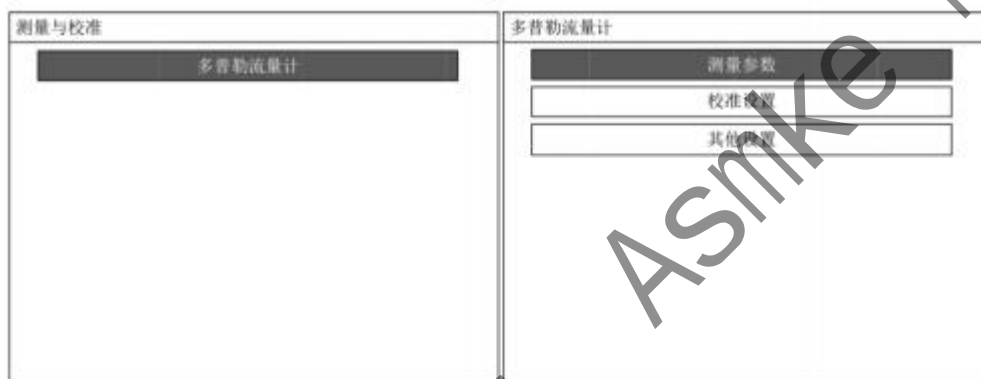
In the main interface, press the "ENTER" key to enter the "Main Menu" interface. The sub-menus include "Measurement and Calibration", "System Settings", "Information Query" and "Advanced Settings". Use the up, down, left and right keys to select a menu and press the "ENTER" key to enter. As shown in the figure below:



Main Menu

6.6 Measurement and Calibration

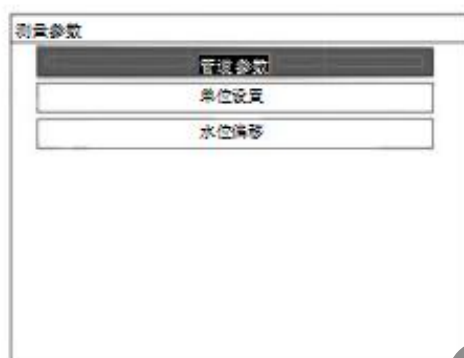
Use the up and down keys to select the "Measurement and Calibration" box, and click "ENTER" to enter the measurement and calibration interface. Click "多普勒流量计" to display the menu with "测量参数", "校准设置" and "校准系数".



Measurement and Calibration Interface

6.6.1 Measurement Parameters

Use the up and down keys to select the "测量参数" box to enter the detailed parameter setting interface. The menu includes "管道参数", "单位设置", and "水位偏移".



Measurement parameter interface

(1) Pipeline Parameters

- > Pipe shape: "circular", "rectangular" and "trapezoidal" are available;
- > Pipe radius: can be set freely;
- > Bottom width: can be set freely; > Slope: can be set freely.

Circular means 圆形, Rectangular means 矩形, trapezoidal means 梯形



管道参数

管道形状: 圆形

半径: 1.00 m

底宽: 0.00 m

坡度: 0.00 %

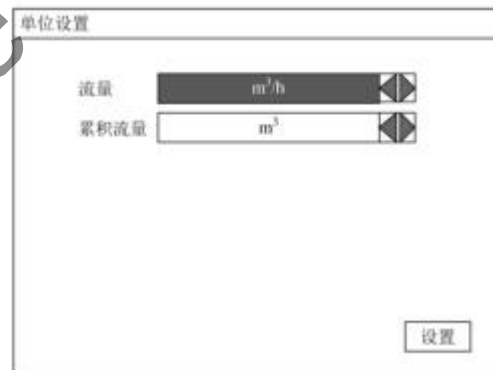
截面积: 0.00 m²

设置

Pipeline Parameters Interface

(2) Unit setting

- > The flow rate can be set in m³/h, m³/s, or L/s;
- > The cumulative flow rate can be set in m³ or L



单位设置

流量: m³/h

累积流量: m³

设置

Unit Settings Interface

(2) Water Level Deviation

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



水位偏移

水位偏移: 0.00 m

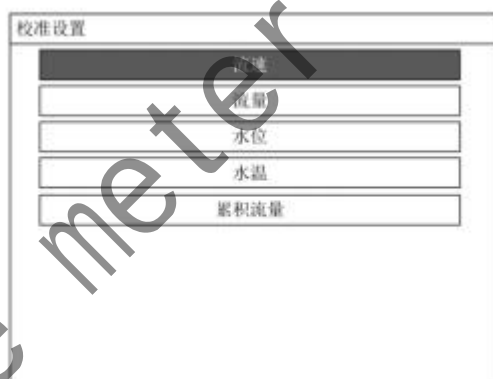
设置

Water Level Offset Interface

6.6.2 Calibration Settings

Use the up and down keys to select the "Calibration Settings" box to enter the calibration settings interface. The sub-menus include "Flow Rate", "Flow", "Water Level", "Water Temperature" and "Cumulative Flow".

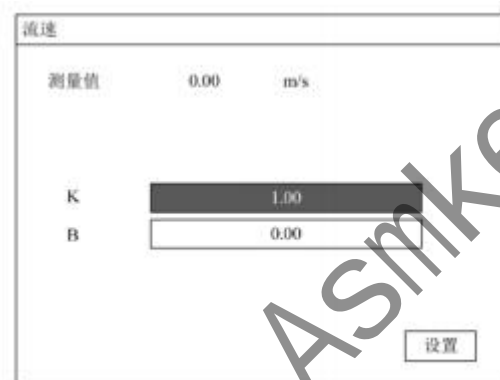
流速 means flow rate, flow means 流量, water level means 水位, water temperature means 水温, Cumulative Flow means 累积流量



Calibration Settings Interface

(1) Flow rate

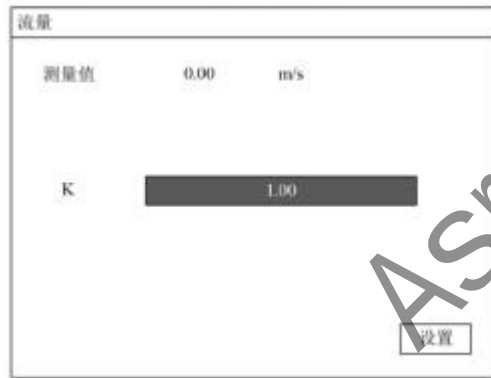
On the flow rate page, you can modify the flow rate zero coefficient b and range coefficient k. After the modification is completed, you need to select the "Set" button and click the "ENTER" key to complete the modification.



Flow Rate Interface

(2) Flow

To compensate for the flow error caused by on-site working conditions, users can modify the flow coefficient k in the system. After the modification is completed, you need to select the "Set" button and click the "ENTER" key to complete the modification.



Flow Interface

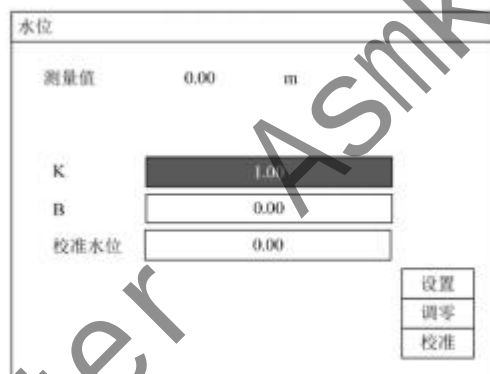
(3) Water level

In the water level interface, users can correct the measurement deviation of the water level sensor. Press the up and down keys to select the parameter to be modified. Press the "Set" key to set the kb value in the current interface to the flow meter.

If the user is not sure what value to change the kb value to, they can also use the "Zero" and "Calibrate" buttons to make corrections.

> Take the flow meter out of the water and put it in the state of 0 water level. After the measured value stabilizes, use the up and down keys to select the "Zero" button and press the "ENTER" key to perform the zeroing action.

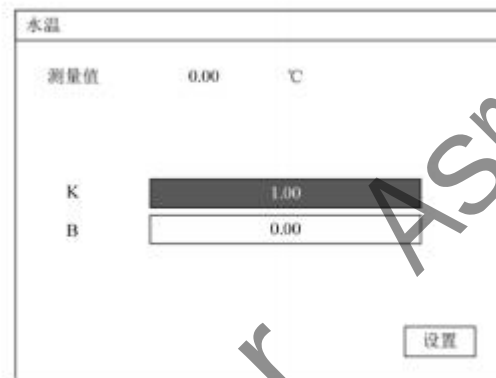
Put the flow meter into the water. The water depth is recommended to be more than 1.5 meters. After the measured value stabilizes, use a tape measure to measure the water level value of the sensor, enter the data into the "Calibrate Water Level", use the up and down keys to select the "Calibrate" button, and press the "ENTER" key to perform the calibration action.



Water Level Interface

(4) Water temperature

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



Water Temperature Interface

(5) Cumulative flow

In the cumulative flow interface, the user can modify the current cumulative flow value in m^3 . Entering a value of 0 will reset the flow to zero.



Cumulative flow interface

6.6.3 Other settings

In the other settings interface, set the cumulative flow proportional output. For example, if it is set to $1000m^3$, when the cumulative flow reaches $1000m^3$, the corresponding relay will close for 5 seconds and then automatically disconnect. In the future, the relay will operate once every time the cumulative flow increases by $1000m^3$.



Other Settings Interface

6.7 System Settings

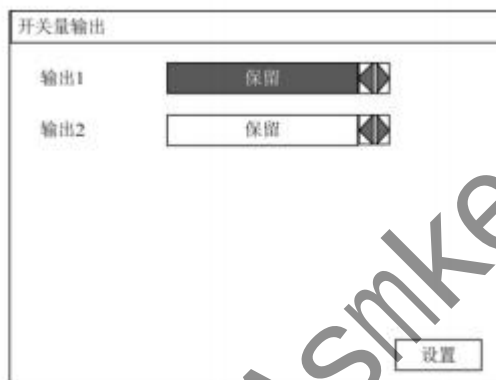
In the main menu interface, use the up and down keys to select the "System Settings" box, and click the "ENTER" key to enter the system settings sub-interface. There are 6 sub-items under the menu, see the figure below for details.



System Settings Interface

6.7.1 Switch Output

The switch output interface can be configured in 4 options: "Flow rate is too low", "Flow rate is too high", "Cumulative flow rate proportional output", and "Retain". Use the up and down keys to select, and press the "Set" key to execute the setting.



Switch 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 switch output is configured with an alarm for low or high flow, the corresponding switch will be closed when the alarm is triggered.

The screenshot shows a window titled "报警参数" (Alarm Parameters). It contains two input fields: "流量上限" (Flow Upper Limit) with the value "99999.00" and "流量下限" (Flow Lower Limit) with the value "0.00". Both fields are followed by the unit "m³/h". A "设置" (Set) button is located at the bottom right.

Parameter	Value	Unit
流量上限 (Flow Upper Limit)	99999.00	m³/h
流量下限 (Flow Lower Limit)	0.00	m³/h

Alarm Parameter Interface

Note: The upper limit value must be greater than the lower limit value.

6.7.3 Communication Settings

The controller has a total of 3 serial ports, of which COM1-USB is a reserved port for future function expansion. COM2-PC is a serial port for external data transmission, supporting modbus protocol transmission. For detailed protocols, see Chapter 7.2 of this manual.

COM4-485 is a sensor communication port, which needs to be configured according to the connected sensor.

The location of each serial port on the circuit board is shown in Chapter 4.5.2 of this manual.

During configuration, select the serial port using the up and down keys, press the "ENTER" key to activate, and then use the left and right arrow keys to select the baud rate. The options are: 9600, 38400, 57600, 115200, and the default is 57600. The device address defaults to 1.

The screenshot shows a window titled "通讯设置" (Communication Settings). It contains a table with three columns: "串口号" (Serial Port Number), "波特率" (Baud Rate), and "设备地址" (Device Address). The rows are for COM1-USB, COM2-PC, and COM4-485. A "设置" (Set) button is at the bottom right.

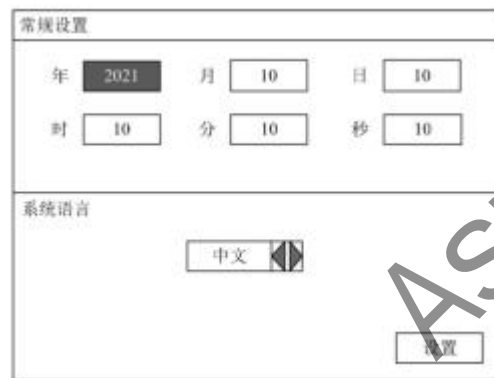
串口号 (Serial Port Number)	波特率 (Baud Rate)	设备地址 (Device Address)
COM1-USB	57600	1
COM2-PC	57600	1
COM4-485	19200	40

Communication Settings Interface

6.7.4 General Settings

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

The language selection can be simplified Chinese and English.



常规设置

年 2021 月 10 日 10

时 10 分 10 秒 10

系统语言

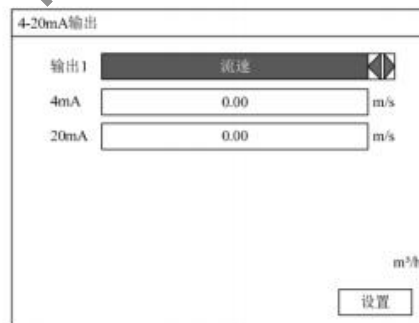
中文

设置

General Settings Interface

6.7.5 4-20mA output

The configuration items of 4-20mA output are velocity, flow rate and retention. You can enter a decimal point and 2 digits after the decimal point. When configured as velocity, the unit is m/s; when configured as flow rate, the unit is m³/h.



4-20mA输出

输出1 流速

4mA 0.00 m/s

20mA 0.00 m/s

m³/h

设置

4-20mA Output Interface

6.7.6 Manual test

In manual test, you can manually open or close the switch value, and manually set the current value of 4-20mA output. To verify whether the device is working normally.

(1) Switch Output Test

You can use the "←" and "→" arrow keys to switch the status of each switch. Click the "Set" button to take effect. Click the "Exit" button to reset the status.



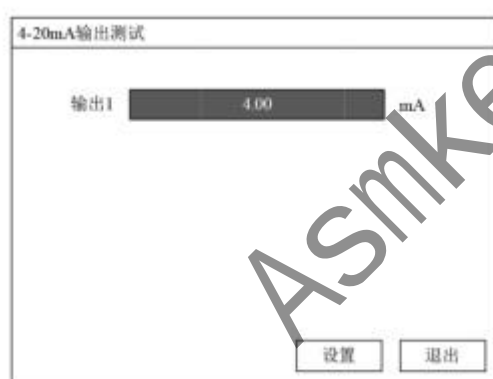
Switch Output Test Interface

(3) 4-20mA Output Test Interface

The current value can be manually set, and the setting range is [4,20]mA.

Click the "Set" button, and 4-20mA will be forced to output according to the set value;

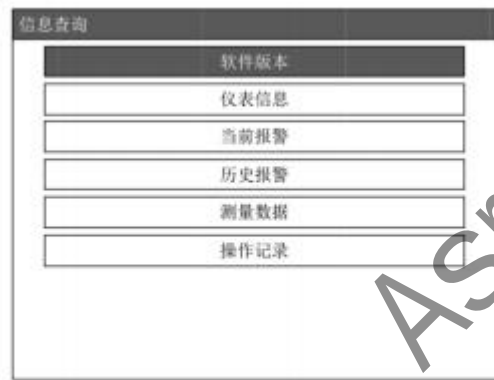
Click the "Exit" button to exit the manual test and reset the 4-20mA output.



4-20mA Output Test Interface

6.8 Information query

You can query the software version, instrument information, current alarms, historical alarms, measurement data and operation records.



Information query interface

6.8.1 Software Version

The current controller software version and the connected sensor software version can be displayed.



Software version interface

6.8.2 Instrument information

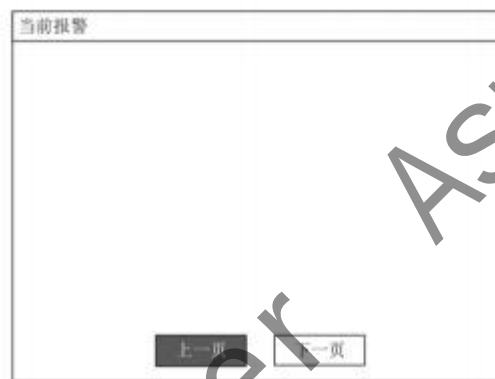
Can display the current controller device number and connected sensor number.



Instrument information interface

6.8.3 Current Alarm

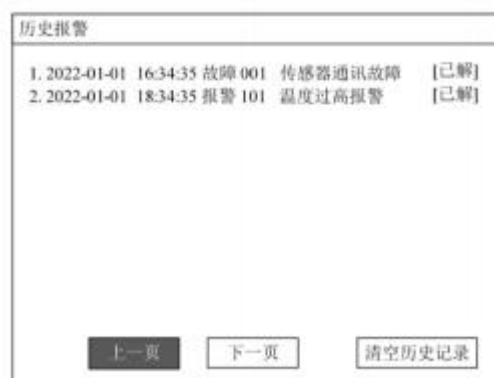
Current alarm only displays the alarm information that has not been cleared. All fault and alarm information are recorded here.



Current alarm interface

6.8.4 Historical alarms

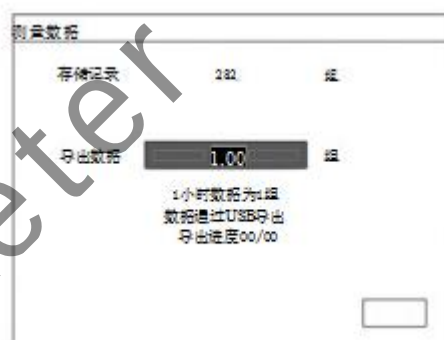
Historical alarms include records of alarm generation and release. The maximum number of records is 100. If more than 100 records are recorded, the earliest record will be deleted. Users can also manually clear alarm records.



Historical alarm interface

6.8.5 Measurement data

This interface displays the recorded measurement data, which is recorded in the form of minute average data, and 1 hour of data is 1 group. When exporting data, you need to select how many groups of data to export, click the "Set" button, and the data will be sent through the COM1-USB serial port.



Measurement data interface

Note: Data export is an extended function. As the software is upgraded, the actual situation may be inconsistent with the description in this manual. The exported data requires special tools to analyze.

6.8.6 Operation log

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



Operation Record Interface

Note: Users cannot clear measurement data and operation records. To clear data, maintenance personnel need to contact the manufacturer for technical support.

7 Communication Protocol

7.1 Flowmeter communication protocol

The communication method of the Doppler flowmeter is RS485, and the communication protocol supports the standard ModbusRtu format, as shown below: Baud rate support: 9600, 19200, 38400, 57600 and 115200 Data bit: 8 Stop bit:

Parameter	Register Start Address	Number of Registers Quantity N	Data Class Type	Permission	Description	Remark
Flow rate value	0x001A	2	float	R	m/s	
temperature	0x001C	2	float	R	Celsius	
Water level depth	0x001E	2	float	R	m	
Measured flow	0x0020	2	float	R	m3/s	Flow rate is related to cross-section setting
Total flow	0x0022	2	float	RWS	Default is m³/h, value varies with unit, saved for 1 min Primary data	Can be manually cleared or set Estimated value during commissioning
Maximum flow rate value	0x0103	2	Float	RWS	Unit: m/s, initial value: 5, adjustable range [1,10]	Flow rate limit range can be set

Device Address	0x010F	1	UINT16	RWS	Default 40; range [0,255]	Fixed address 255
485 baud rate	0x0110	1	UINT16	RWS	silent Recognize 1 ; scope [0, 3] ; meaning: 0=9600; 1=19200; 2=57600 ; 3=115200; [When upgrading remotely, the bandwidth must be set to 57600]	The default baud rate is 19200
Water level reference	0x0115	2	Float	RWS	Default 0; Range [0,1000], Unit: m	
Flow coefficient	0x0117	2	Float	RWS	Default 1, range [0.01, 2]	
Low flow rate cut Threshold	0x0119	2	Float	RWS	Default 0.05, unit: m/s, range [0,1], small At this threshold, the flow rate returns to 0	
Flow Unit	0x011B	1	UINT16	RWS	0:m3/h; 1:m3/s; 2:L/s; Default 0	
Total flow unit	0x011C	1	UINT16	RWS	0:m3; 1:L; Default 0	
Pipeline Type Selection	0x0200	1	UINT16	RS	0:circle; 1:rectangle; 2: Trapezoid; default 0 is circular	
Circular channel radius	0x0201	2	Float	RWS	Unit: m, default 1, range: [0,10]	
Rectangular channel width	0x0203	2	Float	RS	Unit: m, default 1, range: [0,50]	
Trapezoidal channel width	0x0205	2	Float	R W	Unit: m, default 1, range: [0,200]	
Trapezoidal channel angle	0x0207	2	Float	R W S	The unit is °, the initial value is 30, and the range can be set [0,90]	
Water level control command	0x0210	1	UINT16	W	Setting 1: Zero adjustment (the device status changes to zero adjustment, and the measurement is automatically switched after zero adjustment);	
					Setting 2: Calibration (the device status changes to calibration, and it automatically switches to measurement after calibration)	Calibration requires setting the water level first Procedure

Water Level Control Command fruit	0x0211	1	UINT16	R	0: Idle, 1: Running; 2: Successful operation; 3. Run failed	
Water level compensation K	0x0212	2	Float	RS	Default 1	
Water level compensation B	0x0214	2	Float	RW S	Default 0	The coefficients can be modified manually
Water level range	0x0216	2	Float	RWS	Unit: m, default 1, range: [0,20]	Setting for calibrating water level
Flow rate calibration factor k	0x0230	2	Float	RS	Default 1, range [0.01, 2]	
Flow rate zero coefficient b	0x0232	2	Float	RS	Default 0, range [-5,5]	The coefficients can be modified manually
Temperature calibration factor k	0x0270	2	Float	RS	Default 1, range [0,10]	
Temperature zero coefficient b	0x0272	2	Float	RW S	Default 0, range [-10,10]	The coefficients can be modified manually

Protocol format: device address + function code + register

address + number of registers + check code. The data format is

float type. DC BA

Command example: The device address is 40 (decimal)

Parameter	Register Address	Read Command	Receiving Commands
Flow rate	001A	2803001A0002 E235	28030425 F6 B93C DA4E data analysis: 0.02
temperature	001C	2803001C00020234	28030400109541 EC 54 data analysis: 18.63

Example of setting the maximum flow rate value:

Parameter	Register Address	set up	Protocol Commands
Maximum flow rate	0103	Set to 5m/s	281001030002040000 A0404286
Maximum flow rate	0103	Set to 10m/s	2810010300020400002041 E286

Maximum flow rate value reading protocol: float type

Parameter	Register Address	Read Command	Receiving Commands
Maximum flow rate	0103	280301030002320E	2803040000 A0403B 01Data analysis: 5

7.2 Controller Protocol

The communication mode of the controller is RS 485, Communication protocol supports standard Modbus Rtu The format is as follows: Baud rate support: 9600, 19200, 38400, 57600 and 115200

Data bits: 8 Stop bits: 1

Parameters	Register Start Address	Number of Registers N	Data Types	Permissions	Description
Flow rate value	0x0000	2	float	R	m/s
Cross-sectional area	0x0002	2	float	R	m ²
Instantaneous flow	0x0004	2	float	R	m ³ /h
Water Depth	0x0006	2	float	R	m
temperature	0x0008	2	float	R	°C
Total flow	0x000A	2	Float	R	m ³
Switch working mode	0xFFFF	1	Uint16	R	0:Measurement mode 1:Maintenance mode

8 Maintain

8.1 General Maintenance

- Check the entire system regularly to see if the measurement data is normal.
- Check all connections regularly for leaks and corrosion .
- Check all cables regularly for damage.
- Check the flow meter surface regularly to see if it is blocked by debris and clean it regularly.

8.2 Long-term storage

When storing the instrument for a long time, please put it in the instrument packaging box . When storing the instrument for a long time, pay attention to the humidity, temperature and corrosive environment of the instrument . Do not press, do not drench, and do not expose it to the sun.

Avoid placing the instrument near any potential sources of electrical interference (such as pumps, microwave ovens, etc.), high-energy magnetic fields, or sources of radio interference.