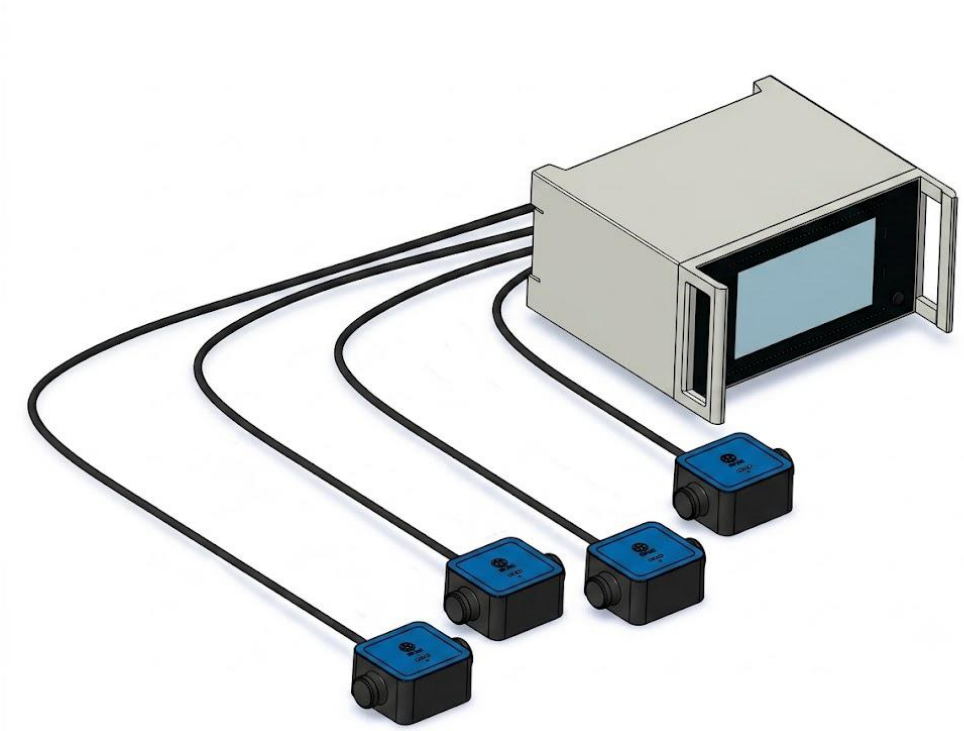
TH Series Ultrasonic Flow Sensors

SFD Series Measurement Systems

User Manual (V1.5)



XY-TEK

June. 2026

Shanghai Xunyin Technology Co., Ltd.

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1. Introduction

XY-TEK is a technology-driven company focused on the research, development, production, and sales of ultrasonic flow sensors. The company is dedicated to providing accurate, stable, and reliable liquid flow sensors for medical devices, biopharmaceuticals, new energy, and industrial automation — enhancing the automation, digitization, and intelligence of liquid flow monitoring.

The TH Series inline ultrasonic flow sensors feature fast response time, enabling precise capture of pulsatile flow characteristics in liquid circuits. They provide accurate and reliable data support for hemodynamic testing and other scientific research and production scenarios.

Key features:

- View and save flow rate and cumulative volume data via PC software
- Fast response time, suitable for pulsatile flow analysis
- Plot hemodynamic pulsatile waveforms and overlaid multi-measurement graphs
- High accuracy and high stability
- Bidirectional measurement, fluid volume calculation, and bubble detection capability
- No blockage, no diversion, no dead space — minimal fluid pressure loss

Common Applications:

- Medical device testing systems: hemodialysis machines, artificial hearts, organ transplant systems, heart-lung machines, blood pumps, artificial heart valves, hemodynamic testing, etc.
- Scientific research and laboratory systems

1.1 Working Principle

The TH Series inline ultrasonic sensors are integrated into a fluid system via fluid connectors. They use the ultrasonic transit-time difference method to measure liquid flow rate. The sensors have negligible pressure loss, and are easy to clean.

Inside the sensor, piezoelectric (PZT) crystals alternately transmit and receive ultrasonic waves in the downstream and upstream directions. The ultrasonic waves are injected into the tubing at an angle relative to the tubing axis and propagate through the liquid. The transit time in the upstream direction is always greater than in the downstream direction. The transit-time difference between the two directions is proportional to the liquid flow velocity; this information is used to calculate the volumetric flow rate.

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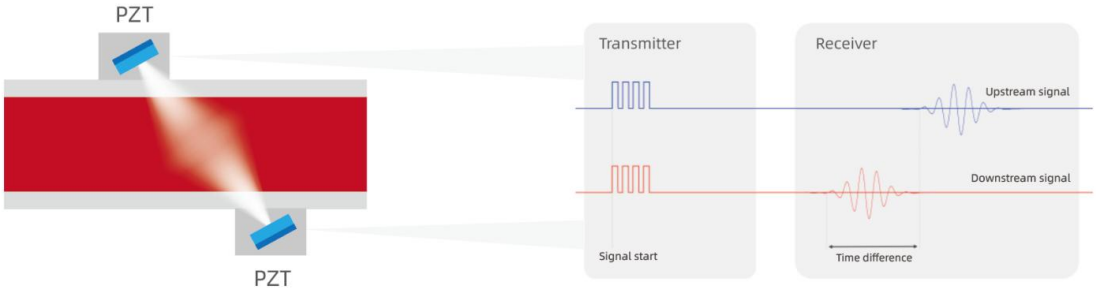

1.2 Contact Information

For further inquiries, please contact us:

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2. Safety Instructions

Please read the user manual carefully before using the flow sensor, the SFD system and their accessories. After opening the package for the first time, inspect the products and accessories for completeness and damage, and store them in a safe location.

2.1 Personnel Requirements

This device is to be operated only by trained and authorized personnel. Operators must be familiar with the relevant safety regulations and must have read and understood this manual.

2.2 Intended Use

The XY-TEK TH Series inline flow sensors are designed for liquid flow measurement using the ultrasonic transit-time principle.

The product is typically used in medical device testing and scientific research applications.

Using this product for purposes other than those specified is prohibited and may result in device damage or measurement failure.

2.3 Workplace Conditions

Before using the device, ensure:

- Temperature and pressure parameters are within the allowable range
- The device is installed in compliance with applicable standards

The TH inline flow sensor is **NOT** suitable for the following applications:

- Gas flow measurement
- Measurement of explosive liquid flow rates
- Outdoor use
- Metering and control equipment used for billing purposes

2.4 Operating Conditions

When operating the device, ensure:

- Awareness of potential personal injury risks
- The device is operated within the specified environmental conditions
- The device is used for its intended purpose
- Operators take responsibility for proper use and safety of the device

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2.5 Product Safety

XY-TEK TH flow sensors, SFD circuit systems, and related accessories comply with applicable safety regulations. Necessary measures have been taken during manufacturing to ensure safe device operation.

Users must ensure that the device's safety performance is not compromised during installation and use. All products undergo factory testing and are delivered in qualified condition.

Note:

- Only personnel who have read and fully understood this manual should modify sensor parameters. Always back up the original configuration before making changes.
- Do not disassemble the SFD circuit system or the flow sensor probe housing.
- Keep the SFD circuit system away from moisture.

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3. Sensor and Circuit System Specifications

3.1 TH Sensor Specifications

General Specifications:

Parameter	Specification
Measurable Liquids	Water, blood, saline, buffer solutions, glycerol, etc.
Measurement Accuracy	±3% plus zero drift*
Calibration	Factory calibration: Option 1 (default): 23±3°C (water) Option 2: 37±3°C (physiological saline) Other options: contact factory
Housing Material	Plastic
Operating Temperature	0°C – 60°C
Storage Temperature	-20°C – 70°C
Shielding	Wire grounding

* Note: Accuracy is guaranteed only within the specified calibration condition.

Inline Sensor Calibration Range*:

Model	Tube ID (inch)	Tube ID (mm)	Barb OD (inch)	Barb OD (mm)	Low Range Linear Limit	Low Range Max	Std Range Linear Limit	Std Range Max
TH038N0	3/8	9.5	0.44	11.1	0.5 L/min	-5 to 5 L/min	1 L/min	-10 to 10 L/min
TH050N0	1/2	12.7	0.58	14.7	1 L/min	-10 to 10 L/min	2 L/min	-20 to 20 L/min
TH063N0	5/8	15.9	0.72	18.3	2.5 L/min	-25 to 25 L/min	5 L/min	-50 to 50 L/min
TH075N0	3/4	19.1	0.86	21.9	2.5 L/min	-25 to 25 L/min	5 L/min	-50 to 50 L/min
TH100N0	1	25.4	1.1	29.0	5 L/min	-50 to 50 L/min	10 L/min	-100 to 100 L/min

Notes:

- To meet accuracy specifications, the flow sensor must be calibrated for the specified liquid, temperature, and flow range.
- Flow sensors are calibrated for the low flow range by default.

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- Measurements below the linear limit may deviate from the stated accuracy specifications.
- Average flow rates below the linear limit can be custom-calibrated, but this may affect accuracy over the full measurement range.
- The flow range includes zero flow: any flow peaks exceeding the maximum flow value (corresponding to ±5V or ±10V) will be clipped.
- Calibration range can reach up to 100 L/min; for higher flow calibration, contact the factory to confirm feasibility.

Bidirectional Flow Output & System Accuracy:

Model	Resolution (10Hz mL/min)	Low Range (1V per)	Std Range (1V per)	Max Flow @ Std Range (5V)	Max Zero Drift (mL/min)	Accuracy (%)
TH038N0	±1	1L	2L	10L	±20	±3
TH050N0	±2	2L	4L	20L	±40	±3
TH063N0	±5	5L	10L	50L	±70	±3
TH075N0	±5	5L	10L	50L	±100	±3
TH100N0	±10	10L	20L	100L	±200	±3

Notes:

- Stated system accuracy applies to TH Series flow sensors.
- It is recommended to perform a zero-point calibration before measurement.
- Standard cable length: 1.5 meters.

3.2 SFD Circuit System Specifications

Parameter	Specification
Screen Display	7-inch LCD touchscreen
Housing Material	Metal
Input Voltage	110–230 VAC, 50/60 Hz
Interfaces	AC power socket Sensor socket: 8-pin aviation connector Voltage output connector: BNC, ±5V / ±10V Digital output connector: Type-C
Operating Temperature	0°C – 60°C
Storage Temperature	-20°C – 70°C
Shielding	Wire grounding
Analog Output	Voltage output: ±5V, ±10V

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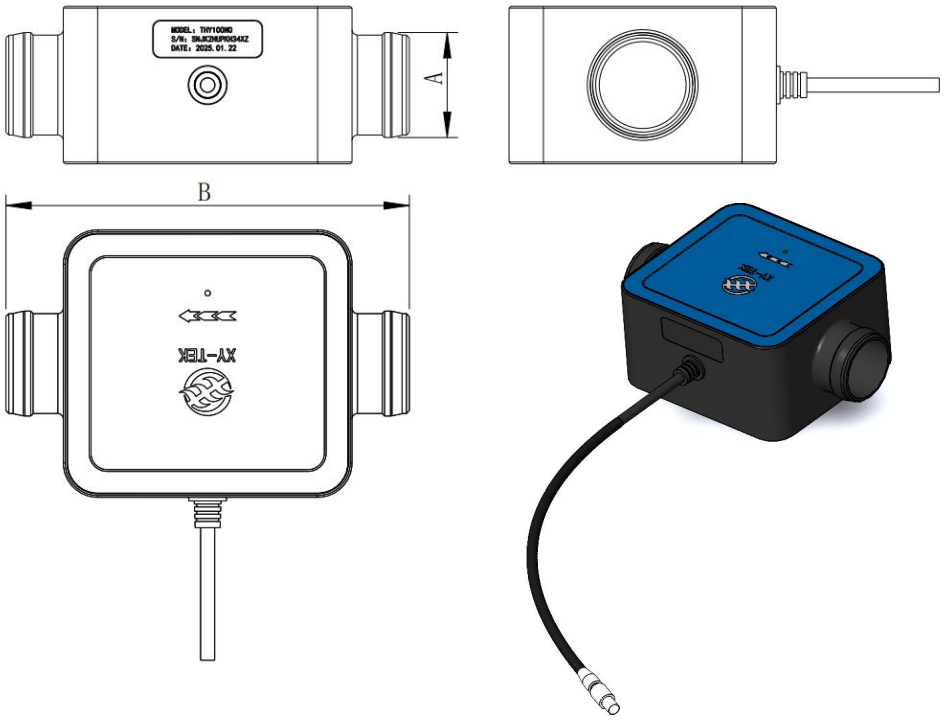
4. Digmensions

4.1 TH Flow Sensor Dimensions



Model	Dimension A	Dimension B
TH038N0	11.1 mm (barb fitting)	78 mm
TH050N0	14.7 mm (barb fitting)	N/A
TH063N0	18.3 mm (barb fitting)	N/A
TH075N0	21.9 mm (barb fitting)	N/A
TH100N0	29.0 mm (barb fitting)	130 mm
TH100N0S (short version)	29.0 mm (barb fitting)	111.5 mm
TH100N5S (short version)	27.6 mm (straight tube)	111.5 mm

4.2 SFD Circuit System Dimensions

The SFD circuit system dimensions are shown in the product drawings. Please refer to the accompanying dimensional diagrams for detailed measurements.

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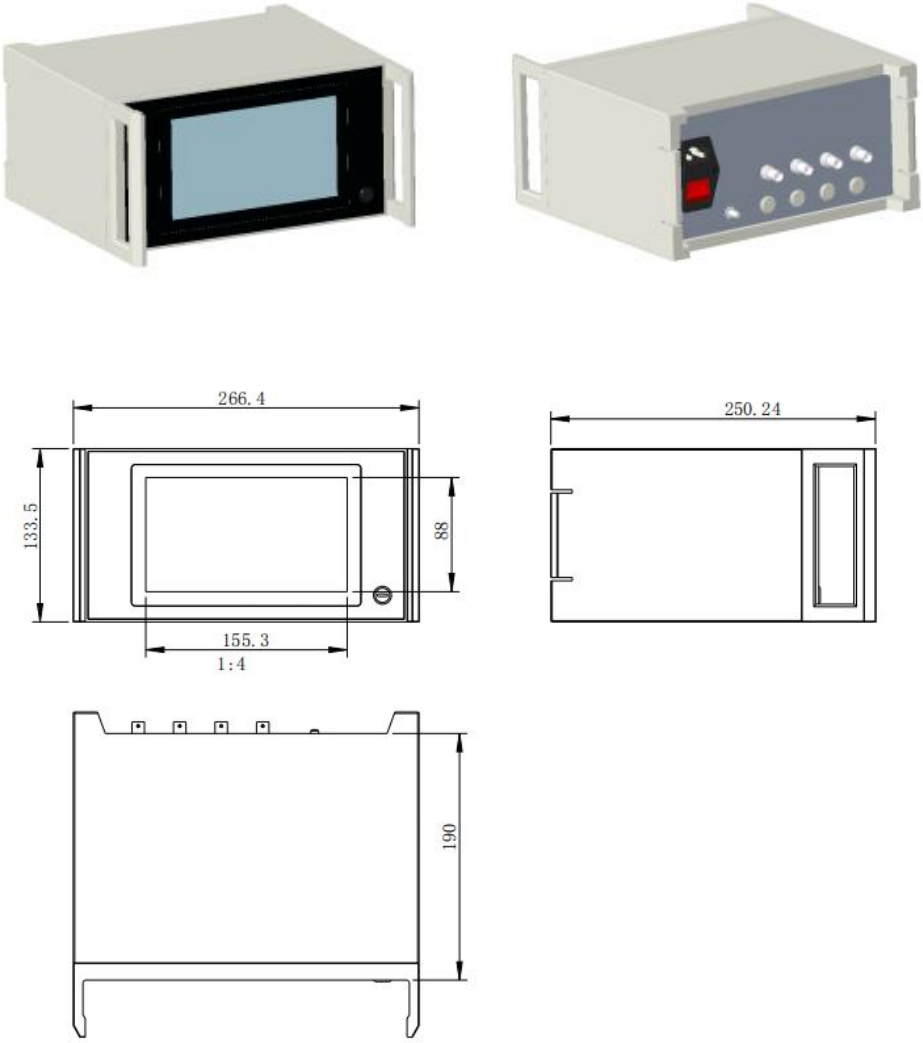

5. Sensor Setup and Operation

To improve flow measurement accuracy, please ensure:

- Maintain a straight section of tubing (at least 5 times larger than the tubing inner diameter) before and after the sensor to reduce flow disturbances on measurement results.
- The direction of liquid flow must match the arrow direction indicated on the sensor's top cover.
- Install the sensor in a location where the tubing remains fully filled with liquid at all times. Avoid locations prone to bubble formation.
- Minimize or isolate environmental mechanical vibrations to avoid impact on measurement accuracy.
- Avoid operating the device in environments with strong electromagnetic interference. Keep signal cables as far as possible from high-power electrical equipment and power cables to reduce EMI effects on measurement stability.

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5.1 Sensor Connection

- Connect the fluid fitting of the sensor into the system flow path, ensuring the flow path and sensor are filled with the liquid to be measured, and purge all air bubbles.
- Insert the aviation connector of the flow sensor into the Sensor socket on the rear panel of the SFD system.

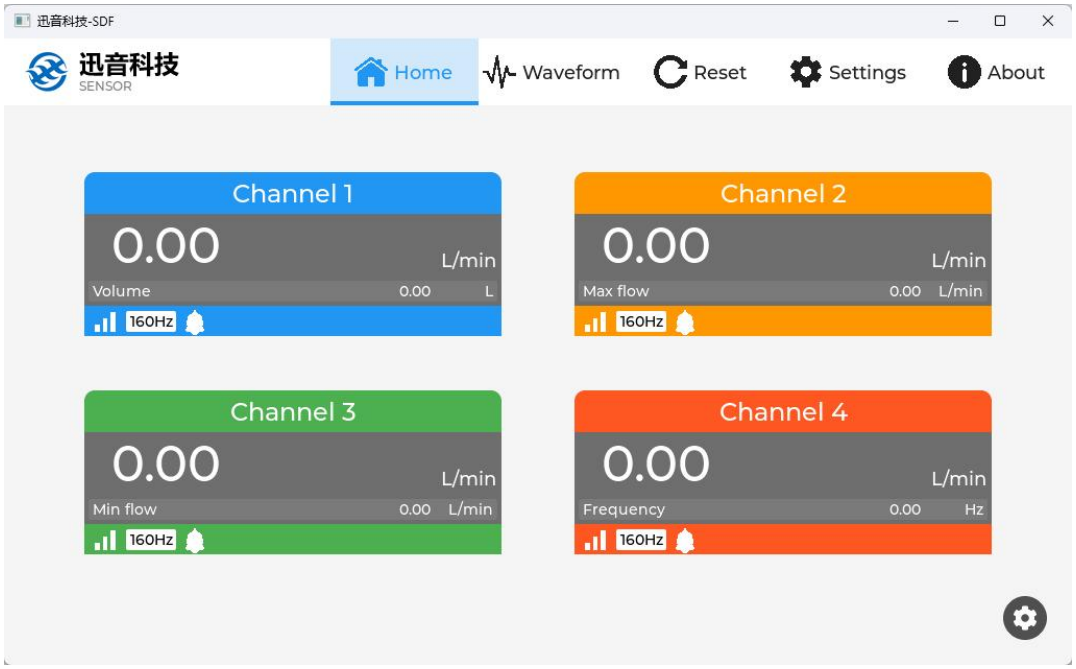
5.2 SFD System Power-On

- If required, connect the voltage output (BNC connector) to a voltage data acquisition device.
- Insert the power plug (with the specified voltage) into the SFD circuit system socket and turn on the power switch. The sensor will immediately begin measuring and outputting results.

5.3 SFD Touchscreen Operations and Settings

This section describes the touchscreen interface functions and operating procedures for the multi-channel measurement system. The interface supports multi-channel real-time data acquisition, waveform monitoring, parameter configuration review, saving of flow rate and cumulative volume data, as well as plotting of pulsatile waveforms and overlaid multi-measurement graphs.

5.3.1 Home Page



Home Page: Displays real-time flow monitoring data for up to 4 channels (channel count range: 1–4, determined by the SFD system model purchased). Channel display settings can be accessed via the gear icon in the lower-right corner of the screen. The menu bar at the top of the screen provides quick access to waveform view, data reset, parameter settings, and the About page.

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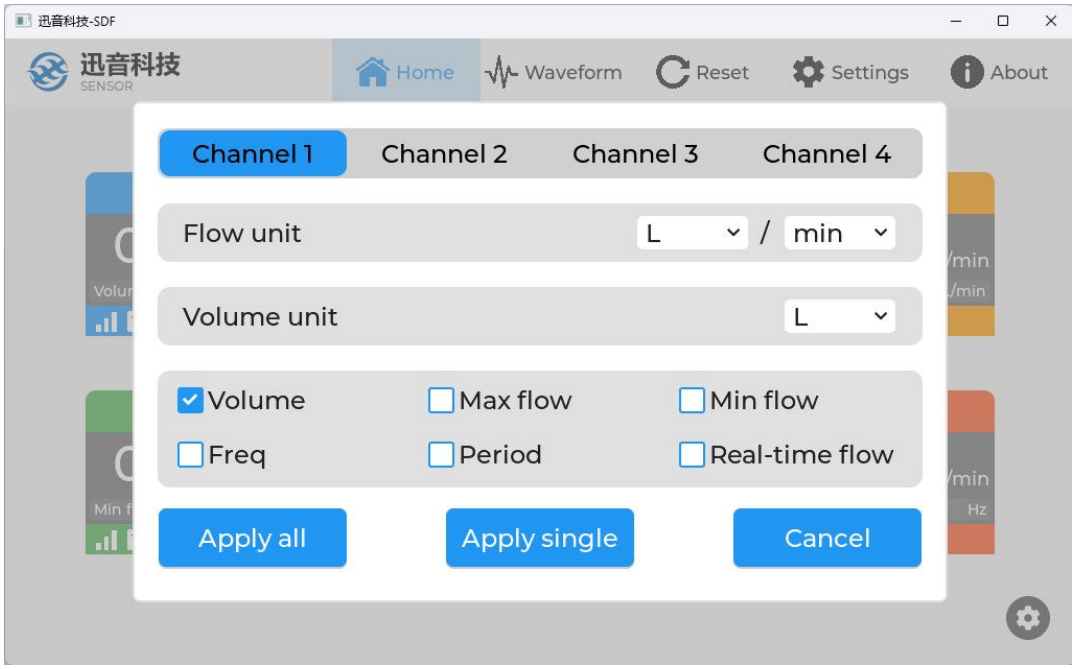
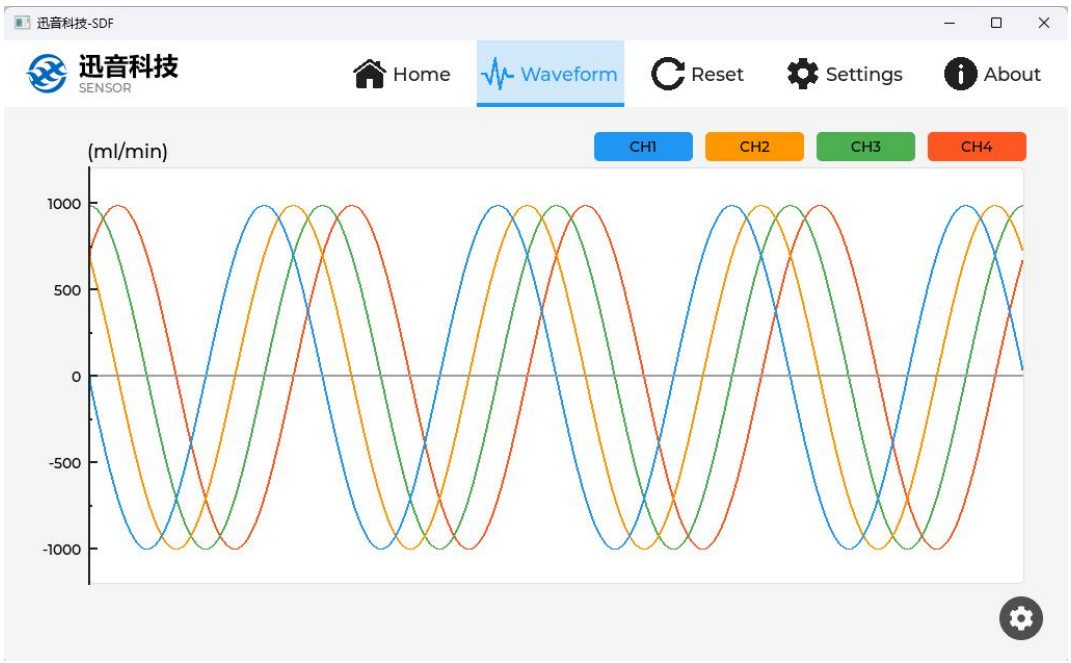


Channel Display Settings: Tap the gear icon in the lower-right corner of the home page to open. This allows customization of the data items and units displayed on the home page for each channel. Options include flow unit and volume unit selection, and toggling display items such as volume, maximum flow, minimum flow, frequency, period, and real-time flow. Supports independent application per channel (click 'Apply single') or synchronize the current configuration to all channels at once via 'Apply All'.

5.3.2 Waveform



Waveform Page: Used for real-time display of flow waveform data for each channel, supporting viewing of flow variation trends across different channels.

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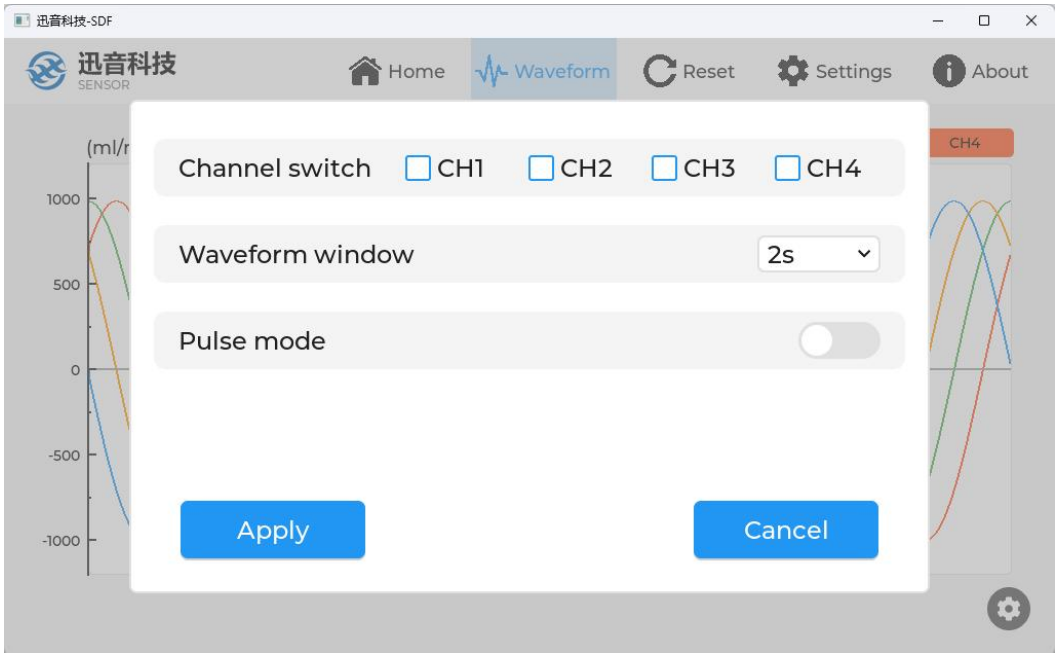
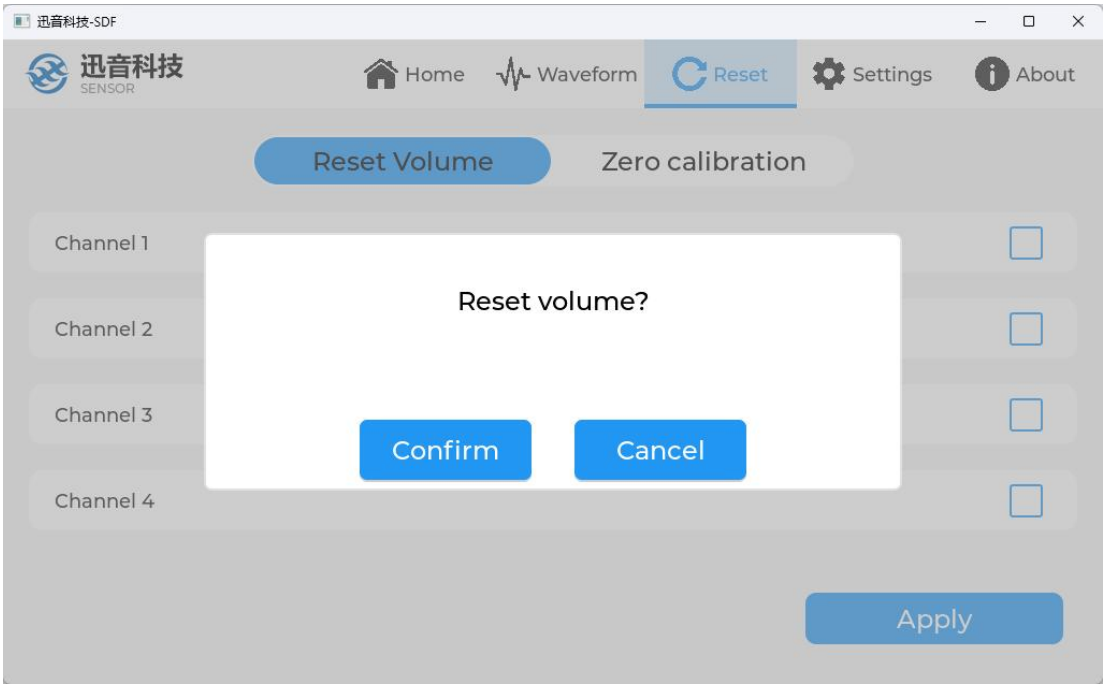


Waveform Parameter Settings: Allows configuration of display channel, waveform time window, and pulse mode parameters.

5.3.3 Reset



Reset Volume: Used to reset the cumulative volume of each channel to zero. Supports selecting a specific

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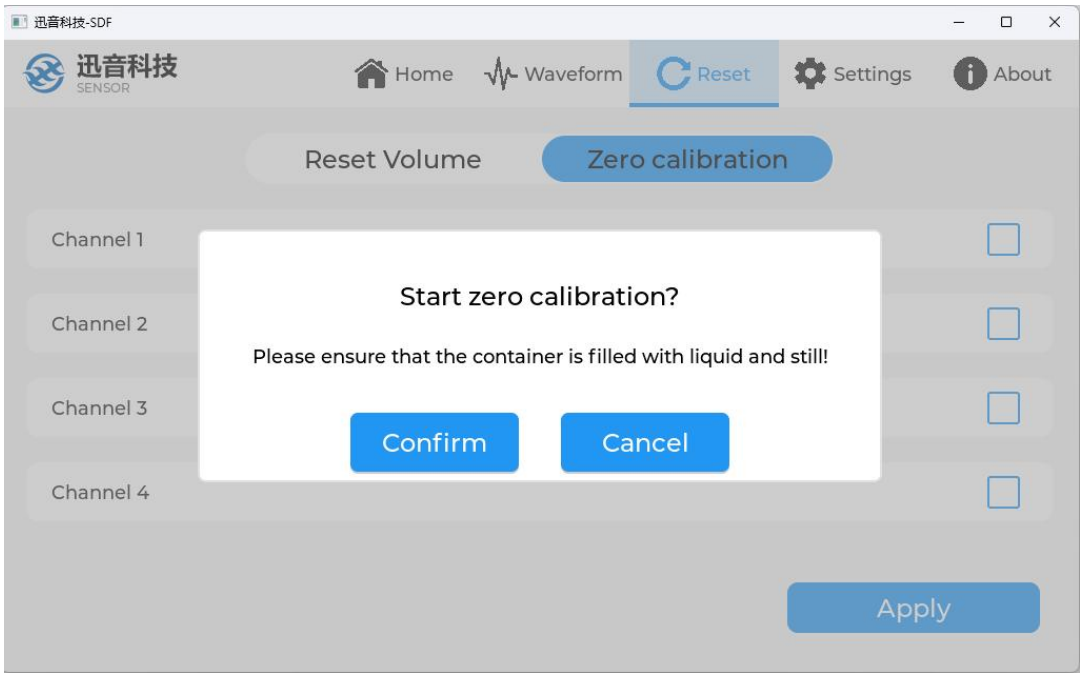
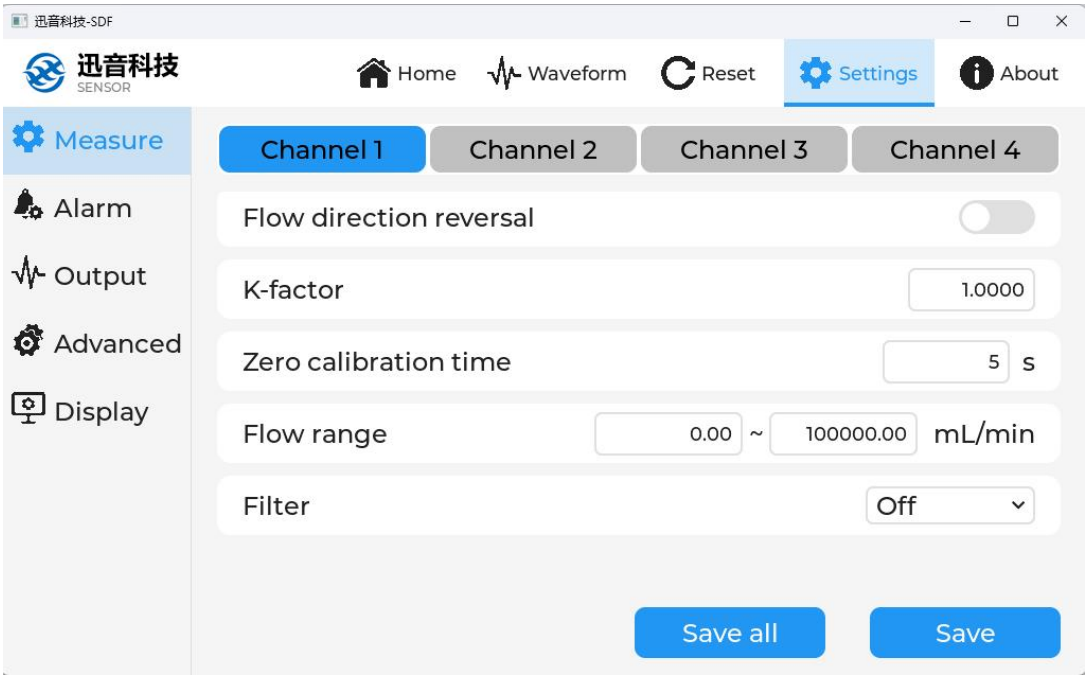
channel for operation.



Zero-Point Calibration: Used to calibrate the reference zero point of the sensor. When executing, ensure the flow line is fully filled with liquid and remains stationary, in order to eliminate static errors and ensure accurate subsequent flow measurements. Supports selecting a specific channel for operation.

5.3.4 Settings



Measurement Parameter Settings: Used to configure flow measurement parameters for each channel, including flow direction reversal, K-factor modification, zero-point calibration duration, flow range, and filter mode settings.

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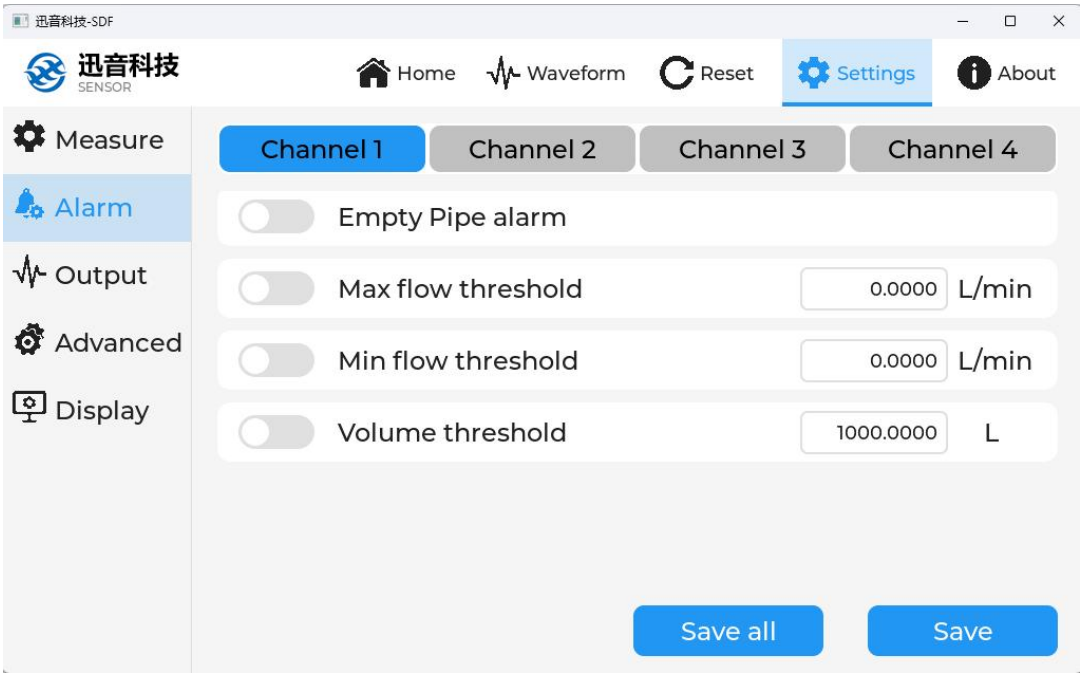
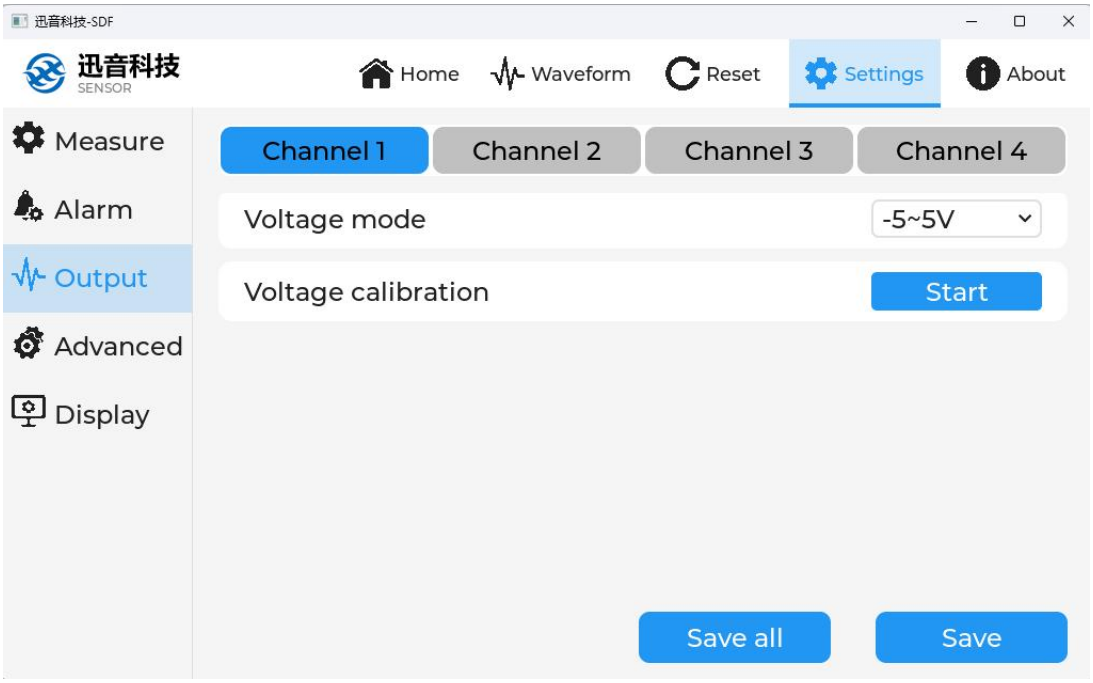
Supports independent saving per channel, or synchronize the current channel configuration to all channels via 'Save All'.



Alarm Settings: Used to configure abnormal status and threshold values for each channel, including empty tubing alarm switch, maximum flow threshold, minimum flow threshold, and cumulative volume threshold. Supports independent saving per channel, or synchronize via 'Save All'.



Output Parameter Settings: Used to configure signal output parameters for each channel, including voltage output mode selection (-5V to 5V or -10V to 10V) and voltage calibration function. Supports independent saving per channel, or synchronize via 'Save All'.

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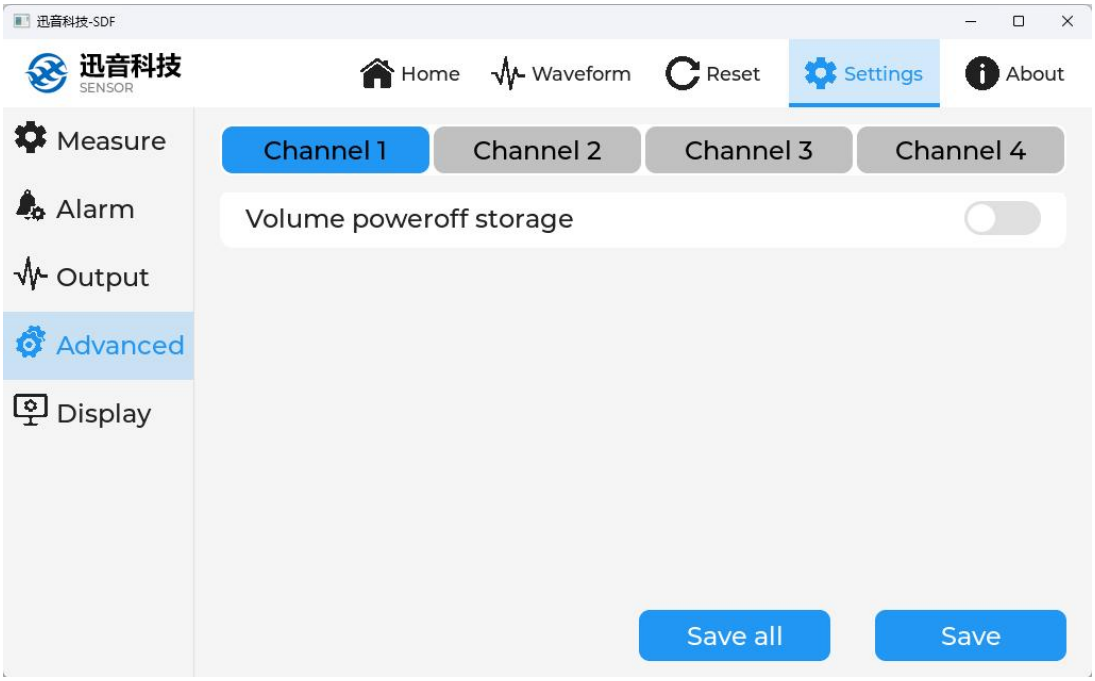
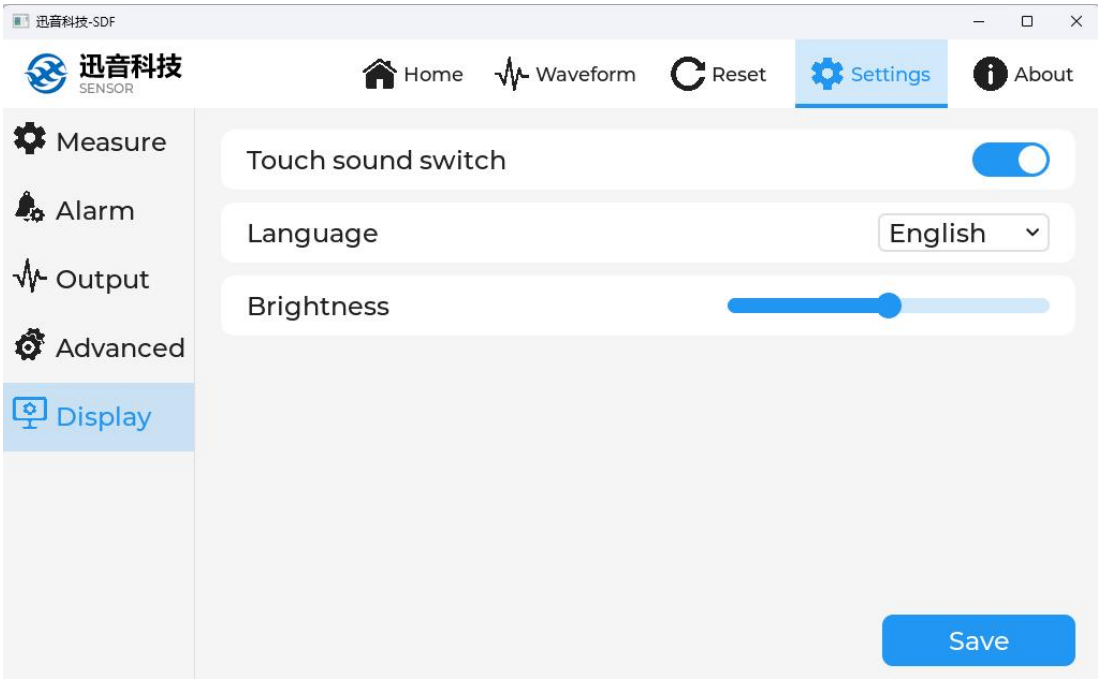


Advanced Parameter Settings: Used to configure the volume power-off save switch for each channel. When enabled, the current cumulative volume data will be automatically saved when the system powers off, preventing data loss. Supports independent saving per channel, or synchronize via 'Save All'.



Display Parameter Settings: Used to configure the system display and interaction properties of the touchscreen, including touch sound switch, system language selection, and screen brightness adjustment. Click 'Save' to apply the current configuration.

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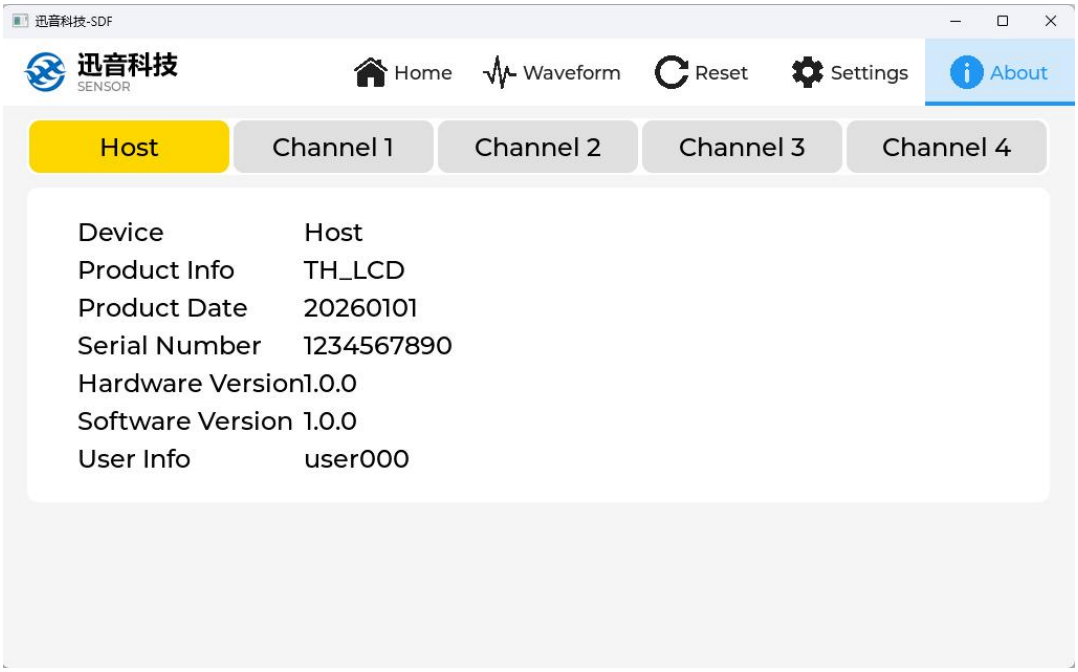
5.3.5 About



About Page: Used to view basic system information. Supports switching between the host and each channel to view device name, product information, production date, serial number, hardware version, software version, and user information.

5.4 Factors Affecting Measurement Accuracy

5.4.1 Proper Calibration

Inline flow sensors can be calibrated for different flow velocities, temperatures, and liquid types. In practice, optimal measurement accuracy is achieved only when the liquid flow velocity range, measurement temperature, and liquid type are consistent with the factory calibration conditions.

5.4.2 Temperature

Temperature fluctuations cause changes in the acoustic properties of the liquid, so it is necessary to ensure that the actual operating temperature of the sensor matches the calibration temperature. To minimize the effect of temperature variations on measurement accuracy, it is recommended to first install the sensor in the fluid system, fill it with liquid, and wait 30 minutes to reach thermal equilibrium before beginning measurement. Accuracy is guaranteed only when the liquid temperature is within ±3°C of the factory calibration temperature. If the actual liquid temperature differs from the calibration temperature by more than ±3°C, users are advised (where feasible) to recalibrate at the actual temperature and adjust the sensor correction coefficient to further improve accuracy.

5.4.3 Liquid Type

Sensors are calibrated at the factory using water at 23°C by default. The temperature of the liquid to be measured, the concentration of dissolved substances, and the presence of bubbles or solid particles all affect measurement accuracy. Therefore, calibrating the sensor at the factory using the

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actual liquid to be measured will yield the best accuracy. In many cases, users cannot send the actual liquid to the factory; in such cases, factory calibration is performed with water, and a correction coefficient for the specific liquid is obtained through on-site calibration to further improve accuracy.

5.4.4 Sensor Installation

For best measurement accuracy, the sensor should ideally be installed in a straight tubing section. Sudden bends or turns in the tubing may affect the flow field distribution and introduce greater measurement uncertainty. Where possible, ensure the straight tubing section upstream of the sensor is at least 10 times of tubing diameters in length, and the straight section downstream is at least 5 times of tubing diameters in length. When installing the sensor in the fluid system, ensure the positive flow direction aligns with the arrow direction on the sensor top cover.

5.4.5 Zero-Point Calibration

Due to changes in ambient temperature and liquid type, the ultrasonic flow sensor may exhibit slight zero drift after prolonged use, requiring a zero-point calibration. When performing a zero-point calibration, ensure that the liquid flow is completely stopped. If the liquid is flowing during zero-point calibration, this will introduce errors into both the calibration and the flow velocity measurement.

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6. Appendix

6.1 Revision History

Date	Description	Author	Version
2024.9.15	Initial release	L.L.	1.0
2024.10.24	Revised: cover; added company introduction; modified and added product models and parameters; removed Quick Start Guide and symbol abbreviations	CM.L.	1.1
2024.10.31	Revised: circuit system model, introduction, features; added circuit screen display specifications	CM.L.	1.2
2025.5.10	Revised: schematic diagram; removed duplicate accuracy specifications	CM.L.	1.3
2025.5.27	Added Section 4.5: SFD operation panel settings	CM.L.	1.4
2026.6.10	Updated SFD appearance, system operation, and TH sensor probe structure	HY.C	1.5

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