# CM Series Ultrasonic Clamp-on Flow Sensor User Manual

**User Manual (V1.4)**

**XY-TEK**

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# CM Series Ultrasonic Clamp-on Flow Sensors

**XY-TEK** is a technology innovation enterprise specializing in the research, development, production, and sales of ultrasonic flow sensors. We are committed to providing accurate, stable, and reliable flow sensors for liquid flow rate measurement in medical devices, biopharmaceuticals, new energy, and industrial automation industry, helping enhance the automation, digitalization, and intelligence of liquid flow monitoring systems.

**XY-TEK CM series ultrasonic clamp-on flow sensors** are compact, and can measure flow and output results without external circuitry. The sensors can be directly clamped on flexible plastic tubing to accurately measure the liquid flow rate and detect air bubbles. The sensors are not in direct contact with the liquid in the tubing and will not contaminate the liquid. They are especially suitable for applications where strict hygiene is required, such as medical devices, bioprocessing, new energy, semiconductors, industrial automation, scientific research, and other fields.

**Features**

- High precision and high stability
- Non-invasive measurement, no direct contact with liquid, hygienic safety
- Bi-directional measurement, which can calculate fluid volume and detect air bubble
- Circuit embedded in the sensor and no external circuit required
- No blockage, no dead area, low fluid pressure loss

**Applications**

- Medical devices such as hemodialysis machines, organ transplantation systems, heart-lung machines, blood pumps, syringe pump


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- Bioprocessing, such as single-use bioreactors, fermenters, cell culture equipment, vaccine production, tangential flow filtration systems, liquid chromatographs, HPLC
- Fluid monitoring during new energy and semiconductor manufacturing, such as high-purity water and corrosive chemicals
- Food & beverage processing, such as milk, juice, and beer production
- Filling equipment, spraying equipment, cooling system, lubrication system
- Scientific experiment system
- Water treatment and wastewater treatment system

**Working Principle**

The XY-TEK clamp-on flow sensors can be clamped on flexible plastic and silicone tubing to measure liquid flow rate non-invasively. The sensors operate using the principle of ultrasonic transit-time difference technology, which is considered to be the most accurate method among some other approaches for non-invasive flow measurement solutions.

In the sensor, two piezoelectric (PZT) crystals transmit/receive ultrasonic waves alternatively in the downstream and upstream directions. The ultrasonic waves propagate through the liquid at an angle relative to the axis of the tubing, and the transit time in the upstream direction is always larger than that in the downstream direction. The time difference in both directions is proportional to the flow velocity, and with that information, the liquid flow rate can be derived.


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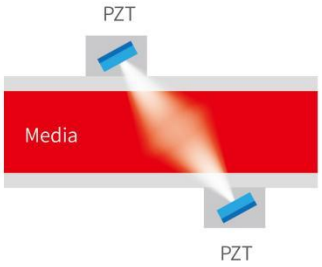


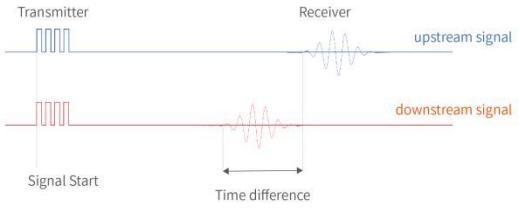


## Flow Sensor Specifications

| | | | | | |
|---|---|---|---|---|---|
| **Liquid** | Water, blood, salt water, drinks, oil, viscosity Liquids, etc | | | | |
| **Measurement Accuracy** | ±3% plus zero offset | | | | |
| **Calibration** | Default: 22±3 °C (water) | | | | |
| **Tubing Material** | PVC, silicone, and other material tubes with smooth inner and outer surfaces | | | | |
| **Standard Products and Tubing Size** | **Sensor** | **Flow Range** | **Accuracy** | **Tubing OD** | **Tubing ID** |
| | **CM016NS** | 0-2000 mL/min | 0-200mL/min: ±6mL/min<br>200-2000mL/min: ±3% | 5/32"(4mm) | 1/16" (1.6mm) |
| | | | | 4mm | 2mm |
| | **CM019NS** | 0-4000 mL/min | 0-200mL/min: ±6mL/min<br>200-4000mL/min: ±3% | 3/16" (4.8mm) | 1/8" (1.6mm) |
| | | | | 5mm | 3mm |
| | **CM025NS** | 0-6000 mL/min | 0-300mL/min: ±9mL/min<br>300-6000mL/min: ±3% | 1/4" (6.4mm) | 1/8" (3.2mm) |
| | | | | 6mm | 4mm |
| | **CM038NS** | 0-8000 mL/min | 0-500mL/min: ±15mL/min<br>500-8000mL/min: ±3% | 3/8" (9.5mm) | 1/4" (6.4mm) |
| | | | | 9mm | 6mm |
| | **CM056NS** | 0-12000 mL/min | 0-800mL/min: ±24mL/min<br>800-12000mL/min: ±3% | 9/16" (14.3mm) | 3/8" (9.5mm) |
| | | | | 14mm | 10mm |
| **Housing Material** | Aluminium alloy or stainless steel | | | | |
| **Fluid Temperature** | 0°C to 60°C | | | | |
| **Ambient temperature** | 0°C to 60°C | | | | |
| **Storage Temperature** | -20°C to 70°C | | | | |
| **Input Voltage** | 5-30 VDC | | | | |
| **Current** | Less than 20mA (no external load) | | | | |
| **Installation** | hanging | | | | |
| **Protection Class** | IP65 | | | | |

*RD: Reading (reading accuracy)


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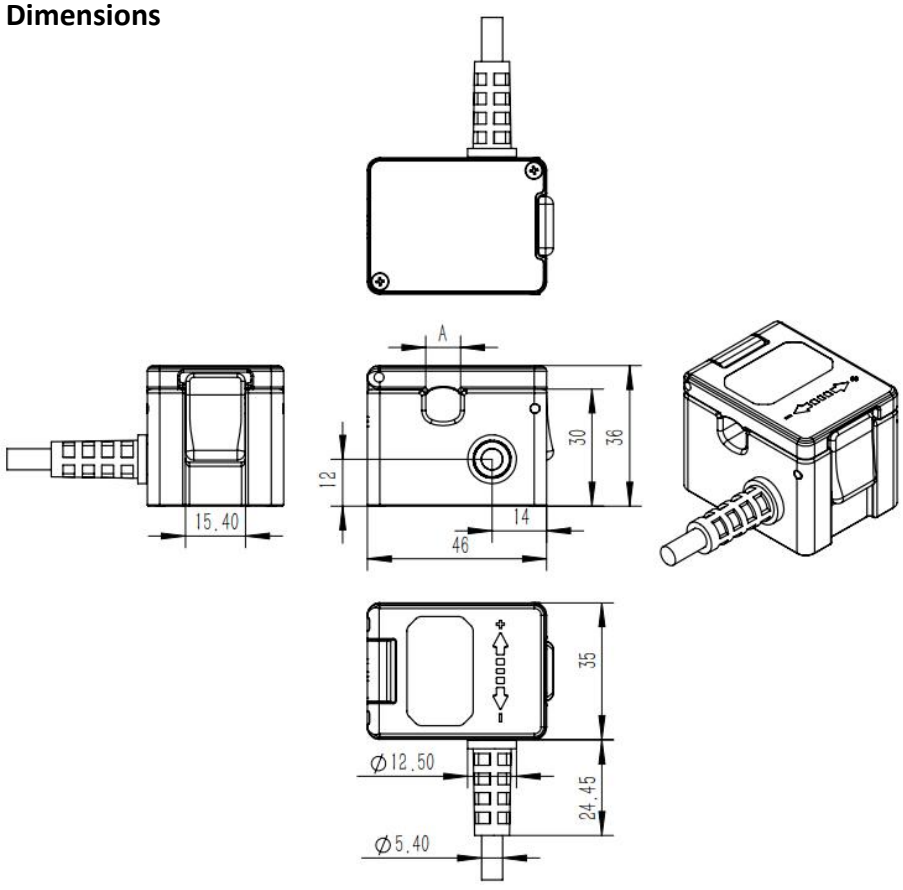
## Cable Wire Assignment

| Pin | Color | Function |
|---|---|---|
| 1 | Red | Voltage input (5-30VDC) |
| 2 | Black | GND |
| 3 | Green | RS485A |
| 4 | Yellow | RS485B |

## External Dimensions





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## Update Records

| Date | Action | Operator | Version |
|---|---|---|---|
| 2024/09/25 | Initial creation | TZ.W | 1.0 |
| 2024/10/21 | Modified: introduction, specifications, product images | CM.L | 1.1 |
| 2024/11/05 | Deleted external dimensions | CM.L | 1.2 |
| 2025/05/08 | Modified flow range, working principle diagram; deleted duplicate accuracy | CM.L | 1.3 |
| 2025/07/31 | Added ambient temperature and RD accuracy description | HY.C | 1.4 |


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