



CS Series Ultrasonic Clamp-on Flow Sensor User Manual



User Manual (V2.5)

XY-TEK

April. 2026

CS Series Ultrasonic Clamp-on Flow Sensors

XY-TEK is a technology-driven enterprise specializing in the R&D, production, and sales of ultrasonic flow sensors. We are committed to providing accurate and reliable flow sensors for liquid transmission tubing in medical devices, biopharmaceuticals, new energy, and industrial equipment, enhancing the automation, informatization, and intelligence of liquid flow measurement.

XY-TEK's **CS series ultrasonic clamp-on flow sensors** feature a compact design and are capable of performing measurements and outputting data without the need for an external circuit system. The sensor can be directly clamped onto the outer surface of a hard plastic pipe to accurately measure the flow velocity of the liquid inside, and it can also detect bubbles and large solid particles within the liquid. Since the sensor does not come into direct contact with the liquid in the pipeline, it avoids contamination, making it particularly suitable for applications that require high levels of hygienic cleanliness, such as liquid flow monitoring in biopharmaceutical processes, medical devices, and semiconductor equipment manufacturing. We offer a range of standard-size products that fit common pipe diameters, and we can also provide customized solutions based on specific user requirements. The sensor can be configured as a flow switch to enable bubble detection and filling functions.

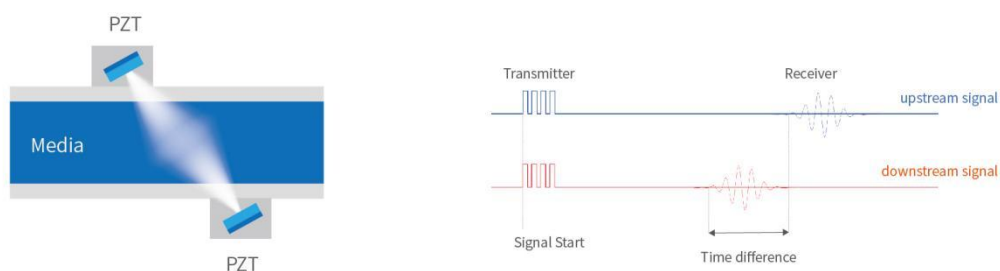
Features:

- High precision and high stability
- Non-invasive measurement, no direct contact with liquid, hygienic safety
- Bi-directional measurement, 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
- Provide standard output methods to seamlessly integrate with customer systems
- Customized calibration of plastic tubing material, size, temperature and liquid type

Working Principle:

The XY-TEK clamp-on flow sensors can be clipped on rigid plastic tubing to measure liquid flow rate non-invasively. The sensors use 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 volume flow rate can be derived.

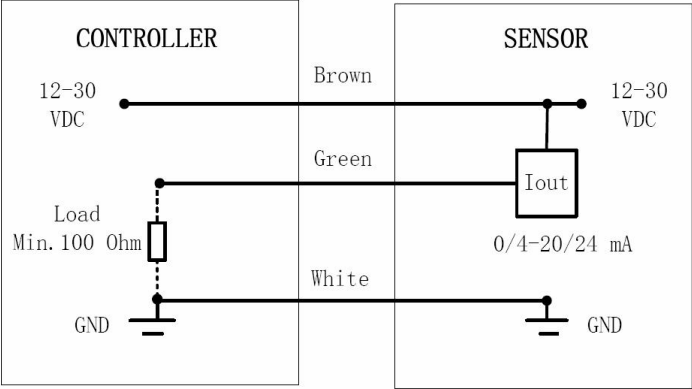
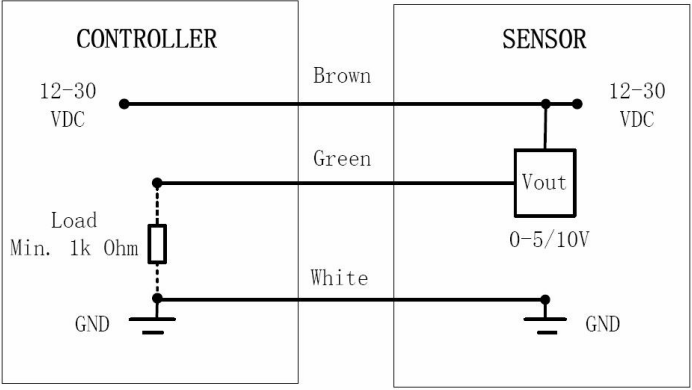


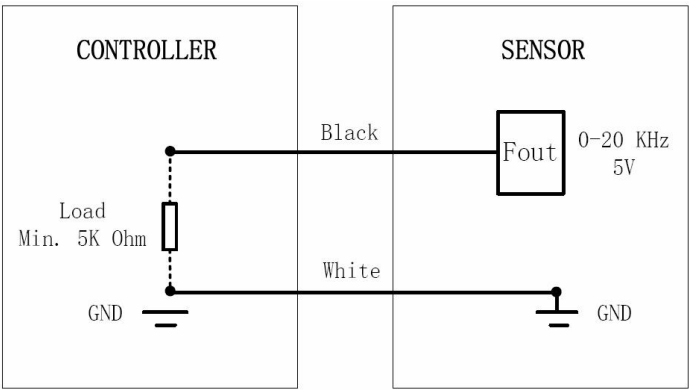
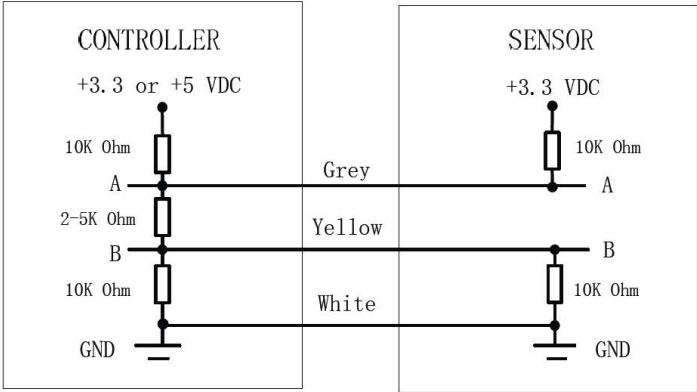
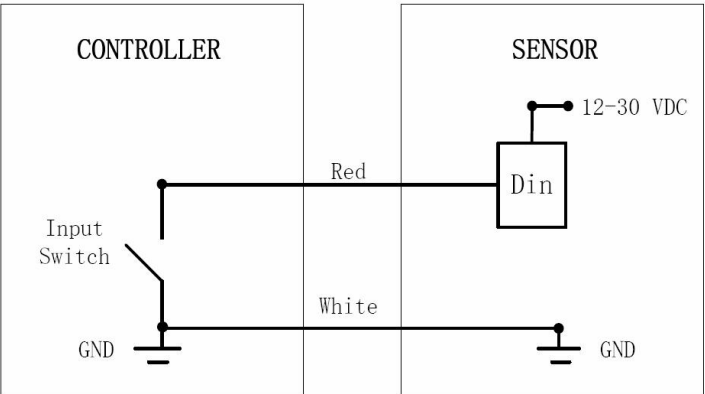
Applications:

- Fluid monitoring during semiconductor manufacturing, such as high purity water and corrosive chemicals
- Medical devices such as hemodialysis machine, organ transplantation system, heart-lung machine, and blood pump
- Biopharmaceutical processes and equipment, such as fermenters, cell culture equipment, vaccine production, tangential flow filtration systems, and liquid chromatographs
- Food & beverage processing, such as milk, juice, and beer production
- Filling equipment, spraying equipment, cooling system, and lubrication system
- Scientific experiment system
- Water treatment and wastewater treatment system

Flow Sensor Specifications:

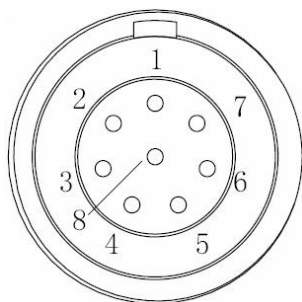
Liquid	Water, DI, drinks, coolant, chemicals, slurry, oil, viscous liquids, etc				
Measurement Accuracy	$\pm 2\%$ RD (plus zero offset)				
Repeatability	$\pm 0.1\%$ f.s. (full scale)				
Calibration	Default: 22 ± 3 °C, water				
Tubing material	PFA, PTFE, Teflon, PP, PVDF, PA etc., smooth inner and outer surfaces				
	Sensor	Max Flow	Accuracy	Tubing OD	Tubing ID
Standard Product Maximum Range, Accuracy*, and Corresponding Plastic Pipe Sizes (8-pin Plastic Connector) *The accuracy shown is the factory calibration accuracy.	CS025NP	5L/min	0-300mL/min: ± 0.006 L/min 0.3-5L/min: $\pm 2\%$ RD	1/4" (6~7mm)	3~5mm
	CS038NP	15L/min	0-600mL/min: ± 0.012 L/min 0.6-15L/min: $\pm 2\%$ RD	3/8" (9~10mm)	5~8mm
	CS050NP	30L/min	0-1L/min: ± 0.02 L/min 1-30L/min: $\pm 2\%$ RD	1/2" (12~13mm)	6~11mm
	CS075NP	50L/min	0-1.6L/min: ± 0.032 L/min 1.6-50L/min: $\pm 2\%$ RD	3/4" (18.5~)	12~16mm
	CS100NP	100L/min	0-2.4L/min: ± 0.048 L/min 2.4-100L/min: $\pm 2\%$ RD	1" (25~26mm)	15~20mm
	CS125NP	200 L/min	0 - 8 L/min: ± 0.16 L/min 8 - 200 L/min: $\pm 2\%$ RD	1 1/4" (31~32mm)	20 ~ 26mm

	CS049MP	400L/min	0-10L/min: ± 0.2 L/min 10-400L/min: $\pm 2\%$ RD	49mm	38-45mm
Housing material	Corrosion-resistant plastic				
Input voltage	12-30 VDC				
Current	Less than 20mA (no external load)				
Connector	8 pin plug				
Fluid temperature	0°C to 60°C				
Ambient Temperature	0°C to 60°C				
Storage temperature	-20°C to 70°C				
Shielding	Grounded				
Protection Class	IP65				
Input and output	1. RS485 output 2. Analog output: current output 4-20mA, 0-20mA, 0-24mA, voltage output 0-5V, 0-10V 3. Frequency output: 0-20KHz 4. Digital output: NPN, PNP, PUSH-PULL 5. Digital input: Ground, lasts at least 20ms				
Current output	Load to GND, and the minimum load is 100 Ω . The maximum load depends on the operating voltage: 12V-250 Ω , 15V-500 Ω , 24V-1000 Ω , 30V-1200 Ω 				
Voltage output	5V and 10V optional. The minimum load is 1000 Ω . 				
	5V default (12-30V optional, contact manufacturer). The minimum load is 5000 Ω .				

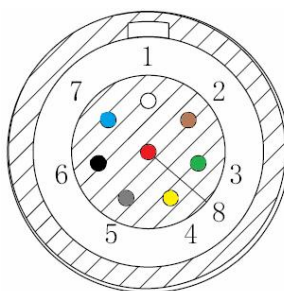
Frequency output	
RS485 interface	
RS485 bus operation	The sensor supports bus operation with maximum 12 subscribers. The default address is #4. The protocol is upon request.
Digital Output	NPN,PNP, PUSH-PULL, can be configured as flow switch, air detection, dosing or pulse output mode.Maximum 100mA
Digital input	Can be configured as zero calibration, volume reset or start dosing. Switch-on time must be larger than 20ms. 
Accessory	8 wire shielded cable, default length 1.5m
Optional accessories	1. USB Data Converter: can connect a sensor to a PC 2. Flow Sensor Tool Box with display: can connect up to 3 sensors to a PC 3. Flow Sensor Monitor: can connect to a sensor with display, and extend the sensor cable out 4. Flow Sensor Data Cable, 3 meters, push-pull plugs at both ends, can connect a Flow Sensor Monitor and a sensor

Electrical Connections:

CS...NB Series

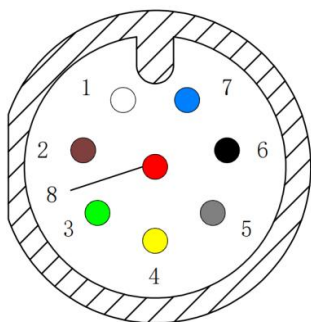


Female (Sensor)

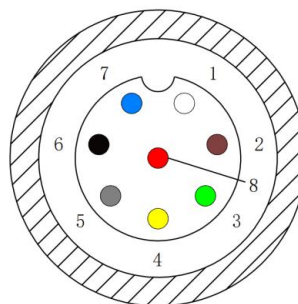


Male (Cable)

CS...NP Series



Male (Sensor)

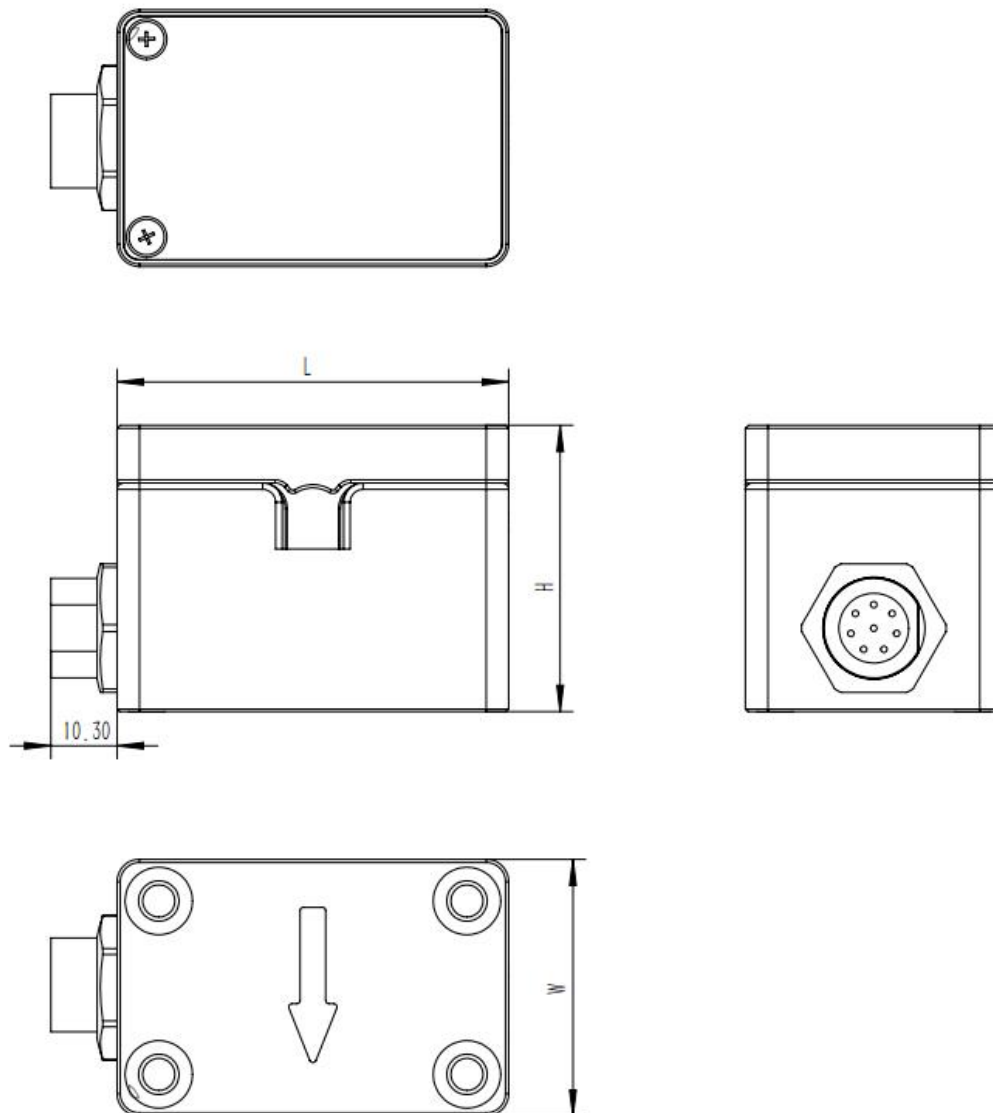


Female (Cable)

Cable wires assignment:

Pin	Color	Function
1	White	GND
2	Brown	Voltage input (12-30VDC)
3	Green	Current output or voltage output
4	Yellow	RS485B
5	Grey	RS485A
6	Black	Frequency output (0-20KHz)
7	Blue	Digital output (NPN, PNP, PUSH-PULL)
8	Red	Digital input (Ground for 20ms)

Dimensions for CS...NP Series:



Sensor	Part Number	L x W x H, mm
CS025NP	XYT10720	61 X 40 X 44.6
CS038NP	XYT10722	61 X 40 X 44.6
CS050NP	XYT10724	61 X 40 X 47.4
CS075NP	XYT10727	64.4 X 44 X 50.7
CS100NP	XYT10729	70 X 50 X 57.1
CS125NP	NA	NA
CS049MP	NA	NA

Update Records:

Date	Action	Operator	Version
2020/5/2	Initiation	K.L.	1.0
2020/5/2	Revise	K.L.	1.1
2021/1/13	Revise	K.L.	1.2
2021/4/7	Revise: Images updated; Modifications of non-technical content	L.L.	1.3
2021/7/6	Revise: Sensor names updated	L.L.	1.4
2021/8/23	Revise: Standard products and tubing size updated	L.L.	1.5
2021/10/14	Revise: Accessory and optional accessories updated; Formatting modifications	L.L.	1.6
2022/5/6	Revise: Sensor specifications updated	L.L.	1.7
2023/2/24	Revise: S.S.	S.S.	1.8
2024/2/2	Revise: Adjust accuracy parameters	L.L.	1.9
2024/8/20	Revise: Add CS...NP Series	CM.L.	2.0
2025/7/31	Revise: Add descriptions for ambient temperature, reading accuracy, and repeatability	HY.C.	2.3
2026/3/30	Revise: Add CS049MP model; delete the sensor version with 8-pin metal	HY.C.	2.4
2026/4/14	Revise: Add CS125NP model	HY.C.	2.5

Shanghai Xunyun Technology Co., Ltd.

Address: Building 7, No. 410 Jinggu Road, Minhang District, Shanghai

Postcode: 200245

Tel: +86-21-33885752

Email: global@xy-tek.cn

Website: www.xy-tek.com



XY-TEK LinkedIn XY-TEK Website

©2018-2025 Shanghai Xunyun Technology Co., Ltd. All rights reserved

The contents described in this manual are subject to change without notice