

INLINE PROCESS REFRACTOMETER USER MANUAL

Model: CZ-E



SINCE 1999

Manufacturer with 26 years of experience

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Safety Matters

- When measuring substances harmful to human body, please pay attention to protective measures;
- If the instrument starts to overheat, smoke or emit abnormal smell, please turn off the power immediately;
- Do not disassemble or modify this instrument;
- Do not apply water or samples to parts of the instrument other than the prism surface;
- Do not measure corrosive media;
- When not in use for a long time, the power should be turned off.

Please read this manual carefully, fully understand the function and operation of each part of the instrument before use, and check whether each part of the instrument works properly before use.

Use Instructions

- Use the instrument at an altitude below 2000 meters (altitude);
- Use the instrument indoors;
- The operating temperature is between 10℃ and 60℃;
- Do not change the ambient temperature of the instrument suddenly;
- Do not use the instrument in a place with a lot of dust and strong vibration;
- Do not place the instrument in a damp place;
- Do not place heavy objects on the instrument;
- Do not install the instrument in direct sunlight or near a heat source, nor in dusty or corrosive gas environments.

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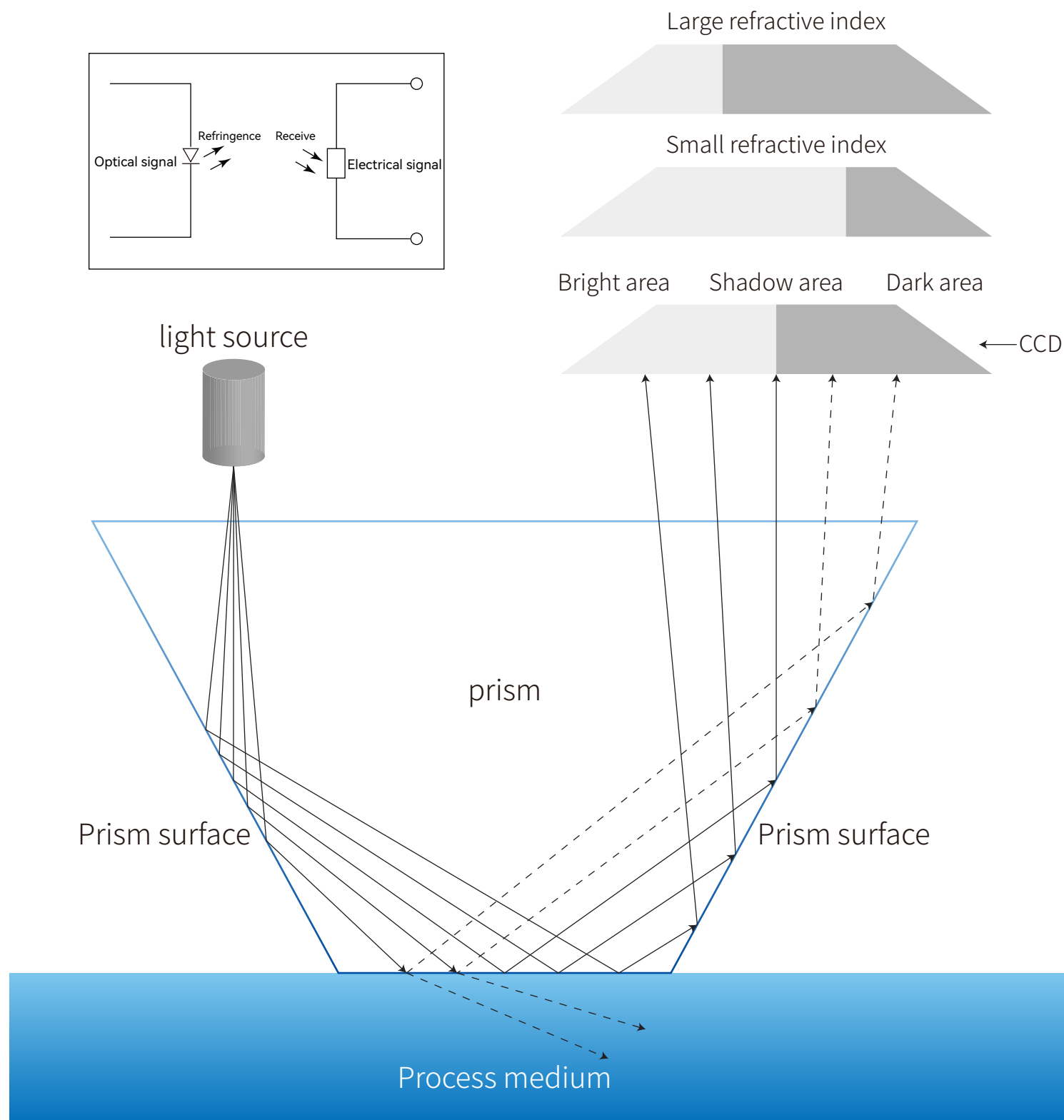
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1. Working Principle



The inline refractometer consists of a light source, sapphire prism, receiver, and signal modulation circuit. The light source emits a fixed wavelength light signal that passes through the sapphire prism to contact the measured medium. Part of the light signal is reflected and received by the receiver. The receiver calculates the refractive index of the measured medium based on the position of the received light signal, thereby obtaining the corresponding concentration through data algorithms. The transmitter internally employs temperature compensation to reduce the impact of temperature drift.

2. Typical Application

Food, Beverage & Agriculture



Sugar Refining



Starch Sweeteners & Sugar Substitutes



Life Science & Pharmaceuticals



Biological & Fermentation Industries



Chemicals & Related Products



Semiconductors



Battery Manufacturing



Pulp, Paper & Wood



Mechanical Processing, Mining



Power & Energy Industries



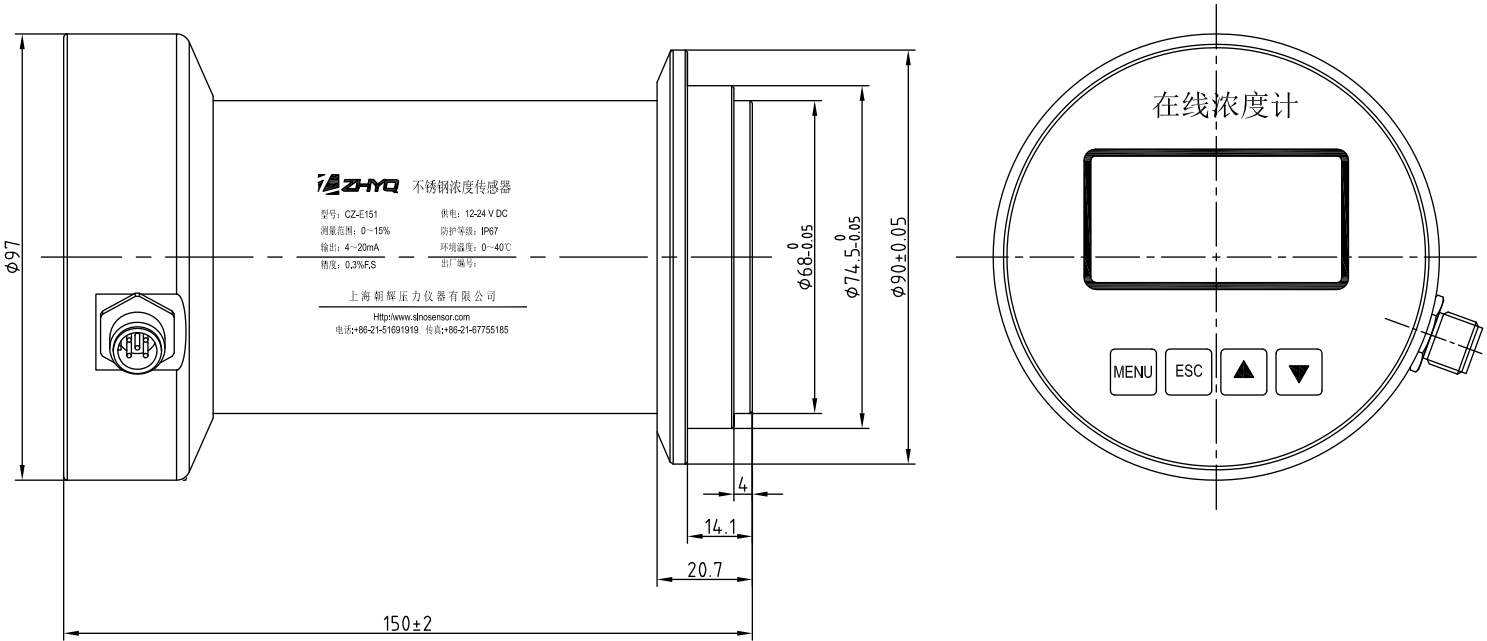
Oil & Gas Refining & Petrochemicals



3. Product Features

Accurate, fast, stable and reliable
Integrated measurement and display
4-20mA/RS485 dual output

4.Drawing

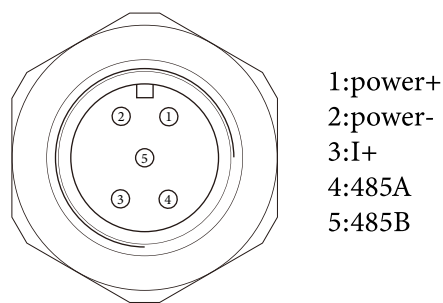


5.Technical Specifications

5.1. Parameters

Product model	CZ-E501	CZ-E151
Measuring parameters	Refractive index (nD), temperature (T), Brix(%)	
Measuring range	nD:1.33299-1.42009/Brix: 0.0~50.0%	nD:1.33299-1.35568/Brix: 0.0~15.0%
Resolution	nD:0.0001 / Brix:0.1% / T:0.1℃	
Accuracy	nD:±0.0003 / Brix:±0.3% / T:±1℃	
Temperature compensation	10-60℃	
Power supply	12~24V DC	
Signal output	DC 4~20mA or RS485	
Ambient temperature	10-60℃	
Protection grade	IP66	
Operating pressure	Maximum tolerance 1Mpa	
High & low limit setting	Can be set by button	
Prism material	Artificial sapphire	
Wetted material	Standard: SS316L (optional: 2205; Hastelloy C-276)	
Process medium	Cutting oil; emulsion; sugar content; juice	
Installation type	Quick-chuck (optional: thread, flange)	
Cleaning accessories	QX-S01、CQX-1A	
Pipeline adapter	Quick-chuck cross pipe fitting, flange cross pipe fitting, threaded cross pipe fitting, (installation type is Quick-chuck)	
Communication Protocol	Standard: modbus (protocol can be customized)	

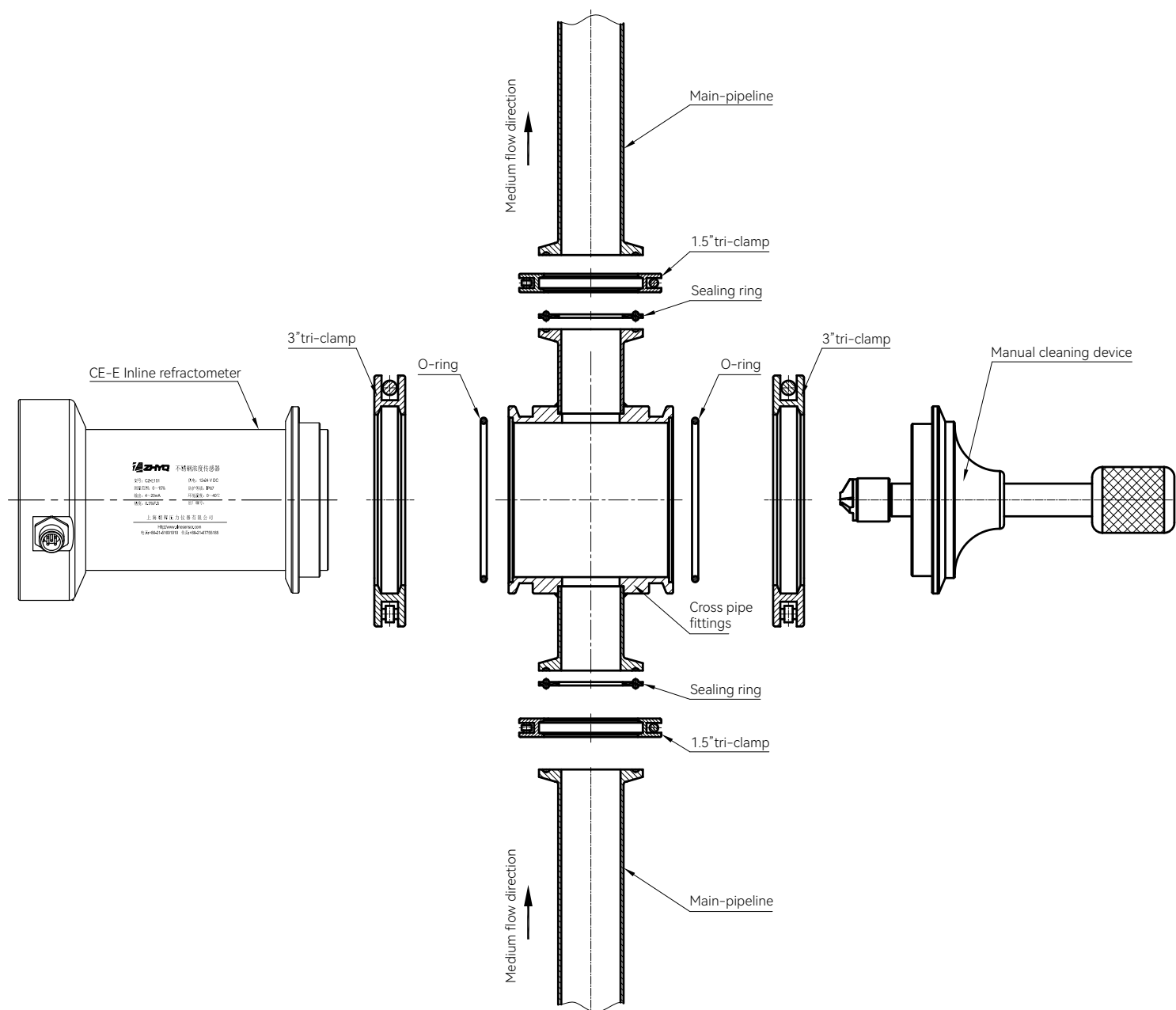
5.2. Wiring Definition



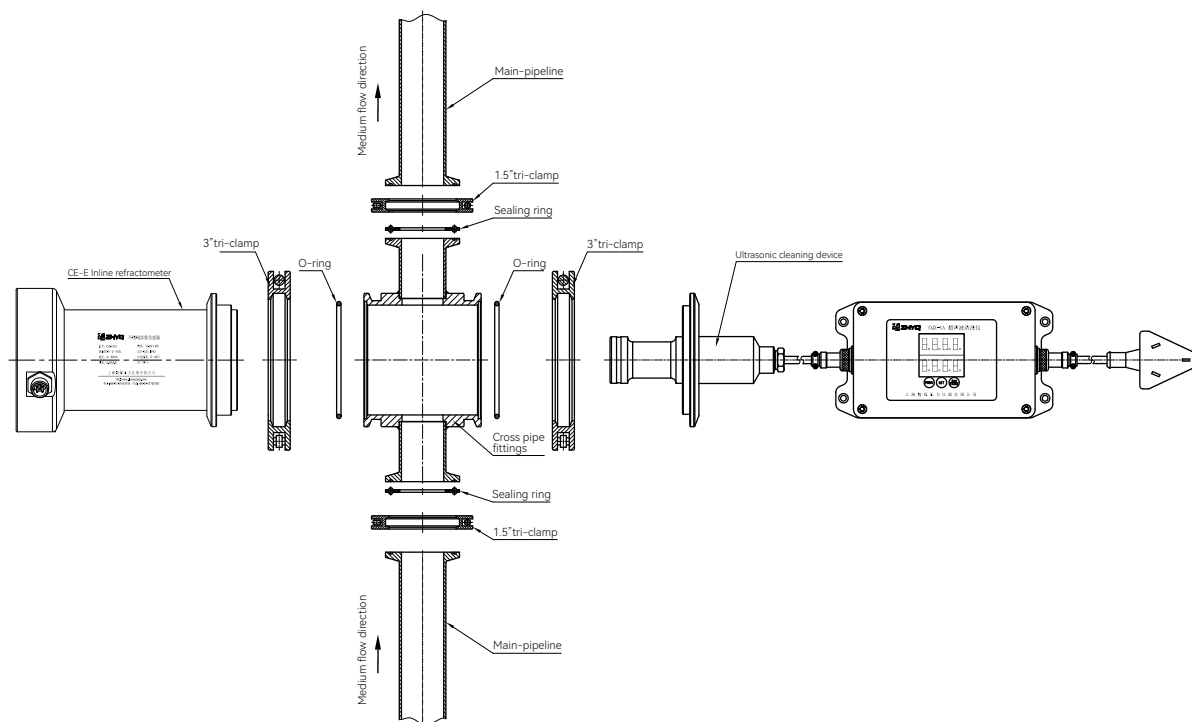
6.Product Installation Method and Precautions

6.1. Product Installation Operation Steps

6.1.1. Before installation, please check whether the required spare parts are complete, as shown in the exploded diagram of the parts



Exploded view of parts (with manual cleaning device)

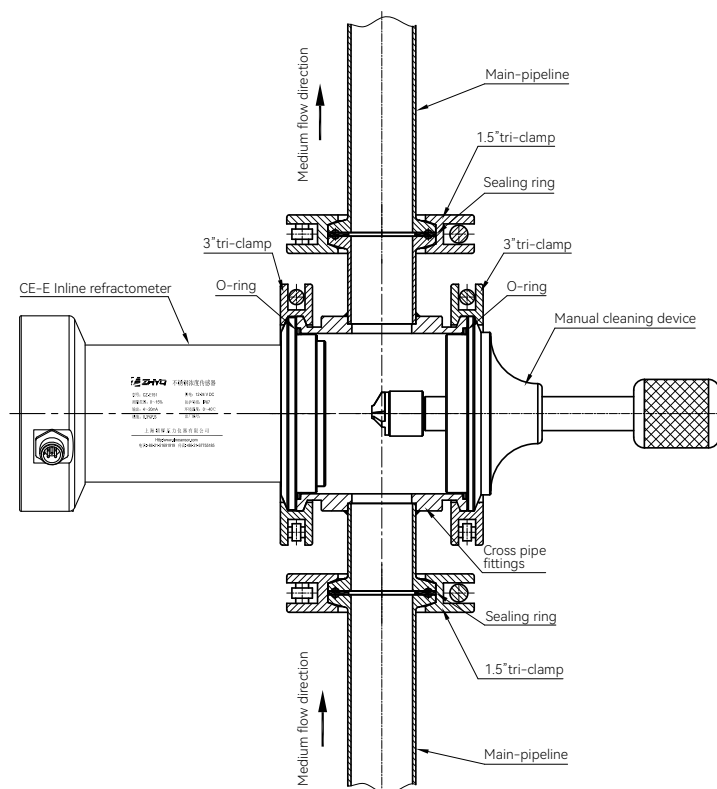


Exploded view of parts (with ultrasonic cleaning device)

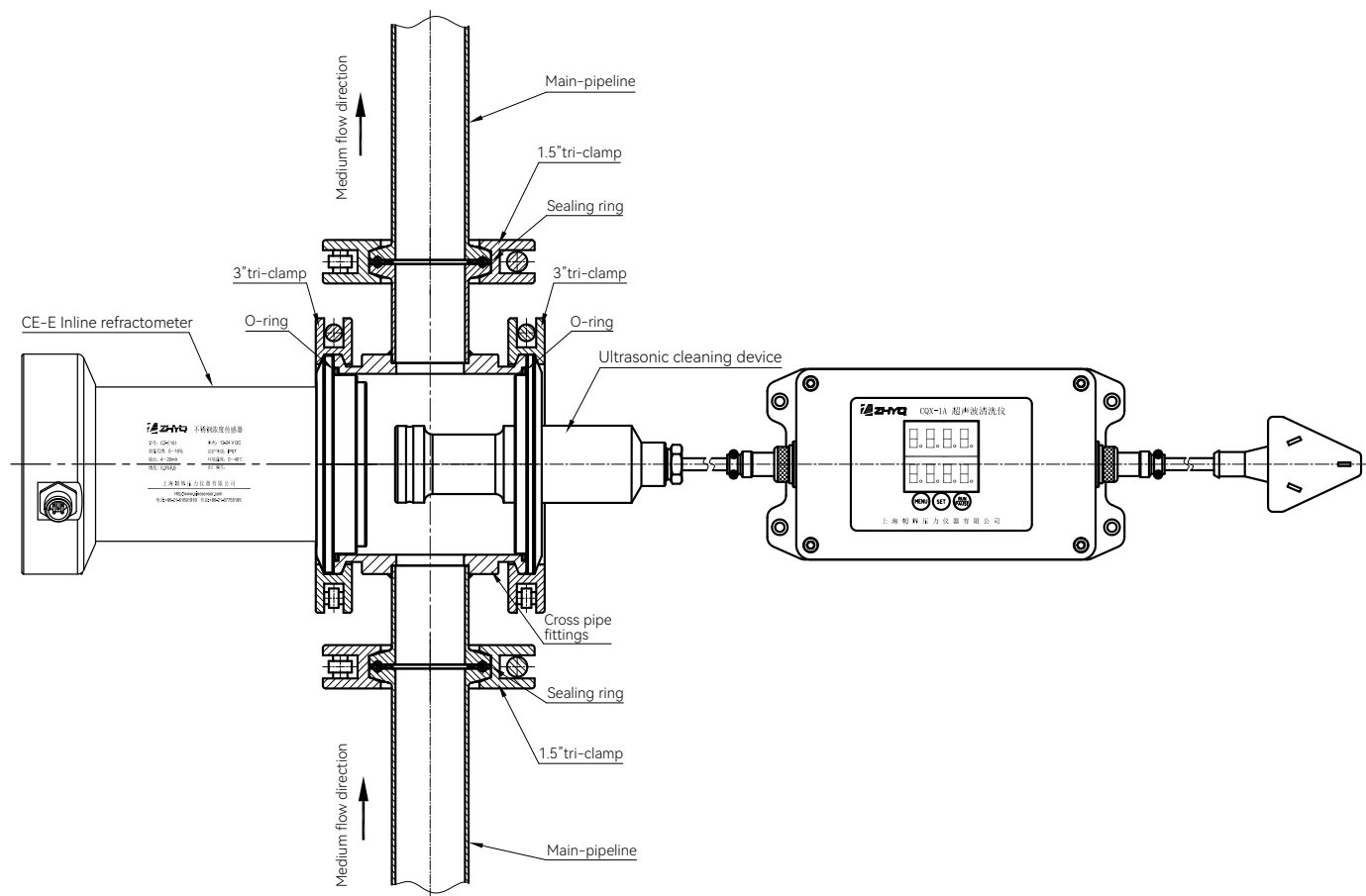
6.1.2. Install the two sealing rings on the cleaning device pipe cross fittings, and then use 1.5" clamps to install the two ends of the pipe cross fittings on the pipes, and finally tighten the clamp screws and check whether it is installed in place;

6.1.3. Install the O-ring on the measuring end of the inline refractometer, and then use a 3" clamp to install the inline refractometer on the pipe, and finally tighten the clamp screws and check whether it is installed in place;

6.1.4. Put the O-ring on the cleaning device, and then use a 3" clamp to install the cleaning device on the pipe, and finally tighten the clamp screws and check whether it is installed in place, as shown in the following figure of the

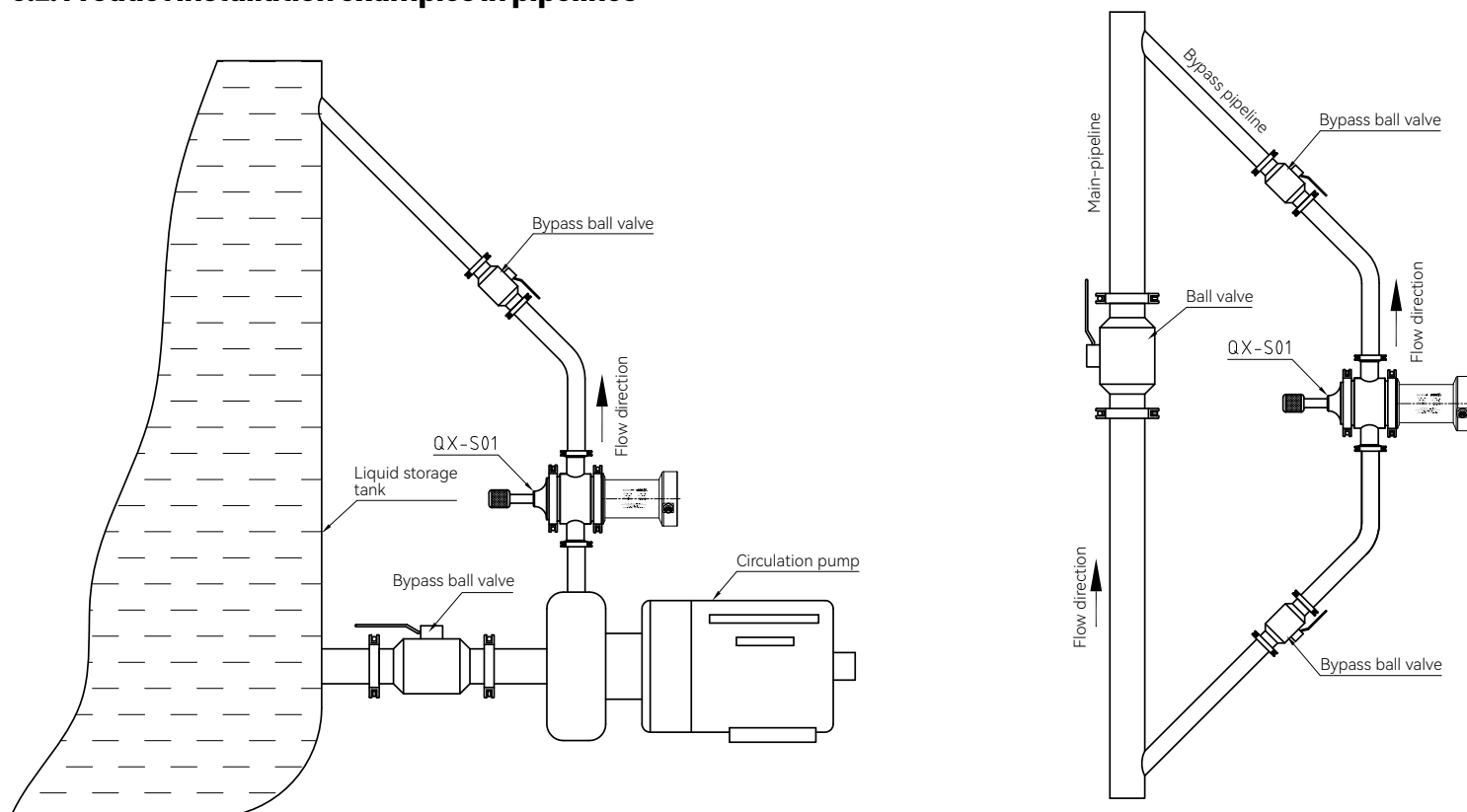


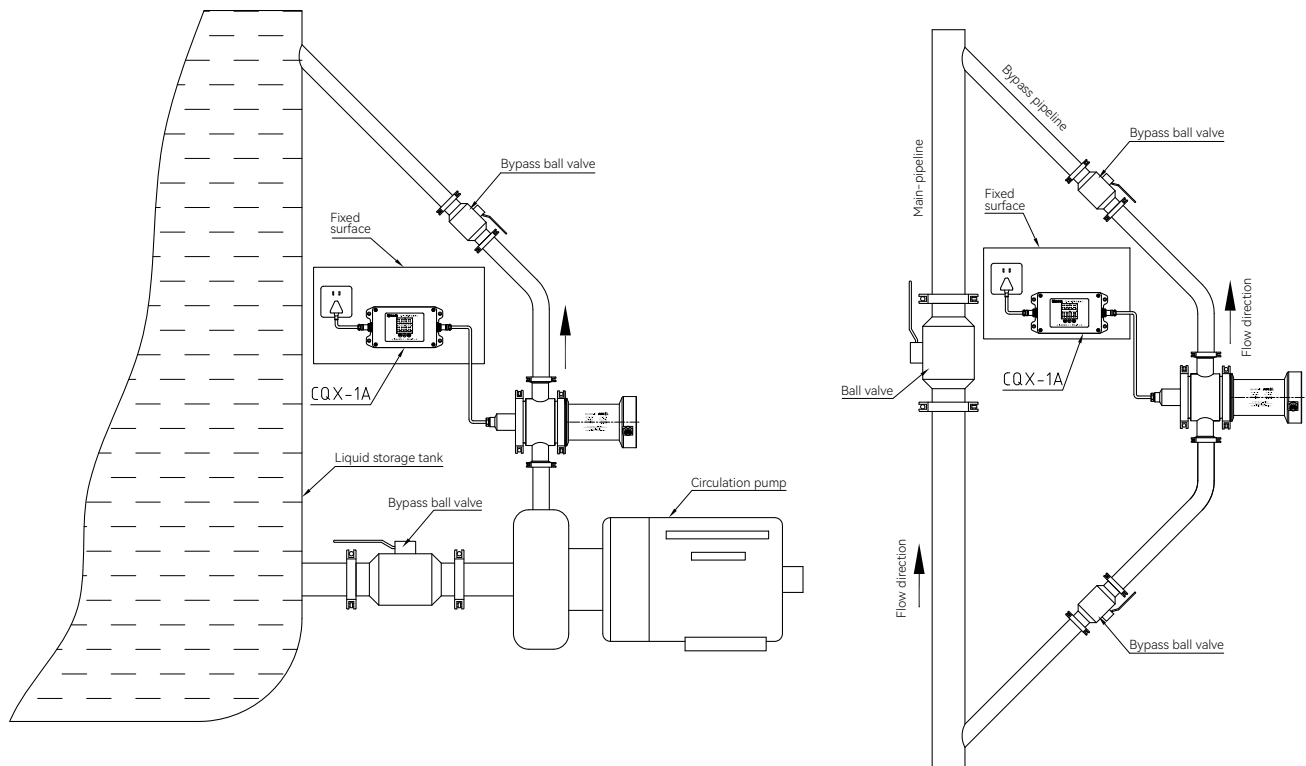
Assembly completed diagram (with manual cleaning device)



Assembly completed diagram (with ultrasonic cleaning device)

6.2. Product installation examples in pipelines



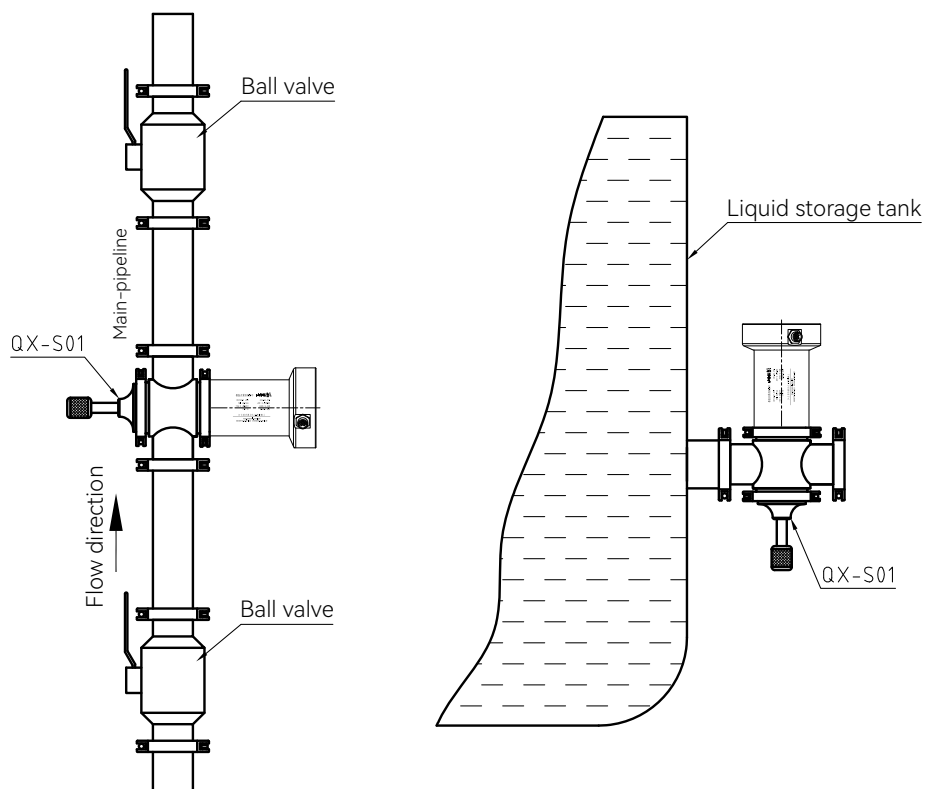


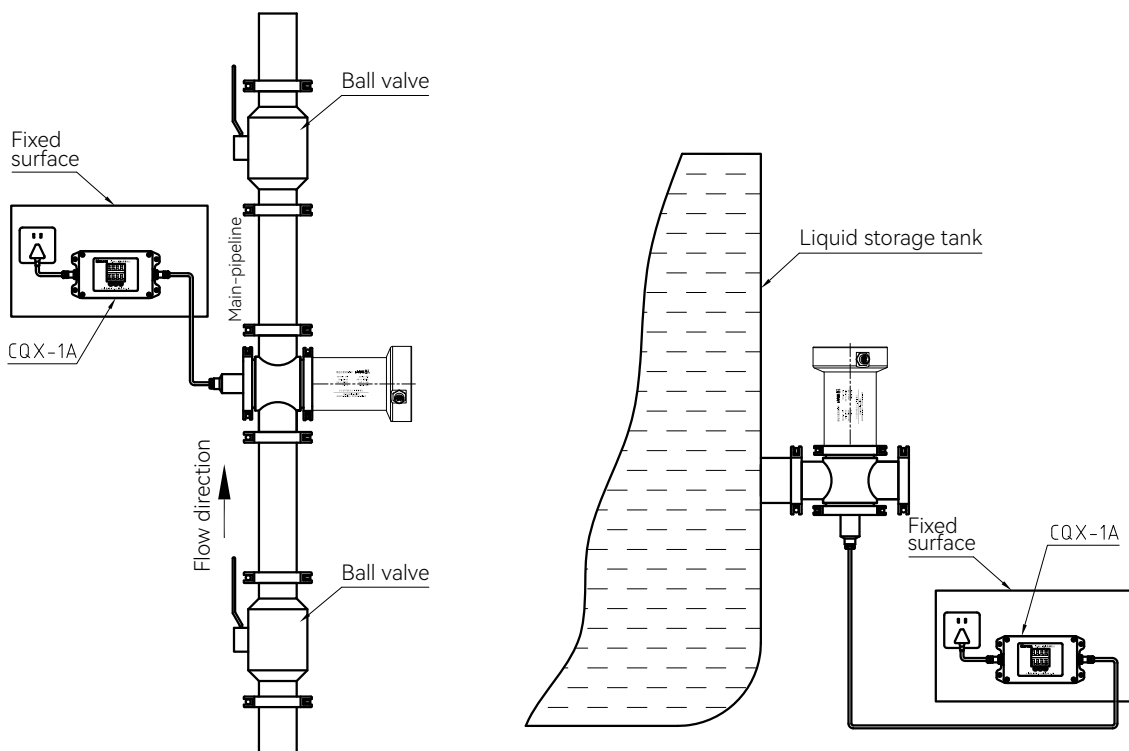
Installation type A

Type A: A bypass installation using a circulating pump is **optimal** as it provides a known, constant flow of media and a steady velocity through the inline refractometer prism. This installation also requires two bypass isolation valves and when using this installation method, it is recommended that a vibration damper be added to the pipe between the circulating pump and the inline refractometer to protect the inline refractometer from pump vibrations.

Installation type B

Type B: A bypass installation configuration without a circulating pump is **acceptable** because the process can support the pressure drop created by the throttling element or throttling valve to ensure that the liquid to be measured flows in the bypass line through the inline refractometer. This installation also requires two shutoff valves to isolate the inline refractometer from the pipeline to allow maintenance without interrupting production.





Installation type C

Type C: It is **not generally recommended** to install an inline refractometer directly on a main pipe. Even though it may be cheaper initially, it will be more difficult to repair later. If repairs are required or the prism needs to be cleaned, the process must be temporarily stopped while the repairs or cleaning are performed. This type of installation usually requires two valves to isolate the inline refractometer from the process line during repairs.

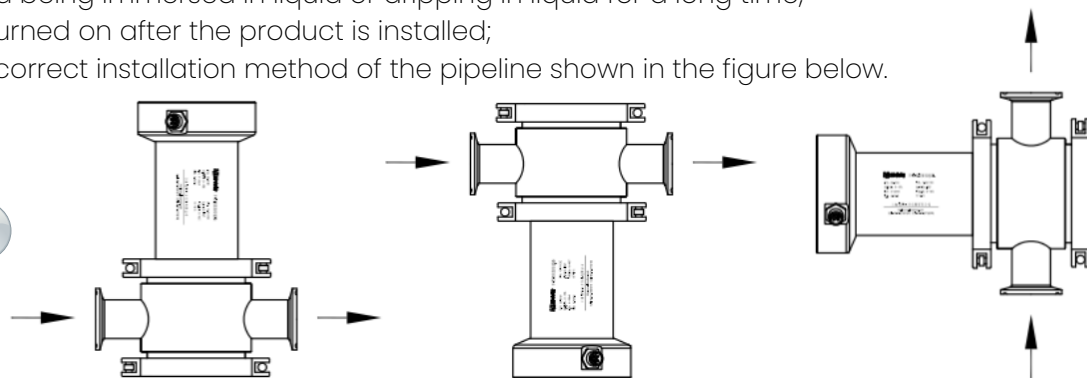
Installation type D

Type D: Tank wall mounting requires that the solution in the tank can flow continuously to avoid the accumulation of impurities and dirt on the prism surface. To mount the inline refractometer directly on the tank wall, use the support adapter flange cross fitting.

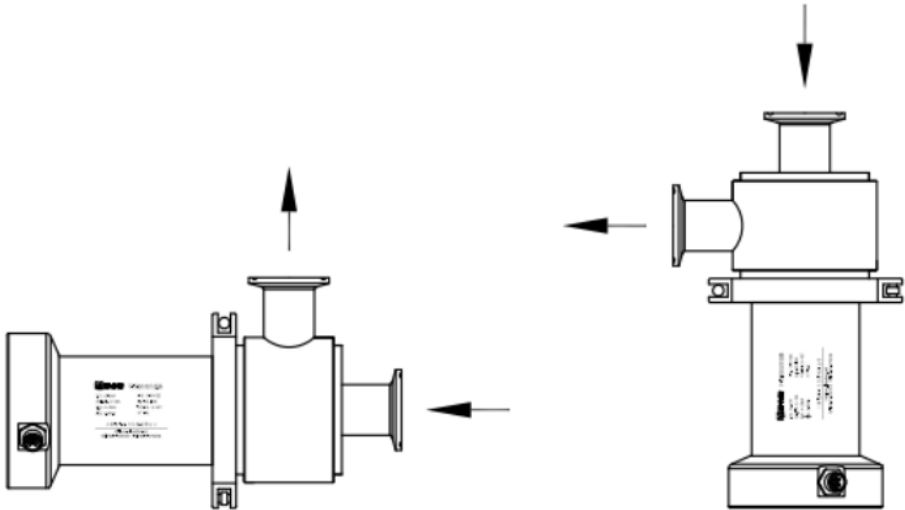
6.3. Installation Precautions

- 6.3.1. The default installation form of this product is the quick-chuck type;
- 6.3.2. During installation, please pay special attention not to scratch the prism and probe;
- 6.3.3. During installation, please pay special attention to avoid strong impact on the instrument;
- 6.3.4. During installation, please pay special attention not to miss the sealing ring or O-ring;
- 6.3.5. Ensure that the cable is correctly connected to the port;
- 6.3.6. The product should be installed away from the pump outlet to avoid abnormal measurement caused by turbulence at the outlet;
- 6.3.7. The product should be installed away from the right-angle turn of the pipeline, which will cause abnormal measurement;
- 6.3.8. The product should avoid being immersed in liquid or dripping in liquid for a long time;
- 6.3.9. The power can only be turned on after the product is installed;
- 6.3.10. Install according to the correct installation method of the pipeline shown in the figure below.

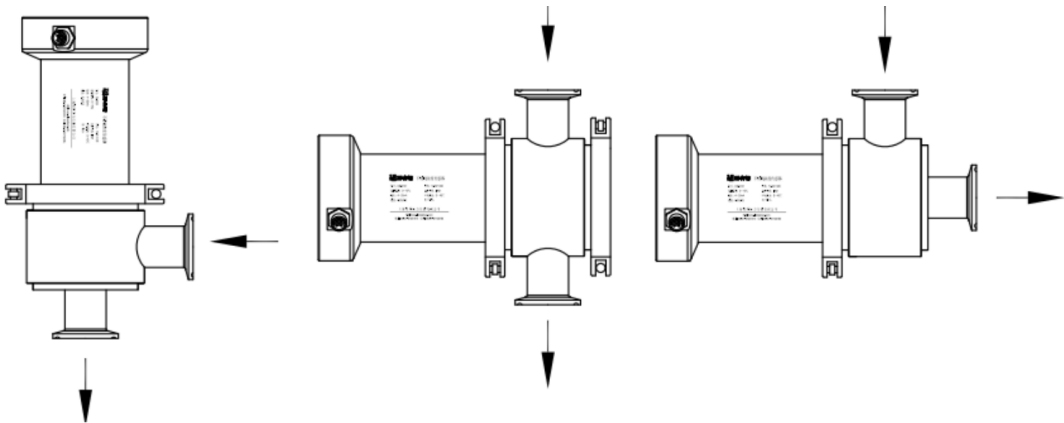
Correct installation method 



Correct installation method



Wrong installation method



7.Operation Instructions

The measurement starts when the instrument is powered on. Before starting the measurement, wipe the surface of the prism clean and calibrate 0 with pure water; when the sample flows into the surface of the prism,display the concentration (%) value and current temperature T.

7.1. Key Definition Menu (Menu) Return (Esc) Up (▲) Down (▼)

Menu is equivalent to the confirm key
ESC eject key
Up (▲) and down (▼) can be pressed or long pressed

7.2. Menu Structure

Menu Type Serial number	Menu	Content description
1	Acquisition cycle	4, 6, 8, 10 seconds; default 4 seconds
2	Calibrate the zero point	If the calibration is successful, it will return to the main page. If it fails, it will display EE0.
3	Full range scale	In the current range of 4~20mA, the concentration corresponding to the upper limit of 20mA is 15% by default
4	Decimal Places	0,1,2 default 2
5	Display temperature, refractive index or polling display	1=Temperature, 2=Polling display, 3=Refractive index
6	Mode-S measurement stability	1, 2, 3, 4, 5. 5 levels in total
7	Temperature calibration	Enter the corresponding temperature for calibration

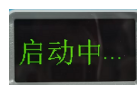
8	Zero point of range	In the current range of 4~20mA, the concentration corresponding to the lower limit of 4mA is 0% by default
9	Temperature upper limit	Increase or decrease by 1, the value range is -10~130
10	Temperature lower limit	Increase or decrease by 1, the value range is -10~130
11	Upper alarm limit	When the measured concentration exceeds the upper limit, the display flashes quickly, and the value range is 0~100. When the set value is greater than 95, it is equivalent to turning off the alarm output.
12	Lower alarm limit	When the measured concentration is lower than the lower limit, the display flashes slowly. When the set value is less than 0, it is equivalent to turning off the alarm output.
13	Device ID Address	Default is 1
14	Restore factory settings	If the recovery is successful, the main page will be returned; if it fails, EE1 will be displayed.
15	Display concentration magnification (this function only displays the concentration magnification, the current output is not magnified)	Default is 1.0
16	Language switch (can be switched to Chinese or English)	The default display is Chinese

Instructions for entering the menu: Press Menu on the measurement page to enter the password page, and ESC to return to the measurement page. The password to enter the menu is "1234". The "Up Key" is used to increase the number, and the "Down Key" is used to move the cursor right. After entering, press Menu to confirm and enter the menu page. Press the "Up Key" and "Down Key" to switch menus. There are a total of [16] function menus. Press Menu on the corresponding menu page to modify the parameters. At this time, the number below the menu is selected. Press the "Up Key" or "Down Key" to modify. After the modification is completed, you need to click the Menu key to confirm.

Example of zero calibration menu [2]: After the product is powered on and displays normally, press the [Menu] key to enter menu [01]. Press the plus key [▲] or minus key [▼] to select menu [02] (zeroing operation, there must be pure water on the mirror surface), and press the [Menu] key again to clear zero. Under normal circumstances, the product will automatically return to the display page, and the concentration display is 0%. The operations of other menus are basically the same. When some menus do not return to the main page, you can press [ESC] to return to the main page.

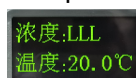
7.3. The startup display is

Starting...



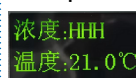
7.4. No solution displayed

Concentration: LLL
Temperature: (current temperature)



7.5. Solution concentration exceeds the measurement range display

Concentration: HHH
Temperature: (current temperature)



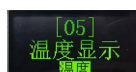
7.6. Normal measurement display

Concentration: (Concentration of the liquid being measured)
Temperature: (Current temperature)



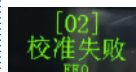
7.7. Refractive index and temperature polling display

You can use menu [05] to choose to display only temperature or refractive



7.8. Calibration failed and displays EE0

Zeroing with no concentration or concentration exceeding 1.5% will



8. Maintenance and Troubleshooting

8.1. Daily Maintenance

If the instrument becomes dirty, wipe it with a soft cloth and do not use gasoline/paint/thinner etc. to clean the instrument.

8.2. Regular/Scheduled Maintenance

- 8.2.1 The inline refractometer needs to be disassembled every month or so, the probe prism needs to be cleaned, wiped clean, and tested by adding pure water. If the displayed value is not equal to zero or the output is not 4mA, clear and calibrate by pressing the button.
- 8.2.2 Inline refractometers that measure high-temperature media or operate under vibration conditions should be calibrated once every six months.
- 8.2.3 After the inline refractometer has been in operation for 5 years, an insulation resistance test should be carried out, and the insulation resistance should be above 500MΩ.

8.3. General Troubleshooting

- 8.3.1 When the inline refractometer has no signal output, first check whether the cable is broken or short-circuited. If so, replace the cable;
- 8.3.2 If the inline refractometer displays a negative number, it is presumed that the zero point is incorrect. Perform zero calibration on page [02] according to 7.2.1;
- 8.3.3 If the inline refractometer displays a large value or no change, press the button to confirm whether the value on page [15] is 1 (the default is 1). If not, change the value to 1; if it is 1, check whether the measuring prism of the inline refractometer is covered with dirt or oil film, and ensure that the measuring prism can be in good contact with the measured solution. Clean the measuring prism, wipe it dry, add pure water and observe whether the display is zero. If not, perform zero calibration on page [02] according to 7.2.1;
- 8.3.4 If the output value of the inline refractometer is inconsistent with the output value of the PLC, connect the output line of the inline refractometer to measure the output current value for comparison. If the inline If the current value of the refractometer is correct, check whether the PLC has loss or conversion problems;
- 8.3.5 If the concentration value displayed by the inline refractometer remains HHHH without any change, (1) Power off and restart, wait for 1 minute, then power on and observe whether the display changes; (2) Remove the inline refractometer, clean the display prism and observe whether the display changes to LLLL; (3) Observe whether the displayed temperature is normal; (4) Record the phenomenon. If the display still shows HHHH after the above operations, the inline refractometer has a problem and needs to be returned to the factory for repair.

9. Product Accessories

9.1. Standard Accessories

Inline refractometer	1 unit
Instruction manual	1 copy
Certificate of conformity	1 piece
5-PIN plug cable	1 piece
O-ring	1 piece
3"Tri-clamp	1 piece

9.2. Optional Accessories

Cleaning device	1 set
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10. Relationship Between Concentration Value and Refractive Index

%	n_D^{20}	%	n_D^{20}	%	n_D^{20}	%	n_D^{20}	%	n_D^{20}
0	1.33299	20	1.36384	40	1.39986	60	1.44193	80	1.49071
1	1.33442	21	1.36551	41	1.40181	61	1.44420	81	1.49333
2	1.33586	22	1.36720	42	1.40378	62	1.44650	82	1.49597
3	1.33732	23	1.36889	43	1.40576	63	1.44881	83	1.49862
4	1.33879	24	1.37060	44	1.40776	64	1.45113	84	1.50129
5	1.34026	25	1.37233	45	1.40978	65	1.45348	85	1.50398
6	1.34175	26	1.37406	46	1.41181	66	1.45584	86	1.50670
7	1.34325	27	1.37582	47	1.41385	67	1.45822	87	1.50940
8	1.34477	28	1.37758	48	1.41592	68	1.46061	88	1.51220
9	1.34629	29	1.37936	49	1.41799	69	1.46303	89	1.51490
10	1.34782	30	1.38115	50	1.42009	70	1.46546	90	1.51770
11	1.34937	31	1.38296	51	1.42220	71	1.46790	91	1.52050
12	1.35093	32	1.38478	52	1.42432	72	1.47037	92	1.52340
13	1.35250	33	1.38661	53	1.42647	73	1.47285	93	1.52620
14	1.35408	34	1.38846	54	1.42863	74	1.47535	94	1.52910
15	1.35568	35	1.39032	55	1.43080	75	1.47787	95	1.53200
16	1.35729	36	1.39220	56	1.43299	76	1.48040		
17	1.35891	37	1.39409	57	1.43520	77	1.48295		
18	1.36054	38	1.39600	58	1.43743	78	1.48552		
19	1.36218	39	1.39792	59	1.43967	79	1.48811		

Focus on sensor & control Since 1999

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