

# ZTD | WITH DLT9010 LEVEL CONTROLLER

## DISPLACER LEVEL TRANSMITTER

ZTD Displacer Level Transmitter

with DLC9010 Level Controller

Operation Manual



## Preface

### **Thank you for choosing the products of Dandong Top Electronics Instrument (Group)Co.,Ltd.**

This operation manual provides you with important information on installation, connection and commissioning as well as on maintenance, troubleshooting and storage. Please read it carefully before installation and commissioning and keep it as part of the product near the meter for easy reading.

This manual can be downloaded by entering the version number at [www.ddtop.com](http://www.ddtop.com) .

If the instructions are not followed, the protection provided by the meter may be destroyed.

### **Trademark, Copyright and Restriction Instructions**

Dandong Top Electronics Instrument (Group) Co.,Ltd.®, Dandong Top Pump Co., Ltd.®, DDTOP® are registered trademarks of the company.

The performance specifications of the meter are effective as of the date of publication and are subject to change without notice. Dandong Top Electronics Instrument (Group)Co.,Ltd. reserves the right to modify the products described in this manual at any time without prior notice.

### **Quality Assurance**

Dandong Top Electronics Instrument (Group) Co.,Ltd. guarantees that all glass plate level gauge have no defects in materials and manufacturing processes within one year from the date of delivery.

During the warranty period, if the product returns with quality problems and the claim is determined by the manufacturer to be within the scope of warranty, Dandong Top Electronics Instrument (Group) Co.,Ltd. is responsible for repair or replacement of the buyer (or owner) free of charge.

Dandong Top Electronics Instrument (Group) Co.,Ltd. is not responsible for the costs caused by improper use of equipment, labor claims, direct or subsequent damage and installation and use of equipment. In addition to the special written warranty certificate for certain products of Dandong Top Electronics Instrument (Group) Co.,Ltd., Dandong Top Electronics Instrument (Group) Co.,Ltd. does not provide any express or implied warranty.

### **Quality**

Dandong Top Electronics Instrument (Group) Co.,Ltd. has passed the ISO9001 quality system certification. The whole process of product production is strictly in accordance with the scope of the quality system, providing the strongest guarantee for product and service quality.

**CONTENTS**

1 Safety Tips .....	4
1.1 Explosion may result in death or serious injury.....	4
1.2 Process leaks can cause serious injury or death.....	4
1.3 Failure to follow safe installation guidelines may result in death or serious injury.....	4
2 Product Manual .....	4
2.1 Main Structure of Product .....	4
2.2 Operating Principle .....	5
2.3 Packing .....	5
2.4 Hoisting and Transporting.....	5
2.5 Warehousing .....	5
3 Technical Characteristics.....	5
3.1 Main Performance .....	5
3.2 Main Parameters.....	5
4 Dimensional Schematic.....	6
Figure 2 Dimensional Schematic.....	7
5 Unpacking and Inspection .....	7
5.1 Unpacking Inspection Notice.....	7
5.2 Check Content .....	8
6 Installation .....	8
6.1 Installation Tool .....	8
6.2 Installation Requirements .....	8
6.3 Installation Operation Process.....	9
7 Debugging .....	12
7.1 Preparation for Commissioning.....	12
7.2 Electrical Wiring.....	12
7.3 Debugging Operation Process.....	13
8 Recautions .....	16
9. Failure Analysis and Elimination.....	17
10 Disassembly.....	19
10.1 Warning.....	19
10.2 Waste Removal .....	19
11 Product Certification.....	19

## 1 Safety Tips

It is expressly prohibited to modify or change products for safety reasons, repair or replacement only allows the use of accessories specified by the manufacturer.

### 1.1 Explosion may result in death or serious injury.

When installing equipment in an explosive atmosphere, be sure to follow applicable local, national, international standards, codes, and procedures. Be sure to install the equipment in Intrinsically safe or non-flammable site operating procedures.

### 1.2 Process leaks can cause serious injury or death.

Care should be taken to lift the transmitter. If the process seal is damaged, the medium may leak at the joint.

### 1.3 Failure to follow safe installation guidelines may result in death or serious injury.

The operations described in this manual are performed by professionally trained and qualified professionals or end-user specialized professionals to complete.

## 2 Product Manual

### 2.1 Main Structure of Product-Figure 1

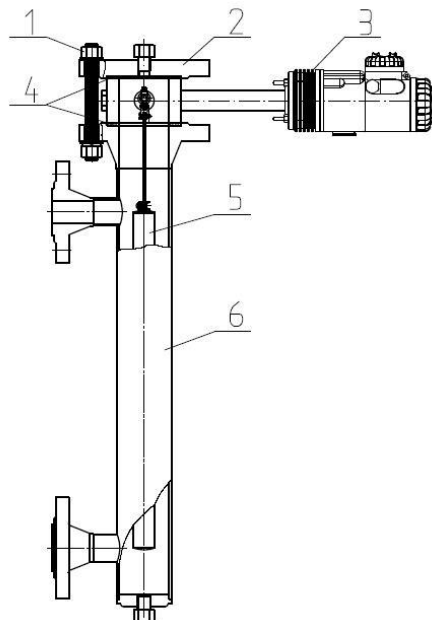


Figure 1 Product Structure

1. Fasteners, including bolt and nut washers
2. Flange cover, can be equipped with venting parts according to user requirements
3. Transmitter, 360° rotation, 8 viewing positions
4. Seal, two pieces
5. Displacer, buoyancy measuring element
6. Chamber

## 2.2 Operating Principle

The change of the level of the measured medium causes the buoyancy of the inner cylinder to change, and the change is transmitted to the torque tube assembly, so that the torque tube rotates at an angle with the mandrel. A sensing system coupled to the torsion spool produces a voltage signal. The level controller electronic component measures the level signal and provides a 4-20 mA current output. The microcontroller measures the ambient temperature to compensate for changes in liquid density due to process temperature changes. The LCD displays information such as analog output, process variables, process temperature (RTD required), torque tube rotation angle, and percentage of level positions.

## 2.3 Packing

Please send the packaging waste to a special recycling agency.

## 2.4 Hoisting and Transporting

Please select qualified hoisting equipment and lifting straps, and pay attention to safety.

## 2.5 Warehousing

Storage temperature -20°C~40°C; storage humidity ≤40%

# 3 Technical Characteristics

## 3.1 Main Performance

3.1.1 Has passed the national explosion-proof certification

Certification mark: Intrinsically safe type Ex iaIICT5 Ga

Explosion-proof type Ex dIICT5/T6 Gb

3.1.2 Product executive standards

GB/T13969 Float Type Level Meter

Q/AMM 013 Float Level Transmitter.

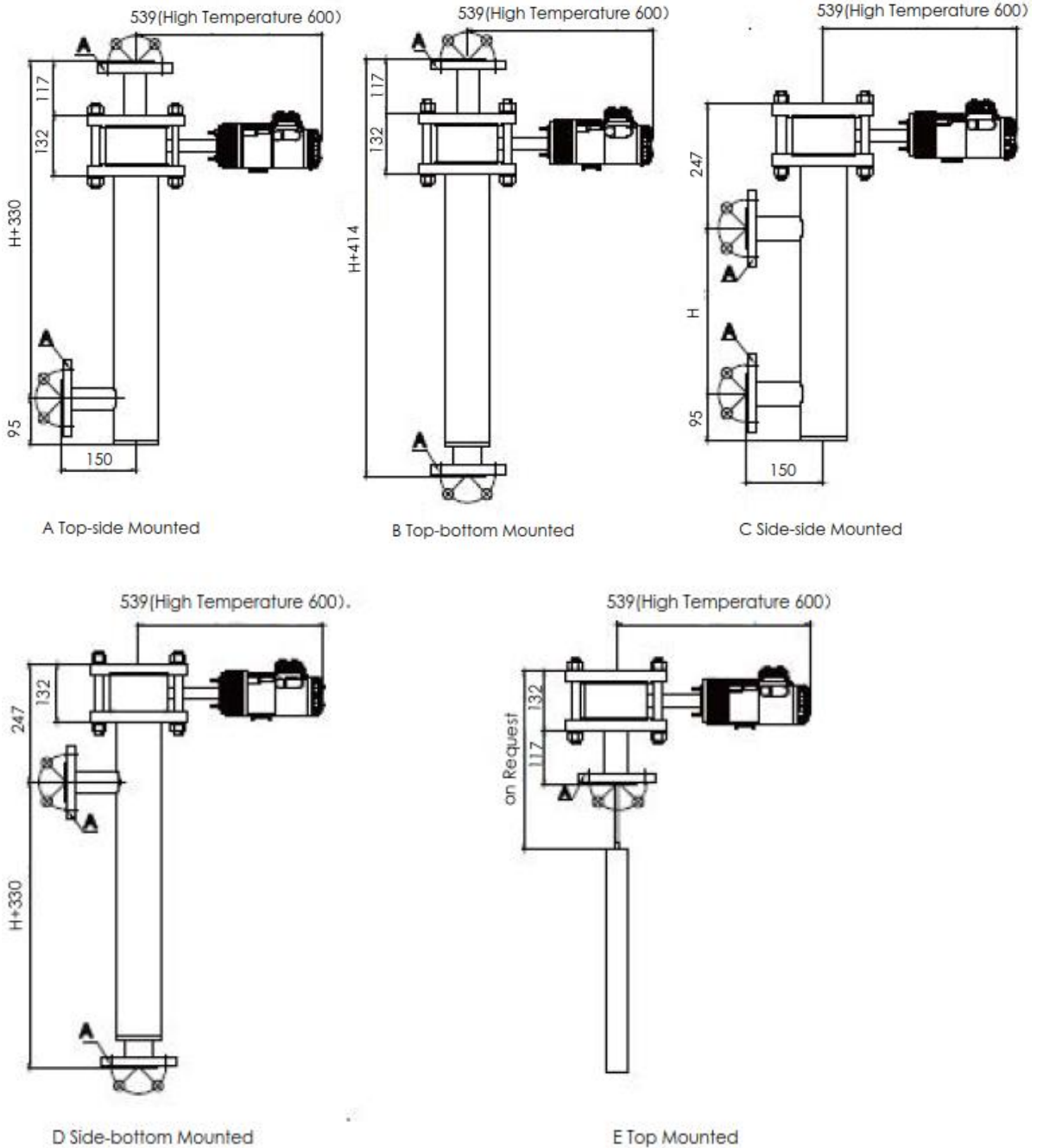
## 3.2 Main Parameters

3.2.1 Power supply: 12~30V DC; reverse polarity protection in the controller (controller voltage ≥17.75 V DC when HART protocol communication).

3.2.2 Output signal: 4 ~ 20mA DC.

4 Dimensional Schematic -Figure 2

If the order is required to be a special size, the actual size will prevail.



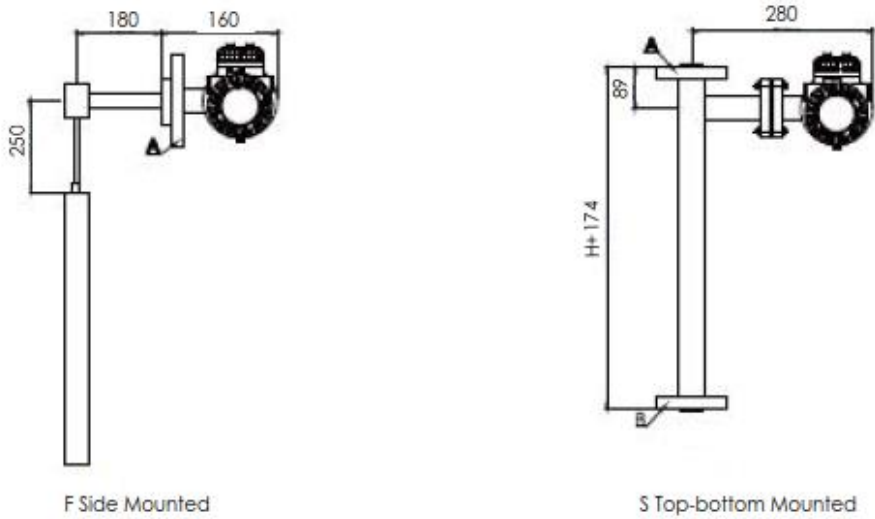


Figure 2 Dimensional Schematic

## 5 Unpacking and Inspection

### 5.1 Unpacking Inspection Notice

5.1.1 Check whether the product nameplate (Figure 3) is consistent with the supply list information.

**DDTOP**  
ELECTRONICS  
INSTRUMENT

○ Displacer Level Transmitter ○  
Model:

Nominal Pressure		Design Temperature	≤	°C
Range	mm	Float Diameter	Φ	mm
Float Weight	Kg	Output Signal	(4~20) mA+Hart	
Light Medium Density		g/m <sup>3</sup>	<input checked="" type="checkbox"/>	Ex ia II CT5 Ga
Heavy Medium Density		g/m <sup>3</sup>	<input checked="" type="checkbox"/>	Ex d II CT5 / T6 Gb
Accuracy		IP66	Tag No.	
Date / Number of Manufacture		/		

○ Dandong Top Electronics Instrument (Group) Co.,Ltd. ○

Figure 3 Product Nameplate

5.1.2 According to the packing list, check the quantity of each part and the material is correct.

## 5.2 Check Content

5.2.1 Check the appearance of the instrument for defects, damage and other abnormal conditions.

5.2.2 If the ZTD transmitter and other parts are packaged separately, before installing the inner cylinder, please remove the two damping rubber rings on the inner cylinder (Figure 4).

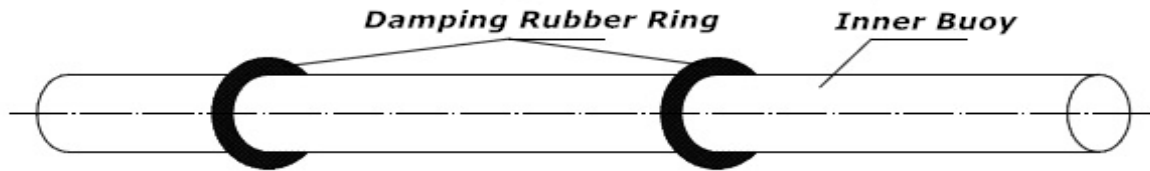


Figure 4 Damping Rubber Ring

## 6 Installation

### 6.1 Installation Tool

6.1.1 Wrenches, flange gaskets and flange bolts for process connections.

6.1.2 Level

### 6.2 Installation Requirements

6.2.1 When installing the measuring chamber, the axis of the outer cylinder side flange must be perpendicular to the horizontal plane (Figure 5). If the ZTD transmitter and the remaining parts are packaged separately, install the parts according to the position shown in Figure 1. If it has been installed as a whole, follow 6.3.5.

6.2.2 Transmitter and inner cylinder installation: Use the connector pull ring on the inner cylinder (Figure 6), insert the connector into the top of the transmitter lever, and then turn the pull ring to the locked position. Locked on the lever (Figure 7)





Figure 5 Unlock



Figure 6 Latch

### 6.3 Installation Operation Process - Figure 7



Figure 7 Installation

6.3.1 Remove the bolt and nut connecting the flange cover and the outer cylinder, take out the sealing gasket, and place one gasket on the upper flange sealing surface of the outer cylinder (Figure 7-1);



Figure 7-1

6.3.2 Connect the inner cylinder and the transmitter according to 6.2.2 and put it into the outer cylinder. Ensure that the ring flange of the transmitter is in good contact with the gasket (Figure 7-2);



Figure 7-2

6.3.3 Place the other gasket on the flange cover sealing surface and install the flange cover on the transmitter ring flange. Ensure that the transmitter ring flange is in good contact with the gasket. Align the flange bolt holes (Figure 7-2).

6.3.4 Install the bolts and nuts that connect the flange cover to the outer cylinder and alternately tighten the nuts (Figure 7-3).

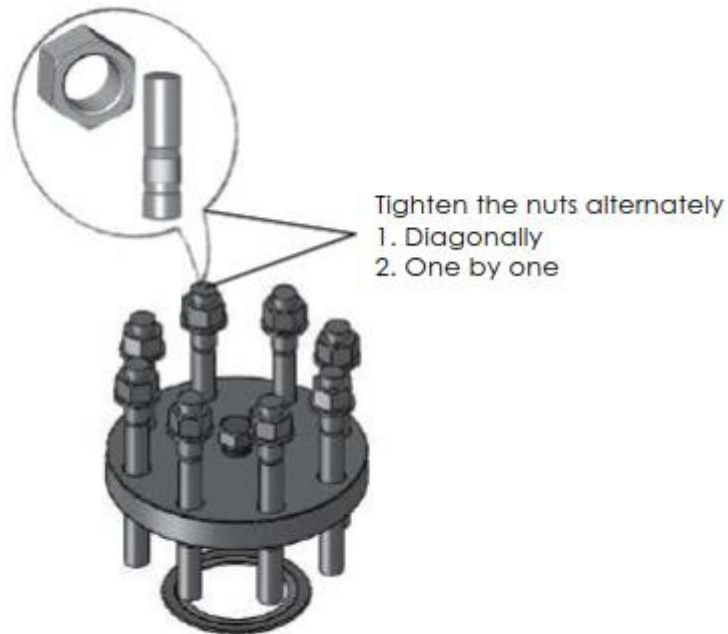


Figure 7-3

6.3.5 Install the outer cylinder side flange on the device, and ensure that the flange and the gasket are in good contact (Figure 7-4).

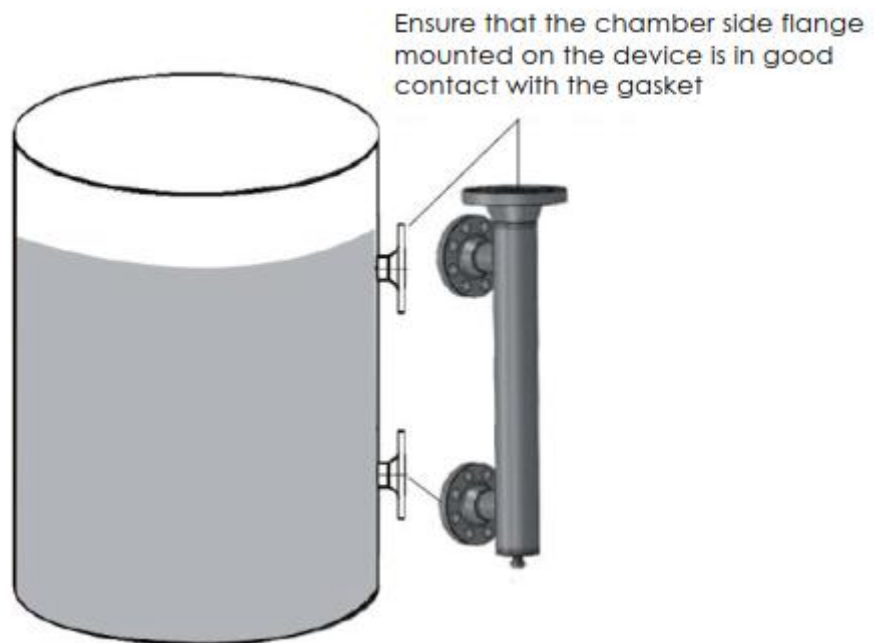


Figure 7-4

## 7 Debugging

### 7.1 Preparation for Commissioning

#### 7.1.1 Debugging tools

- 1) Power supply
- 2) 250Ω-1100Ω resistors for HART communication protocol
- 3) Handheld device supporting HART protocol (Rosemount 475)

#### 7.1.2

Before adjusting the DLC9010 level controller, press and hold the arrow position slider and slide it in the direction of the arrow to the other end, and the slider enters the positioning slot to lock (Figure 8).

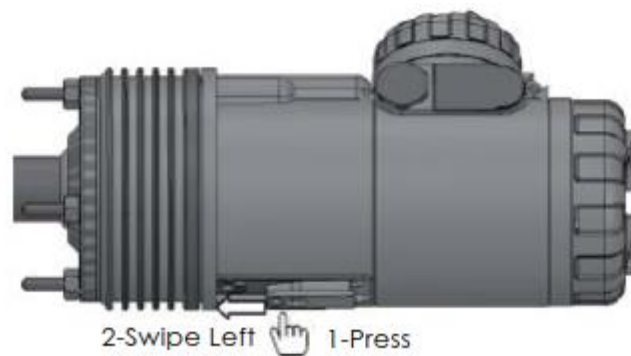


Figure 8

### 7.2 Electrical Wiring

7.2.1 Unscrew the power terminal box cover (Figure 9) and connect the current signal lines (Figure 10). Where T is the test terminal; + is connected to the positive pole of the power supply, - is connected to the negative pole of the power supply; R1, R2 is connected to the PT100 (temperature sensor, if any); the internal grounding wire is connected to the outer casing of the armored cable (if any).



Figure 9

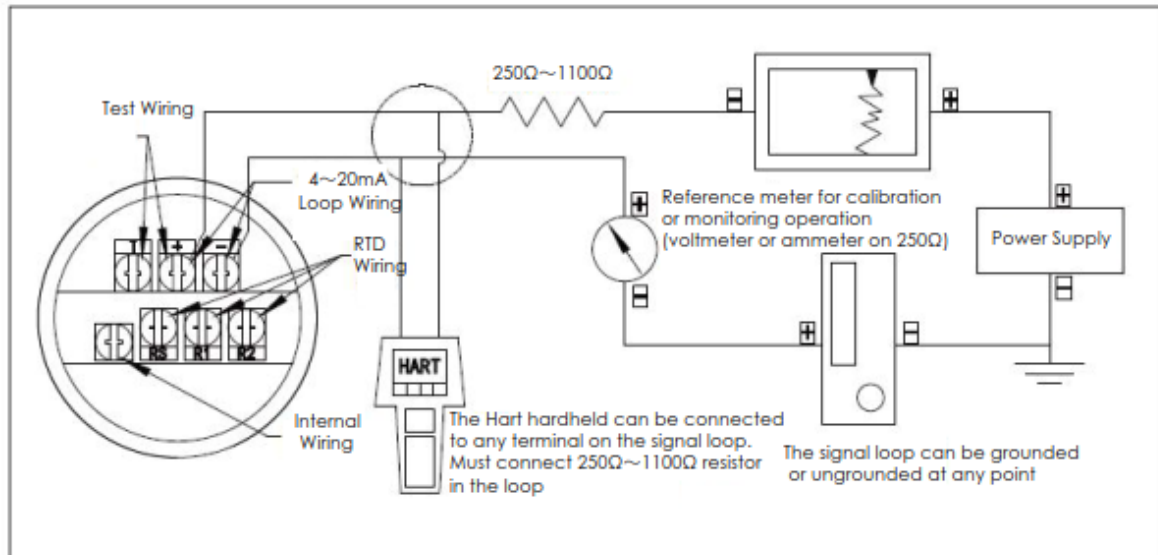


Figure 10

7.2.2 After the wiring is completed, check the polarity of the wiring correctly. The instrument case must be well grounded, and then the 24VDC standard power supply is turned on.

7.2.3 When communicating with HART protocol, the power supply voltage of the intelligent liquid level controller must be  $\geq 17.75\text{VDC}$ . If it is lower than this voltage, the configuration information will be considered incorrect.

7.2.4 A resistance of  $250\ \Omega \sim 1100\ \Omega$  must be connected in the loop to communicate with the HART communicator.

7.2.5 It is recommended to use the handheld device supporting the HART475 communication protocol for debugging.

### 7.3 Debugging Operation Process

#### 7.3.1 Precautions before Commissioning

- 1) The instrument should not be subjected to strong vibration and shock, especially for the lever with the inner cylinder, and should not be pulled hard to avoid damage to the torque tube.
- 2) The instrument shall not participate in impactful process tests such as air sweeps performed before the device is put into production.

7.3.2 During commissioning, if water is used as the medium (non-measured medium), the following two conditions will occur:  $\rho_{\text{medium}} < \rho_{\text{water}}$  and  $\rho_{\text{medium}} > \rho_{\text{water}}$ . But regardless of the density of the medium, you can pass the formula:

$$h_{\text{Water injection height}} = \rho_{\text{medium}} \cdot H_{\text{full scale height}} / \rho_{\text{water}}$$
 Calculate the corresponding water injection height and the corresponding output current value.

※The meter has been calibrated before leaving the factory.

### 7.3.3 Adjusting the on-site LCD Display Value

Key functions: ↑ key is used to increase the value and add menu items; ↓ key is used to decrease the value and decrease menu items. The ← key is used to shift and confirm the value. The operation interface is shown in Figure 11.

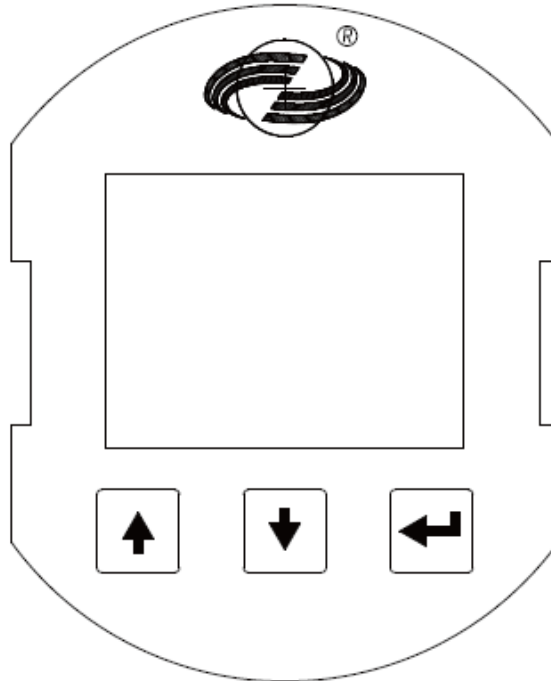


Figure 11

Operational steps.

- 1) Press the "←" key for 5 seconds; enter the operation code: 00005 to start the parameter setting, and then "←" to confirm.
- 2) Press the "↑" key to enter the following operation interface.

#### LCD Display Codes and Meanings

"888" character display	Title	Remarks
No display	Normal measurement status	
01	Opcode	Opcode 00005
02	PV units	
03	Measurement type	"LEVER" ; "INTEA"; "DENSI"
04	Length of displacer	

05	Quality of diaplacer	
06	Volume of diaplacer	
07	Length of torque tube arm	Unit cm
08	Upper limit of measurement	Unit as PV
09	Lower limit of measurement	Unit as PV
10	Damping	0~32S
11	Specific gravity of light medium	
12	Specific gravity of heavy medium	
13	Upper limit for alarms	Unit as PV
14	Lower limit for alarms	Unit as PV
15	Set the coupling point	Measurement room evacuation
16	Lower measurement limit calibration	
17	Upper measurement limit calibration	
18	Fine-tuning of a target	Enter the actual value of the current point
19	Save/Exit	To save or not to save the current configuration data

### 3) Fine-tuning of a target steps.

3-1) Press and hold the "←" for 5 seconds: enter the operation code: 00005, "←" to confirm and enter the menu setting.

3-2) Press the "↑" to select to 18 items, and press the "←" to enter 18 items for fixed-point fine-tuning.

3-3) Press the "←" to select the corresponding value position, press the "↑" to adjust to the corresponding value, enter the liquid level value, and press the "←" to confirm.

3-4) Press "↑" to select to 19 items, press "←" to display "S-CKE" to save and exit.

3-5) Repeat 3-1) operation, enter menu setting; press "↑" to select to 16 items, press "←": enter lower limit calibration of 16 measurement items, enter lower limit measurement point level value; press "←" to go back to menu.

3-6) Press the "↑" to select to 17 items, press the "←": enter the upper limit calibration for 17 measurements and enter the upper limit measurement point level value; press the "←" to go back to the menu.

3-7) Press the "↑" to select up to 19 items, press the "←" to display "S-CKE" to save and exit.

**Note: The density value is entered into the 12 heavy media specific gravity when the level is measured; the 11 light media specific gravity is not involved in the calculation and does not need to be entered.**

4) Calibration procedures for the water calibration method.

4-1) Calculation method: liquid level: no liquid level is the zero point;  $\text{range} * \text{density} = \text{full range}$  corresponding to the irrigation position.

Interface:  $\text{range} * \text{light media density} = \text{watering position corresponding to zero point}$ .

$\text{Range} * \text{heavy media density} = \text{irrigation position corresponding to full range}$ .

4-2) Procedure:  $\text{range} = 80 \text{ cm}$ ; density 0.954 as an example.

When the float chamber level is 0, enter 16 items, enter 0, and perform zero level calibration at this time.

When the water level in the float chamber reaches 763mm, the instrument shows 80cm, enter item 17, input 80cm, then carry out full calibration, when the operation is completed, enter item 19, select save and exit to complete the calibration.

After completing the above operation, the level transmitter can be used.

**\* Pay special attention to the unity of the measurement unit when setting.**

## 8 Recautions

8.1 The density of use should be the same as the design density. If the density changes, the parameters need to be changed again to calibrate the instrument

8.2 During the disassembly and assembly process, the torsion tube should be protected as much as possible to prevent damage to the force;

8.3 Make sure the power supply is safe and reliable, and the power supply should be connected according to the correct positive and negative poles;

8.4 Do not operate the instrument with an unsupported handheld device;

8.5 When the vibration is large, it is not suitable to use the displacer level transmitter;

8.6 Medium with viscosity  $\geq 500 \text{ mPa/s}$  is not suitable for measurement with a displacer level



transmitter;

8.7 The operating temperature range of electronic components is  $-40\text{ }^{\circ}\text{C} \sim +80\text{ }^{\circ}\text{C}$ , the temperature range displayed on the LCD screen is  $-30\text{ }^{\circ}\text{C} \sim +80\text{ }^{\circ}\text{C}$  (out of range LCD display, remote transmission is normal);

8.8 After the commissioning, tighten the display and power cover to prevent the instrument from getting wet.

## 9. Failure Analysis and Elimination

Phenomenon	Reason	Solution
After power-on, the LCD has no display, no signal output	<ol style="list-style-type: none"> <li>1. The power supply polarity is reversed or the power supply is faulty;</li> <li>2. There is an open circuit in the line.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check if the power supply voltage is normal, and check if the power supply circuit has an open circuit;</li> <li>2. If there is a safety barrier in the circuit, check if the safety barrier is working properly;</li> <li>3. Connect the positive and negative power supplies correctly.</li> </ol>
The actual level of the device changes, and the meter indication and output do not change with the level, or the variation range is inconsistent.	<ol style="list-style-type: none"> <li>1. The inner cylinder anti-vibration rubber ring is not removed, and friction occurs with the outer cylinder wall;</li> <li>2. The inner cylinder or lever is caught by the foreign object;</li> <li>3. The outer cylinder is installed without vertical friction with the inner cylinder;</li> <li>4. The inner tube connector is reversed, and the inner tube is rubbed against the outer tube wall;</li> <li>5. The locking device of the transmitter is not pushed to the unlocked position.</li> </ol>	<ol style="list-style-type: none"> <li>1. In the process of transportation, in order to prevent collision damage of the inner and outer cylinders, the inner cylinder will be installed with anti-vibration rubber ring when the factory is shipped, and the rubber ring should be taken out during the installation process;</li> <li>2. Check if there is any foreign matter in the inner cylinder and the lever, and remove the foreign matter;</li> <li>3. Correct the outer cylinder to be perpendicular to the ground;</li> <li>4. Re-install the inner cylinder correctly;</li> <li>5. Push the locking device to the unlocked position. (in the direction of the arrow)</li> </ol>
The meter displays the output maximum or over range, and there is no change in the commissioning, and there is no change in the field indication.	<ol style="list-style-type: none"> <li>1. The inner cylinder is detached;</li> <li>2. The instrument junction box is faulty;</li> <li>3. The locking device of the transmitter is not pushed to the unlocked position.</li> </ol>	<ol style="list-style-type: none"> <li>1. Connect the inner tube</li> <li>2. Replace the junction box</li> <li>3. Push the locking device to the unlock position</li> </ol>

<p>After the meter is calibrated, it is put into use and there is a deviation from the actual level value. The indication is not allowed.</p>	<ol style="list-style-type: none"> <li>1. The process parameters are not accurate (the actual density is inconsistent with the design density);</li> <li>2. On-site heating causes the density of the medium to change;</li> <li>3. Local indication level indicator is not accurate.</li> </ol>	<ol style="list-style-type: none"> <li>1. Re-determine the process parameters, recalibrate the meter at the new density, or modify the meter display and output using the fixed-point migration function.</li> <li>2. Adjust the temperature of the heating to prevent the density of the measured medium from changing;</li> <li>3. Check the local level gauge to determine its accurate reflection of the actual level.</li> </ol>
<p>Tuning instrument is not linear, and has a large difference.</p>	<ol style="list-style-type: none"> <li>1. The inner tube is stuck by debris, and the range cannot be opened.</li> <li>2. The inner cylinder anti-vibration rubber ring is not removed.</li> <li>3. The power supply voltage is abnormal.</li> <li>4. Parameter calculation error during verification</li> <li>5. The locking device of the transmitter is not pushed to the unlock position.</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove debris</li> <li>2. Take out the rubber ring</li> <li>3. Adjust the power supply voltage</li> <li>4. Recalculate the correct parameters.</li> <li>5. Push the locking device to the unlock position</li> </ol>
<p>The header shows garbled characters and the output signal does not change.</p>	<ol style="list-style-type: none"> <li>1. The circuit board is faulty;</li> <li>2. The power supply voltage is abnormal.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace the meter head;</li> <li>2. Detect the power supply replacement barrier.</li> </ol>
<p>When the meter is adjusted, the output current of the meter is high or low.</p>	<ol style="list-style-type: none"> <li>1. Power failure;</li> <li>2. The meter insulation is not good.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the power supply and replace the safety barrier;</li> <li>2. Detect the insulation of the meter terminals. If there is any problem with the insulation, replace the meter head.</li> </ol>
<p>The LCD display percentage and level value do not match the actual output current value.</p>	<ol style="list-style-type: none"> <li>1. URV and LRV input errors;</li> <li>2. The instrument is not calibrated with a regular handheld device, resulting in a digital signal that does not match the analog signal.</li> </ol>	<ol style="list-style-type: none"> <li>1. Re-enter the URV and LRV values (URV=range; LRV=zero).</li> <li>2. Calibrate the current using the handheld Modulo Calibration function.</li> </ol>
<p>The meter displays 0%; the level changes and the meter output do not change.</p>	<ol style="list-style-type: none"> <li>1. The meter parameter density value becomes "0";</li> <li>2. Instrument parameter torque tube stiffness is "0";</li> <li>3. The locking device of the transmitter is not pushed to the unlock position;</li> <li>4. The inner cylinder is detached or the anti-vibration rubber ring is not taken out.</li> </ol>	<ol style="list-style-type: none"> <li>1. Re-enter the correct density value;</li> <li>2. Re-enter the torque tube stiffness value 8-30, and re-calibrate the instrument at two points;</li> <li>3. Push the locking device to the unlocked position;</li> <li>4. Reinstall the inner cylinder or remove the anti-vibration rubber ring.</li> </ol>
<p>The meter output continues to decrease and cannot be properly calibrated.</p>	<ol style="list-style-type: none"> <li>1. Torque tube failure;</li> <li>2. The inner cylinder is smashed, leaked, and fed into the medium.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace the torque tube;</li> <li>2. Replace the inner buoy</li> </ol>

<p>The handheld device is not communicating.</p>	<ol style="list-style-type: none"> <li>1. Check the model and version of the Communicator.</li> <li>2. Check if there is a problem with the power supply.</li> </ol>	<ol style="list-style-type: none"> <li>1. Use a handheld device that supports the HART protocol (Rosemount 275, 375, 475);</li> <li>2. Replace the power supply;</li> <li>3. Change the safety barrier, or string 250 ohm resistor.</li> </ol>
--	--	--

## 10 Disassembly

### 10.1 Warning

Attention should be paid to hazardous process conditions, such as pressure inside the vessel, high temperatures, corrosive or toxic media, etc.

Refer to the instructions in section 6.3 Installation Operation and Section 7.2 Electrical Wiring to remove the parts in the reverse order of operation.

### 10.2 Waste Removal

Waste disposal should be carried out in accordance with the current guidelines in each region.

## 11 Product Certification

Product Certification			
Certification	Certificate No.	Scope of certification/description	
EU CE Pressure Vessel Directive PED Certification	DRG-0036-QS-1217-19	Directive 2014/68/EU Annex III, Module H1	
ATEX Certification	10855485	II 2 G Ex db II C T5 / T6 Gb T5: -40°CsTas+80°C T6: -40°CsTas+60°C II 2G Ex ia II C T5 Gb (-40°CsTas+80°C)	
IECEx Certification	IECEx TUR 13.0001X	Ex db II C T5/T6 Gb T5: -40°CsTas+80°C T6: -40°CsTas+60°C Ex ia II C T5 Gb (-40°CsTas+80°C)	
CSA Certification	C170815	Original Certification, Transmitter, Types DU9D10, rated 12-30Vdc, 22.5mA Max, Type 4X, IP66, XP, Class I, Division 1, Groups B, C and D T5: -40°CsTas+80°C T6: -40°CsTas+60°C; IS: Class I,	
SIL Certification	70194741	IEC 61508 (edition 2)-Parts 1,2,3,4	
CRN Certification	OF 18558.2	936 A/B/C/D/E SERIES	
CE Certification	AE 504635040001		
Explosion-proof Certifications	Intrinsically Safe / Explosion Isolation CE16.5039X	Ex ia II C T5 Ga Ex d II C T5/T6 Gb	
Formal Approval Certification for Measuring Instruments	10F212-21		