

Portable Level Gauge

Manual Book (Ver:1.01)

SHAANXI SHENGKE ELECTRONIC

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1. Instrument Warranty and Service Scope

From the date of shipment, the instrument mainframe is guaranteed for one year, and the instrument repair and maintenance are guaranteed for half a year. This guarantee is limited to the instrument users of the original factory purchaser or designated distributor and is not applicable to any instrument users who use the instrument incorrectly for human reasons, modify, neglect or cause damage by accident or abnormal use.

Free maintenance is provided for faulty instruments returned within the scope of warranty. To obtain the warranty service, please contact the after-sales service department and attach the fault description. With the permission of the company, the instrument will be sent to the after-sales service department.

If the instrument has passed the warranty period or is confirmed that the failure of the instrument is caused by misuse, modification, negligence, accident and abnormal use, the maintenance cost budget will be provided according to the relevant maintenance fee standards and will be maintained after approval. After the instrument is repaired, it will be sent back to the customer, who will pay for the maintenance and transportation. (Attached: Warranty Policy)

2. Opening Inspection and Cautions

2.1 Open Box Audit

- Manual Book
- Qualification Certificate
- Portable Level Gauge
- Packing list
- Check random items according packing list

2. 2 Attentions

- Please read the instruction before installing the instrument.
- Modifications due to product upgrades are subject to change without prior notice. Please refer to the actual product.

3. Storage and Transportation

- $-40\sim+60$ °C Storage Temperature: $-40\sim+60$ Temperature

4. Product Introduction

4. 1 Product Overview

The portable level gauge (hereinafter referred to as level gauge) is a kind of instrument developed by our company, which uses sonar ranging principle to measure liquid level inside of the container from the outside (bottom) of the container. This product realizes complete isolation measurement.

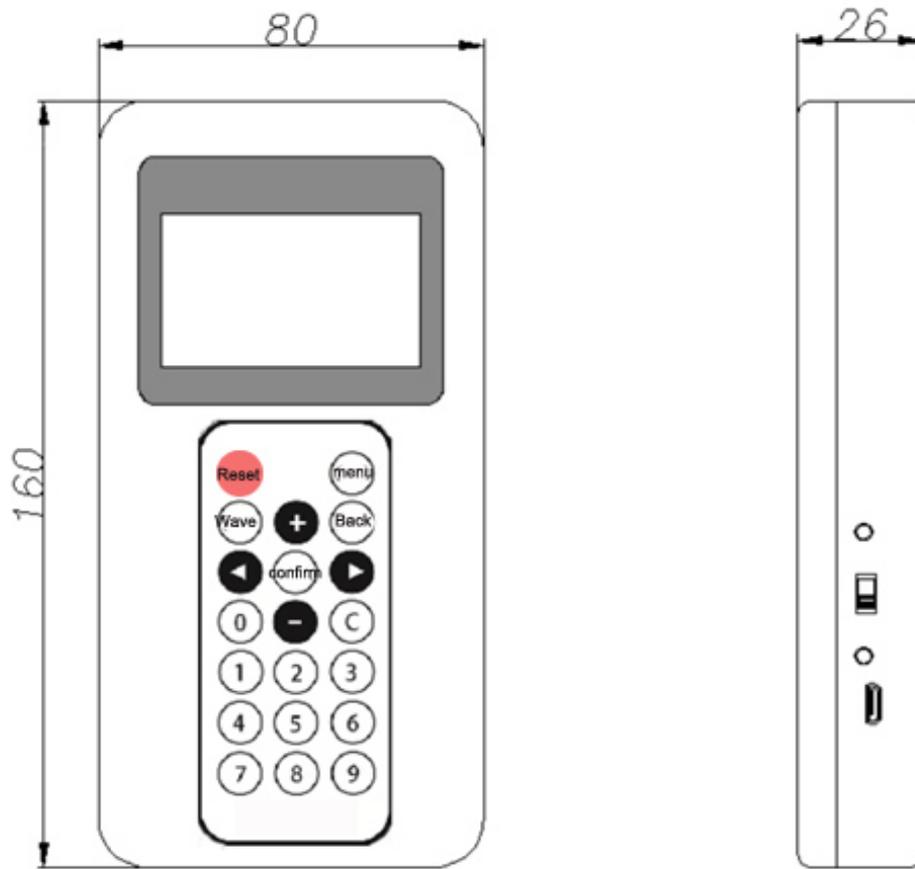
The liquid level gauge breaks the traditional installation method of open tank contact, and realizes the real non-contact measurement of liquid level height in sealed container. Sonar sensor (probe) is installed directly below the outer wall of the vessel under test (bottom). It does not need to open a hole in the vessel under test. It is easy to install and can be installed without stopping production. It can accurately measure the liquid levels of various toxic substances, strong acids, alkalis and various pure liquids in high temperature and high pressure sealed containers.

4. 2 Technical Parameters

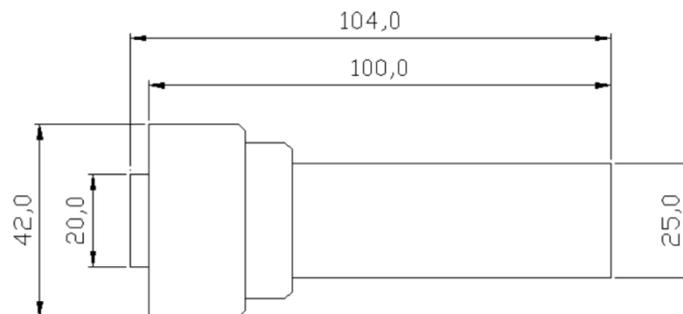
Portable Level Gauge	
Max measure range	6m
Display Resolution	1mm
Error	$\leq 10\text{mm}$
Display	128×64LCD
Dead Zone	Ideal working condition, Dead zone is 3cm, the specific value depends on the complexity of the working condition
Temperature measurement range	$-45^{\circ}\text{C} \sim +80^{\circ}\text{C}$
Accuracy of temperature measurement	1°C
Power	$< 0.5\text{W}$
Power Supply	3.7 V lithium battery
Charging Time	< 3 hours
Continuous Working Hours	> 12 Hours
Mainframe Environment Temperature	$-20^{\circ}\text{C} \sim +70^{\circ}\text{C}$
Environmental Humidity	(0%~95%) RH
Weight	370g
Dimension	Lenth 160mm×Width80mm×Height26mm

5. Level Gauge Dimension

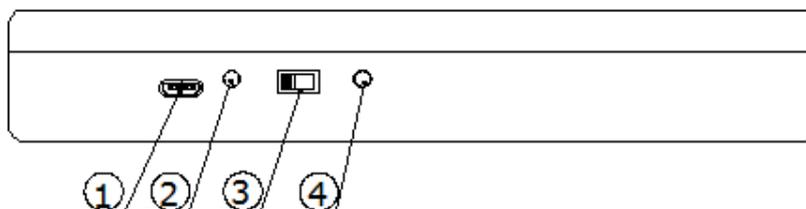
5.1 Level Gauge Mainframe Dimension



5.2 Sensor Probe Dimension



5.3 Electrical Connection

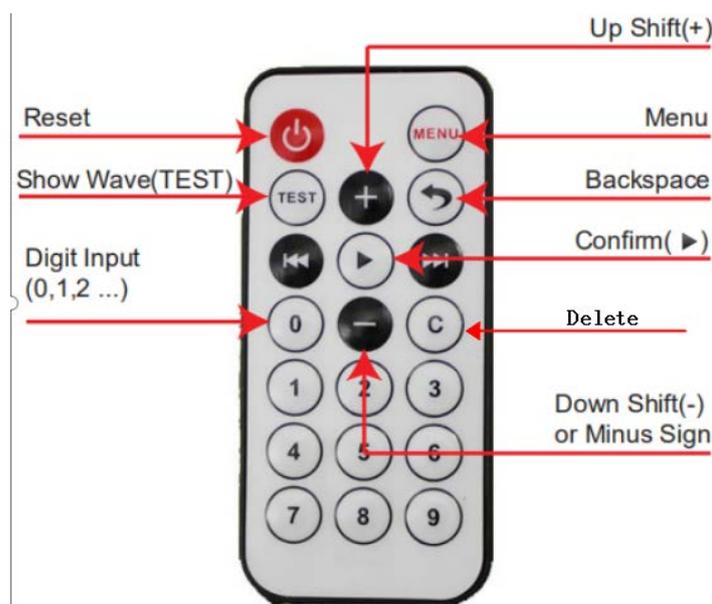


- 1、Micro USB, Only for charging, compatible with the common mobile phone adapter on the market.
- 2、Charging indicator, red light means charging is in progress, green light means charging is completed.
- 3、Power switch.
- 4、The working indicator light is on when working.

6. Instrument Debugging Parameter Description

6.1 Human machine interface for parameter setting

The instrument uses buttons to set parameters, and the functions of the keys are shown in the following figure::



- 1、Reset/restart: ; reset or restart the instrument;
- 2、Menu: Open the menu, check and change the working parameters.
- 3、Test: Display real-time echo wave and parameters of the instrument and assist in debugging and diagnosis.
- 4、Backspace: Under the menu or waveform interface, return to the main working interface.
- 5、All of the other button are used to edit the con-figs

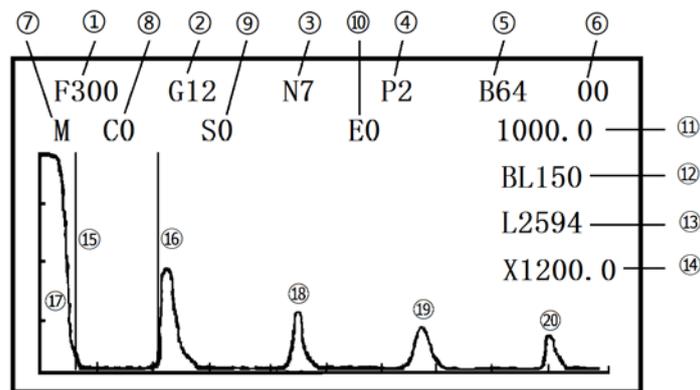
6.2 LCD Main Screen Description



①	Work Indicator	Blinking tips at work
②	Level Display	(m) Level Value (%) Percentage
③	Working Mode	SM: Single probe measure DC: diameter calibration TC: temperature calibration DT: double ways calibration

④	FaultCode	00: No fault 01: Current Output Fault 02: Receiving waveform abnormality 08: Level entering dead zone 10: No echo signals 20: Abnormal transmitting waveform 80: Excessive noise interference
⑤	Temperature	When the temperature calibration function is turned on, the measured temperature value is displayed. When the temperature probe fails, Err°C is displayed.
⑥	Working Probe	RUN: measuring probe is working CAL: calibration probe is working

6.3 Level Gauge LCD Waveform Interface Description



①	F(100~2000) work frequency
②	G(0~96)work gain
③	N(1~10)Number of emission pulses
④	P(1/2) power grade

⑤	B(1~1000)Envelope width
⑥	(00~FF) fault co
⑦	(M/C)measure probe/calibration probe waveform switching display
⑧	C(0/1)Manual Calibrate the Sound Speed
⑨	Sxxxxx (unit: mm) Initial position of waveform display
⑩	Exxxxx (unit: mm) Termination position of waveform display
⑪	(unit: m/s) sound speed value
⑫	BLxxx (Unit: mm) Blindarea value
⑬	Lxxxx (unit: mm) level value
⑭	(unit: mm/格) Waveform area X-axis scale value
⑮	blind area zone position
⑯	echo position (Primary echo)
⑰	Transmitting wave
⑱	Second echo
⑲	Third echo
⑳	Fourth echo

6. 4 Menu of Level Gauge Parameters

6. 4. 1 Menu description of user parameters

user paramet ers	basic setting	max measure range
		sound speed
		transfer volume
	measure mode	single probe
		temperature calibration
	temperature calibration set	medium
		Temperature migration

		Filtering time	
	Debug mode	Automatic measurement mode	
		Manual measurement mode	
	Working Parameters	Measurement Parameters	Frequency、 Gain Type Gain、 Power Pulse Number 、 Envelope Width

6. 4. 2 Scope and Definition of User Parameter Settings

- Basic Setting

Max Measure Range(50~50000)mm: Depending on the working condition, it indicates the highest liquid level that can be measured by the level gauge, and also determines the magnitude of 4-20 mA current output.

Sound Speed (400~1800) m/s: Depending on the medium to be measured, it represents the sound velocity value used by the level gauge in the mode of single probe operation.

Transfer Volume (-9999~9999) mm: According to the specific working conditions, it indicates the displacement of the installation position of the liquid level gauge measuring probe relative to the zero liquid position in the field.

- Measure Mode

Single Probe Mode: The level gauge operates with a fixed sound speed.

Temperature Calibration Mode: The liquid level meter works at sound speed after temperature compensation.

- Temperature Calibration Setting

Medium: Select the type of medium to be measured; when temperature calibration is enabled, the sound velocity is calibrated according to the type of medium.

Temperature Migration (-100~100)°C: When the temperature measured by liquid level gauge deviates from the actual temperature, the temperature error is corrected by "temperature offset".

Filtering Time (1-600) min: Adjust the parameters that show how fast the temperature changes.

- Debug Mode

Automatic Measurement Mode: The instrument automatically searches the echo signal of the probe, calculates and stores the "best working parameters" and then works with this parameter.

Manual Measurement Mode: Manually adjust the working parameters of the probe to get the best echo signal.

- Working Parameters

Measurement Parameters: Indicate the working parameters of the probe.

Frequency (100~2000) kHz: Represents the transmission frequency of sonar waves.

Gain Type (Automatic gain, fixed gain): Automatic gain means that the host automatically adjusts the internal parameters according to the strength of the echo signal, so that the echo signal level is within the expected value. Fixed gain is only used for internal testing.

Gain (0~96): Represents the strength of the echo signal. The larger the gain, the smaller the echo signal.

Power (low grade P1, high grade P2): It is used to set transmitting power, select "low-grade" for EASY-TO-TEST conditions and "high-grade" for complex and difficult-to-test conditions.

Envelope Width (1~1000): The default value of 64 is usually used for the size of the window enveloped by the waveform. The smaller the envelope width is, the more accurate the waveform is and the smoother the waveform is.

Calibration Parameter: Represents the working parameters of the calibration probe. Calibration parameter items and measurement parameters are the same, and Parameter definitions are the same, but the probes used are different

7. Instrument Installation and Debugging

7.1 Preparations Before Installation

- Before debugging, it is necessary to ensure that the liquid level in the tank is higher than 1 m and the liquid level meets the calibration conditions of diameter.
- Understand the internal structure and pipeline arrangement of the tank, and obtain the information of tank diameter, measurement range, wall thickness, etc.

7.2 Probe Installation Position Selection

According to the equipment diagram of storage tank, the optimum installation point of probe is selected.

- Basic Principles of Probe Installation

The probe pointing is completely perpendicular to the liquid level, and the calibration probe pointing is parallel to the liquid level.

The probe is installed as far away as possible from the inlet and outlet and the weld.

The probe points to the front without any obstruction such as pipeline.

- Selection of Probe Installation Location for Different Tank Types

Horizontal Tanks: The measuring probe must be installed at the bottom of the tank (the inclination of the probe will lead to the increase of blind area and instability of measurement); the calibration probe should be installed at the horizontal diameter position of 1/2 tank height.

Vertical Tanks: The measuring probe is mounted on the bottom plate and is as far away from the tank wall as possible, at least 10 cm away from the edge of the tank wall. The calibration probe can be installed in the horizontal diameter position of the tank body above 1 m in height.

Sphere Tanks: The probe can be installed on the bottom manhole flange. If there is more precipitation in the tank, it can be installed next to the manhole flange. The probe should be as close to the manhole as possible. The calibration probe is installed at the equatorial

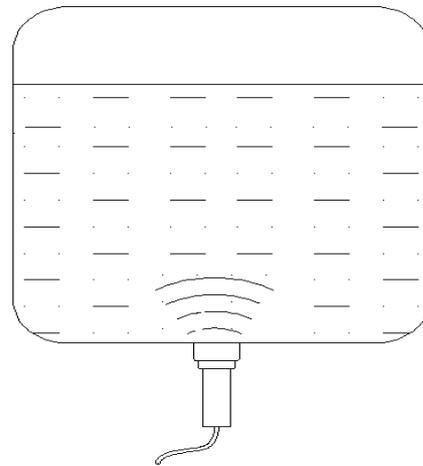
position of the spherical tank.

7.3 Debugging Steps

7.3.1 Installation and debugging of measuring probe

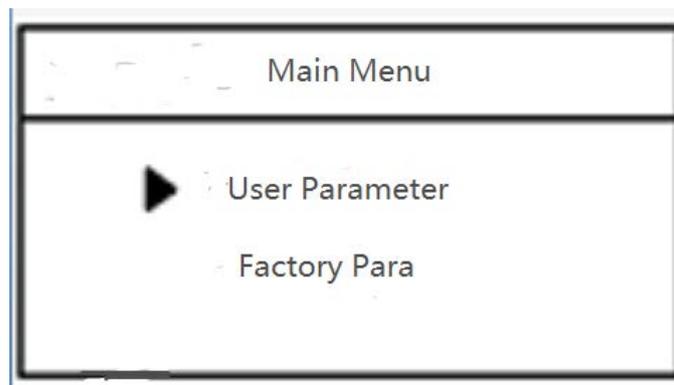
- Installation of Measuring Probe

Adsorb the probe in the selected measuring area (clean up if there is serious rust

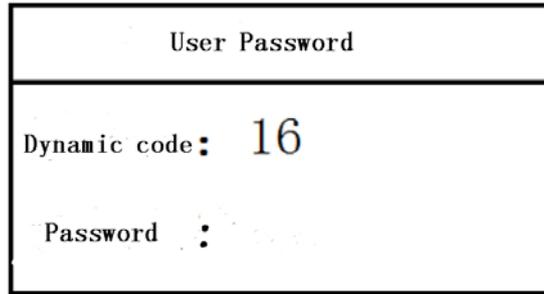


or dirt in the measuring area).

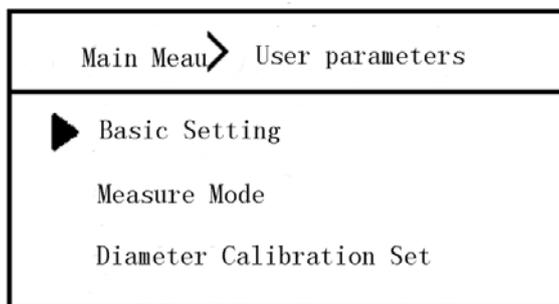
- Instrument Parameter Setting
- In front of the main display window, press the "menu" key of the instrument plate, and the instrument displays the "main menu", as shown in the following figure:



Press the "confirmation" key to enter the "user parameters", then the "dynamic code: XX" will be displayed, prompting you to enter the password.

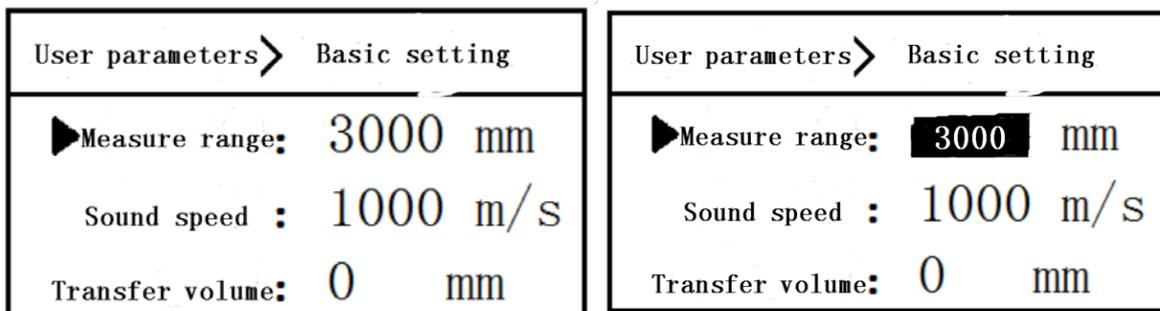


The password value is "XX" multiplied by 2 and subtracted by 1. For example, dynamic code: 16, then the password value is equal to $16 * 2 - 1$; input 31, press the "confirmation" key to enter the "user parameters".

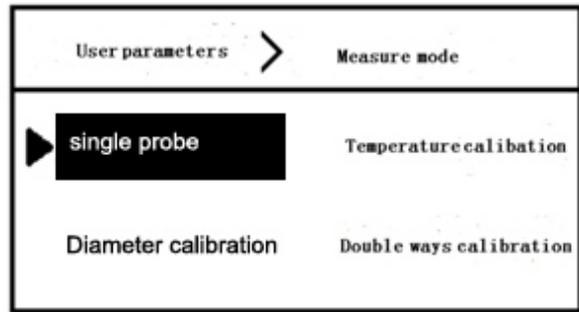
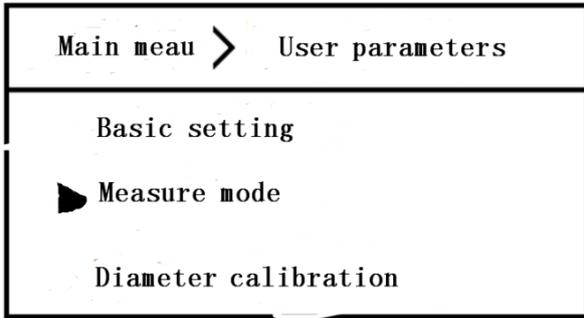


After entering "User Parameters", press "Confirm" to enter "Basic Settings".

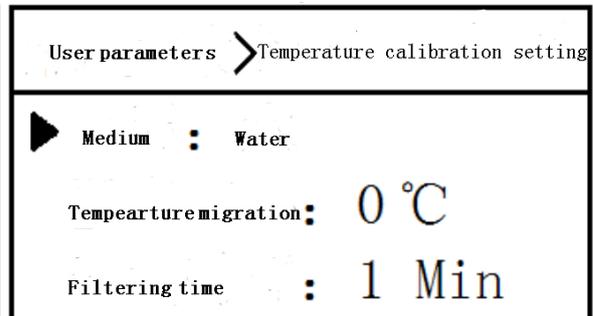
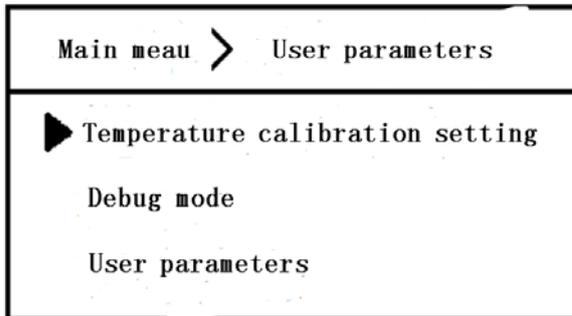
Firstly, according to the working conditions, set the "range", press the "confirmation" key, after the range value is reversed, use the digital key to input the range value, and then press the "confirmation" key to confirm. Press the "-" button to select the "sound velocity" downward, press the "confirmation" button to reflect the sound velocity value, input the sound velocity value of the medium (if the sound velocity of the medium is uncertain, it can be set to 1000), and press the "confirmation" button to confirm. The same step can modify the "migration" and then press the "return" key to return to the "user parameters" interface.



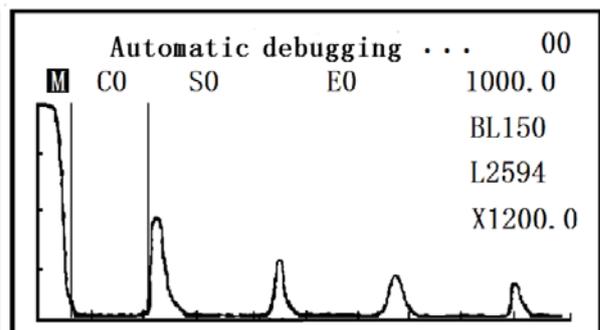
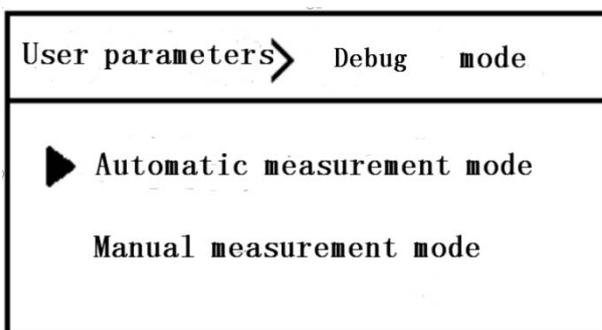
Press "-" to select the "measurement mode", "confirmation" to enter, select the measurement mode according to the product type, and "confirmation" to return by "return" key.



If the "temperature calibration" mode is selected, the "temperature calibration setting" is also required. Select the "medium" to be measured, and then press the "return" key to return.

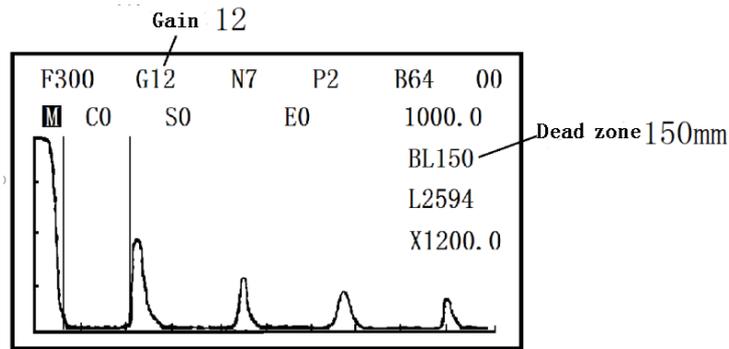


- Automatic Debugging
- Press the "-" key to select the "debugging mode", and then press the "confirmation" key to enter the "automatic measurement mode". At this time, it will display "in automatic debugging..." and observe the echo waveform until the debugging is completed.



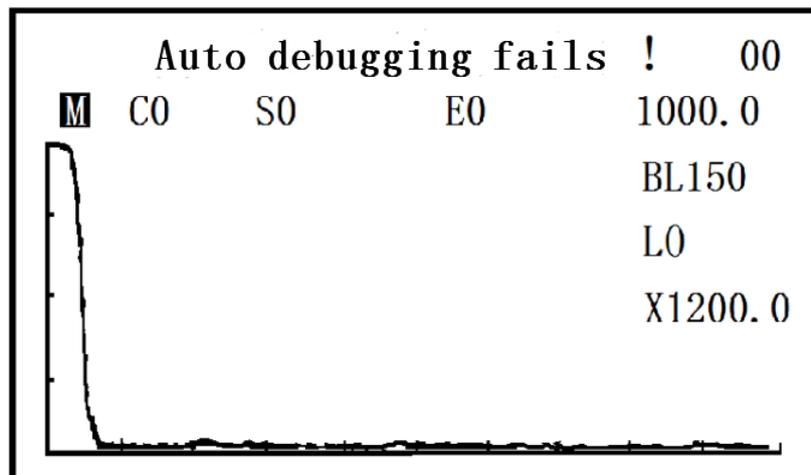
- Echo Signal Judgment

After automatic debugging, the waveform area will display a good echo waveform; the upper screen will display the working parameters after debugging, the larger the gain "Gxx" number, the worse the echo signal; the bigger the right blind area value "BLxxx" number, the bigger the dead zone.



If the gain G and BL are very large, the probe position can be fine-tuned (or the installation position of the probe can be changed) so that the gain and BL value can be minimized as much as possible. Then the gain and BL value can be re-adjusted into the "automatic measurement mode" until the signal meets the requirements.

If the auto debugging fails after debugging is completed, it will be shown that the auto debugging fails! _____ It means that the probe is not installed (or the probe wire is not connected), and the probe is reinstalled, and then it enters the "automatic measurement mode" again until the debugging is successful.



- Quality Requirements for Echo Waveform

Gain "Gxx" and blind area "BLxxx" are as small as possible.

Waveform noise is small and there is no clutter interference.

The amplitude of first echo is higher than that of other echoes.

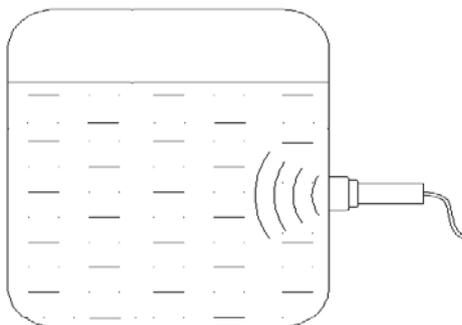
The waveform is smooth and without bifurcation.

The echo position is stable and reliable, and the fault code is 00 (no fault).

7.3.2 Calibration of medium sound speed

- The sound speed value of medium is determined by the known liquid level.

The probe is adsorbed on the side wall of the tank, and the sound speed of the medium is determined by measuring the distance in the horizontal direction of the tank by using the function of "known liquid level calibration".

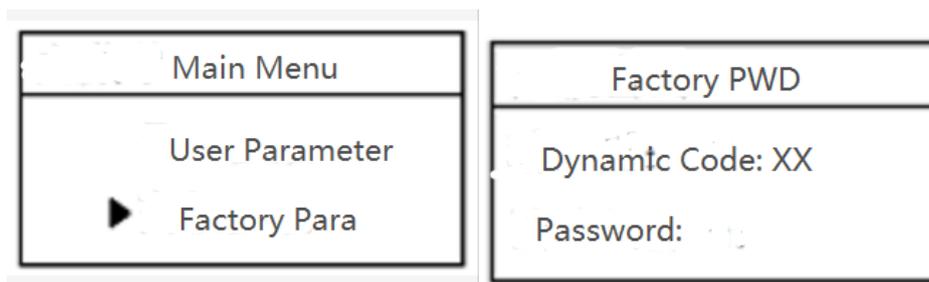


If the liquid level in the tank can be determined by other measurement methods, the probe can also be adsorbed on the bottom of the tank, and the sound speed of the medium can be determined by using the function of "known liquid level calibration".



When calibrating the sound speed, the parameter setting steps are as follows:

Enter "Main Menu" then "Advanced parameters" , input the passwords.



The password value is "XX" multiplied by 2 and subtracted by 1.

Enter "Factory Para", press "-" key choose "Known level cal", press "confirm" key.



Input the actual measured liquid level as "known level", press "confirm" key.

The gauge can automatically calibrate the sound speed of the medium. After the calibration is successful, press the "return" key to return, and the gauge will work according to the calibrated sound speed.

7.4 Measurement application

After parameter setting, the instrument will save working parameters automatically.

For the same type of tank with the same medium, the sensor probe can be directly adsorbed on the bottom of the tank to measure the liquid level in the tank.

If the measured medium is replaced, it needs to be debugged and calibrated again.

8. Maintenance and Repair

- Attention should be paid to keeping the level gauge clean. Waterproof, moisture-proof, anti-corrosion and avoiding severe collisions and strikes by other objects should be achieved as far as possible.
- Level gauge and probe should be tested regularly. (The detection period is determined by the user according to the specific situation)

9. Fault Treatment

Fault	Reason	Solution
Without Display	Power supply error	Charge the gauge through the adapter.
Level Values Display Instability	Excessive fluctuation of liquid level	Change the installation position of probe or reduce the fluctuation of liquid level.
	Weak echo	Reinstall the sensor probe
Large Measurement Error	Wrong sound speed	Calibrate or modify the sound speed value
No Echo Signal	Liquid level entering dead zone	When the liquid level is higher than the blind area, it will return to normal automatically.
	Sensor Probe Installation error	Reinstall the sensor probe
	Probe or mainframe fault	Contact customer service, repair or replacement.
Display Doubled Liquid Level	Inclination of probe installation	Re-install the measuring probe to ensure that the probe points to the vertical liquid level

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