

Ultrasonic Level Transmitter

User Manual



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1. Overview

The instrument is an upgraded visual transparent window, which can be switched and displayed in Chinese or English.

The special ultrasonic processing technology independently developed by our company is the core of the system, which realizes the function of ultra-high speed digital signal processing. It contains a number of patented technologies, with simple operation and convenient installation and maintenance; It has the characteristics of stability, high precision, long service life, etc. it is suitable for monitoring in water treatment, chemical industry and other fields.

The instrument can be connected to the display table, PLC, wireless Internet of things or various DCS systems through 4 ~ 20mA, switch control and RS485 (MODBUS Protocol) to provide real-time monitoring data for industrial automatic operation.

The instrument adopts advanced foreign chips, electronic devices and hardware; Combined with echo analysis and processing technology of high intelligent software to ensure the accuracy and authenticity of detection. In today's era, it can completely replace similar imported instruments, which is convenient for users to use and maintain. The instrument can measure the height of material level and air distance.

Product features

- *Waterproof, good application outdoor and under the well.
- *The patented technology of acoustic intelligent processing can resist all kinds of interference waves.
- *Non contact instrument, no wear, no pollution, low failure.
- *Lightning protection and instantaneous short circuit protection.
- *Long data storage time.
- *Temperature compensation, automatic gain, energy concentration, conducive to complex environment

2. Product installation and principle

Principle: the ultrasonic pulse beam sent by the sensor through the transmitting surface is reflected by the detection surface and received by the sensor. The required time t is combined with the sound velocity s (temperature change, etc.) characteristics. Measurement and calculation can be realized through this principle. The ultrasonic propagation speed is affected by the gas temperature. In the operation of the instrument, the ambient temperature is measured and the sound speed is compensated to ensure the measurement accuracy. The ultrasonic pulse emitted by the level meter and other residual vibration of the sound wave and the echo pulse received have a certain time width, and the detection reflection cannot be distinguished during the period Echo; therefore, a short distance from the probe surface downward cannot be detected normally, which is called the blind area. If the measured highest level enters the blind area, the instrument will not detect correctly, and errors and errors will occur. If necessary, the level meter can be raised when install to avoid the blind area.

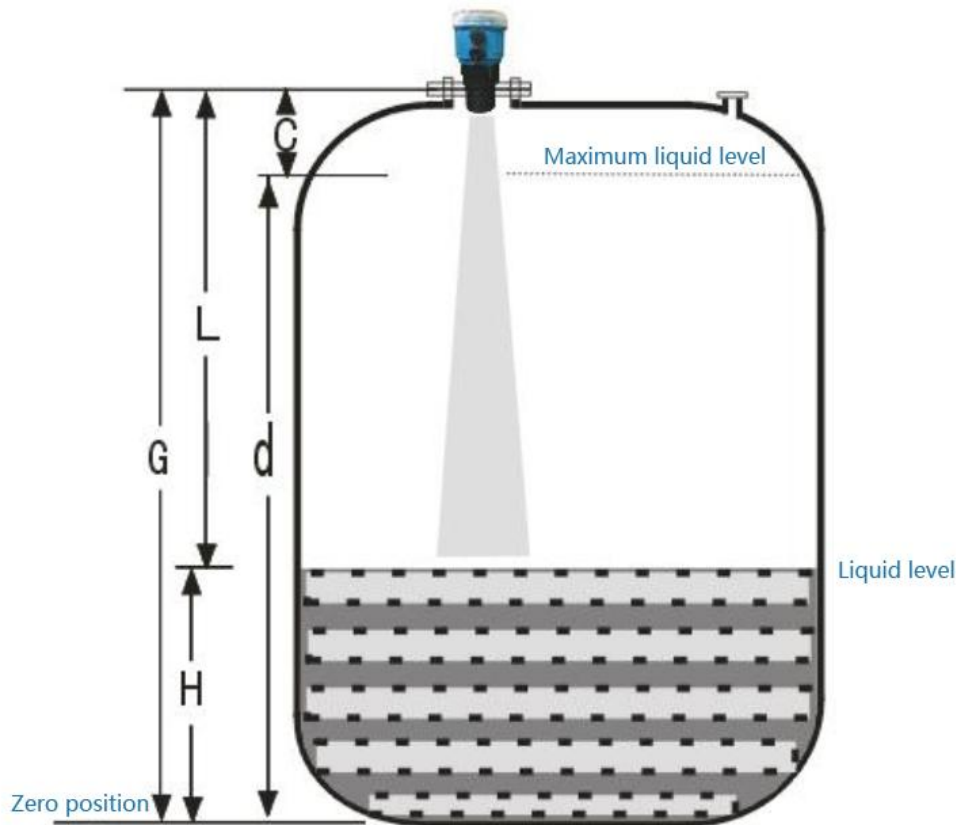


Figure 1

Install height G : (probe to the height of the tank bottom)

Liquid level H :(level or material level height)

Air distance L: (probe to test surface area)

Dead zone C: (the emitting surface area below a short)

Instrument range d: (generally from zero to the highest plane, only linearly corresponding to output P)

Formula:

1、 Ranging: $L = S \cdot T / 2$; $S = 331.45 + 0.61 \cdot n^{\circ}\text{C}$

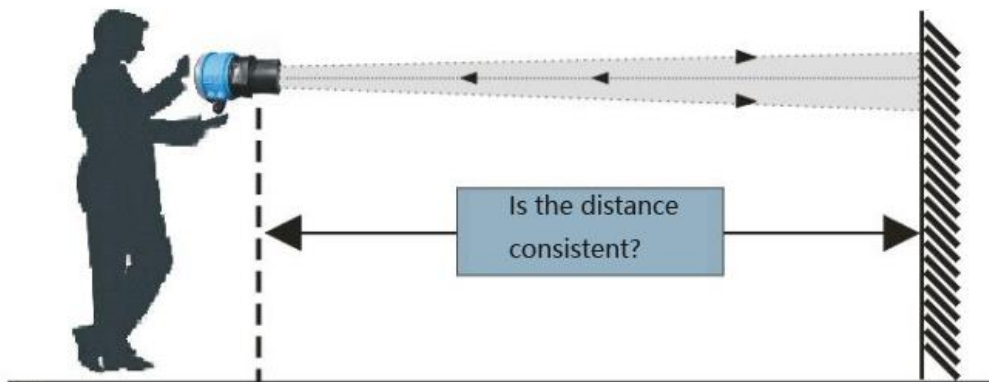
2、 Level: $H = G - L$



3、 Output: $P = H/d \cdot 16 + 4$ or $P = L/d \cdot 16 + 4$ (Note: P output current in mA)

As long as the user sets the installation height G, it can meet the normal use requirements.

3. Instrument inspection

Check whether the air distance is right or not before setting or using the instrument. It is the only reference value for checking whether the instrument is good or bad and whether the operating condition environment is suitable for the instrument, independent of parameter setting.





Specific operation: after power on, vertically face the transmitter of the instrument to the measured surface, and press the shift  key Or set the number  key to switch to the air distance self inspection display interface to check whether the air distance display value of the instrument is about equal to the actual distance value; move the instrument or the measured surface to check whether the change displayed by the instrument is equal to the moving distance value; if it is correct, it indicates that the instrument and working conditions are good, and you can go to the next step for debugging and use; otherwise, you need to find out the reason. (since ultrasonic propagation has a certain emission angle and blind area, it shall be tested or used in the open or low material level area outside the blind area as far as possible.)

4. How to use

Key Description





Parameter display

After power on and startup, the instrument is in the working mode by default, and short press  key or  key in the working mode to cycle through the working parameter pages of the instrument. The parameters on the working page only prompt the current working state of the instrument, and the displayed parameter values can generally directly reflect the performance and requirements of the instrument.






Parameter setting

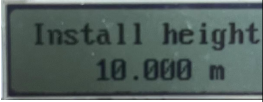

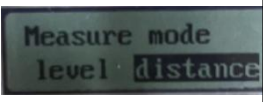
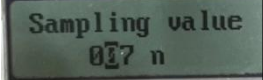
Generally, instrument users only need to set one parameter of reference face value (install height) to meet your work needs.

In the working mode, **long press** the  key for about 3S to enter the user setting mode. **Short press**  key to display the parameter setting menu in sequence; Press

and hold the SET key for about 3S again to save the modification, exit the setting mode and return to the main page of work (depending on the current measurement mode and display mode).

Parameter description







In the working mode, **long press** the  key for about 3S to enter the user setting mode. The shaded part is modifiable, press  key to modify this bit value, press  key to move to the next parameter; **Short press**  key to save the modify and enter next parameter; **Long press**  key for 3 seconds to save the modify and back to the home page.

Char	English	Explanation
G 07.000m		(Reference parameters, as shown in Figure 1: After setting the benchmark installation height G intact, instruments Equation 2 calculates the liquid level)
d 06.000m		(Proportional to analog output: When the H/L is equal with range d, that the full-scale analog output 20mA; the other three output according to the formula 3)
M H L		(Display and analog output level corresponding)
E 007		(Odd bit values: the larger the sample value, the stronger immunity. The general value of 7 or 9)
H. 06.500m	/	(Upper limit switch point value)
h. 01.500m	/	(Point down control segment value)
L. 01.000m	/	(Lower switch point value)

1 . 00 500m	/	(Point up control segment value)
b 09600	/	(RS485 communication)
n 001	/	(Communication response Instrument Number)
Note: the 2-wire system has no switch or Limit switch hysteresis or Baud rate or Instrument address.		

Secondary parameter description

The secondary menu is the calculation of instrument program and parameters in complex environment. It contains many methods and is generally not recommended to be changed.

<p>Long press and hold the  key for 3 seconds, and press the  key at the same time to enter the user setting mode. The shaded part is modifiable, press  key to modify this bit value, press  key to move to the next parameter; Short press  key to save the modify and enter next parameter; Long press  key for 3 seconds to save the modify and back to the home page.</p>		
Char	English	Explanation
C 00. 550m	Set dead zone 00.650 m	Must be greater than the default value
A 0.00 1.00	Auto Gain Closing	0 - auto gain off 1 - turn on auto gain For complex occasions, you can open it and try. It is recommended to close.

t 01.000t	Temperature mode 01.000	Value ≤ 1 , real time temperature compensation; Value > 1 , The temperature compensation is fixed to the set value.
T 015	Signal adjust 015 n	The signal strength is fine tuned by 0 ~ 30, which is inversely proportional to the value Set for special occasions. It is strongly recommended to default to 015
S 00.020m	Set change rate 00.021 m	Maximum change value per sampling, The smaller the stronger the anti-interference
EC Ch Eh	Language mode english char	Characters or English
db 017	LCD contrast 018 n	Contrast is the clarity of the display, The change definition of the value is 1 ~ 60, The default is about 018
Xj- +001	Lower check +001	If the current output is offset: (combined with current upper check) first step Analog output verification 4mA
Sj- +002	Upper check +001	If the current output is offset: (combined with current lower check) step 2 Analog output verification 20mA
PL +00.020m	Distance Adj +00.020	Due to the discreteness of the ultrasonic probe, the measurement distance from the reference plane is not exactly the same, so there will be a slight deviation, which can be fine tuned.

5. Digital communication protocol format

Instrument using standard Modbus RTU protocol format for communication, baud rate 2400 to 38400 optional, 8 data bits, no parity.

Under the MODBUS RTU mode, each frame includes Modbus address field, functional domains, data fields and check domain. Send or receive between two characters each time interval must not exceed 1.5 times the character transmission time. If the two characters more than 3.5 times the interval character transmission

time, the agreement is considered a data has been received, a new data transmission begins.

Start	Address code	Function code	Data	CRC checksum	Stop
3.5T	1 Byte	1 Byte	N*1 Byte	2 Byte	3.5T

Modbus Protocol frame

Address code: meter number, ranging from 1 to 255.

Function code: Function code needs to be achieved, such as Read Holding Registers function code 03.

Data: data content sent as an address register to read the number and so on.

Check: CRC16 checksum, LSB first.

The instrument is currently available only temporarily inquiry Read Holding Registers function code 03 support.

Data Description:

Address	Description	Data Types
0x0000	Liquid level	Float
0x0002	Air distance	Float
0x0004	Mounting height	Float
0x0006	Range of the instrument	Float
0x0008	Instrument blind	Float
0x000A	Output Current	Float
0x000C	Alarm limit	Float
0x000E	Limit hysteresis	Float
0x0010	Alarm limit	Float
0x0012	The lower hysteresis	Float

Instrument return variable for 32 single-precision floating-point type, accounting for 4 bytes, using the IEEE standard way to represent. Each standard Modbus holding register is two bytes, so each float variable occupies two holding registers, the address stored in the low 16 high, high address stored in the low 16. Such as air distance variable is stored in the table start address register is 0x0002, set the air distance is 100.54 (decimal), the corresponding hexadecimal representation for 0x42C9147B, the address is stored in register 0x0002 0x42C9, address 0x0003 register holds 0x147B.

Communication Command:

Function code 03: Read Holding Registers

Send:

Address code	Function code	Register address high byte	Register address low byte	The number of high byte register	The number of low byte register	CRC checksum low byte	CRC checksum high byte
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Response:

Address code	Function code	Returns the number of data bytes	A high Byte data 1	A low Byte data 1	...	A high byte data N	A low byte data N	CRC checksum low byte	CRC checksum high byte
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Description: Address code: Instrument number, can be user-set, ranging from 1 to 255

Register Address: variable starting address, reference data shows.

Number of registers: the number of registers to be read, the value is equal to the number of variables to be read bytes / 2;

Returns the number of bytes of data: the number of bytes read into the variable.

For example: Read the air distance, refer to the table, air distance variable is single-precision floating-point, four-byte, representing the holding register start address is 0x0002, set height is 100.54 air, instrument number is 1, then read process is as follows:

Send:

01	03	00	02	00	02	65	CB
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Response:

01	03	04	42	C9	14	78	31	57
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Simultaneously read multiple variables, simply send the starting address of the first variable, and the need to read the register number (variable number of bytes / 2), the instrument will return multiple variables simultaneously.

Error handling: If the instrument receives the wrong communication request, it returns the corresponding error code according to the error content.

Error response:

Address code	Function code +0x80	Error Codes	CRC checksum low byte	CRC checksum high byte
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Description: Communication error function code when requesting a return to the highest position, such as 0x03 becomes 0x83 (0x03 + 0x80) returns.

Error code:

01: unsupported feature code

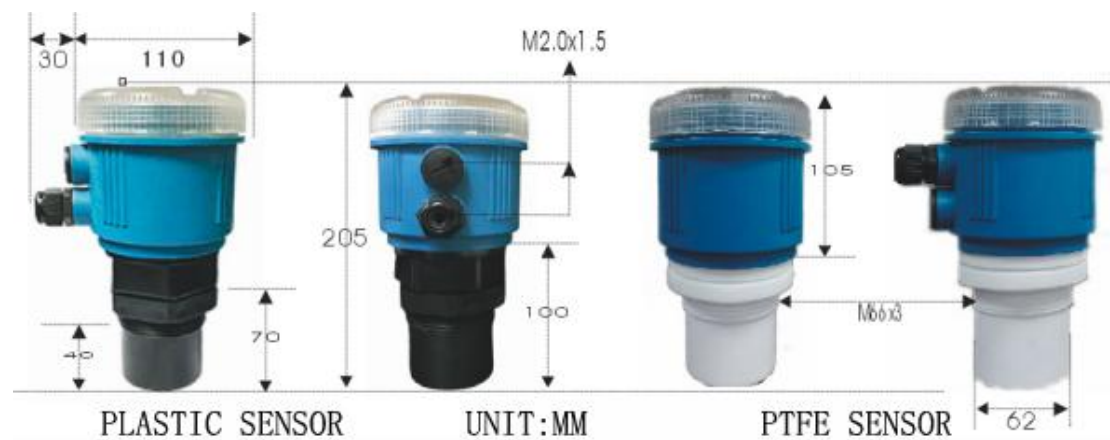
02: Register address error

03: Data contents of the error

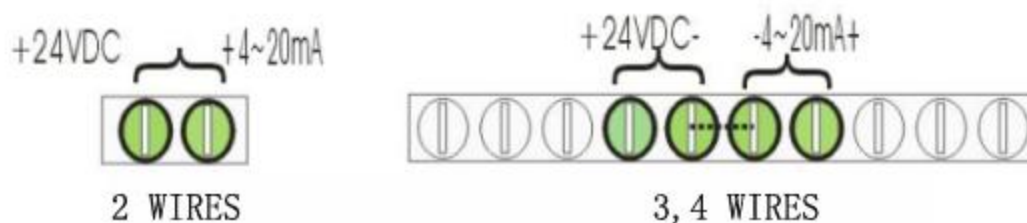
6. Technical Specifications

Parameters	Performance	Parameters	Performance
Range	0.5~30m	Accuracy	0.25%, 0.5%
Supply voltage	220VAC Or 24VDC	Resolution	1~5mm
Show	English or Character	Launch angle	6°~12°
Blind	0.20~0.9m	Frequency	~40KHZ
Analog Output	4~20mA	Digital Output	RS485
Maximum load	750 Ohm	Switching output	<125V;0.5A
Ambient temperature	-20~+55°C	Degree of protection	IP67, IP68
Mounting thread	M66x3、G2	Housing material	PA6、ABS
Electrical interface	M20*1.5		

7. Product size(unit:mm)



8. Wiring



9. Abnormal instrument analysis and processing

Anomalies	Analyze the reasons	Treatment options
Instrument does not display, black	(1) Wiring error (2) Power is not normal (3) The instrument is damp or flooded (4) High voltage series connection and lightning stroke	Check the power supply wiring polarity, voltage, current, the circuit meets the requirements.
Instrument display H ----- Or L FFFFFF (that there is no echo)	(1) the wiring is good (2) whether the vertical installation (3) power is small (4) The instrument is too wet or flooded (5) whether there is detected the media surface foam, floating debris, smoke, dust, etc;	Close analog field instrumentation whether echo (back test procedures) is digitally. If properly handled or change the installation environment.
Instability instrument display, digital bounce, digital fixed, or inconsistent with the actual gap is too large	(1) Supply voltage inferior instability (2) Level height into the blind (3) the level of the top or side obstacles (4) installation of port settings or location does not meet the requirements (5) electromagnetic, high intensity pulse interference (6) and the mounting bracket resonance	Improve supply; Heightening install stagger blind use; Change the installation location, avoiding obstacles, riser installation; Grounding, shielding measures; Installation of anti-vibration rubber gasket installation etc.
Analog signals, digital	(1) Analog output is greater than 20mA (2) PFFFFF (3) The analog output is too small	Display over range The load is too large, the supply voltage is too low Use the loop connection is

signals, the on-off switch is not normal, etc	(4) No analog output (5) No digital signal output (6)the digital signal output intermittent, unstable (7)No switching output	disconnected; Wiring and instrumentation address number, baud rate and protocol format is consistent Whether this function, work overload, must be used within the scope of
Tip: When you can not find the reason repeatedly, please contact the manufacturer to communicate when necessary		

10. Operating conditions and installation matters

For the long-term use of your instrument, you must install a sunshade for outdoor installation and use; Keep the instrument dry and ventilated for indoor use. When used in the environment with weak moisture and corrosive air, be sure to pay attention to sealing (cover, waterproof joint, etc., and it is necessary to seal with sealant or plasticine under special circumstances).

Due to the existence of the emission angle and blind area of the ultrasonic level meter, the installation is safe, so we should stagger the installation position: the angular distance between the blind area and the emission side. It shall not be too close to the highest medium surface and side edge, so as not to affect the normal operation of the instrument.

(the edge distance between the blind area and the transmitting side angle of general instruments is greater than 0.5m or about 10% ~ 5% of the range, only for reference)