User Manual

Hydrstatic Level Transmitter

U-162XP-EN1

Preface

● Thank you for purchasing our products.

● This manual is an instruction manual about the product's functions, wiring methods, setting methods, operation methods, troubleshooting methods, etc.

● Please read this manual carefully before operation and use this product correctly to avoid unnecessary losses due to incorrect operation.

● After you have finished reading, please keep it in an accessible place for your easy reference during operation.

Note

● The contents of this manual are subject to modification without notice due to function upgrades, etc.

● We strive to ensure that the contents of this manual are correct. If you find any errors, please contact us.

● Reproduction or duplication of the contents of this manual is strictly prohibited.

● This product is prohibited from being applied in explosion-proof environments.

Version

U-162XP-EN1

Confirm the package contents

After unpacking, please check the product and its accessories. If you find any discrepancies in model, quantity, or appearance, contact us immediately.

Product List

Product packaging content

Serial number	Item Name	quantity	Remark
1	Hydrstatic Level Transmitter	1	
2	Information Card	1	
3	Certificate of Conformity	1	

Contents

1. Product Overview

Featuring a high-performance diffused silicon piezoresistive pressure sensor, the 2088 Housing Hydrostatic Level Transmitter precisely detects the static pressure of liquids corresponding directly to liquid depth. The built-in signal conditioning circuit converts this pressure into a standard current or voltage output, providing a stable, linear relationship between the output signal and the liquid level.

Compact in size yet highly accurate, the transmitter can be directly immersed in the medium to measure the distance from its tip to the liquid surface, offering simple installation and dependable performance. It is well-suited for level measurement and control industries such as petroleum, chemical processing, power generation, municipal water supply, and hydrological exploration.

2.　Main Features

- **High-performance sensor**

Powered by a premium diffused silicon piezoresistive pressure sensor for stable and accurate measurement.

- **Simple submersible design**

The probe adopts a direct-immersion measuring method, enabling quick and easy installation without complex setup.

- **Robust protection structure**

Built with a multi-layer protective structure to ensure long-lasting performance.

- **Flexible options**

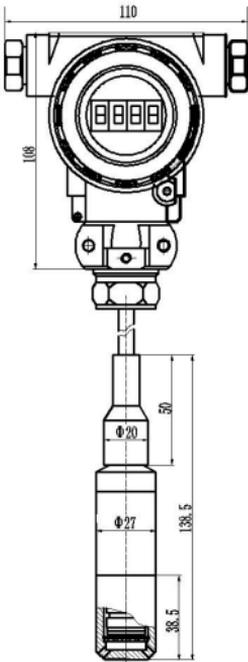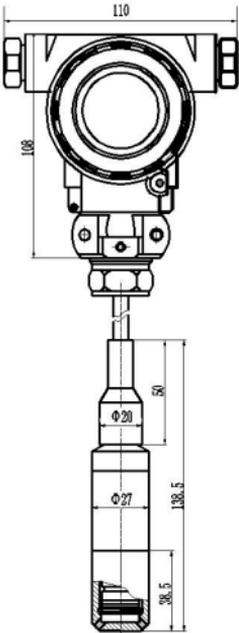Available in a range of models and specifications to meet the needs of various industrial applications.
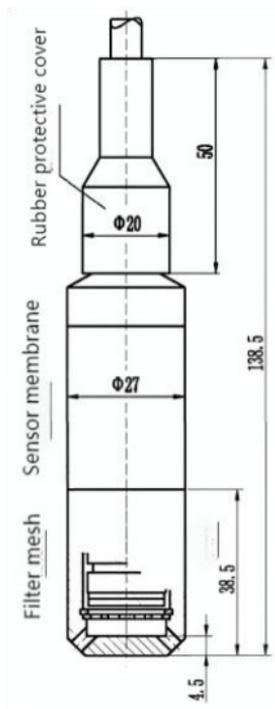
- **Durable and corrosion-resistant**

Crafted from corrosion-resistant stainless steel to suit a wide range of application needs.

3. Dimensions and Installation

2088 housing level transmitter with display	2088 housing level transmitter without display

Direct Lead Type

4. Technical Parameters

Power Supply	(4-20) mA output:	(10-32)V
	(0-10)V output:	(12-32)V
	RS-485 output:	(8- 32)V
Output	(4-20) mA; (1-5) V; (0-10) V; (0-5) V; RS485	
Accuracy	0.5%FS	
Measuring Range	0~1m...200mH$_2$O	
Pressure Type	Gauge pressure	
Compensation Temperature	-10℃～70℃	
Medium Temperature	-10 ℃～65 ℃	
Storage Temperature	-20 ℃～65 ℃	
Zero Output Temperature Drift	±0.3%FS/10℃	
Full Scale Output Temperature Drift	±0.3%FS/10℃	
Overload Pressure	150% FS	
Long - term Stability	±0.2%FS/year	
Response Time	Current/voltage output≤10 ms (rising to 90% FS); RS485 output≤100 ms (rising to 90% FS)	
Insulation Resistance	500MΩ/100VDC	
Protection Level	Sensor IP68, 2088 housing: IP65	
Load Resistance	(U-9V)/0.02A; (Note: U is the supply voltage)	

5. Electrical connections

5.1. 2088 housing electrical connections

2088 housing level transmitter with display	2088 housing level transmitter without display

Direct lead type
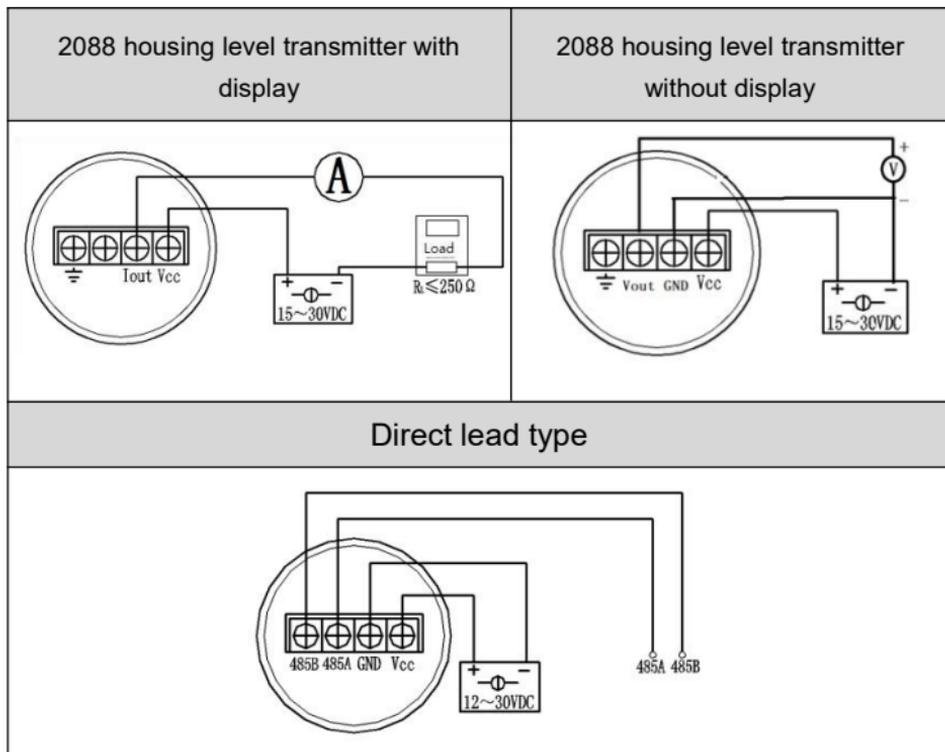
5.2. Lead- type electrical connection

Signal Type	Color	Function
Current	Red	+Vs (24VDC)
	Green	Current output
	Black	GND
Voltage	Red	+Vs (24VDC)
	Green	-Vs
	Yellow	Vout
	Black	GND
RS485	Red	+Vs (24VDC)
	Green	-Vs
	Yellow	485A/D+
	Blue	485B/D-
	Black	GND

6. Function Settings

6.1. Display Area Description

The main and secondary display areas of the screen offer various display modes. The main screen shows pressure value, percentage readings, or current values. The secondary display offers two options — temperature display or no display. The temperature value is derived from the temperature sensor on the circuit board, and the display modes can be switched at any time.

Upon power-up, the device restores the display mode last saved in the software before shutdown. Any mode made via the front panel will be cleared after powering off. Refer to Figure 7 for the LCD display interface.

Fig.1

6.2. Button Function Description
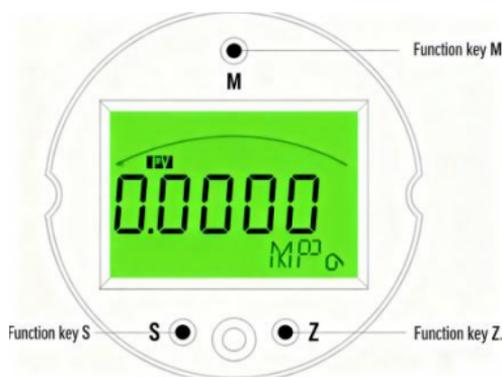
Fig.2

1) Function key "M"

No.	Operating Mode	Action	Function
1	Measurement Mode	Short Press	Powers on and enters the password setting interface.
2		Long Press (5s)	Enters the main variable reset (PV reset) function.
3	Setting Mode	Short Press	**First Press**: Enables parameter modification. The selected parameter will flash. **Second Press**: Confirms and saves the modification. The modified parameter stops flashing.

2) Function key "S"

No.	Operating Mode	Action	Function
1	Measurement Mode	Short Press	Changes the display mode.
2		Long Press (5s)	Enters the full adjustment function (i.e., calibrates the transmitter's full point). Warning: This operation affects accuracy and performance. Do not perform without a standard source.
3	Setting Mode	Short Press	Increases the parameter value by one.
4		Long Press	Continuously shifts and increases the value by one.

3) Function key "Z"

No.	Operating Mode	Action	Function
1	Measurement Mode	Short Press	Changes the display mode.
2		Long Press (5s)	Enters the zero adjustment function (i.e., calibrates the transmitter zero point).
3	Setting Mode	Short Press	Cycle through the parameters or decrease the value.
4		Long Press	Continuously shifts through parameters or decreases the value.

6.3. Menu Description

(1)   The Access Password

It is divided into two types according to the specifications of the transmitter.

Output Type	Access Password	Configurable Items
(4–20) mA Output	00001	Display Unit, Display Resolution, Display Mode
RS485 / RS485 & (4–20) mA Output	00016	Refer to Device Manual **Table 1**

(2) Function setting of (4-20) mA output)

① Loc: Password input menu, the range can be set (19999 ~ 99999), the menu prompt is "PIN"

Set the password to enter the menu. If the password is entered incorrectly or no key is pressed within 30 seconds, the system will automatically return to the measurement mode.

② **Loc: Password Entry**

- Setting Range: 19999 – 99999
- Menu Prompt: PIN
- Description: Enter the correct password to access the configuration menu. The device will automatically return to the measurement mode after an incorrect password entry or 30 seconds of inactivity.

③ **Unt: Unit Selection**

- Setting Range: 0 – 18
- Menu Prompt: The selected unit
- Available Units (19 types): MPa, kPa, Pa, bar, mbar, PSI, mH_2O, mmH_2O, InH_2O, ftH_2O, mHg, mmHg, InHg, Kg/cm^2, atm, Torr, m, cm, mm

④ **dot: Display Accuracy Setting (Decimal Places)**

- Setting Range: 0 – 4
- Menu Prompt: Current pressure unit
- Description:
  ➢ This setting determines the number of decimal places shown in the

measurement value. The user can set it according to the actual field requirements.

➢ Stability First: Using more decimal places does not always mean better readability; ensure the displayed value remains stable.

➢ Range Limitation: The allowable setting is restricted by the transmitter's calibrated maximum range. When the transmitter's maximum measurable value (e.g., 20,000 MPa) is displayed with selected number of decimals, the entire number (Including the decimal point) must not exceed 5 digits. If it exceeds this limit, the transmitter will automatically reduce the number of decimal places until the maximum value can be displayed in full.

● Example:

For a calibration range of 0.0000 ~ 20.000 MPa, the valid display setting range is 0 to 3. Setting it to 4 would make the maximum value exceed the 5-digit display capability.

⑤ **SHO: Display mode setting**

● Setting Range: 0 – 5

● Options:

Value	Display Mode	Prompt Sign
0	Primary Variable	-PV-
1	Current	-mA-
2	Percentage	-%-
3	Primary Variable & Current (Alternating)	PV-mA
4	Primary Variable & Percentage (Alternating)	PV--%
5	Current & Percentage (Alternating)	mA--%

⑥ **End: Exit Setting Menu**

● Setting Range:0-1

- Options:

  ➢ "0" - Do not save the set value and exit the setting mode. Prompt: "NSAVE"

  ➢ "1" - save the change and exit. Prompt: "SAVE

(3) Function setting (RS485 output/RS485 output&(4- 20) mA output)

Table 1
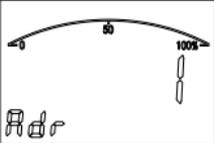
ADR	Rdr	RS485 communication address, range is 1-255.
BOT	bot bPS	Communication baud rate setting. The baud rate range is 1200 , 2400 , 4800 , 9600 , 19200 , 38400 , 57600 , 115200bps The interface displays 1200, 2400, 4800, 9600, 19200, 38400, 57600, 11520
BDL	bdL KPa	The primary variable value corresponding to 4mA is transmitted and used as the transmitter zero value during range scaling. It determines the pressure point at which the transmitter outputs 4mA.
BDH	bdH KPa	The primary variable value corresponding to 20mA is transmitted and is used as the full-scale value during range scaling. It determines the pressure point at which the transmitter outputs 20mA.
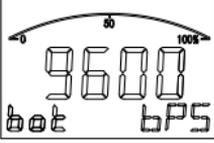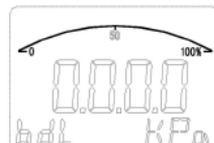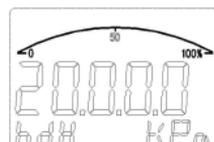
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OFT		The zero offset value of the transmitter's primary variable. This offset value is added to the primary variable and enables the transmitter's zero point shift.
GAI		The gain coefficient of the primary variable. The primary variable gain coefficient does not perform gain correction on the offset value and the zero value. The resolution is 0.0001FS and is intended for secondary calibration by the customer.
FIL		The maximum value for filtering and damping is 30, and the minimum value is 0. The larger the value, the stronger the filtering effect.
SOL		4mA reference calibration. Adjust this parameter while modifying the output current with an external ammeter. Modify the value until the current reading on the ammeter is precisely 4mA.
SOH		20mA reference calibration. Adjust this parameter while modifying the output current with an external ammeter. Modify the value until the current reading on the ammeter is precisely 20mA.
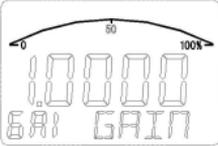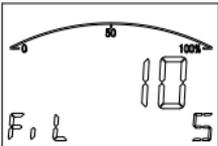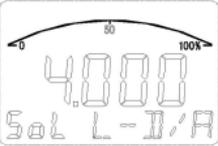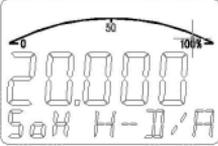
OUT FIX		Current test menu. In this submenu, the transmitter enters the modification mode, which allows the transmitter to output the current value displayed in the menu: 3.800, 4.000, 8.000, 12.000, 16.000, 20.000, 20.800, and 22.500mA respectively.
OUT		This menu sets the transmitter output to either linear or square root. Square root output is generally suitable for differential pressure transmitters in flow measuremen application. For general application, select linear output.
END		Exit and save the menu. In this menu state, press the M key to exit the menu and save the setting.
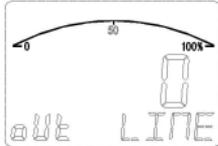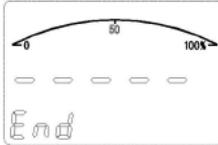
7. Notes

（1）The installation site opts for where is easy for operation and maintenance;

（2）Install it away from strong vibration sources.

（3）Keep it away from heat sources as much as possible.

（4）During the submersible level transmitter, its metal probe needs to be fully submerged into the bottom of the tank.

（5）If additional wiring is required, proper waterproofing measures should be taken (e.g., sealing the junction box). If such measures are not available, route the cable downward in a loop to prevent water from entering and causing malfunction.

（6）The level probe should be secured in place once submerged, and kept away from water inlets.

（7）There is an isolation diaphragm inside the pressure inlet of the transmitter. Do not touch it with foreign objects.

（8）Please strictly follow the wiring instructions for electrical connections. Wrong wiring may cause damage to the amplifier circuit.

（9）Do not use the suspension cable of the submersible level transmitter to lift or support any additional weight.

（10）The probe should be desilted regularly to avoid blockage of the pressure inlet.

（11）The wires are made of special waterproof material. During installation and applications, prevent abrasion, puncture, or cuts. If the cable is exposed to such conditions, protective measures must be taken. Damage caused by improper handling will not be convered under warranty and will incu repair charges.

（12）For any problem arise during installation or operation, please contact us. Do not attempt to disassemble or repair the product yourself when the instrument malfuncts.

8. **Warranty and after-sales service**

We guarantee that all hardware accessories supplied will be in good condition in material and workmanship.

Starting from the date of purchase, if any material or manufacturing defects are reported during the warranty period, we will provide free maintenance or replacement for the confirmed defective products. For all non-customized products, returns or exchanges are accepted within 7 days.

Disclaimer

The warranty does not cover product failures caused by the following:

    (1) Improper use or handling of users.

    (2) Unauthorized disassembly, modification, or repair by the customer.

After-sales service commitment:

    (1) For any technical inquiries, our support team will respond and provide solutions within two hours of receiving the request.

    (2) For instruments returned for repair, we will issue a test report within 3 working days of receipt and complete the repair process within seven working days.

9. Communication Protocol of the 2088 Housing

9.1. Overview

This protocol complies with the MODBUS communication protocol and adopts the RTU mode of the MODBUS protocol subset and the RS485 half-duplex working mode.

9.2. Serial Data Format

- Serial port settings: none/odd/even parity, 8 data bits, 1 stop bit.
  Example: 9600, N, 8, 1 means: 9600bps, no parity, 8 data bits, 1 stop bit.
- The serial port baud rate supported by this transmitter is:
  1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
- CRC check polynomial: 0xA001.
  The communication protocol can transmit signed integers as well as floating-point data.

9.3. Communication Format

Signed integer output:

(1) A. Sending read command format:

Address	Function code	Starting address (H)	Starting address (L)	Number of data (H)	Number of data (L)	CRC16 (L)	CRC16 (H)
0X01	0X03	0X00	0X00	0X00	0X01	0X84	0X0A

B. Return read data format:

Address	Function code	Data length	Data (H)	Data (L)	CRC16(L)	CRC16(H)
0X01	0X03	0X02	0X00	0X01	0X79	0X84

(2) A. Write command format (06 function code) example:

Address	Function code	Starting address (H)	Starting address (L)	Data (H)	Data (L)	CRC16 (L)	CRC16 (H)
0X01	0X06	0X00	0X00	0X00	0X02	0X08	0X0B

B. Example of return read data format:

Address	Function code	Starting address (H)	Starting address (L)	Data (H)	Data (L)	CRC16 (L)	CRC16 (H)
0X01	0X06	0X00	0X00	0X00	0X02	0X08	0X0B

(3) Abnormal response return:

Address	Function code	Exception code	CRC16 (L)	CRC16 (H)
0X01	0X80+function code	0X01 (Illegal function)		
		0X02 (illegal data address)		
		0x03 (illegal data)		

9.4. Integers-Supported Commands&Data and Commands Meaning

Table 7

Function code	Starting address (decimal)	Number of data	Byte	Data range	Instruction definition
0X03 function code reads data					
Integer reading range					
0X03	0	1	2	1-255	Read slave address
0X03	1	1	2	0-1200	Baud rate reading
				1-2400	
				2-4800	
				3-9600	
				4-19200	
				5-38400	
				6-57600	
				7-115200	
0X03	2	1	2	0-No parity	0 - No parity

				1-0DD	1-Odd parity
				2-EVEN	2-even parity
0X03	3	1	2	0-kPa	Pressure units
				1-Mpa	
				2-Ma	
				3-%	
				4-inH$_2$O	
				5-Fth2o	
				6-MmH$_2$O	
				7-MmHg	
				8-psi	
				9-Bar	
				10-Mbar	
				11-kgf/c²	
				12-Pa	
				13-Torr	
				14-Atm	
				15-empty	
				16-M	
				17-Cm	
				18-Mm	
				19-inHg	
				20-mHg	
				21-Mh$_2$O	
				22-℃	
0X03	4	1	2	0-####	The decimal point
				1-###.#	represents 0-4 decimal
				2-##.##	places respectively,
				3-#.###	and the decimal point

				4-#.####	position can adjust the display resolution.
0X03	5	1	2	Shaped measurement value output	Display range: -32768 to 32767
0x03	6	1	2	0-Current display 1-Pressure display 2-Percentage display	Home screen display mode
0x03	7	1	2	0 - Do not display 1- Display temperature	Secondary screen display mode
0x03	8	1	2	0-Linear output 1-Square root output	Current output mode
0x03	9	1	2	0-30	Filter coefficient
The above is the range of floating point data reading					
0x06 Function code write data					
0x06	0	1	2	1-255	Rewrite the slave address
0x06	1	1	2	0-1200 1-2400 2-4800 3-9600	Modify the baud rate

				4-19200	
				5-38400	
				6-57600	
				7-115200	
0x06	2	1	2	0-No checksum 1-ODD 2-EVEN	Modify the communication verification method
0x06	24-25	2	4	-19999-99999	Zero offset value. Pressure output value = calibration measurement value + zero offset value
save					
0x06	65535	1	2	0-Save to user area	

Example of command to read: (hex)

Tx: 01 03 00 16 00 02 25 CF

01 slave address , 03 function code , 00 16 starting address , 00 02 number of words read.

Rx: 01 03 04 BE 40 E6 12 15 A2

01 slave address, 03 function code, 04 number of bytes, BE 40 E6 12 is the floating point number of IEE754.

10. Communication Protocol

10.1. Protocol Introduction

The sensor adopts the standard Modbus-RTU protocol with an RS-485 physical interface and communicates in master/slave mode through serial transmission.

A complete message frame is structured as follows:

Start bit	Device address	Function code	Data	CRC check	End character
Idle time > 3.5 character interval	8-bit	8-bit	n 8-bit	16-bit	Idle time > 3.5 character intervalsl

10.2. Sensor Default Configuration

Communication protocol	Modbus-RTU
Communication interface	RS485
Device address	0x01
Serial port configuration	Baud rate: 9600
	Data bits: 8
	Parity: None
	Stop bit : 1 bit

10.3. Register Address

Register	Register address (Hex)	Operation	Storage data type	Description
Device address	0x0000	03/06	Unsigned double-byte integer	
Baud rate	0x0001	03/06	Unsigned double-byte integer	0x0000=1200 0x0001=2400 0x0002=4800 0x0003=9600 0x0004=19200 0x0005=38400

10 Leaded liquid level gauge communication protocol

Register	Register address (Hex)	Operation	Storage data type	Description
				0x0006=57600 0x0007=115200
Unit	0x0002	03/06	Unsigned double-byte integer	0x0000=MPa 0x0001=kPa 0x0002=Pa 0x0003=bar 0x0004=mbar 0x0005=kg/cm^2 0x0006=psi 0x0007=mH$_2$O 0x0008=mmH$_2$O 0x0009=℃ 0x000A=cmH$_2$O
Decimal point offset	0x0003	03	Unsigned double-byte integer	0x0000=*1 0x0001=*0.1 0x0002=*0.01 0x0003=*0.001
Real-time measurement values	0x0004	03	Double-byte integer	
Linear correction	0x0005	03/06	Double-byte integer	
Zero offset value	0x0006	03/06	Double-byte integer	
Density value	0x0007	03/06	Unsigned double-byte integer	
Parity	0x0008	03/06	Unsigned double-byte integer	0x0000=None 0x0001=Odd 0x0002=Even
Data storage	0x001F	06	Unsigned double-byte integer	0x001F=Save

10.4. Communication Examples

Example 1: How to obtain the sensor output load

Send a request message to obtain the pressure unit, decimal point offset, and real-time pressure value , as follows :

Field Name	Slave Address	Function	Starting Address Hi	Starting Address Lo	Quantity of Registers Hi	Quantity of Registers Lo	Error Check Lo	Error Check Hi
RTU (hex)	01	03	00	02	00	03	A4	0B

For example, the response message is as follows :

Field Name	Slave Address	Function	Byte Count	Data1 Hi	Data1 Lo	Data2 Hi	Data2 Lo	Data3 Hi	Data3 Lo	Error Check Lo	Error Check Hi
RTU (hex)	01	03	06	00	01	00	02	00	64	BC	9E

Dota1 (Unit) = 0x0001=kPa

Data2 (decimal point offset) = 0x0002=0.01

Data3 (real-time measurement value) = 0x0064=100

The sensor output is (100*0.01)kPa=1kPa

Example 2: How to modify the address/baud rate

For example, change the product's default address 1 to address 2.

Send a modification address message as follows :

Field Name	Slave Address	Function	Register Address Hi	Register Address Lo	Write Data Hi	Write Data Lo	Error Check Lo	Error Check Hi
RTU (hex)	01	06	00	00	00	02	08	0B

Send the save message in the modified address state as follows (the slave address of the save message must be the modified device address).

10 Leaded liquid level gauge communication protocol

Field Name	Slave Address	Function	Register Address Hi	Register Address Lo	Write Data Hi	Write Data Lo	Error Check Lo	Error Check Hi
RTU (hex)	02	06	00	1F	00	1F	F9	F7

Example 3: How to use the zero offset function

For example: The measurement range of a product is (0~10)m, with two decimal places reserved. When the no-load output is -0.15, the corresponding parameter needs to be corrected to 0.00.

To make this adjustments, fill 15(in Hexadecimal) int he Write Data filed, i.e., 0x000F (as shown below), and send the write command through the communication line as shown below:

Field Name	Slave Address	Function	Register Address Hi	Register Address Lo	Write Data Hi	Write Data Lo	Error Check Lo	Error Check Hi
RTU (hex)	01	06	00	06	00	0F	29	CF

Send a save message after modification.

Field Name	Slave Address	Function	Register Address Hi	Register Address Lo	Write Data Hi	Write Data Lo	Error Check Lo	Error Check Hi
RTU (hex)	01	06	00	1F	00	1F	F9	C4

Example 4: How to modify the density

For example: a product with a density of 1.00 g/cm^3 and a measuring range of (0 to 2)m is modified to have a density of 0.85 g/cm^3 .

According to the formula "P modified density * 10000", 8500 is converted into hexadecimal 0x2134 and written into register 0x0007.

Field Name	Slave Address	Function	Register Address Hi	Register Address Lo	Write Data Hi	Write Data Lo	Error Check Lo	Error Check Hi
RTU (hex)	01	06	00	07	twenty one	34	twenty one	8C

Send a save message after modification.

Field Name	Slave Address	Function	Register Address Hi	Register Address Lo	Write Data Hi	Write Data Lo	Error Check Lo	Error Check Hi
RTU (hex)	01	06	00	1F	00	1F	F9	C4

10.5. Troubleshooting

If the sensor response message is garbled or there is no response , please check according to the following steps:

1	Check whether the product power supply is normal
2	Check whether the RS485A and RS485B signal lines of the product are connected reversely
3	Check whether the serial communication line is normal
4	Check whether the serial port communication parameter configuration is normal
5	Check whether the CRC of the request message is correct
6	Check whether the sensor device address conflicts in the networking state

10.6. Notes

（1）When the baud rate/address is modified, the sensor will reply the modified data at the baud rate sent by the host. After replying, the transmitter baud rate/address will become the modified target value.

（2）To ensure normal sensor performance, users are generally not allowed to modify the sensor's calibration data. If you need to recalibrate the range, please contact sales technicians.

（3）The real-time output is a double-byte integer. A read value of 0xFFFF indicates "-1" rather than "65535." After modifying parameters such as the address, a save command must be sent for the product to save the data after power failure.

（4）When sending a message, if the slave address and content data change, the CRC will also change. Please use a professional CRC calculation tool to calculate the CRC.