T6500 On-line pH/ORP Meter

Operating Manual

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Preface

Thank you for your support to us. Please read the instruction manual carefully before use to help you use our products correctly.
When receiving the instrument, please carefully open the package, check whether the instrument and accessories are damaged by transportation, whether the accessories are complete, if abnormal, please contact our after-sales service department or regional customer service center, and keep the packaging for return processing.
Wiring or repair shall be done by a professional and operate only on instruments with power-off. In the event of an instrument safety problem, power off the instrument immediately to prevent any unintentional operation.

For example, it may be
Unsafe condition:

1) Significant damage to the instrument;
2) The instrument can not operate properly or provide specified measurements;
3) The instrument was stored in an environment with temperature exceeding 70℃ for a long time.
The instrument must be installed by a professional in accordance with relevant local specifications, and the guidance instructions are included in the operating instruction manual. Comply with the technical specification and input grade of the instrument.

Features

The instrument with different types of pH electrode or ORP electrode is widely used in power plant, petrochemical industry, metallurgical electronics, mining industry, paper industry
Biological fermentation engineering, medicine, food and beverage, environmental water treatment, aquaculture, modern agricultural planting and other industries.
In aqueous solution's pH value, ORP value and temperature value were continuously monitored and controlled.

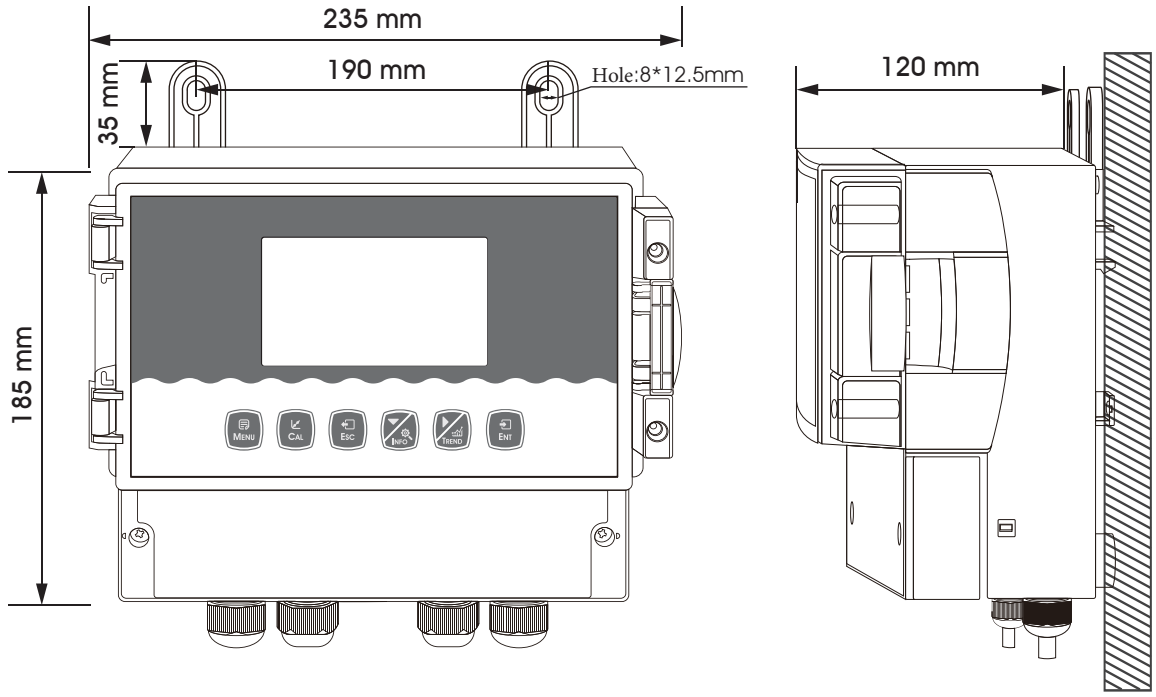
- Large LCD color LIQUID crystal display
- Intelligent menu operation
- Data recording & Curve display
- Various automatic calibration functions
- Differential signal measurement mode, stable and reliable
- Manual and automatic temperature compensation
- Three sets of relay control switches
- High limit, low limit and hysteresis control
- Various output modes of 4-20mA&RS485
- The same interface displays pH/ORP, temperature, current, etc
- Password protection can be set to prevent non-staff misoperation.

Specifications

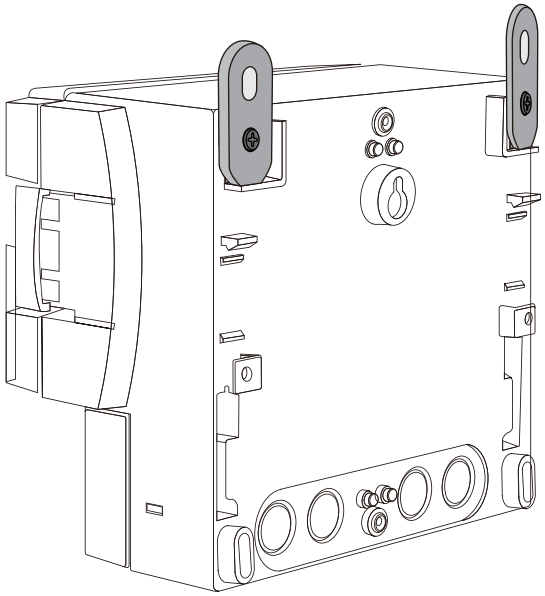
Measuring range	-2～16.00pH；-2000～＋2000mV
Measure Unit	pH、mV
Resolution	0.001pH；1mV
Basic error	±0.01pH；±1mV；
Temperature	-10～150.0°C(it is basesd on the electrode)
Temperature resolution	0.1°C
Temperature basic error	±0.3°C
Woring temperature	0～150°C
Temperature compensation	Automatic or manual
Stability	pH:≤0.01pH/24h；ORP: ≤1mV/24h；
Current output	3 Rd 4～20mA，20～4mA，0～20mA
Communication output	RS485 Modbus RTU
Other functions	Data record/curve display/data upload
Relay control contacts	3 Group:5A 250VAC，5A 30VDC
Optional power supply	85～265VAC,9～36VDC，Power:≤3W
Working environment	There is no strong magnetic interference besides the earth
Ambient temperature	-10～60°C
Relative humidity	No more than 90%
Protection level	IP65
Instrument Weight	1.5kg
Dimensions	235×185×120mm
Installation	Wall mounted

Installations

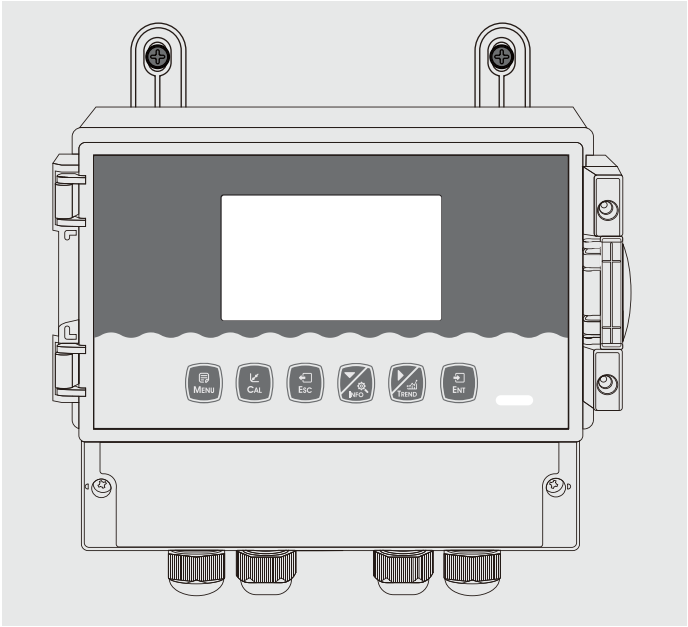
Installation size



Instrument shape, wall - mounted fixed piece size

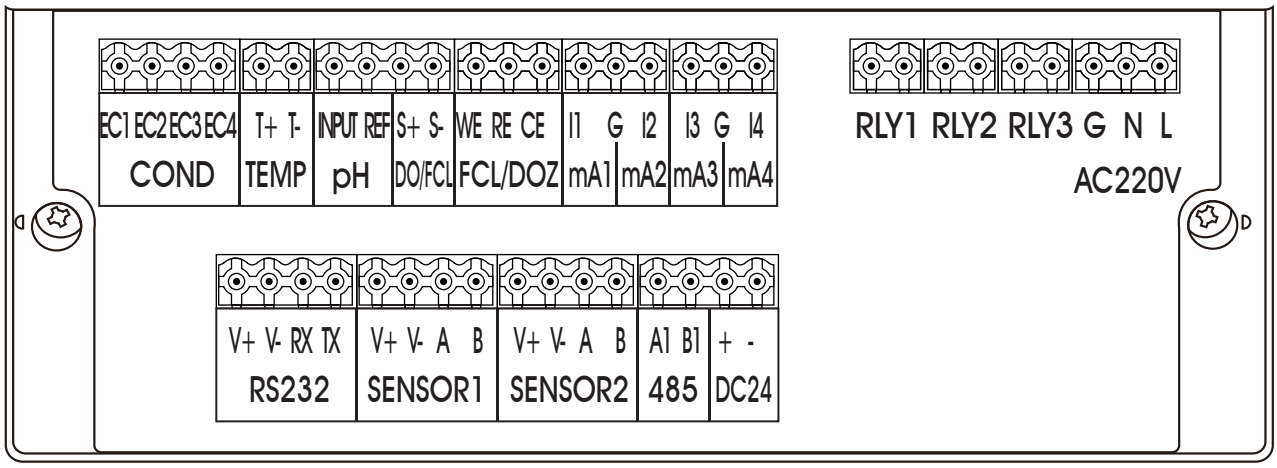


Fix the fixed piece of the instrument



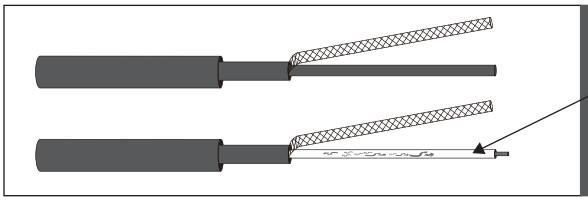
Installation completion drawing

Instrument connection



EC1,EC2,EC3,EC4	Electrical conductivity/resistivity wiring	RLY1 RLY2 RLY3	3 groups of relay
T+,T-	Temperature connection	G,L,N	G-ground wire, L-live, N-neutral
INPUT	pH/ORP/Ion measure		
REF	pH/ORP/Ion reference	V+,V-,RX,TX	RS232 communication output
S+,S-	Membrane dissolved oxygen, FCL	V+,V-,A,B	Digital input channel 1
CE,RE,WE	Constant voltage residual chlorine/ chlorine dioxide/ozone	V+,V-,A,B	Digital input channel 2
I1,G,I2	Output current	A1,B1	RS485 communication output
I3,G,I4	Input current	+,-	DC power supply

The connection between the instrument and the sensor: the power supply, output signal, relay alarm contact and the connection between the sensor and the instrument are all inside the instrument, and the wiring is as shown above. The length of the cable lead fixed by the electrode is usually 5-10 Meters, insert the corresponding label or color wire on the sensor into the corresponding terminal inside the instrument and tighten it.



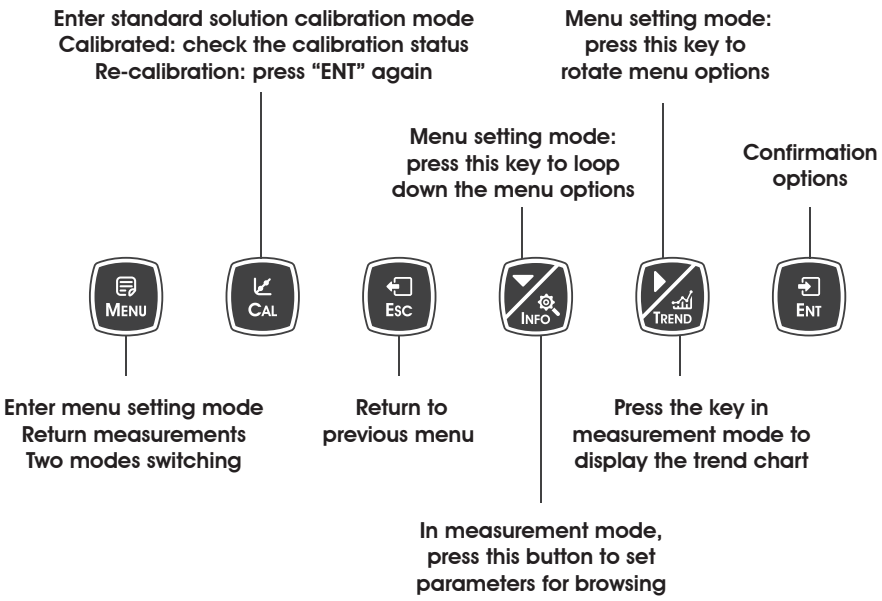
Tips: If the user dials the wire by himself, lengthens the cable or shortens the cable,
Take care to remove the black conductive skin outside the transparent wire.
To prevent short circuit from the reference end of the electrode, please use a multimeter to check
Use the pH dedicated cable connection.

Keypad descriptions

Keypad operation tips:

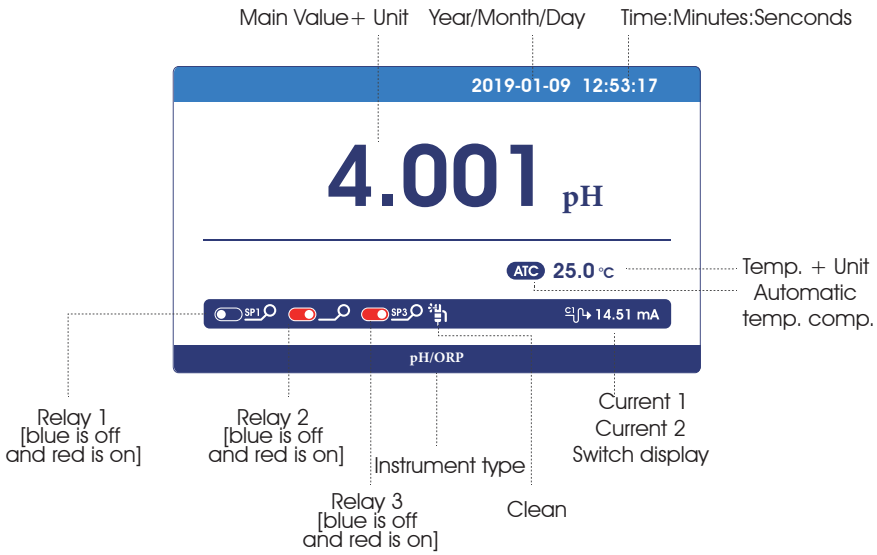
Short Press: Short Press means to release the key immediately after pressing. ((Default to short presses if not indicated below)

Long Press: Long Press is to press the button for 3 seconds and then release it.

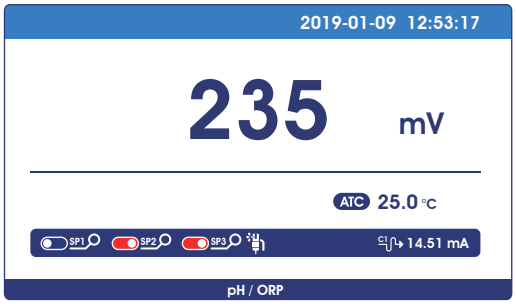


Display descriptions

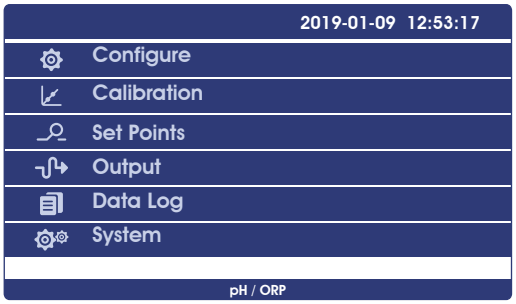
All pipe connections and electrical connections should be checked before use.
After the power is switched on, the meter will display as follows.



Measurement mode

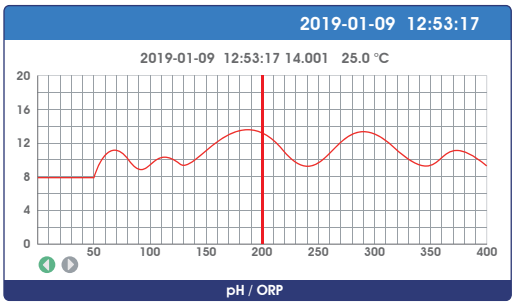


Setting mode



Calibration mode

Trend Chart Display



Menu structure

The following is the menu structure of this instrument

Configure	Sensor	Type	PH
			ORP
		Unit	pH
			mV
	Temperature	Temperature	NTC2.252 kΩ
			NTC10 kΩ
			Pt100
			Pt1000
		Temperature Offset	0.0000
		Temperature Input	Automatic
			Manual
		Temperature Unit	°C
			°F
Calibration	Standard Calibration	USA: 7.00, 4.01, 10.01	Automatic identification of standard solution, calibration of midpoint first
		NIST: 6.86, 4.01, 9.18	
		ORP Standard Calibration	235mV （Default）
		Correction	Offset correction 1
			Slope correction 1
			Offset correction 2
			Slope correction 2
	Field Calibration	Field calibration	
		Offset adjustment	
		Slope adjustment	
Alarm	Relay 1	Status	On
			Off
		High/Low Alarm	High Alarm
			Low Alarm
			Clean
		Limit Value -under cleaning status	(Continuous opening time)
		Hysteresis -under cleaning status	(The interval between the last opening and closing and the next opening)
	Relay 2	Status	On
			Off
		High/Low Alarm	High Alarm
			Low Alarm
			Clean
		Limit Value -under cleaning status	(Continuous opening time)
		Hysteresis -under cleaning status	(The interval between the last opening and closing and the next opening)
	Relay 3	Status	On
			Off
		High/Low Alarm	High Alarm
			Low Alarm
			Clean
		Limit Value -under cleaning status	(Continuous opening time)
		Hysteresis -under cleaning status	(The interval between the last opening and closing and the next opening)

Output	Current 1	Channel	Main
			Temperature
		Output Option	4-20mA
			0-20mA
			20-4mA
		Upper Limit	
		Lower Limit	
	Current 2	Channel	Main
			Temperature
		Output Option	4-20mA
			0-20mA
			20-4mA
		Upper Limit	
		Lower Limit	
	RS485	Baud Rate	4800BPS
			9600BPS
			19200BPS
		Parity Check	None
			Odd
			Even
		Stop Bit	1 Bit
			2 Bit
		Network Node	001+
Data Log	Graphic Trend (trend chart)	Interval/point	
		1h/point	
		12h/point	
		24h/point	
	Data Query	year/month/day	
	Interval	7.5s	
		90s	
		180s	
	Data Output		
	Memory information	176932point	
System	Language	Chinese	
		English	
	Date/Time	Year-Month-Day	
		Hour-Minute-Second	
	Display	Display Speed	Low
			Standard
			Medium
			High
		Backlight	Saving
			Bright
	Soft Version	Soft Version	19-1.0
		Password Settings	0000
		Serial Number	
	Factory Default	No	
		Yes	
	Terminal Current Tuning	Current 1 4mA	(The positive and negative ends of the ammeter are connected to the current 1 or current 2 output terminals of the instrument respectively, press 【▼】 key to adjust the current to 4 mA or 20mA ,press 【ENT】 key to confirm.)
		Current 1 20mA	
		Current 2 4mA	
		Current 2 20mA	
	Relay Test	Relay 1	(Select three groups of relays and hear the sound of two switches, the relay is normal.)
		Relay 2	
		Relay 3	

Calibration

Press [MENU] to enter the setting mode and select the calibration

Calibration	Standard Calibration	USA: 7.00, 4.01, 10.01	Automatic identification of standard solution, calibration of midpoint first
		NIST: 6.86, 4.01, 9.18	
		ORP Standard Calibration	235mV （Default）
	Field Calibration	Field Calibration	
		Offset Adjustment	
		Slope Adjustment	

Standard Calibration

Choose the two group：USA: 7.00, 4.01, 10.01& NIST: 6.86, 4.01, 9.18，

After the selection is completed, press the **[MENU]** key to return to the measurement screen and press the **[CAL]** key to enter the standard liquid calibration mode.
When there is no need to modify the standard liquid group, the standard liquid can be calibrated by pressing the **[CAL]** key.
If the machine has been calibrated, press **[CAL]** to view the calibration state, and recalibration is needed. In this state, press **[ENT]** again to enter recalibration.
If the monitor prompts you for a calibration security password, press [▼] or **[▶]**to set the calibration security password and then press **[ENT]** to confirm the calibration security password.

pH Calibration

ORP Calibration

pH calibration: after entering the calibration mode, the instrument display is as follows.
The picture above,
The instrument automatically identifies the standard solution, calibrates the midpoint (example 7.00pH) first, then calibrates 4.01 pH or 10.01 pH.
The corresponding mV value will be displayed on the left side of the screen.
After calibration, deviation and slope will be displayed on the right side of the screen.
If you only need two points to calibrate, then press **[MENU]** to exit.
During the calibration process, when the standard liquid is wrong, the screen will be prompted with **Error**.
Calibration results: glass electrode slope ≥0.90 is qualified, metallic antimony electrode slope ≥0.80 is qualified.

ORP calibration: press **[MENU]** to enter the setting mode, select **ORP** standard liquid calibration, and enter the known value of standard liquid (default: **235mV**).
Press the **[MENU]** key to return to the measurement screen, and press the **[CAL]** key to enter the standard liquid calibration mode.
This setting is omitted if the value does not need to be modified.
Press **[CAL]** to calibrate the standard liquid.
After entering the calibration mode, the instrument will be displayed as the figure above on the right, and the corresponding mV value will be displayed on the left side of the screen.
After calibration, the slope will be displayed on the right side of the screen.
If the machine has been calibrated, press **[CAL]**to view the calibration state, and recalibration is needed. In this state, press **[ENT]** again to enter recalibration.

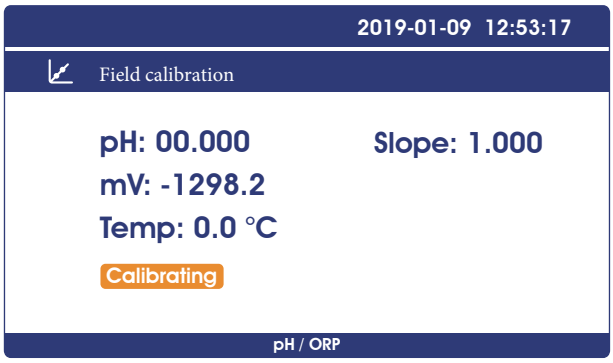
The pH of the buffer is measured at 25 °C.
To calibrate the instrument using the automatic identification buffer, you need a standard pH buffer that matches any of these values Fluid.
Before using automatic calibration, select the correct buffer table (see Buffer Table).
Before the calibration, the electrode can be activated in pH immersion solution to ensure the stability and accuracy of the calibration and monitoring values.

Field calibration

Field Calibration
Select on-site calibration methods:**Field calibration, Offset adjustment, linear adjustment.**

Field Calibration
When the data from laboratory or portable instrument are input into this item, the instrument will automatically correct the data.

Use [▼] [▶] key to input concentration data, press [ENT] key to start calibration, Calibrating icon in calibration is displayed below the value, calibration is completed, after that, the [Done] icon is displayed.
Then press [ESC] to exit.



Offset adjustment
Compare the data of laboratory or portable instrument with the data of instrument measurement, if there are errors, the error data can be modified by this function.

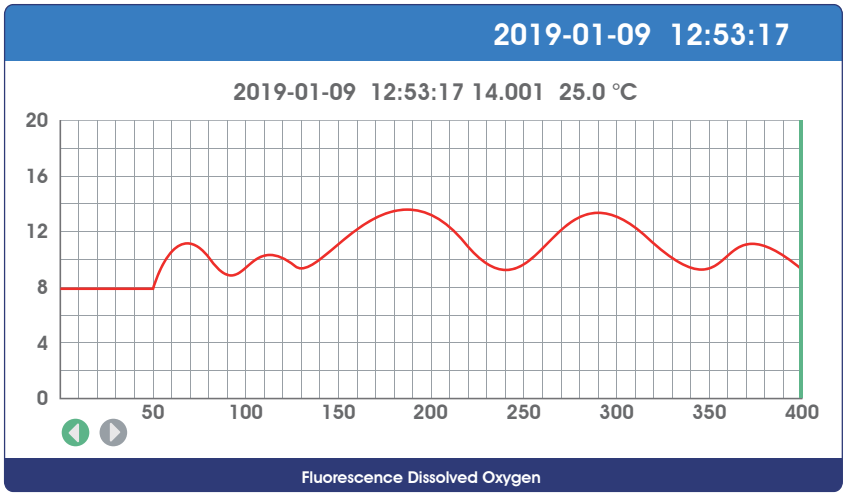
Linear adjustment
Linear values after "field calibration" are stored in this item, with factory data of 1.00.

Graphic Trend(Trend Chart)

Press【Menu】key to enter the setting mode,set the recording interval, and the instrument will

Data Log	Curve query (trend chart)	Interval/point	400 points per screen,displays the most recent data trend graph according to interval Settings
		1h/point	400 points per screen, display trend chart of the last 16 days of data
		12h/point	400 points per screen, display trend chart of the last 200 days of data
		24h/point	400 points per screen, display trend chart of the last 400 days of data
	Data Query	year/month/day	Year/month/day time: minute: second value unit
	Interval	7.5s	Store data every 7.5 seconds
		90s	Store data every 90 seconds
		180s	Store data every 180 seconds

Press the **[MENU]** button returns to the measurement screen. Press the **[▶/TREND]** button in the measurement mode to view the trend chart of the saved data directly. There are 480 sets of data record per screen, and the interval time of each record can be selected [7.5s, 90s, 180s], corresponding to the data displayed in [1h, 12h, 24h] per screen.



In the current mode, press the **[ENT]** key to move the data display line to the left and right (green), and display the data in left and right circles.Long pressing of the **[ENT]** key can accelerates displacement. (When the bottom icon is green, **[ENT]** key is displacement direction,press **[▶/TREND]** key to switch the direction of displacement)

MODBUS RTU General Information

Overview

The hardware version number of this document is V2.0; the software version number is V5.9 and above. This document describes the MODBUS RTU interface in details and the target object is a software programmer.

MODBUS command structure

Data format description in this document;
Binary display, suffix B, for example: 10001B
- decimal display, without any prefix or suffix, for example: 256
Hexadecimal display, prefix 0x, for example: 0x2A
ASCII character or ASCII string display, for example: "YL0114010022"

Command Structure
The MODBUS application protocol defines the Simple Protocol Data Unit (PDU), which is independent of the underlying communication layer.

Figure 1: MODBUS Protocol Data Unit

MODBUS protocol mapping on a specific bus or network introduces additional fields of protocol data units. The client that initiates the MODBUS exchange creates the MODBUS PDU, and then adds the domain to establish the correct communication PDU.

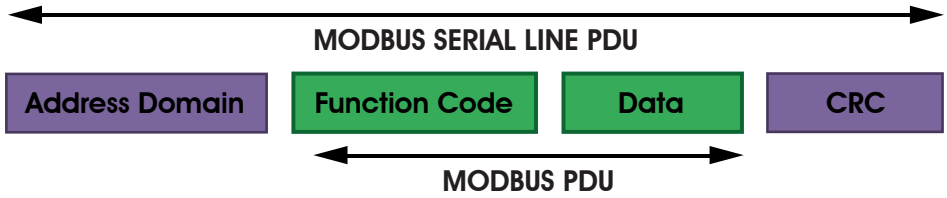


Figure 2: MODBUS architecture for serial communication

On the MODBUS serial line, the address domain contains only the slave instrument address. Tips:
The device address range is 1...247
Set the device address of the slave in the address field of the request frame sent by the host.
When the slave instrument responds, it places its instrument address in the address area of the response frame so that the master station knows which slave is responding.
Function codes indicate the type of operation performed by the server.
CRC domain is the result of the " redundancy check" calculation, which is executed according to the information content.

MODBUS RTU Transmission Mode

When the instrument uses RTU (Remote Terminal Unit) mode for MODBUS serial communication, each 8-bit byte of information contains two 4-bit hexadecimal characters. The main advantages of this mode are greater character density and better data throughput than the ASCII mode with the same baud rate. Each message must be transmitted as a continuous string.

The format of each byte in RTU mode (11 bits):
Coding system: 8-bit binary
Each 8-bit byte in a message contains two 4-bit hexadecimal characters (0-9, A-F)
Bits in each byte: 1 starting bit
8 data bits, the first minimum valid bits without parity check bits
2 stop bits
Baud rate: 9600 BPS
How characters are transmitted serially:
Each character or byte is sent in this order (from left to right) the least significant bit (LSB)... Maximum Significant Bit (MSB)

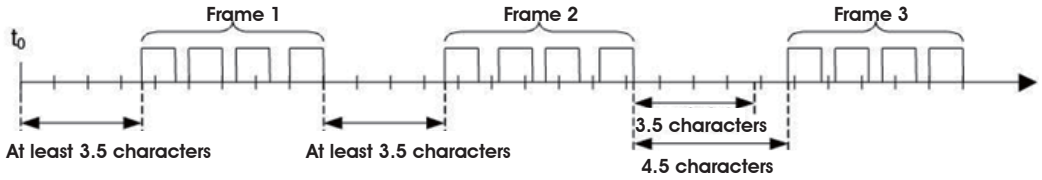
Start bit	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Stop bit**	**Stop bit**

Figure 3: RTU pattern bit sequence
Check Domain Structure: Cyclic Redundancy Check (CRC16)
Structure description:

Slave Instrument	Function Code	Data	CRC	
Address	1 byte	0…252 byte	2 byte	
			CRC Low byte	CRCHigh byte

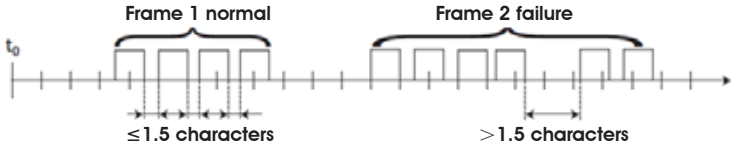
Figure 4: RTU information structure

The maximum frame size of MODBUS is 256 bytes
MODBUS RTU Information Frame
In RTU mode, message frames are distinguished by idle intervals of at least 3.5 character times, which are called t3.5 in subsequent sections.



Starting	Address	Function code	Data	CRC check	End
≥3.5 characters	8 bit	8 bit	Nx8 bit	16 bit	≥3.5 characters

Figure 5: RTU message frame
The entire message frame must be sent in a continuous character stream.
When the pause time interval between two characters exceeds 1.5 characters, the information frame is considered incomplete and the receiver does not receive the information frame.



MODBUS RTU CRC Check
The RTU mode contains an error-detection domain based on a cyclic redundancy check (CRC) algorithm that performs on all message contents. The CRC domain checks the contents of the entire message and performs this check regardless of whether the message has a random parity check. The CRC domain contains a 16-bit value consisting of two 8-bit bytes. CRC16 check is adopted..Low bytes precede, high bytes precede.

Implementation of MODBUS RTU in Instrument

According to the official MODBUS definition, the command starts with a 3.5 character interval triggering command, and the end of the command is also represented by a 3.5 character interval. The device address and MODBUS function code have 8 bits. The data string contains n*8 bits, and the data string contains the starting address of the register and the number of read/write registers. CRC check is 16 bits.

Value	Start	Device address	Function	Data	Summary Check		End
	No signal bytes during 3.5 characters	1-247 1	Function codes conforming to MODBUS specification	Data conforming to MODBUS specification	CRCL	CRCL	No signal bytes during 3.5 characters
Byte	3.5		1	n	1	1	3.5

Figure 7: MODBUS definition of data transmission

Instrument MODBUS RTU function code
The instrument only uses two MODBUS function codes:
0x03: Read-and-hold register
0x10: Write multiple registers

MODBUS Function Code 0x03: Read-and-hold Register
This function code is used to read the continuous block content of the holding register of the remote device. Request the PDU to specify the start register address and the number of registers. Address registers from zero. Therefore, the addressing register 1-16 is 0-15. The register data in the response information is packaged in two bytes per register. For each register, the first byte contains high bits and the second byte contains low bits.

Request

Function code	1 byte	0x03
Start Address	2 byte	0x0000….0xfffff
Read register number	2 byte	1…125

Figure 8: Read-and-hold register request frame

Response

Function code	1 byte	0x03
number of bytes	1 byte	N×2
Register values	N×2 byte	

N = Register number
Figure 9: Read-and-hold register response frame

The following illustrates the request frame and response frame with the read and hold register 108-110 as an example. (The contents of register 108 are read-only, with two byte values of 0X022B, and the contents of register 109-110 are 0X0000 and 0X0064)

Request Frame		Response Frame	
Number Systems	(Hexadecimal)	Number Systems	(Hexadecimal)
Function code	0x03	Function code	0x03
Start address (high byte)	0x00	Byte count	0x06
Start address (low byte)	0x6B	Register Value (High Bytes) (108)	0x02
Number of Read Registers (High Bytes)	0x00	Register Value (Low Bytes)(108)	0x2B
Number of Read Registers (Low Bytes)	0x03	Register Value (High Bytes) (109)	0x00
		Register Value (Low Bytes) (109)	0x00
		Register Value (High Bytes)(110)	0x00
		Register Value (Low Bytes) (110)	0x64

Figure 10: Examples of read and hold register request and response frames

MODBUS function code 0x10: write multiple registers

This function code is used to write continuous registers to remote devices (1... 123 registers) block that specifies the value of the registers written in the request data frame. Data is packaged in two bytes per register. Response frame return function code, start address and number of registers written.

Request

Function code	1 byte	0x10
Start Address	2 byte	2 byte
Number of input registers	2 byte	2 byte
number of bytes	1 byte	1 byte
Register values	N×2 byte	N×2 byte

N = Register number

Figure11:Write multiple register request frames

Response

Function code	1 byte	0x10
Start Address	2 byte	0x0000....0xffff
Register number	2 byte	1...123(0x7B)

N = Register number

Figure 12: write multiple register response frames

The request frame and response frame are illustrated below in two registers that write the values 0x000A and 0x0102 to the start address of 2.

Request Frame	(Hexadecimal)	Response Frame	(Hexadecimal)
Number Systems	0x10	Number Systems	0x10
Function code	0x00	Function code	0x00
Start address (high byte)	0x01	Start address (high byte)	0x01
Start address (low byte)	0x00	Start address (low byte)	0x00
Input register number (high bytes)	0x02	Input register number (high bytes)	0x02
Input register number (low bytes)	0x04	Input register number (low bytes)	
number of bytes	0x00		
Register value (high byte)	0x0A		
Register value (low byte)	0x01		
Register value (high byte)	0x02		
Register value (low byte)			

Figure 13: Examples of writing multiple register request and response frames

Data format in instrument

Overview

Floating Point
Definition: Floating point, conforming to IEEE 754 (single precision)

Description	Symbol	Index	Mantissa	SUM
Bit	3	30…23	22…0	22…0
Index Deviation	127			

Figure 14: floating point single-precision definition (4 bytes, 2 MODBUS registers)
Example: Compile decimal 17.625 to binary

Step 1: Converting 17.625 in decimal form to a floating-point number in binary form, first finding the binary representation of the integer part
17decimal= 16 + 1 = $1\times2^4 + 0\times2^3 + 0\times2^2 + 0\times2^1 + 1\times2^0$
The binary representation of integer part 17 is 10001B
then the binary representation of decimal part is obtained
0.625= 0.5 + 0.125 = $1\times2^{-1} + 0\times2^{-2} + 1\times2^{-3}$
The binary representation of decimal part 0.625 is 0.101B.
So the binary floating point number of 17.625 in decimal form is 10001.101B

Step 2: Shift to find the exponent.
Move 10001.101B to the left until there is only one decimal point, resulting in 1.0001101B, and 10001.101B = 1.0001101 B× 24 . So the exponential part is 4, plus 127, it becomes 131, and its binary representation is 10000011B.

Step 3: Calculate the tail number
After removing 1 before the decimal point of 1.0001101B, the final number is 0001101B (because before the decimal point must be 1, so IEEE stipulates that only the decimal point behind can be recorded). For the important explanation of 23-bit mantissa, the first (i.e. hidden bit) is not compiled. Hidden bits are bits on the left side of the separator, which are usually set to 1 and suppressed.

Step 4: Symbol bit definition
The sign bit of positive number is 0, and the sign bit of negative number is 1, so the sign bit of 17.625 is 0.

Step 5: Convert to floating point number
1 bit symbol + 8 bit index + 23-bit mantissa
0 10000011 00011010000000000000000B (the hexadecimal system is shown as
0 x418d0000)

Reference code:
1. If the compiler used by the user has a library function that implements this function, the library function can be called directly, for example, using
C language, then you can directly call the C library function memcpy to obtain an integer representation of the floating-point storage format in memory.
For example: float floatdata; // converted floating point number
void* outdata; memcpy(outdata,&floatdata,4);
Suppose floatdata = 17.625
If it is a small-end storage mode, after executing the above statement,
the data stored in the address unit outdata is 0x00.
Outdata + 1 stores data as 0x00
address unit (outdata + 2) stores data as 0x8D
address unit (outdata + 3) stores data as 0x41

If it is large-end storage mode, after executing the above statement,
the data stored in outdata of address unit is 0x41
Outdata + 1 stores data as 0x8D
address unit (outdata + 2) stores data as 0x00
address unit (outdata + 3) stores data as 0x00

2. If the compiler used by the user does not implement the library function of this function, the following functions can be used to achieve this function:

```
void memcpy(void *dest,void *src,int n)
{
char *pd = (char *)dest; char *ps = (char *)src;
for(int i=0;i<n;i++) *pd++ = *ps++;
}
```

And then make a call to the above memcpy(outdata,&floatdata,4);

Example: Compile binary floating-point number 0100 0010 0111 1011 0110 0110 0110 10B to decimal number
Step 1: Divide the binary floating-point number 0100 0010 0111 1011 0110 0110 0110B into symbol bit, exponential bit and mantissa bit.
0 10000100 11110110110011001100110B
1-bit sign + 8-bit index + 23-bit tail sign bit S: 0 denotes positive number
Index position E: $10000100B = 1\times2^7+0\times2^6+0\times2^5+0\times2^4+0\times2^3+1\times2^2+0\times2^1+0\times2^0$
$=128+0+0+0+0+4+0+0=132$
Mantissa bits M: $11110110110011001100110B = 8087142$

Step 2: Calculate the decimal number
$D = (-1)\times(1.0 + M/2^{23})\times2^{-127}$
$= (-1)^0\times(1.0 + 8087142/2^{23})\times2^{132-127}$
$= 1\times1.964062452316284\times32$
$= 62.85$

Reference Code:

```
float floatTOdecimal(long int byte0, long int byte1, long int byte2, long int byte3)
{ long int realbyte0,realbyte1,realbyte2,realbyte3; char S;
long int  E,M;

float D;
realbyte0 = byte3; realbyte1 = byte2; realbyte2 = byte1; realbyte3 = byte0;

if((realbyte0&0x80)==0)
{ S = 0;//positive number }
else { S = 1;//negative number }
E = ((realbyte0<<1)|(realbyte1&0x80)>>7)-127;
M = ((realbyte1&0x7f) << 16) | (realbyte2<< 8)| realbyte3;
D = pow(-1,S)*(1.0 + M/pow(2,23))* pow(2,E);

return D; }
```

Function description: parameters byte0, byte1, byte2, byte3 represent 4 bytes of binary floating point number (
The decimal number converted from the return value
For example, the user sends the command to get the temperature value and dissolved oxygen value to the probe. The4 bytes representing the temperature value in the received response frame are 0x00, 0x00, 0x8d and 0x41. Then the user can get the decimal number of the corresponding temperature value through the following call statement.
That is temperature = 17.625.

```
float temperature = floatTOdecimal( 0x00, 0x00, 0x8d, 0x41)
```

Read instruction mode

The communication protocol adopts MODBUS (RTU) protocol. The content and address of the communication can be changed according to the needs of customers.
The default configuration is network address 01, baud rate 9600, even check, one stop bit, users can set their own changes;

Function code 0x04: This function enables the host to obtain real-time measurements from slaves, which are specified as single-precision floating-point type (i.e. occupying two consecutive register addresses), and to mark the corresponding parameters with different register addresses.

Communication address is as follows:
0000-0001: Temperature value
0002-0003: Main Measured Value
0004-0005: Temperature and Voltage Value
0006-0007: Main Voltage Value

Communication examples:
Examples of function code 04 instructions:
Communication address = 1, temperature = 20.0, ion value = 10.0, temperature voltage = 100.0, ion voltage = 200.0

Host Send: 01 04 00 00 08 F1 CC
Slave Response: 01 04 10 00 41 A0 00 41 20 00 42 C8 00 43 48 81 E

Note:
[01] Represents the instrument communication address;
[04] Represents function code 04;
[10] represents 10H (16) byte data;
[00 00 00 41 A0] = 20.0; / temperature value
[00 00 4120]= 10.0; // Main Measured Value
[00 00 42 C8] = 100.0; / / Temperature and Voltage Value
[00 00 43 48] = 200.0; / / Main measured voltage value
[81 E8] represents CRC16 check code;

pH buffer & Temperature value

Temp (°C)	pH4.01	pH6.86	pH9.18	pH4.00	pH7.00	pH10.01
0	4.01	6.98	9.47	4.01	7.12	10.32
5	4.01	6.95	9.38	4.00	7.09	10.25
10	4.00	6.92	9.32	4.00	7.06	10.18
15	4.00	6.90	9.27	4.00	7.04	10.12
20	4.00	6.88	9.22	4.00	7.02	10.06
25	4.01	6.86	9.18	4.00	7.00	10.01
30	4.01	6.85	9.14	4.01	6.99	9.97
35	4.02	6.84	9.10	4.02	6.98	9.93
40	4.03	6.84	9.07	4.03	6.97	9.89
45	4.04	6.83	9.04	4.04	6.97	9.86
50	4.06	6.83	9.01	4.06	6.97	9.83
55	4.08	6.83	8.99	4.07	6.97	9.81
60	4.10	6.84	8.96	4.09	6.98	9.79
70	4.12	6.85	8.92	4.12	6.99	9.76
80	4.16	6.86	8.89	4.16	7.00	9.74
90	4.20	6.88	8.85	4.20	7.02	9.73

Daily maintenance

The instrument generally does not need daily maintenance. In case of failure, you can contact our company for adjustment under the guidance of our technical personnel (you can send back to our company for help or calibration).
Simple calibration method: set the parameter zero offset to 0.0mV and the slope to 1.00, then short-circuit the "Input" and "Ref "terminals of the instrument, and the instrument should display 7.000 or within the error range;
If the display does not indicate that the instrument is out of order, please contact the manufacturer for repair.

FAQ

1.LCD display is not bright
Possible causes:Instrument or LCD Screen power supply failure.
Solutions:Check whether the power supply is connected or not, and check whether the power supply wire of the sensor is connected in the wrong direction.

2.No current output
Possible causes:It could be a fault in the current module or a wiring fault.
Solutions:Please check that the current output wiring is correct. Please refer to the wiring terminal diagram in the instructions.

3.The output current of the transmitter does not match the display current.
Possible causes:Current output may not be correctly calibrated.
Solutions:Please re-calibrate the 20mA output.

4.The instrument shows"???"
Possible causes:The transmitter and sensor are not communicating properly.
Solutions:Check that the sensor signal cable is correct. Please refer to the wiring diagram in the manual.

5.Measurement shows the result as full scale SLOP.
Possible causes:May be sensor was contaminated, damaged or measured value exceeds measurement range.
Solutions:After cleaning the sensor, put it in a medium with low concentration to observe whether the meter works normally. If the meter works normally, the concentration of the measured medium may exceed the range.

6.Measurements display results fluctuate greatly.
Possible causes:Sensor wiring error or low display rate setting.
Solutions:Check wiring or increase display rate appropriately.

Package Set

Product Description	Quantity
1) T6500 Online pH/ORP Meter	1
2) Instrument Installation Accessories	1
3) Operating Manual	1
4) Qualification Certificate	1

Note: Please check the complete set of instruments before use.
The company's other series of analytical instruments, please login to our website for enquiries.

Warranty

Our company guarantees that there will be no significant deviation in material and process of this product within one year from the date of purchase.

During the warranty period, if necessary repair is not caused by improper use or misoperation, please pay the transportation fee to return the instrument, and we will repair it free of charge.

Our customer service department will confirm whether the product problem is caused by the deviation of the product itself or the improper use of the customer.

Product repair beyond the warranty period will be on the basis of replacement.

A fixed fee will be charged.

The above warranties are our only valid warranties and supersede all other warranties, express or implied, including any implied, unrestricted warranties of merchantability or fitness for a particular purpose.

We shall not be responsible for any loss, compensation, expense or damage caused by the negligence or other ACTS of the buyer or any third party.

In no event shall our liability, whatever the cause of action, exceed the cost of the product in question, whether based on contract, warranty, indemnity or infringement (including negligence).

Product repair for any reason must be submitted in the form of repair card (RIR) and approved by our customer Service department before returning.

When applying for repair approval, the name, quantity and reason of the repaired goods must be clearly stated. The repaired goods must be carefully packed to avoid damage in transit and insured. We are not responsible for any damage caused by poor packing.

When the product is repaired, the original packaging of the instrument should be used; otherwise, it should be wrapped in bubble bag and then wrapped in corrugated paper box, preferably with a brief explanation of the fault to facilitate the customer service department to repair the product.

Notes

Distinguished users, please pay attention to the following points when using the instrument, in order to ensure the life and accuracy of the instrument.

1. Careful handling to avoid collision and falling instruments in use.

2. Avoid contact with water or other liquids during use.

3. Don't put the instrument in the sunshine for a long time. After use, it should be stored in a cool, dry and ventilated place.

4. If you don't use the instrument for a long time, you should unplug the power supply to avoid accidents.

5. This instrument is not suitable for use in harsh environment, high temperature, low temperature or strong magnetic field interference,which may lead to instrument damage.

6. If there is any problem with the instrument, please contact the dealer or the company.
Do not disassemble the instrument by yourself. If disassembled, the company will no longer be responsible for the warranty.

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