

# FCL3500 Free Chlorine Controller / Transmitter

Operating Manual



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If the electrode is unresponsive or slightly contaminated, clean the electrode measurement site as follows:

pollutant	abluent
Inorganic metal oxides	Less than 1 mol/L of dilute acid
Organic oils and oils	Sparse detergent (weak alkaline)
Resin polymer material	Alcohol, acetic ether, and acetone
Protein snowball precipitate	5% pepsin + 0.1 mol/L HCL solution
Paint substances	Sparse bleach, hydrogen peroxide

#### XIV、Corresponding values of the different temperatures of the pH buffer

temperatur	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

calibrates the first point;

④ Remove and clean the electrodes (they can be washed with the second standard liquid), put the electrodes into the second standard liquid, and stir them gently, wait for the pH value to stabilize, and use the operating instrument to calibrate the second point;

⑤ When the second point of the pH instrument is calibrated, remove and clean the electrode (with distilled water) and absorb water droplets from the electrode-sensitive membrane with an absorbent tissue. After the calibration, the pH electrodes can be used normally.

The electrode calibration period depends on the frequency of the electrode usage and the measured media. For measurements with general accuracy, weeks or more after one calibration.

### 3. preserve

Keep the residual chlorine and pH electrode sensitive film moist at all times, save the electrode in the electrode protective cap equipped with 3 mol solution, and prohibit to use deionized water, distilled water, pure water and so on. Electrodes are not used for a long time as recommended in the dry shade.

### 4. The electrode aging

Waste chlorine and pH electrodes will age with the number of use, as a result, the electrode reaction is slow and the slope will gradually become smaller. In addition, the wrong preservation, specific media will shorten the electrode service life. We do not have a warranty for electrode failure or mechanical damage due to the testing media.

### 5. Wash

## I、 To inform the user

Thank you for supporting your company. Please read the instructions in detail to help you use our products correctly.

## II、 Product inspection

Carefully open the package, check the instrument for damage and complete accessories, if any abnormality, please contact the dealer or the company immediately.

In any event shall the instrument be removed by itself, and the Company is no longer responsible for the warranty.

## III、 Instrument, introduction

- 128 \* 64 dot-matrix LCD display, switchable in Chinese and English, IP65 protection level, all-weather stable operation
- simple menu design, simple and convenient operation, graphical prompt, beautiful and clear interface
- software digital filtering is adjustable, with enhanced hardware resistance to interference, making measurements more stable and adapted to complex industrial environments
- global access power supply 85~260VAC, but also customized DC model 18 to 36 V D C
- RS-485 digital interface, MODBUS - RTU communication protocol, read and write two-way communication, can achieve remote complete control of the instrument
- The residual chlorine and pH two parameters were measured simultaneously, and the compensation was calculated automatically

## IV、technical parameter

residual chlorine	measuring range	0.00~20mg/L.00
	resolution ratio	0.01 mg/L
hypochloric acid	Measurement accuracy (electronic unit)	±0.10 mg/L
pH value	measuring range	0.00~14.00 pH
	resolution ratio	0.01 pH
	Measurement accuracy (electronic unit)	±0.01 pH
	input impedance	≥10 <sup>12</sup> Ω
temperature	measuring range	-10.0~130.0°C
	resolution ratio	0.1°C
	certainty of measurement	±0.3°C
	Temperature input	PT1000
	temperature compensation	Automatic / manual
Transfer current	Output, type	Two roads of 4~20 mA (the corresponding range can be set)
	Current accuracy	±1% F.S
	output loading	less-than 500Ω
control	Functional relay	One (which can be set to the cleaning or alarm function)
	Switch relay	2 SPST relays
	load capacity	2.5A 230VAC
data transmission	Interface Circuit	All-way RS485 isolation voltage is 2500Vrms
	protocol	MODBUS - RTU (read-write two-way communication)
Other parameters	working power supply	85~260VAC or 18~36VDC (optional before order)
	working temperature	0~60°C
	Work humidity	Relative humidity was <90%
	levels of protection	IP65
	way to install	Panel mount
	outline dimension	(H×W×D) 108×108×132 mm
	Open hole size	92.5 * 92.5 mm (positive tolerance)

## XIII、 Use and maintenance of pH electrodes

### 1. dead work

① Electrodes shall be damaged, clean and clean before normal use.

② Remove the electrode front protective cap and rinse the electrode with distilled water.

③ Suction the water droplets on the pH electrode sensitive membrane with water absorption paper towel, do not wipe the electrode with paper tissue to avoid electrostatic interference.

④ The electrodes were immersed in a neutral standard solution for about 10 min.

⑤ Calibrate and measurement according to the instrument manual.

Note: If the electrode-sensitive membrane dries out, soak the electrode in a neutral standard solution, preferably in a 3M KCL solution for 24 hours. During electrode transport and storage, a small amount of KCL will overflow the electrode protective cap to form white crystals that can be washed directly with water.

### 2. calibration

① Ensure that the standard fluid is at the same temperature as the sample. A temperature compensation setting is recommended if not at the same temperature;

② Ph electrodes are generally calibrated in two points, two standard fluids, according to the common measurement range is selected as follows:

Acid medium environment: pH4.01 and pH7.00 (USA); pH4.01 and pH6.86 (NIST)

Alkaline medium environment: pH10.01 and pH7.00 (USA); pH9.18 and pH6.86 (NIST)

③ Put the electrode into the first standard liquid (pH7.00 or pH6.86) and gently stir it until the pH value is stable and the operating instrument

#### 4. Daily maintenance of the electrodes

Electrodes should be cleaned regularly and recommended once a week. Flush the platinum detection end of the electrode with clear water, and then wipe the platinum ring of the electrode bright with a soft paper towel.

#### 5. technical parameter

Measuring range: 0-20mg / L

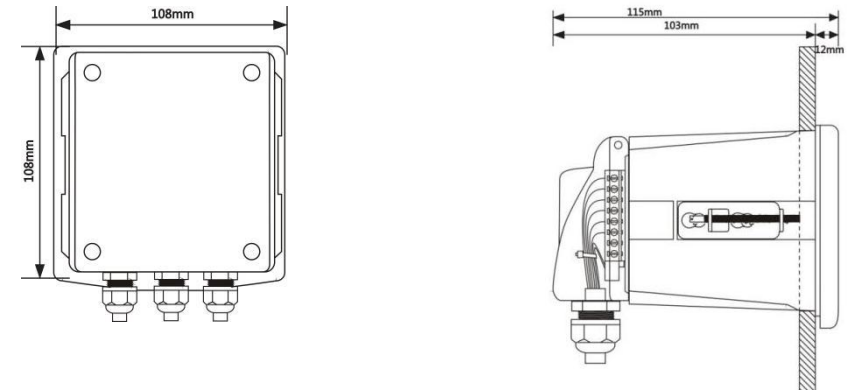
Measurement accuracy:  $\pm 5\%$ F.S

Allow to use the temperature range: 0-50° C

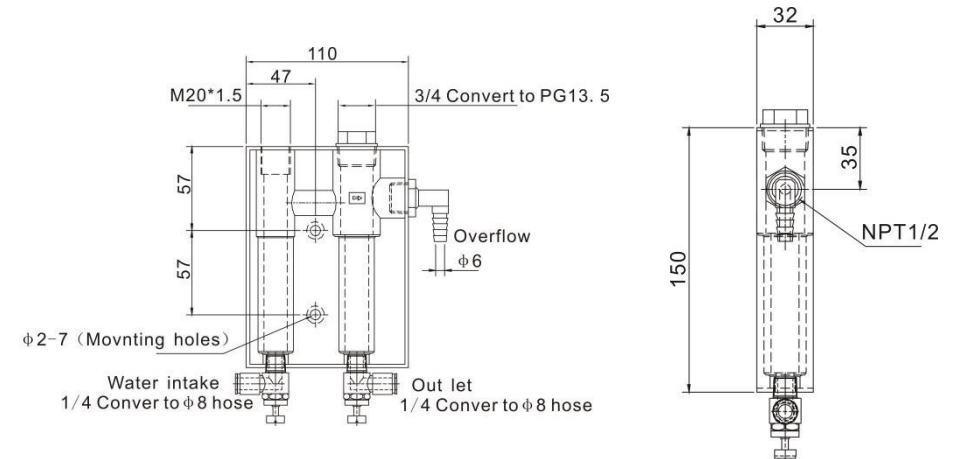
Temperature sensor type: PT1000

Flow speed demand: 20-40L / h

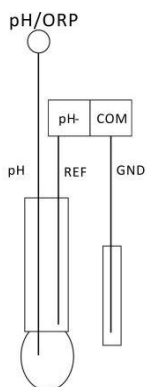
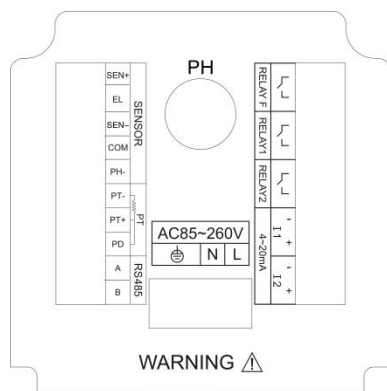
### V、 Installation mode of instrument and circulation tank



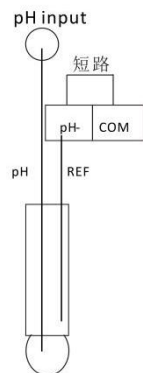
1. Install the opening size 92.5×92.5mm (positive tolerance)
2. It is recommended to use 0.5 to 1 square wire, through the middle waterproof harness head, with a certain length margin.



## VI、 Terminal label



pH symmetric input method



The pH asymmetric input method

## Use and maintenance of the residual chlorine electrodes

### 1. measuring principle

This product is a constant voltage type pole spectrum sensor consisting of a platinum electrode with a reference electrode and a micro-cell measurement system with a polarization electrode. A stable potential potential is maintained at the polarized electrode extreme, where different measured components produce different, linear well-behaved current strengths at the measured platinum electrode.

### 2. dead work

- ① Electrodes shall be damaged, clean and clean before normal use.
- ② Connecting connecting electrodes, the residual chlorine electrode is greatly affected by flow speed and flow rate and needs to work in the circulation channel environment.
- ③ Remove the electrode front protective cap and rinse the electrode with distilled water.
- ④ Wipe the platinum ring of the electrode bright with a soft paper towel, to ensure the sensitivity of the electrode, and do not wipe the rest, so as to avoid electrostatic interference.
- ⑤ Soak the electrodes in clean water for approximately 10 minutes to ensure the liquid junction conduction.
- ⑥ Calibrate and measurement according to the instrument manual.

Note: If the electrode-sensitive membrane dries out, soak the electrode in a neutral standard solution, preferably in a 3M KCL solution for 24 hours. During electrode transport and storage, a small amount of KCL will overflow the electrode protective cap to form white crystals that can be washed directly with water.


### 3. Calibration of electrodes

The electrode needs to be calibrated when used as compared with the DPD colorimetric method to ensure the accuracy and effect of the measurement.



## 10. Unit code table






unit	Code hexagon	Code decimal	unit	Code hexagon	Code decimal
mV	0x00	0	ug/L	0x0D	13
nA	0x01	1	mg/L	0x0E	14
uA	0x02	2	g/L	0x0F	15
mA	0x03	3	ppb	0x10	16
Ω	0x04	4	ppm	0x11	17
KΩ	0x05	5	ppt	0x12	18
MΩ	0x06	6	%	0x13	19
uS/cm	0x07	7	mbar	0x14	20
mS/cm	0x08	8	bar	0x15	21
S/cm	0x09	9	mmHg	0x16	22
pH	0x0A	10			
°C	0x0B	11			
°F	0x0C	12			

binding post	function	binding post	function
pH	The pH + or BNC interface	RELAYF	Functional Relay (cleaning / alarm)
SEN+	The residual chlorine electrode is positive	RELAY1	electric relay 1
EL	polarized electrode	RELAY2	electric relay 2
SEN-	reference electrode	I1-	4~20mA output channel 1, negative end
COM	Signal common, short-connected to pH- upon asymmetric input	I1+	4~20mA output channel 1, positive end
pH-	Parameter electrode by symmetric input method, short connection to COM for asymmetric input (wiring diagram)	I2-	4~The 20mA output channel 2, at the negative end
PT-	PT1000 negative terminal	I2+	4~20mA output channel 2, positive end
PT+	PT1000 positive terminal		Power grounding line
PD	PT1000 drive	N	Power zero line
A	RS-485 Communication T / R +	L	Power line
B	RS-485 Communication T / R-		

Note: 1. This wiring diagram is illustrated with 220V AC, if the 24V DC, the instrument power supply tag is customized by the user.

3. The conventional electrode wiring method adopts asymmetric input method, and in case of strong interference.

## VII、 Key instructions

key	Key function description
	<p>Press this key in measurement mode to enter browse mode to browse the measurement related values</p> <p>Browse to continue in browse mode until measurement mode</p> <p>Press this key in another mode to return the key</p>
	<p>Press this key in the measurement mode to enter the calibration mode</p> <p>Press this button to move the option up when the menu interface has the ▲ symbol</p> <p>This key is the value up key</p>
	<p>Press this key in measurement mode to enter the Settings menu</p> <p>Press this button to move down the option when the menu interface has the ▼ symbol</p> <p>This key is the value is set</p>
	<p>In measurement mode, this key enters the information mode and continue to view the set parameters and instrument information</p> <p>Press this ► button to switch with symbols on the menu interface to the next menu</p> <p>This key is used as the numerical shift key when the value is set</p>
	<p>Press this key to display the device status area in the measurement mode to switch between relay and current states.</p> <p>Press this key in browsing mode to lock the current browsing interface (prevent the browsing timeout from returning the measurement automatically)</p> <p>Press this key for confirmation in another mode</p>

## 9. Communication parameter setting

The contents in the instrument setting menu can be set through the communication function, they are located in the holding register group and the control transmission register group, the holding register group can be written with 0x06 function code, the control transmission register group can be written with 0x10 function code, and can refer to the corresponding subsection.

When setting these parameters, the instrument should be in the menu state of the setting mode. Therefore, in the measurement mode, the calibration mode code 0x0050 is first written to the working mode register (address 64) to enable the instrument to enter the setting mode.

If the password is not set (0000), the instrument goes directly to the Settings menu (Work event register (address 66) value is 1)

If the password is set (not 0000), the instrument displays the password data interface (working event register (address 66) value is 0). The password can be written in the working mode parameter register (address 65), and the password is correct to enter the setting menu.

Set the menu interface to write the following values to the working mode parameter register (address 65)

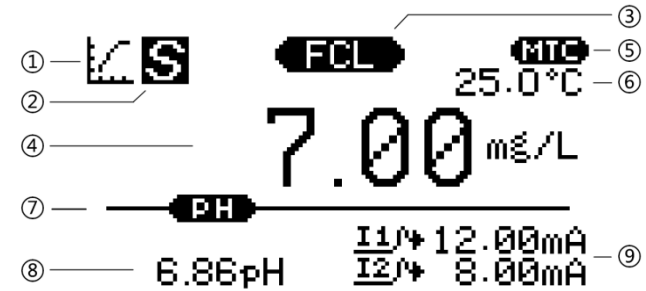
0x7FFF: The instrument resumes the factory operation

0x7FFE: The instrument performs the restart operation

successful, the binary bit corresponding to the calibration case register (address 20) is set one.

Calibration should follow the rules of the midpoint first, midpoint calibration is successful, before the acid or alkaline point can be adjusted, otherwise the wrong calibration order will be indicated.

To clear the pH calibration data, write a value of 0x7FFF in the pH calibration case register.



### measurement pattern

Start the measurement mode, showing the main measurement parameters and instrument status. The interface shows the figure below.

- ① Working mode indication, measurement mode.
- ② The main measurement stability symbol that indicates that the main measurement is stable.
- ③ Parameter 1 Measurement value type.FCL: residual chlorine.HCLO: hypochlorite ic acid.
- ④ Parameter 1 measurement value display area. If OVER indicates the upper limit, UNDER indicates the upper limit.
- ⑤ Temperature measurement value type.MTC: Manual temperature compensation.ATC: Automatic temperature compensation.
- ⑥ Temperature measurement value display area. If OVER indicates the upper limit, UNDER indicates the upper limit.
- ⑦ Parameter 2 Measurement value type.pH: pH value.
- ⑧ Parameter 2 measurement value display area. If OVER indicates the upper limit, UNDER indicates the upper limit.
- ⑨ In the instrument equipment status area, press ENT to switch between the display relay status and the display transmission current value.

RLF: functional relay status, ON: closed.OFF: break.

RL1: Relay 1 status, ON: closed.OFF: break.

RL2: Relay 1 status, ON: closed.OFF: break.

I1: The output current value of the transmission current channel 1.

I2: The output current value of the transmission current channel 2.

## VIII、Browse mode



In the measurement mode, the keys enter the browsing mode. If there are multiple browsing pages, continue to browse in turn until the measurement mode is returned. The browsing mode mainly displays the electrode signal and the calibration situation and other parameters, as a supplement to the main display interface. One-minute no-button operation will automatically return to the measurement mode. If it needs a long time to view, you can lock the current interface, and then the key can exit the lock. The interface is shown



- ① Working mode indicates, Browse mode.
- ② The main display area measures the stability symbol, indicating that the main display area value is stable.
- ③ Interface lock symbol, press ENT key in browsing mode to lock the current interface, to prevent the automatic return of measurement mode without operation.
- ④ Measurement value type in the main display area. HCLO: hypochlorite ic acid. FCL: residual chlorine. PH: pH value.
- ⑤ Main display area measurements. If OVER indicates the upper limit, UNDER indicates the upper limit.
- ⑥ Secondary display area measurement type. SEN: The electrode signal.

pour: The residual chlorine electrode signal is shown here for the main display area type of FCL or HCLO.

- 0x0000: Calibrated successfully (calibration menu returned)
- 0x0001: Calibration (you can read the calibration status register later)
- 0x0002: Wrong buffer (returned to calibration menu)
- 0x0003: Calibration measurement signal stabilized for long time (180 seconds) (calibration menu returned)
- 0x0004: Electrode slope or zero-point offset out of range (Calibration menu returned)

0x0005: Wrong calibration order (calibration menu returned)

If the calibration is successful, repeat steps 2 and 3 to continue to calibrate the other points. Other errors were recalibrated by prompting for excluding errors. To return to the measurement mode, it is available at Write the measurement mode code 0x0010 in the working mode register (address 64). The electrode calibration, electrode zero point offset and slope can be viewed in the holding register group at any time.

### ② Standard liquid code for residual chlorine

When calibrating the slope point, the standard liquid code is 100 times the standard liquid concentration value, for example, one with a concentration of 5.00 mg/L, with the code 500 (0x01F4).

For zero-point calibration, the standard liquid code is 1 (0x0001) (binary bit BIT0).

Calibration follows the rule of first calibration slope, and the electrode calibration case register (address 25) is 0x0002 (binary BIT1 is positioned). After continuing successfully calibrated zero, the electrode calibration case register is 0x0003 (binary BIT0 is also placed).

To clear the calibration data, write to the standard fluid code 0x7FFF.

### ③ Acidity buffer code

Acid Point 4.00 / 4 Code 2 (0x0002) (binary BIT1)

Neutral Point 6.86 / 7 Code of 4 (0x0004) (Binary BIT2)

Alkaline Point 9.18 / 10 code of 8 (0x0008) (Binary bit BIT3)

It can be seen that the pH buffer code and the calibration case register (address 20) are consistent, and if the buffer calibration used is

□ Address 66: Work event, this register value reflects an event where the current instrument is in working mode, and the user generally does not need to care about it.

□ Address 67: Calibration status for electrode calibration operation, refer to the Communication Control Calibration Section.

□ Address 68, 69, 79, 71, 72, 73: Basic information of the instrument, and the values are defined in a 16 decimal mode.

## 8. Communication control calibration

### ① Calibrate step instructions

Users can use the communication function to control the instrument and complete the electrode calibration operation. Please read the calibration mode section for the electrode calibration rules. Communication calibration steps are as follows.

#### □ step 1:

Place the electrodes in the buffer or standard solution.

The pH electrode calibration: Place the pH electrode in the pH buffer.

Calibrated residual chlorine electrode: Put the residual chlorine electrode into the standard solution. If the pH automatic compensation is selected, the pH electrode should also be placed into the same standard solution.

#### □ step 2:

Under the measurement mode or calibration menu, write the buffer or standard liquid code to the electrode calibration case register to initiate the calibration.

Acid-base electrode calibration: Write the buffer code to the pH Calibration case register, address 20 (0X0014).

Residual chlorine electrode calibration: Standard liquid code is written to the FCL calibration case register, address 25 (0X0019).

#### □ step 3:

Read the calibration state register (address 67) to determine the current calibration status, and the register value and calibration status are as follows,

The pH electrode signal is present here when the main display area type is PH.

⑦ Secondary display area measurements. If OVER indicates the upper limit, UNDER indicates the upper limit.

⑧ Electrode calibration information display area. OFFSET: Zero-point offset. SLOPE: Slope. Some values indicate that the corresponding point has been successfully calibrated. Wave lines indicate uncalibration or calibration failure.

pour: When the main display area type is FCL or HCL0, the residual chlorine electrode calibration information.

When the main display area type is PH, the pH electrode calibration information is provided here.

## IX、 Calibration mode

### 1. Enter the calibration menu



In the measurement mode, enter the electrode calibration menu, press the switch residual chlorine calibration menu and the pH calibration menu,



and press Or, key Select the point to be calibrated, and press the key



to enter the calibration interface.

The last item in the calibration menu clear calibration data, which lets you clear calibrated information.

The calibration menu interface is operated without a button for a long time, and the instrument will automatically return to the measurement mode.

### 2. Calibration interface description



The indicator icon of the calibration interface is, refer to the measurement mode and browse mode icons.

### 3. Description of residual chlorine electrodes

① The FCL electrodes can be calibrated at up to two points, and the uncalibrated electrodes must calibrate the slope first, otherwise an incorrect order will be indicated.

② Slope calibration was successful, and the meter calculated the electrode slope. By SLOPE, the allowed range is 30% to 999.9%. The standard liquid concentration value used to calibrate the slope should be greater than 0.10 mg/L.

③ Continue to calibrate the zero point, calibrate the successful instrument to calculate the electrode zero point offset, the allowable range=0.50~0.10mg/L. It is represented by the OFFSET.

④ Repeat calibration zero, the successful calibration recalculates the electrode zero offset, failure the original calibration data.

register	address hexadecimal	address decimal system	name	type	attribute	remarks
keep	0x 003C~0x	60~63				
register	0x 0040	64	work pattern	inte	R/W	
	0x 0041	65	Working mode	inte	R/W	
er	0x 0042	66	Work events	inte	R	
FC	0x 0043	67	Calibration status	inte	R/W	See, this chapter.8
0x 03	0x 0044	68	Instrument type	inte	R	
fetch	0x 0045	69	Instrument model	inte	R	
FC	0x 0046	70	software release	inte	R	
0x06	0x 0047	71	Hardware version	inte	R	
write	0x 0048	72	serial number	inte	R	
	0x 0049	73	serial number	inte	R	
in	0x 004A~0x	74~79				

□ Address 64: Working mode. This register value reflects the current working mode of the instrument. The corresponding value of the working mode to the register can control the instrument to enter the corresponding mode. The corresponding relationship is as follows, and the value is defined in a 16 decimal mode.

0x0010: Measurement mode

0x0020: Information mode

0x0030: Browse mode

0x0050: Set the mode

0x0060: The calibration mode

□ Address 65: Working mode parameters for some operations in instrument control, see specific application. Generally, keys can be replaced, the correspondence is as follows, the values are defined in 16 decimal mode.

0x0001: 0x0002: 0x0003: 0x0004: 0x0006:

0x 0058	88	Relay 2 is available at a turned-on value	integer	R/W/D	Function code 0x 10 is written together
0x 0059	89	Relay 2 turns off the value	integer	R/W/D	
0x 005A~0x	90~99				

- address 80, 81:4~The corresponding values of 20mA channels 1, 4mA and 20mA.
- address 82, 83:4~Corresponding values for 20mA channels, 2, 4mA and 20mA.
- Address 86, 87: on and off value of relay 1.
- Address 88, 89: relay 2 on and off value.

When the above four devices read and write the value of their corresponding register, to judge the multiple relationship between the device correlation and the allowable range and minimum interval, please refer to 11.5 And eleven. 6. Read and write values were 100 times when controlled with FCL, HCL0, and pH, and 10 times when controlled with Temp.

For example, when a device is controlled to the FCL, reading the register value of 1000, indicating 10.00mg/L, to set a value of 5.00 mg/L, the minimum interval corresponding to 500, 40 m A and 20mA is 2.00mg / L.


- Address 84, 85: Two parameters of the functional relay. The value of the register is the integer type, and when the parameter 1 value is 0, the functional relay is the alarm mode. When the value of parameter 1 is 1~1000, the functional relay is cleaning mode, and the value of parameter 1 is cleaning interval in hours. The value of parameter 2 is in cleaning mode, indicating the cleaning duration, range 1~1000, per seconds.

#### 7. Information register group (20 addresses from 0x003C~0x004F)

The information register contains the instrument running status and information, such as the version number, serial number, etc., and is read using the function code 0x03. You can also use the function code 0x06 to modify the relevant register value of the instrument operating status, and control the instrument for electrode calibration and other operations.


- ⑤ Repeat calibration slope, successful calibration clears all previous calibration information, recalculates SLOPE, and fails the original calibration data.

#### 4. Residual chlorine electrode calibration process

- ①  Enter the calibration menu and put the electrode into the buffer. Without the calibrated electrode, select the slope option in the menu, and press the key to enter the standard liquid concentration value input interface. Electrodes with calibrated slope can calibrate zero directly from process ⑤.


- ② Use the value setting key ( ) to set the current buffer value at the input interface of the standard liquid concentration value. After setting, the key will enter the calibration interface and start the calibration.



- ③  The calibration process is fully automatic calibration. After the measurement value is stabilized, the instrument shows the measurement value stability symbol, and the SLOPE is calculated. If the results meet the requirements, the calibration will be successful, otherwise the calibration failure is indicated. Success or not, will be returned to the calibration menu.

- ④ Calibration failure Check the electrode performance or standard fluid according to the error prompt and re-calibrated after excluding the problem. Successful calibration can continue to calibration zero according to subsequent procedures. If a continued calibration is not




- required, press  The key returns the measurement.
- ⑤ Put the electrode into the zero value standard liquid, select the zero point option in the menu, press the key to enter the calibration

interface, and start the calibration zero point.



- ⑥ The calibration process is the same as ③, is fully automatic calibration, waiting for the measurement value to be stable, calculate OFFSET, prompt success or failure, return to the calibration menu. If it fails, the zero point can be recalibrated against the prompt.

- ⑦ After a successful calibration of two points, press  The key returns the measurement mode.



Note: When waiting for the measurement value to stabilize, if the user keys, the instrument will skip the automatic stability judgment, and calculate the calibration result according to the current display value.

## 5. pH electrode calibration instructions

- ① Before electrode calibration, please determine whether the type of buffer used is the same as the instrument settings, which can be viewed in information mode and, if different, modified in setting mode, see the corresponding sections.
- ② Electrodes can be calibrated for up to three points, and uncalibrated electrodes must be calibrated first as neutral, otherwise an incorrect order will be indicated.
- ③ Neutral point calibration was successful and the instrument calculated the electrode zero offset. As a legal offset, the allowed range  $\pm 60\text{mV}$ .
- ④ The second and third points can choose the acid or alkaline points, the calibrated successful instrument calculation electrode slope, the allowable range is  $\pm 30\%$ . The slopes between neutral and acidic points are indicated by SLOPE1, and those between neutral and alkaline points by SLOPE2.
- ⑤ Repeating the acidic or alkaline point, the successful calibration will

## 6. Control transfer register group (20 addresses from 0x0050~0x0063)

The relay switch value and the transmission current corresponding value set by the control transmission register for the user are read using the function code 0x03. When the instrument is in the setting menu interface (setting state), you must use the function code 0x10 to write the value of the two registers of one device at a time. For example, a closed value and a disconnected value of a relay. Of course, they are also continuous in the address. The address list is as follows. Property bar R is readable, W is writable, and D resumes factory operations. This register is restored to the default value. Default reference 9.6, Set the default list of menu options.

register	address hexadecimal	address decimal system	name	type	attribute	remarks
control Change send register FC 0x 03 fetch FC 0x 10 write in	0x 0050	80	4~The corresponding value of the 20mA channel is 1 4mA	integer	R/W/D	Function code 0x 10 is written together
	0x 0051	81	4~Corresponding values for the 20mA channel 1, 20 m	integer	R/W/D	
	0x 0052	82	4~Corresponding value of 20mA channel 2 4mA	integer	R/W/D	Function code 0x 10 is written together
	0x 0053	83	4~Corresponding values for 20mA channel 2, 20 m A	integer	R/W/D	
	0x 0054	84	Function relay parameter 1	integer	R/W/D	Function code 0x 10 is written together
	0x 0055	85	Function Relay Parameter 2	integer	R/W/D	
	0x 0056	86	Relay 1 is turned-on value	integer	R/W/D	Function code 0x 10 is written together
0x 0057	87	Relay 1 turns off the value	integer	R/W/D		



- Address 47: The backlight mode.
  - 0: Delay shutdown (default value)
  - 1: Always on

□ Address 50~54: Correlation, indicating the current device-controlled object. The values of the register represent different objects, refer to floating point register address list where FCL value is object 0, HCL0 value is object 1, and so on.

For example, the address 51 register is 4~20mA channel 2 Correlation, with a register value of 4, then 4~20mA channel Current value of 2, controlled by the temperature value.


recalculate the slope between the point and the neutral point, and failing, the original slope is used.


- ⑥ Repeat calibration of neutral points, successful calibration removes all previous calibration information, recalculates OFFSET, and fails using the original calibration data.

## 6. The pH electrode calibration process


- ① Entering the calibration menu, the uncalibrated electrodes should be put into the neutral point (6.86 or 7.00) buffer, select the neutral point (6.86 / 7) option in the menu, and press the key to enter the calibration interface to start the calibration. Calibrated electrodes can calibrate acid or alkaline points directly from the process




- ②  The calibration process is fully automatic calibration. After the measurement value is stabilized, the instrument shows the measurement value stability symbol, and the OFFSET is calculated. If the results meet the requirements, the calibration is successful, otherwise the calibration failure is indicated. Success or not, will be returned to the calibration menu.

- ③ Calibration failure Check electrode performance or buffer for error according to error prompt and re-calibrated after troubleshooting. Successful calibration continues the calibration of the acid or alkaline points according to the subsequent process. If a continued calibration is not required, press  The key returns the measurement mode.

- ④ Place the electrode in the buffer of acidic point (4.00 or 4.01) or alkaline point (9.18 or 10.01), select the corresponding buffer option in the menu, press the key to enter the calibration interface and start

the calibration. 

- ⑤ The calibration process is the same as ②, which is fully automatic calibration and waits for the measurement to be stable. SLOPE1 is calculated if calibrated is an acidic point, and SLOPE2 is alkaline. After the prompt for success or failure, return to the calibration menu. If it fails, troubleshooting problems can be recalibrated with the prompts.
- ⑥ After two points are successfully calibrated, the remaining points can be calibrated starting from the process ④. Without continued calibration or all three points are calibrated, press . The key returns the measurement mode.



Note: When waiting for the measurement value to stabilize, if the user keys, the instrument will skip the automatic stability judgment, and calculate the calibration result according to the current display value.

2: Automatic PT1000s (default value)

□ Address 33: Temperature supplement setting value. When the temperature supplement type is manual, this register indicates manual temperature value and automatic, this register indicates temperature offset value. This register is a 10-fold value, for example, by reading a register value of 500, it represents 50.0°C. To set a value of -10.0°C, you should write a value of -100.

Manual temperature values are set up to -10.0~130.0°C, temperature offset value set to -10.0~10.0°C.

□ Address 34: Measurement type, namely the display value of the instrument measurement interface, setting this register instrument will restore the factory setting and restart.

0: Residual chlorine (FCL)

1: Hypochlorous acid (HCLO)

□ Address 35: pH compensation type, when set as automatic compensation, the instrument compensates the residual chlorine value according to the acid-base electrode measurement value, and when set as manual, the instrument compensates the residual chlorine value according to the pH manual compensation value.

0: Automatic compensation (default value)

1: manual compensation

□ Address 36: pH manual compensation value, Set up the range of 4.00~9.00pH, with the default value of 4.00. This register value is 100 times value, for example when reading this register value of 700 indicates 7.00pH, to set a value of 6.86pH, you need to write 686.

□ Address 37: pH buffer type, and setting this register removes the electrode calibration information.

0: NIST (4.00/6.86/9.18) (Default value)

1: USA (4/7/10)

□ Address 45: Digital Filter, Set range 1~24, The default value is 12.

□ Address 46: Language, not affected by factory operations.

0: English

1: simplified Chinese

- The addresses 21,22 together form the pH electrode bias data.
- The addresses 26,27 These two registers together constitute the residual chlorine electrode bias data (zero-point offset).

Take the residual chlorine electrode bias data as an example, the address 26 is the integer value, the address 27 high bytes indicate the decimal places, and the low bytes indicate the data units. For example, the address 26 register value is 3, and the address 27 register value is 0x020E (two decimal places, in unit of mg/L), then the offset data is 0.03 mg/L.

- Address 23, 24, 28: Electrode slope, pH slope 1 indicates the slope calculated after the successful calibration of the neutral and acidic point, and slope 2 indicates the slope between the neutral and alkaline point. The residual chlorine electrode successfully calibrated the slope point, and the instrument calculated the electrode slope. The slope defaults 1-bit decimal in percentage.

For example, with a register value of 1001, the slope data is 100.1%

- Address 30: The local address during communication, the set range of 1~247, the default value is 1, not affected by resuming the factory operation.

- Address 31: Communication wave rate, set range of 0~4. The corresponding relationship between register value and communication wave rate is as follows, which is not affected by the recovery of factory operation.

- 0:1200
- 1:2400
- 2:4800
- 3:9600 (Default value)
- 4:19200

- Address 32: the temperature supplement type, the instrument has two types of temperature supplement, manual and automatic, where the automatic temperature supplement mode is PT1000, the corresponding relationship is as follows. After this register is set, the temperature set value of the next address 33. If set to 0 (manual), the register set value changes to 250 (25.0°C), and if 2 (automatic), the set point changes to 0 (0.0°C).

- 0: hand movement

## X、 Setup mode

### 1. Enter the Setup menu



Press in the measurement mode. If the instrument does not set the password, then directly enter the Settings menu. If the instrument sets the password, it will enter the password input interface and use



Value setting key ( ) enter password, then key, password is correct, enter the Settings menu, otherwise the password is wrong.

### 2. Set up the menu button description

- ① The setting menu consists of three main menus, respectively, for the system setting, parameter setting, operation setting, under the main menu interface,



press Key, can switch between three main orders.



Press the key to return to the measurement mode.



Press key to move the cursor in the menu.



press Key, enter the cursor option.

- ② After entering the option,



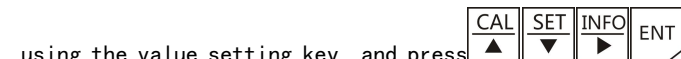
Key, to return to the previous level.

If the current interface selects the interface for the option, press



the cursor, press Key confirmation option.

If the current interface is a numerical setting interface, Set the value



using the value setting key, and press The key confirms

the value.

### 3. System Settings menu options description

#### ① language

The menu displays the language, optional in Chinese or English.

#### ② Backlight mode

Delay closing: there is key operation, backlight is lit, no key operation in one minute after lighting, backlight is off.

Chang Liang: The backlight is always kept on.

#### ③ digital filtering

Digital filtering is performed by sliding weighted mean filtering and set the range 1~24.

The larger the numerical setting, the more stable the data, but the slower the response, suitable for greater interference situations.

#### ④ Change password

When the password has no password set to 0000, measurement mode press SET to directly enter the Settings menu.

The password is set to other values, the measurement mode press SET key to enter the password input interface, the password input is correct, to enter the settings menu.

#### ⑤ Restore the factory

Performing the recovery factory operation, the instrument will clear the calibration information, restore some set parameters to the factory default value, and then restart the instrument.

### 4. Parameter Settings menu options description

#### ① temperature compensation

Manual: If the instrument is not connected to the PT1000 temperature resistance, select this option and continue setting the temperature according to the range of -10.0 to 130.0°C.

Automatic: If the instrument is connected to the PT1000 temperature resistance, you can choose this option, when the instrument prompts to set the temperature offset, first do not adjust the value, directly press

0x001C	28	FCL electrode	inte	R/D	A decimal place,
0x001D	29				
0x001E	30	postal address	inte	R/W	See, eleven.5.1
0x001F	31	Communication	inte	R/W	See, eleven.5.2
0x0020	32	Temperature fill	inte	R/W/D	See, eleven.4.1
0x0021	33	Temperature	inte	R/W/D	See, eleven.4.1
0x0022	34	Measurement type	inte	R/W	See, eleven.4.2
0x0023	35	pH compensation	inte	R/W/D	See, eleven.4.3
0x0024	36	pH manual	inte	R/W/D	See, eleven.4.4
0x0025	37	pH buffer type	inte	R/W/D	See, eleven.4.5
0x0026	38				
0x0027	39	electrode	inte	R/W/D	See, eleven.4.6
0x0028~0x002C	40~44				
0x002D	45	digital filtering	inte	R/W/D	See, eleven.3.3
0x002E	46	language	inte	R/W	See, eleven.3.1
0x002F	47	Backlight mode	inte	R/W/D	See, eleven.3.2
0x0030~0x0031	48~49				
0x0032	50	4~20mA channel 1	inte	R/W/D	See, eleven.5.5
0x0033	51	4~20mA channel 2	inte	R/W/D	See, eleven.5.5
0x0034	52	Functional Relay	inte	R/W/D	See, eleven.5.3
0x0035	53	Relay 1	inte	R/W/D	See, eleven.5.4
0x0036	54	Relay 2	inte	R/W/D	See, eleven.5.4
0x0037~0x003B	55~59				

□ Address 20, 25: acid and residual chlorine calibration register respectively, using the binary position, the register is 16-bit integer, the bit corresponding to the calibration point is the following table, if the calibration point is calibrated, the corresponding bit value is 1, otherwise it is 0.

The 16-bit whole type	BIT15~BIT4	BIT3	BIT2	BIT1	BIT0
Residual chlorine calibration	Unused	Unused	Unused	Slope point	null point
Acid-base calibration situation	Unused	9.18 perhaps 10	6.86 perhaps 7	4.00 perhaps 4	Unused

	0x000E	14	4~20mA channel 1 current value	4.00~ 20.00	Floatin g point type unit mA	R	Over the upper limit of 21.00 Over-lower limit of 3.70
	0x000F	15					
	0x0010	16	4~20mA channel 2 current value	4.00~ 20.00	Floatin g point type unit mA	R	Over the upper limit of 21.00 Over-lower limit of 3.70
	0x0011	17					
	0x0012	18					
	0x0013	19					

① When the temperature compensation is set to automatic, this register is a temperature measurement and set for the user if set to manual.

#### 5. Keep register group (40 addresses from 0 x 0014 to 0 x 003 B)

Keep the register for the user settings and electrode calibration information. Read the register value using the function code 0x03, when the instrument is in the setting menu interface 0 x 03 (in the setting state), write the register value using the function code 0x06, which of course must have writable properties to be allowed to write the value. The address list is as follows. Property bar R is readable, W is writable, and D resumes factory operations. This register is restored to the default value.

regist	address	address	name	type	attrib	remarks
keep	0x0014	20	pH calibration	inte	R/D	Binary bit
regist	0x0015	21	The pH electrode	inte	R/D	
	er	0x0016	pH bias in decimal	inte	R/D	
	0x0017	23	pH electrode slope	inte	R/D	A decimal place,
	0x0018	24	pH electrode slope	inte	R/D	A decimal place,
FC	0x0019	25	The FCL	inte	R/D	Binary bit
0X03	0x001A	26	Zero-point offset	inte	R/D	
fetch	0x001B	27	FCL bias in decimal	inte	R/D	

Confirm key is that the offset is set to 0.0°C. In actual use, if the temperature deviation between the instrument display temperature and the measured object is found is large, such as the instrument display temperature is 26.0°C and the mercury thermometer is 30.0°C, you can enter the temperature compensation option again, select the automatic option, the instrument prompt to set the temperature offset, and set the value to + 4.0°C, press Confirm key confirmation. Returning to the measurement mode shows the temperature display value becomes 30.0°C, or the measurement value is 26.0°C plus offset set value of 4.0°C. The offset value allows to set a range of -10.0 to + 10.0°C.

#### ② Measurement type

The measurement type is the display value of the instrument measurement interface, with optional residual chlorine (FCL) or secondary chlorine acid (HCLO), Choose good After confirmation, the instrument will resume the factory setting and restart, and run according to the set function.

③ pH compensation type

Automatic compensation: The residual chlorine compensation is calculated using the pH electrode measurement.

Manual compensation: After selecting manual, manual compensation should be set with a range of 4.00~9.00pH, when set, using this value to calculate and compensate the residual chlorine.

④ pH buffer type

Type of buffer used for the calibration of the pH electrode.

NIST type: acidic point 4.00, neutral point 6.86, alkaline point 9.18.

USA type: acidic point 4, neutral point 7, alkaline point 10.

After selected confirmation, the instrument will clear the previous acid base electrode calibration information.

⑤ electrode deviation

If the uncalibrated electrode has a large deviation in the zero value environment, set the corrected zero point and then be calibrated. The calibrated electrodes set this value and clear all the calibration information. Deviation allows setting the range-0.10~0.10mg/L.

5. Run the settings menu options description

① postal address

Native address during RS485 MODBUS communication. Set the range of 1~247.

② Communication Porter rate

RS485 MODBUS communication rate, optional 1200, 2400, 4800, 9600, 19200.

③ Functional relay

The function relay can be set to the alarm mode or the cleaning mode.

Alarm mode: suitable for external alarm device, relay 1 and relay 2 either closed, the functional relay closed.

Cleaning mode: suitable for external cleaning equipment, first set cleaning interval, set range of 1~1000 hours, then set cleaning duration, set range of 1~1000 seconds.

④ Relays 1 and relay 2

The correlation of the relay is that the relay switch action is

register	address hexadecimal	address decimal system	name	scope	explain	attribute	remarks
float Floating point type register FC 0X03 fetch	0x0000	0	FCL Residual chlorine value	0.00~20.00	Floating point type The bit mg / L	R	Over the upper limit of 20.01
	0x0001	1					
	0x0002	2	HClO Subchlorate values	0.00~20.00	Floating point type unit mg/L	R	Over the upper limit of 20.01
	0x0003	3					
	0x0004	4	residual chlorine sensor signal	-1.00~60.00	Floating point type unit mV	R	Over the upper limit of 60.01 Ultra-lower limit-1.01
	0x0005	5					
	0x0006	6	pH price	0.00~14.00	Floating point type Position pH	R	Over the upper limit of 14.01 Ultra-lower limit-0.01
	0x0007	7					
	0x0008	8	temperature scale ①	-10.0~130.0	Floating point type unit °C	R	Over the upper limit of 130.1 Ultra-lower limit-10.1
	0x0009	9					
	0x000A	10	pH sensor signal	-2000~2000	Floating point type unit mV	R	Over the upper limit of 2001 Ultra-lower limit-2001
	0x000B	11					
	0x000C	12					
0x000D	13						

0x000E	14	Channel 1 current value	400~2000	inte ger	R	Over the upper limit of 2,100 Ultra-lower limit 370
0x000F	15	Current value decimal number and unit		inte ger	R	
0x0010	16	Channel 2	400~2000	inte	R	Over the upper limit of 2,100 Ultra-lower limit 370
0x0011	17	Current value decimal number and unit		inte ger	R	
0x0012	18	Relay status ②		inte ger	R	binary bit
0x0013	19					

① When the temperature compensation is set to automatic, this register is a temperature measurement and set for the user if set to manual.

② Relay status register represents the relay status in binary mode, the register value is 16-bit integer, the BIT0 means the BIT0, BIT1 indicates the relay 1 state, and BIT2 indicates the relay 2 state. Position value is 1, the relay is on and 0, the relay is off. The following table shows.

The 16-bit whole	BIT15~BIT 3	BIT2	BIT1	BIT0
Relay status	Unused	electric relay 2	electric relay 1	Functional

#### 4. Floating floating-point register group (20 addresses from 0 x 0000 to 0 x 0013)

Floating floating point register is floating point data for the measurement and transmission current values of the meter. Accessing function code 0x03 with address list below. Property bar R indicates readable and W is writable.

One data in the table occupies two register addresses, and when reading the data, two register addresses need to be read at a time to form a floating-point data.

controlled at a certain value, including the residual chlorine value (FCL), hypochlorite acid value (HCLO), acid and base value (pH), and temperature value (Temp).

After the correlation is selected, continue to set an on value, and then set an off value. Both values are set for the same measurement range as the controlled value, and the on and off values cannot be the same. details are as follows:

Controlled in either FCL or HCLO, the setting range of both values is 0.00~20.00mg/L.

Controlled at pH, the setting range of the two values is 0.00~14.00pH.

Controlled in Temp, the two values of the set range-10.0 to 130.0°C.

#### ⑤ 4~20mA channel

4~20mA channel The correlation is Output current values are controlled at A value (varying linearly with this value) selects the residual chlorine value (FCL), hypochlorite acid value (HCLO), acid and base value (pH), and temperature value (Temp).

After the correlation is selected, continue to set the 4mA correspondence value, and then set the 20mA correspondence value. The two values have the same measurement range of the controlled value, and the minimum interval between the two values is 200 words, specifically as follows:

Controlled in either FCL or HCLO, the two values were set with a minimum interval of 2.00mg / L.

Controlled at pH, two values set a minimum interval of 2.00 pH.

Controlled at Temp, the two values were set with a minimum interval of 20.0°C.

#### 6. Set the menu options default value list

If the value in the table is affected by the recovery factory operation, perform the recovery factory operation, and this option becomes the default value. It will not change otherwise.

menu	option	Windows default	Whether to recover Influence of factory operation
System settings	language	the Chinese language	deny
	Backlight mode	Delay closed	yes
	digital filtering	12	yes
	Change password	0000 (No password)	deny
parameter setting	temperature compensation	Automatic temperature compensation, with a temperature offset of 0.0°C	yes
	Measurement type	FCL	deny
	Ph compensation	AUTO	yes
	Ph buffer type	NIST	yes
	electrode	.000mg/L	yes
Run settings	postal address	1	deny
	Communication	9600	deny
	Functional relay	Cleaning function, 1 hour interval for 10 seconds	yes
	electric relay 1	Controlled with the FCL values The turn-on value is 0.00mg / L The turn-off value is 20.00mg/L	yes
	electric relay 2	Controlled with the FCL values The turn-on value is 0.00mg / L The turn-off value is 20.00mg/L	yes
	4~20mA channel 1	Controlled by FCL 4mA corresponding value 0.00mg / L The 20mA corresponding value is 20.00mg/L	yes
	4~20mA channel 2	Controlled by pH The 4mA value corresponds to 0.00pH The 20mA corresponding value is 14.00pH	yes

register	address hexadecimal	addresses decimal system	name	scope	type	attribute	remarks
float integer register FC 0X04 fetch	0x0000	0	FCL price	0~2000	integer	R	Over the upper limit of 7FFF Over the lower limit of 8,000
	0x0001	1	FCL value decimal number and unit		integer	R	
	0x0002	2	HClO price	0~2000	integer	R	Over the upper limit of 7FFF Over the lower limit of 8,000
	0x0003	3	HClO value decimal number and unit		integer	R	
	0x0004	4	sensor	-100~6000	integer	R	Over the upper limit of 7FFF Over the lower limit of 8,000
	0x0005	5	Signal value decimal number and unit		integer	R	
	0x0006	6	pH price	0~1400	integer	R	Over the upper limit of 7FFF Over the lower limit of 8,000
	0x0007	7	Ph value decimal and unit		integer	R	
	0x0008	8	temperature scale ①	-100~1300	integer	R	Over the upper limit of 7FFF Over the lower limit of 8,000
	0x0009	9	Temperature value decimal number and unit		integer	R	
	0x000A	10	pH sensor	-2000~2000	integer	R	Over the upper limit of 7FFF Over the lower limit of 8,000
	0x000B	11	Signal value decimal number and unit		integer	R	
	0x000C	12					
	0x000D	13					



0x04, the address list is listed below. Property bar R indicates readable and W is writable.



A measurement in the table consists of two parts, values in part, decimal and units in part.

For example, the address 0x0006 register is in the integer form of pH value, the address 0x0007 register is decimal digits and units of pH value, where high byte value is used to represent decimal places, low byte value represents unit, obtained by query unit control table. If the read 0x0006 register value is 0x02BC (decimal 700), 0x0007 register value is 0x020A, where 02 indicates 2 decimal places and 0A means unit pH, the current pH value is 7.00pH.

## XI、informative pattern



In the measurement mode, the key can enter the information mode, which can browse the instrument setting parameter value and instrument information. There are the current page and the total page number prompts on the top right of the display interface, such as 1 / 8, the current first page, a total of 8

pages, and  Symbol prompt can press  Key page to browse.



The key can return to the measurement mode. If there is no key operation for a long time, the instrument automatically returns to the measurement mode.

In the first page, if the pH compensation is displayed as automatic, the residual chlorine measurement is currently calculated using the pH electrode measurements. If the pH compensation is displayed as the pH value, the residual chlorine measurement is currently compensated using the pH value set by the user.

## XII、communicating protocol

### 1. Newsletter profile

The instrument adopts the RS485 hardware interface Modbus-RTU communication protocol. Data format N, 8, 1, that is, no parity, data 8 bits, stop bit 1 bit. The factory default native address is 1, and the baud rate is 9600. The address can be set in the range of 1 to 247, and the port rate is optional at 1200, 2400, 4800, 9600, 19200, which the user can set itself based on demand.

### 2. data format

The function codes used in the communication include 0x 03, 0x 04, 0x 06 and 0x10. Here is only a brief introduction of the corresponding data frame format of the function code used. If you know more, you can query the Modbus-RTU related information by yourself.

One register in the data accounts for two bytes.

The floating-point numbers are represented by two registers, namely 4 bytes.

The integer data is represented by a register with high bytes before, low bytes after, and negative numbers in complement form, x FFFF 0, -1.

① Function codes 0x03 and 0x04, read register content, the same instruction format for different register groups.

#### Host instruction format

From the	FC	Read the starting address	Number of number of read	CRC
1 byte	1 byte	2 byte	2 byte	2 byte

#### Next-bit machine reply format

From the	FC	Returns the total number	N register data	CRC
1 byte	1 byte	1 byte	N*2 byte	2 byte

② Function code 0x06 modifies a register value.

#### Host instruction format

From the	FC	Change the address of the	modified value	CRC
1 byte	1 byte	2 byte	2 byte	2 byte

#### Next-bit machine reply format

From the	FC	Change the address of the	Modified values	CRC
1 byte	1 byte	2 byte	2 byte	2 byte

③ The function code 0x10 modifies the multiple consecutive register values, the instrument can only be used to modify the two consecutive register values, and only a few fixed registers can be modified.

Upper computer command format, here to modify two registers for example, N=2 in the table below.

slave address	FC	revise Register start address	revise Register Number of N	modified value Bytes occupied by N * 2	first register modified value	the second register modified value	CRC verification
1 byte	1 byte	2 byte	2 byte	1 byte	2 byte	2 byte	2 byte

#### Next-bit machine reply format

From the	FC	Change the address of	The number of modified	CRC
1 byte	1 byte	2 byte	2 byte	2 byte

④ Error response, the next machine receives an error instruction, and will reply in the following format.

From the machine	FC +0x80	error code	CRC verification
1 byte	1 byte	1 byte	2 byte

⑤ Error code description:

0x01: Wrong function code, and received an unsupported function code.

0x02: Wrong register address and wrong register address to be accessed.

0x03: Wrong number of registers and registers to access are out of range.

0x04: The modified value is beyond the register value.

0x05: Verification error, and the CRC check value is incorrect.

0x06: Write error, the target register does not support the write operation.

3. Floating whole register group (20 addresses from 0x0000~0x0013)

The floating integer register is the integer data of the measurement value and the transmission current value of the instrument. Access using function code