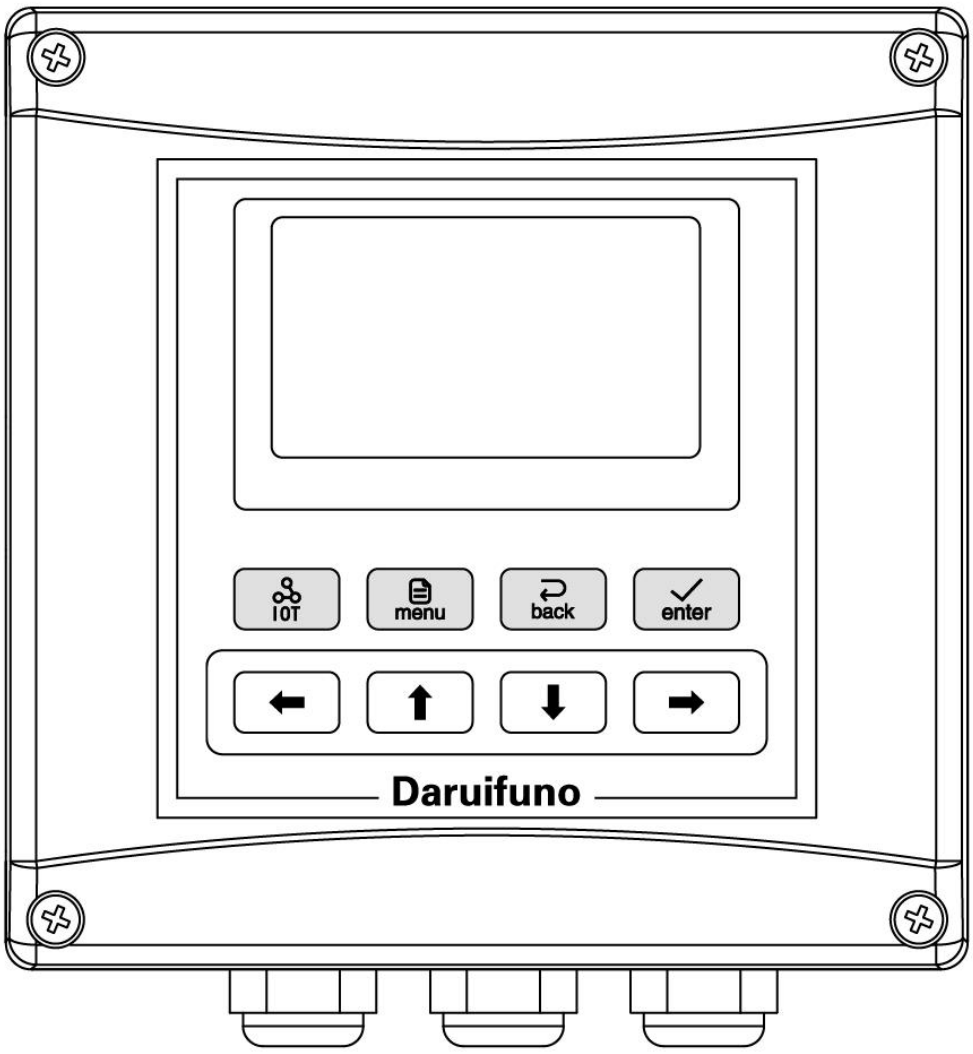
Dual Channel Online pH/ORP Controller

User Manual



Model: APX2-PD

Version 05.04

CONTENTS

Chapter 1 Overview

This product is a dual-channel pH/ORP controller, which can be connected to two pH or two ORP sensors at the same time, and can also be connected to a pH and an ORP sensor respectively; The two channels are isolated from each other and do not interfere with each other, and each channel can be connected to an independent temperature sensing system.

When pH, ORP and temperature are tested simultaneously, algorithms inside the instrument simultaneously assess the pool's disinfection capacity. It is recommended for swimming pools, water parks and other occasions to quickly assess the content of disinfectants in water, and is also widely used in water treatment and dosing, ultrafiltration, circulating water and other occasions.

1.1 Technical Parameters

Measurements	Two channels pH/ORP, two channels temperature
Display Range	pH: 0~14pH, ORP: -2000mV~2000mV, Temp.: -10~+150℃
Resolution	pH: 0.01pH ORP: 1mV Temp.: 0.1℃
Accuracy	pH: ±0.02pH, ORP: ±2mV
Temp. Compensation	NTC10K/PT1000 automatic or manual
Chlorine Calculation	Scientific Algorithm/Linear Correspondence/System Lookup Table
Relay Control	2 SPST relays, 3A 250V AC
	Control Type: main value control / temp. Control / chlorine control / wash control / internal temp. alarm
Current Output	Two active 4~20mA or 0~20mA, Max. Load: 1000Ω
	Corresponding Channel: Main measurement value/ Temp./ chlorine
Comm. Interface	A RS485, support MODBUS-RTU protocol and JSON text format
Calibration Method	pH: 3-point calibration, ORP: 2-point calibration
Display Screen	3.2 inch graphic LCD display
Electronic Clock	Year-Month-Day, Hour-Minute-Second
History Recording	10,000 historical data can be recorded, support historical data download(1)
	100 calibration logs, 100 internal temp. overtemperature alarm logs
Operating Environment	0~+60℃, relative humidity 0~95%, no condensation
Storage Environment	-20~+70℃, relative humidity 0~55%, no condensation
Power Supply	100~240VAC or 18~36VDC, 3W Max
Installation Method	Panel / wall / pipe mounting
Instrument Dimension	144*144*120 (unit: mm)
Protection Grade	IP66
Instrument Weight	About 800g

Note: (1) The download needs to be realized through the RS485 interface external data downloader.

Chapter 2 Mechanical Installation

2.1 Dimension

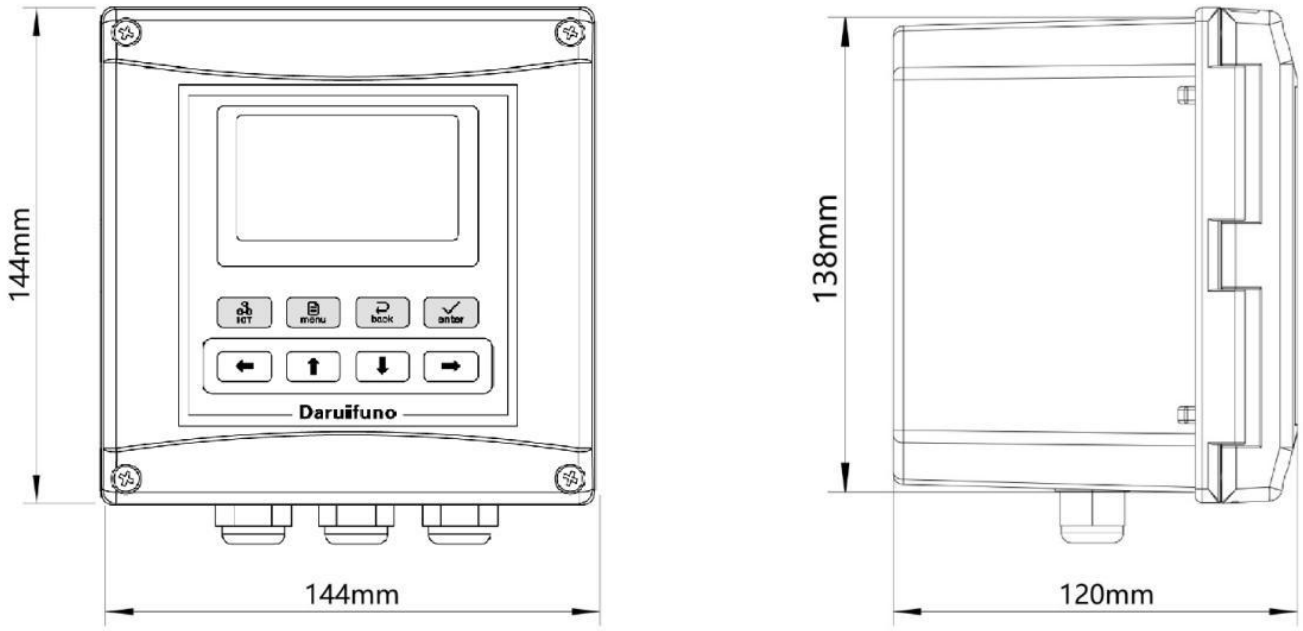


Figure 2-1 Instrument dimension

2.2 Installation

- Panel installation

When selecting a rack mount for the meter, use 2 mounting brackets to secure the meter, and the installation diagram is shown below:

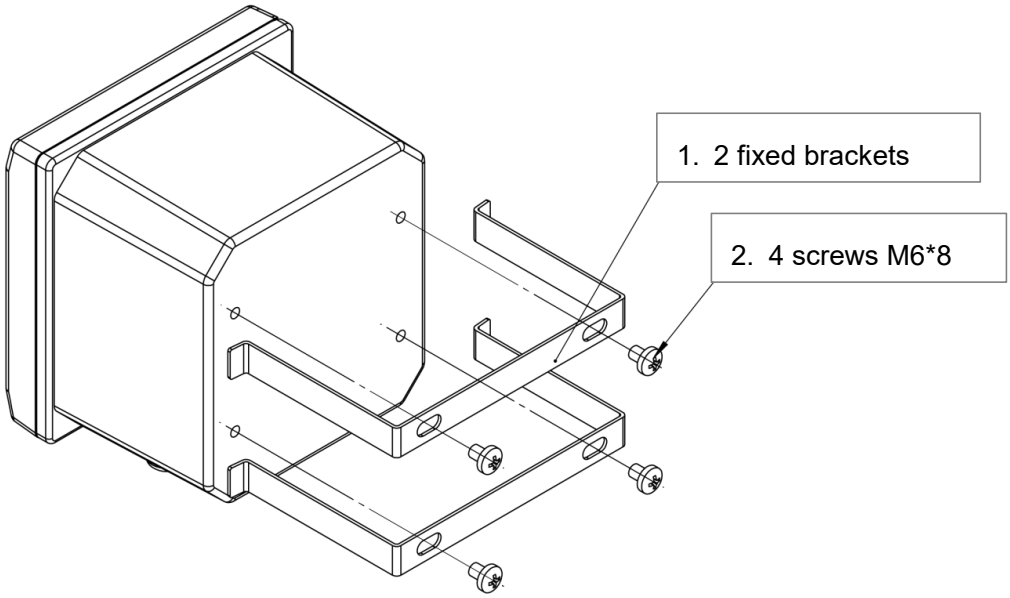


Figure 2-2 Panel mounting

- Wall installation

Connect the gray backplate to the meter, and then install it on the box or wall sidewall, the installation dimensions and schematic diagram are as follows:

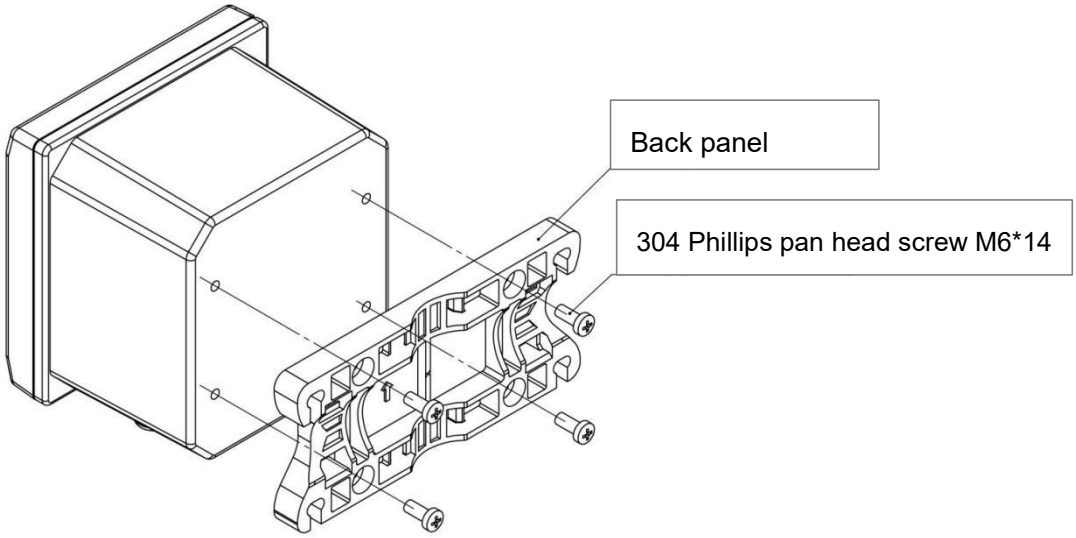


Figure 2-3 Wall mounting

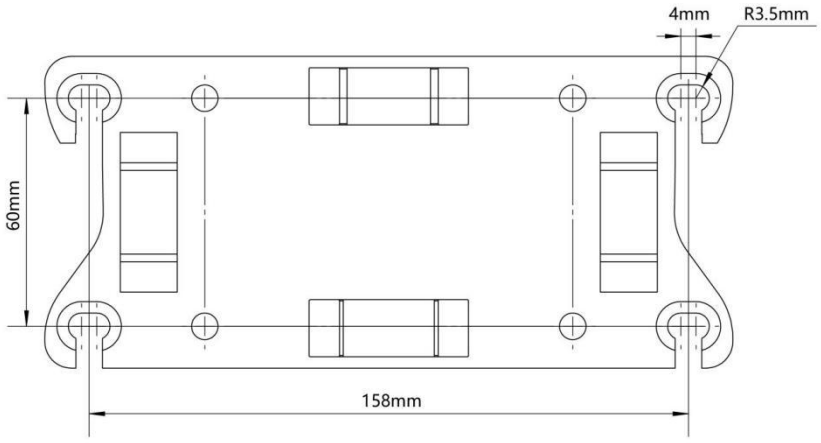
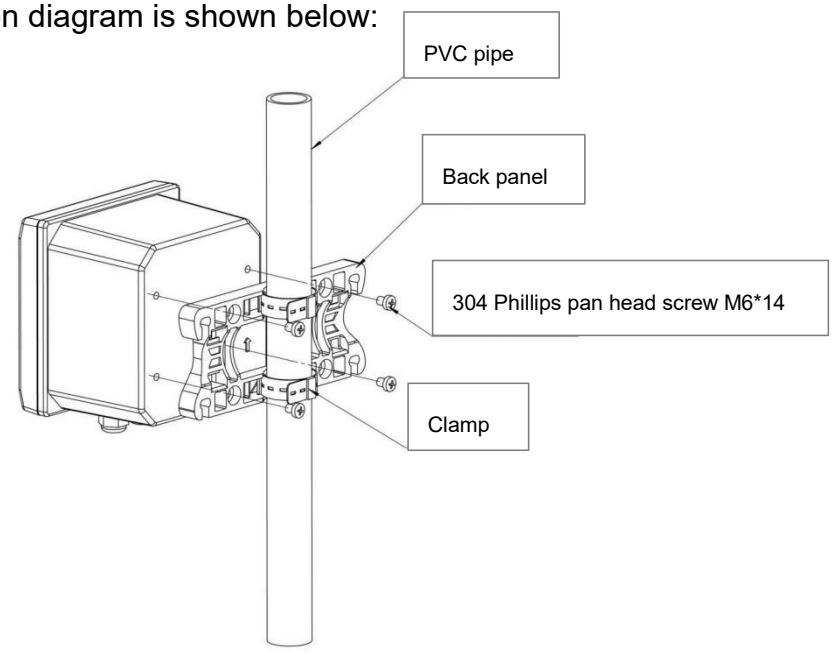


Figure 2-4 Wall mounting hole size dimensional drawing

- Pipe installation

Connect the gray backplate to the meter, and then fix the backplate to the horizontal or vertical pipe with a clamp, the installation diagram is shown below:



Chapter 3 Electrical Installation

3.1 Power Connection

After unscrewing the screws on the back of the meter, remove the cover and see the terminal blocks. According to the power supply type of the instrument, access 100~240VAC or 18~36VDC.

Note: Before connecting AC power, be sure to cut off the power supply !

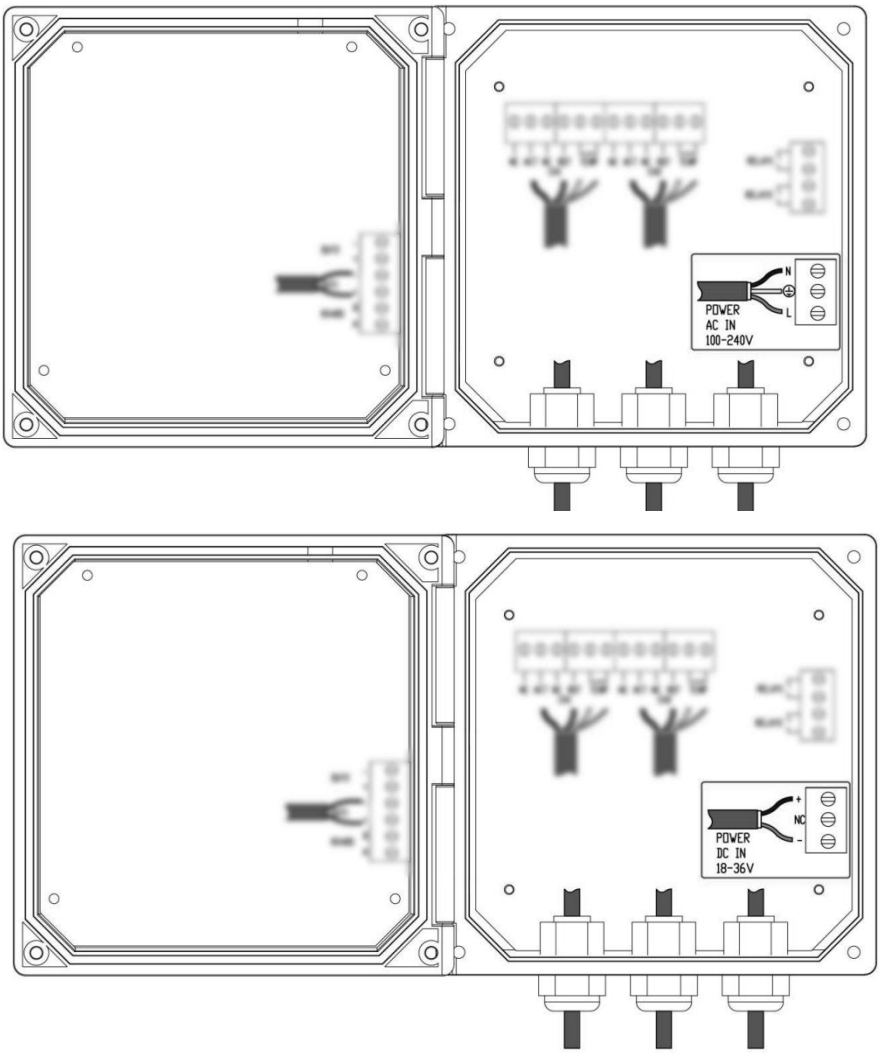


Figure 3-1 Two types of power terminals

Two kinds of power terminals are defined in the Table:

POWER AC IN 100-240V	L	AC power LIVE wire	POWER DC IN 18-36V	+	DC power positive
	⏚	AC power ground wire		NC	Floating terminal
	N	AC power NEUTRAL wire		-	DC power negative

3.2 Terminal Definition

The electrode cable is connected to the ACT, REF, TEMP terminals, and the rest are connected according to actual needs.

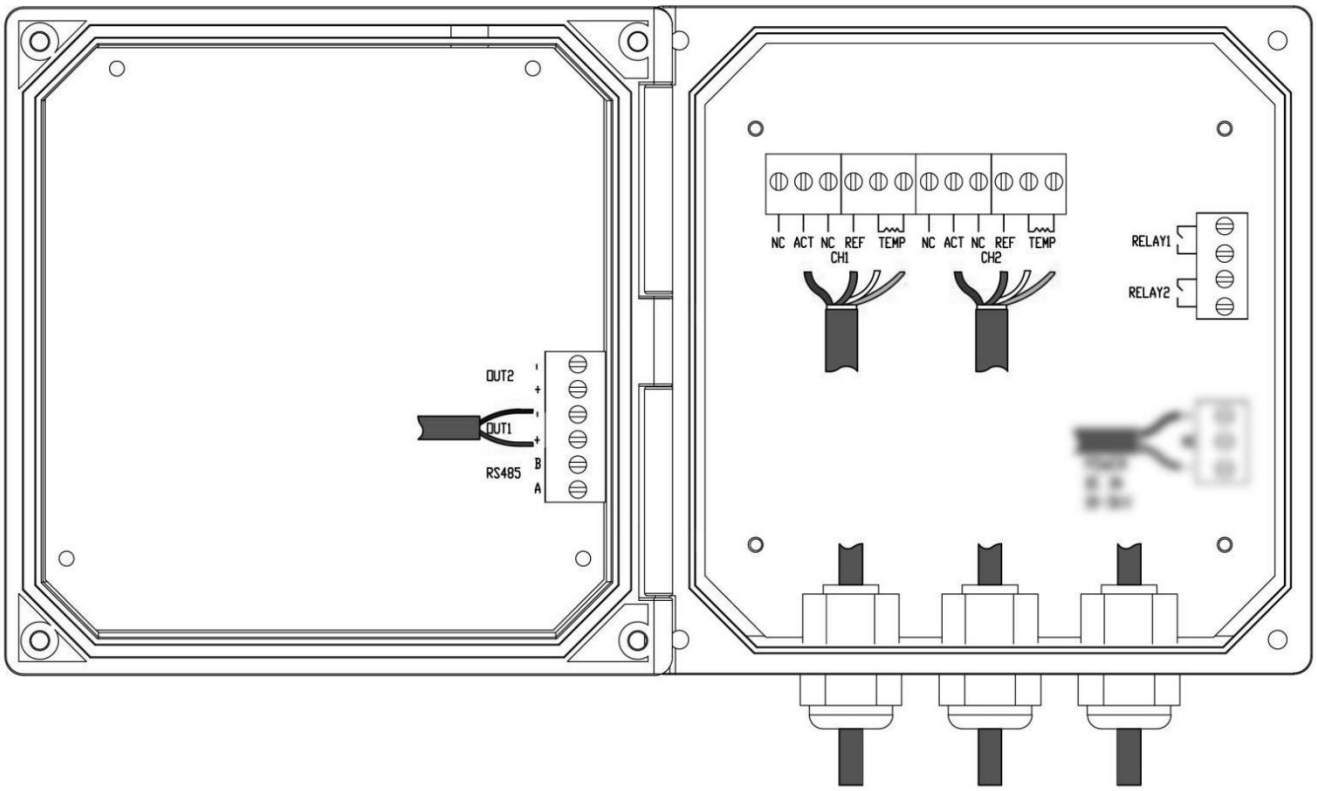


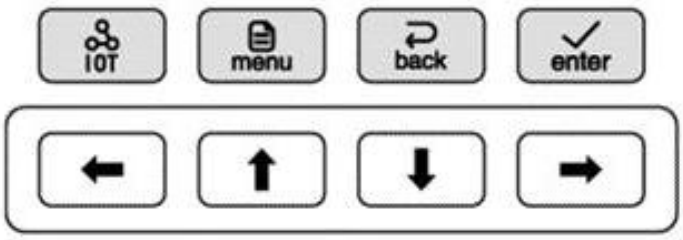
Figure 3-2 terminal blocks

The terminal locations and names are shown in the table below:

OUT2	+	Current 2 Output positive	CH2	ACT	CH2 pH (ORP) probe indication
	-	Current 2 Output negative		REF	CH2 pH (ORP) probe reference
OUT1	+	Current 1 Output positive		TEMP	CH2 temp. probe input terminal
	-	Current 1 Output negative			CH2 temp. probe input terminal
RS485	A	RS485 signal D+(A) terminal	RELAY1		Relay 1 contact
	B	RS485 signal D-(B) terminal			Relay 1 contact
CH1	ACT	CH1 pH (ORP) probe indication	RELAY2		Relay 2 contact
	REF	CH1 pH (ORP) probe reference			Relay 2 contact
	TEMP	CH1 temp. probe input terminal	NC		Floating terminal
		CH1 temp. probe input terminal			

Chapter 4 User Interface

4.1 Panel Button



- **Up key:** In the menu option interface, to move the cursor up;

In the parameter setting interface to increase the data by 1 (change in the order of 0, 1, 2.... 9, 0);
In the measurement interface, can switch the secondary displays.

- **Down key:** In the menu option interface to move the cursor down;

In the parameter setting interface to reduce the data by 1 (change in the order of 9, 8, 7... 0, 9);
In the measurement interface, can switch secondary displays.

- **Left key:** In the parameter setting interface, to move the cursor left;

In the menu interface, to return to the previous menu;
In the measurement mode, when one channel is pH and the other is ORP, can switch displays "pH/ORP measurement" → "chlorine measurement".

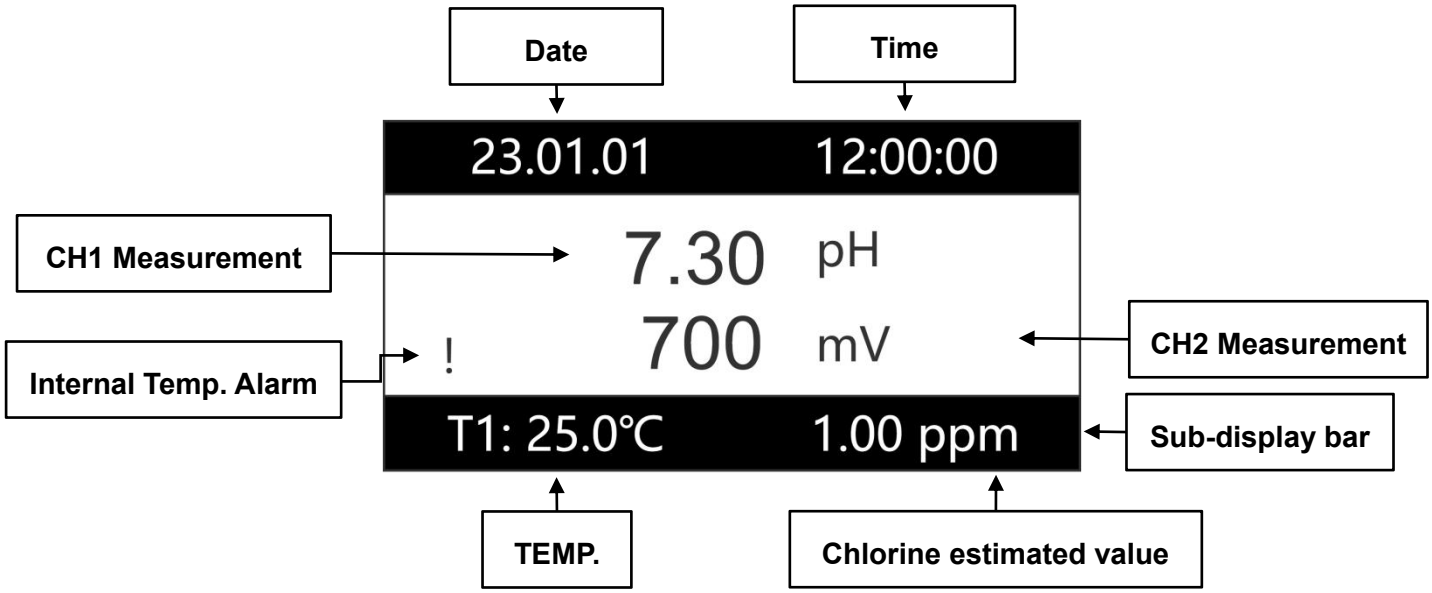
- **Right key:** In the parameter setting interface, to move the cursor right;

In the measurement mode, when one channel is pH and the other is ORP, can switch displays "pH/ORP measurement" → "chlorine measurement".

- **Internet of Things key:** has no function
- **Menu key:** In the measurement interface to enter the menu interface; In the menu option interface to directly return to the measurement state; In the parameter setting interface to return to the previous menu.
- **Back key:** Return to the previous menu, such as in the parameter setting interface, abandon the modification and return to the previous menu.
- **Enter key:** In the menu option interface, press this key to select the option; in the parameter setting interface, press this key to confirm and return to the previous menu.

4.2 Display Screen

The meter normally displays the measurement interface after power-on. The specific information is as follows:



- **Date and Time:** Display the current date and time
- **CH1/2 Measurement:** Display the current pH/ORP value, if " > " or "＜" symbol appears in front of the value, it means the measurement is out of the range. When one channel is pH and the other is ORP, press the left or right key to switch " pH/ORP measurement " and " chlorine measurement "
- **Internal Temp. Alarm:** When the internal temp. of the instrument exceeds 50°C, the measurement interface will appear " ! ", reminding users to increase ventilation and heat dissipation measures.
- **Sub-display Bar:** Press ↑ or ↓ key under the measurement interface to switch the sub-display bar information: "Two temp. values", "Channel 1/2 temp. value & chlorine value" or "Channel 1/2 temp. value & probe type", "Two current values", "Two relay status".
- **Temperature Value:** Display the temp. Value. T1 represents the Channel 1 temp. value and T2 represents the Channel 2 temp. value. The temp. value is not displayed when the temp. probe is not connected.
- **Chlorine Estimated Value:** Displays the current estimated residual chlorine value. The residual chlorine value is only displayed if one channel is pH and the other channel is ORP. When both channels are pH or ORP, this changes to show the currently selected probe type:

  " PH-GLASS " means " pH glass probe "

  " PH-ANT " means " pH antimony probe "

  " ORP " means " ORP probe "

Chapter 5 Menu Description

In the measurement interface, long press the menu button to enter the menu. This chapter describes the main features.

5.1 Probe Setting

Perform sensor calibration and view of sensor status.
After the probe is connected to the controller, it needs to be calibrated first due to the error between the signal of the actual electrode and the standard.

- **pH Calibration**

1. Preparation before calibration
   - In the menu “ select probe ”, select “ pH Glass probe ” or “ pH Antimony probe ”
   - pH 4.01, 6.86, 9.18 standard solution(1)
   - Deionized cleaning solution and absorbent paper
2. Zero Calibration
   (1) Clean the probe with deionized cleaning solution, dry it with absorbent paper and put it into pH 6.86 standard solution;
   (2) After the measured value is stable, select “ 6.86pH CAL ” to start calibration;
3. Acid slope Calibration
   (1) Clean the probe with deionized cleaning solution, dry it with absorbent paper and put it into pH 4.01 standard solution;
   (2) After the measured value is stable, select “ 4.01pH CAL ” to start calibration;
4. Alkali slope Calibration
   (1) Clean the probe with deionized cleaning solution, dry it with absorbent paper and put it into pH 9.18 standard solution;
   (2) After the measured value is stable, select “ 9.18pH CAL ” to start calibration;

- **ORP Calibration**

1. Preparation before calibration
   - In the menu “ select probe ”, select “ ORP probe ”
   - ORP 86mV, 256mV standard solution(1)
   - Deionized cleaning solution and absorbent paper
2. Zero Calibration
   (1) Clean the probe with deionized cleaning solution, dry it with absorbent paper and put it into ORP 86mV standard solution ;
   (2) After the measured value is stable, select " 86mV CAL " to start calibration;
3. Slope Calibration
   (1) Clean the probe with deionized cleaning solution, dry it with absorbent paper and put it into ORP 256mV standard solution;
   (2) After the measured value is stable, select " 256mV CAL " to start calibration;

Note: (1) If there is a standard solution with other values, the calibration value can be modified to the actual value after selecting the calibration value.

- **Chlorine Calculation**

  When one channel measures pH and the other channel measures ORP, the system can perform residual chlorine derivation.

  The instrument provides three ways to derive residual chlorine:

- Scientific algorithm: Output residual chlorine value according to scientific algorithm.
- Linear output: According to the ORP upper and lower limits entered by the user and the corresponding upper and lower limits of residual chlorine, the residual chlorine value is output linearly.
- System lookup table: according to the residual chlorine, pH, ORP values entered by the user to build a table, the system measurement table output residual chlorine value. There are five sets of data in total, and you need to enter 5 residual chlorine values in ascending order, 5 pH values in ascending order, and 5 ORP values in ascending order (5 ORP values in each group, a total of 25 ORP values, and 5 data in each group must be entered in ascending order). When the pH measurement is between two sets of PH, the nearest set of tables is rounded to query, and then the final result is calculated linearly according to the ORP value and residual chlorine value. It is recommended that customers create tables in the format of the table below and file the forms for easy verification at any time.

		The 1st point	The 2nd point	The 3rd point	The 4th point	The 5th point	
	CL / ORP (mV) / pH	0.1	0.2	0.3	0.4	0.5	
The 1st point	5.5	350	450	550	650	750	The 1st group
The 2nd point	6	300	400	500	600	700	The 2nd group
The 3rd point	6.5	280	380	480	580	680	The 3rd group
The 4th point	7	250	350	450	550	650	The 4th group
The 5th point	7.5	200	300	400	500	600	The 5th group

5.2 Alarm Setting

- **Control function**

  When “ Main value Control ” or “ Temp. Control ” is selected in the “ Function Set ” menu, the relay is a control output relay.

  When “ Main value Control ” is selected, the relay is controlled by the main measurement;

  When “ Temp. Control ” is selected, the relay is controlled by the temp. measurement.

  When “ On Value ” > “ Off Value ” are set in the menu, the relay is a high alarm control.

  When “ On Value ” < “ Off Value ” are set in the menu, the relay is low alarm control.

- **Wash relay**

  When “ wash relay ” is selected in the “ Function Set ” menu, the relay is in the wash output state, and the relay will on and off in the set cycle for wash control.

  When “ Hold ” is selected for “ wash State ”, when cleaning, the measurement display value remains unchanged before the relay is operated.

  When “ constant ” is selected for “ wash State ”, the measurement value is the real-time value of continuous measurement.

- **Internal temp. alarm**

  When [Internal temperature alarm] is selected in the menu [Function set], the relay will close when the internal temperature of the instrument exceeds 50 ℃.

5.3 Current Setting

Use a current signal to output the measured value.

Set the measured value for the current in “ Channel Select ”.

The measured values corresponding to the current output “ 20mA ” and “ 0mA/4mA ” are set in “ Max. Value ” and “ Min. value ”, respectively.

5.4 Comm. Setting

Use RS485 interface to output the measured value.

When [ModBus] is selected for [Comm. Protocol], Modbus standard comm. is used. The instrument acts as a slave on the network, requiring the master to send commands first before the instrument returns data. The instrument’s baud rate, parity, and stop bits must match the master port settings. The master uses function code 04 to read the measured values. See the appendix for more details.

When [Json] is selected for [Comm. Protocol], the instrument will send the measured value every one minute as a Hex-formatted ASCII string.

Appendix

ModBus Register Introduction

The instrument communication setting is 9600-8-N-1 by default, and the slave address is 1 by default. To change this, please go to the “communication setting” menu.

The parameters corresponding to the register address are defined as follows:

Register Start Address	Function Code	Parameters	Number of Registers	Data Format
0	04	CH1 Temp value (℃)	2	32-bit floating point default CDAB(2301 or 3412)
2		CH1 pH value		
4		CH1 ORP value(mV)		
6		CH2 Temp value (℃)		
8		CH2 pH value		
10		CH2 ORP value(mV)		
12		Chlorine value(ppm)		

Example of host reading instrument measurement value and sending data (taking the instrument slave address as 1 and data sequence as CDAB):

- Read channel one pH value, taking pH value as 7 as an example

  Host sends: 01 04 00 02 00 02 D0 0B

  Explanation:

  01: Slave address

  04: Function code

  00 02: Register start address

  00 02: Number of registers

  D0 0B: CRC16 checksum

  Instrument returns: 01 04 04 00 00 40 E0 CB CC

  Explanation:

  01: Slave address

04: Function code

04: Number of bytes returned

00 00 40 E0: The instrument output data sequence is a floating-point number in CDAB, which is 0x40E00000 in ABCD sequence, corresponding to the decimal value 7.

CB CC: CRC16 Checksum

- Read channel 2 ORP value, taking ORP value of 25℃ as an example

  Master sends: 01 04 00 0A 00 02 51 C9

  Explanation:

  01: Slave address

  04: Function code

  00 0A: Register start address

  00 02: Number of registers

  51 C9: CRC16 checksum

  Instrument returns: 01 04 04 00 00 43 80 CB 14

  Explanation:

  01: Slave address

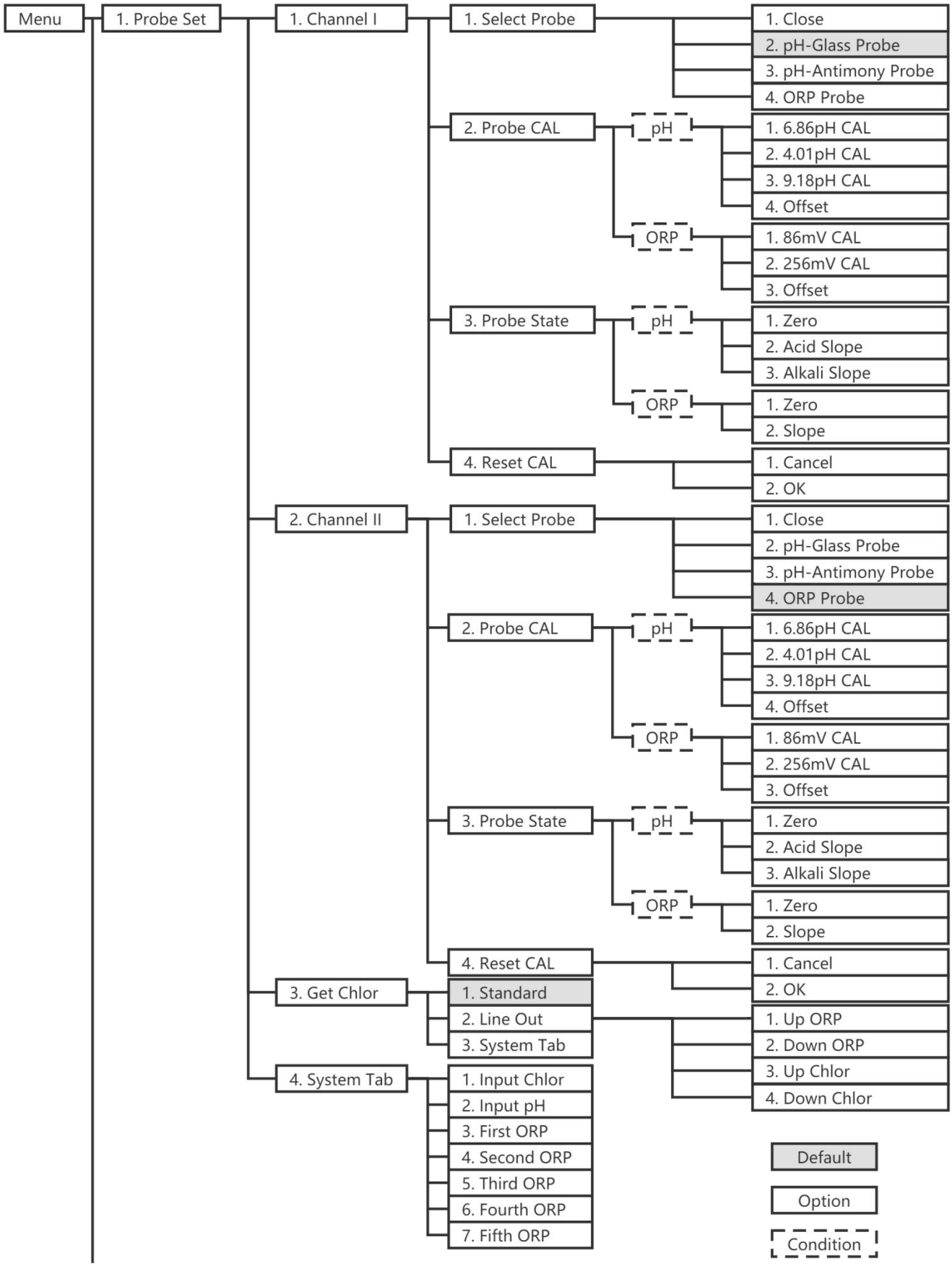
  04: Function code

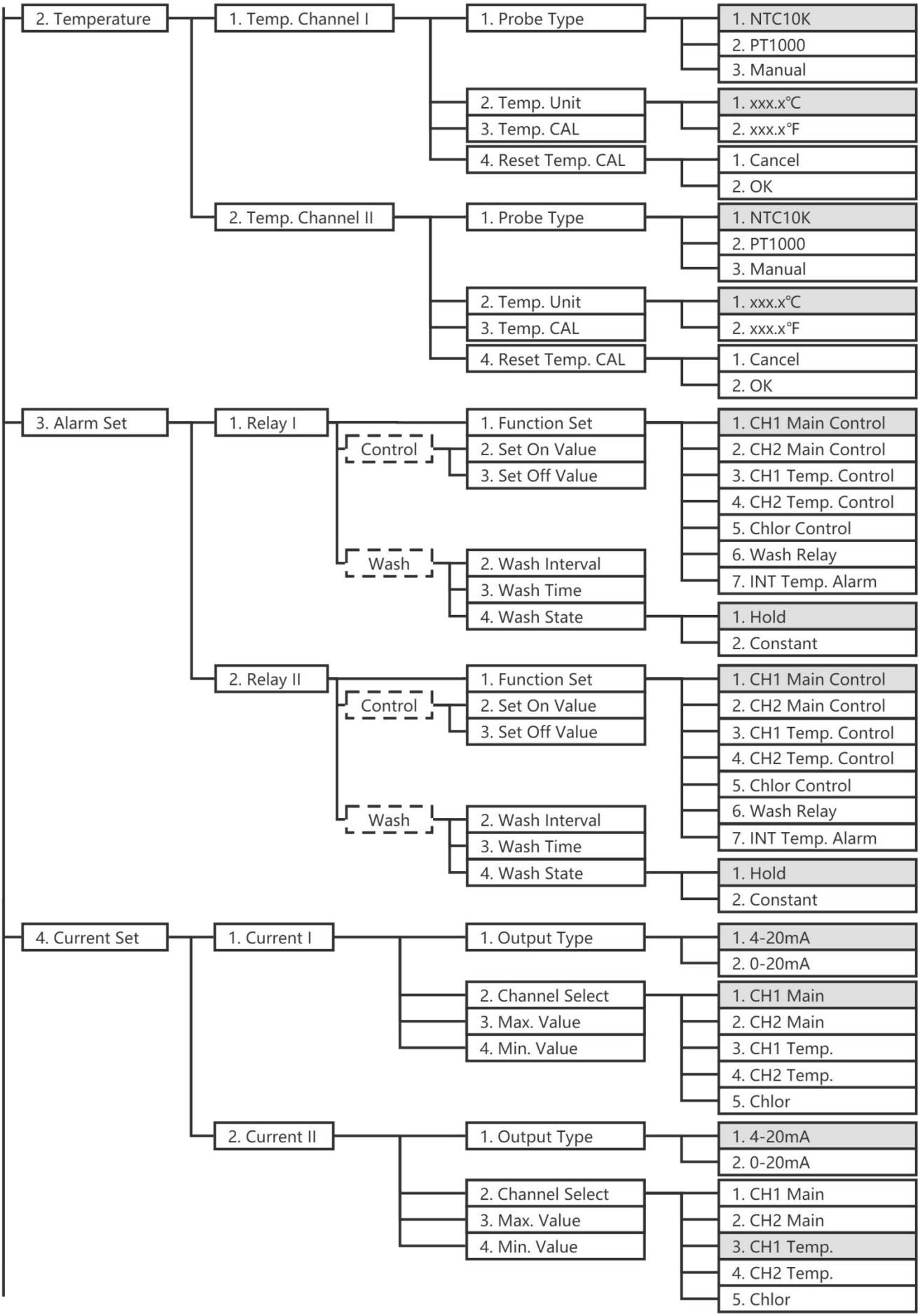
  04: Number of bytes returned

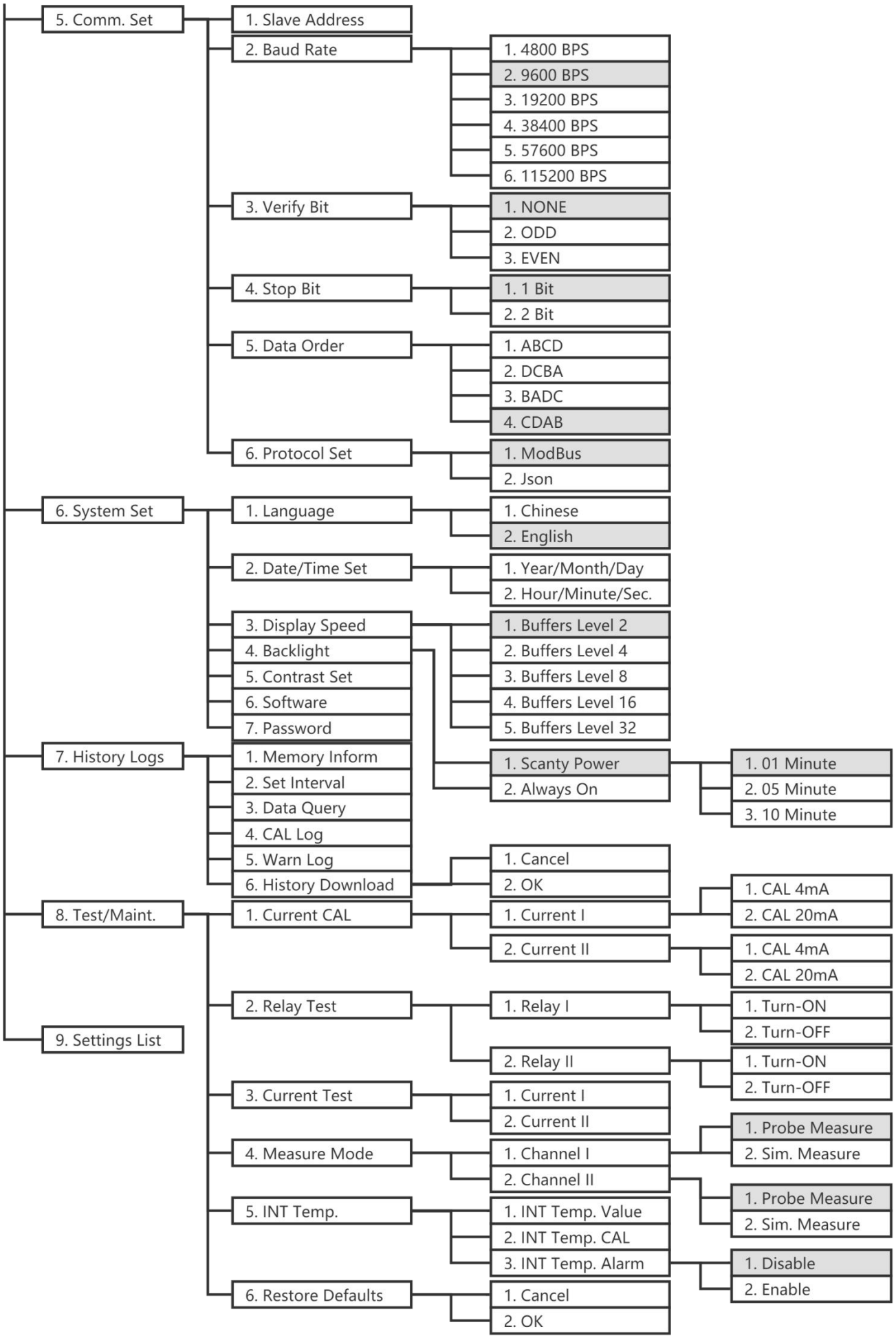
  00 00 43 80: The instrument output data is a floating-point number in CDAB order, which is 0x43800000 in ABCD order, corresponding to the decimal value 256.

  CB 14: CRC16 checksum

Menu Structure Diagram




2. Temperature
1. Temp. Channel I
1. Probe Type
1. NTC10K
2. PT1000
3. Manual
2. Temp. Unit
1. xxx.x℃
2. xxx.x°F
3. Temp. CAL
4. Reset Temp. CAL
1. Cancel
2. OK
2. Temp. Channel II
1. Probe Type
1. NTC10K
2. PT1000
3. Manual
2. Temp. Unit
1. xxx.x℃
2. xxx.x°F
3. Temp. CAL
4. Reset Temp. CAL
1. Cancel
2. OK
3. Alarm Set
1. Relay I
Control
1. Function Set
2. Set On Value
3. Set Off Value
1. CH1 Main Control
2. CH2 Main Control
3. CH1 Temp. Control
4. CH2 Temp. Control
5. Chlor Control
6. Wash Relay
7. INT Temp. Alarm
Wash
2. Wash Interval
3. Wash Time
4. Wash State
1. Hold
2. Constant
2. Relay II
Control
1. Function Set
2. Set On Value
3. Set Off Value
1. CH1 Main Control
2. CH2 Main Control
3. CH1 Temp. Control
4. CH2 Temp. Control
5. Chlor Control
6. Wash Relay
7. INT Temp. Alarm
Wash
2. Wash Interval
3. Wash Time
4. Wash State
1. Hold
2. Constant
4. Current Set
1. Current I
1. Output Type
1. 4-20mA
2. 0-20mA
2. Channel Select
3. Max. Value
4. Min. Value
1. CH1 Main
2. CH2 Main
3. CH1 Temp.
4. CH2 Temp.
5. Chlor
2. Current II
1. Output Type
1. 4-20mA
2. 0-20mA
2. Channel Select
3. Max. Value
4. Min. Value
1. CH1 Main
2. CH2 Main
3. CH1 Temp.
4. CH2 Temp.
5. Chlor


5. Comm. Set
1. Slave Address
2. Baud Rate
1. 4800 BPS
2. 9600 BPS
3. 19200 BPS
4. 38400 BPS
5. 57600 BPS
6. 115200 BPS
3. Verify Bit
1. NONE
2. ODD
3. EVEN
4. Stop Bit
1. 1 Bit
2. 2 Bit
5. Data Order
1. ABCD
2. DCBA
3. BADC
4. CDAB
6. Protocol Set
1. ModBus
2. Json
6. System Set
1. Language
1. Chinese
2. English
2. Date/Time Set
1. Year/Month/Day
2. Hour/Minute/Sec.
3. Display Speed
4. Backlight
5. Contrast Set
6. Software
7. Password
1. Buffers Level 2
2. Buffers Level 4
3. Buffers Level 8
4. Buffers Level 16
5. Buffers Level 32
1. Scanty Power
2. Always On
1. 01 Minute
2. 05 Minute
3. 10 Minute
7. History Logs
1. Memory Inform
2. Set Interval
3. Data Query
4. CAL Log
5. Warn Log
6. History Download
1. Cancel
2. OK
8. Test/Maint.
1. Current CAL
1. Current I
1. CAL 4mA
2. CAL 20mA
2. Current II
1. CAL 4mA
2. CAL 20mA
2. Relay Test
1. Relay I
1. Turn-ON
2. Turn-OFF
2. Relay II
1. Turn-ON
2. Turn-OFF
3. Current Test
1. Current I
2. Current II
4. Measure Mode
1. Channel I
1. Probe Measure
2. Sim. Measure
2. Channel II
1. Probe Measure
2. Sim. Measure
5. INT Temp.
1. INT Temp. Value
2. INT Temp. CAL
3. INT Temp. Alarm
1. Disable
2. Enable
6. Restore Defaults
1. Cancel
2. OK
9. Settings List

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