400 Series Portable pH/Conductivity Meter Instruction Manual

PH400 Portable pH Meter ☐

EC400 Portable Conductivity Meter ☐

PC400 Portable pH/Conductivity Meter ☐

CE ISO9001:2008 IP57 WATERPROOF

APERA INSTRUMENTS, LLC

www.aperainst.com

v4.2

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1 BRIEF INTRODUCTION

Thank you for purchasing Apera Instruments 400 Series Portable pH/Conductivity Meters. Before using the product, please read this manual carefully to help you properly use and maintain the product. For technical support, please contact us at info@aperainst.com or +1 (614)-285-3080

Apera Instruments reserves the right to update the content of this manual without giving prior notices.

1.1 Measuring Parameters

Measuring Parameters	PH400	EC400	PC400
pH/mV	√		√
Conductivity/TDS		√	√
Temperature	√	√	√

1.2 Features and Functions

- The built-in microprocessor chip enables advanced functions such as auto calibration, auto temperature compensation, auto electrode recognition, parameter setting, self-diagnosis, calibration reminder, calibration time check, auto power-off, low-battery reminder, etc.
- The meter adopts advanced digital processing technology, intelligently improves the response time and accuracy of the measurements. Stable reading and auto lock display mode are available for choice.
- Comes with a carrying case, which includes the meter, the electrode(s), calibration solutions, and other accessories, convenient for in-field use.
- Meets IP57 Waterproof and dustproof rating, ideal for use under harsh environment.

1.3 Features in pH Measurement (for PH400 and PC400)

- 1 to 3 points auto calibration with calibration guide and self-diagnosis function.
- Automatic recognition of calibration solutions. Two series of standard solutions for choice: USA and NIST

1.4 Features in Conductivity Measurement (for EC400 and PC400)

- 1 to 4 points auto calibration with calibration guide and auto-check function.
- Single-tap switch between conductivity and TDS.
- Automatic recognition of conductivity calibration solutions.

2 TECHNICAL SPECIFICATIONS

2.1 Parameter Specifications

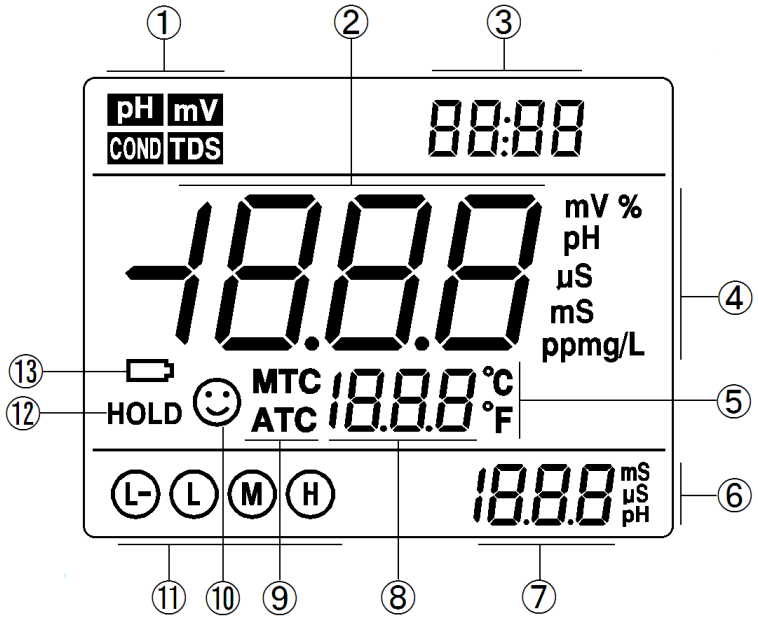
	Technical Parameters		Applicable Models
pH	Measuring Range	(0 to 14.00) pH	PH400 PC400
	Resolution	0.01 pH	
	Accuracy	±0.01 pH ±1 digit	
	Temperature Compensation Range	(0 to 100) °C, Automatic or Manual	
mV	Measuring Range	-1000 mV to 0 to 1000 mV	
	Resolution	1 mV	
	Accuracy	±0.2% F.S ±1 digit	
Conductivity	Measuring Range	Conductivity: 0 to 200 mS/cm, including 5 ranges: (0.00 to 19.99) µS/cm, (20.0 to 199.9) µS/cm, (200 to 1999) µS/cm, (2.00 to 19.99) mS/cm, (20.0 to 199.9) mS/cm TDS: (0 to 100) g/L, including 5 ranges: (0.00 to 9.99) mg/L, (10.0 to 99.9) mg/L, (100 to 999) mg/L, (1.00 to 9.99) g/L, (10.0 to 100.0) g/L	EC400 PC400
	Resolution	0.01/0.1/1 µS/cm, 0.01/0.1 mS/cm	
	Accuracy	±1.0% F.S ±1 digit	
	Temperature Compensation Range	(0 to 50) ℃, Automatic or Manual	
	Electrode Constant	0.1 / 1 / 10 cm^{-1}	
Temperature	Measuring Range	0 to 100℃	PH400 EC400 PC400
	Resolution	0.1℃	
	Accuracy	±0.5℃ ±1 digit	

2.2 Other Specifications

Power Supply	AA Batteries *4 (1.5V*4)
IP Rating	IP57 Waterproof and Dustproof
Dimensions and Weight	Meter: (3.4×7.7×1.3) inches / 12 oz. With case: (14×11×3) inches / 3.5 lbs.

3 INSTRUMENT DESCRIPTION

3.1 LCD Display



① — Measuring parameters
② — Measuring value
③ — Reminder icons
④ — Measurement unit
⑤ — Temperature unit
⑥ — Measuring unit in calibration
⑦ — Calibration value, numberings of data storage, and reminder icons
⑧ — Temperature and reminder icons
⑨ — ATC—Auto Temperature Compensation; MTC— Manual Temperature Compensation
⑩ — Stable reading icon
⑪ — Completed calibration icons
⑫ — Auto-Lock reading mode
⑬ — Low battery reminder. Please replace batteries when this icon is displayed.

3.2 **Keypad**

Figure-1

3.2.1 Short Press — <1.5 s ; Long Press — >1.5 s 。

3.2.2 Power On: Short press ⏻ to power on: LCD displays the measuring mode used last time (Backlight turned on for 1 minute).

3.2.3 Power Off: The meter can only be turned off in measuring mode by short pressing ⏻

Special Notes: Pressing ⏻ in calibration mode or parameter setting mode will NOT turn the meter off. Users need to press CAL MEAS first to go back to measuring mode, and then press ⏻ to power off.

Table- 1 Keypad Operation and Functions

Keypad	Operation	Functions
⏻	Short Press	• Power on/off
MODE SETUP	Short Press	Choose measuring mode: • PH400 pH Meter: pH → mV • EC400 Conductivity Meter: COND→TDS • PC400 pH/Cond. Meter: pH→mV→COND→TDS
	Long Press	• Enter parameter setting
CAL MEAS	Short Press	• Cancel any operation and enter measurement mode
	Long Press	• Enter calibration mode
ENTER	Short Press	• In measurement mode: press to turn on/off the backlight • In calibration mode: press to calibrate • In parameter setting mode: press to confirm choice

△ ▽	Short Press or Long Press	• In manual temperature compensation (MTC) mode: Short press to adjust temperature, long press to adjust swiftly. • In parameter setting mode: press to change the numbering of parameters in main menu and sub-menu. • In sub-menu, press to change parameters and settings.

3.3 **Connectors**

The meter adopts 8-pin connector, into which pH, ORP, and conductivity electrode can be connected. When connected, the meter will automatically switch to the correspondent measurement mode.

3.4 **Display Mode**

3.4.1 Stable Reading Display Mode

When the measuring value is stable, the screen displays ☺ as shown in Figure-2. If ☺ does not appear or is flashing, that means the measuring value has not been stable. Users should wait for the smiley face and not record the readings or conduct calibrations at that moment.

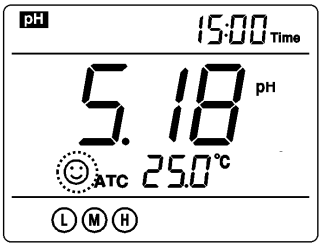


Figure-2

3.4.2 Auto-Lock Display Mode

In parameter setting P4.6, select “On” to turn on the auto-lock display mode, In which the reading will be automatically locked after the measuring value has been stable for more than 10 seconds, and the HOLD icon will come up as shown in Figure-3. Short press CAL/MEAS to cancel the hold.

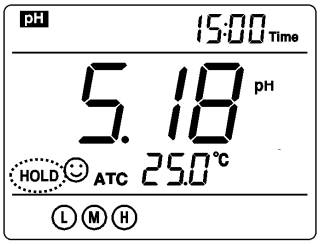


Figure-3

4 pH MEASUREMENT

4.1 **Information regarding the pH Electrode**

The instrument is equipped with a 201T-S 3-in-1 Combination pH Electrode. Its built-in temperature sensor allows for auto. temperature compensation. There is a vial stored with 3M KCL storage solution on top of the electrode. Before using, loosen the cap of the vial, take out the electrode and rinse it in distilled water and then do measurement. When not in use, place the electrode back to the vial and tighten the cap so that the pH sensor can be stored in the best condition. When the pH electrode is dipped into the test sample solution, stir it for a few seconds to remove potential air bubbles inside the probe to help the measurement get stabilized quickly.

When connecting the electrode into the instrument, please slowly rotate the connector, identify the location of the mount to insert it, and then screw it on. Please note that do not pull on the cables in case of poor contact.

Please keep the connector clean and dry. For detailed information of the electrode’s maintenance, please refer to section 4.5.

4.2 **Information regarding pH Calibration**

4.2.1 Standard Buffer Solutions

The instrument adopts two series of standard buffer solutions: USA and NIST as shown in Table-2. Users can select which one to use in P1.1 (refer to section 7.3).

Table-2

Calibration Icons		pH Standard Calibration Solution Series	
		USA Series	NIST Series
3-point calibration	Ⓛ	4.00 pH	4.01 pH
	Ⓜ	7.00 pH	6.86 pH
	Ⓗ	10.01pH	9.18 pH

4.2.2 pH Calibration Modes

The instrument has 1 to 3 points auto calibration mode. The 1st point must be 7.00 pH (or 6.86 if using NIST). Then choose other calibration solutions to conduct 2nd and 3rd points (see Table-3 for details). In the process of calibration, the meter will display the electrode's slope in acid and alkaline ranges.

Table-3 3-point Calibration Mode

	USA	NIS	Calibration icon	When to adopt
1-Point Calibration	7.00 pH	6.86 pH	Ⓜ	accuracy≤ ±0.1 pH
2-Point Calibration	7.00 pH and 4.00/1.68 pH	6.86 pH and 4.01/1.68 pH	ⓁⓂ	Measuring range: 0 to 7.00 pH
	7.00 pH and 10.01 pH	6.86 pH and 9.18 pH	ⓂⒽ	Measuring range: >7.00 pH
3-Point Calibration	7.00pH, 4.00/ 1.68 pH and 10.01 pH	6.86pH, 4.01/ 1.68pH, 9.18 pH	ⓁⓂⒽ	Wide measuring range

4.2.3 How often to calibrate

The frequency that you need to calibrate your meter depends on the tested samples, performace of electrodes, and the requirement of the accuracy. For High-Accuracy measurements (≤ ±0.02pH), the meter should be calibrated before test every time; For ordinary-accuracy Measurements (≥±0.1pH), once calibrated, the meter can be used for about a week or longer. In the following cases, the meter must be re-calibrated:

a) The electrode hasn't been used for a long time or the electrode is brand new.
b) After measuring strong acid (pH<2) or strong base (pH>12) solutions.
c) After measuring fluoride-containing solution and strong organic solution
d) There is a big difference between the temperature of the test sample and the temperature of the buffer solution that is used in the last calibration.

4.3 **pH Calibration** (Take 3-point calibration as an example)

4.3.1 Press CAL/MEAS to enter calibration mode. CAL1 icon will flash in the upper right corner of the LCD. 7.00 pH will flash in the lower right corner of the LCD, reminding you to use pH 7.00 buffer to conduct 1st point of calibration.

4.3.2 Use distilled water to rinse off electrode and then dry it. Dip it into pH 7.00 buffer solution, stir gently and let it stand still and wait for the reading to become stable. In the lower right corner of LCD, the process of auto recognizing the buffer solution will be displayed. Pressing ENTER before the buffer is recognized will generate Er2 (please refer to table 6).

4.3.3 When the meter locks 7.00 pH, ☺ displays on LCD. Press ENTER key to calibrate the meter. **End** icon appears after calibration is done. The 1st point calibration is finished. In the meanwhile, CAL2 will flash at the upper right corner, and 4.00 pH & 10.01 pH will flash alternately at the bottom right, indicating using pH 4.00 or pH 10.01 buffer solution to make the 2nd point calibration.

4.3.4 Take out pH electrode, rinse it in distilled water, dry it, and dip it into pH 4.00 buffer solution. Stir the solution gently and let stand still in the buffer solution until a stable reading is reached. The meter's display will show the recognition process of calibration buffer solution at the lower right of LCD. When the meter recognizes 4.00 pH, ☺ displays on LCD. Press ENTER key to calibrate the meter. End icon and electrode slope of acidity range display after calibration is done. In the meanwhile, CL3 will flash at the upper right corner of the LCD, and 10.01 pH will flash at the lower right, indicating using pH10.01 buffer solution to make the 3rd point calibration.

4.3.5 Take out pH electrode, rinse it in distilled water, dry it, and dip it into pH 10.01 buffer solution. Stir the solution gently and let it stand still in the buffer solution until a stable reading is reached. The meter's display will show recognition process of calibration buffer solution at the bottom right of LCD. When the meter recognizes 10.01 pH, ☺ displays on LCD. Press ENTER key to calibrate the meter. End icon and electrode slope of alkalinity range display after calibration is done. The meter returns to the measurement mode, displays stable measuring value and calibration guide icons. Please see Figure-4 for the above calibration process.

During the calibration process, press CAL/MEAS key to exit from the calibration mode. Correspondent calibration guide icons will appear on the LCD.

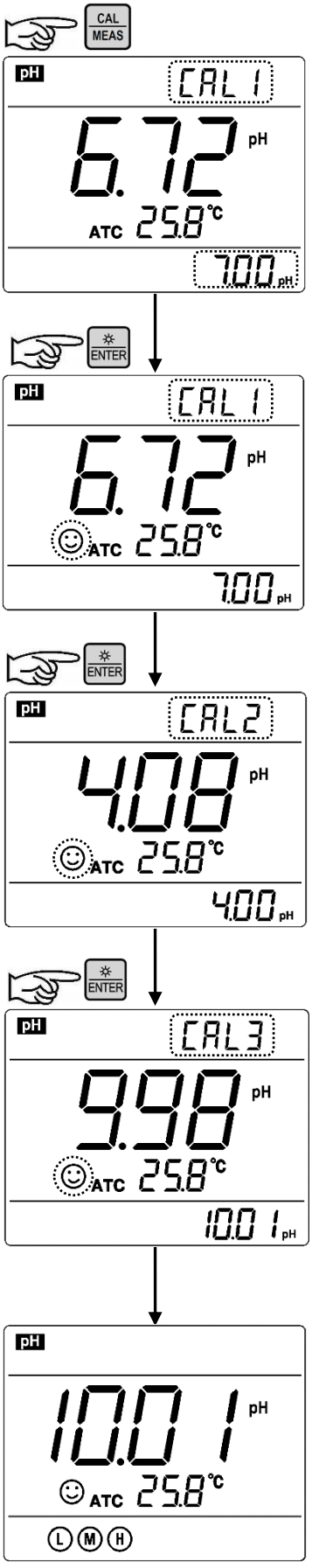
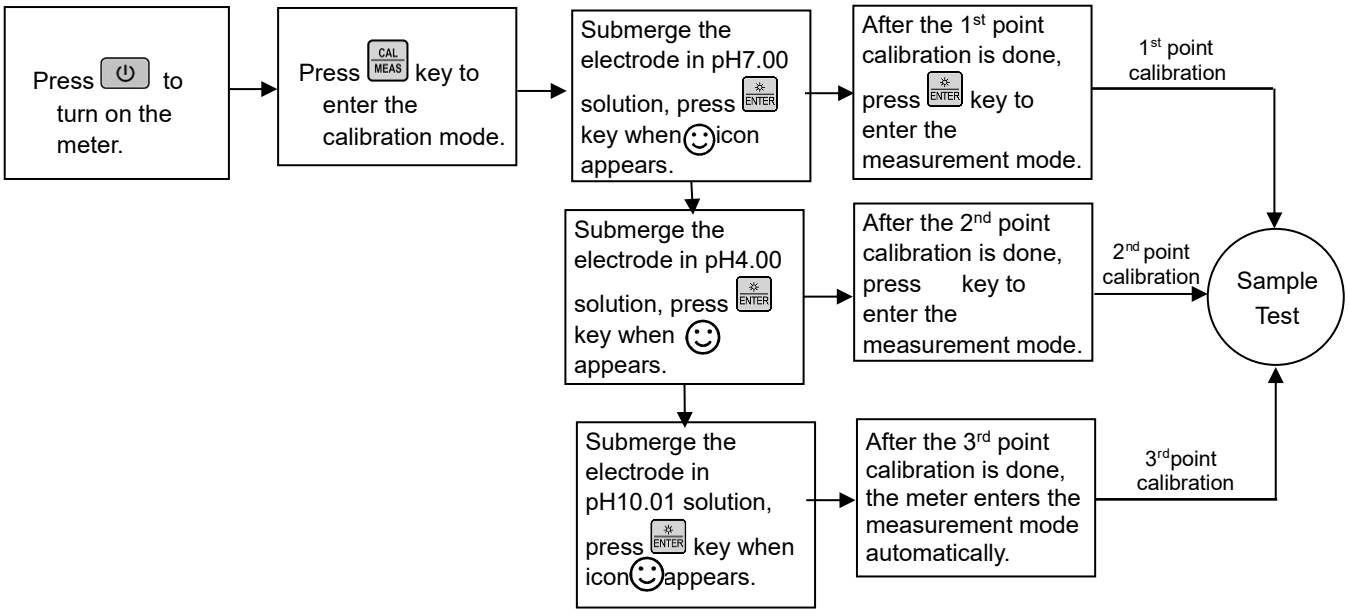


Figure-4

4.4 **Sample Measurement**

4.4.1 Rinse the pH electrode in distilled water, dry it, and dip it into sample solution. Stir the solution gently and let it stand still in the sample solution until ☺ icon appears and stays on LCD, get the pH reading, which is pH value of sample solution, please refer to Figure-5 for calibration and measurement process of the pH meter.

Figure-5 Calibration and measurement process of pH meter



4.4.2 Self-Diagnosis Information

Table – 4 Self-diagnosis information

Display Icons	Contents	How to fix
Er 1	Wrong pH buffer solution or the buffer solution out of range.	1.Check whether pH buffer solution is correct. 2.Check whether the meter connects the electrode properly. 3.Check whether the electrode is damaged.
Er2	Press ENTER when measuring value is not stable during calibration.	Press ENTER key when ☺ icon appears and stays.
Er3	During calibration, the measuring value being unstable for over 3 minutes	1.Check whether there are air bubbles in the glass bulb. To remove the air bubble, hold the electrode firmly and flick the electrode in a downward motion for several times. 2.Replace with a new pH electrode.
Er4	pH electrode zero electric potential out of range（<-60mV or >60mV）	1.Check whether there are air bubbles in the glass bulb. To remove the air bubble, hold the electrode firmly and flick the electrode in a downward motion for several times. 2.Check whether pH buffer solution is correct. 3.Replace with new pH electrode.
Er5	pH electrode slope out of range（<85% or >110%）	

4.4.3 pH isothermal measurement principle

According to the pH isothermal measurement principle, the closer the test sample's temperature is to the calibration solution's, the higher the accuracy of the measurement. So this principle is recommended to follow when conducting tests.

4.4.4 Restore to factory default

The instrument has a function to return to factory default setting, which can be set up in P1.2 (refer to section 7.3). Returning to factory default setting is to restore the meter to the theoretical value (zero potential pH is 7.00, slope is 100%), and set all the parameters to default settings (see appendix 1). When the meter's calibration or measurement is performing abnormally, users can use this function to let the meter return to factory default mode, and conduct calibration and then test again. Please note that this function is irreversible once used.

4.5 Maintenance of the pH Electrode

4.5.1. Daily maintenance

The soaking solution contained in the supplied protective vial is used to maintain the sensitivity of the glass bulb and junction. Loosen the cap, remove the electrode and rinse in distilled water before taking a measurement. Insert the electrode and tighten the cap after measurements to prevent the reference solution from leaking. If the soaking solution is turbid or moldy, replace it with 3M KCL solution. (SKU: AI1107). Soaking the probe in other brands' storage solution could potentially cause damage to the probe.

The electrode **should NOT be soaked in pure or distilled water**, protein solution or acid fluoride solution. In addition, do not soak the electrode in organic lipids.

4.5.2. Calibration buffer solution

For calibration accuracy, the pH of the standard buffer solution must be reliable. The buffer solution should be refreshed often, especially after heavy use. We recommend 10-15 times of use before replacing the pH buffers.

4.5.3 Protect glass bulb

The sensitive glass bulb at the front of the combination electrode should not come in contact with hard surfaces. Scratches or cracks on the electrode will cause inaccurate readings. Before and after each measurement, the electrode should be rinsed with distilled water. If a sample sticks to the electrode or it's contaminated, the electrode should be thoroughly cleaned using a soft brush and then rinsed with distilled water. After that, soak it in the 3M KCL (SKU: AI1107) solution again for 6 hours.

4.5.4 Renew glass bulb

Electrodes that have been used over a long period will become aged. Soak the electrode in 0.1mol/L hydrochloric acid for 24 hours, then wash the electrode in distilled water, then soak it in 3M KCL (SKU: AI1107) storage solution for 24 hours.

The method to prepare 0.1mol/L hydrochloric acid: dilute 9mL hydrochloric acid in distilled water to 1000mL.
For serious passivation, dip the bulb in 4% HF (hydrofluoric acid) for 3-5 seconds, and wash it in distilled water, then soak it in the 3M KCL storage solution (SKU: AI1107) for 24 hours to renew it.

4.5.5. Clean contaminated glass bulb and junction (please refer to Table-5)

Table-5 Clean contaminated glass bulb and junction

Contamination	Cleaning Solutions
Inorganic metal oxide	Dilute acid less than 1mol/L
Organic lipid	Dilute detergent (weak alkaline)
Resin macromolecule	Dilute alcohol, acetone, ether
Proteinic haematocyte sediment	Acidic enzymatic solution (saccharated yeast tablets)
Paints	Dilute bleacher, peroxide

Notes:

1) ***The instruments will NOT give accurate and stable pH readings when measuring distilled or deionized water. This because distilled and deionized water do not have enough ions present for the electrode to function properly. To measure distilled or deionized water's pH, users need to use a specialized electrode. Contact us for more details.***
2) ***The electrode housing is polycarbonate. When using cleaning solutions, take cautions on carbon tetrachloride, trichlorethylene, tetrahydrofuran, acetone, etc., which will dissolve the housing and invalidate the electrode.***

5 mV MEASUREMENT

5.1 ORP measurement

Press MODE STEUP key, and switch the meter to mV measurement mode. Connect ORP electrode (the 301Pt-S combination ORP electrode is sold separately) and dip it in sample solution, stir the solution briefly and allow it to stay in the solution until ☺ icon appears and get the reading.

ORP means Oxidation Reduction Potential. The unit is mV.

5.2 Notes on ORP measurement

5.2.1 ORP measurement does not require calibration. When the user is not sure about ORP electrode quality or measuring value, use ORP standard solution to test mV value and see whether ORP electrode or meter works properly. Table-6 is the data of standard ORP solution for 222 mV.

Table-6

°C	10	15	20	25	30	35	38	40
mV	242	235	227	222	215	209	205	201

5.2.2 Clean and activate ORP electrode

After the electrode has been used over a long period of time, the platinum surface will get polluted which causes inaccurate measurement and slow response. Please refer to the following methods to clean and activate ORP electrode:

(a) For inorganic pollutant, soak the electrode in 0.1mol/L dilute hydrochloric acid for 30 minutes, then wash it in distilled water, then soak it in the 3M KCL storage solution for 6 hours.

(b) For organic or lipid pollutant, clean the platinum surface with detergent, then wash it in distilled water, then soak it in the 3M KCL storage solution for 6 hours.

(c) For heavily polluted platinum surface on which there is oxidation film, polish the platinum surface with toothpaste, then wash it in distilled water, then soak it in the 3M KCL storage solution for 6 hours.

6 CONDUCTIVITY MEASUREMENT

6.1 Information regarding the Conductivity Electrode

6.1.1. Conductivity electrode

Model 2301T-S plastic conductivity electrode with constant K=1.0 and built-in temperature sensor, can realize automatic temperature compensation. The electrode housing is POM plastic which is corrosion resistant and impact resistant. When dipping the conductivity electrode in solution, stir the solution briefly to eliminate the air bubbles and improve response and stability.

6.1.2. Conductivity electrode constant

The meter matches conductivity electrodes of three constants: K=0.1, K=1.0 and K=10.0. Please refer to table-7 for measuring range. Set constant in parameter setting P2.1 and refer to section 7.4

Table– 7 Electrode constant and measuring range

Range	＜20 μS/cm	0.5 μS/cm to 100 mS/cm			＞100mS/cm
Conductivity electrode constant	K=0.1 cm^{-1}	K=1.0 cm^{-1}			K=10 cm^{-1}
Standard solution	84μS/cm	84 μS/cm	1413 μS/cm	12.88 mS/cm	111.8 mS/cm
Electrode's model	DJS-0.1T-S	2301T-S			2310T-S

Note: When testing ultra-pure water with conductivity less than 1.0 μS/cm, a flow test should be conducted in a flow cell.

6.1.3 When connecting the electrode, please rotate slowly to identify the location of the mount before plugging in. The nut on the connector should be screwed on tightly. Once the conductivity electrode is connected, the meter will automatically switch to conductivity mode (no need to switch manually). Please do not pull the cable in case of poor contact. Make sure the connector is clean and dry. See more information regarding the conductivity electrode's maintenance in section 6.6.

6.2 **Information regarding Conductivity Calibration**

6.2.1 Conductivity Standard Calibration Solutions

The meter uses conductivity standard solution of 84 µS/cm, 1413 µS/cm, 12.88 mS/cm and 111.8 mS/cm. The meter can recognize the standard solution automatically, and can perform 1 to 4 points of calibration. The calibration indication icons correspond to the four standard values as shown in Table-8.

Table-8 Conductivity Calibration Solutions

Calibration Icons	Calibration Solutions
L	84 µS/cm
M	1413 µS/cm
H	12.88 mS/cm
H+	111.8 mS/cm

6.2.2. How often to calibrate

(a) The meter has been calibrated before leaving the factory and can generally be used right out of the box.

(b) Normally perform calibration once per month.

(c) For high accuracy measurements or large temperature deviation from the reference temperature (25°C), perform calibration once per week.

(d) Use conductivity standard solution to check whether there is error. Perform calibration if error is large.

(e) For new electrode or the meter has been set to factory default, perform 3-point or 4-point calibration. For general use, choose standard solutions that are closer to the sample solution to perform 1-point or 2-point calibration.

6.2.3. Reference Temperature

The factory default setting for reference temperature is 25℃. The reference temperature can be set from 15℃ to 30℃. Users can set it up in parameter setting P2.2 (see Section 7.4 for details).

6.2.4. Temperature compensation coefficient

The temperature compensation coefficient of the meter setting is 2.0%/°C. However, the conductivity temperature coefficient is different from solutions and concentration. Please refer to Table – 9 and the data collected during testing. Do the setting in P2.3. (see section 7.4 for more).

Note: When the coefficient for the temperature compensation is set to 0.00 (no compensation), the measurement value will be based on the current temperature.

Table – 9 Temperature compensation coefficient of special solutions

Solution	Temperature compensation coefficient
NaCl solution	2.12%/°C
5% NaOH solution	1.72%/°C
Dilute ammonia solution	1.88%/°C
10% hydrochloric acid solution	1.32%/°C
5% sulfuric acid solution	0.96%/°C

6.2.5. Precaution for calibration solution's contamination

Conductivity standard solution has no buffer. Please avoid being contaminated during usage. Before submerging the electrode in standard solution, please rinse the electrode in distilled water and dry it with clean cloth or tissue paper. Please do not use the same cup of conductivity standard solution repeatedly, especially for standard solution of low concentration (84μS/cm). The contaminated standard solution will affect the accuracy.

6.3 Conductivity Calibration

6.3.1. Rinse the electrode in distilled water, allow it to dry, wash with a little of standard solution and dip it in standard solution. Stir the solution briefly and allow it to stay in the solution until a stable reading is reached.

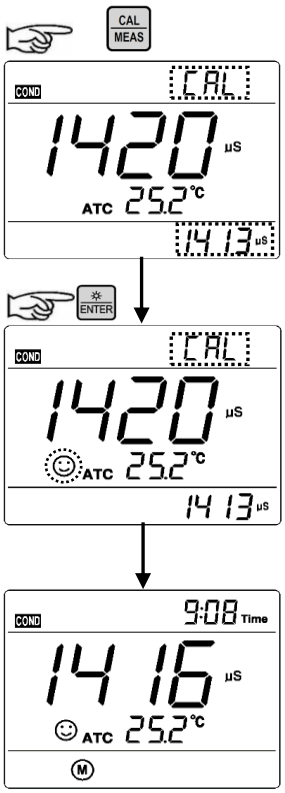


Figure-6

6.3.2. Press CAL/MEAS key to enter the calibration mode.

The meter's display will show blinking "**CAL**" at the top right, and scanning and locking process of calibration solution at the bottom right. When the meter locks1413 mS, stable icon ☺ will display on LCD. Press ENTER key to complete calibration.

The meter will return to measuring mode and Ⓜ is displayed on bottom left of the LCD screen. See Figure-11.

6.3.3. Notes:

(a) Pressing ENTER key before stable icon ☺ appeared on LCD screen, Error indication icon Er 2 will be shown. See Table -11.

(b) Press CAL/MEAS key before confirmation to exit calibration mode (calibration will not be completed).

Figure-11

6.3.4. For multi-point calibrations, please repeat the steps in 6.3.1 to 6.3.2 until all calibrations are finished. The meter can be calibrated in the same calibration solution repeatedly until the reading is stable and repeatable.

6.4 TDS & Conductivity

6.4.1. TDS and conductivity is linear related. The conversion factor is 0.40-1.00. Adjust the factor from parameter P2.6. The factory default setting is 0.71 and please refer to section 7.4. The meter only needs to be calibrated in Conductivity mode, then after calibration of conductivity, the meter can switch from conductivity to TDS.

6.4.2. Adjust TDS conversion factor in parameter setting P2.7 according to the data collected during testing and experience. Table – 10 lists some commonly used Conductivity and TDS conversion factors. This is for your reference only.

Table – 10 Conductivity and TDS conversion factors

Conductivity of solution	TDS conversion factor
0-100 µS/cm	0.60
100-1,000 µS/cm	0.71
1-10 mS/cm	0.81
10-100 mS/cm	0.94

6.5 **Sample test**

6.5.1. Rinse conductivity electrode in distilled water, dry it, and dip it in the sample solution. Stir the solution briefly and allow it to stay in the sample solution until a stable reading is reached and ☺ icon appears on LCD, then get the reading value, which is the conductivity value of the solution.

6.5.2. Press MODE STEUP key to switch to TDS.

6.5.3. During the process of calibration and measurement, the meter has self-diagnosis functions, indicating the relative information as below: Table – 11.

Table – 11 Self-diagnosis information of conductivity measurement mode

Display Icons	Contents	Checking
Er 1	Wrong conductivity calibration solution or the meter recognition of calibration solution out of range.	1. Check whether conductivity calibration solution is correct. 2. Check whether the meter connects the electrode well. 3. Check whether the electrode is damaged.
Er2	Press ENTER key when measuring value is not stable during calibration.	Press ENTER key after ☺ icon appears.
Er3	During calibration, the measuring value being unstable for over 3 minutes.	1. Shake the electrode to eliminate bubbles in electrode head. 2. Replace with new conductivity electrode.

6.5.4. Factory default setting

For factory default setting, please refer to parameter setting P2.7 (Section 7.4). With this function, all calibration data is deleted and the meter restores to the theory value. Some functions restore to the original value (refer to appendix -1). When calibration or measurement fails, please restore the meter to factory default setting and then perform re-calibration or measurement. Please note once set the factory default, all the data deleted will be irretrievable.

6.6 **Maintenance of the Conductivity Electrode**

6.6.1. Always keep the conductivity electrode clean. Before taking a measurement, rinse the electrode in distilled water. It is recommended to rinse it again in the sample solution. When dipping the electrode in solution, stir the solution briefly to eliminate air bubbles and allow it to stay until a stable reading is reached. Conductivity electrodes are usually stored dry. For conductivity electrodes that haven't been used for a long time, users can soak the electrode in 12.88 mS calibration solution for 5-10 minutes, or to soak it in tap water for 1 to 2 hours.

Rinse the electrode in distilled water after measurement.

6.6.2. The sensing rod of Model 2301T-S conductivity electrode is coated with platinum black to minimize electrode polarization and expand measuring range. The platinum black coating adopted our special processing technology, which improves the electrode performance and the firmness of the coating. If the platinum black electrode is stained, gently clean the electrode with soft brush in warm water containing detergent or alcohol.

7 PARAMETER SETTING

7.1 Main Menu

In the measurement mode, press MODE/STEUP key to enter in P1.0, then press △ or ▽ to switch main menu: P1.0→P2.0→P4.0. Please refer to Figure - 7.

P1.0: pH parameter setting menu,

P2.0: Conductivity parameter setting menu,

P4.0: Basic parameter setting menu.

7.2 Sub-Menu

7.2.1 In P1.0, press ENTER to enter the submenu P1.1 for pH setting, press △ and ▽ to change submenu: P1.1→P1.2→ … →P1.5. See Figure-7 for details.

7.2.2 In P2.0, press ENTER to enter the submenu P2.1 for conductivity setting, press △ and ▽ to change submenu: P2.1→P2.2→ … →P2.7. See Figure-7 for details.

7.2.3 In P4.0, press ENTER to enter the submenu P4.1 for basic parameter setting, press △ and ▽ to change submenu: P4.1→P4.2→…→P4.8. See Figure-7 for details.

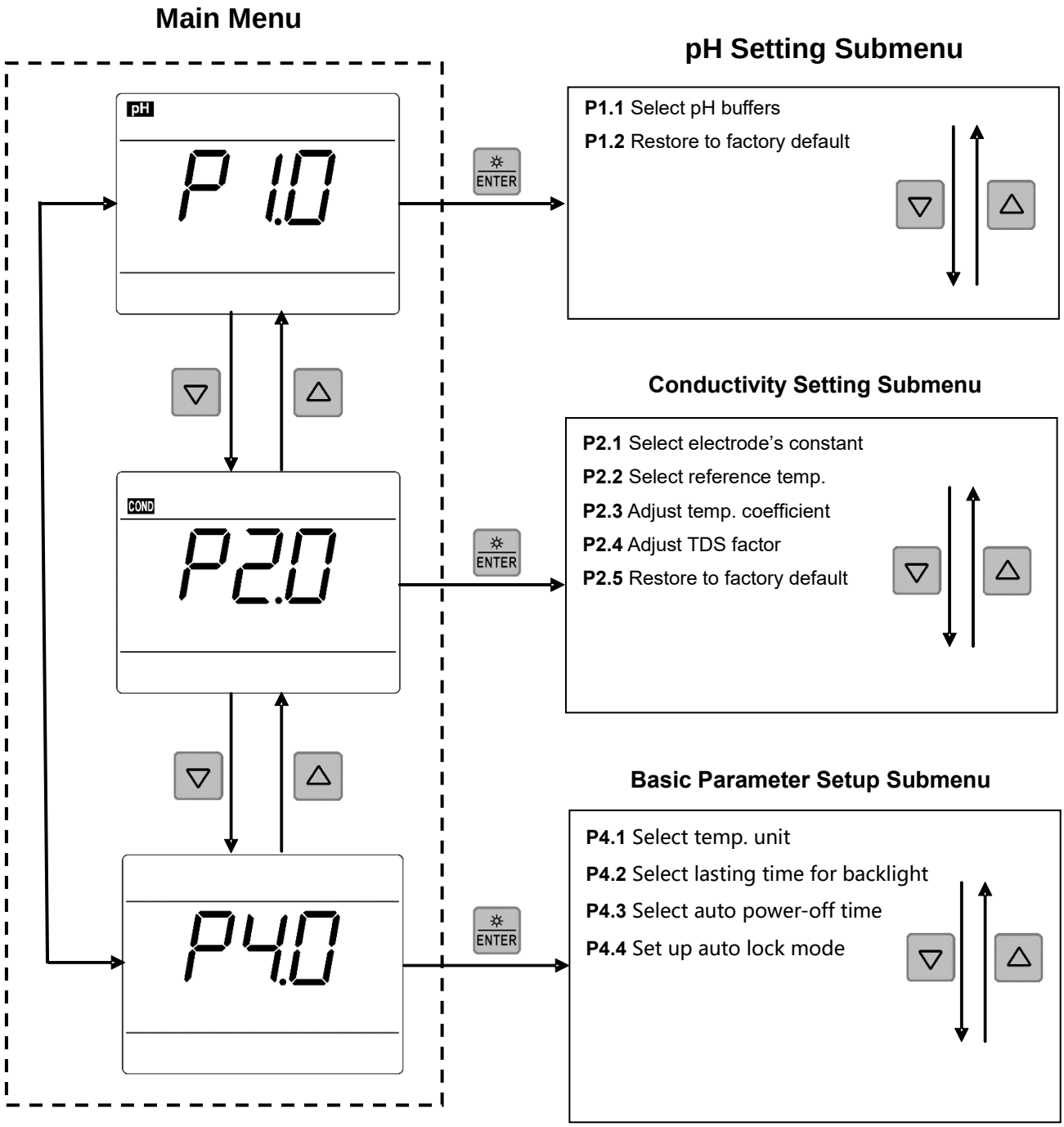
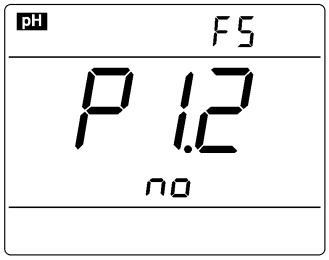


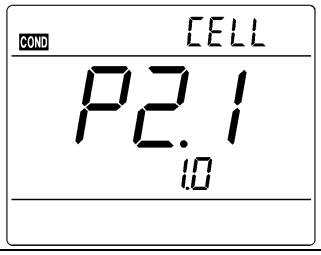
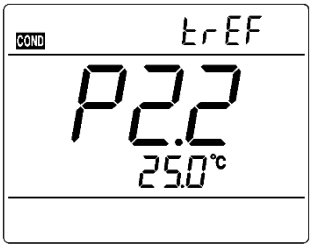
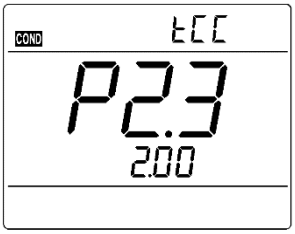
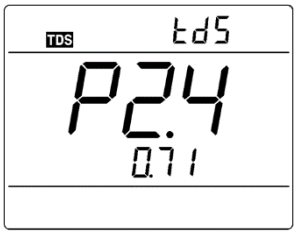
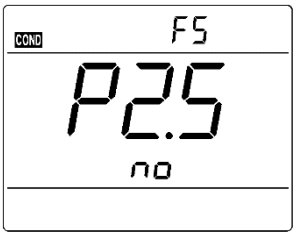
Figure-7

7.3 pH Setting Sub-Menu

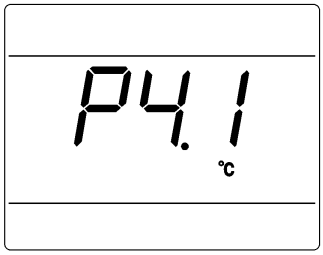
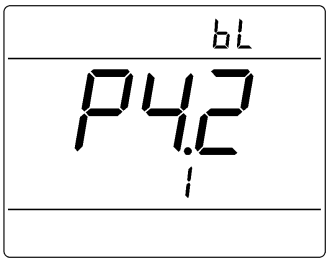
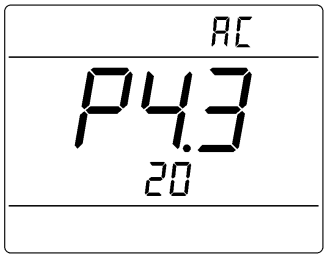
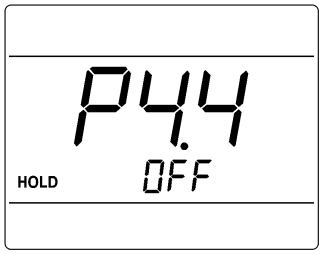
pH buF P 1.1 USA	P1.1 **— Select pH buffer series (**USA—NIST) 1. In measurement mode, long press MODE SETUP to enter P1.0, press ENTER to enter P1.1 2. Press ENTER, "USA" flashes; Press △ to choose USA→NIST; Press ENTER to confirm. USA—USA NIS—NIST 3. Press △ to enter P1.2, or press CAL MEAS to return to measurement mode.

	P1.2 **— Return to factory default mode** (No—Yes) Press ENTER, "No" flashes, press △ to choose No→Yes; Press ENTER to confirm, the meter returns to measurement mode. No**—** not return to factory default mode; Yes—return to factory default mode If not choosing Yes, Press CAL/MEAS to return to measurement mode.

7.4 Conductivity Setting Sub-Menu

	P2.1 **— Select electrode's constant** （1.0—10.0—0.1） 1. In P2.0, press ENTER to enter P2.1 2. Press ENTER, "1.0" flashes, press △ to choose 1.0→10.0→0.1; press ENTER to confirm 3. Press △ to enter P2.2, or press CAL/MEAS to return to measurement mode.
	P2.2**—Select reference temperature** (25.0℃—18.0℃**—**20.0℃) 1. Press ENTER, "25.0℃" flashes, press △ or ▽ to adjust temp. from 15℃ to 30℃; press ENTER to confirm. 2. Press △ to enter P2.3, or press CAL/MEAS to return to measurement mode.
	P2.3**—Adjust temp. compensation coefficient** (0.00-9.99%) 1. Press ENTER, "2.00" flashes, press △ or ▽ to adjust from 0.00-9.99; press ENTER to confirm. 2. Press △ to enter P2.4, or press CAL/MEAS to return to measurement mode.
	P2.4**—Adjust TDS Factor (0.40-1.00)** 1. Press ENTER, "0.71" flashes, press △ or ▽ to adjust from 0.40-1.00; press to confirm. 2. Press △ to enter P2.5, or press CAL/MEAS to return to measurement mode.
	P2.5 **— Return to factory default mode** (No—Yes) Press ENTER, "No" flashes, press △ to choose No→Yes; Press ENTER to confirm, the meter returns to measurement mode. No**—** not return to factory default mode; Yes—return to factory default mode If not choosing Yes, press CAL/MEAS to return to measurement mode.

7.5 **Basic Parameter Setting Sub-Menu**

	P4.1 **—**(°C—°F) 1. Press ENTER , "°C" flashes, press △ , "°F" flashes; when parameter flashes, press ENTER to confirm. 2. Press △ to enter P4.2, or press CAL MEAS to return to measurement mode.
	P4.2**—Select lasting time for backlight** (1—2—3—On) 1. Press ENTER , "1" flashes, press △ to choose from 1→2→3→On; press ENTER to confirm Select On to have the backlight always turned on; time unit is minute. 2. Press △ to enter P4.3, or press CAL MEAS to return to measurement mode.
	P4.3 **— Select auto power-off time** (10—20—30—On) 1. Press ENTER , "20" flashes, press △ to choose from 20→30→On→10, press ENTER to confirm. Select On to shut off the auto power-off function; time unit is minute. 2. Press △ to enter P4.4, or press CAL MEAS to return to measurement mode.
	P4.4 **— Set up Auto-Lock reading mode** (Off—On) 1. Press ENTER , "Off" flashes, press △ to choose Off→On; press ENTER to confirm. 2. Press CAL MEAS to return to measurement mode.

8 COMPLETE KIT

	Content	Quantity	PH400	EC400	PC400
1	PH400 Portable pH Meter	1	√		
2	EC400 Portable Conductivity Meter	1		√	
3	PC400 Portable pH/Conductivity Meter	1			√
4	201T-S Plastic 3-in-1 Combination pH Electrode	1	√		√
5	2301T-S Plastic Combination Conductivity Electrode	1		√	√
6	pH Standard Buffer (4.00 pH,7.00 pH,10.01pH/50mL)	1 for each	√		√
7	Conductivity Standard Solutions (84μS,1413μS,12.88mS/50mL)	1 for each		√	√
10	Carrying Case	1	√	√	
12	Instruction Manual	1	√	√	√

9 WARRANTY

We warrant this instrument to be free from defects in material and workmanship and agree to repair or replace free of charge, at option of APERA INSTRUMENTS, LLC, any malfunctioned or damaged product attributable to responsibility of APERA INSTRUMENTS, LLC for a period of TWO YEARS (SIX MONTHS for the probes) from the delivery.

This limited warranty does not cover any damages due to:
Transportation, storage, improper use, failure to follow the product instructions or to perform any preventive maintenance, modifications, combination or use with any products, materials, processes, systems or other matter not provided or authorized in writing by us, unauthorized repair, normal wear and tear, or external causes such as accidents, abuse, or other actions or events beyond our reasonable control.

10 APPENDIX 1: TABLE OF PARAMETER SETTING AND FACTORY DEFAULT SETTING

Mode	Symbol	Parameter	Abbreviation	Content	Factory Default
P1.0 pH	P1.1	Select Buffer Series	buF	USA - NIST	-
	P1.2	Restore to factory default settings	FS	No - Yes	No
P2.0 Conductivity	P2.1	Select electrode's constant	CELL	1.0 - 10.0 - 0.1	1.0
	P2.2	Select reference temperature	trEF	15℃ - 30℃	25℃
	P2.3	Adjust temperature compensation coefficient	tCC	0.00 - 9.99	2.00
	P2.4	Adjust TDS factor	tdS	0.40 - 1.00	0.71
	P2.5	Restore to factory default setting	FS	No - Yes	No
	P4.1	Select temperature unit	/	℃ - ℉	-
	P4.2	Select lasting time for backlight	bL	1 - 2 - 3 - On	-
	P4.3	Select time for auto power-off	AC	10 - 20 - 30 - On	-
	P4.4	Set up auto-lock reading mode	/	Off—On	-

11 APPENDIX 2: ICONS AND ABBREVIATION

Mode	Symbol	Abbreviation	Content
P1.0 pH	P1.1	buF	Standard buffers
	P1.2	/	Factory default setting
P2.0 Conductivity	P2.1	CELL	Electrode constant
	P2.2	trEF	Reference temperature
	P2.3	tCC	Temperature compensation coefficient
	P2.4	tdS	TDS Factor
	P2.5	FS	Factory default setting
P4.0 Basic Parameters	P4.1	/	
	P4.2	bL	backlight
	P4.3	AC	Auto power-off
	P4.4	/	

Others		USA	USA Series
		n IS	NIST Series
		OFF	Off
		On	On
		no	No
		YES	Yes

12 APPENDIX 3: TABLE OF SELF-DIAGNOSIS

Symbol	Self-Diagnosis Information	pH	Conductivity
Er 1	Wrong conductivity calibration solution or the meter recognition of calibration solution out of range.	√	√
Er2	Press ENTER key when measuring value is not stable during calibration.	√	√
Er3	During calibration, the measuring value is not stable for ≥ 3 min.	√	√
Er4	pH electrode zero electric potential out of range (<-60mV or >60mV)	√	
Er5	pH electrode slope out of range (<85% or >110%)	√	

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