PC820 Precision
Benchtop pH/Conductivity Meter
Instruction Manual

PH820 Lab pH Meter ☐

EC820 Lab Conductivity Meter ☐

PC820 Lab pH/Conductivity Meter ■

RoHS compliant CE ISO 9001:2015 IP54 WATERPROOF

APERA INSTRUMENTS (Europe) GmbH

www.aperainst.de

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Special Notes

- Do NOT pull out the power plug until the meter is turned off.
- Don't pull out USB plug or press ⏻ button to turn off the meter directly when the meter is connecting with PC. Please press "Exit" button first (in the PC interface) to quit PC Link Software, then press ⏻ button to turn off the meter, and pull out USB plug after that.
- There is a CR2032 3V lithium battery in the meter's circuit board, see the picture on the right. It's power source for meter inner clock. When the voltage is lower than 2.6V after long time use, a blue screen with on display values and icons may appear when turn on the meter. At that moment, please open the meter and replace a new CR2032 3V lithium battery.

1. BRIEF INTRODUCTION

Thank you for purchasing PC820 Precision Benchtop pH/Conductivity Meters. Before using the product, please read this manual carefully to help you properly use and maintain the product.

1.1 Measuring Parameters

Measuring Parameters	PH820	EC820	PC820
Instrument Level	0.001 level	0.5 level	pH:0.001 level, Conductivity.:0.5 level
pH/mV	√		√
Conductivity/TDS/Salinity/Resistivity		√	√
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.
- GLP data management, real-time clock display. Manual or Auto timing data storage. USB data communication.
- 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.
- Meets IP54 Waterproof and dustproof rating, connectors of the meter protected by rubber cap, ensuring quality, reliability and service life especially in tough environments.

1.3 Features in pH Measurement (Applicable Models: PH820, PC820)

- 1 to 5 points auto calibration with calibration guide and auto-check function.
- Automatic recognition of pH buffer solutions. Two series of standard solutions for choice: USA and NIST, and customized solution.
- Automatic display of pH electrode slope.

1.4 Features in Conductivity Measurement (Applicable Models: EC820, PC820)

- 1 to 4 points auto calibration with calibration guide and auto-check function.
- Automatic recognition of pH buffer solutions, and customized solution.
- Single-tap switch among conductivity, TDS, salinity, and resistivity.

2. Configuration

	Content	Quantity	PH820	EC820	PC820
1	PH820 Lab pH Meter	1	√		
2	EC820 Lab Conductivity Meter	1		√	
3	PC820 Lab pH/Conductivity Meter	1			√
4	LabSen 211 Lab pH Electrode	1	√		√
5	2401T-F Conductivity Electrode (ATC，k=1.0)	1		√	√
6	MP500 temperature electrode	1	√		√
7	pH Standard Buffer (4.00 pH,7.00 pH,10.01pH/50mL)	1 for each	√		√
8	Conductivity Standard Solution (84μS,1413μS,12.88mS/50mL)	1 for each		√	√
9	3M KCL Solution (50ml)	1	√		√
10	Pipette	1	√		√
11	9V Power Adapter	1	√	√	√
12	Flexible Electrode Holder	1	√	√	√
13	PC-Link Software Disk	1	√	√	√
14	USB Cable	1	√	√	√
15	Instruction Manual	1	√	√	√
16	Quick Manual	1	√	√	√

3. TECHNICAL SPECIFICATIONS

	Technical Parameters		Models
pH	Measuring Range	(-2.000 ~ 19.999） pH	PH820 PC820
	Resolution	0.1/0.01/0.001 pH	
	Accuracy	±0.002 pH ±1 digit	
	Temperature Compensation Range	(0 ~ 100°C) Automatic or Manual	
mV	Measuring Range	±1999.9mV	
	Resolution	0.1mV	
	Accuracy	±0.03% FS ±1 digit	
Cond.	Measuring Range	Conductivity: (0~2000) mS/cm,including 6 ranges: (0.00~19.99) μS/cm; (20.0~199.9) μS/cm (200~1999) μS/cm; (2.00~19.99) mS/cm (20.0~199.9) mS/cm; (200~2000) mS/cm	EC820 PC820
		TDS: (0 ~ 100)g/L, including 5 ranges: (0.00~9.99) mg/L; (10.0~99.9) mg/L (100~999) mg/L; (1.00~9.99) g/L (10.0~100)g/L	
		Salinity: (0~100) ppt, including 2 ranges: (0 ~ 9.99) ppt; (10.0 ~100) ppt,	
		Resistivity: (0~100) MΩ·cm, including 6 ranges: (0 .0~ 99.9)Ω·cm; (100~ 999)Ω·cm; (1.00~ 9.99)KΩ·cm; (10.0~ 99.9)KΩ·cm; (100~ 999)KΩ·cm; (1.0~ 100)MΩ·cm,	
	Resolution	Conductivity: 0.01/0.1/1μS/cm; 0.01/0.1/1mS/cm TDS: 0.01/0.1/1mg/L; 0.01/0.1g/L Salinity: 0.01/0.1/1 ppt; 0.01/0.1 ppt. Resistivity: 0.1/1Ω·cm; 0.01/0.1/1 KΩ·cm; 0.1MΩ·cm.	
	Accuracy	±0.5% FS ±1 digit	
	Temperature Compensation Range	(0 ~ 50°C) Automatic or Manual	
	Electrode Constant	0.01 / 0.1 / 1 / 10 cm^{-1}	
Temp.	Measuring Range	-10 to 110°C	PH820 EC820
	Resolution	0.1°C	

	Accuracy	±0.4°C ±1 digit	PC820
Other	Data Storage	PH820/EC820: 500 Groups; PC820: 1000 Groups	
	Storage Content	Numberings, Date, Time, Measurements, Unit, Temperature	
	Data Output	USB	
	IP Rating	IP54 Waterproof and Dustproof	
	Calibration	pH：1~5 points，Conductivity：1~4 points	

4. INSTRUMENT DESCRIPTION

4.1 LCD Display

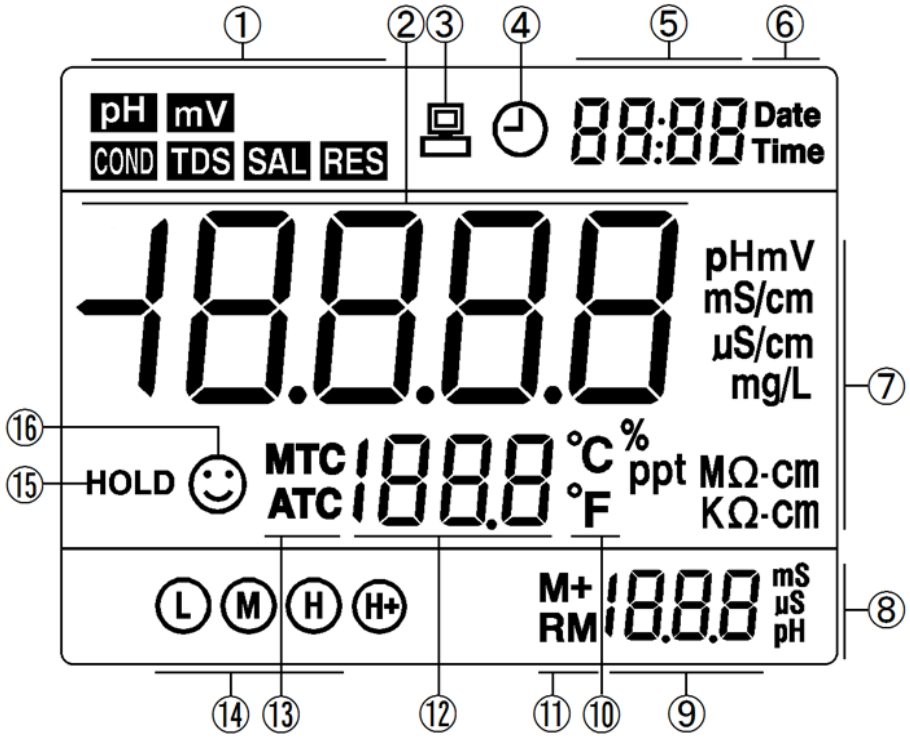


Figure-1

① —— Measuring parameters

② —— Measuring value

③ —— USB data communication. The meter is connected to your PC when this icon is displayed.

④ —— Timing storage

⑤ —— Date, time, and reminder icons

⑥ —— “Date” and “Time”

⑦ —— Measuring unit

⑧ —— Measuring unit in calibration

⑨ —— Calibration value, numberings of data storage, and reminder icons

⑩ —— Temperature unit

⑪ —— Data storage and display icon

M+— Data storage; RM— Recall saved data

⑫ —— Temperature and reminder icons

⑬ —— ATC—Auto Temperature Compensation; MTC— Manual Temperature Compensation

⑭ —— Completed calibration icons

⑮ —— Auto-Lock reading mode

⑯ —— Stable reading icon

4.2 Keypad

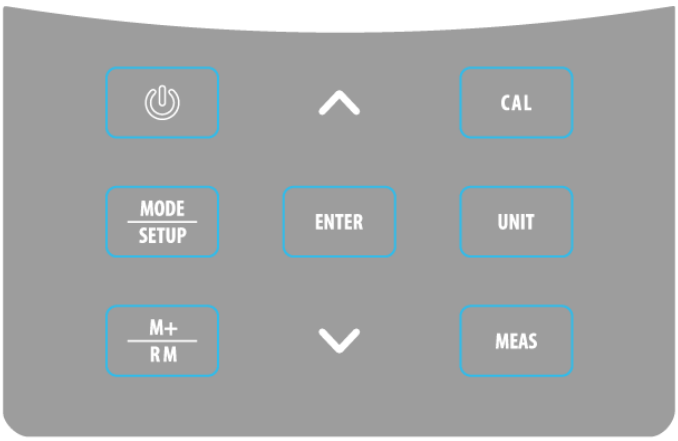


Figure-2

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

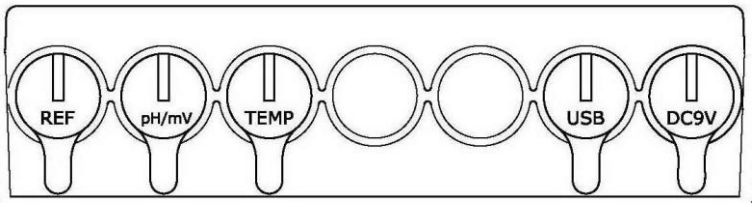
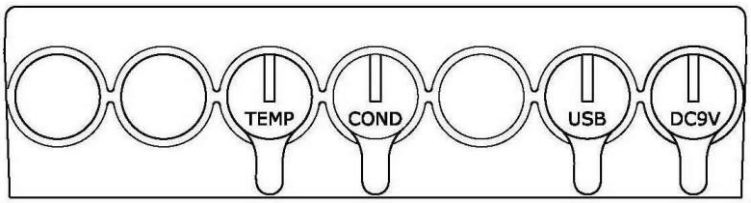
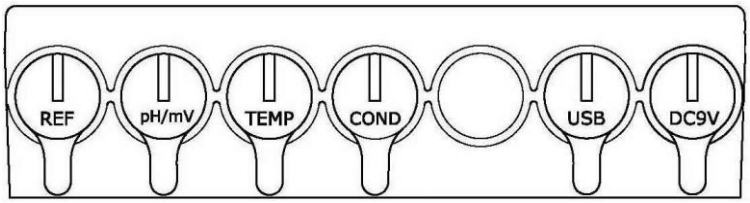
Table-1 Keypad Operation and Functions

Keypad	Operation	Functions
⏻	Short Press	● Power on/off
MODE SETUP	Short Press	Choose measuring mode: ● pH Meter：pH→mV ● pH/Conductivity Meter：pH→mV→COND
	Long Press	● Enter parameter setting
CAL	Short Press	● Enter calibration mode
UNIT	Short Press	● In pH mode: choose resolution: 0.1 pH→0.01pH→0.001pH ● In conductivity mode, choose measuring mode: COND→TDS→SAL→RES
ENTER	Short Press	● In calibration mode: press to calibrate ● In parameter setting mode: press to confirm choice
MEAS	Short Press	● Cancel any operation, the meter goes back to measurement mode
M+/RM	Short Press	● Save measuring data

	Long Press	● Recall saved measuring data
△ ▽	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. ● In recall mode (RM), short press to change numberings, long press to change swiftly.

4.3 Connectors

Table-2 Connectors of Different Models

Connectors	Model
	PH820 pH Meter
	EC820 Conductivity Meter
	PC820 pH/Conductivity Meter

Table–3 Connector Name and Type

Icon	Connector Name	Connector Type
REF	Reference Electrode Plug	Φ2 Banana Plug
pH/mV	pH Electrode and ORP Electrode Plug	BNC Connector
TEMP	Temperature Plug (sharing for pH and conductivity)	RCA Connector
COND	Conductivity Plug	BNC Connector
USB	USB Communication Plug	Standard Four Core Connector
DC9V	DC9V Power Plug	Φ2.5 Power Plug

4.4 Display Mode

4.4.1 Stable Reading Display Mode

When the measuring value is stable, the screen displays ☺ as shown in figure-3. If ☺ does not appear or is flashing, that means the measuring value has not been stable. Users should wait for the smiley face to appear and stay before recording the readings or conducting calibrations.

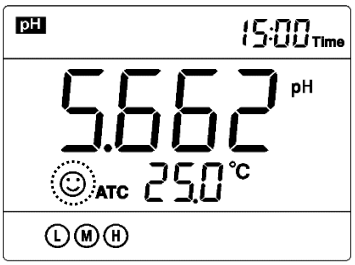


Figure-3

4.4.2 Auto-Lock Display Mode

In parameter setting P5.4, select “On” to turn on the auto-lock mode, in which the measuring reading will be automatically locked after ☺ icon has been stable for 10 seconds, and the HOLD icon will come up as shown in figure-4. At this time, short press MEAS to cancel the hold.

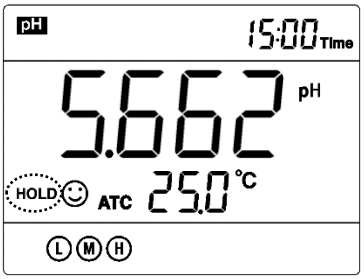


Figure-4

4.5 Data Storage, Recall, and Deletion

4.5.1 Manual Data Storage

When reading is stable, short press M+/RM, the screen will display M+ Icon along with the storage numbering, and the data will be saved, as shown in figure-5. For the storage capacity for each model, please refer to section 3.

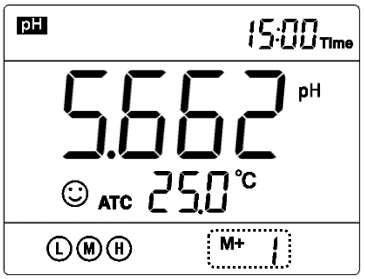


Figure-5

4.5.2 Automatic Timing Data Storage

In parameter setting P5.1, set up the time for timing measurements (e.g. 3 minutes). ◴ will be displayed, meaning the meter is ready to enter the auto timing storage mode. Short press M+/RM, the ◴ icon will start flashing, and the 1st group of data will be stored. 3 minutes later, the 2nd one will be stored. Figure-6 shows that 8 groups of data have been automatically stored. Short press M+/RM again, the ◴ icon will stop flashing. The meter stops the auto timing storage. When in auto timing storage, manual storage is disabled. In parameter setting P5.1, set the time to 0 to exit auto timing storage.

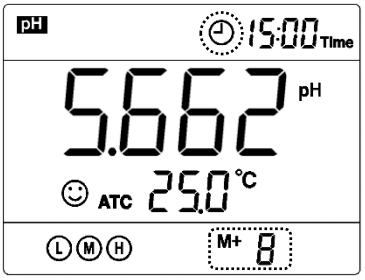


Figure-6

4.5.3 Recall the Stored Data

In measurement mode, long press M+/RM (>1.5 s), the meter will recall the Measured value that was lastly saved, as shown in figure-7, displaying RM Icon and the numbering. Press △ or ▽ to recall other stored data. Long press △ or ▽ to change numberings swiftly. Press MEAS to return to measurement mode.

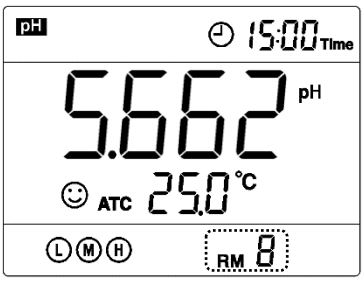


Figure-7

4.5.4 Clear Stored Data

In parameter P5.3, select Yes to clear all the stored data. For details, please refer to section 7.5

5. pH Measurement

5.1 Set up Flexible Electrode Holder

The flexible electrode holder is composed of a base and an electrode holder. Place the electrode holder right above the metal stick on the base through the hole underneath; push down; and adjust the nut on electrode holder to finish installation.

5.2 Equipped Electrode

The instrument is equipped with a LabSen 211 Combination Glass pH Electrode and MP500 Temperature Electrode. Please install both pH and temperature electrode on the electrode holder before using. Please find technical parameter and instructions of LabSen 211 pH electrode from its user manual.

5.3 Information regarding pH Calibration

5.3.1 Standard Buffer Solutions

The instrument adopts two series of standard buffer solutions: USA and NIST as shown in Table-4. Users can select which one to use in P1.1 (refer to section 7.3)

Table-4 pH Standard Buffer Series

Calibration Icons			pH Standard Buffer Series	
			USA Series	NIST Series
5 Points Calibration	L-		1.679 pH	1.679 pH
	L	3 Points Calibration	4.005 pH	4.006 pH
	M		7.000 pH	6.865 pH
	H		10.012 pH	9.180 pH
	H+		12.454 pH	12.454 pH

5.3.2 Two pH Calibration Modes

The instrument adopts two different pH calibration mode: 3 points of calibration (3P) and 5 points of calibration (5P). Users can select which to use in P1.4 (refer to section 7.3)

(a) 3-point calibration mode

3-point calibration is most often used. In the 3-point 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-5 for details). In the process of calibration, the meter will display the electrode's slope in acid and alkaline ranges.

Table-5 3-point Calibration Mode

	USA series	NIST series	Calibration icon	When to adopt
1-Point Calibration	7.000 pH	6.865 pH	(M)	Accuracy≥ ±0.1 pH
2-Point Calibration	7.000 pH and 4.005 pH	6.865 pH and 4.006 pH	(L) (M)	Measuring range: ＜7.000 pH
	7.000 pH and 10.012 pH	6.865 pH and 9.180 pH	(M) (H)	Measuring range: ＞7.000 pH
3-Point Calibration	7.000 pH, 4.005 and 10.012 pH	6.865 pH, 4.006, and 9.180 pH	(L) (M) (H)	Wide measuring range

(b) 5-point calibration mode

In 5-point calibration mode, user can choose 1~5 points to calibration, in any calibration solution and any order. Such as choosing 1.679pH and 4.005pH for measuring strong acid solution and choosing 10.012pH and 12.454pH for measuring strong base solution. The electrode's slope will not be displayed during the calibration.

5.3.3 How often to calibrate

The frequency that you need to calibrate your meter depends on the tested samples, performance of electrodes, and the requirement of the accuracy. For High-Accuracy measurements (≤ ±0.03pH), 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.

5.3.4 Calibration Reminder Function

Preset the interval between calibrations (starting from the time when you set it), and then the meter will remind you to calibrate at the end of that interval. For details, please see P1.2 (Section 7.3). When the (refer to section 7.3), preset time is reached, **Er6** icon will be displayed at the lower right corner of the LCD (as showed in Figure-8). At the time, the meter can still be operated. It is just reminding you to do calibration in order to ensure the accuracy.

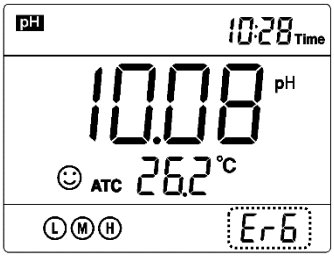


Figure-8

After calibration, the **Er6** icon will disappear; To make it disappear, users can also choose “No” in P1.2 in parameter setting.

5.3.5 Check calibration date

In this mode, users can see the date and time of last calibration to help determine if there is a need to re-calibrate. For details, please see parameter setting P1.3 (Section 7.3)

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

5.4.1 Press CAL 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 solution to conduct 1st point of calibration.

5.4.2 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).

5.4.3 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.

5.4.4 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, CAL3 will flash at the upper right corner of the LCD, and 10.01 pH will flash at the lower right, indicating using pH10.01

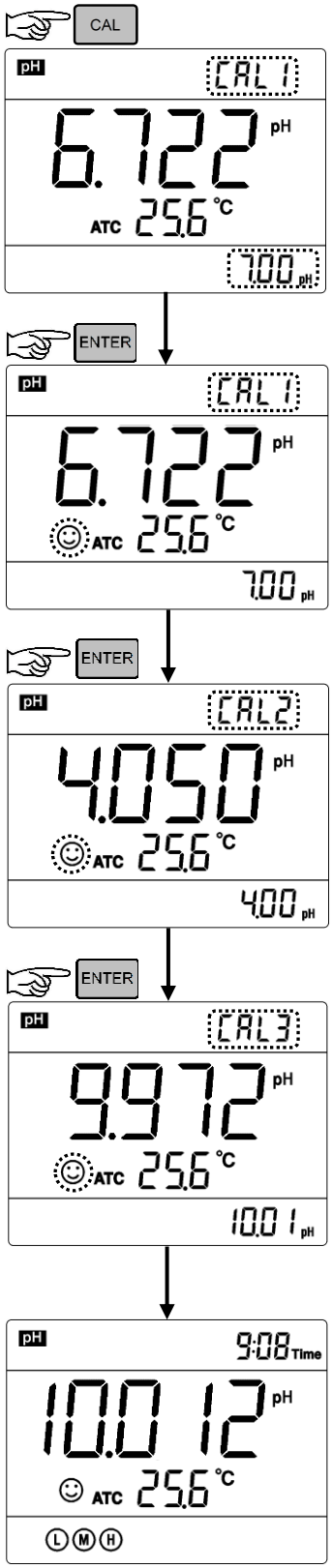


Figure-9

buffer solution to make the 3rd point calibration.

5.4.5 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 (L)(M)(H). Please see Figure-9 for the above calibration process.

5.4.6 Operation of 5 points of calibration is the same as above, but user can determine calibration solution and calibration order. Electrode's slope will not show during the calibration. In 3 points and 5 points of calibration, press MEAS key to return to measurement mode. Users can proceed 1~3 points of calibration in 3P mode, and 1~5 points of calibration in 5P mode, LCD will show relatively calibration icons.

5.5 Customized Calibration (take 1.60 pH & 6.50 pH as example)

5.5.1 Choose **CUS** (customized calibration) in parameter setting P1.1, the meter enters customize calibration mode. Press CAL key, **CAL1** will flash on at the upper right corner of the LCD, indicating start of the 1st point calibration.

5.5.2 Use distilled water to rinse off electrode and then dry it. Dip it into 1.60 pH buffer solution, stir gently and let it stand still and wait for the reading to become stable, ☺ displays on LCD. Press ENTER key, the reading flashes. Press △ or ▽ to adjust reading number to 1.60, then press ENTER key to finish the calibration. **CAL2** will flashes at the upper right corner of LCD, indicating start of 2nd point calibration.

5.5.3 Use distilled water to rinse off electrode and then dry it. Dip it into 6.50 pH buffer solution, stir gently and let it stand still and wait for the reading to become stable, ☺ displays on LCD. Press ENTER key, the reading flashes. Press △ or ▽ to adjust reading number to 6.50, then press ENTER key to finish the calibration and back to measurement mode. **CUS** will flashes at the upper right corner of LCD, but the completed calibration icons stop showing at the bottom left corner of LCD.

5.5.4 Special Notes

(a) The instrument can operate 1~2 points of customize calibration. Press MEAS after finishing the 1st point calibration, the instrument will return to measurement mode. This is 1 point customize calibration.

(b) If the temperature probe is not connected during calibration and measuring, which is MTC. Temperature value will flash after pressing ENTER key. Press △ or ▽ to input the right temperature. Press ENTER key once more, temperature value will flash.

(c) The pH of "customize calibration" is the measurement in certain temperature. The instrument must calibrate or measure in the same temperature, otherwise it will be inaccurate. The instrument does not recognize customize calibration solutions.

5.6 Sample Measurement

5.6.1 Rinse the pH electrode in distilled water or purified 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-10 for calibration and measurement process of the pH meter.

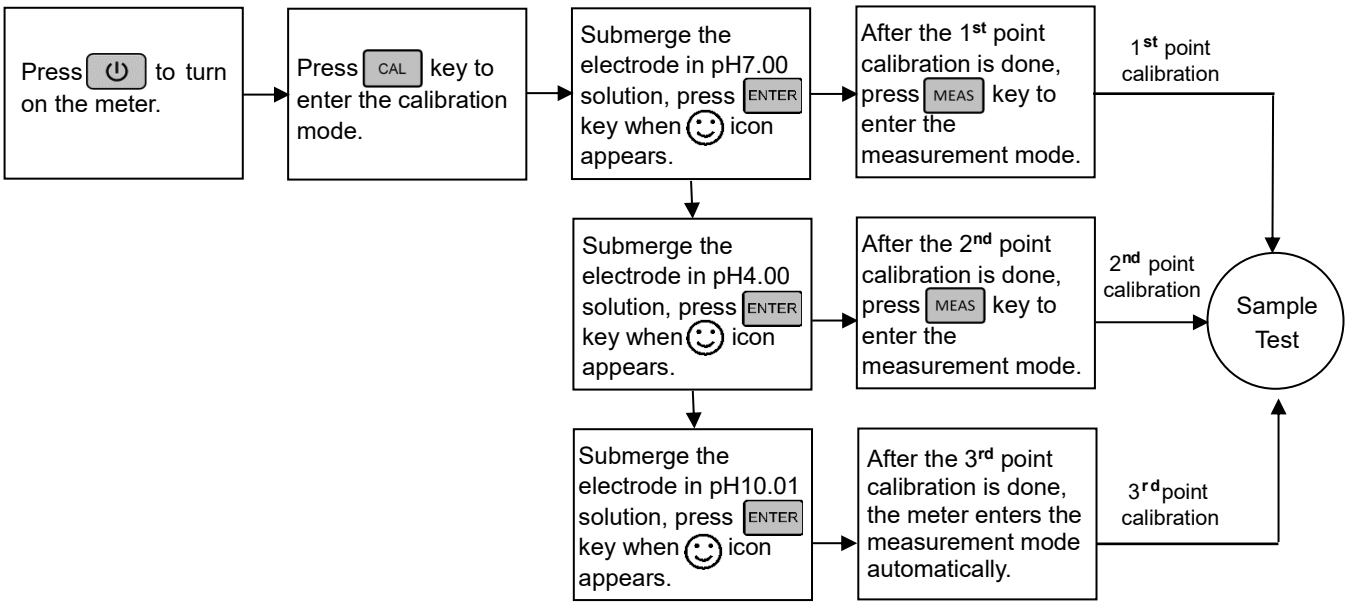


Figure-10

5.6.2 Self-Diagnosis Information

Among the calibration and measurement procedure, the meter has self-diagnosis function, showing Er1~Er6 icon, reminding related information. Please refer to table-6.

Table – 6 Self-diagnosis information

Display Icons	Contents	Checking
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 bubbles in glass bulb. 2.Replace with a new pH electrode.
Er4	pH electrode zero electric potential out of range（<-60mV or >60mV）	1.Check whether there are bubbles in glass bulb. 2.Check whether pH buffer solution is correct. 3.Replace with new pH electrode.
Er5	pH electrode slope out of range (<85% or >110%)	
Er6	Enter in pre-set due calibration to remind calibration	Press CAL key to perform calibration or cancel due calibration setup in parameter P1.2.

5.6.3 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.

5.6.4 The instrument has a function to return to factory default setting, which can be set up in P1.4 (refer to section 7.3). Returning to factory default setting is to restore the meter to 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 then conduct calibration and test again. Please note that this function is irreversible once used.

5.7 Maintenance of the pH Electrode

5.7.1 Cleaning of pH electrode

Rinse the pH electrode in purified water before and after measurement and then dry it. After measuring vicious sample, the electrode needs to be cleaned many times to remove the sample attached to glass membrane, or clean with proper solution and then rinse in the purified water.

5.7.2 Renew the glass bulb

Electrodes that have been used over a long period of time will become aged. Submerge the electrode in 0.1mol/L hydrochloric acid for 24 hours, then wash the electrode in purified water, then submerge

it in KCL soaking solution for 24 hours. For serious passivation, submerge the bulb in 4% HF (hydrofluoric acid) for 3-5 seconds, and wash it in purified water, then submerge it in the soaking solution for 24 hours to renew it.

5.7.3 Clean contaminated glass bulb and junction (please refer to Table-7)

Table-7 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

6. mV Measurement

6.1 ORP measurement

Press ⏻ to open, and press MODE SETUP to switch the meter to mV mode. mV mode is a mode for ORP and Ion electrode measurement. Connect ORP electrode 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.

Connect Ion electrode and reference electrode to measure Ion electric potential.

6.2 Notes on ORP measurement

6.2.1 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-8 is the data of standard ORP solution for 222 mV.

Table-8 ORP Standard Buffer Solution（222mV±15mV，25°C）

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

6.2.2 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, submerge the electrode in 0.1mol/L dilute hydrochloric acid for 30 minutes, then wash it in purified water, then submerge it in the soaking solution for 6 hours.

(b) For organic or lipid pollutant, clean the platinum surface with detergent, then wash it in purified water, then submerge it in the soaking 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 purified water, then submerge it in the soaking solution for 6 hours.

7. Conductivity Measurement

7.1 Set up flexible Electrode Holder (refer to 5.1)

7.2 Information regarding the Conductivity Electrode

7.2.1 Conductivity electrode

EC820 and PC820 are equipped with model 2401T-F plastic conductivity electrode with constant K=1.0 and built-in temperature sensor, can realize automatic temperature compensation. When submerge the conductivity electrode in solution, stir the solution briefly to eliminate the air bubbles and improve response and stability.

7.2.2 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-9 for measuring range. Set constant in parameter setting P2.1 and refer to clause 8.4

Table–9 Electrode constant and measuring range

Range	＜20 μS/cm	1.0 μS/cm to 100 mS/cm			＞100mS/cm
Conductivity electrode constant	K=0.1	K=1.0			K=10
Standard solution	84 μS/cm	84 μS/cm	1413 μS/cm	12.88 mS/cm	111.8 mS/cm
Electrode's model	DJST-0.1-F	2401T-F			2310T-F

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

7.3 Information regarding Conductivity Calibration

7.3.1 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 perform 1~4 points of calibration. The calibration indication icons correspond to the four standard values as shown in Table

Table-10 Conductivity Calibration Solutions

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

7.3.2 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.

7.3.3 Single point and multi-point calibration

If 1-point calibration is conducted after 3-point or 4-point calibration being done, the previous calibration values in the same range will be replaced. In the meanwhile, the meter will display the 1-point calibration's icon, and the other calibration icons will be removed, but the chip will still store the data from the last calibration. When conducting multi-point calibration, users should follow the sequence from low conductivity to high in case the high concentration solution contaminating the low ones.

7.3.4 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 P2.4 (see Section 7.4 for details).

7.3.5 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 – 11 and the data collected during testing. Do the setting in P2.5. (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-11 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

7.3.6 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 wash the electrode and allow it to dry, especially for standard solution of low concentration (84μS/cm). The contaminated standard solution will affect accuracy.

7.3.7 Calibration Reminder Setup

Preset the interval between calibrations (starting from the time when you set it), and then the meter will remind you to calibrate at the end of that interval. For details, please see P2.3 (Section 7.4). When the preset time is reached, **Er6** icon will be displayed at the lower right corner of the LCD (as showed in Figure-11). At the time, the meter can still be operated. It is just reminding you to do calibration in order to ensure the accuracy. After calibration, the **Er6** icon will disappear; To make it disappear, users can also choose "No" in P2.3 in parameter setting.

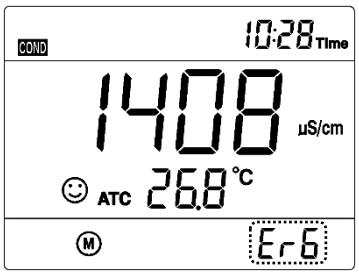


Figure-11

7.3.8 Check calibration date

In this mode, users can see the date and time of last calibration to help determine if there is a need to re-calibrate. For details, please see parameter setting P2.4 (Section 7.4)

7.4 Conductivity Calibration (take 1413 μS/cm as an example)

7.4.1 Rinse the electrode in purified water, allow it to dry, wash with a little of standard solution and submerge it in 1413μS/cm standard solution. Stir briefly and allow it to stay in the solution until a stable reading is reached.

7.4.2 Press CAL 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. **Er2** icon will appear if press ENTER before value is locked. See table-6

7.4.3 When the meter locks 1413 µS, stable icon ☺ will display on LCD. Press ENTER key to complete calibration. End will appear and the meter will return to measuring mode and Ⓜ is displayed on bottom left of the LCD screen. See figure-12.

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

7.4.5 For multi-point calibrations, please repeat the steps in 6.4.1 to 6.4.3 until all calibrations are finished. The meter can be calibrated in the same calibration solution repeatedly until the reading is stable and repeatable.

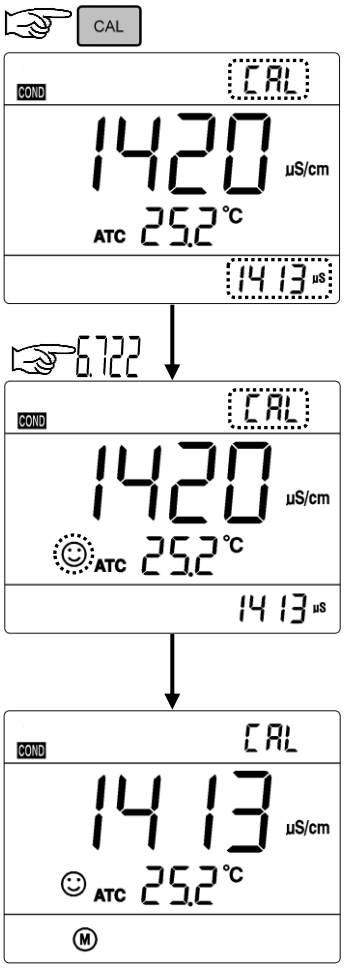


Figure-12

7.5 TDS, Salinity, Resistivity & Conductivity

7.5.1 TDS and conductivity is linear related. The conversion factor is 0.40-1.00. Adjust the factor from parameter P2.7. The factory default setting is 0.71 and please refer to section 7.4. Salinity and resistivity are all proportional to conductivity. The calculating formula is preset in the meter. So the meter only needs to be calibrated in Conductivity mode, then after calibration of conductivity, the meter can switch from conductivity to TDS, salinity, or resistivity.

7.5.2 Adjust TDS conversion factor in parameter setting P2.7 according to the data collected during testing and experience. Table – 12 lists some commonly used Conductivity and TDS conversion factors. This is for your reference only.

Table–12 Conductivity and TDS conversion factors

Conductivity of solution	TDS conversion factor
0~100 µS/cm	0.60
100~1000 µS/cm	0.71
1~10 mS/cm	0.81
10~100 mS/cm	0.94

7.6 Customized Calibration (take 10.50μS/cm as example)

7.6.1 Choose **CUS** (customize calibration) in parameter setting P2.1, the meter enters customize calibration mode. Press [CAL] key, **CAL** will flash on at the upper right corner of the LCD, indicating start of the customize calibration.

7.6.2 Use distilled water to rinse off electrode and then dry it. Dip it into 10.50 μS/cm buffer solution, stir gently and let it stand still and wait for the reading to become stable, ☺ displays on LCD.

7.6.3 Press [ENTER] key, the reading flashes. Press [△] or [▽] to adjust reading number to 1050。Then press [ENTER] key, the decimal point flashes, press [ENTER] key to set the decimal point to 10.50; press [△] key, the unit flashes, press [△] key to set the unit to μS/cm, the whole setting procedure ends.

7.6.4 Press [ENTER] key to calibrate, after calibration the meter back to measurement mode. In customize calibration mode, CUS shows at the upper right corner of LCD, but the completed calibration icons stop showing at the bottom left corner.

7.6.5 Special Notes

(a) The customize calibration is 1-point calibration. The Conductivity of “customize calibration” is the measurement in certain temperature. The instrument must calibrate or measure in the same temperature, otherwise it will be inaccurate. The instrument does not recognize customize calibration solutions.

(b) If the temperature probe is not connected during calibration and measuring, which is MTC. Please press [△] or [▽] to input the right temperature.

7.7 Sample test

7.7.1 Rinse conductivity electrode in distilled or purified water, dry it, and submerge 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.

7.7.2 Press [UNIT] key to switch to TDS, Salinity, and Resistivity.

7.7.3 During the process of calibration and measurement, the meter has self-diagnosis functions, icons Er1~Er3 and Er6, indicating the relative information as below:

Table-13 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.
Er6	Enters pre-set due calibration to remind re-calibration	Press CAL key to perform calibration or cancel due calibration setup in parameter P2.2.

7.7.4 Factory default setting

For factory default setting, please refer to parameter setting P2.8 (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.

7.8 Maintenance of the Conductivity Electrode

7.8.1 Always keep the conductivity electrode clean. Before taking a measurement, rinse the electrode in purified water. It is recommended to rinse it again in the sample solution. When submerge the electrode in solution, stir the solution briefly to eliminate air bubbles and allow it to make the measurement fast and stable.

7.8.2 Keeping the conductivity sensor in wet condition helps the electrode's quick reaction. Electrode may react slowly if kept dry for long time. Submerge it in 12.88mS standard solution for 5 to 10 minutes or in tap water for 1 to 2 hours to renew it. Use distilled water to clean electrode after use.

7.8.3 The sensing rod of Model 2401T-F conductivity electrode is coated with platinum black to minimize electrode polarization and expand measuring range. The platinum black coating adopts 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 a soft brush in warm water containing detergent or alcohol.

8. Parameter Setting

8.1 Main Menu

In the measurement mode, press [MODE SETUP] key to enter in P1.0. The meter has three main menus. Press [△] or [▽] to switch main menu: P1.0→P2.0→P5.0. Please refer to Figure - 14.

P1.0: pH parameter setting menu; P2.0: Conductivity parameter setting menu,

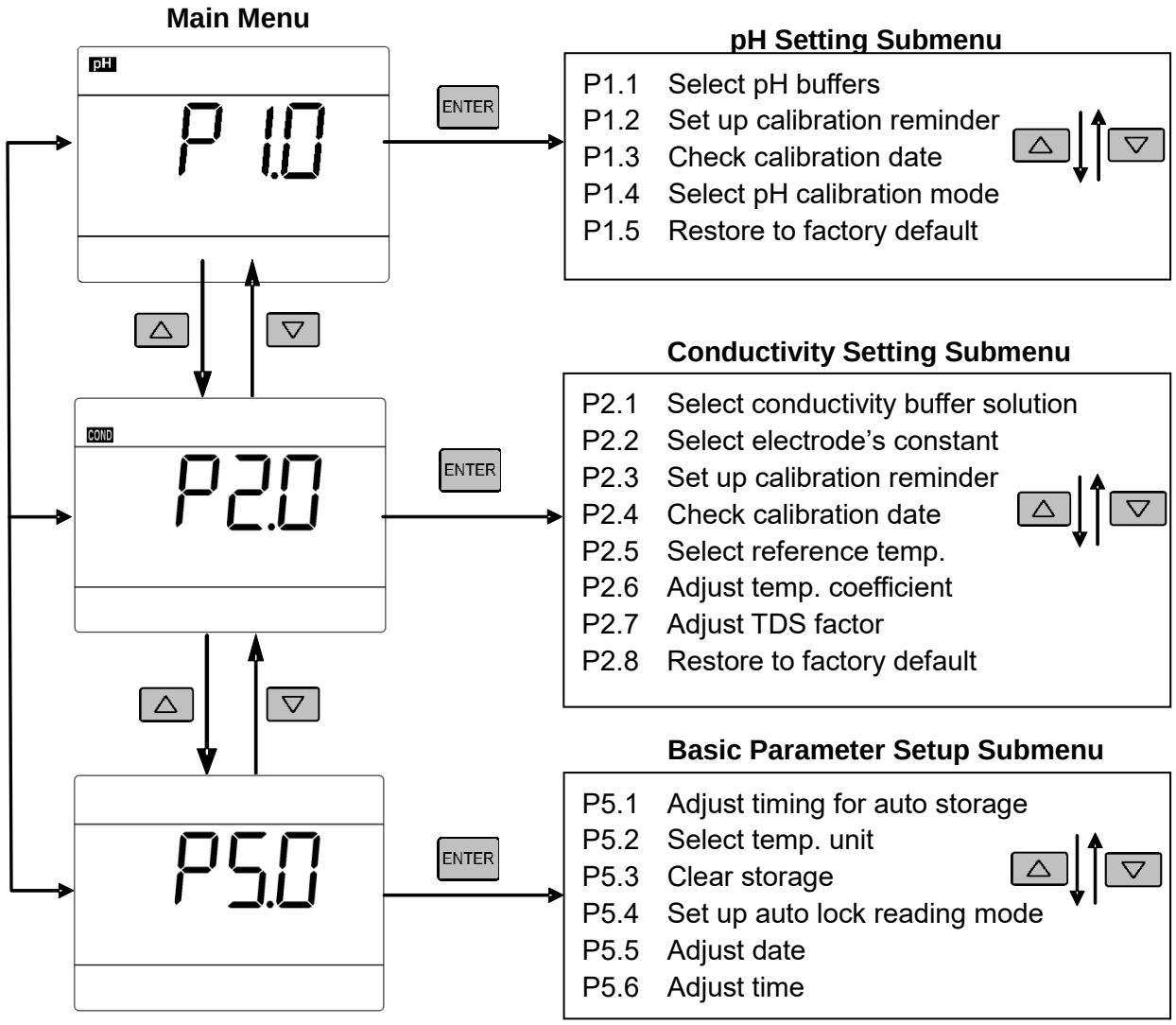
P5.0: Basic parameter setting menu.

8.2 Sub-Menu

8.2.1 In P1.0, press [ENTER] to enter the submenu P1.1 for pH setting, press [△] or [▽] to change submenu: P1.1→P1.2→ … →P1.5. See 7.3 for details.

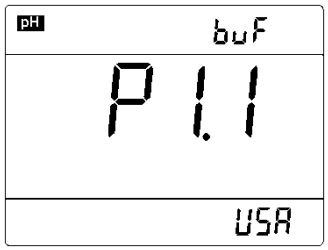
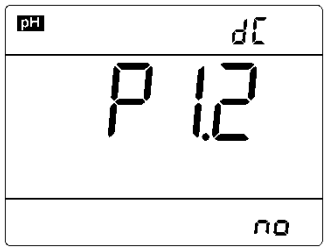
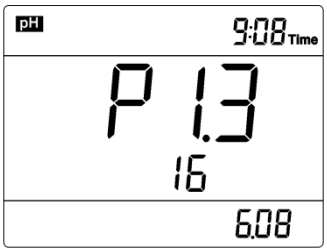
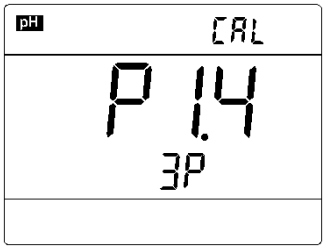
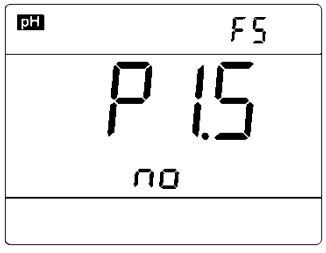
8.2.2 In P2.0, press [ENTER] to enter the submenu P2.1 for conductivity setting, press [△] or [▽] to change submenu: P2.1→P2.2→ … →P2.8. See 7.4 for details.

8.2.3 In P5.0, press [ENTER] to enter the submenu P5.1 for basic parameter setting, press [△] or [▽] to change submenu: P5.1→P5.2→…→P5.6. See 7.5 for details.



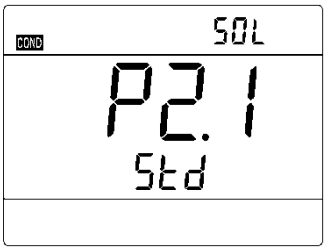
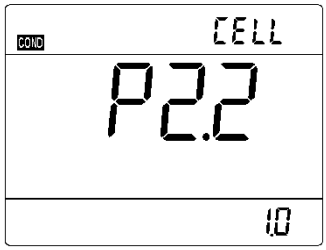
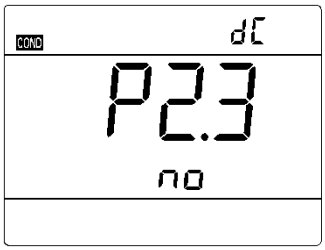
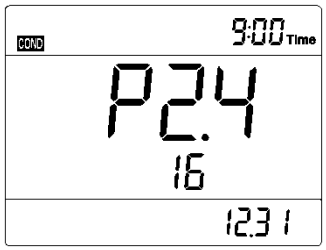
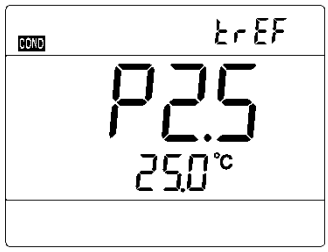
8.3 pH Setting Sub-Menu

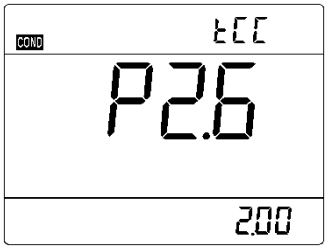
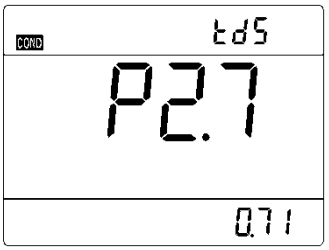
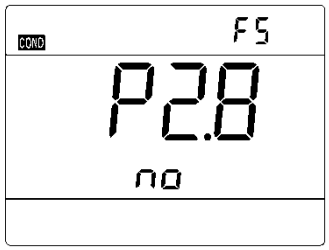
(press △ or ▽ to switch)

	**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; CUS—customize calibration 3. Press △ to enter P1.2, or press MEAS to return to measurement mode.
	**P1.2 — Set up calibration reminder** (No—H00—D00) 1. Press ENTER, ”No” flashes, press △ to choose No➞H00➞D00；NO—no setting; H00—set hours (0~99); D00—set days(0~99). 2. When “H” flashes, press ENTER , “00” flashes, press △ to adjust hours, Press ENTER to confirm; When “D” flashes, press ENTER , “00” flashes, press △ to adjust days, press ENTER to confirm; When “No” flashes, press ENTER to confirm. 3. Press △ to enter P1.3, or press MEAS to return to measurement mode.
	**P1.3 — Check Calibration Time** 1. The data and time of last calibration displayed on the left image is: On June 8, 2016 to 9:08 2. Press △ to enter P1.4, or press MEAS to return to measurement mode.
	**P1.4 — Select pH Calibration Mode (3P-5P)** 1. Press ENTER , 3P flashes, press △ to select 3P→5P, press ENTER key to confirm. 3P—1~3 points of calibration, 5P—1~5 points of calibration. Please refer to section 4.3.2. 2. Press △ to enter P1.5, or press MEAS key to back to measurement mode.
	**P1.5 — Set the Factory Default（No—Yes）** Press ENTER, “NO” flashes, press △ to select NO→Yes, press ENTER to confirm, instrument back to measurement mode. No — Not restore; Yes — Restore factory default

8.4 Conductivity Setting Sub-Menu

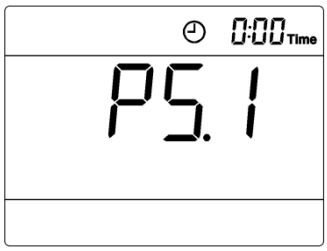
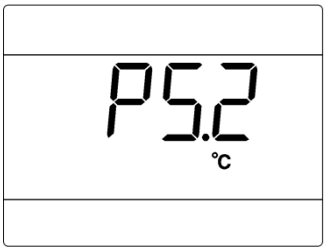
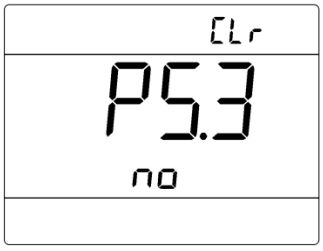
(press △ or ▽ to switch）

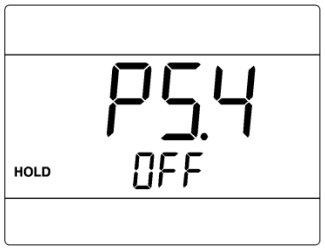
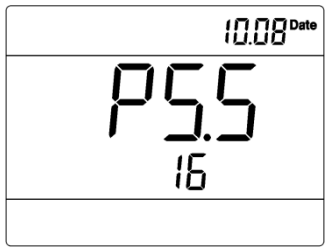
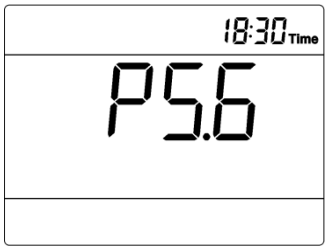
	**P2.1 — Select Conductivity Calibration Solution**（Std-CUS） 1. In P2.0, press ENTER to enter P2.1, see left picture 2. Press ENTER key, Std flashes, press △ key to select Std→CUS, press ENTER key to confirm. Std—Standard, CUS—Customize solution. 3. Press △ key to enter P2.2, or press MEAS key to return to measurement mode.
	**P2.2 — Select electrode's constant**（1.0—10.0—0.1—0.01） 1. Press ENTER , "1.0" flashes, press △ to choose 1.0→10.0→0.1→0.01; press ENTER to confirm. 2. Press △ to enter P2.3, or press MEAS to return to measurement mode.
	**P2.3 — Set up calibration reminder** (No—H00—D00) 1. Press ENTER , "No" flashes, press △ to choose No→H00→D00；NO—no setting; H00—set hours (0~99); D00—set days (0~99). 2. When "H" flashes, press ENTER , "00" flashes, press △ to adjust hours, Press ENTER to confirm; When "D" flashes, press ENTER , "00"flashes, press △ to adjust days, press ENTER to confirm; When "No" flashes, press ENTER to confirm. 3. Press △ to enter P2.4, or press MEAS to return to measurement mode.
	**P2.4 — Check Calibration Time** 1. The data and time of last calibration displayed on the left image is: On August 6, 2016 to 12:00. 2. Press △ to enter P2.5, or press MEAS to return to measurement mode.
	**P2.5 —Select reference temperature** (15.0°C - 30.0°C) 1. Press ENTER , "25.0°C" flashes, press △ or ▽ to adjust temp. from 15° C to 30° C; press ENTER to confirm. 2. Press △ to enter P2.6, or press MEAS to return to measurement mode.

	**P2.6 —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 P2.7, or press MEAS to return to measurement mode.
	**P2.7 —Adjust TDS Factor** (0.40-1.00) 1. Press ENTER, “0.71” flashes, press △ or ▽ to adjust from 0.40-1.00; press ENTER to confirm. 2. Press △ to enter P2.8, or press MEAS to return to measurement mode.
	**P2.8 — Set the Factory Default（No—Yes）** Press ENTER , “No” flashes, press △ to select No→Yes, press ENTER to confirm, instrument back to measurement mode. No — Not restore; Yes — Restore factory default

8.5 Basic Parameter Setting Sub-Menu

（press △ or ▽ to switch）

	**P5.1 — Adjust timing for auto storage** 1. In P5.0, press ENTER to enter P5.1 as shown in the left figure. 2. Press ENTER , ":00" flashes, press △ or ▽ to set minute (0-59), press ENTER again, "0:" flashes, press △ or ▽ to set hours (0-99), press ENTER to confirm. 3. Press ENTER to enter P5.2, or press △ to return to measurement mode.
	**P5.2 — Choose Temp. Parameter** (°C - °F) 1. Press ENTER, “°C” flashes, press △ to choose °C→°F, press ENTER to confirm. 2. Press △ to enter P5.3, or press MEAS to return to measurement mode.
	**P5.3 — Clear storage** (No—Yes) 1. Press ENTER, “No” flashes, press △ to choose No→Yes; press ENTER to confirm. No— not to clear data storage; Yes—clear all data storage 2. Press △ to enter P5.4, or press MEAS to return to measurement mode.

	**P5.4 — Set up Auto-Lock reading mode** (Off—On) 1. Press ENTER , “Of” flashes, press △ to choose Off→On, press ENTER to confirm. Off— not set up, On—set up 2. Press △ to enter P5.5, or press MEAS to return to measurement mode.
	**P5.5 — Adjust Date** 1. Press ENTER to choose “Month”→ “Day”→ “Year”, press △ or ▽ to adjust date, press ENTER to confirm. 2. Press △ to enter P5.6, or press MEAS to return to measurement mode.
	**P5.6— Adjust Time** 1. Press ENTER to choose — “hour”→ “minute”, press △ or ▽ to adjust time, press ENTER to confirm. 2. Press MEAS to return to measurement mode.

9. USB DATA COMMUNICATION

The instrument uses PC-Link software for data communication through USB connector and cable.

9.1 Software Interface

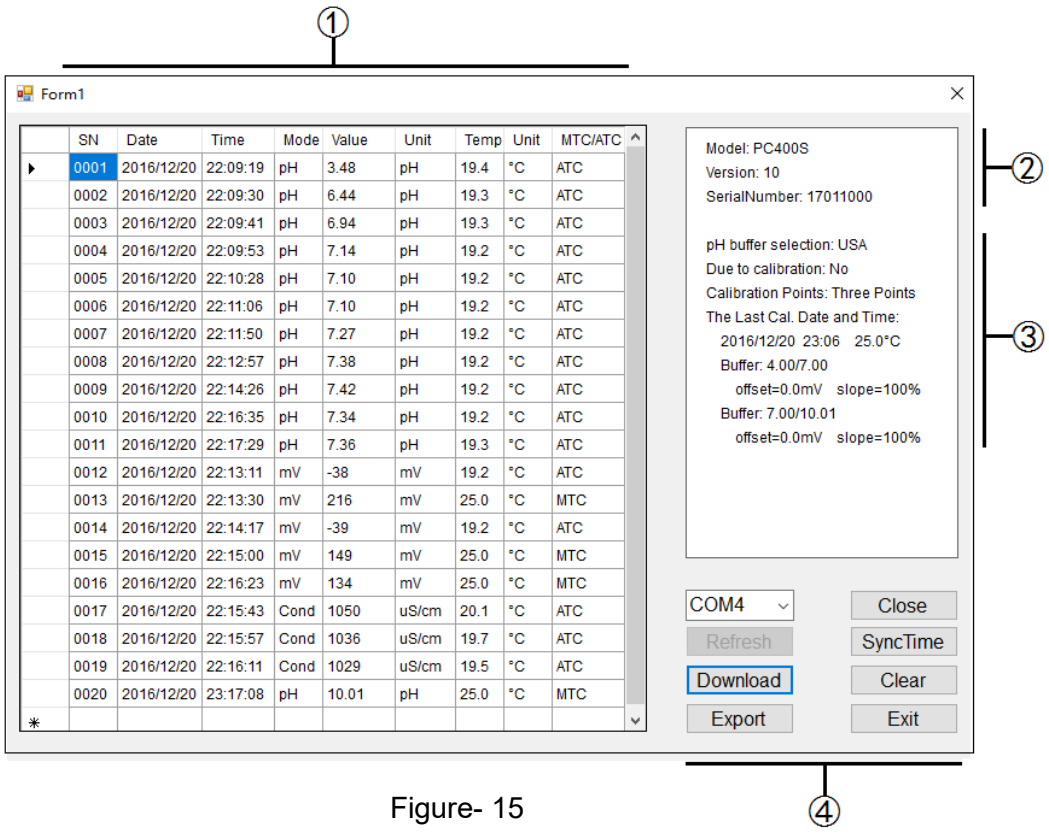


Figure- 15

① — Stored data

（a）Press “Download” Key to upload the data in the meter to the software, including date, time, measurements, temperature, and temperature compensation mode. The program will categorize the data by pH, mV, and Cond.

（b）Press M+/RM after the meter is connected to the computer, or set up auto timing storage function. In this case, all the measuring data will be uploaded to the software, and will not be stored in the meter. See figure-15.

② — Model and Numberings

③ — Calibration information

④ — COM Port #and other buttons

COM Port # is the number for the software to connect with the computer. Every computer’s COM port is different. In Figure-15, the COM port # is COM4.

- Open/Close — Click it to turn on/off the program. When turned on, the LCD will display
- Refresh — COM port reset button; Click it to reset the COM port to COM1.
- Sync Time — Click it to sync the computer’s time and date to the meter’s.
- Download — Click it to upload the data stored in the meter to the computer.
- Clear — Click it to clear all the data.
- Export — Click it to export all the data to a Microsoft Excel file.
- Exit — Click it to exit the program.

9.2 Install the software

The PC-Link software works for all Windows based system (does not work for Mac). Insert the PC-Link disk into the computer, open the PC-Link folder where you will find the folder for PC-Link software and a zipped file for drivers. Typically, users can directly open the file with PCLink icon to use the software. If the meter cannot be connected to the computer, please install the USB driver (in the zipped file) before using the software.

9.3 Choose COM Port

Connect the meter to your computer with the USB cable. Open the PC-Link program. click the arrow icon next to the COM1 Port, and click the bottom port number, and then click Open. The LCD will display icon. If port number is hard to be confirmed, users can identify it in Windows’ Device Manager.

9.4 Run Software

9.4.1 Upload stored data

Click Download key to upload the data stored in the meter to the software, including date, time,

measurements, temperature, and temperature compensation mode. The program will categorize the data by pH, mV, and Cond.

9.4.2 Real-time storage

（a）When the program is running and meter is connected to computer, press M+/RM on the meter or set up auto timing storage to upload all the measuring data to the software. The data will not be stored in the meter in this mode.

（b）The mode and unit for real-time storage is the same as it is in the meter. Press MODE SETUP or UNIT to make changes.

9.4.3 Data Processing

Click “Export” to export all the data to a Microsoft Excel file. Users can process, analyze, and print the data in the Excel file.

10. Recommended pH Electrodes for Specific Applications

Application	**Ideal Apera pH Electrodes to Use with 820 Series Meter**
Regular water solutions	LabSen 211, LabSen 213
Beverage, beer, or wine analysis	LabSen 213
Cosmetics	LabSen 851-1, LabSen 851-3
Dairy products (milk, cream, yogurt, mayo, etc.)	LabSen 823
High-Temperature liquid	LabSen 213
Low-temperature liquid	LabSen881
Meat	LabSen 763
Micro sample testing	LabSen 241-6, LabSen 241-3
Purified Water (Low ion concentration samples)	LabSen 803, LabSen 813
Soil	LabSen 553
Solid or semi-solid samples (cheese, rice, fruit, etc.)	LabSen 753
Strong acid samples	LabSen 831
Strong alkalined samples	LabSen 841
Surface test (skin, paper, carpet, etc.)	LabSen 371
Titration	LabSen 223
TRIS buffer solutions	LabSen 211, LabSen 213, LabSen 223
Viscous liquid samples	LabSen 223, LabSen851-1
Wastewater or emulsion	LabSen 333

*** Visit http://aperainst.de/electrodes or contact us at +49 202 51988998 for more details.**

11. APPENDIX 1: TABLE OF PARAMETER SETTING

Mode	Symbol	Parameter	Abbreviation	Content	Factory Default
P1.0 pH	P1.1	Select Buffer Series	buF	USA－NIST－CUS	USA
	P1.2	Set calibration reminder	dC	No－H00－D00	No
	P1.3	Check calibration date and time	/	—	—
	P1.4	Select pH calibration mode	CAL	3P－5P	3P
	P1.5	Restore factory default	FS	No－Yes	No
P2.0 Conductivity	P2.1	Select conductivity calibration solution	SOL	Std—CUS	Std
	P2.2	Select electrode’s constant	CELL	1.0－10.0－0.01	1.0
	P2.3	Set calibration reminder	dC	No－H00－D00	No
	P2.4	Check calibration date and time	/	—	—
	P2.5	Select reference temperature	trEF	15~30° C	25° C
	P2.6	Adjust temperature compensation coefficient	tCC	0.00~9.99	2.00%
	P2.7	Adjust TDS factor	tdS	0.40~1.00	0.71
	P2.8	Restore factory default	FS	No－Yes	No
P5.0 Basic Parameter	P5.1	Adjust timing for auto storage	/	—	—
	P5.2	Select temperature unit	/	°C - °F	—
	P5.3	Clear data storage	CLr	No－Yes	—
	P5.4	Set up auto-lock reading mode	/	Off—On	—
	P5.5	Adjust date	/	—	—
	P5.6	Adjust time	/	—	—

12. APPENDIX 2: ICONS AND ABBREVIATION

Mode	Symbol	Abbreviation	Stand for
P1.0 pH	P1.1	buF	Standard buffers
	P1.2	dC	Due Calibration
	P1.3	/	/
	P1.4	CAL	Calibration
	P1.5	FS	Factory default setting
P2.0 Conductivity	P2.1	SOL	Solution
	P2.2	CELL	Cell
	P2.3	dC	Due Calibration
	P2.4	/	
	P2.5	trEF	Reference temperature
	P2.6	tCC	Temperature compensation coefficient
	P2.7	tdS	TDS coefficient
	P2.8	FS	Factory default setting
P5.0 Basic Parameter	P5.1	/	
	P5.2	/	
	P5.3	CLr	Clear readings
	P5.4	/	
	P5.5	/	
	P5.6	/	
Others		USA	United States of America
		n IS	Nist
		OFF	Off
		On	On
		no	No
		YES	Yes

13. APPENDIX 3: TABLE OF SELF-DIAGNOSIS SYMBOL

Symbol	Self-Diagnosis Information	pH	Conductivity
Er 1	Wrong 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%)	√	
Er6	Enter in pre-set due calibration to remind re-calibration	√	√

14. 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, any malfunctioned or damaged product attributable to responsibility of APERA INSTRUMENTS for a period of THREE YEARS (SIX MONTHS for the probe) from the delivery.

This limited warranty does not cover any damages due to: accidental damage, 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.

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