

EC850 Portable Conductivity Meter

User Manual



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1 **Introduction**

Thank you for purchasing EC850 portable Conductivity meter.

This product is a great combination of advanced electronics technology, sensor technology, and software design, made for general water solution applications such as water treatment, environmental monitoring, pools and spas, hydroponics, aquaculture, education, beverage making, cooling tower, etc., especially ideal for field use. In order to use and maintain the meter properly, please read the manual thoroughly before use.

1.1 **Measurement Parameters**

Measurement parameters	EC850
pH/mV	
Conductivity/TDS	√
Temperature	√

1.2 **Basic Features**

- The microprocessor-based portable meter features automatic calibration, automatic temperature compensation, function setup, self-diagnostics, automatic power-off and low voltage display.
- The meter's digital filter improves measurement speed and accuracy. There is a stable reading indication on the display.
- The package includes a portable case, a meter, electrodes, standard solutions and all accessories, which is convenient to use in field.
- The meter is dust proof and waterproof, meeting the IP67 rating.

1.3 **Conductivity Measurement Features**

- 1-4 points automatic calibration, the meter provides calibration guide and automatic checking function.
- The meter can switch between conductivity and TDS.
- The meter can recognize conductivity standard solutions automatically.

2 Specifications

2.1 Main Specifications

	Specifications	
Conductivity	Range	Conductivity: 0~200 mS/cm (divided into five ranges): (0.00~19.99) μ S/cm; (20.0~199.9) μ S/cm; (200~1999) μ S/cm; (2.00~19.99) mS/cm; (20.0~199.9) mS/cm TDS: (0~100) g/L.
	Resolution	0.01/0.1/1 μ S/cm 0.01/0.1 mS/cm
	Accuracy	\pm 1.0% F.S \pm 1digit
	Temperature compensation	(0 ~100) $^{\circ}$ C (manual or automatic)
	Electrode constant	0.1 / 1 / 10 cm^{-1}
Temperature	Range	0~100 $^{\circ}$ C
	Resolution	0.1 $^{\circ}$ C
	Accuracy	\pm 0.5 $^{\circ}$ C \pm 1 digit

2.2 Other Specifications:

Power	AAA batteries \times 3 (1.5V \times 3)	
IP rating	IP57	
Dimension & Weight	Meter: (86 \times 196 \times 33) mm / 335 g	
	Portable case:(330 \times 270 \times 82)mm/1.3kg	PH850, EC850

3 Instrument Description

3.1 LCD Display:

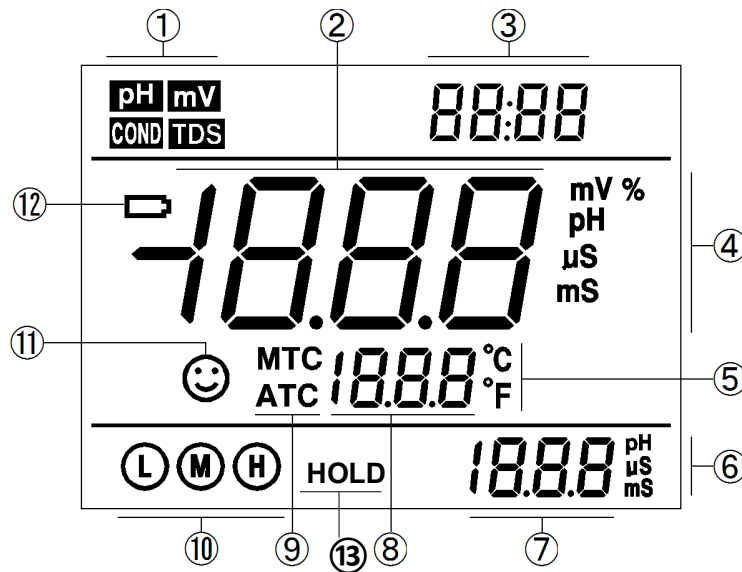


Diagram-2

- (1) — Parameter mode icons
- (2) — Measurement reading
- (3) — Prompts of special display mode
- (4) — Units of measurement
- (5) — Temperature units (°C and °F)
- (6) — Units of pH and conductivity calibration value
- (7) — pH and conductivity calibration value, and prompts of special display mode
- (8) — Temperature value, and prompts of special display mode
- (9) — Temperature compensation icons
 ATC — automatic temperature compensation, MTC — manual temperature compensation
- (10) — Calibration guide icon
- (11) — Stability icon of readings
- (12) — Low battery icon, when this icon appears, please replace the battery
- (13) — Automatic reading hold icon

3.2 Keypad Functions

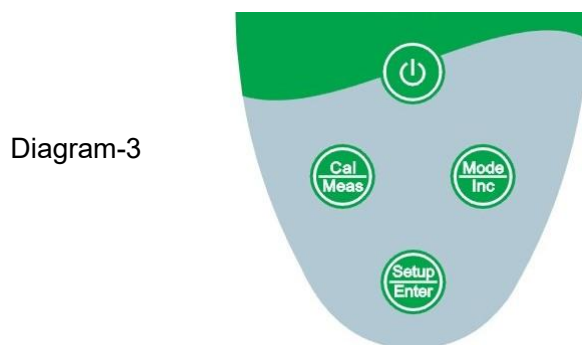



Diagram-3

3.2.1. Keypad operations

Short press ----- <1.5 seconds; Long press ----- >1.5 seconds.

Turn on the meter: Press  to turn on the meter.

Turn off the meter: In the measurement mode, press  and hold for 2 seconds to turn off the meter.









Note: In the calibration mode or the parameter setup mode, pressing  is invalid. Please press  key to return to the measurement mode, then press  to turn off the meter.

Chart -1 Keypad operations and descriptions

Keypad	Operations	Descriptions
	Short press	● In the power-off mode, press this key to turn on the meter
	Long press	● In the measurement mode, press and hold this key for 2 seconds to turn off the meter.
	Short/long press	<p>Select measurement parameters:</p> <ul style="list-style-type: none"> ● EC850 Conductivity meter COND — TDS ● In the measurement mode: long press to enter manual temperature compensation mode, then long press or momentary press this key to change the temperature value (only one direction). ● In the parameter setup mode, press this key to change the serial number of the main menu and the submenu (only one direction) ● In the submenu mode, press this key to change parameters and setup (only one direction)
	Short press	<ul style="list-style-type: none"> ● In the measurement mode, press this key to enter the calibration mode ● In the calibration mode or the parameter setup and auto lock-up (HOLD) mode, press this key to return to the measurement mode
	Short press	<ul style="list-style-type: none"> ● In the measurement mode, press this key to enter the parameter setup main menu ● In the calibration mode, press this key to make calibration ● In the parameter setup mode, press this key to select programs

3.3 Meter Socket

Chart-2 Sockets for Meters

Models	Photos	Description
EC850 Conductivity meter		● Eight-pin socket (left) — connect conductivity electrode

3.4 Reading Stability Display Mode

When the measuring value is stable, smiley icon ☺ appears on LCD, see Diagram – 4. If the smiley icon ☹ does not appear or flash, please do not get the reading value or make calibration until the measuring value is stable. Per parameter P1.3, there are 3 criteria for stability standard: **NOF** (Normal), **HI** (High), and **LO** (Low). The factory default is set “Normal”. “High” is set for stability for longer time, “Low” is set for stability for shorter time. User can select suitable stability criteria according to different testing requirement.

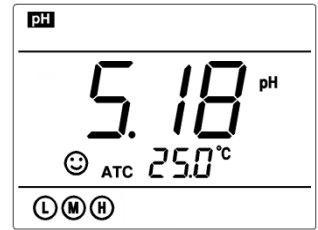



Diagram- 4

3.5 Automatic Lock-Up Display Mode

Select **On** from parameter P4.6 to turn on automatic lock-up display function. When the reading value stabilizes more than 10 seconds, the meter locks the measuring value automatically and displays **HOLD** icon, see Diagram – 5. In the **HOLD** mode, press  to release lock-up.

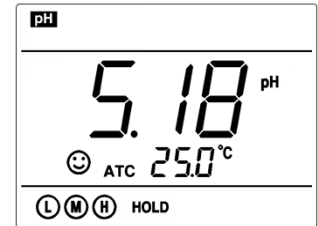






Diagram - 5

3.6 Automatic Power-off

The meter will be power-off if there is no operation for 20 minutes. The time of auto power-off can be set in parameter setting P3.2

3.7 Manual Temperature Compensation (MTC)

When the temperature probe does not connect to the meter, long press  key, temperature value flashes, then long press  key or short press  key to change the temperature value in one way, and press  to confirm the temperature value to achieve Manual Temperature Compensation (MTC).

4 Conductivity Measurement:

4.1 Conductivity Electrode Information

4.1.1. 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 submerge the conductivity electrode in solution, stir the solution briefly to eliminate the air bubbles and improve response and stability.

4.1.2. Conductivity electrode constant

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

Chart – 7 Electrode constant and measuring range

Range	<20 $\mu\text{S/cm}$	1.0 $\mu\text{S/cm}$ to 100 mS/cm			> 100 mS/cm
Conductivity electrode constant	K=0.1	K=1.0			K=10
Standard solution	84 $\mu\text{S/cm}$	84 $\mu\text{S/cm}$	1413 $\mu\text{S/cm}$	12.88 mS/cm	111.8 mS/cm
Electrode's model	DJS-0.1-S conductivity electrode	2301T-S conductivity electrode			2310T-S conductivity electrode

4.2 Conductivity Calibration

4.2.1. Conductivity calibration solutions

The meter uses conductivity standard solution of 84 $\mu\text{S/cm}$, 1413 $\mu\text{S/cm}$, 12.88 mS/cm and 111.8 mS/cm . The meter can recognize the standard solution automatically, can perform one-point or multi-point calibration (the maximum is four-point calibration). The calibration indication icons correspond to the four standard values (**H** icon corresponds to two standards). See chart – 8:

Chart – 8 Conductivity standard solution series

Calibration guide icons	Calibration solution series	Range
L	84 $\mu\text{S/cm}$	0-200 $\mu\text{S/cm}$
M	1413 $\mu\text{S/cm}$	200-2,000 $\mu\text{S/cm}$
H	12.88 mS/cm	2-20 mS/cm
	111.8 mS/cm	20-200 mS/cm

4.2.2. Calibration frequency

- The meter is calibrated before leaving the factory and can generally be used right out of the box.
- Normally perform calibration per month.
- For high accuracy measurements or large temperature deviation from the reference temperature (25°C), perform calibration per week.
- Use conductivity standard solution to check whether there is error. Perform calibration for large error.
- For new electrode or factory default setting, perform 3-point or 4-point calibration. Choose closer standard solution to the sample solution to perform 1- point or 2-point calibration.

4.2.3. Reference temperature

Reference temperature of factory default is 25°C. Other reference temperature can also be set for range 15°C – 30°C. Select per parameter setting P2.2 and see clause 7.4.

4.2.4. Temperature 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 chart – 9 and the data collected during testing. Set per parameter setting P2.3. and see clause 7.4.

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.

Chart -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

4.2.5. Avoid contamination of standard solution


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 dry. 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 accuracy.



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

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

4.3.2. Press  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 locks 1413 mS, stable icon  will stay on LCD.

Press  key to complete calibration. The meter will return to measuring mode and  will be displayed on the bottom left of the LCD screen. See diagram-8.

4.3.3. For multi-point calibration, please repeat clause 6.3.1-6.3.2 until all the calibration is done. The meter can repeat calibration in the same calibration solution until the stable value is reached.

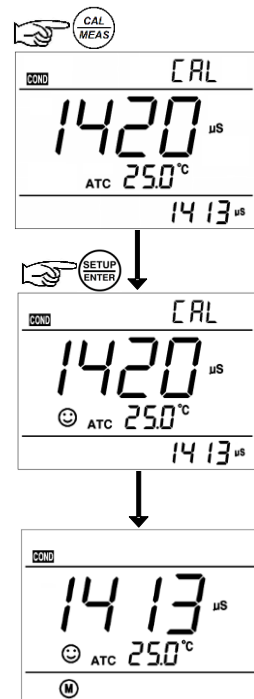


Diagram- 8

4.3.4. Notes:

(a) If press  key before stable icon  appeared on LCD screen, Error indication icon Er 2 will be shown. See Chart -11.

(b) Press  key to exit calibration mode.

4.4 Relations between TDS and Conductivity


4.4.1. TDS and conductivity is linear related. The conversion factor is 0.40-1.00. Adjust the factor from parameter P2.4. The factory default setting is 0.71 and please refer to Item 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 or salinity.


4.4.2 Adjust TDS conversion factor in parameter setting P2.4 according to the data collected during testing and experience. Chart – 10 lists some common use Conductivity and TDS conversion factors. This is for your reference only.

Chart – 10 Conductivity and TDS conversion factors

Conductivity of solution	TDS conversion factor
0-100 $\mu\text{S/cm}$	0.60
100-1,000 $\mu\text{S/cm}$	0.71
1-10 mS/cm	0.81
10-100 mS/cm	0.94

4.5 Sample Test




4.5.1. Rinse conductivity electrode in distilled or deionized water, allow it to dry, 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.

4.5.2. Press  key to switch to TDS.

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

Chart – 11 Self-diagnosis information of conductivity measurement mode

Display Icons	Contents	Checking
<i>Er 1</i>	Wrong conductivity calibration solution or the meter recognition of calibration solution out of range	<ol style="list-style-type: none"> 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  key when measuring value is not stable during calibration.	Press  key after  icon appears
Er3	During calibration, the measuring value is not stable for ≥ 3 min.	<ol style="list-style-type: none"> 1. Shake the electrode to eliminate bubbles in electrode head. 2. Replace with new pH electrode.

4.5.4 Factory default setting

For factory default setting, please refer to parameter setting P2.5 (Item 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.



4.6 Conductivity Electrode Maintenance

4.6.1. Always keep the conductivity electrode clean. Before taking a measurement, rinse the electrode in distilled or deionized water and better 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 stay until a stable reading is reached. For conductivity electrode which is drily stored, soak the electrode in distilled or deionized water for 5-10 minutes. Rinse the electrode in distilled or deionized water after measurement.

4.6.2. The interaction 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



5 Parameter Setting

5.1 Main Menu

In the measurement mode, press  key to enter P2.0, then press  to switch to main menu: P2.0→P3.0. Please refer to diagram – 9.

P2.0: Conductivity parameter setting; P3.0: Basic parameter setting.

5.2 Submenu

7.2.2. In P2.0 mode, press  key to enter submenu P2.1 of conductivity parameter setting, then press  to switch among submenu: P2.1→P2.2→P2.3→P2.4→P2.5, see Diagram– 9.



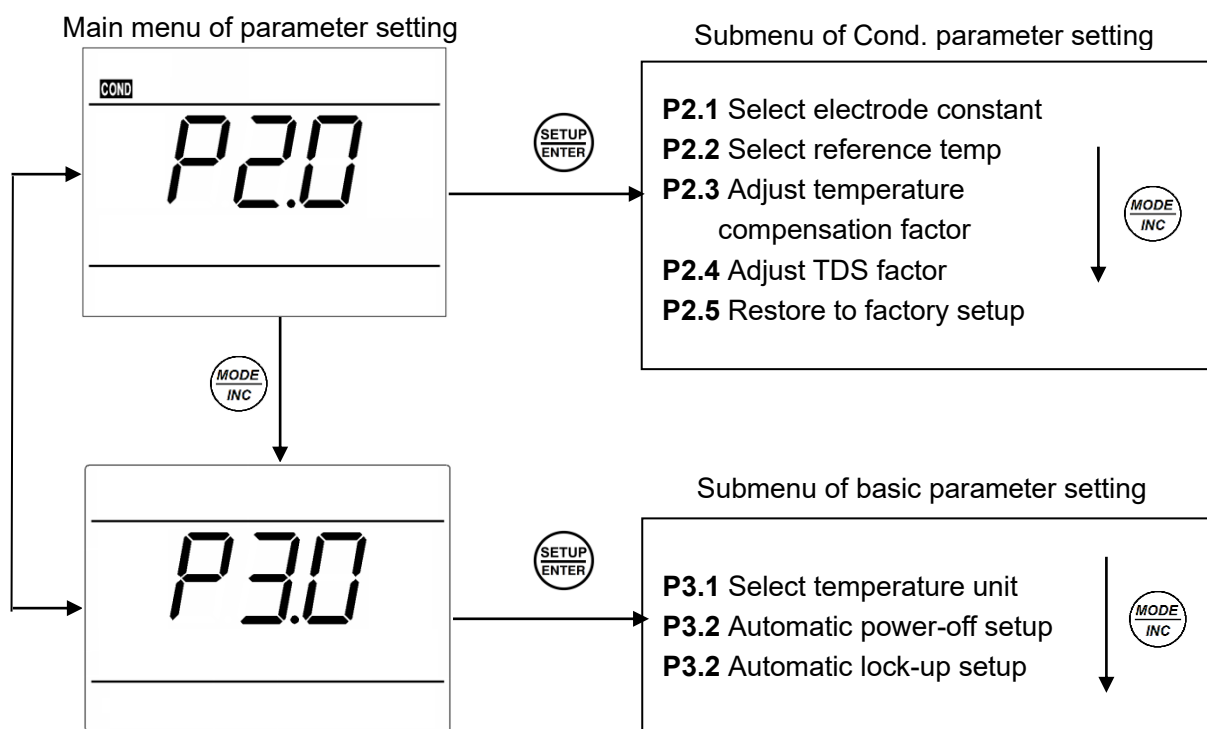
7.2.3. In P3.0 mode, press  key to enter submenu P3.1 of basic parameter setting, then press  to switch among submenu: P3.1→P3.2→P3.3, see Diagram – 9.

Diagram 9



5.3 Submenu of pH Parameter Setting (press key to switch)








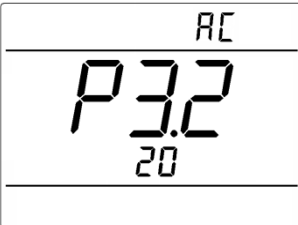





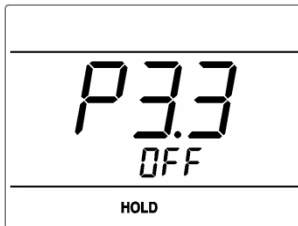




	<p>P1.1. – Select pH standard solution (USA-NIST)</p> <ol style="list-style-type: none"> 1. In measurement mode, press key to enter P1.0 mode, then press to enter P1.1. 2. Press key, USA flashes, press key to select USA→nIS, press to confirm. USA-USA series; nIS-NIST series. 3. After confirming parameter, press key to enter P1.2 mode, or press key to return to the measurement mode.
	<p>P1.2. – Select resolution (0.01 – 0.1)</p> <ol style="list-style-type: none"> 1. Press key, 0.01 flashes, press key to select 0.01→0.1, press key to confirm. 2. After confirming parameter, press key to enter P1.3 mode, or press key to return to the measurement mode.
	<p>P1.3. – Set reading stability criteria (Normal – High – Low)</p> <ol style="list-style-type: none"> 1. Press key, nor flashes. Press key to select nor→HI→Lo, press to confirm. Nor – Normal, Hi – High, Lo – Low. 2. After confirming parameter, press key to enter P1.4 mode, or press key to return to the measurement mode.

	<p>P1.4. –Restore factory setting (No – Yes)</p> <ol style="list-style-type: none"> 1. Press key, no flashes. Press key to select no→YES, press to confirm, the meter returns to the measurement mode. No – Do not restore, Yes – Restore to factory setting. 2. If not choosing Yes , press key to return to the measurement mode.
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5.4 Submenu of Conductivity Parameter Setting (press key to switch)

	<p>P2.1. – Select electrode constant (1.0-10.0-0.1)</p> <ol style="list-style-type: none"> 1. In P2.0 mode, press key to enter P2.1 mode, please refer to the left Diagram. 2. Press key, 1.0 flashes, then press key to select 1.0→10.0→0.1, press key to confirm. 3. After confirming the parameter, press key to enter P2.2 mode, or press key to return to the measurement mode.
	<p>P2.2. – Select reference temperature (15.0°C-30.0°C)</p> <ol style="list-style-type: none"> 1. Press key, 25.0°C flashes, then press key to adjust temperature value 15.0-30.0, press key to confirm. 2. After confirming parameter, press key to enter P2.3 mode, or press key to return to the measurement mode.
	<p>P2.3. – Adjust temperature compensation coefficient (0.00-9.99%)</p> <ol style="list-style-type: none"> 1. Press key, 2.00 flashes, press key to adjust temperature compensation coefficient 0.00 – 9.99, press key to confirm. 2. After confirming the parameter, press key to enter mode P2.4 or press key to return to the measurement mode.
	<p>P2.4. – Adjust TDS factor</p> <ol style="list-style-type: none"> 1. Press key, 0.71 flashes, press key to adjust TDS factor 0.04 – 1.00, press key to confirm. 2. After confirming the parameter, press key to enter mode P2.5 or press key to return to the measurement mode.
	<p>P2.5. –Restore factory setting (No – Yes)</p> <ol style="list-style-type: none"> 1. Press key, no flashes. Press key to select no→YES, press to confirm, the meter returns to the measurement mode. No – Do not restore, Yes – Restore to factory setting. 2. If don't select Yes, press key to return to the measurement mode.

5.5 Submenu of Basic Parameter Setting (press key to switch)

	<p>P3.1. Select temperature unit (°C—°F).</p> <ol style="list-style-type: none"> In P3.0 mode, press  key to enter P3.1 mode, please refer to the left Diagram. Press  key, °C flashes, then press  key to select °C→°F, press  key to confirm. When parameter is confirmed, press  key to enter mode P3.2 or press  key to return to the measurement mode.
	<p>P3.2 – Automatic power-off setup (10→20→30→On)</p> <ol style="list-style-type: none"> Press  key, On flashes, press  key to select 10→20→30→On press  key to confirm. On – turn off automatic power-off; Time unit is minutes. After confirming the parameter, press  key to enter mode P3.3 or press  key to return to the measurement mode.
	<p>P3.2 – Automatic lock-up setup (Off→On)</p> <ol style="list-style-type: none"> Press  key, OFF flashes, press  key to select OFF→On, press  to confirm. Off – not set; On–set (the reading is automatically locked when stabilizes > 10 seconds.) When Parameter is confirmed, press  key to return to the measurement mode.

6 What's in the Kit

No.	Include	Quantity
1.	EC850 portable conductivity meter	1 set
2.	2301T-S plastic conductivity electrode	1 pc
3.	Conductivity calibration solution (1413 μS/12.88 mS/84 μS/50mL)	1 bottle each
4.	Portable case	1 pc
5.	Manual	1 book

7 Warranty

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

This limited warranty does NOT cover any issues due to:

- Accidental damage
- Improper use
- Normal wear and tear
- Transportation
- Storage
- Failure to follow the product instructions
- Unauthorized maintenance, modifications, combination or use with any products, materials, processes, systems or other matter
- Unauthorized repair

8 Appendix I: Parameter Setting & Factory Default Setting

Modes	Prompts	Parameter setting items	Abbreviation	Description	Restore to factory default
P2.0 Cond.	P2.1	Select electrode constant	CELL	1.0 – 10.0 – 0.1	1.0
	P2.2	Select reference temperature	REF	15~30°C	25°C
	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
P3.0 Basic Parameters	P3.1	Select temperature unit	/	°C – °F	°C
	P3.2	Automatic Power-off setup	AC	10 – 20 – 30 – On	20
	P3.3	Automatic Lock-up setup	/	/	Off

9 Appendix II: Abbreviation Glossary

Modes	Prompts	Code and abbreviation	In English	Description
P2.0 Conductivity	P2.1	CELL	Cell	Constant Cell
	P2.2	tREF	Reference temperature	Reference temperature
	P2.3	tCC	Temperature compensation coefficient	Temperature compensation coefficient
	P2.4	tDS	Total dissolved solid	TDS
	P2.5	FS	Factory default setting	Factory default setting
P3.0 Basic parameters	P3.1	/	/	/
	P3.2	AC	Auto close	Automatic Power-off
	P3.3	/	/	/

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