950 Series

Benchtop pH/Conductivity Meter

User Manual

PH950 Benchtop pH Meter ☐

EC950 Benchtop Cond. Meter ☐

PC950 Benchtop pH/Cond. Meter ☐

RoHS compliant CE ISO 9001:2015 IP54 WATERPROOF

APERA INSTRUMENTS, LLC

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Notes

- When the meter is connected to PC, do not pull out the USB cable until the meter is turned off. Otherwise a system crash could occur. To fix the crash, pull out the power cord, put it back in, and reboot the meter.
- Please do NOT pull out the power cord when the meter is turned on.

1   Introduction

Thank you for purchasing the 950 Series Benchtop pH/Cond. Meter.

Before using this meter, please read this manual carefully to help you use and maintain it properly.

1.1   Measuring Parameters

Parameter and configuration	PH950	EC950	PC950
pH/mV	√		√
Conductivity/TDS/Salinity		√	√
Temperature	√	√	√
Electrode Stand	√	√	√

1.2   Basic Features

● Clear TFT color display

● User-friendly operating system with graphics and texts

● Multi-language operating system (English, German, Spanish & Chinese)

● The smiling icon indicates the reading stability, including automatic lock function.

● With built-in microprocessor chip, the meter has intelligent functions such as automatic calibration, automatic temperature compensation, function setting, self-diagnosis, and data logger.

● PC950 meter can measure and display pH & conductivity readings simultaneously.

● Meter can configure with 606 multifunction test bench which is combined by intelligent stirrer and flexible electrode holder. It can hold solution bottles, electrodes and stirrer beads. Stepless speed regulation intelligent stirrer, it can also store rotation speed.

1.3   pH measurement features

● 1–3 point automatic calibration with calibration instruction and automatic check functions.

● Automatically recognize pH buffer solution. 3 series buffer solution selectable: USA series, NIST

   series and China series, as well as user-defined solutions.

● Automatically display electrode slope.

1.4   Conductivity Measurement Features

● 1– 4 point automatic calibration with calibration instruction and automatic checking functions.

● Automatically recognize conductivity standard solution. 2 series standard solution selectable: USA and CH, as well as user-defined solution.

● Single-tap switch among conductivity, TDS, and salinity.

2   Configuration

		Description	Quantity	PH950	EC950	PC950
2.1		PH950 pH meter	1	√		
2.2		EC950 conductivity meter	1		√	
2.3		PC950 pH/conductivity meter	1			√
2.4		606 multi-function stirrer (includes flexible electrode holder)	1	√	√	√
2.5		LabSen211 glass pH combination electrode	1	√		√
2.6		MP500 temperature probe	1	√		√
2.7		2401T-F conductivity electrode (ATC, K=1.0)	1		√	√
2.8		pH buffer solution (4.00/7.00/10.01pH/50mL)	1 bottle each	√		√
2.9		Conductivity standard solution (84μS/1413μS/12.88mS/50mL)	1 bottle each		√	√
2.10		Stirrer connection cable	1	√	√	√
2.11		PCLink-950 Flash Disk	1	√	√	√
2.12		USB communication cable	1	√	√	√
2.13		9V power adapter	1	√	√	√
2.14		Instruction manual	1	√	√	√
2.15		Quick manual	1	√	√	√

3 Specifications

3.1 Technical Parameters

		Technical Parameters	Model
pH	Measuring Range	pH 0.00 – 14.00	PH950 PC950
	Resolution	0.1/0.01 pH	
	Accuracy	± 0.01 pH ± 1 digit	
	Temp. Compensation Range	32 – 212 ˚F (0 – 100) ˚C (Auto. or Manual)	
	Calibration point	1 – 3 points	
mV	Measuring Range	± 2000 mV	
	Resolution	1 mV	
	Accuracy	± 0.1% FS ± 1 digit	
Cond.	Measuring Range	Conductivity： 0 – 200 mS/cm, divided into five ranges, automatically switch measuring range. (0 – 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 TDS： (0 – 100) g/L; Salinity: (0 – 100) ppt	EC950 PC950
	Resolution	0.01/0.1/1μS/cm 0.01/0.1 mS/cm	
	Accuracy	± 1.0% FS ± 1 digit	
	Temp. Compensation Range	32–122 ˚F (0 – 50) ˚C (Auto. or Manual)	
	Cell constant	0.1 / 1 / 10 cm^{-1}	
Temp.	Measuring Range	32 – 212 ˚F (0 – 100 ˚C)	PH950 EC950 PC950
	Resolution	0.1 ˚F (0.1 ˚C)	
	Accuracy	± 0.9 ˚F (± 0.5 ˚C) ±1 digit	

3.2 Other Technical Parameters

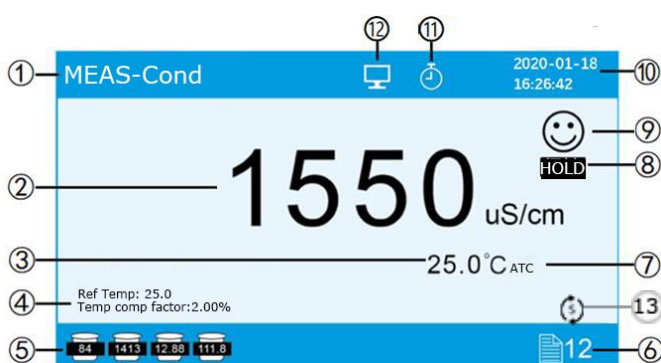|	
Data Storage	200 groups
Storage Content	Number, date, time, measuring value and temperature value
Power	DC9V/600mA
Dimension & Weight	Meter： (195×215×100) mm / 0.9kg

4 Instrument Description

4.1 **LCD Display**

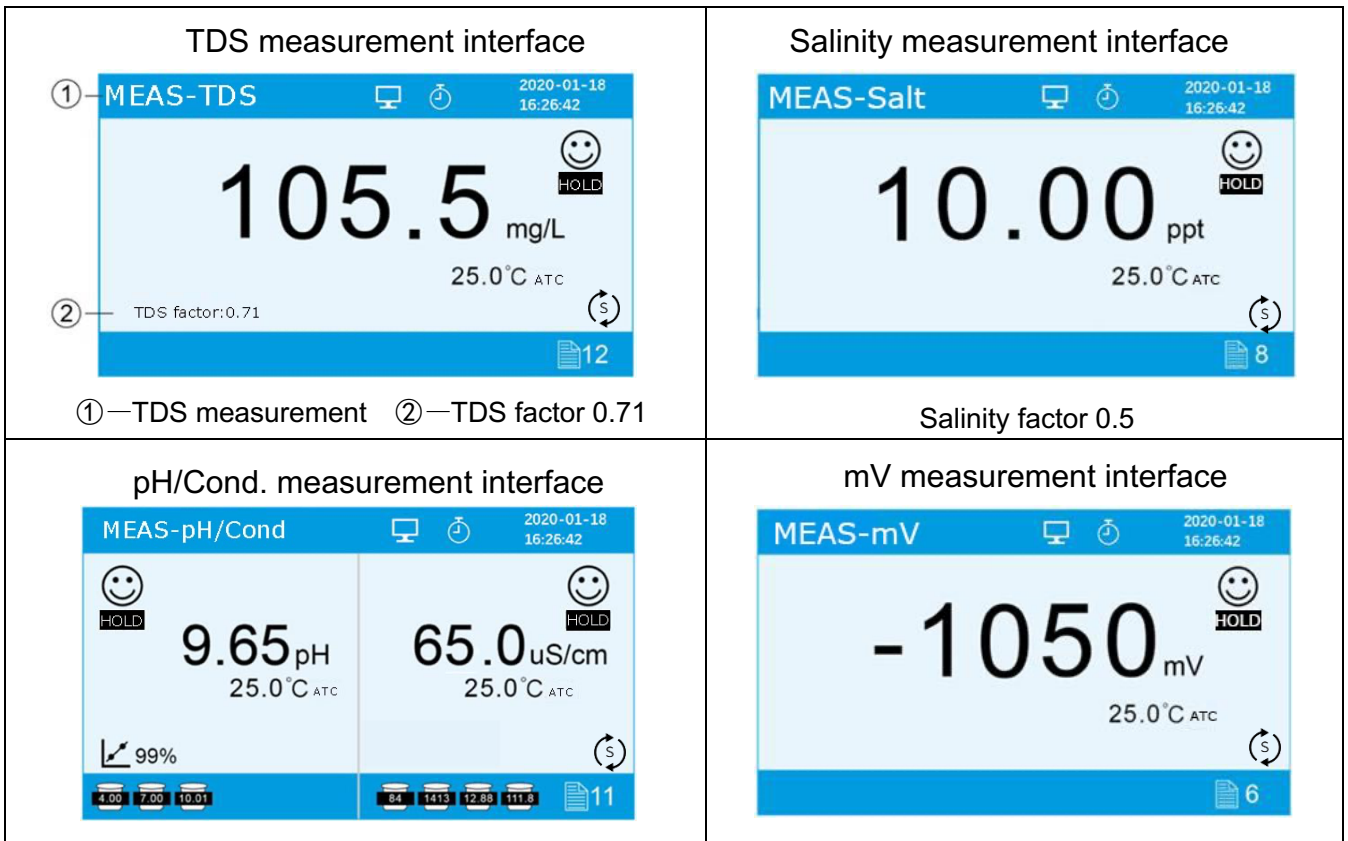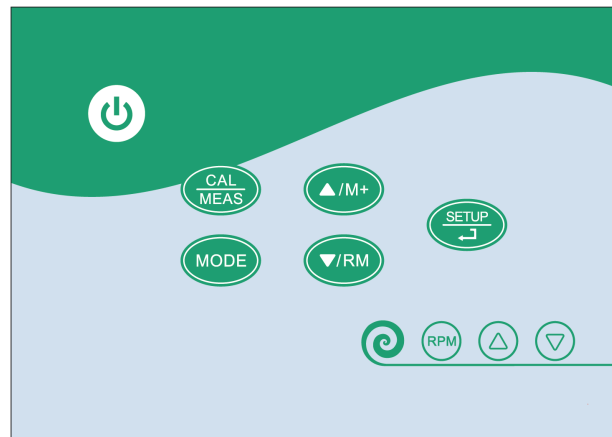|	

pH measurement interface
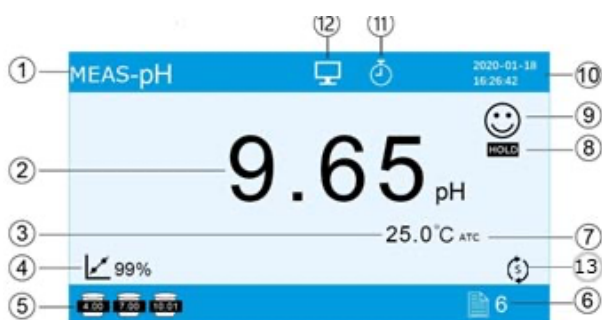 	
(12) (11)
① MEAS-pH 🖥 ⏱ 2020-01-18 16:26:42 ⑩
② **9.65** pH 😊 ⑨ HOLD ⑧
③ 25.0℃ ATC ⑦
④ 〽 99% ⑂ ⑬
⑤ 4.00 7.00 10.01 📄 6 ⑥
	①—pH measurement
	②—pH measuring value and unit
	③—Temperature measuring value
	④—pH electrode slope
	⑤—Calibration solution indication icon
	⑥—Used data storage
	⑦—Temperature compensation icon,
	    MTC-manual temperature compensation
	    ATC-auto. temperature compensation
	⑧—Auto. Hold
	⑨—Stable reading icon
	⑩—Date and time
	⑪—Auto. data log
	⑫—Storage icon and number
	⑬—Stirrer icon

Conductivity measurement interface
 	
(12) (11)
① MEAS-Cond 🖥 ⏱ 2020-01-18 16:26:42 ⑩
② **1550** uS/cm 😊 ⑨ HOLD ⑧
③ 25.0℃ ATC ⑦
④ Ref Temp: 25.0
Temp comp factor:2.00% ⑂ ⑬
⑤ 84 1413 12.88 111.8 📄12 ⑥
	①—Conductivity measurement
	②—Conductivity measuring value and unit
	③—Temperature measuring value
	④—Conductivity parameter:
	25.0 ℃—reference temperature
	2.00%—temperature compensation
	⑤—Calibration solution indication icon
	⑥—Used data storage
	⑦—Temperature compensation icon,
	    MTC-manual temperature compensation
	    ATC-auto. temperature compensation
	⑧—Auto. Hold
	⑨—Stable reading icon
	⑩—Date and time
	⑪—Auto. data log
	⑫—Storage icon and number
	⑬—Stirrer icon

TDS measurement interface	Salinity measurement interface
①—MEAS-TDS 2020-01-18 16:26:42 **105.5** mg/L ☺ HOLD 25.0°C ATC ②— TDS factor:0.71 (S) 📄12	MEAS-Salt 2020-01-18 16:26:42 **10.00** ppt ☺ HOLD 25.0°C ATC (S) 📄8
①—TDS measurement ②—TDS factor 0.71	Salinity factor 0.5
pH/Cond. measurement interface	mV measurement interface
MEAS-pH/Cond 2020-01-18 16:26:42 ☺ HOLD **9.65** pH ☺ HOLD **65.0** uS/cm 25.0°C ATC 25.0°C ATC ↗ 99% (S) 4.00 7.00 10.01 84 1413 12.88 111.8 📄11	MEAS-mV 2020-01-18 16:26:42 **-1050** mV ☺ HOLD 25.0°C ATC (S) 📄6

4.2 **Keypad functions**

Diagram-1

Keypad operation mode

Short press──Press key <2s, buzzer makes a beep;

Long press──Press key >2s, buzzer makes a beep.

Table -1 Keypad operations and functions

Keypad	Operations	Functions
(power icon)	Short press	● Power on/off
MODE	Short press	Press key to select measurement mode: ● PH950: **pH→mV** ● EC950: **Cond→TDS→Salt** ● PC950: **pH→mV→Cond→TDS→Salt→pH/Cond**
	Long press	● Press key to enter temperature adjustment mode (for manual temperature compensation)
CAL MEAS	Long press	● In measurement mode, press key to enter calibration mode
	Short press	● Cancel operation and return to measurement mode;
SETUP	Short press	● In measurement mode: press key to enter parameter setup main menu; ● In calibration mode: press key to conduct calibration; ● In main menu mode: press key to enter submenu; ● In submenu mode: press key to enter parameter setup; ● In parameter setup mode: press key to confirm parameter change; ● In temperature adjustment mode: press key to confirm temperature value.
▲/M+ ▼/RM	Short press	● In measurement mode: press ▲/M+ key to save measurement data, press ▼/RM key to recall the saved data; ● In recall (RM) mode: press ▼/RM or ▲/M+ key to turn page; ● In menu mode: press key to select items; ● In temperature adjustment mode: press key to change temperature value, hold key for fast change.

4.3 **Meter Sockets**

Model	Meter sockets
PH950	① ② ③ ⑥⑦
EC950	④ ⑤ ⑥⑦
PC950	① ② ③ ④ ⑤ ⑥⑦

Diagram-2

Meter Sockets Information

	Socket Type	Information
①	BNC	Connect pH or ORP combination electrode
②	RCA	Connect temperature sensor (for pH)
①+②	BNC+RCA	connect pH/ATC 3-in-1 combination electrode
③	Φ4 banana	Connect reference electrode
④	BNC	Connect conductivity electrode
⑤	RCA	Connect temperature sensor (for conductivity)
④+⑤	BNC+RCA	connect with Cond/ATC electrode
⑥	USB	Connect PC
⑦	Φ2.5 power supply	Connect DC9V adaptor (inside "＋" outside "－")

4.4 Display Mode

4.4.1 *Reading stable display mode*

When the measuring value is stable, smiley icon ☺

appears and stays on LCD screen, see Diagram – 3.

If the smiley icon does not appear or flash, please do

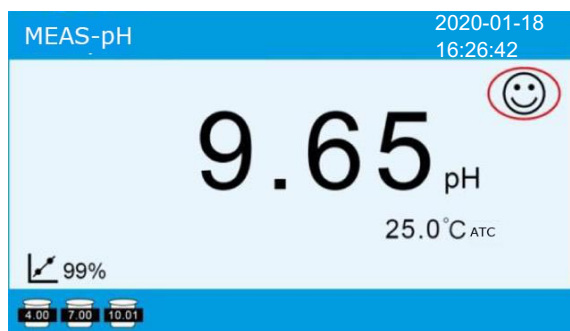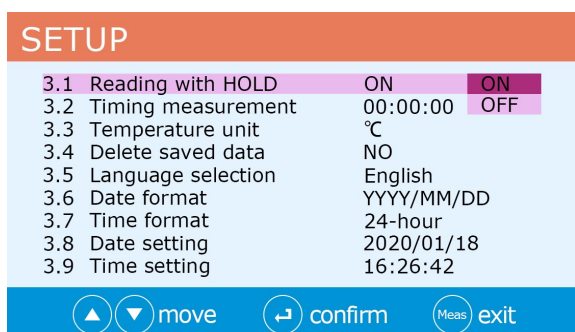not get readings or make calibration until the measuring

value is stable.

Diagram-3

4.4.2 *Auto. lock on display mode*

In parameter setting 3.1, set "Reading with HOLD" to "ON", when ☺ icon stably display for more than 10 seconds, the meter will lock the value automatically and display **HOLD** icon, see Diagram – 4(b). In **HOLD** mode, press (CAL/MEAS) key to cancel auto lock.

(a)   (b)

Diagram-4

4.5 Data Storage, Recall and Delete

4.5.1 *Storage*

(a) *Manual data logger*

Set "auto. timing" to "00:00:00", Press (▲/M+) key to store, icon 📄 6 displays on the down right corner of LCD screen which means it's the 6th group data, see Diagram – 5(a); Each meter can store 200 groups data. For single parameter display mode, 1 serial number corresponds to 1 group measuring vale. For dual parameter display mode (means pH + Cond. meter display mode), 1 serial number corresponds to 2 groups measuring value (pH + conductivity). So for this type of meter, actual store data is 200 groups, but storage number will be less than 200. If press key again when storage value is full, icon Full will flash, see Diagram –5(c) to indicate store memory is already full and need to be deleted for new store value.

(b) *Auto. timing data logger*

Select "Timer" in parameter setting 3.2 and set the data logging interval time (by every X seconds or minutes), for example, 3 minutes. In auto timing data logo mode, ⏱ shows up, press (▲/M+) to start auto. data logger, ⏱ flashes, the first set of measurement data is stored, then every three minutes
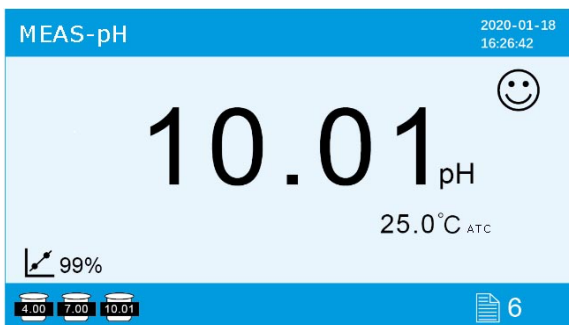
one set of data will be stored and the storage number will be automatically increased. Press ▲/M+ again to stop auto. data logger. In this mode, the manual data logging is invalid.
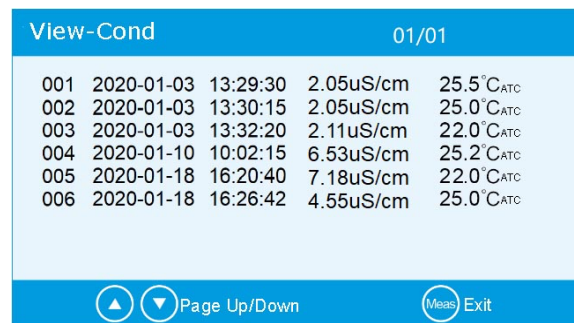
4.5.2 *Data recall*

Press ▼/RM key, meter will display stored 6 groups measuring value, see Diagram – 5(b), press ▲/M+ or ▼/RM key to turn page. Every page displays 8 groups of data.
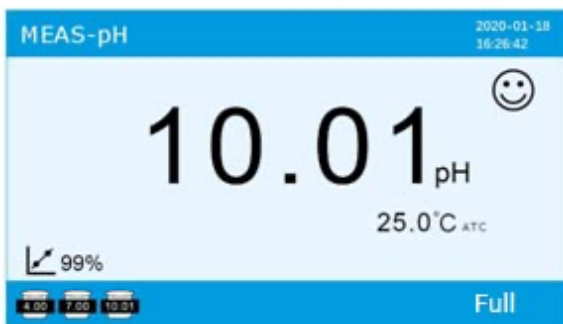
4.5.3 *Delete*

Data need to be deleted when storage memory is full, otherwise no more data can be stored. In parameter setting 3.4 select "Yes" and press SETUP key, see Diagram – 5(d) to delete all stored value. *Note: when connect the meter via USB cable to store the measured values to the computer, there is no limitation on the number of data storage, either manual or automatic storage.*
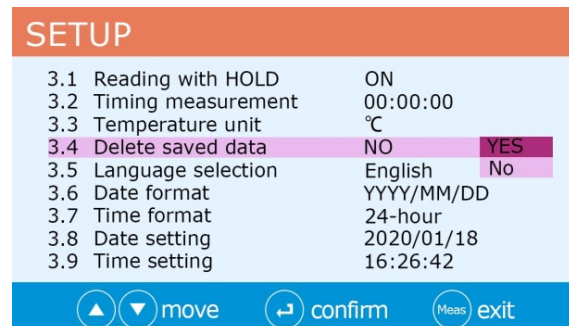

MEAS-pH	2020-01-18 16:26:42

10.01 pH

☺

25.0℃ ATC

⟋ 99%

4.00 7.00 10.01   📄 6

(a)

View-Cond	01/01

001 2020-01-03 13:29:30 2.05uS/cm 25.5℃ATC
002 2020-01-03 13:30:15 2.05uS/cm 25.0℃ATC
003 2020-01-03 13:32:20 2.11uS/cm 22.0℃ATC
004 2020-01-10 10:02:15 6.53uS/cm 25.2℃ATC
005 2020-01-18 16:20:40 7.18uS/cm 22.0℃ATC
006 2020-01-18 16:26:42 4.55uS/cm 25.0℃ATC

▲ ▼ Page Up/Down   Meas Exit

(b)

MEAS-pH	2020-01-18 16:26:42

10.01 pH

☺

25.0℃ ATC

⟋ 99%

4.00 7.00 10.01   Full

(c)

SETUP

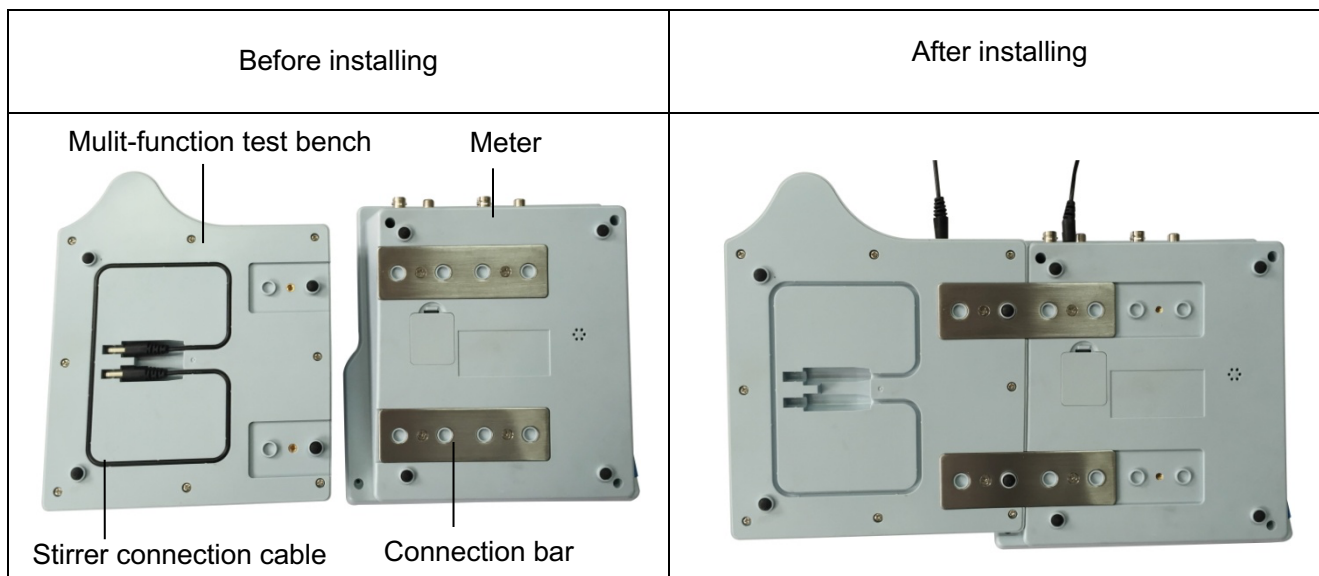| 3.1 | Reading with HOLD | ON | |
3.2	Timing measurement	00:00:00	
3.3	Temperature unit	℃	
3.4	Delete saved data	NO	YES
3.5	Language selection	English	No
3.6	Date format	YYYY/MM/DD	
3.7	Time format	24-hour	
3.8	Date setting	2020/01/18	
3.9	Time setting	16:26:42	

▲ ▼ move   ↵ confirm   Meas exit

(d)

Diagram-5

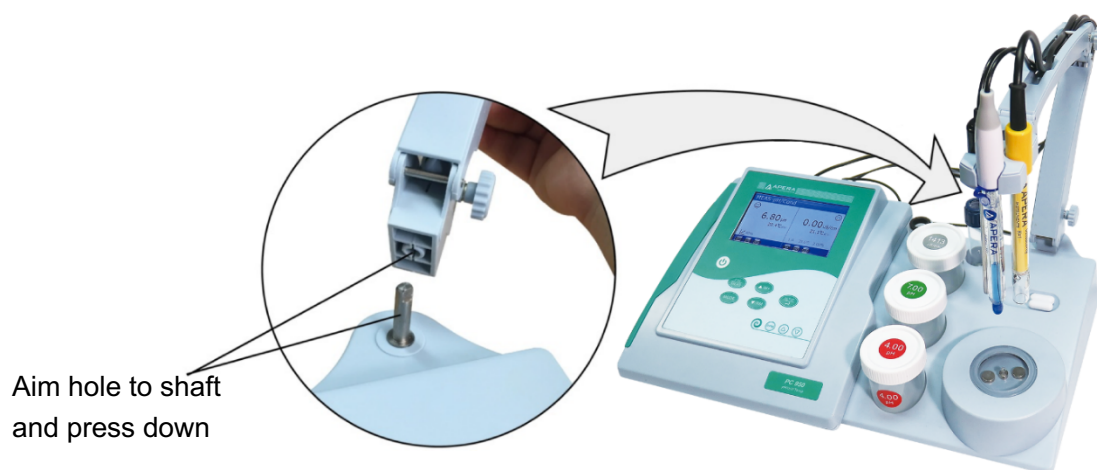## 4.6 **Manually adjust temperature**

When no temperature probe is connected, long press MODE key to enter MTC mode. Press ▲/M+ or ▼/RM key to adjust temperature value. Press and hold the key for fast adjustment. Press SETUP key to confirm and return to measurement mode.
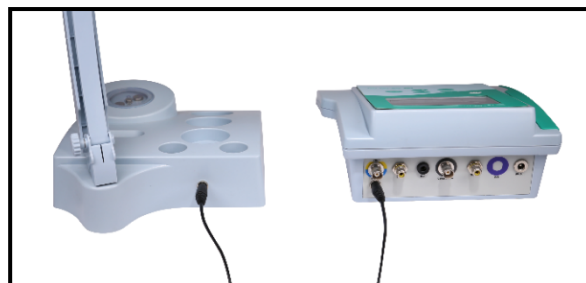
4.7 **Install Meter with Multi-function Test Bench**

Before installing	After installing
Mulit-function test bench Meter Stirrer connection cable Connection bar	

4.8 **Installation of Flexible Electrode Holder**

Aim hole to shaft
and press down

4.9 **Multi-function Test Bench**

a) Combo mode   (b) Separate use (maximum distance 35cm)

5 pH Measurement

5.1 Default Electrodes Information

The meter comes with a LabSen 211 pH combination electrode and MP500 temperature probe, which enables the automatic temperature compensation. The LabSen pH electrodes are made with proprietary sensor technologies and premium materials from Switzerland. LabSen 211 pH electrode is designed for high-precision lab and field pH measurement of general water solutions. The electrode is compatible with TRIS buffers.

For testing pH of special samples such as viscous (sticky), strong acidic or alkaline solutions, solutions at high or low temperature (>50˚C or <10˚C), solid samples, turbid solutions, low ion-concentration solutions & etc…specialized pH electrodes are necessary in order to achieve reliable results. Regular pH electrodes in these special applications usually would generate inaccurate and unstable measurements, and may be damaged by the samples, or even be non-applicable for testing at all.

Please refer to <u>Section 10</u> for ideal pH electrodes to use for other applications.

5.1.1 *Features of LabSen 211 pH Electrode*

● Built with LabSen S-type hemispherical glass membrane, featuring low resistance (fast response) and high firmness
● No more air bubbles inside the glass membrane thanks to the Swiss blue gel electrolyte.
● The long-life reference system significantly increases measuring stability and extends service life.

### 5.1.2 *Technical Specifications of the LabSen211 pH Electrode*

Measuring Range	0-14 pH
Temperature Range	23 to 212 ˚F (-5 to 100 °C)
Membrane Types	S
Body Material	Lead-free Glass
Reference	Long Life
Junction	Ceramic
Reference Solution	3M KCL
Soaking Solution	3M KCL
Membrane Resistance	<150 MΩ
Electrode Dimension	(Φ12×120) mm
Connector and cable length	BNC/1m

5.1.3 *Technical Specifications of the MP500 Temperature Probe*

Temperature Range	14 to 230 ˚F (-10 to 110 °C)
Body Material	Stainless Steel
Sensor	30 KΩ thermistor
Probe Dimension	(Φ5×145) mm
Connector	RCA
Connector and cable length	BNC/1m

5.1.4 _How to use_

1. Insert the blue BNC connector of the electrode to the BNC socket of your pH meter while twisting clockwise until it`s locked, plug the RCA connector into the "TEMP" sockets. Please note not to pull the cables in case of poor contact. Please keep the connectors clean and dry.
2. Before measuring, twist off the storage bottle cap (see graph on the right), pull out the electrode and rinse it off with distilled or deionized water.
3. Unplug the blue rubber plug to maintain a smooth electrolyte flow.
4. Stir the solution briefly to eliminate the air bubbles and in this way, a stable measurement will be reached fast.
5. Perform at least a two-point calibration before measuring after connecting the new electrode to your pH meter.
6. After using, put the electrode back into the storage bottle, twist on the bottle cap, and plug in the refilling hole.
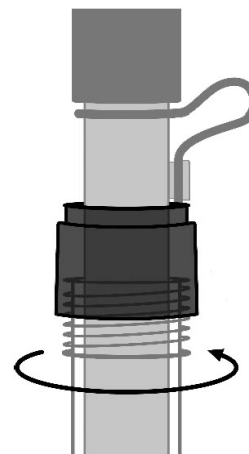
5.1.5 _Maintenance_

1. When not in use, the electrode should be soaked in the storage bottle containing 3M KCL soaking solution (SKU: AI1107) to keep the glass membrane and junction in a healthy condition. Clean the bottle and replace the soaking solution if it gets contaminated. The electrode should never be stored in pure water such as deionized or distilled water.
2. The reference solution will run low as you use the electrode. Whenever the solution level falls to 1/2 height of the electrode, add 3M KCL solution (SKU: AI1107) to the refilling hole (unplug the blue rubber plug) using a syringe or pipette.
3. The electrode is only as accurate as it is clean. Always thoroughly rinse off the electrode before and after each measurement with pure water in a container or with a wash bottle.
4. For tough contaminants, soak the electrode in Apera cleaning solution (AI1166) for 30 minutes. Then use a soft brush to remove the contaminants. Afterwards, soak the electrode in 3M KCL solution (SKU: AI1107) for at least 1 hour. Rinse it off, then re-calibrate it before using again.
5. The connector of the electrode should be kept clean and dry. If contaminated, please clean it with medical cotton and isopropyl alcohol and blow-dry it to prevent short circuit of the electrode or slow response of the electrode.
6. The electrode should avoid testing strong acid and strong alkali solutions, as well as dehydrating media such as absolute ethanol and concentrated sulfuric acid. If testing such solutions, the immersion time should be minimized and the electrode should be carefully cleaned after use.
7. Every pH electrode will eventually age and fail. The typical service life of Apera pH electrodes is 12 to 24 months depending on the frequency of usage and how well you keep it clean and properly stored. We recommend replacing your electrode every 12-18 months to ensure the best performance.

5.2 pH Calibration Related Information

5.2.1 Standard buffer solution

The instrument adopts three series standard buffer solution, USA, NIST and CH series, and also user-defined solution. Please see Table – 2 for the three series of standard buffer solution. The detail of user-defined solution, see clause 5.4.

Table -2 pH standard buffer solution series

Calibration indication icons		pH standard buffer solution series		
		USA series	NIST series	CH series
Three-point calibration	4.00 or 1.68	pH 4.00 or 1.68	pH 4.01 or 1.68	pH 4.00 or 1.68
	7.00	pH 7.00	pH 6.86	pH 6.86
	10.01 or 12.45	pH 10.01 or 12.45	pH 9.18 or 12.46	pH 9.18 or 12.46

Note: calibration indication icons are example of USA series.

5.2.2 Three-point calibration
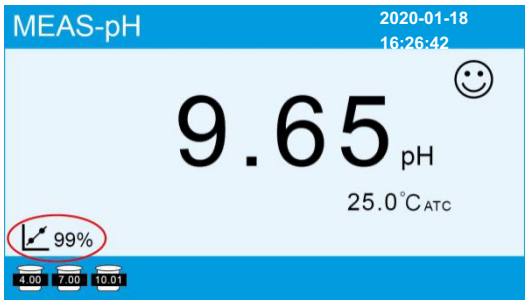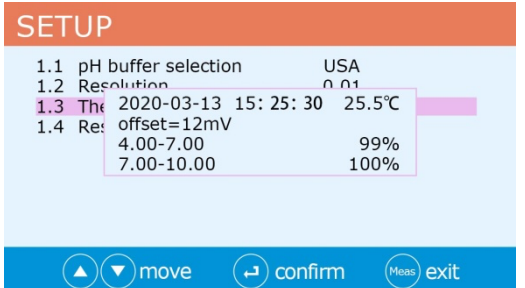
The instrument can perform 1－3 point calibration. In three-point calibration mode, the first point calibration must use pH 7.00 (or pH 6.86) standard solution, then select other standard solution to perform the second and the third point calibration. See Table – 3. Users can choose two-point calibration of pH 7.00 and pH 1.68 for strong acidic solutions (<pH 2), or pH 7.00 and pH 12.45 for strong alkaline solutions (>pH 12).

Table -3 Three-point calibration mode

	USA standard	NIST standard	CH standard	Applicable range
One-point calibration	pH 7.00	pH 6.86	pH 6.86	Accuracy ≤± 0.1pH
Two-point calibration	pH 7.00 and pH 4.00/1.68	pH 6.86 and pH 4.01/1.68	pH 6.86 and pH 4.00/1.68	< pH 7.00
	pH 7.00 and pH 10.01/12.45	pH 6.86 and pH 9.18/12.46	pH 6.86 and pH 9.18/12.46	> pH 7.00
Three-point calibration	pH 7.00, pH 4.00/1.68 and pH 10.01/12.45	pH 6.86, pH 4.01/1.68 and pH 9.18/12.46	pH 6.86, pH 4.00/1.68 and pH 9.18/12.46	pH 0 – 14.00

5.2.3 _Calibration information display_
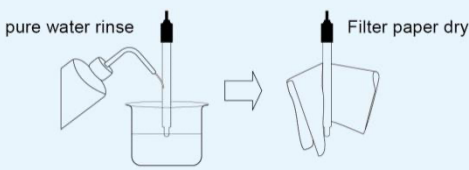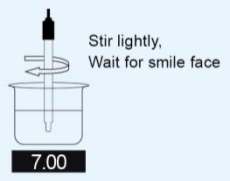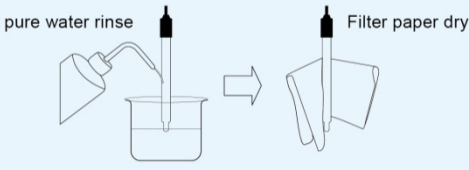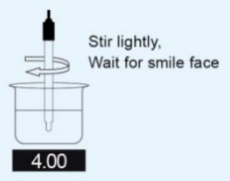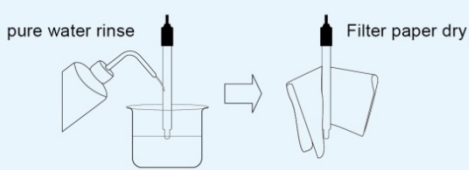
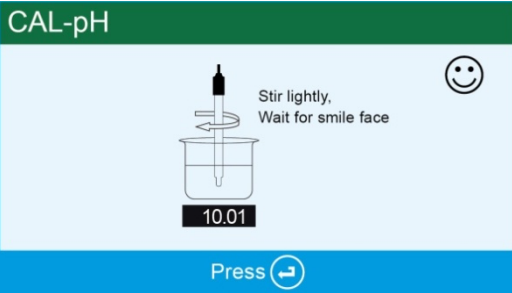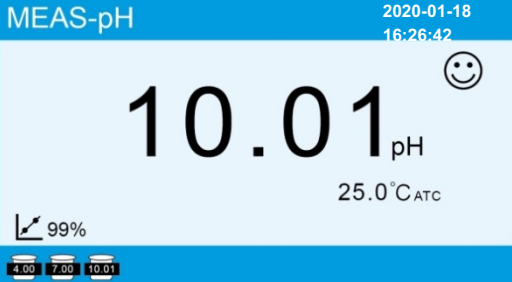|	
MEAS-pH 2020-01-18 16:26:42 ☺ 9.65 pH 25.0°C ATC ↗ 99% 4.00 7.00 10.01	1. Automatically display electrode slope in measurement interface ● Display average slope after two or three point calibration ● Does not display slope after one point calibration

SETUP
 	
 1.1 pH buffer selection   USA
 1.2 Resolution   0.01
 1.3 The 2020-03-13 15:25:30 25.5°C
 1.4 Res offset=12mV
     4.00-7.00   99%
     7.00-10.00   100%
 	
 (▲)(▼) move   (↵) confirm   (Meas) exit
	2. Display last calibration data in pH submenu clause 1.3

5.2.4 _Calibration frequency_

The frequency that you need to calibrate your meter depends on the tested samples, condition 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:

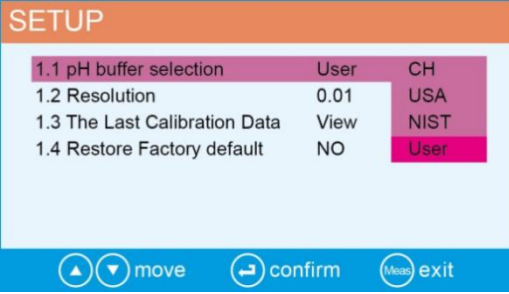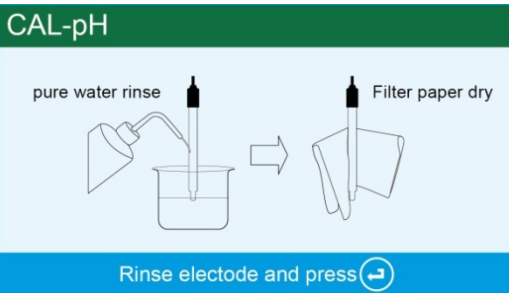a) The electrode hasn't been used for a long time or a new electrode is connected.
b) After measuring strong acidic (pH<2) or strong alkalis (pH>12) solutions.
c) After measuring fluoride-containing solution and strong organic solution
d) There is a significant difference between the temperature of the test sample and the temperature of the buffer solution that is used in the last calibration.
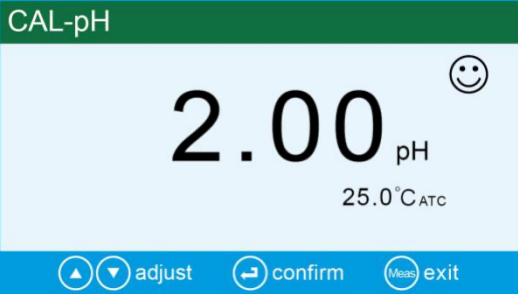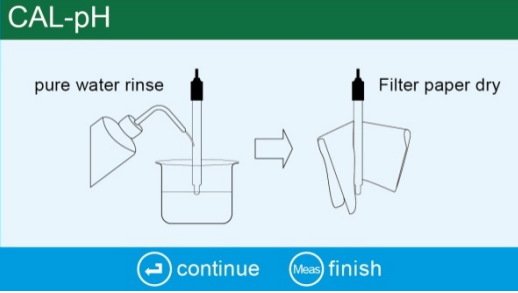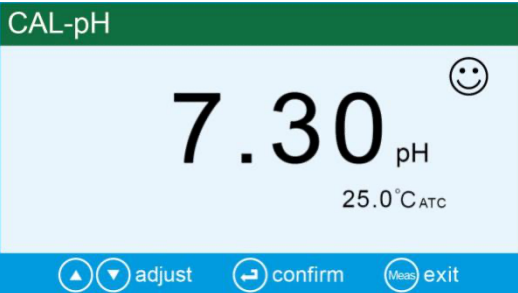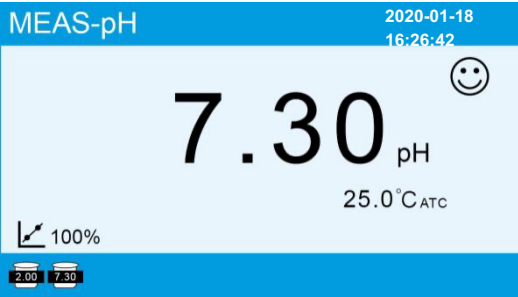
5.3 pH meter calibration (take three-point calibration as an example)

CAL-pH pure water rinse Filter paper dry Rinse electode and press ⏎	Long press **CAL MEAS** key to enter calibration mode, as shown in left graph. Rinse pH electrode in purified water, remove excess water by shaking or filter paper. Press **SETUP ⏎** key to confirm.
CAL-pH ☺ Stir lightly, Wait for smile face 7.00 Press ⏎	Submerge electrode in pH7.00 buffer solution. Stir the solution briefly and allow it to stay in the buffer solution until ☺ appears and stays. Press **SETUP ⏎** key to finish calibration.
CAL-pH pure water rinse Filter paper dry ⏎ continue Meas finish	Rinse pH electrode in purified water, allow it to dry by shaking or filter paper. Press **SETUP ⏎** key to confirm. If only need one point calibration, press **CAL MEAS** key to return to measurement mode.
CAL-pH ☺ Stir lightly, Wait for smile face 4.00 Press ⏎	Submerge electrode in pH4.00 buffer solution. Stir the solution briefly and allow it to stay in the buffer solution until ☺ appears and stays. Press **SETUP ⏎** key to finish calibration.
CAL-pH pure water rinse Filter paper dry ⏎ continue Meas finish	Rinse pH electrode in purified water, remove excess water by shaking or filter paper. Press **SETUP ⏎** key to confirm. If only need two-point calibration, press **CAL MEAS** key to return to measurement mode.

CAL-pH Stir lightly, Wait for smile face ☺ 10.01 Press ⏎	Submerge electrode in pH10.01 buffer solution. Stir the solution briefly and allow it to stay in the buffer solut ☺ until appears and stays. Press [SETUP] key to finish calibration.
MEAS-pH 2020-01-18 16:26:42 ☺ **10.01**_{pH} 25.0°C ATC ↗ 99% 4.00 7.00 10.01	Calibration completed, instrument goes back to measurement mode.

5.4 **User-defined calibration (take pH 2.00 and pH 7.30 calibration solution as an example)**

SETUP 1.1 pH buffer selection User CH 1.2 Resolution 0.01 USA 1.3 The Last Calibration Data View NIST 1.4 Restore Factory default NO User ▲▼ move ⏎ confirm (Meas) exit	1. Select User in parameter setting 1.1, press [CAL/MEAS] key to return to measurement mode.
CAL-pH pure water rinse Filter paper dry Rinse electrode and press ⏎	2. Long press [CAL/MEAS] key to enter calibration mode, as shown in left graph. Rinse pH electrode in purified water, remove excess water by shaking or filter paper. Press [SETUP] key to confirm.

CAL-pH 2.00 pH 25.0°C ATC ▲▼ adjust ↵ confirm Meas exit	3. Submerge electrode in pH2.00 buffer solution. Stir the solution briefly and allow it to stay in the buffer solution until ☺ appears and stays. Press ▲/M+ or ▼/RM key to adjust the value to 2.00 pH. Press SETUP↵ key to finish calibration.
CAL-pH pure water rinse → Filter paper dry ↵ continue Meas finish	4. Rinse pH electrode in purified water, remove excess water by shaking or filter paper. Press SETUP↵ key to confirm. If only need one point calibration, press CAL MEAS key to return to measurement mode.
CAL-pH 7.30 pH 25.0°C ATC ▲▼ adjust ↵ confirm Meas exit	5. Submerge electrode in pH7.30 buffer solution. Stir the solution briefly and allow it to stay in the buffer solution until ☺ appears and stays. Press ▲/M+ or ▼/RM key to adjust the value to 7.30 pH. Press SETUP↵ key to finish calibration.
MEAS-pH 2020-01-18 16:26:42 7.30 pH 25.0°C ATC ⬈ 100% 2.00 7.30	6. Calibration completed, instrument goes back to measurement mode.

Notes

(a) The meter can perform 1-2 point user-defined calibration. When the 1st point calibration is done, press CAL MEAS key, the meter exits from calibration mode. This is one-point user-defined calibration.

(b) The meter does not have the function to recognize user-defined calibration solution. But it requires the error of user-defined calibration solution ≤1pH, the difference between two calibration solution ≥1pH, otherwise the meter will display self-diagnostic error.

(c) The pH value of user-defined solution is a value at a certain temperature. Users should perform calibration and measurement at the same temperature to avoid error.

(d) In manual temperature compensation mode, the temperature value should be adjusted before conducting calibration. It cannot be adjusted during calibrating process.

5.5 **Self-diagnosis Information**

During the process of calibration and measurement, the meter has self-diagnosis functions, see Table – 4. Diagram- 6 for detailed information.
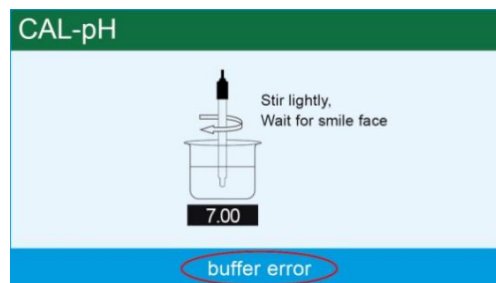
Diagram-6

Table -4 Self-diagnostic information of pH measurement mode

Self-diagnostic information	Description	Check up
buffer error	Wrong pH buffer solution or exceed the recognition range of the meters	1.Check if the pH buffer solution is correct 2. Check if the connection between meter and electrode is good 3. Check if the electrode is failed
no stable	Press [SETUP] key when measuring value is not stable.	Press [SETUP] when 😊 icon appears
electrode error	● The measuring value is not stable for long time (≥3min) ● Electrode slope <75%	1.Check the electrode bulb and make sure there is no air bulb in it 2.Replace the pH electrode with a new one

Note: "electrode error" also includes the situation where electrodes get aged or worn out.

5.6 **Sample measurement**

5.6.1 Rinse pH electrode in purified water, allow it to dry, and submerge it in sample solution. Stir the solution briefly and allow it to stay in the tested solution until ☺ icon appears on LCD and a stable reading is reached. The reading is the pH value of sample solution. Diagram–7 is the calibration and measurement process of pH meter.
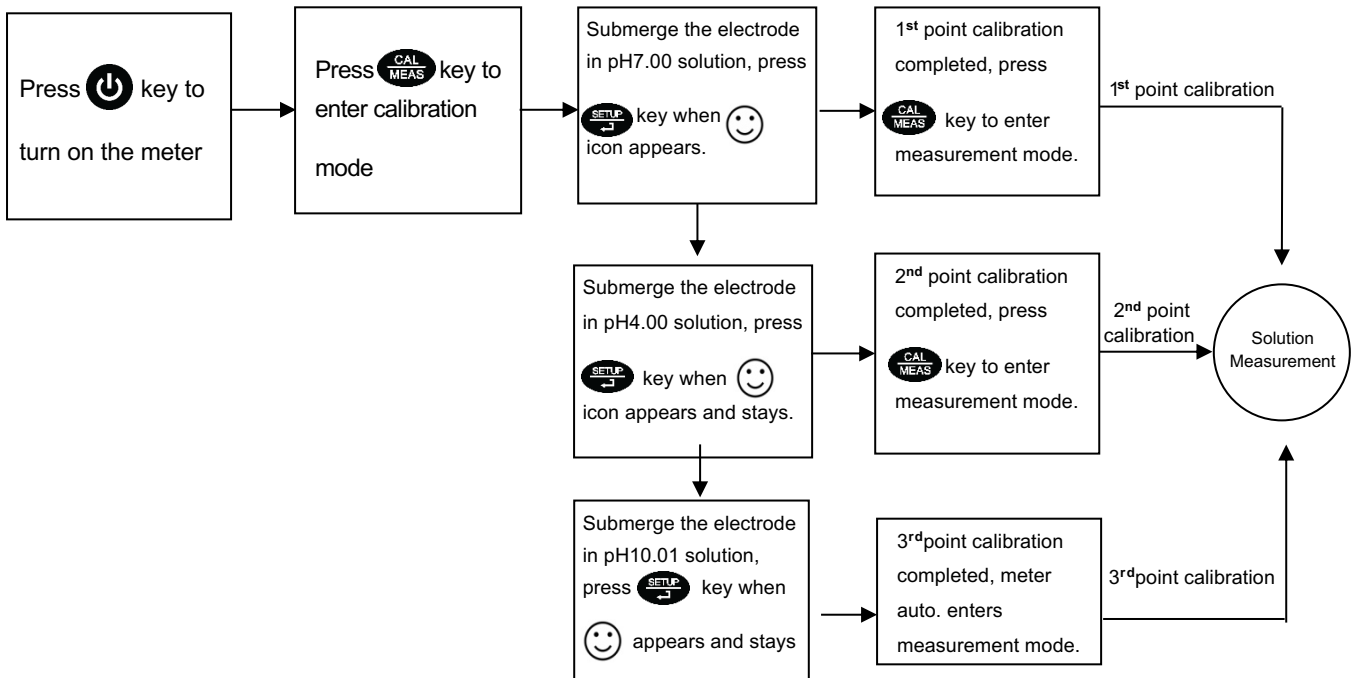

Diagram-7

5.6.2 pH isothermal measurement principle

The closer the temperature of the sample solution to the calibration solution, the more accurate the measurements will be. Please be aware of this principle.

5.6.3 Restore to factory default setting
Instrument has a factory default setting function, please refer to parameter setting clause 1.4 (see Diagram-8). With this function, all calibration data is deleted and the meter will be calibrated to the theory value (pH value of zero electric potential is 7.00, the slope is 100%). Some function settings restore to the original value (refer to clause 8.3). When calibration or measurement fails, please restore the meter to factory

Diagram-8

default setting and then perform re-calibration or measurement. Please note that all the data deleted will not be retrievable if the meter is restored to factory default setting.

6　mV Measurement

6.1　ORP measurement

Press MODE key, and switch the meter to mV measurement mode. Connect ORP electrode (need to purchase it separately) and dip it in sample solution, stir the solution briefly and allow it to stay in the solution until ☺ icon appears and stays. The reading obtained is ORP value. ORP stands for Oxidation Reduction Potential. It means oxidation reduction potential of solution. ORP is the measurement index for the oxidation reduction ability of water solution. Its unit is mV.

6.2　Notes for 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.

6.2.2 Clean and activate ORP electrode: After the electrode has been used over long period of time, the platinum surface of the ORP electrode 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, wash it in purified water, and then submerge it in electrode 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 electrode soaking solution for 6 hours.

(c) For heavily polluted platinum surface on which oxidation film is formed, polish the platinum surface with toothpaste, then wash it in purified water, then submerge it in electrode soaking solution for 6 hours.

6.3　Ion Selective Potential Measurement

Connect ISE electrode and dip it in sample solution, stir the solution briefly and allow it to stay in the solution until ☺ icon appears and stays. The reading obtained is potential value of ion electrode. If ISE electrode is combination type, only need to insert it into "pH/mV" socket. If it's not combination type, proper reference electrode should be selected and insert it to "REF" socket. Two electrodes should be used at the same time.

7 Conductivity Measurement

7.1 Conductivity electrode information

7.1.1 *Using conductivity electrode*

The meter includes one glass conductivity electrode (Model 2401T-F, K=1.0). With built-in temperature sensor, the meter can achieve automatic temperature compensation. BNC plug of the electrode is connected to the meter's conductivity socket while RCA plug is connected to the Temp socket. When the electrode is submerged in solution, stir the solution briefly to eliminate the air bubbles.

For other conductivity electrodes testing low or high range solutions, please refer to section 10.

7.1.2 *Conductivity electrode constant*

The meter can use with conductivity electrodes with three constants (K=0.1, K=1.0 and K=10.0). Please refer to Table-5 for the measuring range. Instrument constant can be set in parameter setting clause 2.1.

Table -5 Electrode constant and measuring range

Measuring Range	＜20 µS/cm	0.5 µS/cm–100 mS/cm			＞100 mS/cm
Conductivity electrode constant	K=0.1 cm^{-1}	K=1.0 cm^{-1}			K=10 cm^{-1}
Standard solution	84 µS/cm	84 µS/cm	1413 µS/cm	12.88 mS/cm	111.8 mS/cm

7.2 Conductivity calibration related information

7.2.1 *Conductivity calibration solutions*

The meter uses Standard series and CH series conductivity solution. The meter can recognize the standard solution automatically and perform 1–4 point calibration. The calibration icons at the bottom left of LCD screen is corresponding to four built-in standard values. See Table – 6:

Table -6 Conductivity standard solution series

Icons	Standard calibration solution	CH conductivity solution
84	84 µS/cm	146.6 µS/cm
1413	1413 µS/cm	1408 µS/cm
12.88	12.88 mS/cm	12.85 mS/cm
111.8	111.8 mS/cm	111.3 mS/cm

Note: calibration indication icons are examples of standard series.

7.2.2 Calibration frequency

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

(b) Normally, performing calibration once a month is recommended.

(c) For high accuracy measurement or larger temperature deviation from the reference temperature (25°C), performing calibration once a week is recommended.

(d) Use conductivity standard solution to check the electrode. Perform calibration if the error is significant.

(e) When using a new electrode for the first time, or the meter has restored to factory default setting, 3-point or 4-point calibration is recommended. For everyday use, standard solution closer to the sample solution can be chosen to perform 1- point or 2-point calibration. For example: 1413 µS/cm standard solution is suitable for measuring range 0-20mS/cm.

7.2.3 Reference temperature

Factory set reference temperature is 25°C. Other reference temperature can also be set within the range 15°C to 30°C. Set up reference temperature in parameter setting clause 2.4

7.2.4 Temperature coefficient

Factory set temperature compensation coefficient of the meter is 2.00%. However, the conductivity temperature coefficient is different from that of various kinds of solution and concentration. Please refer to Table – 7 and the data collected during testing and set up the parameter in clause 2.5.

Note: When the temperature compensation coefficient is set to 0.00, it means there is no temperature compensation. The measurement value will be based on the current temperature.
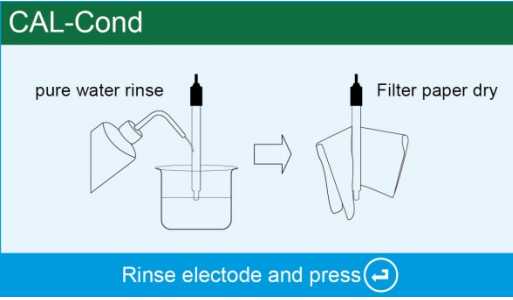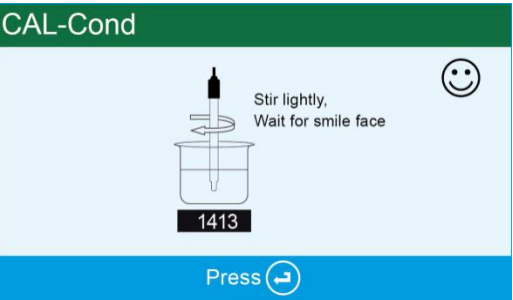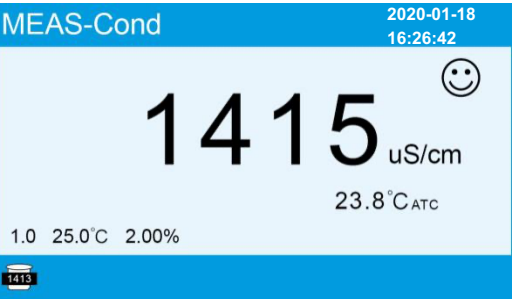
Table -7 Temperature compensation coefficient of certain solutions

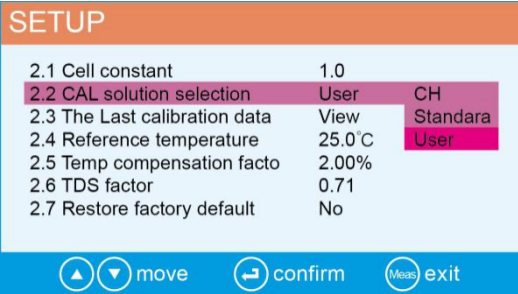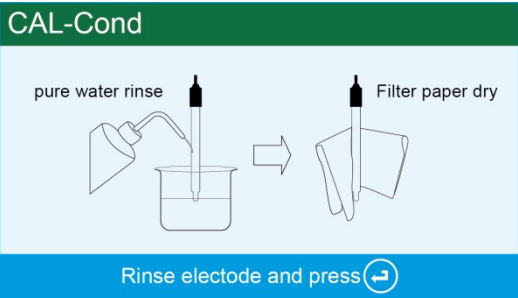| Solution	Temperature compensation coefficient
NaCl solution	2.12 %/ ˚C
5% NaOH solution	1.72 %/ ˚C
Dilute ammonia solution	1.88 %/ ˚C
10% hydrochloric acid solution	1.32 %/ ˚C
5% sulfuric acid solution	0.96 %/ ˚C
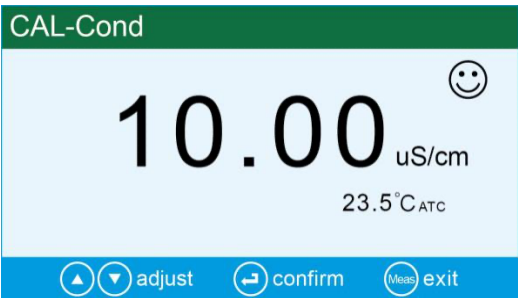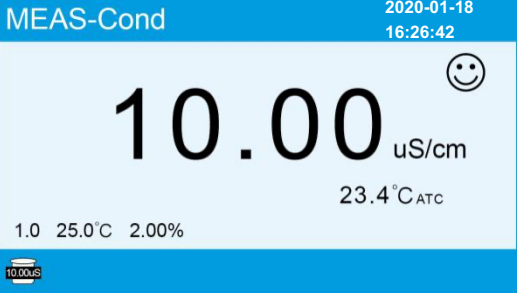
7.2.5 Avoid contamination of standard solutions

Conductivity standard solution has no buffer. Please avoid contamination during usage. Before submerging the electrode in standard solution, please rinse the electrode with purified water and remove excess water with clean tissue. Please do not use the same cup of conductivity standard solution frequently, especially for standard solution of low concentration 84µS/cm. The contaminated standard solution will affect accuracy of measurements.

7.3 Conductivity meter calibration (take 1413μS/cm calibration as an example)

CAL-Cond pure water rinse → Filter paper dry Rinse electode and press ⏎	1. Long press **CAL MEAS** key to enter calibration mode, as shown in left graph. Rinse pH electrode in purified water, remove excess water by shaking or filter paper. Press **SETUP** key to confirm.
CAL-Cond ☺ Stir lightly, Wait for smile face 1413 Press ⏎	2. Submerge electrode in 1413μS/cm solution. Stir the solution briefly and allow it to stay in the buffer solution until ☺ appears and stays. Press **SETUP** key to finish calibration.
MEAS-Cond 2020-01-18 16:26:42 **1415** uS/cm ☺ 23.8℃ATC 1.0 25.0℃ 2.00%	3. Calibration completed, instrument goes back to measurement mode.

- For multi-point calibration, please repeat above 1－3 step until all the calibration is done. The meter can perform calibration in same calibration solution until the value displayed is stable and repeatable.

- To quit calibration mode, please **CAL MEAS** key, meter will return to measurement mode.

- Press **MODE** key to switch measurement mode **Cond→TDS→Salt.**

7.4 **User-defined calibration (take 10μS/cm standard solution as an example)**

SETUP 2.1 Cell constant — 1.0 2.2 CAL solution selection — User CH 2.3 The Last calibration data — View Standara 2.4 Reference temperature — 25.0℃ User 2.5 Temp compensation facto — 2.00% 2.6 TDS factor — 0.71 2.7 Restore factory default — No (▲)(▼) move (⏎) confirm (Meas) exit	1. Select User in parameter setting clause 2.2, press [CAL MEAS] key to return to measurement mode.
CAL-Cond pure water rinse → Filter paper dry Rinse electode and press (⏎)	2. Long press [CAL MEAS] key to enter calibration mode, as shown in left graph. Rinse electrode in purified water, remove excess water by shaking or filter paper. Press [SETUP ⏎] key to confirm.
CAL-Cond ☺ **10.00** uS/cm 23.5℃ ATC (▲)(▼) adjust (⏎) confirm (Meas) exit	3. Submerge electrode in 10μS/cm standard solution. Stir the solution briefly and allow it to stay in the buffer solution until ☺ appears and stays. Press [▲/M+] or [▼/RM] key to adjust measuring value to 10.00μS/cm. Press [SETUP ⏎] key to finish calibration.
MEAS-Cond 2020-01-18 16:26:42 ☺ **10.00** uS/cm 23.4℃ ATC 1.0 25.0℃ 2.00% [10.00uS]	Calibration completed, instrument goes back to measurement mode.

● Only 1-point calibration for user-defined calibration. The conductivity value of user-defined solution is a value in a certain fixed temperature. There is no regulation of temperature coefficient or reference temperature. Calibration and measurement must be performed at the same temperature to avoid significant error.

● The meter does not have the function to recognize user-defined calibration solution.

● In manual temperature compensation mode, the temperature value should be adjusted before conducting calibration. It cannot be adjusted during calibrating process.

7.5 **Self-diagnosis information**

During the process of calibration, the meter has a self-diagnosis function, see Diagram-9, Table – 8 for detailed information.
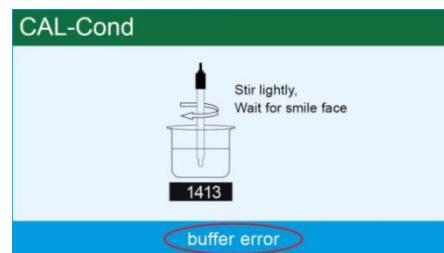

Diagram-9

Table -8 Self-diagnostic information of conductivity measurement mode

Self-diagnostic information	Description	Check up
buffer error	Wrong conductivity calibration solution or exceed recognition range of the meter	1. Check if conductivity solution is correct. 2. Check if the connection between meter and electrode is good 3. Check if the electrode is failed
no stable	Press [SETUP] key when measuring value is not stable.	Press [SETUP] when ☺ icon appears and stays on screen
electrode error	The measuring value is not stable for long time (≥3min)	1.Shake the electrode to eliminate bubbles in electrode head. 2.Replace conductivity electrode with a new one

Note: "electrode error" also includes the situation where electrodes get aged or worn out.

7.6 **Solution measurement**

7.6.1 Rinse conductivity electrode in purified 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 and stays on LCD screen. The reading is the conductivity value of the solution. Diagram – 10 is the calibration and measurement process of conductivity.
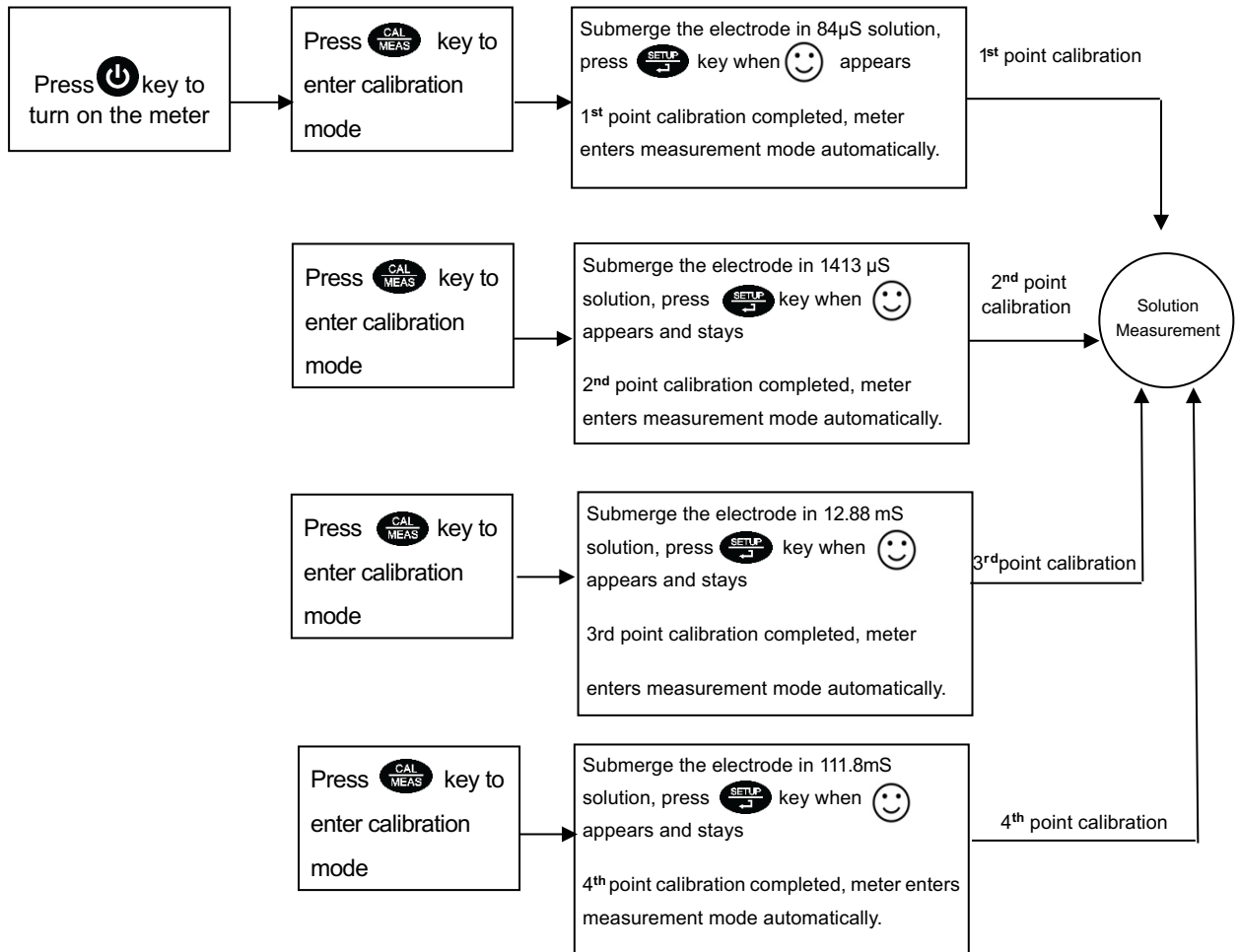

Diagram-10

7.6.2 Relationship of TDS, salinity and conductivity

The conversion factor between TDS and conductivity is 0.40–1.00 which can be adjusted in parameter setting clause 2.6. Factory default setting is 0.71. The conversion coefficient between salinity and conductivity is 0.5. So the meter only needs to be calibrated in conductivity mode, then switch to TDS and salinity mode. Customers can adjust TDS conversion coefficient in parameter setting 2.6 according to testing data and experience. Please refer to Table-9 for some frequently-used conductivity and TDS conversion coefficients.

Table -9 Conversion coefficient between conductivity and TDS

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

7.6.3 Restore to factory default setting

Instrument has a factory default setting function, please refer to parameter setting clause 2.7 (see Diagram-11). With this function, all calibration data is deleted and the meter will be calibrated to the theory value. Some function settings restore to the original value (refer to clause 2.7). When calibration or measurement fails, please restore the meter to factory default setting and then perform re-calibration or measurement. Please note all the data deleted will not be retrievable if the meter is restored to factory default setting.
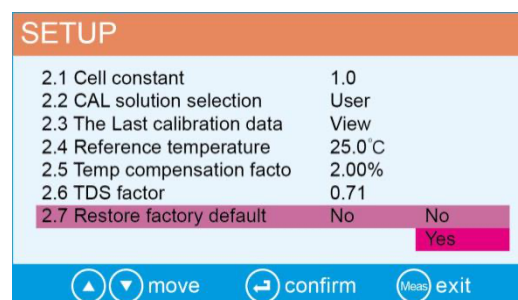

Diagram-11

7.7 **Conductivity electrode maintenance**

7.7.1 Always keep the conductivity electrode clean. Before taking a measurement, rinse the electrode in purified water and allow it dry, then rinse it in the sample solution. When submerge the electrode in solution, stir the solution briefly to eliminate air bubbles and allow it to stay in the solution until a stable reading is reached.

7.7.2 The sensitive rod of Model 2401T-F conductivity electrode is coated with platinum black to minimize electrode polarization and expand measuring range. The platinum black coating of the electrode adopts advanced electroplating technology. This not only increases the surface roughness, but also improves electrode measurement performance. And the coating is tight and firm, it can be washed by a soft brush. This significantly increases the service life of electrode.
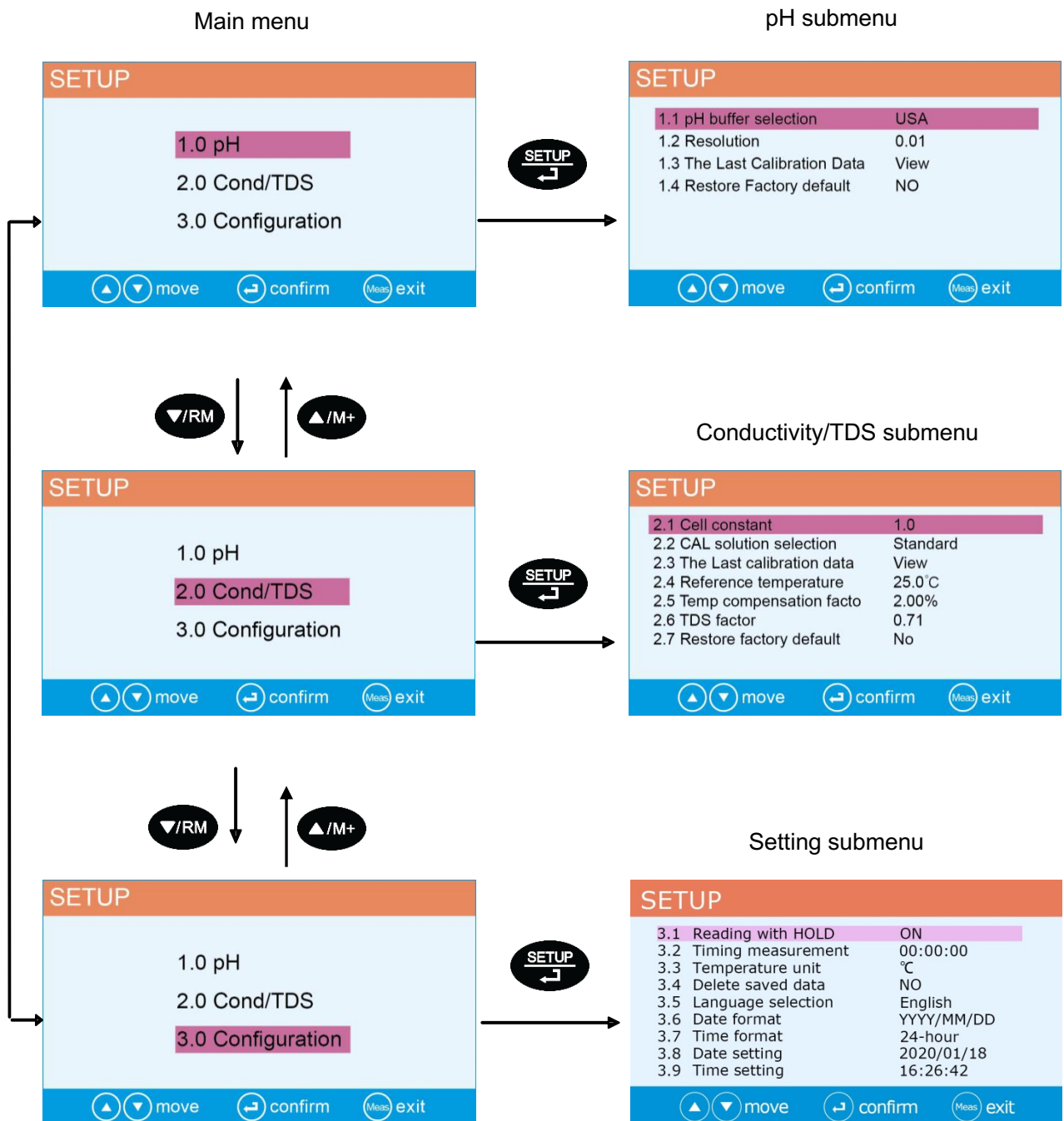
8 Parameter setting

8.1 Main menu and submenu

Main menu

pH submenu

Conductivity/TDS submenu

Setting submenu

Diagram-12

8.2 Operation

Press ⬬SETUP⬬ key to open main menu → press ⬬▲/M+⬬ or ⬬▼/RM⬬ key to select main menu items →

Press ⬬SETUP⬬ key to open main menu item (submenu) → press ⬬▲/M+⬬ or ⬬▼/RM⬬ key to select submenu items(parameter) → press ⬬SETUP⬬ key to open parameter → press ⬬▲/M+⬬ or ⬬▼/RM⬬ key to select parameter items or parameter value → press ⬬SETUP⬬ key to confirm → press ⬬CAL/MEAS⬬ key to return to measurement mode.

Please follow the operating indication in the bottom of LCD screen when operate it.

8.3 Content of parameter setting

Main menu	Serial number	Parameter setting items	Setting content	Factory default
1.0 pH	1.1	pH buffer selection	CH-USA-NIST-User	USA
	1.2	Resolution	0.01-0.1	0.01
	1.3	The last calibration data	View	/
	1.4	Restore factory default	No-Yes	No
2.0 Cond./TDS	2.1	Cell constant	10-1.0-0.1	1.0
	2.2	CAL solution selection	CH-Standard-User	Standard
	2.3	The last calibration data	View	/
	2.4	Reference temperature	15–30 ˚C	25 ˚C
	2.5	Temp compensation factor	0.00–10.00%	2.0%
	2.6	TDS factor	0.40–1.00	0.71
	2.7	Restore factory default	No-Yes	No
3.0 Configuration	3.1	Reading with HOLD	On-Off	/
	3.2	Auto. timing data log	Manual/Automatically	Manual
	3.3	Temperature unit	˚C - ˚F	/
	3.4	Delete saved data	Yes/No	No
	3.5	Language selection	中文-English-Deutsch-Espanl	/
	3.6	Date	Y-M-D	/
	3.7	Time	24hours/12hours	/
	3.8	Date setting	2020-03-13	/
	3.9	Time setting	12:30:30	/

9 Stirrer

9.1 Operation

9.1.1 Insert two ends of stirrer connection cable to the socket of meter and stirrer.

9.1.2 Press ⓔ key to turn on, Ⓢ icon appears in the bottom right corner of LCD screen. At this time the rotation speed is zero. Press △ or ▽ key to increase or decrease rotation speed. Hold the key for fast changing.

9.1.3 RPM key operation: Hold RPM key for 3 seconds to store rotation speed. At this time stirrer icon turns to Ⓗ, then press △ and ▽ key to change rotation speed. The icon turns Ⓢ When using stirrer, press RPM key to switch Ⓗ and Ⓢ between two rotation speeds. When using

Ⓢ — this icon shows up when turn the meter is powered on, it also indicates the adjusted rotation speed.

Ⓗ — It indicates the stored rotation speed.

9.1.4 For required rotation speed, press RPM key to store the speed. Next time, turn on the meter and press RPM key to stir with the specific speed.

9.2 Specification

Speed adjustable range	0 - 2300 revolution per minute (no-load)
Working surface diameter	Φ100mm
Maximum stir capacity	1000ml

9.3 Notes

8.3.1 If the bottom of the beaker is not smooth, it will cause vibration when stirring, even unable to stir. In this case, please replace a qualified beaker.

8.3.2 At zero rotation speed, please don't long press RPM key, otherwise zero rotation speed will be stored. In this case, please press △ key to store once more.

10 USB communication

10.1 Install Software

This instrument uses the PC-Link 950 communication software, and the communication port is USB. Copy the PC-Link 950 program files to the computer from the flash drive, connect the USB communication cable to the PC socket of the meter and the computer's USB port. The software will be automatically open. The instrument and the computer will be automatically connected, and ⬚ will show up on top of the display. If manual data logger is selected, press (▲/M+), data will be uploaded to the computer; if auto. timing data logger is selected, press (▲/M+) data will be uploaded to the computer by the certain timing you set. All the data uploaded to the computer will not be saved in the meter. Auto-timing data logger will generate a measurement curve in PC-Link software as shown in Diagram-13.

10.2 Software Interface
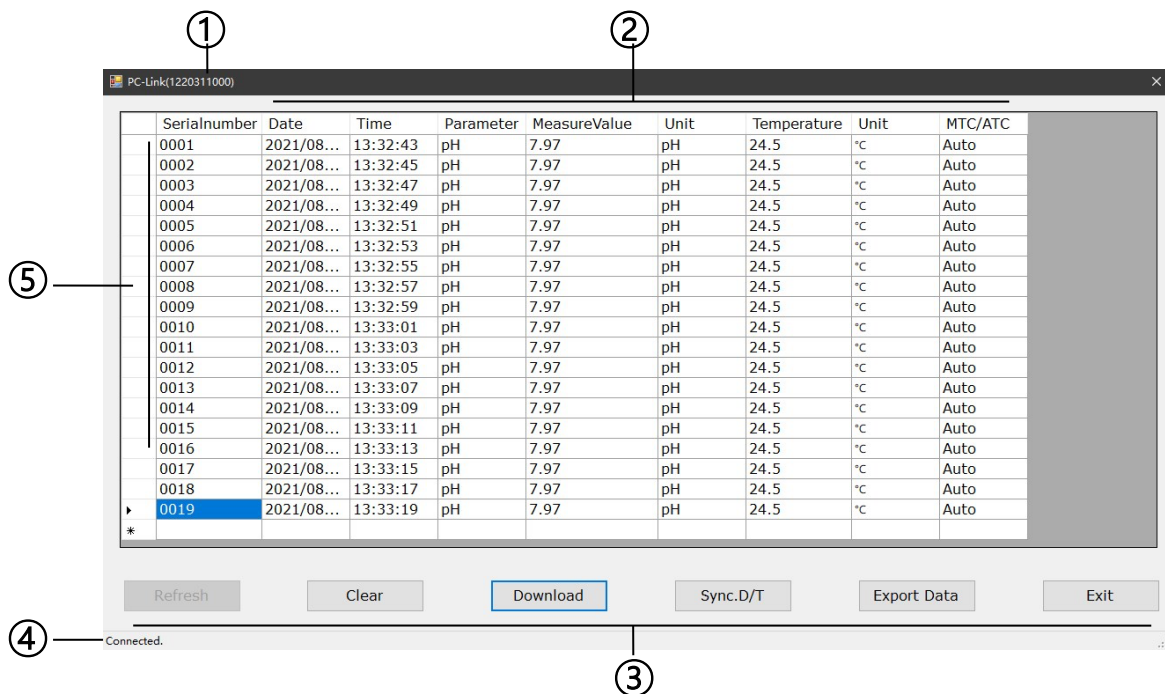
Diagram-13

①	Meter serial number	④	Computer connection icon
②	Data area	⑤	Data stored in meter
③	Operation keys		

10.3 Operation Keys of PC-Link

Refresh — When the meter and the computer are not connected, press the button to connect again.

Clear — Clear the data.

Download — Upload the data in the meter's memory to the computer.

Sync. D/T — Sync the time and date of PC to the meter.

Export Data — Export the stored data to a Microsoft Excel document for further analysis.

Exit — press to exit PC-Link.

11 Recommended pH Electrodes for Specific Applications

Application	Ideal Apera pH Electrodes to Use
General water solutions	LabSen 211
Beverage, beer, or wine analysis	LabSen 211
Cosmetics and other viscous liquid	LabSen 851-S, LabSen 851-H
Dairy products (milk, cream, yogurt, mayo, etc.)	LabSen 821
High-Temperature liquid	LabSen 861
Low-temperature liquid	LabSen 881
Meat	LabSen 761
Micro sample testing	LabSen 241-6, LabSen 241-3, LabSen 241-3SP, LabSen 241-180
Purified Water (Low ion concentration samples)	LabSen 801
Soil	LabSen 551
Solid or semi-solid samples (cheese, rice, fruit, etc.)	LabSen 751
Strong acid samples	LabSen 831
Strong alkalis samples	LabSen 841
Surface test (skin, paper, carpet, etc.)	LabSen 371
Titration	LabSen 221, LabSen 801
TRIS buffer solutions	LabSen 211, LabSen 221
Viscous liquid samples	LabSen 851-1
Wastewater or emulsion	LabSen 331, LabSen 231

12 Recommended Conductivity Electrodes for Specific Applications

Application	Ideal Apera pH Electrodes to Use
Medium range (0-200mS/cm), K=1.0	2301T-F, 2301-C
Medium range (0-200mS/cm) & require higher accuracy, K=1.0	2401T-F, 2401-C
High range (20-2000mS/cm), K=10	2310T-F, 2310-C
Low range (0 to 200µS/cm) e.g. ultra-purified water, K=0.1	DJS-0.1-C, DJS-0.1-F with a flow cell

* Visit aperainst.com or call us at 1-614-285-3080 for more support.

13 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, Co., Ltd, any malfunctioned or damaged product attributable to the responsibility of APERA INSTRUMENTS, Co., Ltd for a period of **THREE YEARS for the instrument and SIX MONTHS for the electrodes 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

APERA INSTRUMENTS, LLC

Address: 6656 Busch Blvd, Columbus, Ohio 43229

Tel: 1-614-285-3080

Email: info@aperainst.com

Website: aperainst.com