# SX721 Portable pH/ORP Meter

# User Manual

pH   ORP

**APERA INSTRUMENTS, LLC**

aperainst.com

# Table of Contents

*Scan the QR code below to watch the tutorial video on Youtube.*

# 1　Brief Instruction

Thank you for choosing Apera Instruments SX721 Portable pH/ORP Meter (will be called "the meter" in short in the following content). Before using the meter, please read this instruction manual carefully in order to help you properly use and maintain it.

The meter can measure the parameters of pH, ORP, and temperature of water solutions with high accuracy. It is suitable for various applications in different industries e.g., water treatment, aquaculture, horticulture, pools and spas, beverage making, mining, power plants, environmental monitoring, etc., especially ideal for in-field use.

The meter has the following features:

1.1. Built-in microprocessor chip with the intelligent functions of auto. calibration, auto. temperature compensation, auto. salinity compensation, manual baromatric pressure compensation, data storage, function settings, auto. power off, and low voltage display etc.

1.2. Adopts digital filter technology to intelligently improve meter's response speed and accuracy. The smiley face icon will appear when the reading is stable.

1.3. Pure water modes available for pH, significantly increasing the accuracy in pure water measurement.

1.4. Meter's LCD screen has clear and bright backlit display.

1.5. Built-tough. IP57 waterproof and dust-proof.

# 2　Technical Specifications

## 2.1　pH

| Measurement range | (-2.00 to 19.99) pH |
|---|---|
| Resolution | 0.1/0.01 pH |
| Accuracy | Meter: ±0.01pH; Overall: ±0.02pH |
| Input current | ≤$2\times10^{-12}$ A |
| Input impendance | ≥$1\times1012$ Ω |
| Stability | ±0.01 pH/3h |
| Temp. compensation range | (0 to 100) ˚C (automatic) |

## 2.2 ORP(mV)

| Measurement range (mV/ORP/EH) | -1999 mV to 0 to 1999mV |
|---|---|
| Resolution | 1mV |
| Accuracy | Meter: ±0.1% FS, Overall: ±15mV |

## 2.3 Other Technical Parameters

| Data storage | 200 sets |
|---|---|
| Data content | Serial number, measurement value, measurement unit, and temperature |
| Power Supply | Two AA alkaline batteries (1.5V x2) |
| Dimensions and weight | Meter: (65×120×31) mm/180g<br>Complete Kit: (255 x 210x 50) mm/1380g |
| Quality and safety certification | CE, ISO 9001:2015 |

## 2.4 Working Condition

| Working temperature | 5 to 35°C |
|---|---|
| Working humidity | ≤85% |
| IP rating | IP57 water-resistant |

# 3 About the Meter

## 3.1 Screen Display
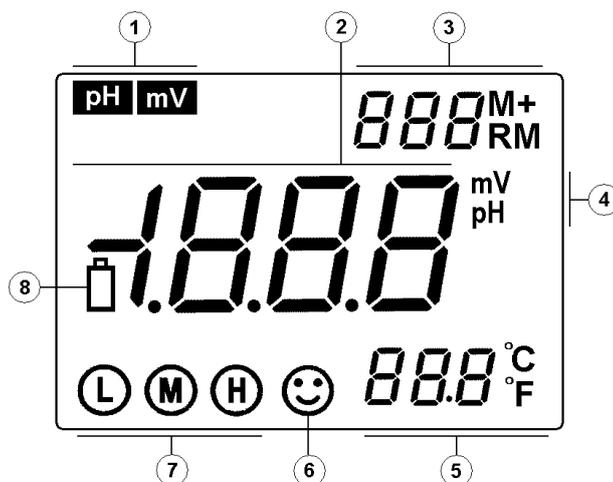


① —— Parameter icon ② —— Measurement value

③ —— Serial number and icon as measurement to be saved and recalled and indication icon for

special states.

**M+** — measurement value to be saved; **RM** — Saved data to be recalled;

④ —— Measurement unit ⑤ —— Temperature measurement value and unit

⑥ —— Measurement stabilization icon ⑦ —— Electrode calibration indication icon

⑧ —— Indication icon of low battery power; appears when the voltage is less than 2.6V, calling attention to replace the batteries.

## 3.2 Keypad

The meter has 5 operation keys in total.

Short press: press time <1 seconds; Long press: press time >2 seconds

3.2.1. ON/OFF — Short press to power on or off.

3.2.2. CAL — Calibration key

(a) When in measurement mode, short press to enter calibration mode.

(b) When in parameter setting mode, short press to make changes.

3.2.3. MODE — Function key

(a) In pH measurement mode, short press (<1.5s) to switch between pH and mV . Long press to enter parameter setting (P1, P2, P3…)

(b) In other measurement mode, short press this key to enter the parameter setting mode (P1, P2, P3…)

3.2.4. ENTER Back light and confirmation key

(a) In measurement mode, short press to turn on or ff the back light.

(b) In calibration mode or the parameter setting, press this key to make confirmation, and return to measurement mode.

(c) When in pH mode, hold this key to change pH resolution: 0.01→0.1 pH in turn. Release key when you confirm the selection.

3.2.5. M+/RM — The key for data saving and recalliing

(a) When in measurement mode, short press to save the measurement data; Long press to recall the saved data.

(b) When in parameter setting mode, press the key to make changes.

## 3.3  Data Log, Recall and Delete

3.3.1. Save the measurement:

In measurement mode, when the reading is stable and 😊 stays on screen, short press [M+/RM] to save the measurement data. **M+** icon and the data serial number will show up on the upper right corner. The meter can store up to 200 sets of data.

3.3.2. Recall saved data:

(a) In measurement mode, long press [M+/RM] , the meter will recall the last saved data and the serial number. **RM** icon will appear in the upper right corner of the screen.

Short press [CAL] again, the meter will recall all the data in turn, hold [CAL] or [M+/RM]

to quickly review the data.

(b) In data recalling mode (**RM** and serial number in the lower right corner), short press [ENTER] to return to measurement mode.

3.3.3. Delete data:

In data recalling mode, hold [ENTER] for 5 seconds, **CLr** will show up for 2 seconds, meaning that all the saved data have been eliminated. Then the meter will return to measurement mode.
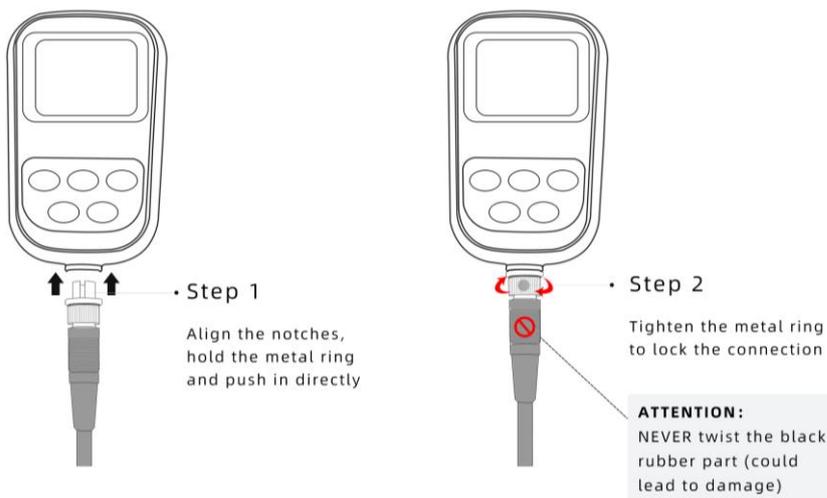
## 4  What's in the kit

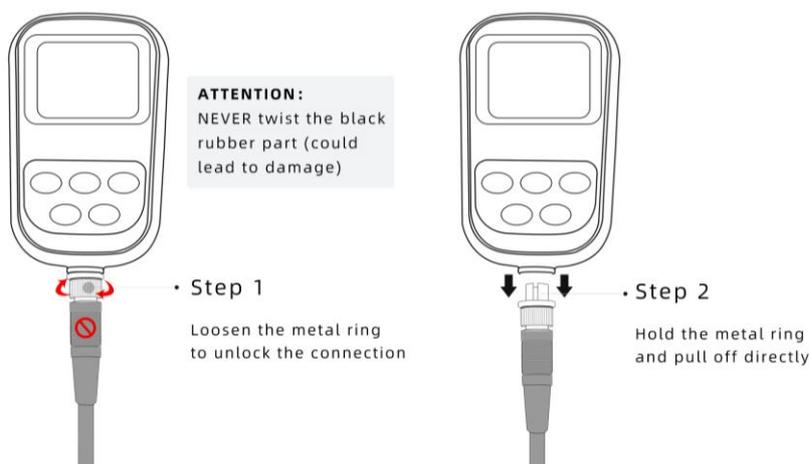| SX721 pH/ORP meter *1 | 201T-S plastic pH/ATC three-in-one combination electrode *1 | 301Pt-S plastic ORP combination electrode *1 |
|---|---|---|
| Carrying case *1 | Screw driver *1 | Spare AA batteries *2 |
| User manual *1 | pH standard buffer solution (pH4.00, pH7.00, pH10.01) *1 50ml bottle/each | |

## 5  Preparation

What you need in addition to what's in the kit:

Pure water (RO, distilled or deionized water) for rinsing off the electrode.

## Connect the Electrode

**Step 1**
Align the notches, hold the metal ring and push in directly

**Step 2**
Tighten the metal ring to lock the connection

**ATTENTION:**
NEVER twist the black rubber part (could lead to damage)

## Disconnect the Electrode

**ATTENTION:**
NEVER twist the black rubber part (could lead to damage)

**Step 1**
Loosen the metal ring to unlock the connection

**Step 2**
Hold the metal ring and pull off directly

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# 6   pH Measurement

Short press [ON/OFF] to turn on the meter. Connect 201T-S pH electrode to the meter (See Section 5 for connection tutorial). The meter will automatically enter pH measurement mode.

## 6.1   pH Electrode

The meter comes with the 201T-S 3-in-1 combination electrode with a built-in temperature sensor, which enables automatic temperature compensation. **This electrode is only suitable for general water solutions' pH testing.** Please refer to Section 6.5 for ideal pH electrodes to use for other applications. A 3M KCL storage bottle comes with the electrode, which is for storing the electrode when not in use to keep the sensitivity of the probe.

### 6.1.1   Technical Specifications of the 201T-F pH Electrode

Measurement Range: 0 - 14 pH, 0 - 80˚C (32 – 176˚F) ; Junction: Single Ceramic

Reference Electrode: Ag/AgCl Connector: 8-pin

Size: ø12*160 mm; cable length: 1 meter

Temperature unit: 30K Thermistor

### 6.1.2 _Use the Electrode_

Screw off the KCL storage bottle, and put it aside (do not dump or spill the KCL solution). Rinse the electrode with distilled or deionized water. Shake off excess water or blot-dry with clean tissue or kimwipe. Stir the electrode for a few seconds after it's dipped into the test solution and then hold it still. Wait for the reading to get fully stabilized ( ☺ appears and stays) and then take the measurement. When the test is finished, place the electrode in the storage bottle and tighten the cap to keep the sensitivity of the pH sensor.

## 6.2  pH Calibration

6.2.1 After powering on the meter, short press (CAL) to enter calibration mode, $\mathcal{C}\mathit{1}$ flickers on LCD, indicating the meter enters the first point calibration.

6.2.2 Rinse off the pH electrode in pure water and remove excess water, then insert it into the pH7.00 buffer solution, make a quick stir and then hold it still. When the reading is stabilized and ☺ stays on screen, short press (CAL) again to finish the 1st point calibration. "**7.00 pH**" will start flickering and a flickering $\mathcal{C}\mathit{2}$ will show up, indicating the 1st point calibration has been finished and the meter is entering the 2nd point calibration.

6.2.3. Rinse off the pH electrode in pure water and remove excess water, then insert it into the pH4.00 buffer solution, make a quick stir and then hold it still. When the reading is stabilized and ☺ stays on screen, short press (CAL) again to finish the 2nd point calibration. "**4.00 pH**" will start flickering and a flickering $\mathcal{C}\mathit{3}$ will show up, indicating the 2nd point calibration has been finished and the meter is entering the 3rd point calibration.

6.2.4. Rinse off the pH electrode in pure water and remove excess water, then insert it into the pH10.01 buffer solution, make a quick stir and then hold it still. When the reading is stabilized and ☺ stays on screen, short press (CAL) again to finish the 3rd point calibration. "**10.01 pH**" will start flickering and then the meter will return to measurement mode.

Picture（4-1）

(L) (M) (H) will show up at the bottom left (see picture 4-1), indicating all 3 calibrations are finished.

## 6.3  Notes about pH Calibration

a) Keeping the freshness and cleanliness of calibration buffers is essential for accurate pH measurement. The small bottles of pH buffers come with the meter should be replaced within 3 months after opening. The new buffer solutions should be made by a legitimate lab supply manufacturer. Avoid sunlight and air contact when the buffers are not being used, and store at room temperature.

1) This meter can adopt random 1-point, 2-point or 3-point automatic calibration. During calibration, short press (ENTER) to return to measurement mode. When the measurement accuracy is ≤±0.1pH, choose a buffer that's close to the estimated measurement range and perform 1-point calibration would be good. Choose pH4.00 and pH7.00 to calibrate if the measurement range is within the acidity range (<pH 7) and choose pH7.00 and pH10.01 to calibrate if just within the alkalinity range (>pH 7).

2) Choose 3-point calibration to achieve a more accurate measurement if the measurement range is wide, or if the electrode has not been used for long. When connecting a new pH electrode, it must be calibrated at 3 points.

3) 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:

- The electrode hasn't been used for a long time or a new electrode is connected.

- After measuring strong acid (pH<2) or strong base (pH>12) solutions.

- After measuring fluoride-containing solution and strong organic solution.

- There is a significant temperature difference between the test sample and the buffer solution.

## 6.4  Sample Test

Power on the meter. Connect the pH electrode and the meter goes to pH measurement mode automatically. Screw off the KCL storage bottle. Rinse the electrode with pure water. Shake off excess water or blot-dry with clean tissue or kimwipe. Stir the electrode for a few seconds after it's dipped into the sample solution and then hold it still. Wait for the reading to get fully stabilized (☺ appears and stays). Then save the measurement by pressing (M+ RM)

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. This principle is recommended to follow for the best result. For example: If you have to test at 150˚F, we recommend warming up the calibration solutions to the same temperature before performing calibration in order to get the most accurate readings.

## 6.5 Recommended pH Electrodes for Different Applications

| Application | Ideal Apera pH Electrodes |
|---|---|
| General water solutions | 201T-S, LabSen 211, LabSen 213 |
| Beverage, beer, wine | LabSen 211, LabSen 213 |
| Low ionic strength solutions (RO water, distilled water, deionized water…) | LabSen 801, LabSen 803 |
| Liquid food (milk, cream, yogurt, jam, sauce, etc.) | LabSen 821, LabSen 823 |
| High-Temperature solutions | LabSen 841, LabSen 861 |
| Low-temperature liquid | LabSen881 |
| High salinity solutions | LabSen 841 |
| Complex and caustic solutions (e.g. electroplating) | LabSen 861 |
| Raw meat | LabSen 761, LabSen 763 |
| Micro sample testing | LabSen 241-6, LabSen 241-3 |
| Cosmetics, skincare products | LabSen 851-1, LabSen 851-S |
| Soil | LabSen 551, LabSen 553 |
| Solid or semi-solid samples (cheese, dough, fruits, meat products, etc.) | LabSen 251, LabSen 751, LabSen 753 |
| Strong acid solutions, HF containing solutions (HF concentration<1%) | LabSen 831 |
| Strong alkaline solutions | LabSen 841 |
| Surface test (skin, paper, carpet, etc.) | LabSen 371 |
| TRIS buffer solutions | LabSen 213, LabSen 223 |
| Viscous solutions | LabSen851-S, LabSen 851-H |
| Wastewater or emulsion | LabSen 333 |

**\* An 8-pin to BNC convertor (AI7103) is required to connect LabSen pH electrode to this meter.**

**\* Visit aperainst.com/product/electrode/labsen or contact us at 1-614-285-3080 for more details.**

## 6.6  Parameter Setting

Table (4-1)

| Prompt Mark | Parameter Setting Items | Code | Parameters |
|---|---|---|---|
| P1 | pH buffer solution series selection | *SOL* | USA (U.S.A series)<br>NIS (NIST series)<br>CH (China series) |
| P2 | Pure water pH temperature compensation setting | *PU 1* | OFF-On (shut-set) |
| P3 | Ammonia added pure water pH temperature compensation setting | *PU 2* | OFF-On (shut-set) |
| P4 | Temperature unit setting | | ˚C - ˚F |
| P5 | Back light display time setting | *bL* | 0-1-3-6min |
| P6 | Auto power off setting | *AC* | 0-10-20min |
| P7 | Restore to producer setting | | OFF-On |

### 6.6.1    pH buffer solution series selection (P1)

(a) Long press MODE, meter enters P1 mode: see picture (4-2).

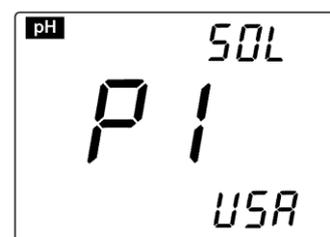(b) Press CAL or M+/RM to choose buffer solution series:

(U.S.A series) — 1.68, 4.00, 7.00, 10.01and 12.45 pH

(NIST series) — 1.68, 4.01, 6.86, 9.18 and 12.45 pH

(China series) — 1.68, 4.00, 6.86, 9.18 and 12.46 pH

(c) Press MODE  to enter next parameter setting or press ENTER to confirm and return to measurement
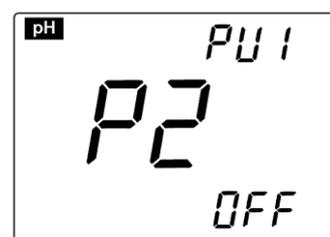
mode.


Picture（4-2）

### 6.6.2    Pure water pH temperature compensation setting (P2)

(a) Short press MODE in P1, the meter enters mode P2, see picture (4-3).

(b) Press CAL or M+/RM to choose *On*

(pure water pH temperature compensation setting) or *OFF*

(c) Press MODE to enter next parameter setting or press ENTER  to confirm

and return to measurement mode.

(d) The factory default setting is OFF

Note: *PU 1*  will appear in the upper right corner of the LCD if pure water temperature compensation


Picture（4-3）

function is set.

### 6.6.3 _Ammonia added pure water pH temperature compensation setting (P3)_

(a) Short press (MODE) in mode P2 to enter mode P3, see picture (4-4).

(b) Press (CAL) or (M+/RM) to choose $On$ (ammonia added pure water pH temperature compensation setting) or $OFF$

(c) Press (MODE) to enter next parameter setting or press (ENTER) to confirm and return to measurement mode.

(d) The factory default setting is OFF

Note: If the ammonia pure water pH temperature compensation function is set, $PU\ 2$ will appear in the right upper corner of the LCD when in measurement mode.

### 6.6.4 _Temperature unit ˚C/˚F setting (P4)_

(a) Short press (MODE) in P3 to enter P4, see picture (4-5).

(b) Press (CAL) or (M+/RM) to choose temperature unit: ˚C or ˚F.

(c) Press (MODE) to enter next parameter setting or press (ENTER) to confirm and return to measurement mode.
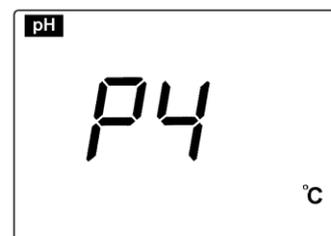
### 6.6.5 _Back light display time setting (P5)_

(a) Short press (MODE) in P4 to enter P5, see picture (4-6).

(b) Press (CAL) or (M+/RM) to choose the time of back light auto off: 0 min, 1 min, 3 min or 6 min. The back light will be closed if choosing 0 min.

(c) Press (MODE) to enter next parameter setting or press (ENTER) to confirm and return to measurement mode.

(d) The factory default setting for P5 is 1min.
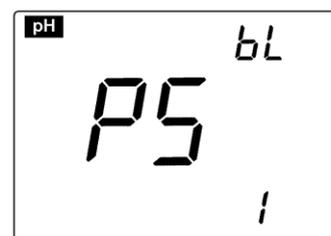
### 6.6.6 _Auto power off time setting (P6)_

(a) Short press (MODE) in P5 to enter P6, see picture (4-7).

(b) Press (CAL) or (M+/RM) to choose the time: 0min, 10min or 20min. The auto power off function will be closed if choosing 0min.

(c) Press (MODE) to enter next parameter setting or press (ENTER) to confirm and return to measurement mode.

(d) The factory default setting for P6 is 10min.
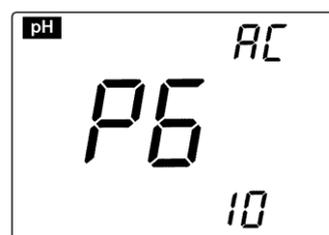
### 6.6.7 _Restore to factory default setting (P7)_

(a) Short press MODE in P6 to enter P7, see picture (4-8).

(b) Press CAL or M+/RM to choose $On$ , meaning that the parameters have been restored to the producer setting mode, and return to measurement mode after 2 seconds. 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. When the meter's calibration or measurement is performing abnormally, users can use this function, and then calibrate and test again. Please note that this function is irreversible once used.

Picture（4-8）

## 6.7 Cleaning pH Electrode

1) The measurement is only as accurate as the electrode is clean. Always thoroughly rinse off the electrode before and after each test with pure water.

2) For tough contaminants, soak the electrode in Apera electrode cleaning solution (AI1166) for at least minutes. Then use a soft brush to remove the contaminants. Afterwards, soak the electrode in 3M KCL soaking solution for at least 2 hours. Rinse it off, then re-calibrate the tester before using again.

3) For other special contaminants, refer to the table below:

| Contamination | Cleaning Solution |
|---|---|
| Inorganic metal oxide | Dilute acid less than 1mol/L |
| Organic lipid, protein containing samples | Apera cleaning solution (AI1166) |
| Resin macromolecule | Dilute alcohol, acetone, ether |
| Paints | Dilute bleacher, peroxide |

## 6.8 The Self-diagnose Information

During usage, the following icons may show up on LCD. This is the meter's self-diagnose information, which can help you understand what may go wrong with the meter or electrode.

6.8.1. The stable icon **-2.00 pH** or **19.99 pH** — this icon appears when the pH value exceeds the measurement range. This icon will also show up when the electrode is not well connected with the meter or when the electrode is not insertd into solution. This is a normal phenomenon.

6.8.2. $Err\ 1$ — Electrode offset out of range (<-60mV or >60mV)

6.8.3. $Err2$ — Electrode slope out of range (< 85% or >105%)

When $Err1$ or $Err2$ shows up:

1) Make sure there is no damage on the electrode's glass bulb (if so, an electrode replacement is necessary). Check if there is air bubble inside the glass bulb. If so, shake the electrode with force for several seconds to remove the bubble.

2) Check the quality of buffer solution. Make sure it's fresh and clean and conforms to the meter's buffer series setting.

3) Set the meter to factory default setting mode (refer to section 6.6.7), then recalibrate it.

If the meter is still not working after the above checkings, it's time to replace a new pH electrode or contact us at +1 (614) 285-3080 or info@aperainst.com for help.

## 6.9  Notes about pH

1) Never store pH electrode in pure water as it will damage the electrode. Always store the electrode in 3M KCL soaking solution (AI1107).

2) If you find any air bubble in the glass bulb of the pH sensor, simply shake the probe with force for a few times to remove it. The existence of an air bubble in the glass bulb will significantly decrease the stableness of measurement.

3) pH electrode is technically a chemical battery. Every pH electrode will eventually die even if you don't use it at all. The typical service life of a pH electrode is 1-2 years depending on how you use and maintain it. We recommend replacing your pH electrode after one year of use to ensure the best result.

4) Always keep the meter's connector clean and dry, otherwise it may lead to an inaccurate measurement. If contaminated, clean the connector with alcohol prep pads and blow-dry.

## 7  ORP Measurement:

## 7.1  Sample Test:

5.1.1. Press [ON/OFF] to power on, connect the ORP combination 301 Pt-S electrode (See Section 5 for connection tutorial), the meter will enter ORP measurement mode automatically.

5.1.2. Screw off the storage bottle. Rinse the electrode with pure water. Shake off excess water or blot-dry with clean tissue or kimwipe. Stir the electrode for a few seconds after it's dipped into the sample solution and then hold it still. Wait for the reading to get fully stabilized ( ☺ appears and stays). Then save the measurement by pressing [M+/RM]

## 7.2 Notes about ORP

ORP measurement does not require calibration. When the user is not sure about ORP electrode quality or measuring value, use ORP 222mV standard solution to test mV value and see whether ORP electrode or meter works properly. Table-9 is the data of standard ORP solution for 222 mV.

Table-9

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

## 7.3 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:

- In general, soaking the ORP electrode in 222mV for 30 minutes will help activate the ORP sensor and restore its accuracy.
- For inorganic pollutant, submerge the electrode in 0.1mol/L dilute hydrochloric acid for 30 minutes, then wash it in distilled water, then submerge it in the soaking solution for 6 hours.
- For organic or lipid pollutant, clean the platinum surface with detergent, then wash it in distilled water, then submerge it in the soaking solution for 6 hours.
- For heavily polluted platinum surface on which there is oxidation film, polish the platinum surface with toothpaste, then wash it in distilled water, then submerge it in the 3M soaking solution for 6 hours.

## 7.4 ORP Parameter Setting

mV and ORP measurement parameter setting Table (Table (5-2))

Table (5-2)

| Prompt mark | Parameter Setting Items | Code | Parameters |
|-------------|-------------------------|------|------------|
| P1 | Back light display time setting | bL | 0 -1-3-6 min |
| P2 | Auto power off time setting | AC | 0 -10-20 min |

### 7.4.1 *Backlight display time setting (P1)*

Press MODE, the meter enters P1, see details in section 6.6.5

### 7.4.2 *Auto power off time setting (P2)*

Short press MODE in P1 mode, the meter enters P2, see details in section 6.6.6

# 8  Limited Warranty

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

This limited warranty does not cover any damages due to:

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

**APERA INSTRUMENTS, LLC**

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