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BANTE instruments

Bante series Portable pH/ORP/Ion/Conductivity/DO Meters

USER MANUAL

Bante Instruments Inc.

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General Guide

This section is applicable to all models of meters

Introduction

Thank you for selecting the Bante series portable water quality meter, this product series includes models below.

Single Parameter Meters

Model	Measurement Parameters
221	pH, mV, ORP
320	pH, mV, ORP, ion
321	Ion, mV
322	Water hardness
530	Conductivity, TDS
531	Conductivity, salinity
540	Conductivity, TDS, salinity, resistivity
821	DO

Multiparameter Meters

Model	Measurement Parameters
900P	pH, mV, ORP, ion, conductivity, TDS, salinity, resistivity, DO
901P	pH, mV, conductivity, TDS
902P	pH, mV, ORP, conductivity, TDS, salinity, resistivity
903P	pH, mV, ORP, DO
904P	Conductivity, TDS, salinity, resistivity, DO

This manual provides a step-by-step guide to help you operate these meters, please carefully read the following instructions according to the model you have purchased.

Environmental Conditions

Before unpacking, ensure that current environmental conditions meet the following requirements.

- Relative humidity is less than 80%
- Ambient temperature between 0°C (32°F) and 50°C (122°F)
- No potential electromagnetic interference
- No corrosive gas exists

Packing List

The following list describes all components of the meter. If any items are missing or damaged, contact the supplier immediately.

1

Meter, electrode clip

2

pH electrode, pH buffer reagents

3

Ion selective electrode, standard solutions, ionic strength adjuster ★

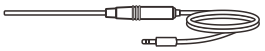
4

Conductivity electrode, conductivity standard solutions

5

Dissolved oxygen electrode, electrolyte solution, membrane cap

6

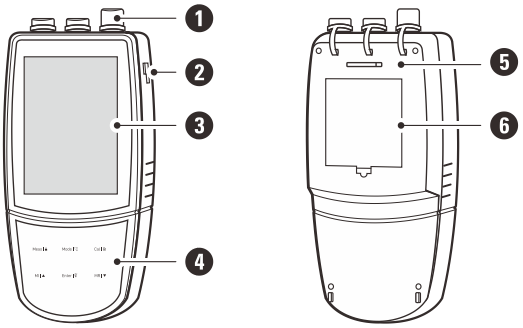


Temperature probe

Model / Components	1	2	3	4	5	6
221	•	•				•
320	•	•				•
321	•		•			•
322	•		•			•
530	•			•		•
531	•			•		•
540	•			•		•
821	•				•	
900P	•	•		•	•	•
901P	•	•		•		•
902P	•	•		•		•
903P	•	•			•	•
904P	•			•	•	•

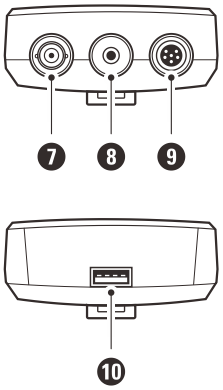
★ Cyanide and sulfide ion meters do not provide above solutions.

Meter Overview



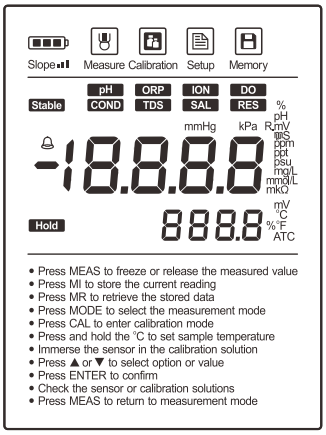
1	Sensor connections
2	Slot for electrode clip
3	Display
4	Membrane keypad
5	Slot for hand strap
6	Battery compartment

Connectors



7	Socket for pH, ORP or ion selective electrode (BNC)
8	Socket for temperature probe (3.5 mm jack)
9	Socket for conductivity or dissolved oxygen electrode (6-pin DIN)
10	USB-A interface to the computer or power adapter

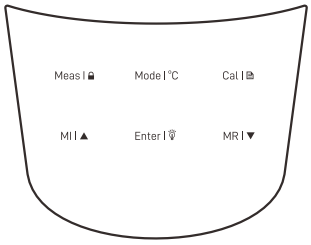
Display



Icon	Description
	Indicates that the meter is in the measurement mode
	Indicates that the meter is in the calibration mode
	Indicates that the meter is in the setup mode
	Indicates that you are viewing the stored readings or a reading is stored into the memory
	Low Battery Alarm - When the battery voltage falls below the minimum power requirements, the icon automatically disappears
Slope	Electrode Condition Indicator - If the pH electrode slope exceeds the allowed range after calibration, the icon automatically disappears
	Calibration Due Alarm - If the electrode has not been recalibrated within a specified time period, the icon automatically shows
ATC	Indicates that the automatic temperature compensation is enabled
Stable	Shown when the measurement is stable
HOLD	Shown when the reading is locked
pH	pH mode
ORP	Oxidation reduction potential (ORP) mode
ION	Ion concentration mode
COND	Conductivity mode
TDS	Total dissolved solids (TDS) mode
SAL	Salinity mode
RES	Resistivity mode
DO	Dissolved oxygen mode

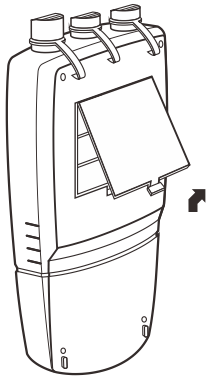
Keypad

Key	Function
Meas I 🔒	• Switch the meter on or off • Lock or unlock the measurement • Exit the calibration, settings, data logs and return to the measurement mode
Mode I °C	• Select the measurement mode • Press and hold the key to enter the temperature setting
Cal I 🗎	• Start calibration • Press and hold the key to enter the setup menu
MI I ▲	• Store current reading to memory • Increase value or scroll up through a list of options
MR I ▼	• View the data logs or calibration logs • Decrease value or scroll down through a list of options
Enter I 💡	• Confirm the calibration or displayed option • Press and hold the key to switch the backlight on or off

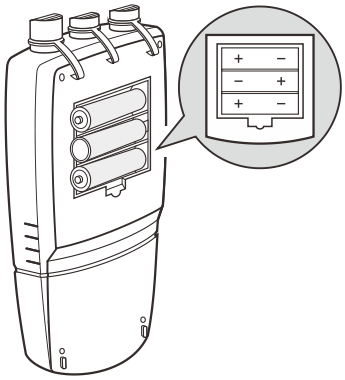


Installing the Batteries

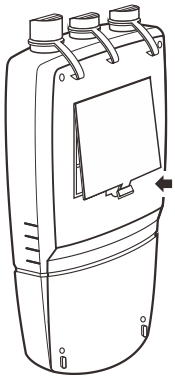
1. Remove the battery compartment cover from the backside of the meter.



2. Insert three AA alkaline batteries into the battery compartment, note polarity.

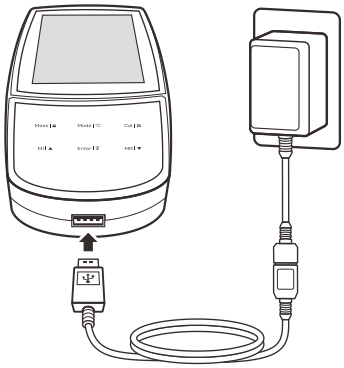


3. Replace the battery compartment cover to its original position, push the limiter until it locks.



Using the Power Adapter

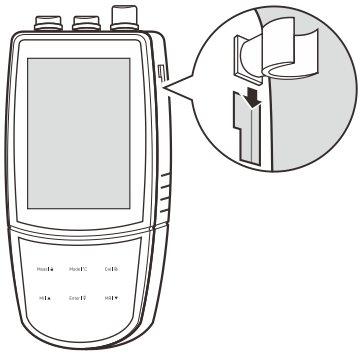
The meter allows using the DC 5V power adapter (order code: DCPA-5V) or the USB port on computer as a power supply.



Note, take out the batteries before connecting an external power supply.

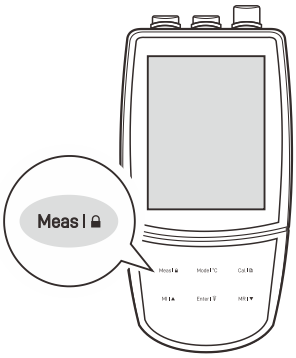
Installing the Electrode Clip

The electrode clip is designed for mounting a sensor, but it is not a necessary component for meter. If you want to install this accessory, insert the electrode clip into the slot on the right of the meter.



Switching the Meter On and Off

- Press the **Meas** key and release to switch on the meter.
- Press and hold the **Meas** key to switch off the meter.

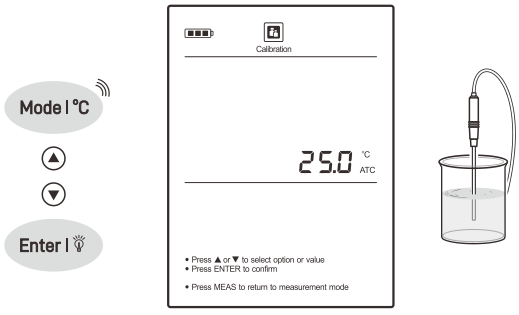


Temperature Calibration

The meter comes with a TP-10K temperature probe for measurement and temperature compensation. If the measured temperature reading differs from that of an accurate thermometer, the probe needs to be calibrated.

Note, the dissolved oxygen electrode has a built-in temperature sensor and do not need to use this probe.

1. Connect the temperature probe to the meter and place into a solution with a known accurate temperature.
2. Press and hold the **°C** key to enter the temperature setting.
3. Press the ▲ / ▼ key to modify the temperature value.
4. Press the **Enter** key to save.



To exit the calibration without saving changes, press the **Meas** key.

General Settings

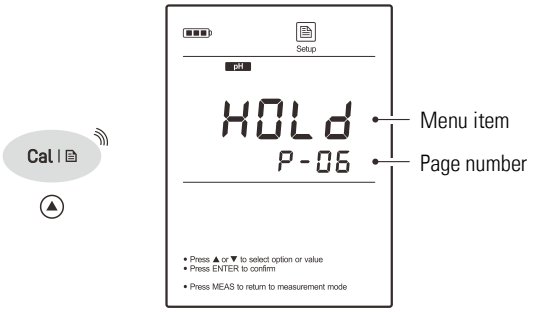
The meter contains an integrated setup menu for customizing the function parameters. In the different modes, the display will show the corresponding menu items. For the general settings, the option will be applied to all modes once setting is changed.

Menu Item	Option and Description	
StA	**Stability Criteria** Set when a measurement is recognized as stable.	
	LO	Standard (default)
	HI	High accuracy
HOLd	**Auto-Hold** If enabled, the meter will automatically sense and lock the measurement endpoint.	
	YES	Enable
	nO	Disable (default)
OFF	**Auto-Power Off** If enabled, the meter will automatically switch off if no key is pressed within a specified time period.	
	...30	10, 20, 30 minutes
	nO	Disable (default)
CALL	**Calibration Due Reminder** Set the calibration interval to activate alarm 🔔.	
	...31	1 to 31 days
	OFF	Disable (default)
dAtE	**Date and Time** Set the date and time for data logs and calibration logs.	
CLr	**Clear Stored Data** Delete all data logs in the memory.	
	YES	Enable
	nO	Disable (default)
rSt	**Factory Reset** Reset the meter to factory default settings. Note, the meter must be recalibrated.	
	YES	Enable
	nO	Disable (default)

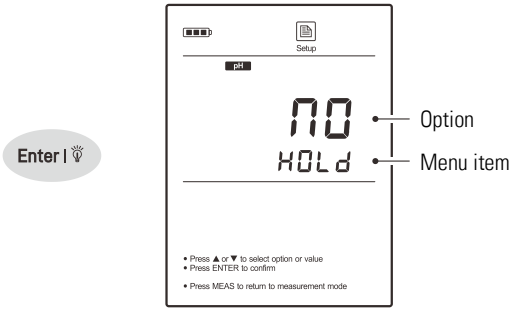
Setting a Default Option

1.1 In the measurement mode, press and hold the 🗎 key to enter the setup menu.

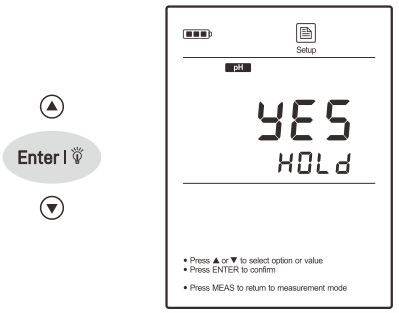
1.2 Press the ▲ key to select a menu item.



1.3 Press the **Enter** key, the meter shows the current option.



1.4 Press the ▲ / ▼ key to select a desired option, press the **Enter** key to save.



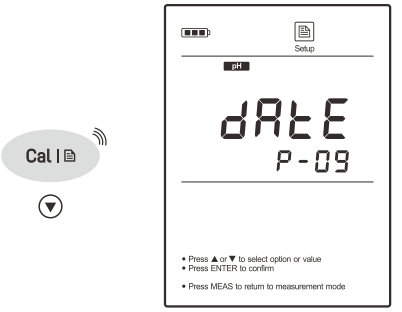
ℹ

To exit the setup menu without saving changes, press the **Meas** key.

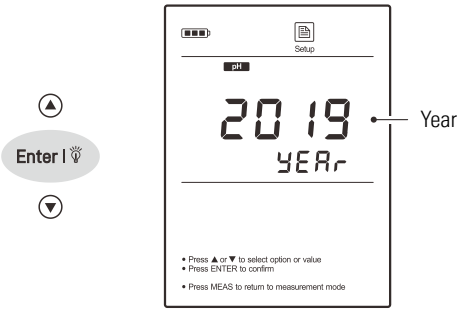
Setting the Date and Time

2.1 In the measurement mode, press and hold the 🗎 key to enter the setup menu.

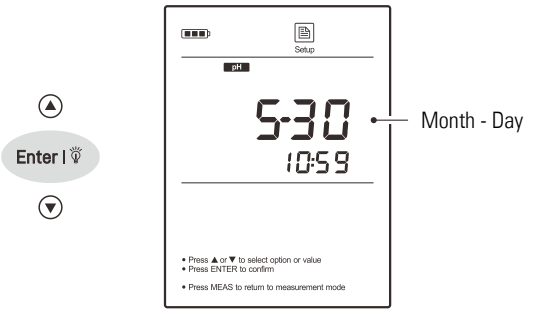
2.2 Press the ▼ key until the meter shows dAtE (date).



2.3 Press the **Enter** key, the meter shows the current year.



2.4 Press the ▲/▼ key to set the year, press the **Enter** key to switch to the date and time options.



2.5 Press the ▲ / ▼ key to set the month, day, hours and minutes, press the **Enter** key to save until the meter returns to the measurement mode.

pH Calibration and Measurement

This section is applicable to models

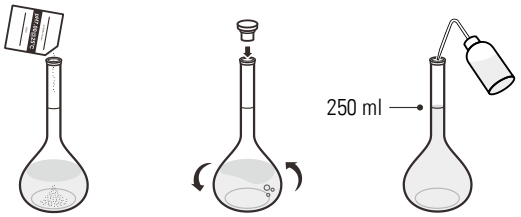
- 221/320
- 900P/901P/902P/903P

Prior to Use

Preparation of pH Buffer Solutions

The meter is packaged with the pH 4.01, 7.00, 10.01 buffer reagents required for calibration.

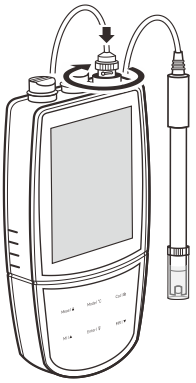
1. Half fill a 250 ml volumetric flask with distilled water and add the pH 7.00 buffer reagent.
2. Swirl the volumetric flask gently to dissolve the reagent and fill to the mark with distilled water.
3. Cap and upend the volumetric flask several times to mix solution.



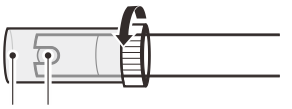
Preparation of pH 4.01 and 10.01 buffer solutions are the same as above. Prepared buffer solutions should be stored in hermetically sealed glass containers and avoid direct sunlight.

Connecting the Electrode

1. Take out the pH electrode from the carrying case. Insert the BNC connector into the connector socket on meter, rotate and push the connector clockwise until it locks.

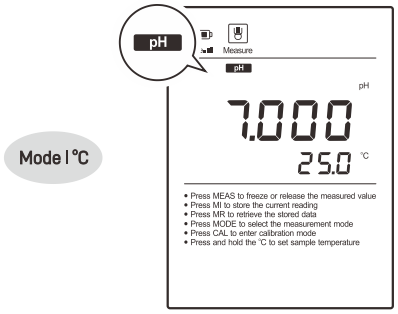


2. Remove the protective cap from the bottom of electrode. If tiny air bubbles are present inside the pH-sensitive glass membrane, gently shake the electrode downward to remove air bubbles.



Selecting the Measurement Mode

Press the **Mode** key until the pH icon appears on the display, the meter enters the pH measurement mode.



pH Settings

The meter contains 4 pH settings and 7 general settings in the setup menu.

Menu Item	Option and Description	
bUF	**pH Buffer Group** Set the pH buffer group for calibration and auto-recognition.	
	USA	USA (default)
	nIST	NIST
	dIN	DIN
	USEr	Custom buffers (any 2 values >1 pH apart)
CAL	**Calibration Points** Set the number of calibration points.	
	...5	1 to 5 points (default 3 points)
rESO	**Resolution** Set the resolution of the pH measurement.	
	0.001	0.001 (default)
	0.01	0.01
	0.1	0.1
UNIt	**Measurement Unit** Set the default temperature unit.	
	°C	Degrees Celsius (default)
	°F	Degrees Fahrenheit

If you want to change the current settings, press and hold the ⎙ key to enter the setup menu. Press the ▲ / ▼ key to select an option and press the **Enter** key to confirm.

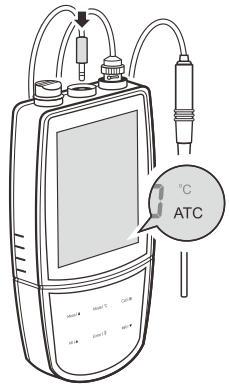
Refer to the ***Setting a Default Option*** section for detailed instructions on page 8.

Temperature Compensation

For better accuracy, we recommend the use of either a sensor with a built-in or a separate temperature probe. The meter will calculate the pH slope with measured temperature and show the temperature compensated readings.

Automatic Temperature Compensation

Connect the temperature probe to the meter. The ATC icon immediately appears on the display, the meter is now switched to the automatic temperature compensation mode.



Manual Temperature Compensation

If the meter does not detect a temperature probe, the degrees Celsius icon (°C) will show on the display indicating the meter is switched to the manual temperature compensation mode. To set the temperature value follow the steps below.

1. Press and hold the **°C** key to enter the temperature setting.
2. Press the ▲ / ▼ key to modify the temperature value.
3. Press the **Enter** key to save.

Press and hold the ▲ / ▼ key will make the value change faster.

pH Calibration

The meter allows 1 to 5 points pH calibration. We recommend that you perform at least 2 points calibration for high accuracy measurement. The meter will automatically recognize and calibrate to following standard buffer values.

USA Standard Buffers	pH 1.68, 4.01, 7.00, 10.01, 12.45
NIST Standard Buffers	pH 1.68, 4.01, 6.86, 9.18, 12.45
DIN Standard Buffers	pH 1.09, 4.65, 6.79, 9.23, 12.75

If the USEr option is selected, the meter will only allow 2 points calibration. Single point calibration should only be carried out with pH 7.00, 6.86 or 6.79, otherwise calibration will not be accepted.

Make sure to calibrate the meter when attaching a new pH electrode or during first use. Do not reuse the buffer solutions after calibration, contaminants in solution will affect the calibration and eventually the accuracy of the measurement.

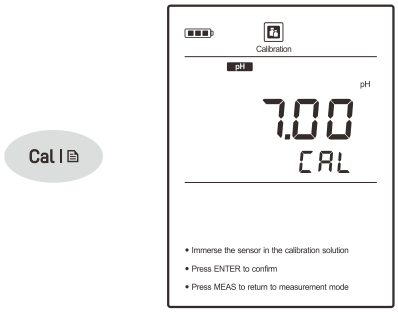
For better result, we recommend to enable the automatic temperature compensation. If the manual temperature compensation is selected, all buffer and sample solutions must be at the same temperature and you have entered the correct temperature value to the meter.

Stir the standards and samples at a uniform rate that will help you get most accurate readings.

Single Point Calibration

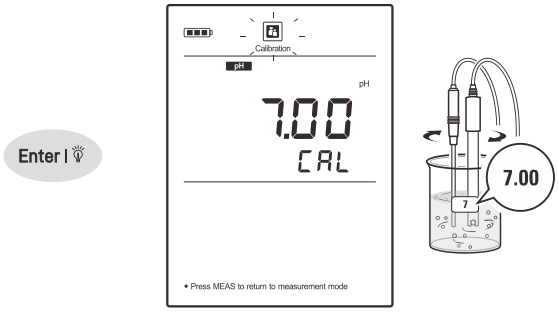
1.1 Ensure that you have selected 1 point calibration in the setup menu.

1.2 Press the **Cal** key, the meter shows 7.00/CAL, 6.86/CAL or 6.79/CAL, depending on the selected pH buffer group.



1.3 Rinse the pH electrode with distilled water, place the electrode (and temperature probe) into the pH 7.00 buffer solution, stir gently to create a homogeneous solution.

1.4 Press the **Enter** key, the Calibration icon begins flashing.

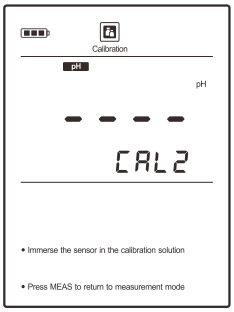


1.5 When the reading has stabilized, the meter will show End and return to the measurement mode.

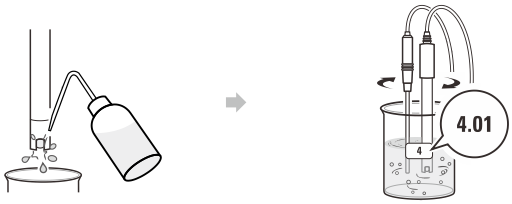
Multipoint Calibration

2.1 Ensure that you have selected 2 to 5 points calibration in the setup menu.

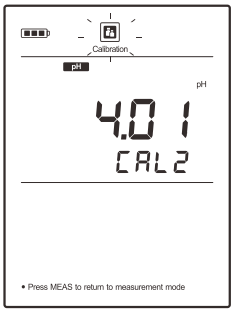
2.2 Repeat steps 1.2 through 1.4 above. When the first calibration point is completed, the display will show ----/CAL2. The meter prompts you to continue with second point calibration.



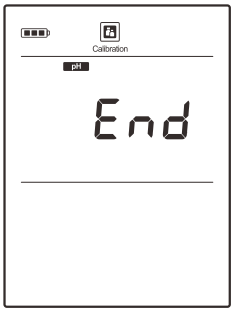
2.3 Rinse the pH electrode with distilled water, place the electrode (and temperature probe) into the next buffer solution (e.g., pH 4.01).



The meter will automatically recognize the buffer solution and begin the calibration, the Calibration icon continuously flashing.

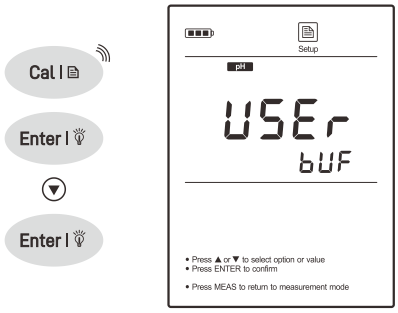


2.4 When the reading has stabilized, the display will show ---/CAL3. The meter prompts you to continue with third point calibration.
2.5 Repeat the step 2.3 above until the meter shows End. Calibration is completed.

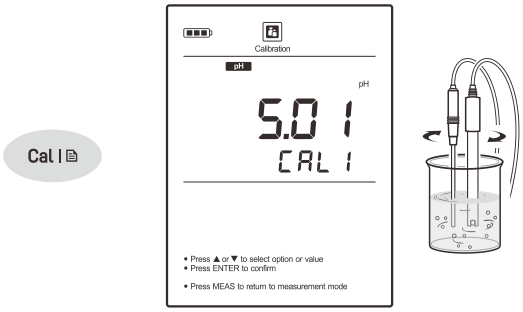


pH Calibration with Custom Buffers

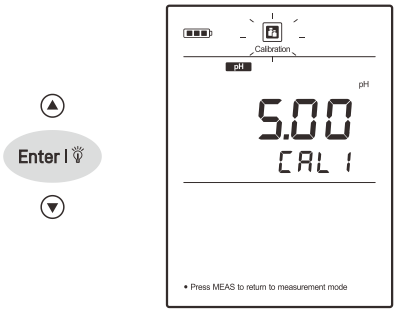
3.1 Ensure that you have selected the USEr option in the setup menu, the custom buffer solutions should be at least 1 pH unit apart from each other.



3.2 Rinse the pH electrode with distilled water, place the electrode (and temperature probe) into the buffer solution, stir gently and wait until the measurement is stable.
3.3 Press the **Cal** key, the meter enters the calibration mode.



3.4 If necessary, press the ▲ / ▼ key to set the calibration value, press the **Enter** key to begin the calibration.



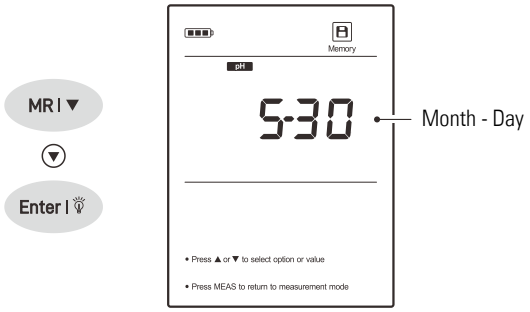
3.5 When the reading has stabilized, the display will show CAL2. The meter prompts you to continue with second point calibration.
3.6 Repeat the steps 3.2 and 3.4 above until the meter shows End. Calibration is completed.

- During the calibration, if the display shows ---- indicating the meter is waiting for recognizing the pH buffer solution.
- If the display shows Err indicating the measured mV value for the current calibration point deviates by more than 60 mV from the theoretical value of the pH buffer. The calibration will not be accepted. Please check the pH electrode and buffer solutions.
- If the calculated electrode slope is not between 70% to 110%, Slope icon will disappear from the display. The pH electrode may need to be replaced.
- To exit the calibration without saving changes, press the **Meas** key.

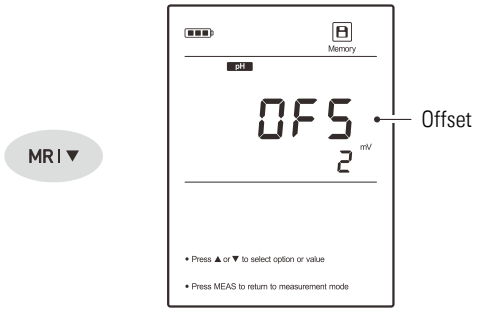
Viewing the Calibration Log

4.1 Press the **MR** key in the pH measurement mode and press the ▼ key until the meter shows ELE/P-02 (Electrode/Page 2).

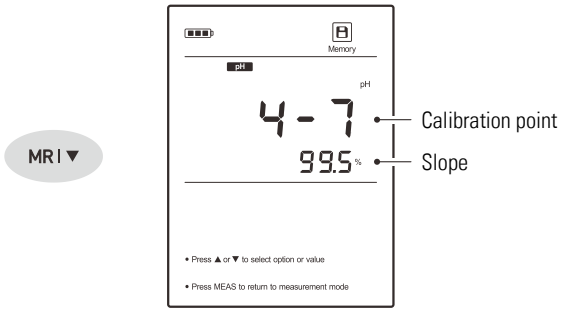
4.2 Press the **Enter** key, the meter shows the last calibration date.



4.3 Press the ▼ key to view the zero-point offset.



4.4 Press the ▼ key to view the calibration points and electrode slope.



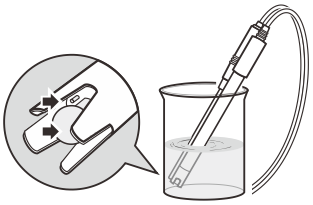
4.5 To exit the calibration log, press the **Meas** key.

ℹ

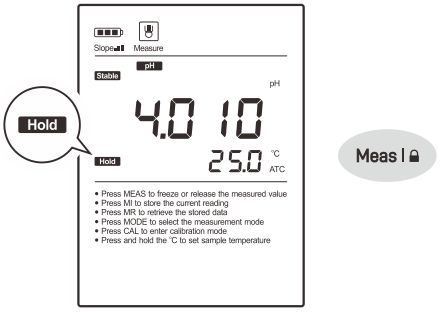
If the meter is not calibrated or custom buffers are used, the display will show ---- only.

pH Measurement

1. Rinse the pH electrode with distilled water. Place the electrode (and temperature probe) into the sample solution and stir gently. Note, the pH-sensitive glass membrane and liquid junction must be completely immersed into the solution.



2. If the Auto-Hold option in the setup menu is enabled, the meter will automatically sense a stable reading and lock measurement, the HOLD icon appears on the display. Press the 🔒 key to resume measuring.
   If the option is disabled, the meter will continuously measure and update the readings.



3. Wait for the measurement to stabilize and record the reading.
4. When all of the samples have been measured, rinse the electrode according to the instructions in the ***Electrode Maintenance***.

ℹ

- During the measurement process, never wipe the pH-sensitive glass membrane as this will cause static interference, blot dry with a lint-free tissue to remove waterdrops on electrode.
- If the meter shows ---- indicating the measurement exceeds the range, remove the electrode from the sample immediately.
- If your sample is pure water, low ionic or low conductivity water, we recommend measuring the pH in the smallest sample volume possible or adding 0.3 ml of the 3M KCl to 100 ml of the sample solution. Note, only high purity KCl can be used.
- To record the measurement at the predefined time intervals, refer to the ***Interval Readings*** section on page 40.

Electrode Maintenance

Cleaning the pH Electrode

Since pH electrode is susceptible to contamination, thoroughly clean as necessary after each use.

- General Cleaning
  Rinse the pH electrode with distilled water and soak in 3M KCl solution.

- Salt Deposits
  Dissolve the deposit by immersing the electrode in warm tap water. Rinse the electrode with distilled water and soak in 3M KCl solution.

- Oil or Grease
  Place the electrode in the detergent or ethanol solution for 15 minutes. Rinse the electrode with distilled water and soak in 3M KCl solution.

- Protein
  (1) Add 1% pepsin to 0.1M HCl solution.
  (2) Place the electrode in above solution for 15 minutes.
  (3) Rinse the electrode with distilled water and soak in 3M KCl solution.

- Clogged Liquid Junction
  (1) Heat a diluted KCl solution to 60°C (140°F).
  (2) Place the electrode into the heated solution for 10 minutes.
  (3) Allow the electrode to cool in unheated KCl solution.

Reactivating the pH Electrode

If the pH-sensitive membrane has dried out, the electrode response will become sluggish. Immerse the electrode in a pH 4.01 buffer solution for about 30 minutes to rehydrate. If this fails, the electrode requires activation.

1. Soak the electrode in a 0.1M of HCl for 10 minutes.
2. Remove and rinse with distilled water, then place into a 0.1M of NaOH for 10 minutes.
3. Remove and rinse again, and soak in 3M KCl solution for at least 6 hours.

If these steps fail to restore the response, replace the electrode.

Storing the pH Electrode

- For best results, always soak the electrode in 3M KCl solution.
- If above solution is not available, use a pH 4.01 buffer solution.

⚠

- DO NOT store the electrode in distilled or deionized water that will deplete the hydration layer of the pH-sensitive membrane and render the electrode useless.
- If you do not use the electrode for a period longer than 1 month, store the electrode in storage solution.

Appendix

Preparation of Electrode Storage Solution

Dissolve 24.6 grams of analytical grade KCl reagent in 100 ml distilled water.

Optional Accessories

pH Electrodes

Order Code	Description
E201-BNC	For measuring non-viscous, non-corrosive solutions
E202-BNC	For measuring semi-solid, gel and viscous samples
E205-BNC	For piercing and measuring soft solids
E206-BNC	For measuring solutions in test tubes
E207-BNC	For measuring non-aqueous solutions
E208-BNC	For measuring strong acid and strong alkaline solutions.
E209-BNC	For measuring solutions containing hydrofluoric acid (concentration < 0.1 mol/L)
E210-BNC	For measuring high temperature solutions (< 130°C)
E211-BNC	For measuring pure water
P11	For measuring mildly corrosive solutions
P16	For measuring Tris-buffered solutions

Temperature Probe

Order Code	Description
TP-10K	Range: 0 to 100°C (32 to 221°F), 1 m (3.3 ft.) cable

Solutions

Order Code	Description
PHCS-USA	pH 4.01, 7.00, 10.01 buffer solutions, 480 ml
PHCS-ES	Electrode storage solution, 480 ml
PHCS-A	For removing acidic deposits, 480 ml
PHCS-B	For removing bacterial contaminants, 480 ml
PHCS-G	For removing oil and grease, 480 ml
PHCS-O	For removing organic contaminants, 480 ml
PHCS-P	For removing protein residues, 480 ml

Communication and Power Supply

Order Code	Description
USB-A	USB Type-A to Type-A data cable, 1 m (3.3 ft)
DCPA-5V	DC 5V power adapter, european standard plug

ORP Calibration and **mV** Measurement

This section is applicable to models

- 221/320
- 900P/901P/902P/903P

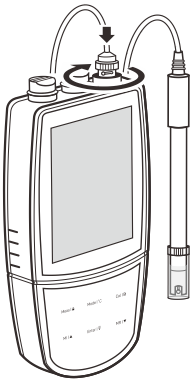
Prior to Use

The meter is capable of measuring the oxidation reduction potential of aqueous solutions through connecting an ORP electrode, selectable sensor includes following options.

Order Code	Description
E501	For measuring samples with strong redox potential
E502	For measuring samples with weak redox potential
E504	For measuring high temperature samples (< 80°C)

Connecting the Electrode

1. Select a suitable ORP electrode.
2. Insert the BNC connector into the connector socket on meter, rotate and push the connector clockwise until it locks.
   After connection is completed, DO NOT pull on the sensor cable.
   Always make sure that the connector is clean and dry.

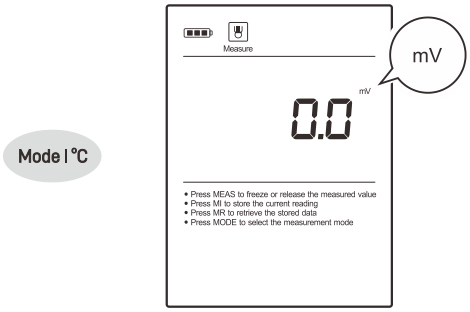


3. Remove the protective cap from the bottom of the electrode.

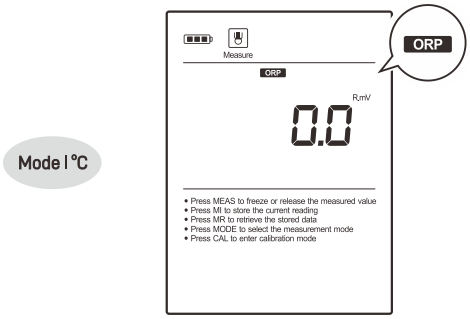
4M KCl solution

Selecting the Measurement Mode

- Raw millivolt (mV)
  Press the **Mode** key until the measurement unit mV appears on the display, the meter enters the absolute mV measurement mode.



- Relative millivolt (R.mV)
  Press the **Mode** key until the ORP icon appears on the display, the meter enters the relative mV measurement mode.



Note, the meter only allows entering the setup menu or performing a calibration or viewing the calibration log in the ORP mode.

ORP Settings

The meter contains 1 ORP setting and 7 general settings in the setup menu.

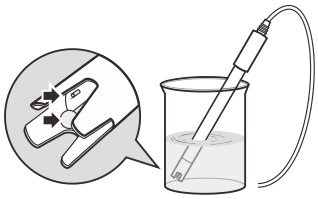
Menu Item	Option and Description	
rESO	**Resolution** Set the resolution of the mV measurement.	
	0.1	0.1 (default)
	1	1

If you want to change the current settings, press and hold the ⊟ key to enter the setup menu. Press the ▲ / ▼ key to select an option and press the **Enter** key to confirm.

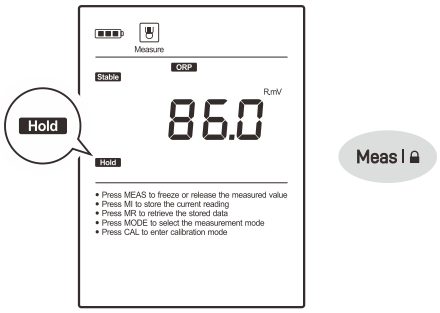
Refer to the ***Setting a Default Option*** section for detailed instructions on page 8.

mV Measurement

1. Rinse the ORP electrode with distilled water. Place the electrode into the sample solution and stir gently. Note, the sensing element and liquid junction must be completely immersed into the solution.



2. If the Auto-Hold option in the setup menu is enabled, the meter will automatically sense a stable reading and lock measurement, the HOLD icon appears on the display. Press the 🔒 key to resume measuring.
   If the option is disabled, the meter will continuously measure and update the readings.



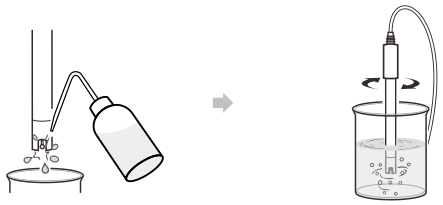
3. Wait for the measurement to stabilize and record the reading.
4. When all of the samples have been measured, rinse the electrode with distilled water and soak in 4M KCl solution.

- The ORP electrode may give unstable readings in solutions that contain chromous, vanadous and titanous ions or other ions that are stronger reducing agents than hydrogen or platinum.
- If the meter shows ---- indicating the measurement exceeds the range, remove the electrode from the sample immediately.
- To record the measurement at the predefined time intervals, refer to the ***Interval Readings*** section on page 40.

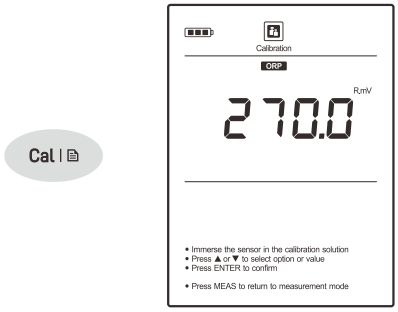
ORP Calibration

The meter allows 1 point calibration in the ORP mode, but calibration is not necessary unless exact readout agreement with a work standard and at a specific ORP value is needed.

1.1 Rinse the ORP electrode with distilled water. Place the electrode into the standard solution, stir gently and wait until the measurement is stable.

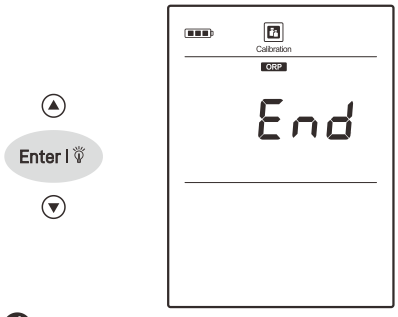


1.2 Press the **Cal** key, the meter enters the calibration mode.



1.3 If necessary, press the ▲ / ▼ key to set the calibration value.

1.4 Press the **Enter** key, the meter will show End and return to the measurement mode. Calibration is completed.

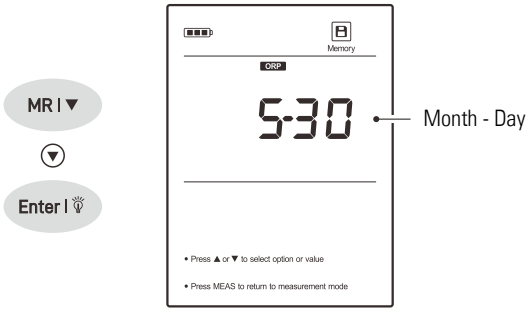


To exit the calibration without saving changes, press the **Meas** key.

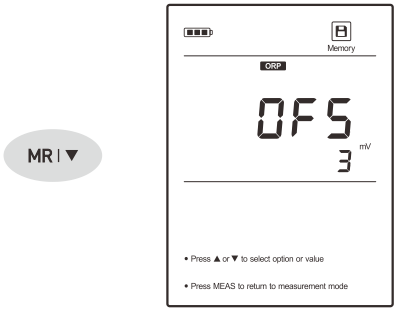
Viewing the Calibration Log

2.1 Press the **MR** key in the ORP measurement mode and press the ▼ key until the meter shows ELE/P-02 (Electrode/Page 2).

2.2 Press the **Enter** key, the meter shows the last calibration date.



2.3 Press the ▼ key to view the offset potential.



2.4 To exit the calibration log, press the **Meas** key.

If the meter is not calibrated with standard solution, the display will show ---- only.

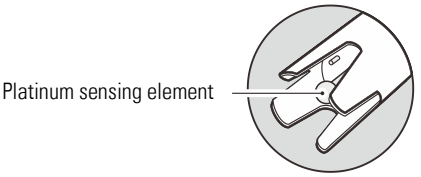
Electrode Maintenance

- Rinse the ORP electrode thoroughly with distilled water after use.
- In the corrosive chemicals, viscous solutions and solutions with heavy metals or proteins, take readings quickly and rinse electrode immediately.
- If the electrode response becomes sluggish, refer to the instructions below to clean the electrode.

(1) Inorganic Deposits
Place the electrode in 0.1M HCl solution for 10 minutes. Rinse the electrode with distilled water and soak in 4M KCl solution for at least 6 hours.

(2) Oil or Grease
Place the electrode in detergent such as dishwashing liquid for about 30 minutes. Rinse the electrode with distilled water and soak in 4M KCl solution.

(3) If the platinum sensing element is severely contaminated, polish the platinum surface gently with an abrasive paper of 600 grid. Place the electrode in 0.1M HCl solution for 10 minutes. Remove and rinse with distilled water, then soak in 4M KCl solution for at least 6 hours.
If the electrode does not restore normal performance, replace the electrode.



Storing the ORP Electrode

If you do not use the electrode for long periods, store the electrode in 4M KCl solution or storage solution.

Appendix

Preparation of ORP Standard Solutions

Quinhydrone solution A: Dissolve 3 grams of quinhydrone reagent in 500 ml of the pH 4.01 buffer solution, stir the solution for 10 minutes. Undissolved quinhydrone reagent must be present. If necessary, add the reagent.

Temperature	Potential (±10 mV)
20°C	268 mV
25°C	263 mV
30°C	260 mV

Quinhydrone solution B: Dissolve 3 grams of quinhydrone reagent in 500 ml of the pH 7.00 buffer solution, stir the solution for 10 minutes. Undissolved quinhydrone reagent must be present. If necessary, add the reagent.

Temperature	Potential (±10 mV)
20°C	94 mV
25°C	87 mV
30°C	80 mV

⚠
Due to the quinhydrone solution is susceptible to air oxidation in storage, make sure to prepare the fresh solution before use.

Preparation of Electrode Storage Solution

Dissolve 29.8 grams of analytical grade KCl reagent in 100 ml distilled water.

Optional Accessories

Order Code	Description
ORP-CS	ORP standard solution, 228 mV (@25°C) For checking or calibrating ORP electrode, 100 ml
PHCS-ES	Electrode storage solution, 480 ml

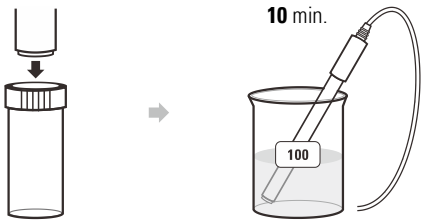
Ion Calibration and Measurement

This section is applicable to models

- 320/321
- 900P

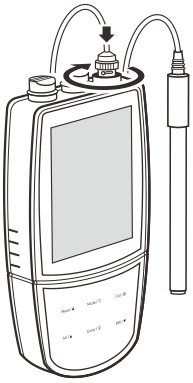
Prior to Use

1. Take out the ion selective electrode from the carrying case.
2. Remove the protective cap and soak the electrode in 100 ppm standard solution for 10 minutes.



Connecting the Electrode

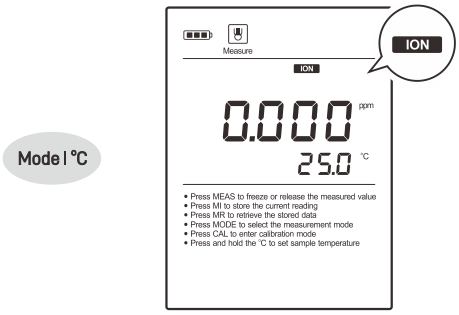
Insert the BNC connector into the connector socket on meter, rotate and push the connector clockwise until it locks.



After connection is completed, DO NOT pull on the sensor cable. Always make sure that the connector is clean and dry.

Selecting the Measurement Mode

Press the **Mode** key until the ION icon appears on the display, the meter enters the ion concentration measurement mode.



Ion Settings

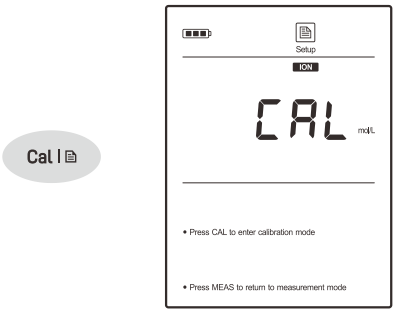
The meter contains 3 ion settings and 7 general settings in the setup menu.

Menu Item	Option and Description	
UNIt	**Measurement Unit** Set the ion concentration and temperature units.	
	ppm	Parts per million (default)
	mg/L	Milligrams per liter
	mol/L	Moles per liter
	°C	Degrees Celsius (default)
	°F	Degrees Fahrenheit
CAL	**Calibration Points** Set the number of calibration points.	
	...5	2 to 5 points (default 2 points)
ION	**Ionic Valency** Set the ion valence of electrode.	
	1	Monovalent (default)
	2	Divalent

If you want to change the current settings, press and hold the ⎙ key to enter the setup menu. Press the ▲ / ▼ key to select an option and press the **Enter** key to confirm.

Refer to the ***Setting a Default Option*** section for detailed instructions on page 8.

If the ion concentration unit has converted, the meter will show CAL always and wait for calibration. Press the **Cal** key and refer to the ***Ion Calibration*** section to perform the calibration, the meter will switch to selected concentration unit when calibration is completed.

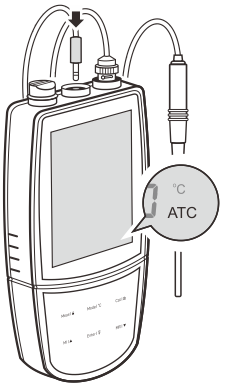


Temperature Compensation

Due to the temperature difference between the standard and sample solutions will cause approximately 2% measurement error for every degree centigrade of temperature change, we recommend to enable the temperature compensation during the calibration and measurement.

Automatic Temperature Compensation

Connect the temperature probe to meter, the ATC icon appears on the display, the meter is now switched to the automatic temperature compensation mode.



Manual Temperature Compensation

If the meter does not detect a temperature probe, the degrees Celsius icon (°C) will show on the display indicating the meter is switched to the manual temperature compensation mode. To set the temperature value follow the steps below.

1. Press and hold the **°C** key to enter the temperature setting.
2. Press the ▲ / ▼ key to modify the temperature value.
3. Press the **Enter** key to save.

Press and hold the ▲ / ▼ key will make the value change faster.

Ion Calibration

The meter allows 2 to 5 points calibration in the ion mode, acceptable calibration points include the following options.

Measurement Unit	Calibration Points
ppm	0.001, 0.01, 0.1, 1, 10, 100, 1000, 10000
mg/L	0.001, 0.01, 0.1, 1, 10, 100, 1000, 10000
mol/L	0.001, 0.01, 0.1, 1, 10
mmol/L	0.001, 0.01, 0.1

Before beginning the calibration, ensure that the ionic valency option in the setup menu matches connected electrode. All of the standards and samples should be at the same temperature and calibration points cover the anticipated range of the samples.

For the low concentration or sample contains the interference ions, we recommend to add the ionic strength adjuster (ISA) to all of the standards and samples. A typical addition would be 2 ml ISA to 100 ml of standard and sample.

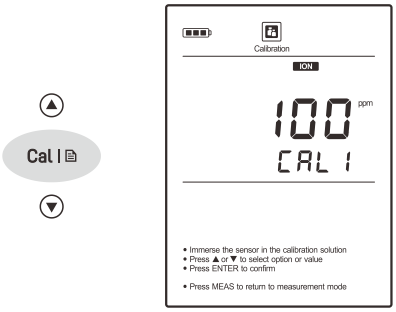
For the low level sodium determination (<1 ppm), make sure to use the laboratory plastic beaker as a container.

Stir the standards and samples at a uniform rate that will help you get most accurate readings.

Calibrating the Meter

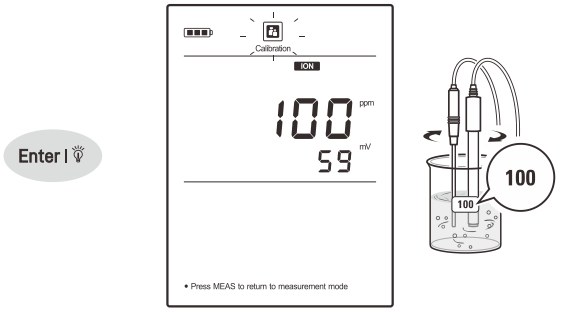
1.1 Press the **Cal** key, the meter shows 0.001 ppm/CAL1 or mg/L, mol/L, mmol/L, depending on the selected concentration unit.

1.2 Press the ▲ key to select first calibration point (e.g., 100 ppm), the meter will automatically perform the calibration from the low to high concentrations.



1.3 Rinse the ion selective electrode with distilled water, then rinse with a small amount of standard solution. Place the electrode (and temperature probe) into the standard solution, stir gently to create a homogeneous solution.

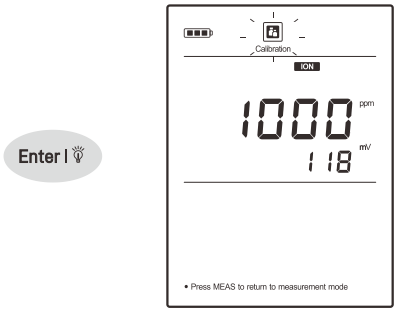
1.4 Press the **Enter** key, the Calibration icon begins flashing.



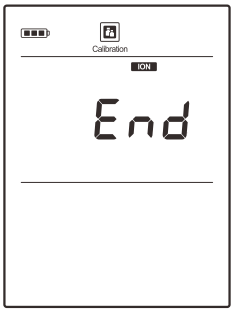
1.5 When the reading has stabilized, the display will show 1000 ppm /CAL2. The meter prompts you to continue with second point calibration.

1.6 Rinse the ion selective electrode with distilled water, then rinse with a small amount of standard solution. Place the electrode (and temperature probe) into the next standard solution and stir gently.

1.7 Press the **Enter** key, the Calibration icon begins flashing.



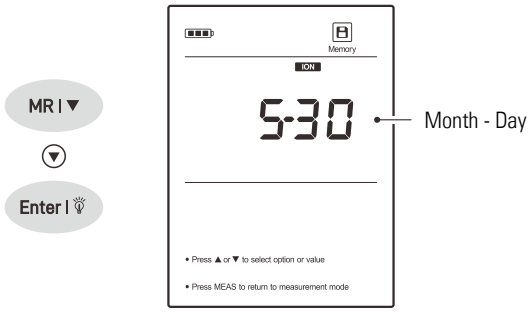
1.8 When the reading has stabilized, the display will show CAL3. The meter prompts you to continue with third point calibration.
1.9 Repeat the steps 1.6 and 1.7 above until the meter shows End. Calibration is completed.



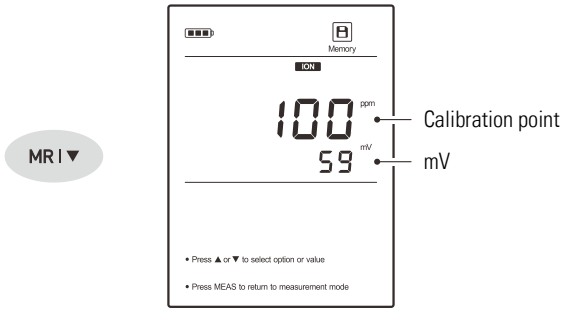
To exit the calibration without saving changes, press the **Meas** key.

Viewing the Calibration Log

2.1 Press the **MR** key in the ion measurement mode and press the ▼ key until the meter shows ELE/P-02 (Electrode/Page 2).
2.2 Press the **Enter** key, the meter shows the last calibration date.



2.3 Press the ▼ key to view the calibration point and mV value.

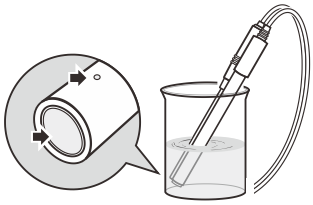


2.4 Press the ▼ key to view the next data set.
2.5 To exit the calibration log, press the **Meas** key.

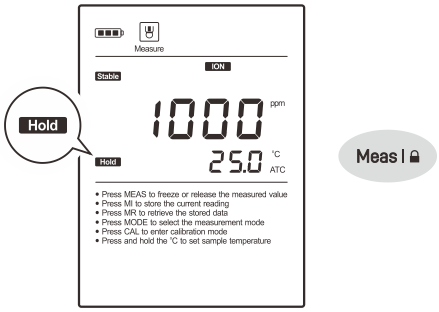
If the meter is not calibrated with standard solutions, the display will show ---- only.

Ion Measurement

1. Rinse the ion selective electrode with distilled water. Place the electrode (and temperature probe) into the sample solution and stir gently. Note, the ion sensitive membrane and liquid junction must be completely immersed into the solution.



2. If the Auto-Hold option in the setup menu is enabled, the meter will automatically sense a stable reading and lock measurement, the HOLD icon appears on the display. Press the 🔒 key to resume measuring.
   If the option is disabled, the meter will continuously measure and update the readings.

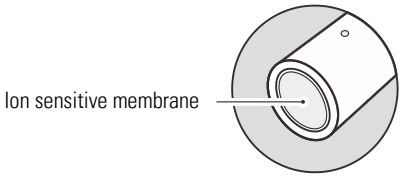


3. Wait for the measurement to stabilize and record the reading.
4. When all of the samples have been measured, rinse the electrode with distilled water.

- During the measurement process, never wipe the ion sensitive membrane, blot dry with a lint-free tissue to remove waterdrops on electrode.
- If the meter is not calibrated with connected electrode, the display will always show 0.000.
- If the meter shows ---- indicating the measurement exceeds the range, remove the electrode from the sample immediately.
- To record the measurement at the predefined time intervals, refer to the ***Interval Readings*** section on page 40.

Electrode Maintenance

- Rinse the ion selective electrode thoroughly with distilled water after use, wipe clean with a lint-free tissue, then replace protective cap and store the electrode in a dry, cool and well-ventilated area.
- Never scratch the ion sensitive membrane on the bottom of the electrode.
- If the electrode response becomes sluggish, soak the electrode in 100 ppm standard solution for at least 1 hour.



Appendix

Preparation of Ion Standard Solution (1000 ppm)

1. Half fill a 1 liter volumetric flask with distilled water and add the analytical grade reagent according to the instructions in table below.

Ion Type	Reagent	Weight
Ammonium	NH_4Cl	2.97 g
Bromide	NaBr	1.29 g
Cadmium	$Cd(NO_3)_2 \bullet 4H_2O$	2.74 g
Calcium	$CaCl_2 \bullet 2(H_2O)$	3.67 g
Chloride	NaCl	1.65 g
Cupric	$Cu(NO_3)_2 \bullet 3H_2O$	3.80 g
Cyanide	NaCN	1.88 g
Fluoride	NaF	2.21 g
Iodide	NaI	1.18 g
Lead	$Pb(NO_3)_2$	1.60 g
Nitrate	$NaNO_3$	1.37 g
Potassium	KCl	1.91 g
Silver	$AgNO_3$	1.57 g
Sodium	NaCl	2.54 g
Sulfide	$Na_2S \bullet 9H_2O$	7.49 g
Ammonia	NH_4Cl	3.15 g

2. Swirl the volumetric flask gently to dissolve the reagent and fill to the mark with distilled water.
3. Cap and upend the volumetric flask several times to mix the solution.

Optional Accessories

Ion Selective Electrodes

Order Code	Description	Range
ISE-NH4	Ammonium (NH_4^+)	0.1 to 18000 ppm
ISE-Br	Bromide (Br^-)	0.4 to 81000 ppm
ISE-Cd	Cadmium (Cd^{2+})	0.1 to 11200 ppm
ISE-Ca	Calcium (Ca^{2+})	0.02 to 40100 ppm
ISE-Cl	Chloride (Cl^-)	1 to 35000 ppm
ISE-Cu	Cupric (Cu^{2+})	0.06 to 6400 ppm
ISE-CN	Cyanide (CN^-)	0.03 to 260 ppm
ISE-F	Fluoride (F^-)	0.02 to 1900 ppm
ISE-I	Iodide (I^-)	0.06 to 127000 ppm
ISE-Pb	Lead (Pb^{2+})	0.2 to 20800 ppm
ISE-NO3	Nitrate (NO_3^-)	0.4 to 62000 ppm
ISE-K	Potassium (K^+)	0.04 to 39000 ppm
ISE-Ag	Silver (Ag^+)	0.01 to 107900 ppm
ISE-Na	Sodium (Na^+)	0.002 to 69000 ppm
ISE-S	Sulfide (S^{2-})	0.003 to 32000 ppm
ISE-NH3	Ammonia (NH_3)	0.01 to 17000 ppm

Standard Solutions

Order Code	Description	Volume
ION-NH4	1000 ppm ammonium standard	480 ml
ION-Br	1000 ppm bromide standard	480 ml
ION-Cd	1000 ppm cadmium standard	480 ml
ION-Ca	1000 ppm calcium standard	480 ml
ION-Cl	1000 ppm chloride standard	480 ml
ION-Cu	1000 ppm cupric standard	480 ml
ION-F	1000 ppm fluoride standard	480 ml
ION-I	1000 ppm iodide standard	480 ml
ION-Pb	1000 ppm lead standard	480 ml
ION-NO3	1000 ppm nitrate standard	480 ml
ION-K	1000 ppm potassium standard	480 ml
ION-Ag	1000 ppm silver standard	480 ml
ION-Na	1000 ppm sodium standard	480 ml

Ionic Strength Adjusters

Order Code	Description	Volume
ISA-NH4	Ammonium (NH_4^+)	480 ml
ISA-Br	Bromide (Br^-)	480 ml
ISA-Cd	Cadmium (Cd^{2+})	480 ml
ISA-Ca	Calcium (Ca^{2+})	480 ml
ISA-Cl	Chloride (Cl^-)	480 ml
ISA-Cu	Cupric (Cu^{2+})	480 ml
ISA-CN	Cyanide (CN^-)	480 ml
ISA-F	Fluoride (F^-)	480 ml
ISA-I	Iodide (I^-)	480 ml
ISA-Pb	Lead (Pb^{2+})	480 ml
ISA-NO3	Nitrate (NO_3^-)	480 ml
ISA-K	Potassium (K^+)	480 ml
ISA-Ag	Silver (Ag^+)	480 ml
ISA-Na	Sodium (Na^+)	480 ml
ISA-NH3	Ammonia (NH_3)	480 ml

Filling Solution

Order Code	Description
FS-NH3	Filling solution for ammonia electrode, 480 ml

Temperature Probe

Order Code	Description
TP-10K	Range: 0 to 100°C (32 to 221°F), 1 m (3.3 ft.) cable

Communication and Power Supply

Order Code	Description
USB-A	USB Type-A to Type-A data cable, 1 m (3.3 ft)
DCPA-5V	DC 5V power adapter, european standard plug

Water Hardness

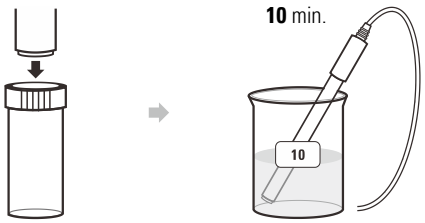
Calibration and Measurement

This section is applicable to model

- 322

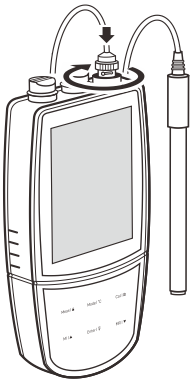
Prior to Use

1. Take out the water hardness electrode from the carrying case.
2. Remove the protective cap and soak the electrode in 10 mmol/L standard solution for 10 minutes.



Connecting the Electrode

Insert the BNC connector into the connector socket on meter, rotate and push the connector clockwise until it locks.



Selecting the Measurement Mode

The meter contains 8 water hardness measurement modes. Press the **Mode** key, the display will show corresponding icon and automatically enter selected measurement mode.

LCD Display	Measurement Mode	Measurement Unit
ION	Ion concentration	mmol/L
CACO	$CaCO_3$	mg/L
CAO	CaO	mg/L
bOL	Boiler	mmol/L
CA	Ca^{2+}	mg/L
FH	French degree	°fH
dH	German degree	°dH
EH	English degree	°e

ⓘ Note, the meter allows entering the setup menu or performing the calibration in the ION mode only.

Water Hardness Settings

The meter contains 1 water hardness setting and 7 general settings in the setup menu.

Menu Item	Option and Description	
CAL	**Calibration Points** Set the number of calibration points.	
	...5	2 to 5 points (default 2 points)

If you want to change the current settings, press and hold the ⎙ key to enter the setup menu. Press the ▲ / ▼ key to select an option and press the **Enter** key to confirm.

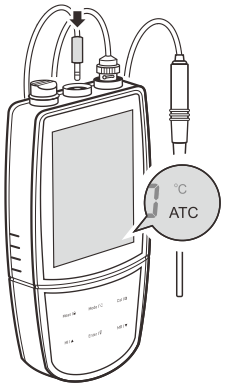
Refer to the ***Setting a Default Option*** section for detailed instructions on page 8.

Temperature Compensation

In order to get accurate measurement results, we recommend that all of the standards and samples should be at the same temperature. If you want to enable the temperature compensation, use either of the following two methods.

Automatic Temperature Compensation

Connect the temperature probe to meter, the ATC icon appears on the display, the meter is now switched to the automatic temperature compensation mode.



Manual Temperature Compensation

If the meter does not detect a temperature probe, the degrees Celsius icon (°C) will show on the display indicating the meter is switched to the manual temperature compensation mode. To set the temperature value follow the steps below.

1. Press and hold the **°C** key to enter the temperature setting.
2. Press the ▲ / ▼ key to modify the temperature value.
3. Press the **Enter** key to save.

Press and hold the ▲ / ▼ key will make the value change faster.

Water Hardness Calibration

The meter allows 2 to 5 points calibration with standard solutions, acceptable calibration points include the following options.

Measurement Unit	Calibration Points
mol/L	0.001, 0.01, 0.1
mmol/L	0.001, 0.01, 0.1

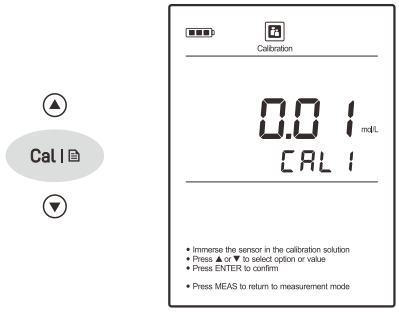
For better accuracy, we recommend to add the ionic strength adjuster (ISA) to all of the standards and samples and selected calibration points cover anticipated range of the samples. A typical addition would be 2 ml ISA to 100 ml of standard and sample.

Calibrating the Meter

1.1 Press the **Mode** key until the display shows ION, the meter enters the ion concentration measurement mode.

1.2 Press the **Cal** key to enter the calibration mode, the display shows 0.001 mmol/L / CAL1.

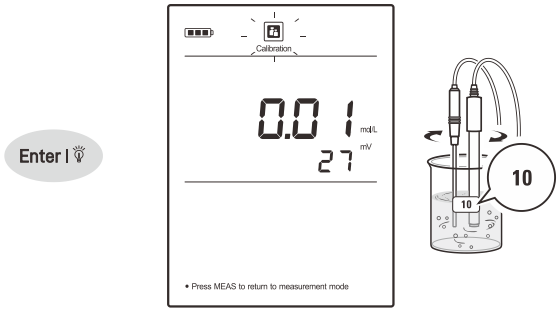
1.3 Press the ▲ / ▼ key to select first calibration point (e.g., 0.01 mol/L), the meter will automatically perform the calibration from the low to high concentrations.



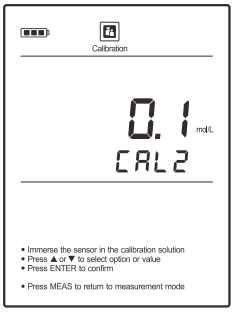
The meter is packaged with 10 and 100 mmol/L standard solutions, its related calibration points are 0.01 and 0.1 mol/L.

★ 1 mol/L = 1000 mmol/L

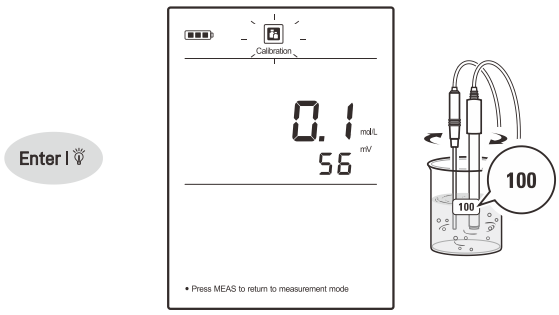
1.4 Rinse the water hardness electrode with distilled water, then rinse with a small amount of standard solution. Place the electrode (and temperature probe) into the standard solution (e.g., 10 mmol/L), stir gently to create a homogeneous solution.
1.5 Press the **Enter** key, the Calibration icon begins flashing.



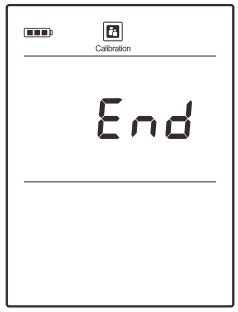
1.6 When the reading has stabilized, the display will show 0.1 mol/L /CAL2. The meter prompts you to continue with second point calibration.



1.7 Rinse the water hardness electrode with distilled water, then rinse with a small amount of standard solution. Place the electrode (and temperature probe) into the next standard solution.
1.8 Press the **Enter** key, the Calibration icon begins flashing.



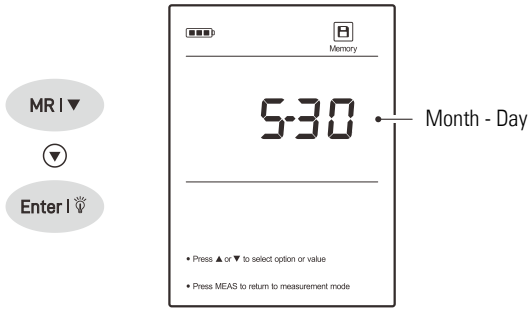
1.9 When the reading has stabilized, the display will show CAL3. The meter prompts you to continue with third point calibration.
2.0 Repeat the steps 1.7 and 1.8 above until the meter shows End. Calibration is completed.



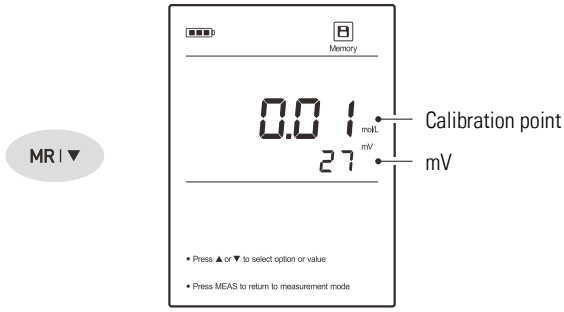
To exit the calibration without saving changes, press the **Meas** key.

Viewing the Calibration Log

2.1 Press the **MR** key in the measurement mode and press the ▼ key until the meter shows ELE/P-02 (Electrode/Page 2).
2.2 Press the **Enter** key, the meter shows the last calibration date.



2.3 Press the ▼ key to view the calibration point and mV value.

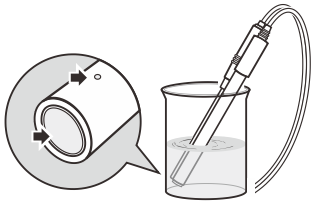


2.4 Press the ▼ key to view the next data set.
2.5 To exit the calibration log, press the **Meas** key.

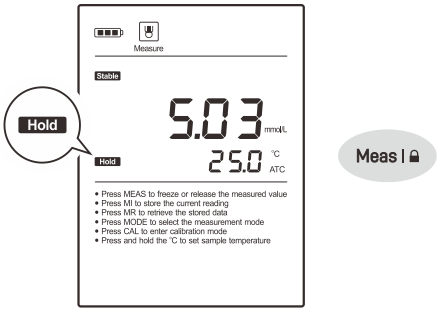
If the meter is not calibrated with standard solutions, the display will show ---- only.

Water Hardness Measurement

1. Rinse the water hardness electrode with distilled water. Place the electrode (and temperature probe) into the sample solution and stir gently. Note, the sensitive membrane and liquid junction must be completely immersed into the solution.



2. If the Auto-Hold option in the setup menu is enabled, the meter will automatically sense a stable reading and lock measurement, the HOLD icon appears on the display. Press the 🔒 key to resume measuring.
   If the option is disabled, the meter will continuously measure and update the readings.



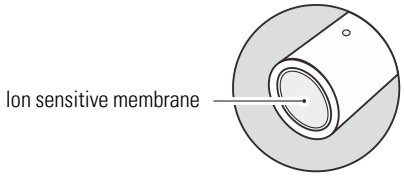
3. Wait for the measurement to stabilize and record the reading.
4. When all of the samples have been measured, rinse the electrode with distilled water.

ℹ

- During the measurement process, never wipe the ion sensitive membrane, blot dry with a lint-free tissue to remove waterdrops on electrode.
- If the meter is not calibrated with connected electrode, the display will always show 0.000.
- If the meter shows ---- indicating the measurement exceeds the range, remove the electrode from the sample immediately.

Electrode Maintenance

- Rinse the water hardness electrode thoroughly with distilled water after use, wipe clean with a lint-free tissue, then replace protective cap and store the electrode in a dry, cool and well-ventilated area.
- Never scratch the ion sensitive membrane on the bottom of the electrode.
- If the electrode response becomes sluggish, soak the electrode in 10 mmol/L standard solution for at least 1 hour.



Appendix

Preparation of Standard Solution (100 mmol/L)

1. Half fill a 1 liter volumetric flask with distilled water and add 14.7 grams of analytical grade calcium chloride ($CaCl_2 \cdot 2H_2O$) reagent.
2. Swirl the volumetric flask gently to dissolve the reagent and fill to the mark with distilled water.
3. Cap and upend the volumetric flask several times to mix the solution.

Optional Accessories

Sensors

Order Code	Description
ISE-WH	Water hardness electrode, range: 0.05 to 200 mmol/L
TP-10K	Temperature probe, range: 0 to 100°C (32 to 221°F)

Solutions

Order Code	Description
ION-WH	100 mmol/L standard solution, 480 ml
ISA-WH	Ionic strength adjuster, 480 ml

Communication and Power Supply

Order Code	Description
USB-A	USB Type-A to Type-A data cable, 1 m (3.3 ft)
DCPA-5V	DC 5V power adapter, european standard plug

Conductivity/TDS/Salinity/ Resistivity

Calibration and Measurement

This section is applicable to model

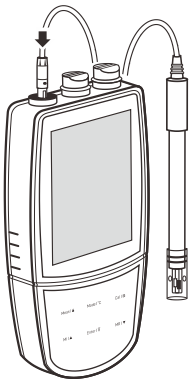
- 530/531/540
- 900P/901P/902P/904P

Prior to Use

1. Take out the conductivity electrode from the carrying case.
2. Soak the electrode for about 10 minutes in tap water to remove dirt and oil stains on the sensor surface.

Connecting the Electrode

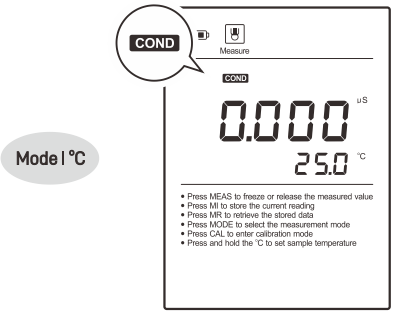
Insert the 6-pin connector into the connector socket on meter, ensure the connector is fully seated.



After connection is completed, DO NOT pull on the sensor cable. Always make sure that the connector is clean and dry.

Selecting the Measurement Mode

Press the **Mode** key, the meter will show the conductivity (COND), TDS, salinity (SAL) and resistivity (RES) icons. Select a desired mode.



Conductivity/TDS/Salinity Settings

The meter contains 7 conductivity/TDS settings and 7 general settings in the setup menu.

Menu Item	Option and Description	
CELL	**Cell Constant** Set the cell constant to match connected conductivity electrode.	
	0.1	K = 0.1
	1	K = 1 (default)
	10	K = 10
	USEr	Custom
COE	**Temperature Coefficient** Set the temperature coefficient for linear temperature compensation.	
	2.10	0.00 to 10.00%/°C (default 2.10)
CAL	**Calibration Points** Set the number of calibration points.	
	...5	1 to 5 points (default 1 point)
PUrE	**Pure Water Compensation** If enabled, the pure water compensation coefficient will be applied automatically for ultra-pure water measurements.	
	YES	Enable
	nO	Disable (default)
StD	**Reference Temperature** Set the normalization temperature for measurement, the readings will automatically compensate to the selected temperature during measurement.	
	25°C	25°C (default)
	20°C	20°C
tdS	**TDS Factor** Set the default TDS conversion factor.	
	0.50	0.40 to 1.00 (default 0.50)
UNIt	**Measurement Unit** Set the default temperature unit.	
	°C	Degrees Celsius (default)
	°F	Degrees Fahrenheit

If you want to change the current settings, press and hold the 🗎 key to enter the setup menu. Press the ▲ / ▼ key to select an option and press the **Enter** key to confirm.

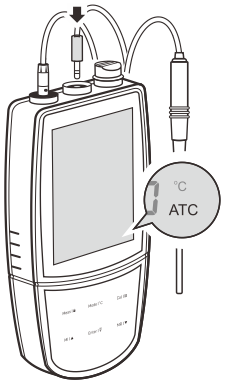
Refer to the ***Setting a Default Option*** section for detailed instructions on page 8.

Temperature Compensation

The temperature compensation has a large effect on the conductivity measurement. If enabled, the meter will use the measured conductivity and temperature readings to calculate the result and automatically compensate to the selected reference temperature. If the temperature coefficient is set to 0, the temperature compensation will be disabled, the meter only shows the actual conductivity at the measured temperature.

Automatic Temperature Compensation

Connect the temperature probe to meter, the ATC icon appears on the display, the meter is now switched to the automatic temperature compensation mode.



Manual Temperature Compensation

If the meter does not detect a temperature probe, the degrees Celsius icon (°C) will show on the display indicating the meter is switched to the manual temperature compensation mode. To set the temperature value follow the steps below.

1. Press and hold the **°C** key to enter the temperature setting.
2. Press the ▲ / ▼ key to modify the temperature value.
3. Press the **Enter** key to save.

Press and hold the ▲ / ▼ key will make the value change faster.

Selecting a Conductivity Electrode

The meter is capable of connecting the three types of conductivity electrodes. Before the calibration and measurement, ensure that you have selected a suitable electrode according to the anticipated sample conductivity. The following table lists the selectable electrode and its effective measurement ranges.

Electrode	Measurement Range	Cell Constant
CON-0.1	0.5 to 100 µS/cm	K = 0.1
CON-1	10 µS/cm to 20 mS/cm	K = 1
CON-10	100 µS/cm to 200 mS/cm	K = 10

Conductivity Calibration

Automatic Calibration

The meter allows 1 to 5 points calibration in the conductivity mode. Before calibration, ensure that selected cell constant (K=0.1, 1, 10) matches connected electrode. If you have selected the manual calibration (USEr), the meter will wait to enter a cell constant.

For better accuracy, we recommend to perform 3 points calibration or select a standard solution closest to the sample conductivity you are measuring. The meter will automatically detect the standard solution and prompt the user to perform the calibration.

The following table shows the default standard solution for each measurement range.

Measurement Range	Default Standard Solution
0 to 20 µS/cm	10 µS/cm
20 to 200 µS/cm	84 µS/cm
200 to 2000 µS/cm	1413 µS/cm
2 to 20 mS/cm	12.88 mS/cm
20 to 200 mS/cm	111.8 mS/cm

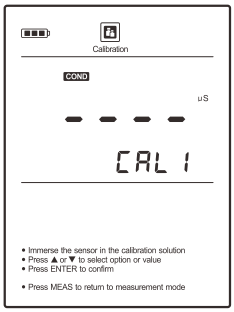
If you have changed the conductivity electrode, the meter must be recalibrated. Every electrode has a different cell constant.

Single Point Calibration

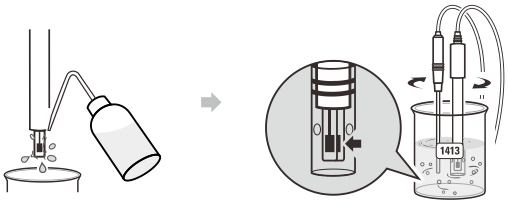
1.1 Press the **Mode** key to enter the conductivity measurement mode and select 1 point calibration in the setup menu.

1.2 Press the **Cal** key, the display shows ----/CAL1, the meter waits for recognizing the standard solution.

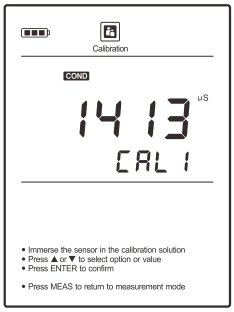
Cal



1.3 Rinse the conductivity electrode with distilled water, then rinse with a small amount of standard solution. Place the electrode (and temperature probe) into the standard solution, stir gently to remove air bubbles trapped in the slot of the sensor.

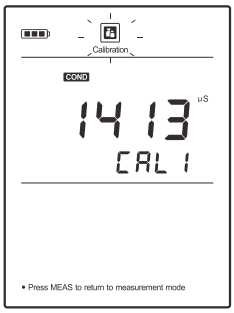


The meter will automatically show the calibration standard (e.g., 1413 µS/cm).

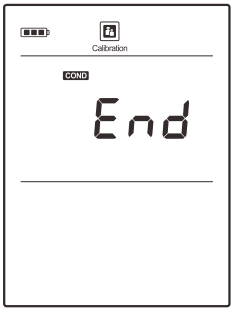


1.4 If necessary, press the ▲ / ▼ key to modify the calibration value. Press the **Enter** key, the Calibration icon begins flashing.

Enter



1.5 When the reading has stabilized, the meter will show End and return to the measurement mode.



Multipoint Calibration

2.1 Ensure that you have selected 2 to 5 points calibration in the setup menu. When the first calibration point is completed, the display will show ----/CAL2. The meter prompts you to continue with second point calibration.

2.2 Repeat steps 1.3 and 1.4 above until the meter shows End. Calibration is completed.

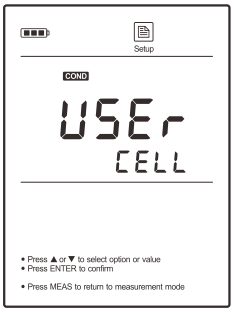
Manual Calibration

The meter provides an easy manual calibration mode. If the conductivity standard solution is not ready, you are able to use this method to calibrate the meter.

3.1 Press and hold the key to enter the setup menu.

3.2 Press the **Enter** key, the display shows 1/CELL.

3.3 Press the ▲ / ▼ key to select USEr/CELL.



3.4 Press the **Enter** key, the first digit begins flashing.

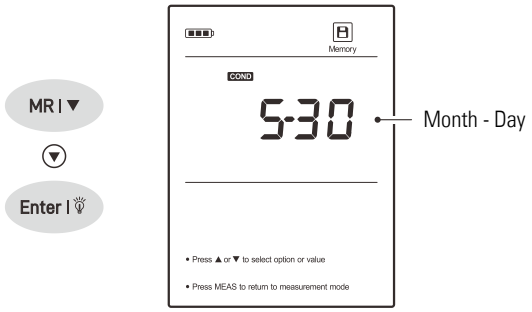
3.5 Press the ▲ / ▼ key to set the cell constant, press the **Enter** key to save until the meter returns to the measurement mode.

- Performing the conductivity calibration will simultaneously calibrate the corresponding TDS, salinity and resistivity values.
- To exit the calibration without saving changes, press the **Meas** key.

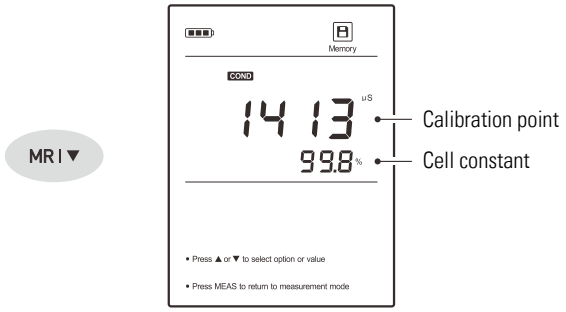
Viewing the Calibration Log

4.1 Press the **MR** key in the measurement mode and press the ▼ key until the meter shows ELE/P-02 (Electrode/Page 2).

4.2 Press the **Enter** key, the meter shows the last calibration date.



4.3 Press the ▼ key to view the calibration point and cell constant (e.g., 0.998).



4.4 Press the ▼ key to view the next data set.

4.5 To exit the calibration log, press the **Meas** key.

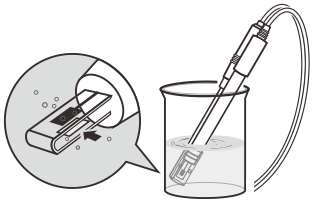
If the meter is not calibrated with standard solution, the display will show ---- only.

Measurements

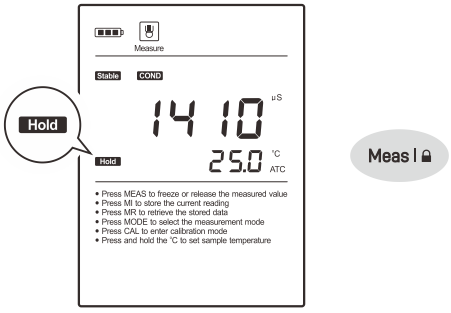
1. Press the **Mode** key to select the measurement mode.

- In the total dissolved solids (TDS) mode, ensure that you have set a correct conductivity-to-TDS conversion factor in the setup menu (default 0.50).
- In the salinity mode SAL, the meter provides 2 measurement units. When the PSU appears on the right of the measurement value indicating the meter is in the practical salinity measurement mode. When the ppt appears on the display indicating the meter is in the natural seawater measurement mode.

2. Rinse the conductivity electrode with distilled water. Place the electrode (and temperature probe) into the sample solution and stir gently. Ensure that no air bubbles on the sensor surface.



3. If the Auto-Hold option in the setup menu is enabled, the meter will automatically sense a stable reading and lock measurement, the HOLD icon appears on the display. Press the 🔒 key to resume measuring.
   If the option is disabled, the meter will continuously measure and update the readings.



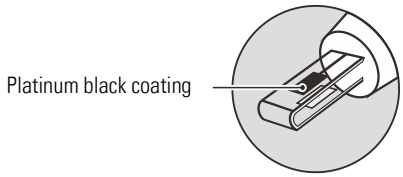
4. Wait for the measurement to stabilize and record the reading.
5. When all of the samples have been measured, rinse the electrode with distilled water.

ℹ

- If the meter shows ---- indicating the measurement exceeds the range, replace a conductivity electrode that is appropriate for the conductivity range of the sample solution you are measuring.
- To record the measurement at the predefined time intervals, refer to the ***Interval Readings*** section on page 40.

Electrode Maintenance

- Rinse the conductivity electrode thoroughly with distilled water after use.
- Do not touch the platinum black coating on the sensor surface and always keep it clean.



- If there is a build-up of solids inside the sensor, remove carefully, then recalibrate the electrode.
- If you do not use the electrode for long periods, wipe clean with a lint-free tissue and store the electrode in a dry and cool area.
- If your electrode is model CON-10, store the electrode with tap water. This sensor needs to be kept wet always.

Appendix

Preparation of Conductivity Standard Solutions

1. Place the analytical grade potassium chloride (KCl) in a beaker and dry in an oven for about 3 hours at 105°C (221°F), then cool to room temperature.
2. Add the reagent to a 1 liter volumetric flask according to the instructions in table below.

Conductivity Standard	Reagent	Weight
84 µS/cm	KCl	42.35 mg
1413 µS/cm	KCl	745.5 mg
12.88 mS/cm	KCl	7.45 g
111.8 mS/cm	KCl	74.5 g

3. Fill the distilled water to the mark, mix the solution until the reagent is completely dissolved.

Calculating the Cell Constant

1. Refer to the ***Manual Calibration*** section to set the cell constant to 1.000.
2. Place the electrode into a standard solution and record the reading.
3. Calculate the cell constant using the following formula.

$$K = (C_{std} / C_{meas}) \times G$$

Where:
K = Cell constant
C_{std} = Value of conductivity standard solution
C_{meas} = Measured value
G = Raw cell constant (0.1, 1 or 10)

Calculating the Temperature Coefficient

1. Do not connect the temperature probe to the meter.
2. Press and hold the **°C** key to enter the temperature setting.
3. Press the ▲ / ▼ key to set the temperature to 25°C and press the **Enter** key to confirm.
4. Place the conductivity electrode into the sample solution, record the temperature value T_A and conductivity value C_{TA}.
5. Condition the sample solution and electrode to a temperature T_B that is about 5 to 10°C different from T_A. Record the conductivity value C_{TB}.
6. Calculate the temperature coefficient using the formula below.

$$T_C = [C_{TB} - C_{TA}] / [C_{TA}(T_B - 25) - C_{TB}(T_A - 25)]$$

Where:
T_C = Temperature coefficient
C_{TA} = Conductivity at temperature A
C_{TB} = Conductivity at temperature B
T_A = Temperature A
T_B = Temperature B

Calculating the TDS Conversion Factor

To determine the TDS factor of sample solution use the formula below.

Factor = Actual TDS / Actual Conductivity @25°C

Where:
Actual TDS = value from the high purity water and precisely weighed NaCl or KCL reagent
Actual Conductivity = the meter measured conductivity value

For example:
Dissolve 64 grams of the potassium chloride (KCl) reagent in 1 liter distilled water. If measured conductivity is 100 mS/cm, then TDS factor is 0.64.

Conductivity to TDS Conversion Factors

Conductivity at 25°C	TDS (KCl)		TDS (NaCl)	
	ppm	Factor	ppm	Factor
84 µS/cm	40.38	0.5048	38.04	0.4755
1413 µS/cm	744.7	0.527	702.1	0.4969
12.88 mS/cm	7447	0.5782	7230	0.5613

Optional Accessories

Conductivity Electrodes

Order Code	Description
CON-0.1	For measuring low conductivity liquids / pure water
CON-1	For general purpose applications
CON-10	For measuring high conductivity liquids / wastewater

Conductivity Flow Cell

Order Code	Description
CON-FC	Compatible with the CON-0.1 conductivity electrode for measuring pure and ultrapure water below 10 µS/cm

Temperature Probe

Order Code	Description
TP-10K	Range: 0 to 100°C (32 to 221°F), 1 m (3.3 ft.) cable

Solutions

Order Code	Description
ECCS-84	Conductivity standard solution 84 µS/cm, 480 ml
ECCS-1413	Conductivity standard solution 1413 µS/cm, 480 ml
ECCS-1288	Conductivity standard solution 12.88 mS/cm, 480 ml
ECCS-5000	Conductivity standard solution 50.00 mS/cm, 480 ml
ECCS-1118	Conductivity standard solution 111.8 mS/cm, 480 ml

Communication and Power Supply

Order Code	Description
USB-A	USB Type-A to Type-A data cable, 1 m (3.3 ft)
DCPA-5V	DC 5V power adapter, european standard plug

Dissolved Oxygen

Calibration and Measurement

This section is applicable to model

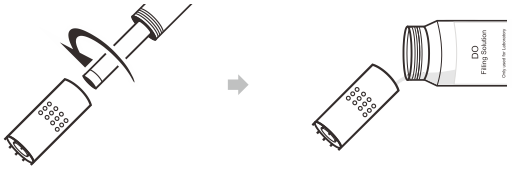
- 821
- 900P/903P/904P

Prior to Use

Filling the Electrolyte Solution

1.1 Take out the dissolved oxygen electrode and electrolyte solution from the packaging. Unscrew the membrane cap from the bottom of the electrode, rinse the inside and outside with distilled water and blot dry.

1.2 Fill the membrane cap halfway with electrolyte solution.



1.3 Screw membrane cap back onto the electrode. Some electrolyte solution will overflow during this process.

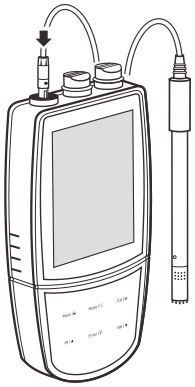
1.4 Check the electrode, ensure that no air bubbles are trapped in the electrolyte solution and the membrane is not creased or damaged.

Remove air bubbles

Polarizing the Electrode

2.1 Insert the 6-pin connector into the connector socket on meter, ensure the connector is fully seated.

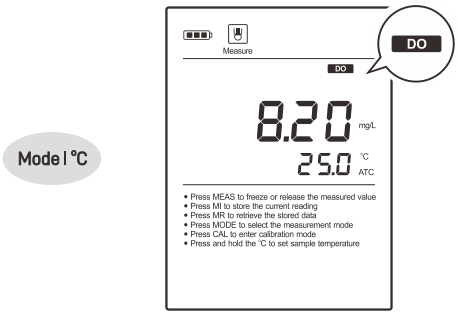
2.2 Switch on the meter and wait 10 minutes for the electrode to polarize.



The dissolved oxygen electrode must be polarized before use.

Selecting the Measurement Mode

Press the **Mode** key until the DO icon and measurement unit mg/L or ppm appears on the display, the meter enters the dissolved oxygen concentration mode.
Press the key again, the measurement unit will switch to %, the meter enters the percentage saturation mode.



Dissolved Oxygen Settings

The meter contains 5 dissolved oxygen settings and 7 general settings in the setup menu.

Menu Item	Option and Description	
CAL	**Calibration Points** Set the number of calibration points.	
	1	1 point
	2	2 points (default)
PrES	**Pressure Coefficient** Set the barometric pressure coefficient according to the local altitude.	
	760.0	450.0 to 850.0 mmHg, 60.0 to 113.3 kPa (default 760.0 mmHg, 101.3 kPa)
SAL	**Salinity Coefficient** Set the salinity compensation coefficient of sample.	
	0.0	0.0 to 50.0 ppt (default 0.0)
rESO	**Resolution** Set the resolution of the dissolved oxygen measurement.	
	0.01	0.01 mg/L, 0.1% (default)
	0.1	0.1 mg/L, 1%
UNIt	**Measurement Units** Set the default dissolved oxygen, barometric pressure and temperature units.	
	mg/L	Milligrams per liter (default)
	ppm	Parts per million
	mmHg	Millimeter of mercury (default)
	kPa	Kilopascal
	°C	Degrees Celsius (default)
	°F	Degrees Fahrenheit

If you want to change the current settings, press and hold the ⎙ key to enter the setup menu. Press the ▲ / ▼ key to select an option and press the **Enter** key to confirm.

ⓘ Refer to the ***Setting a Default Option*** section for detailed instructions on page 8.

The following table describes the relationship between the altitude and barometric pressure, make sure to set a compatible parameter before the calibration and measurement.

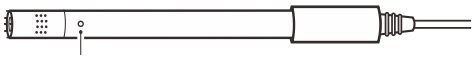
ⓘ Press and hold the ▲ / ▼ key will make the value change faster.

Altitude (m)	kPa	mmHg	Altitude (m)	kPa	mmHg
0	101.3	760	1800	80.9	607
100	100.1	750	1900	79.9	599
200	98.8	741	2000	78.9	592
300	97.6	732	2100	77.9	584
400	96.4	723	2200	76.9	577
500	95.2	714	2300	76.0	570
600	94.0	705	2400	75.0	563
700	92.8	696	2500	74.1	556
800	91.7	688	2600	73.2	549
900	90.5	679	2700	72.3	542
1000	89.4	671	2800	71.4	536
1100	88.3	662	2900	70.5	529
1200	87.2	654	3000	69.6	522
1300	86.1	646	3100	68.7	515
1400	85.0	638	3200	67.9	509
1500	84.0	630	3300	67.0	502
1600	82.9	622	3400	66.2	496
1700	81.9	614	3500	65.4	490

Dissolved Oxygen Calibration

The meter allows 1 or 2 points calibration in the dissolved oxygen mode. If you have selected the 1 point calibration in the setup menu, we recommend that you perform a 100% saturation calibration in the air-saturated water. If the 2 points calibration is selected, the zero oxygen solution needs to be used.

During the calibration and measurement, the temperature sensor on electrode must be immersed in solution completely and the solution should keep 0.3 m/s of minimum flow rate to avoid oxygen starvation at the membrane.

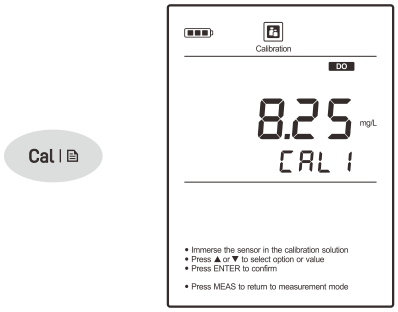


Temperature sensor

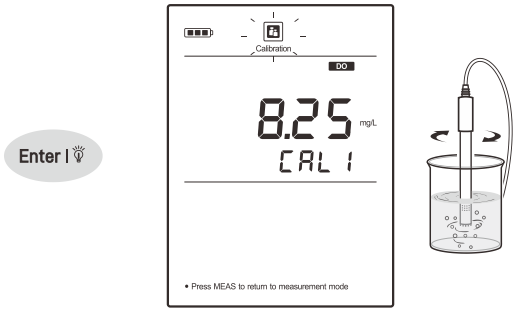
DO Calibration in mg/L or ppm Mode

1.1 Press the **Mode** key to enter the dissolved oxygen concentration mode and select the 1 point calibration in the setup menu.

1.2 Press the **Cal** key, the display shows 8.25 mg/L / CAL1 (@25°C).



1.3 Place the dissolved oxygen electrode into the air-saturated water for 10 minutes and stir gently. Press the **Enter** key, the meter begins the calibration, the Calibration icon continuously flashing.

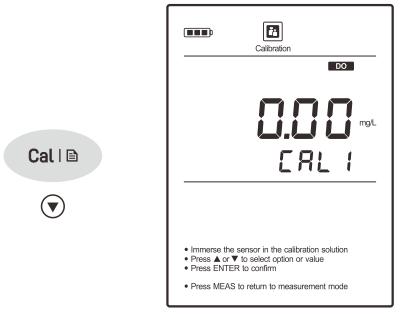


1.4 When the reading has stabilized, the meter will show End and return to the measurement mode.

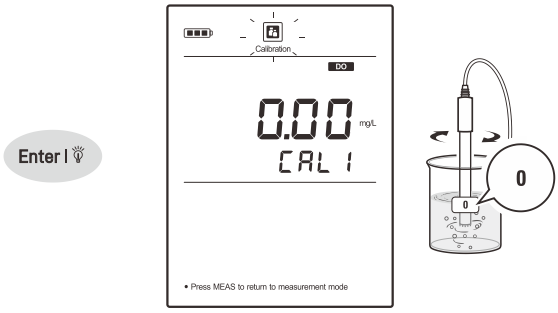
2 Points Calibration

2.1 Ensure that you have selected 2 points calibration in the setup menu.

2.2 Press the **Cal** key and ▼ key, the meter shows 0.00 mg/L / CAL1.

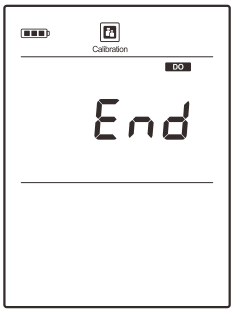


2.3 Place the dissolved oxygen electrode into the zero oxygen solution for about 10 minutes and stir gently. Press the **Enter** key to begin the calibration.



2.4 When the reading has stabilized, the display will show 8.25 mg/L / CAL 2 (@25°C). The meter prompts you to continue with second point calibration.

2.5 Repeat the step 1.3 above until the meter shows End. Calibration is completed.



DO Calibration in % Saturation Mode

3.1 Press the **Mode** key to enter the % saturation mode and select the 1 point calibration in the setup menu.

3.2 Press the **Cal** key, the display shows 100.0% / CAL1.
3.3 Hold the dissolved oxygen electrode in the air at 100% relative humidity or place the electrode into the air-saturated water for 10 minutes. Press the **Enter** key, the meter begins the calibration.
3.4 When the reading has stabilized, the meter will show End and return to the measurement mode.

2 Points Calibration

4.1 Ensure that you have selected 2 points calibration in the setup menu.
4.2 Press the **Cal** key and the ▼ key, the meter shows 0% / CAL1.
4.3 Place the electrode into the zero oxygen solution for 10 minutes and stir gently. Press the **Enter** key to begin the calibration.
4.4 When the reading has stabilized, the display will show 100% / CAL2. The meter prompts you to continue with second point calibration.
4.5 Place the electrode into the air-saturated water for 10 minutes and stir gently. Press the **Enter** key to begin the calibration.
4.6 When the reading has stabilized, the meter will show End and return to the measurement mode.

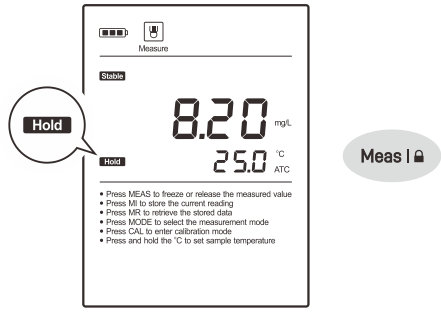
To exit the calibration without saving changes, press the **Meas** key.

Dissolved Oxygen Measurement

The meter can be used to measure the water, wastewater, brine and other liquids. If your sample is seawater or water containing large amounts of salt, make sure to set the salinity coefficient before measurement. Some gas and steam such as chloride, sulfur dioxide, sulfureted hydrogen and carbon dioxide can permeate the membrane via diffusion. Their existence will influence the measurements. If the sample contains the solvent, grease, sulfide and alga, the membrane will be damaged or eroded.

1. Set the barometric pressure and salinity coefficient in the setup menu.
2. Rinse the dissolved oxygen electrode with distilled water. Place the electrode into the sample solution and stir gently.
3. If the Auto-Hold option in the setup menu is enabled, the meter will automatically sense a stable reading and lock measurement, the HOLD icon appears on the display. Press the 🔒 key to resume measuring.
   If the option is disabled, the meter will continuously measure and update the readings.
4. Wait for the measurement to stabilize and record the reading.

- If the meter shows ---- indicating the measurement exceeds the range, remove the electrode from the sample immediately.
- To record the measurement at the predefined time intervals, refer to the ***Interval Readings*** section on page 40.



Electrode Maintenance

- Rinse the dissolved oxygen electrode thoroughly with distilled water after use.
- Do not touch the membrane and always keep it is clean and wet.
- If you do not use the electrode for long periods, screw off the membrane cap and rinse the electrode anode, cathode, membrane cap with distilled water and blot dry. Install the electrode and store dry.

Appendix

Preparation of Zero Oxygen Solution

Dissolve 500 mg of the sodium sulfate (Na_2SO_3) reagent and a small amount of cobalt (II) chloride hexahydrate ($CoCl_2 \cdot 6H_2O$) in the 250 ml distilled water, mix the solution until reagent is completely dissolved.

Preparation of Air-Saturated Water

Use an air-pump to blow air into distilled water at least 1 hour, while stirring the solution.

Optional Accessories

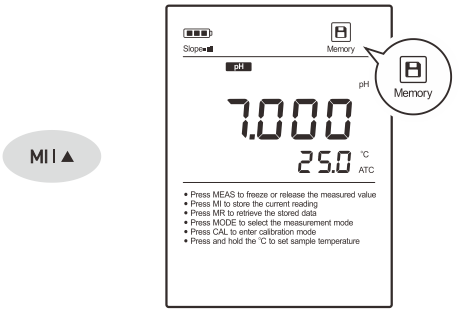
Order Code	Description
DO100	Dissolved oxygen electrode, range: 0 to 20 mg/L
DO-MEM	Membrane cap, 2 PCS/set
DO-ES	Electrolyte solution, 30 ml
DO-ZO	Zero oxygen solution, 100 ml
USB-A	USB Type-A to Type-A data cable, 1 m (3.3 ft)
DCPA-5V	DC 5V power adapter, european standard plug

Data Management

The meter is capable of storing and recalling up to 500 data sets.

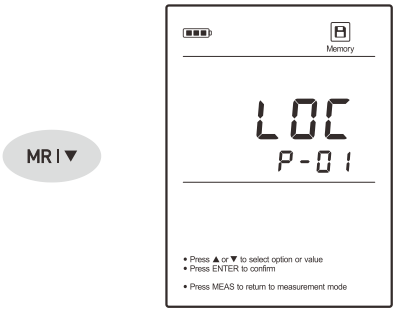
Storing a Measurement Result

During the measurement, press the **MI** key to store the reading into the memory, the Memory icon appears on the display.

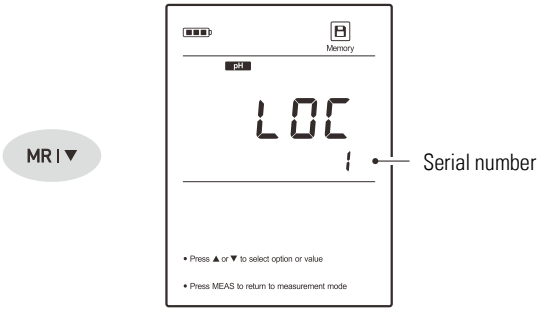


Viewing the Data Logs

1.1 Press the **MR** key in the measurement mode, the meter shows LOC/P-01 (Log/Page 1).



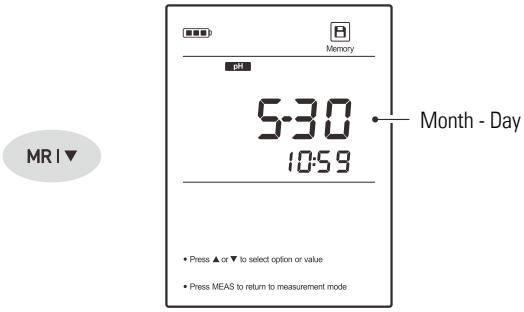
1.2 Press the **Enter** key, the meter shows the serial number of stored data.



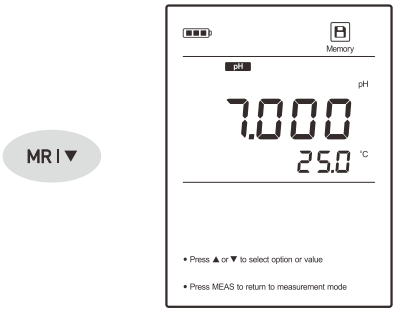
1.3 Press the ▼ key to view the date and time of measurement.

Data Management

This section is applicable to all models of meters



1.4 Press the ▼ key to view the stored data.



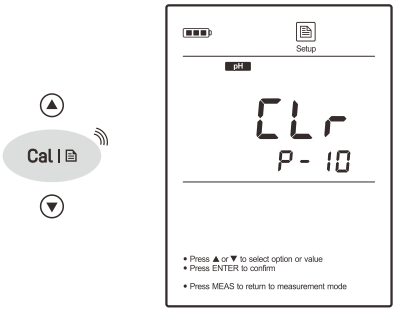
1.5 Press the ▼ key to view the next data set.
1.6 To exit the data log, press the **Meas** key.

If the meter does not store any reading, the display will show ---- only.

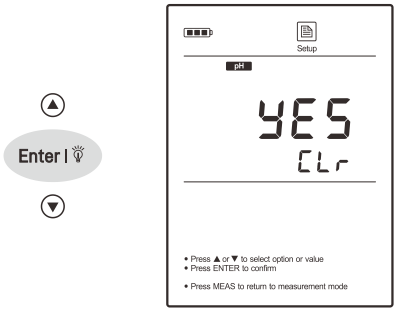
Clearing the Data Logs

If the memory is full, the meter will automatically show FULL when the **MI** key is pressed. To delete the data logs, please follow the steps below.

2.1 Press and hold the key to enter the setup menu.
2.2 Press the ▼ key until the meter shows CLr.



2.3 Press the **Enter** key, the meter shows nO/CLr.
2.4 Press the ▼ key to select the YES/CLr.
2.5 Press the **Enter** key to confirm.



Communication

The meter can transfer data to a computer or export data to Excel using DAS software. You can download the software from our official website. Before installation, ensure that Windows 10 is installed on your computer and you have a USB-A data cable.

Receiving the Data

1. Connect the USB cable to meter and computer.
2. Double-click "**9series_APP**". The system scans for an available port and displays "Device port successfully recognized."
3. Click **OK** to start the application.
4. Click **Connect**. The screen displays "Connection established."
5. Click **OK** to continue.
6. Click **Receive**. The measurement values stored in the meter are automatically transferred to the computer.

Interval Recording

This function helps the user record measurement values at regular intervals over a specified time period. The recording interval can be set to 10/30/60 seconds, 10/30 minutes, or turned off.

1. Click the Interval Recording dropdown and select a parameter.
2. Click **Receive** to begin automatically transferring the measured values to the data sheet.

Do not press any key on the meter during Interval Recording mode, as this may interrupt communication.

Creating an Excel File

1. Click **Save as Excel** to open the Save As dialog.
2. Enter a file name, then click **Save**.

Once the software is closed, all received measurement values will be lost and cannot be recovered.

Specifications and **Troubleshooting**

This section is applicable to all models of meters

Meter Specifications

pH

Range	-2.000 to 20.000 pH
Resolution	0.001, 0.01, 0.1 pH
Accuracy	±0.002 pH
Calibration Points	1 to 5 points
pH Buffer Options	USA (pH 1.68, 4.01, 7.00, 10.01, 12.45)
	NIST(pH 1.68, 4.01, 6.86, 9.18, 12.45)
	DIN (pH 1.09, 4.65, 6.79, 9.23, 12.75)
Temperature Compensation	0 to 100°C (32 to 212°F)

ORP

Range	-1999.9 to 1999.9 mV
Resolution	0.1, 1 mV
Accuracy	±0.2 mV
Calibration Point	1 point (only for relative mV mode)

Ion Concentration

Range	0.001 to 19999 ppm, mg/L, mol/L, mmol/L
Resolution	0.001, 0.01, 0.1, 1
Accuracy	±0.5% F.S. (monovalent)
	±1% F.S. (divalent)
Calibration Points	2 to 5 points
Calibration Solutions	0.001, 0.01, 0.1, 1, 10, 100, 1000, 10000
Temperature Compensation	0 to 100°C (32 to 212°F)

Water Hardness

Range	0.05 to 200 mmol/L
Resolution	0.001, 0.01, 0.1, 1
Accuracy	±1% F.S.
Calibration Point	2 to 5 point
Calibration Solutions	0.001, 0.01, 0.1
Temperature Compensation	0 to 50°C

Conductivity

Range	0.01 to 20.00, 200.0, 2000 µS/cm,
	20.00, 200.0 mS/cm
Resolution	0.001, 0.01, 0.1, 1

Accuracy	±0.5% F.S.
Calibration Points	1 to 5 points
Calibration Solutions	10 µS/cm, 84 µS/cm, 1413 µS/cm, 12.88 mS/cm, 111.8 mS/cm
Temperature Compensation	0 to 100°C (32 to 212°F)
Temperature Coefficient	Linear (0.0 to 10.0%/°C) Pure water
Reference Temperature	20°C or 25°C
Cell Constant	K = 0.1, 1, 10 or custom

TDS

Range	0.00 to 200.0 ppt
Resolution	0.01, 0.1, 1
Accuracy	±1% F.S.
TDS Factor	0.1 to 1.0 (default 0.5)

Salinity

Range	0.00 to 80.00 ppt, 0.00 to 42.00 psu
Resolution	0.01
Accuracy	±1% F.S.

Resistivity

Range	0.00 to 20.00 MΩ
Resolution	0.01, 0.1
Accuracy	±1% F.S.

Dissolved Oxygen

Range	0.00 to 20.00 mg/L 0.0 to 200.0% saturation
Resolution	0.01, 0.1
Accuracy	±0.2 mg/L, ±2.0%
Calibration Points	1 or 2 points
Temperature Compensation	0 to 50°C (32 to 122°F)
Pressure Correction	60.0 to 113.3 kPa, 450 to 850 mmHg
Salinity Correction	0.0 to 50.0 g/L

Temperature

Range	0 to 105°C (32 to 221°F)
Resolution	0.1°C (0.1°F)
Accuracy	±0.5°C (±0.9°F)
Calibration Point	1 point

Other Specifications

Memory	500 data sets
Communication Interface	USB-A
Operating Temperature	0 to 50°C (32 to 122°F)
Storage Temperature	0 to 60°C (32 to 140°F)
Relative Humidity	< 80% (non-condensing)
Display	LCD, 80 × 60 mm (3.15 × 2.36 in.)
Power Requirements	3 × 1.5V AA alkaline batteries or DC 5V power adapter
Dimensions	170 (L) × 85 (W) × 30 (H) mm (6.69 × 3.35 × 1.18 in.)
Weight	300 g (10.5 oz.)

Troubleshooting

Fault	Cause and Corrective Action
Screen shows - - - -	Electrode dried out. Soak the pH electrode in 3M KCl solution for about 30 minutes. Soak the ion selective electrode in 100 ppm standard solution for about 30 minutes. Soak the conductivity electrode in tap water for about 10 minutes.
	Measurement exceeded the maximum range. Check the electrode and sample.
Drifting erratic readings	Check whether electrode is contaminated, clogged or broken.
Screen shows Err	pH buffer problem. Use freshly prepared buffer solutions to calibrate the meter.
	Electrode has expired. Replace pH electrode.
	DO electrolyte solution is depleted. Refilling electrolyte solution.
	Zero oxygen solution is contaminated. Replace the calibration solution.
Keypad is not working	Replace the batteries.

Disposal

This product is required to comply with the European Union's Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC and may not be disposed of in domestic waste. Please dispose of product in accordance with local regulations at the collecting point specified for electrical and electronic equipment.

Warranty

The warranty period for meter is one year from the date of shipment. Above warranty does not cover the electrodes and standard solutions. Out of warranty products will be repaired on a charged basis.

The warranty on your meter shall not apply to defects resulting from:

- Improper or inadequate maintenance by customer
- Unauthorized modification or misuse
- Operation outside of the environment specifications of the products

For more information, please contact the supplier.

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