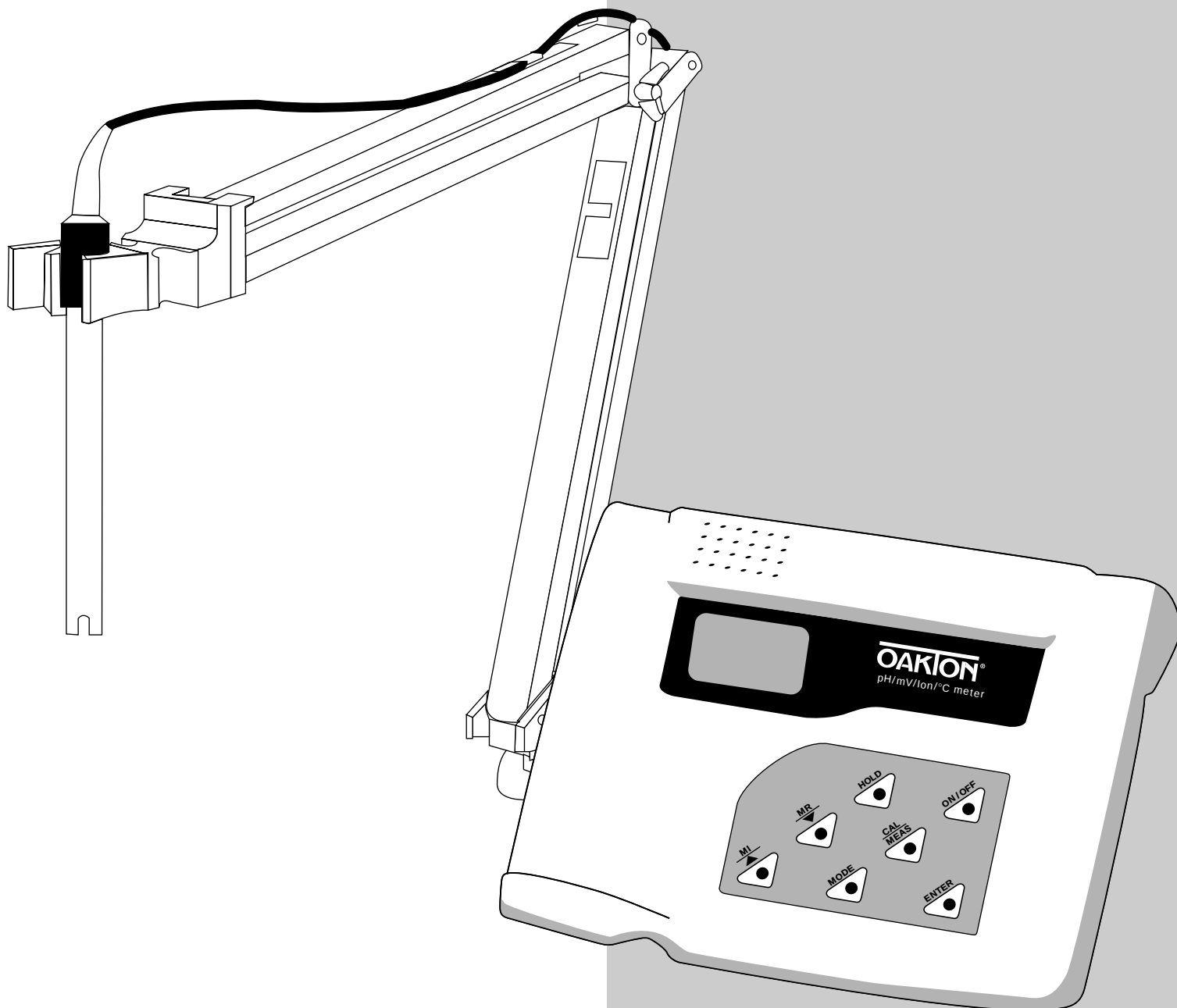


The **OAKTON**[®] pH 510 and Ion 510 Series Benchtop Meters



pH 510—pH/mV/°C meter

WD-35619-00, -02, -03, -05, -07,
-08, -10, -12, -15, -17

Ion 510—pH/Ion/mV/°C meter

WD-35619-20, -22, -23, -25, -27, -28

OAKTON[®]

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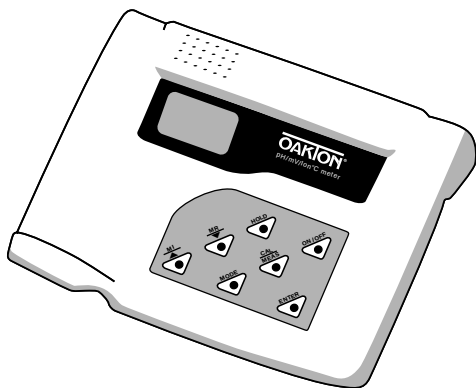
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Quick tip
let the mini table of contents in the outer
margins of this manual guide you instantly
to the right section



1. Introduction

Thank you for purchasing the OAKTON® WD-35619-series Benchtop meters. These meters are microprocessor controlled, user-friendly and reliable. The large customized LCD allows clear, easy operation. The display has mode annunciators for pH, temperature, mV and ion readings.

Keypad

See Figure 1.

A large membrane keypad with touch feedback makes the meter easy to use. Names and symbols describe the function button controls.

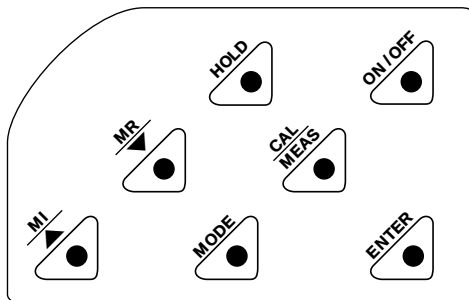


Figure 1

Key	Description
ON/OFF	Powers the meter ON/OFF . When the meter is switched on, it starts in the mode the meter was last in when powered down.
CAL/MEAS	Switches between the measurement and calibration modes of the meter. In SETUP mode, CAL/MEAS returns to the measurement mode.
MODE	pH 510: <i>Measurement:</i> MODE switches between pH and mV. <i>Calibration:</i> MODE switches from pH to temperature in the pH calibration mode (if MODE is pressed again, it will NOT switch back to pH). Ion 510: <i>Measurement:</i> MODE switches between pH, mV and ion. <i>Calibration:</i> MODE switches from pH to temperature in the pH calibration mode (if MODE is pressed again, it will NOT switch back to pH).
MI/▲	▲ Scrolls values in mV and temperature calibration mode. Selects calibration points in the ion calibration mode (Ion 510). Scrolls to the next program in the SETUP mode. MI inputs measurements into memory and scrolls through memory values.
MR/▼	▲ Scrolls values in mV and temperature calibration mode. Selects calibration points in the ion calibration mode (Ion 510). Scrolls to the previous program in the SETUP mode. MR recalls measurements from memory and scrolls through memory values.
HOLD	Freezes a measurement on the display. Press again to get current readings.
ENTER	Confirms and enters the value selected for calibration. Enter also functions in the memory mode.

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Rear Panel

See Figure 2.

The OAKTON® WD-35619-series meters provide a complete set of input connections for the various accessories commonly used. Listed in the table below are details of the connections that you can make.

Connection	Function
ATC	Phono jack connection from the temperature probe for Automatic Temperature Compensation.
INPUT	For connection to sensor electrodes with BNC type connectors. The meter accepts any pH, ORP or ISE with BNC connector. Always make sure that the connector is clean and dry.
REF	For connection to pin type reference electrode normally used with half cell (mono) type pH electrodes or ISEs.
REC	For connection to strip chart recorders. Use subminiature plug with positive tip.
GND	For connection to the earth ground jack (standard tip connectors).
DC	For connection of the AC adapter power supply (included).

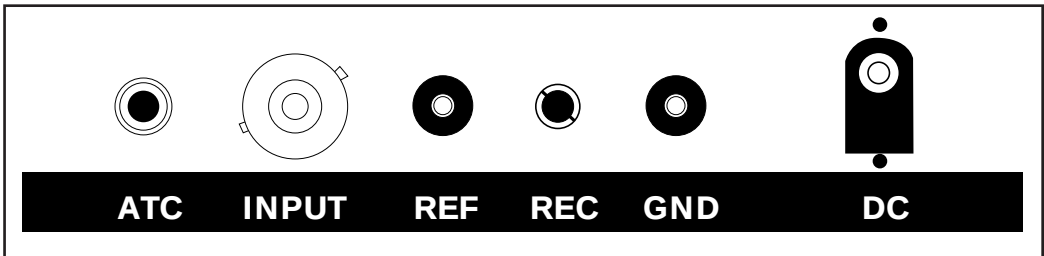


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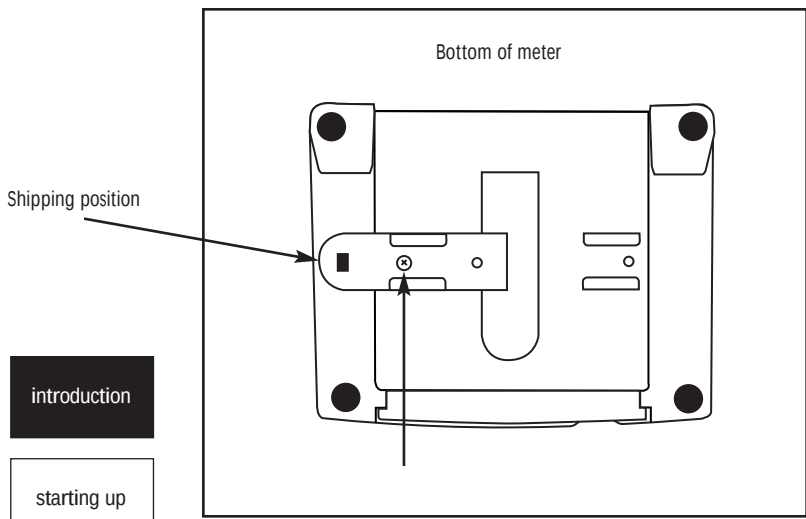


Figure 3

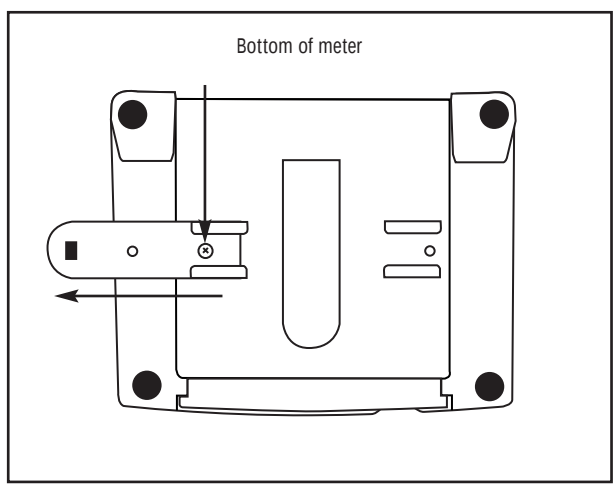


Figure 4

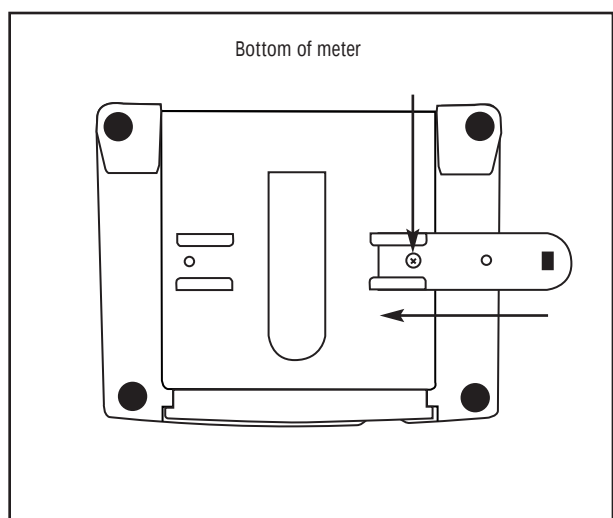


Figure 5

Optional Electrode Holder

If you have purchased a benchtop meter with the optional electrode holder, the electrode holder is included in the same box as the meter.

To attach the electrode holder to the meter:

1. The electrode holder base attached to the bottom of the meter comes in the shipping position.
— See Figure 3.
2. Use a Phillips screwdriver to remove the screw holding the electrode holder in shipping position.
— See Figure 3.
3. Slide the electrode base away from the meter until the second screw slot lines up with the original screw hole. Use the screw removed earlier to secure electrode holder base into position.
— See Figure 4.
4. The electrode holder arm is reversible. If desired, remove screw holding electrode holder base and slide base out of brackets. Slide base into brackets on opposite side and replace screw.
— See Figure 5.

5. To install the electrode arm, turn meter back to the upright position.
— See Figure 6.
6. Line up the hole on the base of the electrode holder arm with the peg on the electrode holder base. Slide the hole securely onto the electrode holder base.
— See Figure 7.

The electrode arm is now ready to swing into desired position.— See Figure 8.

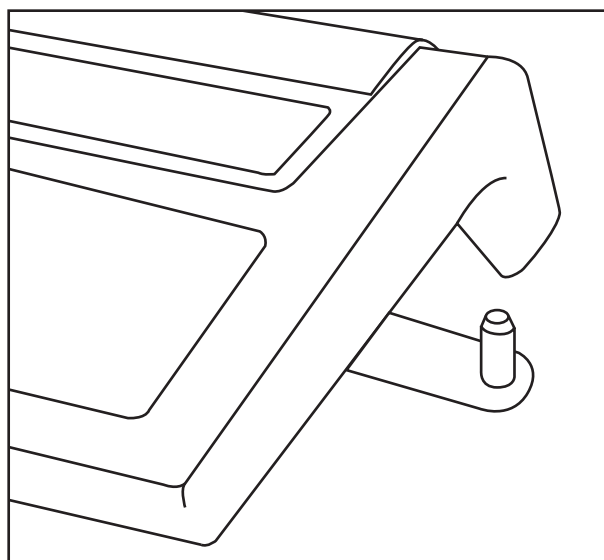


Figure 6

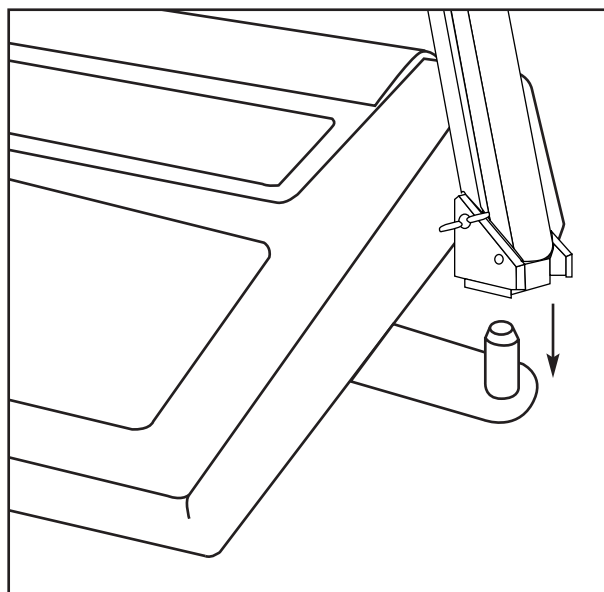


Figure 7

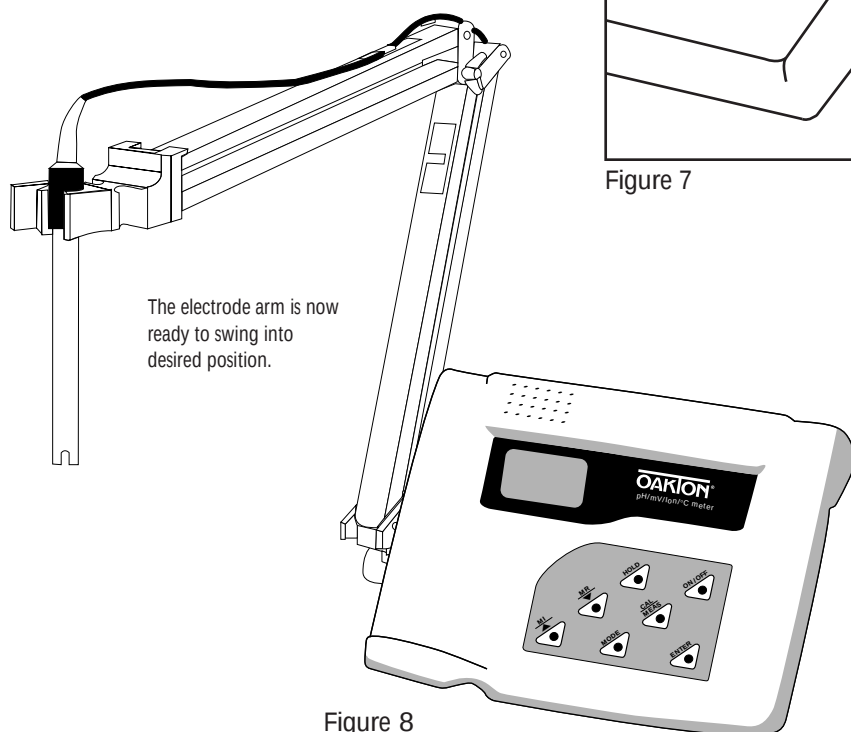


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2. Starting Up

Attention!

Do not get water on the BNC connector during operation. Avoid touching the connector with soiled or wet hands.

Back panel connections

See Figure 9 .

- 1. Connect the AC adapter** from an AC power source to the power jack (DC). Slide in the adapter jack of the A/C adapter into the meter until it is firmly seated. Voltage is set at 9V and the current is at 500 mA, (center positive connector).
- 2. Connect a sensor electrode** to the BNC input connector (**INPUT**). The meter can accept any pH, ORP, or Ion Selective Electrode with a BNC connector. Make sure the connector is clean and dry. Slide the electrode connector of the electrode over the BNC connector socket. Make sure the slots of the connector are in line with the posts of the socket. Rotate and push the connector clockwise until it locks. For separate reference electrodes, push electrode pin into jack marked "**REF**".
- 3. Connect a temperature probe** to the input jack marked **ATC**. Insert the probe into the jack marked with **ATC** on the rear of the instrument panel.
- 4. Connect your chart recorder** to the jack marked **REC**
You can connect chart recorders or other data collection devices. Plug in the sub miniature (2.5 mm) connector from the chart recorder into the jack marked with **REC**. Output signal is a mV signal equal to the measured electrode output. The tip of the connector is positive, the sleeve is negative

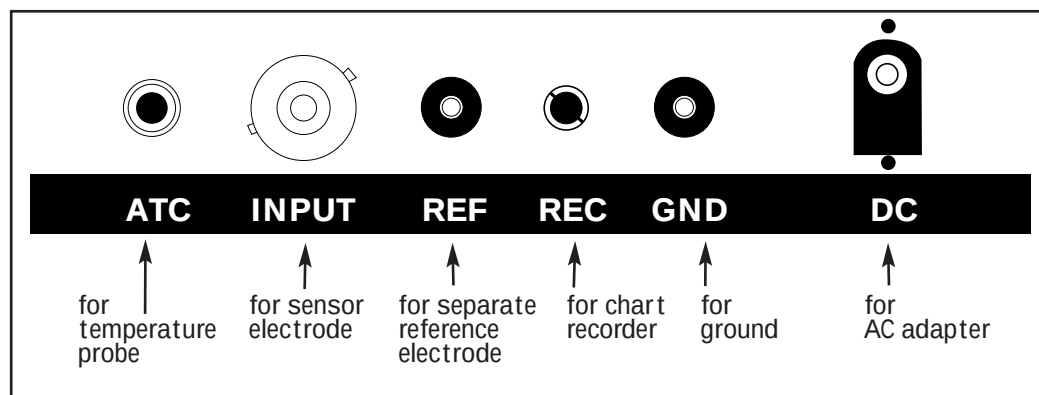


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3. pH calibration and measurement

For best accuracy calibrate at least a two points using fresh pH buffers. Select calibration buffers with calibration values closest to the measurement range you expect to work in. A three point calibration (USA buffers: 4.01, 7.01, and 10.01 or NIST buffers: 4.01, 6.86 and 9.18) ensures maximum accuracy throughout the measurement range.

For quick checks with less accuracy, perform a one point calibration. Select the buffer value closest to the measurement range you will work in.

If you choose to calibrate to only 1 or 2 pH values, the older calibration values you do not calibrate to will remain stored. These old stored calibration values may cause accuracy loss when your readings are close to the old stored calibration values. To clear old calibration data, reset the meter as shown in Section 8, Program 4.0 on page 23.

For ATC measurements, attach the temperature probe to the meter. The **ATC** mode annunciator shows on the display. —See Figure 10. Insert the probe into the solution to be measured so that the sample temperature can be recorded and pH readings automatically temperature compensate. If manual temperature compensation is preferred, do not plug a temperature probe into the meter.

DO NOT REUSE SOLUTIONS AFTER CALIBRATION.

Contaminants in the solution can affect the calibration, and eventually the accuracy of the measurements.

All new pH calibrations will over-ride existing stored pH calibration data at these calibration points. The meter retains stored pH calibrations even when the meter is turned **OFF**.

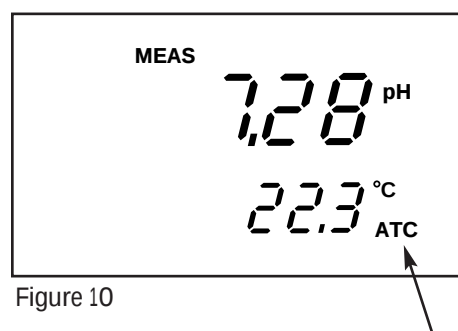


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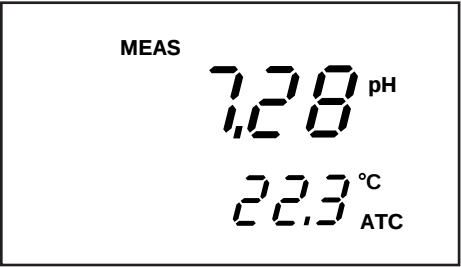


Figure 11

pH calibration

NOTE: We recommend that you perform at least a 2-point calibration using buffers that bracket (one above and one below) the expected sample range. You can perform a 1-point calibration, but make sure that the buffer value is close to the sample value you are measuring. Select pH 4, 7, or 10 buffers in pouches or bottles from the OAKTON standard buffer solutions.

1. Press the **ON/OFF** key. All the LCD segments display for a few seconds. The LCD switches to the last mode the meter was turned **OFF** in when powered down from the key pad. —See Figure 11

The customized LCD display will indicate the following:

Display	Remarks
MEAS	Measurement mode is selected.
pH	Unit of measurement
°C	Unit of temperature measurement
ATC	Automatic Temperature Compensation (if temperature probe or "All-in-One" probe is connected)

pH Calibration

1. Make sure the meter is **ON** and if necessary, press the **MODE** key to select pH mode. The pH indicator appears in the upper right hand corner of the display. —See Figure 11.
2. Rinse the electrode in deionized water or rinse solution. If using the ATC function with a separate temperature probe, rinse the temperature probe as well. **DO NOT WIPE THE pH OR TEMPERATURE PROBES DRY!** Wiping the probes causes static, and will create calibration and measurement instability.
3. Select the pH buffer and pour some into a CLEAN container.
4. Dip the probe into the calibration buffer. The end of the probe must be completely immersed into the sample. Stir the probe gently to create a homogeneous sample.
5. Press **CAL/MEAS** to enter the pH calibration mode. The **CAL** indicator appears. The primary display will show the measured reading while the smaller secondary display will indicate the pH standard buffer solution. —See Figure 12.
The meter automatically recognizes the buffers in the set you have selected in the **SETUP** mode (see page 23 for instructions on how to select buffer sets): USA (4.01, 7.00 or 10.01) or NIST (4.01, 6.86, or 9.18) buffers.
7. Wait for the measured pH value to stabilize (when the **READY** indicator displays in the left hand corner) —See Figure 13.



Figure 12

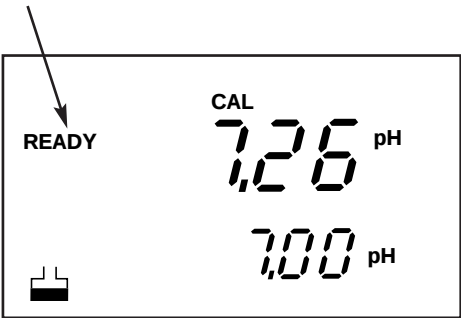


Figure 13

8. Press the **ENTER** button. The primary display flashes the calibration value. The calibration point is now stored in the meter. —See Figure 14.
 - If you are performing a one-point calibration, press **CAL/MEAS** to return to the measurement mode and start taking pH readings.
 - If you are performing a multi-point calibration go to step 9.
9. Rinse the probe with de-ionized water or a rinse solution, and place it in the next pH buffer. The meter automatically switches to the next buffer solution selected in the secondary display.
10. Wait for the measured pH value to stabilize (when the **READY** indicator displays in the left hand corner)
11. Press the **ENTER** button. The primary display flashes the calibration value. The calibration point is now stored in the meter.
 - If you are performing a two-point calibration, press **CAL/MEAS** to return to the measurement mode and start taking pH readings.
 - If you are performing a three-point calibration go to step 12.
12. Rinse the probe with de-ionized water or a rinse solution, and place it in the next pH buffer.
13. Wait for the measured pH value to stabilize (when the **READY** indicator displays in the left hand corner).
14. Press the **ENTER** button. The primary display flashes the calibration value. The calibration point is now stored in the meter. The meter automatically returns to the pH measurement mode after a three-point calibration is performed.

NOTES:

To exit from pH calibration mode without confirming calibration, **DO NOT** press **ENTER** in step 8. Press **CAL/MEAS** instead.

If the selected buffer value is not within the accepted window (see below) from the measured pH value: the electrode and buffer icon blink and **ERR** annunciator appears next to the secondary display. Press **CAL/MEAS** to exit the **ERR** condition.

—See Figure 15.

Window of Accepted Values:

USA	4.01	±1.00
	7.00	±1.50
	10.01	±1.00
NIST	4.01	±1.00
	6.86	±1.25
	9.18	±1.00

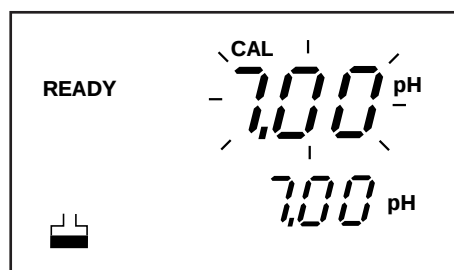


Figure 14

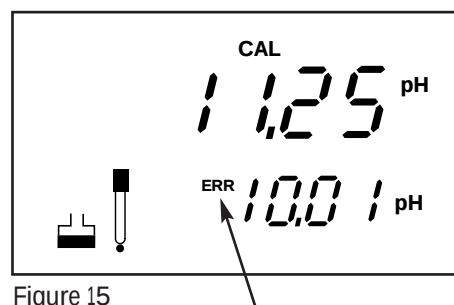


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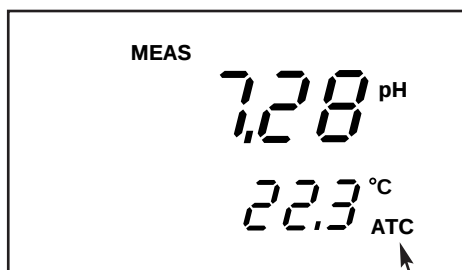


Figure 16

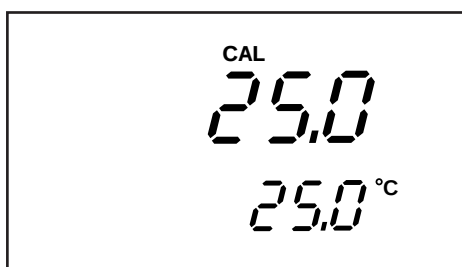


Figure 17

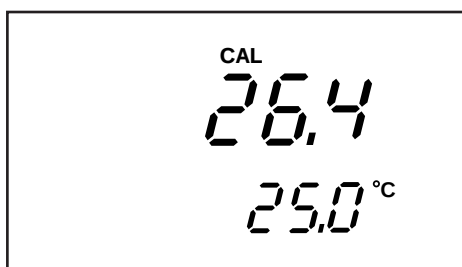


Figure 18

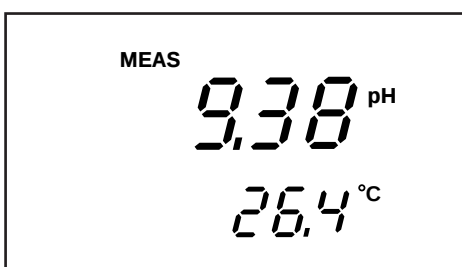


Figure 19

pH Measurement

This meter is capable of taking measurements with automatic or manual temperature compensation. Automatic temperature compensation only occurs when a temperature sensor is plugged into the meter. If there is no temperature sensor plugged into the meter, the default setting is automatically 25°C (if the meter has never been manually set for temperature) or the last manually set value will display. You can manually set the temperature to match your working conditions using a separate thermometer.

Automatic Temperature Compensation

For automatic temperature compensation (ATC) simply plug the temperature probe into the meter (see page 8 for directions). The **ATC** indicator will light on the LCD.

—See Figure 16..

NOTE: If you are using a temperature probe, the probe must be submersed in the liquid you are measuring.

Manual Temperature Compensation

IMPORTANT: For manual compensation, you must disconnect the temperature probe.

1. Switch the meter on. Press the **MODE** key to select pH mode.
2. Press the **CAL/MEAS** key to enter pH calibration mode. The **CAL** indicator will appear above the primary display.
3. While the pH calibration mode, press the **MODE** key to enter temperature calibration mode. The primary display shows the current temperature setting and the secondary display shows the default value 25°C (if the meter has never been manually set for temperature) or the last manually set value if the meter has previously set for manual temperature compensation. If you have not set the current temperature setting the primary display will also show the default value of 25°C. —See Figure 17.
4. Check the temperature of your sample using an accurate thermometer.
5. Press the ▼ or ▲ keys to offset the temperature to the measured value from step 4. —See Figure 18.
6. Press **ENTER** to confirm the selected temperature and to return to the pH measurement mode.

The meter will now compensate pH reading for the manually set temperature. —See Figure 19.

NOTE: To exit this program without confirming the manual temperature compensation value, **DO NOT** press **ENTER** in step 6. Press **CAL/MEAS** instead.

Taking pH Measurements

Be sure to remove the electrode soaker bottle or protective rubber cap on the electrode before measurement.

To take readings:

1. Rinse the probe with deionized or distilled water before use to remove any impurities adhering to the probe body. If the pH electrode had dehydrated, soak it for 30 minutes in OAKTON electrode storage solution or a 2M-4M KCl solution.
2. Press **ON** to switch on meter. The **MEAS** annunciator appears on the top center of the LCD. The **ATC** indicator appears in the lower right hand corner to indicate Automatic Temperature Compensation if temperature probe is plugged. (For Manual Temperature Compensation see page 12)
—See Figure 20.
3. Dip the probe into the sample. When dipping the probe into the sample, the sensor or the glass bulb of the electrode must be completely immersed into the sample. Stir the probe gently in the sample to create a homogenous sample.
4. Allow time for the reading to stabilize. When the readings stabilize, a **READY** indicator displays. The **READY** mode shows the readings are stable within a range of ± 0.01 pH. When this occurs, **READY** appears on the top left corner of your display.
—See Figure 21.
5. To toggle between pH and mV in the pH 510, or to toggle between pH, mV and ion in the Ion 510, press the **MODE** key.

HOLD Function

This feature lets you freeze the value of pH and temperature, mV and temperature or Ion and mV (Ion 510 only).

HOLD can be used anytime when in **MEAS** mode.

1. To hold a measurement, Press the **HOLD** key while in measurement mode. "**HOLD**" will appear on the display. —See Figure 22.
2. To release the held value, press **HOLD** again. Continue to take measurements.

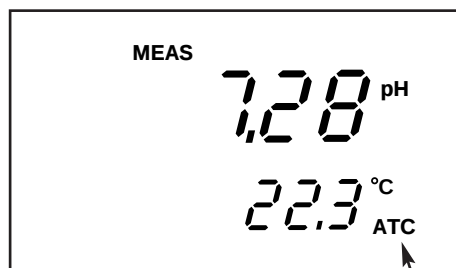


Figure 20

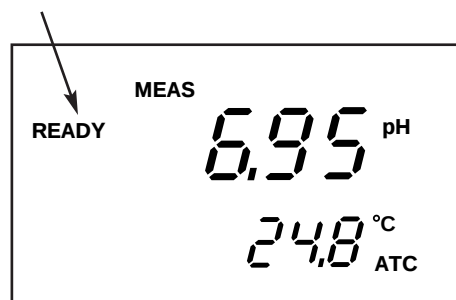


Figure 21

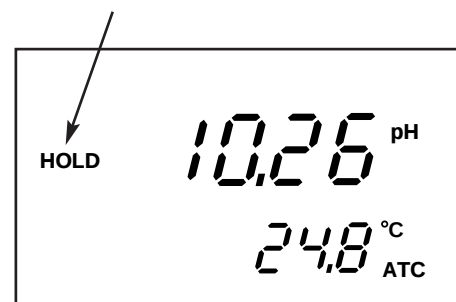


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4. mV calibration and measurement

mV calibration

The customized LCD display will indicate the following:

Display	Remarks
MEAS	Measurement mode is selected.
R.mV	Unit of measurement
°C	Unit of temperature measurement
ATC	Automatic Temperature Compensation (if temperature probe or "All-in-One" probe is connected)

mV Calibration

1. Make sure the meter is **ON** and if necessary, press the **MODE** key to select mV mode. The mV indicator appears in the upper right hand corner of the display. —See Figure 23.
 2. Press the **CAL/MEAS** key The **CAL** indicator appears above the primary display. The primary display shows the relative mV reading and the secondary display shows the absolute mV value. —See Figure 24.
- NOTE:** If you have never calibrated relative mV or if the meter has been reset, the value shown in the primary display is the same as the absolute mV value.
3. Press the ▲ or ▼ keys to enter the relative mV value that matches your desired reading. —See Figure 25.
 4. Press the **ENTER** key to confirm the reading and to return to the measurement mode. The primary display now shows the relative mV reading. The **R.mV** indicator appears in the upper hand corner. The meter automatically returns to the mV measurement mode the **ENTER** key is pressed. —See Figure 26.

NOTE: New mV calibrations will over-ride existing the stored mV calibration data. The meter retains stored mV calibrations even when the meter is turned **OFF**.

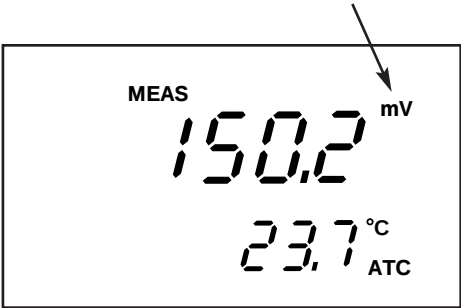


Figure 23



Figure 24

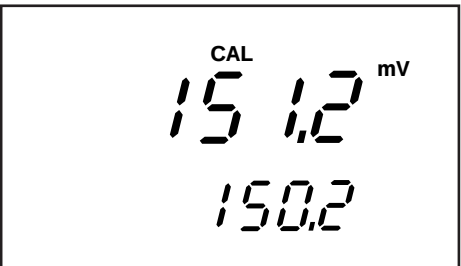


Figure 25

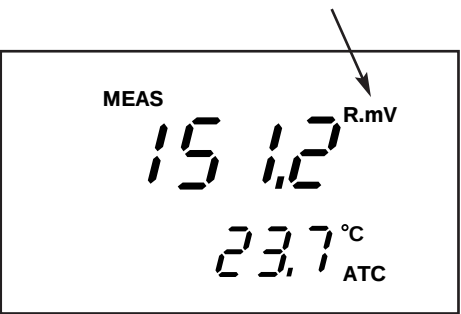


Figure 26

mV Measurement

1. Make sure you are in the mV measurement mode.
Press the **MODE** key to choose the mV mode.
2. Dip the electrode into the sample. The sensor or glass bulb of the electrode must be completely immersed into the sample. Stir the electrode gently to create a homogeneous sample.
4. Allow time for the reading to stabilize. The primary display will show the mV reading, and the secondary display will show the current temperature reading. When the readings stabilize, a **READY** indicator displays. The **READY** mode shows the readings are stable within ± 0.1 mV. When this occurs, **READY** appears on the top left corner of your display.
—See Figure 27.
5. To toggle between pH and mV in the pH 510, or to toggle between pH, mV and ion in the Ion 510, press the **MODE** key. —See Figure 28.

HOLD Function

This feature lets you freeze the value of pH and temperature, mV and temperature or Ion and mV (Ion 510 only). **HOLD** can be used anytime when in **MEAS** mode.

1. To hold a measurement, Press the **HOLD** key while in measurement mode. "**HOLD**" will appear on the display. —See Figures 29 and 30.
2. To release the held value, press **HOLD** again. Continue to take measurements.

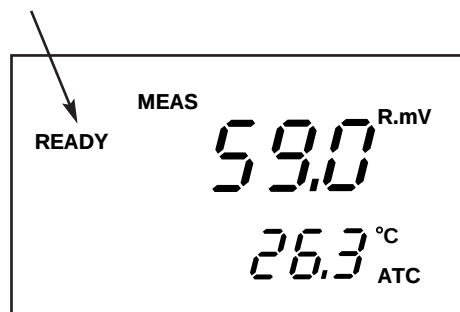


Figure 27

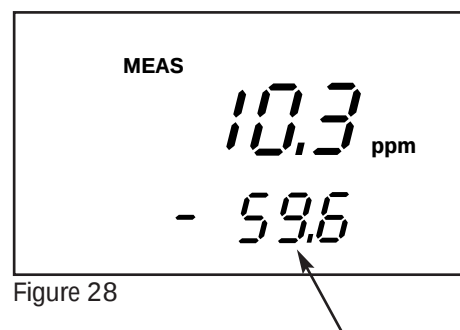


Figure 28

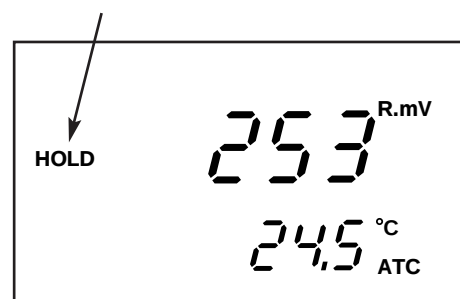


Figure 29

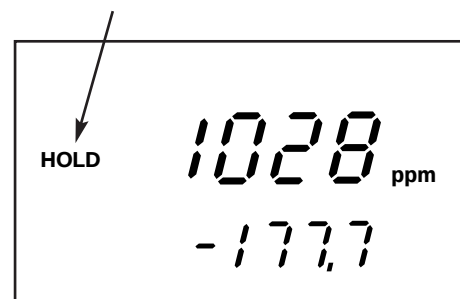


Figure 30

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5. Ion calibration and measurement (Ion 510 only)

Ion calibration

This instrument is capable of up to three-point ion calibration with a minimum of two-point calibration. Calibration values are 0.10, 1.0, 10.0 or 100.0. All calibration should be one decade apart. For example you may perform three-point calibration to 0.10, 1.0 and 10.0, or two-point calibration to 10.0 and 100.0. Do **NOT** perform two-point calibration to 1.0 and 100.0 the meter will display "**Er4**". For best accuracy calibrate your meter to points with similar concentrations to the solutions you want to test.

ION Calibration

The customized LCD display will indicate the following:

Display	Remarks
MEAS	Measurement mode is selected.
ppm	Unit of measurement

1. Connect an Ion Selective Electrode (ISE) to the BNC input connector on the back of the meter (See page 8) and turn the meter **ON**.
 2. Press **MODE** to select ion measurement mode. If the meter has not been previously calibrated in the Ion mode, the display will read "- - -" in the primary display —See Figure 31.
 3. Dip the electrode into the first calibration standard. Make sure to start with the calibration standard that has the lowest concentration and move up to the standards that have higher concentrations.
 4. Press **CAL** to enter the ion calibration mode. The **CAL** indicator appears above the primary display and primary display reads "**0.10**" —See Figure 32.
 5. The first calibration point of **0.10 ppm** appears on the display. If you do **NOT** wish to calibrate to this point, press **▲** (up arrow) to skip and continue to the next calibration point of 1.0 ppm or 10.0 ppm.
 6. If you **DO** wish to calibrate to 0.10 ppm, make sure the electrode is in the 0.10 calibration standard. The meter will display the mV output of your electrode in the standard solution in the lower display. Allow the mV reading to stabilize. When the reading stabilizes the **READY** indicator will appear on the display. —See Figure 33.
- Stabilization may take a few minutes depending on electrode and standard concentration. Electrode response in low concentrations is much slower than response in high concentrations.
7. Press **ENTER** to confirm your calibration. The primary display will flash for a few seconds —See Figure 34. The meter will move on to the next calibration standard of **1.0 ppm**.

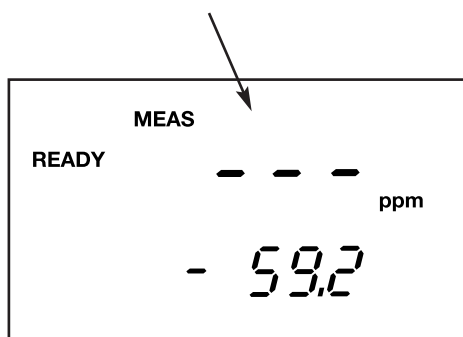


Figure 31

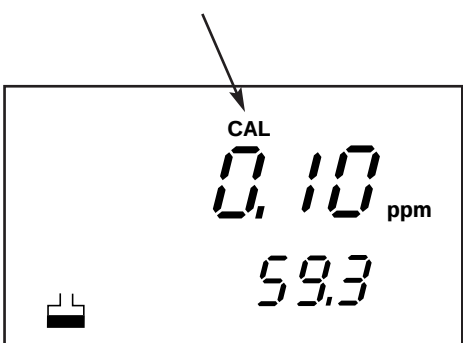


Figure 32

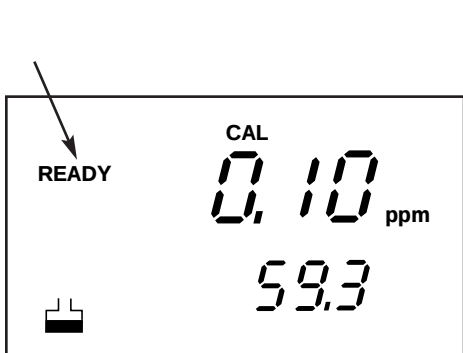


Figure 33

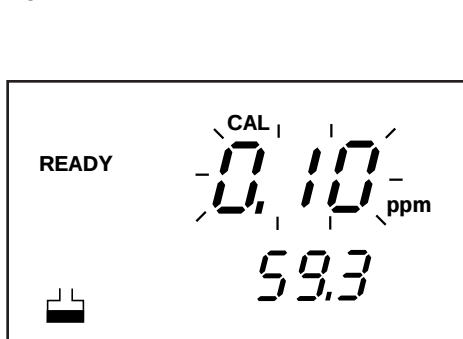


Figure 34

8. Rinse off the electrode with deionized water before placing it in the next calibration standard.
9. Allow meter to stabilize in the next calibration standard. Wait for the **READY** indicator to appear before you press the **ENTER** key to confirm the second calibration point. The primary display flashes for a few seconds then moves to the next calibration point of **10.0 ppm**.

If you are performing a 2-point ion calibration, press **CAL/MEAS**. "SLO" appears in the primary display with the mV indicator, the number in the secondary display is the actual electrode slope in mV. —See Figure 35. After a few seconds the meter reverts to the measurement mode. You are now ready to take ion measurements. If the slope is outside acceptable limits or if incorrect standards have been used the primary display will show **Er3**. —See Figure 36.

If you are performing a 3-point ion calibration, rinse off the electrode with deionized water and place it in the next calibration standard.

10. Allow meter to stabilize in the next calibration standard. Wait for the **READY** indicator to appear before you press the **ENTER** key to confirm the third calibration point. The primary display flashes for a few seconds then "SLO" appears in the primary display with the mV indicator, the number in the secondary display is the average electrode slope in mV. —See Figure 35. After a few seconds the meter reverts to the measurement mode. You are now ready to take ion measurement.

NOTES: You may compare the average electrode slope value with the expected slope value for your electrode from your electrode manual to verify electrode operation.

If you want to leave the calibration mode prior to confirming two calibration points, press the **CAL/MEAS** key to exit the calibration mode. The meter will revert to back to the earlier calibration curve. If you have calibrated to two points pressing **CAL/MEAS** will confirm the new calibration

You must calibrate to at least two points in order for calibration to take effect. If you only confirm the one calibration point, the meter will display "Er2" when you exit the calibration mode, and the meter will revert back to the earlier calibration curve.—See Figure 37.

New ion calibrations will over-ride existing the stored ion calibration data. The meter retains stored ion calibrations even when the meter is turned **OFF**.

Ion calibrations will be erased if the power cord is unplugged or power is cut off to the AC adapter even if the meter is turned off.

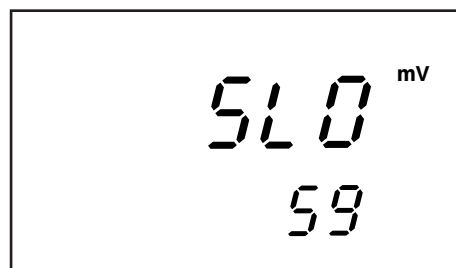


Figure 35

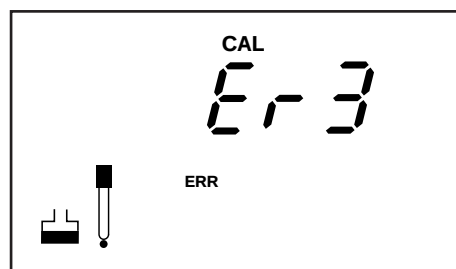


Figure 36

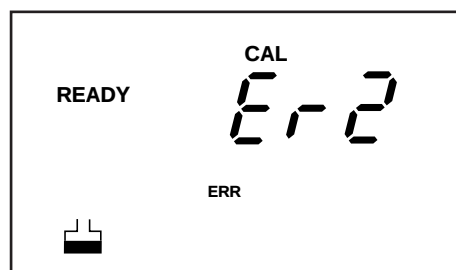


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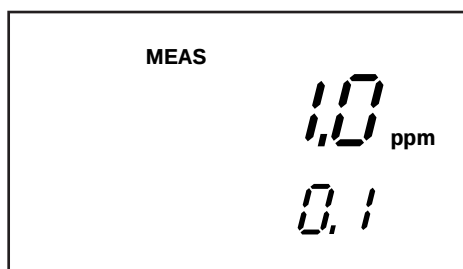


Figure 38

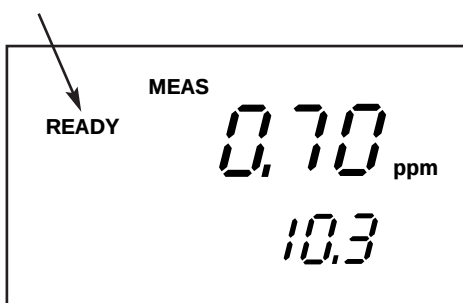


Figure 39

Ion measurement

1. Turn meter **ON**. Press **MODE** to select ion measurement mode. —See Figure 38.
2. Prepare samples as necessary (i.e. add Ionic Strength Adjuster). Sample preparation varies depending on ion type—see your electrode manual for details on the specific electrode that you are using.
3. Dip electrode into the sample. The sensor or glass bulb of the electrode must be completely immersed into the sample.
4. Allow time for the reading to stabilize. When the readings stabilize, a **READY** indicator displays. The **READY** indicator shows when the readings are stable. When this occurs, **READY** appears on the top left corner of your display. The reading holds until the measured value fluctuation exceeds the set limits. —See Figure 39.

NOTE: The lower display in the ion measurement mode shows mV that correlates to the electrode output. Change in mV will typically be 59.7 mV for monovalent ions (1^+ or 1^- charge) and 29.8 mV for divalent ions (2^+ or 2^- charge).

HOLD Function

This feature lets you freeze the value of pH and temperature, mV and temperature or Ion and mV (Ion 510 only).

HOLD can be used anytime when in **MEAS** mode.

1. To hold a measurement, Press the **HOLD** key while in measurement mode. "**HOLD**" will appear on the display—See Figure 40.
2. To release the held value, press **HOLD** again. Continue to take measurements.

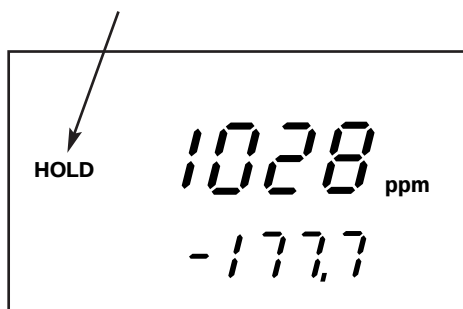


Figure 40

6. Memory functions

Memory Input

Your meter can store up to 50 sets of data in any combination of values:

pH 510 meter:

- pH and temperature
- mV (or relative mV) and temperature.

Ion 510 meter:

- pH and temperature
- mV (or relative mV) and temperature.
- ion and mV

For example, you can store 32 pH and 18 mV values for the pH 510 or 15 ion, 12 mV and 23 pH values for the Ion 510.

To store a readings:

1. During any measurement or HOLD function, press the **MI** key to input any data into the memory
2. **MEM**, “**StO**” and memory number will flash. The meter then returns to measurement mode.
—See Figure 41.

NOTE: If the memory is full, the first value stored will be erased to create space for the new value.

Memory Recall

This function recalls the previous readings stored in the memory. You can only access MR from the measurement mode. Memory recall is in “Last In First Out” order.

To recall readings:

1. Press the **MR** key once to retrieve the last reading stored. The memory location screen—**MEM**, “**LOC**” and the memory number—will flash on the display. —See Figure 42.
2. Press the **ENTER** key to recall the reading stored under that memory number. —See Figure 43.
3. Press the **ENTER** key again to return to the memory location screen. The display automatically moves to the next memory location screen. —See Figure 44.
4. If necessary, press the ▲ key to select the next memory location screen; press the ▼ key to select the previous memory location screen.
5. Repeat steps 2-4 to review additional stored data sets.
6. To exit Memory Recall, press the **MEAS** key to return to the measurement mode.

NOTES: Readings stored in memory are retained even if the unit is turned off. To erase all readings stored in memory, see program P1.0 on page 21.

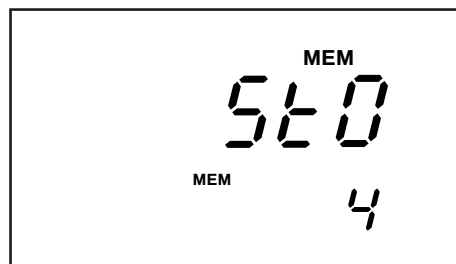


Figure 41

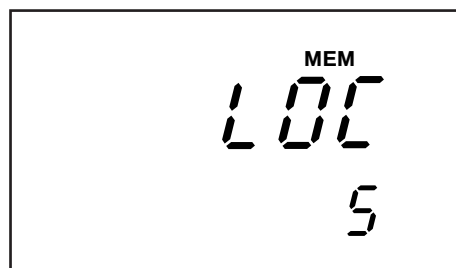


Figure 42

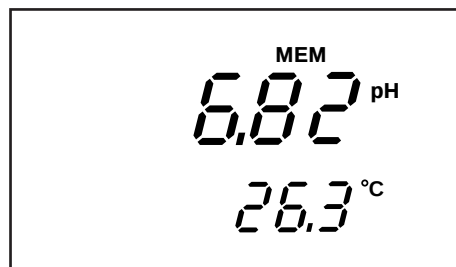


Figure 43

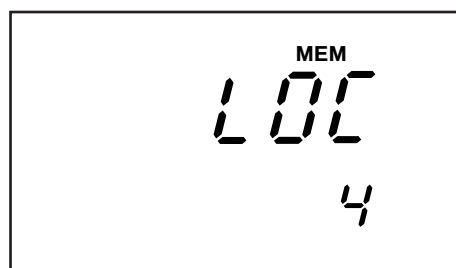


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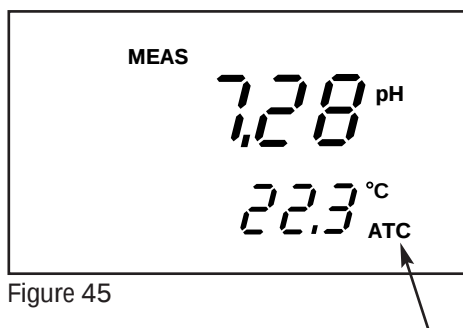


Figure 45

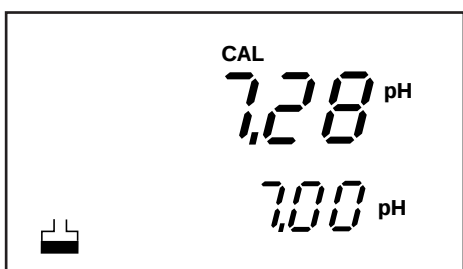


Figure 46

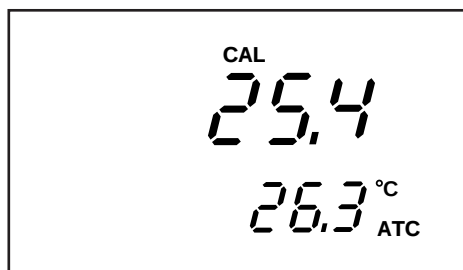


Figure 47

7. Temperature calibration

Temperature Calibration

In this calibration procedure, the ATC probe is attached to the meter and the **ATC** annunciator displays on the right hand side of the LCD.—See Figure 45.

1. Dip the temperature probe into a solution of known temperature, such as a temperature bath for a few minutes until the temperature probe stabilizes.
2. To perform temperature calibration, you must be in the pH measurement mode.
3. Press **MODE** to switch to the pH measurement mode if you are in the mV or ion measurement modes.
4. Press **CAL/MEAS** to enter pH calibration mode.
—See Figure 46.
5. Press **MODE** again to switch to temperature calibration
—See Figure 47.
6. Press **▲** and **▼** to scroll to the correct temperature value corresponding to the known solution temperature. The meter allows a limit of $\pm 5^{\circ}\text{C}$ variation (with 0.1°C resolution) of the input reading, and of the original displayed reading.
7. Once you select the correct temperature, press **ENTER** to confirm. The meter automatically returns to the pH measurement mode.

NOTE: The meter will not allow input values that exceed the allowable limit of $\pm 5^{\circ}\text{C}$ of the original displayed reading.

8. Setup Mode

The advanced **SETUP** mode lets you customize your meter's preferences and defaults:

- P1.0:** Memory clear (**CLr**)
- P2.0:** Viewing electrode data (**ELE**)
- P3.0:** Selecting buffer sets (**bUF**)
- P4.0:** Reset to factory default settings (**rSt**)

To enter the **SETUP** mode:

1. Turn meter **OFF**.
2. With meter off, press and hold the **MODE** key.
Continue to hold down the **MODE** key while pressing and releasing the **ON** key. The will show the **SETUP** indicator. —See Figure 48. Release the **MODE** key if the **SETUP** indicator is present. If the display indicates you are in the measurement mode (**MEAS** indicator) turn the meter off and try step 2 again until **SETUP** appears.

NOTE: To exit the **SETUP** mode at anytime without confirming changes press **CAL/MEAS** until the measurement mode reappears. If the meter is inside a program, press **CAL/MEAS** two times to revert the meter to the measurement mode.

P1.0: Memory Clear

Use this program to clear all memory values when you need to store a new series of values. This lets you avoid confusing the old values with the new ones. **NO** is the default setting.

1. Enter the **SETUP** mode as described above. The meter automatically goes to program **P1.0**. **CLr** appears in the primary display and **P1.0** in the secondary display.
—See Figure 48.
2. Press the **ENTER** key to enter program **P1.0**.
3. Press **▲** and **▼** keys to toggle between **NO** and **YES**.
—See Figures 49 and 50.
 - **NO** retains current memory values.
 - **YES** clears all memory
4. Press **ENTER** to confirm selection and return to the **SETUP** mode. Press **CAL/MEAS** to return to the measurement mode.

To continue to the next **SETUP** program, press the **▲** or **▼** keys to select a new program.

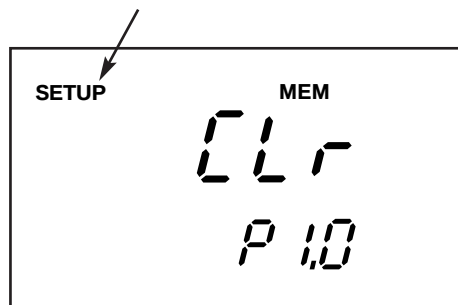


Figure 48

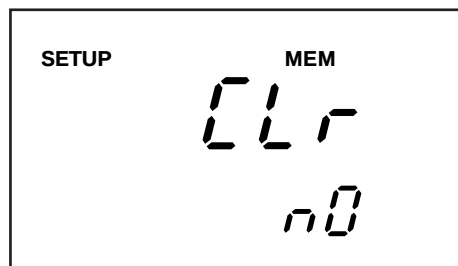


Figure 49

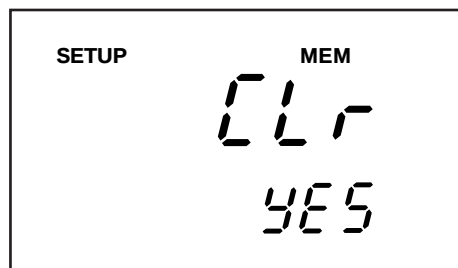


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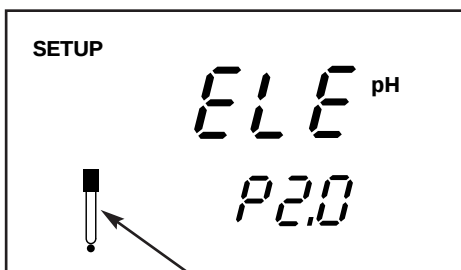


Figure 51

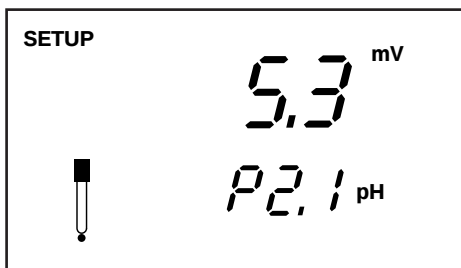


Figure 52

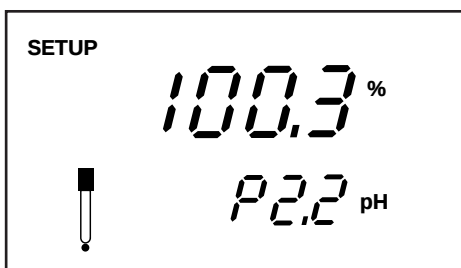


Figure 53

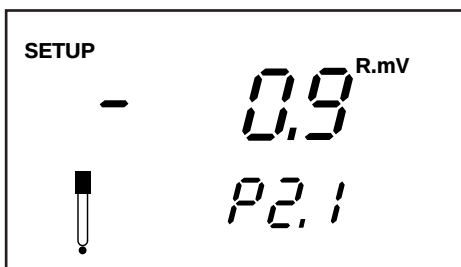


Figure 54

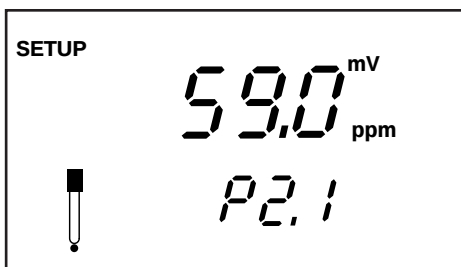


Figure 55

P2.0: Viewing electrode data

This program lets you check the electrode parameters for diagnostic purposes.

1. Enter the **SETUP** mode as described on page 21. The meter automatically goes to program **P1.0**.
2. Press **▲** and **▼** keys to scroll through the programs until you view **ELE** in the primary display and **P2.0** in the secondary display. The electrode annunciator also appears.

—See Figure 51.

3. Press the **ENTER** key to enter program **P2.0**. The secondary display will read **P2.1**

The information you will see in program **P2.0** will depend upon which **MODE** the meter was in prior to shutting the meter off:

From the pH measurement MODE:

P2.1 shows the mV offset of the electrode.

Press **ENTER** to go to **P2.2**

P2.2 shows the slope in % of the electrode.

—See Figures 52 and 53.

From the mV measurement MODE:

P2.1 shows the mV offset of the electrode

—See Figure 54.

From the ion measurement MODE (Ion 510 only):

P2.1 show the slope in mV of the electrode

—See Figure 55.

4. To exit **P2.0** program press **ENTER** until **ELE** is in the primary display and **P2.0** is in the secondary display
—See Figure 51. press the **▲** or **▼** keys to select a new program OR press **CAL/MEAS** to return to the measurement mode.

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P3.0: Selecting buffer sets

This program lets select between two standard calibration buffer sets, depending upon your requirements.

The available sets are USA and NIST.

1. Enter the **SETUP** mode as described on page 21. The meter automatically goes to program **P1.0**.
2. Press **▲** and **▼** keys to scroll through the programs until you view **buf** in the primary display and **P3.0** in the secondary display. The buffer annunciator also appears. —See Figure 56.
3. Press the **ENTER** key to enter program **P3.0**. The secondary display will read either **USA** or **nSt**.
4. Press the **▲** and **▼** keys to select the buffer set you require:
 - *USA buffers:* 4.01, 7.00 and 10.01
 - *NIST buffers:* 4.01, 6.86 and 9.18
5. To confirm the buffer set, press **ENTER**. All the characters on the display will flash for about a second then returns to **P3.0**.
6. To exit **P3.0** program press the **▲** or **▼** keys to select a new program OR press **CAL/MEAS** to return to the measurement mode.

P4.0: Resetting to factory default settings

This program resets and clears all calibration data and memory data EXCEPT the offset value in temperature calibration and manually set temperature for manual temperature compensation. **NO** is the default setting.

1. Enter the **SETUP** mode as described on page 21. The meter automatically goes to program **P1.0**.
2. Press **▲** and **▼** keys to scroll through the programs until you view **rSt** in the primary display and **P4.0** in the secondary display. The mV and pH annunciators also appear. —See Figure 59.
3. Press the **ENTER** key to enter program **P4.0**. The secondary display will read **NO**. —See Figure 60.
4. Press the **▲** and **▼** keys to select **NO** or **YES**. Selecting **YES** erases all calibration values for all modes (pH, mV and ion) and all memory values. —See Figures 60 and 61.
5. To confirm the reset, make sure **YES** is selected and press **ENTER**. All the characters on the display will flash for about a second then the meter returns to the measurement mode.

NOTE: Once **YES** is selected and the **ENTER** key is pressed, the reset program clears all old calibration data and memory data. The data is no longer retrievable. You must calibrate the meter before taking any new measurements. Meter will however retain buffer set selection (NIST or USA).

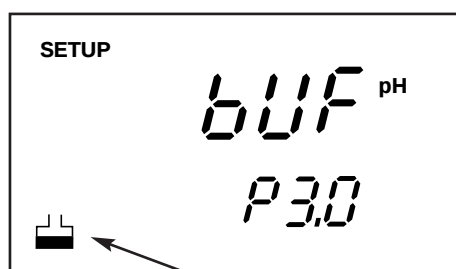


Figure 56

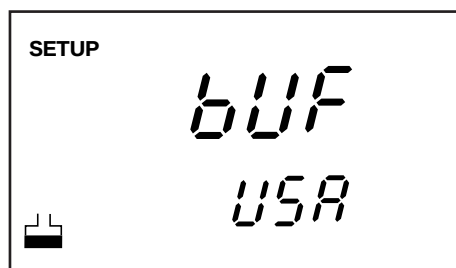


Figure 57

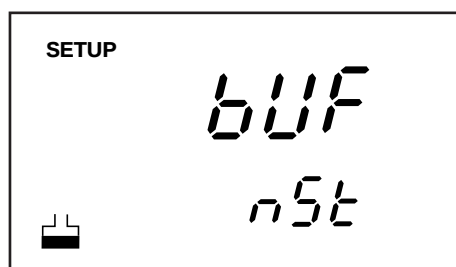


Figure 58

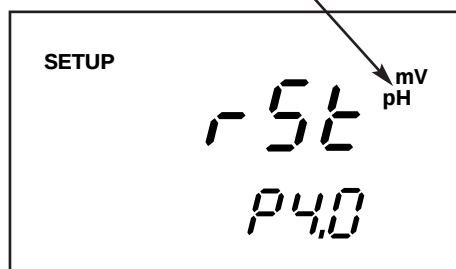


Figure 59

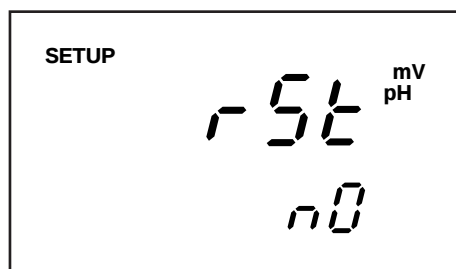


Figure 60

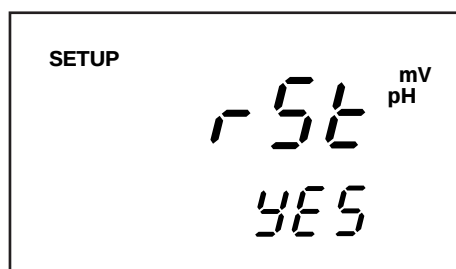


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9. Electrode Care

Electrode Activation

DO NOT touch or rub the glass bulb. If you follow the storing and maintenance procedure, you can use your electrode immediately. If the electrode responds sluggishly or drifts, the bulb may be dehydrated. Immerse the electrode in an ideal storage solution such as electrode storage solution or pH 4 buffer solution for 1-2 hours to hydrate it. See **Storing pH/ORP electrodes** below.

If this procedure does not hydrate the electrode, reactivate or replace it.

Use 2 or 3 point calibration to test your electrode performance. If you do not get good readings, use a different pH electrode to confirm the meter is working properly. If the results are still not satisfactory, consult your OAKTON distributor.

Electrode Maintenance

pH electrodes are susceptible to dirt dehydration and contamination. Clean them regularly depending on the extent and condition of use.

Storing pH/ORP electrodes

For best results, always keep the pH bulb wet, preferably in pH 4 buffer with 1% saturated KCl. Other pH buffers or tap water are also acceptable storage solutions. Do not store in de-ionized water. The protective rubber cap filled with buffer solution is an adequate method for storing pH electrodes.

OAKTON® offers a complete line of low cost electrode storage and cleaning solutions and containers.

After Use

1. After each series of measurements, wash the electrode and reference junction in deionized water.
2. If using a refillable electrode, close the refilling hole by returning its rubber sleeve or stopper plug over the opening in the side of the electrode. —See Figure 62.
3. Store the electrode as mentioned above.

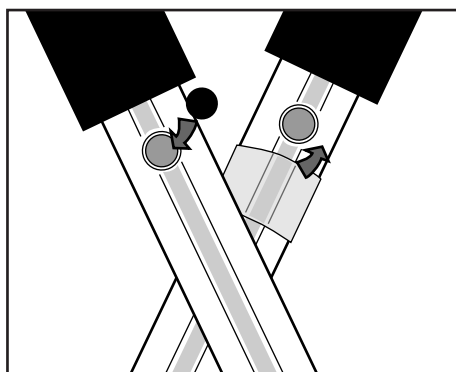


Figure 62

Electrode Cleaning

Electrodes that are mechanically intact can often be restored to normal performance by one or a combination of the following options.

Some suggestions for:

a. Salt deposits which are normal on all electrodes.

Dissolve the deposit by immersing the electrode in tap water for ten to fifteen minutes. Thoroughly rinse with de-ionized water.

b. General dirt and light oil coatings.

Soak the electrode for several hours in OAKTON general purpose electrode cleaning solutions. Rinse in deionized or distilled water.

c. Oil/Grease Films

Wash the electrode pH bulb in a little dish washing detergent and water. Rinse the electrode tip with de-ionized water.

d. Clogged reference junction

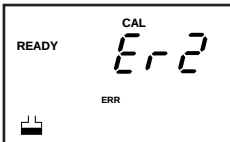
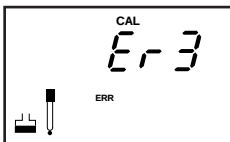
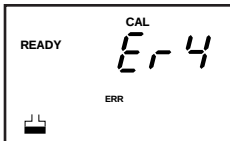
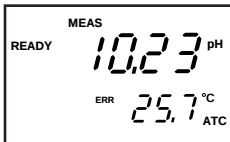
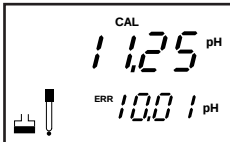
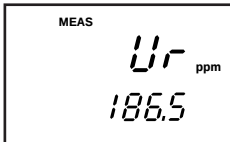
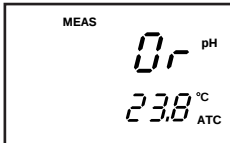
Heat a dilute 1% KCl solution or pH 4.01 buffer solution to 60-80°C. Place the sensing portion of the pH electrode into the heated KCl solution for approximately 30 minutes. Allow the electrode to cool while immersed in some unheated KCl solution or pH 4.01 buffer solution. Rinse with deionized water.

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10. Troubleshooting

Error Messages

The following table provides a guideline to enable diagnosis of possible problems indicated by the messages generated by the OAKTON WD-35619-series. The table also provides possible solutions to the problems encountered.

Error Message	Indicates	Cause	Corrective Action
Err. 2 (In primary display) During Ion calibration 	Too few calibration points	Meter calibrated with only 1-point in ion calibration	Recalibrate using 2 or more points
Err. 3 (In primary display) During Ion calibration 	Slope error	Calibration solution not within acceptable range Bad electrode	Recalibrate using fresh ion solutions Replace electrode
Err. 4 (In primary display) During Ion calibration 	Calibration points more than 1 decade apart	Calibration points more than 1 decade apart	Recalibrate using calibration points 1 decade apart
Err (In secondary display) 	Wrong keypad input.	Button does not work in the current operation mode.	Release key. Select valid buttons depending on mode.
Electrode icon (Indicator) 	Calibration error	Buffer value does not match value displayed or electrode is disconnected or failing.	Use fresh buffer or check electrode connection. Possibly replace electrodes.
Ur or Or (In primary display) 	Measured value out of range	Electrode not connected Meter not calibrated Electrode clogged, dirty or broken Measurement is under range or over range	Make sure electrode is connected Recalibrate meter Clean or replace electrode Treat samples to bring within meter measuring range
			

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Problem	Cause	Solution
Nothing is displayed when the ON/OFF key is selected.	a. AC outlet power not switched on. b. AC adapter socket not inserted properly.	a. Switch on the power supply b. Re-insert Ac adapter socket.
Unstable reading	a. Insufficient reference electrolyte in electrode. b. Broken electrode. c. Electrical field interference (electrical noise caused by a nearby motor or ultrasonic device). d. Dirty electrode	a. Fill electrode with reference electrolyte. b. Replace electrode. c. Remove or switch off interfering device. d. Clean the electrode. Hydrate if needed.
Slow response	a. Dirty electrode	a. Clean electrode. Hydrate if needed.
No response from keypad.	a. HOLD mode in operation Hold displayed. See LCD. b. Internal program error.	a. Cancel HOLD mode. Press Hold button. b. Reset all internal programs by removing A/C adapter from meter and re-inserting

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11. Additional Information

pH and Temperature

The pH electrode is affected by temperature changes. Automatic Temperature Compensation (ATC) compensates for temperature changes. Some solutions show an increase while others a decrease in pH with the same temperature change. Record the solution temperature along with the pH value, or the measurement may be meaningless. Temperature changes also affect the signal the pH electrode sends to the meter and causes a loss of accuracy for the reading. To limit the loss of accuracy during calibration, make the temperature of the pH buffer calibrating solutions and the sample solution the same.

pH Buffer Calibration Solution

Use standard buffer solutions to calibrate a pH meter before you measure the pH of a sample. Calibration solutions serve as basis of comparison between measurements. The most common standard buffers are the pH 4.01, pH 7.00 and pH 10.01. For 1-point calibration, use a standard buffer of pH 7.00 or a standard buffer whose pH value is close to that of the sample. Use 2-point calibration when you know the sample is acidic (low pH) or basic (high pH). For acidic samples, use standard buffers of pH 7.00 and pH 4.01. For basic samples, use standards of pH 7.00 and pH 10.01. Use a 3-point calibration when the sample pH is completely unknown. Use all pH 7.00, pH 4.01 and pH 10.01 calibration solutions. Contact your OAKTON® distributor for information on pH buffer and calibration solutions.

Standard pH Buffers

The following table shows the various pH values at different temperature of the solution during calibration.

The table also illustrates why a calibration value may be different from the buffer value at 25°C.

Temperature		pH buffer values		
°C	°F	4.01 (phthalate)	7.00 (neutral phosphate)	10.00 (carbonate)
0	32	4.01	7.12	10.33
5	41	4.01	7.09	10.25
10	50	4.00	7.06	10.18
15	59	4.00	7.04	10.11
20	68	4.00	7.02	10.05
25	77	4.01	7.00	10.00
30	86	4.01	6.99	9.95
35	95	4.02	6.98	9.92
40	104	4.03	6.98	9.88
45	113	4.04	6.97	9.85
50	122	4.06	6.97	9.82
55	131	4.07	6.98	9.80
60	140	4.09	6.98	9.77
70	158	4.12	6.99	9.73
80	176	4.16	7.00	9.69
90	194	4.20	7.02	9.66

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12. Specifications

Mode	pH 510	Ion 510
pH Range Resolution Accuracy Calibration	0.0 to 14.0 pH 0.01 pH ±0.01 pH 1 to 3 points USA: 4.01, 7.00, 10.01 NIST: 4.01, 6.86, 9.18	
mV Range Resolution Accuracy Calibration	-1999 to 1999 mV 0.1 mV between ±199.9 mV 1 mV beyond ±199.9 mV ±0.2 mV between ±199.9 mV ±2 mV beyond ±199.9 mV Offset up to ±150 mV	
Ion Range Resolution Accuracy Calibration Minimum slope Maximum slope		0.01 to 1999 ppm 0.01 ppm for 0.01 to 0.99 ppm 0.1 ppm for 1.0 to 199.9 ppm 1 ppm for 200 to 1999 ppm ±0.5% of full scale for monovalent ions 1% of full scale for divalent ions 2 to 3 points 0.1, 1, 10, 100 ppm 15 mV 90 mV
Temp Range Resolution Accuracy Calibration	0 to 100°C 0.1°C ±0.3°C Offset in 0.1°C increments; Offset range: ±5°C	

Temperature compensation: automatic (ATC) or manual from 0 to 100°C

Operating temperature: 0 to 50°C

Power: 9V DC adapter for 110 or 220 VAC

Display: Dual LCD

Connectors: pH/mV/Ion uses BNC connector, temperature uses mini-phono plug, recorder uses mini-pin (sub-mini phono plug)

Memory: Stores up to 50 readings

Recorder Output: ±1999 mV directly proportional to input

Power Requirements: 110 or 220 VAC depending upon model.

Input Impedance: $10^{12} \Omega$

Instrument Drift: < 50 $\mu\text{V}/^\circ\text{C}$

Input Bias Current: 50 pA max. at 25°C

Hold function: YES

ATC Function: 0.0 to 100.0°C

READY Indicator: YES

Meter Dimensions: 7.2" L x 9.2" W x 2.52" H (180 x 230 x 63 mm)

Shipping weight: 1.4 lbs (0.64 kg)

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13. Accessories

To order some accessories, contact your OAKTON® distributor and describe the items listed below.

WD-35613-05 ATC probe

WD-35615-07 110 VAC adapter

WD-35615-08 220 VAC adapter

WD-35801-00 OAKTON general purpose pH electrode

WD-35805-04 OAKTON general purpose double junction refillable liquid filled pH electrode. Glass body.

WD-35805-15 OAKTON general purpose double junction ORP electrode. Epoxy body.

WD-35811-71 OAKTON All-in-One single junction sealed gel filled general purpose pH electrode with temperature sensor. Epoxy body.

WD-00654-00 pH 4.01 buffer calibration solution, 1 pint

WD-00654-04 pH 7.01 buffer calibration solution, 1 pint

WD-00564-08 pH 10.00 buffer calibration solution, 1 pint

WD-35653-00 De-ionized rinse water pouches 20/box

WD-35653-01 pH 4.01 buffer calibration solution pouches 20/box

WD-35653-02 pH 7.01 buffer calibration solution pouches 20/box

WD-35653-03 pH 10.00 buffer calibration solution pouches 20/box

WD-35653-04 Buffer pouches assortment pack, 5 each pH 4, 7, 10 and rinse water

14. Warranty

OAKTON warrants this meter to be free from significant deviations in material and workmanship for a period of three years from date of purchase. OAKTON warrants this probe to be free from significant deviations in material and workmanship for a period of six months from date of purchase. If repair or adjustment is necessary and has not been the result of abuse or misuse within the warranted time period, please return—freight prepaid—and correction will be made without charge. OAKTON alone will determine if the product problem is due to deviations or customer misuse.

15. Return of items

Authorization must be obtained from our Customer Service Department before returning items for any reason. When applying for authorization, please include data regarding the reason the items are to be returned. For your protection, items must be carefully packed to prevent damage in shipment and insured against possible damage or loss. We will not be responsible for damage resulting from careless or insufficient packing. a restocking charge will be made on all unauthorized returns.

NOTE: We reserve the right to make improvements in design, construction, and appearance of products without notice

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