OPERATING INSTRUCTIONS

OAKTON® pH 100 Series

Portable pH/mV/°C Meter



Printed in Singapore. 8/00 Rev 6

OAKTON®

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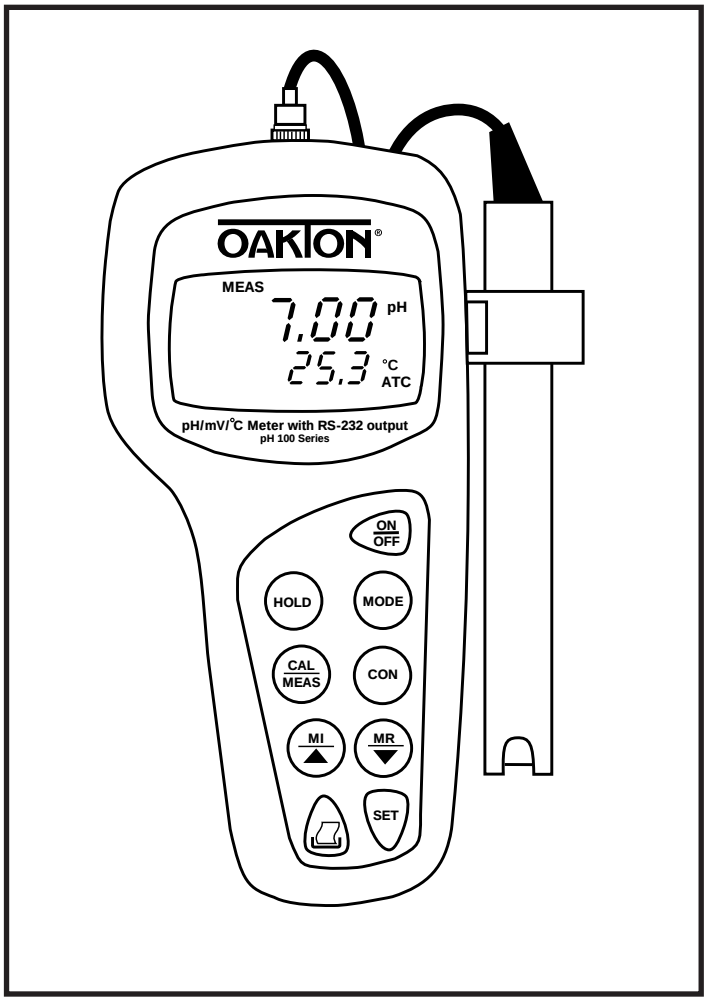
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1. Introduction

Thank you for selecting an OAKTON meter. The OAKTON pH/mV/°C portable meter is a microprocessor-based instrument that measures pH, mV, and temperature. This meter has many user-friendly features—all of which are completely accessible through the water-resistant membrane keypad.

Your meter includes two electrode holders, batteries and OAKTON PC Datalog Assist Software on a 3½" disk.

Please read this manual thoroughly before operating your meter.



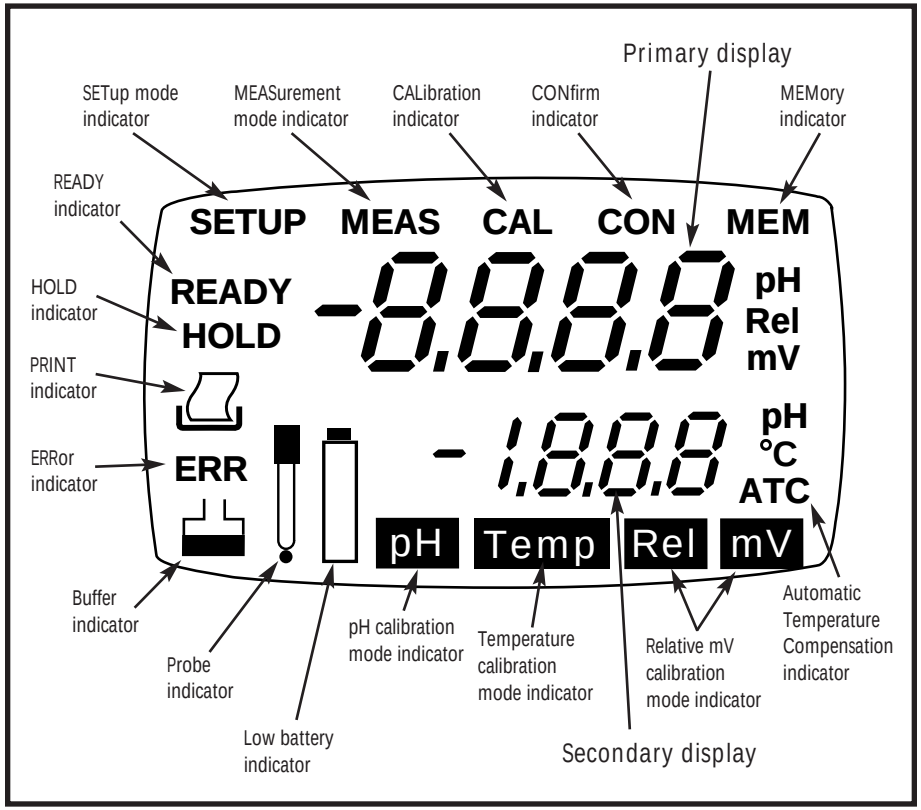
2. Display and Keypad Functions

2.1 Display

The LCD has a primary and secondary display.

- The primary display shows the measured pH or Relative mV reading.
- The secondary display shows the temperature of the reading in °C.

The display also shows error messages, keypad functions and program functions.



2.2 Keypad

The large membrane keypad makes the instrument easy to use. Each button, when pressed, has a corresponding graphic indicator on the LCD.

ON/OFF.....Powers and shuts off the meter.

HOLD .....Freezes the measured reading. To activate, press **HOLD** while in measurement mode. To release, press **HOLD** again

MODE.....Selects the measurement parameter (pH, mV or relative mV). Press MODE to toggle between pH, mV and relative mV mode.

CAL/MEAS.....Toggles user between Calibration and Measurement mode.

- If you were in pH Measurement mode, press **CAL/MEAS** to enter pH Calibration mode.
- If you were in mV Measurement mode, press **CAL/MEAS** to enter mV Calibration mode.

NOTE: Manual Temperature compensation is accessible from temperature mode; see page 17 for instructions.

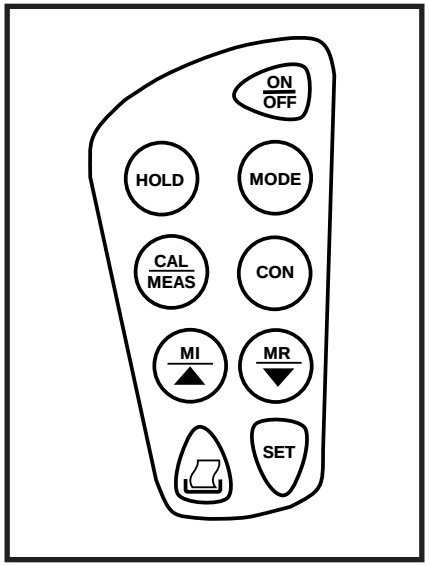
CON.....Press to confirm your calibration values in Calibration mode.

MI ▲ / **MR** ▼ .....▲ /▼ scrolls values up and down in Calibration mode.

MI/MR work in the measurement mode. **MI** (memory input) stores the measured value into memory. **MR** (memory recall) recalls the sets of values stored in the memory.

(PRINT).....Sends measurement to either the printer or computer.

SET.....Enters the SETUP mode. Lets you customize the preferences and defaults.

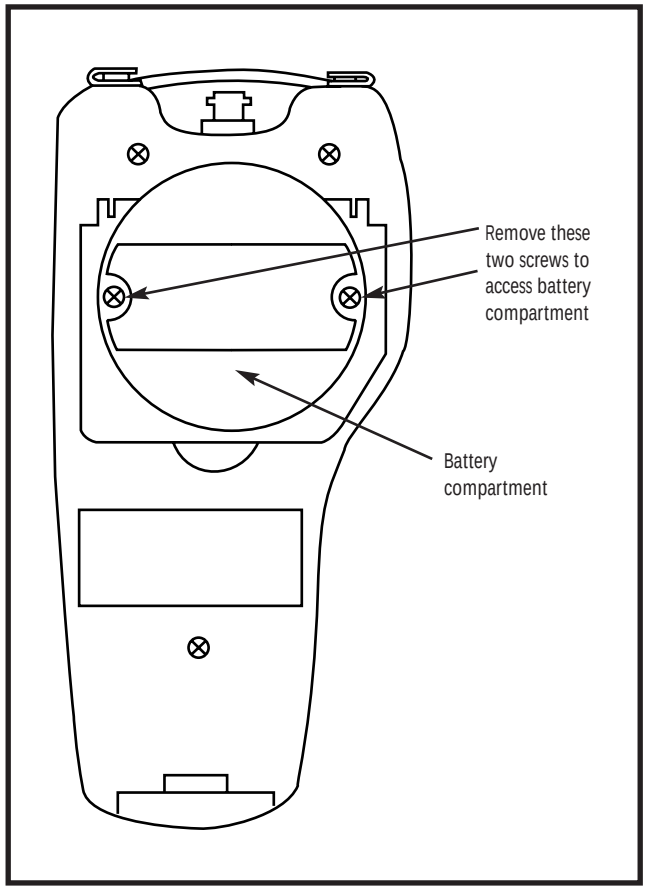


3. Preparation

3.1 Inserting the Batteries

Four AAA batteries are included with your meter.

1. Use a Phillips screwdriver to remove the two screws holding the battery cover. See figure below.
2. Lift meter stand to expose battery cover. Remove battery cover.
3. Insert batteries. Follow the diagram inside the cover for correct polarity.
4. Replace the battery cover into its original position using the two screws removed earlier.



3.2 Connecting the Electrode and Temperature Probe

The OAKTON pH / mV meter uses any standard pH, ORP, or ISE electrode with a BNC connector and separate temperature probe or an "All-in-One" combination pH / temperature probe.

NOTE: Keep connector dry and clean. Do not touch connector with soiled hands.

To connect the pH, ORP or ISE electrode:

1. Slide the BNC connector of the probe over the BNC connector socket on the meter. 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

See figure A

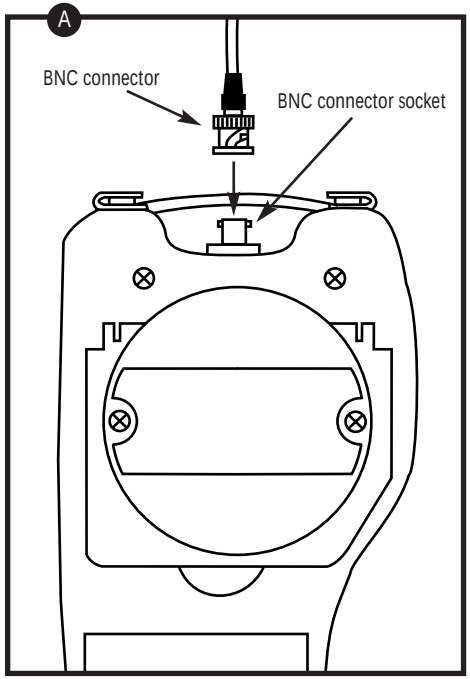
2. To remove probe, push and rotate the connector counter clockwise . While holding onto the metal part of the connector, pull probe away from the meter.

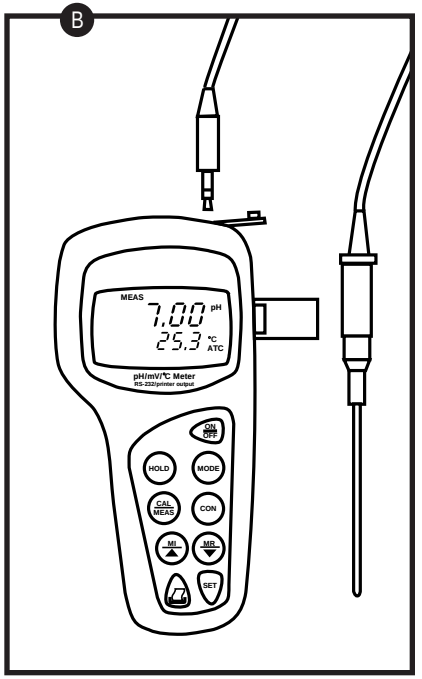
CAUTION: Do not pull on the probe cord or the probe wires might disconnect.

To connect the temperature probe:

1. Plug temperature in the phone jack as shown in figure B

Note: You should calibrate your temperature probe when you replace the probe and when using an OAKTON® "All-in-One" combination pH and temperature probe. See Temperature Calibration on pages 14-16 for instructions.





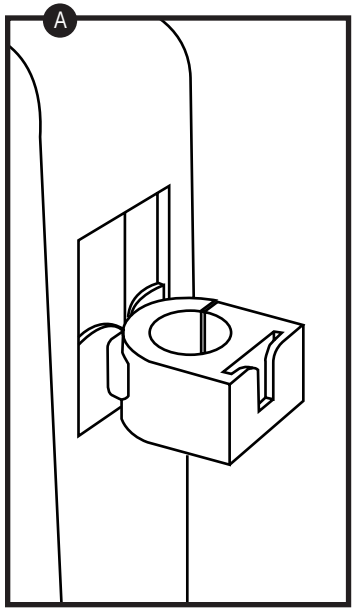
3.3 Attaching the Electrode Holder to the Meter

1. Place the electrode holder with the flange facing the slot on the meter. See Figure A
2. Gently slide the flange of the holder into the slot on the meter. Make sure the holder is secured properly into the slot.

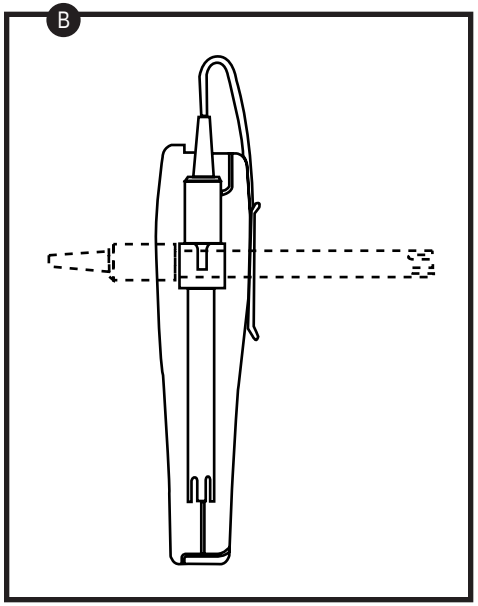
You can attach the electrode holder in different positions. See figure B

This flexibility facilitates one-hand operation.

A



B



3.4 Inserting the Electrode into the Electrode Holder

Two electrode holders are included with your meter.

NOTE: Do not use excessive force when inserting electrodes into the holders.

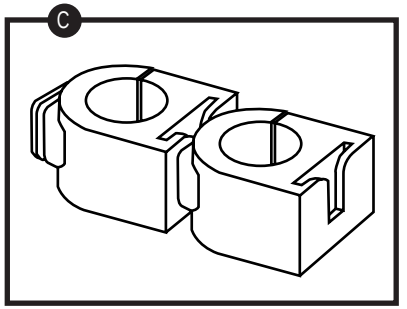
1. Insert the pH electrode into the opening of the holder until the top housing of the electrode touches the top of the holder.

NOTE: The holder is designed for probes 12 mm in diameter. Electrodes larger than 12 mm may not fit in the holder. Forcing the electrode into the opening may damage the holder or your electrode.

3.5 Attaching Two Electrode Holders

1. Align the flange of the second electrode holder with the slot of the first holder. See Figure C
2. Slide the flange of the second holder into the slot of the first holder until the tops of the holders are aligned and secure.

C

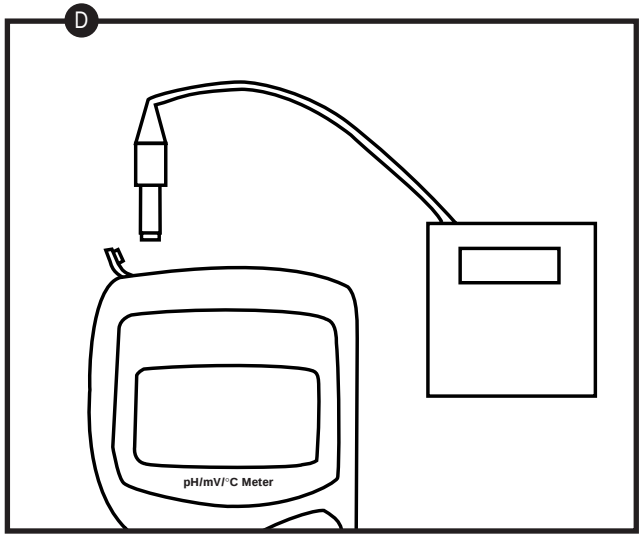


3.6 Connecting the AC Adapter

The AC adapter is not included with your meter; order separately on page 42.

1. Insert the AC jack as shown in figure D below.
2. **Switch off the meter before plugging the adapter into the power source.** This safety precaution protects the software in your meter.
3. Press the ON / OFF button to switch meter on.

D



4. Calibration

4.1 Important Information on Meter Calibration

When you recalibrate your meter, old pH, Rel mV and mV are replaced on a point by point basis. For example, if you previously calibrated your meter at pH 4.01, 7.00, and 10.01, and you recalibrate at pH 7.00, the meter retains the old calibration data at pH 4.01 and pH 10.01. To view current calibration points see Program 2 in the SETUP section, page 24.

To completely recalibrate your meter, or when you use a replacement probe, it is best to set the meter to its factory defaults and recalibrate the meter at all points. To reset the meter to its factory defaults see the SETUP section Program 1 (P 1.1), page 23.

For information on how to calibrate your meter:

- See section 4.3 on pages 11-12 for pH calibration
- See section 4.4 on page 13 for Relative mV calibration
- See section 4.5 on pages 14-16 for Temperature Calibration of replacement temperature probes or replacement “All-in-One” electrodes

4.2 Preparing the Meter for Calibration

Before starting calibration, make sure you are in the correct measurement mode. When you switch on the meter, the meter starts up in the units you shut it off in (either pH, Rel mV, or mV). For example, if you shut the meter off in "Rel mV" units, the meter will read "Rel mV" units when you switch the meter on.

The pH / mV meter uses any standard pH, ORP, or ISE electrode with a BNC connector and separate temperature probe or an ALL IN ONE combination pH / temperature probe.

Be sure to remove the protective electrode storage bottle or rubber cap of the probe before calibration or measurement. If the electrode has been stored dry, wet the probe in tap water for 10 minutes before calibrating or taking readings to saturate the pH electrode surface and minimize drift.

Wash your probe in deionized water after use, and store in pH 4.0 or 7.0 electrode storage solution.

Do not reuse buffer solutions after calibration. Contaminants in the solution can affect the calibration, and eventually the accuracy of the measurements.

4.3 pH calibration

This instrument is capable of up to 5-point pH calibration to ensure accuracy across the entire pH range of the meter. You can perform 1-, 2-, 3-, 4- or 5-point calibration with standard pH buffers 1.68, 4.01, 7.00, 10.01, and 12.45.

We recommend that you perform at least a 2-point calibration using standard buffers that bracket (one above and one below) the expected sample range. You can also perform a 1-point calibration, but make sure that the buffer value is close to the sample value you are measuring.

This meter features five preprogrammed pH buffers (pH 1.68, 4.01, 7.00, 10.01, and 12.45). The meter automatically recognizes and calibrates to these standard buffer values, which makes pH calibration faster and easier. See pages 44-45 for information on our high-quality OAKTON pH buffers.

All new calibration data will over-ride existing stored calibration data.

Calibrating for pH:

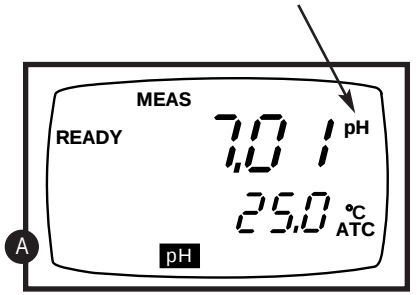
1. **If necessary, press the MODE key to select pH mode**. The pH indicator appears in the upper right hand corner of the display.

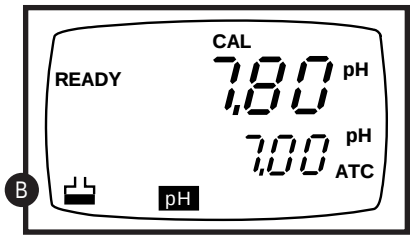
See figure A

2. **Rinse the probe thoroughly with de-ionized water or a rinse solution.** Do not wipe the probe; this causes a build-up of electrostatic charge on the glass surface.
3. **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.
4. **Press CAL/MEAS** to enter pH calibration mode. The primary display will show the measured reading while the smaller secondary display will indicate the pH standard buffer solution.

See figure B

NOTE: If using a pH buffer other than pH 7, press the ▲ or ▼ keys to scroll up or down until the secondary display value is the same as your pH buffer value (pH 1.68, 4.01, 7.00, 10.01, or 12.45).





5. **Wait for the measured pH value to stabilize.** The **READY** indicator will display when the reading stabilizes.

See figure C

6. After the **READY** indicator turns on, **press CON to confirm calibration**. A confirming indicator **(CON)** flashes and disappears. The meter is now calibrated at the buffer indicated in the secondary display.

See figure D

The secondary display automatically scrolls to the next buffer calibration option.

- If you are performing multipoint calibration, go to step 7.
- If you are performing one-point calibration, go to step 10.

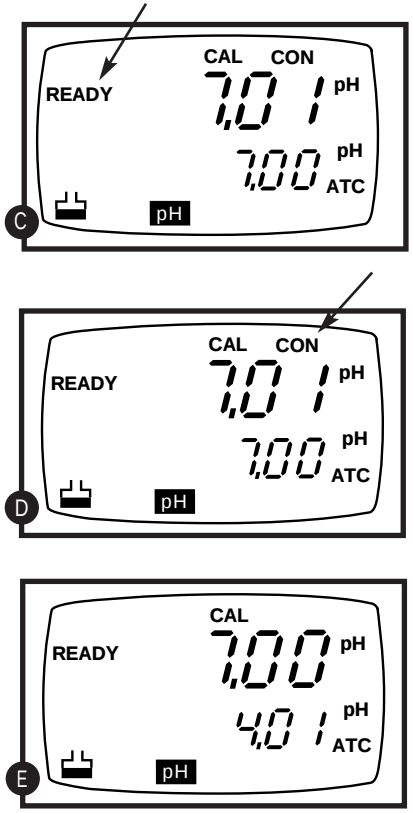
7. **Press the ▲ or ▼ keys** to select the next buffer value you want to calibrate (pH 1.68, 4.01, 7.00, 10.01, or 12.45).

See figure E

8. **Rinse the probe with de-ionized water or a rinse solution, and place it in the next pH buffer.**

9. Follow steps 5 to 8 for additional calibration points (up to 5 values).

10. When calibration is complete, **press CAL/MEAS to return to pH measurement mode**.



Notes

To exit from pH Calibration mode without confirming calibration, DO NOT press **CON** in step 6. Press **CAL/MEAS** instead.

If the selected buffer value is not within ±1.0 pH from the measured pH value: the electrode and buffer icon blink and the ERR annunciator appears in the lower left corner of the display. These indicators also flash if the buffer used is not the same as the buffer value on the secondary display.

4.4 Relative mV Calibration

1. **While in the measurement function, press MODE** to enter the relative mV mode. The primary display indicator shows "**Rel mV**". If you have never calibrated mV or if the meter has been reset, the value shown is the same as the absolute mV value. Once calibrated, the value shown will be relative mV. The secondary display shows the temperature.

See figure A

2. **Press the CAL/MEAS key.** The **CAL** indicator appears above the primary display. The primary display shows the measured reading and the secondary display shows the temperature.

See figure B

3. **Press the ▲ or ▼ keys** to the mV value to be added or subtracted from the reading.

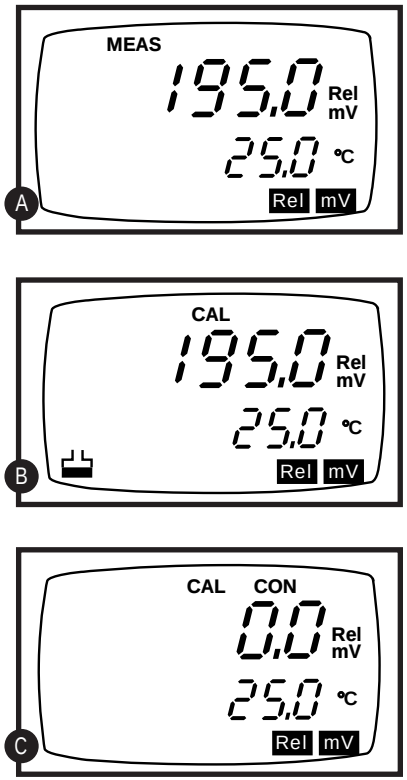
4. **Press the CON key** to confirm calibration.

NOTE: If you press **CON** without entering a mV (without scrolling with the ▲ or ▼ keys) the meter will subtract the entire reading value displayed–that is, it will zero the mV reading. The LCD will then show 0 mV.

See figure C

5. Press **CAL/MEAS** to return to the measurement mode. The primary display now shows the relative mV reading. To recall the selected base value, use the **SETUP** mode Program 2. See page 24 for instructions.

6. To reset all calibration values in memory to the factory default settings, use the **SETUP** mode Program 1 (P 1.1). See page23.

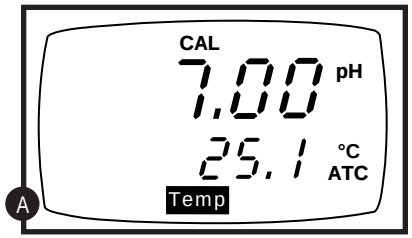


4.5 Temperature Calibration

1-point temperature calibration

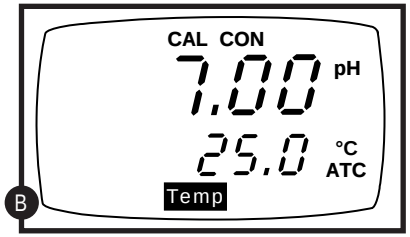
1. Connect ATC probe (or temperature connector of the "All-in-One" electrode) to the phone jack. The ATC annunciator will appear at the right-hand side of the LCD.
2. Press the **MODE** key to select temperature mode **(Temp)**.
3. Press the **CAL/MEAS** key to enter calibration mode. The primary display shows the measured pH value and the secondary display shows the temperature.

See Figure A



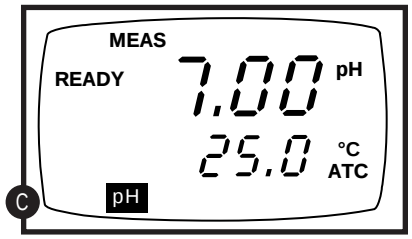
4. Dip the ATC probe (or "All-in-One" electrode) into a solution of known temperature (i.e. a temperature bath). Allow some time for the temperature probe to stabilize.
5. Scroll up or down with the ▼ and ▲ keys to set the correct temperature value (i.e. the temperature of the temperature bath). You can adjust the reading in increments of 0.1°C. Note that the current input reading can only vary ±5°C from the reading originally displayed on the meter.
6. Once you have selected the correct temperature, press the **CON** key. A confirming indicator **(CON)** flashes on the display for one second, then disappears.

See Figure B



7. Press the **CAL/MEAS** key to return to pH measurement mode.

See Figure C



2-point temperature calibration

In most cases 1-point temperature calibration will give you accurate temperature measurement and compensation. If you notice inaccurate measurements at high or low temperatures after 1-point calibration, you may need to do a 2-point calibration. Perform the following procedure:

A. Preparing Temperature Baths

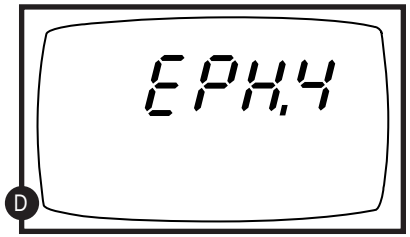
1. Prepare two temperature baths for temperature calibration.
2. Set the temperature of the baths. Using a good reference thermometer, preferably certified, set one bath at 0°C ±3.0°C and the second bath at 77-80°C .

NOTE: Make sure to set the baths within the pH electrode operating temperature. For the epoxy-body All-in-One probe (included with meter), do not set the high temperature bath above 80°C. If you are using a glass-body "All-in-One" electrode or a separate electrode and metal ATC probe, set bath to 90.0°C ±3.0°C.

B. Entering 2-point Calibration Mode

1. Attach the temperature probe or electrode to the meter.
2. Turn the meter off.
3. Press the **CAL/MEAS** key.
4. Without releasing the **CAL/MEAS** key, press the **ON/OFF** key.
5. When the LCD lights up, release the **ON/OFF** key.
6. Wait for 2 seconds, then release the **CAL/MEAS** key. The upper display will show "**EPH.3**" or "**EPH.4**" (depending on the software version number). The meter is now in 2-point Calibration Mode.

See Figure D

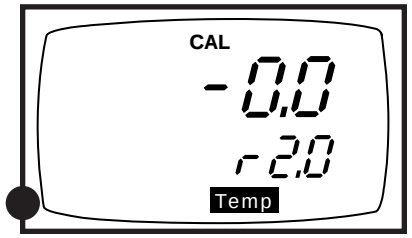


7. Press the **CON** key three times to enter temperature low point calibration.

C. Temperature Low Point Calibration

The primary display will show "**0.0**" and the secondary display will show "**r2.0**".

See Figure A

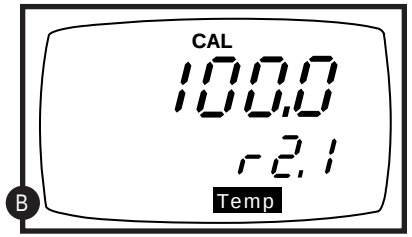


1. Insert the temperature sensor or electrode with built-in temperature sensor into the low temperature bath.
2. Press the ▼ and ▲ keys to set the primary display temperature to match the low temperature bath's temperature.
3. Press the **CON** key to store the selected value. The display will show the A/D value for the temperature. This value appears as a number on the display.
4. Press the **CON** key to store the A/D value when the number stabilizes.

D. Temperature High Point Calibration

The primary display will show "**100.0**" and secondary display will show "**r2.1**".

See Figure B



1. Insert the temperature sensor or electrode with built-in temperature sensor into the high temperature bath.

NOTE: To avoid breaking the electrode with temperature shock, allow your electrode to reach room temperature before putting it in a high temperature bath.

2. Press the ▼ and ▲ keys to set the primary display temperature to match the high temperature bath's temperature.
3. Press the **CON** key to store the selected value. The display will show the A/D value for the temperature. This value appears as a number on the display.
4. Press the **CON** key to store the A/D value when the number stabilizes.. The meter displays all LCD segments.
5. Press the **ON/OFF** key to switch off the meter.

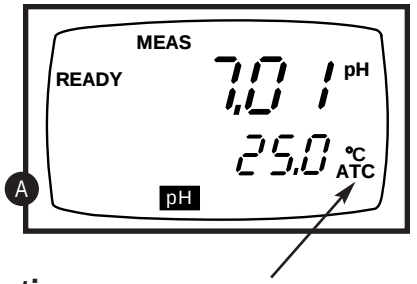
5. Measurement

This meter is capable of taking measurements with automatic or manual temperature compensation. Automatic temperature compensation only occurs when the temperature probe is plugged into the meter or when using an OAKTON "All-in-One" electrode. If there is no temperature probe plugged into the meter the default temperature is automatically 25°C. You can manually set the temperature to match your working conditions using a separate thermometer.

5.1 Automatic Temperature Compensation

For automatic temperature compensation (ATC) simply plug the temperature probe into the meter (see page 7). The ATC indicator will show on the LCD.

See figure A

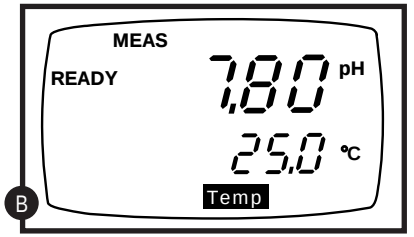


NOTE: If you are using a temperature probe, the probe must be submersed in the liquid you are measuring.

5.2 Manual Temperature Compensation

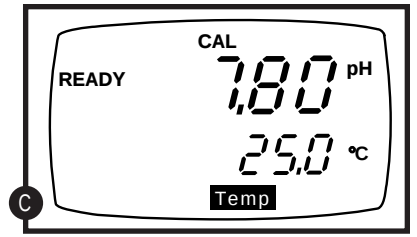
1. Turn the meter on. Make sure meter is set to the pH measurement mode. **Press MODE** to select temperature mode.

See figure B



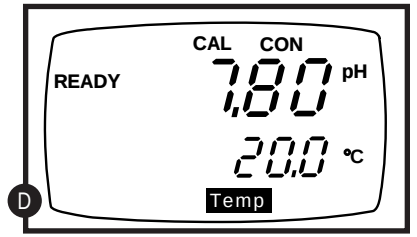
2. **Press the CAL/MEAS key to enter calibration mode.** The **CAL** indicator will appear above the primary display. The primary display shows the measured pH value and the secondary display shows the temperature.

See figure C



3. **Check the temperature of your sample** using an accurate thermometer.
4. **Press the ▲ or ▼ keys** to set the temperature to the measured value.
5. **Press CON** to confirm the selected temperature. The **CON** indicator flashes for one second and then disappears.

See figure D



5. **Press CAL/MEAS** to return to the pH measurement mode.

The meter is now prepared for temperature compensation without the temperature probe.

5.3 Taking Measurements

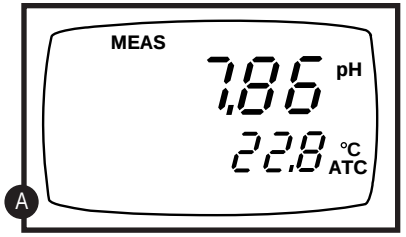
The **READY** indicator appears on the display when the reading stabilizes. The reading holds until the measured value exceeds the tolerance (± 0.02 pH; ± 0.8 mV <400; ±1.2 mV >400), then the **READY** annunciator turns off.

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

To take readings:

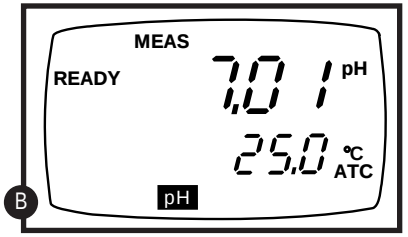
1. Rinse the probe with deionized or distilled water before use to remove any impurities adhering to the probe body. If the pH electrode has dehydrated, soak it for 30 minutes in OAKTON electrode storage solution or a 2M–4M KCl solution.
2. Switch on the meter. The **MEAS** annunciator appears on the top center of the LCD. The ATC indicator appears in the lower right hand corner to indicate Automatic Temperature Compensation (See page 17 for setting Manual Temperature Compensation).

See Figure A



3. Dip the probe into the sample.

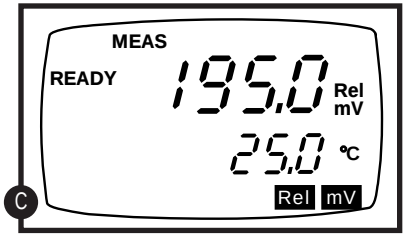
NOTE: When dipping the probe into the sample, the sensor or the glass bulb of the electrode must be completely immersed into the sample. Stir the probe gently in the sample to create a homogenous sample. *Be sure to tap probe to remove air bubbles. Air bubbles will cause errors in the reading.*



pH measurement mode display

4. Allow time for the reading to stabilize. Note the reading on the display. When the reading is stable, the **READY** annunciator appears.
5. To toggle between pH, Rel mV, and mV readings, press the **MODE** key.

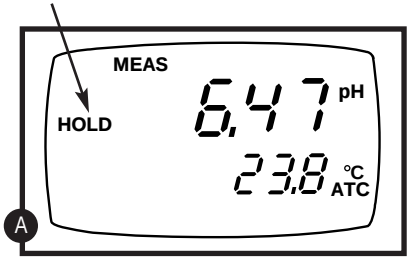
See figures B and C



Relative mV measurement mode display

6. HOLD function

This feature lets you freeze the value of the pH, Rel mV or mV and temperature readings for a delayed observation. **HOLD** can be used any time 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 A

2. To release the held value, press **HOLD** again. Continue to take measurements.

NOTE: This meter will hold a reading for up to 30 minutes, because it features automatic shutoff after 30 minutes to conserve batteries.

7. Memory and data input functions

7.1 Memory Input

Data is stored in sets:

- pH and temperature
- relative mV and temperature
- mV and temperature

This meter can store up to 16 sets of data in any combination of values (pH, mV, and relative mV). For example you can store 7 pH, 5 mV, and 4 relative mV values. The meter uses the last-in-first-out **(LIFO)** method of memory management within each of the three modes, but not between the modes when used in combination. For example, a pH reading will not replace a relative mV or mV reading. pH readings can only replace pH readings. Relative mV readings can only replace relative mV readings. mV readings can only replace mV readings.

1. **During any measurement function (MEAS),** press the **MI** key to input any data into the memory
2. **MEM will flash,** for a few seconds on the display. The meter stays in measurement mode.
3. **If the memory is full, the first value stored will be erased to create space for the new value.**

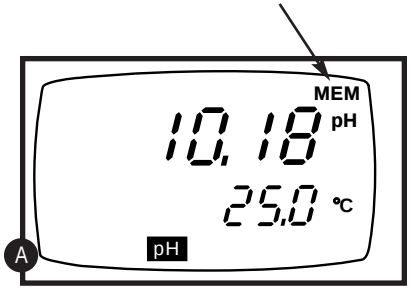
7.2 Memory Recall

This function recalls the previous readings stored in the memory. You can only access **MR** in the **MEAS**urement mode. In pH mode, **MR** recalls stored pH values; in Rel mV mode, **MR** recalls stored relative mV values; and in mV mode, **MR** recalls stored mV values.

1. **Set the mode** to the parameter that you wish to recall (pH, relative mV, or mV).
2. **Press the MR key once** to recall the last reading stored. **MEM** will flash on the display.

See Figure A

3. **Press the MR key again** to recall the next to the last reading stored, and so on. **NOTE:** Readings stored in memory are retained even if the unit is turned off. To erase all readings stored in Memory use the **SETUP** mode Program 1 (P1.0 or P1.1) on page 23.
4. To prevent accidental memory clearing use the SETUP mode Program 1 (P1.0 and P1.1) and turn the memory clear and reset **OFF**, see **SETUP** section page 23 for instructions.
5. To exit Memory Recall, press the **CAL/MEAS key** to return to the measurement mode.



8. Setup Functions

The **SETUP** mode lets you customize the meters preferences and defaults through a series of advanced programs.

The **SETUP** mode has four main programs:

- **Memory clear and reset:** clears or resets all stored values.
- **Electrode Data:** provides diagnostic information on electrode offset and slope, and relative mV offset value. Shows calibration data for both pH and temperature
- **Meter functions:** activates the **"Ready"** and **"Auto-Off"** functions. Sets pH resolution.
- **Communication data:** sets up communication parameters for use with a printer or computer.

8.1 SETUP Functions at a Glance

Program	Function Keys	Activation	Options Settings	Default
P1.0	Memory Clear	MR & MI	ON, OFF	OFF
P1.1	RESET	MR & MI	ON, OFF	OFF
P2.0	Electrode Offset	–	Indication only	0.0 mV
P2.1	Electrode Slope	–	Indication only	100.0
P2.2	Displays pH Calibration buffer data	MR & MI	1.68, 4.01, 7.00, 10.01, 12.45 Indication only	"---" No calibration performed
P2.3	Last pH Calibration Temperature	–	Indication only	25.0 °C
P2.4	Relative mV Offset	–	Indication only	0.0 mV
P3.0	pH Resolution	MR & MI	0.1, 0.01	0.01
P3.1	READY	MR & MI	ON, OFF	ON
P3.2	Auto Shut Off	MR & MI	ON, OFF	ON
P4.0	Baud Rate	MR & MI	2.4, 4,8, 9.6, 19.2 Kbps	9.6 Kbps
P4.1	Parity	MR & MI	1, 2, 0	2
P4.2	Stop Bit	MR & MI	1, 2	2

8.2 General Instructions for All SETUP Programs

Please read the next four sections before operating **SETUP** functions. Refer to "SETUP functions at a glance" page 22, for a quick review.

1. To enter **SETUP** mode, press **SETUP** key while in any measurement mode (pH, relative mV, or mV). The meter automatically enters Program 1, Option 0 (P1.0). You can only access **SETUP** through the measurement mode.
2. Use **MI/MR** keys to select options, if changes are required
3. Press **CON** to confirm the option in each program. The meter then automatically scrolls to the next program in sequence.
4. To exit the program, press **CAL/MEAS** and return to the measurement mode.

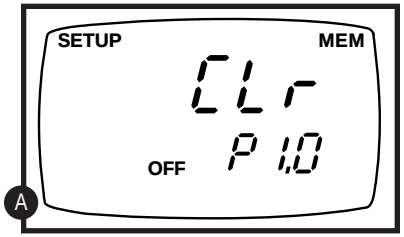
8.3 Program 1: Memory Clear and Reset

Program 1 has two options.

IMPORTANT: OFF is the default setting for both **Memory Clear** and **Reset**. Read this section carefully before changing options. Accidentally selecting the wrong option will wipe out all memory.

P1.0 **Memory Clear:** Selecting **ON** clears all measurement values committed to memory (all 16 values despite the mode). Press **MI** or **MR** to select **ON**, if desired. Once memory is cleared, this program will return to the default setting **OFF**. Clear memory each time you need to store a new series of values, to avoid confusing the old memory values with the new ones. Press **CON**.

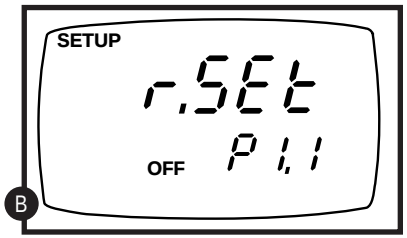
See Figure A



A

P1.1 **Reset:** Selecting **ON** resets the entire meter. The meter immediately switches off, and you must power **ON** before proceeding with any other functions. If reset is required, press **MI** or **MR** to select **ON** and then press **CON** to activate. Reset clears all data: memory values for pH, Rel mV, and mV; and all calibration data. Once memory is cleared, all settings will return to the default setting. Press **CON** to continue to the next program.

See Figure B



B

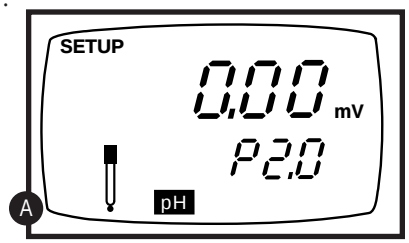
8.4 Program 2: Electrode Data

Program 2 has five options that lets you check the electrode parameters for diagnostic purposes.

NOTE: The electrode icon shows on the display.

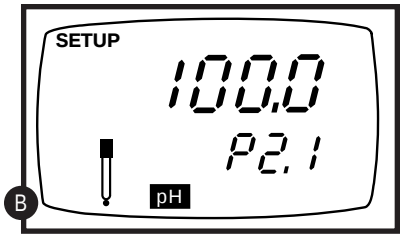
P2.0 **Electrode Offset:** Shows the pH electrode offset value in mV. The offset is based on the 7.00 pH buffer calibration. If you do not calibrate any buffer, the primary display shows 0.00 mV. No options to select. Press **CON**.

See Figure A



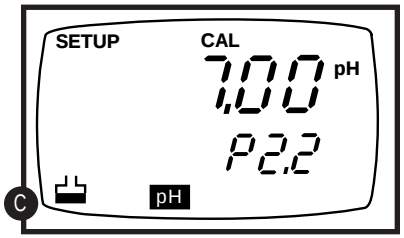
P2.1 **Electrode slope:** Shows electrode slope in percentage. Slope displayed is the average slope based on the calibrations. Default setting is 100.0. If you did not perform any calibrations, the display will show 100.0. No options to select. Press **CON**.

See Figure B



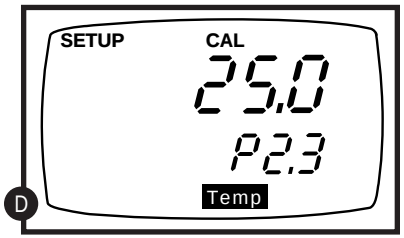
P2.2 **Calibration Data:** Records calibrations made on the meter, and lets you view all current calibrations points (up to 5). Use **MI** or **MR** key to scroll through the five calibrations. Press **CON** when finished.

See Figure C



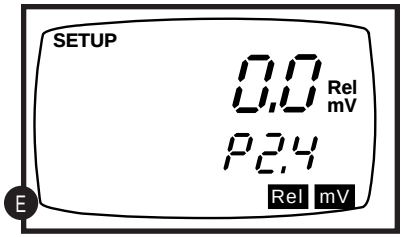
P2.3 **Calibration Temperature:** Indicates temperature at the last calibration. Default setting is 25°C. No options to set. Press **CON**.

See Figure D



P2.4 **Relative mV Offset Value:** Shows the relative mV base value in mV. Based on your selected value during calibration for REL mV measurement. Default setting is 0 mV. If you did not perform any calibration, the display will show 0 mV. No options to select. Press **CON**.

See Figure E

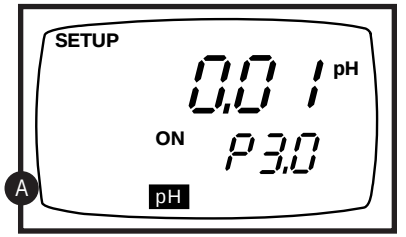


8.5 Program 3: Selectable Meter Functions

Program 3 has three options for customizing.

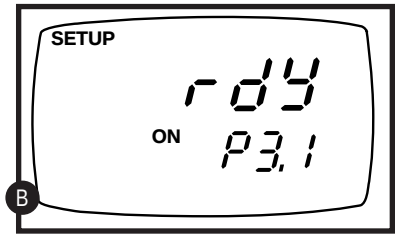
P3.0 **Resolution:** In the pH mode, select resolution of 0.1 or 0.01 pH. 0.01 pH is the default setting. Press **MI** or **MR** to switch to 0.1 or 0.01 pH (0.1 pH resolution is optimal for fast pH checks). Press **CON**

See Figure A



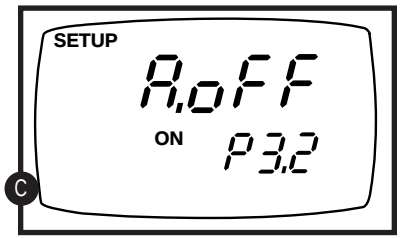
P3.1 **READY selection:** Use the **MI** or **MR** key to turn **ON** or **OFF** the **READY** option. **READY** indicator will display when the reading stabilizes within ±0.02 pH (±0.8 mV <400 mV; ±1.2 mV >400 mV). The default setting is **ON**. Use **MI** or **MR** key to select **ON** or **OFF**. Press **CON**.

See Figure B



P3.2 **Auto-Off:** To conserve energy, this function automatically shuts off the meter within 30 minutes after the last key has been pressed. Default setting is **ON**. Use **MI** or **MR** key to select **ON** or **OFF**.

See Figure C



8.6 Program 4: Communication Set-Up

Program 4 has three options that lets you set up the meter communication parameters when operating with either your optional printer or PC. Set these options to match your printer or PC requirements.

P4.0 **Baud Rate:** Press **MI** or **MR** to select a baud rate of 2.4, 4.8, 9.6, or 19.2 Kbps (2400, 48000, 9600, or 19200 bps). The default setting is 9.6 Kbps (9600 bps). Press **CON**.

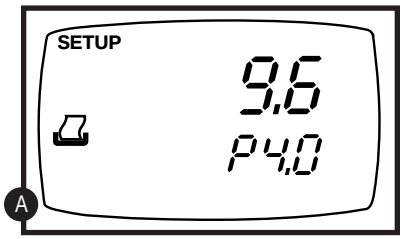
See Figure A

P4.1 **Parity:** Press **MI** or **MR** to select parity of 1, 2, or 0. Default setting is 2 (EVEN). Press **CON**.

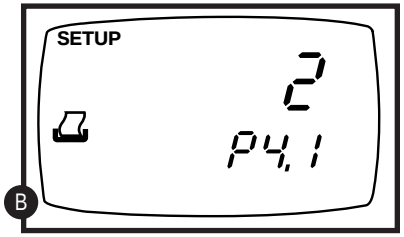
See Figure B

P4.2 **Stop Bit:** Press **MI** or **MR** to select the stop bit to be 1 or 2. Default setting is 2. Press **CON**.

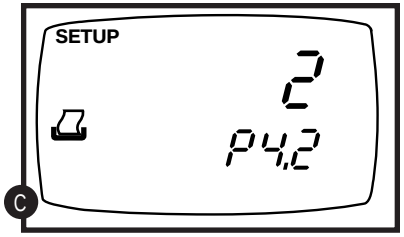
See Figure C



A



B



C

9. Optional Printer and RS-232 Output Setup

The pH 100 meter provides an output for transmitting readings to a printer or computer. The data is supplied in ASCII format. ASCII format allows data to be imported into most popular software programs, and to most printers.

9.1 Using with OAKTON Printer WD-35622-00

See Printer manual for more details

1. Connect cable WD-35622-05 from printer to meter.
2. Configure printer for handheld pH meter.
3. Press **PRINT** key ( )

9.2 Using with a Non-OAKTON Printer

Minimum printer requirements to print data:

- A 9 pin RS-232 serial port on printer.
- Printer should have the option to receive 8 data bits; even (2), odd (1) or none (0) parity bits; and 1 or 2 stop bits.

NOTE: To print data, connect the meter directly to the printer. You do not need to connect the meter to the computer.

Connecting the cable to the meter

1. Carefully open the port cover located on the heel of the meter. Do not use excessive force.

See figure A

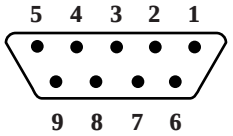
2. Noting the orientation of the RS-232 connector, plug the male connector into the RS-232 port on the meter.
3. Tighten the two screws on the sides of the male RS-232 connector.



NOTE: For the meter and printer to properly communicate and transfer data, the pin configurations on both units must match. To determine this, compare the pin configuration of your printer (see the printer manual) with the pin configuration of this meter (see figure below). Since there is no industry standard for the pin configuration on printers, you might need to configure the pins. Configuring the pins may require soldering. Also, jumper boxes and cable-making products are available from most computer stores.

The meter has a 9 pin female RS-232 connector with this configuration:

Pin Number	Description
1	–
2	Transmit Data
3	–
4	DSR (Data Set Ready)
5	GND (Ground)
6	–
7	CTS (Clear To Send)
8	–
9	–



If the printer has a 25 pin connector, use a 25 pin to 9 pin converter. Use the following configuration:

Pin Number of meter	Pin number of printer
2 (TXD)	3 (RXD)
4 (DSR)	20 (DTR)
5 (GND)	7 (GND)
7 (CTS)	4 (RTS)

Preparing the printer

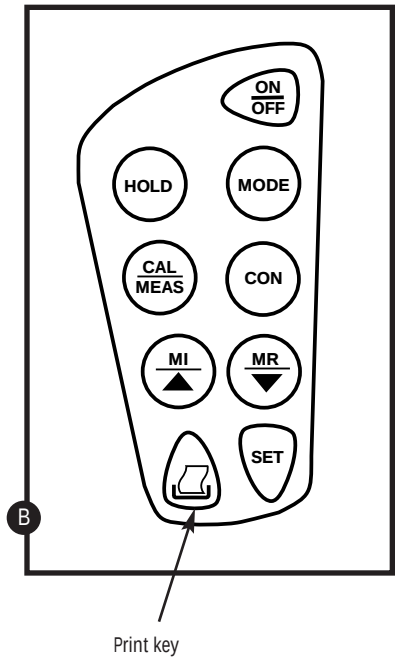
Set printer to match the meters RS-232 parameters as set in SETUP Program P4.0, P4.1, and P4.2 on page 26 (consult the printer manual for details).

Printing data

Press the **PRINT** key ( ) on the meter to send data to the printer .

See figure B

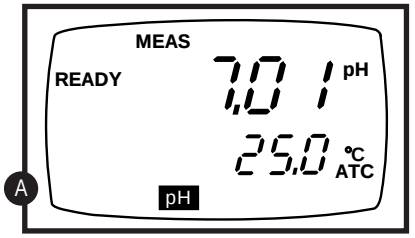
"Or" on the LCD, printer, or computer screen as pH value means overrange. The pH probe might be disconnected. Check probe connections and mode setting (pH, mV, or rel mV).



9.3 Using with a printer to download stored memory

The meter will only print measurements that are on the display, either "live" or stored measurements maximum 16 values. To print stored measurements, first recall measurements from memory. To recall a measurement from memory, the meter must be in the **MEAS** mode (not **CAL**), and in the the same measurement mode it was in when the measurement was stored.

Examples: To recall a measurement stored as a pH value, the meter must be in the **MEAS** pH mode. To recall a measurement stored as a mV value, the meter must be in the **MEAS** mV mode.



A

See figure A

1. To download stored readings in memory to a printer, set up the meter and printer described on pages 27-29.
2. While the meter is in the **MEAS** mode, press **MR** to display the last measurement value stored in memory.
3. Press **PRINT** key ( )on the meter to print the last value.
4. Press **MR** again to recall the second-to-last measured value stored in memory.
5. Press **PRINT** to print the second-to-last value.
6. Repeat steps 4 and 5 above until all stored values are printed.
7. To print other measurement values stored in memory, press **CAL/MEAS** to return to measurement mode.
8. Select the next measurement mode (pH, rel mV, or mV) for the values stored in memory
9. Repeat step 2 through 6 above until all values stored in the same measurement mode are printed.
10. Repeat steps 7 through 9 above until all stored values are printed.

9.4 Using with a Computer and the OAKTON Datalog Assist Software

Minimum Computer Requirements to run software:

- IBM® PC / XT / AT® or 100% compatible (DOS 3.0 or later)
- 640K RAM memory
- Monitor
- RS-232 serial port
- 3½" floppy disk drive

The OAKTON Datalog Assist Software is a very basic data acquisition software that provides a convenient way to capture data for future analysis. Data is stored in the ASCII format. This allows the data to be transferred to a variety of popular software programs. The disk includes three programs:

README BAT: simply type README to see the content of the README.DOC file.

ONDATA EXE: the data acquisition software.

README DOC: is a program that describes what the ONDATA and DEMO programs do.

To see this list, type **"DIR"** at the DOS prompt for directory. Data files will also appear on the directory as they are created.

Connecting the cable to the meter

1. Carefully open the port cover located on the heel of the meter. Do not use excessive force.

See figure B

2. Noting the orientation of the RS-232 connector, plug the male connector into the RS-232 port on the meter.
3. Tighten the two screws on the sides of the male RS-232 connector.



B

Connecting the cable to the computer

1. Locate the port on the computer.
2. Noting the orientation of the RS-232 connector, plug the male connector into the RS-232 port on the computer.
3. Tighten the two screws on the sides of the male RS-232 connector.
4. If the computer has a 25 pin connector, you will need a 25 pin to 9 pin adapter.

Loading the OAKTON Datalog Assist Software

1. Turn on computer.
2. Insert the 3 ½" disk provided with the meter into the floppy disk drive on the computer. See the computer instruction manual to locate the drive. Be sure "write protect" on disk is off or unlocked.
3. To boot the software

   from DOS, type **"ONDATA"**, the name of the data acquisition program. You can also type **"DIR"** at the DOS prompt. **"DIR"** will show you the directory of the programs on the disk. To enter the data acquisition program, type **"ONDATA"** at the DOS prompt. At the **A:**\ type **"RUN ONDATA"**

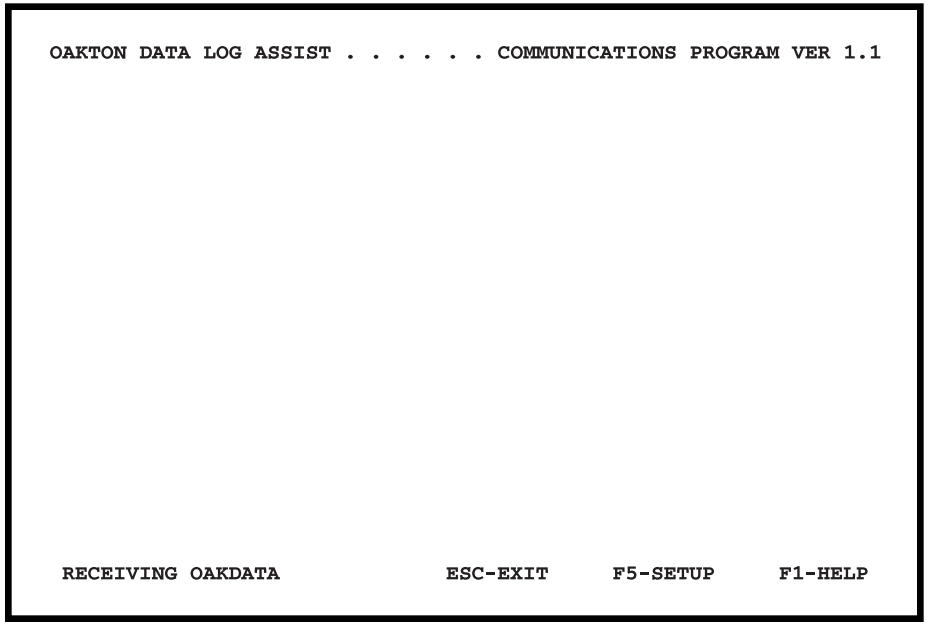
   f**rom Windows Program Manager,** select **"RUN"** and enter the file name **"ONDATA"**.

   from Windows 95, taskbar select **"START"** and **"RUN"**. Click the **"BROWSE"** button. Find and select the **"ONDATA"** file on your **A:**\ drive.

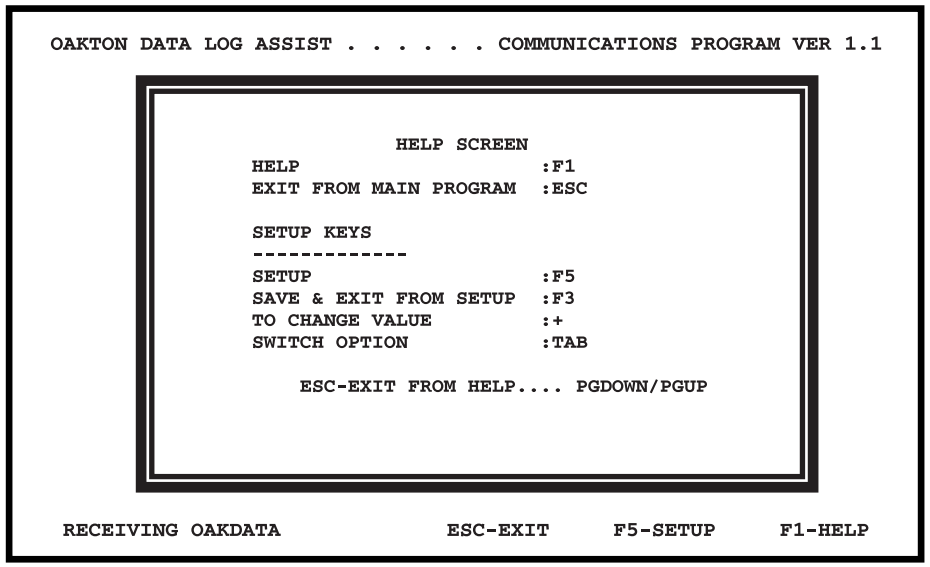
Setting the communication parameters

The meter is capable of different communication configurations for baud rate, parity bits and stop bits. The values chosen for these parameters for the meter must match those chosen for the computer.

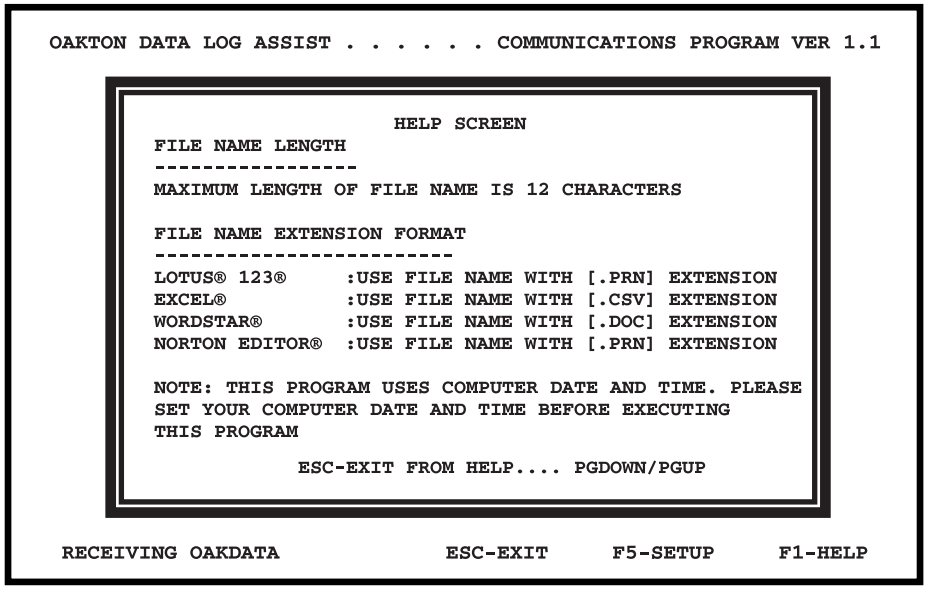
After entering **ONDATA** as stated on page 32 , a blank screen appears where the measurement data will go. The following screen will appear:



1. Push **F1** to enter the **HELP** program. The first screen of **HELP** explains the function keys used in the **SETUP** program.

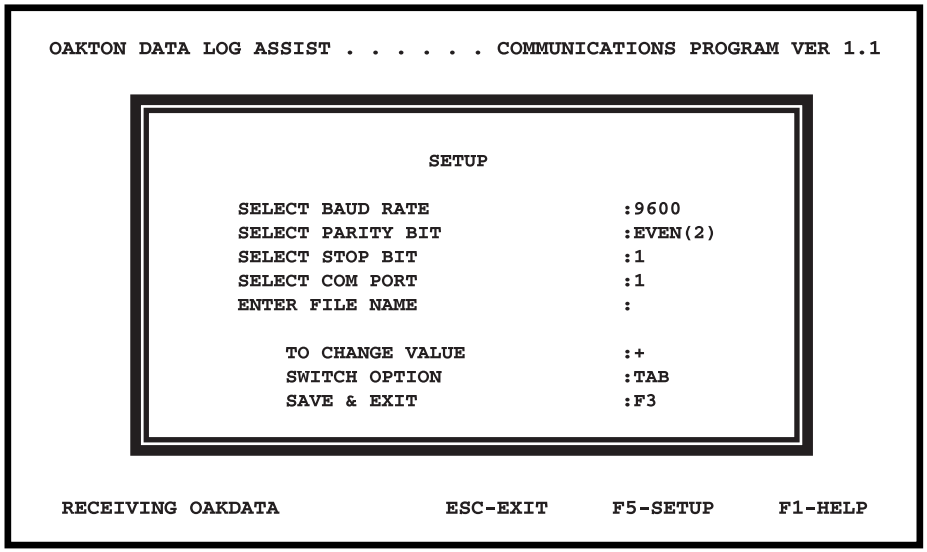


Push either **"Page Up"** or **"Page Down"** to advance to the second screen of **HELP**. This screen indicates the proper file name extensions that you must use when naming files (done in the **SETUP** program) that will be imported into other software programs. No extension is needed if you are not importing the data into another program.



2. Push **ESC** to exit the **HELP** program.

3. Push **F5** to enter the **SETUP** program. You will see the following:



You may select from the following settings:

Baud rate : 2400, 4800, 9600, 19200
Parity bit : NONE (0), ODD (1), EVEN (2)
Stop bit : 1, 2
Com port : 1, 2

(the Com port is communication port that the cable is hooked to on the computer)

4. Set each parameter to the same value as the value chosen in the **SETUP** program of the meter. To set these parameters in the meter, see **SETUP** mode, Program 4 on page 26 of this manual for complete instructions. Use the **"+"** key to toggle between the choices for each parameter.

5. After choosing a value for a parameter, push the **"TAB"** key to move to the next line. Continue until all parameters (baud rate, parity bit, stop bit and com port) are chosen. Push **"TAB"** to move to the next line, **"Enter file name."**

6. Enter a file name. If the data will be imported into another software program, use the proper file extension as shown on the second screen of **HELP**. The entire file name, including the period and three-letter extension (for example **".PRN"** for Lotus 1-2-3®), can be maximum of 12 characters. If the data will not be imported into another software program, then a file extension is not required. Push "**enter"** to enter the file name.

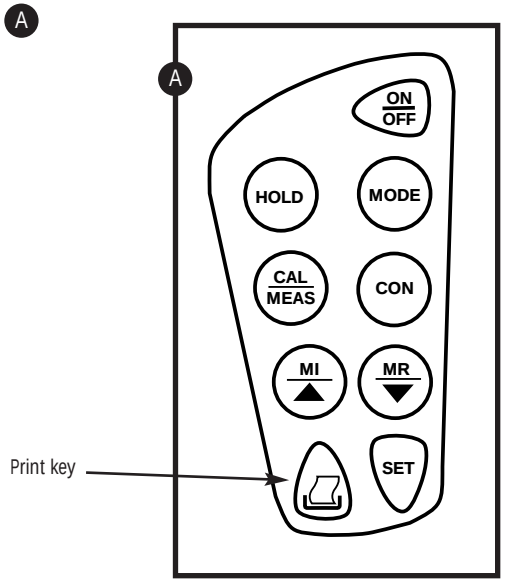
7. Push **F3** to save the parameters and the file name, and to exit the **SETUP** program. The file name will be listed in the directory.
IMPORTANT: If you exit this program by pressing **Esc** instead of **F3**, all information just selected will be lost. All parameters and the file name will convert back to those that had been shown when you first entered the **SETUP** program.

8. No matter which key you pressed to exit the **SETUP** program (either **F3** or **ESC**), the **ONDATA** screen will now appear.

9.5 Sending data to the computer

1. Press the **PRINT** key ( ) on the meter to send data to the computer.

See figure A



2. The data appears on the **ONDATA** computer screen as follows:

```
OAKTON DATA LOG ASSIST . . . . . COMMUNICATIONS PROGRAM VER 1.1


 PH: 5.74     TEMP: 25.0     DATE: 01-19-1993     TIME: 13:50:10









 RECEIVING OAKDATA              ESC-EXIT      F5-SETUP      F1-HELP
```

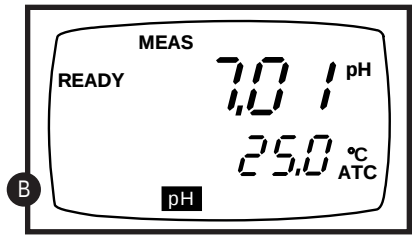
3. Continue to push **PRINT** on the meter to send data to the computer.
4. When all data has been collected, push **ESC** to quit the **ONDATA** program.

9.6 Using with a Computer and the OAKTON Datalog Assist Software to Download Stored Memory

The meter will only send measurements to the computer that are on the display, either "live" or stored measurements (only five stored values per measurement mode). To download stored measurements, first recall measurements form memory. To recall a measurement from memory, the meter must be in the **MEAS** mode (not **CAL**), and in the same measurement mode it was in when the measurement was stored. Date and time of measurement are not stored. When downloading stored measurements, the date and time on screen will be the current date and time.

EXAMPLES: To recall a measurement stored as a pH value, the meter must be in the **MEAS** pH mode. To recall a measurement stored as a mV value, the meter must be in the **MEAS** mV mode.

See Figure B



1. To download stored readings in memory to a computer, set up the meter and computer as described on pages 28-31 of this manual.
2. While the meter is in the **MEAS** mode, press **MR** to display the last measured value stored in memory.
3. Press **PRINT** key ( ) on the meter to send the last value to the computer.
4. Press **MR** again to recall the second-to-last value.
5. Press **PRINT** key ( ) on the meter to send the second-to-last value to the computer.
6. Repeat steps 4 and 5 above until all measurement values stored are sent to the computer.
7. To send other measurement values stored in memory to the computer, press **CAL/MEAS** to return to the measurement mode.
8. Select the next measurement mode (pH, Rel mV, or mV) for the measurement values stored in memory.
9. Repeat steps 2 through 5 above until all values stored in the same measurement mode are downloaded to the computer.
10. Repeat steps 7 through 9 above until all measurement values stored in memory are downloaded.

9.7 Viewing a Data File

1. To view a data file, type **"type"**, followed by a space, and the file name at the DOS prompt. The contents of the file will appear, but you will not be able to change the data.
2. To view a data file and change any information in the file, type **"edit"**, followed by a space, and the file name at the DOS prompt. The contents of the file will appear. Use the arrow keys on the computer to move the cursor around.
3. To quit, press **ESC**. If you made change to the file, the computer will ask if you want to save the change. Press **Y** for yes and **N** for no.

9.8 Printing Errors

If the LCD shows **ERR**, the print annunciator blinks or the meter prints or downloads garbled data, or prints or downloads nothing; the printer or computer might not be connected properly; check cable connections. Also, the dip switch setting could be set wrong. Check dip switches for baud rate, data bits, and parity.

10. Probe Care and Maintenance

Because your pH electrode is susceptible to dirt and contamination, clean it every one to three months depending on the extent and condition of use.

NOTE: for specialty electrode care, consult the instruction manual included with your electrode.

pH electrode storage

For best results, always keep the pH bulb wet. Use the protective electrode storage bottle or rubber cap filled with OAKTON electrode storage solution to store your electrode (see page 44 for ordering information). Also, you can store in a pH 4 buffer with 1/100 part of saturated KCl. Other pH buffers are OK for storage, but NEVER use distilled water for storage.

After measuring

1. Rinse the pH electrode and reference junction in de-ionized water.
2. **Store the electrode as recommended above in "pH electrode storage," or as recommended by the manufacturer.**
3. Prior to next use, rinse the liquid junction with de-ionized water and tap dry–**never wipe electrode.**

NOTE: If this does not restore electrode to normal response, see "Reactivating the pH electrode" section.

pH electrode cleaning

Salt deposits: dissolve the deposits by immersing the electrode in tap water for ten to fifteen minutes. Ten thoroughly rinse with distilled water.

Oil/grease film: wash electrode pH bulb gently in some detergent and water. Rinse electrode tip with distilled water or use a general purpose electrode cleaner (see page 44 for ordering information).

Clogged reference junction: heat a diluted KCl solution to 60 to 80°C. Place the sensing part of the electrode into the heated solution for about 10 minutes. Allow the electrode to cool in some unheated KCl solution.

Protein deposits: prepare a 1% pepsin solution in 0.1 M of HCl. Set the electrode in the solution for five to ten minutes. Rinse the electrode with distilled water.

Reactivating the pH electrode

If stored and cleaned properly, your pH electrode should be ready for immediate use. However, a dehydrated bulb may cause sluggish response. To rehydrate the bulb, immerse the electrode in a pH 4 buffer solution for 10 to 30 minutes. If this fails, the electrode requires activation. **Never touch or rub glass bulb. Contact builds up an electrostatic charge.**

pH electrode activation (for glass bodied electrodes only)

WARNING: Only qualified persons proficient with the safe handling of dangerous chemicals should perform the procedure below. Provide proper containers, fume hoods, ventilation, and waste disposal. Safety goggles and protective clothing must be worn while performing this procedure. If possible, replace with another electrode instead of performing this reactivation procedure.

1. **Dip or stir the pH electrode** in alcohol for 5 minutes.
2. **Leave the electrode in tap water** for 15 minutes.
3. **Dip and stir the electrode** in concentrate acid (such as HCl or H_2SO_4) for five minutes.
4. **Repeat step 2.**
5. **Dip and stir in strong base** (NaOH) for five minutes.
6. **Leave for 15 minutes** in distilled or deionized water.
7. **Now test with standard calibration buffer solutions** to see if the electrode yields acceptable results. You may repeat step 3 through 6 up to three times for better response. If the response does not improve, then your electrode is no longer functioning–replace with a new electrode. Call your OAKTON Distributor.

11. Troubleshooting

Problem	Cause	Solution
Power on but no display	a) Batteries not in place.	a) Check that batteries are in place and making good contact.
	b) Batteries not in correct polarity (+ and –).	b) Reinsert batteries with correct polarity.
	c) Weak batteries.	c) Replace batteries or attach optional AC adapter.
Unstable readings	a) Air bubbles in probe.	a) Tap probe to remove bubbles.
	b) Dirty probe.	b) Clean the probe and recalibrate.
	c) Probe not deep enough in sample.	c) Make sure sample entirely covers the probe sensors.
	d) External noise pickup or induction caused by nearby electric motor.	d) Move or switch off interfering motor.
	e) Broken probe.	e) Replace probe. See page 44.
Slow response	a) Dirty / Oily probe.	a) Clean probe. See "Probe Care & Maintenance", pages 39-40.

12. Error Messages

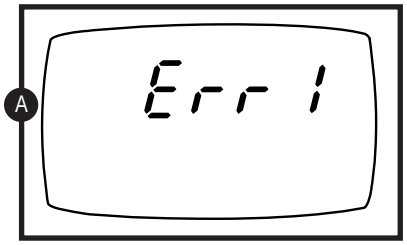
LCD Display	Indicates	Cause	Solution
Err annunciator	Unrecognized input from keypad	Wrong input in selected mode.	Release key. Select valid operations depending on mode.
CAL & Err annunciators on/ Buffer and electrode indicators blink	Calibration error	Wrong buffer value input at calibration. Dirty probe.	Check your buffer input value, clean probe. See Calibration sections or Probe Maintenance section.
Battery indicator blinks	Low battery level	Need new batteries or battery connection is bad	Clean battery contacts. Replace batteries with fresh ones, noting polarity
Err annunciator & printer indicator blinks	Unable to print	Printer/computer is off, cable is unplugged or cable is faulty	Turn printer/computer on, check cable connections, or check printer/computer settings on both the meter and receiving device.
Err. 1 (in primary display)	Memory write error	Instrument too old (>10 years). Hardware failure	Turn meter on and off again. If message persists, return unit*
Err. 2 (in primary display)	Memory checksum error	Hardware failure.	Turn meter on and off again. If message persists, return unit*
Err. 3 (in primary display)	ACD converter error	Hardware failure.	Turn meter on and off again. If message persists, return unit*
Err. 4 (in primary display)	Keypad error	Fault in keypad	Turn meter on and off again. If message persists, return unit*

* See "Warranty" and "Return of Items" on page 44

If an error message appears in the primary display (the upper row of larger digits), switching off the meter and switching it on again may eliminate the error message.

See figure A

If error persists, or the meter shows incorrect values, return the meter.



ERR 1 in primary display

For a complete diagram of the display, see page 4.

13. Specifications

Mode	pH	Temperature	mV
Range	-2.00 to 16.00 pH	-9.9 to 100.0˚C	-2000 to 2000 mV (same for Rel mV)
Resolution	0.01 or 0.1 pH	0.1˚C	0.1 mV between ±399.9 mV 1 mV beyond ±399.9 mV
Accuracy	±0.01 pH	±0.5˚C	±0.2 mV between ±399.9 mV ±2 mV beyond ±399.9 mV
Calibration	Up to five points (pH 1.68, 4.01, 7.00, 10.01, 12.45)	Offset in 0.1°C increments	Offset up to ±2000 mV

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

Operating temperature: 0 to 50°C

RS-232 Communication: 9 pin female, select baud rates 2.4, 4.8, 9.6, and 19.2 kbps (2400, 4800, 9600, 19200 bps); stop bit and parity

Power: four 1.5 V AAA batteries (included) or AC adapter (optional; order separately on page 42)

Battery life: > 50 hours

Dimensions:
Meter: 7.5"L x 3.5"W x 1.75"H
(19.1 cm x 8.9 cm x 4.5 cm)
Boxed: 9.2"L x 8.5"W x 2.75"H
(23.3 cm x 21.6 cm x 7 cm)

Shipping weight: 1.4 lbs (0.64 kg)

14. Accessories

Replacement probes, electrodes and accessories

WD-35615-05 Replacement ATC probe, 316 SS, 4.5”L x 0.11” (3mm) dia.

WD-35615-09 RS-232/Printer cable, 9- pin male for units with RS-232 printer output.

WD-35615-07 AC adapter, 9 VDC to 110 VAC.

WD-35615-08 AC adapter, 9 VDC to 220 VAC.

WD-35615-75 Belt loop portable meter carrying case. Soft case with clear plastic front panel protects your meter while allowing you to take measurements. Top and side openings let probe and probe connections remain accessible.

WD-35614-79 Deluxe pH Meter Kit (meter not included). Includes 5 each of pH 4.01, 7.00, and 10.00 buffers, rinse bottle, and hard carrying case.

WD-00653-04 Electrode storage solution, 1 pint bottle. Keeps electrode bulb moist for faster, more accurate readings. Shpg wt 1.1 lbs/510 gms.

WD-00653-06 Electrode cleaning solution, 1 pint bottle. Removes buildup from electrodes and maintains electrode sensitivity. Shpg wt 1.1 lbs/510 gms.

WD-35615-06 Replacement electrode holder.

WD-35801-00 Oakton® replacement general purpose pH electrode.

WD-35801-71 Oakton® replacement "All-in-One", sealed general purpose pH electrode, with built-in temperature element.

WD-35801-70 Oakton® "All-in-One" refillable general purpose pH electrode with temperature element.

WD-35801-72 Oakton® "All-in-One", sealed double junction pH electrode with built-in temperature element.

OAKTON calibration solutions

pH solutions have ±0.01 pH accuracy at 25°C. Shpg wt 1.1 lb (510 g).

WD-00654-01 pH 1.68 calibration buffer, 1 pint.

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

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

WD-00654-08 pH 10.01 calibration buffer, 1 pint.

WD-00654-12 pH 12.45 calibration buffer, 1 pint.

OAKTON “Singles” calibration solution pouches

WD-35653-00 Deionized rinse water solution pouches, 20/box.

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

WD-35653-02 pH 7.00 Calibration buffer solution pouches, 20/box.

WD-35653-03 pH 10.00 Calibration buffer solution pouches, 20/box.

WD-35653-04 Assortment pack, 5 ea. deionized water, pH 4.01, pH 7.00, and pH 10.00 solution pouches.

Consult your OAKTON® Distributor for a complete selection of pH and ORP electrodes, solutions, holders, and accessories.

NOTE: Remember to check the temperature calibration when replacing the ATC probe or when using with an OAKTON® "All-in-One" combined pH and temperature probe. See section 4.5, "Temperature calibration" (pages 14-16).

To order OAKTON accessories, contact your OAKTON distributor.

NOTES:

NOTES:

15. Warranty

OAKTON warrants this product to be free from significant deviations in material and workmanship for a period of one year 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 warrantied 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.

Out-of-warranty products will be repaired on a charge basis.

16. 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.

OAKTON®