

Sartorius Basic pH Meter PB-20

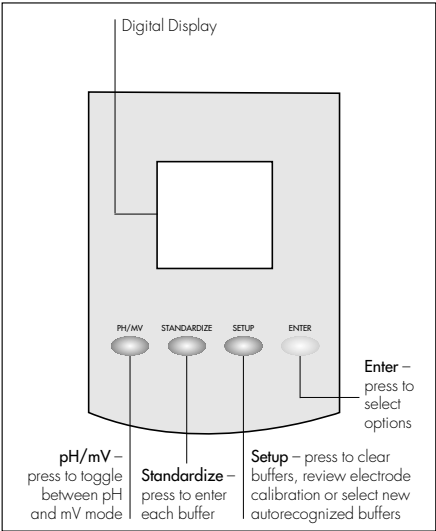
Operation Manual



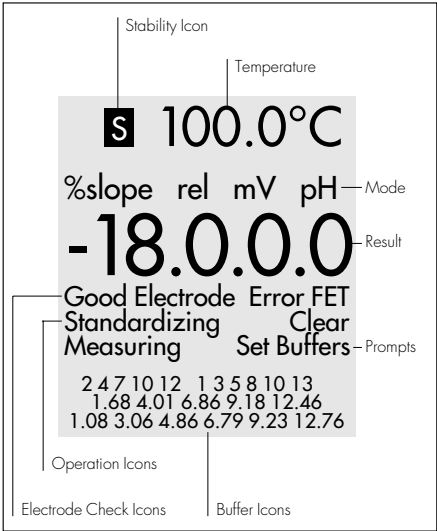
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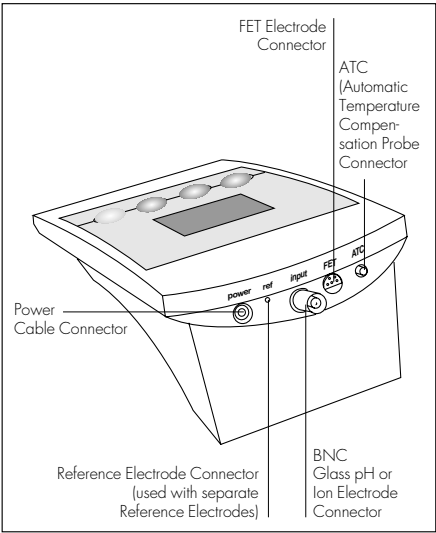
General View



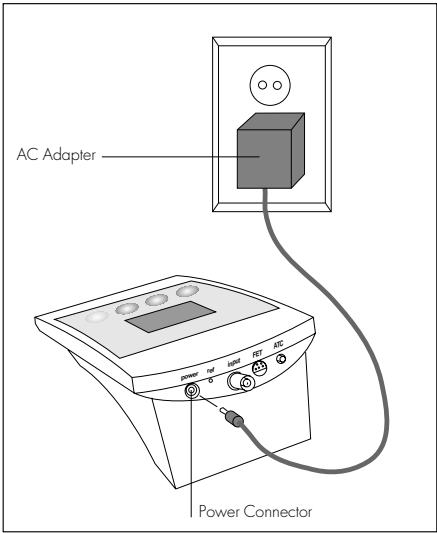
1. Front Panel Controls



2. Digital Display



3. Rear Panel Connectors



4. Connecting to a Power Source

Warning and Safety Information

For safety and operating reasons, only authorized service technicians may open the Basic Meter PB-20 housing. Therefore, only authorized technicians may repair or perform maintenance on this pH meter. Any tampering with the pH meter or negligent or intentional damage to this equipment will void any warranty claims against the manufacturer.

If liquid gets into the pH meter, unplug it from AC power (mains supply) and have an authorized service technician check the pH meter.

If you do not plan to use this pH meter for a relatively long period, please disconnect it from AC power.

For safety reasons, use this equipment only for the application described in this operation manual.

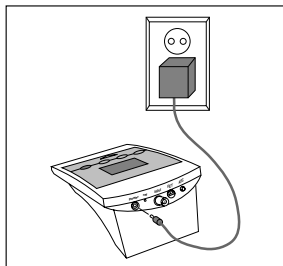
Make sure that the buffers used for standardizing have exactly the same values that are stored.

Information on Radio Frequency Interference

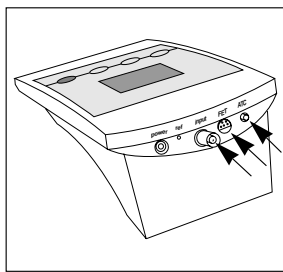
Warning!

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference, when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

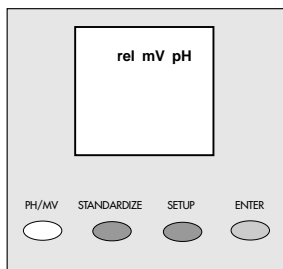
Basic pH Meter Quick Reference



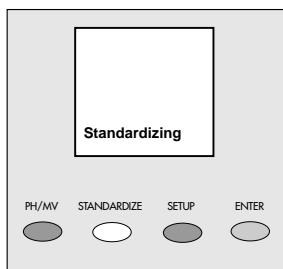
1. Connect power cable to meter power jack and to AC power source.



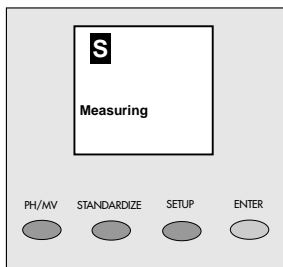
2. Connect a glass pH electrode to the input and ATC connectors, **or** connect the FET pH electrode to the FET connector.



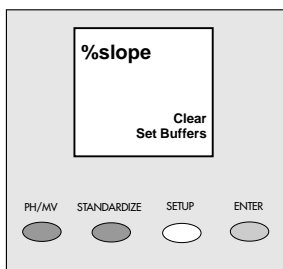
3. Press **pH/mV** until the display indicates the appropriate measurement mode (pH or mV/relative mV).



4. Standardize the meter using up to three buffers by immersing the electrode in a buffer, stirring, then pressing **Standardize** to enter each buffer.



5. The display shows the current reading in pH, mV, or relative mV units.



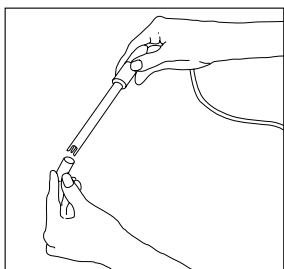
6. Press **Setup** to review electrode calibration and to clear or select buffer sets.

Installing and Maintaining Electrodes

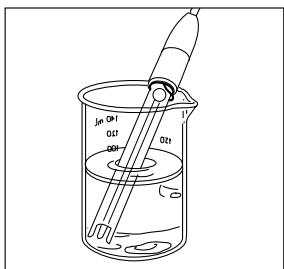
This PB-20 meter allows you to use two types of pH electrodes: a glass pH electrode and the FET (field effect transistor) pH/ATC electrode. If both types of electrodes are installed, the meter will read the FET electrode.

Note: If both electrodes are connected to the meter, do not put them in a solution together because you will get inaccurate measurements.

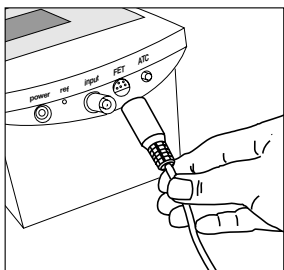
1. Remove the protective end cover from electrode.

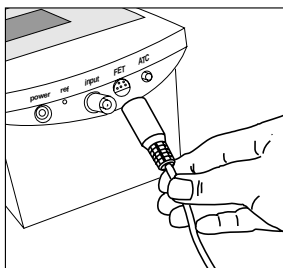


2. Before first use of your glass pH electrode, or whenever the electrode is dry, soak over night in an Electrode Filling Solution, KCl solution or Electrode Storage Solution.

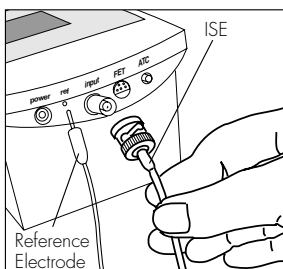


3. Remove the shorting cap on the BNC connector. Install the combination glass pH/ATC electrode by plugging it into the **input** connection (push on and twist to lock) and the ATC connector into the **ATC** jack.

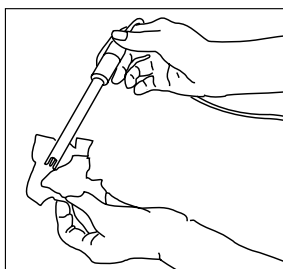




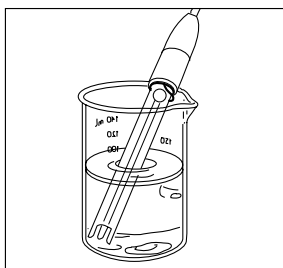
4. Option: Install the optional FET pH/ATC electrode by plugging it into the **FET** jack on the back of the meter panel. Allow the FET electrode to stabilize for one minute prior to use.



5. Option: Install ORP or Ion Selective Electrode pairs by removing the BNC shorting cap and plugging the BNC connector (twist-lock) into the BNC jack. If a separate reference electrode is used, plug the reference electrode into the **ref** pin.



6. Rinse and blot-dry electrodes between each measurement (**do not wipe**). Rinse electrodes with distilled water or deionized water, or part of the next solution to be measured.

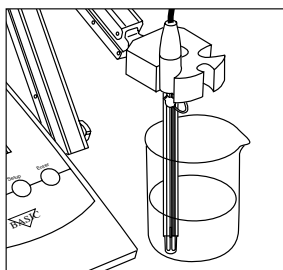


7. Store glass pH electrodes in Electrode Filling Solution, KCl solution or Electrode Storage Solution. Always leave the filling hole open and refill with Filling Solution when the internal solution level gets low. Store FET pH/ATC electrodes dry.

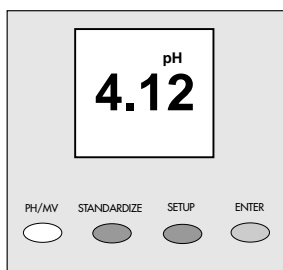
Standardizing for pH Measurement

Because electrodes vary in their response, you must standardize your pH meter and electrode to compensate for electrode variation. The more frequently you standardize, the more accurate your measurements. Standardize daily, or more often, for accurate results.

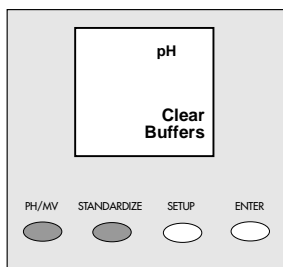
This pH meter allows automatic standardization using up to three buffers. When you enter a fourth buffer, the buffer farthest away is replaced by the new buffer pH. The pH meter performs automatic temperature compensation.



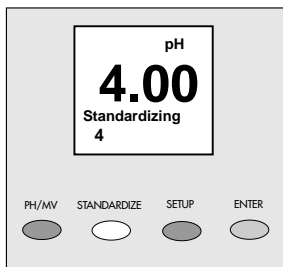
1. Immerse electrode in a buffer solution. Stir gently. Allow the electrode to reach a stable value.



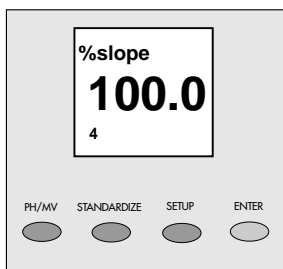
2. Press and release the **pH/mV** button until your digital display indicates pH mode. This button toggles between pH and mV modes.



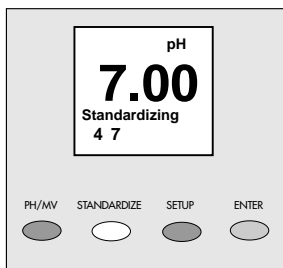
3. Clear existing buffers when doing a new 2 or 3 point standardization. Use the **Setup** and **Enter** buttons to clear existing buffers and to select a new set of buffers. See page 13–14.



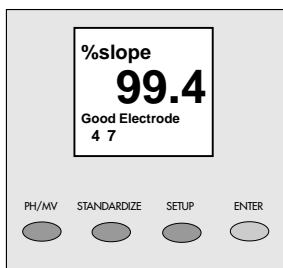
4. Press **Standardize**. The meter recognizes the buffer and flashes a buffer icon. When the signal is stable, or when you press **Enter**, the buffer is entered.



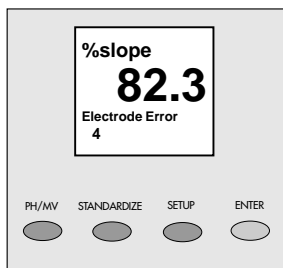
5. The meter displays the **%slope** of the electrode as 100.0%. On entering a second or third buffer, the meter performs a diagnostic check on the electrode and displays the slope.



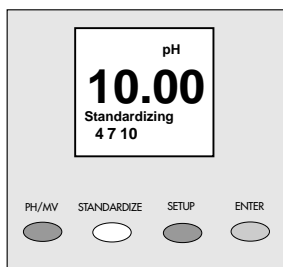
6. To enter a second buffer, place the electrode in the second buffer solution, stir, allow time for the electrode to stabilize, and press **Standardize** again. The meter recognizes the buffer and displays the first and second buffer icons.



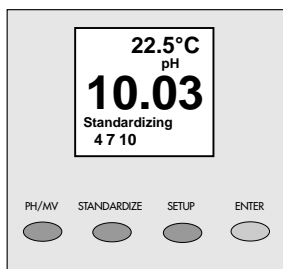
7. Next, the meter performs a diagnostic test of the electrode. The display indicates either **Good Electrode** or **Electrode Error**. The meter displays the %slope of the electrode.



8. **Electrode Error** indicates that your electrode is not working properly. The electrode response must be between 90 and 105% slope. Measurements causing **Electrode Error** are not accepted, used or stored by the meter (see "Troubleshooting" on page 22). Press **Enter** to clear the Error, then try re-entering the buffer as described in step 6.



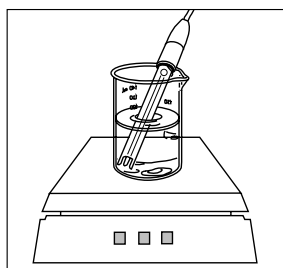
9. To set a third standard, place the electrode in the third buffer solution, stir, allow to stabilize, and press **Standardize**. The results will be the same as in steps 7 and 8, except the display will show three buffer icons.



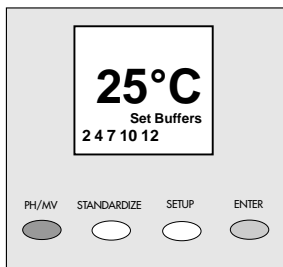
10. After entering each buffer, the **Standardizing** icon goes off and the **Measuring** icon appears on the display to indicate that the meter returns to Measuring operation.

Note:

The meter continually adjusts for temperature. Therefore, buffers may vary slightly from the nominal values because of temperature.



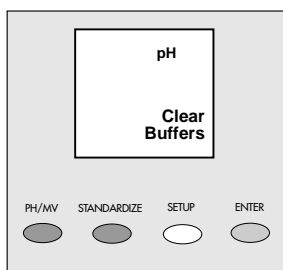
11. Standardize your meter and electrode using at least two buffers with pH values bracketing the expected pH of your samples. Stirring with a magnetic stir bar and stirrer provides faster electrode response.



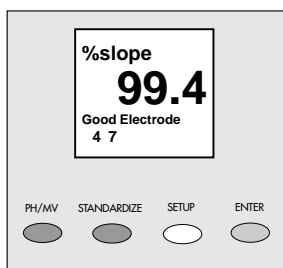
12. The first set of buffers in the meter is used at 25°C in North America and, typically, at 20°C in Europe. In pH mode, press **Standardize** and **Setup** together to show the current buffer temperature setting. Press both **Standardize** and **Setup** again to toggle between the temperature settings. Press **Enter** to select the displayed temperature setting and to return to **Measuring**.

Using Setup

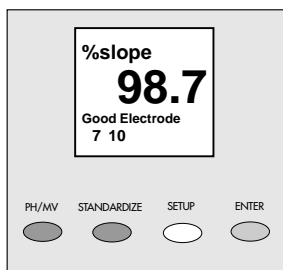
The **Setup** button lets you clear all the buffers that you have entered, review calibration information, or select the buffer set that you want. Note: You can escape the setup mode at any time by pressing **pH/mV**.



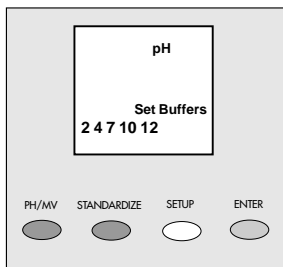
1. Press **Setup** and the meter displays a flashing **Clear Buffers** icon. Use this step only when you wish to clear all buffers you have entered. To clear all existing buffers, press **Enter**. The meter clears all buffers and returns to **Measuring**.



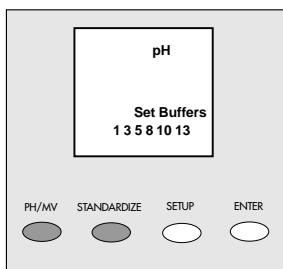
2. Press **Setup** again to show electrode performance. If the meter has accepted two buffers, it will display **Good Electrode**, display the slope between the first and second buffers and display the two buffer icons.



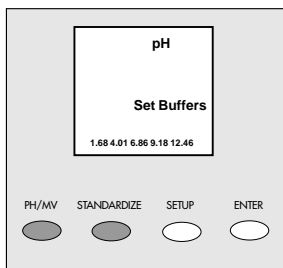
3. Pressing **Setup** again shows the electrode slope between the second and third buffers (if three buffers have been entered) and shows the second and third buffer icons.



4. Press **Setup** again to display a flashing **Set Buffers** icon and to display the first buffer set icons.



5. Press **Enter** to select the set of buffers shown on the display or Press **Setup** again to view the next set of buffers. Continue pressing **Setup** to view the third and fourth buffer sets.



6. Press **Enter** to select the displayed buffer set that contains the buffer you want to use. Press **Setup** again, or press **pH/mV** at any time, to return to Measuring.

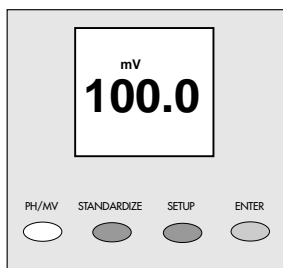
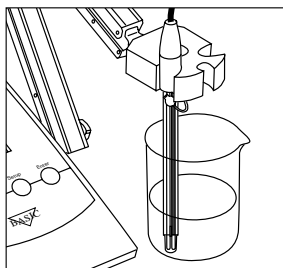
Note: You may mix buffers from different sets.

Standardizing for Millivolt Measurement (Relative Millivolts)

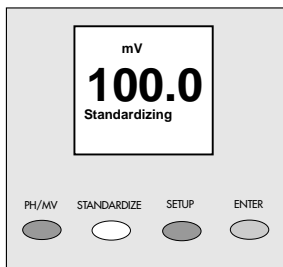
You use millivolt measurement for determining ion concentration and for measuring redox potential (also called ORP, oxidation reduction potential). You will normally use an ion selective electrode (ISE), combined with a reference electrode, to measure ion concentration. The ISE senses the ion concentration and responds with a millivolt potential. The millivolt readings are then used to determine ion concentrations.

You will normally use a platinum indicator electrode, combined with a reference electrode, to measure redox potential (ORP). ORP measurements indicate the oxidizing or reducing capability of a solution. You can use ORP values to monitor or control solutions requiring a set amount of oxidants or reductants.

1. Immerse electrode in a standard solution.



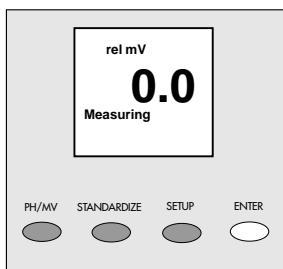
2. Press the **pH/mV** button until your digital display indicates mV mode.



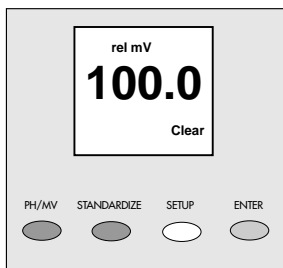
3. Press **Standardize** to enter a mV standard and read relative mV.

Note:

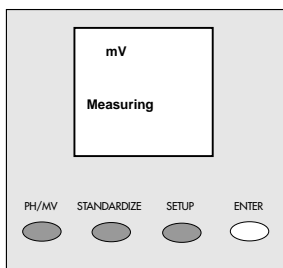
Relative mV mode is not allowed with the FET electrode.



4. When the signal becomes stable, or when you press **Enter**, the current absolute mV value becomes zero relative millivolts.

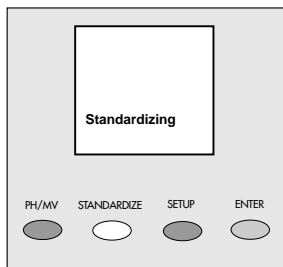


5. To clear a mV offset and return to absolute millivolt mode, press **Setup**. The meter displays a flashing **Clear** icon, and shows the current relative millivolt offset.

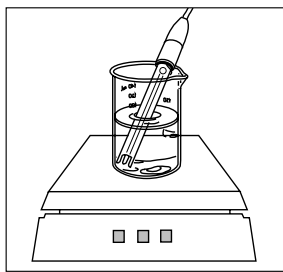


6. To clear the mV standard, press **Enter**. You then return to absolute mV mode.

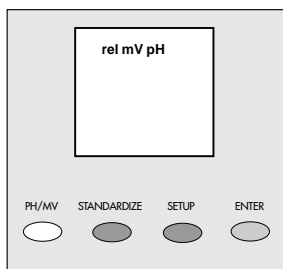
Measuring pH or Millivolts



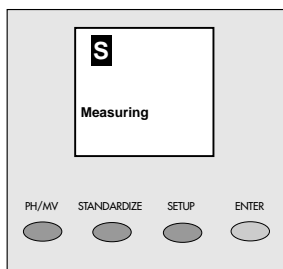
1. Standardize your meter. See page 21 (pH) or page 16 (mV).



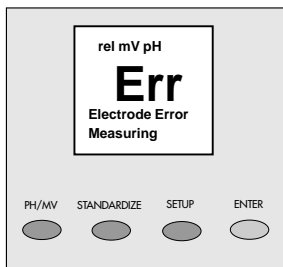
2. Rinse electrode and immerse in sample solution. Stir gently.



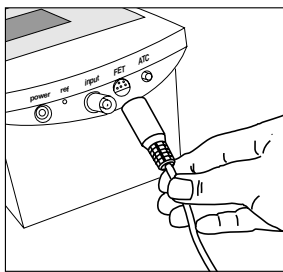
3. Press **pH/mV** until your display indicates the correct mode (pH, mV or relative mV).



4. The display shows the current reading in pH, mV, or relative mV units. When the signal is stable, the meter displays the **S** icon. The **S** icon means the signal is changing less than 0.007 pH or 0.08 mV from the prior reading.



5. You may receive an out of range error, **Err**, if your electrode is not immersed in a solution. To correct the error, immerse the electrode in a solution.



6. Separate calibrations for the glass and FET electrodes are stored in memory. Plugging the FET in recalls its calibration; unplugging the FET recalls the glass electrode calibration.

Understanding pH Theory

Defining pH

The measurement of pH plays an important role in identifying and controlling acidity and alkalinity levels for industry and research. pH is a measure of the acidity or alkalinity of a solution and can be represented by this equation:

$$\text{pH} = -\log [\text{H}^+]$$

with $[\text{H}^+]$ representing the concentration of hydrogen ions in the solution. pH is sometimes referred to as the power of the hydrogen ion in a solution.

By using a pH meter, you can determine exact pH levels of solutions. For example, rather than say that lemon juice is quite acidic, you can say that lemon juice has a pH of 2.4. An exact pH value can be used to control or measure acidity levels for manufacturing processes or for basic research.

pH values generally range from 0 to 14, with a pH value of 7 being the neutral point, or the value of pure water. pH values greater than 7 represent increasing alkalinity, whereas pH values below 7 represent increasing acidity (Figure 1).

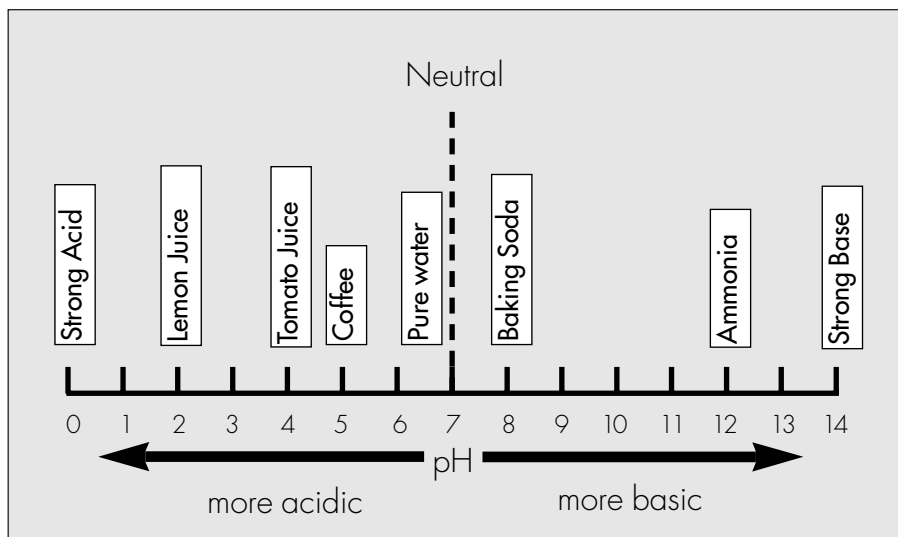


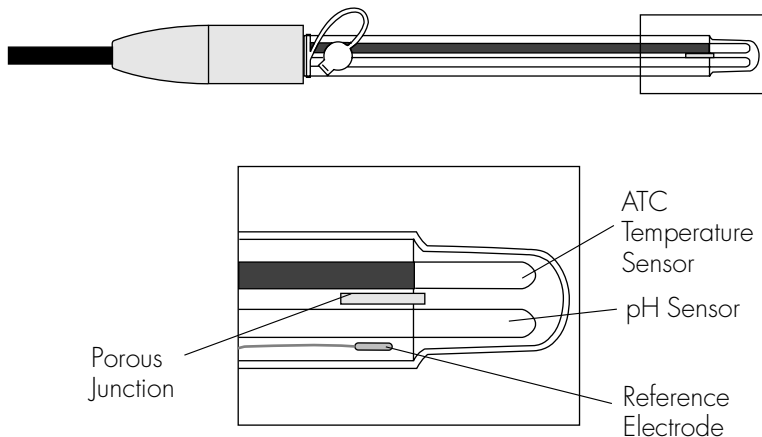
Figure 1.

pH Scale showing the relative acidity or basicity of some common substances.

Measuring pH

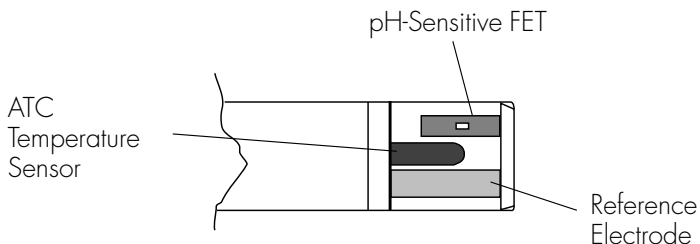
To measure pH with a conventional glass pH electrode, the meter uses a pH-sensing glass bulb that is sensitive to hydrogen ions. The potential developed at the glass membrane is directly related to the pH of the solution.

The glass electrode is paired with a reference electrode which completes the electrical measuring circuit and provides a stable reference point. These two electrodes are joined to create a combination electrode. The combination glass electrode is connected to the pH meter which reads the voltage, converts it to pH units, and displays the result.

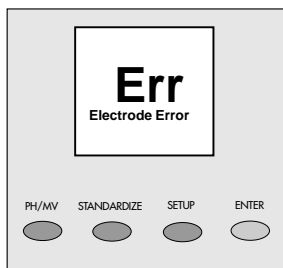


Combination Glass pH Electrode

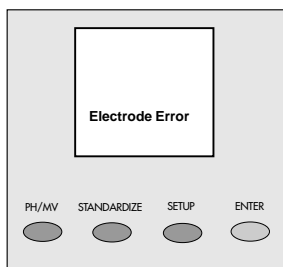
This meter can also use the Field Effect Transistor (FET) electrode for measuring pH. The FET uses an ion-sensitive solid state membrane attached to the transistor to measure the hydrogen ion concentration of a solution. The FET is paired with a reference electrode that maintains a constant potential while the FET responds to the sample.



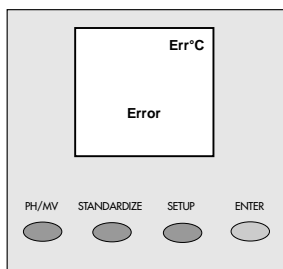
Troubleshooting



1. If the signal from the electrode is out of range, the display will show **Err**. This may happen when the electrode is not in a solution.



2. The meter will display **Electrode Error** when it detects an error in electrode response. During standardization, the message indicates that the electrode is less than 90% or more than 105% of the correct response. The **Electrode Error** message can indicate either a bad electrode or bad buffer(s).



3. If the meter detects an error in the temperature probe, the display shows **Err°C**. If you do not use a temperature probe, the meter uses the default temperature that you set, either 20°C or 25°C.

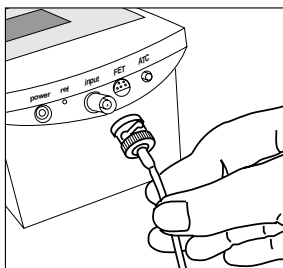
Electrode Test

pH 7 0 ± 30 mV

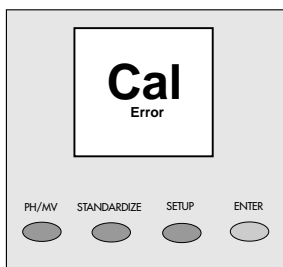
pH 4 169 to
186 mV more
than pH 7

pH 10 159 to
185 mV less
than pH 7

4. To test the pH electrode, place it in a good pH 7 buffer. Press **pH/mV** to use the mV mode, and note the millivolt reading. Make sure the meter is in mV mode and not relative mV mode. Repeat for either a pH 4 or pH 10 buffer. The electrode signal must be within the limits shown below (when temperature is near 25°C).



5. To test the meter for correct operation, install the BNC (input) shorting cap. Press **pH/mV** to select the mV mode, and note the mV reading. Make sure the meter is in mV mode and not relative mV mode. If the meter reads 0 ± 0.3 mV, it is measuring correctly. Note that a long-term drift of 0.1 mV/month since last calibration is specified.



6. If the meter detects a loss of calibration or a hardware error during its power-up self-test, the display shows **CAL Error**. This means the mV accuracy may be reduced, but pH accuracy after standardization will be the same. Press **Enter** to continue using the meter.

Meter Specifications

pH	–1.99 to 19.99 displayed to 0.01 accurate to ± 0.005
mV	–1800.0 to 1800.0 mV displayed to 0.1 mV accurate to ± 0.3 mV
Temperature	–5.0 to 105.0°C displayed to 0.1°C accurate to $\pm 0.4^\circ\text{C}$
Standardization	0, 1, 2 or 3 buffers
Auto buffer recognition	22 buffers 2, 4, 7, 10, 12 1, 3, 6, 8, 10, 13 1.68, 4.0, 6.86, 9.18, 12.46 1.09, 3.06, 4.65, 6.79, 9.23, 12.75
Auto Temperature Compensation (ATC)	
Automatic electrode slope correction for 90–105%	
Direct reading with both a glass and FET pH electrode	

Accessories

You can order the following accessories for your pH meter:

Plastic-body pH/ATC Electrode, with built-in temperature sensor 3mol/l KCl liquid-filled	PY-P10
Glass body pH/ATC Electrode, 3mol/l KCl liquid-filled, platinum junction	PY-P11
Plastic body pH Electrode, gell-filled	PY-20
Glass body pH Electrode, platinum junction	PY-21
FET pH/ATC Electrode, with built-in temperature sensor	PY-P30
ATC Temperature Probe	PY-T01

Other electrodes, such as ion selective electrodes and redox electrodes are also available. Call your sales representative.

CE Marking

The **CE** marking affixed to the equipment indicates that the equipment meets the requirements of the following Directive(s):

Council Directive 89/336/EEC "Electromagnetic compatibility (EMC)"

Applicable European Standards:

Limitation of emissions:

EN 50081-2 Industrial environment

Defined immunity to interference:

EN 50082-1 Residential, commercial and light industry

EN 50082-2 Industrial environment

Warning

This is a Class A device that can cause radio interference in residential areas. If this should occur, the user may be required to take suitable measures to correct and eliminate such interference, and to pay the costs incurred as a result.

Important Note:

The operator shall be responsible for any modifications to Sartorius equipment and for any connections of cables or equipment not supplied by Sartorius and must check and, if necessary, correct these modifications and connections.

On request, Sartorius will provide information on the minimum operating specifications (in accordance with the Standards listed above for defined immunity to interference).

Council Directive 73/23/EEC

"Electrical equipment designed for use within certain voltage limits"

Applicable European Standards:

EN 60950 Safety of information technology equipment including electrical business equipment

EN 61010 Safety requirements for electrical equipment for measurement, control and laboratory use
Part 1: General requirements

If you use electrical equipment in installations and under ambient conditions requiring higher safety standards, you must comply with the provisions as specified in the applicable regulations for installation in your country.

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specifications and design of the equipment
without notice.

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