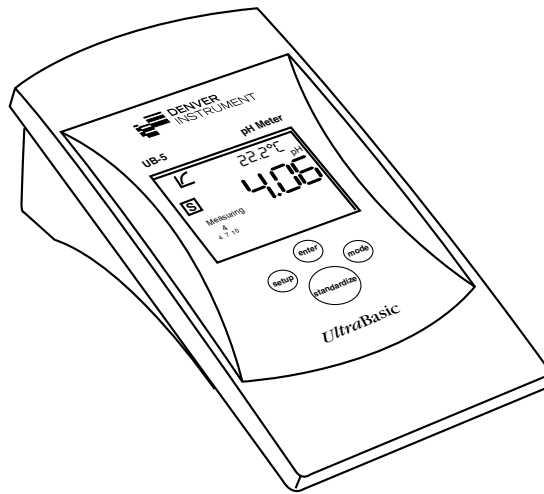


UltraBasic Benchtop pH Meter

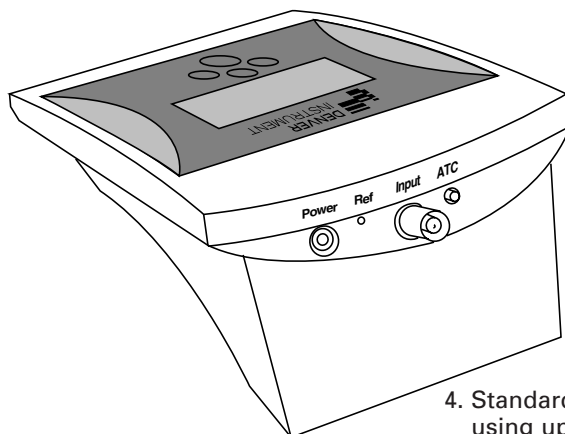
Operation Manual



UltraBasic Meter Quick Reference

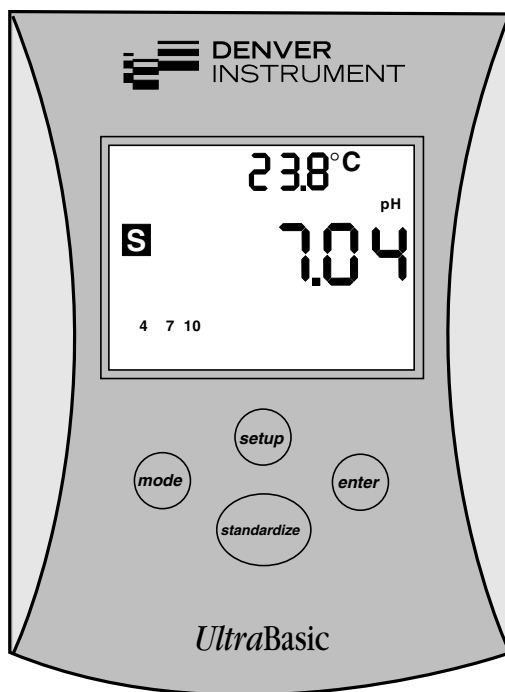
1. Connect a AC adapter to the power connection.

2. Connect an electrode to the Input and ATC connectors, if desired.



3. Press **mode** 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.

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Disclaimers

Important Note:

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

You have purchased a quality precision meter that requires handling with care.

Read entire contents of this Operation Manual prior to operating your new Denver Instrument meter.

Caution:

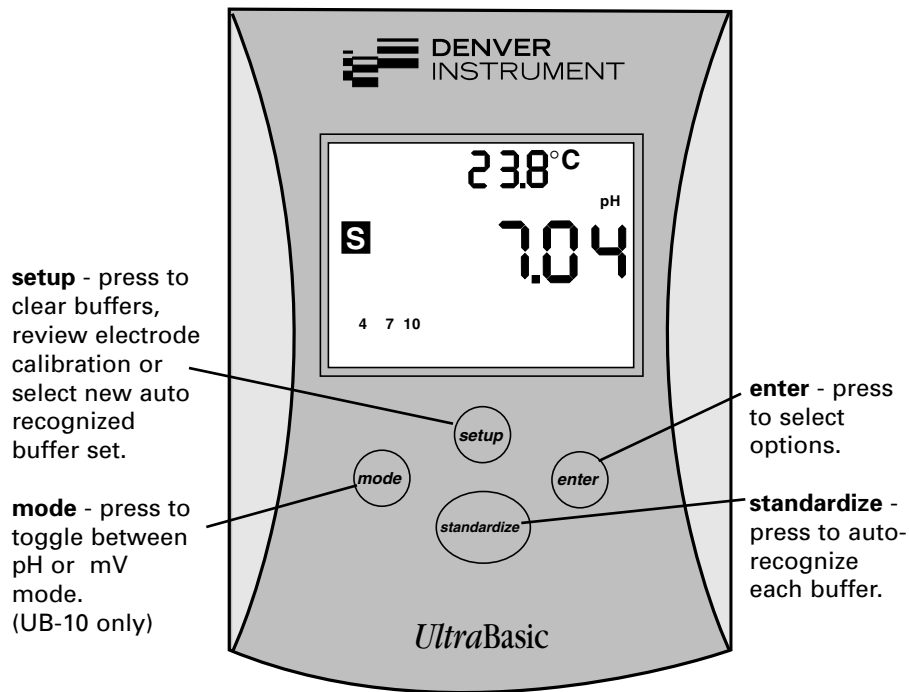
Changes or modifications not expressly approved by the manufacturer could void the product's warranty.

Manufactured in the U.S.A. by:

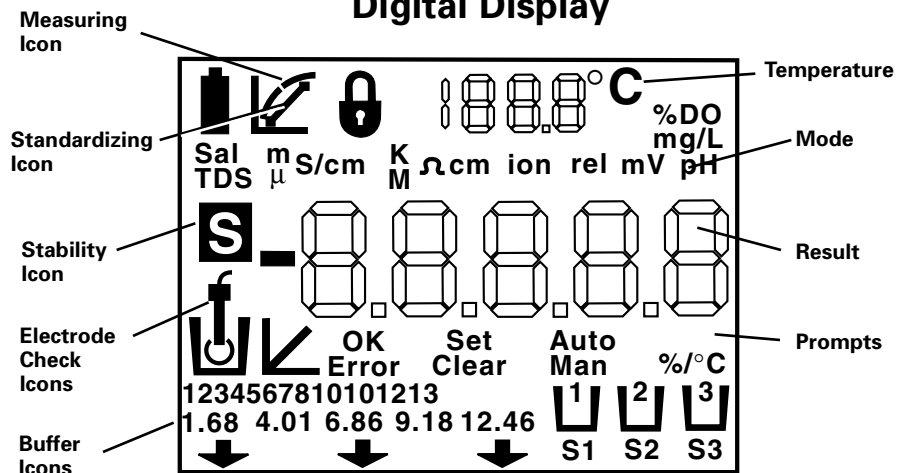


Getting Started

Front Panel Controls

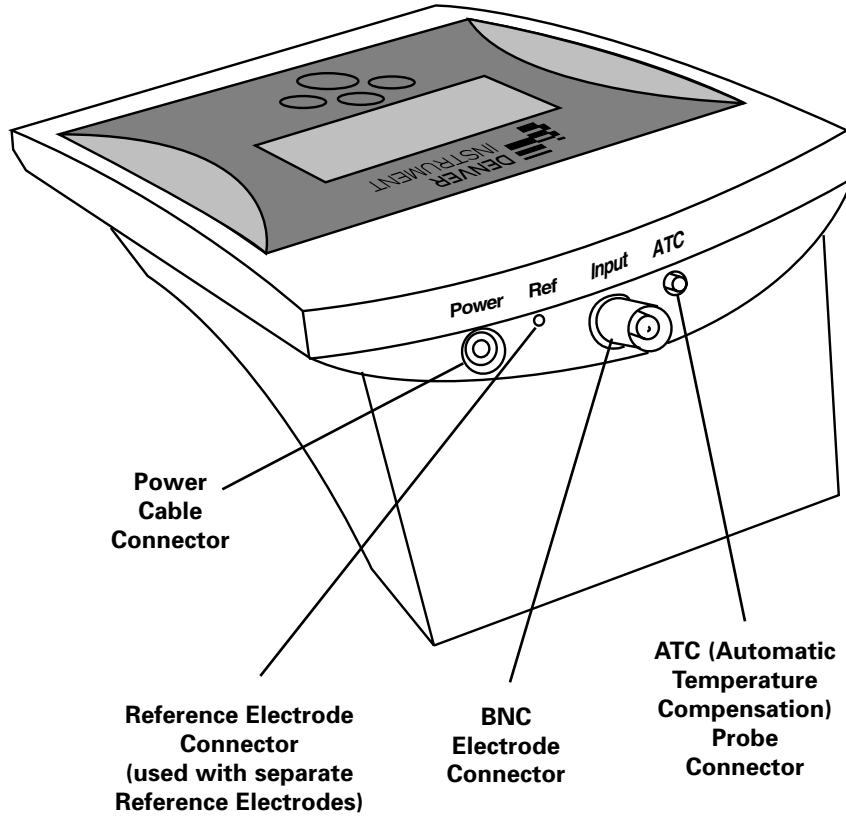


Digital Display



Note: Not all icons on display will be used.

Rear Panel Connectors

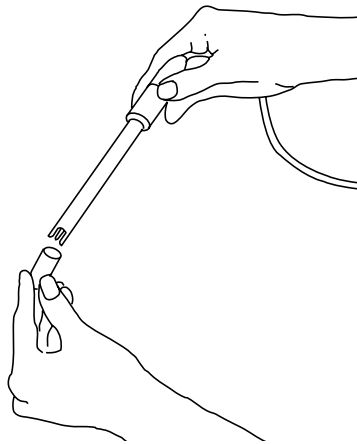


Installing and Maintaining Electrodes

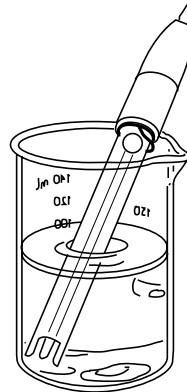
This meter allows you to use:

- Combination pH electrode with BNC connector
- 3-in-1 combination electrode with BNC connector and 2.5 mm phone jack for ATC
- Indicating pH electrode with BNC connector and separate reference
- Separate 2.5 mm phone jack for ATC
- Ion selective or ORP electrode with BNC connector.

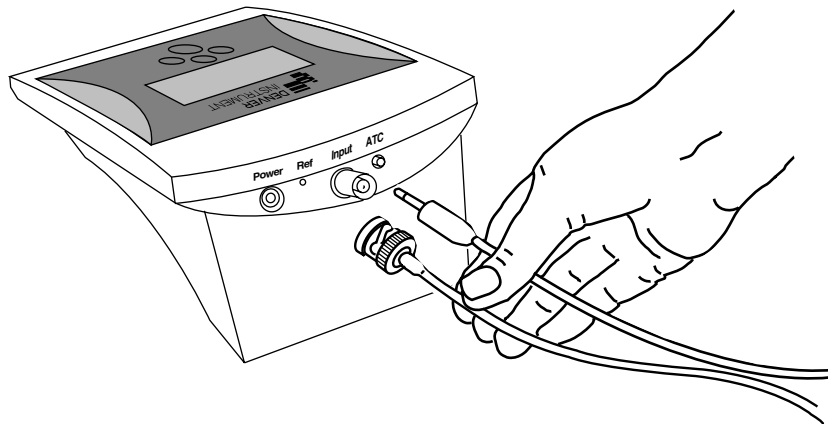
1. Remove the protective end cover from electrode.

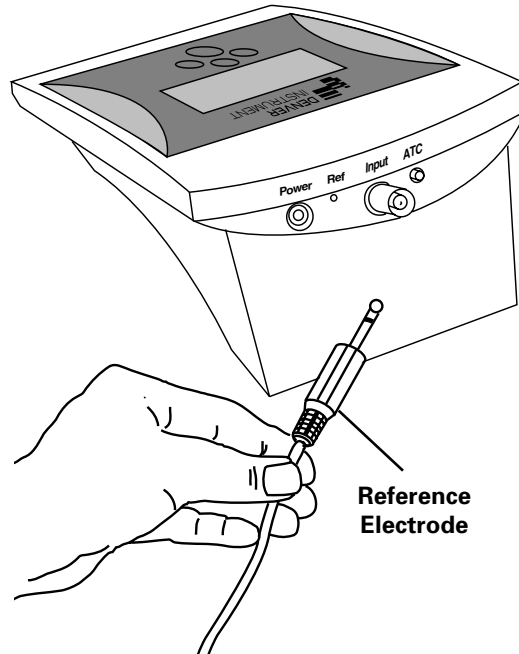


2. Before using your pH electrode, or whenever the electrode is dry, soak over-night in an Electrode Filling Solution, KCl solution or Electrode Storage Solution.



3. Remove the shorting cap on the BNC connector. Install the electrode by plugging it into the **input** connection (push on and twist to lock). An accessory ATC probe can be installed in the **ATC** port for the most accurate measurement.

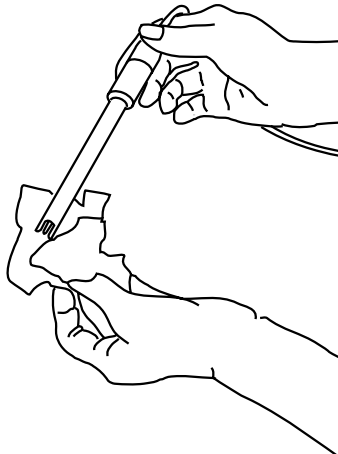




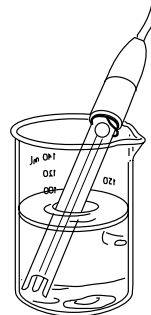
4. If a separate reference electrode is used, plug the reference electrode into the **ref** pin.

5. 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.

6. Store pH electrodes in KCl solution or Electrode Storage Solution. Always leave the filling hole open when in use and closed when in storage. Refill with Filling Solution when the internal solution level gets 1" below fill hole.



Note: The electrode that comes with the UltraBasic kit is gel-filled. It has no fill solution or filling hole.

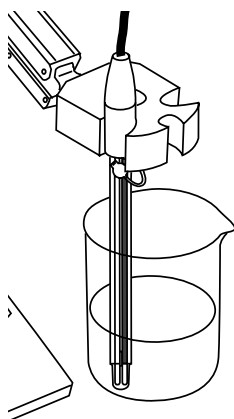


Standardizing for pH Measurement

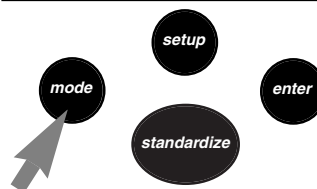
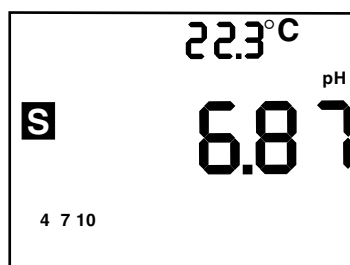
Because electrodes vary in their response, you must standardize your pH meter and electrode to compensate for electrode variation. The more frequently you standardize, the more accurate your measurements. Standardize daily, or more often, for accurate results.

Note: To escape from standardizing mode, press "Standardize" key again.

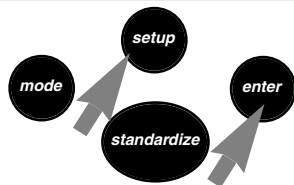
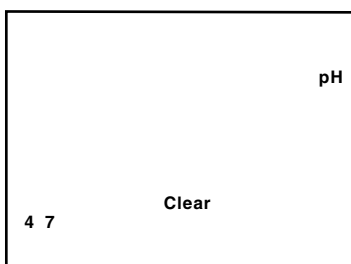
1. Immerse electrode in a buffer solution. Stir gently. Allow the electrode to reach a stable value.



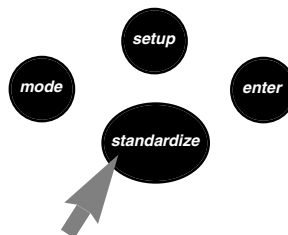
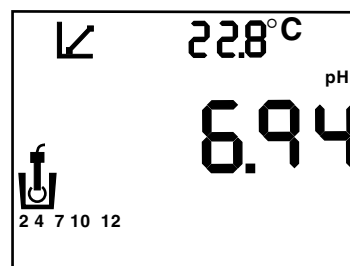
2. Press and release the **mode** button until your digital display indicates pH mode.



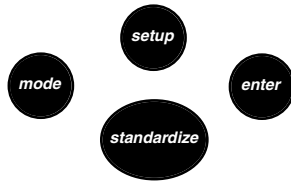
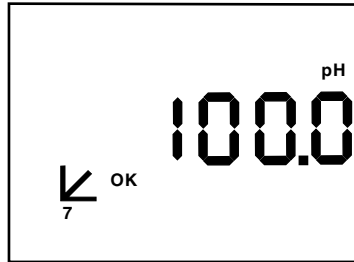
3. Clear existing buffers when doing a new standardization. Use the **setup** and **enter** buttons to clear existing buffers.



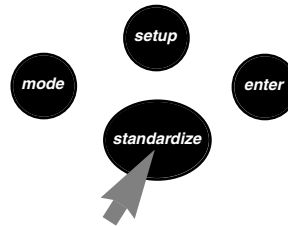
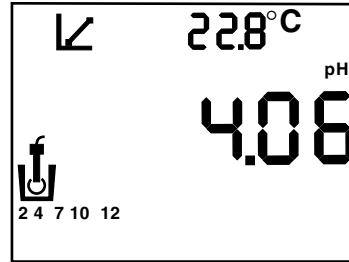
4. Press **standardize**. The meter flashes the current buffer set and recognizes the flashing buffer. When the signal is stable, or when you press **enter**, the buffer is entered.



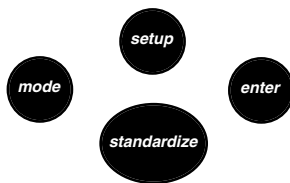
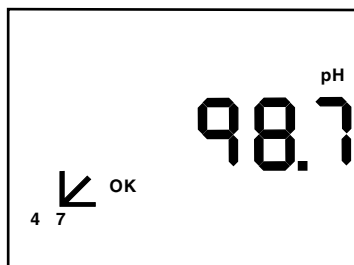
5. The meter displays the percent slope of the electrode as 100.0% on the first buffer. On entering a second or third buffer, the meter performs a diagnostic check on the electrode and displays the slope.



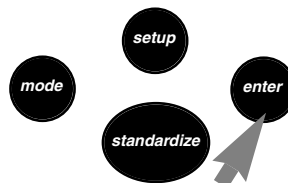
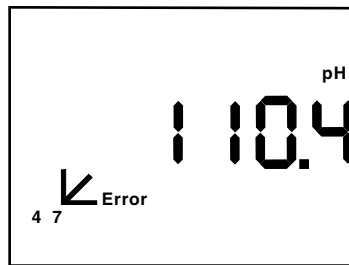
6. To enter a second buffer, place the electrode in the second buffer solution, stir, allow time for the electrode to stabilize, and press **standardize** again. The meter recognizes the buffer.



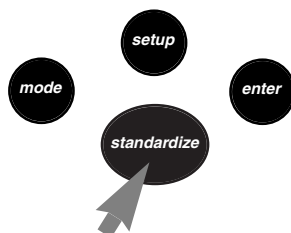
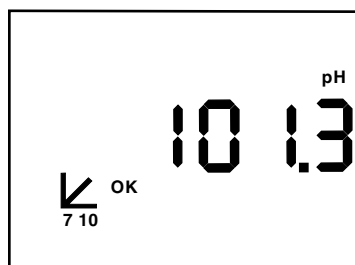
7. Next, the meter performs a diagnostic test of the electrode. The display indicates electrode condition. The meter displays the % slope of the electrode.



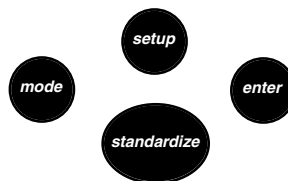
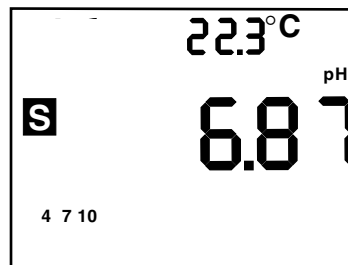
8. **Slope Error** indicates that your electrode is not working properly. The electrode response must be between 90 and 105% slope. Measurements causing Slope Error are not accepted, used or stored by the meter. Press **enter** to continue.



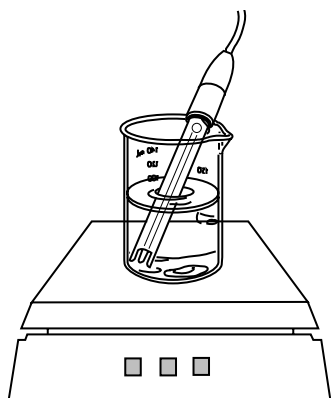
9. To enter a third standard, place the electrode in the third buffer solution, stir, allow to stabilize, and press **standardize**. The results will be the same as in steps 7 and 8.



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



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.



Note: If an ATC probe is used, the meter continually adjusts for temperature. Therefore, buffers may vary slightly from the nominal values because of temperature.

Default temperature is 25 oC

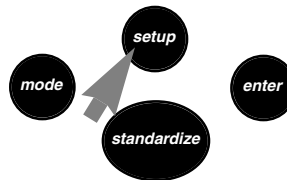
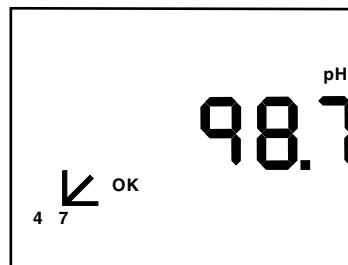
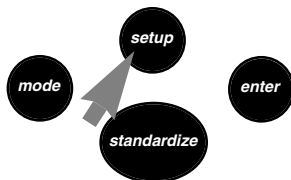
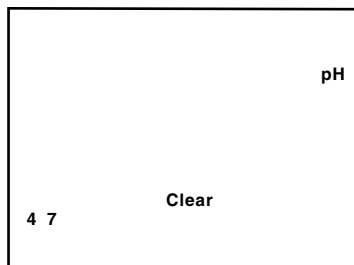
Note: The temperature is only displayed when an ATC probe is attached.

Using Setup in pH Mode

The **setup** button lets you clear all the buffers/standards that you have entered, review calibration information, or select the buffer/standard set that you want.

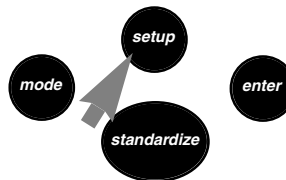
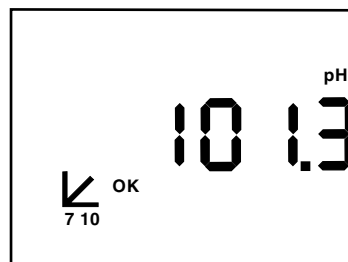
Note: Continuing to press **setup** will return you to measurement mode.

1. Press **setup** and the meter displays a flashing *Clear* 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* screen.
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.

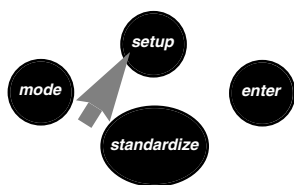
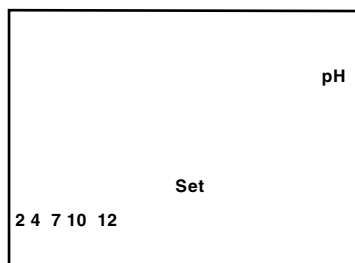


3. Pressing **setup** again shows the electrode slope between the second and third buffers (if three buffers have been entered) and shows the second and third buffer icons.

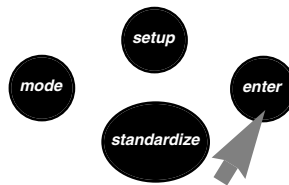
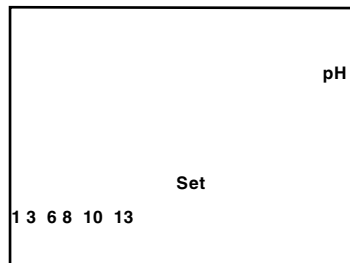
Note: These screens will only be displayed if buffers are stored.



4. Press **setup** again to display a flashing *Set Buffers* icon and to display the first buffer set (U.S. buffer set) icons.



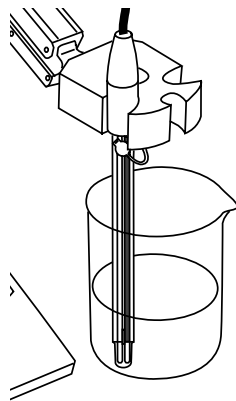
5. Press **enter** to select the set of buffers shown on the display or
Press **setup** again to view the next set of buffers (Merck buffer set). Continue pressing Setup to view the third buffer set (NIST buffer set).



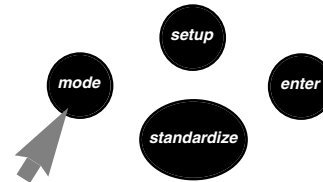
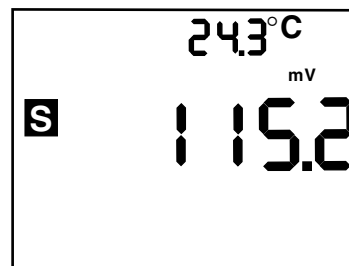
Standardizing for Millivolt Measurement/ Relative Millivolts (UB-10 Model only)

You use millivolt measurement for electrode diagnostics, titration or measuring redox potential (also called ORP, oxidation reduction potential). 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.

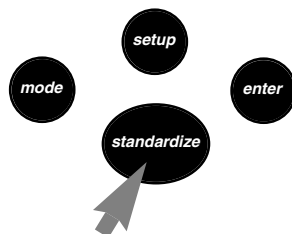
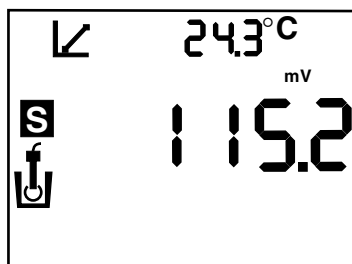
1. Immerse electrode in a standard solution.



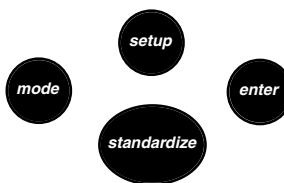
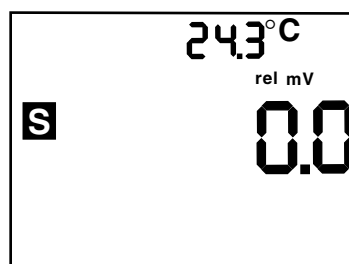
2. Press the **mode** button until your digital display indicates mV mode.



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

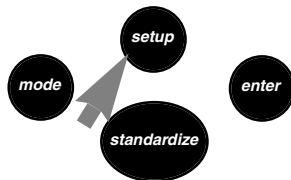
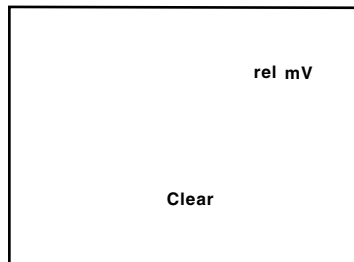


4. When the signal becomes stable, or when you press **enter**, the current absolute mV value becomes zero relative millivolts.

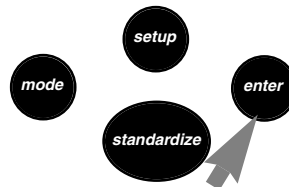
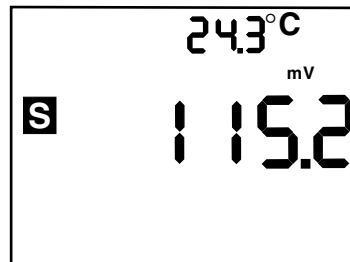


Using Setup in mV Mode (UB-10 Model)

1. 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.



2. To clear the mV standard, press **enter**. You then return to absolute mV mode.



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).

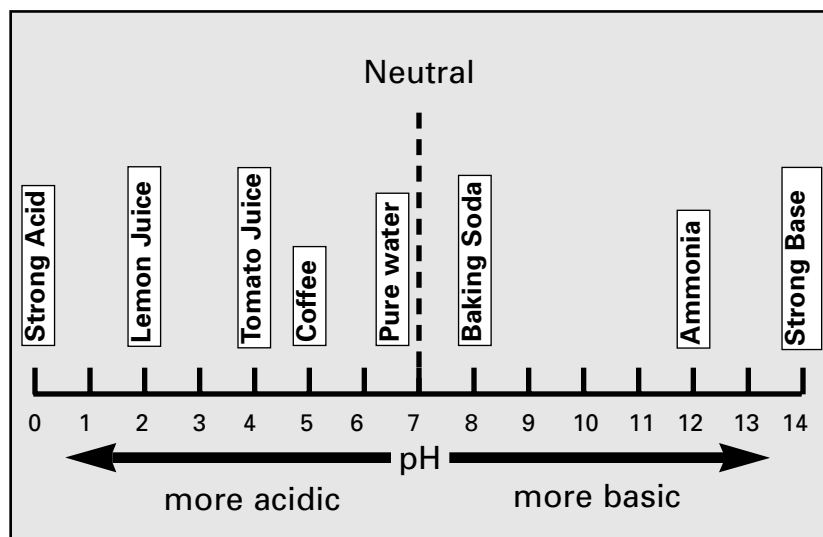


Figure 1.
pH Scale showing the relative acidity or basicity
of some common substances.

Understanding Temperature Compensation

NOTE: Temperature compensation only takes effect when an ATC probe is attached.

There are two ways that temperature compensation affects pH measurement:

1. Buffer pH values change with temperature.

Each buffer changes depending on the temperature of the solution. These values are typically found on the label of the buffer. The tables below are representative of most buffers.

When standardization is performed in pH mode, the pH value is adjusted to the current value for the current temperature.

For example, if your pH 7 buffer is at 20°C the meter will standardize your buffer at 7.02 instead of 7.00 which is the value at 25°C.

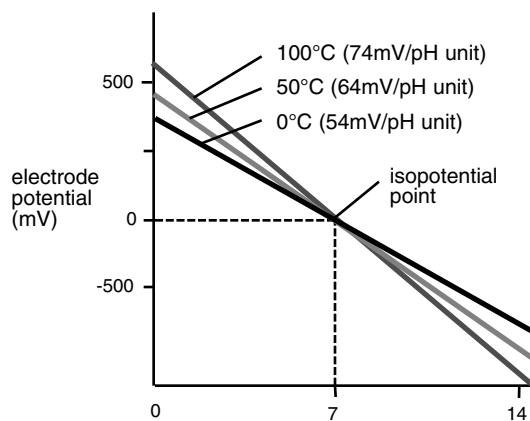
U.S. Standard Buffer

	pH 4.00	pH 7.00	pH 10.00
0°C	4.005	7.13	10.34
5°	4.003	7.10	10.26
10°	4.001	7.07	10.19
15°	4.002	7.05	10.12
20°	4.003	7.02	10.06
25°	4.008	7.00	10.00
30°	4.010	6.99	9.94
35°	4.020	6.98	9.90
40°	4.03	6.97	9.85
50°	4.061	6.97	9.78

2. The electrode efficiency changes with temperature.

The standard mV change per pH unit is approximately 59.17 at 25°C. However, as shown in the below graph, this mV per pH unit value changes as temperature changes.

The meter compensates for this change by changing the pH reading as temperature changes.

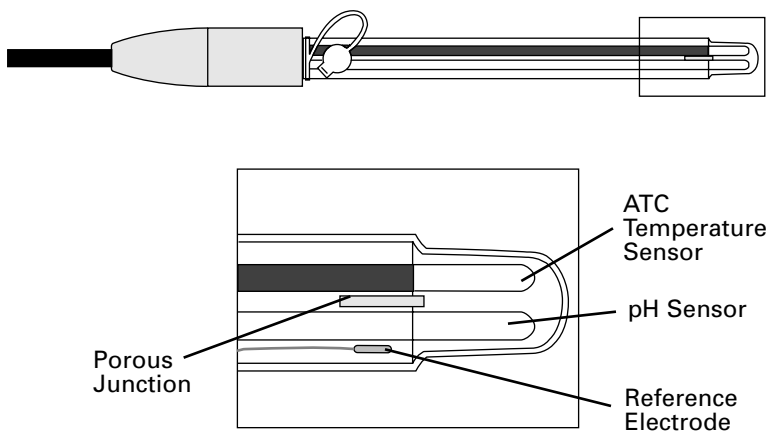


Typical pH electrode response as a function of temperature

Measuring pH

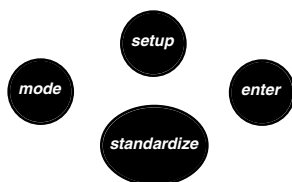
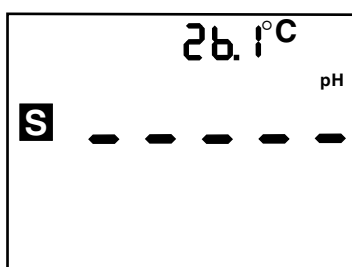
To measure pH with a conventional glass pH electrode, the meter uses a pH-sensing glass bulb that is sensitive to hydrogen ions. The potential developed at the glass membrane is directly related to the pH of the solution.

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.

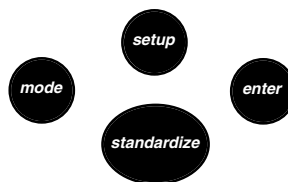
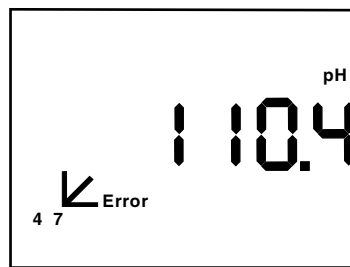


Troubleshooting

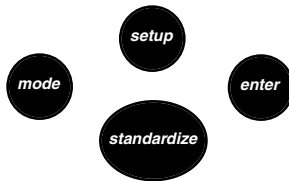
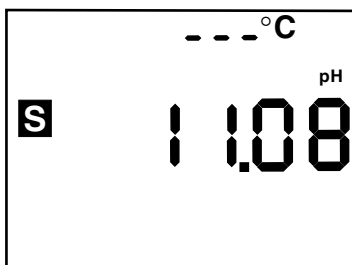
1. If the signal from the electrode is *out of range*, the display will show " - - ". This may happen when the electrode is not in a solution.



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 " - - ". If you do not use a temperature probe, the meter uses the default temperature of 25°C .



4. To test the pH electrode, place it in a good pH 7 buffer. Press **mode** 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).

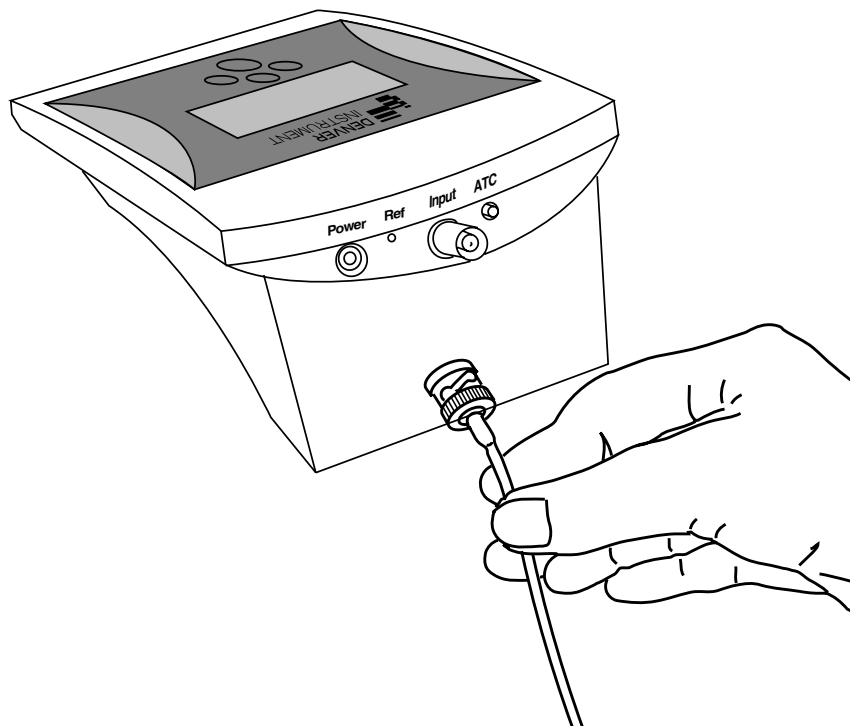
Electrode Test

pH 7 0 ± 30 mV

pH 4 159 to 186 mV
more than pH 7

pH10 159 to 186 mV
less than pH 7

5. To test the meter for correct operation, install the BNC (input) shorting cap. Press **mode** 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 0.1mV/month since last calibration is specified.



Accessories

You can order the following accessories for your pH meter:

Replacement UltraBasic pH Electrode	301423.1
Plastic-body pH/ATC Electrode	300728.1
High-performance glass-body pH/ATC Electrode (Tris-compatible)	300729.1
ATC Temperature Probe	300733.1
Free-standing Electrode Arm with Base	300401.1

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

Meter Specifications

pH	Range	0.00 to 14.00 pH
	Resolution	0.01 pH
	Accuracy	±0.01 pH
mV (UB-10 only)	Range	-1800.0 to 1800.0 mV
	Resolution	0.1 mV
	Accuracy	±0.2 mV or 0.05%, whichever is greater
Temperature	Range	0.0 to 100.0°C
	Resolution	0.1°C
	Accuracy	±0.2°C
Standardization		1, 2 or 3 buffers
Auto buffer recognition		16 buffers 2, 4, 7, 10, 12 1, 3, 6, 8, 10, 13 1.68, 4.01, 6.86, 9.18, 12.46

Auto pH Temperature Compensation with ATC probe
Automatic pH electrode slope correction for 90-105%

Warranty Instructions

1. Please return the prepaid, pre-addressed Purchase Registration Card to Denver Instrument Company promptly upon your purchase of the Denver Instrument product. The return of the card is not a condition precedent to warranty coverage.
2. If you have any questions about a Denver Instrument product, please contact the nearest Denver Instrument office as listed below.
3. If it becomes necessary to return your Denver Instrument product for service, you must obtain a "**Return Authorization Number**". Please pack the product securely in its original approved packing carton or an other suitable container. Include your Return Authorization Number on the shipping label. Shipping charges must be fully prepaid.

Return to authorized distributor or :

<i>North and South America:</i>	Denver Instrument Company 6542 Fig Street Arvada, Colorado 80004 1-800-321-1135 Tel: 303-431-7255 Fax: 303-423-4831
<i>U.K. and Ireland:</i>	Denver Instrument Company Denver House, Sovereign Way Trafalgar Business Park Downham Market Norfolk PE38 9SW England Tel: 44 136 63862 42 Fax: 44 136 63862 04
<i>Europe, Asia and Australia:</i>	Denver Instrument GmbH Robert-Bosch-Briete 10 37079 Gottingen Germany Tel: 49 551 20977 31 Fax: 49 551 20977 39



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