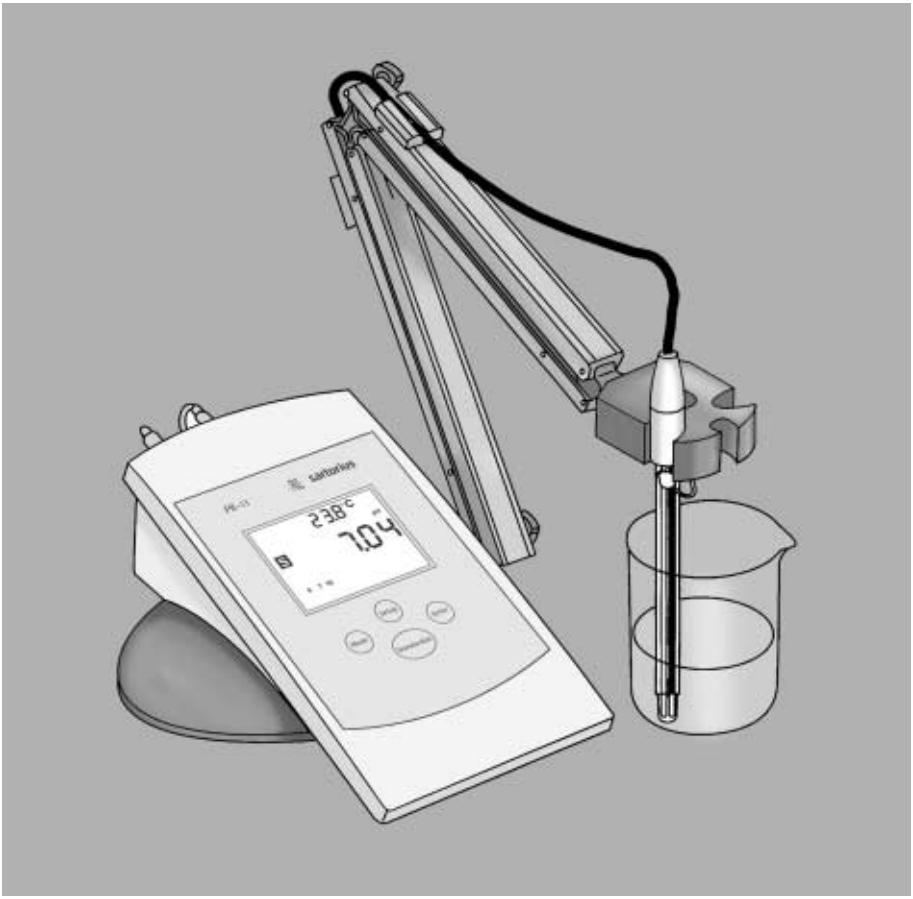
sartorius

Operation Manual

Sartorius Basic Meter PB-11



98648-012-08

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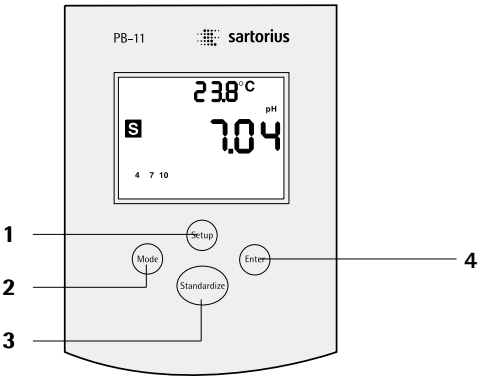
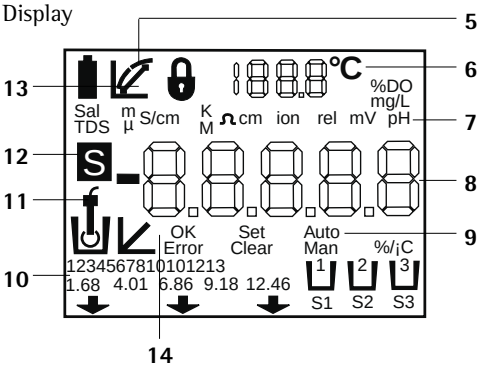
Front View



Display



1 Setup button:
Press to clear buffers, review electrode calibration or select new autorecognized buffers

2 Mode button:
Press to toggle between pH and mV mode

3 Standardize button:
Press to enter each buffer

4 Enter button:
Press to select menu item options

5 Measuring icon

6 Temperature

7 Mode

8 Result

9 Prompts

10 Buffer icons

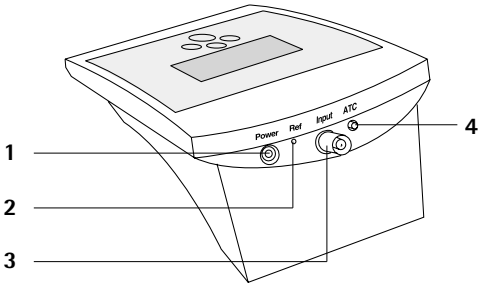
11 Icon: standardization (calibration of the meter) in process

12 Stability icon

13 Standardizing icon

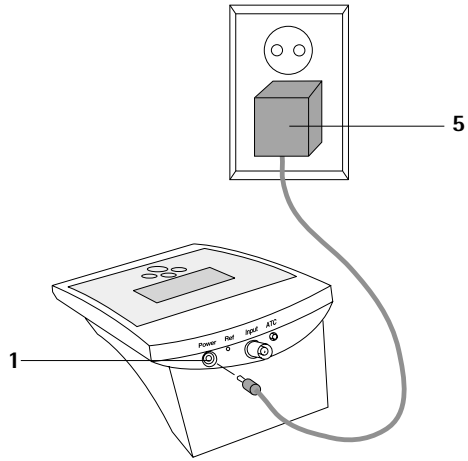
14 Standardization result

Rear View



1 Power cable connector
2 Reference electrode connector (used with separate reference electrodes)
3 BNC electrode connector
4 Temperature compensation probe connector
5 AC adapter

Connecting to a Power Source



Warning and Safety Information

For safety and operating reasons, only authorized service technicians may open the Basic Meter PB-11 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.

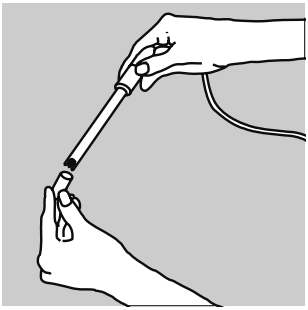
If liquid gets into the pH meter, unplug it from AC power (mains supply) and have an authorized service technician check the pH meter.

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

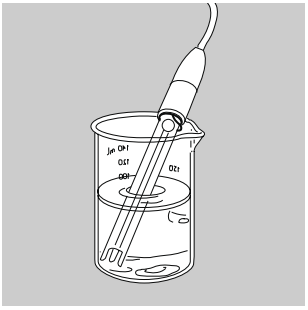
For safety reasons, use this equipment only for the application described in this operation manual.

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

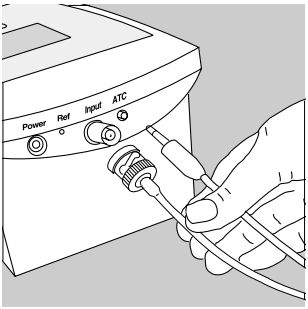
Installing and Maintaining Electrodes



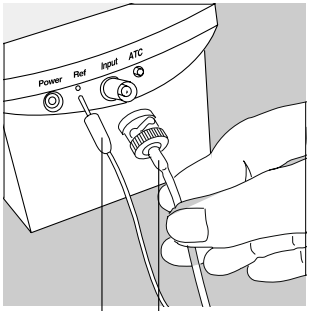
1. Remove the protective end cover from the electrode.



2. Before first use of your electrode, or whenever the electrode is dry, soak overnight in a standard solution or KCl solution.



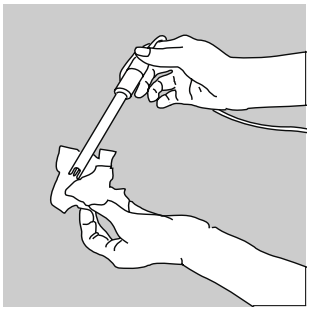
3. Remove the shorting cap on the pH meter connector. Install the electrode by plugging the BNC and ATC connectors into the jacks on the rear panel.



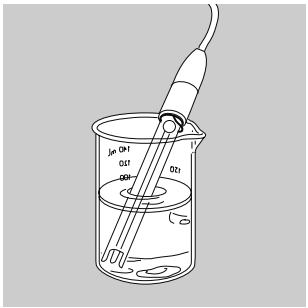
Reference Electrode

ISE

4. Option: Install an ion selective electrode by removing the BNC shorting cap and plugging the BNC connector (twist-lock) into the BNC jack. If a combination electrode is not available, plug the separate reference electrode into the ref pin.



5. Clean the electrode between each measurement with distilled water or deionized water, or part of the next solution to be measured.

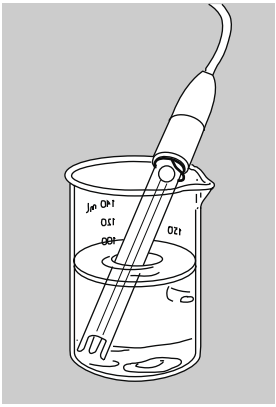


6. Store glass pH electrodes in KCl solution or electrode filling solution. Make sure the liquid level of the internal filling solution is always a few centimeters higher than that of the measurement solution.

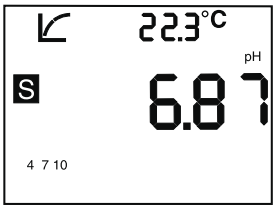
Standardizing for pH Measurement

Because electrodes vary in their response, you must standardize (calibrate) 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.

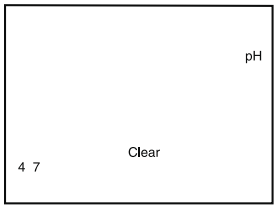
This pH meter allows automatic standardization using up to three buffers. Press the Standardize button again to delete all the standardization data stored up to that point. The pH meter performs automatic temperature compensation.



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

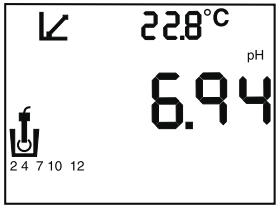


2. Press the **Mode** button until your digital display indicates pH mode. This button toggles between pH and mV modes.

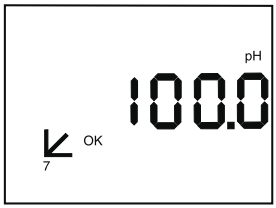


3. Clear existing buffers when doing a new 2- or 3-point standardization. Use the **Setup** button. Also use the **Setup** button to select the individual sets of buffers. (See page 13.)

[Standardize]

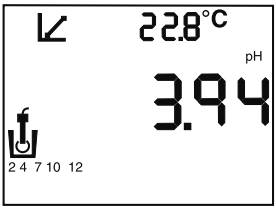


4. Press **Standardize**. The meter recognizes the buffer and flashes a buffer icon. When the signal is stable, the buffer is entered. By pressing **ENTER** you can also enter the current buffer directly.

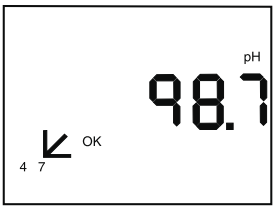


5. The meter displays the slope of the electrode as 100.0%. On entering a second or third buffer, the meter performs a diagnostic check on the electrode and displays the slope. (See step 7 ff.)

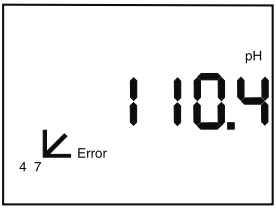
[Standardize]



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 values.

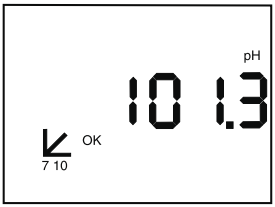


7. Next, the meter performs a diagnostic test of the electrode. The display indicates either Good Electrode ("OK") or Electrode Error ("Error"). The meter also displays the slope of the electrode.

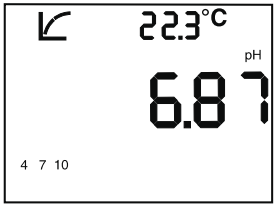


8. **Error** indicates that your electrode or the buffer is not working properly, or a wrong set of buffers has been selected. The electrode response must be between 90 and 105% slope. (See Troubleshooting, on page 21.) Press **Enter** to clear the Error, then try re-entering the buffer as described in step 6.

[Standardize]

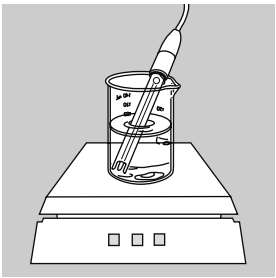


9. To set a third standard, place the electrode in the third buffer solution, stir, allow to stabilize, and press **Standardize**. The results will be the same as in steps 6 and 7, except the display will show three buffer values.



10. After entering three buffers, the **Standardizing** icon goes out 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.

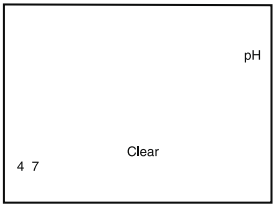


11. Standardize your pH meter using at least two buffers with pH values bracketing the expected pH of your samples. Stirring with a magnetic stir bar provides faster electrode response.

Using Setup

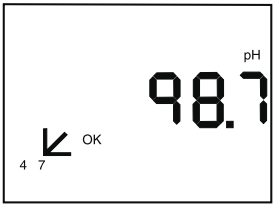
The **Setup** button lets you clear all the standardization data that you have entered, review calibration information, or select the buffer set that you want. You can escape the setup mode at any time by pressing pH/mV.

[Setup]



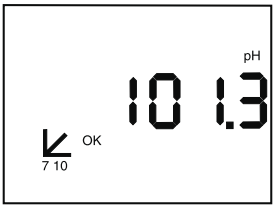
1. Press **Setup** once to clear all buffers you have entered. If you are sure you want to clear the buffers, press **Enter**. The meter clears all buffers and returns to **Measuring**.

[Enter]



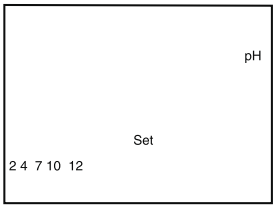
2. Press **Setup** again to show electrode performance, slope and the first and second calibration points. The two buffer values will also be displayed.

2× [Setup]



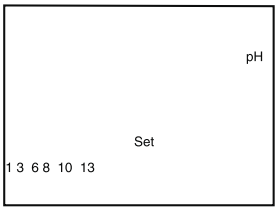
3. Pressing **Setup** again shows the electrode slope between the second and third buffers (if three buffers have been entered) and shows the second and third buffer icons.

[Setup]



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

[Setup] or [Enter]



5. Press **Enter** to select the set of buffers shown on the display or Press **Setup** again to toggle between the existing sets of buffers.

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

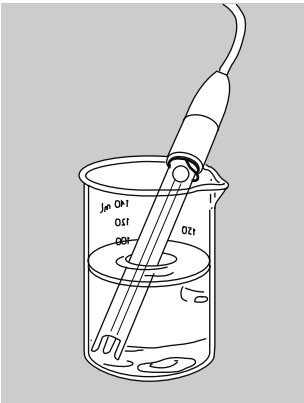
⚠ Note:
You may select buffers from different sets.

Standardizing for Millivolt Measurement (Relative Millivolt)

You will normally use millivolt measurements for determining ion concentration and for measuring redox potential (also called ORP, oxidation reduction potential).

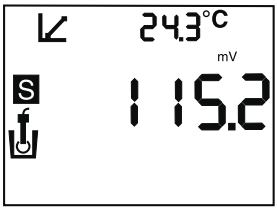
You will use an ion selective electrode (ISE), combined with a reference electrode, to measure ion concentration. The ISE senses the ion concentration and responds with a millivolt potential. The millivolt readings are then used to determine ion concentrations (on the basis of a previously entered calibration curve).

You will normally use a redox/ORP 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.



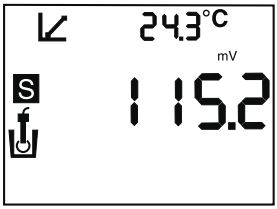
1. Immerse electrode in a standard solution.

[Mode]

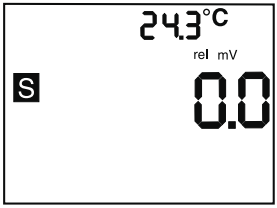


2. Press **Mode** until your digital display indicates mV mode.

[Standardize]

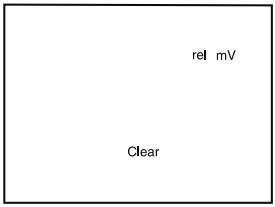


3. Press **Standardize** to enter an mV standard and read relative mV.



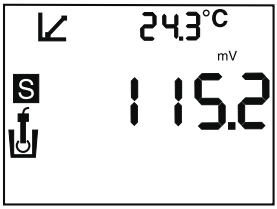
4. When the signal becomes stable, or when you press **Enter**, the current absolute mV value (offset) becomes zero relative millivolts.

[Setup]



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

[Enter]



6. To clear the previous mV offset, 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:

$pH = -\log [H^+]$

with $[H^+]$ 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 to14, with a pH 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).

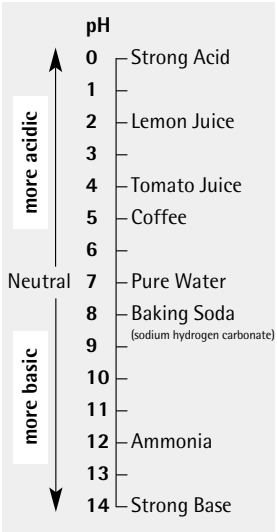


Figure 1.
pH scale showing the relative acidity or basicity of some common substances.

Temperature Compensation

⚠ Note: Automatic temperature compensation only functions properly if a temperature probe is connected.

Temperature compensation influences the results in two different ways:

1. pH values of the buffers change as a function of temperature.
   Each buffer varies as a function of the temperature of the respective solution. Typically, these values are indicated on the buffer label. The values detailed in the table below apply to most technical buffers.

   If standardization is performed in the pH mode, the pH value is adapted to the nominal value of the current temperature.

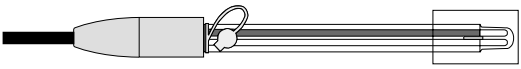
   For example, if the buffer has a nominal pH of 7.00 at a temperature of 25°C, the meter will standardize the buffer to 7.02 instead of 7.00 at a temperature of 20°C.

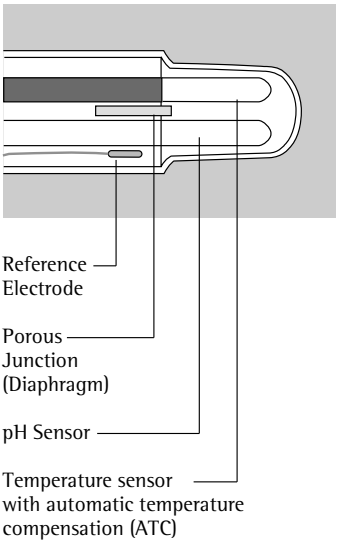
2. Electrode slope changes as a function of temperature.
   Theoretically, the change of voltage per pH unit is approx. 59.16 mV at 25°C. However, this mV per pH unit changes as a function of temperature. The meter compensates for these changes by taking into account the temperature dependency of the Nernst factor when calculating pH values.

Standard buffers:

	pH 4.00	pH 7.00	pH 10.00
0°C	4.005	7.13	10.34
5°C	4.003	7.10	10.26
10°C	4.001	7.07	10.19
15°C	4.002	7.05	10.12
20°C	4.003	7.02	10.06
25°C	4.008	7.00	10.00
30°C	4.010	6.99	9.94
35°C	4.020	6.98	9.90
40°C	4.030	6.97	9.85
50°C	4.061	6.97	9.78

Measuring pH



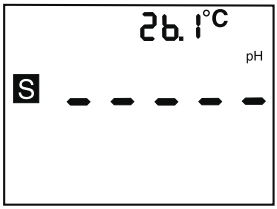


To measure pH with a conventional glass pH electrode, the meter uses a pH-sensing glass bulb that is sensitive to hydrogen ions. The potential developed at the glass membrane is directly related to the pH of the solution.

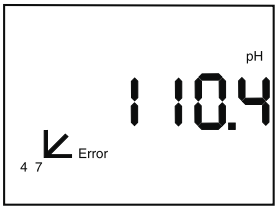
The glass electrode is paired with a reference electrode which completes the electrical measuring circuit and provides a stable reference point. These two electrodes are joined to create a combination electrode.

The combination glass electrode is connected to the pH meter which reads the voltage, converts it to pH units, and displays the result.

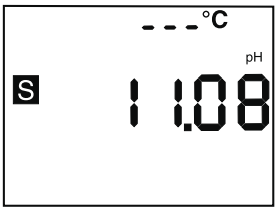
Troubleshooting



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



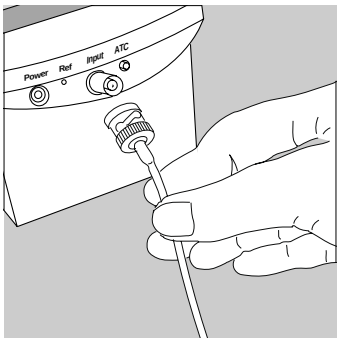
2. The meter will display **Error** when it detects an error in electrode response. During standardization, the message indicates that the electrode is less than 90% or more than 105% of the correct response. The **Error** message can indicate either a bad electrode or bad buffer(s).



3. If the meter detects an error in the temperature measurement, the display shows "--°C." If you do not use a temperature probe, the meter uses the standard temperature (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. Repeat for either a pH 4 or pH 10 buffer. The electrode signals must be within the limits shown below (when temperature is approx. 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. 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.

Meter Specifications

pH		–2.00 bis +20.00
	Readability	0.01
	Accuracy	± 0.01
mV		–1800.0 to 1800.0 mV
	Readability	0.1 mV
	Accuracy	± 0.2 mV (0.05% if <– 400 mV/>+ 400 mV)
Temperature range		–5.0 to +105.0°C
	Readability	0.1°C
	Accuracy	± 0.2°C
Calibration points		Maximum 3 buffers
Automatic buffer recognition		16 buffers 2; 4; 7; 10; 12 1; 3; 6; 8; 10; 13 1.68; 4.0; 6.86; 9.18; 12.46
Automatic temperature compensation		
Automatic electrode slope correction between 90–105% of the theoretical slope		

Accessories

	Order No.
pH combination electrodes:	
– Plastic body with built-in temperature sensor, KCl liquid-filled	**PY-P10**
– Glass body with built-in temperature sensor KCl liquid-filled, platinum junction	**PY-P11**
– Plastic body with built-in temperature sensor, gel-filled	**PY-P12**
– Plastic body, gel-filled	**PY-P20**
– Glass body, KCl liquid-filled, platinum junction	**PY-P21**
Temperature Probe	**PY-T01**

Other pH electrodes and sensors for special measuring conditions including ion selective electrodes and redox electrodes are also available on request.

CE Declaration of Conformity to Council Directives 89/336/EEC and 73/23/EEC

The PB-11 Basic Meter (pH/mV meter)

meets the requirements of the test standards listed below, in conjunction with the associated power supplies, auxiliary peripheral devices and installation equipment listed in Annex A2 (see Annex A1 for a list of the individual type designations and technical descriptions).

1. Electromagnetic Compatibility
1.1 Source of 89/336/EEC: Official Journal of the European Communities, No. 2002/C62/02

EN 61326-1 Electrical equipment for measurement, control and laboratory use/ EMC requirements
Part 1: General requirements

Defined immunity to interference: Minimum test requirements, non-continuous operation

Limitation of emissions: Residential areas, Class B

2. Safety of Electrical Equipment
2.1 Source of 73/23/EEC: Official Journal of the European Communities, No. 2001/C106/03

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

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