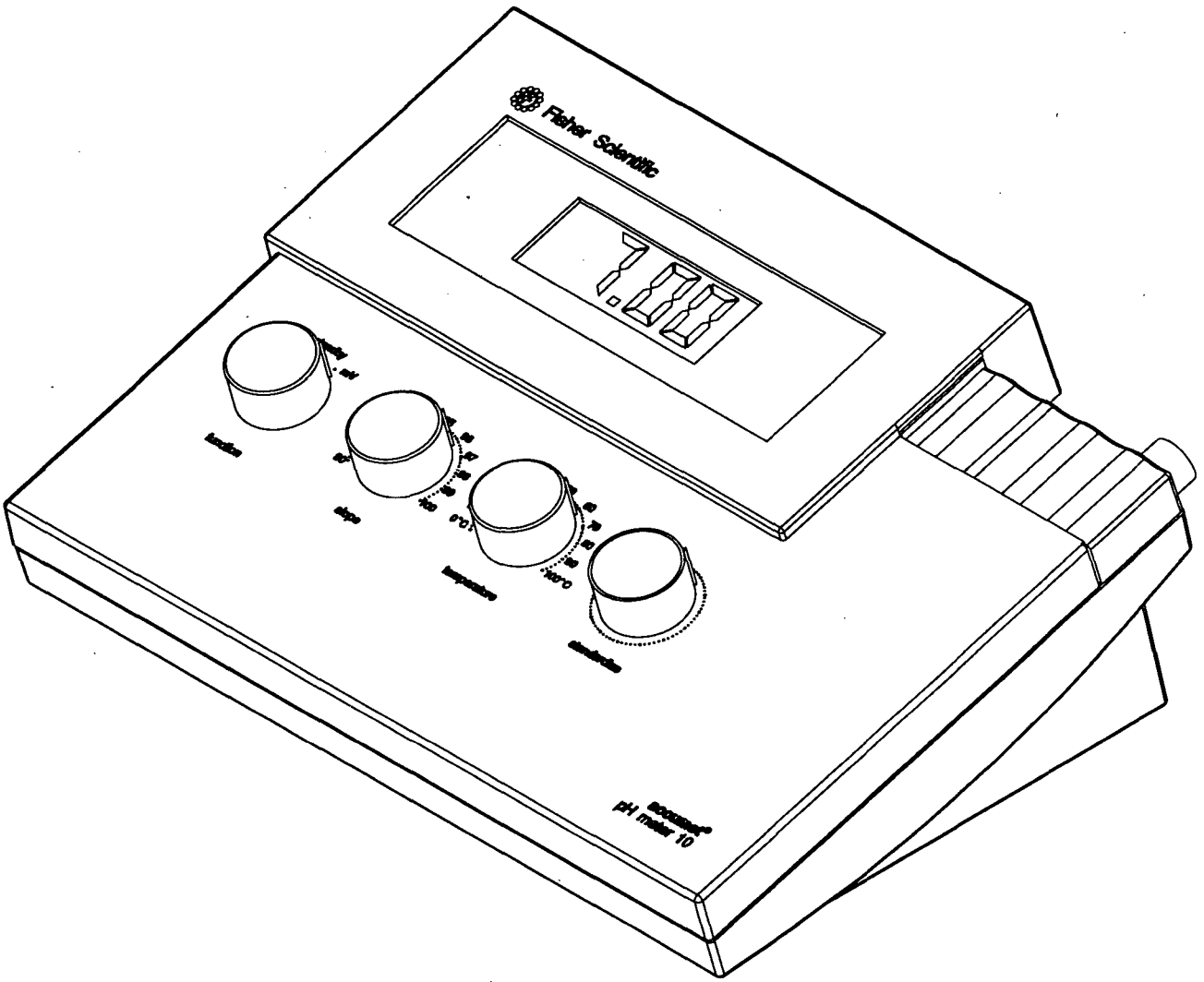
Model 10
pH Meter

Operating Instructions



Fisher Scientific

Class A Digital Devices:

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

CAUTION: Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

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accumet

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ILLUSTRATIONS

PERFORMANCE CHARACTERISTICS

Ranges:	
pH	0.00 - 14.00 pH
Millivolts	±1999 mV
Resolution:	
pH	0.01 pH
Millivolts	1 mV
Repeatability:	
pH	±0.01 pH
Millivolts	±1 mV
Relative Accuracy:	
pH	± 0.02 pH
Millivolts	±1 mV
Input Impedance	$>10^{12}$ ohms
Stability	Less than ± 0.01 pH or ±1mV drift over a 24 hour period.
Temperature Compensation:	
Manual	0 to 100 °C
Automatic	0 to 100 °C
Readout	4-digit LCD, 0.75 inch character height.
K.F. Polarizing Current	-10 µ A
Recorder Output	Buffered Probe Millivolts
Slope Control	90 to 100%

SPECIFICATIONS

Power Requirements:	
12V DC	120VAC
Environmental Requirements:	
Humidity	0 to 90% RH (non-condensing)
Temperature	+15 to +40 °C (operating)
	-25 to +50 °C (storage)
Physical Data:	
Size	10-1/4" L x 8" W x 3-3/4" H
Weight	4.5 lb.

INTRODUCTION

The Fisher Model 10 Accumet pH meter is a moderately-priced digital display unit incorporating up-to-date electronics and numerous state-of-the-art control features. It therefore performs as a true general laboratory instrument, yet is ideal for classroom experimental work.

The pH meter incorporates all the necessary controls and/or connections to compensate manually or automatically for the effects of solution temperature; to correct electrode response to that predicted by Nernstian theory; to standardize the meter with a buffer; to attach temperature probe for automatic temperature compensation; and to attach a laboratory recorder. The 4-digit display is direct-reading for pH from 0 to 14 and millivolt potential from 0 to ±1999 mV. The controls are clearly marked on the front panel, and all connectors are placed across the instrument's rear panel for easy access and simplified operation. Measurement is automatically tracked through 0 in either direction with a minus indicator for negative voltages.

UNPACKING

The Accumet ® pH Meter is shipped in a single carton containing the items listed below. Fill out and return the warranty card shipped with the pH Meter.

NOTE: In the event that shipping damage has been observed, retain the carton and packing material intact with the unit, and file claim with the final carrier. Usually, the firm will send an inspector to ascertain liability.

Quantity	Item	Cat. No. or Part No.
1	Accumet pH Meter	
	115V unit	13-635-10
	230V unit	13-635-11
1	Electrode Support and Bracket	13-637-672
1	Instruction Manual	call 1-800-388-8355
1	Electrode	13-620-10
1	Transformer	
	115 V unit	AIN-100126
	230 V unit	AIN-100220

ACCESSORIES

The following is a list of accessories that may be useful in a variety of applications. Additionally, consult your current Fisher Catalog for a full line of buffers, electrodes, burettes, and other pH related materials.

Item	Cat. No. or Part No
BNC to Pin-Jack Adaptor	13-620-490
Thermometer (0 to 100 °C)	13-640-280
Free Standing Electrode Support Assembly	13-637-675
Electrode Support Assembly	13-637-672
ATC Probe	13-620-16

ELECTRODE SUPPORT ASSEMBLY

The electrode support assembly can be easily installed by performing the following steps:

1. Loosen the friction knob near the support bracket to ease the assembly.
2. Locate the electrode holder and place hole (in base of holder) down over the pin on the holder bracket.
3. Tighten the friction knob to secure.

OPERATING CONTROLS

Before operating the pH meter, locate and become familiar with the function of the front panel controls, the readout display, and the rear panel input jacks and output terminals.

FRONT PANEL (Figure 1)

FUNCTION

The **function** selector is a 3-position rotary switch that places the instrument on **standby** when measurements are not being taken and selects the operating mode: **pH** for pH determination and **mV** for millivolt measurements.

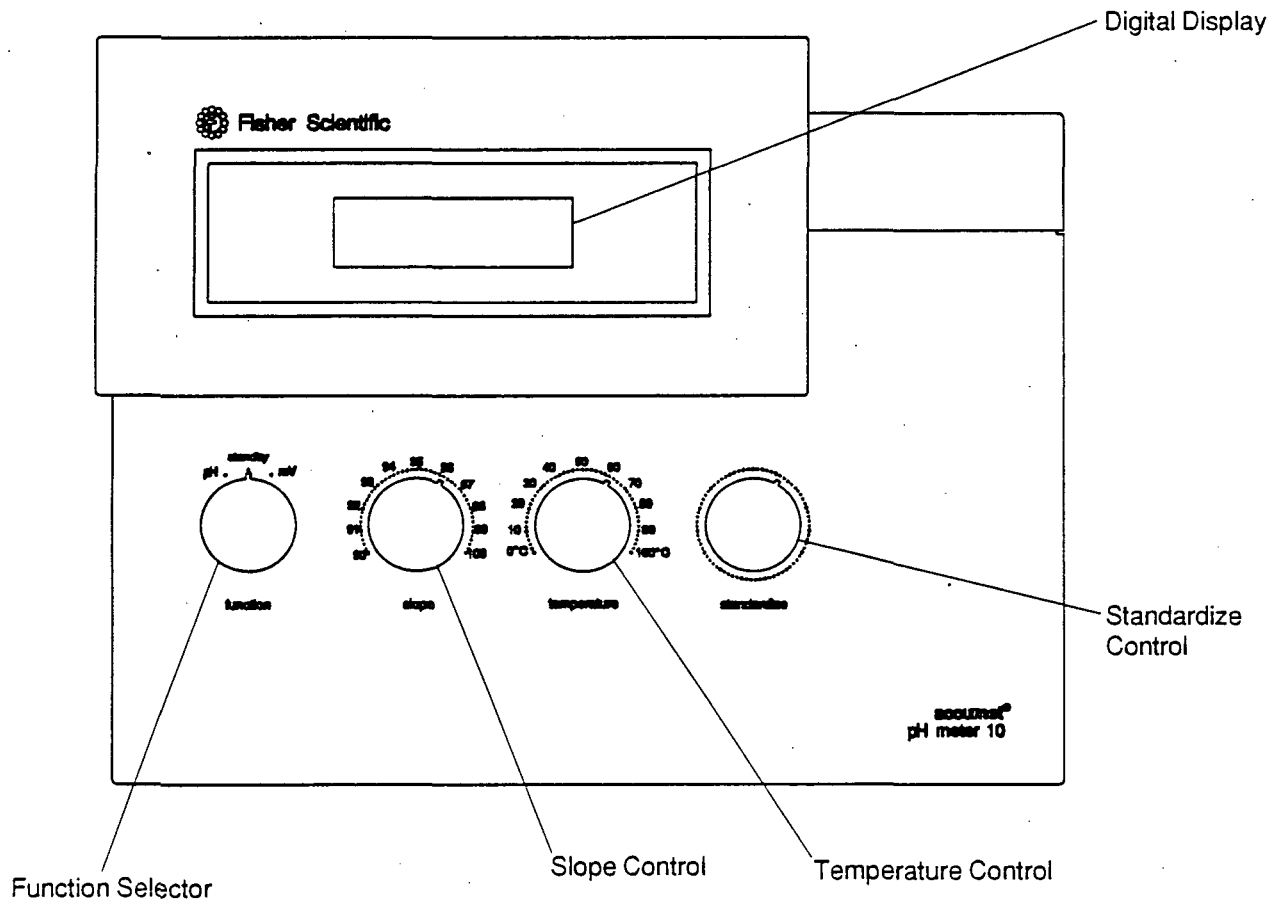

Figure 1. Front Panel

SLOPE

The **slope** control is a single-turn potentiometer used only in the pH mode to compensate for electrode efficiency. In practice, very few electrodes will exhibit the ideal Nernstian response; hence the **slope** control is used to correct the measurement, as required by the particular electrode in use.

TEMPERATURE

The **temperature** control is a single-turn potentiometer calibrated in two-degree increments over the range of 0 to 100 °C. This control is used exclusively for manual temperature compensation in the pH measuring mode. It compensates for pH temperature dependence. During operation, it is set initially to the temperature of the standardizing buffer, then to that of each sample.

Note: The **temperature** control is not used when you use an optional atc (automatic temperature compensation) probe.

STANDARDIZE

The **standardize** control is a multiturn potentiometer that is used in pH determinations to set the pH meter to the pH value of a buffer solution, thereby compensating for the difference in the zero potential of electrode systems. In millivolt and redox (oxidation-reduction) measurements, the control establishes the millivolt zero reference point on the meter.

DIGITAL DISPLAY

This display is a 4-digit, Liquid Crystal Display (LCD) having decimal point and minus sign capability; the decimal point is utilized for pH determinations and the minus sign for millivolt measurements. In the pH measuring mode, test results are displayed over the full 0-14 pH range to the nearest hundredth of a unit and, in the millivolt mode, up to four digits display the results over a range of 0 to ± 1999 mV to the nearest 1 mV. The minus sign automatically displays when the input millivolt potential is negative. Should the input level exceed the range of the instrument, the right most three digits are blanked and a 1 or -1 will be displayed in the left most digit position. Additionally, when the mode selector is turned to **standby**, the display nominally shows zero as a reminder that the instrument is energized.

REAR PANEL (Figure 2)

INPUT A

This is a standard BNC jack that accepts the BNC plug of an indicator electrode or combination electrode. The pin-jack adapter (Cat. No. 13-620-490) adapts the jack to accept electrodes with pin connectors.

REF A

This is a pin-jack that accepts the pin connector of the reference electrode.

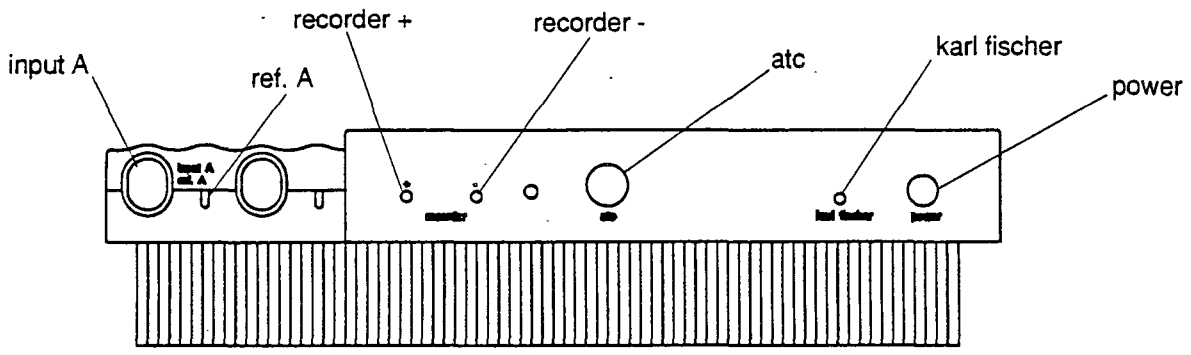

Figure 2. Rear Panel

ATC (Automatic Temperature Compensation)
The **atc** jack receives the male connector of the automatic temperature compensator (Fisher No. 13-620-16). When this probe is plugged into the phone jack, it disconnects the manual temperature control.

RECORDER + -
The **recorder** jack is a standard pin jack used to connect the recorder input leads.

KARL FISCHER
The **karl fischer** pin-jack provides a -10 µ A polarizing current for Karl Fischer and other dead-stop titrations.

PRELIMINARY PROCEDURES

Prior to making pH or millivolt determinations, the pH meter must be connected to a suitable power source and have the appropriate electrode system properly installed. The following procedures should be performed with the unit located on a flat, clean and dry surface near the power source.

Power Source Connection

The meter operates on 12V DC.
To connect the instrument to a power source, perform the following:

1. Set the **function** selector to the **standby** position.
2. Connect the transformer lead to the **power** jack on the rear panel of the pH meter.
3. Connect the transformer to an outlet of proper voltage and frequency.

Electrode Installation

The pH meter and the electrode support will accept a variety of electrodes for performing pH determina tions and electrode potential measurements. (Consult your Fisher electrode handbook accompanying your pH Meter.) The **ref. A** and **input A** jacks accommodate pin and BNC type cable plugs respectively; the electrode support holder accommodates a standard electrode pair, a standard combination electrode, an accessory probe such as a temperature compensator, and a micro combination electrode. To install the electrode see the following procedures.

To mount an indicator, reference, or combination electrode, perform the following steps:

1. Insert the electrode tip into one of the semi-circular slots located along either side of the electrode holder.
2. Lower the electrode until cap is firmly seated in the slot.

Electrode Support Adjustment

Adjust the electrode support as follows:

1. Maneuver support into approximate desired operating position.
2. Adjust friction knobs on support until support maintains a set position but can be raised or lowered at the touch of a finger.

Cable Connections

Connect the electrode cable leads to the pH meter as follows:

NOTE: At this point, the electrode should be properly conditioned according to manufactures's instructions. The electrode should be soaked in a pH buffer of 4.0 for a few hours (preferably overnight) prior to use.

1. Remove the cap from the **input A** BNC jack.
2. The combination electrode is attached by connecting the BNC connector to the jack marked **input A**. If an electrode pair is being used, connect the reference electrode to the jack marked **ref. A**, and connect the indicating electrode (pH, ion selective, or metallic) to the jack marked **input A**.

   NOTE: If an indicator electrode with a pin-jack is to be used, a pin-jack adaptor should be connected to the **input A** BNC jack.

OPERATION

Basic operating modes for the pH meter are covered separately below. Included are procedures for pH measurement (with subsections covering the use of manual temperature compensation, automatic temperature compensation, and **slope** control adjustments), millivolt measurement, and recorder connection.

pH Measurement

Prior to making one or a series of pH measurements, the pH meter must be standardized to compensate for the difference in the zero potential of the electrode. This requirement is accomplished by immersing the electrode into a buffer solution of known pH value and adjusting the standardize knob so the meter reads the specified value of the buffer.

In pH meter standardization, as well as in pH measurement, attention must be given to the temperature of both the buffer and the sample solutions since the pH of a solution changes with temperature (buffer pH at a specified temperature is usually indicated on the manufacturer's label). Moreover, temperature affects the voltage output of the electrode. During operation, the latter is generally compensated for by manually adjusting the **temperature** control first to the temperature of the buffer, then to that of the sample. However, the instrument is equipped with an **atc** probe input which can replace the **temperature** control in the measuring circuit and provides automatic temperature compensation in the pH measuring mode.

NOTE: Proper electrode care is fundamental to obtaining reliable pH measurements. Improper care of electrode may cause the meter reading to drift, respond slowly, or produce erroneous readings. For this reason, the electrode should always be conditioned and used in accordance with manufacturer's instructions.

One Point Standardization with Manual Temperature Compensation

To perform pH measurements using the manual **temperature** control, proceed as follows:

1. Set the **function** selector to **pH** position.
2. Set **slope** control to 100%.
3. Select a buffer which has a pH value within 1 or 2 units and a temperature within ±10 °C of the solution to be measured.
4. Immerse the electrode and thermometer into the buffer solution.

5. Wait until electrode and buffer solution reach thermal equilibrium (about two minutes), then adjust **temperature** control to agree with the indicated temperature of the buffer solution.
6. Determine the exact pH of the buffer solution from a table of the buffer pH versus temperature (usually found on the label). Adjust the **standardize** control until the digital display indicates the pH of the buffer solution.

   NOTE: The display will read two decimal places (i.e., 0.00 to 14.00 pH).

7. Remove the electrode and thermometer from the buffer solution.
8. To avoid contamination of one solution with another, rinse the electrode and the thermometer with distilled water before proceeding with pH measurements.
9. Immerse the electrode and thermometer into sample solution.
10. Wait until the electrode and sample solutions reach thermal equilibrium. Then adjust **temperature** control to agree with the indicated temperature of sample solution.
11. Read pH of sample from digital display, and record value.
12. Remove the electrode and thermometer from solution.
13. Rinse the electrode and thermometer with distilled water before proceeding with next measurement.
14. Repeat steps 9 through 13 for remaining samples that fall within the same pH and temperature ranges of the buffer; otherwise, re-standardize instrument prior to making measurements by repeating steps 3 through 13.

One Point Standardization with Automatic Temperature Compensation (atc)

When performing pH measurements, the operator may use the atc in lieu of manual **temperature** control. The atc is particularly useful when continuously measuring and recording the pH of a solution that changes temperature or when measuring samples that vary widely in temperature. To perform pH measurements using the atc, proceed as follows:

1. Set the **function** selector to the **pH** position.
2. Set the **slope** control at 100%.
3. Insert the atc probe into the large center hole of the electrode holder until the cap seats.
4. Insert the probe cable plug into the **atc** jack on rear panel of the pH meter.

   NOTE: The manual **temperature** control is disconnected from the measuring circuit when the compensator is connected to the instrument.

5. Select a buffer that has a pH value within 1 or 2 pH units and a temperature ±10 °C of the solution to be measured.
6. Immerse the electrode system and compensator probe, as well as a thermometer, into buffer solution.
7. Wait until the electrode system and buffer solution reach thermal equilibrium, then determine the exact pH of buffer solution from a table of buffer pH versus temperature (usually found on the buffer the label). Adjust the **standardize** control until the digital display indicates the pH of the buffer solution.

Slope Control, 2-Point Standardization

All gel electrodes will drop in efficiency with age and pH electrodes rarely reproduce the Nernstian theoretical output of 59.16 mV per pH unit at 25 °C. Therefore, to measure the pH values of samples that vary over a range wider than 2 pH units, a two-point standardization method should be employed to compensate for less than 100% electrode efficiency. The **standardize** control is used to set the first point, and the **slope** control sets the second.

At pH 7, the **slope** control has no effect on the reading. But as readings increasingly differ from pH 7, the effect on the control becomes more pronounced. For this reason, a pH 7 buffer always is recommended as the first standard.

To perform a two-point standardization, proceed as follows:

1. Set the **function** selector to the **pH** position
2. Set the **slope** control to 100%.
3. Obtain two buffer solutions with values that bracket the desired measuring range (e.g., pH 7.00 and pH 10.00 for samples that fall between pH 7 and 10).

   NOTE: For best results, all solutions should be at the same temperature.

4. Place a beaker, containing the buffer nearest in value to pH 7, in position and immerse the electrode and thermometer into the solution.
5. Allow about two minutes for the thermometer to equilibrate, then set the **temperature** control to the corresponding temperature. If an atc probe is being used, the temperature will be automatically set.
6. Adjust the **standardize** control until display indicates exact buffer value (determine from the temperature of the buffer).
7. Remove the electrode and thermometer from the buffer solution.
8. Rinse the electrode and thermometer with distilled water.
9. Place a beaker containing the second buffer in position, and immerse the electrode into the solution.

   NOTE: With buffer and sample solutions maintained at the same temperature, there should be no need to readjust the **temperature** control.

10. Adjust the **slope** control until the digital display indicates the exact buffer value (determined from the temperature of the buffer).

11. Remove the electrode from the buffer and rinse with distilled water.

12. Measure the pH of samples as previously described, being careful not to change positions of the **standardize** or **slope** controls.

    NOTE: When using the manual **temperature** control, be sure to set the control to the temperature of the sample.

Millivolt Measurement

The meter is a convenient tool for measuring electrode potential and indicating results in millivolts. There is no need to standardize the pH meter with a buffer solution. Readings can be taken as soon as the millivolt zero reference is established.

With the preliminary procedures completed, perform millivolt or redox measurement as follows:

1. Set the **function** selector to the **mV** position.
2. Short the **input A** jack of the meter.
3. Adjust the **standardize** control until digital display indicates 0 millivolts.
4. Remove the short from **input A**.
5. Mount and connect the electrode as directed by **Electrode Installation** under **PRELIMINARY PROCEDURES.** (See Page 5)
6. Immerse the electrode into sample solution.

7. Allow sufficient time for the electrode to reach thermal equilibrium with the sample solution (normally about two minutes).
8. Read the potential of the sample from digital display.
9. Remove the electrode from the solution.
10. To avoid contamination, rinse the electrode with distilled water before proceeding with next measurement.
11. Repeat steps 6 through 10 for remaining samples.

RECORDER

Any potentiometric recorder may be used with the pH meter by connecting the recorder to the **recorder** jacks. These jacks are standard "pin" style. The output of the recorder is the same scale, in millivolts, as the probe.

MAINTENANCE

Maintenance is limited to periodic cleaning of the case with a damp cloth. A mild detergent may be used for a more thorough clean up. **NEVER** use a chemical solvent on the case.

WARNING: *Secured access panels, covers, and etc. should never be removed from this equipment by anyone other than experienced service personnel. Fisher Scientific maintains fully staffed service centers at all major Fisher branches to deal with any service problems.*

RETURN SHIPPING INSTRUCTIONS

* Make certain that you have received a return authorization number from the Customer Service Department (1-800-321-1135).

* Write a detailed description of the unit malfunction on the packing slip.

* Unplug and remove the power supply.

* Place the pH meter and power supply in the original shipping carton. Secure the unit with the original packing material. (If the original packing is not available, call the Customer Service Department 1-800-321-1135.)
The factory packing must be used!

* Enclose the packing slip.

* Close the carton and secure with packing tape.

* Write the return authorization number on the outside of the carton.

Upon receipt and inspection of the defective unit, we will promptly repair or replace your unit.

Units which have not been maintained in accordance with the operating instructions, or have been misused or abused, will be repaired and returned. Charges will apply.

WARRANTY

This product is warranted to the end user against defects in materials and workmanship, including parts and labor, under normal use for a period of **two** (2) years. The warranty period becomes effective upon receipt of the product by the end user.

Additional information concerning the practical theory and use of meters and electrodes can be found in the Fisher Electrode Handbook. You can reorder this free publication or get help with any electrochemistry question by calling the Fisher Scientific Technical Service Hotline 1-800-388-8355.

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