

MODEL 370 pH/mV METER
OPERATING MANUAL

370 250/REV A/09-00

**MODEL 370
pH/mV METER
OPERATING INSTRUCTIONS**

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INTRODUCTION

The Model 370 is a general purpose hand held pH/mV meter offering a 1 or 2 point calibration and automatic buffer recognition (4.00, 7.00, 9.22 and 10.05) with manual override. The custom backlit liquid crystal display simultaneously shows temperature compensated pH readings or electrode potential and temperature. The instrument is housed in a robust, ergonomically designed case that is environmentally protected to IP67. Calibration errors are clearly indicated together with the parameter in error. An indication of battery life is also permanently shown on the display. An automatic switch off facility helps to conserve battery life.

SPECIFICATION

pH	(1 or 2 point cal)
Range:	-2 to 16.00pH
Resolution/Accuracy:	0.01pH / ± 0.02 pH
mV	(Absolute or Relative)
Range:	-1999 to +1999mV
Resolution/Accuracy:	1mV / ± 1 mV
Temperature Ranges:	-10 to +105°C / 14 to 221°F
Resolution/Accuracy:	0.1°C / 1°F / ± 0.5 °C / ± 1 °F
ATC Range:	0 to 100°C / 32 to 212°F
Manual Temp. Comp. Range:	0 to 100°C / 32 to 212°F
Auto Buffer Recognition:	4.00, 7.00, 9.22, 10.05 (manual override)
Calibration:	User selectable 1or 2 pt
Power:	2 AA cells
Battery Life:	500 hours typical (@ 25°C with alkaline cells)
Size:	175(l)x75(w)x35(d)mm
Weight:	250g

INSTALLATION

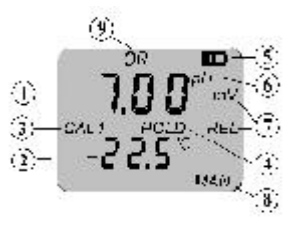
Unpack the instrument and ensure the following items are present:

1. Model 370 pH/mV Meter (370 201)
2. Epoxy bodied combination pH electrode (924 001)
3. Temperature/ATC probe (027 297)
4. pH4, 7 & 10 buffer sachets
5. Instruction manual (370 250)
6. Condensed operating instructions (370 251)
7. 2 x AA alkaline batteries (021 007)(fitted)

Optional accessories which may have been ordered:

1. Carrying Case (033 268)
2. Protective Boot (985 531)

DISPLAYS



1. Main display - 3½ digit backlit display providing direct readout of pH or mV. Underrange (-1) and Overage (1) symbols will be displayed if the instrument is reading outside the ranges of:

pH -2.00 to 16.00 / mV -1999 to +1999

In addition, the instrument will display an erroneous result momentarily at the same time as the secondary display indicates the error code.

2. Secondary display - 4 digit display showing temperature (manual temperature compensation value or ATC probe temperature, if connected) in °C or °F. In the event of a calibration error the display will show an error code momentarily (if the reading is outside the

range of -10 to 105°C / 14 to 220°F) at the same time as the primary display indicates the erroneous reading. These codes will be shown as Err1, Err2 or Err3.

3. CAL 1 or CAL 2 indicator - shows which point of the calibration routine has been reached.

4. Reading hold indication.

5. Battery Life Indication - 4 levels will be shown ranging from <25%, 25-50%, 50-75% and 75-100%. Sensor calibration data and user parameters are retained during battery replacement.



6. Mode annunciator - pH or mV is displayed depending on which mode of operation is selected.

7. REL - this is the relative mV mode annunciator selected via the Cal key. If the mV mode is selected and this annunciator is not shown then the instrument is reading in absolute mV.

8. MAN - this is displayed to indicate when manual temperature compensation or manual pH calibration is being performed. This will not appear on the display when the ATC probe is connected.

9. OR annunciator - this indicates an out of range condition on the primary display (pH/mV).

KEYPAD CONTROLS

Hold	The main operating mode displays pH or mV and temperature, which can be held by pressing the Hold key (subsequent Hold key press returns to live measurement). Manual temperature compensation values cannot be adjusted if the Hold facility is being used.
I:O	Switches the instrument on and off. This key should be pressed and held for 1-2 seconds to operate. The instrument will automatically switch off after 30 minutes if no key is pressed.
	Back light. Pressing this key will illuminate the back light for 10 seconds. It should be noted that, if used excessively, this will degrade battery life.
	Enables manual setting of pH buffer values when performing a calibration, and adjustment of the manual temperature compensation value.
CAL	This key is used to select and perform calibration in the pH mode. In the mV mode pressing the Cal key will enable the user to toggle between Absolute and Relative mV.
Mode	This key changes the measurement parameter to pH or mV mode as required and sets to °C/°F.

OPERATION

Switch the instrument on by holding down the I/O key for 1-2 seconds. All display segments will be illuminated for approximately 2 seconds. The display will either power up mV or pH mode depending upon previous usage. If no ATC probe is connected to the instrument the MAN annunciator will be shown. Manual temperature compensation should always be entered prior to commencing a calibration sequence.

Remove the electrode from the packaging and ensure it is in good condition (not broken or leaking excessively). Connect the electrode to the instrument via the BNC socket and remove the wetting cap which contains pH buffer solution. Prior to performing sample measurement it is necessary to perform a 1 or 2 point calibration using the buffer sachet(s) provided. Immerse the body of the electrode into the first buffer solution so that the bulb and junction are covered. Connect the ATC probe to the mini-DIN socket (if used).

CALIBRATION

Auto buffer recognition operates over the range of 0 to 100°C, and will recognise 4.00, 7.00, 9.22 and 10.05pH. Alternative values may be entered during the calibration sequence by using the ▲ ▼ keys to set the preferred values.

NOTE: Manual temperature compensation (if being used) should be entered prior to commencing a calibration sequence using the ▲ ▼ keys. (If the displayed reading is altered the auto buffer recognition feature will be disabled. To retrieve the auto buffer recognition values it is necessary to exit the calibration sequence by pressing the mode key).

Rinse electrode(s) in deionised water between measurements.

Select pH mode using the Mode key. To commence the calibration press the Cal key and the display will show the CAL 1 annunciator. The instrument will automatically calibrate to one of the pre-programmed buffer values. To override this facility use the ▲ ▼ keys to adjust the display to read the preferred value.

Press the Cal key again to complete the 1 point calibration. The CAL 2 annunciator will illuminate.

If a one point calibration only is required, pressing the Mode key will return the display to pH measurement mode. The instrument is now ready to perform sample measurements.

If a two point calibration is required, the electrode(s) should be rinsed and then placed into the second buffer solution. The display will update to one of the pre-programmed buffer values indicated above. To override this facility use the ▲ ▼ keys to adjust the display to read the preferred value. Allow the reading to stabilise prior to pressing the Cal key. Once the instrument has performed the second part of the calibration it will then return to the pH mode. Sample measurement can now be performed.

ERROR CODES

If a problem is detected during calibration the following error codes will be displayed:

Err1 This indicates that the calculated electrode offset at pH7 is outside the range of -30 to +30mV. The error code will be displayed for 3 seconds on the secondary display, together with the erroneous electrode offset value on the primary display. The instrument will then reset the calibration data back to the ideal Nernst response of 0mV offset at 7pH and a slope of 59.16mV/pH at 25°C.

Err2 This indicates that the slope value is out of range. The error code will be displayed for 3 seconds on the secondary display, together with the erroneous value on the primary display. The instrument will then reset the calibration data back to the ideal Nernst response of 0mV offset at 7pH and a slope of 59.16mV/pH at 25°C. The allowable range for slope is 75 to 125% of the ideal Nernst figure.

Err3 This indicates that the instrument has not recognised the buffer. The displayed reading must be within 1pH of the calibration buffer value for automatic buffer recognition and calculated electrode offset at pH7 must be within the range of -30 to +30mV. The error code will be displayed for 3 seconds on the secondary display, together with the erroneous pH buffer value on the primary display. The instrument will then reset the calibration data back to the ideal Nernst response of 0mV offset at 7pH and a slope of 59.16mV/pH at 25°C.

mV MODE

Absolute mV

When this mode is selected the instrument will display the actual voltage developed by the electrode when it is immersed in a solution containing ions to which the electrode is sensitive.

Combination type pH, redox and ion selective electrodes can all be used in this mode. Most of these determinations will require the preparation of calibration curves or other analytical methods to be converted to a concentration unit.

This range is also useful for monitoring the performance of standard pH electrodes. Using accurate and fresh buffers at a constant temperature the millivolt output of the electrode should be noted and compared to the theoretical ideal. As the electrode ages, becomes contaminated or dirty these values will drift, indicating that corrective action should be taken. Recording these values as part of a routine quality control programme can give a good indication of the condition of the electrode.

Relative mV

This mode is also suitable for determinations using redox and ion selective electrodes with the additional benefit of being able to zero any offset developed by the electrode in a blank solution, i.e. a solution that has none of the ions to be measured, but has all the other characteristics of the unknown samples. A blank solution would normally have its ionic strength and pH adjusted as required for the electrode in use.

As the display is zeroed automatically when the relative mV mode is selected it is necessary to immerse the electrode in the blank solution with the absolute mV mode selected. When the reading has stabilised the relative mV mode should then be selected. The display will be set to zero, thereby removing any offset voltage. Sample measurement is then carried out by using a variety of well tried analytical methods; from simple calibration curves through titrations, to single and multiple addition methods.

MANUAL TEMPERATURE COMPENSATION

When making measurements without ATC, the displayed temperature reading can be adjusted to the correct value using the ▲ ▼ keys. The instrument will default to this mode if a temperature sensing element is not detected by the electronics. Manual temperature adjustment must be made prior to commencing a calibration sequence.

AUTO SHUT OFF

This will occur after 30 minutes if no key is pressed

GOOD PRACTICE GUIDELINES

The types of pH electrodes are many and various. For the majority of tests carried out on aqueous solutions; with a reasonable ionic strength, at ambient temperatures and with limited use in strongly acidic solutions, the epoxy bodied combination electrode supplied is ideal.

For other applications a more suitable pH/reference electrode pair may be required. Details or advice supplied on request.

The following general guidelines indicate the care and maintenance required:

1. **After Use** - Rinse thoroughly with distilled water.
 Short Term Storage - Immerse in pH 4 buffer
 Long Term Storage - Fit wetting cap filled with pH4 buffer

2. Electrodes should be stored:
 - a) away from direct sunlight
 - b) in a vertical position
 - c) within their specified temperature range

3. Always ensure the electrode is used within its specified temperature range of 0 to 80°C. Ageing of electrodes used above their specified temperature is rapid and irreversible.

4. **DO NOT** touch the sensitive glass pH membrane or reference junction during use. Excess droplets of solution may be removed by gently blotting with filter paper or tissue.
DO NOT rub the electrode as this may induce an electrostatic charge.

5. During use ensure the electrode is rinsed between each measurement to eliminate the contamination of solutions.

MAINTENANCE

CLEANING/RE-CONDITIONING OF GLASS ELECTRODES

For general purpose use, combination electrodes can be cleaned with a mild detergent solution or a commercial glass cleaning solution (provided these are not strongly acidic). The electrode surface should be wiped with a clean cloth soaked in the cleaning agent, and/or allow the membrane to stand in the solution until clean. Rinse and repeat as necessary.

TABLE FOR CLEANING OF GLASS ELECTRODES

NOTE: The epoxy bodied electrode supplied with the instrument should not be cleaned with aggressive solvents.

Deposit	Cleaning agents
General deposits	Mild detergent solution
Inorganic coatings	Commercial glass cleaning solution (not strongly acidic)
Metal compounds	Acid solution, not stronger than 1M
Oil/Grease	Complexing agent (EDTA) or suitable solvent
Resins/Lignins	Acetone, alcohol or detergent (not strongly alkaline)
Proteins (blood, etc)	Enzyme solutions e.g. Pepsin in 0.1M HCl
Stubborn deposits	Weak hydrogen peroxide solution, Sodium Hypochlorite solution or domestic bleach.

Electrodes which have been allowed to dry out, (often indicated by a hard, dry deposit of KCl crystals on the electrode body), should be rehabilitated by soaking overnight in warm distilled water.

TROUBLESHOOTING GUIDE

FAULT	PROBABLE CAUSE	ACTION
No power	Battery failure Battery polarity incorrect	Replace batteries Refit batteries
Cal error 1, 2 or 3	Incorrect value buffer used Contaminated buffer solution	Use correct value Use fresh buffer solutions
Cal error 1 or 2	pH electrode defective Same buffer used for 2 point cal	Replace pH electrode Recalibrate on 2 buffer solutions
Unstable display	pH electrode defective	Replace pH electrode
Display U/O range	Intermittant or no connection pH electrode defective Contaminated solutions	Check electrode connection to unit Replace pH electrode Replace solutions
Temp. value incorrect	Defective temperature probe	Replace temperature probe
Intermittant display	Probes not fitted correctly	Check connections
I/O switch not working	I/O key not held down >2 secs	Retry holding key for 2 seconds
▲ ▼ keys not working	Operating in incorrect mode	Refer to operation section of manual

TROUBLESHOOTING GUIDE

FAULT	PROBABLE CAUSE	ACTION
Back light not on/goes out	10 second time elapsed/ normal function	Recheck
Unable to adjust manual temperature	Hold function selected	Deselect Hold function
	Incorrect mode of operation	Reselect mode
	ATC probe connected	Disconnect probe

CHECKING pH ELECTRODE FUNCTION

If the pH electrode is considered to be defective the following procedure can be carried out to confirm this:

Connect the electrode to a mV source and apply 0mV. Press the Cal key and the display should read 7 pH.

Apply +180mV and calibrate to 4 pH.

Apply -180mV and the display should show 10 pH.

Re-calibrate using a known good electrode.

CHECKING TEMPERATURE INPUT

Apply a 10Kohm resistor across the pins shown:

Check the display reads 25.0°C ±0.5°C

BATTERY REPLACEMENT

If necessary, switch the unit off using the I/O key.

To fit new batteries; loosen the battery compartment cover (the screws are captive in the cover), remove and carefully discard the used batteries. Fit the new batteries, type R6, AA or AM3, ensuring the correct polarities are observed, as indicated on the moulding. Refit the battery compartment cover, ensuring that the fixings are secured into place, but are not overtightened.

OPTIONAL ACCESSORIES

The following list of items are available for use with the Model 370:

033 268	Carrying Case
985 531	Protective Boot
025 179	pH 4 buffer sachets (pack 10)
025 180	pH 7 buffer sachets (pack 10)
025 181	pH 10 buffer sachets (pack 10)

A comprehensive range of electrodes and consumables are available for use with this product. Details on request.

EC Declaration of Conformity

JENWAY Model 370 pH/mV Meter complies with the following European Standards:

- EN 50081-1:1992 Electromagnetic compatibility - Generic emission standard
- EN 61326:1998 Electrical equipment for measurement, control and laboratory use - EMC requirements
- EN 61010-1:1993 Safety requirements for electrical equipment for measurement, control and laboratory use

Following the provision of:

EMC Directive - 89/336/EEC and Low Voltage Directive - 73/23/EEC

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