

**MODEL 430 PORTABLE  
pH/CONDUCTIVITY METER**

**OPERATING MANUAL**

430 350/REV A/10-03

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**INTRODUCTION**

The Model 430 is designed to readily withstand the rigours of portable analysis, whilst reliably measuring pH and conductivity in a simple and professional manner. This product allows the simultaneous readout of pH, conductivity or TDS and temperature using a custom backlit liquid crystal display. Calibration errors are clearly indicated, together with the parameter in error.

The 430 offers 1 or 2 point pH calibration and automatic buffer recognition with a manual override facility. Conductivity calibration can be performed with direct calibration on standard solutions or by direct cell constant entry.

The best conductivity/TDS range is automatically selected for optimum resolution and temperature compensated using an adjustable temperature coefficient.

The 430 is supplied with a combined pH and conductivity probe assembly (a temperature sensor is also incorporated to provide automatic temperature compensation). The probe connects to the instrument via a single mini-DIN connector for operator convenience.

An automatic switch off facility helps to conserve battery life, with low battery indication being shown on the display.

**SPECIFICATION****pH (1 or 2 point calibration)**

Range: 0 to 14pH  
Resolution: 0.01pH  
Accuracy:  $\pm 0.02$ pH

**Conductivity**

Ranges: 0 to 19.99 $\mu$ S / 0 to 199.9 $\mu$ S  
(automatic selection) 0 to 1999 $\mu$ S / 0 to 19.99mS  
0 to 199.9mS  
Resolution: 0.01 $\mu$ S, 0.1 $\mu$ S, 1 $\mu$ S, 0.01mS,  
0.1mS  
Accuracy:  $\pm 0.5\%$   $\pm 2$  digits

**TDS**

Ranges: 0 to 19.99mg/l / 0 to 199.9mg/l  
(automatic selection) 0 to 1999mg/l / 0 to 19.99g/l  
0 to 199.9g/l  
Resolution: 0.01mg/l, 0.1mg/l, 1mg/l, 0.01g/l,  
0.1g/l  
Accuracy:  $\pm 0.5\%$   $\pm 2$  digits

**Temperature**

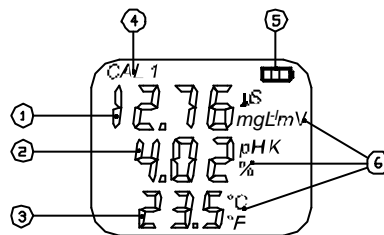
Ranges: -9.9 to +99.9°C  
14 to 212°F  
Resolution: 0.1°C / 1°F  
Accuracy:  $\pm 0.5^\circ\text{C}$  /  $\pm 1^\circ\text{F}$   
ATC range: 0 to 99.9°C / 32 to 212°F  
Manual Temp. Comp. 0 to 99.9°C / 32 to 212°F  
Auto pH buffer recog: 4.00, 7.00, 9.22 and 10.00  
Auto conductivity std recog: 10 $\mu$ S, 84 $\mu$ S, 1413 $\mu$ S and 12.88mS  
Reference temperature: 18, 20 or 25°C  
Cell constant: 0.01 to 19.99  
EC ratio (TDS) 0.50 to 0.80  
Temperature coefficient: 0 to 4.00%/°C  
Power: 2 AA cells  
Battery life: Typically 100 hours  
Size: 175(l) x 75 (w) x 35(d) mm  
Weight: 250g

## INSTALLATION

Unpack the instrument and ensure the following items are present:

1. Model 430 pH/Conductivity Meter (430 201)
2. Combined pH/Conductivity probe (430 231)
3. pH 4, 7 and 10 buffer sachets
4. 2 x AA batteries (021 007) (fitted)
5. Carrying Case (if ordered)
6. Conductivity standards (if ordered)

## DISPLAYS



1. Main display - 3½ digit display providing direct readout of conductivity (in  $\mu\text{S}$  or  $\text{mS}$ ) or total dissolved solids (in  $\text{mg/l}$  or  $\text{g/l}$ ). The display will also show Underrange (-1) and Overage (1) symbols if the instrument is reading outside the operating ranges. In addition, the display will show an erroneous result momentarily, at the same time as the secondary display indicates the error code.

2. Secondary display - 3 digit display showing pH, the cell constant value (K) or the temperature coefficient as a percentage. In the event of a calibration error the display will show the error code momentarily, at the same time as the primary display indicates the erroneous reading.



3. Tertiary display - 3 digit display showing temperature (manual temperature compensation value or ATC value).

4. CAL 1 or CAL 2 indicator – shows which point of the pH calibration routine has been reached.

5. Low battery indication – Shown when level reaches approx. <20%. Sensor calibration and user parameters are retained during battery replacement.

6. Mode annunciators - the appropriate annunciator is displayed depending on which mode of operation is selected.

## CONTROLS

STO RCL	STO stores the current data reading. RCL recalls the data reading stored.
I:O	Switches the instrument on and off. The instrument will automatically switch off after 20 minutes if no keys are pressed.
	Back light. Pressing this key will illuminate the back light for 10 seconds. It should be noted that, if used excessively, this will reduce battery life.
	Enables adjustment of calibration values and set up parameters dependent on mode selected.
CAL	Places the instrument into calibration modes.
MODE	Selects conductivity or TDS on the primary display. Enters conductivity calibration mode after calibration has been initiated. Allows the user to gain access to the instrument set up parameters by holding the key down for 3 seconds.

## **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. An internal self check routine is run during this display and on successful completion normal operating mode is activated. The display will power up showing conductivity, pH and temperature modes simultaneously.

Remove the electrode from the packaging and ensure it is in good condition. Connect the electrode to the instrument via the 8 way mini-DIN socket and remove the wetting cap. Prior to performing sample measurement it is necessary to perform a 1 or 2 point pH calibration and/or a conductivity calibration.

The main operating mode displays conductivity, pH and temperature. Pressing the MODE key toggles the display to TDS, pH and temperature.

## **SETTING PARAMETERS**

To gain access to the instruments adjustable parameters whilst measuring, hold down the MODE key for 3 seconds. This allows the following parameters to be adjusted:

1. Temperature units of measurement – these can be set to °C or °F using the ▲ ▼ keys. Pressing the MODE key confirms this setting.
2. Conductivity reference temperature can be adjusted to 18, 20 or 25°C using the ▲ ▼. Pressing the MODE key confirms this setting.
3. Conductivity temperature coefficient can be set between the values of 0 to 4.00%/°C. Pressing the MODE key confirms this setting.
4. EC ratio can be set between the values of 0.50 to 0.80. Pressing the MODE key confirms this setting. The final MODE key press will return the instrument to live measurements.



#### **pH CALIBRATION**

**Note: Ensure probes are rinsed between measurements to avoid solution contamination.**

Auto buffer recognition operates over the range of 0 to 100°C, and will recognise 4.00, 7.00, 9.22 and 10.00 pH buffer values. Alternative values may be entered manually by using the up/down keys to set the preferred values. However, this then disables the auto buffer recognition feature. To retrieve the auto buffer recognition values it is necessary to exit the calibration sequence by pressing the mODE key.

**Place the combined sensor assembly into the first buffer solution.**

Pressing the CAL key places the instrument in the pH calibration mode and flashes the Cal 1 icon. The current pH reading is displayed on the secondary display with probe potential (mV) now being displayed on the primary display. If manual temperature compensation is selected the °C symbol will be flashing. A subsequent CAL key press calibrates to the nearest standard buffer. Alternatively, the up/down arrow keys can be used to set the secondary pH display to the required value after the first press of the CAL key. Pressing the CAL key again confirms the set value. The Cal 1 icon is extinguished and the Cal 2 icon will flash. (If a 1 point calibration only is required, exiting the calibration sequence can be performed by pressing the MODE key. The instrument will return to live conductivity and pH readings.)

**Place the combined sensor assembly into the second buffer solution.**

To perform a two point calibration a subsequent CAL key press calibrates to the nearest standard buffer or the up/down arrow keys can be used to set the secondary pH display to the required value. Pressing the CAL key again confirms the set value. The instrument will then return to live conductivity and pH readings.

## **CONDUCTIVITY CALIBRATION**

### **a) WITH KNOWN CELL CONSTANT**

Auto standard recognition operates over the range of 0 to 100°C, and will recognise 10 $\mu$ S, 84 $\mu$ S, 1413 $\mu$ S and 12.88mS. Alternatively, the up/down arrow keys can be used to manually adjust the cell constant (K) and subsequent conductivity reading to the required value, confirmed by pressing the CAL key.

When measuring, pressing the CAL key places the instrument in the pH calibration mode and flashes the Cal 1 icon. Pressing the MODE key skips further action, places the instrument in conductivity calibration mode and flashes the conductivity Cal icon. Current conductivity readings are displayed in the primary display with cell constant (K) being displayed in the secondary display.

The  $\blacktriangle$   $\blacktriangledown$  keys can then be used to adjust the cell constant to the value indicated on the conductivity cell being used.

The use of the cell constant as a calibration method is only recommended where no standard exists. This calibration method will not account for changes in the probe characteristics over time or any other factor which may affect the reading. The use of a known calibration standard is always recommended.

### **b) ON STANDARD SOLUTION (Auto Value Recognition)**

When measuring, pressing the CAL key places the instrument in the pH calibration mode and flashes the Cal 1 icon. Pressing the MODE key skips further action, places the instrument in conductivity calibration mode and flashes the conductivity Cal icon. Current conductivity readings are displayed in the primary display with cell constant (K) being displayed in the secondary display.

Place the combined sensor into the calibration standard. Press the CAL key and allow the reading to stabilise.

A subsequent CAL key press calibrates to the nearest conductivity standard and returns the instrument to live conductivity and pH readings.

To abort the calibration sequence at any time press the MODE key.

**c) ON NON-STANDARD SOLUTION (Manual Value Entry)**

When measuring, pressing the CAL key places the instrument in the pH calibration mode and flashes the Cal 1 icon. Pressing the MODE key skips further action, places the instrument in conductivity calibration mode and flashes the conductivity Cal icon. Current conductivity readings are displayed in the primary display with cell constant (K) being displayed in the secondary display.

Place the combined sensor into the calibration standard. Enter the preferred calibration standard value using the ▲ ▼ keys (this also adjusts the cell constant value). Allow the reading to stabilise. Press the CAL key again to complete the calibration.

To abort the calibration sequence at any time press the MODE key.

## ERROR CODES

Any errors encountered during either a pH or conductivity calibration are indicated for three seconds by an error code displayed on the secondary display and the parameter in error displayed on the primary display. If a problem is detected the following error codes will be displayed:

- Err1** This indicates that the calculated electrode offset at 7pH is outside the range of -30mV to +30mV. The error code will be displayed for 3 seconds on the secondary display, together with the erroneous electrode offset value in mV on the primary display. The instrument will then reset the calibration data back to the ideal Nernst response of 0mV offset at 7 pH and a slope of 59.16mV/pH at 25°C.
- Err 2** 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 as a % on the primary display. The instrument will then reset the calibration data back to the ideal Nernst response of 0mV offset at 7 pH and a slope of 59.16mV/pH at 25°C. The allowable range for slope is 75% to 125% of the ideal Nernst figure.
- Err 3** This indicates that the instrument has not recognised the buffer. The displayed reading must be within 1pH unit of the calibration buffer value for automatic buffer recognition. 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 7 pH and a slope of 59.16mV/pH at 25°C.
- Err 4** This indicates that the calculated conductivity cell constant (K) is out of range (0.01 to 19.99).

### **MANUAL & AUTOMATIC TEMPERATURE COMPENSATION**

When making measurements without ATC the units of measurement will flash on the display. The displayed temperature reading can be adjusted to the correct value using the ▲ ▼ keys.

### **AUTO SHUT OFF**

This will occur after 20 minutes if no key is pressed

### **DATA STORAGE**

The 430 holds 1 reading in its internal memory.

Press the STO key to store the current reading. **Sto** will momentarily be displayed, then the instrument will return to the previous operating mode.

Press the RCL key to recall the stored reading. **rCl** will momentarily be displayed, then the instrument will display the previously stored reading. The HOLD symbol will also be displayed.

Press the MODE key to return to normal operation.

It should be noted that it is not possible to delete the stored reading. The reading will be overwritten when the next reading is stored.

### GOOD PRACTICE GUIDELINES – pH

The types of pH electrodes are many and various. The supplied epoxy combination electrode is suitable for the majority of tests carried out on aqueous solutions.

The following general guidelines indicate the care and maintenance required:

1. After use – rinse thoroughly with distilled water.  
Short term storage – immerse in storage solution (025 192)  
Long term storage – fit wetting cap filled with storage solution (025 192) and replace in original packaging
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. Ageing of electrodes used above their specified temperature is rapid and irreversible.
4. **DO NOT** touch the sensitive glass pH membrane 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.

### GOOD PRACTICE GUIDELINES - CONDUCTIVITY

1. The presence of particulate matter in the sample can lead to unstable and non-reproducible results. If necessary filter, or allow the particles to settle prior to immersion.
2. Ensure no air bubbles are trapped in the measuring cell. Gentle agitation of the cell should ensure that bubbles are purged.
3. The entire plate area must be immersed in the solution under test. The slots in the side of the sensor should be below the surface.
4. When measuring samples at a temperature that differs significantly from ambient, sufficient time must be allowed for the internal temperature sensor to respond to this change.
5. Measuring low conductivity samples must be performed with great care to avoid contamination. At the lowest levels readings may be affected by the leeching of substances from the sample container or absorption of gases from the atmosphere.
6. It is advisable to clean the sensor if contamination is evident. This should be approached in a progressive manner, beginning with deionised water and progressing to other solvents or a soft air brush if the deposits persist. The carbon plates can be damaged and should not come into contact with anything which is likely to abrade their surface.
7. The temperature coefficient is very dependent on the solution being measured and its concentration level. The effect of temperature change on conductivity can be very significant, and if the temperature coefficient is not known it is wise to measure all samples at the same temperature.

8. The TDS mode displays results which have been calculated from the measurement of conductivity and assumes some knowledge of the electrolyte balance of the analyte. The EC ratio allows selection of a factor suitable for the solution under test. Most analysers which do not offer this option use a default value of 0.6.

## 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.**

<b>Deposit</b>	<b>Cleaning agents</b>
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

<b>FAULT</b>	<b>PROBABLE CAUSE</b>	<b>ACTION</b>
No power	Battery failure Battery polarity incorrect	Replace batteries Refit batteries
Cal error 1, 2 or 3	Incorrect value pH 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 shows 1 or -1 only	Intermittant / no connection pH electrode defective Contaminated solutions	Check electrode connection to unit Replace pH electrode Replace solutions
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
Cal Error 4	Incorrect standard used Incorrect manual standard value entered Faulty or incorrect conductivity probe fitted	Use correct standard Enter correct value Replace probe

### TROUBLESHOOTING GUIDE

FAULT	PROBABLE CAUSE	ACTION
Unstable display	Conductivity cell defective	Replace conductivity cell
Back light not on/ goes out	10 second time elapsed/normal function	Recheck
Reading drifts	Conductivity cell stored dry CO <sub>2</sub> absorption by sample	Allow to soak for 2 hours Noticeable for low conductivity - do not allow sample to stand in unstoppered bottles
Non linear readings	Conductivity cell not zeroed	Zero conductivity cell
Poor reproducibility	Carryover between solutions	Rinse cell in distilled water between measurements

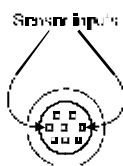
If a fault is identified during the start up self check routine an error code will be displayed. This indicates an internal hardware or software software problem. In the event of this, please contact your local distributor or service agent.

### CHECKING pH METER FUNCTION

Connect the meter 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 10.0Kohm resistor across the pins shown:  
Check the display reads 25.0°C ±0.5°C



#### BATTERY REPLACEMENT

It is strongly recommended that the batteries be replaced immediately the low battery indication is given to avoid compromising instrument readings. 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 430:

<b>033 269</b>	Carrying Case
<b>025 139</b>	Conductivity Standard 10µS
<b>025 164</b>	Conductivity Standard 84µS
<b>025 138</b>	Conductivity Standard 1413µS
<b>025 156</b>	Conductivity Standard 12.88mS
<b>025 179</b>	pH 4 buffer sachets (pack 10)
<b>025 180</b>	pH 7 buffer sachets (pack 10)
<b>025 181</b>	pH 10 buffer sachets (pack 10)

### **EC Declaration of Conformity**

JENWAY Model 430 pH/Conductivity 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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