

**MODEL 470 PORTABLE
CONDUCTIVITY/TDS METER**

OPERATING MANUAL

470 350/REV A/10-03

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INTRODUCTION

The Model 470 is a general purpose, hand held Conductivity/TDS meter offering direct calibration on standard solutions or by direct cell constant entry. The custom liquid crystal display simultaneously shows temperature compensated conductivity or TDS and temperature. The best conductivity/TDS range is automatically selected for optimum resolution and temperature compensated using an adjustable temperature coefficient. The instrument is housed in a robust, ergonomically designed case. 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

Conductivity

Ranges: 0 to 1999mS* (*only with cell constant >5)
0 to 199.9mS
0 to 19.99mS
0 to 1999 μ S
0 to 199.9 μ S
0 to 19.99 μ S

Resolution: 1mS*/0.1mS/0.01mS/1 μ S/0.1 μ S/0.01 μ S

Accuracy: \pm 0.5% \pm 2 digits

TDS Ranges: 0 to 1999g/l* (* only with cell constant >5)
0 to 199.9g/l
0 to 19.99g/l
0 to 1999mg/l
0 to 199.9mg/l
0 to 19.99mg/l

Resolution: 1g/l*/0.1g/l/0.01g/l/1mg/l/0.1mg/l/0.01mg/l

Accuracy: \pm 0.5% \pm 2 digits

Temperature Range: -10 to +105°C / 14 to 220°F
Resolution: 0.1°C / 1°F
Accuracy: ±0.5°C / ±1°F
ATC & Manual Ranges: 0 to +100°C / 32 to 212°F
Cell Constant: Digitally settable 0.01 to 19.99
Reference Temperature: 18, 20 or 25°C selectable
Temperature Coefficient: 0.00 to 4.00%/°C
E/C Ratio: 0.5 - 0.8 settable
Auto Standard Recognition: 10µS, 84µS, 1413µS or 12.88mS
(with manual override)
Battery Life Indication: 500 hours typical
(@ 25°C with alkaline cells)
Probe Input: Mini-DIN conductivity/temperature
Power: 2 AA cells
Size: 175(l) x 75(w) x 35(d)mm
Weight: 250g

INSTALLATION

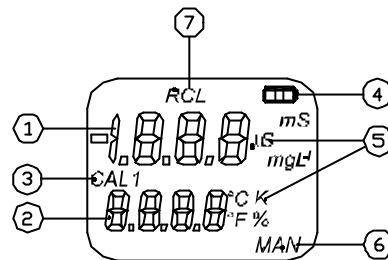
Unpack the instrument and ensure the following items are present:

1. Model 470 Conductivity Meter (470 201)
2. Conductivity/Temperature Probe (epoxy bodied) (027 298)
3. 2 x AA alkaline batteries (021 007)

Optional accessories which may have been ordered:

1. Carrying Case (033 269)
2. Conductivity Standard 10µS (025 139)
3. Conductivity Standard 84µS (025 164)
4. Conductivity Standard 1413µS (025 138)
5. Conductivity Standard 12.88mS (025 156)
6. Cell K=1, epoxy bodied (027 298)
7. Cell K=0.1, epoxy bodied (027 801)
8. Cell K=10, epoxy bodied (027 802)

DISPLAYS



1. Main display - 3½ digit backlit LCD providing direct readout of conductivity (in μS or mS) and total dissolved solids (TDS) (in mg/l or g/l). The display will also show Underrange (-1) and Overrange (1) symbols if the instrument is reading outside the operating ranges.

2. Secondary display - 4 digit display showing temperature (manual temperature compensation value or probe temperature) in $^{\circ}\text{C}$ or $^{\circ}\text{F}$, the cell constant value (K) or the temperature coefficient value as a percentage (%).

3. CAL - will be displayed momentarily to indicate auto standard recognition calibration or probe zero.



4. 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.

5. Mode annunciators.

6. Manual temperature compensation/calibration indication.

7. RCL annunciator - this indicates that the displayed reading is the last stored value, recalled from the internal memory.

CONTROLS

| | |
|---|---|
| STO | STO stores the current data reading. |
| RCL | RCL enters recall mode to view the stored readings. |
| I/O | Switches the instrument on and off. The instrument will automatically switch off after 30 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 conductivity, calibration points, cell constant and temperature coefficient values in the appropriate modes. |
| CAL | The Cal key is used to perform automatic conductivity calibration on 10 μ S, 1413 μ S, 12.88mS or 0 μ S. In TDS mode the unit calibrates to 6.6mg/l, 933mg/l, 8.5g/l or 0mg/l. |
| MODE | Pressing the MODE key selects either conductivity (μ S or mS), TDS (mg/l or g/l), cell constant (K) or temperature coefficient (%). Pressing the MODE key for 3 seconds enables adjustment of temperature units, reference temperature and EC ratio. |

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.

Remove the conductivity cell from the packaging and ensure it is in good condition. Connect the cell to the instrument.

Before use calibration and probe zeroing will be necessary. Refer to the following paragraphs for details.

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. 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.

PROBE ZERO

Ensure the cell is clean and dry. Do not immerse in any liquid. Press the CAL key. The CAL mode annunciator will illuminate. Ensure the reading displayed is less than 2µS. A further press of the CAL key will set any offset to zero.

CALIBRATION

Auto standard recognition operates over the range of 0 to 100°C and will recognise 10µS, 84µS, 1413µS or 12.88mS standards. Alternative manual values may be entered during the calibration sequence by using the ▲ ▼ keys to set the preferred values.

NOTE: Manual temperature compensation should be entered prior to commencing a calibration sequence if ATC is not being used. If the displayed reading is altered, the auto standard recognition feature will be disabled. To retrieve the auto standard recognition values it is necessary to exit the calibration sequence by pressing the MODE key.

a) WITH KNOWN CELL CONSTANT

Connect a standard pre-calibrated cell to the unit. Select K using the MODE key. The display will show the current cell constant.



The ▲ ▼ 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)

Place the conductivity cell into the calibration standard. Press the CAL key and allow the reading to stabilise prior to pressing the CAL key again to complete the calibration.

To abort the calibration sequence press the MODE key.

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

Place the conductivity cell into the calibration standard. Press the CAL key and then enter the preferred calibration standard value using the ▲ ▼ keys. If the displayed reading is altered the auto standard recognition feature will be disabled. To retrieve the auto standard recognition values it is necessary to exit the calibration sequence by pressing the MODE key.

Allow the reading to stabilise. Press the Cal key again to complete the calibration. To abort the calibration sequence press the MODE key.

TEMPERATURE COEFFICIENT

Conductivity is a temperature dependent measurement. The displayed conductivity value is the conductivity of the solution at the selected reference temperature. All substances have a conductivity coefficient which varies from 1%/°C to 3%/°C. The default temperature coefficient is 2%/°C, this being adequate for most routine determinations. Where greater accuracy is required and the actual temperature coefficient is unknown, then all samples should be held at the reference temperature by use of a thermostatic water bath or equivalent.

To comply with certain standard methods e.g. USP conductivity of water measurement, the temperature coefficient must be set to 0%/°C and the samples maintained at the reference temperature by use of a thermostatted water bath.



Adjustment of the coefficient may be made by selecting % on the secondary display using the MODE key and then using the ▲ ▼ keys to set the required value.

SAMPLE MEASUREMENT

After calibration measurement is carried out by immersing the cell in the samples, allowing the reading to stabilise and recording the result. The cell should be rinsed in deionised water between each sample to avoid contamination, shaken to remove internal droplets, and the outside wiped prior to immersion in the next sample.



On completion of sample measurement the cell should be thoroughly rinsed in deionised water.

The units of measurement should be noted with the conductivity value due to the autoranging ability of the meter. The most appropriate range for the measurement will be selected by the instrument during each measurement.

ERROR CODES

Err 1 indicates that the calculated cell constant (K) is out of range (0.01 to 19.99).

CELL STORAGE

Short Term The cell should be immersed in deionised water to keep the plates in a wetted condition.

Long Term The cell should be thoroughly rinsed in deionised water, the exterior body wiped and then stored dry.

NOTE: When preparing the cell for storage the plate area should be rinsed and left to air dry. The plates area must not be wiped dry. When using a dry cell initial stability on re-use may be impaired until the cell plates become re-wetted.

DATA STORAGE

The 470 can store up to 32 readings. Storage is initiated by manual key press.

Storing Data

Pressing the STO key stores the current reading in the next available data location. The storage location is indicated by **Sto** and a number (1-32) momentarily displayed for the data. The results are stored sequentially until the memory is full. When all 32 data locations are filled, the next stored reading will overwrite the result previously stored in position 1. The stored data is retained in the event of battery failure and during battery replacement.

Recalling Data

Pressing the RCL key recalls the last stored reading on to the display. The instrument is now in RCL mode, indicated by the RCL annunciator at the top of the display.

The ▲ ▼ keys are used to select previously stored data points. The storage location is indicated by **rCL** and a number (1-32) momentarily displayed prior to the data.

To clear all readings press and hold the CAL key (>3 seconds) while in RCL mode. When all stored readings are cleared the display will momentarily show **CLr ALL**. The instrument will then return to the main operating mode.

If storage locations are empty and the RCL key is pressed, the display will show **ALL CLr**.

NOTE: It is not possible to delete individual stored readings.

GOOD PRACTICE GUIDELINES

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.

TROUBLESHOOTING GUIDE

| FAULT | PROBABLE CAUSE | ACTION |
|-----------------------------------|--|---|
| No power | Battery failure Battery polarity incorrect | Replace batteries Refit batteries |
| Unstable display | Conductivity cell defective | Replace conductivity cell |
| Display permanently shows 1 or -1 | Intermittent or no connection Conductivity cell defective Contaminated solutions Particulate matter in sample | Check cell connection to instrument Replace cell Replace solutions Filter sample |
| Intermittent display | Conductivity cell not fitted correctly | Check connections |
| I/O switch not working | I/O key not held down long enough Batteries not fitted Batteries flat | Retry holding key for 2 seconds Fit batteries Replace batteries |
| ▲ ▼ 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/Recheck normal function | |
| Unable to adjust manual temp. | Incorrect mode of operation | Reselect mode |
| Reading drifts | Conductivity cell stored dry CO ₂ 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.

AUTO SHUT OFF

This will occur after 30 minutes if no key is pressed.

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 470:

| | |
|----------------|------------------------------------|
| 033 269 | Carrying Case |
| 025 139 | Conductivity Standard 10 μ S |
| 025 164 | Conductivity Standard 84 μ S |
| 025 138 | Conductivity Standard 1413 μ S |
| 025 156 | Conductivity Standard 12.88mS |
| 027 298 | Cell K=1, epoxy bodied |
| 027 801 | Cell K=0.1, epoxy bodied |
| 027 802 | Cell K=10, epoxy bodied |

Details available on www.jenway.com

SPARE PARTS

Recommended spares list for 2 years:

| | |
|------------------------------------|---------|
| Batteries (Qty 8) | 021 007 |
| Conductivity Cell | 027 298 |
| Conductivity standards as required | |

EC Declaration of Conformity

JENWAY Model 470 Conductivity/TDS 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



Thank you for reading this data sheet.

For pricing or for further information, please contact us at our UK Office, using the details below.



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Please note - Product designs and specifications are subject to change without notice. The user is responsible for determining the suitability of this product.