

**MODEL 470 PORTABLE
CONDUCTIVITY/TDS METER
OPERATING MANUAL
MANUEL D'UTILISATION
BETRIEBSHANDBUCH
MANUALE OPERATIVO
MANUAL DE OPERAÇÃO
MANUAL DE FUNCIONAMIENTO**

470 250/REV A/09-00

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OPERATING MANUAL**

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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 backlit liquid crystal display simultaneously shows temperature compensated conductivity or TDS and temperature. The 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 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

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:	$\pm 0.5\%$ ± 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:	$\pm 0.5\%$ ± 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:	25°C
Temperature Coefficient	0.00 to 4.00%/°C linear
E/C Ratio:	0.6
Auto Standard Recognition:	10µS, 84µS, 1413µS or 12.88mS (with manual override)
Battery Life Indication:	<25%, 25-50%, 50-75%, 75-100%
Probe Input:	Mini-DIN conductivity/temperature
Power:	2 AA cells
Size:	175(l) x 75(w) x 35(d)mm
Weight:	250g

INSTALLATION

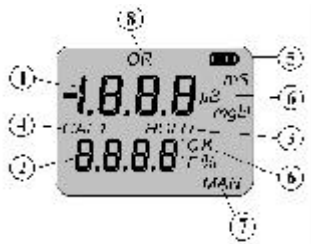
Unpack the instrument and ensure the following items are present:

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. Protective boot (985 531)
3. Conductivity Standard 10µS (025 139)
4. Conductivity Standard 84µS (025 164)
5. Conductivity Standard 1413µS (025 138)
6. Conductivity Standard 12.88mS (025 156)
7. Cell K=1, epoxy bodied (027 298)
8. Cell K=0.1, epoxy bodied (027 801)
9. 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 Overage (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. Reading hold indication.
4. CAL - will be displayed momentarily to indicate auto standard recognition calibration or probe zero.
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 annunciators.
7. Manual temperature compensation/calibration indication.
8. OR annunciator - indicates an out of range condition.

CONTROLS

- Hold** The main operating mode displays conductivity readings and temperature, which can be held by pressing the Hold key (subsequent Hold key press returns to live measurement).
- 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 degrade battery life.
- ▲ ▼** Enables adjustment of conductivity, cell constant and temperature coefficient values.
- Cal** Pressing the Cal key illuminates the Cal mode indicator. A subsequent Cal key press calibrates to the nearest conductivity standard or probe offset to zero (if the reading is less than 2 μ S). Alternatively, the ▲ ▼ keys can be used to set the conductivity display to the required value, which must be confirmed by pressing the Cal key. The Cal key is used to perform a 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. Calibration errors are indicated for 3 seconds by an error code displayed on the secondary display, together with the parameter in error displayed on the primary display.
- Mode** °C or °F temperature units can be selected by pressing the mode key for 3 seconds. Pressing the Mode key changes to TDS measurement and temperature display. Subsequent mode key presses will go through TDS and cell constant display (adjustable via ▲ ▼ keys) and TDS and temperature coefficient display (adjustable via ▲ ▼ keys).

PROBE ZERO

Pressing the Cal key illuminates the Cal mode indicator. A subsequent Cal key press calibrates to the nearest conductivity standard or probe offset to zero (if the reading is less than $2\mu\text{S}$).

PREPARATION OF CONDUCTIVITY STANDARDS

Suitable conductivity standards are available commercially or these can be made up as required from A.R. reagents with reference to the relevant physical tables.

Method for general purpose conductivity standard

1) Accurately weigh out 0.746 grammes of dried A.R. grade Potassium Chloride (KCl).

2) Dissolve in 1 litre of good quality deionised water.

This produces a 0.01N solution with a conductivity of $1413\mu\text{S}$ @ 25°C .

Storage

This solution must be stored in a plastic container and the air space should be kept to an absolute minimum. The shelf life of 1 week can be increased by storing below 4°C , but where any doubt exists about the viability of stored solution a fresh batch should be prepared.

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.

Remove the conductivity cell from the packaging and ensure it is in good condition (not broken). Connect the cell to the instrument.

CALIBRATION

Auto standard recognition operates over the range of 0 to 100°C and will recognise 10 μ S, 84 μ S, 1413 μ S or 12.88mS. Alternative values may be entered during the calibration sequence by using the \blacktriangle \blacktriangledown keys to set the preferred values.

NOTE: Manual temperature compensation should be entered prior to commencing a calibration sequence. (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 \blacktriangle \blacktriangledown keys can then be used to adjust the cell constant to the value indicated on the conductivity cell body.

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) ONNON- STANDARD SOLUTION (Manual Value Entry)

Place the conductivity cell into the calibration standard. 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).

Press the Cal key and allow the reading to stabilise. Press the Cal key again to complete the calibration. To abort the calibration sequence press the Mode key.

SAMPLE MEASUREMENT

Conductivity is a temperature dependent measurement. All substances have a conductivity coefficient which varies from 1%/°C to 3%/°C for most commonly occurring substances. The temperature coefficient defaults to 2%/°C, this being adequate for most routine determinations. Conductivity readings varying with temperature may be due to the substances under test having a coefficient other than the typical value of 2%/°C. To eliminate this variation it is necessary to maintain all samples at the reference temperature by use of a thermostatic water bath or equivalent.

Adjustment may be made by selecting % on the secondary display via the Mode key and then using the ▲ ▼ keys to the required value.



After calibration the measurement of samples 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.

TDSmode



Conductivity mode



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

ERROR CODES

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

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 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.

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. 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.
5. 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.
6. The TDS mode displays results which have been calculated from the measurement of conductivity. The salinity mode assumes that the major constituent responsible for the conductivity of the solution is sodium chloride. If significant quantities of other conductive species are present then the displayed results could be inaccurate.
Likewise, the TDS mode assumes some knowledge of the electrolyte balance of the analyte. The EC ratio parameter found in the set up routine 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 under or over range	Intermittent or no connection Conductivity cell defective Contaminated solutions	Check cell connection to instrument Replace conductivity cell Replace solutions
Intermittent display	Conductivity cell not fitted correctly	Check connections
I/O switch not working	I/O key not held down long enough	Retry holding key for 2 seconds
▲ ▼ keys not working	Operating in incorrect mode	Refer to operation section of manual
Back light not on/ goes out	10 second time elapsed/ normal function	Recheck
Unable to adjust manual temperature	Hold function selected Incorrect mode of operation	Deselect Hold function 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

FAULT	PROBABLE CAUSE	ACTION
Non linear readings	Conductivity cell not zeroed	Zero conductivity cell
Poor reproducibility	Carryover between solutions	Rinse cell in distilled water between measurements

BATTERY REPLACEMENT

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
985 531	Protective Boot
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

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

Martyn J. Fall
Managing Director, Jenway Limited,
Gransmore Green, Felsted, Dunmow,
Essex, CM6 3LB, England