Moranlord Ltd
Unit 3H
Northland Business Park
Warnham
West Sussex
RH12 3SH
Tel: 01306-628480
Fax: 01306-628481
Email info@moranlord.co.uk
http://www.moranlord.co.uk

HEP3T handheld
Electrodeless conductivity meter

User Guide

October 2007

Contents

Section 1
Introduction

The HEP3T is a rugged precision handheld instrument that uses the latest contact-free electrodeless technology to measure conductivity.

Its encapsulated sensor design means the HEP3T continues to remain accurate even in applications where fouling and build-up of contaminates would render conventional contacting type sensors inaccurate.

An integrated stainless temperature sensor reacts rapidly to changes in temperature enabling precise temperature-compensated conductivity readings of liquids to be made. The HEP3T is also an accurate thermometer.

The HEP3T can be used in many different applications where a hard-wearing accurate instrument is required e.g.;

- measuring rinse water carry-in levels
- determining chemical dosing levels
- laboratory use
- water treatment industry

Section 2
Principles of conductivity measurement:- FAQs

2.1 What is conductivity?

The conductivity of a liquid is a measure of its ability to conduct an electric current from one point to another. In liquids this current flow is made possible by positively and negatively charged ions, cations (+) and anions (-) respectively. When the liquid conducts a current the ions move to the oppositely charged regions in the liquid, so the anions flow to the anode (+) and the cations flow to the cathode (-). This is the basis of electrolytic conduction, the greater the number of ions present, the greater the conductivity of the liquid. The two main techniques for measuring conductivity are contacting sensors (electrode) and non-contacting sensors sometimes known as electrodeless or toroidal.
Contacting type sensors do not remain accurate for very long because they suffer from surface contamination effects, and therefore the HEP3T uses as electrodeless type sensor.

2.2 How does an electrodeless sensor work?
Electrodeless conductivity measurement does not require any electrode contact with the liquid being measured. Instead, a pair of wire-wound toroidal cores encapsulated in a protective body act as the sensor.
One toroid is driven with a constant voltage which generates a magnetic field in the liquid. In turn the current induced by this magnetic field in the liquid magnetically couples with the second toroid to produce a signal. This signal induced in the second toroid's windings is in direct proportion to the amount of magnetic coupling, and so varies proportionally to the conductivity of the solution. This signal is amplified, and gives an output of conductivity in the solution being measured.

2.3 Temperature Compensation
A characteristic of conductive liquids is that as their temperature increases so does their conductivity. The conductivity measured at a certain temperature therefore has to be compensated for so all readings for different liquids can be compared at a fixed temperature. The HEP3T conductivity sensor actually contains signal processing electronics which carry out temperature compensation, ensuring very accurate conductivity measurement with variations in water temperature.

2.4 What are the units of conductivity?
Conductivity of water is expressed in the inverse of resistance, and the units are Siemens. One Siemen represents a very conductive solution and is not usually experienced in most situations, so a smaller unit is used, the micro-Siemen.
There are 1000,000 uS to 1 Siemen.

2.5 How conductive is water?
Distilled water and de-ionised water have low conductivity. The conductivity of water purified in this way is about 2-5uS.

Fig 2.5a – HEP3T hand-held electrodeless conductivity meter.

.

Section 3
Features:

3.1) Electrodeless Sensor Wand:

The sensor wand has an encapsulated electrodeless (a.k.a. toroidal) conductivity sensor with built-in stainless temperature sensor.

No fouling - Electrodeless Precision
The conductivity sensor is entirely encapsulated in polypropylene with no exposed metal contacts to foul up, ensuring consistent accuracy.

Rapid Response – Temperature compensation & measurement
The stainless thermometer quickly responds to changes in temperature to give temperature compensated conductivity measurement as well as separate temperature measurements.

Shield:
A shield clips over the end of the sensor. This is to prevent the sensor from being rested directly on or against the bottom or sides of a container, ensuring there is always a sufficient volume of liquid around the toroids for accurate measurement.

Connector:
The sensor wand plugs into the handheld control box via a 4-pole IP68 plug with locking ring.

3.2) Handheld Meter

Easy-to-read display
The HEP3T displays conductivity (on 3 selectable ranges) and temperature on a large LCD display.

Versatile
Conductivity measurement across 3 separate ranges:
i) 0- 9999uS,
ii) 0 – 99-99mS
iii) 0 – 200.0mS

Rugged & practical
The HEP3T has a protective moulding with back stand.

Section 4
Conductivity measurement

With the HEP3T switched on (**I/0**) insert the sensor in the liquid you are making measurements of.

Attention!

4.1 Use of the Shield

The sensor has a shield which eliminates proximity effects when the sensor is placed near the edge of the beaker/tank etc by ensuring a sufficient volume of liquid surrounds the toroids.

It is recommended that this shield is in place on the sensor for all measurements. However if the shield is removed take care not to rest the sensor on the bottom or against the sides of the liquid container.

4.2 Selecting conductivity range

There are 3 separate conductivity ranges;

i) 0- 9999uS
ii) 0- 99.99mS
iii) 0-200 mS

Press the mode button **(m)** repeatedly until the desired range is indicated by a green LED.

The units of conductivity being displayed ("**uS**" or "**mS**") are also indicated by orange LED's.

The conductivity value is displayed on the LCD display.

4.3 Measurements in different liquids

Rinse the sensor off in water between measurements in different liquids and after the final measurement – this is to avoid carrying in contaminates.

Section 5
Temperature measurement

5.1 Temperature Measurement
To measure temperature of a liquid press the mode button (**m**) repeatedly until the green "**Temp**" LED is on, indicating the HEP3T is in temperature measurement mode.

The temperature is indicated in °C or °F on the LCD display.

5.2 Changing temperature scale between °C and °F
To set to **°C ;**

With the HEP3T switched off, press and hold the "up" arrow button and then press the on button (**I/0**). "CEn" is displayed on the LCD display, indicating °C is selected.

Save this setting by pressing the mode button (**m**).

To set to **°F ;**

With the HEP3T switched off, press and hold the "down" arrow button and then press the on button (**I/0**). "FAr" is displayed on the LCD display, indicating °F is selected.

Save this setting by pressing the mode button (**m**).

5.3 Adjusting temperature compensation
The HEP3T comes factory set with the standard temperature compensation value of 1.7%/degC

To adjust this value press and hold the mode select button m when in temperature measurement mode (**Temp**) until the LED flashes fast.
The temperature compensation value is displayed and can be adjusted using the up/down arrows.

Press '**m**' again to save the selected compensation value.

Section 6
Calibrating the HEP3T

The electrodeless design of the HEP3T's conductivity sensor means the need for frequent calibration is greatly reduced.

If you do need to calibrate then the following method described should be used:
NB: Each conductivity range calibrates separately. When calibrating a range always calibrate the zero first.

Important!
Always calibrate the zero first.

6.1 To calibrate the zero:
Select conductivity range to be calibrated.
With the sensor wand out of liquid (zero conductivity) press and hold '**m**' for several seconds until CAL appears on display.
The LED's will flash. The meter will automatically calibrate to zero provided the reading is below 200 counts.
Press '**m**' again to finish, the display flashes 'donE' to confirm zero is set.

6.2 Using a calibration solution to calibrate to a known value:
NOTE: When calibrating the handheld use a calibration solution of a reasonably high value that is at least a quarter of the range's full scale reading (must be above 200 counts).

Place the sensor in the calibration solution. Allow the sensor to reach the temperature of the solution.

Select the conductivity range to be calibrated. Press & hold the '**m**' button for several seconds until CAL
Appears on the display.
The LED's will flash.
Use the up/down arrows to adjust the temperature compensated reading to the calibration value.
Press the '**m**' button to finish setting the conductivity calibration.
'donE' flashes once on the display to confirm this setting and the display returns to displaying the measured conductivity.

6.3 Factory re-set
If you should want to return the HEP3T to its original factory settings this can be done by doing the following:

Start with the HEP3T switched off:
1) Press and keep held down both up and down arrow buttons
2 Press and hold the I/0 button until "CLr" is displayed to indicate that the factory settings have been restored.

4) Release all buttons.

You will now be prompted to set the temperature scale to °C or °F using the up/down arrows.
5) Press 'm' to save selection.

Section 7
HEP3T Specification

Handheld enclosure
Material: ABS
Weight: approx 615g (incl batteries)
Protection: IP65
Dimensions: 100 x 165mm
Protective moulding dimensions: 110 x 190 mm
Sensor connector socket IP68

Sensor wand
Material: Polypropylene
Weight: approx 200g
Dimensions (max): 250 x 40 mm
Stainless PT1000 temperature sensor
Encapsulated Electrodeless Conductivity Sensor
Maximum operating temperature : 50°C*
Lead length: 1.10m
Connector plug IP68

Measurement ranges:
Conductivity: 0 – 9999uS 0 - 99.99mS 0 – 200.0 mS
Temperature: 0 – 50°C*

Accuracy:
Conductivity ±3% or 3 counts (whichever is greater)
Temperature: ± 0.5°C

Battery: 4 x 1.5V AA cells

* continuous operation.

Section 8
Care and Precautions

8.1 Cleaning the HEP3T

The handheld unit can be cleaned using a damp cloth and soapy water.
The sensor wand can be cleaned with a toothbrush or other nylon brush using soapy water.

8.2 Caution!

The maximum operating temperature for the sensor in continuous use is 50°C.
The sensor may be immersed in liquids up to 100°C for brief periods for no longer than 2 minutes.