How to get the most from your Delta-T Devices WET Sensor

Delta-T Devices

The WET Sensor is widely used in horticulture and it is a trusted tool for many growers for effective substrate and fertigation management.

But is the WET Sensor always used to its full potential and configured to give you the most accurate results?

This poster looks at a few aspects of the WET Sensor you may not be familiar with or fully appreciate.

Using the WET Sensor to measure fluid

Did you know you can use the WET Sensor to estimate the EC of your nutrient solutions and drain water?

The WET Sensor is not specified for measuring EC in fluid, but it does a good job nonetheless.

As a simple test we compared measurements taken with two WET Sensors with a laboratory spec EC probe (Oakton CON 100 Series).

Solution	Oakton	WET (2015)	WET (2007)
NaCl	274	279	274
NaCl	158	160	158
NaCl	75	75	75
Tapwater	44	44	43
Plant feed	210	210	207
Plant feed	120	120	118

(EC measurement units: $mS.m^{-1}$)

For all the measurements the WET Sensors gave virtually the same reading as the laboratory instrument, and always well within its specified performance *.

The WET Sensor can output pore water conductivity (EC_p) and also bulk conductivity (EC_b). For solutions under about $300mS.m^{-1}$ both measurement options can be used. At solutions with higher conductivity levels the EC_b option works best.

*The WET Sensor accuracy specification is based on a reading taken in substrate and for an EC of under $300mS.m^{-1}$.
Accuracy is typically ±5% (max ±10%) of reading.

How to test your WET Sensor

Is there an easy way to check that your WET Sensor is giving you an accurate EC reading?

Some growers use a certified calibration solution to test their sensor, such as the Conductivity Solution from Hanna Instruments (supplier code HI70031P). This has a conductivity of 1413µS/cm (141mS/m at 25°C).

You will need to add the contents of **two** 20ml sachets together to get enough volume to **completely cover the metal rods** of the WET Sensor otherwise the reading will be inaccurate.

The Hanna calibration solution **maintained at 25°C** in a water bath and its EC measured using both the Oakton laboratory probe, and a WET Sensor. Measurements compared to the predicted EC of $141mS.m^{-1}$ for the solution at 25°C.

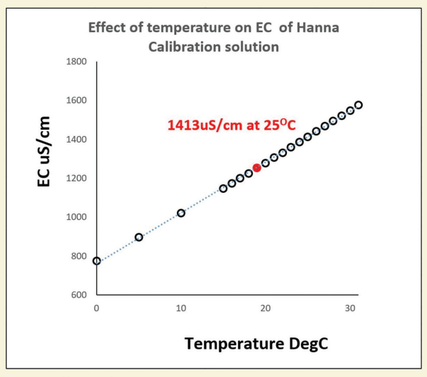
Oakton		WET (2015)		Predicted
°C	$mS.m^{-1}$	°C	$mS.m^{-1}$	$mS.m^{-1}$
24.6	132	25.2	135	141

Neither probe in this case measured $141mS.m^{-1}$ exactly, but the WET Sensor was closest, its measurement again well within specified error. Perhaps check your sensor at the start of the season, and a couple of times during it. The WET Sensor is remarkably stable. Many of the tests in this poster uses a WET Sensor manufactured in 2007!

Does temperature matter?

Yes, it does for EC measurements.

The Hanna EC Calibration Solution has predicted EC values corresponding to temperatures from 0°C to 31°C. The EC of the solution can therefore range from 776 – 1575 µS/cm depending on temperature. (chart below is based on Hanna sachet table).



Effect of temperature on Hanna EC solution

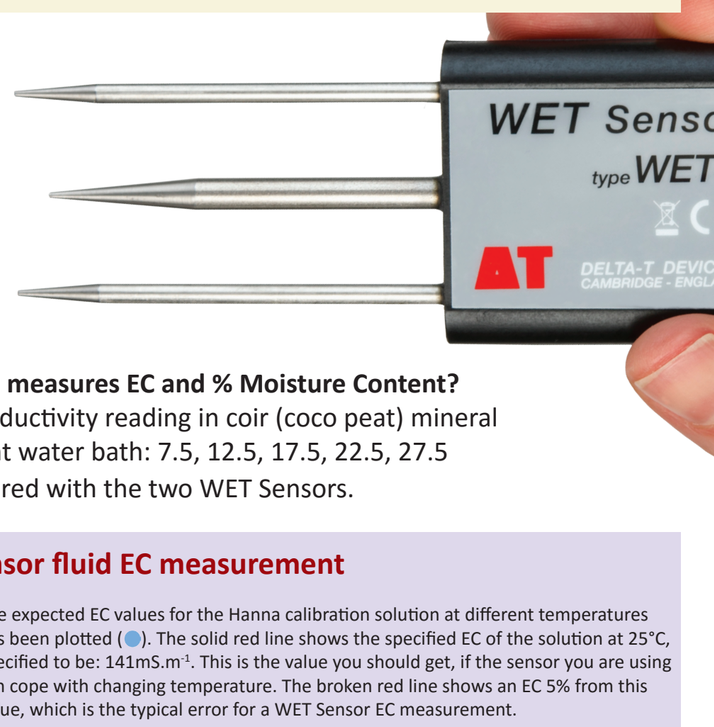
This is important

The EC that you measure will be subject to the temperature of your substrate or fluid, **unless the measurement is compensated.**

As a rule of thumb, depending on the dissolved salts, each degree C change in temperature can result a change in EC measurement of 2% or more.

This means that for a solution with an EC around $200mS.m^{-1}$ a temperature change of just 10°C could mean an uncompensated EC measurement being wrong by perhaps $40mS.m^{-1}$

Even in a well-managed polytunnel temperatures can easily fluctuate by more than 10°C in just 24 hours, and for a few weeks during a typical season temperatures can vary even more. This can have a huge impact on how you manage the EC of your substrate to maintain optimal growing conditions.

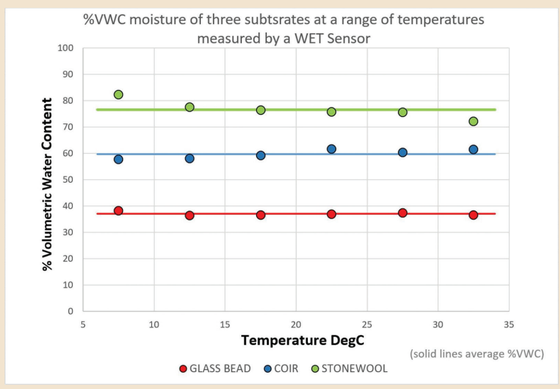


In part 2 of this poster we look at how the WET Sensor performs in three artificial media. **Does temperature affect how well it measures EC and % Moisture Content?** We used two WET Sensors, one manufactured in 2015, the other in 2007, and we took a moisture content and pore water conductivity reading in coir (coco peat) mineral wool, and in 2mm glass beads. Each substrate was equilibrated for at least three hours at the following temperatures in a Grant water bath: 7.5, 12.5, 17.5, 22.5, 27.5 and 32.5°C. The Hanna calibration solution was also subjected to the same temperature regime, and the EC of this fluid measured with the two WET Sensors.

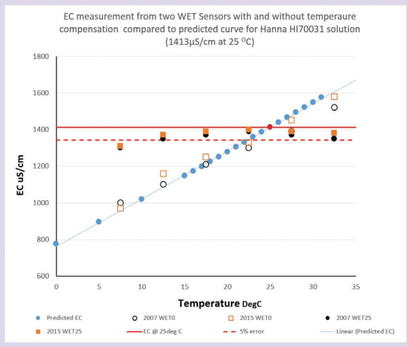
Effect of temperature on WET Sensor moisture measurement

For the three substrates, WET Sensor moisture measurements remain reasonably stable over temperature range 7.5-32.5°C.

The solid lines on each chart show the average moisture content for the six measurements for each substrate at the six temperatures regimes.



Effect of temperature on WET Sensor fluid EC measurement

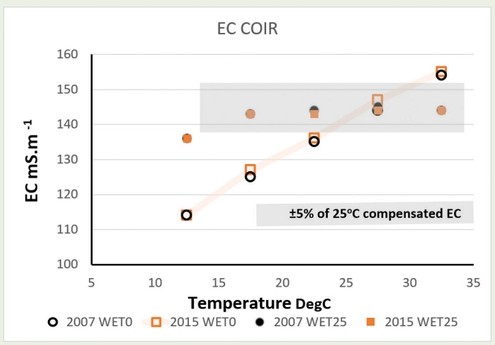


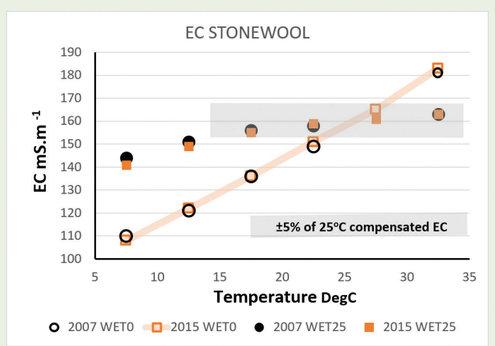
The expected EC values for the Hanna calibration solution at different temperatures has been plotted (●). The solid red line shows the specified EC of the solution at 25°C, specified to be: $141mS.m^{-1}$. This is the value you should get, if the sensor you are using can cope with changing temperature. The broken red line shows an EC 5% from this value, which is the typical error for a WET Sensor EC measurement.

The open chart shapes (○□) show an uncompensated (WET0) EC measurement of the solution using two WET sensors, whilst the solid shapes (●■) show measurements taken when a **25°C compensation** was applied. (WET25).

In Hanna calibration fluid the effect of applying a temperature compensation to the WET Sensor measurement is clear, with most compensated measurements well within 5% of the predicted value of this solution for both WET Sensors, as per the WET Sensor specification. All the compensated measurements are within the maximum error of ±10%.

Effect of temperature on WET Sensor EC substrate measurements

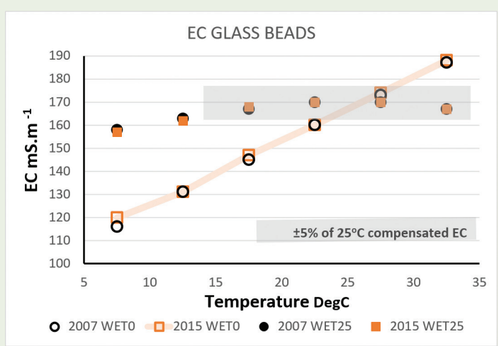




For stable EC measurements in substrate it is clear that temperature compensation is needed. Without temperature compensation the measured pore EC varies significantly with changing temperature – charts for all three substrates show a similar trend to that observed with the Hanna solution (WET0 ○□).

When the HH2 is set to a temperature compensated EC measurement (WET25 ●■) the measurements become much more stable, denoted by grey shading on the chart which is an area covering ±5% of the estimated EC value at 25°C. Compensated measurements falling within this grey area could be considered a more accurate estimate of pore water EC for that substrate at that temperature.

For most accurate pore water EC measurement it is therefore recommended that temperature compensation is used. It is possible, if you have characterised your solution, to modify the compensation factor. The 2% per degree C default can be changed to reflect the response of your particular solution to changing temperature.



How to program your HH2 for temperature compensation

Press [Esc] key

```
Delta-T  Devices
ΔTMoisture Meter
```

Press [Set] key & Scroll ▼

```
Options:
 Compensation
```

Press [Set] key & Scroll ▼

```
Compensation:
 Temperature
```

Press [Set] key & Scroll ▼

```
Temperature:
 25ºC
```

Press [Set] key to confirm