Data Sheet

True TDR-310H
Soil Water-Temperature-BEC Sensor



Description:

The TDR-310H is the replacement to the former Acclima TDR-310S. It is fully compatible with the '310S but incorporates several improvements. Like the '310S it is an integrated time domain reflectometer that combines ultra-fast waveform generating and digitizing functions with a precision 5 ps resolution time base and highly sophisticated waveform digitizing and analyzing firmware that provides true time domain analysis of soil-propagated waveforms. Its form factor is designed for easy vertical installation in an augured hole using a 34 mm flat-bottomed auger. It mates with a 1" schedule 40 PVC pipe that acts as a handle in its installation to any desired depth. Its main improvements over the '310S are its faster rise time, its shaped incident wave, its lower power consumption and its very fast response time. Its interface is SDI-12 and is compatible with any data recorder that is compliant with SDI-12 version 1.4.

Features:

3-element 10 cm stainless steel waveguide
34 mm round cross section with glue-on protrusion for mating with 1" schedule 40 PVC pipe
10 m 3-conductor waterproof cable
Waterproof Epoxy-filled Housing
20% to 80% Incident Wave Rise Time: 150 ps
Waveform Digitizing Resolution: 5 ps

Measurement Functions:

Volumetric Water Content:	0% to 100%
Medium Permittivity:	1 to 80
Medium Bulk Electrical Conductivity:	0 to 5000 µS/cm
Medium Temperature:	-40 to +60 degrees C
Pore Water EC (Hilhorst Model):	0 to 55000 µS/cm

Battery Operation Performance:

A major advantage of the TDR-310H over its predecessor TDR-310S is that its battery life has been increased 10 fold. This is due to lower current consumption and a faster read time.

Read Time (from issuance of read command until the return of data)			0.25 seconds
Operating Voltage Range:			3.5 to 15 volts dc
Idle Current Consumption:			< 10 µA
Idle Daily Energy Consumption @ 3.5 v:			2 J/day
Current and Energy Consumption during Read:	current	power	energy*
15v	32 mA	0.48 W	0.12 J
12v	36 mA	0.43 W	0.11 J
6v	62 mA	0.37 W	0.09 J
3.5v	88 mA	0.31 W	0.08 J

*A typical 18650 Lithium ion battery stores about 40,000 Joules of energy

Permittivity Reporting:

Permittivity is calculated directly from waveform propagation time and does not incorporate any voltage or current parameters. Hence the permittivity calculation is independent of soil electrical conductivity. This is the main advantage of true Time Domain Sensors over other types of sensors.

Reading Range:	1 to 80 relative permittivity units
Reporting Resolution:	0.1 relative permittivity units
Repeatability (RMS deviation):	0.07 permittivity units
Reporting Accuracy:	
Coarse and medium textured soils:	±1 relative permittivity units
Fine textured soils:	±2 relative permittivity units
Stability of permittivity readings vs Bulk EC:	< 1 relative permittivity unit 0 to 4000 µS/cm BEC

Volumetric Water Content Reporting:

VWC is calculated from permittivity using the Topp equation. Hence the accuracy of VWC reporting is that of the permittivity reporting and those further small errors imposed by the Topp equation. Note that the Topp equation is effective only to about 50% VWC. Acclima has replaced that segment of the equation with a linear function of propagation time beyond 50% VWC.

Reading Range:	0 to 100% VWC
Reporting Resolution:	0.1% VWC
Repeatability (RMS deviation):	0.07%
Reporting Accuracy:	
Coarse and medium textured soils:	±1 percentage point
Fine textured soils:	±2.5 percentage points
Stability of VWC readings vs Bulk EC:	< 1 percentage point 0 to 4000 µS/cm BEC

Bulk Electrical Conductivity Reporting:

Bulk Electrical Conductivity of the soil is calculated from soil resistance measurements between the waveguide elements. Chromium oxide deposits on the waveguide elements becomes significant at high EC levels and the error correspondingly degrades in accuracy at those levels.

Reading Range:	0 to 5000 µS/cm
Reporting Resolution:	1 µS/cm
Repeatability (RMS deviation):	3 µS/cm

Reporting Accuracy:

0 to 1000 µS/cm	25 µS/cm
1000 to 2000 µS/cm	±2.5%
2000 to 5000 µS/cm	±5%

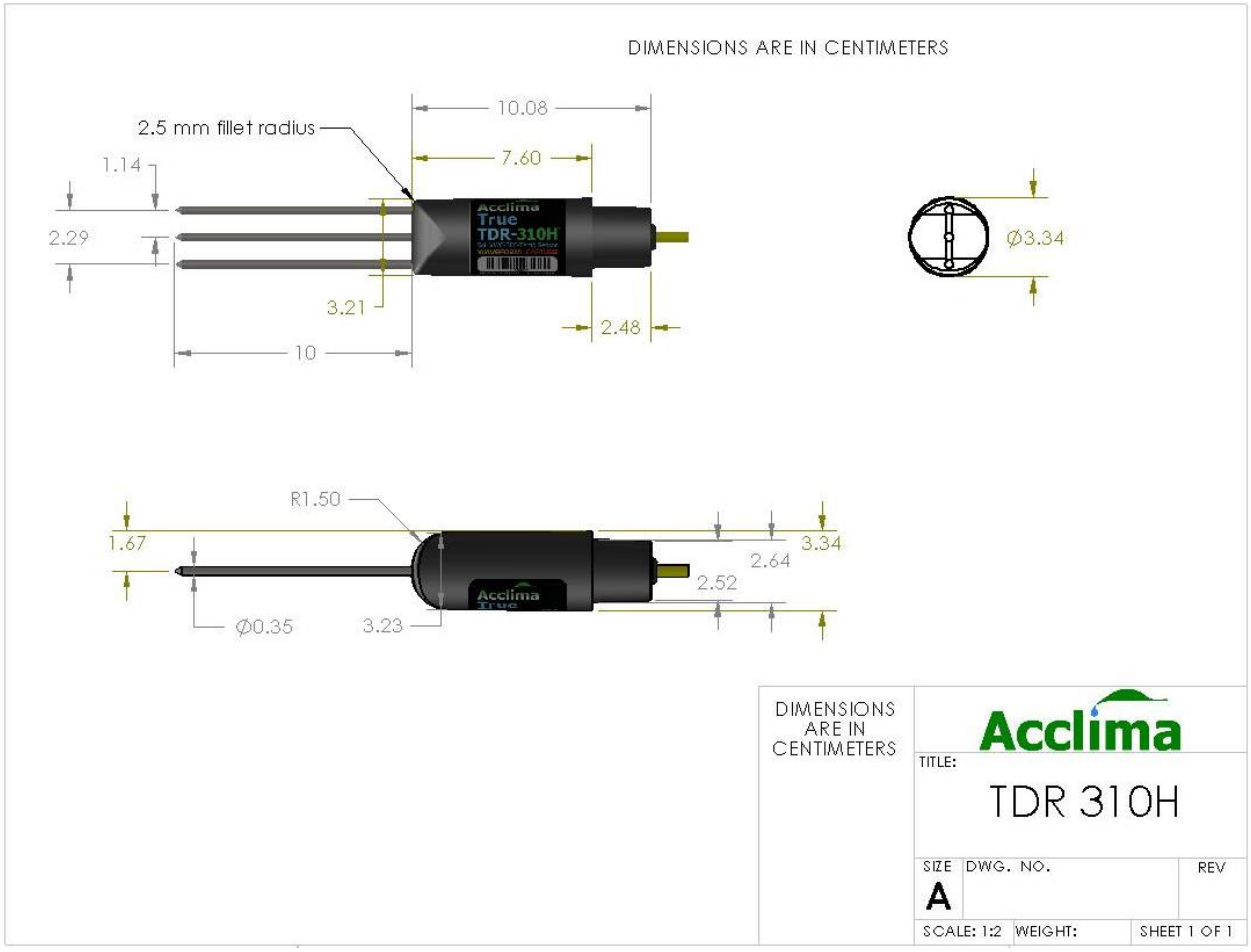
Temperature Reporting:

Soil Temperature is measured with a highly precise thermistor that is located about 2mm from one of the outer waveguide electrodes.

Reading Range:	-40C to +60C
Reporting Resolution:	0.1 degree C
Repeatability (RMS deviation):	.01 % C
Reporting Accuracy:	±0.25 degrees C

Pore Water EC Reporting:

This reading is calculated from permittivity and bulk EC using the Hilhorst model with an assumed soil type. Hence it is of limited accuracy and should be used only as a ball-park reading.



 © 2019 Acclima, Inc. USA