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Description, AN, Measuring UMS tensiometers with non-UMS CDA systems		13426-01	
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Rev.	Description	Revision By	Date

Production Filename: 13426 (In Product Library)

Path to Working Files: DecaDoc\Application Notes\Master

Dimensions: 8.5 inch wide, 11 inch tall

Material: Paper, 92 Bright White or better, 75g/m² or heavier

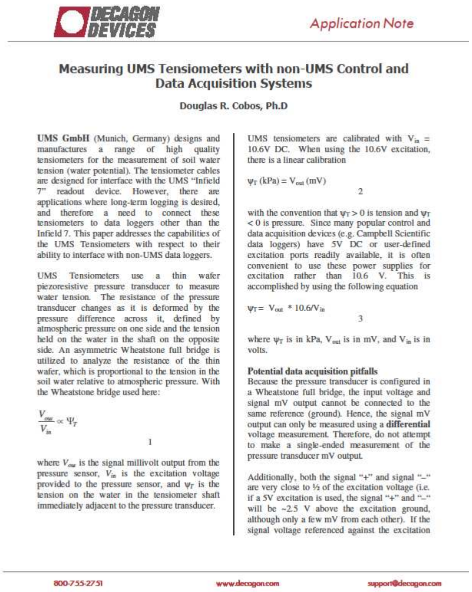
Colors: Color Print on White

Printer: HP Color LaserJet 8550-PS

Finish: None

Adhesive: None

Special Notes: Illustrations are Ref Only ** Not to Scale ** (Shown page 1 of 3)



DECAGON DEVICES Application Note

Measuring UMS Tensiometers with non-UMS Control and Data Acquisition Systems

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UMS GmbH (Munich, Germany) designs and manufactures a range of high quality tensiometers for the measurement of soil water tension (water potential). The tensiometer cables are designed for interface with the UMS "Infield 7" readout device. However, there are applications where long-term logging is desired, and therefore a need to connect these tensiometers to data loggers other than the Infield 7. This paper addresses the capabilities of the UMS Tensiometers with respect to their ability to interface with non-UMS data loggers.

UMS Tensiometers use a thin wafer piezoresistive pressure transducer to measure water tension. The resistance of the pressure transducer changes as it is deformed by the pressure difference across it, defined by atmospheric pressure on one side and the tension held on the water in the shaft on the opposite side. An asymmetric Wheatstone full bridge is utilized to analyze the resistance of the thin wafer, which is proportional to the tension in the soil water relative to atmospheric pressure. With the Wheatstone bridge used here:

$$\frac{V_{out}}{V_{in}} \propto \Psi_T \quad (1)$$

where V_{out} is the signal millivolt output from the pressure sensor, V_{in} is the excitation voltage provided to the pressure sensor, and ψ_T is the tension on the water in the tensiometer shaft immediately adjacent to the pressure transducer.

UMS tensiometers are calibrated with V_{in} = 10.6V DC. When using the 10.6V excitation, there is a linear calibration

$$\psi_T \text{ (kPa)} = V_{out} \text{ (mV)} \quad (2)$$

with the convention that $\psi_T > 0$ is tension and $\psi_T < 0$ is pressure. Since many popular control and data acquisition devices (e.g. Campbell Scientific data loggers) have 5V DC or user-defined excitation ports readily available, it is often convenient to use these power supplies for excitation rather than 10.6 V. This is accomplished by using the following equation

$$\psi_T = V_{out} * 10.6/V_{in} \quad (3)$$

where ψ_T is in kPa, V_{out} is in mV, and V_{in} is in volts.

Potential data acquisition pitfalls

Because the pressure transducer is configured in a Wheatstone full bridge, the input voltage and signal mV output cannot be connected to the same reference (ground). Hence, the signal mV output can only be measured using a **differential** voltage measurement. Therefore, do not attempt to make a single-ended measurement of the pressure transducer mV output.

Additionally, both the signal "+" and signal "–" are very close to ½ of the excitation voltage (i.e. if a 5V excitation is used, the signal "+" and "–" will be ~2.5 V above the excitation ground, although only a few mV from each other). If the signal voltage referenced against the excitation

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