METER

WHY IS MY TEROS 21/22 SENSOR READING -0.1 KPA?

The TEROS 21 Gen 2 and the TEROS 22 measure the water content of the sensor's ceramic matrix and use the well-known retention curve for that ceramic to infer the matric potential of the ceramic and, therefore, the surrounding soil with which it is in equilibrium. In several cases, the sensor will remain at or near -0.1 kPa, very near saturation, and not move as expected, even though a co-located water content sensor is changing. This is a complex situation because there are several factors contributing to this state:

- Soil to sensor (ceramic) contact between the ceramic and the surrounding soil
- Air entry potential of the ceramic and the surrounding soil
- The shape of the Soil water retention curve

Details for these three circumstances are included below.

The key takeaway is that it may take several weeks for the TEROS 21/22 to work as expected because of hydraulic contact, air entry potential, and soil water retention curve causing a delay in anticipated readings. Often waiting resolves the issue. If it does not resolve with time, reinstallation may be needed. Please review METER'S installation video and contact Customer Service if it does not resolve.

SOIL TO SENSOR (CERAMIC) CONTACT

This measurement method only works with good hydraulic contact between the ceramic and the soil. The soil particles must have sufficient contact to transfer water molecules in and out of the ceramic through cohesive forces with other water molecules and adhesion with the soil and ceramic surfaces. The ceramic on the sensor works the same way as soil.

Suppose contact between the ceramic and soil particles is broken or never adequately established. In that case, water can only be transferred in the vapor phase, which is excruciatingly slow. Seeing an appreciable change in the sensor reading can take weeks or months. The change in the sensor reading can take this long because even at the -1500 kPa permanent wilting point, the pore spaces in the soil are at approximately 98% relative humidity. It will take a long time to dry. Fortunately, it is only challenging to get good contact in coarse soils. There have been confirmed problems in coarse sand and the occasional fine sand. With finer

textures in the soil, following METER'S installation video becomes much easier. The most difficult part is that it is hard to know if good contact was achieved during the installation. In soils finer in texture than medium sand, good contact is more likely and easily achieved.

AIR ENTRY POTENTIAL

Water can only drain from a porous substrate if air can get in. The ceramic of the TEROS 21 (and soils) have an air entry potential around -4 to -7 kPa. This air entry potential means that until the soil near a saturated sensor dries to approximately -7 kPa, there will be no change in the sensor output.

Once air can get into the sensor to displace water and cause it to drain out, the sensor readings jump down to the air entry potential and then continue drying in equilibrium with the soil around it.

This insensitivity in the sensor can be confusing, but it is a normal physical phenomenon in the sensor and soils.

SOIL WATER RETENTION CURVE

The soil water retention curve is the relationship between water content and matric potential in the soil. Explore more info on soil water retention curves here.

In brief, a change in 3-4 % VWC in the wet range, near saturation, may be a minuscule change in matric potential. On the dry end of the curve, a small change in water content will most likely have a much larger effect on the matric potential.

All this means that it is normal to see changes in VWC near saturation that the matric potential does not reflect.