Odyssey Soil Moisture Logger.

Contents.

Theory of Operation.

The Odyssey Soil Moisture Probe uses the proven and sensitive technique of measurement of the dielectric constant of moist soil to determine the moisture content. As the water content in the soil increases, the resultant measured dielectric constant increases.

The dielectric constant of a material is defined as the ratio of the electric flux density produced in the material to that produced in free space (i.e. a vacuum) by the same electric force. The dielectric constant of air is normally taken as one (1). Thus the dielectric constant of a substance is the ratio in which the capacitance between two electrodes is increased when the space between them is filled with some other medium instead of air. In the case of the soil moisture measurement it is a mixture of soil and water.

The dielectric constant of oven-dried soil is typically four (4), and that of water is eighty (80). The measurement of the combined dielectric constant of the soil and water offers a very sensitive determination of soil moisture content. Variations in electrical conductivity of the soil moisture due to dissolved salts have very little effect on the measurement because the frequency used to measure the soil moisture is very high.

It has been shown, for an irrigated crop, that production per unit volume of water can in most cases be improved dramatically with accurate management of irrigation water. To do this, the moisture content of the soil in the root zone of the plant must be known.

Water Proofing.

The Odyssey soil moisture recorder is housed in a waterproof container. The ‘O’ ring seal on the top must be kept clean and have a very light coating of either Silicon grease or petroleum jelly on the ‘O’ ring and the thread. The sensor is also waterproof. The cable glands at the bottom of recorder and the top of the soil moisture sensor must never be undone as this will break the seal and allow water to leak into the sensor or recorder.

Installation Methods.

For measurement of the soil moisture very close to the ground surface the sensor can simply be pushed into the soil. The cable gland on the top of the sensor must be just below the soil surface. To help to avoid water running down the side of the sensor, it should be pushed into the soil at an angle of approximately 45 degrees.

For deeper installation of the sensor a hole should be excavated to the depth required and then the sensor should be pushed into the side of the excavated hole. The first 5cm of cable should be positioned lower than the cable gland on the top of the sensor. This will prevent surface water that runs down the cable from changing the soil moisture value reading from the sensor.

The soil should then be replaced into the hole in the same order as it was excavated. The soil should also be lightly tramped down to ensure that the bulk density of the soil is the same as the original soil profile.

To remove the sensor from the position under the ground, do not pull it out by the cable as this will either damage the sensor or the cable. The hole must be carefully excavated, taking care not to damage the cable. When you have reached the depth that the sensor was installed it can then be lifted out.

Calibration.

The sensor has an offset value supplied with the logger. This is the value that the sensor will read in dry soil.

Calibration Chart - Dry Soil Offset Value
Record any changes in offset or offsets specific to soil types on this chart.

Serial Number	Factory Offset

To calibrate the sensor for the soil being measured, place a soil sample from the depth that the sensor is being installed in an airtight plastic bag. A sealable plastic food bag is ideal. The soil sample size required would be about 100 to 200 grams. If you have a soil core sampler this could be used. The sample in the steel corer requires to be placed in a sealed container to prevent moisture evaporation.

The moist soil sample should first be weighed and then placed in a drying dish. The soil is then dried in an oven at 105 degrees for 24 hours.

When the first block of data is retrieved from the soil moisture sensor, the calibration can be calculated using the following procedure. If a soil corer is used then the volume of the corer is used in the calculation. If a manual bulk sample is taken then the volume must be determined by placing the sample in small measuring jug or in a tin. Shake the sample down to ensure that the volume is close to the original volume in the field. Then measure the volume of the sample.

Example of Results from a Sand Soil Sample.

Total mass of soil sample = 184g
Volume of soil sample = 130cc
Dry soil mass = 151g

Soil water mass = 184 - 151 = 33g
Volume of water = Mass of water / Density of water = 33/1 = 33cc
(Density of water = 1g per cc)

Water (%) by mass = (Soil water mass / Dry soil mass) x 100
= (33 / 151) x 100 = 21.85%

Water (%) by volume = (Volume of water / Volume of sample) x 100
= (33/130) x 100 = 25.38%

Sensor Offset Value = 17483
Average Value from 1st data block = 16250

Enter the data in the calibration calculator

	UN-CALIBRATED VALUE	**MEASURED VALUE**
FIRST VALUE	17483	0
SECOND VALUE	16250	21.8

Slope = -56.559
Calculated Offset = 17483

Memory Storage Capacity.

These loggers store 2 bytes per reading.

The amount of memory is capable of recording 32764 records. The time span in days can be calculated by dividing 32764 by the number of logs per day.

Example. A scan time of 30 minutes has 48 recordings each day. The total number of days is *682 days. A scan of 10 minutes has 144 recordings each day. The total number of days is 227 days.

When the memory is full the recorder shuts down.

****Note:*** *When using a long scan time it is possible for the battery to expire before the memory becomes full.*