Featured Product:

Performing a Wenner Soil Resistivity Test with the AEMC® Model 6472

Soil resistivity is a key factor for determining what the resistance of a grounding electrode will be, to what depth it must be driven in order to obtain low earth resistance, and even the type of grounding system that should be designed for this location and facility.

The resistivity of the soil varies widely throughout the world and changes seasonally. Resistivity is strongly affected by the content of electrolytes in the soil, its moisture content, and even its temperature. Soil resistivity measurements are therefore critical for designing and constructing a grounding system appropriate for your site and requirements.

This article describes a simple way to measure soil resistivity known as the Wenner method. Our test instrument will be the AEMC® Ground Tester Model 6472. This instrument automatically calculates and displays soil resistivity, with no manual calculations necessary.

The Model 6472 also features advanced capabilities such as test currents up to 250 milliamps for testing soils with high resistivity, automatic test frequency selection for testing in high EMI environments, and the ability to connect to a computer via AEMC's DataView® data analysis software.

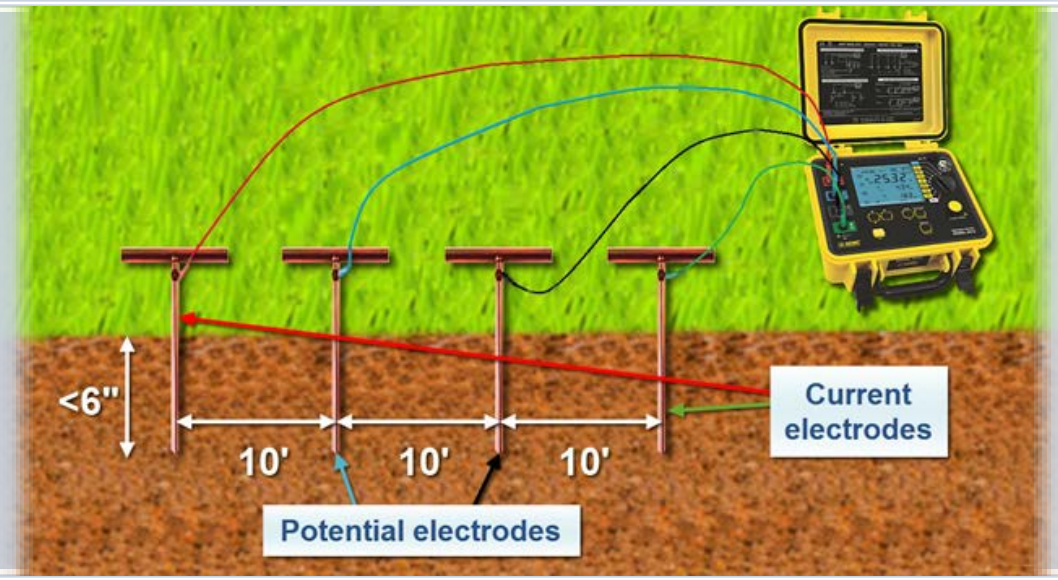
Soil Resistivity vs Resistance

In this article, we refer to both soil resistivity and soil resistance. To avoid possible confusion, it's important to have a basic understanding of what these terms mean and how they differ. Simply put, resistance (represented by the letter **R**) is a property of a specific physical item of a definite size and shape; while resistivity (represented by the Greek letter ρ), is a general property of a material irrespective of its shape or size.

For example, a 500-foot length of 10-gauge copper wire has a specific resistance, measureable in ohms (Ω); while copper as a material possesses a general resistivity, expressed in units such as ohm-centimeters (Ωcm) or ohm-meters (Ωm). Changing the length or gauge of the wire changes its resistance, while the resistivity of the copper from which it is made remains the same.

Wenner Test Setup

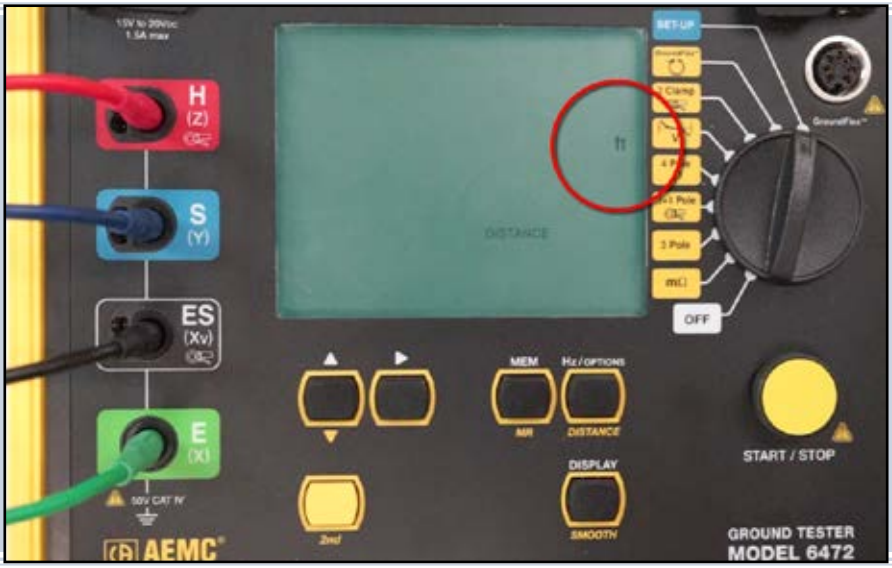
The Wenner test involves placing four equally spaced and in-line electrodes into the ground. The two outer electrodes (called the current electrodes) inject current into the soil. The two inner electrodes (called the potential electrodes) measure voltage, which is then used to calculate soil resistance.



The Model 6472 automatically calculates soil resistivity using a formula that assumes the auxiliary electrodes are inserted into the ground to a depth that does not exceed 1/20th of the spacing distance between electrodes. So for our demonstration, we will place the electrodes 10 feet apart and no more than 6 inches deep. Other distances can be used, as long as depth does not exceed 1/20th of the spacing. Note that when calculating the spacing-to-depth ratio, the spacing distance is the primary value. Determine the electrode spacing first, and then adjust the depth accordingly.

The two outer electrodes are connected to the instrument's outer terminals, labeled H and E. The inner electrodes are connected the inner terminals, labeled S and ES.

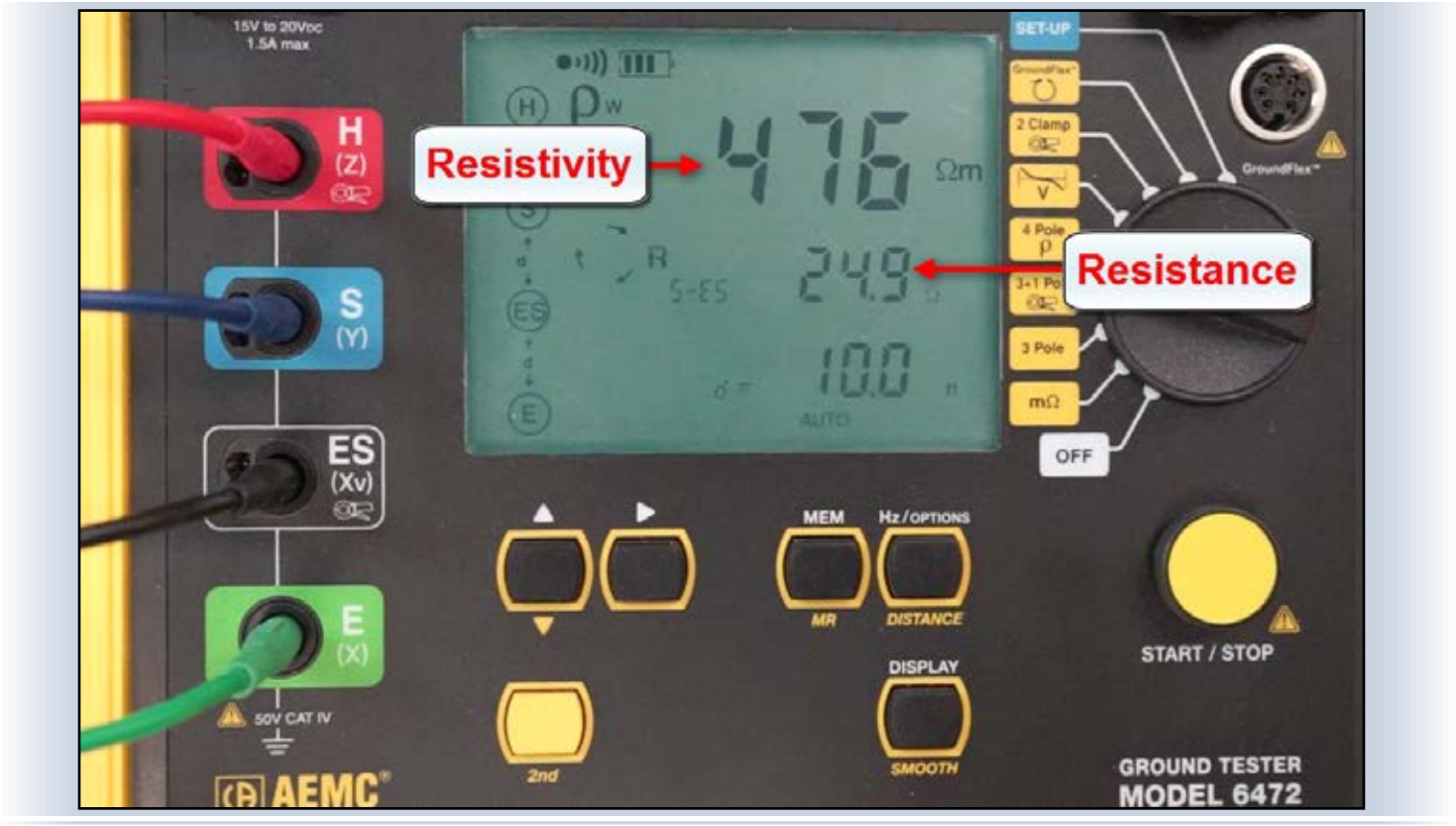
To enable the instrument to accurately calculate soil resistivity, we must enter the electrode spacing distance. We start by ensuring the instrument is configured for the correct units of measure. Turn the instrument's dial to the set-up setting. Then press the DISPLAY button. The unit of measure, either meters (m) or feet (ft), appears blinking on the screen. Pressing the Up button toggles between these two options. In our example we're using feet, so if this is set to meters press the Up button to change this setting.



Next, turn the dial to the 4-pole ρ setting. To enter the spacing distance, press the yellow button labeled 2nd. The symbol 2nd appears on the screen, indicating buttons will now perform the actions labeled in yellow.

Press the DISTANCE button. The word DISTANCE appears on the screen, and the first digit in the distance field blinks, indicating it is in edit mode. Use the Up and Right buttons to navigate through this field and make selections. For example, to set the distance to 10 feet, press the Right button to navigate to the second digit and press the Up button to change this to 1. The field should now be set to 10 feet.

You can save the setting by pressing the yellow 2nd button to enter 2nd mode and then pressing the DISTANCE button.



You are now ready to take a soil resistivity measurement. To do this, push the START/STOP button and hold it down for at least two seconds. After a few moments, the resistivity reading appears, displayed in ohm-meters. The resistance of the soil between the two potential electrodes is also displayed, in ohms.

To save the measurement in the instrument's memory, press the MEM button twice. This saves the reading, along with the date and time the reading was taken. This stored record can later be displayed on the instrument's screen, and downloaded to a computer using DataView® for further analysis.

This concludes our quick explanation of how to perform a Wenner soil resistivity measurement with the Model 6472. For more information about this instrument, please visit our Product Page*.*