



Soil Box

Suggested Procedure for using Soil Box

Purpose:

Measurement of electrical resistivity (in ohm-centimeters) of liquid or earth, sand or other particulate material which can be tamped into the soil box.

Equipment Required:

- 1.) Battery or DC power supply capable of putting out at least 20V DC at about 100ma
- 2.) Soil Box
- 3.) DC milliammeter with ranges of about 1ma to 100ma.
- 4.) DC Electronic Voltmeter with input resistance of at least 10 Megohms and ranges of up to 20V .
- 5.) Four insulated test leads.

Procedure:

- a.) Pour or tamp material to be tested into soil box until flush with top of box.
Where soil or similar material is to be tested, the two brass potential pins should be temporarily removed to facilitate filling the box. Material should be tamped down until compacted to same degree as soil at test site.
- b.) Connect power supply and DC milliammeter so as to pass current between the two end terminals of the soil box. (See diagram on page 3.)
- c.) Connect DC Electronic Voltmeter between the two brass potential pins, which are located near the center of the soil box.
- d.) Using appropriate Milliammeter and Voltmeter ranges, measure the potential between the two brass pins with no current applied and again with measured current passed between the end terminals of the soil box.

$$\text{Resistivity (in Ohm-cm)} = \frac{\text{*Change in Potential (mV)}}{\text{Curent (ma)}}$$

* The change in potential is an algebraic difference, since initial potential difference may be of opposite polarity to potential obtained when test current is supplied. It is usually more convenient to express the current in ma and the change in potential in mV.

Resistivity in ohms/cm is average resistivity of soil to a depth equal to the, pin spacing (equal spacing between pins),

Remarks:

The resistivity of both liquids and soils is a function of temperature. In order to obtain results which best agree with field conditions, the sample should be at the same temperature as would be experienced at the test site. The resistivity of soils is also a function of moisture content; therefore, all soil samples should be kept tightly capped and measured as soon as possible after they are removed from their containers. Soil boxes should be thoroughly cleaned with distilled water after each use. The soil box may also be used with four-terminal, AC meters, such as soil resistance meters as shown in the instructions included with those meters.

Soil Box

Attach the "c" binding posts to the end terminals of the box and the "P" binding posts to the adjacent center terminals. (see fig. 1)

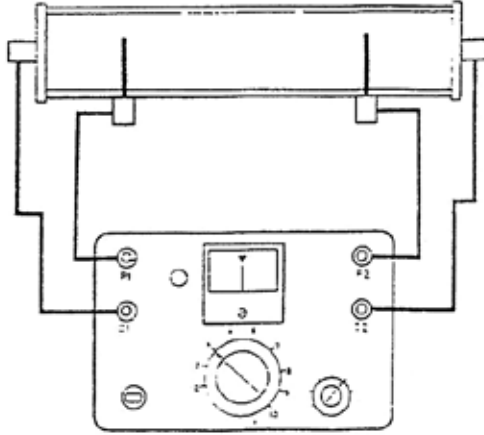


fig. 1

Balance and read in the usual way. Apply the correct multiplying factor, if any, for the box you are using. To obtain the resistivity of a sample of soil or water, the box should be filled even with the top, with no voids.

2-Pin Method

To measure the resistance between two pins or anodes, connect "C1" and "P1" and "C2" and "P2" to the two pins or anodes, using separate leads. (see fig. 2)

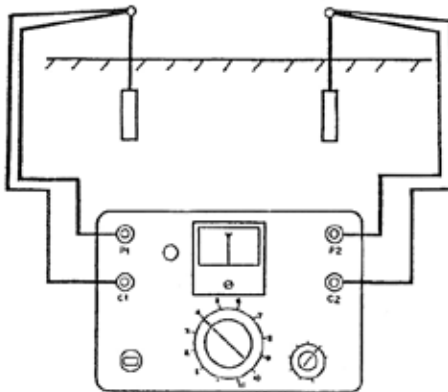


fig. 2

Balance and read in the usual way. Note that this reading includes the resistance of the two pins or anodes to the soil, the soil resistance between them, and the resistance of any cables from the connections to the anode or rod.

3-Pin Method

The three-pin method can be used to measure the resistance to earth of a ground rod, ground bed, anode, etc. For this method, connect the "C1" and "P1" binding posts to the object being measured using separate leads, (See fig. 3), Connect "C2" to a pin driven into the soil far enough away from the object under test so as not to influence the reading. 100 feet would be typical for a ground rod 15 to 20 feet deep. Connect "P2" to a pin 62% of the distance from the object being tested to the "C2" pin. Balance and read in the usual way.

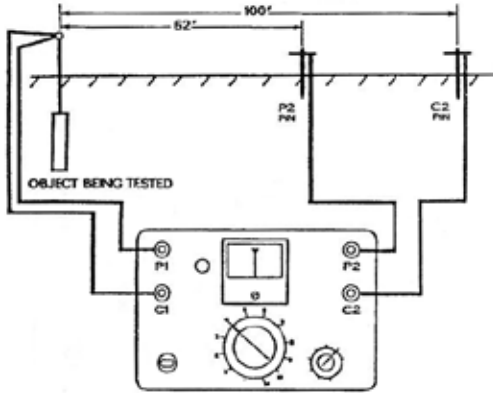


fig. 3 — A Typical Example

Single Probe Method

To use a single probe, connect "C1" to "P1" and "C2" to "P2". Make the probe connections to "P1" and "P2". (see fig. 4)

Drive the probe into the soil to the desired depth. Balance and read in the usual way. Multiply the reading in ohms by the correct factor for the probe being used to obtain resistivity in ohms/cm.

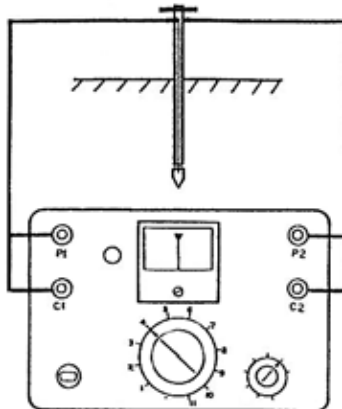
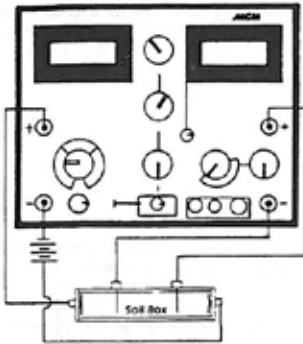
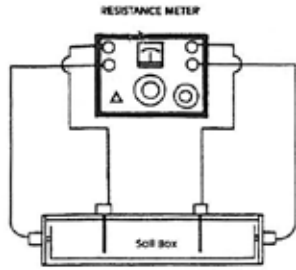


fig. 4

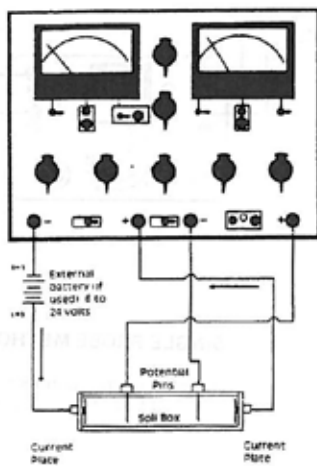


(1)

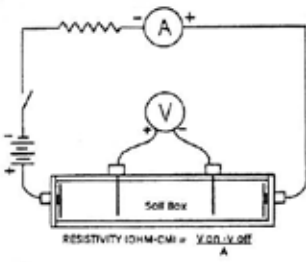


RESISTIVITY (OHM-CM) = R

RESISTIVITY OF SOIL OR WATER BY SOIL BOX METHOD USING AN EARTH RESISTIVITY MEASURING SET



(2)



RESISTIVITY (OHM-CM) = $\frac{V_{SOIL}}{I_{SOIL}}$

RESISTIVITY OF SOIL OR WATER BY SOIL BOX METHOD USING A COMBINATION OF METERS AND BATTERIES

TYPICAL CONNECTIONS FOR USE OF SOIL BOX WITH VARIOUS TYPES OF INSTRUMENTS

RESISTIVITY OF SOIL OR WATER BY SOIL BOX METHOD USING:

- (1) DIGITAL MULTIMETER
- (2) ANALOG MULTIMETER

NOTE:

- 1 When using multi-meters be sure readings on both meters are obtained simultaneously.
2. Potential must be in volts, current must be in amperes to obtain result in ohm-cm.
3. Multiplication factor for the H-4386 soil box is 1.
4. When used with the H-4385A Soil Resistance Meter, no calculations are necessary because the multiplication factor is 1 ohm-cm. Therefore, the resistivity value of the sample can be read directly off the meter dial. Refer to the instruction sheet included with each meter for additional information.

SOIL BOX TEST LEADS
 2 Foot Long,
 2-Black, 2-Red,
 W/Banana Plug and pointed Plug Ends

Warranty

Humboldt Mfg. Co. warrants its products to be free from defects in material or workmanship. The exclusive remedy for this warranty is Humboldt Mfg. Co., factory replacement of any part or parts of such product, for the warranty of this product please refer to Humboldt Mfg. Co. catalog on Terms and Conditions of Sale. The purchaser is responsible for the transportation charges. Humboldt Mfg. Co. shall not be responsible under this warranty if the goods have been improperly maintained, installed, operated or the goods have been altered or modified so as to adversely affect the operation, use performance or durability or so as to change their intended use. The Humboldt Mfg. Co. liability under the warranty contained in this clause is limited to the repair or replacement of defective goods and making good, defective workmanship.

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