NILSSON MODEL 400

SOLID STATE

4-PIN SOIL RESISTANCE METER

INSTRUCTION MANUAL

SINCE 1919

NILSSON ELECTRICAL LABORATORY, **INC.**

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NILSSON MODEL 400 4-PIN SOIL RESISTANCE METER

CONTENTS

MODEL 110
RECHARGEABLE
12 VOLT BATTERY

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RECHARGEABLE12 VOLTBATTERYPACK
7 ampERE HOURS
DESIGNED FOR USE WITH
NILSSON MODEL 715 PIPE&CABLE LOCATOR
AND MODELS820 & 830CURRENT INTERRUPTERS
Plugs into any 110 A.C. outlet

DESCRIPTIONOF MODEL 400

The Nilsson Model 400 Soil Resistance Meter is a 4 terminal, null balancing ohmmeter. It measures resistance from .01 ohm to 1.1 megohms. The Model 400 can be used as a 4, 3, or 2 pin device for soil resistance measurements, or can be used with a soil box or a single probe.

The unit generates a low voltage 97 Hz square wave current between the Cl and C2 binding posts. The detector, whose input is connected between the Pl and P2 binding posts is only sensitive to 97 Hz, and so is not affected by stray A.C. or D.C. currents. The detector senses the voltage drop between the P1 and P2 binding posts, compares it to internal standard resistors, and indicates a difference on the null detector. When the null detector is balanced, using the range switch and the dial, the resistance in ohms between Pl and P2 is the dial reading multiplied by the range switch position.

OPERATING INSTRUCTIONS

4 PIN METHOD

When using the 4 pin method to measure soil resistance, the 4 pins should be driven into the ground in a straight line at the desired spacing. Good contact with the soil is important. The two "C" binding posts are connected to the two end pins, and the two "P" binding posts are connected to the adjacent center pins. (see fig. 1)

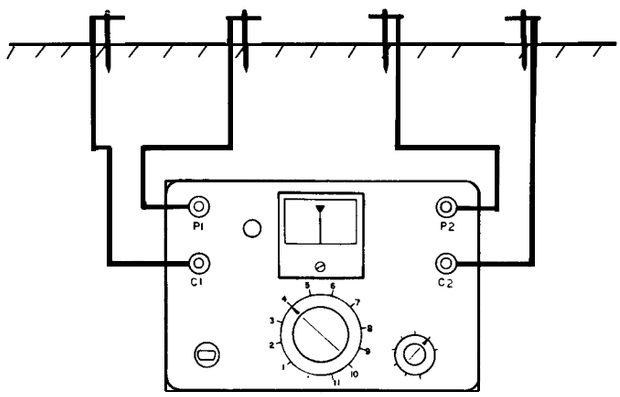

FIG. 1

If the approximate resistance is not known, place the range switch at the "X1OOK" position and the dial at 10. Pull the sensitivity key to the "LOW" position and note that the meter pointer moves to the right, indicating too high a setting. While holding the key in the "LOW" position step down thru the ranges until the pointer moves to the left of center. Then step back up one range and balance with the dial. For increased sensitivity and a finer balance, push the sensitivity key to the "HIGH" position and refine the balance. When a satisfactory balance has been achieved, multiply the indicated dial reading by the range switch setting to obtain the resistance in ohms. To calculate the resistivity in ohms/cm apply the proper pin spacing multiplier factor or formula. (See table)

SPACING EVEN FEET	MULTIPLIER	SPACING FEET–INCHES	MULTIPLIER
1	191.5	2'7"	...500
2	383.0	5'3"	...1000
3	574.5	7'10"	...1500
4	766.0	10'5"	...2000
5	957.5	13'1"	...2500
10	...1915.0	15'8"	...3000
15	...2872.5	18'3"	...3500
20	...3830.0	20'10"	...4000
25	...4787.5	23'6"	...4500

ohms/cm =6.28XSXR (S in centimeters) all spaces equal

ohms/cm =191 .5XSXR (S in feet and tenths) all spaces equal

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

SOIL BOX

For use with a 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. 2)

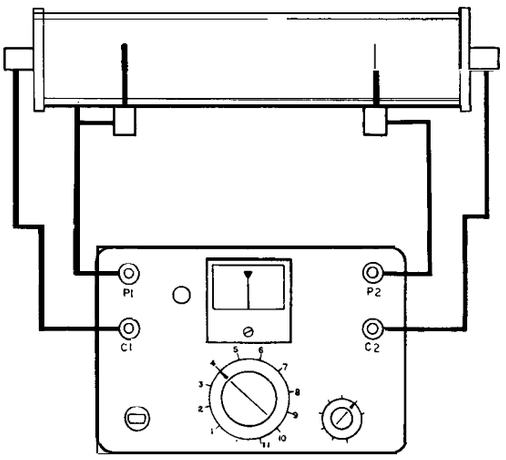

FIG. 2

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.**

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 "Cl" and "Pl" 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.

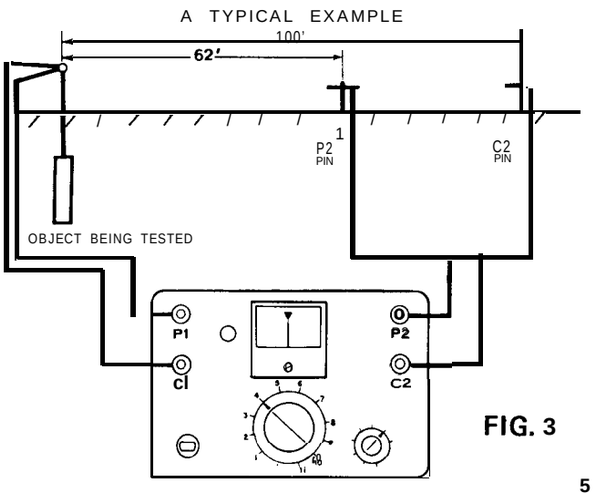

FIG. 3

2 PIN METHOD

To measure the resistance between two pins or anodes, connect "Cl" and "PI" and ''C2'' and "P2" to the two pins or anodes, using separate leads. (see fig. 4)

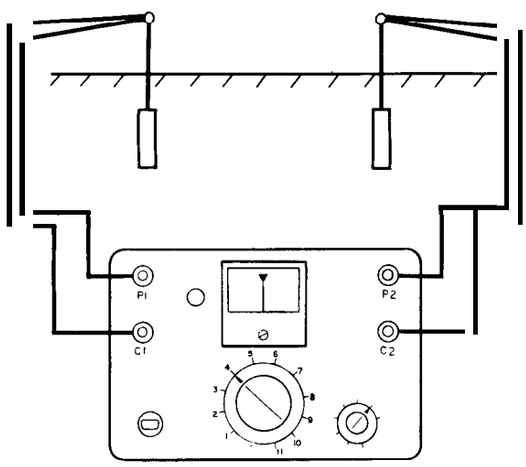

FIG. 4

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.

SINGLE PROBE METHOD

To use a single probe, connect "Cl" to "PI" and ''C2'' to ''P2''. Make the probe connections to "PI" and ''P2''. (see fig. 5)

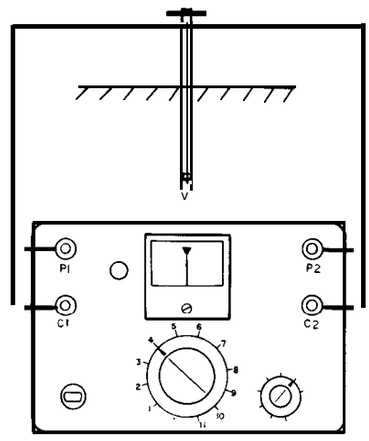

FIG. 5

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 .

OPERATING NOTES

As in any electrical measurement, correct reliable connections are essential for proper results.

1. The connections to the binding posts, as shown in the diagrams, must be correct or erroneous readings will result.

2. Pins should be firmly driven into the soil, not loose. In very dry soils, it may be desirable to wet the soil around the pins to make reliable contact.

3. Open or broken lead wires will result in the inability to achieve a balance on any range, or an incorrect balance on a number of ranges. The trouble is revealed by the abnormal action of the null meter. Examination of the lead wires, connections and pin setting will reveal the source of the trouble.

4. When using the X1OOK range setting, the capacitance between connecting wires may cause low readings. It is suggested that separate wires, as short as possible, be used on this range. Do not use cabled wires.

MAINTENANCE

The only normal maintenance required is to change the battery. The Model 400 operates on a single 12 volt lantern battery (Eveready #732, NEDA #926, or equal) mounted in the bottom of the unit. Battery life cannot be predicted, since the drain varies with the range being used and the length of time the key is held in operation. Battery drain is less than 150 ma. on the "X1OO" range and above. Heaviest drain occurs on the two lowest ranges.

A low battery warning lamp is provided. This is NOT a pilot light. It will ONLY light when the battery voltage is down to 9-10 volts, indicating the need to replace or recharge the battery.

This is done by removing the four panel screws and lifting out the panel. Unscrew the cover over the battery and remove. When putting the battery lead on the new battery, be sure to observe proper polarity. The unit is protected against battery reversal, but it will not operate in this condition,

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Should any repairs ever be necessary, we recommend that the unit be returned to the factory with a description of the difficulty.

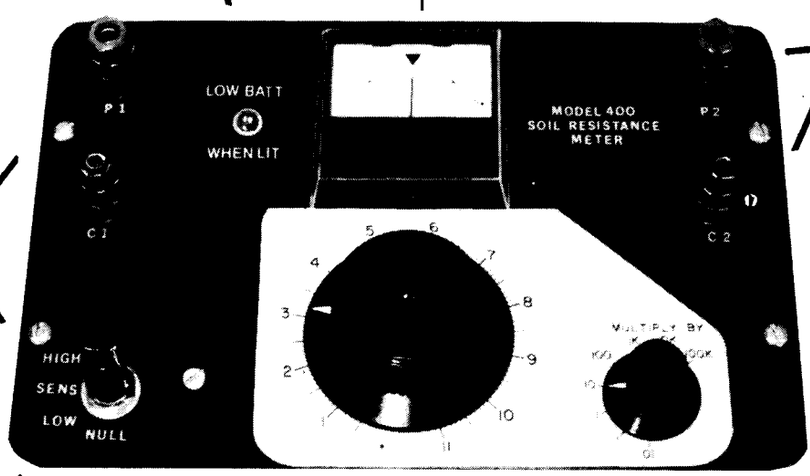
NILSSON MODEL 400 4-PIN SOIL RESISTANCE METER

BATTERY CHECK LAMP

NULL INDICATOR
Scale shows if "off balance" reading is high or low.

5-WAY BINDING POSTS
Used for all measurements.

12 VOLT LANTERN CELL
Clamped in 101wer case. Easily thanged by removing 4 panel screws.



OPERATING KEY
In low position, null pointer will not go off scale, so approach to balance can be seen.

OHMS BALANCE DIAL
100 divisions. Provides cross over of 10% between ranges.

RANGE SWITCH
Range switch has 8 ranges, from .01 to 100 K. Total resistance range from .01 ohm to 1.1 megohms.

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