ElectraDyne -1000 Series Megohmmeter Test Kit Manual

NOTE: THIS MANUAL IS NOT TO BE SEPARATED FROM METER

Test Electrical Resistivity and Conductance, Electrical Grounding, Point to Point Resistance, Resistance to Ground, Temperature and Humidity.

United Static Control Products Inc
2124 S Prairie Ave, Building D, Pueblo, CO 81005
United States of America
Telephone (USA) 719 676 3928

OPERATION MANUAL

INTRODUCTION:

The ElectraDyne-1000 Megohmmeter is a dependable and easy to use audit kit for measuring electrical conductance (or lack thereof). Electrical conductance is a key factor in controlling electrostatic discharge (ESD). Unlike instruments that provide only LED readouts in decades, this instrument is fully digital and breaks down the decades thus providing optimal accuracy and precision.

The ElectraDyne-1000 test kit is perfect for use in all facets of static free production including engineering, maintenance, quality control, incoming inspection, manufacturing, research, educational, and sales. This multi-purpose kit is ideal for testing anti-static mats, floor finishes, paints, wrist straps, smocks, foot wear, bags, containers, and much more. It is designed to test conductive, anti-static, static dissipative, and insulative surfaces for electrical resistivity / conductance according to ANSI/ESD, CECC, ASTM and UL test procedures. The internal parallel electrodes (located on the back of the instrument) are compliant with DIN EN 100 015/1 and some US standards. The precision external industry compliant five pound electrodes that are provided in the kit are compliant with standards issued by IEC 61340-4-1, ANSI / ESDA S4.1 & ANSI / ESDA S7.1, 97.1, TR-53, ANSI ESD S20.2021, ASTM F-150 and most others popular test procedures. The ElectraDyne-1000 Megohmmeter also measures temperature (presented in Celsius) and humidity (presented in % rH).

- This kit includes NIST Certification, it is has been designed and assembled in Colorado (U.S.A.) using foreign and domestic components. It is provided with a 1 year warranty from date of purchase (details apply) and designed to last a lifetime with proper care.

Additional electrodes such as our PN MP-1235 Miniature Test Electrode (compliant with ESD 11.11) and our CP-1111 Concentric Ring Electrode are available to measure a wide variety of specialty applications including small parts, ESD bags etc.

The ElectraDyne 1000 Megohmmeter Includes:

1) ElectraDyne Dyne Resistance / Conductance / Humidity / Temperature Test Instrument
2) Two each 5 lb. industry compliant electrodes
3) One each alligator clip
4) One each metal test plate (for ESD chairs, carts with drag chains, etc.).
5) One each ground cord
6) Two each curly cables (monaural to banana)
7) 9 volt long life battery
8) Blow Molded foam lined travel case
9) Product instructions and operation manual
10) Certificate of calibration

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FRONT LEGEND / QUICK START

Figure 1
FRONT UNDER LOAD

A) Electrical Resistance in OHMS*	**E)** Case ground for high resistance testing
B) Temperature and Humidity	**F)** Input for external Electrode or ground
C) Press and Hold Test Button	**G)** Input for external Electrode or ground
D) Voltage Selection	

*** NOTE: Disregard ohms/sq when using external electrodes**

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BACK AND TOP LEGENDS

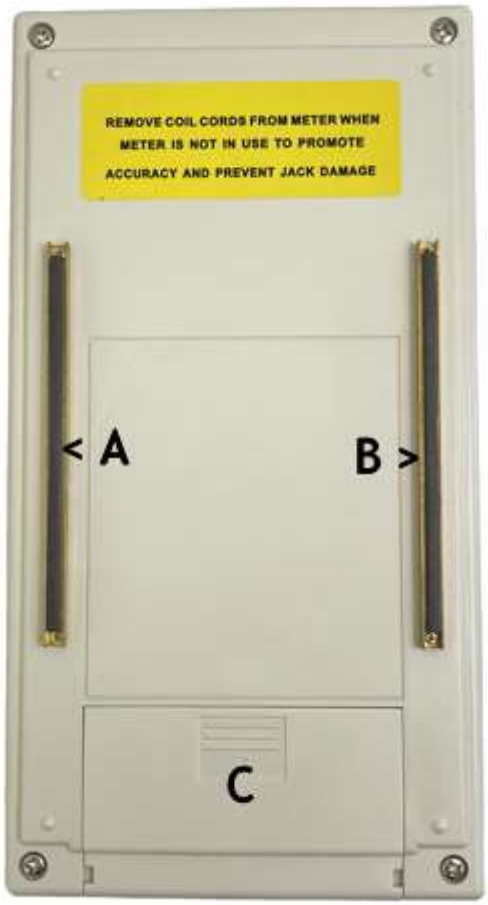

Figure 2
BACK

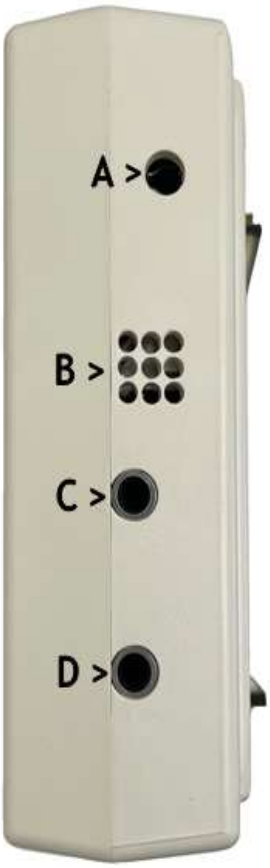

Figure 3
TOP

Figure 2	Figure 3
A) Internal parallel electrode *	**A)** case ground **
B) Internal parallel electrode	**B)** Humidity and temperature sensor ***
C) 9 Volt battery compartment	**C)** External electrode input ****
	D) External electrode input ****

*Disregard ohms/sq when using external electrodes

**Use only for readings above 1.0E10

***Do not cover this sensor

****Use of these ports for external electrodes will disconnect internal electrodes

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INDUSTRY COMPLIANT EXTERNAL ELECTRODES

Figure 4

A) Insulative screw on T handles	**D)** Screw on type auxiliary connection
B) Insulative safety cover	**E)** Conductive rubber face
C) Banana jack input for curly cord	

COMPLIANT TO THE LATEST STANDARDS for RESISTANCE MEASUREMENT ELECTRODES:

Cylindrical electrode, 2.27 kg +/- 2.5% (5 lb. +/-2.5%) with a diameter of 63.5 mm +/- 5% (2.5 inches +/- 5%) having a contact of electrical conductive material with a Shore-A (IRHD) durometer hardness between 50 and 70.

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EXTERNAL TEST LEAD CABLES

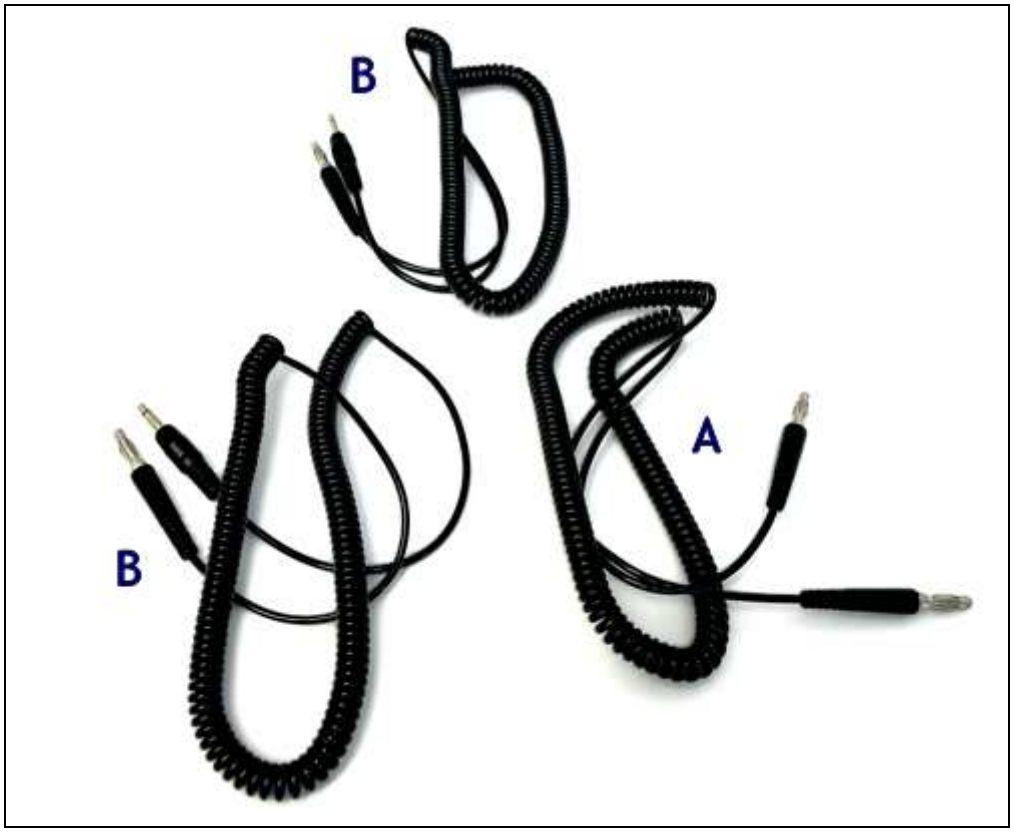

Figure 5

A) Case Ground cable for testing in the high static dissipative range (>1.0E09) Note: This cable is terminated with a banana plug ON EACH END. Use of the case ground helps shield the instrument from static electricity AND stray voltages. Both variables may cause inaccuracy when testing in the highly insulative ranges. One is supplied with each kit. Replacement cables are readily available from United SCP.
B) These cables are used for external electrodes. Note: one end of these cables terminate in a pin plug, the opposite end terminates with a banana plug. The PIN plugs are inserted into *figure 3* C and D. The banana plug is inserted into the external electrodes or into a standard alligator clip or the third plug (the ground connection) of an extension cord. This is helpful when testing Resistance to ground.

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Limits

Resistivity: 10^3-10^{12} ohms/sq

Resistance: 10^3-10^{12} ohms

Relative Humidity: 10% - 90% RH

Temperature: 0 – 37.7 degrees C.

Measuring voltage: 10 v and 100 v, (self-ranging or manual modes)

When using the built-in electrodes, the optional mini probe, or concentric ring probe, the meter's test values for surface resistivity are in ohms per square. When using the external five pound electrodes, the meter's test values for resistance are in ohms (although they are displayed in ohms/sq on the readout).

DECADE SCALE

10^3	=	1 kilohm
10^4	=	10 kilohms
10^5	=	100 kilohms
10^6	=	1 meg ohm
10^7	=	10 meg ohms
10^8	=	100 meg ohms
10^9	=	1000 meg ohms
10^{10}	=	10,000 meg ohms
10^{11}	=	100,000 meg ohms
10^{12}	=	1,000,000 meg ohms

The test value is indicated on the LCD display. Unlike meters with LED readout that only indicate single decades the fully digital E-Dyne-1000 will break down these decades thus providing optimal accuracy.

- **NOTE: The ability to break down decades can make or break compliance!**

TEST VOLTAGE: The test voltage ranges are 10 and 100 volts per recommendations of most ESD standards. Per most ANSI / ESD standards one should choose 10 volts for conductive surfaces (less than 1.0E06) and 100 volts for materials 1.0E06 or greater. If the instrument cannot apply the correct voltage automatically, it will advise you to change to the proper setting manually. Use the switch in front of the meter to change voltage setting.

As defined by the ESD Association, values indicate the following:

Voltage	Range	Definition
10 volt	< 1.0E06 (10^6)	Conductive
100 volt	>1.0E06 to 1.0E11 (10^6-10^{11})	Dissipative
100 volt	>1.0E12 (10^{12})	Insulative

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A NOTE ABOUT VOLTAGE:

In previous years, technicians desiring to measure resistivity or resistance followed the ASTM D264, ASTM 991, NFPA 56A or NFPA99 test standards. These procedures required testing at either 500 or 1000 volts. Due to safety concerns for personnel ESDA and European test methods standardized the test procedures so that lower voltages could be used at specific ranges.

The E-Dyne-1000 meter uses a 9 volt battery to power the device. Some meters with 9 volts batteries do not give the accuracy that you need to perform the tests especially at values higher than 10^7. The E-Dyne-1000 is built with a transformer that converts the 9 volt charge from the battery to 10 volts or 100 volts at very low micro amperage. The instrument applies a constant charge over the complete voltage range. Accuracy is depends on applied voltage, temperature, and humidity.

TEMPERATURE AND HUMIDITY:

The humidity and temperature affect the electrical properties of materials being tested. The combination of low humidity and low temperature will give the highest electrical resistance results or slowest dissipation times. At high humidity a thin layer of water is condensed or absorbed on or in the material being tested. This is true of hydroscopic additives that are added to a material to increase the electrical conductivity. These additives will allow moisture to be absorbable in the materials they are added to.

At elevated temperatures the mobility of free electrons is increased thereby increasing the materials conductivity. This is especially true for carbon black, metallic oxides, metals, and other materials added to a material. When the material is at a lower temperature, built in stresses occur which might increase the resistance due to increased distance between the conductive additives. Thus, humidity and temperature must be known.

RECORDING DATA:

ANSI/ESD Association and European CECC recognize the environmental effects to test measurements and specify in their standards that they measured and recorded. It is possible to test or manufacture a material at high humidity and pass all the test specifications, but when the customer receives the material and uses it at a lower humidity or temperature the material fails to pass the specifications. This can cause rejects and loss of product.

- **NOTE: Most ESD Test Methods require recording the Temperature and Humidity readings at the time of resistance testing. The ElectraDyne provides this information.**

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CALIBRATION:

Calibration is recommended annually. The ElectraDyne-1000 is provided with an NIST certificate when ordered. After one year the instrument may be sent back to United Static Control Products for testing and recertification. Please note: United is a non ISO organization. It may also be sent to an ISO certified calibration lab or done “in house” using the calibration directions supplied in this document.

MEASURING WITH INTERNAL ELECTRODES:

The parallel resistivity probe method, complies with EOS/ESD-S11.11. It is used to give fast electrical resistivity measurements on flat homogeneous materials. It may be used on multilayered materials, but this should be noted along with the temperature and humidity value on the data report.

When the measurement is taken between the tester’s two conductive rubber rails the tester will indicate the surface resistivity of the material being tested.

A. Prior to testing, make certain that surfaces to be tested are clean and free of contaminants.
B. Allow the meter to equilibrate to the atmosphere the meter is to be used in. It may take a half hour for the meter to adjust to new environment conditions.
C. Place the meter on the desired surface to be tested.
D. Move switch to desired test voltage position, either 10 or 100 volts, depending on the target range of the material.
E. Press and hold the test button with approximately 5 pounds of applied force. Note: This function is times for compliance purposes. The display will show the humidity and temperature. After approximately 10 seconds, the meter will display the surface resistivity in ohms of resistance presented in exponentials.

The instrument will keep updating the display while the button is held down. The last reading will display for approximately 20 seconds after the button is released.

MEASURING WITH EXTERNAL ELECTRODES

When the measurement is taken using the 5lb external electrodes, the tester will indicate the resistance of the material being tested once the button is depressed

- NOTE: Readout Values are presented in OHMS (example 3.50E 07) (35 M Ohms) Note: Ignore ohms/sq.) when using external 5 pound electrodes.

By utilizing the External electrodes that are included with the kit the ElectraDyne-1000 can measure Point to Point (PTP) Resistance, Resistance to Ground (RTG), Volume Resistance and Combination resistance values of carts, technicians etc. in conjunction with the ESD floor (or ESD floor mats).

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Using these external electrodes will allow compliancy with various standards including ANSI/ESDA S4.1 for Worksurface – Resistance Measurements, ANSI/ESD S7.1 for ESD flooring, ESD TR53 Garments Section, ESD TR-53 Footwear Section, ESD TR-53 Flooring Section, ESD TR53 Seating Section, ESD TR53 Static Control Garment Section, ESD TR53Groundable Static Control Garment Section, ESD TR53 Packaging Section and many others.

When auditing is finished, unplug the cables and store probes in the protective case. If cables are left in the tester, the jacks will lose their elasticity. If the jacks are damaged or left in the open position, the internal probes will not engage when testing for surface resistivity.

Measuring Resistance Point to Point:

Point to Point measurements are used in the evaluation of floors, work surfaces and other ESD controlled materials and products. Procedures vary regarding sample preparation, probe preparation and spacing of the 5 pound electrodes. Select and read the correct test procedure or standard for the desired measurement. Test procedures may be purchased from https://www.esda.org or https://astm.org

A. Connect one end of each of the banana test leads into the sockets of the meter. Connect the other end of the test coil cords into the 5 pound electrodes.

B. Place both probes on the material according to test procedures or standard being used.

C. Press the “TEST” button and the value will be displayed on the LCD. The meter will apply the correct voltage (10v or 100v) according to the value of what is measured. When performing test do not touch lead wires or probes. Avoid overlapping of lead wires. This will ensure accurate readings.

Measuring Resistance to ground:

Resistance to ground measurements can be used for the evaluation of floors, carts, work surfaces and other ESD controlled materials and products. Keeping a record of test results for temperature, humidity and electrical properties will provide a reference. Procedures vary regarding sample preparation and location of the 5 pound electrode. Select and read the correct test procedure or standard for the desired measurement. Test procedures may be purchased from https://www.esda.org or https://astm.org

A. Connect the pin jack into the sockets of the instrument. Connect the other end of the cable (banana plug) into a single 5 pound electrode. GROUND the banana jack of one lead.

B. Place a single electrode on the material according to test procedures or standard being used.

C. Press the “TEST” button and the value will be displayed on the LCD. The meter will apply the correct voltage (10v or 100v) according to the value of what is measured. Note: When performing test do not touch lead wires or probes. Avoid overlapping of lead wires. This will ensure accurate readings.

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Measuring Volume Resistance to Ground:

Volume Resistance measures the electrical path through a material.

A. Connect one end of each of the banana test leads into the sockets of the meter. Connect the other end of the test coil cords into the 5 pound probes.
B. Place sample material on a conductive metal plate (such as stainless steel). Place one of the 5 pound probes on the material so that the material is sandwiched between the probe and metal plate. (see below)
C. Place the second 5 pound probe on the conductive metal plate.
D. Press the "TEST" button and the value will be displayed on the LED. Volume Resistance is in ohms-cm.

ElectraDyne Calibration Instructions:

The ElectraDyne-1000 is calibrated to be most accurate in the most widely used range (10^6-10^8). The lab calibrates meters between 30-40%RH at 65-73°F. If you are using the meter in atmospheres different than above, it is strongly advised to recalibrate the meter to your conditions.

- NOTE: The ElectraDyne-1000 shall not be used in explosive environments

1. Purchase 1% 10^3-10^{12} ohm resistors, high accuracy relative humidity hygrometer, and high accuracy thermometer.
2. Open meter being careful not to disturb or break the two wires connecting the power button to the circuit board.
3. Observe on the right lower side of the meter printed circuit board four (4) calibration pots.
4. **ALLOW THE METER TO EQUILIBRATE AND NORMALIZE IN THE ENVIRONMENT FOR 2 HOURS BEFORE TESTING.**
5. Using the supplied coil cords, attach alligator clips to the banana plug ends of the cords.
6. Insert the 3.5mm ends into the meter jacks.
7. Attach the ends of the resistors to the ends of the alligator clips.
8. The top pot is for humidity. The next pot under the top is for resistivity. The third pot is for temperature. The last pot on the bottom is to fine tune resistivity. Adjustment is done with a small screw driver. Clockwise is to increase the value, counter clockwise to decrease the value.
9. Press the power button and compare the resistor value, humidity, and temperature to the parameter to be calibrated.
10. Release the power button and slowly turn the correct adjustment pot.
11. Re-press the power button, and observe the LCD screen.
12. Re-press and adjust the pot if necessary.
13. Close case and tighten the 4 screws.
14. Press the power button to verify that the meter is working.
15. Test at **10** volts for values **under** $1x10^6$ ohms. Test at **100** volts for values **over** $1x10^6$ ohms.
16. Tolerance from 10^3-10^8 ohms is 10%
    10^9-10^{10} ohms is 15%

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10^{11}-10^{12} ohms is 25%

17. When testing at high resistance values, ground the meter with a ground cord in the “grounding” jack. Electrical interference and ESD can affect the tolerances and accuracy.
18. The tolerance for temperature and humidity are:

    ±3°Fahrenheit up to 70°F

    ±3% RH up to 70%

    ±5°F over 70°F

    ±5% RH over 70%RH

To increase the accuracy adjusts the calibration at the temperatures and humidity the meter will be used. For example, if you were using the meter at 70°F and 70 RH you would calibrate the meter exactly at those conditions using a 1% accuracy standard thermometer and relative humidity meter.

EXAMPLE of data acquisition results when testing an installed ESD Floor to ANSI ESD S7.1:

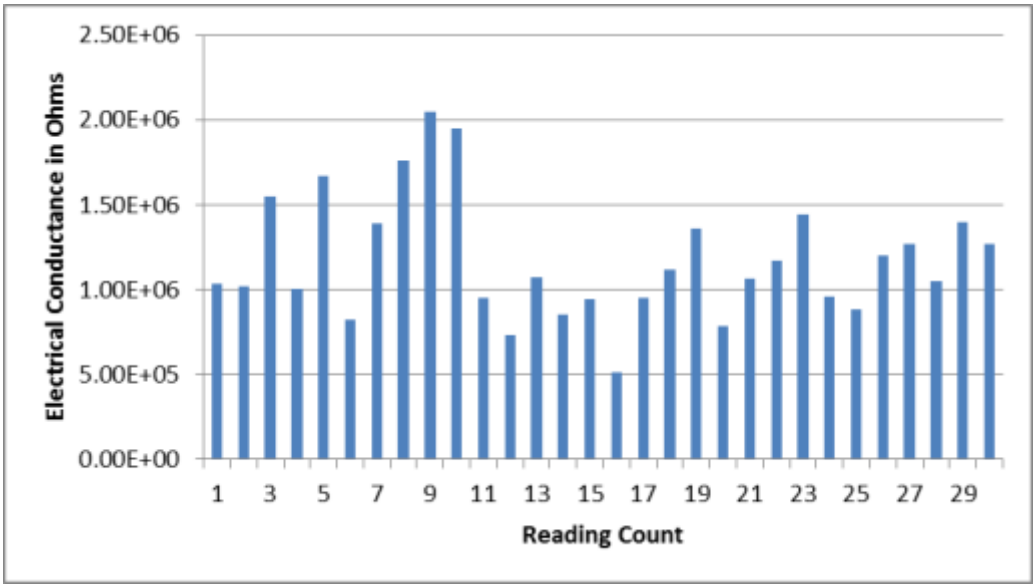
Electrical Resistance to Ground

Testing per ANSI/ESD STM7.1-2020

Environmental Conditions: 47.6% rH, 67.2° F (avg.) @ 100/10 VDC

Minimum: 5.14E05 Maximum: 2.05E06

Median: 1.07E06 Average: 1.17E06



END OF DOCUMENT, Initial release 2.8.24, approved for release by Stephen R Cooter

For Tech support with this device or suggestions for revisions to this document please contact me direct at techsupport@ultrastatinc.com

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