OPERATING INSTRUCTION MANUAL

BFN-TR1380 (Surface Resistance Meter)

PRODUCT INTRODUCTION

The BFN-TR1380 Surface Resistance Meter is an easy to use tester for measuring surface resistivity. The TR1380 meter with TR-BPP accessory is a dependable audit kit for conductive and dissipative surfaces. This meter is designed to be used in all facets of production materials including engineering, maintenance, quality control, incoming inspection, manufacturing, research, or sales departments for testing anti-static mats, floor finishes, paints, wrist straps, smocks, footwear, bags, and containers.

The BFN-TR1380 is a light weight, pocket sized, auto ranging surface resistance meter designed to test conductive, anti-static, and static dissipative surfaces for electrical resistivity according to the ESDA's parallel resistivity probe method DIN ED 100 015/1 & ANSI/ESDA-S11.11.

If meter is purchased with the accessory kit, it will comply to IEC61340-4-1, ANSI/ESDA S4.1 & ANSI/ESDA S7.1 when the two 5-pounds electrodes are used.

When using the built-in parallel electrodes, the meter's test values for surface resistivity are in ohms per square (ohms/sq). And when using the external 5-pounds electrodes, the meter's test values for resistance are in ohms.

TEST LIMITS

- Resistivity: 10^3 – 10^{12} ohms/sq
- Resistance: 10^3 – 10^{12} ohms
- Measuring Voltage: 10V and 100V

PRODUCT PHOTO

PACKING LIST

- TR1380 Meter
- 2 accordion cables (Stereo jack to banana jack)
- 9V battery
- Certificate of Calibration

OPTIONAL ACCESSORIES

- 2 – 5lbs probes (Model: TR-BPP)
- Foam lined carrying case

PRODUCT SPECIFICATIONS

- Size: 85mm x 171mm x 47.5mm
- Weight: 110g (approx.)
- Power: Battery operated PP3 9V
- Connections: 2 x 3.5mm jack plug
- Test Range: $10^3 – 10^{12}$

DECADE SCALE

- 10^3 = 1 kilo ohms
- 10^4 = 10 kilo ohms
- 10^5 = 100 kilo ohms
- 10^6 = 1 Mega ohms
- 10^7 = 10 Mega ohms
- 10^8 = 100 Mega ohms
- 10^9 = 1 Giga ohms
- 10^{10} = 10 Giga ohms
- 10^{11} = 100 Giga ohms
- 10^{12} = 1 Tera ohms

The test value is indicated on the LED display. Half decades provide greater accuracy by giving closer indication to the measurement value. A decade will brighten to the according test result. LED colors signify the test values.

Color	Test Property	Values (ohm)
Green	Conductive	10^3 - 10^5
Yellow	Dissipative: Ideal test measurement	3 x $10^5 – 10^9$
Orange	Dissipative but close to out of specs	3 x $10^9 – 10^{10}$
Red	Near insulative to insulative	$10^{11} – 10^{12}$

TEST VOLTAGE

- The test voltage ranges are 10V and 100V. According to ESDA standards S4.1, S7.1, and S11.11, 10V should be applied for the conductive surfaces less than 10^6 and 100V for materials greater than 10^6. The TR1380will automatically generate proper voltage according to test measurement.
- As defined by the ESD association, values indicate the following:

Voltage	Range	Definition
10 volts	< 10^6 ohms per square	Conductive
100 volts	$10^6 – 10^{11}$ ohms per square	Dissipative
100 volts	> 10^{11} ohms per square	Insulative

A NOTE ABOUT VOLTAGE

In previous years, people desiring to measure resistivity or resistance that follows the ASTMD264, ASTM 991, NFPA 56A, or NFPA 99 test standards. These procedures required people to test at either 500 or 1000 volts. This caused concern regarding safety of the person doing the tests. The ESDA standardized the test procedures so that lower volts could be used at specific ranges.

The TR1380 meter uses a 9V battery. Some meters with 9V battery do not give the accuracy that you need to perform the tests especially at values higher than 10^7. The TR1380 is built with a transformer that converts the

9V charge from the battery to 10V or 100V (which ever value is selected). The meter applies constant charge over the complete voltage range. Accuracy depends on the applied voltage, temperature, and humidity.

TEMPERATURE AND HUMIDITY

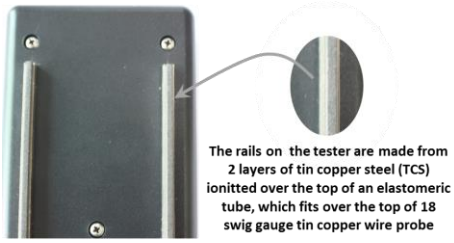
The humidity and temperature affect the electrical properties of the material being tested. The combination of low humidity and low temperature will give the highest electrical resistance results or slowest dissipation time. At high humidity, a thin layer of water is condensed or absorbed on or in the 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 absorbed in the materials they are added to.
At elevated temperature, the mobility of free electrons is increased thereby increasing the materials conductivity. This 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 recognized the environmental effects of the 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 customer receives the material and uses it at a lower humidity or temperature the materials fail to pass the specifications. This can cause rejects and loss of products. Both ESD S4.1 (ESD Protective Work Surface) section 6.2.4 and ESD S7.1 1994 (Resistive Characterization of Materials Floor Materials) section 5.2.4 and 5.3.3 require reporting of temperature and humidity at the same time of testing. ANSI/EOS/ESD S11.11 1993 (Surface Resistance Measurement of Static Dissipative Planar Materials) Section 11.0B states, “report the condition period, relative humidity, and temperature.”

MEASURING WITH INTERNAL ELECTRODES

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



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

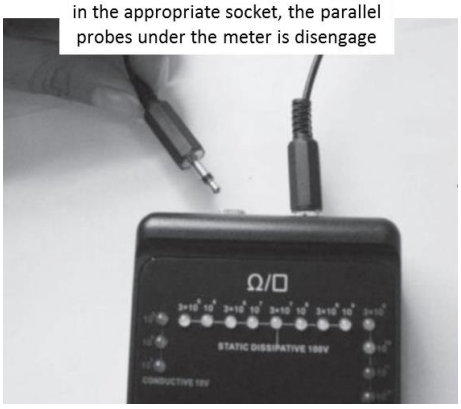
- Prior to testing, make certain that the surfaces to be tested are clean and free of contaminants.
- Allow the meter to equilibrate to the atmospheric condition of the testing area. It may take half hour for the meter to adjust to the new environment condition.
- Place the meter on the desired surface to be tested.
- Press and hold the red button with approximately 5lbs of applied force. The meter will display the surface resistivity in ohms per square.
- When using the built-in electrodes, the meter test values for surface resistivity are in ohms per square (although they are displayed in ohms).
- The test value is indicated by the LED light. A decade will brighten to the according test value. Colors signify the value functions.

MEASURING WITH EXTERNAL ELECTRODES

When the measurement is taken using the 5lbs external probes, the tester will indicate the resistance of the material in ohms. By utilizing these probes to the TR1380's socket, it is possible to measure Point-toPoint (RTT) resistance, Surface-to-Ground (RTG), and volume resistance. Using these probes will allow compliancy with various standards including ANSI/ESDA S4.1 for Work Surface – Resistance Measurements, ANSI/ESDA S7.1 Resistive Characterization of Materials – Floor Materials.

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

When the cables have been plugged in the appropriate socket, the parallel probes under the meter is disengage



RESISTANCE BETWEEN TWO POINTS (RTT)

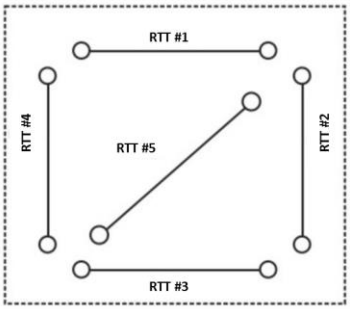
RTT measurements can be used for the evaluation of floors, chairs, carts, work surfaces, and other ESD controlled materials and products. Procedures vary regarding sample preparation, probe preparation, and spacing of 5lbs probes. Select and read the correct test procedure or standard for the desired measurement.

- Connect one end of each of the banana test leads into the sockets of the meter and connect the other end of the test coil cords into the 5lbs probes.
- Place both probes on the material according to test procedures or standard being used.
- Press "TEST" button and the value will be displayed by the LED indicator.
- When performing test, do not touch lead wires or probes. Avoid overlapping of wires to ensure accurate readings.

MEASURING RTT ON DISSIPATIVE FLOORING

Taking routine measurements of tiles with dissipative finish will ensure proper maintenance routines and will indicate any problems that may arise. Good record keeping will insure success when developing and maintaining a maintenance program.

To get an average measurement of a floor, map out a 4' x 4' section and conduct 5 tests (one at a time) within the square. Conduct a test for each side of the square and a final test diagonally through the center as shown in the drawing. Each RTT test utilizes the 5lbs probes placed 3 feet apart (36 inches). Connect the test leads to the meter and attach the 5lbs probe to the end of each lead. Press and hold "TEST" button until a value is displyed.



RESISTANCE TO GROUND (RTG)

RTg measurements can be used for the evaluation of floors, chairs, carts, work surfaces, and other ESD controlled materials and products. Keeping record of test results will providea reference.

MEASURING RTG ON DISSIPATIVE FLOORING

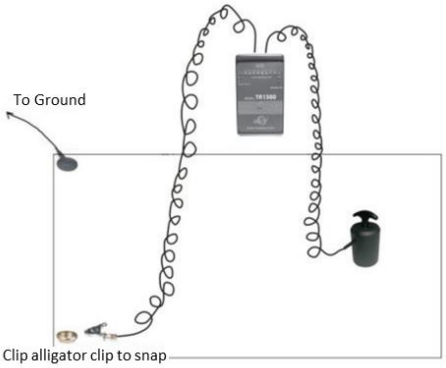
For testing resistance on floors, ESDA S7.1 requires a minimum of 5 RTG per 5000 SqFt.

- Connect the leads for the external electrodes to the meter.
- Attached one lead to a 5lbs probe and place the probe on the floor that is being tested.

- Attach the other lead to an alligator clip and connect to a ground able point (RTGP). If using a ground adapter plug, plug the banana lead into the adapter after the adapter is plugged into the receptacle.

MEASURING RTG ON DISSIPATIVE TABLE MATS

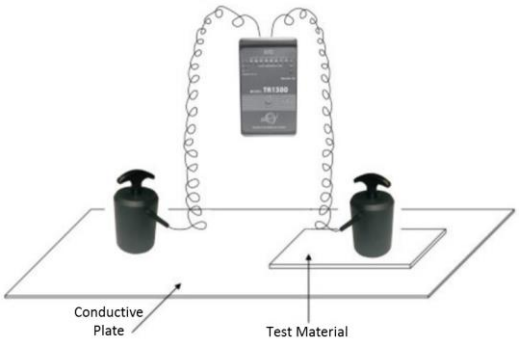
- To test RTG for a work station, used the first cable to connect the meter and a 5lbs probe and put the probe on the work surface. Then used the seccond cable to connect the meter to a groundable point (RTGP).
- To attach cable to RTGP, slip the alligator clip to the banana jack and connect it to the ground snap or connect the banana jack to a common point ground plug.
- Press “TEST” button and the value will be displayed by the LED indicator. When performing test, do not touch lead wires or probe. Avoid overlapping of lead wires to ensure accurate readings.
- Resistance values are in ohms. When recording test values also record the temperature and humidity as environment test reference.



VOLUME RESISTANCE MEASUREMENT

Volume resistance measures the electrical path through the material.

- Use cables to connect the meter and the two 5lbs probes.
- Place sample material on a conductive metal plate (such as stainless steel). Place one of the 5lbs probe on the material so that the material is sandwiched between the probe and the metal plate.
- Place the second 5lbs probe on the conductive metal plate.
- Press “TEST” button and value will be displayed by the LED indicator. Volume resistance is in ohms/cm.



CALIBRATION

Calibration is recommended annually. The TR1380 meter comes with a calibration certificate when ordered. After 1 year, the meter can be sent back to HORB FACTORY for a new calibration certificate (Lab Fee is applied) or it can be sent to a certified calibration lab. The meter also comes with a CE mark approval. A tester resistance can be applied across the parallel bars to verify if the meter is within specification using a resistance decade box. Calibration can be obtained by contacting HORB office or by a certified calibration laboratory.

MEASUREMENT METHOD

- Surface Resistivity: ohms per square
- Point-to-Point (RTT) / Point-to-Ground (RTG) Resistance: ohms
- Accuracy:
    - ± 0.5 Decade in Conductive range
    - ± 0.25 Decade in Dissipative range
- Resistance Decade Box
- Test Leads

The resistance decade box required to have a range of/from >1kohms to 999Mohms or 10^9. Measurements greater than 10^9 are calculated using cad generated techniques, as high resistances greater than 10^9 are difficult to verify with a test voltage of 9 volts.
Connect the test leads from the resistance decade box to the test probes of the checker, set the decade box to the desired resistance (i.e. 10^3 = 1kohms), then press and hold the tester's test button, the 10^3 LED indicator should light. 10k = 10^4 LED indicator should light and so on. To measure the changeover point between decades, increase the resistance of the decade box while pressing the tester's test button. Record the resistance when the next LED indicator lights permanently (this is the changeover resistance).

Example: The first green LED is illuminated 10^3 = 1kohm
At 3 or 4 kohms, 10^4 LED is illuminated, the changeover point is 3 or 4 kohms. 10^4 = 10kohms so between 3 or 4 kohms and 30 of 40 kohms will be the changeover points from 10^4 to 10^5.

Please note that the tester has no internal parts to adjust, so verification of calibration can be schieved by using above process. If verification cannot be achieved, the unit should be returned to the supplier.

Operating manual is only for BFN-TR1380 users. It includes the tester's components, operation and some concerning information, some upgrading property with continuing stability, slightly difference will be allowed with operation and manual.

Suppliers Information