

RESISTANCE/RESISTIVITY PROBE SYSTEM

Model 823-847



Operating Instructions

5/09



electro-tech systems, inc.

www.electrotechsystems.com

3101 Mt. Carmel Avenue, Glenside, PA 19038 • Tel: (215) 887-2196 • Fax: (215) 887-0131

1.0 DESCRIPTION

The Model 823-847 Resistance/Resistivity Probe System incorporates an ETS Series 800 Resistance Probe mounted in a press to provide controlled force to the sample under test to measure surface and/or volume resistance (optional volume resistance metal plate electrode required). A 6" (152mm) sq. acrylic plate is attached to the base of the press, using Velcro to provide the insulated surface specified in ESD STM11.11. The optional 4" (102mm) sq. metal electrode is placed on top of the acrylic plate to provide either the guard specified in ASTM D257 or become the bottom electrode to measure volume resistance.

Resistivity is calculated from the measured resistance using the geometry of the specific electrode configuration. Figure 1.0-1 shows a standard Model 823-S4F probe with an array of spring-loaded flat electrodes, designed to measure the surface resistance of non-flat surfaces. When configured with S4K or S4B pointed electrodes as shown in Figure 1.0-2 and mounted into the press, the Model 823-823-S4K-847 System is capable of measuring the resistance of both the outer layers and an adjacent buried conductive layer of penetrable, multi-layer material such as ESD safe paperboard. Other configurations may include the ETS Model 803B or the Model 850 Resistance Probes. With the appropriate adapters the System can be configured to accommodate other probe designs such as the ETS Series 840 Resistance Probes.



Figure 1.0-1: Model 823 Resistance/Resistivity Probe

ETS Probes are based on the concentric ring electrode configuration specified in ASTM D 257, IEC Publication 93 (1980), ESD Association ESD STM11.11 (Surface Resistance) and STM11.12 (Volume Resistance) and other similar resistance/resistivity standards. The geometric design of the concentric rings normally provides a surface resistivity calculation equal to 10x the measured resistance (R_m). Volume resistivity is calculated using the center electrode geometry (A =area of electrode cm^2) and the thickness (t cm) of the sample

$$\rho_v = a/t R_m \text{ Ohms-cm.}$$

The Model 823 is a modified Model 803B Probe configured with an array of 54 spring-loaded electrodes instead of the specified solid conductive rubber electrodes. The 2.5" outer and 1.2" inner diameter electrodes plus a weight of 5 pounds meet the requirements of ESD STM11.11 and STM11.12, the electronics industry standards for measuring surface and volume resistance of planar materials. For many materials, the

measurements obtained with the Model 823 correlate very closely with measurements taken with the standard Model 803B.

The Model 850 is a 2.5" diameter solid electrode Probe that can be used to measure volume resistance.



Figure 1.0-2: Model 8200-823-S4K Surface Resistance Measuring System

The Model 823 consists of an outer ring of thirty-six (36) and an inner ring of eighteen (18) equally spaced spring-loaded electrodes. The diameter of the standard flat electrode is 0.156" (3.96mm) and the force required to fully compress a single electrode is 5 oz. (140 g). Therefore, the total force required to fully compress all of the electrodes is approximately seventeen (17) pounds (7.6 kg).

The electrodes are installed into individual sockets to facilitate replacement when required. Available electrode configurations for the Model 823 Probe are shown in Figure 1.0-3.

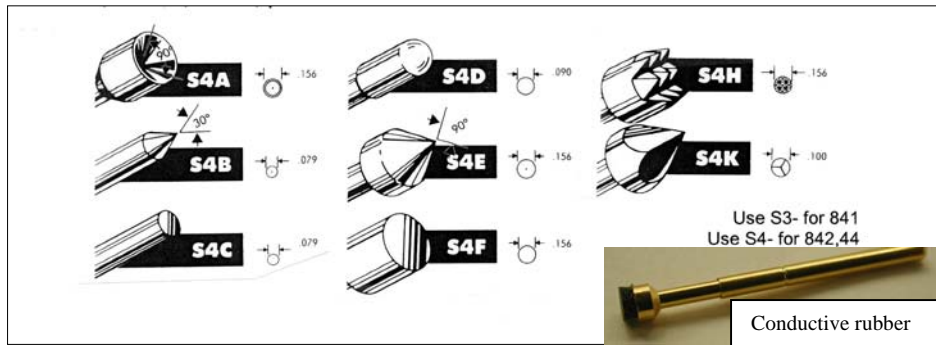


Figure 1.0-3: Available electrode configurations

For those applications where it is desired to penetrate deeper into the test material it is suggested that the S4B pin configuration be used.

2.0 SET UP

The Model 8200 System can be used with any resistance meter that has standard banana cable connections and meet the range and accuracy requirements specified for the measurement. ETS can provide standard or custom adapters to for use with meters having different connectors or cables.

The Model 823 Probe and press are shipped separately. The basic press adjustments are preset at the factory. The press incorporates an aluminum adapter that screws on to the ¼-20 threaded stud located on the top of the Probe. The press is shipped disassembled and requires the user to install the press assembly onto the base and attach the Probe.

To install the press assembly onto the base place it into the hole located at the rear of the base and secure it by tightening the hex nut sufficiently so the assembly does not rotate.

To install the Model 823 Probe onto the press remove the wrench located at the rear of the press assembly under the retaining knob. Place the wrench on the nut shown in Figure 2.0-1 and screw the Probe in until it is tight. Replace the wrench so it does not get misplaced.

If using the ETS Series 840 Probes, shown in Figure 2.0-2 the adapter will incorporate a BNC connector to which the probes will be attached.

Model 841 is a .875" (2.2 cm) diameter concentric ring Probe with a single .156" (.4 cm) diameter center electrode and 7, .100" (.25) diameter outer electrodes on .438" (1.1 cm) centers. Minimum measurement size is a .5" (1.3 cm) diameter surface with a .438" (1.1 cm) deep cavity.



Model 842 is a 1.5" (3.8 cm) diameter concentric ring Probe with an inner ring of 5, .156" (.4 cm) electrodes and an outer ring of 17, .156" diameter outer electrodes on .875" (2.2 cm) centers. Minimum measurement size is 1.25" (3.2 cm) with a .25" (.64 cm) deep cavity.



Model 844 is a .875" (2.2cm) diameter 2-point Probe with 2, .156 (.4 cm) diameter electrodes spaced .25" (.64 cm) between centers. Minimum measurement size is .75" x .188" (1.9 x .48 cm) with a .438 (1.1 cm) cavity." Also available with .125: dia. conductive rubber electrode tips.



Model 845 is a 2.5" (6.4 cm) diameter single point Probe with the standard conductive rubber electrode. Electrode resistance is less than 100 Ohms. It is a 1 lb (2.2 kg) version of the ESD Assoc. S4.1 and NFPA specified 5 lb Probe.



Figure 2.0-2: Series 840 Probes

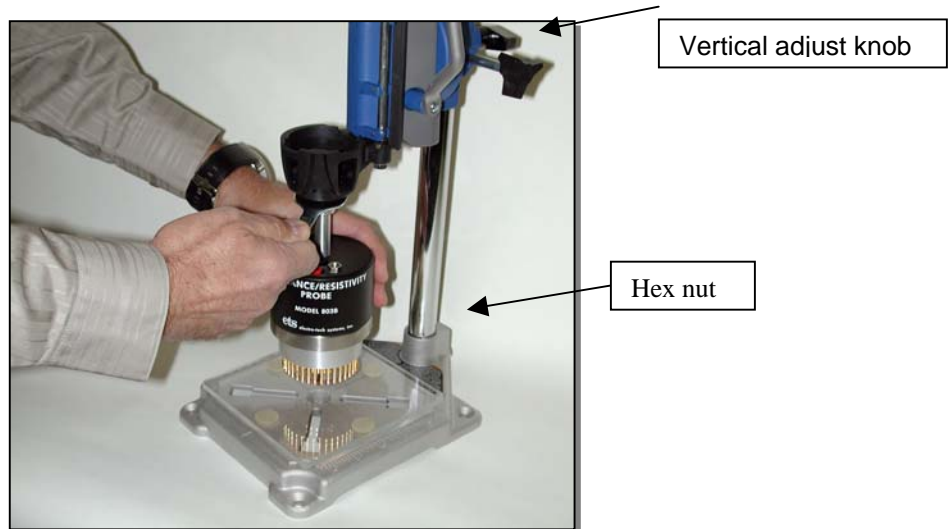


Figure 2.0-1: Installation of Probe onto press assembly

Plug the cables into the respective banana jacks and secure to the mounting slots as shown in Figure 2.0-3. As an example, the cable from the ETS Model 871 is shown snapped into the slots. Cables from other meters may have to be secured differently

With the press handle in the full up position and the assembly at maximum height, the tips of the electrodes are approximately 1" (25mm) above the acrylic test bed. To adjust, loosen the knob holding the press assembly to the vertical shaft and reposition as necessary. This is the basic setting and may be necessary to readjust to compensate for sample thickness.



Figure 2.0-3: Complete test set-up

3.0 OPERATION

3.1 Surface Resistance

For surface resistance measurements the red jack or plug is connected to the outer ring and should be connected to the V-Out or red connector on the meter. The black jack or plug is connected to the inner ring and should be connected to the SENSE or black connector on the meter. The GROUND jack or plug is connected to the meter ground via the green banana plug. If the meter does not have a ground connection, then leave the green banana plug loose. If the V-Out and SENSE connections are not defined then plug the banana plugs into the resistance meter jacks.

To make a surface resistance measurement using the standard Model 823 Probe, simply place the sample on the acrylic surface and apply sufficient pressure to compress the spring-loaded electrodes approximately half way as shown in Figure 3.1-1. When measuring non-planar materials the spring travel of each electrode will compensate for both non-perpendicular placement of the probe and uneven test surfaces. For uneven surfaces apply sufficient additional pressure so that all electrodes are at least partially compressed. Approximately 10 pounds (4.5 kg) of force should be sufficient to partially compress all the pins.

To make a measurement with the Model 823-S4K or S4B Probe different levels of force may be required depending upon the surface being measured. When measuring the outside layers of a planar material 5 lbs of force (weight of the Model 823 Probe) should, in most cases, be sufficient to provide stable measurements. To measure a buried layer it is necessary to apply enough additional force on the Probe to both fully compress the electrodes and to penetrate the outer layer.

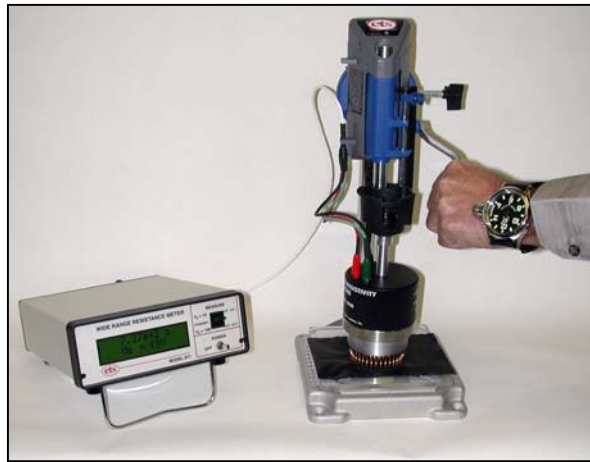


Figure 3.1-1: Applying pressure

When the handle is pulled down all the way the electrode pins should be fully compressed when a test sample is in place and measurement of the buried layer is desired.

NOTE:

The resistance of the buried layer must be lower than the resistance of the outer layer that is being penetrated. Sufficient force will have to be applied to ensure that the pins penetrate the outer layer and make total contact with the buried layer. Be careful not to apply excessive force.

To measure just the outer layer, apply just enough force for the pointed pins to make contact with the surface. Be careful not to apply too much force as this may cause the pins to penetrate the outer layer.

3.2 Volume Resistance

The Models 823-S4F and 850 Probes can also be used to measure volume resistance. The center ring of electrode pins remains connected to the SENSE input of the resistance meter. The V_E output of the resistance meter is connected to the metal plate electrode that is placed on top of the acrylic plate. The resistance is then measured through the material.

The volume resistivity is calculated by multiplying the measured resistance by the surface area of the SENSE electrode divided by the thickness of the material. For these probes, the area used in the calculation is the number of center pins times the area of each pin in centimeters. The area of each pin is 0.123cm^2 . Therefore, the total measuring area used in the calculation for the Model 823 is $18 \times 0.123 = 2.22\text{cm}^2$. For the Models 804 and 850 the area of the center electrodes is 0.85 and 31.9cm^2 respectively.

3.3 Using Model 823 without the Model 847 Press

To use the Model 823 without the Press simply remove the Probe from the press assembly. A spare handle is included. Simply screw it onto the $\frac{1}{4}$ -20 stud protruding from the top of the Probe. Tighten sufficiently so that the handle lines up parallel to the input banana jacks.

3.4 Using Models 803B & 850 Resistance Probes with the Model 847

The Model 847 Press can also be used with existing ETS Model 803B and 850 Probes. For the Model 803B, place the probe on the sample and lower the handle until the aluminum adapter fitting touches the top of the handle as shown in Figure 3.4-1. Then apply additional force necessary to obtain a stable reading. This configuration is very helpful in obtaining stable measurements when the planer test sample is not totally flat such as sample test plaques.

If using the Model 850 Probe it will be necessary to remove the aluminum adapter fitting. It will be necessary to grip the fitting with a pair of pliers and rotating the nut using the supplied wrench

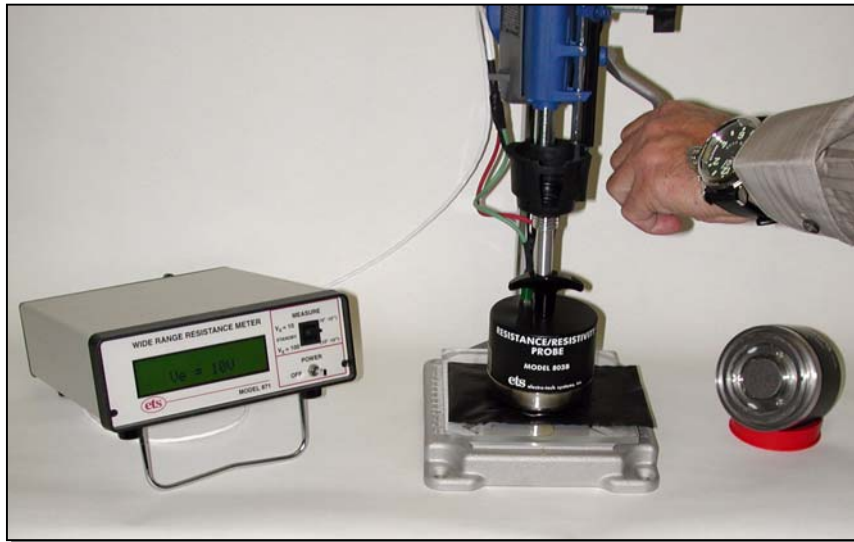


Figure 3.4-1: Using Press with Model 803B Probe

4.0 MAINTENANCE

The standard Model 823 should not require any service if care is exercised in its use. However, if one or more spring-loaded contacts become damaged or if the pointed pins become dull, they can be easily replaced by taking a small needle nose pliers to remove them. Replacement contacts are available from ETS and are installed simply by inserting them into the socket and then pushing them in all the way in. Use a piece of wood or other relatively soft material to insert the pointed pins.

5.0 WARRANTY

Electro-Tech Systems, Inc. warrants its equipment, its accessories and parts of its manufacture to be and remain free from defects in material and workmanship for a period of one (1) year from the date of invoice., ETS will, at it's discretion, either replace or repair without charge, F.O.B. Glenside, similar equipment or a similar part to replace any equipment or part of its manufacture which, within the above stated time, is proved to have been defective at the time it was sold. All equipment claimed defective must be returned properly identified to the Seller (or presented to one of its agents for inspection). This warranty only applies to equipment operated in accordance with Seller's operating instructions.

Seller's warranty with respect to those parts of the equipment that are purchased from other manufacturers shall be subject only to the manufacturer's warranty. The Seller's liability hereunder is expressly limited to repairing or replacing any parts of the equipment manufactured by the manufacturer and found to have been defective. The Seller shall not be liable for damage resulting or claimed to result from any cause whatsoever.

This warranty becomes null and void should the Resistance/Resistivity Kit, or any part thereof, be abused or modified by the customer or if used in any application other than that for which it was intended. This warranty to replace or repair is the only warranty, either expressed or implied or provided by law. It is in lieu of all other warranties and the Seller denies any other promise, guarantee, or warranty with respect to the equipment or accessories and, in particular, as to its or their suitability for the purposes of the buyer or its or their performance, either quantitatively or qualitatively or as to the products which it may produce. The buyer is expected to expressly waive rights to any warranty other than that stated herein.

ETS must be notified before any equipment is returned for repair. ETS will issue an RMA (Return Material Authorization) number for return of said equipment. Equipment should be shipped in the original packaging. If this is not possible, the equipment should be packed in a sufficiently large box of double wall construction with substantial packing around all sides. A description of the problem along with the contact name and telephone number must be included in formal paperwork and enclosed with the instrument. Electro-Tech Systems, Inc. will not assume responsibility for additional cost of repair due to damage Incurred during shipment as a result of poor packaging.