

Super Megohm Meter SM7110

Measuring the Surface Resistance of Industrial Materials

Static electricity buildup on non-metallic materials can lead to hazardous situations, making the resistance testing of surface materials, especially in potentially explosive areas and life-saving environments, essential. Super megohm meters such as the Hioki SM7110 offer a wide resistance range and user-friendly features and functions to assist in this important application.



SM7110
Super Megohm Meter

Static electricity is an imbalance between negative and positive charges in objects. Charge remains until it is able to move away through electric current or discharge through another object. One spectacular example found in nature is lightning. Static electricity has contributed to the invention of products used daily such as supercapacitors, laser printers and paint spray guns. While static is useful, it can also be a nuisance, causing painful shock and damage to delicate electronics. In extreme cases, it can lead to danger such as explosions in hazardous zones.

A hazardous zone is defined as an area where flammable liquids, gases, vapors or combustible dusts exist in sufficient quantities to produce an explosion or fire. A tiny spark may be emitted from the simple act of toggling the power switch. In an ordinary atmosphere, the spark is harmless. However, it can be a concern if flammable vapor is present as it could ignite an explosion. Examples of these locations are chemical factories, oil refineries and marine facilities. Generally, measures are put in place to reduce risk. One of the simplest methods is to minimize the amount of electrical equipment installed in the hazardous area by completely not allowing the equipment in the area, or making the area less hazardous

[1] Definition of EN 60079-0:2012 for Ex Component part of electrical equipment or a module, marked with symbol "U", which is not intended to be used alone and requires additional consideration when incorporated into electrical equipment or systems for use in explosive atmosphere

by process improvements. Equipment that is allowed in the area are required to be intrinsically safe or explosion-proof by limiting energy, whether electrical and thermal, that is available through ignition.

IEC 60079-0 (explosive atmosphere standards) specifies the general requirements for construction, testing and making of electrical equipment and Ex Components [1] intended for use in explosive atmospheres. One of the design considerations is the material selection for equipment casing which is critical. For example, magnesium is prohibited within explosive areas. Common materials such as aluminum must go through metallurgical efforts to allow it to have specific properties. Polymers generally are not used. The materials used have to satisfy anti-static properties which is difficult to achieve. Anti-static agents are also used to treat materials to have a conducting layer, hence reducing the buildup of static electricity.

According to the IEC standards, equipment that contains non-metallic materials as enclosures is required to have its surface resistance tested. The test is conducted on parts of the enclosure or a test piece in accordance to the specified dimensions. The test object has to be



Critical environments such as hospital operating theaters require stringent static control



Fig. 1: SURFACE/VOLUME RESISTANCE MEASUREMENT ELECTRODE SM9001
(With integrated low resistance [500 kΩ]/high resistance [1 TΩ] test surfaces)

conditioned at least 24 hours at 23°C and 50% relative humidity and also tested in the same ambient conditions. A direct 500 V will be applied for 65 seconds between 2 electrodes. The surface resistance will then be measured. The typical value of the surface resistance is between 106 to 1012 Ω. A high surface resistance value indicates that the material is more insulative.

In critical environments such as hospital operating rooms where sensitive electronic equipment is used, stringent static control is required. Furthermore, compressed oxygen is often used in the room. A small discharge has the potential of disturbing the sensitive electronic components resulting in the malfunction of equipment and causing fire hazards due to the compressed oxygen. To address this, electrostatic discharge (ESD) measures are put in place to prevent the build-up for static electricity. Static dissipative ESD flooring is also used. Other preventive measures include humidity control of the operating room and use of static-controlled clothing and footwear. In order to be ESD safe, the flooring material is tested in accordance to IEC61340-2-3 (Part 2-3: Methods of test for determining the resistance and resistivity of solid materials used to avoid electrostatic charge accumulation).

A super megohm meter (also known in industry as an

electrometer or picoammeter) such as the Hioki SM7110 is used to measure the surface resistance of materials. The SM7110 can perform simultaneous measurement of temperature and humidity. This is important when conducting measurement and managing new materials as changes in either can affect the insulation resistance.

The sequence mode feature of the SM7110 enables the user to set the time for “Discharge – Recharge – Measurement – Discharge” flow and perform repeated measurements without the use of a computer. Various electrodes and shield boxes are available to cater to different applications. For example, the SM9001 Electrode (Figure 1) is compliant to IEC61340-2-3 standards, making it suitable for measuring anti-static flooring materials. Measurements can be conducted easily as no cutting of samples is required. This is because the electrode uses a conductive rubber where the size conforms to standards. Hence, only the electrode needs to be placed on the desired point for stable measurements under the load of 2.5 kg.

The SM7110 delivers strong resistance against noise, giving a high stability which is crucial for high resistance measurement. It also provides a management range up to $2 \times 10^{19} \Omega$. With the capability to give reliable readings and the availability of various accessories, the SM7110 is ideal for accomplishing the task of testing the resistance of surface material in order to ensure a safe industrial environment.

Measure without cutting samples



Electrode Shapes Compliant with Standards

