

Medical Equipment Test Applications Using the 7000 Precision LCR Meter

A medical equipment manufacturer knows full well that a patient's health can ultimately depend on their product. This is especially true for implantable devices such as pacemakers or defibrillators. A **pacemaker** is a device for sensing cardiac activity and is called on to stimulate the heart if and when an interval has elapsed without a sensed beat. A **defibrillator** is a device which delivers a high voltage shock to the heart in the event of ventricular fibrillation, a condition in which the heart beats very fast and is unable to pump blood. The **hearing aid**, an electronic device that amplifies sound, also exhibits critical medical equipment characteristics. These are just some of the devices which render themselves to the test applications of the 7000 Series Precision LCR meters.

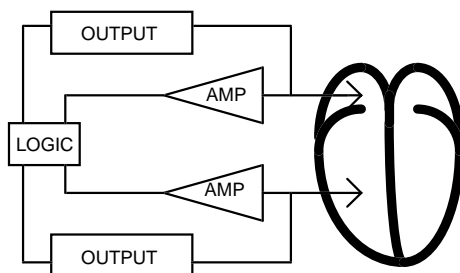


Figure 1: Automatic Pacemaker

Some of these devices can remain inactive for long periods of time and become activated only during life threatening situations. Therefore, for the components used by the manufacturers of medical devices, it's important that emphasis is placed on **miniaturization, reliability and traceability**.



Figure 2: QuadTech 7000 Series Precision LCR Meter

Incorporation of Surface Mount Technology

The escalating use of surface mount technology (SMT) is creating special challenges among most and especially small, medical equipment manufacturers. The advantages of SMT in this industry too overwhelming to ignore include: *reduced size, enhanced performance, increased reliability and lower cost*, just to name a few.

A major drawback to SMT technology is the inability of small manufacturers to deal with the assembly and test of small surface mount devices (SMD). For all but the largest companies, the high start-up costs associated with SMT may exclude the possibility of adding elaborate in-house capabilities. The alternative for many manufacturers is shop for subcontractors to help with their circuit board requirements. As an extension of a company's manufacturing process a subcontractor for medical device manufacturers must comply with certain FDA regulations. Moving the assembly from manufacturer to subcontractor does not remove the burden of assembly and test, it only shifts the burden.

In an SMT assembly operation, automated testing is commonplace and a cost-effective way of dealing with product in volume. But, even here component misalignment can occur during the soldering process potentially causing opens and shorts. Also, because many chip components lack identifying marks it is easy for two reels of components to be interchanged. Because of the need for special handling and potential damage to SMT assemblies, central repair stations are often utilized to deal with identified defective product. The bottom line is that there are several opportunities in the overall assembly and test process to improve product and **reduce costs through component testing**.

Connection and Handling of Small Unleaded Devices

One of the difficulties being faced with small components used in medical devices is a means of making reliable contact during test. An accessory available for use with the 7000 Series of meters is a set of chip component tweezers. The tweezers plug directly onto the 7000 and are intended for handling small components as well as for making the electrical connection to them. A surface mount component fixture is also available.

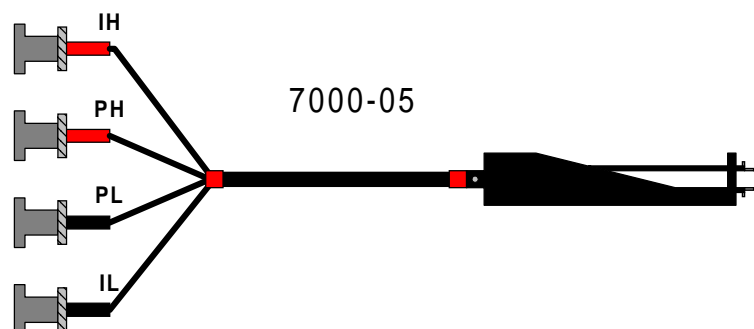


Figure 3: QuadTech's Chip Component Tweezers

Typical 7000 Measurement Applications

- ❑ **Hybrid Assembly (by Medical Device Manufacturer or Hybrid Assembly House)**
 - ❑ Sample test of devices at incoming inspection - Instills confidence that quality parts are being moved into the manufacturing process.
 - ❑ Spot-check of devices on reels on in bins before assembly - Prevents components from being accidentally interchanged and installed in the wrong locations.
 - ❑ Repair Station - Analyze failed product to locate and replace defective components. Ability to program low-level AC signal allows in-circuit testing without excitation of other components.
 - ❑ Collect Data - Monitor trends in test results and archive for future reference.
- ❑ **Component Manufacturers for Medical Equipment**
 - ❑ Evaluation of New Components - Analyze the functionality of new components, for example: using the 7000 sweep function to determine resonant frequency of hearing aid coils.
 - ❑ Production Test - Make sure good components are consistently delivered to the end user.
 - ❑ Setup Storage - Test conditions are easily stored and later recalled so devices can be tested the same way each time.
- ❑ **Battery Manufacturers for Medical Devices**
 - ❑ Impedance Measurements of Batteries - Internal impedance and AC resistance measurements to ensure battery quality and longevity.
- ❑ **Most Useful Instrument Features**
 - ❑ Swept Parameter Measurements - For component evaluation over a selectable frequency range. Tabular or graphical format on the front panel LCD display.
 - ❑ Menu Programming - Easy to change test conditions and easy to use by different operators, no training needed.
 - ❑ Test Data Collection - Test results can be stored automatically on the built-in floppy drive or transferred to computer for further analysis and traceability.
 - ❑ Setup Storage - Test conditions can be easily stored and later recalled so devices can be tested the same way every time.

More QuadTech Instruments for Testing Medical Devices

Guardian 6000 Series of Electrical Safety Analyzers

The hipot test (dielectric withstand) is used to stress insulation to ensure that it can withstand voltages above its normal use. Today's test requirements commonly specify that an **insulation resistance test precede and follow any hipot test**. This is intended to make sure that the hipot test does not degrade the material under test. The cables, components and circuits used in variety of medical devices often require this type of test in a production or R&D environment. The G6100 unit measures **true** line leakage current, a stringent requirement in medical device testing.



Figure 4: Guardian 6000 Series Electrical Safety Analyzer

1865 Megohmmeter/IR Tester

Equally important with medical devices are insulation resistance tests. The transducers, sensors, cables, circuits boards, capacitors and other components often require testing to meet rigid standards or to locate material defects.



Figure 5: 1865 Megohmmeter

For complete product specifications on the 7000 Series Precision LCR meters or any of QuadTech's products, visit us at <http://www.quadtech.com/resources/dataindex.html>.

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