Application Note

Instructions for Use of LD-3 Cell with 7600 Plus LCR Meter

The LD-3 Rigid Dielectric Cell is designed for testing rigid flat materials. Material up to 8cm (3-1/8 inches) with a maximum thickness of 1.1 cm (7/16 inch) can be used in the dielectric cell. The dielectric cell is made up of two electrodes. One electrode is fixed with a grounded guard ring and the other is movable via a micrometer. The micrometer allows precise measurement of electrode spacing. The grounded guard ring reduces fringe effects to improve measurements.

The three terminal electrical connections are made via GR-874 connection on the fixed electrode side (optional BNC to GR-874 adapter is available) and banana connection, Pomona Electronics 4684, on the movable electrode side. A 1 Meter BNC to BNC-T cable set 1689-9602 is available for connection to the cell.

Parts required for connection are shown below in Table 1.

Part Number	Description
LD-02	BNC Tees
1689-9602	1 Meter BNC Cable Set
LD-05	BNC to Banana Adapter
LD-08	GR874 Adapter

Table 1 Accessories for LC-3T

Figure 1 shows the correct connection of the 7600 Plus with a LD-3 Dielectric Cell. It is important to make sure that the shields from all BNC cables are connected at the cell especially for high frequency operation. This is accomplished on the movable electrode side by use of a shielded banana adapter and GR-874 to BNC Adapter on the fixed side.

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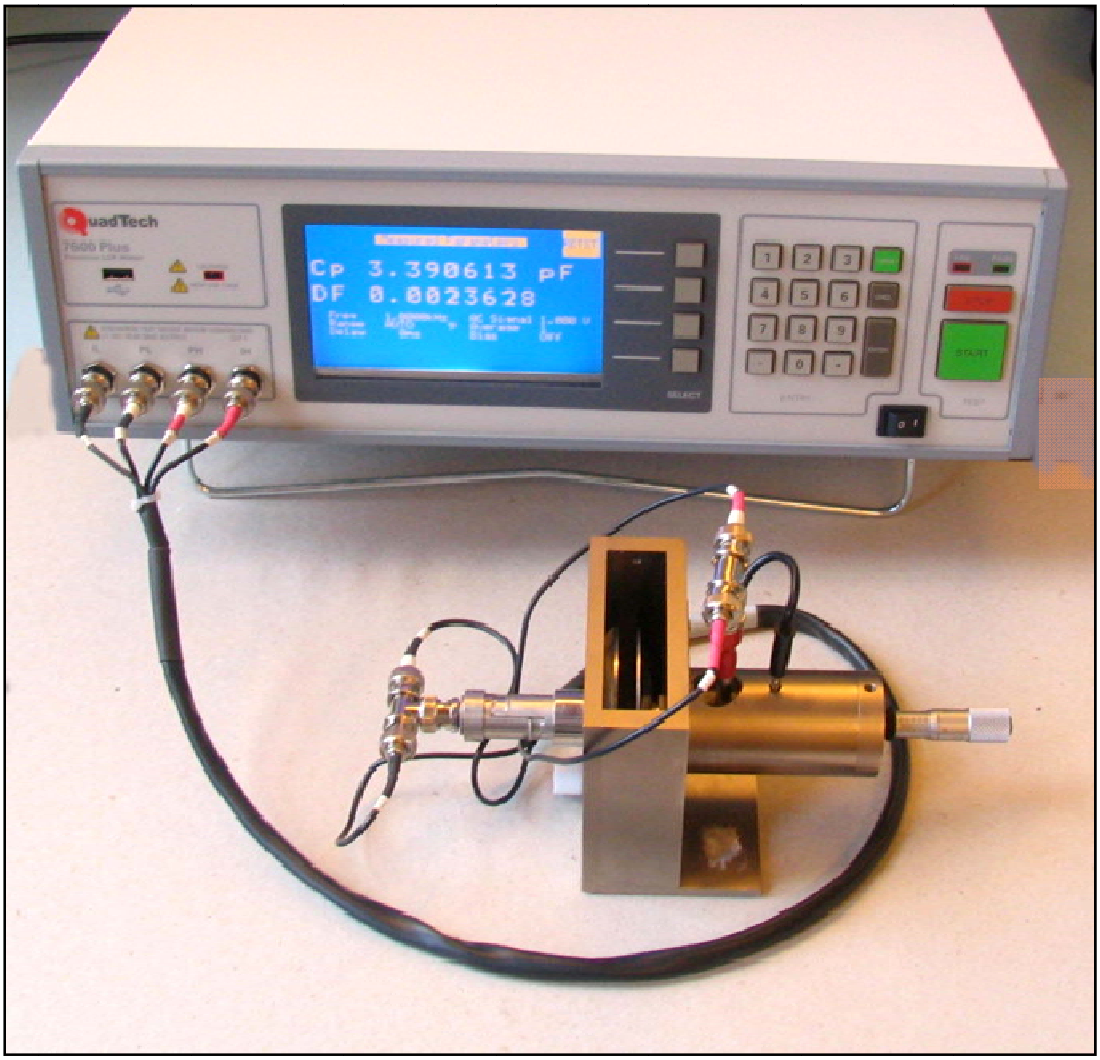

Figure 1 IET Labs 7600 Plus Precision LCR Meter Connected to an LD-3 Rigid Dielectric Cell

Connect the 7000-01 BNC to BNC cable lead set to the pair of BNC tees on the test fixture. The BNC tees are then connected via an 874 adapter to the specific LD3 cell. Make sure that the PH/IH connectors go to one BNC tee and the PL/IL connectors go to the other BNC tee. Prior to making measurements, perform an open and short compensation on your test fixture.

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Open & Short Compensation

It is very important to perform an OPEN and SHORT circuit zero with the instrument before making measurement. Figure 2 illustrates the preferred method to accomplish this. The cables should be placed the same distance apart during an open as when they are attached to the test fixture for measurement. Note that the connection to the movable electrode should not be made during open compensation.

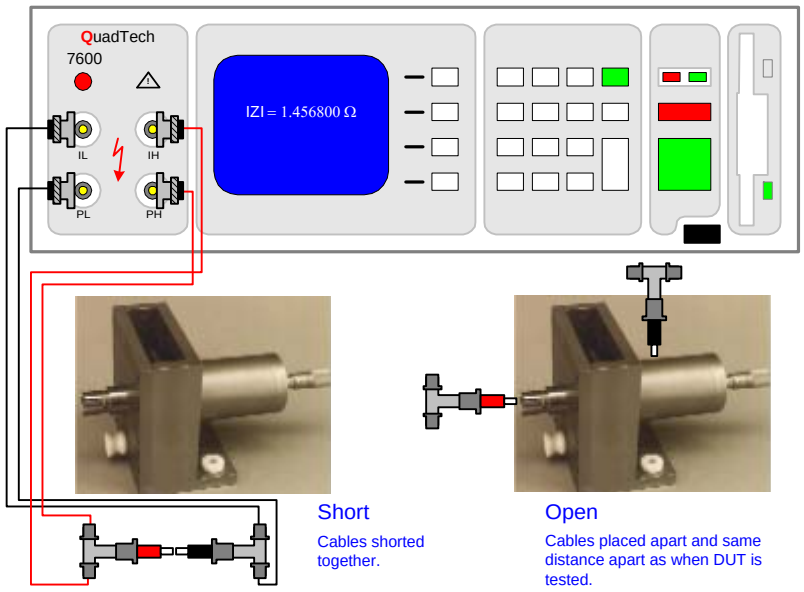

Figure 2: Cable Lead Position for Open & Short Compensation

First the sample is inserted in the cell and the electrodes closed with the micrometer until they just touch the sample. Do not force the electrodes against the sample. Turn the micrometer with a light finger touch. Record the electrometer setting, or zero the micrometer, as h_m. Set the instrument to measure *parallel* capacitance and measure the capacitance and dissipation factor of the sample as C_{xm} and D_{xm}.

Open the electrodes and remove the sample. Then close the electrodes to the same micrometer reading h_m, or back to zero if micrometer was zeroed. Measure C (parallel) and D of empty cell as C_a and D_a.

Calculate K_x and D_x of the sample from:

$K_x = (1.0005)\ C_{xm}/C_a$ and $D_x = D_{xm} - D_a$

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The factor 1.0005 in the formula for K_X corrects for the dielectric constant of (dry) air. Subtracting D_a from D_{xm} removes any constant phase error in the instrument. For even better D accuracy, adjust the electrode spacing until the measured capacitance is approximately equal to C_{xm} and then measure D_a.

Note that for air it is possible to get negative numbers for Df when below 0.0001 due to errors in the LCR meter and open/short compensation. As the accuracy of the 7600 for Df is 0.0005 this is well within the accuracy of the meter.

A Teflon sample TS-100 is available for checking measurements on the LD-3T. The TS-100 has a dielectric constant value of 2.0 and dissipation factor of less than 0.0002 over a broad frequency range from 1kHz to 1MHz.

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