

Application Note

Charged Capacitor Protection Circuit for the IET LCR Meters

All IET's LCR meters and Digibridges are protected from damage from charged capacitors. However, no matter how much internal protection is provided, there will always be some combination of voltage and energy that can damage the front end of any bridge or LCR Meter. Protection can be improved by adding components in the test connections. Although these components should be selected so as to minimize the effect on measurement accuracy.

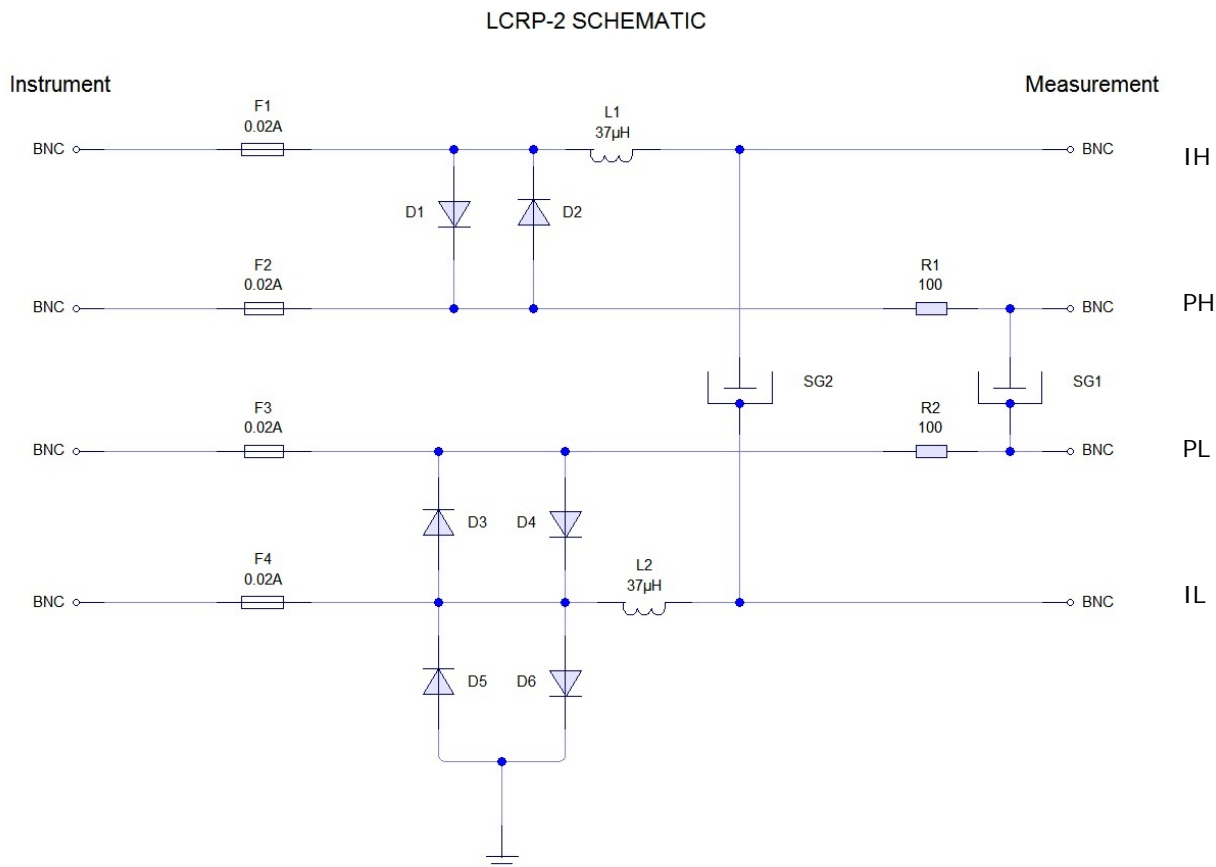


Figure 1: Digibridge Protection Circuit

A suggested external circuit is shown in Figure 1. Here, all diodes are small power rectifiers capable of carrying several amperes peak current but having reasonable capacitance at low signal levels (less than 100pF). Being very conservative, the power rating of the resistors should be E^2/R , where E is the possible peak voltage in volts. This may result in very large power ratings that may not be practical. Wire wound resistors usually can tolerate a large short overload and for them a rating to the possible peak energy in joules $CV^2/2$ will usually be sufficient.

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Suggested Values of Components

| | | |
|-----------|---------------|---|
| Resistor: | R1, R2 | 100Ω wire wound 2W |
| Inductor: | L1, L | 37μH 190mA |
| Diode: | D1 to D6 | IN4005 rectifier |
| Fuse: | F1 to F4 | 20mA fast blow (Note may need to be increased depending upon LCR meter) |
| SG: | Spark Gap 20V | |

Trouble Shooting the Component Values

These added components can cause errors under certain conditions and may have to be modified in value. The values given are conservative so they may be somewhat reduced. The rectifiers, D1 and D6 put stray capacitance to ground which can cause an error when making low capacitance measurements at higher frequencies. If this is the case, these diodes can be omitted from the circuit and the resistor R2 should be increased in value by a factor of four.

Resistors R1 and R2 generally can be of the suggested values, but they could cause D or Q errors at high frequencies.

Note that the circuit has been tested under a variety of conditions. All values given are conservative and will provide substantially improved protection, but we cannot guarantee that this protection will be good enough in all cases. In any event, both for safety of the operator and protection of the LCR meter, capacitors should always be discharged after a high voltage test.



Figure 27600 Plus and 1693 Digibridge

For complete product specifications on IET's line of LCR meters, visit us at <http://www.ietlabs.com/lcr-meter.html>. IET also have a variety of applications notes and historical information from GenRad, QuadTech and ESI. Please see <http://www.ietlabs.com/notes/lcr-meter>