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## Application Note

### High Voltage DC Bias on the 1659, 1689, 1692 or 1693 Digibridge

The bias applied to a GenRad Digibridge instrument is limited by two factors. The first limiting factor is what voltage is considered safe (60V) by national and international standards. Secondly, the voltage rating (100V) of the blocking capacitors in the potential input circuits ( $P_H$  and  $P_L$ ) also puts a limit on the DC bias. To increase the voltage capability of the input circuits high voltage capacitors with additional protection circuitry should be placed in series with the existing capacitors to limit the voltage on them.

The time constants of the new input circuit affect the phase (D or G) accuracy of the Digibridge instrument and in some cases also affect the R, L or C accuracy on lossy components. A complete calibration with the 1689-9604 Calibration Kit is necessary if the effective values are changed. Moreover, the phase angle ( $1/\omega RC$ ) of the high bias circuit should be small enough at the test frequency that a reasonable change in R or C of the blocking capacitor with temperature or time won't cause any significant error. This generally means that lower frequency measurements will have poorer accuracy because high-value high-voltage capacitors are impractical to use in most cases. The D or G error caused by a change in R or C is shown in Equation 1.

$$\text{Equation 1: } \phi = \frac{1}{\omega RC} \left( \frac{\Delta R}{R} + \frac{\Delta C}{C} \right)$$

Where:

$$\omega = 2\pi f$$

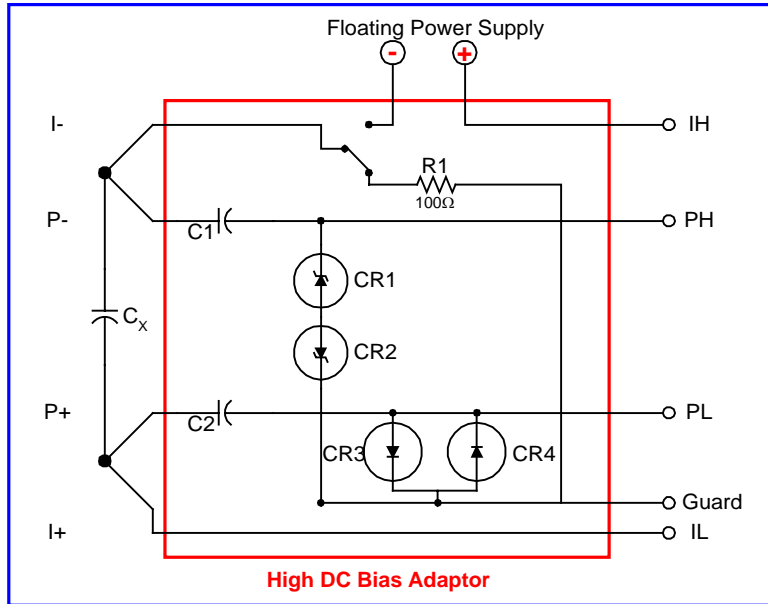
$$R = 5.62M\Omega$$

$$C = C_{1\text{NEW BLOCKING CAPACITOR}} + C_{2\text{EXISTING INTERNAL BLOCKING CAPACITOR}}$$

$$C = \frac{0.27\mu F \times C1}{0.27\mu F + C1}$$

If the new capacitor C is much less than 0.27uF, then a new calibration should be made at the test frequency to be used.

As illustrated in Figure 1, capacitors are added to both the  $P_H$  and the  $P_L$  terminals. If only high impedance (low value capacitors) devices are to be measured, the added capacitor in the  $P_L$  connection is not necessary. The rectifiers in the  $P_L$  circuit should be added in any case.



**Figure 1: High Bias Adaptor Circuit**

- C1 = approximately 0.03uF, with a voltage rating higher than the bias voltage.
- C2 = C1 (however, not needed for high impedance measurements.)
- CR1, CR2 = 10V Zener Diodes
- CR3, CR4 = Rectifiers (IN4001)
- R1 = 100Ω (Discharge Resistor)

**WARNING**

Always set all power sources to zero (0) before making or breaking connections. Set Charge/Discharge switch to Discharge at all times except when making the measurement. Use redundant safety measures to reduce the shock hazard to the operator and avoid damage to the instrument.

For complete product specifications on the Digibridge Line of LCR meters or any of IET's products, visit us at <http://www.ietlabs.com/digibridges.html> Do you have an application specific testing need? Call us at 1800-899-8436 or email engineering at sales@ietlabs.com and we'll work with you on a custom solution. Put IET to the test because we're committed to solving your testing requirements.