

Increasing Test Voltage on the GenRad Digibridge (Model 1659, 1689, 1692 and 1693)

The internal test voltage supplied by a Digibridge is 1.275 V RMS or less, the exact level available is model dependent. This application note describes several methods to increase the test voltage applied to a device under test. In cases where the digibridge is not capable of supplying the desired test voltage, an external amplifier or synchronized oscillator is used to boost the test voltage to the desired level for the device under test. This is then followed by a voltage divider network to reduce the voltage to a level within the operating range of the bridge. The maximum voltage that may be applied is determined by the total amount of current flowing into the I- lead of the bridge and the range in which the bridge is set on (refer to procedure section 3). Figure 1 represents the technique employed where moderate accuracy is required.

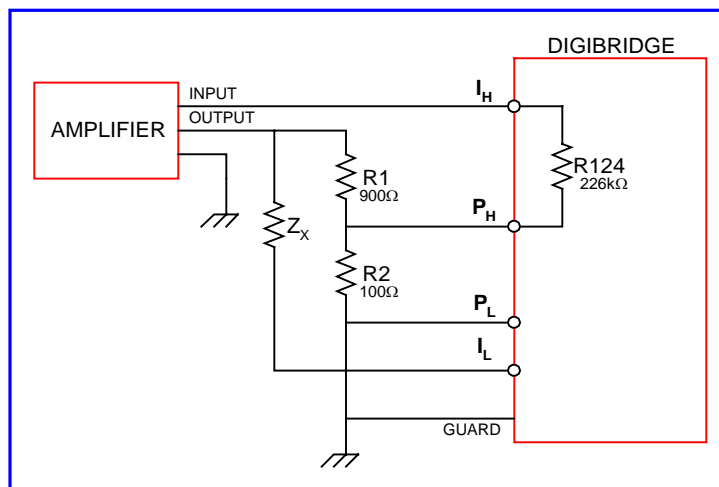


Figure 1: External Amplifier

SETUP PROCEDURE

1. Build the setup shown in Figure 1.
2. The accuracy of the measurement will depend on the accuracy of the divider ratio (R_1/R_2). The resistors should be padded to yield a 10:1 voltage ratio or a 9:1 resistance ratio. A 10:1 ratio is used to make the results easier to read, however other ratios may be used. When padding R_1/R_2 be sure to include the loading effect of R_{124} as this affects the P_H voltage.

Setup Continued

When operating over a wide frequency range it may also be necessary to compensate the divider for capacitive/inductive effects due to the loading effect of the bridge or of the type of resistors used in the divider. The best solution would be a transformer type divider. This would give an accurate ratio and would be almost un-effected by R124 or by loading (see Figure 2).

3. The maximum allowable test voltage is determined by Equation 1.

$$\text{Equation 1: } V = (v/r) (z)$$

V = maximum test voltage

v = bridge test voltage (.005 to 1.275 V model / setting dependent)

r = range resistance (range 4 = 25Ω , range 3 = 375Ω , range 2 = $6k\Omega$, range 1 = $95k\Omega$)

z = unknown impedance

NOTE

To apply the maximum amount of current, select the highest internal bridge test voltage.

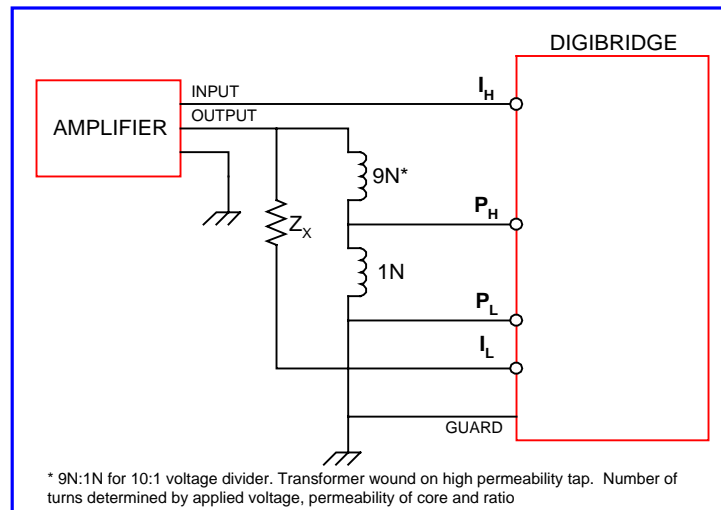


Figure 2: Voltage Divider

The maximum current that can be supplied by the amplifier should be limited so that I (Eq.2) is not exceeded. This must be done to protect the bridge from damaging currents if the device under test fails or if an improper connection is made.

$$\text{Equation 2: } I = (v/r)$$

Measurement Procedure

1. Hold range on correct range, DO NOT ALLOW BRIDGE TO AUTORANGE.
2. Set bridge test voltage, set amplifier output to ZERO amplitude
3. Set the frequency and all other desired measurement parameters.
4. Install device under test.
5. Slowly adjust the amplifier for the desired amplitude,
DO NOT PROCEED IF BRIDGE DISPLAY INDICATES AN OVERLOAD CONDITION.
6. Make measurement and correct the reading per Table 1.

Table 1: RLC & DQ Corrections

Measurement Parameter	RLC Correction	DQ Correction
R/Q	$\times 10$ or Divider Ratio	None Required
L/Q	$\times 10$ or Divider Ratio	None Required
C/D	$\div 10$ or Divider Ratio	None Required

7. Reduce amplifier output to zero and remove device under test.

Measurement Error Correction

The bridge error can be found by first measuring the device under test without the external circuitry, and then comparing this to the measurement with the external circuitry in place at the same test voltage level. The bridge error once found can be used to correct the final reading. To improve the accuracy further, a Kelvin connection can be made at the low side, but this should not be necessary unless you need extreme precision. If it is necessary, use the circuit illustrated in Figure 3, note that this circuit requires an additional divider to be constructed and padded. The reference designation for this divider is R1a and R2a.

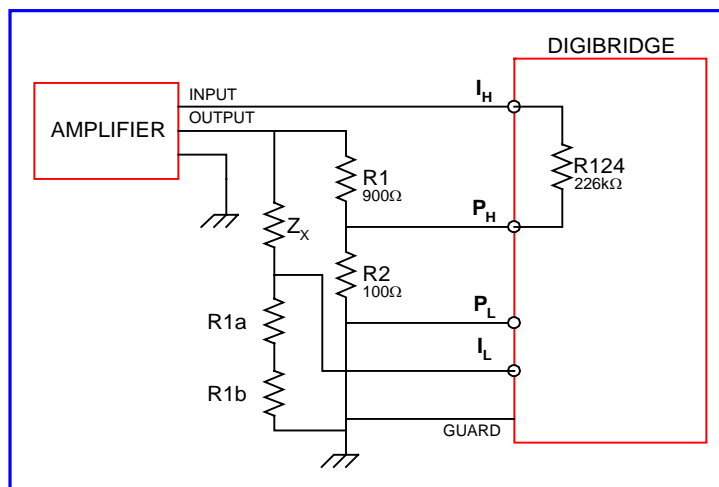


Figure 3: Bridge Error Correction Circuit

Conclusion

So it is possible with external circuitry to increase the test voltage on the GenRad Model 1659, 1689, 1692 & 1693 Digibridge instruments. Refer to the data sheet of the particular Digibridge model for the instrument internal test voltage and other specifications.

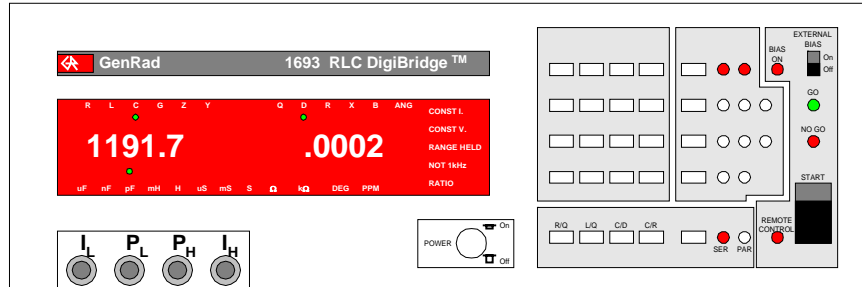


Figure 4: GenRad 1693 Digibridge

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.