



CAPACITANCE AND INDUCTANCE MEASUREMENTS FROM 20 TO 100 KC WITH THE TYPE 1650-A IMPEDANCE BRIDGE

One of General Radio's most popular instruments is the TYPE 1650-A Impedance Bridge. The TYPE 1650-A is essentially five bridges built into a single, neat, portable package, with its own generator and detector for dc and 1-kc ac measurements of capacitance, resistance, and inductance. An external generator can be connected to the bridge for measurements at frequencies other than 1 kc. The specifications for the TYPE 1650-A claim 1% accuracy up to 20 kc for inductance and capacitance measurements, and up to 5 kc for resistance measurements.

Because the bridge circuits were carefully designed to minimize stray capacitances and inductances, it was reasonable to assume that the bridge would perform well at frequencies above the nominal 20-kc limit. For several reasons, such higher-frequency performance was not incorporated in the instrument specifications. Among these reasons were a desire to keep the basic

accuracy statements as simple as possible, a realization that higher-frequency test procedures in the calibration laboratory would add to the cost of the instrument, and the belief that the great majority of users would be interested in 1-kc measurements only.

Since the introduction of the TYPE 1650-A, however, the experience of many of our customers and our own further tests indicate that this bridge can be used up to 100 kc with only a slight sacrifice in accuracy. Moreover, there is a growing interest in C and L measurements in the 100-kc region. The following detailed account of the accuracy of the TYPE 1650-A is given, not as an addition to bridge specifications, but as a guide for those wondering what accuracy they might reasonably expect at frequencies from 20 to 100 kc.

Figure 1 is a modification of Figure 14 in the instruction manual for the bridge. Up to 20 kc, the numbered lines show the limits of D and Q within which the basic 1% C and L accuracy is possible. Above 20 kc, the lines set forth the DQ ranges over which the accuracies given in this article apply. The various numbered lines are:

1. the end of the DQ rheostat range (no C or L error),
2. the first division on LOW D or HIGH Q scales (no C or L error),
3. the limit imposed by the D of the standard capacitor (no C or L error),
4. the 20-cps low-frequency limit imposed by meter response (no C or L error),
5. the error in C or L caused by capacitance across the series combination of the standard capacitor and the DQ rheostat,
6. the error in C_s or L_p caused by inductance in the DQ rheostat,
7. the end of the LOW D and HIGH Q scales (no error),
8. the limit of 1% C and L accuracy, even with *Orthonull*, because of sliding null,
9. another limit caused by inductance in the DQ rheostat. Above this line there may be an additional C_p and L_s error of +1%.

(Limit number 5 was the nominal 20-kc limit given in the instrument specifications.)

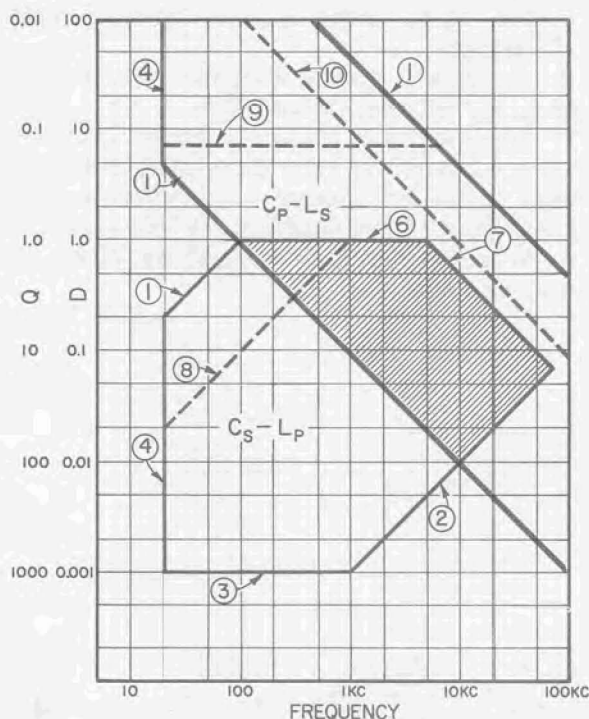


Figure 1. C and L accuracy ranges as a function of D and Q frequency.

