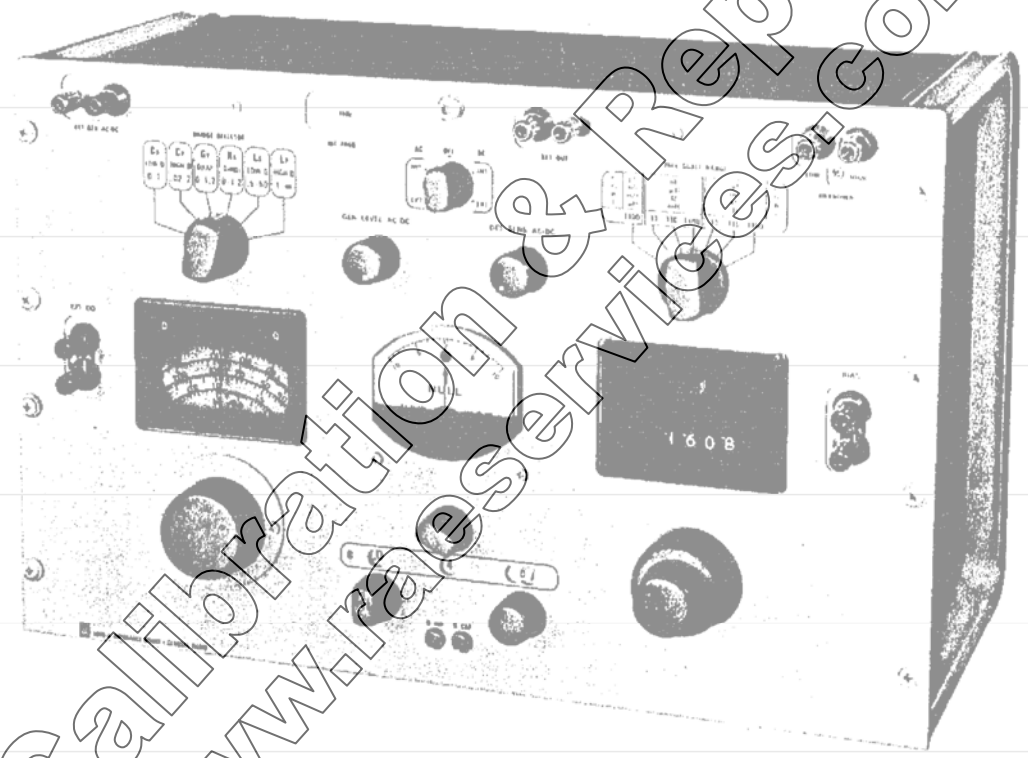
Type 1608-A IMPEDANCE BRIDGE

- measures C, R, L, and G with digital readout
- ±0.05% accuracy
- 20 Hz to 20 kHz (external generator)
- internal 1-kHz oscillator and detector
- measures impedance of any phase-angle
- accurate D and Q readings



This wide-range bridge will measure precision components to an accuracy of 0.05% — capacitance, inductance, and ac as well as dc resistance and conductance. An almost error-free readout and rapid-balance adjustments allow accurate and fast laboratory or production tests. Six bridge circuits cover all possible phase angles so that any network can be measured, even such "black boxes" as filters, transducers, and equalizers.

In ac resistance and conductance measurements, a Q adjustment for precise balancing gives phase information useful in predicting high-frequency behavior. This capability is also useful for measuring lossy reactances, such as rf chokes, without a sliding null. The high phase precision of ±0.0005 radian makes D or Q measurements meaningful on low-loss reactances, which must often have tight D or Q tolerances for use in precision networks.

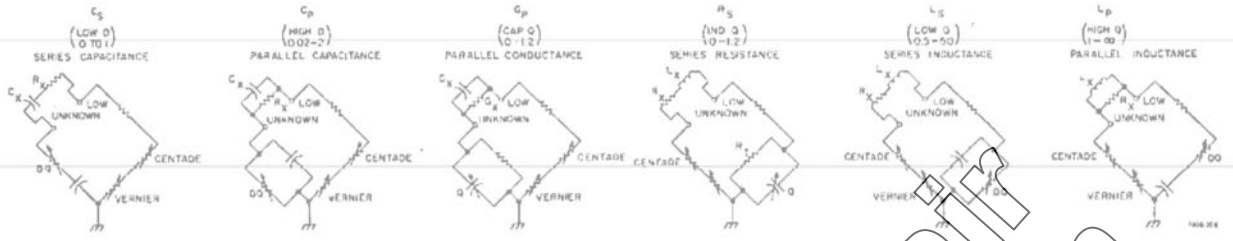
It will measure resistors at EIA-specified dc voltages, three-terminal capacitors and small capacitors remotely located, voltage-biased capacitors or current-biased inductors and resistors. Almost any impedance is measurable over the audio-frequency range.

The ability to measure small capacitances by a three-terminal connection makes possible the measurement of the capacitance between components, wires, or mounting structures. Long, shielded cables can be used without significantly affecting the accuracy of the measurement.

For production testing of components, a test jig, Type 1650-P1, is available.

DESCRIPTION

This self-contained bridge system includes six bridges, along with suitable ac and dc sources and detectors. The



Elementary schematics of the capacitance, conductance, resistance, and reactance bridges.

bridge elements are precision units. The wire-wound resistors are similar to those used in GR decade resistance boxes; the standard capacitor is a combination silver-mica and stabilized-polystyrene unit, with a low temperature coefficient.

The readout system is digital for C, R, L, and G, as well as for the Q of resistors. D and Q for capacitors and inductors are read from a dial with the correct scale illuminated. Decimal points and units are indicated automatically, and there are no multiplying factors for any quantity at 1 kHz or dc.

The C-R-L-G readout has both coarse and fine adjustments controlled by concentric knobs.

The 1-kHz frequency-selective networks for the internal oscillator and tuned detector are on a plug-in module, which can be easily replaced with modules available for other internal test frequencies. Provision is made for use with an external oscillator and detector. Three dc supplies are included to obtain maximum sensitivity over a wide range of resistance.

specifications

RANGES

Capacitance: 0.05 pF to 1100 μF in seven ranges, series or parallel.

Inductance: 0.05 μH to 1100 H in seven ranges, series or parallel.

Resistance: (series) 0.05 milliohm to 1.1 megohms ac or dc.

Conductance: (parallel) 0.05 nanomho to 1.1 mhos, ac or dc (20,000 megohms to 0.9 ohm).

D: (of series capacitance) — 0.0005 to 1 at 1 kHz.
(of parallel capacitance) — 0.002 to 2 at 1 kHz.

Q: (of series inductance) — 0.5 to 50 at 1 kHz.
(of parallel inductance) — 1 to 2000 at 1 kHz.
(of series resistance) — 0.0005 to 1.2 inductive at 1 kHz.
(of parallel conductance) — 0.0005 to 1.2 capacitive at 1 kHz.

Frequency: 1 kHz with internal oscillator module supplied; 20 Hz to 20 kHz with external oscillator.

ACCURACY

C, G, R, L

At 1 kHz: ±0.05% ±0.005% of full scale except on lowest R and L ranges and highest C and G ranges, where it is ±0.2% ±0.005% of full scale.

Additional % error terms for high frequency and large phase angle:

C and L: $(\pm 0.001 f_{kHz}^2 \pm 0.1 D f_{kHz} \pm 0.5 D^2)$% of measured value.

R and G: $(\pm 0.002 f_{kHz}^2 \pm 0.000001 f_{kHz}^4 \pm 0.1 Q)$% of measured value.

Residual Terminal Impedance: R ≃ 0.001 Ω, L ≃ 0.15 μH, C ≃ 0.25 pF.

DC Resistance and Conductance: Same as for 1-kHz measurement, except that accuracy is limited by sensitivity at the range extremes. Balances to 0.1% are possible from 1 ohm to 1 megohm with the internal supply and detector.

D $\left(\text{or } \frac{1}{Q}\right)$ **of C or L:** ±0.0005 ±5% at 1 kHz or lower.
$\pm 0.0005 f_{kHz}$ ±5% above 1 kHz.

Q of R or G: $\pm 0.0005 f_{kHz}$ ±2%.

GENERAL

Generator: Internal, 1 kHz ±1% module normally supplied; plug-in modules for other frequencies available on special order. Level control provided. With external generator, frequency range of bridge is 20 Hz to 20 kHz. Type 1310-B or the 1210-C Oscillator recommended if external generator required. Internal dc supply 3.5, 35, and 350 V, adjustable; power limited to ⅓W or less.

Detector: Internal or external; ac; can be used either flat or selective at frequency of plug-in module (normally 1 kHz); other frequencies available; second-harmonic rejection of 25 dB. Sensitivity control provided. Type 1232-A Tuned Amplifier and Null Detector recommended when external generator is used.

Dc Bias: Capacitors can be biased to 500 V from external source; bias current can be applied to inductors up to 40 mA.

Power Required: 105 to 125 or 210 to 250 V, 50 to 60 Hz; 10 W.

Accessories Supplied: Power cord, spare indicator lamps.

Accessories Available: 1650-P1 Test Jig.

Mounting: Rack-Bench Cabinet.

Dimensions (width x height x depth): Bench model, 19 x 12½ x 11½ in. (485 x 320 x 295 mm); rack model, 19 x 12¼ x 10 in. (485 x 315 x 255 mm).

Weight: Net, 36½ lb (17 kg); shipping, 54 lb (24.5 kg).

Catalog Number	Description
	1608-A Impedance Bridge
1608-9801	Bench Model, 115 V
1608-9802	Bench Model, 230 V
1608-9811	Rack Model, 115 V
1608-9812	Rack Model, 230 V