

GR 1656 Impedance Bridge



**NEW**

An inexpensive 0.1% CRL bridge with fast-balance lever switches, designated the GR 1656 Impedance Bridge.

The basic limitations on the accuracy of our 1% impedance bridge (GR 1650-B)<sup>1</sup> are the resolution and accuracy of the main rheostat and its dial. If a decade resistor were used, it would be relatively easy to tighten the tolerances on the internal standards to get a more accurate bridge. However, decade resistors (with the exception of the new GR 1436) have a row of knobs or concentric knobs which, while satisfactory for occasional adjustment, are tiresome for those who must continually balance bridges. Our most accurate universal bridge (the GR Type 1608,<sup>2</sup> now 0.05%) solves this problem by use of a special 100-position switch, so that only two concentric knobs are needed. This assembly, however, is comparatively expensive. Its use, plus installation of many other measurement and convenience features, results in a relatively expensive general-purpose instrument.

We think we've found the answer to the problem of designing a quickly balanced, high-resolution bridge. Our precision capacitance bridge (GR Type 1615)<sup>3</sup> uses a lever switch with digital readout which we, and our customers, have found very convenient. While this switch design is too expensive for a low-price instrument, we have, with the help of the Oak Manufacturing Company, developed a new lever switch for general-purpose use. This switch is the

<sup>1</sup>Havener, C. D., "The Universal Impedance Bridge - New Face, New Features," *GR Experimenter*, May 1968.

<sup>2</sup>Hall, H. P., "A Precise, General-Purpose Impedance Bridge," *GR Experimenter*, March 1962.

<sup>3</sup>Hersh, J. F., "Accuracy, Precision, and Convenience for Capacitance Measurements," *GR Experimenter*, August/September 1962.

main readout control in the new GR 1656. With it, we have substantially reduced the time required to make a balance and greatly simplified the work required to set several digits to zero - with one sweep of the hand!

The improved readout resolution of the GR 1656, in addition to allowing better accuracy in readings, offers two other advantages. The smallest  $C$ ,  $R$ ,  $G$  or  $L$  that can be detected is extended by a factor of ten to 0.1 pF, 100  $\mu\Omega$ , 100 p $\bar{U}$  (or pico-siemens) and 0.1  $\mu\text{H}$ , respectively, and standards of even-decade values can be compared to 0.01%.

Another important improvement is the sensitive field-effect-transistor chopper-type dc detector that provides good sensitivity over all ranges of the  $R$  and  $G$  bridges, from  $10^{-4}$  to  $10^{10} \Omega$ . This wide range, with its basic 0.1% accuracy, makes the GR 1656 a good dc resistance bridge as well as a good ac bridge.

In other respects the new instrument is very similar to the popular GR

1650-B, having in common its six bridges (series and parallel  $C$  and  $L$ , plus  $R$  and  $G$ ), its battery operation, its internal signal source and detector, and its high  $D$  and  $Q$  accuracy. The 0.001- $D$  accuracy is particularly important in a 0.1% bridge for, in many circuits, such a difference in  $D$  is just as important as a 0.1% difference in the value of the parameter.

The obvious use of the new bridge is in component measurement, particularly those components of tight tolerance which have come into wide use during the past few years. If the detector sensitivity is adjusted to cause a given meter deflection for a given percent unbalance, it may be used for rapid go/no-go measurements. It can be used also for a variety of measurements on networks and electrical devices.

Development of the GR 1656 was by H. P. Hall, who also contributed the foregoing material.

Complete specifications for the items below are in Catalog U.

Catalog Number	Description	Price in USA
	<b>1413 Precision Decade Capacitor</b>	
1413-9700	Bench Model	\$930.00
1413-9701	Rack Model	950.00
0480-9703	Rack-Adaptor Set	20.00
	<b>Coaxial Resistance Standard</b>	
1442-9702	1442-C, 0.5 $\Omega$	80.00
1442-9703	1442-D, 1.0 $\Omega$	80.00
1442-9704	1442-E, 2.0 $\Omega$	80.00
	<b>1656 Impedance Bridge</b>	
1656-9701	Portable Model	700.00
1656-9702	Rack Model	735.00
1650-9601	1650-P1 Test Jig	35.00
	<b>1654 Impedance Comparator</b>	
1654-9700	Bench Model	1300.00
1654-9701	Rack Model	1250.00
	<b>1654-Z2 Sorting System</b>	
1654-9702	(with decade capacitor)	2230.00

Prices subject to quantity discount.