the GENERAL RADIO Experimenter

Since 1915 — Manufacturers of Electronic Apparatus for Science and Industry

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Photo Courtesy General Telephone Company of California

In This Issue

THE GENERAL RADIO EXPERIMENTER

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COVER

In the measurement of crosstalk between communication channels, the use of random noise to excite the interfering channel results in a considerable saving of time over the point by point methods formerly used. Since random noise has constant energy per cycle, the interchannel crosstalk can be evaluated by a single measurement. The photograph shows Frederick D. Dahl, Transmission Engineering Department, General Telephone Company of California, using the General Radio Type 1390-A Random Noise Generator and the Type 1206-B Unit Amplifier in this type of measurement.

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REPAIR SERVICES

WEST COAST:	Western Instrument Co., 826 North Victory Boulevard, Burbank, Calif. *Telephone—VIctoria 9-3013*
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3302, 3304, 3306,
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MARCH 18-21
NEW YORK COLISEUM
RADIO ENGINEERING SHOW
IRE NATIONAL CONVENTION

You'll see two General Radio exhibits at the 1957 Radio Engineering Shows at the New York Coliseum:

(1) A DISPLAY OF NEW AND UP-TO-DATE TEST INSTRUMENTS ON THE THIRD FLOOR;

(2) A DISPLAY OF PRECISION PARTS AND COMPONENTS ON THE SECOND FLOOR.

PRECISION INSTRUMENTS

Booths 3302—3304—3306

Many of the instruments that you have read about in the *Experimenter* during the past year will be on display.

Impedance Comparator — Compares two impedances to 0.01% — For production testing, it can be used for inspection and acceptance tests, on inductors, capacitors and resistors; for the inspection and adjustment of ganged units for proper tracking; for materials inspection, such as silvered-mica sheets; for acceptance tests on balanced windings, and for selecting resistors to minimum phase-shift specifications. In the laboratory, it speeds up such measurements as that of drift in resistors, and of temperature and humidity characteristics; for these latter, built-in guard circuits provide for measurements in conditioning chambers, and output circuits for recorder operation are provided. The precision and speed of this comparator bring laboratory accuracy to production line testing; conversely, they bring production-test speed to laboratory measurements.

Type 1605-A Impedance Comparator

Type 1391-A Pulse, Sweep, and Time-Delay Generator

Electrometer—Basically an ultra-high-resistance millivoltmeter, this instrument measures voltages as low as 0.5 millivolt, currents as low as 5×10^{-15} amperes, and resistances up to 5×10^{14} ohms. Direct-reading, with high sensitivity and excellent stability, it has met immediate acceptance in engineering, science, and industry. Such features as guard terminal, recorder output, careful shielding make it adaptable to a wide variety of measurements.

Impact Noise Analyzer—This unusual instrument was specifically designed to evaluate the impact-type noises encountered in all types of modern industry; noises produced by such operations as stamping, punching, and riveting. It simplifies the measurement of such noises, which formerly required an extensive array of equipment. Also in this display are other instruments, comprising a complete sound-measuring system.

Pulse, Sweep, and Time-Delay Generator—This generator produces push-pull pulses, saw-tooth sweep voltages, and time delays to meet the requirements of laboratories engaged in time-domain measurements. High accuracy, excellent stability, and complete flexibility are combined in this generator with very wide ranges of operation.

Type 1230-A D-C Amplifier and Electrometer

Type 1603-A Z-Y Bridge

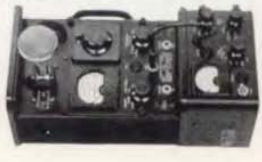
Universal Audio-Frequency Bridge—The Z-Y Bridge possesses the unusual property that it can be balanced for any impedance connected to its terminals, from short to open circuit, real or imaginary, positive or negative. Covering the frequency range from 20 cycles to 20 kilocycles, it has, in addition to the routine measurement of R, L, and C, many applications in determining the characteristics of magnetic circuits, transformers, electro-acoustic transducers, and electrolytes.

Unit Instruments—Oscillator, Time/Frequency Calibrator, Pulse Generator, Pulse Amplifier.

This group, representative of recent additions to GR's line of widely used Unit Instruments, offers the electronics engineer outstanding performance and quality at minimum price. Small in size, versatile in application, and reliable in operation, they are practically indispensable laboratory items.

Military Electronics—A group of General Radio instruments designed especially for military use will be shown, including a fuel-gauge calibrator, an r-f bridge, and a voltage regulator.

Type 1213-A Time/Frequency Calibrator



Sound-Level Meter with Impact-Noise Analyzer

PRECISION COMPONENTS

Booth 2319

This exhibit on the second floor gives us a long-awaited opportunity to present to you our line of high-quality, precision instrument parts and accessories. Although designed orginally for use in General Radio instruments, these parts are widely used by other manufacturers both in their own products and in special-purpose laboratory instruments built for use in their own plants. Each item is built to definite and carefully controlled electrical and mechanical specifications to meet the exacting requirements of instrument makers.

In this group of items are decade assemblies of R, L, and C; variable air capacitors; transformers; knobs; dials; dial drives; coaxial connectors; plugs and jacks; patch cords; potentiometers; and binding posts. Also included is an extensive display of the world-famous Variac continuously variable autotransformer.




THERE IS NO SUBSTITUTE FOR QUALITY

General Radio products are designed for long life and reliable operation. A background of 41 years of experience in the design and manufacture of electronic instruments and components is represented in each GR product.

A cordial welcome awaits you at both General Radio Exhibits. Come in and talk over your measurement problems.

THREE-WIRE POWER CORD

A three-wire power cord, TYPE CAP-15, is now available from stock. Like the popular TYPE CAP-35 two-wire cord, the new three-wire model is 7 feet long with male connector at one end, female at the other. Both connectors are molded integrally with the rubber-covered cord and conform to the American Standard for Grounding-Type Attachment Plug Caps and Receptacles C73a-1953.

All three conductors are No. 18 AWG; electrical ratings are 7 amperes 125 volts.

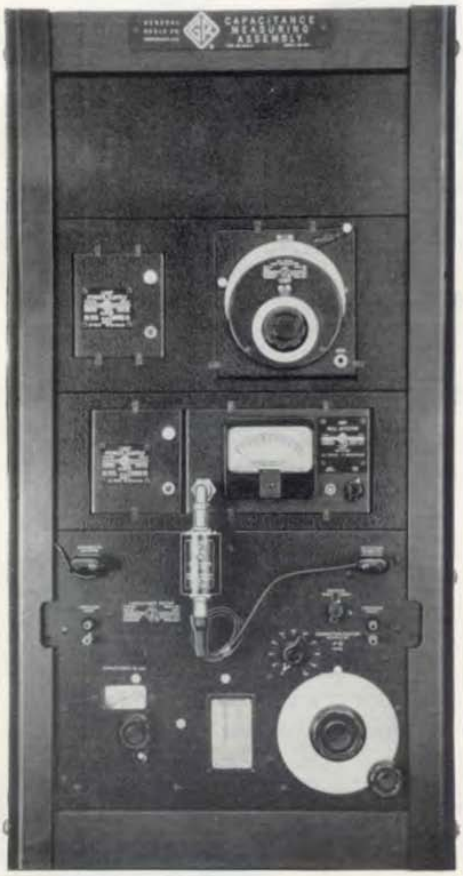
Type		*Code Word*	*Price*
CAP-15	**3-Wire Power Cord**	TRICO	**$2.25**

CAPACITANCE BRIDGE ASSEMBLY FOR MEASUREMENTS AT ONE MEGACYCLE

Both commercial and military specifications for capacitors of 1000 $\mu\mu$f and less call for measurement of capacitance and dissipation factor at a frequency of one megacycle. The TYPE 716-CS1 Capacitance Bridge [1] has been designed specifically for these measurements. In conjunction with a suitable sample holder, it can be used equally well for 2-terminal measurements of dielectric constant and dissipation factor of dielectrics.

This bridge is now offered in a complete assembly, Type 1610-AK, including generator and detector, and consisting of the following items:

TYPE 716-CS1 Capacitance Bridge
TYPE 1211-B Unit Oscillator
TYPE 1212-A Unit Null Detector
TYPE 1212-P2 One-Megacycle Filter
Two TYPE 1203-A Unit Power Supplies
TYPE 480-P5UC1 and TYPE 480-P4U3 Adaptor Panels
Relay Rack Cabinet
Connection Cables and Power Cord



Although calibrated for a frequency of one megacycle, the bridge can be used at any frequency between 0.1 and 5 megacycles (see *Accuracy*, below). Accessories are available which enhance the usefulness and convenience of the assembly for specific measurements. For the measurement of small capacitors, particularly disc-ceramic types, the TYPE 1691-A Capacitor Test Fixture [2] is recommended. With the TYPE 1690-A Dielectric Sample Holder,[3] specimens of dielectric materials in the form of standard ASTM 2-inch discs can be measured.

[1] Ivan G. Easton, "A One-Megacycle Schering Bridge," *General Radio Experimenter*, 26, 9; February, 1952; pp. 4–7.
[2] "A Convenient Test Fixture for Small Capacitors," *General Radio Experimenter*, 30, 5; October, 1955; pp. 4–6.
[3] "A Sample Holder for Solid Dielectric Materials," *General Radio Experimenter*, 26, 3; August, 1951; pp. 1–5.

SPECIFICATIONS

Capacitance Range: Direct Method, 100 to 1150 $\mu\mu$f; Substitution Method, 0.1 to 1050 $\mu\mu$f.

Dissipation Factor Range: Direct Method, 0.00002 to 0.56; Substitution Method, 0.00002 $\times \frac{C'}{C_x}$ to 0.56 $\times \frac{C'}{C_x}$, where C' is the capacitance setting of the internal standard capacitor and C_x the capacitance of the unknown.

Frequency Range: Calibrated for one megacycle, the bridge operates satisfactorily at frequencies between 0.1 and 5 megacycles.

Accuracy (at one megacycle):
Direct Reading: Capacitance, $\pm 0.1\% \pm 1$ $\mu\mu$f when the dissipation factor of the unknown is less than 0.01; Dissipation Factor, ± 0.0005

or ± 2% of dial reading, whichever is larger, for values of D below 0.1.

Substitution Method: Capacitance, ± 0.2% or ± 2 μμf, whichever is larger; Dissipation Factor, ± 0.00005 or ± 2% of the change in D observed, when the change is less than 0.06.

When the dissipation factor of the unknown exceeds the limits given above, additional errors occur in both capacitance and dissipation-factor readings. Correction formulae are supplied, by means of which the accuracy given above can be maintained.

A correction chart for the precision capacitor is supplied, giving scale corrections to 0.1 μμf at multiples of 100 μμf. By using these data substitution measurements can be made to ± 0.1% or ± 0.8 μμf, whichever is the larger. For capacitance less than 25 μμf, the error will decrease linearly to ± 0.1 μμf. It is also possible to obtain, at an extra charge, a worm-correction calibration with which substitution measurements can be made to an accuracy of 0.1% or ± 0.2 μμf, whichever is the larger.

This same accuracy can be obtained at other frequencies between 0.1 Mc and 3 Mc, if corrections are made for the effects of residual impedance, and if adequate filtering is provided for the null detector. The filter furnished with the assembly operates at 1 Mc only.

Accessories Available: For measurements on unguarded dielectric specimens, the TYPE 1690-A Dielectric Sample Holder is recommended. For measurements of small capacitors having parallel, side-by-side leads, the TYPE 1691-A Capacitor Test Fixture is recommended.

Dimensions: (Height) 43 × (width) 22½ × (depth) 20 inches, over-all.

Net Weight: 150 pounds, approximately.

Type		*Code Word*	*Price*
1610-AK	Capacitance Measuring Assembly	SIREN	$1290.00
	Worm-Correction Calibration for Internal Precision Capacitor	WORMY	50.00
1690-A	Dielectric Sample Holder	LOYAL	435.00
1691-A	Capacitor Test Fixture	EDICT	22.50

CORRECTIONS—December Issue

In the table on page 9 of our December issue, the General Radio Slotted Line should be listed as TYPE 874-LBA. The older TYPE 874-LB is not adaptable to motor drive.

The first entry in the table, TYPE 1302-A Oscillator, indicates that the TYPE 1750-A Sweep Drive can be used with a graphic recorder or an X-Y plotter. The drive is designed primarily for use in CRO displays and its minimum speed is (0.5 sweep per second) somewhat high for recorder work. It is possible to operate the drive manually, however, to obtain an X-Y plot.

The TYPE 1750-A Sweep Drive can also be used with the TYPES 1001-A, 805-C, and 1021-A Standard-Signal Generators and the TYPE 1330-A Bridge Oscillator, although the sweep range is restricted to that covered by 300° of the slow-motion drive.

NEW GR OFFICE AT LOS ALTOS FOR SAN FRANCISCO BAY AREA

The General Radio Company announces the opening of a sales and engineering office at

1182 Los Altos Avenue
Los Altos, California
Telephone: WHitecliff 8-8233

This office will enable us to give better service to our customers in the rapidly growing industrial San Francisco Bay area.

Manager of the new office will be James G. Hussey, formerly of the staff of the General Radio Los Angeles Office.

James G. Hussey

ARMSTRONG MEDAL TO MELVILLE EASTHAM

Melville Eastham (right) receives medal from Frank Gunther, Vice President of Radio Engineering Laboratories

The Armstrong Medal of the Radio Club of America was awarded to Melville Eastham at the Club's 47th Anniversary Banquet held at the Columbia University Club, New York, on December 14, 1956. The award was made "in recognition of his outstanding contributions to the art of precision measurements in the radio and electronic field.

"For fifty years a design engineer, Mr. Eastham's effort made available to many workers in the electronic art reliable test equipment of a standardized nature which previously did not exist or had to be specially assembled as a laboratory setup.

"Beside his many technical contributions, Mr. Eastham was a leader in recognizing the importance of good employee relations, and assisted and encouraged his associates in continuing their technical education and in making contributions to technical literature. His thorough, practical approach to design problems and his enlightened management practices should be an inspiration to younger men."

Melville Eastham founded the General Radio Company in 1915 and was its president from 1915 to 1944. Upon his retirement in 1950, the Directors of the Company voted him the title of Honorary President.

A Member of the Radio Club, Mr. Eastham is also a Fellow of the Institute of Radio Engineers and of the American Association for the Advancement of Science. He is a Member of the American Institute of Electrical Engineers, the Acoustical Society of America, the American Physical Society, and the American Meteorological Society.

The Armstrong Medal

General Radio Company