the GENERAL RADIO Experimenter

Since 1915 — Manufacturers of Electronic Apparatus for Science and Industry

VOLUME 32 Nos. 15 & 16 AUGUST-SEPTEMBER, 1958

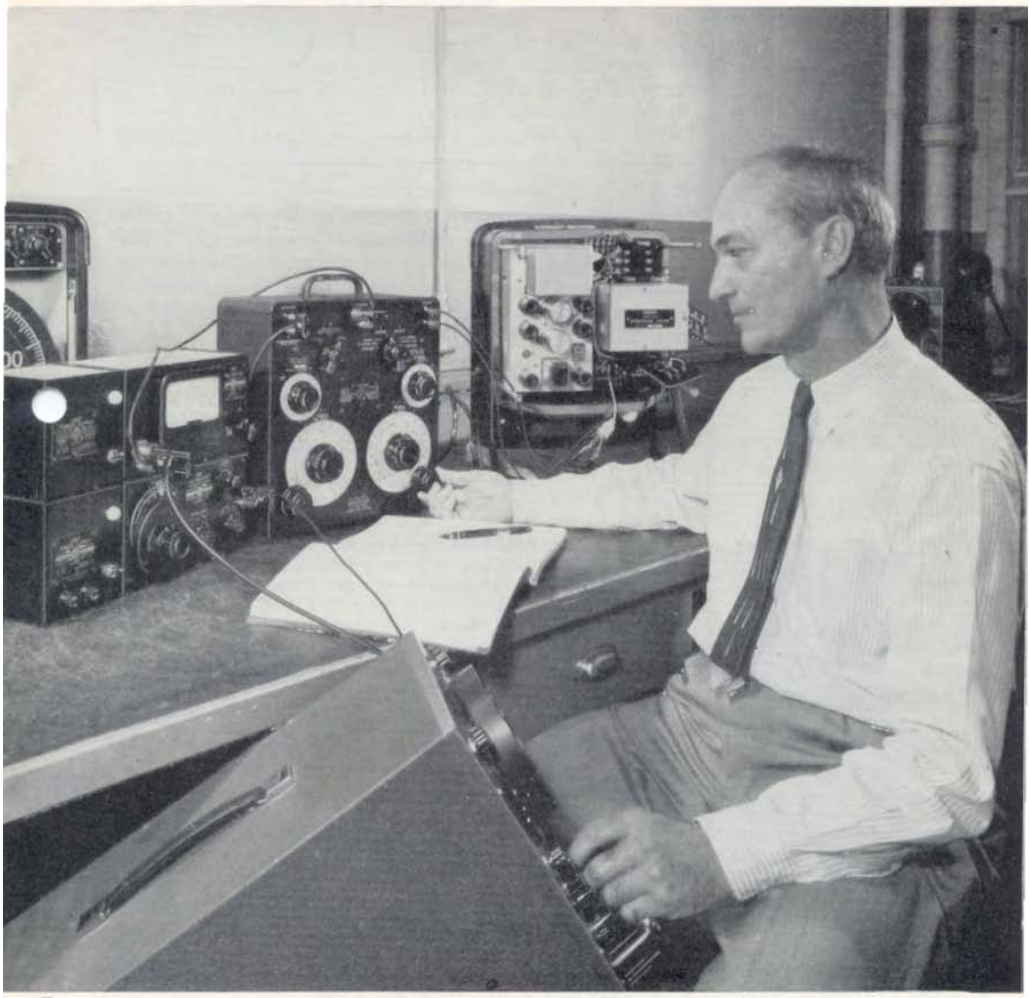

Photo courtesy The Foxboro Company

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the GENERAL RADIO Experimenter

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The General Radio EXPERIMENTER is mailed without charge each month to engineers, scientists, technicians, and others interested in electronic techniques in measurement. When sending requests for subscriptions and address-change notices, please supply the following information: name, company address, type of business company is engaged in, and title or position of individual.

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COVER

The Type 1603-A Z-Y Bridge will balance for any impedance, real or imaginary, positive or negative, over the entire audio-frequency range. This photograph shows the bridge in use in the Electronic Design Department of The Foxboro Company, makers of *Dynalog* self-balancing recorders, to measure impedance characteristics of a "Dynapoise Drive," self-balancing recorder element.

THE TYPE W20 — A NEW 20-AMPERE VARIAC® AUTOTRANSFORMER

Figure 1. Uncased, 115-volt model, Type W20.

Variacs, unlike automobiles, are *not* restyled each year to meet the whims, real or fancied, of hypothetical purchasers. Their design is the result of long-term, frequently reviewed planning, the purpose of which is to supply the best possible continuously adjustable autotransformers for today's dollar. Barring radical improvements in economically justifiable core material or a competitively priced superconductor, Variacs closely approach the optimum design criteria.

The design features of W-model Variacs, already proved in the W2, W5, and W50 sizes, have now been incorporated in the new TYPE W20 series. These features, which were discussed in a previous article,[1] make the W-model Variac® a more rugged, more adaptable, and more durable device than its predecessors.

You will find wrought metallic parts substituted for castings in the interest of improved mechanical properties. Heat transfer between coil and base, brush and radiator has been improved. Ball-bearing models for motor-drive and other demanding applications are stock items. Totally enclosed and portable models are included in the new line.

All W20 models have *Duratrak* contact surface, developed by General Radio, which minimizes brush-track deterioration under adverse environmental or load conditions and assures long and trouble-free life.

Basic Uncased Models — Types W20, W20H

The two uncased models, TYPE W20 for 115-volt service and TYPE W20H for 230-volt service, are normally used for back-of-panel mounting on switchboards or built into electrical equipment, as shown in Figure 1, but, when the shaft

Figure 2. Type W20M, with case.

[1] "The TYPE W5 Variac® — A New and Better Variable Autotransformer," *General Radio Experimenter*, 30, 7, December, 1955.

is extended on the winding side rather than the base plate side and the dial attached to the knob, they can also be used on a bench or table. This arrangement, however, affords no protection against electric shock or against accidental damage to the Variac from abrasion.

Cased Models — Types W20M, W20MH

These models, each consisting of a basic TYPE W20 or W20H Variac® mounted in an aluminum case, are finished in attractive gray enamel. For conduit or armored cable, cases are provided with four knockouts, two on the end and one on each side. There is ample space inside the case for wiring. The front half of the case is easily removable for access to terminals, mounting holes, and brush. These models are easy to install — on wall, on bench, or behind panel.

Figure 3. Portable model, Type W20MT3, with case, overload breaker, 3-wire output receptacle, and heavy-duty cord and plug.

Portable Models — Types W20MT3, W20HMT3

The portable models include, in addition to the case, a 3-wire output receptacle, an on-off switch and an overload circuit breaker, which trips on either excessive current or excessively-high prolonged operating temperature. Heavy-duty, 3-wire cord and plug are permanently attached.

GENERAL SPECIFICATIONS

Frequency: Specifications are for 50- to 60-cycle service. Variacs can be operated at rated current and voltage at line frequencies from 50 to 400 cycles.

Rated Current can be drawn from the Variac at any dial position. When the overvoltage connection is used, the load should not take more than rated current at maximum output voltage.

Maximum Current can be drawn at the input line voltage when the line-voltage connection is used. At any lower setting the Variac will control a constant-impedance load drawing no more than the maximum current at line voltage.

Output Voltage is the range of voltage available at the output terminals with rated input voltage.

Dials: Portable models (MT3, HMT3) are wired for overvoltage connections and have corresponding dial scales but can be supplied on special order with line-voltage connections and dials.

Dial plates for all other models are reversible, with line-voltage scale on one face and overvoltage on the other. Angle of rotation is approximately 320 degrees.

Line-Voltage or Overvoltage Output Connections: "Line-Voltage Connection" refers to the connection for output voltage range of zero to line voltage. "Overvoltage Connection" refers to the connection for output voltage range of zero to 17% above line voltage.

KVA Rating is the maximum current multiplied by normal input line voltage. A Variac can handle, at any lower setting, a constant-impedance load that draws at rated input voltage a current no greater than the maximum current.

Temperature Rise: Variac ratings are based on operation at ordinary room temperatures, with an average temperature rise of not more than 50°C. When ambient temperature exceeds

50°C., kva ratings should be decreased as shown in the chart, Figure 6.

No-Load Loss: 27 watts at 60 cycles with rated input voltage. Losses are guaranteed not to exceed this value.

Driving Torque is the torque required to turn the Variac shaft: 55 to 110 ounce inches for single units.

Panel Thickness is the maximum thickness of the panel on which the Variac can be mounted, with the shaft normally supplied: 15/32 inch.

Dimensions: Uncased model, base 7½ x 7½ inches, depth behind panel 4⅝ inches; case dimensions, (width) 8⅝ x (height) 11 5/16 x (depth) 5⅜ inches.

Weight: See individual specifications.

Type and Mounting	Input Volts	Line-Voltage Connection: Rated Output Amps.	Output Voltage	Max. Output Amps.	Output KVA	Overvoltage Connection: Output Volts	Rated Output Amps.	Net Weight Pounds	Code Word	Price
W20 Uncased	115	20	0–115	26	3.0	0–135	20	21⅜	FEDAL	**$45.00**
W20M With case	115	20	0–115	26	3.0	0–135	20	24½	FEDER	**58.00**
W20MT3 Portable	115					0–135	20	28⅛	FEDOM	**87.00**
W20H	230	8	0–230	10.4	2.4	0–270	8	20¼	MEPAL	**47.00**
Uncased	115	4				0–270	4			
W20HM	230	8	0–230	10.4	2.4	0–270	8	23⅜	MEPER	**60.00**
With case	115	4				0–270	4			
W20HMT3 Portable	230					0–270	8	27	MEPOM	**85.00**

BALL BEARINGS

All W20-model Variacs can be supplied with ball bearings. When ordering, add the suffix BB to the type number and add to the price the amount shown in the following table:

Model	*Surcharge for Ball Bearings*
Single	**$8.00**
2-gang	**10.00**
3-gang	**12.00**

Type W20 and Type W20H Variacs are approved by the Underwriters' Laboratories

GANGED MODELS

2- and 3-gang assemblies of W20-model Variacs are available either uncased or with cases.

Type		Load Rating KVA: Parallel	Series	Delta	Y	Input Line Volts	Code Word	Price
W20G2	**2-gang Type W20**.....	6				115	FEDALGANDU	**$100.00**
			6			230		
				5.2		115		
W20G2M	**2-gang W20 with case.**	Same as TYPE W20G2					FEDALBONDU	**125.00**
W20G3	**3-gang Type W20**.....	9				115	FEDALGANTY	**147.00**
					10.4	230		
W20G3M	**3-gang W20 with case.**	Same as TYPE W20G3					FEDALBONTY	**175.00**
W20HG2	**2-gang Type W20H**....	4.8				230	MEPALGANDU	**104.00**
			4.8			460		
				4.2		230		
W20HG2M	**2-gang W20HM**.....	Same as TYPE W20HG2					MEPALBONDU	**129.00**
W20HG3	**3-gang Type W20H**....	7.2				230	MEPALGANTY	**153.00**
					8.3	460		
W20HG3M	**3-gang W20H with case**	Same as TYPE W20HG3					MEPALBONTY	**181.00**

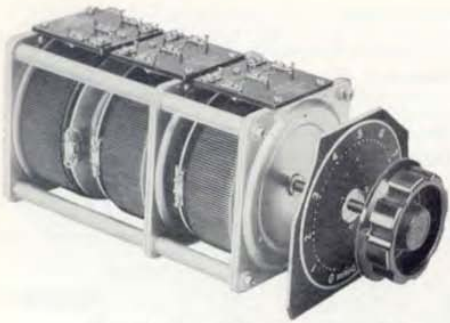

Figure 4. Uncased three-gang assembly, Type W20G3.

Figure 5. Three-gang assembly with case, Type W20G3M.

MOTOR DRIVE

As with other W-model Variacs, motor-driven units and assemblies can be supplied. These simple, relatively inexpensive drives are available for both servo and remote positioning applications. Cases similar to those used on ganged assemblies (Figure 2) can be supplied for applications where complete enclosure is desired.

The price for motor drive varies with the quantity ordered. We shall be glad to quote prices and to recommend the model best suited to your requirements.

Figure 6. For ambient temperatures above 50°C., Variacs should be derated according to this curve.

TYPE 1201-B UNIT REGULATED POWER SUPPLY

The Unit Regulated Power Supply has been redesigned for reduced ripple voltage and more nearly constant output voltage. The new model number is Type 1201-B. The d-c output voltage of the new instrument is constant within ±¼% for all values of load current and line voltage, and the ripple voltage is less than 1 millivolt (120 cps) at full load. The Type 1201-B Unit Regulated Power Supply is recommended for use with General Radio Unit Instruments as well as with other equipment in applications where line-voltage fluctuations are serious.

SPECIFICATIONS

Output: 300 v dc (±1%) at 70 ma.
6.3 v ac at 4 amp. (unregulated).

Regulation: D-c output voltage is constant within ±¼% for all values of load current and line voltage.

Ripple: Less than 1 mv (120 cps) at full load.

Internal Impedance: 0.4Ω + 10 μh (max).

Input: 105–125 volts, 50-60 cps, 87 w, full load at 115 v.

Connectors: Line cord permanently attached to instrument. Standard 4-point connector mounted on cabinet side for other Unit Instruments.

Accessories Supplied: Line cord; mating plug for equipment other than Unit Instruments.

Mounting: Black-crackle-finish aluminum panel and sides. Aluminum cover finished in clear lacquer.

Dimensions: Width 5 in., height 5¾ in., depth 6¼ in. over-all, not including power cord.

Weight: 6 pounds.

Type		*Code Word*	*Price*
1201-B	Unit Regulated Power Supply.....	ASSET	$85.00

EQUIPMENT LEASING

In our dynamic economy, capital equipment users often face the problem of acquiring large quantities of equipment for modernization, expansion, replacement, and for Government contracts. This demand for capital equipment can tie up substantial amounts of working capital that might be more profitably used otherwise. Because of this, there is a strong trend towards leasing, which has been sparked by the growing realization that it may be better to pay for the use of equipment out of current income than to pay for ownership out of past profits, debt, or equity financing. The following benefits may be realized by leasing test equipment:

(1) Liquid capital can be most profitably employed.

(2) Equipment costs can be pinpointed to specific projects or contracts.

(3) Government contracts can be partially financed on a lease basis.

(4) Monthly payments can be handled as an operating expense.

(5) The normal credit pool is not dried up, leaving cash and borrowing facilities intact for other purposes.

(6) New instruments are acquired on a pay-its-way basis.

(7) Because equipment can be leased long before funds can be made available through inflexible capital budgets, expensive delays can be avoided.

(8) By not making heavy demands on liquid cash, leasing encourages management to provide their valuable engineering talent with the most efficient up-to-date instrumentation. The result is an increase in output per man-hour.

To meet this need for leased instruments, a number of reputable concerns provide leasing services for creditworthy companies in the electronic industry. It is important to note that these companies *lease* equipment and *do not rent* equipment. The difference is that leased equipment is purchased by a leasing company on specific orders from the user and placed in the user's plant under leasing arrangements, whereas rented equipment implies that an inventory of instruments is available for short-term sporadic demands. Because of the extreme diversity of modern electronic instrumentation, the capital demands for maintaining an instrument inventory are so great that rental-service companies have not evolved. As far as we know, no leasing company stocks equipment for rent.

How does one go about leasing an instrument? The first step is to determine what instrument you need and

who manufactures it. This step is no different than the making of a regular capital purchase. You look over the field and select the instrument and manufacturer who has the desired instrument. You then get in touch with his Sales Department to discuss the technical details and inquire about delivery and cost. Do *not* go to a leasing company for technical details or specifications of the instrument. Once you have established, in cooperation with the equipment manufacturer, the particular instrument desired, *then* go to the leasing company. The leasing company will furnish you with a quotation for the leasing of the specific instrument that you have selected. If the leasing terms are acceptable to you, a lease will be drawn, and upon execution the leasing company will place a purchase order with the equipment manufacturer directing shipment to the user. All equipment warranties offered by the manufacturer are extended to the user. With General Radio Company, all instruments carry a two-year warranty. Should you have a service problem after purchasing the instrument, all negotiations would be directly between you and the manufacturer. Most electronic equipment is leased on a 36-month basis. Thereafter, annual renewals are made available at nominal rates.

A typical example is the purchase of a General Radio TYPE 1100-AP Primary Frequency Standard. The catalog price for this instrument is $2440. The cost per month for the Frequency Standard will be approximately $80.50 for 36 months. If at the end of the 36-month period you wish to renew the lease, it can be done for $146.50 per *annum*. When a larger-dollar-volume is involved, the rate may be reduced somewhat, depending upon the complexity of the order.

It may be seen from these rates that it is possible through leasing to keep your laboratory and production test equipment completely modernized at a nominal cost and still have capital available for other investments.

— ROBERT B. RICHMOND

EXHIBIT CALENDAR

During the months of September and October, many of the newest General Radio instruments will be on display at the technical meetings and conventions listed below. A cordial invitation is extended to all *Experimenter* readers who attend these conventions to visit the General Radio booths and to talk over your measurement problems with our engineers.

IRE CONFERENCE ON COMMUNICATIONS — **CEDAR RAPIDS, IOWA**
September 12 and 13, 1958 — Booths 111 and 112 — Sheraton Montrose Hotel

IRE CANADIAN CONVENTION — **TORONTO, CANADA**
October 8-9-10, 1958 — Booth 450 — Exhibition Park

NATIONAL ELECTRONICS CONFERENCE — **CHICAGO, ILLINOIS**
October 13-14-15, 1958 — Booths 172, 173, 174 — Hotel Sherman

General Radio Company

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