the GENERAL RADIO Experimenter

Since 1915 — Manufacturers of Electronic Apparatus for Science and Industry

VOLUME XXIX No. 5 OCTOBER, 1954

UNMOUNTED MOTOR SPEED CONTROLS FOR ASSEMBLY INTO OTHER EQUIPMENT

● **TO MEET** a definite customer demand, we have for some time supplied, on special order, "stripped-down" models of our Variac® Motor Speed Controls. These have had such a wide acceptance by manufacturers of motor-powered equipment that they are now made available as standard catalog items and will be carried in stock.

These models include the basic components of the original controls but omit the switches, overload protection, and cabinet. The elements are mounted on a base plate, and all connections are brought out to a terminal strip. The Variac® Autotransformer, which is the speed control element, is included as a separate unit and can be mounted with the starting switch in any convenient location.

Although intended primarily for machine manufacturers, the stripped-down controls are also used frequently to avoid duplicating the auxiliary components in applications where special switching circuits are required. These controls should be considered for possible cost savings whenever special wiring is involved or when a suitable protected location for the basic unit is available, such as in the cabinet of the driven machine.

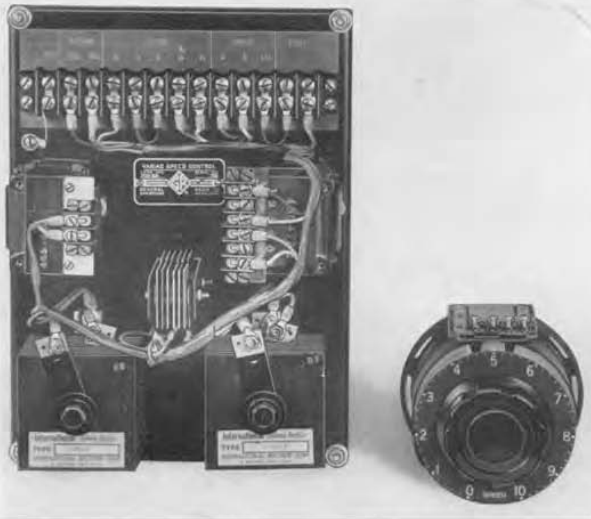

Figure 1. View of the Type 1700-BW Variac Speed Control. Transformers, rectifiers, and choke are assembled to a metal chassis, which can be mounted in the cabinet of the driven machine. Location of the Variac® Autotransformer and the necessary switching can then be dictated by operating convenience.

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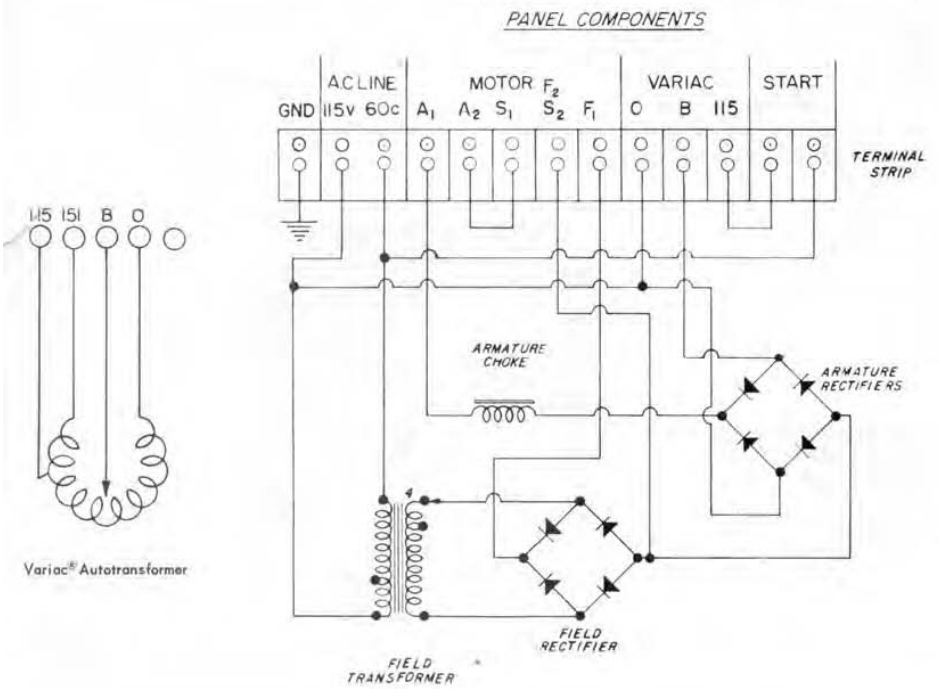
Figure 1 shows pictorially, and Figure 2 in schematic form, the components and connections in these basic control assemblies. The model shown is Type 1700-BW, with a rating of ⅓ horsepower. All parts are mounted on a metal chassis, with leads brought out to a convenient terminal strip for connection to the external control elements.

Figure 3 shows how connections are made to the terminal strip to perform the functions of starting, stopping, braking, reversing, and overload protection. The start-stop-reverse control may be either a toggle switch or drum-type controller. A magnetic circuit breaker of the relay type can be used instead of the fuses and line switch shown. When only a single direction of rotation is required without dynamic braking, the only auxiliary components needed are the line switch and fuses. Other circuit arrangements with a list of suitable components are given in the Operating Instructions.

Variac Motor Speed Controls are versatile, general-purpose devices for operating d-c shunt or compound motors from a-c power lines. They have constant-torque characteristics, that is, the same maximum torque can be provided at all speed settings. They are suitable for all applications except where speed must be precisely maintained under varying load or where speed must be

Figure 2. Schematic circuit diagram of the stripped-down speed control. All terminals are clearly identified, as shown.



SPECIFICATIONS

TYPE NUMBER		1701 AKW		1701 AUW		1703 AW			1700 BW		1702 AW		1704 AW			1705 AW		
Motor Horsepower Range		1/12 & less		1/12 & less		1/12 to 1/4			1/4 and 1/3		1/2 and 3/4		1			1 1/2		
Power Supply (Single Phase 60 cycles)	Volts	115		115		115			115		115		230			230		
	Full-Load Amperes	1.5		1.5		2.2			5		10		6.5			8.5		
Line-Voltage Limits		105–125		105–125		105–125			105–125		105–125		210–250			210–250		
Input Power—Watts	Full Load	175		175		255			560		1150		1500			1950		
	Standby	None		None		30			50 approx.		65		90			90		
Motor Control Output — DC																		
Armature	Amperes	0.8		0.8		1.5			3		6.5		4.5			6		
	Volts	0–115		0–115		0–115			0–115		0–115		0–230			0–230		
Field	Amperes	0.2		1.25	1.0	0.2			0.4		0.4		0.5			0.5		
	Volts	115	38	10	16	115	66	48	115	75	115	75	230	160	128	230	160	128
Speed Range		0 to rated	0 to 2 rated	0 to rated		0 to rated	0 to 1.25 rated	0 to 1.5 rated	0 to rated	0 to 1.15 rated	0 to rated	0 to 1.15 rated	0 to rated	0 to 1.12 rated	0 to 1.25 rated	0 to rated	0 to 1.12 rated	0 to 1.25 rated
Dynamic Braking		Not included — can be provided by user																
Armature Overload Protection		Not included — to be provided by user																
Control Station		Speed control element (Variac) furnished — Start, stop, reverse, and braking controls to be provided by user																
Over-all Dimensions (inches)	Chassis	$6\frac{3}{4}\times9\frac{3}{8}\times2\frac{3}{4}$*				$6\frac{3}{4}\times10\times3$			$9\times12\frac{3}{8}\times3\frac{1}{4}$		$10\frac{1}{2}\times15\times4\frac{5}{16}$		$19\frac{11}{16}\times11\frac{3}{8}\times5\frac{3}{8}$			$19\frac{11}{16}\times13\frac{1}{8}\times5\frac{3}{8}$*		
	Variac	$3\frac{1}{4}\times3\frac{11}{16}\times4\frac{3}{8}$				$3\frac{1}{4}\times3\frac{11}{16}\times4\frac{3}{8}$			$4\frac{7}{8}\times5\times5\frac{3}{8}$		$6\frac{5}{32}\times6\frac{19}{32}\times5\frac{11}{16}$		$7\frac{7}{8}\times9\frac{11}{16}\times5\frac{11}{16}$			$7\frac{7}{8}\times9\frac{11}{16}\times5\frac{11}{16}$		
Net Weight (pounds)	Chassis	2 1/2*				3			11 1/2		17 1/2		24			30*		
	Variac	3 1/2				3 1/2			7		11 1/4		21 1/2			21 1/2		
Recommended Motor†		Mod-5		Mod-4		Mod-11			Mod-3		Mod-6		Mod-9			Mod-10		
Code Word						SABOT			SALTY		SATIN		SAVOR			SAXON		
Price††																		
1 to 4 units		$67.00		$67.00		$93.00 ea.			$135.00 ea.		$195.00 ea.		$310.00 ea.			$328.00 ea.		
5 to 19 units		63.50		63.50		83.70 ea.			122.00 ea.		177.50 ea.		295.00 ea.			315.00 ea.		
20 and up units		60.50		60.50		79.00 ea.			116.00 ea.		170.00 ea.		280.00 ea.			300.00 ea.		

*Approximate
†For motor specifications and prices, see *Experimenter* for December, 1953
††All prices are net, f.o.b. factory

SPECIFICATIONS

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	Full-Load Amperes	1.5		1.5		2.2			5		10		6.5			8.5		
Line-Voltage Limits		105–125		105–125		105–125			105–125		105–125		210–250			210–250		
Input Power—Watts	Full Load	175		175		255			560		1150		1500			1950		
	Standby	None		None		30			50 approx.		65		90			90		
Motor Control Output — DC																		
Armature	Amperes	0.8		0.8		1.5			3		6.5		4.5			6		
	Volts	0–115		0–115		0–115			0–115		0–115		0–230			0–230		
Field	Amperes	0.2		1.25	1.0	0.2			0.4		0.4		0.5			0.5		
	Volts	115	38	10	16	115	66	48	115	75	115	75	230	160	128	230	160	128
Speed Range		0 to rated	0 to 2 rated	0 to rated		0 to rated	0 to 1.25 rated	0 to 1.5 rated	0 to rated	0 to 1.15 rated	0 to rated	0 to 1.15 rated	0 to rated	0 to 1.12 rated	0 to 1.25 rated	0 to rated	0 to 1.12 rated	0 to 1.25 rated
Dynamic Braking		Not included — can be provided by user																
Armature Overload Protection		Not included — to be provided by user																
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Over-all Dimensions (inches)	Chassis	$6\frac{3}{4}\times9\frac{3}{8}\times2\frac{3}{4}$*				$6\frac{3}{4}\times10\times3$			$9\times12\frac{3}{8}\times3\frac{1}{4}$		$10\frac{1}{2}\times15\times4\frac{5}{16}$		$19\frac{11}{16}\times11\frac{3}{8}\times5\frac{3}{8}$			$19\frac{11}{16}\times13\frac{1}{8}\times5\frac{3}{8}$*		
	Variac	$3\frac{1}{4}\times3\frac{11}{16}\times4\frac{3}{8}$				$3\frac{1}{4}\times3\frac{11}{16}\times4\frac{3}{8}$			$4\frac{7}{8}\times5\times5\frac{3}{8}$		$6\frac{5}{32}\times6\frac{19}{32}\times5\frac{11}{16}$		$7\frac{7}{8}\times9\frac{11}{16}\times5\frac{11}{16}$			$7\frac{7}{8}\times9\frac{11}{16}\times5\frac{11}{16}$		
Net Weight (pounds)	Chassis	$2\frac{1}{2}$*				3			$11\frac{1}{2}$		$17\frac{1}{2}$		24			30*		
	Variac	$3\frac{1}{2}$				$3\frac{1}{2}$			7		$11\frac{1}{4}$		$21\frac{1}{2}$			$21\frac{1}{2}$		
Recommended Motor†		Mod-5		Mod-4		Mod-11			Mod-3		Mod-6		Mod-9			Mod-10		
Code Word						SABOT			SALTY		SATIN		SAVOR			SAXON		
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5 to 19 units		63.50		63.50		83.70 ea.			122.00 ea.		177.50 ea.		295.00 ea.			315.00 ea.		
20 and up units		60.50		60.50		79.00 ea.			116.00 ea.		170.00 ea.		280.00 ea.			300.00 ea.		

*Approximate
†For motor specifications and prices, see *Experimenter* for December, 1953
††All prices are net, f.o.b. factory

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CABLE TESTING CONSOLES USE GENERAL RADIO EQUIPMENT

The test consoles described in this article are interesting examples of how the products of several manufacturers can be grouped together for making a specified series of tests. For the information on which this article is based, we are indebted to Mr. E. Mark Wolf, Electrical Engineer of Rome Cable Corporation.

One of the products of the Rome Cable Corporation of Rome, N. Y., is Spiral Four Cable, a four-conductor shielded cable, ⅜ inch in diameter, with polyethylene insulation and with polyvinyl chloride outer sheath. This cable is used by the Signal Corps, U. S. Army, for carrier voice communication and for teletype and facsimile communication. It is furnished to the Signal Corps in standard lengths with watertight connectors attached.

Because this cable is used at carrier frequencies, its capacitance and resistance must be held within narrow limits, and, hence, production tests must be made with laboratory precision. Tests are divided into four parts:

1. Preliminary electrical test.
2. Final electrical test.
3. AC/DC resistance measurement.
4. Connector water seal test.

Special test consoles for making the preliminary and final tests were designed by the Rome Cable Corporation and built for them by the Power Equipment Company of Detroit, Michigan.

Preliminary Electrical Tests

Figure 1 shows the console for preliminary electrical tests. The instruments shown are:

General Radio TYPE 716-C Capacitance Bridge

General Radio TYPE 1231-B Amplifier and Null Detector

Figure 1. View of the console for preliminary electrical tests. The Type 716-C Capacitance Bridge is at the right, the Type 1231-B Amplifier and Null Detector at the top center of the pouch. At the left part face of the console is the Variac® Autotransformer.

General Radio TYPE 723-C 1000-cycle Vacuum-Tube Fork
General Radio TYPE V20M Variac® Autotransformer
Leeds and Northrup Wheatstone bridge and galvanometer
Siemens & Halske Coupling Meter
Peerless 115V to 1500V transformer, meters, timers, switches, indicators, etc.

Seven of these consoles are used at Rome Cable. Tests performed are as follows:

1. *High Voltage* — This test is performed to detect defective cable before the connectors are attached. 1500 volts is applied between all four conductors and shield for 15 seconds. Voltage is adjusted by means of the Variac.

2. *Mutual Capacitance* — Measured on each pair of the cables, using the TYPE 716-C Capacitance Bridge. The oscillator supplying power to the bridge is the TYPE 723-C Vacuum-Tube Fork, and the detector is the TYPE 1231-B Amplifier and Null Detector.

3. *Capacitance Unbalance* — Side-to-side and side-to-ground capacitance unbalance is measured with the Siemens & Halske Coupling Meter and the General Radio oscillator and null detector, as used in (2) above.

4. *D-C Copper Resistance* — Measured for each pair with the Leeds and Northrup bridge and galvanometer.

Final Electrical Tests

The console for these tests is shown in Figure 2. The instruments used are:

General Radio Variac Autotransformer and Peerless transformer, as in the preliminary test console.
General Radio TYPE 1861-A Megohmmeter
Leeds and Northrup Wheatstone bridge and galvanometer
Switching, meters, indicators, etc.

Five individual consoles are used.

Tests performed are as follows:

1. *High Voltage*—1500 volts ac for one minute, applied between each conductor in turn and the remaining three conductors and shield, all grounded. Test voltage is supplied by the Peerless transformer and adjusted by means of the Variac.

2. *Insulation Resistance* between each conductor in turn and the three remain-

Figure 2. View of the console for final electrical tests. The General Radio Megohmmeter is at the right of the panel, and the Variac at the front face of the left-hand pedestal.

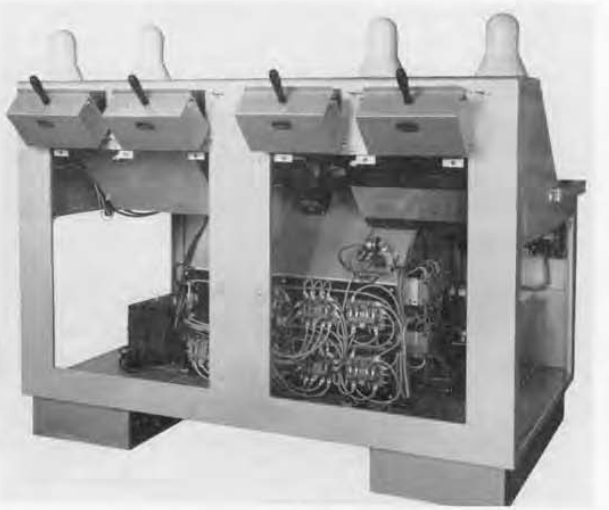

Figure 3. Rear view of the preliminary-electrical-test console, showing switching, relays, wiring, and details of construction.

ing conductors and shield, all grounded; measured with the General Radio TYPE 1861-A Megohmmeters.

3. *D-C Copper Resistance* of each pair is measured with the Leeds and Northrup bridge and galvanometer.

4. *Braid Continuity,* and

5. *Conductor Continuity* — These tests are made by completing an electrical circuit with the cable assembly in series with an indicating lamp and power source.

These test consoles have been in use for nearly three years and have been completely satisfactory. Other cable companies, with the permission of Rome Cable, have had similar units built for their use in testing the same type of cable.

In addition to the tests made at the consoles, two other measurements involve the use of General Radio instruments, the AC/DC Resistance Measurement and the Connector Water Seal Test.

The ratio of a-c resistance at 60 kc to the d-c resistance of the cable is measured with a 60-kc Network Manufacturing Co. Impedance Bridge, in which a number of General Radio components are used. The power source is a General Radio TYPE 1302-A Oscillator, and the detector a General Radio TYPE 1231-B Amplifier and Null Detector with a TYPE 1231-P5 Filter.

The Connector Water Seal Test checks the ability of mated or capped connectors to be immersed in water without a decrease in insulation resistance greater than that specified. Measurements are made before and after immersion, using a portable General Radio TYPE 1862-A Megohmmeter.

MISCELLANY

VISITORS: We have welcomed recently at our Cambridge plant the following visitors from foreign countries: G. R. Lawrance, Equipment Engineer, Stand-

ard Telephones & Cables, Ltd., Newport, England; Jean Brune, Chief Research Engineer, Lignes Telegraphiques et Telephoniques of Conflans, Ste. Honorine, France; Peter J. A. Goebels, Vocational Specialist, National Economic Ministry, Germany; Dr. Erwin K. H. Krause, Director, Institute for Vocational Education, Bonn, Germany; Prof. Erik Hallen, L'Ecole Royale Superieure Polytechnique, Stockholm, Sweden; Dr. Tino Gaumann, Organic Chemical Institute, Swiss Technical High School, Zurich, Switzerland; Nagatoshi Azuma, Chief, Design Section, Hitachi, Ltd., Yokohama, Japan; Yoshinohu Imamura, Engineer, Hitachi, Ltd., Yokohama, Japan; I. Kimura, Iida & Co., Tokyo, Japan; Dr. Yoji Ito, Koden Electronics Co., Ltd., Tokyo, Japan; Isokazu Tanaka, Director, Koden Electronics Co., Ltd., Tokyo, Japan; Ki Kato, Daisuke Kawata, Toku Uchida, Shigeki Yamato, Heijiro Yomezawa, Nippon Electric Co., Tokyo, Japan; S. Katsurai, Nippon Kikai Boeki Kaisha, Chuo-ku, Tokyo, Japan; Naokiti Tamaru, Manager, Shibaura Plant, Oki Electric Industry Co., Minato-Ku, Tokyo, Japan; Shuichiro Oka, Deputy Manager, Radio Engineering Dept., Tokyo Shibaura Electric Co., Ltd., Kawasaki, Japan.

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We take pleasure in announcing the appointment of Midoriya Electric Company Ltd. as exclusive distributors of General Radio products in Japan.

Our friends and customers in Japan should address their orders and requests for information to

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