PHILIPS VARIABLE TRANSFORMERS

The Philips range of variable transformers extends from a miniature type for 0.5 A output up to 20 A types, and include both bench and panel-mounting versions. Loads of up to 7.8 KVA can be controlled. Accessories are available for reversed mounting; union sets for ganging make it easy to multiply the output rating or to control three-phase voltages. Double-wound units are also available which provide mains isolation.

APPLICATION

Variable transformers provide a relatively inexpensive means of manual regulation of low-frequency alternating voltages. As compared with resistors, they have the paramount advantage of low energy losses, and an almost unlimited life; unlike transformers with fixed taps, they permit accurate adjustment. They are extremely easy to operate and require a minimum of maintenance. Auto-transformer types have an inherent advantage of reduced bulk compared with the double-wound variety, but the latter may be preferred in applications where mains isolation is paramount.

From the wealth of applications, two principal uses emerge:

(a) adjusting varying AC voltages to their nominal value:

(b) transforming AC supply voltages to a value between 0 and 120% of their actual value.

Variable transformers are used either panel-mounted or for bench use in factories, works and repair shops, laboratories, test stations, checking establishments, educational institutions, halls and studios, for electric and electronic equipment of most divergent kinds. On account of their ability to accurately control AC voltages, variable transformers are eminently suitable for controlling light intensities (e.g., of shop-window and stage lighting, festive illuminations and sky-signs), temperatures (e.g., of electric heating and melting devices, inclusive of HF heating equipment) and (in combination with rectification equipment) the speed of DC motors and galvanic processes.

With the aid of union sets for ganging variable transformers, combinations can be made of two or three panel-mounting transformers in order either to multiply the output rating or to control three-phase voltages.

PHILIPS TYPES

Four groups of variable transformers comprise the Philips range. These are:

1. *Standard variable auto-transformers.*
2. *Higher-power rating (20 A) variable auto-transformers.*
3. *Variable transformers with separate windings.*
4. *A miniature auto-transformer for panel-mounting.*

Standard Variable Transformers

Because these are auto-transformers, the windings are lighter than those required for two-winding transformers passing a set load current. This results in units varying between 6½lb. for a panel-mounting 260 VA model and 29lb. for a bench-type 2080 VA model.

A single-layer winding on the toroidal core has its annular face ground bright and flat to form a track for the carbon brush. The voltage between adjacent turns is sufficiently low to provide very smooth control. Corresponding to an angle of rotation of approximately 320°, the standard dial is graduated from 0 to 260 V for normal voltage input. Normal connection is shown in Fig. 7 (i.e., clockwise rotation increases secondary voltage from min. to max.). Details of other connections (including suitable dials) are available on request.

The transformers are available either for panel mounting (Figs. 1 and 2) or for bench use (Figs. 3 and 4). Both types are tropic-proofed. The panel types can be mounted, using the three screws provided, on panels up to $\frac{3}{16}$" thickness for models corresponding to Fig. 1, and on panels up to $\frac{1}{8}$" thickness for types corresponding to Fig. 2. Accessories are available for reverse mounting.

The transformers are supplied with full mounting and operating instructions.

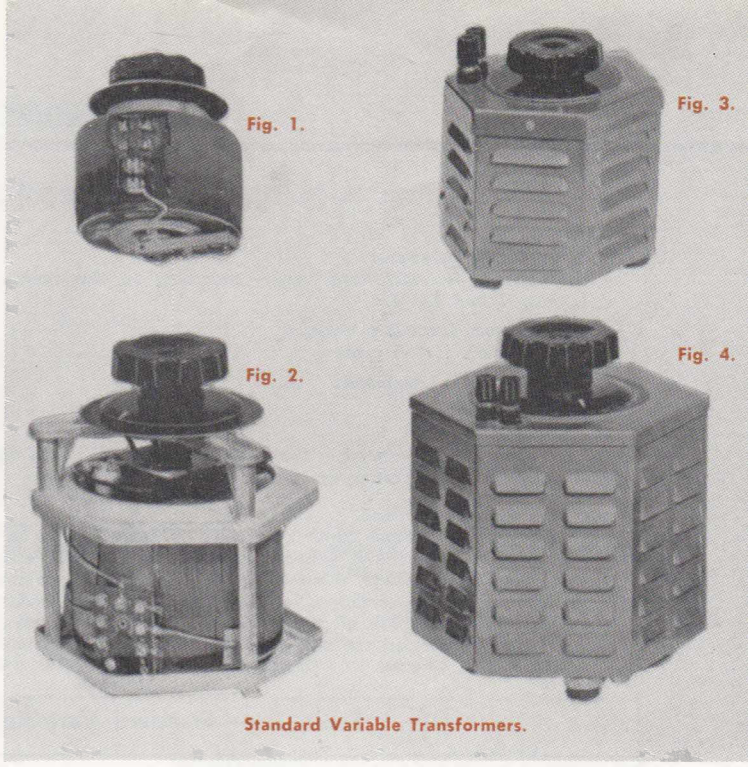
Higher-Power (20 A) Variable Transformers

Like the standard variable transformers described in the preceding section, the higher-powered types are wound-core auto-transformers with natural convection cooling. The flat design results in the optimum weight-to-performance ratio. There are five carbon brushes in parallel, which operate on a polished and silver-plated track to ensure the most reliable contact and to prevent oxidisation.

Over the angle of rotation between stops of 324°, the dial is graduated 0-260 V, giving correct indication when used with normal connections and nominal input voltage.

The 20 A variable transformers are available either for bench use (*Digest* front cover) or for panel mounting. The panel-types can be mounted, using four screws supplied, on panels having a thickness up to $\frac{3}{8}$″.

Normal connection and the range of alternative connections are the same as for the standard variable transformers with the addition of a centre-tap.



Standard Variable Transformers.

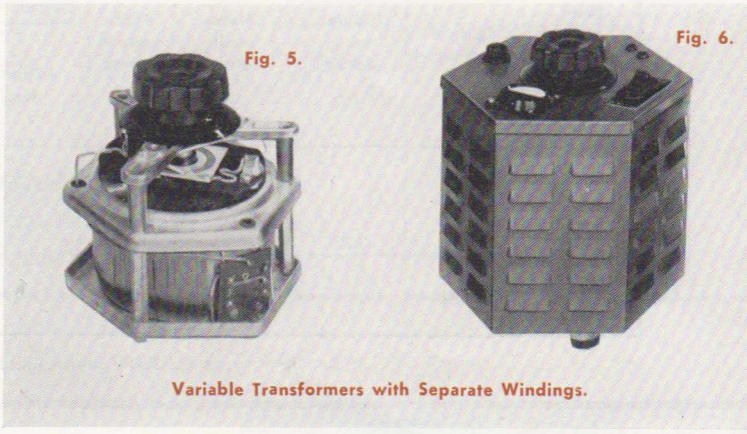
Variable Transformers with Separate Windings

By using separate primary and secondary windings, these transformers avoid the direct connection of the output side with the mains which may make the use of auto-transformers undesirable. Isolation of the secondary is particularly useful when the transformer is used to feed radio and TV sets under repair. Thus these types are frequently found in electronic repair shops, laboratories and research establishments. An additional advantage for such work is that the windings are not only insulated, but also electrostatically screened to eliminate interference when measurements are being made.

The construction is similar to that of the standard types except that there are two separated, single-layer windings and the carbon brush moves over the secondary winding.

The panel-mounting (B8 709 50/01) and bench (B8 709 00/02) types are shown in Figs. 5 and 6 respectively, whilst circuit diagrams are given in Figs. 8 and 9. Two output voltage ranges, essentially overlapping, are provided in each case. The "0-240 V max." switch position (Range 2) provides better resolution.

The panel-mounting types have a connecting panel with soldering terminals. They can be mounted, using three screws supplied, on panels having a thickness up to $\frac{1}{8}$″. Two pairs of output sockets are provided in the cover, allowing a precision voltmeter to be connected simultaneously with a load for especially accurate work and enabling the built-in moving-iron voltmeter to be checked. Bench type transformers without voltmeter, flex and plug can be supplied under type number B8 709 00/03.



Variable Transformers with Separate Windings.

Miniature Variable Transformer

The E 401 ZZ/01 is a panel mounting variable auto-transformer which offers economy and compactness in such applications as small-motor speed control, air-cooling control, lighting control and power supply control.

Its unusually small dimensions ($3\frac{5}{16}$″ diameter) are made possible by winding the enamelled copper wire in two layers on a ring-shaped core of high-permeability laminations. The upper layer forms the brush track, so that the brush sweeps half the total winding. Thus the output voltage can be varied over either of two ranges according to the connections used. The requirements of most applications can be met if the output is taken between points A and C (Fig. 11)—that is, from zero volts to one half of the input voltage. Adjustment over the remaining half of the input voltage can be obtained by taking the output between B and C.

The transformer is encapsulated in reinforced polyester resin.

FULL INFORMATION ON THE VARIABLE TRANSFORMERS AND ACCESSORIES IN THE PHILIPS RANGE IS AVAILABLE ON REQUEST TO ANY OF THE ADDRESES ON THE BACK COVER OF THE *Digest*.

STANDARD VARIABLE TRANSFORMERS

Voltage Increments
Voltage between turns varies, according to the rating, between 0.3 V and 1.1 V.

Minimum Secondary Voltage
3 V max. for all types.

Permissible Temperature
40°C max.

Protective Fuse
A fuse is incorporated in the secondary circuit of bench types which have an output rating up to and including 1040 VA.

Permissible Overload
The nominal output currents specified in Table 1 may be exceeded by 25%. For output voltages in the ranges 0 - 15% and 8 - 110% of the input voltage, this overload can be applied continuously. The least favourable conditions for load capacity are at secondary voltages of 50% and 120% of primary voltage (most heat developed) when the 25% overload can only be applied for 30 minutes with intervals of at least 4 hours.

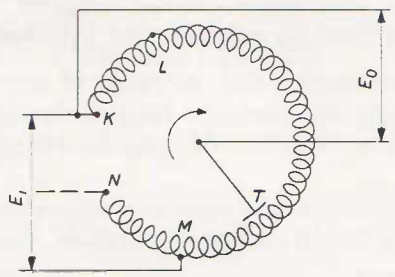


Fig. 7—Diagram of variable transformer showing normal connection.

Table 1 — Standard Variable Transformers (Normal Connection)

Nom. prim. voltage* 50-60 c/s (V)	Output rating (VA)	Nom. secdy. voltage (V)	Nom. secdy. current (A)	Max. no-load losses (W)	Panel mounting				Bench mounting			
					Type No.	Fig. No.	Proj'n. behind panel (ins.)	Max. width (ins.)	Type No.	Fig. No.	Overall Height (ins.)	Max. width (ins.)
220	260	0-260	1	3	84527/01	1	$3\frac{15}{16}$	$4\frac{3}{8}$	84526/01	3	$5\frac{15}{16}$	$5\frac{13}{16}$
	520		2	4	84531/01	1	$4\frac{3}{4}$	$4\frac{3}{8}$	84530/01	3	$6\frac{13}{16}$	$5\frac{13}{16}$
	1040		4	7	84535/01	2	$5\frac{15}{16}$	8	84534/01	4	$8\frac{1}{2}$	$8\frac{1}{4}$
	2080		8	12.5	84537/01	2	$6\frac{15}{16}$	8	84536/01	4	$9\frac{7}{16}$	$8\frac{1}{4}$

* Details of types for 130 V (also suitable for 110 V) input are available on application.

20 A VARIABLE TRANSFORMERS

Ratings
The output voltage can be regulated between 0 and 260 V (no-load) or 255 V (current drainage I_n). The maximum voltage between turns is 0.75 - 0.9 V.
An output current I_{max} is permissible if the output voltage differs by no more than 10 V from the nominal input voltage.

No-Load Losses
Max. 40 W when the brushes short-circuit one turn of the winding. (N.B. half this loss is in the contact of the brushes.)

Overall Dimensions
Approx. $7\frac{1}{2}$" high x $12\frac{3}{8}$" wide.

Insulation Resistance
Min. 1000 MΩ between winding and frame or core (N.B. The winding has been tested at 2.2 KV AC with respect to frame and core.)

Permissible Temperature
Ratings apply at max. $T_{amb} = 40°C$.

Table 2 — 20 A Variable Transformers (Normal Connection and 240 V Input)

Type	Fig. No.	Nominal Input Voltage 50-60 c/s (V)	Type No.	Output				
				Nominal Voltage (V)	I_n* (A)	I_{max}* (A)	Rated Power (KVA)	Max. Power (KVA)
Panel	5	240	E401BB/201	0-260	23	30	6	7.8
Bench	6	240	E401AB/201	0-260	20	28	5.2	7.3

* For explanations, see under "Ratings" above.