

PHILIPS

Data handbook



Electronic
components
and materials

Components and materials

Part 8 June 1979

Variable mains transformers

COMPONENTS AND MATERIALS

PART 8 — JUNE 1979

VARIABLE MAINS TRANSFORMERS

GENERAL

VARIABLE MAINS TRANSFORMERS
(AUTO-TRANSFORMERS)

VARIABLE MAINS TRANSFORMERS
(SEPARATE WINDINGS)

ACCESSORIES



DATA HANDBOOK SYSTEM

Our Data Handbook System is a comprehensive source of information on electronic components, sub-assemblies and materials; it is made up of three series of handbooks each comprising several parts.

ELECTRON TUBES	BLUE
SEMICONDUCTORS AND INTEGRATED CIRCUITS	RED
COMPONENTS AND MATERIALS	GREEN

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

Where ratings or specifications differ from those published in the preceding edition they are pointed out by arrows. Where application information is given it is advisory and does not form part of the product specification.

If you need confirmation that the published data about any of our products are the latest available, please contact our representative. He is at your service and will be glad to answer your inquiries.

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ELECTRON TUBES (BLUE SERIES)

Part 1a	December 1975	ET1a 12-75	Transmitting tubes for communication, tubes for r.f. heating Types PE05/25 to TBW15/25
Part 1b	August 1977	ET1b 08-77	Transmitting tubes for communication, tubes for r.f. heating, amplifier circuit assemblies
Part 2a	November 1977	ET2a 11-77	Microwave tubes Communication magnetrons, magnetrons for microwave heating, klystrons, travelling-wave tubes, diodes, triodes T-R switches
Part 2b	May 1978	ET2b 05-78	Microwave semiconductors and components Gunn, Impatt and noise diodes, mixer and detector diodes, backward diodes, varactor diodes, Gunn oscillators, sub- assemblies, circulators and isolators
Part 3	January 1975	ET3 01-75	Special Quality tubes, miscellaneous devices
Part 4	March 1975	ET4 03-75	Receiving tubes
Part 5a	March 1978	ET5a 03-78	Cathode-ray tubes Instrument tubes, monitor and display tubes, C.R. tubes for special applications
Part 5b	December 1978	ET5b 12-78	Camera tubes and accessories, image intensifiers
Part 6	January 1977	ET6 01-77	Products for nuclear technology Channel electron multipliers, neutron tubes, Geiger-Müller tubes
Part 7a	March 1977	ET7a 03-77	Gas-filled tubes Thyratrons, industrial rectifying tubes, ignitrons, high-voltage rectifying tubes
Part 7b	May 1979	ET7b 05-79	Gas-filled tubes Segment indicator tubes, indicator tubes, switching diodes, dry reed contact units
Part 8	May 1977	ET8 05-77	TV picture tubes
Part 9	March 1978	ET9 03-78	Photomultiplier tubes; phototubes

SEMICONDUCTORS AND INTEGRATED CIRCUITS (RED SERIES)

Part 1a August 1978	SC1a 08-78	Rectifier diodes, thyristors, triacs Rectifier diodes, voltage regulator diodes ($> 1,5$ W), transient suppressor diodes, rectifier stacks, thyristors, triacs
Part 1b May 1977	SC1b 05-77	Diodes Small signal germanium diodes, small signal silicon diodes, special diodes, voltage regulator diodes ($< 1,5$ W), voltage reference diodes, tuner diodes
Part 2 November 1977	SC2 11-77	Low-frequency and dual transistors
Part 3 January 1978	SC3 01-78	High-frequency, switching and field-effect transistors
Part 4a December 1978	SC4a 12-78	Transmitting transistors and modules
Part 4b September 1978	SC4b 09-78	Devices for optoelectronics Photosensitive diodes and transistors, light emitting diodes, photocouplers, infrared sensitive devices, photoconductive devices
Part 4c July 1978	SC4c 07-78	Discrete semiconductors for hybrid thick and thin-film circuits
Part 5a November 1976	SC5a 11-76	Professional analogue integrated circuits
Part 5b March 1977	SC5b 03-77	Consumer integrated circuits Radio-audio, television
Part 6 October 1977	SC6 10-77	Digital integrated circuits LOCMOS HE4000B family
Signetics integrated circuits 1978		Bipolar and MOS memories Bipolar and MOS microprocessors Analogue circuits Logic - TTL

COMPONENTS AND MATERIALS (GREEN SERIES)

Part 1	June 1977	CM1 06-77	Assemblies for industrial use High noise immunity logic FZ/30-series, counter modules 50-series, NORbits 60-series, 61-series, circuit blocks 90-series, circuit block CSA70(L), PLC modules, input/output devices, hybrid circuits, peripheral devices, ferrite core memory products
Part 2a	October 1977	CM2a 10-77	Resistors Fixed resistors, variable resistors, voltage dependent resistors (VDR), light dependent resistors (LDR), negative temperature coefficient thermistors (NTC), positive temperature coefficient thermistors (PTC), test switches
Part 2b	February 1978	CM2b 02-78	Capacitors Electrolytic and solid capacitors, film capacitors, ceramic capacitors, variable capacitors
Part 3	January 1977	CM3 01-77	Radio, audio, television Components for black and white television, components for colour television
Part 3a	September 1978	CM3a 09-78	FM tuners, television tuners, surface acoustic wave filters
Part 3b	October 1978	CM3b 10-78	Loudspeakers
Part 4a	November 1978	CM4a 11-78	Soft ferrites Ferrites for radio, audio and television, beads and chokes, Ferroxcube potcores and square cores, Ferroxcube transformer cores
Part 4b	February 1979	CM4b 02-79	Piezoelectric ceramics, permanent magnet materials
Part 6	April 1977	CM6 04-77	Electric motors and accessories Small synchronous motors, stepper motors, miniature direct current motors
Part 7	September 1971	CM7 09-71	Circuit blocks Circuit blocks 100 kHz-series, circuit blocks 1-series, circuit blocks 10-series, circuit blocks for ferrite core memory drive
Part 7a	January 1979	CM7a 01-79	Assemblies Circuit blocks 40-series and CSA70 (L), counter modules 50-series, input/output devices
Part 8	June 1979	CM8 06-79	Variable mains transformers
Part 9	March 1976	CM9 03-76	Piezoelectric quartz devices
Part 10	April 1978	CM10 04-78	Connectors

GENERAL



INTRODUCTION

Applications

The main applications of our variable transformers are:

- distortion-free voltage control for measuring equipment and voltage stabilizers;
- power control for electric heating, heat sealing of plastics and motor speed;
- current control for galvanizing plants;
- light control in hotels, cinemas and homes;
- ventilation control in buildings, livestock houses and greenhouses.

TYPES

Our programme of variable transformers covers an output current range from 0,5 to 23 A. Most types in our programme are auto-transformers; for 3 A output current a transformer with separate windings is available.

All auto-transformers are available as **panel model** and some also as **bench model** or **laboratory model**.

A **panel model transformer** is a transformer of which the live parts are not protected.

A **bench model transformer** is a transformer in a protective housing and provided with a knob and dial.

A **laboratory model transformer** is a bench model transformer provided with a handle, a 3-core cable (including earth) with plug for input connection, an outlet socket, and a fuse; both plug and socket are of the side-contact earth model.

The transformer with separate windings is available as panel model and as laboratory model. This laboratory model is provided with a handle, an overload protection, a voltmeter for indicating the output voltage, a cable with plug for input connection, and an outlet socket.

Features

Our transformers have the following features:

- continuous voltage control;
- small dimensions and high efficiency by using core material of high quality;
- very low stray losses by using toroid coil shape and specially treated contact surface with low and stable contact resistance between brush and contact surface resulting in low losses at the most critical place; under normal conditions, the brush track needs no maintenance;
- corrosion proof;
- long life carbon brushes and smooth contact surface;
- simple replacement of carbon brushes;
- adjustable side-to-side spindle position;
- low coil resistance;
- high overload characteristics;
- simple coupling in parallel or three-phase combinations;
- remote-controlled motor drive available for either coupled or individual transformers.

All transformers meet the safety requirements laid down in SEV1003; most types have SEV approval, which is indicated on the transformer and in the relevant data sheet.



SURVEY

In the table on the next page the transformers are listed in order of their nominal input voltages, and for each input voltage in order of their output currents.

The data given in the 5th, 6th and 7th columns hold for over-wind transformers to which the input voltage is connected to the complete winding. (Over-wind transformers are transformers with a maximum output voltage higher than the input voltage.)

Detailed specification can be found in the data sheets, which are placed in two sections (with tabbed dividers): auto-transformers and transformers with separate windings. The data sheets are listed according to transformer size code. Conversion of catalogue number to transformer size code is given in the list on page 6.



1 input voltage nom. V	2 3 output current		4 output voltage no-load V	5 6 output current *		7 output voltage no-load V *	8 trans- former size code	9 10 11 catalogue number 2422 530			12 page
	nom. A	max. A		nom. A	max. A			panel model	bench model	lab. model	
42	4	4,8	0-42				E2	90031			31
60	1,2	1,32	0-60				E1	00007			27
110	0,6	0,7	0-110				E1	00107			27
115	1,2	1,4	0-130	1,32	1,54	0-115	E2	01607			31
	1,4	1,7	0-115				E2	11607			31
127	2,5	3,2	0-150	2,75	3,25	0-127	C1	02306			17
	5	6,3	0-150	5,5	6,5	0-127	C2	03306			21
	10	12,6	0-150	11	13	0-127	E6.1	04307			51
220	0,7	0,83	0-240	0,77	0,91	0-220	E2	01407			31
	0,83	1	0-220				E2	11407			31
	1	1,25	0-260	1,1	1,3	0-220	C1	02406	02401		17
	1,2	1,4	0-260	1,32	1,56	0-220	E3	08407			35
	1,4	1,7	0-220				E3	18407			35
	2	2,4	0-260	2,2	2,6	0-220	E4	03407			39
	2,5	3	0-220				E4	13407			39
	2,5	3,2	0-260	2,75	3,25	0-220	C2	03406	03401	03405	21
	4	4,8	110-220				E5	90023			43
	4	4,8	0-220				E5	90024			43
	4,5	5	0-253	5	5,85	0-220	E6	90028			47
	5	6	0-220				E6	90027			47
	5	6,3	0-260	5,5	6,5	0-220	E6.1	04407	04411	04415	51
	8,5	11,2	0-260	9,3	11,5	0-220	E7	05407	05411	05415	57
	10	12	0-220				E7	15407			57
12	15	0-260	13,2	15,6	0-220	E8	06407			63	
15	18	0-220				E8	16407			63	
23	30	0-260	25,3	30	0-220	E10	07407	07411		67	
240	0,5	0,55	120-0 120-240				E1	00407			27
	0,5	0,55	120-0 120-240				E1	90004			27
	0,5	0,55	0-120 240-120				E1	90011			27
	1	1,25	0-270	1	1,25	0-240	C1	02506	02501		17
	2	2,4	0-260	2	2,4	0-240	E4	03507			39
	2,5	3,2	0-270	2,5	3,2	0-240	C2	03506	03501		21
	4,5	5	0-276	4,5	5	0-240	E6	90028			47
	5	6,3	0-270	5	6,3	0-240	E6.1	04507	04511		51
	8,5	11,2	0-270	8,5	11,2	0-240	E7	05507	05511		57
	12	15	0-260	12	15	0-240	E8	06507			63
	23	30	0-260	23	30	0-240	E10	07507	07511		67
type with separate windings											
220	3		0-242				E7.1	00008		00007	73

* Data valid for over-wind transformers, when not used as such; see also explanation on the opposite page.

VARIABLE MAINS TRANSFORMERS

CONVERSION LIST

Conversion of catalogue number to transformer size code.

catalogue number	transformer size code	page	catalogue number	transformer size code	page
2422 529 00007	E7.1	73	2422 530 05411	E7	57
00008	E7.1	73	05415	E7	57
			05507	E7	57
2422 530 00007	E1	27	05511	E7	57
00107	E1	27	06407	E8	63
00407	E1	27			
01407	E2	31	06507	E8	63
01607	E2	31	07407	E10	67
			07411	E10	67
02306	C1	17	07507	E10	67
02401	C1	17	07511	E10	67
02406	C1	17			
02501	C1	17	08407	E3	35
02506	C1	17	11407	E2	31
			11607	E2	31
03306	C2	21	13407	E4	39
03401	C2	21	15407	E7	57
03405	C2	21			
03406	C2	21	16407	E8	63
03407	E4	39	18407	E3	35
03501	C2	21	90004	E1	27
03506	C2	21	90011	E1	27
03507	E4	39	90023	E5	43
04307	E6.1	51			
04407	E6.1	51	90024	E5	43
			90027	E6	47
04411	E6.1	51	90028	E6	47
04415	E6.1	51	90031	E2	31
04507	E6.1	51			
04511	E6.1	51			
05407	E7	57			



VARIABLE MAINS TRANSFORMERS
(AUTO-TRANSFORMERS)



OPERATIONAL NOTES

Note: Deviations from the following are given in the data sheets.

General

An auto-transformer is a variable mains transformer with a continuously variable secondary voltage. The common winding which serves as both primary and secondary winding is usually a single layer, wound on an annular core. A carbon brush, serving as the movable secondary tap, is made to contact the partly bared winding. The primary winding may be provided with one or more fixed taps.

Input voltage

The input voltage is connected to all or part of the primary winding of the transformer. In the data sheets the two input terminals for a stated input voltage are indicated. The **second letter** indicates the common input and output terminal. Unless otherwise stated the input/output terminals indicated are given so that a clockwise rotation of the spindle results in an increasing output voltage when the transformer is mounted behind a panel.

The nominal input voltage may continuously be exceeded by 10%.

Output voltage

The output voltage (at no load) cannot always be set at exactly the same value as the input voltage as the carbon brush contact point with the slider against the end stop does not always coincide with the beginning or the end of the winding.

Terminals

The input terminals are denoted N, K, L or M; Z is a mid-tap. The output voltage is taken from T (carbon brush) and one of the other terminals.

Nominal output current

This is the current which the transformer may continuously supply under the most unfavourable brush condition and ambient temperature.



Continuous overload (Maximum output current)

In an auto-transformer the distribution of the currents, and consequently the copper losses and heat generation in the windings, depends on the brush position. The nominal continuous current is defined by the most unfavourable brush position and the cooling capacity of the transformer. Starting from that cooling capacity it is obvious that the output current may be adapted to the brush position. Measurements have shown that a certain overload is permissible within 10% from the primary tapplings. In the graphs, Fig. 1, Fig. 2 and Fig. 3, the maximum load current is plotted as a function of the no-load output voltage which corresponds with the brush position. For the values of input voltage, nominal output current and maximum output current see under "Electrical data" in the data sheets.

If any doubt arises as to the cooling, do not overload the transformer. A considerable overload can be tolerated if the transformer, and especially the brush track contact, is artificially cooled or immersed in oil. Since this depends greatly on given circumstances, the only hard-and-fast directive is that the temperature rise (ΔT) of the brush track contact may not exceed 70 °C or 90 °C (see the relevant data sheet), or the maximum temperature is attained (see Fig. 6).

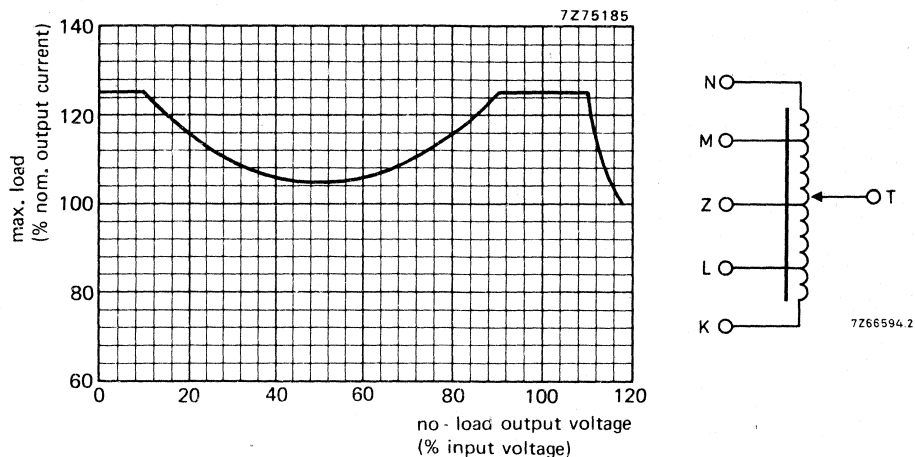


Fig. 1 Maximum load as a function of the output voltage; input voltage M to K or L to N.

When the ends of the winding are used as input terminals, an even higher load is permitted.

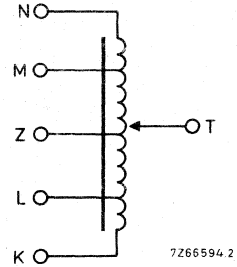
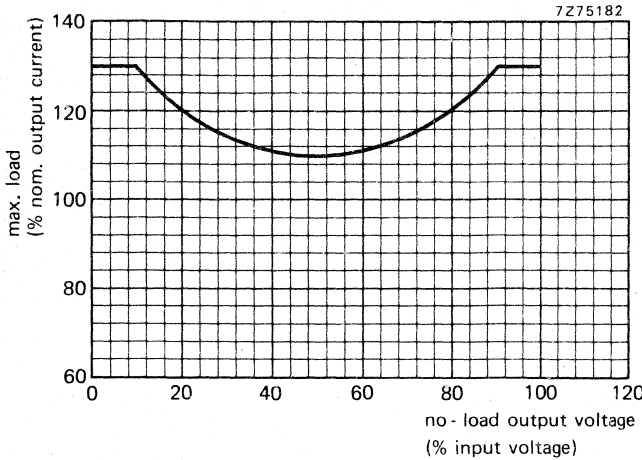


Fig. 2 Maximum load as a function of the output voltage; input voltage N to K.

For a transformer without taps the maximum load as a function of the output voltage is given in Fig. 3.

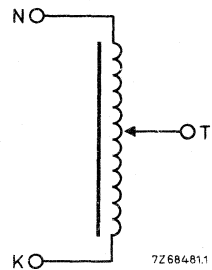
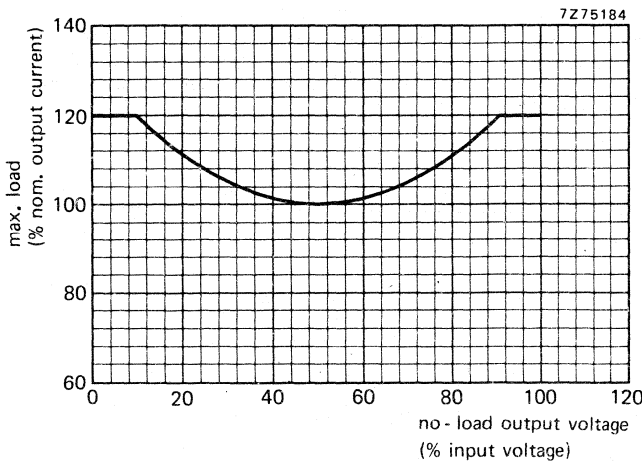


Fig. 3 Maximum load as a function of the output voltage; input voltage N to K.

Momentary overloads

High momentary overloads can be permitted due to the construction of the brush track and of the brush gear. The curve (Fig. 4) gives the relation between maximum permissible load and time. It is based on the maximum permissible temperature of the brush and on the unfavourable brush position. Therefore, after occasional overloading, no additional cooling of the transformer is required.

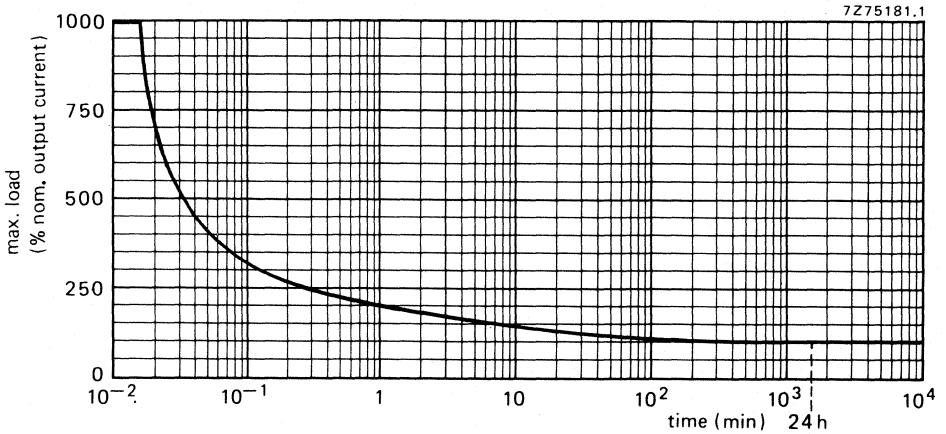


Fig. 4 Maximum non-repetitive overload as a function of time.

To avoid damage to the brush and the track the absolute limit for instantaneous loads is 1000%.

Overload protection and inrush current

Protection of the transformer can be effected by inserting appropriate overload protection in the output line. Due to the high permeability of the core material, high inrush currents (up to 20 times the nominal current) may occur. Although these last only a few cycles, and will not damage the transformer, primary fuses may be blown. It is therefore necessary to employ delayed fuses or other delayed protection devices.

Voltage per turn of winding

The smallest step of voltage regulation (finest resolution) is that which occurs as the carbon brush "switches over" from one turn of the winding to the next.

Operational notes

Voltage drop

Due to copper and brush-losses the output voltage will drop in proportion to the output current. The curves (Fig. 5) show the voltage drop as a percentage of the maximum voltage drop given in the data sheets as a function of brush setting. The upper curve applies to a constant current load (nominal output current). The lower curve applies to a constant impedance load (current approximately proportional to the voltage, increasing to maximum current at nominal input voltage).

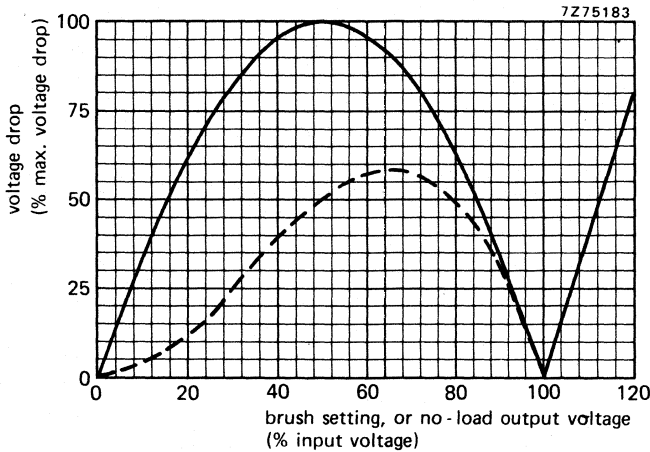


Fig. 5 Voltage drop as a function of brush setting.

Losses, no load

The core material has a practically constant specific no-load loss for frequencies of 50 to 400 Hz. The values given in the data sheets, refer to a mains frequency of 50 Hz. For lower frequencies the mains voltage must be decreased proportionally to avoid saturation of the core, and hence excessive core losses. Theoretically, the mains voltage can be increased for higher frequencies. However, the brush losses, being related to the voltage per turn of winding, would cause overheating of the brush contact point. For this reason it is not advisable to increase the input voltage.

Ambient temperature range

The data refer to an ambient temperature range of -15 to $+40$ °C. See also following paragraph.

Derating for higher ambient temperatures

The nominal data refer to a maximum ambient temperature of 40 °C. For higher temperatures the current must be derated in conformity with the curves of the figure below. These curves are also based on the most unfavourable brush position and should be combined with figures of preceding pages for different conditions.

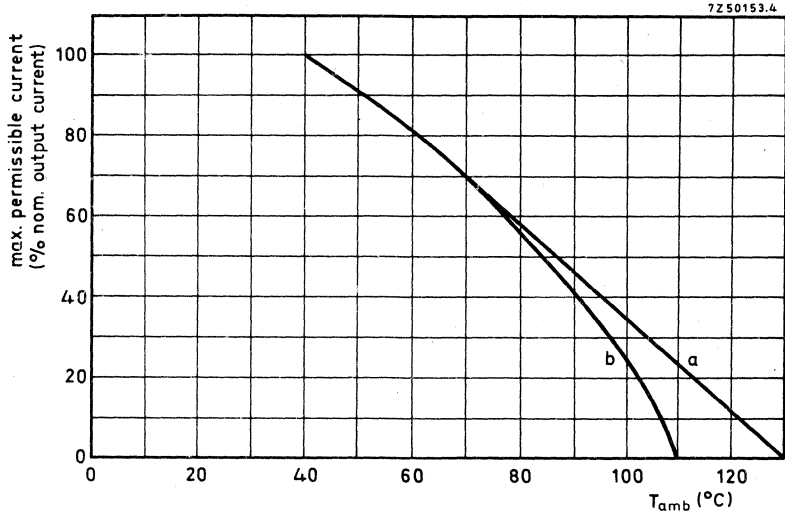


Fig. 6 Maximum permissible output current as a function of temperature. Curve a applies to transformers for which the maximum permissible temperature rise at any point is 90 °C. Curve b applies to transformers for which the maximum permissible temperature rise at any point is 70 °C.

Frequency range

The transformers may be used at frequencies between 50 and 400 Hz. See also "Losses, no load".

Insulation resistance

The insulation resistance between live and non-live parts after the damp heat test (IEC 68-2-3, test Ca, 21 days) is > 5 MΩ.

Test voltage

All transformers are tested for 1 min at 2000 V, 50 Hz.

Operational notes

Air gap

The air gap between live and non-live parts is ≥ 4 mm.

Leakage path

The leakage path between live and non-live parts is ≥ 5 mm.

Earthing the output circuit

If it is necessary to earth the output circuit, an isolating transformer must be connected between the mains and the variable transformer, so as to prevent short-circuits.

Angle of rotation

The total angle of rotation is $\approx 320^\circ$.

Life

The **guaranteed life** of the carbon brushes, if used within the ratings, is $> 100\,000$ two-way turns, however, the **life expectancy** is $\geq 250\,000$ two-way turns.

Parallel connection

For parallel connection of two or more transformers, chokes should be connected between the secondary windings to prevent high interchange currents caused by small differences in ganging. See section "Accessories".

Environmental tests

The transformers are designed to meet the following tests:

Damp heat test	IEC 68-2-3, test Ca, 21 days
Temperature cycling	IEC 68-2-14, test Na, $-10/+85$ °C, 1 cycle
Shock test	IEC 68-2-27, test Ea Acceleration, peak, 30 g (294 m/s ²) Pulse duration, 6 ms Number of shocks, 3 in 3 x 2 directions
Vibration test	IEC 68-2-6, test Fc, Procedure B4 10-55-10 Hz, 1 oct./min, amplitude 0,35 mm, 3 x 2 h

Climatic category

The climatic category of the transformers is, according to IEC 68-1: 15/040/21.

Accessories

The following accessories are available:

- control knobs
- ganging units
- motor drive modules
- chokes for parallel connection of transformers
- a.c. stabilizer module.

See section "Accessories".

VARIABLE MAINS TRANSFORMERS

- Size code C1
- To be read in conjunction with Operational Notes

QUICK REFERENCE DATA

input voltage V	output current A	output voltage V	catalogue number 2422 530	
			bench model	panel model
127/150	2,5	0 to 150		02306*
220/260	1	0 to 260	02401*	02406*
240/270	1	0 to 270	02501	02506*

APPLICATION

These panel model and bench model transformers are designed for use in laboratories and in industrial and professional equipment.

DESCRIPTION

These transformers have a single layer of copper wire wound on an annular core. This part is vacuum-impregnated and it is mounted on a diecast aluminium frame. The construction permits an adjustment down to exactly 0 V.

The spindle protrudes at both sides; its side-to-side position is adjustable. The spindle can be easily replaced by one of another length.

Screw terminals are provided for connecting the leads.

The bench models can also be used for panel mounting.

* Approved by SEV.

TRANSFORMERS SIZE CODE C1

ELECTRICAL DATA

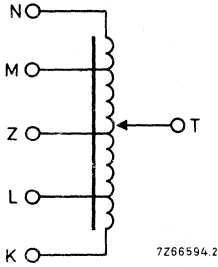


Fig. 1 Circuit diagram of panel model.
KL = NM; Z = centre tap.

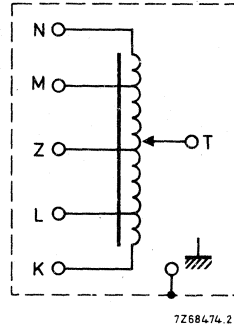


Fig. 2 Circuit diagram of bench model.
KL = NM; Z = centre tap.

Input voltage L to N*
Input voltage K to N
Output voltage, no load, T to N**
Voltage drop at nominal output current*
Nominal output current over the whole control range
Maximum output current**
Voltage per turn of winding
Losses, no load
Permissible temperature rise at any point**

2422 530			
bench	02401	02501	
panel	02306	02406	02506
Input voltage L to N*	127 V +10%	220 V + 10%	240 V + 10%
Input voltage K to N	150 V + 10%	260 V + 10%	270 V + 10%
Output voltage, no load, T to N**	0 to ≥ 150 V	0 to ≥ 260 V	0 to ≥ 270 V
Voltage drop at nominal output current*	≤ 6 V	≤ 13 V	≤ 13 V
Nominal output current over the whole control range	2,5 A	1 A	1 A
Maximum output current**	3,2 A [^]	1,25 A [^]	1,25 A [^]
Voltage per turn of winding	0,4 V	0,38 V	0,39 V
Losses, no load	≤ 7 W	≤ 5 W	≤ 6,2 W
Permissible temperature rise at any point**	max. 90 °C	max. 70 °C	max. 70 °C

* Second letter denotes the common input/output terminal.

** The output voltage is stated for clockwise rotation when the transformer is mounted behind a panel.

• See "Operational notes" paragraph "Voltage drop".

• See "Operational notes" paragraph "Continuous overload".

[^] See also data in the 5th, 6th and 7th column of the table on page 5.

^{^^} See "Operational notes" paragraph "Derating for higher ambient temperatures".

MECHANICAL DATA

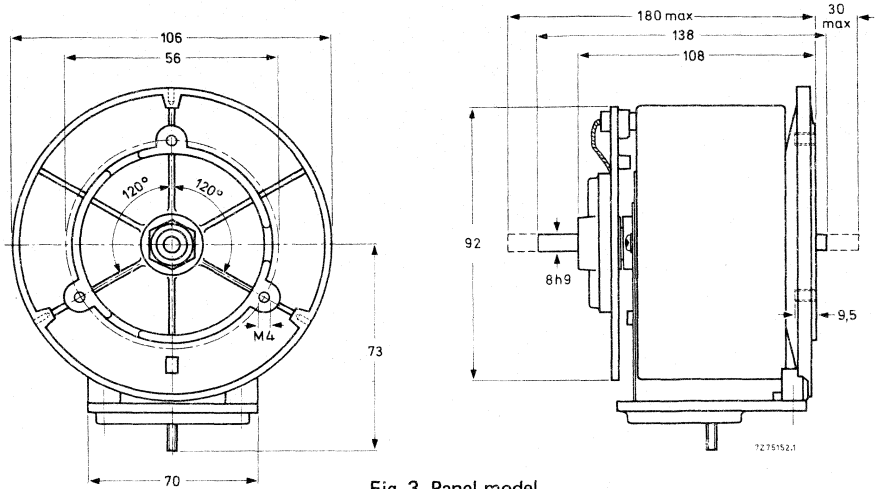
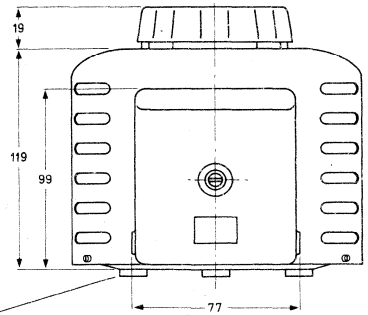


Fig. 3 Panel model.



The pads protrude approximately 3 mm.

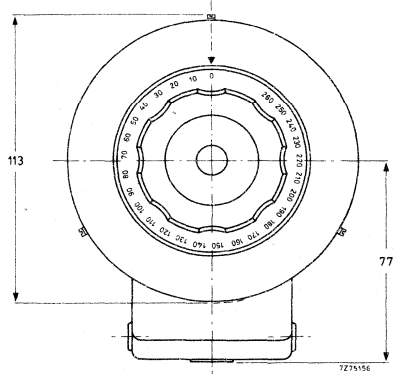


Fig. 4 Bench model.

TRANSFORMERS SIZE CODE C1

Degree of protection (IEC 144)

panel model
bench model

IP00
IP20

Mass

panel model
bench model

approx. 2,4 kg
approx. 2,8 kg

Operating torque

0,07 to 0,15 Nm

Permissible end stop torque

max. 4 Nm

Mounting

The transformer can be mounted in any position. It can be fitted to a panel or a chassis by means of 3 screws M4 (maximum length = panel thickness +9,5 mm).

Carbon brushes

Spare carbon brushes can be supplied under catalogue number 4322 026 19310 (or service number 5322 362 40011).

ACCESSORIES

The following accessories are available:

- control knobs
- ganging units
- motor drive module
- a.c. stabilizer module.

See section "Accessories"; use transformer size code C1 when selecting.
Further information on request.

VARIABLE MAINS TRANSFORMERS

- Size code C2
- To be read in conjunction with Operational Notes

QUICK REFERENCE DATA

input voltage V	output current A	output voltage V	catalogue number 2422 530		
			bench model	panel model	laboratory model
127/150	5	0 to 150		03306*	03405
220/260	2,5	0 to 260	03401*	03406*	
240/270	2,5	0 to 270	03501	03506*	
220	2,5	0 to 260			

APPLICATION

These panel model, bench model and laboratory model transformers are designed for use in laboratories and in industrial and professional equipment.

DESCRIPTION

These transformers have a single layer of copper wire wound on an annular core. This part is vacuum-impregnated and mounted on a diecast aluminium frame. The construction permits an adjustment down to exactly 0 V.

The spindle protrudes at both sides; its side-to-side position is adjustable. The spindle can be easily replaced by one of another length.

Screw terminals are provided for connecting the leads, except for the laboratory model. The bench models can also be used for panel mounting. The laboratory model transformer is a bench model transformer provided with a handle, a 3-core cable (including earth) with plug for input connection, an outlet socket, and a fuse. Both plug and socket are of the side-contact earth model.

* Approved by SEV.

TRANSFORMERS SIZE CODE C2

ELECTRICAL DATA

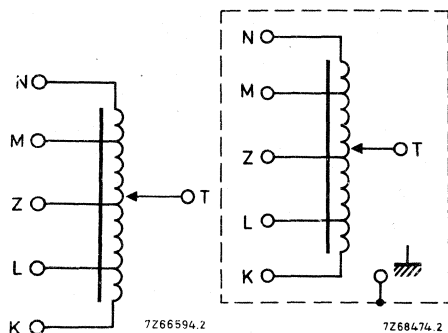


Fig. 1 Circuit diagram of panel model.
KL = NM; Z = centre tap.

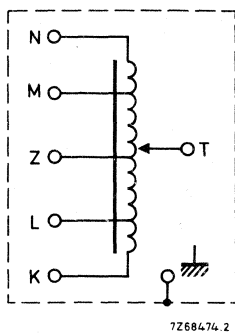


Fig. 2 Circuit diagram of bench model.
KL = NM; Z = centre tap.

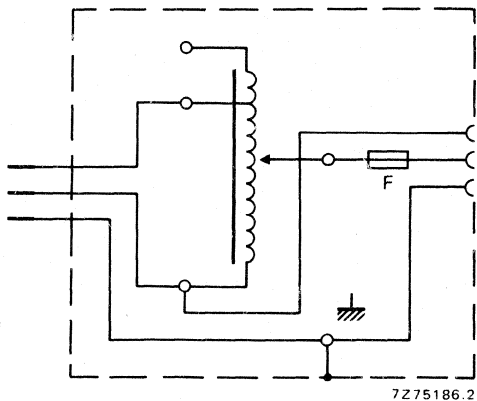


Fig. 3 Circuit diagram of laboratory model; F = 2,5 A.

2422 530

	03401	03501	
bench	03401	03501	
panel	03306	03406	03506
lab.			03405
Input voltage L to N*	127 V + 10%	220 V + 10%	240 V + 10%
Input voltage K to N	150 V + 10%	260 V + 10%	270 V + 10%
Input voltage			220 V + 10%
Output voltage, no load, T to N**	0 to ≥ 150 V	0 to ≥ 260 V	0 to ≥ 270 V
Output voltage, no load			0 to ≥ 260 V
Voltage drop at nominal output current*	≤ 5 V	≤ 9 V	≤ 9 V
Nominal output current	5 A	2,5 A	2,5 A
Maximum output current**	6,3 A [▲]	3,2 A [▲]	3,2 A [▲]
Voltage per turn of winding	0,5 V	0,48 V	0,51 V
Losses, no load	≤ 7 W	≤ 8 W	≤ 8,5 W
Permissible temperature rise at any point ^{▲▲}	max. 90 °C		

* Second letter denotes the common input/output terminal.

** The output voltage is stated for clockwise rotation when the transformer is mounted behind a panel.

• See "Operational notes" paragraph "Voltage drop".

•• See "Operational notes" paragraph "Continuous overload".

▲ See also data in the 5th, 6th and 7th column of the table on page 5.

▲▲ See "Operational notes" paragraph "Derating for higher ambient temperatures".

MECHANICAL DATA

Dimensions in mm

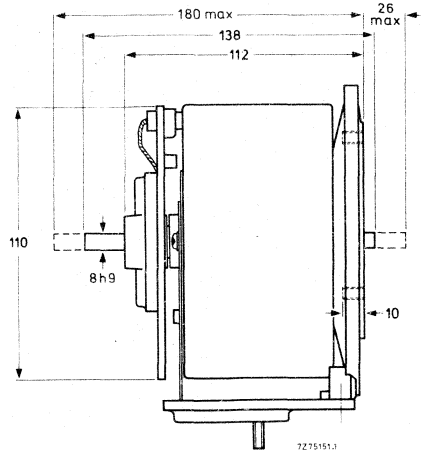
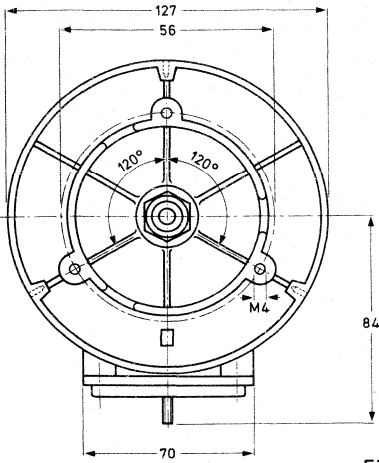
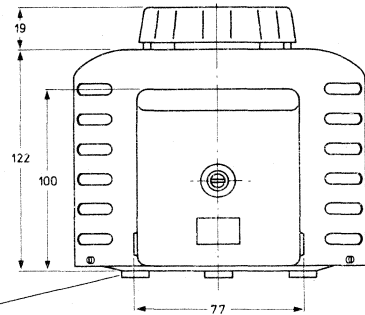


Fig. 4 Panel model.



The pads protrude approximately 3 mm.

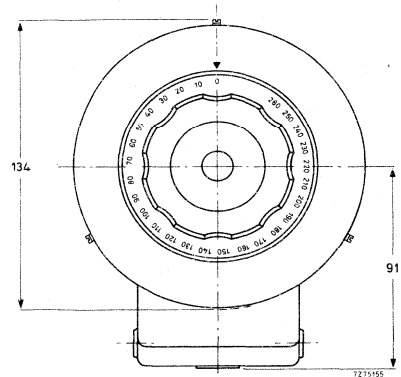


Fig. 5 Bench model.

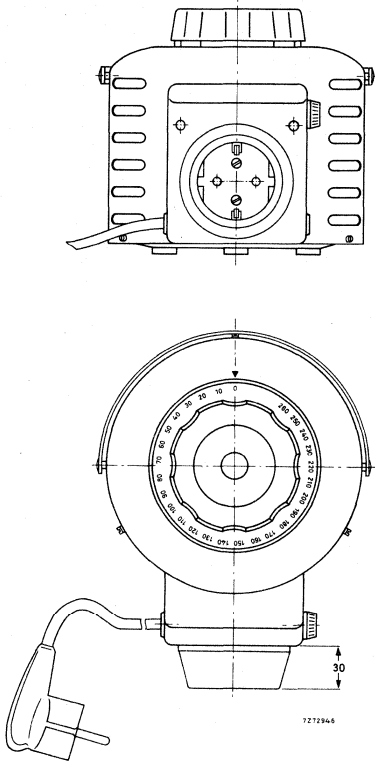


Fig. 6 Laboratory model; dimensions are identical with those in Fig. 5, except as shown.

Degree of protection (IEC144)

panel model
bench model

IP00
IP20

Mass

panel model
bench model
laboratory model

approx. 3,65 kg
approx. 4,1 kg
approx. 4,35 kg

Operating torque

0,1 to 0,2 Nm

Permissible end stop torque

max. 4 Nm

Mounting

The transformer can be mounted in any position. It can be fitted to a panel or a chassis by means of 3 screws M4 (maximum length = panel thickness + 10 mm).

Carbon brushes

Spare carbon brushes can be supplied under catalogue number 4322 027 75160 (service number 5322 362 40044).

ACCESSORIES

The following accessories are available:

- control knobs
- ganging units
- motor drive module
- a.c. stabilizer module.

See section "Accessories"; use transformer size code C2 when selecting. Further information on request.



VARIABLE MAINS TRANSFORMERS

- Moulded types; size code E1
- To be read in conjunction with Operational Notes

QUICK REFERENCE DATA

input voltage V	output current A	output voltage V	catalogue number 2422 530
240	0,5	120 to 0 or 120 to 240	00407*
120 or 240	0,25/0,5	120 to 0 or 120 to 240	90004*
240	0,5	0 to 120 or 240 to 120	90011*
110	0,6	0 to 110	00107*
60	1,2	0 to 60	00007*

APPLICATION

These panel model transformers will find their main application in those cases where inefficient load potentiometers or adjustable series resistors are used. They can also successfully replace tapped transformers in some types of inductive voltage control.

DESCRIPTION

The transformers are moulded in reinforced polyester resin. The construction is rugged and professional; the winding is protected by the moulding. The mounting is simple by means of a nut on a threaded bushing.

Soldering tags are provided for connecting the leads.

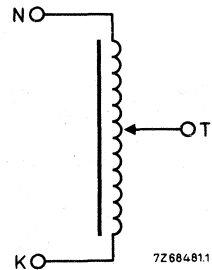
The coils of the 240 V types are wound in two layers. The outer layer forms the brush track, so that the brush sweeps half the total winding.

* Approved by SEV.

TRANSFORMERS SIZE CODE E1

ELECTRICAL DATA

Fig. 1 Circuit diagram of transformers
2422 530 00007 and 2422 530 00107.



Input voltage K to N*

Output voltage, no load, T to N**

Voltage drop at nominal output current*

Nominal output current over the whole
control range

Maximum output current**

Voltage per turn of winding

Losses, no load

Permissible temperature rise at any point[▲]

2422 530	
00007	00107
60 V + 10%	110 V + 10%
0 (+2) to 60 (-2) V	0 (+3) to 110 (-3) V
≤ 6 V	≤ 10 V
1,2 A	0,6 A
1,32 A	0,7 A
0,122 V	0,12 V
≤ 1,1 W	≤ 1,8 W
max. 70 °C	

* Second letter denotes the common input/output terminal.

** The output voltage is stated for clockwise rotation when the transformer is mounted behind a panel.

• See "Operational notes" paragraph "Voltage drop".

• See "Operational notes" paragraph "Continuous overload".

▲ See "Operational notes" paragraph "Derating for higher ambient temperatures".

▲▲ 0,25 A/0,28 A for input connection between terminals Z and N.

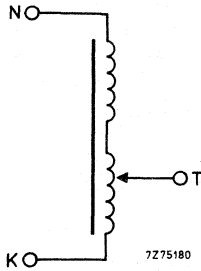


Fig. 2 Circuit diagram of transformer 2422 530 00407.

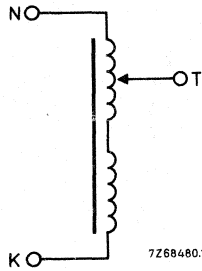


Fig. 3 Circuit diagram of transformer 2422 530 90011.

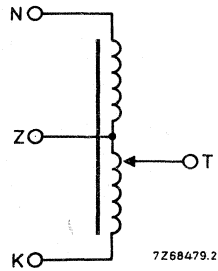


Fig. 4 Circuit diagram of transformer 2422 530 90004.

Input voltage N to K*
Output voltage, no load, T to K**

Input voltage K to N
Output voltage, no load, T to N**

Input voltage Z to N
Output voltage, no load, T to N**

Input voltage Z to K
Output voltage, no load, T to K**

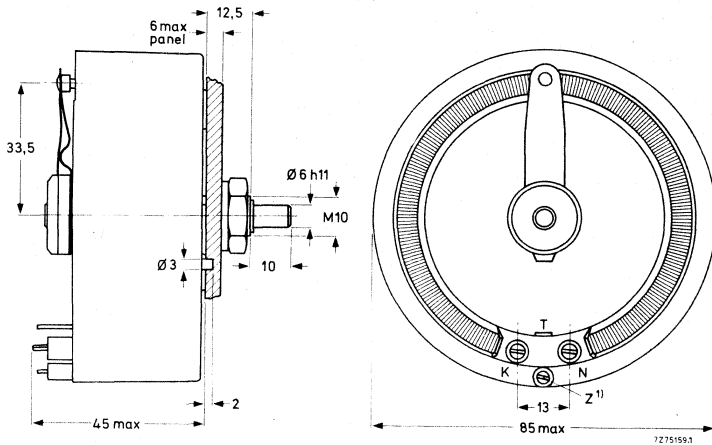
Voltage drop at nominal output current*
Nominal output current over the whole control range
Maximum output current**
Voltage per turn of winding
Losses, no load
Permissible temperature rise at any point^Δ

	2422 530		
	00407	90011	90004
Input voltage N to K*	240 V + 10%	240 V + 10%	240 V + 10%
Output voltage, no load, T to K**	120 (±2) to 0 (+3) V	240 (-3) to 120 (±2) V	120 (±2) to 0 (+3) V
Input voltage K to N	240 V + 10%	240 V + 10%	240 V + 10%
Output voltage, no load, T to N**	120 (±2) to 240 (-3) V	0 (+3) to 120 (±2) V	120 (±2) to 240 (-3) V
Input voltage Z to N			120 V + 10%
Output voltage, no load, T to N**			120 (±2) to 240 (-3) V
Input voltage Z to K			120 V + 10%
Output voltage, no load, T to K**			120 (±2) to 0 (+3) V
Voltage drop at nominal output current*	≤ 20 V	≤ 20 V	≤ 20 V
Nominal output current over the whole control range	0,5 A	0,5 A	0,5 A (0,25 A ^{ΔΔ})
Maximum output current**	0,55 A	0,55 A	0,55 A (0,28 A ^{ΔΔ})
Voltage per turn of winding		0,133 V	
Losses, no load		≤ 1,8 W	
Permissible temperature rise at any point ^Δ		max. 70 °C	

Notes: see preceding page.

MECHANICAL DATA

Dimensions in mm



¹⁾ only for 2422 530 90004

Fig. 5.

Degree of protection (IEC 144)
Mass
Operating torque
Permissible end stop torque

IP00
approx. 700 g
0,03 to 0,07 Nm
max. 1 Nm

Mounting

The transformer can be mounted in any position. It can be fitted to a panel or a chassis (maximum thickness 6 mm) by means of the nut on the threaded bushing. The mounting hole pattern is given in Fig. 6.

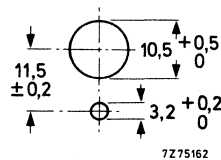


Fig. 6.

Carbon brushes

Spare carbon brushes, already mounted in the contact arm, can be supplied under catalogue number 4322 027 78660 (or service number 5322 362 40038).

ACCESSORIES

For these transformers a control knob with dial is available; see section "Accessories". Further information on request.

VARIABLE MAINS TRANSFORMERS

- Moulded types; size code E2
- To be read in conjunction with Operational Notes

QUICK REFERENCE DATA

input voltage V	output current A	output voltage V	catalogue number 2422 530
220/240	0,7	0 to 240	01407*
220	0,83	0 to 220	11407*
115/130	1,2	0 to 130	01607*
115	1,4	0 to 115	11607*
42	4	0 to 42	90031*

APPLICATION

These panel model transformers will find their main application in those cases where inefficient load potentiometers or adjustable series resistors are used. They can also successfully replace tapped transformers in some types of inductive voltage control.

DESCRIPTION

The transformers are moulded in reinforced polyester resin. The construction is rugged and professional; the winding is protected by the moulding. The mounting hole pattern is simple, the support area is relatively wide and therefore the transformers can be mounted on thin chassis or panels.

The spindle protrudes at both sides; its side-to-side position is adjustable. The spindle can be easily replaced by one of another length.

Screw terminals are provided for connecting the leads.

* Approved by SEV.

TRANSFORMERS SIZE CODE E2

ELECTRICAL DATA

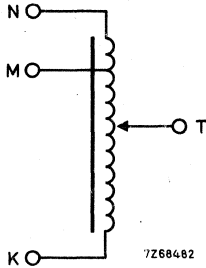


Fig. 1 Circuit diagram of transformers
2422 530 01407 and 2422 530 01607.

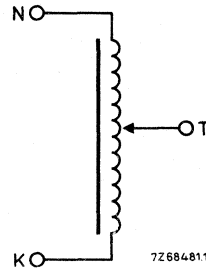


Fig. 2 Circuit diagram of transformers
2422 530 11407, 2422 530 11607 and
2422 530 90031.

Input voltage M to K*
 Input voltage N to K
 Output voltage, no load, T to K**
 Voltage drop at nominal output current*
 Nominal output current over the
 whole control range
 Maximum output current**
 Voltage per turn of winding
 Losses, no-load
 Permissible temperature rise at any point**

2422 530		
01407	11407	90031
220 V + 10%		
240 V + 10%	220 V + 10%	42 V + 10%
0 (+3) to 240 (-3) V	0 (+3) to 220 (-3) V	0 (+1) to 42 (-1) V
≤ 16 V	≤ 13 V	≤ 2 V
0,7 A	0,83 A	4 A
0,83 A [▲]	1 A	4,8 A
0,242 V	0,23 V	0,206 V
≤ 4 W	≤ 4 W	≤ 2 W
max. 70 °C		

* Second letter denotes the common input/output terminal.

** The output voltage is stated for clockwise rotation when the transformer is mounted behind a panel.

• See "Operational notes" paragraph "Voltage drop".

•• See "Operational notes" paragraph "Continuous overload".

▲ See also data in the 5th, 6th and 7th column of the table on page 5.

▲▲ See "Operational notes" paragraph "Derating for higher ambient temperatures".

2422 530

Input voltage M to K[•]
 Input voltage N to K
 Output voltage, no load, T to K^{**}
 Voltage drop at nominal output current[•]
 Nominal output current over the whole
 control range
 Maximum output current^{**}
 Voltage per turn of winding
 Losses, no load
 Permissible temperature rise at any point^{^^}

01606	11607
115 V + 10%	
130 V + 10%	115 V + 10%
0 (+2) to 130 (-2) V	0 (+2) to 115 (-2) V
≤ 7 V	≤ 6 V
1,2 A	1,4 A
1,4 A [^]	1,7 A
0,211 V	0,186 V
≤ 4 W	≤ 4 W

max. 70 °C



VARIABLE MAINS TRANSFORMERS

- Moulded types; size code E3
- To be read in conjunction with Operational Notes.

QUICK REFERENCE DATA

input voltage V	output current A	output voltage V	catalogue number 2422 530
220/260	1,2	0 to 260	08407*
220	1,4	0 to 220	18407*

APPLICATION

These panel model transformers are used as power or voltage controls in mass produced apparatus , such as air heaters, ventilator controls, etc.

DESCRIPTION

The transformers are moulded in reinforced polyester resin. The construction is rugged and professional; the winding is protected by the moulding. The mounting hole pattern is simple, the support area is relatively wide and therefore the transformers can be mounted on thin chassis or panels.

The spindle protrudes at both sides; its side-to-side position is adjustable. The spindle can be easily replaced by one of another length.

Screw terminals are provided for connecting the leads.



* Approved by SEV.

SIZE CODE E3 TRANSFORMERS

ELECTRICAL DATA

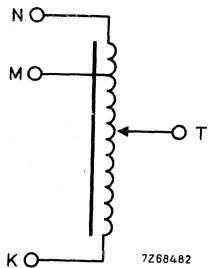


Fig. 1 Circuit diagram of transformer
2422 530 08407.

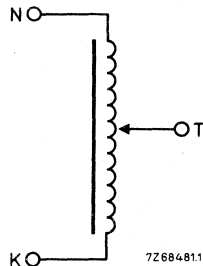


Fig. 2 Circuit diagram of transformer
2422 530 18407.

Input voltage M to K*

Input voltage N to K

Output voltage, no load, T to K**

Voltage drop at nominal output current*

Nominal output current over the whole
control range

Maximum output current**

Voltage per turn of winding

Losses, no load

Permissible temperature rise at any point**

2422 530	
08407	18407
220 V + 10%	220 V + 10%
260 V + 10%	220 V + 10%
0 (+3) to 260 (-3) V	0 (+3) to 220 (-3) V
≤ 13 V	≤ 14 V
1,2 A	1,4 A
1,4 A [^]	1,7 A
0,36 V	0,36 V
≤ 6 W	≤ 5 W
max. 70 °C	

* Second letter denotes the common input/output terminal.

** The output voltage is stated for clockwise rotation when the transformer is mounted behind a panel.

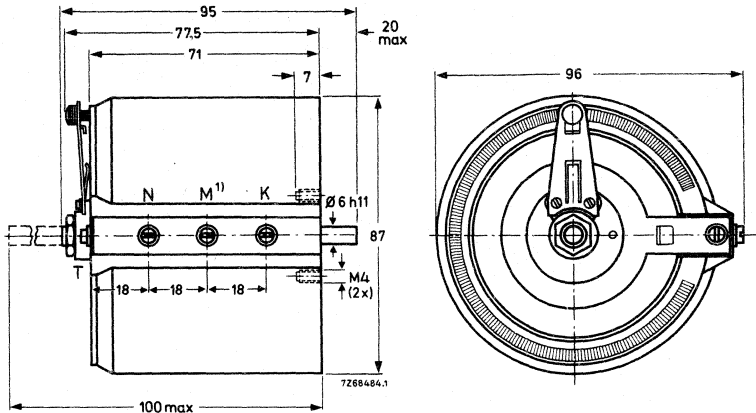
• See "Operational notes" paragraph "Voltage drop".

•• See "Operational notes" paragraph "Continuous overload".

[^] See also data in the 5th, 6th and 7th column of the table on page 5.

^{^^} See "Operational notes" paragraph "Derating for higher ambient temperatures".

MECHANICAL DATA



¹¹ only for 2422 530 08407

Fig. 3.

Degree of protection (IEC144)
Mass
Operating torque
Permissible end stop torque

IP00
approx. 1800 g
0,03 to 0,07 Nm
1 Nm

Mounting

The transformer can be mounted in any position. It can be fitted to a panel or a chassis by means of 2 screws M4 (maximum length = panel thickness +7 mm). The mounting hole pattern is given in Fig. 4.

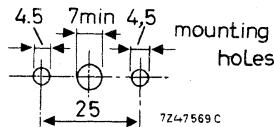


Fig. 4.

Carbon brushes

Spare carbon brushes, already mounted in the contact arm, can be supplied under catalogue number 4322 026 16310 (or service number 5322 362 40054).

ACCESSORIES

The following accessories are available:

- control knobs
- ganging units
- motor drive module
- a.c. stabilizer module.

See section "Accessories"; use size code E3 when selecting. Further information on request.



VARIABLE MAINS TRANSFORMERS

- Moulded types; size code E4
- To be read in conjunction with Operational Notes

QUICK REFERENCE DATA

input voltage V	output current A	output voltage V	catalogue number 2422 530
220/260	2	0 to 260	03407*
240/260	2	0 to 260	03507*
220	2,5	0 to 220	13407*

APPLICATION

These panel model transformers are used as power or voltage controls in mass produced apparatus, such as air heaters, ventilator controls, etc.

DESCRIPTION

The transformers are moulded in reinforced polyester resin. The construction is rugged and professional; the winding is protected by the moulding. The mounting hole pattern is simple, the support area is relatively wide and therefore the transformers can be mounted on thin chassis or panels.

The spindle protrudes at both sides; its side-to-side position is adjustable. The spindle can easily be replaced by one of another length.

Screw terminals are provided for connecting the leads.



* Approved by SEV.

TRANSFORMERS SIZE CODE E4

ELECTRICAL DATA

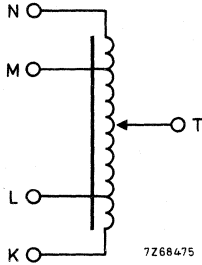


Fig. 1 Circuit diagram of transformers
2422 530 03407 and 2422 530 03507.

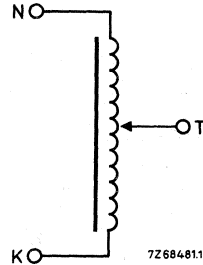


Fig. 2 Circuit diagram of transformer
2422 530 13407.

Input voltage M to K*
 Input voltage N to K
 Output voltage, no load, T to K**

 Voltage drop at nominal output current*
 Nominal output current over the whole control range
 Maximum output current**
 Voltage per turn of winding
 Losses, no load
 Permissible temperature rise at any point^^

2422 530		
03407	03507	13407
220 V + 10%	240 V + 10%	220 V + 10%
260 V + 10%	260 V + 10%	
0 (+3) to 260 (-3) V	0 (+3) to 260 (-3) V	0 (+3) to 220 (-3) V
≤ 7 V	≤ 7 V	≤ 7 V
2 A	2 A	2,5 A
2,4 A [^]	2,4 A [^]	3 A
0,488 V	0,488 V	0,478 V
≤ 8 W		
max. 70 °C		

* Second letter denotes the common input/output terminal.

** The output voltage is stated for clockwise rotation when the transformer is mounted behind a panel.

• See "Operational notes" paragraph "Voltage drop".

•• See "Operational notes" paragraph "Continuous overload".

[^] See also data in the 5th, 6th and 7th column of the table on page 5.

^{^^} See "Operational notes" paragraph "Derating for higher ambient temperatures".

MECHANICAL DATA

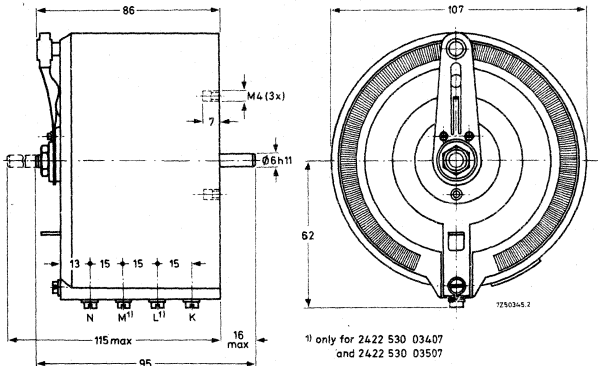


Fig. 3.

Degree of protection

IP00

Mass

approx. 3100 g

Operating torque

0,05 to 0,1 Nm

Permissible end stop torque

1 Nm

Mounting

The transformer can be mounted in any position. It can be fitted to a panel or a chassis by means of 3 screws M4 (maximum length = panel thickness + 7 mm). The mounting hole pattern is given in Fig. 4.

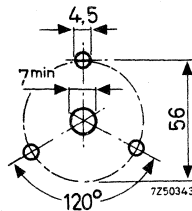


Fig. 4.

Carbon brushes

Spare carbon brushes, already mounted in the contact arm, can be supplied under catalogue number 4322 026 65540 (or service number 5322 362 40079).

ACCESSORIES

The following accessories are available:

- control knobs
- ganging units.
- motor drive module.
- a.c. stabilizer module.

See section "Accessories"; use size code E4 when selecting. Further information on request.

VARIABLE MAINS TRANSFORMERS

- Moulded types; size code E5
- Utility version
- To be read in conjunction with Operational Notes

QUICK REFERENCE DATA

input voltage V	output current A	output voltage V	catalogue number 2422 530
220	4	110 to 220	90023*
220	4	0 to 220	90024*

APPLICATION

These panel model transformers are designed to be built in laboratory, industrial and professional equipment.

DESCRIPTION

The transformers are partly moulded in reinforced polyester resin. The construction is simple but rugged; the impregnated winding is unprotected. The mounting hole pattern is simple, the support area is relatively wide and therefore the transformers can be mounted on thin chassis or panels.

The transformers do not require maintenance under normal conditions.

Screw terminals are provided for connecting the leads.

The transformers are supplied without knob or dial.



* Approved by SEV.

TRANSFORMERS SIZE CODE E5

ELECTRICAL DATA

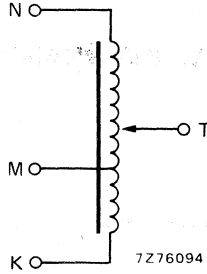


Fig. 1 Circuit diagram.

Input voltage N to K*

Output voltage, no load, T to K**

Output voltage, no load, M to K

Voltage drop at nominal output current*

Nominal output current over the whole control range

Maximum output current**

Voltage per turn of winding

Losses, no load

Permissible temperature rise at any point[^]

2422 530	
90023	90024
220 V + 10%	220 V + 10%
110 (±3) to 220 (-3) V	0 (+3) to 220 (-3) V
80 (±3) V	80 (±3) V
≤ 8,1 V	
4 A	
4,8 A	
0,61 V	
≤ 6,5 W	
max. 70 °C	

* Second letter denotes the common input/output terminal.

** The output voltage is stated for clockwise rotation when the transformer is mounted behind a panel.

• See "Operational notes" paragraph "Voltage drop".

•• See "Operational notes" paragraph "Continuous overload".

[^] See "Operational notes" paragraph "Derating for higher ambient temperatures".

MECHANICAL DATA

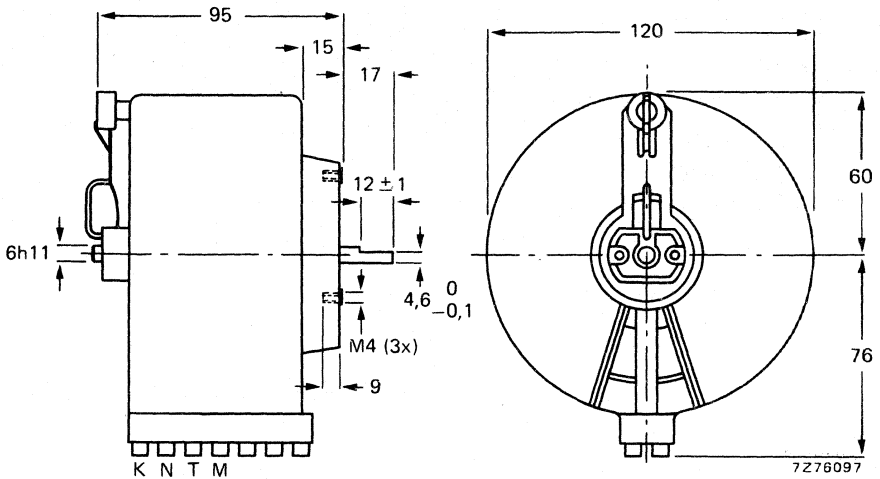


Fig. 2.

Degree of protection (IEC 144)

Mass

Operating torque

Permissible end stop torque

Total angle of rotation

2422 530 90023

2422 530 90024

IP00

approx. 4030 g

0,05 to 0,15 Nm

max. 1 Nm

approx. 160°

approx. 320°

Mounting

The transformer can be mounted in any position. It can be fitted to a panel or a chassis by means of 3 screws M4 (maximum length = panel thickness + 9 mm). The mounting hole pattern is shown in Fig. 3.

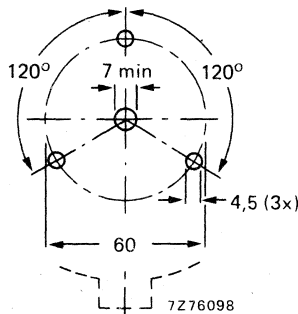


Fig. 3.

TRANSFORMERS SIZE CODE E5

Carbon brushes

Spare carbon brushes can be supplied under catalogue number 4322 028 01821 (service number 5322 362 44017).

ACCESSORIES

The following accessories are available:

- ganging units
- motor drive module
- a.c. stabilizer module.

Further information on request.



VARIABLE MAINS TRANSFORMERS

- Moulded types; size code E6
- Utility version
- To be read in conjunction with Operational Notes

QUICK REFERENCE DATA

input voltage V	output current A	output voltage V	catalogue number 2422 530
220/240/276 220	4,5 5	0 to 253 or 0 to 276 0 to 220	90028* 90027

APPLICATION

These panel model transformers are designed for use in laboratories and in industrial and professional equipment.

DESCRIPTION

The transformers are partly moulded in reinforced polyester resin. The construction is simple but rugged; the impregnated winding is unprotected. The mounting hole pattern is simple, the support area is relatively wide and therefore the transformers can be mounted on thin chassis or panels.

The transformers do not require maintenance under normal conditions.

The spindle protrudes at both sides; its side-to-side position is adjustable. The spindle can be easily replaced by one of another length.

Screw terminals are provided for connecting the leads.



* Approved by SEV.

TRANSFORMERS SIZE CODE E6

ELECTRICAL DATA

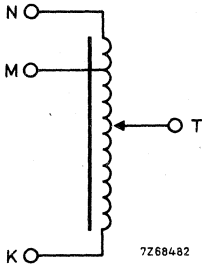


Fig. 1 Circuit diagram of transformer
2422 530 90028.

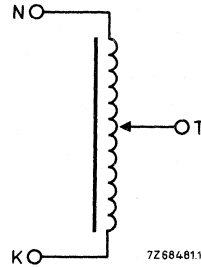


Fig. 2 Circuit diagram of transformer
2422 530 90027.

Input voltage M to K*
Output voltage, no load, T to K**
Input voltage M to K
Output voltage, no load, T to K**
Input voltage N to K
Output voltage, no load, T to K**
Voltage drop at nominal output current*
Nominal output current over the whole control range
Maximum output current**
Voltage per turn of winding
input 220 V
input 240 V
Losses, no load
Permissible temperature rise at any point**

2422 530	
90028	90027
220 V	
0 (+3) to 253 (-3) V	
240 V	
0 (+3,3) to 276 (-3,3) V	
276 V	220 V
0 (+3,3) to 276 (-3,3) V	0 (+3) to 220 (-3) V
≤ 6 V	≤ 6 V
4,5 A	5 A
5 A [▲]	6 A
0,56 V	0,543 V
0,61 V	
	≤ 8 W
	max. 70 °C

* Second letter denotes the common input/output terminal.

** The output voltage is stated for clockwise rotation when the transformer is mounted behind a panel.

• See "Operational notes" paragraph "Voltage drop".

•• See "Operational notes" paragraph "Continuous overload".

▲ See also data in the 5th, 6th and 7th column of the table on page 5.

▲▲ See "Operational notes" paragraph "Derating for higher ambient temperatures".

MECHANICAL DATA

Dimensions in mm

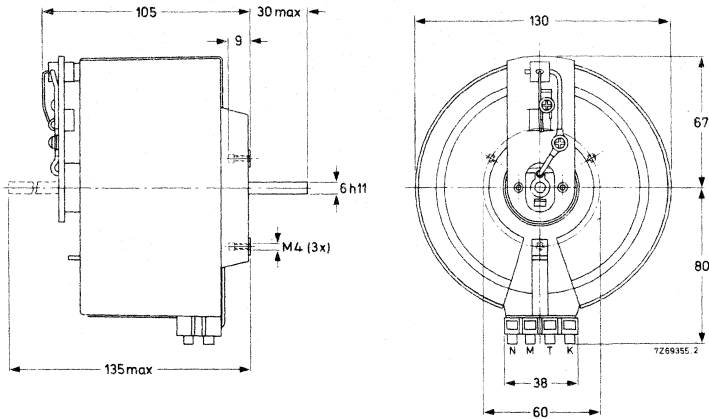


Fig. 3.

Degree of protection (IEC 144)

IP00

Mass

approx. 4,5 kg

Operating torque

0,05 to 0,15 Nm

Permissible end stop torque

max. 1 Nm

Mounting

The transformer can be mounted in any position. It can be fitted to a panel or chassis by means of 3 screws M4 (maximum length = panel thickness + 9 mm). The mounting hole pattern is in accordance with DIN42595 and shown in Fig. 4.

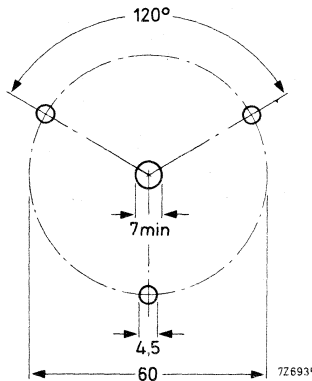


Fig. 4.



TRANSFORMERS SIZE CODE E6

Carbon brushes

Spare carbon brushes can be supplied under catalogue number 4322 027 75750 (or service number 5322 362 44012).

ACCESSORIES

The following accessories are available;

- control knobs
- ganging units
- chokes for parallel connection
- motor drive module
- a.c. stabilizer module.

See section "Accessories"; use size code E6 when selecting. Further information on request.



VARIABLE MAINS TRANSFORMERS

- Moulded types; size code E6.1
- To be read in conjunction with Operational Notes

QUICK REFERENCE DATA

input voltage V	output current A	output voltage V	catalogue number 2422 530		
			bench model	panel model	lab model
127/150	10	0 to 150		04307	
220/260	5	0 to 260	04411	04407	
240/270	5	0 to 270	04511	04507	
220	5	0 to 220			04415

APPLICATION

These panel model, bench model and laboratory model transformers are designed for use in laboratories and in industrial and professional applications.

DESCRIPTION

The annular core with a single layer of insulated copper wire is moulded in a reinforced polyester resin bottom part. The construction is simple but rugged; the transformers need no maintenance under normal conditions.

The spindle protrudes at both sides; its side-to-side position is adjustable. The spindle can be easily replaced by one of another length.

Screw terminals are provided for connecting the leads, except for the laboratory model. The bench models can also be used for panel mounting. The laboratory model transformer is a bench model transformer provided with a handle, a 3-core cable (including earth) with plug for input connection, an outlet socket, and a fuse.

Both plug and socket are of the side-contact earth model.



TRANSFORMERS SIZE CODE E6.1

ELECTRICAL DATA

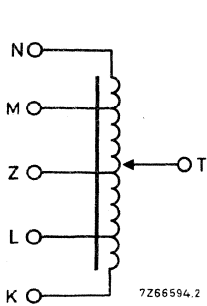


Fig. 1 Circuit diagram of panel model, KL = NM; Z = centre tap.

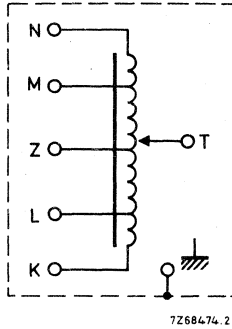


Fig. 2 Circuit diagram of bench model, KL = NM; Z = centre tap.

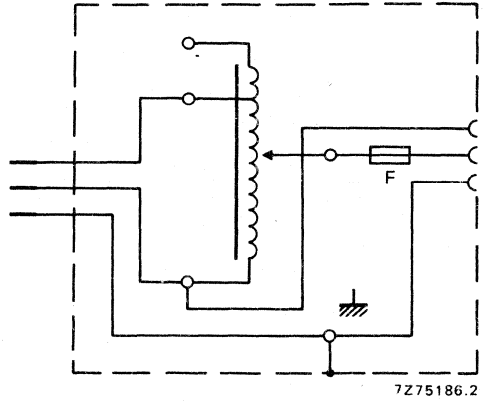


Fig. 3 Circuit diagram of laboratory model; F = 5 A.

2422 530				
bench	04411	04511		
panel 04307	04407	04507		
lab.			04415	
Input voltage L to N*	127 V + 10%	220 V + 10%	240 V + 10%	220 V + 10%
Input voltage K to N	150 V + 10%	260 V + 10%	270 V + 10%	
Input voltage				
Output voltage, no load, T to N**	0 to ≥ 150 V	0 to ≥ 260 V	0 to ≥ 270 V	
Output voltage				0 to ≥ 260 V
Voltage drop at nominal output current*	≤ 5 V	≤ 6 V	≤ 6 V	≤ 6 V
Nominal output current	10 A	5 A	5 A	5 A
Maximum output current**	12,6 A [^]	6,3 A [^]	6,3 A [^]	6,3 A
Voltage per turn of winding	0,65 V	0,63 V	0,66 V	0,63 A
Losses, no load	$\leq 10,5$ W	≤ 9 W	$\leq 10,5$ W	≤ 9 W

max. 90 °C

* Second letter denotes the common input/output terminal.

** The output voltage is stated for clockwise rotation when the transformer is mounted behind a panel.

• See "Operational notes" paragraph "Voltage drop"

•• See "Operational notes" paragraph "Continuous overload".

[^] See also data in the 5th, 6th and 7th column of the table on page 5.

^{^^} See "Operational notes" paragraph "Derating for higher ambient temperatures".

MECHANICAL DATA

Dimensions in mm

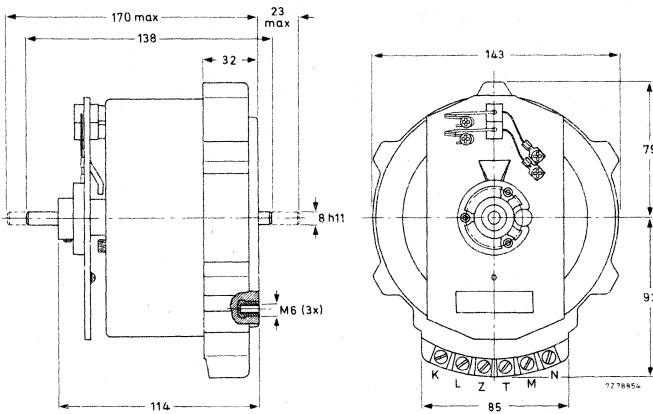
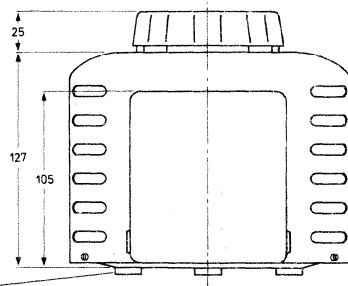


Fig. 4 Panel model.



The pads protrude approximately 4 mm.

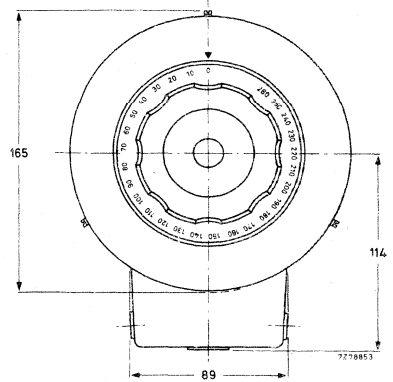


Fig. 5 Bench model.

TRANSFORMERS
SIZE CODE E6.1

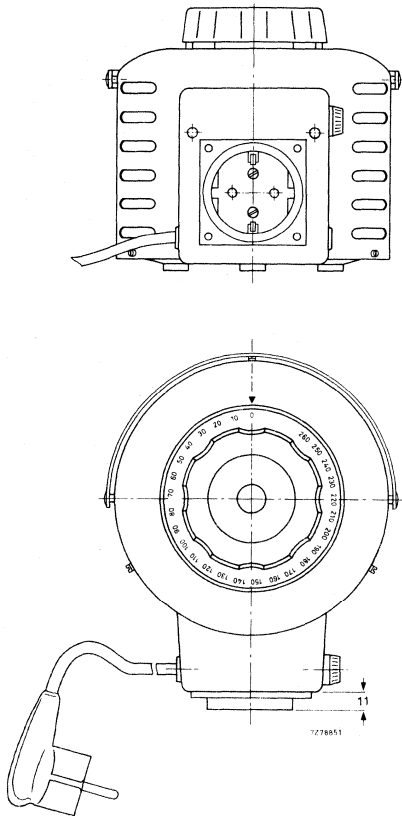


Fig. 6 Laboratory model; dimensions are identical with those in Fig. 5, except as shown.

Degree of protection	
panel model	IP00
bench model	IP20
Mass	
panel model	approx. 6 kg
bench model	approx. 6,6 kg
laboratory model	approx. 6,9 kg
Operating torque	0,15 to 0,25 Nm
Permissible end stop torque	max. 4 Nm

Mounting

The transformer can be mounted in any position. It can be fitted to a panel or a chassis by means of 3 screws M6 (maximum length = panel thickness + 10 mm). The mounting hole pattern is shown in Fig. 7.

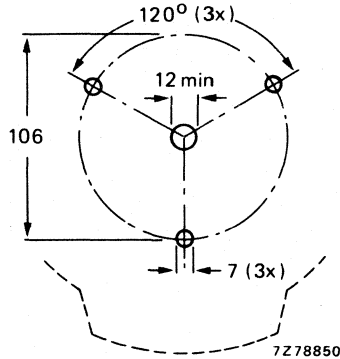


Fig. 7.

Carbon brushes

Spare carbon brushes can be supplied under catalogue number 4322 027 75160 (service number 5322 362 40044). For complete replacement transformer 2422 530 04307 need two brushes.

ACCESSORIES

The following accessories are available:

- control knobs
- ganging units
- chokes for parallel connection
- motor drive module
- a.c. stabilizer module.

See section "Accessories"; use transformer size code E6.1 when selecting. Further information on request.



VARIABLE MAINS TRANSFORMERS

- Moulded types; size code E7
- To be read in conjunction with Operational Notes

QUICK REFERENCE DATA

input voltage A	output current A	output voltage V	catalogue number 2422 530		
			bench model	panel model	lab. model
220	10	0 to 220		15407	
220/260	8,5	0 to 260	05411	05407	
240/270	8,5	0 to 270	05511	05507	
220	8,5	0 to 260			05415

APPLICATION

These panel mounting, bench model and laboratory model transformers are designed for use in laboratories and in industrial and professional equipment.

DESCRIPTION

The annular core with a single layer of insulated copper wire is moulded in a reinforced polyester resin bottom part. The construction is simple but rugged; the transformers need no maintenance under normal conditions.

The spindle protrudes at both sides; its side-to-side position is adjustable. The spindle can be easily replaced by one of another length.

Screw terminals are provided for connecting the leads, except for the laboratory model. The bench models can also be used for panel mounting. The laboratory model transformer is a bench model transformer provided with a handle, a 3-core cable (including earth) with plug for input connection, an outlet socket, and a fuse. Both plug and socket are of the side-contact earth model.



TRANSFORMERS SIZE CODE E7

ELECTRICAL DATA

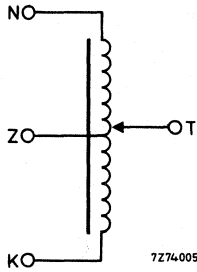


Fig. 1 Circuit diagram of panel model 2422 530 15407; Z = centre tap.

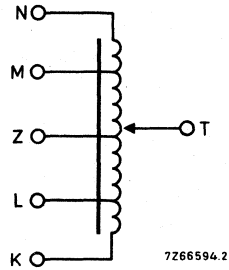


Fig. 2 Circuit diagram of panel models 2422 530 05407 and 2422 530 05507. KL = NM; Z = centre tap.

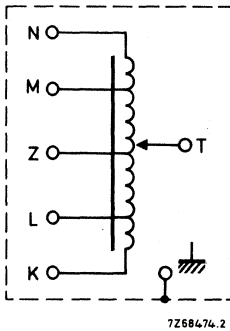


Fig. 3 Circuit diagram of bench model. KL = NM; Z = centre tap.

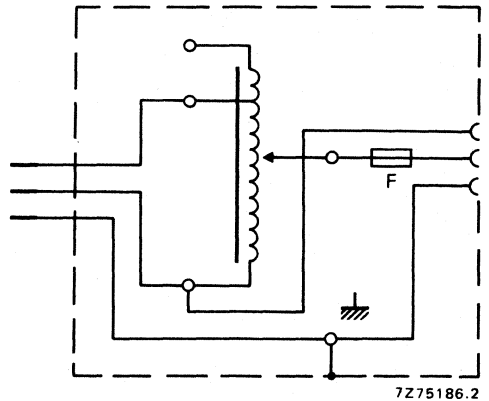


Fig. 4 Circuit diagram of laboratory model; F = 8 A.

2422 530				
	bench	05511	05511	
	panel 15407	05407	05507	
	lab.			05415
Input voltage L to N*		220 V + 10%	240 V + 10%	
Input voltage K to N	220 V + 10%	260 V + 10%	270 V + 10%	
Input voltage				220 V + 10 %
Output voltage, no load, T to N**	0 to \geq 220 V	0 to \geq 260 V	0 to \geq 270 V	
Output voltage, no load				0 to \geq 260 V
Voltage drop at nominal output current*	\leq 4 V	\leq 6 V	\leq 6 V	\leq 6 V
Nominal output current over the whole control range	10 A	8,5 A	8,5 A	8,5 A
Maximum output current**	12 A [^]	11,2 A [^]	11,2 A [^]	11,2 A
Voltage per turn of winding	0,81 V	0,81 V	0,85 V	0,81 V
Losses, no load	\leq 16 W	\leq 16 W	\leq 17,5 W	\leq 16 W
Permissible temperature rise at any point [^] [^]	max. 90 °C			

* Second letter denotes the common input/output terminal.

** The output voltage is stated for clockwise rotation when the transformer is mounted behind a panel.

• See "Operational notes" paragraph "Voltage drop".

• See "Operational notes" paragraph "Continuous overload".

[^] See also data in the 5th, 6th and 7th column of the table on page 5.

[^][^] See "Operational notes" paragraph "Derating for higher ambient temperatures".



MECHANICAL DATA

Dimensions in mm

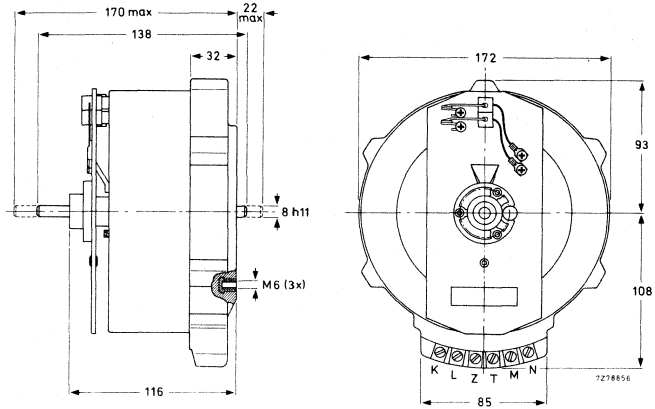
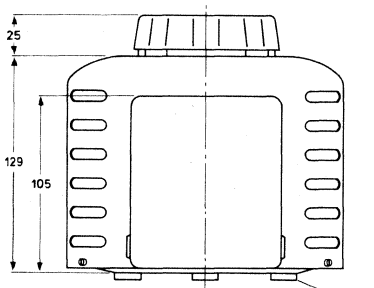


Fig. 5 Panel model.



The pads protrude approximately 4 mm.

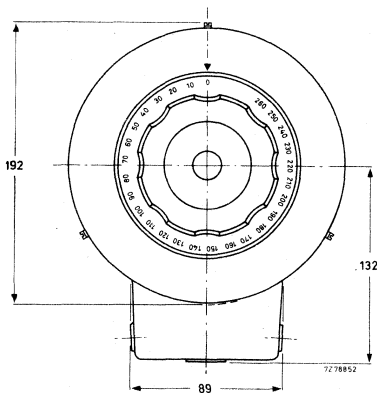


Fig. 6 Bench model.

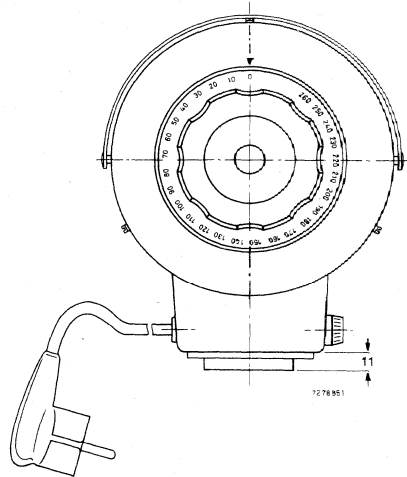
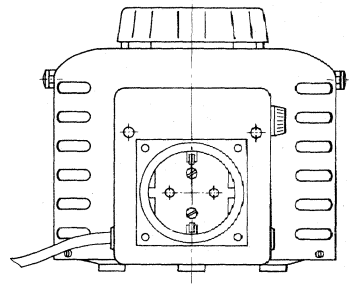


Fig. 7 Laboratory model; dimensions are identical with those in Fig. 6, except as shown.

Degree of protection (IEC 144)

- panel model
- bench model

IP00
IP20

Mass

- panel model
- bench model
- laboratory model

approx. 8,8 kg
approx. 9,6 kg
approx. 9,85 kg

Operating torque

0,2 to 0,3 Nm

Permissible end stop torque

max. 4 Nm

TRANSFORMERS SIZE CODE E7

Mounting

The transformer can be fitted to a panel or chassis by means of 3 screws M6 (maximum length = panel thickness + 11 mm). The mounting hole pattern is shown in Fig. 8.

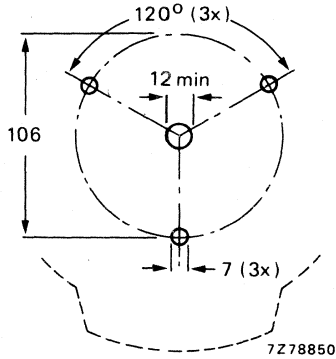


Fig. 8.

Carbon brushes

Spare carbon brushes can be supplied under catalogue number 4322 027 75160 (service number 5322 362 40044). For complete replacement the transformers need two brushes.

ACCESSORIES

The following accessories are available:

- control knobs
- ganging units
- chokes for parallel connection
- motor drive module
- a.c. stabilizer module.

See section "Accessories"; use transformer size code E7 when selecting. Further information on request.

VARIABLE MAINS TRANSFORMERS

- Moulded types; size code E8
- To be read in conjunction with Operational Notes

QUICK REFERENCE DATA

input voltage V	output current A	output voltage V	catalogue number 2422 530
220/260	12	0 to 260	06407
240/260	12	0 to 260	06507
220	15	0 to 220	16407

APPLICATION

These panel model transformers have been developed to meet the demand for larger power requirements e.g. power plants, studios, cinemas, etc.

DESCRIPTION

The annular core with a single layer of insulated copper wire is moulded in a reinforced polyester resin bottom part. The contact surface is on the cylindrical outside and it has a special metal finish to ensure permanently perfect contact and to prevent any oxidation by overheating.

The spindle protrudes at both sides; its side-to-side position is adjustable. The spindle can easily be replaced by one of another length.

Screw terminals are provided for connecting the leads.



ELECTRICAL DATA

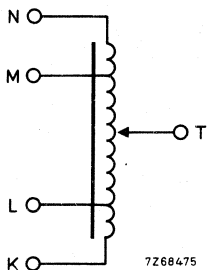


Fig. 1 Circuit diagram of transformers
2422 530 06407 and 2422 530 06507;
KL = NM.

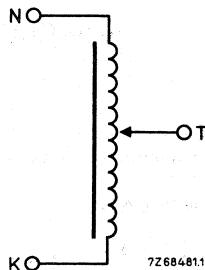


Fig. 2 Circuit diagram of transformer
2422 530 16407.

Input voltage L to N*
 Input voltage K to N
 Output voltage, no load, T to N**
 Voltage drop at nominal output current*
 Nominal output current over the whole
 control range
 Maximum output current**
 Voltage per turn of winding
 Losses, no load
 Permissible temperature rise at any point^^

2422 530		
06407	06507	16407
220 V + 10%	240 V + 10%	
260 V + 10%	260 V + 10%	220 V + 10%
0 to 260 (+3) V	0 to 260 (+3) V	0 to 260 (+3) V
≤ 6 V	≤ 6 V	≤ 4,5 V
12 A	12 A	15 A
15 A [^]	15 A [^]	18 A
0,75 V	0,75 V	0,75 V
	≤ 19,5 W	
	max. 90 °C	

* Second letter denotes the common input/output terminal.

** The output voltage is stated for clockwise rotation when the transformer is mounted behind a panel.

• See "Operational notes" paragraph "Voltage drop".

•• See "Operational notes" paragraph "Continuous overload".

[^] See also data in the 5th, 6th and 7th column of the table on page 5.

^{^^} See "Operational notes" paragraph "Derating for higher ambient temperatures".

MECHANICAL DATA

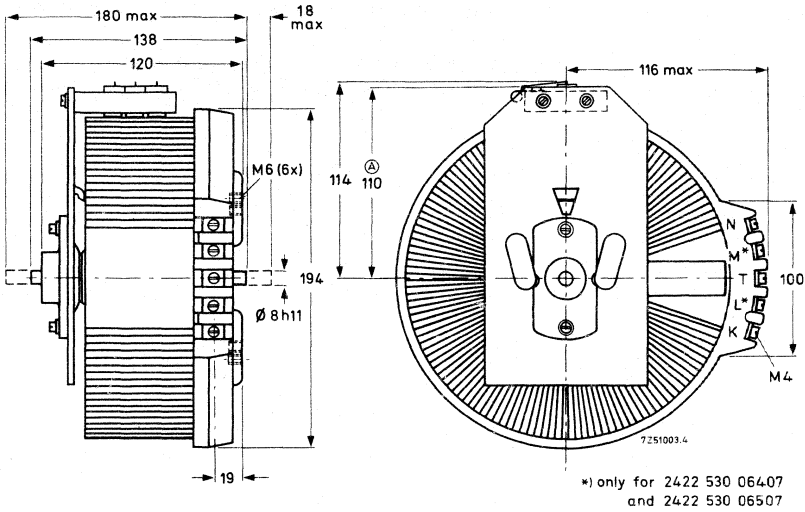


Fig. 3.

Degree of protection (IEC 144)

IP00

Mass

approx. 10 kg

Operating torque

0,25 to 0,5 Nm

Permissible end stop torque

max. 4 Nm

Mounting

The transformer can be mounted in any position. It can be fitted to a panel or chassis by means of 3 screws M6 (maximum length = panel thickness + 10 mm). The mounting hole pattern is given in Fig. 4. 3 Holes on the outer circle or on the inner circle are sufficient for mounting.

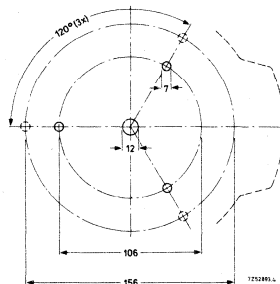


Fig. 4.

Carbon brushes

Spare carbon brushes can be supplied under catalogue number 4322 028 01801 (service number 5322 362 44016).

For older transformers with a dimension $A = 102$ mm, Fig. 3, the catalogue number of the carbon brushes is 4322 027 54810 (service number 5322 362 40096). For complete replacement the transformers need 3 brushes.

ACCESSORIES

The following accessories are available:

- control knobs
- ganging units
- chokes for parallel connection
- motor drive module
- a.c. stabilizer module.

See section "Accessories"; use size code E8 when selecting. Further information on request.



VARIABLE MAINS TRANSFORMERS

- Moulded types; size code E10
- To be read in conjunction with Operational Notes

QUICK REFERENCE DATA

input voltage V	output current A	output voltage V	catalogue number 2422 530	
			bench model	panel model
220/260	23 A	0 to 260	07411	07407
240/260	23 A	0 to 260	07511	07507

APPLICATION

These panel model and bench model transformers have been designed for industrial use e.g. cinemas, studios, power plants, etc.

DESCRIPTION

The transformers are partly moulded in reinforced polyester resin. The construction is simple but rugged. The transformers need no maintenance.

The spindle protrudes at both sides; its side-to-side position is adjustable. The spindle can be easily replaced by one of another length.

Screw terminals are provided for connecting the leads.



TRANSFORMERS SIZE CODE E10

ELECTRICAL DATA

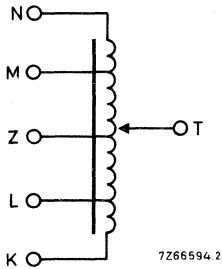


Fig. 1 Circuit diagram of panel model.

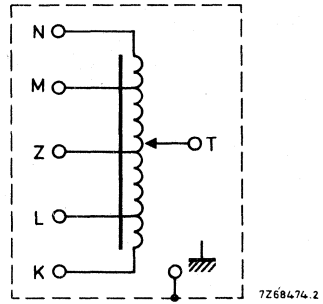


Fig. 2 Circuit diagram of bench model.

Input voltage L to N*
 Input voltage K to N
 Output voltage, no load, T to N**
 Voltage drop at nominal output current*
 Nominal output current over the whole control range
 Maximum output current**
 Voltage per turn of winding
 Losses, no load
 Permissible temperature rise at any point^^

		2422 530	
bench	07411	07511	
panel	07407	07507	
	220 V + 10%	240 V + 10%	
		260 V + 10%	
		0 to 260 (+3) V	
		≤ 6 V	
		23 A	
		30 A^	
		0,9 V	
		≤ 40 W	
		max. 90 °C	

* Second letter denotes the common input/output terminal.

** The output voltage is stated for clockwise rotation when the transformer is mounted behind a panel.

• See "Operational notes" paragraph "Voltage drop".

• See "Operational notes" paragraph "Continuous overload".

^ See also data in the 5th, 6th and 7th column of the table on page 5.

^^ See "Operational notes" paragraph "Derating for higher ambient temperatures".

MECHANICAL DATA

Dimensions in mm

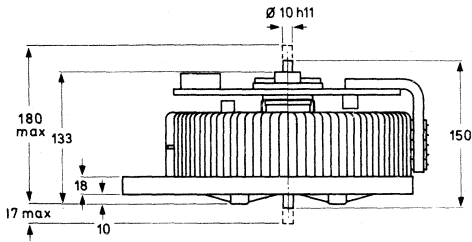
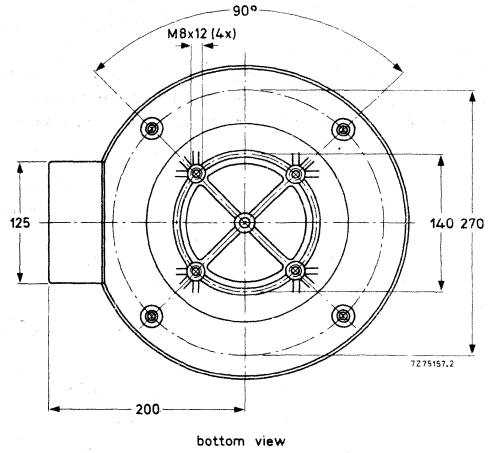
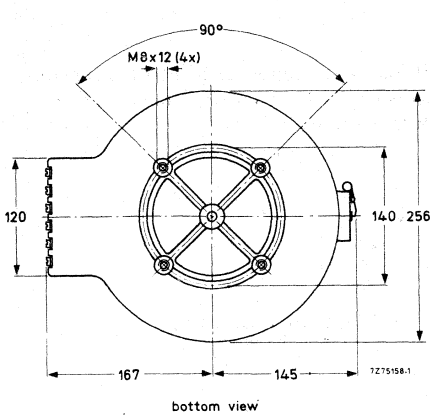


Fig. 3 Panel model.

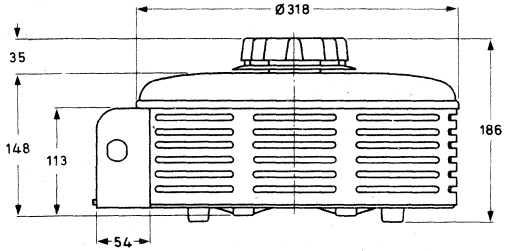


Fig. 4 Bench model.

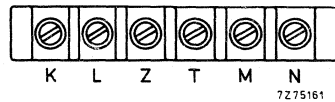


Fig. 5 Connection strip.

Degree of protection (IEC 144)

Mass

Operating torque

Permissible end stop torque

bench model	panel model.
IP20	IP00
approx. 19,8 kg	approx. 17,9 kg
	1 to 1,5 Nm
	max. 5 Nm

TRANSFORMERS SIZE CODE E10

Carbon brushes

Spare carbon brushes can be supplied under catalogue number 4322 028 01801 (service number 5322 362 44016). For complete replacement the transformers need 5 brushes.

Mounting

The transformer can be mounted in any position. Both panel and bench models can be fitted to a panel or chassis by means of 4 screws M8 (maximum length = panel thickness +12 mm). The mounting hole pattern is shown in Fig. 6. Remove pads of bench model before mounting.

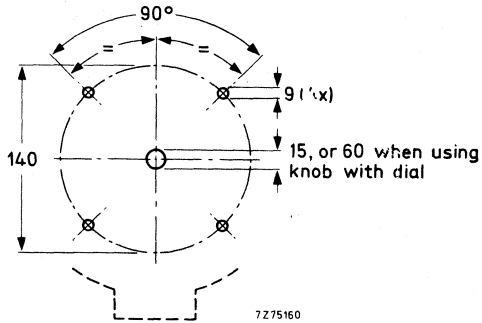


Fig. 6.

ACCESSORIES

The following accessories are available:

- control knobs
- ganging units
- chokes for parallel connection
- motor drive module
- a.c. stabilizer module.

See section "Accessories"; use size code E10 when selecting. Further information on request.

VARIABLE MAINS TRANSFORMERS
(SEPARATE WINDINGS)



VARIABLE MAINS TRANSFORMERS

- With separate windings; size code E7.1
- Moulded types

QUICK REFERENCE DATA

input voltage V	output current A	output voltage V	catalogue number 2422 529	
220	3	0 to 262	panel model	lab. model
			00008	00007

APPLICATION

These variable transformers find their main application as isolating transformers in radio and television repair shops and in laboratories.

DESCRIPTION

The annular core with two separated layers of insulated copper wire is moulded in a reinforced polyester resin bottom part. The construction is simple but rugged; the transformers need to maintainance under normal conditions.

The coil resistance is very low. The contact surface is on the top of the coil. The angle of rotation is 320°; end stops prevent the two brushes, which operate in parallel, from overrunning the contact track.

The spindle protrudes at both sides; its side-to-side position is adjustable. The spindle can easily be replaced by one of another length.

The panel model is provided with screw terminals for connecting the leads.

The laboratory model is a metal encased Class II transformer. It is short-circuit proof by means of a non-self-resetting thermal and magnetical cut-out, which opens the output circuit when the transformer is overloaded or short-circuited. The transformer is provided with a plug according to CEE7 (pin diameter 4,8 mm; pin distance 19 mm), a socket outlet for accepting similar plugs, and a voltmeter for indicating the output voltage.



TRANSFORMERS SIZE CODE E7.1

ELECTRICAL DATA

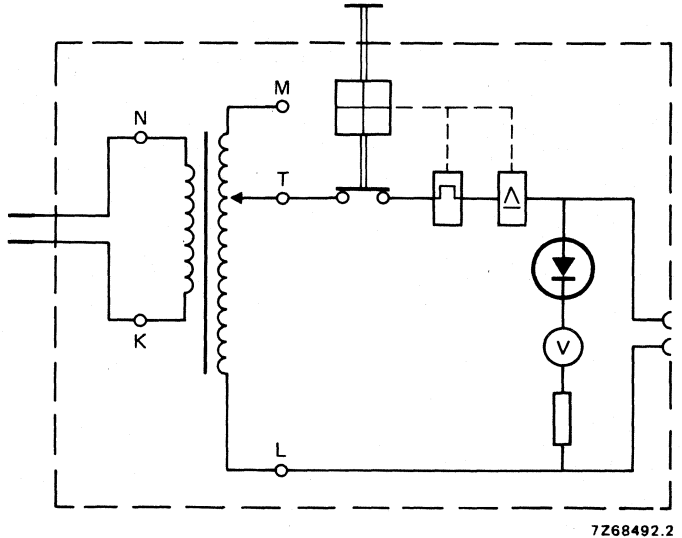
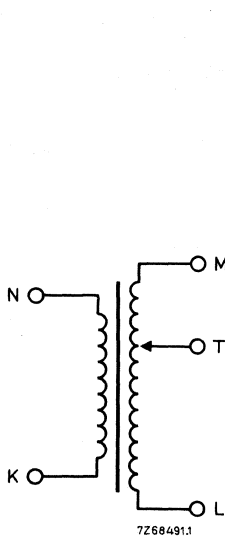


Fig. 1 Circuit diagram of panel model.

Fig. 2 Circuit diagram of laboratory model.

Input voltage N to K	220 V + 10%
Output voltage, no load M to T *	0 to ≥ 262 V
Voltage drop at nominal output current	≤ 12 V
Nominal output current over the whole control range	3 A
Short term overload current	5 A
Voltage per turn of winding	0,83 V
Losses, no load	≤ 11 W
Frequency range	50 to 60 Hz
Insulation resistance** after damp heat test (IEC 68-2, test Ca, 21 days)	> 5 M Ω
Test voltage** for 1 min	2000 V, 50 Hz
Air gap**	≥ 4 mm
Leakage path**	≥ 5 mm
Ambient temperature range	-10 to +40 °C
Climatic category, IEC 68-1	10/040/21
Maximum temperature rise at any point	70 °C

* Clockwise rotation of the spindle results in an increasing output voltage when the transformer is mounted behind a panel.

** Between windings and between live and non-live parts.

MECHANICAL DATA

Dimensions in mm

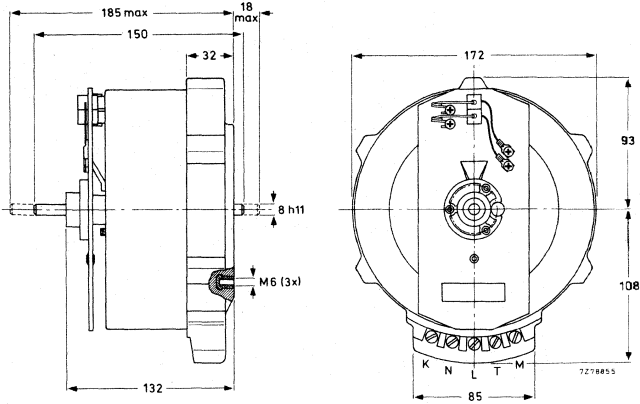


Fig. 3 Panel model.

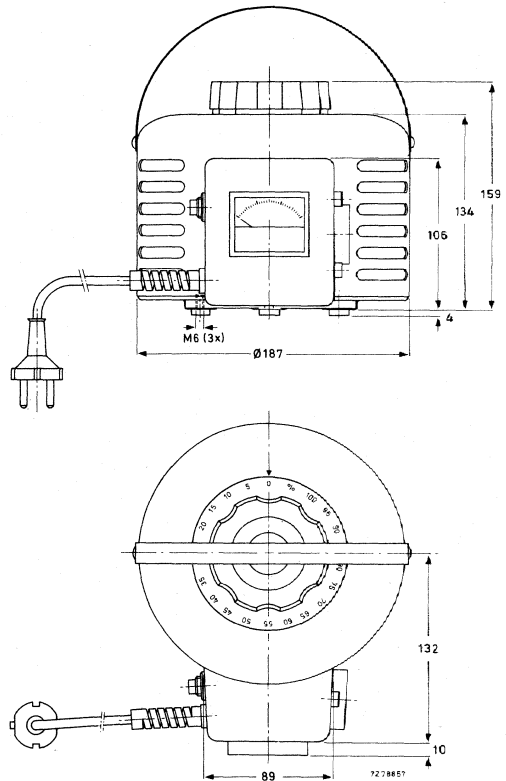


Fig. 4 Laboratory model.

TRANSFORMERS SIZE CODE E7.1

Degree of protection (IEC 144)

panel model
laboratory model

IP00
IP20

Mass

panel model
laboratory model

approx. 9 kg
approx. 10,2 kg

Operating torque

0,15 to 0,3 Nm

Permissible end stop torque

max. 4 Nm

Total angle of rotation

320°

Life of carbon brushes, guaranteed

> 100 000 complete rotations

Life of carbon brushes, expected

> 250 000 complete rotations

Mounting

Mounting position: any

The transformers can be fitted to a panel or a chassis by means of 3 screws M6 (maximum length = panel thickness + 10 mm). The mounting hole pattern is shown in Fig. 5.

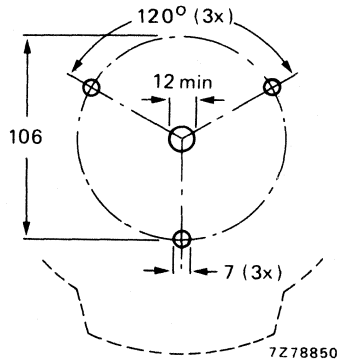


Fig. 5.

Carbon brushes

Spare carbon brushes can be supplied under catalogue number 4322 027 75160 (or service number 5322 362 40044). For complete replacement the transformers need two brushes.

ACCESSORIES

For these transformers a control knob with dial is available. See section "Accessories"; use size code E7.1 when selecting. Further information on request.

ACCESSORIES



	page
Ganging and motor drive	79
A.C. stabilizer module	103
Control knobs	109

GANGING AND MOTOR DRIVE

INTRODUCTION

Variable mains transformers can be electrically connected in parallel or in series. To prevent high inter-change currents, caused by differences in output voltage between parallel connected transformers, **chokes** should be inserted between the output terminals of the transformers.

For the mechanical ganging of two or three variable transformers **ganging units** must be used, which are supplied in an assembly kit.

Most transformers, either ganged or individual, can be provided with a remote-controlled **motor drive module**.

A motor drive module consists of the following parts:

- reversible synchronous motor;
- phasing capacitor;
- gear box;
- ganging unit for the motor drive;
- top plate with connecting block, switches and auxiliary parts (supplied in assembly kit).

Instructions for use are packed with the kit for assembling the top plate.

For ordering the required parts, see paragraph 'Ordering'.



ELECTRICAL COUPLING

Parallel connection

Two or three variable mains transformers can be connected in parallel for the supply of higher single-phase secondary currents.

Chokes must be used to prevent high interchange currents between the parallel-connected circuits.

Transformers with size code E6, E6.1 and E7

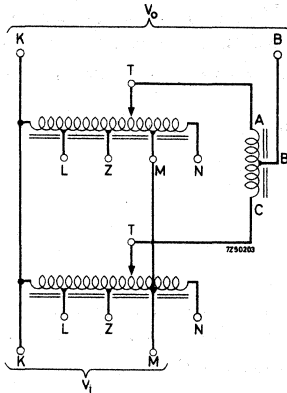


Fig. 1 Two transformers connected in parallel.

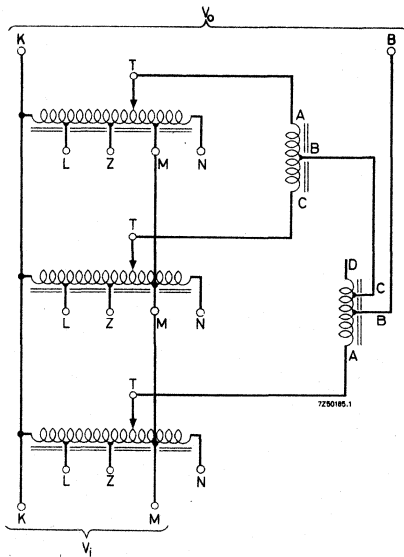


Fig. 2 Three transformers connected in parallel.

Transformers with size code E8 and E10

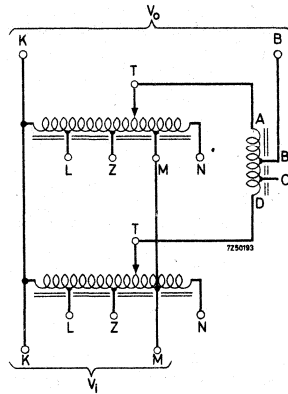


Fig. 3 Two transformers connected in parallel.

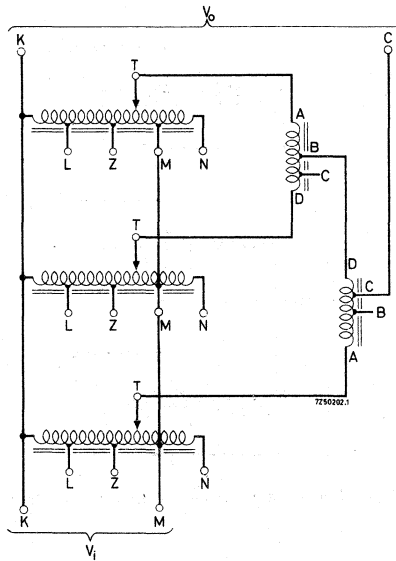


Fig. 4 Three transformers connected in parallel.

Series connection

Two variable mains transformers can be connected in series for connection of high input voltages (max. 520 V).

The two brushes move simultaneously toward, or away from, the line terminals of the transformers, which means that the load is "floating".

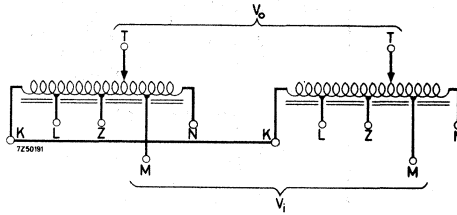


Fig. 5 Two transformers connected in series.

Three-phase connection

Three transformers in star circuit

To control three-phase voltages, three transformers can be connected in star.

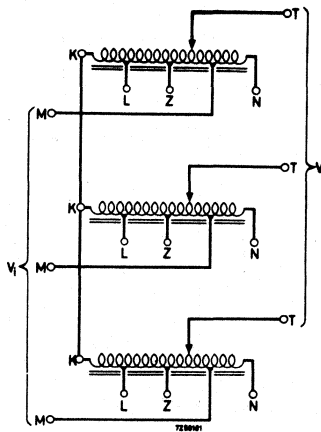


Fig. 6 Three transformers connected in star circuit.

Two transformers in open delta circuit

Voltage control of the three-phase mains can also be obtained by using two variable transformers, connected in "open delta".

The circuit applies to 127/220 V mains for transformers with 220 V input. This circuit provides full control without phase shift.

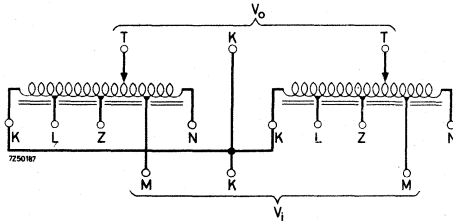


Fig. 7 Two transformers connected in open delta circuit.



Chokes

For parallel connection of two or three transformers, chokes must be inserted between the output terminals to prevent high interchange currents caused by differences in coupling. The permissible output voltage difference between the coupled transformers is ≤ 2 V.

The diagrams of the available chokes are shown in Figs 8, 9 and 10.

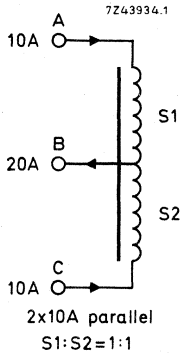


Fig. 8 Circuit diagram of choke 2422 532 00014.

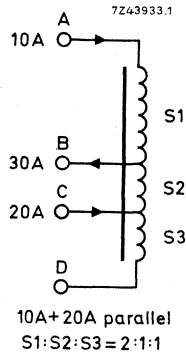


Fig. 9 Circuit diagram of choke 2422 532 00013.

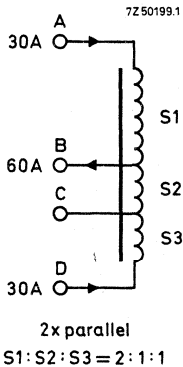
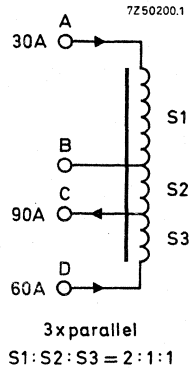


Fig. 10 Circuit diagram of choke 2422 532 00017.



MECHANICAL GANGING

Dimensions in mm

Transformers with size code C1, C2, E2, E3 and E4

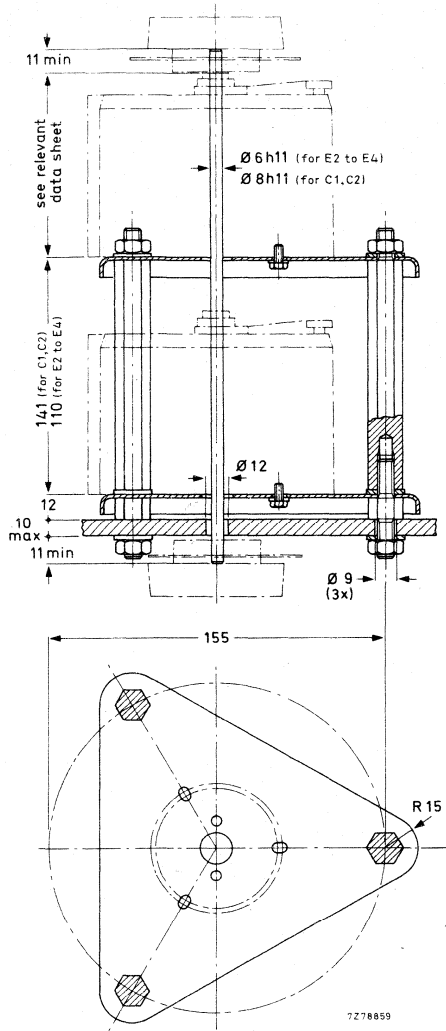


Fig. 11 Two ganged transformers.

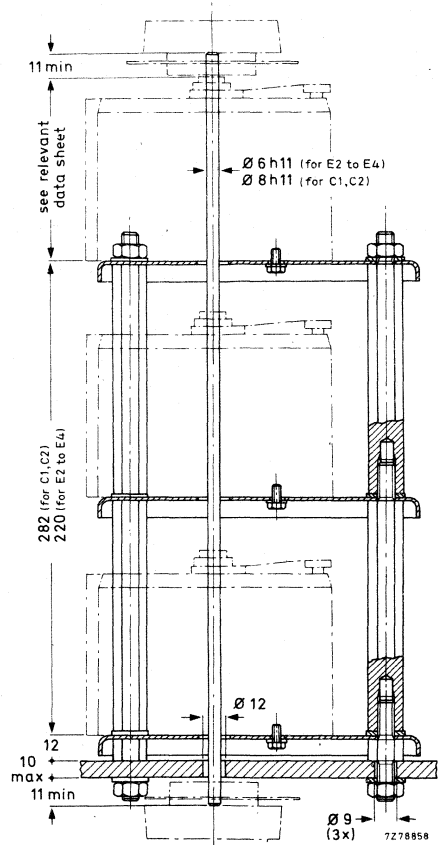


Fig. 12 Three ganged transformers.

Transformers with size code E6, E6.1 and E7

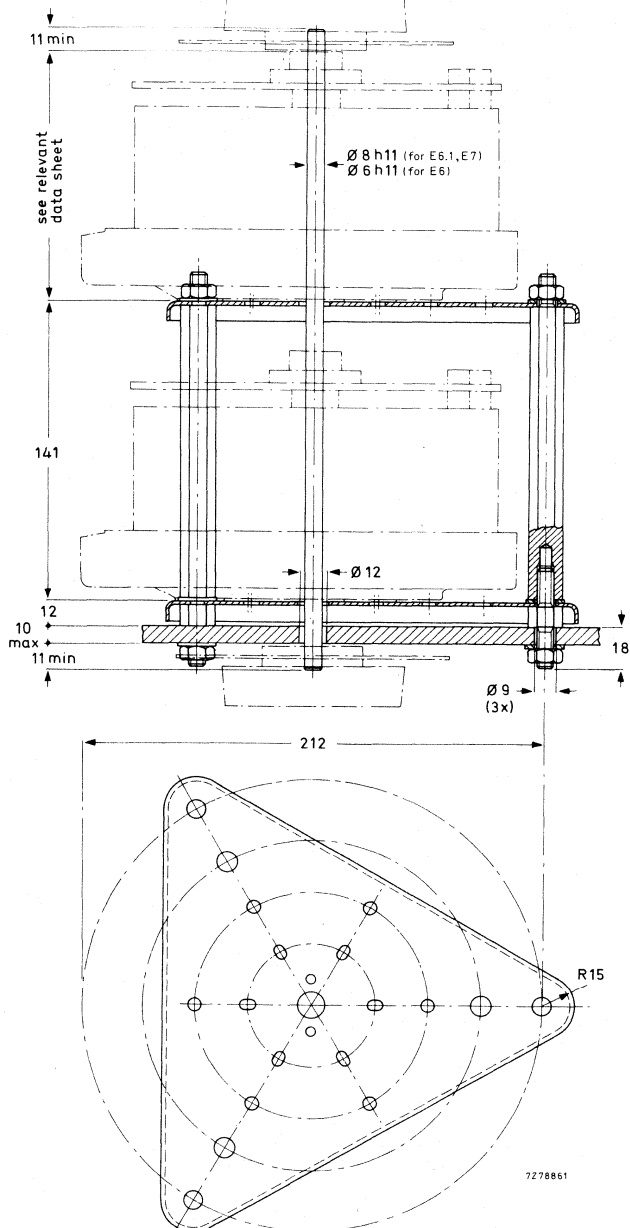


Fig. 13 Two ganged transformers.

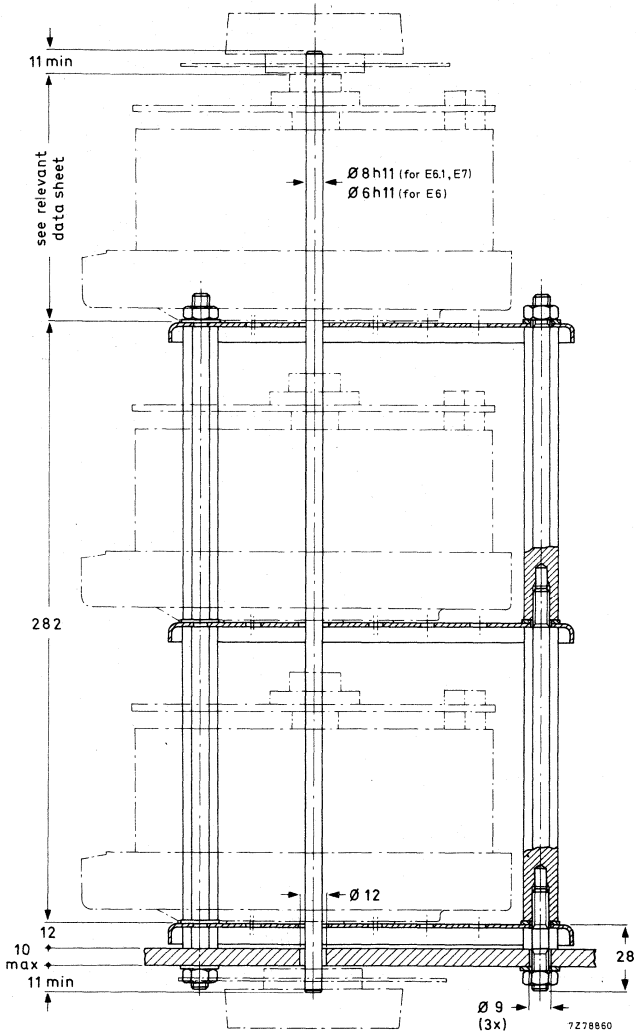


Fig. 14 Three ganged transformers.

Transformers with size code E8

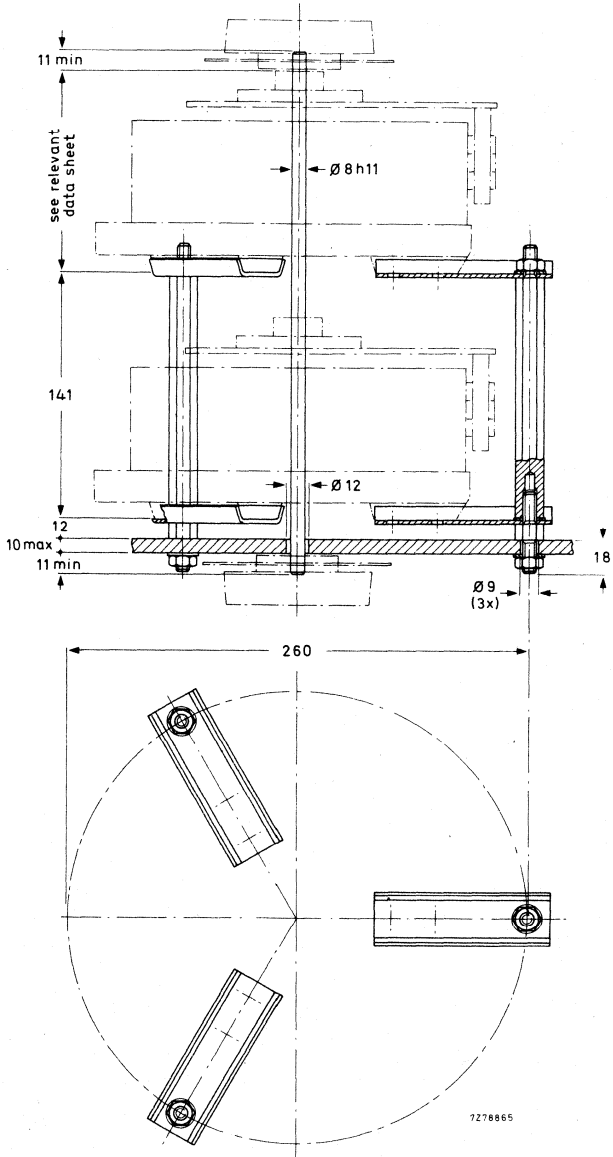


Fig. 15 Two ganged transformers.

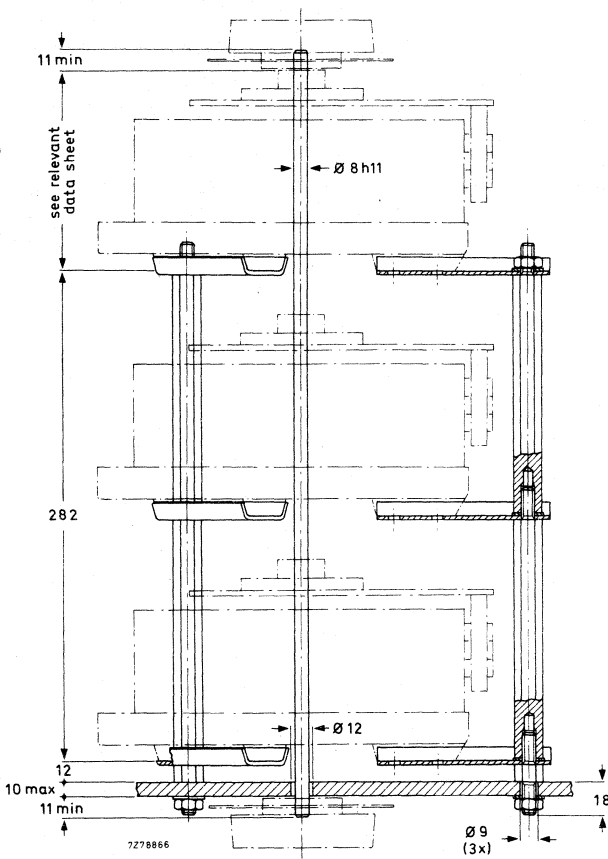


Fig. 16 Three ganged transformers.



Transformers with size code E10

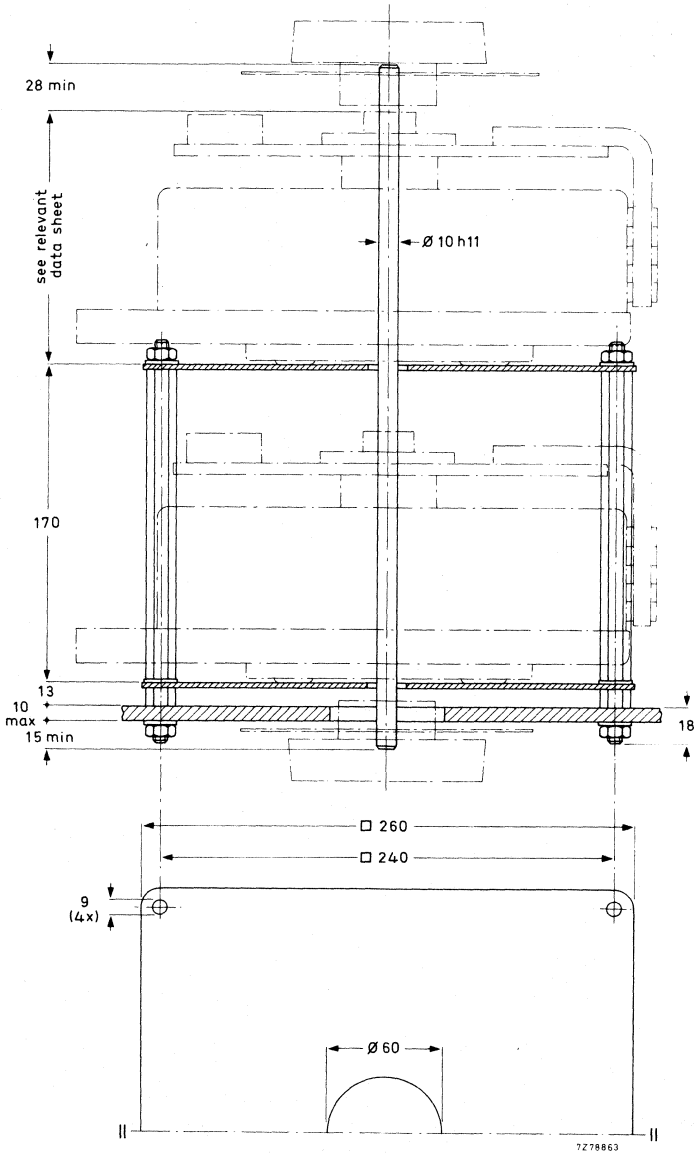


Fig. 17 Two ganged transformers.

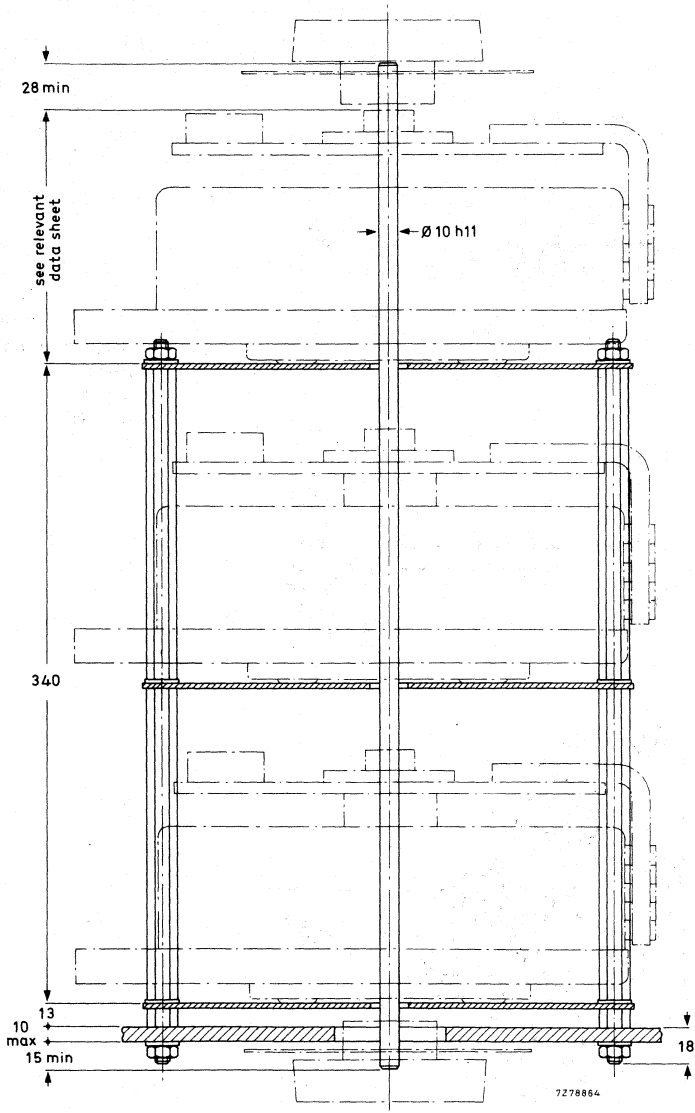


Fig. 18 Three ganged transformers.

Motor drive for transformers with size code C1, C2, E2, E3, E4, E6, E6.1 and E7

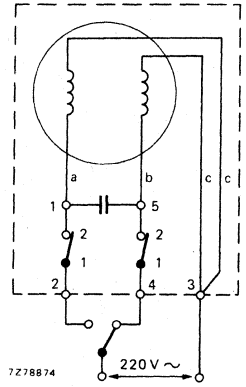
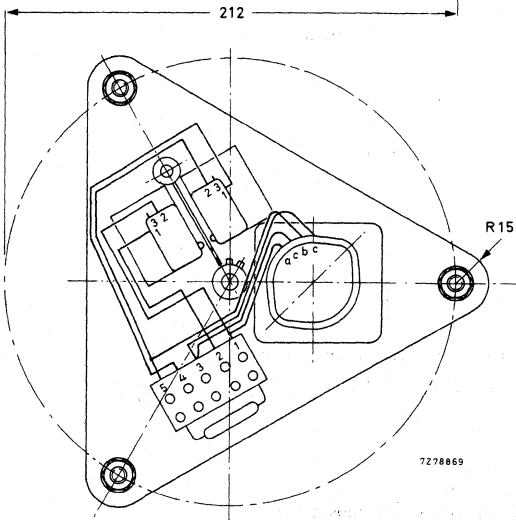
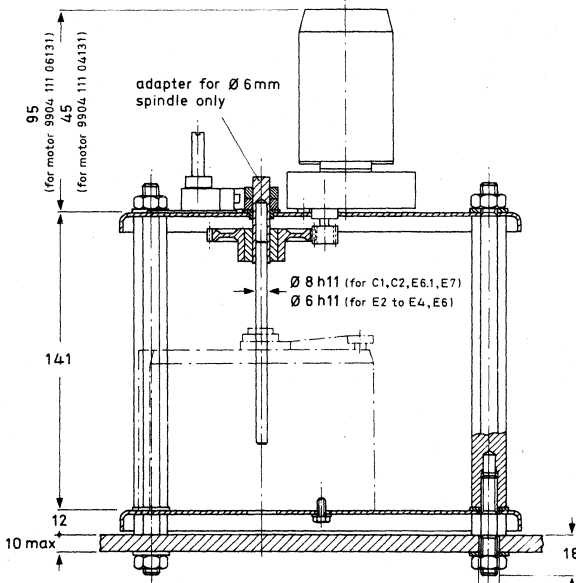


Fig. 20 Connection diagram for top-plate parts; a = blue, b = red, c = grey.

Fig. 19 Motor drive for one transformer.

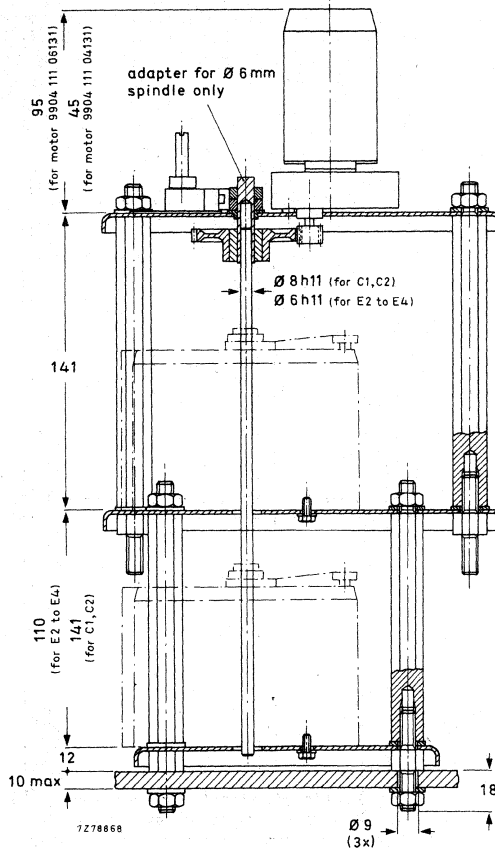


Fig. 21 Motor drive for two ganged transformers with size code C1, C2, E2, E3, E4.
For connections of top-plate parts, see Fig. 20.
For three ganged transformers, consult also Fig. 12.

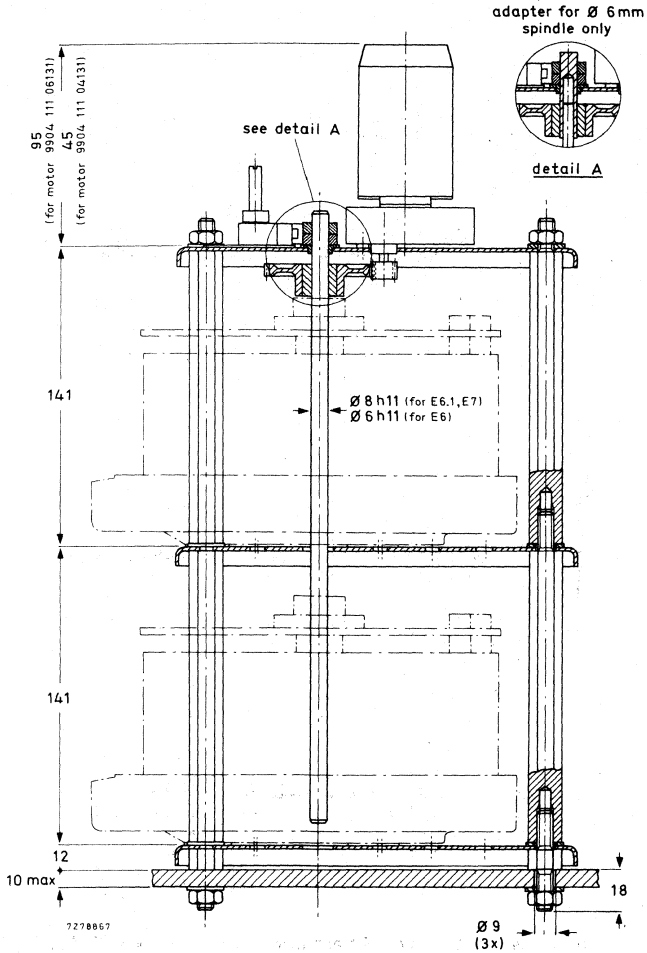


Fig. 22 Motor drive for two ganged transformers with size code E6, E6.1 and E7. For connections of top-plate parts, see Fig. 20. For three ganged transformers, consult also Fig. 14.

Motor drive for transformers with size code E8

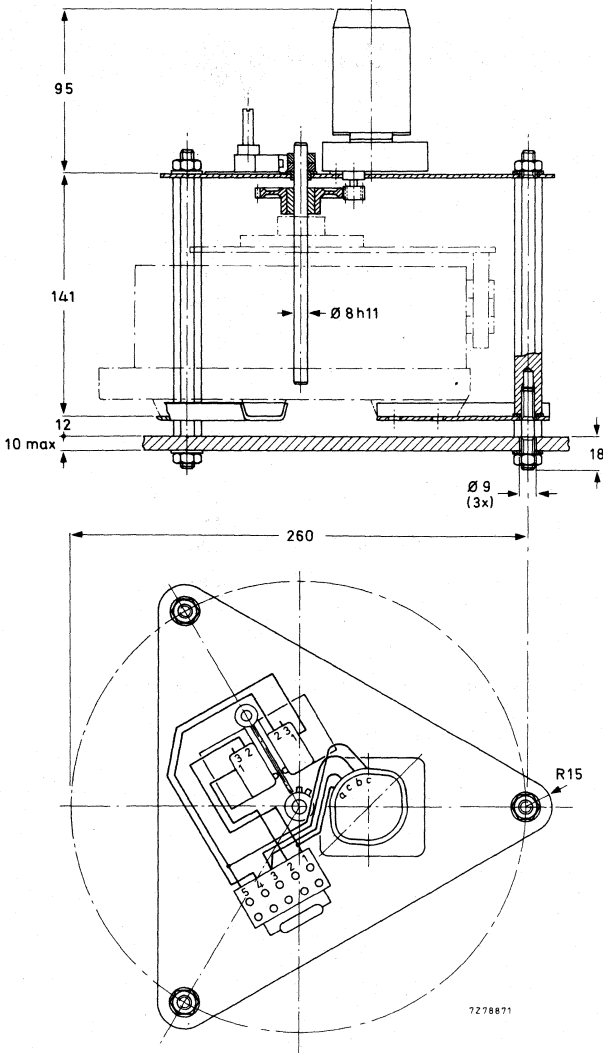


Fig. 23 Motor drive for one transformer.

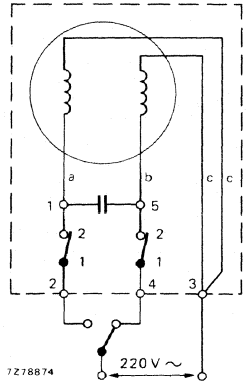


Fig. 24 Connection diagram for top-plate parts;
a = blue
b = red
c = grey.



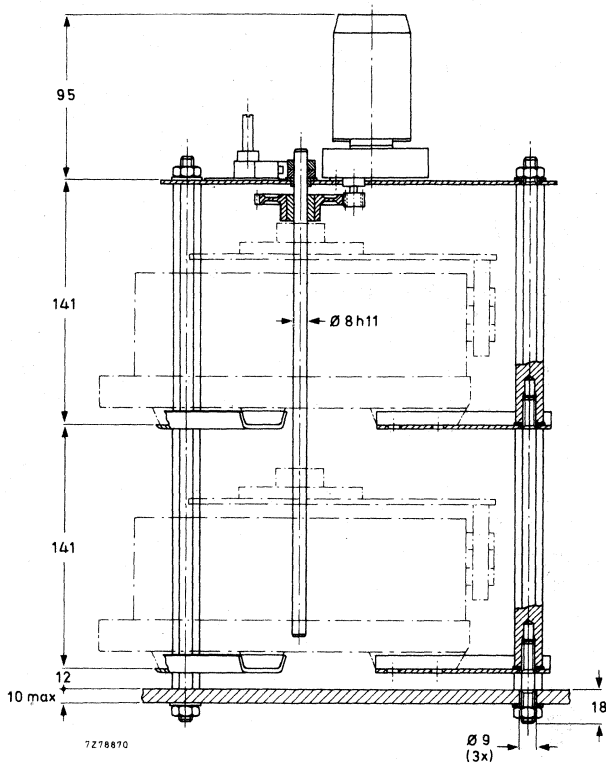


Fig. 25 Motor drive for two ganged transformers. For connection of top-plate parts, see Fig. 24.
For three ganged transformers, consult also Fig. 16.

Motor drive for transformers with size code E10

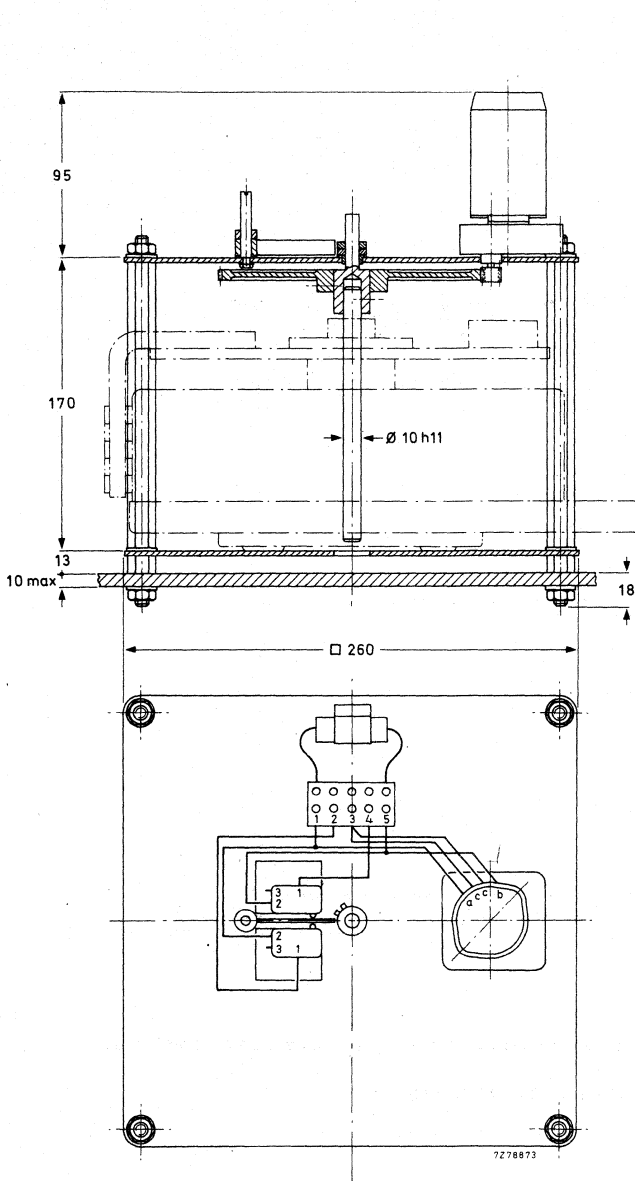


Fig. 26 Motor drive for one transformer.

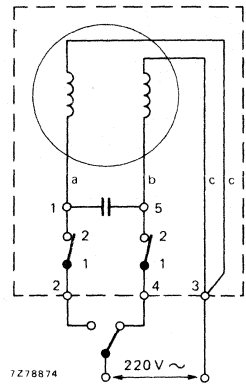


Fig. 27 Connection diagram for top-plate parts;
 a = blue
 b = red
 c = grey.

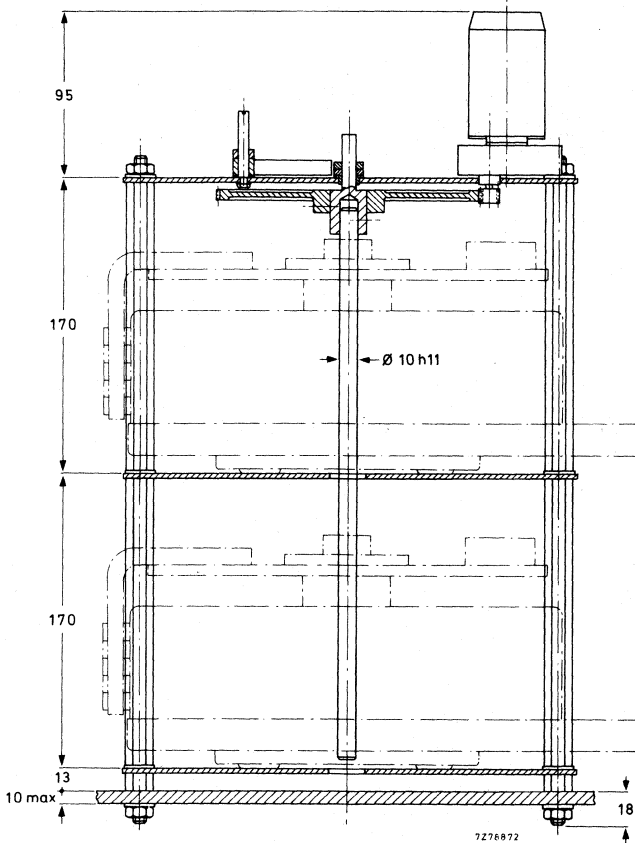


Fig. 28. Motor drive for two ganged transformers. For connection of top-plate parts, see Fig. 27.
For three ganged transformers, consult also Fig. 18.

ORDERING

In the following tables the required parts to be ordered — with catalogue number and number of pieces — are given for the various transformer size codes.

Simple motor drive components for various rotational frequencies (rotation times) as well as components for mechanical ganging (hand or motor driven) or electrical coupling may be derived from the tables.

For correct ordering pay attention to the following points:

1. For **mechanical ganging without motor drive** order ganging unit and spindle.
2. For **motor drive** order in addition to 1 the components given under the heading "motor drive".
3. For **electrical parallel connection** order also chokes.
4. If the brushes of the transformer have to stop at intermediate positions, order the special switch set, catalogue number 2422 532 00032.

**Notes to the tables on the following pages**

1. The effective rotation angle of the variable mains transformers is 320° , so the actual rotation time between end stops is $\frac{320}{360} \times$ listed rotation time.
2. A series of gear-boxes with gear ratio from 25:6 to 15000:1, catalogue number 9904 130 01 . . . is available. With these gear-boxes a pinion set 2422 532 00037 must be ordered. For further information ask your supplier.
3. Choke 2422 532 00014 may be replaced by 2422 532 00013.

ACCESSORIES

transformer size code	mechanical ganging		motor drive																
	2 transformers	3 transformers	rotation time for 1 rev. of 360° (note 1)	numbers of transf. used	top plate kit 2422 532 00027	ganging unit for motor drive 2422 532 00058	gear box (2) gear ratio						revers. synchr. motor 220 V 50 Hz 9904 111	phasing capac. 330 V a.c.		adapter spindle 4322 026 68990			
							4322 026							0,18 µF	0,056 µF				
							5:1	25:2	25:1	50:1	100:1	1500:1					3000:1		
65761	65771	65781	65791	65801	65811	65821	06131	04131	1	1									
E2, E3 and E4	ganging unit 2422 532 00057 spindle 4322 026 66750	ganging unit 2422 532 00053 spindle 4322 026 66740	6 s	1	1	1	1							1		1	1		
				2	1	1	1	1							1		1	1	
				3															1
			15 s	1	1	1		1								1		1	1
				2	1	1	1	1								1		1	1
				3	1	1		1								1		1	1
			30 s	1	1	1		1								1		1	1
				2	1	1	1	1								1		1	1
				3	1	1		1								1		1	1
			1 min	1	1	1			1							1		1	1
				2	1	1			1							1		1	1
				3	1	1			1							1		1	1
	2 min	1	1	1				1						1		1	1		
		2	1	1				1						1		1	1		
		3	1	1				1						1		1	1		
	30 min	1	1	1					1					1		1	1		
		2	1	1					1					1		1	1		
		3	1	1					1					1		1	1		
	1 h	1	1	1						1				1		1	1		
		2	1	1						1				1		1	1		
		3	1	1						1				1		1	1		
	C1 and C2	ganging unit 2422 532 00016 spindle 4322 026 08350	ganging unit 2422 532 00005 spindle 4322 026 08360	6 s	1	1	1	1							1		1		
					2	1	1	1	1							1		1	
					3														
15 s				1	1	1		1								1		1	
				2	1	1	1	1								1		1	
				3	1	1		1								1		1	
30 s				1	1	1			1							1		1	
				2	1	1	1	1								1		1	
				3	1	1		1								1		1	
1 min				1	1	1				1						1		1	
				2	1	1				1						1		1	
				3	1	1				1						1		1	
2 min		1	1	1					1					1		1			
		2	1	1					1					1		1			
		3	1	1					1					1		1			
30 min		1	1	1						1				1		1			
		2	1	1						1				1		1			
		3	1	1						1				1		1			
1 h		1	1	1							1			1		1			
		2	1	1							1			1		1			
		3	1	1							1			1		1			

Notes are on page 99.

transformer size code	mechanical ganging		choke		motor drive																	
	2 transformers	3 transformers	2 transformers	3 transformers:	rotation time for 1 rev. of 360° (note 1)	number of transf. used	top plate kit 2422 532 00027	ganging unit for motor drive		gear box (2)						revers. synchr. motor 220 V 50 Hz		phasing capac. 330 V a.c.		adapter spindle 4322 026 68990		
								2422 532 00058	2422 532 00028	gear ratio						06131	04131	0.18 µF	0.056 µF			
										5:1	25:2	25:1	50:1	100:1	1500:1						3000:1	
4322 026								65761	65771	65781	65791	65801	65811	65821	9904	111						
E6	ganging unit 2422 532 00055 spindle 4322 026 66750	ganging unit 2422 532 00056 spindle 4322 026 66740	2422 532 00014 (note 3)	2422 532 00013 + 2422 532 00014 (note 3)	6 s	1	1	1	1	1							1	1	1			
						2	1		1	1								1	1	1		
						3																1
					15 s	1	1	1				1							1	1	1	1
						2	1		1	1		1							1	1	1	1
						3	1		1	1		1							1	1	1	1
					30 s	1	1	1					1						1	1	1	1
						2	1		1	1		1							1	1	1	1
						3	1		1	1		1							1	1	1	1
					1 min	1	1	1						1					1	1	1	1
						2	1		1	1		1							1	1	1	1
						3	1		1	1		1							1	1	1	1
	2 min	1	1	1							1				1	1	1	1				
		2	1		1	1		1							1	1	1	1				
		3	1		1	1		1							1	1	1	1				
	30 min	1	1	1								1			1	1	1	1				
		2	1		1	1		1							1	1	1	1				
		3	1		1	1		1							1	1	1	1				
	1 h	1	1	1									1		1	1	1	1				
		2	1		1	1		1							1	1	1	1				
		3	1		1	1		1							1	1	1	1				
	E6.1 and E7	ganging unit 2422 532 00055 spindle 4322 026 08350	ganging unit 2422 532 00056 spindle 4322 026 08360	2422 532 00014 (note 3)	2422 532 00013 + 2422 532 00014 (note 3)	6 s	1	1	1		1						1	1				
							2	1		1	1						1	1				
							3															
15 s						1	1	1				1							1	1	1	
						2	1		1	1		1							1	1	1	
						3	1		1	1		1							1	1	1	
30 s						1	1	1					1						1	1	1	
						2	1		1	1		1							1	1	1	
						3	1		1	1		1							1	1	1	
1 min						1	1	1						1					1	1	1	
						2	1		1	1		1							1	1	1	
						3	1		1	1		1							1	1	1	
2 min		1	1	1							1				1	1	1					
		2	1		1	1		1							1	1	1					
		3	1		1	1		1							1	1	1					
30 min		1	1	1								1			1	1	1					
		2	1		1	1		1							1	1	1					
		3	1		1	1		1							1	1	1					
1 h		1	1	1									1		1	1	1					
		2	1		1	1		1							1	1	1					
		3	1		1	1		1							1	1	1					

Notes are on page 99.

A.C. STABILIZER MODULE

2422 532 00071

QUICK REFERENCE DATA

Input voltage	220 V, +10%, -15%; 50 Hz
Stabilized output voltage of the controlled transformer	5 to 115% of input voltage
Maximum stabilization accuracy	$\pm 0,5$ V
Ambient temperature range	-10 to +45 °C

APPLICATION

This automatic stabilizer module can be used in combination with motor driven transformers for correction of voltage variations. Its main use will be in those applications where the speed of response is of secondary importance to waveform distortion, and where the price per kVA of controlled power must be kept low. Examples of areas of application are test and research laboratories, service shops, and factories with complex machinery. The module can also be used as a voltage, light or temperature-sensitive control for different power sources.

DESCRIPTION

A complete a.c. stabilizer circuit consists of:

- one or more mains transformers;
- a transformer ganging unit, if two or three transformers are used;
- a motor drive module with 220 V reversible synchronous motor, see "ganging and motor drive";
- the a.c. stabilizer module;
- a control potentiometer.

The stabilizer circuit is shown in Fig. 1 in block diagram form. A stabilized power supply provides a d.c. reference voltage (V_{ref}), which is applied to the control potentiometer. This potentiometer reduces the reference voltage by a factor k_1 , thus the voltage k_1V_{ref} is applied to the comparator. The output voltage of the variable mains transformer is applied to the primary of a step-down transformer whose secondary output is rectified. The output of the rectifier, k_2V_{Out} , is applied to the other comparator input. The comparator provides an output e to the switching amplifier when the difference between k_2V_{Out} and k_1V_{ref} exceeds the value set by the accuracy potentiometer on the module. The output of the switching amplifier energizes the appropriate relay for driving the motor in the direction which corrects the voltage variation of the transformer.

The accuracy potentiometer (see Fig. 2) adjusts the stabilization accuracy between $\pm 0,5$ V and $\pm 2,5$ V; correct adjustment is necessary to prevent the system hunting. The system has a tendency to hunt because the rotor of a synchronous motor has permanent magnets and cannot stop between pole pairs, and also because the movement of the transformer brush from winding to winding causes a stepping voltage. A coincidence of these conditions can exceed the accuracy potentiometer setting causing the stabilizer to hunt for the accurate transformer brush position, therefore the accuracy potentiometer would need re-adjustment. The phenomenon is dependent on control speed, i.e. the total gear ratio between motor and transformer drive spindle, thus a high control speed must be combined with a large voltage tolerance.

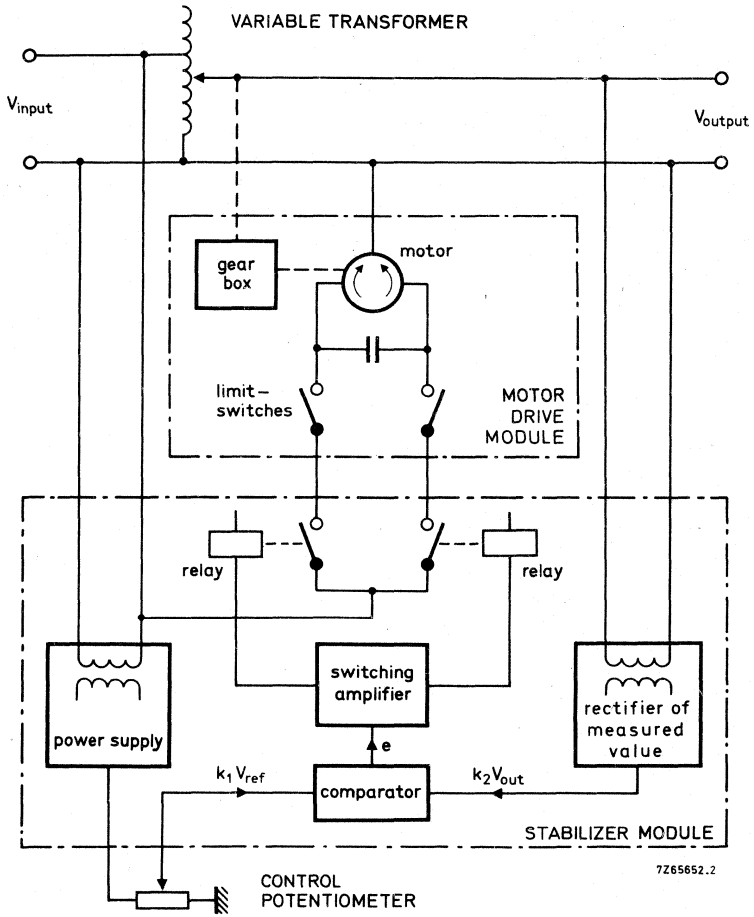
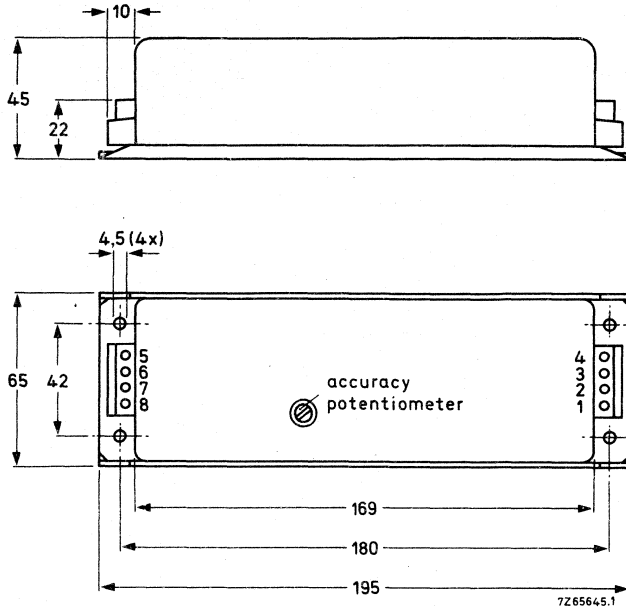


Fig. 1.

MECHANICAL DATA

Dimensions in mm

Fig. 2.



Mass: approx. 700 g
 Housing: lacquered metal
 Connections are made via two screw-terminal blocks.

ELECTRICAL DATA

Terminals 1 and 2	
input voltage	220 V, +10%, -15%; 50 Hz
power consumption, relays not operating	2,5 W
relays operating	3 W
Terminals 2 and 3	
voltage to be stabilized	0 to 260 V (a.c.)
impedance	5 kΩ
Terminals 2 and 4, and 2 and 8	
maximum switching capability of relays	250 V (a.c.), 1 A, $\cos \phi = 0,7$
Terminals 5(+) and 7(-)	
reference output voltage	+12 V (d.c.)
maximum load	5 mA
Terminals 6(+) and 7(-)	
reference input voltage	0 to +12 V (d.c.)
maximum current consumption	1 mA
Stabilized output voltage	
transformers 220 V/0-220 V	adjustable between 5 and 100% of input voltage
transformers 220 V/0-260 V	adjustable between 5 and 115% of input voltage



ACCESSORIES

Accuracy

adjustable with accuracy potentiometer between $\pm 0,5$ V (a.c.) or voltage per turn of winding, whichever is the higher*, and $\pm 2,5$ V (a.c.)

Maximum control speed

23 A transformers

6,5 V/s**

other transformers

50 V/s**

Operating temperature range

-10 to +45 °C

Storage temperature range

-25 to +85 °C

Connections

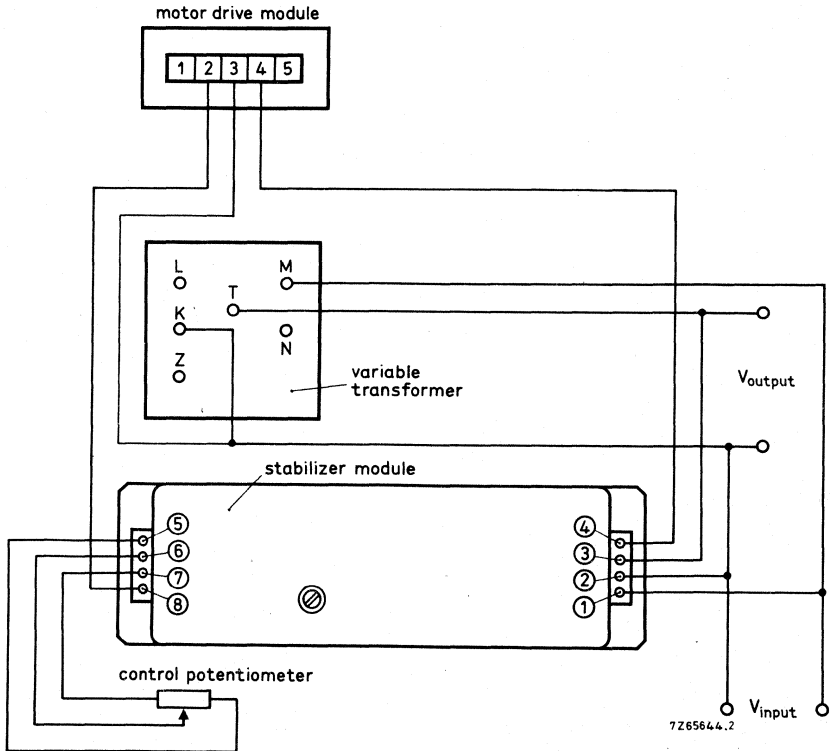


Fig. 3a.

* Valid for gear ratios $> 10:1$, see the Tables of "ganging and motor drive".

** Provided the motor and gearbox are selected from the Tables of "ganging and motor drive".

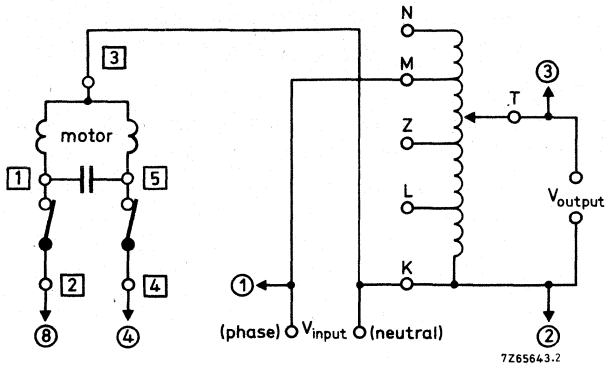


Fig. 3b.

Notes

Connections to terminals 1 and 5 of the motor drive module may require interchanging to produce correct direction of rotation (depends on type of gearbox used).

The recommended value of the control potentiometer is $5\text{ k}\Omega$, $\pm 20\%$, $0,25\text{ W}$.

If only stabilization or positioning at a lower voltage than the input voltage is required the phase can be connected to N in stead of M.

For the value of the phasing capacitor, see "ganging and motor drive".

APPLICATION INFORMATION

Heavy load application

Stabilizing a heavy load so that it is independent of input or total load current variations can be achieved by a boost transformer connected in series with the variable transformer. The permissible load is thus increased by the boost ratio factor. For example, with an input voltage of 220 V, an 8,5 A variable transformer can supply 0 to 110 V to a 5:1 ratio boost transformer thus controlling 42,5 A over 22 V.

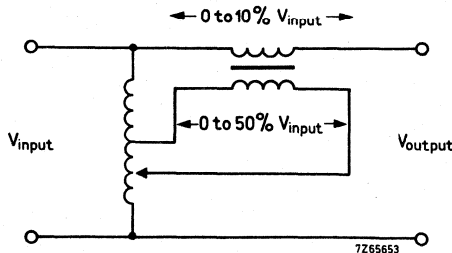


Fig. 4.

Programmed stabilization

An external programmed voltage source can be injected into the stabilizer module. This can be done by connecting a control voltage (V_{control}) of max. 12 V to terminals 6(+) and 7(-); terminal 5 is not used. Then the stabilized output voltage is: $V_{\text{output}} = k \cdot V_{\text{control}}$, in which $k = 23 \pm 7\%$.

Temperature and illumination level control

Instead of a control potentiometer a combination of fixed resistors and NTC thermistors or LDRs can be used to control a temperature or illumination level respectively.



CONTROL KNOBS

A selection of combined control knob and dial accessories is listed below. These items are intended for **panel model** transformers, to enable ease of adjustment and to provide a visual setting indication.

Choice of control knob is determined by the spindle diameter and output voltage range of the transformer. The selection includes large diameter dials which allows panel screws to be concealed.

All control knobs have a clamping collet enabling them to be locked in any position on the spindle.

dial calibration	d mm	D1 mm	D2 mm	H1 mm	H2 mm	H3 mm	catalogue number	intended for transformer size code
0 - 260 V	6	60	78	15	4	24	2922 511 90043	E1, E2, E3, E4, E6
0 - 115 %	6	60	78	15	4	24	90044	
0 - 270 V	6	60	78	15	4	24	90045	
0 - 100 %	6	60	78	15	4	24	90046	
0 - 100 %	8	60	78	15	4	24	2922 511 90047	C1, C2
0 - 115 %	8	60	78	15	4	24	90048	
0 - 260 V	8	60	78	15	4	24	90049	
0 - 270 V	8	60	78	15	4	24	90051	
0 - 100 %	8	80	106	19	4	28	2922 511 90052	E6.1, E7, E7.1, E8
0 - 115 %	8	80	106	19	4	28	90053	
0 - 260 V	8	80	106	19	4	28	90054	
0 - 270 V	8	80	106	19	4	28	90055	
0 - 100 %	8	80	125	19	4	28	2922 511 90056	E10
0 - 115 %	8	80	125	19	4	28	90057	
0 - 260 V	8	80	125	19	4	28	90058	
0 - 270 V	8	80	125	19	4	28	90059	
0 - 260 V	10	100	155	22	5	44	2922 511 90071	

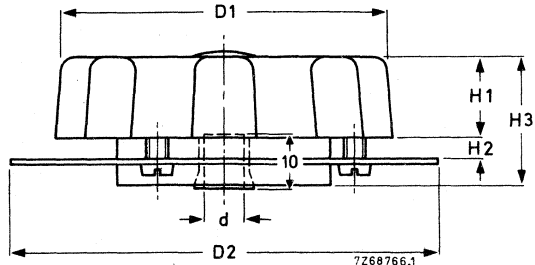


Fig. 1 Control knob with dial.


VARIABLE MAINS TRANSFORMERS




GENERAL



VARIABLE MAINS TRANSFORMERS
(AUTO-TRANSFORMERS)



VARIABLE MAINS TRANSFORMERS
(SEPARATE WINDINGS)



ACCESSORIES

Argentina: FAPESA I.y.C., Av. Covara 2550, Tablada, Prov. de BUENOS AIRES, Tel. 652-7438/7478.

Australia: PHILIPS INDUSTRIES HOLDINGS LTD., Elcoma Division, 67 Mars Road, LANE COVE, 2066, N.S.W., Tel. 427 08 88.

Austria: ÖSTERREICHISCHE PHILIPS BAUELEMENTE Industrie G.m.b.H., Triester Str. 64, A-1101 WIEN, Tel. 62 91 11.

Belgium: M.B.L.E., 80, rue des Deux Gares, B-1070 BRUXELLES, Tel. 523 00 00.

Brazil: IBRAPE, Caixa Postal 7383, Av. Brigadeiro Fari Alima, 1735 SAO PAULO, SP, Tel. (011) 211-2600.

Canada: PHILIPS ELECTRONICS LTD., Electron Devices Div., 601 Milner Ave., SCARBOROUGH, Ontario, M1B 1M8, Tel. 292-5161.

Chile: PHILIPS CHILENA S.A., Av. Santa Maria 0760, SANTIAGO, Tel. 39-40 01.

Colombia: SADAPE S.A., P.O. Box 9805, Calle 13, No. 51 + 39, BOGOTA D.E. 1., Tel. 600 600.

Denmark: MINIWATT A/S, Emdrupvej 115A, DK-2400 KØBENHAVN NV., Tel. (01) 69 16 22.

Finland: OY PHILIPS AB, Elcoma Division, Kaivokatu 8, SF-00100 HELSINKI 10, Tel. 1 72 71.

France: R.T.C. LA RADIOTECHNIQUE-COMPELEC, 130 Avenue Ledru Rollin, F-75540 PARIS 11, Tel. 355-44-99.

Germany: VALVO, UB Bauelemente der Philips G.m.b.H., Valvo Haus, Burchardstrasse 19, D-2 HAMBURG 1, Tel. (040) 3296-1.

Greece: PHILIPS S.A. HELLENIQUE, Elcoma Division, 52, Av. Syngrou, ATHENS, Tel. 915 311.

Hong Kong: PHILIPS HONG KONG LTD., Elcoma Div., 15/F Philips Ind. Bldg., 24-28 Kung Yip St., KWAI CHUNG, Tel. NT 24 51 21.

India: PHILIPS INDIA LTD., Elcoma Div., Band Box House, 254-D, Dr. Annie Besant Rd., Prabhadevi, BOMBAY-25-DD, Tel. 457 311-5.

Indonesia: P.T. PHILIPS-RALIN ELECTRONICS, Elcoma Division, "Timah" Building, Jl. Jen. Gatot Subroto, P.O. Box 220, JAKARTA, Tel. 44 163.

Ireland: PHILIPS ELECTRICAL (IRELAND) LTD., Newstead, Clonskeagh, DUBLIN 14, Tel. 69 33 55.

Italy: PHILIPS S.p.A., Sezione Elcoma, Piazza IV Novembre 3, I-20124 MILANO, Tel. 2-6994.

Japan: NIHON PHILIPS CORP., Shuwa Shinagawa Bldg., 26-33 Takanawa 3-chome, Minato-ku, TOKYO (108), Tel. 448-5611.
(IC Products) SIGNETICS JAPAN, LTD., TOKYO, Tel. (03) 230-1521.

Korea: PHILIPS ELECTRONICS (KOREA) LTD., Elcoma Div., Philips House, 260-199 Itaewon-dong, Yongsan-ku, C.P.O. Box 3680, SEOUL, Tel. 794-4202.

Malaysia: PHILIPS MALAYSIA SDN. BERHAD, Lot 2, Jalan 222, Section 14, Petaling Jaya, P.O.B. 2163, KUALA LUMPUR, Selangor, Tel. 77 44 11.

Mexico: ELECTRONICA S.A. de C.V., Varsovia No. 36, MEXICO 6, D.F., Tel. 533-11-80.

Netherlands: PHILIPS NEDERLAND B.V., Afd. Elonco, Boschdijk 525, 5600 PD EINDHOVEN, Tel. (040) 79 33 33.

New Zealand: PHILIPS ELECTRICAL IND. LTD., Elcoma Division, 2 Wagener Place, St. Lukes, AUCKLAND, Tel. 867 119.

Norway: NORSK A/S PHILIPS, Electronica, Sørkedalsveien 6, OSLO 3, Tel. 46 38 90.

Peru: CADESA, Rocca de Vergalio 247, LIMA 17, Tel. 62 85 99.

Philippines: PHILIPS INDUSTRIAL DEV. INC., 2246 Pasong Tamo, P.O. Box 911, Makati Comm. Centre, MAKATI-RIZAL 3116, Tel. 86-89-51 to 59.

Portugal: PHILIPS PORTUGESA S.A.R.L., Av. Eng. Duharte Pacheco 6, LISBOA 1, Tel. 68 31 21.

Singapore: PHILIPS PROJECT DEV. (Singapore) PTE LTD., Elcoma Div., P.O.B. 340, Toa Payoh CPO, Lorong 1, Toa Payoh, SINGAPORE 12, Tel. 53 88 11.

South Africa: EDAC (Pty.) Ltd., South Park Lane, New Doornfontein, JOHANNESBURG 2001, Tel. 24/6701.

Spain: COPRESA S.A., Balmes 22, BARCELONA 7, Tel. 301 63 12.

Sweden: A.B. ELCOMA, Lidingsvägen 50, S-115 84 STOCKHOLM 27, Tel. 08/67 97 80.

Switzerland: PHILIPS A.G., Elcoma Dept., Allmendstrasse 140-142, CH-8027 ZÜRICH, Tel. 01/43 22 11.

Taiwan: PHILIPS TAIWAN LTD., 3rd Fl., San Min Building, 57-1, Chung Shan N. Rd, Section 2, P.O. Box 22978, TAIPEI, Tel. 5513101-5.

Thailand: PHILIPS ELECTRICAL CO. OF THAILAND LTD., 283 Silom Road, P.O. Box 961, BANGKOK, Tel. 233-6330-9.

Turkey: TÜRK PHILIPS TICARET A.S., EMET Department, Inonu Cad. No. 78-80, ISTANBUL, Tel. 43 59 10.

United Kingdom: MULLARD LTD., Mullard House, Torrington Place, LONDON WC1E 7HD, Tel. 01-580 6633.

United States: (Active devices & Materials) AMPEREX SALES CORP., Providence Pike, SLATERSVILLE, R.I. 02876, Tel. (401) 762-9000.
(Passive devices) MEPCO/ELECTRA INC., Columbia Rd., MORRISTOWN, N.J. 07960, Tel. (201) 539-2000.
(IC Products) SIGNETICS CORPORATION, 811 East Arques Avenue, SUNNYVALE, California 94086, Tel. (408) 739-7700.

Uruguay: LUZIELECTRON S.A., Rondeau 1567, piso 5, MONTEVIDEO, Tel. 9 43 21.

Venezuela: IND. VENEZOLANAS PHILIPS S.A., Elcoma Dept., A. Ppal de los Ruices, Edif. Centro Colgate, CARACAS, Tel. 36 05 11.