

PHILIPS

Data handbook



Electronic
components
and materials

Components and materials

Part 8 September 1981

Variable mains transformers

COMPONENTS AND MATERIALS

PART 8 — SEPTEMBER 1981

VARIABLE MAINS TRANSFORMERS

GENERAL (WITH SURVEY)

AUTO-TRANSFORMERS

VARIABLE MAINS TRANSFORMERS
WITH 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 four series of handbooks each comprising several parts.

ELECTRON TUBES	BLUE
SEMICONDUCTORS	RED
INTEGRATED CIRCUITS	PURPLE
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)

Starting in 1980, new part numbers and corresponding codes are being introduced. The former code of the preceding issue is given in brackets under the new code.

Part 1	February 1980	T1 02-80 (ET1a 12-75)	Tubes for r.f. heating
Part 2	April 1980	T2 04-80 (ET1b 08-77)	Transmitting tubes for communications
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	June 1980	T3 06-80 (ET2a 11-77)	Klystrons, travelling-wave tubes, microwave diodes
Part 3	January 1975	ET3 01-75	Special Quality tubes, miscellaneous devices
Part 4	September 1980	T4 09-80 (ET2a 11-77)	Magnetrons
Part 5	August 1981	T5 08-81	Cathode-ray tubes Instrument tubes, monitor and display tubes, C.R. tubes for special applications.
Part 6	July 1980	T6 07-80 (ET6 01-77)	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	July 1979	ET8 07-79	Picture tubes and components Colour TV picture tubes, black and white TV picture tubes, monitor tubes, components for colour television, components for black and white television.
Part 9	June 1980	T9 06-80 (ET9 03-78)	Photo and electron multipliers Photomultiplier tubes, phototubes, single channel electron multipliers, channel electron multiplier plates.
Part 10	May 1981	T10 05-81 (ET5b 12-78)	Camera tubes and accessories, image intensifiers

SEMICONDUCTORS (RED SERIES)

Starting in 1980, new part numbers and corresponding codes are being introduced. The former code of the preceding issue is given in brackets under the new code.

Part 1	March 1980	S1 03-80 (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, rectifier diodes
Part 2	May 1980	S2 05-80 (SC1a 08-78)	Power diodes, thyristors, triacs Rectifier diodes, voltage regulator diodes (> 1,5 W), rectifier stacks, thyristors, triacs
Part 3	April 1980	S3 04-80 (SC2 11-77, partly) (SC3 01-78, partly)	Small-signal transistors
Part 4	September 1981	S4 09-81 (SC2 06-79)	Low-frequency power transistors
Part 4a	December 1978	SC4a12-78	Transmitting transistors and modules
Part 5	October 1980	S5 10-80 (SC3 01-78, partly)	Field-effect transistors
Part 7	December 1980	S7 12-80 (SC4c 07-78)	Microminiature semiconductors for hybrid circuits
Part 8	April 1980	S8 06-81 (SC4b 09-78)	Devices for optoelectronics Photosensitive diodes and transistors, light-emitting diodes, displays, photocouplers, infrared sensitive devices, photoconductive devices
Part 10	September 1981	S10 09-81 (SC3 01-78, partly)	Wideband transistors and wideband hybrid IC modules

INTEGRATED CIRCUITS (PURPLE SERIES)

Starting in 1980, new part numbers and corresponding codes are being introduced. The former code of the preceding issue is given in brackets under the new code. Books with the purple cover will replace existing red covered editions as each is revised.

Part 1	May 1980	IC1 05-80 (SC5b 03-77)	Bipolar ICs for radio and audio equipment
Part 2	May 1980	IC2 05-80 (SC5b 03-77)	Bipolar ICs for video equipment
Part 5a	November 1976	SC5a 11-76	Professional analogue integrated circuits
Part 4	October 1980	IC4 10-80 (SC6 10-77)	Digital integrated circuits LOC MOS HE4000B family
Part 6b	August 1979	SC6b 08-79	ICs for digital systems in radio and television receivers

Signetics integrated circuits

Bipolar and MOS memories 1979
Bipolar and MOS microprocessors 1978
Analogue circuits 1979
Logic - TTL 1978

COMPONENTS AND MATERIALS (GREEN SERIES)

Starting in 1980, new part numbers and corresponding codes are being introduced. The former code of the preceding issue is given in brackets under the new code.

Part 1	July 1979	CM1 07-79	Assemblies for industrial use PLC modules, high noise immunity logic FZ/30 series, NORbits 60-series, 61-series, 90-series, input devices, hybrid integrated circuits, peripheral devices
Part 2	June 1981	C2 06-81 (CM3a 09-78)	FM tuners, television tuners, video modulators, surface acoustic wave filters
Part 3	January 1981	C3 01-81 (CM3b 10-78)	Loudspeakers
Part 4a	November 1978	CM4a 11-78	Soft Ferrites Ferrited 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	May 1981	C6 05-81 (CM6 04-77)	Electric motors and accessories Permanent magnet synchronous motors, stepping motors, direct current motors
Part 7a	January 1979	CM7a 01-79	Assemblies Circuit blocks 40-series and CSA70 (L), counter modules 50-series, input/output devices
Part 8	September 1981	C8 09-81 (CM8 06-79)	Variable mains transformers
Part 9	August 1979	CM9 08-79	Piezoelectric quartz devices Quartz crystal units, temperature compensated crystal oscillators
Part 10	October 1980	C10 10-80	Connectors
Part 11	December 1979	CM11 12-79	Non-linear resistors Voltage dependent resistors (VDR), light dependent resistors (LDR), negative temperature coefficient thermistors (NTC), positive temperature coefficient thermistors (PTC)
Part 12	November 1979	CM12 11-79	Variable resistors and test switches
Part 13	December 1979	CM13 12-79	Fixed resistors
Part 14	April 1980	C14 04-80 (CM2b 02-78)	Electrolytic and solid capacitors
Part 15	May 1980	C15 05-80 (CM2b 02-78)	Film capacitors, ceramic capacitors, variable capacitors



GENERAL
(WITH SURVEY)



INTRODUCTION

Applications

The main applications are:

- distortion-free voltage control for measuring equipment and voltage stabilizers;
- power control for electric heating, heat sealing of plastics;
- current control for galvanizing plants;
- lighting control;
- ventilation control in farm buildings and greenhouses;
- motor speed control.

TYPES

These variable transformers have an output current range from 0,5 to 23 A. Most are auto-transformers; a transformer with separate windings for 3 A output current is available.

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

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

A **bench model** is a transformer in a protective housing and has a knob and scale.

A **laboratory model** is a bench model with a handle, a 3-core input cable (including earth) with plug and a fused outlet socket; the plug and socket have side-contact earth connections.

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

Features

- continuous voltage control;
- small size and high efficiency by using high quality core material;
- very low stray losses by using toroidal coil and specially treated track with low and stable contact resistance between brush and track 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 winding resistance;
- high overload capability;
- simple coupling in parallel or three-phase combinations;
- remote-controlled motor drive available for coupled and individual transformers.

All transformers meet the safety requirements laid down in SEV1003; the relevant types (output current ≤ 10 A) 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 overwound transformers (transformers with a maximum output voltage higher than the input voltage) with the input voltage applied across the complete winding.

Detailed specifications are in the data sheets, which are in two sections (with tabbed dividers): auto-transformers and transformers with separate windings. The data sheets are listed according to transformer size code.⁽¹⁾ Conversion of catalogue number to transformer size code is given in the list on page 6.



→ (1) Transformer size code is introduced to simplify division of the transformers into groups.
(2) See explanation above.

1 input voltage nom. V	2 3 output current		4 output voltage no-load V	5 6 output current (2)		7 output voltage no-load V(2)	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	2,5	3	0- 42				E1.1	90032			31
	4	4,8	0- 42				E2	90031			35
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			35
	1,4	1,7	0-115				E2	11607			35
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			55
220	0,5	0,6	0-220				E1.1	10407			31
	0,7	0,83	0-240	0,77	0,91	0-220	E2	01407			35
	0,83	1	0-220				E2	11407			35
	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			39
	1,4	1,7	0-220				E3	18407			39
	2	2,4	0-260	2,2	2,6	0-220	E4	03407			43
	2,5	3	0-220				E4	13407			43
	2,5	3,2	0-260	2,75	3,25	0-220	C2	03406	03401	03405	21
	4	4,8	110-220				E5	90023			47
	4	4,8	0-220				E5	90024			47
	4,5	5	0-253	5	5,85	0-220	E6	90028			51
	5	6	0-220				E6	90027			51
	5	6,3	0-260	5,5	6,5	0-220	E6.1	04407	04411	04415	55
	8,5	11,2	0-260	9,3	11,5	0-220	E7	05407	05411	05415	61
10	12	0-220				E7	15407			61	
12	15	0-260	13,2	15,6	0-220	E8	06407			67	
15	18	0-220				E8	16407			67	
23	30	0-260	25,3	30	0-220	E10	07407	07411		71	
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			43
	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			51
	5	6,3	0-270	5	6,3	0-240	E6.1	04507	04511		55
	8,5	11,2	0-270	8,5	11,2	0-240	E7	05507	05511		61
	12	15	0-260	12	15	0-240	E8	06507			67
23	30	0-260	23	30	0-240	E10	07507	07511		71	

type with separate windings

2422 529

220	3		0-262				E7.1	00008		00007	77
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VARIABLE MAINS TRANSFORMERS

CONVERSION LIST

Conversion of catalogue number to transformer size code.

catalogue number	transformer size code	page
2422 529 00007	E7.1	73
00008	E7.1	73
2422 530 00007	E1	27
00107	E1	27
00407	E1	27
01407	E2	31
01607	E2	31
02306	C1	17
02401	C1	17
02406	C1	17
02501	C1	17
02506	C1	17
03306	C2	21
03401	C2	21
03405	C2	21
03406	C2	21
03407	E4	39
03501	C2	21
03506	C2	21
03507	E4	39
04307	E6.1	51
04407	E6.1	51
04411	E6.1	51
04415	E6.1	51
04507	E6.1	51
04511	E6.1	51
05407	E7	57

catalogue number	transformer size code	page
2422 530 05411	E7	61
05415	E7	61
05507	E7	61
05511	E7	61
06407	E8	67
06507	E8	67
07407	E10	71
07411	E10	71
07507	E10	71
07511	E10	71
08407	E3	39
10407	E1.1	31
11407	E2	35
11607	E2	35
13407	E4	43
15407	E7	61
16407	E8	67
18407	E3	39
90004	E1	27
90011	E1	27
90023	E5	47
90024	E5	47
90027	E6	51
90028	E6	51
90031	E2	35
90032	E1.1	31

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 tapings. 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. Overloads up to 70% 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).

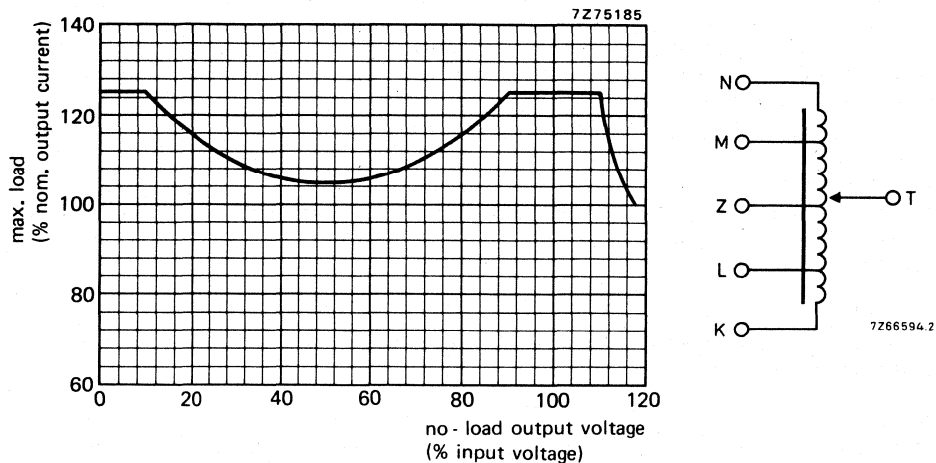


Fig. 1 Maximum load as a function of the output voltage; input voltage M to K or L to N.

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

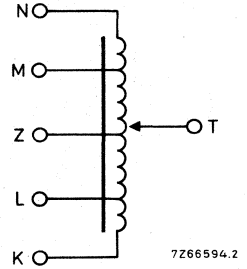
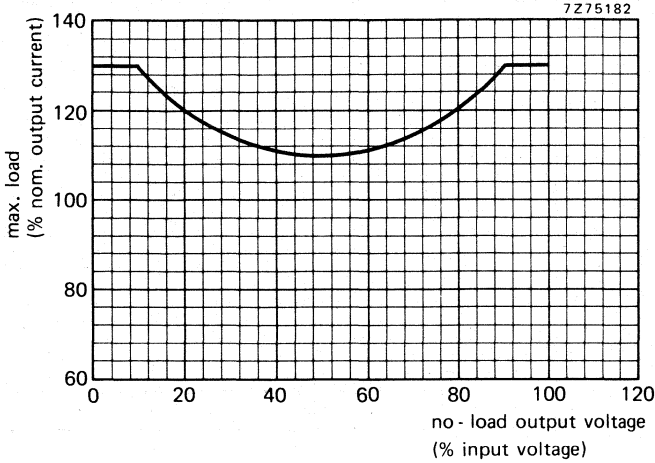


Fig. 2 Maximum load as a function of the output voltage; input voltage N to K.

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

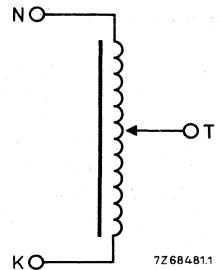
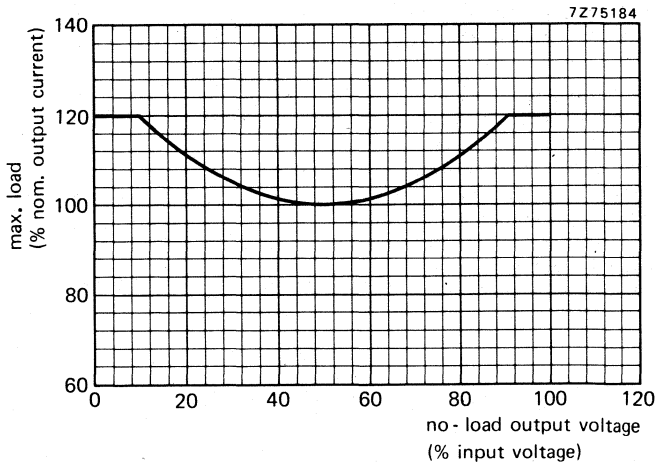


Fig. 3 Maximum load as a function of the output voltage; input voltage N to K.

Transient overloads

High transient 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 transient overload, additional cooling of the transformer is not required.

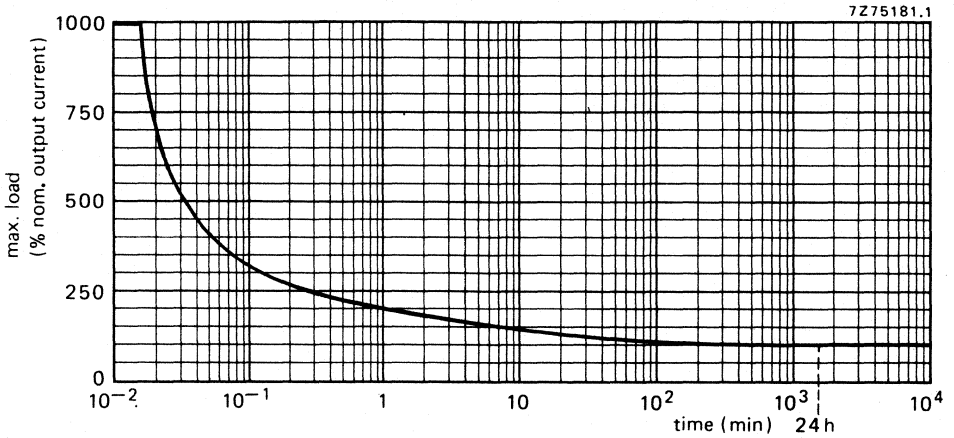


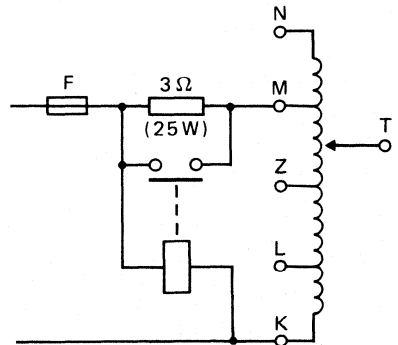
Fig. 4 Maximum non-repetitive overload as a function of time.

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

Overload protection and inrush current

As a result of the variable transformation ratio, fuses or other safety devices in the primary circuit cannot provide adequate overload protection in the secondary circuit. It is, therefore always necessary to provide secondary circuit protection.

Attention should be paid to the high inrush currents (up to 20 times the nominal current) when providing protection for the primary circuit. As these currents last for a few cycles only, the transformer will not be damaged, but the primary current safety devices may be operated. Safety devices with slow-to-operate characteristics should be used, or measures should be taken to limit the inrush current, e.g. a resistor switched in series with the transformer during the switching delay of a relay (see diagram).



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Voltage per turn of winding

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

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).

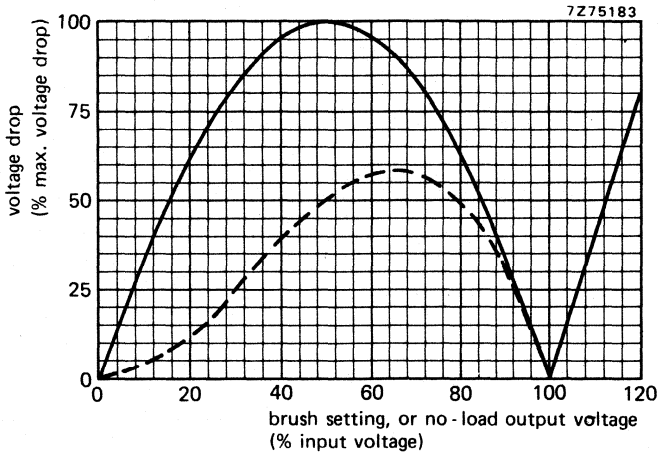


Fig. 5 Voltage drop as a function of brush setting.

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.

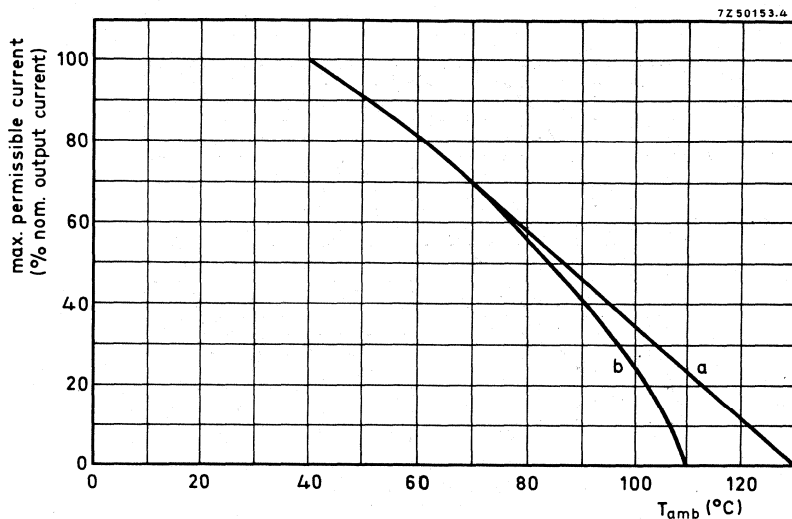


Fig. 6 Maximum permissible output current as a function of temperature. Curve a applies to transformers for which the maximum permissible temperature rise at any point is 90 °C. Curve b applies to transformers for which the maximum permissible temperature rise at any point is 70 °C.

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 $> 5 \text{ M}\Omega$.

Test voltage

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

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 for use in laboratories and in industrial and professional equipment.

DESCRIPTION

These transformers have a single layer toroidal copper winding which 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.

The bench models can also be panel mounted.

* Approved by SEV.

TRANSFORMERS SIZE CODE C1

ELECTRICAL DATA

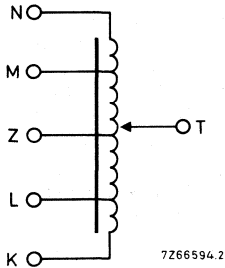


Fig. 1 Circuit diagram of panel model.
KL = NM; Z = centre tap.

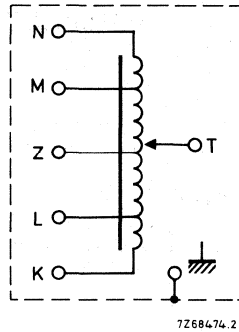


Fig. 2 Circuit diagram of bench model.
KL = NM; Z = centre tap.

catalogue number, bench model panel model	2422 530		
	02306	02401 02406	02501 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 ¹ *	≤ 6 V	≤ 13 V	≤ 13 V
Nominal output current over the whole control range	2,5 A	1 A	1 A
Maximum output current ² **	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	$\leq 6,2$ W
Permissible temperature rise at any point ³ **	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

Dimensions in mm ←

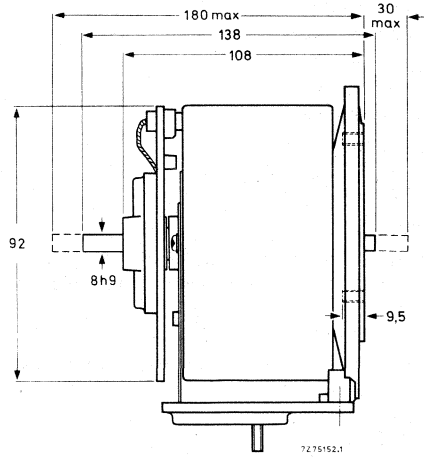
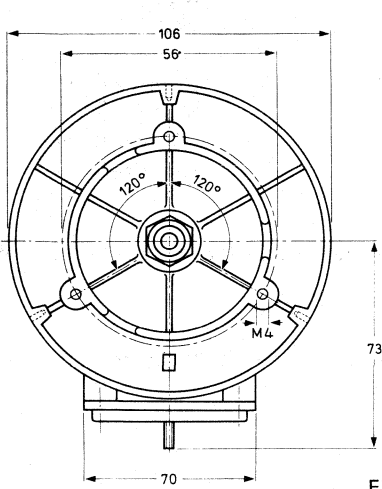
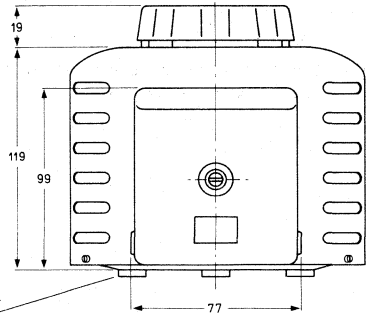


Fig. 3 Panel model.



The pads protrude approximately 3 mm.

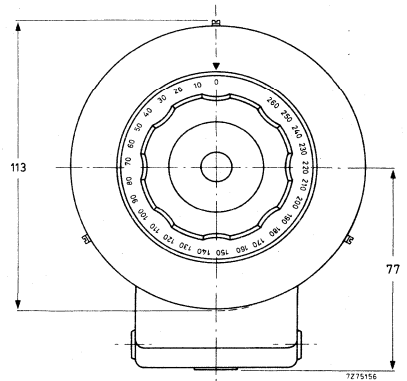


Fig. 4 Bench model.

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*	
220/260	2,5	0 to 260	03401*	03406*	
240/270	2,5	0 to 270	03501*	03506*	
220	2,5	0 to 260			03405

APPLICATION

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

DESCRIPTION

These transformers have a single layer toroidal copper winding which 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 is a bench model with a handle, a 3-core cable (including earth) with plug for input connection, an outlet socket, and a fuse. Both plug and socket have a side-contact earth connection.

* Approved by SEV.

TRANSFORMERS SIZE CODE C2

ELECTRICAL DATA

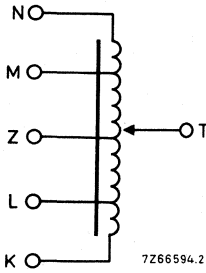


Fig. 1 Circuit diagram of panel model.
KL = NM; Z = centre tap.

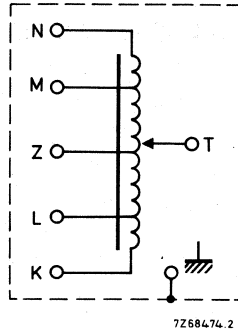


Fig. 2 Circuit diagram of bench model.
KL = NM; Z = centre tap.

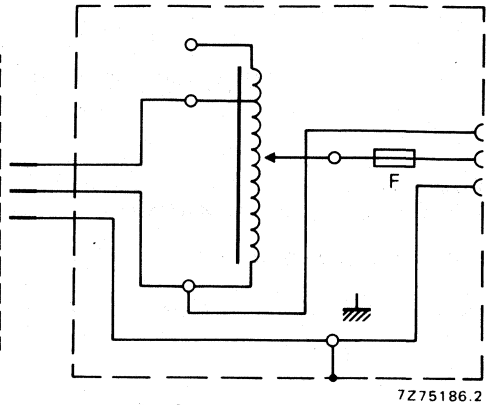


Fig. 3 Circuit diagram of laboratory model; F = 2,5 A.

catalogue number, bench model panel model laboratory model	2422 530			
	03306	03401 03406	03501 03506	03405
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				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	≤ 9 V
Nominal output current	5 A	2,5 A	2,5 A	2,5 A
Maximum output current**	6,3 A [^]	3,2 A [^]	3,2 A [^]	3,2 A
Voltage per turn of winding	0,5 V	0,48 V	0,51 V	0,48 V
Losses, no load	≤ 7 W	≤ 8 W	≤ 8,5 W	≤ 8 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

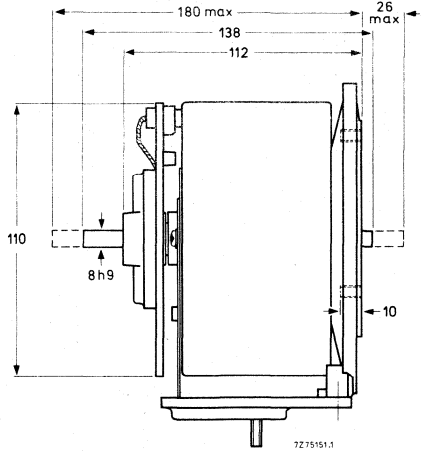
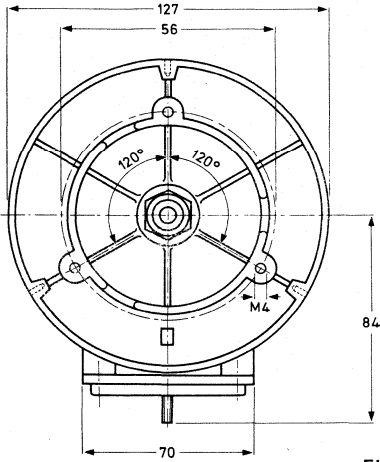
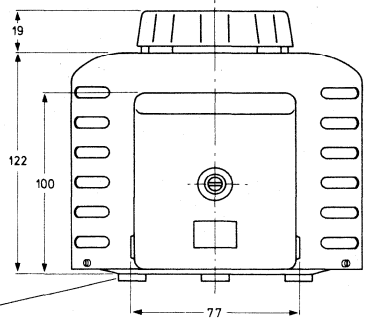


Fig. 4 Panel model.



The pads protrude approximately 3 mm.

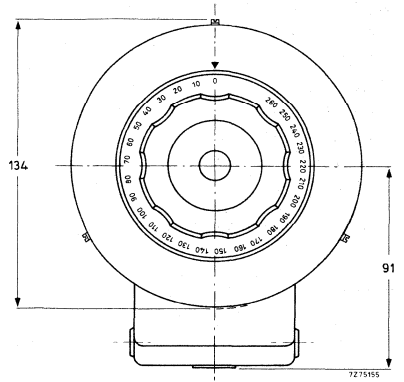


Fig. 5 Bench model.

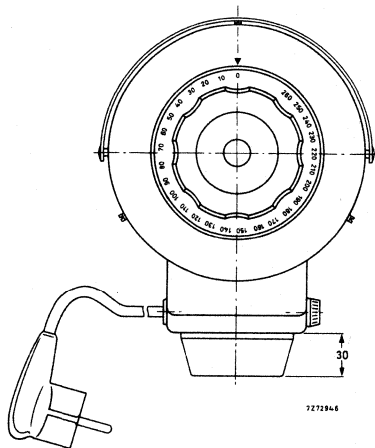
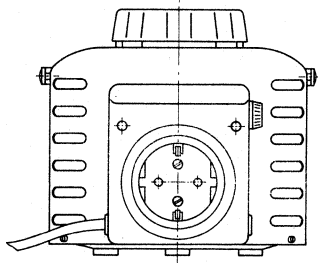


Fig. 6 Laboratory model; dimensions are identical with those in Fig. 5, except as shown.

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.

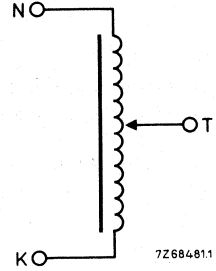
The coils of the 240 V types are wound in two layers. The outer layer forms the brush track, so that the brush sweeps half the total winding.

* Approved by SEV.

TRANSFORMERS SIZE CODE E1

ELECTRICAL DATA

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



catalogue number	2422 530	
	00007	00107
Input voltage K to N*	60 V + 10%	110 V + 10%
Output voltage, no load, T to N**	0 (+2) to 60 (-2) V	0 (+3) to 110 (-3) V
Voltage drop at nominal output current*	≤ 6 V	≤ 10 V
Nominal output current over the whole control range	1,2 A	0,6 A
Maximum output current**	1,32 A	0,7 A
Voltage per turn of winding	0,122 V	0,12 V
Losses, no load	≤ 1,1 W	≤ 1,8 W
Permissible temperature rise at any point [▲]	max. 70 °C	

* Second letter denotes the common input/output terminal.

** The output voltage is stated for clockwise rotation.

• 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.

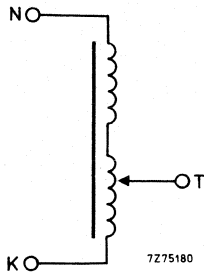


Fig. 2 Circuit diagram of transformer 2422 530 00407.

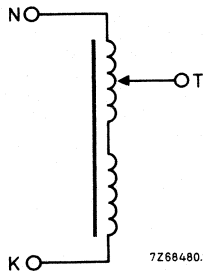


Fig. 3 Circuit diagram of transformer 2422 530 90011.

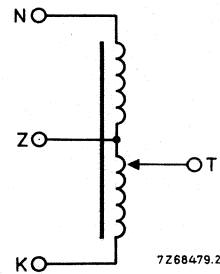


Fig. 4 Circuit diagram of transformer 2422 530 90004.

catalogue number	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**)
Maximum output current**	0,55 A	0,55 A	0,55 A (0,28 A**)
Voltage per turn of winding		0,133 V	
Losses, no load		≤ 1,8 W	
Permissible temperature rise at any point [^]		max. 70 °C	

Notes: see preceding page.

MECHANICAL DATA

Dimensions in mm

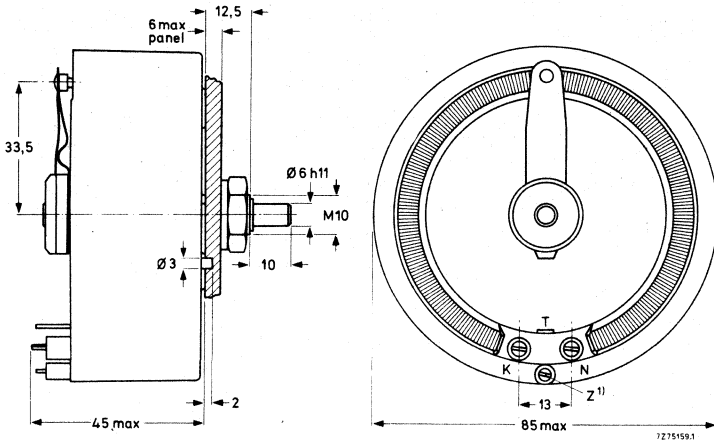


Fig. 5.

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.

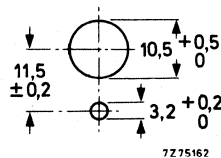


Fig. 6.

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 TRANSFORMER

- Moulded types; size code E1.1
- To be read in conjunction with Operational Notes

QUICK REFERENCE DATA

input voltage	output current	output voltage	catalogue number
220 V	0,5 A	0 to 220 V	2422 530 10407*
42 V	2,5 A	0 to 42 V	2422 530 90032*

APPLICATION

These panel model transformers will find their main application in those cases where 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 transformer can be mounted on thin chassis or panels. Screw terminals are provided for connecting the leads.



* Approved by SEV.

TRANSFORMERS SIZE CODE E1.1

ELECTRICAL DATA

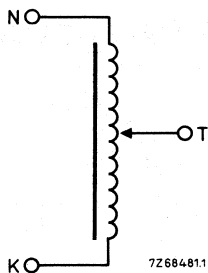


Fig. 1 Circuit diagram.

catalogue number	2422 530 10407	2422 530 90032
Input voltage N to K*	220 V + 10%	42 V + 10%
Output voltage, no load, T to K**	0 (+ 3) to 220 (-3) V	0 (+ 1) to 42 (-1) V
Voltage drop at nominal output current●	≤ 15 V	≤ 2,6 V
Nominal output current over the whole control range	0,5 A	2,5 A
Maximum output current●●	0,6 A	3 A
Voltage per turn of winding	0,2 V	0,16 V
Losses, no-load	≤ 3 W	
Permissible temperature rise at any point▲	max. 70 °C	

- * Second letter denotes the common input/output terminal.
- ** The output voltage increases for clockwise rotation when viewed on the shaft.
- See "Operational notes" paragraph "Voltage drop".
- See "Operational notes" paragraph "Continuous overload".
- ▲ See "Operational notes" paragraph "Derating for higher ambient temperatures".

MECHANICAL DATA

Dimensions in mm

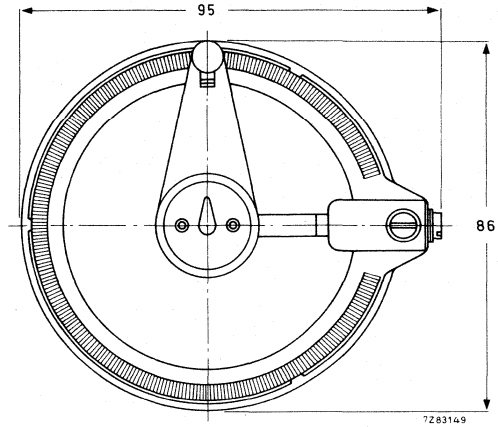
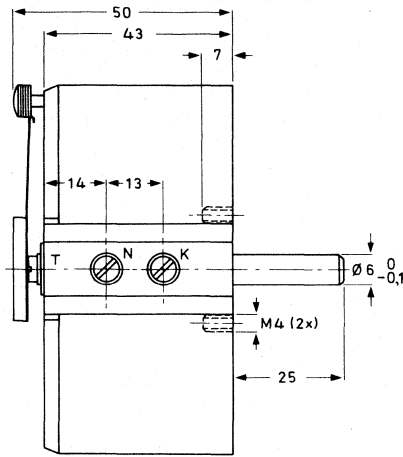


Fig. 2.

Degree of protection (IEC 144)

IP00

Mass

1000 g

Operating torque

0,05 to 0,1 Nm

Permissible end stop torque

max. 1 Nm

Mounting

The transformers can be mounted in any position. They can be fitted to a panel or a chassis by 2 screws M4 (maximum length = panel thickness + 7 mm).

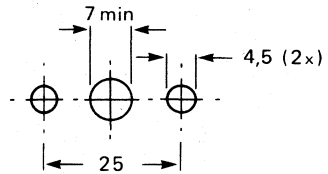


Fig. 3 Mounting hole pattern.

Carbon brushes

A subassembly consisting of a spindle, a contact arm with carbon brushes, and a locking washer can be supplied under:

cat. no. 4322 028 04980 (service no. 5322 362 44025) for transformer 2422 530 10407

cat. no. 4322 028 05710 (service no. 5322 362 44027) for transformer 2422 530 90032.

ACCESSORIES

For this transformer a control knob with dial is available; see section "Accessories".

Further information on request.

7283148.1

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

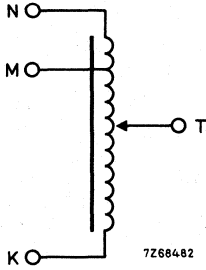


Fig. 1 Circuit diagram of transformers
2422 530 01407 and 2422 530 01607.

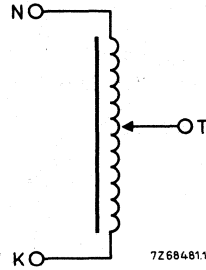


Fig. 2 Circuit diagram of transformers
2422 530 11407, 2422 530 11607 and
2422 530 90031.

catalogue number	2422 530		
	01407	11407	90031
Input voltage M to K*	220 V + 10%		
Input voltage N to K	240 V + 10%	220 V + 10%	42 V + 10%
Output voltage, no load, T to K**	0 (+3) to 240 (-3 V)	0 (+3) to 220 (-3) V	0 (+1) to 42 (-1) V
Voltage drop at nominal output current*	≤ 16 V	≤ 13 V	≤ 2 V
Nominal output current over the whole control range	0,7 A	0,83 A	4 A
Maximum output current**	0,83 A [▲]	1 A	4,8 A
Voltage per turn of winding	0,242 V	0,23 V	0,206 V
Losses, no-load	≤ 4 W	≤ 4 W	≤ 2 W
Permissible temperature rise at any point ^{▲▲}	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".

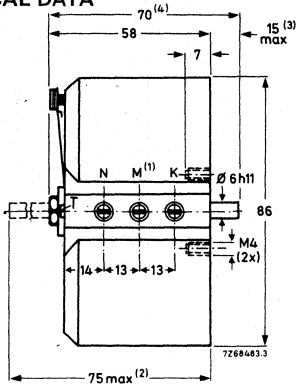
catalogue number	2422 530	
	01607	11607
Input voltage M to K*	115 V + 10%	
Input voltage N to K	130 V + 10%	115 V + 10%
Output voltage, no load, T to K**	0 (+2) to 130 (-2) V	0 (+2) to 115 (-2) V
Voltage drop at nominal output current*	≤ 7 V	≤ 6 V
Nominal output current over the whole control range	1,2 A	1,4 A
Maximum output current**	1,4 A [^]	1,7 A
Voltage per turn of winding	0,211 V	0,186 V
Losses, no load	≤ 4 W	≤ 4 W
Permissible temperature rise at any point ^{^^}	max. 70 °C	



Notes: see preceding page.

TRANSFORMERS SIZE CODE E2

MECHANICAL DATA



- (1) for 2422 530 01407 and 01607
- (2) 105 for 2422 530 90031
- (3) 37 for 2422 530 90031
- (4) 95 for 2422 530 90031

Dimensions in mm

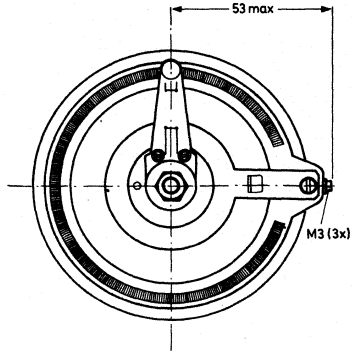


Fig. 3.

Degree of protection (IEC 144)

IP00

Mass

1250 g

Operating torque

0,05 to 0,1 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 a chassis with 2 screws M4 (maximum length = panel thickness + 7 mm). The mounting hole pattern is given in Fig. 4.

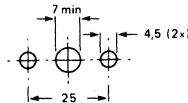


Fig. 4.

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). For 2422 530 90031; 4322 027 78720 (or service number 5322 362 44015).

ACCESSORIES

The following accessories are available:

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

See section "Accessories"; use size code E2 when selecting. Further information on request.

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.

TRANSFORMERS SIZE CODE E3

ELECTRICAL DATA

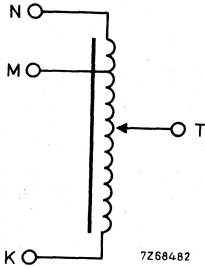


Fig. 1 Circuit diagram of transformer
2422 530 08407.

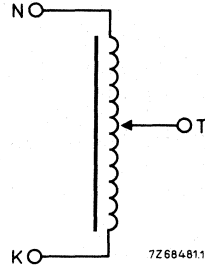


Fig. 2 Circuit diagram of transformer
2422 530 18407.

catalogue number	2422 530	
	08407	18407
Input voltage M to K*	220 V + 10%	
Input voltage N to K	260 V + 10%	220 V + 10%
Output voltage, no load, T to K**	0 (+3) to 260 (-3) V	0 (+3) to 220 (-3) V
Voltage drop at nominal output current*	≤ 13 V	≤ 14 V
Nominal output current over the whole control range	1,2 A	1,4 A
Maximum output current**	1,4 A [▲]	1,7 A
Voltage per turn of winding	0,36 V	0,36 V
Losses, no load	≤ 6 W	≤ 5 W
Permissible temperature rise at any point ^{▲▲}	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".

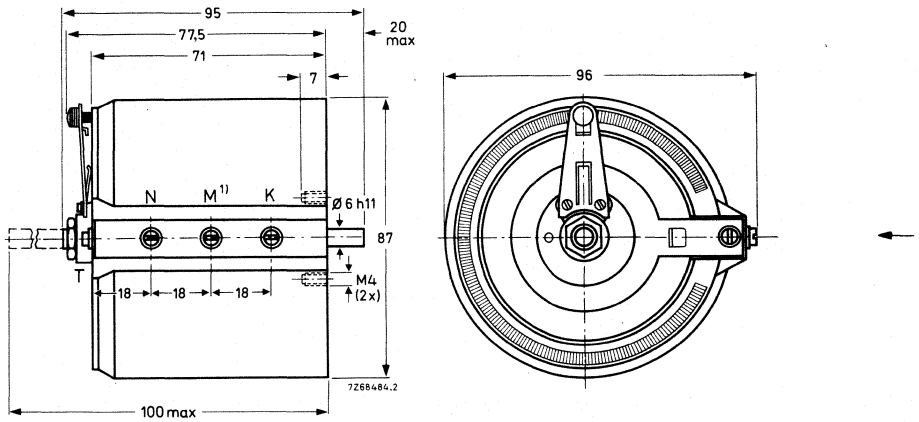
•• See "Operational notes" paragraph "Continuous overload".

▲ 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



¹⁾ only for 2422 530 08407

Fig. 3.

Degree of protection (IEC144)

IP00

Mass

approx. 1800 g

Operating torque

0,05 to 0,10 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 with 2 screws M4 (maximum length = panel thickness + 7 mm). The mounting hole pattern is given in Fig. 4.

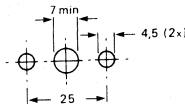


Fig. 4.

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

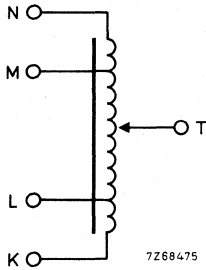


Fig. 1 Circuit diagram of transformers
2422 530 03407 and 2422 530 03507.

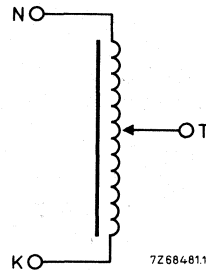


Fig. 2 Circuit diagram of transformer
2422 530 13407.

catalogue number	2422 530		
	03407	03507	13407
Input voltage M to K*	220 V + 10%	240 V + 10%	
Input voltage N to K	260 V + 10%	260 V + 10%	220 V + 10%
Output voltage, no load, T to K**	0 (+3) to 260 (-3) V	0 (+3) to 260 (-3) V	0 (+3) to 220 (-3) V
Voltage drop at nominal output current*	≤ 7 V	≤ 7 V	≤ 7 V
Nominal output current over the whole control range	2 A	2 A	2,5 A
Maximum output current**	2,4 A [▲]	2,4 A [▲]	3 A
Voltage per turn of winding	0,488 V	0,488 V	0,478 V
Losses, no load	≤ 8 W		
Permissible temperature rise at any point ^{▲▲}	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

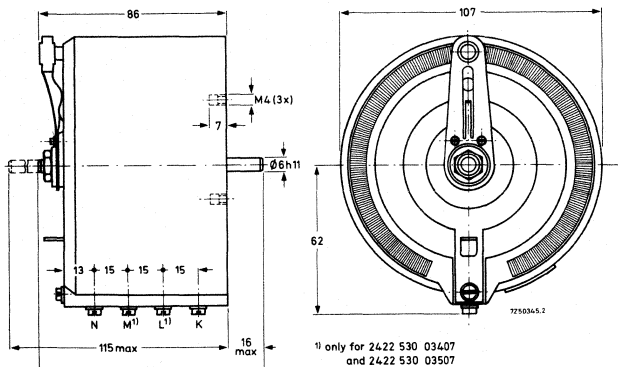


Fig. 3.

Degree of protection

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 with 3 screws M4 (maximum length = panel thickness + 7 mm). The mounting hole pattern is given in Fig. 4.

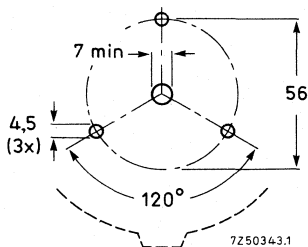


Fig. 4.

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

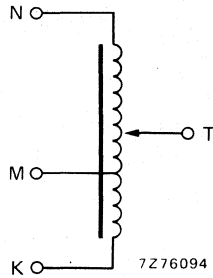


Fig. 1 Circuit diagram.

catalogue number	2422 530	
	90023	90024
Input voltage N to K*	220 V + 10%	220 V + 10%
Output voltage, no load, T to K**	110 (±3) to 220 (-3) V	0 (+3) to 220 (-3) V
Output voltage, no load, M to K	80 (±3) V	80 (±3) V
Voltage drop at nominal output current*	≤ 8,1 V	
Nominal output current over the whole control range	4 A	
Maximum output current**	4,8 A	
Voltage per turn of winding	0,61 V	
Losses, no load	≤ 6,5 W	
Permissible temperature rise at any point [^]	max. 70 °C	

* Second letter denotes the common input/output terminal.

** The output voltage is stated for clockwise rotation.

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

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

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

MECHANICAL DATA

Dimensions in mm

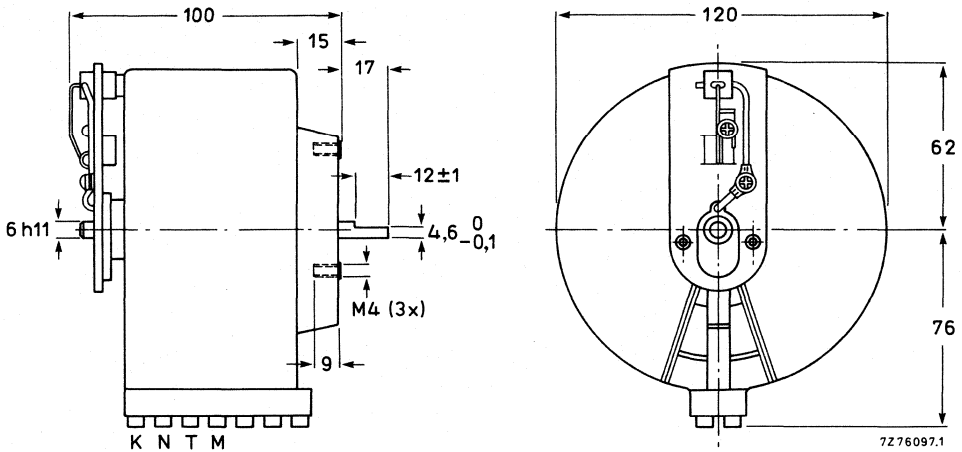


Fig. 2.

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 with 3 screws M4 (maximum length = panel thickness + 9 mm). The mounting hole pattern is shown in Fig. 3.

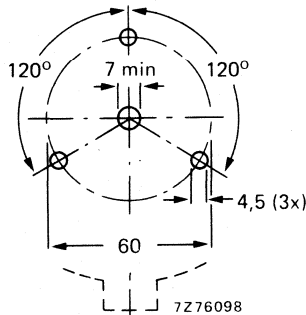


Fig. 3.

TRANSFORMERS SIZE CODE E5

Carbon brushes

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



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

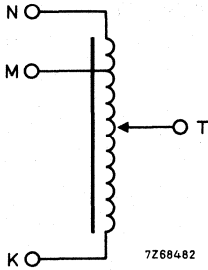


Fig. 1 Circuit diagram of transformer
2422 530 90028.

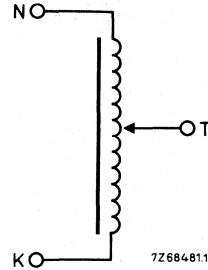


Fig. 2 Circuit diagram of transformer
2422 530 90027.

catalogue number	2422 530	
	90028	90027
Input voltage M to K*	220 V	
Output voltage, no load, T to K**	0 (+3) to 253 (-3) V	
Input voltage M to K	240 V	
Output voltage, no load, T to K**	0 (+3,3) to 276 (-3,3) V	
Input voltage N to K	276 V	220 V
Output voltage, no load, T to K**	0 (+3,3) to 276 (-3,3) V	0 (+3) to 220 (-3) V
Voltage drop at nominal output current*	≤ 6 V	≤ 6 V
Nominal output current over the whole control range	4,5 A	5 A
Maximum output current**	5 A [^]	6 A
Voltage per turn of winding input 220 V	0,56 V	0,543 V
input 240 V	0,61 V	
Losses, no load	≤ 8 W	
Permissible temperature rise at any point ^{^^}	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

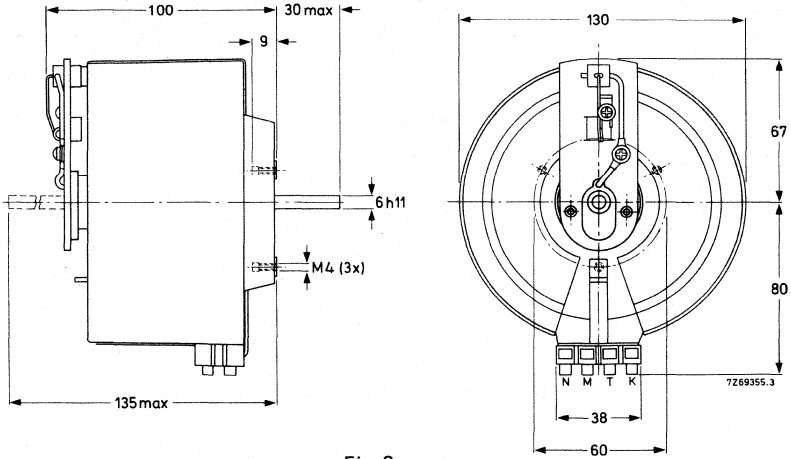


Fig. 3.

Degree of protection (IEC 144)

IP00

Mass

approx. 4,5 kg

Operating torque

0,05 to 0,15 Nm

Permissible end stop torque

max. 2 Nm

Mounting

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

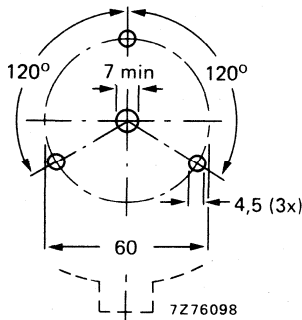


Fig. 4.

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 is a bench model with a handle, a 3-core cable (including earth) with plug for input connection, an outlet socket, and a fuse. Both plug and socket have a side-contact earth connection.

* Approved by SEV.

TRANSFORMERS SIZE CODE E6.1

ELECTRICAL DATA

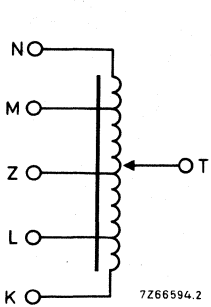


Fig. 1 Circuit diagram of panel model, KL = NM; Z = centre tap.

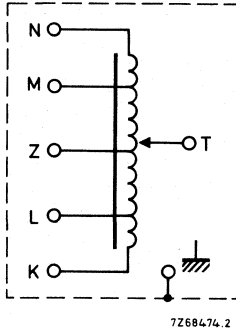


Fig. 2 Circuit diagram of bench model, KL = NM; Z = centre tap.

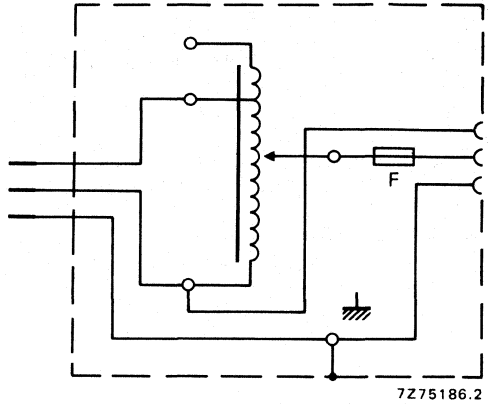


Fig. 3 Circuit diagram of laboratory model; F = 5 A.

catalogue number,	2422 530			
	04307	04411 04407	04511 04507	04415
bench model				
panel model				
laboratory model				
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 V.
Losses, no load	≤ 10,5 W	≤ 9 W	≤ 10,5 W	≤ 9 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

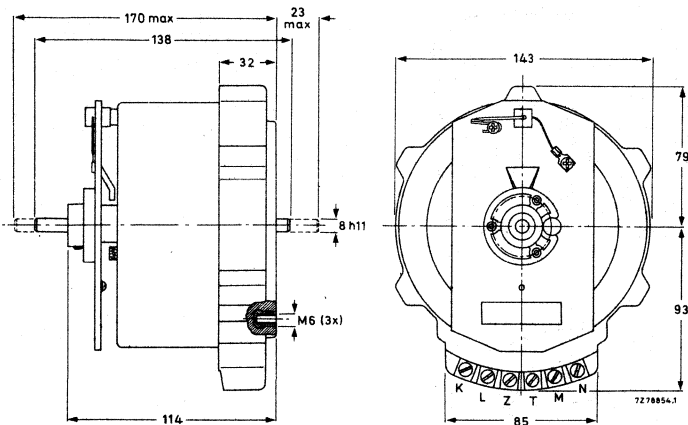
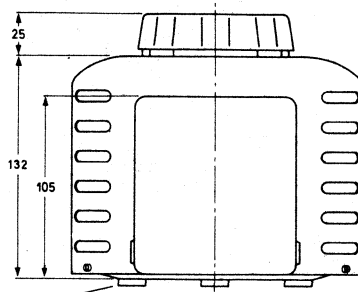


Fig. 4 Panel model.



The pads protrude approximately 4 mm.

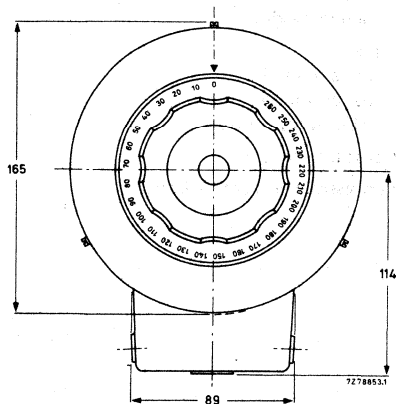


Fig. 5 Bench model.

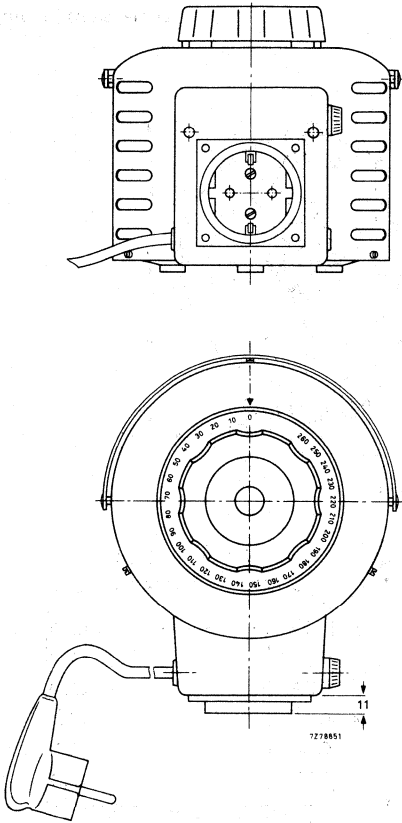


Fig. 6 Laboratory model; dimensions are identical with those in Fig. 5, except as shown.

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.

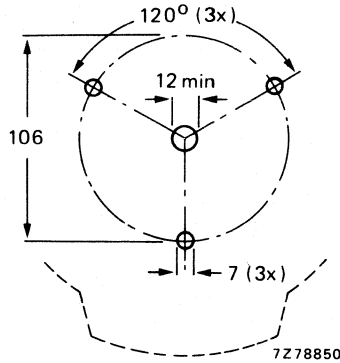


Fig. 7.

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 *	05415
220/260	8,5	0 to 260	05411 *	05407 *	
240/270	8,5	0 to 270	05511 *	05507 *	
220	8,5	0 to 260			

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 is a bench model with a handle, a 3-core cable (including earth) with plug for input connection, an outlet socket, and a fuse. Both plug and socket have a side-contact earth connection.

* Approved by SEV.

TRANSFORMERS SIZE CODE E7

ELECTRICAL DATA

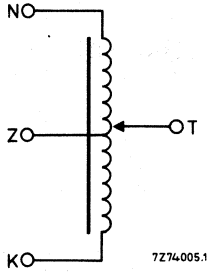


Fig. 1 Circuit diagram of panel model 2422 530 15407; Z = centre tap.

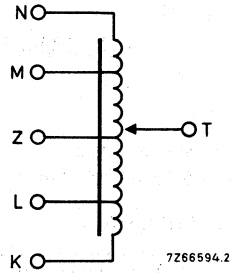


Fig. 2 Circuit diagram of panel models 2422 530 05407 and 2422 530 05507. KL = NM; Z = centre tap.

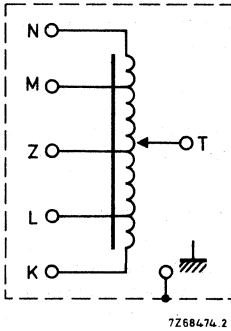


Fig. 3 Circuit diagram of bench model. KL = NM; Z = centre tap.

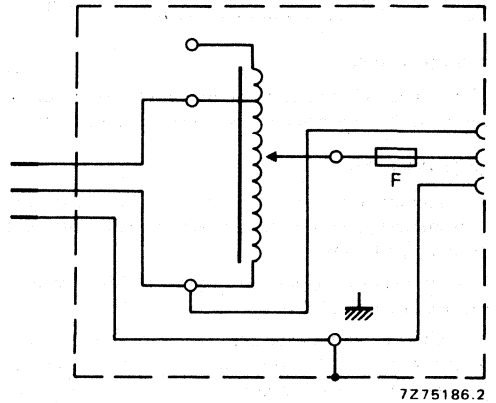


Fig. 4 Circuit diagram of laboratory model; F = 8 A.

catalogue number	2422 530			
	bench model	05411	05511	
panel model	15407	05407	05507	
laboratory model				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

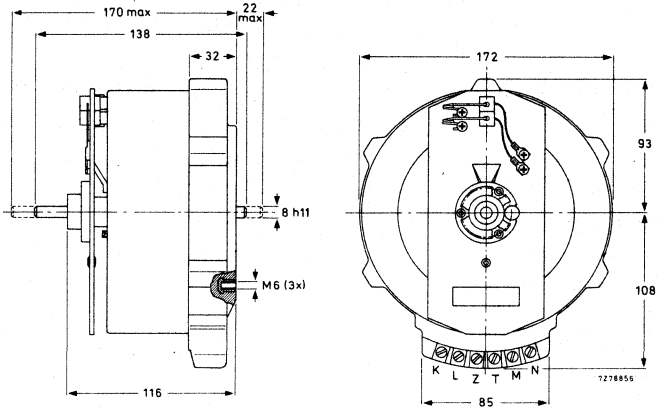
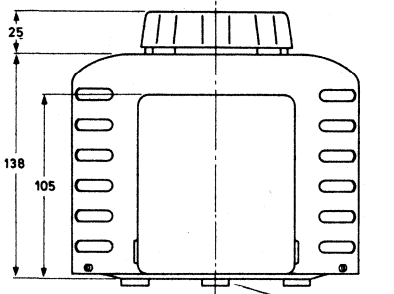


Fig. 5 Panel model.



The pads protrude approximately 4 mm.

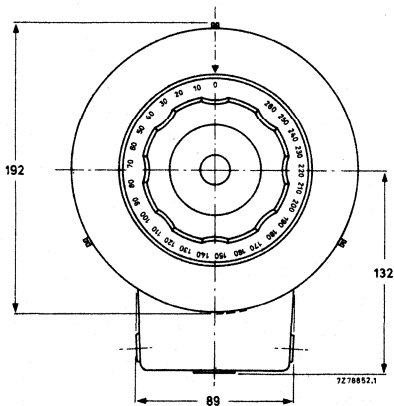


Fig. 6 Bench model.

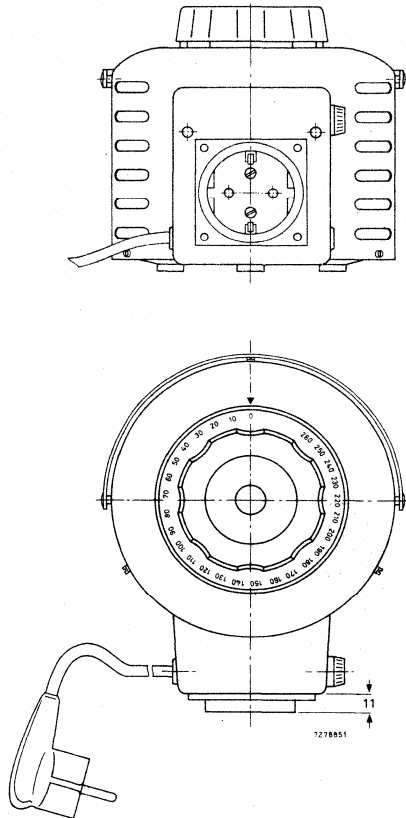


Fig. 7 Laboratory model; dimensions are identical with those in Fig. 6, except as shown.

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

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.

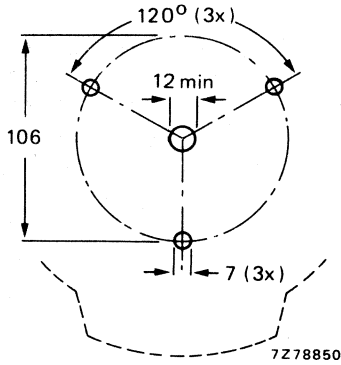


Fig. 8.

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.



TRANSFORMERS SIZE CODE E8

ELECTRICAL DATA

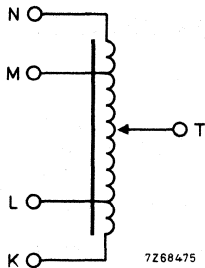


Fig. 1 Circuit diagram of transformers
2422 530 06407 and 2422 530 06507;
KL = NM.

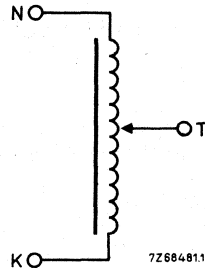


Fig. 2 Circuit diagram of transformer
2422 530 16407.

catalogue number	2422 530		
	06407	06507	16407
Input voltage L to N*	220 V + 10%	240 V + 10%	
Input voltage K to N	260 V + 10%	260 V + 10%	220 V + 10%
Output voltage, no load, T to N**	0 to 260 (+3) V	0 to 260 (+3) V	0 to 220 (+3) V
Voltage drop at nominal output current*	≤ 6 V	≤ 6 V	≤ 4,5 V
Nominal output current over the whole control range	12 A	12 A	15 A
Maximum output current**	15 A [^]	15 A [^]	18 A
Voltage per turn of winding	0,75 V	0,75 V	0,75 V
Losses, no load		≤ 19,5 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

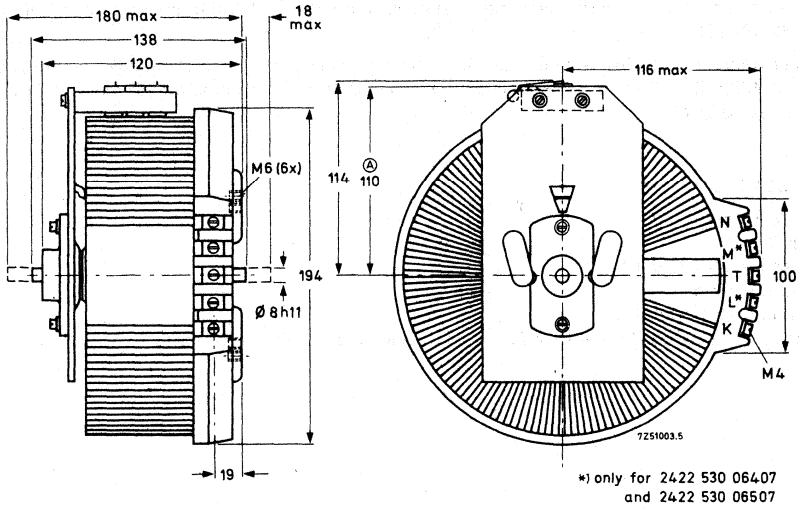


Fig. 3.

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

IP00
approx. 10 kg
0,25 to 0,5 Nm
max. 4 Nm

Mounting

The transformer can be mounted in any position. It can be fitted to a panel or chassis with 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.

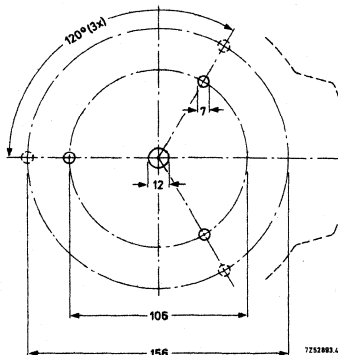


Fig. 4.

Carbon brushes

→ Spare carbon brushes can be supplied under catalogue number 4322 028 01800 (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

- 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

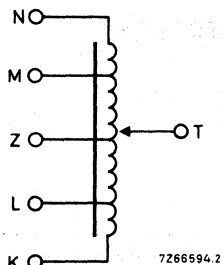


Fig. 1 Circuit diagram of panel model.

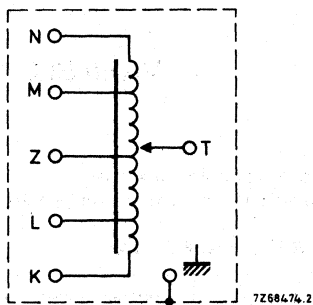


Fig. 2 Circuit diagram of bench model.

catalogue number, bench model panel model	2422 530	
		07411
	07407	07507
Input voltage L to N*	220 V + 10%	240 V + 10%
Input voltage K to N	260 V + 10%	
Output voltage, no load, T to N**	0 to 260 (+3) V	
Voltage drop at nominal output current*	≤ 6 V	
Nominal output current over the whole control range	23 A	
Maximum output current**	30 A [^]	
Voltage per turn of winding	0,9 V	
Losses, no load	≤ 40 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

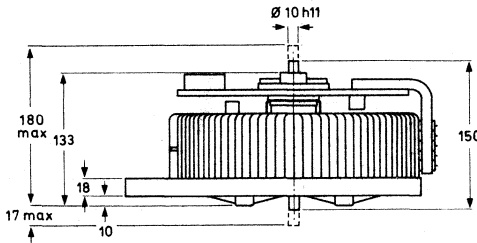
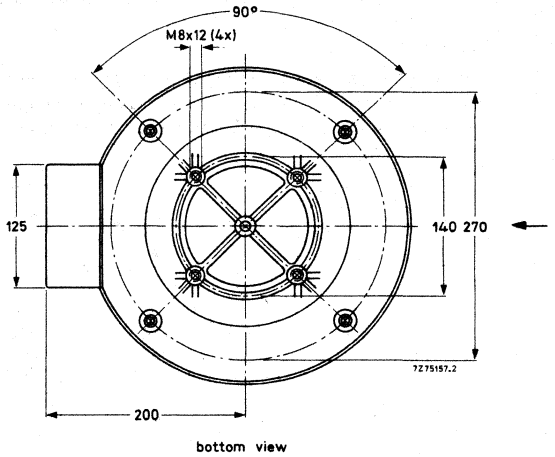
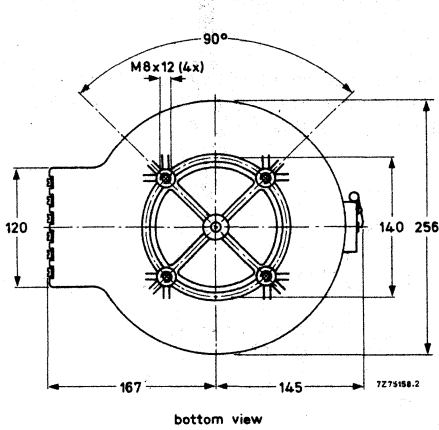


Fig. 3 Panel model.

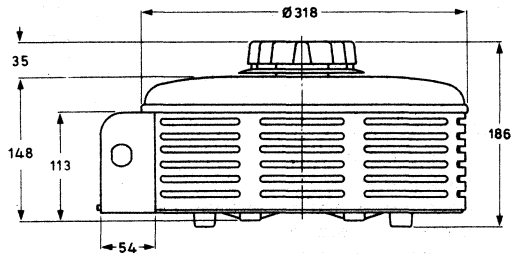


Fig. 4 Bench model.



Fig. 5 Connection strip.

7275161

Degree of protection (IEC 144)

Mass

Operating torque

Permissible end stop torque

bench model

IP20

approx. 19,8 kg

panel model.

IP00

approx. 17,9 kg

1 to 1,5 Nm

max. 5 Nm

Carbon brushes

Spare carbon brushes can be supplied under catalogue number 4322 028 01800 (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 with 4 screws MB (maximum length = panel thickness +12 mm). The mounting hole pattern is shown in Fig. 6. Remove pads of bench model before mounting.

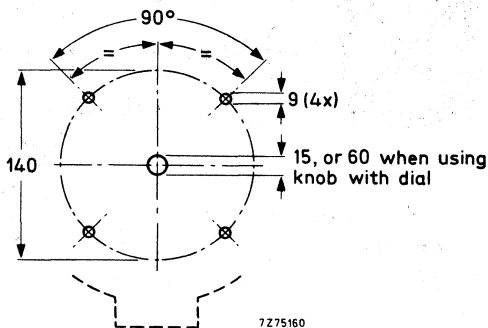


Fig. 6.

ACCESSORIES

- 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
WITH 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	
			panel model	lab. model
220	3	0 to 262	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 no maintenance 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.

* Approved by SEV.

** Approved by SEV + TUV.

ELECTRICAL DATA

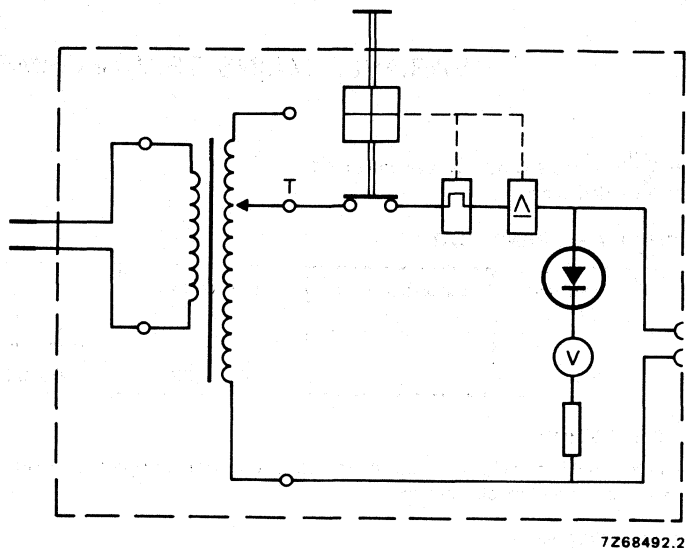
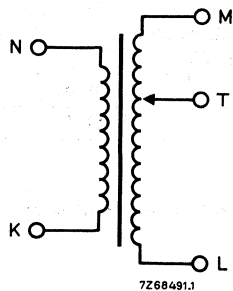


Fig. 1 Circuit diagram of panel model.

Fig. 2 Circuit diagram of laboratory model.

Input voltage N to K	220 V + 10%
Output voltage, no load L 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	5000 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

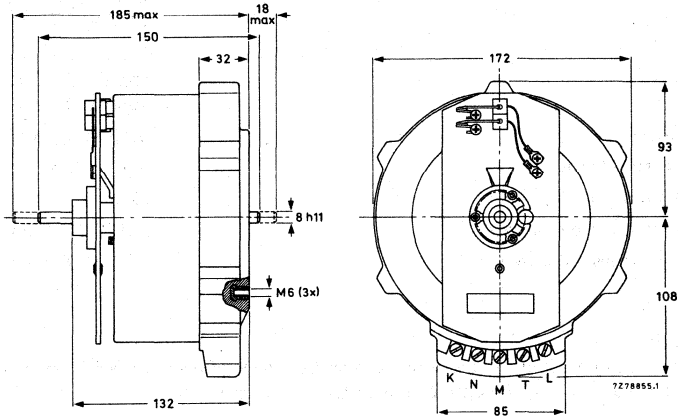


Fig. 3 Panel model.

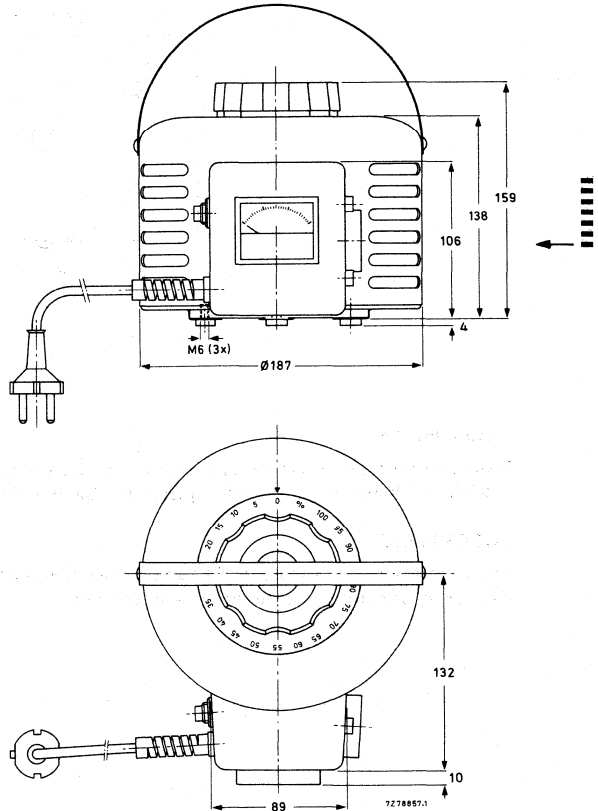


Fig. 4 Laboratory model.

TRANSFORMERS SIZE CODE E7.1

Degree of protection (IEC 144)	
panel model	IP00
laboratory model	IP20
Mass	
panel model	approx. 9 kg
laboratory model	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.

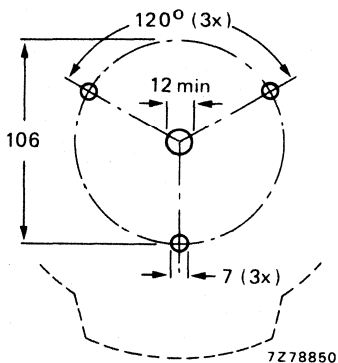


Fig. 5.

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	83
A.C. stabilizer module	107
Control knobs	113



GANGING AND MOTOR DRIVE

INTRODUCTION

Variable mains transformers can be electrically connected in parallel or in series. To ensure correct current distribution **chokes** should be inserted between the output terminals of transformers connected in parallel.

For 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**.

A motor drive can include:

- 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 come 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

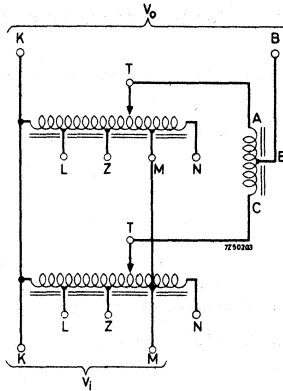


Fig. 1 Two transformers connected in parallel.

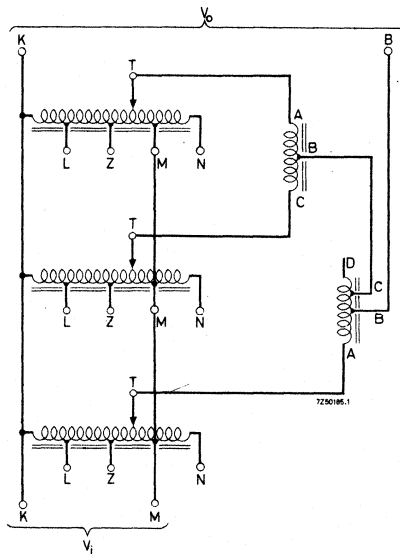


Fig. 2 Three transformers connected in parallel.

Transformers with size code E8 and E10

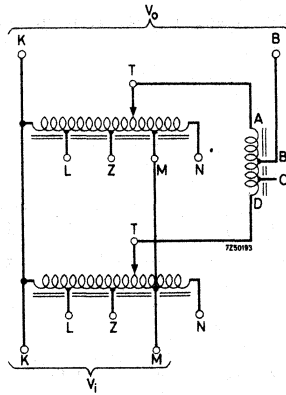


Fig. 3 Two transformers connected in parallel.

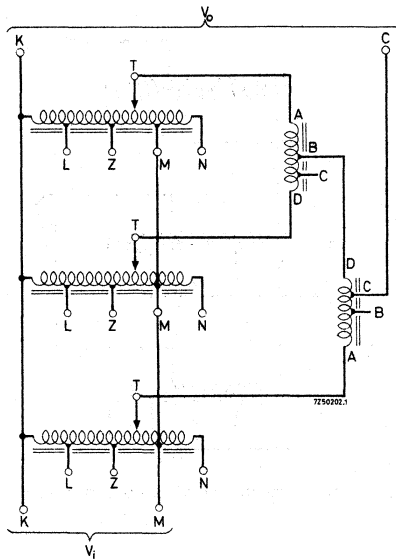


Fig. 4 Three transformers connected in parallel.

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".

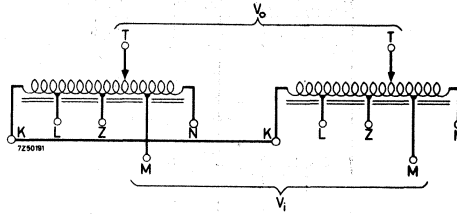


Fig. 5 Two transformers connected in series.

Three-phase connection

Three transformers in star circuit

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

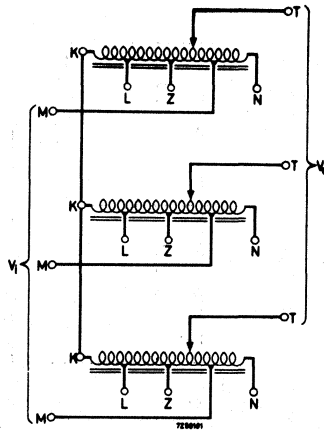


Fig. 6 Three transformers connected in star circuit.

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.

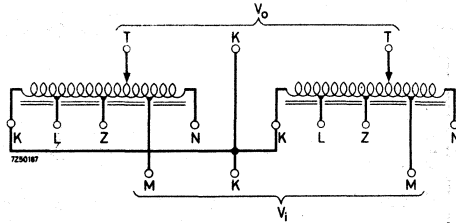


Fig. 7 Two transformers connected in open delta circuit.



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.

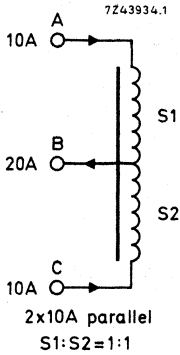


Fig. 8 Circuit diagram of choke 2422 532 00014.

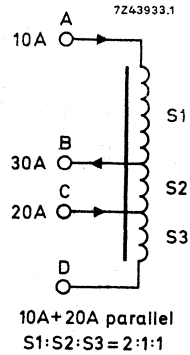


Fig. 9 Circuit diagram of choke 2422 532 00013.

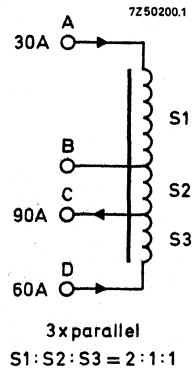
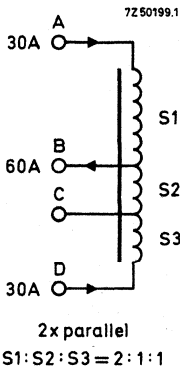


Fig. 10 Circuit diagram of choke 2422 532 00017.

MECHANICAL GANGING

Dimensions in mm

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

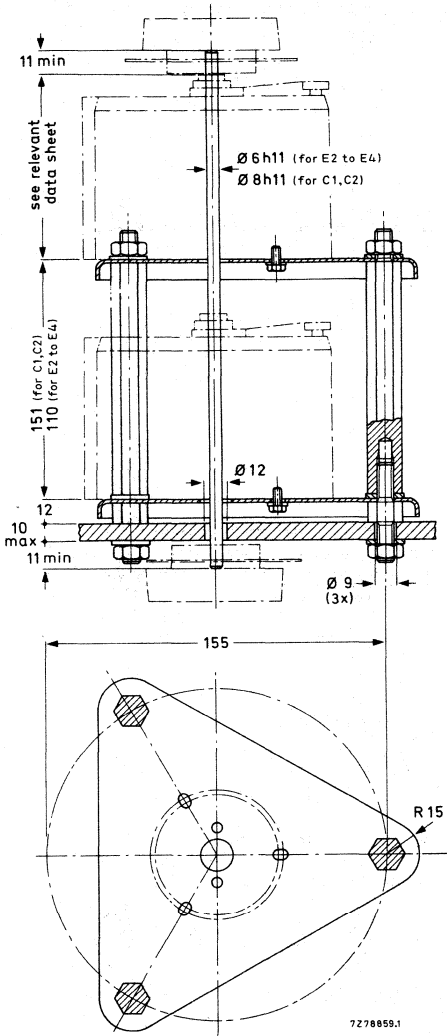


Fig. 11 Two ganged transformers.

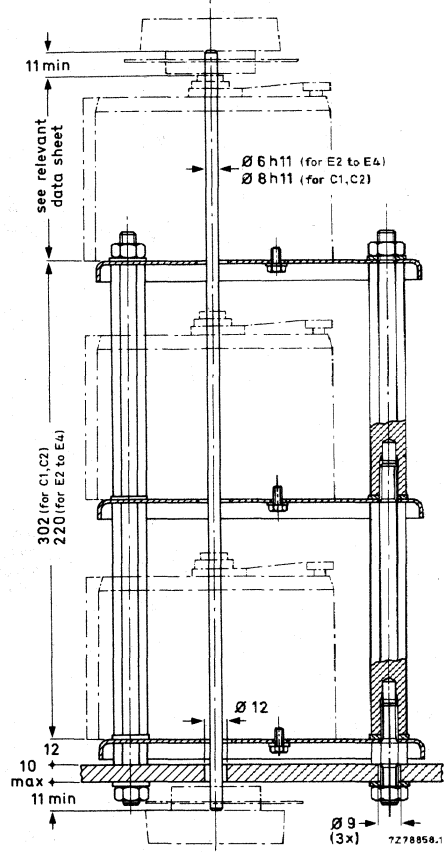


Fig. 12 Three ganged transformers.

Transformers with size code E6, E6.1 and E7

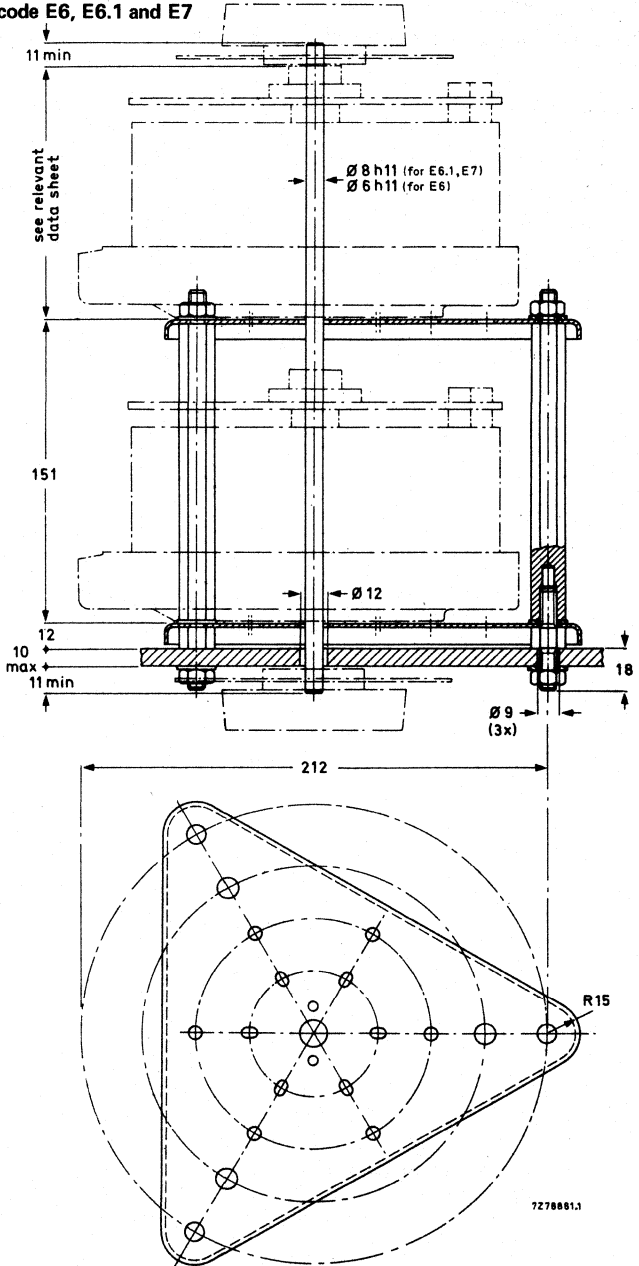


Fig. 13 Two ganged transformers.

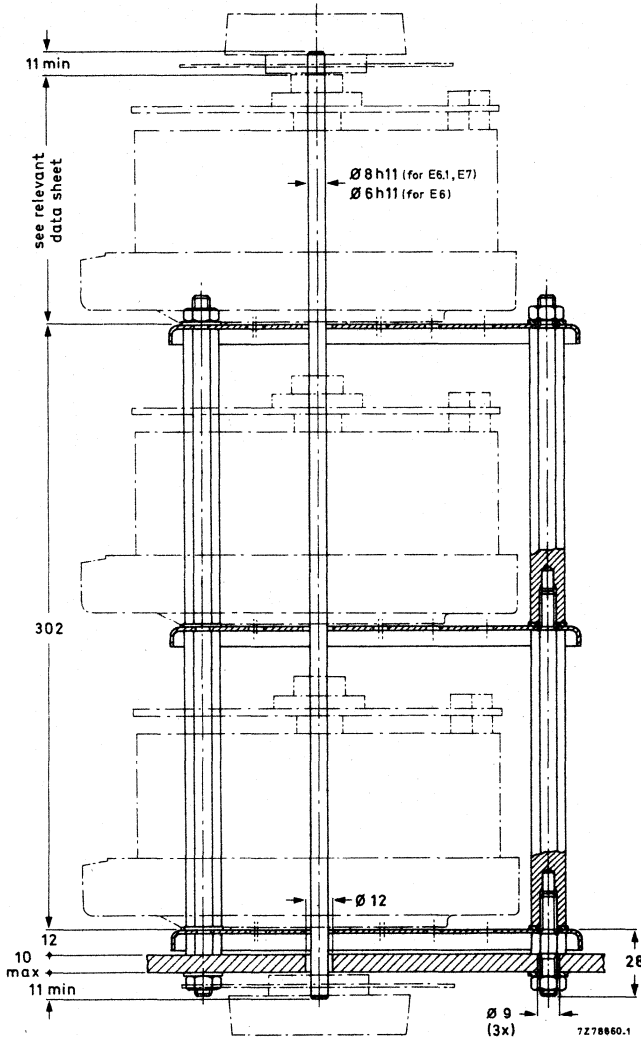


Fig. 14 Three ganged transformers.

Transformers with size code E8

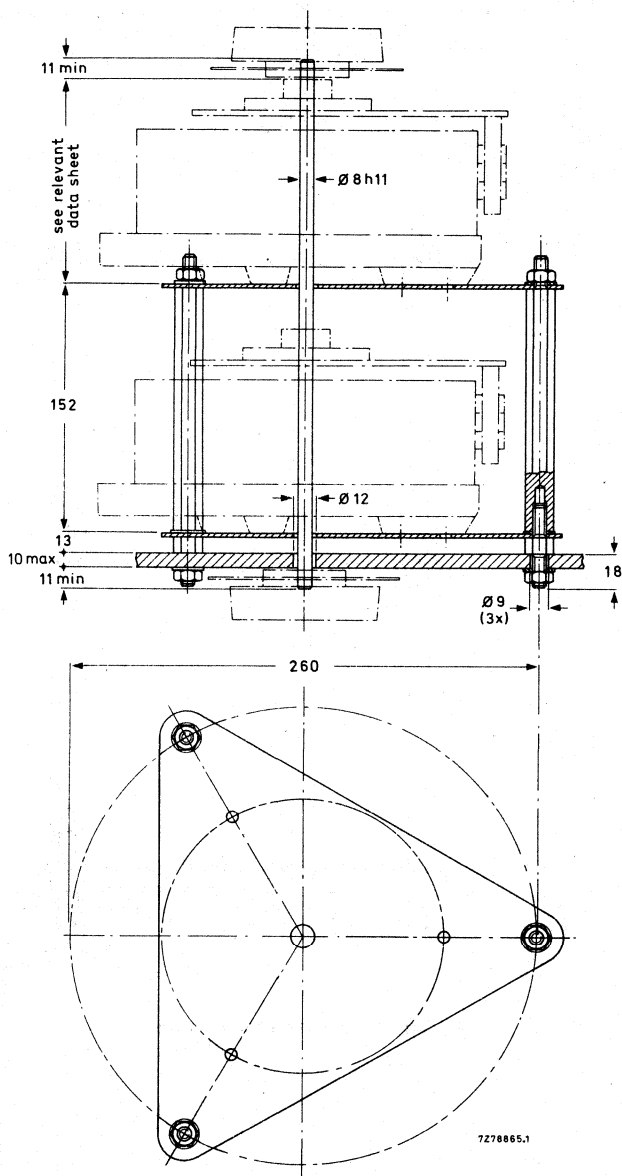


Fig. 15 Two ganged transformers.

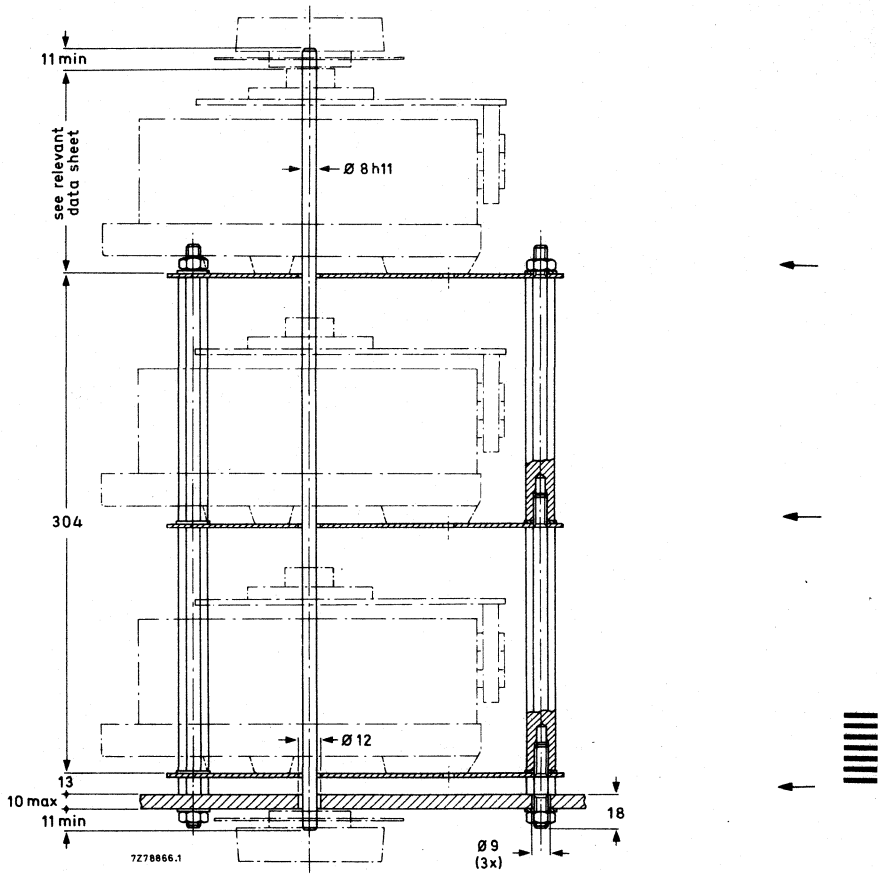


Fig. 16 Three ganged transformers.

Transformers with size code E10

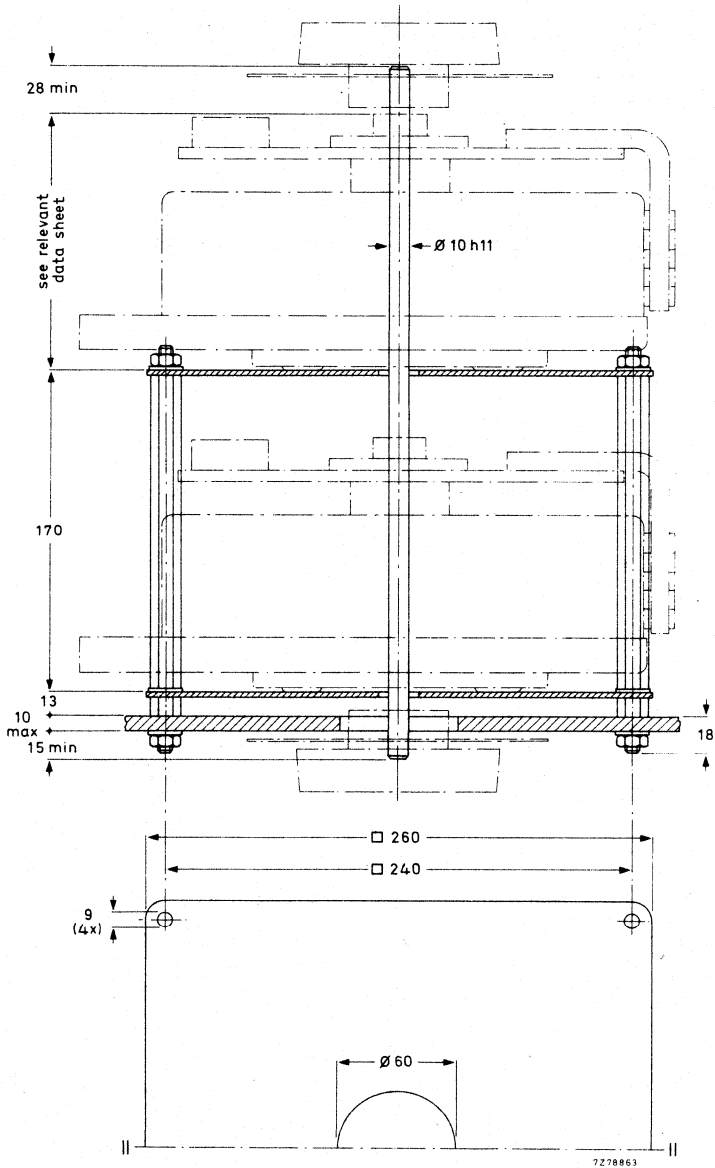


Fig. 17 Two ganged transformers.

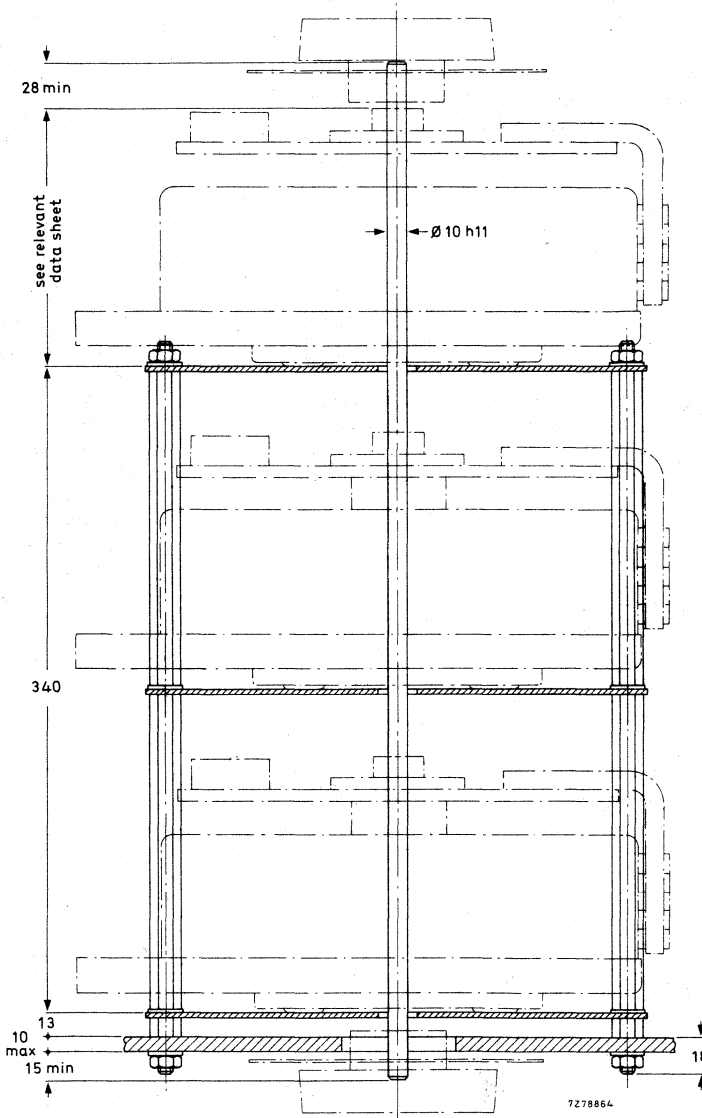


Fig. 18 Three ganged transformers.

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

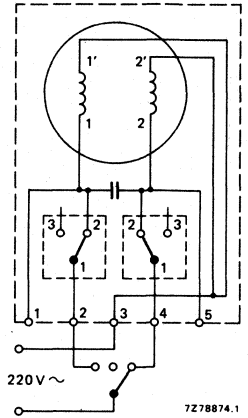
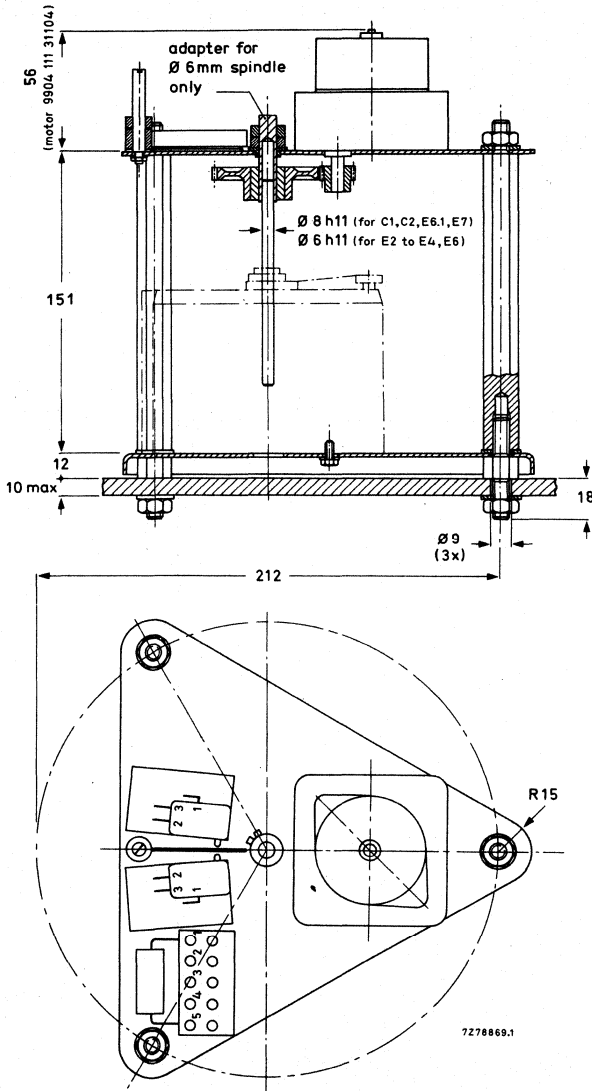


Fig. 20 Connection diagram for top-plate parts.
 Connection of motor terminals 1 and 2 may require interchanging (to terminals 5 and 1 respectively) for correct direction of rotation, depending on gearbox used.

Fig. 19 Motor drive for one transformer.

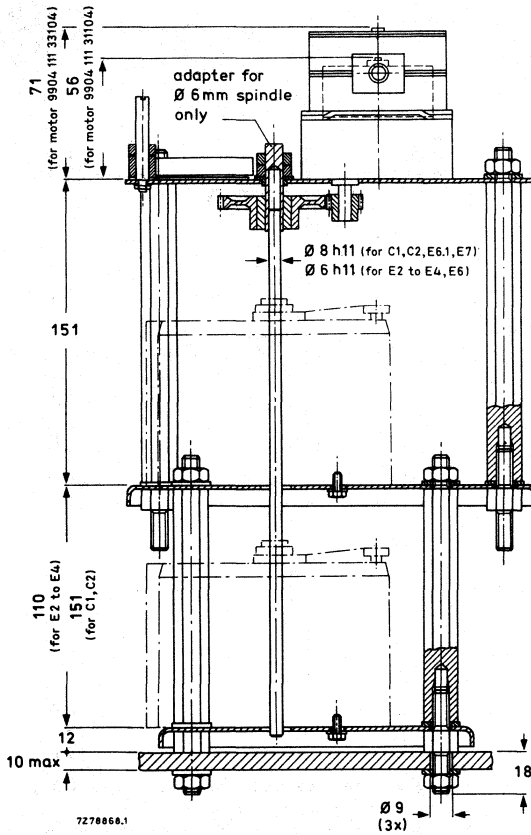


Fig. 21 Motor drive for two ganged transformers with size code C1, C2, E2, E3, E4.
For connections of top-plate parts, see Fig. 20.
For three ganged transformers, consult also Fig. 12.

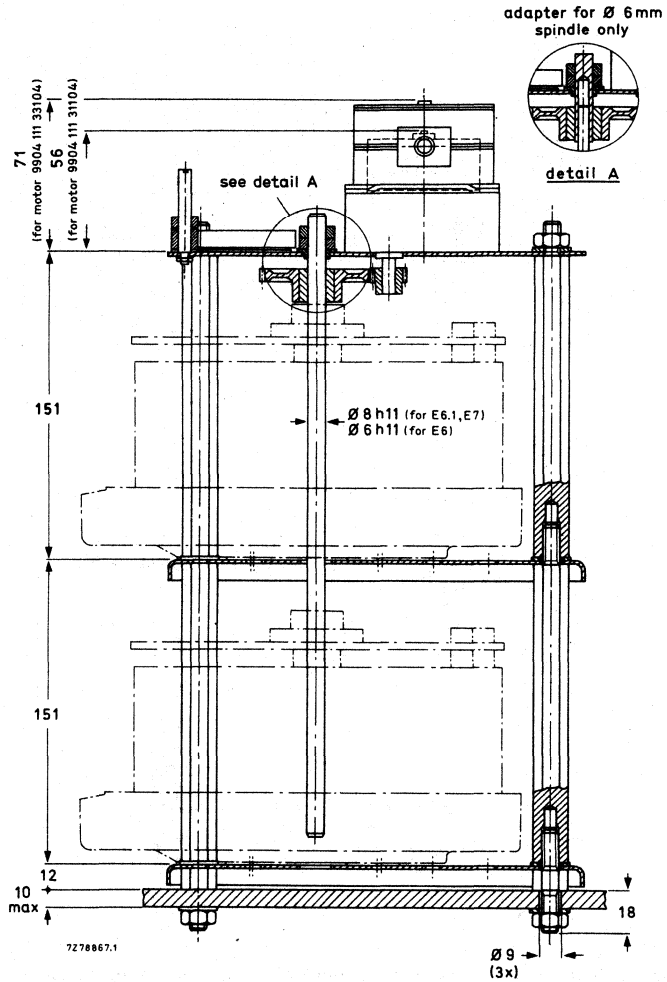


Fig. 22 Motor drive for two ganged transformers with size code E6, E6.1 and E7. For connections of top-plate parts, see Fig. 20. For three ganged transformers, consult also Fig. 14.

Transformers with size code E8

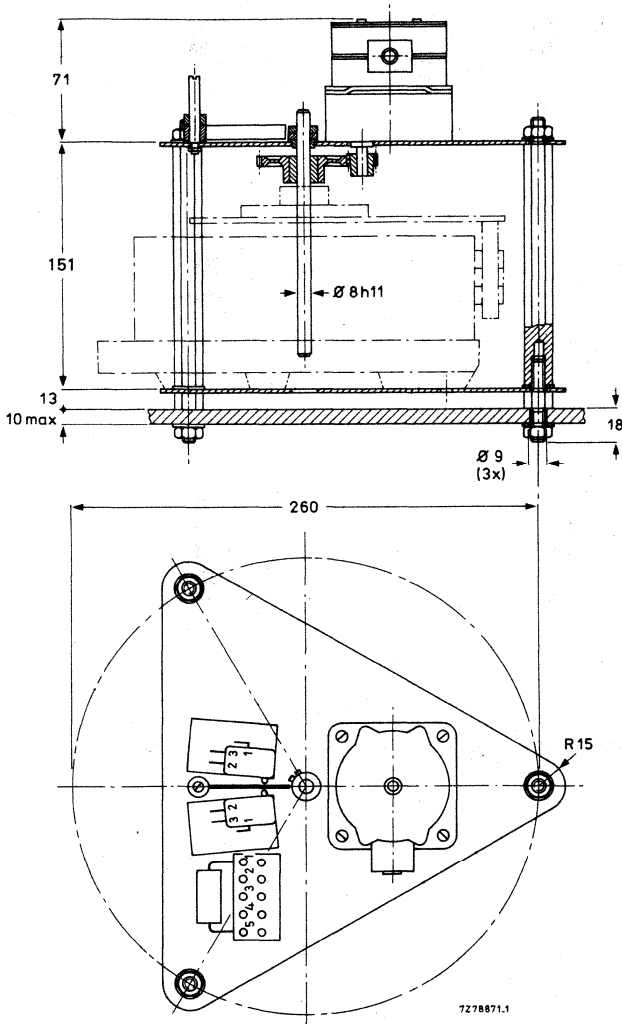


Fig. 23 Motor drive for one transformer.

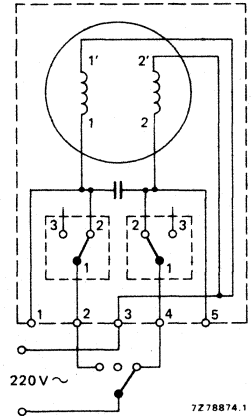


Fig. 24 Connection diagram for top-plate parts.

Connection of motor terminals 1 and 2 may require interchanging (to terminals 5 and 1 respectively) for correct direction of rotation, depending on gearbox used.



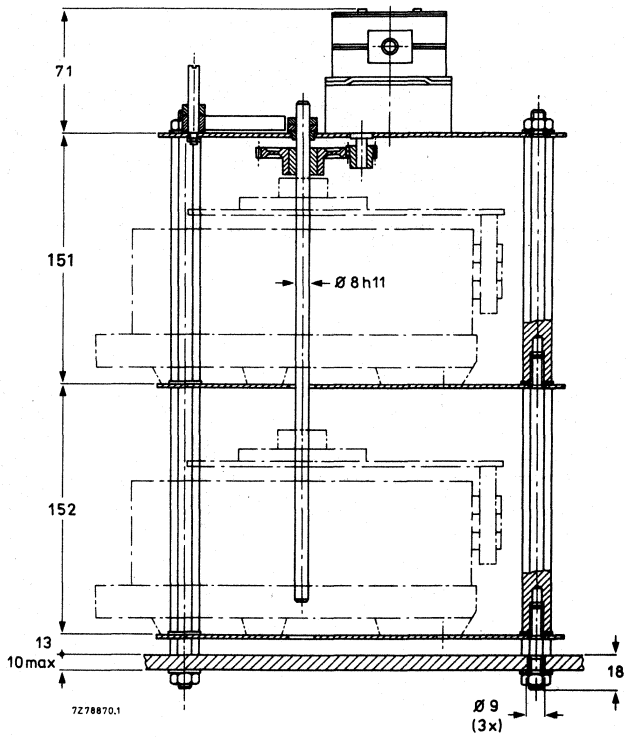


Fig. 25 Motor drive for two ganged transformers. For connection of top-plate parts, see Fig. 24.

For three ganged transformers, consult also Fig. 16.

Transformers with size code E10

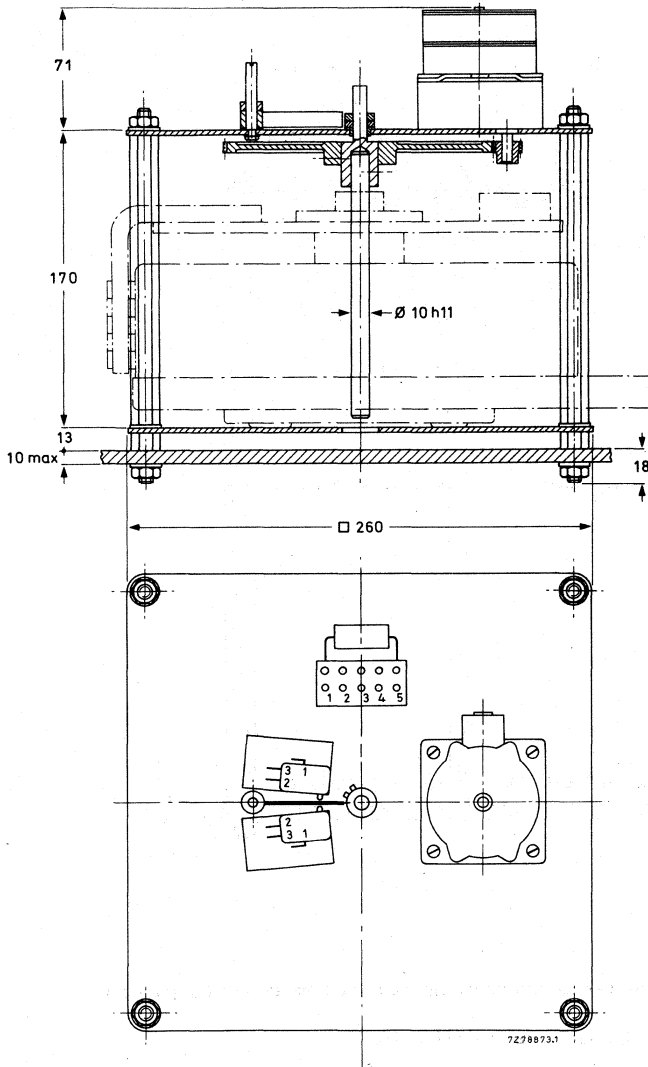


Fig. 26 Motor drive for one transformer.

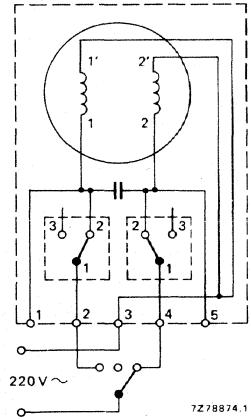


Fig. 27 Connection diagram for top-plate parts.

Connection of motor terminals 1 and 2 may require interchanging (to terminals 5 and 1 respectively) for correct direction of rotation, depending on gearbox used.



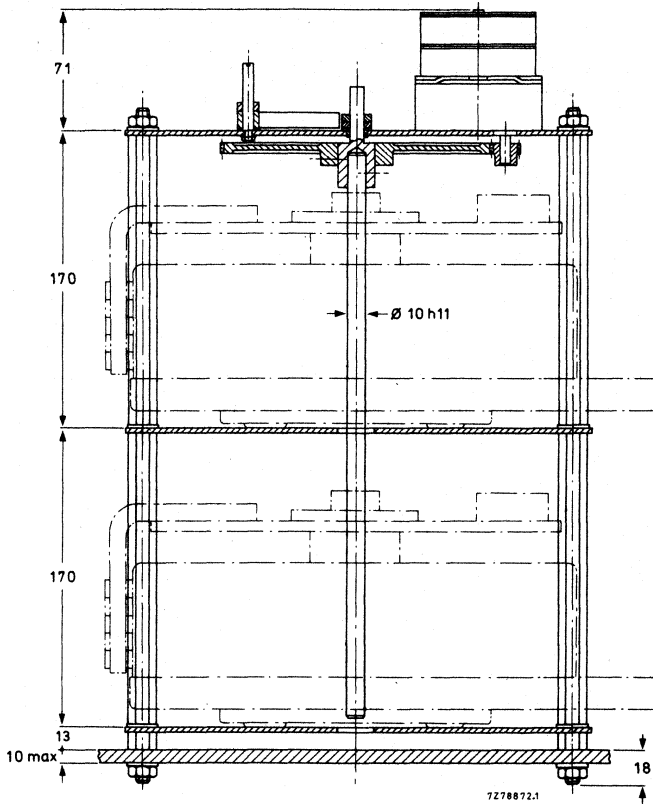


Fig. 28. Motor drive for two ganged transformers. For connection of top-plate parts, see Fig. 27.
For three ganged transformers, consult also Fig. 18.

ORDERING

See pages 104 and 105.

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.

The required phasing capacitor for the motor is supplied with the top plate kit.



ACCESSORIES



transformer size code	number of transformers	mechanical ganging		parallel connection	motor drive						
		ganging unit 2422 532	spindle 4322 026		choke 2422 532 (1)	top plate kit 2422 532	ganging unit for motor drive 2422 532	rotation time in s/rev. (2)			adaptor spindle 4322 026
								6,66	10	40	
E2.1 E3 E4	1					31	31	31	31	31	
	2	00057	66750		00072	33	31	31	31	31	68990
	3	00053	66740			33	33	31	31	31	
C1 C2	1					31	31	31	31	31	
	2	00016	08350		00072	33	31	31	31	31	
	3	00005	08360			33	33	31	31	31	
E6	1					31	31	31	31	31	
	2	00055	66750	00014	00072	33	33	31	31	31	68990
	3	00056	66740	00013+ 00014		33	33	33	31	31	
E6.1 E7	1					31	31	31	31	31	
	2	00055	08350	00014	00072	33	33	31	31	31	
	3	00056	08360	00013+ 00014		33	33	33	31	31	
E8	1					33	33	33	33	33	
	2	00066	08350	00017	00068	33	33	33	33	33	
	3	00067	08360	2x00017			33	33	33	33	

A.C. STABILIZER MODULE

2422 532 00071

QUICK REFERENCE DATA

Input voltage	220 V, + 10%, - 15%; 50/60 Hz	←
Stabilized output voltage of the controlled transformer	5 to 115% of input voltage	
Maximum stabilization accuracy	± 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. Application areas are in test and research laboratories, service centres, and factories. The module can also be used as a voltage, light or temperature-sensitive control for power sources. It is not intended for transformers with separate windings.

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 with 220 V reversible synchronous motor, see "ganging and motor drive";
- the a.c. stabilizer module;
- a control potentiometer.

Figure 1 shows the block diagram of the stabilizer circuit. 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 $k_1 V_{ref}$ 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, $k_2 V_{out}$, is applied to the other comparator input. The comparator provides an output e to the switching amplifier when the difference between $k_2 V_{out}$ and $k_1 V_{ref}$ 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 ± 0,5 V and ± 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 turn to turn causes a stepping voltage. Simultaneous occurrence 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.

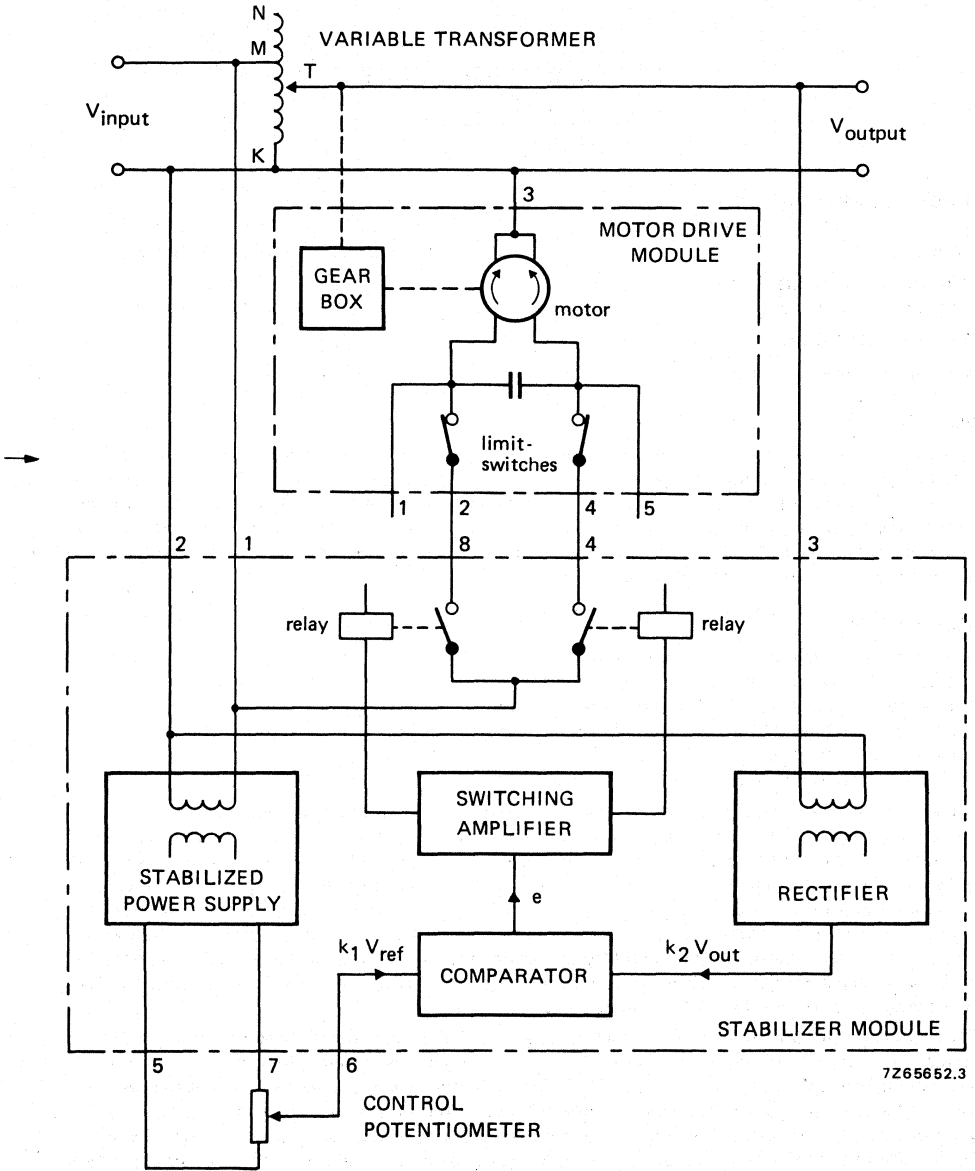


Fig. 1.

MECHANICAL DATA

Dimensions in mm

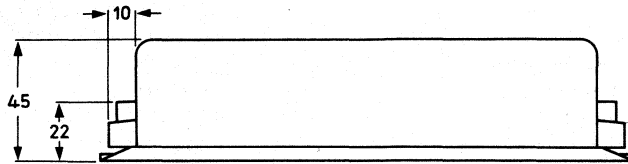
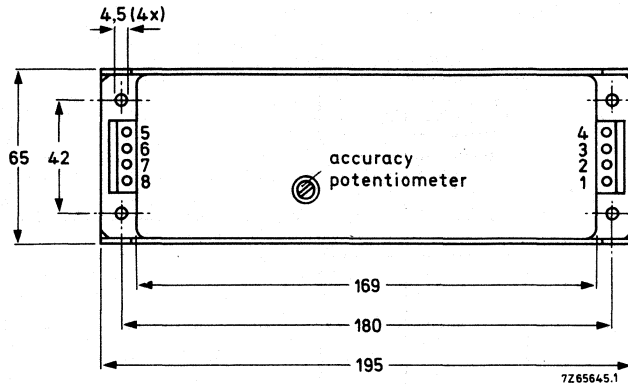


Fig. 2.



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%; 50/60 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 φ = 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
other transformers

14,5 V/s**

43 V/s**

Operating temperature range

-10 to +45 °C

Storage temperature range

-25 to +85 °C

Connections

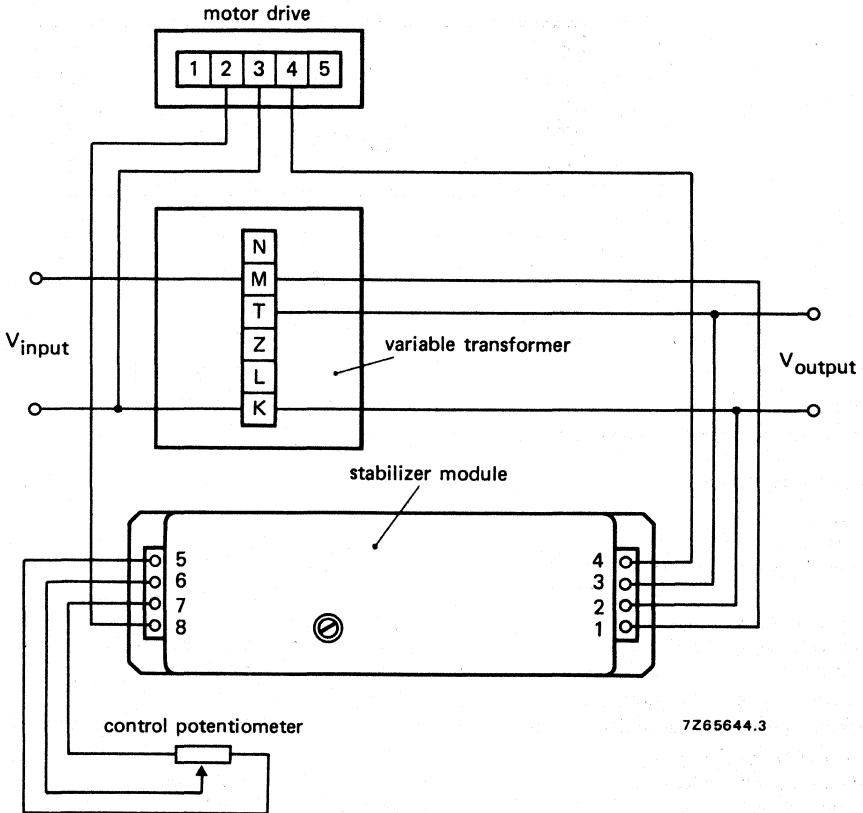


Fig. 3.

* 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".

Notes

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

Recommended control potentiometer $5\text{ k}\Omega \pm 20\%$, $0,25\text{ W}$.

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

APPLICATION INFORMATION**Heavy load application**

Greater output current that is stabilized against load and input voltage variations can be achieved by a boost transformer connected according to Fig. 4. The permissible load current 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.

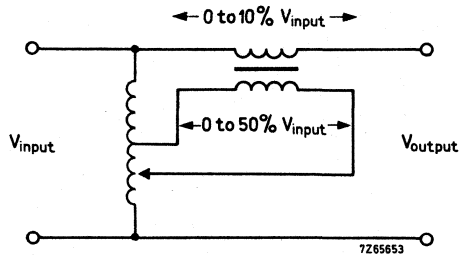


Fig. 4.

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 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

These knobs with scales are for panel model transformers. They have a clamping collet enabling them to be locked in any position on the spindle. The range includes knobs with large diameter scales which allow transformer mounting screws to be concealed.

scale 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, E1.1, 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	
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	E10

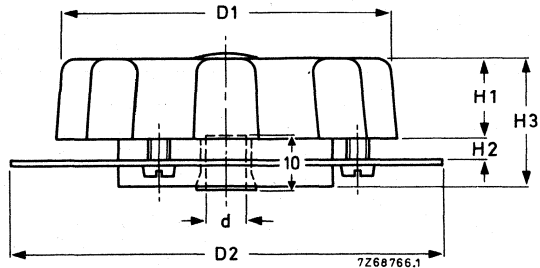


Fig. 1 Control knob with dial.


VARIABLE MAINS TRANSFORMERS




GENERAL (WITH SURVEY)



AUTO-TRANSFORMERS



VARIABLE MAINS TRANSFORMERS
WITH SEPARATE WINDINGS



ACCESSORIES

Argentina: FAPESA, Av. Crovara 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. 6291 11.

Belgium: M.B.L.E., 7, rue du Pavillon, B-1030 BRUXELLES, Tel. (02) 242 7400.

Brazil: IBRAPE, Caixa Postal 7383, Av. Brigadeiro Faria Lima, 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: PHILIPS GmbH, Miramstr. 87, 3500 KASSEL, Tel. (0561)5011.

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. 12-24 51 21.

India: PEICO ELECTRONICS & ELECTRICALS LTD., Ramon House, 169 Backbay Reclamation, BOMBAY 400020, Tel. 295144.

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Ireland: PHILIPS ELECTRICAL (IRELAND) LTD., Newstead, Clonskeagh, DUBLIN 14, Tel. 69 3355.

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.
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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 PB EINDHOVEN, Tel. (040) 79 33 33.

New Zealand: PHILIPS ELECTRICAL IND. LTD., Elcoma Division, 2 Wagener Place, St. Lukes, AUCKLAND, Tel. 894-160.

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

Peru: CADESA, Rocca de Vergallo 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., Lorong 1, Toa Payoh, SINGAPORE 1231, Tel. 25 38 811.

South Africa: EDAC (Pty) Ltd., 3rd Floor Rainer House, Upper Railway Rd. & Ove St., New Doornfontein, JOHANNESBURG 2001, Tel. 614-2362/9.

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

Sweden: SVENSKA A.B. PHILIPS, Industrielektronik, Avd. Matinstrumnt, Fack 102 50, STOCKHOLM 27, Tel. 08/63 50 00.

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

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

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

United Kingdom: RILTON ELECTRONICS LTD., Millbrook Ind. Est., CROWBOROUGH, Sussex, Tel. (08926) 4489.

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., Avda Rondeau 1576, piso 5, MONTEVIDEO, Tel. 91 43 21.

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