

PHILIPS

Data handbook



Electronic
components
and materials

Components and materials

Book C7

1985

Variable capacitors

VARIABLE CAPACITORS

Selection guide	<i>page</i> 2
Device specifications	
Precision tuning capacitors.	5
Film dielectric trimmers	17

DATA HANDBOOK SYSTEM

Our Data Handbook System comprises more than 60 books with specifications on electronic components, subassemblies and materials. It is made up of four series of handbooks:

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

The contents of each series are listed on pages iv to viii.

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

When ratings or specifications differ from those published in the preceding edition they are indicated with arrows in the page margin. Where application information is given it is advisory and does not form part of the product specification.

Condensed data on the preferred products of Philips Electronic Components and Materials Division is given in our Preferred Type Range catalogue (issued annually).

Information on current Data Handbooks and on how to obtain a subscription for future issues is available from any of the Organizations listed on the back cover.

Product specialists are at your service and enquiries will be answered promptly.

ELECTRON TUBES (BLUE SERIES)

The blue series of data handbooks comprises:

- T1 Tubes for r.f. heating**
- T2a Transmitting tubes for communications, glass types**
- T2b Transmitting tubes for communications, ceramic types**
- T3 Klystrons**
- T4 Magnetrons for microwave heating**
- T5 Cathode-ray tubes**
Instrument tubes, monitor and display tubes, C.R. tubes for special applications
- T6 Geiger-Müller tubes**
- T7 Gas-filled tubes (will not be reprinted)**
- T8 Colour display systems**
Colour TV picture tubes, colour data graphic display tube assemblies, deflection units
- T9 Photo and electron multipliers**
- T10 Plumbicon camera tubes and accessories**
- T11 Microwave semiconductors and components**
- T12 Vidicon and Newvicon camera tubes**
- T13 Image intensifiers**
- T14 Infrared detectors**
- T15 Dry reed switches**
- T16 Monochrome tubes and deflection units**
Black and white TV picture tubes, monochrome data graphic display tubes, deflection units

} Data collations on these subjects are available now.
Data Handbooks will be published in 1985.

SEMICONDUCTORS (RED SERIES)

The red series of data handbooks comprises:

- S1 Diodes**
Small-signal germanium diodes, small-signal silicon diodes, voltage regulator diodes (< 1,5 W), voltage reference diodes, tuner diodes, rectifier diodes
- S2a Power diodes**
- S2b Thyristors and triacs**
- S3 Small-signal transistors**
- S4a Low-frequency power transistors and hybrid modules**
- S4b High-voltage and switching power transistors**
- S5 Field-effect transistors**
- S6 R.F. power transistors and modules**
- S7 Surface mounted semiconductors**
- S8 Devices for optoelectronics**
Photosensitive diodes and transistors, light-emitting diodes, displays, photocouplers, infrared sensitive devices, photoconductive devices.
- S9 Power MOS transistors**
- S10 Wideband transistors and wideband hybrid IC modules**
- S11 Microwave semiconductors (to be published in this series in 1985)**
At present available in Handbook T11
- S12 Surface acoustic wave devices**

INTEGRATED CIRCUITS (PURPLE SERIES)

The purple series of data handbooks comprises:

EXISTING SERIES

Superseded by:

IC1	Bipolar ICs for radio and audio equipment	IC01N
IC2	Bipolar ICs for video equipment	IC02N
IC3	ICs for digital systems in radio, audio and video equipment	IC01N and IC02N
IC4	Digital integrated circuits CMOS HE4000B family	
IC5	Digital integrated circuits – ECL ECL10 000 (GX family), ECL100 000 (HX family), dedicated designs	IC08N
IC6	Professional analogue integrated circuits	
IC7	Signetics bipolar memories	
IC8	Signetics analogue circuits	IC11N
IC9	Signetics TTL logic	IC09N and IC15N
IC10	Signetics Integrated Fuse Logic (IFL)	IC13N
IC11	Microprocessors, microcomputers and peripheral circuitry	

NEW SERIES

IC01N	Radio, audio and associated systems Bipolar, MOS	(published 1985)
IC02N	Video and associated systems Bipolar, MOS	(published 1985)
IC03N	Telephony equipment Bipolar, MOS	
IC04N	HE4000B logic family CMOS	
IC05N	HE4000B logic family uncased integrated circuits CMOS	(published 1984)
IC06N	High-speed CMOS; PC54/74HC/HCT/HCU Logic family	(published 1985)
IC07N	PC54/74HC/HCU/HCT uncased integrated circuits HCMOS	
IC08N	10K and 100K logic family ECL	(published 1984)
IC09N	Logic series TTL	(published 1984)
IC10N	Memories MOS, TTL, ECL	
IC11N	Linear LSI	(published 1985)
IC12N	Semi-custom gate arrays & cell libraries ISL, ECL, CMOS	
IC13N	Semi-custom Integrated Fuse Logic	(published 1985)
IC14N	Microprocessors, microcontrollers & peripherals Bipolar, MOS	
IC15N	Logic series FAST TTL	(published 1984)

Note

Books available in the new series are shown with their date of publication.




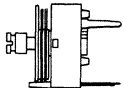
COMPONENTS AND MATERIALS (GREEN SERIES)

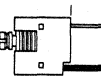
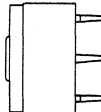
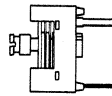
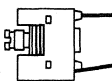
The green series of data handbooks comprises:

- C1 Programmable controller modules**
PLC modules, PC20 modules
- C2 Television tuners, coaxial aerial input assemblies, surface acoustic wave filters**
- C3 Loudspeakers**
- C4 Ferroxcube potcores, square cores and cross cores**
- C5 Ferroxcube for power, audio/video and accelerators**
- C6 Synchronous motors and gearboxes**
- C7 Variable capacitors**
- C8 Variable mains transformers**
- C9 Piezoelectric quartz devices**
- C10 Connectors**
- C11 Non-linear resistors**
Voltage dependent resistors (VDR), light dependent resistors (LDR), negative temperature coefficient thermistors (NTC), positive temperature coefficient thermistors (PTC)
- C12 Potentiometers, encoders and switches**
- C13 Fixed resistors**
- C14 Electrolytic and solid capacitors**
- C15 Ceramic capacitors**
- C16 Permanent magnet materials**
- C17 Stepping motors and associated electronics**
- C18 Direct current motors**
- C19 Piezoelectric ceramics**
- C20 Wire-wound components for TVs and monitors**
- C21 Assemblies for industrial use**
HNIL FZ/30 series, NORbits 60-, 61-, 90-series, input devices
- C22 Film capacitors**

SELECTION GUIDE

SELECTION GUIDE

catalogue number	housing dimensions mm	capacitance range C_{min}/C_{max} pF	rated voltage V	temp. coeff. $10^{-6}/K$	temperature range $^{\circ}C$	page
FILM DIELECTRIC TRIMMERS; general purpose						
2222 808 23 . . . 2238 808 20 . . .	ϕ 5 	1,2/5 to 3/27	150	-250 \pm 200 to -50 \pm 200	-40 to +70	19
2222 808 2238 808	ϕ 7,5 	1,2/6 to 3/50	250	-500 \pm 450 to -100 \pm 300	-40 to +70 -40 to +85	25
2222 808 3 2222 808 6	ϕ 10 	1,8/15 to 5/105	250	-500 \pm 150 to -100 \pm 300	-40 to +70 -40 to +85	33
2222 808 4 2222 808 7	ϕ 13,5 	8/130 and 15/200	150	-200 \pm 300 and 0 \pm 300	-40 to +85	43

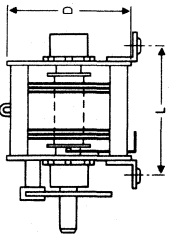
catalogue number	housing dimensions mm	capacitance range C_{min}/C_{max} pF	rated voltage V	temp. coeff. $10^{-9}/K$	temperature range $^{\circ}C$	page
FILM DIELECTRIC TRIMMERS; professional purpose						
2222 809 050 ..	6 x 8 x 9 	1,2/3,5 to 2/18	300	-250 ± 150 and -350 ± 150	-40 to + 125	51
2222 809 070 ..	11 x 14 x 9 	2/12 to 7/150	200	0 ± 200	-40 to + 125	59
2222 809 080 ..	10 x 11 x 11 	4/40 and 5/60	300	-250 ± 150	-40 to + 125	65
2222 809 090 ..	8 x 9 x 10 	1,4/5,5 to 2/18	300	-250 ± 150	-40 to + 125	73

Notes

Some data on our trimmers, such as the temperature coefficient and the climatic category, are defined on the basis of type approval tests. All specified values are continuously checked by a random test system of which the results are gathered in periodical surveys from which typical values can be derived and made available on request.

VARIABLE CAPACITORS

catalogue number	dimensions L x D		variable capacitance range pF	page
	number of gangs	D = mm		
		D = 60 x 40 mm	40 x 40 mm linear	60 x 60 mm logarithmic
		D = 60 x 60 mm		
PRECISION TUNING CAPACITORS				
	1	L = 45	single 1 to 4 gangs	100 to 640
	2	L = 76,5	split 1 to 4 gangs	100 to 500
	3	L = 108		25 to 125
2222 805 *	4	L = 139,5	differential 1 gang	25 to 125
		L = 218,5		—



* Maintenance type.

PRECISION TUNING CAPACITORS

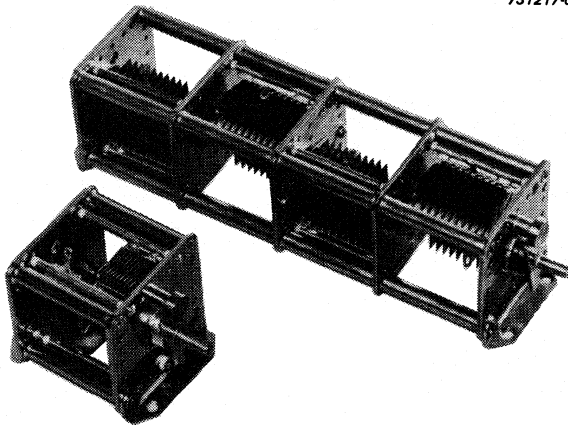
PRECISION TUNING CAPACITORS

QUICK REFERENCE DATA

type	40 x 40 mm standard torque	60 x 60 mm standard torque	
	linear law	linear law	logarithmic law
single stator 1 - 4 gangs	16 - 250 pF*	100 - 640 pF	100 - 500 pF
split stator 1 - 4 gangs	10 - 64 pF	25 - 125 pF	25 - 125 pF
differential 1 gang	64 - 160 pF*		
Law and ganging tolerances		± 0,7%	

* 1 gang types also available with high torque and spindle-end slotted.

731217-03-01



APPLICATION

These air dielectric capacitors are applicable where a high accuracy of adjustment and a high degree of stability are required.

They are available with one to four gangs.

DESCRIPTION**Frame**

Nickel-plated brass plates and bars, assembled by riveting and soldering.

Spindle

Ball bearings on both ends.

Rotor

Clean brass vanes soldered to the shaft. The rotor sections are insulated from the frame and from each other by siliconized ceramic bars.

Stator

Clean brass vanes supported and insulated by siliconized ceramic balls.

Protruding spindle end

Diameter 6 mm, standard free length 10 and 14,5 mm for (40 x 40 mm) version and (60 x 60 mm) version respectively.

Direction of rotation

Clockwise for increasing capacitance.

Angle of rotation

180° or 360° at choice.

Owing to the eccentric rotor vanes, the versions with logarithmic laws have 180° as maximum angle of rotation.

High stability and freedom from noise are obtained by soldering all the metal parts together. Low contact is ensured by silver contact points on the rotor drag spring and a gold plated contact ring soldered to the rotor.

Silicone treated ceramics are used exclusively for insulation ensuring that the insulation resistance is high and the losses are low, even in humid conditions. The resistance to shock and vibration is high as the stator is supported by and insulated with ceramic balls. The ceramic spindles are able to withstand severe impact and vibration.

The standard spindle end is provided with a detent which, together with a removable stop on the front plate, permits the accurate setting of a rotation angle of 15° as a reference for checking the capacitance and its variation as a function of rotation. For rotation angles of 165° and above, the stop should be removed.

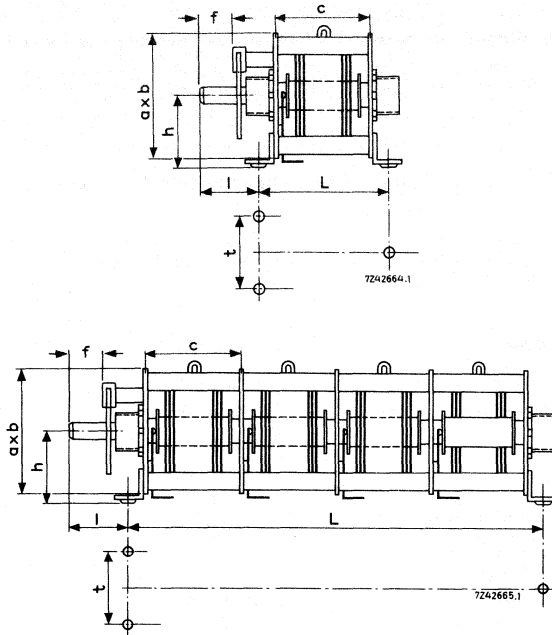
Single capacitors of the (40 x 40 mm) version for direct drive operation have the spindle end slotted for screwdriver adjustment.

The capacitors are built entirely of basic parts with symmetrically placed stator and rotor packs. Non-listed combinations having non-standard capacitances, extra compartments, longer spindle ends (protruding up to 50 mm from both faces) and different connections, can be obtained on customers specification.

Fully customer-built capacitors, of which the technical specification has been discussed with the local field engineer, can also be supplied.

MECHANICAL DATA

Dimensions in mm



dimensions in mm		a x b	number of gangs			
			1	2	3	4
distance between mounting holes (± 0,5)	L	40 x 40 60 x 60	45 67	76,5 117,5	108 168	139,5 218,5
	t	40 x 40 60 x 60	22 35			
compartment length (± 0,2)	c	40 x 40 60 x 60	31,5 50,5			
spindle length (± 0,5)	l	40 x 40 60 x 60	16 18			
spindle height (± 0,5)	h	40 x 40 60 x 60	22,5 32,5			
free spindle length	f	40 x 40 60 x 60	10 14,5			
mass (g)		40 x 40	120	200	300	400
		60 x 60	400	700	1000	1300

Direction of rotation for increase in capacitance

clockwise

Effective angle of rotation

linear capacitor

360°

logarithmic capacitor

180°

Maximum axial thrust

50 N

operating torque	1 gang		2 gangs	3 gangs	4 gangs	
	direct drive	indirect drive				
minimum	20					mNm
maximum	50	20	25	30	35	mNm

Mounting

The capacitors can be mounted by means of screws passed through the three holes in the mounting brackets.

Connecting leads:

Two wires of 1,5 mm maximum diameter can be connected to each soldering tag.

ELECTRICAL DATA

Nominal capacitance swing see C_{var} in table I

Maximum capacitance at 0° see C_0 in table I

Test voltage see V_{test} in table I

Rated voltage $\frac{1}{2} V_{test}$

Coupling capacitance
 between stator packs $\leq 0,02 \text{ pF}$
 between rotor packs (if insulated) $\leq 0,05 \text{ pF}$

Insulation resistance between stator and rotor and between frame and stator and rotor $> 10\,000 \text{ M}\Omega$

Contact resistance between any soldering tag and the relative rotor pack $\leq 5 \text{ m}\Omega$

Parallel damping at 1,5 MHz with 50 pF (or max. capacitance if $< 50 \text{ pF}$) $> 10 \text{ M}\Omega$

Temperature coefficient of capacitance for the first compartment (at $C = 1/3 \text{ cap. swing} + \text{capacitance at } 15^\circ$) in ppm/°C.

version	40 x 40 mm	60 x 60 mm
1 gang	20 ± 20	30 ± 30
2 gangs	20 ± 20	30 ± 30
3 gangs	30 ± 30	50 ± 50
4 gangs	50 ± 50	50 ± 50

Capacitance law

angle of rotation	capacitance increase (% of capacitance swing)	
	linear law	logarithmic law
15°	0	0
20°	3,12	0,83
30°	9,38	2,68
40°	15,62	4,81
50°	21,88	7,28
70°	34,38	13,41
90°	46,88	21,58
110°	59,38	32,49
130°	71,88	47,03
150°	84,38	66,42
175°	100	100

Capacitance tolerance

For angles of rotation between 15° and 175°, the capacitance tolerance in the first compartment is given by the expression:

$$\pm 0,7 (0,11 C + C')/100$$

where

C = capacitance swing (minimum 25 pF)

C' = capacitance increase calculated from the capacitance law.

Ganging tolerance (rotation angles between 15° and 175°)

The capacitance in the second, third and fourth compartments will not differ from the actual capacitance in the first compartment by more than $\pm 0,7\%$.

Backlash (reproducibility)

(for indirect drive capacitors)

better than $150 \times 10^{-6} \text{pF/pF}$

Category temperature range

-40 to + 85 °C

ELECTRICAL DATA (continued)

Table I

C_{var} (pF)	size a x b = 40 x 40 mm linear capacitance law		size a x b = 60 x 60 mm linear capacitance law		size a x b = 60 x 60 mm logarithmic capacitance law	
	single-stator or differential type	split-stator type	single-stator type	split-stator type	single-stator type	split-stator type
	$C_0 \pm 1$ pF ¹⁾ (V d.c.)	$C_0 \pm 1$ pF (pF)	$C_0 \pm 1$ pF (pF)	$C_0 \pm 1$ pF (pF)	$C_0 \pm 1$ pF (pF)	$C_0 \pm 1$ pF (pF)
	V_{test} ²⁾ (V d.c.)	V_{test} ³⁾ (V d.c.)	V_{test} ³⁾ (V d.c.)	V_{test} ³⁾ (V d.c.)	V_{test} ³⁾ (V d.c.)	V_{test} ³⁾ (V d.c.)
10		3				
16	8	2500				5
25	8,5	2000		5	4000	5
32		4		5	3000	5,5
40	9	1500		5	2500	5,5
50		4		5,5	2000	5,5
64	9	1000		5,5	2000	5,5
80		4		5,5	2000	5,5
100	10	1000	14,5	5,5	2000	5,5
125			15	6	1600	5,5
160	11	800	15,5			1300
250			16			
200	11,5	650 ⁴⁾	16			
320			17,5			
400			19			
500			20,5			
640			21,5			

1) For the differential version the C_0 values are 1 pF less than the tabulated values

2) Between rotor and stator

3) Between the two stators

4) Differential type only up to and including $C_{var} = 160$ pF

CATALOGUE NUMBERS

2222 805

suffix, see Tables II and III

00 for 40 x 40 mm version

02 for 60 x 60 mm version

Table II 40 x 40 mm version

type	C _{var} (pF)	single-stator		split stator	differential type	
		indirect drive 1)	direct drive 2)	indirect drive 1)	indirect drive 1)	direct drive 2)
1 gang	10			187		
	16	131	173	188		
	25	132	178	189		
	40	133	174	191		
	64	134	175	192	239	252
	100	135	176		241	253
	160	136	177		242	254
	250	137	179			
2 gangs	2 x 10			194		
	2 x 16	138		195		
	2 x 25	139		196		
	2 x 40	141		197		
	2 x 64	142		198		
	2 x 100	143				
	2 x 160	144				
	2 x 250	145				
3 gangs	3 x 10					
	3 x 16	146		201		
	3 x 25	147		202		
	3 x 40	148		203		
	3 x 64	149		204		
	3 x 100	151		205		
	3 x 160	152				
3 x 250	153					
4 gangs	4 x 10			207		
	4 x 16	154		208		
	4 x 25	155		209		
	4 x 40	156		211		
	4 x 64	157		212		
	4 x 100	158				
	4 x 160	159				
	4 x 250	161				

1) low torque

2) high torque

Table III 60 x 60 mm version

type	C _{var} (pF)	single-stator		split-stator	
		linear law	logarithmic law	linear law	logarithmic law
1 gang	25			298	345
	32			299	346
	40			301	347
	50			302	348
	64			303	349
	80			304	351
	100	196	249	305	352
	125	197	251	306	353
	160	198	252		
	200	199	253		
	250	201	254		
	320	202	255		
	400	203	256		
	500	204	257		
	640	205			
	2 gangs	2 x 25			307
2 x 32				308	355
2 x 40				309	356
2 x 50				311	357
2 x 64				312	358
2 x 80				313	359
2 x 100		206	258	314	361
2 x 125		207	259	315	362
2 x 160		208	261		
2 x 200		209	262		
2 x 250		211	263		
2 x 320		212	264		
2 x 400		213	265		
2 x 500		214	266		
2 x 640		215			

Table III (continued)

type	C_{var} (pF)	single-stator		split-stator	
		linear law	logarithmic law	linear law	logarithmic law
3 gangs	3 x 25			316	363
	3 x 32			317	364
	3 x 40			318	365
	3 x 50			319	366
	3 x 64			321	367
	3 x 80			322	368
	3 x 100	216	267	323	369
	3 x 125	217	268	324	371
	3 x 160	218	269		
	3 x 200	219	271		
	3 x 250	221	272		
	3 x 320	222	273		
	3 x 400	223	274		
	3 x 500	224	275		
	3 x 640	225			
4 gangs	4 x 25			325	372
	4 x 32			326	373
	4 x 40			327	374
	4 x 50			328	375
	4 x 64			329	376
	4 x 80			331	377
	4 x 100	226	276	332	378
	4 x 125	227	277	333	379
	4 x 160	228	278		
	4 x 200	229	279		
	4 x 250	231	281		
	4 x 320	232	282		
	4 x 400	233	283		
	4 x 500	234	284		
	4 x 640	235			

FILM DIELECTRIC TRIMMERS

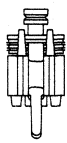
FILM DIELECTRIC TRIMMERS

- Housing diameter 5 mm
- For consumer and industrial equipment

QUICK REFERENCE DATA

C_{\min}/C_{\max}	1,2/5 to 3/27 pF
Rated voltage (d.c.)	150 V
Housing diameter	5 mm
Climatic category (IEC 68)	40/070/21
Related specification	IEC 418-1 and 4

Selection chart

reference C_{\min}/C_{\max}	catalogue number	
	vertical spindle	
	5,6 mm pitch	5,08 mm pitch
pF	round head; top + bottom adjustment	
1,2/5	2222 808 23508	2238 808 20508
1,4/10	2222 808 23109	2238 808 20109
1,6/15	2222 808 23159	2238 808 20159
3,5/20	2222 808 23209	2238 808 20209
3/27	2222 808 23279	2238 808 20279

DESCRIPTION

The vanes of the trimmers are stacked on a sturdy plastic base, the colour of which indicates the maximum capacitance (Table 1). The dielectric is a film of polypropylene which supports the vanes in such a way that good stability is ensured and no microphony can occur. Flux absorption between the vanes is prevented.

The trimmers are resistant to all standard cleaning solvents except trichloroethylene and trichloroethane. Top and bottom adjustment by means of a screwdriver is possible.

2222 808
2238 808
Ø 5 mm

MECHANICAL DATA

Dimensions in mm

Outlines	See Fig.1
Effective angle of rotation	180°
Operating torque	1 to 15 mNm
Maximum axial thrust ($\Delta C \leq 0,3\%$ of C_{max})	2 N
Mass	approx. 0,45 g

Mounting

The trimmers can be mounted on printed-wiring boards; hole diameter min. 1,25 mm. See for hole pattern Fig.2.

Soldering conditions: max. 260 °C, max. 10 s. (See also 'Tests and Requirements'.)

ELECTRICAL DATA; see also Table 1

Rated voltage (d.c.)	150 V
Test voltage (d.c.) for 1 min.	300 V
Contact resistance	max. 10 mΩ
Insulation resistance	min. 10 000 MΩ
Category temperature range	- 40 to + 70 °C
Climatic category (IEC 68)	40/070/21
Minimum storage temperature	- 55 °C

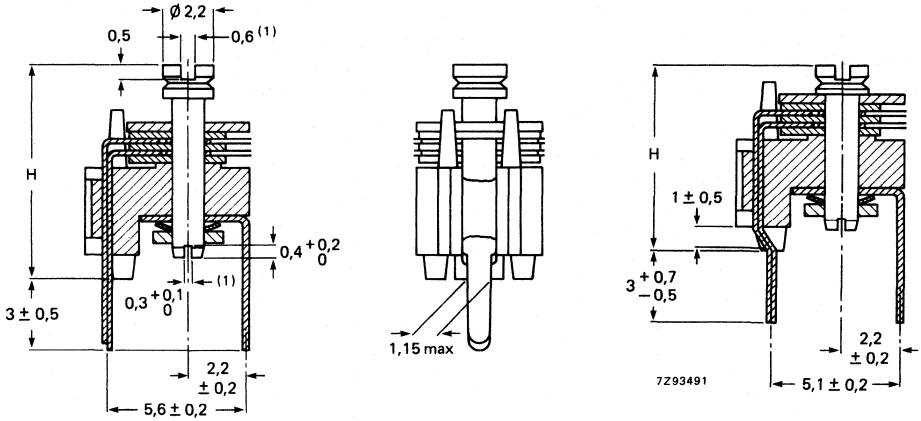
Table 1

reference C_{\min}/C_{\max} (note 1) pF	cat. number 2222 808 followed by	spindle	shape of head	pitch	adjustment mode	diel- etric film (note 2)	guaranteed max. C_{\min} min. C_{\max} at 200 kHz pF	$\tan \delta$ at $C_{\max} \times 10^{-4}$ MHz	temp. coeff. (note 3) $10^{-6}/K$	min. f_{res} at C_{\max} MHz	colour of base pack- ing quant.
1,2/5	20508* 23508	vertical	round	5,08 5,6	top + bottom	PP	1,5/5	< 10	-200 ± 300	grey	1000
1,4/10	20109* 23109	vertical	round	5,08 1,6	top + bottom	PP	2/10	< 10	-200 ± 300	yellow	1000
1,6/15	20159* 23159	vertical	round	5,08 5,6	top + bottom	PP	2,5/15	< 10	-50 ± 200	blue	1000
3,5/20	20209* 23209	vertical	round	5,08 5,6	top + bottom	PP	4/20	< 10	-50 ± 200	green	1000
3/27	20279* 23279	vertical	round	5,08 5,6	top + bottom	PP	4,5/27	< 10	-250 ± 200	red	1000

* Different catalogue number: 2238 808

Notes to Table 1

1. This column indicates the reference values of the capacitance ranges currently available on the market which are equivalent to our range.
2. PP = polypropylene.
3. C at 60 to 80% of C_{\max} ; ΔT from $+20$ to $+70$ °C.



Trimmers 2222 808 23...

Trimmers 2238 808 20...

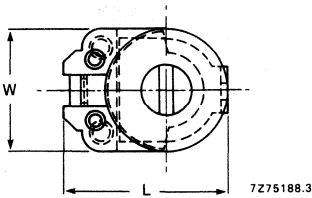


Fig.1 See Table 2 for dimensions H, W and L.
 (1) Angle between screwdriver slots is arbitrary.

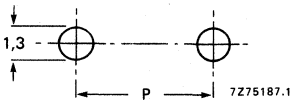


Fig.2 $P = 5,6 \text{ mm}$ for trimmers 2222 808 23...
 $P = 5,08 \text{ mm}$ for trimmers 2238 808 20...

Table 2

reference C_{\min}/C_{\max} pF	H_{\max} mm	W_{\max} mm	L_{\max} mm
1,2/5	7	5,5	7
1,4/10	7	5,5	7
1,6/15	8,8	5,5	7
3,5/20	8,8	5,5	7
3/27	9,0	6,2	7,8

PACKING

Bulk packing in cardboard boxes lined with expanded plastic, 1000 pieces per box.

QUALITY LEVEL

Sampling and data evaluation for quality level in accordance with MIL-STD-105D and IEC 410.

A.Q.L. 0,4%, major defects

A.Q.L. 1,5%, minor defects

Each capacitor is tested for minimum C_{\max} and is also subjected to the full test voltage. See also Note under Survey of variable capacitors.

TESTS AND REQUIREMENTS

IEC418-1 clause	IEC68 test method	test	procedure	requirements
4.2		method of mounting	method A	
14		capacitance drift	after T.C. measurement	$\Delta C/C$ < 1,75%
19		thrust	axial thrust of 2 N	$\Delta C/C$ < 0,4%
21		robustness of terminations:		
21.1	Ua	tensile	1 N	
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle: 1/2 h at lower and 1/2 h at upper category temp.	$\Delta C/C$ < 2,5%
23	T	soldering		
	Ta	solderability	solder bath, immersion 3 mm, 235 °C, 2 s	good wetting, no mechanical damage
	Tb	resistance to heat	solder bath 260 °C, 10 s	no mechanical damage
24	Eb	impact bump	4000 ± 10 bumps, 40g, 6 ms	< 1% no mechanical damage
25	Fc	vibration	freq. 10 to 55 Hz, ampl. 0,75 mm, 1,5 h	$\Delta C/C$ < 1% no mechanical damage

TESTS AND REQUIREMENTS (continued)

IEC418-1 clause	IEC68 test method	test	procedure	requirements
26		climatic sequence		$\Delta C/C$ < 4% $\tan \delta$ < 15×10^{-4}
26.1	B	dry heat	16 h at upper category temp.	R_{ins} > 10 000 M Ω rotor contact R < 10 m Ω
26.2	D	damp heat accelerated, first cycle	1 cycle, 24 h, + 40 °C, 95 to 100% R.H.	voltage proof 300 V for 1 min visual examination no mechanical damage
26.3	Aa	cold	16 h, - 40 °C	operating torque 1 to 15 mNm
26.5		damp heat accelerated remaining cycles	1 cycle, 24 h, + 40 °C, 95 to 100% R.H.	
27	Ca	damp heat steady state	21 days, + 40 °C, 90 to 95% R.H.	$\Delta C/C$ < 3% $\tan \delta$ < 15×10^{-4} R_{ins} > 10 000 M Ω rotor contact R < 10 m Ω voltage proof 300 V for 1 min visual examination no mechanical damage operating torque 1 to 15 mNm
29 29.1		endurance mechanical	10 cycles	$\Delta C/C$ < 3% $\Delta C/C$ after axial thrust < 0,3% rotor contact R < 10 m Ω voltage proof 300 V for 1 min visual examination no mechanical damage operating torque 0,5 to 22,5 mNm

FILM DIELECTRIC TRIMMERS

- Housing diameter 7,5 mm
- For basic grid of 2,54 mm (0,1 in) or 2,50 mm
- For consumer and industrial equipment

QUICK REFERENCE DATA

C_{min}/C_{max}	1,2/6 to 3/50 pF
Rated voltage (d.c.)	250 V
Housing diameter	7,5 mm
Climatic category (IEC 68)	40/070/21 or 40/085/21
Related specification	IEC 418 - 1 and 4

Selection chart

reference C_{min}/C_{max}	catalogue number 2222 808 followed by			
	vertical spindle		horizontal spindle	
pF	round head		hexagonal head	round head
	top + bottom adjustment	top adj.	top adjustment	top + bottom adjustment
1,2/6	11558	00004		
1,4/6	00018			
1,4/10	11109	00005	17109*	51109
1,6/15	11159			
1,6/18	00016			
1,8/22	11229	00006	17229*	51229
1,8/27	11279			51279
2/33	11339			
2/40	11409		17409*	51409*
3/50	11509		17509*	51509*

* Different catalogue number: 2238 808

DESCRIPTION

The vanes of the trimmers are stacked on a sturdy plastic base, the colour of which indicates the maximum capacitance (Table 1). The dielectric is a film of polypropylene, polyethylene, polycarbonate or PTFE which supports the vanes in such a way that good stability is ensured and no microphony can occur. Flux absorption between the vanes is prevented.

The trimmers are resistant to all cleaning solvents except trichloroethane and trichloroethylene.

A version with vertical spindle (Fig.1) and a version with horizontal spindle (Fig.3) are available. Both versions have top adjustment by means of a screwdriver or trimming key, and bottom adjustment by means of a key according to Fig.5.

MECHANICAL DATA

Dimensions in mm

Outlines	See Figs 1 and 3
Effective angle of rotation	180°
Operating torque	1 to 15 mNm
Maximum axial thrust ($\Delta C < 0,3\%$ of C_{max})	2 N
Mass	approx. 0,8 g

Mounting

The trimmers can be mounted on printed-wiring boards with a grid of 2,50 mm or 2,54 mm (0,1 in); hole diameter min. 1,25 mm. See for hole patterns Figs 2 and 4.

Soldering conditions: max. 260 °C, max. 10 s. (See also 'Tests and Requirements'.)

ELECTRICAL DATA; see also Table 1

Rated voltage (d.c.)	250 V
Test voltage (d.c.) for 1 min.	500 V
Contact resistance	max. 10 mΩ
Insulation resistance	min. 10 000 MΩ
Category temperature range	
$C_{max} = 10, 15, 22, 33$ pF	- 40 to + 70 °C
$C_{max} = 5,5, 9, 18, 27, 40, 50$ pF	- 40 to + 85 °C
Climatic category (IEC 68)	
$C_{max} = 10, 15, 22, 33$ pF	40/070/21
$C_{max} = 5,5, 9, 18, 27, 40, 50$ pF	40/085/21
Minimum storage temperature	- 55 °C

Notes to Table 1 on the next page.

1. This column indicates the reference values of the capacitance ranges currently available on the market which are equivalent to our range.
2. PC = polycarbonate,
PE = polyethylene,
PP = polypropylene,
PTFE = polytetrafluorethylene.
3. C at 60 to 80% of C_{max} ; ΔT from + 20 to upper category temperature.

Table 1 (Notes are on preceding page)

reference C _{min} /C _{max} (note 1) pF	cat. number 2222 808 followed by	spindle shape of head	fig.	adjustment mode	diel- etric film (note 2)	guaranteed max. C _{min} min. C _{max} at 200 KHz pF	tan δ at C _{max} x 10 ⁻⁴ 1 MHz	temp. coeff. (note 3) 10 ⁻⁶ /K	min. f _{res} at C _{max} MHz	colour of base pack- ing quant.
1,2/6	11558 00004	vertical round vertical round	1 1	top + bottom top	PE	1,4/5,5	< 10	-400 ± 300	850	grey 1400 1400
1,4/6	00018	vertical round	1	top + bottom	PTFE	2/9	< 10	-500 ± 450	480	yellow 1400
1,4/10	11109 00005 17109* 51109	vertical round vertical hexagon. vertical round horizont. round	1 1 1 3	top + bottom top top top + bottom	PP	2/9	< 10	-450 ± 350	480	yellow 1400 1400 1200
1,6/15	11159	vertical round	1	top + bottom	PP	2/15	< 10	-200 ± 350	450	blue 1400
1,8/18	00016	vertical round	1	top + bottom	PTFE	2/18	< 10	-400 ± 200	350	green 1400
1,8/22	11229 00006 17229* 51229	vertical round vertical hexagon. vertical round horizont. round	1 1 1 3	top + bottom top top top + bottom	PP	2/22	< 10	-250 ± 350	350	green 1400 1400 1200
1,8/27	11279 51279	vertical round vertical round horizont. round	1 3	top + bottom top + bottom	PC	2/27	< 50	-250 ± 300	350	red 1400 1200
2/33	11339	vertical round	1	top + bottom	PP	3/33	< 10	-250 ± 300	300	brown 1400
2/40	11409 17409* 51409*	vertical round vertical hexagon. vertical round horizont. round	1 1 3	top + bottom top top + bottom	PC	3/40	< 50	-100 ± 300	300	violet 1400 1400 1200
3/50	11509 17509* 51509*	vertical round vertical hexagon. vertical round horizont. round	1 1 3	top + bottom top top + bottom	PC	3/50	< 50	-100 ± 300	250	black 1400 1400 1200

* Different catalogue number: 2238 808

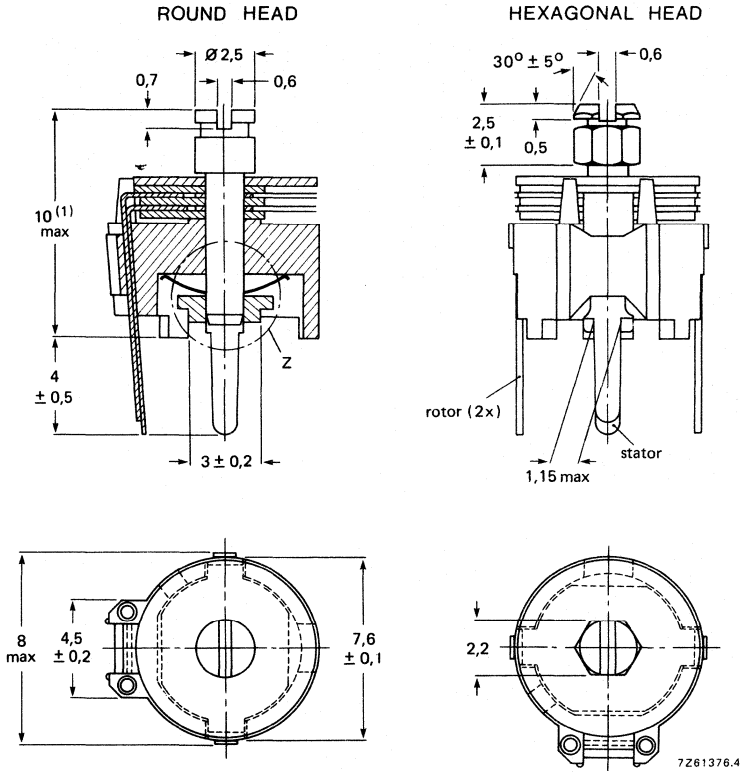


Fig. 1 Version with vertical spindle.
 (1) 11 max. for $C_{max} = 40 \text{ pF}$ and 50 pF .

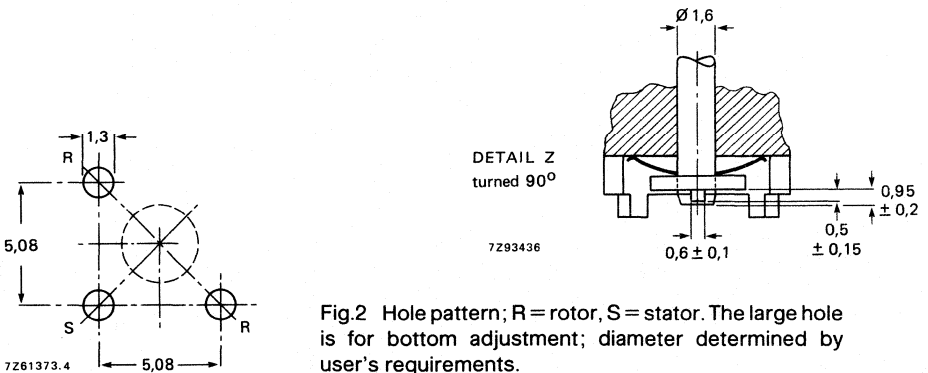


Fig. 2 Hole pattern; R = rotor, S = stator. The large hole is for bottom adjustment; diameter determined by user's requirements.

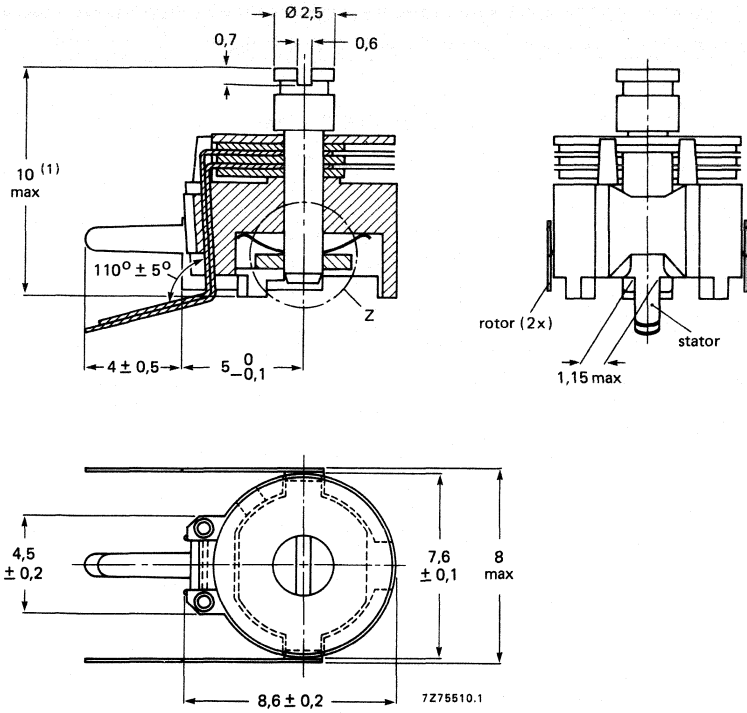


Fig.3 Version with horizontal spindle.
(1) 11 max. for $C_{max} = 40 \text{ pF}$ and 50 pF .

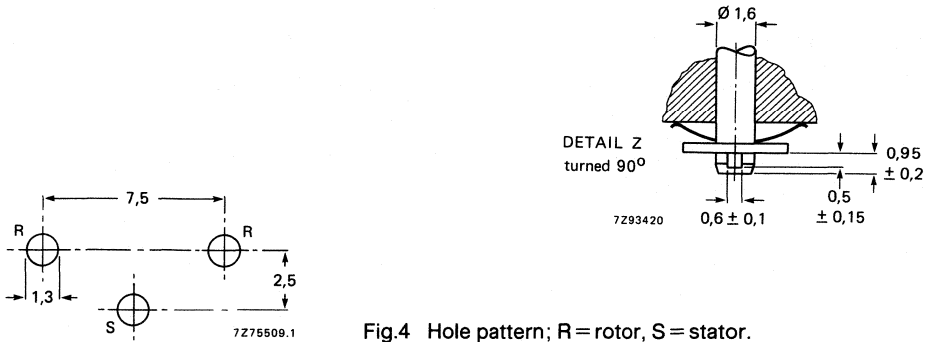


Fig.4 Hole pattern; R = rotor, S = stator.

ADJUSTMENT

For top adjustment a screwdriver or trimming key can be used; for bottom adjustment a key is required as shown in Fig.5. This key (catalogue number 7122 347 21600) and the associated handle (catalogue number 7122 005 47910) can be supplied on request.

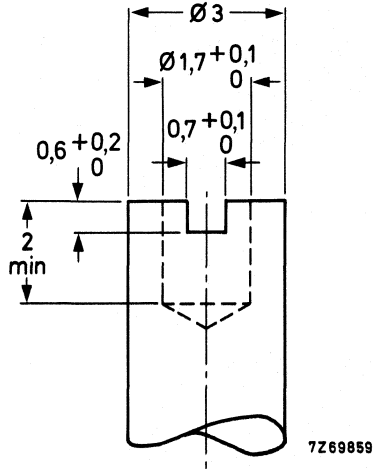


Fig.5.

PACKING

Bulk packing in cardboard boxes lined with expanded plastic; versions with vertical spindle 1400 per box, versions with horizontal spindle 1200 per box.

QUALITY LEVEL

Sampling and data evaluation for quality level in accordance with MIL-STD-105D and IEC 410.

A.Q.L. 0,4%, major defects

A.Q.L. 1,5%, minor defects

Each capacitor is tested for minimum C_{max} and is also subjected to the full test voltage. See also Note under Survey of variable capacitors.

TESTS AND REQUIREMENTS

IEC418-1 clause	IEC68 test method	test	procedure	requirements
4.2		method of mounting	method A	
14		capacitance drift	after T.C. measurement	$\Delta C/C$ $\leq 1\%$; $\leq 2,5\%$ for $C_{max} > 40$ pF
19		thrust	axial thrust of 2 N	$\Delta C/C$ $\leq 0,3\%$
21		robustness of terminations:		
21.1	Ua	tensile	1 N	
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle: 1/2 h at lower and 1/2 h at upper category temp.	$\Delta C/C$ $\leq 2\%$
23	T	soldering		
	Ta	solderability	solder bath, immersion 3 mm, 235 °C, 2 s	good wetting, no mechanical damage
	Tb	resistance to heat	solder bath 260 °C, 10 s	no mechanical damage
24	Eb	impact bump	4000 ± 10 bumps, 40g, 6 ms	$\Delta C/C$ $\leq 0,6\%$ no mechanical damage
25	Fc	vibration	freq. 10 to 55 Hz, ampl. 0,35 mm, 1,5 h	$\Delta C/C$ $\leq 0,6\%$ no mechanical damage

TESTS AND REQUIREMENTS (continued)

IEC418-1 clause	IEC68 test method	test	procedure	requirements
26		climatic sequence		$\Delta C/C$ < 4% $\tan \delta$ < 10×10^{-4} < 70×10^{-4} for $C_{\max} > 27 \text{ pF}$ > $10\,000 \text{ M}\Omega$ < $10 \text{ m}\Omega$
26.1	B	dry heat	16 h at upper category temp.	R_{ins} rotor contact R
26.2	D	damp heat accelerated, first cycle	1 cycle, 24 h, + 40 °C, 95 to 100% R.H.	voltage proof 500 V for 1 min visual examination no mechanical damage
26.3	Aa	cold	16 h, - 40 °C	operating torque 1 to 15 mNm
26.5		damp heat accelerated remaining cycles	1 cycle, 24 h, + 40 °C, 95 to 100% R.H.	
27	Ca	damp heat steady state	21 days, + 40 °C, 90 to 95% R.H.	$\Delta C/C$ < 5% $\tan \delta$ < 30×10^{-4} < 70×10^{-4} for $C_{\max} > 27 \text{ pF}$ > $10\,000 \text{ M}\Omega$ < $10 \text{ m}\Omega$ R_{ins} rotor contact R voltage proof 500 V for 1 min visual examination no mechanical damage operating torque 1 to 15 mNm
29 29.1		endurance mechanical	10 cycles	$\Delta C/C$ < 1,5% $\Delta C/C$ after axial thrust < 0,3% rotor contact R < $10 \text{ m}\Omega$ voltage proof 500 V for 1 min visual examination no mechanical damage operating torque 1 to 15 mNm

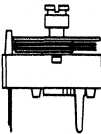
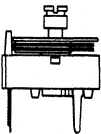
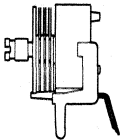
FILM DIELECTRIC TRIMMERS

- Housing diameter 10 mm
- For consumer and industrial equipment

QUICK REFERENCE DATA

C_{min}/C_{max}	1,8/15 to 5/105 pF
Rated voltage (d.c.)	250 V
Housing diameter	10 mm
Climatic category (IEC 68)	40/070/21 or 40/085/21
Related specification	IEC 418-1 and 4

Selection chart

reference C_{min}/C_{max}	catalogue number 2222 808 followed by					
	vertical spindle		vertical spindle		horizontal spindle	
	hole pattern 5 mm x 10 mm	hole pattern 7,5 mm x 5 mm	hole pattern 5 mm x 10 mm			
	round head	hexagonal head	round head	hexagonal head	round head	hexagonal head
pF	top + bottom adjustment		top + bottom adjustment		top + bottom adjustment	
1,8/15	31159*		32159*		61159*	
2,5/25	31229*		32229*		61229*	
4/40	31409		32409*		61409	
4/50	01029		01006*			
4,5/70	31659	34659	32659*		61659	64659
5/90	31809	34809	32809*	35809*	61809	64809
5/105	31101		32101*		61101	64101

* Not for new design.

DESCRIPTION

The vanes of the trimmers are stacked on a sturdy plastic base, the colour of which indicates the maximum capacitance (Table 1). The dielectric is a film of polypropylene, polycarbonate or PTFE which supports the vanes in such a way that good stability is ensured and no microphony can occur. Flux absorption between the vanes is prevented. The trimmers are resistant to all standard cleaning solvents except trichloroethane and trichloroethylene.

Two versions with vertical spindle (Figs 1 and 3) and a version with horizontal spindle (Fig.5) are available. All versions have top adjustment by means of a screwdriver or spanner, and bottom adjustment by means of a key (Fig.7).

MECHANICAL DATA

Dimensions in mm

Outlines	See Figs 1, 3 and 5
Effective angle of rotation	180°
Operating torque	2 to 25 mNm
Maximum axial thrust ($\Delta C \leq 0,3\%$ of C_{max})	2 N
Mass	approx. 1,3 g

Mounting

The trimmers can be mounted on printed-wiring boards with a grid of 2,50 mm or 2,54 mm (0,1 in); hole diameter min. 1,25 mm. See for hole patterns Figs 2, 4 and 6.

Soldering conditions: max. 260 °C, max. 10 s. (See also 'Tests and Requirements'.)

ELECTRICAL DATA; see also Table 1

Rated voltage (d.c.)	250 V
Test voltage (d.c.) for 1 min.	500 V
Contact resistance	max. 10 mΩ
Insulation resistance	min. 10 000 MΩ
Category temperature range	
$C_{max} = 15, 25, 40, 70$ pF	-40 to +70 °C
$C_{max} = 50, 90, 105$ pF	-40 to +85 °C
Climatic category (IEC68)	
$C_{max} = 15, 25, 40, 70$ pF	40/070/21
$C_{max} = 50, 90, 105$ pF	40/085/21
Minimum storage temperature	-55 °C

Notes to Table 1 on the next page

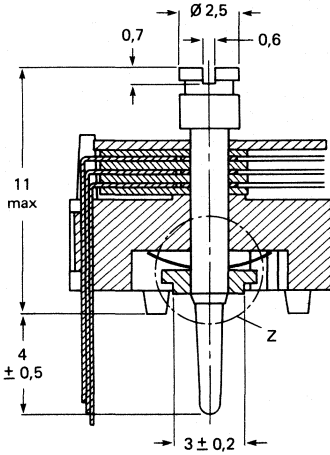
1. This column indicates the reference values of the capacitance ranges currently available on the market which are equivalent to our range.
2. PC = polycarbonate
PP = polypropylene
PTFE = polytetrafluorethylene
3. C at 60 to 80% of C_{max} ; ΔT from +20 °C to upper category temperature.

Table 1 (Notes are on preceding page)

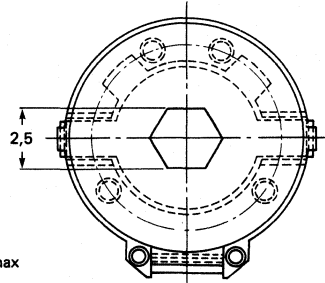
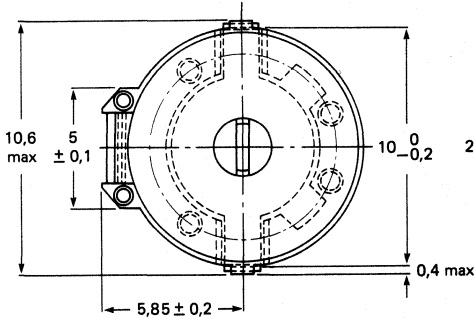
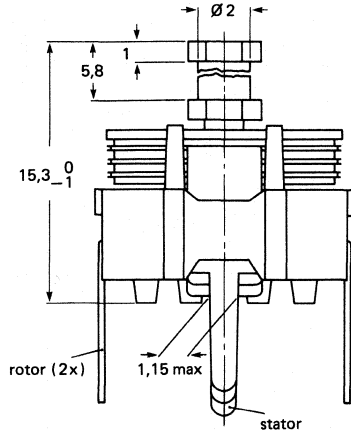
reference C_{min}/C_{max} (note 1) pF	cat. number 2222 808 followed by	spindle	shape of head	hole pattern Fig.	adjustment mode	diel- ectric film (note 2)	guaranteed max. C_{min} min. C_{max} at 200 kHz pF	$\tan \delta$ at $C_{max} \times 10^{-4}$ 1 MHz	temp. coeff. (note 3) $10^{-6}/K$	min. f_{res} at C_{max} MHz	colour of base	small- est pack- ing quant.
1,8/15	31159*	vertical	round	2	top + bottom	PP	2,5/15	< 10	-150 ± 500	420	blue	800
	32159*	vertical	round	4								800
	61159*	horizont.	round	6								700
2,5/25	31229*	vertical	round	2	top + bottom	PP	3/22,5	< 10	-150 ± 400	200	green	800
	32229*	vertical	round	4								800
	61229*	horizont.	round	6								700
4/40	31409	vertical	round	2	top + bottom	PP	5,5/40	< 10	-150 ± 350	200	grey	800
	32409*	vertical	round	4								800
	61409	horizont.	round	6								700
4/50	01029	vertical	round	2	top + bottom	PTFE	5,5/50	< 10	-500 ± 150	170	yellow	800
	01006*	vertical	round	4								800
4,5/70	31659	vertical	round	2								800
	32659*	vertical	round	4								800
	61659	horizont.	hexagonal	2	top + bottom	PP	5,5/65	< 10	-200 ± 300	170	yellow	700
	64659	horizont.	hexagonal	6								600
5/90	31809	vertical	round	2								800
	34809	vertical	hexagonal	2								700
	32809*	vertical	round	4	top + bottom	PC	6/80	< 50	-100 ± 300	170	red	800
	35809*	vertical	hexagonal	4								700
64809	61809	horizont.	round	4								700
	64809	horizont.	hexagonal	6								600
5/105	31101	vertical	round	2	top + bottom	PC	7/100	< 50	-100 ± 300	170	violet	800
	32101*	vertical	round	4								800
	61101	horizont.	round	6								700
	64101	horizont.	hexagonal	6								600

* Not for new design.

ROUND HEAD



EXTENDED HEXAGONAL HEAD



7269862.1

DETAIL Z
 turned 90°

7293435

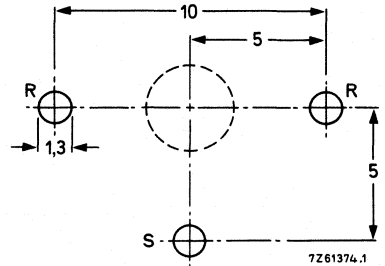
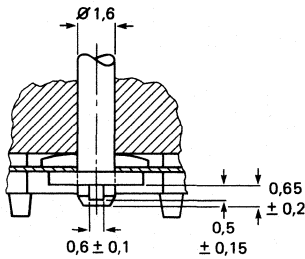


Fig.1 Version with vertical spindle;
 hole pattern 5 mm x 10 mm.

Fig.2 Hole pattern; R = rotor, S = stator.
 The large hole is for bottom adjustment;
 diameter determined by user's requirements.

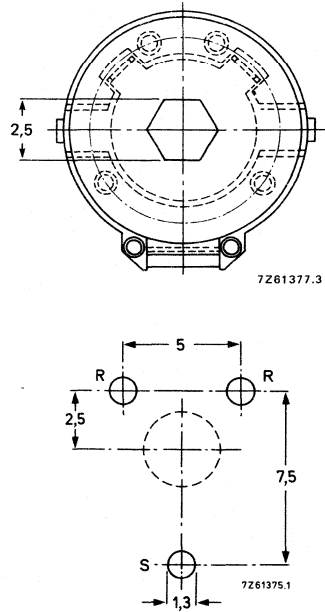
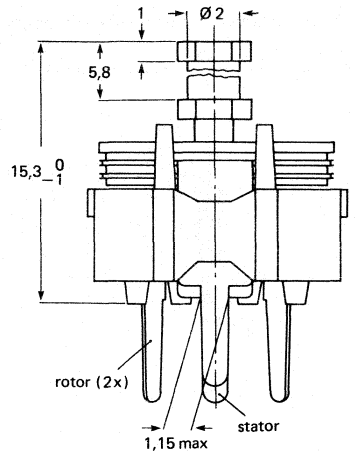
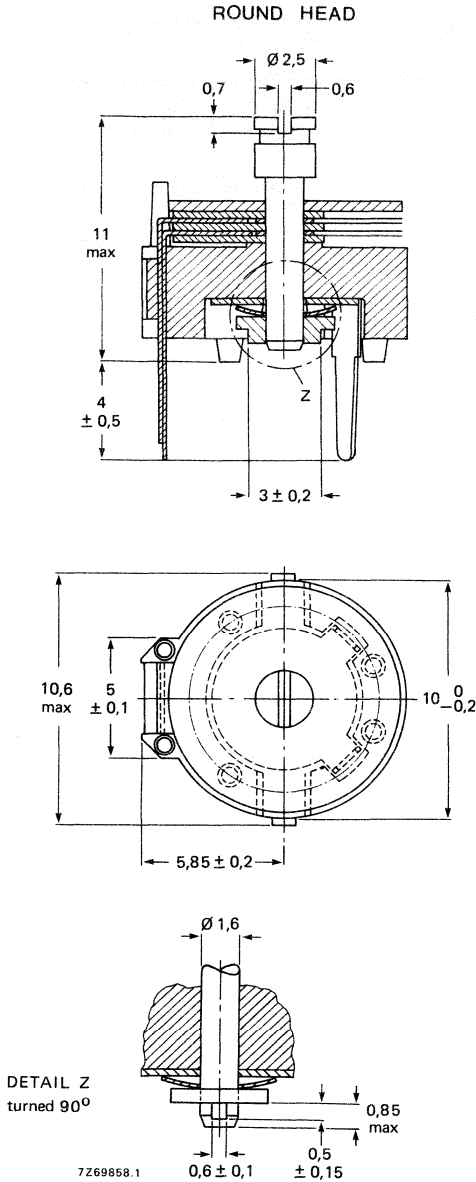


Fig.3 Version with vertical spindle;
 hole pattern 7,5 mm x 5 mm.

Fig.4 Hole pattern; R = rotor, S = stator.
 The large hole is for bottom adjustment;
 diameter determined by user's requirements.

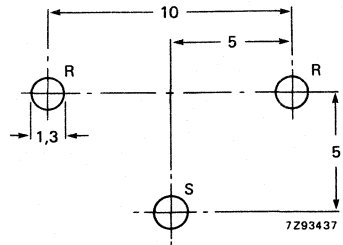
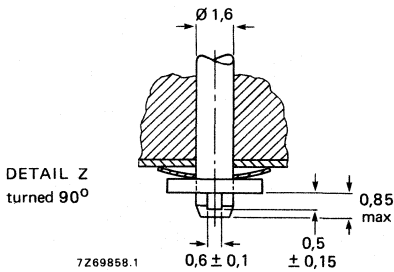
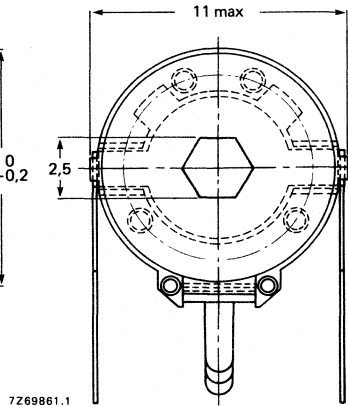
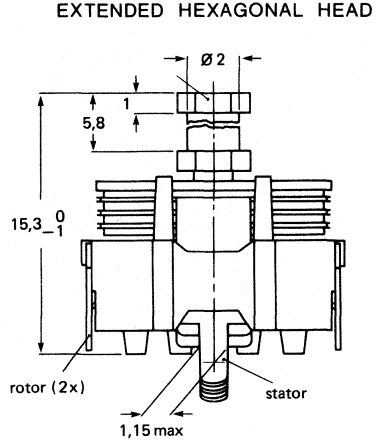
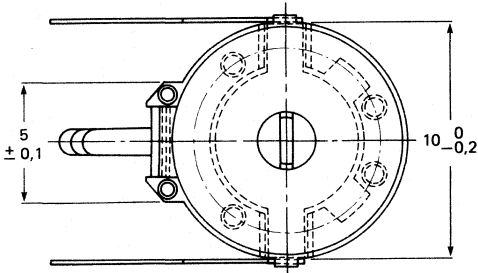
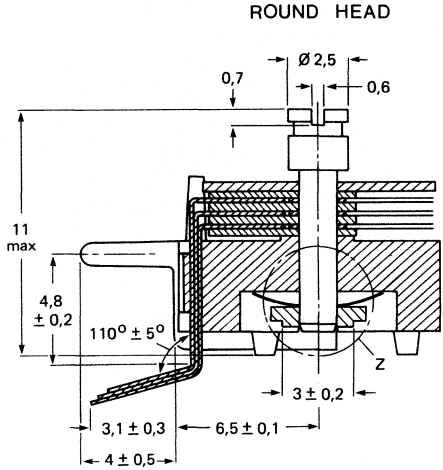


Fig.5 Version with horizontal spindle.

Fig.6 Hole pattern; R = rotor, S = stator

ADJUSTMENT

For top adjustment a screwdriver or spanner can be used, for bottom adjustment a key is required as shown in Fig.7. This key (catalogue number 7122 347 21600) and the associated handle (catalogue number 7122 005 47910) can be supplied on request.

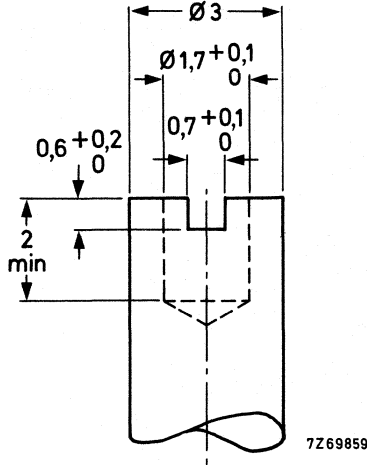


Fig.7.

The hexagonal spindle head is specially designed for the trimming of car radios with a spanner. It enables adjustment of the trimmer from the front by means of a long flexible rod provided with a hexagonal hole. The special shape of the trimmer head prevents a bending load on the trimmer spindle when the adjustment rod and spindle are not in line. It also allows a large axial tolerance.

PACKING

Bulk packing in cardboard boxes lined with expanded plastic.

- Version with vertical spindle and round head: 800.
- Version with vertical spindle and hexagonal head: 700
- Version with horizontal spindle and round head: 700
- Version with horizontal spindle and hexagonal head: 600.

QUALITY LEVEL

Sampling and data evaluation for quality level in accordance with MIL -STD- 105D and IEC 410.

A.Q.L. 0,4%, major defects

A.Q.L. 1,5%, minor defects

Each capacitor is tested for minimum C_{max} and is also subjected to the full test voltage. See also Note under Survey of variable capacitors.

TESTS AND REQUIREMENTS

IEC418-1 clause	IEC68 test method	test	procedure	requirements
4.2		method of mounting	method A	
14		capacitance drift	after T.C. measurement	$\Delta C/C$ < 1,5%; < 1% for $C_{max} > 50$ pF
19		thrust	axial thrust of 2 N	$\Delta C/C$ < 0,3%
21		robustness of terminations:		
21.1	Ua	tensile	1 N	
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle: 1/2 h at lower and 1/2 h at upper category temp.	$\Delta C/C$ < 1,5%
23	T	soldering		
	Ta	solderability	solder bath, immersion 3 mm, 235 °C, 2 s	good wetting, no mechanical damage
	Tb	resistance to heat	solder bath 260 °C, 10 s	no mechanical damage
24	Eb	impact bump	4000 ± 10 bumps, 40g, 6 ms	$\Delta C/C$ < 0,4% no mechanical damage
25	Fc	vibration	freq. 10 to 55 Hz, ampl. 0,35 mm, 1,5 h	$\Delta C/C$ < 0,8% no mechanical damage

TESTS AND REQUIREMENTS(continued)

IEC418-1 clause	IEC68 test method	test	procedure	requirements
26		climatic sequence		$\Delta C/C$ < 3%; < 6% for $C_{max} \geq 80$ pF $\tan \delta$ < 15×10^{-4} ; < 85×10^{-4} for $C_{max} \geq 80$ pF
26.1	B	dry heat	16 h at upper category temp.	R_{ins} > 10 000 M Ω rotor contact R < 10 m Ω
26.2	D	damp heat accelerated, first cycle	1 cycle, 24 h, + 40 °C, 95 to 100% R.H.	voltage proof 500 V for 1 min visual examination no mechanical damage
26.3	Aa	cold	16 h, - 40 °C	operating torque 2 to 35 mNm
26.5		damp heat accelerated remaining cycles	1 cycle, 24 h, + 40 °C, 95 to 100% R.H.	
27	Ca	damp heat steady state	21 days, + 40 °C, 90 to 95% R.H.	$\Delta C/C$ < 3%; < 3,5% for $C_{max} > 100$ pF $\tan \delta$ < 20×10^{-4} ; < 70×10^{-4} for $C_{max} > 80$ pF R_{ins} > 10 000 M Ω rotor contact R < 10 m Ω voltage proof 500 V for 1 min visual examination no mechanical damage operating torque 2 to 35 mNm
29 29.1		endurance mechanical	10 cycles	$\Delta C/C$ < 1% $\Delta C/C$ after axial thrust < 0,4% rotor contact R < 10 m Ω voltage proof 500 V for 1 min visual examination no mechanical damage operating torque 1,5 to 37 mNm

FILM DIELECTRIC TRIMMERS

- Housing diameter 13,5 mm
- For basic grid of 2,54 mm (0,1 in) or 2,50 mm
- For consumer and industrial equipment

QUICK REFERENCE DATA

C_{min}/C_{max}	8/130 pF and 15/200 pF
Rated voltage (d.c.)	150 V
Housing diameter	13,5 mm
Climatic category (IEC 68)	40/085/21
Related specification	IEC 418-1 and 4

Selection chart

reference C_{min}/C_{max}	catalogue number 2222 808 followed by			
	vertical spindle		horizontal spindle	
pF	round head	hexagonal head	round head	hexagonal head
	top + bottom adjustment		top + bottom adjustment	
8/130	41121	44121	71121	74121
15/200		44201		74201

DESCRIPTION

The vanes of the trimmers are stacked on a sturdy plastic base, the colour of which indicates the maximum capacitance (Table 1). The dielectric is a film of polycarbonate which supports the vanes in such a way that good stability is ensured and no microphony can occur. Flux absorption between the vanes is prevented. The trimmers are resistant to all standard cleaning solvents except trichloroethane and trichloroethylene.

A version with vertical spindle (Fig.1) and a version with horizontal spindle (Fig.3) are available. Both versions have top adjustment by means of a screwdriver or a spanner, and bottom adjustment by means of a screwdriver.

2222 808
Ø 13,5 mm

MECHANICAL DATA

Dimensions in mm

Outlines	See Figs 1 and 3
Effective angle of rotation	180°
Operating torque	2 to 35 mNm
Maximum axial thrust ($\Delta C < 0,3\%$ of C_{max})	2 N
Mass	approx. 2 g

Mounting

The trimmers can be mounted on printed-wiring boards with a grid of 2,50 mm or 2,54 mm (0,1 in); hole diameter min. 1,25 mm. See for hole patterns Figs 2 and 4.

Soldering conditions: max. 260 °C, max. 10 s. (See also 'Tests and Requirements'.)

ELECTRICAL DATA; see also Table 1

Rated voltage (d.c.)	150 V
Test voltage (d.c.) for 1 min.	300 V
Contact resistance	max. 10 mΩ
Insulation resistance	min. 10 000 MΩ
Category temperature range	- 40 to + 85 °
Climatic category (IEC 68)	40/085/21
Minimum storage temperature	- 55 °C

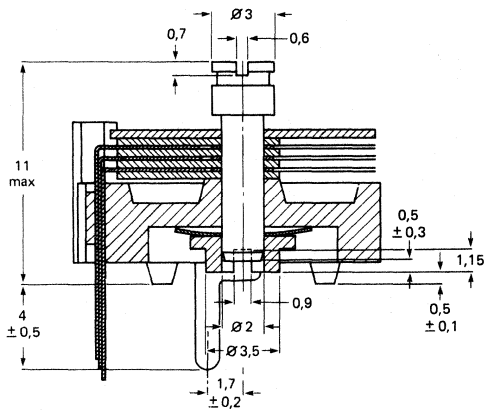
Table 1

reference C_{\min}/C_{\max} (note 1) pF	cat. number 2222 808 followed by	spindle	shape of head	adjustment mode	diel- ectric film (note 2)	guaranteed max. C_{\min} min. C_{\max} at 200 kHz pF	$\tan \delta$ at $C_{\max} \times 10^{-4}$ at 1 MHz	temp. coeff. (note 3) $10^{-6}/K$	min. f_{res} at C_{\max} MHz	colour of base	smal- lest pack- ing quant.
8/130	41121 44121 71121 74121	vertical	round	top + bottom	PC	12/120	< 50	0 ± 300	150	green	400
		vertical hexagon.	top + bottom	0 ± 300							
		horizont. round	top + bottom	-200 ± 300							
15/200	44201 74201	horizont.	hexagon.	top + bottom	PC	15/200	< 50	0 ± 300	100	yellow	400
		vertical hexagon.	top + bottom	-200 ± 300							

Notes to Table 1

1. This column indicates the reference values of the capacitance ranges currently available on the market which are equivalent to our range.
2. PC = polycarbonate.
3. C at 60 to 80% of C_{\max} ; ΔT from +20 to +85 °C.

ROUND HEAD



EXTENDED HEXAGONAL HEAD

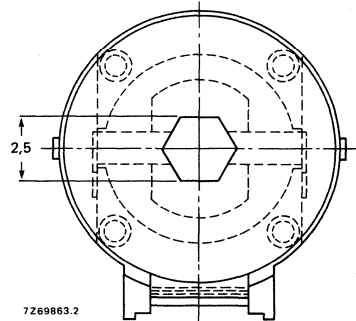
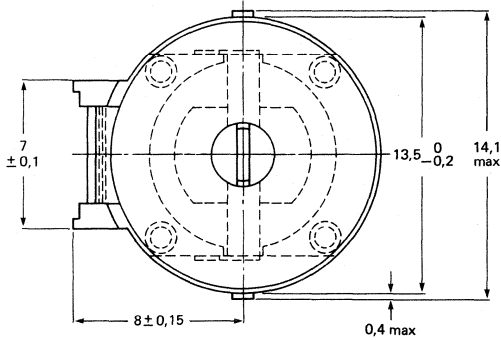
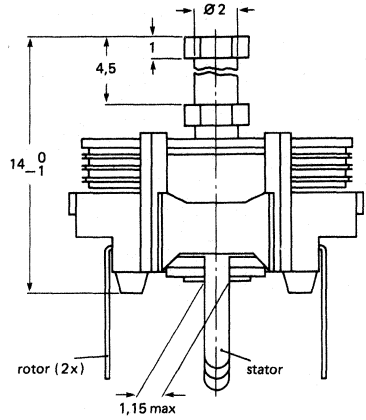


Fig.1 Version with vertical spindle.

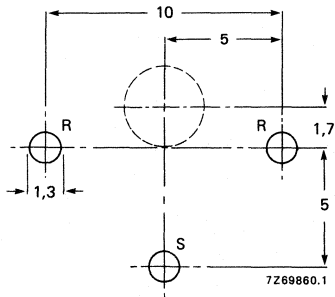


Fig.2 Hole pattern; R=rotor, S=stator.

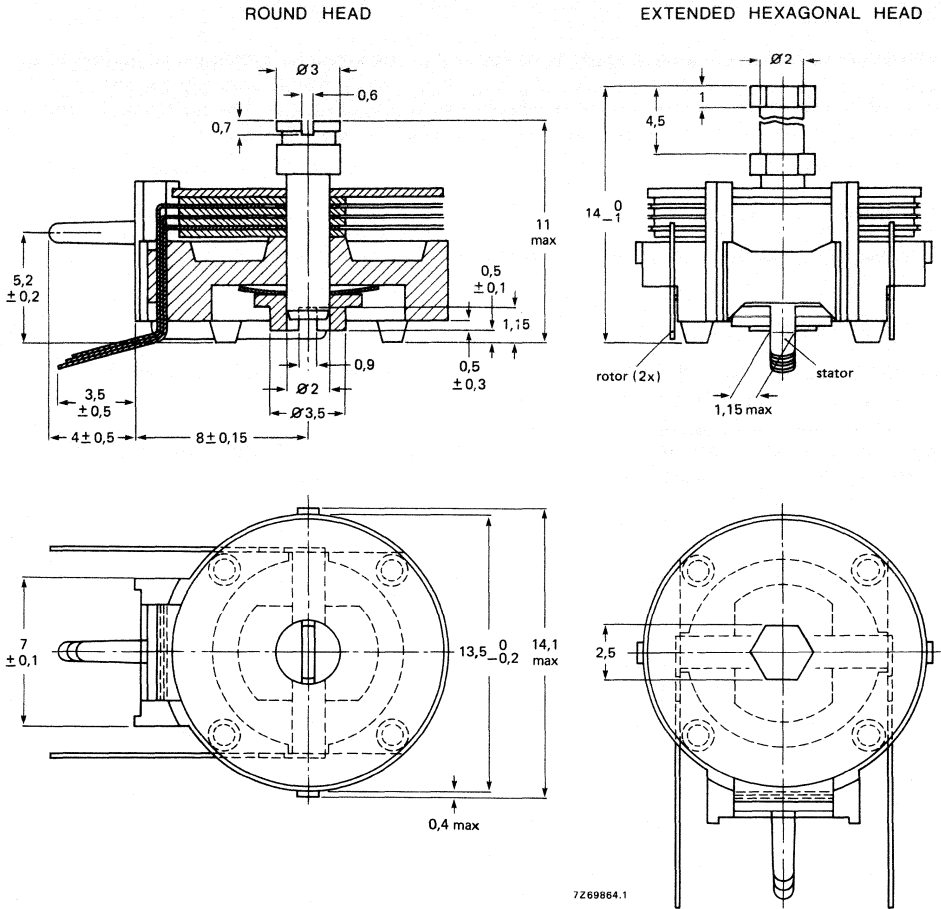


Fig.3 Version with horizontal spindle.

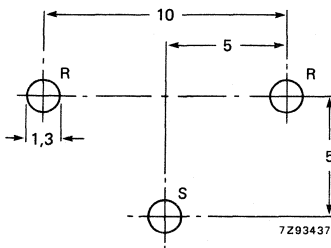


Fig.4 Hole pattern; R = rotor, S = stator.

2222 808
Ø 13,5 mm

ADJUSTMENT

The hexagonal spindle head is specially designed for the trimming of car radios. It enables adjustment of the trimmer from the front by means of a long flexible rod provided with a hexagonal hole. The special shape of the trimmer head prevents a bending load on the trimmer spindle when the adjustment rod and spindle are not in line. It also allows a large axial tolerance.

PACKING

Bulk packing in cardboard boxes lined with expanded plastic, 400 per box.

QUALITY LEVEL

Sampling and data evaluation for quality level in accordance with MIL-STD-105D and IEC 410.

A.Q.L. 0,4%, major defects

A.Q.L. 1,5%, minor defects

Each capacitor is tested for minimum C_{\max} and is also subjected to the full test voltage. See also Note under Survey of variable capacitors.

TESTS AND REQUIREMENTS

IEC418-1 clause	IEC68 test method	test	procedure	requirements
4.2		method of mounting	method A	
14		capacitance drift	after T.C. measurement	$\Delta C/C$ $< 1\%$ ($C_{max} = 120pF$) $< 3\%$ ($C_{max} = 200pF$)
19		thrust	axial thrust of 2 N	$\Delta C/C$ $< 0,3\%$
21		robustness of terminations:		
21.1	Ua	tensile	1 N	
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle: 1/2 h at lower and 1/2 h at upper category temp.	$\Delta C/C$ $< 2\%$
23	T Ta	soldering solderability	solder bath, immersion 3 mm, 235 °C, 2 s	good wetting, no mechanical damage
	Tb	resistance to heat	solder bath 260 °C, 10 s	no mechanical damage
24	Eb	impact bump	4000 ± 10 bumps, 40g, 6 ms	$\Delta C/C$ $< 0,6\%$ no mechanical damage
25	Fc	vibration	freq. 10 to 55 Hz, ampl. 0,35 mm, 1,5 h	$\Delta C/C$ $< 0,6\%$ no mechanical damage

TESTS AND REQUIREMENTS (continued)

IEC418-1 clause	IEC68 test method	test	procedure	requirements
26		climatic sequence		$\Delta C/C$ < 3,5% $\tan \delta$ < 70×10^{-4}
26.1	B	dry heat	16 h at upper category temp.	R_{ins} > 10 000 M Ω rotor contact R < 10 m Ω
26.2	D	damp heat accelerated, first cycle	1 cycle, 24 h, + 40 °C, 95 to 100% R.H.	voltage proof 300 V for 1 min visual examination no mechanical damage
26.3	Aa	cold	16 h, - 40 °C	operating torque 2 to 35 mNm
26.5		damp heat accelerated remaining cycles	1 cycle, 24 h, + 40 °C, 95 to 100% R.H.	
27	Ca	damp heat steady state	21 days, + 40 °C, 90 to 95% R.H.	$\Delta C/C$ < 3% $\tan \delta$ < 50×10^{-4} R_{ins} > 10 000 M Ω rotor contact R < 10 m Ω voltage proof 300 V for 1 min visual examination no mechanical damage operating torque 2 to 35 mNm
29 29.1		endurance mechanical	10 cycles	$\Delta C/C$ < 0,3% (120 pF) < 1,5% (200 pF) $\Delta C/C$ after axial thrust < 0,3% rotor contact R < 10 m Ω voltage proof 300 V for 1 min visual examination no mechanical damage operating torque 1,5 to 30 mNm

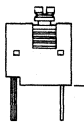
FILM DIELECTRIC TRIMMERS

- High temperature type
- Housing dimensions 6 mm x 8 mm x 9 mm
- For basic grid of 2,54 mm
- For professional applications, e.g. fine adjustment of h.f. tuned circuits

QUICK REFERENCE DATA

C_{min}/C_{max}	1,2/3,5 to 2/18 pF
Rated voltage (d.c.)	300 V
Housing dimensions	6 mm x 8 mm x 9 mm
Climatic category (IEC 68)	40/125/21
Related specification	IEC 418-1 and 4

Selection chart

catalogue number	
C_{min}/C_{max}	vertical spindle 
pF	round head; top + bottom adjustment
1,2/3,5	2222 809 05001
1,8/10	2222 809 05002
2/18	2222 809 05003

DESCRIPTION

The trimmers consist of a polysulphone housing, brass rotor and plated brass stator with a PTFE film as the dielectric. The stator plates with their tag are heat-sealed to the housing. The rotor contact surfaces are plated to ensure a long life and a stable contact even under severe climatic conditions. Flux absorption between the vanes is prevented. A colour dot indicates the maximum capacitance.

The trimmers have top and bottom adjustment; top adjustment should be done by means of a screwdriver, bottom adjustment by means of the key according to Fig.3.

MECHANICAL DATA

Dimensions in mm

Outlines	See Fig.1
Effective angle of rotation	180°
Operating torque	
$C_{max} = 3,5 \text{ pF}$	1 to 15 mNm
$C_{max} = 10 \text{ and } 18 \text{ pF}$	2,5 to 20 mNm
Maximum axial thrust ($\Delta C < 0,3\%$ of C_{max})	2 N
Mass	approx. 0,7 g

Mounting

The trimmers can be mounted on printed-wiring boards with a grid of 2,54 mm; hole diameter min. 1,25 mm. See for hole pattern Fig.2.

Soldering conditions: max. 260 °C, max. 10 s. (See also 'Tests and Requirements'.)

ELECTRICAL DATA; see also Table 1

Rated voltage (d.c.)	300 V
Test voltage (d.c.) for 1 min.	600 V
Contact resistance	max. 5 m Ω
Insulation resistance between stator and rotor	min. 10 000 M Ω
Category temperature range	-40 to +125 °
Climatic category (IEC 68)	40/125/21
Minimum storage temperature	-55 °C

Table 1

guaranteed max. C_{min} min. C_{max} at 200 kHz pF	cat. number 2222 809 followed by	spindle	shape of head	adjustment mode	dielectric film (note 1)	$\tan \delta$ at $C_{max} \times 10^{-4}$ MHz	temp coeff. (note 2) $10^{-9}/K$	min. f_{res} at C_{max} MHz	colour of dot	smallest packing quantity
1,2/3,5	05001	vertical	round	top + bottom	PTFE	< 10	-250 ± 150	850	orange	140
1,8/10	05002	vertical	round	top + bottom	PTFE	< 10	-350 ± 150	580	white	140
2/18	05003	vertical	round	top + bottom	PTFE	< 10	-350 ± 150	360	red	140

Notes to Table 1

1. PTFE = polytetrafluoroethylene.
2. C at 60 to 80% of C_{max} ; ΔT from $+20$ to $+125$ °C.

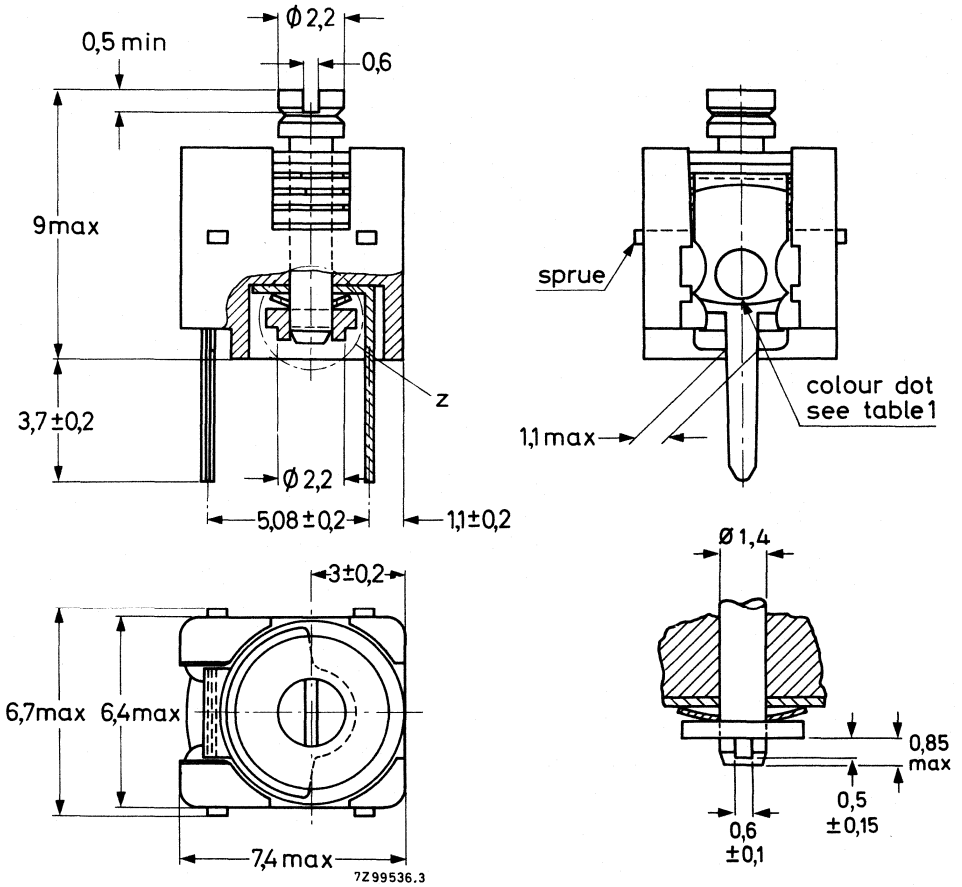


Fig.1.

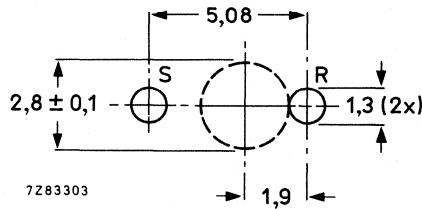


Fig.2 Hole pattern; the large hole is necessary only if bottom adjustment is to be used. R = rotor, S = stator.

ADJUSTMENT

For top adjustment a screwdriver or trimming key can be used; for bottom adjustment a key is required as shown in Fig.3. This key (catalogue number 7122 347 21600) and the associated handle (catalogue number 7122 005 47910) can be supplied on request.

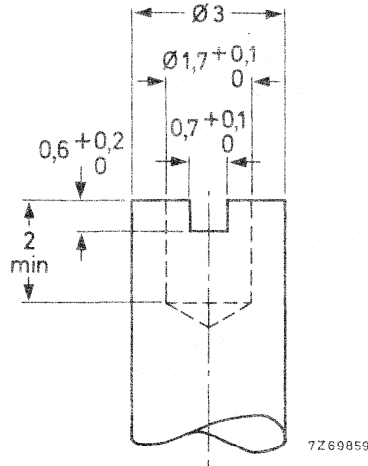


Fig.3.

PACKING

Blister packs of 140 pieces each.

QUALITY LEVEL

Sampling and data evaluation for quality level in accordance with MIL-STD-105D and IEC 410.

A.Q.L. 0,4%, major defects

A.Q.L. 1,5%, minor defects

Each capacitor is tested for minimum C_{max} and is also subjected to the full test voltage. See also Note under Survey of variable capacitors.

TESTS AND REQUIREMENTS

IEC418-1 clause	IEC68 test method	test	procedure	requirements
4.2		method of mounting	method A	
14		capacitance drift	after T.C. measurement	$\Delta C/C$ < 1%
19		thrust	axial thrust of 2 N	$\Delta C/C$ < 0,3%
21		robustness of terminations:		
21.1	Ua	tensile	1 N	
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle: 1/2 h at lower and 1/2 h at upper category temp.	$\Delta C/C$ < 2%
23	T	soldering		
	Ta	solderability	solder bath, immersion 3 mm, 235 °C, 2 s	good wetting, no mechanical damage
	Tb	resistance to heat	solder bath 260 °C, 10 s	no mechanical damage
24	Eb	impact bump	4000 ± 10 bumps, 40g, 6 ms	$\Delta C/C$ < 0,6% no mechanical damage
25	Fc	vibration	freq. 10 to 55 Hz, ampl. 0,35 mm, 1,5 h	$\Delta C/C$ < 0,2% no mechanical damage

TESTS AND REQUIREMENTS (continued)

IEC418-1 clause	IEC68 test method	test	procedure	requirements
26		climatic sequence		$\Delta C/C$ < 2,5% $\tan \delta$ (< 18 pF) < 10×10^{-4} (> 18 pF) < 40×10^{-4}
26.1	B	dry heat	16 h at upper category temp.	R_{ins} > 10 000 M Ω rotor contact R < 5 m Ω
26.2	D	damp heat accelerated, first cycle	1 cycle, 24 h, + 40 °C, 95 to 100% R.H.	voltage proof 600 V for 1 min visual examination no mechanical damage
26.3	Aa	cold	16 h, - 40 °C	operating torque 1 to 20 mNm
26.5		damp heat accelerated remaining cycles	1 cycle, 24 h, + 40 °C, 95 to 100% R.H.	
27	Ca	damp heat steady state	21 days, + 40 °C, 90 to 95% R.H.	$\Delta C/C$ < 2,5% $\tan \delta$ (< 18 pF) < 10×10^{-4} (> 18 pF) < 25×10^{-4} R_{ins} > 10 000 M Ω rotor contact R < 5 m Ω voltage proof 600 V for 1 min visual examination no mechanical damage operating torque 1 to 20 mNm
29 29.1		endurance mechanical	25 cycles	$\Delta C/C$ < 0,3% $\Delta C/C$ after axial thrust < 0,3% rotor contact R < 5 m Ω voltage proof 600 V for 1 min visual examination no mechanical damage operating torque 1 to 20 mNm

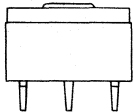
FILM DIELECTRIC TRIMMERS

- High temperature type
- Housing dimensions 11 mm x 14 mm x 9 mm
- For basic grid of 2,54 mm
- For professional applications, e.g. fine adjustment of h.f. tuned circuits, capacitive volume or voltage control

QUICK REFERENCE DATA

C_{\min}/C_{\max}	
single stator type	2,5/20 to 7/100
differential type	2/12 to 7/150
Rated voltage (d.c.)	200 V
Housing dimensions	11 mm x 14 mm x 9 mm
Climatic category (IEC 68)	40/125/21
Related specification	IEC 418-1 and 4

Selection chart

C_{\min}/C_{\max}	catalogue number	
	vertical spindle	
pF	single stator type	differential type
2/12		2222 809 07018
2,5/20	2222 809 07004	2222 809 07006
4/40	2222 809 07008	2222 809 07009
5/60	2222 809 07011	2222 809 07012
6/80	2222 809 07013	2222 809 07014
7/100	2222 809 07015	2222 809 07016
7/150		2222 809 07107

DESCRIPTION

The trimmers consist of a glass reinforced polysulphone frame with a polysulphone dust cover, brass rotor and stator with PTFE or polycarbonate film as the dielectric. The stator plates are stacked on pins and separated by rings, so that it is possible to produce a single-stator or a differential type. The rotor contact surfaces are plated to ensure a long life and a stable contact even under severe climatic conditions.

The trimmers have top adjustment by means of a screwdriver; capacitance increase is obtained with clockwise rotation. (Trimmers with counter-clockwise rotation and trimmers with insulated rotor are available on request.)

MECHANICAL DATA

Dimensions in mm

Outlines	See Fig.1
Effective angle of rotation	180°
Operating torque	1,5 to 25 mNm
Maximum axial thrust ($\Delta C < 0,3\%$ of C_{\max})	2 N
Mass	
single-stator type	approx. 2,3 g
differential type	approx. 2,9 g

Mounting

The trimmers can be mounted on printed-wiring boards with a grid of 2,54 mm; hole diameter min. 1,25 mm. See for hole pattern Fig.2.

Soldering conditions: max. 260 °C, max. 10 s. (See also 'Tests and Requirements'.)

ELECTRICAL DATA; see also Table 1

Rated voltage (d.c.)	200 V
Test voltage (d.c.) for 1 min.	400 V
Contact resistance	max. 5 m Ω
Insulation resistance between stator and rotor	min. 10 000 M Ω
Category temperature range	- 40 to + 125 °C
Climatic category (IEC 68)	40/125/21
Minimum storage temperature	- 55 °C

Table 1

guaranteed type max. C_{min} min. C_{max} at 200 kHz pF	cat. number 2222 809 followed by	spindle	adjustment mode	dielectric film (note 1)	$\tan \delta$ at C_{max} $\times 10^{-4}$ 1 MHz 100 MHz (note 2)	temp. coeff. $10^{-6}/K$	smallest packing quantity
2/12 differential	07018	vertical	top	PTFE	< 10	0 ± 200	70
2,5/20 single-stator differential	07004 07006	vertical	top	PTFE	< 10	0 ± 200	70
4/40 single-stator differential	07008 07009	vertical	top	PTFE	< 10	0 ± 200	70
5/60 single-stator differential	07011 07012	vertical	top	PTFE	< 10	0 ± 200	70
6/80 single-stator differential	07013 07014	vertical	top	PTFE	< 10	0 ± 200	70
7/100 single-stator differential	07015 07016	vertical	top	PTFE	< 10	0 ± 200	70
7/150 differential	07107	vertical	top	PC	< 50	0 ± 200	70

Notes to Table 1

1. PTFE = polytetrafluorethylene;
PC = polycarbonate.
2. C at 60 to 80% of C_{max} ; ΔT from $+20$ to $+125$ °C.

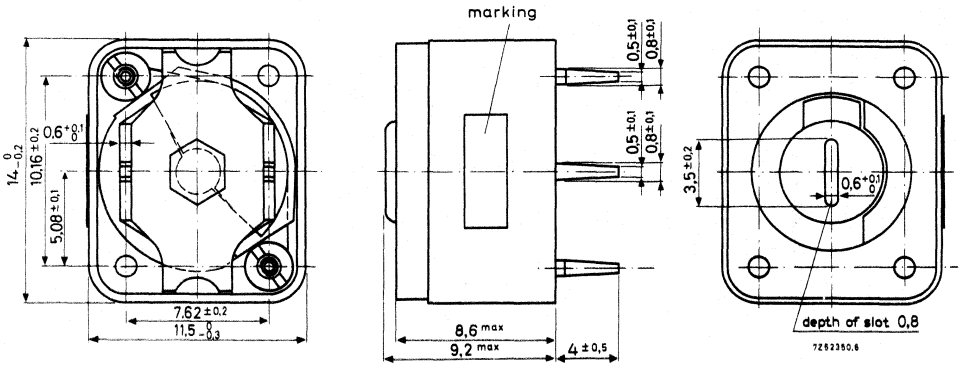


Fig. 1.

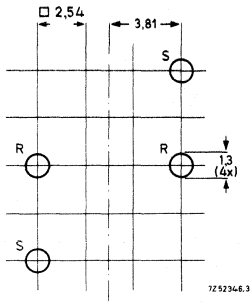


Fig. 2 Hole pattern; R = rotor, S = stator.

MARKING

The trimmers are marked with the capacitance value in pF, followed by the letter E (single-stator type) or the letter D (differential type).

ADJUSTMENT

The trimmers can be adjusted with a screwdriver or trimming key (top adjustment).

PACKING

Blister packs of 70 pieces each.

QUALITY LEVEL

Sampling and data evaluation for quality level in accordance with MIL-STD-105D and IEC 410.

A.Q.L. 0,4%, major defects

A.Q.L. 1,5%, minor defects

Each capacitor is tested for minimum C_{max} and is also subjected to the full test voltage. See also Note under Survey of variable capacitors.

TESTS AND REQUIREMENTS

IEC418-1 clause	IEC68 test method	test	procedure	requirements	
4.2		method of mounting	method A		
14		capacitance drift	after T.C. measurement	$\Delta C/C$	$< 1\%$
19		thrust	axial thrust of 2 N	$\Delta C/C$	$< 0,3\%$
21		robustness of terminations:			
21.1	Ua	tensile	1 N		no damage
21.2	Ub	bending			bending not al- lowed
22	Na	rapid change of temperature	1 cycle: 1/2 h at lower and 1/2 h at upper category temp.	$\Delta C/C$	$< 1\%$
23	T Ta	soldering solderability	solder bath, immersion 3 mm, 235 °C, 2 s		good wetting, no mechanical damage
	Tb	resistance to heat	solder bath 260 °C, 10 s		no mechanical damage
24	Eb	impact bump	4000 \pm 10 bumps, 40g, 6 ms	$\Delta C/C$	$< 0,2\%$ no mechanical damage
25	Fc	vibration	freq. 10 to 55 Hz, ampl. 0,35 mm, 1,5 h	$\Delta C/C$	$< 0,25\%$ no mechanical damage

TESTS AND REQUIREMENTS (continued)

IEC418-1 clause	IEC68 test method	test	procedure	requirements	
26		climatic sequence		$\Delta C/C$	< 3%
				$\tan \delta$	< 10×10^{-4}
26.1	B	dry heat	16 h at upper category temp.	R_{ins} rotor contact R	> 10 000 M Ω < 10 m Ω
26.2	D	damp heat accelerated, first cycle	1 cycle, 24 h, + 40 °C, 95 to 100% R.H.	voltage proof	400 V for 1 min
26.3	Aa	cold	16 h, - 40 °C	visual examination	no mechanical damage
26.5		damp heat accelerated remaining cycles	1 cycle, 24 h, + 40 °C, 95 to 100% R.H.	operating torque	1,5 to 35 mNm
27	Ca	damp heat steady state	21 days, + 40 °C, 90 to 95% R.H.	$\Delta C/C$	< 3%
				$\tan \delta$	< 10×10^{-4}
				R_{ins} rotor contact R	> 10 000 M Ω < 10 m Ω
				voltage proof	400 V for 1 min
				visual examination	no mechanical damage
				operating torque	1,5 to 35 mNm
29 29.1		endurance mechanical	25 cycles	$\Delta C/C$	< 0,3%
				$\Delta C/C$ after axial thrust	< 0,3%
				rotor contact R	< 10 m Ω
				voltage proof	400 V for 1 min
				visual examination	no mechanical damage
				operating torque	1 to 50 mNm

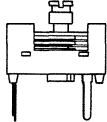
FILM DIELECTRIC TRIMMERS

- High temperature type
- Housing dimensions 10 mm x 11 mm x 11 mm
- For basic grid of 2,54 mm
- For professional applications, e.g. fine adjustment of h.f. tuned circuits

QUICK REFERENCE DATA

C_{min}/C_{max}	4/40 pF and 5/60 pF
Rated voltage (d.c.)	300 V
Housing dimensions	10 mm x 11 mm x 11 mm
Climatic category (IEC 68)	40/125/21
Related specification	IEC 418-1 and 4

Selection chart

catalogue number	
C_{min}/C_{max}	vertical spindle 
pF	round head; top + bottom adjustment
4/40	2222 809 08002
5/60	2222 809 08003

DESCRIPTION

The trimmers consist of a polysulphone housing, brass rotor and plated brass stator with a PTFE film as the dielectric. The stator plates with their tag are heat-sealed to the housing. The rotor contact surface is plated to ensure a long life and a stable contact even under severe climatic conditions. Flux absorption between the vanes is prevented. A colour dot indicates the maximum capacitance.

The trimmers have top and bottom adjustment; top adjustment should be done by means of a screwdriver, bottom adjustment by means of the key according to Fig.3.

MECHANICAL DATA

Dimensions in mm

Outlines	See Fig.1
Effective angle of rotation	180°
Operating torque	2 to 25 mNm
Maximum axial thrust ($\Delta C < 0,3\%$ of C_{max})	2 N
Mass	approx. 1,6 g

Mounting

The trimmers can be mounted on printed-wiring boards with a grid of 2,54 mm; hole diameter min. 1,25 mm. See for hole pattern Fig.2.

Soldering conditions: max. 260 °C, max. 10 s. (See also 'Tests and Requirements'.)

ELECTRICAL DATA; see also Table 1

Rated voltage (d.c.)	300 V
Test voltage (d.c.) for 1 min.	600 V
Contact resistance	max. 5 m Ω
Insulation resistance	min. 10 000 M Ω
Category temperature range	- 40 to + 125 °C
Climatic category (IEC 68)	40/125/21
Minimum storage temperature	- 55 °C

Table 1

guaranteed max. C_{min} min. C_{max} at 200 kHz pF	cat. number 2222 809 followed by	spindle	shape of head	adjustment mode	dielectric film (note 1)	$\tan \delta$ at $C_{max} \times 10^{-4}$ 1 MHz	temp. coeff. (note 2) $10^{-6}/K$	min. f_{res} at C_{max} MHz	colour of dot	smallest packing quantity
4/37	08002	vertical	round	top + bottom	PTFE	< 10	-250 ± 150	170	yellow	70
5/57	08003	vertical	round	top + bottom	PTFE	< 10	-250 ± 150	150	blue	70

Notes to Table 1

1. PTFE = polytetrafluorethylene.
2. C at 60 to 80% of C_{max} ; ΔT from +20 to +125 °C.

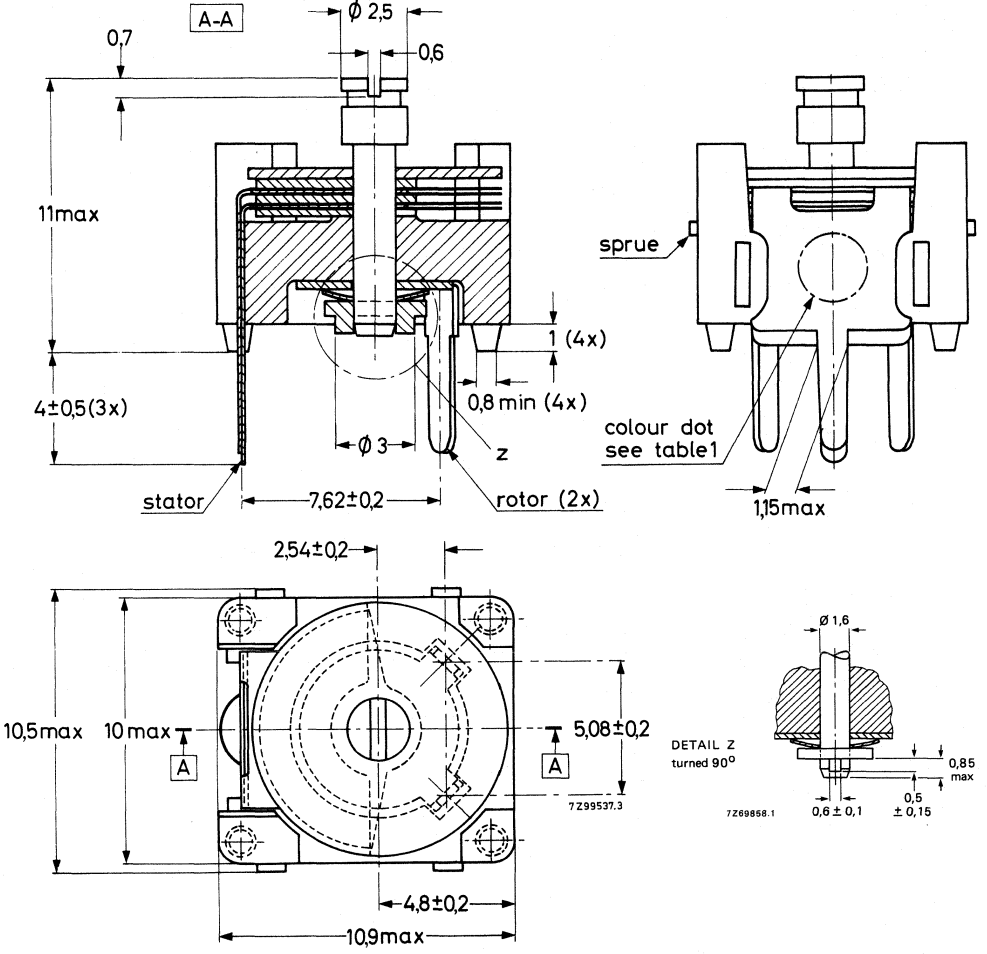


Fig. 1.

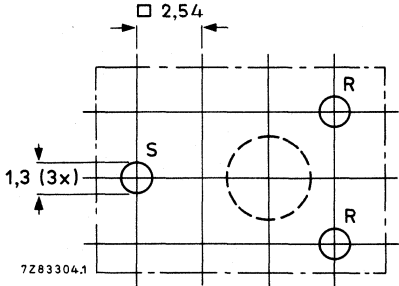


Fig. 2 Hole pattern; the large hole is necessary only if bottom adjustment is to be used. R = rotor, S = stator.

ADJUSTMENT

For top adjustment a screwdriver or trimming key can be used; for bottom adjustment a key is required as shown in Fig.3. This key (catalogue number 7122 347 21600) and the associated handle (catalogue number 7122 005 47910) can be supplied on request.

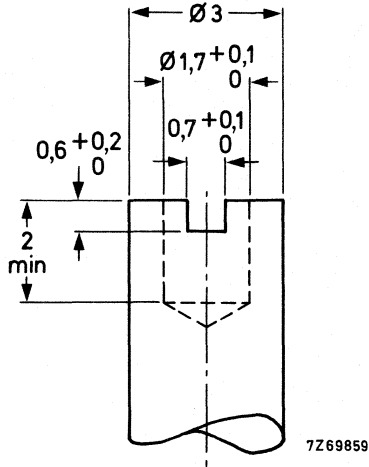


Fig.3.

PACKING

Blister packs of 70 pieces each.

QUALITY LEVEL

Sampling and data evaluation for quality level in accordance with MIL-STD-105D and IEC 410.

A.Q.L. 0,4%, major defects

A.Q.L. 1,5%, minor defects

Each capacitor is tested for minimum C_{\max} and is also subjected to the full test voltage. See also Note under Survey of variable capacitors.

TESTS AND REQUIREMENTS

IEC418-1 clause	IEC68 test method	test	procedure	requirements
4.2		method of mounting	method A	
14		capacitance drift	after T.C. measurement	$\Delta C/C$ < 1,5%
19		thrust	axial thrust of 2 N	$\Delta C/C$ < 0,2%
21		robustness of terminations:		
21.1	Ua	tensile	1 N	
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle: 1/2 h at lower and 1/2 h at upper category temp.	$\Delta C/C$ < 2,5%
23	T Ta	soldering solderability	solder bath, immersion 3 mm, 235 °C, 2 s	good wetting, no mechanical damage
	Tb	resistance to heat	solder bath 260 °C, 10 s	no mechanical damage
24	Eb	impact bump	4000 \pm 10 bumps, 40g, 6 ms	< 0,5% no mechanical damage
25	Fc	vibration	freq. 10 to 55 Hz, ampl. 0,35 mm, 1,5 h	$\Delta C/C$ < 0,2% no mechanical damage

TESTS AND REQUIREMENTS (continued)

IEC418-1 clause	IEC68 test method	test	procedure	requirements
26		climatic sequence		$\Delta C/C$ < 2,5% $\tan \delta$ < 10×10^{-4}
26.1	B	dry heat	16 h at upper category temp.	R_{ins} > 10 000 M Ω rotor contact R < 5 m Ω
26.2	D	damp heat accelerated, first cycle	1 cycle, 24 h, + 40 °C, 95 to 100% R.H.	voltage proof 600 V for 1 min visual examination no mechanical damage
26.3	Aa	cold	16 h, - 40 °C	operating torque 1 to 20 mNm
26.5		damp heat accelerated remaining cycles	1 cycle, 24 h, + 40 °C, 95 to 100% R.H.	
27	Ca	damp heat steady state	21 days, + 40 °C, 90 to 95% R.H.	$\Delta C/C$ < 2,5% $\tan \delta$ < 10×10^{-4} R_{ins} > 10 000 M Ω rotor contact R < 5 m Ω voltage proof 600 V for 1 min visual examination no mechanical damage operating torque 1 to 20 mNm
29 29.1		endurance mechanical	25 cycles	$\Delta C/C$ < 0,3% $\Delta C/C$ after axial thrust < 0,3% rotor contact R < 5 m Ω voltage proof 600 V for 1 min visual examination no mechanical damage operating torque 1 to 20 mNm

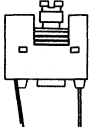
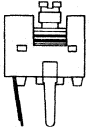
FILM DIELECTRIC TRIMMERS

- High temperature type
- Housing dimensions 8 mm x 9 mm x 10 mm
- For basic grid of 2,54 mm
- For professional applications, e.g. fine adjustment of h.f. tuned circuits

QUICK REFERENCE DATA

C_{min}/C_{max}	1,4/5,5 to 2/18 pF
Rated voltage (d.c.)	300 V
Housing dimensions	8 mm x 9 mm x 10 mm
Climatic category (IEC 68)	40/125/21
Related specification	IEC 418-1 and 4

Selection chart

	catalogue number	
C_{min}/C_{max}	vertical spindle 	vertical spindle 
	round head; top + bottom adjustment	round head; top + bottom adjustment
pF	version with 1 rotor tag	version with 2 rotor tags
1,4/5,5	2222 809 09004	2222 809 09001
2/9	2222 809 09005	2222 809 09002
2/18	2222 809 09006	2222 809 09003

DESCRIPTION

The trimmers consist of a polysulphone housing, brass rotor and plated brass stator with a PTFE film as the dielectric. The stator plates with their tag are heat-sealed to the housing. The rotor contact surface is plated to ensure a long life and a stable contact even under severe climatic conditions. Flux absorption between the vanes is prevented. A colour dot indicates the maximum capacitance.

Versions with one rotor tag and with two rotor tags are available. The trimmers have top and bottom adjustment; top adjustment should be done by means of a screwdriver, bottom adjustment by means of the key according to Fig.5.

MECHANICAL DATA

Dimensions in mm

Outlines	See Figs 1 and 3
Effective angle of rotation	180°
Operating torque	
$C_{max} = 5,5 \text{ pF}$	1 to 15 mNm
$C_{max} = 9 \text{ and } 18 \text{ pF}$	2,5 to 20 mNm
Maximum axial thrust ($\Delta C < 0,3\%$ of C_{max})	2 N
Mass	approx. 0,8 g

Mounting

The trimmers can be mounted on printed-wiring boards; hole diameter min. 1,25 mm. See for hole patterns Figs 2 and 4.

Soldering conditions: max. 260 °C, max. 10 s. (See also 'Tests and Requirements'.)

ELECTRICAL DATA; see also Table 1

Rated voltage (d.c.)	300 V
Test voltage (d.c.) for 1 min.	500 V
Contact resistance	max. 5 mΩ
Insulation resistance between stator and rotor	min. 10 000 MΩ
Category temperature range	-40 to +125 °C
Climatic category (IEC 68)	40/125/21
Minimum storage temperature	-55 °C

Table 1

guaranteed max. C_{min} min. C_{max} at 200 KHz pF	cat. number 2222 809 followed by	spindle	shape of head	adjustment mode	dielectric film (note 1)	$\tan \delta$ at $C_{max} \times 10^{-4}$ MHz	temp. coeff. (note 2) $10^{-6}/K$	min. f_{res} at C_{max} MHz	colour of dot	smallest packing quantity
1,4/5,5	09004* 09001**	vertical	round	top + bottom	PTFE	< 10	-250 ± 150	850	green	105
2/9	09005* 09002**	vertical	round	top + bottom	PTFE	< 10	-250 ± 150	580	white	105
2/18	09006* 09003**	vertical	round	top + bottom	PTFE	< 10	-250 ± 150	360	red	105

* With one rotor contact

** With two rotor contacts

Notes to Table 1

1. PTFE = polytetrafluoroethylene.
2. C at 60 to 80% of C_{max} ; ΔT from +20 to +125 °C.

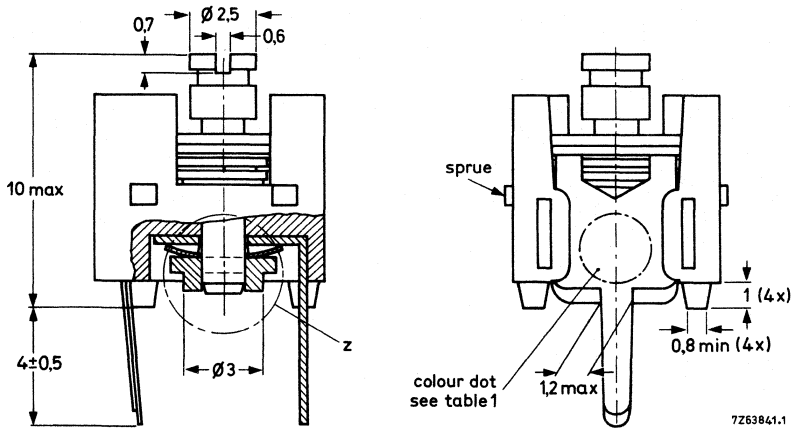


Fig.1 Version with one rotor contact.

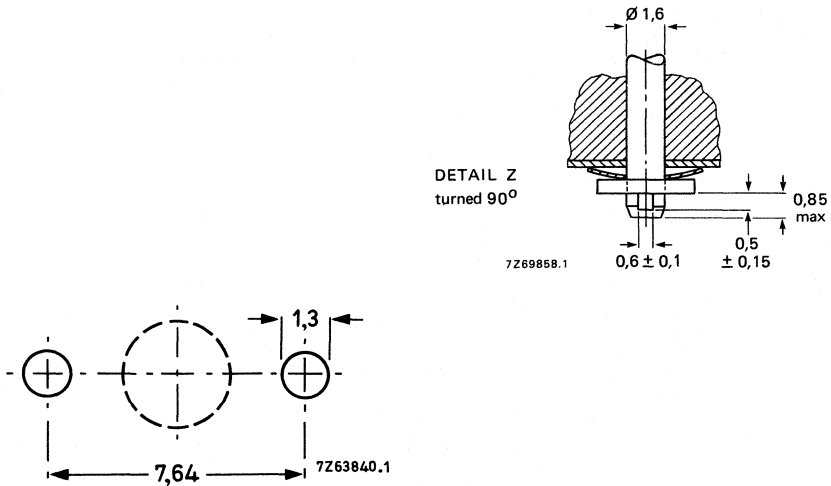


Fig.2 Hole pattern. The large hole is for bottom adjustment; the diameter is determined by user's requirements.

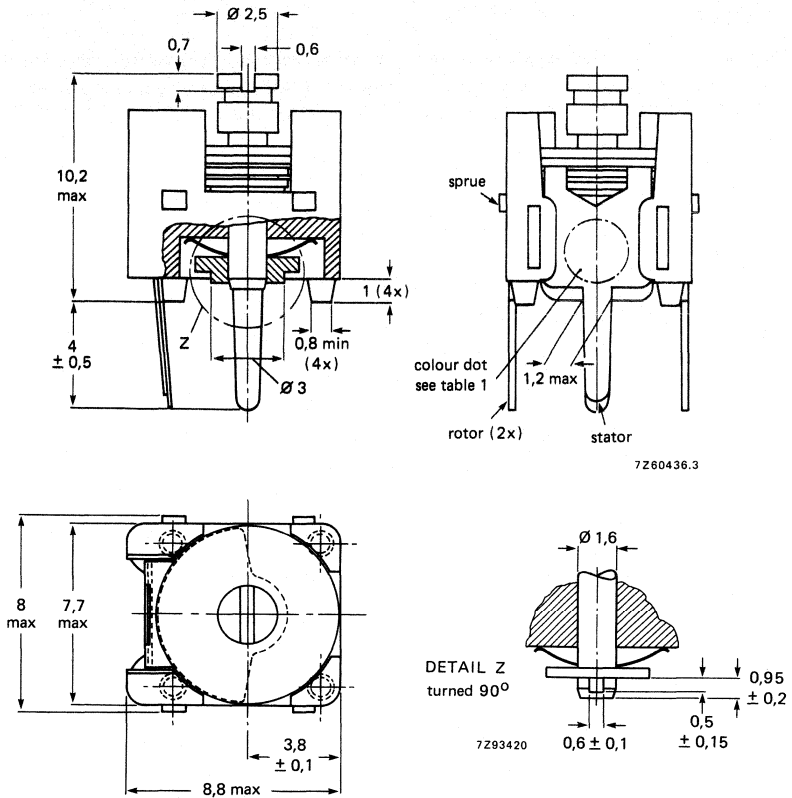


Fig.3 Version with two rotor contacts.

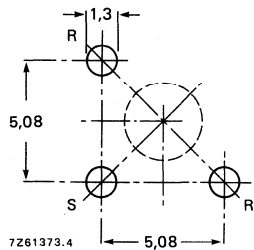


Fig.4 Hole pattern; R=rotor, S=stator. The large hole is for bottom adjustment; the diameter is determined by user's requirements.

ADJUSTMENT

For top adjustment a screwdriver or trimming key can be used; for bottom adjustment a key is required as shown in Fig.5. This key (catalogue number 7122 347 21600) and the associated handle (catalogue number 7122 005 47910) can be supplied on request.

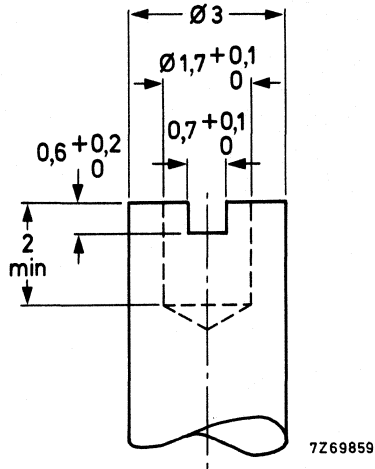


Fig.5.

PACKING

Blister packs of 105 pieces each.

QUALITY LEVEL

Sampling and data evaluation for quality level in accordance with MIL-STD-105D and IEC 410.

A.Q.L. 0,4%, major defects

A.Q.L. 1,5%, minor defects

Each capacitor is tested for minimum C_{max} and is also subjected to the full test voltage. See also Note under Survey of variable capacitors.

TESTS AND REQUIREMENTS

IEC418-1 clause	IEC68 test method	test	procedure	requirements
4.2		method of mounting	method A	
14		capacitance drift	after T.C. measurement	$\Delta C/C$ < 1,5%
19		thrust	axial thrust of 2 N	$\Delta C/C$ < 0,3%
21		robustness of terminations:		
21.1	Ua	tensile	1 N	
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle: 1/2 h at lower and 1/2 h at upper category temp.	$\Delta C/C$ < 1%
23	T Ta	soldering solderability	solder bath, immersion 3 mm, 235 °C, 2 s	good wetting, no mechanical damage
	Tb	resistance to heat	solder bath 260 °C, 10 s	no mechanical damage
24	Eb	impact bump	4000 ± 10 bumps, 40g, 6 ms	$\Delta C/C$ < 0,5% no mechanical damage
25	Fc	vibration	freq. 10 to 55 Hz, ampl. 0,35 mm, 1,5 h	$\Delta C/C$ < 0,3% no mechanical damage

TESTS AND REQUIREMENTS (continued)

IEC418-1 clause	IEC68 test method	test	procedure	requirements
26		climatic sequence		$\Delta C/C$ < 2,5% $\tan \delta$ < 10×10^{-4}
26.1	B	dry heat	16 h at upper category temp.	R_{ins} > 10 000 M Ω rotor contact R < 5 m Ω
26.2	D	damp heat accelerated, first cycle	1 cycle, 24 h, + 40 °C, 95 to 100% R.H.	voltage proof 500 V for 1 min visual examination no mechanical damage
26.3	Aa	cold	16 h, - 40 °C	operating torque 1 to 20 mNm
26.5		damp heat accelerated remaining cycles	1 cycle, 24 h, + 40 °C, 95 to 100% R.H.	
27	Ca	damp heat steady state	21 days, + 40 °C, 90 to 95% R.H.	$\Delta C/C$ < 3% $\tan \delta$ < 10×10^{-4} R_{ins} > 10 000 M Ω rotor contact R < 5 m Ω voltage proof 500 V for 1 min visual examination no mechanical damage operating torque 1 to 20 mNm
29 29.1		endurance mechanical	25 cycles	$\Delta C/C$ < 3% $\Delta C/C$ after axial thrust < 0,3% rotor contact R < 5 m Ω voltage proof 500 V for 1 min visual examination no mechanical damage operating torque 1 to 20 mNm

Argentina: PHILIPS ARGENTINA S.A., Div. Elcoma, Vedia 3892, 1430 BUENOS AIRES, Tel. 541-7 141/7242/7343/7444/7545.

Australia: PHILIPS INDUSTRIES HOLDINGS LTD., Elcoma Division, 67 Mars Road, LANE COVE, 2066, N.S.W., Tel. 427 0888.

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

Belgium: N.V. PHILIPS & MBLE ASSOCIATED, 9 rue du Pavillon, B-1030 BRUXELLES, Tel. (02) 242 74 00.

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. 39-4001.

Colombia: IND. PHILIPS DE COLOMBIA S.A., c/o IPRELENSO LTD., Calle 17, No. 9-21, Of. 202, BOGOTA, D.E., Tel. 57-2347493.

Denmark: MINIWATT A/S, Strandlodsvej 2, P.O. Box 1919, DK 2300 COPENHAGEN S, Tel. (01) 54 11 33.

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

France: R.T.C. LA RADIODIETECHNIQUE-COMPELEC, 130 Avenue Ledru Rollin, F-75540 PARIS 11, Tel. 338 80-00.

Germany (Fed. Republic): VALVO, UB Bauelemente der Philips G.m.b.H., Valvo Haus, Burdhardstrasse 19, D-2 HAMBURG 1, Tel. (040) 3296-0.

Greece: PHILIPS S.A. HELLENIQUE, Elcoma Division, 52, Av. Syngrou, ATHENS, Tel. 92151111.

Hong Kong: PHILIPS HONG KONG LTD., Elcoma Div., 15/F Philips Ind. Bldg., 24-28 Kung Yip St., KWAI CHUNG, Tel. (0)-2451 21.

India: PEICO ELECTRONICS & ELECTRICALS LTD., Elcoma Dept., Band Box Building, 254-D Dr. Annie Besant Rd., BOMBAY - 400 025, Tel. 4220387/4220311.

Indonesia: P. T. PHILIPS-RALIN ELECTRONICS, Elcoma Div., Panim Bank Building, 2nd Fl., Jl. Jend. Sudirman, P.O. Box 223, JAKARTA, Tel. 716 131.

Ireland: PHILIPS ELECTRICAL (IRELAND) LTD., Newstead, Clonskeagh, DUBLIN 14, Tel. 693355.

Italy: PHILIPS S.p.A., Sezione Elcoma, Piazza IV Novembre 3, I-20124 MILANO, Tel. 2-6752.1.

Japan: NIHON PHILIPS CORP., Shuwa Shinagawa Bldg., 26-33 Takanawa 3-chome, Minato-ku, TOKYO (108), Tel. 448-5611.
(IC Products) SIGNETICS JAPAN LTD., 8-7 Sanbancho Chiyoda-ku, TOKYO 102, Tel. (03) 230-1521.

Korea (Republic of): PHILIPS ELECTRONICS (KOREA) LTD., Elcoma Div., Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL, Tel. 794-4202.

Malaysia: PHILIPS MALAYSIA SDN. BERHAD, No. 4 Persiaran Barat, Petaling Jaya, P.O.B. 2163, KUALA LUMPUR, Selangor, Tel. 77 44 11.

Mexico: ELECTRONICA, S.A. de C.V., Carr. México-Toluca km. 62.5, TOLUCA, Edo. de México 50140, Tel. Toluca 91 (721) 613-00.

Netherlands: PHILIPS NEDERLAND, Marktgroep Elonco, Postbus 90050, 5600 PB EINDHOVEN, Tel. (040) 793333.

New Zealand: PHILIPS NEW ZEALAND LTD., Elcoma Division, 110 Mt. Eden Road, C.P.O. Box 1041, AUCKLAND, Tel. 605-914.

Norway: NORSK A/S PHILIPS, Electronica Dept., Sandstuveien 70, OSLO 6, Tel. 68 02 00.

Peru: CADESA, Av. Alfonso Ugarte 1268, LIMA 5, Tel. 326070.

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 PORTUGUESA S.A.R.L., Av. Eng. Duarte Pacheco 6, 1009 LISBOA Codex, Tel. 683121.

Singapore: PHILIPS PROJECT DEV. (Singapore) PTE LTD., Elcoma Div., Lorong 1, Toa Payoh, SINGAPORE 1231, Tel. 2538 811.

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

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

Sweden: PHILIPS KOMPLEMENTER A.B., Lidingövägen 50, S-11584 STOCKHOLM 27, Tel. 08/7821000.

Switzerland: PHILIPS A.G., Elcoma Dept., Allmendstrasse 140-142, CH-8027 ZÜRICH, Tel. 01-488 22 11.

Taiwan: PHILIPS TAIWAN LTD., 3rd Fl., San Min Building, 57-1, Chung Shan N. Rd, Section 2, P.O. Box 22978, TAIPEI, Tel. (02)-5631717.

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., Elcoma Department, İnönü Cad. No. 78-80, İSTANBUL, Tel. 43 59 10.

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

United States: (Active Devices & Materials) AMPEREX SALES CORP., Providence Pike, SLATERSVILLE, R.I. 02876, Tel. (401) 762-9000.
(Passive Devices) MEPCO/ELECTRA INC., Columbia Rd., MORRISTOWN, N.J. 07960, Tel. (201) 539-2000.
(Passive Devices & Electromechanical Devices) CENTRALAB INC., 5855 N. Glen Park Rd., MILWAUKEE, WI 53201, Tel. (414) 228-7380.
(IC Products) SIGNETICS CORPORATION, 811 East Arques Avenue, SUNNYVALE, California 94086, Tel. (408) 739-7700.

Uruguay: LUZILECTRON S.A., Avda Uruguay 1287, P.O. Box 907, MONTEVIDEO, Tel. 91 43 21.

Venezuela: IND. VENEZOLANAS PHILIPS S.A., Elcoma Dept., A. Ppal de los Ruices, Edif. Centro Colgate, CARACAS, Tel. 3605 11

For all other countries apply to: Philips Electronic Components and Materials Division, International Business Relations, Building BAE, P.O. Box 218, 5600 MD EINDHOVEN, The Netherlands, Tel. +31 4072 3304, Telex 35000 phntnl