

PHILIPS

Data handbook



Electronic
components
and materials

Components and materials

Part 7 December 1982

Variable capacitors

COMPONENTS AND MATERIALS

PART 7 - DECEMBER 1982

VARIABLE CAPACITORS

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)

The blue series of data handbooks is comprised of the following parts:

- T1 Tubes for r.f. heating**
- T2 Transmitting tubes for communications**
- T3 Klystrons, travelling-wave tubes, microwave diodes**
- ET3 Special Quality tubes, miscellaneous devices (will not be reprinted)**
- T4 Magnetrons**
- T5 Cathode-ray tubes**
Instrument tubes, monitor and display tubes, C.R. tubes for special applications
- T6 Geiger-Müller tubes**
- T7 Gas-filled tubes**
Segment indicator tubes, indicator tubes, dry reed contact units, thyratrons, industrial rectifying tubes, ignitrons, high-voltage rectifying tubes, associated accessories
- T8 Picture tubes and components**
Colour TV picture tubes, black and white TV picture tubes, colour monitor tubes for data graphic display, monochrome monitor tubes for data graphic display, components for colour television, components for black and white television and monochrome data graphic display
- T9 Photo and electron multipliers**
Photomultiplier tubes, phototubes, single channel electron multipliers, channel electron multiplier plates
- T10 Camera tubes and accessories, image intensifiers**
- T11* Microwave components and assemblies**

* Will become available in the course of 1982.

SEMICONDUCTORS (RED SERIES)

The red series of data handbooks is comprised of the following parts:

- S1 Diodes**
Small-signal germanium diodes, small-signal silicon diodes, voltage regulator diodes (< 1,5 W), voltage reference diodes, tuner diodes, rectifier diodes
- S2 Power diodes, thyristors, triacs**
Rectifier diodes, voltage regulator diodes (> 1,5 W), rectifier stacks, thyristors, triacs
- S3 Small-signal transistors**
- S4 Low-frequency power transistors and hybrid IC modules**
- S5 Field-effect transistors**
- S6 R.F. power transistors and modules**
- S7 Microminiature semiconductors for hybrid circuits**
- S8 Devices for optoelectronics**
Photosensitive diodes and transistors, light-emitting diodes, displays, photocouplers, infrared sensitive devices, photoconductive devices.
- S9 Taken into handbook T11 of the blue series**
- S10 Wideband transistors and wideband hybrid IC modules**

INTEGRATED CIRCUITS (PURPLE SERIES)

The purple series of data handbooks is comprised of the following parts:

- IC1 Bipolar ICs for radio and audio equipment
- IC2 Bipolar ICs for video equipment
- IC3 ICs for digital systems in radio, audio and video equipment
- IC4 Digital integrated circuits
LOC MOS HE4000B family
- IC5 Digital integrated circuits – ECL
ECL10 000 (GX family), ECL100 000 (HX family), dedicated designs
- IC6* Professional analogue integrated circuits
- IC7 Signetics bipolar memories
- IC8 Signetics analogue circuits
- IC9 Signetics TTL logic

* This handbook will be available by the end of 1982.

COMPONENTS AND MATERIALS (GREEN SERIES)

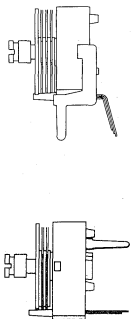
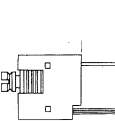
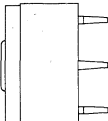
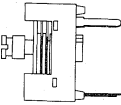

The green series of data handbooks is comprised of the following parts:

- C1 Assemblies for industrial use**
PLC modules, PC20 modules, HN1L FZ/30 series, NORbits 60-, 61-, 90-series, input devices, hybrid ICs, peripheral devices
- C2 Television tuners, video modulators, surface acoustic wave filters**
- C3 Loudspeakers**
- C4 Ferroxcube potcores, square cores and cross cores**
- C5 Ferroxcube for power, audio/video and accelerators**
- C6 Electric motors and accessories**
Permanent magnet synchronous motors, stepping motors, direct current motors
- C7 Variable capacitors**
- C8 Variable mains transformers**
- C9 Piezoelectric quartz devices**
Quartz crystal units, temperature compensated crystal oscillators, compact integrated oscillators, quartz crystal cuts for temperature measurements
- 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 Variable resistors and test switches**
- C13 Fixed resistors**
- C14 Electrolytic and solid capacitors**
- C15 Film capacitors, ceramic capacitors**
- C16 Piezoelectric ceramics, permanent magnet materials**

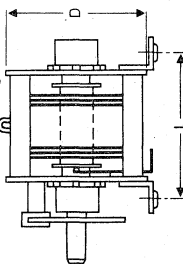
SURVEY

SURVEY

FILM DIELECTRIC TRIMMERS

model	capacitance max. $C_{min}/min.$ C_{max} pF	rated voltage (d.c.) V	temperature coefficient $10^{-6}/K$	temperature range $^{\circ}C$	dimensions range mm	catalogue number 2222 followed by
(1) 	1,5/5 to 4/20 1,4/5,5 to 3/50 2,5/15 to 7/100 11/120 and 15/200	150 250 250 150	-50 ± 200 to -500 ± 450	-40 to $+70$ -40 to $+70$ -40 to $+85$ -40 to $+70$ -40 to $+85$ -40 to $+85$	$\phi 5$ $\phi 7,5$ $\phi 10$ $\phi 13,5$	808.....
(1) 	1,2/3,5 1,8/10 2/18	300	-250 ± 150 -350 ± 150 -350 ± 150	-40 to $+125$	6 x 8	809 05001 809 05002 809 05003
(2) 	2,5/20 to 7/100 2/12 to 7/150	200	0 ± 200	-40 to $+125$	11 x 14	809 070 ..
(1) 	4/40 5/60	300	-250 ± 150	-40 to $+125$	10 x 11	809 08002 809 08003
(1) 	1,4/5,5 2/9 2/18	300	-250 ± 150	-40 to $+125$	8 x 9	809 09001 809 09002 809 09003

PRECISION TUNING CAPACITORS

model	capacitance range pF			L x D mm		catalogue number
	stator types	40 x 40 mm linear	60 x 60 mm linear logarithmic	number of gangs	D = 40 x 40 mm D = 60 x 60 mm	
 <p>temperature range: -40 to +85 °C</p>	single 1 - 4 gangs	16 - 250	100 - 640	1	L = 45 L = 67	2222 805
	split 1 - 4 gangs	10 - 64	25 - 125	2	L = 76,5 L = 117,5	
	differential 1 gang	64 - 160	—	3	L = 108 L = 168	
				4	L = 139,5 L = 218,5	

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.

1. Top and bottom adjustment.
2. Top adjustment only.

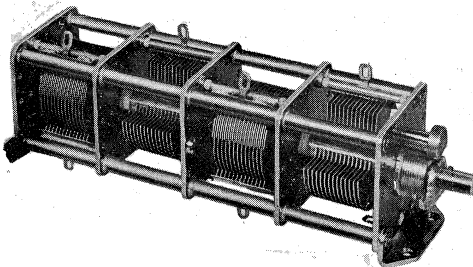


PRECISION TUNING CAPACITORS

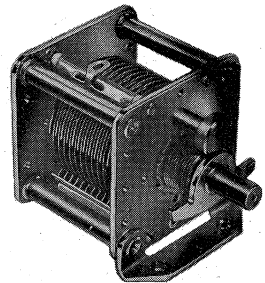
QUICK REFERENCE DATA			
types	40 x 40 mm standard torque	60 x 60 mm standard torque	
	linear law	linear law	logarithmic law
single stator 1-4 gangs	16-250 pF *)	100-640 pF	100-500 pF
split stator 1-4 gangs	10-64 pF	25-125 pF	25-125 pF
differential 1 gang	64-160 pF *)		
Law and ganging tolerances		±0,7%	

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

37482-57



6486/19



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.

DESCRIPTIONFrame

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 (40x40 mm) version and (60x60 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 resistance 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.

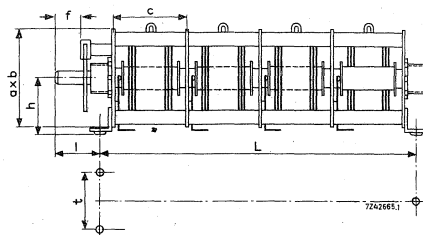
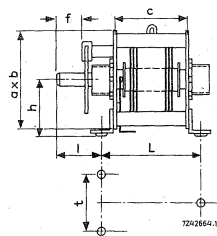
Single capacitors of the (40x40 mm) version for direct drive operation have the spindle end slotted for screwdriver adjustment.

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 (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	31,5			
		60 x 60	50,5			
spindle length (±0.5)	l	40 x 40	16			
		60 x 60	18			
spindle height (±0.5)	h	40 x 40	22,5			
		60 x 60	32,5			
free spindle length	f	40 x 40	10			
		60 x 60	14,5			
weight (g)		40 x 40	120	200	300	400
		60 x 60	400	700	1000	1300

Direction of rotation for increase in capacitance

clock wise

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 mm² 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 ≤ 0.02 pF

between rotor packs (if insulated) ≤ 0.05 pF

Insulation resistance between

stator and rotor and between
frame and stator and rotor $> 10\,000$ M Ω

Contact resistance

between any soldering tag and
the relative rotor pack ≤ 5 m Ω

Parallel damping at 1.5 MHz

with 50 pF (or max. capacitance
if < 50 pF) > 10 M Ω

Temperature coefficient of capacitance for the first compartment, (at $C = 1/3$ cap. swing + capacitance at 15°) in ppm/°C.

version	40 x 40 mm	60 x 60 mm
1 gang	20 \pm 20	30 \pm 30
2 gangs	20 \pm 20	30 \pm 30
3 gangs	30 \pm 30	50 \pm 50
4 gangs	50 \pm 50	50 \pm 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 150×10^{-6} pF/pF

Category temperature range

-40 to +85 °C

Electrical Data continued

Table I

Cvar (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 ± 1 pF ¹⁾ (pF)	V _{rest} ²⁾ (Vd.c.)		C ₀ ± 1pF (pF)	V _{rest} ³⁾ (Vd.c.)		C ₀ ± 1pF (pF)	V _{rest} ³⁾ (Vd.c.)	C ₀ ± 1pF (pF)	V _{rest} ³⁾ (Vd.c.)									
10			3	3000																
16	8	2500	3.6	2000																2500
25	8.5	2000	4	2000																2500
32																				2000
40	9	1500	4	1600																2000
50																				2000
64	9	1000	4	1300																1600
80																				1600
100	10	1000																		1600
125																				1600
160	11	800																		1300
250																				
200	11.5	650 ⁴⁾																		
320																				
400																				
500																				
640																				

1) For the differential version the C₀ values are 1pF less than the tabulated values


2) Between rotor and stator

3) Between the two stators

4) Differential type only up to and including Cvar = 160pF

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	2x 10			194		
	2x 16	138		195		
	2x 25	139		196		
	2x 40	141		197		
	2x 64	142		198		
	2x 100	143				
	2x 160	144				
	2x 250	145				
3 gangs	3x 10					
	3x 16	146		201		
	3x 25	147		202		
	3x 40	148		203		
	3x 64	149		204		
	3x 100	151		205		
	3x 160	152				
	3x 250	153				
4 gangs	4x 10			207		
	4x 16	154		208		
	4x 25	155		209		
	4x 40	156		211		
	4x 64	157		212		
	4x 100	158				
	4x 160	159				
	4x 250	161				

1) low torque

2) high torque

Table III 60 x 60 mm version

type	Cvar (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	2x 25			307	354
	2x 32			308	355
	2x 40			309	356
	2x 50			311	357
	2x 64			312	358
	2x 80			313	359
	2x 100	206	258	314	361
	2x 125	207	259	315	362
	2x 160	208	261		
	2x 200	209	262		
	2x 250	211	263		
	2x 320	212	264		
	2x 400	213	265		
	2x 500	214	266		
	2x 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

QUICK REFERENCE DATA

Max. $C_{min}/min. C_{max}$	1,5/5 to 4/20 pF *
Diameter	5 mm
Rated voltage (d.c.)	150 V
Climatic category (IEC 68)	40/070/21
Basic specification	IEC 418-1 and 4

APPLICATION

These film dielectric trimmers are for use on printed-wiring boards, e.g. in radio sets. Their good stability also makes them suitable for industrial equipment.

DESCRIPTION

The vanes are stacked on a sturdy plastic base. 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. The capacitor has top and bottom adjustment by means of a screwdriver. Flux absorption between the vanes is prevented. The trimmers are resistant to all standard cleaning solvents except trichloroethylene and trichloroethane.

MECHANICAL DATA

Dimensions in mm

Outlines

See Fig. 1.

Table 1

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

* The data on the 5 pF version are provisional.

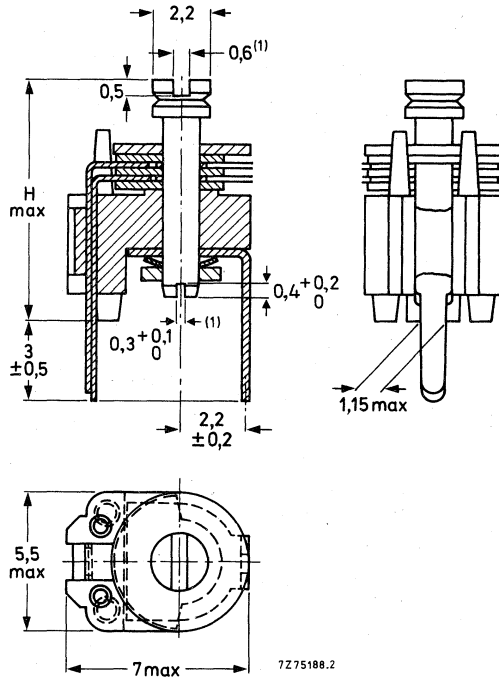


Fig. 1 H is given in Table 2.

(1) Angle between screwdriver adjustment slots is arbitrary.

Type identification

The different capacitance values can be identified by the colour of the base, see Table 2.

Soldering

Soldering conditions max. 260 °C, max. 10 s

Mounting

The trimmers can be mounted on printed-wiring boards with holes with a minimum diameter of 1,25 mm. The hole pattern is given in the figure below.

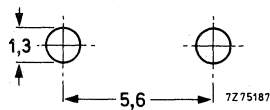


Fig. 2.

ELECTRICAL DATA

Table 2

reference C_{min}/C_{max} (note 1) pF	guaranteed max. C_{min} min. C_{max} (note 2) pF	tan δ at C_{max} $\times 10^{-4}$		temperature coefficient (note 3) $10^{-6}/K$	min. f_{res} at C_{max} MHz	colour of base	H in Fig. 1 mm	catalogue number
		1 MHz	100 MHz					
1,2/5	1,5/5	< 10	< 25	-200 ± 300		grey	6,8	2222 808 23508
1,4/10	2 /10	< 10	< 25	-200 ± 300	500	yellow	6,8	2222 808 23109
1,6/15	2,5/15	< 10	< 25	-50 ± 200	400	blue	8,8	2222 808 23159
3,5/20	4 /20	< 10	< 25	-50 ± 200	300	green	8,8	2222 808 23209

Rated voltage (d.c.)

150 V

Test voltage (d.c.) for 1 minute

300 V

Contact resistance

max. 10 m Ω

Insulation resistance

min. 10 000 M Ω

Category temperature range

 -40 to $+70$ °C

Climatic category (IEC 68)

40/070/21

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 Notes under Survey of variable capacitors.

PACKAGING

Bulk packing in cardboard boxes lined with expanded plastic, 3000 per box.

Notes

1. This column indicates the reference values of the capacitance ranges currently available on the market which are equivalent to our range.
2. Measured at 200 kHz.
3. C at 60 to 80% of C_{max} ; ΔT from $+20$ °C to upper category temperature.

TESTS AND REQUIREMENTS

IEC 418-1 clause	IEC 68 test method	test	procedure	requirements
4.2		method of mounting cap. drift thrust	method A after T.C. measurement axial thrust of 2N	$\Delta C/C$ $\Delta C/C$ $\leq 1,75\%$ $\leq 0,4\%$
14		robustness of terminations:		
19		tensile	1N	no damage
21		bending	1 cycle	$\leq 2,5\%$
21.1	Ua	rapid change of temperature	1 cycle: 1/2 h at the lower and 1/2 h at the upper category temperature	$\Delta C/C$
21.2	Ub	soldering		good wetting, no mech. damage
22	Na	solderability	solder bath, immersion 3 mm, 235 °C, 2 s	no mech. damage
23	T Ta Tb	resistance to heat	solder bath 260 °C, 10 s	$\Delta C/C$
24	Eb	impact bump	4000 ± 10 bumps, 40g, 6 ms	$\leq 1\%$ no mech. damage
25	Fc	vibration	freq. 10 to 55 Hz, amplitude 0,75 mm, 1 1/2 h	$\leq 1\%$ no mech. damage

IEC418-1 clause	IEC 68 test method	test	procedure	requirements
26		climatic sequence		$\Delta C/C$ $\tan \delta$ R_{ins} rotor contact R voltage proof visual examination operating torque
26.1	B	dry heat	16 h at the upper category temperature	$\leq 4\%$ $\leq 15 \times 10^{-4}$ $\geq 10\,000\ M\Omega$
26.2	D	damp heat accelerated, first cycle	1 cycle, 24 h + 40 °C, 95 to 100% R.H.	$\leq 10\ m\Omega$ as specified no mech. damage
26.3	Aa	cold	16 h -40 °C	1-15 mN/m
26.5		damp heat accelerated, remaining cycles	1 cycle 24 h + 40 °C, 95 to 100% R.H.	
27	C	damp heat steady state	21 days + 40 °C, 90 to 95% R.H.	$\Delta C/C$ $\tan \delta$ R_{ins} rotor contact R voltage proof visual examination operating torque
29		endurance mechanical	10 cycles	$\leq 3\%$ 15×10^{-4} $\geq 10\,000\ M\Omega$ $\leq 10\ m\Omega$ as specified no mech. damage 1-15 mN/m
29.1				$\Delta C/C$ rotor contact R voltage proof $\Delta C/C$ after axial thrust visual examination operating torque
				$\leq 3\%$ $\leq 10\ m\Omega$ as specified $\leq 0.3\%$ no mech. damage 0.5-22.5 mN/m

FILM DIELECTRIC TRIMMERS

QUICK REFERENCE DATA

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

APPLICATION

These film dielectric trimmers are for use on printed-wiring boards, e.g. in radio sets. Their good stability also makes them suitable for industrial equipment.

DESCRIPTION

The vanes are stacked on a sturdy plastic base. The dielectric is a film of polyethylene, polypropylene, polycarbonate or P.T.F.E. 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. 2) are available (see Table 2). Both versions have top adjustment by means of a screwdriver * and bottom adjustment by means of a key (see Fig. 5), except the types marked ** in Table 2.

MECHANICAL DATA

Dimensions in mm

Outlines

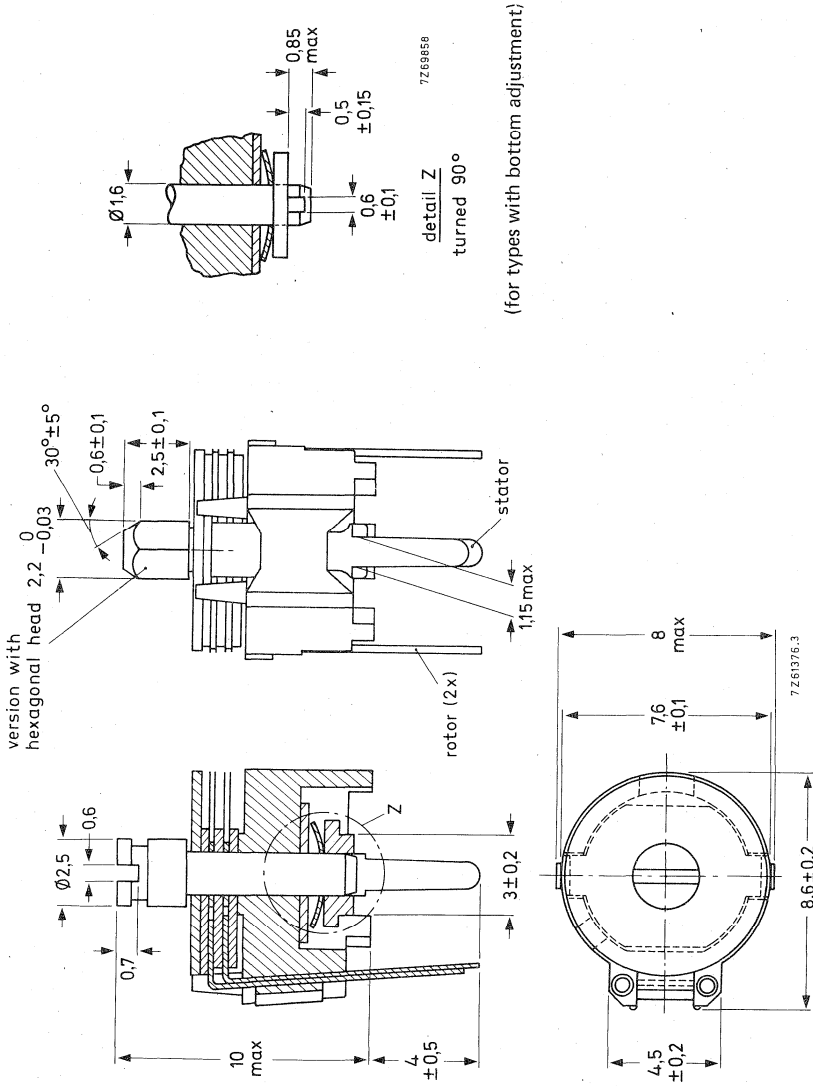
See Figs 1 and 2.

Table 1

Effective angle of rotation	180°
Operating torque	1-15 mNm
Maximum axial thrust ($\Delta C \leq 0,3\%$ of C_{max})	2 N
Mass (approximately)	0,8 g

* The 22 pF trimmer is also available with hexagonal head (see Table 2) for automatic trimming by means of a spanner.

2222 808 SERIES
7,5 mm dia.



(for types with bottom adjustment)

7Z69856

detail Z
turned 90°

Fig. 1 Version with vertical spindle.

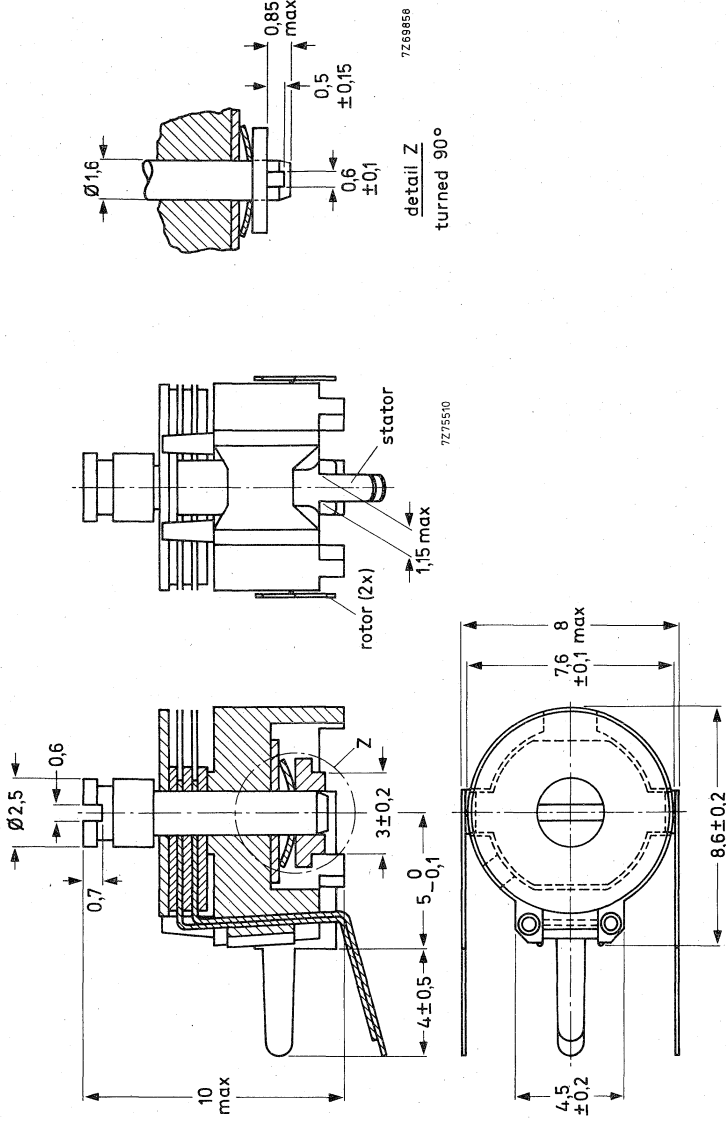


Fig. 2 Version with horizontal spindle.

Type identification

The capacitance of the trimmer is indicated by the colour of the base, see Table 2.

Soldering

Soldering conditions: max. 260 °C, max. 10 s.

Mounting

The trimmers can be mounted on printed-wiring boards with a hole pitch of 2,50 mm or 2,54 mm (0,1 in); hole diameter minimum 1,25 mm. The hole pattern is given in the figures below (R = rotor; S = stator).

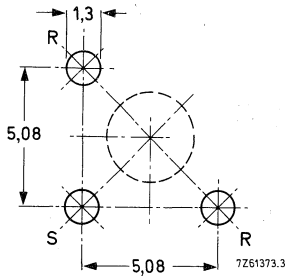


Fig. 3 For types of Fig. 1.

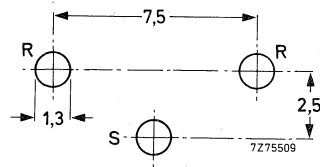


Fig. 4 For types of Fig. 2.

Note

The large hole is necessary for bottom adjustment of the vertical types. Diameter determined by the user's requirements.

Key for adjustment

The dimensions essential for the design of a key are given in Fig. 5.

A key (catalogue number 7122 347 21600) and the associated handle (catalogue number 7122 005 47910) are available.

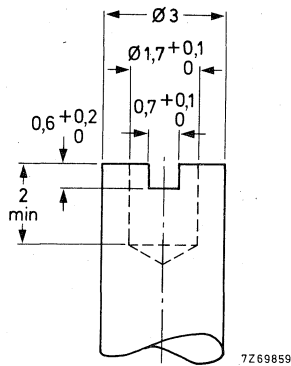


Fig. 5.

ELECTRICAL DATA

Table 2

reference C_{min}/C_{max} (note 1) pF	guaranteed max. C_{min} min. C_{max} (note 2) pF	$\tan \delta$ at C_{max} $\times 10^{-4}$		temperature coefficient (note 3) $10^{-6}/K$	min. f_{res} at C_{max} MHz	colour of base	Fig.	catalogue number (note 4)
		1 MHz	100 MHz					
1,2/6	1,4/5,5	≤ 10	≤ 25	-400 ± 300	850	grey	1 1*	2222 808 11558 2222 808 00004**
1,4/6	2/9	≤ 10	≤ 15	-500 ± 450	480	yellow	1	2222 808 00018**
1,4/10	2/9	≤ 10	≤ 25	-450 ± 350	480	yellow	1 1 2	2222 808 11109 2222 808 00005** 2222 808 51109
1,6/15	2/15	≤ 10	≤ 25	-200 ± 350	450	blue	1	2222 808 11159
1,8/18	2/18	≤ 10	≤ 15	-400 ± 200	350	green	1	2222 808 00016
1,8/22	2/22	≤ 10	≤ 25	-250 ± 350	350	green	1 1 1*	2222 808 11229 2222 808 00006** 2222 808 17229
1,8/27	2/27	≤ 50		-250 ± 300	350	red	1 2	2222 808 11279 2222 808 51279
2/33	3/33	≤ 10		-250 ± 300	300	brown	1	2222 808 11339
2/40	3/40	≤ 50		-100 ± 300	300	violet	1	2222 808 11409
3/50	3/50	≤ 50		-100 ± 300	250	black	1	2222 808 11509

* Version with hexagonal head.

** Without notches for bottom adjustment.

Rated voltage (d.c.)	250 V
Test voltage (d.c.) for 1 minute	500 V
Contact resistance	max. 10 m Ω
Insulation resistance	min. 10 000 M Ω
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

Notes

1. This column indicates the reference values of the capacitance ranges currently available on the market which are equivalent to our range.
2. Measured at 200 kHz.
3. C at 60 to 80% of C_{max} ; ΔT from $+20$ °C to upper category temperature.
4. All capacitance values are available according to Fig. 2 on request.

2222 808.SERIES
7,5 mm dia.

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.

PACKAGING

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

TESTS AND REQUIREMENTS

IEC 418-1 clause	IEC 68 test method	test	procedure	requirements
4.2		method of mounting	method A	
14		cap. drift	after T.C. measurement	$\Delta C/C \leq 1\%$
19		thrust	axial thrust of 2N	$\leq 2,5\%$ for $C_{max} \geq 40$ pF
21		robustness of terminations:		$\leq 0,3\%$
21.1	Ua	tensile	1N	
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle: $\frac{1}{2}$ h at the lower and $\frac{1}{2}$ h at the upper category temperature	$\Delta C/C \leq 2\%$
23	T	soldering		
	Ta	solderability	solder bath, immersion 3 mm, 235 °C, 2 s	good wetting, no mech. damage
	Tb	resistance to heat	solder bath 260 °C, 10 s	no mech. damage
24	Eb	impact bump	4000 \pm 10 bumps, 40g, 6 ms	$\leq 0,6\%$ no mech. damage
25	Fc	vibration	freq. 10 to 55 Hz, amplitude 0,35 mm, $1\frac{1}{2}$ h	$\leq 0,6\%$ no mech. damage

TESTS AND REQUIREMENTS (continued)

IEC 418-1 clause	IEC 68 test method	test	procedure	requirements
26		climatic sequence		
26.1	B	dry heat	16 h at the upper category temperature	$\leq 4\%$ $\leq 10 \times 10^{-4}$
26.2	D	damp heat accelerated, first cycle	1 cycle, 24 h + 40 °C, 95 to 100% R.H.	$\leq 70 \times 10^{-4}$ for $C_{max} \geq 27$ pF $\geq 10\,000$ M Ω ≤ 10 m Ω
26.3	Aa	cold	16 h -40 °C	as specified
26.5		damp heat accelerated, remaining cycles	1 cycle 24 h + 40 °C, 95 to 100% R.H.	no mech. damage 1-15 mNm
27	C	damp heat steady state	21 days + 40 °C, 90 to 95% R.H.	$\leq 5\%$ $\leq 30 \times 10^{-4}$ $\leq 70 \times 10^{-4}$ for $C_{max} \geq 27$ pF $\geq 10\,000$ M Ω ≤ 10 m Ω
29 29.1		endurance mechanical	10 cycles	rotor contact R voltage proof visual examination operating torque no mech. damage 1-15 mNm
				$\leq 1,5\%$ ≤ 10 m Ω as specified $\leq 0,3\%$ no mech. damage 1-15 mNm

FILM DIELECTRIC TRIMMERS

QUICK REFERENCE DATA

Max. $C_{min}/min. C_{max}$	2,5/15 to 7/100 pF
Diameter	10 mm
Rated voltage (d.c.)	250 V
Climatic category (IEC 68)	40/070/21 or 40/085/21
Basic specification	IEC 418-1 and 4

APPLICATION

These film dielectric trimmers are for use on printed-wiring boards, e.g. in radio sets. Their good stability also makes them suitable for industrial equipment.

DESCRIPTION

The vanes are stacked on a sturdy plastic base. The dielectric is a film of polypropylene, polycarbonate or P.T.F.E. 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.

This series comprises different versions, see Table 1. For complete catalogue numbers refer to Table 3.

Table 1 Versions

position of spindle	angle between 2 rotor tags	hole pattern Fig.	adjustment		Fig. 1	
			top	bottom		
vertical	90°	4	screwdriver	key	} see also Fig. 6	1
vertical	180°	5	screwdriver	key		2
vertical	180°	5	spanner	key		2
horizontal		5	screwdriver	key		3
horizontal		5	spanner	key		3

MECHANICAL DATA

Dimensions in mm

Outlines See Figs 1, 2 and 3.

Table 2

Effective angle of rotation	180°
Operating torque	2-25 mNm
Maximum axial thrust ($\Delta C \leq 0,3\%$ of C_{max})	2 N
Mass (approximately)	1,3 g

2222 808 SERIES
10 mm dia.

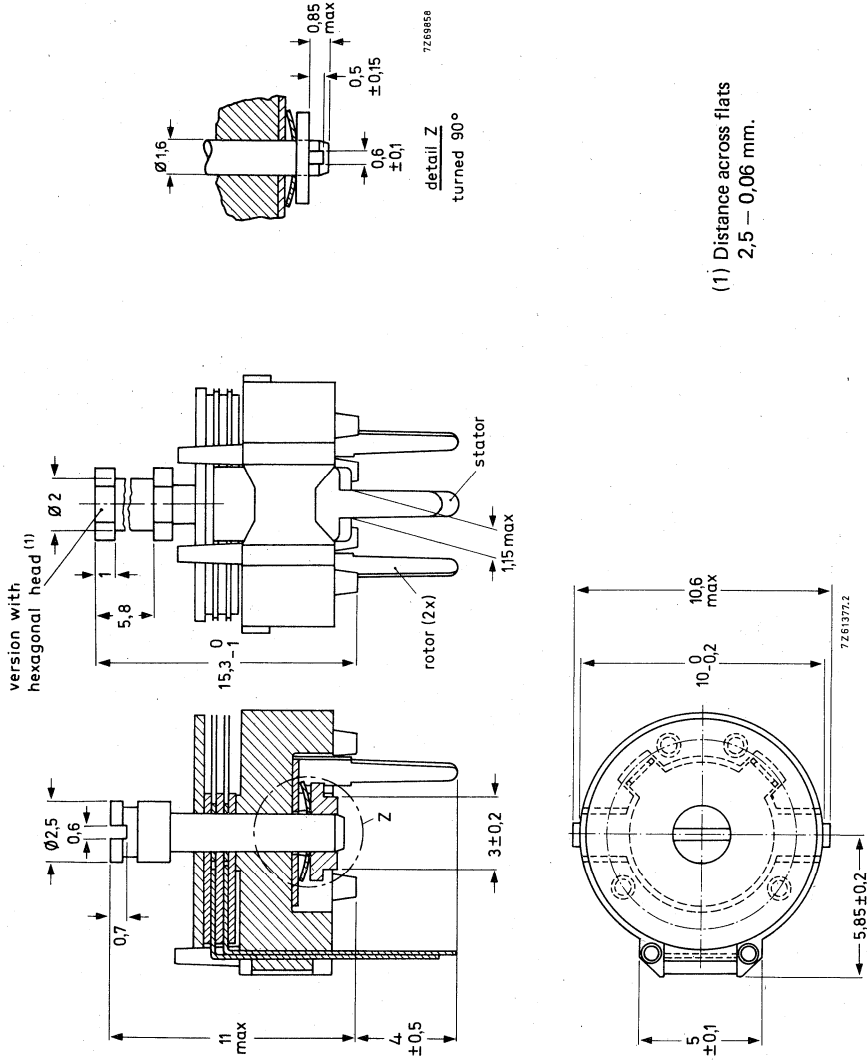
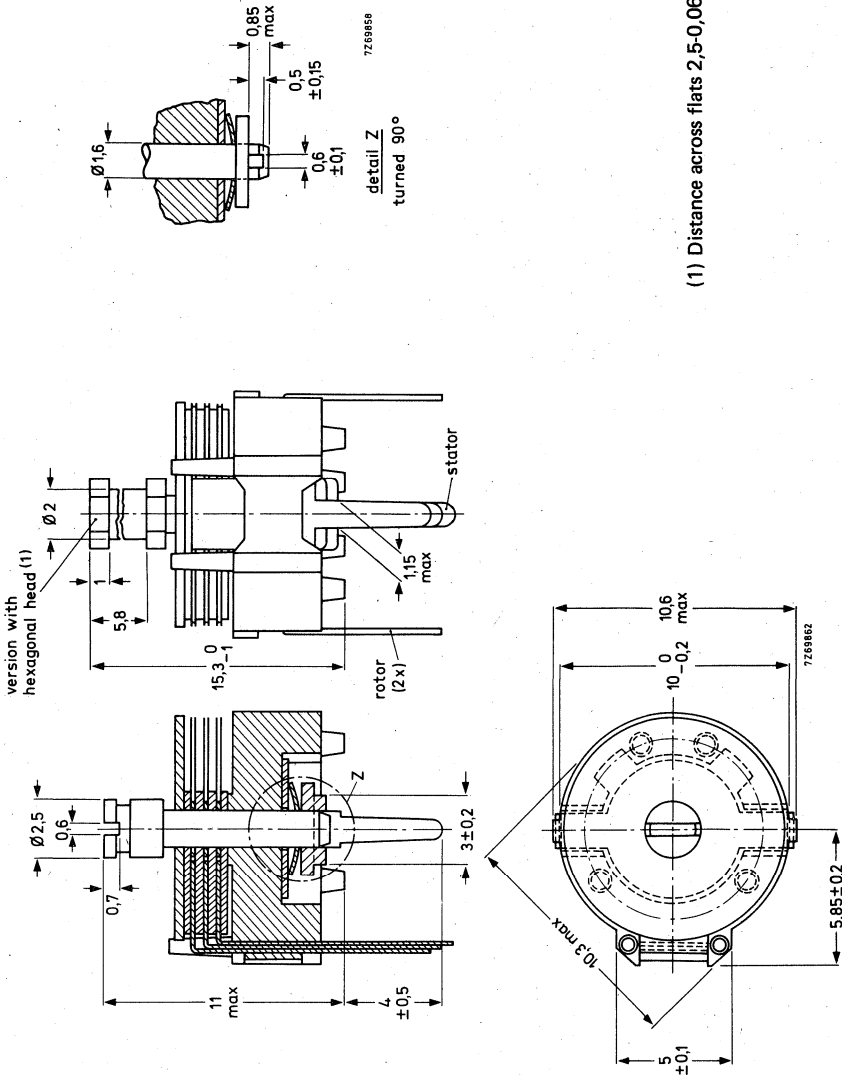


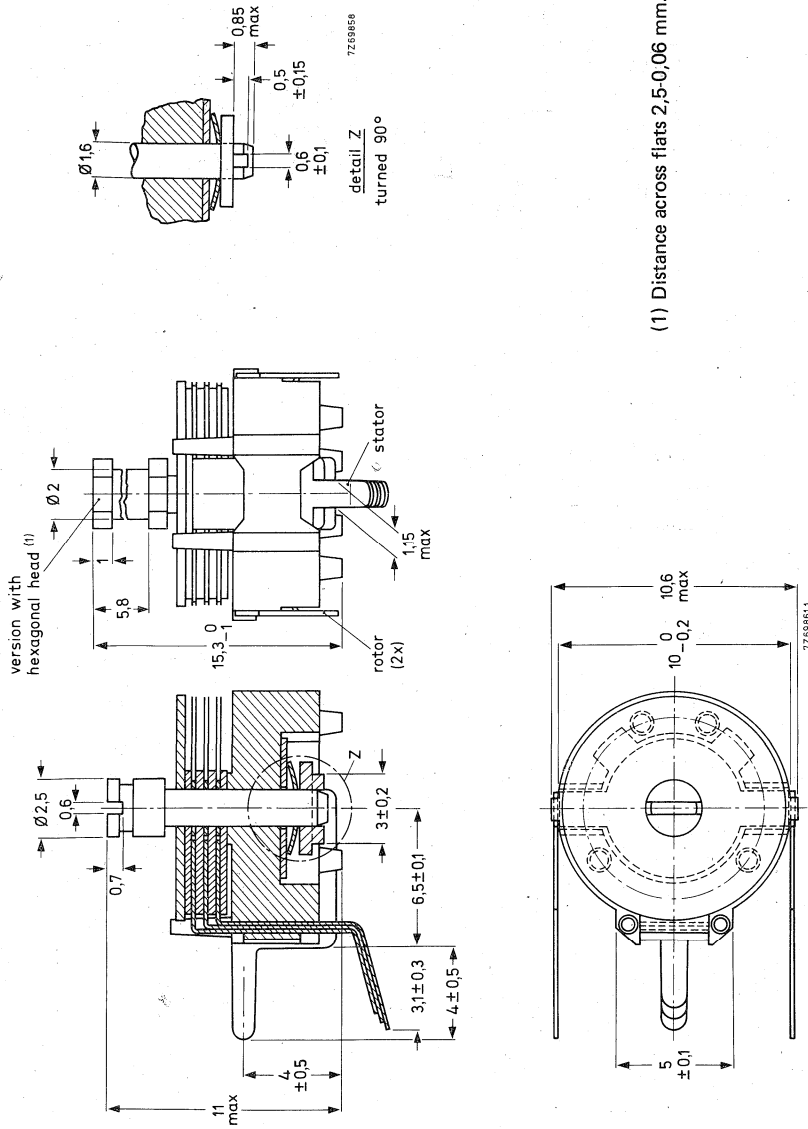
Fig. 1 Version with vertical spindle and hole pattern of Fig. 4.



(1) Distance across flats 2,5-0,06 mm.

Fig. 2 Version with vertical spindle and hole pattern of Fig. 5.

2222 808 SERIES
10 mm dia.



(1) Distance across flats 2,5-0,06 mm.

Fig. 3. Version with horizontal spindle and hole pattern of Fig. 5.

Type identification

The different capacitance values can be identified by the colour of the base, see Table 3.

Soldering

Soldering conditions: max. 260 °C, max. 10 s.

Mounting

The trimmers can be mounted on printed-wiring boards with a pitch of 2,50 mm or 2,54 mm (0,1 in) and holes with a minimum diameter of 1,25 mm. The hole pattern is given in the figures below (R = rotor; S = stator).

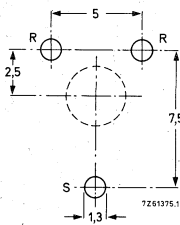


Fig. 4 For types of Fig. 1.

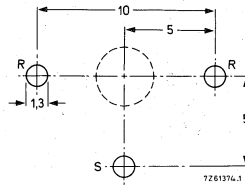


Fig. 5 For types of Figs 2 and 3.

Note

The large hole is necessary for bottom adjustment of the vertical types. Diameter determined by the user's requirements.

Spanner 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.

Key for adjustment

The dimensions essential for the design of a key are given in Fig. 6.

A key (catalogue number 7122 347 21600) and the associated handle (catalogue number 7122 005 47910) can be supplied on request.

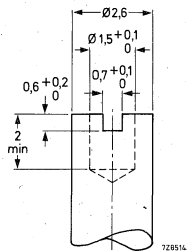


Fig. 6.

2222 808 SERIES
10 mm dia.

ELECTRICAL DATA

Table 3

reference C_{min}/C_{max} (note 1) pF	guaranteed max. C_{min} min. C_{max} (note 2) pF	tan δ at C_{max} $\times 10^{-4}$		temperature coefficient (note 3) $10^{-4}/K$	min. f_{res} at C_{max} MHz	colour of base	Fig.	catalogue number
		1 MHz	100 MHz					
1,8/15	2,5/15	≤ 10	≤ 25	-150 ± 500	420	blue	1	2222 808 32159
							2	2222 808 31159
							3	2222 808 61159
2,5/25	3/22,5	≤ 10	≤ 25	-150 ± 400	200	green	1	2222 808 32229
							2	2222 808 31229
							3	2222 808 61229
4/40	5,5/40	≤ 10	≤ 25	-150 ± 350	200	grey	1	2222 808 32409
							2	2222 808 31409
							3	2222 808 61409
4/50	5,5/50	≤ 10	≤ 25	-500 ± 150	170	yellow	1	2222 808 01006
							2	2222 808 01029
4,5/70	5,5/65	≤ 10	≤ 25	-200 ± 300	170	yellow	1	2222 808 32659
							2	2222 808 31659
							2*	2222 808 34659
							3	2222 808 61659
							3*	2222 808 64659
5/90	6/80	≤ 50	—	-100 ± 300	170	red	1	2222 808 32809
							1*	2222 808 35809
							2	2222 808 31809
							2*	2222 808 34809
							3	2222 808 61809
5/105	7/100	≤ 50	—	-100 ± 300	170	violet	1	2222 808 32101
							2	2222 808 31101
							3	2222 808 61101
							3*	2222 808 64101

* Version with hexagonal head.

Rated voltage (d.c.)	240 V
Test voltage (d.c.) for 1 minute	500 V
Contact resistance	max. 10 m Ω
Insulation resistance	min. 10 000 M Ω
Category temperature range,	
$C_{max} = 15, 22,5, 40, 65$ pF	-40 to $+70$ °C
$C_{max} = 50, 80, 100$ pF	-40 to $+85$ °C
Climatic category (IEC 68)	
$C_{max} = 15, 22,5, 40, 65$ pF	40/070/21
$C_{max} = 50, 80, 100$ pF	40/085/21

Notes

1. This column indicates the reference values of the capacitance ranges currently available on the market which are equivalent to our range.
2. Measured at 200 kHz.
3. C at 60 to 80% of C_{max} , ΔT from $+20$ °C to upper category temperature.

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.

PACKAGING

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 hexagonal head: 600.

TESTS AND REQUIREMENTS

IEC 418-1 clause	IEC 68 test method	test	procedure	requirements
4.2		method of mounting	method A	
14		cap. drift	after T. C. measurement	$\Delta C/C \leq 1,5\%$; $\leq 1\%$ for $C_{max} \geq 50$ pF
19		thrust	axial thrust of 2N	$\Delta C/C \leq 0,3\%$
21		robustness of terminations:		
21.1	Ua	tensile	1N	
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle: $\frac{1}{2}$ h at the lower and $\frac{1}{2}$ h at the upper category temperature	$\Delta C/C \leq 1,5\%$
23	T Ta Tb	soldering solderability resistance to heat	solder bath, immersion 3 mm, 235 °C, 2 s solder bath 260 °C, 10 s	good wetting, no mech. damage no mech. damage
24	Eb	impact	4000 \pm 10 bumps, 40g, 6 ms.	$\Delta C/C \leq 0,4\%$ no mech. damage
25	Fc	bump vibration	freq. 10 to 55 Hz, amplitude 0,35 mm, 1 $\frac{1}{2}$ h	$\Delta C/C \leq 0,8\%$ no mech. damage

IEC 418-1 clause	IEC 68 test method	test	procedure	requirements
26		climatic sequence dry heat damp heat accelerated, first cycle cold damp heat accelerated, remaining cycles	16 h at the upper category temperature 1 cycle, 24 h + 40 °C, 95 to 100% R.H. 16 h -40 °C 1 cycle 24 h + 40 °C, 95 to 100% R.H.	$\Delta C/C$ $\leq 3\%$ $\leq 6\%$ for $C_{max} \geq 80$ pF $\leq 15 \times 10^{-4}$ $\leq 85 \times 10^{-4}$ for $C_{max} \geq 80$ pF $\geq 10\,000$ M Ω rotor contact R ≤ 10 m Ω voltage proof visual examination no mech. damage operating torque 2-35 mNm
27	C	damp heat steady state	21 days + 40 °C, 90 to 95% R.H.	$\Delta C/C$ $\tan \delta$ $\leq 3\%$, $\leq 3,5\%$ for $C_{max} \geq 100$ pF $\leq 20 \times 10^{-4}$ $\leq 70 \times 10^{-4}$ for $C_{max} \geq 80$ pF $\geq 10\,000$ M Ω ≤ 10 m Ω rotor contact R voltage proof visual examination no mech. damage operating torque 2-35 mNm
29 29.1		endurance mechanical	10 cycles	$\Delta C/C$ rotor contact R voltage proof $\Delta C/C$ after axial thrust visual examination operating torque $\leq 1\%$ ≤ 10 m Ω as specified $\leq 0,4\%$ no mech. damage 1,5-37 mNm

FILM DIELECTRIC TRIMMERS

QUICK REFERENCE DATA

Max. C_{\min} /min. C_{\max}	11/120 pF and 15/200 pF
Diameter	13,5 mm
Rated voltage (d.c.)	150 V
Climatic category (IEC 68)	40/085/21
Basic specification	IEC 418-1 and 4

APPLICATION

These film dielectric trimmers are for use on printed-wiring boards, e.g. in radio sets. Their good stability also makes them suitable for industrial equipment.

DESCRIPTION

The vanes are stacked on a sturdy plastic base. 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. The capacitor has top and bottom adjustment by means of a screwdriver. Flux absorption between the vanes is prevented. The trimmers are resistant to all standard cleaning solvents except trichloroethylene and trichloroethane. A version with vertical spindle (Fig. 1) and a version with horizontal spindle (Fig. 2) are available (see Table 2). All types have top adjustment either by means of a screwdriver or a spanner, and bottom adjustment by means of a screwdriver.

MECHANICAL DATA

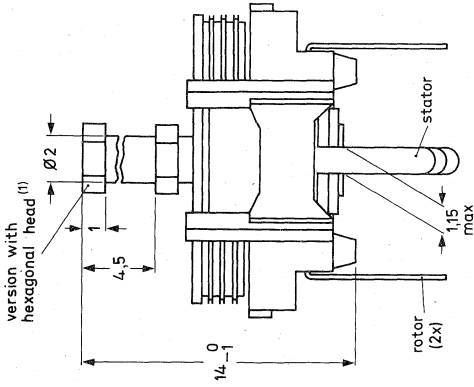
Dimensions in mm

Outlines

See Figs 1 and 2.

Table 1

Effective angle of rotation	180°
Operating torque	2-35 mNm
Maximum axial thrust ($\Delta C \leq 0,3\%$ of C_{\max})	2 N
Mass (approximately)	2 g



7Z698831

(1) Distance across flats 2,5-0,06 mm.

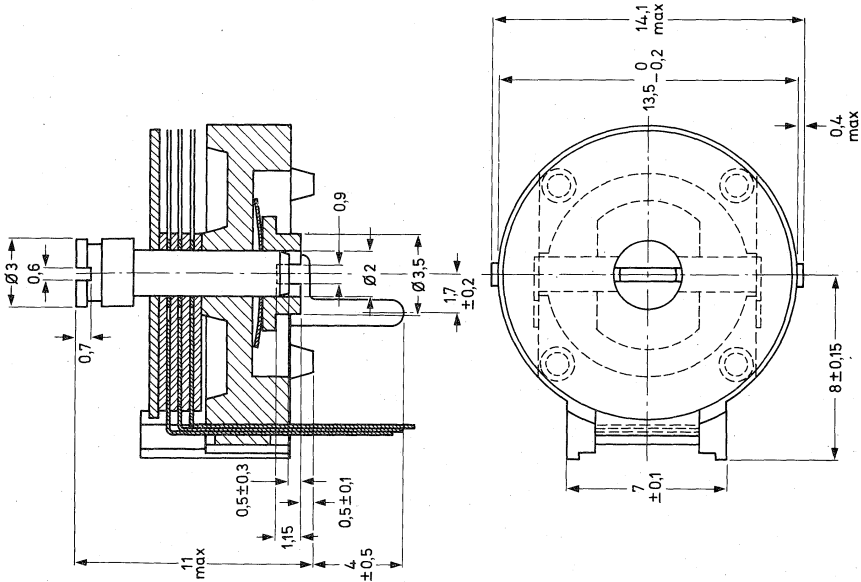


Fig. 1 Outlines of the capacitors 2222 808 41 . . . and 2222 808 44 . . . (versions with vertical spindle).

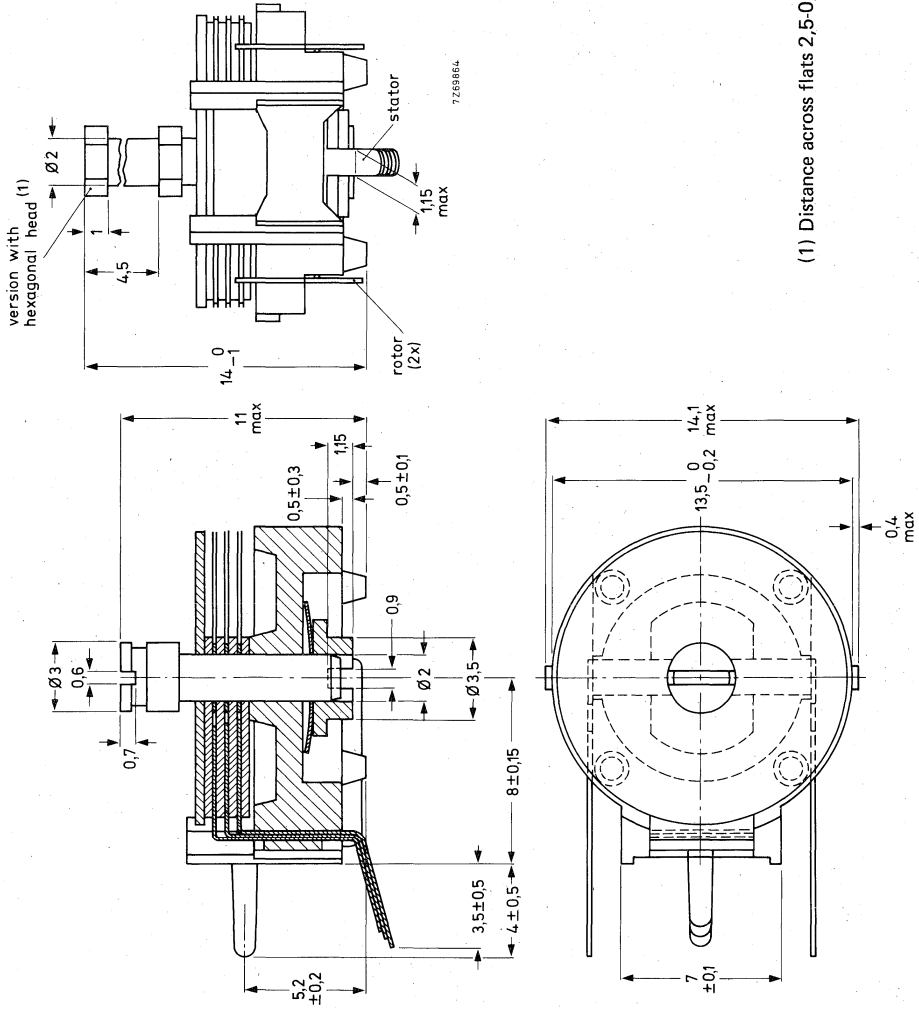


Fig. 2 Outlines of the capacitors 2222 808 71 . . . and 2222 808 74 . . . (versions with horizontal spindle).

2222 808 SERIES

13,5 mm dia.

Type identification

The capacitance of the trimmer is indicated by the colour of the base, see Table 2.

Soldering

Soldering conditions: max. 260 °C, max. 10 s.

Mounting

The trimmers can be mounted on printed-wiring boards with a hole pitch of 2,50 mm or 2,54 mm (0,1 in); hole diameter minimum 1,25 mm. The hole pattern is given in the figure below (R = rotor; S = stator).

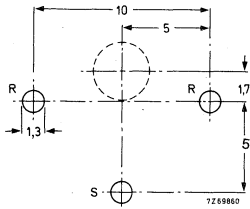


Fig. 3.

Note

The large hole is necessary for bottom adjustment of the vertical types. Diameter determined by the user's requirements.

Spanner 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.

ELECTRICAL DATA

Table 2

reference C_{\min}/C_{\max} (note 1) pF	guaranteed max. C_{\min} min. C_{\max} (note 2) pF	$\tan \delta$ at C_{\max} at 1 MHz $\times 10^{-4}$	temperature coefficient (note 3) $10^{-5}/K$	f_{res} at C_{\max} MHz	colour of base	Fig.	catalogue number
8/130	12/120	≤ 50	0 ± 300	> 150	green	1	2222 808 41121
8/130	12/120	≤ 50	0 ± 300	> 150	green	1*	2222 808 44121
8/130	12/120	≤ 50	-200 ± 300	> 150	green	2	2222 808 71121
8/130	12/120	≤ 50	-200 ± 300	> 150	green	2*	2222 808 74121
15/200	15/200	≤ 50	0 ± 300	> 100	yellow	1*	2222 808 44201
15/200	15/200	≤ 50	-200 ± 300	> 100	yellow	2*	2222 808 74201

* Version with hexagonal head.

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

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.

PACKAGING

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

Notes

1. This column indicates the reference values of the capacitance ranges currently available on the market which are equivalent to our range.
2. Measured at 200 kHz.
3. C at 60 to 80% of C_{\max} , ΔT from + 20 to + 85 °C.

TESTS AND REQUIREMENTS

IEC 418-1 clause	IEC 68 test method	test	procedure	requirements
4.2		method of mounting	method A	
14		cap. drift	after T.C. measurement	$\Delta C/C$ $\Delta C/C$
19		thrust	axial thrust of 2N	$120 \text{ pF} \leq 1\%$, $200 \text{ pF} \leq 3\%$ $\leq 0,3\%$
21		robustness of terminations:		
21.1	Ua	tensile	1N	
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle: $\frac{1}{2}$ h at the lower and $\frac{1}{2}$ h at the upper category temperature	$\Delta C/C$ $\leq 2\%$
23	T Ta Tb	soldering solderability resistance to heat	solder bath, immersion 3 mm, 235 °C, 2 s solder bath 260 °C, 10 s	good wetting, no mech. damage no mech. damage
24	Eb	impact bump	4000 \pm 10 bumps, 40g, 6 ms freq. 10 to 55 Hz, amplitude 0,35 mm, $1\frac{1}{2}$ h	$\Delta C/C$ $\leq 0,6\%$ no mech. damage
25	Fc	vibration		$\Delta C/C$ $\leq 0,6\%$ no mech. damage

IEC 418-1 clause	IEC 68 test method	test	procedure	requirements
26		climatic sequence		$\Delta C/C$ $\tan \delta$ R_{ins} rotor contact R voltage proof visual examination operating torque
26.1	B	dry heat	16 h at the upper category temperature	$\leq 3,5\%$ $\leq 70 \times 10^{-4}$ $\geq 10\ 000\ M\Omega$
26.2	D	damp heat accelerated, first cycle	1 cycle, 24 h + 40 °C, 95 to 100% R.H.	$\leq 10\ m\Omega$ as specified no mech. damage 2-35 mNm
26.3	Aa	cold	16 h -40 °C	
26.5		damp heat accelerated, remaining cycles	1 cycle 24 h + 40 °C, 95 to 100% R.H.	
27	C	damp heat steady state	21 days + 40 °C, 90 to 95% R.H.	$\Delta C/C$ $\tan \delta$ R_{ins} rotor contact R voltage proof visual examination operating torque
29		endurance mechanical		$\leq 3\%$ $\leq 50 \times 10^{-4}$ $\geq 10\ 000\ M\Omega$ $\leq 10\ m\Omega$ as specified no mech. damage 2-35 mNm
29.1			10 cycles	$\Delta C/C$ rotor contact R voltage proof $\Delta C/C$ after axial thrust visual examination operating torque
				120 pF $\leq 0,3\%$, 200 pF $\leq 1,5\%$ $\leq 10\ m\Omega$ as specified $\leq 0,3\%$ no mech. damage 1,5-30 mNm

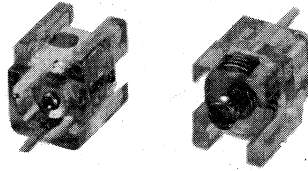
FILM DIELECTRIC TRIMMERS

high temperature type

QUICK REFERENCE DATA

Max. $C_{\min}/\min. C_{\max}$	1,2/3,5 pF 1,8/10 pF 2/18 pF
Overall dimensions	6 x 8 x 9 mm
Rated voltage (d.c.)	300 V
Climatic category (IEC 68)	40/125/21
Basic specification	418-1 and 4

RZ 30185-5



APPLICATION

For use in miniaturized measuring and telecommunication equipment, e.g. for fine adjustment of h.f. tuned circuits.

DESCRIPTION

The trimmers consist of a polysulphone housing, brass rotor and silver-plated brass stator with either a P.T.F.E., or a polyimide/F.E.P. sandwich film as the dielectric. The stator plates with their tag are heat-sealed to the housing. The rotor contact surfaces are gold plated to ensure a long life and a stable contact even under severe climatic conditions. Flux absorption between the vanes is prevented. The capacitors 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

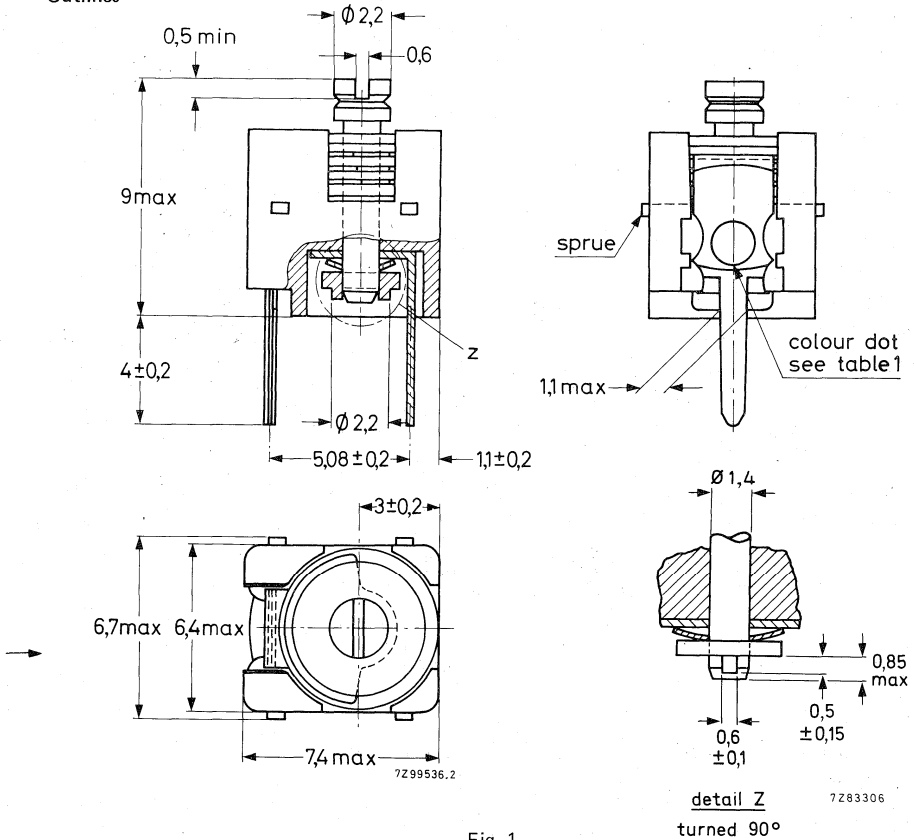


Fig. 1.

Table 1

	3,5 pF	10 pF	18 pF
max. capacitance	3,5 pF	10 pF	18 pF
effective angle of rotation	180°	180°	180°
operating torque	1-15 mNm	2,5-20 mNm	2,5-20 mNm
maximum axial thrust ($\Delta C \leq 0,3\%$ of C_{max})	2 N	2 N	2 N
mass approx.	0,7 g	0,7 g	0,7 g
colour dot	orange	white	red

Type identification

The different capacitance values can be identified by the colour dot, see Table 1.

Soldering

Soldering conditions: max. 260 °C, max. 10 s.

Mounting

The trimmers can be mounted on printed-wiring boards having holes with a minimum diameter of 1,25 mm. The hole pattern is given in the figure below.

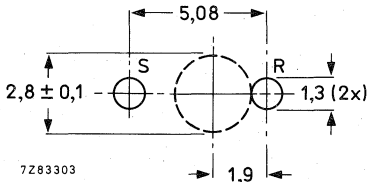


Fig. 2 The large hole is necessary only if bottom adjustment is to be used. R = rotor, S = stator.

Key for adjustment

The dimensions essential for the design of a key are given in Fig. 3.

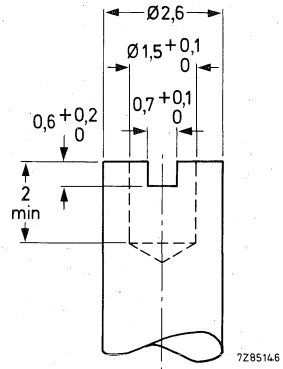


Fig. 3.

ELECTRICAL DATA

Table 2

C_{max}^* pF	C_{min}^* pF	max. $\tan \delta$ at 1 MHz	max. $\tan \delta$ at 100 MHz	temperature coefficient** $10^{-6}/K$	min. f_{res} at C_{max} MHz	catalogue number
$\geq 3,5$	$\leq 1,2$	10×10^{-4}	20×10^{-4}	-250 ± 150	850	2222 809 05001
≥ 10	$\leq 1,8$	10×10^{-4}	20×10^{-4}	-350 ± 150	580	2222 809 05002
≥ 18	≤ 2	25×10^{-4}	40×10^{-4}	-350 ± 150	360	2222 809 05003

Rated voltage (d.c.)

300 V

Test voltage (d.c.) for 1 minute

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 °C

Climatic category (IEC 68)

40/125/21

* Measured at 200 kHz.

** C at 60 to 80% of C_{max} ; ΔT from + 20 to + 125 °C.

TESTS AND REQUIREMENTS
Table 3

IEC 418-1 clause	IEC 68 test method	test	procedure	requirements
4.2		method of mounting	method A	
14		cap. drift	after T.C. measurement	$\Delta C/C \leq 1\%$
19		thrust	axial thrust of 2N	$\Delta C/C \leq 0,3\%$
21		robustness of terminations:		
21.1	Ua	tensile	1N	
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle: 1/2 h at the lower and 1/2 h at the upper category temperature	$\Delta C/C \leq 2\%$
23	T Ta Tb	soldering solderability resistance to heat	solder bath, immersion 3 mm, 235 °C, 2 s solder bath 260 °C, 10 s	good wetting, no mech. damage no mech. damage
24	Eb	impact	4000 ± 10 bumps, 40g, 6 ms	$\Delta C/C \leq 0,6\%$ no mech. damage
25	Fc	bump vibration	freq. 10 to 55 Hz, amplitude 0,35 mm, 1 1/2 h	$\Delta C/C \leq 0,2\%$ no mech. damage

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

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.

PACKAGING

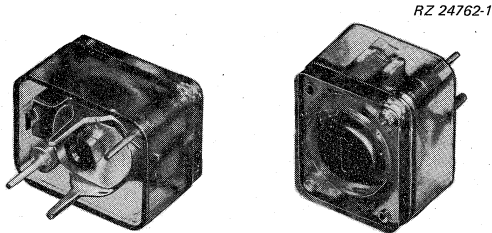
Blister packs of 100 pieces each.

FILM DIELECTRIC TRIMMERS

high temperature type

QUICK REFERENCE DATA

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



APPLICATION

For use in miniaturized measuring and telecommunication equipment, specially where high temperatures occur and a low temperature coefficient is important, e.g. single-stator trimmers are suitable for fine adjustment of h.f. tuned circuits, and differential types for capacitive volume or voltage control.

DESCRIPTION

The trimmers consist of a glass reinforced polysulphone frame with a transparent polysulphone dust cover, brass rotor and stator with P.T.F.E. 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 silver plated to ensure a long life and a stable contact even under severe climatic conditions.

The capacitors have top adjustment by means of a screwdriver. Capacitance increase is obtained with clockwise rotation*.

* Capacitors with counter-clockwise rotation and capacitors with insulated rotor are available on request.

MECHANICAL DATA

Outlines

Dimensions in mm

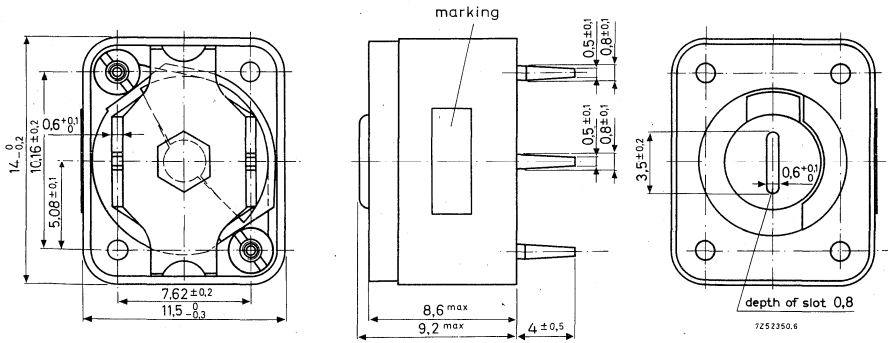


Fig. 1.

Table 1

	single stator type	differential type
effective angle of rotation	180°	180°
operating torque	1,5-25 mNm	1,5-25 mNm
max. endstop torque	100 mNm	100 mNm
max. axial thrust ($\Delta C \leq 0,3\%$ of C_{max})	2N	2N
mass approx.	2,3 g	2,9 g

Type identification (marking)

Capacitance value in pF letter E, in the case of a differential capacitor followed by the letter D.

Soldering

Soldering conditions: max. 260 °C, max. 10 s.

Mounting

The trimmers can be mounted on printed-wiring boards having holes with a minimum diameter of 1,25 mm. The hole pattern is given in the figure below.

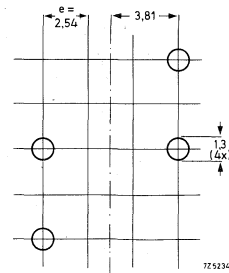


Fig. 2.

Bending the tags is not permitted.

ELECTRICAL DATA

Table 2

type	C_{max}^* pF	C_{min}^* pF	max. $\tan \delta$ at 100 MHz	catalogue number
single-stator	≥ 20	$\leq 2,5$	17×10^{-4}	2222 809 07004
	≥ 40	≤ 4	17×10^{-4}	07008
	≥ 60	≤ 5	25×10^{-4}	07011
	≥ 80	≤ 6	25×10^{-4}	07013
	≥ 100	≤ 7	25×10^{-4}	07015
differential	≥ 12	≤ 2	17×10^{-4}	07018
	≥ 20	$\leq 2,5$	17×10^{-4}	07006
	≥ 40	≤ 4	17×10^{-4}	07009
	≥ 60	≤ 5	25×10^{-4}	07012
	≥ 80	≤ 6	25×10^{-4}	07014
	≥ 100	≤ 7	25×10^{-4}	07016
	≥ 150	≤ 7	—	07107

Rated voltage (d.c.)

200 V

Test voltage (d.c.) for 1 minute

400 V

Tan δ at 1 MHzmax. 10×10^{-4} differential cap. with $C_{max} \geq 150$ pFmax. 50×10^{-4}

Contact resistance

max. 5 m Ω

Insulation resistance

between stator and rotor

min. 10 000 M Ω

Temperature coefficient**

 $(0 \pm 200) \times 10^{-6}/K$

Category temperature range

-40 to + 125 °C

Climatic category (IEC 68)

40/125/21

* Measured at 200 kHz.

** C at 60 to 80% of C_{max} ; ΔT from + 20 to + 125 °C.

TESTS AND REQUIREMENTS

Table 3

IEC 418-1 clause	IEC 68 test method	test	procedure	requirements
4.2		method of mounting cap. drift thrust	method A after T. C. measurement axial thrust of 2N	$\Delta C/C$ $\Delta C/C$
14				$\leq 1\%$
19				$\leq 0,3\%$
21		robustness of terminations:		
21.1	Ua	tensile	1N	no damage
21.2	Ub	bending		bending not allowed
22	Na	rapid change of temperature	1 cycle: $\frac{1}{2}$ h at the lower and $\frac{1}{2}$ h at the upper category temperature	$\Delta C/C$ $\leq 1\%$
23	T Ta Tb	soldering solderability resistance to heat	solder bath, immersion 3 mm, 235 °C, 2 s solder bath 260 °C, 10 s	good wetting, no mech. damage no mech. damage
24	Eb	impact bump	4000 \pm 10 bumps, 40g, 6 ms	$\Delta C/C$ $\leq 0,2\%$ no mech. damage
25	Fc	vibration	freq. 10 to 55 Hz, amplitude 0,35 mm, 1 $\frac{1}{2}$ h	$\Delta C/C$ $\leq 0,25\%$ no mech. damage

IEC 418-1 clause	IEC 68 test method	test	procedure	requirements
26		climatic sequence	16 h at the upper category temperature	ΔC/C tan δ
26.1	B	dry heat	1 cycle, 24 h + 40 °C, 95 to 100% R.H.	≤ 3% ≤ 10 x 10 ⁻⁴
26.2	D	damp heat accelerated, first cycle	1 cycle 24 h + 40 °C, 95 to 100% R.H.	≥ 10 000 MΩ ≤ 10 mΩ
26.3	Aa	cold	16 h -40 °C	400 V for 1 min no mech. damage
26.5		damp heat accelerated, remaining cycles	1 cycle 24 h + 40 °C, 95 to 100% R.H.	1,5-35 mNm operating torque
27	Ca	damp heat steady state	21 days + 40 °C, 90 to 95% R.H.	ΔC/C tan δ
				≤ 3% ≤ 10 x 10 ⁻⁴
				≥ 10 000 MΩ
				≤ 10 mΩ
				400 V for 1 min no mech. damage
				1,5-35 mNm operating torque
29		endurance	25 cycles	ΔC/C
29.1		mechanical		rotor contact R voltage proof
				≤ 0,3% ≤ 10 mΩ
				400 V for 1 min
				ΔC/C after axial thrust
				≤ 0,3% no mech. damage
				1-50 mNm operating torque

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.

PACKAGING

Blister packs of 50 pieces each.

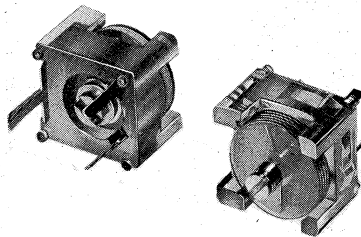
FILM DIELECTRIC TRIMMERS

high temperature type

QUICK REFERENCE DATA

Max. $C_{\min}/\min. C_{\max}$	4/40 pF 5/60 pF
Overall dimensions	10 x 11 x 11 mm
Rated voltage (d.c.)	300 V
Climatic category (IEC 68)	40/125/21
Basic specification	IEC 418-1 and 2

A55374-1



APPLICATION

For use in miniaturized measuring and telecommunication equipment, specially where high temperatures occur and a low temperature coefficient is important, e.g. for fine adjustment of h.f. tuned circuits.

DESCRIPTION

The trimmers consist of a polysulphone housing, brass rotor and silver-plated brass stator with P.T.F.E. film as the dielectric. The stator plates with their tag are heat sealed to the housing. The rotor contact surface is silver plated to ensure a long life and a stable contact even under severe climatic conditions. Flux absorption between the vanes is prevented. The trimmers have top adjustment by means of a screwdriver and bottom adjustment by means of a key (see Fig. 3).

MECHANICAL DATA

Dimensions in mm

Outlines

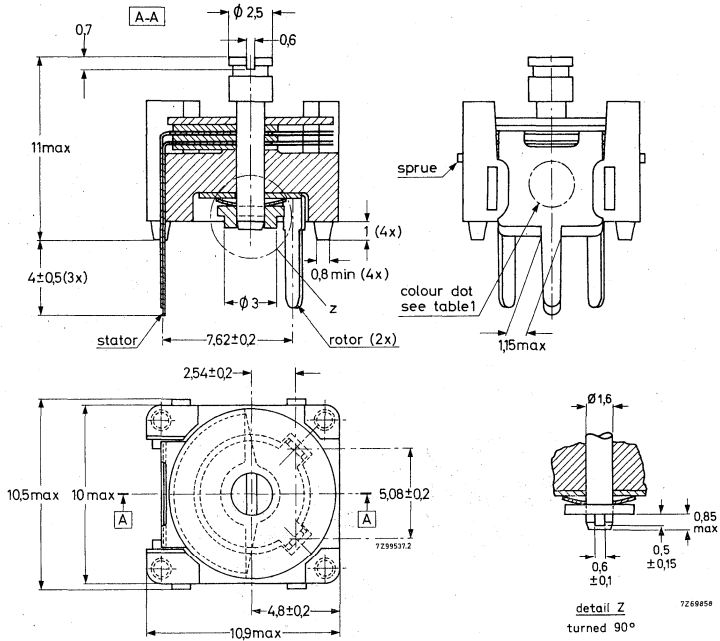


Fig. 1.

Table 1

max. capacitance	40 pF	60 pF
effective angle of rotation	180°	180°
operating torque	2-25 mNm	2-25 mNm
maximum axial thrust ($\Delta C \leq 0,3\%$ of C_{max})	2 N	2 N
mass	1,6 g	1,6 g
colour dot	yellow	blue

Type identification

The different capacitance values can be identified by the colour dot, see Table 1.

Soldering

Soldering conditions: max. 260 °C, max. 10 s.

Mounting

The trimmers can be mounted on printed-wiring boards having holes with a minimum diameter of 1,25 mm. The hole pattern is given in the figure below.

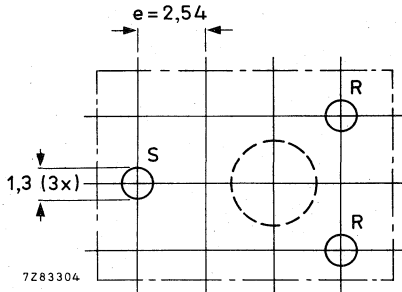


Fig. 2 Large hole is necessary only if bottom adjustment is to be used
R = rotor, S = stator.

Key for adjustment

The dimensions essential for the design of a key are given in Fig. 3.

A key (catalogue number 7122 347 21600) and the associated handle (catalogue number 7122 005 47910) can be supplied on request.

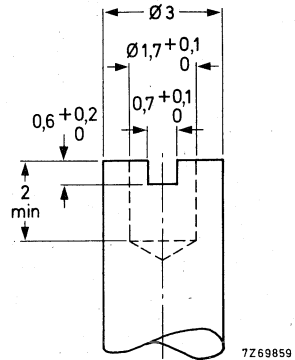


Fig. 3.

ELECTRICAL DATA

Table 2

C_{max}^* pF	C_{min}^* pF	max. $\tan \delta$ at 1 MHz	max. $\tan \delta$ at 100 MHz	temperature coefficient** $10^{-6}/K$	min. f_{res} at C_{max} MHz	catalogue number
≥ 40	≤ 4	10×10^{-4}	25×10^{-4}	-250 ± 150	170	2222 809 08002
≥ 60	≤ 5	10×10^{-4}	25×10^{-4}	-250 ± 150	150	2222 809 08003

Rated voltage (d.c.)	300 V
Test voltage (d.c.) for 1 minute	600 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

* Measured at 200 kHz.

** C at 60 to 80% of C_{max} ; ΔT from + 20 to + 125 °C.

TESTS AND REQUIREMENTS

Table 3

IEC 418-1 clause	IEC 68 test method	test	procedure	requirements
4.2		method of mounting	method A	
14		cap. drift	after T. C. measurement	$\Delta C/C$
19		thrust	axial thrust of 2N	$\Delta C/C$
21		robustness of terminations:		
21.1	Ua	tensile	1N	
21.2	Ub	bending	1 cycle	no damage
22	Na	rapid change of temperature	1 cycle: 1/2 h at the lower and 1/2 h at the upper category temperature	$\Delta C/C$
23	T Ta Tb	soldering solderability resistance to heat	solder bath, immersion 3 mm, 235 °C, 2 s solder bath, 260 °C, 10 s	good wetting no mech. damage no mech. damage
24	Eb	impact		$\Delta C/C$
25	Fc	bump vibration	4000 ± 10 bumps, 40g, 6 ms freq. 10 to 55 Hz, amplitude 0,35 mm. 1/2 h	no mech. damage $\Delta C/C$

IEC 418-1 clause	IEC 68 test method	test	procedure	requirements
26		climatic sequence		$\Delta C/C$ $\tan \delta$ R_{ins} rotor contact R voltage proof visual examination operating torque
26.1	B	dry heat	16 h at the upper category temperature	$\leq 2,5\%$ $\leq 10 \times 10^{-4}$ $> 10\,000\, M\Omega$
26.2	D	damp heat accelerated, first cycle	1 cycle, 24 h + 40 °C, 95 to 100% R.H.	$\leq 5\, m\Omega$ 600 V for 1 min no mech. damage
26.3	Aa	cold	16 h -40 °C	1-20 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.	$\Delta C/C$ $\tan \delta$ R_{ins} rotor contact R voltage proof visual examination operating torque
29		endurance mechanical	25 cycles	$\leq 2,5\%$ $\leq 10 \times 10^{-4}$ $> 10\,000\, M\Omega$ $\leq 5\, m\Omega$ 600 V for 1 min no mech. damage 1-20 mNm
29.1				$\Delta C/C$ rotor contact R voltage proof $\Delta C/C$ after axial thrust visual examination operating torque
				$\leq 0,3\%$ $\leq 5\, m\Omega$ 600 V for 1 min $\leq 0,3\%$ no mech. damage 1-20 mNm

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.

PACKAGING

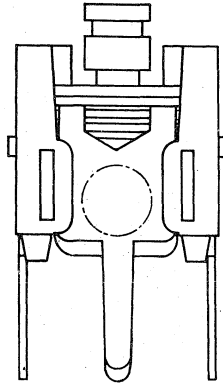
Blister packs of 50 pieces each.

FILM DIELECTRIC TRIMMERS

high temperature type

QUICK REFERENCE DATA

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



APPLICATION

For use in measuring and telecommunication equipment, specially where high temperatures occur and a low temperature coefficient is important, e.g. for fine adjustment of h.f. tuned circuits.

DESCRIPTION

The trimmers consist of a polysulphone housing, brass rotor and silver-plated brass stator with P.T.F.E. film as the dielectric. The stator plates with their tag are heat sealed to the housing. The rotor contact surface is silver plated to ensure a long life and a stable contact even under severe climatic conditions. Flux absorption between the vanes is prevented. The trimmers have top adjustment by means of a screwdriver and bottom adjustment by means of a key (see Fig. 5). Two versions are available, a 3-tag version with two rotor tags and a 2-tag version with one rotor tag.

MECHANICAL DATA

Dimensions in mm

Outlines

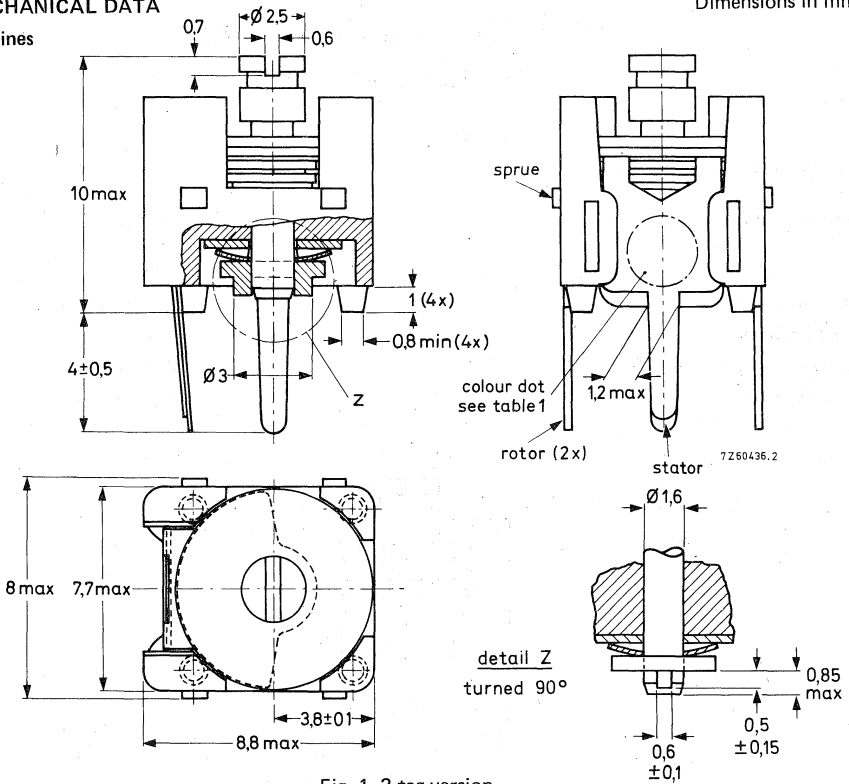


Fig. 1 3-tag version.

7269858

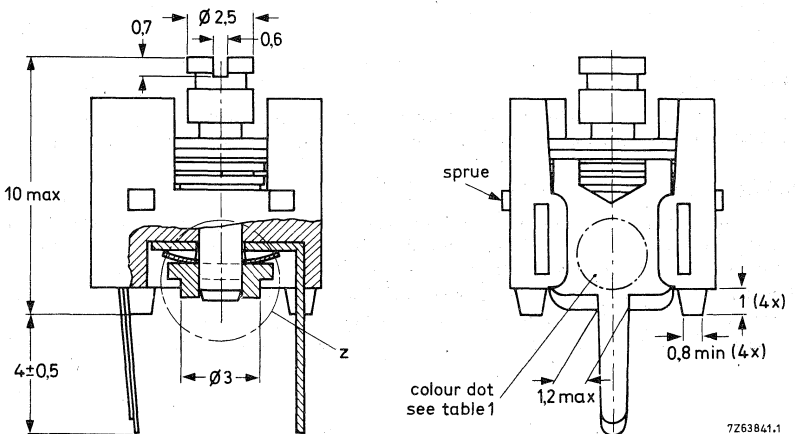


Fig. 2 2-tag version.

7263841.1

Table 1

max. capacitance	5,5 pF	9 pF	18 pF
effective angle of rotation	180°	180°	180°
operating torque	1-15 mNm	2,5-20 mNm	2,5-20 mNm
maximum axial thrust ($\Delta C \leq 0,3\%$ of C_{max})	2 N	2 N	2 N
mass approx.	0,8 g	0,8 g	0,9 g
colour dot	green	white	red

Type identification

The different capacitance values can be identified by the colour dot, see Table 1.

Soldering

Soldering conditions: max. 260 °C, max. 10 s.

Mounting

The trimmers can be mounted on printed-wiring boards having holes with a minimum diameter of 1,25 mm. The hole pattern is given in the figures below (R = rotor; S = stator).

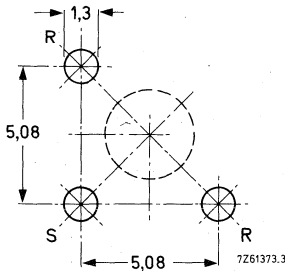


Fig. 3 For types of Fig. 1.

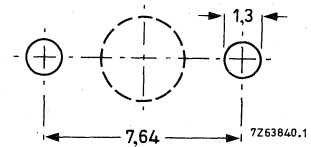


Fig. 4 For types of Fig. 2.

Note

The large hole is necessary only for bottom adjustment.

Key for adjustment

The dimensions essential for the design of a key are given in Fig. 5.

A key (catalogue number 7122 347 21600) and the associated handle (catalogue number 7122 005 47910) can be supplied on request.

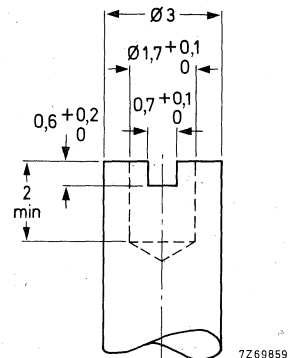


Fig. 5.

ELECTRICAL DATA

Table 2

C_{\max}^* pF	C_{\min}^* pF	max. $\tan \delta$ at 1 MHz	max. $\tan \delta$ at 100 MHz	temperature coefficient** $10^{-6}/K$	min. f_{res} at C_{\max} MHz	catalogue number 2222 809	
						2-tag version	3-tag version
$\geq 5,5$	$\leq 1,4$	10×10^{-4}	15×10^{-4}	-250 ± 150	850	09004	09001
≥ 9	≤ 2	10×10^{-4}	15×10^{-4}	-250 ± 150	580	09005	09002
≥ 18	≤ 2	10×10^{-4}	15×10^{-4}	-250 ± 150	360	09006	09003

Rated voltage (d.c.)	300 V
Test voltage (d.c.) for 1 minute	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 °C
Climatic category (IEC 68)	40/125/21

* Measured at 200 kHz.

** C at 60 to 80% of C_{\max} ; ΔT from + 20 to + 125 °C.

TESTS AND REQUIREMENTS

Table 3

IEC 418-1 clause	IEC 68 test method	test	procedure	requirements
4.2		method of mounting	method A	
14		cap. drift	after T.C. measurement	$\Delta C/C \leq 1.5\%$
19		thrust	axial thrust of 2N	$\Delta C/C \leq 0.3\%$
21		robustness of terminations:		
21.1	Ua	tensile	1N	no damage
21.2	Ub	bending	1 cycle	
22	Na	rapid change of temperature	1 cycle: 1/2 h at the lower and 1/2 h at the upper category temperature	$\Delta C/C \leq 1\%$
23	T Ta Tb	soldering solderability resistance to heat	solder bath, immersion 3 mm, 235 °C, 2 s solder bath 260 °C, 10 s	good wetting, no mech. damage no mech. damage
24	Eb	impact	4000 ± 10 bumps, 40g, 6 ms	$\Delta C/C \leq 0.5\%$ no mech. damage
25	Fc	bump vibration	freq. 10 to 55 Hz, amplitude 0,35 mm, 1 1/2 h	$\Delta C/C \leq 0.3\%$ no mech. damage

TESTS AND REQUIREMENTS (continued)

IEC 418-1 clause	IEC 68 test method	test	procedure	requirements
26		climatic sequence		
26.1	B	dry heat	16 h at the upper category temperature	$\Delta C/C$
26.2	D	damp heat accelerated, first cycle	1 cycle, 24 h + 40 °C, 95 to 100% R.H.	$\tan \delta$ R_{ins} rotor contact R voltage proof visual examination operating torque
26.3	Aa	cold	16 h -40 °C	$\leq 2,5\%$ $\leq 10 \times 10^{-4}$ $> 10\,000 \text{ M}\Omega$ $\leq 5 \text{ m}\Omega$ 600 V for 1 min no mech. damage 1-20 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.	$\Delta C/C$ $\tan \delta$ R_{ins} rotor contact R voltage proof visual examination operation torque
29 29.1		endurance mechanical	25 cycles	$\Delta C/C$ rotor contact R voltage proof $\Delta C/C$ after axial thrust visual examination operating torque

QUALITY LEVEL

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

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

A.O.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.

PACKAGING

In blisters containing 100 capacitors.

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