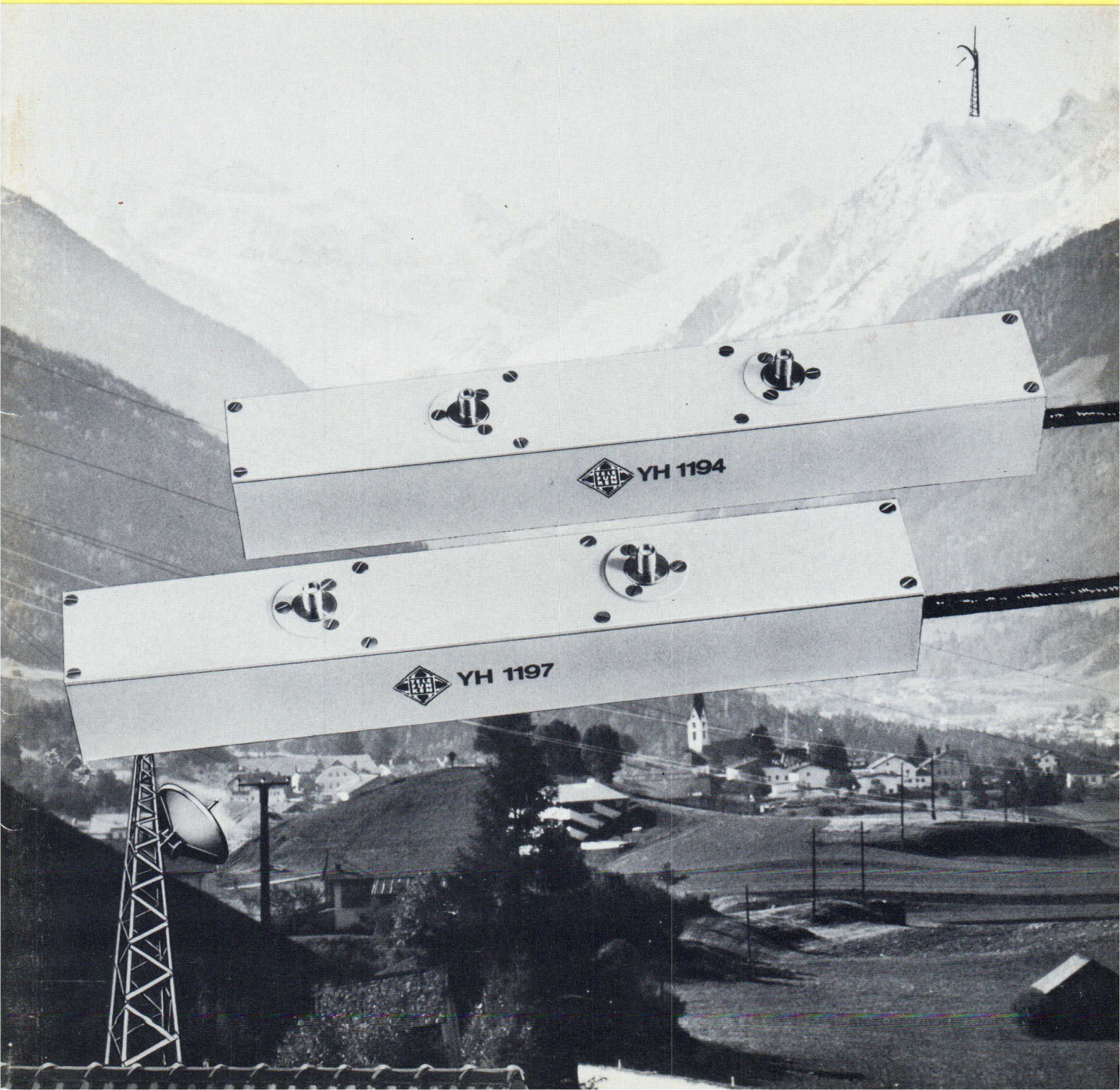
AEG-TELEFUNKEN

Short form catalogue
1978/1979

Tubes and Sub-Assemblies



This short form catalogue contains a summary of appropriate Tubes and Sub-Assemblies for different applications. Only important datas are given.
By developing and designing the equipments, please refer to our latest data sheets, which we are willing to forward you on request.

Publisher:

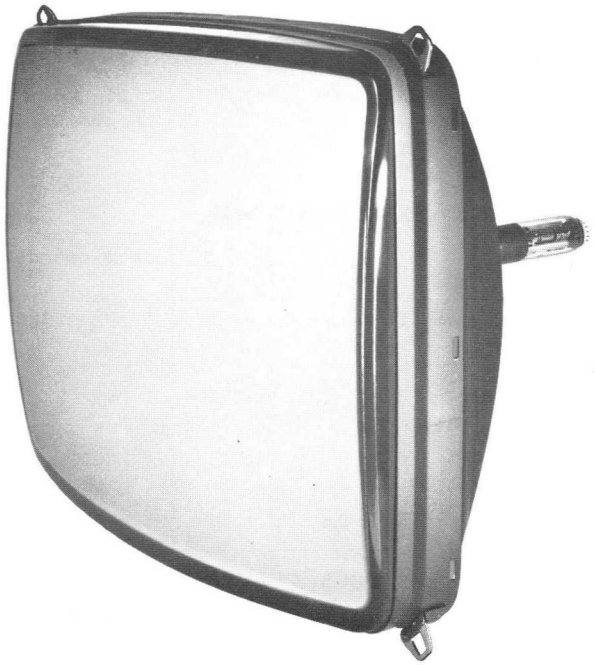
AEG-TELEFUNKEN Serienprodukte
Tubes and Sub-Assemblies
P.O.B. 4309
D-7900 Ulm
☎ (07 31) 1911 ⁂ 712 601

Contents Page

Listing of letter symbols

c_{case}	Case capacitance
c_j	Junction capacitance
D	Pulse duty factor $t_{imp} \cdot f_p$
D	Deflection electrode
E	(Input-) illumination
f	Frequency (general)
f_1	Frequency of the input signal
f_2	Frequency of the output signal
f_p	Pulse repetition frequency
$f \cdot Q$	Quality frequency
$\Delta f 1/2$	Electronic bandwidth (Δf between half-power points)
F	Noise figure
I_A	Anode DC current
I_{Ap}	Anode DC current during pulsing
I_D	Diode current
I_F	Heater or filament current
I_G	Grid current
I_H	Helix current
I_{HMM}	Horizontal deflection current (peak-to-peak value)
I_K	Cathode current
I_{RES}	Resonator current
I_S	Signal current
I_{VMM}	Vertical deflection current (peak-to-peak value)
L	Inductance (general)
L_H	Inductance of the horizontal deflection coil
L_s	Substitutional series inductance
L_V	Inductance of the vertical deflection coil
n	Mode of oscillation
P_A	Anode dissipation
P_{G2}	Screen grid dissipation
P_2	Output power
P_{2p}	Pulse output power
Q_{6V}	Quality factor, at 6 V reverse voltage
R	Resistance (general)
R_H	Resistance of the horizontal deflection coil
r_s	Substitutional series resistance
R_{thJC}	Thermal resistance, junction/case
R_V	Resistance of the vertical deflection coil
S	Mutual conductance at the given operating point
t_{imp}	Pulse duration (time)
t_t	Transition time
U_A	Anode DC voltage
U_{Ap}	Anode DC voltage during pulsing
U_B	Supply voltage
$U_{(BR)}$	Breakdown voltage
U_C	Collector voltage
U_F	Heater of filament voltage (RMS)
U_{FOC}	Focusing voltage
U_G	Voltage of the corresponding electrode related to cathode
$U_{G1\ sperr}$	Grid 1 cut-off voltage
U_H	Helix voltage
U_K	Voltage at the photocathode
U_P	Voltage at the signal electrode
U_R	Diode reverse voltage
U_{RES}	Resonator DC voltage
U_{RFL}	Reflector DC voltage
V_c	Conversion gain
V_p	Power gain
μ	Amplification factor
μ_{g2g1}	Amplification factor of grid 2/grid 1
η	Efficiency

TV picture tubes



Colour TV picture tube (Inline tube 20 AX with quick heating cathode)

Type	General data					Typical operation				
	Focusing	Deflection	Screen area mm x mm	Overall length mm	Weight kg	U_A kV	U_{G3} kV	U_{G2} V	U_{G1} sperr V	Luminance (Brightness) cd/m²
A 56-500 X	electrostatic	magn., 110°	334 x 444	374 ± 6	ca. 14	25	4 ... 4,8	300 210...495	-70...-140 -105	100
A 66-500 X	electrostatic	magn., 110°	390 x 518	411,6 ± 6	ca. 20	25	4 ... 4,8	300 210...495	-70...-140 -105	100
A 66-510 X	electrostatic	magn., 110°	390 x 518	411,6 ± 6	ca. 20	25	4 ... 4,8	300 210...495	-70...-140 -105	170

Colour TV picture tubes (Delta tubes)

Type	General data					Typical operation				Notes
	Focusing	Deflection	Screen area mm x mm	Overall length mm	Weight kg	U_A kV	U_{G3} kV	U_{G2} V	U_{G1} sperr	
A 51-170 X	electrostatic	magn., 110°	303 x 404	372,6 ± 6,5	ca. 12	25	4,2 ... 5	300 210...495	-70...-140 -105	with quick heating cathode
A 66-120 X	electrostatic	magn., 90°	390 x 518	522 ± 6,5	ca. 20	25	4,2 ... 5	300 210...495	-70...-140 -105	
A 66-410 X	electrostatic	magn., 110°	390 x 518	431,6 ± 6,5	ca. 20	25	4,2 ... 5	300 210...495	-70...-140 -105	with quick heating cathode

Black and white TV picture tubes

Type	General data					Typical operation				
	Focusing	Deflection	Screen area mm x mm	Overall length mm	Weight kg	U_A kV	U_{G4} V	U_{G3} V	U_{G2} V	U_{G1} sperr V
A 61-120 W/2	electrostatic	magn., 110°	375 x 481	360 ± 8	ca. 13	20	0 ... 400	-	400 500	-40 ... -77 -50 ... -93
A 65-11 W/2	electrostatic	magn., 110°	416 x 530	383 ± 8	ca. 18	18	0 ... 400	-	400 500	-40 ... -77 -50 ... -93

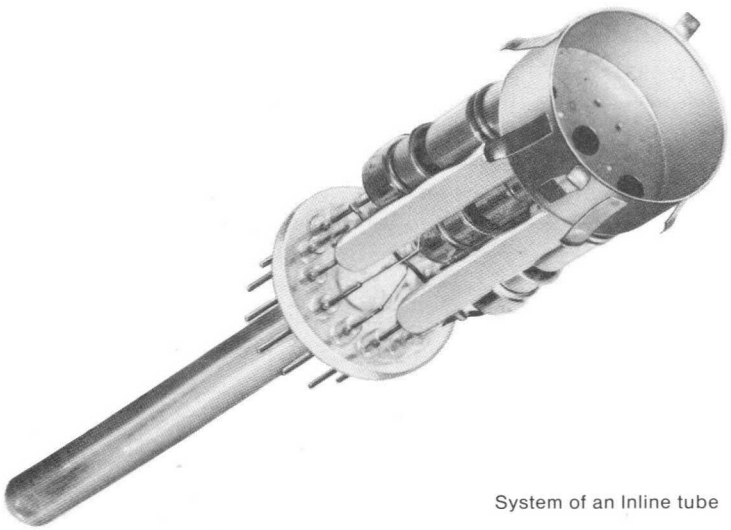
TV picture tubes

TELESTAR colour TV picture tube (system redesigned, Inline tube 20 AX)

Type	General data					Typical operation				Notes
	Focusing	Deflection	Sreen area mm x mm	Overall length mm	Weight kg	U_A kV	U_{G3} kV	U_{G2} V	U_{G1} sperr V	
A 66-500 X	electrostatic	magn., 110°	390 x 518	411,6 ± 6	ca. 20	25	4 ... 4,8	300 210...495	-70...-140 -105	with quick heating cathode

TELESTAR colour TV picture tubes (system redesigned, delta tubes)

Type	General data					Typical operation				Notes
	Focusing	Deflection	Screen area mm x mm	Overall length mm	Weight kg	U_A kV	U_{G3} kV	U_{G2} V	U_{G1} sperr	
A 51-170 X	electrostatic	magn., 110°	303 x 404	372,6 ± 6,5	ca. 12	25	4,2 ... 5	300 210...495	-70...-140 -105	with quick heating cathode
A 56-120 X	electrostatic	magn., 90°	337 x 447	472 ± 9,5	ca. 15	25	4,2 ... 5	300 210...495	-70...-140 -105	
A 63-120 X	electrostatic	magn., 90°	396 x 504	521 ± 9,5	ca. 20	25	4,2 ... 5	300 210...495	-70...-140 -105	
A 66-120 X	electrostatic	magn., 90°	390 x 518	522 ± 6,5	ca. 20	25	4,2 ... 5	300 210...495	-70...-140 -105	
A 67-100 X	electrostatic	magn., 90°	396 x 528	544,1 ± 9,5	ca. 20	25	4,2 ... 5	300 210...495	-70...-140 -105	
A 66-140 X	electrostatic	magn., 110°	390 x 518	431,6 ± 6,5	ca. 20	25	4,2 ... 5	300 210...495	-70...-140 -105	
A 66-410 X	electrostatic	magn., 110°	390 x 518	431,6 ± 6,5	ca. 20	25	4,2 ... 5	300 210...495	-70...-140 -105	with quick heating cathode



System of an Inline tube

Deflection units

Deflection unit for the 110° colour TV picture tube A 66-500 X (Inline tube 20 AX)

Type	Horizontal deflection coils			Vertical deflection coils			
	L_H mH	R_H Ω	I_{HMM} A	L_V mH	R_V [3] Ω	I_{VMM} A	R/NTC-Combination Ω
AEF 1080	1,11 ± 4 %	1,15 ± 10 %	6,34	3,5 ± 10 %	3,0 ± 7 %	3,35	–

Deflection units for 110° colour TV picture tubes (Delta tubes) with 36,5 mm neck diameter

Type	Horizontal deflection coils			Vertical deflection coils			
	L_H mH	R_H Ω	I_{HMM} A	L_V mH	R_V [3] Ω	I_{VMM} A	R/NTC-Combination Ω
AEF 1062	4,8	3,7	2,9	24,0 [1] 6,15 [2]	15,0 [1] 3,8 [2]	1,2 2,4	4,4 1,1
Remarks: [1]) if both coil segments are connected in series; [2]) if both coil segments are connected in parallel; [3]) without R/NTC-combination							

Deflection units for 110° black and white TV picture tubes with 44 cm to 61 cm diagonal and 28,6 mm neck diameter

Type	Horizontal deflection coils			Vertical deflection coils				suitable line transformer type
	L_H mH	R_H Ω	$\frac{1}{2} \cdot L_H \cdot I^2_{HMM}$ µWs	L_V mH	R_V (without NTC) Ω	R_V (without NTC) Ω	$R_V \cdot I^2_{VMM}$ mW	
AE 64/6	2,95	4	80 · U_A	80	39	50	90 · U_A	ZT 63/6
AE 68/7	2,1	3,9	110 · U_A	66	29	39	115 · U_A	ZT 68/13
AE 73/8	0,105	0,2	110 · U_A	66	29	39	115 · U_A	ZT 73/8
AE 75/8	0,126	0,16	80 · U_A	12,4	6,5	–	90 · U_A	ZT 73/8

Deflection units for 90° black and white TV picture tubes with 17 cm to 31 cm diagonal and 20 mm neck diameter

Type	Horizontal deflection coils				Vertical deflection coils				for picture tube type
	L_H mH	R_H Ω	I_{HMM} [1]) A	$\frac{1}{2} \cdot L_H \cdot I^2_{HMM}$ [1] µWs	L_V mH	R_V Ω	I_{VMM} [1]) A	$R_V \cdot I^2_{VMM}$ [1]) mW	
AE 66/T 3	1,6	4,2	0,76	470	55	28	0,144	610	M 28 – 12 and A 28 – 14 W
AE 66/T 4	1,6	4,2	0,64	330	55	28	0,120	430	M 17 – 11
AE 67/T 9	0,08	0,25	3,45	470	14	7,5	0,144	610	A 28 – 14 W and A 31 – 20 W
AE 67/T 10	0,08	0,25	2,9	330	14	7,0	0,234	410	M 17 – 11
Remarks: [1]) at picture tube high-voltage U_A = 11 kV; [2]) with NTC: 38 Ω									

Deflection correction parts

Multi-pole unit for the 20 AX deflection unit AEF 1080

Type	for adjustment of	Notes
AEF 1081	Static convergence, north/south raster symmetry, colour purity	corresponding to AT 1081

Convergence segment for the deflection unit AEF 1062 (110° deflection)

Type	Horizontal coils				Vertical coils				Notes
	Parallel connection		Series connection		Parallel connection		Series connection		
	L mH	*R* Ω	*L* mH	*R* Ω	*L* mH	*R* Ω	*L* mH	*R* Ω	
AEF 72 K 4612	1,3	5,75	5,1	23	360	48,5	1450	194	Coil ends connected to soldering points

Blue lateral units (with oxide magnet for adjustment of static lateral shift)

Type	Coil for static shift		Coil for dynamic correction		Suitable to deflection unit
	L mH	*R* Ω	*L* mH	*R* Ω	
AEF 70 B 6501	3,7	20	0,7	2,8	AEF 71[1]) (110°)
BLS 302	–	–	3	40	diverse (90°)
Remarks: ..[1]) With other connecting clamp suitable for AEF 1062 too					

Correction coils for deflection circuits for 20 AX conception

Type	Denomination	Function
AEF 4180	Transductor	N/S raster correction in connection with the 2H coil AEF 4429
AEF 4217	Linearity coil	Adjustment of horizontal linearity and equalisation of the vertical lines at the left tube side
AEF 4414	Bridge coil	East/west correction (qualified for transistor and thyristor deflection circuits)
AEF 4420	East/west drive coil	Decoupling between driving circuit and diode modulator (qualified for transistor and thyristor deflection circuits)
AEF 4426	Symmetry coil	Differential coil for symmetry of both horizontal coil segments
AEF 4427	Four-pole adjustment coil	Tolerance compensation of the vertical red/blue convergency
AEF 4429	2H coil	Adjustment of the series resonant circuit in the N/S raster correction circuit with the transductor AEF 4180
TD 746	Transductor	N/S raster correction

Line transformers

For colour TV picture tubes (Delta tubes)

Type	For picture tubes with diagonal deflection angle	Active components			Characteristics				Suitable deflection unit
		Horizontal output stage	Booster diode	Rectifier or HV-multiplier	High-voltage [1] kV	Internal resistance MΩ	Inductance of the horizontal deflection coil mH	Supply voltage V	
ZT 73/3 X[2])	110°	PL 519	PY 500 A	KT 20	25	ca. 2	4,8	340[3])	AEF 71 S
Remarks: [1]) Beam current 50 µA; [2]) for multi standard TV sets; [3]) stabilized									

For black and white TV picture tubes

Type	For picture tubes with diagonal deflection angle	Active components			Characteristics				Suitable deflection unit
		Horizontal output stage	Booster diode	Rectifier or HV-multiplier	High-voltage [1] kV	Internal resistance MΩ	Inductance of the horizontal deflection coil mH	Supply voltage V	
ZT 63/6	110°	PL 504	PY 88	DY 86	17,1	3,5	ca. 3	220	AE 64/6
ZT 66/T 3[2])	110°	Transistor	Si-diode	DY 51	11	5	1,6	11[3])	AE 66/T 3 or AE 66/T 4
ZT 67/T 9[2])	110°	Transistor	Si-diode	Selen TV 12	11	5	0,08	11[3])	AE 67/T 9
ZT 73/8[2])	110°	Transistor	Si-diode	KTS 806	17	2	0,105	17	AE 73/8
Remarks: [1]) Beam current 50 µA; [2]) for multi standard TV sets; [3]) stabilized									

Cathode-ray tubes for oscilloscopes, monitors, radar display units, flying spot scanners

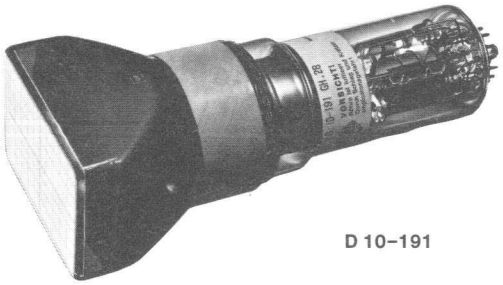
. . . with electrostatic deflection

Oscilloscope tubes

Type	Screen shape	Screen diameter or diagonal cm	Deflection coefficient D_3D_4 V/cm	Deflection coefficient D_1D_2 V/cm	Total acceleration voltage V	Useful scan Direction D_3D_4 mm	Useful scan Direction D_1D_2 mm	Heather power W	Overall length mm
D 3-11	○	3	58	51	500	27	27	1,9	103,2
D 3-111	○	3	58	51	500	27	27	0,6	103,2
D 5-100	□	5	90	90	2000	40 (X)	30 (Y)	0,035	116
D 7-16	○	7	21	43	800	60	65	0,6	162
D 7-210	○	7	11,5	29	1000	50	60	1,9	223
D 9-10	□	9	15	15	1000	70 (X)	40 (Y)	0,6	206,5
D 10-19	□	10	23	23	10000	56	68	0,6	217,5
D 10-191	□	10	8	8	3000	56	68	0,6	217,5
D 10-194	□	10	7,8	8	5000	56	68	0,6	217,5
D 10-250	□	10	13	24	3000	56	68	0,6	217,5
D 10-260	○	10	13,7	30	1500	60	80	1,9	254
D 10-650	□	10	4,8	10,2	7000	56	68	0,6	294,5
D 12-100	□	12	12,7	27,4	1500	64	80	1,9	264,5
D 12-101	□	12	12,7	27,4	1500	64	80	0,6	264,5
D 12-110	□	12	6	13,2	8000	64	80	1,5	300
D 13-41	○	13	8,5	18,5	3000	80	100	1,9	349
D 13-620	○	13	14,5	28	2000	80	100	1,9	304
D 13-621	○	13	12,5	22,5	2000	80	100	1,9	334,5
D 13-622	○	13	14,5	28	2000	80	100	1,9	304
D 13-650	○	13	5	11	10000	80	100	1,5	335,5
D 14-11	□	14	5	11	10000	60	100	0,6	350
D 14-111	□	14	4,5	9	12500	60	100	1,9	350
D 14-131	□	14	5,3	9	12500	80	100	1,9	350
D 14-132	□	14	5,3	9	12500	80	100	0,6	350
D 14-140	□	14	11	20	16000	80	100	1,9	350
D 14-220	□	14	3,3	6,5	18000	80	100	1,9	380
D 14-221	□	14	8,5	17	18000	80	100	1,9	380
D 14-230	□	14	9	19,5	3000	80	100	1,9	308
D 14-231	□	14	9	19,5	3000	80	100	0,6	308
D 14-650	□	14	5	11	10000	80	100	1,5	323
D 18-11	○	18	16	27	6000	120	150	1,9	425
D 18-150	□	18	3,8	7,6	18000	100	120	1,9	445

Dual-beam oscilloscope tubes

E 13-13	○	13	11	11	4000	100	100	3,8	419
E 14-120	□	14	5	12	12500	80	100	3,8	435



D 10-191

D 13-620

Cathode-ray tubes for oscilloscopes, monitors, radar display units, flying spot scanners

. . . with magnetic deflection

Monitor tubes

Type	Screen shape diagonal	Screen diameter or diagonal cm	Neck diameter mm	Acceleration voltage kV	Useful Screen hight mm	 Screen width mm	Heater power W	Overall length mm
M 14–100	□	14	21	8	85	110	0,9	180
M 17–11	□	17	21	11	93	124	0,8	204
M 17–111	□	17	21	11	93	124	0,8	204
M 17–210	□	17	29,6	16	93	124	1,9	225
M 22–100	□	22	23	18	120	160	1,9	250
M 23–100	□	23	21	9	140	183	0,9	219
M 28–12	□	28	21	11	171	228	0,8	250
M 31–140	□	31	29,6	16	195	257	1,9	310
M 31–150	□	31	29,6	16	195	257	1,9	243
M 31–200	□	31	21	11	195	257	0,8	277
M 38–121	□	38	29,6	16	226	290	1,9	266,5
M 44–120	□	44	29,6	16	270	346	1,9	291
M 44–121	□	44	29,6	18	270	346	1,9	326,5
M 50–120	□	50	29,6	16	308	394	1,9	319
M 61–120	□	61	29,6	16	375	481	1,9	370

Radar tubes

F 7–100	○	7	23	15	⌀ 60	1,9	187
F 8–100	○	8	23	18,5	⌀ 68,9	1,9	256
F 17–100	○	17	21	11	⌀ 155	0,8	205
F 18–100	○	18	22	10	⌀ 152,5	1,9	220
F 31–150	○	31	29,6	12	⌀ 279	1,9	466
F 42–10	○	42	38	12	⌀ 365	1,9	613
F 58–100	○	58	38	16	⌀ 508	1,9	720

Flying spot tubes

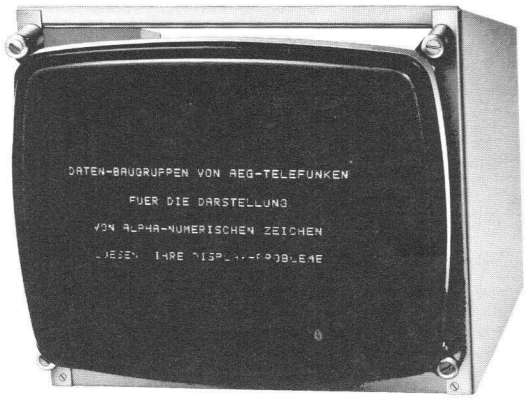
Q 7–110	○	7	29,6	16	⌀ 62	1,9	210
Q 13–10	○	13	38	20	⌀ 108	1,9	431
Q 13–120	○	13	38	20	⌀ 108	1,9	505
Q 25–100	○	25	38	20	⌀ 228	1,9	645
Q 28–100	○	28	38	20	⌀ 250	1,9	783

M 17–111

F 58–100

Q 28–100

Display modules DCM 31, DCM 38 and DCM 44



Modules for installation in data terminals for display of alpha-numericals

Each module consists of a high resolution picture tube, horizontal and vertical deflection circuit, video amplifier as well as a power supply mounted on a solid metal chassis.

The most important specifications:

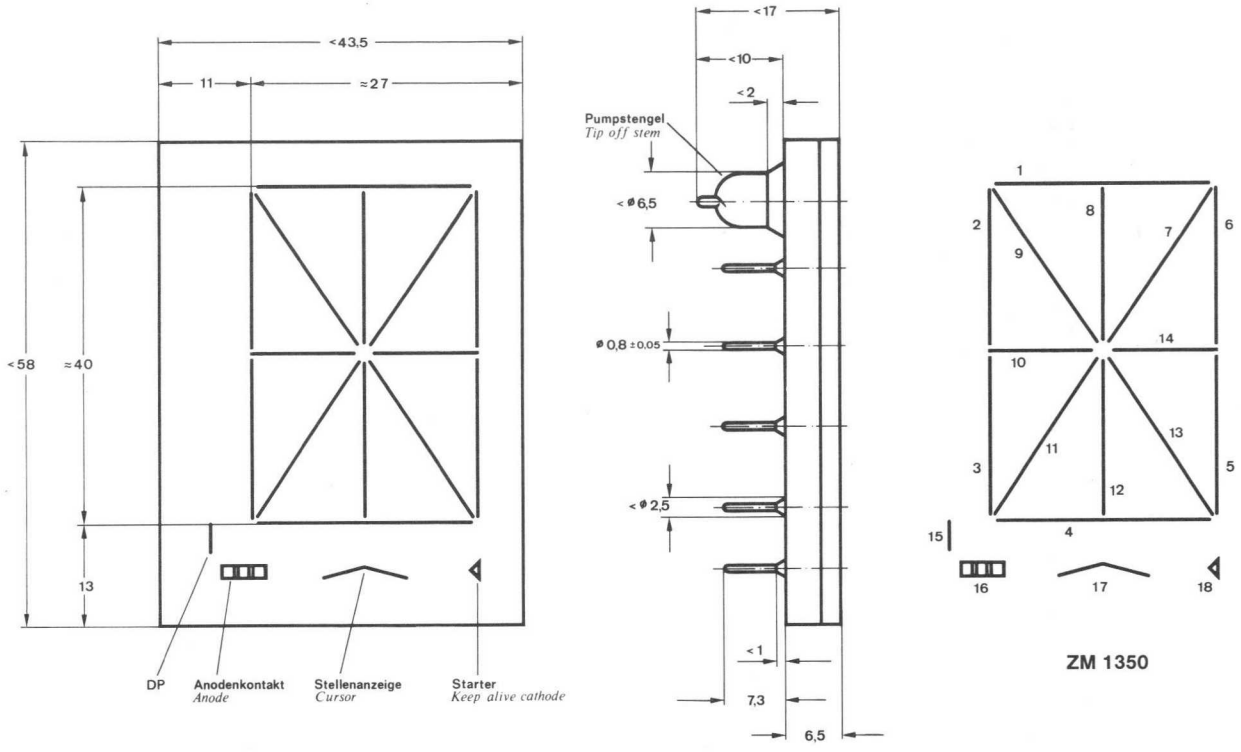
Picture tube:		DCM 31: Diagonal 31 cm (12") Deflection angle 90° DCM 38: Diagonal 38 cm (15") Deflection angle 110° DCM 44: Diagonal 44 cm (17") Deflection angle 110°
Phosphors:		P 4 standard white, persistance medium short
	or	P 31, green, persistance medium short
	or	P 39, green, persistance long
Resolution:		80 characters per line with 5 x 7 matrix
Standard:		625 lines, 50 c/s
Input characteristics:		Composite video U_{pp} = 1.4 V ±50%, modulation negativ
	or	direct TTL-video-signal with two additional TTL-signals for horizontal and vertical synchronization.
Input resistance:		75 Ω
Power input:		Line voltage 220 V ±10% or 110 V ±10%
	or	U = 21 V~ ±10%

Varisymbol

Gas discharge display

Type	Ignition voltage on keep alive cathode	Anode firing voltage	Anode to cathode voltage drop [1]	Anode extinction voltage	Firing delay time		Cathode current [2]		Brightness [3]
					inital firing	repeated firing	Minimum value	Maximum value	
	V	V	V	V	µs	µs	mA	mA	cd/m²
ZM 1350	ca. 135	ca. 130	ca. 128	ca. 125	< 10	< 10	0,8	1,5	ca. 750

Remarks: [1]) Depending on cathode current; [2]) At DC operation (segment 7)
[3]) Segment 7: Cathode current value 1.2 mA



Transmitting tubes

Type	Kind	P_2 [1] W	f max. MHz	S mA/V	μ ($\mu g_2 g_1$)	U_A max. V	P_A max. W	U_{G2} max. V	P_{G2} max. W	U_F V	I_F A	Notes
EL 3010	Pentode	70	30	50 ±9	(16)	900	35	250	5,5	6,3 16,6	ca. 2,2 ca. 1,1	
RS 614	Triode	350	200	3,2	25	3000	150	–	–	6,3	ca. 5,8	
RS 630	Triode	800	100	5,0	25	4000	350	–	–	5,0	ca. 14,5	
RS 631	Triode	1250	100	4,5	30	4000	450	–	–	10,0	ca. 10	
RS 635	Triode	3000	50	5,1	22	7000	800	–	–	6,3	ca. 32	
RS 685	Tetrode	300	200	2,5	(6,2)	3000	125	660	20	5,0	ca. 6,5	
RS 686	Tetrode	850	110	4,4	(5,1)	4000	400	850	35	5,0	ca. 14,5	
RS 687	Tetrode	1150	110	6	(9,5)	4500	500	700	65	10,0	ca. 10,5	
YL 1260	Pentode	220 [2]	30	45	(13) [3]	1500	250	±100 400 (G_3)	2 15 (G_3)	12,6	ca. 2,3	Pentode with shadow grid
YL 1510	Tetrode	1100 [2]	30	35	(4,5)	1850	1500	300	30	12,6	ca. 3,7	Forced air-cooling beam power tetrode
6360	Twin-tetrode	14	200	3,3	(7,5)	300	2 x 5	200	2	6,3 12,6	ca. 0,82 ca. 0,41	

Remarks: [1]) for class B operation; [2]) for class AB operation; [3]) $\mu\, g_3 g_1$

Microwave tubes

Travelling-wave tubes for point-to-point radio links

Type	Fig. Nr.	Typical operation						n_C [3]	Cooling [4]	Focusing [5]	Length	Weight	RF connections input/output [6]	Power supply
		f	P_2	U_H	I_K	V_p [2]	η_{ges}							
		GHz	W	kV	mA	dB	%				mm	kg		
YH 1000 [1]	1	1,7 ... 2,3	16	1,1	80	> 40	17	1	Dr	EM	281	0,2	WA / WA	–
TL 6 [1]	1	3,6 ... 4,2	6	1,35	30	> 30	13	1	Dr	EM	266	0,2	WA / WA	–
YH 1160	3	3,6 ... 4,2	8	1,85	35	36	23	1	Kd	PPM	292	0,8	CO / CO	NYH 1160
YH 1162	5	3,6 ... 4,2	22	2,2	55	39	38	2	Kd	PPM	377	1,6	WA / WA	NYH 1162
YH 1050 [1]	2	4,4 ... 5,0	2	1,1	20	> 26	12	1	Kv	PM	205	0,09	WA / WA	–
YH 1201	3	5,2 ... 5,8	15	2,5	39	45	25	1	Kd	PPM	292	0,8	CO / CO	NYH 1201
YH 1110 [1]	4	5,8 ... 8,5	15	2,9	50	40	18	1	Kd	EM	264	0,11	WA / WA	–
YH 1202	3	5,8 ... 6,4	11	2,5	40	39	24	1	Kd	PPM	292	0,8	CO / CO	NYH 1202
YH 1205	3	5,9 ... 7,1	15	2,7	40	39	38	2	Kd	PPM	292	1,0	CO / CO	NYH 1205
YH 1203	5	6,4 ... 7,1	22	3,0	55	39	26	1	Kd	PPM	377	1,6	CO / CO	NYH 1203
YH 1208	3	6,4 ... 7,1	11	2,5	40	39	24	1	Kd	PPM	292	0,8	CO / CO	NYH 1208
YH 1204	3	7,7 ... 8,5	11	3,12	40	39	24	1	Kd	PPM	292	0,8	CO / CO	NYH 1204
YH 1206	3	7,7 ... 8,5	11	3,12	40	39	30	2	Kd	PPM	292	1,0	CO / CO	NYH 1206
YH 1191	6	10,7 ... 11,7	20	3,35	50	43	28	1	Kd	PPM	275	1,1	CO / CO	NYH 1191
YH 1193	6	10,7 ... 11,7	22	3,38	48	40	38	2	Kd	PPM	275	1,2	CO / CO	NYH 1193
YH 1192	6	11,7 ... 12,4	20	3,4	51	43	27	1	Kd	PPM	275	1,1	CO / CO	NYH 1192
YH 1197	6	11,7 ... 12,5	22	3,38	48	30	38	2	Kd	PPM	275	1,2	CO / CO	NYH 1197
YH 1194	6	12,5 ... 13,2	22	3,3	53	30	38	2	Kd	PPM	275	1,2	CO / CO	NYH 1194
YH 1196	6	14,0 ... 14,5	16	3,45	50	45	23	1	Kd	PPM	275	1,1	CO / CO	NYH 1196

Remarks: [1]) As replacement only for existing systems; [2]) For high level; [3]) Number of collector stages; [4]) Dr = compressed-air, Kd = conduction, Kv = convection; [5]) EM = electro-magnetic beam focussing system, PPM = periodic permanent-magnet system integrated with the tube; [6]) CO = coaxial line, WA = waveguide.

Fig. 1

Fig. 2

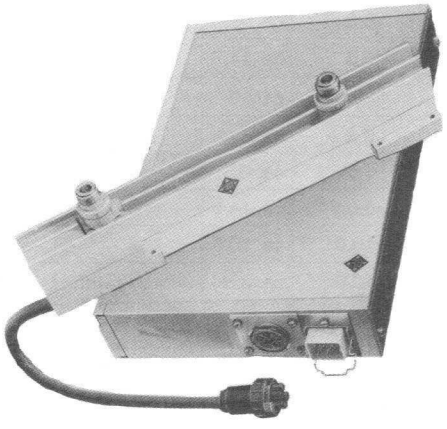


Fig. 3

Fig. 4

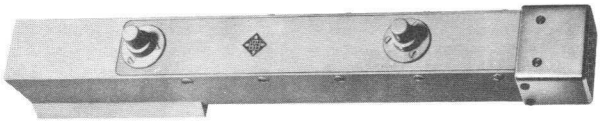


Fig. 5

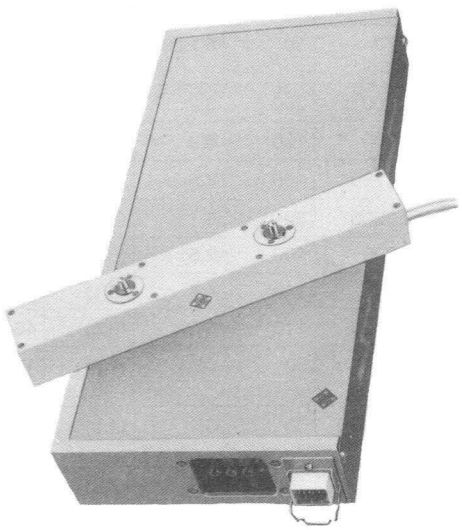


Fig. 6

Microwave tubes

High-power TWT's for satellite ground stations/radar/troposcatter

Type	Fig. Nr.	Typical operation						n_C [3]	Cooling [4]	Focusing [5]	Length	Weight	RF connections input/output [6]
		f	P_2	U_H	I_K	V_p [2]	η_{ges}						
		GHz	W	kV	mA	dB	%				mm	kg	
YH 1150	7	1,7... 2,3	1000	6,3	1200	> 32	19	1	Fl	EM	855	11	CO/CO
TL 3400	8	3,0... 3,6	1300	13	700	> 23	22	1	Dr	PPM	830	20	CO/WA
YH 1181	8	4,4... 5,0	1000	13,5	650	36	23	1	Dr	PPM	830	20	CO/WA
TL 5080 [1]	9	5,2... 5,7	90000	45	12500	40	25	1	Fl	PPM	769	23	WA/WA
YH 1300	10	5,9... 6,4	200	5,2	250	> 40	25	1	Dr	PPM	404	4,3	WA/WA
YH 1301	10	7,7... 8,0	200	7,1	220	34	25	1	Dr	PPM	404	4,3	WA/WA
YH 1190	11	11,7... 12,7	70	6	100	40	25	1	Kd	PPM	390	3	WA/WA
TL 16000 [1]	12	16,0... 17,0	4000	22	1700	> 36	23	1	Fl	PPM	392	5,5	WA/WA

Remarks: [1]) The ratings indicated for this tube apply for pulse operation; [2]) For high level; [3]) Number of collector stages; [4]) Fl = liquid, Dr = compressed-air, Kd = conduction; [5]) EM = electro-magnetic beam focussing system, PPM = periodic permanent-magnet system integrated with the tube; [6]) CO = coaxial line, WA = waveguide.

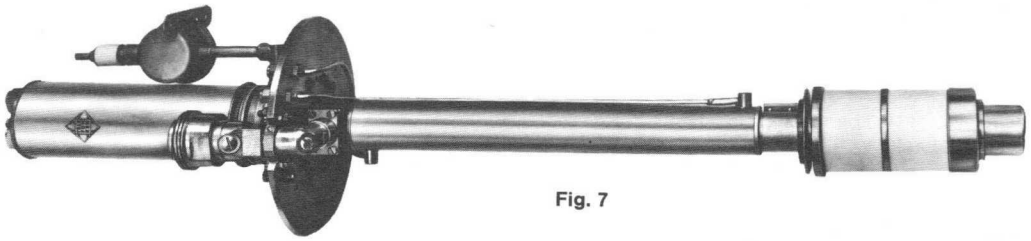


Fig. 7

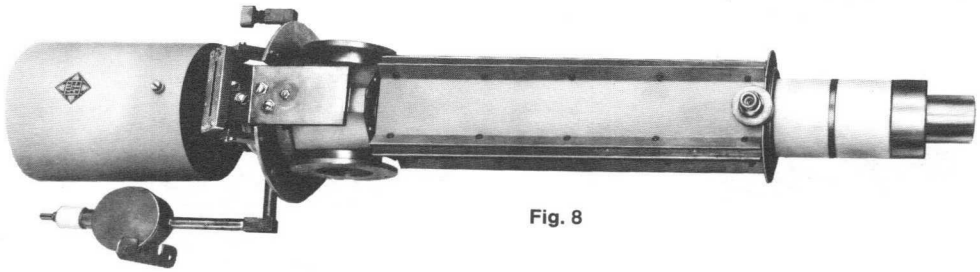


Fig. 8

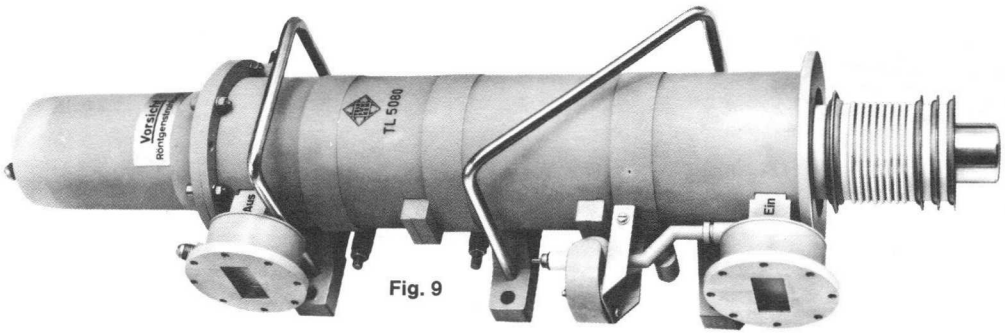


Fig. 9

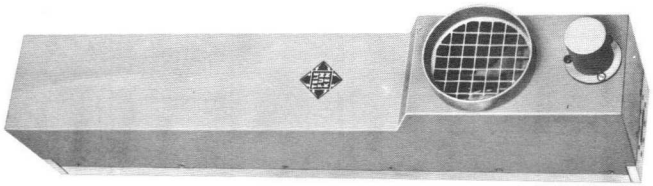


Fig. 10

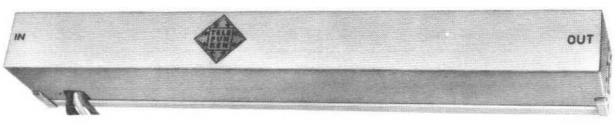


Fig. 11

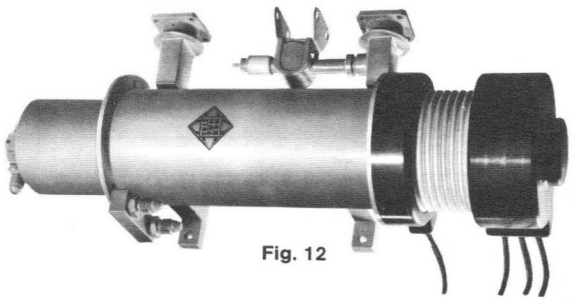


Fig. 12

Microwave tubes

Travelling-wave tubes for satellite-borne applications

Type	Fig. Nr.	Typical operation						n_C [2]	Cooling [3]	Focusing [4]	Length	Weight	RF connections input/output [5]
		f	P_2	U_H	I_K	V_p [1]	η_{ges}						
		GHz	W	kV	mA	dB	%				mm	kg	
TL 4002	13	3,7 ... 4,2	10	1,9	30	43	33	1	Kd	PPM	301	0,65	CO / CO
TL 4003	13	3,7 ... 4,2	13	1,9	35	46	32	1	Kd	PPM	301	0,65	CO / CO
TL 4010	13	3,7 ... 4,2	10	1,55	37	54	40	3	Kd	PPM	350	0,68	CO / CO
TL 4012	13	3,7 ... 4,2	12	1,59	41	57	44	3	Kd	PPM	350	0,68	CO / CO
TL 12 008	15	10,9 ... 11,5	9	2,45	32	58	42	3	Kd	PPM	295	0,6	CO / WA
TL 12 016	15	11,7 ... 12,2	15	2,95	42	56	43	3	Kd	PPM	311	0,6	CO / WA
TL 12 022	14	10,9 ... 11,8	20	3,35	47	55	41	2	Kd	PPM	285	0,6	CO / CO
TL 12 024	15	11,7 ... 12,2	20	3,5	45	52	48	3	Kd	PPM	305	0,7	CO / WA
TL 12 025	15	11,7 ... 12,2	20	3,35	47	55	41	2	Kd	PPM	295	0,82	CO / WA
TL 12 026	15	11,7 ... 12,2	20	3,35	47	55	44	3	Kd	PPM	311	0,6	CO / WA
TL 12 030	15	11,7 ... 12,2 13,4 ... 14,05	30 >25	4,270	54	58 55	40 39	2	Kd	PPM	320	0,62	CO / WA
TL 12 200	16	11,7 ... 12,2	200	7,2	220	45	45	3	St	PPM	444	4,5	CO / WA
TL 12 450	16	11,7 ... 12,2	450	8,3	450	50	50	5	St	PPM	446	5,5	WA / WA
TL 12 800	16	11,7 ... 12,2	700	12	375	46	46	5	St	PPM	460	8	WA / WA

Remarks: [1]) For high level; [2]) Number of collector stages; [3]) Kd = conduction, St = radiation; [4]) PPM = periodic permanent-magnet system integrated with the tube; [5]) CO = coaxial line, WA = waveguide.

Fig. 13

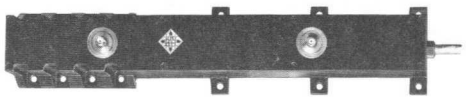


Fig. 14

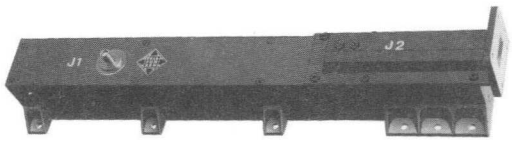


Fig. 15

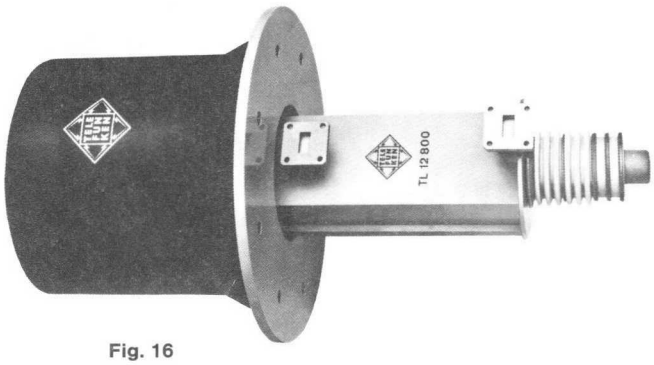


Fig. 16

Pulse magnetrons

Type	Fig. Nr.	Typical operation								Weight
		f	P_{2p}	U_F	I_F	U_{Ap}	I_{Ap}	t_{imp}	D	
		GHz	kW	V	A	kV	A	µs		kg
YJ 1210 **YJ 1211**	17	8,5...9,6	250	13,75	3	22	27,5	1	0,001	6,2
YJ 1230	18	1,25...1,35	5000	14	155	70	155	5	0,0018	55
YJ 1350 **6344**	19	5,45...5,875	170	11	11	22	22	1,3	0,00085	10,7
YJ 1360 **2 J 51 A**	20	8,5...9,6	45	6,3	1	14	4	1	0,001	2,3
YJ 1400	21	16,3...16,9	57	12,6	1,81	13,5	12	0,22	0,001	1,7
YJ 1405	without Fig.	15,5...17,5	100	12,6	3	17,5	18	2,5	0,001	6,3
YJ 1460	22	9,3...9,8	3	6	1,2	3,5	3,2	1	0,001	1,8
YJ 1461	22	9,3...9,8	10	6	1,2	5,5	5,2	1	0,001	2,3
YJ 1462	22	8,6...9,6	25	12,6	1,5	8,3	9	2,5	0,001	2,3
YJ 1463	22	8,6...9,6	70	12,6	2,8	15	15	2,5	0,001	3
YJ 1464	17	8,5...9,6	100	13,75	3	20	15	0,1...1	0,0015	6,2

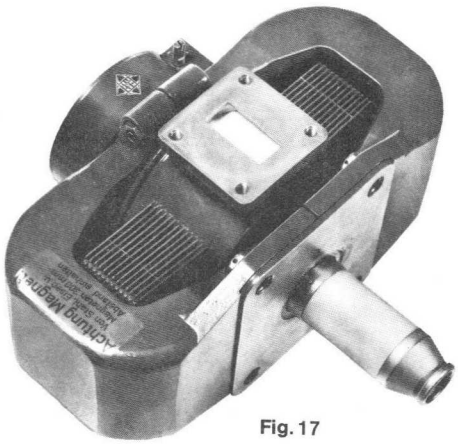


Fig. 17

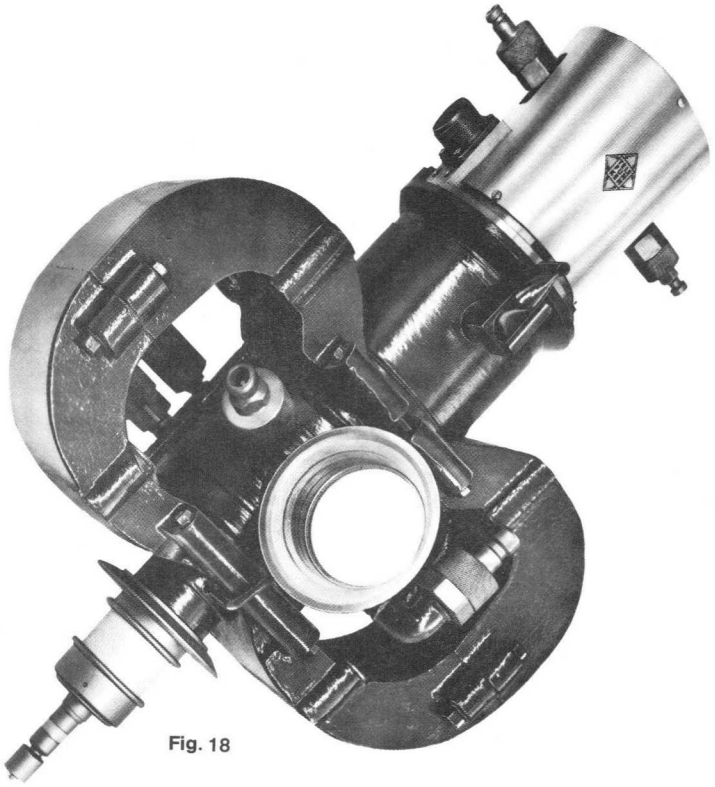


Fig. 18

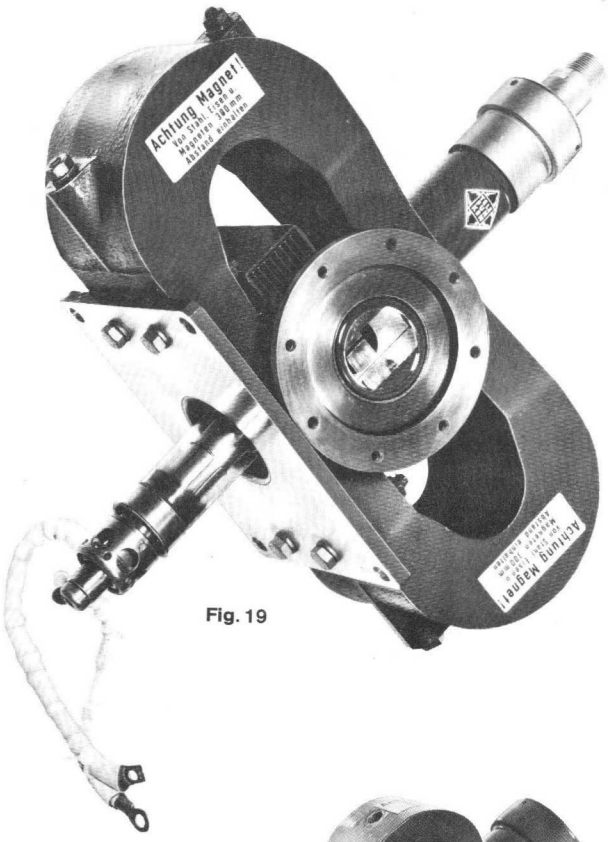


Fig. 19

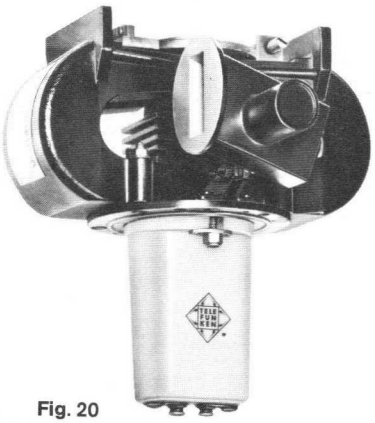


Fig. 20

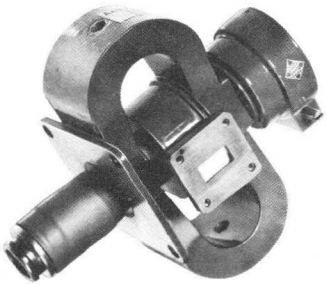


Fig. 21

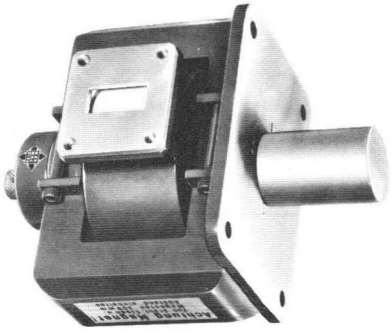


Fig. 22

Microwave tubes

Reflexklystrons

Type	Fig. Nr.	Typical operation									Dimensions	Weight
		f	n	P_2	U_F	I_F	U_{RES}	I_{RES}	U_{RFL}	Δf ½		
		GHz		mW	V	A	V	mA	V	MHz	mm	g
S-Band TK 8	23	3,7...4,3	3	105	6,3	0,38	300	28	-60...-170	58	⌀43 x 87	50
C-Band TK 61	24	6,5...7,7	3	180	6,3	0,4	300	28	-50...-190	49	⌀44 x 87	50
YK 1023[1])	25	7,6...8,2	2	120	6,3	0,44	300	28	-100...-260	25	86 x 62 x 57	250
YK 1030	28	6,2...7,2	2,3	1400	6,3	1,55	750	75	-120...-850	50	97 x 79 x 50	420
YK 1050	26	7,0...8,2	3	170	6,3	0,4	300	28	-80...-290	35	⌀44 x 87	50
X-Band YK 1080	29	9,8...10,5	3	25	6,3	1,23	300	25	-98...-118	22	63 x 41 x 43	160
YK 1081	29	9,4...10	3	25	6,3	1,23	300	25	-90...-100	22	63 x 41 x 43	160
YK 1082	29	9,3...9,6	2	125	6,3	1,23	330	33	-115...-185	30	60 x 31 x 35	160
YK 1160 6975	without Fig.	8,5...9,66	7¾	45	6,3	0,42	300	29	-85...-150	38	40 x 77 x 42	90
2 K 25	27	8,5...9,66	2	35	6,3	0,44	300	22	-85...-200	37	⌀41 x 90	55
723 A/B	27	8,7...9,5	2	30	6,3	0,44	300	22	-100...-190	40	⌀41 x 90	55

Remarks: [1]) With thermal frequency tuning

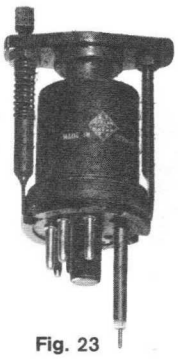


Fig. 23

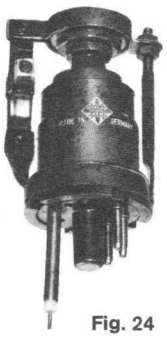


Fig. 24

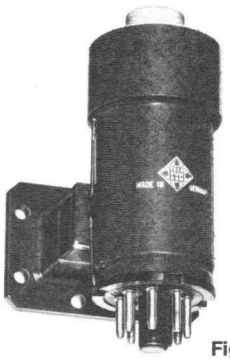


Fig. 25

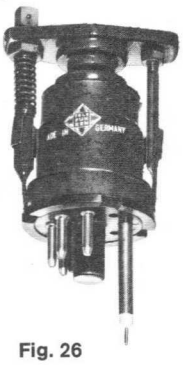


Fig. 26

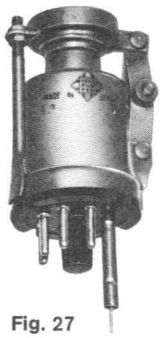


Fig. 27

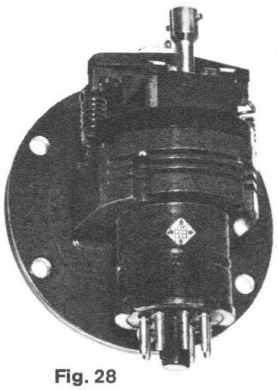


Fig. 28

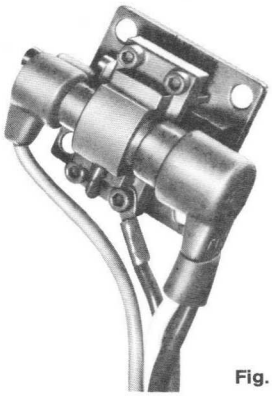


Fig. 29

Lighthouse tubes

Fig. 30

Fig. 31

Fig. 32

Fig. 33

Fig. 34

Microwave tubes

Lighthouse tubes

Type	Fig. Nr.	Measuring values					Typical operation						
		U_F V	I_F A	U_A V	I_A mA	S mA/V	f GHz	U_F V	U_A V	$-U_G$ V	I_A mA	I_G mA	P_2 W
YD 1040	31	6	1	600	75	25	1,1	6	1700	45	1900[1])	1100[1])	1500[1])
YD 1050	31	6	1	500	95	25	0,5 2,5	5,8 4,8	600 600	20 16	80 100	25 6	26 16
YD 1051	31	6	1	500	100	30	0,6 2,5	5,6 4,6	850 850	20 16	100 100	10 5	30 20
YD 1052	31	6,3	1	500	125	32	1,6	6,3	1500	35	2500[1])	1400[1])	1000[1])
YD 1053	30	6	1	500	100	27	0,5 2,5	5,8 4,8	600 600	20 16	80 100	25 6	26 16
YD 1054	31	6,3	1	700	150	12	0,8	6,3	800	16	140	–	25
YD 1055	31	6,3	1	600	100	27	1,03	6,3	2000	35	5	–	1500[1])
YD 1060/01	33	6	0,8	420	60	16	6	6	420	35	60	9	1,8
2 C 39 A	32	6,3	1	600	75	25	2,5 2,5	4,8 4,8	800 600	24 15	100 100	8 10	21 15
2 C 39 BA	31	6	1	600	75	25	2,5 2,5	4,8 4,8	800 600	24 15	100 100	8 10	24 16
2 C 40	34	6,3	0,7	250	17,5	5	2,3 3,3	6,3 6,3	250 250	10 5	20 20	1,2 0,3	0,5 0,075
2 C 40 A	34	6,3	0,7	250	17,5	5	3	6,3	1400[1])	0	1500	–	0,2
7211	31	6,3	1	600	90	30	0,5 2,5	6 4,8	900 900	30 20	140 140	40 15	60 25
7815 R	31	6	1	600	75	25	2,5	5,8	3500[1])	45	3000[1])	1400[1])	2000[1])
Remarks: [1]) Pulse													

Microwave semiconductor diodes

Microwave silicon LID-diodes [1])

Type	Fig.	$U_{(BR)}$ V	c_j at U_R = 6 V pF	c_{case} pF	t_t ns	R_{thJC} K/W	Notes
BAV 98	35	18	0,3...0,6	0,14	–	300	Mixer varactor diode
BXY 49/A	35	36	1,7...2,1	0,1	0,2	180	Step recovery diode
BXY 49/B	35	36	0,4...0,8	0,1	0,2	280	
BXY 49/C	35	36	0,4...0,6	0,1	0,2	280	
Remarks: [1]) Diodes with other capacities on request							

Schottky barrier diodes

Type	Fig. Nr.	$U_{(BR)}$ V	c_j pF	r_S Ω	c_{case} pF	L_S nH	F dB	V_C dB
BAW 69	35	6	0,13	9	0,14	0,8	7	–5
BAW 70	36	6	0,13	9	0,23	0,8	6,5	–5

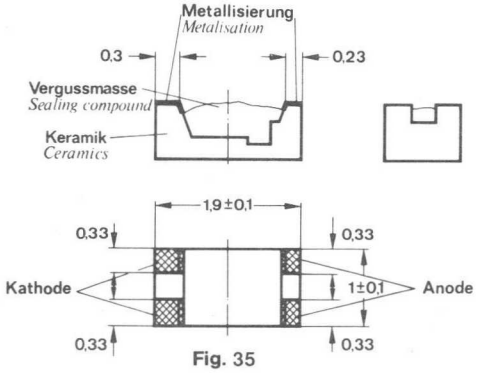


Fig. 35

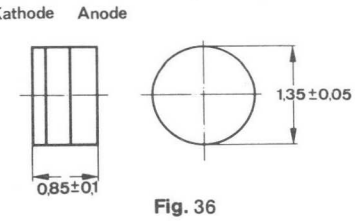


Fig. 36

Microwave semiconductor diodes

Microwave PN silicon diodes

Type	Fig. Nr.	$U_{(BR)}$ V	c_j at U_R = 6 V pF	$f \cdot Q_{6V}$ GHz	t_t ns	R_{thJC} K/W	Notes
BAX 11/I o	37	90	10...15	33	2	10	
BAX 11/I u	37	90	6,8...10	33	2	10	
BAX 11/II o	37	60	4,7...6,8	47	1	12	
BAX 11/II u	37	60	3,3...4,7	47	1	12	
BAX 11/III o	37	60	2,2...3,3	68	0,5	20	
BAX 11/III u	37	60	1,5...2,2	68	0,5	20	
BAY 79/III o	38	48	2,2...3,3	68	0,5	80	
BAY 79/III u	38	48	1,5...2,2	68	0,5	80	
BAY 79/IV o	38	36	1...1,5	100	0,25	100	
BAY 79/IV u	38	36	0,68...1	100	0,25	100	
BAY 79/V	38	24	0,33...0,68	150	0,16	150	Step recovery diode
BXY 26/I o	39	90	10...15	33	2	10	
BXY 26/I u	39	90	6,8...10	33	2	10	
BXY 26/II o	39	60	4,7...6,8	47	1	12	
BXY 26/II u	39	60	3,3...4,7	47	1	12	
BXY 26/III o	39	60	2,2...3,3	68	0,5	20	
BXY 26/III u	39	60	1,5...2,2	68	0,5	20	
BXY 26/IV o	39	36	1...1,5	100	0,25	30	
BXY 26/IV u	39	36	0,68...1	100	0,25	35	
BXY 61	40	30	0,45...0,85	100	0,1	35	
OA 1122 Si	41	18	0,22...0,55	68	–	200	Mixer varactor diode

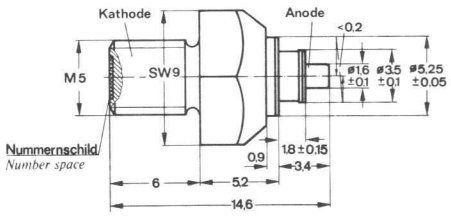


Fig. 37

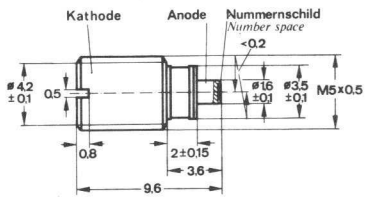


Fig. 39

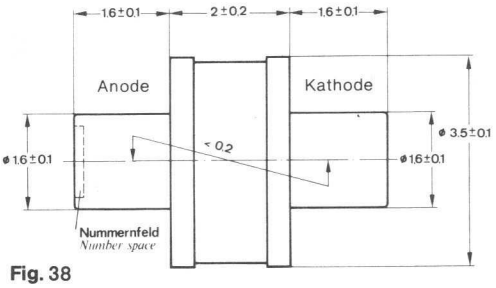


Fig. 38

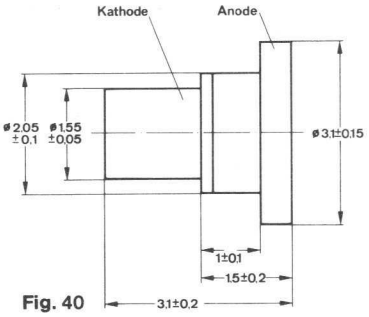


Fig. 40

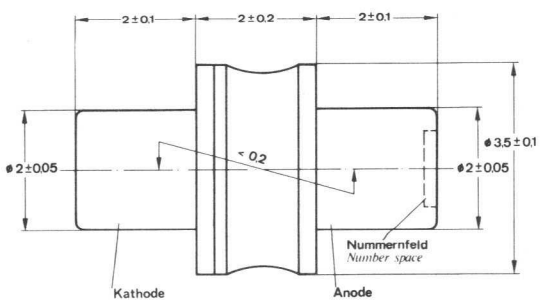


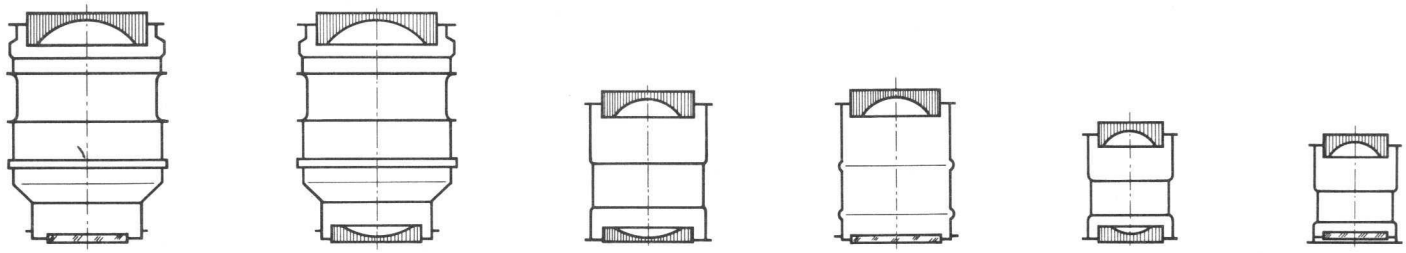
Fig. 41

Image intensifier tubes

Single stage

Type	XX 1110	XX 1111	XX 1190	XX 1191	XX 1200	XX 1201
Configuration	Tetrode	Tetrode	Diode	Diode	Diode	Diode
Focusing method	electrostatic					
Input face plate	Fiber optics, flat					
useful ⌀ in mm	38	38	25	25	18	18
Photocathode	Spectral type S 20 r					
Paraxial image magnification	variable: 1 : 0.3 ... 1 : 0.7		fixed: ca. 1 : 94			
Output face plate	Glass	Fiber optics		Glass	Fiber optics	Glass
Output flourescent screen	Type P 20, yellow-green					
Average luminance gain [2] in cd · m^{-2}/lx	300[1]	210[1]	35	32	35	30
Average center resolution in Lp/mm	40	35	60	65	60	65
Typical operating and max. ratings						
U_{FOC} 1 in V	−70...−200[1]	−70...−200[1]	–	–	–	–
U_{FOC} 2 in kV	4...5[1]	4...5[1]	–	–	–	–
U_A in kV	16...20[1]	16...20[1]	14 max. 15	14 max. 15	12 max. 13	12 max. 13
Length in mm	90	90	62	62	49	47
Diameter in mm	69	69	60	60	45	45
Weight in g	ca. 220	ca. 240	ca. 200	ca. 190	ca. 180	ca. 170

Remarks: [1]) Paraxial image magnification 1 : 0.5 [2]) Photocathode irradiated by a tungsten-filament lamp: T_{Farb} = 2850 K, t_{amb} = 20 °C



XX 1110 XX 1111 XX 1190 XX 1191 XX 1200 XX 1201

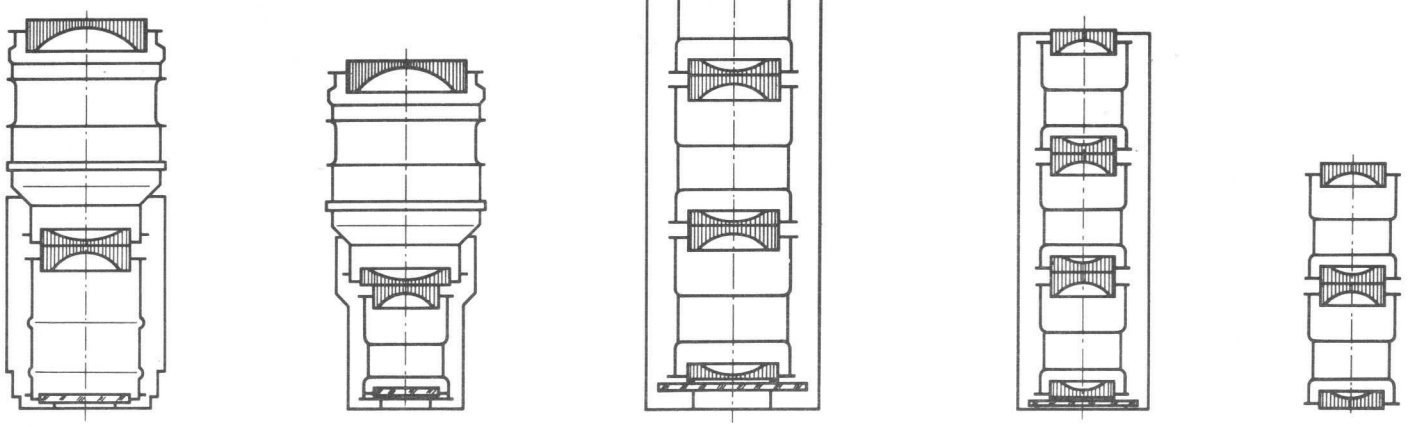
Measure ca. 1:3

Image intensifier tubes

2-/3 stages

Type	XX 1112	XX 1350	XX 1060	XX 1210	XX 1250
Typ combination			3 x XX 1190	3 x XX 1200	2 x XX 1200
Input stage Output stage	XX 1111 XX 1191	XX 1111 XX 1201	with voltage multiplier	with integral oscillator and voltage multiplier	coupled
Configuration	Tetrode + Diode		3 diodes		2 diodes
Focusing method	electrostatic				
Input face plate	Fiber optics, flat				
useful ⌀ in mm	38	35	25	18	18
Photocathode	Spectral type S 20 r				
Paraxial image magnification	variable: 1 : 0.3 ... 1 : 0.6		fixed: 1 : 0.8 ... 1.1		fixed: 1 : 0.9 ... 1.0
Output face plate	Glass		Fiber optics		
Output fluorescent screen	Type P 20, yellow-green				
Average luminance gain in cd · m^{-2}/lx	$4 \cdot 10^3$	$4 \cdot 10^3$	$1{,}4 \cdot 10^4$	$1{,}4 \cdot 10^4$	600
Average center resolution in Lp/mm	30	30	32	35	42
Typical operating and max. ratings					
$U_{FOC\,1}$ in V	−60...−160[1]) min. −70...max. +300		–	–	–
$U_{FOC\,2}$ in kV	+4,1...+4,6[1]) max. +8,5		–	–	–
$U_{A\,1}$ in kV	−20[1]) max. +20,5		–	–	–
$U_{A\,2}$ in kV	+32[1]) max. +33	–	–	–	–
U_B in V	–	–	2700 ~	min. 2,5, max. 3	–
Length in mm	152	150	194	148	96
Diameter in mm	70	70	70	53	47
Weight in g	ca. 420	ca. 400	ca. 950	ca. 750	ca. 360

Remarks: [1]) Paraxial image magnification 1 : 0.5; [2]) Photocathode irradiated by a tungsten-filament lamp: T_{Farb} = 2850 K, t_{amb} = 20 °C



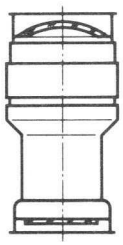
XX 1112 XX 1350 XX 1060 XX 1210 XX 1250

Measure ca. 1 : 3

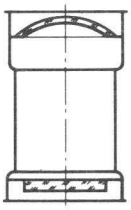
Infra-red image converter tubes

Type	B 80	6914	6929	8598
Configuration	Triode	Diode	Diode	Diode
Focusing method	electrostatic			
Input face plate	Glass, spherical arched			
useful ⌀ in mm	26	25,4	19	11
Photocathode	Type S 1			
Spectral sensitivity in nm	ca. 800 < 1200			
Paraxial image magnification	1 : 0,7	1 : 0,75	1 : 0,75	1 : 1
Output face plate	Glass, flat			
Output flourescent screen	Type P 20, yellow-green			
Conversion coefficient [1]) in cd/lm	> 0,6	> 0,6	> 0,4	> 0,5
Equivalent screen background input [2]) in mlx	20 max. 50	12 max. 25	12 max. 25	20 max. 50
Average center resolution in Lp/mm	60	70	60	80
Typical operating and maximum ratings				
U_{FOC} in kV	ca. 3	–	–	–
U_A in kV	16 max. 17	16 max. 17	12 max. 12,5	16 max. 17
Length in mm	88	74	58	42
Diameter in mm	42	48	34	30
Weight in g	ca. 200	ca. 170	ca. 160	ca. 140

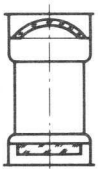
Remarks: [1]) Light source T_{Farb} = 2850 K. A Schott filter UG 8/3 mm must be inserted in the beam path in front of cathode. The beam impinging on the cathode is measured as luminuous flux without filter.
[2]) It is determined by the equivalent illumination on the photocathode, which produces the same luminance on the screen as the dark current of the photocathode. t_{amb} = 20 °C.



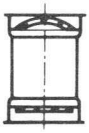
B 80



6914



6929



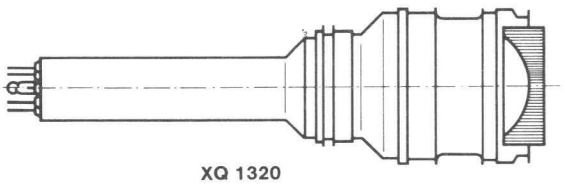
8598

Measure ca. 1 : 3

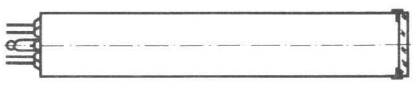
Camera tubes

Type	XQ 1003[1]) XQ 1007[2])	XQ 1004[1]) XQ 1008[2])	XQ 1250[1]) XQ 1260[2])	XQ 1320[1])	XQ 1340[1])
Application	Industrial and school TV systems	Industrial and amateur TV systems	TV systems, high sensitive in infrared, burn in resistent	Low light level TV scen illumination 0.001 ... 1 lx	Low light level TV scen illumination 0.01 ... 1 lx
Configuration	Vidicon		Si-Vidicon[3])	Tetroden-Ebsicon[4])	Dioden-Ebsicon[4])
Input face plate	Glass, flat			Fiber optics, flat	
useful ⌀ in mm	26	26	26	32	20
Dimensions of scanned target in mm^2	9,6 x 12,8	9,6 x 12,8	9,6 x 12,8	9,6 x 12,8	9,6 x 12,8
Focusing method	–	–	–		
Intensifier section				electrostatic	
Scanning section	electromagnetic				
Deflection method, Scanning section	electromagnetic				
Typical operation and maximum ratings					
Intensifier section					
U_K in kV	–	–	–	–12... max. –15	–5... max. –15
$U_{FOC\,1}$ in V[6])	–	–	–	–80...–250	–
$U_{FOC\,2}$	–	–	–	$0{,}8 \cdot U_K$	–
U_A	–	–	–	0	0
Scanning section					
U_P in V	20...80	20...80	5...25 max. 35	5...20 max. 30	10 max. 20
U_{G4} in V	340 max. 1000	340 max. 1000	380 max. 450	340 max. 400	340 max. 350
U_{G3} in V	300 max. 1000	300 max. 1000	300 max. 450	300 max. 400	300 max. 350
U_{G2} in V	300 max. 750	300 max. 750	300 max. 350	300 max. 350	300 max. 350
U_{G1} in V	–25...–80	–25...–80	–25...–80	–25...–80 max. –200	0... max. –150
Photoelectrical layer	Type S 18		Si	Type S 20	
Spectral response in nm	400...600		400...1050	400...900	
Dark current in nA	20	20	≦ 40 (at U_P = 10 V)	≦ 30 (at U_P = 10 V)	≦ 30 (at U_P = 10 V)
Signal current I_S in nA at					
E[5]) = 8 lx, T_{Farb} = 2850 K	≧ 180	≧ 150	–	–	–
E = 0,5 lx, T_{Farb} = 2850 K	–	–	≧ 200	–	–
E = 0,001 lx, T_{Farb} = 2850 K	–	–	–	≧ 250	≧ 80
Gamma rating	ca. 0,7	ca. 0,7	1	1	1
Center resolution in TV lines	≧ 750	≧ 600	≧ 600	≧ 600	≧ 600
Lag after in %					
100 ms, E = 8 lx, I_S = 200 nA	≦ 20	≦ 20	–	–	–
60 ms, E = 0,5 lx, I_S = 200 nA	–	–	≦ 8	≦ 8	≦ 6
Length in mm	max. 161	max. 161	max. 161	max. 245	max. 188
Diameter in mm	max. 28,6	max. 28,6	max. 28,6	max. 72	max. 48
Weight in g	ca. 60	ca. 60	ca. 60	ca. 300	ca. 200

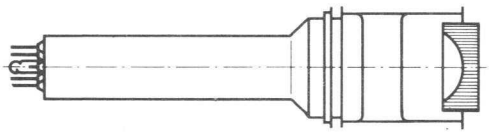
Remarks: [1]) Heating: DC or AC indirectly, 6.3 V ±10%, 300 mA; [2]) Heating: DC or AC indirectly, 6.3 V ±5%, ca. 95 mA; [3]) Vidicon tube with silicon diode array target [4]) Low light level-TV camera tube using an electron bombarded silicon target (EBSI) [5]) E = Input illuminance (Photocathode-target) [6]) Refered to cathode



XQ 1320



XQ 1003 XQ 1008
XQ 1004 XQ 1250
XQ 1007 XQ 1260



XQ 1340

Measure ca. 1 : 3

X-ray tubes

X-ray tubes for self-rectifying operation

Type	Fig. Nr.	U_A max. kV	I_A at U_A max. oil-insulated mA	I_A at U_A max. gas-insulated mA	Focal spot size mm x mm	Emission angle	Inherent filtration	Notes
R 200/3 . . *)	1	200	8	5	3 x 3	60° x 40°	1,5 mm Al	Full anode
R 200/5 . . *)	1	200	5	4	1,5 x 1,5	60° x 40°	1,5 mm Al	Full anode
R 300/2	2	300	6	–	3,5 x 3,5	60° x 40°	2 mm Al	Full anode
R 301/1 . . *)	3	300	6	5	3,5 x 3,5	60° x 40°	2 mm Al	Full anode
R 301/2 . . *)	4	300	3,0	2,7	2 x 2	60° x 40°	2 mm Al	Full anode
R 301/3 . . *)	4	300	6	5	3,5 x 3,5	60° x 40°	2 mm Al	Full anode
RC 200/1 . . *)	5	200	5	4	ø 5	360° x 50°	1,5 mm Al	Conical anode
RC 200/3 . . *)	5	200	5	4	ø 5	360° x 50°	1,5 mm Al	Conical anode, high reciprocal amplification factor
RC 300/2	6	300	5	–	ø 5	360° x 50°	0,7 mm Cu	Conical anode
RC 301/1 . . *)	7	300	5	3	ø 5	360° x 50°	0,7 mm Cu	Conical anode
RI 301/1 . . *)	4	300	6	5	3,5 x 3,5	60° x 40°	2 mm Al	Anode with incorporated radiation protection of approx. 11 mm Pb
RP 300/1	8	300	5	–	ø 5	360° x 35°	0,7 mm Cu	Flat anode
RP 301/1 . . *)	9	300	5	3	ø 5	360° x 35°	0,7 mm Cu	Flat anode
SW 150/2	10	150	10	10	ø 5	360 x 40°	0,3 mm Cu	Rod anode, grounded

*) Modular series, in compliance with equipment concept the tubes are provided with radiator and base.

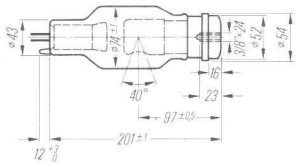


Fig. 1

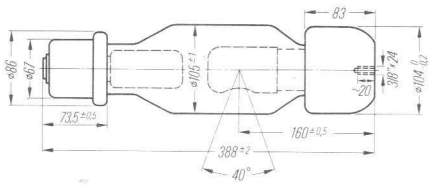


Fig. 2

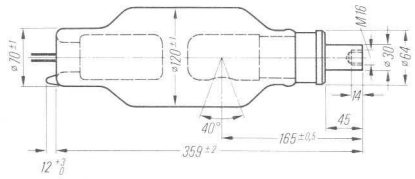


Fig. 3

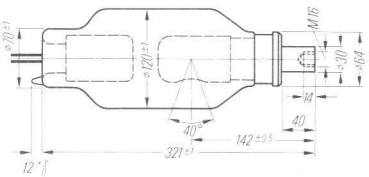


Fig. 4

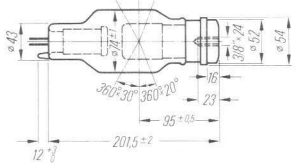


Fig. 5

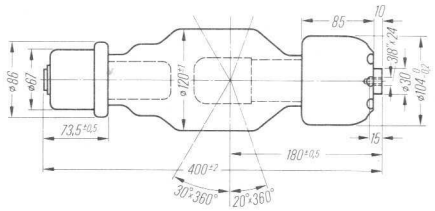


Fig. 6

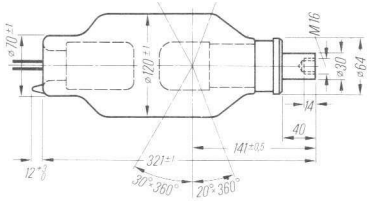


Fig. 7

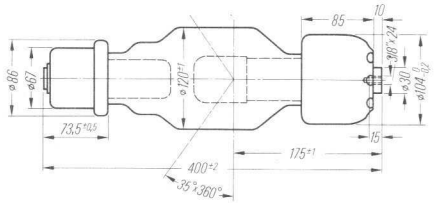


Fig. 8

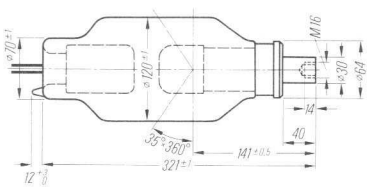


Fig. 9

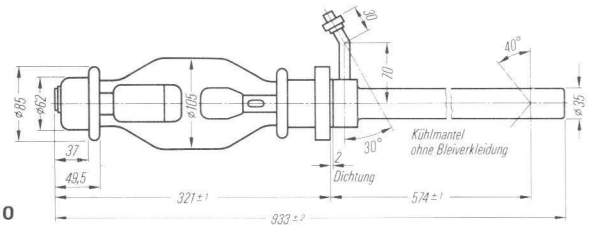


Fig. 10

X-ray tubes

X-ray tubes for constant DC operation

Type	Fig. Nr.	U_A max. kV	I_A at U_A max. mA	Focal spot size mm x mm	Emission angle	Inherent filtration	Notes
KB 150/6	11	150	20 4	3 x 3 0,4 x 0,4	60° x 40°	3 mm Be	Tube with two focal spots, Anode grounded
KB 160/1	12	160	19	3 x 3	60° x 40°	1 mm Be	Ceramic-tube, Anode grounded
KB 160/2	12	160	6,25	1 x 1	60° x 40°	1 mm Be	Ceramic-tube, Anode grounded
KB 160/3	12	160	3,1	0,5 x 0,5	60° x 40°	1 mm Be	Ceramic-tube, Anode grounded
KB 160/4	12	160	19 3,1	3 x 3 0,5 x 0,5	60° x 40°	1 mm Be	Ceramic-tube with two focal spots, Anode grounded
KB 160/5	12	160	19	9 x 1,5	60° x 40°	1 mm Be	Ceramic-tube, Anode grounded
KBP 160/1	13	160	5	2,5 x 2,5	360° x 20°	3 mm Al	Ceramic omnidirectional tube, Anode grounded
S 150/2	14	150	15	⌀ 5	360° x 40°	0,3 mm Ni	Rod anode, grounded
Z 300/3	15	300	10 4	4 x 4 1,2 x 1,2	60° x 40°	3 mm Al	Tube with two focal spots
Z 320/2	16	320	10 2	4 x 4 0,8 x 0,8	60° x 40°	3 mm Al	Tube with two focal spots
Z 320/3	16	320	10 4	4 x 4 1,2 x 1,2	60° x 40°	3 mm Al	Tube with two focal spots
Z 400/7	17	400	10 4	4 x 4 1,8 x 1,8	60° x 40°	4 mm Al	Tube with two focal spots

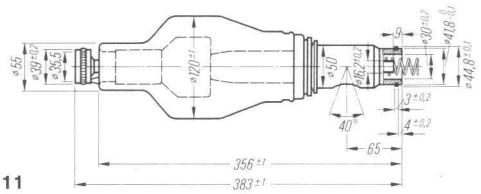


Fig. 11

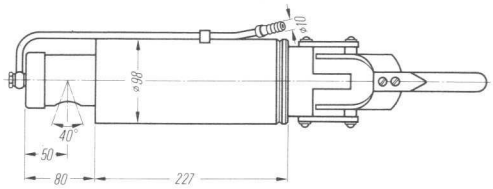


Fig. 12

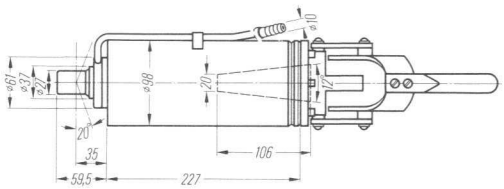


Fig. 13

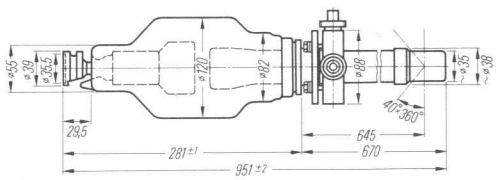


Fig. 14

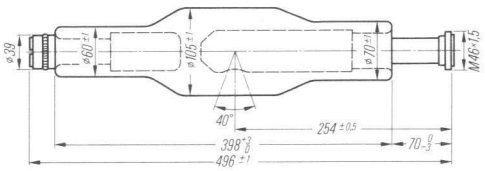


Fig. 15

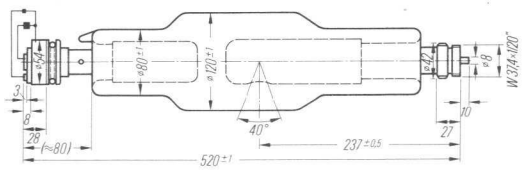


Fig. 16

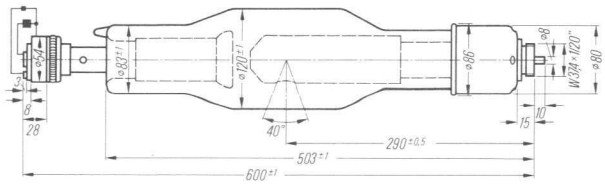


Fig. 17

X-ray tubes

X-ray tube for diffraction work and spectral analysis

Type	Fig. Nr.	U_A max. kV	I_A at U_A max. mA	Focal spot size mm x mm	Target	Inherent filtration	Notes
F 60-10 CU	18/19	60	33	1 x 1 10 x 0,1	Cu	0,4 mm Be	X-ray tubes with 4 beam output windows, air insulated, anode grounded Alternatively supplied as long anode tube Fig. 18, or as short anode tube Fig. 19.
F 60-10 W	18/19	60	40		W	0,4 mm Be	
F 60-10 MO	18/19	60	40		Mo	0,4 mm Be	
F 60-10 CR	18/19	60	30		Cr	0,4 mm Be	
F 60-10 CO	18/19	60	30		Co	0,4 mm Be	
F 60-10 FE	18/19	60	25		Fe	0,4 mm Be	
F 60-10 AG	18/19	60	33		Ag	0,4 mm Be	
F 60-01 CU	18/19	60	13	0,15 x 0,8 0,015 x 8	Cu	0,4 mm Be	
F 60-01 W	18/19	60	13		W	0,4 mm Be	
F 60-01 MO	18/19	60	13		Mo	0,4 mm Be	
F 60-01 CR	18/19	60	13		Cr	0,4 mm Be	
F 60-01 CO	18/19	60	10		Co	0,4 mm Be	
F 60-01 FE	18/19	60	5		Fe	0,4 mm Be	
F 60-01 AG	18/19	60	13		Ag	0,4 mm Be	
F 60-04 CU	18/19	60	25	0,4 x 0,8 0,04 x 8	Cu	0,4 mm Be	
F 60-04 W	18/19	60	33		W	0,4 mm Be	
F 60-04 MO	18/19	60	33		Mo	0,4 mm Be	
F 60-04 CR	18/19	60	22		Cr	0,4 mm Be	
F 60-04 CO	18/19	60	20		Co	0,4 mm Be	
F 60-04 FE	18/19	60	15		Fe	0,4 mm Be	
F 60-04 AG	18/19	60	25		Ag	0,4 mm Be	
F 60-20 CU	18/19	60	45	1,2 x 2,0 12 x 0,2	Cu	0,4 mm Be	
F 60-20 W	18/19	60	45		W	0,4 mm Be	
F 60-20 MO	18/19	60	45		Mo	0,4 mm Be	
F 60-20 CR	18/19	60	45		Cr	0,4 mm Be	
F 60-20 CO	18/19	60	45		Co	0,4 mm Be	
F 60-20 FE	18/19	60	37		Fe	0,4 mm Be	
F 60-20 AG	18/19	60	45		Ag	0,4 mm Be	
A 60/102	20	60	33	8 x 8	W	1,0 mm Be	X-ray tubes in oil-filled tube shield.
A 60/103	20	60	33		Cr	0,4 mm Be	
A 60/106	20	60	33		Au	0,4 mm Be	
A 60/107	20	60	33		Ag	0,4 mm Be	
A 80/100	21	80	37,5		W	1,0 mm Be	High-efficiency X-ray tubes in oil-filled tube shield
A 80/101	21	80	37,5		Cr	0,4 mm Be	
A 80/102	21	80	37,5		Au	0,4 mm Be	
A 80/103	21	80	37,5		Ag	0,4 mm Be	
A 80/104	21	80	37,5		Mo	1,0 mm Be	

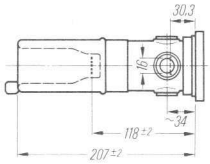


Fig. 18

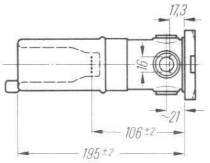


Fig. 19

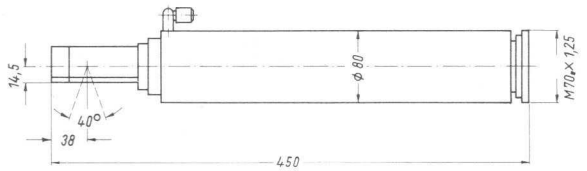


Fig. 20

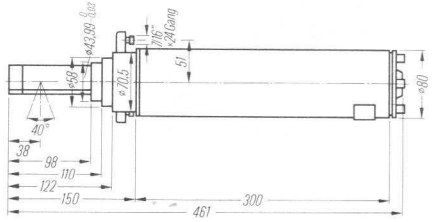


Fig. 21

Potentiometers, carbon composition

Single and tandem slide potentiometers

Kind	Type	Fig. Nr.	Version	Dimensions in mm W	L	Slide length mm	Loading capacity	Resistance range
Single	**803/00** **804/00** **805/00**	1	Open version for printed circuits, without screening. Mounting: By catches on the plastic body.	7 7 7	48 58 68	30 40 50	0,4 W lin. 0,2 W log.	100 Ω...10 MΩ lin. 1 kΩ...10 MΩ log.
Single	**845/00** **845/20**	2	Open version for printed circuits or with solder taps for wire connections; without screening.	17	74	40	0,4 W lin. 0,2 W log.	100 Ω...10 MΩ lin. 1 kΩ...10 MΩ log.
Single	**844/00**	3	Open version for printed circuits, without screening. Mounting: Directly into the printed circuit board without additional elements.	11	86,5	58	0,4 W lin. 0,2 W log.	100 Ω...10 MΩ lin. 1 kΩ...10 MΩ log.
Single	**813/00**	4	Open version for printed circuits. Mounting: Directly on the printed circuit board without additional elements.	11	67,5	48	0,4 W lin. 0,2 W log.	100 Ω...10 MΩ lin. 1 kΩ...10 MΩ log.
Single	**814/00**	5	Screening version for printed circuits. Mounting: Directly into the printed circuit, without additional elements.	13	86,5	58	0,3 W lin. 0,15 W log.	100 Ω...10 MΩ lin. 1 kΩ...10 MΩ log.
Single	**846/00** **846/20**	6	Open version for printed circuits or with solder taps for wire connections; without screening.	19	85	58	0,4 W lin. 0,2 W log.	100 Ω...10 MΩ lin. 1 kΩ...10 MΩ log.
Tan-dem	**848/00**	7	Screened version for printed circuits. Mounting: Directly into the printed circuit without additional elements.	11	67,5	48	0,4 W lin. 0,2 W log.	100 Ω...10 MΩ lin. 1 kΩ...10 MΩ log.
Tan-dem	**858/00**	5	Screened version for printed circuits. Mounting: Directly into the printed circuit without additional elements.	13	86,5	58	0,3 W lin. 0,15 W log.	100 Ω...10 MΩ lin. 1 kΩ...10 MΩ log.
Single	**773**	8	Screened version for printed circuits and for wire connections. Mounting: By catches or screws. Low height, excellent slide properties »Softgang«. Available as from summer 1978.	13	60	40	0,3 W lin. 0,15 W log.	100 Ω ... 10 MΩ lin. 1 kΩ ... 10 MΩ log.

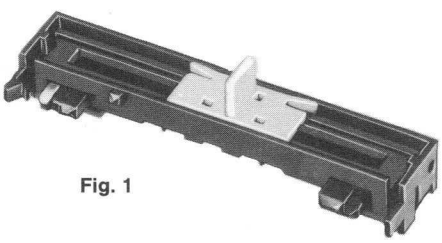


Fig. 1

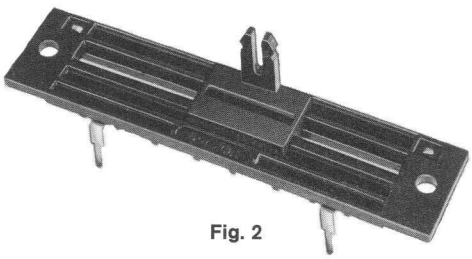


Fig. 2

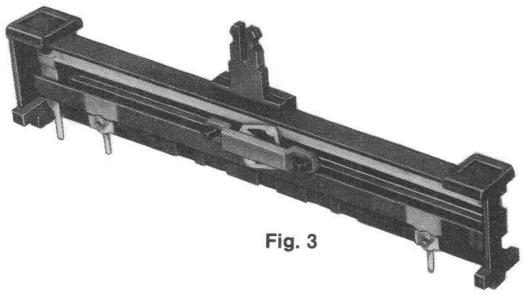


Fig. 3

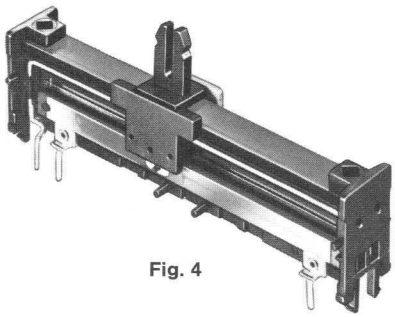


Fig. 4

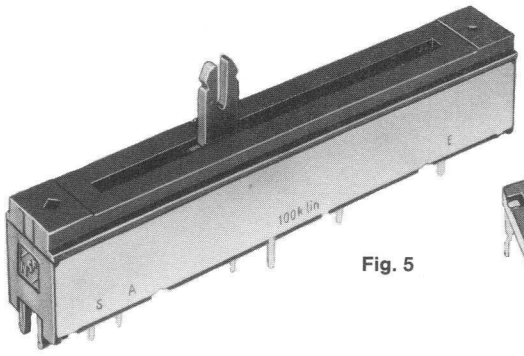


Fig. 5

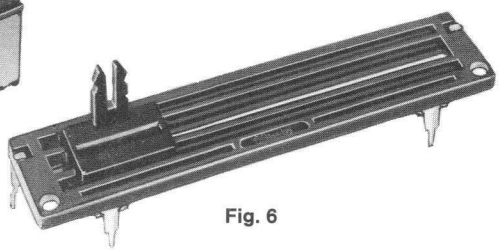


Fig. 6

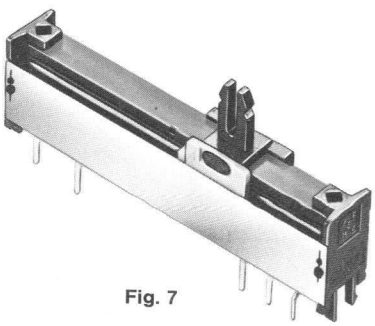


Fig. 7

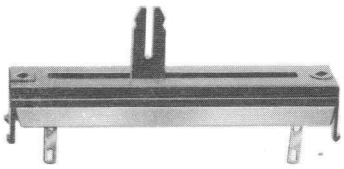


Fig. 8

Potentiometers, carbon composition

Multiple slide potentiometers

Kind	**Type**	Fig. Nr.	**Version**	Dimensions in mm W	L	Slide length	Loading capacity	Resistance range
Double	**810/10**	10	Open version for printed circuits. Mounting: Directly into the printed circuit board by the solder pins.	35,5	67	40	0,4 W lin. 0,2 W log.	100 Ω...10 MΩ lin. 1 kΩ...1 MΩ log.
Double	**810/07**	11	This version contains two tandem slide potentiometers with a common wiper connection. The slides are designed as wipers. Mounting: By snap-in fixing without additional fixing elements.	40,5	89	48	0,4 W lin. 0,2 W log.	100 Ω...10 MΩ lin. 1 kΩ...1 MΩ log.
Double	**810/11**	12	Open version for printed circuits. Mounting: Directly into the printed circuit board by the solder pins.	39	93	58	0,4 W lin. 0,2 W log.	100 Ω...10 MΩ lin. 1 kΩ...1 MΩ log.
Triple	**810/06**	13	Open version with AMP plug-in connectors for wireless installation in the equipment. Fitted with two single and one tandem slide potentiometers	64,5	92,5	48	0,4 W lin. 0,2 W log.	100 Ω...10 MΩ lin. 1 kΩ...1 MΩ log.
Triple	**810/14**	14	Open version for printed circuits. Mounting: Directly into the printed circuit board by the solder pins.	53	93	58	0,4 W lin. 0,2 W log.	100 Ω...10 MΩ lin. 1 kΩ...1 MΩ log.
Quad-ruple	**810/25** **810/26**	15	Open version for printed circuits or with solder taps for wire connection.	82,5	92	48	0,3 W lin. 0,15 W log.	100 Ω...10 MΩ lin. 1 kΩ...1 MΩ log.
Quad-ruple	**810/19** **810/23**	16	Open version with solder taps for wire connection or for printed circuits.	33	130	40	0,4 W lin. 0,2 W log.	100 Ω...10 MΩ lin. 1 kΩ...1 MΩ log.
Quad-ruple	**810/16**	17	Open version with solder taps for wire connection. The base plate can be fitted with mains switch and earphone socket. With soldering terminal between pot. I and pot. II	40	228	40	0,4 W lin. 0,2 W log.	100 Ω...10 MΩ lin. 1 kΩ...1 MΩ log.
Quin-tuple	**811/18**	18	Open version with solder taps for wire connection. Four slide potentiometers dust-protected by cover plate. One film potentiometer with milled-edge knob.	33,5	145,5	40 270°	0,4 W lin. 0,2 W log. 0,2 W lin. 0,1 W log.	100 Ω...10 MΩ lin. 1 kΩ...1 MΩ log.

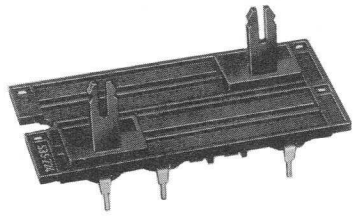


Fig. 10

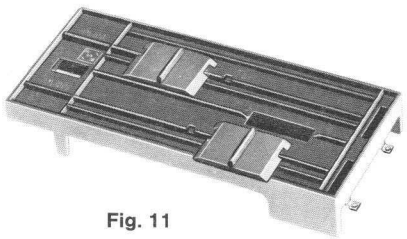


Fig. 11

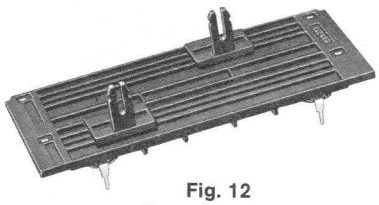


Fig. 12

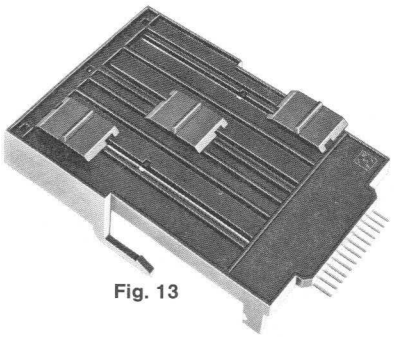


Fig. 13

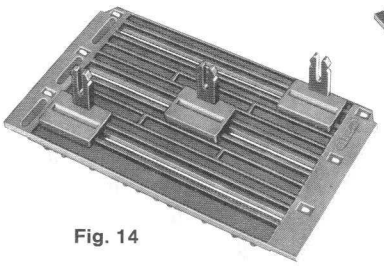


Fig. 14

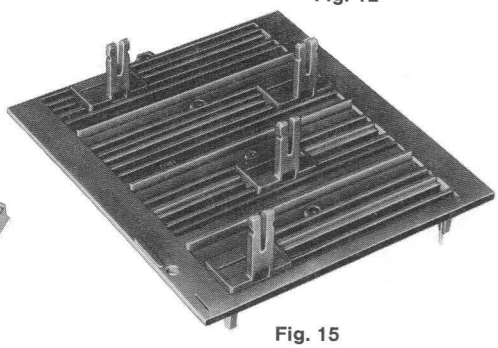


Fig. 15

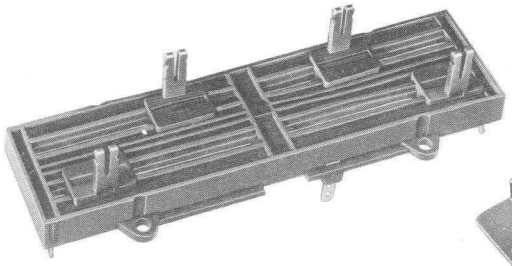


Fig. 16

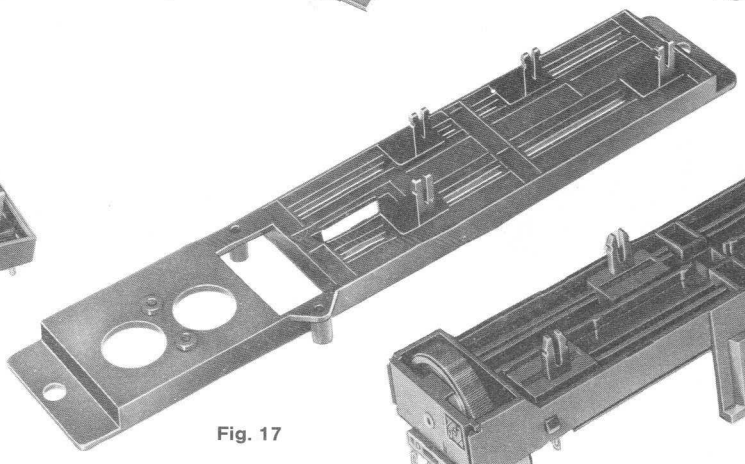


Fig. 17

Fig. 18

Potentiometers, carbon composition

Multiple slide potentiometers

Kind	Type	Fig. Nr.	Version	Dimensions in mm W	L	Slide length mm	Loading capacity	Resistance range
Quad-ruple	**810/17**	19	Open version with solder taps for wire connection. The base plate can be fitted with mains switch and earphone socket. With soldering terminal between pot. I and pot. II.	104	130	40	0,4 W lin. 0,2 W log.	100 Ω ... 10 MΩ lin. 1 kΩ ... 10 MΩ log.
Quintuple + mains	**811/03**	20	Open version with solder taps for wire connections. Dust-protected by cover plate. Two-pole mains switch. Latch mounting.	75	90	40	0,4 W lin. 0,2 W log.	100 Ω ... 10 MΩ lin. 1 kΩ ... 10 MΩ log.
Triple + mains	**811/13**	21	Open version with soldering taps for wire connections. Two-pole mains switch.	52	112,5	40	0,4 W lin. 0,2 W log.	100 Ω ... 10 MΩ lin. 1 kΩ ... 10 MΩ log.
Triple + mains	**811/04**	22	Open triple version with solder taps for wire connection and two-pole mains switch.	55	126	58	0,4 W lin. 0,2 W log.	100 Ω ... 10 MΩ lin. 1 kΩ ... 10 MΩ log.
Quintuple + mains	**811/07**	23	Open potentiometer version with solder taps for wire connection. Slide potentiometers dust-protected by cover plate. Two-pole mains switch, pulse switch and indicator lamp.	75	125	40	0,4 W lin. 0,2 W log.	100 Ω ... 10 MΩ lin. 1 kΩ ... 10 MΩ log.

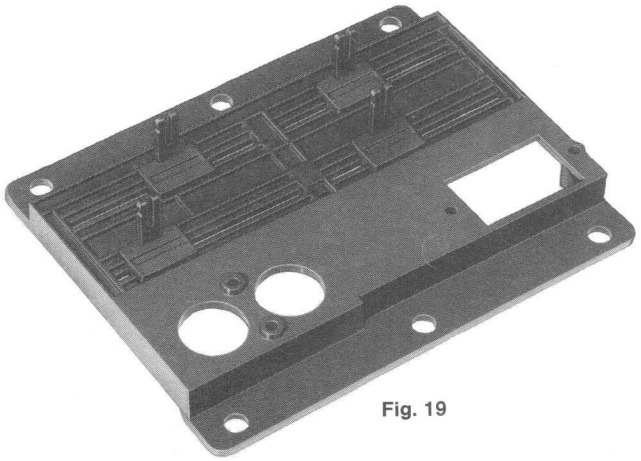


Fig. 19

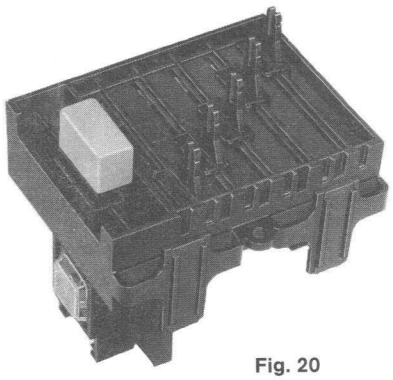


Fig. 20

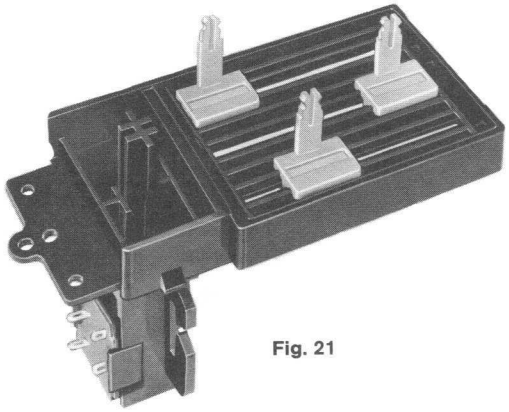


Fig. 21

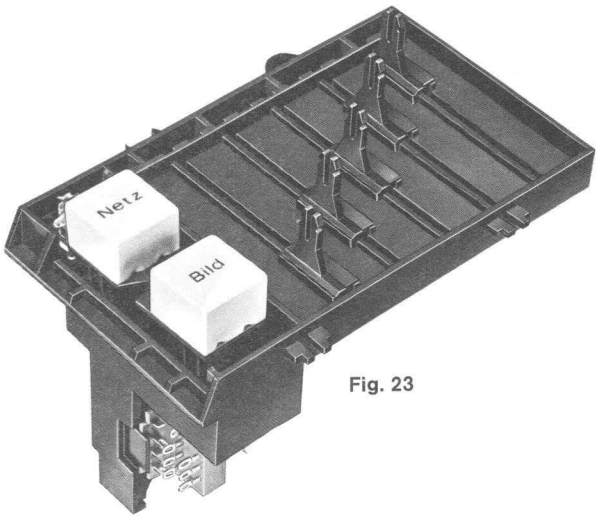


Fig. 23

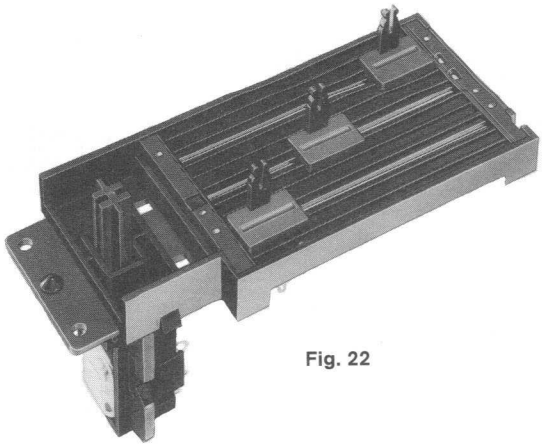


Fig. 22

Potentiometers, carbon composition

Single and multiple trim potentiometers and film potentiometers

Kind	**Type**	Fig. Nr.	**Version**	Dimensions in mm W	H	Loading capacity	Resistance range
Single	**880/03**	24	Closed and dust-protected version for printed circuits. The trim potentiometer is designed for circuits with high critical voltages, e.g. as vocus control in color TV sets.	37,5	43	1,0 W lin. 0,5 W log.	100 Ω...10 MΩ lin. 1 kΩ...10 MΩ log.
Single	**899/03**	25	Open version for printed circuits. The trim potentiometer can be supplied either with metal or carbon contact. Snap-in connection lugs and tapping at ½ rotary range with soldering tap for wire connection possible.	20,5	30,3	0,3 W lin. 0,15 W log.	100 Ω...10 MΩ lin. 1 kΩ...10 MΩ log.
Single	**895/03**	26	Open version for printed circuits. Can be operated from both sides by means of plug-in shaft or screwdriver. The trim potentiometer is designed for circuits with high critical voltages.	27	33,5	0,4 W lin. 0,2 W log.	100 Ω...10 MΩ lin. 1 kΩ...10 MΩ log.
Triple	**812/03**	27	Closed version for printed circuits. Tappings possible at ½ rotary range respectively. The multiple trim potentiometer can be mounted offset behind each other in such a manner that they can be operated through the holes 5 mm in diameter	59	23	0,2 W lin. 0,1 W log.	100 Ω...10 MΩ lin. 1 kΩ...10 MΩ log.
Triple	**812/05**	28	Open version for printed circuits. Tappings at ½ rotary range respectively with solder taps for wire connection possible. The multiple trim potentiometers can be supplied with either a metal or carbon contact.	65,5	30,3	0,3 W lin. 0,15 W log.	100 Ω...10 MΩ lin. 1 kΩ...10 MΩ log.
Quad-ruple	**812/10**	29	Closed potentiometer version for printed circuits. Tappings possible at ½ rotary range respectively. Can be operated from both sides by means of plug-in shaft or screwdriver. The multiple trim potentiometers can be mounted behind each other, offset in such a manner that they can be operated through the 5 mm ⌀ holes.	79	23	0,2 W lin. 0,1 W log.	100 Ω...10 MΩ lin. 1 kΩ...10 MΩ log.
Quad-ruple	**809/01**	30	Open version with soldering taps for wire connections. Two-pole mains switch. Thanks to the constructional design the mains switch may be fitted behind one of the four film potentiometers.	102,5	24	0,2 W lin. 0,1 W log.	100 Ω...10 MΩ lin. 1 kΩ...10 MΩ log.

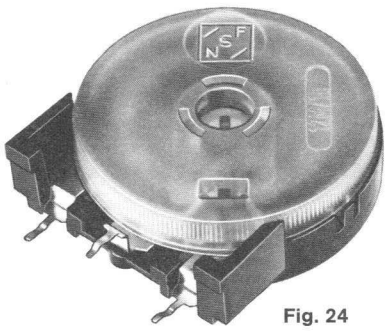


Fig. 24

Fig. 25

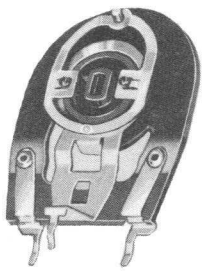


Fig. 26

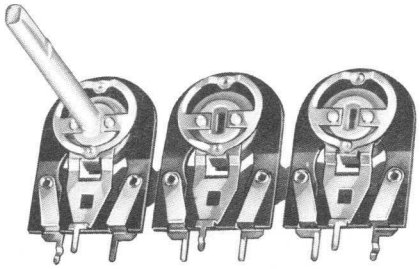


Fig. 28

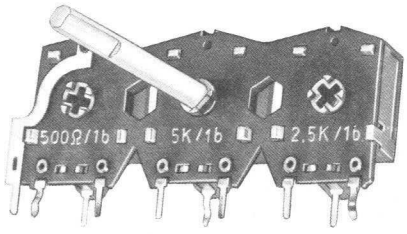


Fig. 27

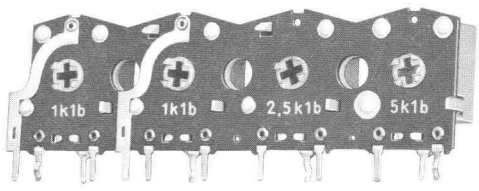


Fig. 29

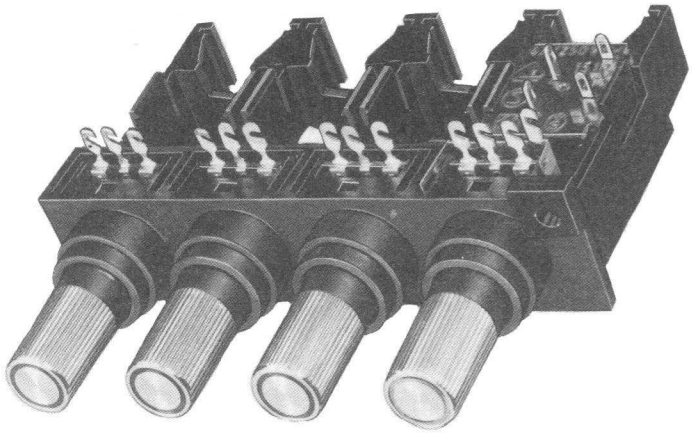


Fig. 30

Potentiometers, carbon composition

Multiple film potentiometers

Kind	**Type**	Fig. Nr.	**Version**	Dimensions in mm L x W x H	Loading capacity	Resistance range
Quin-tuple	**808/02**	31	Open version, may be integrated with other components on the circuit board. Can be operated from both sides by means of plug-in shaft or screwdriver. Wiper contact: Carbon or metal cap. Climatic/Humidity category: HSF.	132 x 32 x 18,4	0,2 W lin. 0,1 W log.	100 Ω ... 10 MΩ lin. 1 kΩ ... 10 MΩ log.
Quin-tuple	**808/03**	32	Open version, may be integrated with other components on the circuit board. Can be operated from both sides by means of plug-in shaft or screwdriver. Wiper contact: Carbon or metal cap. Climatic/Humidity category: HSF.	83 x 29,5 x 18,4	0,2 W lin. 0,1 W log.	100 Ω ... 10 MΩ lin. 1 kΩ ... 10 MΩ log.
Quad-ruple	**790**	33	Open version with connecting cable, may be intergrated with other components on the circuit board. Can be operated from both sides by means of plug-in shaft or screwdriver. Wiper contact: Metal cap, by reguest: carbon. Climatic/Humidity category: HSF	65,5 x 51 x 18,4 (without cable)	0,2 W lin. 0,1 W log.	100 Ω ... 10 MΩ lin. 1 kΩ ... 10 MΩ log.

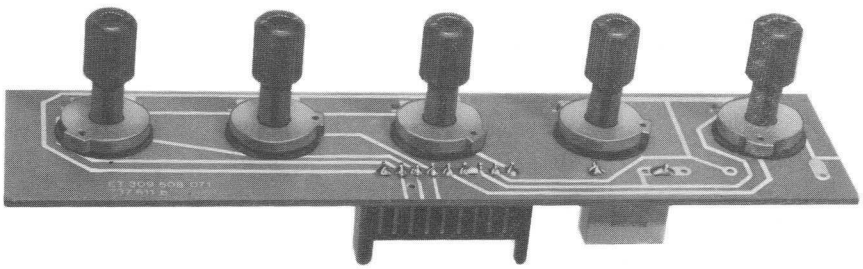


Fig. 31

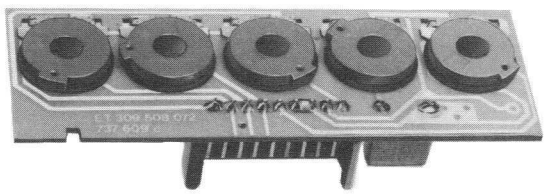


Fig. 32

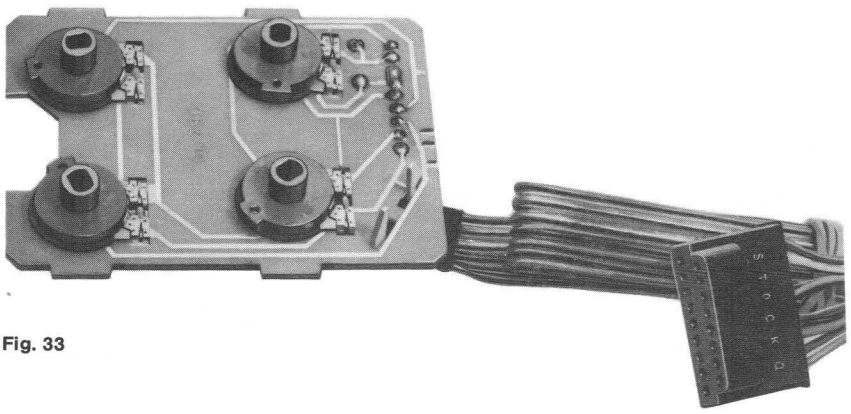


Fig. 33

Resistor cores

Type	Fig. Nr.	Version	Loading capacity	Notes
750/01	34	Resistor track with plug connection. Material: Phenol laminated paper. Number of resistor tracks to customer order.	–	Resistance range and dimensions on enquiry.
750/02	35	Resistor track with contact pin connection. Material: Phenol laminated paper. Number of resistor tracks to customer order.	–	Resistance range and dimensions on enquiry.
827/01	36	Flexible resistor core. Radius of bend $\geq$ 20 mm. Climatic/Humidity category: HSF (GND possible). Non-linear resistance characteristic to order (e. g. diode characteristic).	0,4 W	Resistance range: 1 kΩ ... 25 kΩ lin. Linearity tolerance: max. ± 5 % above 1 mm on resistor track.
827/02	37	Potentiometer plate. Material: Phenol laminated paper 0,8 mm thick. Contact pins: CuZn silver-plated and passivated for soldering. Climatic/Humidity category: JSG Application example: Precision resistor for measuring purposes.	$<$ 1 mA $\leq$ 8 V	Linearity tolerance: max. ± 1,5 % referred to $R_{ges.}$

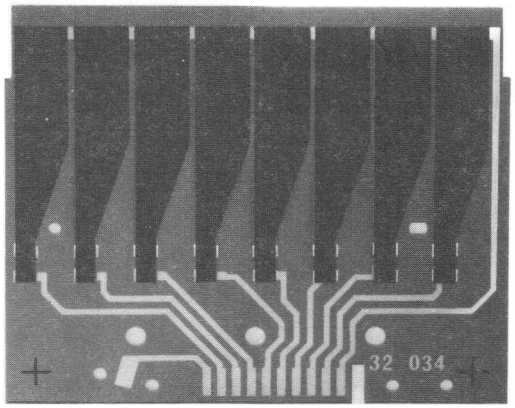
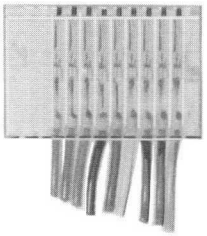


Fig. 34



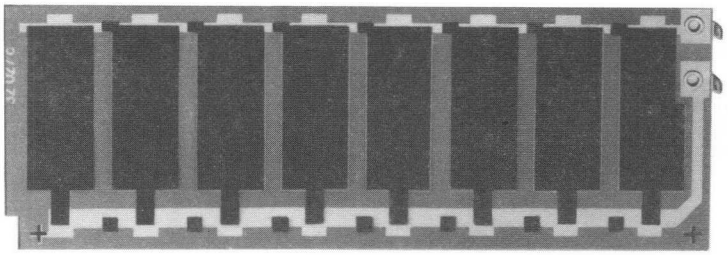


Fig. 35

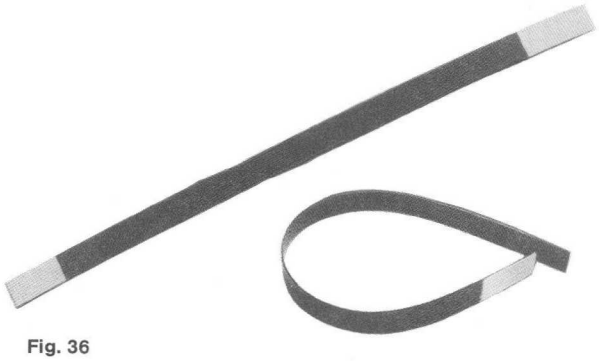


Fig. 36

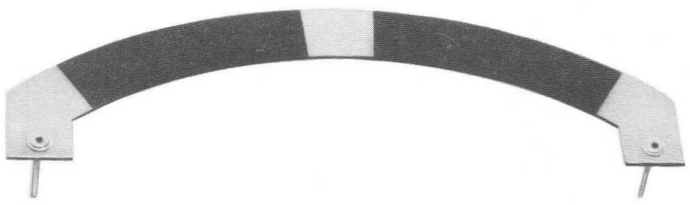


Fig. 37

Switches and jacks

Combination connection jack

Type	Fig. Nr.	Version	Dimensions in mm WxHxD	Loading capacity
301	38	Jack-switch combination a) Earphone jack. Material: CuZn, bright nickel plated. b) Tape recorder jack. Transit resistance $< 10\ m\Omega$ c) Switch 1x On. Transit resitance $< 10\ m\ \Omega$ Contact points hard silver-plated and passivated.	40,2 x 14 x 20,2	3 A 34 V 2 A 34 V

Built-in mains switches

Type	Fig. Nr.	Version	Rated load	Rated switching power
227	39	Double pole mains switch with single latching.	4 A 250 V~ (VAC)	64 A in accordance with VDE 0860
267	39	This switch corresponds to type 227, but has an additional single-pole low voltage changeover switch or single-pole momentary switch (operated by over stroke).	4 A 250 V~ (VAC)	64 A in accordance with VDE 0860
268	40	Mains changeover switch with single-pole low voltage change-over switch and single latching.	4 A 250 V~ (VAC)	64 A in accordance with VDE 0860

Coding switch

285	41	Coding: 2 digits, BCD and special versions.	50 mA 50 V~	–

Touch, pulse and service switches

880	42	Single or double-pole change-over switch. Single latching possible.	–	500 mA 12 V~ 50 mA 220 V~
274	43	Pulse switch, pin connections for lying or upright mounting.	–	500 mA 12 V~ 50 mA 220 V~
269	44	Three-pole service switch, switching angle 90°	50 mA (for contact transfer resistance) $<100\ m\Omega$).	1 mA 700 V~ 1 A 12 V

Switch base plate

713	45	Single-pole switch base plate (max. 32 switches). Switching movement 0.2 . . . 0.5 mm, Switching force 1.4 . . . 2 N	–	–

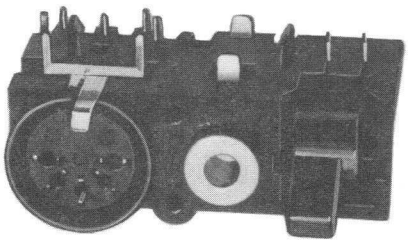


Fig. 38

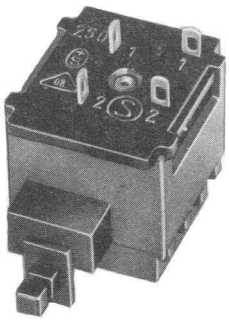


Fig. 39

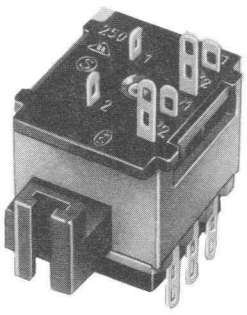


Fig. 40

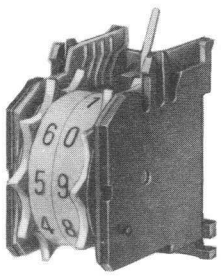


Fig. 41

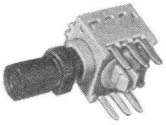


Fig. 42

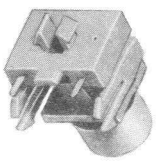


Fig. 43

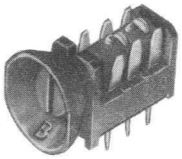


Fig. 44

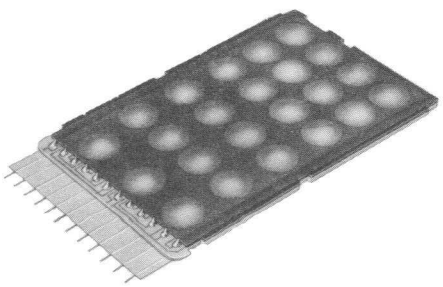
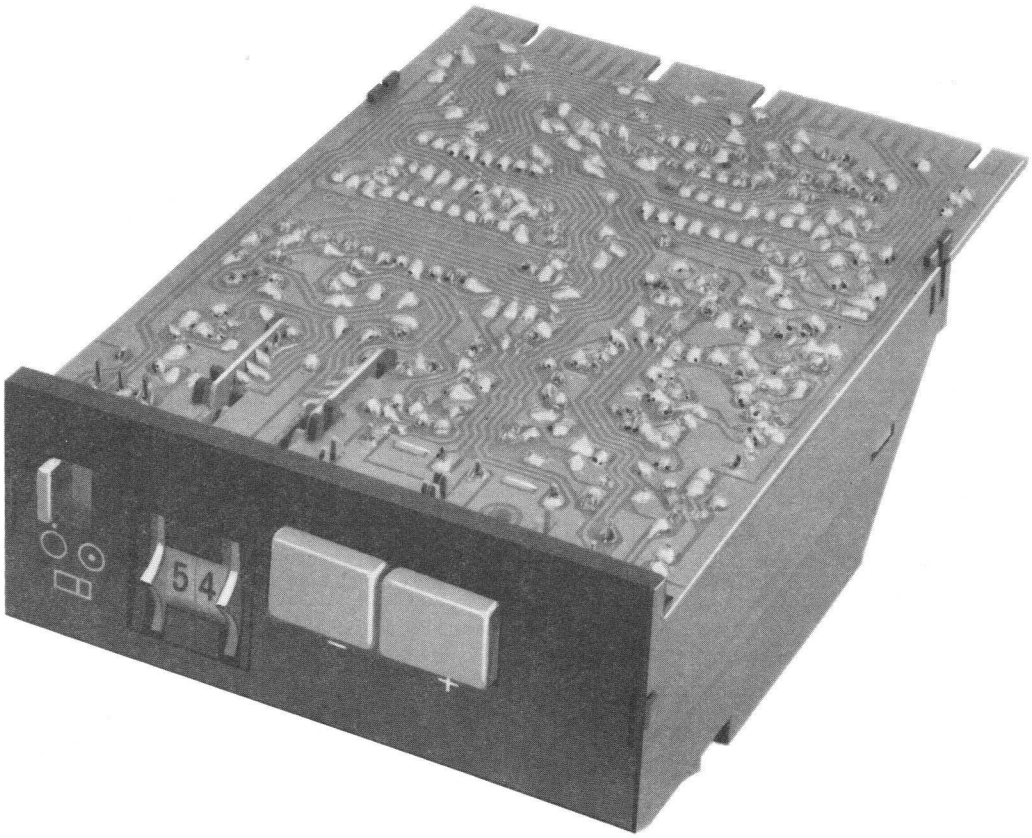


Fig. 45

Tuning units

Digital program memory

Type	Function	Version
219	Digital program memory for frequency synthesis with PLL.	Memory points for 16 TV programs. Direct channel selection with crystal-governed accuracy. Connection for binary coded or sequential remote control. Seperate fine tuning ± 4 MHz for all 16 programs with memory point.



Tuning units

Tuners

Type	Fig. Nr.	Function	Description
173	1	UHF diode tuner.	Image frequency rejection ≧53 dB. UHF up to channel 68. Available on special order with IF post amplifier. Especially designed for British standards and CCIR. Optionally with band pass filter.
176	2	Diode tuner for VHF and UHF, flat design. Common 75 ohm antenna input.	Various antenna inputs possible. Mounting socket can be supplied. UHF up to channel 68. Standards: CCIR, South Africa.
185	2	Large signal diode tuner for VHF and UHF. Common 75 ohm antenna input.	VHF with tuned input stage and dual-gate-MOS-FET in input stage and mixing stage. UHF up to channel 69. Image frequency rejection typically 50 dB. Mounting socket is available. Standard: CCIR.
187	2	Diode tuner for VHF and UHF, flat design. Common 75 ohm antenna input.	Mechanically and electrically exchangeable with type 176. Standards: Australia and OIRT.
188	2	Diode tuner for VHF and UHF, flat design. Common 75 ohm antenna input.	Mechanically and electrically exchangeable with type 176. Standards: Italy and CCIR.
191	3	VHF diode tuner for cable television.	Double mixing principle: extremely low interfering voltage at antenna input (≦ 28 dB µV). Reception range: 47 ... 300 MHz without band switching.
193	4	Large signal diode tuner for VHF and UHF. Common 75 ohm antenna input with isolating capacitors conformable to VDE.	PIN control. MOS-FET in VHF preselector and mixer stage. High-current preselector stage for UHF. Fully interchangeable with type 185. Standard: CCIR.
196	5	VHF tuner for French standard.	Input with tuned preselector circuit. Mixer stage contains MOS-FET. French and CCIR standards.
197	6	VHF tuner for French standard.	Especially good noise and selection properties. Standards: Optionally French or French + CCIR.
201	7	Large-signal tuner for VHF and UHF.	As type 193 but with antenna transformer instead of isolating capacitors (VDE).
202	8	UHF tuner.	Image frequency suppression >53 dB. UHF up to channel 69. PIN control. Especially for British standard + CCIR.
203	8	VHF tuner.	Good selection features and high suppression of cross modulation through tuned input circuit and MOS-FET input and mixer stage. Standard: CCIR.
206	4	Large-signal tuner for VHF and UHF. Common 75 ohm antenna input.	As type 193 but for Italian standard + CCIR.
207	9	Large-signal tuner for PLL channel tuning.	RF section identical with type 193. Incorporated frequency divider for operation with digital program memory type 219. Standard: CCIR
208	4	Cable TV tuner with UHF section. Common 75 ohm antenna input.	Mechanically and electrically exchangeable with type 193. Range I: CCIR channels (Band I) and special channels (47 ... 116 MHz). Range II: CCIR channels (Bd. III) and special channels (110 ... 300 MHz). Range III: UHF channels (470 ... 860 MHz).
209	9	Cable TV tuner with UHF section for PLL channel tuning.	RF section identical with type 208 but with incorporated frequency divider for operation with digital program memory.
210	9	Large-signal tuner for PLL channel tuning.	As type 207 but for Italian standard + CCIR.
213	7	Large-signal tuner for VHF and UHF. Common 75 ohm antenna input.	As type 206 but with antenna transformer instead of isolating capacitors (VDE).
214	10	Large-signal tuner for PLL channel tuning.	As type 207 but with antenna transformer instead of isolating capacitors (VDE).

Tuning Units

Tuners

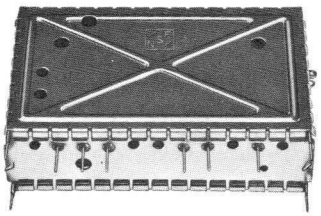


Fig. 1

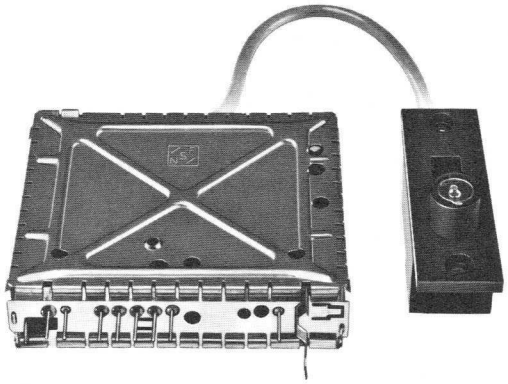


Fig. 2

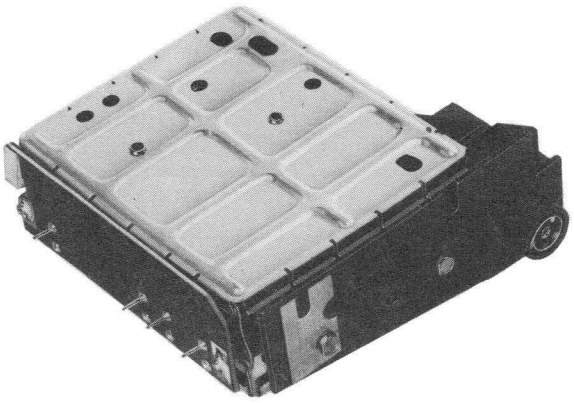


Fig. 3

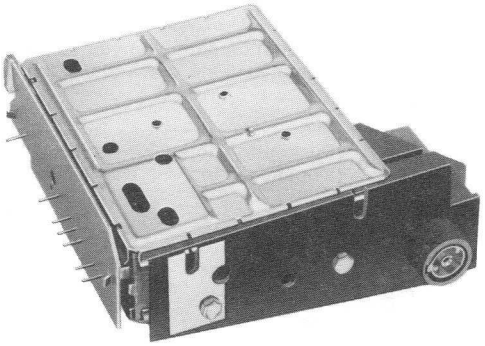


Fig. 4

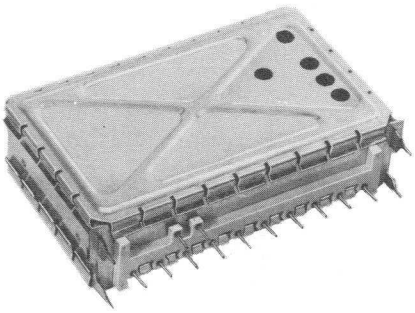


Fig. 6

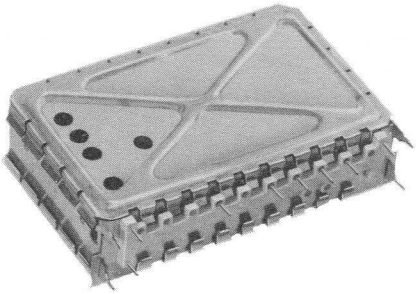


Fig. 5

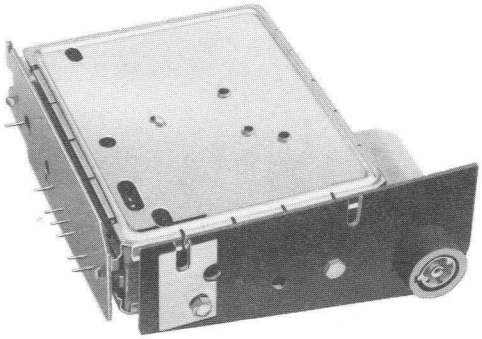


Fig. 7

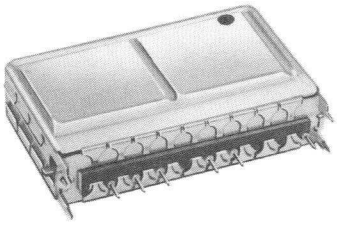


Fig. 8

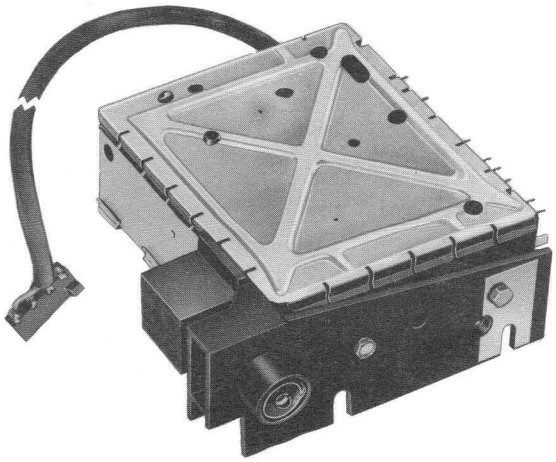


Fig. 9

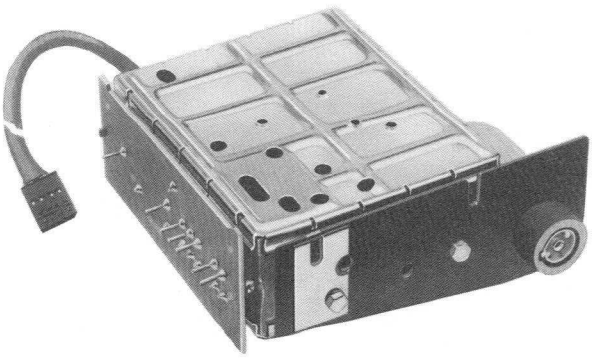


Fig. 10

Tuning units

Electronic program memories

Type	Fig. Nr.	Function	Description
174 RF	11	Electronic program memory unit for station selection in the VHF (FM) band.	Seven memory points, memory point No. 8 for the main tuning scale. Program indication by illumination of the integrated contact panels.
174 BR	12	Electronic band switch for selection of broadcasting bands.	Memory points for six different bands (e.g. SW, MW, LW, VHF (FM), pick-up, tape recorder). Automatic silent tuning. Indication of selected range by illumination of the integrated contact panels.
184 FS	13	Electronic program memory for station selection in the VHF and UHF range.	This electronic program memory is available with 8, 12, 16 or 24 positions. Convertible for remote control. Various designs and mounting possibilities. Tuning knobs can be pulled out.

Pushbutton potentiometers

Type	Fig. Nr.	Function	Description
050	14	Pushbutton potentiometer for station selection in the VHF and UHF range.	This pushbutton unit is supplied with 6 positions, but 4 or 5 position versions are also available. The unit can be supplied with an AFC-switch. Flame retarding material on request. Various designs.
078	15	Pushbutton potentiometer for station selection in the VHF and UHF range.	This pushbutton unit is available with 6 or 7 positions. Various designs available on request, flame retarding material optional.

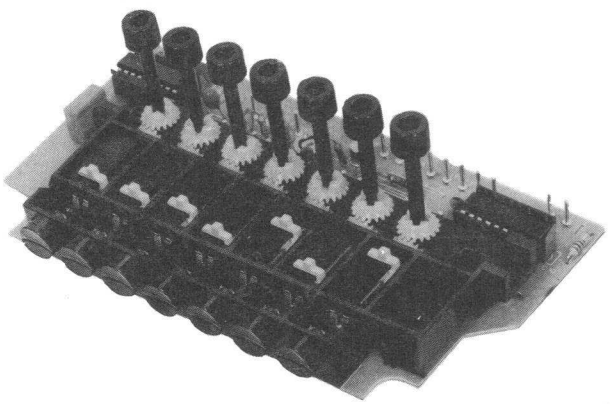


Fig. 11

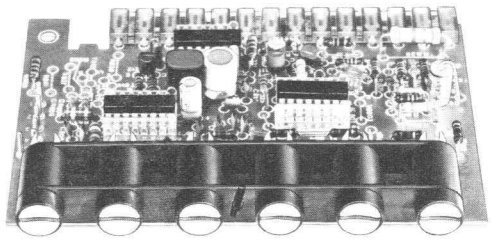


Fig. 12

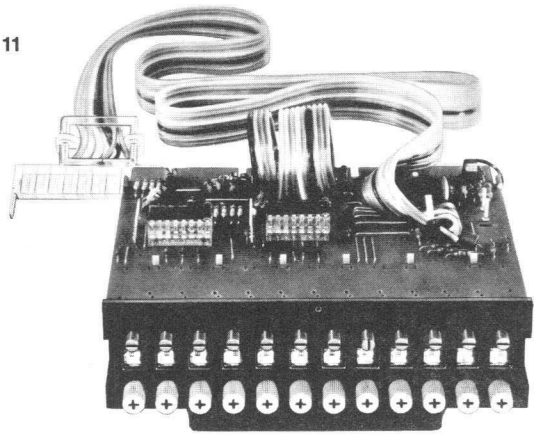


Fig. 13

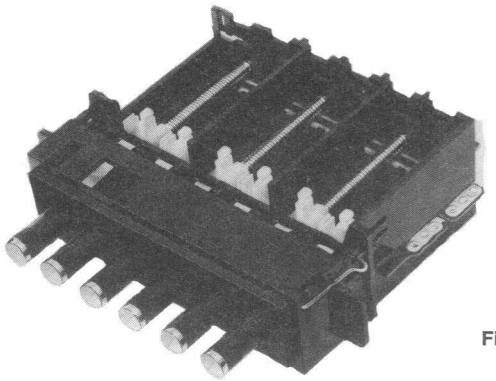


Fig. 14

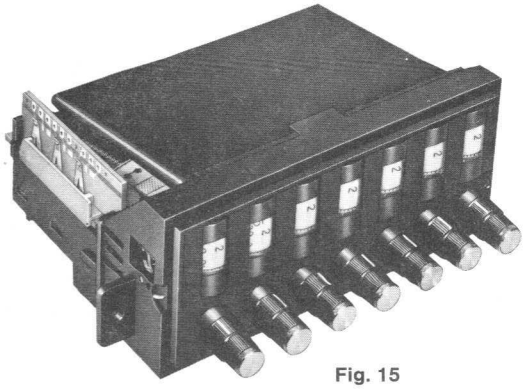


Fig. 15

Printed circuits

Introduction

The continuing integration on electronic functions in the smallest possible space requires miniaturization on the conductor pattern. At the same time, the power requirements of electronic circuits is steadily decreasing. The result of these developements is the requirement for conductor widths as low as 0,2 mm and conductor spacing which can be reduced to 0,25 mm for the supply voltages between 12 and 30 V generally used today.

The conventional printing and etching techniques have today reached such a high quality that they can satisfy all requirements of circuit technology.

The limits of these techniques are today generally determined by the quality of the base material, such as the adhesive qualities of the conductors, particularly during welding, and by the furthur processing of printed circuit boards. In this area, AEG-TELEFUNKEN, in close cooperation with the manufacturers of basis materials such as, for example, the AEG Isolier- und Kunststoff GmbH in Kassel, and with a multitude of users in all areas of electronics, has gathered a wide range of know kow.

Production Programs

1. Standard Techniques

Technique I
Printing-etching technique with single-sided (or double-sided) conductors made of copper, but without through-plating of holes.

Technique II
Through-plated printed circuit boards with conductors on both sides.

Technique III
Through-plated printed circuit boards with conductors on both sides, but with selective galvanic tinning of soldering holes and additional solder masks for selective soldering.

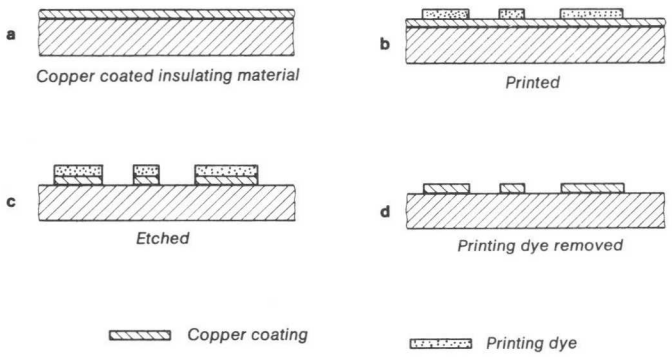
Technique V
Printing circuit boards with conductors on one (or both) sides and additional galvanic coating of the surface but without through-plating.

2. Special Techniques

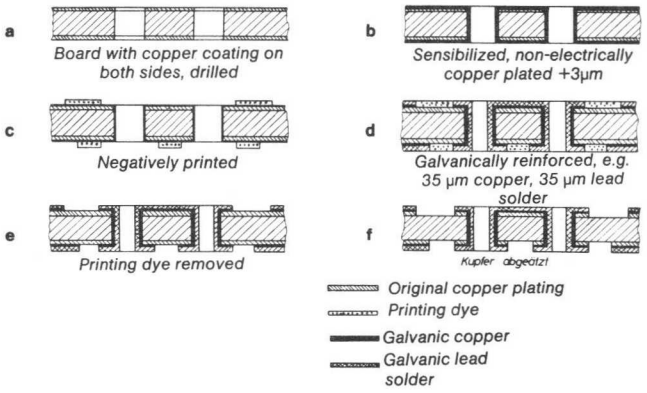
Multi-layer printed circuit boards

Semi-additive technique.

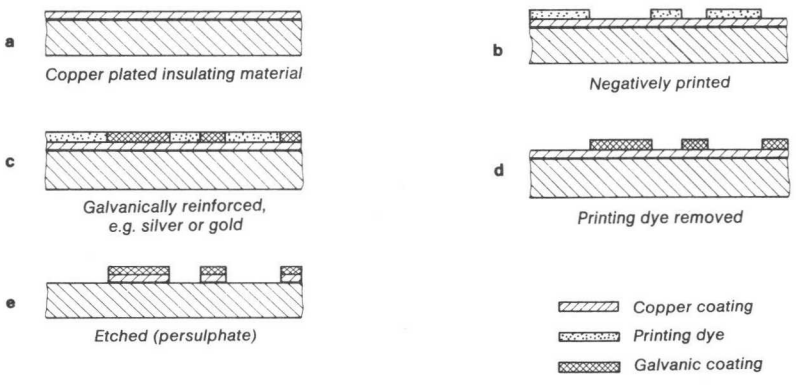
Technique I (Printing – Etching Technique)



Technique II



Technique V



Printed circuits

Versions of the printed circuit

Technique Version	Conductors on one or two sides	Conductor with mm	Possible galvanic coating			Through-plating	Possible additional masking by		
			Solder	Precious metal	Solder plus gold finger		Solder stop paint	Isulation masking paint	Service printing
Standard techniques Conductor with ≧ 0.2 mm									
I Silk screen printing	1 or 2	> 0,4	–	–	–	–	×	×	×
I Position silk screen printing	1 or 2	> 0,25	–	–	–	–	×		×
I Photographic method	1 or 2	0,2–0,4	–	–	–	–	×	×	×
II Silk screen printing	2	> 0,4	×	×	×	×	×°	×	×
II Position silk screen printing	2	> 0,25	×	×	×	×	×°	×	×
II Photographic method	2	0,2–0,4	×	×	×	×	×°	×	×
III Silk screen printing	2	> 0,4	*			×	×∞	×	×
III Position silk screen printing	2	> 0,25				×	×∞	×	×
III Photographic method		0,2–0,4				×	×∞	×	×
V Silk screen printing	1 or 2	> 0,4	×	×	×		×°	×	×
V Position silk screen printing	1 or 2		×	×	×		×°	×	×
V Photographic method	1 or 2	0,2–0,4	×	×	×		×°	×	×
Standard techniques Conductor with < 0.2 mm									
I Fine conductor printed circuit boards using the photographic method	1 or 2	< 0,2	–	–	–	–	×	×	×
II Fine conductor printed circuit boards using the photographic method	2	< 0,2	×	×	×	×	×	×	×
V Fine conductor printed circuit boards using the photographic method	2	< 0,2	×	×	×	–	×	×	×
Special techniques Conductor with ≧ 0.2 mm									
Multi-layer circuits:									
Photographic method	3–12 layers	0,2–0,4	×	×	×	×	×°	×	×
Semi-additive technique									
Silk screen printing	2	> 0,4	Galvanic reinforcement with			×	×	×	×
Photographic method	2	0,2–0,4	35 µm copper or with:			×	×	×	×
Special techniques Conductor with < 0.2 mm									
Semi-additive technique									
Thin conductor printed circuit boards using the photographic method	2	< 0,2	×	×	×	×	×°	×	×

Remarks: ° Except for the case of solder coatings; ∞ Also possible with solder coatings; * **Galvanic coatings:** holes and solder points = tin > 15 µm. Conductors and other surfaces = 5–12 µm, e.g. nickel or tin or silver

Technical Data for Printed Circuits Drawing

Drawing number without change index

1. Details of drawing – printed circuits –

(Check the appropriate items)

1.1 Grid dimensions ☐ 2.5 mm ☐ 2.54 mm

1.2 Coating ☐ one-sided ☐ both sided

1.3 Holes ☐ not through-plated ☐ through-plated

1.4 The drawing – printed circuits – is shown as viewed on the conductor pattern of the soldering side L

1.5 Conductors on soldering side L: full lines, red or black ..... ☐

1.6 Conductors on component side B: dotted lines, green ..... ☐

1.7 Earth surface ..... ☐

or

The conductor pattern can be reproduced from film only if electrical parameters (C, L, R, Z) are affected. ..... ☐

1.8 Surface which is kept free of conductors and markings on both sides

1.9 Holes and solder points

Identifier	Hole ⌀		Solder point ⌀ Side		Number of holes
	Not through-plated	Through-plated	L	B	approx.
Without	±	±	≧	≧	
a	±	±	≧	≧	
b	±	±	≧	≧	
c	±	±	≧	≧	
d	±	±	≧	≧	
e	±	±	≧	≧	
f	±	±	≧	≧	
g	±	±	≧	≧	
h	±	±	≧	≧	
k	±	±	≧	≧	

1.10 Conductors Identifier

Identifier	Conductor widths
Without	
A	
B	
C	
D	
E	

☐ Sharp corners ☐ Rounded corners

☐ Sharp or rounded corners

1.11 Insulating spacing

Identifier	Insulation spacing
Without	≧
Y	≧
Z	≧

2. Materials

2.1 Base material

Thickness | Tolerance class | Copper coating µm

2.2 Metal reinforcement .....

2.3 Insulation paint (masking paint) for B side

2.4 Marking paint (additional lettering) B side

2.5 Solder stop point (solder masking paint) for L side .....

2.6 Protective paint for L side .....

2.7 Pre-tinning .....

2.8 Test strips .....

3. Production technology

3.1 Residual ring width .....

3.2 Displacement between insulation printing and holes .....

3.3 Displacement of information printing to holes

3.4 Displacement of solder stop printing to holes

3.5 Perimeter treatment .....

3.6 Further supply and delivery conditions 01 1409

4. Comments

	Name	Date
Written		
Handled		
Checked		
Standard		

AEG-TELEFUNKEN

Printed circuits

Technical data

Consists of ..... sheets

Sheet number

PT-No. T

Replaces

Replaced by

P-No.

Changes before release	No.	Change condition	Change notice	Date	Name

Total additions

Page	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Addition																														

Address:

Company:

Dept.:

Name:

Address:

Please send data sheets of the following types:

Date Signature

Address:

Company:

Dept.:

Name:

Address:

Please send data sheets of the following types:

Date Signature

Address:

Company:

Dept.:

Name:

Address:

Please send data sheets of the following types:

Date Signature

Short form catalogue
Tubes and
Sub-Assemblies

1978/79

AEG-TELEFUNKEN
Serienprodukte
Tubes and Sub-Assemblies
P.O.B. 4309

D-7900 Ulm

Short form catalogue
Tubes and
Sub-Assemblies

1978/79

AEG-TELEFUNKEN
Serienprodukte
Tubes and Sub-Assemblies
P.O.B. 4309

D-7900 Ulm

Short form catalogue
Tubes and
Sub-Assemblies

1978/79

Bauelemente für Elektronik und Nachrichtentechnik

Components for Electronics and Telecommunication Systems

Geschäftsbereich Röhren und Baugruppen

1. Röhren: Postfach 4309 · 7900 Ulm · ☎ (07 31) 19 11 ⫞ 7 12 601

Bildröhren für Schwarz/Weiß- und Farbfernsehgeräte	*Picture Tubes for Monochrome and Colour TV Sets*
Ablenkmittel für Fernsehbildröhren	*Deflecting Units for TV Picture Tubes*
Bauteile für Farbfernsehen	*Components for Colour TV Sets*
Mikrowellenröhren, Mikrowellen-Si-Dioden	*Microwave Tubes, Microwave Silicon Diodes*
Elektronenstrahlröhren für Oszilloskope	*Cathode-ray Tubes for Oscilloscopes*
Monitorröhren, Radarröhren	*Monitor Tubes, Radar Tubes*
Bildabtaströhren	*Flying Spot Tubes*
Bildwandlerröhren	*Image Converter Tubes*
Bildverstärkerröhren	*Image Intensifier Tubes*
Bildaufnahmeröhren, Fotozellen	*Camera Tubes, Photocells*
Stabilisatoren, Thyratrons, Kaltkathodenröhren	*Stabilizers, Thyratrons, Cold-cathode Tubes*
Gasentladungs-Anzeigeelemente	*Gas Discharge Display Elements*
Bildschirm-Module	*Display Modules*
Empfänger- und Verstärkerröhren	*Receiving and Amplifying Tubes*
Spezialverstärkerröhren	*Special-purpose Amplifying Tubes*
Senderöhren, Röntgenröhren	*Transmitting Tubes, X-ray Tubes*

2. Baugruppen: Postfach 144 · 8070 Ingolstadt 2 · ☎ (08 41) 8 20 11 19 ⫞ 055 875

Schaltdioden-Tuner	*Switch Diode Tuner*
Digitale und elektronische Programmspeicher	*Digital and Electronic Programme Memory*
Potentiometertasten	*Potentiometer Switching Units*
Leiterplatten	*Printed Circuits*
Schicht-Regelwiderstände und Schalter	*Potentiometers Carbon Composition and Switches*

Geschäftsbereich Halbleiter

Postfach 1109 · 7100 Heilbronn · ☎ (07 131) 88 21 ⫞ 7 28 746

Digitale integrierte Schaltungen	*Digital Integrated Circuits*
Lineare integrierte Schaltungen	*Linear Integrated Circuits*
Kundenspezifizierte Schaltungen in MOS-Technik	*Custom designed MOS-Circuits*
Transistoren und Dioden für Industrie- und Konsumanwendungen	*Transistors and Diodes for Industrial and Consumer Applications*
Optoelektronische Bauelemente	*Optoelectronic Devices*

Geschäftsbereich Passive Bauelemente

1. Vertrieb Kondensatoren und Schichtschaltungen
Postfach · 8500 Nürnberg 107 · ☎ (09 11) 27 71 ⫞ 06 22 551

Al-Elektrolytkondensatoren	*AL Electrolytic Capacitors*
Tantal-Kondensatoren	*Tantalum Capacitors*
Kunststoff-Folienkondensatoren	*Plastic foil Capacitors*
Dickschichtschaltungen	*Thick film Circuits*

2. Vertrieb Starkstromkondensatoren
Sickingenstraße 21 · 1000 Berlin 21 · ☎ (0 30) 3 93 81 ⫞ 81 847

Funk-Entstörmittel	*Noise suppressors*
MP-Kondensatoren für Gleichspannung	*Metallized paper (MP) capacitors d.c. applications*
Motor-Kondensatoren	*Motor capacitors*
Kondensatoren für Entladungslampen	*Capacitors for fluorescent lamps*
Glättungskondensatoren ab 1 kV	*Smoothing capacitors, ratings from 1 kV*
Leistungs-Kondensatoren	*Power capacitors*
Anlagenschutz-Kondensatoren	*Protection Capacitors*
Elektroprint-Papier	*Electroprint Paper*

AEG-TELEFUNKEN

Printed in Western Germany · Bestell-Nr.: S 7/V.3.53/0678