Television Tuners
Coaxial Aerial Input
Assemblies

BOOK DC03 1990

Philips Components

PHILIPS

PHILIPS

TELEVISION TUNERS
COAXIAL AERIAL INPUT ASSEMBLIES

SELECTION GUIDES

V.H.F./U.H.F. TUNERS			
	FE618Q	UV411 UV412	UV411HKM
System	CCIR: B, G, H	CCIR: B, G	CCIR: D
Channels			
v.h.f.	E2 to C* E5 to E12	N21 to C M4 to E12	C1 to C5 C6 to C12
u.h.f.	E21 to E69	E21 to E69	C13 to C57
Frequency ranges (MHz)	46 to 110 111 to 300 470 to 861	44 to 92 162 to 230 470 to 861	48 to 92 167 to 224 470 to 870
I.F. frequency (MHz)			
picture	38.9	38.9	37.0
sound	33.4	33.4	30.5
Divider ratio	256	256 or 64 (UV412 only)	–
Supply voltage	+ 12 V ± 10%	+ 12 V ± 10%	+ 12 V ± 10%
Tuning voltage	+ 0.8 to + 28 V	+ 1 to + 28 V	+ 1 to + 28 V
A.G.C. voltage	+ 2.5 V to + 7 V	+ 9.2 to + 0.85 V	+ 9.2 to + 0.85 V
Amplification, typical	–	26 dB	27 dB
Noise figure, typical	–	5 dB	5 dB
Overall dimensions l x w x h (mm)	147 x 20 x 55	95 x 23 x 77	95 x 23 x 77
Aerial input plug	IEC	phono or IEC	IEC
Meets Amtsblatt DBP69/1981	no	no	no
Page	15	67	83
	*cable: S01 to S1 S2 to S20		

V.H.F./U.H.F. TUNERS

	UV417/MK2 UV418/MK2	UV431	UV461 UV462	UV471 UV472	UV615S UV616S
System	CCIR: B,G	RTMA: M,N	CCIR: B,G	CCIR: I	CCIR: B,G,H
Channels v.h.f. u.h.f.	 E2 to C* E5 to E12 E21 to E69	 A2 to A6 A7 to A13 A14 to A83	 0 to 4 5 to 11 28 to 63	 4 to 13 21 to 69	 E2 to C* E5 to E12 E12 to E69
Frequency ranges (MHz)	47 to 111 111 to 300 470 to 860	55.25 to 83.25 175.25 to 211.25 471.25 to 885.25	45 to 101 101 to 222 526 to 814	– 174 to 254 470 to 860	46 to 110 111 to 300 300 to 470 470 to 860
I.F. frequency (MHz) picture sound	 38.9 33.4	 45.75 41.25	 38.875 31.375	 38.9 32.9	 38.9 33.4
Divider ratio	256 or 64 (UV418 only)	–	256 (UV462 only)	–	256 (UV616 only)
Supply voltage	+ 12 V ± 10%	+ 12 V ± 10%	+ 12 V ± 10%	+ 12 V ± 10%	+ 12 V ± 10%
Tuning voltage	+ 1 to + 28 V	+ 1 to + 28 V	+ 1 to + 28 V	+ 1 to + 28 V	+ 1 to + 28 V
A.G.C. voltage	+ 9.2 to + 0.85 V	+ 9.2 to + 0.85 V	+ 9.2 to + 0.85 V	+ 9.2 to + 0.85 V	+ 9.2 to + 0.85 V
Amplification, typical	18 dB	26 dB	24 dB	24 dB	40 dB
Noise figure, typical	8 dB	5 dB	7 dB	6 dB	6 dB
Overall dimensions l x w x h (mm)	 95 x 23 x 77	 95 x 23 x 77	 95 x 23 x 77	 95 x 23 x 77	 84 x 20 x 55
Aerial input plug	phono or IEC	phono	phono or IEC	phono	IEC
Meets Amtsblatt DBP69/1981	yes	no	no	no	yes
Page	99	111	127	143	157
	* cable: S01 to S1 S2 to S20				* cable + hyper-band: S01 to S1 S2 to S20 S21 to S41

UV617 UV618	UV711 UV712	UV711NZ UV712NZ	UV751 UV752
CCIR: B,G,H	CCIR: B,G	CCIR: B,G	OIRT: D,R
E2 to C* E5 to E12 E21 to E69	E2 to C M4 to E12 E21 to E69	NZ1 to E4 E5 to E12 E21 to E69	C1 to R5 C6 to R12 C13 to C57
46 to 110 111 to 300 470 to 860	46 to 84 162 to 225 470 to 860	44 to 84 174 to 225 470 to 860	46 to 84 165 to 228 470 to 860
38.9 33.4	38.9 33.4	38.9 33.4	38.0 31.5
256 (UV618 only)	256 or 64 (UV712 only)	256 (UV712 only)	256 (UV752 only)
+ 12 V ± 10%	+ 12 V ± 10%	+ 12 V ± 10%	+ 12 V ± 10%
+0.8 to +28 V	+ 1 to +28 V	+ 1 to 28 V	+ 1 to + 28 V
+9.2 to +0.85 V	+9.2 to 0.85 V	+9.2 to 0.85 V	+9.2 to +0.85 V
40 dB	40 dB	40 dB	40 dB
6 dB	8 dB	8 dB	8 dB
84 x 20 x 55	66.2 x 20 x 38	66 x 20 x 38	66 x 20 x 38
IEC	IEC or phono	IEC or phono	IEC or phono
yes	no	no	no
169	181	193	205
* cable: S01 to S1 S2 to S20			

V.H.F./U.H.F. TUNERS

	UV815 UV816	UV915E UV916E	UV933 UV934	UV935 UV936
System	CCIR B,G,H,I I′,L,L′	CCIR B,G,H,I I′,L,L′	RTMA M,N	RTMA M,N
Channels v.h.f.	E2 to C* E5 to E12	E2 to C* E5 to E12	2 to 13	2 to 13*
u.h.f.	E21 to E69	E21 to E69	14 to 83	14 to 69
Frequency ranges (MHz)	46 to 170 170 to 450 450 to 860	46 to 170 170 to 450 450 to 860	55 to 212 470 to 886	55 to 158 450 to 802
I.F. frequency (MHz) picture sound	 – –	 – –	 45.75 41.25	 45.75 41.25
Divider ratio	256 or 64 (UV816 only)	256 or 64 (UV916E only)	–	–
Supply voltage	+ 12 V ± 10%	+ 12 V ± 10%	+ 12 V ± 10%	+ 12 V ± 10%
Tuning voltage	+ 0.7 to + 28 V	+ 0.7 to + 28 V	+ 0.3 to + 28 V	+ 0.3 to + 28 V
A.G.C. voltage	+ 9.2 to + 0.85 V	+ 9.2 to + 0.85 V	+ 9.2 to + 0.85 V	+ 9.2 to + 0.85 V
Amplification, typical	40 dB	40 dB	40 dB	40 dB
Noise figure, typical	7 dB	8 dB	8 dB	7 dB
Overall dimensions l x w x h (mm)	84 x 20 x 54	62 x 20 x 46	62 x 20 x 46	62 x 20 x 46
Aerial input plug	IEC/SNIR	IEC/phono	IEC, phono or balanced	IEC or phono
Meets Amtsblatt DBP69/1981	yes	yes	no	no
Page	217	235	247	261
	* cable S01 to S10 S11 to S39 S40 to S41	* cable S01 to S10 S11 to S39 S40 to S41		* cable A-2 to 65

UV963 UV964	UV983 UV984
CCIR B,G,H	Japanese M
0 to 5 SA to 12 21 to 69	J1 to J3 J4 to J12 J13 to J62
46 to 103 138 to 225 470 to 860	91 to 104 170 to 218 470 to 766
38.875 31.375	58.75 54.25
–	–
+ 12 V ± 10%	+ 12 V ± 10%
+ 0.3 to + 28 V	+ 0.3 to + 28 V
+ 9.2 to + 0.85 V	+ 9.2 to + 0.85 V
40 dB	40 dB
8 dB	8 dB
62 x 20 x 46	62 x 20 x 46
IEC or phono	phono or balanced
no	no
273	287

	V.H.F. TUNERS	U.H.F. TUNERS		
	V431	SFE212	U743/U744	U943/U944
System	RTMA: M,N	D2-MAC	CCIR: I	CCIR: I
Channels	A2 to A6 A7 to A13	*	E21 to E69	E21 to E69
Frequency ranges (MHz)	54 to 88 174 to 216	950 to 1750	470 to 860	470 to 860
I.F. frequency (MHz)		479.5		
picture	45.75		39.5	39.5
sound	41.25		33.5	33.5
Divider ratio	–	–	256 (U744 only)	–
Supply voltage	+ 12 V ± 10%	+ 12 V ± 10%	+ 12 V ± 10%	+ 12 V ± 10%
Tuning voltage	+ 1 to + 28 V	+ 0.8 to + 28 V	+ 1 to + 28 V	+ 0.7 to + 28 V
A.G.C. voltage	+ 9.2 to + 0.85 V	–	+ 9.2 to + 1 V	+ 9.2 to + 1 V
Amplification, typical	26 dB	–	40 dB	40 dB
Noise figure, typical	5 dB	10 dB	6.5 dB	7 dB
Overall dimensions l x w x h (mm)	95 x 23 x 77	145 x 22 x 55	66 x 20 x 38	66 x 20 x 38
Aerial input plug	phono	IEC	phono or IEC	phono or IEC
Page	301	29	43	55

* Channels 1 to 40 according to WARC77.

COAXIAL AERIAL INPUT ASSEMBLIES

With mains separation

Frequency range	40 to 890 MHz
Impedance	75 Ω asymmetrical
Input connector	meets the demands of IEC 169.2 and DIN 45325 (dia. 9,5 mm), and of SNIR (dia. 9,0 mm)
Safety requirements	IEC 65; approbation approvals have been received or sought from BSI, DEMKO, EI, FEMKO, KEMA, LCEE, NEMKO, SEMKO, SEV and VDE.

cable length mm	insertion loss at frequency MHz	insertion loss dB	catalogue number	page
90 145 250	40–700 700–890	$\leqslant$ 1,5 $\leqslant$ 2	3122 127 01240 3122 127 03500* 3122 127 05900	319
–	40–890 50–230 470–850	$\leqslant$ 1 $\leqslant$ 1 $\leqslant$ 1	3122 127 10260 3122 127 10450	323
–	50–230 470 850	$\leqslant$ 1 $\leqslant$ 1 $\leqslant$ 1,5	3122 127 14730	323
–	40–300 470–890	$\leqslant$ 1 $\leqslant$ 1	3122 127 21300**	329
–	40–230 230–300 470–890	$\leqslant$ 1 $\leqslant$ 1,5 $\leqslant$ 1,5	3122 127 24140	335

* These assemblies comply with the requirements of immunity from radiated interference of Amtsblatt DBP69/1981.

** This assembly complies with the requirements of immunity from radiated interference of BS905.

Pin Compatibility

All tuners of our 600-series and 700-series, and the tuner parts of our 600-series front-ends are pin-compatible, i.e. the pins for the same function are situated at the same place. However, the position of the mounting tab at the aerial input side of the tuners in the 700-series (MT4) is different, because these tuners are smaller. For this reason these tuners are also available with a longer aerial connector for interchangeability purposes. The front-ends have an extra mounting tab (MT3).

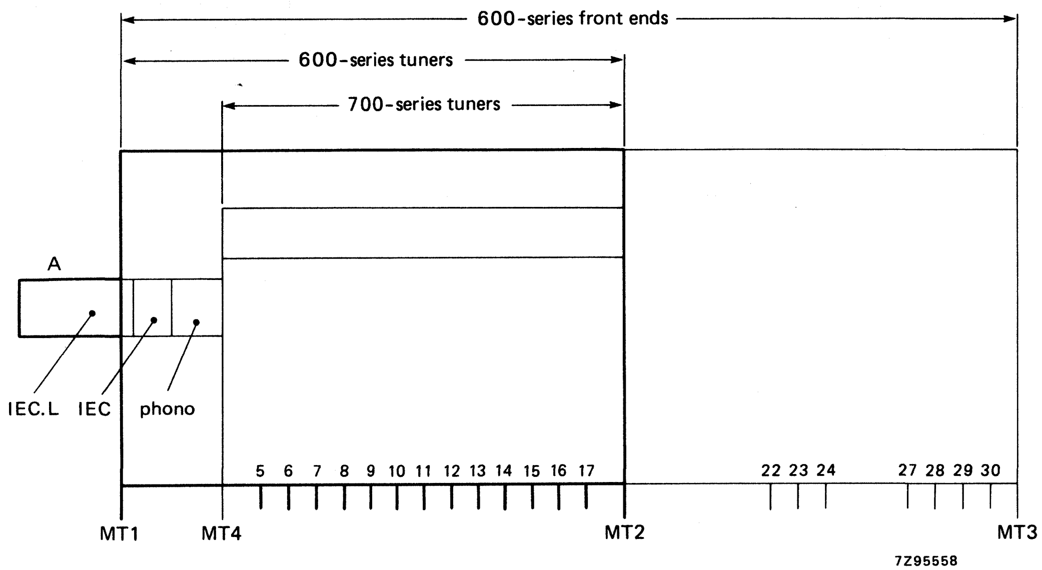


Fig.10 600/800 and 700/900 series.

Terminal designation		deviations	
Tuners and front end		700/900 series	800 series (PLL)
A	= aerial input connector		
5	= AGC voltage		
6	= supply voltage, + 12 V		
7	= supply voltage, low VHF, + 12 V		low band switch input } 815/6 divider
8	= supply voltage, high VHF, + 12 V		mid band switch input } 815/6 divider
9	= supply voltage, hyperband, + 12 V		
10	= supply voltage, UHF, + 12 V		high band switch input
11	= tuning voltage		
12	= supply voltage, frequency divider, + 5 V		supply voltage + 5 V
13, 14	= balanced output voltage of freq. divider		serial clock line I^2C-bus
15	= earth		address selection/switch mode
16, 17	= IF output	16 = earth	

Front ends only

22	= switching voltage AGC
23	= AFC output
24	= IF sound
27	= earth
28	= video output
30	= supply voltage, IF, demodulation part, + 12 V

Mounting tabs

600/800 series tuners	MT1, MT2
700/900 series tuners	MT4, MT2
600/600 series front ends	MT1, MT2, MT3

TELEVISION TUNERS

VHF / UHF TELEVISION TUNER AND IF DEMODULATOR

QUICK REFERENCE DATA

Systems	CCIR systems B, G and H	
Channels	off-air	cable
low VHF	E2 to C	S01 to S1
high VHF	E5 to E12	S2 to S20
UHF	E21 to E69	
Intermediate frequencies		
picture	38.90 MHz	
colour	34.47 MHz	
sound 1	33.40 MHz	
sound 2	33.16 MHz	
Video output signal		
peak-to-peak voltage	2.1 to 2.8 V	
top sync level	2.2 to 2.6 V	
Intercarrier sound output signals		
5.50 MHz	200 to 500 mV RMS	
5.74 MHz	90 to 225 mV RMS	

APPLICATION

Designed to cover the tuner function according to the CCIR systems B, G and H with extended VHF frequency ranges, combined with a quasi split sound IF function to demodulate the video signal and to convert the sound signal.

The tuner part of the FE618Q/256 is equipped with a frequency divider, which makes it suitable for digital tuning systems based on frequency synthesis.

This tuner compies with the requirements of radiation, signal handling capability, and immunity from radiated interference of Amtsblatt DBP69/1961, and for Finland E.I.S. bulletin T33-82, section 4, when installed professionally in an adequare TV receiver.

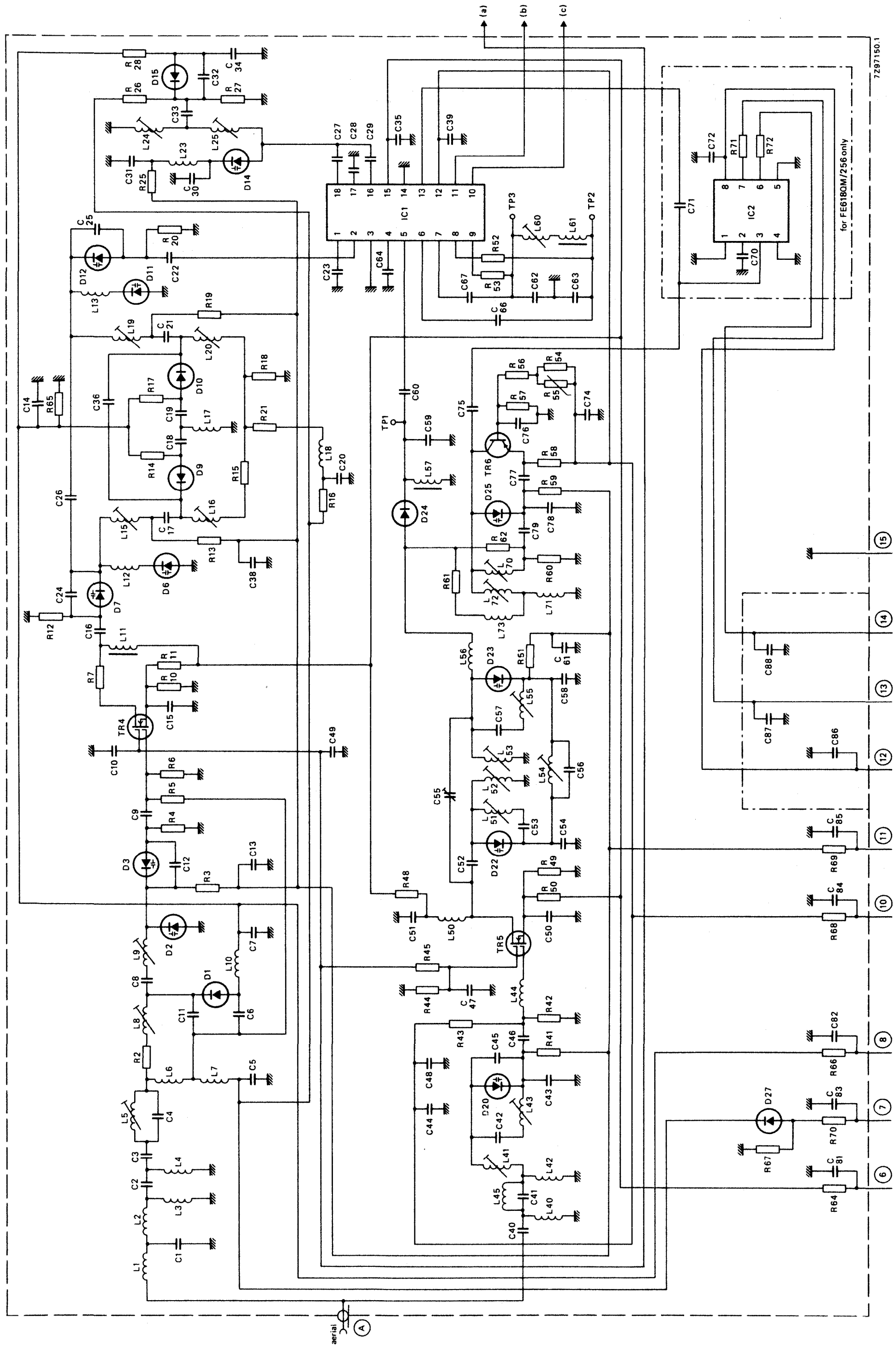
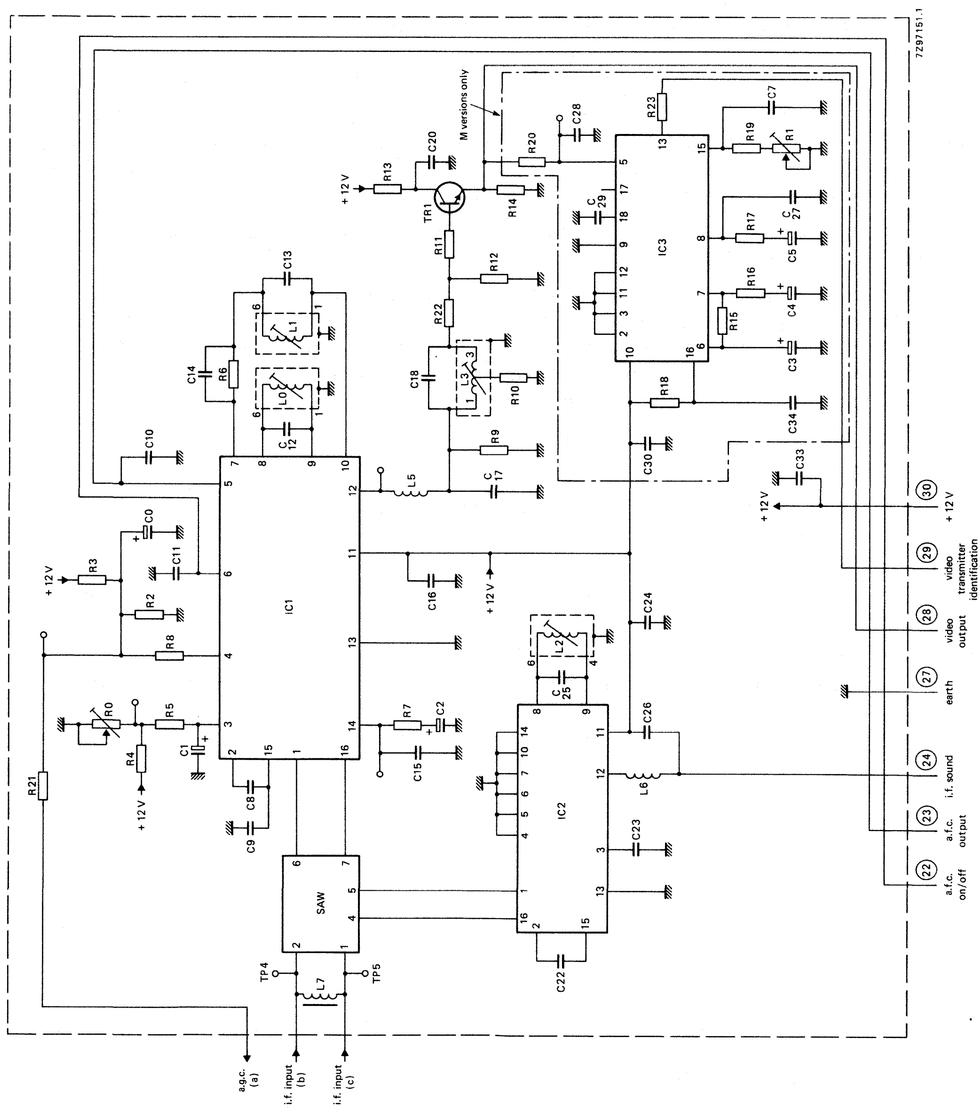


Fig. 1 Tuner part.



For connections see Fig. 3.

DESCRIPTION

The front end contains a VHF/UHF tuner with electronic tuning and band switching, covering the low VHF band (frequency range 46 to 110 MHz), the high VHF band (frequency range 111 to 300 MHz), and the UHF band (frequency range 470 to 860 MHz).

Mechanically, the front end consists of a tuner part and an i.f. part built on separate low-loss printed-wiring boards, carrying all components, in a housing made of a rectangular diecast metal frame and front and rear covers (see Fig. 3). The common IEC coaxial aerial connector (75 Ω) is integrated in one of the frame sides of the housing, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, IF output) are made via terminals in the underside. The mounting method is shown in Fig. 4.

Electrically, the tuner part consists of VHF and UHF parts (see Fig. 1). They are equipped with a common aerial input and provided with RF MOSFET input stages. The VHF mixer, VHF oscillator and IF amplifier functions are provided by a tuner IC. This IC has terminals between mixer and i.f. amplifier to connect the IF preselection.

The RF band pass filter and oscillator circuits are tuned by 7 tuning diodes; band switching is achieved by 4 switching diodes.

The UHF part of the tuner has a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the RF signal to the Schottky barrier mixer diode. The IF signal from the mixer diode is amplified by the IF pre-amplifier of the tuner IC.
The RF band pass filter and oscillator circuits are tuned by 4 tuning diodes.

In all bands the tuner is gain-controlled via gate 2 of the input MOSFET tetrode.

A test point TP1 is provided for IF injection.

The electrical circuit of the FE618Q256 is extended with a frequency divider (division ratio of 256), with inputs connected to the VHF and UHF oscillators. The symmetrical ECL outputs are connected to terminals 13 and 14.

The IF part is of the quasi-split sound type. It has separate ICs for video demodulation and sound conversion (see Fig. 2).

The demodulated (CVBS—) video signal is available at the video output of the front end and the converted sound signal, with intercarrier frequencies of 5.50 MHz and 5.74 MHz, is available at the sound output.

Terminal designations in Fig. 3

A	= aerial input (IEC female 75 Ω)
6	= supply voltage, tuning part, + 12 V
7	= supply voltage, low VHF + 12 V
8	= supply voltage, high VHF + 12 V
10	= supply voltage, UHF + 12 V
11	= tuning voltage, + 0.48 to + 28 V
12	= supply voltage, frequency divider, + 5 V
13, 14	= balanced output voltage of frequency divider (1 kΩ)
15	= earth
22	= switching voltage AFC
23	= AFC output
24	= IF sound
27	= earth
28	= video output
30	= supply voltage IF demodulation part, + 12 V

MECHANICAL DATA

Dimensions in mm

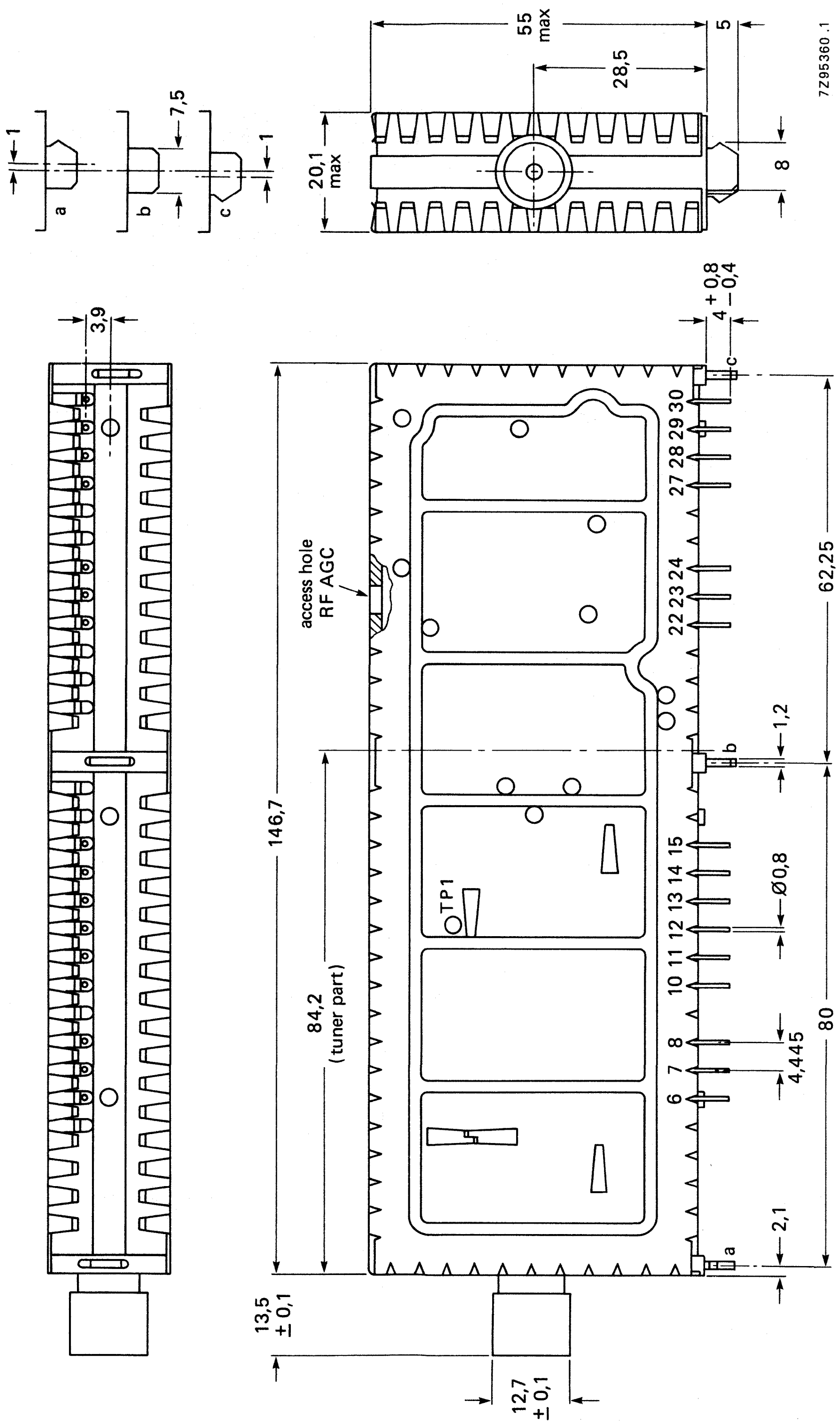


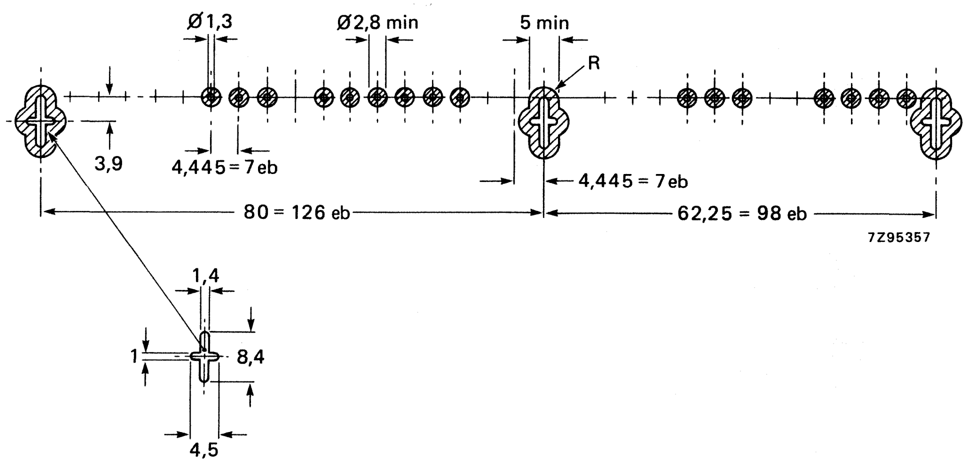
Fig. 3 Unless otherwise stated the tolerance is ± 0,05 mm.

Mass approx. 160 g

Mounting

The unit may be mounted by soldering it on to a printed-wiring board (using the piercing diagram shown in Fig. 4). The construction and positioning of the 3 mounting tags is such that a 'click' indicates the correct seating of the unit on the printed-wiring board. The unit may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tags is according to IEC 68-2, test Ta (235 ± 5 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).



1 eb = 0,025 inch

Fig. 4 Piercing diagram viewed from solder side of board. Unless otherwise stated the tolerance is ± 0,05 mm.

In order to withstand vibrations, shocks and bumps that could damage the solder joints of the mounting tags, the front end should be mounted and soldered without clearance between the supporting area and the printed-wiring board.

This can be achieved by:
— twisting the mounting tags 18° (−3°); or
— pressing the front end against the printed-wiring board during soldering; or
— supporting the front end at its aerial connector.

If the aerial connector is used as a direct input to the television set, it should be supported to prevent the printed-wiring board from stress.

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, supply and band switching voltages of 12 ± 0,3 V.

General

Semiconductors, VHF bands	
RF amplifier	BF992
mixer / oscillator	TDA5030
tuning diodes	7 x BB909
switching diodes	4 x BA482/483/484
d.c. blocking diodes	2 x BAS15
Semiconductors, UHF bands	
RF amplifier	BF990
oscillator	BF970
mixer	1SS99
tuning diodes	4 x BB405
Frequency divider	SP4653
Semiconductors, IF	
IF amplifier and demodulator	TDA2541
quasi-split-sound circuit	TDA2545A
synchronization circuit	TDA2577A
video output transistor	BC548
S.A.W. filter	OFW G3203
Ambient temperature range	
operating	−10 to + 60 °C
storage	−25 to + 85 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltages (tuner and IF part)	+ 12 V ± 10%
Current drawn from + 12 V supply	
VHF bands	max. 50 mA
UHF bands	max. 45 mA
bandswitching	max. 15 mA
IF part	max. 200 mA, without mute 140 mA

For operation in all bands the terminals 6 and 30 are permanently connected to their voltage supplies. Additionally the supply voltage for band switching is connected to:

terminal 7 for operation in low VHF band
terminal 8 for operation in high VHF band
terminal 10 for operation in UHF bands

Tuning voltage range	+ 0.8 to + 28 V
Current drawn from 28 V tuning voltage supply	
at T_{amb} = 25 °C and 60% R.H.	max. 0.5 μA
at T_{amb} = 25 °C and 95% R.H.	max. 2 μA
at T_{amb} = 60 °C and 60% R.H.	max. 2 μA

Note: The source impedance of the tuning voltage offered to terminal 11 must be maximum 47 kΩ.

Aerial input characteristics

Input impedance	75 Ω
VSWR and reflection coefficient (values between picture and sound carrier, as well as values at picture carrier)	
VSWR	at nominal gain and during gain control
VHF bands	max. 4
UHF bands	max. 5
reflection coefficient	
VHF bands	max. 60%
UHF bands	max. 66%
Gain limited sensitivity level	
VHF CCIR channels and UHF channels	typ. 25 dB (μV), max. 33 dB (μV)
S-channels	typ. 29 dB (μV), max. 37 dB (μV)
A.G.C. limited aerial input level	
VHF bands	min. 100 dB (μV)
UHF bands	min. 90 dB (μV)
Oscillator voltage level (fundamental and harmonics up to 1000 MHz) at the input	
VHF bands	max. 44 dB (μV)
UHF bands	max. 66 dB (μV)
Surge protection	max. 5 kV

Tuning characteristics

Frequency ranges	
low VHF band	channel E2 (picture carrier 48.25 MHz) to channel S1 (picture carrier 105.25 MHz).
high VHF band	channel S2 (picture carrier 112.25 MHz) to channel S20 (picture carrier 294.25 MHz).
UHF bands	channel E21 (picture carrier 471.25 MHz) to channel E69 (picture carrier 855.25 MHz).

The frequency ranges remain valid under the specified operating conditions during the entire life time of the unit.
The oscillator frequency is higher than the aerial signal frequency.

Slope of tuning characteristic		
low VHF band, channel E2	5 MHz/V	typical values
channel S1	1 MHz/V	typical values
high VHF band, channel S2	10 MHz/V	typical values
channel S20	2 MHz/V	typical values
UHF bands, channel E21	22 MHz/V	typical values
channel E69	5 MHz/V	typical values
Tuning voltage range within which the divided oscillator frequency increases monotone with the tuning voltage	0,45 to 30 V	
Slope of tuning characteristic		
low VHF band	1 to 6 MHz/V	
high VHF band	2 to 14 MHz/V	
UHF bands	4 to 25 MHz/V	
Tuning voltage range within which the tuning frequency increases monotone with the tuning voltage	0.45 to 30 V	
Time constant of varicap voltage	1.5 ms	
Aerial input level causing detuning of −300 or + 1000 kHz		
VHF bands	min. 100 dB (μV)	
UHF bands	min. 90 dB (μV)	

Oscillator characteristics

Shift of oscillator frequency at a change of the supply voltage of 5%	
VHF bands	max. 250 kHz
UHF bands	max. 500 kHz
Drift of oscillator frequency	
during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)	max. 250 kHz
during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)	max. 250 kHz
at a change of the ambient temperature from + 25 to + 50 °C and from + 25 to + 0 °C	
VHF bands	max. 500 kHz
UHF bands	max. 1000 kHz
at a change of humidity from 60 ± 15% to 93 ± 2%, at T_{amb} = 25 ± 5 °C	
low VHF band	max. 500 kHz
high VHF band	max. 1000 kHz
UHF bands	max. 1500 kHz

Frequency divider characteristics

Supply voltage	+ 5 V ± 5%
Current drawn from + 5 V supply	max. 35 mA; typ. 25 mA
Output voltage, unloaded, measured with probe 10 MΩ/11 pF	min. 0.5 V(p-p)
Output impedance	typ. 1 kΩ
Output imbalance	max. 0.1 V

AFC output characteristics

Output capacitance	typ. 1.2 nF
Output voltage, when loaded with 25 kΩ AFC switched off	6 V
AFC switched on voltage for an aerial input of 50 dB (μV)	
correctly tuned	6 V
detuning of + 100 kHz	max. 1.5 V
detuning of −100 kHz	min. 10.5 V
AFC output slope at V_{afc} = 6 V and V_{aerial} = 50 dB (μV)	min. 50 V/MHz, max. 150 V/MHz
AFC voltage when no aerial input	min. 3 V, max. 8 V

Video output characteristics

Measuring conditions: video output (terminal 28) loaded with 155 Ω, decoupling of i.f. supply (terminal 30) with 220 μF.

Video peak-to-peak voltage, video modulation 100%, rest carrier 10%	min. 2.1 V, max. 2.8 V
Top sync level	min. 2.2 V, max. 2.6 V
No-signal level	min. 5.0 V, max. 5.7 V
Video signal expansion for a change of the aerial input signal level from 40 dB (μV) to 90 dB (μV)	max. 0.5 dB
Unweighted video signal to noise ratio for an aerial input level of 50 dB (μV)	
VHF CCIR channels	typ. 36 dB, min. 33 dB
S-channels	typ. 34 dB, min. 31 dB
UHF channels	typ. 32 dB, min. 29 dB

Unweighted video S/N-ratio for V_{aerial} = 70 dB (μV)			
VHF CCIR channels	typ. 46 dB		
S-channels	typ. 44 dB		
UHF channels	typ. 46 dB		
Flatness (0.1 – 3.5 MHz)			
VHF/UHF for V_{aerial} up to 70 dB (μV)	max. 3 dB		
VHF for V_{aerial} = 100 dB (μV)	max. 4 dB		
UHF for V_{aerial} = 90 dB (μV)	max. 4 dB		
Group delay time deviation (0.1 – 3.5 MHz) for V_{aerial} up to 70 dB (μV)			
VHF, channels E3 and up; UHF channels	max. 50 ns		
VHF, channel E2 minus 1 MHz	max. 60 ns		
Gain drop at colour carrier for V_{aerial} = 70 dB (μV); 1 MHz reference			
at 4.43 MHz	typ. 5 dB	max. 8.5 dB	
at 4.00 MHz	typ. 2 dB		
at 4.80 MHz	typ. 11 dB		
Group delay time deviation at colour carrier frequency (4.43MHz)	typ. 60 ns		
2T-impulse response			
top level referred to black-white response	typ. 105%	min. 85%	max. 125%
50% level width	min. 180 ns	max. 220 ns	
K-rating	max. 4%		
Differential gain	typ. 4%	max. 10%	
Differential phase	typ. 2^{o}	max. 10^{o}	
Field time waveform distortion	max. 10%		
Line time waveform distortion	max. 10%		
1.07 MHz sound-chroma interference level conditions			
gain control	30 dB		
picture carrier/colour carrier ratio	16 dB		
picture carrier/sound carrier ratio	10 dB		
40 dB interference distance at video output	typ. 90 dB (μV)		

Sound carriers rejection		
5.48 MHz to 5.52 MHz	min.	50 dB
5.74 MHz	min.	35 dB
Level residual IF carrier and harmonics	max.	3.5 mV
Frequency divider interference distance for V_{aerial} = 50 dB (μV) (referred to 1 MHz)	min.	40 dB
Image rejection for V_{aerial} = 70 dB (μV)		
VHF bands	min.	66 dB
UHF bands	min.	53 dB
First repeat spot interference aerial input level		
VHF bands	min.	75 dB (μV)
UHF bands	min.	63 dB (μV)
Unwanted aerial input level for 1% cross modulation at a wanted signal level of 50 dB (μV)		
N ± 1 VHF	min.	74 dB (μV)
N ± 1 UHF	min.	74 dB (μV)
In-band VHF -low, N ± 2	typ.	92 dB (μV)
In-band VHF -high, N ± 3	typ.	92 dB (μV)
In-band UHF , N ± 5	typ.	100 dB (μV)
Out-of-band	min.	100 dB (μV)
Breakthroughs	typ.	80 dB (μV)
Ripple susceptibility		
at pins 7, 8 and 10	min.	5 mV (p-p)
at pins 6 and 30	min.	30 mV (p-p)

Video identification (QM versions only)

Load impedance 100 kΩ

Output voltage (terminal 29)	
no video	min. 10 V
video	max. 0.5 V
Line frequency for guaranteed video identification	min. 15.0 kHz; max. 16.2 kHz
Aerial input sensitivity level	typ. 25 dB (μV)

Sound carrier output characteristics

Measuring conditions:	
Sound output load impedance (via DC block capacitor)	3 kΩ
Sound carrier levels related to picture carrier level:	
first sound carrier (5.50 MHz)	typ. −13 dB
second sound carrier (5.74 MHz)	typ. −20 dB
Nominal RMS signal level	
5.50 MHz	min. 200 mV; max. 500 mV
5.74 MHz	min. 90 mV; max. 225 mV
DC voltage level (terminal 24)	min. 4.8 V; max. 7 V
Signal to noise ratio weighted according to CCIR 468-3, determined after f.m.-detection for aerial input signal level 70 dB (μV) and video contents:	
black, 5.50 MHz	typ. 50 dB
black, 5.74 MHz	typ. 55 dB
5 kHz sine wave, 5.50 MHz	min. 42 dB; typ. 50 dB
5 kHz sine wave, 5.74 MHz	min. 40 dB; typ. 50 dB
250 kHz sine wave, 5.50 MHz	min. 42 dB; typ. 50 dB
250 kHz sine wave, 5.74 MHz	min. 32 dB; typ. 34 dB

Miscellaneous

Radio interference Oscillator radiation and oscillator voltage at the aerial terminal	Within the limits of C.I.S.P.R. 13 (1975) + amendment 1 (1983), VDE0872/7.72., Amtsblatt DBP69/1981, and for Finland E.I.S., bulletin T33-82, section 4, when applying the unit in an adequate TV receiver
Microphonics	There will be no microphonics, provided the unit is installed in a professional manner.
Surge protection of aerial input against voltages	max. 5 kV

Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes	max. 30 kV, 400 mWs

Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

SATELLITE FRONT ENDS

QUICK REFERENCE DATA

System	D2-MAC, PAL, SECAM
Frequency band	950 to 1750 MHz
Intermediate frequency (note 1)	479.5 MHz
Channels	1 to 40 in accordance with WARC77

APPLICATION

The SFE212 satellite front ends are designed for reception of satellite signals in the 11.7 to 12.5 GHz band via a down converter. They are a combination of a UHF tuner, frequency range 950 to 1750 MHz, covering the 40 channels defined by the WARC77 frequency allocation, with an IF signal processing unit suitable for the D2-MAC packets system. The unit has a built-in digitally controlled (I^2C) PLL tuning system. This front end is also suitable for processing of PAL and SECAM signals broadcast throughout Europe.

Table 1 Available versions

	AFC	input connector	auxiliary IF output	catalogue number
SFE212	internal digital	IEC female	–	3111 268 5002
SFE212S	external analog	IEC female	–	3111 268 5006
SFE212/A	internal digital	IEC female	phono	3111 268 5003
SFE212S/A	external analog	IEC female	phono	3111 268 5007

These tuners comply with the requirements of radiation, signal handling capability and immunity from radiated interference of Amtsblatt NR164, January 1986 and Amtsblatt vfg 754/1971.

Note

1. The oscillator frequency is higher than the aerial signal frequency.

DESCRIPTION

These satellite front ends are a combination of a UHF tuner with electronic tuning covering the frequency range from 950 to 1750 MHz and a 479.5 MHz IF signal processing unit.

The incoming FM signals are uniformly distributed over 40 channels each in right or left polarization. If channel 'n' is transmitted with left polarization, channel 'n + 1' is transmitted with right polarization. Therefore channels 'n', 'n + 2', 'n + 4' . . ., are transmitted with left polarization and channels 'n + 1', 'n + 3' . . ., with right polarization.

The unit is mounted in a metal housing constructed within a rectangular frame with front and rear covers (see Fig.3). It is equipped with one common IEC type RF female connector (75 Ω) with the possibility of supplying and controlling one down converter or a set up of several down converters via the inner conductors.

The tuner is fitted with a broadband matching network followed by the RF amplifier which is loaded with a two resonator bandpass filter.

The selected signal enters a bipolar mixer driven by a negative resistance oscillator and the converted signal is transferred to the IF unit.

The IF unit includes:
- A selective amplifier with one MOSFET gain controlled stage and two bipolar stages .
- The selectivity which is controlled by two helical filters .
- The IF IC which incorporates the PLL demodulator, the level detector and the loop amplifier.
- The AFC interface and a low ohmic output impedance video amplifier.

The unit is controlled via the I^2C-bus by a synthesizer tuning IC located in the tuner section.

A version with auxiliary IF output is available on request.

DEVELOPMENT DATA

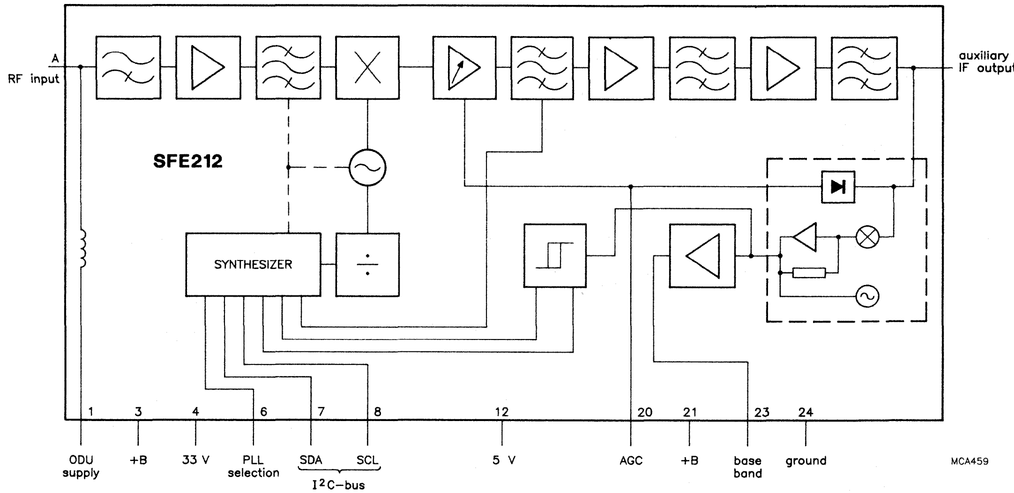


Fig.1 SFE212 block diagram.

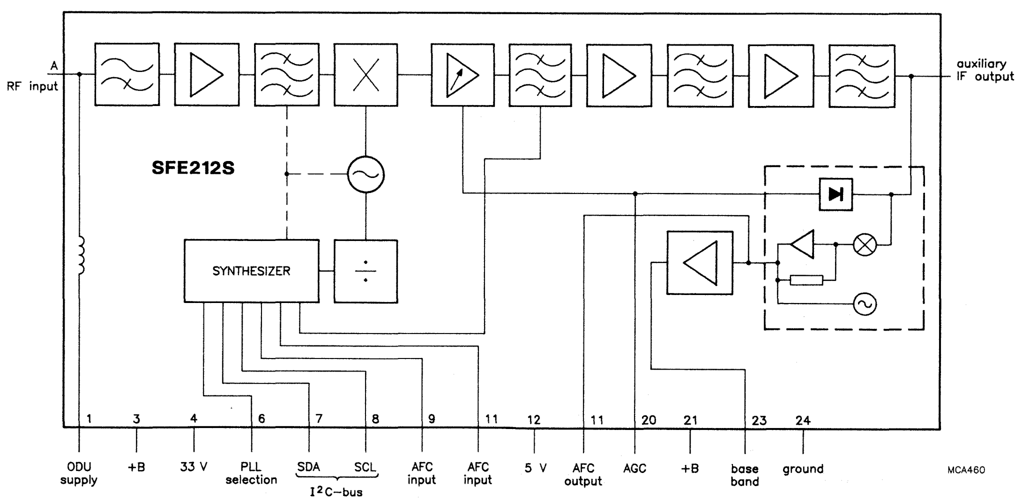


Fig.2 SFE212S block diagram.

MECHANICAL DATA Dimensions in mm

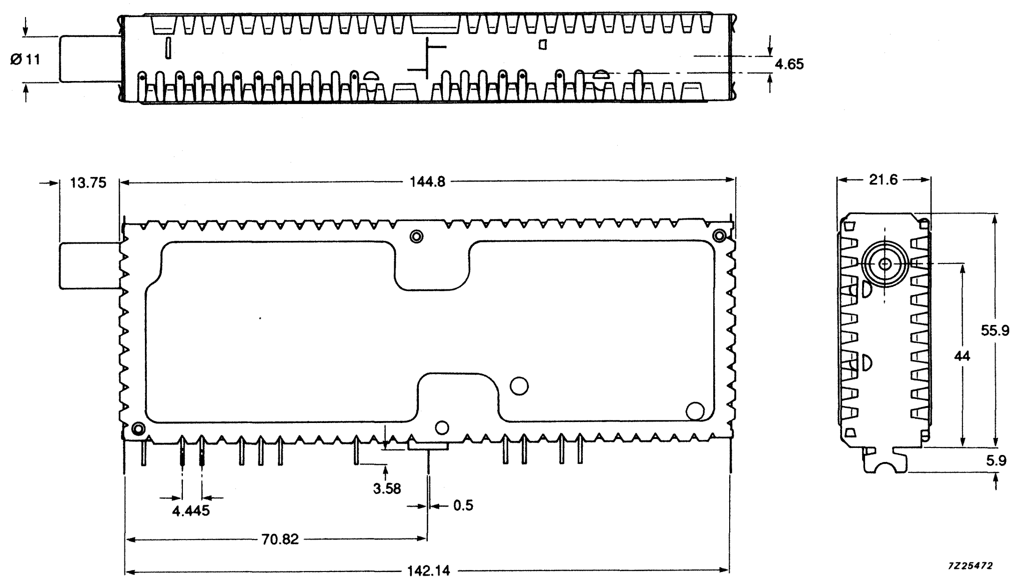


Fig. 3 Mechanical detail.

Pin/connector identity

A	Aerial input	
1	Outdoor unit supply	
3	Tuner supply voltage	12 V
4	Tuning voltage	33 V via 22 kΩ series resistor
6	PLL selection	
7	SDA serial data line	I^2C-bus
8	SCL serial clock line	I^2C-bus
9	AFC input (SFE212S & SFE212S/A only)	
11	AFC input (SFE212S & SFE212S/A only)	
12	PLL and prescaler supply voltage	5 V
19	AFC output (SFE212S & SFE212S/A only)	
20	IF AGC output	
21	IF supply voltage	12 V
23	Baseband output	
24	Ground	
MT1, MT2, MT3	Mounting tab grounded	

Mass: approx. 140 grams

Mounting

The unit may be mounted by soldering it on to a printed-wiring board using the piercing diagram shown in Fig.4. The connection pins should be bent in accordance with Fig.5. The unit may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the pins and mounting tabs is in accordance with IEC 68-2-20, test Ta (230 ± 10 °C, 2 ± 0.5 s). The resistance to soldering heat is in accordance with IEC 68-2-20, test Tb (260 ± 5 °C, 10 ± 1 s).

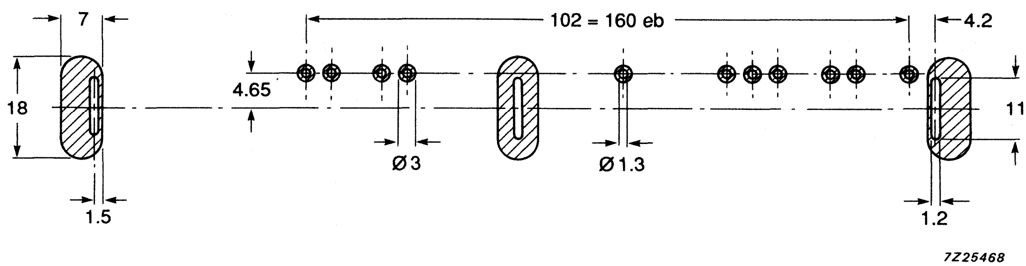


Fig.4 Piercing diagram viewed from solder side of board.

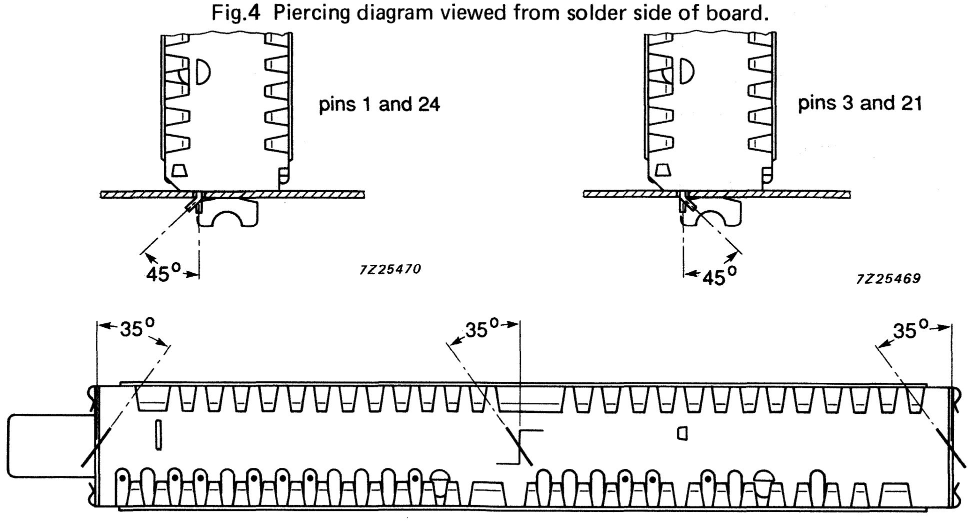


Fig.5 Bending of connecting pins and mounting tags.

Note:

In order to prevent any stress to the printed-wiring board, the tuner should be supported at its aerial connector.

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0.3 V, a prescaler and PLL supply voltage of 5 ± 0.2 V and a tuning voltage of 33 ± 0.5 V via a 22 kΩ resistor. The front end is tuned by means of a built in synthesizer. For further information refer to Application information.

General

Semiconductors and ICs	
RF amplifier	BFG67
mixer	BFR92AR
oscillator	BFR93AR
tuning diodes	6 x BB215
PLL tuning IC	TSA5510
frequency divider	SAB8726
IF amplifier	BF998, BFR92A
filter	Helical filter
switching diodes	BA682
demodulator IC	SL1451
Ambient temperature range	
operating	−10 to +60 °C
storage	−25 to +85 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltage (tuner + IF)	12 V ± 10%
Current drawn from +12 V supply (tuner + IF)	max. 210 mA
PLL and prescaler supply voltage	5 V ± 10%
PLL and prescaler supply current	max. 140 mA
Tuning voltage range	33 V (via 22 kΩ) (note 1)
Tuning voltage source impedance	max. 47 kΩ

Note

1. An external pull-up resistor of 22 kΩ ± 5% has to be connected between the tuning supply voltage and terminal 4. The tuning supply current is 1.7 mA max.

Typical performance

Channel	1	20	40	
Tuning voltage	2.6	9.5	22	V
Noise figure	9	9	9	dB
Image rejection	48	39	40	dB
In channel third order intermodulation	77	90	80	dBμV
Baseband output level (note 1)	1	1	1	V
Linearity luminance (note 1)	1.5	1.5	1.5	%
Signal to noise ratio unweighted (C/N 10 dB) (note 1)	25	25	25	dB
Static demodulation threshold (note 1)		6		

Aerial input characteristics

Input impedance	75 Ω

RF input characteristics

In band VSWR referred to 75 Ω	typ. 1.5 max. 2
Return losses	min. 10 dB
RF input level range	min. −65dBm/44 dBμV max. −30dBm/79 dBμV
Oscillator voltage at aerial input (fundamental and harmonics)	
from 40 MHz to 1750 MHz	max. 46 dBμV
from 1750 MHz to 2200 MHz	max. 60 dBμV
Surge protection	max. 5 kV

Baseband output (terminal 23) characteristics

Measuring conditions
unless otherwise specified baseband output characteristics apply to:

RF input level	60 dBμV
C/N	min. 20 dB
Modulation characteristics	
frequency peak to peak deviation	13.5 MHz/V

MAC pre-emphasis
PAL coded FDM (Frequency Division Multiplex) video signal
Positive modulation : i.e. the frequency increases from black to white level

Baseband output load	470 Ω ± 5%

DEVELOPMENT DATA

Note

1. Measured with a PAL signal with 13.5 MHz/V deviation and MAC pre-emphasis applied.

Baseband output (terminal 23) characteristics with MAC pre-emphasis

Impedance	typ.	50 Ω
Output load	min.	470 Ω
DC level when correctly tuned (note 1)	min.	5.4 V
	typ.	5.7 V
	max.	6.0 V
Demodulation threshold	typ.	C/N = 6 dB
	max.	C/N = 7.5 dB
Demodulation non linearity within 10 MHz around 479.5 MHz	max.	2%
Linearity (luminance)	max.	4%
Differential gain	max.	6%
Differential phase	max.	5^{o}
1 dB bandwidth	min.	9 MHz
Group delay inequality luminance - chrominance	max.	25 ns (pk-pk)
2 T pulse response		
Amplitude between		95 and 105%
Asymmetry and pulse shape		see Fig.6
2 T pulse width at 50% height of total 2 T amplitude		200 ns ± 10%

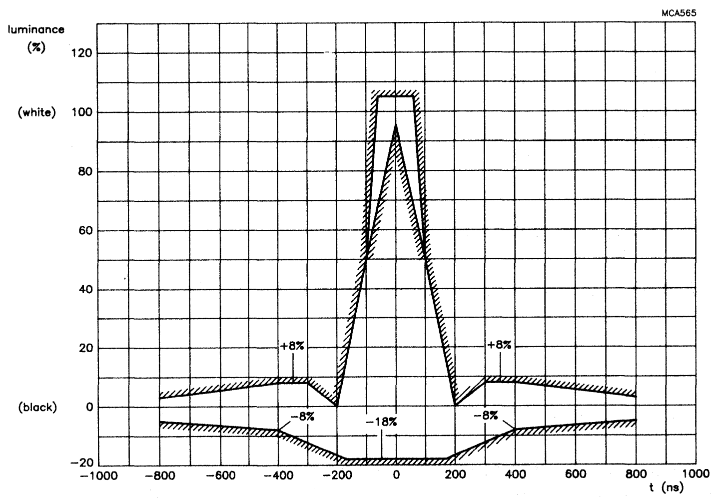


Fig.6 Luminance - chrominance graph.

Line tilt	max.	3%
Signal to noise ratio (unweighted) with 8.5 MHz low pass filter		
for C/N = 30 dB	typ.	45 dB S/N
for C/N = 18 dB	typ.	33 dB S/N
for C/N = 14 dB	typ.	29 dB S/N
for C/N = 10 dB	typ.	25 dB S/N
for C/N = 8 dB	typ.	23 dB S/N

Note

1. With 60 dBμV unmodulated RF signal.

Data signal characteristics

These assessments are carried out with a D2MAC modulated signal (duobinary data rate of 10.125 MHz)

Bit error rate (BER)	
For C/N = 13 dB	typ. 10^{-6}
For C/N = 12 dB	typ. 5.10^{-6}
For C/N = 10 dB	typ. 10^{-4}
For C/N = 8 dB	typ. 10^{-3}
For C/N = 7 dB	typ. 5.10^{-3}

AFC input (terminals 9 and 11) (SFE212S only)

Terminal 9 is connected to port P5 of the TSA5510 PLL tuning IC via an CR cell (100 pF to ground and 100 Ω aerial resistor). Terminal 11 is connected to port P4 of the same IC via a similar CR cell.

AFC output (terminal 19) (SFE12S only)

Output impedance	typ. 1 kΩ
DC voltage when correctly tuned	4.7 ± 0.2 V
Slope detuning	70 mV/MHz

IF AGC output characteristics

Output impedance	typ. 3 kΩ
Output level range with 100 kΩ load	
for 79 dBμV unmodulated input signal	typ. 1.5 V
for 44 dBμV unmodulated input signal	typ. 5 V

IF output characteristics (auxiliary IF output, /A versions only)

Phono connector output	
VSWR referred to 75 Ω	typ. 1.5
	max. 2
Output level	min. 65 dBμV
	typ. 67 dBμV
	max. 69 dBμV
Bandwidth at 3 dB	typ. 27 MHz
in band tilt between top edges 479.5 ± 10 MHz	typ. 3 dB
in band group delay (27 MHz)	typ. 25 ns (pk-pk)
Selectivity	
fc – 19.18 MHz	min. 8 dB
fc + 19.18 MHz	min. 8 dB
fc – 38.36 MHz	min. 40 dB
fc + 38.36 MHz	min. 40 dB

PLL selection characteristics — See application information.

Frequency range

Channel 1 (picture carrier 977.48 MHz) to channel 40 (picture carrier 1725.50 MHz). Margin at extreme channels: min. 10 MHz.

Noise figure	max. 15 dB
Image rejection	min. 30 dB
IF rejection	min. 50 dB

In channel 1% third order intermodulation

Excluding channel 1	min. 80 dBμV
For channel 1	min. 74 dBμV

Maximum level difference between any in-band channels

Note: This specification is determined by the broadband intermodulation Behaviour of the tuner (channelling fully loaded).

Level difference	max. 12 dB

Out of band intermodulation

For unwanted signals in the 40 to 862 MHz range	min. 44 dBμV

Oscillator characteristics

The oscillator is tuned with 125 kHz pitch.

Instability of the oscillator under any combination of operational conditions	max. 80.10^{-6}
Time required for tuning from channel 1 to channel 40	
charge pump. current 5I	typ. 45 ms
change pump. current I	typ. 210 ms

Miscellaneous

Radio interference	in accordance with Amtsblatt 164/1986 and Amtsblatt vfg 754/1971
Immunity from radiated interference	
immunity in the wanted signal range (950 to 1750 MHz)	*
immunity in the IF range 479.5 ± 10 MHz	*

Immunity from conducted interference

On any channel (desired signal at 60 dBμV) a signal at IF and image frequencies of 60 dBμV, applied to the front end terminals (except optional IF output) will cause no impairment on the video picture.

* Value to be fixed.

Microphonics

For sound signals in the audio frequency range 100 Hz to 10 kHz and sound pressure levels up to 105 dB (20 μPa) the video signal to sound interference ratio will be greater than 40 dB.

Oscillator voltage at terminals in the 950 MHz to 1750 MHz range
supply, control and video output pins max. 60 dBμV

IF voltage at the terminals

ESD protection at the terminals

All terminals of the front end are protected against electrostatic discharge up to 2 kV.

The product is classified in category B (MIL-STD-883C).

DEVELOPMENT DATA

* Value to be fixed.

APPLICATION INFORMATION

For further information regarding general aspects of I^2C-bus control refer to:
" The I^2C bus specification ", published by Philips Components.

Logic diagram

Address Byte	S	1	1	0	0	0	MA1	MA2	0	A

Prov. Div. Byte 1	0	n14	n13	n12	n11	n10	n9	n8	A	
Prog. Div. Byte 2	n7	n6	n5	n4	n3	n2	n1	n0	A	
Control Info. Byte 1	1	CP	TI	TO	1	1	1	0	A	
Control Info. Byte 2	P7	P6	P5	P4	P3	P2	P1	P0	A	P

S = Start
A = Acknowledge
P = Stop

Programmable divider setting

Divider ratio: N = 16* [Frf, pc (MHz) + Fif, pc (MHz)]

N = 16384 * n14 + 8192 * n13 + 4096 * n12 + 2048 * n11 + 1024 * n10 + 512 * n9 + 256 * n8 + 128 * n7 + 64 * n6 + 32 * n5 + 16 * n4 + 8 * n3 + 4 * n2 + 2 * n1 + n0

Control info byte 1

TI, TO = 0 (normal setting)

Address selection

MA1	MA0	voltage at terminal 6
0	0	0 . . . 0.1 V PLL
0	1	don't care (general address)
1	0	0.4 . . . 0.6 V PLL
1	1	0.9 . . . 1.1 V PLL

Telegram examples

Start – Adr – TV2 – TV1 – ST1 – ST2 – Stop
Start – Adr – ST1 – ST2 – TV1 – TV2 – Stop
Start – Adr – TV1 – TV2 – ST1 – Stop
Start – Adr – TV1 – TV2 – Stop

Start = start condition
Adr = addressing
TV1 = divider ratio first byte
TV2 = divider ratio second byte
ST1 = control word first byte
ST2 = control word second byte
Stop = stop condition

Read mode (R/W = 1)

Logic diagram

	MSB							LSB
CIDIPS Address byte	1	1	0	0	0	MA1	MA0	1
Status byte	POR	FL	I2	I1	I0	A2	A1	A0

FL is set to 1 when the tuning loop is in lock.

POR (power on reset) is intentionally set to 1 in case V PLL drops below 3 V.
The POR bit is reset when an end-of-data is detected by the PLL IC.

I0 to I2 and A0 to A2 do not contain any relevant data and can be ignored.

Internal capacitance at terminal 8 SCL max. 60 pF

Internal capacitance at terminal 7 SDA max. 60 pF

DEVELOPMENT DATA

ADDITIONAL INFORMATION

Tuning voltage

A tuning voltage of 33 V must be connected via a series 22 kΩ resistor to pin 4. A prefered method is a constant current supply of 1 – 1.5 mA to the pin.
Figure 7 shows this with a 140 V supply. The zener diode prevents the voltage at pin 4 exceeding 33 V.

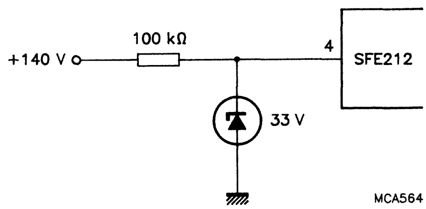


Fig.7 Constant current supply.

U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

Systems	C.C.I.R. system I (United Kingdom)
Channels	E21 to E 69
Intermediate frequencies	
picture	39.5 MHz
sound	33.5 MHz

APPLICATION

Tuners U743 and U744 are intended for use in u.h.f. single standard receivers and to drive an i.f. surface acoustic wave (SAW) filter. For this, the tuners have a post-amplifier to compensate for the losses of the SAW filter.

The U743 is identical to the U744 but without frequency divider, necessary to drive digital tuning systems.

The pinning arrangements of the tuners are compatible with the tuners UV615S, UV616S, UV617, UV618, and the tuner part of the FE618Q/256.

SURVEY OF TYPES

tuner type	aerial input connector	frequency divider (IC)	catalogue number
U743	phono	–	3122 237 00270
U743/IEC	IEC (14.5 mm)	–	3122 237 00280
U743/IEC.L	IEC (32.2 mm)	–	3122 237 00290
U744/256	phono	1 : 256	3122 237 00300
U744/256/IEC	IEC (14.5 mm)	1 : 256	3122 237 00310
U744/256/IEC.L	IEC (32.2 mm)	1 : 256	3122 237 00320

DESCRIPTION

The tuners are u.h.f. tuners with electronic tuning covering the u.h.f. band from 470 to 860 MHz (channels E21 to E69).

Mechanically the tuners are built on a printed-wiring board and enclosed in a metal housing, comprising a rectangular frame and front and rear covers (see Fig. 2). The aerial connection (phono or IEC) is on one of the frame sides, the supply voltage and i.f. connections are on the bottom side and the i.f. injection point is accessible through a hole in the cover as shown in Fig. 2.

Electrically the tuners consist of an input circuit with a high-pass characteristic and a MOS-FET tetrode BF990. The tetrode acts as an r.f. amplifier and as an a.g.c. device controlled by an a.g.c. voltage, fed to gate 2. The drain of the MOS-FET is connected to a double tuned circuit which transfers the signal to the mixer transistor 2SC3545. The r.f. selectivity of this circuit at the image frequency has been improved by special means. The mixer transistor is driven by an oscillator transistor BF569. The i.f. signal from the mixer is connected to a tuned i.f. filter and amplified by a BF370 post-amplifier, suitable to drive a surface acoustic wave filter (asymmetric), and to compensate for the SAW losses.

The combination of the r.f. MOS-FET, the 2 GHz mixer transistor and the i.f. post-amplifier ensures good noise figures and signal handling properties.

Three capacitance diodes BB405 tune the r.f. band-pass filter and oscillator circuit.

The electrical circuit of type U744 is extended with a frequency divider (division ratio of 256), the input of which is connected to the oscillator. The symmetrical outputs are connected to terminals 13 and 14.

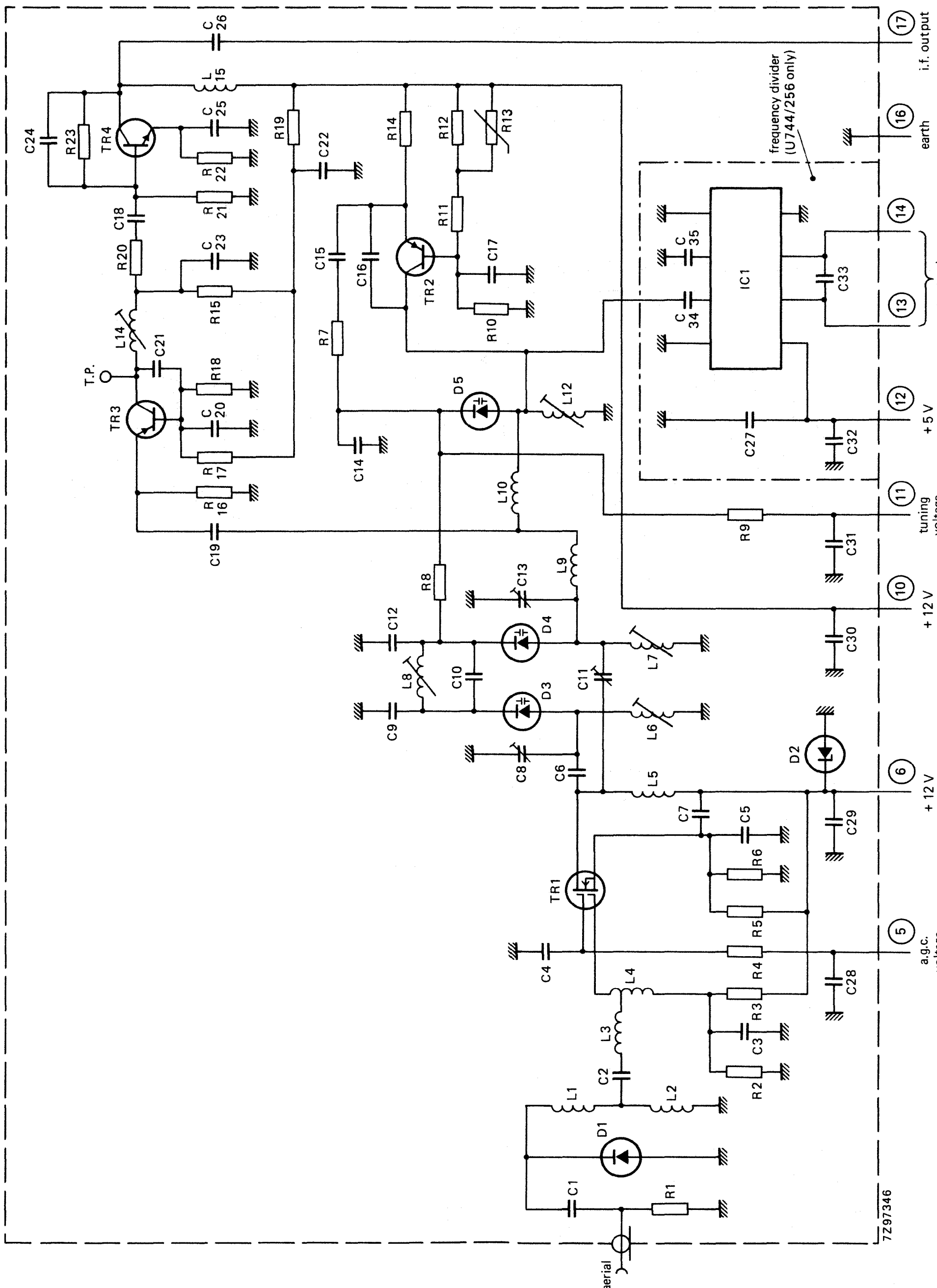


Fig. 1 For connections see also next page. T.P. = test point (i.f. injection).

MECHANICAL DATA

Dimensions in mm

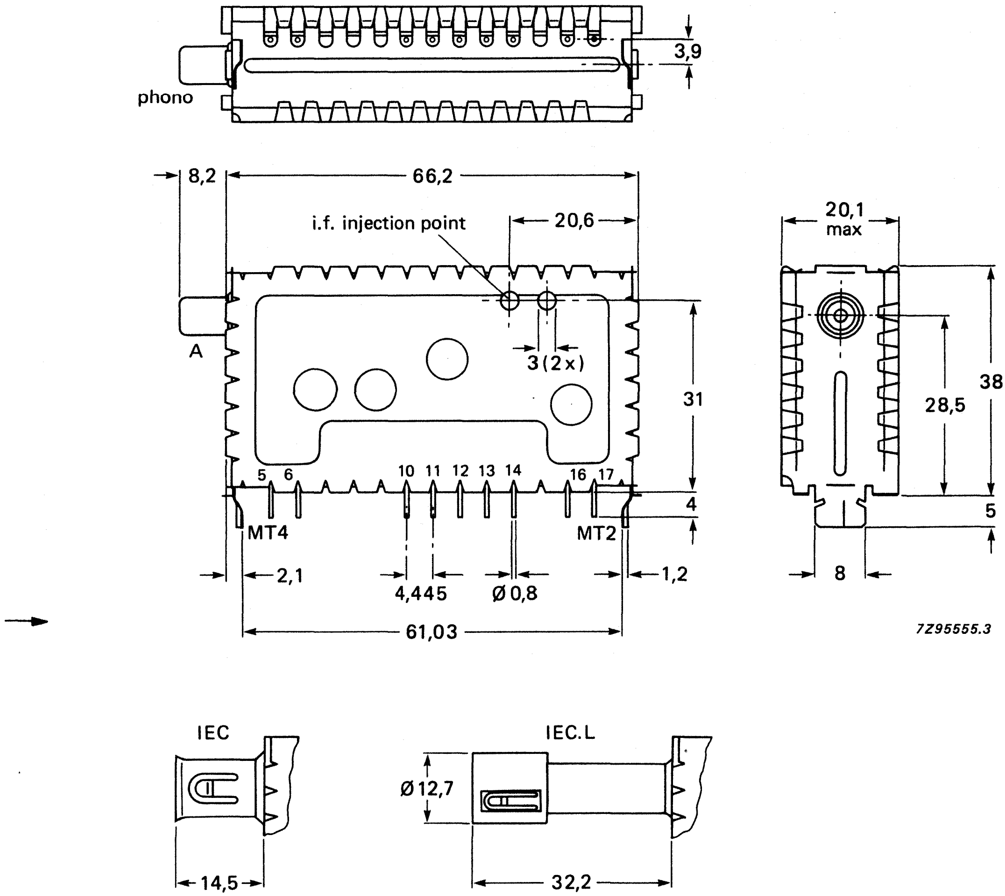


Fig. 2 Mechanical detail.

Terminal

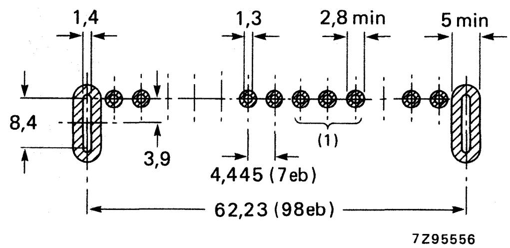
A =	aerial input (phono/IEC female 75 Ω)	
5 =	a.g.c. voltage, + 9,2 to 0,85 V	
6 =	supply voltage, prestage, + 12 V	
10 =	supply voltage, oscillator, mixer, i.f., + 12 V	
11 =	tuning voltage, + 1 to + 28 V	
12 =	supply voltage frequency divider, + 5 V	U744 only
13, 14 =	balanced frequency divider output	U744 only
16 =	earth	
17 =	i.f. output	

Mass approx. 45 g

Mounting

The tuner may be mounted by soldering it on to a printed-wiring board (using the piercing diagram shown in Fig. 3) without clearance between tuner supports and board. It may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).



(1) Only for U744

1 eb = 0,025 inch

Fig. 3 Piercing diagram viewed from solder side of board.
Unless otherwise stated the tolerance is ± 0,05 mm.

In order to prevent any stress to the printed-wiring board, the tuner should be supported at its aerial connector.

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V, an a.g.c. voltage of 9,2 ± 0,2 V, and a divider supply voltage of 5 ± 0,2 V.

Within the given tolerance range of supply voltage and a.g.c. voltage only insignificant deviations from the specified values can be expected. Under the extreme conditions of temperature and humidity as given below, the tuner will function normally, but some specified limits may be exceeded.

General

Semiconductors	
r.f. amplifier	BF990
mixer transistor	2SC3545
oscillator	BF569
tuning diodes	3 x BB405
i.f. post-amplifier	BF370
surge protection diode	BAV10
surge protection diode	BZX79
Frequency divider	SP4653
Ambient temperature range	
operating	−10 to + 60 °C
storage	−25 to + 85 °C
Relative humidity	max. 100%

Voltages and currents

Supply voltage	+ 12 V ± 10% (+ 10%, −15%)

Note: Supply voltages of + 12 V −15% are admissible if a deterioration of gain, noise figure, signal handling, oscillator shift and drift is accepted. In this case the min. a.g.c. voltage has to be decreased to 0,8 V to cover the specified a.g.c. range.

Ripple susceptibility

Defined as the peak-to-peak value of a sine wave signal (20 Hz — 500 kHz) on the supply voltages causing an amplitude modulation with a modulation depth of 0,28% on the picture carrier after passing the Nyquist curve of the i.f. filter of a tv receiver.

ripple susceptibility	min.	3 mV peak-to-peak
Current drawn from + 12 V supply		
r.f. amplifier, at nominal gain	max.	21 mA
r.f. amplifier, at 30 dB gain reduction	typ.	11 mA
oscillator/i.f. amplifier	max.	36 mA
A.G.C. voltage (Fig. 4)		
voltage at nominal gain		+ 9,2 ± 0,5 V
voltage at 30 dB gain reduction	min.	+ 1 V

Note: A.G.C. voltages between 0 and + 10,5 V may be applied without risk of damage.

A.G.C. current		
during gain control (0 to 30 dB)	max.	+ 15 μA
at nominal gain	typ.	+ 11 μA

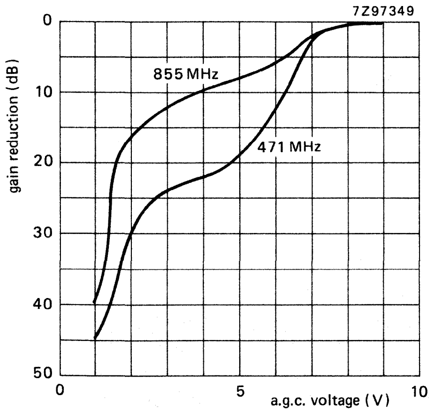


Fig. 4.

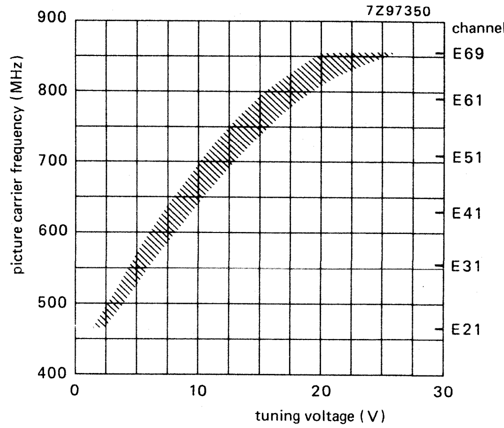


Fig. 5.

Tuning voltage range (Fig. 5)	+ 1 to + 28 V
Current drawn from + 28 V tuning voltage supply	
at 25 °C	max. 0,15 μA
at 60 °C	max. 0,6 μA
at 25 °C (relative humidity 95%)	max. 0,6 μA
Slope of tuning characteristic	min. 4 MHz/V

Frequencies

Frequency range	channel E21 (picture carrier 471,25 MHz) to channel E69 (picture carrier 855,25 MHz). Margin at the extreme channels: min. 3 MHz.
Intermediate frequencies	
picture	39,5 MHz
sound	33,5 MHz

The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance asymmetrical	75 Ω
V.S.W.R. and reflection coefficient at picture carrier frequency, at nominal gain and at 30 dB gain reduction	
v.s.w.r.	typ. 4
reflection coefficient	typ. 60%
R.F. bandwidth	typ. 20 MHz
Overall curves, tilt R.F. in —I.F. out	on any channel the amplitude difference between the top of the overall curve and the picture carrier, the sound carrier, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.
A.G.C. range	min. 30 dB
Voltage gain (i.f. load = 1200 Ω// 15 pF, see Fig. 7)	min. 40 dB
channel E21	typ. 40 dB
channel E40	typ. 41 dB
channel E69	typ. 42 dB
Gain difference between any two channels	typ. 4 dB
Noise figure	max. 10 dB
channel E21	typ. 6,0 dB
channel E40	typ. 6,5 dB
channel E69	typ. 7,5 dB
Overloading	
Input signal producing 1 dB gain compression at nominal gain	typ. 85 dB (μV) into 75 Ω
Input signal producing either a detuning of the oscillator of + 300 kHz or —1000 kHz or stopping of the oscillations at nominal gain	typ. 100 dB (μV) into 75 Ω

1,6 MHz moire rejection (for i.f. 39,5/33,5 MHz)

Wanted signal level of a tv signal (picture to sound ratio of 7 dB and picture to chroma ratio of 16 dB), which produces an unwanted i.f. component (37,8 MHz) 52 dB below the i.f. picture carrier, when the tuner is 30 dB gain controlled.

tv signal (picture carrier)	typ. 100 dB (μV) into 75 Ω

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)		
at nominal gain, channels E21 to E60	min.	53 dB; typ. 60 dB
at 20 dB gain reduction, channels E21 to E60	typ.	50 dB
I.F. rejection (measured at picture carrier and colour sub-carrier frequency)	min.	80 dB

1st repeat spot rejection (for i.f. 39,5/33,5 MHz)

Defined as the input level of the picture carrier of channel N + 2, the sound carrier of which produces an i.f. signal (35,0 MHz), which is 52 dB below the picture carrier of the wanted signal N (picture to sound ratio 7 dB; wanted signal 60 dB (μV), tuner operating at nominal gain.

interfering signal	typ.	80 dB (μV) into 75 Ω

N ± 4 rejection
Interference signal for an interference ratio of 53 dB referred to wanted picture carrier (picture to sound carrier ratio of 7 dB; wanted signal 60 dB (μV); tuner operating at nominal gain)

N + 4 rejection	typ.	80 dB (μV) into 75 Ω
N −4 rejection	typ.	78 dB (μV) into 75 Ω

Cross modulation
Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

at nominal gain (wanted input level 60 dB (μV))	typ.	80 dB (μV) into 75 Ω
at 26 dB gain reduction (wanted input level 86 dB (μV))	typ.	94 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 5).

at nominal gain (wanted input level 60 dB (μV))	typ.	92 dB (μV) into 75 Ω
at 26 dB gain reduction (wanted input level 86 dB (μV))	typ.	95 dB (μV) into 75 Ω
Out of band modulation, at nominal gain	typ.	100 dB (μV) into 75 Ω

Unwanted signal handling capability

The tuner operates together with a standard tv receiver with normal A.G.C. for tuner and i.f. amplifier. Unwanted tv signal 3 channels higher or lower than wanted. Unwanted signal level adjusted for just not visible interference.

Unwanted picture carrier signal	typ.	96 dB (μV)

Oscillator characteristics

Pulling Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain	typ.	85 dB (μV) into 75 Ω
Shift of oscillator frequency at a change of the supply voltage of 5%	max.	500 kHz
Drift of oscillator frequency during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)	max.	250 kHz
at a change of the ambient temperature from + 25 to + 50 °C and + 25 °C to 0 °C (measured after 3 cycles from + 25 to + 55 °C) channels E21 to E69	max.	1000 kHz
at a change of humidity from 60% ± 15% to 93% ± 2% measured at T_{amb} = 25 °C ± 5 °C	max.	1500 kHz

I.F. characteristics

Bandwidth of i.f. output circuit	typ.	9 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 7, tuning voltage 10 V.

I.F. output impedance	approx.	100 Ω

Frequency divider characteristics

Values valid in the tuning voltage range 0,5 to 30 V

Supply voltage	5 V ± 10%	
Supply current	max.	35 mA, typ. 25 mA
Output voltages (probe 10 MΩ//11 pF) at pin 7	min.	0,5 V peak-to-peak
at pin 8	min.	0,5 V peak-to-peak
Output unbalance	max.	0,1 V
Signal to interference ratio at an aerial input level of 100 μV, measured at i.f. output	min.	46 dB

Miscellaneous

Radio interference Oscillator radiation and oscillator voltage at the aerial terminal	Within the limits of C.I.S.P.R. 13 (1975) + amendment 1 (1983). Use is made of the relaxed limit of 3 mV/m (70 dB (μVm)).

Immunity from radiated interference	Aerial terminal meets requirements of BS905, provided the aerial cable is connected in a professional manner.
Microphonics	There will be no microphonics, provided the tuner is installed in a professional manner.
Surge protection	
Protection against voltages	max. 5 kV

Note: Ten discharges of a 470 pF capacitor into the aerial terminal.

E.S.D. protection	min. 2 kV

Note: acc. to MIL STD 003C

ADDITIONAL INFORMATION

I.F. injection

The tuner has an i.f. injection point at the collector of the mixer transistor (see Figs 1 and 2). The i.f. generator can be connected directly to this point (Fig. 6), via a 0,3 pF capacitor. The tuner needs normal supply voltages and a tuning voltage of 10 V.

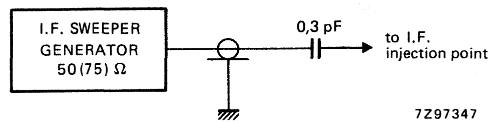


Fig. 6.

Voltage gain

Since the r.f. input and the i.f. output load impedances differ, the gain of the U743 U744 tuners are expressed in terms of voltage gain. It is defined as the ratio between the i.f. output voltage and the corresponding r.f. input voltage.

The i.f. output of the tuner is loaded with an impedance of 1200 Ω in parallel with a 15 pF capacitor representing a standard replacement of the input impedance of a SAW filter.

To be able to carry out tuner measurements with existing 75 Ω equipment a matching circuit is connected to the i.f. output of the tuner. The input gives the required load to the tuner output while the output represents a source impedance suitable to connect to standard 75 Ω equipment, see Fig. 7.

Total losses of the circuit are 26 dB.

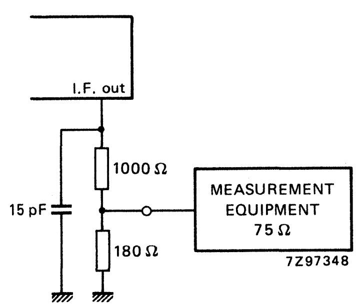


Fig. 7.

UHF TELEVISION TUNERS

QUICK REFERENCE DATA

System	CCIR system I (United Kingdom)		
Channels	E21 to E69		
Intermediate frequencies			
picture	39.50	or	38.90
colour	35.07		34.47
sound 1	33.50		32.90
sound 2	33.00		32.40

APPLICATION

The U943/944 tuners are designed to cover the UHF channels of CCIR system I. They belong to the 900 series of small size tuners and front ends and are designed for a wide range of applications.

The U944 tuner is equipped with a built-in digitally controlled (I^2C) PLL tuning system. The U943 tuner is designed for voltage controlled tuning and does not have the PLL tuning system.

The IF output of the tuner is asymmetrical and designed to directly drive a variety of SAW filters.

SURVEY OF TYPES

tuner type	aerial connector	tuning method	catalogue number
U943	phono	0.7 - 28 V	3122 237 00680
U943/IEC	IEC (14.5 mm)	0.7 - 28 V	3122 237 00690
U943/L	IEC (32.2 mm)	0.7 - 28 V	3122 237 00700
U944	phono	PLL/I^2C	3122 237 00650
U944/IEC	IEC (14.5 mm)	PLL/I^2C	3122 237 00660
U944/L	IEC (32.2 mm)	PLL/I^2C	3122 237 00670

DESCRIPTION

The U943 and U944 tuners are designed to cover the UHF band from 470 MHz to 860 MHz (channels E21 to E69).

The tuners are built on a low-loss, single sided printed-wiring board with an additional small vertical printed-wiring board carrying the PLL tuning system components in the U944 tuner. The tuners are housed in a sheet steel casing with front and rear covers. The aerial connection (phono or IEC) is mounted on one side of the casing.

The RF stage of the tuners consists of a high-pass filter, dual gate MOSFET and a double tuned bandpass filter. The RF signal is then fed to a transistor mixer, driven by a separate oscillator.
The IF signal is then fed to an IF amplifier, which has an asymmetrical output, able to drive a surface acoustic wave (SWA) filter.

The IF output impedance of the UV943/944 tuners is approximately 75 Ω to ensure sufficient triple transient suppression of the SAW filter.

The U944 tuner has an I^2C controlled phase-locked-loop tuning system enabling direct channel access with crystal accuracy.

DEVELOPMENT DATA

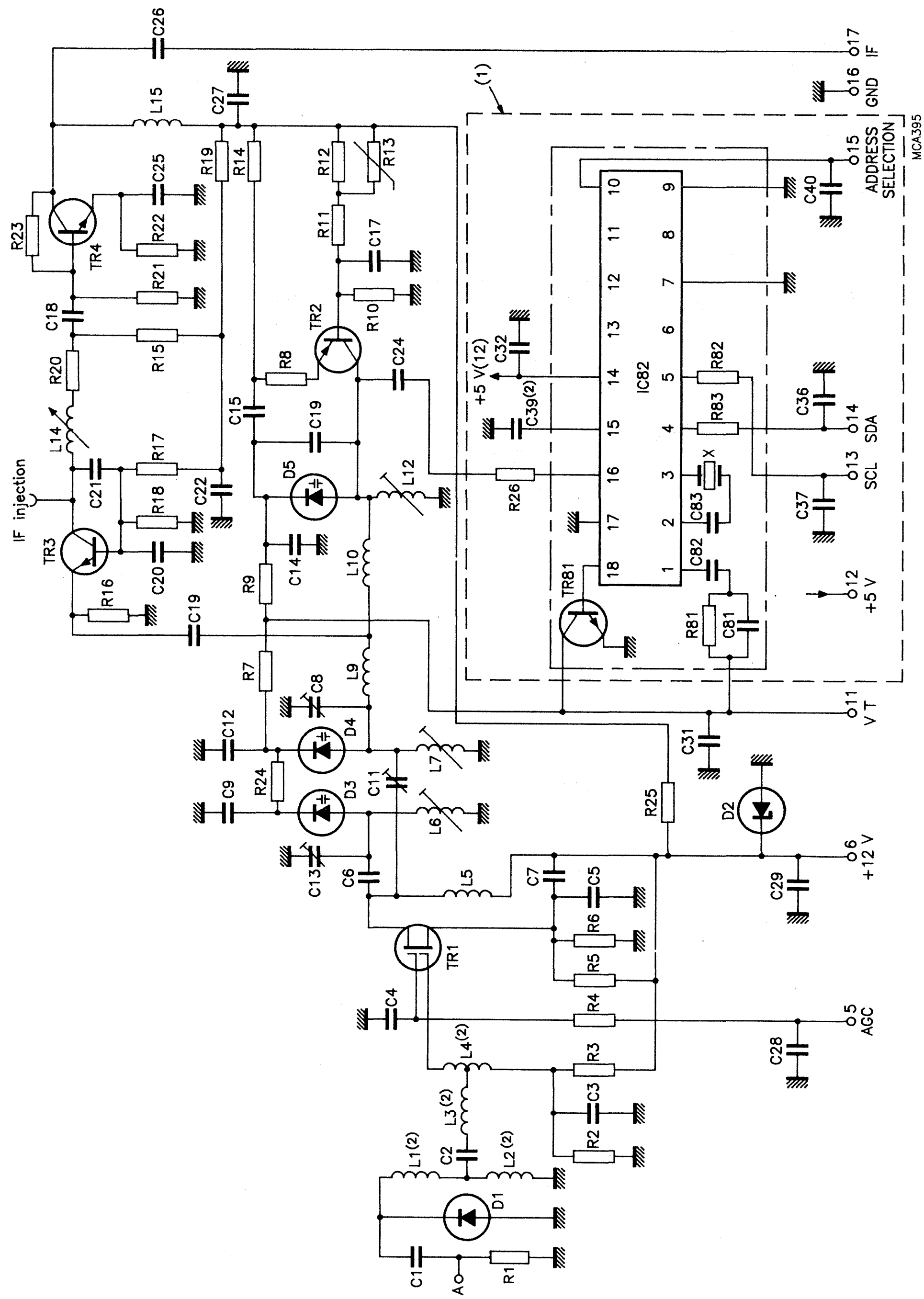
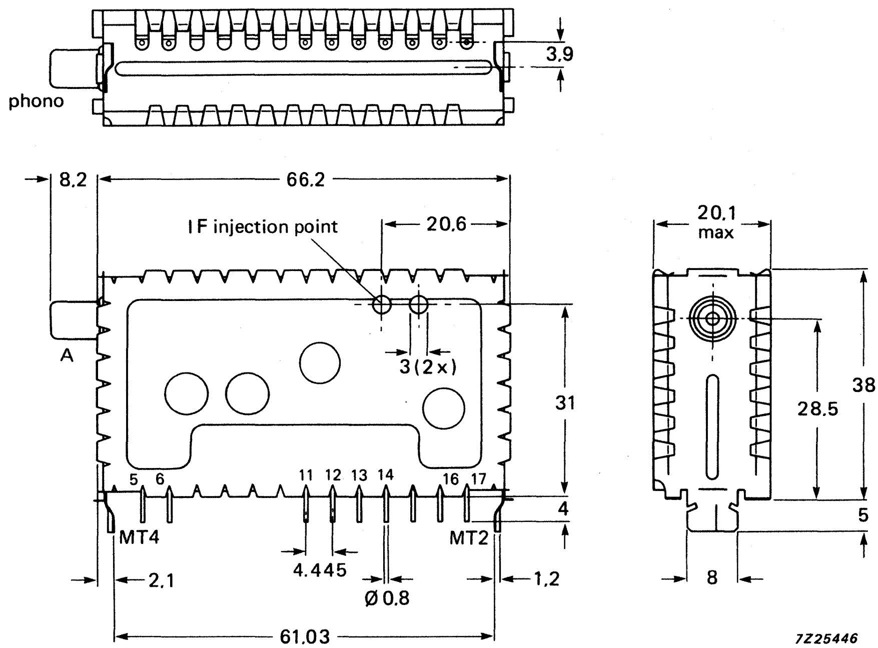


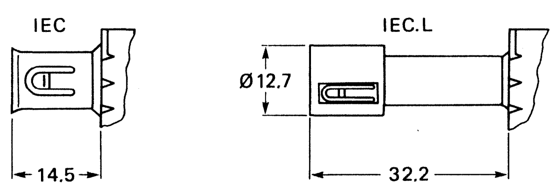
Fig.1 Circuit diagram.

(1) U944 only.
(2) Printed on board.

MECHANICAL DATA

Dimensions in mm





Terminal	U943	U944	
A	Aerial input	Aerial input	
5	AGC voltage (9.2 - 1.0 V)	AGC voltage (9.2 - 1.0 V)	
6	Supply voltage (12 V)	Supply voltage (12 V)	
11	Tuning supply (0.7 - 28 V)	Tuning supply (33 V via 22 kΩ series resistor)	
12		Supply voltage PLL (5 V)	
13	U944 only	SCL serial clock line	I^2C-bus
14		SDA serial data line	
15		Address select input	
16	Ground	Ground	
17	IF output asymmetrical	IF output asymmetrical	
MT2, MT4	Ground	Ground	

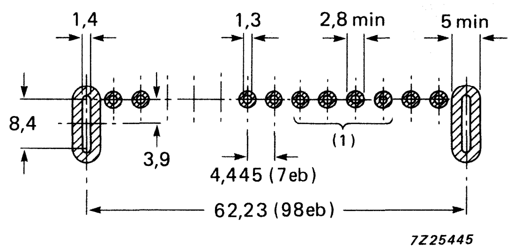
Fig.2 Mechanical diagram.

Mass: approximately 50 grams

Mounting

The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig.3 without clearance between the tuner supporting surface and the board. The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the pins and mounting tabs is in accordance with IEC 68-2-20, test Ta (230 ± 10 °C, 2 ± 0.5 s). The resistance to soldering heat is in accordance with IEC 68-2-20 test Tb (260 ± 5 °C, 10 ± 1 s).



(1) U944 only.
1 eb = 0.025 inch.

Fig.3 Piercing diagram viewed from solder side of board.

DEVELOPMENT DATA

Note

When using the L version (long IEC) it is recommended that the tuner be supported at its aerial connector in order to prevent any stress to the printed-wiring board.

ELECTRICAL DATA

Unless otherwise stated all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0.3 V and an AGC voltage of 9.2 ± 0.2 V.

General

Semiconductors	
RF amplifier	BF998
mixer	2SC3545
oscillator	BF569
tuning diodes	OF643
surge diode	1N4150
ESD protection diode	BZX79-C24
IF amplifier	BFS17
PLL synthesizer IC (U944 versions only)	TSA5510
tuning transistor (U944 versions only)	BC847B
Ambient temperature range	
operating	−10 to + 60 °C
storage	−25 to + 85 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltage	12 V ± 10%
PLL supply voltage (U944 versions only)	5 V ± 10%
Ripple susceptibility (peak-to-peak value)	min. 5 mV
Current drawn from 12 V supply	max. 50 mA
Current drawn from 5 V supply (U944 versions only)	max. 55 mA
AGC voltage (Fig.4)	
AGC voltage range	9.2 to 0.85 V
AGC at nominal gain	9.2 ± 0.5 V
AGC at 30 dB gain reduction	typ. 1.5 V
AGC current	max. 30 μA
Slope of AGC characteristic at the end of the specified range	100 dB/V
Tuning voltage (Fig.5) (U943 versions only)	0.7 - 28 V
Current drawn from tuning supply	
at 25 °C	max. 0.15 μA
at 60 °C	max. 0.6 μA
at 25 °C, 95% relative humidity	max. 0.6 μA
Tuning slope	4 to 40 MHz/V

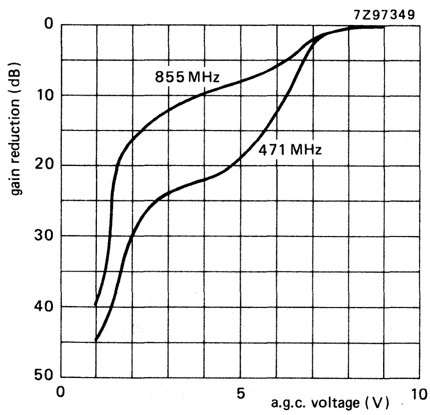


Fig.4 AGC characteristic.

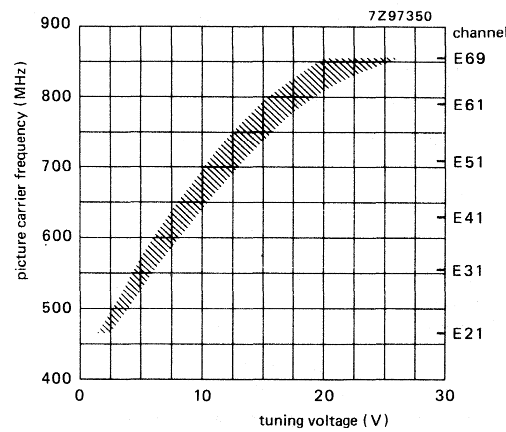


Fig.5 Tuning characteristic.

DEVELOPMENT DATA

Frequencies

Frequency range	channel E21 (picture carrier 471.25 MHz) to channel E69 (picture carrier 855.25 MHz). Margin at extreme channels: min. 3 MHz

Wanted signal characteristics

Input impedance	75 Ω
VSWR referred to 75 Ω	max. 6
Reflection coefficient	max. 71%
RF bandwidth	typ. 20 MHz
RF curves, tilt	on any channel the amplitude difference between the top of the overall curve and the picture carrier, the sound carrier, or any frequency between them will not exceed 3 dB at nominal gain and 4 dB in the AGC range between nominal gain and 20 dB gain reduction
AGC range	min. 30 dB
Voltage gain	min. 40 dB
Gain taper	typ. 4 dB
Noise figure	max. 10 dB typ. 7 dB

Unwanted signal characteristics

Cross modulation

The undesired carrier level required to produce 1% transfer of its modulation onto the desired carrier shall be equal to or exceed the desired carrier level (60 dB/μV at nominal gain) for all gain values between maximum gain and 30 dB gain reduction:

in channel	typ. 80 dB/μV
in band N ± 5	typ. 92 dB/μV
out of band	typ. 100 dB/μV

ELECTRICAL DATA (continued)

Oscillator characteristics

Pulling

Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz at nominal gain	typ. 84 dB/μV

UV943 versions

Shift of oscillator frequency	
change of supply voltage of 5%	max. 500 kHz
during AGC	max. 150 kHz
Drift of oscillator frequency	
during warm-up time	max. 250 kHz
during change of ambient temperature from + 25 to + 50 °C and + 25 to 0 °C	max. 1000 kHz
during change of relative humidity from 60% to 93 ± 2% at an ambient temperature of 25 ± 5 °C	max. 1500 kHz

UV944 versions

PLL tuning resolution	max. 62.5 kHz
Stability of lock oscillator frequency	max. 50^{-6}

IF characteristics

IF output impedance	approx. 75 Ω
Allowable IF load impedance	min. 1 kΩ max. 22 pF

Miscellaneous

Immunity from radiated interference

The aerial input of the tuner meets the requirements of BS905, provided the aerial cable is fitted with the appropriate plug.

Radio interference

Oscillator radiation and oscillator voltage at the aerial input are within the limits of CISPR 13 (1975) amendment No. 1 (1983).

Microphonics

There will be no microphonics provided that the tuner is installed in a professional manner.

Surge protection	
protection against voltages (note 1)	max. 5 kV
protection against flashes (note 2)	max. 30 kV, 400 mW

ESD protection at the terminals

All the terminals of the tuner are protected against electrostatic discharge up to 2 kV.

The product is classified in category B (MIL-STD-883C).

Notes

1. 10 discharges of 1 470 pF capacitor into the aerial terminal.
2. A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal. Power removed from tuner during test.

APPLICATION INFORMATION

For further information regarding general aspects of I²C-bus control refer to:

"The I²C-bus specification", published by Philips Components.

For a more detailed description of the PLL IC see the device specification of the TSA5510.

Logic diagram (WRITE mode)

	MSB							LSB
Address byte	1	1	0	0	0	MA1	MA0	0
Prog. div. byte 1	0	n14	n13	n12	n11	n10	n9	n8
Prog. div. byte 2	n7	n6	n5	n4	n3	n2	n1	n0
Control byte 1	1	5I	T1	T0	1	1	1	0
Control byte 2	P7	P6	P5	P4	P3	P2	P1	P0

Address selection

active address	voltage at terminal 15	MA1	MA0
C0	0 . . . . 0.1 V PLL	0	0
C2	don't care	0	1
C4	0.4 . . . . 0.6 V PLL	1	0
C6	0.9 . . . . 13.5 V PLL	1	1

Programmable divider setting

Divider ratio: $N = 16 \times [f_{RF, pc}\ (\text{MHz}) + f_{IF, pc}\ (\text{MHz})]$

$f_{OSC} = N/16$ (MHz)

$N = 16384 \times n14 + 8192 \times n13 + 4096 \times n12 + 2048 \times n11 + 1024 \times n10 + 512 \times n9 + 256 \times n8 +$
$+ 128 \times n7 + 64 \times n6 + 32 \times n5 + 16 \times n4 + 8 \times n3 + 4 \times n2 + 2 \times n1 + n0$

Control byte 1

Charge pump setting: CP can be set to either 0 (low current) or 1 (high current). CP = 1 results in faster tuning, CP = 0 in moderate speed tuning with slightly better residual oscillator FM.

Test mode setting: T1, T0 = 0 for normal operation.

* The tuner will always respond to C2. The second address will depend on the voltage applied at terminal 15.

APPLICATION INFORMATION (continued)

Telegram examples WRITE mode

Start – ADD – ACK – DIV1 – ACK – DIV2 – ACK – CB1 – ACK – CB2 – ACK – Stop
Start – ADD – ACK – DIV1 – ACK – DIV2 – ACK – DIV1 – ACK – Stop
Start – ADD – ACK – DIV1 – ACK – DIV2 – ACK – Stop
Start – ADD – ACK – CB1 – ACK – CB2 – ACK – Stop
Start – ADD – ACK – CB1 – ACK – CB2 – ACK – DIV1 – ACK – Stop

Start = start condition
ADD = address
ACK = acknowledge
DIV1 = divider ratio byte 1
DIV2 = divider ratio byte 2
CB1 = control byte 1
CB2 = control byte 2
Stop = stop condition

Logic diagram (READ mode)

	MSB							LSB
Address byte	1	1	0	0	0	MA1	MA0	1
Status byte	POR	FL	I2	I1	I0	A2	A1	A0

FL indicates the tuning loop to be in lock. For FL to be set to 1 the loop must be phase-locked during at least 8 periods of the 7.8125 kHz reference frequency (1 ms).

POR (power-on-reset) is intentionally set to 1 in case the PLL supply voltage drops below 3 V. The POR bit is reset when an end-of-data is detected by the PLL IC.

I0 to I2 and A0 to A2 do not contain any relevant data and can be ignored.

Telegram examples READ mode

Start – ADD – ACK – STB – ACK – STB – * – Stop ----- From processor

Start – ADD – ACK – STB – * – Stop ----- From PLL

Start = start condition
ADD = address
ACK = acknowledge
STB = status byte
Stop = stop condition

* No acknowledge, therefore end-of-data.

ADDITIONAL INFORMATION

Tuning supply voltage

For the U944 versions, a tuning voltage of 33 V must be connected via a series 22 kΩ resistor to pin 11. A preferred method is to use a constant current source. Fig.6 shows this using a 140 V supply. The zener diode prevents the voltage at pin 11 exceeding 33 V.

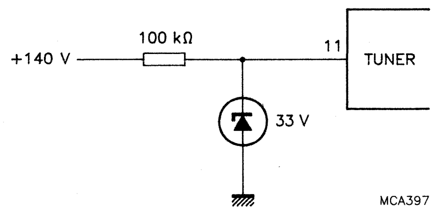


Fig.6 Constant current supply.

IF loading

To guarantee optimal signal handling performance the reactive load of the IF output circuit (internal capacitance, interconnections, SAW filter) has to be tuned to the IF centre frequency by means of a coil L in parallel with the SAW filter.

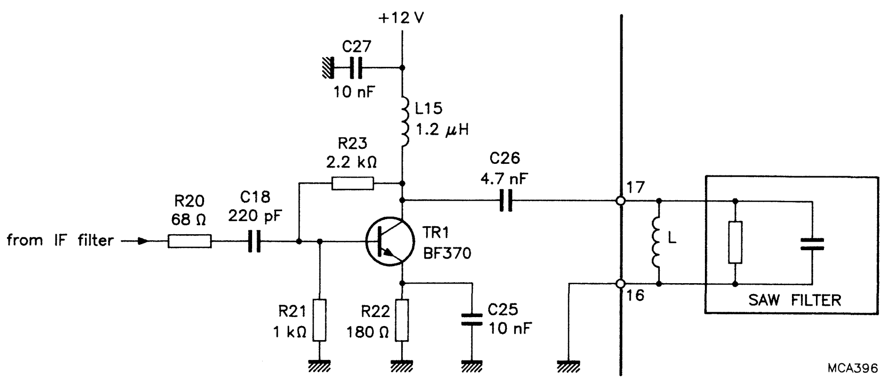


Fig.7 IF output circuit.

DEVELOPMENT DATA

V.H.F./U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

Systems	C.C.I.R. systems B and G
Channels	
v.h.f. I	NZ1 to C
v.h.f. III	M4 to E12
u.h.f.	E21 to E69
Intermediate frequencies	
picture	38,9 MHz
sound	33,4 MHz

APPLICATION

Designed to cover the v.h.f. and u.h.f. channels of C.C.I.R. systems B and G, with extended v.h.f. frequency ranges.

The tuners of the UV412 series are equipped with a frequency divider, which makes them suitable for digital tuning systems based on frequency synthesis; for the remainder they are equal to type UV411.

Available versions

	aerial input connector	frequency divider (IC)	division ratio	catalogue number
UV411	phono	–	–	3122 127 24360
UV411/IEC	IEC	–	–	3122 127 08870
UV412	phono	14-pin	256	3122 127 42010
UV412/256	phono	8-pin	256	3122 127 09060
UV412/256/IEC	IEC	8-pin	256	3122 127 08880
UV412/64	phono	8-pin	64	3122 127 08900
UV412/64/IEC	IEC	8-pin	64	3122 127 08890

DESCRIPTION

The UV411 and UV412 are combined v.h.f./u.h.f. tuners with electronic tuning and band switching, covering the v.h.f. band I including the New Zealand channel 1, and the Italian channel C (frequency range 44 to 92 MHz), the v.h.f. band III including the Morocco channel M4 (frequency range 162 to 230 MHz), and the u.h.f. band (frequency range 470 to 861 MHz).

Mechanically, the tuners are built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common phono or IEC aerial connector (v.h.f. and u.h.f.) is on one of the frame sides, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuners consist of v.h.f. and u.h.f. parts. The v.h.f. aerial signal is fed via switchable v.h.f. band I/III wide band input filters to gate 1 of an input MOSFET tetrode (with internal gate protection against surge).
The input filters are provided with an i.f. and f.m. suppression circuit. The drain load of the MOSFET tetrode is formed by a double tuned switchable bandpass filter, transferring the r.f. signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor.

The collector circuit of the mixer transistor is a single tuned i.f. resonant circuit, at the low end of which the i.f. signal is coupled out of the tuner. A test point (terminal 4) is provided for i.f. injection to align the i.f. output circuit of the tuner together with the i.f. amplifier of the television receiver. An additional test point, which is accessible through a hole in the top of the tuner, is connected to the collector of the mixer transistor.

The r.f. band pass filter and oscillator circuits are tuned by 3 tuning diodes; band switching is achieved by 5 switching diodes.

The u.h.f. part of the tuner consists of a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the v.h.f. mixer transistor, now operating as an i.f. amplifier.
The r.f. band pass filter and oscillator circuits are tuned by 3 tuning diodes.

In all bands the tuner is gain controlled via gate 2 of the input MOSFET tetrode.

The electrical circuit of the UV412 series is extended with a frequency divider (division ratio of 64 or 256), which inputs are connected to the v.h.f. and u.h.f. oscillator. The complementary outputs are connected to terminals 12 and 13.

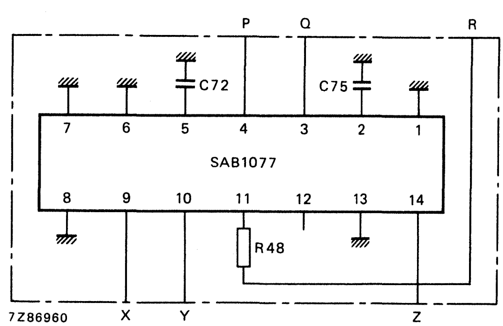


Fig. 1a.

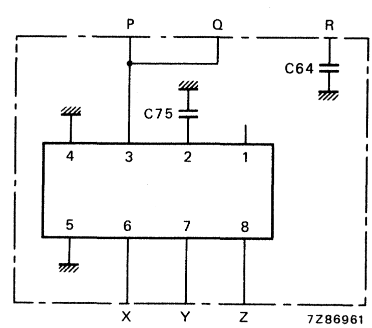


Fig. 1b.

See Fig. 1c.

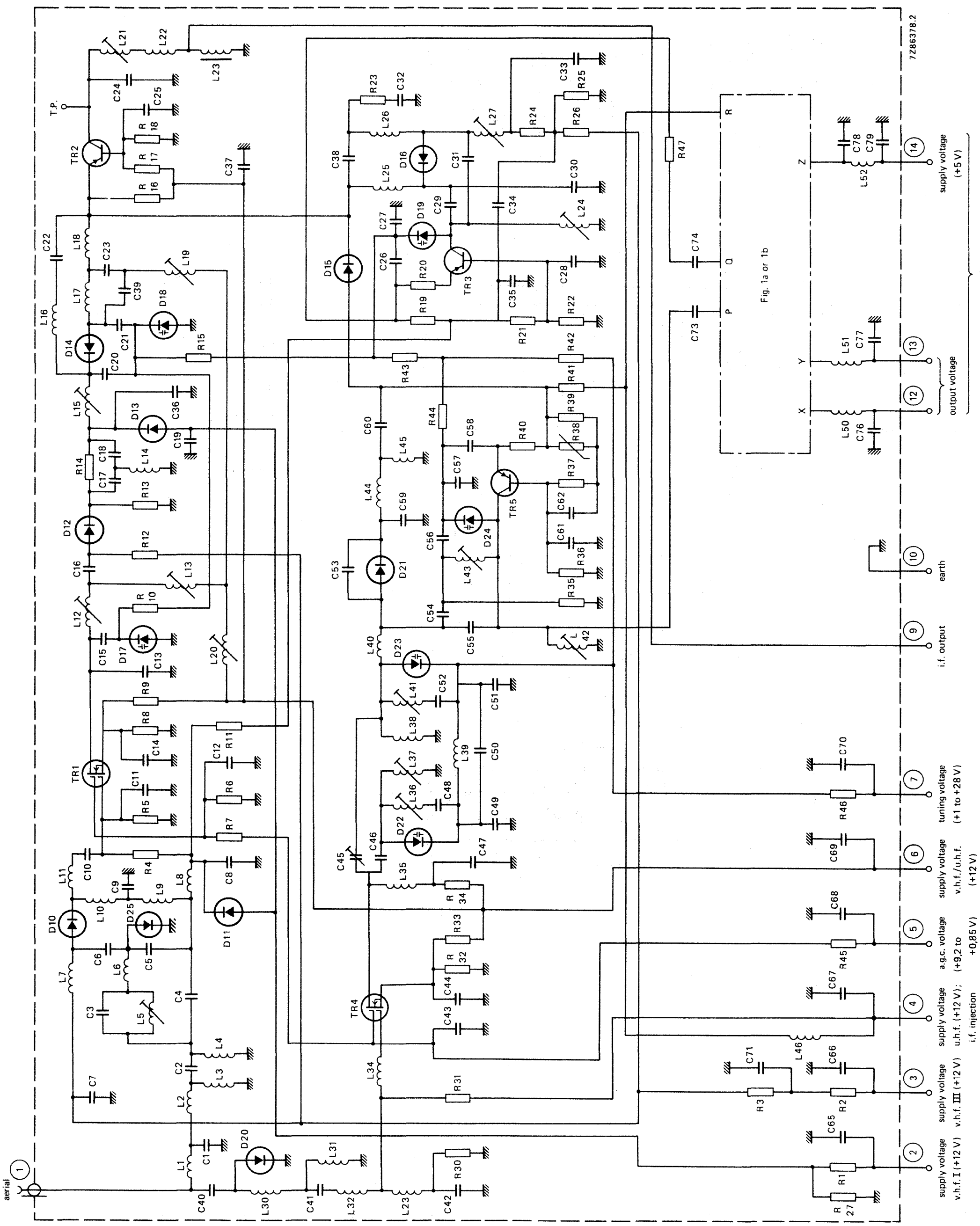


Fig. 1c.

* C64 only in versions with IC of Fig. 1b.

MECHANICAL DATA

Dimensions in mm

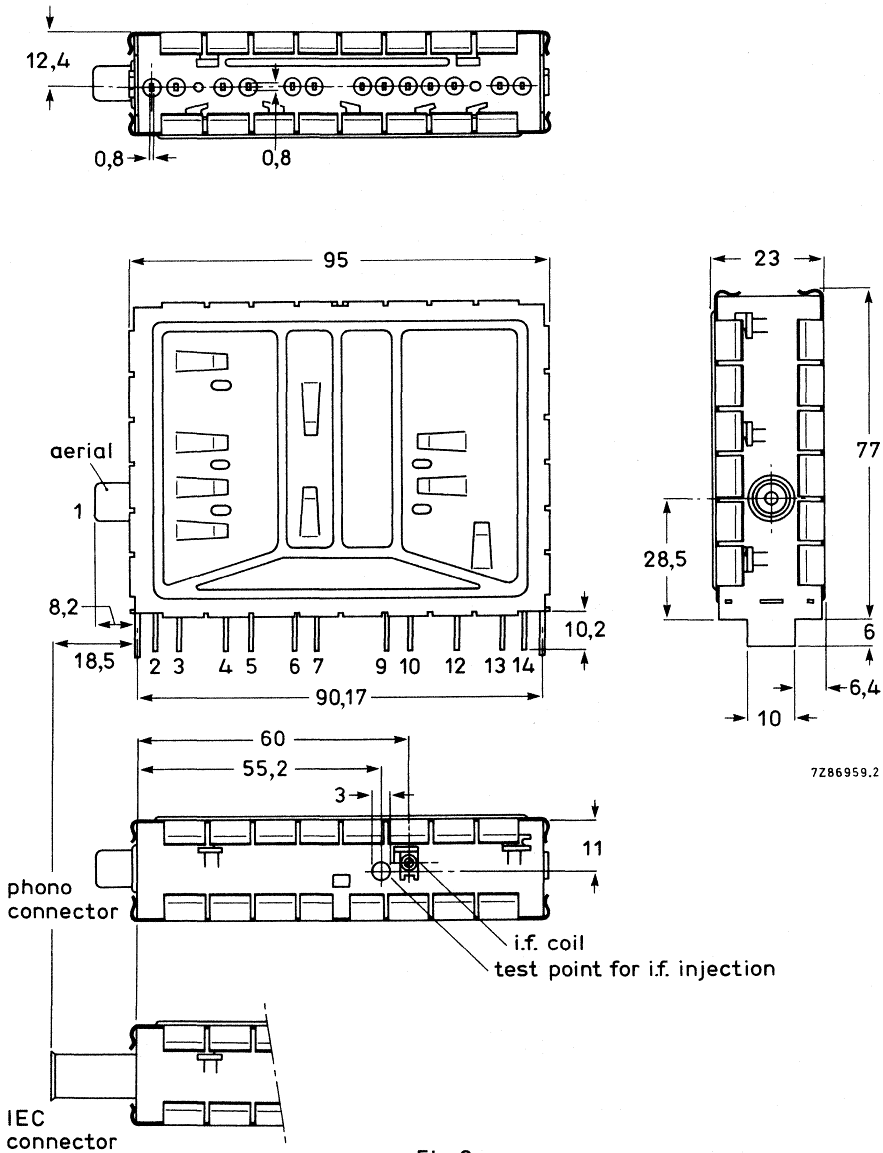
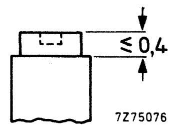


Fig. 2a.

Terminal

1 = aerial
2 = supply voltage, v.h.f. I, + 12 V
3 = supply voltage, v.h.f. III, + 12 V
4 = supply voltage, u.h.f., + 12 V; i.f. injection
5 = a.g.c. voltage, + 9,2 to + 0,85 V
6 = supply voltage, v.h.f. and u.h.f., + 12 V
7 = tuning voltage, + 1 to + 28 V
9 = i.f. output
10 = earth
12,13 = balanced output voltage of frequency divider } only for UV412
14 = supply voltage, frequency divider, + 5 V } only for UV412

Fig. 2b I.F. output coil.
Torque for alignment: 2 to 15 mNm.
Press-through force: ⩾ 10 N.

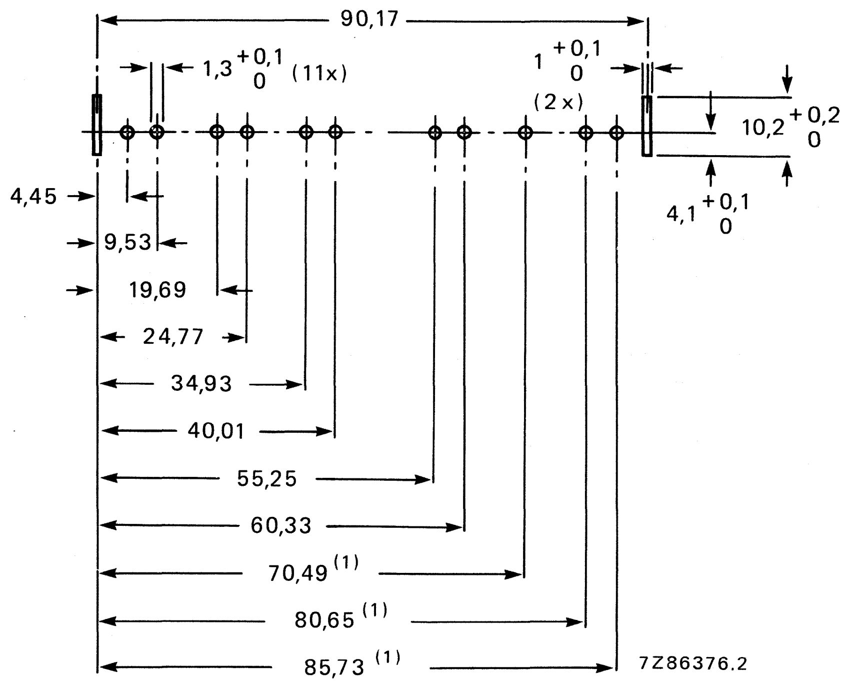


Mass approx. 127 g

Mounting

The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. (The tuner may also be mounted by means of a bracket. Information will be supplied upon request.) The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC68-2, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC68-2, test Tb (260 ± 5 °C, 10 ± 1 s).



(1) Only for UV412.

Fig. 3 Piercing diagram viewed from solder side of board. Unless otherwise stated the tolerance is ± 0,05 mm.

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General

Semiconductors, bands I and III	
r.f. amplifier	BF982
mixer	BF324
oscillator	BF926
tuning diodes	3 x BB809
switching diodes	5 x BA482/483/484
d.c. blocking diodes	2 x BAW62
Semiconductors, bands IV and V	
r.f. amplifier	BF980 (3SK87)
oscillator	BF970
mixer	1SS99
tuning diodes	3 x BB405B
surge protection diodes	2 x BAV10
frequency divider	SP4653 or SP4632
Ambient temperature range	
operating	0 to + 55 °C
storage	−25 to + 70 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltage	+ 12 V ± 10%
Current drawn from + 12 V supply	
bands I and III	max. 55 mA; typ. 44 mA
bands IV and V	max. 50 mA; typ. 40 mA

Bandswitching
For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
terminal 2 for operation in band I,
terminal 3 for operation in band III,
terminal 4 for operation in bands IV and V.

A.G.C. voltage (Figs 4, 5 and 6)	
voltage range	+ 9,2 to + 0,85 V
voltage at nominal gain	+ 9,2 ± 0,5 V
voltage at 40 dB gain reduction	
band I	typ. 3 V
band III	typ. 1,5 V
voltage at 30 dB gain reduction	typ. 2 V

Note: A.G.C. voltages between 0 and + 10,5 V may be applied without risk of damage.

A.G.C. current	max. 0,3 mA
Slope of a.g.c. characteristic, at the end of the specified a.g.c. range	
bands I and III	typ. 25 dB/V
bands IV and V	typ. 50 dB/V

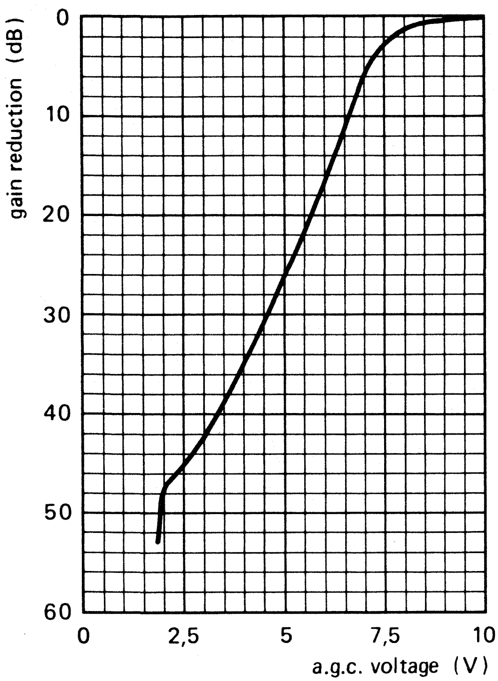


Fig. 4 Typical a.g.c. characteristic, band I.

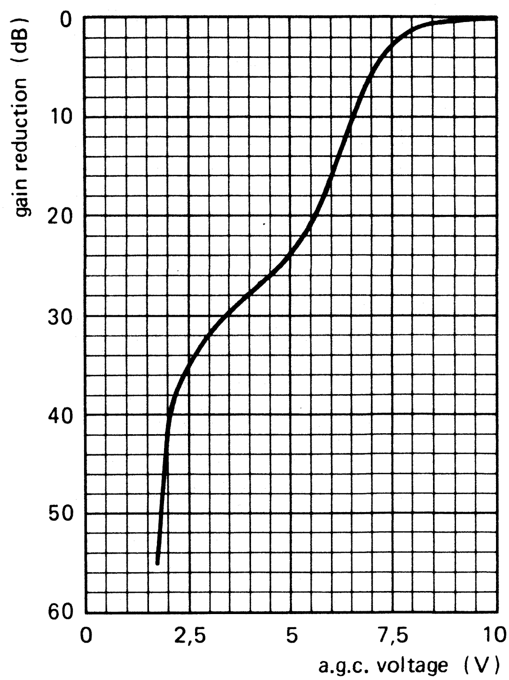


Fig. 5 Typical a.g.c. characteristic, band III.

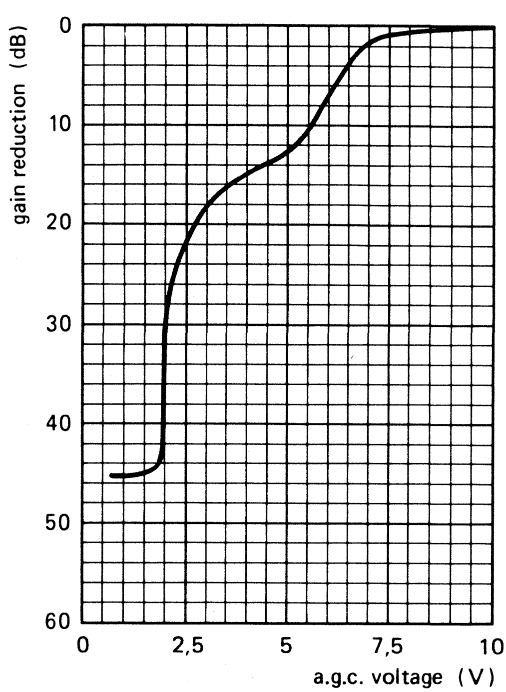


Fig. 6 Typical a.g.c. characteristic, bands IV and V.

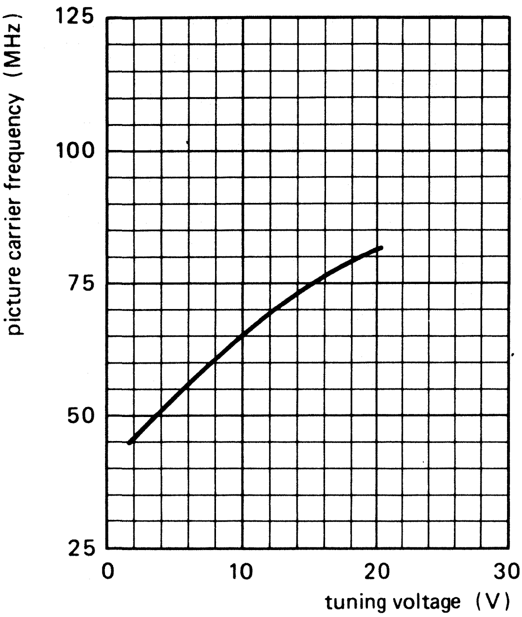


Fig. 7 Typical tuning characteristic, band I.

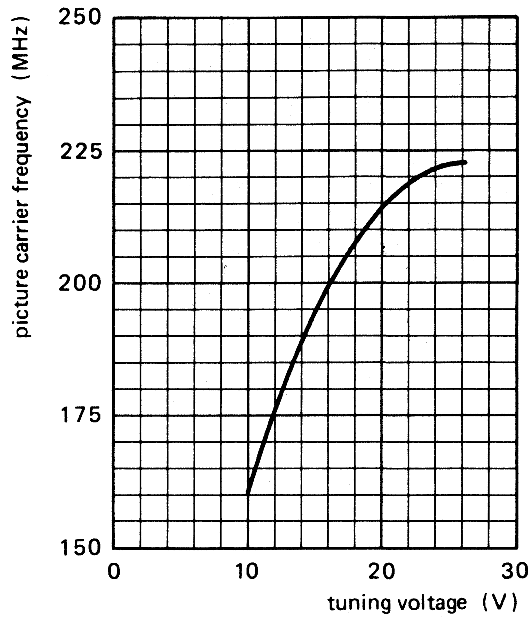


Fig. 8 Typical tuning characteristic, band III.

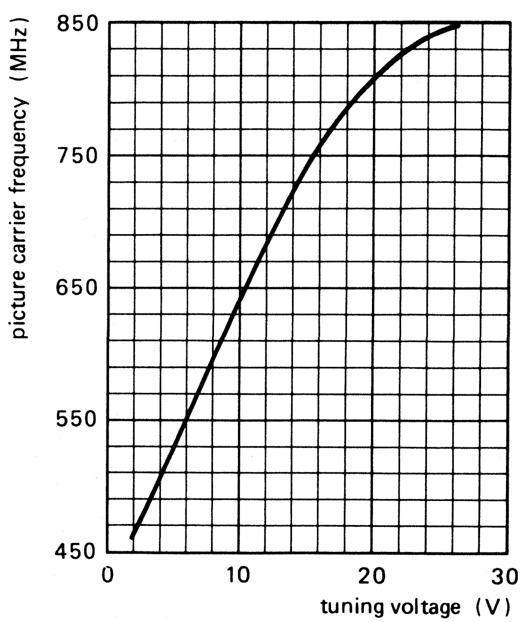


Fig. 9 Typical tuning characteristic, bands IV and V.

Tuning voltage range (Figs 7, 8 and 9)	+ 1 to + 28 V
Current drawn from 28 V tuning voltage supply	
at T_{amb} = 25 °C	max. 0,5 μA
at T_{amb} = 55 °C	max. 2 μA

Note: The source impedance of the tuning voltage offered to terminal 7 must be maximum 47 kΩ.

Slope of tuning characteristic		
band I, channel E2	3 MHz/V	typical values
channel E4	2 MHz/V	
band III, channel E5	7 MHz/V	
channel E12	2 MHz/V	
bands IV and V, channel E21	22 MHz/V	
channel E69	5 MHz/V	

Frequencies

Frequency ranges	
band I	channel NZ1 (picture carrier 45,25 MHz) to channel C (picture carrier 82,25 MHz).* Margin at the extreme channels: min. 1,5 MHz.
band III	channel M4 (picture carrier 163,25 MHz) to channel E12 (picture carrier 224,25 MHz). Margin at the extreme channels: min. 2 MHz.
bands IV and V	channel E21 (picture carrier 471,25 MHz) to channel E69 (picture carrier 855,25 MHz). Margin at the extreme channels: min. 3 MHz.
Intermediate frequencies	
picture	38,9 MHz
sound	33,4 MHz
	The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance	75 Ω	
V.S.W.R. and reflection coefficient (values between picture and sound carrier, as well as values at picture carrier)		
	at nominal gain	during gain control
v.s.w.r.		
bands I and III	max. 4,5	max. 5,5
bands IV and V	max. 5	max. 7
reflection coefficient		
bands I and III	max. 64%	max. 69%
bands IV and V	max. 66%	max. 75%
R.F. curves, bandwidth		
band I	typ. 11 MHz	
band III	typ. 13 MHz	
bands IV and V	typ. 20 MHz	

* Channel R4 (picture carrier 85,25 MHz) is within the frequency range, but not specified.

R.F. curves, tilt	on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.
A.G.C. range	
bands I and III	min. 40 dB
bands IV and V	min. 30 dB
Power gain (see also Measuring method of power gain)	
bands I and III	min. 22 dB
channel E3	typ. 28 dB
channel E5	typ. 28 dB
channel E12	typ. 28 dB
bands IV and V	min. 20 dB
channel E21	typ. 28 dB
channel E40	typ. 27 dB
channel E69	typ. 26 dB
Maximum gain difference	
between any two v.h.f. channels	typ. 2 dB
between any two u.h.f. channels	typ. 3 dB
between any v.h.f. and u.h.f. channel	typ. 4 dB
Noise figure	
bands I and III, except channels NZ1 and M4	max. 7 dB
channels NZ1 and M4	max. 10 dB
channel E3	typ. 4 dB
channel E5	typ. 4 dB
channel E12	typ. 5 dB
bands IV and V	max. 10 dB
channel E21	typ. 6 dB
channel E40	typ. 6 dB
channel E69	typ. 7 dB
Overloading	
Input signal producing 1 dB gain compression at nominal gain	
bands I and III	typ. 90 dB (μV) into 75 Ω
bands IV and V	typ. 90 dB (μV) into 75 Ω
Input signal producing either a detuning of the oscillator of + 300 kHz or −1000 kHz or stopping of the oscillations at nominal gain	
bands I and III	typ. 100 dB (μV) into 75 Ω
bands IV and V	typ. 100 dB (μV) into 75 Ω

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)	
bands I and III, except channels C and R4	min. 60 dB; typ. 70 dB
channels C and R4	min. 55 dB
bands IV and V	min. 44 dB; typ. 53 dB

I.F. rejection (measured at picture carrier frequency)	
channel NZ1	min. 40 dB
channel E2	min. 45 dB
channels E3 to C	min. 50 dB
band III	min. 60 dB
bands IV and V	min. 60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection.

N ± 4 rejection (for u.h.f. only) Interference signal for an interference ratio of 53 dB referred to wanted picture carrier (picture to sound carrier ratio of 10 dB; wanted signal 60 dB (μV); tuner operating at nominal gain)	typ. 75 dB (μV) into 75 Ω

Cross modulation
Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

bands I and III	
at nominal gain (wanted input level 60 dB (μV))	typ. 74 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 94 dB (μV) into 75 Ω
bands IV and V	
at nominal gain (wanted input level 60 dB (μV))	typ. 74 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 94 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for v.h.f. I, or channel N ± 3 for v.h.f. III, or channel N ± 5 for u.h.f.)

bands I and III	
at nominal gain (wanted input level 60 dB (μV))	typ. 82 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 94 dB (μV) into 75 Ω
bands IV and V	
at nominal gain (wanted input level 60 dB (μV))	typ. 82 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 94 dB (μV) into 75 Ω

Out of band cross modulation at nominal gain	
v.h.f. I, interfering from v.h.f. III	typ. 94 dB (μV) into 75 Ω
v.h.f. I, interfering from u.h.f.	typ. 90 dB (μV) into 75 Ω
v.h.f. III, interfering from v.h.f. I	typ. 94 dB (μV) into 75 Ω
v.h.f. III, interfering from u.h.f.	typ. 90 dB (μV) into 75 Ω
u.h.f. interfering from v.h.f. I	typ. 94 dB (μV) into 75 Ω
u.h.f. interfering from v.h.f. III	typ. 86 dB (μV) into 75 Ω

Oscillator characteristics

Pulling Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain	
bands I and III	typ. 80 dB (μV) into 75 Ω
bands IV and V	typ. 80 dB (μV) into 75 Ω
Shift of oscillator frequency at a change of the supply voltage of 5%	
bands I and III	max. 200 kHz
bands IV and V	max. 400 kHz
Drift of oscillator frequency	
during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)	max. 250 kHz
during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)	max. 250 kHz
at a change of the ambient temperature from + 25 to + 40 ^{o}C (measured after 3 cycles from + 25 to + 55 ^{o}C)	
bands I and III	max. 300 kHz
bands IV and V	max. 500 kHz

Frequency divider characteristics of version UV412

Supply voltage	+ 5 V ± 5%
Current drawn from + 5 V supply	
bands I and III	max. 45 mA; typ. 35 mA
bands IV and V	max. 55 mA; typ. 45 mA
Output voltage	3,4 to 10 V, depending on load and supply voltage
Output current	
at output voltage 3,4 V	min. 1 mA
at output voltage 5 V	max. 1,5 mA
Interference signal on the i.f. output	max. 3 μV

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10.

The output voltage is determined by the external load and the supply voltage, which is connected to this load. They should be chosen such that:
— the output-voltage rating of 10 V is not exceeded;
— the output voltage does not drop more than 1,6 V below 5 V (supply voltage of frequency divider);
— the output-voltage swing does not exceed 1 V.

Radiation by the output signal may be reduced by transporting the two complementary signals via twisted wires or a flat cable, even if only one signal is to be used to drive the subsequent circuit.

Frequency divider characteristics of the UV412/64 and UV412/256 versions

Supply voltage	+5 V ± 10%
Current drawn from +5 V supply	max. 35 mA; typ. 25 mA
Output voltage, unloaded, measured with probe 10 MΩ/11 pF	min. 0,8 V p-p
Output impedance	typ. 1 kΩ
Output imbalance	typ. 0,1 V
Interference signal on the i.f. output	
UV412/256	max. 3 μV
UV412/64	max. 20 μV

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10.

I.F. circuit characteristics

Bandwidth of i.f. output circuit 5 ± 1 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10; tuning voltage 2 V; u.h.f. band switched on.

Bandwidth variation of i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 2 V) max. 650 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 10, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

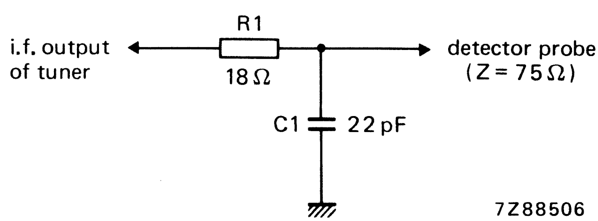


Fig. 10.

Detuning of the i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 2 V) max. 500 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 10, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

Minimum tuning range of i.f. output coil 33 to 40 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10.

Attenuation between i.f. injection point and i.f. output of the tuner typ. 16 dB

Miscellaneous

Radio interference Oscillator radiation and oscillator voltage at the aerial terminal	Within the limits of C.I.S.P.R. 13 (1975) and VDE 0872/7.72.
Microphonics	There will be no microphonics, provided the tuner is installed in a professional manner.
Surge protection Protection against voltages	max. 5 kV

Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes	max. 30 kV, 400 mWs

Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

ADDITIONAL INFORMATION

I.F. injection

Terminal 4 (supply voltage u.h.f.) can be used as i.f. injection point, provided the u.h.f. supply voltage is applied to terminal 4 via a resistor of 10 Ω (see Fig. 11). The u.h.f. band should be switched on; tuning voltage should be 2 V.

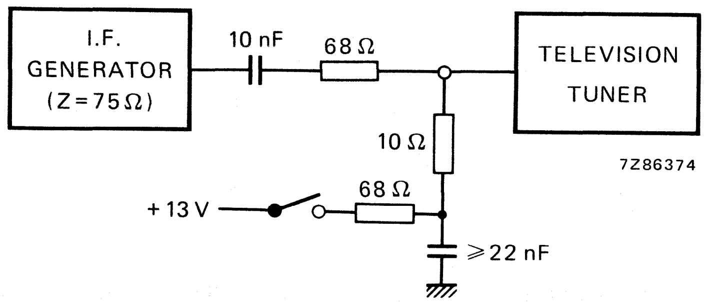


Fig. 11.

Connection of the i.f. amplifier

No special precautions are required to load and to match the i.f. output of the tuner.

Connection of supply voltages

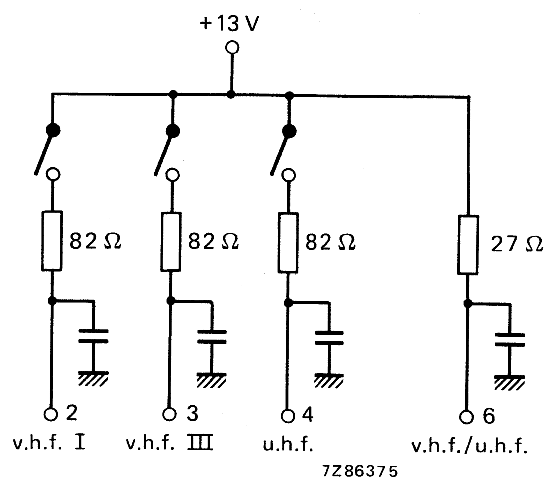


Fig. 12.

Measuring method of power gain

The i.f. output of the tuner should be terminated with the RC-circuit given in Fig. 10.

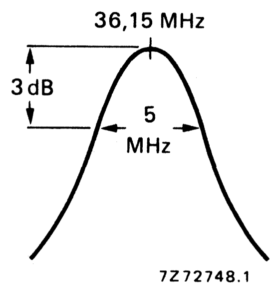


Fig. 13.

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit, which should be tuned to 36,15 MHz; the bandwidth is approx. 5 MHz (Fig. 13).

Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector.

Alignment of the i.f. output coil

The i.f. output coil should be adjusted with a brass tool with a blade as shown in Fig. 14. A suitable tool is available under catalogue number 7122 005 47680.

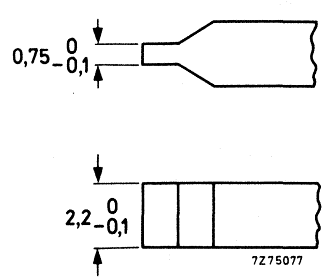


Fig. 14.

V.H.F./U.H.F. TELEVISION TUNER

QUICK REFERENCE DATA

Systems	C.C.I.R. system D
Channels	
low v.h.f.	C1 to C5
high v.h.f.	C6 to C12
u.h.f.	C13 to C57
Intermediate frequencies	
picture	37,00 MHz
sound	30,50 MHz

APPLICATION

Designed to cover the v.h.f. and u.h.f. channels of C.C.I.R. system D.

A tuner UV412HKM/256/IEC with a frequency divider (1 : 256) is available under catalogue number 3122 237 00240. This version is suitable for digital tuning systems based on frequency synthesis.

DESCRIPTION

The UV411 HKM/IEC is a combined v.h.f./u.h.f. tuner with electronic tuning and band switching, covering the low v.h.f. band (frequency range 48 to 92 MHz), the high v.h.f. band (frequency range 167 to 224 MHz), and the u.h.f. band (frequency range 470 to 870 MHz).

Mechanically, the tuner is built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common IEC aerial connector (v.h.f. and u.h.f.) is on one of the frame sides, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuner consists of v.h.f. and u.h.f. parts. The v.h.f. aerial signal is fed via switchable wide band input filters to gate 1 of an input MOSFET tetrode (with internal gate protection against surge).
The input filters are provided with an i.f. and f.m. suppression circuit. The drain load of the MOSFET tetrode is formed by a double tuned switchable bandpass filter, transferring the r.f. signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor.

The collector circuit of the mixer transistor is a single tuned i.f. resonant circuit, at the low end of which the i.f. signal is coupled out of the tuner. A test point (terminal 4) is provided for i.f. injection to align the i.f. output circuit of the tuner together with the i.f. amplifier of the television receiver. An additional test point, which is accessible through a hole in the top of the tuner, is connected to the collector of the mixer transistor.

The r.f. band pass filter and oscillator circuits are tuned by 3 tuning diodes; band switching is achieved by 5 switching diodes.

The u.h.f. part of the tuner consists of a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the v.h.f. mixer transistor, now operating as an i.f. amplifier.
The r.f. band pass filter and oscillator circuits are tuned by 3 tuning diodes.

In all bands the tuner is gain controlled via gate 2 of the input MOSFET tetrodes.

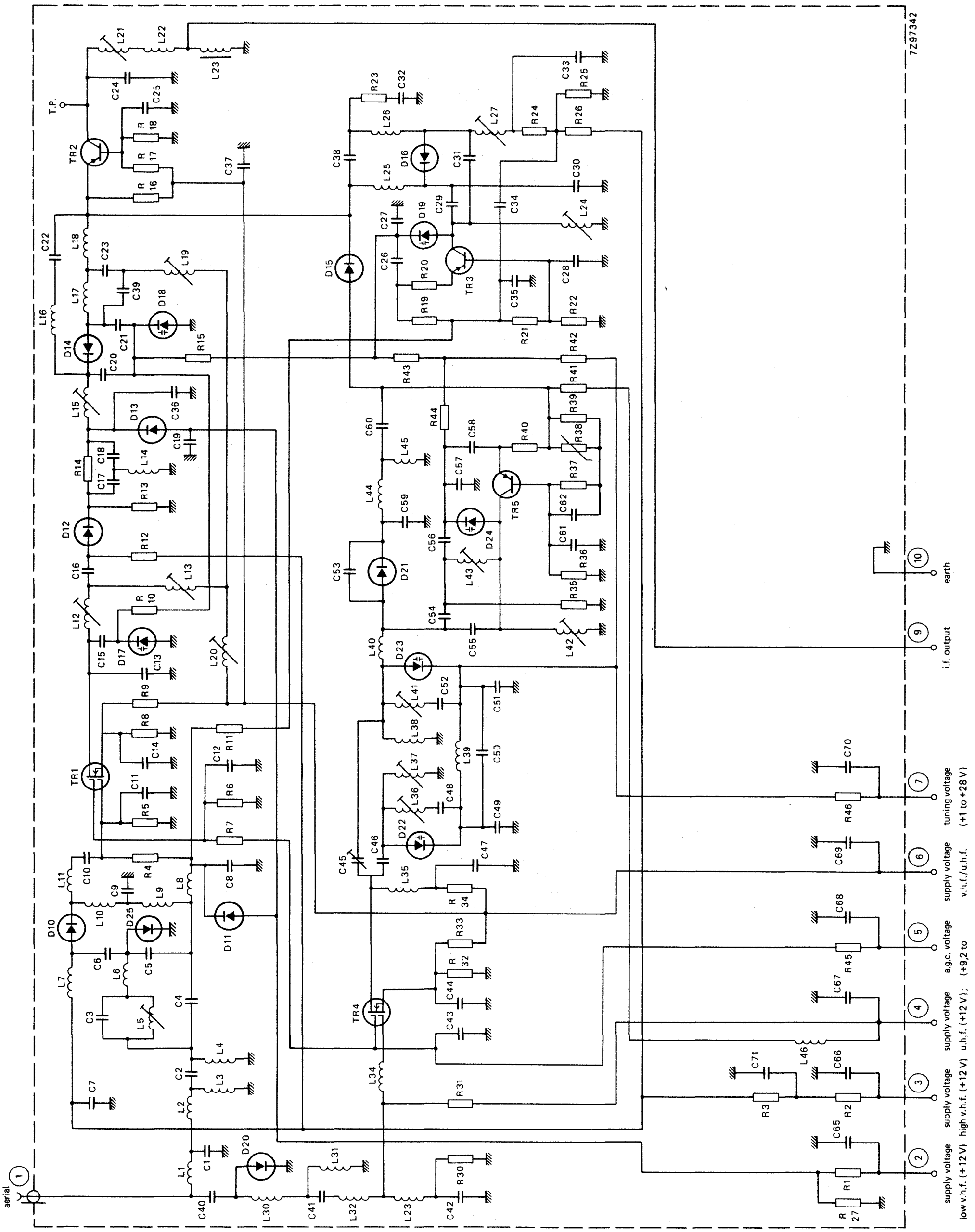

7Z97342
aerial
supply voltage low v.h.f. (+12 V)
supply voltage high v.h.f. (+12 V)
supply voltage u.h.f. (+12 V); i.f. injection
a.g.c. voltage (+9,2 to +0,85 V)
supply voltage v.h.f./u.h.f. (+12 V)
tuning voltage (+1 to +28 V)
i.f. output
earth
T.P.

Fig. 1.

MECHANICAL DATA

Dimensions in mm

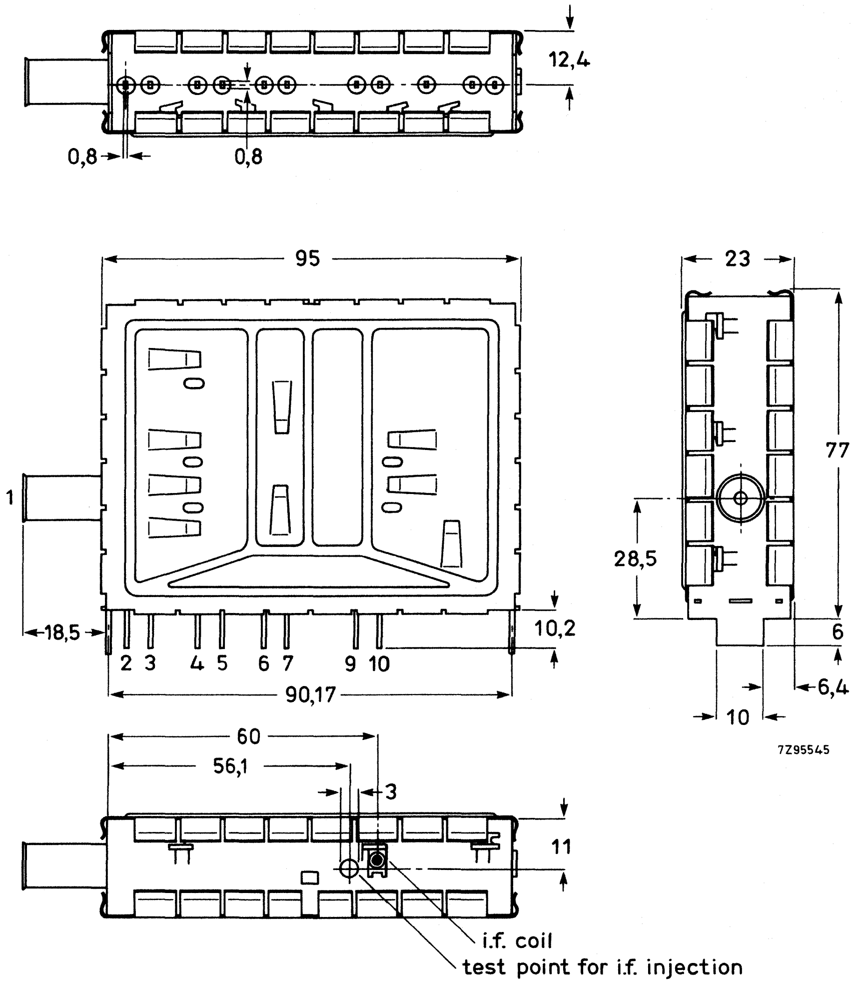
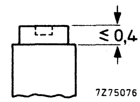


Fig. 2a.

Terminal

1 = aerial
2 = supply voltage, low v.h.f., + 12 V
3 = supply voltage, high v.h.f., + 12 V
4 = supply voltage, u.h.f., + 12 V
5 = a.g.c. voltage, + 9,2 to + 0,85 V
6 = supply voltage, v.h.f. and u.h.f., + 12 V
7 = tuning voltage, + 1 to + 28 V
9 = i.f. output
10 = earth

Fig. 2b I.F. output coil.
Torque for alignment: 2 to 15 mNm.
Press-through force: ⩾ 10 N.



Mass approx. 127 g

Mounting

The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. (The tuner may also be mounted by means of a bracket. Information will be supplied upon request.) The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

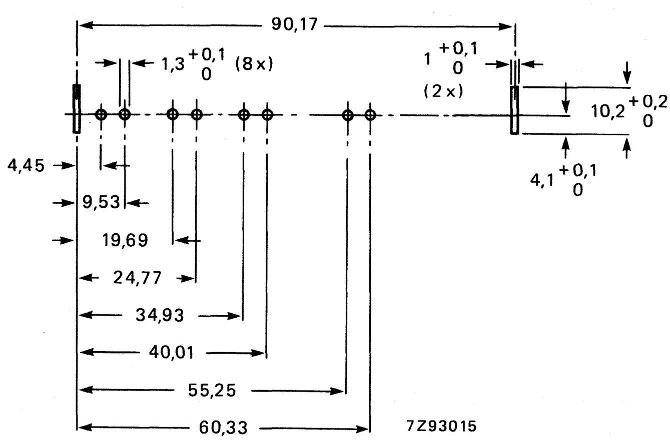


Fig. 3 Piercing diagram viewed from solder side of board. Unless otherwise stated the tolerance is ± 0,05 mm.

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General

Semiconductors, v.h.f. bands	
r.f. amplifier	BF982
mixer	BF324
oscillator	BF926
tuning diodes	3 x BB809
switching diodes	5 x BA482/483/484
d.c. blocking diodes	2 x BAW62
Semiconductors, u.h.f. bands	
r.f. amplifier	BF980
oscillator	BF970
mixer	1SS99
tuning diodes	3 x BB405B
surge protection diodes	2 x BAV10
(frequency divider	SP4653 or SP4632)
Ambient temperature range	
operating	0 to + 55 °C
storage	−25 to + 70 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltage	+ 12 V ± 10%
Current drawn from + 12 V supply	
v.h.f. bands	max. 55 mA; typ. 44 mA
u.h.f. bands	max. 50 mA; typ. 40 mA

Bandswitching

For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:

terminal 2 for operation in low v.h.f. band
terminal 3 for operation in high v.h.f. band
terminal 4 for operation in u.h.f. bands

A.G.C. voltage (Figs 4, 5 and 6)	
voltage range	+ 9,2 to + 0,85 V
voltage at nominal gain	+ 9,2 ± 0,5 V
voltage at 40 dB gain reduction	
low v.h.f. band	typ. 3 V
high v.h.f. band	typ. 1,5 V
voltage at 30 dB gain reduction	typ. 2 V

Note: A.G.C. voltages between 0 and + 10,5 V may be applied without risk of damage.

A.G.C. current	max. 0,3 mA
Slope of a.g.c. characteristic, at the end of the specified a.g.c. range	
v.h.f. bands	typ. 25 dB/V
u.h.f. bands	typ. 50 dB/V

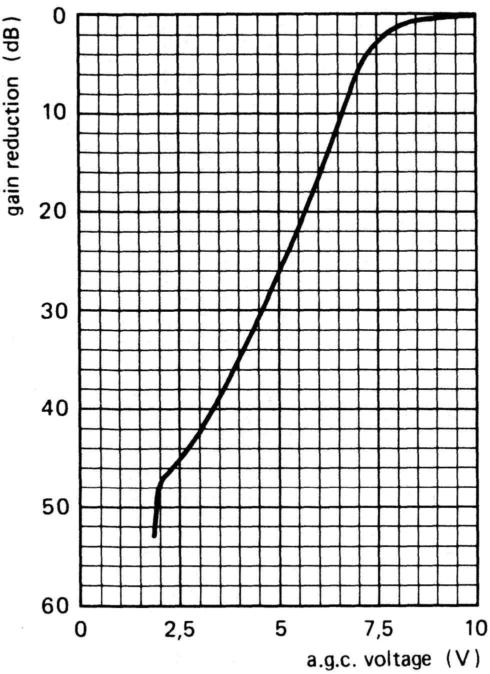


Fig. 4 Typical a.g.c. characteristic, low v.h.f. band.

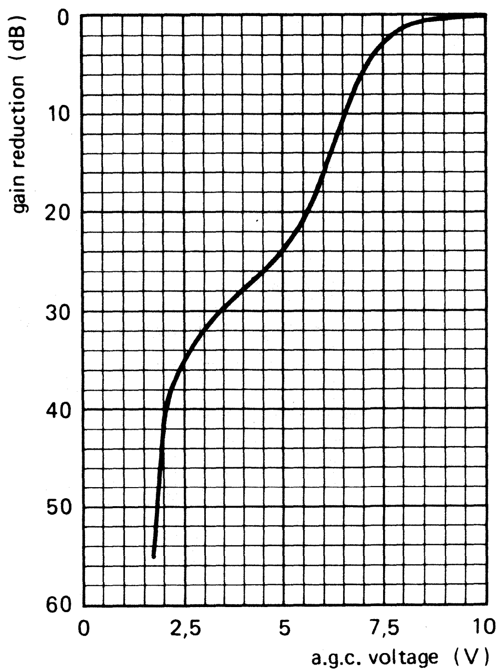


Fig. 5 Typical a.g.c. characteristic, high v.h.f. band.

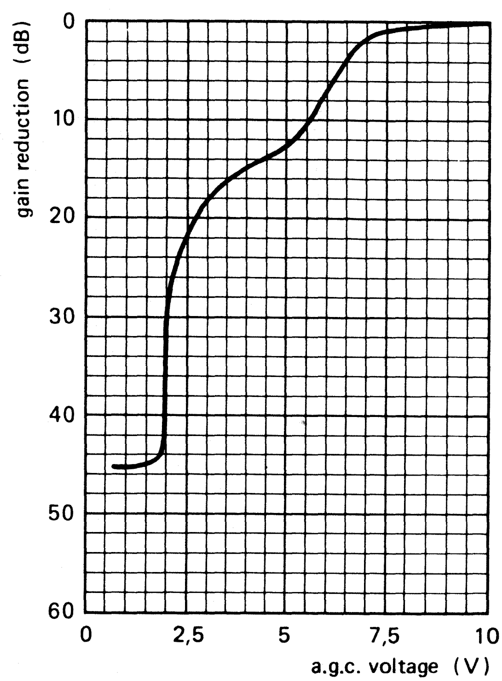


Fig. 6 Typical a.g.c. characteristic, u.h.f. bands.

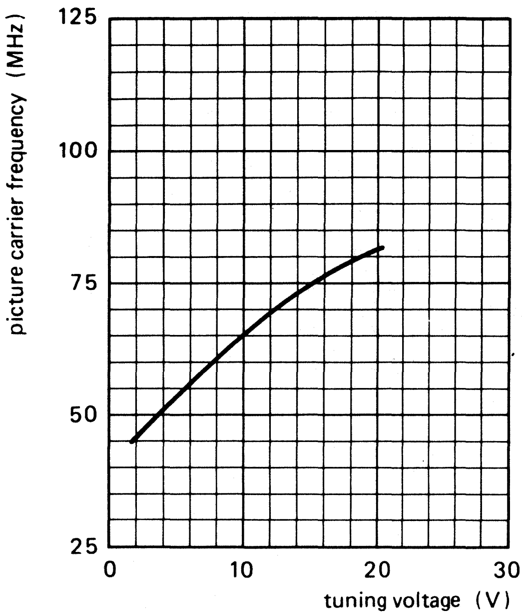


Fig. 7 Typical tuning characteristic, low v.h.f. band.

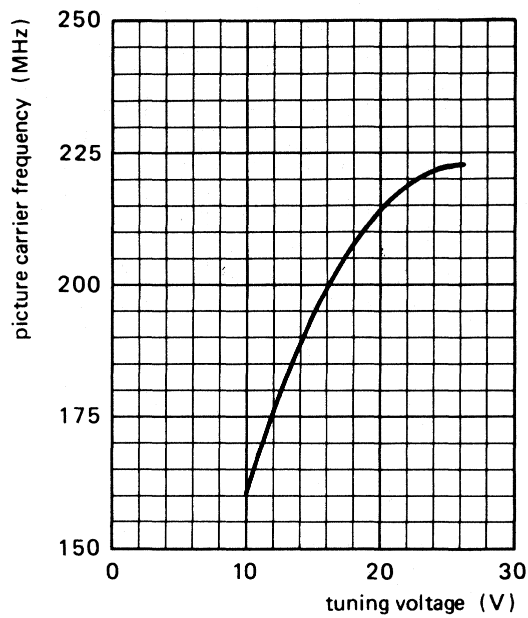


Fig. 8 Typical tuning characteristic, high v.h.f. band.

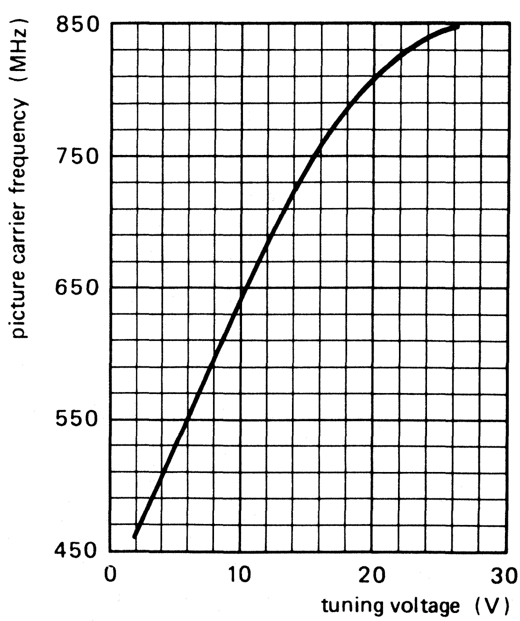


Fig. 9 Typical tuning characteristic, u.h.f. bands.

Tuning voltage range (Figs 7, 8 and 9)	+ 1 to + 28 V
Current drawn from 28 V tuning voltage supply	
at T_{amb} = 25 °C	max. 0,5 μA
at T_{amb} = 55 °C	max. 2 μA

Note: The source impedance of the tuning voltage offered to terminal 7 must be maximum 47 kΩ.

Slope of tuning characteristic		
low v.h.f. band, channel C1	3 MHz/V	typical values
channel C5	1 MHz/V	
high v.h.f. band, channel C6	6 MHz/V	
channel C12	3 MHz/V	
u.h.f. bands, channel C13	22 MHz/V	
channel C56	4 MHz/V	

Frequencies

Frequency ranges	
low v.h.f. band	channel C1 (picture carrier 49,75 MHz) to channel C5 (picture carrier 85,25 MHz). Margin at the extreme channels: min. 1,5 MHz.
high v.h.f. band	channel C6 (picture carrier 168,25 MHz) to channel C12 (picture carrier 216,25 MHz). Margin at the extreme channels: min. 2 MHz.
u.h.f. bands	channel C13 (picture carrier 471,25 MHz) to channel C57 (picture carrier 863,25 MHz). Margin at the extreme channels: min. 3 MHz.
Intermediate frequencies	
picture	37,0 MHz
sound	30,5 MHz
	The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance	75 Ω	
V.S.W.R. and reflection coefficient (values between picture and sound carrier, as well as values at picture carrier)		
	at nominal gain	during gain control
v.s.w.r.		
v.h.f. bands	max. 4,5	max. 5,5
u.h.f. bands	max. 5	max. 7
reflection coefficient		
v.h.f. bands	max. 64%	max. 69%
u.h.f. bands	max. 66%	max. 75%
R.F. curves, bandwidth		
low v.h.f. band	typ. 11 MHz	
high v.h.f. band	typ. 13 MHz	
u.h.f. bands	typ. 20 MHz	

R.F. curves, tilt	on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.
A.G.C. range	
v.h.f. bands	min. 40 dB
u.h.f. bands	min. 30 dB
Power gain (see also Measuring method of power gain)	
v.h.f. bands	min. 22 dB
channel C2	typ. 28 dB
channel C7	typ. 28 dB
channel C12	typ. 28 dB
u.h.f. bands	min. 20 dB
channel C13	typ. 28 dB
channel C27	typ. 27 dB
channel C56	typ. 26 dB
Maximum gain difference	
between any two v.h.f. channels	typ. 2 dB
between any two u.h.f. channels	typ. 3 dB
between any v.h.f. and u.h.f. channel	typ. 4 dB
Noise figure	
v.h.f. bands	max. 8 dB
channel C2	typ. 4 dB
channel C7	typ. 4 dB
channel C12	typ. 5 dB
u.h.f. bands	max. 10 dB
channel C13	typ. 6 dB
channel C27	typ. 6 dB
channel C56	typ. 7 dB
Overloading	
Input signal producing 1 dB gain compression at nominal gain	
v.h.f. bands	typ. 90 dB (μV) into 75 Ω
u.h.f. bands	typ. 90 dB (μV) into 75 Ω
Input signal producing either a detuning of the oscillator of + 300 kHz or −1000 kHz or stopping of the oscillations at nominal gain	
v.h.f. bands	typ. 100 dB (μV) into 75 Ω
u.h.f. bands	typ. 100 dB (μV) into 75 Ω

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)	
v.h.f. bands, except channel C5	min. 60 dB; typ. 70 dB
channel C5	min. 55 dB; typ. 59 dB
u.h.f. bands, channels C13 up to C50	min. 44 dB; typ. 53 dB
channels C51 up to C57	min. 40 dB; typ. 44 dB

I.F. rejection (measured at picture carrier frequency)

low v.h.f. band	
channel C1	min. 45 dB
channels C2 up to C5	min. 50 dB
high v.h.f. band	min. 60 dB
u.h.f. bands	min. 60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection.

Cross modulation
Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

v.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 74 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 94 dB (μV) into 75 Ω
u.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 74 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 94 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for low v.h.f., or channel N ± 3 for high v.h.f., or channel N ± 5 for u.h.f.)

v.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 82 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 94 dB (μV) into 75 Ω
u.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 82 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 94 dB (μV) into 75 Ω

Out of band cross modulation at nominal gain

low v.h.f., interfering from high v.h.f.	typ. 94 dB (μV) into 75 Ω
low v.h.f., interfering from u.h.f.	typ. 90 dB (μV) into 75 Ω
high v.h.f., interfering from low v.h.f.	typ. 94 dB (μV) into 75 Ω
high v.h.f., interfering from u.h.f.	typ. 90 dB (μV) into 75 Ω
u.h.f. interfering from low v.h.f.	typ. 94 dB (μV) into 75 Ω
u.h.f. interfering from high v.h.f.	typ. 86 dB (μV) into 75 Ω

Oscillator characteristics

Pulling	
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain	
v.h.f. bands	typ. 80 dB (μV) into 75 Ω
u.h.f. bands	typ. 80 dB (μV) into 75 Ω
Shift of oscillator frequency at a change of the supply voltage of 5%	
v.h.f. bands	max. 200 kHz
u.h.f. bands	max. 400 kHz
Drift of oscillator frequency	
during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)	max. 250 kHz
during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)	max. 250 kHz
at a change of the ambient temperature from + 25 to + 40 °C (measured after 3 cycles from + 25 to + 55 °C)	
v.h.f. bands	max. 300 kHz
u.h.f. bands	max. 500 kHz

I.F. circuit characteristics

Bandwidth of i.f. output circuit	5 ± 1 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10; tuning voltage 2 V; u.h.f. band switched on.

Bandwidth variation of i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 2 V)	max. 650 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 10, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner. I.F. output adjusted to 33,75 MHz.

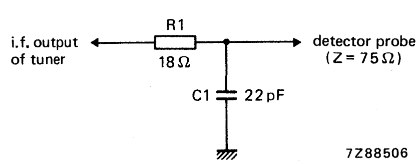


Fig. 10.

Detuning of the i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 2 V)	max. 500 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 10, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

Minimum tuning range of i.f. output coil	30 to 39 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10.

Attenuation between i.f. injection point and i.f. output of the tuner	typ. 16 dB

Miscellaneous

Radio interference

Oscillator radiation and oscillator voltage at the aerial terminal	Within the limits of C.I.S.P.R. 13 (1975) and VDE 0872/7.72.
Microphonics	There will be no microphonics, provided the tuner is installed in a professional manner.

Surge protection

Protection against voltages	max. 5 kV

Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes	max. 30 kV, 400 mWs

Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

ADDITIONAL INFORMATION

I.F. injection

Terminal 4 (supply voltage u.h.f.) can be used as i.f. injection point, provided the u.h.f. supply voltage is applied to terminal 4 via a resistor of 10 Ω (see Fig. 11). The u.h.f. band should be switched on; tuning voltage should be 2 V.

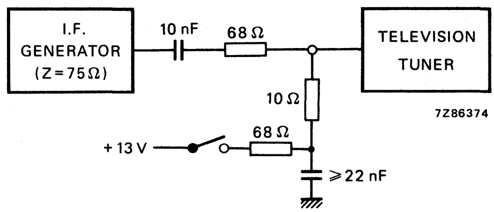


Fig. 11.

Connection of the i.f. amplifier

No special precautions are required to load and to match the i.f. output of the tuner.

Connection of supply voltages

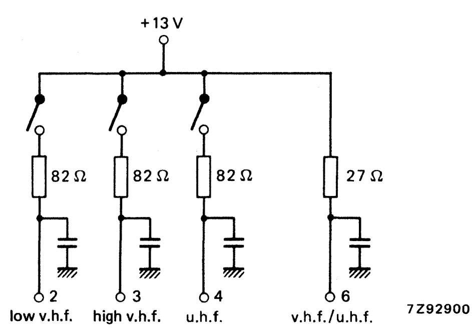


Fig. 12.

Measuring method of power

The i.f. output of the tuner should be terminated with the RC-circuit given in Fig. 10.

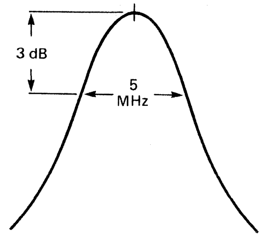


Fig. 13.

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit, which should be tuned to 33,75 MHz; the bandwidth is approx. 5 MHz (Fig. 13).

Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector.

Alignment of the i.f. output coil

The i.f. output coil should be adjusted with a plastic tool which has a cross head as shown in Fig. 14.
A suitable tool for automatic alignment is available:

holder	catalogue number 7122 005 47910
cross-head	catalogue number 3122 131 63390.

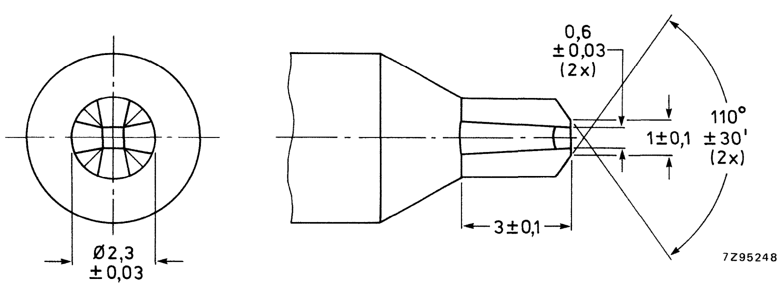


Fig. 14.

V.H.F./U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

Systems	C.C.I.R. systems B and G
Channels	
low v.h.f.	E2 to S1
high v.h.f.	S2 to S20
u.h.f.	E21 to E69
Intermediate frequencies	
picture	38,9 MHz
sound	33,4 MHz

APPLICATION

Designed to cover the v.h.f. and u.h.f. channels of C.C.I.R. systems B and G, with extended v.h.f. frequency ranges.

The tuner UV418 is equipped with a frequency divider, which makes it suitable for digital tuning systems based on frequency synthesis; otherwise this tuner is equal to type UV417.

Both tuners comply with the requirements of radiation, signal handling capability, and immunity from radiated interference of Amtsblatt DBP69/1981, when installed professionally in an adequate TV receiver.

Available versions

type number	aerial input connector	frequency divider (IC)	division ratio	catalogue number
UV417	phono	–	–	3112 218 52660
UV417/IEC	IEC	–	–	3112 218 52690
UV418/256	phono	8-pin	256	3112 218 52720
UV418/256/IEC	IEC	8-pin	256	3112 218 52780
UV418/64	phono	8-pin	64	3112 218 52750
UV418/64/IEC	IEC	8-pin	64	3112 218 52810

DESCRIPTION

The UV417 and UV418 are combined v.h.f./u.h.f. tuners with electronic tuning and band switching, covering the low v.h.f. band (frequency range 47 to 111 MHz), the high v.h.f. band (frequency range 111 to 300 MHz), and the u.h.f. band (frequency range 470 to 860 MHz).

Mechanically, the tuners are built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common phono aerial connector (v.h.f. and u.h.f.) is on one of the frame sides, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuners consist of v.h.f. and u.h.f. parts. The v.h.f. aerial signal is fed via switchable wideband low v.h.f. and high v.h.f. input filters to gate 1 of an input MOSFET tetrode (with internal gate protection against surge).
The input filters are provided with an i.f. suppression circuit. The drain load of the MOSFET tetrode is formed by a double tuned switchable bandpass filter, transferring the r.f. signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor (T.P.1.).

The collector circuit of the mixer transistor is a single tuned i.f. resonant circuit, where at the low impedance side the i.f. signal is coupled out of the tuner. A test point, which is accessible through a hole in the top of the frame is provided for i.f. injection to align the i.f. output circuit of the tuner together with the i.f. amplifier of the television receiver. An additional test point, which is accessible through a hole in the top of the tuner, is connected to the collector of the mixer transistor (T.P.1.).

The input, the r.f. band pass filter and oscillator circuits are tuned by 5 tuning diodes; band switching is achieved by 5 switching diodes.

The u.h.f. part of the tuner consists of a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the v.h.f. mixer transistor, now operating as an i.f. amplifier.
The input, the r.f. bandpass filter and oscillator circuits are tuned by 4 tuning diodes.

In all bands the tuner is gain controlled via gate 2 of the input MOSFET tetrode.

The electrical circuit of the UV418 series is extended with a frequency divider (division ratio of 64 or 256), which inputs are connected to the v.h.f. and u.h.f. oscillator. The complementary outputs are connected to terminals 12 and 13.

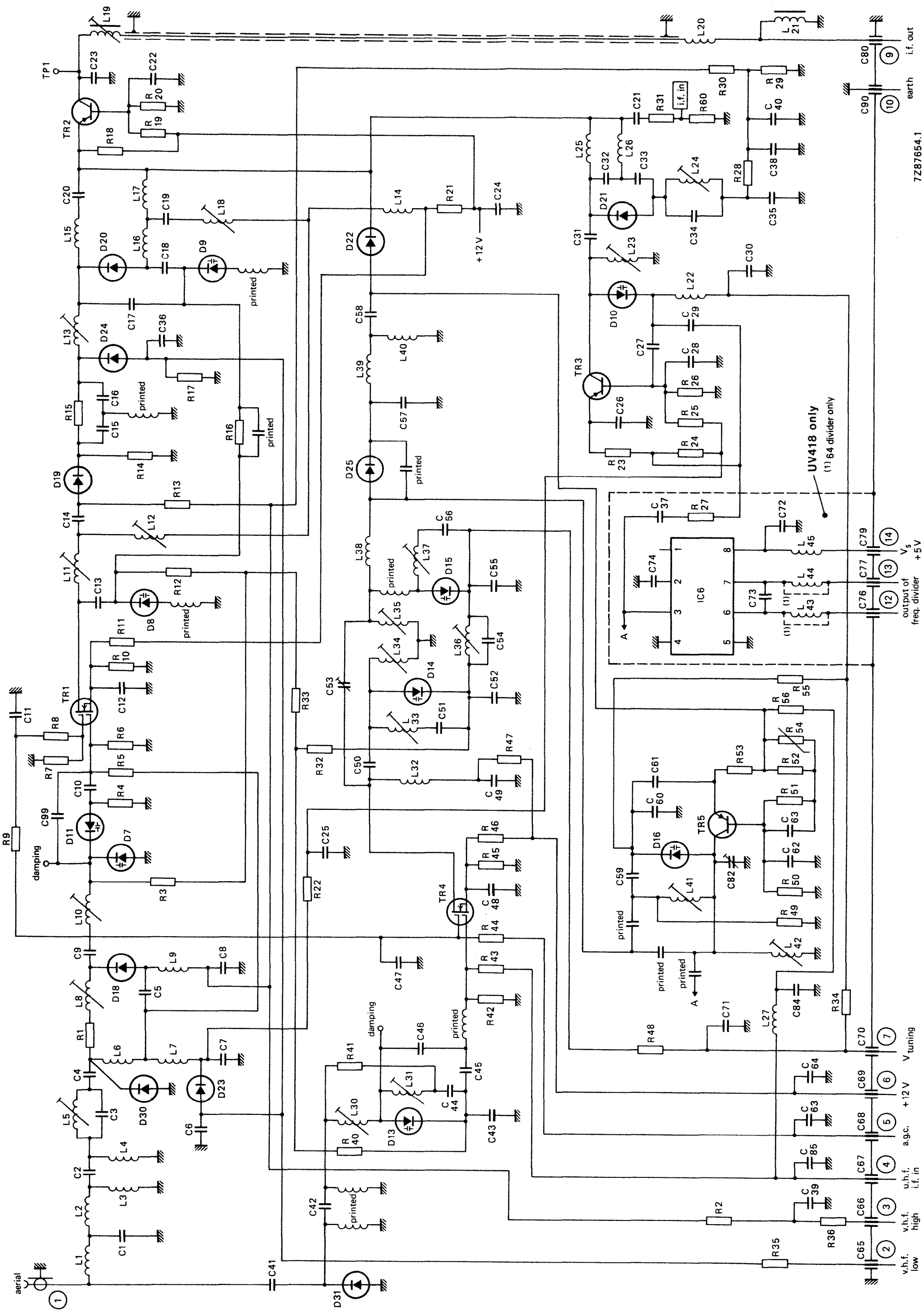
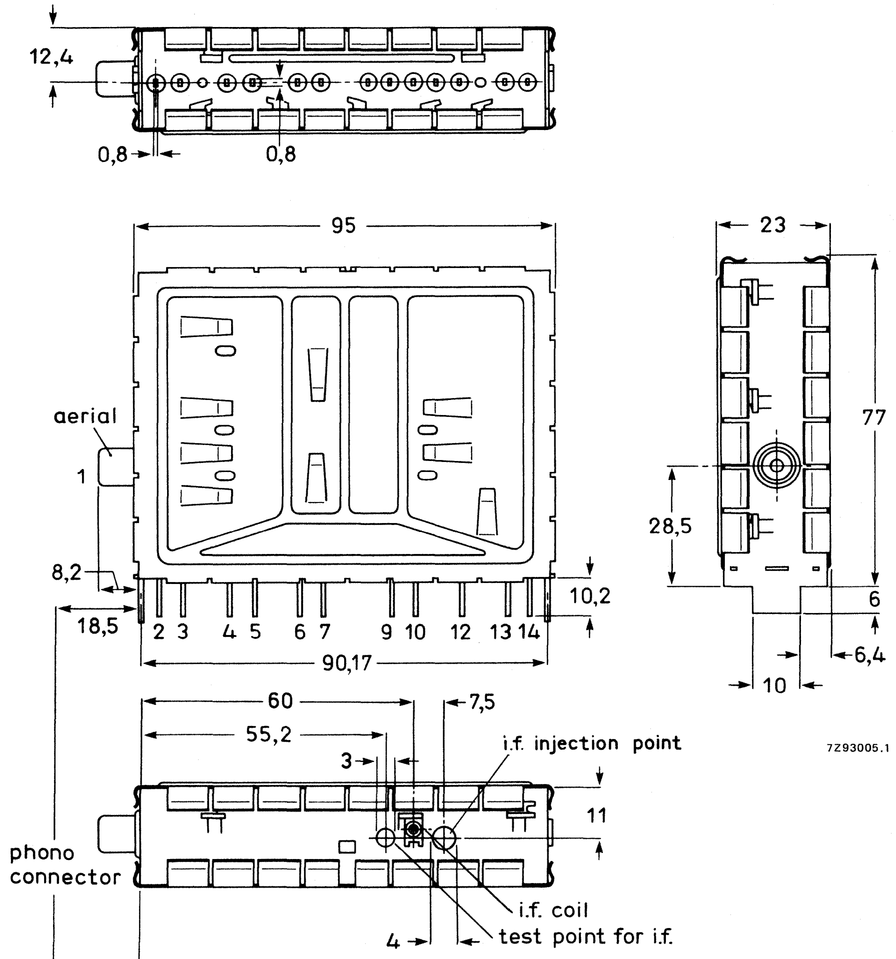
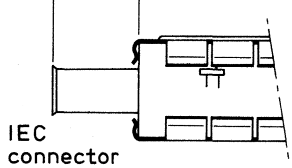


Fig. 1 Circuit diagram. For connections see also next page.

MECHANICAL DATA

Dimensions in mm





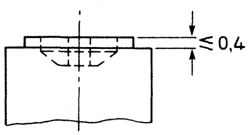


Fig. 2b I.F. output coil.
Torque for alignment: 2 to 15 mNm.
Press-through force: ⩾ 10 N.

Terminal

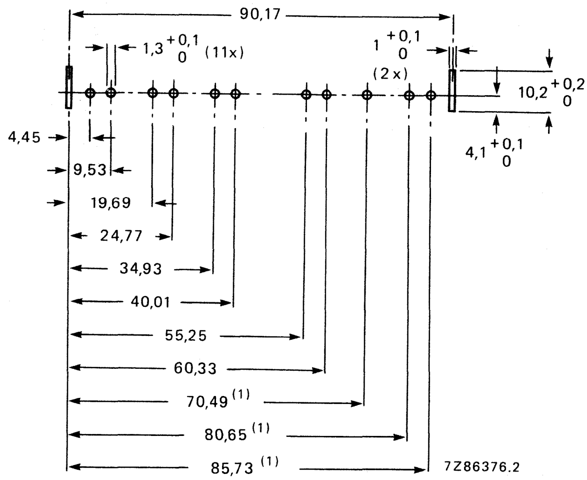
1	=	aerial	
2	=	supply voltage, low v.h.f., + 12 V	
3	=	supply voltage, low v.h.f., + 12 V	
4	=	supply voltage, u.h.f., + 12 V; i.f. injection	
5	=	a.g.c. voltage, + 9,2 to + 0,85 V	
6	=	supply voltage, v.h.f. and u.h.f., + 12 V	
7	=	tuning voltage, + 1 to + 28 V	
9	=	i.f. output	
10	=	earth	
12, 13	=	balanced output voltage of frequency divider	only for UV418
14	=	supply voltage, frequency divider, + 5 V	only for UV418

Mass approx. 127 g

Mounting

The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. (The tuner may also be mounted by means of a bracket. Information will be supplied upon request). The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2-20, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC 68-2-20, test Tb (260 ± 5 °C, 10 ± 1 s).



(1) Only for UV418.

Fig. 3 Piercing diagram viewed from solder side of board. Unless otherwise stated the tolerance is ± 0,05 mm.

Marking

The tuner is provided with a label showing the following date:
- type number
- catalogue number
- code for factory of origin
- change code
- code for year and week of production

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General

Semiconductors, v.h.f. bands	
r.f. amplifier	BF980
mixer	BF324
oscillator	BF926
tuning diodes	4 x BB909, 1 x BB405
switching diodes	2 x BA482, 2 x BA483, 1 x BA484
d.c. blocking diodes	2 x BAW62
Semiconductors, u.h.f. bands	
r.f. amplifier	BF980
oscillator	BF970
mixer	1SS99
tuning diodes	4 x BB405B
frequency divider ÷ 256	SP4653
frequency divider ÷ 64	SP4632
Ambient temperature range	
operating	0 to + 55 °C
storage	−25 to + 70 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltage	+ 12 V ± 10%

The supply voltage of band switching (terminals 2, 3 and 4) may never deviate more than + 10%/−5% from the unswitched supply voltage (terminal 6) within the specified margin of ± 10%.

The ripple susceptibility is defined as the peak-to-peak value of a sinewave signal (20 Hz - 500 kHz) on the supply voltages causing an amplitude modulation with a modulation depth of 0,28% on the picture carrier after passing the Nyquist curve of the i.f. filter of a TV receiver.

Current drawn from + 12 V supply	
v.h.f. bands	max. 42 mA
u.h.f. bands	max. 42 mA
Band switching	max. 11 mA

For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
- terminal 2 for operation in low v.h.f. band.
- terminal 3 for operation in high v.h.f. band.
- terminal 4 for operation in u.h.f. bands.

A.G.C. voltage (Note: voltages between 0 and + 10,5 V may be applied without risk of damage.)

voltage range	+ 9,2 to + 0,85 V
voltage at nominal gain	+ 9,2 ± 0,5 V
voltage at 40 dB gain reduction	
low v.h.f. band	typ. 3 V
high v.h.f. band	typ. 1,5 V
voltage at 30 dB gain reduction	
u.h.f.	typ. 2 V

A.G.C. current	max. 0,3 mA
Slope of a.g.c. characteristic, at the end of the specified a.g.c. range	
v.h.f. bands	typ. 25 dB/V
u.h.f. bands	typ. 50 dB/V
Tuning voltage range	+ 1 to + 28 V
Current drawn from 28 V tuning voltage supply	
at T_{amb} = 25 °C and 60% R.H.	max. 0,5 μA
at T_{amb} = 25 °C and 95% R.H.	max. 2 μA
at T_{amb} = 55 °C and 60% R.H.	max. 2 μA

Note: The source impedance of the tuning voltage offered to terminal 7 is maximum 47 kΩ.

Slope of tuning characteristic		
low v.h.f. band, channel E2	5 MHz/V	typical values
channel S1	1 MHz/V	
high v.h.f. band, channel S2	7 MHz/V	
channel S20	2 MHz/V	
u.h.f. band, channel E21	22 MHz/V	
channel E69	5 MHz/V	

Frequencies

Frequency ranges	
low v.h.f. band	channel E2 (picture carrier 48,25 MHz) to channel S1 picture carrier 105,25 MHz). Margin at the extreme channels: min. 1,5 MHz.
high v.h.f. band	channel S2 (picture carrier 112,25 MHz) to channel S20 (picture carrier 294,25 MHz). Margin at the extreme channels: min. 2 MHz.
u.h.f. bands	channel E21 (picture carrier 471,25 MHz) to channel E69 (picture carrier 855,25 MHz). Margin at the extreme channels: min. 3 MHz.

Intermediate frequencies	
picture	38,9 MHz
sound	33,4 MHz

The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance 75 Ω

V.S.W.R. and reflection coefficient (values between picture and sound carrier, as well as values at picture carrier)

	at nominal gain	during gain control
v.s.w.r.		
v.h.f.	max. 4,5	max. 5,5
u.h.f.	max. 5	max. 7
reflection coefficient		
v.h.f.	max. 63%	max. 69%
u.h.f.	max. 66%	max. 75%

ELECTRICAL DATA (continued)

R.F. curves, bandwidth	
low v.h.f. band	typ. 10 MHz
high v.h.f. band	typ. 13 MHz
u.h.f. bands	typ. 18 MHz
R.F. curves, tilt	on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.
A.G.C. range	
v.h.f.	min. 40 dB
u.h.f.	min. 30 dB
Power gain (see also Measuring method of power gain)	
v.h.f. bands (channels S2 to S4 excluded)	min. 20 dB
channels S2 and S3	min. 17 dB
channel S4	min. 19 dB
channel E3	typ. 27 dB
channel E5	typ. 27 dB
channel E12	typ. 27 dB
u.h.f. bands	min. 16 dB
channel E21	typ. 28 dB
channel E40	typ. 27 dB
channel E69	typ. 26 dB
Maximum gain difference	
between any two v.h.f. channels	typ. 8 dB
between any two u.h.f. channels	typ. 4 dB
between any v.h.f. and u.h.f. channel	typ. 8 dB
Noise figure	
v.h.f. bands	
E channels	max. 8 dB
S channels	max. 10 dB
channel E3	typ. 5 dB
channel E5	typ. 5 dB
channel E12	typ. 6 dB
u.h.f. bands	max. 13 dB
channel E21	typ. 7 dB
channel E40	typ. 7 dB
channel E69	typ. 8 dB
Overloading	
Input signal producing 1 dB gain compression at nominal gain	
v.h.f.	typ. 90 dB (μV) into 75 Ω
u.h.f.	typ. 90 dB (μV) into 75 Ω
Input signal producing either a detuning of the oscillator of + 300 kHz or −1000 kHz or stopping of the oscillations at nominal gain	
v.h.f.	typ. 100 dB (μV) into 75 Ω
u.h.f.	typ. 100 dB (μV) into 75 Ω

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)	
v.h.f. bands	min. 60 dB; typ. 70 dB
u.h.f. bands, except channels E61 to E69	min. 50 dB; typ. 62 dB
channels E61 to E69	min. 44 dB
I.F. rejection (measured at picture carrier frequency)	
low v.h.f., except channel E2	min. 50 dB
channel E2	min. 45 dB
high v.h.f.	min. 60 dB
u.h.f.	min. 60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection

Cross modulation
Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

v.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 84 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 100 dB (μV) into 75 Ω
u.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 84 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 100 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for low v.h.f., or channel N ± 3 for high v.h.f., or channel N ± 5 for u.h.f.)

v.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 92 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 100 dB (μV) into 75 Ω
u.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 92 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 100 dB (μV) into 75 Ω

Out of band cross modulation at nominal gain	
low v.h.f., interfering from high v.h.f.	typ. 100 dB (μV) into 75 Ω
low v.h.f., interfering from u.h.f.	typ. 100 dB (μV) into 75 Ω
high v.h.f., interfering from low v.h.f.	typ. 100 dB (μV) into 75 Ω
high v.h.f., interfering from u.h.f.	typ. 100 dB (μV) into 75 Ω
u.h.f. interfering from low v.h.f.	typ. 100 dB (μV) into 75 Ω
u.h.f. interfering from high v.h.f.	typ. 100 dB (μV) into 75 Ω

Unwanted signal handling capability (visibility test)

For the channel combinations
v.h.f.: N ± 1, N ± 5, N + 11
u.h.f.: N ± 1, N ± 5, N + 9

The tuner meets the requirements of "Amtsblatt" DBP69/1981, item 5.1.2., when measured in an adequate TV receiver. The a.g.c. circuit of the TV receiver has to be adjusted with an input signal of 74 dB (μV) on channel E60 in such a way, that the gain of the tuner is decreased by 10 dB.

ELECTRICAL DATA (continued)

Oscillator characteristics

Pulling	
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain	
v.h.f. bands	typ. 85 dB (μV) into 75 Ω
u.h.f. bands	typ. 85 dB (μV) into 75 Ω
Shift of oscillator frequency at a change of the supply voltage of 5%	
v.h.f. bands	max. 400 kHz
u.h.f. bands	max. 500 kHz
When using the supply circuit of Fig. 12 an additional oscillator frequency shift will occur during a.g.c.	
v.h.f. bands	max. 150 kHz
u.h.f. bands	max. 150 kHz
Drift of oscillator frequency	
during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)	max. 250 kHz
during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)	max. 250 kHz
at a change of the ambient temperature from + 25 to + 40 °C (measured after 3 cycles from + 25 to + 55 °C)	
v.h.f. bands	max. 500 kHz
u.h.f. bands	max. 500 kHz
at a change of humidity from 60 ± 15% to 93 ± 2%, at T_{amb} = 25 ± 5 °C	
low v.h.f.	max. 500 kHz
high v.h.f.	max. 1500 kHz
u.h.f., channel E21	max. 1500 kHz
u.h.f., channel E69	max. 3000 kHz

Frequency divider characteristics of version UV418

Supply voltage	+ 5 V ± 5%
Current drawn from + 5 V supply	max. 35 mA; typ. 25 mA
Output voltage, unloaded, at terminals	min. 0,7 V p-p
12 and 13 with 820 Ω load	min. 0,3 V p-p
Output imbalance	typ. 0,1 V
Interference signal on the i.f. output	max. 3 μV

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10.

I.F. circuit characteristics

Bandwidth of i.f. output circuit	5,5 ± 1 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 4; tuning voltage 25 V; u.h.f. band switched on.

Bandwidth variation of i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 25 V; a.g.c. voltage 1 V; i.f. output circuit adjusted to 36,15 MHz)	max. 500 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 4, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

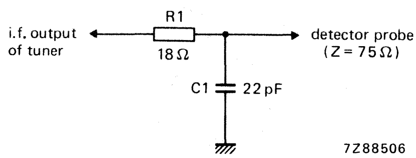


Fig. 4.

Detuning of i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 25 V; a.g.c. voltage 1 V; i.f. output circuit adjusted to 36,15 MHz)	max. 500 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 4, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

Minimum tuning range of i.f. output coil	33 to 40 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 4.

Attenuation between i.f. injection point and i.f. output of the tuner	typ. 16 dB

Miscellaneous

Radio interference

Oscillator radiation and oscillator voltage at the aerial terminal	Within the limits of C.I.S.P.R. 13 (1975) and VDE 0872/7.72 and Amtsblatt DBP69/1981, when applying the tuner in an adequate TV receiver.
Microphonics	There will be no microphonics, provided the tuner is installed in a professional manner.

Surge protection

Protection against voltages	max. 5 kV

Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes	max. 30 kV, 400 mWs

Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

ADDITIONAL INFORMATION

I.F. injection

An i.f. signal from a generator with an internal resistance of 50 Ω or 75 Ω should be connected to the i.f. injection point at the top of the tuner (see Fig. 2) via a resistor of 68 Ω. The u.h.f. band should be switched on; tuning voltage should be 25 V, a.g.c. voltage 1 V.

Measuring method of power gain

The i.f. output of the tuner should be terminated with the RC-circuit given in Fig. 4.

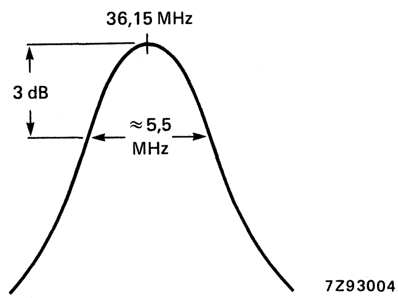


Fig. 5.

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit, which should be tuned to 36,15 MHz; the bandwidth is approx. 5,5 MHz (Fig. 5).

Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector.

Alignment of the i.f. output coil

The i.f. output coil should be adjusted with a plastic tool which has a cross head as shown in Fig. 6. A suitable tool for automatic alignment is available under catalogue number **8104 004 11040**.

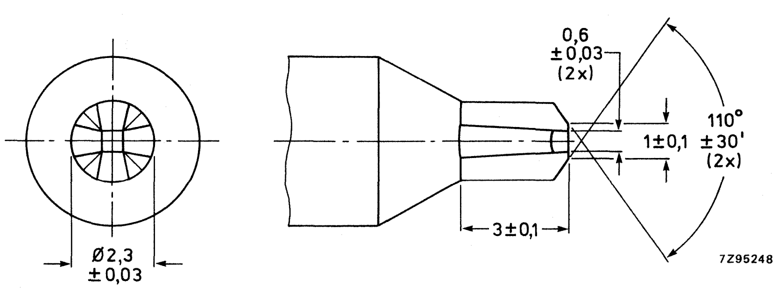


Fig. 6.

V.H.F./U.H.F. TELEVISION TUNER

QUICK REFERENCE DATA

Systems	C.C.I.R. systems M and N (R.T.M.A.)
Channels	
low v.h.f.	A2 to A6
high v.h.f.	A7 to A13
u.h.f.	A14 to A83
Intermediate frequencies	
picture	45,75 MHz
sound	41,25 MHz

APPLICATION

This tuner is designed to cover the v.h.f. and u.h.f. channels of C.C.I.R. systems M and N (R.T.M.A.).

It can be provided with a frequency divider, which makes this tuner suitable for digital tuning systems based on frequency synthesis.

DESCRIPTION

The UV431 is a combined v.h.f./u.h.f. tuner with electronic tuning and band switching, covering the low v.h.f. band (frequency range 55,25 to 83,25 MHz), the high v.h.f. band (frequency range 175,25 to 211,25 MHz), and the u.h.f. band (frequency range 471,25 to 885,25 MHz).

Mechanically, the tuner is built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common phono aerial connector (v.h.f. and u.h.f.) is on one of the frame sides, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuner consists of a v.h.f. and a u.h.f. part. The v.h.f. aerial signal is fed via low pass, high pass, i.f. and f.m. suppression filters to a switchable single tuned input circuit for low and high v.h.f. operation, which is capacitively coupled to the gate 1 of a MOS-FET tetrode (with internal gate protection against surge). The drain load of the MOS-FET tetrode is formed by a double tuned, switchable bandpass filter, transferring the r.f. signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor.

The collector circuit of the mixer transistor is a single tuned i.f. resonant circuit, at the low end of which the i.f. signal is coupled out of the tuner. A test point (terminal 4) is provided for i.f. injection to align the i.f. output circuit of the tuner together with the i.f. amplifier of the television receiver. An additional test point, which is accessible through a hole in the top of the tuner, is connected to the collector of the mixer transistor.

The single tuned input, the r.f. band pass filter and oscillator circuits are tuned by 4 tuning diodes; band switching is achieved by 5 switching diodes.

The u.h.f. part of the tuner consists of a fixed double tuned band pass filter with a built-in protection diode against surge which is connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the v.h.f. mixer transistor, now operating as an i.f. amplifier.
The r.f. band pass filter and oscillator circuits are tuned by 3 tuning diodes.

In all bands the tuner is gain controlled via gate 2 of the input MOSFET tetrodes.

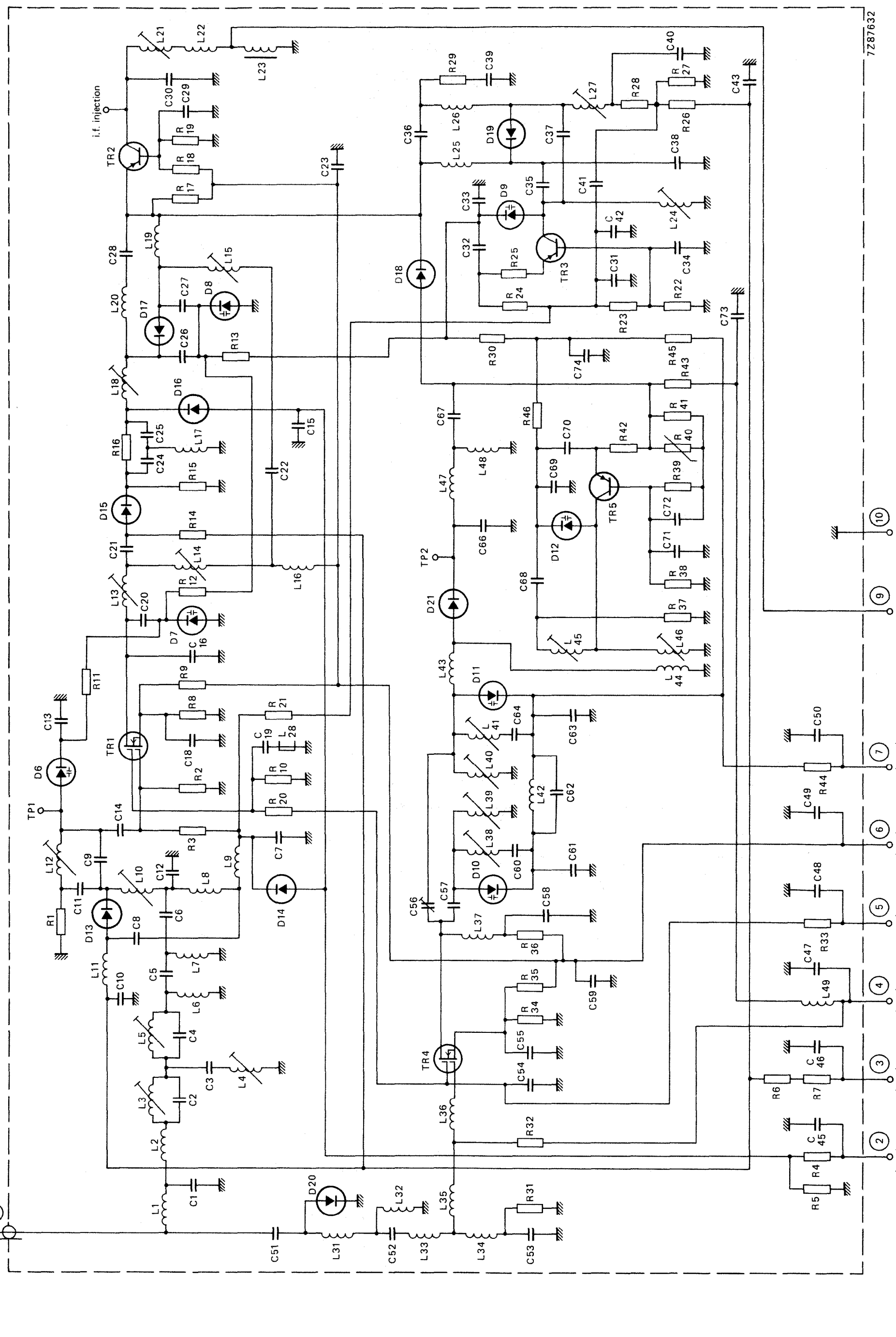


Fig. 1.

MECHANICAL DATA

Dimensions in mm

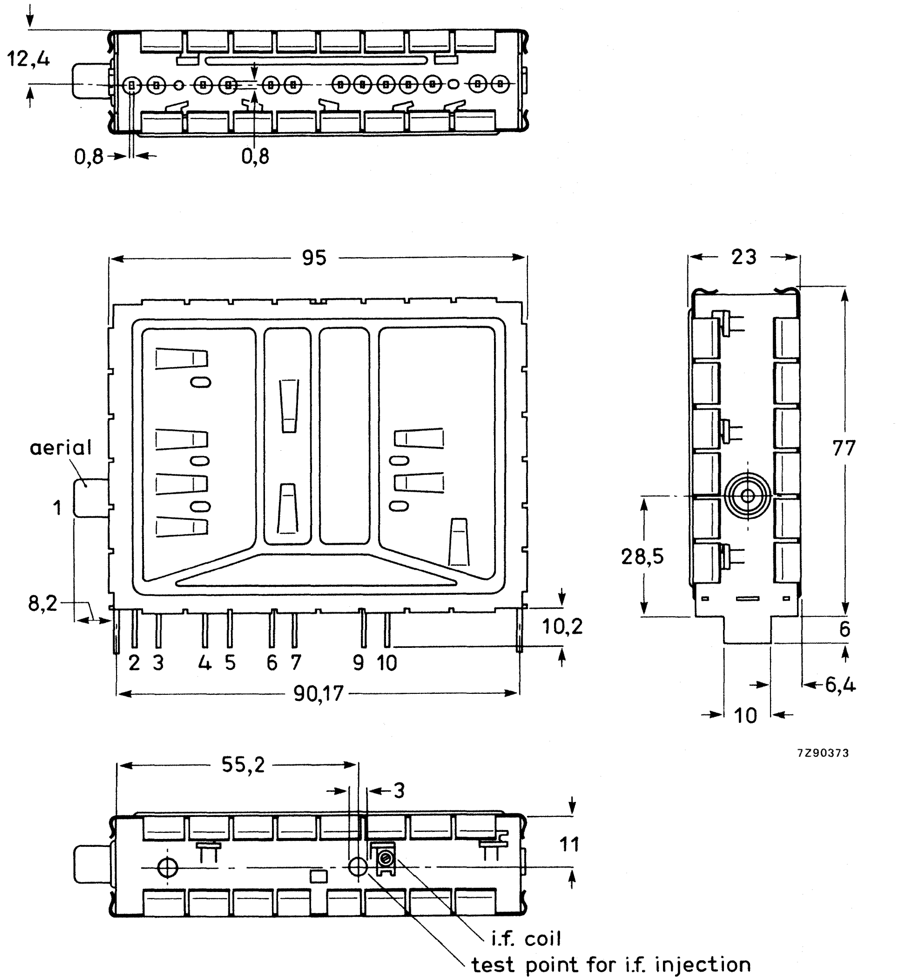


Fig. 2a

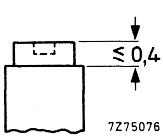


Fig. 2b I.F. output coil.
Torque for alignment: 2 to 15 mNm.
Press-through force: ⩾ 10 N.

Terminal

1 = aerial
2 = supply voltage, low v.h.f., + 12 V
3 = supply voltage, high v.h.f., + 12 V
4 = supply voltage, u.h.f., + 12 V, i.f. injection
5 = a.g.c. voltage, + 9,2 to + 0,85 V
6 = supply voltage, v.h.f. and u.h.f., + 12 V
7 = tuning voltage, + 1 to + 28 V
9 = i.f. output
10 = earth

Mass approx. 125 g.

Mounting

The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. (The tuner may also be mounted by means of a bracket. Information will be supplied upon request.)

It is recommended that the tuner be installed in the cool part of the receiver cabinet and not exposed to the vibrations of the loudspeaker. There are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

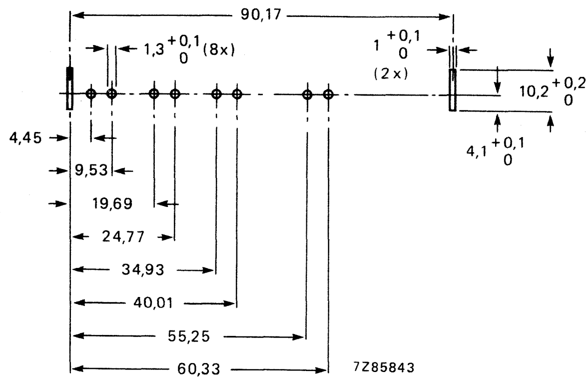


Fig. 3 Piercing diagram viewed from solder side of board.
Unless otherwise stated the tolerance is ± 0,05 mm.

Marking

The tuner is provided with a label showing the following data:
- type number UV 431
- catalogue number 3112 127 43630
- code for factory of origin
- change code
- code for year and week of production

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ±0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General

Semiconductors, v.h.f. bands	
r.f. amplifier	BF982
mixer	BF324
oscillator	BF926
tuning diodes	4 x BB809
switching diodes	5 x BA482/483/484
d.c. blocking diodes	2 x BAW62
Semiconductors, u.h.f. bands	
r.f. amplifier	BF980
oscillator	BF970
mixer	1SS99
tuning diodes	3 x BB405B
surge protection diodes	BAV10
Ambient temperature range	
operating	0 to + 55 °C
storage	−25 to + 70 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltage	+ 12 V ± 10%*
Current drawn from + 12 V supply	
low and high v.h.f.	max. 55 mA; typ. 42 mA
u.h.f.	max. 50 mA; typ. 42 mA

Bandswitching
For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
terminal 2 for low v.h.f. operation
terminal 3 for high v.h.f. operation
terminal 4 for u.h.f. operation

A.G.C. voltage (Figs 4, 5 and 6)	
voltage range	+ 9,2 to + 0,85 V
voltage at nominal gain	+ 9 ± 0,5 V
voltage at 40 dB gain reduction	
low v.h.f.	typ. 3,2 V
high v.h.f.	typ. 1,5 V
voltage at 30 dB gain reduction	
u.h.f.	typ. 1,4 V

Note: A.G.C. voltages between 0 and + 10,5 V may be applied without risk of damage.

A.G.C. current	max. 0,3 mA
Slope of a.g.c. characteristic,	
at the end of the specified a.g.c. range	
v.h.f.	typ. 25 dB/V
u.h.f.	typ. 50 dB/V

* A tolerance of −15% on the supply voltage is admissible, if a deterioration of gain, noise figure, oscillator shift and oscillator drift is acceptable.

Typical a.g.c. characteristics

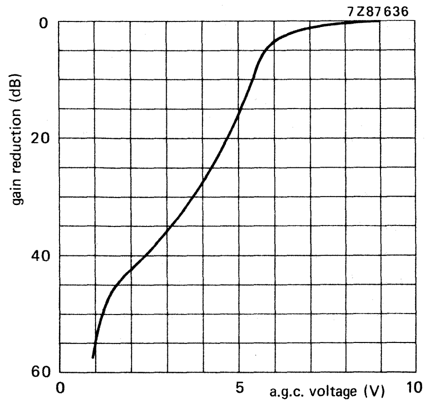


Fig. 4 Low v.h.f.

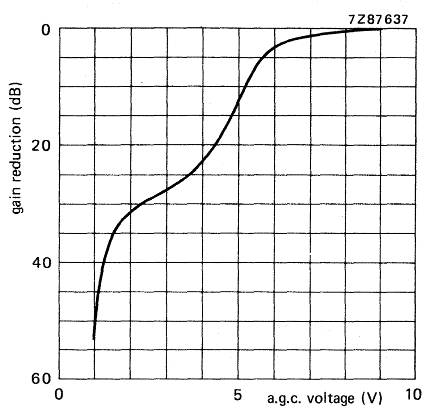


Fig. 5 High v.h.f.

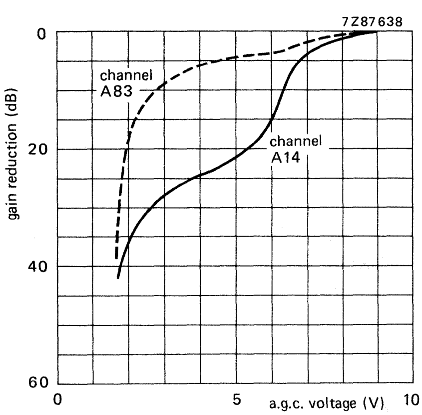


Fig. 6 U.H.F.

Typical tuning characteristics

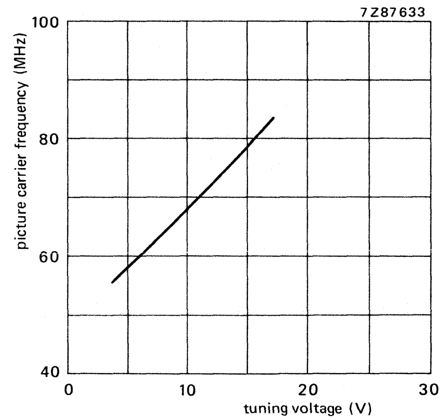


Fig. 7 Low v.h.f.

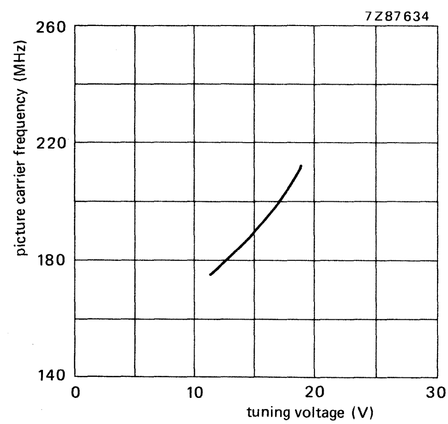


Fig. 8 High v.h.f.

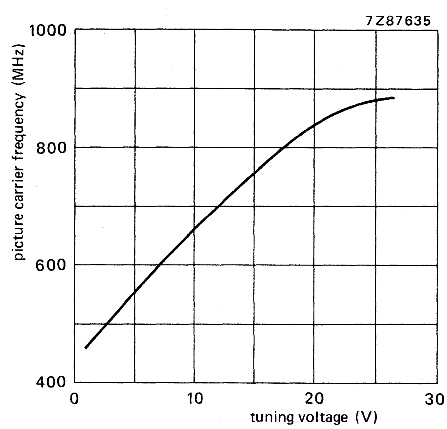


Fig. 9 U.H.F.

Tuning voltage range (Figs 7, 8 and 9) + 1 to + 28 V

Current drawn from 28 V tuning voltage supply

at T_{amb} = 25 °C and R.H. = 60%	max. 0,5 μA
at T_{amb} = 55 °C and R.H. = 60%	max. 2 μA
at T_{amb} = 25 °C and R.H. = 95%	max. 2 μA

Note: The source impedance of the tuning voltage offered to terminal 7 must be maximum 47 kΩ.

Slope of tuning characteristic (typical values)

low v.h.f., channel A2	3 MHz/V
channel A6	2 MHz/V
high v.h.f., channel A7	6 MHz/V
channel A13	4 MHz/V
u.h.f., channel A14	21 MHz/V
channel A83	4 MHz/V

Frequencies

Frequency ranges

low v.h.f.	channel A2 (picture carrier 55,25 MHz) to channel A6 (picture carrier 83,25 MHz). Margin at the extreme channels: min. 1,5 MHz.
high v.h.f.	channel A7 (picture carrier 175,25 MHz) to channel A13 (picture carrier 211,25 MHz). Margin at the extreme channels: min. 2 MHz.
u.h.f.	channel A14 (picture carrier 471,25 MHz) to channel A83 (picture carrier 885,25 MHz). Margin at the extreme channels: A13 min. 3 MHz, A83 min. 4 MHz.

Intermediate frequencies

picture	45,75 MHz
sound	41,25 MHz

The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance 75 Ω

V.S.W.R. and reflection coefficient (values between picture and sound carrier, as well as values at picture carrier)

	at nominal gain	during gain control
v.s.w.r.		
v.h.f.	max. 5	max. 5
u.h.f., channels A14 to A73	max. 5	max. 7
channels A74 to A83	max. 5	max. 8
reflection coefficient		
v.h.f.	max. 66%	max. 66%
u.h.f., channels A14 to A73	max. 66%	max. 75%
channels A74 to A83	max. 66%	max. 78%

R.F. curves, bandwidth

low v.h.f.	typ. 10 MHz
high v.h.f.	typ. 12 MHz
u.h.f.	typ. 24 MHz

R.F. curves, tilt	on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.
A.G.C. range	
v.h.f.	min. 40 dB
u.h.f.	min. 30 dB
Power gain (see also Measuring method of power gain)	
v.h.f. bands	min. 22 dB
channel A4	typ. 26 dB
channel A7	typ. 26 dB
channel A13	typ. 27 dB
u.h.f. bands	min. 20 dB
channel A14	typ. 26 dB
channel A40	typ. 26 dB
channel A83	typ. 24 dB
Maximum gain difference	
between any two v.h.f. channels	typ. 4 dB
between any two u.h.f. channels	typ. 4 dB
between any v.h.f. and u.h.f. channel	typ. 6 dB
Noise figure	
v.h.f. bands, except channel A6	max. 7 dB
channel A6	max. 9 dB
channel A4	typ. 5 dB
channel A7	typ. 5 dB
channel A13	typ. 5 dB
u.h.f. bands	max. 10 dB
channel A14	typ. 5 dB
channel A40	typ. 5,5 dB
channel A83	typ. 7 dB
Overloading	
Input signal producing 1 dB gain compression at nominal gain	
v.h.f.	typ. 90 dB (μV) into 75 Ω
u.h.f.	typ. 90 dB (μV) into 75 Ω
Input signal producing either a detuning of the oscillator of + 300 kHz or −1000 kHz or stopping of the oscillations at nominal gain	
v.h.f.	typ. 100 dB (μV) into 75 Ω
u.h.f.	typ. 100 dB (μV) into 75 Ω

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)	
v.h.f.	min. 60 dB; typ. 70 dB
u.h.f.	min. 40 dB; typ. 50 dB

I.F. rejection (measured at picture carrier frequency)		
low v.h.f.		
channel A2	min.	45 dB
channels A3 to A6	min.	50 dB
high v.h.f.	min.	60 dB
u.h.f.	min.	60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection.

F.M. rejection, low v.h.f. Level of an f.m. signal of 91,5 MHz which produces an i.f. signal (47,75 MHz) 57 dB below the level of the wanted picture carrier		
channel A2	typ.	100 dB (μV)
channel A4	typ.	100 dB (μV)
channel A6	typ.	60 dB (μV)
F.M. rejection, high v.h.f. Level of an f.m. signal between 88 and 105 MHz, which produces an i.f. interfering (45,75 MHz) 57 dB below the level of the wanted picture carrier. Level of input picture carrier is 60 dBμV		
channel A8	typ.	95 dB (μV)
channel A11	typ.	92 dB (μV)
channel A13	typ.	95 dB (μV)

Channel A6 colour beat

The colour beat is an interference at 42 MHz from picture and sound carrier signals of channel A6 with the oscillator signal (input levels of picture/sound carrier signals 54 dB(μV); tuner operated at nominal gain.

Rejection below IF picture carrier of 45,75 MHz.	typ.	45 dB
N ± 7 rejection (for u.h.f. only) Interference signal for an interference ratio of 53 dB referred to wanted picture carrier (wanted signal 60 dB (μV); tuner operating at nominal gain)	typ.	65 dB (μV) into 75 Ω

Cross modulation
Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

v.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 76 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 94 dB (μV) into 75 Ω
u.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 74 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 88 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for low v.h.f., or channel N ± 3 for high v.h.f., or channel N ± 5 for u.h.f.)

v.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 88 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 100 dB (μV) into 75 Ω
u.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 82 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 88 dB (μV) into 75 Ω

Out of band cross modulation at nominal gain

low v.h.f., interfering from high v.h.f.	typ. 100 dB (μV) into 75 Ω
low v.h.f., interfering from u.h.f.	typ. 100 dB (μV) into 75 Ω
high v.h.f., interfering from low v.h.f.	typ. 100 dB (μV) into 75 Ω
high v.h.f., interfering from u.h.f.	typ. 100 dB (μV) into 75 Ω
u.h.f. interfering from low v.h.f.	typ. 94 dB (μV) into 75 Ω
u.h.f. interfering from high v.h.f.	typ. 86 dB (μV) into 75 Ω

Oscillator characteristics

Pulling:

Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain

low v.h.f.	typ. 88 dB (μV) into 75 Ω
high v.h.f.	typ. 86 dB (μV) into 75 Ω
u.h.f.	typ. 80 dB (μV) into 75 Ω

Shift of oscillator frequency at a charge of the supply voltage of 5%

v.h.f. bands	max. 200 kHz
u.h.f bands,	
channels A14 to A73	max. 400 kHz
channels A74 to A83	max. 800 kHz

Drift of oscillator frequency

during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)	max. 250 kHz
during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)	max. 250 kHz
at a change of the ambient temperature from + 25 to + 50 °C (measured after 3 cycles from + 25 to + 55 °C)	max. 600 kHz
at a change of humidity from 60 ± 15% to 93 ± 2% (measured at T_{amb} = 25 ± 5 °C)	
v.h.f.	max. 600 kHz
u.h.f.	max. 1000 kHz

I.F. circuit characteristics

Bandwidth of i.f. output circuit	5 ± 1 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10; tuning voltage 10 V; u.h.f. band switched on.

Bandwidth variation of i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 10 V; i.f. output circuit adjusted to 43,5 MHz)	max. 650 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 10, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

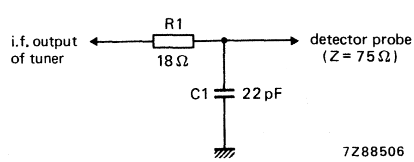


Fig. 10.

Detuning of the i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 10 V; i.f. output circuit adjusted to 43,5 MHz)	max. 650 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 10, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

Minimum tuning range of i.f. output coil	41 to 47 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10. The tuner is supplied with the i.f. output circuit adjusted to 43,5 ± 1 MHz.

Attenuation between i.f. injection point and i.f. output of the tuner	typ. 16 dB

Miscellaneous

Radio interference Oscillator radiation and oscillator voltage at the aerial terminal	Within the limits of C.I.S.P.R. 13 (1975)
Microphonics	There will be no microphonics, provided the tuner is installed in a professional manner.
Surge protection Protection against voltages	max. 5 kV

Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes	max. 30 kV, 400 mWs

Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

ADDITIONAL INFORMATION

I.F. injection

Terminal 4 (supply voltage u.h.f.) can be used as i.f. injection point, provided the u.h.f. supply voltage is applied to terminal 4 via a resistor of 10 Ω (see Fig. 11). The u.h.f. band should be switched on; tuning voltage should be 2 V.

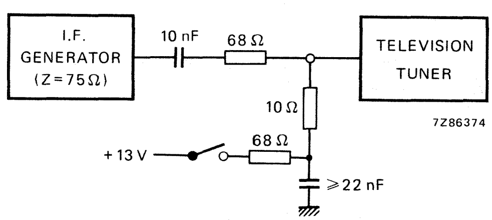


Fig. 11.

Connection of the i.f. amplifier

- By means of a print track as short as possible.
- By means of a shielded track, e.g. a coaxial cable.

Connection of supply voltages

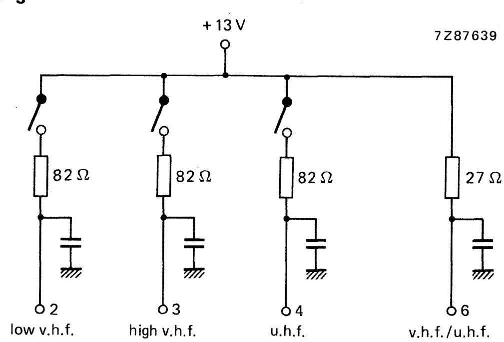


Fig. 12.

Measuring method of power gain

The i.f. output of the tuner should be terminated with the RC-circuit given in Fig. 10.

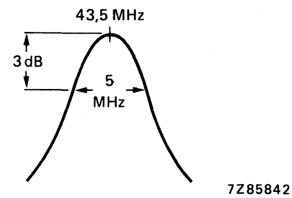


Fig. 13.

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit which should be tuned to 43,5 MHz; the bandwidth is approx. 5 MHz (Fig. 13).

Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector.

Measurement of bandwidth variation and detuning of i.f. output circuit

A sweep signal of 30 to 50 MHz from a frequency sweep generator is connected to the i.f. injection point via a capacitor of 0,5 pF. The coaxial cable is terminated with 75 Ω.

Alignment of the i.f. output coil

The i.f. output coil should be adjusted with a brass tool with a blade as shown in Fig. 14. A suitable tool is available under catalogue number 7122 005 47680.

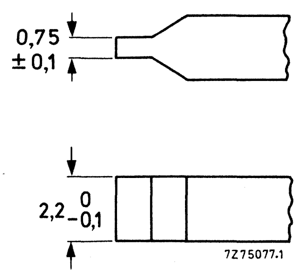


Fig. 14.

TESTS AND REQUIREMENTS

IEC 68-2	test	procedure	requirements
Ab	cold	–25 °C, 96 h	Checked within 10 min after all tests mentioned: no catastrophic failures (in operation of 1 or more channels).
Bb	dry heat	+ 70 °C, 96 h	
Db	damp heat, cyclic	+ 25 to + 40 °C R.H. 90 to 100% 21 cycles of 24 h	
Ca	damp heat, steady state	+ 40 °C, R.H. 93% 21 days	After 1 h reconditioning under normal conditions: change of osc. freq. low v.h.f. ≤ 1,5 MHz high v.h.f. ≤ 2 MHz change of power gain ≤ 2 dB change of tilt r.f. curve ≤ 2 dB change of tuning current ≤ 0,5 μA
Na	rapid change of temperature	3h –25 °C/3h + 70 °C 5 cycles	
Fc	vibration	10-55-10 Hz, amplitude 0,35 mm 3 directions 30 min per direction	
Eb	bump	1000 bumps, acceleration 25g, in 6 directions	
Ea	shock	half sine pulse 11 ms, acceleration 50g in 6 directions 3 times per direction	

V.H.F./U.H.F. TELEVISION TUNERS

QUCIK REFERENCE DATA

Systems	C.C.I.R. systems B and G
Channels *	
low v.h.f. band	0 to 4
high v.h.f. band	5 to 11
u.h.f. bands	28 to 63
Intermediate frequencies	
picture	38,875 MHz
sound	31,375 MHz

APPLICATION

Designed to cover the Australian v.h.f. and u.h.f. channels of C.C.I.R. systems B and G.

The tuners UV462 are equipped with a frequency divider, which makes them suitable for digital tuning systems based on frequency synthesis; for the remainder they are equal to type UV461.

Available versions

	aerial input connector	frequency divider (IC)	division ratio	catalogue number
UV461	phono	–	–	3122 127 48460
UV461/IEC	IEC	–	–	3122 237 00020
UV462/256	phono	8-pin	256	3122 237 00030
UV462/256/IEC	IEC	8-pin	256	3122 237 00040

* In accordance with the publications of the Australian Broadcasting Control Board (A.B.C.B.).

DESCRIPTION

The UV461 and UV462 are combined v.h.f./u.h.f. tuners with electronic tuning and band switching, covering the low v.h.f. band including the New Zealand channel 1, and the Italian channel C (frequency range 44 to 92 MHz), the high v.h.f. band including the Morocco channel M4 (frequency range 162 to 230 MHz), and the u.h.f. band (frequency range 470 to 861 MHz).

Mechanically, the tuner is built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common 75 Ω phono or IEC aerial connector (v.h.f. and u.h.f.) is on one of the frame sides, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuner consists of v.h.f. and u.h.f. parts. The v.h.f. aerial signal is fed via switchable low and high v.h.f. wide band input filters to gate 1 of an input MOSFET tetrode (with internal gate protection against surge).
The input filters are provided with an i.f. suppression circuit. The drain load of the MOSFET tetrode is formed by a double tuned switchable bandpass filter, transferring the r.f. signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor.

The collector circuit of the mixer transistor is a single tuned i.f. resonant circuit, at the low end of which the i.f. signal is coupled out of the tuner. A test point (terminal 4) is provided for i.f. injection to align the i.f. output circuit of the tuner together with the i.f. amplifier of the television receiver. An additional test point, which is accessible through a hole in the top of the tuner, is connected to the collector of the mixer transistor.

The r.f. band pass filter and oscillator circuits are tuned by 5 tuning diodes; band switching is achieved by 5 switching diodes.

The u.h.f. part of the tuner consists of a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the v.h.f. mixer transistor, now operating as an i.f. amplifier.
The r.f. band pass filter and oscillator circuits are tuned by 3 tuning diodes.

In all bands the tuner is gain controlled via gate 2 of the input MOSFET tetrodes.

The electrical circuit of the UV462 is extended with a frequency divider (division ratio of 256), which inputs are connected to the v.h.f. and u.h.f. oscillator. The complementary outputs are connected to terminals 12 and 13.

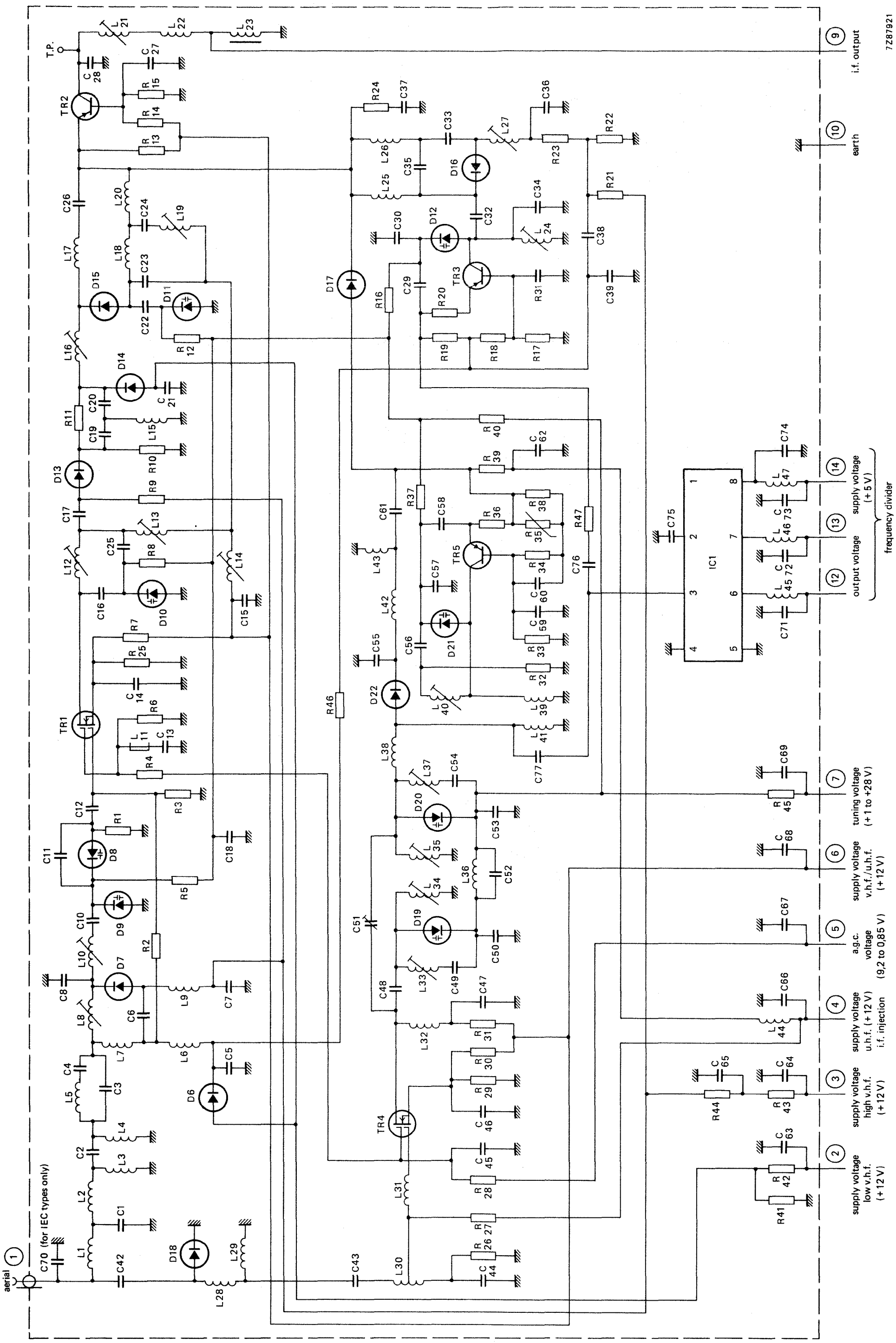

aerial
(for IEC types only)
T.P.
i.f. output
earth
supply voltage (+5 V)
output voltage
frequency divider (UV462 only)
tuning voltage (+1 to +28 V)
supply voltage v.h.f./u.h.f. (+12 V)
a.g.c. voltage (9,2 to 0,85 V)
supply voltage u.h.f. (+12 V) i.f. injection
supply voltage high v.h.f. (+12 V)
supply voltage low v.h.f. (+12 V)
IC1
7Z87921

Fig. 1.

MECHANICAL DATA

Dimensions in mm

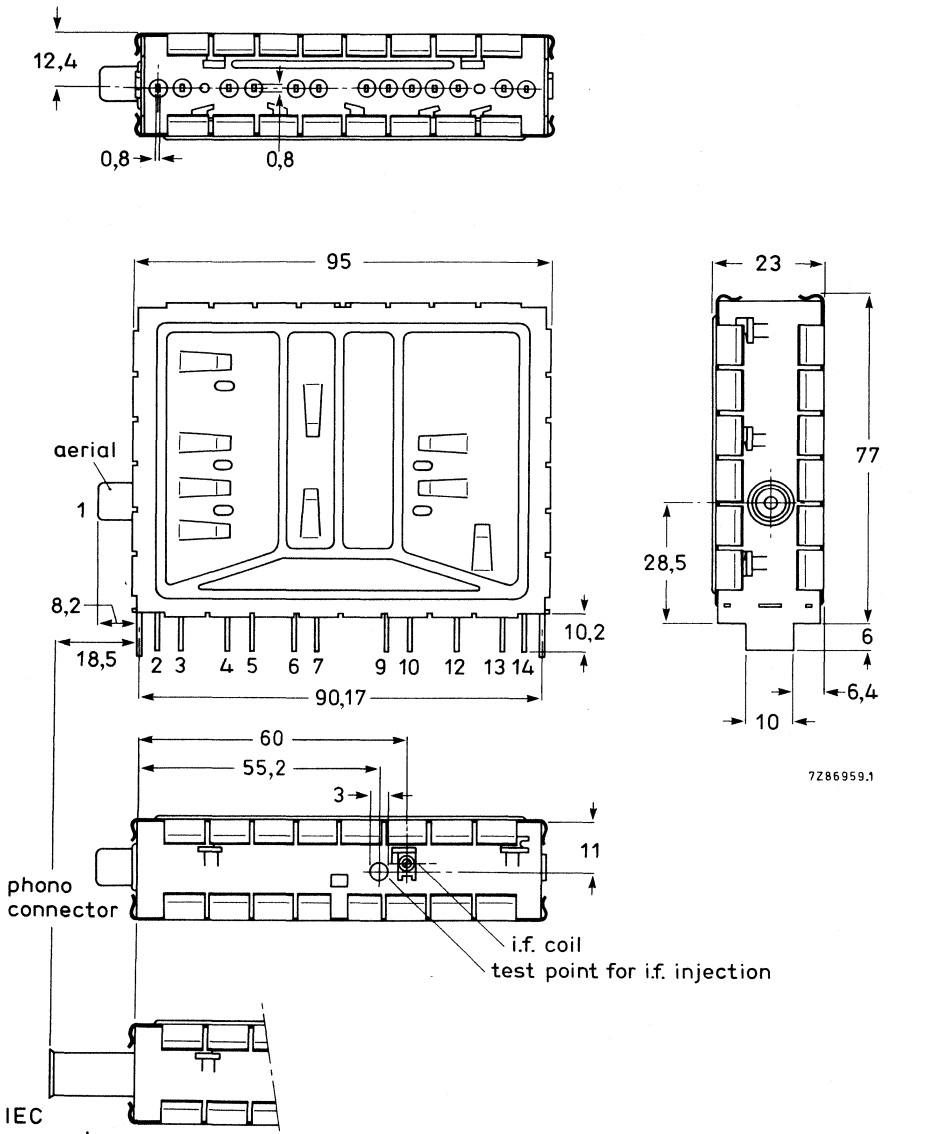


Fig. 2a.

Terminal

1 = aerial
2 = supply voltage, low v.h.f., + 12 V
3 = supply voltage, high v.h.f., + 12 V
4 = supply voltage, u.h.f., + 12 V; i.f. injection
5 = a.g.c. voltage, + 9,2 to 0,85 V
6 = supply voltage, v.h.f. and u.h.f., + 12 V
7 = tuning voltage, + 1 to + 28 V
9 = i.f. output
10 = earth
12, 13 = balanced output voltage of frequency divider } only for UV462
14 = supply voltage, frequency divider, + 5 V } only for UV462

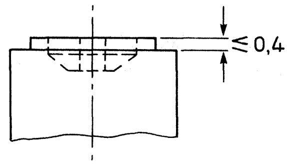


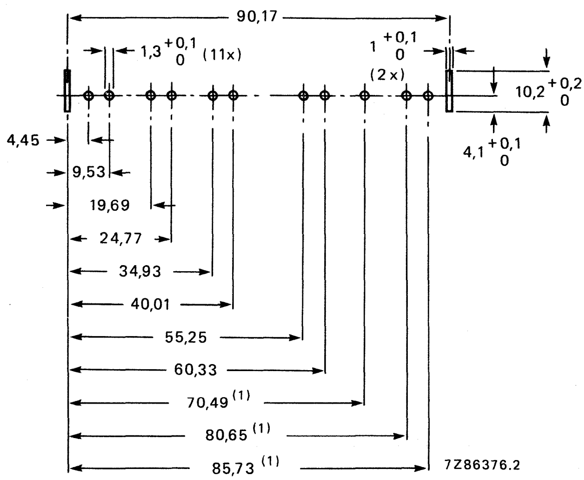
Fig. 2b I.F. output coil.
Torque for alignment: 2 to 15 mNm.
Press-through force: ≥ 10 N.

Mass approx. 127 g

Mounting

The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. (The tuner may also be mounted by means of a bracket. Information will be supplied upon request). The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).



(1) Only for UV462.

Fig. 3 Piercing diagram viewed from solder side of board.
Unless otherwise stated the tolerance is ± 0,05 mm.

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General

Semiconductors, v.h.f. bands	
r.f. amplifier	BF980
mixer	BF324
oscillator	BF926
tuning diodes	5 x BB909B
switching diodes	5 x BA482/483/484
d.c. blocking diodes	2 x IN4148
Semiconductors, u.h.f. bands	
r.f. amplifier	BF980
oscillator	BF970
mixer	1SS99
tuning diodes	3 x OF643
surge protection diodes	1 x BAV10
frequency divider	SP4653
Ambient temperature range	
operating	0 to + 55 °C
storage	−25 to + 70 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltage	+ 12 V ± 10%
Current drawn from + 12 V supply	
v.h.f. bands	max. 55 mA; typ. 39 mA
u.h.f. bands	max. 50 mA; typ. 40 mA

Bandswitching
For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
terminal 2 for operation in the low v.h.f. band
terminal 3 for operation in the high v.h.f. band
terminal 4 for operation in the u.h.f. bands

A.G.C. voltage (Figs 4, 5 and 6)	
voltage range	+ 9,2 to + 0,85 V
voltage at nominal gain	+ 9,2 ± 0,5 V
voltage at 40 dB gain reduction	
low v.h.f. band	typ. 3 V
high v.h.f. band	typ. 2 V
voltage at 30 dB gain reduction, u.h.f. bands	typ. 1,6 V

Note: A.G.C. voltages between 0 and + 10,5 V may be applied without risk of damage.

A.G.C. current	max. 0,3 mA
Slope of a.g.c. characteristic, at the end of the specified a.g.c. range	
v.h.f. bands	typ. 25 dB/V
u.h.f. bands	typ. 50 dB/V

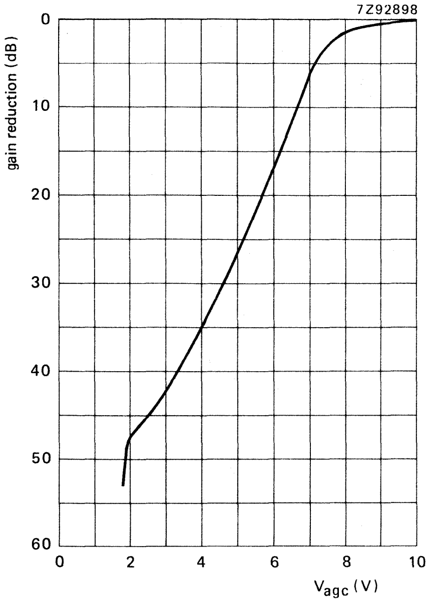


Fig. 4 Typical a.g.c. characteristic, low v.h.f. band.

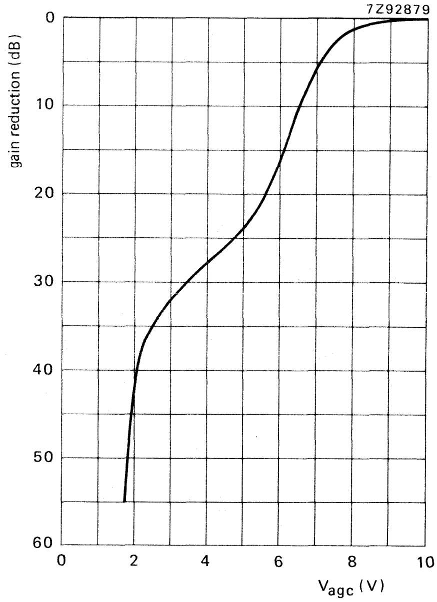


Fig. 5 Typical a.g.c. characteristic, high v.h.f. band.

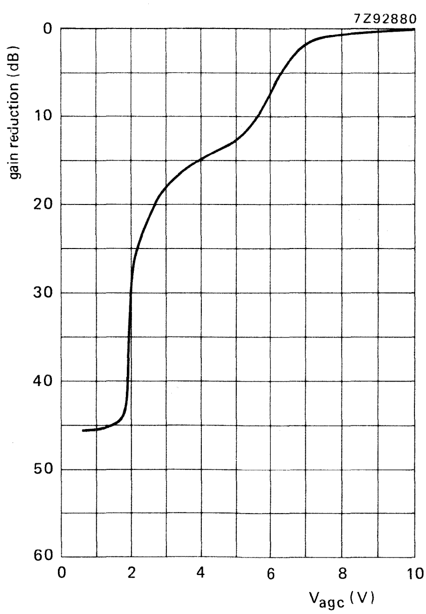


Fig. 6 Typical a.g.c. characteristic, u.h.f. bands.

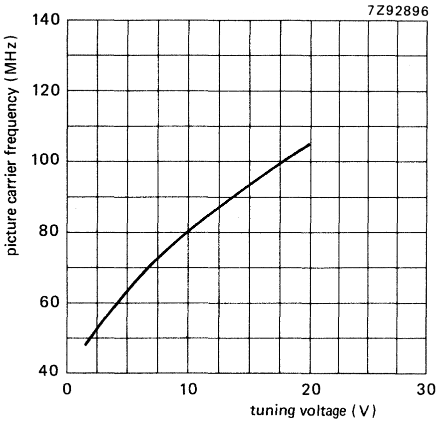


Fig. 7 Typical tuning characteristic, low v.h.f. band.

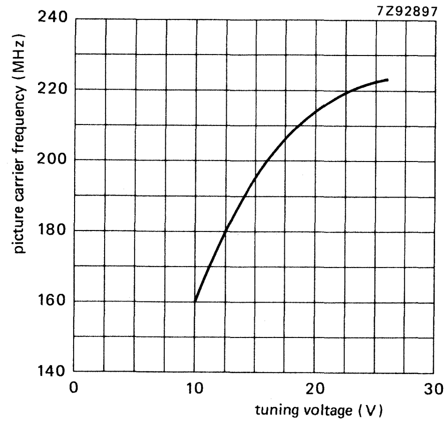


Fig. 8 Typical tuning characteristic, high v.h.f. band.

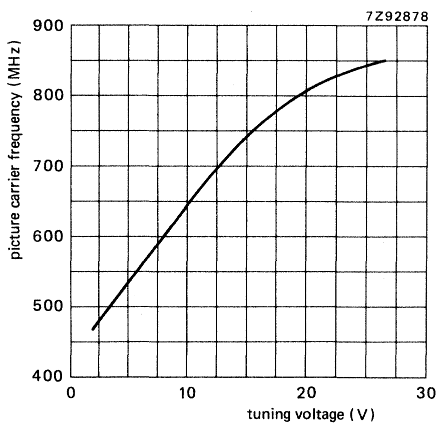


Fig. 9 Typical tuning characteristic, u.h.f. bands.

Tuning voltage range (Figs 7, 8 and 9)	+ 1 to + 28 V
Current drawn from 28 V tuning voltage supply	
at T_{amb} = 25 °C	max. 0,5 μA
at T_{amb} = 55 °C	max. 2 μA

Note: The source impedance of the tuning voltage offered to terminal 7 must be maximum 47 kΩ.

Slope of tuning characteristic			
low v.h.f. band,	channel 0	5 MHz/V	typical values
	channel 2	4 MHz/V	
high v.h.f. band,	channel 5A	8 MHz/V	
	channel 11	3 MHz/V	
u.h.f. bands,	channel 28	19 MHz/V	
	channel 63	10 MHz/V	

Frequencies

Frequency ranges

low v.h.f. band	channel 0 (picture carrier 46,25 MHz) to channel 5 (picture carrier 102,25 MHz). Margin at the extreme channels: min. 1,5 MHz.
high v.h.f. band	channel 5A (picture carrier 138,25 MHz) to channel 12 (picture carrier 224,25 MHz). Margin at the extreme channels: min. 2 MHz.
u.h.f. bands	channel 21 (picture carrier 471,25 MHz) to channel 69 (picture carrier 855,25 MHz). Margin at the extreme channels: min. 3 MHz.

Intermediate frequencies

picture	36,875 MHz
sound	31,375 MHz

The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance: 75 Ω

V.S.W.R. and reflection coefficient
(values between picture and sound carrier,
as well as values at picture carrier)

	at nominal gain	during gain control
v.s.w.r.		
v.h.f. bands	max. 4	max. 5
u.h.f. bands	max. 5	max. 7
reflection coefficient		
v.h.f. bands	max. 60%	max. 66%
u.h.f. bands	max. 66%	max. 75%

R.F. curves, bandwidth

low v.h.f. band	typ. 10 MHz
high v.h.f. band	typ. 12 MHz
u.h.f. bands	typ. 17 MHz

R.F. curves, tilt	on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.
A.G.C. range	
v.h.f. bands	min. 40 dB
u.h.f. bands	min. 30 dB
Power gain (see also Measuring method of power gain)	
v.h.f. bands	min. 22 dB
channel 0	typ. 27 dB
channel 5	typ. 28 dB
channel 5A	typ. 27 dB
channel 11	typ. 29 dB
u.h.f. bands	min. 20 dB
channel 28	typ. 28 dB
channel 40	typ. 28 dB
channel 63	typ. 26 dB
Maximum gain difference	
between any two v.h.f. channels	typ. 3 dB
between any two u.h.f. channels	typ. 3 dB
between any v.h.f. and u.h.f. channel	typ. 4 dB
Noise figure	
v.h.f. bands	max. 8 dB
channel 0	typ. 5 dB
channel 5	typ. 4 dB
channel 5A	typ. 5,5 dB
channel 11	typ. 5,5 dB
u.h.f. bands	max. 10 dB
channel 28	typ. 6 dB
channel 40	typ. 6 dB
channel 63	typ. 7 dB
Overloading	
Input signal producing 1 dB gain compression at nominal gain	
v.h.f. bands	typ. 90 dB (μV) into 75 Ω
u.h.f. bands	typ. 90 dB (μV) into 75 Ω
Input signal producing either a detuning of the oscillator of + 300 kHz or −1000 kHz or stopping of the oscillations at nominal gain	
v.h.f. bands	typ. 100 dB (μV) into 75 Ω
u.h.f. bands	typ. 100 dB (μV) into 75 Ω

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)

v.h.f. bands	min. 60 dB; typ. 70 dB
u.h.f. bands, channels 21 to 27	min. 40 dB; typ. 46 dB
channels 28 to 62	min. 44 dB; typ. 53 dB
channels 63 to 69	min. 40 dB; typ. 46 dB

I.F. rejection (measured at picture carrier frequency)

v.h.f. bands	min. 60 dB
u.h.f. bands	min. 60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection.

N ± 4 rejection (for u.h.f. only)
Interference signal for an interference ratio of 47 dB referred to wanted picture carrier (picture to sound carrier ratio of 10 dB; wanted signal 60 dB (μV); tuner operating at nominal gain) — typ. 70 dB (μV) into 75 Ω

Cross modulation
Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

v.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 74 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 60 dB (μV))	typ. 94 dB (μV) into 75 Ω
u.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 74 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 94 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for low v.h.f., or channel N ± 3 for high v.h.f., or channel N ± 5 for u.h.f.)

v.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 82 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 94 dB (μV) into 75 Ω
u.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 82 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 94 dB (μV) into 75 Ω

Out of band cross modulation at nominal gain

low v.h.f., interfering from high v.h.f.	typ. 94 dB (μV) into 75 Ω
low v.h.f., interfering from u.h.f.	typ. 90 dB (μV) into 75 Ω
high v.h.f., interfering from low v.h.f.	typ. 94 dB (μV) into 75 Ω
high v.h.f., interfering from u.h.f.	typ. 90 dB (μV) into 75 Ω
u.h.f., interfering from low v.h.f.	typ. 94 dB (μV) into 75 Ω
u.h.f., interfering from high v.h.f.	typ. 86 dB (μV) into 75 Ω

Oscillator characteristics

Pulling	
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain	
v.h.f. bands	typ. 80 dB (μV) into 75 Ω
u.h.f. bands	typ. 80 dB (μV) into 75 Ω
Shift of oscillator frequency at a change of the supply voltage of 5%	
v.h.f. bands	max. 200 kHz
u.h.f. bands	max. 400 kHz
Drift of oscillator frequency	
during warm-up time (after the tuner has been completely out of operation for 15 min. measured between 5 s and 15 min after switching on)	max. 250 kHz
during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)	max. 250 kHz
at a change of the ambient temperature from + 25 to + 50 °C (measured after 3 cycles from + 25 to + 55 °C)	
v.h.f. bands	max. 600 kHz
u.h.f. bands	max. 1000 kHz

Frequency divider characteristics (UV462)

Supply voltage	+ 5 V ± 10%
Current drawn from + 5 V supply	max. 35 mA; typ. 25 mA
Output voltage, at terminals 12 and 13	min. 0,8 V p-p
unloaded	min. 0,7 V p-p
with 820 Ω load	min. 0,3 V p-p
Output impedance	typ. 1 kΩ
Output imbalance	typ. 0,1 V
Interference signal on the i.f. output	max. 3 μV

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10.

I.F. circuit characteristics

Bandwidth of i.f. output circuit	5 ± 1 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10; tuning voltage 18 V; u.h.f. band switched on.

Bandwidth variation of i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 18 V)	max. 500 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 10, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

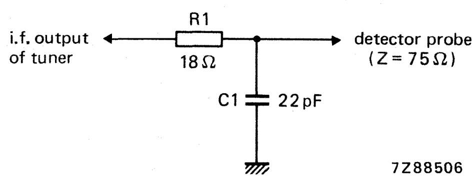


Fig. 10.

Detuning of the i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 18 V)	max. 500 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 10, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

Minimum tuning range of i.f. output coil	$\leqslant$ 31,5 to $\geqslant$ 37,5 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 10.

Attenuation between i.f. injection point and i.f. output of the tuner	typ. 16 dB

Miscellaneous

Radio interference	
Oscillator radiation and oscillator voltage at the aerial terminal	In conformity with the oscillator interference limits of the Australian Standard AS1053-1973 and the limits of C.I.S.P.R. 13 (1975).
Microphonics	There will be no microphonics, provided the tuner is installed in a professional manner.
Surge protection	
Protection against voltages	max. 5 kV

Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes	max. 30 kV, 400 mWs

Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

ADDITIONAL INFORMATION

I.F. injection

Terminal 4 (supply voltage u.h.f.) can be used as i.f. injection point, provided the u.h.f. supply voltage is applied to terminal 4 via a resistor of 10 Ω (see Fig. 11). The u.h.f. band should be switched on; tuning voltage should be 18 V.

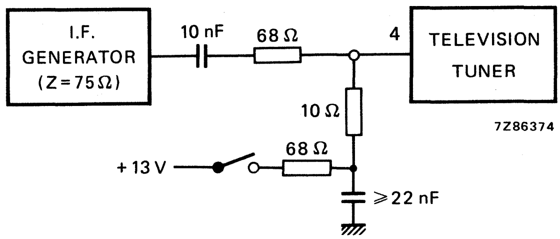


Fig. 11.

Connection of the i.f. amplifier

No special precautions are required to load and to match the i.f. output of the tuner.

Connection of supply voltages

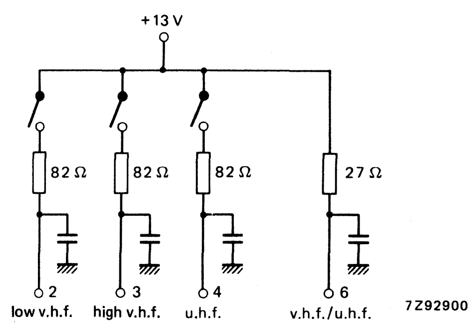


Fig. 12.

Measuring method of power gain

The i.f. output of the tuner should be terminated with the RC-circuit given in Fig. 10.

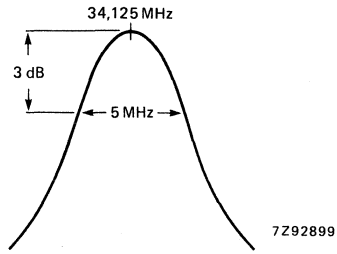


Fig. 13.

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit, which should be tuned to 34,125 MHz; the bandwidth is approx. 5 MHz (Fig. 13).

Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector.

Alignment of the i.f. output coil

The i.f. output coil should be adjusted with a plastic tool, which has a crosshead as shown in Fig. 14. A suitable tool for automatic alignment is available under catalogue number 8104 004 11040.

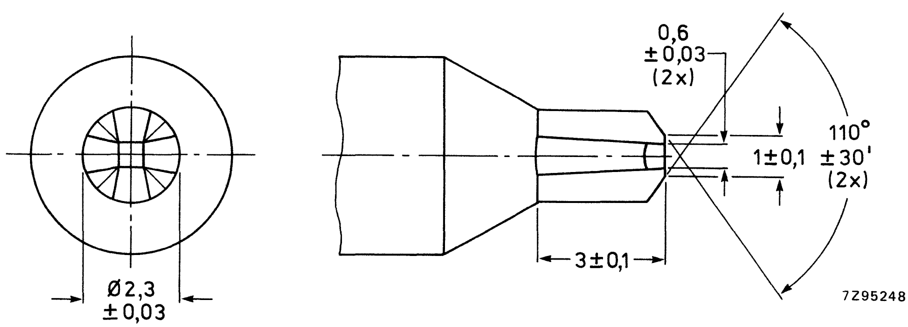


Fig. 14.

V.H.F./U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

Systems	C.C.I.R. system I
Channels (South African channel distribution)	
v.h.f.	4 to 13
u.h.f.	21 to 69
Intermediate frequencies	
picture	38,9 MHz
sound	32,9 MHz

APPLICATION

Designed to cover the South African v.h.f. and u.h.f. channels of C.C.I.R. system I.
The tuners UV472 are equipped with a frequency divider, which makes them suitable for digital tuning systems based on frequency synthesis; for the remainder they are equal to type UV471.

Available versions

	aerial input connector	frequency divider (IC)	catalogue number
UV471	phono	–	3122 127 03310
UV472/256	phono	1:256	3122 237 00340
UV472/64	phono	1:64	3122 237 00360

DESCRIPTION

The UV471 and UV472 are combined v.h.f./u.h.f. tuners with electronic tuning and band switching, covering the television bands used in South Africa in accordance with the publications of the South African Bureau of Standards (S.A.B.S.).

Mechanically, the tuners are built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common 75 Ω aerial connector (v.h.f. and u.h.f.) is on one of the frame sides, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuners consist of v.h.f. and u.h.f. parts. The v.h.f. aerial signal is fed via a tuned input circuit to gate 1 of an input MOSFET tetrode (with internal gate protection against surge).
The drain load of the MOSFET tetrode is formed by a double tuned filter, transferring the r.f. signal to the emitter of the mixer transistor.

The collector circuit of the mixer transistor is a single tuned i.f. resonant circuit, at the low end of which the i.f. signal is coupled out of the tuner. A test point (terminal 4) is provided for i.f. injection to align the i.f. output circuit of the tuner together with the i.f. amplifier of the television receiver.
An additional test point (T.P.), which is accessible through a hole in the top of the tuner, is connected to the collector of the mixer transistor.

The r.f. band pass filter and oscillator circuits are tuned by 4 tuning diodes.

The u.h.f. part of the tuners consist of a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode.
The i.f. signal from the mixer diode is amplified by the v.h.f. mixer transistor, now operating as an i.f. amplifier.
The r.f. band pass filter and oscillator circuits are tuned by 3 tuning diodes.

In all bands the tuners are gain controlled via gate 2 of the input MOSFET tetrode.

The electrical circuit of the UV472 is extended with a frequency divider (division ratio of 256 or 64), which inputs are connected to the v.h.f. and u.h.f. oscillator. The complementary outputs are connected to terminals 12 and 13.

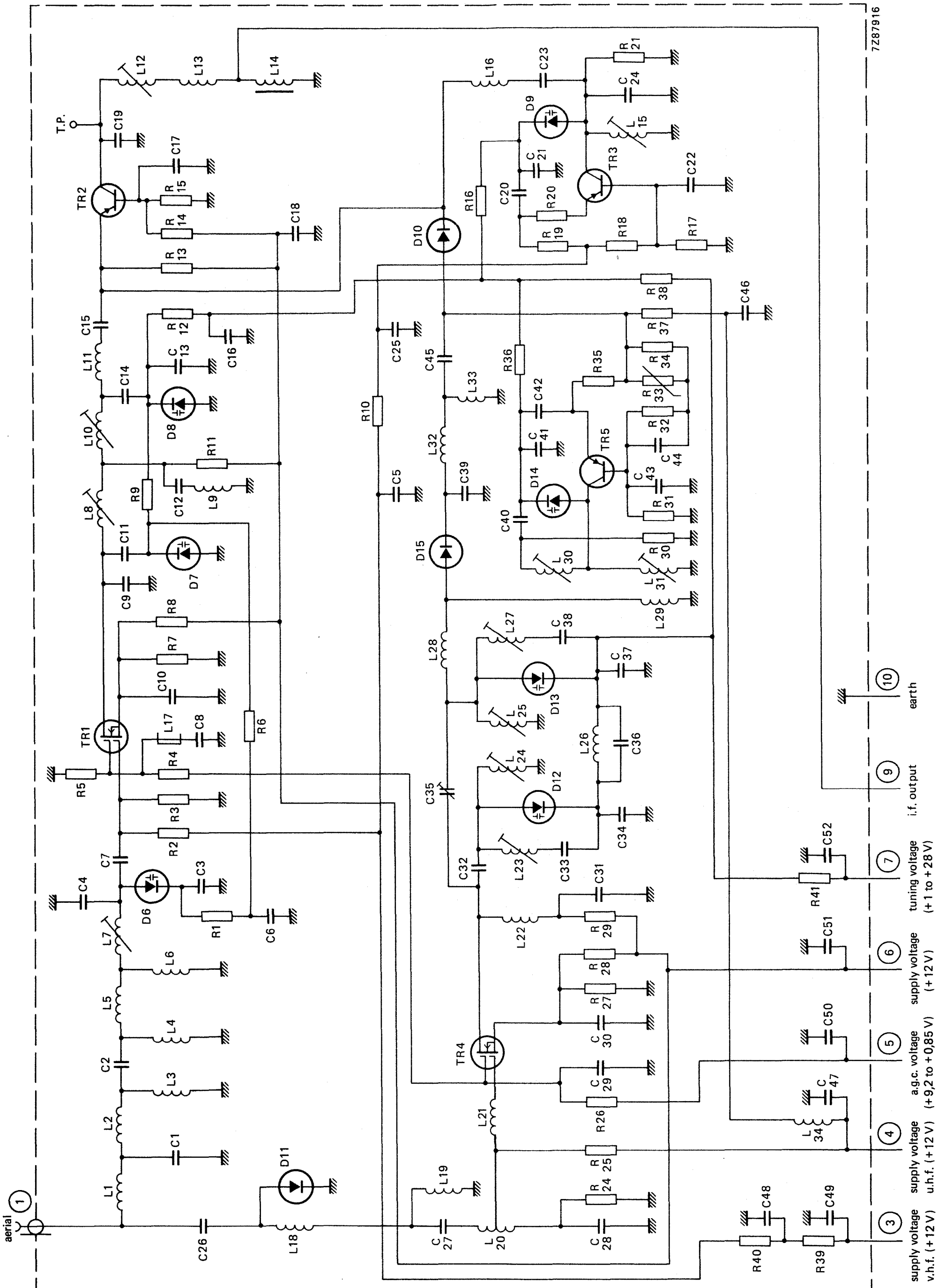


Fig. 1. Circuit diagram of the UV471.

MECHANICAL DATA

Dimensions in mm

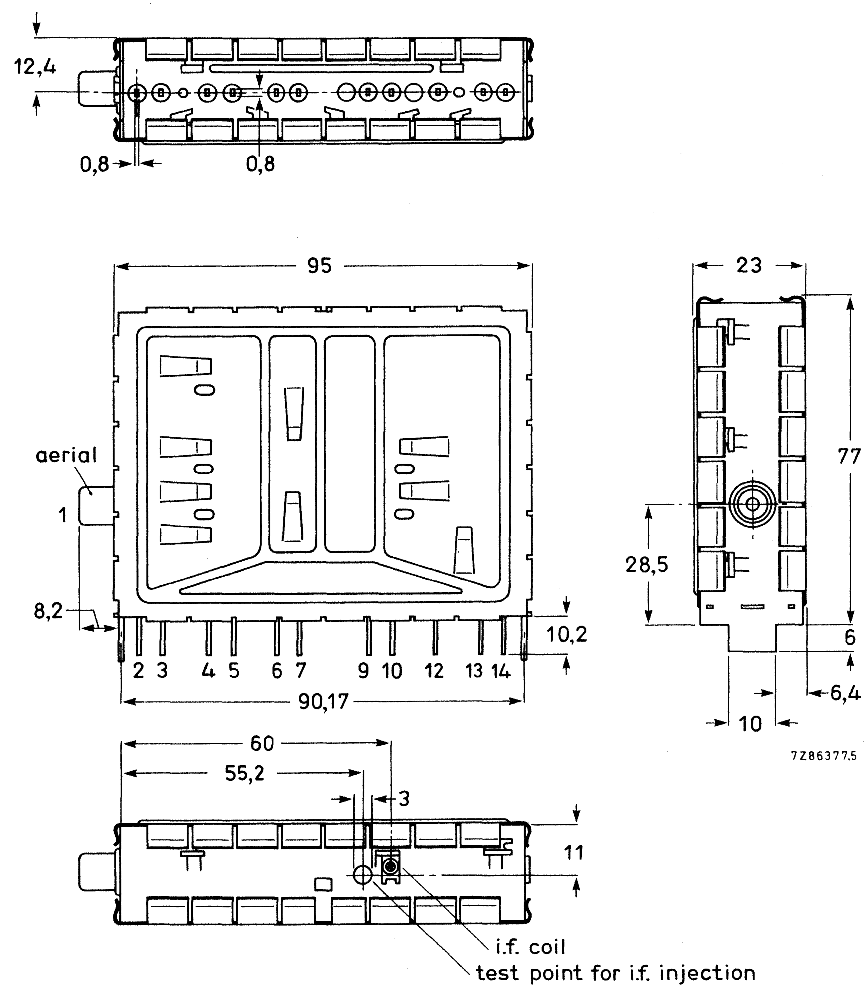


Fig. 2a.

Terminal

1	= aerial		
3	= supply voltage, v.h.f., + 12 V		
4	= supply voltage, u.h.f., + 12 V; i.f. injection		
5	= a.g.c. voltage, + 9,2 to + 0,85 V		
6	= supply voltage, v.h.f. and u.h.f., + 12 V		
7	= tuning voltage, + 1 to + 28 V		
9	= i.f. output		
10	= earth		
12, 13	= balanced output voltage of frequency divider	UV472 only	
14	= supply voltage, frequency divider, + 5V	UV472 only	

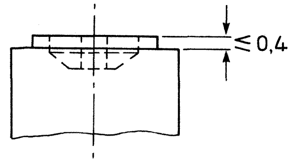


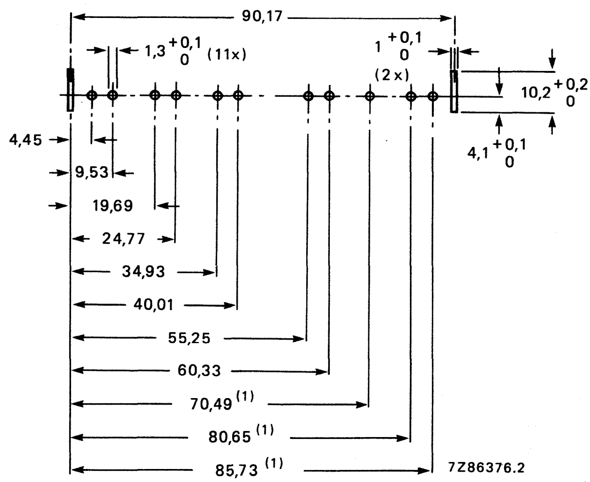
Fig. 2b I.F. output coil.
Torque for alignment: 2 to 15 mNm.
Press-through force: ⩾ 10 N.

Mass approx. 127 g

Mounting

The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. (The tuner may also be mounted by means of a bracket. Information will be supplied upon request). The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).



(1) Only for UV472

Fig. 3 Piercing diagram viewed from solder side of board. Unless otherwise stated the tolerance is ± 0,05 mm.

ELECTRICAL DATA

Unless otherwiss specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General

Semiconductors, v.h.f. band	
r.f. amplifier	BF980
mixer	BF324
oscillator	BF926
tuning diodes	4 x BB405B
switching diodes	1 x BA482
Semiconductors, u.h.f. band	
r.f. amplifier	BF980
oscillator	BF970
mixer	1SS99
tuning diodes	3 x BB405B
surge protection diodes	1 x BAV10
Frequency divider	SP4653 or SP4632
Ambient temperature range	
operating	0 to + 55 °C
storage	−25 to + 70 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltage	+ 12 V ± 10%
Current drawn from + 12 V supply	
v.h.f. band	max. 50 mA; typ. 31 mA
u.h.f. band	max. 50 mA; typ. 37 mA

Bandswitching

For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:

terminal 3 for operation in the v.h.f. band
terminal 4 for operation in the u.h.f. band

A.G.C. voltage (Figs 4 and 5)		
voltage range		+ 9,2 to + 0,85 V
voltage at nominal gain		+ 9,2 ± 0,5 V
voltage at 40 dB gain reduction	(v.h.f. band)	typ. 1,5 V
voltage at 30 dB gain reduction	(v.h.f. band)	typ. 2 V

Note: A.G.C. voltages between 0 and + 10,5 V may be applied without risk of damage.

A.G.C. current	max. 0,3 mA
Slope of a.g.c. characteristic, at the end of the specified a.g.c. range	
v.h.f. band	typ. 25 dB/V
u.h.f. band	typ. 50 dB/V

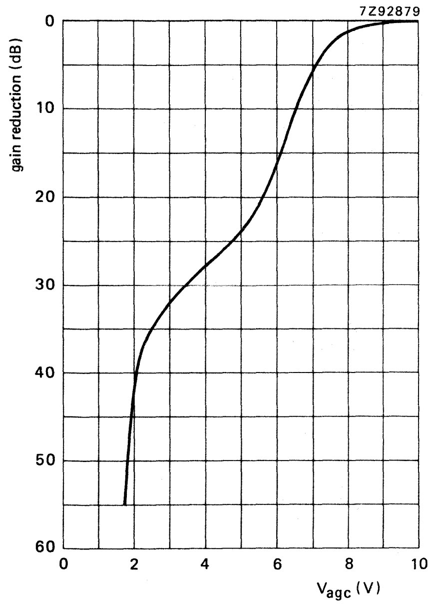


Fig. 4 Typical a.g.c. characteristic, v.h.f. band.

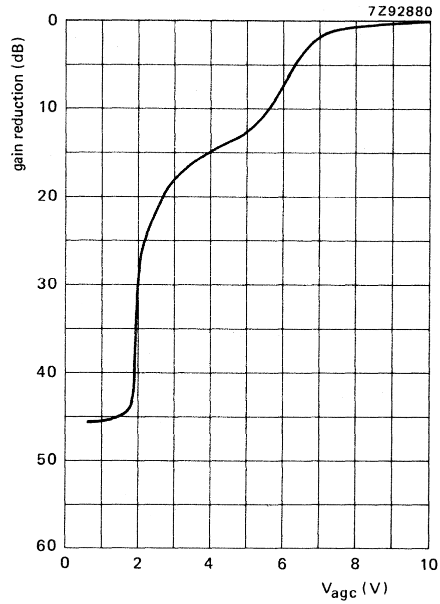


Fig. 5 Typical a.g.c. characteristic, u.h.f. band.

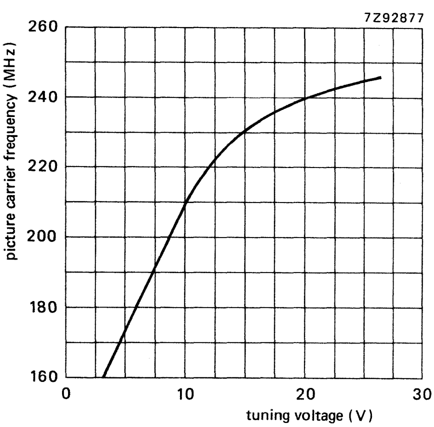


Fig. 6 Typical tuning characteristic, v.h.f. band.

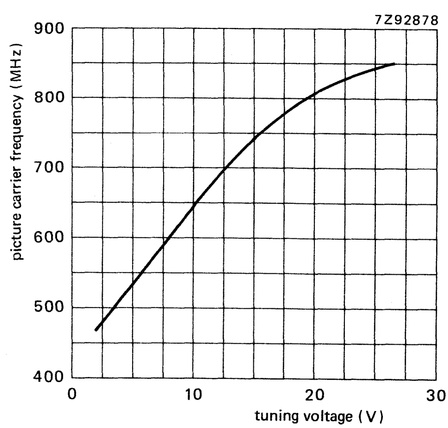


Fig. 7 Typical tuning characteristic, u.h.f. band.

Tuning voltage range (Figs 6 and 7)	+ 1 to + 28 V
Current drawn from 28 V tuning voltage supply	
at T_{amb} = 25 °C	max. 0,5 μA
at T_{amb} = 55 °C	max. 2 μA

Note: The source impedance of the tuning voltage offered to terminal 7 must be maximum 47 kΩ.

Slope of tuning characteristic		
v.h.f. band, channel 4	7 MHz/V	typical values
channel 8	6 MHz/V	
channel 13	1,8 MHz/V	
u.h.f. band, channel 21	22 MHz/V	
channel 69	4 MHz/V	

Frequencies

Frequency ranges	
v.h.f.	channel 4 (picture carrier 175,25 MHz) to channel 13 (picture carrier 247,43 MHz). Margin at the extreme channels: min. 2 MHz.
u.h.f. band	channel 21 (picture carrier 471,25 MHz) to channel 69 (picture carrier 855,25 MHz). Margin at the extreme channels: min. 3 MHz.
Intermediate frequencies	
picture	38,9 MHz
sound	32,9 MHz
	The oscillator frequency is higher than the aerial signal frequency

Wanted signal characteristics

Input impedance	75 Ω	
V.S.W.R. and reflection coefficient (values between picture and sound carrier, as well as values at picture carrier)	at nominal gain	during gain control
v.s.w.r.		
v.h.f. band,	max. 4	max. 5
u.h.f. band	max. 5	max. 7
reflection coefficient		
v.h.f. band	max. 60%	max. 66%
u.h.f. band	max. 66%	max. 75%
R.F. curves, bandwidth		
v.h.f. band	typ. 10 MHz	
u.h.f. band	typ. 17 MHz	
R.F. curves, tilt	on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.	

A.G.C. range		
v.h.f. band	min.	40 dB
u.h.f. band	min.	30 dB
Power gain (see also Measuring method of power gain)		
v.h.f. band	min.	22 dB
channel 4	typ.	31 dB
channel 7	typ.	30 dB
channel 10	typ.	31 dB
channel 13	typ.	31 dB
u.h.f. band	min.	20 dB
channel 21	typ.	32 dB
channel 40	typ.	31 dB
channel 69	typ.	32 dB
Maximum gain difference		
between any two v.h.f. channels	typ.	4 dB
between any two u.h.f. channels	typ.	4 dB
between any v.h.f. and u.h.f. channel	typ.	6 dB
Noise figure		
v.h.f. band	max.	8 dB
channel 4	max.	4,5 dB
channel 7	typ.	4,5 dB
channel 10	typ.	4,5 dB
channel 13	typ.	4,5 dB
u.h.f. band	max.	10 dB
channel 21	typ.	6 dB
channel 40	typ.	6 dB
channel 69	typ.	7 dB
Overloading		
Input signal producing 1 dB gain compression at nominal gain		
v.h.f. band	typ.	90 dB (μV) into 75 Ω
u.h.f. band	typ.	90 dB (μV) into 75 Ω
Input signal producing either a detuning of the oscillator of + 300 kHz or −1000 kHz or stopping of the oscillations at nominal gain		
v.h.f. band	typ.	100 dB (μV) into 75 Ω
u.h.f. band	typ.	100 dB (μV) into 75 Ω

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)		
v.h.f. band	min.	60 dB; typ. 75 dB
u.h.f. band	min.	44 dB; typ. 53 dB
I.F. rejection (measured at picture carrier frequency)		
v.h.f. band	min.	60 dB
u.h.f. band	min.	60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection.

N ± 4 rejection (for u.h.f. only) Interference signal for an interference ratio of 53 dB referred to wanted picture carrier (picture to sound carrier ratio of 10 dB; wanted 60 dB (μV); tuner operating at nominal gain)	typ.	75 dB (μV) into 75 Ω

Cross modulation
Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

v.h.f. band		
at nominal gain (wanted input level 60 dB (μV))	typ.	74 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ.	94 dB (μV) into 75 Ω
u.h.f. band		
at nominal gain (wanted input level 60 dB (μV))	typ.	74 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ.	94 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ∓ 3 for v.h.f. or channel N ± 5 for u.h.f.)

v.h.f. band		
at nominal gain (wanted input level 60 dB (μV))	typ.	82 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ.	94 dB (μV) into 75 Ω
u.h.f. band		
at nominal gain (wanted input level 60 dB (μV))	typ.	82 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ.	94 dB (μV) into 75 Ω

Out of band cross modulation at nominal gain

v.h.f. interfering from u.h.f.	typ.	90 dB (μV) into 75 Ω
u.h.f. interfering from v.h.f.	typ.	86 dB (μV) into 75 Ω

Oscillator characteristics

Pulling
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain

v.h.f. band	typ.	80 dB (μV) into 75 Ω
u.h.f. band	typ.	80 dB (μV) into 75 Ω

Shift of oscillator frequency at a change of the supply voltage of 5%

v.h.f. band	max.	200 kHz
u.h.f. band	max.	400 kHz

Drift of oscillator frequency

during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)	max.	250 kHz
during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)	max.	250 kHz

Drift of oscillator frequency at a change of the ambient temperature from + 25 to + 50 °C (measured after 3 cycles from + 25 to + 55 °C)	
v.h.f. band	max. 600 kHz
u.h.f. band	max. 1000 kHz

Frequency divider characteristics (UV472 only)

Division ratio	256 or 64
Supply voltage	+ 5 V ± 10%
Current drawn from + 5 V supply	max. 55 mA
Output voltage, unloaded, measured with probe 10 MΩ/11 pF	min. 0,5 V_{p-p}
Output impedance	typ. 1 kΩ
Output imbalance	max. 0,1 V
Interference signal on the i.f. output	max. 3 μV

Note: I.F. output of the tuner terminated with 10 MΩ/11 pF

I.F. circuit characteristics

Bandwidth of i.f. output circuit — 5 ± 1 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 8; tuning voltage 25 V; u.h.f. band switched on.

Bandwidth variation of i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 25 V) — max. 500 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 8, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

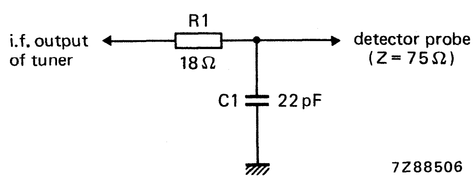


Fig. 8.

Detuning of the i.f. output circuit as a result of r.f. tuning and band switching (reference: u.h.f.; tuning voltage 25 V) — max. 500 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 8, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

Minimum tuning range of i.f. output coil — 32,5 to 40 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 8.

Attenuation between i.f. injection point and i.f. output of the tuner — typ. 16 dB

Miscellaneous

Radio interference Oscillator radiation and oscillator voltage at the aerial terminal	Within the limits of C.I.S.P.R. 13 (1975) and S.A.B.S. requirements
Microphonics	There will be no microphonics, provided the tuner is installed in a professional manner.
Surge protection Protection against voltages	max. 5 kV

Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes	max. 30 kV, 400 mWs

Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

ADDITIONAL INFORMATION

I.F. injection

Terminal 4 (supply voltage u.h.f.) can be used as i.f. injection point, provided the u.h.f. supply voltage is applied to terminal 4 via a resistor of 10 Ω (see Fig. 9). The u.h.f. band should be switched on; tuning voltage should be 25 V.

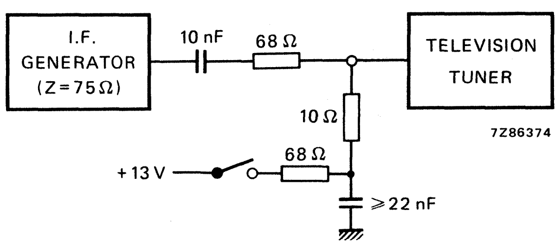


Fig. 9.

Connection of the i.f. amplifier

No special precautions are required to load and to match the i.f. output of the tuner.

Connection of supply voltages

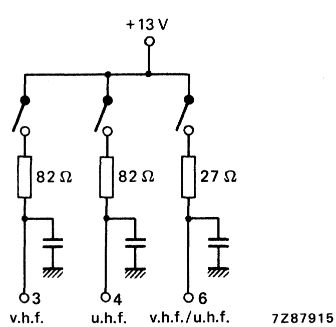


Fig. 10.

Measuring method of power gain

The i.f. output of the tuner should be terminated with the RC-circuit given in Fig. 8.

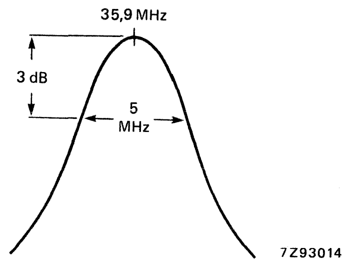


Fig. 11.

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit, which should be tuned to 35,9 MHz; the bandwidth is approx. 5 MHz (Fig. 11).

Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector.

Alignment of the i.f. output coil

The i.f. output coil should be adjusted with a plastic tool, which has a cross head as shown in Fig. 12. A suitable tool for automatic alignment is available under catalogue number 8104 004 11040.

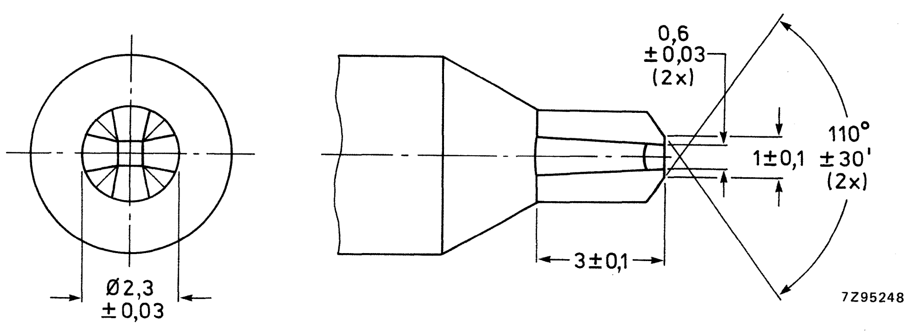


Fig. 12.

VHF/UHF TELEVISION TUNERS

QUICK REFERENCE DATA

Systems	CCIR systems B, G and H	
Channels	off-air	cable
low VHF	E2 to C	S01 to S2
high VHF	E5 to E12	S3 to S20
hyperband		S21 to S36
		S37 to S41
UHF	E21 to E69	
Intermediate frequencies		
picture	38,90 MHz	
colour	34,47 MHz	
sound 1	33,40 MHz	
sound 2	33,16 MHz	

APPLICATION

Designed to cover the VHF and UHF channels of CCIR systems B, G and H with extended VHF frequency ranges, including the hyperband.

The IF output is designed for direct drive of a variety of SAW filters.

The UV616S series of tuners are equipped with frequency dividers, which make them suitable for digital tuning systems based on frequency synthesis; apart from this they are equal to type UV615S.

Table 1 Available versions (Note 1)

	aerial input connector	frequency divider (IC)	catalogue number
UV615S	IEC		3122 237 00560
UV616S/256	IEC	1:256	3122 237 00450
UV616S/6456 (Note 2)	IEC	1:64 or 1:256	3122 237 00530
UV616S/256T (Note 3)	IEC	1:256	3122 237 00550

Notes to Table 1

1. These tuners comply with the requirements of radiation, signal handling capability and immunity from radiated interference of Amtsblatt DBP69/1981, when installed professionally in an adequate TV receiver.
2. The frequency divider ratio is switchable.
3. Incorporates 40.4 MHz trap.

DESCRIPTION

The UV615S/616S series feature combined VHF/UHF handling capability with electronic tuning and band switching. The tuners cover the low VHF band (frequency range 46 to 115 MHz), the high VHF band (frequency range 115 to 300 MHz), the hyperband (frequency range 300 to 430 MHz) and the UHF band (frequency range 430 to 860 MHz).

The tuners are built on a low-loss printed-wiring board, carrying all components, in a die-cast metal housing made of a rectangular frame, with front and rear covers (see Fig. 2). The common IEC coaxial aerial connector (75 Ω) is integrated in one of the frame sides of the housing, all other connections (supply voltages, AGC voltage, tuning and switching voltages, IF output) are made via pins in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuners consist of VHF, hyperband and UHF parts (see Fig. 1). They are equipped with a common aerial input and provided with tuned RF input stages. The mixer, oscillator and IF preamplifier functions for low VHF, high VHF and hyperband are provided by a tuner IC. This IC has terminals between mixer and IF amplifier to connect IF preselections. Type UV616S/256T incorporates a 40.4 MHz trap to improve the selectivity of common SAW filters for adjacent channel N − 1 (system B).

Output impedance of the symmetrical IF terminals is approximately 75 Ω to ensure sufficient triple transient suppression of the SAW filter.

The RF bandpass filter and oscillator circuits of the VHF part are tuned by eight tuning diodes, with band switching by means of four switching diodes. The hyperband uses four diodes for tuning and one diode for band switching.

The UHF part of the tuner has a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the RF signal to the Schottky barrier mixer diode. The IF signal from the mixer diode is amplified by the IF preamplifier of the tuner IC. The RF bandpass filter and oscillator circuits are tuned by four tuning diodes.

In all bands the tuner is gain-controlled via gate 2 of the input MOSFET tetrode.

A test point, TP1, is provided for IF injection.

The electrical circuit of the UV616S versions is extended by means of a frequency divider (see Table 1 for division ratios), whose input is connected to the VHF, hyperband and UHF oscillators. The symmetrical ECL outputs are connected to pins 13 and 14.

DEVELOPMENT DATA

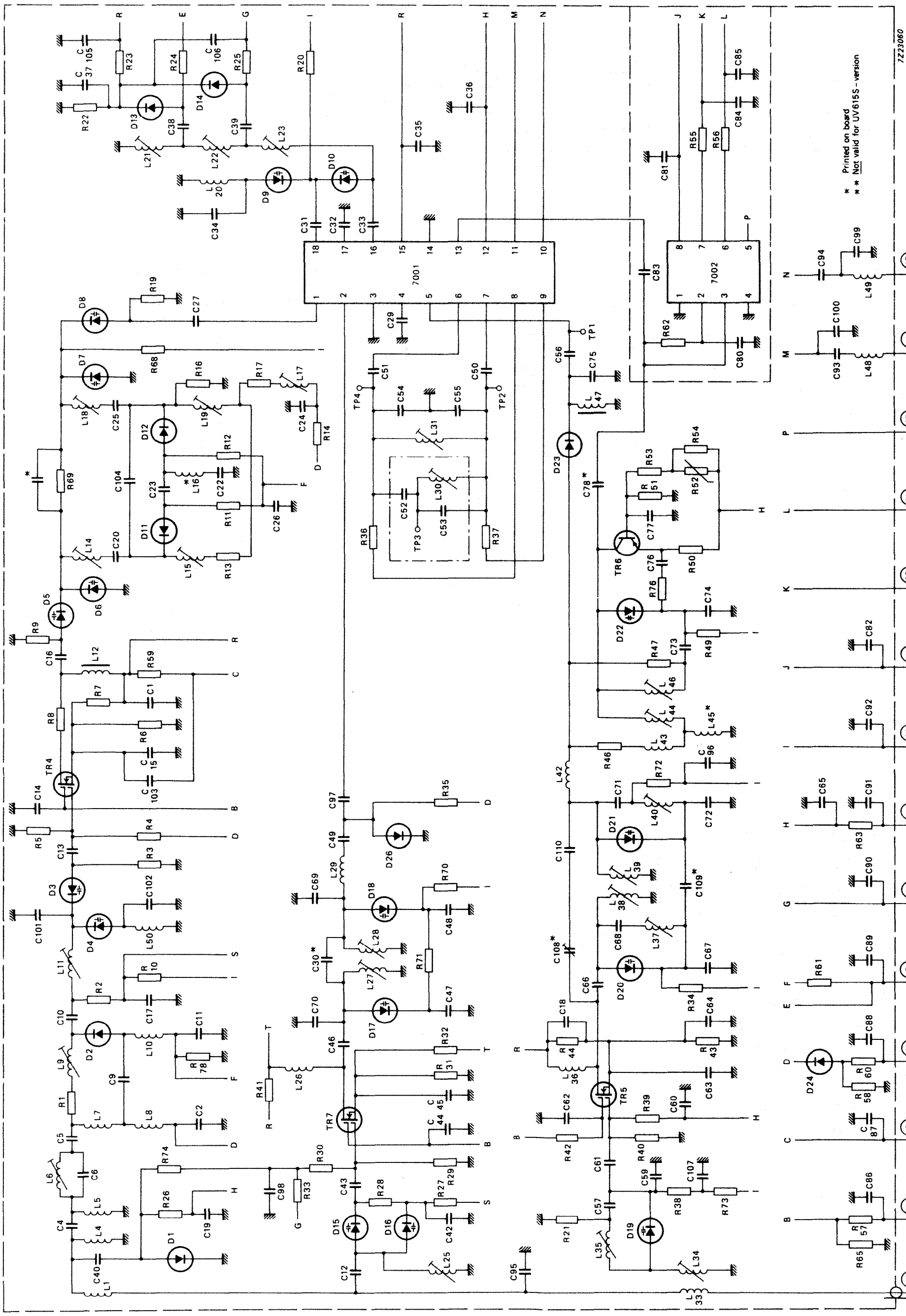
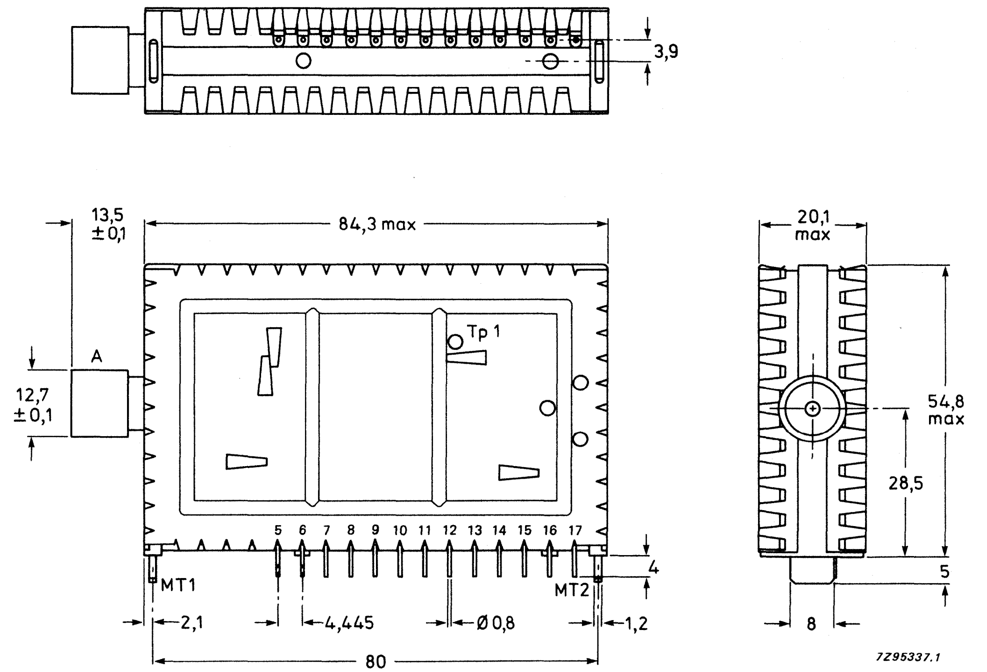


Fig. 1 Circuit diagram.

MECHANICAL DATA

Dimensions in mm



Unless otherwise stated the tolerance is ± 0,05 mm.

Pin/connector identity

A	= aerial input (IEC female 75 Ω)
5	= AGC voltage, + 9,2 to + 0,85 V
6	= supply voltage, tuning part, + 12 V
7	= supply voltage, low VHF, + 12 V
8	= supply voltage, high VHF, + 12 V
9	= supply voltage, hyperband, + 12 V
10	= supply voltage, UHF, + 12 V
11	= tuning voltage, + 0,7 to + 28 V
12	= supply voltage, frequency divider, + 5 V } for UV616S versions only
13, 14	= balanced output voltage of frequency divider (1 kΩ) } for UV616S versions only
15	= prescaler switch mode (UV616S/6456) with pin 15 floating, division ratio = 1:64 with pin 15 grounded, division ratio = 1:256
16	= } IF symmetrical output (approximately 75 Ω)
17	= } IF symmetrical output (approximately 75 Ω)

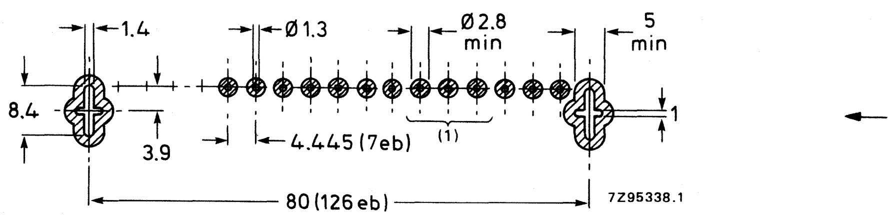
Fig. 2 Mechanical detail.

Mass: approximately 95 grams.

Mounting

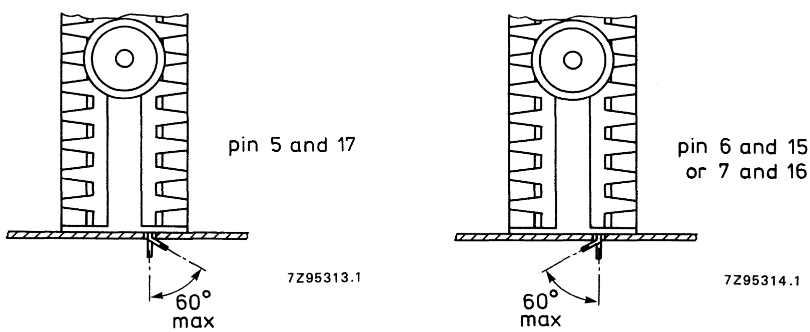
The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3 without clearance between tuner supporting surface and board. The connection pins should be bent according to Fig. 4. The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the pins and mounting tabs is in accordance with IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is in accordance with IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).



1 eb = 0,025 inch
(1) For UV616S versions only

Fig. 3 Piercing diagram viewed from solder side of board.
Unless otherwise stated the tolerance is ± 0,05 mm.



Note

In order to prevent any stress to the printed-wiring board, the tuner should be supported at its aerial connector.

Fig. 4 Bending of connecting pins.

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an AGC voltage of 9,2 ± 0,2 V.

General

Semiconductors, VHF bands	
RF amplifier	BF992
mixer, oscillator	TDA5030
tuning diodes	8 x OF633
switching diodes	4 x BA482/483/484
DC blocking diodes	2 x BAS15
Semiconductors, hyperband	
RF amplifier	BF990
mixer, oscillator	TDA 5030
tuning diodes	4 x OF643
switching diodes	1 x BA482
DC blocking diodes	2 x BAW62
Semiconductors, UHF bands	
RF amplifier	BF990
oscillator	BF970
mixer	1SS99
tuning diodes	4 x OF643
Frequency divider	
1:256 division ratio	SP4653
1:64/256 division ratio	SDA 4212
Ambient temperature range	
operating	−10 to + 60 °C
storage	−25 to + 70 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltage	+ 12 V ± 10%
Current drawn from + 12 V supply	
VHF bands, UHF bands, hyperband	max. 65 mA
Bandswitching	max. 24 mA

For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:

pin 7 for operation in low VHF band
pin 8 for operation in high VHF band
pin 9 for operation in the hyperband
pin 10 for operation in UHF bands

AGC voltage	
voltage range	+ 9,2 to + 0,85 V (max. 30 μA)
voltage at nominal gain	+ 9,2 ± 0,5 V
voltage at 40 dB gain reduction	
low VHF band, high VHF band	typ. 3 V
voltage at 30 dB gain reduction	
hyperband	typ. 1,7 V
UHF band	typ. 1,0 V

Note: AGC voltages between 0 and + 10,5 V may be applied without risk of damage.

AGC current	max. 0,03 mA
Slope of AGC characteristic at the end of the specified AGC range	
low VHF band	typ. 20 dB/V
high VHF band, hyperband	typ. 30 dB/V
Tuning voltage range	+ 0,7 to + 28 V
Current drawn from 28 V tuning voltage supply	
at T_{amb} = 25 °C and 60% RH	max. 0,5 μA
at T_{amb} = 25 °C and 95% RH	max. 2 μA
at T_{amb} = 60 °C and 60% RH	max. 2 μA

Note: The source impedance of the tuning voltage offered to pin 11 must be maximum 47 kΩ.

Slope of tuning characteristic (typical values)

low VHF band	3,5 MHz/V
high VHF band	8 MHz/V
hyperband	10 MHz/V
UHF bands	50 MHz/V

DEVELOPMENT DATA

Frequencies

Frequency ranges

low VHF band	Channel E2 (picture carrier 48,25 MHz) to channel S2 (picture carrier 112,25 MHz). Margin at the extreme channels: min. 2,5 MHz.
high VHF band	Channel S3 (picture carrier 119,25 MHz) to channel S20 (picture carrier 294,25 MHz). Margin at the extreme channels: min. 2 MHz.
hyperband	Channel S21 (picture carrier 303,25 MHz) to channel S36 (picture carrier 423,25 MHz). Margin at the extreme channels: min. 6 MHz.
UHF bands	Channel S37 (picture carrier 431,25 MHz) to channel E69 (picture carrier 855,25 MHz). Margin at the extreme channels: min. 3 MHz.

Intermediate frequencies	
picture	38,90 MHz
colour	34,47 MHz
sound 1	33,40 MHz
sound 2	33,16 MHz The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance	75 Ω
VSWR and reflection coefficient	
VSWR	**at nominal gain and during gain control**
VHF bands	max. 4
hyperband	max. 5
UHF bands	max. 5
reflection coefficient	
VHF bands	max. 60%
hyperband	max. 66%
UHF bands	max. 66%
Output impedance (IF)	75 Ω approximately
Capacitance between terminals	typ. 3,5 pF
Load impedance	min. 1 kΩ/max. 22 pF total capacitance load to be tuned to 36,15 MHz by means of an inductance between pins 16 and 17 (min. L: 890 nH)
RF curves bandwidth	
low VHF band	typ. 13 MHz
high VHF band	typ. 13 MHz
hyperband	typ. 15 MHz
UHF bands	typ. 13 MHz
RF curves, tilt	On any channel the amplitude difference between the top of the RF resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain and 5 dB in AGC range between nominal gain and 20 dB gain reduction.
AGC range	
VHF bands	min. 40 dB
hyperband UHF bands	min. 30 dB
Voltage gain	
low VHF band high VHF band	min. 40 dB; max. 50 dB
channels S2 to S6	min. 36 dB; max. 50 dB
channels S7 to S20	min. 38 dB; max. 50 dB
channels S21 to S41 UHF bands	min. 40 dB; max. 50 dB

Maximum gain difference	
off air channels	max. 5 dB
Noise figure	
VHF bands	
E channels	typ. 5 dB; max. 8 dB
S channels and hyperband channels	typ. 7 dB; max. 10 dB
UHF bands	typ. 8 dB; max. 11 dB
Overloading	
Input signal producing 1 dB gain compression at nominal gain	
VHF bands and hyperband	typ. 90 dB (μV) into 75 Ω
UHF bands	typ. 90 dB (μV) into 75 Ω
Input signal producing either a detuning of the oscillator of + 300 kHz or −1000 kHz or stopping of the oscillators at nominal gain	
VHF bands	typ. 105 dB (μV) into 75 Ω; min. 100 dB (μV)
UHF bands and hyperband	typ. 100 dB (μV) into 75 Ω; min. 90 dB (μV)

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)	
VHF bands	min. 66 dB; typ. 70 dB
hyperband	min. 66 dB; typ. 70 dB
UHF bands	min. 53 dB; typ. 65 dB
IF rejection (measured at picture carrier frequency)	
all bands	min. 60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection.

Cross modulation

Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

VHF bands and hyperband	
at nominal gain (wanted input level 60 dB (μV))	typ. 75 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 100 dB (μV) into 75 Ω
UHF bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 75 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 100 dB (μV) into 75 Ω

DEVELOPMENT DATA

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for low VHF, or channel N ± 3 for high VHF, or channel N ± 5 for UHF and hyperband)

VHF bands and hyperband	
at nominal gain (wanted input level 60 dB (μV))	typ. 95 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 100 dB (μV) into 75 Ω
UHF bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 100 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 100 dB (μV) into 75 Ω
Out of band cross modulation at nominal gain each of the VHF, UHF or hyperbands interfering with any of the other bands mentioned	typ. 100 dB (μV) into 75 Ω

Unwanted signal handling capability (visibility test)

For the channel combinations
VHF and hyperband: N ± 1, N ± 5, N + 11
UHF: N ± 1, N ± 5, N + 9

The tuner meets the requirements of "Amtsblatt" DPB/1981, item 5.1.2, when measured in an adequate TV receiver.

Oscillator characteristics

Pulling

Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain	
all bands	typ. 86 dB (μV) into 75 Ω
Shift of oscillator frequency at a change of the supply voltage of ± 5%	
VHF bands	max. 250 kHz
hyperband	max. 500 kHz
UHF bands	max. 500 kHz
Drift of oscillator frequency	
during warm-up time (after the tuner has been completely out of operation for 15 minutes, measured between 5 s and 15 minutes after switching on)	max. 250 kHz
during warm-up time (after the input stage is in operation for 15 minutes, measured between 2 s and 15 minutes after band switching)	max. 250 kHz
at a change of the ambient temperature from + 25 to + 50 °C (measured after 3 cycles from + 25 to 0 °C)	
VHF bands	max. 500 kHz
hyperband	max. 750 kHz
UHF bands	max. 1000 kHz
at a change of humidity from 60 ± 15% to 93 ± 2%, at T_{amb} = 25 ± 5 °C	
low VHF band	max. 500 kHz
high VHF band	max. 1000 kHz
hyperband	max. 1300 kHz
UHF bands	max. 1500 kHz

Frequency divider characteristics of the UV616S versions

Frequency division ratio	
UV616S/256	256
UV616S/64/256	switchable, 64 or 256
Supply voltage	+ 5 ± 5%
Current drawn from + 5 V supply	max. 35 mA; typ. 25 mA
Output voltage, unloaded, measured with probe 10 MΩ/11 pF	min. 0,5 V p-p
Output impedance	typ. 1 kΩ
Output imbalance	typ. 0,1 V
Interference signal on the IF output (IF output terminated with 10 MΩ/11 pF)	max. 30 dB (μV)

Miscellaneous

Radio interference Oscillator radiation and oscillator voltage at the aerial terminal	Within the limits of CISPR 13 (1975), VDE0872/7.72 and Amtsblatt DBP69/1981, when applying the tuner in an adequate TV receiver.
Microphonics	There will be no microphonics, provided the tuner is installed in a professional manner.
Surge protection	
Protection against voltages (note 1)	max. 5 kV
Protection against flashes (note 2)	max. 30 kV, 400 mW

Notes to Miscellaneous characteristics

1. 10 discharges of a 470 pF capacitor into the aerial terminal.
2. A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

DEVELOPMENT DATA

ADDITIONAL INFORMATION

IF injection

An IF signal from a generator (internal resistance 50 Ω or 75 Ω) should be connected to the IF injection point (TP1), accessible through a hole in the cover (see Fig. 2) via a probe (see Fig. 5).

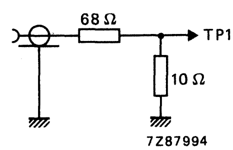


Fig. 5 IF injection.

V.H.F./U.H.F. TELEVISION TUNERS

QUICK REFERENCE DATA

Systems	C.C.I.R. systems B, G and H	
Channels	off-air	cable
low v.h.f.	E2 to C	S01 to S1
high v.h.f.	E5 to E12	S2 to S20
u.h.f.	E21 to E69	
Intermediate frequencies		
picture	38,90 MHz	
colour	34,47 MHz	
sound 1	33,40 MHz	
sound 2	33,16 MHz	

APPLICATION

Designed to cover the v.h.f. and u.h.f. channels of C.C.I.R. systems B, G and H with extended v.h.f. frequency ranges.

The tuner UV618/256 is equipped with a frequency divider, which makes it suitable for digital tuning systems based on frequency synthesis; for the remainder it is equal to type UV617.

Available versions

	aerial input connector	frequency divider (IC)	catalogue number
UV617	IEC	–	3122 237 00060
UV618/256	IEC	1 : 256	3122 237 00010

Both tuners comply with the requirements of radiation, signal handling capability, and immunity from radiated interference of Amtsblatt DBP69/1981, when installed professionally in an adequate TV receiver.

DESCRIPTION

The UV617 and UV618/256 are combined v.h.f./u.h.f. tuners with electronic tuning and band switching, covering the low v.h.f. band (frequency range 46 to 110 MHz), the high v.h.f. band (frequency range 111 to 300 MHz), and the u.h.f. band (frequency range 470 to 860 MHz).

Mechanically, the tuners are built on a low-loss printed-wiring board, carrying all components, in a die-cast metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common IEC coaxial aerial connector (75 Ω) is integrated in one of the frame sides of the housing, all other connections (supply voltages, a.g.c. voltage, tuning and switching voltages, i.f. output) are made via terminals in the underside. The mounting method is shown in Fig. 3.

Electrically, the tuners consist of v.h.f. and u.h.f. parts (see Fig. 1). They are equipped with a common aerial input and provided with r.f. MOSFET input stages. The v.h.f. mixer, v.h.f. oscillator and i.f. amplifier functions are provided by a tuner IC. This IC has terminals between mixer and i.f. amplifier to connect i.f. preselections, a 40,4 trap is provided to improve the selectivity of common SAW filters for adjacent channel N - 1 (system B).
Output impedance of the symmetrical i.f. terminals is approx. 75 Ω to insure sufficient triple transient supression of the SAW.
The r.f. band pass filter and oscillator circuits are tuned by 7 tuning diodes; band switching is achieved by 4 switching diodes.

The u.h.f. part of the tuner has a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the r.f. signal to the Schottky barrier mixer diode. The i.f. signal from the mixer diode is amplified by the i.f. pre-amplifier of the tuner I.C..
The r.f. band pass filter and oscillator circuits are tuned by 4 tuning diodes.

In all bands the tuner is gain-controlled via gate 2 of the input MOSFET tetrode.

A test point TP1 is provided for i.f. injection.

The electrical circuit of the UV618/256 is extended with a frequency divider (division ratio of 256), with inputs connected to the v.h.f. and u.h.f. oscillator. The symmetrical ECL outputs are connected to terminals 13 and 14.

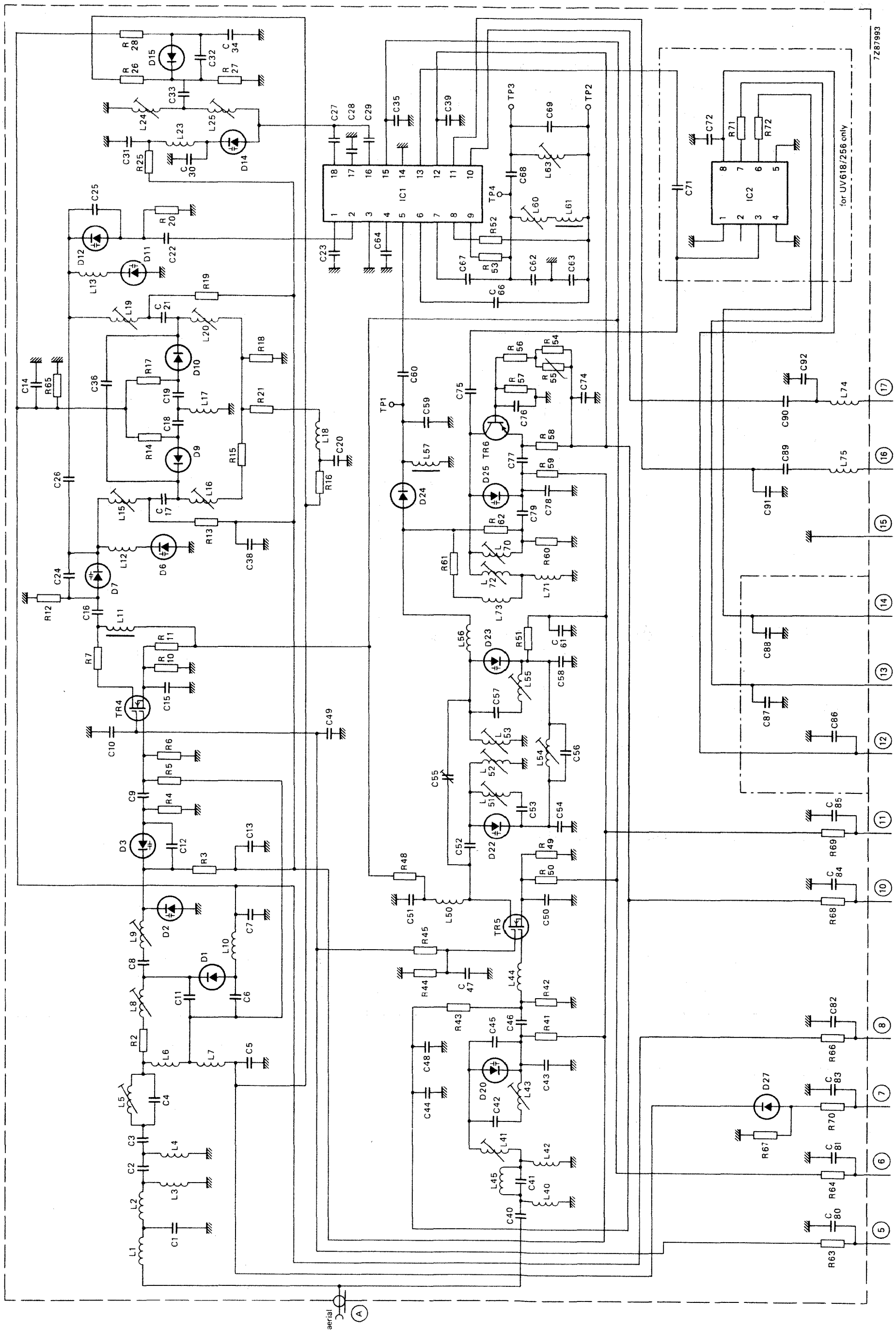
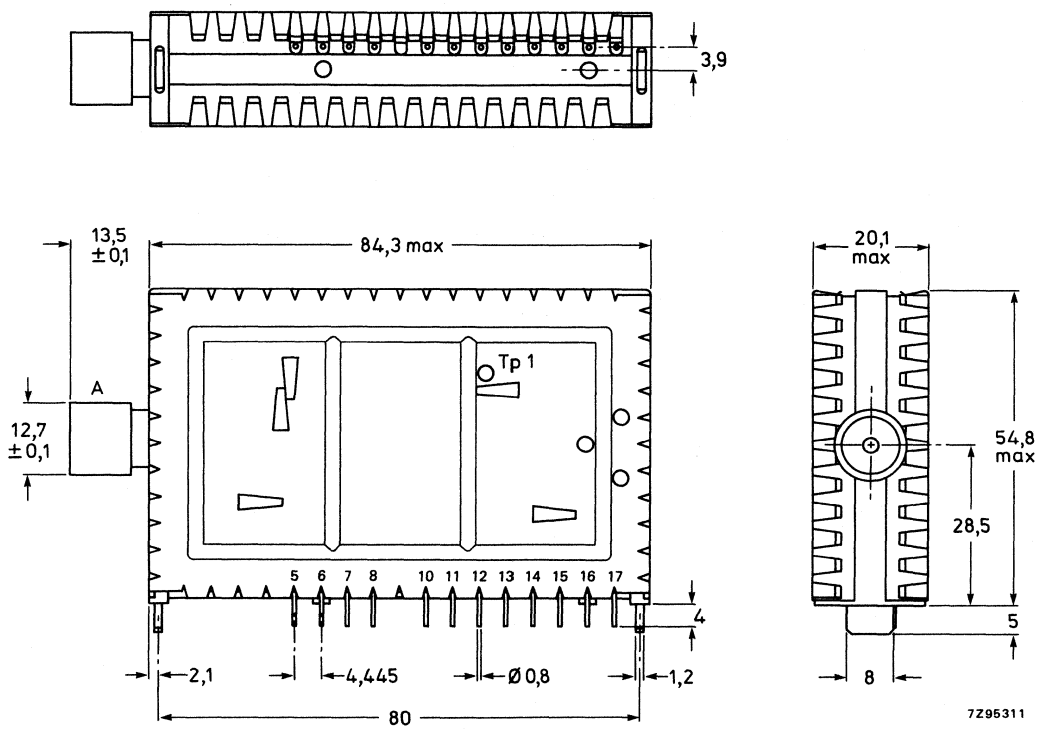


Fig. 1.

For type UV617 delete: C71, C72, C86, C87, C88, R71, R72, IC2.
For connections see next page.

MECHANICAL DATA

Dimensions in mm



Unless otherwise stated the tolerance is ± 0,05 mm.

Fig. 2.

Terminal

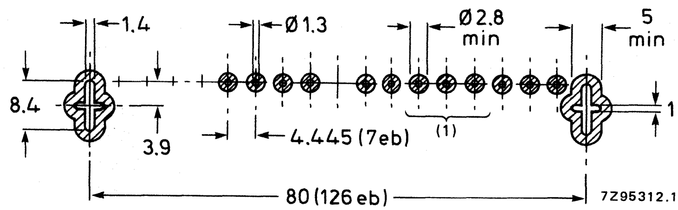
A = aerial input (IEC female 75 Ω)
5 = a.g.c. voltage, + 9,2 to + 0,85 V
6 = supply voltage, tuning part, + 12 V
7 = supply voltage, low v.h.f. + 12 V
8 = supply voltage, high v.h.f., + 12 V
10 = supply voltage, u.h.f., + 12 V
11 = tuning voltage, + 0,8 to + 28 V
12 = supply voltage, frequency divider, + 5 V } only for UV618/256
13,14 = balanced output voltage of frequency divider (1 kΩ) } only for UV618/256
15 = earth
16 = } i.f. output, symm. (approx. 75 Ω)
17 = } i.f. output, symm. (approx. 75 Ω)

Mass approx. 95 g

Mounting

The tuner may be mounted by soldering it on to a printed-wiring board (using the piercing diagram shown in Fig. 3) without clearance between tuner supporting surface and board. The connection pins should be bent according to Fig. 4. The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).



(1) Only for UV618/256

1 eb = 0,025 inch

Fig. 3 Piercing diagram viewed from solder side of board. Unless otherwise stated the tolerance is ± 0,05 mm.

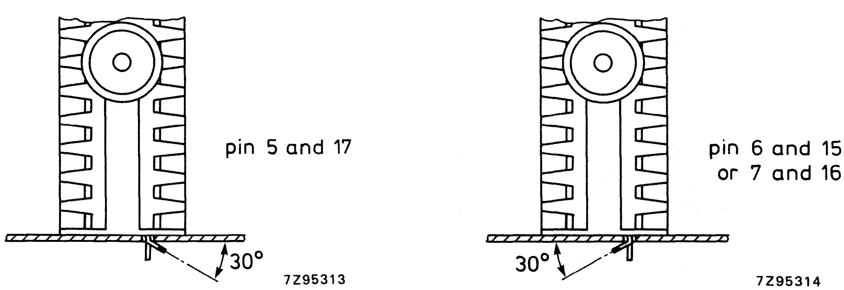


Fig. 4.

In order to prevent any stress to the printed-wiring board, the tuner should be supported at its aerial connector.

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General

Semiconductors, v.h.f. bands	
r.f. amplifier	BF992
mixer, oscillator	TDA5030
tuning diodes	7 x OF633
switching diodes	4 x BA482/483/484
d.c. blocking diodes	2 x BAS15
Semiconductors, u.h.f. bands	
r.f. amplifier	BF990
oscillator	BF970
mixer	1SS99
tuning diodes	4 x OF643
frequency divider	SP4653
Ambient temperature range	
operating	−10 to +60 °C
storage	−25 to +85 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltage	+ 12 V ± 10%
Current drawn from + 12 V supply	
v.h.f. bands	max. 50 mA
u.h.f. bands	max. 45 mA
Bandswitching	max. 15 mA

For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
terminal 7 for operation in low v.h.f. band
terminal 8 for operation in high v.h.f. band
terminal 10 for operation in u.h.f. bands

A.G.C. voltage (Figs 4, 5 and 6)	
voltage range	+ 9,2 to + 0,85 V (max. 30 μA)
voltage at nominal gain	+ 9,2 ± 0,5 V
voltage at 40 dB gain reduction	
low v.h.f. band	typ. 3 V
high v.h.f. band	typ. 2 V
voltage at 30 dB gain reduction	
u.h.f. band	typ. 2 V

Note: A.G.C. voltage between 0 and + 10,5 V may be applied without risk of damage.

A.G.C. current	max. 0,03 mA
Slope of a.g.c. characteristic,	
at the end of the specified a.g.c. range	
low v.h.f. bands	typ. 40 dB/V
high v.h.f. bands	typ. 80 dB/V

Tuning voltage range	+ 0,8 to + 28 V
Current drawn from 28 V tuning voltage supply	
at T_{amb} = 25 °C and 60% R.H.	max. 0,5 μA
at T_{amb} = 25 °C and 95% R.H.	max. 2 μA
at T_{amb} = 60 °C and 60% R.H.	max. 2 μA

Note: The source impedance of the tuning voltage offered to terminal 11 must be maximum 47 kΩ.

Slope of tuning characteristic (typical values)

low v.h.f. band,	channel E2	5 MHz/V
	channel S1	1 MHz/V
high v.h.f. band,	channel S2	10 MHz/V
	channel S20	2 MHz/V
u.h.f. bands,	channel E21	22 MHz/V
	channel E69	5 MHz/V

Frequencies

Frequency ranges

low v.h.f. band	channel E2 (picture carrier 48,25 MHz) to channel S1 (picture carrier 105,25 MHz). Margin at the extreme channels: min. 2 MHz.
high v.h.f. band	channel S2 (picture carrier 112,25 MHz) to channel S20 (picture carrier 294,25 MHz). Margin at the extreme channels: min 2 MHz.
u.h.f. bands	channel E21 (picture carrier 471,25 MHz) to channel E69 (picture carrier 855,25 MHz). Margin at the extreme channels: min 3 MHz.

Intermediate frequencies

picture	38,90 MHz
colour	34,47 MHz
sound 1	33,40 MHz
sound 2	33,16 MHz

The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance	75 Ω
V.S.W.R. and reflection coefficient (values between picture and sound carrier, as well as values at picture carrier)	
v.s.w.r.	at nominal gain and during gain control
v.h.f. bands	max. 4
u.h.f. bands	max. 5
reflection coefficient	
v.h.f. bands	max. 60%
u.h.f. bands	max. 66%
Output impedance (i.f.)	75 Ω approx.
Capacitance between terminals	typ. 3,5 pF
Load impedance	min. 1 kΩ//max. 22 pF total capacitance load to be tuned to 36,15 MHz by means of an inductance between terminals 16 and 17 (min. L: 590 nH)
R.F. curves bandwidth	
low v.h.f. band	typ. 10 MHz
high v.h.f. band	typ. 10 MHz
u.h.f. bands	typ. 15 MHz

R.F. curves, tilt	on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction.
A.G.C. range	
v.h.f. bands	min. 40 dB
u.h.f. bands	min. 30 dB
Voltage gain	
low v.h.f. band	min. 40 dB; max. 50 dB
high v.h.f. band	
channels S2 to S6	typ. 36 dB; max. 46 dB
channels S7 to S20	typ. 40 dB; max. 50 dB
u.h.f. bands	min. 40 dB; max. 50 dB
Maximum gain difference	
between any two v.h.f. channels	typ. 6 dB
between any two u.h.f. channels	typ. 6 dB
between any v.h.f. and u.h.f. channel	typ. 6 dB
Noise figure	
v.h.f. bands	
E channels	typ. 5 dB; max. 8 dB
S channels	typ. 7 dB; max. 10 dB
u.h.f. bands	typ. 8 dB; max. 11 dB
Overloading	
Input signal producing 1 dB gain compression at nominal gain	
v.h.f. bands	typ. 90 dB (μV) into 75 Ω; min. 85 dB(μV)
u.h.f. bands	typ. 100 dB (μV) into 75 Ω; min. 90 dB(μV)
Input signal producing either a detuning of the oscillator of + 300 kHz or −1000 kHz or stopping of the oscillations at nominal gain	
v.h.f. bands	typ. 110 dB (μV) into 75 Ω; min. 100 dB(μV)
u.h.f. bands	typ. 110 dB (μV) into 75 Ω; min. 100 dB(μV)

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)	
v.h.f. bands	min. 66 dB; typ. 70 dB
u.h.f. bands	min. 53 dB; typ. 60 dB

I.F. rejection (measured at picture carrier frequency)

low v.h.f. band	min. 60 dB
high v.h.f. band	min. 60 dB
u.h.f. bands	min. 60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection.

Cross modulation

Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

v.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 80 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 100 dB (μV) into 75 Ω
u.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 80 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 100 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for low v.h.f., or channel N ± 3 for high v.h.f., or channel N ± 5 for u.h.f.)

v.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 95 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 100 dB (μV) into 75 Ω
u.h.f. bands	
at nominal gain (wanted input level 60 dB (μV))	typ. 94 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 100 dB (μV) into 75 Ω

Out of band cross modulation at nominal gain

low v.h.f., interfering from high v.h.f.	typ. 100 dB (μV) into 75 Ω
low v.h.f., interfering from u.h.f.	typ. 100 dB (μV) into 75 Ω
high v.h.f., interfering from low v.h.f.	typ. 100 dB (μV) into 75 Ω
high v.h.f., interfering from u.h.f.	typ. 100 dB (μV) into 75 Ω
u.h.f. interfering from low v.h.f.	typ. 100 dB (μV) into 75 Ω
u.h.f. interfering from high v.h.f.	typ. 100 dB (μV) into 75 Ω

Unwanted signal handling capability (visibility test)

For the channel combinations
v.h.f.: N ± 1, N ± 5, N + 11
u.h.f.: N ± 1, N ± 5, N + 9

The tuner meets the requirements of "Amtsblatt" DBP/1981, item 5.1.2., when measured in an adequate TV receiver. The a.g.c. circuit of the receiver has to be adjusted with an input signal of 74 dB (μV) on channel E60 in such a way, that the gain of the tuner is decreased by 10 dB.

Oscillator characteristics

Pulling

Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain		
v.h.f. bands	typ.	86 dB (μV) into 75 Ω
u.h.f. bands	typ.	86 dB (μV) into 75 Ω
Shift of oscillator frequency at a change of the supply voltage of 5%		
v.h.f. bands	max.	250 kHz
u.h.f. bands	max.	500 kHz
Drift of oscillator frequency		
during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)	max.	250 kHz
during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)	max.	250 kHz
at a change of the ambient temperature from + 25 to + 40 ^{o}C (measured after 3 cycles from + 25 to + 55 ^{o}C)		
v.h.f. bands	max.	500 kHz
u.h.f. bands	max.	500 kHz
at a change of humidity from 60 ± 15% to 93 ± 2%, at T_{amb} = 25 ± 5 ^{o}C		
low v.h.f. band	max.	500 kHz
high v.h.f. band	max.	1000 kHz
u.h.f. bands	max.	1500 kHz

Frequency divider characteristics of the UV618/256

Division ratio	256
Supply voltage	+ 5 V ± 5%
Current drawn from + 5 V supply	max. 35 mA; typ. 25 mA
Output voltage, unloaded, measured with probe 10 MΩ/11 pF	min. 0,3 $V_{p\text{-}p}$
Output impedance	typ. 1 kΩ
Output imbalance	typ. 0,1 V
Interference signal on the i.f. output	max. 30 dB (μV)

Note: I.F. output of the tuner terminated with 10 MΩ/11 pF

Miscellaneous

Radio interference Oscillator radiation and oscillator voltage at the aerial terminal	Within the limits of C.I.S.P.R. 13 (1975), VDE0872/7.72. and Amtsblatt DBP69/1981, when applying the tuner in an adequate TV receiver
Microphonics	There will be no microphonics, provided the tuner is installed in a professional manner.
Surge protection Protection against voltages	max. 5 kV

Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes	max. 30 kV, 400 mWs

Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

ADDITIONAL INFORMATION

I.F. injection

An i.f. signal from a generator (internal resistance 50 Ω or 75 Ω) should be connected to the i.f. injection point TP1, accessible through a hole in the cover (see Fig. 2) via a probe (see Fig. 5).

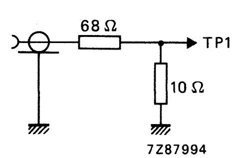


Fig. 5.

VHF/UHF TELEVISION TUNERS

QUICK REFERENCE DATA

Systems	CCIR systems B and G
Channels	
VHF I	E2 to C
VHF III	M4 to E12
UHF	E21 to E69
Intermediate frequencies	
picture	38,9 MHz
sound	33,4 MHz

APPLICATION

Designed to cover the VHF and UHF channels of CCIR systems B and G, with extended VHF frequency ranges.

The tuners of the UV712 series are equipped with a frequency divider, which makes them suitable for digital tuning systems based on frequency synthesis; for the remainder they are equal to type UV711.

Table 1 Available versions (Note 1)

	connector			
	aerial input	local oscillator	frequency divider (IC)	catalogue number
UV711	phono	note 1		3139 147 10040
UV711/IEC	IEC	note 1		3139 147 10030
UV711/IEC.L	long IEC	note 1		3112 297 10020
UV712/256	phono		1:256	3139 147 10070
UV712/256/IEC	IEC		1:256	3139 147 10060
UV712/256/IEC.L	long IEC		1:256	3139 147 10050
UV712/64	phono		1:64	3139 147 10100
UV712/64/IEC	IEC		1:64	3139 147 10090
UV712/64/IEC.L	long IEC		1:64	3139 147 10080

Note to Table 1

1. UV711 tuners with local oscillator coupling (phono connector) are available on request.

DESCRIPTION

The UV711/UV712 are combined VHF/UHF tuners with electronic tuning and band switching, covering the VHF band I including the Italian channel C (frequency range 46 to 84 MHz), the VHF band III including the Morocco channel M4 (frequency range 162 to 225 MHz), and the UHF band (frequency range 470 to 860 MHz).

Mechanically, the tuners are built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common phono or IEC aerial connector (VHF and UHF) is on one of the frame sides, all other connections (supply voltages, AGC voltage, tuning and switching voltages, IF output) are made via pins in the under-side. The mounting method is shown in Fig. 3.

Electrically, the tuners consist of VHF and UHF parts. The VHF aerial signal is fed via switchable VHF band I/III wide band input filters to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The input filters are provided with an IF and FM suppression circuit. The drain load of the MOSFET tetrode is formed by a double tuned switchable bandpass filter, transferring the RF signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor.

A triple filter in the collector circuit minimizes the oscillator voltage at the IF output. The output of the filter is buffered by an IF preamplifier stage. A test point (TP, Fig. 1) for IF injection is accessible through a hole in one of the covers of the tuner. This test point is connected to the emitter of the mixer transistor.

The RF bandpass filter and oscillator circuits are tuned by 3 tuning diodes; band switching is achieved by 4 switching diodes.

The UHF part of the tuner consists of a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the RF signal to the Schottky barrier mixer diode. The IF signal from the mixer diode is amplified by the VHF mixer transistor, now operating as an IF amplifier.

The RF bandpass filter and oscillator circuits are tuned by 3 tuning diodes. In all bands the tuner is gain controlled via gate 2 of the input MOSFET tetrode.

The electrical circuit of the UV712 series is extended with a frequency divider (division ratio of 64 or 256), the inputs of which are connected to the VHF and UHF oscillator. The complementary outputs are connected to pins 13 and 14.

DEVELOPMENT DATA

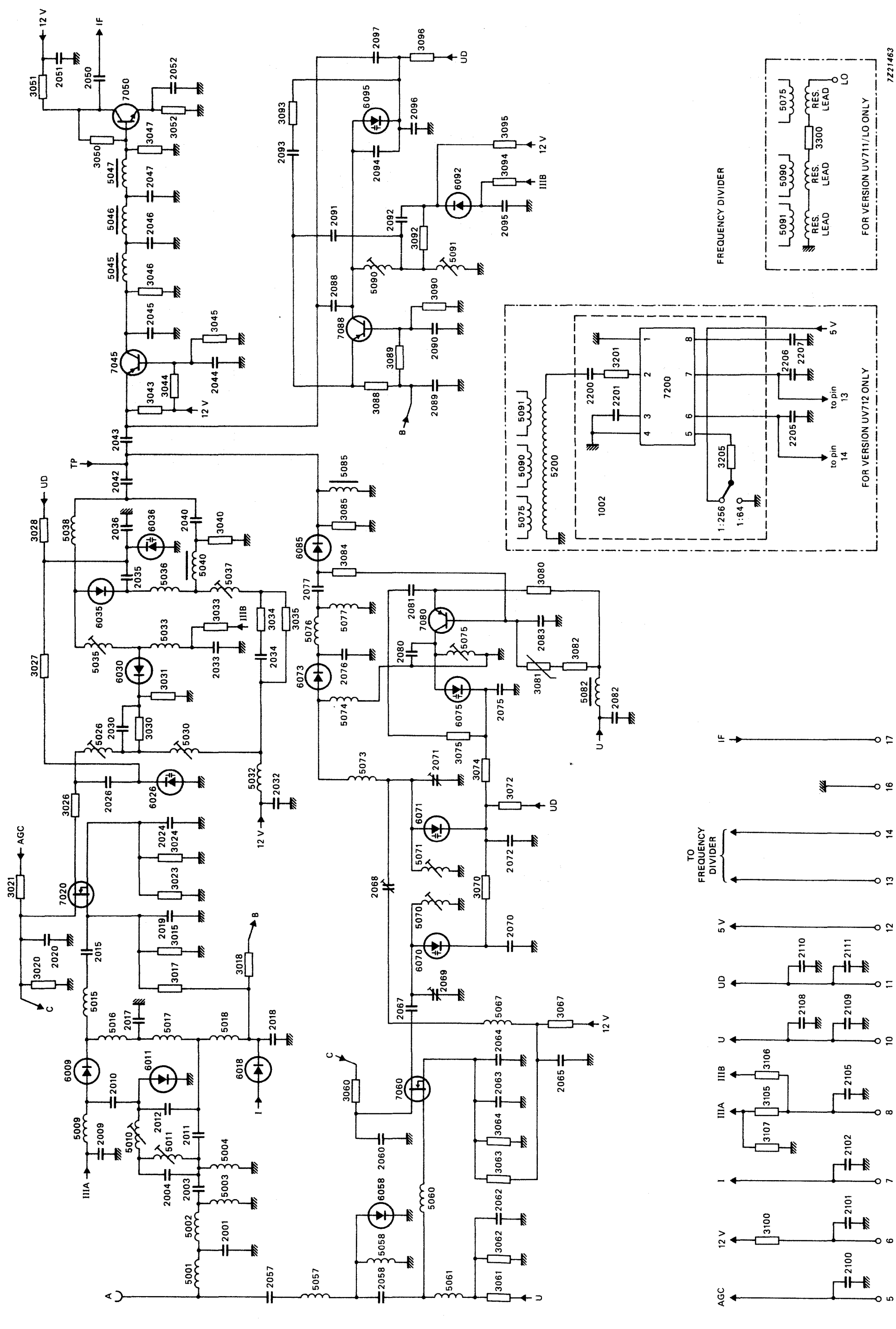
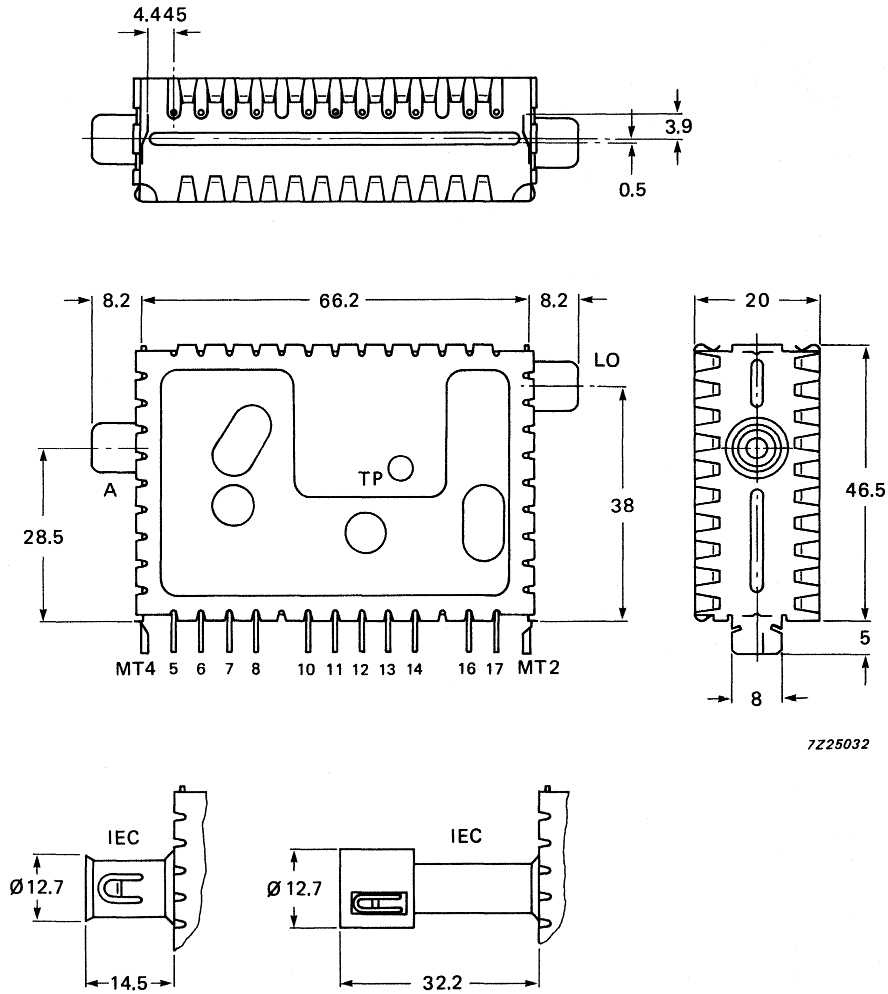


Fig. 1 Circuit diagram.

MECHANICAL DATA

Dimensions in mm



Pin/connector identity

A	= aerial input connector	
5	= AGC voltage, + 9,2 to + 0,85 V	
6	= supply voltage, VHF and UHF, + 12 V	
7	= supply voltage, VHF I, + 12 V	
8	= supply voltage, VHF III, + 12 V	
10	= supply voltage, UHF, +12 V; IF injection	
11	= tuning voltage, +1 to +30 V (+0,45 V UV711 LO only)	
12	= supply voltage, frequency divider, + 5 V	for UV712 only
13, 14	= balanced output voltage of frequency divider	for UV712 only
16	= earth	
17	= IF output	

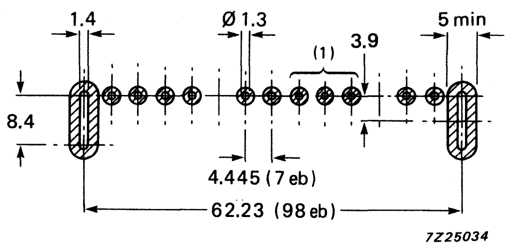
Fig. 2 Mechanical detail.

Mass: approximately 80 grams.

Mounting

The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the pins and mounting tabs is in accordance with IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is in accordance with IEC 68-2, test Tb (250 ± 5 °C, 10 ± 1 s).



1 eb = 0,025 inch
(1) For UV712 only

Fig. 3 Piercing diagram viewed from solder side of board.
Unless otherwise stated the tolerance is ± 0,05 mm.

DEVELOPMENT DATA

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an AGC voltage of 9,2 ± 0,2 V.

General

Semiconductors, bands I and III	
RF amplifier	BF992 R
mixer	BF824
oscillator	BF660
tuning diodes	3 x BB809
switching diodes	5 x BA682
DC blocking diodes/surge protection	2 x BAV100
Semiconductors, bands IV and V	
RF amplifier	BF990 R
oscillator	BF569
mixer	ISS99
tuning diodes	3 x OF643
switching diodes	BA682
IFpreamplifier	BFS17
Frequency divider	SDA 4212 X
Ambient temperature range	
operating	0 to + 60 °C
storage	–25 to + 70 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltage	+ 12 V ± 10%
Current drawn from + 12 V supply	
band I	max. 66 mA; typ. 55 mA
band III	max. 75 mA; typ. 63 mA
bands IV and V	max. 65 mA; typ. 55 mA

Bandswitching

For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:

terminal 7 for operation in band I,
terminal 8 for operation in band III,
terminal 10 for operation in bands IV and V.

AGC voltage	
voltage range	+ 9,2 to + 0,85 V
voltage at nominal gain	+ 9,2 ± 0,3 V
voltage gain at 40 dB gain reduction	
band I	typ. 2,5 V
band III	typ. 1,7 V
voltage at 30 dB gain reduction bands IV and V	typ. 1,7 V

Note: AGC voltages between 0 and + 10,5 V may be applied without risk of damage.

AGC current	max. 0,1 mA
Slope of AGC characteristic at the end of the specified AGC range	
band I	5 dB/V
band III	12 dB/V
bands IV and V	16 dB/V
Tuning voltage range	+ 0,45 to + 30 V
For specified channels	+ 1 to + 28 V
Current drawn from 28 V tuning voltage supply	
at T_{amb} = 25 °C and 60% RH	max. 0,5 μA
at T_{amb} = 25 °C and 95% RH	max. 2 μA
at T_{amb} = 55 °C and 60% RH	max. 2 μA

Note: The source impedance of the tuning voltage offered to terminal 11 must be maximum 47 kΩ.

Slope of tuning characteristic (typical values)

band I,	channel E2	3,5 MHz/V
	channel E4	2,5 MHz/V
band III,	channel E5	5,5 MHz/V
	channel E12	2,0 MHz/V
bands IV and V,	channel E21	25,0 MHz/V
	channel E69	6,5 MHz/V

DEVELOPMENT DATA

Frequencies

Frequency ranges

band I	Channel E2 (picture carrier 48,25 MHz) to channel C (picture carrier 82,25 MHz). Margin at the extreme channels: min. 1,5 MHz.
band III	Channel M4 (picture carrier 163,25 MHz) to channel E12 (picture carrier 224,25 MHz). Margin at the extreme channels: min. 2 MHz.
bands IV and V	Channel E21 (picture carrier 471,25 MHz) to channel E69 (picture carrier 855,25 MHz). Margin at the extreme channels: min. 3 MHz.

Intermediate frequencies

picture	38,9 MHz
sound	33,4 MHz

The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance	75 Ω	
VSWR and reflection coefficient (values between picture and sound carrier, as well as values at picture carrier)		
VSWR	**at nominal gain**	**during gain control**
bands I and III	max. 5	max. 6
bands IV and V	max. 5	max. 6
reflection coefficient		
bands I and III	max. 66%	max. 70%
bands IV and V	max. 66%	max. 70%
RF curves, bandwidth		
band I	typ. 11 MHz	
band III	typ. 13 MHz	
bands Iv and V	typ. 16 MHz	
RF curves, tilt	On any channel the amplitude difference between the top of the RF resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the AGC range between nominal gain and 20 dB gain reduction.	
AGC range		
bands I and III	min. 40 dB	
bands IV and V	min. 30 dB	
Voltage gain (see also Measuring method of voltage gain)		
bands I and III	min. 40 dB	
channel E3	typ. 43 dB	
channel E5	typ. 43 dB	
channel E12	typ. 43 dB	
bands IV and V	min. 40 dB	
channel E21	typ. 42 dB	
channel E40	typ. 43 dB	
channel E69	typ. 44 dB	
Maximum gain difference		
between any two VHF channels	typ. 5 dB	
between any two UHF channels	typ. 5 dB	
between any VHF and UHF channel	typ. 8 dB	
Noise figure		
bands I and III, except channels		
E2 and M4	max. 8 dB	
channel E3	typ. 5,5 dB	
channel E5	typ. 5,5 dB	
channel E12	typ. 6,5 dB	
bands IV and V	max. 10 dB	
channel E21	typ. 7 dB	
channel E40	typ. 6,5 dB	
channel E69	typ. 7 dB	

Overloading

Input signal producing 1 dB gain compression at nominal gain	
bands I and III	typ. 80 dB (μV) into 75 Ω
bands IV and V	typ. 80 dB (μV) into 75 Ω
Input signal producing either a detuning of the oscillator of + 300 kHz or −1000 kHz or stopping of the oscillations at nominal gain	
bands I and III	typ. 110 dB (μV) into 75 Ω
bands IV and V	typ. 100 dB (μV) into 75 Ω

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)	
bands I and III	min. 60 dB; typ. 66 dB
bands IV and V	min. 44 dB; typ. 50 dB
IF rejection (measured at picture carrier frequency)	
channel E2	min. 50 dB
channels E3 to C	min. 60 dB
band III	min. 60 dB
bands IV and V	min. 60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection.

N ± 4 rejection (for UHF only)
Interference signal for an interference ratio of 53 dB referred to wanted picture carrier (picture to sound carrier ratio of 10 dB; wanted signal 60 dB (μV); tuner operating at nominal gain) — 75 dB (μV) typ.

Cross modulation
Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

bands I and III	
at nominal gain (wanted input level 60 dB (μV))	typ. 70 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 90 dB (μV) into 75 Ω
bands IV and V	
at nominal gain (wanted input level 60 dB (μV))	typ. 70 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 90 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for VHF 1, or channel N ± 3 for VHF III, or channel N ± 5 for UHF)

bands I and III	
at nominal gain (wanted input level 60 dB (μV))	typ. 80 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 90 dB (μV) into 75 Ω
bands IV and V	
at nominal gain (wanted input level 60 dB (μV))	typ. 80 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 90 dB (μV) into 75 Ω

DEVELOPMENT DATA

Out of band cross modulation at nominal gain	
VHF I, interference from VHF III	typ. 90 dB (μV) into 75 Ω
VHF I, interference from UHF	typ. 90 dB (μV) into 75 Ω
VHF III, interference from VHF I	typ. 90 dB (μV) into 75 Ω
VHF III, interference from UHF	typ. 90 dB (μV) into 75 Ω
UHF, interference from VHF I	typ. 90 dB (μV) into 75 Ω
UHF, interference from VHF III	typ. 86 dB (μV) into 75 Ω

Oscillator characteristics

Pulling	
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain	
bands I and III	typ. 80 dB (μV) into 75 Ω
bands IV and V	typ. 80 dB (μV) into 75 Ω
Shift of oscillator frequency at a change of the supply voltage of 5%	
band I	max. 250 kHz
band III	max. 350 kHz
bands IV and V	max. 500 kHz
Drift of oscillator frequency	
during warm-up time (after the tuner has been completely out of operation for 15 minutes, measured between 5 s and 15 minutes after switching on)	max. 250 kHz
during warm-up time (after the input stage is in operation for 15 minutes, measured between 2 s and 15 minutes after band switching)	max. 250 kHz

Frequency divider characteristics of the UV712/256 and UV712/64 versions

Frequency division ratio	
UV712/256	256
UV712/64	64
Supply voltage	+ 5 V ± 10%
Current drawn from + 5 V supply	max. 35 mA
Output voltage, unloaded, measured with probe 10 MΩ/11 pF	min. 0,5 V p-p
Output impedance	typ. 1 kΩ
Output imbalance	max. 0,1 V
Interference ratio on the IF output	
UV712/256 (division ratio 256)	min. 57 dB (μV)
UV712/64 (division ratio 64)	max. 100 dB (μV)

IF circuit characteristics

IF output	common output (terminal 17)
Output impedance	110 Ω ± 30%

Miscellaneous

Radio interference Oscillator radiation and oscillator voltage at the aerial terminal	Within the limits of CISPR 13 (1975)
Microphonics	There will be no microphonics provided the tuner is installed in a professional manner.
Surge protection	
Protection against voltages (note 1)	max. 5 kV
Protection against flashes (note 2)	max. 30 kV, 400 mW

Notes to Miscellaneous characteristics

1. 10 discharges of a 470 pF capacitor into the aerial terminal.
2. A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

DEVELOPMENT DATA

ADDITIONAL INFORMATION

IF injection

Using a coaxial lead terminated by a 75 Ω resistor connected to earth, feed a sweep generator signal of 30 to 50 MHz to testpoint (TP).

Measuring method of voltage gain

The IF output of the tuner should be terminated with a transformer circuit as shown in Fig. 4.

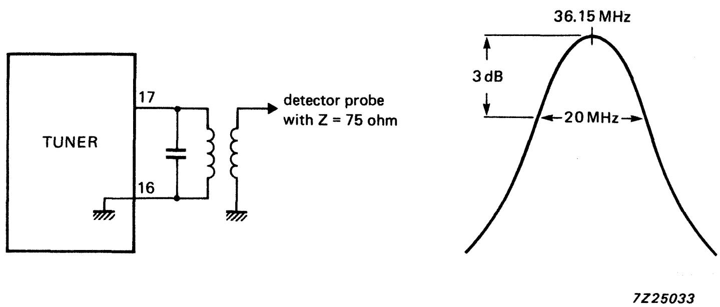


Fig. 4 Voltage gain measurement.

The transformer circuit roughly matches the IF output impedance to 75 Ω at the resonant frequency of the IF output circuit, which should be tuned to 36,15 MHz; the bandwidth is approximately 20 MHz.

As both the input and output impedances of the tuner are now 75 Ω, the voltage gain may be measured inserting tuner and transformer circuit between a 75 Ω source and a 75 Ω detector.

VHF/UHF TELEVISION TUNERS

QUICK REFERENCE DATA

Systems	CCIR systems B and G
Channels	
VHF I	NZ1 to E4
VHF III	E5 to E12
UHF	E21 to E69
Intermediate frequencies	
picture	38.9 MHz
sound	33.4 MHz

APPLICATION

Designed to cover the VHF and UHF channels of CCIR systems B and G, including channel NZ1.

The tuners of the UV712 series are equipped with a frequency divider, which makes them suitable for digital tuning systems based on frequency synthesis; for the remainder they are equal to type UV711.

Table 1 Available versions (Note 1)

	connector			
	aerial input	local oscillator	frequency divider (IC)	catalogue number
UV711NZ	phono	note 1		3139 147 10190
UV711NZ/IEC	IEC	note 1		3139 147 10180
UV711NZ/IEC.L	long IEC	note 1		3139 147 10170
UV712NZ	phono		1:256	
UV712NZ/IEC	IEC		1:256	
UV712NZ/IEC.L	long IEC		1:256	

Note to Table 1

1. UV711NZ tuners with local oscillator coupling (phono connector) are available on request.

DESCRIPTION

The UV711NZ/UV712NZ are combined VHF/UHF tuners with electronic tuning and band switching, covering the VHF band I (frequency range 44 to 84 MHz), the VHF band III (frequency range 174 to 225 MHz) and the UHF band (frequency range 470 to 860 MHz).

Mechanically, the tuners are built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common phono or IEC aerial connector (VHF and UHF) is on one of the frame sides, all other connections (supply voltages, AGC voltage, tuning and switching voltages, IF output) are made via pins in the under-side. The mounting method is shown in Fig. 3.

Electrically, the tuners consist of VHF and UHF parts. The VHF aerial signal is fed via switchable VHF band I/III wide band input filters to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The input filters are provided with an IF and FM suppression circuit. The drain load of the MOSFET tetrode is formed by a double tuned switchable bandpass filter, transferring the RF signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor.

A triple filter in the collector circuit minimizes the oscillator voltage at the IF output. The output of the filter is buffered by an IF preamplifier stage. A test point (TP, Fig. 1) for IF injection is accessible through a hole in one of the covers of the tuner. This test point is connected to the emitter of the mixer transistor.

The RF bandpass filter and oscillator circuits are tuned by 3 tuning diodes; band switching is achieved by 4 switching diodes.

The UHF part of the tuner consists of a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the RF signal to the Schottky barrier mixer diode. The IF signal from the mixer diode is amplified by the VHF mixer transistor, now operating as an IF amplifier.

The RF bandpass filter and oscillator circuits are tuned by 3 tuning diodes. In all bands the tuner is gain controlled via gate 2 of the input MOSFET tetrode.

The electrical circuit of the UV712NZ series is extended with a frequency divider (division ratio of 256), the inputs of which are connected to the VHF and UHF oscillator. The complementary outputs are connected to pins 13 and 14.

DEVELOPMENT DATA

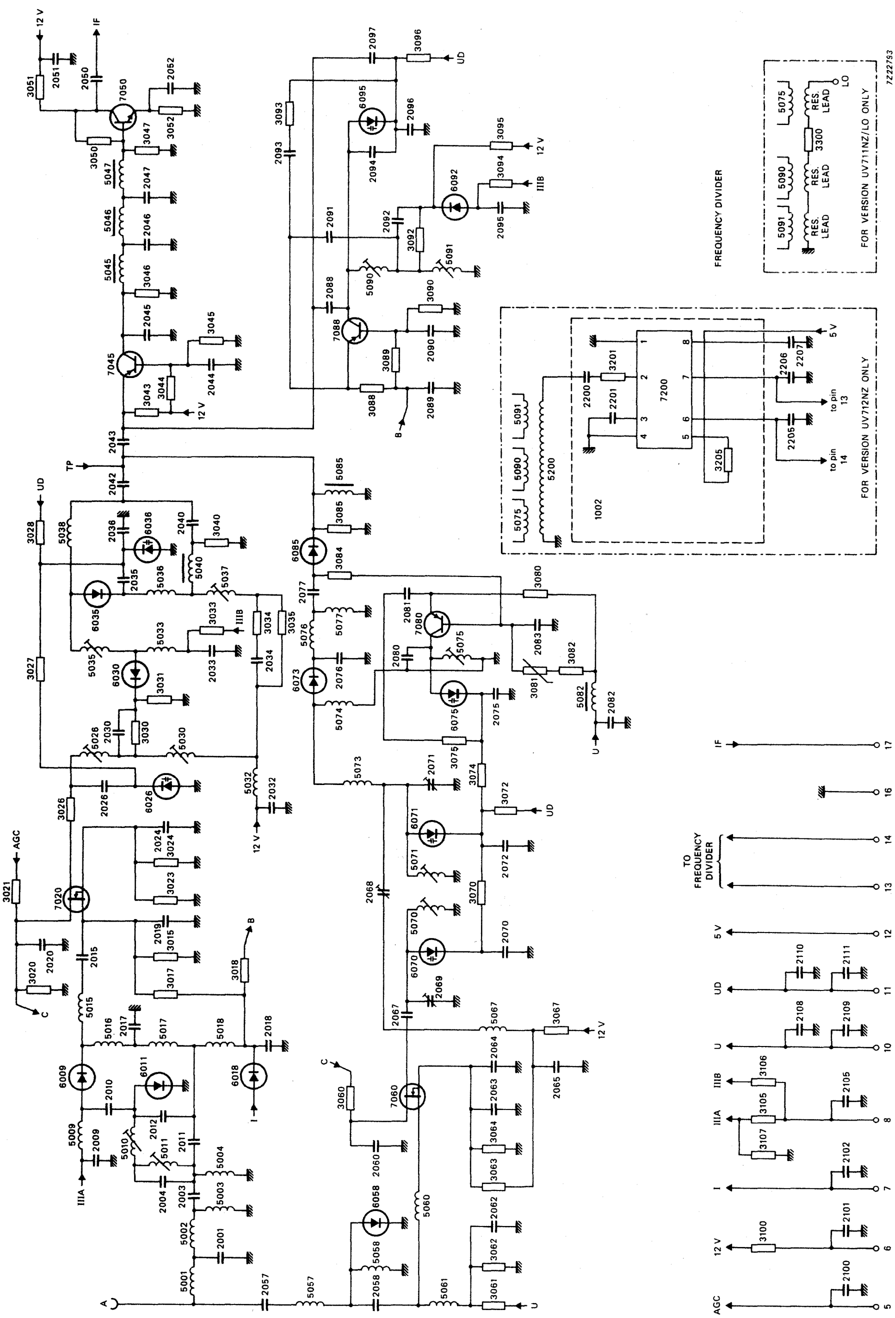
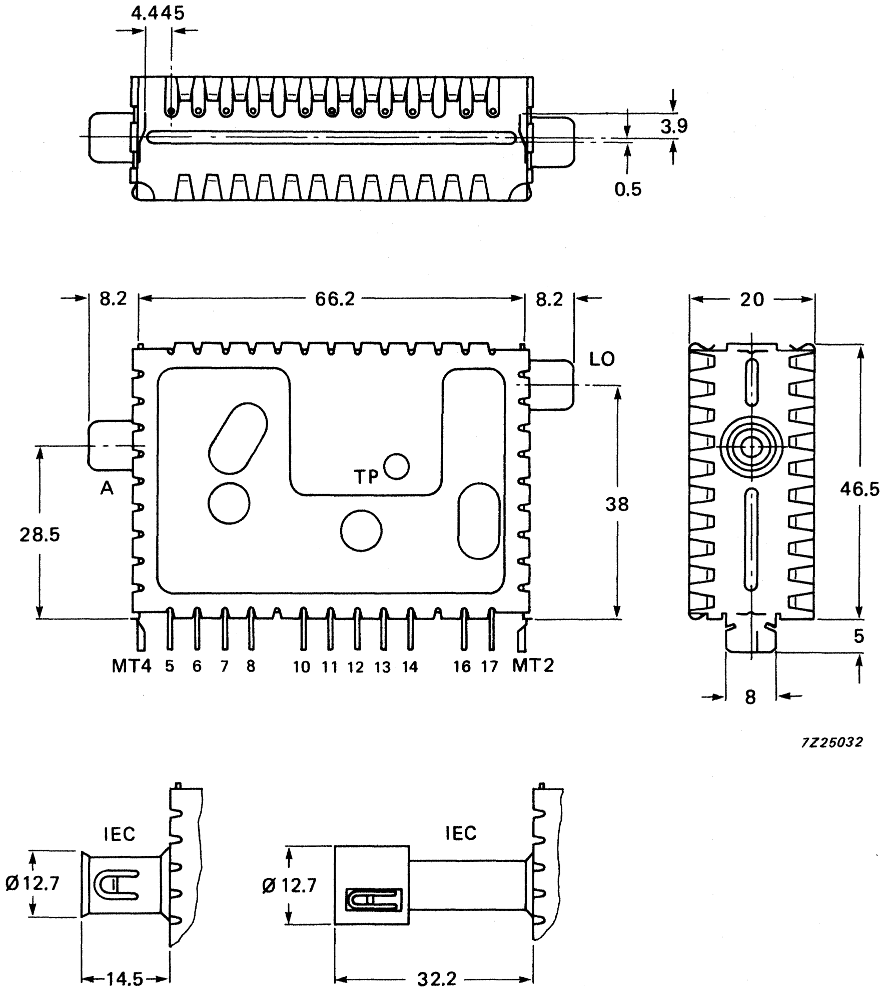


Fig.1 Circuit diagram.

MECHANICAL DATA

Dimensions in mm



Pin/connector identity

A	= aerial input connector
5	= AGC voltage, + 9.2 to + 0.85 V
6	= supply voltage, VHF and UHF, + 12 V
7	= supply voltage, VHF I, + 12 V
8	= supply voltage, VHF III, + 12 V
10	= supply voltage, UHF, +12 V; IF injection
11	= tuning voltage, +1 to +30 V (+ 0.45 to + 30 V for UV711NZLO and UV712NZ only)
12	= supply voltage, frequency divider, + 5 V } for UV712NZ only
13, 14	= balanced output voltage of frequency divider } for UV712NZ only
16	= earth
17	= IF output

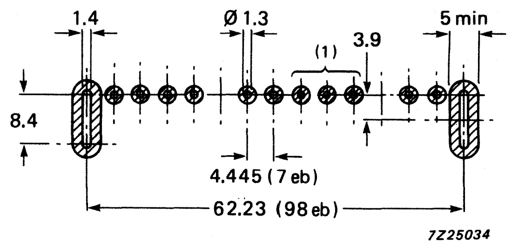
Fig. 2 Mechanical detail.

Mass: approximately 80 grams.

Mounting

The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the pins and mounting tabs is in accordance with IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0.5 s). The resistance to soldering heat is in accordance with IEC 68-2, test Tb (250 ± 5 °C, 10 ± 1 s).



1 eb = 0.025 inch
(1) For UV712NZ only

Fig. 3 Piercing diagram viewed from solder side of board.
Unless otherwise stated the tolerance is ± 0.05 mm.

DEVELOPMENT DATA

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0.3 V and an AGC voltage of 9.2 ± 0.2 V.

General

Semiconductors, bands I and III	
RF amplifier	BF992 R
mixer	BF824
oscillator	BF660
tuning diodes	3 x BB809
switching diodes	5 x BA682
DC blocking diodes/surge protection	2 x BAV100
Semiconductors, bands IV and V	
RF amplifier	BF990 R
oscillator	BF569
mixer	ISS99
tuning diodes	3 x OF643
switching diodes	BA682
IFpreamplifier	BFS17
Frequency divider	SDA 4212 X
Ambient temperature range	
operating	0 to + 60 °C
storage	–25 to + 70 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltage	+ 12 V ± 10%
Current drawn from + 12 V supply	
band I	max. 66 mA; typ. 55 mA
band III	max. 75 mA; typ. 63 mA
bands IV and V	max. 65 mA; typ. 55 mA

Bandswitching

For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:

terminal 7 for operation in band I,
terminal 8 for operation in band III,
terminal 10 for operation in bands IV and V.

AGC voltage	
voltage range	+ 9.2 to + 0.85 V
voltage at nominal gain	+ 9.2 ± 0.3 V
voltage gain at 40 dB gain reduction	
band I	typ. 2.5 V
band III	typ. 1.7 V
voltage at 30 dB gain reduction bands IV and V	typ. 1.7 V

Note: AGC voltages between 0 and + 10.5 V may be applied without risk of damage.

AGC current	max. 0.1 mA
Slope of AGC characteristic at the end of the specified AGC range	
band I	5 dB/V
band III	12 dB/V
bands IV and V	16 dB/V
Tuning voltage range	+ 0.45 to + 30 V
For specified channels	+ 1 to + 28 V
Current drawn from 28 V tuning voltage supply	
at T_{amb} = 25 °C and 60% RH	max. 0.5 μA
at T_{amb} = 25 °C and 95% RH	max. 2 μA
at T_{amb} = 55 °C and 60% RH	max. 2 μA

Note: The source impedance of the tuning voltage offered to terminal 11 must be maximum 47 kΩ.

Slope of tuning characteristic

band I,	channel E2	3.5 MHz/V	typical values
	channel E4	2.5 MHz/V	
band III,	channel E5	5.5 MHz/V	
	channel E12	2.0 MHz/V	
bands IV and V,	channel E21	25.0 MHz/V	
	channel E69	6.5 MHz/V	

Frequencies

Frequency ranges	
band I	Channel NZ1 (picture carrier 45.25 MHz) to channel E4 (picture carrier 62.25 MHz). Margin at the extreme channels: min. 1.5 MHz.
band III	Channel E5 (picture carrier 175.25 MHz) to channel E12 (picture carrier 224.25 MHz). Margin at the extreme channels: min. 2 MHz.
bands IV and V	Channel E21 (picture carrier 471.25 MHz) to channel E69 (picture carrier 855.25 MHz). Margin at the extreme channels: min. 3 MHz.
Intermediate frequencies	
picture	38.9 MHz
sound	33.4 MHz

The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance	75 Ω	
VSWR and reflection coefficient (values between picture and sound carrier, as well as values at picture carrier)		
VSWR	**at nominal gain**	**during gain control**
bands I and III	max. 5	max. 6
bands IV and V	max. 5	max. 6
reflection coefficient		
bands I and III	max. 66%	max. 70%
bands IV and V	max. 66%	max. 70%
RF curves, bandwidth		
band I	typ. 11 MHz	
band III	typ. 13 MHz	
bands Iv and V	typ. 16 MHz	
RF curves, tilt	On any channel the amplitude difference between the top of the RF resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the AGC range between nominal gain and 20 dB gain reduction.	
AGC range		
bands I and III	min. 40 dB	
bands IV and V	min. 30 dB	
Voltage gain (see also Measuring method of voltage gain)		
bands I and III	min. 40 dB	
channel E3	typ. 43 dB	
channel E5	typ. 43 dB	
channel E12	typ. 43 dB	
bands IV and V	min. 40 dB	
channel E21	typ. 42 dB	
channel E40	typ. 43 dB	
channel E69	typ. 44 dB	
Maximum gain difference		
between any two VHF channels	typ. 5 dB	
between any two UHF channels	typ. 5 dB	
between any VHF and UHF channel	typ. 8 dB	
Noise figure		
bands I and III, except channels	max. 8 dB	
channel E3	typ. 5.5 dB	
channel E5	typ. 5.5 dB	
channel E12	typ. 6.5 dB	
bands IV and V	max. 10 dB	
channel E21	typ. 7 dB	
channel E40	typ. 6.5 dB	
channel E69	typ. 7 dB	

Overloading

Input signal producing 1 dB gain compression at nominal gain	
bands I and III	typ. 80 dB (μV) into 75 Ω
bands IV and V	typ. 80 dB (μV) into 75 Ω
Input signal producing either a detuning of the oscillator of + 300 kHz or −1000 kHz or stopping of the oscillations at nominal gain	
bands I and III	typ. 110 dB (μV) into 75 Ω
bands IV and V	typ. 100 dB (μV) into 75 Ω

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)	
bands I and III	min. 60 dB; typ. 66 dB
bands IV and V	min. 44 dB; typ. 50 dB
IF rejection (measured at picture carrier frequency)	
channel E2	min. 50 dB
channels E3 to C	min. 60 dB
band III	min. 60 dB
bands IV and V	min. 60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection.

N ± 4 rejection (for UHF only) Interference signal for an interference ratio of 53 dB referred to wanted picture carrier (picture to sound carrier ratio of 10 dB; wanted signal 60 dB (μV); tuner operating at nominal gain)	75 dB (μV) typ.

Cross modulation

Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)	
bands I and III	
at nominal gain (wanted input level 60 dB (μV))	typ. 70 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 90 dB (μV) into 75 Ω
bands IV and V	
at nominal gain (wanted input level 60 dB (μV))	typ. 70 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 90 dB (μV) into 75 Ω
In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for VHF 1, or channel N ± 3 for VHF III, or channel N ± 5 for UHF)	
bands I and III	
at nominal gain (wanted input level 60 dB (μV))	typ. 80 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 90 dB (μV) into 75 Ω
bands IV and V	
at nominal gain (wanted input level 60 dB (μV))	typ. 80 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 90 dB (μV) into 75 Ω

Out of band cross modulation at nominal gain	
VHF I, interference from VHF III	typ. 90 dB (μV) into 75 Ω
VHF I, interference from UHF	typ. 90 dB (μV) into 75 Ω
VHF III, interference from VHF I	typ. 90 dB (μV) into 75 Ω
VHF III, interference from UHF	typ. 90 dB (μV) into 75 Ω
UHF, interference from VHF I	typ. 90 dB (μV) into 75 Ω
UHF, interference from VHF III	typ. 86 dB (μV) into 75 Ω

Oscillator characteristics

Pulling	
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain	
bands I and III	typ. 80 dB (μV) into 75 Ω
bands IV and V	typ. 80 dB (μV) into 75 Ω
Shift of oscillator frequency at a change of the supply voltage of 5%	
band I	max. 250 kHz
band III	max. 350 kHz
bands IV and V	max. 500 kHz
Drift of oscillator frequency	
during warm-up time (after the tuner has been completely out of operation for 15 minutes, measured between 5 s and 15 minutes after switching on)	max. 250 kHz
during warm-up time (after the input stage is in operation for 15 minutes, measured between 2 s and 15 minutes after band switching)	max. 250 kHz

Frequency divider characteristics of the UV712 version

Frequency division ratio	256
Supply voltage	+ 5 V ± 10%
Current drawn from + 5 V supply	max. 35 mA
Output voltage, unloaded, measured with probe 10 MΩ/11 pF	min. 0.5 V p-p
Output impedance	typ. 1 kΩ
Output imbalance	max. 0.1 V
Interference ratio on the IF output	min. 57 dB (μV)

IF circuit characteristics

IF output	common output (terminal 17)
Output impedance	110 Ω ± 30%

Miscellaneous

Radio interference Oscillator radiation and oscillator voltage at the aerial terminal	Within the limits of CISPR 13 (1975)
Microphonics	There will be no microphonics provided the tuner is installed in a professional manner.
Surge protection	
Protection against voltages (note 1)	max. 5 kV
Protection against flashes (note 2)	max. 30 kV, 400 mW

Notes to Miscellaneous characteristics

1. 10 discharges of a 470 pF capacitor into the aerial terminal.
2. A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

ADDITIONAL INFORMATION

IF injection

Using a coaxial lead terminated by a 75 Ω resistor connected to earth, feed a sweep generator signal of 30 to 50 MHz to testpoint (TP).

Measuring method of voltage gain

The IF output of the tuner should be terminated with a transformer circuit as shown in Fig. 4.

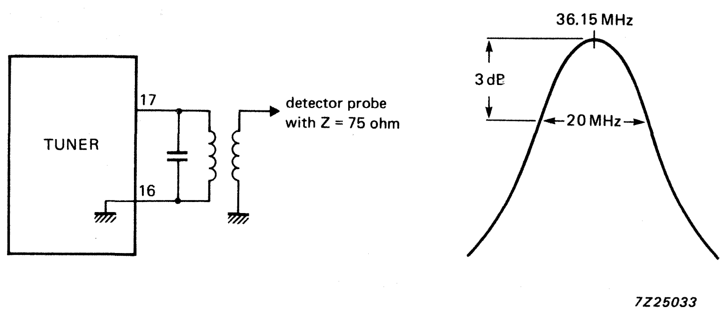


Fig. 4 Voltage gain measurement.

The transformer circuit roughly matches the IF output impedance to 75 Ω at the resonant frequency of the IF output circuit, which should be tuned to 36.15 MHz; the bandwidth is approximately 20 MHz.

As both the input and output impedances of the tuner are now 75 Ω, the voltage gain may be measured inserting tuner and transformer circuit between a 75 Ω source and a 75 Ω detector.

VHF/UHF TELEVISION TUNERS

QUICK REFERENCE DATA

Systems	OIRT systems D and R
Channels	
VHF I	C1 to R5
VHF III	C6 to R12
UHF	C13 to C57
Intermediate frequencies	
picture	38.0 MHz
sound	31.5 MHz

APPLICATION

The UV751 series and UV752 series tuners are combined VHF/UHF tuners designed to cover the channels of the OIRT system and The Peoples's Republic of China systems D and R.

The UV752 series tuners are equipped with a frequency divider, which makes them suitable for digital tuning systems based on frequency synthesis, otherwise they are equivalent to type UV751 tuners.

Table 1 Available versions (Note 1)

	connector			
	aerial input	local oscillator	frequency divider (IC)	catalogue number
UV751	phono	note 1		3139 147 10160
UV751/IEC	IEC	note 1		3139 147 10150
UV751/IEC.L	long IEC	note 1		3139 147 10140
UV752	phono		1:256	3139 147 10230
UV752/IEC	IEC		1:256	3139 147 10310
UV752/IEC.L	long IEC		1:256	3139 147 10110

Note to table 1

1. UV751 tuners with local oscillator coupling (phono connector) are available on request.

DESCRIPTION

The UV751/UV752 are combined VHF/UHF tuners with electronic tuning and band switching, covering the VHF band I (frequency range 46 to 84 MHz), the VHF band III (frequency range 165 to 228 MHz) and the UHF band (frequency range 470 to 860 MHz).

Mechanically, the tuners are built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear covers (see Fig. 2). The common phono or IEC aerial connector (VHF and UHF) is on one of the frame sides, all other connections (supply voltages, AGC voltage, tuning and switching voltages, IF output) are made via pins in the under-side. The mounting method is shown in Fig. 3.

Electrically, the tuners consist of VHF and UHF parts. The VHF aerial signal is fed via switchable VHF band I/III wide band input filters to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The input filters are provided with an IF and FM suppression circuit. The drain load of the MOSFET tetrode is formed by a double tuned switchable bandpass filter, transferring the RF signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor.

A triple filter in the collector circuit minimizes the oscillator voltage at the IF output. The output of the filter is buffered by an IF preamplifier stage. A test point (TP, Fig. 1) for IF injection is accessible through a hole in one of the covers of the tuner. This test point is connected to the emitter of the mixer transistor.

The RF bandpass filter and oscillator circuits are tuned by 3 tuning diodes; band switching is achieved by 4 switching diodes.

The UHF part of the tuner consists of a high-pass input circuit connected to gate 1 of an input MOSFET tetrode (with internal gate protection against surge). The drain load of this MOSFET tetrode is formed by a double tuned circuit transferring the RF signal to the Schottky barrier mixer diode. The IF signal from the mixer diode is amplified by the VHF mixer transistor, now operating as an IF amplifier.

The RF bandpass filter and oscillator circuits are tuned by 3 tuning diodes. In all bands the tuner is gain controlled via gate 2 of the input MOSFET tetrode.

The electrical circuit of the UV752 series is extended with a frequency divider (division ratio of 256), the inputs of which are connected to the VHF and UHF oscillator. The complementary outputs are connected to pins 13 and 14.

DEVELOPMENT DATA

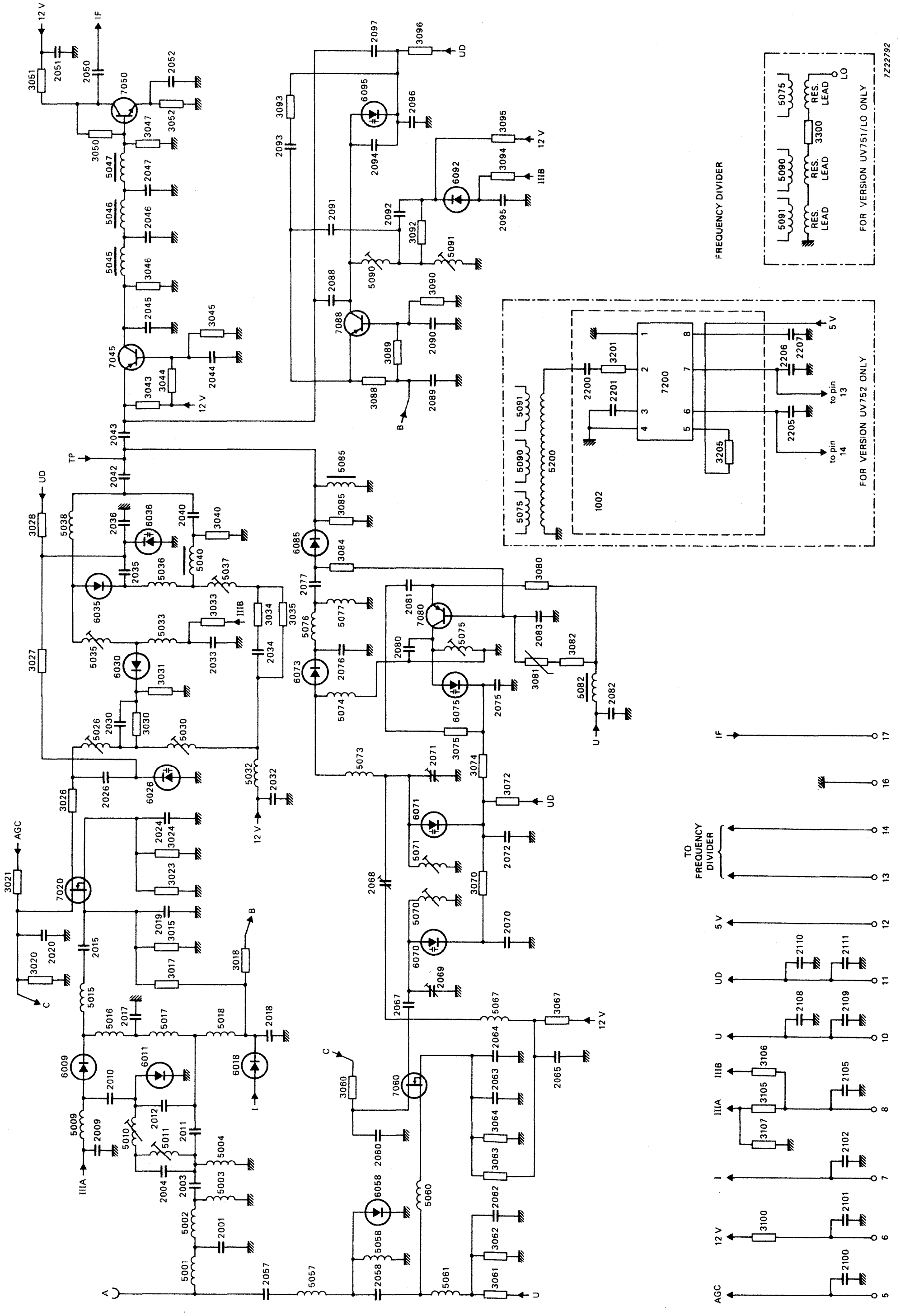
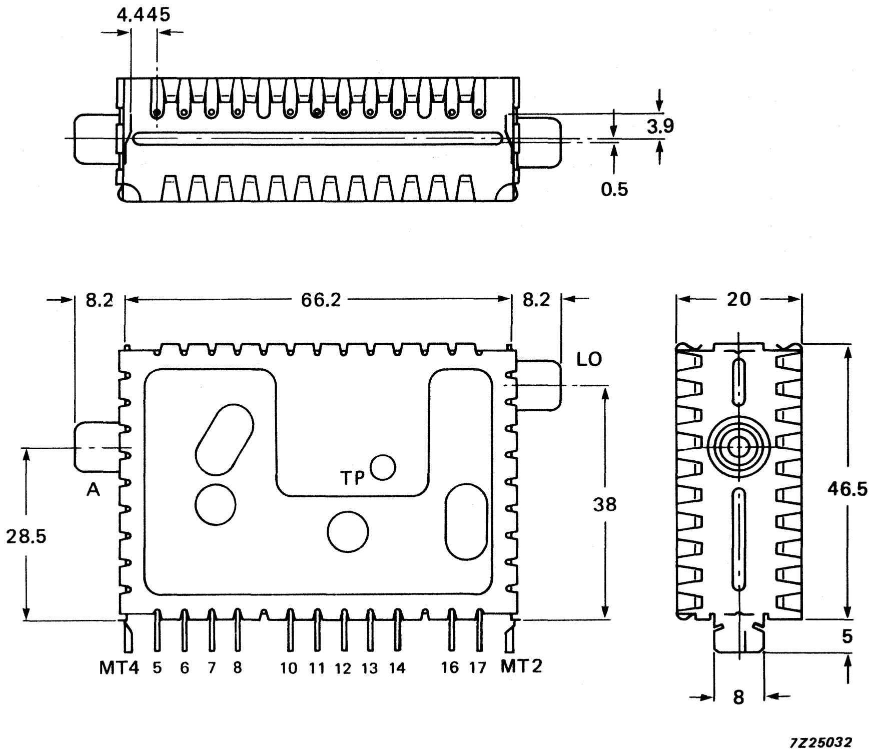
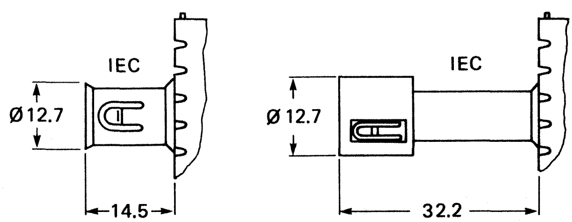


Fig.1 Circuit diagram.

MECHANICAL DATA Dimensions in mm





Pin/connector identity

A	= aerial input connector
5	= AGC voltage, + 9.2 to + 0.85 V
6	= supply voltage, VHF and UHF, + 12 V
7	= supply voltage, VHF I, + 12 V
8	= supply voltage, VHF III, + 12 V
10	= supply voltage, UHF, +12 V; IF injection
11	= tuning voltage, + 1 to + 30 V (+ 0.45 to + 30 V for UV751 LO and UV752 only)
12	= supply voltage, frequency divider, + 5 V } for UV752 only
13, 14	= balanced output voltage of frequency divider } for UV752 only
16	= earth
17	= IF output

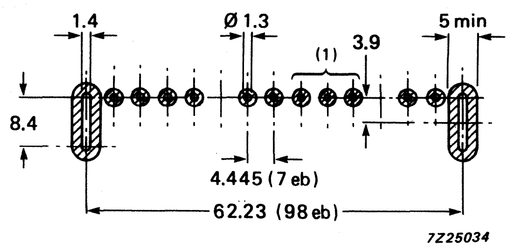
Fig. 2 Mechanical detail.

Mass: approximately 80 grams.

Mounting

The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the pins and mounting tabs is in accordance with IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0.5 s). The resistance to soldering heat is in accordance with IEC 68-2, test Tb (250 ± 5 °C, 10 ± 1 s).



1 eb = 0.025 inch
(1) For UV752 only

Fig. 3 Piercing diagram viewed from solder side of board.
Unless otherwise stated the tolerance is ± 0.05 mm.

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0.3 V and an AGC voltage of 9.2 ± 0.2 V.

General

Semiconductors, bands I and III	
RF amplifier	BF992 R
mixer	BF824
oscillator	BF660
tuning diodes	3 x BB809
switching diodes	5 x BA682
DC blocking diodes/surge protection	2 x BAV100
Semiconductors, bands IV and V	
RF amplifier	BF990 R
oscillator	BF569
mixer	ISS99
tuning diodes	3 x OF643
switching diodes	BA682
IFpreamplifier	BFS17
Frequency divider	SDA 4212 X
Ambient temperature range	
operating	0 to + 60 °C
storage	–25 to + 70 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltage	+ 12 V ± 10%
Current drawn from + 12 V supply	
band I	max. 66 mA; typ. 55 mA
band III	max. 75 mA; typ. 63 mA
bands IV and V	max. 65 mA; typ. 55 mA

Bandswitching

For operation in all bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:

terminal 7 for operation in band I,
terminal 8 for operation in band III,
terminal 10 for operation in bands IV and V.

AGC voltage	
voltage range	+ 9.2 to + 0.85 V
voltage at nominal gain	+ 9.2 ± 0.3 V
voltage gain at 40 dB gain reduction	
band I	typ. 2.5 V
band III	typ. 1.7 V
voltage at 30 dB gain reduction bands IV and V	typ. 1.7 V

Note: AGC voltages between 0 and + 10.5 V may be applied without risk of damage.

AGC current	max. 0.1 mA
Slope of AGC characteristic at the end of the specified AGC range	
band I	5 dB/V
band III	12 dB/V
bands IV and V	16 dB/V
Tuning voltage range	+ 0.45 to + 30 V
For specified channels	+ 1 to + 28 V
Current drawn from 28 V tuning voltage supply	
at T_{amb} = 25 °C and 60% RH	max. 0.5 μA
at T_{amb} = 25 °C and 95% RH	max. 2 μA
at T_{amb} = 55 °C and 60% RH	max. 2 μA

Note: The source impedance of the tuning voltage offered to terminal 11 must be maximum 47 kΩ.

Slope of tuning characteristic

band I,	channel R2	3.5 MHz/V	typical values
	channel R4	2.5 MHz/V	
band III,	channel R5	5.5 MHz/V	
	channel R12	2.0 MHz/V	
bands IV and V,	channel C13	25.0 MHz/V	
	channel C57	6.5 MHz/V	

DEVELOPMENT DATA

Frequencies

Frequency ranges

band I	Channel C1 (picture carrier 49.75 MHz) to channel R5 (picture carrier 93.25 MHz). Margin at the extreme channels: min. 1.5 MHz.
band III	Channel C6 (picture carrier 168.25 MHz) to channel R12 (picture carrier 223.25 MHz). Margin at the extreme channels: min. 2 MHz.
bands IV and V	Channel C13 (picture carrier 471.25 MHz) to channel C57 (picture carrier 863.25 MHz). Margin at the extreme channels: min. 3 MHz.

Intermediate frequencies

picture	38.0 MHz
sound	31.5 MHz

The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance	75 Ω	
VSWR and reflection coefficient (values between picture and sound carrier, as well as values at picture carrier)		
VSWR	**at nominal gain**	**during gain control**
bands I and III	max. 5	max. 6
bands IV and V	max. 5	max. 6
reflection coefficient		
bands I and III	max. 66%	max. 70%
bands IV and V	max. 66%	max. 70%
RF curves, bandwidth		
band I	typ. 11 MHz	
band III	typ. 13 MHz	
bands Iv and V	typ. 16 MHz	
RF curves, tilt	On any channel the amplitude difference between the top of the RF resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the AGC range between nominal gain and 20 dB gain reduction.	
AGC range		
bands I and III	min. 40 dB	
bands IV and V	min. 30 dB	
Voltage gain (see also Measuring method of voltage gain)		
bands I and III	min. 40 dB	
channel C2	typ. 43 dB	
channel C7	typ. 43 dB	
channel R12	typ. 43 dB	
bands IV and V	min. 40 dB	
channel C13	typ. 42 dB	
channel C27	typ. 43 dB	
channel C57	typ. 44 dB	
Maximum gain difference		
between any two VHF channels	typ. 5 dB	
between any two UHF channels	typ. 5 dB	
between any VHF and UHF channel	typ. 8 dB	
Noise figure		
bands I and III	max. 8 dB	
channel R2	typ. 5.5 dB	
channel R5	typ. 5.5 dB	
channel R12	typ. 6.5 dB	
bands IV and V	max. 10 dB	
channel C13	typ. 7 dB	
channel C27	typ. 6.5 dB	
channel C57	typ. 7 dB	

Overloading

Input signal producing 1 dB gain compression at nominal gain	
bands I and III	typ. 80 dB (μV) into 75 Ω
bands IV and V	typ. 80 dB (μV) into 75 Ω
Input signal producing either a detuning of the oscillator of + 300 kHz or −1000 kHz or stopping of the oscillations at nominal gain	
bands I and III	typ. 110 dB (μV) into 75 Ω
bands IV and V	typ. 100 dB (μV) into 75 Ω

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)	
bands I and III	min. 55 dB; typ. 66 dB
bands IV and V	min. 44 dB; typ. 50 dB
IF rejection (measured at picture carrier frequency)	
channel C1	min. 50 dB
channels R1 to R5	min. 60 dB
band III	min. 60 dB
bands IV and V	min. 60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection.

N ± 4 rejection (for UHF only)

Interference signal for an interference ratio of 53 dB referred to wanted picture carrier (picture to sound carrier ratio of 10 dB; wanted signal 60 dB (μV); tuner operating at nominal gain)	75 dB (μV) typ.

Cross modulation

Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

bands I and III	
at nominal gain (wanted input level 60 dB (μV))	typ. 70 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 90 dB (μV) into 75 Ω
bands IV and V	
at nominal gain (wanted input level 60 dB (μV))	typ. 70 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 90 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for VHF 1, or channel N ± 3 for VHF III, or channel N ± 5 for UHF)

bands I and III	
at nominal gain (wanted input level 60 dB (μV))	typ. 80 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 90 dB (μV) into 75 Ω
bands IV and V	
at nominal gain (wanted input level 60 dB (μV))	typ. 80 dB (μV) into 75 Ω
at 30 dB gain reduction (wanted input level 90 dB (μV))	typ. 90 dB (μV) into 75 Ω

Out of band cross modulation at nominal gain	
VHF I, interference from VHF III	typ. 90 dB (μV) into 75 Ω
VHF I, interference from UHF	typ. 90 dB (μV) into 75 Ω
VHF III, interference from VHF I	typ. 90 dB (μV) into 75 Ω
VHF III, interference from UHF	typ. 90 dB (μV) into 75 Ω
UHF, interference from VHF I	typ. 90 dB (μV) into 75 Ω
UHF, interference from VHF III	typ. 86 dB (μV) into 75 Ω

Oscillator characteristics

Pulling	
Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain	
bands I and III	typ. 80 dB (μV) into 75 Ω
bands IV and V	typ. 80 dB (μV) into 75 Ω
Shift of oscillator frequency at a change of the supply voltage of 5%	
band I	max. 250 kHz
band III	max. 350 kHz
bands IV and V	max. 500 kHz
Drift of oscillator frequency	
during warm-up time (after the tuner has been completely out of operation for 15 minutes, measured between 5 s and 15 minutes after switching on)	max. 250 kHz
during warm-up time (after the input stage is in operation for 15 minutes, measured between 2 s and 15 minutes after band switching)	max. 250 kHz
at a change of ambient temperature from +25 to 0 °C	
VHF bands	max. 500 kHz
UHF bands	max. 1200 kHz
at a change of ambient temperature from +25 to +50 °C (measured after 3 cycles from +25 to 0 °C)	
VHF bands	max. 500 kHz
UHF bands	max. 1000 kHz

Frequency divider characteristics of the UV752

Frequency division ratio	256
Supply voltage	+5 V ± 10%
Current drawn from +5 V supply	max. 35 mA
Output voltage, unloaded, measured with probe 10 MΩ/11 pF	min. 0.5 V p-p
Output impedance	typ. 1 kΩ
Output imbalance	max. 0.1 V
Interference ratio on the IF output	min. 57 dB (μV)

IF circuit characteristics

IF output	common output (terminal 17)
Output impedance	110 Ω ± 30%

Miscellaneous

Radio interference	
Oscillator radiation and oscillator voltage at the aerial terminal	Within the limits of CISPR 13 (1975)
Microphonics	There will be no microphonics provided the tuner is installed in a professional manner.
Surge protection	
Protection against voltages (note 1)	max. 5 kV
Protection against flashes (note 2)	max. 30 kV, 400 mW

Notes to Miscellaneous characteristics

1. 10 discharges of a 470 pF capacitor into the aerial terminal.
2. A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

DEVELOPMENT DATA

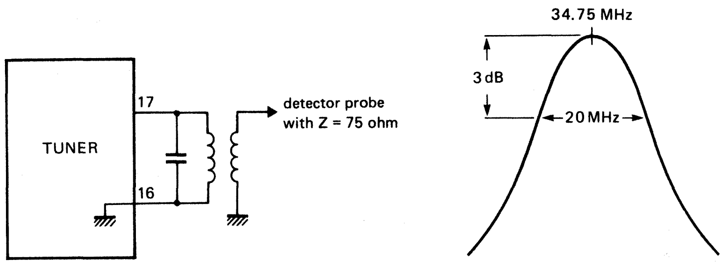
ADDITIONAL INFORMATION

IF injection

Using a coaxial lead terminated by a 75 Ω resistor connected to earth, feed a sweep generator signal of 30 to 50 MHz to testpoint (TP).

Measuring method of voltage gain

The IF output of the tuner should be terminated with a transformer circuit as shown in Fig. 4.



7Z21982

Fig. 4 Voltage gain measurement.

The transformer circuit roughly matches the IF output impedance to 75 Ω at the resonant frequency of the IF output circuit, which should be tuned to 34.75 MHz; the bandwidth is approximately 20 MHz.

As both the input and output impedances of the tuner are now 75 Ω, the voltage gain may be measured inserting tuner and transformer circuit between a 75 Ω source and a 75 Ω detector.

VHF/UHF TELEVISION TUNERS

QUICK REFERENCE DATA

Systems	CCIR systems B, G and H; I, I′, L, L′ and D2MAC	
Channels	off-air	cable
low band	E2 to C	S01 to S10
mid band	E5 to E12	S11 to S39
high band	E21 to E69	S40 to S41

Intermediate frequencies (MHz)

System	B, G and H	I	L	I′	L′	D2MAC
Picture	38.90	39.50	38.90	38.90	33.40	38.90
Colour	34.47	35.07	34.47	34.47	37.83	
Sound 1	33.40	33.50	32.40	32.90	39.90	
Sound 2	33.16	33.00		32.40		
Bandedge						30.50

APPLICATION

Designed to cover the VHF and UHF channels of CCIR systems B, G and H; I, I′, L, L′ and D2MAC with extended VHF/UHF frequency ranges, including cable and hyperband.

The IF output is designed to directly drive a variety of SAW filters.

The UV816/256 and UV816/6456 tuners are equipped with frequency dividers which make them suitable for digital tuning systems based on frequency synthesis; apart from this they are equivalent to type UV815.

In the UV816/PLL tuner the frequency divider is replaced by a built-in digital controlled (I^2C) PLL tuning system.

Table 1 Available versions (note 1)

	aerial input connector	frequency divider (IC)	catalogue number
UV815	IEC/SNIR		3112 297 10501
UV816/256	IEC/SNIR	1:256	3112 297 10511
UV816/6456 (note 2)	IEC/SNIR	1:64 or 1:256	3112 297 10521
UV816/PLL	IEC/SNIR		3122 237 00441

Notes to Table 1

1. These tuners comply with the requirements of radiation, signal handling capability and immunity from radiated interference of Amtsblatt DBP69/1981, when installed professionally in an adequate TV receiver.
2. The frequency divider is switchable.

DESCRIPTION

The UV815/816 series feature combined VHF/UHF handling capability with electronic tuning and band switching. The tuners cover the low band (frequency range 46 to 170 MHz), the mid band (frequency range 170 to 450 MHz) and the high band (frequency range 450 to 860 MHz).

The tuners are built on a low-loss printed-wiring board carring all components in a die-cast metal housing made of a rectangular frame, with front and rear covers (see Fig.2). The common IEC and SNIR aerial connector (75 Ω) is integrated in one of the frame sides of the housing, all other connections (supply voltages, AGC voltage, tuning and switching voltages, IF output) are made via pins on the underside. (For mounting method, see Figs 3 and 4).

Electrically, the tuners consist of low, mid and high band parts (see Figs 1A and 1B). They are equipped with a common aerial input and provided with three tuned mosfet input stages. The oscillators, mixers and IF amplifier are contained in a mixer-oscillator IC. The IF output is designed to directly drive a variety of SAW filters.

The output impedance of the symmetrical IF terminals is approximately 75 Ω to ensure sufficient triple transient suppression of the SAW filter.

The UV815 tuner (basic type without divider) can be controlled by a voltage synthesizer tuning system.

The frequency divider of the type UV816/256 tuner has a division ratio of 256, that of the type UV816/6456 a switchable ratio of 64 or 256, with symmetrical ECL output connected to two terminals at the underside of the tuner. The UV816 PLL is provided with a digital programmable phase-locked-loop tuning system. This enables tuning with a 62.5 kHz pitch with crystal accuracy. Besides tuning, the band switching is also carried out via the I^2C bus.

DEVELOPMENT DATA

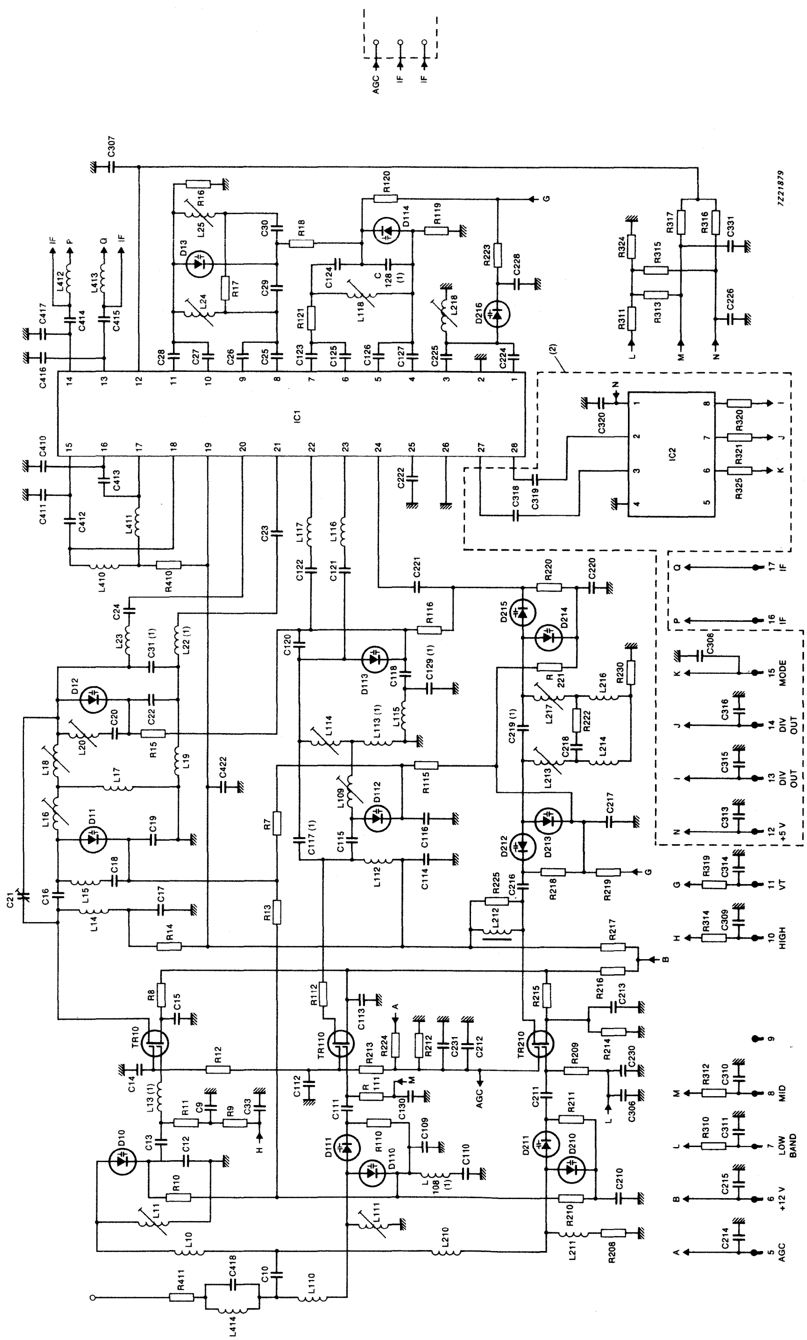


Fig.1A Circuit diagram for UV815, UV816/256, UV816/6456.

(1) Printed on board.
(2) Not used in UV815.

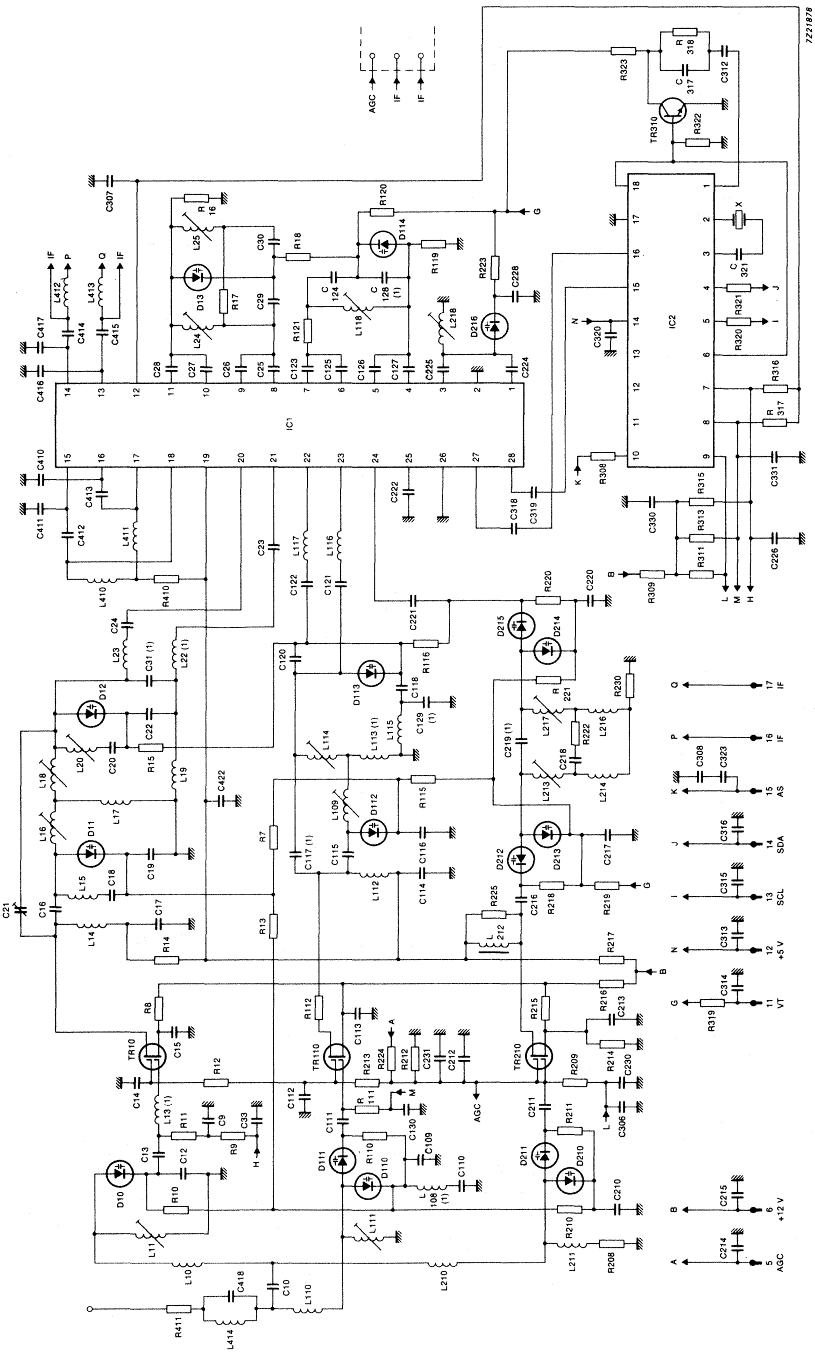


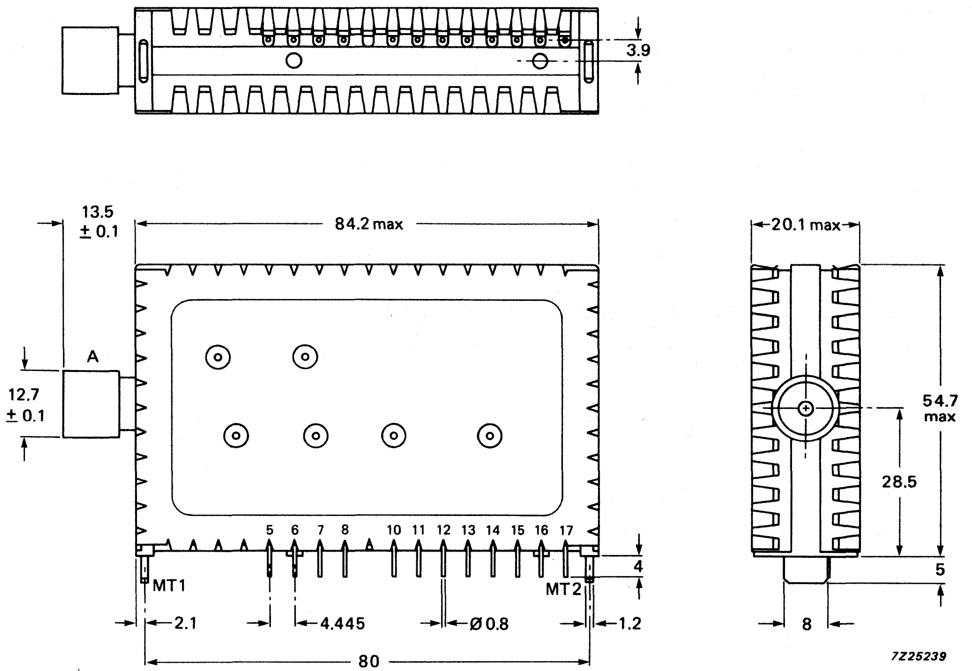
Fig.1B Circuit diagram for UV816 PLL.

(1) Printed on board.

DEVELOPMENT DATA

MECHANICAL DATA

Dimensions in mm



Unless otherwise stated the tolerance is ± 0.05 mm

Pin/connector identity

	UV815	UV816/Divider	UV816 PLL
A	IEC 9.5 mm and SNIR 9 mm	IEC 9.5 mm and SNIR 9 mm	IEC 9.5 mm and SNIR 9 mm
5	AGC voltage 9.2 to 0.85 V	AGC voltage 9.2 to 0.85 V	AGC voltage 9.2 to 0.85 V
6	Supply voltage + 12 V	Supply voltage + 12 V	Supply voltage + 12 V
7	Low band supply + 12 V	Low band supply + 12 V	
8	Mid band supply + 12 V	Mid band supply + 12 V	
10	High band supply + 12 V	High band supply + 12 V	
11	Tuning voltage 0.7 to 28 V	Tuning voltage 0.7 to 28 V	33 V via 22 kΩ series resistor
12		Prescaler supply + 5 V	PLL supply + 5 V
13		Prescaler output 1.2 kΩ	SCL serial clock line I^{2}C
14		Prescaler output 1.2 kΩ	SDA serial data line bus
15		To be grounded for 256 ratio, floating for 64 ratio (UV816/6456 only)	Address selection
16	IF output symm.	IF output symm.	IF output symm.
17	Approximately 75 Ω	Approximately 75 Ω	Approximately 75 Ω
MT1 MT2	Mounting tab grounded	Mounting tab grounded	Mounting tab grounded

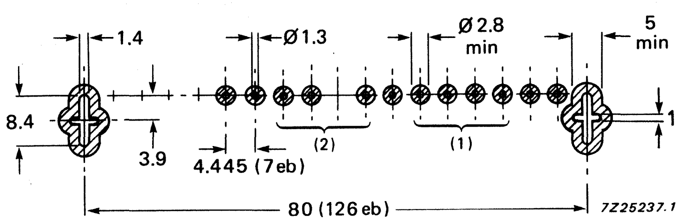
Fig.2 Mechanical detail.

Mass: approximately 95 grams

Mounting

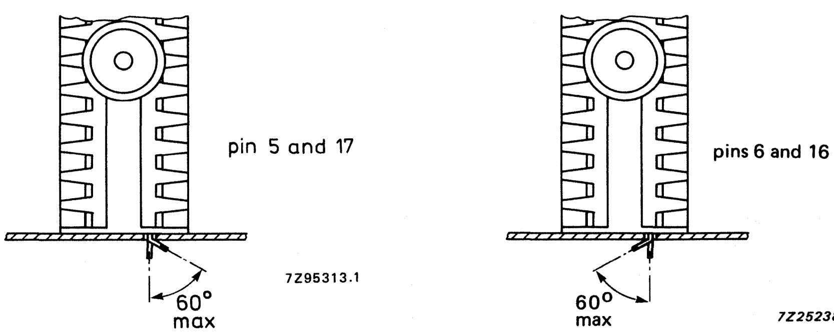
The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig.3 without clearance between tuner supporting surface and board. The connection pins should be bent according to Fig.4. The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the pins and mounting tabs is in accordance with IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0.5 s). The resistance to soldering heat is in accordance with IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).



1 eb = 0.025 inch
(1) On 816 PLL, 816/256 and 816/6456 only.
(2) On 816/256 and 816/6456 only.

Fig.3 Piercing diagram viewed from solder side of board; unless otherwise stated the tolerance is ± 0,05 mm.



Note: In order to prevent any stress to the printed-wiring board, the tuner should be supported at its aerial connector.

Fig.4 Bending of connecting pins.

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0.3 V and an AGC voltage of 9.2 ± 0.2 V.

General

Semiconductors, low band	
RF amplifier	BF998
tuning diodes	4 x BB911
coupling diodes	1 x BBY31 2 x BB901
Semiconductors, mid band	
RF amplifier	BF998
tuning diodes	4 x BB910
coupling diodes	1 x BB405
Semiconductors, high band	
RF amplifier	BF998
tuning diodes	4 x BB405
Mixer/oscillator IC	TDA5330
Tuning transistor (UV816/PLL only)	BC847B
PLL synthesizer (UV816/PLL only)	TSA5510 SP5510 multi addressable SDA3202 single addressable
Frequency divider	SDA4213 SP4653X SAB6457
Ambient temperature range	
operating	−10 to + 60 °C
storage	−25 to + 70 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltage	+ 12 V ± 10%
Current drawn from + 12 V supply with one band selected	
low band mid band high band	max. 85 mA
Bandswitching	max. 8 mA

For operation in all bands the supply voltage is permanently connected to pin 6. Additionally the supply voltage is connected to:

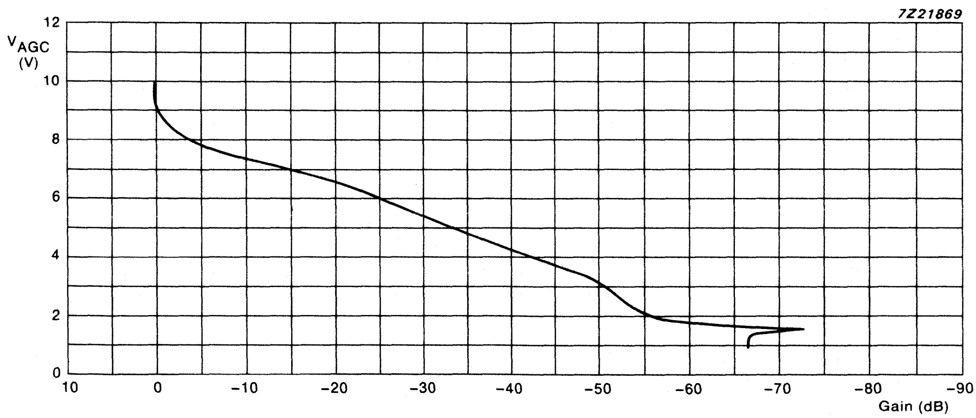
pin 7 for operation in low band
pin 9 for operation in mid band
pin 10 for operation in high band
} for UV815, 816/256 and 816/6456 only

Input impedance	75 Ω
VSWR at nominal gain and during gain control	
low band	max. 4
mid band	max. 4 max. 3 } between 300 to 450 MHz to
high band	max. 4 max. 3 } ensure D2MAC application
Reflection coefficient	
low band	max. 60%
mid band	max. 60% max. 50% } between 300 to
high band	max. 60% max. 50% } 450 MHz to ensure D2MAC application
Output impedance (IF)	75 Ω approximately
Capacitance between terminals	typ. 3.5 pF
Load impedance	min. 1 kΩ/max. 22 pF total capacitance load to be tuned to 36.15 MHz by means of an inductance between pins 16 and 17 (min. L: 890 nH)
RF curves bandwidth	
low band	typ. 8 to 11 MHz
mid band	typ. 8 to 13 MHz
high band	typ. 14 to 12 MHz
RF curves, tilt	on any channel the amplitude difference between the top of the RF resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 4 dB at nominal gain and 5 dB in AGC range between nominal gain and 20 dB gain reduction. See Fig.8.
AGC range	
low band	min. 40 dB
mid band	min. 40 dB
high band	min. 30 dB
AGC voltage	
voltage range	+ 9.2 to + 0.85 V (max. 30 μA)
voltage at nominal gain	+ 9.2 ± 0.5 V
voltage at 40 dB gain reduction	
low band	typ. 3 V
mid band	typ. 3 V
voltage at 30 dB gain reduction	
high band	typ. 2 V

Note: AGC voltages between 0 and + 10.5 V may be applied without risk of damage

AGC current	max. 0.03 mA
Slope of AGC characteristic at the end of the specified AGC range	
low-mid band	typ. 40 dB/V
high band	typ. 80 dB/V

AGC characteristic E2 (48.25 MHz)



AGC characteristic S10 (168.25 MHz)

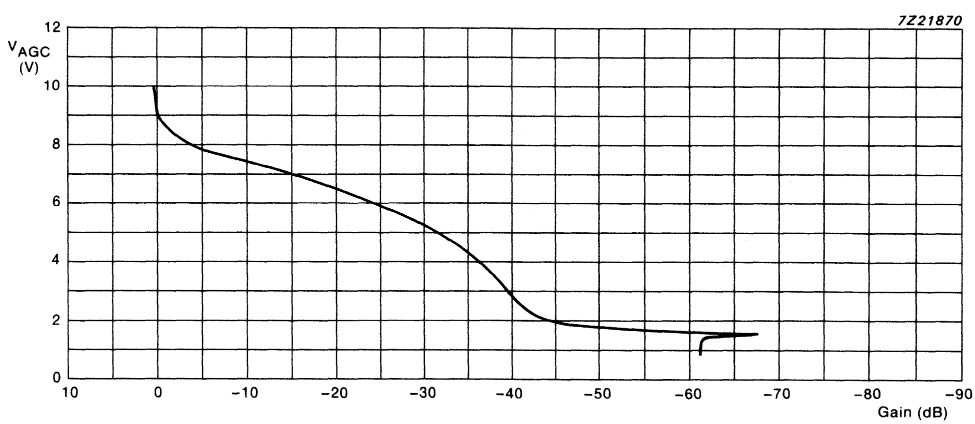
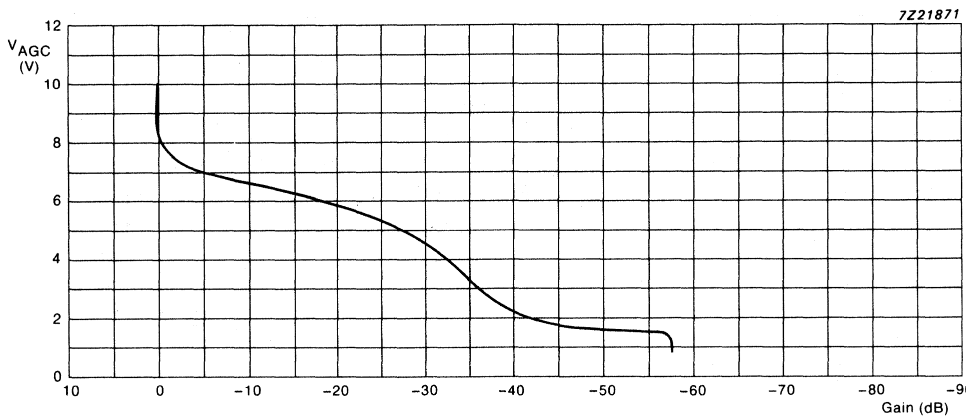


Fig.5 Typical AGC curves, low band.

AGC characteristic E5 (175.25 MHz)



AGC characteristic S39 (447.25 MHz)

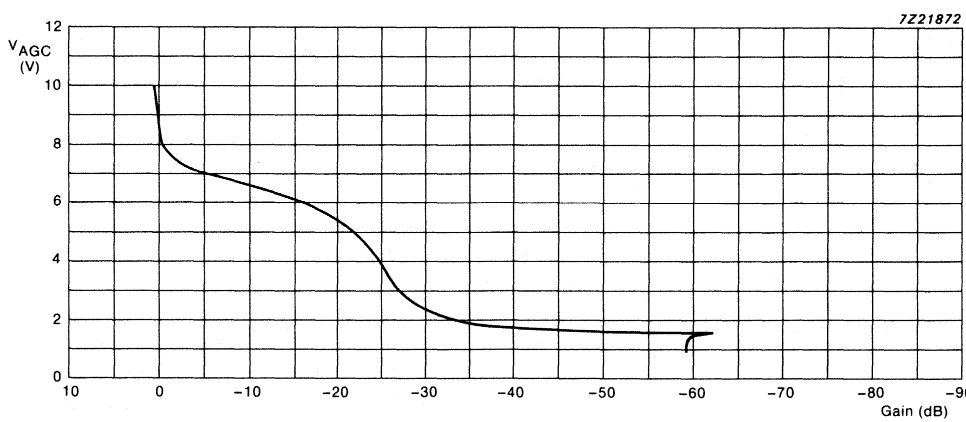
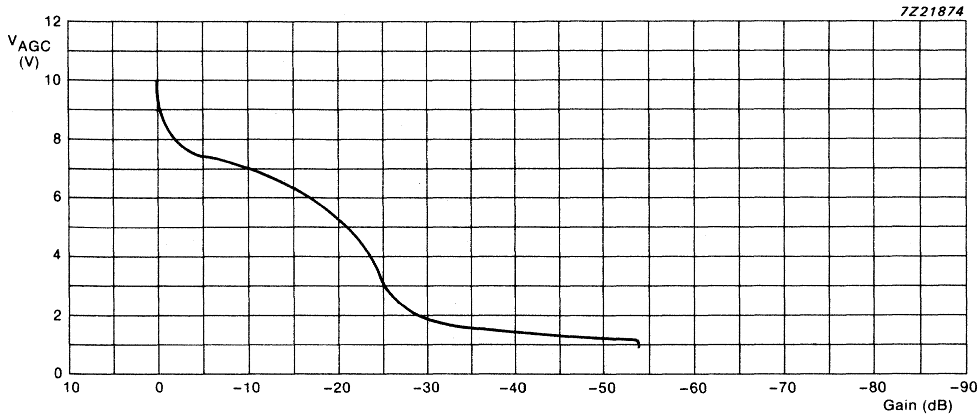


Fig.6 Typical AGC curves, mid band.

DEVELOPMENT DATA

AGC characteristic S40 (455.25 MHz)



AGC characteristic E69 (855.25 MHz)

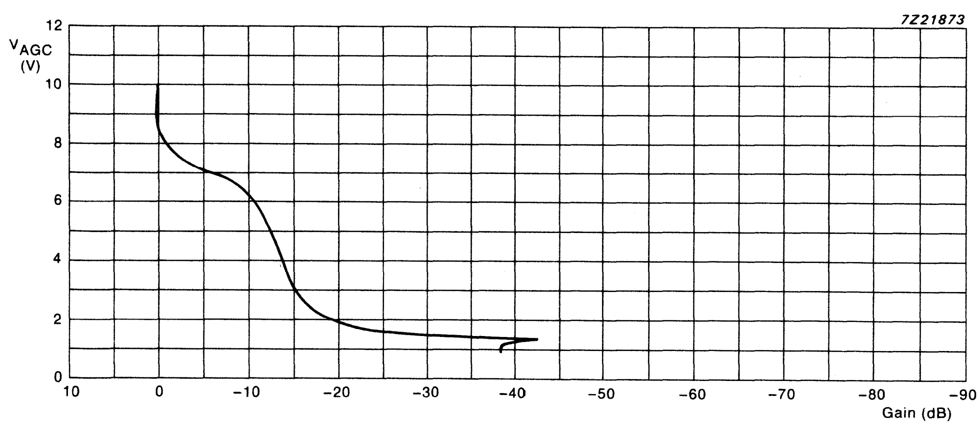


Fig.7 Typical AGC curves, high band.

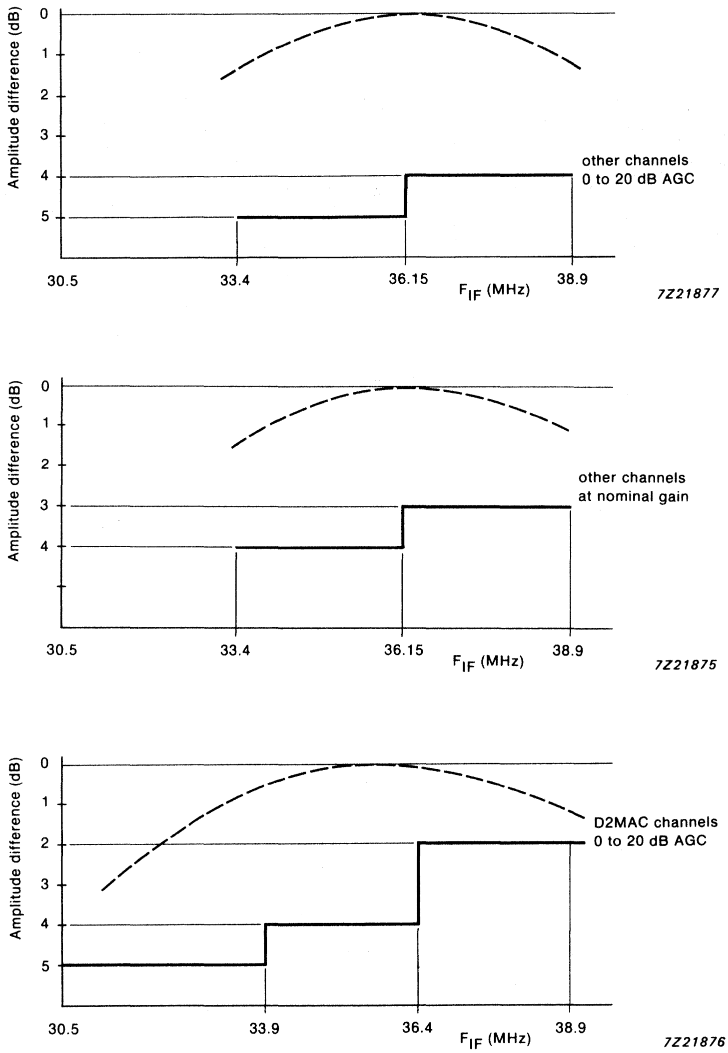


Fig.8 Tilt overall response curves.

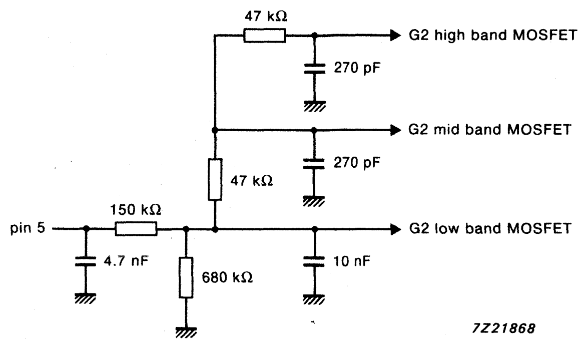


Fig.9 AGC circuit.

Tuning voltage range, UV815, UV816 with divider	+ 0.7 to + 28 V
Tuning voltage, UV816 PLL	+ 33 V nominal (via 22 kΩ)*
Current drawn from 28 V tuning voltage supply	
at T_{amb} = 25 °C and 60% RH	max. 0.5 μA
at T_{amb} = 25 °C and 95% RH	max. 2 μA
at T_{amb} = 60 °C and 60% RH	max. 2 μA
Slope of tuning characteristic	
low band	0.5 to 10 MHz/V
mid band	1 to 20 MHz/V
high band	2 to 25 MHz/V

Frequencies

low band	Channel E2 (picture carrier 48.25 MHz) to channel S10 (picture carrier 168.25 MHz). Margin at the extreme channels: min. 2.0 MHz.
mid band	Channel E5 (picture carrier 175.25 MHz) to channel S39 (picture carrier 447.25 MHz). Margin at the extreme channels: min. 2.0 MHz.
high band	Channel S40 (picture carrier 455.25 MHz) to channel E69 (picture carrier 855.25 MHz). Margin at the extreme channels: min. 2.0 MHz.

* An external pull-up resistor of 22 kΩ ± 5% has to be connected between the tuning supply voltage and terminal 11. The tuning supply current is 1.7 mA max.

Voltage gain	
low + mid + high band	min. 40 dB; max. 50 dB
Maximum gain difference	7 dB
Noise figure	
low band	typ. 6 dB; max. 9 dB
mid band	typ. 7 dB; max. 10 dB
high band	typ. 8 dB; max. 11 dB

Overloading

Input signal producing 1 dB gain compression at nominal gain	
low, mid and high band	typ. 90 dB (μV) into 75 Ω
Input signal producing either a detuning of the oscillator of + 300 kHz or −1000 kHz or stopping of the oscillations at nominal gain	
low + mid band	typ. 105 dB (μV) into 75 Ω; min. 100 dB
high band	typ. 100 dB (μV) into 75 Ω; min. 90 dB

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)	
low, mid band < 300 MHz	min. 70 dB; typ. 75 dB
low, mid band > 300 MHz	min. 66 dB; typ. 70 dB
high band < 470 MHz	min. 60 dB; typ. 65 dB
high band > 470 MHz	min. 53 dB; typ. 65 dB
IF rejection (measured at picture carrier frequency)	
all bands	min. 60 dB (Channel E2: min. 50 dB)

Note: At colour sub-carrier frequency maximum 6 dB less rejection

Cross modulation

Input signal productING 1% cross modulation, i.e. 1% of the modulation depth of interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

All bands	
at nominal gain	
(wanted input level 60 dB (μV))	typ. 75 dB (μV) into 75 Ω for systems L and L′ 70 dB (μV)
at 40 dB gain reduction	
(wanted input level 100 dB (μV))	typ. 100 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for low band or channel N ± 3 for mid channel or channel N ± 5 for high band)

low + mid band	
at nominal gain	
(wanted input level 60 dB (μV))	typ. 95 dB (μV) into 75 Ω
at 40 dB gain reduction	
(wanted input level 100 dB (μV))	typ. 100 dB (μV) into 75 Ω
high band	
at nominal gain	
(wanted input level 60 dB (μV))	typ. 100 dB (μV) into 75 Ω
at 30 dB gain reduction	
(wanted input level 90 dB (μV))	typ. 100 dB (μV) into 75 Ω

Out of band cross modulation at nominal gain
each of the low, mid or high band interfering with any of the other bands mentioned — typ. 100 dB (μV) into 75 Ω

Unwanted signal handling capability (visibility test)

For the channel combinations
VHF and hyperband: N ± 1, N ± 5, N + 9, N + 11
UHF: N ± 1, N ± 5, N + 9

Oscillator characteristics

Pulling

Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain

all bands	min. 74 dB (μV) into 75 Ω

Shift of oscillator frequency at a change of supply voltage of ± 5%

low band	max. 250 kHz
mid band	max. 500 kHz
high band	max. 500 kHz

Drift of oscillator frequency

during warm-up time (after the tuner has been completely out of operation for 15 minutes, measured between 5 s and 15 minutes after switching on)	max. 250 kHz
during warm-up time (after the input stage is in operation for 15 minutes, measured between 2 s and 15 minutes after band switching)	max. 250 kHz

DEVELOPMENT DATA

at a change of the ambient temperature from + 25 °C to + 50 °C (measured after 3 cycles from + 25 to 0 °C)	
low band	max. 500 kHz
mid band	max. 750 kHz
high band	max. 1000 kHz
at a change of humidity from 60 ± 15% to 93 ± 2%, at T_{amb} = 25 ± 5 °C	
low band	max. 500 kHz
mid band	max. 1300 kHz
high band	max. 1500 kHz

Frequency divider characteristics

Frequency division ratio	
UV816/256	256
UV816/6456	switchable, 64 or 256
Supply voltage	+ 5 V ± 10%
Current drawn from + 5 V supply	max. 35 mA; typ. 25 mA
Output voltage, unloaded, measured with probe 10 MΩ/11 pF	min. 0.5 V (p-p) for 256 division ratio min. 0.25 V (p-p) for 64 division ratio
Output impedance	typ. 1 kΩ
Output imbalance	typ. 0.1 V
Signal disturbance ratio at IF output, IF output terminated with 10 MΩ/11 pF	57 dB min.

Miscellaneous

Radio interference Oscillator radiation and oscillator voltage at the aerial terminal	Within the limits of CISPR 13 (1975), VDE0872/7.72 and Amtsblatt DBP69/1981, item 5.1.2 and CENELEC proposal European standard EN55013 and EN55020 and Finland Requirements Bulletin 33-86 when applying the tuner in an adequent TV receiver.
Microphonics	There will be no microphonics, provided the tuner is installed in a professional manner.
Surge protection	
Protection against voltages (note 1)	max. 5 kV
Protection against flashes (note 2)	max. 30 kV, 400 mW

Notes to the characteristics

1. 10 discharges of a 470 pF capacitor into the aerial terminal.
2. A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal. (Power removed from tuner during test).

APPLICATION INFORMATION

For further information regarding general aspects of I^2C-bus control refer to:
"The I^2C-bus specification", published by Philips Components.

Logic diagram

	MSB							LSB	
Address Byte	1	1	0	0	0	MA1	MA0	0	A
Prog. div. Byte 1	0	n14	n13	n12	n11	n10	n9	n8	A
Prog. div. Byte 2	n7	n6	n5	n4	n3	n2	n1	n0	A
Control info Byte 1	1	5I	0	0	1	1	1	0	A
Control info Byte 2	P7	P6	P5	P4	0	P2	P1	P0	A

A = Acknowledge

Address selection

MA1	MA0	voltage at terminal 15
0	0	0 . . . 0 . 1 x V PLL
0	1	don't care
1	0	0 . 4 . . . 0 . 6 x V PLL
1	1	0 . 9 . . . 2 . 7 x V PLL

DEVELOPMENT DATA

VHF/UHF TELEVISION TUNERS

QUICK REFERENCE DATA

Systems	CCIR systems B, G and H; I, I′, L, L′ and D2 MAC	
Channels	off-air	cable
low band	E2 to C	S01 to S10
mid band	E5 to E12	S11 to S39
high band	E21 to E69	S40 and S41

Intermediate frequencies (MHz)

System	B, G and H	I	L	I′	L′	D2MAC
Picture	38.90	39.50	38.90	38.90	33.40	38.90
Colour	34.47	35.07	34.47	34.47	37.83	
Sound 1	33.40	33.50	32.40	32.90	39.90	
Sound 2	33.16	33.00		32.40		
Bandedge						30.50

APPLICATION

Designed to cover the VHF and UHF channels of CCIR systems B, G and H, I, I′, L, L′ and D2MAC with extended VHF/UHF frequency ranges, including cable and hyperband.

The IF output is designed to directly drive a variety of SAW filters.

The UV916E/256 and UV916E/6456 tuners are equipped with frequency dividers which make them suitable for digital tuning systems based on frequency synthesis; apart from this they are equivalent to type UV915E.

In the UV916E/PLL tuner the frequency divider is replaced by a built-in digital controlled (I^2C) PLL tuning system.

Table 1 Available versions (note 1)

	aerial input connector	frequency divider (IC)	catalogue number
UV915E	phono		3139 147 10771
UV915E/IEC (note 3)	IEC (14.5 mm)		3139 147 10781
UV916E/256 (note 3)	phono	256	
UV916E/6456 (notes 2 and 3)	phono	1:64 or 1:256	
UV916E/PLL	phono		3139 147 10471
UV916E/PLL/IEC (note 3)	IEC (14.5 mm)		3139 147 10361

Notes to Table 1

1. These tuners comply with the requirements of radiation, signal handling capability and immunity from radiated interference of Amtsblatt DBP69 1981, DIN VDE 0872, CISPR (1973) including amendment 1 (1983) and CENELEC proposal European Standard EN55013, EN55020.
2. The frequency divider ratio is switchable.
3. Available on special request.

DESCRIPTION

The UV915E/916E series feature combined VHF/UHF handling capability with electronic tuning and band switching. The tuners cover the low band (frequency range 46 to 170 MHz), the mid band (frequency range 170 to 450 MHz) and the high band (frequency range 450 to 860 MHz).

The tuners are built on a low-loss printed-wiring board carrying all components in a metal housing made of a rectangular frame, with front and rear covers (see Fig.1). The common IEC and SNIR aerial connector (75 Ω) is mounted on one of the frame sides of the housing, all other connections (supply voltages, AGC voltage, tuning and switching voltages, IF output) are made via pins on the underside. (For mounting method, see Figs 2 and 3).

The tuners have three tuned RF input stages. The mixers and oscillators (low, mid and high bands) and IF amplifiers are biased for high signal handling capabilities. Between the mixers and the IF amplifier, a double tuned IF filter is provided to improve IF selectivity and maintain a flat response for the selected frequencies.

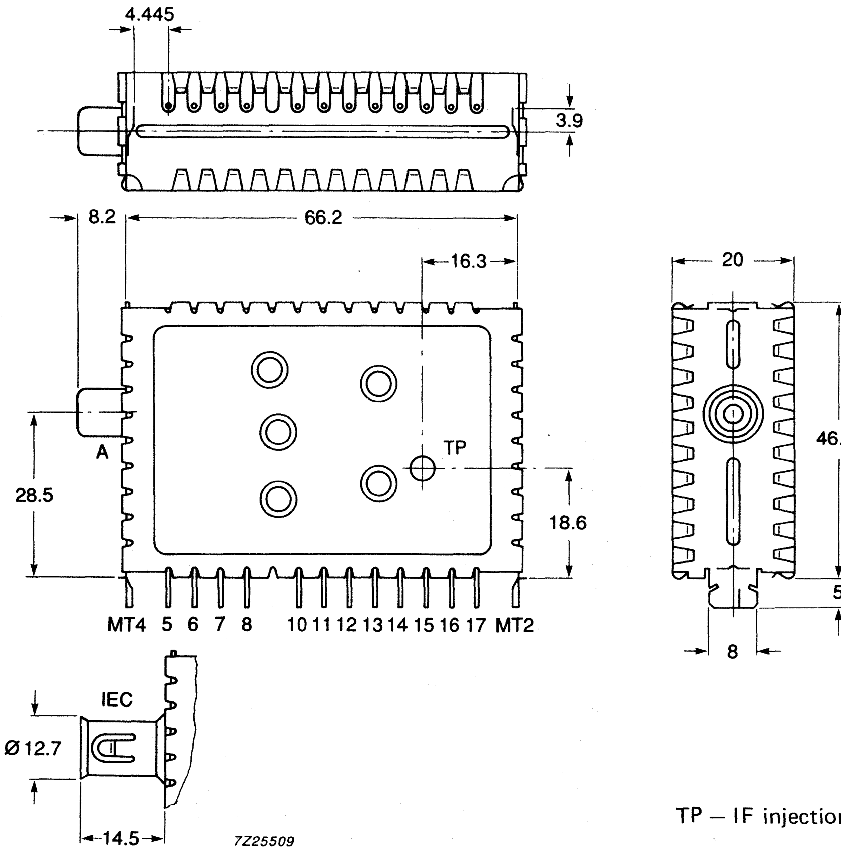
The IF output is designed for direct drive of a variety of SAW filters. The output impedance of the asymmetrical IF terminals is approximately 75 Ω to ensure sufficient triple transient suppression of the SAW filter.

The UV916E tuners are provided with a digital programmable phase-locked-loop tuning system. This enables tuning with a 62.5 kHz pitch with crystal accuracy. Band switching is also carried out via the I^2C-bus.

DEVELOPMENT DATA

MECHANICAL DATA

Dimensions in mm



TP — IF injection point

Pin/connector identity	UV915E	UV916E/Divider	UV916E PLL
A	IEC 9.5 mm and SNIR 9 mm	IEC 9.5 mm and SNIR 9 mm	IEC 9.5 mm and SNIR 9 mm
5	AGC voltage 9.2 to 0.85 V	AGC voltage 9.2 to 0.85 V	AGC voltage 9.2 to 0.85 V
6	Supply voltage + 12 V	Supply voltage + 12 V	Supply voltage + 12 V
7	Low band supply + 12 V	Low band supply + 12 V	
8	Mid band supply + 12 V	Mid band supply + 12 V	
10	High band supply + 12 V	High band supply + 12 V	
11	Tuning voltage 0.3 to 28 V	Tuning voltage 0.3 to 28 V	33 V via 22 kΩ series resistor
12		Prescaler supply + 5 V	PLL supply + 5 V
13		Prescaler output 1.2 kΩ	SCL serial clock line
14		Prescaler output 1.2 kΩ	SDA serial data line
15		To be grounded for 256 ratio, floating for 64 ratio (UV816/6456 only)	Multiple address selection
16	Ground	Ground	Ground
17	IF output	IF output	IF output
MT1, MT2	Mounting tab grounded	Mounting tab grounded	Mounting tab grounded

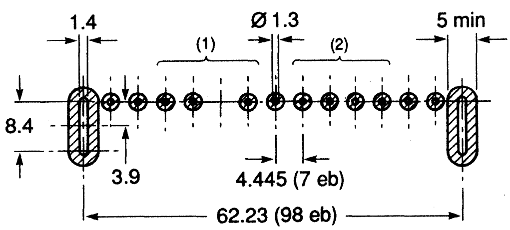
Fig.1 Mechanical diagram.

Mass: approximately 80 grams

Mounting

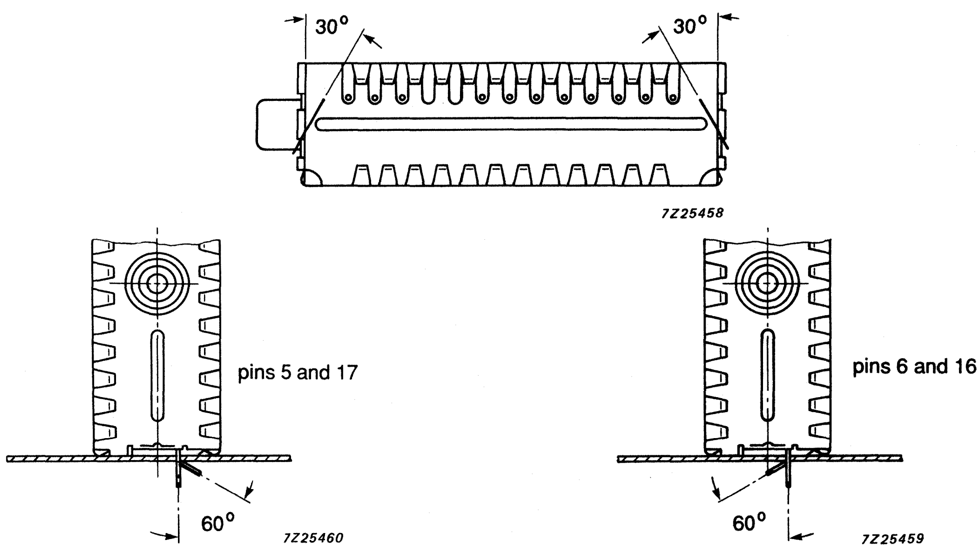
The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig.2 without clearance between the tuner supporting surface and the board. The connecting pins should be bent according to Fig.3. The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the pins and mounting tabs is in accordance with IEC 68-2-20, test Ta (230 ± 10 °C, 2 ± 0.5 s). The resistance to soldering heat is in accordance with IEC 68-2-20 test Tb (260 ± 5 °C, 10 ± 1 s).



1 eb = 0.025 inch.
(1) UV916E types only.
(2) UV915E and UV916E/Divider only.

Fig.2 Piercing diagram viewed from solder side of board; unless otherwise stated the tolerance is ± 0.05 mm.



Note: In order to prevent any stress to the printed-wiring board, the tuner should be supported at its aerial connector.

Fig.3 Bending of connecting pins and mounting tabs.

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0.3 V and an AGC voltage of 9.2 ± 0.2 V.

General

Semiconductors, low band	
RF amplifier	BF998R
mixer	2SC2480
oscillator	BFS17
tuning diodes	BF911
coupling diodes	OF643
Semiconductors, mid band	
RF amplifier	BF998R
mixer	2SC2480
oscillator	2SC3545
tuning diodes	OF612
coupling diodes	OF612
Semiconductors, high band	
RF amplifier	BF990A/01R
mixer	2SC3841
oscillator	2SC2480
tuning diodes	OF643
IF amplifier	BFS17
PLL tuning IC	SP/TSA 5510
Charge pump buffer transistor (NPN)	BC847B
Ambient temperature range	
operating	−10 to + 60 °C
storage	−25 to + 85 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltage	+ 12 V ± 10%
Current drawn from † 12 V supply with one band selected	
low band	
mid band	max. 85 mA
high band	
Bandswitching	max. 8 mA

For operation in all bands the supply voltage is permanently connected to pin 6. Additionally the supply voltage is connected to:

pin 7 for operation in low band	
pin 8 for operation in mid band	for UV915E, 916E/256 and 916E/6456 only
pin 10 for operation in high band	
Input impedance	75 Ω
VSWR at nominal gain and during gain control	
low band	max. 4
mid band	max. 4 max. 3 between 300 to 450 MHz to
high band	max. 4 ensure D2MAC application

ELECTRICAL DATA (continued)

Voltages and currents (continued)

Reflection coefficient	
low band	max. 60%
mid band	max. 60% max. 50% between 300 to 450 MHz to
high band	max. 60% ensure D2MAC application
Output impedance	75 Ω approximately
Load impedance	min. 1 kΩ/max. 22 pF total capacitance load to be tuned to 36.15 MHz by means of an inductance between pins 16 (ground) and 17 (min. L: 890 nH)
RF curves bandwidth	
low band	typ. 8 to 11 MHz
mid band	typ. 8 to 13 MHz
high band	typ. 14 to 12 MHz
RF curves, tilt	on any channel the amplitude difference between the top of the RF resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 4 dB at nominal gain and 5 dB in AGC range between nominal gain and 20 dB gain reduction
AGC range	
low band	min. 40 dB
mid band	min. 40 dB
high band	min. 30 dB
AGC voltage	
voltage range	+ 9.2 to + 0.85 V (max. 30 μA)
voltage at nominal gain	+ 9.2 ± 0.5 V
voltage at 40 dB gain reduction	
low band	typ. 3 V
mid band	typ. 3 V
voltage at 30 dB gain reduction	
high band	typ. 2 V

Note: AGC voltages between 0 and + 10.5 V may be applied without risk of damage.

AGC current	max. 30 μA
Slope of AGC characteristic at the end of the specified AGC range	
low-mid band	typ. 40 dB/V max. 100 dB/V
high band	typ. 80 dB/V max. 100 dB/V
Tuning voltage range, UV915E, UV916E with divider	+ 0.7 to + 28 V
Tuning voltage, UV916E PLL	+ 33 V nominal (via 22 kΩ)*

* An external pull-up resistor of 22 kΩ ± 5% has to be connected between the tuning supply voltage and terminal 11. The tuning supply current is 1.7 mA max.

Current drawn from 28 V tuning voltage supply	
at T_{amb} = 25 °C and 60% RH	max. 0.5 μA
at T_{amb} = 25 °C and 95% RH	max. 2 μA
at T_{amb} = 60 °C and 60% RH	max. 2 μA
Slope of tuning characteristic	
low band	0.5 to 10 MHz/V
mid band	1 to 20 MHz/V
high band	2 to 25 MHz/V

Frequencies

Frequency ranges	
low band	channel E2 (picture carrier 48.25 MHz) to channel S10 (picture carrier 168.25 MHz). Margin at the extreme channels: min. 2.0 MHz
mid band	channel E5 (picture carrier 175.25 MHz) to channel S39 (picture carrier 447.25 MHz). Margin at the extreme channels: min. 2.0 MHz
high band	channel S40 (picture carrier 455.25 MHz) to channel E69 (picture carrier 855.25 MHz). Margin at the extreme channels: min. 2.0 MHz
Voltage gain	
low + mid + high band	min. 38 dB; max. 50 dB
Maximum gain difference	
off-air	7 dB
cable	9 dB
Noise figure	
low band	max. 9 dB; typ. 6 dB
mid band	max. 10 dB; typ. 7 dB
high band	max. 11 dB; typ. 8 dB

Overloading

Input signal producing 1 dB gain compression at nominal gain	
low, mid and high band	typ. 90 dB (μV) into 75 Ω
Input signal producing either a detuning of the oscillator of + 300 kHz or −1000 kHz or stopping of the oscillations at nominal gain	
low + mid band	typ. 105 dB (μV) into 75 Ω; min. 100 dB
high band	typ. 100 dB (μV) into 75 Ω; min. 90 dB

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)	
low, mid band < 300 MHz	min. 70 dB
low, mid band > 300 MHz	min. 66 dB
high band < 470 MHz	min. 60 dB
high band > 470 MHz	min. 53 dB

DEVELOPMENT DATA

ELECTRICAL DATA (continued)

Unwanted signal characteristics (continued)

IF rejection (measured at picture carrier frequency)	
channel E2	min. 45 dB
all other channels	min. 60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection.

Cross modulation
input signal producing 1% cross modulation, i.e. 1% of the modulation depth of interfering signal is transferred to the wanted signal

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)	
all systems	min. 70 dB (μV)
In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for low band or channel N ± 3 for mid channel or channel N ± 5 for high band)	
low + mid band	typ. 80 dB (μV)
high band	typ. 84 dB (μV)
Out of band cross modulation at nominal gain each of the low, mid or high band interfering with any of the other bands mentioned	typ. 100 dB (μV) into 75 Ω

Unwanted signal handling capability (visibility test)

The tuner meets the requirements of DBP Amtsblatt 69/1981 item 5.1.2 and CENELEC EN55020 section 4.2 when measured in an adequate TV receiver.

The AGC must be adjusted such that the picture carrier level (top sync.) does not exceed 107 dB (μV) at an input signal level of 74 dB (μV) or more.

Oscillator characteristics

Pulling

Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain	
all bands	min. 74 dB (μV) into 75 Ω
Shift of oscillator frequency at a change of supply voltage of ± 5%	
low band	max. 250 kHz
mid band	max. 500 kHz
high band	max. 500 kHz

Drift of oscillator frequency	
during warm-up time (after the tuner has been completely out of operation for 15 minutes, measured between 5 s and 15 minutes after switching on)	max. 250 kHz
during warm-up time (after the input stage is in operation for 15 minutes, measured between 2 s and 15 minutes after band switching)	max. 250 kHz
at a change of the ambient temperature from + 25 °C and + 50 °C (measured after 3 cycles from + 25 to 0 °C)	
low band	max. 500 kHz
mid band	max. 750 kHz
high band	max. 1000 kHz
at a change of humidity from 60 ± 15% to 93 ± 2%, at T_{amb} = 25 ± 5 °C	
low	max. 500 kHz
mid	max. 1300 kHz
high	max. 1500 kHz

DEVELOPMENT DATA

Frequency divider characteristics

Frequency division ratio	
UV916E/256	256
UV916E/6456	switchable, 64 or 256
Supply voltage	+ 5 V ± 10%
Current drawn from + 5 V supply	max. 35 mA; typ. 25 mA
Output voltage, unloaded, measured with probe 10 MΩ/11 pF	min. 0.5 V (p-p) for 256 division ratio min. 0.25 V (p-p) for 64 division ratio
Output impedance	typ. 1 kΩ
Output imbalance	typ. 0.1 V
Signal disturbance ratio at IF output, IF output terminated with 10 MΩ/11 pF	57 dB min.

Miscellaneous

Radio interference

Oscillator radiation and oscillator voltage at the aerial terminal are within the limits of:
– CISPR 13 (1975) amendment No. 1 (1983)
– Amtsblatt 69/1981 + DIN VDE 0872
– CENELEC proposal European Standard EN55013, EN55020.

Microphonics

For sound signals in the audio frequency range 100 Hz to 10 kHz and sound pressure levels up to 105 dB (20 μPa) the video signal to sound interference ratio will be min. 40 dB.

ESD protection at the terminals

All terminals of the tuner are protected against electrostatic discharge up to 2 kV.

The product is classified in category B (MIL-STD-883C).

APPLICATION INFORMATION

For further information regarding general aspects of I^2C-bus control refer to:
" The I^2C - bus specification ," published by Philips Components.

I^2C-bus requirements (SDA and SCL pins)

V_{IL} max.	= 1.5 V	(maximum input LOW voltage)
V_{IH} min.	= 3.0 V	(minimum input HIGH voltage)
I_{IL} max.	= −10 μA	(maximum LOW level input current)
I_{IH} max.	= 10 μA	(maximum HIGH level input current)
V_{OL} max.	= 0.4 V	(maximum output LOW voltage at 3 mA sink current)

Logic diagram

	MSB							LSB	
Address byte	1	1	0	0	0	MA1	MA0	0	A
Prog. div. byte 1	0	0	n13	n12	n11	n10	n9	n8	A
Prog. div. byte 2	n7	n6	n5	n4	n3	n2	n1	n0	A
Control info byte 1	1	5I	0	0	1	1	1	0	A
Control info byte 2	P7	P6	P5	P4	0	P2	P1	P0	A

A = Acknowledge

Address selection

	MA1	MA0	voltage at terminal 15
	0	0	0 . . . 0.1 x V PLL
*	0	1	don't care
	1	0	0.4 . . . 0.6 x V PLL
	1	1	0.9 . . . 2.7 x V PLL

* This general address is always valid for all tuner types of this group.

Note: It is not recommended to use the address MA1 = 0. MA2 = 0 in the set to enable a multi-addressable tuner to be used. Terminal 15 of that tuner may then be grounded.

Programmable divider setting (byte 1 and 2)

Divider ratio: N = 16 * 1 f_{RF}, pc (MHz) + f_{IF}, pc (MHz)

$$N = 8192 \times n13 + 4096 \times n12 + 2048 \times n11 + 1024 \times n10 + 512 \times n9 + 256 \times n8 + 128 \times n7 + 64 \times n6 + 32 \times n5 + 16 \times n4 + 8 \times n3 + 4 \times n2 + 2 \times n1 + n0.$$

Control info byte 1

Charge pump setting 5I = 0 for all bands.

Improved tuning speed is achieved by 5I = 1 for frequencies higher than channel:
S5 in low band
S29 in mid band
E47 in high band

Control info byte 2

bandswitching	P0	P1	P2	P3	P4	P5	P6	P7
low band	X	X	X	0	0	1	1	0
mid band	X	X	X	0	1	0	1	0
high band	X	X	X	0	1	1	0	0

X = don't care P0 . . . P7: band select outputs

Telegram examples

Start – Adr – Dr1 – Dr2 – Cw1 – Cw2 – Stop
Start – Adr – Cw1 – Cw2 – Dr1 – Dr2 – Stop
Start – Adr – Dr1 – Dr2 – Cw1 – Stop
Start – Adr – Dr1 – Dr2 – Stop

Start = start condition
Dr1 = divider ratio byte 1
Dr2 = divider ratio byte 2
Cw1 = control word byte 1
Cw2 = control word byte 2
Stop = stop condition

DEVELOPMENT DATA

ADDITIONAL INFORMATION

RF AGC setting

The RF AGC must be set such that the IF output level of the tuner (with IF load as stated) does not exceed 107 dB/μV.

IF injection

An IF signal from a generator (internal resistance 50 Ω or 75 Ω) should be connected to the IF injection point TP, accessible through a hole in the cover (see Fig.1) using probe 3139 147 10950.

Tuning supply voltage

A tuning voltage of 33 V must be connected via a series 22 kΩ resistor to pin 11. A preferred method is constant current supply of 1 to 1.5 mA to the pin. Figure 4 shows this with a 140 V supply. The zener diode prevents the voltage at pin 11 exceeding 33 V.

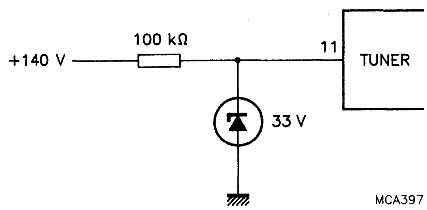


Fig.4 Constant current supply.

UHF/VHF TELEVISION TUNERS

QUICK REFERENCE DATA

Systems	RTMA M and N	
Channels	off-air	cable
low band	2 to 13	A-2 to I
high band	14 to 83	
Intermediate frequencies		
picture	45.75 MHz	
sound	41.25 MHz	
colour	42.17 MHz	

APPLICATION

The UV933/934 tuners belong to the 900 series family of small size tuners which are designed to meet a wide range of applications.

The tuners are available with separate UHF and VHF inputs (75 Ω phono for VHF, 300 Ω balanced for UHF) or with a combined, single 75 Ω input (phono or IEC).

The UV934 is equipped with a built-in digital controlled (I^2C) PLL tuning IC. Band switching is also carried out via the I^2C-bus. The UV933 types are intended for voltage controlled tuning and do not have the PLL synthesizer.

The tuner IF output is designed with low output impedance to directly drive a variety of SAW filters.

Table 1 Available types

type	catalogue number	aerial input connector	tuning system
V933 (note 1)	3122 237 00620	75 Ω phono	0.3 - 28 V
UV933	3122 237 00590	75 Ω phono	0.3 - 28 V
UV933/D	3122 237 00600	75 Ω phono/ 300 Ω balanced	0.3 - 28 V
UV933/IEC (note 2)	3122 237 00610	75 Ω IEC	0.3 - 28 V
UV934	3122 237 00570	75 Ω phono	PLL/I^2C
UV934/D	3122 237 00580	75 Ω phono/ 300 Ω balanced	PLL/I^2C
UV934/IEC (note 2)	3122 237 00640	75 Ω IEC	PLL/I^2C

Notes to Table 1

1. VHF only.
2. Available on special request.

DESCRIPTION

The UV933/934 tuners are combined VHF/UHF units covering the low band (frequency range 55.25 to 211.25 MHz) and the high band (frequency range 471.25 to 885.25 MHz).

The tuners are built on a low-loss printed-wiring board carrying all components and a small vertical printed-wiring board carrying the PLL tuning system components for the UV934. The boards are housed in a sheet-steel housing with separate front and rear covers. The aerial connector (phono, IEC or balanced) is mounted on one side of the frame.

High selectivity is achieved in both low and high bands by means of a tuned aerial circuit and a double tuned bandpass filter separated by a MOSFET RF amplifier.

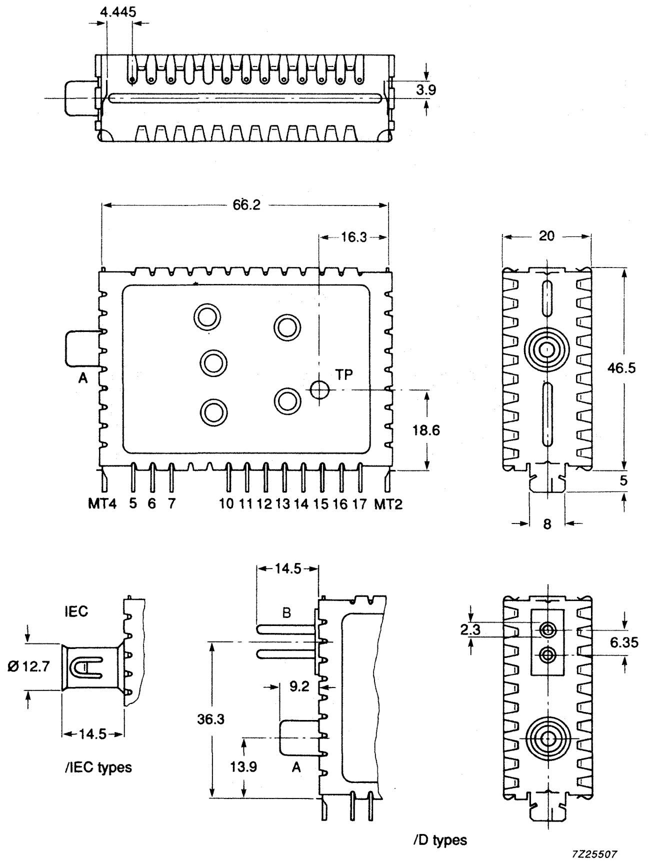
An FM bandstop filter, an IF rejection filter and a combined highpass/CB rejection filter precede the low band section. The mixers and oscillators in both bands are built using bipolar transistors in common-base configuration.

An IF bandpass filter is present between the mixers and the final IF amplifier. The output impedance at the IF output pin is approximately 90 Ω to ensure adequate triple transient suppression in the SAW filter.

The UV934 tuners contain an I^2C-bus controlled phase-locked-loop tuning system enabling direct channel access with crystal controlled accuracy.

MECHANICAL DATA

Dimensions in mm



	UV933 and V933	UV934
A	aerial input	aerial input
B	balanced UHF input (/D types only)	balanced UHF input (/D types only)
5	AGC voltage 9.2 to 0.85 V	AGC voltage 9.2 to 0.85 V
6	supply voltage + 12 V	supply voltage + 12 V
7	VHF switch input (UV933 versions only)	
10	UHF switch input	
11	tuning voltage 0.3 to 28 V	tuning supply voltage (33 V via 22 kΩ series resistor)
12		supply voltage PLL + 5 V
13		SCL serial clock line
14		SDA serial data line
15		address selection input
16	ground	ground
17	IF output	IF output
MT1	mounting tab grounded	mounting tab grounded
MT2	mounting tab grounded	mounting tab grounded

Fig.1 Mechanical detail.

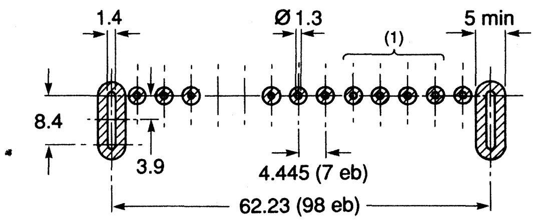
DEVELOPMENT DATA

Mass: approximately 55 grams

Mounting

The tuner may be mounted by soldering it to a printed-wiring board, using the piercing diagram shown in Fig.2 without clearance between the tuner supporting surface and the board. The connecting pins and mounting tabs should be bent in accordance with Fig.3.
The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the pins and mounting tabs is in accordance with IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0.5 s). The resistance to soldering heat is in accordance with IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).



(1) UV934 types only

1 eb = 0.025 inch.

Fig.2 Piercing diagram viewed from solder side of board.

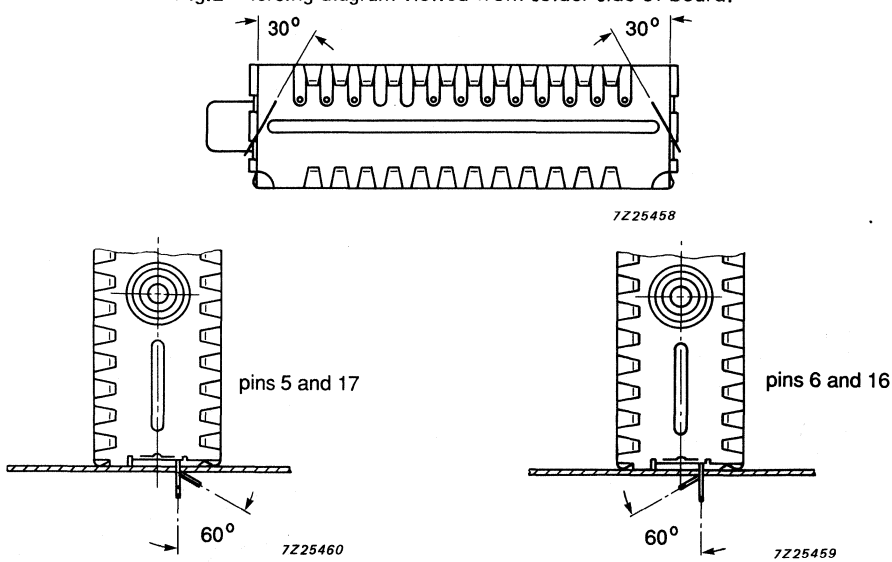


Fig.3 Bending of connecting pins and mounting tabs.

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0.3 V, an AGC voltage of 9.2 ± 0.2 V, a PLL supply voltage of 5 ± 0.3 V and a tuning supply voltage of 33 ± 0.5 V via a 22 kΩ series resistor.

General

Semiconductors, low band	
RF amplifier	BF998
mixer	BFS17
oscillator	BFSS17A
tuning diodes	OF4052
coupling diodes	BB901
Semiconductors, high band	
RF amplifier	BF900A/01
mixer	2SC3841
oscillator	ON4438
tuning diodes	OF643
IF amplifier	BFS17
Tuning/bandswitching IC (UV934 types only)	SP5510 or TSA5510
Tuning voltage transistor (UV934 types only)	BC847B
Ambient temperature range	
operating	−10 °C to + 60 °C
storage	−25 °C to + 85 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltage	+ 12 V ± 10%
PLL supply voltage (UV934 only)	+ 5 V ± 10%
Current drawn	
supply current	max. 50 mA
PLL current	max. 55 mA
Tuning supply voltage	min. 30 V typ. 33 V max. 35 V
Tuning supply current	max. 1.7 mA
Bandswitching voltage (UV933 types only)	+ 12 V ± 10%
Bandswitching current (UV933 types only)	max. 2 mA

DEVELOPMENT DATA

Aerial input characteristics

VSWR referred to 75 Ω/300 Ω impedance	
low band	max. 5
high band	max. 5
Reflection coefficient referred to 75 Ω/300 Ω impedance	
low band	max. 66%
high band	max. 66%
Surfe protection	min. 6 kV
Oscillator voltage at aerial terminal	
54 - 300 MHz	max. 50 dB/μV
300 - 1000 MHz	max. 66 dB/μV
Unbalance of 300 Ω aerial terminal (D versions only)	
up to channel 64	min. 10 dB
channel 70 to channel 83	min. 10 dB

IF output characteristics

IF output impedance (between pins 17 and 16 (ground)	90 Ω
Permitted IF load impedance	min. 1 kΩ max. 22 pF

Frequency range

Low band	channel 2 (picture carrier 55.25 MHz) to channel 13 (picture carrier 211.25 MHz). Margin at extreme channels: min. 1 MHz.
High band	channel 14 (picture carrier 471.25 MHz) to channel 83 (picture carrier 885.25 MHz). Margin at extreme channels: min. 1 MHz.

Wanted signal characteristics

Voltage gain	
all channels	min. 38 dB max. 50 dB
gain difference of off-air channels	max. 8 dB
Noise figure	
low band off air channels 2 and 6	typ. 8 dB max. 10 dB
low band, all other off-air channels	typ. 6.5 dB max. 8 dB
high band up to channel 69	typ. 9 dB max. 10 dB
high band channels 70 to 83	typ. 10 dB max. 12 dB
AGC range	
low band	min. 45 dB
high band	min. 30 dB

Overloading	
input signal producing a gain compression of 1 dB	min. 74 dB/μV
input signal producing oscillator detuning of + 300/−1000 kHz	
low band	min. 90 dB/μV
high band	min. 80 dB/μV
input signal causing the PLL to fail to lock to desired signal	
low band	min. 90 dB/μV
	typ. 100 dB/μV
high band	min. 90 dB/μV
	typ. 100 dB/μV
Image rejection (between 0 and 10 dB gain reduction)	
low band	min. 65 dB
high band	min. 50 dB
IF rejection	
channel 2	min. 50 dB
	typ. 55 dB
channel 3	min. 55 dB
	typ. 60 dB
all other channels	min. 60 dB
Channel 6 beat rejection	min. 50 dB
CB susceptibility	min. 108 dB/μV

Amplitude response curves

Tilt of overall response

At any channel the amplitude differences between:

Off-air channels	
top of response curve and picture	max. 4 dB
top of response curve and sound carrier	min. 0.5 dB
	max. 6 dB
valley	max. 1 dB
sound carrier above picture carrier	max. 3 dB

IF response

Amplitude difference between:

top of response curve and picture carrier	max. 1 dB
top of response curve and sound carrier	max. 1 dB

DEVELOPMENT DATA

Unwanted signal characteristics

Break through susceptibility	min. 60 dB/μV

Cross modulation

The undesired carrier level required to produce 1% transfer of its modulation onto the desired carrier shall be equal to or exceed the desired carrier level (60 dB/μV at nominal gain) for all gain values between maximum gain and 40 dB (low band) or 30 dB (high band) reduction or be:

In channel low band	min. 66 dB/μV
high band	min. 66 dB/μV
In band N ± 2 low band	min. 78 dB/μV
In band N ± 5 high band	min. 84 dB/μV
Out of band	typ. 100 dB/μV
FM rejection	
at channel 6 (90.5 MHz, antenna level 60 dB/μV)	min. 50 dB
at channel 6 (93 to 108 MHz, antenna level 90 dB/μV)	min. 50 dB

Oscillator characteristics (UV933 types only)

Drift of oscillator frequency

Warm up (tuner on-off, bandswitching)	
low band	max. 250 kHz
high band, up to channel 69	max. 250 kHz
high band, channel 70 to 83	max. 500 kHz
Change of ambient temperature 25 ± 25 °C	
low band	max. 500 kHz
high band	max. 1000 kHz
Change of humidity 60% to 93% ± 2%	
low band	max. 500 kHz
high band, up to channel 69	max. 1000 kHz
high band, channels 70 to 83	max. 1500 kHz
Shift of oscillator frequency at a change of supply voltage of 5%	
low band	max. 250 kHz
high band up to channel 69	max. 500 kHz
high band, channels 70 to 83	max. 750 kHz
during AGC	max. 150 kHz
Pulling (10 kHz)	min. 74 dB/μV

PLL tuning characteristics (UV934 types only)

PLL tuning resolution	max. 62.5 kHz

Deviation from nominal of the locked oscillator frequency under any combination of the operation conditions: 50^{-6}.

Miscellaneous

Radio interference

When the tuner is mounted in a television chassis in such a way as to reduce chassis radiation to a minimum, the radiated signal shall be:

channels 2 to 6	max. 50 μV/m
channels 7 to 13	max. 150 μV/m
channels 14 to 69 any single frequency	max. 750 μV/m
average of any 10 individual frequencies	max. 350 μV/m

Microphonics

With the tuner exposed to sound signals in the audio frequency range 100 Hz to 10 kHz and sound pressure levels up to 105 dB (20 μPa), the video signal to sound interference ratio will be:

min. 40 dB

Oscillator voltage at the pins

supply and control pins	max. 60 dB/μV
IF terminals - low band	max. 85 dB/μV
IF terminals - high band	max. 80 dB/μV

ESD protection at the pins

All pins of the tuner are protected against electrostatic discharge up to 2 kV.

The product is classified in category B (MIL-STD-883C).

APPLICATION INFORMATION

For information regarding general aspects of I^2C-bus control refer to:
" The I^2C bus specification ", published by Philips Components.

I^2C-bus requirements (SDA and SCL pins)

$V_{IL(max)}$ = 1.5 V (maximum input LOW voltage)
$V_{IH(min)}$ = 3.0 V (minimum input HIGH voltage)
$I_{IL(max)}$ = −10 μA (maximum LOW input current)
$I_{IH(max)}$ = 10 μA (maximum HIGH input current)
$V_{OL(max)}$ = 0.4 V (maximum output LOW voltage at 3 mA sink current)

Logic diagram (WRITE mode, R/$\overline{W}$ = 0)

	MSB							LSB
Address byte	1	1	0	0	0	MA1	MA0	R/$\overline{W}$
Prog. div. byte 1	0	n14	n13	n12	n11	n10	n9	n8
Prog. div. byte 2	n7	n6	n5	n4	n3	n2	n1	n0
Control byte 1	1	5I	T1	T0	1	1	1	0
Control byte 2	P7	P6	P5	P4	P3	P2	P1	P0

Address selection

MA1	MA0	Address	Voltage at pin 15
0	0	C0	0 to 0.1 V PLL
0	1	C2	irrelevant*
1	0	C4	0.4 to 0.6 V PLL
1	1	C6	0.9 V PLL to 13.5 V

The UV934 types have pin 15 (address input) biased internally using a 47 kΩ resistor to B+ (+ 12 V). Therefore, with pin 15 open circuit, the tuner will respond to address C2 and C6.

* The tuner will always respond to address C2. The second address will depend on the voltage applied at pin 15.

Programmable divider setting (bytes 1 and 2)

Divider ratio: $N = 16 \times (f_{rf}, pc\ (MHz) + f_{if}, pc\ (MHz))$
$f_{osc} = N/16\ (MHz)$

$N = 16384 \times n14 + 8192 \times n13 + 4096 \times n12 + 2048 \times n11 + 1024 \times n10 + 512 \times n9 + 256 \times n8 + 128 \times n7 + 64 \times n6 + 32 \times n5 + 16 \times n4 + 8 \times n3 + 4 \times n2 + 2 \times n1 + n0$

Control byte 1

Charge pump (CP) setting: CP can be set to either logic 0 (low current) or logic 1 (high current). CP = 1 results in faster tuning, CP = 0 in moderate tuning speed with slightly better residual oscillator FM.

Test mode setting: T1, T0 = 0 for normal operation.

PLL disabling: OS = 0 for normal operation
OS = 1 switches the charge pump transistor to the non-conductive state, enabling the tuner to be manually tuned by applying a variable tuning voltage to pin 11. When selecting OS to logic 1 it is recommended to simultaneously set T0 to logic 1.

Control byte 2

Bandswitching

	P0	P1	P2	P3	P4	P5	P6	P7
low band	x	x	x	0	0	1	1	x
high band	x	x	x	0	1	1	0	x

x = don't care
P0 to P7: output ports on PLL device

P3 must be programmed with 0 since the address voltage is applied at this combined input/output port.

DEVELOPMENT DATA

Telegram examples (WRITE mode)

Start	ADD	ACK	DIV1	ACK	DIV2	ACK	CB1	ACK	CB2	ACK	Stop

Start	ADD	ACK	DIV1	ACK	DIV2	ACK	DIV1	ACK	Stop

Start	ADD	ACK	DIV1	ACK	DIV2	ACK	Stop

Start	ADD	ACK	CB1	ACK	CB2	ACK	Stop

Start	ADD	ACK	CB1	ACK	CB2	ACK	DIV1	ACK	Stop

Start = start condition
ADD = address
ACK = acknowledge
DIV1 = divider ratio byte 1
DIV2 = divider ratio byte 2
CB1 = control byte 1
CB2 = control byte 2
Stop = stop condition

Logic diagram (READ mode, R/$\overline{W}$ = 1)

	MSB							LSB
Address byte	1	1	0	0	0	MA1	MA0	R/$\overline{W}$
Status byte	POR	FL	I2	I1	I0	A2	A1	A0

FL indicates when the tuning loop of the PLL to be in lock. The loop must be phase-locked for at least 8 periods of the internal 7.8125 kHz reference frequency (i.e. 1 ms) before the FL flag is set to logic 1.

POR (power on reset) is internally set to logic 1 if the PLL voltage drops below 3 V. The POR bit is reset when an end-of-data is detected by the PLL IC.

I0 to I2 and A0 to A2 do not contain any relevant data for the tuner application and can be ignored.

Telegram examples (READ mode)

Start	ADD	ACK	STB	ACK	STB		Stop	⇒ from processor

no Acknowledge = end-of-data

Start	ADD	ACK	STB		Stop	⇒ from PLL

Start = Start condition
ADD = Address
ACK = Acknowledge
STB = Status byte
Stop = Stop condition

ADDITIONAL INFORMATION

RF AGC setting

The RF AGC must be set such that the IF output level of the tuner (with IF load as stated) does not exceed 107 dB/μV.

IF injection

An IF signal from a generator (internal resistance 50 Ω or 75 Ω) should be connected to the IF injection point TP, accessible through a hole in the cover (see Fig.1) using probe 3139 147 10950.

Tuning supply voltage

A tuning voltage of 33 V must be connected via a series 22 kΩ resistor to pin 11. A preferred method is constant current supply of 1 to 1.5 mA to the pin. Figure 4 shows this with a 140 V supply. The zener diode prevents the voltage at pin 11 exceeding 33 V.

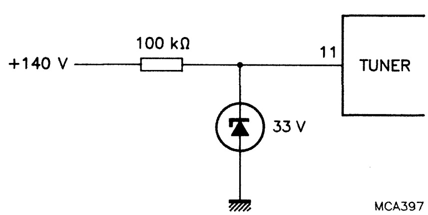


Fig.4 Constant current supply.

VHF/UHF TELEVISION TUNERS

QUICK REFERENCE DATA

Systems	RTMA systems M and N
Channels	
VHF	channels 2 to 6, channels 7 to 13
UHF	channels 14 to 69
CATV	channels A-2 to 65
Intermediate frequencies	
picture	45.75 MHz
sound	41.25 MHz
colour	42.17 MHz

APPLICATION

The tuners are designed to cover all frequencies in the range ch 2 (55.25 MHz) to ch 69 (801.25 MHz) of RTMA systems M and N.

The IF output is designed to directly drive a variety of SAW filters. The UV936 tuner is equipped with an I^2C-bus for digital programmable phase-locked-loop frequency synthesis with crystal accuracy. Bandswitching is also carried out via the I^2C-bus.

The UV935 tuner is designed for voltage controlled tuning and does not have the PLL tuning system.

The tuners comply with the requirements of radiation, signal handling capability and immunity of the FCC.

Table 1 Available versions

type	aerial connector	tuning method	catalogue number
UV935	phono	0.3 - 28 V	3139 147 11010
UV935/IEC (note 1)	IEC (14.5 mm)	0.3 - 28 V	
UV936	phono	PLL/I^2C	3139 147 10381
UV936/IEC (note 1)	IEC (14.5 mm)	PLL/I^2C	

Note to Table 1

1. Available on special request only.

DESCRIPTION

The UV935 and UV936 tuners are combined VHF/UHF tuners with electronic tuning and band switching. The tuners cover the low band (frequency range 55.25 to 157.25 MHz), the mid band (frequency range 163.25 to 451.25 MHz) and the high band (frequency range 457.25 to 801.25 MHz).

The tuners are built on a low-loss printed-wiring board carrying all components in a metal housing with front and rear covers.

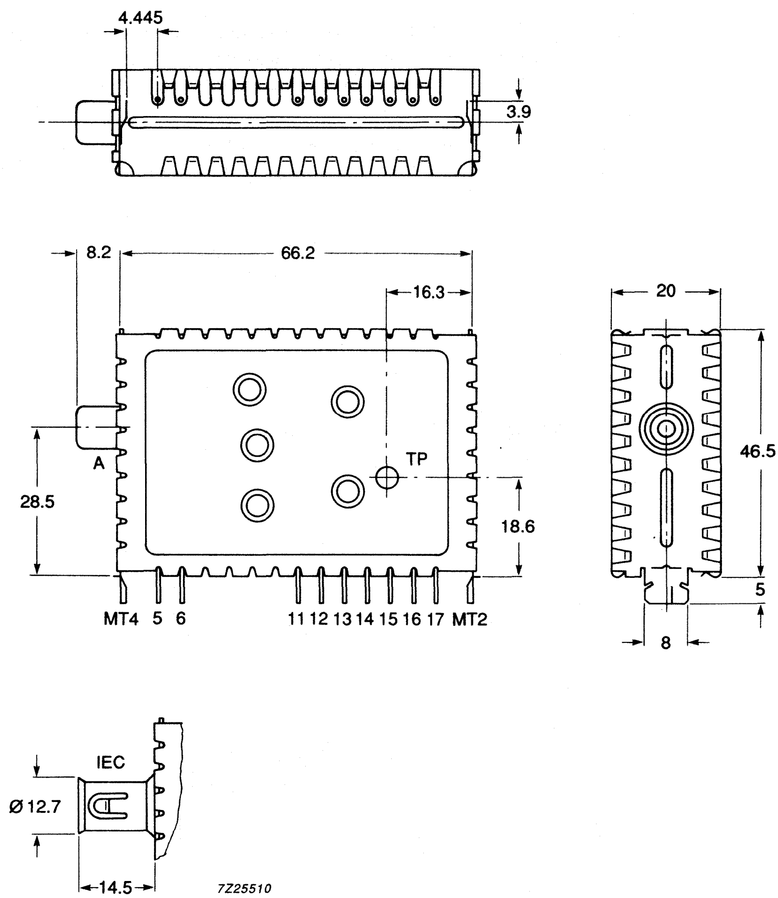
The tuners are equipped with a common phono aerial input and provided with three tuned RF MOSFET input stages. The mixers and oscillators (bands I, II and III) and IF amplifiers are biased for high signal handling capabilities. Between the mixers and the IF amplifier, a double tuned IF filter is provided to improve IF selectivity and to maintain a flat response for the desired frequencies.

The low output impedance of the asymmetrical IF terminals ensures sufficient triple transient suppression of the SAW filter.

The UV936 tuner is provided with a digital programmable (I^2C) phase-locked-loop tuning system. This enables tuning with a 62.5 kHz pitch with crystal accuracy. Band switching is also carried out via the I^2C-bus.

MECHANICAL DATA

Dimensions in mm



Pin/connector identity	UV935	UV936
A	Aerial input (phono)	Aerial input
5	AGC voltage (9.2 - 0.85 V)	AGC voltage (9.2 - 0.85 V)
6	Supply voltage B+ (+ 12 V)	Supply voltage B+ (+ 12 V)
11	Tuning supply (0.3 - 28 V)	Tuning supply (33 V via 22 kΩ series resistor)
12		Supply voltage PLL + 5 V
13		SCL serial clock line } I^2C-bus
14		SDA serial data line } I^2C-bus
15		Address select input
16	Ground	Ground
17	IF output	IF output
MT2, MT4	Mounting tabs, grounded	Grounded

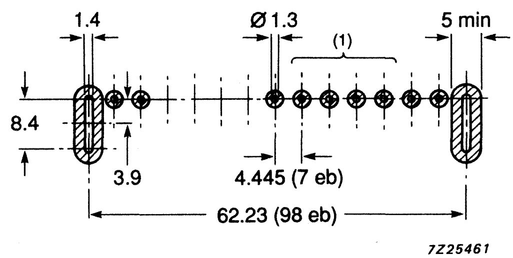
Fig.1 Mechanical diagram.

Mass: approximately 80 grams

Mounting

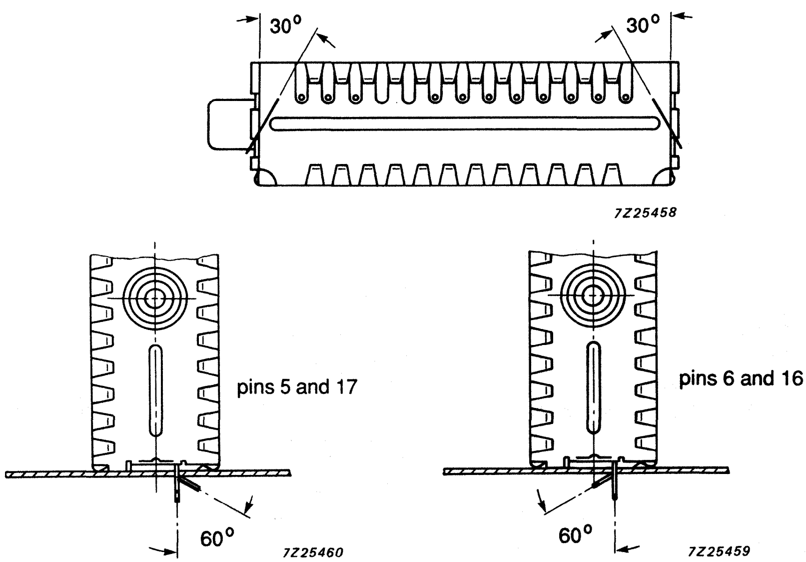
The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig.2 without clearance between the tuner supporting surface and the board. The connecting pins should be bent according to Fig.3. The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

The solderability of the pins and mounting tabs is in accordance with IEC 68-2-20, test Ta ($230 \pm 10\ ^{o}C$, 2 ± 0.5 s). The resistance to soldering heat is in accordance with IEC 68-2-20 test Tb ($260 \pm 5\ ^{o}C$, 10 ± 1 s).



(1) UV936 only.
1 eb = 0.025 inch.

Fig.2 Piercing diagram viewed from solder side of board.



Note: In order to prevent any stress to the printed-wiring board, the tuner should be supported at its aerial connector.

Fig.3 Bending of connecting pins and mounting tabs.

ELECTRICAL DATA

Unless otherwise stated all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0.3 V, an AGC voltage of 9.2 ± 0.2 V, a PLL supply voltage of 5 ± 0.3 V and a tuning supply voltage of 33 ± 0.5 V via a 22 kΩ series resistor.

General

Semiconductors, low band	
RF amplifier	BF990A/01R
mixer	2SC2480
oscillator	BFS17
tuning diodes	OF612
coupling diodes	OF643
Semiconductors, mid band	
RF amplifier	BF998R
mixer	2SC2480
oscillator	2SC3545
tuning diodes	OF612
coupling diodes	OF612
Semiconductors, high band	
RF amplifier	BF990A/01R
mixer	2SC3841
oscillator	2SC2757
tuning diodes	OF643
IF amplifier	BF817
PLL tuning IC	TSA 5510T
Charge pump buffer transistor (npn)	BC847B
Ambient temperature range	
operating	−10 to + 60 °C
storage (non-operational)	−25 to + 85 °C
Relative humidity	
operating	max. 95%
non-operating	max. 100%

Voltages and currents

Supply voltage	
tuner	12 V ± 10%
PLL	5 ± 10%
Tuner ripple susceptability (peak-to-peak value)	max. 20 mV
PLL ripple susceptability (peak-to-peak value)	max. 20 mV
Supply current	
tuner	max. 50 mA
PLL	max. 70 mA
AGC voltage	
voltage range	+ 0.85 to + 9.2 V
AGC current	max. 1 μA
AGC source impedance	10 kΩ

DEVELOPMENT DATA

ELECTRICAL DATA (continued)

Voltages and currents (continued)

Tuning supply voltage (note 1)	min. 30 V typ. 33 V max. 35 V
Ripple amplitude on tuning supply	max. 10 mV (p-p)
Tuning supply current	max. 1.7 mA

Frequencies

Frequency ranges	
low band	channel 2 (picture carrier 55.25 MHz) to channel G (picture carrier 157.25 MHz). Margin at extreme channels: min. 1.5 MHz
mid band	channel H (picture carrier 162.000 MHz) to channel CC (picture carrier 451.25 MHz). Margin at extreme channels: min. 3.0 MHz
high band	channel AAA (picture carrier 457.25 MHz) to channel 69 (picture carrier 801.25 MHz). Margin at extreme channels: min. 3.0 MHz
Intermediate frequencies	
picture	45.75 MHz
sound	41.25 MHz
colour	42.17 MHz

Wanted signal characteristics

Input impedance	75 Ω
VSWR and reflection coefficient (worst case on or between picture and sound carrier at maximum gain)	
VSWR (all channels)	max. 6
reflection coefficient	max. 66%
RF curves bandwidth	
channels 2 - 6, A-2 - I, 7 - 13	min. 5 MHz max. 13 MHz
channels J - EEE, 14 - 69	min. 5 MHz max. 18 MHz
RF curves, tilt:	
at any channel the amplitude difference between:	
— top of response curve and picture carrier	max. 4 dB
— top of response curve and sound carrier	max. 6 dB
— valley	max. 1.5 dB

Note

1. An external pull-up resistor of 22 kΩ ± 5% must be connected between the tuning supply and terminal 11. The tuning supply current is 1.7 mA.

AGC range	
VHF off-air channels	min. 45 dB
cable channels	min. 35 dB
UHF off-air channels	min. 30 dB
Voltage gain	min. 38 dB
	max. 50 dB
Maximum gain difference	max. 8 dB
Noise figure	
low band channels 2 and 6	max. 8 dB
low band other channels	max. 7 dB
mid band channels H and I	max. 10 dB
mid band other channels	max. 8 dB
high band	max. 10 dB
Overloading	
input signal producing 1 dB compression at nominal gain	
VHF/UHF off-air channels	min. 74 dB/μV
PLL lockout	
input signal producing either a detuning of the oscillator of + 300 kHz or —1000 kHz or stopping the oscillations at nominal gain	
off-air channels	min. 100 dB/μV
cable channels	min. 86 dB/μV

Unwanted signal characteristics

Image rejection (maximum gain)	
channels 2 - 6, A-2 - I, 7 - 13	min. 60 dB
channels J - EEE, 14 - 69	min. 45 dB
IF rejection (measured at picture carrier frequency)	
channel 2	typ. 55 dB
	min. 50 dB
channel 3	typ. 60 dB
	min. 55 dB
all other channels	min. 60 dB

Cross modulation

The undesired carrier level required to produce 1% modulation on the desired carrier shall be equal to or exceed the desired carrier level for all gain values between maximum gain and —40 dB (VHF), —30 dB (UHF) gain reduction or be:

in band N ± 2: channels 2 - W	min. 78 dB/μV
in band N ± 3: channels AA - ZZ	min. 78 dB/μV
in band N ± 5: channels AAA - 69	min. 84 dB/μV

PLL tuning characteristics

The oscillator is tuned with a 62.5 kHz pitch.

Stability of the oscillator under any operational conditions	
all channels	max. 40 ppm
Channel 69 oscillator resolution	max. 62.5 kHz
Tuning response time (charge pump is set high)	max. 100 ms

ELECTRICAL DATA (continued)

PLL tuning characteristics (continued)

Oscillator voltage at terminals	
IF output - channels 2, 3 and 4	max. 94 dB/μV
IF output - all other channels	max. 84 dB/μV
all other terminals	max. 70 dB/μV

IF output characteristics

IF output impedance (between pins 16 (ground) and 17) at 43.96 MHz	typ. 75 Ω
IF load impedance	max. 1 kΩ/22 pF

The total capacitance loading at the IF terminals must be tuned at the IF centre frequency by means of a coil between pins 16 (ground) and 17 (minimum value: 750 nH).

Miscellaneous

Radio interference

The tuner must be mounted in the television chassis in such a manner as to reduce chassis radiation to a minimum. Measurements made in accordance with IEEE standard procedure RS 207 and 54IRE 17, S1.

Channels 2 - 6		max. 50 μV/m
Channels 7 - 13		max. 150 μV/m
Channels 14 - 69	any single frequency	max. 750 μV/m
	average of 10 individual frequencies	max. 350 μV/m

Immunity (RF ingress)

In the field of a synchronous television signal having measured field strength of 100 mV/m and the input terminated in 75 Ω load with a quarter wave stub, the IF output shall be at least 40 dB below the level of a 1 mV reference signal applied to the aerial input. In the field of a non-synchronous television signal the IF output shall be at least 55 dB below the reference signal.

Microphonics

For sound signals in the audio frequency range 100 Hz to 10 kHz with sound pressure levels up to 105 dB (20 μPa) the video signal to sound interference ratio will be min. 40 dB.

ESD protection

All the terminals of the tuner are protected against electrostatic discharge up to 2 kV.

The product is classified in category B (MIL-STD-883C).

DEVELOPMENT DATA

APPLICATION INFORMATION

For further information regarding general aspects of I^2C-bus control refer to:
"The I^2C-bus specification", published by Philips Components.

I^2C-bus requirements (SDA and SCL pins)

$V_{IL(max)}$	= 1.5 V	(maximum input LOW voltage)
$V_{IH(min)}$	= 3.0 V	(minimum input HIGH voltage)
$I_{IL(max)}$	= −10 μA	(maximum LOW level input current)
$I_{IH(max)}$	= 10 μA	(maximum HIGH level input current)
$V_{OL(max)}$	= 0.4 V	(maximum output LOW voltage at 3 mA sink current)

Programming description

For I^2C programming, there is one module address (7 bits) and the R/$\overline{W}$ bit for selecting READ or WRITE mode.

1	1	0	0	0	MA1	MA0	R/$\overline{W}$

Logic diagram

	MSB							LSB
Address byte	1	1	0	0	0	MA1	MA0	0
Prog. div. byte 1	0	n14	n13	n12	n11	n10	n9	n8
Prog. div. byte 2	n7	n6	n5	n4	n3	n2	n1	n0
Control byte 1	1	5I	T1	T0	1	1	1	0
Control byte 2	P7	P6	P5	P4	P3	P2	P1	P0

Address selection

active address	voltage at terminal 15	MA1	MA0
C0	0 . . . . 0.1 V PLL	0	0
C2	don't care	0	1
C4	0.4 . . . . 0.6 V PLL	1	0
C6	0.9 . . . . 1.1 V PLL	1	1

Programmable divider setting

Divider ratio: $N = 16 \times [f_{RF,}\ \text{pc (MHz)} + f_{IF,}\ \text{pc (MHz)}]$
$f_{OSC} = N/16$ (MHz)

$N = 16384 \times n14 + 8192 \times n13 + 4096 \times n12 + 2048 \times n11 + 1024 \times n10 + 512 \times n9 + 256 \times n8 +$
$+ 128 \times n7 + 64 \times n6 + 32 \times n5 + 16 \times n4 + 8 \times n3 + 4 \times n2 + 2 \times n1 + n0$

APPLICATION INFORMATION (continued)

Control byte 1

Charge pump setting 5I = 0 for all bands.
Test mode setting T1, T0 = 0 for normal operation.

Control byte 2

bandswitching	P0	P1	P2	P3	P4	P5	P6	P7
band I	X	X	X	0	0	1	1	0
band II	X	X	X	0	1	0	1	0
band III	X	X	X	0	1	1	0	0

X = don't care   P0 . . . . P7: band selection outputs

P7 is used to switch-off the charge pump transistor during alignment. P3 must be programmed to logic 0, as the address voltage is applied at this port.

Telegram examples WRITE mode

Start – ADD – ACK – DIV1 – ACK – DIV2 – ACK – CB1 – ACK – CB2 – ACK – Stop
Start – ADD – ACK – DIV1 – ACK – DIV2 – ACK – CB1 – ACK – CB2 – ACK – Stop
Start – ADD – ACK – DIV1 – ACK – DIV2 – ACK – DIV1 – ACK – Stop
Start – ADD – ACK – DIV1 – ACK – DIV2 – ACK – Stop
Start – ADD – ACK – CB1 – ACK – CB2 – ACK – Stop
Start – ADD – ACK – CB1 – ACK – CB2 – ACK – DIV1 – ACK – Stop

Start = start condition
ADD = address
ACK = acknowledge
DIV1 = divider ratio byte 1
DIV2 = divider ratio byte 2
CB1 = control byte 1
CB2 = control byte 2
Stop = stop condition

Read mode (R/$\overline{W}$ = 1)

Logic diagram

	MSB							LSB
Address byte	1	1	0	0	0	MA1	MA0	1
Status byte	POR	FL	I2	I1	I0	A2	A1	A0

FL is set to 1 when the tuning loop is in lock.

POR (power-on-reset) is intentionally set to 1 in case V PLL drops below 3 V. The POR bit is reset when an end-of-data is detected by the PLL IC.

I0 to I2 and A0 to A2 do not contain any relevant data and can be ignored.

Telegram examples READ mode

Start – ADD – ACK – STB – ACK – STB – Stop ----- From processor

Start – ADD – ACK – STB – Stop ----- From PLL

Start = start condition
ADD = address
ACK = acknowledge
STB = status byte
Stop = stop condition

ADDITIONAL INFORMATION

RF AGC setting

The RF AGC must be set such that the IF output level of the tuner (with IF load as stated) does not exceed 107 dB/μV.

IF injection

An IF signal from a generator (internal resistance 50 Ω or 75 Ω) should be connected to the IF injection point TP, accessible through a hole in the cover (see Fig.1) using probe 3139 147 10950.

Tuning supply voltage

A tuning voltage of 33 V must be connected via a series 22 kΩ resistor to pin 11. A preferred method is constant current supply of 1 to 1.5 mA to the pin. Figure 4 shows this with a 140 V supply. The zener diode prevents the voltage at pin 11 exceeding 33 V.

DEVELOPMENT DATA

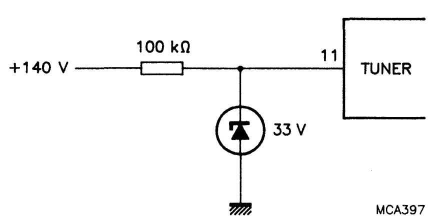


Fig.4 Constant current supply.

UHF/VHF TELEVISION TUNERS

QUICK REFERENCE DATA

Systems	CCIR systems B, G and H
Channels	
low band	0 to 5
mid band	5A to 12
high band	21 to 69
Intermediate frequencies	
picture	38.875 MHz
colour	32.441 MHz
sound 1	31.375 MHz
sound 2	31.133 MHz

APPLICATION

The UV963/964 tuners belong to the 900 series of small size tuners which are designed to meet a wide range of applications.

The UV964 is equipped with a built-in digital controlled (I^2C) PLL tuning IC. Band switching is also carried out via the I^2C-bus. The UV963 types are intended for voltage controlled tuning and do not have the PLL synthesizer.

The tuner IF output is designed with low output impedance to directly drive a variety of SAW filters.

These tuners comply the radiation, signal handling and immunity requirements of CISPR 13 (1973) including amendment (1983) and Australian standard AS2839.1 (1986).

Table 1 Available versions

type	aerial connector	tuning method	catalogue number
UV963	phono	0.3 V - 28 V	
UV963/IEC (note 1)	IEC (14.5 mm)	0.3 V - 28 V	
UV963/L (note 1)	IEC (32.2 mm)	0.3 V - 28 V	
UV964	phono	PLL/I^2C	
UV964/IEC (note 1)	IEC (14.5 mm)	PLL/I^2C	
UV964/L (note 1)	IEC (32.2 mm)	PLL/I^2C	

Note to Table 1

1. Available on special request.

DESCRIPTION

The UV963/964 tuners are combined VHF/UHF units covering the low band (frequency range 46.25 to 102.25 MHz), the mid band (frequency range 138.25 to 224.25 MHz) and the high band (frequency range 471.25 to 855.25 MHz).

The tuners are built on a low-loss printed-wiring board carrying all components and are housed in a sheet steel housing with separated front and rear covers. The aerial connector (phono or IEC) is mounted on one side of the frame.

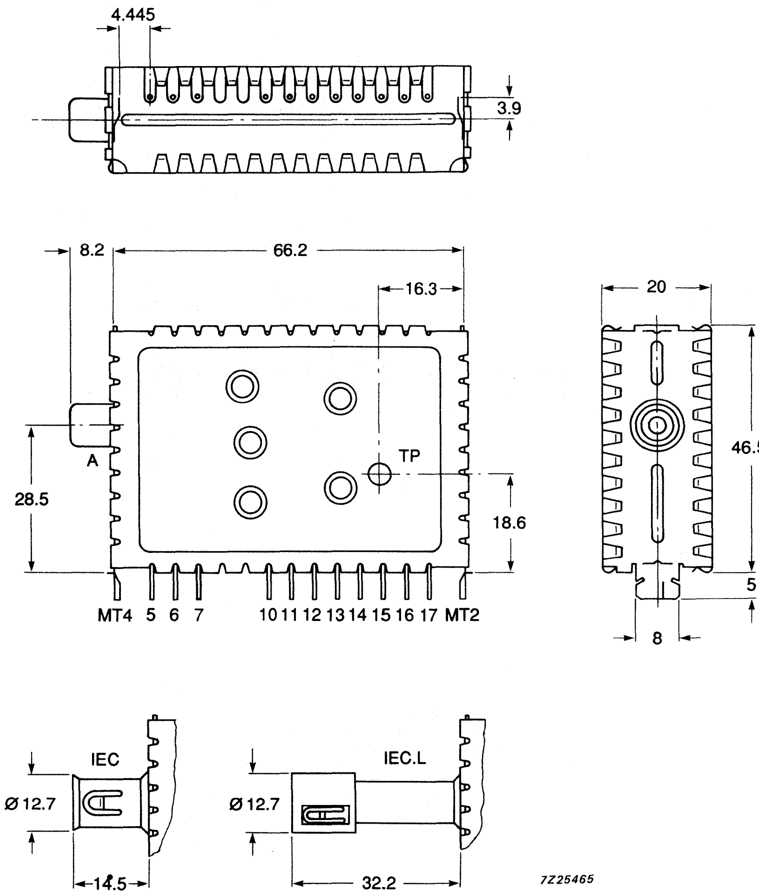
The tuners are equipped with a common aerial input connector (IEC or phono) and are provided with three tuned RF MOSFET input stages. The mixers and oscillators (bands I, II and III) and IF oscillators are biased for high signal handling capabilities.
Between the mixers and the IF amplifier, a double tuned IF filter is provided to improve IF selectivity and to maintain a flat response for the desired frequencies.

The low output impedance of the asymmetrical IF output ensures sufficient triple transient suppression of the SAW filter.

The UV964 tuners contains an I^2C-bus controlled phase-locked-loop tuning system enabling direct channel access with crystal controlled accuracy. Band switching is also carried out via the I^2C-bus.

MECHANICAL DESCRIPTION

Dimensions in mm



	UV963	UV964
A	aerial input	aerial input
5	AGC voltage 9.2 to 0.85 V	AGC voltage 9.2 to 0.85 V
6	supply voltage + 12 V	supply voltage + 12 V
7	VHF switch input	
10	UHF switch input	
11	tuning voltage 0.3 to 28 V	tuning supply voltage (33 V via 22 kΩ series resistor)
12		supply voltage PLL + 5 V
13		SCL serial clock line
14		SDA serial data line
15		address selection input
16	ground	ground
17	IF output	IF output
MT1	mounting tab grounded	mounting tab grounded
MT2	mounting tab grounded	mounting tab grounded

Fig.1 Mechanical detail.

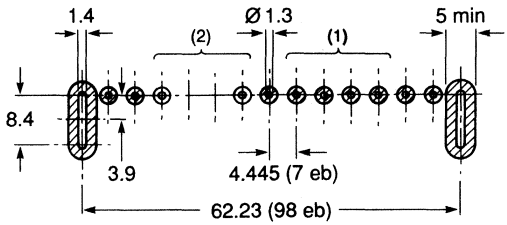
DEVELOPMENT DATA

Mass: approximately 55 grams

Mounting

The tuner may be mounted by soldering it to a printed-wiring board, using the piercing diagram shown in Fig.2 without clearance between the tuner supporting surface and the board. The connecting pins and mounting tabs should be bent in accordance with Fig.3.
The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

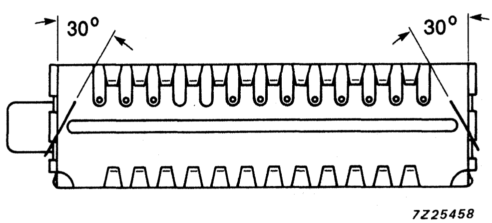
The solderability of the pins and mounting tabs is in accordance with IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0.5 s). The resistance to soldering heat is in accordance with IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

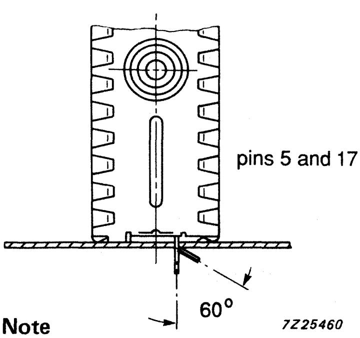


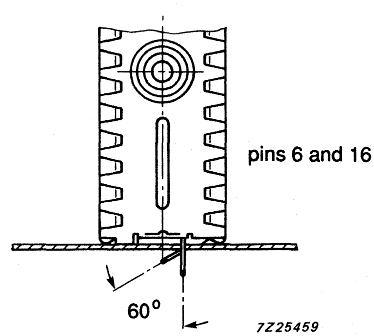
(1) UV964 types only
(2) UV963 types only

1 eb = 0.025 inch.

Fig.2 Piercing diagram viewed from solder side of board.







Note

In order to prevent any stress to the printed-wiring board, the tuner should be supported at its aerial connector.

Fig.3 Bending of connecting pins and mounting tabs.

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0.3 V, an AGC voltage of 9.2 ± 0.2 V, a PLL supply voltage of 5 ± 0.3 V and a tuning supply voltage of 33 ± 0.5 V via a 22 kΩ series resistor.

General

Semiconductors, low band	
RF amplifier	BF998
mixer	BFS17
oscillator	BFSS17A
tuning diodes	OF4052
coupling diodes	BB901
Semiconductors, high band	
RF amplifier	BF900A/01
mixer	2SC3841
oscillator	ON4438
tuning diodes	OF643
IF amplifier	BFS17
Tuning/bandswitching IC (UV964 types only)	SP5510 or TSA5510
Tuning voltage transistor (UV964 types only)	BC847B
Ambient temperature range	
operating	−10 °C to + 60 °C
storage	−25 °C to + 85 °C
Relative humidity	max. 95%

Voltages and currents

Supply voltage	+ 12 V ± 10%
PLL supply voltage (UV964 only)	+ 5 V ± 10%
Current drawn	
supply current	max. 50 mA
PLL current	max. 55 mA
Tuning supply voltage (UV964 only)*	min. 30 V typ. 33 V max. 35 V
Tuning supply voltage (UV963 only)	0.3 to 28 V
Tuning supply current	max. 1.7 mA
Bandswitching voltage (UV963 types only)	+ 12 V ± 10%
Bandswitching current (UV963 types only)	max. 2 mA

* Via 22 kΩ series resistor.

Aerial input characteristics

VSWR referred to 75 Ω impedance	
low band	max. 4
mid band	max. 4
high band	max. 4
Reflection coefficient referred to 75 Ω impedance	
low band	max. 60%
mid band	max. 60%
high band	max. 60%
Surge protection	min. 6 kV
Oscillator voltage at aerial terminal	
54 - 300 MHz	max. 50 dB/μV
300 - 1000 MHz	max. 66 dB/μV

IF output characteristics

IF output impedance (between pins 17 and 16 (ground))	90 Ω
Permitted IF load impedance	min. 1 kΩ max. 22 pF

Frequency range

Low band	channel 0 (picture carrier 46.25 MHz) to channel 5 (picture carrier 102.25 MHz). Margin at extreme channels: min. 1 MHz.
Mid band	channel 5A (picture carrier 138.25 MHz) to channel 12 (picture carrier 224.25 MHz). Margin at extreme channels: min. 1 MHz.
High band	channel 21 (picture carrier 471.25 MHz to channel 69 (picture carrier 855.25 MHz). Margin at extreme channels: min. 1 MHz.

Wanted signal characteristics

Voltage gain	
all channels	min. 38 dB max. 50 dB
gain difference of off-air channels	max. 8 dB
Noise figure	
low band	max. 8 dB
mid band	max. 8 dB
high band	max. 11 dB
AGC range	
low and mid bands	min. 40 dB
high band	min. 30 dB

Overloading	
input signal producing a gain compression of 1 dB	min. 74 dB/μV
input signal producing oscillator detuning of + 300/−1000 kHz	
low band	min. 90 dB/μV
high band	min. 80 dB/μV
input signal causing the PLL to fail to lock to desired signal	
low band	min. 90 dB/μV
	typ. 100 dB/μV
high band	min. 90 dB/μV
	typ. 100 dB/μV
Image rejection (between 0 and 10 dB gain reduction)	
low band	typ. 66 dB
mid band	typ. 66 dB
high band	min. 53 dB
IF rejection	
channel 0	min. 50 dB
other channels	min. 60 dB

Amplitude response curves

Tilt of overall response

At any channel the amplitude differences between:

Off-air channels	
top of response curve and picture	max. 4 dB
top of response curve and sound carrier	min. 0.5 dB
	max. 6 dB
valley	max. 1 dB
sound carrier above picture carrier	max. 3 dB

IF response

Amplitude difference between:	
top of response curve and picture carrier	max. 1 dB
top of response curve and sound carrier	max. 1 dB

Unwanted signal characteristics

Break through susceptibility	min. 60 dB/μV

Cross modulation

The undesired carrier level required to produce 1% transfer of its modulation onto the desired carrier shall be equal to or exceed the desired carrier level (60 dB/μV at nominal gain) for all gain values between maximum gain and 40 dB (low band) or 30 dB (high band) reduction or be:

In channel low band	min. 70 dB/μV
In band N ± 2 low band	min. 80 dB/μV
In band N ± 3 mid band	min. 80 dB/μV
In band N ± 5 high band	min. 84 dB/μV
Out of band	typ. 100 dB/μV

FM rejection	
at channel 6 (90.5 MHz, antenna level 60 dB/μV)	min. 50 dB
at channel 6 (93 to 108 MHz, antenna level 90 dB/μV)	min. 50 dB

Oscillator characteristics (UV963 types only)

Drift of oscillator frequency	
Warm up (tuner on-off, bandswitching)	
low band	max. 250 kHz
high band, up to channel 69	max. 250 kHz
high band, channel 70 to 83	max. 500 kHz
Change of ambient temperature 25 ± 25 °C	
low band	max. 500 kHz
mid band	max. 750 kHz
high band	max. 1000 kHz
Change of humidity 60% to 93% ± 2%	
low band	max. 500 kHz
high band, up to channel 69	max. 1000 kHz
high band, channels 70 to 83	max. 1500 kHz
Shift of oscillator frequency at a change of supply voltage of 5%	
low band	max. 250 kHz
mid and high bands	max. 500 kHz
during AGC	max. 150 kHz
Pulling (10 kHz)	min. 74 dB/μV

PLL tuning characteristics (UV964 types only)

PLL tuning resolution	max. 62.5 kHz
Deviation from nominal of the locked oscillator frequency under any combination of the operation conditions	50^{-6}

Miscellaneous

Radio interference

When the tuner is mounted in a television chassis in such a way as to reduce chassis radiation to a minimum, radiated signal shall be:

channels 2 to 6	max. 50 μV/m
channels 7 to 13	max. 150 μV/m
channels 14 to 69 any single frequency	max. 750 μV/m
average of any 10 individual frequencies	max. 350 μV/m

Microphonics

With the tuner exposed to sound signals in the audio frequency range 100 Hz to 10 kHz and sound pressure levels up to 105 dB (20 μPa), the video signal to sound interference ratio will be: min. 40 dB

Oscillator voltage at the pins

supply and control pins	max. 60 dB/μV
IF pins - low band	max. 85 dB/μV
IF pins - high band	max. 80 dB/μV

ESD protection at the pins
All pins of the tuner are protected against electrostatic discharge up to 2 kV.

The product is classified in category B (MIL-STD-883C).

APPLICATION INFORMATION

For information regarding general aspects of I^2C-bus control refer to:
" The I^2C bus specification ', published by Philips Components.

I^2C-bus requirements (SDA and SCL pins)

$V_{IL(max)}$ = 1.5 V (maximum input LOW voltage)
$V_{IH(min)}$ = 3.0 V (minimum input HIGH voltage)
$I_{IL(max)}$ = −10 μA (maximum LOW input current)
$I_{IH(max)}$ = 10 μA (maximum HIGH input current)
$V_{OL(max)}$ = 0.4 V (maximum output LOW voltage at 3 mA sink current)

Logic diagram (WRITE mode, $R/\overline{W}$ = 0)

	MSB							LSB
Address byte	1	1	0	0	0	MA1	MA0	$R/\overline{W}$
Prog. div. byte 1	0	n14	n13	n12	n11	n10	n9	n8
Prog. div. byte 2	n7	n6	n5	n4	n3	n2	n1	n0
Control byte 1	1	5I	T1	T0	1	1	1	0
Control byte 2	P7	P6	P5	P4	P3	P2	P1	P0

Address selection

MA1	MA0	Address	Voltage at pin 15
0	0	C0	0 to 0.1 V PLL
0	1	C2	irrelevant*
1	0	C4	0.4 to 0.6 V PLL
1	1	C6	0.9 V PLL to 13.5 V

The UV964 types have pin 15 (address input) biased internally using a 47 kΩ resistor to B+ (+ 12 V). Therefore, with pin 15 open circuit, the tuner will respond to address C2 and C6.

* The tuner will always respond to address C2. The second address will depend on the voltage applied at pin 15.

Programmable divider setting (bytes 1 and 2)

Divider ratio: $N = 16 \times (f_{rf}, \text{pc (MHz)} + f_{if}, \text{pc (MHz)})$
$f_{osc} = N/16$ (MHz).

$N = 16384 \times n14 + 8192 \times n13 + 4096 \times n12 + 2048 \times n11 + 1024 \times n10 + 512 \times n9 + 256 \times n8 + 128 \times n7 + 64 \times n6 + 32 \times n5 + 16 \times n4 + 8 \times n3 + 4 \times n2 + 2 \times n1 + n0$

Control byte 1

Charge pump (CP) setting: CP can be set to either logic 0 (low current) or logic 1 (high current). CP = 1 results in faster tuning, CP = 0 in moderate tuning speed with slightly better residual oscillator FM.

Test mode setting: T1, T0 = 0 for normal operation.

PLL disabling: OS = 0 for normal operation.
OS = 1 switches the charge pump transistor to the non-conducting state, enabling the tuner to be manually tuned by applying a variable tuning voltage to pin 11. When selecting OS to logic 1 it is recommended to simultaneously set T0 to logic 1.

DEVELOPMENT DATA

Control byte 2

Bandswitching

	P0	P1	P2	P3	P4	P5	P6	P7
low band	x	x	x	0	0	1	1	0
mid band	x	x	x	0	1	0	1	0
high band	x	x	x	0	1	1	0	0

x = don't care
P0 to P7: output ports on PLL device

P3 must be programmed with 0 since the address voltage is applied at this combined input/output port.

Telegram examples (WRITE mode)

Start	ADD	ACK	DIV1	ACK	DIV2	ACK	CB1	ACK	CB2	ACK	Stop

Start	ADD	ACK	DIV1	ACK	DIV2	ACK	DIV1	ACK	Stop

Start	ADD	ACK	DIV1	ACK	DIV2	ACK	Stop

Start	ADD	ACK	CB1	ACK	CB2	ACK	Stop

Start	ADD	ACK	CB1	ACK	CB2	ACK	DIV1	ACK	Stop

Start = start condition
ADD = address
ACK = acknowledge
DIV1 = divider ratio byte 1
DIV2 = divider ratio byte 2
CB1 = control byte 1
CB2 = control byte 2
Stop = stop condition

Logic diagram (READ mode, $R/\overline{W} = 1$)

	MSB							LSB
Address byte	1	1	0	0	0	MA1	MA0	$R/\overline{W}$
Status byte	POR	FL	I2	I1	I0	A2	A1	A0

FL indicates when the tuning loop of the PLL to be in lock. The loop must be phase-locked for at least 8 periods of the internal 7.8125 kHz reference frequency (i.e. 1 ms) before the FL flag is set to logic 1.

POR (power on reset) is internally set to logic 1 if the PLL voltage drops below 3 V. The POR bit is reset when an end-of-data is detected by the PLL IC.

I0 to I2 and A0 to A2 do not contain any relevant data for the tuner application and can be ignored.

Telegram examples (READ mode)

Start	ADD	ACK	STB	ACK	STB		Stop	⇒ from processor

no Acknowledge = end-of-data

Start	ADD	ACK	STB		Stop	⇒ from PLL

Start = Start condition
ADD = Address
ACK = Acknowledge
STB = Status byte
Stop = Stop condition

ADDITIONAL INFORMATION

RF AGC setting

The RF AGC must be set such that the IF output level of the tuner (with IF load as stated) does not exceed 107 dB/μV.

IF injection

An IF signal from a generator (internal resistance 50 Ω or 75 Ω) should be connected to the IF injection point TP, accessible through a hole in the cover (see Fig.1) using probe 3139 147 10950.

Tuning supply voltage

A tuning voltage of 33 V must be connected via a series 22 kΩ resistor to pin 11. A preferred method is constant current supply of 1 to 1.5 mA to the pin. Figure 4 shows this with a 140 V supply. The zener diode prevents the voltage at pin 11 exceeding 33 V.

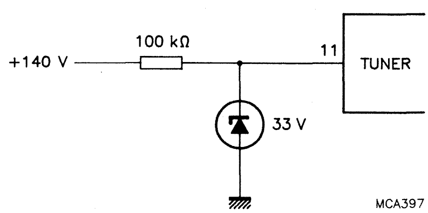


Fig.4 Constant current supply.

UHF/VHF TELEVISION TUNERS

QUICK REFERENCE DATA

Systems	Japanese system M
Channels	
low band	J1 to J3
mid band	J4 to J12
high band	J13 to J62
Intermediate frequencies	
vision	58.75 MHz
sound	54.25 MHz

APPLICATION

The UV983/984 tuners belong to the 900 family of small size tuners which are designed to meet a wide range of applications.

The tuners are available with separate UHF and VHF inputs (75 Ω phono for VHF, 300 Ω balanced for UHF) or with a combined, single 75 Ω input (phono or IEC).

The UV984 is equipped with a built-in digital controlled (I^2C) PLL tuning IC. Band switching is also carried out via the I^2C-bus. The UV983 types are intended for voltage controlled tuning and do not have the PLL synthesizer.

The tuner IF output is designed with low output impedance to directly drive a variety of SAW filters.

Table 1 Available types

type	aerial input connector	tuning system	catalogue number
UV983	75 Ω phono	0.3 - 28 V	
UV983/D	75 Ω phono/300 Ω balanced	0.3 - 28 V	
UV984	75 Ω phono	PLL/I^2C	
UV984/D	75 Ω phono/300 Ω balanced	PLL/I^2C	

DESCRIPTION

The UV983/984 tuners are combined VHF/UHF units covering the low band (frequency range 91.25 to 103.25 MHz), the mid band (frequency range 171.25 to 217.25 MHz) and the high band (frequency range 471.25 to 765.25 MHz).

The tuners are built on a low-loss printed-wiring board carrying all components and a small vertical printed-wiring board carrying the PLL tuning system components for the UV984. The boards are housed in a sheet steel housing with separated front and rear covers. The aerial connector (phono, IEC or balanced) is mounted on one side of the frame.

High selectivity is achieved in both low and high bands by means of a tuned aerial circuit and a double tuned bandpass filter separated by a MOSFET RF amplifier.

An FM bandstop filter, an IF rejection filter and a combined high-pass/CB rejection filter precede the low band section. The mixers and oscillators in both bands are built using bipolar transistors in common-base configuration.

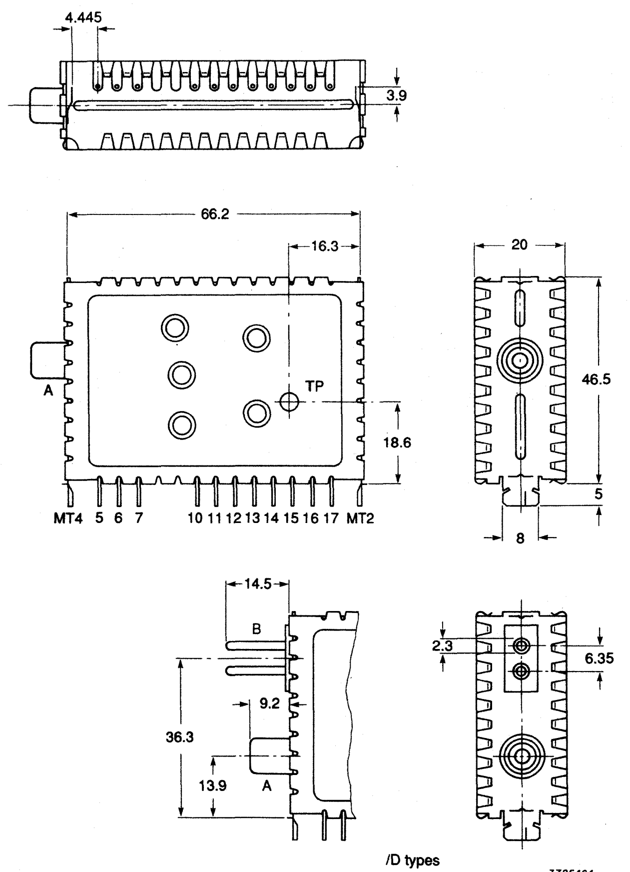
An IF bandpass filter is present between the mixers and the final IF amplifier. The output impedance at the IF output pin is approximately 90 Ω to ensure adequate triple transient suppression in the SAW filter.

The UV984 tuners contains an I^2C-bus controlled phase-locked-loop tuning system enabling direct channel access with crystal controlled accuracy.

DEVELOPMENT DATA

MECHANICAL DESCRIPTION

Dimensions in mm



Pin	UV983	UV984
A	aerial input	aerial input
B	balanced UHF input (/D types only)	balanced UHF input (/D types only)
5	AGC voltage 9.2 to 0.85 V	AGC voltage 9.2 to 0.85 V
6	supply voltage + 12 V	supply voltage + 12 V
7	VHF switch input (UV983 versions only)	
10	UHF switch input	
11	tuning voltage 0.3 to 28 V	tuning supply voltage (33 V via 22 kΩ series resistor)
12		supply voltage PLL + 5 V
13		SCL serial clock line
14		SDA serial data line
15		address selection input
16	ground	ground
17	IF output	IF output
MT1	mounting tab grounded	mounting tab grounded
MT2	mounting tab grounded	mounting tab grounded

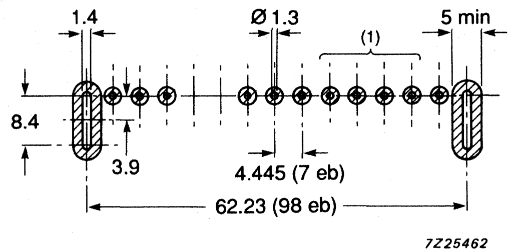
Fig.1 Mechanical detail.

Mass: approximately 55 grams

Mounting

The tuner may be mounted by soldering it to a printed-wiring board, using the piercing diagram shown in Fig.2 without clearance between the tuner supporting surface and the board. The connecting pins and mounting tabs should be bent in accordance with Fig.3.
The tuner may be mounted anywhere in the receiver and there are no restrictions on orientation.

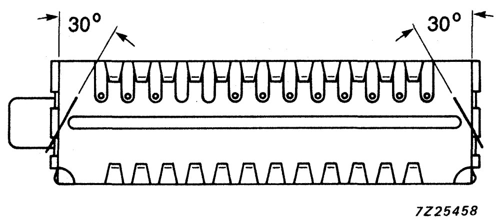
The solderability of the pins and mounting tabs is in accordance with IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0.5 s). The resistance to soldering heat is in accordance with IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

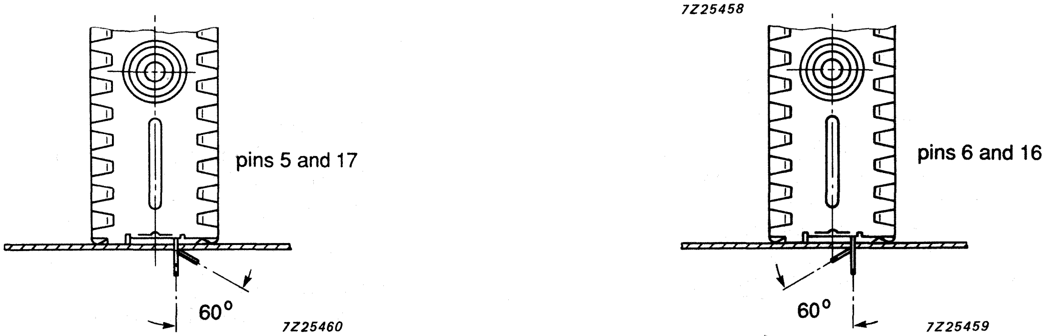


(1) UV984 types only

1 eb = 0.025 inch.

Fig.2 Piercing diagram viewed from solder side of board.





Note

In order to prevent any stress to the printed-wiring board, the tuner should be supported at its aerial connector.

Fig.3 Bending of connecting pins and mounting tabs.

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0.3 V, an AGC voltage of 9.2 ± 0.2 V, a PLL supply voltage of 5 ± 0.3 V and a tuning supply voltage of 33 ± 0.5 V via a 22 kΩ series resistor.

General

Semiconductors, low band	
RF amplifier	BF998
mixer	BFS17
oscillator	BFSS17A
tuning diodes	OF4052
coupling diodes	BB901
Semiconductors, high band	
RF amplifier	BF900A/01
mixer	2SC3841
oscillator	ON4438
tuning diodes	OF643
IF amplifier	BFS17
Tuning/bandswitching IC (UV984 types only)	SP5510 or TSA5510
Tuning voltage transistor (UV984 types only)	BC847B
Ambient temperature range	
operating	−10 °C to + 60 °C
storage	−25 °C to + 85 °C
Relative humidity	max. 95%

Voltages and current

Supply voltage	+ 12 V ± 10%
PLL supply voltage (UV984 only)	+ 5 V ± 10%
Current drawn	
supply current	max. 50 mA
PLL current	max. 55 mA
Tuning supply voltage	min. 30 V typ. 33 V max. 35 V
Tuning supply current	max. 1.7 mA
Bandswitching voltage (UV983 types only)	+ 12 V ± 10%
Bandswitching current (UV983 types only)	max. 2 mA

DEVELOPMENT DATA

Aerial input characteristics

VSWR referred to 75 Ω/300 Ω impedance	
low band	max. 5
high band	max. 5
Reflection coefficient referred to 75 Ω/300 Ω impedance	
low band	max. 66%
high band	max. 66%
Surge protection	min. 6 kV
Oscillator voltage at aerial terminal	
54 - 300 MHz	max. 50 dB/μV
300 - 1000 MHz	max. 66 dB/μV
Unbalance of 300 Ω aerial terminal (D versions only)	
all channels	min. 10 dB

IF output characteristics

IF output impedance (between pins 17 and 16 (ground)	90 Ω
Permitted IF load impedance	min. 1 kΩ max. 22 pF

Frequency range

Low band	channel J1 (picture carrier 91.25 MHz) to channel J3 (picture carrier 103.25 MHz). Margin at extreme channels: min. 1 MHz.
Mid band	channel J4 (picture carrier 171.25 MHz) to channel J12 (picture carrier 217.25 MHz). Margin at extreme channels: min. 1 MHz.
High band	channel J13 (picture carrier 471.25 MHz) to channel J62 (picture carrier 765.25 MHz). Margin at extreme channels: min. 1 MHz.

Wanted signal characteristics

Voltage gain	
all channels	min. 40 dB max. 50 dB
gain difference of channels	max. 8 dB
Noise figure	
low and mid bands	max. 7 dB
high band	max. 10 dB
AGC range	
low band	min. 45 dB
high band	min. 30 dB

Overloading	
input signal producing a gain compression of 1 dB	min. 74 dB/μV
input signal producing oscillator detuning of + 300/−1000 kHz	
low band	min. 90 dB/μV
high band	min. 80 dB/μV
input signal causing the PLL to fail to lock to desired signal	
low band	min. 90 dB/μV
	typ. 100 dB/μV
high band	min. 90 dB/μV
	typ. 100 dB/μV
Image rejection (between 0 and 10 dB gain reduction)	
low and mid bands	min. 60 dB
high band	min. 50 dB
IF rejection	
low and mid bands	min. 55 dB
high band	min. 60 dB

Amplitude response curves

Tilt of overall response

At any channel the amplitude differences between:

Off-air channels	
top of response curve and picture	max. 4 dB
top of response curve and sound carrier	min. 0.5 dB
	max. 6 dB
valley	max. 1 dB
sound carrier above picture carrier	max. 3 dB

IF response

Amplitude difference between:	
top of response curve and picture carrier	max. 1 dB
top of response curve and sound carrier	max. 1 dB

Unwanted signal characteristics

Break through susceptibility	min. 60 dB/μV

Cross modulation

The undesired carrier level required to produce 1% transfer of its modulation onto the desired carrier shall be equal to or exceed the desired carrier level (60 dB/μV at nominal gain) for all gain values between maximum gain and 40 dB (low band) or 30 dB (high band) reduction or be:

In channel	min. 66 dB/μV
In band N ± 2 low and mid bands	min. 78 dB/μV
In band N ± 5 high band	min. 84 dB/μV
Out of band	typ. 100 dB/μV

FM rejection	
at channel 6 (90.5 MHz, antenna level 60 dB/μV)	min. 50 dB
at channel 6 (93 to 108 MHz, antenna level 90 dB/μV)	min. 50 dB

Oscillator characteristics (UV983 types only)

Drift of oscillator frequency	
Warm up (tuner on-off, bandswitching)	
low and mid band	max. 250 kHz
high band, up to channel 69	max. 250 kHz
Change of ambient temperature 25 ± 25 °C	
low and mid bands	max. 500 kHz
high band	max. 1000 kHz
Change of humidity 60% to 93% ± 2%	
low band	max. 500 kHz
high band, up to channel 69	max. 1000 kHz
high band, channels 70 to 83	max. 1500 kHz
Shift of oscillator frequency at a change of supply voltage of 5%	
low and mid bands	max. 250 kHz
high band	max. 500 kHz
during AGC	max. 150 kHz
Pulling (10 kHz)	min. 74 dB/μV

PLL tuning characteristics (UV984 types only)

PLL tuning resolution	max. 62.5 kHz
Deviation from nominal of the locked oscillator frequency under any combination of the operation conditions	50^{-6}

Miscellaneous

Radio interference

When the tuner is mounted in a television chassis in such a way as to reduce chassis radiation to a minimum, the radiated signal shall be:

channels 2 to 6	max. 50 μV/m
channels 7 to 13	max. 150 μV/m
channels 14 to 69 any single frequency	max. 750 μV/m
average of any 10 individual frequencies	max. 350 μV/m

Microphonics

With the tuner exposed to sound signals in the audio frequency range 100 Hz to 10 kHz and sound pressure levels up to 105 dB (20 μPa), the video signal to sound interference ratio will be:

min. 40 dB

Oscillator voltage at the pins

supply and control pins	max. 60 dB/μV
IF pins - low band	max. 85 dB/μV
IF pins - high band	max. 80 dB/μV

ESD protection at the pins
All pins of the tuner are protected against electrostatic discharge up to 2 kV.

The product is classified in category B (MIL-STD-883C).

DEVELOPMENT DATA

APPLICATION INFORMATION

For information regarding general aspects of I^2C-bus control refer to:
" The I^2C bus specification ', published by Philips Components.

I^2C-bus requirements (SDA and SCL pins)

$V_{IL(max)}$ = 1.5 V (maximum input LOW voltage
$V_{IH(min)}$ = 3.0 V (minimum input HIGH voltage)
$I_{IL(max)}$ = −10 μA (maximum LOW input current)
$I_{IH(max)}$ = 10 μA (maximum HIGH input current)
$V_{OL(max)}$ = 0.4 V (maximum output LOW voltage at 3 mA sink current)

Logic diagram (WRITE mode $R/\overline{W}$ = 0)

	MSB							LSB
Address byte	1	1	0	0	0	MA1	MA0	$R/\overline{W}$
Prog. div. byte 1	0	n14	n13	n12	n11	n10	n9	n8
Prog. div. byte 2	n2	n6	n5	n4	n3	n2	n1	n0
Control byte 1	1	5I	T1	T0	1	1	1	0
Control byte 2	P7	P6	P5	P4	P3	P2	P1	P0

Address selection

MA1	MA0	Address	Voltage at pin 15
0	0	C0	0 to 0.1 V PLL
0	1	C2	irrelevant*
1	0	C4	0.4 to 0.6 V PLL
1	1	C6	0.9 V PLL to 13.5 V

The UV984 types have pin 15 (address input) biased internally using a 47 kΩ resistor to B+ (+ 12 V). Therefore, with pin 15 open circuit, the tuner will respond to address C2 and C6.

* The tuner will always respond to address C2. The second address will depend on the voltage applied at pin 15.

Programmable divider setting (bytes 1 and 2)

Divider ratio: $N = 16 \times (f_{rf,\ pc}\ (MHz) + f_{if,\ pc}\ (MHz))$
$f_{osc} = N/16\ (MHz)$.

$N = 16384 \times n14 + 8192 \times n13 + 4096 \times n12 + 2048 \times n11 + 1024 \times n10 + 512 \times n9 + 256 \times n8 + 128 \times n7 + 64 \times n6 + 32 \times n5 + 16 \times n4 + 8 \times n3 + 4 \times n2 + 2 \times n1 + n0$

Control byte 1

Charge pump (CP) setting: CP can be set to either logic 0 (low current) or logic 1 (high current). CP = 1 results in faster tuning, CP = 0 in moderate tuning speed with slightly better residual oscillator FM.

Test mode setting: T1, T0 = 0 for normal operation.

PLL disabling: OS = 0 for normal operation
OS = 1 switches the charge pump transistor to the non-conducting state, enabling the tuner to be manually tuned by applying a variable tuning voltage to pin 11. When selecting OS to logic 1 it is recommended to simultaneously set T0 to logic 1.

Control byte 2

DEVELOPMENT DATA

Bandswitching

	P0	P1	P2	P3	P4	P5	P6	P7
low band	x	x	x	0	0	1	1	x
mid band	x	x	x	0	1	0	1	0
high band	x	x	x	0	1	1	0	x

x = don't care
P0 to P7: output ports on PLL device

P3 must be programmed with 0 since the address voltage is applied at this combined input/output port.

Telegram examples (WRITE mode)

Start	ADD	ACK	DIV1	ACK	DIV2	ACK	CB1	ACK	CB2	ACK	Stop

Start	ADD	ACK	DIV1	ACK	DIV2	ACK	DIV1	ACK	Stop

Start	ADD	ACK	DIV1	ACK	DIV2	ACK	Stop

Start	ADD	ACK	CB1	ACK	CB2	ACK	Stop

Start	ADD	ACK	CB1	ACK	CB2	ACK	DIV1	ACK	Stop

Start = start condition
ADD = address
ACK = acknowledge
DIV1 = divider ratio byte 1
DIV2 = divider ratio byte 2
CB1 = control byte
CB2 = control byte 2
Stop = stop condition

Logic diagram (READ mode, R/$\overline{W}$ = 1)

	MSB							LSB
Address byte	1	1	0	0	0	MA1	MA0	R/$\overline{W}$
Status byte	POR	FL	I2	I1	I0	A2	A1	A0

FL indicates when the tuning loop of the PLL to be in lock. The loop must be phase-locked for at least 8 periods of the internal 7.8125 kHz reference frequency (i.e. 1 ms) before the FL flag is set to logic 1.

POR (power on reset) is internally set to logic 1 if the PLL voltage drops below 3 V. The POR bit is reset when an end-of-data is detected by the PLL IC.

I0 to I2 and A0 to A2 do not contain any relevant data for the tuner application and can be ignored.

Telegram examples (READ mode)

Start	ADD	ACK	STB	ACK	STB		Stop	⇒ from processor

no Acknowledge = end-of-data

Start	ADD	ACK	STB		Stop	⇒ from PLL

Start = Start condition
ADD = Address
ACK = Acknowledge
STB = Status byte
Stop = Stop condition

ADDITIONAL INFORMATION

RF AGC setting

The RF AGC must be set such that the IF output level of the tuner (with IF load as stated) does not exceed 107 dB/μV.

IF injection

An IF signal from a generator (internal resistance 50 Ω or 75 Ω) should be connected to the IF injection point TP, accessible through a hole in the cover (see Fig.1) using probe 3139 147 10950.

Tuning supply voltage

A tuning voltage of 33 V must be connected via a series 22 kΩ resistor to pin 11. A preferred method is constant current supply of 1 to 1.5 mA to the pin. Figure 4 shows this with a 140 V supply. The zener diode prevents the voltage at pin 11 exceeding 33 V.

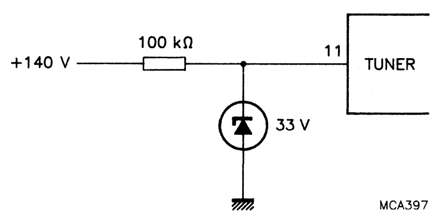


Fig.4 Constant current supply.

DEVELOPMENT DATA

V.H.F. TELEVISION TUNER

QUICK REFERENCE DATA

Systems	C.C.I.R. systems M and N (R.T.M.A.)
Channels	
low v.h.f.	A2 to A6
high v.h.f.	A7 to A13
Intermediate frequencies	
picture	45,75 MHz
sound	41,25 MHz

APPLICATION

This tuner is designed to cover the v.h.f. channels of C.C.I.R. systems M and N (R.T.M.A.).

It can be provided with a frequency divider, which makes this tuner suitable for digital tuning systems based on frequency synthesis.

DESCRIPTION

This v.h.f. tuner has electronic tuning and band switching, covering the low v.h.f. band channels A2 to A6 (frequency range 54 to 88 MHz) and the high v.h.f. band channels A7 to A13 (frequency range 174 to 216 MHz).

Mechanically, the tuner is built on a low-loss printed-wiring board, carrying all components, in a metal housing made of a rectangular frame and front and rear cover (see Fig. 2a). All connections (supply voltage, a.g.c. voltage, tuning voltage, band switching, i.f. output) are made via terminals on the underside, except the coaxial aerial connection of 75 Ω which is on one of the frame sides. The mounting method is shown in Fig. 3.

Electrically the v.h.f. aerial signal is fed via low pass, high pass, i.f. and f.m. suppression filters to a switchable single tuned input circuit for low and high v.h.f. operation, which is capacitively coupled to the gate 1 of a MOS-FET tetrode (with internal gate protection against surge). The drain load of the MOS-FET tetrode is formed by a double tuned, switchable bandpass filter, transferring the r.f. signal to the emitter of the mixer transistor. The oscillator signal is also fed to the emitter of the mixer transistor.

The collector circuit of the mixer transistor is a single tuned i.f. resonant circuit, where the i.f. signal is coupled out at the low impedance side.

A test point (terminal 4) is provided for i.f. injection to adjust the i.f. output circuit of the tuner together with the i.f. amplifier of a television receiver. An additional test point, which is accessible through a hole in the top of the frame, is connected with the collector of the v.h.f. mixer transistor.

The single tuned input, the r.f. bandpass filter and oscillator circuits are tuned by 4 varicap diodes, band switching is achieved by switching diodes.

The tuner is gain controlled via gate 2 of the input MOS-FET tetrode.

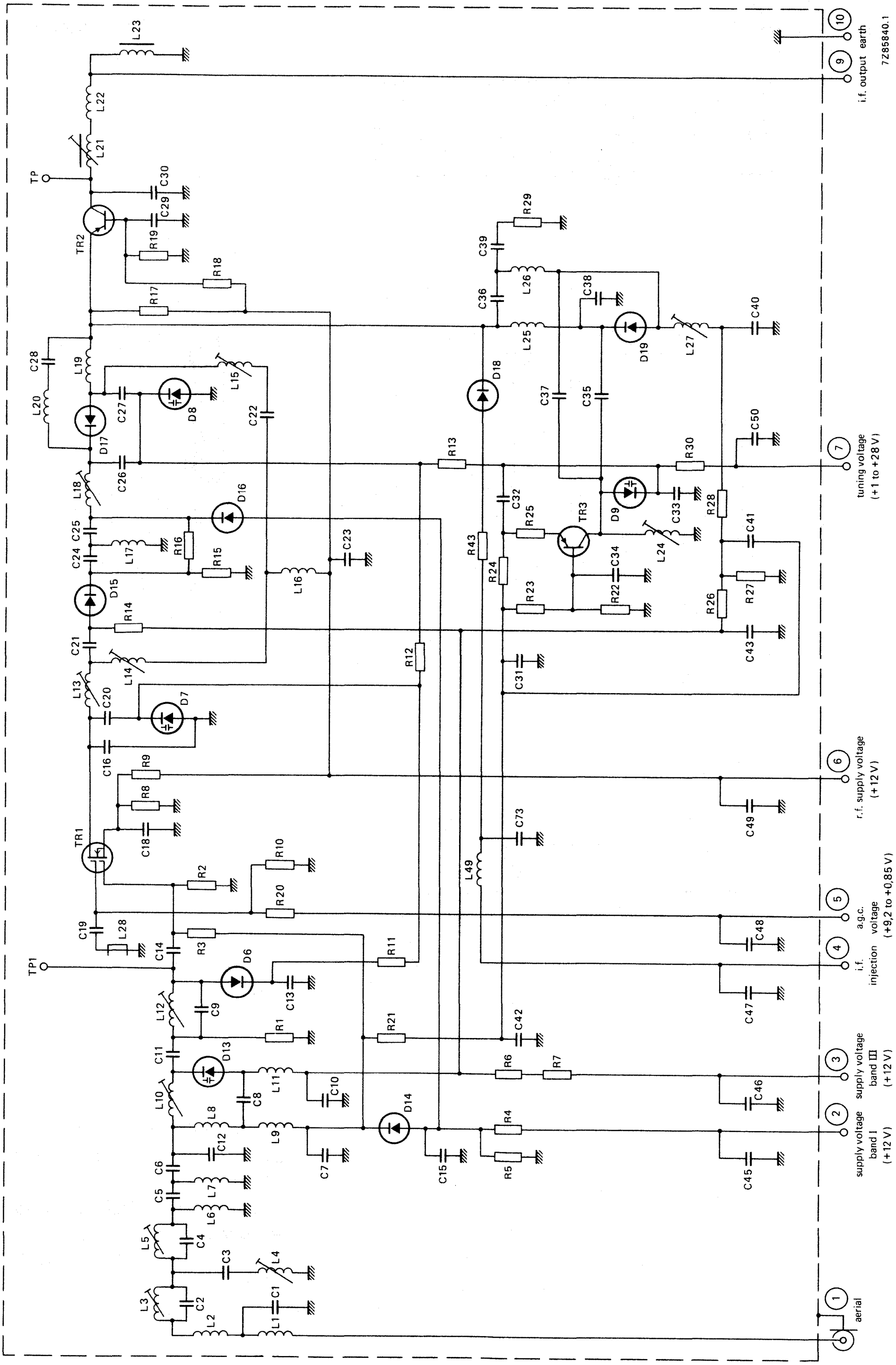

TP
TP1
TR1
TR2
TR3
1 aerial
2 supply voltage band I (+12 V)
3 supply voltage band III (+12 V)
4 i.f. injection
5 a.g.c. voltage (+9,2 to +0,85 V)
6 r.f. supply voltage (+12 V)
7 tuning voltage (+1 to +28 V)
9 i.f. output
10 earth
7Z85840.1

Fig. 1.

MECHANICAL DATA

Dimensions in mm

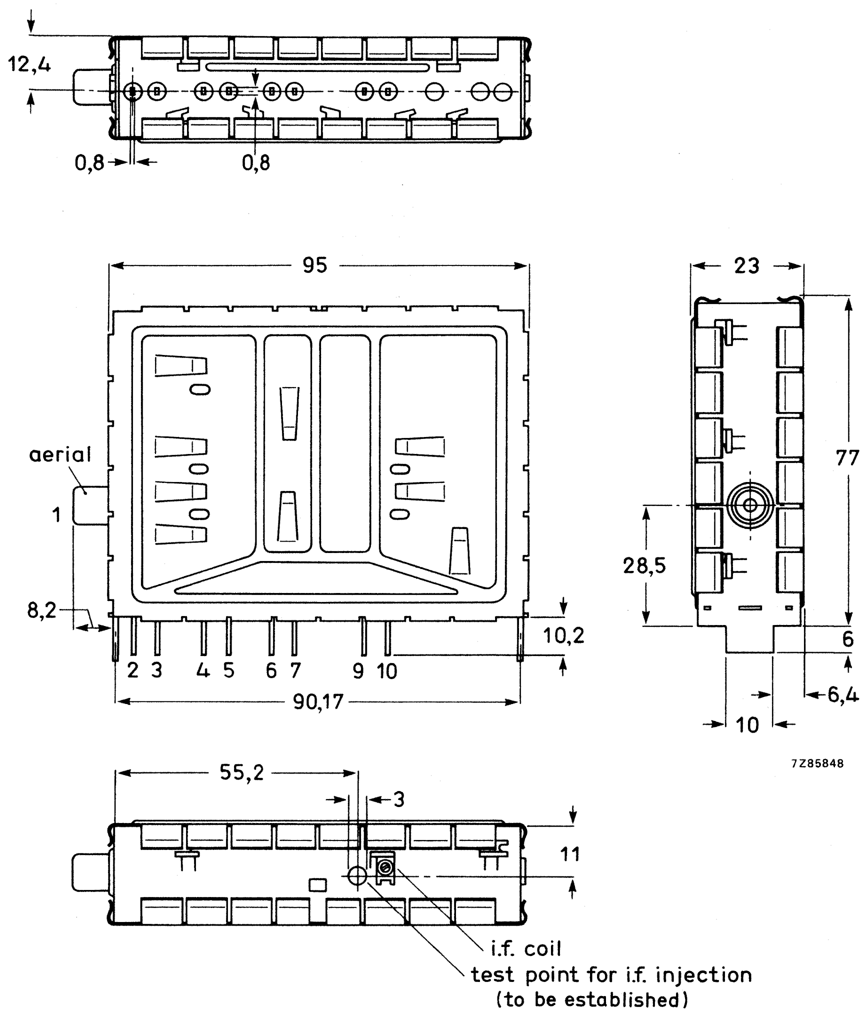


Fig. 2a.

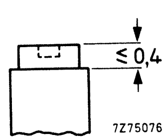


Fig. 2b I.F. output coil.
Torque for alignment: 2 to 15 mNm
Press-through force: ⩾ 10 N

Terminal

1	= aerial
2	= supply voltage, v.h.f. I, + 12 V
3	= supply voltage, v.h.f. III, + 12 V
4	= i.f. injection
5	= a.g.c. voltage, + 9,2 to + 0,85 V
6	= supply voltage, + 12 V
7	= tuning voltage, + 1 to + 28 V
9	= i.f. output
10	= earth

Mass approx. 125 g.

Mounting

The tuner may be mounted by soldering it on to a printed-wiring board, using the piercing diagram shown in Fig. 3. (The tuner may also be mounted by means of a bracket. Information will be supplied upon request.)

It is recommended that the tuner be installed in the cool part of the receiver cabinet and not exposed to the vibrations of the loudspeaker. There are no restrictions on orientation.

The solderability of the terminals and mounting tabs is according to IEC 68-2, test Ta (230 ± 10 °C, 2 ± 0,5 s). The resistance to soldering heat is according to IEC 68-2, test Tb (260 ± 5 °C, 10 ± 1 s).

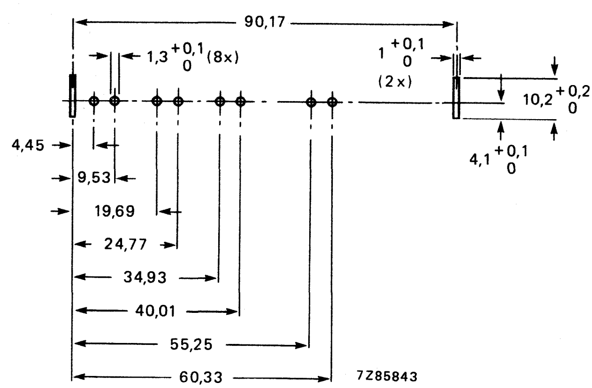


Fig. 3 Piercing diagram viewed from solder side of board. Unless otherwise stated the tolerance is ± 0,05 mm.

Marking

The tuner is provided with a label showing the following data:

- type number V431
- catalogue number 3112 218 51830
- code for factory of origin
- change code
- code for year and week of production

ELECTRICAL DATA

Unless otherwise specified all electrical values apply at an ambient temperature of 25 ± 5 °C, a relative humidity of 60 ± 15%, a supply voltage of 12 ± 0,3 V and an a.g.c. voltage of 9,2 ± 0,2 V.

General

Semiconductors	
r.f. amplifier	BF982
mixer	BF324
oscillator	BF926
tuning diodes	4 x BB809
switching diodes	4 x BA482/483/484
d.c. blocking diodes	3 x BAW62
Ambient temperature range	
operating	0 to +60 °C
storage	−25 to +70 °C
Relative humidity	max. 95%

Voltage and currents

Supply voltage	+ 12 V ± 10%*
Current drawn from + 12 V supply	
low v.h.f.	max. 52 mA; typ. 39 mA
high v.h.f.	max. 52 mA; typ. 39 mA

Bandswitching
For operation in both bands the supply voltage is permanently connected to terminal 6. Additionally the supply voltage is connected to:
terminal 2 for operation in the low v.h.f. band,
terminal 3 for operation in the high v.h.f. band,
terminal 4 for i.f. injection

A.G.C. voltage	
voltage range	+9,2 to +0,85 V
voltage at nominal gain	+9 ± 0,5 V
voltage at 40 dB gain reduction	
low v.h.f.	typ. 3,2 V
high v.h.f.	typ. 1,5 V

Note: A.G.C. voltages between 0 and + 10,5 V may be applied without risk of damage.

A.G.C. current	max. 0,1 mA
Slope of a.g.c. characteristic, at the end of the specified a.g.c. range	typ. 25 dB/V

* A tolerance of −15% on the supply voltage is admissible, if a deterioration of gain, noise figure, oscillator shift and oscillator drift is acceptable.

Tuning voltage range (Figs 4 and 5)	+1 to +28 V
Current drawn from 28 V tuning voltage supply	
at T_{amb} = 25 °C and R.H. = 60%	max. 0,3 μA
at T_{amb} = 25 °C and R.H. = 95%	max. 1 μA
at T_{amb} = 55 °C and R.H. = 60%	max. 1 μA

Note: The source impedance of the tuning voltage offered to terminal 7 must be maximum 47 kΩ.

Slope of tuning characteristic			
low v.h.f.	channel A2	3 MHz/V	typical values
	channel A6	2 MHz/V	
high v.h.f.	channel A7	6 MHz/V	
	channel A13	4 MHz/V	

Frequencies

Frequency ranges

low v.h.f.	channel A2 (picture carrier 55,25 MHz) to channel A6 picture carrier 83,25 MHz).* Margin at the extreme channels: min. 1,5 MHz.
high v.h.f.	channel A7 (picture carrier 175,25 MHz) to channel A13 (picture carrier 211,25 MHz). Margin at the extreme channels min. 2 MHz.

Intermediate frequencies

picture	45,75 MHz
sound	41,25 MHz

The oscillator frequency is higher than the aerial signal frequency.

Wanted signal characteristics

Input impedance — 75 Ω

V.S.W.R. and reflection coefficient (values between picture and sound carrier, as well as values at picture carrier)

	at nominal gain	during gain control
v.s.w.r.		
all channels except A6	max. 4	max. 5
channel A6	max. 5	max. 5
reflection coefficient		
all channels except A6	max. 60%	max. 66%
channel A6	max. 66%	max. 66%

R.F. curves, bandwidth

low v.h.f.	typ. 10 MHz
high v.h.f.	typ. 12 MHz

R.F. curves, tilt	on any channel the amplitude difference between the top of the r.f. resonant curve and the picture frequency, the sound frequency, or any frequency between them will not exceed 3 dB at nominal gain, and 4 dB in the a.g.c. range between nominal gain and 20 dB gain reduction, except for channel A6.
A.G.C. range (Figs 6 and 7)	min. 40 dB
Power gain (see also Measuring method of power gain)	min. 22 dB
channel A4	typ. 26 dB
channel A7	typ. 26 dB
channel A13	typ. 27 dB
Maximum gain difference between any two v.h.f. channels	typ. 4 dB
Noise figure	
all channels except A6	max. 7 dB
channel A6	max. 9 dB
channel A4	typ. 5 dB
channel A7	typ. 5 dB
channel A13	typ. 5 dB

Overloading:

Input signal producing 1 dB gain compression at nominal gain	typ. 90 dB (μV) into 75 Ω
Input signal producing either a detuning of the oscillator of +300 kHz or −1000 kHz or stopping of the oscillations at nominal gain	typ. 100 dB (μV) into 75 Ω

Unwanted signal characteristics

Image rejection (measured at picture carrier frequency)	min. 60 dB; typ. 70 dB
I.F. rejection (measured at picture carrier frequency)	
low v.h.f. channel A2	min. 45 dB
low v.h.f. channels A3 to A6	min. 50 dB
high v.h.f.	min. 60 dB

Note: At colour sub-carrier frequency maximum 6 dB less rejection.

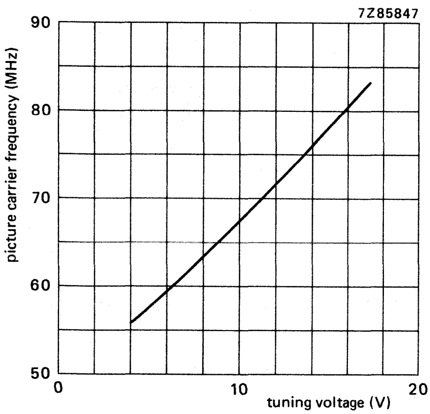


Fig. 4 Typical tuning characteristic, low v.h.f.

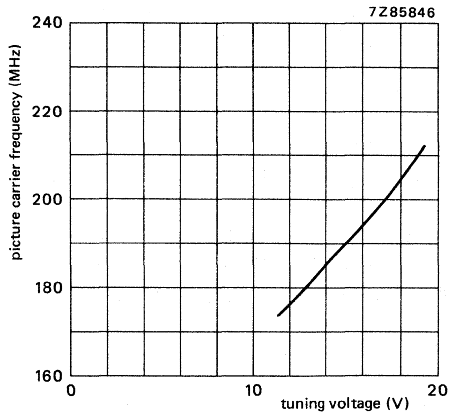


Fig. 5 Typical tuning characteristic, high v.h.f.

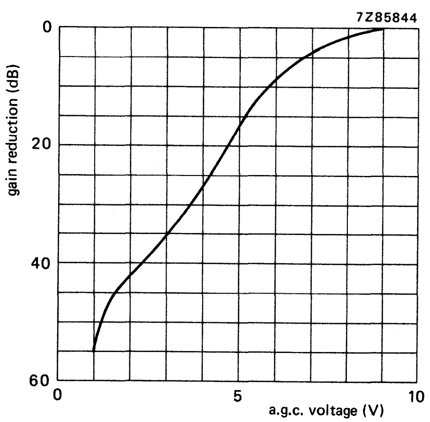


Fig. 6 Typical a.g.c. characteristic, low v.h.f.

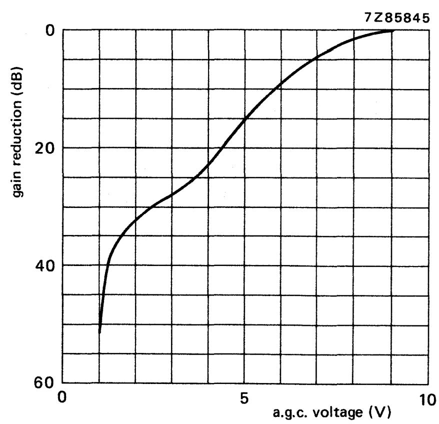


Fig. 7 Typical a.g.c. characteristic, high v.h.f.

F.M. rejection, low v.h.f.
Level of an f.m. signal of 91,5 MHz which produces an i.f. signal (47,75 MHz) 57 dB below the level of the wanted picture carrier

channel A2	typ. 100 dB (μV)
channel A4	typ. 100 dB (μV)
channel A6	typ. 60 dB (μV)

F.M. rejection, high v.h.f.
Level of an f.m. signal between 88 and 105 MHz, which produces an i.f. interfering (45,75 MHz) 57 dB below the level of the wanted picture carrier. Level of input picture carrier is 60 dBμV

channel A8	typ. 95 dB (μV)
channel A11	typ. 92 dB (μV)
channel A13	typ. 95 dB (μV)

Cross modulation:
Input signal producing 1% cross modulation, i.e. 1% of the modulation depth of the interfering signal is transferred to the wanted signal.

In channel cross modulation (wanted signal: picture carrier frequency; interfering signal: sound carrier frequency)

at nominal gain (wanted input level 60 dB (μV)	typ. 76 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 94 dB (μV) into 75 Ω

In band cross modulation (wanted signal: picture carrier of channel N; interfering signal: picture carrier of channel N ± 2 for low v.h.f. or channel N ± 3 for high v.h.f.

at nominal gain (wanted input level 60 dB (μV))	typ. 88 dB (μV) into 75 Ω
at 40 dB gain reduction (wanted input level 100 dB (μV))	typ. 100 dB (μV) into 75 Ω

Out of band cross modulation at nominal gain

low v.h.f., interfering from high v.h.f.	typ. 100 dB (μV) into 75 Ω
high v.h.f., interfering from low v.h.f.	typ. 90 dB (μV) into 75 Ω

Oscillator characteristics

Pulling:

Input signal of tuned frequency producing a shift of the oscillator frequency of 10 kHz, at nominal gain	
low v.h.f.	typ. 88 dB (μV) into 75 Ω
high v.h.f.	typ. 86 dB (μV) into 75 Ω
Shift of oscillator frequency at a change of the supply voltage of 5%	max. 200 kHz
When using supply circuit of Fig. 10 additional shift	max. 150 kHz
Drift of oscillator frequency	
during warm-up time (after the tuner has been completely out of operation for 15 min, measured between 5 s and 15 min after switching on)	max. 250 kHz
during warm-up time (after the input stage is in operation for 15 min, measured between 2 s and 15 min after band switching)	max. 250 kHz
at a change of the ambient temperature from +25 to +50 ^{o}C (measured after 3 cycles from +25 to +55 ^{o}C)	max. 600 kHz
at a change of humidity from 60 ± 15% to 93 ± 2% (measured at T_{amb} = 25 ± 5 ^{o}C)	
low v.h.f.	max. 500 kHz
high v.h.f.	max. 1000 kHz

I.F. circuit characteristics

Bandwidth of i.f. output circuit — 5 ± 0,5 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 8; tuning voltage 15 V, high v.h.f. band switched on.

Bandwidth variation of i.f. output circuit as a result of r.f. tuning and band switching (reference: high v.h.f., tuning voltage 15 V; i.f. output circuit adjusted to 43,5 MHz) — max. 650 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 8, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

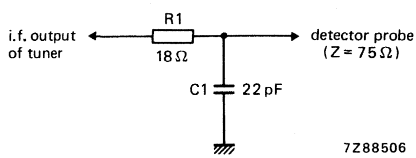


Fig. 8.

Detuning of the i.f. output circuit as a result of r.f. tuning and band switching (reference: high v.h.f. tuning voltage 15 V; i.f. output circuit adjusted to 43,5 MHz) — max. 300 kHz

Note: I.F. output of the tuner terminated with a modified circuit of Fig. 8, i.e. a 100 pF capacitor is connected in parallel with the i.f. output of the tuner.

Minimum tuning range of i.f. output coil — 41 to 47 MHz

Note: I.F. output of the tuner terminated with the circuit shown in Fig. 8. The tuner is supplied with the i.f. output circuit adjusted to 43,5 ± 1 MHz.

Attenuation between i.f. injection point and i.f. output of the tuner — typ. 16 dB

Miscellaneous

Radio interference:
Oscillator radiation and oscillator voltage at the aerial terminal — Within the limits of C.I.S.P.R. 13 (1975)

Microphonics — There will be no microphonics, provided the turner is installed in a professional manner.

Surge protection:
Protection against voltages — max. 5 kV

Note: 10 discharges of a 470 pF capacitor into the aerial terminal.

Protection against flashes max. 30 kV, 400 mWs

Note: A flashover circuit producing flashes with frequencies of 1 to 20 Hz for 30 s is connected to the aerial terminal.

ADDITIONAL INFORMATION

I.F. injection

Terminal 4 can be used as i.f. injection point. The i.f. generator is connected according to Fig. 9. High v.h.f. should be switched on; tuning voltage should be 15 V.

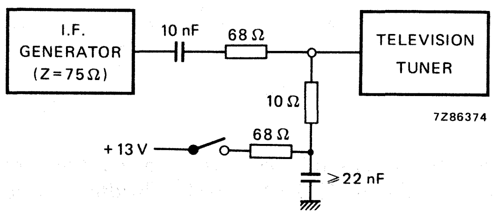


Fig. 9.

Connection of the i.f. amplifier

— By means of a print track as short as possible.
— By means of a shielded track, e.g. a coaxial cable.

Connection of supply voltages

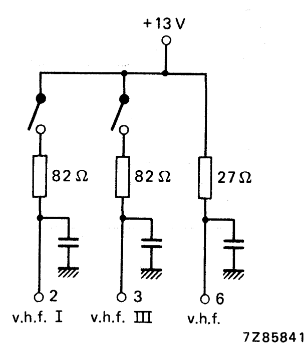


Fig. 10.

Measuring method of power gain

The i.f. output of the tuner should be terminated with the RC-circuit given in Fig. 8.

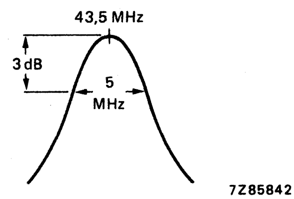


Fig. 11.

The RC-circuit roughly matches the i.f. output impedance to 75 Ω at the resonant frequency of the i.f. output circuit which should be tuned to 43,5 MHz; the bandwidth is approx. 5 MHz (Fig. 11).

Because the input and output impedances of the tuner are now 75 Ω, the power gain can be measured in the conventional manner by inserting tuner and RC-circuit between a 75 Ω source and a 75 Ω detector.

Alignment of the i.f. output coil

The i.f. output coil should be adjusted with a brass tool with a blade as shown in Fig. 12. A suitable tool is available under catalogue number 7122 005 47680.

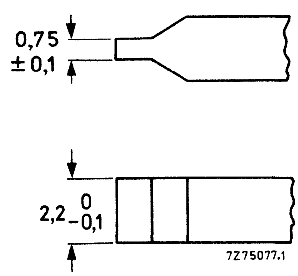


Fig. 12.

TESTS AND REQUIREMENTS

IEC 68-2	test	procedure	requirements
Ab	cold	−25 °C, 96 h	Checked within 10 min after all tests mentioned: no catastrophic failures (in operation of 1 or more channels).
Bb	dry heat	+70 °C, 96 h	
Db	damp heat, cyclic	+25 to +40 °C R.H. 90 to 100% 21 cycles of 24 h	
Ca	damp heat, steady state	−40 °C, R.H. 93% 21 days	After 1 h reconditioning under normal conditions:
Na	rapid change of temperature	3h −25 °C/3h +70 °C 5 cycles	change of osc. freq. band I ⩽ 1,5 MHz band III ⩽ 2 MHz
Fc	vibration	10-55-10 Hz, amplitude 0,35 mm 3 directions, 30 min per direction	change of power gain ⩽ 2 dB change of tilt r.f. curve ⩽ 2 dB
Eb	bump	1000 bumps, acceleration 25 g, in 6 directions	change of tuning current ⩽ 0,5 μA
Ea	shock	half sine pulse 11 ms, acceleration 50 g in 6 directions 3 times per direction	

COAXIAL AERIAL INPUT ASSEMBLIES

COAXIAL AERIAL INPUT ASSEMBLY

QUICK REFERENCE DATA

Frequency range	40 to 890 MHz
Impedance	75 Ω asymmetrical

APPLICATION

This coaxial aerial input assembly has been developed for application in TV sets without mains separation and provided with a television tuner of the UV400 family. Thanks to the use of safety capacitors in the assembly, the chassis of the TV set is separated from the aerial input. The input connector of the assembly meets the demands of IEC 169.2 and DIN 45325 (diameter 9,5 mm).

The coaxial aerial input assembly complies with the requirements of immunity from radiated interference of Amtsblatt DBP69/1981. It meets the safety requirements of IEC 65; approbation approval has been sought from VDE.

DESCRIPTION

The assembly is provided with safety capacitors, which are moulded in thermo-setting insulation material, thus forming capacitor blocks. These capacitor blocks are built in a metal housing with cover, and are connected to the housing, coaxial cable and the output plug (see Fig. 1). The coaxial cable is a double insulated, screened 75 Ω cable, which leads to the female input connector on a plastic plate. The output connector (phono) is mounted on the housing and fits the aerial input of the tuner (see Fig. 2).

The assembly can be supplied with three cable lengths:

free cable length	catalogue number
90 mm	3122 127 01240
145 mm	3122 127 03500
250 mm	3122 127 05900

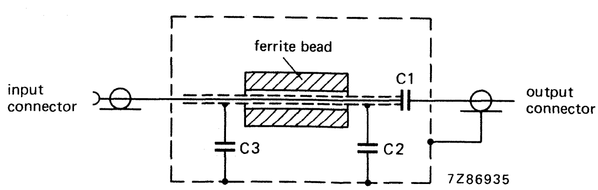


Fig. 1 Ferrite bead = $\phi 8 \times \phi 3 \times 10$ mm.

C_1 = 390 pF
C_2 = 1000 pF
C_3 = 1000 pF

ELECTRICAL DATA

The electrical values are measured at an ambient temperature of 25 ± 5 °C and a relative humidity of 60 ± 15%.

Impedance of input connector	75 Ω, asymmetric
Impedance of output plug	75 Ω, asymmetric
Frequency range	40 to 890 MHz
Reflection at the input connector, output plug matched with phono connector 3122 128 74660 and 75 Ω	
40 to 470 MHz	⩽ 25%
470 to 700 MHz	⩽ 35%
700 to 890 MHz	⩽ 45%
Reflection at the output plug, input connector matched with IEC plug and 75 Ω	
40 to 470 MHz	⩽ 25%
470 to 700 MHz	⩽ 35%
700 to 890 MHz	⩽ 45%
Insertion loss	
40 to 700 MHz	max. 1,5 dB, typ. 0,6 dB
700 to 890 MHz	max. 2,0 dB, typ. 1,4 dB
Contact resistance of input connector	
inner conductor	⩽ 10 mΩ
outer conductor	⩽ 5 mΩ
Contact resistance of output plug	
inner conductor	⩽ 10 mΩ
outer conductor	⩽ 10 mΩ
Insulation resistance	⩽ 500 MΩ
Immunity from radiated interference	in conformity with requirements of Amtsblatt DBP69/1981 provided the unit is connected to a television tuner of the UV400 family in the right way.
Safety	the unit meets the requirements of IEC 65, 4th edition, clause 14.2. Approbation approval has been sought from VDE. Quality assessment in production centres is according to the rules of VDE.

ENVIRONMENTAL CONDITIONS

Operating temperature range	0 to + 55 °C
Storage temperature range	–40 to + 70 °C
Relative humidity	⩽ 95%
Maximum bump acceleration	245 m/s^2 (25g)
Maximum shock acceleration	490 m/s^2 (50g)
Maximum vibration amplitude	0,35 mm

MECHANICAL DATA

Dimensions in mm

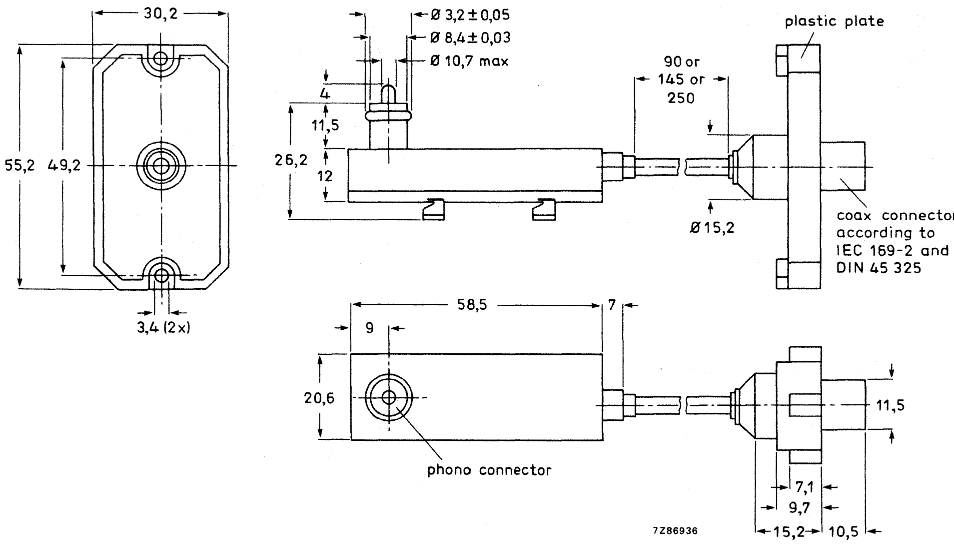


Fig. 2.

Mass 50 g approximately

MOUNTING

The metal housing is connected to the television tuner of the UV400 family by inserting the phono plug into the aerial input plug of the tuner. The plastic plate with input connector can be fixed by means of two M3 screws (13 mm) or by using a snap-in holder.

It is advised not to use aluminium plugs.

Insertion force		
input connector	max.	50 N
inner conductor of output plug	max.	30 N
Pull-out force		
input connector		10 to 50 N
inner conductor of output plug	min.	3 N
Tensile strength to cable connections at both sides	max.	100 N

TESTS AND REQUIREMENTS

IEC publication		name of test	procedure	requirements
IEC 68-2-1	Ab	cold	−40 °C, 96 h	all requirements mentioned under electrical and mechanical data must be met, except the insulation resistance which must be min. 300 MΩ
IEC 68-2-2	Bb	dry heat	+70 °C, 96 h	
IEC 68-2-30	Db	damp heat, cyclic	+25/+40 °C, 90/100% R.H., 21 cycles of 24 h	
IEC 68-2-3	Ca	damp heat, steady state	+40 °C, 93% R.H.; 21 days	
IEC 68-2-14	Na	rapid change of temperature	3 h −40 °C/3 h +70 °C, 5 cycles	
IEC 68-2-6	Fc	vibration	10-55-10 Hz, sinusoidal, amplitude 0,35 mm, 3 directions, 30 min per direction	
IEC 68-2-29	Eb	bump	1000 bumps, 25g, 6 directions	
IEC 68-2-27	Ea	shock	half sinewaves of 11 ms, accel. 50g, 6 directions, 3 shocks per direction	

MARKING

Moulded in the front side of the plastic plate (see Fig. 2):

- PHILIPS
- 7106 (safety code)
- 250 V; 390 pF 1x, 1000 pF 2x

PACKING

The assemblies are supplied in cardboard boxes of 490 x 295 x 153 mm, 64 pieces per box.

COAXIAL AERIAL INPUT ASSEMBLY

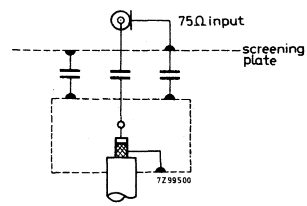
APPLICATION

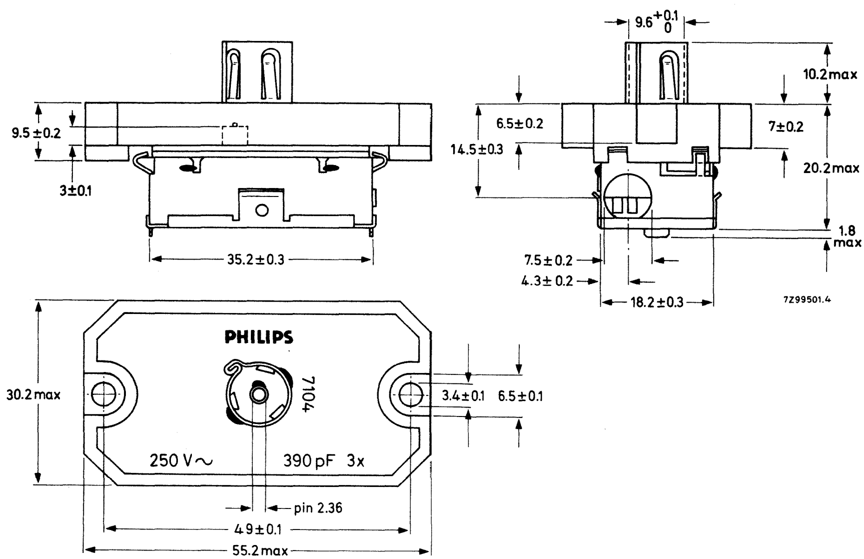
These coaxial aerial input assemblies have been developed for application in television sets with 75 ohm input impedance, for use in v.h.f. as well as in u.h.f. (40-890 MHz). The connectors meet the demands of both the IEC standards (diameter 9,5 mm) and the French standards (diameter 9,0 mm). They have to be used with plugs complying with the properties mentioned in DIN 45325, IEC 169-2 (diameter 9,5 mm) and SNIR (diameter 9,0 mm). The units meet the safety requirements of IEC 65.

AVAILABLE TYPES

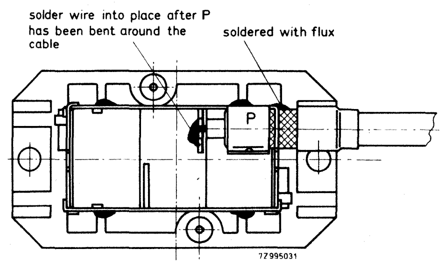
Coaxial aerial input assembly 75 Ω

Attenuation	: ≤ 1 dB
Reflection, v.h.f.	: ≤ 15%
u.h.f.	: ≤ 25%
Catalogue number	: 3122 127 10260

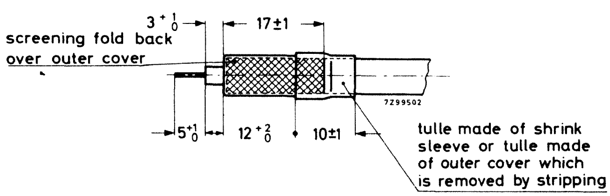




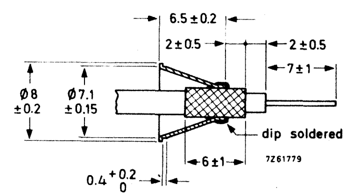
Dimensions in mm



Recommended fixing of the aerial cable
Soldering conditions: 370 ± 5 °C; 3,5 ± 0,5 s



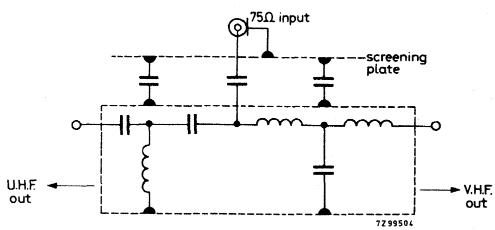
Cable diameter ≥ 5 mm

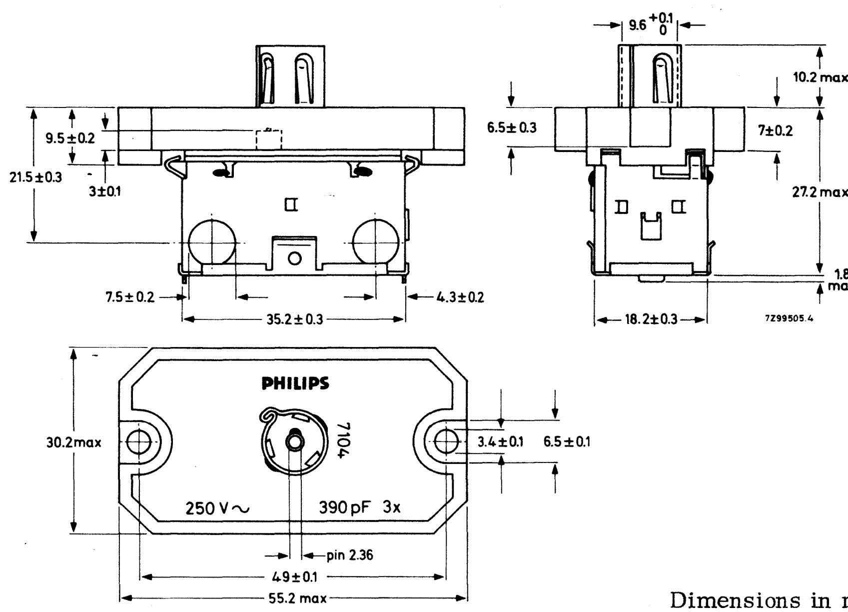


Cable diameter < 5 mm

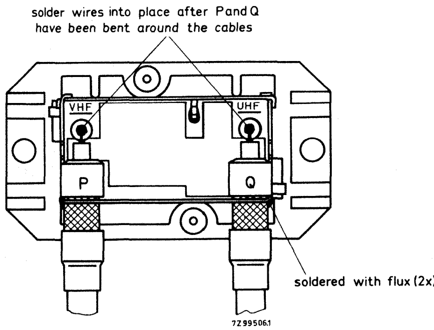
Coaxial aerial input assembly 75 Ω, with filter

Reflection, v.h.f.		≤ 25%
u.h.f.		≤ 30%
Frequency characteristic		
v.h.f.,	50 to 230 MHz	≤ 1 dB
	470 MHZ	≥ 13 dB
	700 MHz	23 dB (typical value)
u.h.f.,	470 to 850 MHz	≤ 1 dB
	230 MHz	≥ 15 dB
	100 MHz	40 dB (typical value)
Catalogue number		3122 127 10450

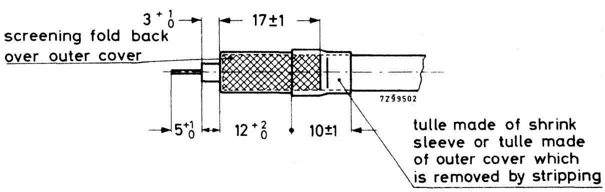




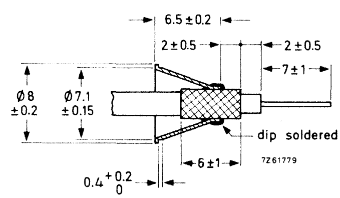
Dimensions in mm



Recommended fixing of the aerial cable
Soldering conditions: 370 ± 5 °C; 3,5 ± 0,5 s



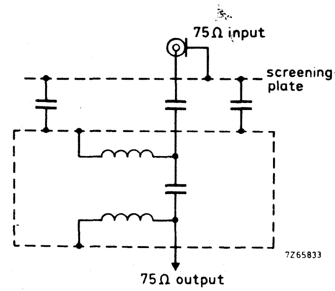
Cable diameter ≥ 5 mm



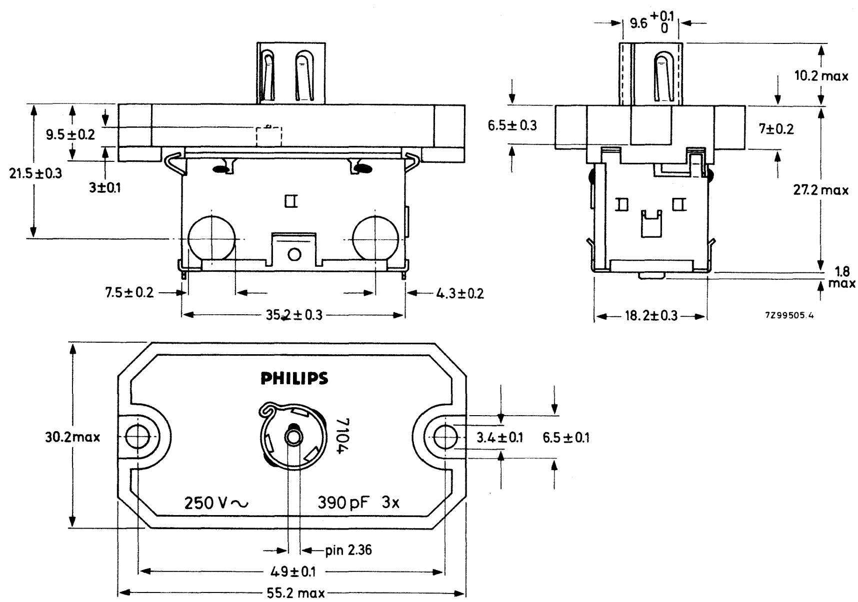
Cable diameter < 5 mm

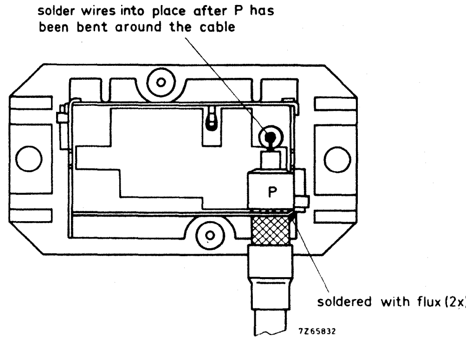
Coaxial aerial input assembly 75 Ω, with high-pass filter

Attenuation at	1 MHz	: 60 dB (typical value)
	5 MHz	: 40 dB (typical value)
	10 MHz	: ≥ 25 dB
	50 MHz	: ≤ 1 dB
	230 MHz	: ≤ 1 dB
	470 MHz	: ≤ 1 dB
	850 MHz	: ≤ 1,5 dB
Reflection,	v.h.f. I	: ≤ 35%
	v.h.f. III	: ≤ 15%
	u.h.f.	: ≤ 35%
Catalogue number		: 3122 127 14730

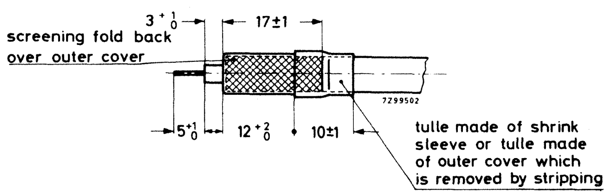


Dimensions in mm

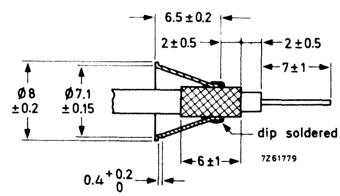




Recommended fixing of the aerial cable
Soldering conditions: 370 ± 5 °C; 3,5 ± 0,5 s



Cable diameter ≥ 5 mm



Cable diameter < 5 mm

COAXIAL AERIAL INPUT ASSEMBLY

APPLICATION

This coaxial aerial input assembly has been developed for application in TV sets with 75 Ω input impedance, for use in v.h.f. as well as in u.h.f. bands. Thanks to the use of safety capacitors in the assembly, the chassis of the TV set is separated from the aerial input. The connector for the aerial input meets the demands of the IEC standards (diameter 9,5 mm) and the French standards (diameter 9,0 mm).

The coaxial aerial input assembly complies with the requirements of immunity from radiated interference of BS 905. It meets the safety requirements of IEC 65; approbation approvals have been sought from KEMA, VDE, SEV, BSI, DEMKO, NEMKO, SEMKO, EI and LCEE.

DESCRIPTION

The assembly is provided with safety capacitors, which are moulded in thermo-setting insulation material, thus forming a capacitor block. This capacitor block is built in a metal housing, with lid, which is carried by a plastic fixing plate. All points to the safety capacitors are press contacts, achieved by the metal housing. The housing has an outlet for the coaxial cable to the television tuner.

ELECTRICAL DATA

The electrical values are measured at an ambient temperature of 25 ± 5 °C and a relative humidity of 60 ± 15%.

Input impedance of connector	75 Ω, asymmetrical
Frequency ranges	
v.h.f.	40 to 300 MHz
u.h.f.	470 to 890 MHz
Reflection	
v.h.f.	⩽ 15%
u.h.f.	⩽ 25%
Insertion loss	
v.h.f.	⩽ 1 dB; typ. 0,2 dB
u.h.f.	⩽ 1 dB; typ. 0,4 dB
Contact resistance of connector after 1 plug insertion	
inner bush	⩽ 10 mΩ
outer bush	⩽ 5 mΩ
Insulation resistance	> 500 MΩ
Immunity from radiated interference	in conformity with requirements of BS 905, provided the assembly is installed in a professional manner, and a proper coaxial cable is used.

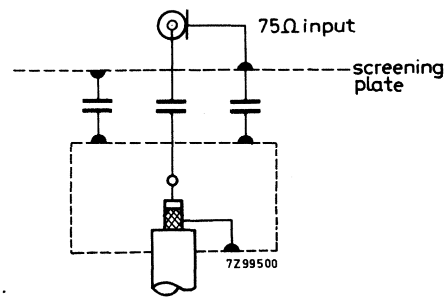


Fig. 1.

ENVIRONMENTAL DATA

Operating temperature range	0 to + 55 °C
Storage temperature range	−40 to + 85 °C
Relative humidity	⩽ 95%

MECHANICAL DATA

Dimensions in mm

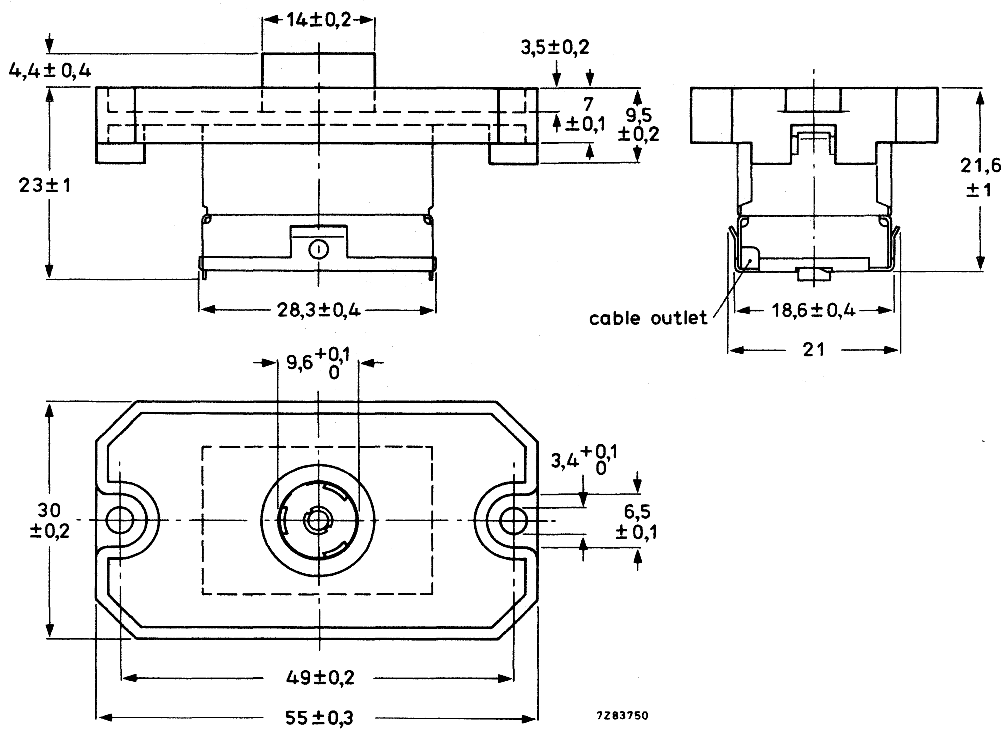


Fig. 2.

MOUNTING

The assembly can be mounted to the chassis of the TV set with two self-tapping screws, 4N x 9,5.

It must be connected to the tuner via a coaxial cable with a diameter of 3 mm. The inner cable conductor should be soldered to the metal plating of the capacitor block, and the cable earth sheath to the metal housing, see Fig. 3.

The soldering conditions are: 340 ^{o}C, 2 s.

Plugs to be used with the assembly have to comply with the properties mentioned in DIN 45325, IEC 69-2 (9,5 mm diameter) and SNIR (9 mm diameter).

It is advised not to use aluminium plugs.

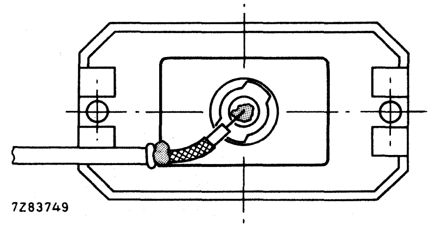


Fig. 3 Recommended fixing of the aerial cable.

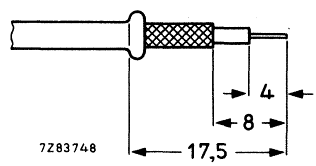


Fig. 4 Recommended cable stripping.

COAXIAL AERIAL INPUT ASSEMBLY

APPLICATION

This coaxial aerial input assembly has been developed for application in TV sets with 75 Ω input impedance, for use in v.h.f. as well as in u.h.f. bands. Thanks to the use of safety capacitors in the assembly, the chassis of the TV set is separated from the aerial input. The connector for the aerial input meets the demands of the IEC standards (diameter 9,5 mm) and the French standards (diameter 9,0 mm).

The coaxial aerial input assembly complies with the requirements of immunity from radiated interference of BS 905. It meets the safety requirements of IEC 65; approbation approvals have been sought from KEMA, VDE, SEV, BSI, DEMKO, NEMKO, SEMKO, EI and LCEE.

DESCRIPTION

The assembly is provided with safety capacitors, which are moulded in thermo-setting insulation material, thus forming a capacitor block. This capacitor block is built in a metal housing with lid, which is carried by a plastic fixing plate. All points to the safety capacitors are press contacts, achieved by the metal housing. A printed circuit board containing a splitter for v.h.f. and u.h.f. signals is built in the housing. The housing has two outlets for coaxial cables to the television tuner.

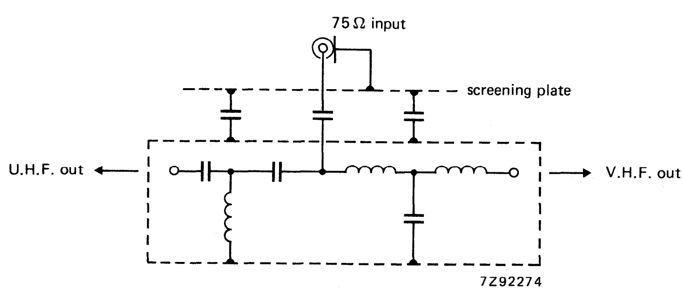


Fig. 1 Electrical diagram.

ELECTRICAL DATA

The electrical values are measured at an ambient temperature of 25 ± 5 °C and a relative humidity of 60 ± 15%.

Input impedance of connector	75 Ω, asymmetrical
Frequency ranges	
v.h.f.	40 to 300 MHz
u.h.f.	470 to 890 MHz
Reflection	
v.h.f.; u.h.f. output terminated with 75 Ω	⩽ 30%
u.h.f.; v.h.f. output terminated with 75 Ω	⩽ 30%
Insertion loss	
v.h.f., 40 – 230 MHz	⩽ 1 dB; typ. 0,7 dB
v.h.f., 230 – 300 MHz, u.h.f. terminated with 75 Ω	⩽ 1,5 dB; typ. 1,2 dB
u.h.f., v.h.f. terminated with 75 Ω	⩽ 1,5 dB, typ. 0,9 dB
Suppression	
of u.h.f. frequencies at v.h.f. output	
40 – 230 MHz	⩾ 15 dB
230 – 300 MHz	⩾ 10 dB
measured at	
40 MHz	typ. 50 dB
200 MHz	typ. 22 dB
230 MHz	typ. 18 dB
300 MHz	typ. 11 dB
of v.h.f. frequencies at u.h.f. output	
470 – 890 MHz	⩾ 13 dB
measured at	
470 MHz	typ. 14 dB
700 MHz	typ. 21 dB
890 MHz	typ. 22 dB
Contact resistance of connector after 1 plug insertion	
inner bush	⩽ 10 mΩ
outer bush	⩽ 5 mΩ
Insulation resistance	> 500 MΩ
Immunity from radiated interference	in conformity with requirements of BS 905, provided the assembly is installed in a professional manner, and a proper coaxial cable is used.

Quality assessment in production centres are according to the rules of BSI and VDE.

ENVIRONMENTAL DATA

Operating temperature range	0 to +55 °C
Storage temperature range	−40 to +85 °C
Relative humidity	⩽ 95%
Maximum bump acceleration	25g
Maximum shock acceleration	50g
Maximum vibration amplitude	0,35 mm

MECHANICAL DATA

Dimensions in mm

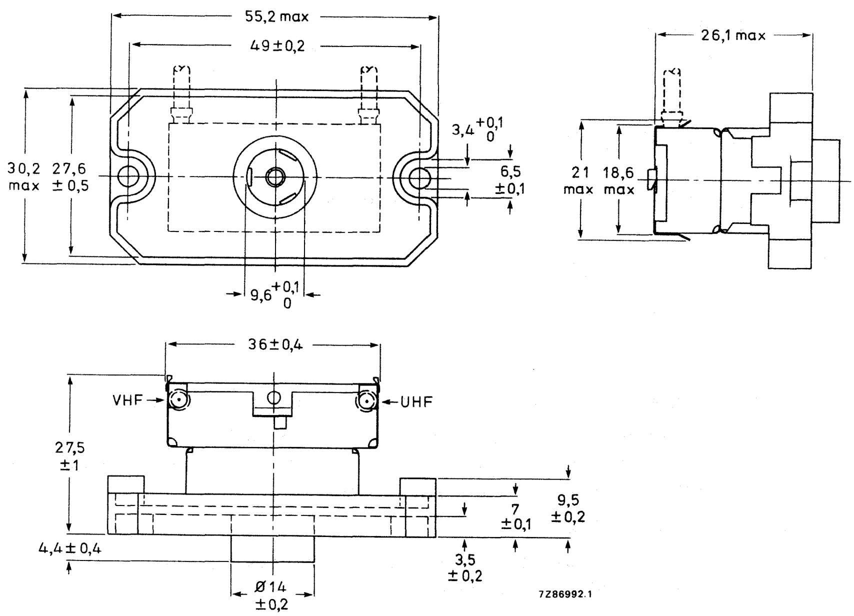


Fig. 2.

Mass 26 g approximately

Connector

Insertion force	⩽ 50 N
Pull-out force	10 to 50 N
Pull-out force of inner bush, measured with a min. gauge of 2,29 mm dia., after 5 insertions of a max. plug gauge of 2,43 mm dia.	⩾ 1 N
Loading of inner bush in axial direction for 5 s	⩽ 50 N
Pull-out force of outer bush, measured with a min. plug gauge of 9 mm dia., after 5 insertions of a max. plug gauge of 9,5 mm dia.	⩾ 1,5 N
Loading of outer bush in 4 radial and axial directions for 5 s	⩽ 50 N

Marking

Moulded at the front of the fixing plate:
- PHILIPS
- 7105 (for the National Approbation Offices regarding the safety aspects)
- 250 V~, 390 pF 3x

Punched into one of the side faces of the metal housing:
- letter code for factory of origin
- production date code (year and week)

MOUNTING

The assembly can be mounted to the chassis of the TV set with two self-tapping screws, 4N x 9,5.

It must be connected to the tuner via coaxial cables with a diameter of 3 mm stripped according to Fig. 3. The inner cable conductors should be soldered to the inputs of splitters which line up with the cable inlets, the cable earth sheaths soldered to the metal housing.

The soldering conditions are: 340 °C, 2 s.

Plugs to be used with the assembly have to comply with the properties mentioned in DIN 45325, IEC 69-2 (9,5 mm diameter) and SNIR (9 mm diameter).

It is advised not to use aluminium plugs.

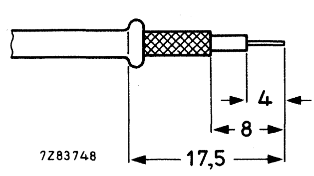


Fig. 3 Recommended cable stripping.
Cable length max. 150 mm.

CONVERSION LIST

catalogue number	type number	page
3111 268 50021	SFE212	29
50031	SFE212/A	29
50061	SFE212S	29
50071	SFE212S/A	29
3112 218 51830	V431	301
52660	UV417	99
52690	UV417/IEC	99
52720	UV418/256	99
52750	UV418/64	99
52780	UV418/256/IEC	99
52810	UV418/64/IEC	99
3112 297 10020	UV711/IEC.L	181
10501	UV815	217
10511	UV816/256	217
10521	UV816/6456	217
3122 127 01240		319
03310	UV471	143
03500		319
05900		319
08870	UV411/IEC	67
08880	UV412/256/IEC	67
08890	UV412/64/IEC	67
08900	UV412/64	67
09060	UV412/256	67
10260		323
10450		323
14730		323
24140		333
24360	UV411	67
31200		329
42010	UV412	67
43630	UV431	111
48460	UV461	127
3122 131 63390	cross head	97
3122 237 00010	UV618/256	169
00020	UV461/IEC	127
00030	UV462/256	127
00040	UV462/256/IEC	127
00060	UV617	169
00200	UV411HKM/IEC	83

CONVERSION LIST (continued)

catalogue number	type number	page
3122 237 00240	UV412HKM/256/IEC	83
00270	U743	43
00280	U743/IEC	43
00290	U743/IEC.L	43
00300	U744/256	43
00310	U744/256/IEC	43
00320	U744/256/IEC.L	43
00340	UV472/256	143
00360	UV472/64	143
00441	UV816/PLL	217
00450	UV616S/256	157
00530	UV616S/6456	157
00550	UV616S/256T	157
00560	UV615S	157
00570	UV934	247
00580	UV934/D	247
00590	UV933	247
00600	UV933/D	247
00610	UV933/IEC	247
00620	V933	247
00640	UV934/IEC	247
00650	U944	55
00660	U944/IEC	55
00670	U944/L	55
00680	U943	55
00690	U943/IEC	55
00700	U943/L	55
10030	FE618Q/256	15
3139 147 10030	UV711/IEC	181
10040	UV711	181
10050	UV712/256/IEC.L	181
10060	UV712/256/IEC	181
10070	UV712/256	181
10080	UV712/64/IEC.L	181
10090	UV712/64/IEC	181
10100	UV712/64	181
10110	UV752/IEC.L	205
10140	UV751/IEC.L	205
10150	UV751/IEC	205
10160	UV751	205

catalogue number	type number	page
3139 147 10170	UV711NZ/IEC.L	193
10180	UV711NZ/IEC	193
10190	UV711NZ	193
10230	UV752	205
10310	UV752/IEC	205
10361	UV916E/PLL/IEC	235
10381	UV936	261
10471	UV916E/PLL	235
10771	UV915E	235
10781	UV915E/IEC	235
11010	UV935	261
10950	injection probe	*
7122 005 47680	adjustment tool	82
47910	holder	97
8104 004 11040	adjustment tool	110

* Appears in all UV9xx series datasheets.

DATA HANDBOOK SYSTEM

DATA HANDBOOK SYSTEM

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

INTEGRATED CIRCUITS

DISCRETE SEMICONDUCTORS

DISPLAY COMPONENTS

PASSIVE COMPONENTS*

PROFESSIONAL COMPONENTS**

MATERIALS*

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

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

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

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

Information on current Data Handbooks and how to obtain a subscription for future issues is available from any of the Organizations listed on the back cover.
Product specialists are at your service and enquiries will be answered promptly.

* Will replace the Components and materials (green) series of handbooks.
** Will replace the Electron tubes (blue) series of handbooks.

INTEGRATED CIRCUITS

This series of handbooks comprises:

code	handbook title
IC01	**Radio, audio and associated systems** Bipolar, MOS
IC02a/b	**Video and associated systems** Bipolar, MOS
IC03	**ICs for Telecom** Bipolar, MOS Subscriber sets, Cordless Telephones
IC04	**HE4000B logic family** CMOS
IC05	**Advanced Low-power Schottky (ALS) Logic Series**
IC06	**High-speed CMOS; PC74HC/HCT/HCU** Logic family
IC07	**Advanced CMOS logic (ACL)**
IC08	**ECL 10K and 100K logic families**
IC09N	**TTL logic series**
IC10	**Memories** MOS, TTL, ECL
IC11	**Linear Products**
IC12	**I^2C-bus compatible ICs**
IC13	**Semi-custom** Programmable Logic Devices (PLD)
IC14	**Microcontrollers** NMOS, CMOS
IC15	**FAST TTL logic series**
IC16	**CMOS integrated circuits for clocks and watches**
IC17	**ICs for Telecom** Bipolar, MOS Radio pagers Mobile telephones ISDN
IC18	**Microprocessors and peripherals**
IC19	**Data communication products**

DISCRETE SEMICONDUCTORS

This series of data handbooks comprises:

current code	new code	handbook title
S1	**SC01**	**Diodes** High-voltage tripler units
S2a	**SC02**	**Power diodes**
S2b	**SC03***	**Thyristors and triacs**
S3	**SC04**	**Small-signal transistors**
S4a	**SC05**	**Low-frequency power transistors and hybrid IC power modules**
S4b	**SC06**	**High-voltage and switching power transistors**
S5	**SC07**	**Small-signal field-effect transistors**
S6	**SC08** **SC09**	**RF power transistors** **RF power modules**
S7	**SC10**	**Surface mounted semiconductors**
S8a	**SC11***	**Light emitting diodes**
S8b	**SC12**	**Optocouplers**
S9	**SC13***	**PowerMOS transistors**
S10	**SC14**	**Wideband transistors and wideband hybrid IC modules**
S11	**SC15**	**Microwave transistors**
S15**	**SC16**	**Laser diodes**
S13	**SC17**	**Semiconductor sensors**
S14	**SC18***	**Liquid crystal displays and driver ICs for LCDs**

* Not yet issued with the new code in this series of handbooks.
** New handbook in this series; will be issued shortly.

DISPLAY COMPONENTS

This series of data handbooks comprises:

current code	new code	handbook title
T8	**DC01**	**Colour display components**
T16	**DC02**	**Monochrome monitor tubes and deflection units**
C2	**DC03**	**Television tuners, coaxial aerial input assemblies**
C3	**DC04***	**Loudspeakers**
C20	**DC05**	**Flyback transformers, mains transformers and general-purpose FXC assemblies**

* These handbooks are currently issued in another series; they are not yet issued in the Display Components series of handbooks.

PASSIVE COMPONENTS

This series of data handbooks comprises:

current code	new code	handbook title
C14	**PA01**	**Electrolytic capacitors; solid and non-solid**
C11	**PA02**	**Varistors, thermistors and sensors**
C12	**PA03**	**Potentiometers and switches**
C7	**PA04**	**Variable capacitors**
C22	**PA05***	**Film capacitors**
C15	**PA06***	**Ceramic capacitors**
C9	**PA07***	**Piezoelectric quartz devices**
C13	**PA08**	**Fixed resistors**

* Not yet issued with the new code in this series of handbooks.

PROFESSIONAL COMPONENTS

This series of data handbooks comprises:

current code	new code	handbook title
T1	*	**Power tubes for RF heating and communications**
T2a	*	**Transmitting tubes for communications, glass types**
T2b	*	**Transmitting tubes for communications, ceramic types**
T3	**PC01****	**High-power klystrons**
T4	*	**Magnetrons for microwave heating**
T5	**PC02****	**Cathode-ray tubes**
T6	**PC03****	**Geiger-Müller tubes**
T9	**PC04****	**Photo and electron multipliers**
T10	**PC05**	**Plumbicon camera tubes and accessories**
T11	**PC06**	**Circulators and Isolators**
T12	**PC07**	**Vidicon and Newvicon camera tubes and deflection units**
T13	**PC08**	**Image intensifiers**
T15	**PC09****	**Dry reed switches**
C8	**PC10**	**Variable mains transformers; annular fixed transformers**
	PC11	**Solid state image sensors and peripheral integrated circuits**

* These handbooks will not be reissued.

** Not yet issued with the new code in this series of handbooks.

MATERIALS

This series of data handbooks comprises:

current code	new code	handbook title
C4 C5	MA01*	**Soft Ferrites**
C16	MA02**	**Permanent magnet materials**
C19	MA03**	**Piezoelectric ceramics**

* Handbooks C4 and C5 will be reissued as one handbook having the new code MA01.

** Not yet issued with the new code in this series of handbooks.

Philips Components – a worldwide company

Argentina: PHILIPS ARGENTINA S.A., Div. Philips Components, Vedia 3892, 1430 BUENOS AIRES, Tel. (01) 541-4261.
Australia: PHILIPS COMPONENTS PTY Ltd, 11 Waltham Street, ARTARMON, N.S.W. 2064, Tel. (02) 439 3322.
Austria: ÖSTERREICHISCHE PHILIPS INDUSTRIE G.m.b.H., UB Bauelemente, Triester Str. 64, 1101 WIEN, Tel. (0222) 60 101-820.
Belgium: N.V PHILIPS PROF. SYSTEMS – Components Div., 80 Rue Des Deux Gares, B-1070 BRUXELLES, Tel. (02) 52 56 111.
Brazil: PHILIPS COMPONENTS (Active Devices) Av. Brigadeiro Faria Lima, 1735-SAO PAULO-SP, Tel. (011) 211-2600. PHILIPS COMPONENTS (Passive Devices & Materials) Av. Francisco Monteiro, 702-RIBEIRO PIRES-SP, Tel. (011) 459-8211.
Canada: PHILIPS ELECTRONICS LTD., Philips Components, 601 Milner Ave., SCARBOROUGH, Ontario, M1B 1M8, Tel. (416) 292-5161.
Chile: PHILIPS CHILENA S.A., Av. Santa Maria 0760, SANTIAGO, Tel. (02) 77 38 16.
Colombia: IPRELENSO LTDA., Carrera 21 No. 56-17, BOGOTA, D.E., P.O. Box 77621, Tel. (01) 249 76 24.
Denmark: PHILIPS COMPONENTS A/S, Prags Boulevard 80, PB1919, DK-2300 COPENHAGEN S, Tel. 01-54 11 33.
Finland: PHILIPS COMPONENTS, Sinikalliontie 3, SF-2630 ESPOO HELSINKI 10, Tel. 358-0-50 261.
France: PHILIPS COMPOSANTS RTC-COMPELEC, 117 Quai du Président Roosevelt, 92134 ISSY-LES-MOULINEAUX Cedex, Tel. (01) 40 93 80 00.
Germany (Fed. Republic): VALVO, UB Bauelemente der Philips G.m.b.H., Valvo Haus, Burchardstrasse 19, D-2 HAMBURG 1, Tel. (040) 3296-0.
Greece: PHILIPS HELLENIQUE S.A., Components Division, No. 15, 25th March Street, GR 17778 TAVROS, Tel. (01) 4894 339/4894 911.
Hong Kong: PHILIPS HONG KONG LTD., Components Div., 15/F Philips Ind. Bldg., 24-28 Kung Yip St., KWAI CHUNG, Tel. (0)-42 45 121.
India: PEICO ELECTRONICS & ELECTRICALS LTD., Components Dept., Band Box Building, 254-D Dr. Annie Besant Rd., BOMBAY – 400025, Tel. (022) 4930311/4930590.
Indonesia: P.T. PHILIPS-RALIN ELECTRONICS, Components Div., Setiabudi II Building, 6th Fl., Jalan H.R. Rasuna Said (P.O. Box 223/KBY) Kuningan, JAKARTA 12910, Tel. (021) 51 79 95.
Ireland: PHILIPS ELECTRONICS (IRELAND) LTD., Components Division, Newstead, Clonskeagh, DUBLIN 14, Tel. (01) 69 33 55.
Italy: PHILIPS S.p.A., Philips Components, Piazza IV Novembre 3, I-20124 MILANO, Tel. (02) 6752.1.
Japan: PHILIPS K.K. Philips Components Division, Philips Bldg 13-37, Kohnan 2-chome, Minato-ku, TOKYO (108), Tel. (03) 740 5028.
Korea (Republic of): PHILIPS ELECTRONICS (KOREA) LTD. Components Division, Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL, Tel. (02) 794-5011.
Malaysia: PHILIPS MALAYSIA SDN BHD, Components Div., 3 Jalan SS15/2A SUBANG, 47500 PETALING JAYA, Tel. (03) 73 45 511.
Mexico: PHILIPS COMPONENTS, Paseo Triunfo de la Republica, No 215 Local 5, Cd Juarez CHI HUA HUA 32340 MEXICO Tel. (16) 18-67-01/02.
Netherlands: PHILIPS NEDERLAND, Marktgroep Philips Components, Postbus 90050, 5600 PB EINDHOVEN, Tel. (040) 78 37 49.
New Zealand: PHILIPS NEW ZEALAND LTD., Components Division, 110 Mt. Eden Road, C.P.O. Box 1041, AUCKLAND, Tel. (09) 605-914.
Norway: NORSK A/S PHILIPS, Philips Components, Box 1, Manglerud 0612, OSLO, Tel. (02) 68 02 00.
Pakistan: PHILIPS ELECTRICAL CO. OF PAKISTAN LTD., Philips Markaz, M.A. Jinnah Rd., KARACHI-3, Tel. (021) 72 57 72.
Peru: CADESA, Av. Pardo y Aliaga No. 695, 6th Floor, San Isidro, LIMA 100, P.O. Box 5612, Tel. (014) 70 70 80.
Philippines: PHILIPS INDUSTRIAL DEV. INC., 2246 Pasong Tamo, P.O. Box 911, Makati Comm. Centre, MAKATI-RIZAL 3116, Tel. (02) 868951 to 59.
Portugal: PHILIPS PORTUGUESA S.A.R.L., Av. Eng. Duarte Pacheco 6, 1009 LISBOA Codex, Tel. (019) 68 31 21.
Singapore: PHILIPS SINGAPORE, PTE LTD., Components Div., Lorong 1, Toa Payoh, SINGAPORE 1231, Tel. 35 02 000.
South Africa: S.A. PHILIPS PTY LTD., Components Division, JOHANNESBURG 2000, P.O. Box 7430.
Spain: PHILIPS COMPONENTS, Balmes 22, 08007 BARCELONA, Tel. (03) 301 63 12.
Sweden: PHILIPS COMPONENTS, A.B., Tegeluddsvägen 1, S-11584 STOCKHOLM, Tel. (0)8-78 21 000.
Switzerland: PHILIPS A.G., Components Dept., Allmendstrasse 140-142, CH-8027 ZÜRICH, Tel. (01) 488 22 11.
Taiwan: PHILIPS TAIWAN LTD., 150 Tun Hua North Road, P.O. Box 22978, TAIPEI, Taiwan, Tel. (02) 71 20 500.
Thailand: PHILIPS ELECTRICAL CO. OF THAILAND LTD., 283 Silom Road, P.O. Box 961, BANGKOK, Tel. (02) 233-6330-9.
Turkey: TÜRK PHILIPS TICARET A.S., Philips Components, Talatpasa Cad. No. 5, 80640 LEVENT/ISTANBUL, Tel. (01) 179 27 70.
United Kingdom: PHILIPS COMPONENTS LTD., Mullard House, Torrington Place, LONDON WC1E 7HD, Tel. (01) 580 6633.
United States: (Colour picture tubes – Monochrome & Colour Display Tubes) PHILIPS DISPLAY COMPONENTS COMPANY, 1600 Huron Parkway, P.O. Box 963, ANN ARBOR, Michigan 48106, Tel. 313/996-9400. (IC Products) SIGNETICS CORPORATION, 811 East Arques Avenue, SUNNYVALE, CA 94088-3409, Tel. (408) 991-2000. (Passive Components, Discrete Semiconductors, Materials and Professional Components) PHILIPS COMPONENTS, Discrete Products Division, 2001 West Blue Heron Blvd., P.O. Box 10330, RIVIERA BEACH, Florida 33404, Tel. (407) 881-3200.
Uruguay: PHILIPS COMPONENTS, Coronel Mora 433, MONTEVIDEO, Tel. (02) 70-40 44.
Venezuela: MAGNETICA S.A., Calle 6, Ed. Las Tres Jotas, CARACAS 1074A, App. Post. 78117, Tel. (02) 241 75 09.
Zimbabwe: PHILIPS ELECTRICAL (PVT) LTD., 62 Mutare Road, HARARE, P.O. Box 994, Tel. 47211.

For all other countries apply to: Philips Components Division, Strategic Accounts and International Sales, P.O. Box 218, 5600 MD EINDHOVEN, The Netherlands, Telex 35000 phtcnl, Fax. 23753

AS75 © Philips Export B.V. 1989

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner.

The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

Printed in The Netherlands 9398 162 50011

Philips Components

PHILIPS

PHILIPS