PHILIPS

DATA HANDBOOK

PHILIPS ELECTRONIC COMPONENTS AND MATERIALS DIVISION

COMPONENTS AND MATERIALS

PART 3 JANUARY 1969

Radio

Audio

Television

C3.03/53(3)

COMPONENTS AND MATERIALS

Radio onderdelen 5820/10

Part 3 TV " 5820/11 **January 1969**

FOR "FERRITES FOR RADIO, AUDIO AND TELEVISION" SEE RELEVANT SECTION OF PART 4

Comprehensive contents list at the back

DATA HANDBOOK SYSTEM

To provide you with a comprehensive source of information on electronic components, subassemblies and materials, our Data Handbook System is made up of three series of handbooks, each comprising several parts.
The three series, identified by the colours noted, are:

ELECTRON TUBES (9 parts)	BLUE
SEMICONDUCTORS AND INTEGRATED CIRCUITS (5 parts)	RED
COMPONENTS AND MATERIALS (5 parts)	GREEN

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued annually; the contents of each series are summarized on the following pages.
We have made every effort to ensure that each series is as accurate, comprehensive and up-to-date as possible, and we hope you will find it to be a valuable source of reference. You will understand that we can not guarantee that all products listed in any one edition of the handbook will remain available, or that their specifications will not be changed, before the next edition is published. If you need confirmation that the published data about any of our products are the latest available, may we ask that you contact our representative. He is at your service and will be glad to answer your inquiries.

ELECTRON TUBES (BLUE SERIES)

This series consists of the following parts, issued on the dates indicated.

Part 1 **December 1968**

Transmitting tubes (Tetrodes, Pentodes)
Associated accessories

Part 2 **February 1969**

Tubes for microwave equipment

Part 3 **February 1968**

Special Quality tubes
Miscellaneous devices

Part 4 **March 1968**

Receiving tubes
T.V. picture tubes

Part 5 **April 1968**

Cathode-ray tubes
Photo tubes
Camera tubes
Photoconductive devices
Associated accessories

Part 6 **July 1968**

Photomultiplier tubes
Radiation counter tubes
Scintillators
Semiconductor radiation detectors
Miscellaneous nuclear devices

Part 7 **May 1968**

Voltage stabilizing and reference tubes
Counter, selector, and indicator tubes
Trigger tubes
Switching diodes
Thyratrons
Ignitrons
Industrial rectifying tubes
High-voltage rectifying tubes

Part 9 **December 1968**

Transmitting tubes (Triodes)
Tubes for R.F. heating (Triodes)
Associated accessories

SEMICONDUCTORS AND INTEGRATED CIRCUITS (RED SERIES)

This series consists of the following parts, issued on the dates indicated.

Part 1 **September 1968**

General section
Signal diodes
Variable capacitance diodes
Voltage regulator diodes
Rectifier diodes
Thyristors
Rectifier stacks
Accessories and heatsinks

Part 2 **October 1968**

General section
Germanium transistors
Photo devices
Accessories and heatsinks

Part 3-4 **November 1968**

General section
Silicon transistors
Accessories and heatsinks

Part 5 **January 1969**

General section
Digital integrated circuits
Linear integrated circuits

COMPONENTS AND MATERIALS (GREEN SERIES)

This series consists of the following parts, issued on the dates indicated.

Part 1 Circuit Blocks, Input/Output Devices **September 1968**

Circuit blocks:
- 100 kHz Series
- 1-Series
- 10-Series
- 20-Series
- 40-Series
- Norbits (60-Series)

Circuit blocks for ferrite core memory drive

Input/output devices

Accessories for circuit blocks:
- Power supplies
- Mounting chassis
- Printed-wiring boards

Part 2 Resistors, Capacitors **November 1968**

Fixed resistors
Variable resistors
Non-linear resistors
Ceramic capacitors
Polycarbonate, paper, mica, polystyrene capacitors
Electrolytic capacitors
Variable capacitors

Part 3 Radio, Audio, Television **January 1969**

FM tuners
Coils and resonators
Audio and mains transformers
Loudspeakers
Electronic organ assemblies
Television tuners
Components for black and white television
Components for colour television
Deflection assemblies for camera tubes

Part 4 Magnetic Materials, White Ceramics **March 1968**

Ferrites for radio, audio and television
Ferroxcube potcores
Microchokes
Ferroxcube transformer cores
Piezoxide
Insulating and dielectric materials
Permanent magnet materials

Part 5 Memory Products, Magnetic Heads, Quartz Crystals, Microwave Devices, Variable Transformers, Electro-mechanical Components **June 1968**

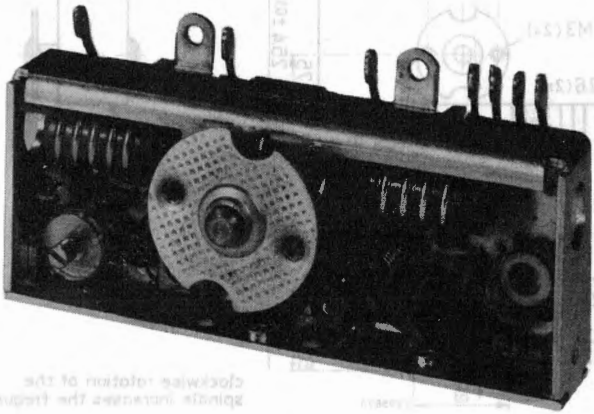
Ferrite memory cores
Matrix planes, matrix stacks
Complete memories
Magnetic heads
Quartz crystal units, crystal filters
Isolators, circulators
Variable mains transformers
Electro-mechanical components

This Handbook does not give information on delivery or terms.

The information given in this Handbook does not imply a licence under any patent.

FM tuners

F.M. TUNER



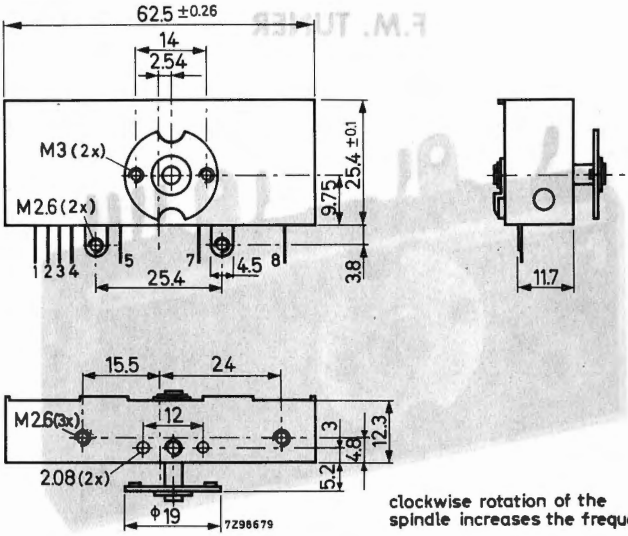
F.M. tuner for European band; with automatic frequency control
Equipped with silicon transistors.

APPLICATION

For use in radio sets for reception of F.M. signals in the European frequency band (not for portable and car radios as no supply voltage stabilisation is present).

MECHANICAL DATA

Dimensions in mm



clockwise rotation of the spindle increases the frequency

ELECTRICAL DATA

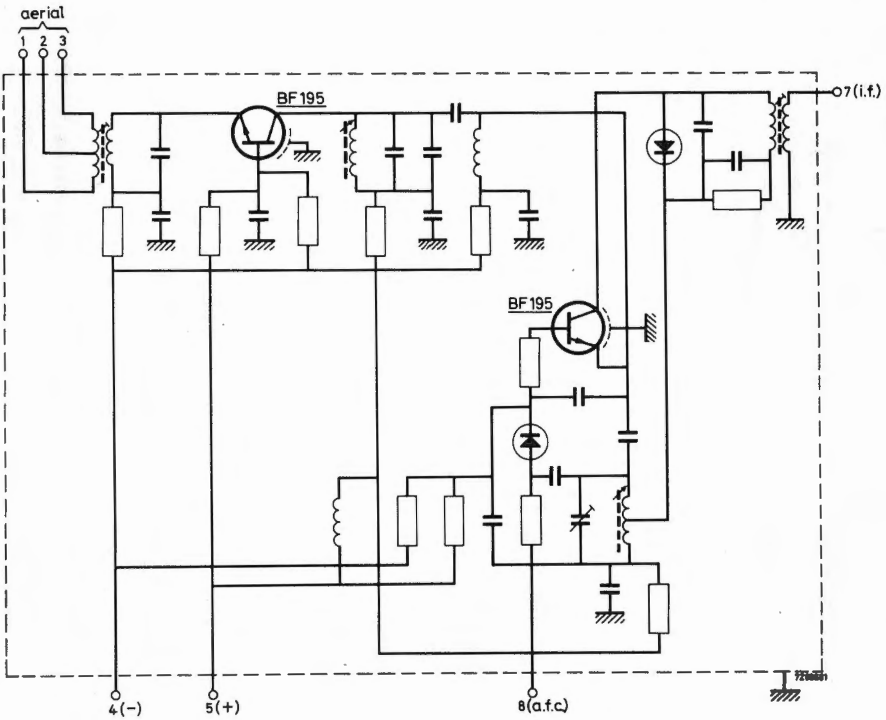
Supply voltage	9 V_{dc}
Frequency range	87-104 MHz
Tolerance on scale calibration	< 350 kHz
Padding deviation	< 0.75 MHz
Total gain [1]	4.5 x
I.F. frequency	10.7 MHz The oscillator frequency is higher than the signal frequency
I.F. bandwidth (3 dB) [1]	210 kHz
Maximum frequency drift	10 kHz/deg C
Radiation measured at a distance of 3 m (I.E.C.)	
fundamental wave	1000 μV/m
second harmonic	300 μV/m

[1]) Measured with secondary i.f. filter 3122 108 22850 (see Gain Measurement).

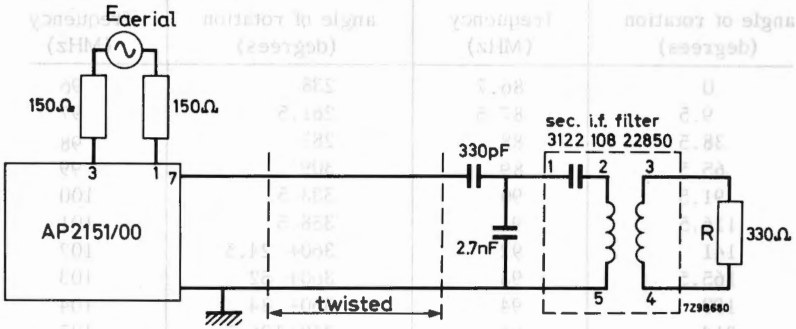
Scale calibration

angle of rotation (degrees)	frequency (MHz)	angle of rotation (degrees)	frequency (MHz)
0	86.7	238	96
9.5	87.5	261.5	97
38.5	88	285	98
65.5	89	309	99
91.5	90	333.5	100
116.5	91	358.5	101
141	92	360+ 24.5	102
165.5	93	360+ 52	103
190	94	360+ 84	104
214	95	360+126.5	105

Circuit diagram



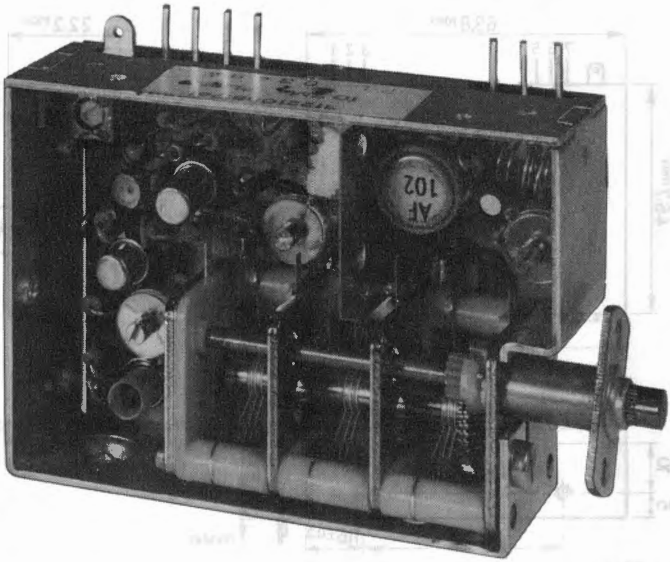
GAIN MEASUREMENT



The aerial impedance of 300 Ω is connected symmetrically.

$$\text{The gain} = \frac{\text{i.f. voltage across R}(= 330\ \Omega)}{\text{aerial e.m.f.}}$$

F.M. TUNERS



F.M. tuner AP2152/00 for European band; with soldering lugs
AP2152/01 for European band; with pins for printed-wiring
AP2152/02 for American band; with soldering lugs

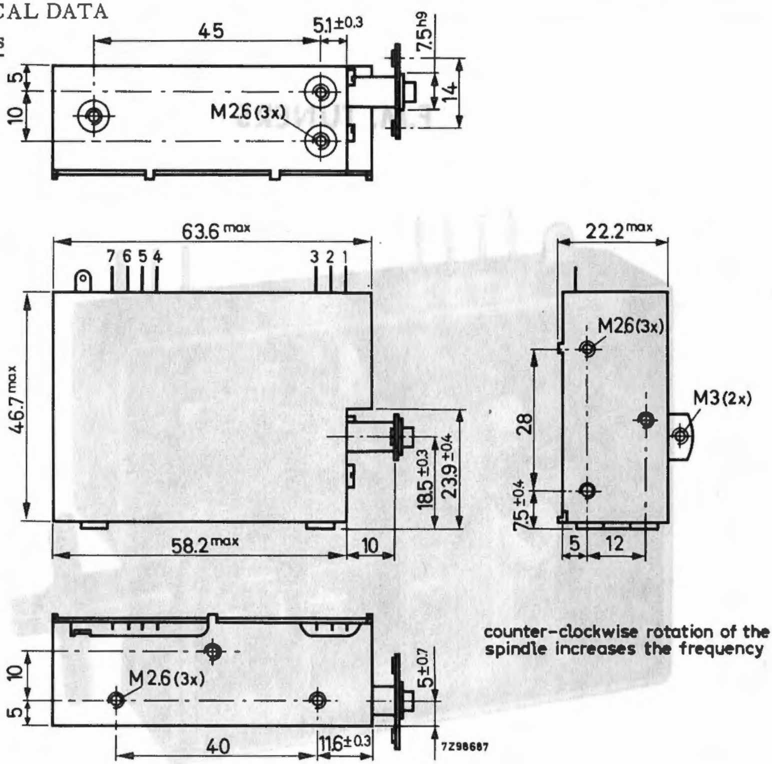
Automatic frequency control
Equipped with germanium transistors

APPLICATION

For use in Hi-Fi radio sets (not for portable radios as no supply voltage stabilisation is present).
The advantage of this tuner is the excellent big signal handling.

MECHANICAL DATA

Dimensions in mm



ELECTRICAL DATA

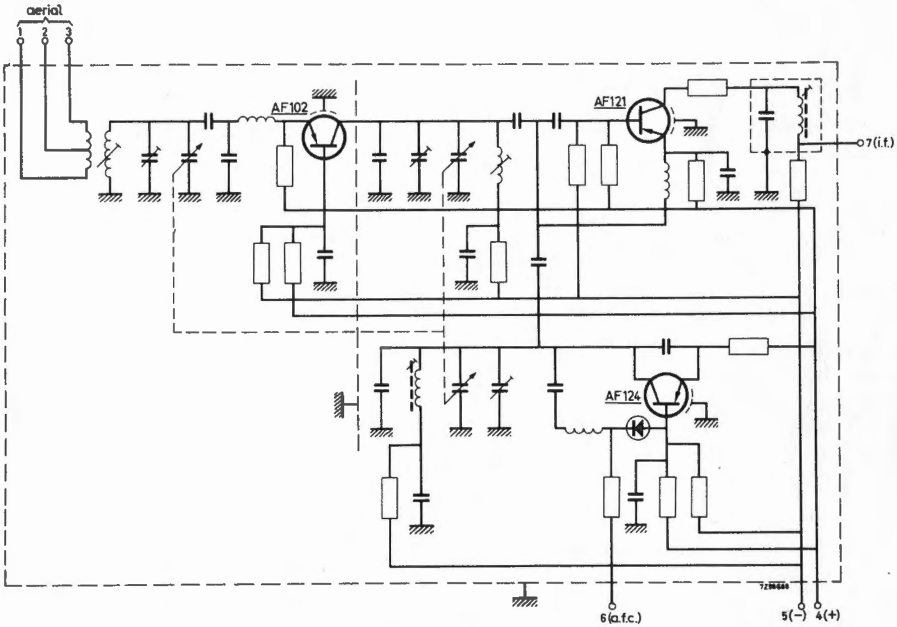
	AP2152/00 AP2152/01	AP2152/02
Supply voltage	14 V_{dc}	14 V_{dc}
Frequency range	87-104 MHz	87-108.9 MHz
Tolerance on scale calibration	< 350 kHz	< 350 kHz
Padding deviation	< 0.5 MHz	< 0.5 MHz
Total gain 1)	4 x	4 x
I.F. frequency	10.7 MHz	10.7 MHz
	The oscillator frequency is higher than the signal frequency	The oscillator frequency is lower than the signal frequency
I.F. bandwidth (3 dB) 1)	225 kHz	225 kHz
Radiation measured at a distance of 3 m (I.E.C.)		
fundamental wave	1000 μV/m	1000 μV/m
second harmonic	300 μV/m	300 μV/m

1) Measured with secondary i.f. filter 3122 108 22850 (see Gain Measurement).

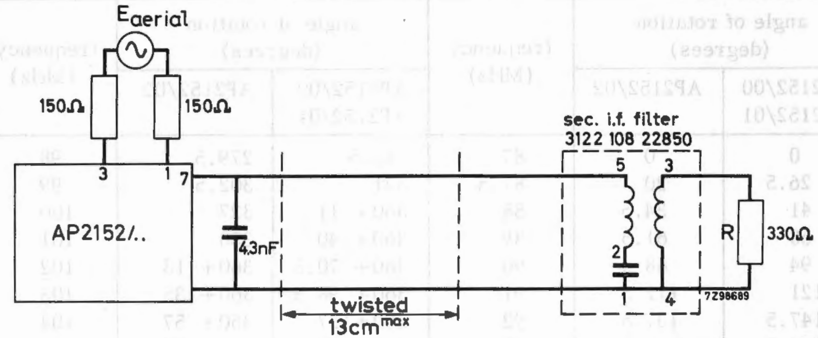
Scale calibration

angle of rotation (degrees)		frequency (MHz)	angle of rotation (degrees)		frequency (MHz)
AP2152/00 AP2152/01	AP2152/02		AP2152/00 AP2152/01	AP2152/02	
0	0	87	311.5	279.5	98
26.5	20	87.5	341	302.5	99
41	34.5	88	360+ 11	327	100
68	61.5	89	360+ 40	350	101
94	88	90	360+ 70.5	360+ 13	102
121	112.5	91	360+ 98.5	360+ 35	103
147.5	137.5	92	360+127	360+ 57	104
174.5	161.5	93	360+159	360+ 78.5	105
202.5	185.5	94		360+ 98.5	106
230	209.5	95		360+118	107
257	232.5	96		360+138.5	108
284	256	97		360+158.4	108.9

Circuit diagram



GAIN MEASUREMENT

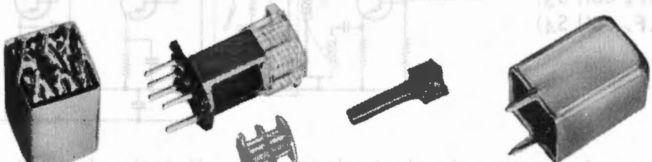


The aerial impedance of 300 Ω is connected symmetrically.

$$\text{The gain} = \frac{\text{i.f. voltage across R } (= 330\ \Omega)}{\text{aerial e.m.f.}}$$

Coils and resonators

COILS
for transistorised radio sets

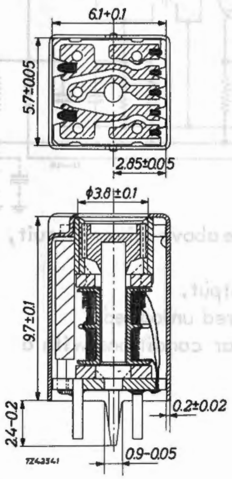


RZ 16012-1

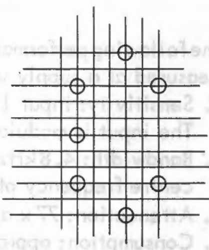
intermediate frequency AM	450 - 470 kHz
FM	10.7 MHz
quality factor Q	100 - 140
inductance adjustment range	± 10% to ± 15%
temperature coefficient	100.10^{-6} - 400.10^{-6}/deg C

These coils are designed for mounting in printed-wiring boards with an ϵ-grid ($\epsilon = \frac{e}{4} = 0.635$ mm).
They can be supplied with a built-in capacitor (capacitance values 47, 82, 100 or 150 pF).

Dimensions in mm



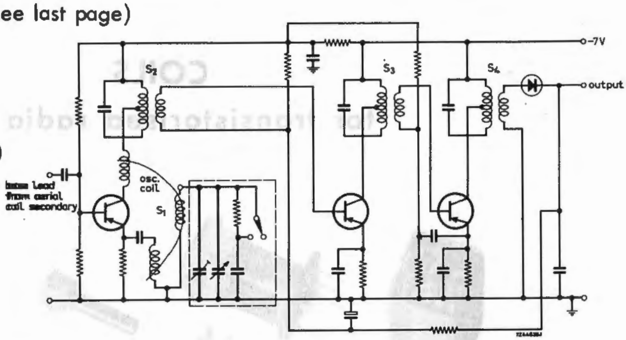
7Z43541



Hole pattern

7Z43542

TYPES (for catalog numbers see last page)



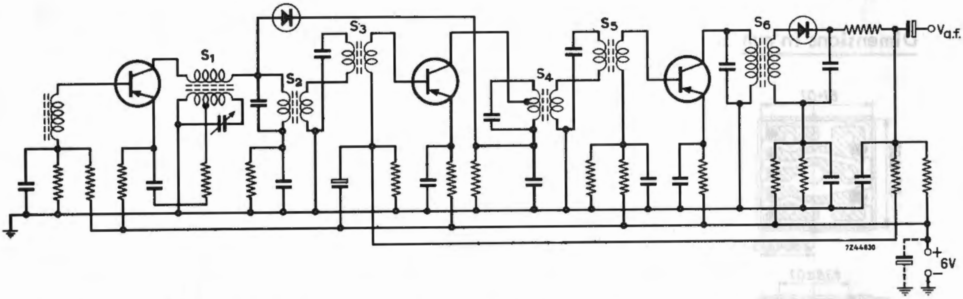
AM receivers

AP 1051/11 (oscillator coil S_1)
AP 1051/15 (I.F. coil S_2)
AP 1051/13 (I.F. coil S_3)
AP 1051/14 (I.F. coil S_4)

The following performance can be obtained with these coils in the above-given circuit, measured at a supply voltage of -7V.

a. Sensitivity: input 2 µV ± 6 dB at 1 MHz for 50 mV audio output. The input is modulated 30% at 400 Hz. The output is measured across a 5 kΩ load.
b. Bandwidth: 5.1 kHz ± 500 Hz at 6 dB measured under similar conditions with a centre frequency of 470 kHz.
c. Attenuation: 26 dB ± 3 dB at 9 kHz from centre frequency.
d. Consumption: approx. 3.3 mA

AP 1051/20 (I.F. coil S_2)
AP 1051/21 (I.F. coils S_3 and S_5)
AP 1051/22 (I.F. coil S_4) (S_1 = oscillator coil)
AP 1051/23 (I.F. coil S_6)

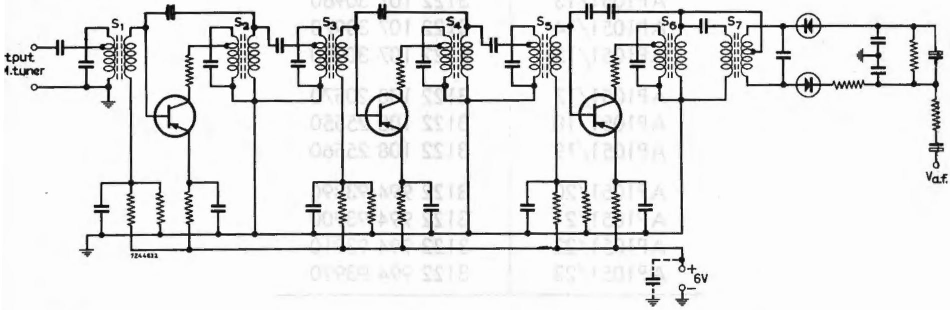


The following performance can be obtained with these coils in the above-given circuit, measured at a supply voltage of 6V.

a. Sensitivity: input 1.6 µV ± 6 dB at 1 MHz for 10 mV audio output.
The input is modulated 30% at 400 Hz. The output is measured unloaded.
b. Bandwidth: 4.8 kHz ± 500 Hz at 6 dB. Measured under similar conditions with a centre frequency of 460 kHz.
c. Attenuation: 77 x at 9 kHz from centre frequency.
d. Consumption: approx. 3.3 mA
e. Max. input: on base of first transistor 20 mV (1 MHz).

FM receivers

AP 1051/17 (I.F. coils S_1, S_2, S_3, S_4, S_5)
AP 1051/18 (Detector coil S_6)
AP 1051/19 (Detector coil S_7)



The following performance can be obtained with these coils in the above-given circuit, measured at a supply voltage of 6 V.

a. Sensitivity: input 44 µV for 10 mV audio output. The output is measured unloaded. $\Delta f = 15$ kHz.
b. Bandwidth: 160 kHz at 6 dB.
c. Attenuation: 450 x at 300 kHz from centre frequency.
d. Consumption: approx. 3.3 mA

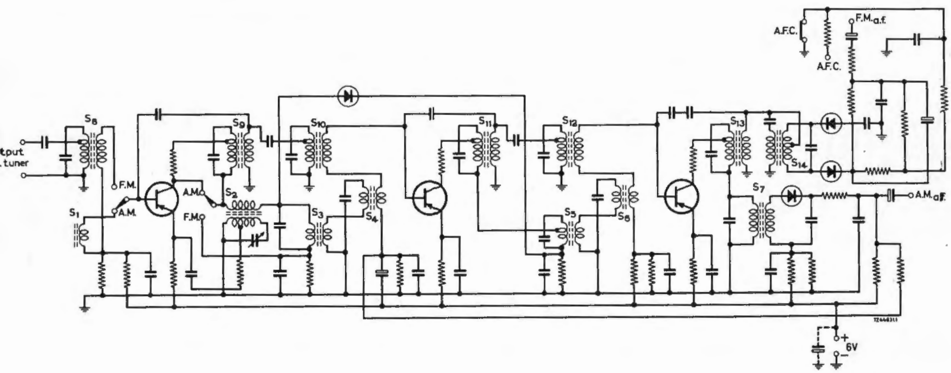
AM/FM receivers

AP 1051/20 (I.F. coil S_3)
AP 1051/21 (I.F. coil S_4, S_6)
AP 1051/22 (I.F. coil S_5)
AP 1051/23 (I.F. coil S_7)

AP 1051/17 (I.F. coils S_8, S_9, S_{10}, S_{11}, S_{12})
AP 1051/18 (Detector coil S_{13})
AP 1051/19 (Detector coil S_{14})

(S_1 = aerial coil a.m. ; S_2 = oscillator coil a.m.)

For performance see above.



CATALOG NUMBERS (for ordering)

type	catalog number
AP1051/11	3122 107 30940
AP1051/13	3122 107 30960
AP1051/14	3122 107 30970
AP1051/15	3122 107 30980
AP1051/17	3122 108 20570
AP1051/18	3122 108 25550
AP1051/19	3122 108 25560
AP1051/20	3122 994 93890
AP1051/21	3122 994 93900
AP1051/22	3122 994 93910
AP1051/23	3122 994 93920

PIEZOELECTRIC CERAMIC RESONATORS
for a.m. radio sets

RZ 24572-1

Resonant frequency	452, 455, 460, 468, 470 and 480 kHz
Quality factor	> 800
Ambient temperature range	-25 to +85 °C

GENERAL

The piezoelectric effect of lead zirconate titanate ceramic material makes it possible to achieve frequency selective elements with electrical characteristics far better than coils and far more economical than quartz crystals.

This series of ceramic resonators is intended to be used in intermediate stages of a.m. radio receivers. Compared with coils the resonators offer several advantages:

- no installation alignment
- high selectivity
- miniature size
- no shielding (due to the absence of magnetic fields)
- low price.

CONSTRUCTION

A disc of extremely pure and stable piezoelectric ceramic material is provided with two gold electrodes. The disc is clamped between two gold-plated springs with lock-fitting printed-wiring terminals. This assembly is encapsulated in an insulating casing.
For each specific frequency between 452 and 480 kHz two versions are available:
- for printed-wiring boards with holes of 1.3 mm (Fig.1)
- for printed-wiring boards with holes of 0.8 mm (Fig.2).

Dimensions in mm

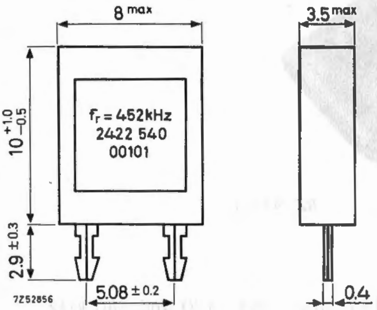


Fig.1

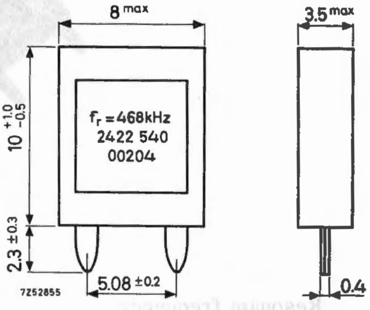


Fig.2

Marking

The resonators are marked with the resonant frequency (f_r) and the catalogue number.

PHYSICAL BEHAVIOUR

The mechanical resonance of the ceramic disc causes the frequency selectivity. Due to the piezoelectricity this mechanical vibration can be described with the equivalent circuit of Fig.3.

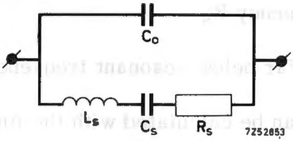


Fig.3

This circuit is valid over a very wide frequency range.
A typical impedance curve, in which impedance is plotted against frequency is shown in Fig.4.

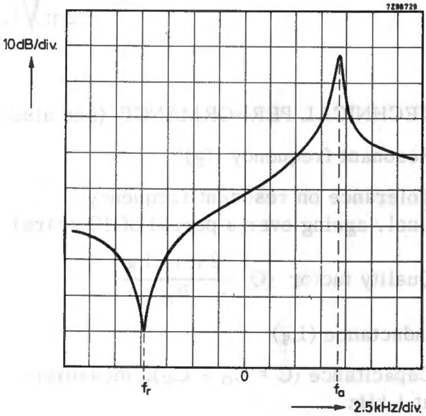


Fig.4.

f_r = resonant frequency = 452 kHz

f_o = frequency at 0-point of horizontal scale = 462 kHz

f_a = anti-resonant frequency = 470 kHz

The impedance curve can be measured with the circuit shown in Fig.5.

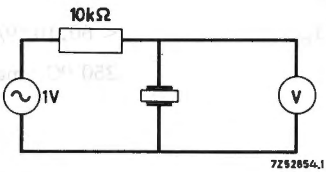


Fig.5

At resonant frequency 100 V_{rms} should be considered as maximum a.c. voltage.

To calculate the elements of the equivalent circuit (Fig.3) measuring of the following parameters is sufficient:

- resonant frequency f_r
- impedance at resonant frequency R_s
- anti-resonant frequency f_a
- capacitance at a frequency far below resonant frequency (1 kHz) $C = C_o + C_s$.

The elements of the circuit can be calculated with the formulae:

$$f_r = \frac{1}{2\pi\sqrt{L_s C_s}}$$

$$f_a = \frac{1}{2\pi\sqrt{L_s \cdot \frac{C_s C_o}{C_s + C_o}}}$$

TECHNICAL PERFORMANCE (see also Fig.3)

Resonant frequency (f_r)	452, 455, 460, 468, 470 or 480 kHz
Tolerance on resonant frequency (incl. ageing over a period of 10 years)	$\pm$ 1 kHz
Quality factor ($Q = \frac{2\pi f_r L_s}{R_s}$)	> 800 (typical 1000)
Inductance (L_s)	8.5 mH $\pm$ 10%
Capacitance ($C = C_o + C_s$), measured at 1 kHz	190 pF $\pm$ 10%
Maximum permissible a.c. voltage at resonant frequency	100 mV_{rms}
Maximum d.c. voltage	30 V
Ambient temperature range	−25 to +85 °C
Temperature coefficient of f_r	< 60.10^{-6}/deg C
Solderability	250 °C, max. soldering time 5 s

AVAILABLE VERSIONS

f_r (kHz)	catalogue number: version for printed-wiring boards with holes of 1.3 mm	catalogue number: version for printed-wiring boards with holes of 0.8 mm
452	2422 540 00101	2422 540 00201
455	102	202
460	103	203
468	104	204
470	105	205
480	106	206

APPLICATION INFORMATION

General

The ceramic resonators 2422 540 00... are characterised by a high quality factor (which results in a high selectivity and low losses) a well-defined temperature behaviour, and a high stability.
The mechanical resonance responsible for these good properties also has some drawbacks, however, mainly regarding parasitic resonance effects. Although being designed to effectively suppress the harmonics of the fundamental radial vibration, in the 3 to 6 MHz frequency range the resonators will behave as thickness vibrators with inherent resonant frequencies. Therefore measures must be taken to suppress these parasitic effects.
It should be remembered that connecting a low impedance in parallel or a high one in series with the resonator is likely to affect the low impedance at the resonant frequency, as well as the high impedance at other frequencies (also when these frequencies are in the immediate neighbourhood of the resonant frequency), which is essential for the resonator's high Q factor.

Filters

The application to be described here is in intermediate frequency bandpass filters for entertainment and communication a.m. radio receivers. Here the resonators are used as coupling elements in a configuration where tuned LC circuits provide sufficient suppression of parasitic signals, whilst the resonators are responsible for high selectivity and low losses in the passband. The presence of the low-loss resonators allow the whole selectivity to be concentrated in a block preceding the i.f. amplifier. This lumped selectivity, being a feature in manufacturing conventional radio receivers, is a must when integrated circuits are used in the i.f. part. In the following sections three filters are shown of increasing quality. These filters are given as examples only. For specific requirements on selectivity and impedance levels more application assistance can be given on request.

Second order hybrid bandpass filter

This filter can serve as complete selectivity unit in simple radio receivers or replace double tuned LC sections in more complicated receivers. The ceramic resonator is used as coupling element between a tuned LC circuit and the first i.f. transistor. The capacitor C_n is a neutralising capacitor which compensates the asymmetry of the bandpass curve caused by the parallel resonance of the resonator.

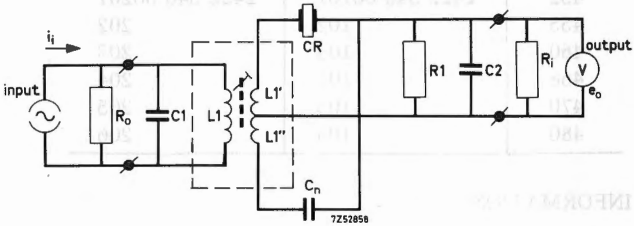


Fig.6. Circuit diagram of a second order hybrid bandpass filter

Parts list:

R_o = output impedance of the mixer/oscillator transistor BF195 (typ. 250 kΩ at 1 mA)
R_i = input impedance of the i.f. transistor BF194 (typ. 3 kΩ at 1 mA)
R_1 = 470 Ω

C_1 = 3000 pF
C_2 = 3300 pF
C_n = 180 pF
L_1 = 40 μH
$V_{L1'}/V_{L1} = V_{L1''}/V_{L1} = 0.115$
Coupling factor k = 1 approx.
Quality factor Q_o of tuned circuit = 130; Q_o (resonator) = 1000 approx.

CR = ceramic resonator 2422 540 00...

Characteristics:

B_{3dB} = 4.5 kHz
Selectivity (± 9 kHz) = 26 dB
Centre frequency (f_c) = 452 kHz
Transfer impedance (Z_T) = 700 Ω

Frequency characteristics (centre frequency f_c = 452 kHz):

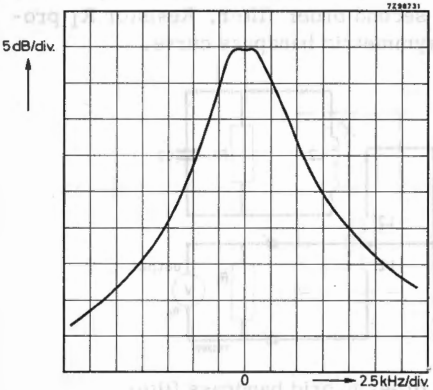


Fig.7

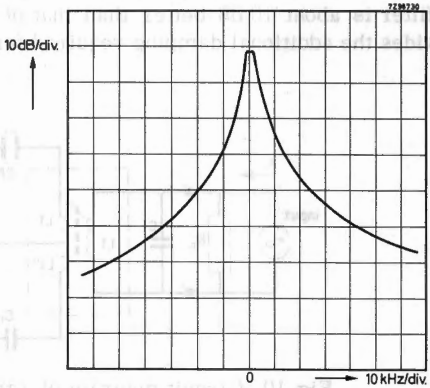


Fig.8

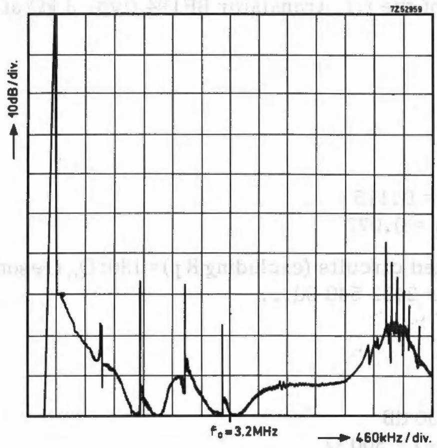


Fig.9

Third order hybrid bandpass filter

A triple filter has been designed for more sophisticated radio receivers. It consists of two LC circuits intercoupled with a ceramic resonator. The selectivity of this filter is about 10 dB better than that of the second order filter. Resistor R_1 provides the additional damping required for a symmetric bandpass curve.

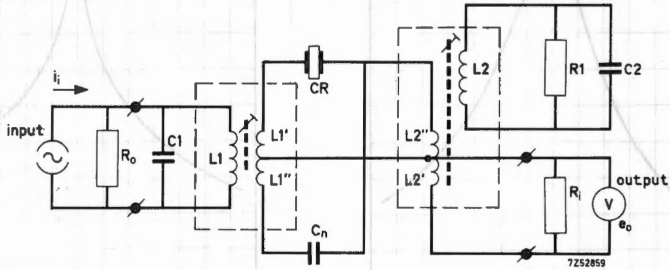


Fig.10. Circuit diagram of a third order hybrid bandpass filter

Parts list:

R_o = output impedance of the mixer/oscillator transistor BF195 (typ. 250 kΩ at 1 mA)
R_i = input impedance of the i.f. transistor BF194 (typ. 3 kΩ at 1 mA)
R_1 = 82 kΩ

C_1 = 3000 pF
C_2 = 3000 pF
C_n = 270 pF

$L_1 = L_2 = 40\ \mu H$
$V_{L1'}/V_{L1} = V_{L2'}/V_{L2} = 0.115$
$V_{L1''}/V_{L1} = V_{L2''}/V_{L2} = 0.077$

Quality factor Q_o of tuned circuits (excluding R_1) = 130; Q_o (resonator) = 1000 approx.
CR = ceramic resonator 2422 540 00...

Characteristics:

B_{3dB} = 4.5 kHz
Selectivity ($\pm$ 9 kHz) = 36 dB
Transfer impedance (Z_T) = 500 Ω

Frequency characteristics (centre frequency f_C = 452 kHz):

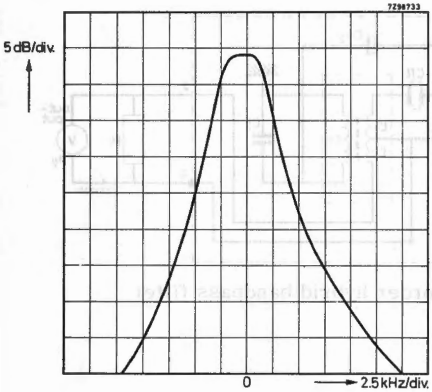


Fig.11

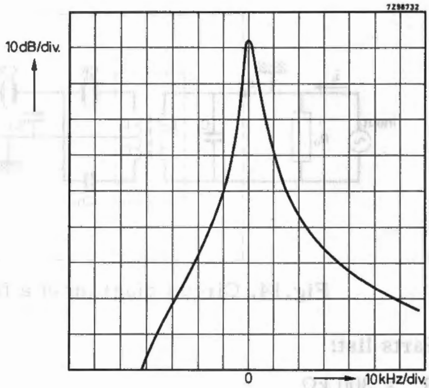


Fig.12

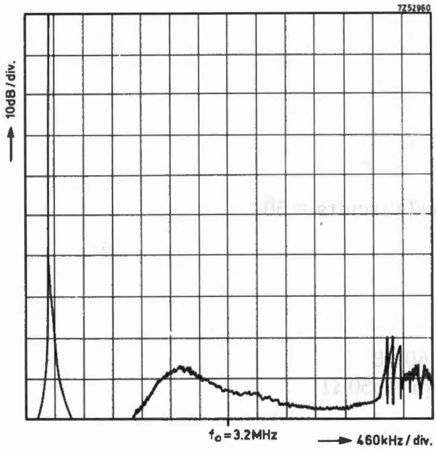


Fig.13

Fifth order hybrid bandpass filter

This filter can provide the selectivity of a communication or a high-class entertainment receiver. Three resonators in series are intercoupling two LC circuits.

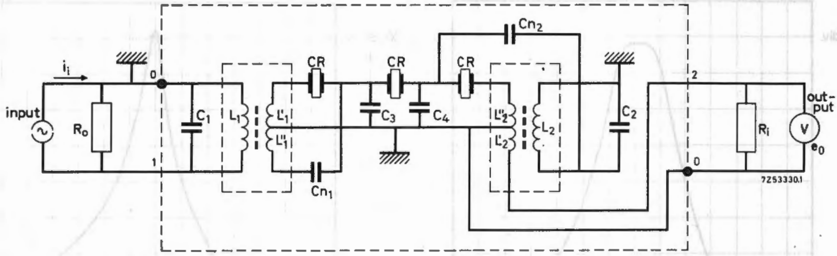


Fig.14. Circuit diagram of a fifth order hybrid bandpass filter

Parts list:

R_o = 300 kΩ
R_i = 1200 Ω

$C_1 = C_2$ = 1000 pF
$C_3 = C_4$ = 1000 pF

$L_1 = L_2$ = 122 μH

$$\frac{V_{L1'}}{V_{L1}} = \frac{V_{L2'}}{V_{L2}} = 0.097$$

$$\frac{V_{L1''}}{V_{L1}} = \frac{V_{L2''}}{V_{L2}} = 0.129$$

Quality factor Q_o of tuned circuits = 50
CR = ceramic resonator

Characteristics:

B_{6dB} = 7.5 kHz
Selectivity (±15 kHz) ≥ 60 dB
Transfer impedance (Z_T) = 650 Ω

Frequency characteristics (centre frequency f_c = 455 kHz):

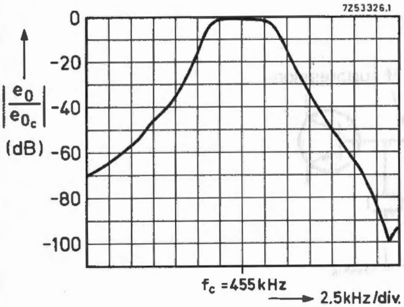


Fig.15

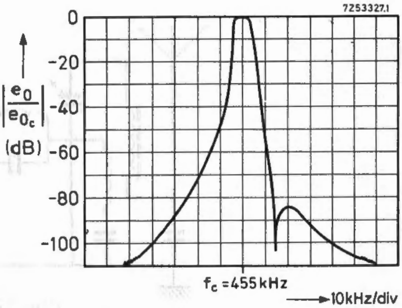


Fig.16

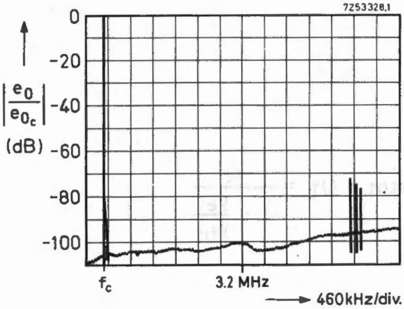


Fig.17

Aerial filter

A ceramic resonator in the aerial circuit can suppress the i.f. frequency about 32 dB. The resonator decouples the base of the mixer-transistor at the i.f. frequency. This application is not recommended for short-wave receivers due to the thickness resonances of the resonator.

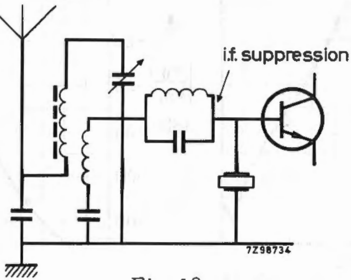


Fig.18

Emitter bypassing

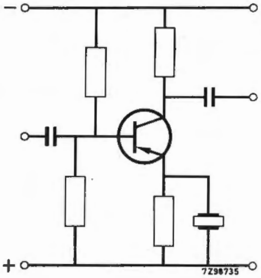


Fig.19

At the resonant frequency and in the neighbourhood of this frequency the ceramic resonator diminishes the feedback effect of the emitter resistor

Loaded quality of the resonator = $Q_L = \dfrac{Q}{1 + \dfrac{y_e}{y_{fe}}}$

$$B_{3dB} = \frac{f_o}{Q}\left(1 + \frac{y_e}{y_{fe}}\right)$$

in which:

f_o = resonant frequency of the resonator
Q = quality factor of the resonator
y_e = admittance of the emitter circuit (resonator parallel to resistor) at resonant frequency
y_{fe} = forward transfer admittance of the transistor.

Audio and mains transformers

INTRODUCTION

C3/66

The range of audio transformers comprises a number of carefully designed items in various sizes for tube and transistor circuits. They show the following features:

- <u>High efficiency</u>

  Thanks to a special manufacturing technique, the efficiency is high, even in the case of the smallest types.

- <u>Sturdy construction</u>

  In order to obtain a very stable construction and a superior copper-space factor, the coils - with a few exceptions - are compressed after winding.

- <u>Fully tropicalised</u>

  A moisture-repellent plastic is used as an inter-layer insulator. Moreover, the transformers are impregnated with a particular medium. Any electrolytic dissociation, which is the usual cause of burn-outs, is therefore avoided and the transformers are suitable for use under the most adverse climatic conditions.

- <u>Superior quality</u>

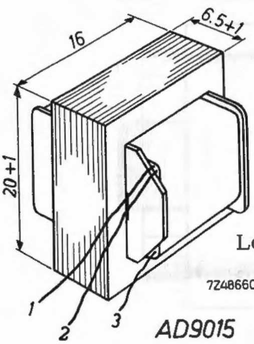
  Low distortion and a flat frequency-response curve allow the transformers to be used in high-quality equipment.

AUDIO TRANSFORMERS
FOR PUSH-PULL CIRCUITS WITH TRANSISTORS

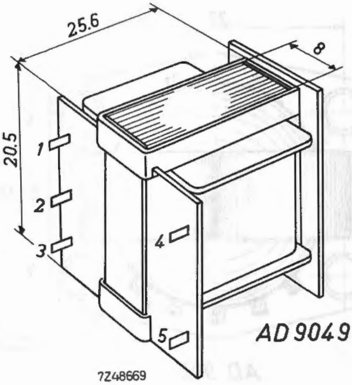
Thanks to the application of anisotropic core material, these transformers will give excellent results in spite of their small size. They are symmetrically wound in order to obtain two absolutely identical halves as regards inductance, capacitance and d.c. resistance.

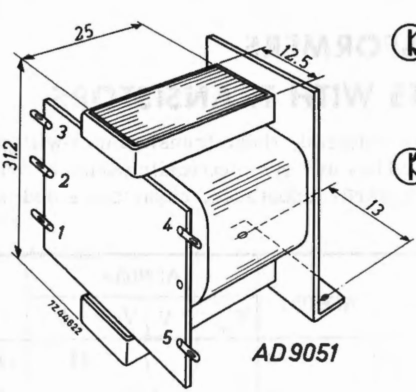
type number	AD9015	AD9049	AD9051	AD9054		
				V_b = 7 V	V_b = 14 V	
Primary impedance	360	52	98	7	41	Ω
Secondary impedance	3	3	3	3-5		Ω
Power	0.2	0.3	0.75	8		W
Efficiency at 400 Hz	85	85	80	70		%
Transformation ratio	11	4.2	5.7	1.6-1.25	3.65-2.85	
Primary inductance	0.6	0.3	0.48	0.2		H
D.C. bias magnetization	–	–	–			mA
Primary resistance	16	2.6	9.5	2.13		Ω
Frequency response between −3 dB points (reference 1 kHz)	45-35 000	50-10 000	50-10 000	10-10 000		Hz
Distortion is 1 % at	160	–	–	90		Hz

Dimensions (in mm) and connections

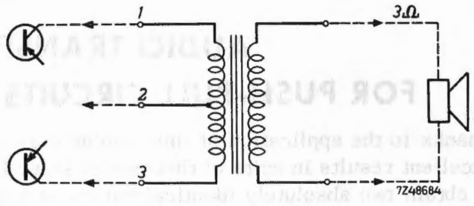


Lead 1 = brown
2 = red
3 = blue

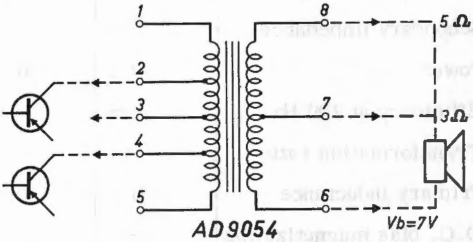




AD9051



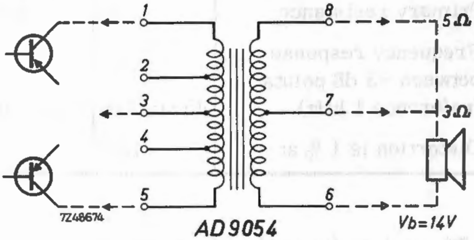
AD9015,9049,9051



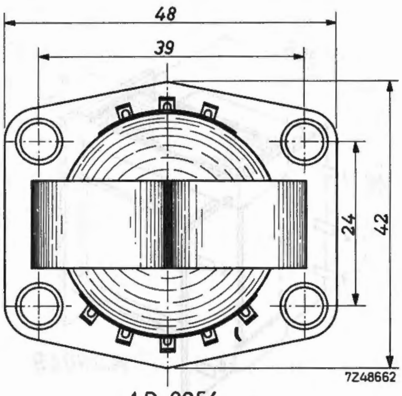
AD9054

7Z48675

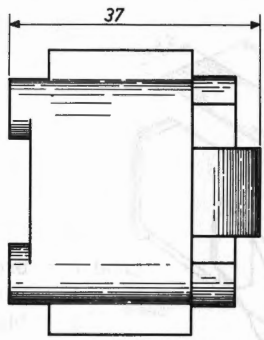
catalog numbers (for ordering)	
AD9015	3122 991 53900
AD9049	3122 991 54310
AD9051	3122 991 54290
AD9054	3122 991 54330



AD9054



AD 9054



AUDIO TRANSFORMERS
FOR SINGLE-ENDED CIRCUITS

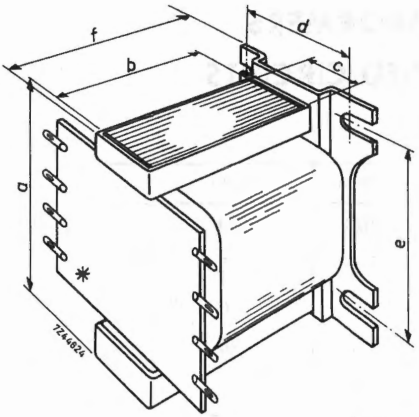
	AD9008	AD9020	
Primary impedance	5 400	5 400	Ω
Secondary impedance	3-5	3-5	Ω
Power	3	6	W
Efficiency at 400 Hz	75	76	%
Extra windings:			
anti-hum (% of N_{prim})	10	–	%
feed-back (% of N_{sec})	–	112	%
Transformation ratio	45-34	46-33	
Primary inductance	10	10	H
D.C. bias magnetization	36	40	mA
Primary resistance	550	540	Ω
Frequency response between –3 dB points (reference 1 kHz)	50 - 10 000	40 - 20 000	Hz
Distortion is 1% at	60	65	Hz

In the AD9057 the coils are wound around a C-type core of oriented laminated sheet. The stray inductance and the winding capacitance are low and, consequently, the resonance frequency is so high that heavy feedback can be applied without risking instability.

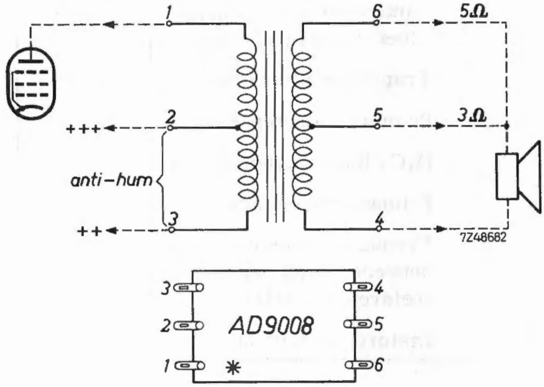
Catalogue numbers (for ordering)

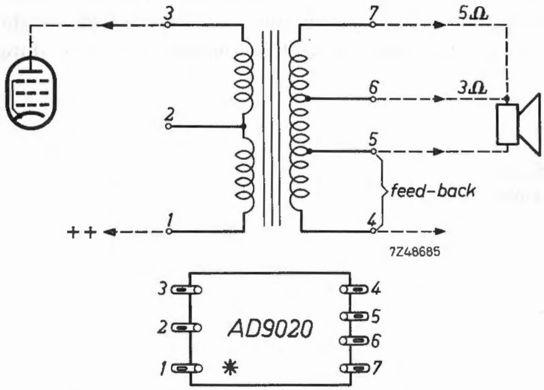
type AD9008: cat. No. 3122 991 53040
AD9020: 3122 108 39990

Dimensions (in mm) and connections



	AD9008	AD9020
a	40	50
b	32	40
c	16	20
d	36.5	41
e	38	45.5
f	41	49

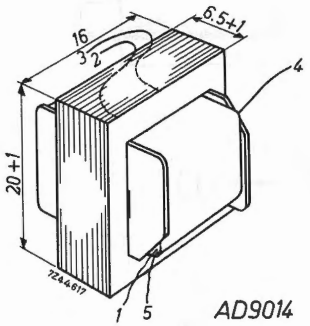




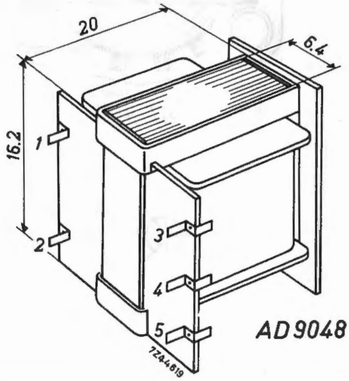
AUDIO TRANSFORMERS
FOR DRIVER CIRCUITS WITH TRANSISTORS

type number 1)	AD9014	AD9048	AD9050	AD9053	
Efficiency at 400 Hz	70	70	75	95	%
Transformation ratio	1	0.65	1.15	1.24	
Primary inductance	10	1.1	3.4	0.44	H
D.C. bias magnetization	1	4.5	4	75	mA
Primary resistance	400	106	123	4	Ω
Frequency response between −3 dB points (reference 1 kHz)	20-40 000	50-10 000	50-10 000	10-60 000	Hz
Distortion is 1% at	70	–	–	–	Hz

Dimensions (in mm) and connections



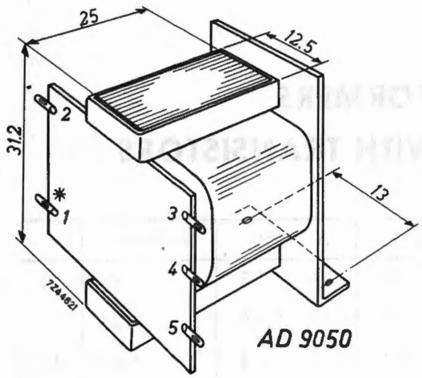
AD9014



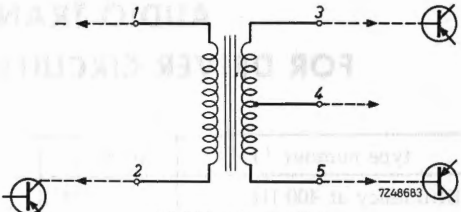
AD 9048

Lead 1 = red
2 = blue
3 = yellow
4 = black
5 = green

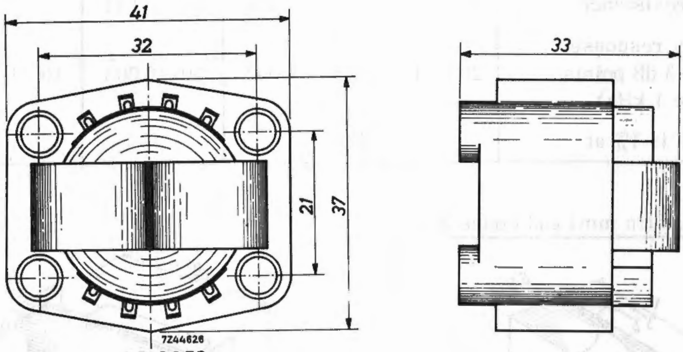
1) For ordering see last page.



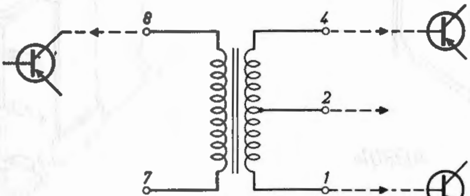
AD 9050



AD9014,9048,9050



AD 9053

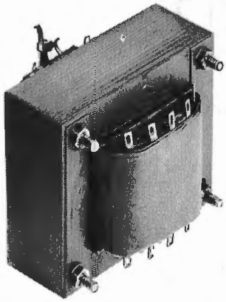


AD9053

Catalog numbers (for ordering)

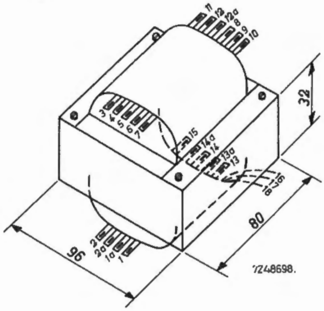
type	catalog number
AD9014	3122 991 62030
AD9048	3122 991 62260
AD9050	3122 991 62240
AD9053	3122 991 62270

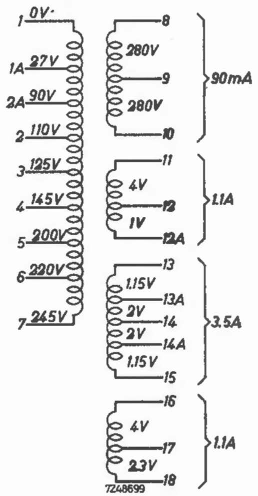
FIXED MAINS TRANSFORMERS



RZ 17539-4

Type AD9026

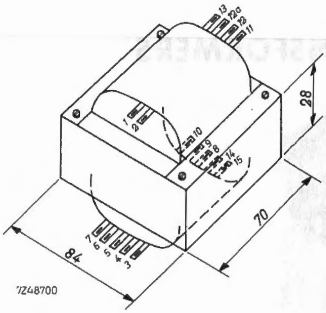


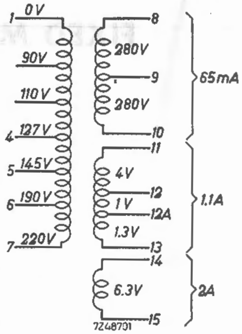


Catal. No. : 3122 108 39790
No-load current: max. 130 mA
No-load losses : max. 7.5 W
Weight : 1.93 kg

The secondary voltages indicated in the diagram apply to the loaded condition.

Type AD9027





Catal. No. : 3122 108 39800
No-load current : max. 90 mA
No-load losses : max. 6 W
Weight : 1.27 kg

The secondary voltages indicated in the diagrams apply to the loaded condition.

Loudspeakers

CONTENTS

SURVEY OF LOUDSPEAKER TYPES

STANDARD RANGE

nominal size (inches)	shape of flange	basic part of type No. 1)	versions 2)	max. power (W)	old type number (basic part)	page
$2\frac{1}{2}$	round	AD2070	Z4, Z8, Z15, Z25	0.5	AD3207	D31
3 3	round square	AD3070 AD3370	Y4, Y8, Y15, Y25 Y150	1 1	- -	D33 4)
3 x 5	oval	AD3590	X4, X8, X15, X50, X400	2	AD3359	D37
4 4 4	round round round	AD4070 AD4080 AD4090	Y4, Y8, Y15, Y25 X4, X8, X15, X25 X8, X15 X400	1 3 2 0.6	- - AD3419	D43 D45 D47
3 x 8	oval	-	(X4) (X15)	2 2	AD3386RX AD3386PX	D35
3 x 8	oval	AD3890	X4, X8	2	-	4)
4 x 6	oval	AD4680	Z4, Z8, Z15, Z25 M4, M8, M15, M25 X4, X8, X15, X25	3 4 6	-	D51
4 x 6	oval	AD4690	M4, M50, M400, M800	4 4	AD3469	4)
5	octag.	AD5080	Z4, Z8, Z15, Z25 M4, M8, M15, M25 X4, X8, X15, X25	3 4 6	-	D57
5 x 7	oval	AD5780	X4, X8, X15, X25 M4, M8, M15, M25	4 4	-	D59
$6\frac{1}{2}$	octag.	AD7080	M4, M8 X4, X8	4 6	-	D65
$6\frac{1}{2}$	octag.	AD7091 3)	X4, X8 M4, M800	3 3	AD3729	D67

1) A complete type No. is composed of a basic part, a stroke and a version code, e.g. AD2070/Z4, AD7091/M800.

2) Letter for type of response characteristic (see General section), followed by the nominal impedance in Ω.

3) Inverted magnet system.

4) Data sheets will be issued separately.

nominal size (inches)	shape of flange	basic part of type No. 1)	versions 2)	max. power (W)	old type number (basic part)	page
6 x 9	oval	–	(X4)	6	AD3696RX	D39
			(M4)	6	AD3696RM	
			(M8)	6	AD3696SM	
6 x 9	oval	AD6980	X4, X8, M4, M8	6	–	4)
8	octag.	–	(X4)		AD3806RX	D41
			(X8)		AD3806SX	
			(M4)		AD3806RM	
			(M8)		AD3806SM	
8	octag.	AD8080	X4, X8, M4, M8	6	–	4)

SPECIAL AND HIGH QUALITY LOUDSPEAKERS

Tweeters

$2\frac{1}{4}$	round	AD2070	T4, T8	10 5)	–	D29
4	square	AD4490	T4, T8	10	AD3408	D49

Woofers

5	octag.	AD5060	W4, W8	10 6)	AD3503	D55
$6\frac{1}{2}$	octag.	AD7065	W8	20 6)	AD3703	D63
8	octag.	AD8065	W8	20 6)	AD3803	D71
10	round	AD1055	W8	40 6)	–	D11
12	round	AD1255	W8	20	AD5201	D17

Wide frequency range

5	octag.	AD5060	M4, M8	6	AD3501	D53
$6\frac{1}{2}$	octag.	AD7060	M5	10	AD3701	D61
8	octag.	AD8050	M5	6	AD4800	D69
$8\frac{1}{2}$	round	–	M7	10	9710M/01	D73
			M800	10	9710AM/01	
10	round	AD1050	M7, M800	10	AD4000	D9
12	round	AD1250	M7, M800	20	AD4200	D11
12	round	AD1255	M7, M800	20	AD5200	D15
12	round	AD1260	M5	10	AD4201	D27

4) Data sheets will be issued seperately.
5) With 5 μF in series.
6) In a closed acoustic box of specified volume.

GENERAL

INTRODUCTION

A correctly chosen loudspeaker is essential to obtain adequate acoustic results from electro-acoustic equipment. The following factors should be considered.

- Shape, size and attachment with reference to the available space.
- Quality and sensitivity, a compromise between fidelity of reproduction and price.
- The frequency-response characteristic in relation to the kind of application.
- Impedance and power-handling capacity, which should be adapted to the output stage of the equipment.
- Appearance and finish.

With a view to these factors our loudspeakers are divided into three groups:

Standard speakers

The standard speakers form an extensive group offering a diversity in characteristics, size and price for all kinds of radio and television sets, gramophones, tape recorders, sound columns, etc.

Most standard speakers have a flat magnet system of powerful Ferroxdure. For television sets and other applications where the leakage field should be as small as possible, there are loudspeakers having a Ticonal magnet in a pot system. Due to the use of Ticonal 750 these pot systems are very small.

Special speakers

The special speakers have specific applications.

High-quality speakers

The high-quality speakers have been specially designed for use in Hi-Fi equipment, where a high power-handling capacity, a very wide frequency-range and a negligible distortion level are required. Examples of application: acoustic boxes, bass-reflex boxes, juke boxes, Hi-Fi enclosures with or without cross-over network and stereo columns.

NEW COMMERCIAL CODING SYSTEM

AD5080/M25
AD1255/W8

ADxx xx/xx

Nominal size and shape

20 = $2\frac{1}{4}$-$2\frac{1}{2}$ in round
30 = 3 in round
33 = 3 in square
35 = 3 x 5 in oval
38 = 3 x 8 in oval
40 = 4 in round
44 = 4 in square
46 = 4 x 6 in oval
50 = 5 in round
57 = 5 x 7 in oval
69 = 6 x 9 in oval
70 = $6\frac{1}{2}$ in round
80 = 8 in round
10 = 10 in round
12 = 12 in round

Nominal impedance: direct in Ω

Type of response curve

Z = Notably higher sensitivity around a response peak at about 3 kHz
Y = Notably higher response level in the region 2 to 6 kHz
X = Same as Y, but a wider frequency range
M = Smooth response over wide frequency range
W = Woofer, extremely low resonance frequency
T = Tweeter, high frequency range

Magnet system

90[1]) = sinterpot
80 = ferroxdure standard round
70 = ferroxdure square
65 = ferroxdure big, high quality
60 = ferroxdure small, high quality
55 = "Ticonal" big, high quality
50 = "Ticonal" small, high quality

IMPEDANCES

The nominal impedance is the lowest impedance on the impedance/frequency curve measured at the high-frequency side of the resonance peak.
Loudspeakers with impedances not given in the data sheets are available to special order. Details on request.

---

1) Mechanical or acoustical variations are indicated by replacing 0 or 5 by some other figure (91 = Sinterpot Wafer).

FREQUENCY RESPONSE CURVES

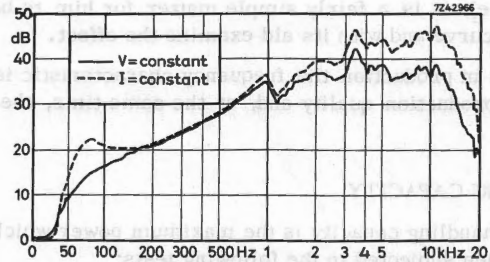
Measuring conditions

The frequency-response curves are measured under the following conditions:

1. recorded in anechoic room;
2. without baffle;
3. microphone in axis of loudspeaker at a distance of 50 cm;
4. input 50 mW (12" high-quality types 25 mW);
5. constant voltage;
6. 0 dB of the curves corresponds with 52 dB above $2x10^{-4}$ μbar.

Comparing a constant-current characteristic of any loudspeaker with a constant-voltage one, we find the latter flatter in the region of the resonance frequency, whereas it drops more abruptly at the higher frequencies. This is explained as follows:

The power which moves the coil and the cone is proportional to the current through the coil. In the case of constant voltage the current will decline, as a consequence of rising coil impedance, in the neighbourhood of the resonance frequency and at higher frequencies. The result is a dropping sound pressure in these frequency regions. This should be borne in mind when comparing our response curves with those of other documentations.



The use of response curves

First of all we wish to emphasise that these curves should be used exclusively for comparison.

Never compare curves which are not based on one and the same measuring method (identical measuring equipment, measuring room, distance, power input and, even, identically mounted speakers). Only experienced experts are able to compare response curves not based on exactly identical conditions. Also the condition of the anechoic chamber may greatly affect the results.

Contrary to many other manufacturers' methods, frequency characteristics of our loudspeakers were determined without a baffle.

The response curves for making comparisons

The response curve does help us to disclose differences in reproduction quality. The comparison of curves determined under identical conditions may give a picture of a few acoustical aspects. A difference in level means a difference in sensitivity (efficiency) in various frequency regions. A difference in width means a difference in frequency range.

One should never forget, however, that the curves represent the sound pressure only in the centre of a circular plane. Since the distribution of the sound pressure is not uniform over the plane and different in various cases, the sound impression may differ more than the response curves suggest.

It will be evident that a high degree of expertness is required to interpret the differences in response curves. For the greater part, this expertness is gained through experience.

Response curves an aid for the manufacturer

Response curves play a great part in the development of loudspeakers, pinpointing their acoustic characteristics, manufacture and production checks.

It is but a small problem for the development engineer to establish response curves required for a particular application. And then, as the acoustic characteristics of a speaker are largely associated with its moving parts (coil, centring ring and cone), it is a fairly simple matter for him to base modifications on the frequency curve and with its aid examine the effect.

For loudspeakers in production the frequency characteristic is excellently useful to check the production quality and, at the same time, the sensitivity of the magnet system.

POWER HANDLING CAPACITY

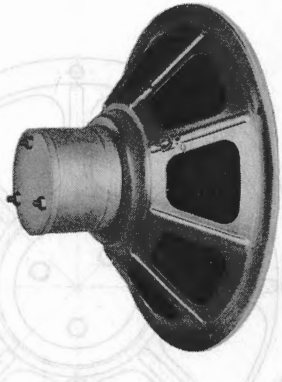
The rated power handling capacity is the maximum power which the loudspeaker can withstand, when subjected to the following tests:

1. Operational test.
   A test voltage of audio frequency is applied to the loudspeaker. The loudspeaker is then checked for buzz, chips, rattle, or cone break-up. The test voltage $V = 0.7 \times \sqrt{Z \times P_{max}}$, where Z = nominal impedance in ohms and P_{max} = power handling capacity in watts.
2. Continuous load test.
   100 hours life-test conforming to DIN 45573 - sheet 2 with a test-power of P_{max} and a white noise generator.

FINISH

The loudspeakers are tropic-proof, and cadmium-plated to prevent corrosion.

10" HIGH-QUALITY LOUDSPEAKERS



RZ 14210-5

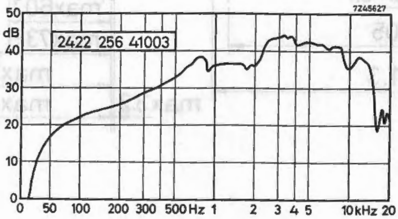
Primary application

Hi-Fi and stereo equipment (see "Enclosures").

Details

Very high sensitivity, Ticonal magnet.
Particularly large air gap, resulting in the voice coil being completely enclosed by a uniform magnetic field even at the largest amplitudes. No distortion will thus be experienced as the coil amplitude is disproportional to the current.
Constant voice-coil impedance throughout the entire frequency range, so that the output stage always has a perfectly matched load.
Very smooth response curves.
Clear bass response without boom effects, because of mechanical damping at low frequencies.

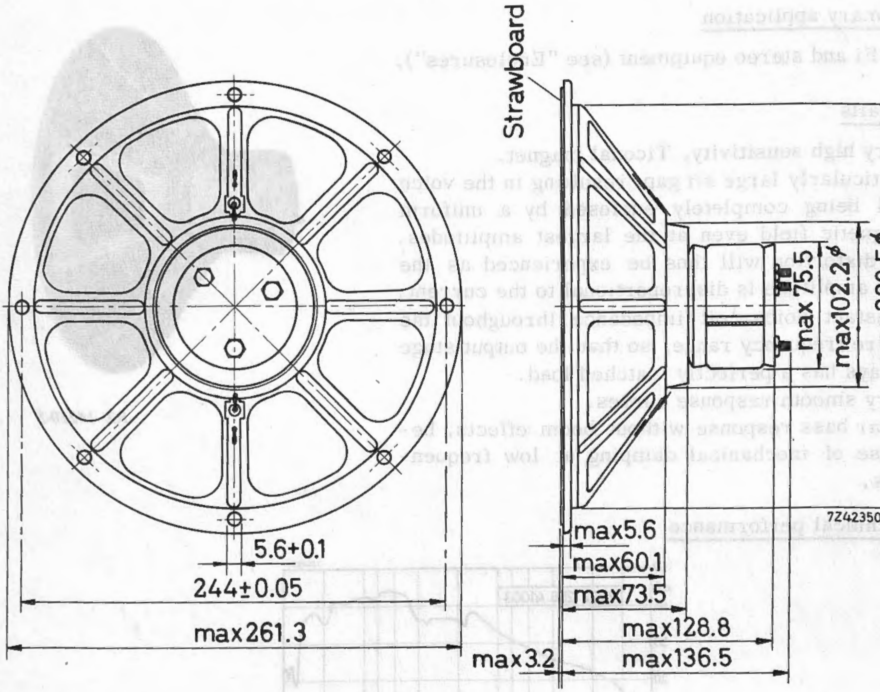
Technical performance



version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
M7	M	7	10	50	98 000	8000	2422 256 41003
M800	M	800	10	50	98 000	8000	2422 156 41002

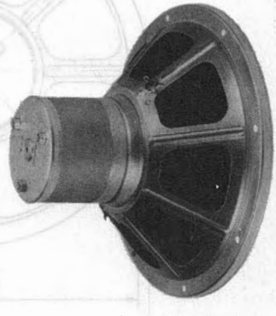
1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 1.77 kg

10 in HIGH-QUALITY WOOFER LOUDSPEAKER



RZ 25052-31

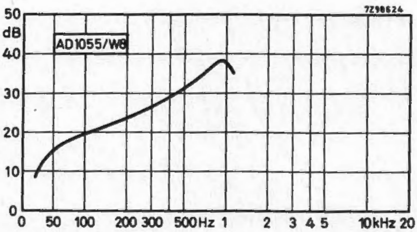
Application

In acoustic enclosures for Hi-Fi reproduction; suitable for frequencies of 18 to 1000 Hz. See data sheet on the 40 W combination with AD5060/M8 and AD3506SM or AD5080/M8 in an acoustic box of 35 litres.

Construction

Ticonal magnet.
Weight of magnet 880 g.
Constant flux through moving voice coil resulting in a low distortion.
Rigid paper cone with highly flexible butyl-rubber suspension.

Technical performance

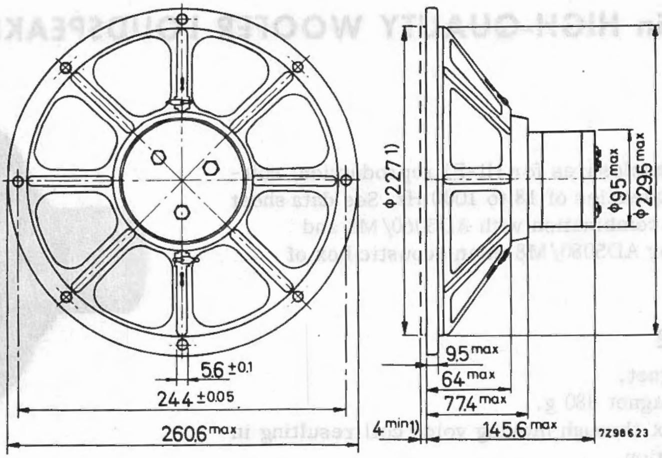


version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 2)
W8	W	8	40 1)	24	130 000	> 9000	4304 078 70261

1) In an acoustic enclosure of max. 35 litres, and conforming to DIN45573.

2) For bulk packing the catal. No. is 4304 079 01001; for single-unit packing the catal. No. is 4304 079 01021.

Dimensions in mm



1) Baffle hole and clearance depth required for cone movement at 40 W input.

A red mark near one of the tags serves for in-phase connection with other loudspeakers of our range.

Weight: 3 kg

12" HIGH-QUALITY LOUDSPEAKERS

RZ 19741-15

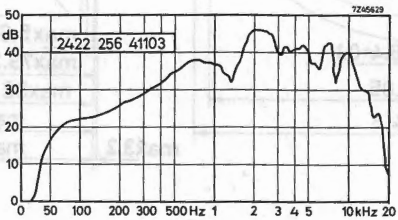
Primary application

Hi-Fi installations.

Details

Very high sensitivity, Ticonal magnet.
Particularly large air gap, resulting in the voice coil being completely enclosed by a uniform magnetic field even at the largest amplitudes. No distortion will thus be experienced as the coil amplitude is disproportional to the current. Constant voice-coil impedance throughout the entire frequency range, so that the output stage always has a perfectly matched load.
Very smooth response curve.
Clear bass response without boom effects, because of mechanical damping at low frequencies.

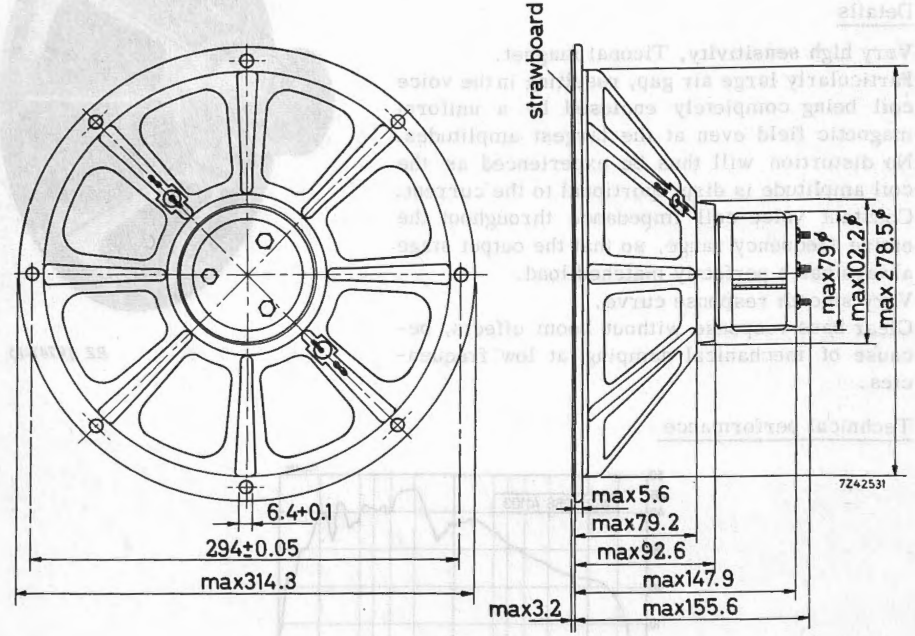
Technical performance



version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
M7	M	7	20	50	98 000	8000	2422 256 41103
M800	M	800	20	50	98 000	8000	2422 256 41102

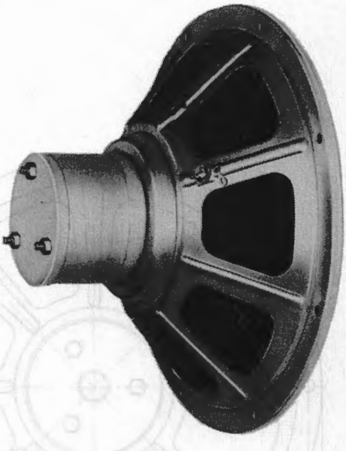
1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 1.8 kg

12" HIGH-QUALITY LOUDSPEAKERS



C 65219

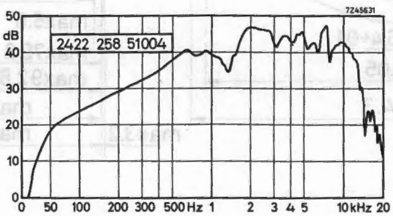
Primary application

Hi-Fi installations.

Details

Extremely high sensitivity thanks to the use of a very powerful Ticonal magnet.
Particularly large air gap, resulting in the voice coil being completely enclosed by a uniform magnetic field even at the largest amplitudes. No distortion will thus be experienced as the coil amplitude is disproportional to the current.
Constant voice-coil impedance throughout the entire frequency range, so that the output stage always has a perfectly matched load.
Very smooth response curves.
Clear bass response without boom effects, because of mechanical damping at low frequencies.

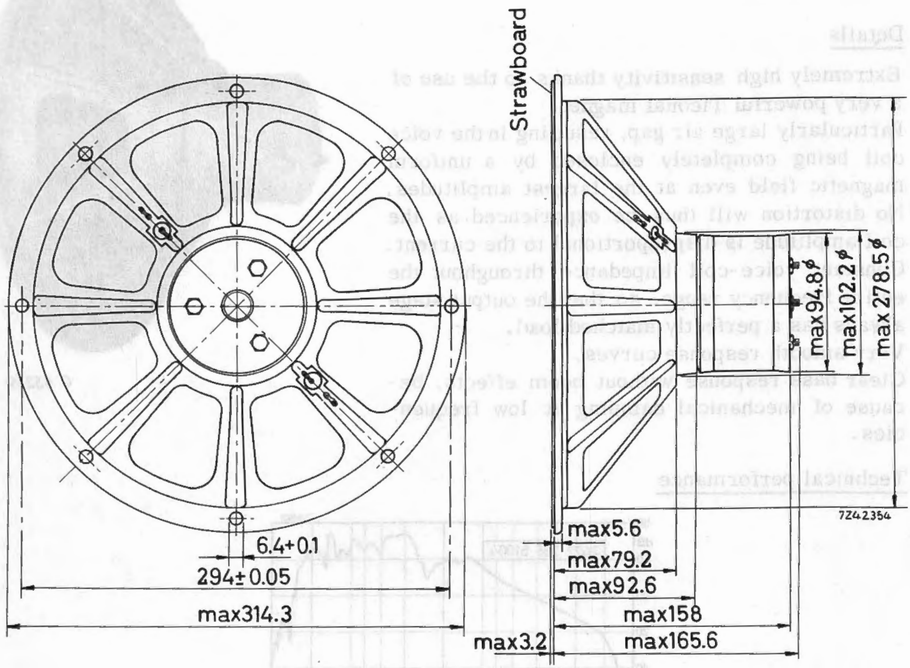
Technical performance



version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
M7	M	7	20	50	134 000	11 000	2422 258 51004
M800	M	800	20	50	134 000	11 000	2422 258 51003

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 3.5 kg

12" HIGH-QUALITY WOOFER LOUDSPEAKER

RZ 19218-1

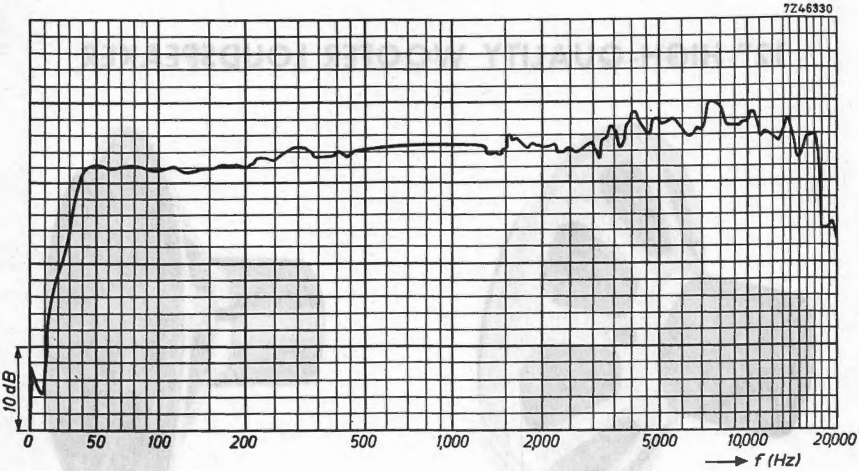
RZ 19218-2

Though the design of this woofer is based on the normal electrodynamical principle, a number of striking features make it unique in its kind. The use of new materials and techniques allowed the development of a Hi-Fi low-note speaker which, in conjunction with high and medium-note speakers and housed in an acoustically adequate enclosure, will be found a major contribution towards natural sound reproduction. Because of its specific design and characteristics, this speaker is a solitary in our programme.

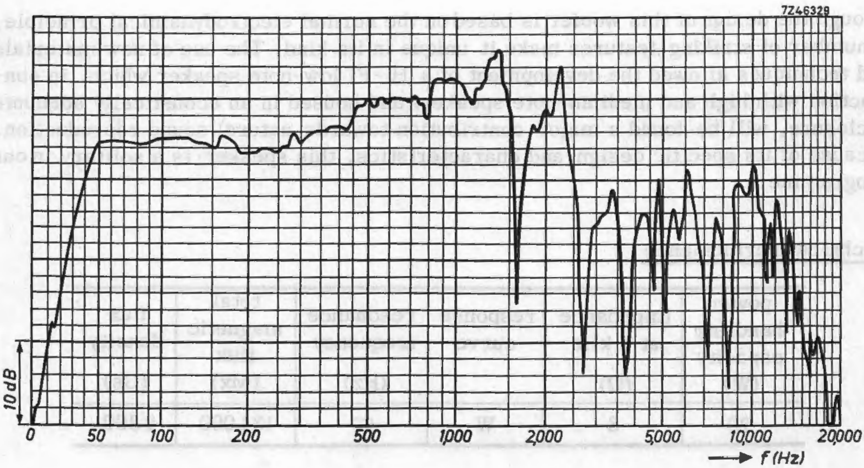
<u>Technical performance</u>

power handling capacity (W)	impedance at 1 kHz (Ω)	response curve	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)
20	8	W	29	134 000	9 300

Catalog number, bulk packing : 2422 258 41121
single-unit packing : 2422 258 41161
on loudspeaker itself: 2422 258 41101



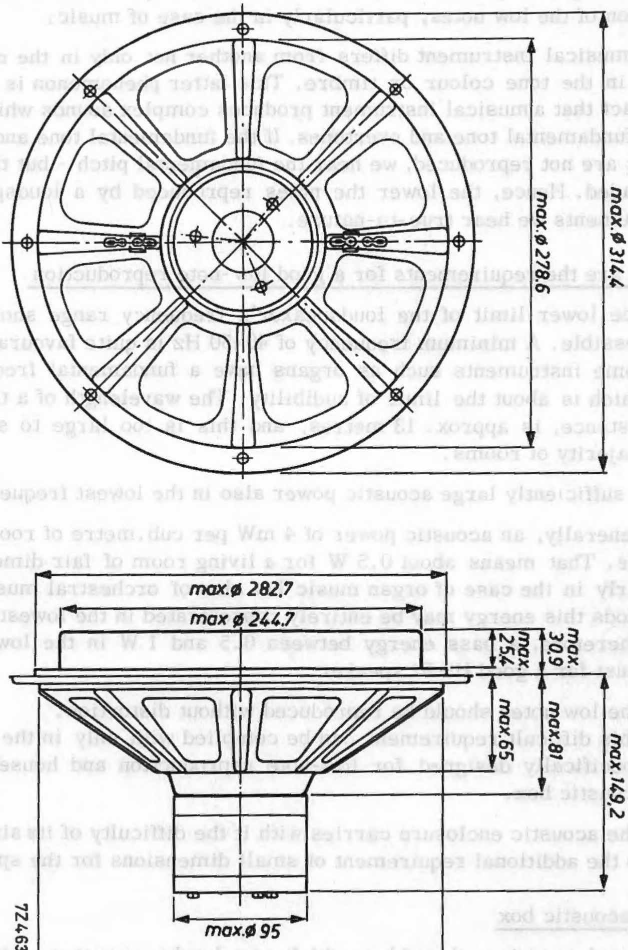
Response of the woofer in conjunction with two 5 x 7" standard speakers (M4 version) and a cross-over filter in a 45-litre acoustic box.



Response of the woofer (alone) in a 45-litre acoustic box.

Note: See also "Recommended enclosures".

Dimensions in mm



Weight: 3.5 kg

REMARKS ON LOW-NOTE REPRODUCTION

Introduction

Low notes are a perpetual obstacle on the way to Hi-Fi reproduction. Prior to discussing this problem, let us consider the importance of an effective reproduction of the low notes, particularly in the case of music.

One musical instrument differs from another not only in the range of notes but also in the tone colour or timbre. This latter phenomenon is a consequence of the fact that a musical instrument produces complex sounds which are composed of a fundamental tone and overtones. If the fundamental tone and the lower overtones are not reproduced, we hear the fundamental pitch - but the timbre will be degraded. Hence, the lower the notes reproduced by a loudspeaker, the more instruments we hear true-to-nature.

What are the requirements for a good low-note reproduction

1. The lower limit of the loudspeaker's frequency range should be as low as possible. A minimum frequency of 40-50 Hz is quite favourable.
   Some instruments such as organs have a fundamental frequency of 16 Hz, which is about the limit of audibility. The wavelength of a tone of 25 Hz, for instance, is approx. 13 metres, and this is too large to sound well in the majority of rooms.
2. A sufficiently large acoustic power also in the lowest frequencies.
3. Generally, an acoustic power of 4 mW per cub.metre of room volume is ample. That means about 0.5 W for a living room of fair dimensions. Particularly in the case of organ music but also of orchestral music, for short periods this energy may be entirely concentrated in the lowest octaves.
   Therefore, a bass energy between 0.5 and 1 W in the lowest octaves is a must for a good Hi-Fi speaker.
4. The low notes should be reproduced without distortion.
   This difficult requirement can be complied with only in the case of speakers specifically designed for low-note reproduction and housed in an adequate acoustic box.
5. The acoustic enclosure carries with it the difficulty of its size, and this leads to the additional requirement of small dimensions for the speaker system.

The acoustic box

The enclosure is a closed box which completely separates a given volume of air at the rear of the speaker.

Advantages

1. Between the so-called relaxation frequency (800-1000 Hz) and the frequency resonance, the low-note reproduction is improved by about 6 dB per octave with regard to a speaker without baffle.
   The acoustic box acts, as it were, as a baffle of infinite size.
2. The separated air volume accomplishes an effective damping and, hence, an increased loadability.
3. The separated air volume increases the stiffness of the cone suspension and so prevents distortion due to non-linearity of the cone movement.

Drawbacks

1. The separated air raises the resonance frequency of the system.
2. The large box occupies much space.
   With this woofer, these drawbacks are limited to the strict minimum.

The loudspeaker

The following equation applies to the acoustic power produced by a loudspeaker:

$W = k \times f^4 \times s^2 \times A^2$, where

W = the acoustic energy in watts,
f = the frequency,
s = the stroke of the moving coil,
A = the area of the cone.

This implies that the product sA should be large enough to render, also in the lowest octaves, the required quantity of acoustic power (s is two times the amplitude of the coil movement in the air gap).

For a satisfactory low-note reproduction, the self-resonance of the speaker should be as low as possible, and also the resonance increase resulting from the insertion in a box. This increase will be greater when the box volume is smaller and the cone diameter larger. Hence, to obtain the final resonance-frequency of the system as low as possible at a box volume as small as possible, the cone diameter should not be chosen too large.

In order nevertheless to have a large product sxA, a large stroke is therefore a requirement of pre-eminent importance.
For the avoidance of distortion, notwithstanding the long stroke of the coil, the following requirements should be met.

Even in its ultimate positions, the coil should remain within the homogeneous magnetic field.
The reaction of cone and centring ring should always be in accordance with the coil movements.

This means that the cone suspension should be flexible, that the cone itself should be stiff, and that the non-harmonic movements of cone and centring ring should be adequately damped. Furthermore, an efficiency as high as possible is of importance to acquire the maximum acoustic output with the minimum electric input. This requires, among other things, a powerful magnetic field, a light cone and a light centring ring. Requirements to obtain a low resonance frequency are, inter alia, a flexible cone suspension and a not too small cone mass, which involves a fairly large cone diameter.

To complete the situation, we observe that an adequate loadability requires an effective damping and, therefore, a not too large volume of separated air, a sufficiently strong cone and a sturdy suspension.

From the above, the following will be clear.

The loudspeaker should have a cone of great stiffness, a powerful magnetic field, a large coil stroke in a homogeneous field, and a low resonance frequency.

The optimum compromise should be found for the stiffness of the cone suspension, the cone diameter, the cone weight and the box volume.
After a great numbre of experiments, we obtained the following as the optimum result.

DESIGN OF THE WOOFER

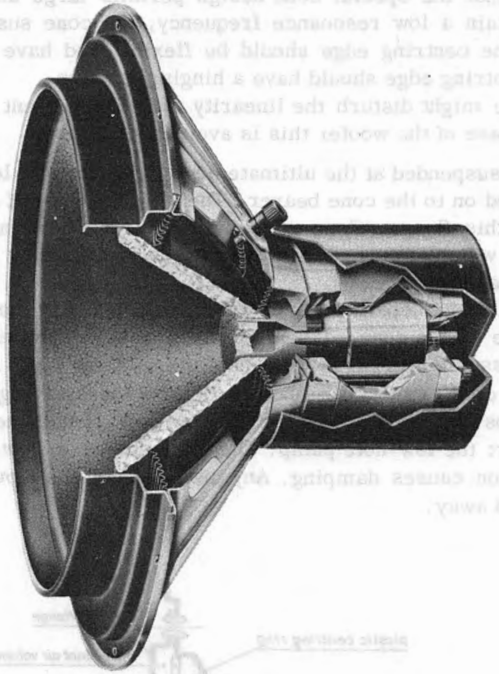
The cone

Foam plastic as the cone material guarantees a combination of great stiffness and a low mass.

Of course, though not ideal, paper is not a bad cone material; until recently, there was no second of equal strength, lightness and acoustic effect. The specific weight of cone paper is 0.2. However, the lacquer required to obtain resistance to moisture, raises the specific weight to 0.5.

The specific weight of the plastic foam used for the woofer is 0.02. That means, the thickness may be 25 times as large before the weight of a corresponding cone in paper is reached. Thus, diaphragms having a thickness of 1 cm and more can be used that are perfectly rigid. These diaphragms, included the voice coil, do not weigh more than about 12 g.

In this case, it is not necessary to stiffen the cone artificially through the box to reduce the distortion, and the dimensions of the box can be chosen purely in view of the low-note reproduction. Distortions as a result of deformations of the diaphragms are likewise out of the question.



Frequency characteristic

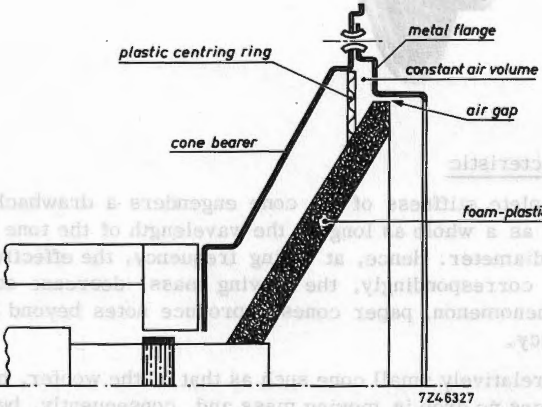
The almost complete stiffness of the cone engenders a drawback. Paper diaphragms vibrate as a whole as long as the wavelength of the tone produced exceeds the cone diameter. Hence, at rising frequency, the effective area of the paper cone and, correspondingly, the moving mass, decrease steadily. As a result of this phenomenon, paper cones reproduce notes beyond 1 kHz with an adequate efficiency.

In the case of a relatively small cone such as that of the woofer, however, rise in frequency causes no drop in moving mass and, consequently, beyond the frequency at which the cone ceases to act as a piston, no effective output is to be expected. Therefore, the woofer should be used exclusively in conjunction with other speakers for reproduction of the high and the medium notes.

Cone suspension

It will be clear that the special cone design permits large amplitudes. Therefore, and to obtain a low resonance frequency, the cone suspension should be flexible. Also the centring edge should be flexible and have a large area; the ridges in the centring edge should have a hinging function.
The hinging edge might disturb the linearity of the movement and so cause distortion. In the case of the woofer this is avoided as follows.

The cone is not suspended at the ultimate edge but somewhat lower, and a metal flange is attached on to the cone bearer. The ultimate edge of the cone moves to and fro within this flange. Cone edge, centring ring and flange form a ring-shaped chamber which is only connected to the external air by means of a narrow gap between cone and flange.
The dimensions of the separate air chamber are such that theoretically, during the entire stroke of the cone edge, the volume of the chamber remains almost constant if we assume a linear movement of the centring ring. According as non-linearity in the cone suspension tends to deform the centring ring, any change in volume pumps the air through the narrow gap. Hence the surname of this original speaker: the low-note pump. The gap acts as a flow resistance whose energy absorption causes damping. Any distortion of the moving system is, as it were, pumped away.



The permissible stroke of the cone

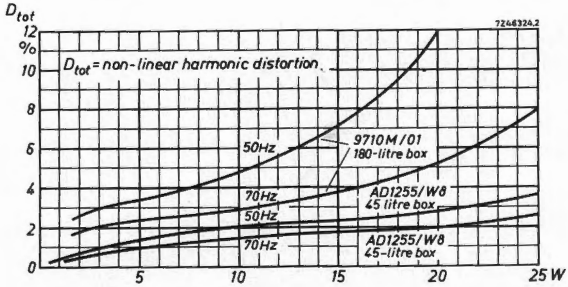
All causes of distortion resulting from diaphragm deformations now being eliminated, or at least substantially reduced, it is all the more important to avoid any distortion resulting from non-linearity in the diaphragm drive as well.

The force exerted on the voice coil is 0.1 x B x I x L, where B, is the induction, I the current through the coil and L the length of wire. At any moment and independent of the position of the coil, this force should be proportional to I and, therefore, the coil should be always in a field of constant intensity.

In principle, there are two manners to meet this condition. The first one is making the coil considerably longer than the thickness of the pole plate or, in other words, the height of the field in the air gap. An advantage of this method is a high field-intensity without a heavy magnet, which tends to keep the price low.

A disadvantage is a significant increase in mass and resistance of the coil, resulting in a drop in efficiency. Therefore, a more powerful amplifier will be required and the price of the total equipment will rise. Of even greater consequence may be the fact that the inactive part of the coil increases the internal resistance of the amplifier and so adversely affects the damping factor.

An alternative is heightening the air gap so as to keep the coil movement within the homogeneous field. In this case, the mass and the resistance of the coil can be kept as small as possible - but a drawback is, of course, the necessity of a much larger magnet. Freedom of distortion cannot be obtained on the cheap.
It is the second method that was applied to the woofer. The thickness of the pole plate is two times the length of the coil which can, thus, make a stroke of 8 mm within the homogeneous part of the filed. This stroke is an enormous feature of this speaker, the more so as - even at the stroke of this length - no distortion whatever of the signal occurs.



Non-linear distortion as a function of the input power compared with that of an $8\frac{1}{2}$", 10 W high-quality loudspeaker.

The acoustic box

Building the speaker into an enclosure of about 40 litres nett, makes the resonance frequency of 29 Hz rise to about 50 Hz.

Measurements in a box of this volume demonstrated that even a 50-W load did not cause any audible distortion; in larger boxes, an energy of at least 20 W is permissible (these figures apply to normal orchestral music). In the case of musical passages such as low organ notes, where almost the entire reproduction occurs in the lowest frequencies, a smaller electric energy suffices for an adequate sound intensity.

To obtain the optimum reproduction quality, we advice to build the speaker in an enclosure of 40-50 litres nett, which results in an almost flat response curve between 40 and 1000 Hz. At a load of 30 W, the distortion is max. 3 % at half an octave beyond the resonance frequency.

Reproduction of the high and medium notes

If the speakers for these notes are housed in the same enclosure - of course in a separate room - it is not necessary to choose the cross-over frequency extra low: this would cause difficulties as regards the filter dimensions. A cross-over frequency of 800 Hz and a cut-off rate of 12 dB per octave are recommended.

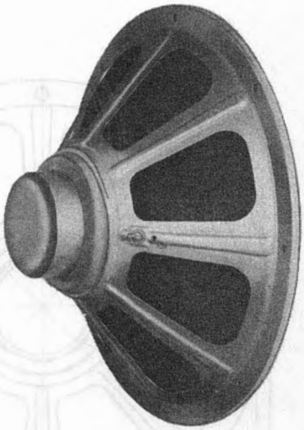
12" SPECIAL LOUDSPEAKERS

Primary application

Juke boxes; acoustic boxes for musical installations. See "Recommended enclosures".

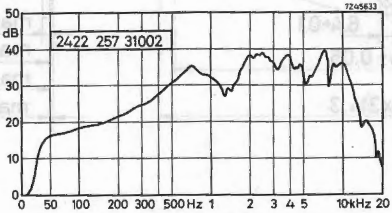
Details

Inexpensive speaker with a reasonably good efficiency, well suitable for those installations where both costs and quality are factors of importance.
Suited for stereo reproduction because of its wide frequency range.
Ferroxdure magnet.



RZ 14211-10

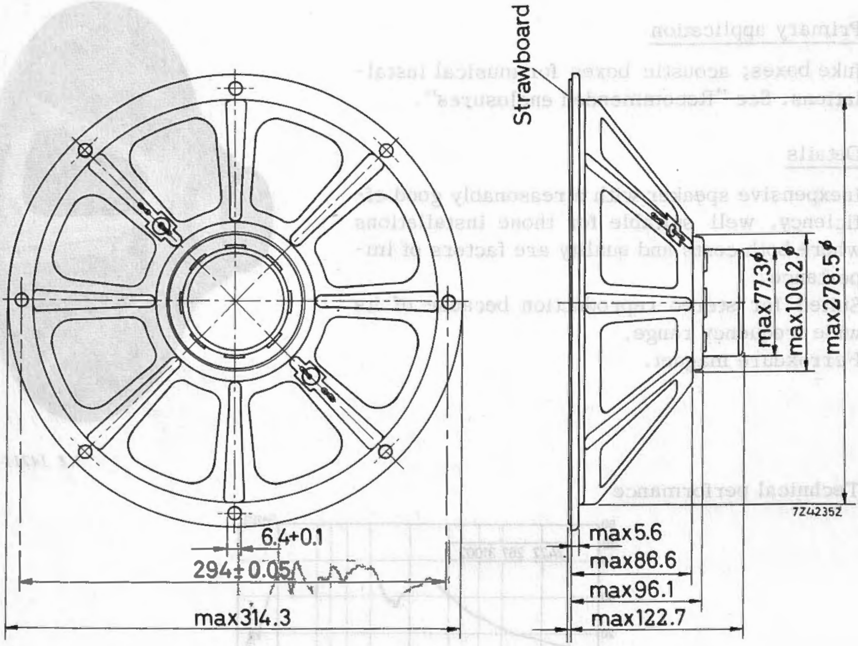
Technical performance



power handling capacity (W)	impedance at 1 kHz (Ω)	response curve	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number (bulk packing) [1]
10	5	M	50	42 600	9 500	2422 257 31002

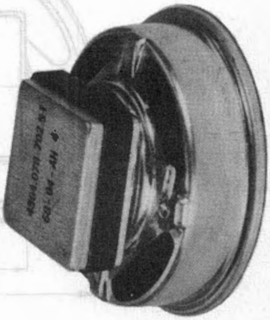
[1]) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 850 g

2 1/4 in TWEETER LOUDSPEAKERS



RZ 25052-32B

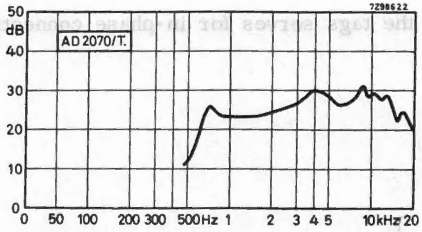
Application

In acoustic enclosures; suitable for frequencies of 800 Hz to 19 kHz. These tweeters can be combined with the 5 in woofer AD5060/W without extra loud-speaker being necessary for the medium frequency range.

Construction

Flat square magnet of Ferroxdure 300 R.
Weight of magnet 20 g.

Technical performance

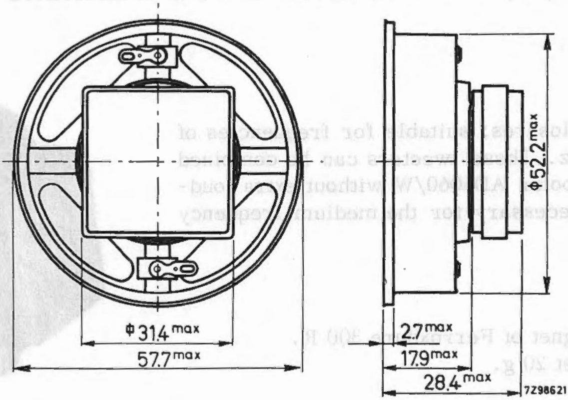


version	re-sponse curve	nom. impe-dance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 2)
T4	T	4	10 1)	800	6900	> 6900	2422 257 22001
T8	T	8	10 1)	800	6900	> 6900	2422 257 22002

1) With a capacitor of 5 μF in series and a signal in conformity with DIN45573.

2) When ordering bulk packing add 20 to the last two digits; when ordering single-unit packing add 60 to the last two digits.

Dimensions in mm

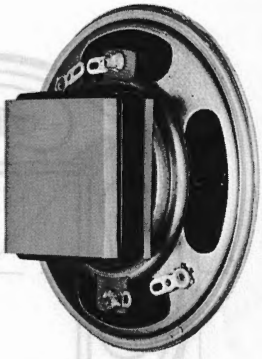


Baffle hole diameter 52 mm

A red mark near one of the tags serves for in-phase connection with other loudspeakers of our range.

Weight: 70 g

2½ in STANDARD LOUDSPEAKERS



RZ 20704-2

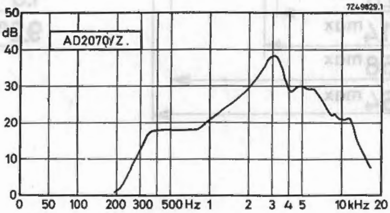
Application

Small transistorized radios.

Construction

Flat square magnet of Ferroxdure 300R.

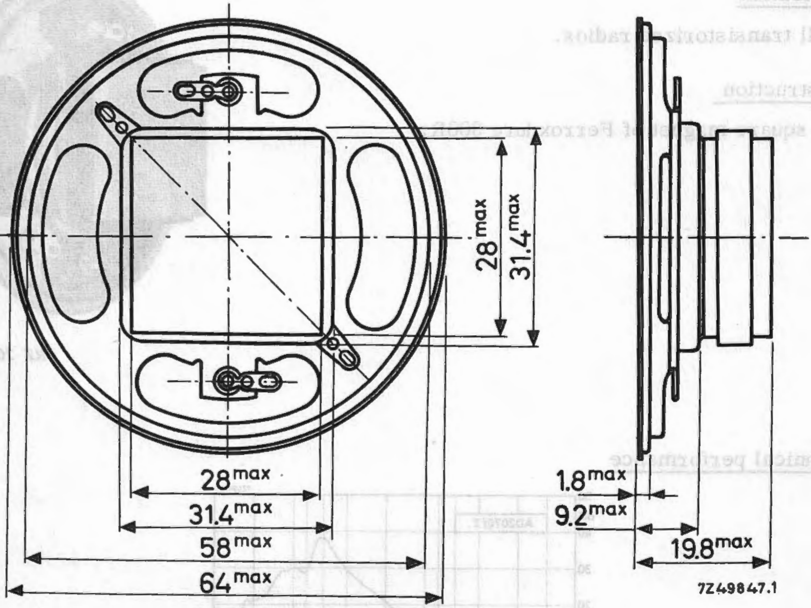
Technical performance



version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalogue number 1)
Z4	Z	4	0.5	360	6300	> 7400	2422 257 23801
Z8	Z	8	0.5	360	6300	> 7400	2422 257 23802
Z15	Z	15	0.5	360	6300	> 7400	2422 257 23803
Z25	Z	25	0.5	330	6300	> 7400	2422 257 23804

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimension in mm



Baffle hole diameter 59 mm.

Weight: 65 g

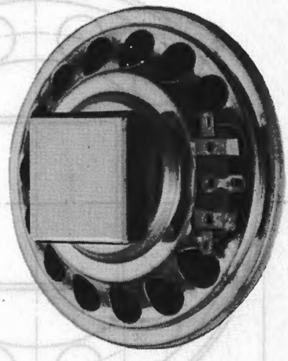
3 in STANDARD LOUDSPEAKERS

Application

Portable receivers.

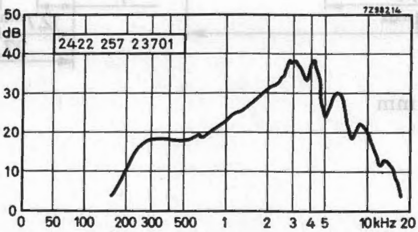
Construction

Flat square magnet system of Ferroxdure 300R.



RZ 24408-4

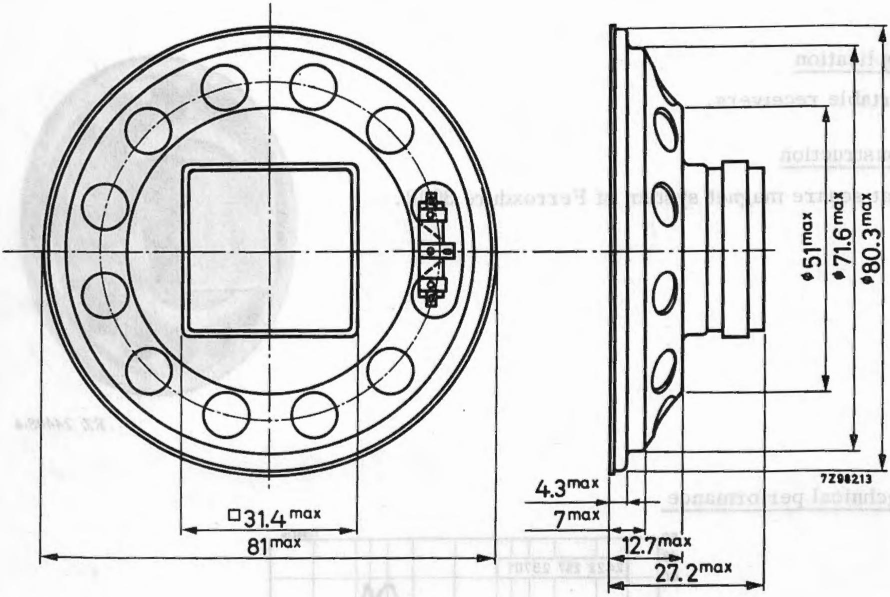
Technical performance



version	re-sponse curve	impe-dance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
Y4	Y	4	1	250	6300	7500	2422 257 23701
Y8	Y	8	1	250	6300	7500	2422 257 23702
Y15	Y	15	1	250	6300	7500	2422 257 23703
Y25	Y	25	1	250	6300	7500	2422 257 23704

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

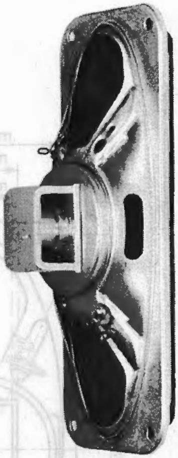
Dimensions in mm



Baffle hole diameter 72 mm

Weight: 75 g

3"×8" STANDARD LOUDSPEAKERS



RZ 21906-9

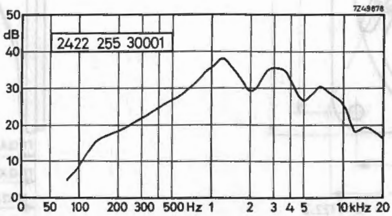
Primary application

Radio and TV receivers.

Details

Magnet of Ticonal 750 and a pressed voice coil.

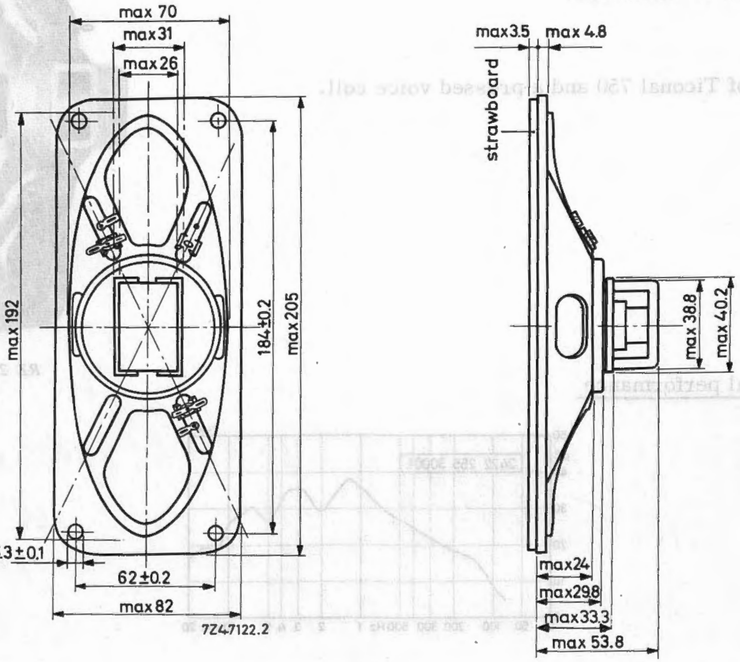
Technical performance



version	re-sponse curve	impe-dance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
RX	X	4	2	130	15 800	8800	2422 255 30001
PX	X	15	2	130	15 800	8800	2422 255 30002

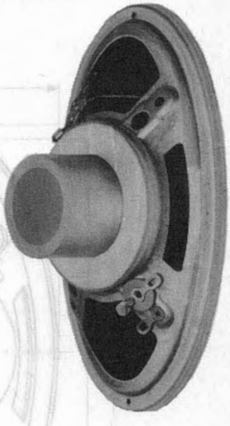
1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 210 g

3 X 5 in STANDARD LOUDSPEAKERS



RZ 20704-3

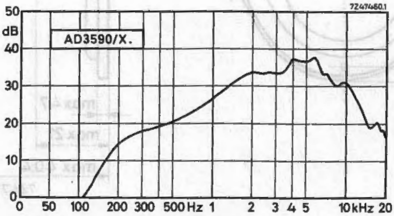
Application

TV sets, portable radios, tape recorders

Construction

Equipped with a powerful magnet of Ticonal 750 and a pot of sintered iron.
Negligible stray field (at 1 mm distance from the magnet system, the stray field is hardly measurable).

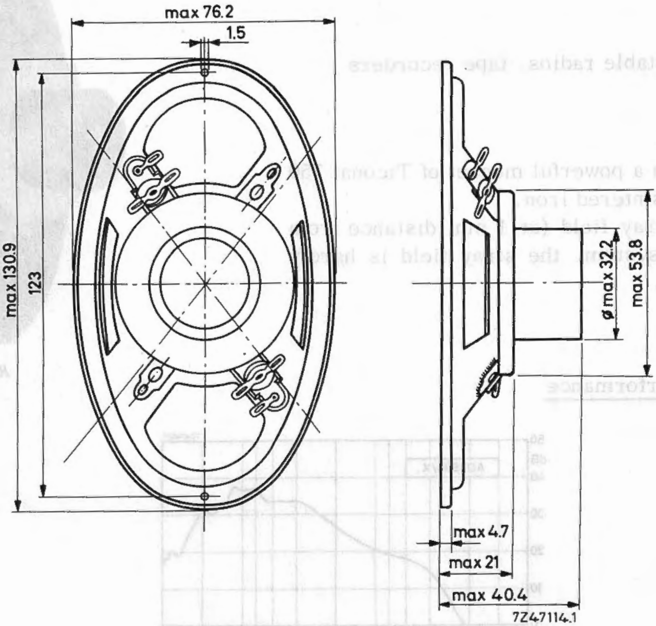
Technical performance



version	re-sponse curve	nom. impe-dance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catal. number 1)
X4	X	4	2	200	11 800	10 000	2422 256 30301
X8	X	8	2	200	11 800	10 000	2422 256 30304
X15	X	15	2	200	11 800	10 000	2422 256 30305
X50	X	50	2	200	11 800	10 000	2422 256 30302
X400	X	400	2	200	11 800	10 000	2422 256 30303

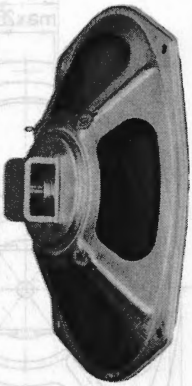
1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 135 g

6"×9" STANDARD LOUDSPEAKERS



RZ 21096-6

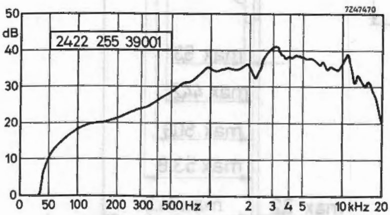
Primary application

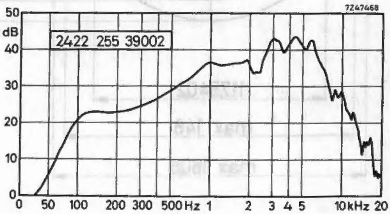
AM/FM receivers, TV receivers, radiograms.

Details

Equipped with a powerful magnet of Ticonal 750 and a pressed voice coil.

Technical performance

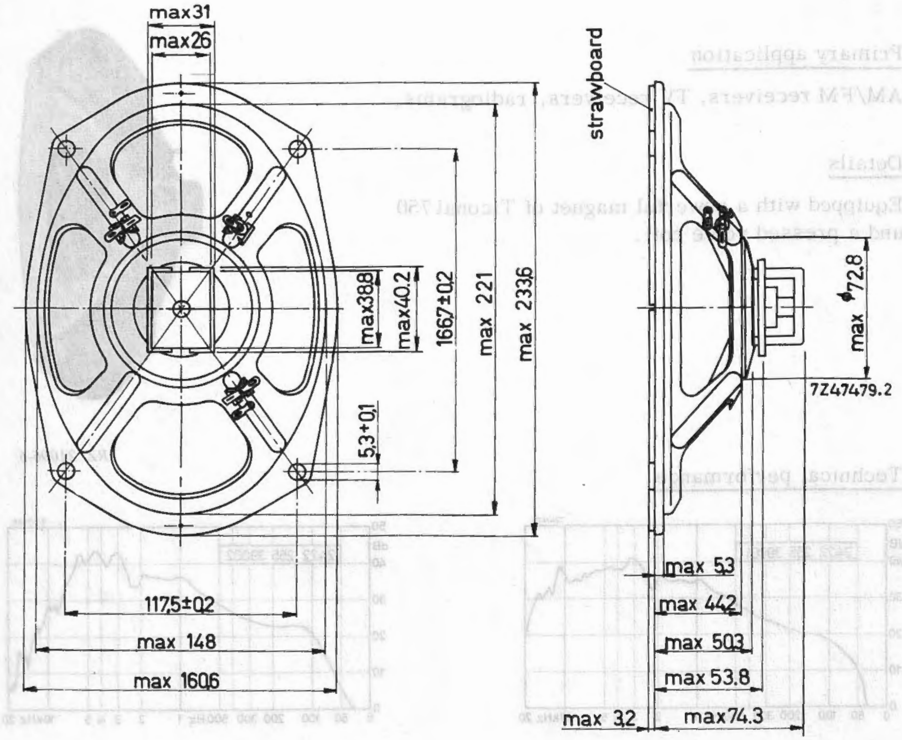




version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
RM	M	4	6	77	14 500	8100	2422 255 39001
SM	M	8	6	77	14 500	8100	2422 255 39004
RX	X	4	6	85	15 800	8800	2422 255 39002

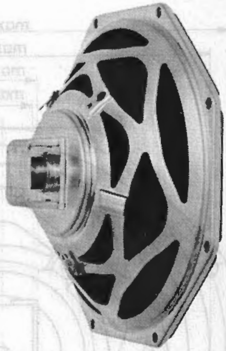
1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 310 g

8" STANDARD LOUDSPEAKERS



RZ 20890-12

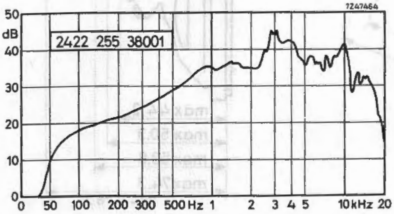
Primary application

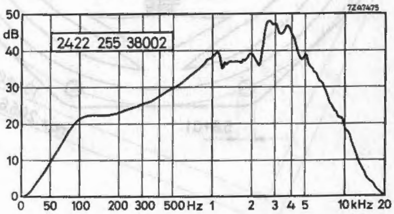
Radio and TV receivers.

Details

Equipped with a powerful magnet of Ticonal 750 and a pressed voice coil.

Technical performance

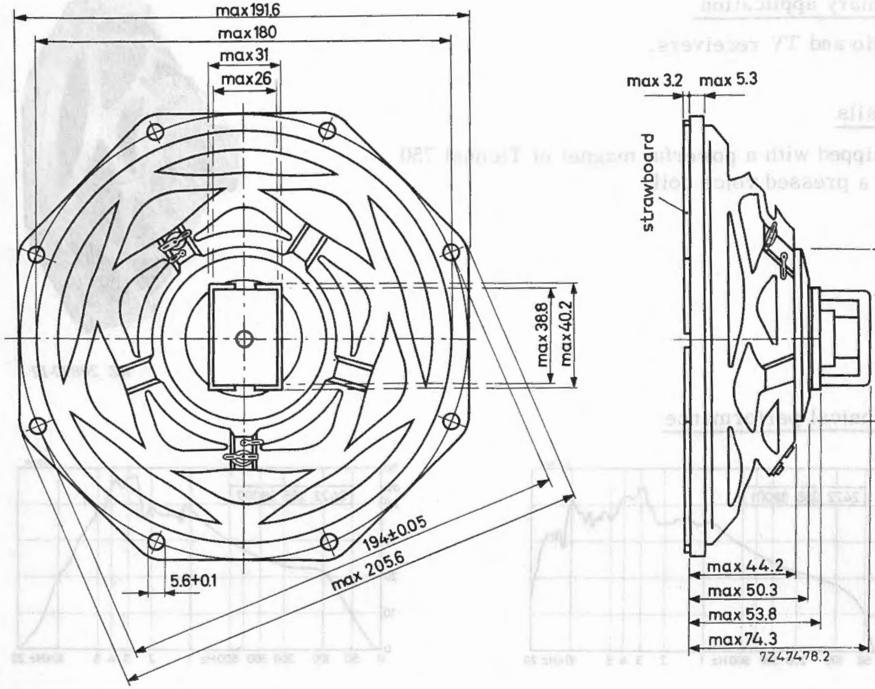




version	re-sponse curve	impe-dance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
RM	M	4	6	75	14500	8100	2422 255 38001
SM	M	8	6	75	14500	8100	2422 255 38004
RX	X	4	6	95	15800	8800	2422 255 38002
SX	X	8	6	95	15800	8800	2422 255 38003

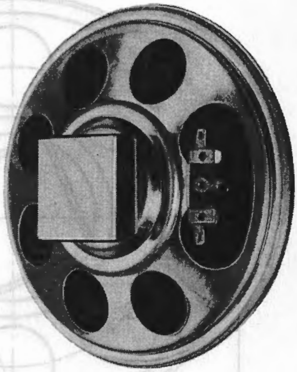
1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 280 g

4 in STANDARD LOUDSPEAKERS



RZ 22408-3

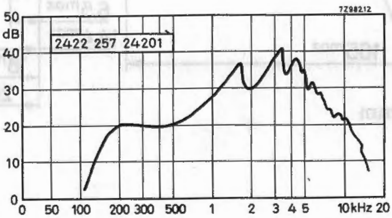
Application

Portable receivers, small tape recorders, intercoms.

Construction

Flat square magnet system of Ferroxdure 300R.

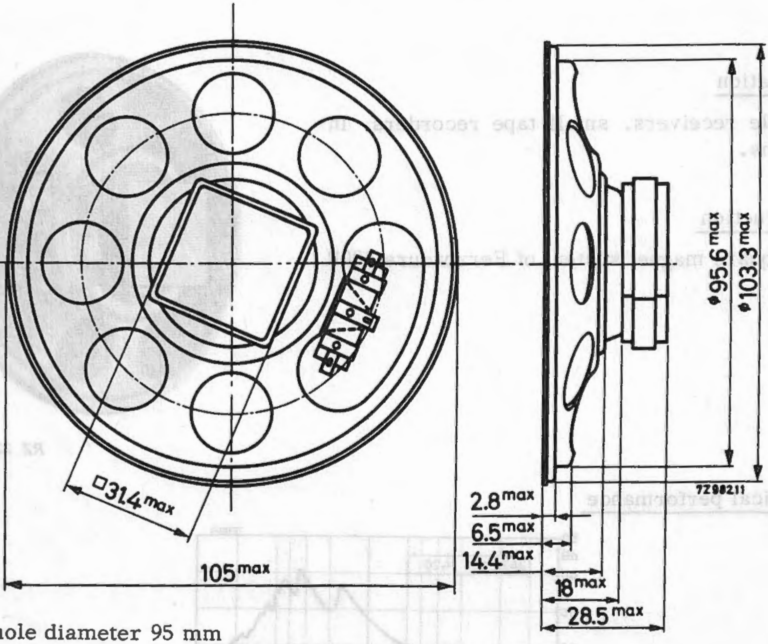
Technical performance



version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catal. number 1)
Y4	Y	4	1	200	6300	7400	2422 257 24201
Y8	Y	8	1	200	6300	7400	2422 257 24202
Y15	Y	15	1	200	6300	7400	2422 257 24203
Y25	Y	25	1	200	6300	7400	2422 257 24204

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

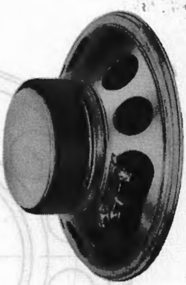
Dimensions in mm



Baffle hole diameter 95 mm

Weight: 85 g

4 in STANDARD LOUDSPEAKERS



RZ 24635-1

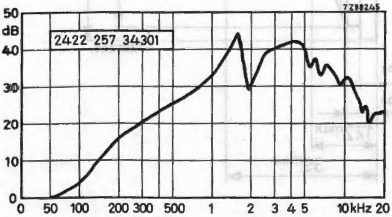
Application

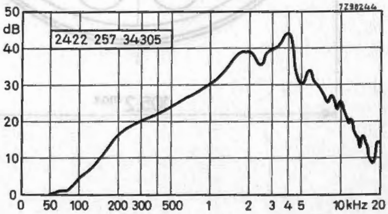
Portable receivers, small tape recorders, intercoms.

Construction

Highly sensitive magnet system of Ferroxdure 300R.

Technical performance

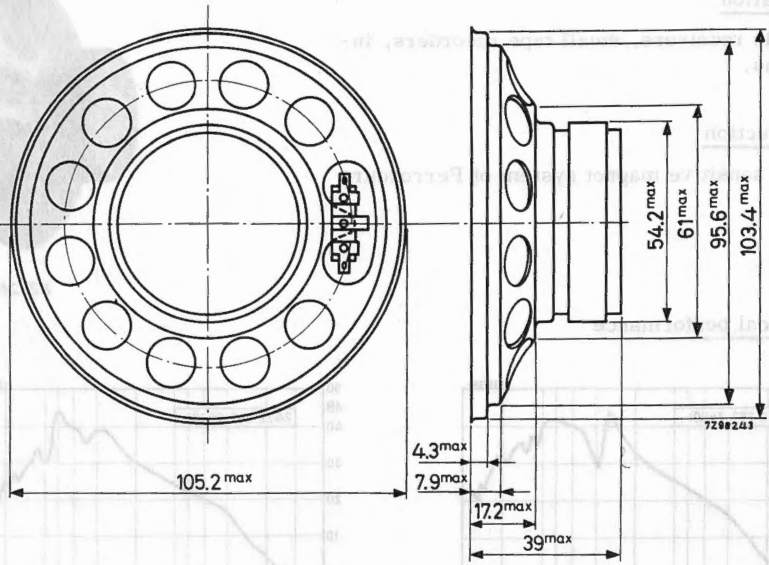




version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catal. number 1)
X4	X	4	3	165	17500	9800	2422 257 34301
X8	X	8	3	165	17500	9800	2422 257 34302
X15	X	15	3	165	17500	9800	2422 257 34303
X25	X	25	3	165	17500	9800	2422 257 34304
Z4	Z	4	3	185	17500	9800	2422 257 34305
Z8	Z	8	3	185	17500	9800	2422 257 34306
Z15	Z	15	3	185	17500	9800	2422 257 34307
Z25	Z	25	3	185	17500	9800	2422 257 34308

) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Baffle hole diameter 96 mm

Weight: 250 g

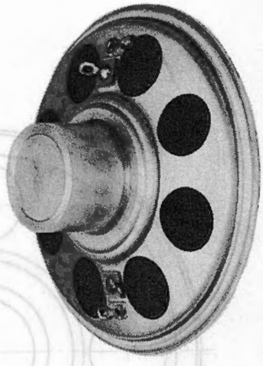
4 in STANDARD LOUDSPEAKERS

Primary application

Portable receivers (in particular for AM/FM)

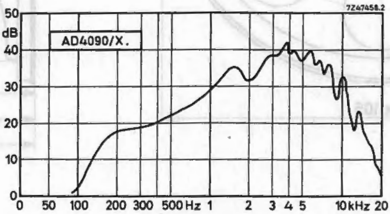
Details

High sensitivity
Magnet of Ticonal 750 and a pot of sintered iron.
Negligible stray field (at 1 mm distance from the magnet system, the stray field is hardly measurable).



RZ 20704-5

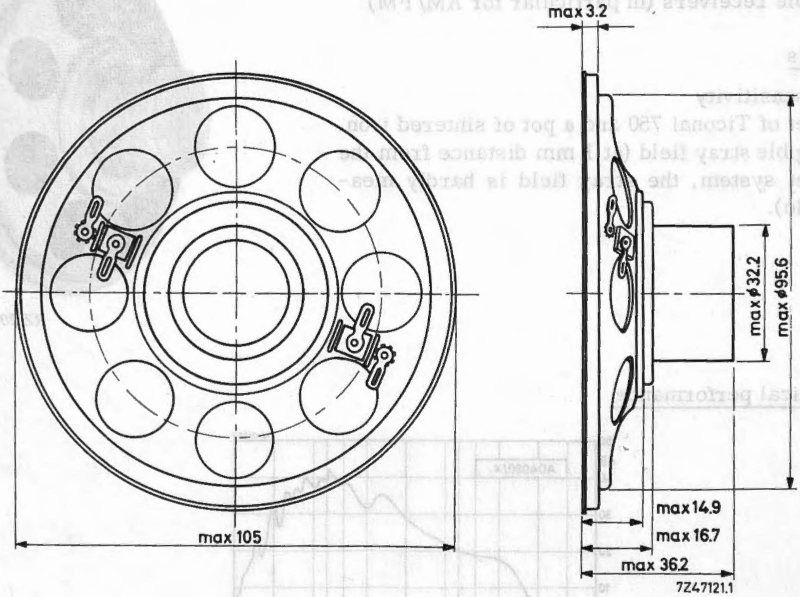
Technical performance



version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catal. number 1)
X8	X	8	2	180	11 800	10 000	2422 256 34301
X15	X	15	2	175	11 800	10 000	2422 256 34302
X400	X	400	0.6	190	11 800	10 000	2422 256 34303

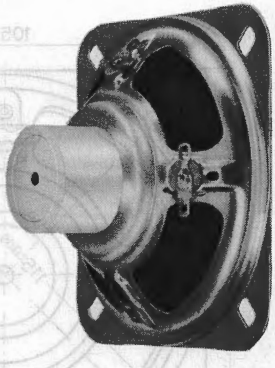
1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 125 g

4" HIGH-QUALITY TWEETER LOUDSPEAKERS



RZ 21906-5

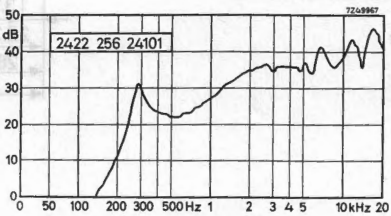
Primary applications

Hi-Fi high-note reproduction. Particularly suitable for use in combination with high-quality loudspeakers for low- and medium-note reproduction.

Details

Equipped with a relatively small, but nevertheless powerful magnet of Ticonal 750, which ensures a high efficiency.
Rigid cone suspension.
Reproduction of high frequencies up to over 20 kHz.

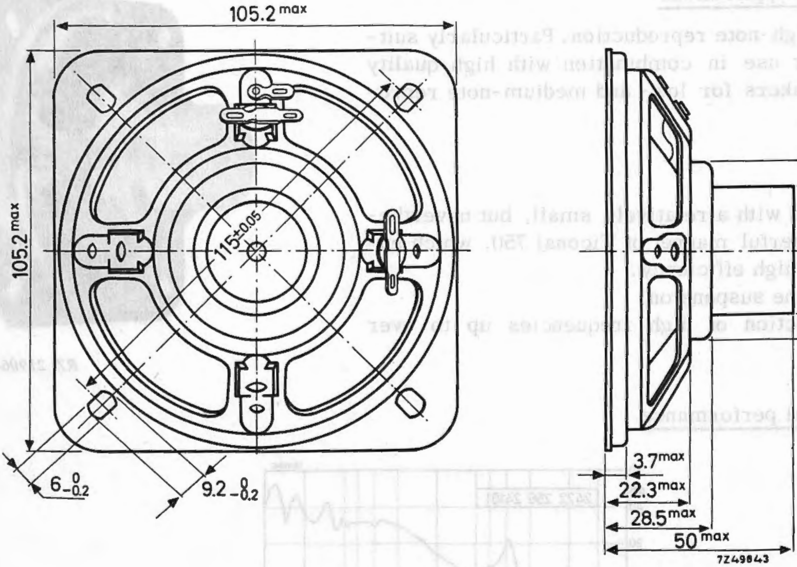
Technical performance



version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number [1]
T4	T	4	10	300	18 800	> 7000	2422 256 24102
T8	T	8	10	300	18 800	> 7000	2422 256 24101

[1]) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm

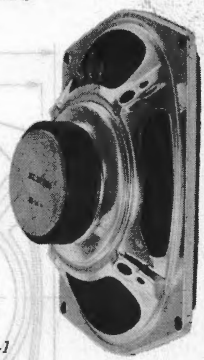


Baffle hole diameter 96 mm.

A red mark near one of the tags serves for in-phase connection with other loudspeakers of our range.

Weight: 140 g

4 x 6 in STANDARD LOUDSPEAKERS



RZ 25809-1

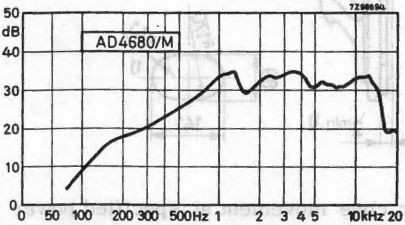
Application

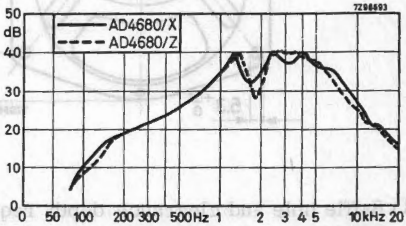
Radios (car and domestic), tape recorders and TV receivers.

Construction

Round magnet of Ferroxdure 300R.
Weight of magnet 100 g.
Pressed voice coil.

Technical performance

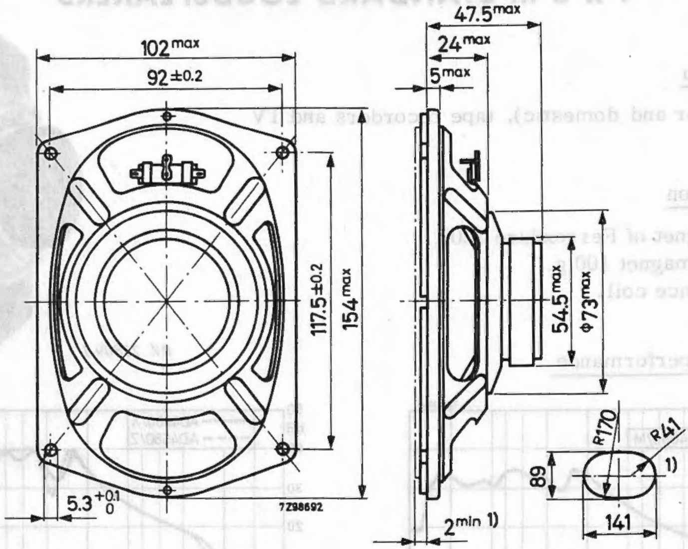




version	re-sponse curve	nom. impe-dance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 2)
M4	M	4	4 1)	125	18 000	> 10 000	2422 257 30209
M8	M	8					2422 257 30211
M15	M	15					2422 257 30212
M25	M	25					2422 257 30213
X4	X	4	6 1)	140	18 000	> 10 000	2422 257 30205
X8	X	8					2422 257 30206
X15	X	15					2422 257 30207
X25	X	25					2422 257 30208
Z4	Z	4	3 1)	155	18 000	> 10 000	2422 257 30201
Z8	Z	8					2422 257 30202
Z15	Z	15					2422 257 30203
Z25	Z	25					2422 257 30204

1) With an input signal in conformity with DIN 45573.
2) When ordering bulk packing add 20 to the last two digits; when ordering single-unit packing add 60 to the last two digits.

Dimensions in mm

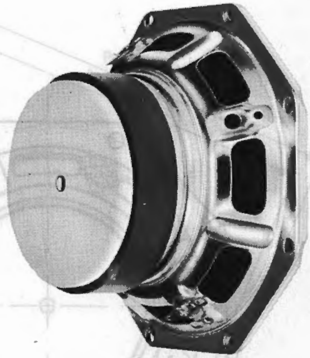


1) Baffle hole and clearance depth required for cone movement at specified power handling capacity.

A red mark near one of the tags serves for in-phase connection with other loudspeakers.

Weight: 0.26 kg.

5 in HIGH-QUALITY LOUDSPEAKERS


RZ 21906-13

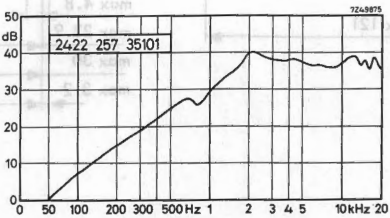
Primary application

5-8 litres acoustic enclosures.

Details

Equipped with a very sensitive Ferroxdure magnet system.
Special textile cone rim allows large amplitudes of the cone movements at low frequencies. This results in an optimum bass reproduction in the smallest enclosures. Low resonance frequency and wide frequency range.

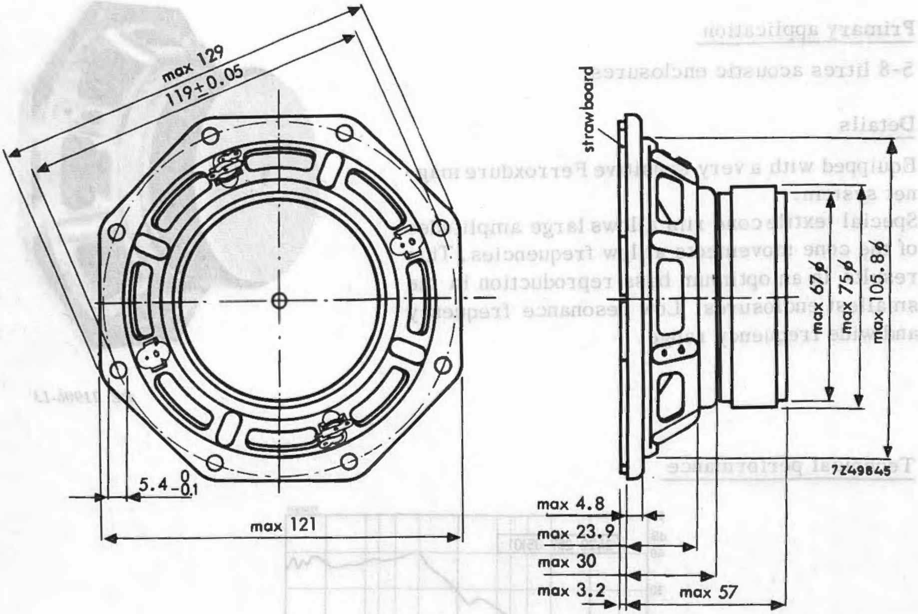
Technical performance



version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
M4	M	4	6	85	29 400	9800	2422 257 35101
M8	M	8	6	85	29 400	9800	2422 257 35102

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 655 g

5 in WOOFER LOUDSPEAKERS

Application

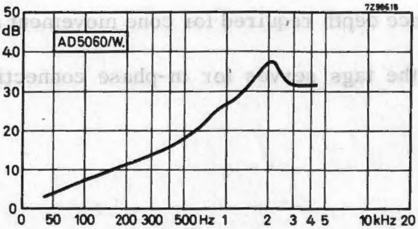
In very small acoustic enclosures; suitable for frequencies of 38 to 2000 Hz. See data sheet on the 10 W combination with tweeter AD2070/T in an acoustic box of 3 litres.

Construction

Round magnet of Ferroxdure 300R.
Weight of magnet 260 g.
Constant flux through moving voice coil. Rigid paper cone with a highly flexible butyl-rubber suspension.

RZ 25052-32A

Technical performance

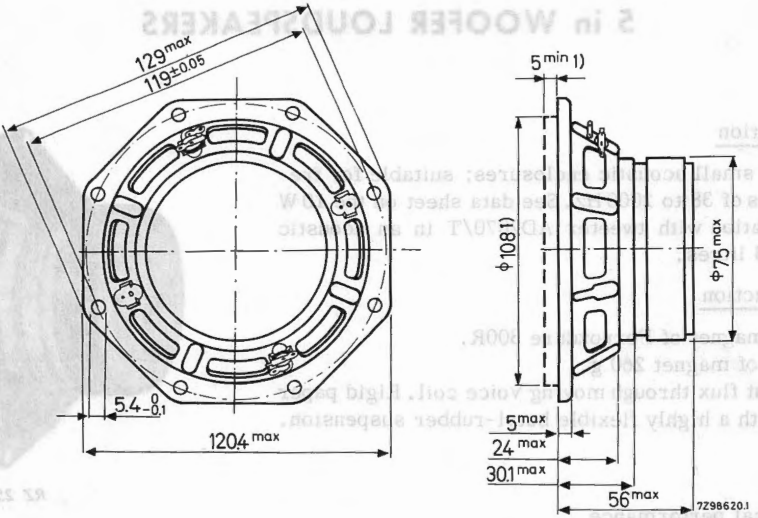


version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number [2]
W4	W	4	10 [1]	50	39000	> 9300	2422 257 35301
W8	W	8	10 [1]	50	39000	> 9300	2422 257 35302

[1]) In an acoustic enclosure of max. 3 litres, and conforming to DIN45573.

[2]) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm

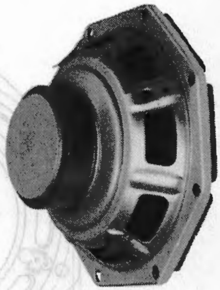


1) Baffle hole and clearance depth required for cone movement at 10 W input.

A red mark near one of the tags serves for in-phase connection with other loudspeakers of our range.

Weight: 700 g

5 in STANDARD LOUDSPEAKERS



RZ 25905-1

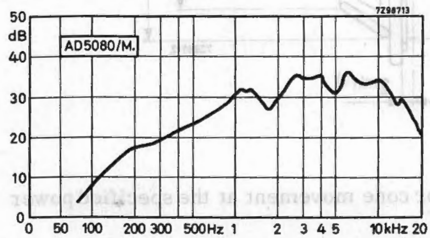
Application

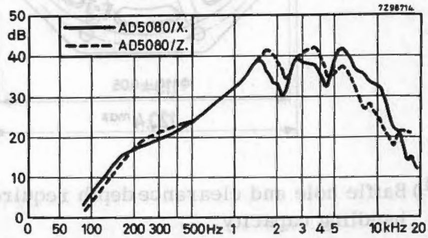
Radios (car and domestic), television sets, tape recorders, portable gramophones, intercoms.

Construction

Round magnet of Ferroxdure 300R.
Magnet mass 100 g.

Technical performance



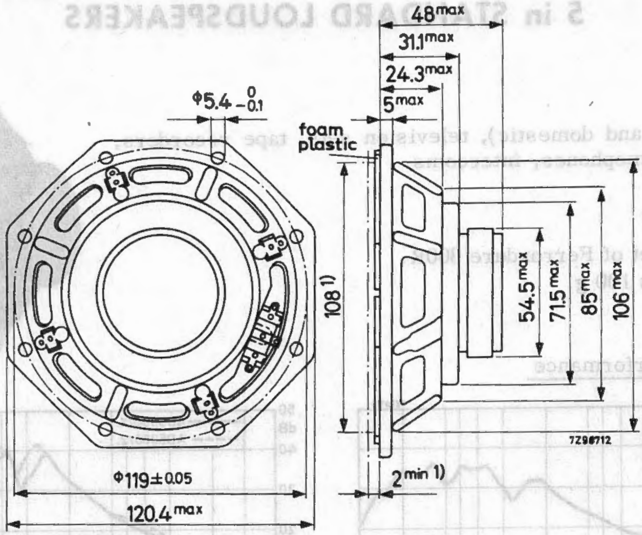


version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catal. number 2)
M4	M	4	4 1)	130	18 000	> 10 000	2422 257 35209
M8		8					11
M15		15					12
M25		25					13
X4	X	4	6 1)	140	18 000	> 10 000	2422 257 35205
X8		8					06
X15		15					07
X25		25					08
Z4	Z	4	3 1)	155	18 000	> 10 000	2422 257 35201
Z8		8					02
Z15		15					03
Z25		25					04

1) Signal in conformity with DIN45573.

2) When ordering bulk packing add 20 to the last two digits; when ordering single-unit packing add 60 to the last two digits.

Dimensions in mm

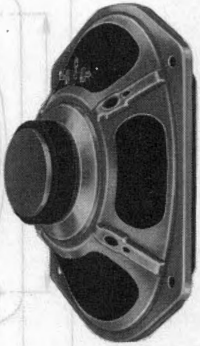


1) Baffle hole and clearance depth required for cone movement at the specified power handling capacity.

A red mark near one of the tags serves for in-phase connection with other loudspeakers of our range.

Weight: 260 g

5x7 in STANDARD LOUDSPEAKERS


RZ-25809-4

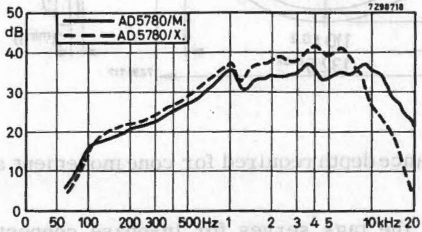
Application

Radios (car and domestic), television sets, portable gramophones, acoustic enclosures.

Construction

Round magnet of Ferroxdure 300R.
Magnet mass 100 g.

Technical performance

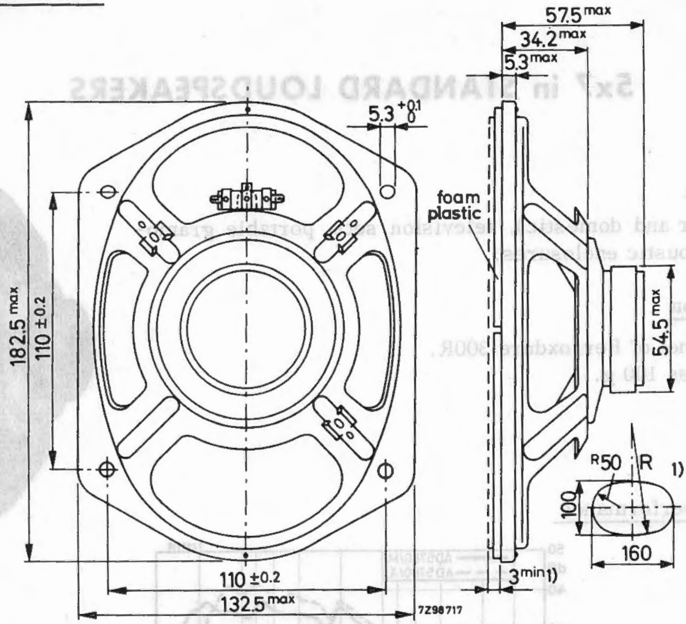


version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catal. number 2)
M4	M	4	4 1)	100	17 500	> 9800	2722 257 36105
M8		8					06
M15		15					07
M25		25					08
X4	X	4	3 1)	115	17 500	> 9800	2722 257 36101
X8		8					02
X15		15					03
X25		25					04

1) Signal in conformity with DIN 45573.

2) When ordering bulk packing add 20 to the last two digits; when ordering single-unit packing add 60 to the last two digits.

Dimensions in mm



1) Baffle hole and clearance depth required for cone movement at the specified power handling capacity.

A red mark near one of the tags serves for in-phase connection with other loudspeakers of our range.

Weight: 320 g.

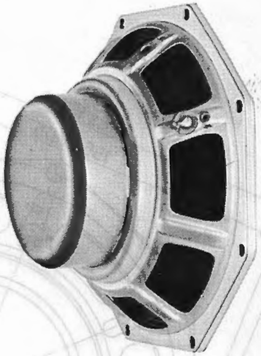
6½ in HIGH QUALITY LOUDSPEAKERS

Primary application

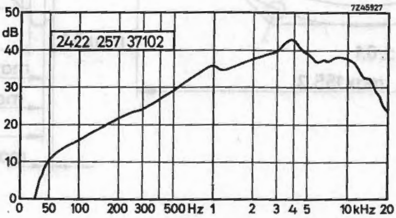
Small closed cabinets for monophonic and stereophonic reproduction. See "Recommended enclosures".

Details

Hi-Fi reproduction over a very wide frequency range owing to the special double cone which has a very low resonance frequency and reproduces even the highest tones so as to ensure a true timbre.
Great power-handling capacity when placed in a closed cabinet having a volume of maximum 25 litres.
Very high sensitivity owing to the large annular Ferroxdure magnet.


RZ 14210-9

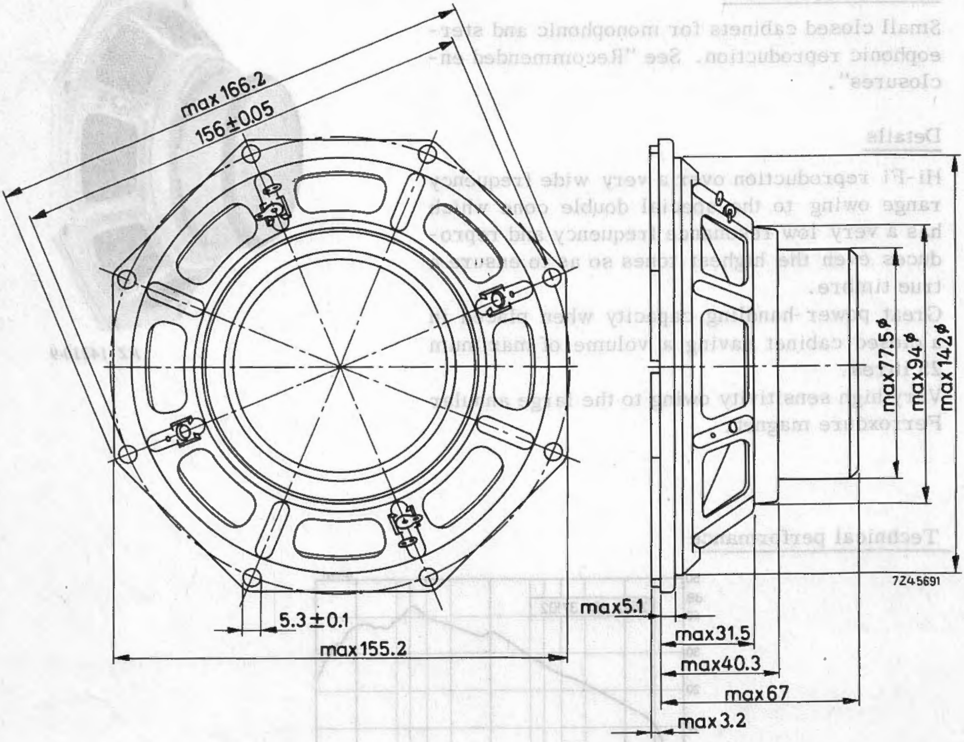
Technical performance



power handling capacity (W)	impedance at 1 kHz (Ω)	response curve	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
10	5	M	55	42 600	9500	2422 257 37102

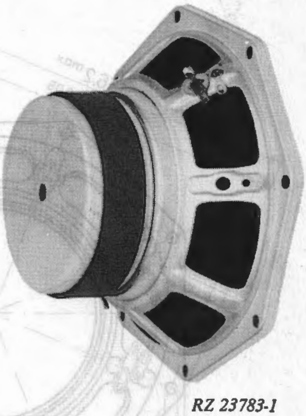
1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 525 g

6½" HIGH-QUALITY WOOFER LOUDSPEAKER



RZ 23783-1

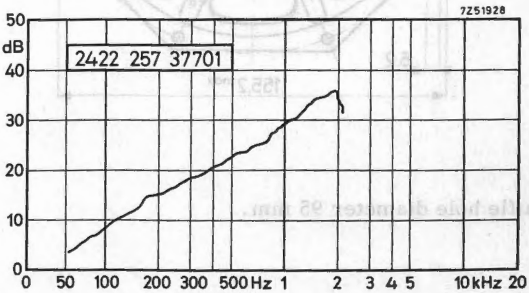
Primary application

Small acoustic enclosures for low-note reproduction.

Details

Very low resonance frequency, thanks to the rigid paper cone together with butyl-rubber cone rim. High flexible suspension of the cone, resulting in a sound reproduction with extremely low distortion, even at high powers.
Housed in a well damped acoustic box, even in a small volume of 9 litres, and in combination with the right loudspeaker for the medium and high-note reproduction [1]), this 6½" woofer loudspeaker meets the requirements of DIN45500 (Hi-Fi) specifications.

Technical performance



Material of magnet system	Ferroxdure 300R
Weight of magnet system	450 g
Height of air gap	5 mm
Length of voice coil	9.5 mm

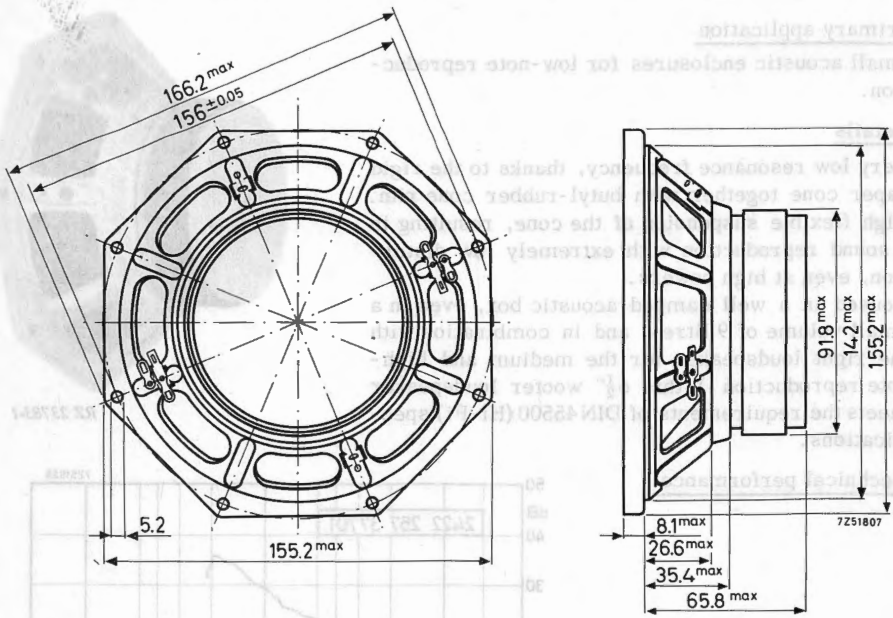
power handling capacity (W)	nominal impedance (Ω)	response curve	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number [3])
20 [2])	8	W	28	45 000	9600	2422 257 37701

[1]) See data sheet "9 l acoustic box for AD7065/W8 and AD5080/M4".

[2]) In an acoustic box of 30 litres or smaller conforming to the recommendations of DIN45573, page 2.

[3]) For bulk packing the catalog number is 2422 257 37721, for single-unit packing the catalog number is 2422 257 37761.

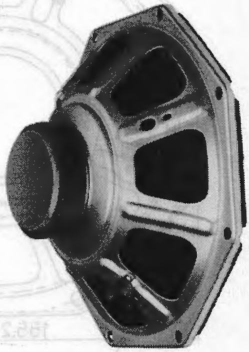
Dimensions in mm



Baffle hole diameter 95 mm.

Weight: 1.2 kg

6½ in STANDARD LOUDSPEAKERS



RZ 25905-5

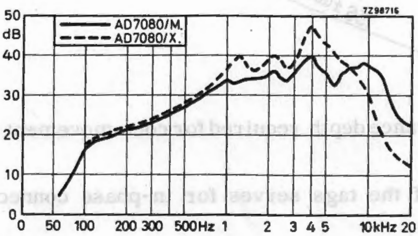
Application

Radios (car and domestic), television sets, acoustic enclosures.

Construction

Round magnet of Ferroxdure 300R.
Magnet mass 100 g.

Technical performance

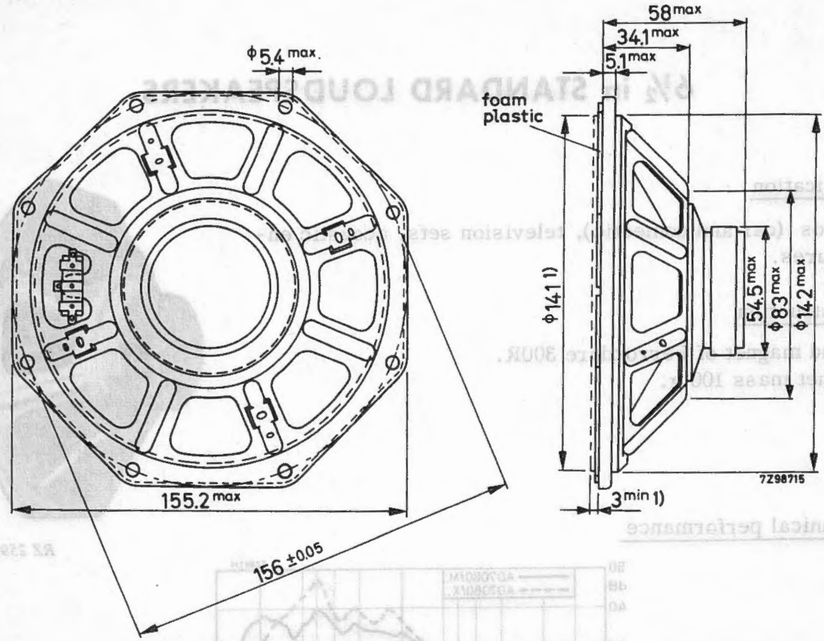


version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catal. number 2)
M4 M8	M	4 8	4 1)	95	17 500	> 9800	2422 257 37803 04
X4 X8	X	4 8	6	110	17 500	> 9800	2422 257 37801 02

1) Signal in conformity with DIN45573.

2) When ordering bulk packing add 20 to the last two digits; when ordering single-unit packing add 60 to the last two digits.

Dimensions in mm

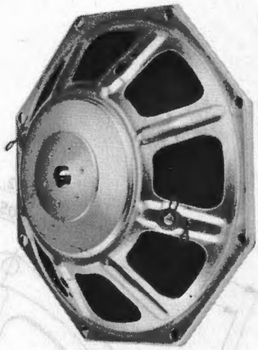


1) Baffle hole and clearance depth required for cone movement at the specified power handling capacity.

A red mark near one of the tags serves for in-phase connection with other loudspeakers of our range.

Weight: 300 g

6½ in STANDARD LOUDSPEAKERS



RZ 19741-14

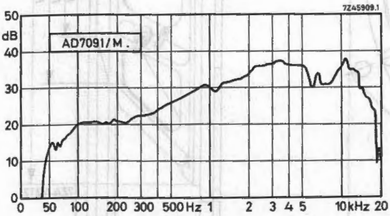
Application

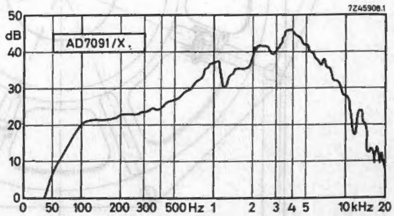
TV receivers.

Construction

Small mounting depth as a result of the inverted construction.
High sensitivity owing to the use of a Ticonal 650 magnet.
Absence of a stray field.
When the speakers, which are supplied in a plastic envelope, are built in, the front must be covered with a piece of muslin so as to prevent dust from entering the air gap.

Technical performance

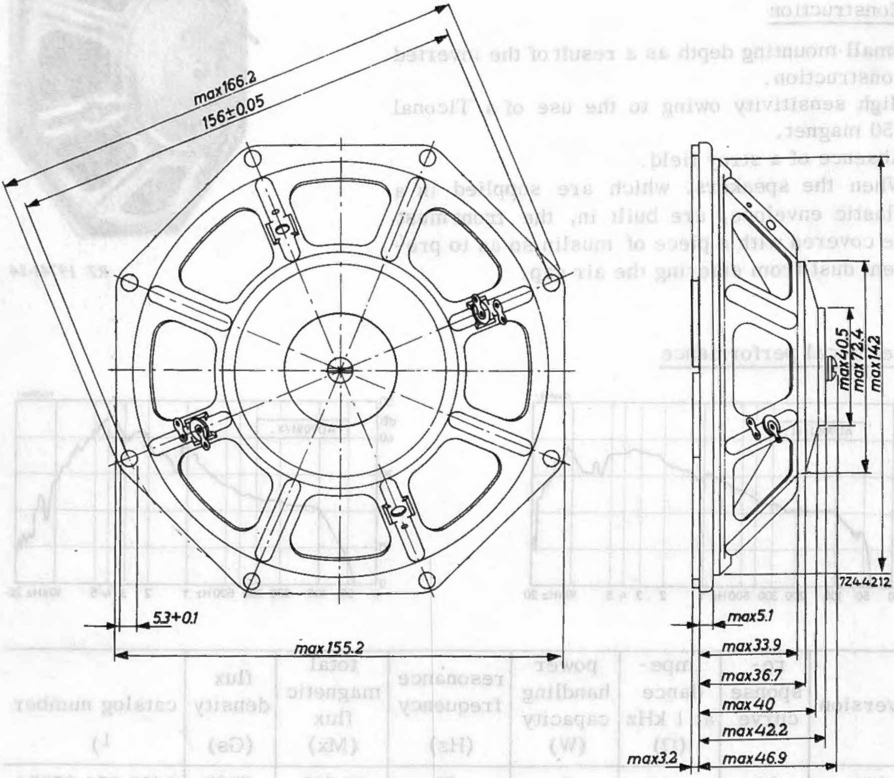




version	re-sponse curve	impe-dance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
M4	M	4	3	95	18 900	7000	2422 256 37004
M800	M	800	3	95	18 900	7000	2422 256 37001
X4	X	4	3	100	18 900	7000	2422 256 37005
X800	X	800	3	100	18 900	7000	2422 256 37002

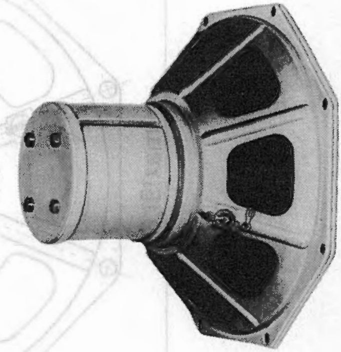
1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 250 g

8" HIGH-QUALITY LOUDSPEAKERS



A 46102

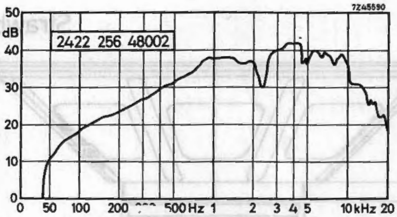
Primary application

Hi-Fi and stereo equipment. See "Recommended enclosures"

Details

High sensitivity, Ticonal magnet.
When these speakers are placed in an acoustic box or any other suitable enclosure, their sensitivity and response qualities result in an almost constant sound pressure over the entire audible frequency range.
Practically undistorted sound reproduction.

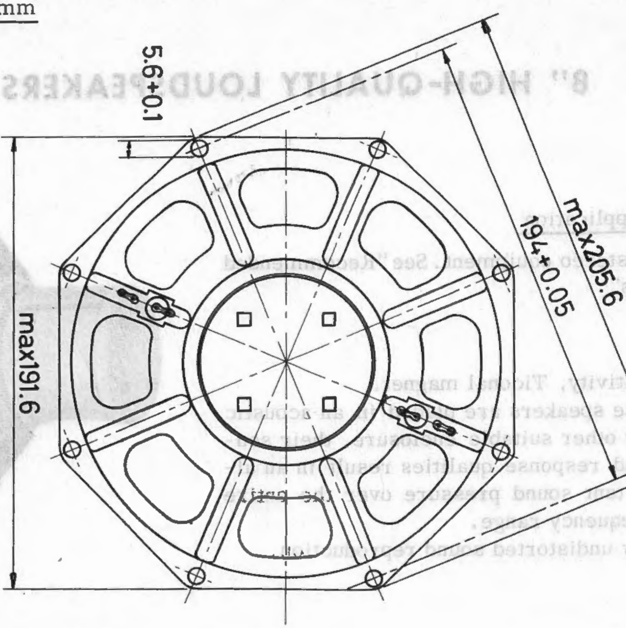
Technical performance

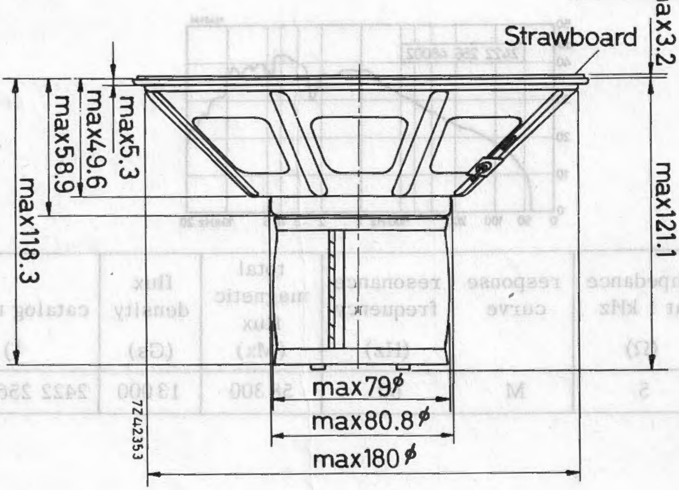


power handling capacity (W)	impedance at 1 kHz (Ω)	response curve	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
6	5	M	60	58 300	13 000	2422 256 48002

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

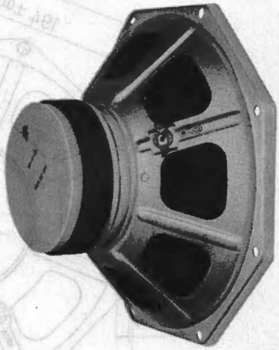
Dimensions in mm





Weight: 1.5 kg

8 in HIGH-QUALITY WOOFER LOUDSPEAKER



RZ 24709-5

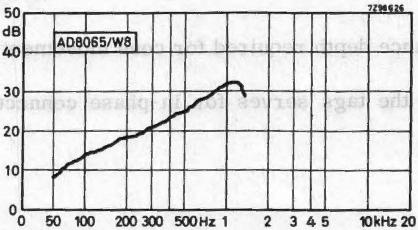
Application

In small acoustic enclosures for Hi-Fi reproduction; suitable for frequencies of 22 to 1800 Hz. See data sheet on the 20 W combination with AD5780/M4 in an acoustic box of 15 litres.

Construction

Round magnet of Ferroxdure 300 R.
Weight of magnet 450 g.
Constant flux through moving voice coil, resulting in a low distortion.
Rigid paper cone with highly flexible butyl-rubber suspension.

Technical performance

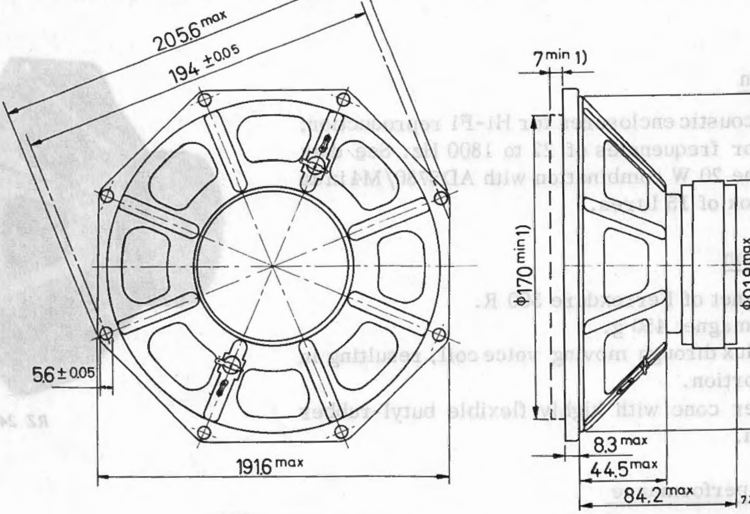


version	re-sponse curve	nom. impe-dance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 2)
W8	W	8	20 1)	28	45000	> 9000	2422 257 38101

1) In an acoustic enclosure of max. 15 litres, and conforming to DIN45573.

2) For bulk packing the catalog number is 2422 257 38121, for single-unit packing 2422 257 38161.

Dimensions in mm

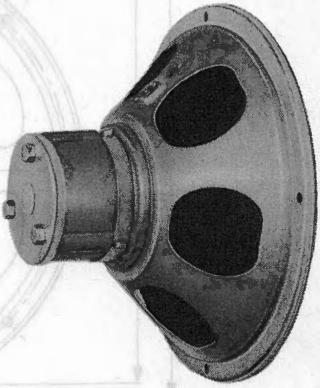


[1]) Baffle hole and clearance depth required for cone movement at 20 W input.

A red mark near one of the tags serves for in-phase connection with other loudspeakers of our range.

Weight: 1.35 kg

8½" HIGH-QUALITY LOUDSPEAKERS



C 65233

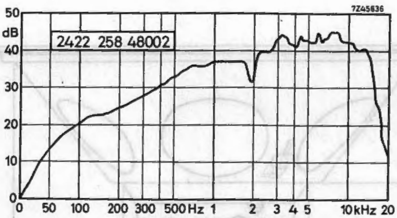
Primary application

Hi-Fi equipment. See "Recommended enclosures".

Details

High sensitivity, Ticonal magnet.
Particularly large air gap, resulting in the voice coil being completely enclosed by a uniform magnetic field even at the largest amplitudes. No distortion will thus be experienced as the coil amplitude is disproportional to the current.
Constant voice-coil impedance throughout the entire frequency range, so that the output stage always has a perfectly matched load.
Very smooth response curve.
Clear bass response without boom effects, because of mechanical damping at low frequencies.

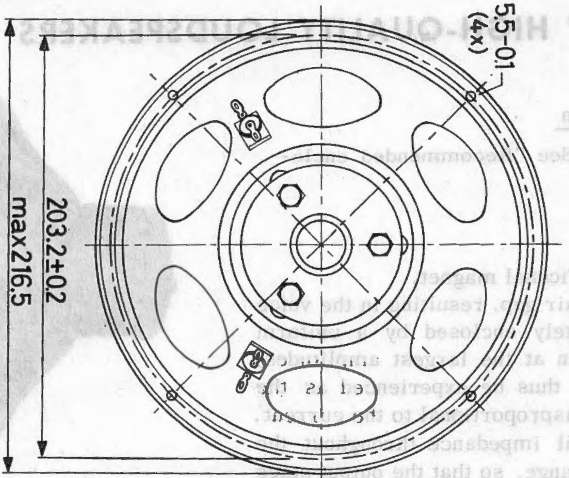
Technical performance

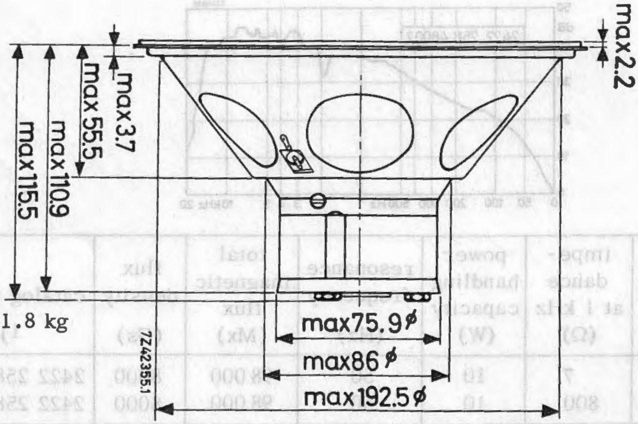


version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
M/01	M	7	10	50	98 000	8000	2422 258 48002
AM/01	M	800	10	50	98 000	8000	2422 258 48004

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm





Weight: 1.8 kg

GENERAL

INTRODUCTION

On the following pages drawings are shown of enclosures which will give good results when used in combination with the indicated loudspeaker types. We distinguish standard class and high-fidelity class combinations.

Standard class

In some of the combinations of standard quality, less expensive standard loudspeakers are employed, and the acoustic boxes can in general be made cheaply by the user himself. Yet, used in conjunction with a good radio, tape recorder or record player with amplifier, the enclosures will give the builder much pleasure because of their good quality of reproduction.

High-fidelity class

Combinations of this class have an exceptional performance thanks to the use of high-quality loudspeakers. Users are recommended to employ hi-fi equipment for best results.

POINTS TO OBSERVE WHEN ASSEMBLING ACOUSTIC BOXES

All boxes are built up of three mains parts:

- a front panel (1)
- four side panels, fastened together (2)
- a rear panel (3).

These components can be screwed together. Of course, the handy man may well decide to join the front panel and the four side panels together in his own way. He should, however, remember the following pieces of advice:

1. Use strong and rigid material for the sides, preferably multi-layer plywood or chipboard.
2. Minimum wall thickness is indicated on the Installation drawings.
3. A suitable damping lining must be provided, e.g. cotton wool 2 cm thick.
4. The enclosure must be acoustically sealed.
5. Make sure that the loudspeaker is properly fastened and that there are no loose component parts.
6. Make sure to use suitable loudspeaker cloth because otherwise the sound might be muffled.

GENERAL

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2. Minimum wall thickness is indicated on the installation drawings.
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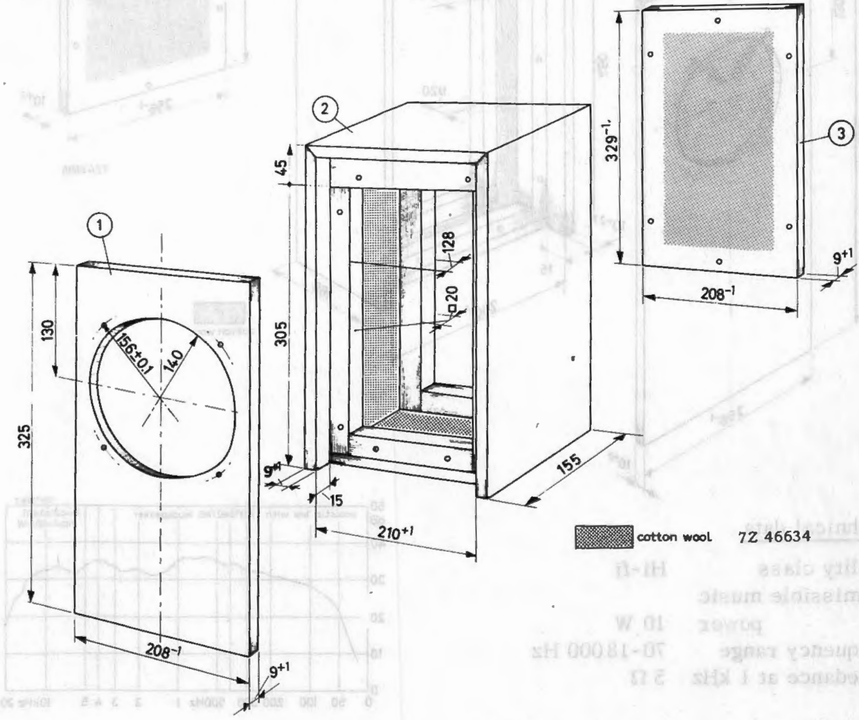
5. Make sure that the loudspeaker is properly fastened and that there are no loose component parts.
6. Make sure to use suitable loudspeaker cloth because otherwise the sound might be muffled.

ACOUSTIC BOX FOR 6½" LOUDSPEAKER

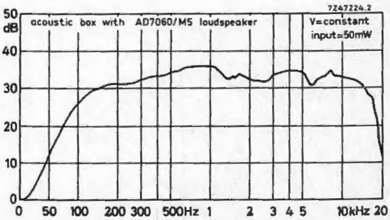
This enclosure can be built for loudspeaker AD7060/M5 (AD3701M).

Installation drawing (dimensions in mm)



Technical data

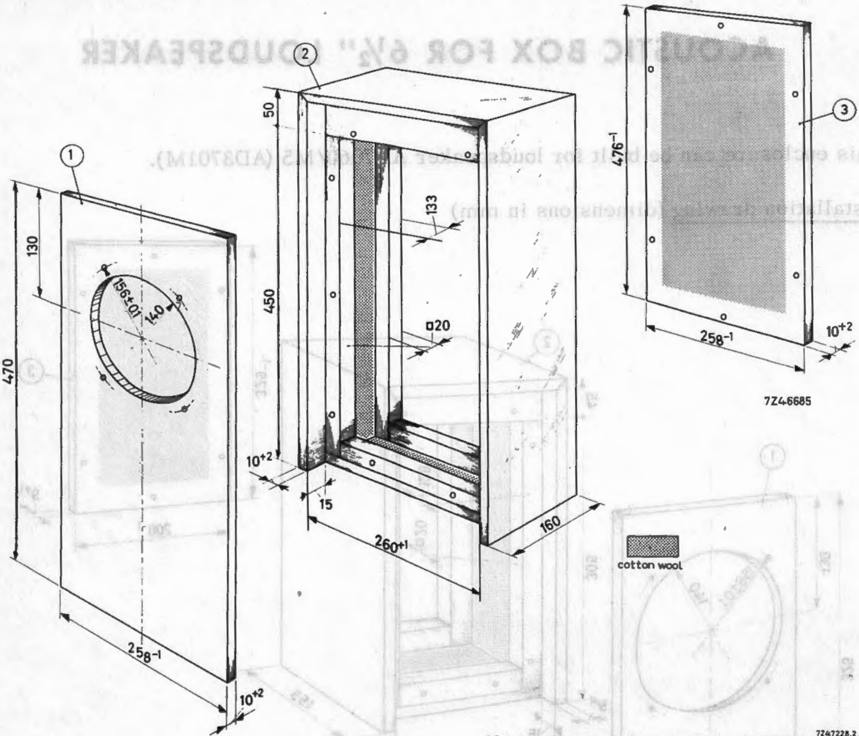
Quality class	Hi-fi
Permissible music power	10 W
Frequency range	100-18 000 Hz
Impedance at 1 kHz	5 Ω

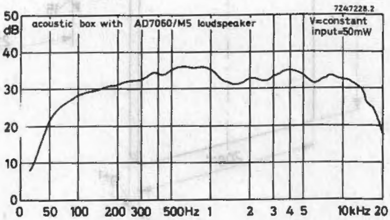


ACOUSTIC BOX FOR 6½" LOUDSPEAKER

This enclosure can be built for loudspeaker AD7060/M5 (AD3701M).

Installation drawing (dimentions in mm)





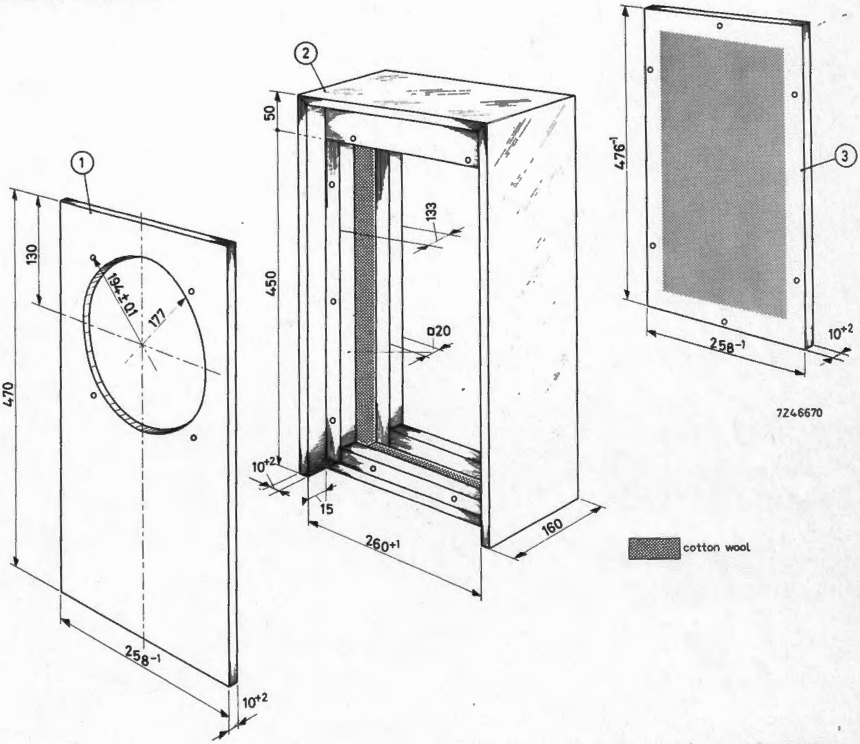
Technical data

Quality class	Hi-fi
Permissible music power	10 W
Frequency range	70-18 000 Hz
Impedance at 1 kHz	5 Ω

ACOUSTIC BOX FOR 8" LOUDSPEAKER

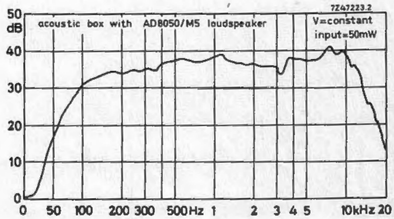
This enclosure can be built for loudspeaker AD8050/M5 (AD4800M).

Installation drawing (dimensions in mm)



Technical data

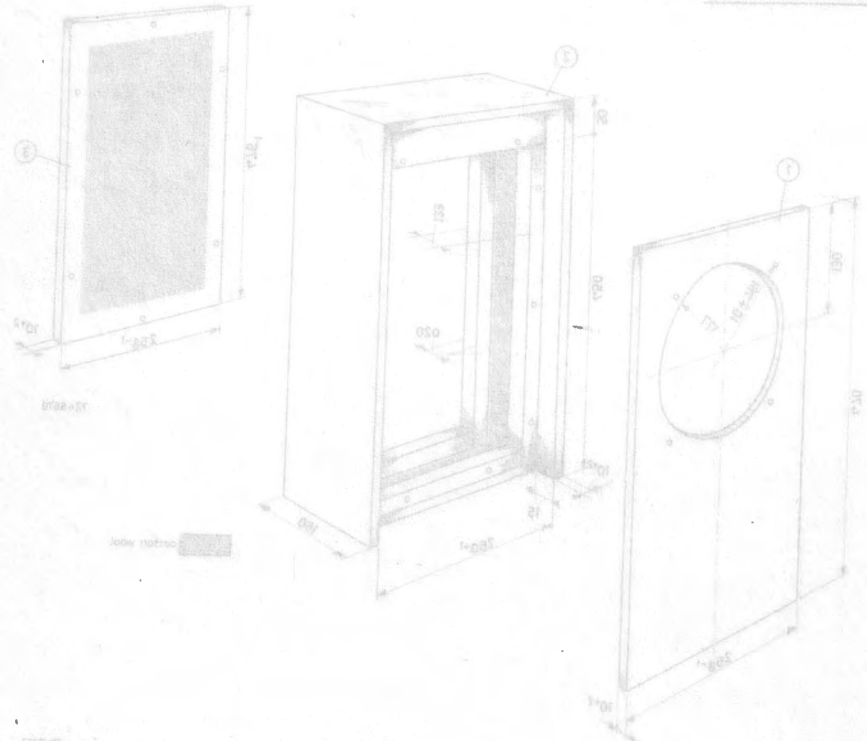
Quality class	Hi-Fi
Permissible music power	15 W
Frequency range	80-18 000 Hz
Impedance at 1 kHz	5 Ω



ACOUSTIC BOX FOR 8" LOUDSPEAKER

This enclosure can be built for loudspeaker AD8050/M5 (AD4800M).

Installation drawing (dimensions in mm)



Technical data

Quality class	Hi-Fi
Permissible music power	15 W
Frequency range	80 - 18 000 Hz
Impedance at 1 kHz	5 Ω

3 l ACOUSTIC BOX FOR AD5060/W. AND AD2070/T.

This box can be built for the 5 in woofer AD5060/W4 or /W8 and the $2\frac{1}{4}$ in tweeter AD2070/T4 or T8.
Main properties: max. 10 W; 90-20 000 Hz; simple filter.

Constructional data

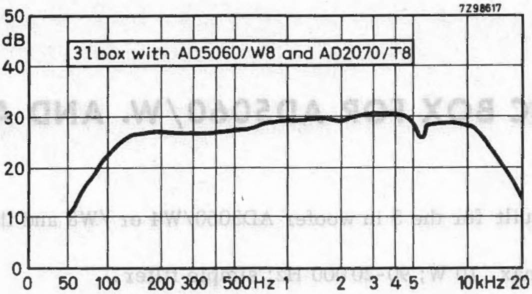
Nett volume	3 litres
Wall thickness	min. 7 mm
Damping	5 cm damping material against the back panel
Fastening of the panels	with glue, baffle with screws

Both loudspeakers to be mounted behind the baffle, the tweeter acoustically sealed off from the woofer.
The clearance depth for the woofer's cone movement falls within baffle thickness.

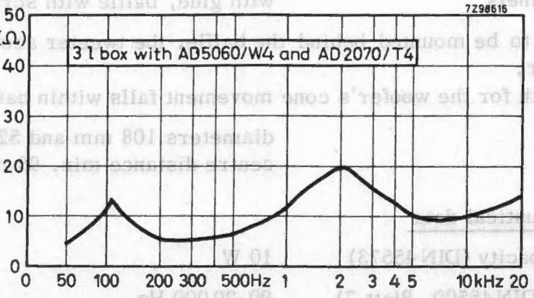
Baffle holes	diameters 108 mm and 52 mm, centre to centre distance min. 98 mm

Electrical and acoustical data

Power handling capacity (DIN 45573)	10 W
Frequency range (DIN 45500, Blatt 7)	90-20 000 Hz
Cross-over filter	1 mH in series with the woofer 5 μF in series with the tweeter
Cross-over frequency	2000 Hz
Resonance frequency	110 Hz
Nominal impedance	4 Ω or 8 Ω
Sensitivity: input power for an average sound level of 86 dB (4 μbar) over 50-12 500 Hz at 3 m distance from the box	8 W



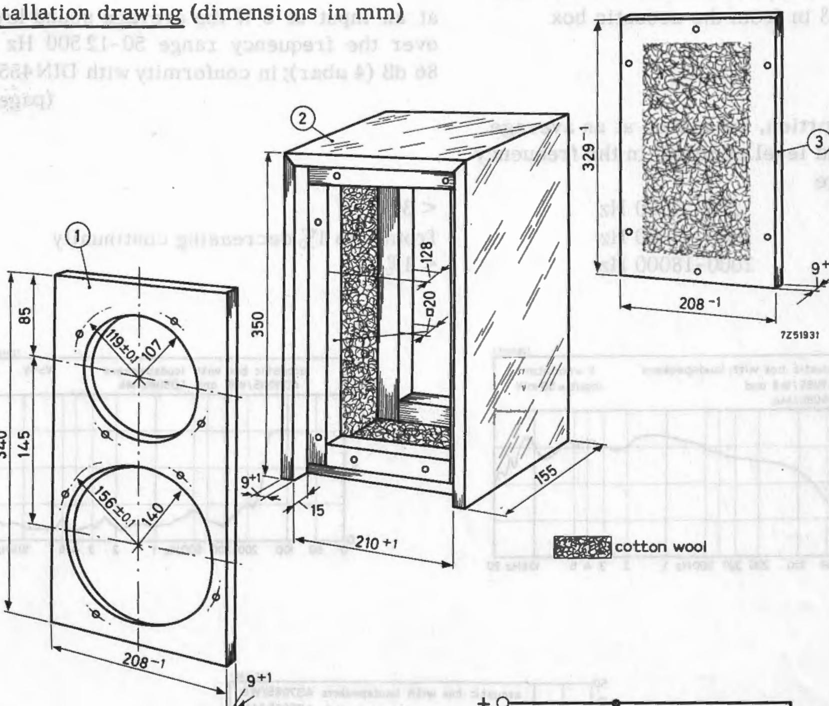
0 dB corresponds with 52 dB above 2x10^{-4} μbar
V = constant; input = 50 mW at 400 Hz; microphone at 50 cm



9 l ACOUSTIC BOX FOR AD7065/W8 AND AD5080/M4

This box can be built for the $6\frac{1}{2}$ in woofer AD7065/W8 and the 5 in loudspeaker AD5080/M4. (Instead of the 5 in loudspeaker, the 4 in tweeter AD4490/T4 can be used) Main properties: max. 20 W; 50-18 000 Hz; filter available.

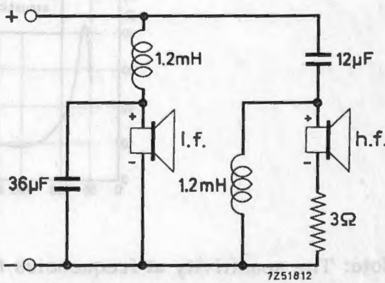
Installation drawing (dimensions in mm)



Notes

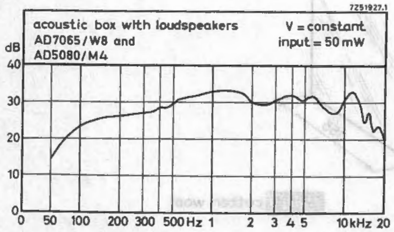
The 5" loudspeaker must be acoustically sealed off from the remainder of the enclosure.

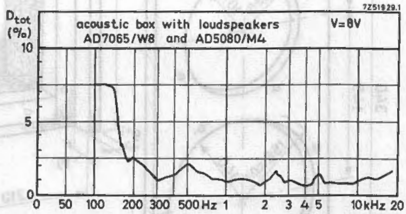
The use of the cross-over filter, given in the adjacent figure, is recommended. This filter has its cross-over frequency at 350 Hz; it can be ordered under the catalog number 4304 078 71330.

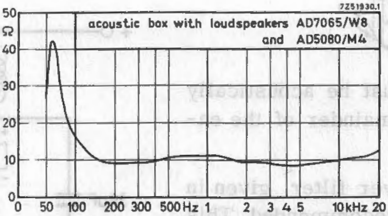


TECHNICAL DATA

Quality class	Hi-fi; in conformity with DIN 45500 (page 7)
Nett volume	9 litres
Permissible music power	20 W; in conformity with DIN 45573 (page 2)
Frequency range	50-18 000 Hz; in conformity with DIN 45500 (page 7)
Resonance frequency	60 Hz
Impedance	8 Ω
Sensitivity, measured at a distance of 3 m from the acoustic box	at an input of 8 W the average sound level over the frequency range 50-12 500 Hz is 86 dB (4 μbar); in conformity with DIN 45500 (page 7)
Distortion, measured at an average sound level of 86 dB, in the frequency range	
250- 1000 Hz	< 3%
1000- 2000 Hz	from 3 to 1% decreasing continually
2000-18000 Hz	< 1%







Note: The sensitivity at frequencies from 1.5 kHz upwards will be about 3 dB higher, if the M8 version of the 5" loudspeaker is used, and the 3 Ω resistor in the cross-over filter is short-circuited.

15 I ACOUSTIC BOX FOR AD8065/W8 AND AD3576RM

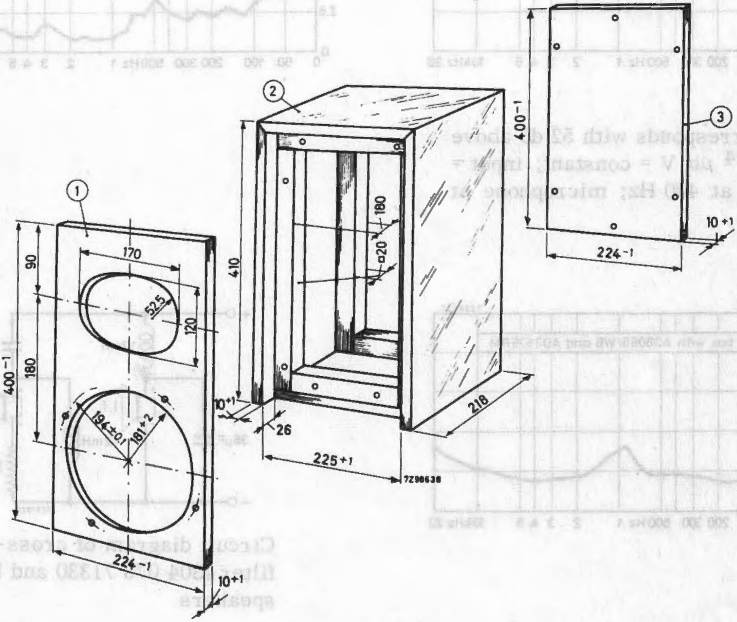
This box can be built for the 8 in woofer AD8065/W8 and the 5x7 in loudspeaker AD3576RM (or AD5780/M4).

Main properties: max. 20 W; 50-16 000 Hz; filter available.

Constructional data

Nett volume	15 litres
Inside height x width x depth	400x225x180 mm
Wall thickness	10 mm (minimum)
Damping	5 cm damping material against the back panel

Both loudspeakers to be mounted against front of baffle, the AD3576RM acoustically sealed off from the remainder of the compartment.

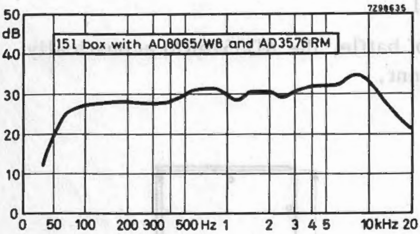


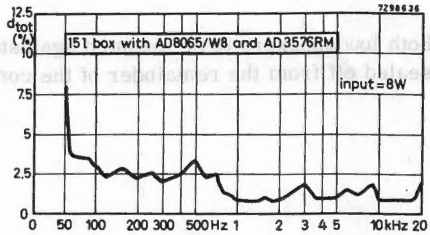
Installation drawing (dimensions in mm)

15 l ACOUSTIC BOX FOR AD8065/W8 AND AD3576RM

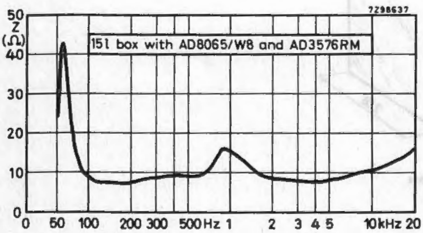
Electrical and acoustical data

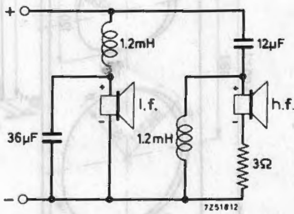
Power handling capacity (DIN 45573)	20 W
Frequency range (DIN 45500, Blatt 7)	50-16 000 Hz
Cross-over filter	catalog number 4304 078 71330
Cross-over frequency	850 Hz
Resonance frequency	55 Hz
Nominal impedance	8 Ω
Sensitivity: input power for an average sound level of 86 dB (4 μb) over 50-12 500 Hz at 3 m from the box	8 W
Distortion, measured at an average sound level of 86 dB	conforms to DIN 45500, Blatt 7; see curve.





0 dB corresponds with 52 dB above 2×10^{-4} μb V = constant; input = 50 mW at 400 Hz; microphone at 50 cm





Circuit diagram of cross-over filter 4304 078 71330 and loudspeakers

35 l ACOUSTIC BOX FOR AD1055/W8, AD5060/M8 AND AD3506SM

This box can be built for the 10 in woofer AD1055/W8, the 5 in loudspeaker AD5060/M8 (AD3501SM) for the medium notes and the 5 in loudspeaker AD3506SM or AD5080/M8 for the high notes.
Main properties: max. 40 W; 40-20 000 Hz

<u>Constructional data</u>

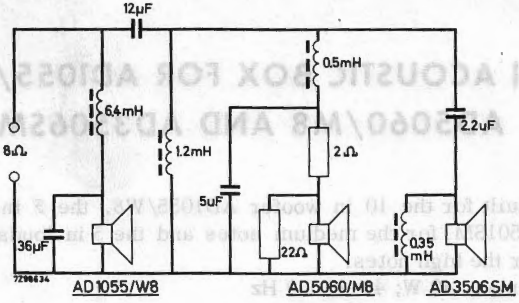
Nett volume	35 l
Wall thickness	min. 13 mm
Damping	box entirely filled with damping material
Mounting of the loudspeakers	behind baffle, each fixed by 8 screws. The AD5060/M8 and the AD3506SM should be acoustically sealed off from the woofer.
Baffle hole diameters	227 mm, 105 mm and 105 mm

The clearance depth for the woofer's cone movement falls within the baffle thickness.

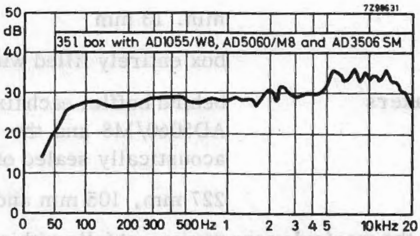
<u>Electrical and acoustical data</u>

Power handling capacity (DIN 45573)	40 W
Frequency range (DIN 45500, Blatt 7)	40-20 000 Hz
Cross-over network	see below
Cross-over frequencies	500 Hz and 4000 Hz
Resonance frequency	48 Hz
Nominal impedance	8 Ω
Sensitivity; input power for an average sound level of 86 dB (4 μb) over 50-12 500 Hz at 3 m from the box	8 W
Distortion, measured at an average sound level of 86 dB	conforms to DIN 45500, Blatt 7; see curve

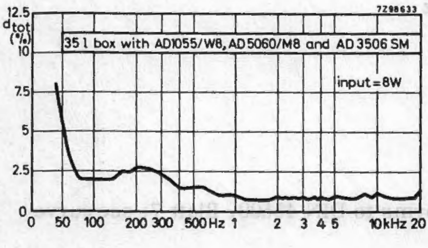
35 l ACOUSTIC BOX FOR AD1055/W8, AD5060/M8 AND AD3506SM

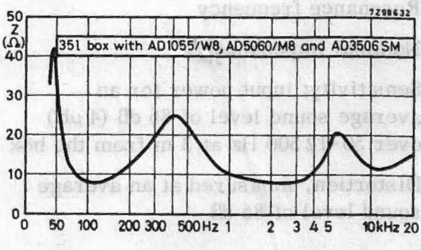


cross-over network



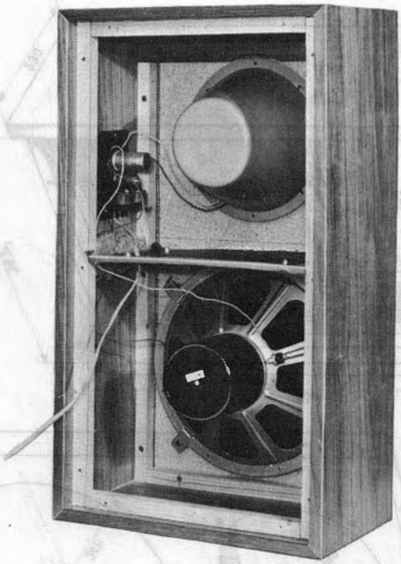
0 dB corresponds with 52 dB above 2×10^{-4} μbar. V = constant; input = 50 mW at 400 Hz; microphone at 50 cm





45 l ACOUSTIC BOX FOR AD1255/W8 AND 9710/01

This enclosure can be built for the high-quality loudspeakers 9710M/01 and the AD1255/W8 (AD5201S/77). This is a combination of one of the best middle and high-note loudspeakers and that remarkable woofer (also called "Bombardon") which has a resonance frequency of 29 Hz.

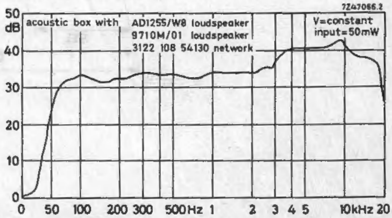


RZ 20890-9

Rear view, box opened; top loudspeaker enclosed in plastic pot.

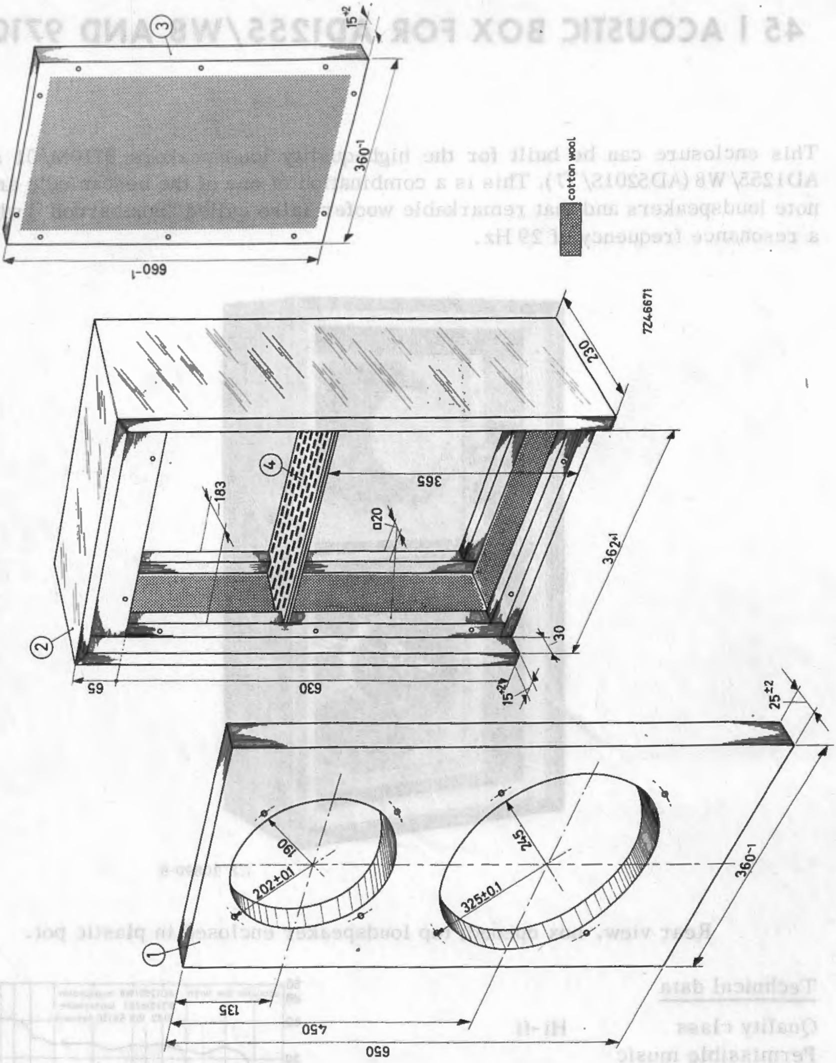
Technical data

Quality class	Hi-fi
Permissible music power	40 W
Frequency range	40-18 000 Hz
Impedance at 1 kHz	7 Ω



45 l ACOUSTIC BOX FOR AD1255/W8 AND 9710M/01

Installation drawing (without plastic pot, dimensions in mm)

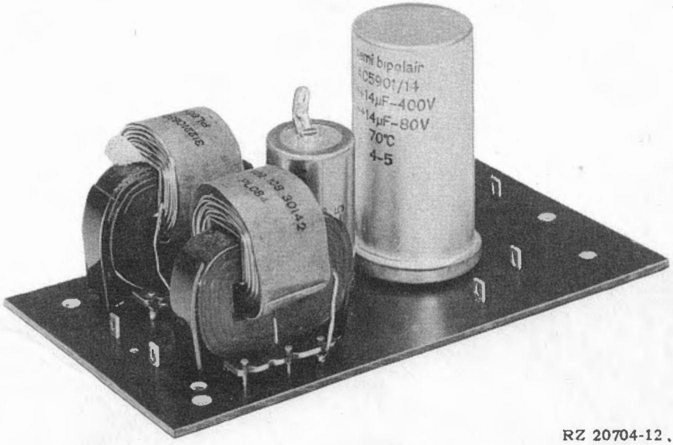


Notes

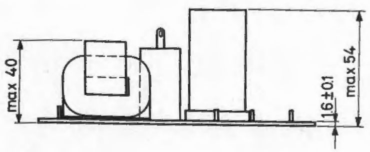
1. The top loudspeaker must be acoustically sealed off from the remainder of the enclosure, otherwise it will affect the reproduction quality of the low-tone loudspeaker. The polystyrene pot is not available, a cubic wooden enclosure is a good alternative.

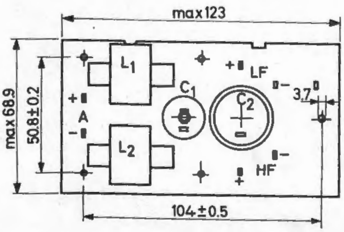
2. For proper damping of the low tones, a partition must be placed between the two loudspeakers; this should be made from a perforated plate covered by two layers of flannel.

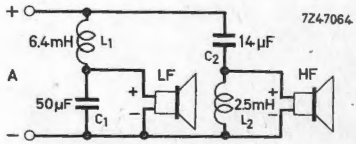
3. The use of a cross-over filter is recommended. The one shown below has its cross-over frequency at 450 Hz and a rate of attenuation of 12 dB per octave; it can be ordered under No.3122 108 54130.



RZ 20704-12







Electronic organ assemblies

INTRODUCTION

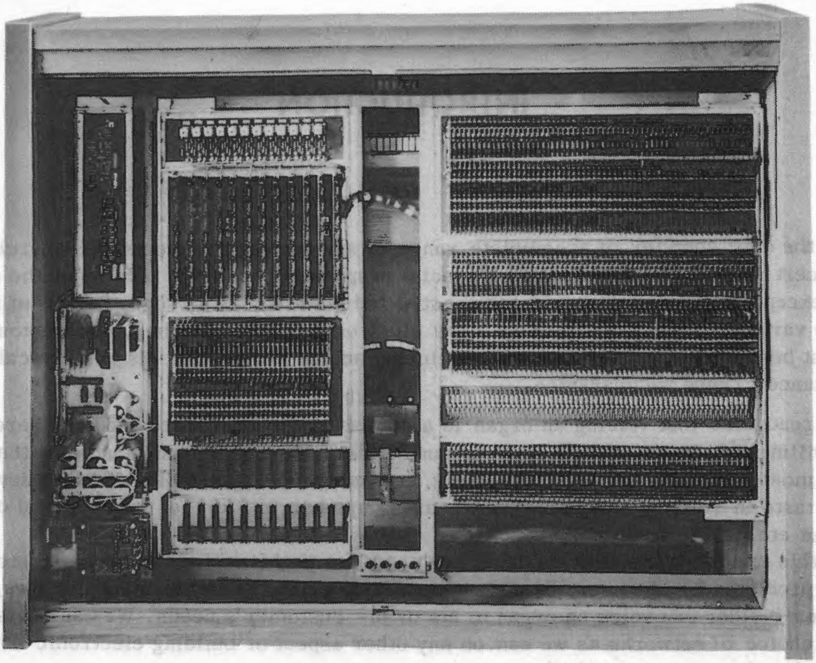
As the only supplier of a complete range of assemblies for electronic church and concert organs, we are aware of special responsibilities. Not only must the units be exceptionally well designed and constructed but also, as a range, permit of infinite variety in their end product - the electronic organ. Further, our customers must be confident of a prompt and continuing supply and of first-class technical assistance. These we guarantee.

We recognize that voicing an organ is a matter of personal taste and are therefore unwilling to inflict our taste on an organ-builder. We supply basic functions that for the most part only need interconnecting, and leave the organ-builder free to develop his taste in voicing, number of key-boards, number and kind of stops, sound character etc.
To this end the transistorised units are complete in themselves and pose no technical problems for the user. By adding equalizing networks and formant circuits, the organ-builder can voice an organ to his or his customer's needs. We can advise on the choice of networks as we can on any other aspect of building electronic organs for churches or concert-halls.

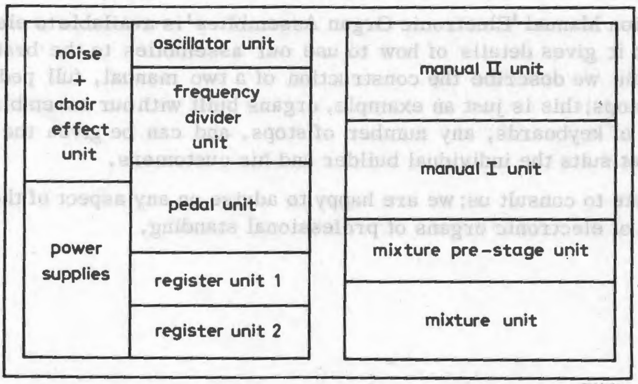
Although the electronic organs built with our assemblies are much cheaper than equivalent pipe-organs of the same scope, we can truthfully say that it is very difficult to distinguish their sound characters from those of pipe-organs.

Our Instruction Manual 'Electronic Organ Assemblies' is available to electronic organ builders; it gives details of how to use our assemblies to the best advantage. As an example we describe the construction of a two manual, full pedal, organ of twenty-one stops; this is just an example, organs built with our assemblies can have any number of keyboards, any number of stops, and can be given the voicing and character that suits the individual builder and his customers.

Do not hesitate to consult us; we are happy to advise on any aspect of the design and construction of electronic organs of professional standing.



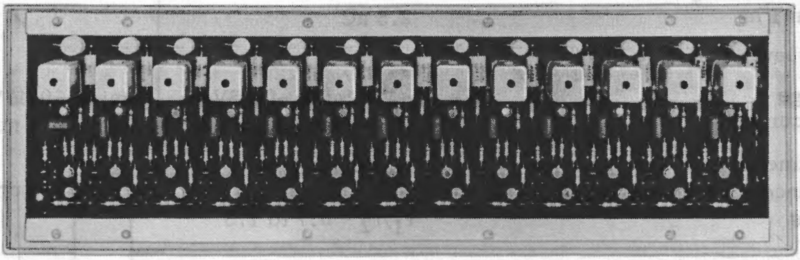
Typical layout for a small (2 manual) organ. *A 51473*



7Z52768

Block diagram of above organ.

SET OF 12 + 1 OSCILLATORS



RZ 23681-19

DESCRIPTION

This unit contains 13 oscillator circuits for the frequencies between 4096 Hz and 8192 Hz, spaced in 12 steps according to the equal tempered scale.
The frequencies are generated as sine waves, but converted to square waves to drive the frequency dividers and to feed the input of the gating circuits of the highest octave. The inductance in each oscillator circuit can be fine tuned within a range of at least 250 Hz above and below the nominal frequency.

MECHANICAL AND ENVIRONMENTAL DATA

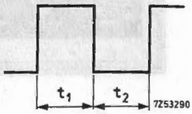
Overall dimensions	396 mm x 123 mm x 45 mm
Weight	800 g
Ambient temperature range	
storage :	−20 °C to +70 °C
operating:	+5 °C to +50 °C
Max. relative humidity	80%

ELECTRICAL DATA

Note: A positive current value indicates a current flowing toward the circuit.

Power supply	V_P = +6V ± 10%; I_P = 18 mA V_N = −6V ± 10%; I_N = −22 mA
Frequency range	4096 Hz to 8192 Hz in 12 steps according to equal tempered scale
Frequency adjustment	± 250 Hz per oscillator
Stability/temperature	≤ 0.1 ‰/°C

Output data	at collector	at emitter
Output level "negative low"		
voltage	$-V$ = max. $-0.25V_N$	max. $-0.01V_N$
load current	$-I$ = max. 0.9 mA	max. 0.08 mA
transient charge over 3 V in 1 μs	2.5 nC	
Output level "negative high"		
voltage	$-V$ = min. $-0.95V_N$	min. $-0.17V_N$
load current	$+I$ = max. 0.03 mA	max. 0.1 mA
Rise time trigger edge	t_r = max. 1 μs	
Tolerance between half pulse periods	t_1/t_2 = 0.7 to 1.3	

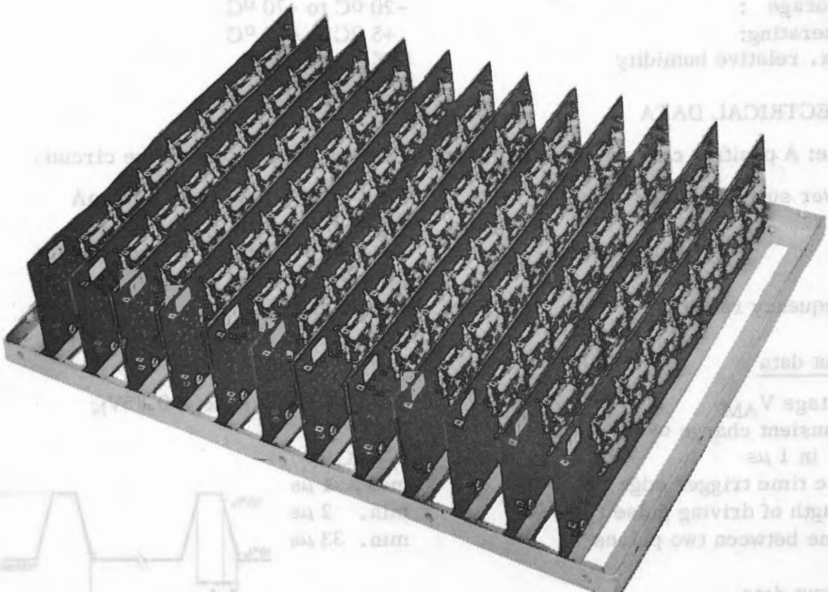


Input data

From noise and choir effect unit:

voltage	min. 1 V_{p-p}
current	max. 0.5 mA_{p-p}

SET OF 12 FREQUENCY DIVIDERS



RZ 23856-10

DESCRIPTION

The frequency dividers are a series of transistor flip-flops, each stage being triggered by the preceding, or in the case of the first stage, by the master oscillators. The set comprises twelve sub-units, each responsible for one note of the octave, and containing seven or eight stages. The first stage halves the frequency of the associated oscillator to give a note of the c_4 octave, the second stage for the c_3 octave, and so on down to the contra octave, or in the case of an eight stage divider - the sub contra. Both seven and eight stage dividers are standard, the last named being needed if a 32' pitch is included in the pedal unit.

Catalogue number 7 stages: 4322 026 37650
Catalogue number 8 stages: 4322 026 37660

MECHANICAL AND ENVIRONMENTAL DATA

Overall dimensions	396 mm x 289 mm x 75 mm
Weight 7-stage version	2100 g
8-stage version	2150 g
Ambient temperature range	
storage :	−20 °C to +70 °C
operating:	+5 °C to +50 °C
Max. relative humidity	80%

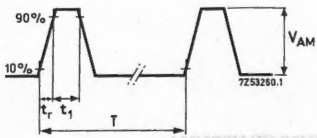
ELECTRICAL DATA

Note: A positive current value indicates a current flowing toward the circuit.

Power supply 7-stage version	V_P = +6 V ± 10%; I_P = 60 mA
	V_N = −6 V ± 10%; I_N = −550 mA
8-stage version	V_P = +6 V ± 10%; I_P = 69 mA
	V_N = −6 V ± 10%; I_N = −630 mA
Frequency range	0 to 30 kHz

Input data

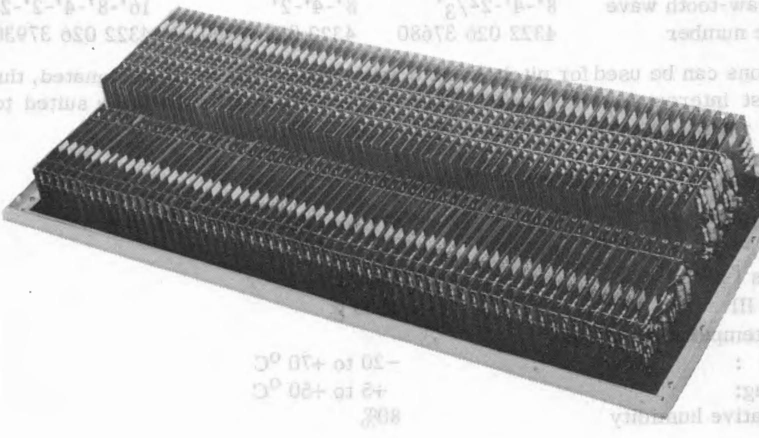
Voltage V_{AM}	min. $-0.7V_N$; max. $-0.85V_N$
Transient charge over 3 V in 1 μs	2.3 nC
Rise time trigger edge t_r	max. 1 μs
Length of driving pulse t_1	min. 2 μs
Time between two pulses T	min. 33 μs



Output data

Output level "negative low"	
voltage	−V = max. 0.2 V
load current	$+I_Q$ = max. 0 mA
Output level "negative high"	
voltage	−V = min. $-0.15V_N$
load current	$+I_Q$ = max. 0.1 mA

MANUAL UNITS



RZ 23856-5

DESCRIPTION

In design and print-lay-out the three versions are identical, they differ only in the facilities provided.

The main printed wiring board carries 61 sub-units, each sub-unit being connected to a particular key on the keyboard. The sub-units are in two parts: one having provision for 5 gates to control the admission of tones to the stop circuits; the other having a network to delay the response of certain pitches, plus facilities to insert wind-noise and gate the chiff.

Each gate controls a particular pitch and can have two outputs, a saw-tooth for the open diapason and reed characters, and a square wave for the flute stops.

When a key is depressed, all associated gates are opened and all outputs are admitted to the stop circuits, where the stop switches determine which output shall become audible. The outputs are fed to the stop-circuits via equalising networks that over the full compass of the keyboard pre-shape the tone to the main characters, so that a single voicing network in each stop circuit can determine the specific character of the individual voices.

In the second part of the sub-units, three networks are shared among the five pitches to delay the gating of a note for a specific period depending on its pitch. The same unit also gates the two chiff frequencies, obtained by strapping the chiff input to a selected output of the frequency dividers. The chiff frequency will be heard in advance of the note played, in the same way that partials precede the fundamental in pipe organs.

Versions I and II are not fully equipped as far as the gating circuits are concerned experience having shown that the majority of organs do not need all the facilities available. Version III is fully equipped.

	Version I	Version II	Version III
Number of gates	4	4	5
Gate-pitches	8'-4'-2'-2 2/3'	8'	16'-8'-4'-2'-2 2/3'
Outputs square wave	8'-4'-2'-2 2/3'	8'-4'-2'-2 2/3'	16'-8'-4'-2'-2 2/3'
Outputs saw-tooth wave	8'-4'-2 2/3'	8'-4'-2'	16'-8'-4'-2'-2 2/3'
Catalogue number	4322 026 37680	4322 026 37690	4322 026 37930

All versions can be used for pitches one octave higher than those designated, this is of greatest interest for version III. This unit is so versatile as to be suited to any keyboard - great organ, swell organ, solo organ, etc.

MECHANICAL AND ENVIRONMENTAL DATA

Overall dimensions	671 mm x 276 mm x 75 mm
Weight	
versions I and II	5200 g
version III	5500 g
Ambient temperature range	
storage :	-20 to +70 °C
operating:	+5 to +50 °C
Max. relative humidity	80%

ELECTRICAL DATA

Note: A positive current value indicates a current flowing toward the circuit.

Gating circuits

Power supply — $V_N = -6\ V \pm 10\%$
$I_N = -0.7$ mA for each gate

Input data for each gate

Output level "negative low"

voltage	$-V_G$ = min. $-0.15V_N$	max. $-V_N$
current	$-I_G$ = max. 0.014 mA (at $V_G = 0.15V_N$)	

Output level "negative high"

voltage	$-V_G$ = max. 0.2 V	min. 0 V

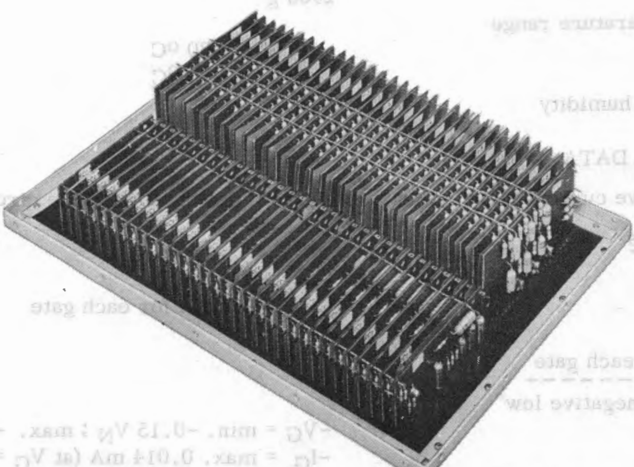
Output data

	square wave output	saw-tooth output
Output level "negative low"	$-V = \text{max.}\ -V_N - \Delta V$ $\Delta V = \frac{4.4}{62 - n}\ V$ (n = number of operated keys)	max. 0 V
Output level "negative high"	$-V = -V_N$	$-V = \text{min.}\ 0 - \Delta V$ $\Delta V = \frac{3}{62 - n}\ V$ (n = number of operated keys)

RC time delay circuits

Power supply	$V_N = -1.5\ V \pm 10\%$ $I_N = -0.5\ mA$
Time delays	between 2 ms and 25 ms (approx., depending on pitch and position in unit)

PEDAL UNITS



RZ 23856-7

DESCRIPTION

This unit is identical to the manual units as far as functions are concerned. The main printed-wiring board, however, has only 32 sub-units (each in two parts) corresponding to the number of keys in the pedal.

In version I the first part of the sub-units is equipped with only three gating circuits, each with both square wave and saw-tooth wave outputs, for the pitches 16', 8' and 4'. The second part of each sub-unit has 2 delay circuits and one gating circuit for the chiff frequency (instead of three and two as on the manual units).

Version II is fully equipped.

	Version I	Version II
Number of gates	3	5
Gate-pitches	16' - 8' - 4'	32' - 16' - 8' - 4' - $5^1/_3$'
Outputs square wave	16' - 8' - 4'	32' - 16' - 8' - 4' - $5^1/_3$'
Outputs saw-tooth wave	16' - 8' - 4'	32' - 16' - 8' - 4' - $5^1/_3$'
Catalogue number	4322 026 37670	4322 026 37920

MECHANICAL AND ENVIRONMENTAL DATA

Overall dimensions	396 mm x 276 mm x 75 mm
Weight	
version I	2800 g
version II	2900 g
Ambient temperature range	
storage :	−20 °C to +70 °C
operating:	+5 °C to +50 °C
Max. relative humidity	80%

ELECTRICAL DATA

Note: A positive current value indicates a current flowing toward the circuit.

Gating circuits

Power supply	$V_N = -6\ \text{V} \pm 10\%$ $I_N = -0.7$ mA for each gate

Input data for each gate

Output level "negative low"		
voltage	$-V_G$ = min. $-0.15\ V_N$; max. $-V_N$	
current	$-I_G$ = max. 0.014 mA (at $V_G = 0.15\ V_N$)	
Output level "negative high"		
voltage	$-V_G$ = max. 0.2 V	min. 0 V

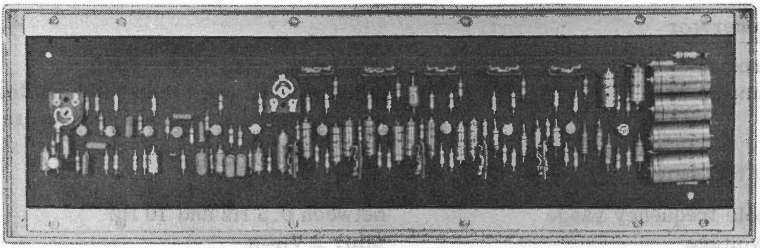
Output data

	square wave output	saw-tooth output
Output level "negative low"	$-V$ = max. $-V_N - \Delta V$ $\Delta V = \frac{4.4}{33-n}$ V (n = number of operated keys)	max. 0 V
Output level "negative high"	$-V = -V_N$	$-V$ = min. $0 - \Delta V$ $\Delta V = \frac{3}{33-n}$ V (n = number of operated keys)

RC time delay circuits

Power supply	$V_N = -1.5\ \text{V} \pm 10\%$ $I_N = -0.5$ mA
Time delays	between 8 ms and 50 ms (nominal)

NOISE GENERATOR AND CHOIR-EFFECT UNIT



RZ 23681-21

DESCRIPTION

The noise and choir-effect circuits are combined on a single printed wiring board. The noise generator provides the background hiss that simulates the wind-noise of a pipe-organ, and is fed to the manual and pedal gating circuits via the resistor/capacitor time delay circuits.
The choir-effect unit consists of 5 individual oscillators with separately adjustable frequencies and amplitudes; these are fed to the master oscillators, where they randomly modulate the generated frequencies to prevent over-purity of tone.
The third oscillator can be used as tremulant if required.

Catalogue number: 4322 026 37730

MECHANICAL AND ENVIRONMENTAL DATA

Overall dimensions	396 mm x 123 mm x 25 mm
Weight	700 g
Ambient temperature range	
storage :	-20 °C to +70 °C
operating:	+5 °C to +50 °C
Max. relative humidity	80%

ELECTRICAL DATA

Note: A positive current value indicates a current flowing toward the circuit.

Power supply	V_P = +6 V ± 10%; I_P = 16 mA
	V_N = −6 V ± 10%; I_N = −16 mA

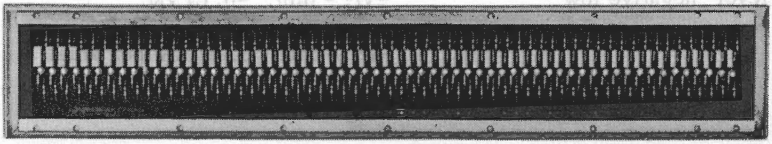
Noise generator

Noise frequency band	20 kHz at least
Noise amplitude	adjustable between 0 and 300 mV loaded with two manual and one pedal units

Choir-effect unit

Adjustable frequency range	between 0.5 Hz and 10 Hz
Output voltage	min. 2 V_{p-p}
Output current	max. 1.5 mA_{p-p}

MIXTURE PRE-STAGE UNIT



RZ 23681-17

This unit consists of 61 separate stages each shaping a particular frequency for the main mixture unit.

The inputs are square waves direct from the master oscillators and frequency dividers; the frequencies used depend upon the type of mixture or cymbal to be constructed (based on 2' and $\frac{1}{2}$' or $1^{1}/_{3}$' and $^{1}/_{3}$' etc.) The outputs are saw-tooth waveforms to suit the open diapason character of the mixture stops.

Catalogue number: 4322 026 37750

IECHANICAL AND ENVIRONMENTAL DATA

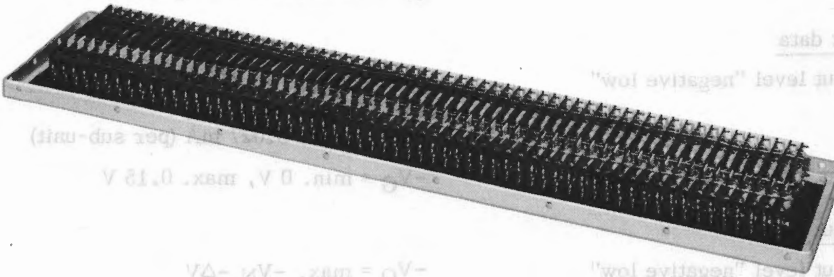
verall dimensions	671 mm x 114 mm x 15 mm
/eight	1050 g
mbient temperature range	
storage :	−20 °C to +70 °C
operating:	+5 °C to +50 °C
:ax. relative humidity	80%

ELECTRICAL DATA

Note: A positive current value indicates a current flowing toward the circuit.

Power supply	V_N = −6 V ± 10%
	I_N = −85 mA
Input data	
Output level "negative low"	$-V_G$ = min. $-0.15\ V_N$
	= max. $-V_N$
	$-I_G$ = max. 0.05 mA (per stage at $V_G = 0.15\ V_N$)
Output level "negative high"	$-V_G$ = min. 0 V max. 0.2 V
Output data	
Output level "negative low"	$-V_Q$ = min. 0 V
Output level "negative high"	$-V_Q$ = min. $-0.15\ V_N$
	$+I_Q$ = max. 0.03 mA (per stage)

MIXTURE UNIT



RZ 23856-6

DESCRIPTION

This unit has 61 separate sub-units (one per key on the keyboard) each of which has two circuits, a four-input and a three-input mixture. The mixtures are quite separate, generally they are gated from different keyboards. If desired the outputs can be strapped to form chords of up to seven notes. The gates must then be strapped as well.

The unit is so arranged that, by mixing outputs from the pre-stage, the organ builder can construct chords to suit his own taste.

Although the stages are basically similar, there are differences in component values along the keyboard, to compensate for the frequency dependence of the ear's sensitivity, and to meet specific voicing requirements. No equalising networks are needed, just a single voicing network in the stop circuits.

Catalogue number: 4322 026 38190

MECHANICAL AND ENVIRONMENTAL DATA

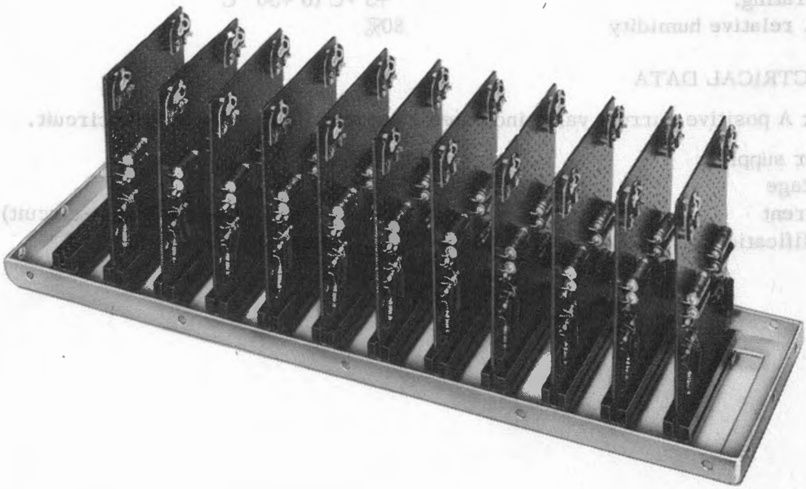
Overall dimensions	671 mm x 143 mm x 38 mm
Weight	1800 g
Ambient temperature range	
storage	-20 °C to +70 °C
operating	+5 °C to +50 °C
Max. relative humidity	80%

ELECTRICAL DATA

Note: A positive current value indicates a current flowing toward the circuit.

Power supply	V_N = −6 V ± 10% I_N = −1 mA (for each gate)
Input data	
Output level "negative low"	$-V_G$ = min. −0.15 V_N = max. −0.25 V_N $-I_G$ = max. 0.027 mA (per sub-unit)
Output level "negative high"	$-V_G$ = min. 0 V, max. 0.15 V
Output data	
Output level "negative low"	$-V_Q$ = max. $-V_N - \Delta V$ $\Delta V = \frac{2.04}{62 - n}$ V (n = number of operated keys)
Output level "negative high"	$-V_Q$ = min. $-V_N$
RC time delay	between 4 ms and 10 ms (actual value depends on position in unit)

STOP UNIT



RZ 23856-11

DESCRIPTION

Each stop-unit panel contains 11 plug-in printed wiring boards mounted on a chassis. Each printed wiring board contains two stop circuits that can be used separately or together.
They are completely equipped except for those components that affect voice, these may be inserted to suit particular needs and personal taste.
The circuits contain provision for an input from the equalizing networks and an input for a chiff frequency. A potentiometer enables the volume of the stop to be adjusted to suit the organ's location.

Catalogue number: 4322 026 37720

MECHANICAL AND ENVIRONMENTAL DATA

Overall dimensions	396 mm x 110 mm x 140 mm
Weight	1050 g
Ambient temperature range	
storage :	−20 °C to +70 °C
operating:	+5 °C to +50 °C
Max. relative humidity	80%

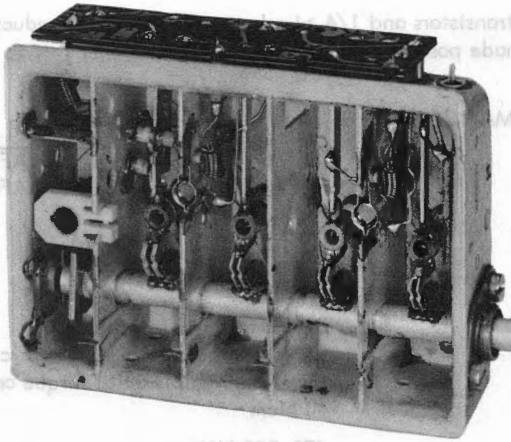
ELECTRICAL DATA

Note: A positive current value indicates a current flowing toward the circuit.

Power supply	
voltage	V_N = −6 V ± 10%
current	I_N = −0.3 mA (for each stop-circuit)
Amplification	V_{out} = min. 30 x V_{in}

Television tuners

UHF TELEVISION TUNERS



RZ 20305-3

System	CCIR
Frequency range	470 - 890 MHz (bands IV and V)
Intermediate frequencies	
picture	38.9 MHz
sound	33.4 MHz
Equipped with transistors	

GENERAL

These continiously variable UHF transistor tuners are designed for the reception of television signals in the UHF bands IV and V covering the frequency range of 470 - 890 MHz. The tuners with indication /01 are equipped with transistors AF 139 in both RF and mixer-oscillator stages; the /03 versions are equipped with transistors AF 186 in the stages mentioned. Moreover the /03 versions have a damping resistor of 100Ω, located near the Lecher system.

Tuning is achieved by a 4-gang variable capacitor, which is coupled to 1/4 λ-Lecher wires.

The spindle of the capacitor is brought out directly through the tuner case, permitting the use of various forms of drives, e.g. push buttons. When no push buttons are used a suitable reduction gear should be mounted on to the spindle, which will assist in reducing the direct axial spindle torque.

Inside the case a stop has been mounted by which the spindle rotation is limited to approx. 180°. This stop can be removed for motor tuning in case 360° angle rotation is required (clockwise or counter-clockwise). When slow motion dials are used the gearing should be about 1 : 40.

Thanks to the use of transistors and 1/4 λ-Lecher wires an overall reduction in the size of the tuners has been made possible.

TECHNICAL PERFORMANCE

		/01	/03
Transistors	RF amplifier :	AF 139	AF 186
	Mixer-oscillator:	AF 139	AF 186

Supply	V_{osc}, V_{RF} } 12V (9.5V min) I_{total} ~ 8 mA (without AGC)
Mechanical drive	Direct to tuner spindle. C_{max} = spindle fully turned in clockwise direction Max. permissible axial torque on the spindle = 40 Ncm
Frequency range	470–890 MHz (Angle of rotation approximately 180°; frequency dependency approximately linear)
RF bandwidth	10–20 MHz at the 3 dB points
Intermediate frequencies	Picture IF 38.9 MHz Sound IF 33.4 MHz The oscillator frequency is higher than the receiving frequency. The IF filter on the tuner is adjusted to approximately 36.5 MHz.
Aerial impedance	300 Ω symmetrical
Standing wave ratio	$p < 3$
Maximum permissible input voltage	50 mV_{emf} at 300 Ω
Gain	> 14 dB (for an IF bandwidth of 6 MHz at the 3 dB points)
Gain reduction	> 30 dB (forward AGC)
Noise	at 470 MHz ≤ 10 dB (average 8.5 dB) at 800 MHz ≤ 11 dB (average 9.5 dB) at 860 MHz ≤ 12 dB (average 10.5 dB) at 890 MHz ≤ 13 dB (average 11 dB)
Image frequency rejection	> 43 dB

IF rejection	>60 dB
IF output	Capacitive foot coupling (capacity in the tuner ~42 pF)
Oscillator frequency stability	$\Delta f_{osc} \leq \pm$ 150 kHz at supply-voltage variations of ± 10%. Δf_{osc} <500 kHz, measured between 0 and 60 min after switching on and a rise of the ambient temperature from 25 °C to 40 °C.
Difference in amplitudes between picture and sound carriers	≤ 2 dB at nominal gain ≤ 4 dB at a gain reduction of 20 dB
Maximum permissible case temperature	60 °C (at nominal value of the supply voltage)

VERSIONS

AT6381/02, for Great Britain	3122 108 59490
AT6381/30, for France	3122 108 59510
AT6381/38, for Italy and the FCC system	3122 108 59500

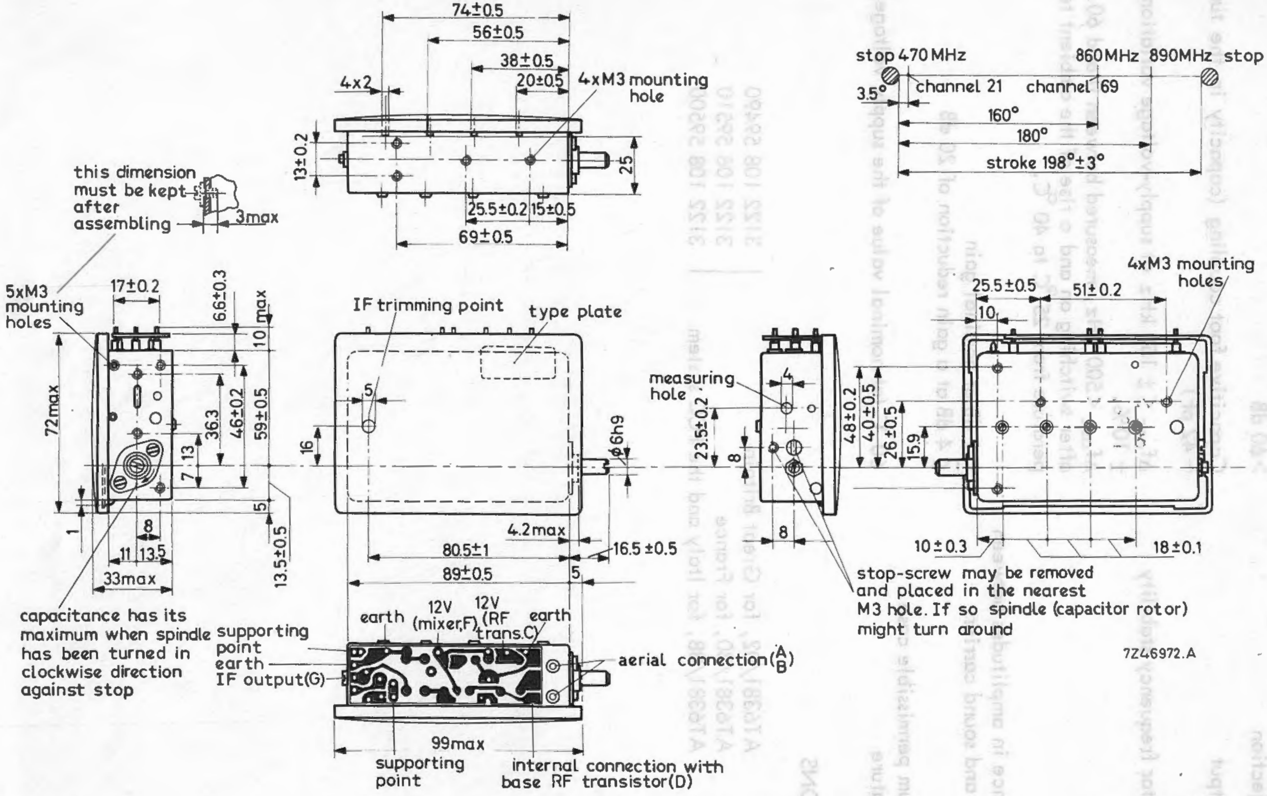
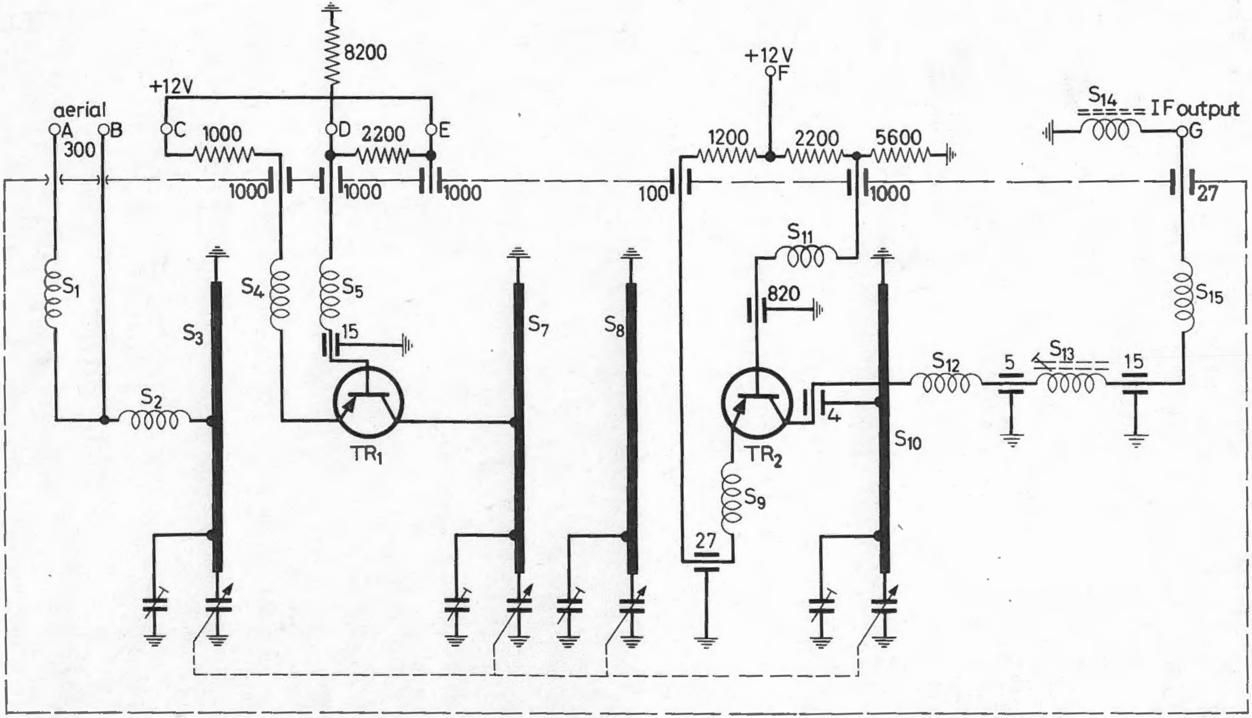


Fig. 1. Dimensions in mm



Capacitors indicated in pF
Resistors indicated in Ω

Fig. 2. Circuit diagram

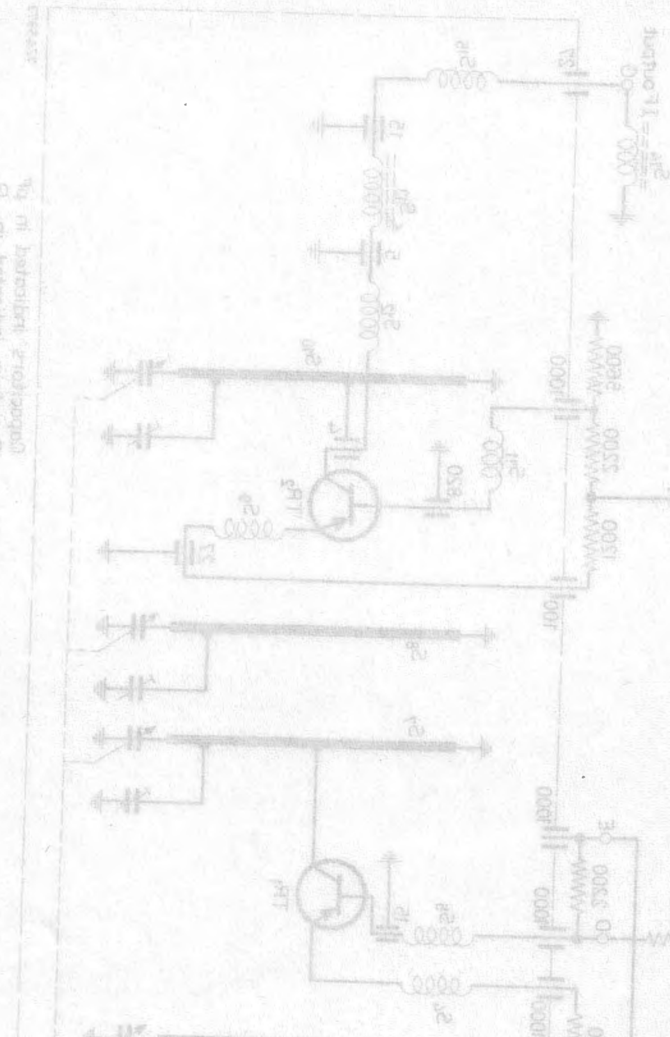
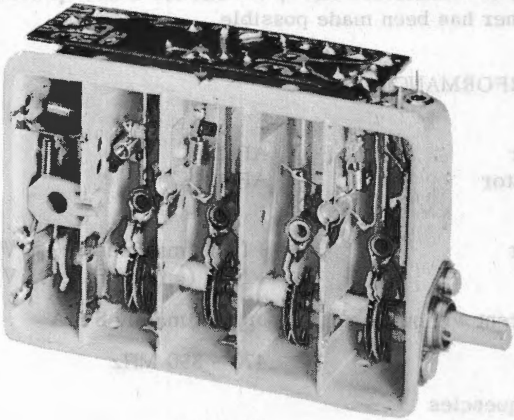


Fig. 2 Circuit diagram

U.H.F. TELEVISION TUNER



RZ23508-1

System	C.C.I.R.
Frequency range	470 - 890 MHz (bands IV and V)
Intermediate frequencies	
picture	38.9 MHz
sound	33.4 MHz
Equipped with transistors	

GENERAL

This continuously variable u.h.f. transistor tuner is designed for the reception of television signals in the u.h.f. bands IV and V covering the frequency range of 470 - 890 MHz.

The r.f. stage operates with a transistor AF 239; in the mixer-oscillator stage a transistor AF 139 is used.

Tuning is achieved by a 4-gang variable capacitor, which is coupled to 1/4 λ-Lecher wires.

The spindle of the capacitor is brought out directly through the tuner case, permitting the use of various forms of drives, e.g. push buttons. When no push buttons are used a suitable reduction gear should be mounted on to the spindle, which will assist in reducing the direct axial spindle torque.

Inside the case a stop has been mounted by which the spindle rotation is limited to approximately 180°. This stop can be removed for motor tuning in case 360° angle rotation is required (clockwise or counter-clockwise). When slow motion dials are used the gearing should be about 1 : 40.

Thanks to the use of transistors and 1/4 λ-Lecher wires an overall reduction in the size of the tuner has been made possible.

TECHNICAL PERFORMANCE

Transistors	
r.f. amplifier	AF 239
mixer-oscillator	AF 139
Supply voltages	
r.f. amplifier	+12 V (minimum +9.5 V)
oscillator	+12 V (minimum +9.5 V)
Total supply current without a.g.c.	approximately 8 mA
Frequency range	470 - 890 MHz
Intermediate frequencies	
picture	38.9 MHz
sound	33.4 MHz
	The oscillator frequency is higher than the signal frequency. The i.f. filter is adjusted to approximately 36.5 MHz.
R.F. bandwidth at 3 dB	10 - 18 MHz
Gain for an i.f. bandwidth of 7 MHz at 3 dB	> 18 dB
Gain reduction (forward a.g.c.)	> 30 dB
Maximum permissible input voltage	
without modulation distortion	50 mV_{emf} at 300 Ω
at a cross modulation factor of 1%	20 mV_{emf} at 300 Ω
Aerial impedance	300 Ω
Standing wave ratio	$p < 3$
Noise, at 470 MHz	average value 7.0 dB (max. 8.5 dB)
at 600 MHz	average value 7.0 dB (max. 8.0 dB)
at 800 MHz	average value 7.0 dB (max. 8.5 dB)
at 860 MHz	average value 8.5 dB (max. 10.0 dB)
at 890 MHz	average value 9.0 dB (max. 11.0 dB)

Image frequency rejection	> 46 dB
I.F. rejection	> 60 dB
Oscillator frequency stability at supply-voltage variations of ±10%	≤ ±150 kHz
between 0 and 60 min after switching on and a rise of the ambient temperature from 25 °C to 40 °C	< 500 kHz
I.F. output	capacitive foot coupling. Capacitance in the tuner is approximately 42 pF.
Difference in amplitude between picture carrier and sound carrier	
at nominal gain	≤ 2 dB
at a gain reduction of 20 dB	≤ 4 dB
Maximum permissible case temperature at the nominal value of the supply voltage	60 °C
Frequency variation with the angle of rotation	approximately linear
Maximum angle of rotation	180°
Mechanical drive	direct to tuner spindle. (C_{max} = spindle fully turned in clockwise direction.)
Permissible axial spindle torque	≤ 40 Ncm

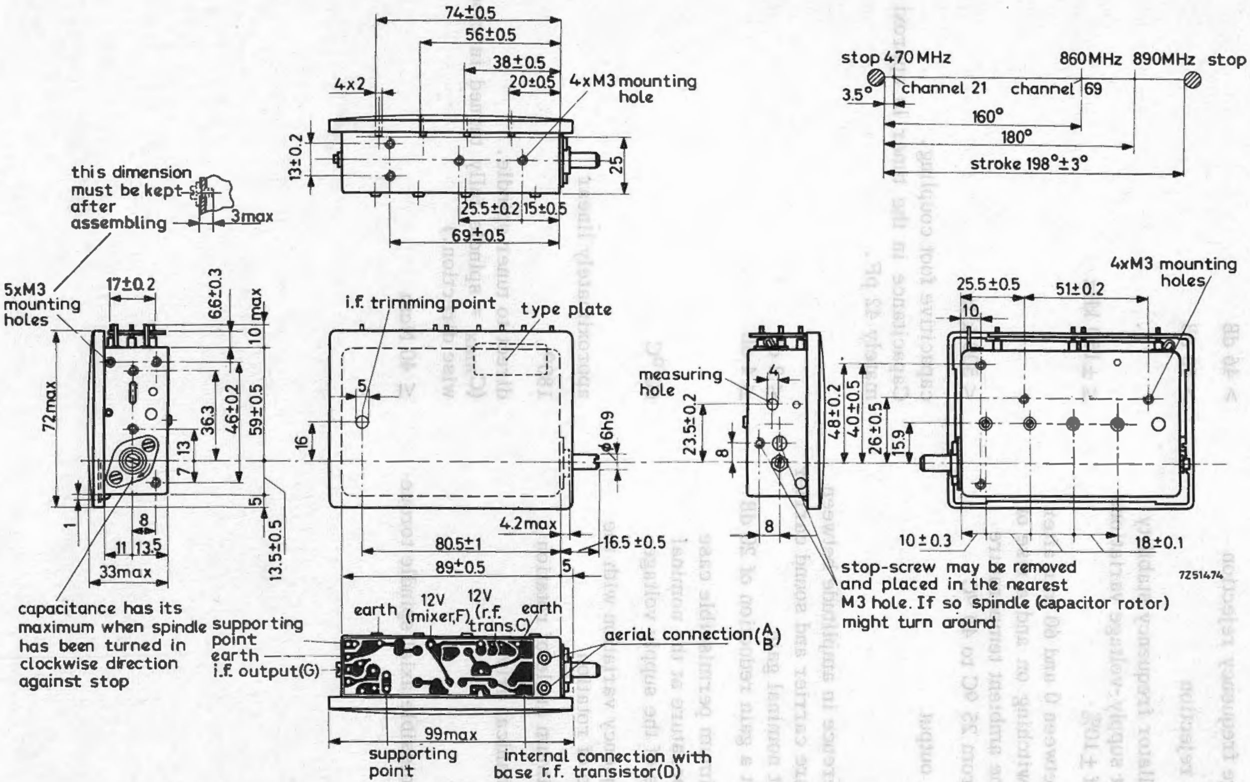


Fig. 1. Dimensions in mm

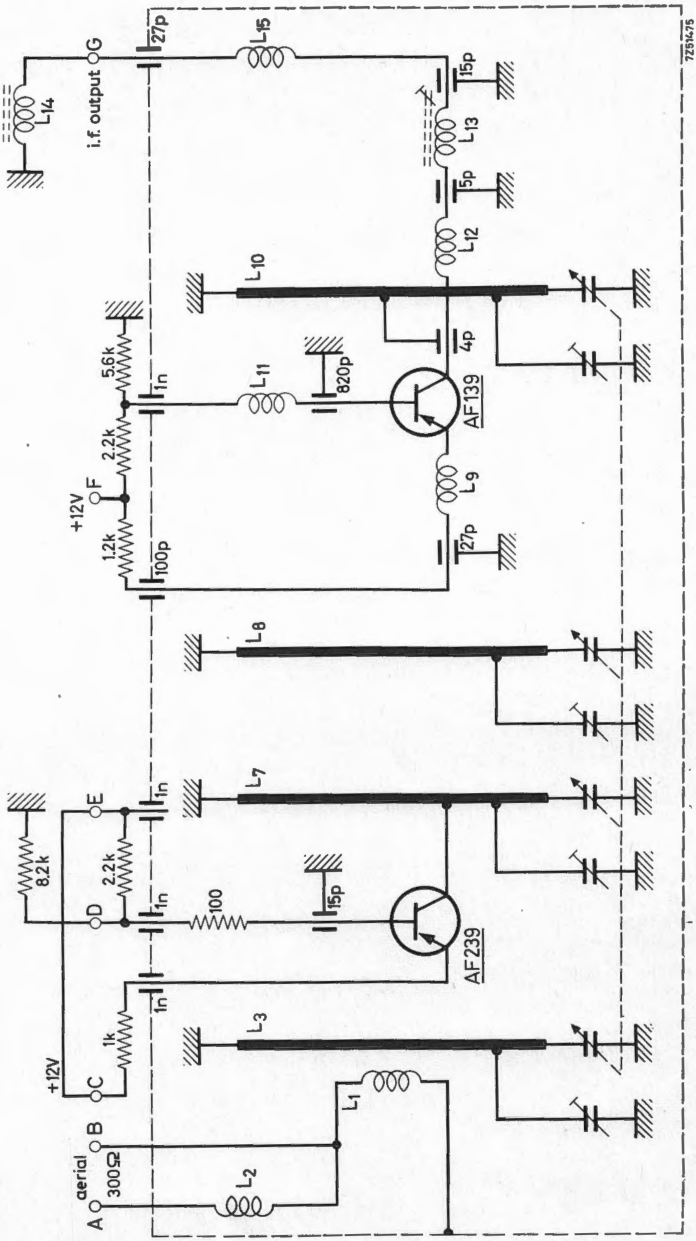
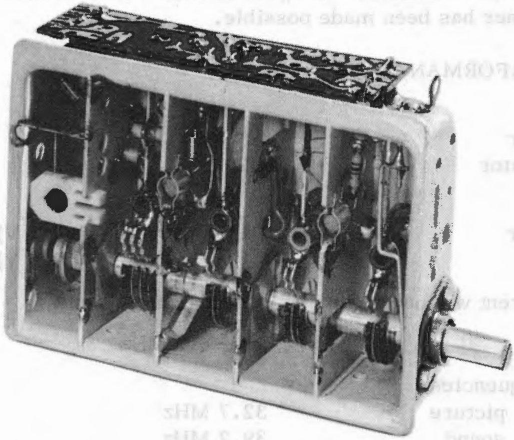


Fig.2. Circuit diagram

U.H.F. TELEVISION TUNER



RZ 23096-1

System	French u.h.f.
Frequency range	470 - 890 MHz (bands IV and V)
Intermediate frequencies	
picture	32.7 MHz
sound	39.2 MHz
Equipped with transistors	

GENERAL

This continuously variable u.h.f. transistor tuner is designed for the reception of the French u.h.f. channels in the bands IV and V covering the frequency range of 470 - 890 MHz.
The r.f. stage operates with a transistor AF 239; in the mixer-oscillator stage a transistor AF 139 is used.

Tuning is achieved by a 4-gang variable capacitor, which is coupled to 1/4 λ-Lecher wires.
The spindle of the capacitor is brought out directly through the tuner case, permitting the use of various forms of drives, e.g. push buttons. When no push buttons are used a suitable reduction gear should be mounted on to the spindle, which will assist in reducing the direct axial spindle torque.

Inside the case a stop has been mounted by which the spindle rotation is limited to approximately 180°. This stop can be removed for motor tuning in case 360° angle rotation is required (clockwise or counter-clockwise). When slow motion dials are used the gearing should be about 1 : 40.

Thanks to the use of transistors and 1/4 λ-Lecher wires an overall reduction in the size of the tuner has been made possible.

TECHNICAL PERFORMANCE

Transistors	
r.f. amplifier	AF 239
mixer-oscillator	AF 139
Supply voltages	
r.f. amplifier	+12 V (minimum +9.5 V)
oscillator	+12 V (minimum +9.5 V)
Total supply current without a.g.c.	approximately 8 mA
Frequency range	470 - 890 MHz
Intermediate frequencies	
picture	32.7 MHz
sound	39.2 MHz The oscillator frequency is lower than the signal frequency. The i.f. filter is adjusted to approximately 36.5 MHz.
R.F. bandwidth at 3 dB	10 - 14 MHz
Gain for an i.f. bandwidth of 7 MHz at 3 dB	> 24 dB
Gain reduction (forward a.g.c.)	> 30 dB
Maximum permissible input voltage	25 mV_{emf} at 75 Ω
Aerial impedance	75 Ω
Standing wave ratio	$\rho < 3$
Noise, at 470 MHz	average value 6.5 dB (max. 7.5 dB)
at 600 MHz	average value 6.5 dB (max. 7.0 dB)
at 750 MHz	average value 6.5 dB (max. 7.0 dB)
at 860 MHz	average value 8.0 dB (max. 9.0 dB)
at 890 MHz	average value 8.5 dB (max. 10.0 dB)

Image frequency rejection	> 46 dB
I.F. rejection	> 60 dB
Oscillator frequency stability	
at supply-voltage variations of ±10 %	≤ ±150 kHz
between 0 and 60 min after switching on and a rise of the ambient temperature from 25 °C to 40 °C	< 500 kHz
I.F. output	capacitive foot coupling. Capacitance in the tuner is approximately 42 pF.
Difference in amplitude between picture carrier and sound carrier	
at nominal gain	≤ 2 dB
at a gain reduction of 20 dB	≤ 4 dB
Maximum permissible case temperature at the nominal value of the supply voltage	60 °C
Frequency variation with the angle of rotation	approximately linear
Maximum angle of rotation	180°
Mechanical drive	direct to tuner spindle. (C_{max} = spindle fully turned in clockwise direction.)
Permissible axial spindle torque	≤ 40 Ncm

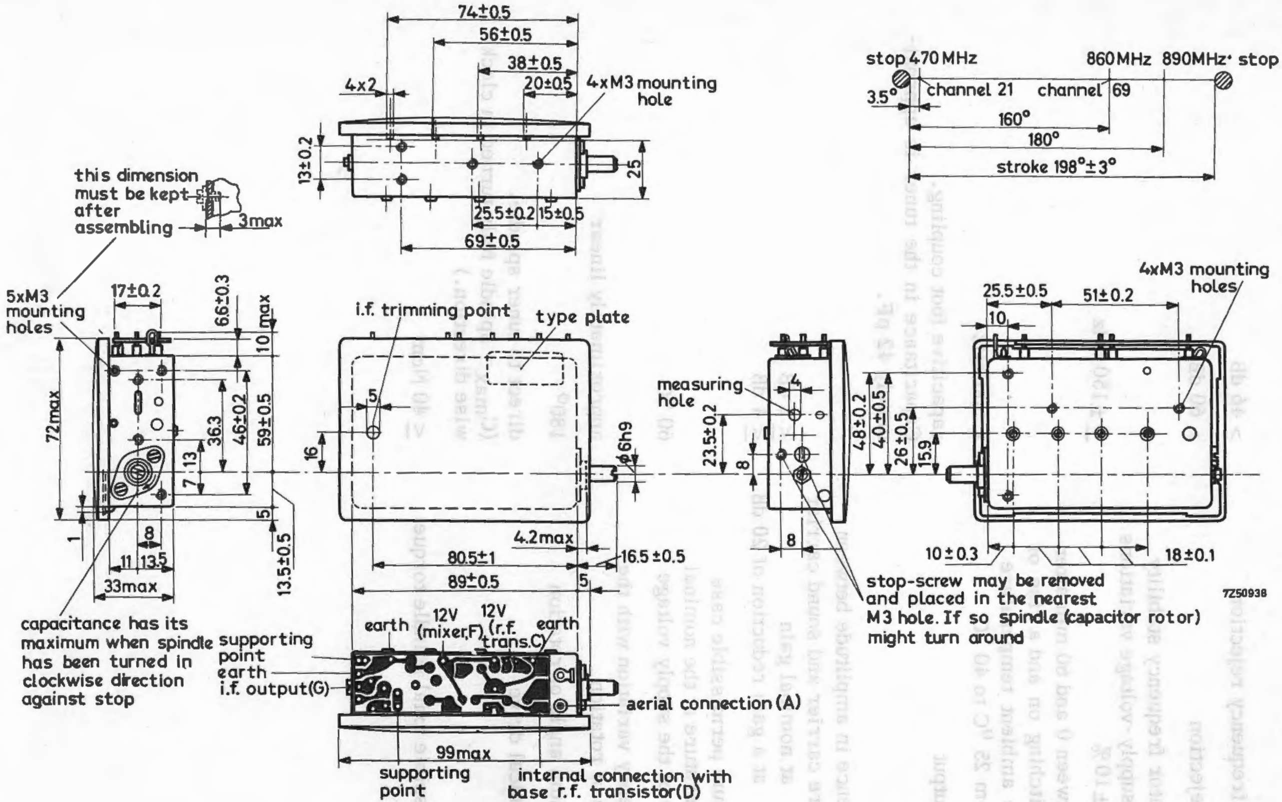


Fig.1. Dimensions in mm

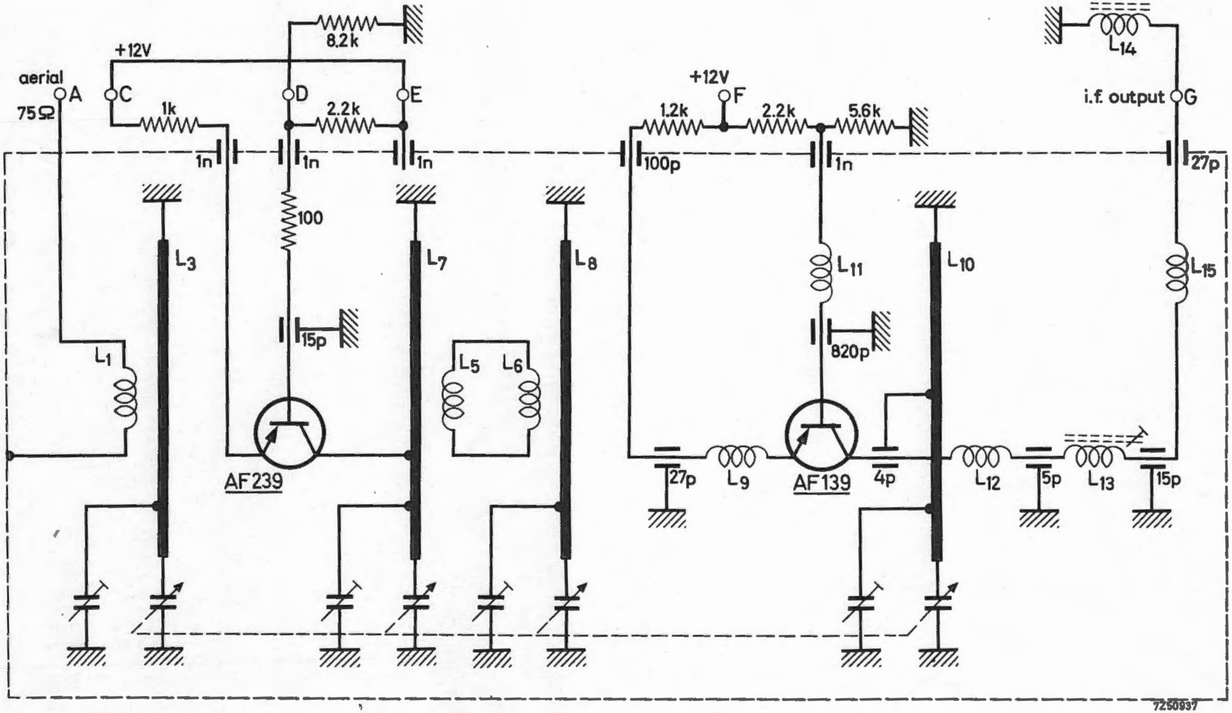
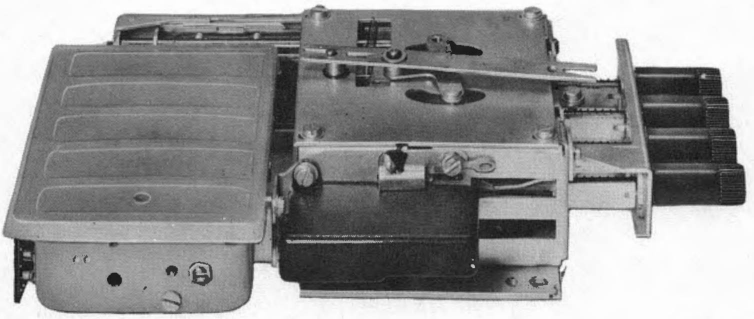


Fig.2. Circuit diagram

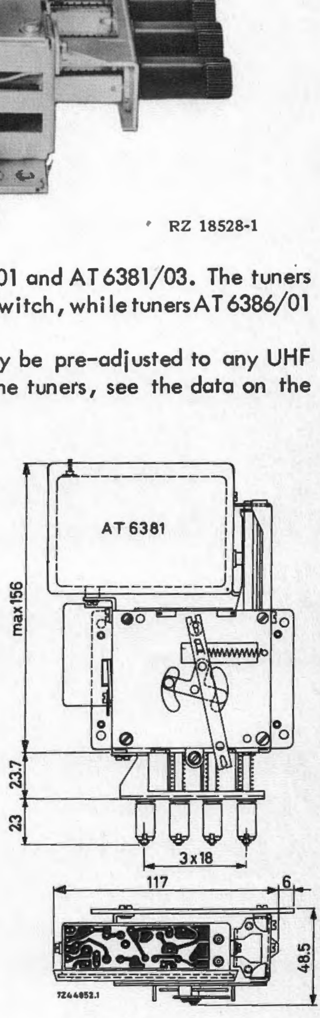
UHF TELEVISION TUNERS



RZ 18528-1

These tuners are push-button versions of the AT 6381/01 and AT 6381/03. The tuners AT 6385/01 and AT 6385/03 are fitted with a VHF/UHF switch, while tuners AT 6386/01 and AT 6386/03 have not.
Up to four selections are possible, each of which may be pre-adjusted to any UHF channel. For information on all other properties of the tuners, see the data on the UHF television tuners AT 6381/01 and AT 6381/03.

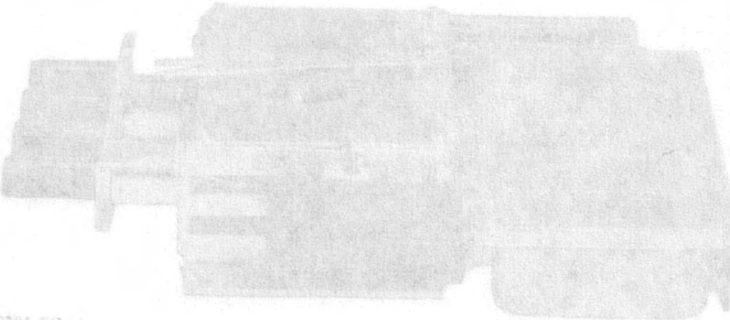
Dimensions in mm



Catalog numbers

AT6385/01	3122 108 51050
AT6385/03	3122 108 00440
AT6386/01	3122 108 54380
AT6386/03	3122 108 54610

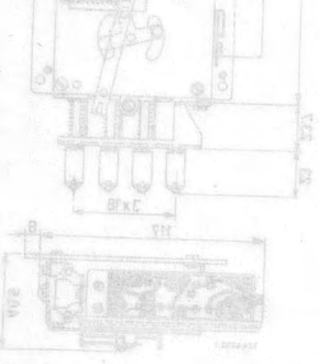
UHF TELEVISION TUNERS



RZ 18528-1

These tuners are push-button versions of the AT6381/01 and AT6381/03. The tuners AT6385/01 and AT6385/03 are fitted with a VHF/UHF switch, while tuners AT6386/01 and AT6386/03 have not.
Up to four selections are possible, each of which may be pre-adjusted to any UHF channel. For information on all other properties of the tuners, see the data on the UHF television tuners AT6381/01 and AT6381/03.

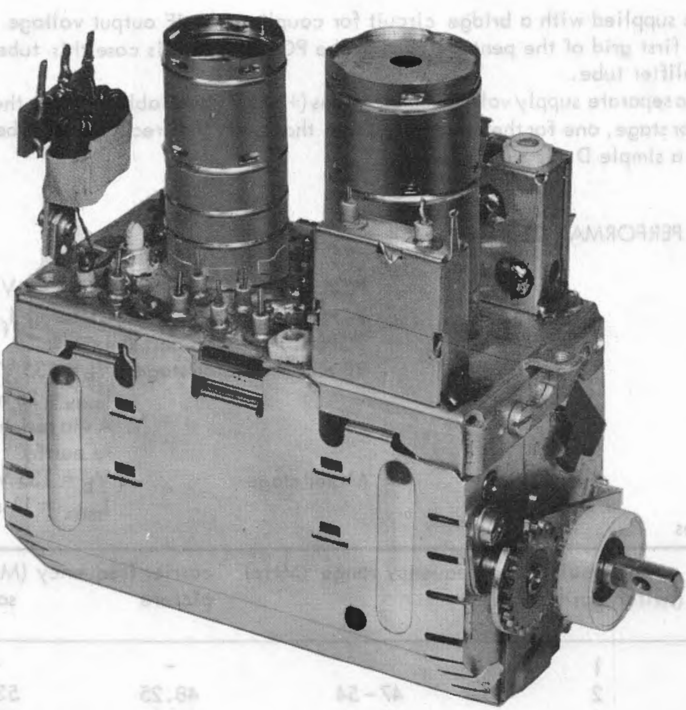
Dimensions in mm



Catalog numbers

AT6385/01	3122 108 51050
AT6385/03	3122 108 00440
AT6386/01	3122 108 54380
AT6386/03	3122 108 54610

VHF TELEVISION TUNER



RZ 20117-3

System	CCIR
Frequency ranges	47 - 68 MHz (band I)
	174 - 223 MHz (band III)
Intermediate frequencies	
picture	38.9 MHz
sound	33.4 MHz
Equipped with tubes	

GENERAL

This small VHF tuner has a 13-position turret switch equipped with 10 VHF-CCIR channel strips (channels 2 - 11) covering the frequency bands I and III (47 - 68 MHz and 174 - 223 MHz respectively).
The tuner has a compact and simplified memomatic fine-tuning device at the front of the tuner, which is operated from the spindle of the turret; it can be adjusted to each individual channel.

In the RF stage a PC 900 in neutrodyne configuration is used; the oscillator/mixer stage operates with a PCF 801.

This tuner is supplied with a bridge circuit for coupling the IF output voltage of a UHF tuner to the first grid of the pentode part of the PCF 801: in this case this tube operates as an IF amplifier tube.
There are two separate supply voltage connections (+ 135 V) available (one for the RF stage and oscillator stage, one for the mixer stage), so that UHF/VHF reception can be effected by means of a simple D.C. supply switch.

TECHNICAL PERFORMANCE

Tubes — PC900 (RF amplifier); PCF801, triode part (oscillator); PCF801, pentode part (mixer) — $V_f = 12$ V, $I_{f\,nom} = 300$ mA

Supply — RF and oscillator stages: $V_b = 135$ V
$I_{max} = 25$ mA (point A via resistor of 1 MΩ to earth)
Mixer stage: $V_b = 135$ V
$I_{max} = 11$ mA

Tuning ranges

band	channel (switch position)	frequency range (MHz)	carrier frequency (MHz) picture	sound
I	1	-	-	-
	2	47 - 54	48.25	53.75
	3	54 - 61	55.25	60.75
	4	61 - 68	62.25	67.75
III	5	174 - 181	175.25	180.75
	6	181 - 188	182.25	187.75
	7	188 - 195	189.25	194.75
	8	195 - 202	196.25	201.75
	9	202 - 209	203.25	208.75
	10	209 - 216	210.25	215.75
	11	216 - 223	217.25	222.75
	12	-	-	-
	13	-	-	-

Fine tuning range — Band I: Δf = 2 - 5 MHz
Band III: Δf = 2.5 - 8 MHz

RF bandwidth — Band I: ≤ 10 MHz; Band III: ≤ 15 MHz — at the 3 dB points

The RF bandwidth is measured at the testpoint H (which is external connected to earth via a resistor of 220 kΩ) of the mixer grid with the oscillator in operation and $V_{agc} = -1.4$ V. In Fig. 1 the ideal bandpass curves together with the tolerated deviations are shown.

Tilt of the bandpass curves: ≤ 20% for all channels at $V_{agc} = -1.4$ V

IF frequencies: Picture-carrier frequency: 38.9 MHz
Sound-carrier frequency : 33.4 MHz
The oscillator frequency lies beyond the receiving frequency. The IF primary coil on the tuner is adjusted to approximately 36.5 MHz

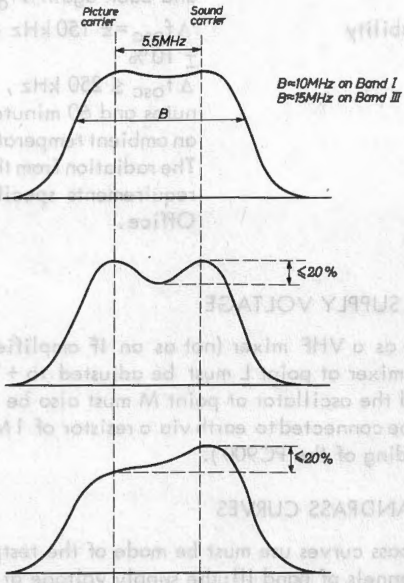


Fig. 1

Aerial input impedance	300 Ω symmetrical
Reflections	≲ 40% at maximum gain
Gain	35 dB from aerial-emf to the grid of the first IF stage (for an IF bandwidth of 6.5 MHz at the 3dB points and flat within 5%)
Gain of the pentode part of the PCF801 used as an IF amplifier	20 dB
Noise	Band I : ≲ 3.5 kT_o Band III: ≲ 6.5 kT_o
Image frequency rejection	Band I : > 60 dB Band III: > 54 dB
IF rejection	Band I : > 40 dB symmetrical Band III: > 60 dB symmetrical for both picture and sound
Reset accuracy	When switching from one channel to another and back again Δf_{osc} < 100 kHz
Oscillator frequency stability	Δf_{osc} = ± 150 kHz at variations of $V_{b\ osc}$ of ± 10% Δf_{osc} ≲ 250 kHz, measured between 2 minutes and 60 minutes after switching on and an ambient temperature rise from 20 °C to 55 °C.
Radiation	The radiation from the tuner complies with the requirements specified by the German Post Office.

ADJUSTMENT OF THE SUPPLY VOLTAGE

When the tuner is used as a VHF mixer (not as an IF amplifier for UHF reception) the supply voltage for the mixer at point L must be adjusted to + 135 V; the supply voltage for the RF amplifier and the oscillator at point M must also be adjusted to + 135 V.
Moreover point A must be connected to earth via a resistor of 1 MΩ. (This resistor is necessary to prevent overloading of the PC900).

TESTING OF THE IF BANDPASS CURVES

For testing the IF bandpass curves use must be made of the testpoint N. The tuner has to be set in one of the channels of band III; the supply voltage at point M must be switched off (oscillator switched off). Point F must be connected to earth.
When the tuner is used as a VHF mixer, point H must be connected to earth via a resistor of 220 kΩ; the AGC voltage must be connected to point A.
When used as an IF amplifier for UHF the resistor of 220 kΩ must be switched off and the AGC voltage must be switched over to point H.

CATALOG NUMBER OF THE CHANNEL STRIPS

channel	indication	catalog number	channel	indication	catalog number
2	E2V	3122 997 57290	7	E7V	3122 997 57340
3	E3V	3122 997 57300	8	E8V	3122 997 57350
4	E4V	3122 997 57310	9	E9V	3122 997 57360
5	E5V	3122 997 57320	10	E10V	3122 997 57370
6	E6V	3122 997 57330	11	E11V	3122 997 57380

TUNER VERSIONS

type	for	catalog number
AT7650/11	New Zealand	3122 108 54651
AT7650/18	the FCC system	3122 108 50091
AT7650/21	Great Britain	3122 108 50061
AT7650/25	France	3122 108 50111
AT7650/38	Italy (Italian IF)	3122 108 50081
AT7650/39	Italy (CCIR IF)	3122 108 50071
AT7650/80	Germany (11 channels)	3122 108 54071
AT7650/82	Austria	3122 108 50021
AT7650/84	Finland	3122 108 50031
AT7650/86	Belgium	3122 108 50051

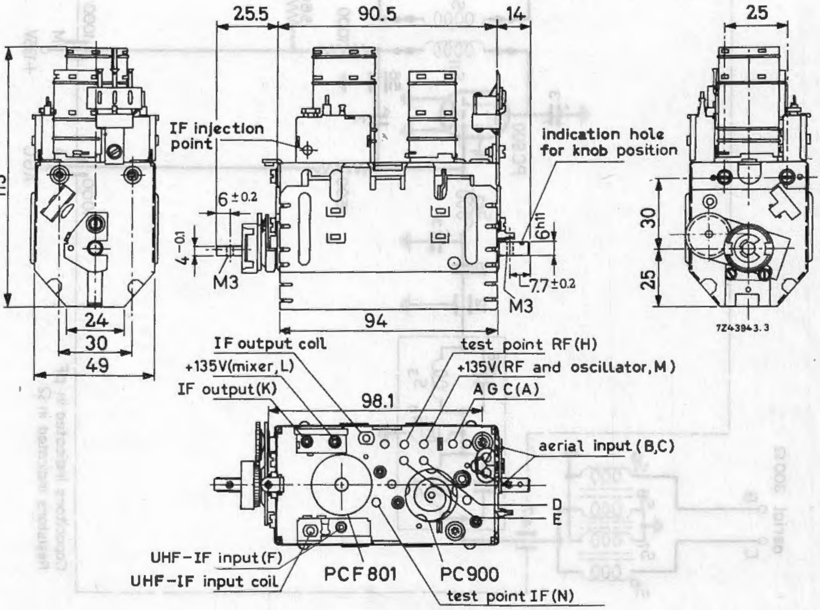


Fig. 2. Dimensions in mm

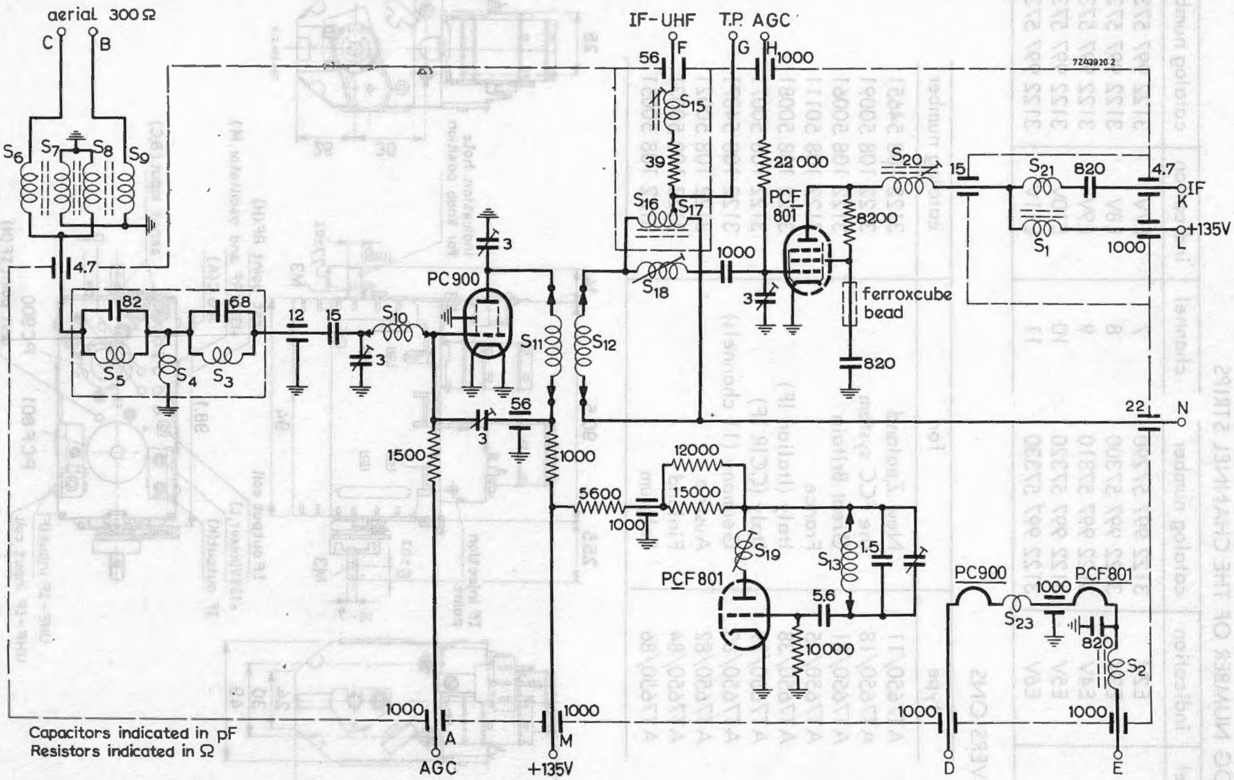
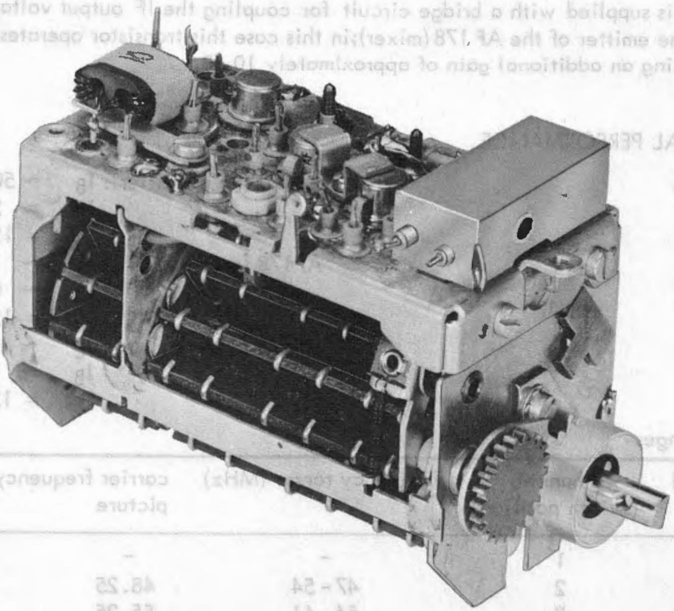


Fig. 3. Circuit diagram

VHF TELEVISION TUNER



RZ 20305-5

System		CCIR
Frequency ranges		47 - 68 MHz (band I)
		174 - 223 MHz (band III)
Intermediate frequencies		
	picture	38.9 MHz
	sound	33.4 MHz
Equipped with transistors		

GENERAL

This VHF transistor tuner has a 13-position turret switch equipped with 10 VHF-CCIR channel strips (channels 2-11) covering the frequency bands I and III (47 - 68 MHz and 174-223 MHz respectively).

The tuner has the same memomatic fine-tuning system as used in the VHF tuner AT7650/90; it can be adjusted to each individual channel.

The RF stage operates with a transistor AF180 [1]. In the mixer stage and in the oscillator stage a transistor AF178 is used.

1) Known as AF180 double star

Forward AGC can be applied to the RF stage by means of which a gain reduction can be obtained of ~ 40 dB.

The tuner is supplied with a bridge circuit for coupling the IF output voltage of a UHF tuner to the emitter of the AF 178 (mixer); in this case this transistor operates as an IF amplifier giving an additional gain of approximately 10 dB.

TECHNICAL PERFORMANCE

Transistors

AF180 (RF amplifier): I_B ~ 50 µA
I_E = 2.5 mA
V_{agc} = 12 V

AF178 (oscillator) : I_E ~ 1.85 mA
I_B ~ 0.92 mA
V_b = 12 V

AF178 (mixer) : I_E ~ 1.9 mA
I_B ~ 1.15 mA
V_b = 12 V

Tuning ranges

band	channel (switch position)	frequency range (MHz)	carrier frequency (MHz) picture	sound
I	1	-	-	-
	2	47-54	48.25	53.75
	3	54-61	55.25	60.75
	4	61-68	62.25	67.75
III	5	174-181	175.25	180.75
	6	181-188	182.25	187.75
	7	188-195	189.25	194.75
	8	195-202	196.25	201.75
	9	202-209	203.25	208.75
	10	209-216	210.25	215.75
	11	216-223	217.25	222.75
	12	-	-	-
	13	-	-	-

Fine tuning range: Band I : Δf = 2.5-5 MHz
Band III : Δf = 2.5-8 MHz

RF bandwidth: Band I : ≤ 14 MHz
Band III: ≤ 12 MHz } at the 3dB points
The RF bandpass curves are adjustable at I_E = 2.5 mA

Tilt of the bandpass curves: < 25% for all channels

IF frequencies	Picture-carrier frequency : 38.9 MHz Sound-carrier frequency : 33.4 MHz The oscillator frequency lies beyond the receiving frequency. The IF coil on the tuner is adjusted to approximately 36.5 MHz
Aerial input impedance	300 Ω symmetrical
Reflections	≤ 40 % at maximum gain and I_E = 2.5 mA
Gain	26 dB from aerial - emf to the first IF stage (for an IF bandwidth of 6.5 MHz at the 3 dB points and flat within 5 %)
Gain reduction	40 dB at V_{agc} ~ 8 V I_{agc} ~ 0.66 mA I_B ~ 180 µA I_E ~ 8 mA
Noise	Band I : ≤ 5 k T_o Band III : ≤ 9 k T_o
Image frequency rejection	Band I : >32 dB, Band III : >46 dB } at V_{agc} = 12 V and an input voltage of the chosen signal ≤ 100 µV
IF rejection	Band I : >40 dB, Band III : >60 dB } at V_{agc} = 12 V; for both picture and sound
Reset accuracy	When switching from one channel to another and back again : Δ f_{osc} < 100 kHz
Minimum oscillator voltage	100 mV
Oscillator frequency stability	Band I : Δf_{osc} ≤-150 kHz and ≤+120 kHz at a voltage variation from 12 V to 10 V. Band III : Δf_{osc} ≤-500 kHz and ≤+400 kHz at a voltage variation from 12 V to 14 V. Δ f_{osc} < 400 kHz , measured between 0 and 30 minutes after switching on and an ambient temperature rise from 25 °C to 55 °C.

CATALOG NUMBERS OF THE CHANNEL STRIPS

channel	indication	catalog number
2	E2T	3122 108 51820
3	E3T	3122 108 51830
4	E4T	3122 108 51840
5	E5T	3122 108 51850
6	E6T	3122 108 51860
7	E7T	3122 108 51870
8	E8T	3122 108 51880
9	E9T	3122 108 51890
10	E10T	3122 108 51900
11	E11T	3122 108 51910

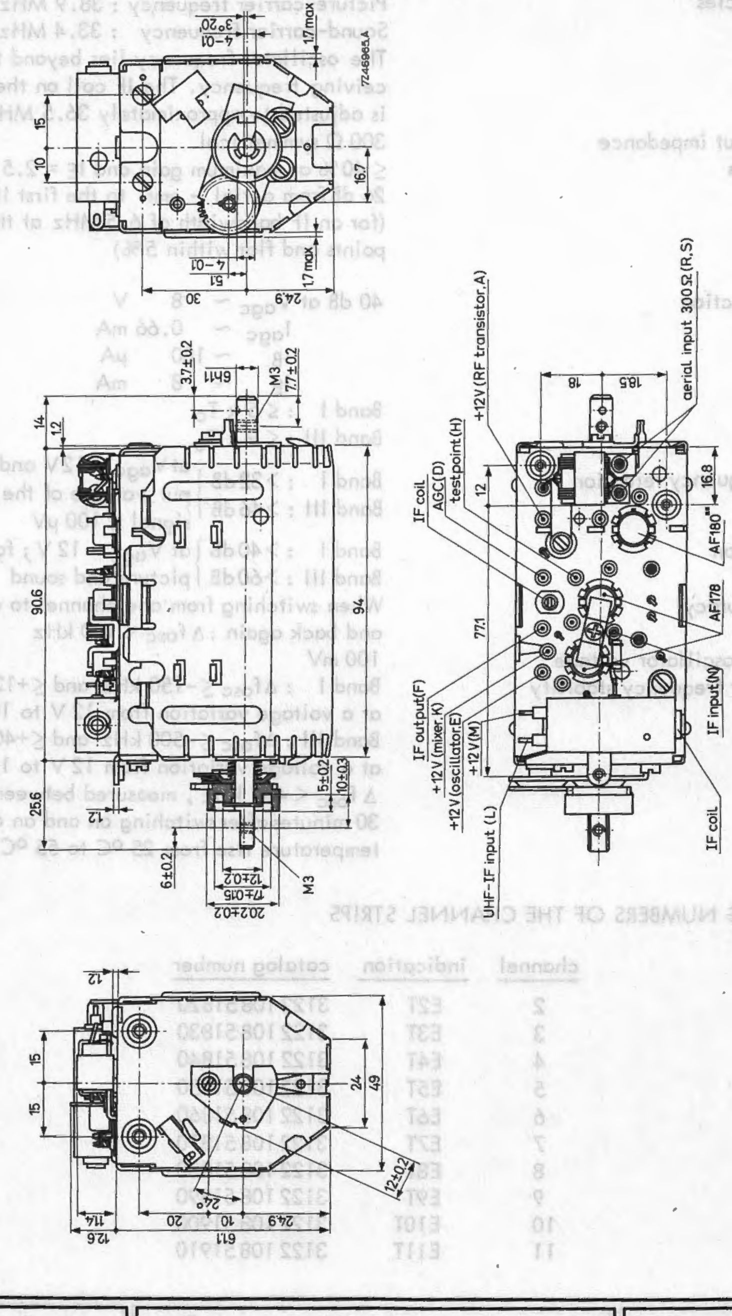


Fig. 1. Dimensions in mm

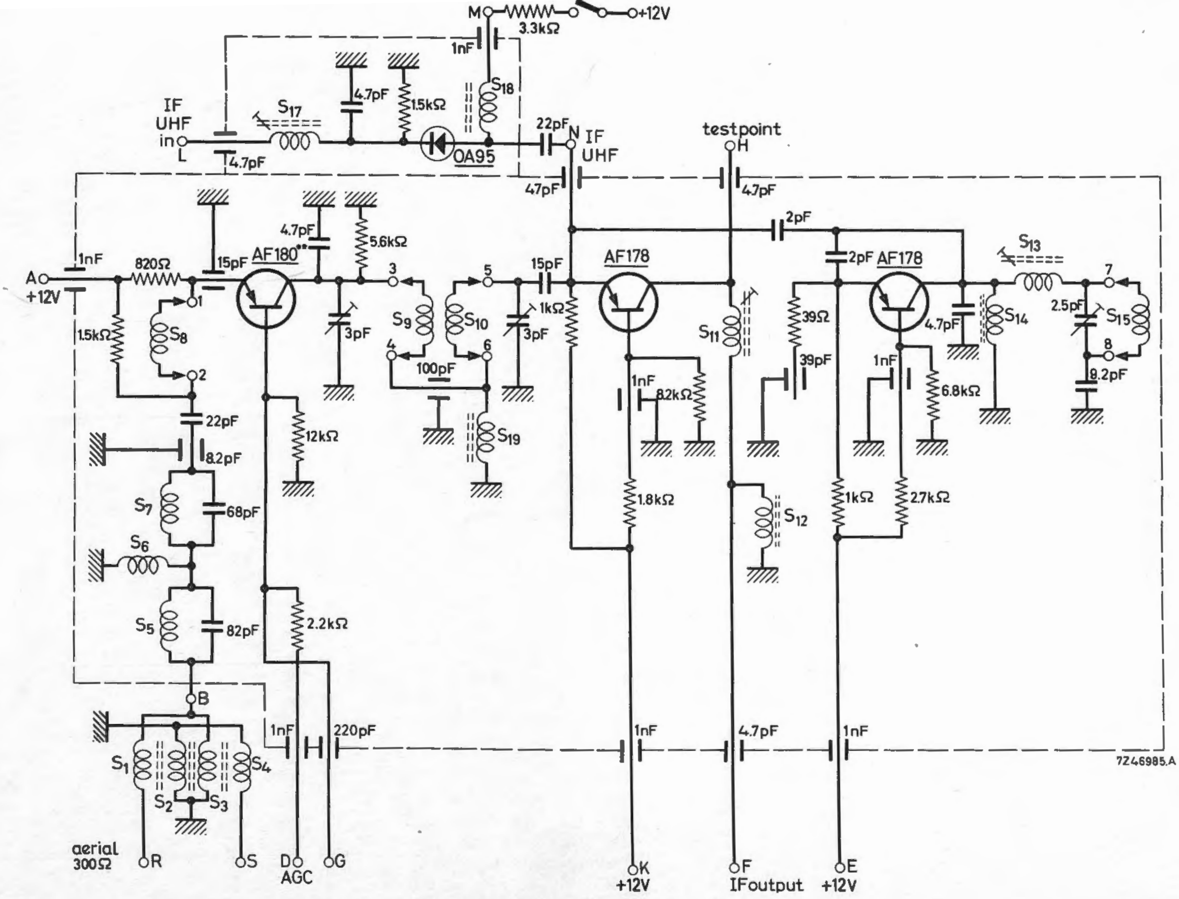
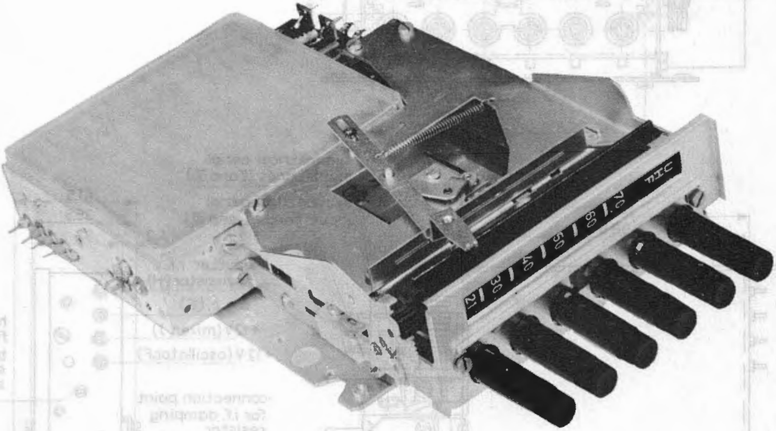


Fig. 2. Circuit diagram

VHF/UHF TELEVISION TUNER



RZ 22666-1

System	CCIR
Frequency ranges	47 - 68 MHz (band I)
	174 - 230 MHz (band III)
	470 - 890 MHz (bands IV and V)
Intermediate frequencies	
picture	38.9 MHz
sound	33.4 MHz
With push-button unit	
Equipped with transistors	

APPLICATION

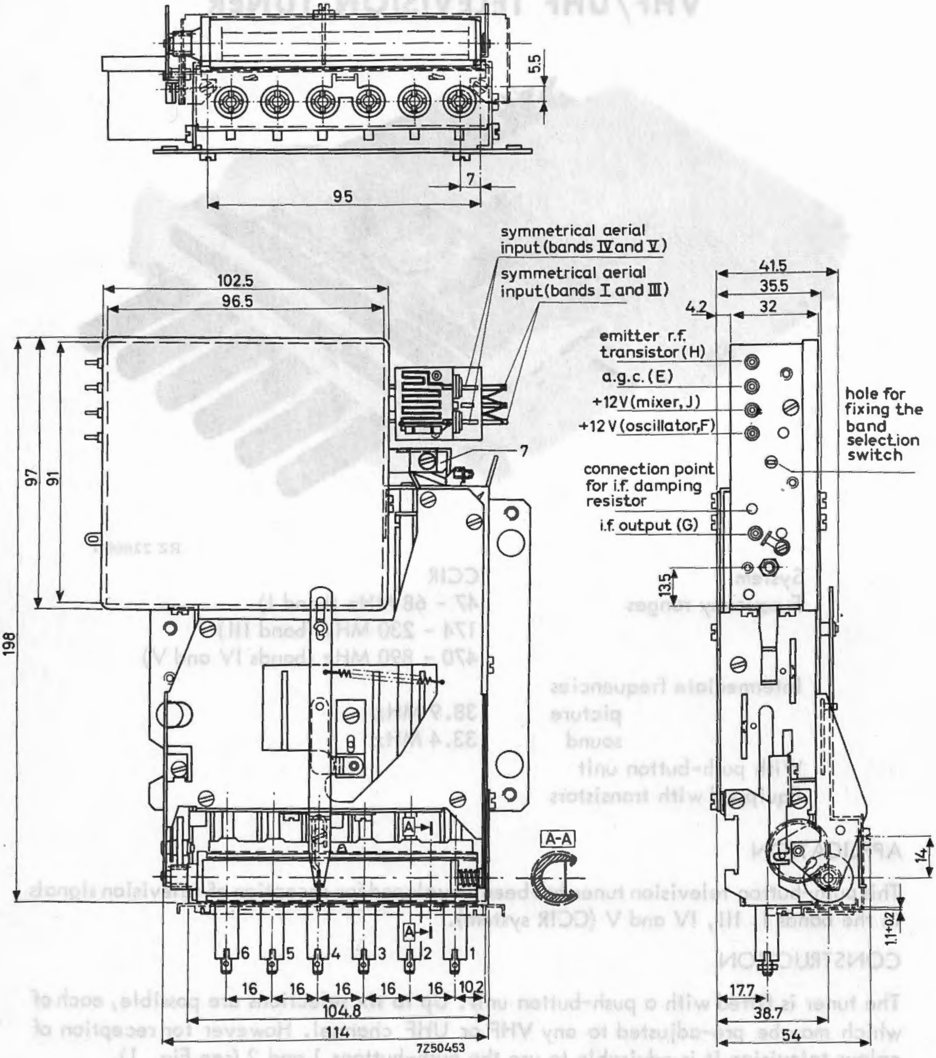
This push-button television tuner has been developed for reception of television signals in the bands I, III, IV and V (CCIR system).

CONSTRUCTION

The tuner is fitted with a push-button unit. Up to six selections are possible, each of which may be pre-adjusted to any VHF or UHF channel. However for reception of colour television it is advisable to use the push-buttons 1 and 2 (see Fig. 1).

The band selection slide switch (7, Fig. 1) is operated by a push-button which must be first fully depressed and then turned.

All dimensions are given in mm.



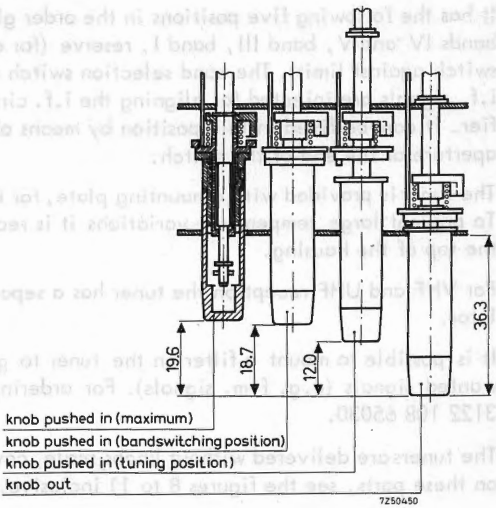


Fig. 2. (Knobs are not delivered with the tuners)

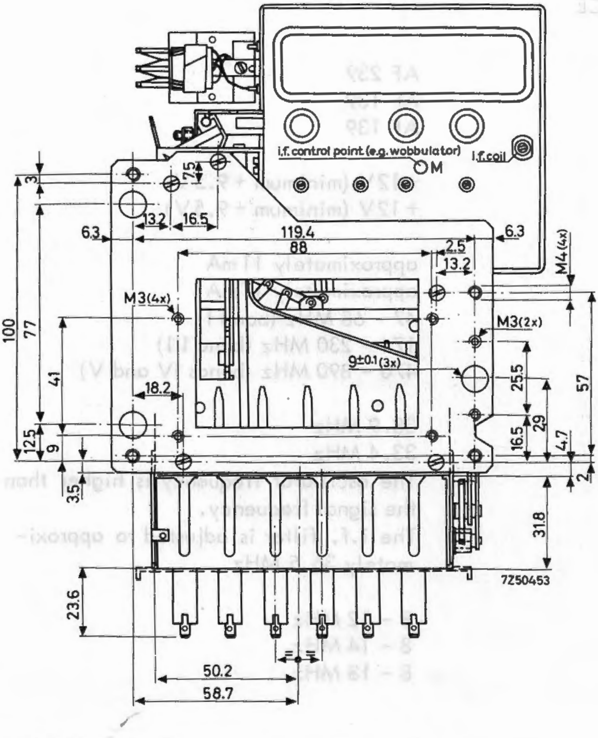


Fig. 1

It has the following five positions in the order given:
bands IV and V, band III, band I, reserve (for other systems) and test position(slide switch against limit). The band selection switch must be set in the test position when i.f. signals are injected for aligning the i.f. circuit of the tuner and the i.f. amplifier. It can be fixed in this position by means of a little pin (0.8 mm ϕ) through the aperture at the end of the switch.

The tuner is provided with a mounting plate, for building into the television receiver. To prevent large temperature variations it is recommended to mount the tuner not in the top of the housing.

For VHF and UHF reception the tuner has a separate r.f. amplifier, mixer and oscillator.

It is possible to mount a filter on the tuner to give an extra rejection of strong unwanted signals (e.g. f.m. signals). For ordering this filter use the catalog number 3122 108 65030.

The tuners are delivered without knobs, scale, cover plate and pointer. For suggestions on these parts, see the figures 8 to 11 inclusive.

TECHNICAL PERFORMANCE

Transistors	
r.f. amplifier	AF 239
mixer	AF 139
oscillator	AF 139
Supply voltages	
r.f. amplifier	+ 12 V (minimum + 9.5 V)
oscillator	+ 12 V (minimum + 9.5 V)
Total supply current	
without a.g.c.	approximately 11 mA
with a.g.c.	approximately 17 mA
Frequency ranges	47 - 68 MHz (band I)
	174 - 230 MHz (band III)
	470 - 890 MHz (bands IV and V)
Intermediate frequencies	
picture	38.9 MHz
sound	33.4 MHz
	The oscillator frequency is higher than the signal frequency.
	The i.f. filter is adjusted to approximately 36.5 MHz.
R.F. bandwidth at 3 dB	
band I	8 - 12 MHz
band III	8 - 14 MHz
bands IV and V	8 - 18 MHz

Gain for an i.f. bandwidth of 7 MHz at 3 dB	
bands I and III	≥ 22 dB (average value 26 dB)
bands IV and V	≥ 18 dB (average value 24 dB)
Gain reduction (see Figs 3 and 4)	
bands I and III	≥ 40 dB
bands IV and V	≥ 30 dB
Maximum permissible input voltage	18 mV
Aerial impedance	300 Ω, symmetrical
Reflection factor	≤ 40 %
Noise, band I	≤ 7.0 dB (average value 5.5 dB)
band III	≤ 7.5 dB (average value 6 dB)
at 470 MHz	≤ 9.0 dB (average value 6 dB)
at 650 MHz	≤ 9.0 dB (average value 7 dB)
at 800 MHz	≤ 10.0 dB (average value 8 dB)
at 860 MHz	≤ 11.0 dB (average value 9.5 dB)
at 890 MHz	≤ 12.0 dB (average value 10 dB)

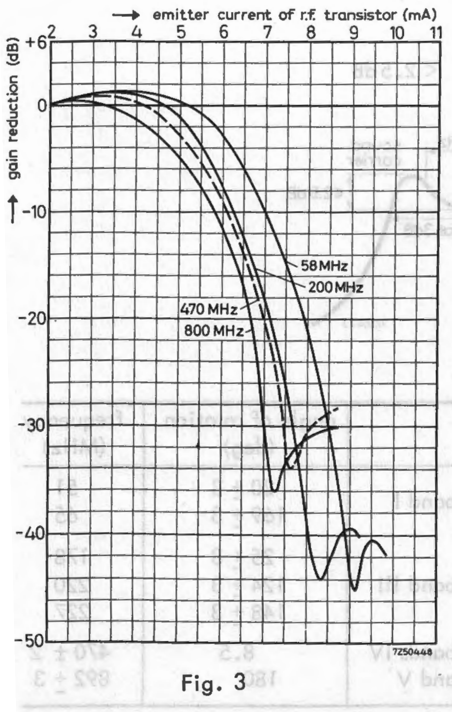


Fig. 3

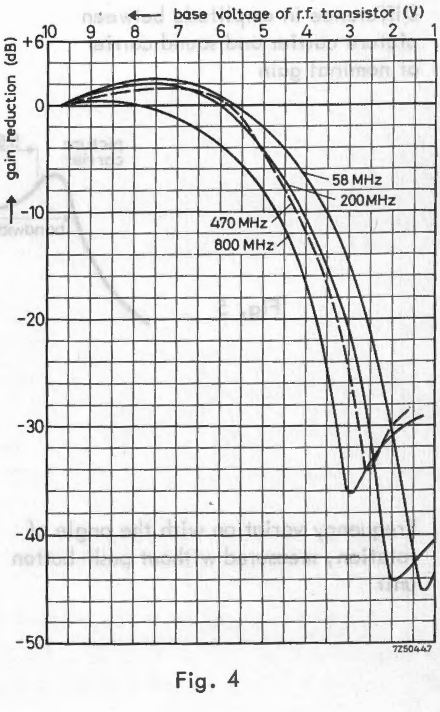


Fig. 4

Image frequency rejection	
band I	$\geq$ 60 dB
band III	$\geq$ 56 dB
bands IV and V	$\geq$ 50 dB
I.F. rejection	
band I	$\geq$ 34 dB
band III	$\geq$ 60 dB
bands IV and V	$\geq$ 60 dB
Oscillator frequency stability	
at a supply voltage variation from 12 to 10 V or from 12 to 14 V	$\leq$ 250 kHz/V
at a temperature variation of 25 °C	
band I	$\leq$ 300 kHz
band III	$\leq$ 700 kHz
bands IV and V	$\leq$ 1 MHz
Reset accuracy	$\leq$ 250 kHz
I.F. output	bottom coupled band pass filter. Capacitance in the tuner is approximately 20 pF
Difference in amplitude between picture carrier and sound carrier at nominal gain	$\leq$ 2.5 dB

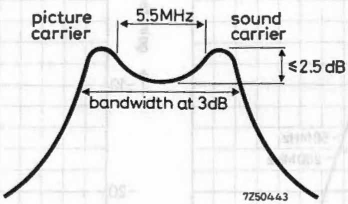


Fig. 5

Frequency variation with the angle of rotation, measured without push-button unit

	angle of rotation (deg)	frequency (MHz)
band I	20 ± 3	51
	169 ± 3	65
band III	25 ± 3	178
	124 ± 3	220
	148 ± 3	227
bands IV and V	8.5	470 ± 2
	180	892 ± 3

Maximum permissible ambient temperature at the nominal value of the supply voltage	60 °C
Radiation	in conformity with the requirements of VDE 0872 and of CISPR. See table below

	distance	requirement
fundamental wave of channels 2, 3 and 4	30 m	≤ 50 μV/m
second harmonic of channels 2, 3 and 4	30 m	≤ 30 μV/m
fundamental wave of channels 5 and 6	30 m	≤ 150 μV/m
second harmonic of channels 8 to 11 inclusive	10 m	≤ 90 μV/m
third harmonic of channels 5 to 11 inclusive	10 m	≤ 90 μV/m
fundamental wave of u.h.f. channels	10 m	≤ 450 μV/m

MEASUREMENTS

Conditions

The supply circuit must be connected as given in Fig. 6.
The a.g.c. voltage can be adjusted by means of potentiometer R (switch S closed).
The r.f. signals should be applied to the symmetrical aerial inputs.
The aerial input impedance is 300Ω.

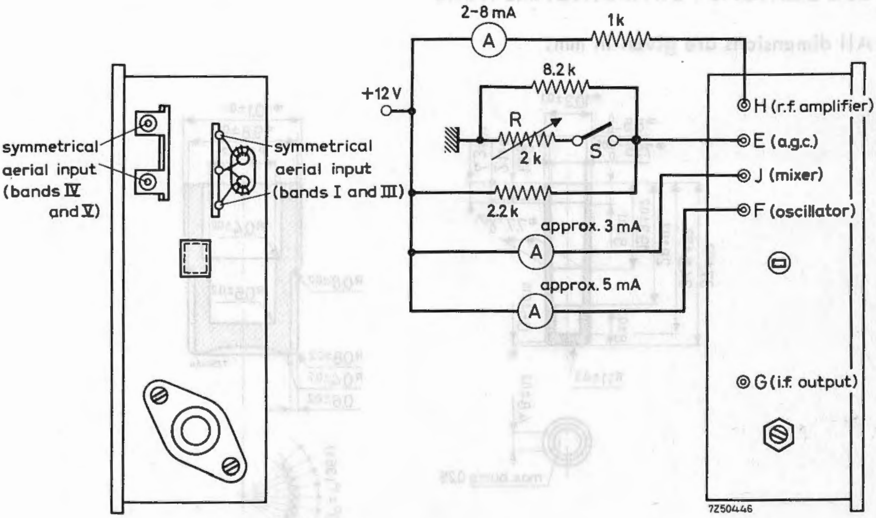


Fig. 6

Gain measurements

The circuit of Fig. 7 should be connected to the i.f. output of the tuner (point G), to form an i.f. bandpass filter and i.f. detector. The coupling capacitance (approximately 39 pF) and the damping resistance (approximately 2700Ω) should be so chosen that at 36.15 MHz the bandwidth curve is 7 MHz at 3 dB down, flat within 5%.

The gain is defined as $\frac{e_{ko}}{emf_{300}}$ (emf_{300} measured at the aerial input terminals).

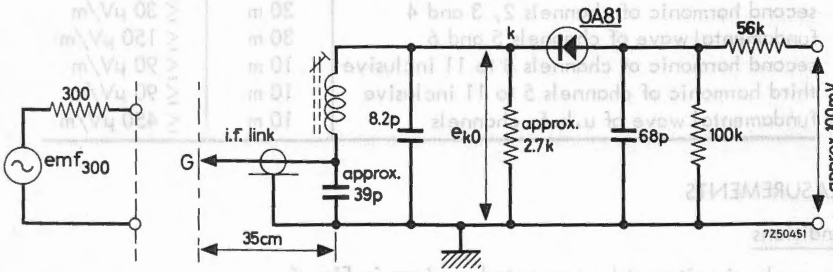


Fig. 7

SUGGESTIONS FOR ADDITIONAL PARTS

All dimensions are given in mm.

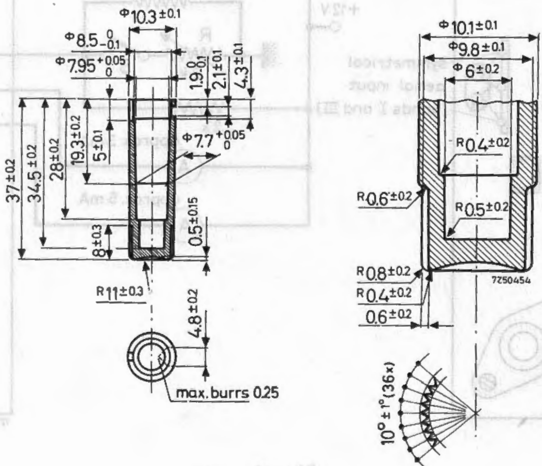


Fig. 8. Knob

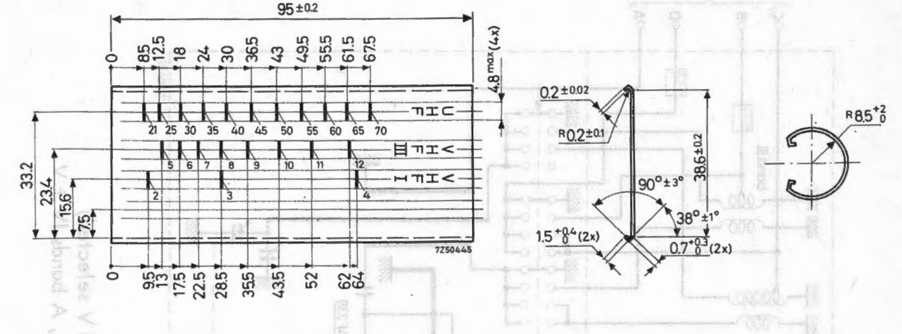


Fig. 9. Scale

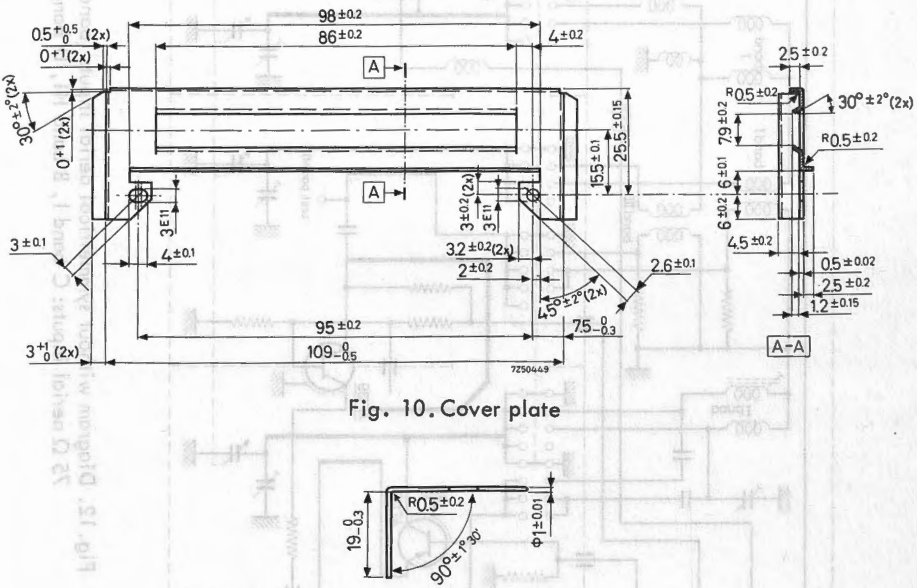


Fig. 10. Cover plate

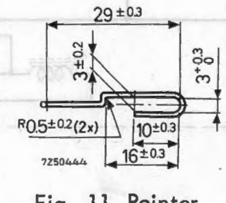


Fig. 11. Pointer

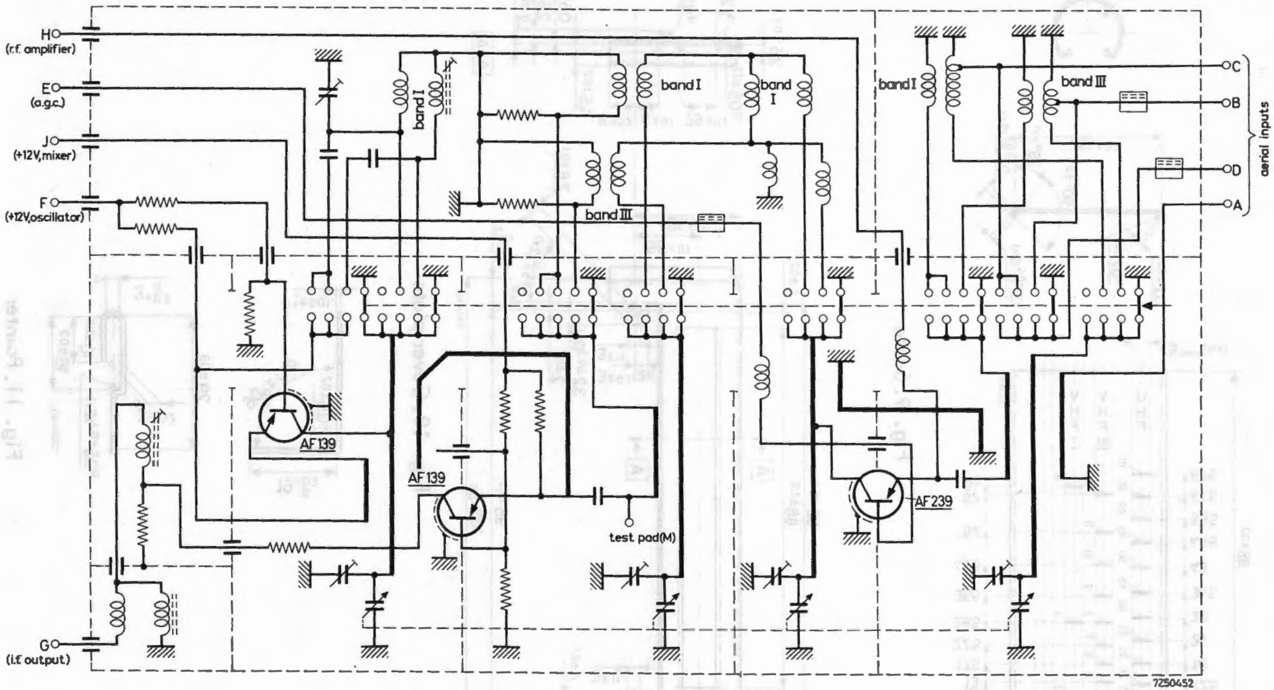
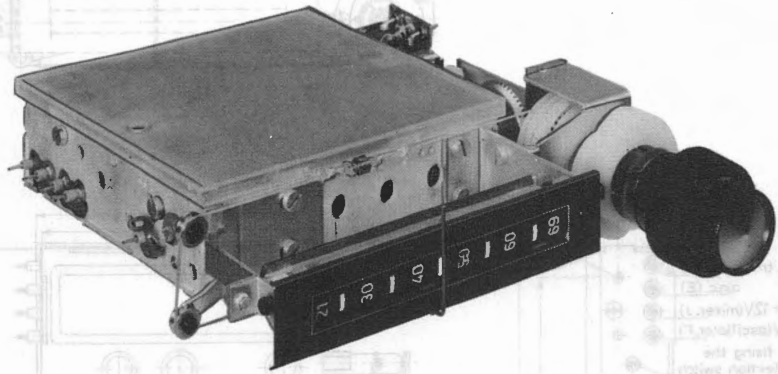


Fig. 12. Diagram without symmetrical aerial inputs (bands IV and V selected)
75 Ω aerial inputs: C band I, B band III, D bands I + III, A bands IV + V.

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



RZ 24108-11

Standard system	C.C.I.R.
Frequency ranges	47 - 68 MHz (band I)
	174 - 230 MHz (band III)
	470 - 890 MHz (bands IV and V)
Intermediate frequencies	
picture	38.9 MHz
sound	33.4 MHz

Tuning by means of two concentric knobs

Equipped with transistors

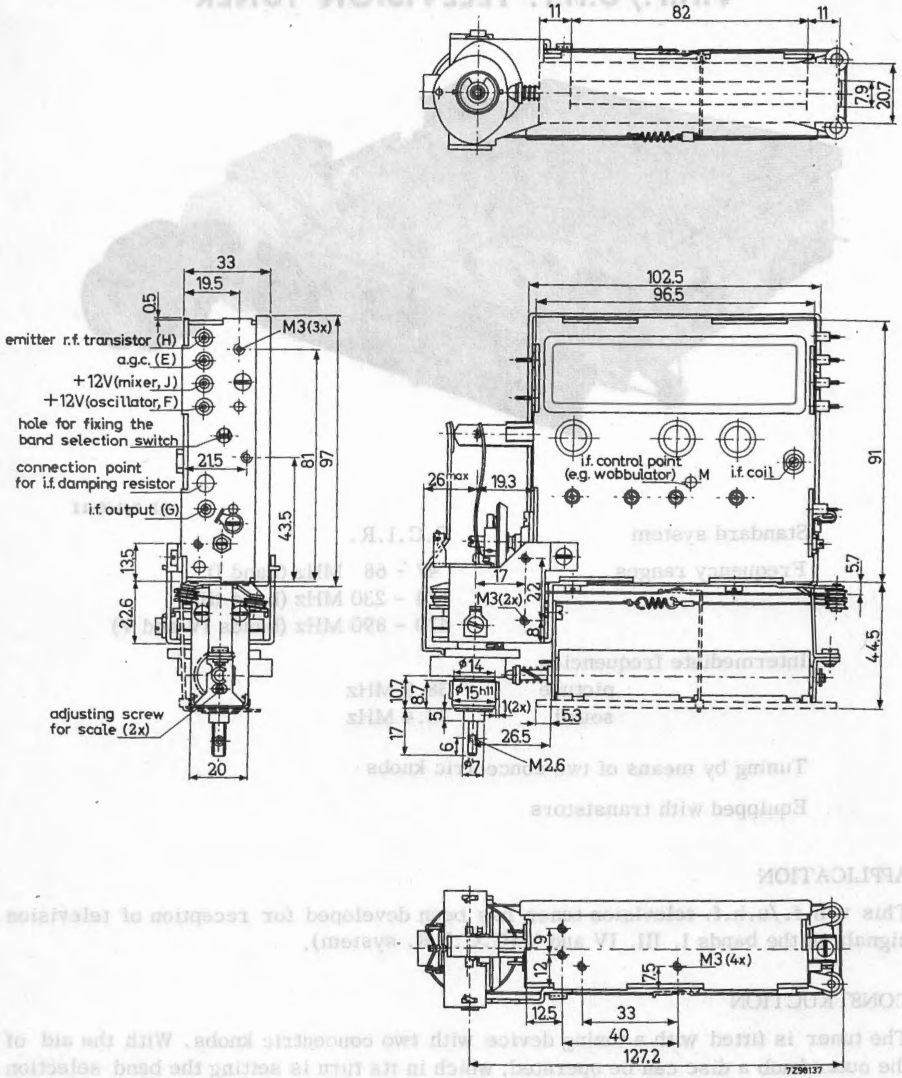
APPLICATION

This v.h.f./u.h.f. television tuner has been developed for reception of television signals in the bands I, III, IV and V (C.C.I.R. system).

CONSTRUCTION

The tuner is fitted with a tuning device with two concentric knobs. With the aid of the outer knob a disc can be operated, which in its turn is setting the band selection slide switch to the desired band. With the inner knob, a channel out of this band can now be chosen. By slightly pushing the inner knob the tuner can be coarse tuned. After release of the knob, fine tuning is possible. The device is coupled to an indication mechanism consisting of a drum, onto which a scale can be fitted, and a pointer.

Dimensions are given in mm



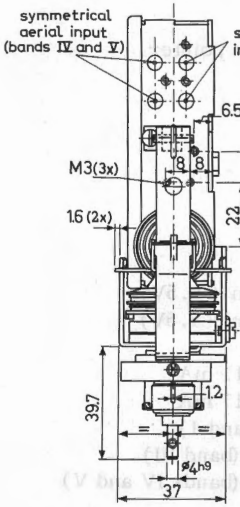

symmetrical aerial input (bands IV and V)
symmetrical aerial input (bands I and III)
6.5
8
8
M3(3x)
33.8
22
1.6 (2x)
1.2
39.7
ø4h9
37

Fig. 1

The band selection switch has the following five positions in the order given: bands IV and V, band III, band I, reserve (for other systems) and test position (slide switch against limit). It must be set in the test position when i.f. signals are injected for aligning the i.f. circuit of the tuner and the i.f. amplifier. It can be fixed in this position by means of a little pin (0.8 mm ∅) through the aperture at the end of the switch.

To prevent large temperature variations it is recommended to mount the tuner not in the top of the housing.

For v.h.f. and u.h.f. reception the tuner has a separate r.f. amplifier, mixer and oscillator.

It is possible to mount a filter on the tuner to give an extra rejection of strong unwanted signals (e.g. f.m. signals). For ordering this filter use the catalog number 3122 108 65030.

The tuner is delivered without knobs, scale, cover plate and pointer.

TECHNICAL PERFORMANCE

Transistors	
r.f. amplifier	AF 239
mixer	AF 139
oscillator	AF 139
Supply voltages	
r.f. amplifier	+ 12V (minimum + 9.5V)
oscillator	+ 12V (minimum + 9.5V)
Total supply current	
without a.g.c.	approximately 11 mA
with a.g.c.	approximately 17 mA
Frequency ranges	47 - 68 MHz (band 1) 174 - 230 MHz (band III) 470 - 890 MHz (bands IV and V)
Intermediate frequencies	
picture	38.9 MHz
sound	33.4 MHz
	The oscillator frequency is higher than the signal frequency. The i.f. filter is adjusted to approximately 36.5 MHz
R.F. bandwidth at 3 dB	
band I	8 - 12 MHz
band III	8 - 14 MHz
bands IV and V	8 - 18 MHz

Gain for an i.f. bandwidth of 7 MHz at 3 dB	
bands I and III	$\geq$ 22dB (average value 26dB)
bands IV and V	$\geq$ 18dB (average value 24dB)
Gain reduction (see Figs. 2 and 3)	
bands I and III	$\geq$ 40dB
bands IV and V	$\geq$ 30dB
Maximum permissible input voltage	18 mV
Aerial impedance	300 Ω, symmetrical
V.S.W.R.	$\leq$ 2.5
Noise, band I	$\leq$ 7.0 dB (average value 5.5 dB)
band III	$\leq$ 7.5 dB (average value 6 dB)
at 470 MHz	$\leq$ 9.0 dB (average value 6 dB)
at 650 MHz	$\leq$ 9.0 dB (average value 7 dB)
at 800 MHz	$\leq$ 10.0 dB (average value 8 dB)
at 860 MHz	$\leq$ 11.0 dB (average value 9.5 dB)
at 890 MHz	$\leq$ 12.0 dB (average value 10 dB)

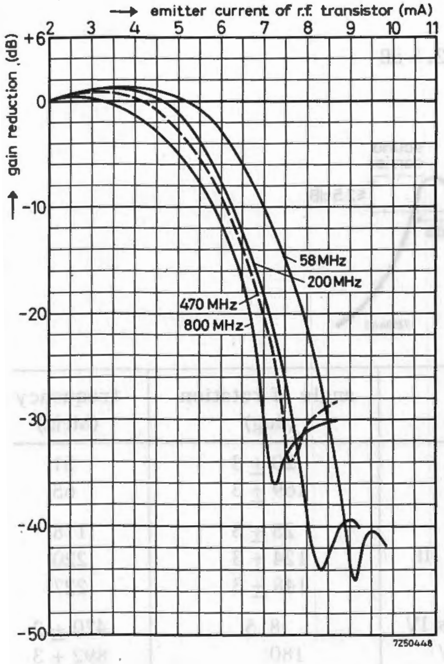


Fig. 2

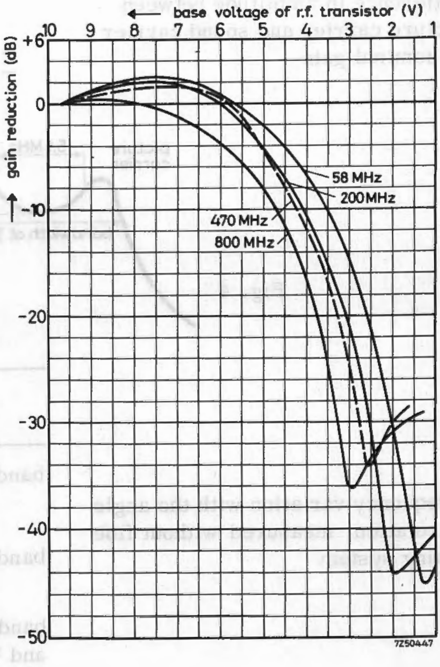


Fig. 3

Image frequency rejection
- band I — ≥ 60 dB
- band III — ≥ 56 dB
- bands IV and V — ≥ 50 dB

I.F. rejection
- band I — ≥ 34 dB
- band III — ≥ 60 dB
- bands IV and V — ≥ 60 dB

Oscillator frequency stability
- at a supply voltage variation from 12 to 10 V or from 12 to 14 V — ≤ 250 kHz/V
- at a temperature variation of 15 ^{o}C
  - band I — ≤ 300 kHz
  - band III — ≤ 350 kHz
  - bands IV and V — ≤ 500 kHz

I.F. output — bottom coupled band pass filter. Capacitance in the tuner is approximately 20 pF

Difference in amplitude between picture carrier and sound carrier at nominal gain — ≤ 2.5 dB

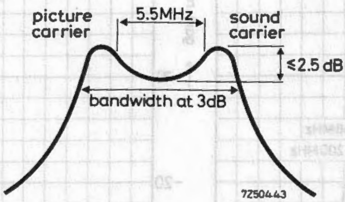


Fig. 4

Frequency variation with the angle of rotation, measured without fine tuning system

	angle of rotation (deg)	frequency (MHz)
band I	20 ± 3	51
	169 ± 3	65
band III	25 ± 3	178
	124 ± 3	220
	148 ± 3	227
bands IV and V	8.5	470 ± 2
	180	892 ± 3

Maximum permissible ambient temperature at the nominal value of the supply voltage	60 °C
Radiation	in conformity with the requirements of VDE 0872 and of CISPR. See table below

	distance	requirement
fundamental wave of channels 2, 3 and 4	30 m	≤ 50 μV/m
second harmonic of channels 2, 3 and 4	30 m	≤ 30 μV/m
fundamental wave of channels 5 and 6	30 m	≤ 150 μV/m
second harmonic of channels 8 to 11 inclusive	10 m	≤ 90 μV/m
third harmonic of channels 5 to 11 inclusive	10 m	≤ 90 μV/m
fundamental wave of u.h.f. channels	10 m	≤ 450 μV/m

MEASUREMENTS

Conditions

The supply circuit must be connected as given in Fig. 5.
The a.g.c. voltage can be adjusted by means of potentiometer R (switch S closed).
The r.f. signals should be applied to the symmetrical aerial inputs.
The aerial input impedance is 300 Ω.

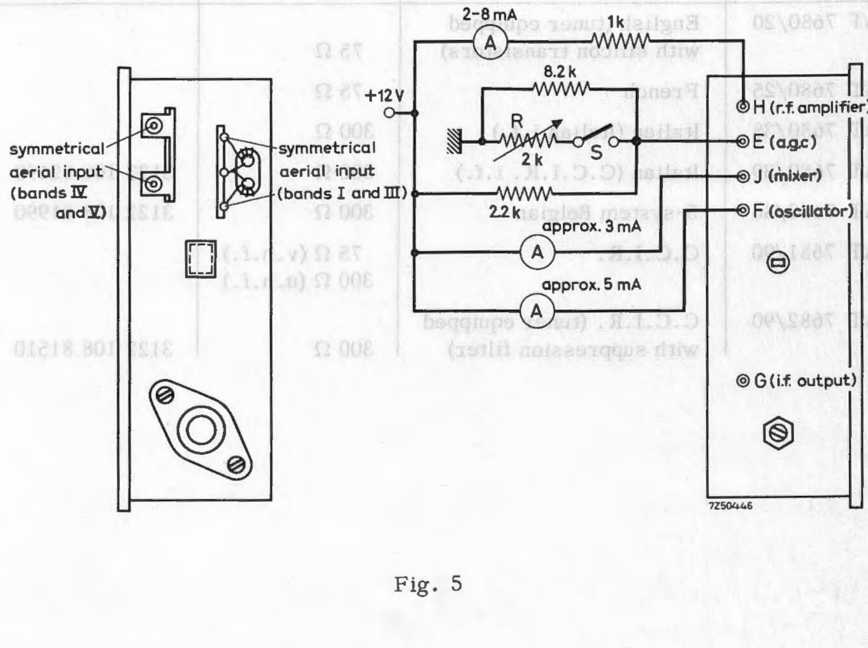


Fig. 5

Gain measurements

The circuit of Fig. 6 should be connected to the i.f. output of the tuner (point G), to form an i.f. bandpass filter and i.f. detector. The coupling capacitance (approximately 39 pF) and the damping resistance (approximately 2700 Ω) should be so chosen that at 36.15 MHz the bandwidth curve is 7 MHz at 3 dB down, flat within 5%.
The gain is defined as $\frac{e_{ko}}{emf_{300}}$ (emf_{300} measured at the aerial input terminals).

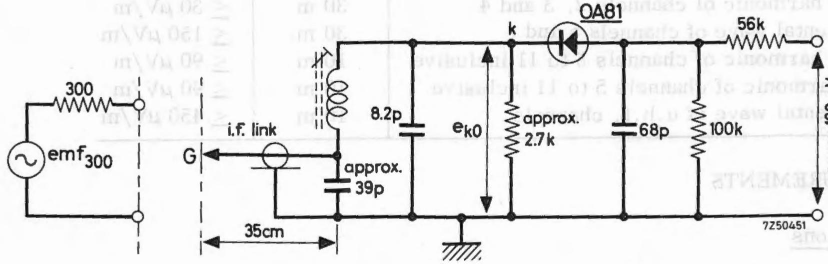


Fig. 6

VERSIONS

type number	system	aerial impedance	catalog number
AT 7680/20	English (tuner equipped with silicon transistors)	75 Ω	
AT 7680/25	French	75 Ω	
AT 7680/38	Italian (Italian i.f.)	300 Ω	
AT 7680/39	Italian (C.C.I.R. i.f.)	300 Ω	3122 108 82190
AT 7680/86	5-system Belgian	300 Ω	3122 108 81990
AT 7681/90	C.C.I.R.	75 Ω (v.h.f.) 300 Ω (u.h.f.)	
AT 7682/90	C.C.I.R. (tuner equipped with suppression filter)	300 Ω	3122 108 81510

SUGGESTION FOR ADDITIONAL PART

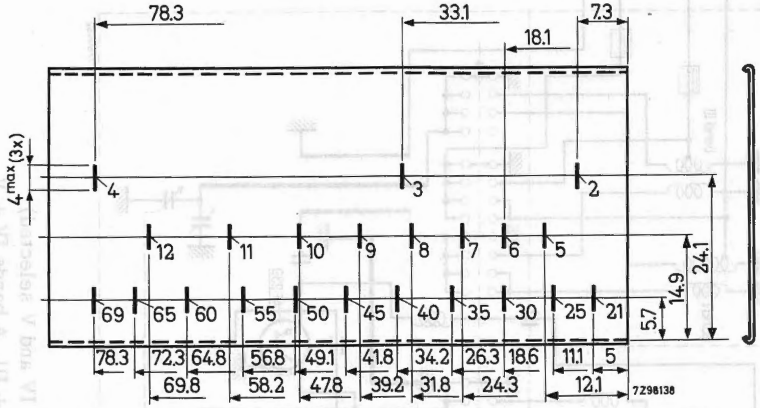


Fig. 7. Scale (dimensions in mm)

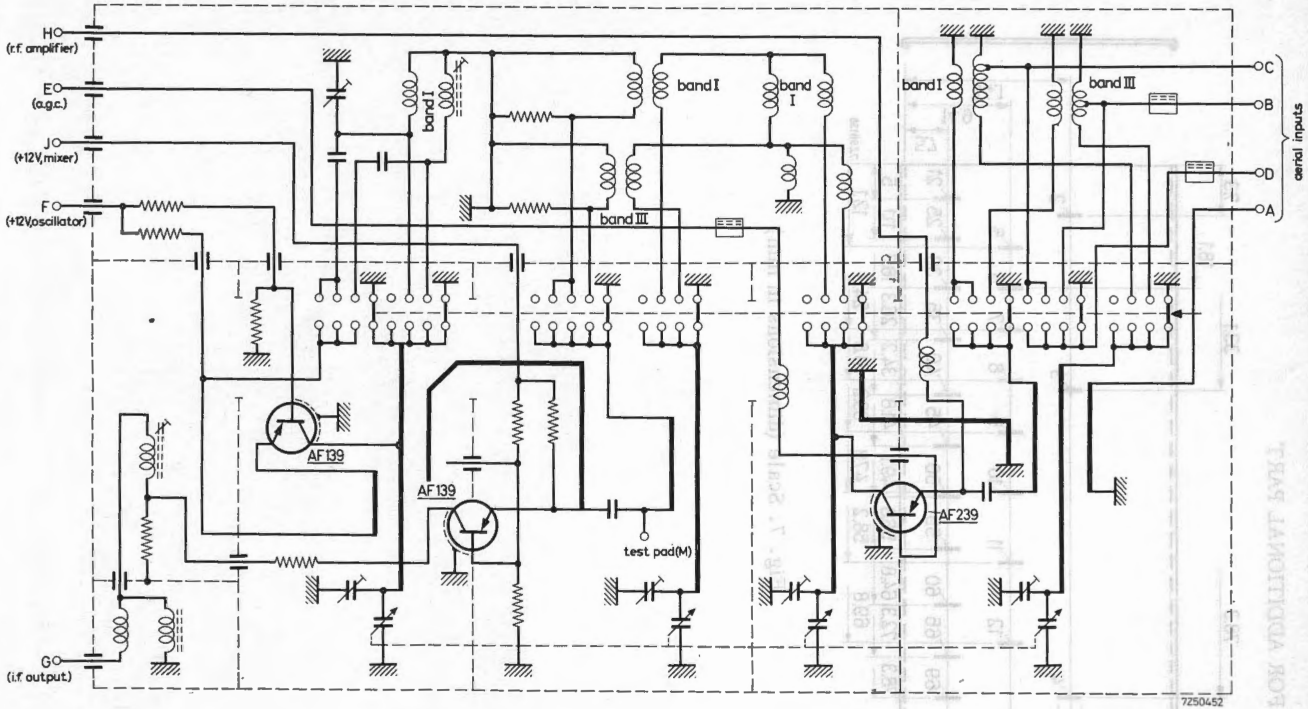
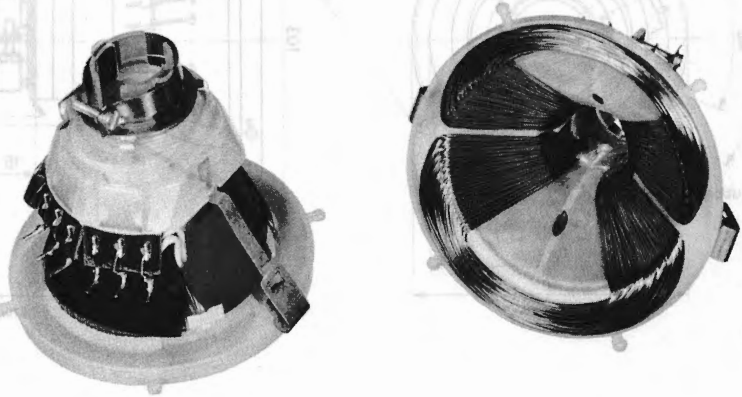


Fig.8. Diagram without symmetrical aerial inputs (bands IV and V selected)
75 Ω aerial inputs: C band I, B band III, D bands I + III, A bands IV + V.

Components for black and white television

DEFLECTION UNIT



RZ 20526-2

For transistor-equipped television receivers

APPLICATION

This deflection unit is designed for use with the 11 inch 90° picture tube A28-14W and the 12 inch 90° picture tube A31-20W, in conjunction with the line-output transformer AT2042/01 and the linearity control unit AT4036 in transistor-equipped television sets.

CONSTRUCTION

The saddle-shaped line deflection coils are moulded so that the deflection centre is well within the conical part of the picture tube.
The frame deflection coils are wound on a ferroxcube yoke ring which is flared so that the frame and line deflection centres coincide. The provision of separate connecting points makes it possible to connect the frame deflection coils either in series or in parallel.
At the rear, the line and frame deflection coils, as well as the yoke ring, are potted in polyester resin.

Dimensions in mm

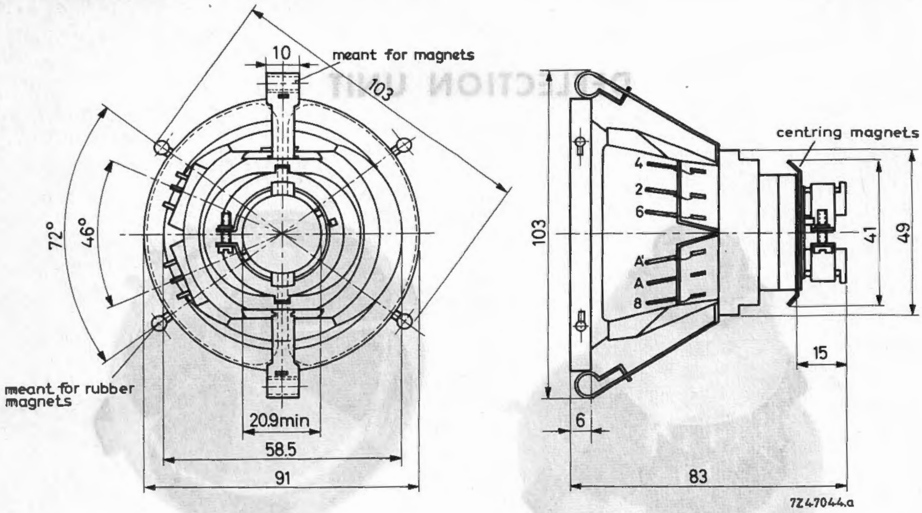


Fig. 1

TECHNICAL PERFORMANCE

Maximum working temperature	95 °C
Line deflection coils	parallel connected, see Fig. 2
Connecting terminals	2 and 4
Inductance	81 μH
Resistance	0.15 Ω
Sensitivity	23 μVs/cm
Frame deflection coils	series or parallel connected, see Fig. 3
Connecting terminals	6 and 8
Inductance	2 x 21 mH
Resistance	2 x 15 Ω
Sensitivity	9 mW/cm²

$\left.\begin{array}{l}2\times 21\ \text{mH}\\ 2\times 15\ \Omega\\ 9\ \text{mW/cm}^2\end{array}\right\}$ when coils are series connected

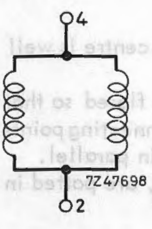


Fig. 2

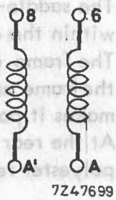


Fig. 3

MOUNTING

The unit should be mounted as far forward as possible on the neck of the picture tube, so that it touches the cone.
External circuit connection is made to soldering tags, positioned as indicated in Fig. 1. If the frame deflection coils are to be connected in series, tags A and A' must be interconnected; for parallel connection, tag 8 must be connected with tag A, and tag 6 with tag A'.

To orient the raster correctly, the unit may be rotated by hand on the neck of the picture tube, with which it makes a slip fit. A screw-tightened clamping ring, cooperative with a pair of rubber friction shoes, permits it to be locked, both axially and radially, in the desired position.

CENTRING THE BEAM

With the deflection unit mounted on the picture tube and clamped in position, the beam can be centred by rotating two, independently movable, steel magnet discs positioned adjacent the clamping ring.

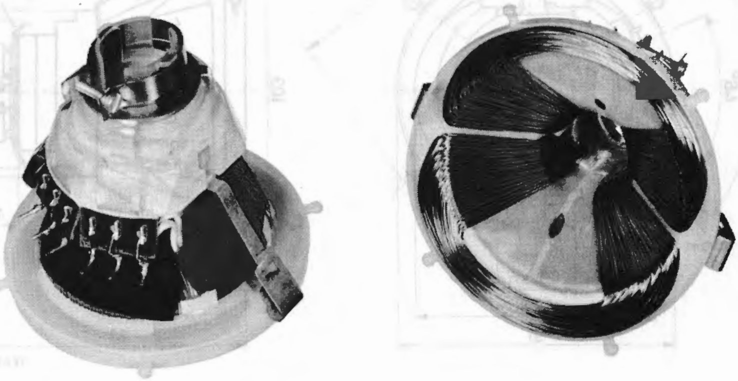
RASTER ADJUSTMENT POSSIBILITIES

Vertical pin-cushion distortion can be corrected by small ferroxdure rods, which can be mounted on the deflection unit brackets. Limited correction of asymmetrical vertical pin-cushion distortion can be achieved by unequal rotation of the rods.

The shape of the corners of the raster can be adjusted by means of small rubber magnets having a centre hole to fit the pins on the rim of the deflection unit.

Both the ferroxdure rods (catalog number 4312 020 60101) and the rubber magnets (catalog number 3122 104 02721) can be supplied on request.

DEFLECTION UNIT



RZ 20526-2

For tube-equipped television receivers

APPLICATION

This deflection unit is designed for use with the 11 inch 90° picture tube A28-14W and the 12 inch 90° picture tube A31-20W, in conjunction with the line-output transformer AT2043 and the linearity control unit AT4037 in tube-equipped television receivers.

CONSTRUCTION

The saddle-shaped line deflection coils are moulded so that the deflection centre is well within the conical part of the picture tube.

The frame deflection coils are wound on a ferroxcube yoke ring which is flared so that the frame and line deflection centres coincide.

At the rear the line and frame deflection coils, as well as the yoke ring, are potted in polyester resin.

The unit is equipped with a built-in NTC-thermistor (with a parallel connected carbon resistor) connected in series with the frame coils in order to compensate for temperature dependence of the coils. By this, in frame-output circuits with voltage feedback for linearising the saw-tooth voltage a constant deflection current and so a constant picture height has been obtained throughout the temperature range 25 °C to 85 °C.

For frame-output circuits using current feedback it is possible to make connection to the frame coils without the NTC-thermistor.

Dimensions in mm

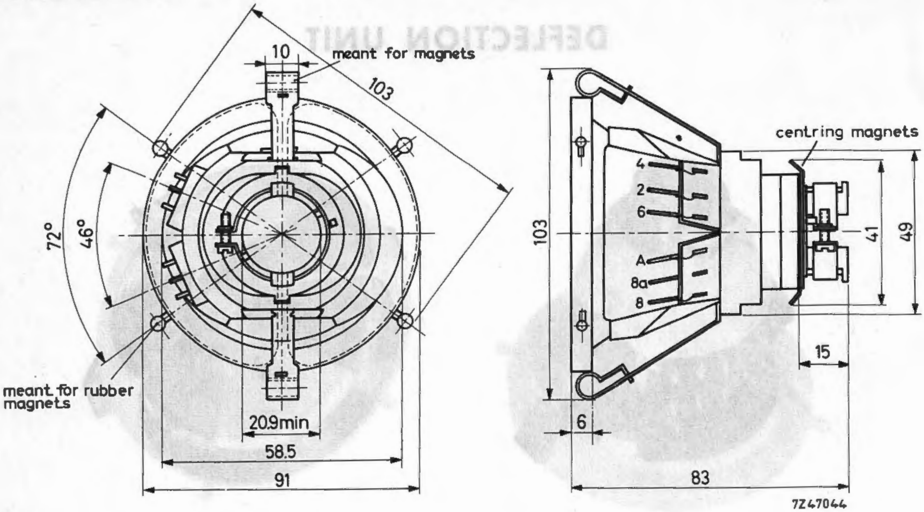


Fig. 1

TECHNICAL PERFORMANCE

Maximum working temperature	95 °C
Line deflection coils	parallel connected, see Fig. 2
Connecting terminals	2 and 4
Inductance	1.7 mH
Resistance	3.6 Ω
Sensitivity	108 μVs/cm
Frame deflection coils	series connected, see Fig. 3
Connecting terminals	6 and 8a (centre tap at A)
Inductance	42 mH
Resistance	30 Ω, between connecting terminals 6 and 8
	38 Ω, between connecting terminals 6 and 8a
Sensitivity	9 mW/cm^2

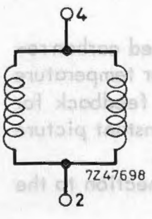


Fig. 2

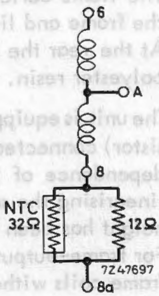


Fig. 3

MOUNTING

The unit should be mounted as far forward as possible on the neck of the picture tube, so that it touches the cone.

External circuit connection is made to soldering tags, positioned as indicated in Fig. 1.

To orient the raster correctly, the unit may be rotated by hand on the neck of the picture tube, with which it makes a slip fit. A screw-tightened clamping ring, cooperative with a pair of rubber friction shoes, permits it to be locked, both axially and radially, in the desired position.

CENTRING THE BEAM

With the deflection unit mounted on the picture tube and clamped in position, the beam can be centred by rotating two, independently movable, steel magnet discs positioned adjacent the clamping ring.

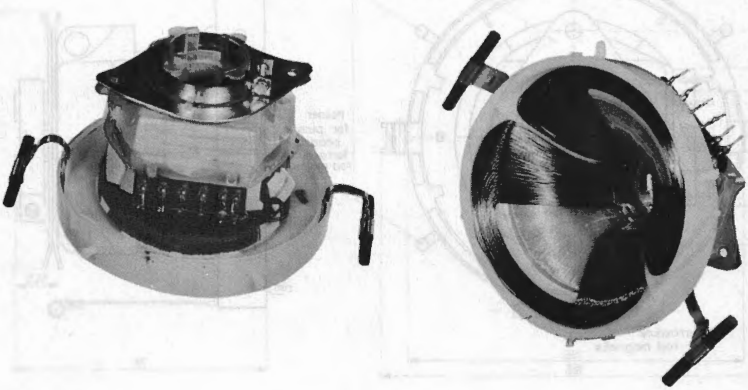
RASTER ADJUSTMENT POSSIBILITIES

Vertical pin-cushion distortion can be corrected by small ferroxdure rods, which can be mounted on the deflection unit brackets. Limited correction of asymmetrical vertical pin-cushion distortion can be achieved by unequal rotation of the rods.

The shape of the corners of the raster can be adjusted by means of small rubber magnets having a centre hole to fit the pins on the rim of the deflection unit.

Both the ferroxdure rods (catalog number 4312 020 60101) and the rubber magnets (catalog number 3122 104 02721) can be supplied on request.

DEFLECTION UNIT



RZ 20980-1

For tube-equipped television receivers

APPLICATION

This deflection unit has been designed for use with 110° (114°) picture tubes with a neck diameter of 28 mm in conjunction with the line-output transformer AT2025/01 and the linearity control unit AT4034/01 in tube-equipped television receivers.

CONSTRUCTION

he saddle-shaped line deflection coils are moulded so that the deflection centre is well within the conical part of the picture tube.
he frame deflection coils are wound on a ferroxcube yoke ring which is flared so that he frame and line deflection centres coincide.
t the rear the line and frame deflection coils, as well as the yoke ring, are potted in olyester resin.

he unit is equipped with a built-in NTC thermistor connected in series with the frame de-ection coils in order to compensate for temperature dependence of the coils. By this, frame-output circuits with voltage feedback for linearising the saw-tooth voltage a onstant deflection current and so a constant picture height has been obtained up to mperatures of 95 °C.
or frame-output circuits using current feedback it is possible to make connection to the ame coils without the NTC thermistor.

Dimensions in mm

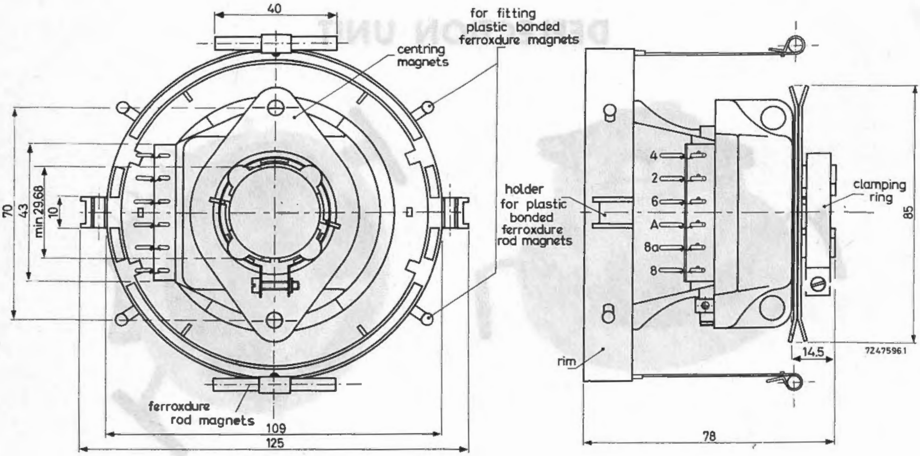


Fig. 1

TECHNICAL PERFORMANCE

Maximum working temperature	95 °C
Line deflection coils	parallel connected, see Fig. 2
Connecting terminals	2 and 4
Inductance	2.9 mH
Resistance	4.6 Ω
Deflection current at 18 kV for a deviation of 495 mm	2.29 A_{p-p}
Sensitivity	135 μVs/cm
Frame deflection coils	series connected, see Fig. 3
Connecting terminals	6 and 8 (centre tap at A)
Inductance	82 mH
Resistance between terminals 6 and 8	38 Ω
between terminals 6 and 8a at 25 °C	48 Ω
Deflection current at 18 kV for a deviation of 390 mm	0.44 A_{p-p}
Sensitivity	4.8 mW/cm^2

Fig. 2

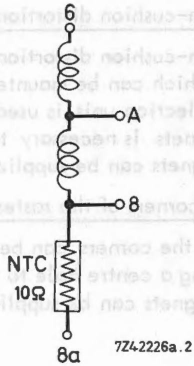


Fig. 3

MOUNTING

The unit should be mounted as far forward as possible on the neck of the picture tube, so that it touches the cone.

External circuit connection is made to soldering tags, positioned as indicated in Fig. 1.

To orient the raster correctly, the unit may be rotated by hand on the neck of the picture tube, with which it makes a slip fit. A screw-tightened clamping ring, cooperative with a pair of rubber friction shoes, permits it to be locked, both axially and radially, in the desired position.

ADJUSTMENT POSSIBILITIES

Vertical pin-cushion distortion

Vertical pin-cushion distortion can be corrected by small ferroxdure rod magnets, which have been mounted on the deflection unit brackets. Limited correction of asymmetrical vertical pin-cushion distortion can be achieved by unequal rotation of these magnets.

Eccentricity of the picture tube

After adjustment of the linearity of the deflection current, the eccentricity of the picture tube and the deflection unit can be corrected by means of two independently movable centring magnets. These magnets are diametrically magnetised. By turning the magnets with respect to each other the magnetic force of the resultant field of both magnets is adjusted. The direction of the resultant magnetic field is adjusted by turning the magnets simultaneously.
It should be noted that these centring magnets can not be used for compensating the effects of non-linearity or of phase differences between synchronisation and time base, as otherwise the correction needed becomes excessive and, even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

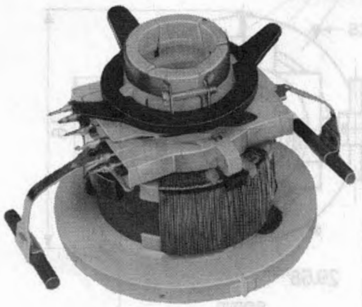
Horizontal pin-cushion distortion

Horizontal pin-cushion distortion can be corrected by two rod magnets of plastic bonded ferroxdure, which can be mounted on the two holders on the rim.
When the deflection unit is used in conjunction with a 19 inch picture tube the use of these rod magnets is necessary to get an optimum raster.
These rod magnets can be supplied on request (catalog number 3122 104 90360).

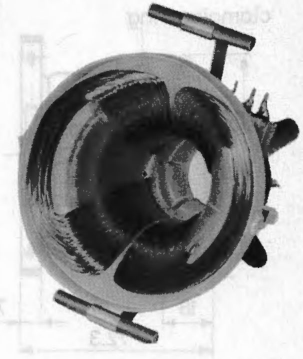
Shape of the corners of the raster

The shape of the corners can be adjusted by means of small plastic bonded ferroxdure magnets having a centre hole to fit the pins on the rim of the deflection unit.
These four magnets can be supplied on request (catalog number 3122 104 93540).

DEFLECTION UNIT



RZ 24284-13



RZ 24284-14

For tube-equipped and transistor-equipped television receivers

APPLICATION

This deflection unit has been designed for use with 110° (114°) picture tubes with a neck diameter of 28 mm. The unit can be driven by the line-output transformer AT2036 (standard), the AT2036/25 (which has auxiliary windings for 3x110 V_p) or the AT2034 (819/625 lines) in tube-equipped television sets, and by the AT 2045 in fully transistorised television sets.

The standard frame output transformer is the AT3513, which can be used for tube and transistor-equipped television sets.

The linearity control is accomplished by the unit AT4042/02.

CONSTRUCTION

The frame deflection coils are wound on a ferroxcube yoke ring which is flared so :hat the frame and line deflection centres coincide.

The unit is equipped with a built-in NTC thermistor and a parallel resistor con- ıected in series with the frame deflection coils in order to compensate for temper- ıture dependence of the coils. By this, in frame-output circuits with voltage feed- ›ack for linearising the saw-tooth voltage a constant deflection current and so a onstant picture height has been obtained up to temperatures of 100 °C.
'or frame-output circuits using current feedback it is possible to make connection › the frame coils without the temperature compensating network.

Dimensions in mm

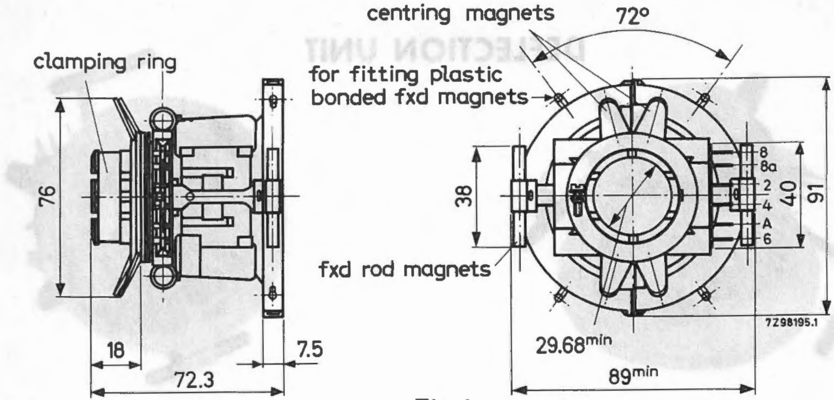


Fig. 1

TECHNICAL PERFORMANCE

Maximum operating temperature	100 °C
Maximum peak voltage between terminals of frame and line coil (50 Hz)	2000 V
Line deflection coils	parallel connected, see Fig. 2
Connecting terminals	2 and 4
Inductance	2.1 mH ± 5%
Resistance	3.9 Ω ± 10%
Peak to peak current	2.82 A ± 2.5% 1)
Frame deflection coils	series connected, see Fig. 3
Connecting terminals	6 and 8 (centre tap at A)
Inductance	66 mH ± 10%
Resistance between terminals 6 and 8	30 Ω ± 8%
between terminals 6 and 8a at 25 °C	44 Ω 2)
Peak to peak current	545 mA ± 5% 3)

1) At 18 kV accelerator voltage and a deviation of 495 mm on the 23 inch reference picture tube.

2) Variation of total circuit resistance within 10 to 95 °C is ±0.1 Ω when using the output transformer AT3513.

3) At 18 kV accelerator voltage and a deviation of 390 mm on the 23 inch reference picture tube.

Characteristics measured at 18 kV accelerator voltage on a 23 inch reference picture tube:

Pin cushion distortion	3.5% 4)
Trapezium distortion	3.5% 4)
Barrel pattern distortion	none 4)
Line asymmetry	1.5% 4)
Frame asymmetry	1.5% 4)
Eccentricity of deflection centre	< 2 mm 4)
Adjustment range of centring magnets	> 5 mm diameter < 45 mm diameter
Geometry distortion 4)	Fig.4. The edges of the raster fall between the rectangles.

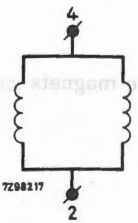


Fig.2

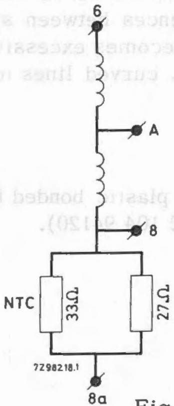


Fig.3

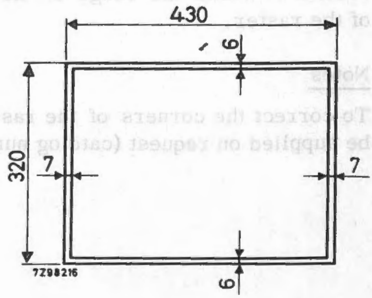


Fig.4

MOUNTING

The unit should be mounted as far forward as possible on the neck of the picture tube, so that it touches the cone.

External circuit connection is made to soldering tags, positioned as indicated in Fig.1.

To orient the raster correctly, the unit may be rotated by hand on the neck of the picture tube, with which it makes a slip fit. A screw-tightened clamping ring permits it to be locked, both axially and radially, in the desired position.

4) Measured without correction magnets.

ADJUSTMENT FACILITIES

Vertical pin-cushion distortion

Vertical pin-cushion distortion can be corrected by small ferroxdure rod magnets, which have been mounted on the deflection unit brackets. Limited correction of a-symmetrical vertical pin-cushion distortion can be achieved by unequal rotation of these magnets.

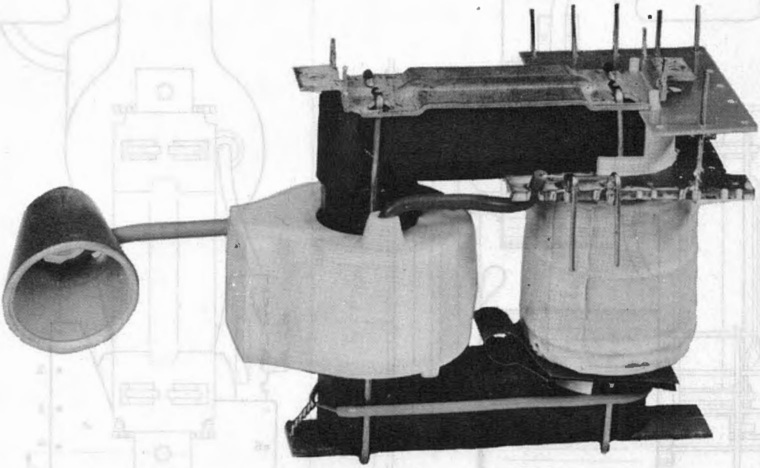
Eccentricity of the picture tube

After adjustment of the linearity of the deflection current, the eccentricity of the picture tube and the deflection unit can be corrected by means of two independently movable centring magnets of plastic-bonded ferroxdure. These magnets are diametrically magnetised. By turning the magnets with respect to each other the magnetic force of the resultant field of both magnets is adjusted. The direction of the resultant magnetic field is adjusted by turning the magnets simultaneously.
It should be noted that these centring magnets can not be used for compensating the effects of non-linearity or of phase differences between synchronisation and time base, as otherwise the correction needed becomes excessive and, even if the correction is within the range of the magnets, curved lines may appear in the centre of the raster.

Notes

To correct the corners of the raster small plastic bonded ferroxdure magnets can be supplied on request (catalog number 3122 104 94120).

LINE-OUTPUT TRANSFORMER



RZ 17574-1

For tube-equipped television receivers
Without auxiliary winding

APPLICATION

This line-output transformer has been developed to provide the required scanning amplitude for 19" or 23" picture tubes in television receivers presenting 625 lines at 50 frames per second (CCIR) or 525 lines at 60 frames per second (USA).
It is intended for use in conjunction with deflection unit AT 1030, linearity control unit AT 4034/01, line-output tube PL504, rectifying tube DY802 and booster diode PY 88. The EHT is stabilised at 18 kV.

CONSTRUCTION

The magnetic circuit of the transformer comprises a ferroxcube U-core and a ferroxcube I-core. The primary winding 5 - 8 and the secondary windings 1 - 2 and 3 - 4 (see Fig. 2) are polyester dipped and situated on one leg of the core.
The EHT winding is polyester encapsulated and situated on the other leg.

The transformer has been provided with four mounting pins and two threaded holes for mounting.

External circuit connection is made to connecting pins, positioned as indicated in Fig. 1.

Dimensions in mm

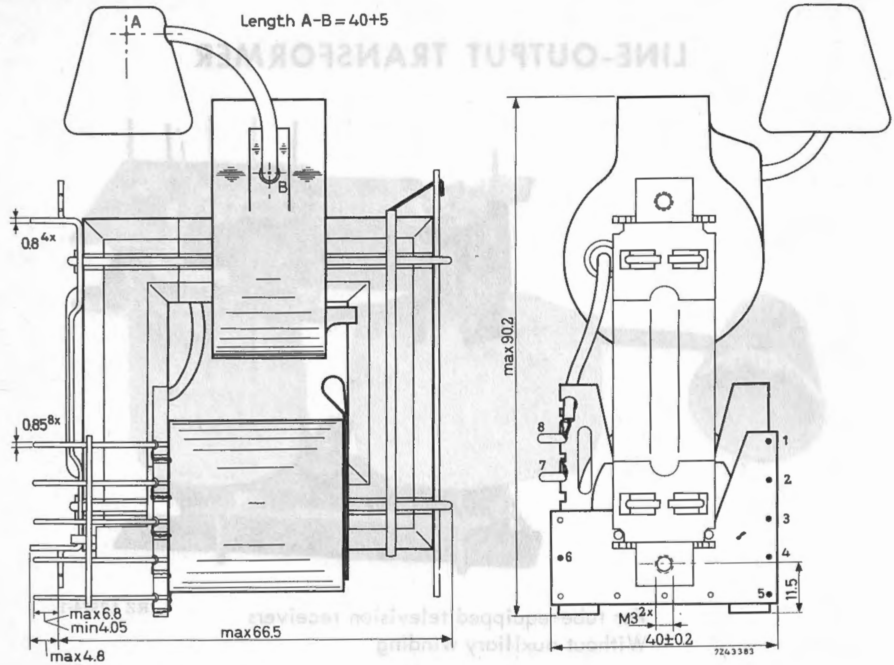


Fig. 1

ELECTRICAL DATA (see Fig. 2)

The electrical data are measured with a booster load at connection (5) of 1 mA and a capacitance of 100 pF between connections (1) and (4) at different values of capacitor C 4.

C 4	0 pF		120 pF		270 pF		
Beam current 1)	35	400	35	400	35	400	µA
Supply voltage 2)	240		240	225	240		V
Booster voltage	640		650	618	660		V
EHT voltage	18.1		18.0	16.4	17.6		kV
Overscan 1)	+6		+9		+12		%
Stability down to	194	205	195	205	197	208	V
Flyback ratio	17.2		17.5		17.9		%
Internal resistance of EHT		≤ 4.5		≤ 4.5		≤ 4.5	MΩ

1) A beam current increase of 200 µA results in an amplitude increase of maximum 2%.
2) Internal resistance of power supply = 250 Ω.

C4	0 pF		120 pF		270 pF		
PY 88							
Average booster current	103		100	135	104		mA
Peak booster current	215	230	220	235	230	245	mA
Booster current at end of scan	5	60	5	50	5	55	mA
PL 504							
Peak cathode current	280	360	280	360	280	360	mA
Peak anode current			255	330			mA
Average screen-grid current			10	13			mA
Average screen-grid voltage			227	209			V
Anode dissipation				9			W
Screen-grid dissipation				3			W

The transformer core should not be left "floating", but must be connected to the chassis.

Driving pulse of the PL 504:

Cut-off time at least 19% at - 100 V
Peak voltage higher than - 120 V
Slope of leading edge of driving pulse less than 2 µs per 100 V. The shape of the driving pulse in the conducting period of the PL 504 should be such that the booster current at end-of-scan (measured with zero beam current) just does not disappear.

The maximum load on the transformer, including the booster load (but excluding the load of the VDR stabilization circuit) should not exceed 2.5 W.
This load results in a current increase of about 15 mA.

The maximum capacitive load is (with a view to parasitic oscillations after flyback):

between (1) and (2) : 270 pF,
absolute maximum permissible is e.g. (with C4 = 120 pF) :

270 pF between (1) (2) and
330 pF between (3) (4).

or: 120 pF between (1) (2) and
390 pF between (3) (4).

Line-output stage (see Fig. 2)

C1 4700 pF ceramic
C2 1500 pF ceramic
C3 270 pF ceramic, 1000 V_{dc}
C4 0-270 pF ceramic, 2000 V_{p-p}, amplitude adjustment
C5 22000 pF paper } 1300 V, booster
C7 56000 pF paper } capacitors
C6 0.18 µF (5%) } S-correctors 1)
C8 0.20 µF (5%) }

R1 2.2 MΩ, 1200 V_{p-p}
R2 1000 Ω, 1/4 W
R3 2200 Ω, 2 W 2)
R4 10 MΩ, 1200 V_{dc}
R5 0.5 MΩ, potentiometer, booster voltage adjustment
R6 1500 Ω, 1 W
R7 2700 Ω, 1 W
VDR 2322 564 90014 (910 V)

1) The picture width depends on this value.
2) With low supply voltage, dissipation may exceed 1 W.

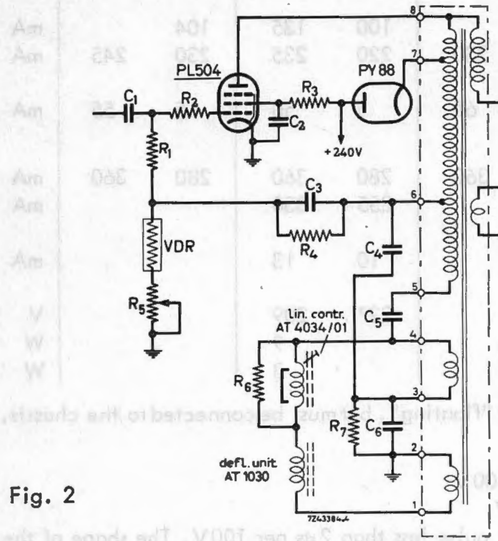


Fig. 2

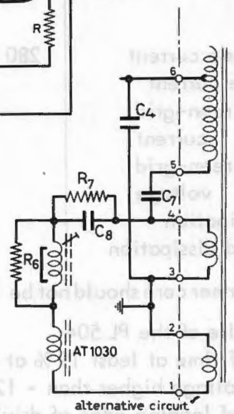


Fig. 2a

The operation of the transformer is influenced by its surroundings. Variations in electrical characteristics due to the influence of surrounding components, shields and circuitry can be compensated to a certain degree by selecting the right value for the capacitor C 4 parallel to part of the transformer primary.
The deflection unit is connected to a secondary which is separated from the primary by the booster capacitor C5. Pulses for blanking, synchronisation, etc. are to be taken directly from the deflection unit connections. There is no auxiliary winding on this transformer. A circuit diagram of a flywheel synchronisation circuit is given below.

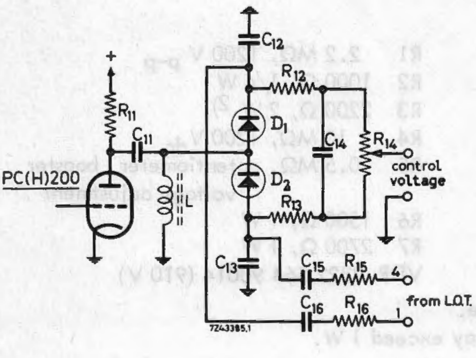


Fig. 3

C11	6800 pF, ceramic
C12, C13	1000 pF, ceramic
C14	0. μF, polyester
C15, C16	120 pF, ceramic
R11	10 kΩ, 1/2 W
R12, R13	39 kΩ, 1/4 W
R14	5 MΩ, trimmer potentiometer
R15, R16	15 kΩ, 1/4 W
L	25-35 mH, choke
D1, D2	OA 202

The split secondary offers two possibilities to the setmaker. If the transformer is connected according to Fig. 2a, the conventional circuit is obtained, with booster capacitor C7 = 56 nF and S-correction capacitor C8 = 200 nF (± 5%).
If, however, the S-correction capacitor is placed between the two halves of the secondary (C6 in Fig. 2), the booster capacitance has to be reduced considerably (22 nF instead of 56 nF) because the parabola voltages on C6 and C5 are of opposite sign. Besides, the S-correction capacitor has to be reduced (180 nF). This means an important saving in cost.

From connection (3) a parabola-shaped voltage of 90 V_{p-p} can be taken for use in the TV set.
If the resistive load on connection (3) is about 2700 Ω or less, the resistor R7 (damping resistor against dynatron oscillations) can be omitted. The load resistance should, however, not be lower than about 820 Ω.

If the boosted d.c. voltage is needed elsewhere in the set, it has to be filtered from the booster parabola voltage and from the flyback peaks.

MOUNTING

The transformer can be mounted on either a printed-wiring board or a metal chassis. The latter should be apertured as shown in the mounting diagram, Fig. 4, to pass the pins. The transformer is secured by two 3 mm screws. The mounting pins can be bent or soldered.
When mounted on a printed-wiring board the transformer is secured by means of its four mounting pins and two 3 mm screws. The fit of the connecting pins in a printed-wiring grid with a pitch of 0.1" is illustrated in Fig. 5.

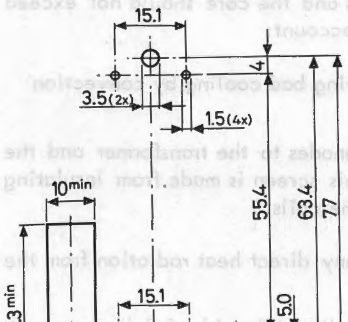


Fig. 4

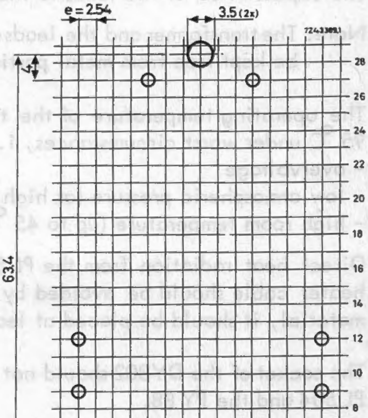


Fig. 5

Like the other connections, those to the PL 504 and PY 88 can be soldered to the printed-wiring board. If bent upwards (as supplied) they are very suitable for direct connection to the anode caps of these tubes.

A tube socket for the DY802 (type AT7130) comprising a resistor (R, Fig.2) of 1.6 Ω is available; for ordering this socket the catalog number 3122 107 31240 should be used. See also the relevant data sheet.

Certain minimum distances between the transformer and neighbouring components and shields must be maintained.

- The radial distance between the EHT coils and any flat metal part (free from sharp edges) should be at least 25 mm.
  The axial distance from the EHT coil should be at least 15 mm.
- The distance from the EHT cap and lead should be at least 25 mm.
- The distance between the primary coil and any flat and smooth metal part should be at least 10 mm.
- The distance between the upper edge of the DY802 socket and the primary coil should be at least 7 mm.

In the design of a printed-wiring board and also of a handwired chassis the following peak pulse voltages should be taken into account:

Connection (1)	: -	500 V_{p-p}
(5), (4)	: +	500 V_{p-p}
(6)	: +	1100 V_{p-p}

The capacitance of the leads to the PL 504 and PY 88 caps should be less than 2 pF.

Note: The transformer and the leads and components carrying high tension pulses should be kept free from metal particles, solder drops etc.

The operating temperature of the transformer coils and the core should not exceed 95 °C under worst circumstances, i.e. taking into account:
- overvoltage
- low atmospheric pressure (at high altitudes) implying bad cooling by convection
- high room temperature (up to 45 °C).

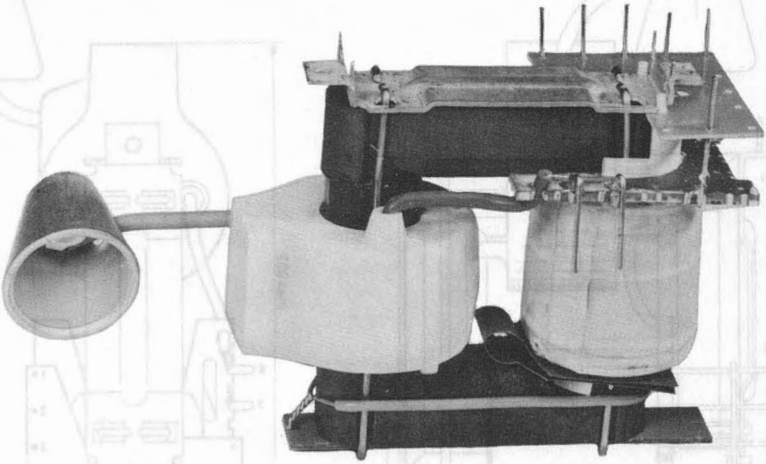
Direct heat radiation from the PL 504 and PY 88 anodes to the transformer and the heater cable should be avoided by a screen. (If this screen is made from insulating material, it should be placed at least 15 mm from the coils.)

The socket of the DY802 should not be exposed to any direct heat radiation from the PL 504 and the PY 88.

The heater cable should be able to withstand 95 °C without the risk of the copper core damaging the insulating material under mechanical stress; a p.v.c. sleeve for mechanical protection is sufficient.

Ample cool air circulation should be provided around the transformer.

LINE-OUTPUT TRANSFORMER



RZ 17574-1

For tube-equipped television receivers
Without auxiliary winding

APPLICATION

This line-output transformer has been developed to provide the required scanning amplitude for 17, 19, 20, 23 or 24 inch picture tubes in television receivers presenting 625 lines at 50 frames per second (CCIR) or 525 lines at 60 frames per second (USA).
It is intended for use in conjunction with deflection unit AT1040, linearity control unit AT4042/02, line-output tube PL504, rectifying tube DY802 and booster diode PY88. The EHT is stabilised at 18 kV.

CONSTRUCTION

The magnetic circuit of the transformer comprises a ferroxcube U-core and a ferroxcube I-core. The primary winding 5-8 and the secondary windings 1-2 and 3-4 (see Fig.2) are polyester dipped and situated on one leg of the core.
The EHT winding is polyester encapsulated and situated on the other leg.

The transformer has been provided with four mounting pins and two threaded holes for mounting.

External circuit connection is made to connecting pins, positioned as indicated in Fig.1.

Dimensions in mm

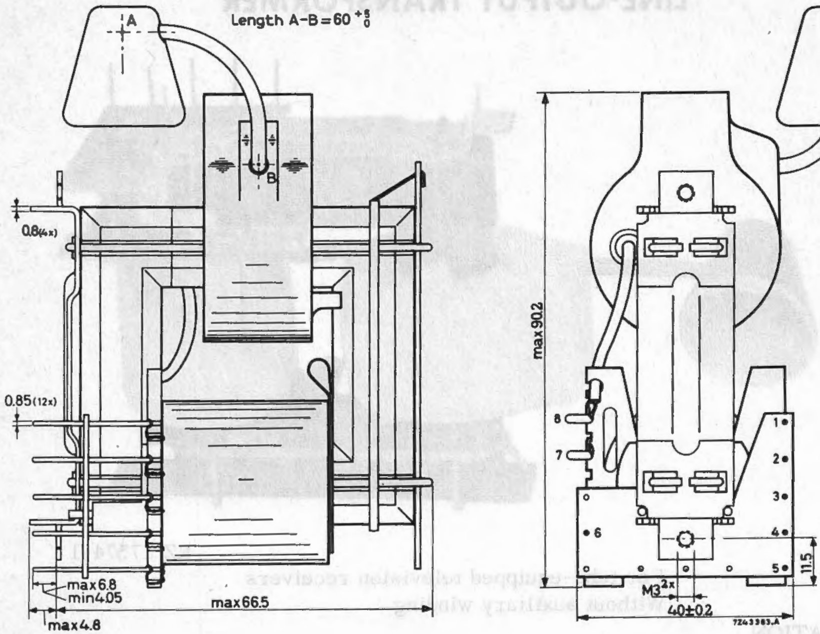


Fig.1

ELECTRICAL DATA (see Fig.2)

The electrical data are measured with a booster load at connection (5) of 1 mA and a capacitance of 100 pF between connections (1) and (4), at different values of capacitor C4.

C4	120 pF		270 pF		390 pF		
Beam current 1)	35	400	35	400	35	400	μA
Supply voltage 2)	240	234	240	234	240	234	V
Booster voltage	632	616	640	622	648	632	V
EHT voltage	18.3	17.0	18.2	16.9	18.1	16.8	kV
Overscan 1)	+7		+9		+11		%
Stability down to	212	217	215	220	217	222	V
Flyback ratio	16.8		17		17.2		%
Internal resistance of EHT		≤ 4.5		≤ 4.5		≤ 4.5	MΩ

1) A beam current increase of 200 μA results in an amplitude increase of maximum 2%.

2) Internal resistance of power supply = 180 Ω.

C4	120 pF		270 pF		390 pF		
PY88							
Average booster current	110	150	109	149	110	150	mA
Peak booster current	250		250		250		mA
Booster current at end of scan	50		50		50		mA
Peak booster voltage			5.4				kV
PL504							
Peak cathode current			280	330			mA
Peak anode current			270	320			mA
Average screen-grid current			10				mA
Average screen-grid voltage			220				V
Anode dissipation				11.5			W
Screen-grid dissipation			3				W
Peak anode voltage			6.8				kV

The transformer core should not be left "floating", but must be connected to the chassis.

Driving pulse of the PL504:
- Cut-off time at least 19% at −100 V
- Peak voltage higher than −120 V
- Slope of leading edge of driving pulse less than 2 μs per 100 V. The shape of the driving pulse in the conducting period of the PL504 should be such that the booster current at end-of-scan (measured with zero beam current) just does not disappear.

The maximum load on the transformer, including the booster load (but excluding the load of the VDR stabilization circuit) should not exceed 2.5 W. This load results in a current increase of about 15 mA.

The maximum capacitive load is (with a view to parasitic oscillations after flyback):

to be established

Line-output stage (see Fig. 2)

C1 4700 pF ceramic
C2 22000 pF ceramic
C3 270 pF ceramic, 1000 V_{dc}
C4 120-390 pF ceramic, 2000 V_{p-p}, amplitude adjustment
C5 27000 pF } paper, 1300 V
C7 56000 pF } booster capacitors
C6 0.22 μF (5%) } S-correctors 1)
C8 0.27 μF (5%) }

R1 2.2 MΩ, 1200 V_{p-p}
R2 1000 Ω, 1/4 W
R3 2200 Ω, 2 W 2)
R4 10 MΩ, 1200 V_{dc}
R5 0.5 MΩ, potentiometer, booster voltage adjustment
R6 1500 Ω, 1 W
R7 2700 Ω, 1 W
VDR 2322 564 90014 (910 V)

1) The picture width depends on this value.
2) With low supply voltage, dissipation may exceed 1 W.

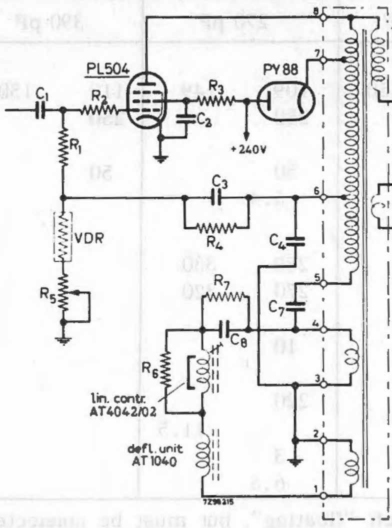


Fig.2.

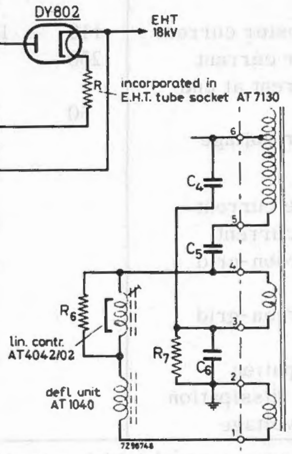


Fig.2a

The operation of the transformer is influenced by its surroundings. Variations in electrical characteristics due to the influence of surrounding components, shields and circuitry can be compensated to a certain degree by selecting the right value for the capacitor C4.

The deflection unit is connected to a secondary which is separated from the primary by the booster capacitor C7. Pulses for blanking, synchronisation, etc. are to be taken directly from the deflection unit connections. There is no auxiliary winding on this transformer. A circuit diagram of a flywheel synchronisation circuit is given below.

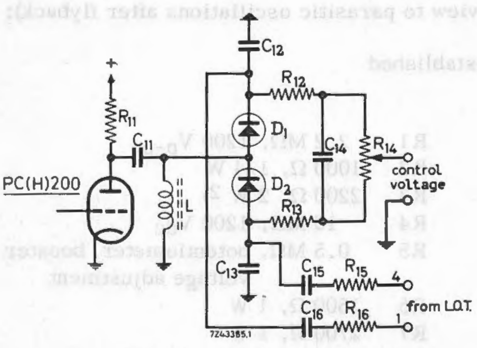


Fig.3

C11	6800 pF, ceramic
C12, C13	1000 pF, ceramic
C14	0.1 μF, polyester
C15, C16	120 pF, ceramic
R11	10 kΩ, 1/2 W
R12, R13	39 kΩ, 1/4 W
R14	5 MΩ, trimmer potentiometer
R15, R16	15 kΩ, 1/4 W
L	25-35 mH, choke
D1, D2	OA202

The split secondary offers two possibilities to the setmaker. If the transformer is connected according to Fig.2, the conventional circuit is obtained, with booster capacitor C7 = 56 nF and S-correction capacitor C8 = 270 nF (±5%).
If, however, the S-correction capacitor is placed between the two halves of the secondary (C6 in Fig.2a), the booster capacitance has to be reduced considerably (27 nF instead of 56 nF) because the parabola voltages on C6 and C5 are of opposite sign. Besides, the S-correction capacitor has to be reduced (220 nF). This means an important saving in cost.
From connection (3) a parabola-shaped voltage of 90 V_{p-p} can be taken for use in the TV set.
If the resistive load on connection (3) is about 2700 Ω or less, the resistor R7 (damping resistor against dynatron oscillations) can be omitted. The load resistance should, however, not be lower than about 820 Ω.

If the boosted d.c. voltage is needed elsewhere in the set, it has to be filtered from the booster parabola voltage and from the flyback peaks.

MOUNTING

The transformer can be mounted on either a printed-wiring board or a metal chassis. The latter should be apertured as shown in the mounting diagram, Fig.4, to pass the pins. The transformer is secured by two 3 mm screws. The mounting pins can be bent or soldered.
When mounted on a printed-wiring board the transformer is secured by means of its four mounting pins and two 3 mm screws. The fit of the connecting pins in a printed-wiring grid with a pitch of 0.1 inch is illustrated in Fig.5.

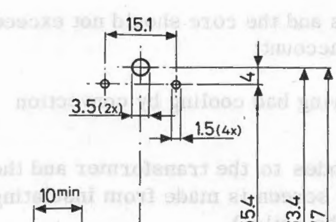


Fig.4

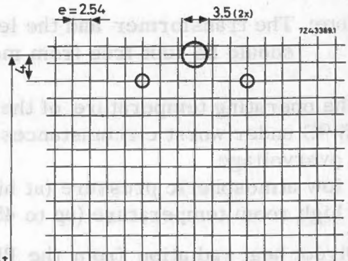


Fig.5

Like the other connections, those to the PL504 and PY88 can be soldered to the printed-wiring board. If bent upwards (as supplied) they are very suitable for direct connection to the anode caps of these tubes.

A tube socket for the DY802 (type AT7130) comprising a resistor (R, Fig.2) of 1.6 Ω is available, for ordering this socket use the catalog number 3122 107 31240. See also the relevant data sheet.

Certain minimum distances between the transformer and neighbouring components and shields must be maintained.

- The radial distance between the EHT coils and any flat metal part (free from sharp edges) should be at least 25 mm.
  The axial distance from the EHT coil should be at least 15 mm.
- The distance from the EHT cap and lead should be at least 25 mm.
- The distance between the primary coil and any flat and smooth metal part should be at least 10 mm.
- The distance between the upper edge of the DY802 socket and the primary coil should be at least 7 mm.

In the design of a printed-wiring board and also of a handwired chassis the following peak pulse voltages should be taken into account:

Connection (1)	:	$- 500\ V_{p-p}$
(5), (4)	:	$+ 500\ V_{p-p}$
(6)	:	$+1100\ V_{p-p}$

The capacitance of the leads to the PL504 and PY88 caps should be less than 2 pF.

Note: The transformer and the leads and components carrying high tension pulses should be kept free from metal particles, solder drops etc.

The operating temperature of the transformer coils and the core should not exceed 95 °C under worst circumstances, i.e. taking into account:

- overvoltage
- low atmospheric pressure (at high altitudes) implying bad cooling by convection
- high room temperature (up to 45 °C).

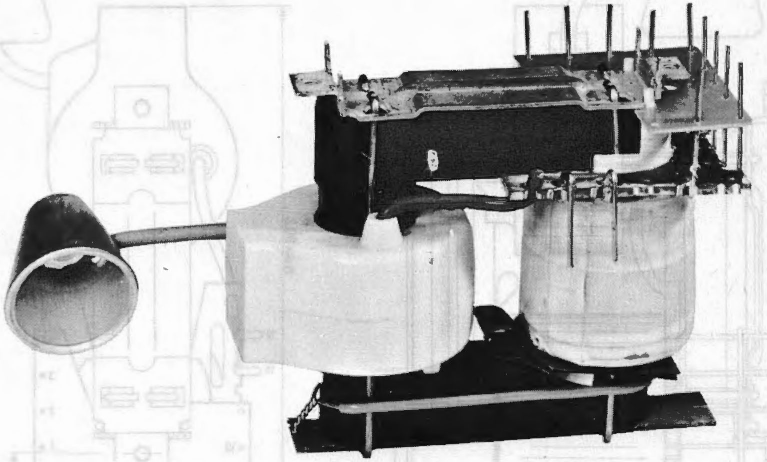
Direct heat radiation from the PL504 and PY88 anodes to the transformer and the heater cable should be avoided by a screen. (If this screen is made from insulating material, it should be placed at least 15 mm from the coils.)

The socket of the DY802 should not be exposed to any direct heat radiation from the PL504 and the PY88.

The heater cable should be able to withstand 95 °C without the risk of the copper core damaging the insulating material under mechanical stress; a p.v.c. sleeve for mechanical protection is sufficient.

Ample cool air circulation should be provided around the transformer.

LINE-OUTPUT TRANSFORMER



RZ 17574-1R

For tube-equipped television receivers
With auxiliary winding

APPLICATION

This line-output transformer has been developed to provide the required scanning amplitude for 17, 19, 20, 23 or 24 inch picture tubes in television receivers presenting 625 lines at 50 frames per second (CCIR) or 525 lines at 60 frames per second (USA).
It is intended for use in conjunction with deflection unit AT1040, linearity control unit AT4042/02, line-output tube PL504, rectifying tube DY802 and booster diode PY88. The EHT is stabilised at 18 kV.

CONSTRUCTION

The magnetic circuit of the transformer comprises a ferroxcube U-core and a ferroxcube I-core. The primary winding 9-12, the secondary windings 5-6 and 7-8 and the auxiliary winding 1-4 (see Fig.2) are polyester dipped and situated on one leg of the core. The EHT winding is polyester encapsulated and situated on the other leg.

The transformer has been provided with four mounting pins and two threaded holes for mounting.
External circuit connection is made to connecting pins, positioned as indicated in Fig.1.

Dimensions in mm

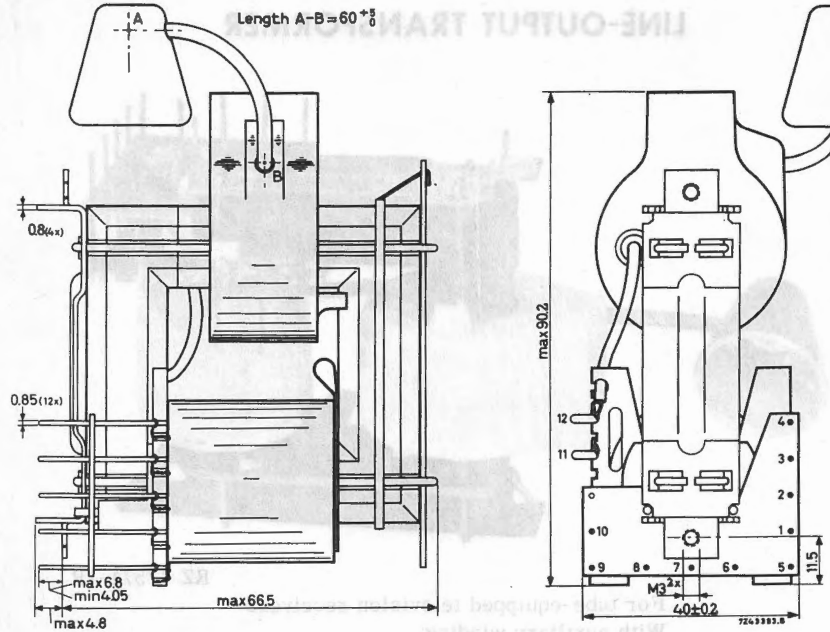


Fig.1

→ ELECTRICAL DATA (see Fig.2)

The electrical data are measured with a booster load at connection (9) of 1 mA and a capacitance of 100 pF between connections (5) and (8) at different values of capacitor C4.

C4	120 pF		270 pF		390 pF		
Beam current [1]	35	400	35	400	35	400	μA
Supply voltage [2]	240	234	240	234	240	234	V
Booster voltage	632	616	640	622	648	632	V
EHT voltage	18.9	17.0	18.2	16.9	18.1	16.8	kV
Overscan [1]	+7		+9		+11		%
Stability down to	212	217	215	220	217	222	V
Flyback ratio	16.8		17		17.2		%
Internal resistance of EHT		≤ 4.5		≤ 4.5		≤ 4.5	MΩ

1) A beam current increase of 200 μA results in an amplitude increase of maximum 2%.

2) Internal resistance of power supply = 180 Ω.

C4	120 pF		270 pF		390 pF		
Auxiliary voltage between (1) and (2)			−110				V_{p-p}
Auxiliary voltage between (3) and (2)			+110				V_{p-p}
Auxiliary voltage between (4) and (2)			+220				V_{p-p}
PY88							
Average booster current	110	150	109	149	110	150	mA
Peak booster current	250		250	250	250		mA
Booster current at end of scan	50		50	100	50		mA
Peak booster voltage			5.4				kV
PL504							
Peak cathode current			280	330			mA
Peak anode current			270	320			mA
Average screen-grid current			10				mA
Average screen-grid voltage			220				V
Anode dissipation				11.5			W
Screen-grid dissipation			3				W
Peak anode voltage			6.8				kV

The transformer core should not be left "floating", but must be connected to the chassis.

Driving pulse of the PL504:

Cut-off time at least 19% at −100 V

Peak voltage higher than −120 V

Slope of leading edge of driving pulse less than 2 μs per 100 V. The shape of the driving pulse in the conducting period of the PL504 should be such that the booster current at end-of-scan (measured with zero beam current) just does not disappear.

The maximum load on the transformer, including the booster load (but excluding the load of the VDR stabilization circuit) should not exceed 2.5 W.
This load results in a current increase of about 15 mA.

The maximum capacitive load is (with a view to parasitic oscillations after flyback):

to be established

Line-output stage

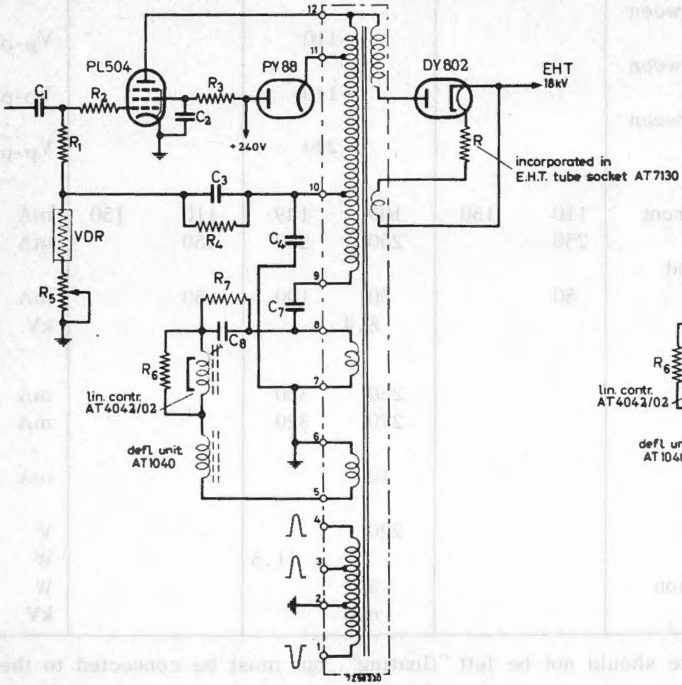


Fig.2

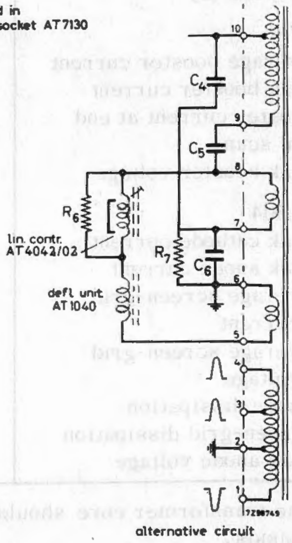


Fig.2a

C1	4700 pF	ceramic
C2	22000 pF	ceramic
C3	270 pF	ceramic, 1000 V_{dc}
C4	120-390 pF	ceramic, 2000 V_{p-p}, amplitude adjustment
C5	27000 pF	paper, 1300 V booster capacitors
C7	56000 pF	paper, 1300 V booster capacitors
C6	0.22 μF (5%)	S-correctors 1)
C8	0.27 μF (5%)	S-correctors 1)

R1	2.2 MΩ, 1200 V_{p-p}
R2	1000 Ω, 1/4 W
R3	2200 Ω, 2 W 2)
R4	10 MΩ, 1200 V_{dc}
R5	0.5 MΩ, potentiometer, booster voltage adjustment
R6	1500 Ω, 1 W
R7	2700 Ω, 1 W
VDR	2322 564 90014 (910 V)

1) The picture width depends on this value.
2) With low supply voltage, dissipation may exceed 1 W.

The operation of the transformer is influenced by its surroundings. Variations in electrical characteristics due to the influence of surrounding components, shields and circuitry can be compensated to a certain degree by selecting the right value for the capacitor C4.

The deflection unit is connected to a secondary which is separated from the primary by the booster capacitor C7. Pulses for blanking, synchronisation, etc. are to be taken directly from the deflection unit connections. There is an auxiliary winding on this transformer, which delivers +110 V_{p-p}, +220 V_{p-p} and −110 V_{p-p} if connection (2) is connected to earth. A circuit diagram of a flywheel synchronisation circuit is given below.

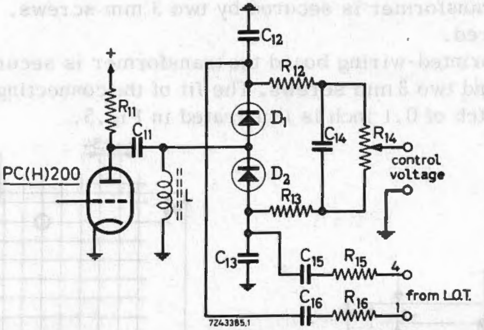


Fig.3

C11	6800 pF, ceramic
C12, C13	1000 pF, ceramic
C14	0.1 μF, polyester
C15, C16	120 pF, ceramic
R11	10 kΩ, 1/2 W
R12, R13	39 kΩ, 1/4 W
R14	5 MΩ, trimmer potentiometer
R15, R16	15 kΩ, 1/4 W
L	25-35 mH, choke
D1, D2	OA202

The split secondary offers two possibilities to the setmaker. If the transformer is connected according to Fig.2, the conventional circuit is obtained, with booster capacitor C7 = 56 nF and S-correction capacitor C8 = 270 nF (± 5%).

If, however, the S-correction capacitor is placed between the two halves of the secondary (C6 in Fig.2a), the booster capacitance has to be reduced considerably (27 nF instead of 56 nF) because the parabola voltages on C6 and C5 are of opposite sign. Besides, the S-correction capacitor has to be reduced (220 nF). This means an important saving in cost.

From connection (7) a parabola-shaped voltage of 90 V_{p-p} can be taken for use in the TV set.
If the resistive load on connection (7) is about 2700 Ω or less, the resistor R7 (damping resistor against dynatron oscillations) can be omitted. The load resistance should, however, not be lower than about 820 Ω.
If the boosted d.c. voltage is needed elsewhere in the set, it has to be filtered from the booster parabola voltage and from the flyback peaks.

MOUNTING

The transformer can be mounted on either a printed-wiring board or a metal chassis. The latter should be apertured as shown in the mounting diagram, Fig.4, to pass the pins. The transformer is secured by two 3 mm screws. The mounting pins can be bent or soldered.
When mounted on a printed-wiring board the transformer is secured by means of its four mounting pins and two 3 mm screws. The fit of the connecting pins in a printed-wiring grid with a pitch of 0.1 inch is illustrated in Fig.5.

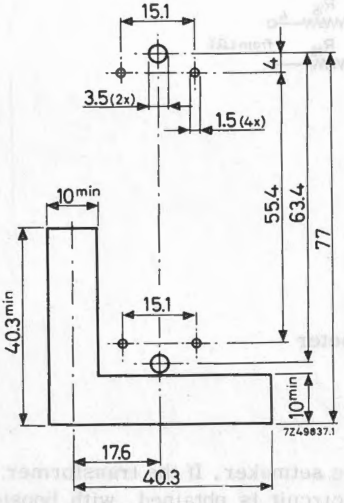


Fig.4

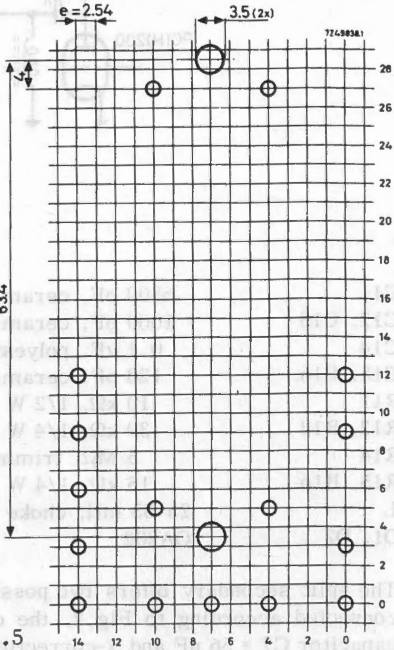


Fig.5

Like the other connections, those to the PL504 and PY88 can be soldered to the printed-wiring board. If bent upwards (as supplied) they are very suitable for direct connection to the anode caps of these tubes.
A tube socket for the DY802 (type AT7130) comprising a resistor (R, Fig.2) of 1.6 Ω is available; for ordering this socket use the catalog number 3122 107 31240. See also the relevant data sheet.

Certain minimum distances between the transformer and neighbouring components and shields must be maintained.

- The radial distance between the EHT coils and any flat metal part (free from sharp edges) should be at least 25 mm.
  The axial distance from the EHT coil should be at least 15 mm.
- The distance from the EHT cap and lead should be at least 25 mm.
- The distance between the primary coil and any flat and smooth metal part should be at least 10 mm.
- The distance between the upper edge of the DY802 socket and the primary coil should be at least 7 mm.

In the design of a printed-wiring board and also of a handwired chassis the following peak pulse voltages should be taken into account:

Connection	(1)	: $-$ 110 V_{p-p}
	(3)	: + 110 V_{p-p}
	(4)	: + 220 V_{p-p}
	(5)	: $-$ 500 V_{p-p}
	(9)	: + 500 V_{p-p}
	(10)	: +1100 V_{p-p}

The capacitance of the leads to the PL504 and PY88 caps should be less than 2 pF.

Note: The transformer and the leads and components carrying high tension pulses should be kept free from metal particles, solder drops etc.

The operating temperature of the transformer coils and the core should not exceed 95 °C under worst circumstances, i.e. taking into account:

- overvoltage
- low atmospheric pressure (at high altitudes) implying bad cooling by convection
- high room temperature (up to 45 °C).

Direct heat radiation from the PL504 and PY88 anodes to the transformer and the heater cable should be avoided by a screen. (If this screen is made from insulating material, it should be placed at least 15 mm from the coils).

The socket of the DY802 should not be exposed to any direct heat radiation from the PL504 and the PY88.

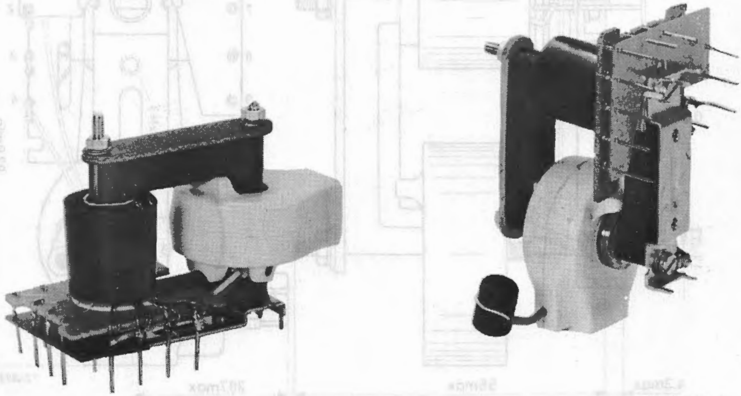
The heater cable should be able to withstand 95 °C without the risk of the copper core damaging the insulating material under mechanical stress; a p.v.c. sleeve for mechanical protection is sufficient.

Ample cool air circulation should be provided around the transformer.

LINE-OUTPUT TRANSFORMER

This line-output transformer is derived from the AT2036/25. Provided with an E.H.T. lead of 75 + 5 mm, without E.H.T. cap, it can be used with E.H.T. solid-state rectifier stacks.
For further data, see data sheets of the line-output transformer AT2036/25.

LINE-OUTPUT TRANSFORMER



RZ 20305-1

For transistor-equipped television receivers

APPLICATION

This line-output transformer has been developed to provide the required scanning amplitude for the 11 inch 90° picture tube A28-14W and the 12 inch 90° picture tube A31-20W in transistor-equipped television receivers presenting 625 lines at 50 frames per second (C.C.I.R.) or 525 lines at 60 frames per second (U.S.A.). It is intended for use in conjunction with deflection unit AT1020/01, linearity control unit AT4036, line-output transistor AU103, parallel diode BY118 and rectifying tube DY51.

CONSTRUCTION

The magnetic circuit of the transformer comprises two ferroxcube U-cores. The primary winding 1-4 and the secondary windings 5-12 and 10-11 (see Fig.2) are situated on one leg of the transformer. On the opposite leg, the E.H.T. winding is situated. This winding is polyester-encapsulated and is terminated in a conductive rubber grommet in which the anode lead of the E.H.T. rectifier may be inserted.

The transformer has been provided with four mounting pins and two threaded holes for mounting.

External circuit connection is made to connecting pins, positioned as indicated in Fig.1.

Dimensions in mm

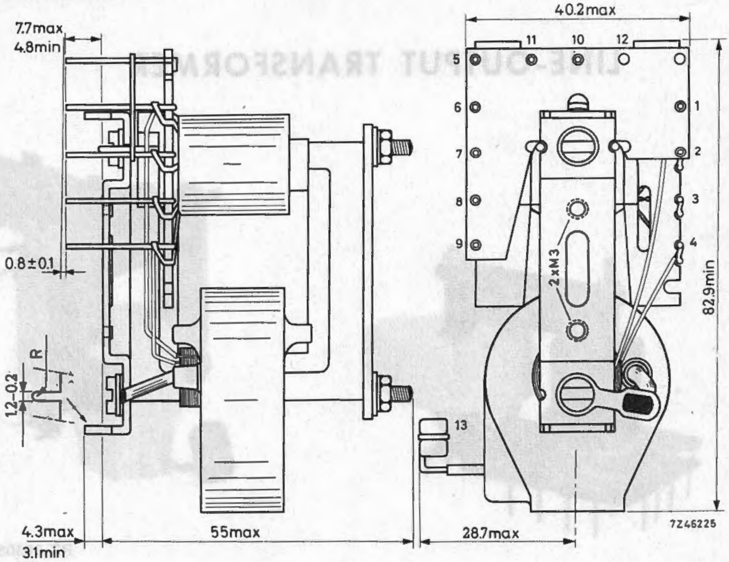


Fig.1

ELECTRICAL DATA

E.H.T. voltage (no load)	11 kV
Flyback ratio	17.5 %
Average current	0.52 A
Overscan	5 %

The values mentioned above have been measured with an extra winding on the transformer (load of 1 W) and including a heating power of the E.H.T. rectifier DY51 of 0.77 W.

Line-output stage

The line-output circuit of Fig.2 is designed around the line-output transistor AU103, the parallel diode BY118 and the E.H.T. rectifier DY51.
The circuit is fed from a stabilized power supply at 11 V and driven by a pulse of the shape shown.

The deflection unit AT1020/01 and the series connected adjustable linearity control unit AT4036 are connected in parallel with the diode BY118. The 0.068 μF capacitor and the various parasitic capacitances of the transformer form, together with the inductances of the deflection unit and the transformer, a resonant LC circuit which determines the flyback time.

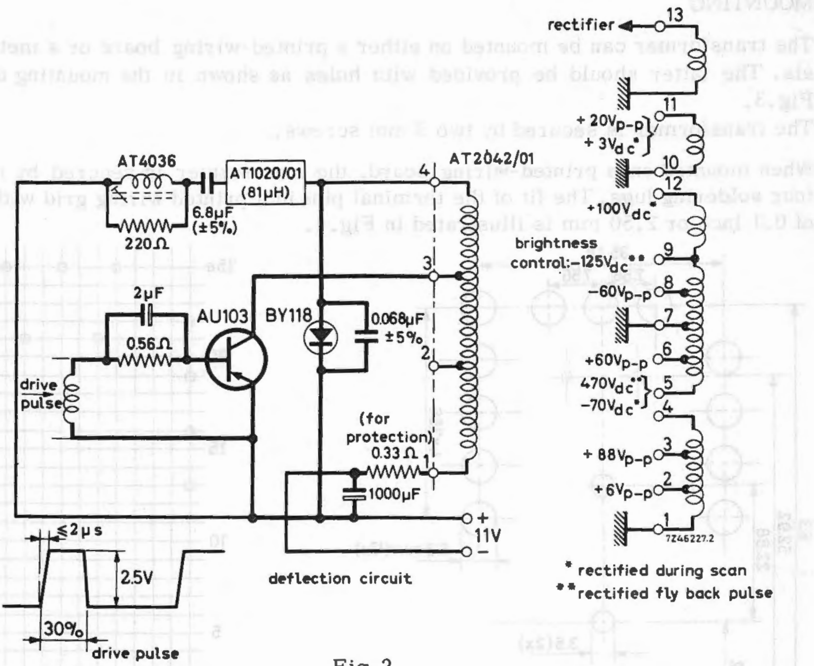


Fig.2

To damp ringing oscillations, the coil of the linearity control unit must be shunted by a 220 Ω, 1 W, carbon resistor. To prevent spurious oscillations, which would manifest themselves as ringing bars in the picture, the connecting leads should be as short as possible. In Fig.2 the critical leads are indicated by heavy lines. The 0.068 μF capacitor, especially, should be closely connected to the parallel diode BY118.

The heater current for the DY51 may be supplied by two turns around the cross member of the transformer core, in series with a resistor of 0.5 Ω.

The supply voltage for the transistor in the video-output stage of the receiver and for the first anode and focus electrode of the picture tube is available at terminal 5.

The supply voltage for the brightness control of the picture tube is provided by the winding 9-12.

Symmetrical voltage pulses of 60 V for a.g.c. gating and horizontal synchronizing circuits are available at terminals 6 and 8.

Where a d.c. voltage with low spread in value and low internal resistance is required, the best way to obtain it is by rectification during the scan. Less critical voltages can be obtained by pulse rectification during flyback.

MOUNTING

The transformer can be mounted on either a printed-wiring board or a metal chassis. The latter should be provided with holes as shown in the mounting diagram, Fig.3.
The transformer is secured by two 3 mm screws.

When mounted on a printed-wiring board, the transformer is secured by means of four soldering lugs. The fit of the terminal pins in a printed-wiring grid with a pitch of 0.1 inch or 2.50 mm is illustrated in Fig.4.

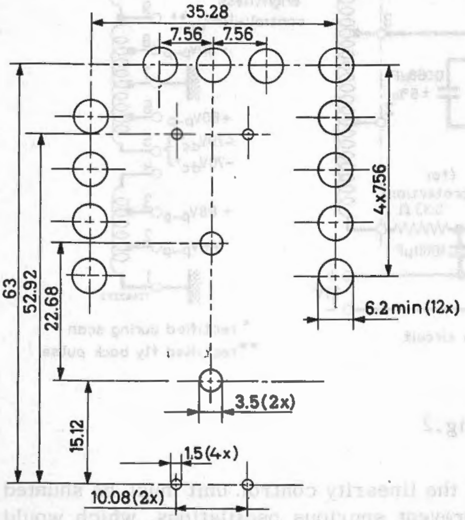


Fig.3

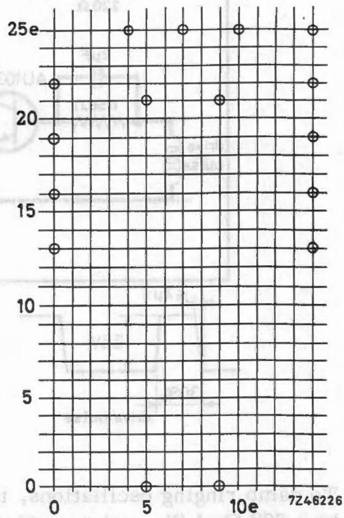


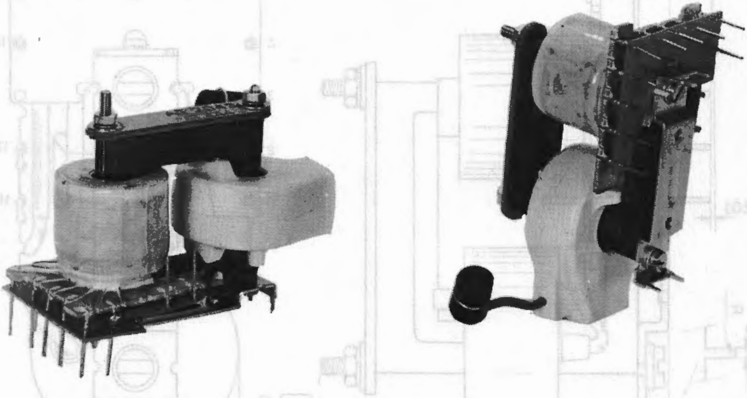
Fig.4 (e = 0.1 inch or 2.50 mm)

Whether it is board- or chassis-mounted the core of the transformer must be earthed.

A special tube socket for the DY51 rectifier (type number AT7108/50) is delivered with the line-output transformer. The socket includes a plate with soldering tags for making circuit connections to the tube, and can be secured to the transformer by means of a screw.
The following minimum distances between the transformer and neighbouring conductive surfaces must be maintained:
- radially from the E.H.T. winding, 18 mm
- axially from the E.H.T. winding, 10 mm
- radially and axially from the primary winding, 8 mm.

To avoid corona discharge, care must be taken that the anode lead of the E.H.T. rectifier does not protrude beyond the rubber grommet.

LINE-OUTPUT TRANSFORMER



RZ 20305-2

For tube-equipped television receivers

APPLICATION

This line-output transformer has been developed to provide the required scanning amplitude for the 11 inch 90° picture tube A28-14W and the 12 inch 90° picture tube A31-20W in tube-equipped television receivers presenting 625 lines at 50 frames per second (C.C.I.R.) or 525 lines at 60 frames per second (U.S.A.).
It is intended for use in conjunction with deflection unit AT1021/01, linearity control unit AT4037, line-output tube PL81, booster diode PY81 and rectifying tube DY51.
Thanks to the low deflection power requirement of the picture tubes mentioned above, the transformer losses are small and its operating temperature is, therefore, advantageously low, which is important in view of the use of semiconductor devices in the television receiver.

CONSTRUCTION

The magnetic circuit of the transformer comprises two ferroxcube U-cores. The primary winding 9-12, secondary windings 1-2 and 3-4 and auxiliary windings 5-6 and 7-8 (see Fig.2) are polyester dipped and situated on one leg of the core.
The E.H.T. winding 10-13 is polyester encapsulated and situated on the other leg. Terminal 13 is a conductive rubber grommet in which the anode lead of the E.H.T. rectifier may be inserted.

The transformer has been provided with four mounting pins and two threaded holes for mounting.

External circuit connection is made to connecting pins, positioned as indicated in Fig.1.

Dimensions in mm

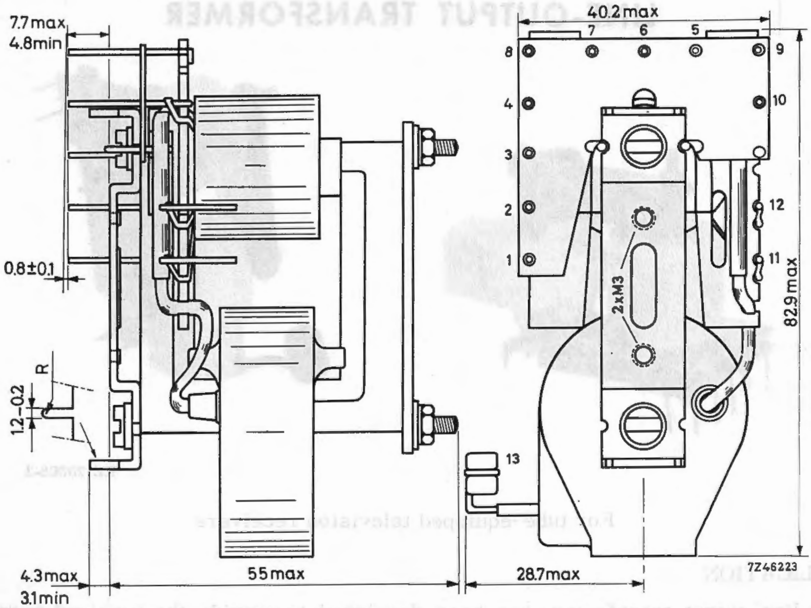


Fig.1

ELECTRICAL DATA

E.H.T. voltage (no load)	11 kV
Booster voltage	240 + 440 = 680 V
Flyback ratio	17.5 %
Average current	38 mA
Overscan	5 %
Maximum load capability of auxiliary windings 5-6 and 7-8	0.7 W, during scan
	0.3 W, during flyback

Line-output stage

The circuit of Fig.2 is designed around the line-output tube PL81, the booster diode PY81, and the E.H.T. rectifier DY51.
The stabilizing circuit for the supply voltage includes the voltage-dependent resistor 2322 564 90014, which operates down to a supply voltage of about 205 V.
The stabilizing circuit must be adjusted to the nominal value of the booster voltage (680 V) at the nominal value of the supply voltage (240 V) by means of the 500 kΩ potentiometer.

One terminal of the 0.022 μF booster capacitor is connected to the positive terminal of the voltage supply, so that at an adjusted voltage of 440 V across the capacitor the total booster voltage is 680 V. The scanning amplitude and E.H.T. will then be correct, since the line-output transformer has been made for the proper ratio of booster voltage, E.H.T. and scanning amplitude, within narrow tolerances.
The drive voltage must be adjusted so that the booster diode conducts throughout the whole scanning period, the booster current at the end of the scan ranging from 5 to 10 mA.

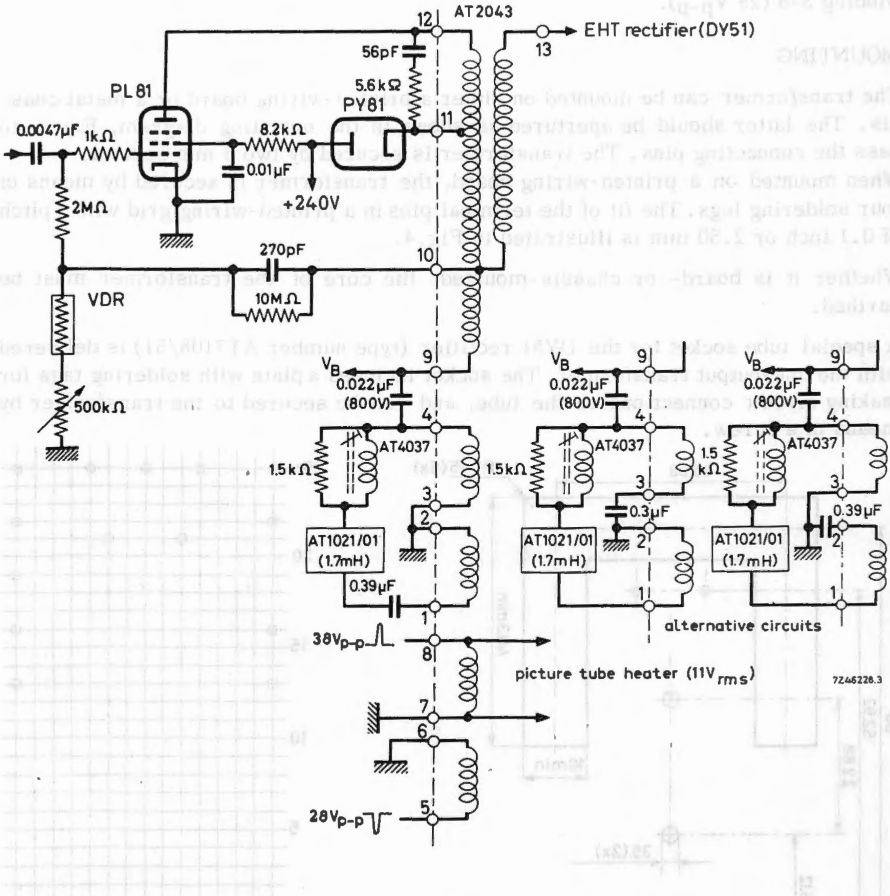


Fig.2

The deflection unit AT1021/01 and the adjustable linearity control unit AT4037 are connected to the secondary winding 1-4 of the line-output transformer. The split secondary winding offers the set manufacturer three possible modes of connection.

To minimize ringing oscillations after flyback, the linearity control unit AT4037 must be connected nearest to terminal 4, that is, to the "positive" side of the deflection unit AT1021/01. In addition, the coil of the linearity control unit must be shunted by a 1500 Ω, 1 W, carbon resistor.

The heater current for the DY51, may be supplied by a single turn around the cross member of the transformer core, without series resistor.
The heater supply for the picture tube is provided by the auxiliary winding 7-8, which delivers a peak-to-peak voltage of 38 V, corresponding to 11 V_{rms}. Current supply for transistor circuits in hybrid receivers is provided by the auxiliary winding 5-6 (28 V_{p-p}).

MOUNTING

The transformer can be mounted on either a printed-wiring board or a metal chassis. The latter should be apertured as shown in the mounting diagram, Fig.3, to pass the connecting pins. The transformer is secured by two 3 mm screws.
When mounted on a printed-wiring board, the transformer is secured by means of four soldering lugs. The fit of the terminal pins in a printed-wiring grid with a pitch of 0.1 inch or 2.50 mm is illustrated in Fig.4.

Whether it is board- or chassis-mounted, the core of the transformer must be earthed.

A special tube socket for the DY51 rectifier (type number AT7108/51) is delivered with the line-output transformer. The socket includes a plate with soldering tags for making circuit connections to the tube, and can be secured to the transformer by means of a screw.

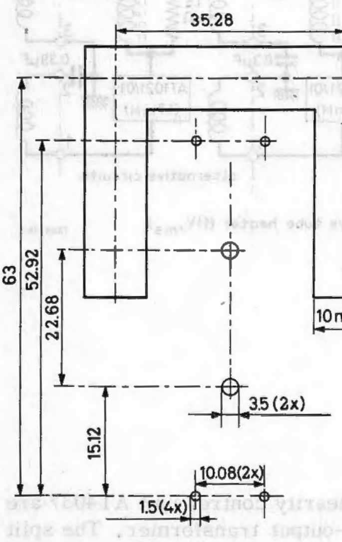


Fig.3

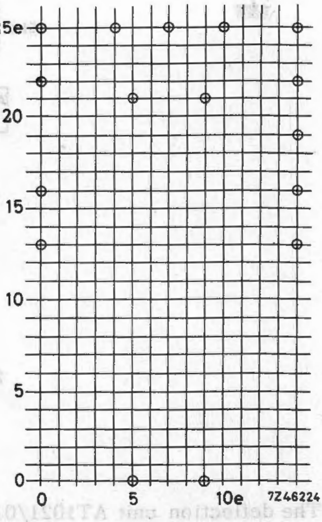


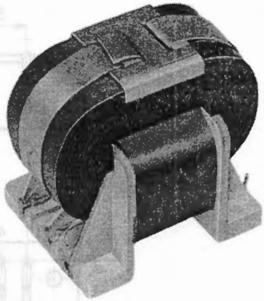
Fig.4 (e = 0.1 inch or 2.50 mm)

The following minimum distances between the transformer and neighbouring conductive surfaces must be maintained:

- radially from the E.H.T. winding, 18 mm
- axially from the E.H.T. winding, 10 mm
- radially and axially from the primary winding, 8 mm.

To avoid corona discharge, care must be taken that the anode lead of the EHT rectifier does not protrude beyond the rubber grommet.

FRAME-OUTPUT TRANSFORMER



RZ 24284-11

For tube-equipped and transistorised television receivers

APPLICATION

This frame-output transformer is intended for use with 19 and 23 inch 110° (114°) picture tubes, in conjunction with the deflection unit AT1040.

CONSTRUCTION

The magnetic circuit of the transformer comprises two C-cores. The transformer has three separate windings; the tertiary winding can be used for voltage feedback. The transformer has been provided with four holes for mounting on either a printed-wiring board or a metal chassis.
External circuit connection is made to connecting pins, positioned as indicated in Fig.1.

Dimensions in mm

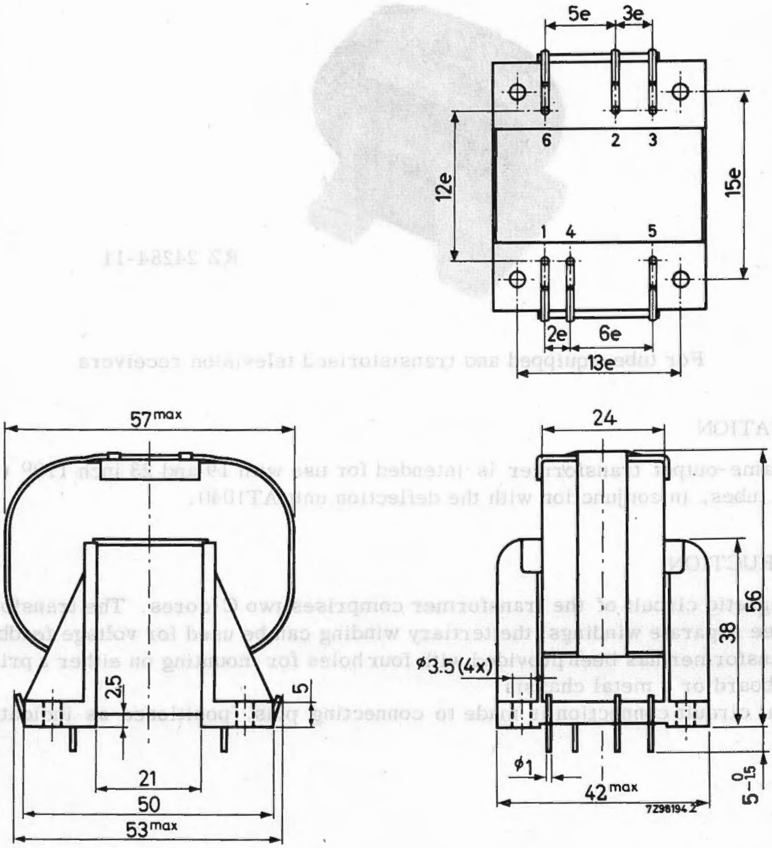


Fig.1. e = 2.52 mm, suitable for mounting on a grid with 2.54 mm (0.1") or 2.50 mm pitch.

ELECTRICAL DATA

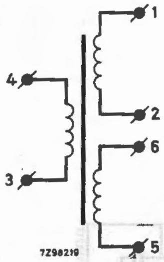


Fig.2

Primary winding	
Connecting terminals	1 and 2
Inductance	
at a primary d.c. current of 55 mA	7.5 H ± 10%
at a primary d.c. current of 70 mA	6 H ± 10%
Resistance	230 Ω ± 12%
Secondary winding	
Connecting terminals	3 and 4
Resistance	9.7 Ω ± 12%
Tertiary winding	
Connecting terminals	5 and 6
Resistance	165 Ω ± 12%
Transformation ratio $\frac{N_{prim}}{N_{sec}}$	5.6
$\frac{N_{prim}}{N_{tert}}$	3.9
Maximum primary d.c. current	75 mA
Maximum primary peak voltage	1500 V
Maximum ambient temperature	70 °C

Frame-output stages

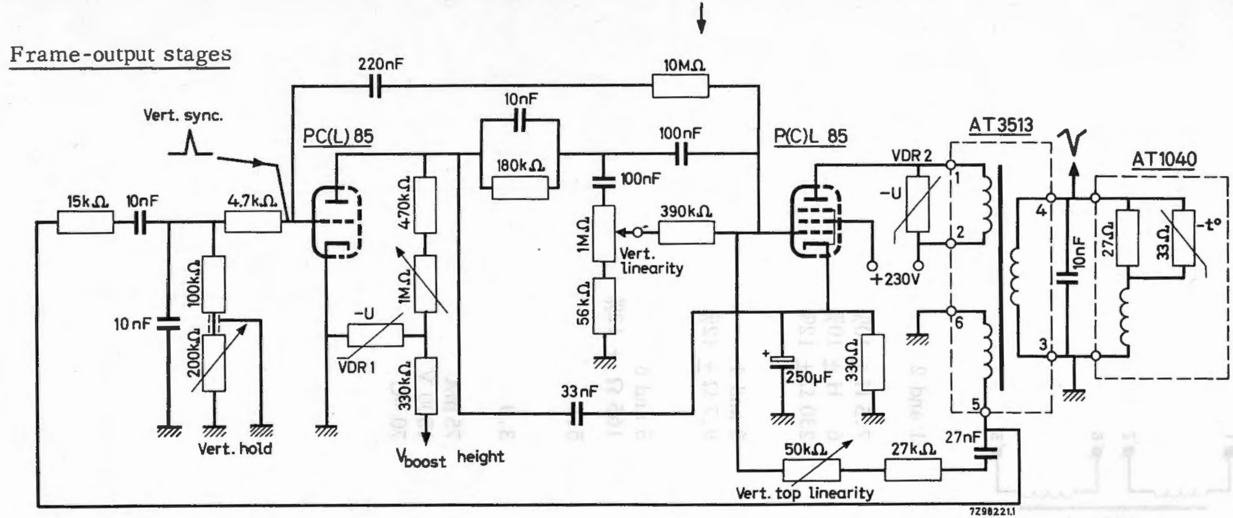


Fig.3

Pentode data:

Supply voltage	230 V
Anode peak voltage 1)	840 V
Anode voltage at end of scan 1)	85 V
Anode peak current	160 mA
Anode d.c. current	57 mA
Anode standing current	12 mA
Anode dissipation	7.2 W
Screen-grid dissipation	1.2 W

Voltage dependent resistors:

$VDR_1 = VDR_2$ 1 W disc, 330 V: 2322 553 03541

1) With respect to chassis.

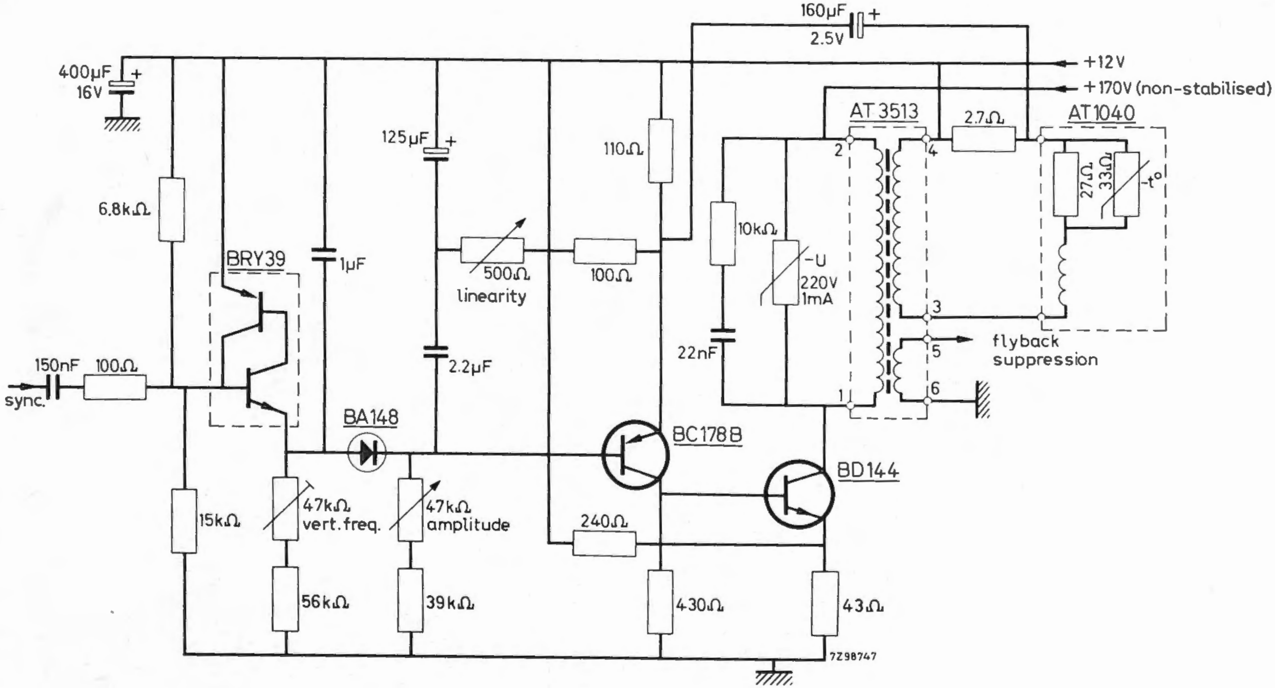

160µF
2.5V
+12V
+170V (non-stabilised)
400µF
16V
AT 3513
2.7Ω
AT 1040
125µF
110Ω
27Ω
33Ω
-t°
6.8kΩ
10kΩ
-U
220V
1mA
BRY39
1µF
500Ω
linearity
100Ω
22nF
flyback
suppression
150nF
100Ω
sync.
2.2µF
BA148
BC178B
BD144
15kΩ
47kΩ
vert.freq.
47kΩ
amplitude
240Ω
56kΩ
39kΩ
430Ω
43Ω
7Z98747

Fig.4

ADJUSTABLE LINEARITY CONTROL UNIT

RZ 20167-1

For tube-equipped television receivers

APPLICATION

This unit has been designed for use in tube-equipped television receivers, to adjust the linearity of the line deflection. It can be used in combination with deflection unit AT 1030 and line-output transformer AT2025/01.

CONSTRUCTION

This control unit consists of a coil wound on a ferroxcube rod, two ferroxdure magnets and one magnet of plastic bonded ferroxdure. The last mentioned magnet is placed around the ferroxcube rod, above the coil. One of the ferroxdure magnets has the shape of a half ring; it is placed around the ferroxcube rod under the coil. The other ferroxdure magnet is cylindrical; it is positioned parallel to and clamped against the ferroxcube rod opposite the first one. It is provided with a square hole to facilitate turning to adjust the biasing field and so the linearity of the line deflection.

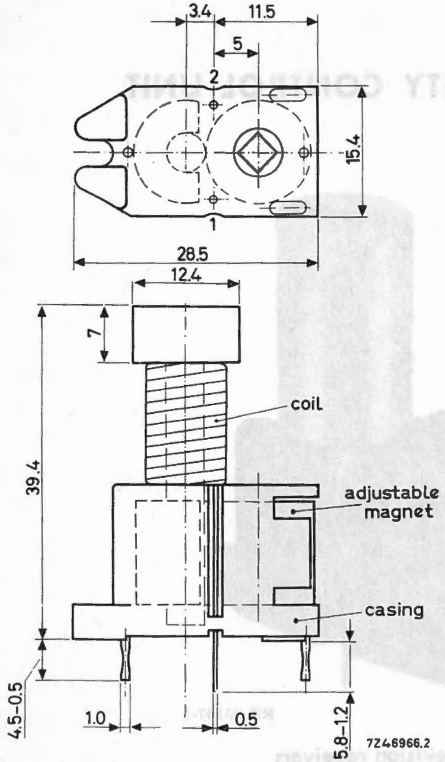


Fig. 1. Dimensions in mm

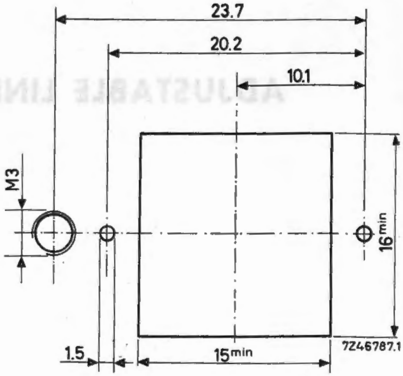


Fig. 2. Hole pattern for mounting on a chassis

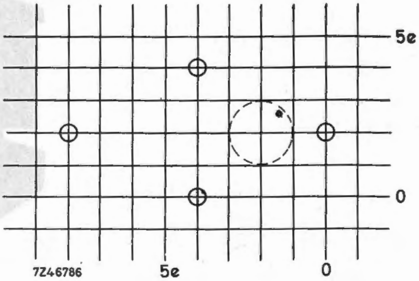


Fig. 3. Hole pattern for mounting on a printed-wiring board (e = 0.1" or 2.50 mm)

ELECTRICAL DATA

When a saw-tooth current (without S-correction) of 2.4 A_{p-p}, frequency 15,625 Hz, flyback ratio 18%, flows through the linearity control unit (one connection point to earth), the correction voltage is adjustable between 12 V and 24 V.

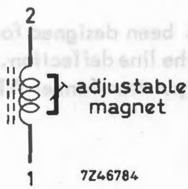


Fig. 4. Circuit diagram

MOUNTING

The unit can be mounted either on printed-wiring boards by means of its two connection pins and two mounting pins (see Fig. 3), or on metal chassis, by bending of the two mounting pins and/or by means of a screw through an aperture in the casing (see Fig. 2). To prevent distortion of the magnetic field no iron part should approach the magnetic parts anywhere nearer than 3 mm. The coil should be shunted with a 1 W carbon resistor of 1500 Ω to damp ringing phenomena.

* Hole only necessary for bottom adjustment.

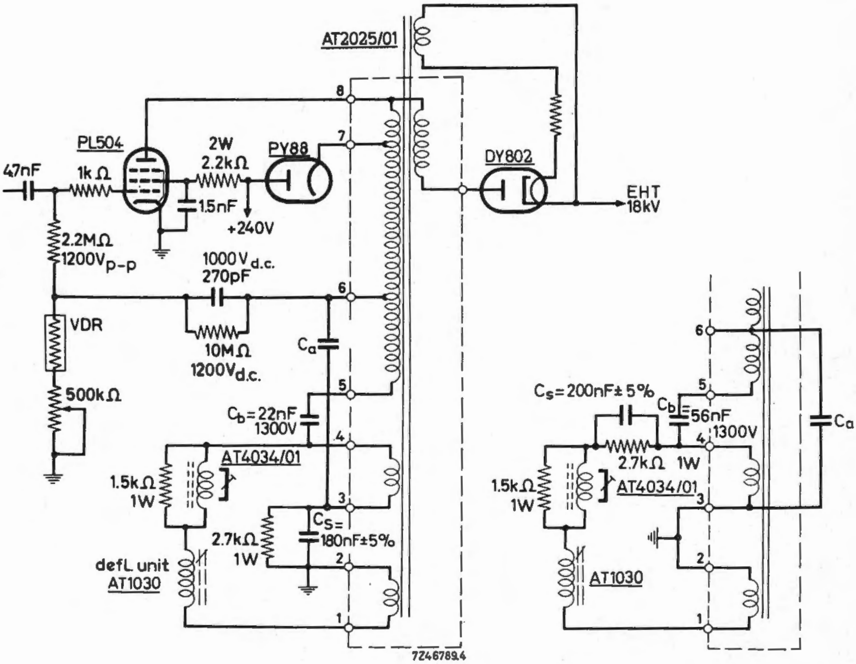


Fig. 5. Two versions of a line-output stage.
C_a 0–270 pF, 2000 V_{p-p}, amplitude adjustment
C_b booster capacitor
C_s S-corrector
VDR = 2322 564 90014 (910 V)

ADJUSTABLE LINEARITY CONTROL UNITS

RZ 19806-3

AT 4036

RZ 19806-2

AT 4037

For tube-equipped (AT4037) and transistor-equipped (AT4036) television receivers

APPLICATION

These linearity control units are designed to be used in television receivers, in combination with the 11 inch 90° picture tube A28-14W and the 12 inch 90° picture tube A31-20W.
The unit AT4036 is intended for use in transistor-equipped sets, in conjunction with the deflection unit AT1020/01 and the line-output transformer AT2042/01.
The unit AT4037 is intended for use in tube-equipped sets, in conjunction with the deflection unit AT1021/01 and the line-output transformer AT2043.
The difference between the two units lies only in the number of turns of the coils.

CONSTRUCTION

The unit consists of a coil wound on a ferroxcube rod and two ferroxdure magnets. One of these magnets has the shape of a half ring and is placed around the ferroxcube rod under the coil. The other magnet is cylindrical; it is placed parallel to and clamped against the ferroxcube rod opposite the first one. This magnet is provided with a square hole to facilitate turning of it to adjust the biasing field and so the linearity of the line deflection.

Dimensions in mm

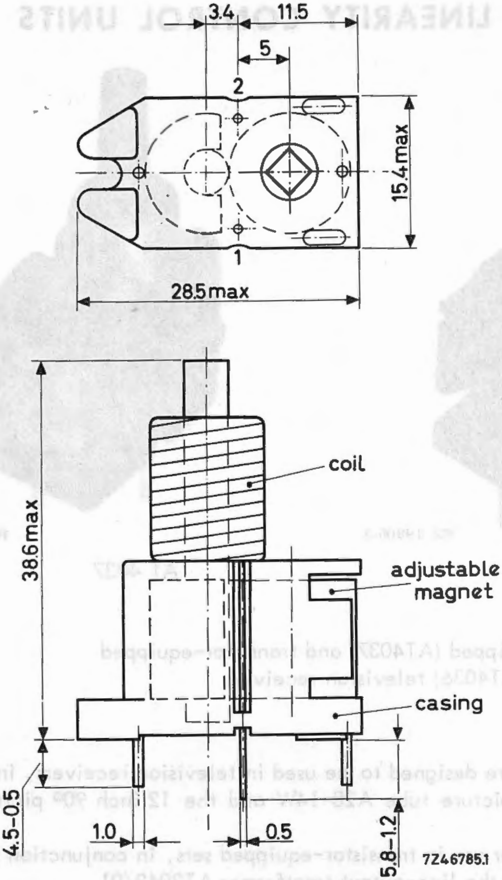


Fig. 1

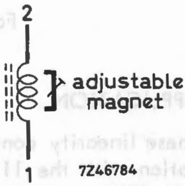


Fig. 2. Circuit diagram

ELECTRICAL DATA

AT 4036

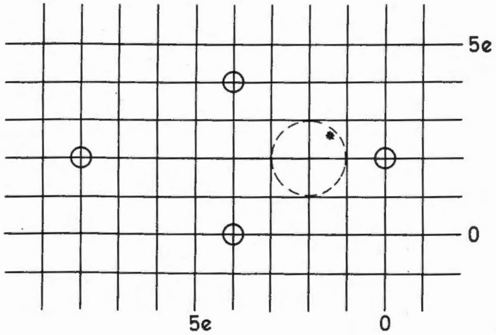
When a saw-tooth current (without S-correction) of $6A_{p-p}$, frequency 15,625 Hz, fly-back ratio 18%, flows through the linearity control unit (one connection point to earth), the correction voltage is adjustable between 1.05V and 1.95V.

AT 4037

When a saw-tooth current (without S-correction) of $1.4A_{p-p}$, frequency 15,625 Hz, fly-back ratio 18%, flows through the linearity control unit (one connection point to earth), the correction voltage is adjustable between 5.3V and 9.5V.

MOUNTING

The unit can be mounted either on printed-wiring boards by means of its two connection pins and two mounting pins (see Fig. 3), or on conventional panels by bending of the two mounting pins and/or by means of a screw through an aperture in the casing (see Fig. 4). To prevent distortion of the magnetic field no iron part should approach the magnetic parts anywhere nearer than 3mm. The coil should be shunted with a 1W carbon resistor to damp ringing phenomena.



7Z46786

Fig. 3. Hole pattern for mounting on a printed-wiring board (e = 0.1 inch or 2.50 mm)

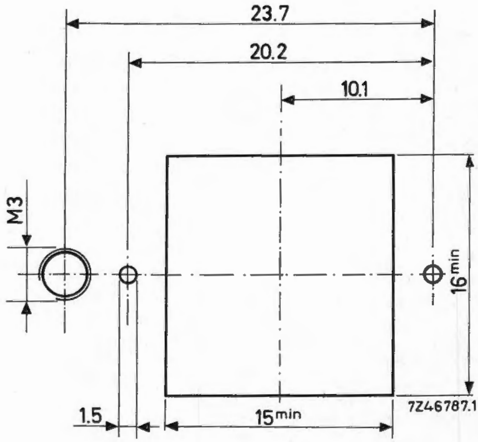


Fig. 4. Hole pattern for mounting on a chassis

* Hole only necessary for bottom adjustment.

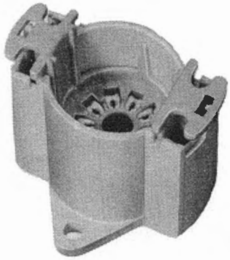
ADJUSTABLE LINEARITY CONTROL UNIT

APPLICATION

This unit is intended to be used in black and white, and in colour television sets equipped with tubes, to adjust the linearity of the line deflection.
In black and white television sets it can be used in conjunction with deflection unit AT1040 and line-output transformer AT2036, AT2036/25, AT2036/36, AT2034 or AT2045.

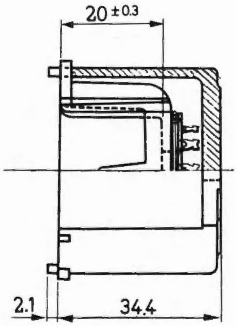
For further information see section "Components for colour television".

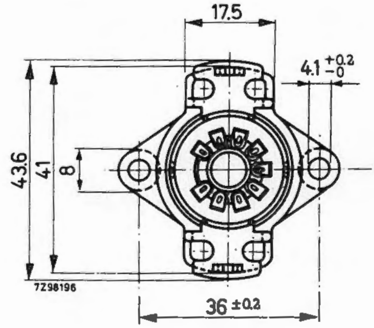
E.H.T. SOCKET FOR TUBE DY802



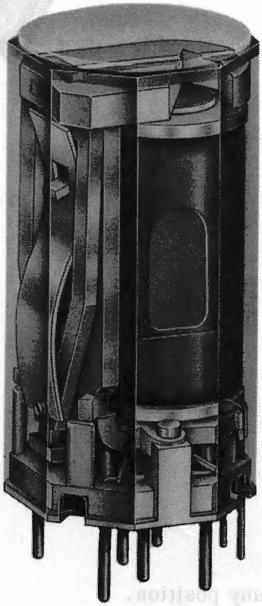
The socket has been provided with a series resistor of 1.6 Ω in the heater circuit.

Dimensions in mm





RELAYS



A 50733-1

GENERAL

These relays find their application in a variety of electronic and electrical equipment, e.g. for system switching in universal television receivers.
They have been developed on the principle of only one spring acting on both the armature and the contacts. The switching action is positive owing to the minimum contact bounce; the contact capacitance is very low.
The sockets of the relays are provided with pins, which are arranged to fit printed-wiring boards with a grid of 0.1".

CONSTRUCTION

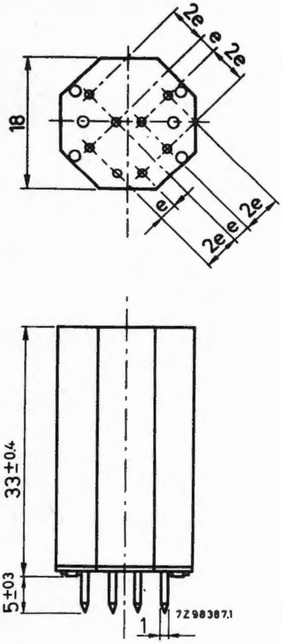
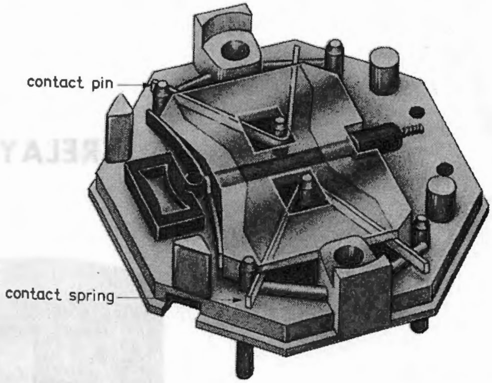


Fig.1. Dimensions in mm.
e = 2.54 mm (0.1").



A 50733-2

Fig.2. View on contacts

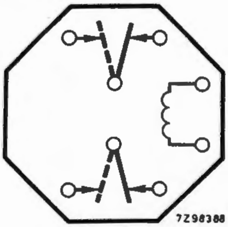


Fig.3.
Rest position of relay

Mounting

The relays can be mounted in any position.
The pin length is sufficient for board thicknesses up to 4 mm.

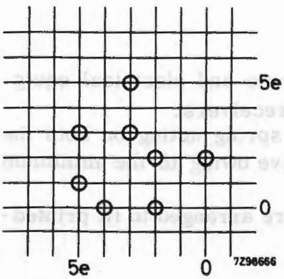


Fig.4. Hole pattern for mounting on a printed-wiring board (e = 0.1")

TECHNICAL PERFORMANCE

General

Maximum permissible acceleration 10 g

Solderability 400 °C during 5 s

Weight 20 g

Operating (for d.c. voltage)

		ER1000	ER1010	ER1020	ER1030	ER1040	ER1050	
Voltage	±15%	55	36	24	12	6	3	V_{dc}
Current	±20%	11	16.5	22	50	93	200	mA
Power	nom.	600	600	530	600	560	600	mW
Resistance at 20 °C	nom.	5000	2200	1100	240	65	15	Ω
Temperature rise of the coil	nom.	30	30	30	30	30	30	deg C
Temperature	max.	100	100	100	100	100	100	°C
Number of turns		15000	9600	7100	3300	1600	900	

Security demands no
Climatic robustness tropic proof
Contact bounce minimum

Contact

Minimum pressure $0.1\ N/cm^2$
Voltage 300 V_{dc}
Current 40 mA
Maximum resistance 100 mΩ
Minimum insulation resistance 40 MΩ
Maximum capacitance 2 pF
Number of operations minimum 5×10^5

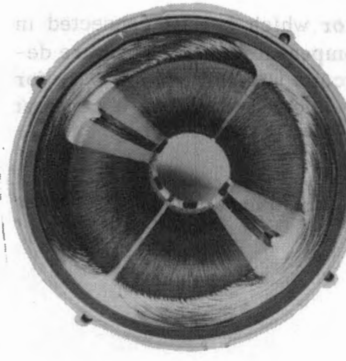
CATALOG NUMBERS (for ordering)

type number	catalog number
ER1000	3122 107 95940
ER1010	3122 108 86520
ER1020	3122 108 86510
ER1030	3122 108 86500
ER1040	3122 108 86490
ER1050	3122 108 86480

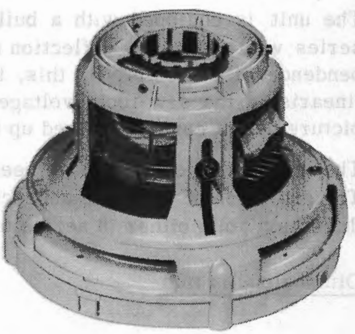
Components for colour television

NON-PREFERRED

DEFLECTION UNITS



RZ 24284-8



RZ 24284-10

APPLICATION

These deflection units have been designed for use with 22in and 25in 90° shadow mask colour picture tubes, in conjunction with line-output transformer AT2053/.. [1]) or line-deflection transformer AT2051/.. and E.H.T. transformer AT2052/.., and convergence unit AT1023/.., blue lateral unit AT1025/.. or AT1028.., linearity control unit AT4042/.. and transductor AT4041/...

1) future type

MECHANICAL DATA

The saddle-shaped line and frame deflection coils as well as the yoke ring are mounted in a polypropylene ring. This set is built in a polypropylene coaxial housing provided with a guidance in which the set is movable in axial direction over 12 mm.
After the complete unit has been mounted on the colour tube the coils can be moved for purity adjustment and then secured by means of two winged nuts.

The moulding at the rear of the housing is extended so, that the convergence unit AT1023/.. can be easily mounted.

The unit is equipped with a built-in NTC thermistor which can be connected in series with the frame deflection coils in order to compensate for temperature dependence of the coils. By this, in frame-output circuits with voltage feedback for linearising the saw-tooth voltage a constant deflection current and so a constant picture height can be obtained up to temperatures of 95 °C.

The line deflection coils have been connected in parallel.
The provision of separate connecting points makes it possible to connect the frame deflection coils either in series or in parallel.

Dimensions in mm

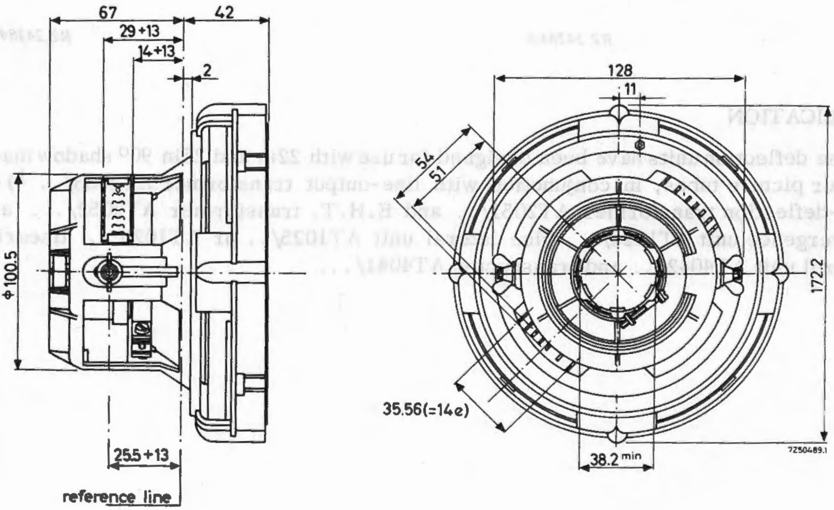


Fig.1

Mounting

The housing should be mounted as far forward as possible on the neck of the picture tube, so that it touches the cone.

External circuit connection is made to soldering tags, positioned as indicated in Fig.3.

To orient the raster correctly, the housing may be rotated by hand on the neck of the picture tube, with which it makes a slip fit. A screw-tightened clamping ring, cooperative with rubber friction shoes, permits it to be locked radially in the desired position.

Subsequently the correct centre of deflection can be determined by moving the coil assembly in axial direction; it can be locked by means of the two winged nuts.
In Fig.2 an assembly consisting of deflection unit AT1022/.., convergence unit AT1023/.. and blue lateral unit AT1025/.. on a picture tube is given.

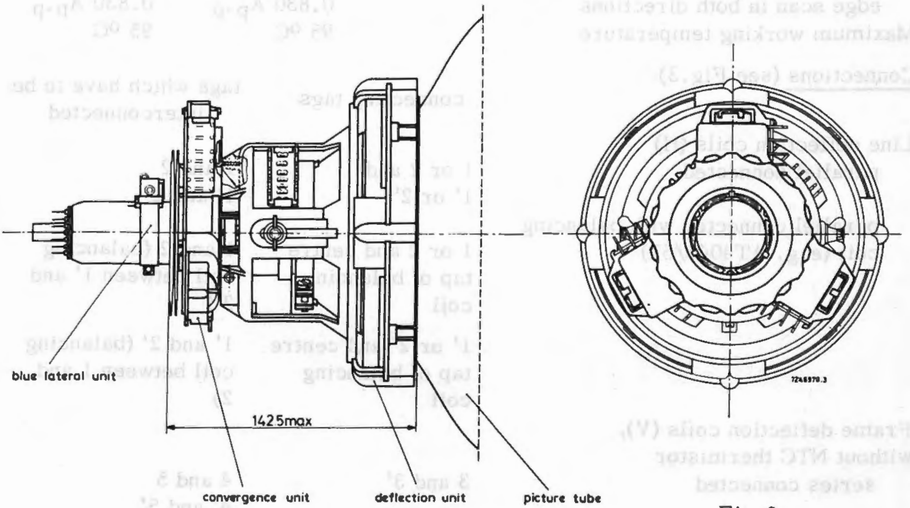


Fig.2

ELECTRICAL DATA

Two versions are available, the AT1022/04 with a circuit (NTC thermistor of 50 Ω // resistor of 33 Ω) compensating for temperature dependence in the case of series connected frame coils and the AT1022/06 with a circuit (NTC thermistor of 6 Ω // resistor of 12 Ω) compensating for temperature dependence in the case of parallel connected frame coils.

Typical values

	AT1022/04	AT1022/06
Line deflection coils, parallel connected		
Inductance	2.95 mH	2.95 mH
Resistance at 25 °C	2.9 Ω	2.9 Ω
Deflection current at 25 kV, edge to edge scan in both directions	2.6 A_{p-p}	2.6 A_{p-p}
Frame deflection coils, series connected		
Inductance	114 mH	114 mH
Resistance at 25 °C	56 + 20* Ω	56 Ω
Deflection current at 25 kV, edge to edge scan in both directions	0.415 A_{p-p}	0.415 A_{p-p}
Frame deflection coils, parallel connected		
Inductance	28 mH	28 mH
Resistance at 25 °C	14 Ω	14 + 4** Ω
Deflection current at 25 kV, edge to edge scan in both directions	0.830 A_{p-p}	0.830 A_{p-p}
Maximum working temperature	95 °C	95 °C

Connections (see Fig.3)

	connecting tags	tags which have to be interconnected
Line deflection coils (H)		
parallel connected	1 or 2 and 1' or 2'	1 and 2 1' and 2'
parallel connected with balancing coil (e.g. AT4040/57)	1 or 2 and centre tap of balancing coil	1 and 2 (balancing coil between 1' and 2')
	1' or 2' and centre tap of balancing coil	1' and 2' (balancing coil between 1 and 2)
Frame deflection coils (V), without NTC thermistor		
series connected	3 and 3'	4 and 5 4' and 5' 6 and 6'
parallel connected	3 and 3'	3 and 4 5 and 6 3' and 4' 5' and 6' 6 and 6'

* NTC thermistor in parallel with a resistor of 33 Ω.

** NTC thermistor in parallel with a resistor of 12 Ω.

	connecting tags	tags which have to be interconnected
Frame deflection coils (V), with NTC thermistor		
AT1022/04		
series connected coils	3 and 3'	4 and 5 6 and 7 4' and 5' 6' and 7'
AT1022/06		
parallel connected coils	3 and 3'	3 and 4 5 and 6 6 and 7 3' and 4' 5' and 6' 6' and 7'

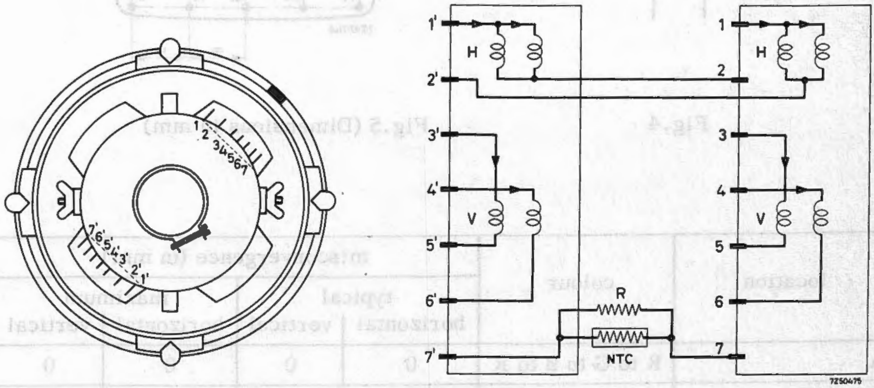


Fig.3

Misconvergence (dynamic convergence tolerances)

Misconvergence is defined as the distance between the centres of the red, blue and green beams on the screen using rectangular coordinates (see Fig.4).
The centre is defined as the centre of the brightest portion of the beam.

The misconvergences listed in the table below, are given for a nominal 25in 90° colour picture tube equipped with a deflection unit AT1022/.., a convergence unit AT1023/.. and a blue lateral unit AT1025/.. or AT1028/.., at 25 kV. The values in the table are only valid provided that these units have been adjusted to optimum convergence on the lines BC and DE (See Fig.5).

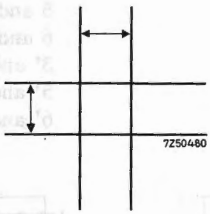


Fig.4

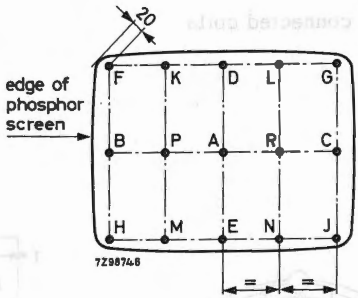
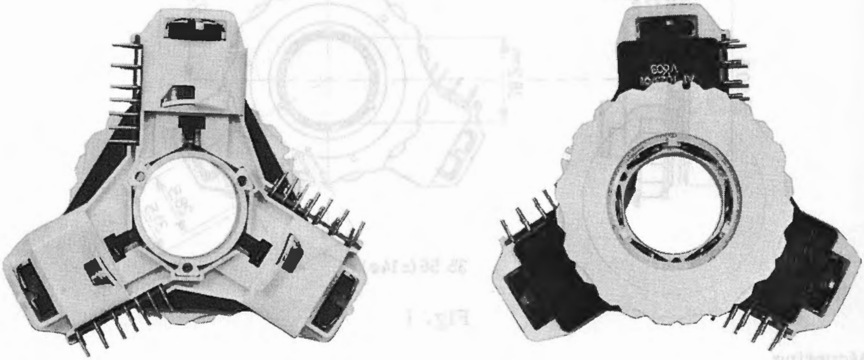


Fig.5 (Dimensions in mm)

location	colour	misconvergence (in mm)			
		typical		maximum	
		horizontal	vertical	horizontal	vertical
A	R to G to B to R	0	0	0	0
B, C	R to G B to R/G	0 < 0.5	0 < 0.5	0 1	0 1
D, E	R to G B to R/G	0 < 0.5	0 0	0 1	0 0
K, L, P, R, M, N	R to G to B to R	< 0.5	< 0.5	1	1
F, G, H, J	R to B to G to R	< 1.5	< 1.5	2	2

NON-PREFERRED

CONVERGENCE UNIT



RZ 22858-5 RZ 22858-6

APPLICATION

This unit is intended to be used with a 90° shadow mask colour picture tube, in conjunction with the deflection unit AT1022/.. and the blue lateral unit AT1025/.. or AT1028/.., to converge the three colour pictures statically and dynamically and to adjust the purity.

MECHANICAL DATA

Dimensions in mm

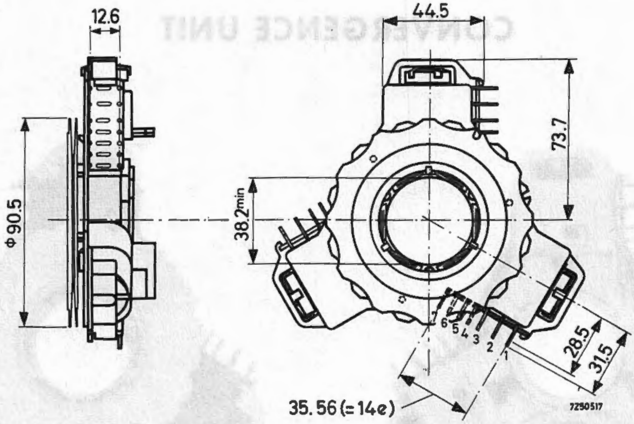


Fig. 1

Mounting

The convergence unit can easily be mounted on the deflection unit. To this end the three hooks of the convergence unit have to be placed in the circular slot at the rear of the deflection unit. Consequently the convergence unit must be turned to the right as fas as possible; then it is locked in axial direction by means of two retaining pins and a screw. When this screw is fastened, the convergence unit is also locked in radial direction.
The cover plate of the convergence unit is provided with three holes to facilitate fixing of cables.

In Fig.2 an assembly consisting of deflection unit, convergence unit and blue lateral unit on a picture tube is given.

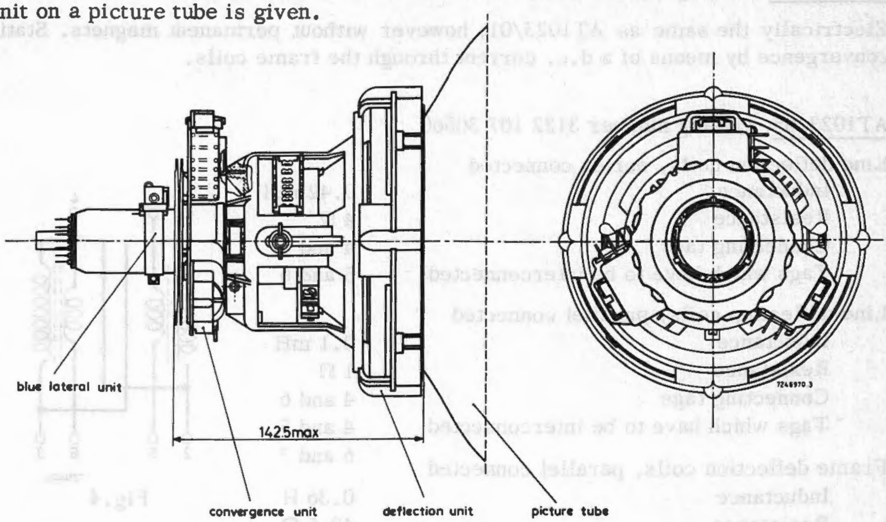


Fig.2

ELECTRICAL DATA

Every convergence unit AT1023/.. consists of three identical parts, one for each colour; so the electrical data given for one part suit all three.

Static convergence shift with magnet,	for red and green	± > 14 mm
	for blue	± > 20 mm

Dynamic convergence takes place by feeding the line and frame coils with parabolic and sawtooth currents respectively.

AT1023/01, catalog number 3122 107 30530

Line deflection coils, series connected

Inductance	0.42 mH
Resistance	4 Ω
Connecting tags	5 and 7

Frame deflection coils, series connected

Inductance	1.44 H
Resistance	170 Ω
Connecting tags	3 and 4

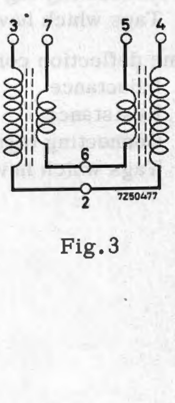


Fig.3

AT1023/02, catalog number 3122 107 30330

Electrically the same as AT1023/01, however without permanent magnets. Static convergence by means of a d.c. current through the frame coils.

AT1023/05, catalog number 3122 107 30560

Line deflection coils, series connected	
Inductance	0.42 mH
Resistance	4 Ω
Connecting tags	4 and 7
Tags which have to be interconnected	5 and 6
Line deflection coils, parallel connected	
Inductance	0.1 mH
Resistance	1 Ω
Connecting tags	4 and 6
Tags which have to be interconnected	4 and 5 6 and 7
Frame deflection coils, parallel connected	
Inductance	0.36 H
Resistance	42.5 Ω
Connecting tags	2 and 3

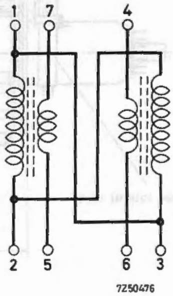


Fig.4

AT1023/10, catalog number 3122 107 30540

Line deflection coils, series connected	
Inductance	4.7 mH
Resistance	46 Ω
Connecting tags	5 and 7
Frame deflection coils, series connected	
Inductance	1.44 H
Resistance	170 Ω
Connecting tags	1 and 4
Tags which have to be interconnected	2 and 3
Frame deflection coils, parallel connected	
Inductance	0.36 H
Resistance	42.5 Ω
Connecting tags	1 and 3
Tags which have to be interconnected	1 and 2 3 and 4

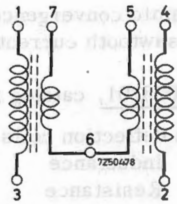


Fig.5

AT1023/12, catalog number 3122 107 30430

Line deflection coils, parallel connected	
Inductance	1.2 mH
Resistance	11.5 Ω
Connecting tags	6 and 7
Frame deflection coils, series connected	
Inductance	1.44 H
Resistance	170 Ω
Connecting tags	1 and 4
Tags which have to be interconnected	2 and 3
Frame deflection coils, parallel connected	
Inductance	0.36 H
Resistance	42.5 Ω
Connecting tags	1 and 3
Tags which have to be interconnected	1 and 2
	3 and 4

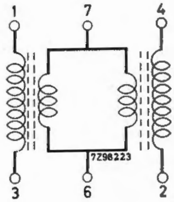


Fig.6

AT1023/13, catalog number 3122 107 31480

Electrically the same as AT1023/10, however without permanent magnets. Static convergence by means of a d.c. current through the frame coils.

Purity adjustment

The purity can be adjusted by means of two independently movable magnets. These magnets are diametrically magnetised; when the notches of the magnets coincide the magnetic fields are in opposite phase. By turning the magnets with respect to each other the magnetic force of the resultant field of both magnets is adjusted. The direction of the resultant magnetic field is adjusted by turning the magnets simultaneously. The area of purity adjustment which can be obtained on the screen of the picture tube is given in Fig.7.

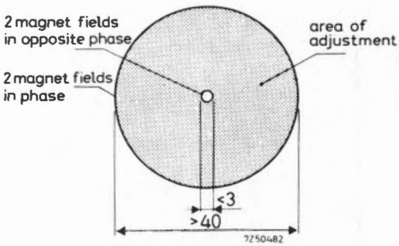


Fig.7 (Dimensions in mm)

AT1023/12, catalog number 3122 107 30430

Line deflection coils, parallel connected

Inductance	1.2 mH
Resistance	11.5 Ω
Connecting tags	6 and 7

Frame deflection coils, series connected

Inductance	1.44 H
Resistance	170 Ω
Connecting tags	1 and 4
Tags which have to be interconnected	2 and 3

Frame deflection coils, parallel connected

Inductance	0.36 H
Resistance	42.5 Ω
Connecting tags	1 and 3
Tags which have to be interconnected	1 and 2 3 and 4

Fig.6

AT1023/13, catalog number 3122 107 31480

Electrically the same as AT1023/10, however without permanent magnets. Static convergence by means of a d.c. current through the frame coils.

Purity adjustment

The purity can be adjusted by means of two independently movable magnets. These magnets are diametrically magnetised; when the notches of the magnets coincide the magnetic fields are in opposite phase. By turning the magnets with respect to each other the magnetic force of the resultant field of both magnets is adjusted. The direction of the resultant magnetic field is adjusted by turning the magnets simultaneously. The area of purity adjustment which can be obtained on the screen of the picture tube is given in Fig.7.

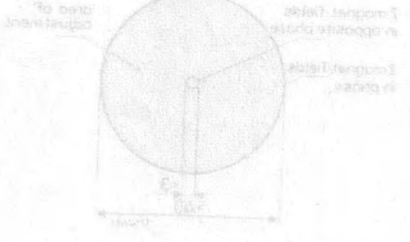
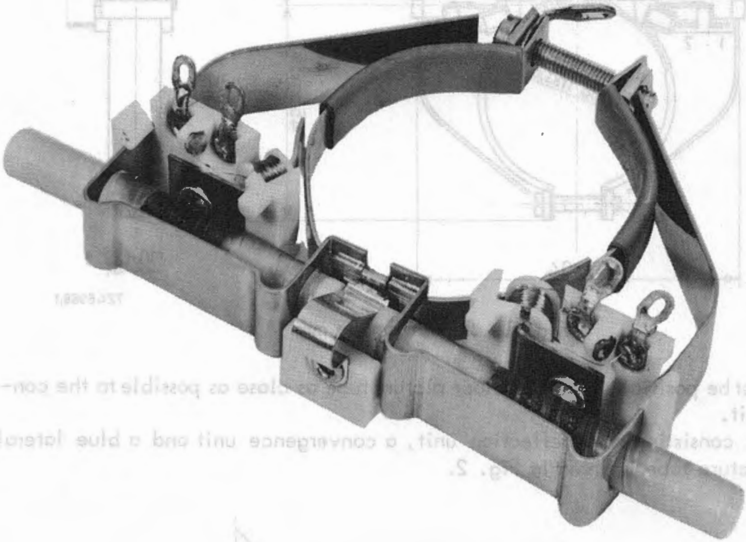


Fig.7 (Dimensions in mm)

BLUE LATERAL UNIT



RZ 22858-4

For series or parallel connection

APPLICATION

This unit is intended for use with a 90° shadow mask colour picture tube in conjunction with a deflection unit AT 1027/.. and convergence units AT 4045/.. or AT 4046/.. for static and dynamic lateral adjustment, or in conjunction with a deflection unit AT 1022/.. and a convergence unit AT 1023/.. respectively.

MECHANICAL DATA

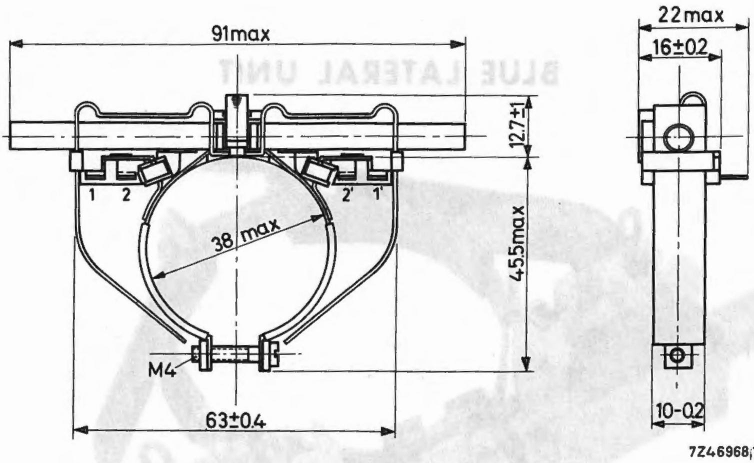


Fig. 1. Dimensions in mm

The unit must be positioned on the colour picture tube as close as possible to the convergence unit.
An assembly consisting of a deflection unit, a convergence unit and a blue lateral unit on a picture tube is given in Fig. 2.

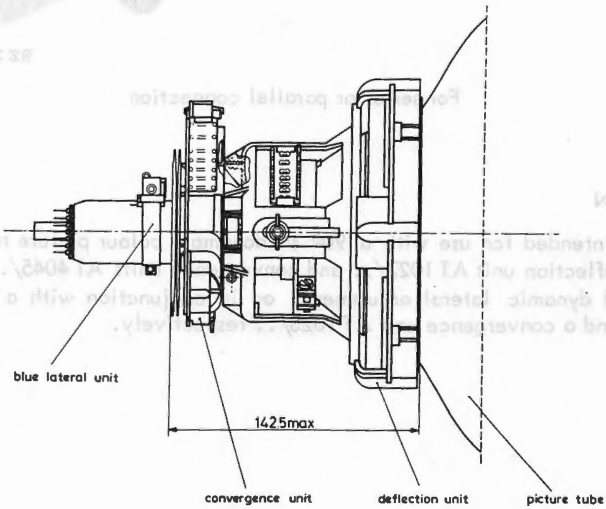


Fig. 2

ELECTRICAL DATA

Coils, series connected	
Inductance	3.2 mH
Resistance	36 Ω

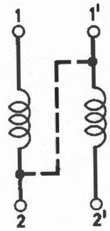


Fig. 3

Coils, parallel connected	
Inductance	0.63 mH
Resistance	9 Ω

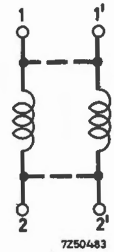


Fig. 4

Maximum working temperature	95 °C

Static lateral adjustment

Static lateral adjustment in the centre can be obtained by turning the magnet holder. A turn of 360° gives a minimum adjustment range of 6.5 mm; red/green and blue are in opposite phase (see Fig. 5).

Dynamic lateral adjustment

A horizontal shift in the points B and C between red/green and blue of ≥ 3.5 mm can be obtained with a saw tooth current of 350 mA_{p-p}, frequency 15 kHz, through the coils when they are series connected, a saw tooth current of 700 mA_{p-p} when they are parallel connected (see Fig. 6).

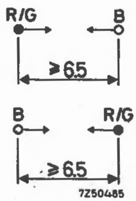


Fig. 5

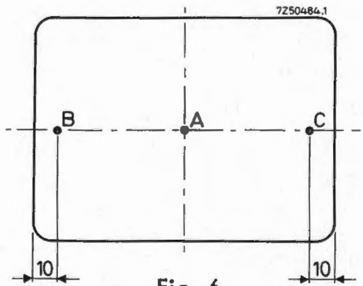


Fig. 6

ELECTRICAL DATA

Coils, series connected

Inductance	3.2 mH
Resistance	36 Ω

Fig. 3

Coils, parallel connected

Inductance	0.63 mH
Resistance	9 Ω

Fig. 4

Maximum working temperature 95 °C

Static lateral adjustment

Static lateral adjustment in the centre can be obtained by turning the magnet holder. A turn of 360° gives a minimum adjustment range of 6.5mm; red/green and blue are in opposite phase (see Fig. 5).

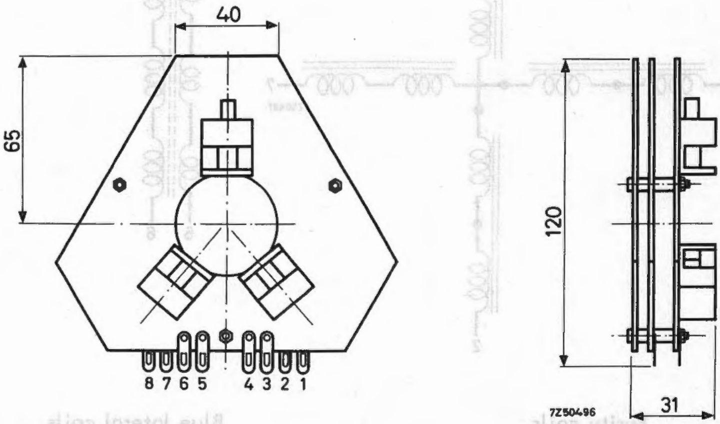
Dynamic lateral adjustment

A horizontal shift in the points B and C between red/green and blue of ≥ 3.5 mm can be obtained with a saw tooth current of 350mA$_{p-p}$, frequency 15 kHz, through the coils when they are series connected, a saw tooth current of 700mA$_{p-p}$ when they are parallel connected (see Fig. 6).

Fig. 6

Fig. 5

PURITY AND BLUE LATERAL UNIT



Dimensions in mm

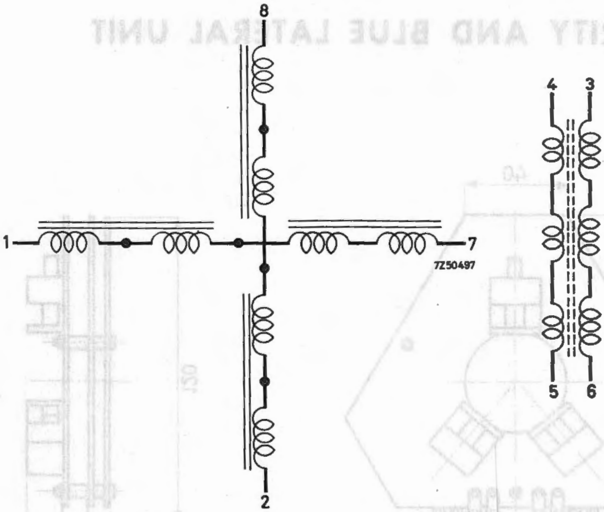
APPLICATION

This unit has been designed for electrical purity and blue lateral adjustment in monitors, etc.. It must be used in combination with the convergence unit AT 1023/.. .

MOUNTING

After removing the purity rings, convergence magnets and the cover of the AT 1023/..,
this unit can be fixed onto the AT 1023/.. by means of a snap-lock construction.
The combination must be positioned on the deflection unit in such a way that the connections of the AT 1026 are opposite the blue gun.

ELECTRICAL DATA



Purity coils		Blue lateral coils	
Horizontal shift	1 - 7 (R = 60 Ω)	Static shift	3 - 6 (R = 130 Ω)
Vertical shift	2 - 8 (R = 60 Ω)	Dynamic shift	4 - 5 (R = 5.8 Ω, L = 0.6 mH)

Note: Static convergence can be achieved by means of a direct current through the frame coils of the AT 1023/.. .

NON-PREFERRED

DEFLECTION UNIT

RZ 26059-4

RZ 26059-5

With built-in NTC thermistor of 50 Ω in parallel with a resistor of 33 Ω

APPLICATION

This deflection unit has been designed for use with 22in and 25in 90° shadow mask colour picture tubes, in conjunction with line-output transformer AT2053/.. 1) or line-deflection transformer AT2051/.. and E.H.T. transformer AT2052/.., and convergence units AT4045/.. or AT4046/.., blue lateral unit AT1025/.. or AT1028/.., linearity control unit AT4042/.. and transductor AT4041/...

1) future type

MECHANICAL DATA

The saddle-shaped line and frame deflection coils as well as the yoke ring are mounted in a polypropylene ring. This set is built in a polypropylene coaxial housing provided with a guidance in which the set is movable in axial direction over 20 mm. After the complete unit has been mounted on the colour tube the coils can be moved for purity adjustment and then secured by means of four winged nuts.
The housing also includes a construction in which the convergence units AT4045/.. or AT4046/.. easily fit.
The unit is equipped with a built-in NTC thermistor which can be connected in series with the frame deflection coils in order to compensate for temperature dependence of the coils. By this, in frame-output circuits with voltage feedback for linearising the saw-tooth voltage a constant deflection current and so a constant picture height can be obtained up to temperatures of 95 °C.

The line deflection coils have been connected in parallel.
The provision of separate connecting points makes it possible to connect the frame deflection coils either in series or in parallel.

Dimensions in mm

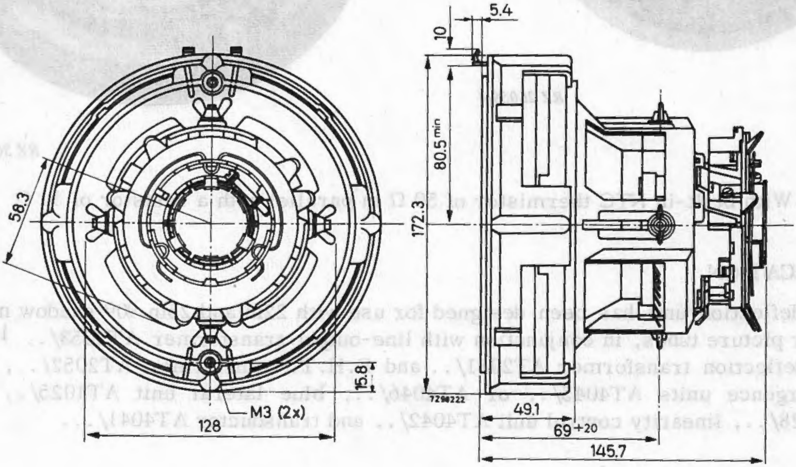


Fig.1

Mounting

The housing should be mounted as far forward as possible on the neck of the picture tube, so that it touches the cone.

External circuit connection is made to soldering tags, positioned as indicated in Fig.3.

To orient the raster correctly, the housing may be rotated by hand on the neck of the picture tube, with which it makes a slip fit. A screw-tightened clamping ring, co-operative with rubber friction shoes, permits it to be locked radially in the desired position.

Subsequently the correct centre of deflection can be determined by moving the coil assembly in axial direction; it can be locked by means of the four winged nuts.

In Fig.2 an assembly consisting of deflection unit AT1027/04 and three convergence units AT4045/.. is given.

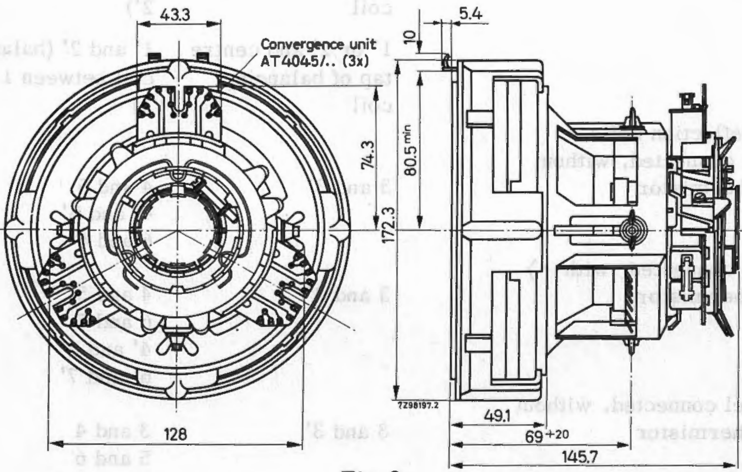


Fig.2

ELECTRICAL DATA (typical values)

Line deflection coils, parallel connected

Inductance	2.95 mH
Resistance at 25 ^{o}C	2.9 Ω
Deflection current at 25 kV, edge to edge scan in both directions	2.6 A_{p-p}

Frame deflection coils, series connected

Inductance	114 mH
Resistance at 25 ^{o}C	56 + 20* Ω
Deflection current at 25 kV, edge to edge scan in both directions	0.415 A_{p-p}

* NTC thermistor in parallel with a resistor of 33 Ω.

Frame deflection coils, parallel connected

Inductance	28 mH
Resistance at 25 °C	14 Ω
Deflection current at 25 kV, edge to edge scan in both directions	0.830 A_{p-p}
Maximum working temperature	95 °C

Connections (see Fig.3)

	connecting tags	tags which have to be interconnected
Line deflection coils, parallel connected	1 or 2 and 1' or 2'	1 and 2 1' and 2'
parallel connected with balancing coil (e.g. AT4040/57)	1 or 2 and centre tap of balancing coil	1 and 2 (balancing coil between 1' and 2')
	1' or 2' and centre tap of balancing coil	1' and 2' (balancing coil between 1 and 2)
Frame deflection coils, series connected, without NTC thermistor	3 and 3'	4 and 5 4' and 5' 6 and 6'
series connected, with *) NTC thermistor	3 and 3'	4 and 5 6 and 7 4' and 5' 6' and 7'
parallel connected, without NTC thermistor	3 and 3'	3 and 4 5 and 6 3' and 4' 5' and 6' 6 and 6'

*) NTC-thermistor value is such that right compensation for temperature dependence is obtained with series connected frame coils.

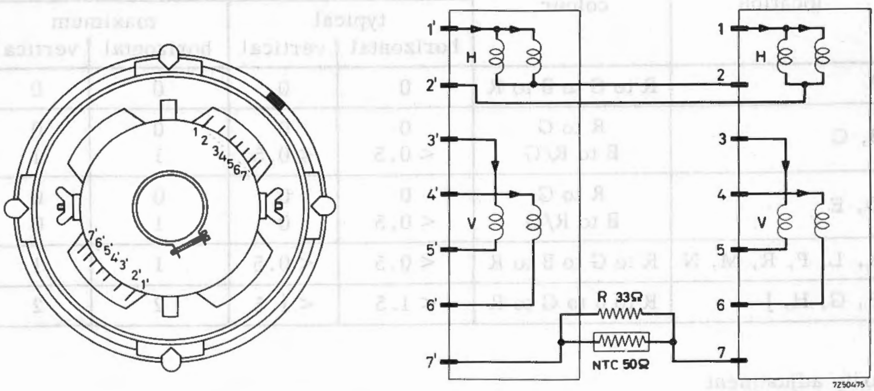


Fig.3

Misconvergence (dynamic convergence tolerances)

Misconvergence is defined as the distance between the centres of the red, blue and green beams on the screen using rectangular coordinates (see Fig.4).
The centre is defined as the centre of the brightest portion of the beam.

The misconvergences listed in the table below, are given for a nominal 25in 90° colour picture tube equipped with a deflection unit AT1027/04, convergence units AT4045/.. or AT4046/.. and a blue lateral unit AT1025/.. or AT1028/.., at 25 kV. The values in the table are only valid provided that these units have been adjusted to optimum convergence on the lines BC and DE (see Fig.5).

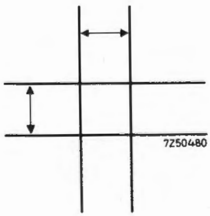


Fig.4

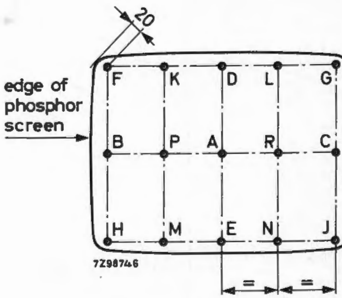


Fig.5 Dimensions in mm

location	colour	misconvergence (in mm)			
		typical		maximum	
		horizontal	vertical	horizontal	vertical
A	R to G to B to R	0	0	0	0
B, C	R to G B to R/G	0 < 0.5	0 < 0.5	0 1	0 1
D, E	R to G B to R/G	0 < 0.5	0 0	0 1	0 0
K, L, P, R, M, N	R to G to B to R	< 0.5	< 0.5	1	1
F, G, H, J	R to B to G to R	< 1.5	< 1.5	2	2

Purity adjustment

The purity can be adjusted by means of two independently movable magnets. These magnets are diametrically magnetised; when the notches of the magnets coincide the magnetic fields are in opposite phase. By turning the magnets with respect to each other the magnetic force of the resultant field of both magnets is adjusted. The direction of the resultant magnetic field is adjusted by turning the magnets simultaneously. The area of purity adjustment which can be obtained on the screen of the picture tube is given in Fig.7.

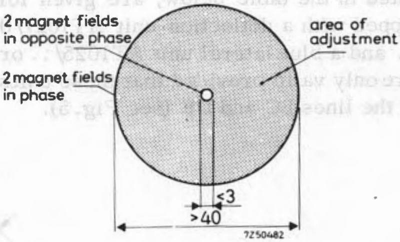


Fig.7

DEFLECTION UNIT

RZ 26059-4

RZ 26059-5

With built-in NTC thermistor of 6 Ω in parallel with a resistor of 12 Ω

APPLICATION

This deflection unit has been designed for use with 22in and 25in 90° shadow mask colour picture tubes, in conjunction with line-output transformer AT2053/.. [1]) or line-deflection transformer AT2051/.. and E.H.T. transformer AT2052/.., and convergence units AT4045/.. or AT4046/.., blue lateral unit AT1025/.. or AT1028/.., linearity control unit AT4042/.. and transductor AT4041/...

---

1) future type

MECHANICAL DATA

The saddle-shaped line and frame deflection coils as well as the yoke ring are mounted in a polypropylene ring. This set is built in a polypropylene coaxial housing provided with a guidance in which the set is movable in axial direction over 20 mm. After the complete unit has been mounted on the colour tube the coils can be moved for purity adjustment and then secured by means of four winged nuts.
The housing also includes a construction in which the convergence units AT4045/.. or AT4046/.. easily fit.
The unit is equipped with a built-in NTC thermistor which can be connected in series with the frame deflection coils in order to compensate for temperature dependence of the coils. By this, in frame-output circuits with voltage feedback for linearising the saw-tooth voltage a constant deflection current and so a constant picture height can be obtained up to temperatures of 95 ^{o}C.

The line deflection coils have been connected in parallel.
The provision of separate connecting points makes it possible to connect the frame deflection coils either in series or in parallel.

Dimensions in mm

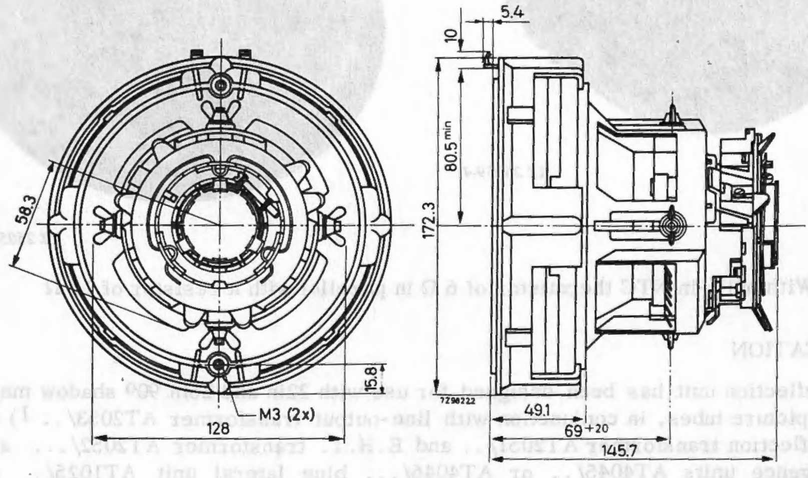


Fig.1

Mounting

The housing should be mounted as far forward as possible on the neck of the picture tube, so that it touches the cone.

External circuit connection is made to soldering tags, positioned as indicated in Fig.3.

To orient the raster correctly, the housing may be rotated by hand on the neck of the picture tube, with which it makes a slip fit. A screw-tightened clamping ring, cooperative with rubber friction shoes, permits it to be locked radially in the desired position.

Subsequently the correct centre of deflection can be determined by moving the coil assembly in axial direction; it can be locked by means of the four winged nuts.
In Fig.2 an assembly consisting of deflection unit AT1027/06 and three conververgence units AT4045/.. is given.

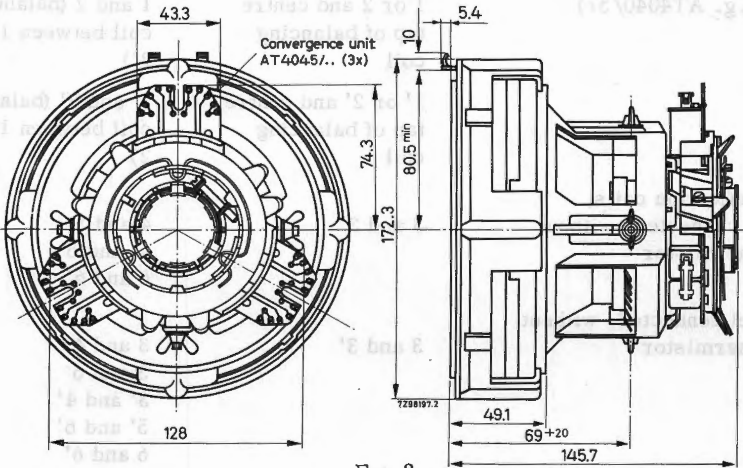


Fig.2

ELECTRICAL DATA (typical values)

Line deflection coils, parallel connected	
Inductance	2.95 mH
Resistance at 25 °C	2.9 Ω
Deflection current at 25 kV, edge to edge scan in both directions	2.6 A_{p-p}
Frame deflection coils, series connected	
Inductance	114 mH
Resistance at 25 °C	56 Ω
Deflection current at 25 kV, edge to edge scan in both directions	0.415 A_{p-p}

Frame deflection coils, parallel connected

Inductance	28 mH
Resistance at 25 °C	14 + 4* Ω
Deflection current at 25 kV, edge to edge scan in both directions	0.830 A_{p-p}
Maximum working temperature	95 °C

Connections (see Fig.3)

	connecting tags	tags which have to be interconnected
Line deflection coils, parallel connected	1 or 2 and 1' or 2'	1 and 2 1' and 2'
parallel connected with balancing coil (e.g. AT4040/57)	1 or 2 and centre tap of balancing coil	1 and 2 (balancing coil between 1' and 2')
	1' or 2' and centre tap of balancing coil	1' and 2' (balancing coil between 1 and 2)
Frame deflection coils, series connected, without NTC thermistor	3 and 3'	4 and 5 4' and 5' 6 and 6'
parallel connected, without NTC thermistor	3 and 3'	3 and 4 5 and 6 3' and 4' 5' and 6' 6 and 6'
parallel connected, with NTC thermistor **)	3 and 3'	3 and 4 5 and 6 6 and 7 3' and 4' 5' and 6' 6' and 7'

*) NTC thermistor in parallel with a resistor of 12 Ω.

**) NTC thermistor value is such that right compensation for temperature dependence is obtained with parallel connected frame coils.

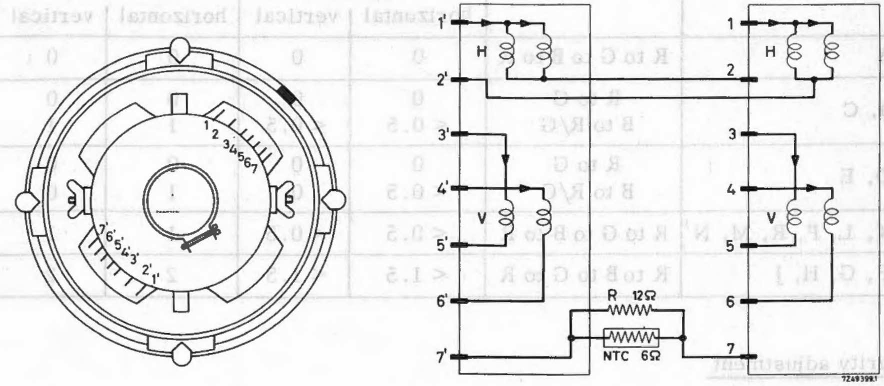


Fig.3

Misconvergence (dynamic convergence tolerances)

Misconvergence is defined as the distance between the centres of the red, blue and green beams on the screen using rectangular coordinates (see Fig.4).
The centre is defined as the centre of the brightest portion of the beam.

The misconvergences listed in the table below, are given for a nominal 25in 90° colour picture tube equipped with a deflection unit AT1027/06, convergence units AT4045/.. or AT4046/.. and a blue lateral unit AT1025/.. or AT1028/.., at 25 kV. The values in the table are only valid provided that these units have been adjusted to optimum convergence on the lines BC and DE (see Fig.5).

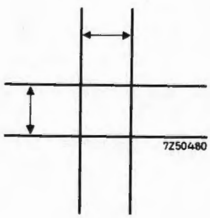


Fig.4

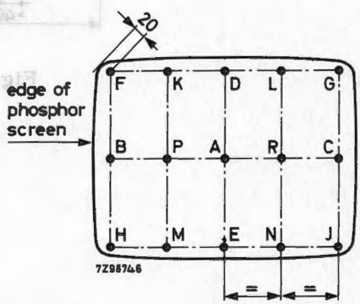


Fig.5. Dimensions in mm

location	colour	misconvergence (in mm)			
		typical		maximum	
		horizontal	vertical	horizontal	vertical
A	R to G to B to R	0	0	0	0
B, C	R to G B to R/G	0 < 0.5	0 < 0.5	0 1	0 1
D, E	R to G B to R/G	0 < 0.5	0 0	0 1	0 0
K, L, P, R, M, N	R to G to B to R	< 0.5	< 0.5	1	1
F, G, H, J	R to B to G to R	< 1.5	< 1.5	2	2

Purity adjustment

The purity can be adjusted by means of two independently movable magnets. These magnets are diametrically magnetised; when the notches of the magnets coincide the magnetic fields are in opposite phase. By turning the magnets with respect to each other the magnetic force of the resultant field of both magnets is adjusted. The direction of the resultant magnetic field is adjusted by turning the magnets simultaneously. The area of purity adjustment which can be obtained on the screen of the tube is given in Fig.7.

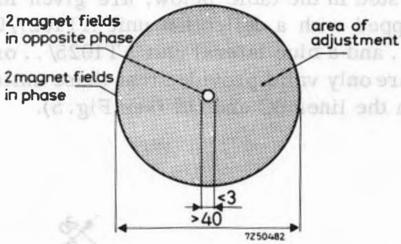
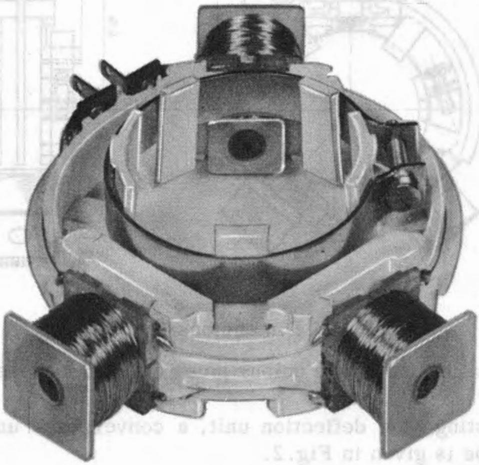


Fig.7

NON-PREFERRED

BLUE LATERAL UNIT



RZ 24284-15

APPLICATION

This blue lateral unit is intended for use with a 90° shadow mask colour picture tube in conjuction with a deflection unit AT1022/.. and a convergence unit AT1023/.., or deflection unit AT1027/.. with convergence units AT4045/.. or AT4046/.. for electrical static and dynamic lateral adjustment.

MECHANICAL DATA

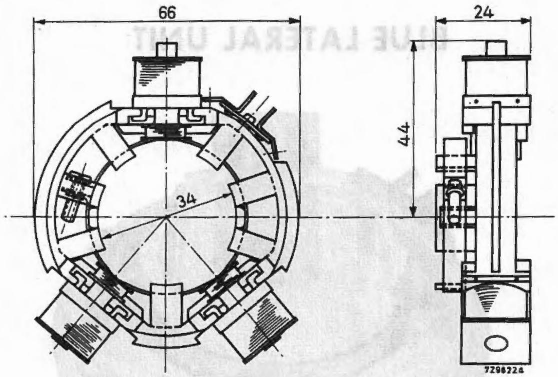


Fig. 1. Dimensions in mm

The unit must be positioned on the colour picture tube as close as possible to the convergence unit.
An assembly consisting of a deflection unit, a convergence unit and a blue lateral unit on a picture tube is given in Fig. 2.

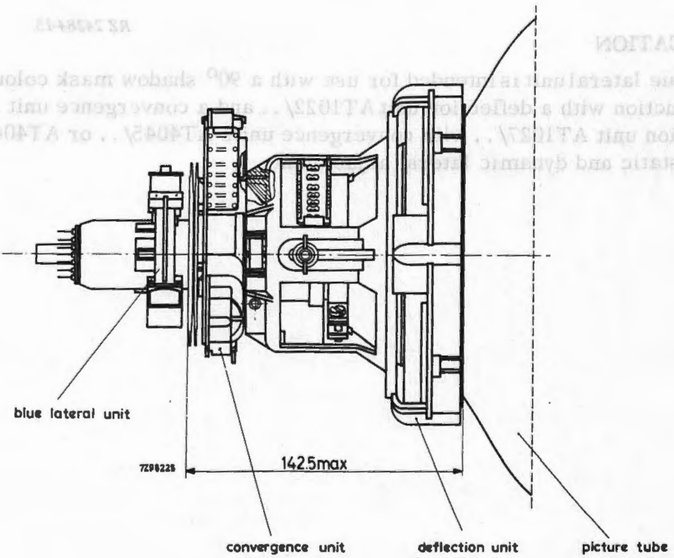


Fig. 2

ELECTRICAL DATA

There are two versions of blue lateral unit: AT1028/00 and AT1028/01, which are different as regards the coils for static lateral adjustment. The electrical values of these coils are adapted to either a low d.c. voltage or a higher one.

<u>Static lateral adjustment</u>	AT1028/00	AT1028/01
Terminals	3 and 4	3 and 4
Resistance	175 Ω	18 Ω
D.C. current for minimum shift of 6.5 mm in centre *)	35 mA	110 mA

<u>Dynamic lateral adjustment</u>

In points B and C a horizontal shift between red/green and blue of ≥ 3.5 mm can be obtained with a saw tooth current of 500 mA_{p-p}, frequency 15 kHz. (See Fig. 4)

Terminals	1 and 2
Resistance	5.8 Ω
Inductance	0.6 mH

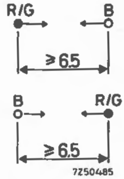


Fig. 3

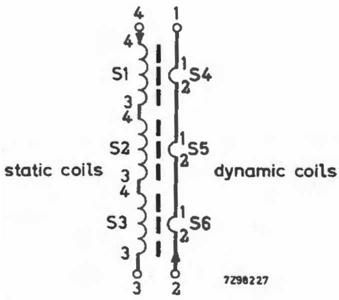


Fig. 5. Circuit diagram

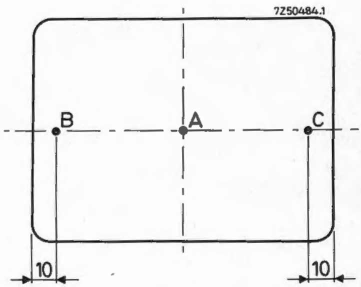
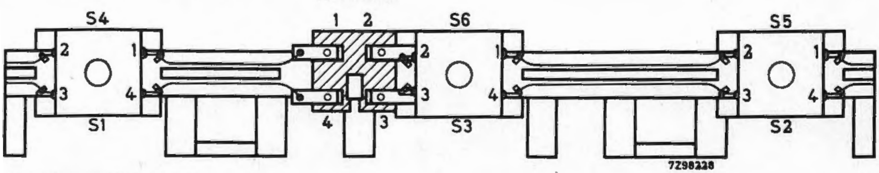


Fig. 4

Fig. 6. Wiring diagram



) red/green and blue move in opposite direction (see Fig. 3)

ELECTRICAL DATA

There are two versions of blue lateral unit: AT1028/00 and AT1028/01, which are different as regards the coils for static lateral adjustment. The electrical values of these coils are adapted to either a low d.c. voltage or a higher one.

Static lateral adjustment	AT1028/00	AT1028/01
Terminals	3 and 4	3 and 4
Resistance	175 Ω	18 Ω
D.C. current for minimum shift of 6.5 mm in centre *)	35 mA	110 mA

Dynamic lateral adjustment

In points B and C a horizontal shift between red/green and blue of ≥ 3.5 mm can be obtained with a saw tooth current of 500 mA_{p-p}, frequency 15 kHz. (See Fig.4)

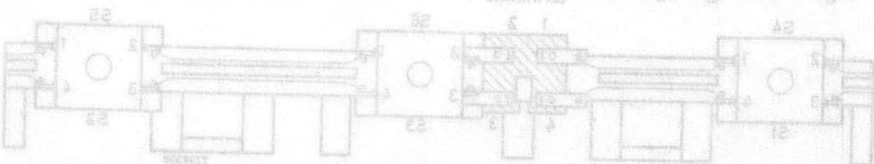
Terminals	1 and 2
Resistance	5.5 Ω
Inductance	0.6 mH

Fig.3

Fig.4

Fig.5. Circuit diagram

Fig.6. Wiring diagram



*) red/green and blue move in opposite direction (see Fig.3)

DEFLECTION UNITS

RZ 26059-4

RZ 26059-5

With built-in NTC thermistor of 6 Ω in parallel with a resistor of 12 Ω

APPLICATION

This deflection unit has been designed for use with a 19in 90° shadow mask colour picture tube, in conjunction with line-output transformer AT2053/.. [1]) or line-deflection transformer AT2051/.. and E.H.T. transformer AT2052/.., and convergence units AT4045/.. or AT4046/.., blue lateral unit AT1025/.. or AT1028/.., linearity control unit AT4042/.. and transductor AT4041/...

For further information see AT1027/04 and AT1027/06 respectively. Misconvergence of the AT1029/.. is given for a nominal 19in 90° colour picture tube.

1) future type

LINE-OUTPUT TRANSFORMER

RZ 24284-3

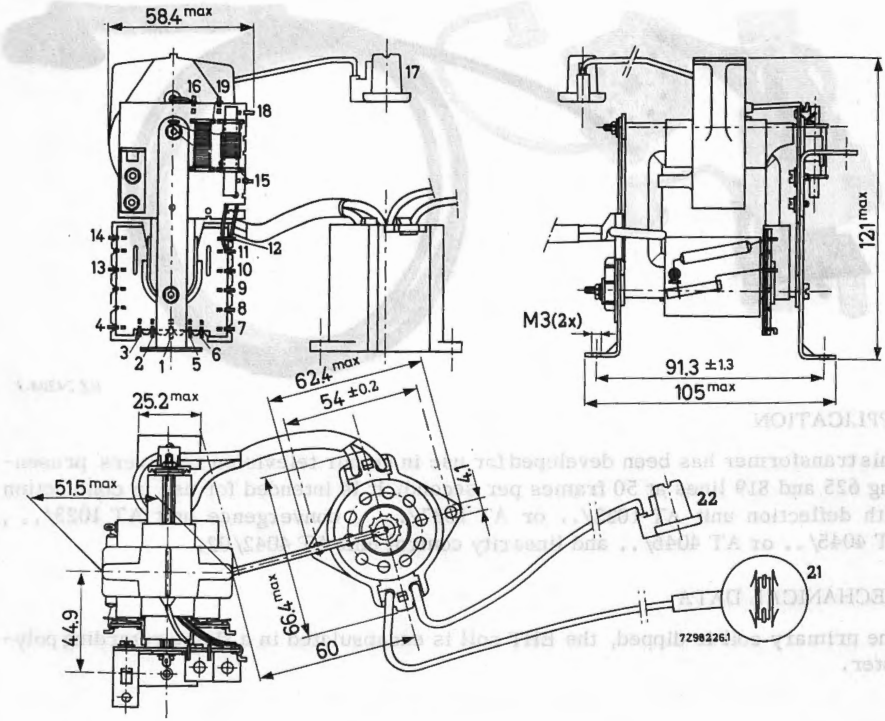
APPLICATION

This transformer has been developed for use in colour television receivers presenting 625 and 819 lines at 50 frames per second. It is intended for use in conjunction with deflection unit AT 1022/.. or AT 1027/.. , convergence unit AT 1023/.. , AT 4045/.. or AT 4046/.. and linearity control unit AT 4042/02.

MECHANICAL DATA

The primary coil is dipped, the EHT coil is encapsulated in a flame retarding polyester.

Dimensions in mm



Mounting instructions

1. Temperature

   a. The operating temperature of the transformer coils and the core should not exceed 95 °C under worst circumstances, i.e. taking into account:
      - overvoltage
      - low atmospheric pressure (at high altitudes) implying bad cooling by convection
      - high room temperature (up to 45 °C).

   b. Direct heat radiation from the PL509 and PY500 to the transformer and the heater cable of the GY501 should be avoided by a screen. (If this screen is made from insulating material, it should be placed at least 20 mm from the coils.)

   c. The socket of the GY501 should not be exposed to any direct heat radiation from the PL509 and the PY500.

   d. Ample cool air circulation should be provided around the transformer.

2. Distances

   It is important in the design of a line output and E.H.T. stage to maintain certain minimum distances between the transformer and the surrounding components and shields.

   a. The radial distance between the E.H.T. coils and any flat metal part (free from sharp edges) should be at least 30 mm.
      The axial distance from the E.H.T. coil should be at least 20 mm.

   b. The distance from the E.H.T. cap and lead should be at least 45 mm.

   c. The distance between the primary coil and any flat and smooth metal part should be at least 10 mm.

   d. The distance between the upper edge of the GY501 socket and the primary coil should be at least 15 mm.

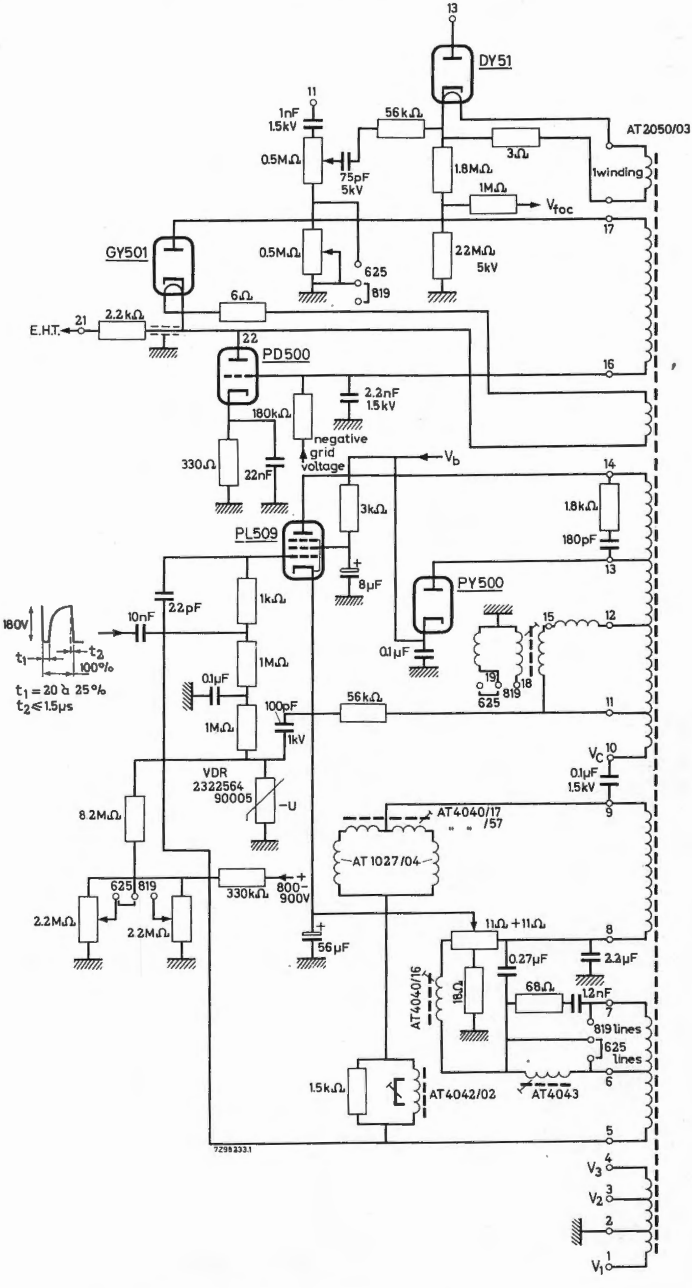
   e. The distances between the caps of PL509 and PY500 and any flat and smooth metal part should be at least 15 mm.

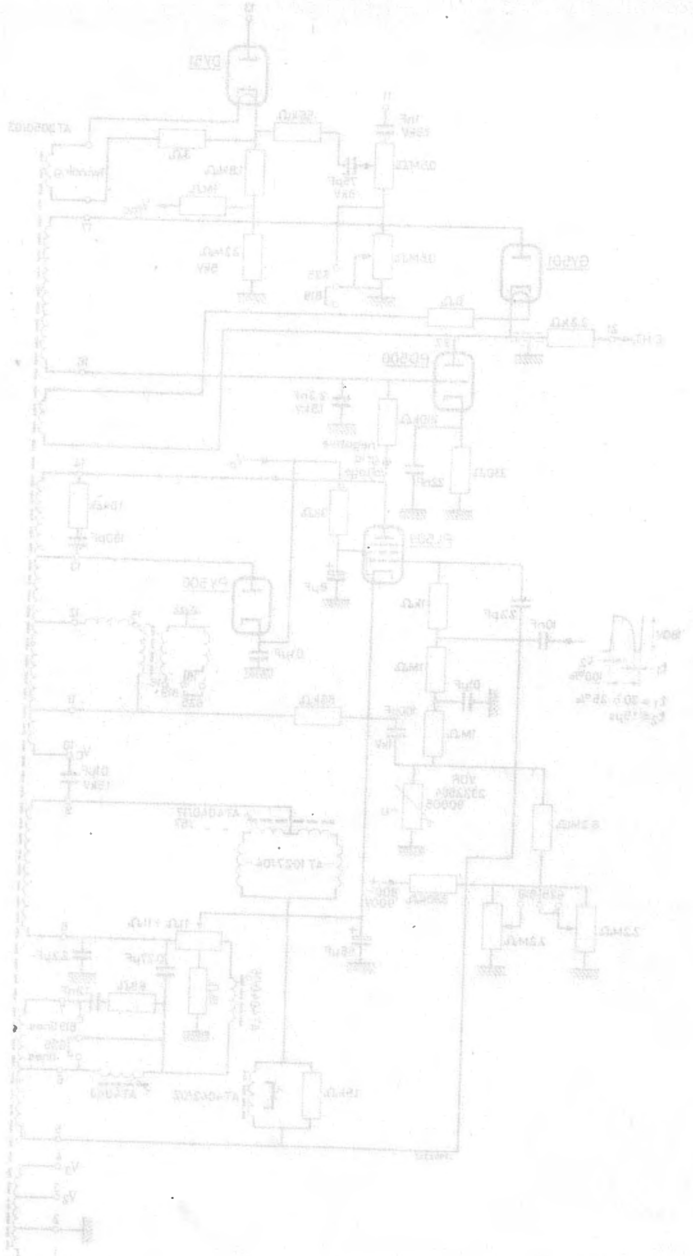
   f. The transformer and the leads and components carrying high tension pulses should be kept free from metal particles, solder drops etc.

3. The metal bracket must be connected to the chassis.

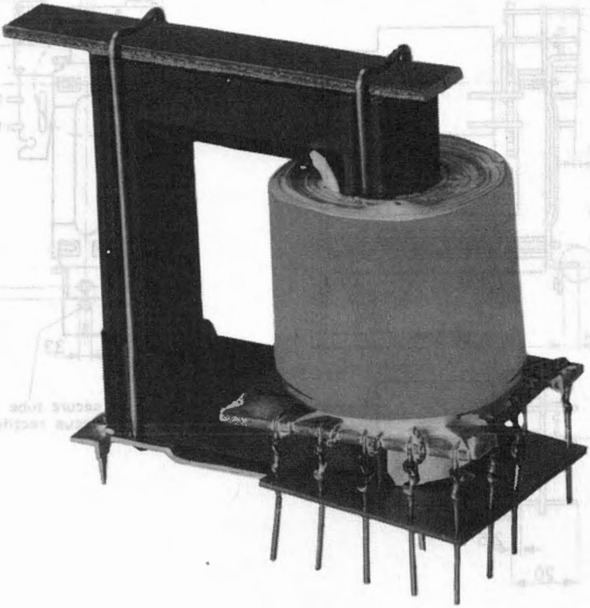
ELECTRICAL DATA (see circuit diagram)

	625 lines	819 lines
V_b	315 V	315 V
V boost	590 V	590 V
E.H.T.	24.7 kV	24.1 kV
I load	312 mA	330 mA
Overscan	+ 9%	+ 9%
Stabilisation	V_b - 15%	V_b - 12%
V_1 p-p	- 135 V	- 125 V
V_2 p-p	+ 135 V	+ 125 V
V_3 p-p	+ 310 V	+ 280 V
PL 509		
V_{bg2}	315 V	315 V
V_a p-p	6.9 kV	6.6 kV
I_a p-p	620 mA	630 mA
W_a	27 W	29 W
PY 500		
I_k	510 mA	600 mA
V_k	5.4 kV	5.1 kV
I_k rest (end of scan)	80 mA	80 mA


13
DY51
11
1nF
1.5kV
56kΩ
AT2050/03
0.5MΩ
75pF
5kV
1.8MΩ
3Ω
1winding
1MΩ
V_{foc}
17
GY501
0.5MΩ
625
22MΩ
5kV
819
6Ω
21
2.2kΩ
E.H.T.
22
PD500
16
2.2nF
1.5kV
180kΩ
negative
grid
voltage
330Ω
22nF
V_b
14
3kΩ
1.8kΩ
PL509
180pF
13
8μF
PY500
180V
10nF
22pF
1kΩ
15
12
t_1
t_2
100%
t_1 = 20 à 25%
t_2 ≤ 1.5μs
1MΩ
0.1μF
19
18
819
625
0.1μF
56kΩ
11
100pF
1MΩ
1kV
V_C 10
0.1μF
1.5kV
VDR
2322564
90005
−U
9
AT4040/17
/57
8.2MΩ
AT 1027/04
625
819
330kΩ
800−900V
2.2MΩ
2.2MΩ
11Ω + 11Ω
8
56μF
0.27μF
2.2μF
AT4040/16
18Ω
68Ω
1.2nF
7
819 lines
625 lines
6
1.5kΩ
AT4042/02
AT4043
5
7Z98333.1
V_3 4
V_2 3
2
V_1 1



LINE-DEFLECTION TRANSFORMER



RZ 22830-7B

APPLICATION

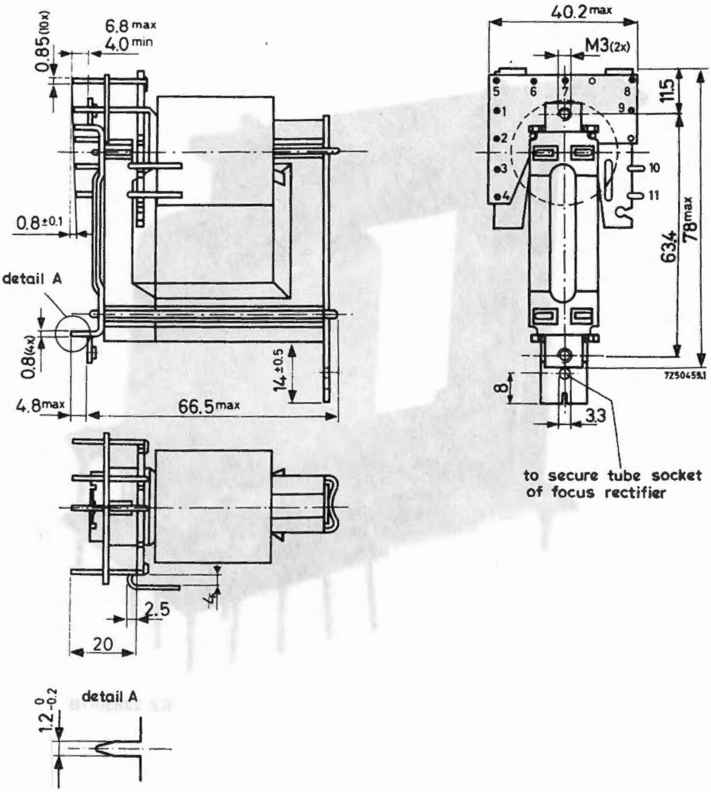
This transformer has been designed to be used in combination with the E.H.T. transformer AT 2052/.. to drive a colour picture tube with a deflection angle of 90° and an E.H.T. of 25 kV.

It is intended for use in conjunction with deflection unit AT 1027/.. or AT 1022/.., linearity control AT 4042/.., transductor AT 4041/.., line-output tube PL500, focus voltage rectifier DY51 and booster diode PY88.

MECHANICAL DATA

The coil is dipped in a flame retarding polyester.

Dimensions in mm



Mounting

The transformer can be mounted on either a printed-wiring board or a metal chassis.
If a metal chassis is used, holes for the pins must be cut in it in accordance with Fig. 2.
The transformer must be secured with two 3mm screws. The mounting pins can be bent or soldered.
For mounting on a printed-wiring board the fit of the connecting and mounting pins in a printed-wiring grid with a pitch of 2.54 or 2.50 mm is illustrated in Fig. 3.
The metal bracket must be connected to the chassis.
Like the other connections, those to the PL500 and PY88 can be soldered to the printed-wiring board. If bent upwards (as supplied) they are very suitable for direct connection to the top caps of these tubes.

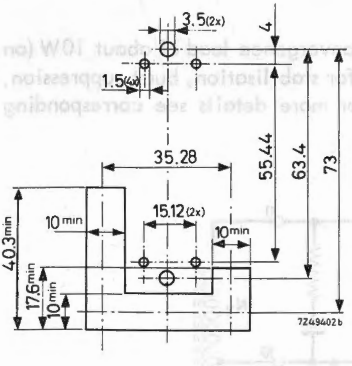


Fig. 2

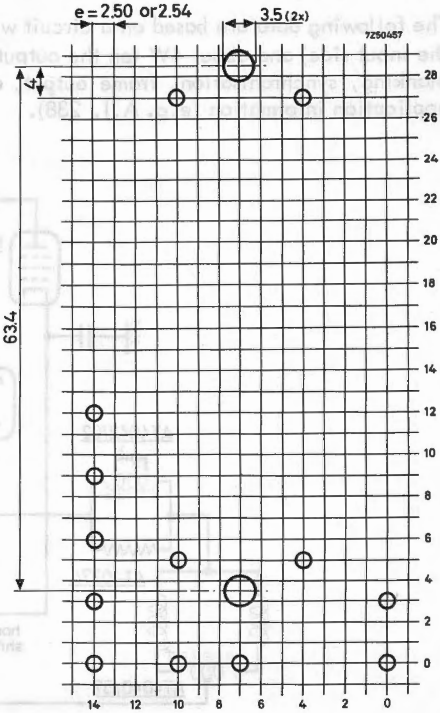


Fig. 3

The distance between the primary coil and any flat and smooth metal part should be at least 10 mm.

The transformer and the leads and components carrying high tension pulses should be kept free from metal particles, solder drops etc.

The operating temperature of the transformer coils and the core should not exceed 95 °C under worst circumstances, i.e. taking into account:

- overvoltage
- low atmospheric pressure (at high altitudes) implying bad cooling by convection
- high room temperature (up to 45 °C)

Direct heat radiation from the PL500 and PY88 anodes to the transformer and the heater cable should be avoided by a screen. (If this screen is made from insulating material, it should be placed at least 15 mm from the coils).

Ample cool air circulation should be provided around the transformer.

ELECTRICAL DATA

The following data are based on a circuit with a convergence load of about 10 W (on the input side) and about 4 W (on the output side) for stabilisation, burst suppression, blanking, synchronisation, frame output, etc. For more details see corresponding application information (e.g. A.I. 238).

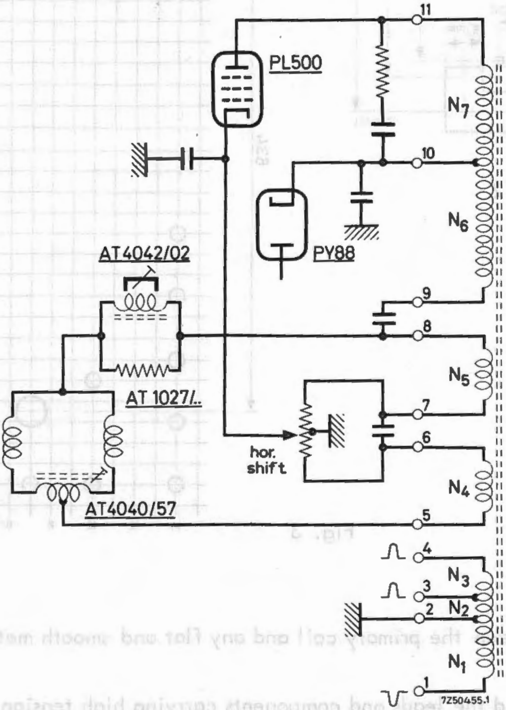


Fig. 4

Flyback time	18 %
Stabilisation	V_b - 12 % 1)
Overscan	6 %
Deflection current	2.8 A_{p-p}

PY88	PL500
V_b = 240 V	V_{g2} = 203 V
V_{boost} (between point 9 and anode) = 580 V	$I_{a\ p-p}$ = 410 mA
I_a (av) = 180 mA	$I_{k\ p-p}$ = 435 mA
I_a end-of-scan = 30 mA	$V_{a\ p-p}$ = 6.2 kV
$I_{a\ p-p}$ = 390 mA	W_a = 11.5 W
$V_{a\ p-p}$ = 5 kV	W_{g2} = 2 W

1) The stabilisation can be improved to V_b - 15 % with the PL504 (instead of PL500) at V_b = 255 V.

Auxiliary windings

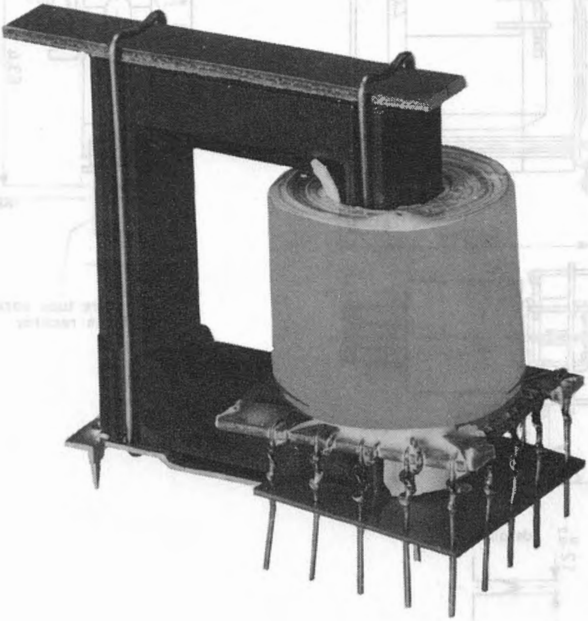
Connection 2 to chassis: + 110 V_{p-p} between 3 and 2
+ 250 V_{p-p} between 4 and 2
− 250 V_{p-p} between 1 and 2

Connection 3 to chassis: + 140 V_{p-p} between 4 and 3
− 360 V_{p-p} between 1 and 3
− 110 V_{p-p} between 2 and 3

Notes

1. With a view to the total load of the transformer the average booster current (PY88, I_a) must not exceed 200 mA.
2. An excessive additional capacitive load on a connection point of the transformer may increase the ringing just after flyback.
3. For adjustment of the amplitude V_{boost} may be set to within ±4% of the given nominal value.

LINE-DEFLECTION TRANSFORMER



RZ 22830-7A

APPLICATION

This transformer has been designed to be used in combination with the E.H.T. transformer AT 2052/.. to drive a colour picture tube with a deflection angle of 90° and an E.H.T. of 25 kV.
It is intended for use in conjunction with deflection unit AT 1027/.. or AT 1022/.., linearity control AT 4042/.., transductor AT 4041/.., line-output tube PL500, focus voltage rectifier DY51 and booster diode PY88.

MECHANICAL DATA

The coil is dipped in a flame retarding polyester.

Dimensions in mm

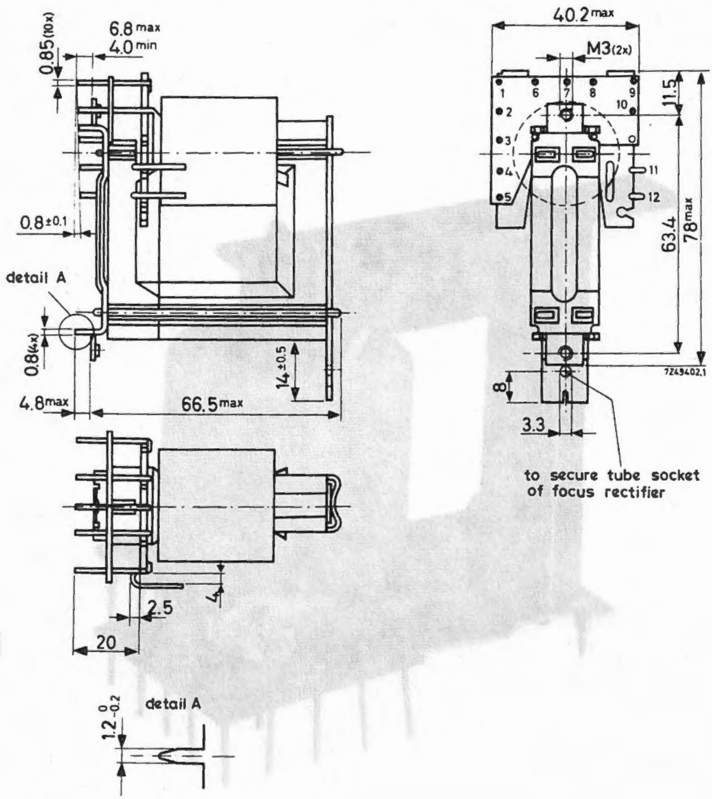


Fig.

Mounting

The transformer can be mounted on either a printed-wiring board or a metal chassis. If a metal chassis is used, holes for the pins must be cut in it in accordance with Fig. 2. The transformer must be secured with two 3mm screws. The mounting pins can be bent or soldered.
For mounting on a printed-wiring board the fit of the connecting and mounting pins in a printed-wiring grid with a pitch of 2.54 or 2.50 mm is illustrated in Fig. 3.
The metal bracket must be connected to the chassis.
Like the other connections, those to the PL500 and PY88 can be soldered to the printed-wiring board. If bent upwards (as supplied) they are very suitable for direct connection to the top caps of these tubes.

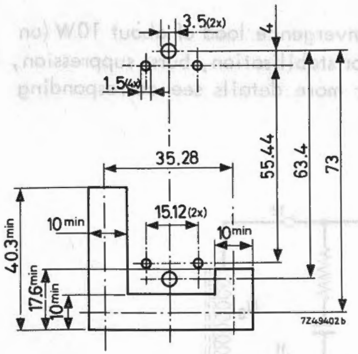


Fig. 2

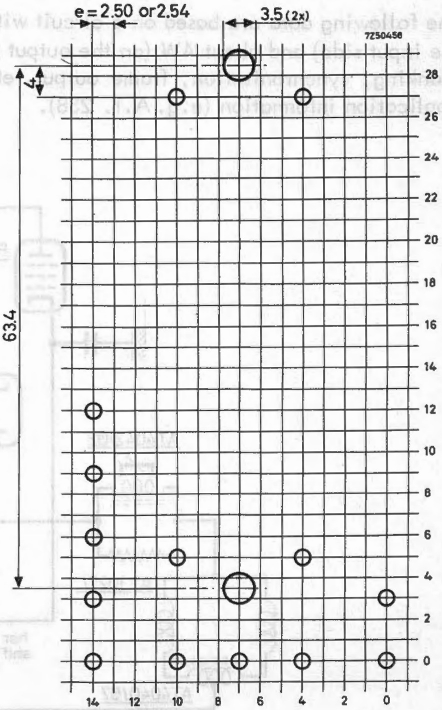


Fig. 3

The distance between the primary coil and any flat and smooth metal part should be at least 10 mm.

The transformer and the leads and components carrying high tension pulses should be kept free from metal particles, solder drops etc.

The operating temperature of the transformer coils and the core should not exceed 95 °C under worst circumstances, i.e. taking into account:
- overvoltage
- low atmospheric pressure (at high altitudes) implying bad cooling by convection
- high room temperature (up to 45 °C)

Direct heat radiation from the PL500 and PY88 anodes to the transformer and the heater cable should be avoided by a screen. (If this screen is made from insulating material, it should be placed at least 15 mm from the coils).

Ample cool air circulation should be provided around the transformer.

ELECTRICAL DATA

The following data are based on a circuit with a convergence load of about 10W (on the input side) and about 4W (on the output side) for stabilisation, burst suppression, blanking, synchronisation, frame output, etc. For more details see corresponding application information (e.g. A.I. 238).

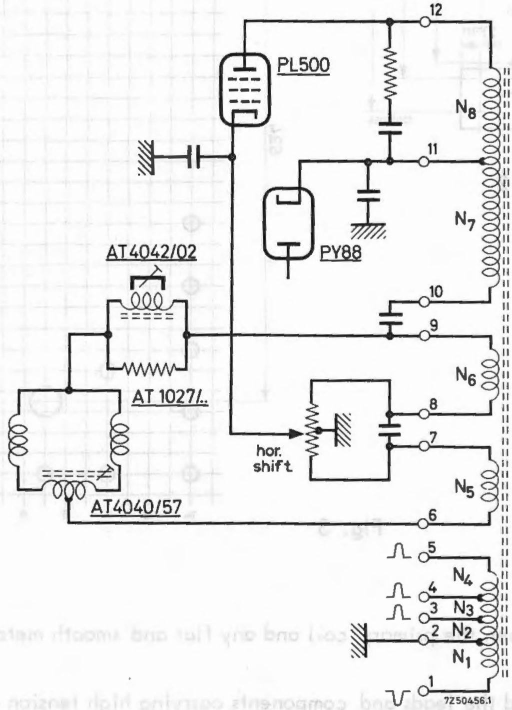


Fig. 4

Flyback time	18%
Stabilisation	V_b - 12% 1)
Overscan	6%
Deflection current	2.8 A_{p-p}

PY88	PL500
V_b = 240 V	V_{g2} = 203 V
V_{boost} (between point 10 and anode) = 580 V	$I_{a\ p-p}$ = 410 mA
I_a (av) = 180 mA	$I_{k\ p-p}$ = 435 mA
I_a end-of-scan = 30 mA	$V_{a\ p-p}$ = 6.2 kV
$I_{a\ p-p}$ = 390 mA	W_a = 11.5 W
$V_{a\ p-p}$ = 5 kV	W_{g2} = 2 W

1) The stabilisation can be improved to V_b - 15% with the PL504 (instead of PL500) at V_b = 255 V.

Auxiliary windings

Connection 2 to chassis:	+ 55	V_{p-p}	between 3 and 2
	+ 110	V_{p-p}	between 4 and 2
	+ 405	V_{p-p}	between 5 and 2
	- 295	V_{p-p}	between 1 and 2
Connection 3 to chassis:	+ 55	V_{p-p}	between 4 and 3
	+ 350	V_{p-p}	between 5 and 3
	- 350	V_{p-p}	between 1 and 3
	- 55	V_{p-p}	between 2 and 3
Connection 4 to chassis:	+ 295	V_{p-p}	between 5 and 4
	- 405	V_{p-p}	between 1 and 4
	- 110	V_{p-p}	between 2 and 4
	- 55	V_{p-p}	between 3 and 4

Notes

1. With a view to the total load of the transformer the average booster current (PY88, I_a) must not exceed 200 mA.
2. An excessive additional capacitive load on a connection point of the transformer may increase the ringing just after flyback.
3. For adjustment of the amplitude V_{boost} may be set to within ± 4% of the given nominal value.

E.H.T. TRANSFORMER

RZ 22830-1

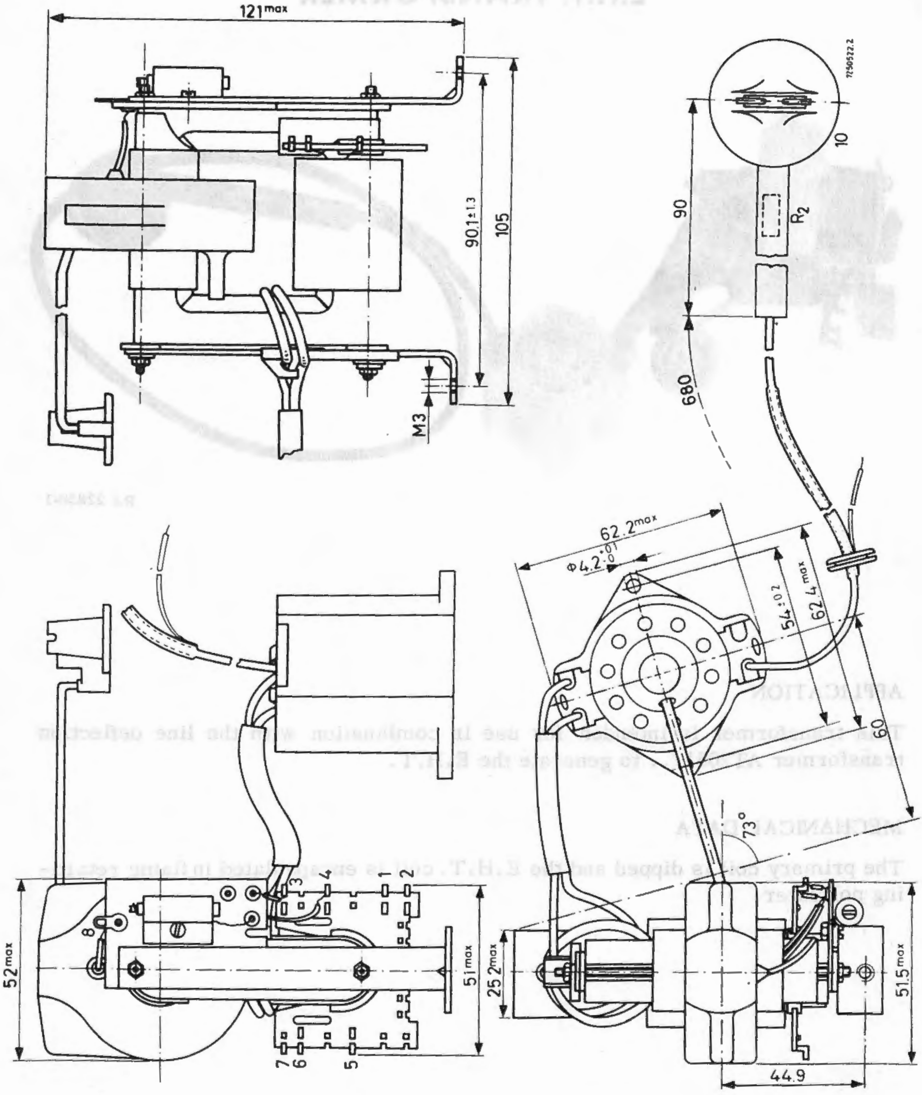
APPLICATION

This transformer is intended for use in combination with the line deflection transformer AT2051/.. to generate the E.H.T.

MECHANICAL DATA

The primary coil is dipped and the E.H.T. coil is encapsulated in flame retarding polyester.

Dimensions in mm



Mounting instructions

1. Temperature

   a. The operating temperature of the transformer coils and the core should not exceed 95 °C under worst circumstances, i.e. taking into account:
      - overvoltage
      - low atmospheric pressure (at high altitudes) implying bad cooling by convection
      - high room temperature (up to 45 °C).

   b. Direct heat radiation from the PL505 and PY500 to the transformer and the heater cable of the GY501 should be avoided by a screen. (If this screen is made from insulating material, it should be placed at least 20 mm from the coils.)

   c. The socket of the GY501 should not be exposed to any direct heat radiation from the PL505 and the PY500.

   d. Ample cool air circulation should be provided around the transformer.

2. Distances

   It is important in the design of a E.H.T. stage to maintain certain minimum distances between the transformer and the surrounding components and shields.

   a. The radial distance between the E.H.T. coils and any flat metal part (free from sharp edges) should be at least 25 mm.
      The axial distance from the E.H.T. coil should be at least 20 mm.

   b. The distance from the E.H.T. cap and lead should be at least 45 mm.

   c. The distance between the primary coil and any flat and smooth metal part should be at least 10 mm.

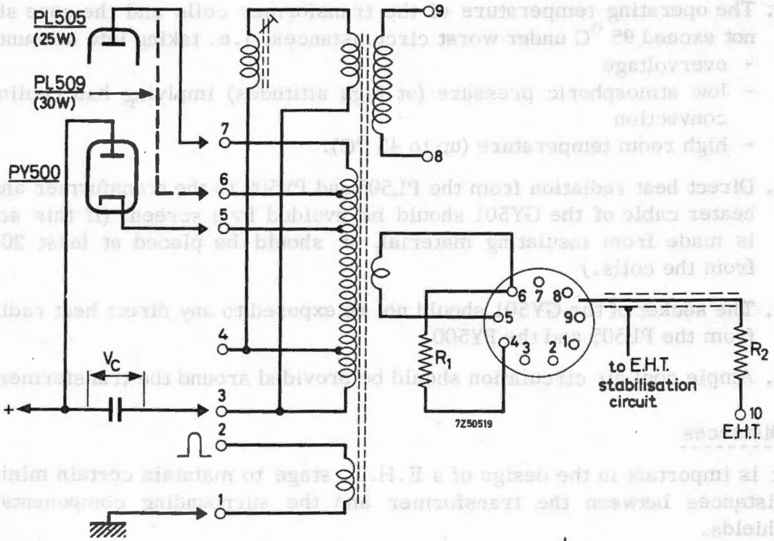
   d. The distance between the upper edge of the GY501 socket and the primary coil should be at least 15 mm.

   e. The distances between the caps of PL505 and PY500 and any flat and smooth metal part should be at least 15 mm.

   f. The transformer and the leads and components carrying high tension pulses should be kept free from metal particles, solder drops etc.

3. The metal bracket must be connected to the chassis.

ELECTRICAL DATA

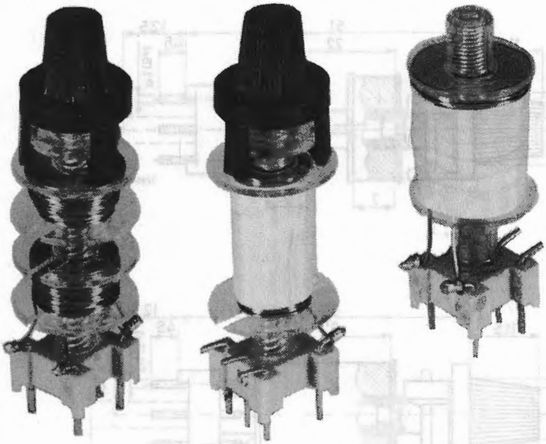


		if PL505 is used		if PL509 is used	
I_{beam}	(μA)	0	1500	0	1500
V_C	(V)	430	485	430	485
V_{10} (E.H.T.)	(kV)	25	25	25	25
$V_{2\text{-}1\ p\text{-}p}$ (1 to chassis)	(V)	500	500	500	500
$V_{4\text{-}3\ p\text{-}p}$	(V)	1050	1050	1050	1050
flyback time	(%)		16.7		16.7
PY500					
V_b	(V)	285	270	285	270
I_a end of scan		adjusted to 0 mA for I_{beam} = 1000 μA			
I_a (av)	(mA)	145	300	175	330
$I_{a\ p\text{-}p}$	(mA)	500	500	500	500
$V_{a\ p\text{-}p}$	(kV)	4.3	5.2	4.3	5.2

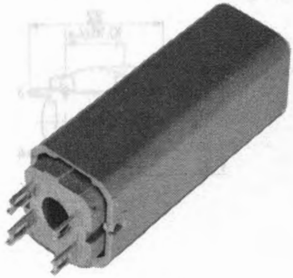
ELECTRICAL DATA (continued)

		if PL505 is used		if PL509 is used	
I_{beam}	(μA)	0	1500	0	1500
I_a p-p	(mA)	430	730	430	730
I_{g2} p-p	(mA)	45	70	45	70
I_{g2} (av)	(mA)	12	25	12	25
I_k p-p	(mA)	475	800	475	800
V_a p-p	(kV)	5.5	6.8	5.5	6.8
W_a	(W)	25	21	27.5	28.5
W_{g2}	(W)	3	5.5	3	5.5
stabilisation to	(V)		230		215

CONVERGENCE AND PIN-CUSHION ADJUSTORS



RZ 24284-6



RZ 24284-5

APPLICATION

The convergence adjustors are intended for use in conjunction with the convergence unit AT1023/.., AT4045/.. or AT4046/.. for convergence adjustment.
The pin-cushion adjustors are intended for use in conjunction with the transductor AT4041/.. (for pin-cushion adjustment), and deflection unit AT1027/.. or AT1022/..; the adjustor AT4040/50 for deflection units with parallel connected frame coils, the adjustor AT4040/55 for deflection units with series connected frame coils.

MECHANICAL DATA

The convergence adjustors are provided with pins for mounting on printed-wiring boards and have a knob at the top for adjustment. Except for the AT4040/17 which can easily be soldered directly on the soldering tags of the deflection unit and can be adjusted by means of a screw-driver. Also the pin-cushion adjustors can be adjusted by means of a screw-driver and are suitable for mounting on printed-wiring boards.

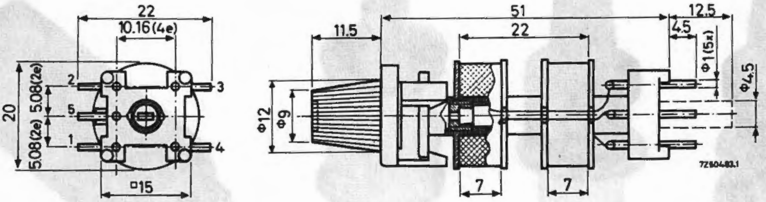


Fig.1

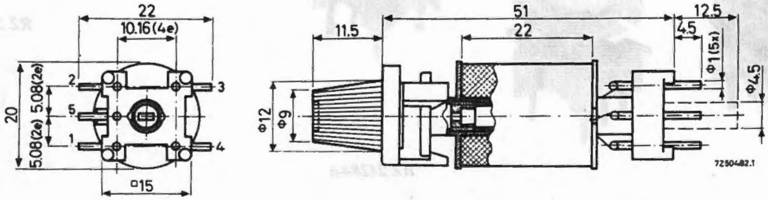


Fig.2

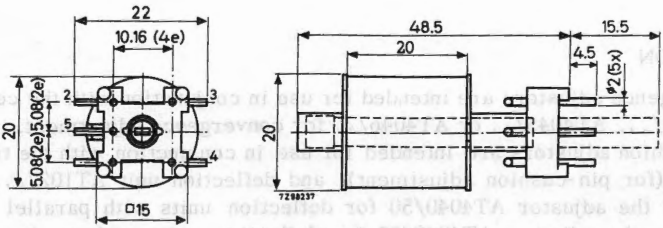


Fig.3

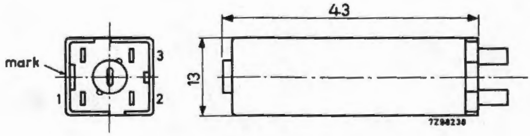


Fig.4

type number 1)	circuit diagram	Fig.	ter-minals	L-range *) (mH)	d.c. *) resistance (Ω)	catalog number
Convergence adjustors 2)						
(AT4040/17)	E	4	1-3 2-3	0.1-0.32	0.66	3122 107 30740
AT4040/49	A	1	1-2 3-4	0.32-1.08	2.4	3122 107 30030
(AT4040/52)	C	2	3-4	0.925-5.0	4.1	3122 107 30050
AT4040/53	D	2	3-4	0.635-3.725	3.65	3122 107 30060
(AT4040/54)	C	2	3-4	0.035-0.275	0.88	3122 107 30070
AT4040/56	B	1	1-4 5-4	0.00575-0.0225	0.11	3122 107 30080
			2-3	0.0295-0.0105	0.165	
AT4040/57	A	1	1-2 3-4	0.1-0.32	0.66	3122 107 30090
(AT4040/58)	A	1	1-2 3-4	2.5-8.25	20.7	3122 107 30100
(AT4040/59)	C	2	3-4	10-45	28	3122 107 30110
(AT4040/61)	D	2	3-4	7.2-33.5	23.1	3122 107 30130
AT4040/63	A	1	1-2 3-4	0.117-0.44	1.35	3122 107 30480
(AT4040/67)	F	2**)	5-6	0.7-3.6	3.65	3122 107 30570
Pin-cushion adjustors						
AT4040/50	C	3	3-4	0.9-3.2	1.1	3122 107 31210
(AT4040/55)	C	3	3-4	3-10	4.1	3122 107 31220

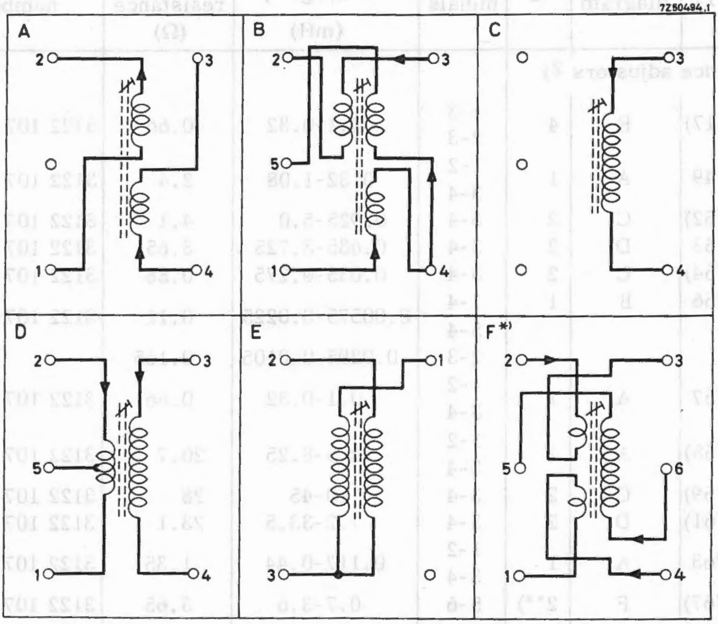
*) Typical values.

**) However, with a 6-pins socket.

1) Type numbers between brackets for non-preferred types.

2) At a frequency of 15 kHz, the current through the convergence adjustment coils has to be such that the formula $I^2_{RMS} \cdot R_{dc} \leq 0.3$ W remains in force.

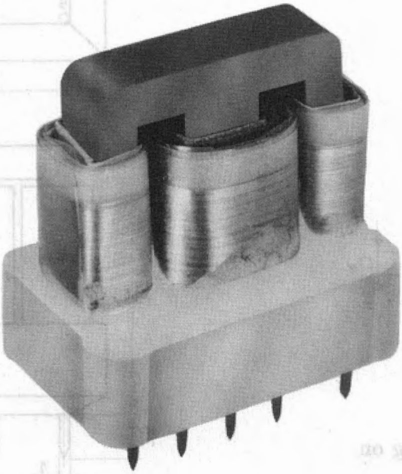
ELECTRICAL DATA



*) The socket has a colour dot near pin 5.

NON-PREFERRED

TRANSDUCTOR



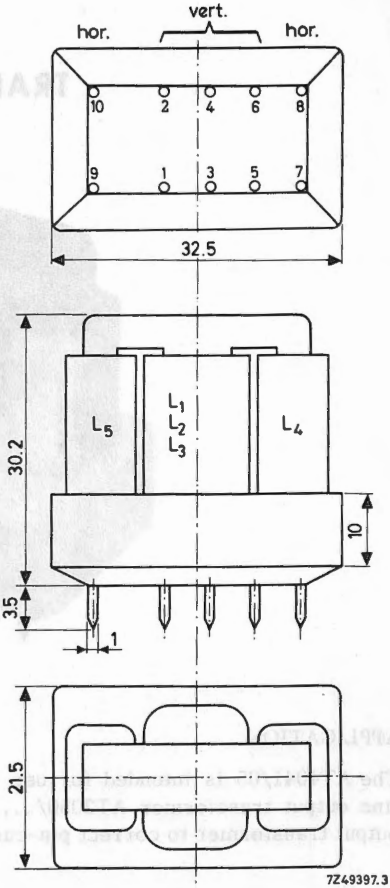
RZ 22830-6

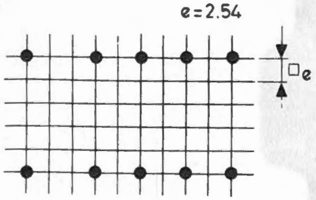
APPLICATION

The AT4041/05 is intended for use in conjunction with deflection unit AT1027/.., line output transformer AT2050/.., pin-cushion adjustor AT4040/.. and a frame output transformer to correct pin-cushion distortion.

MECHANICAL DATA

Dimensions in mm

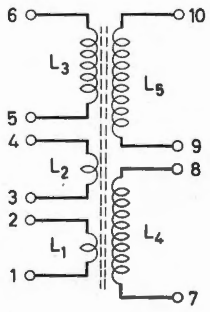




Hole pattern for mounting on a printed-wiring board.

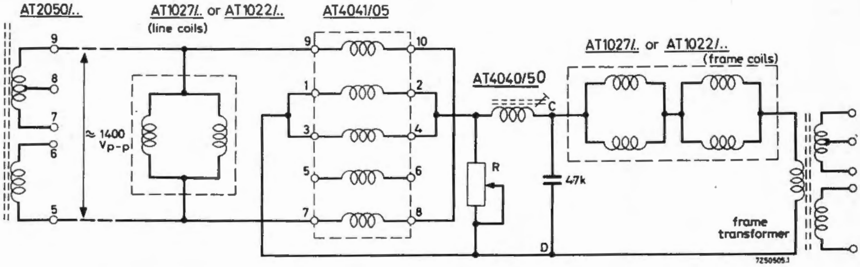
ELECTRICAL DATA

Circuit diagram

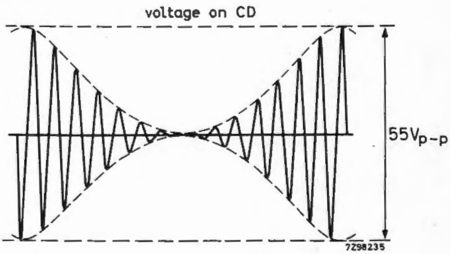


Connections

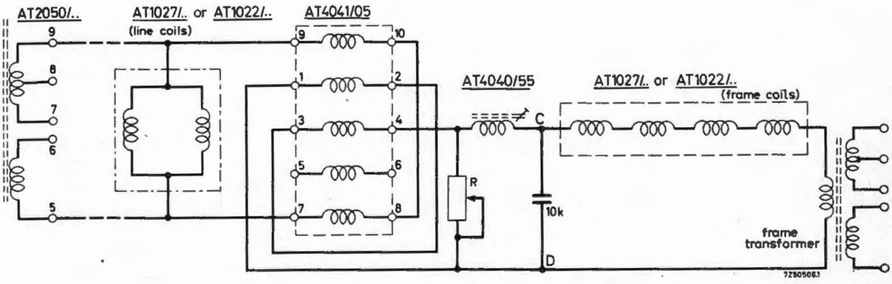
For AT1027/.. or AT1022/.. with parallel connected frame coils



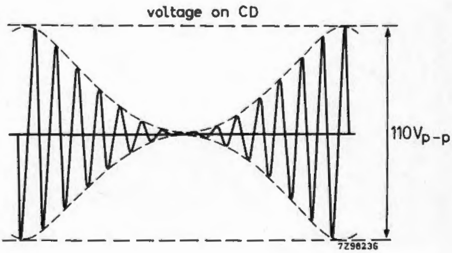
R = potentiometer of 47 Ω, adjusted to 20 Ω (typical value)



For AT1027/.. or AT1022/.. with series connected frame coils

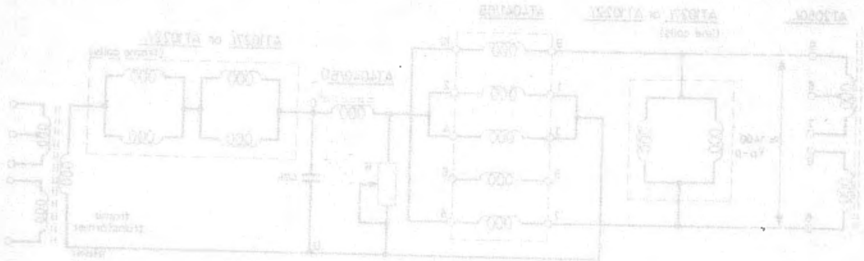


R = potentiometer of 150 Ω



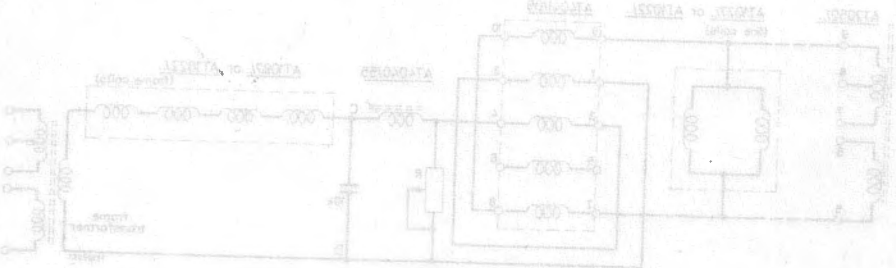
Connections

For AT1027/.. or AT1022/.. with parallel connected frame coils



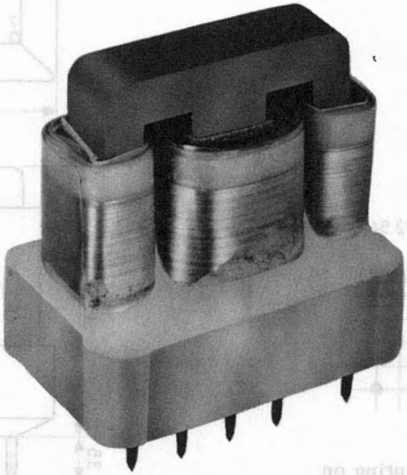
R = potentiometer of 47 Ω, adjusted to 20 Ω (typical value)

For AT1027/.. or AT1022/.. with series connected frame coils



R = potentiometer of 150 Ω

TRANSDUCTOR



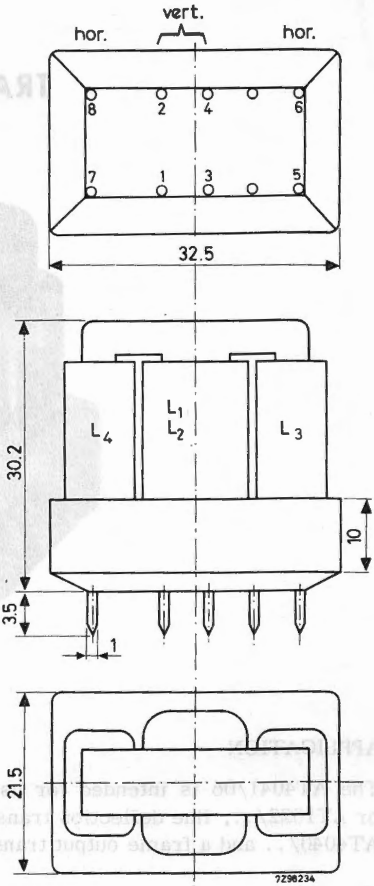
RZ 22830-6

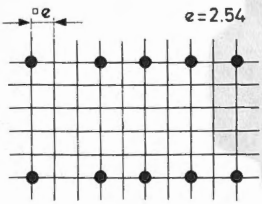
APPLICATION

The AT4041/06 is intended for use in conjunction with deflection unit AT1027/.. or AT1022/.., line deflection transformer AT2051/.., pin-cushion adjustor AT4040/.. and a frame output transformer to correct pin-cushion distortion.

MECHANICAL DATA

Dimensions in mm

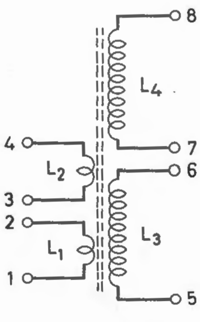




Hole pattern for mounting on a printed-wiring board.

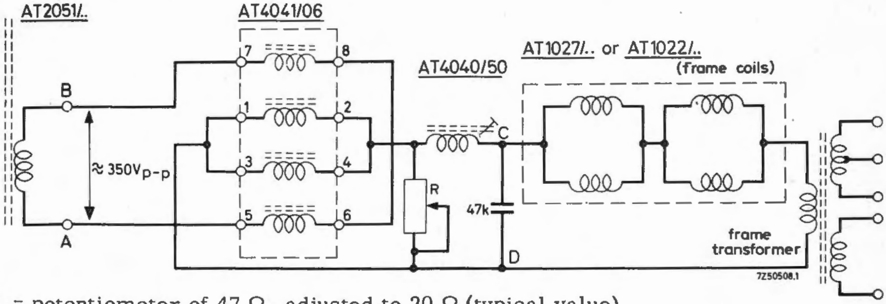
ELECTRICAL DATA

Circuit diagram



Connections

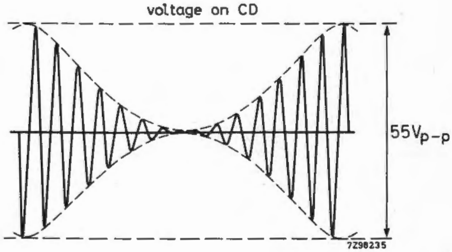
For AT1027/.. or AT1022/.. with parallel connected frame coils



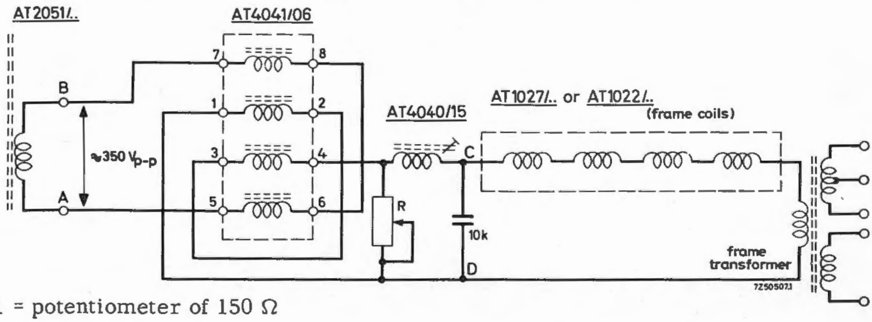
R = potentiometer of 47 Ω, adjusted to 20 Ω (typical value)

For AT2051/00
A-B = 1-3

For AT2051/01
A-B = 3-5 or 3-1



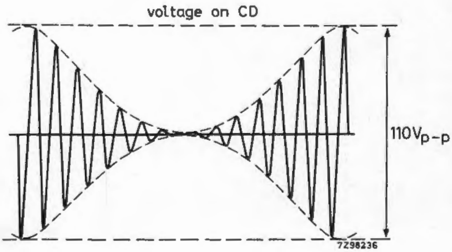
For AT1021/.. or AT1022/.. with series connected frame coils



R = potentiometer of 150 Ω

For AT2051/00
A-B = 1-3

For AT2051/01
A-B = 3-5 or 3-1



ADJUSTABLE LINEARITY CONTROL UNIT

RZ 22858-8

APPLICATION

This unit is intended to be used in black and white, and in colour TV sets equipped with tubes, to adjust the linearity of the line-deflection. In colour TV sets it can be used in combination with deflection unit AT 1027/.. or AT 1022/.. and line-output transformer AT 2050/.. or AT 2051/...

CONSTRUCTION

This control unit consists of a coil wound on a ferroxcube rod, and three ferroxdure magnets. One magnet is placed around the ferroxcube rod, above the coil. One of the magnets has the shape of a half ring, it is placed around the ferroxcube rod under the coil. The third ferroxdure magnet is cylindrical, it is positioned parallel to and clamped against the ferroxcube rod opposite the second. It is provided with a square hole to facilitate turning to adjust the biasing field and so the linearity of the line deflection.

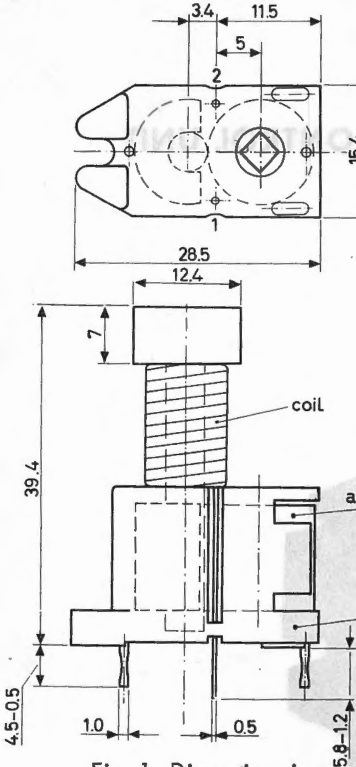


Fig. 1. Dimensions in mm

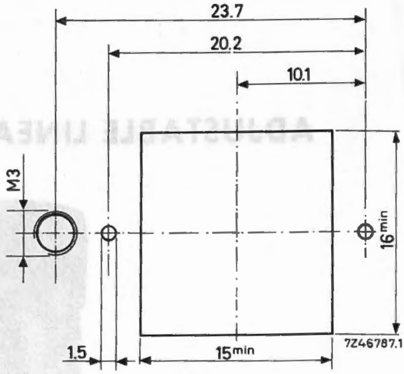


Fig. 2. Hole pattern for mounting on a chassis

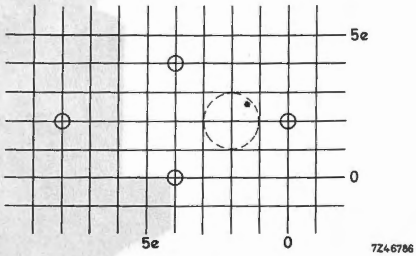


Fig. 3. Hole pattern for mounting on a printed-wiring board (e = 0.1")

ELECTRICAL DATA

When a saw-tooth current (without S-correction) of 2.8 A_{p-p}, frequency 15,625 Hz, flyback ratio 18 %, flows through the linearity control unit (one connection point to earth), the correction voltage is adjustable between 15 V and 26 V.

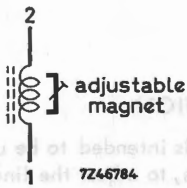


Fig. 4. Circuit diagram

MOUNTING

The unit can be mounted either on printed-wiring boards by means of its two connection pins and two mounting pins (see Fig. 3), or on metal chassis, by bending of the two mounting pins and/or by means of a screw through an aperture in the casing (see Fig. 2). To prevent distortion of the magnetic field no iron part should approach the magnetic parts anywhere nearer than 3 mm. The coil should be shunted with a carbon resistor to damp ringing phenomena (value of resistor depends on applied line-deflection transformer).

*Hole only necessary for bottom adjustment.

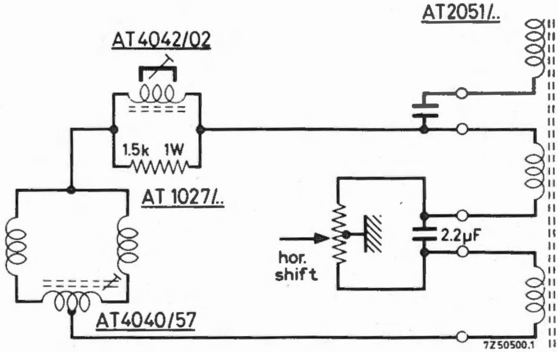
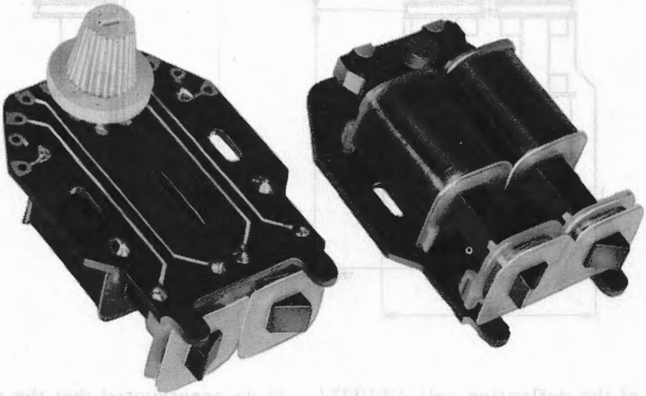


Fig. 5. Line-output circuit

CONVERGENCE UNITS



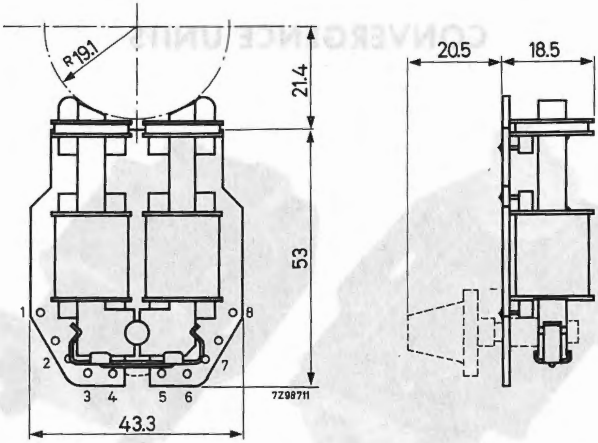
RZ 26110-4

APPLICATION

These units are intended to be used with a 90° shadow mask colour picture tube, in conjunction with the deflection unit AT1027/.. and the blue lateral unit AT1025/05 or AT1028/.. to converge the three colour pictures statically and dynamically and to adjust the purity.

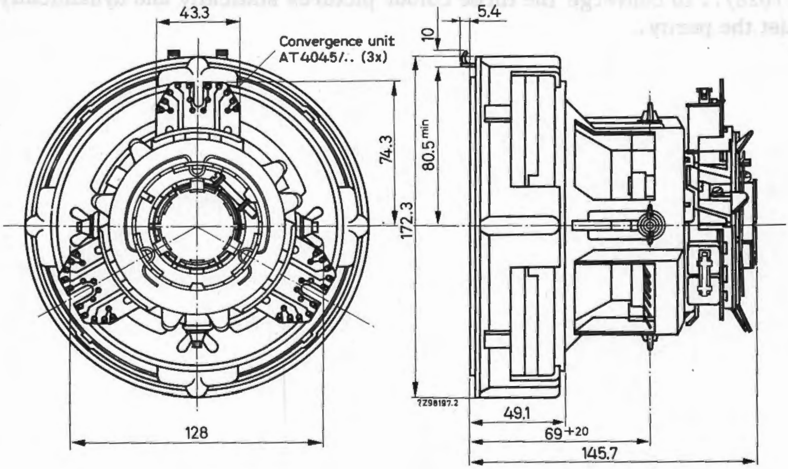
MECHANICAL DATA

Dimensions in mm



Mounting

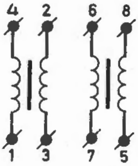
The housing of the deflection unit AT1027/.. is so constructed that the convergence units can easily slide in and then, after they have been properly pushed back, lock. The units have to be put into the housing with the printed wiring up (see drawing below). To take out the units the locks must be released; this can be done by pushing a screwdriver or the like between each unit and the housing.



Assembly consisting of a deflection unit AT1027/.. and three convergence units AT4045/...

ELECTRICAL DATA

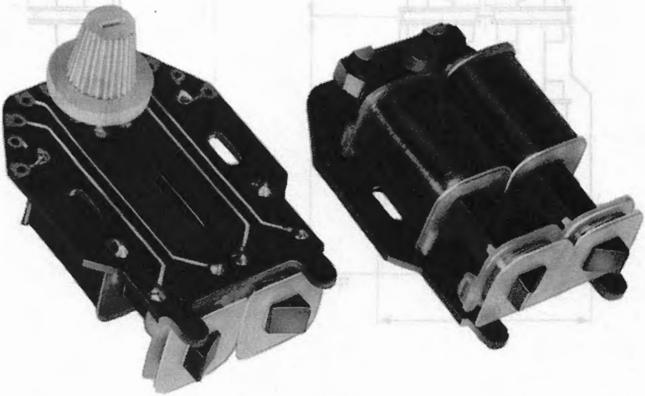
The units have 4 coils, two for horizontal and two for vertical deflection. They are mounted on a printed-wiring board. The coils can be connected either by soldering to the printed-wiring pads or by pushing a plug over the pins. The convergence unit AT4046/07 is provided with a permanent magnet for static convergence with which a shift of $\pm > 20$ mm can be obtained. Static convergence with the AT4045/07 is effected by a d.c. current through its frame coils.



	AT4045/07	AT4046/07
Series connected line coils		
Inductance	0.40 mH	0.43 mH
Resistance	2.5 Ω	2.5 Ω
Connecting tags	3 and 7	3 and 7
Tags to be interconnected	2 and 6	2 and 6
Parallel connected line coils		
Inductance	0.10 mH	0.11 mH
Resistance	0.6 Ω	0.6 Ω
Connecting tags	2 and 3	2 and 3
Tags to be interconnected	2 and 7, 3 and 6	2 and 7, 3 and 6
Series connected frame coils		
Inductance	1.40 H	1.48 H
Resistance	155 Ω	194 Ω
Connecting tags	1 and 5	1 and 5
Tags to be interconnected	4 and 8	4 and 8
Parallel connected frame coils		
Inductance	0.35 H	0.37 H
Resistance	38.8 Ω	48.5 Ω
Connecting tags	1 and 4	1 and 4
Tags to be interconnected	1 and 8, 4 and 5	1 and 8, 4 and 5

NON-PREFERRED

CONVERGENCE UNITS



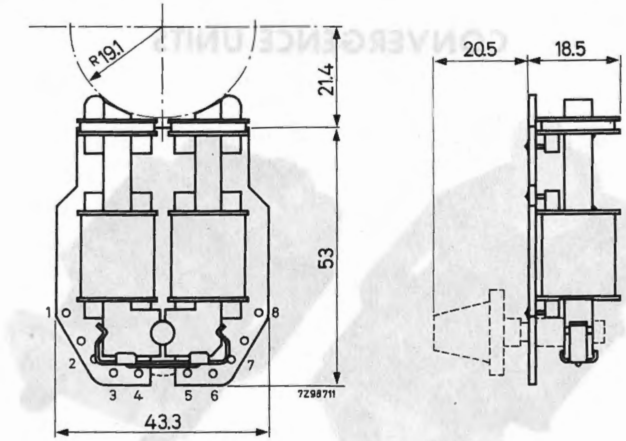
RZ 26110-4

APPLICATION

These units are intended to be used with a 90^{o} shadow mask colour picture tube, in conjunction with the deflection unit AT1027/.. and the blue lateral unit AT1025/05 or AT1028/.. to converge the three colour pictures statically and dynamically and to adjust the purity.

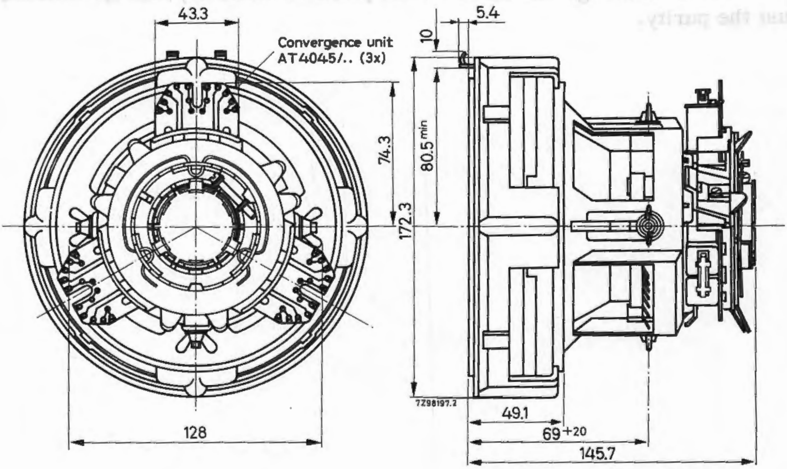
MECHANICAL DATA

Dimensions in mm



Mounting

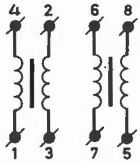
The housing of the deflection unit AT1027/.. is so constructed that the convergence units can easily slide in and then, after they have been properly pushed back, lock. The units have to be put into the housing with the printed wiring up (see drawing below). To take out the units the locks must be released; this can be done by pushing a screwdriver or the like between each unit and the housing.



Assembly consisting of a deflection unit AT1027/.. and three convergence units AT4045/...

ELECTRICAL DATA

The units have 4 coils, two for horizontal and two for vertical deflection. They are mounted on a printed-wiring board. The coils can be connected either by soldering to the printed-wiring pads or by pushing a plug over the pins. The convergence unit AT4046/08 is provided with a permanent magnet for static convergence with which a shift of ± > 20 mm can be obtained. Static convergence with the AT4045/08 is effected by a d.c. current through its frame coils.



	AT4045/08	AT4046/08
Series connected line coils		
Inductance	4.8 mH	5.2 mH
Resistance	22.6 Ω	22.6 Ω
Connecting tags	3 and 7	3 and 7
Tags to be interconnected	2 and 6	2 and 6
Parallel connected line coils		
Inductance	1.2 mH	1.3 mH
Resistance	5.7 Ω	5.7 Ω
Connecting tags	2 and 3	2 and 3
Tags to be interconnected	2 and 7, 3 and 6	2 and 7, 3 and 6
Series connected frame coils		
Inductance	1.40 H	1.52 H
Resistance	155 Ω	194 Ω
Connecting tags	1 and 5	1 and 5
Tags to be interconnected	4 and 8	4 and 8
Parallel connected frame coils		
Inductance	0.35 H	0.38 H
Resistance	38.8 Ω	48.5 Ω
Connecting tags	1 and 4	1 and 4
Tags to be interconnected	1 and 8, 4 and 5	1 and 8, 4 and 5

LUMINANCE DELAY LINE

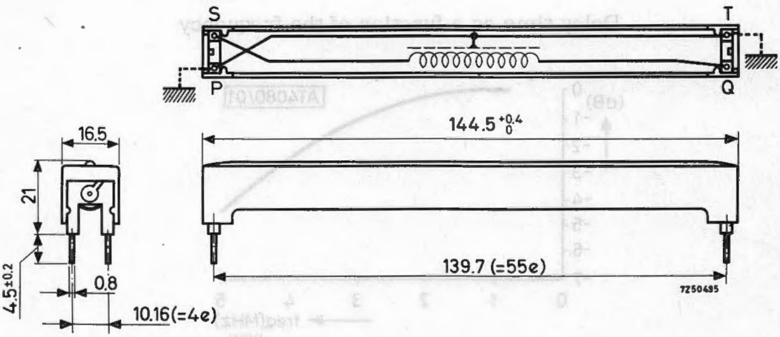
RZ 22858-3

APPLICATION

This delay line is intended for use in the luminance video amplifier of colour TV sets.

MECHANICAL DATA

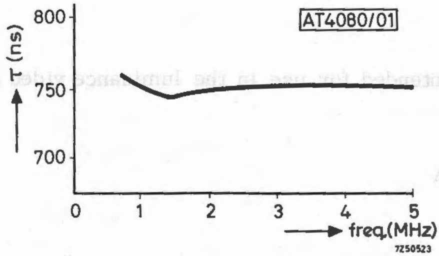
Dimensions in mm



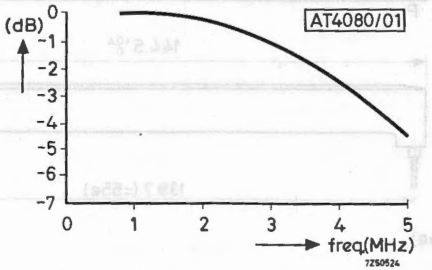
e = 2.54 mm

ELECTRICAL DATA

Delay time (τ)	750 ns $\pm$5 %
Rise time	85 ns
Impedance	1000 Ω $\pm$10 %
Temperature coefficient of the delay time	0.04 %/deg C
Maximum permissible temperature	90 ^{o}C
Maximum d.c. working voltage (between SQ and PT)	75 V
Pre-shoot	5 %



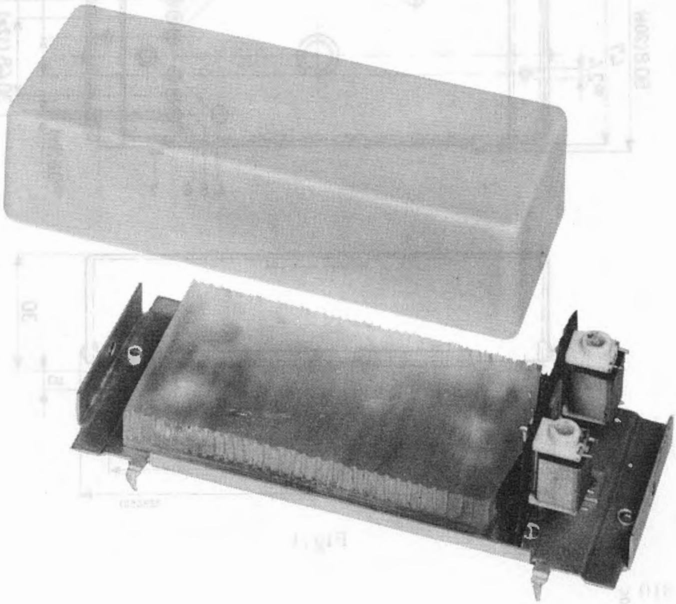
Delay time as a function of the frequency



Amplitude characteristic

NON-PREFERRED

DELAY LINE



RZ 24284-9

APPLICATION

This delay-line is intended for use in the decoder circuits of television receivers. It consists of a glass delay-line, appropriate transductors and coils which are accurately adjusted during manufacture to provide the correct overall phase delay-time when fed by a source with an internal impedance of 100 Ω and terminated with a load of 100 Ω.

MECHANICAL DATA

Dimensions in mm

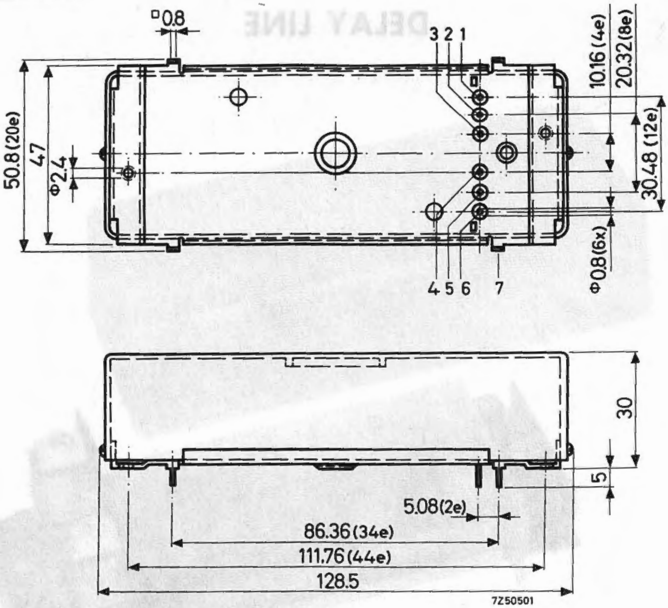


Fig.1

Weight 310 g

Mounting

The unit is intended for insertion directly into a printed-wiring board. Additionally, two holes are provided in the underside for the purpose of fixing the unit by means of self-tapping screws, if so required.

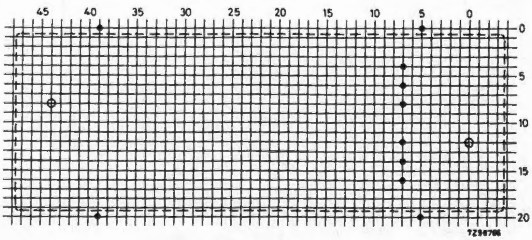


Fig.2. Hole pattern for mounting on a printed-wiring board. e = 2.54 mm.

ELECTRICAL DATA

Nominal frequency f_{nom}	4.433619 MHz
Nominal phase delay-time ($V_1 - V_2$) at f_{nom} (unmodulated sinewave voltage)	63.943 μs
Accuracy of adjustment	$\pm$ 5 ns
−3 dB points (bandwidth)	one below 3.43 MHz, the other above 5.23 MHz
Insertion loss	13 $\pm$ 4 dB at f_{nom}
Temperature drift (relative to 25 °C)	measured while temperature is made to rise linearly ($\pm$ 1 °C) in an interval of 3 h from 20 to 50 °C, after which it is kept constant at 50 °C for 2 h.
phase delay	max. $\pm$ 5 ns, typical value 3 ns
insertion loss	typical $\pm <$ 0.3 dB
Maximum input at f_{nom} (terminals 4 and 6)	10 $V_{p\text{-}p}$
Termination impedances	100 Ω
Unwanted reflections at 3τ	− < 22 dB with respect to 1τ signal
other reflections	− < 27 dB with respect to 1τ signal measured at f_{nom} with a burst of 25 μs length and a repetition frequency of 2.6 kHz
Operating temperature range	−20 °C/+70 °C
Asymmetry of the coils at f_{nom} $\left\lvert \frac{V_0}{V_2} \right\rvert$	< 0.05 (see Fig. 4)

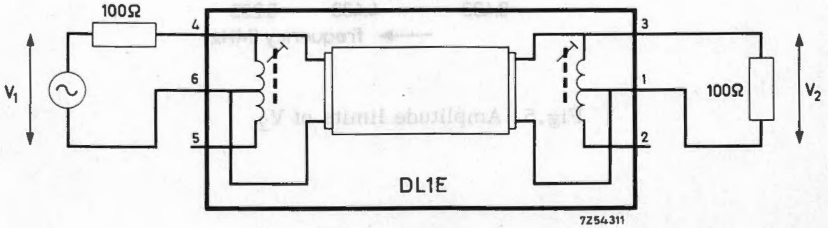


Fig. 3. Circuit diagram and connections

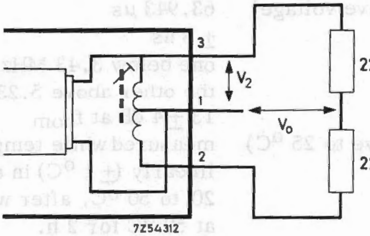


Fig.4. Set-up for measuring coil asymmetry
V_o/V_2 (at f_{nom})

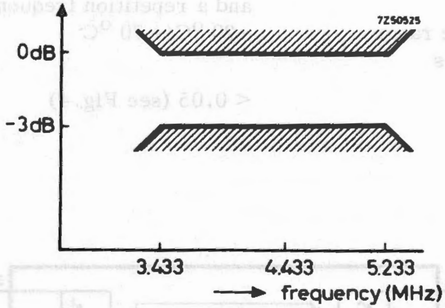
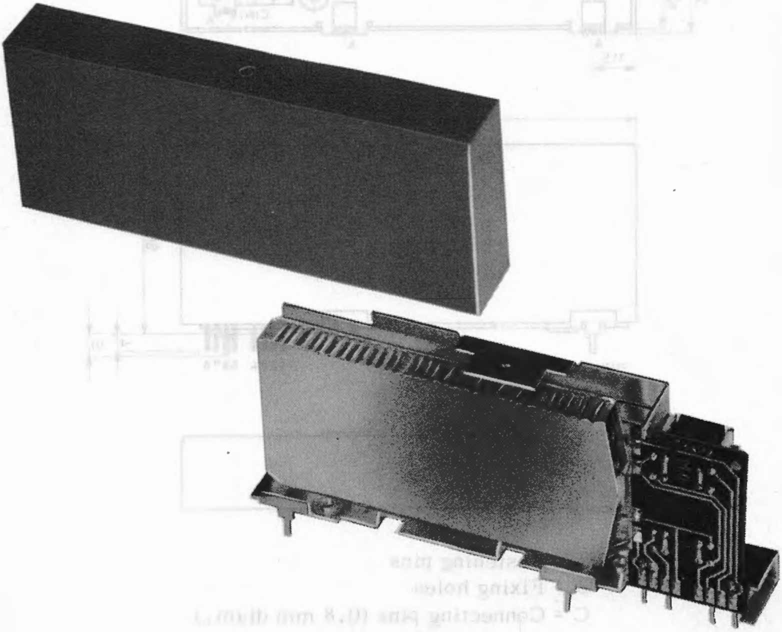


Fig.5. Amplitude limits of V_2

DELAY LINE



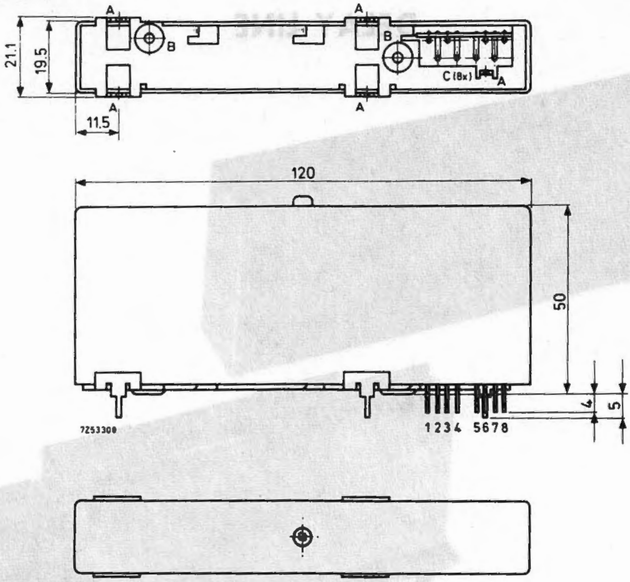
RZ 26110-2

APPLICATION

This delay-line is intended for use in the decoder circuits of television receivers. It consists of a glass delay-line, appropriate transductors and coils which are accurately adjusted during manufacture to provide the correct overall phase delay-time when fed by a source with an internal impedance of 100 Ω and terminated with a load of 100 Ω.

MECHANICAL DATA

Dimensions in mm



A = Fastening pins
B = Fixing holes
C = Connecting pins (0.8 mm diam.)

Weight 165 g

Mounting
The unit is intended for insertion directly into a printed-wiring board. Additionally, two holes are provided in the underside for the purpose of fixing the unit by means of M3 screws, if so required.

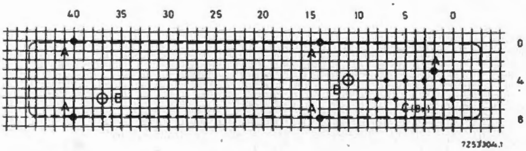


Fig.2. Hole pattern for mounting on a printed-wiring board. e = 2.54 mm.

ELECTRICAL DATA

Nominal frequency f_{nom}	4.433619 MHz
Nominal phase delay-time ($V_1 - V_2$) at f_{nom} (unmodulated sinewave voltage)	63.943 μs
Accuracy of adjustment	$\pm$ 5 ns
-3 dB points (bandwidth)	one below 3.43 MHz, the other above 5.23 MHz
Insertion loss	11 $\pm$ 3 dB at f_{nom}
Temperature drift (relative to 25 °C)	measured while temperature is made to rise linearly ($\pm$ 1 °C) in an interval of 3 h from 20 to 50 °C, after which it is kept constant at 50 °C for 2 h.
phase delay	max. $\pm$ 5 ns, typical value 3 ns
insertion loss	typical $\pm < 0.3$ dB
Maximum input at f_{nom} (terminals 3 and 4)	10 V_{p-p}
Termination impedances	100 Ω
Unwanted reflections at 3τ	- < 22 dB with respect to 1τ signal
other reflections	- < 27 dB with respect to 1τ signal measured at f_{nom} with a burst of 25μs lenght and a repetition frequency of 2.6 kHz
Operating temperature range	-20 °C/+ 70 °C
Asymmetry of the coils at f_{nom} $\left\lvert\frac{V_o}{V_2}\right\rvert$	< 0.05 (see Fig.4)

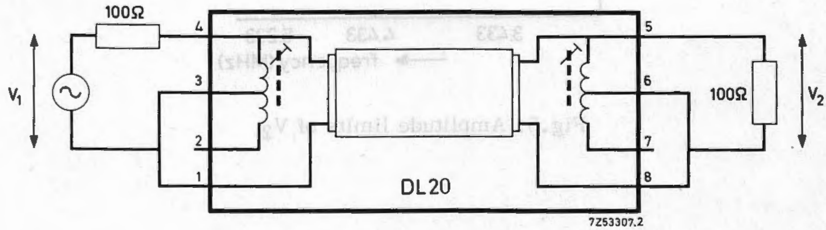


Fig.3. Circuit diagram and connections

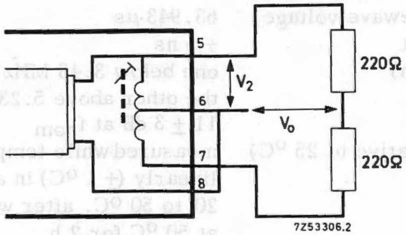


Fig.4. Set-up for measuring coil asymmetry V_o/V_2 (at f_{nom})

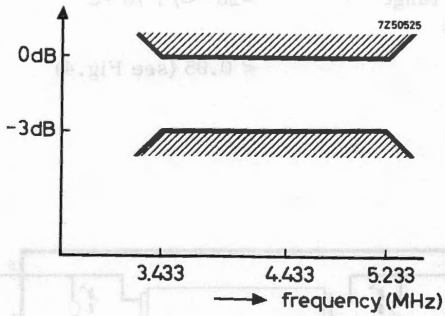


Fig.5. Amplitude limits of V_2

Deflection assemblies for camera tubes

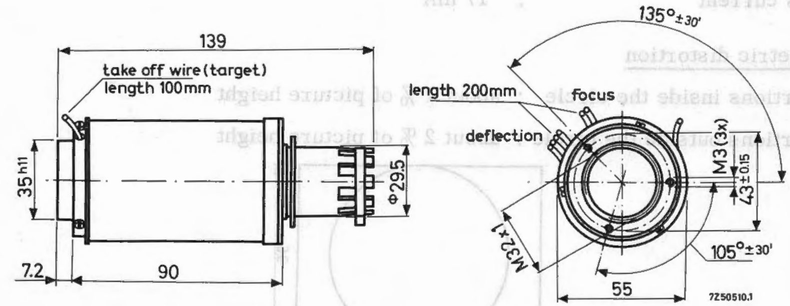
VIDICON DEFLECTION UNIT

APPLICATION

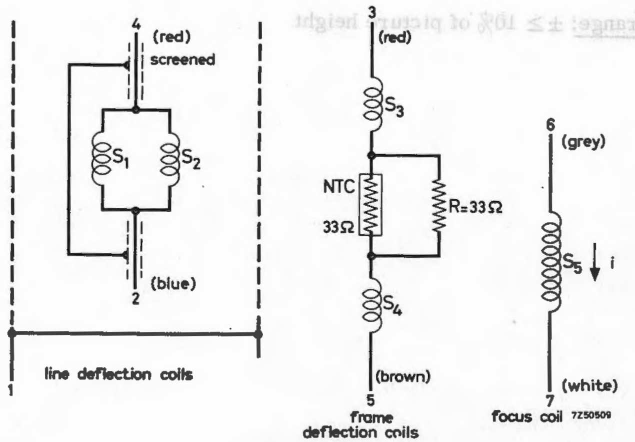
Deflection assembly, consisting of deflection and focus coils and alignment ring magnets, for a 1" Vidicon.

MECHANICAL DATA

Dimensions in mm



ELECTRICAL DATA (typical values)



coils	measuring points	earth points	inductance (mH)	resistance (Ω)
$S_1 + S_2$	2 - 4	2	0.75	2.5
$S_3 + S_4$	3 - 5	5	23	80
S_5	6 - 7	-	-	4200

Required currents for normal operation (V_{g4} = 300 V)

Line deflection current : 170 mA p-p

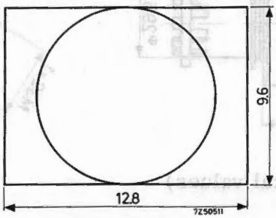
Frame deflection current : 24 mA p-p

Focus current : 17 mA

Geometric distortion

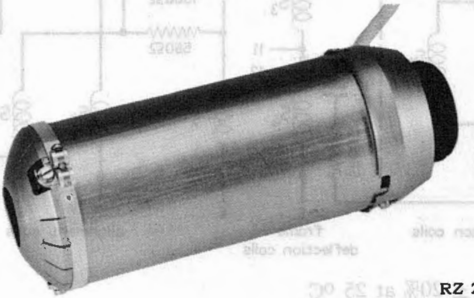
Distortions inside the circle : about 1 % of picture height

Distortions outside the circle : about 2 % of picture height



Alignment range: ± ≥ 10% of picture height

PLUMBICON DEFLECTION UNIT

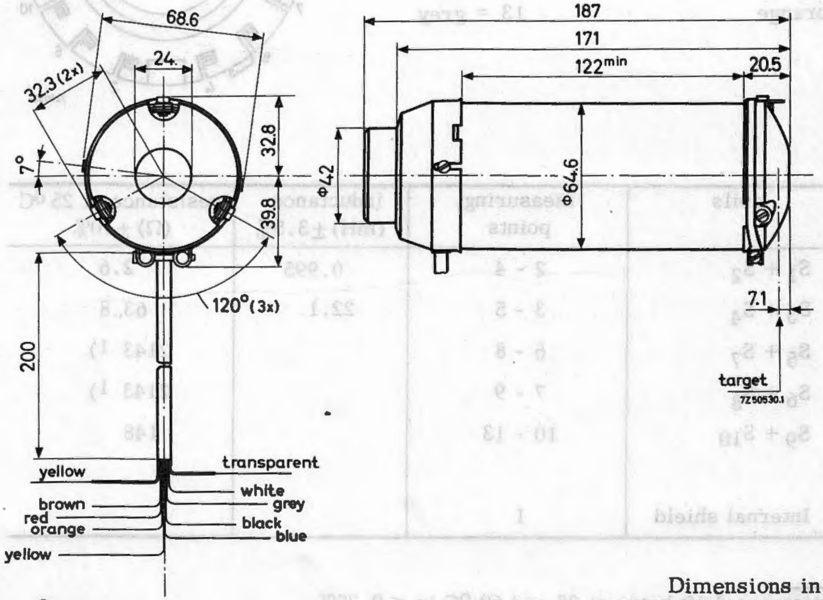


RZ 22858-10

APPLICATION

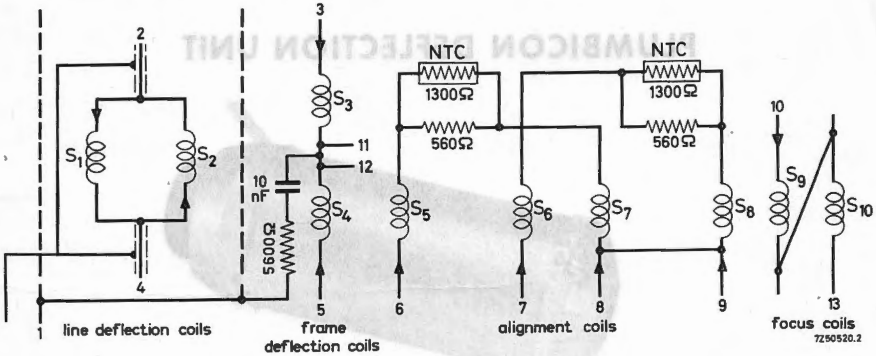
Deflection assembly, consisting of deflection, focus and alignment coils, for a Plumbicon.

MECHANICAL DATA

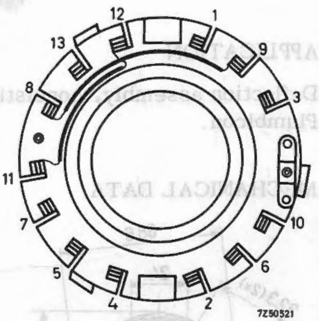


Dimensions in mm

ELECTRICAL DATA (typical values)



NTC = 1300 Ω ± 20% at 25 °C
R = 560 Ω ± 5%



1 = black
2 = transparent (screened)
3 = brown
4 = yellow (screened)
5 = red
6 = orange
7 = yellow
8 = 9 = blue
10 = white
11 = –
12 = –
13 = grey

coils	measuring points	inductance (mH) ±3.5%	resistance at 25 °C (Ω) ±10%
$S_1 + S_2$	2 - 4	0.995	2.6
$S_3 + S_4$	3 - 5	22.1	63.8
$S_5 + S_7$	6 - 8		2143 1)
$S_6 + S_8$	7 - 9		2143 1)
$S_9 + S_{10}$	10 - 13		148
Internal shield	1		

1) Resistance drift between 25 and 60 °C is < 0.75%

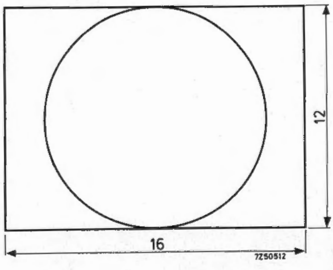
Required currents for normal operation

		V_{g3} = 300 V	V_{g3} = 600 V
Line deflection current	:	160 mA p-p	225 mA p-p ←
Frame deflection current	:	25 mA p-p	35 mA p-p
Focus current	:	75 mA ($S_9 + S_{10}$ in series)	100 mA
Maximum alignment currents	:	± 5 mA	± 5 mA

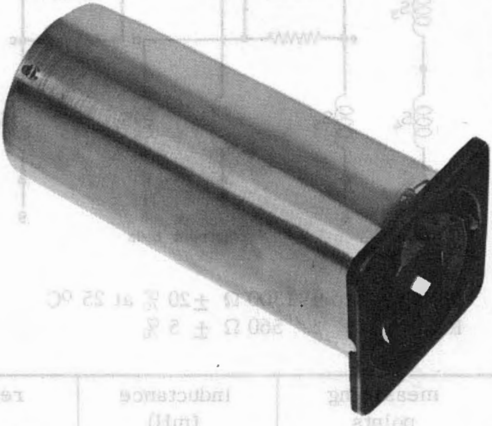
Geometric distortion

Distortions inside the circle max. 0.5 % of picture height

Distortions outside the circle max. 1 % of picture height



PLUMBICON DEFLECTION UNIT



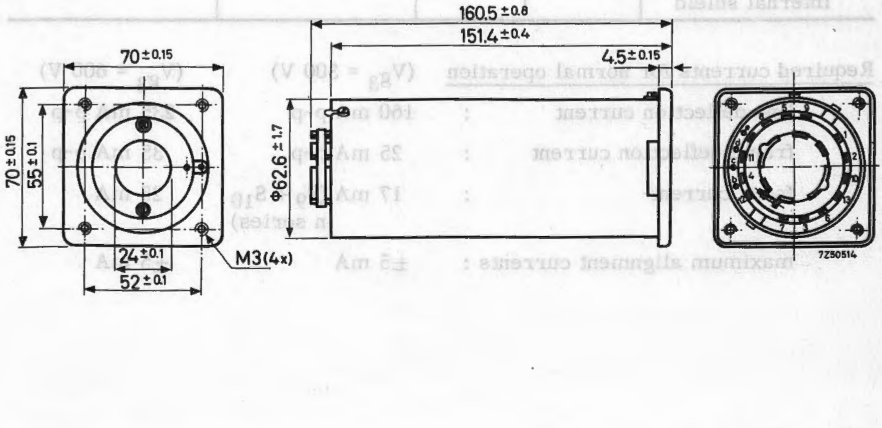
RZ 18033-18

APPLICATION

Deflection assembly, consisting of deflection, focus and alignment coils for a Plumbicon.

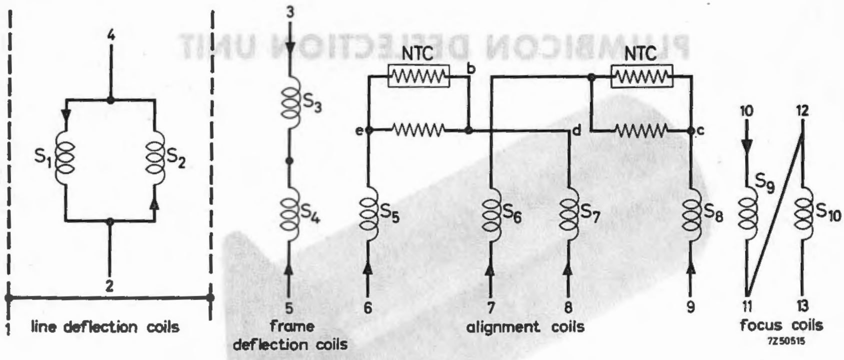
MECHANICAL DATA

Dimensions in mm



7Z50514

ELECTRICAL DATA (typical values)



NTC resistor: 1300 Ω ±20 % at 25 °C
R : 560 Ω ± 5 %

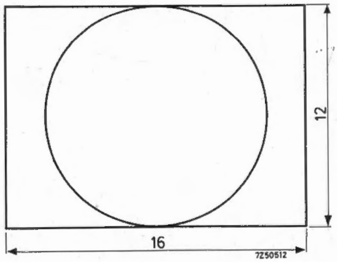
coils	measuring points	inductance (mH)	resistance (Ω)
$S_1 + S_2$	2 - 4	0.99	2.6
$S_3 + S_4$	3 - 5	22.1	63.8
$S_5 + S_7$	6 - 8		2390
$S_6 + S_8$	7 - 9		2390
S_9	12 - 13		1100
S_{10}	10 - 11		1650
Internal shield	1		

Required currents for normal operation		(V_{g_3} = 300 V)	(V_{g_3} = 600 V)
line deflection current	:	160 mA p-p	235 mA p-p
frame deflection current	:	25 mA p-p	35 mA p-p
focus current	:	17 mA ($S_9 + S_{10}$ in series)	25 mA
maximum alignment currents	:	±5 mA	±5 mA

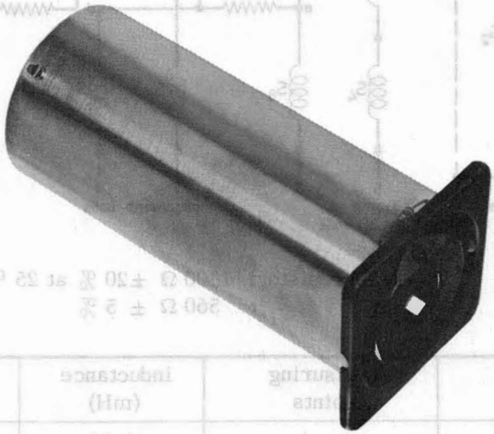
Geometric distortion

Distortions inside the circle : max. 1 % of picture height

Distortions outside the circle : max. 2 % of picture height



PLUMBICON DEFLECTION UNIT



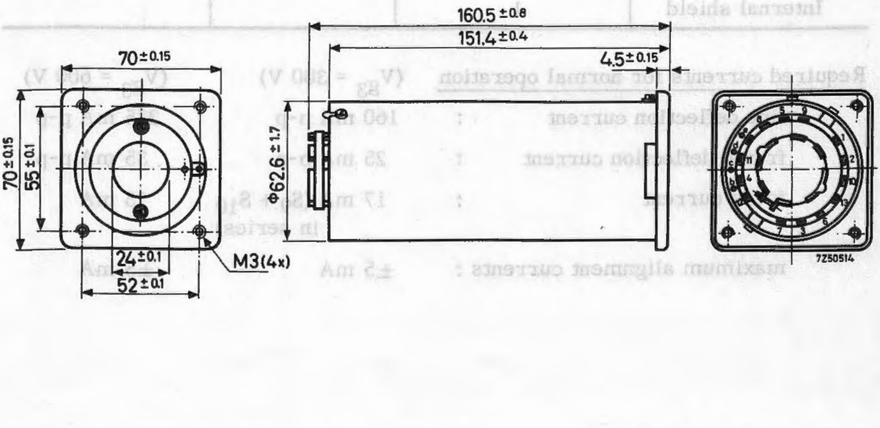
RZ 18033-18

APPLICATION

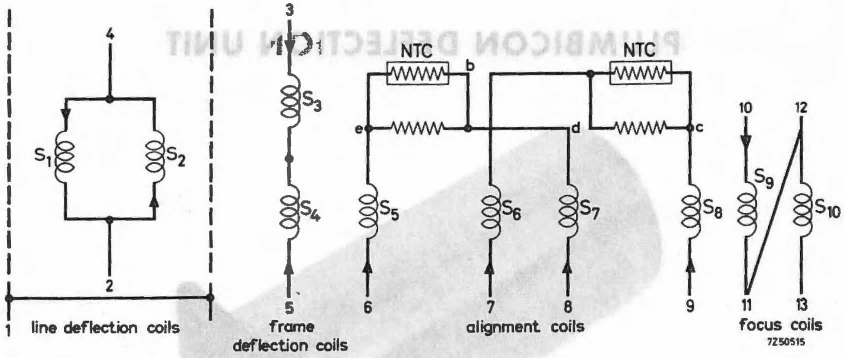
Deflection assembly, consisting of deflection, focus and alignment coils for a Plumbicon.

MECHANICAL DATA

Dimensions in mm



ELECTRICAL DATA (typical values)



NTC resistor: 1300 Ω ±20 % at 25 °C
R : 560 Ω ± 5 %

coils	measuring points	inductance (mH)	resistance (Ω)
$S_1 + S_2$	2 - 4	0.99	2.6
$S_3 + S_4$	3 - 5	22.1	63.8
$S_5 + S_7$	6 - 8		2390
$S_6 + S_8$	7 - 9		2390
S_9	12 - 13		1100
S_{10}	10 - 11		1650
Internal shield	1		

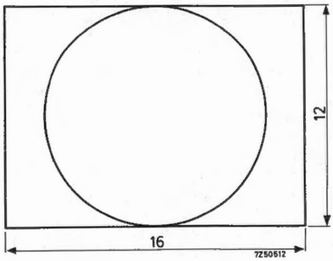
<u>Required currents for normal operation</u> (V_{g3} = 300 V) (V_{g3} = 600 V)

		V_{g3} = 300 V	V_{g3} = 600 V
line deflection current	:	160 mA p-p	235 mA p-p
frame deflection current	:	25 mA p-p	35 mA p-p
focus current	:	17 mA ($S_9 + S_{10}$ in series)	25 mA
maximum alignment currents	:	±5 mA	±5 mA

Geometric distortion

Distortions inside the circle : max. 0.5 % of picture height

Distortions outside the circle : max. 1 % of picture height



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D Loudspeakers

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F Television tuners

G Components for black and white television

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K Deflection assemblies for camera tubes

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