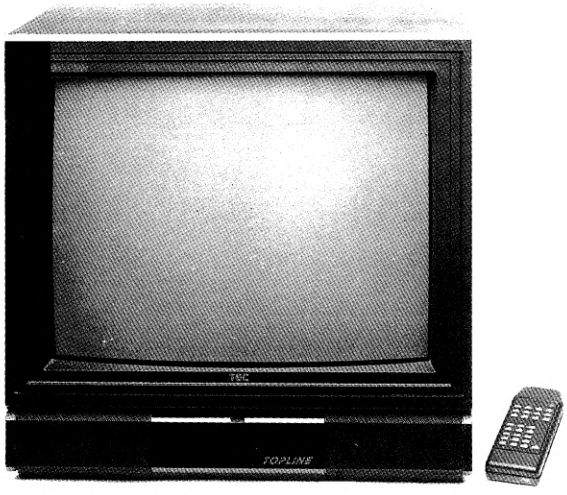
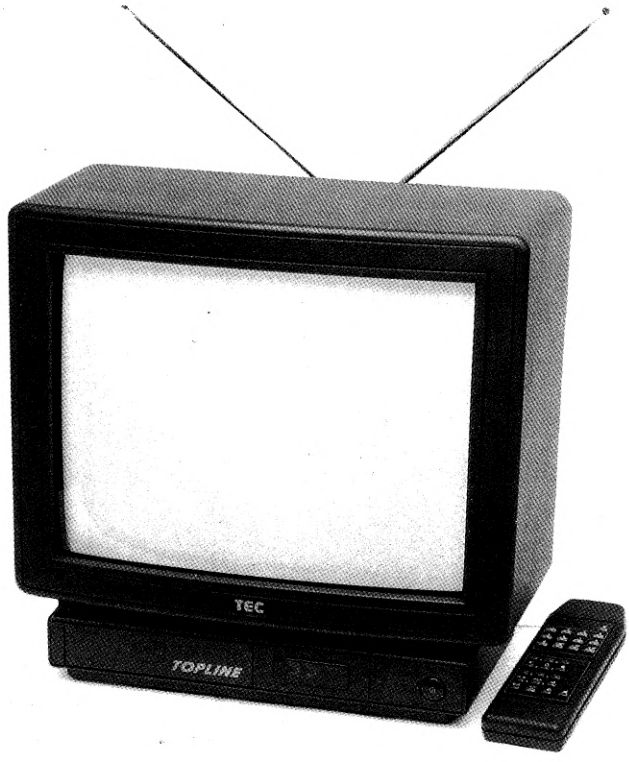
ELPRO-SERVICE

TEC®

Technik zum Anfassen

Service-Unterlagen





TEC 3781VR
TEC 3782VR
TEC 4081VR
TEC 4082VR
TEC 5180VR
TEC 5181VR
TEC 5182VR
TEC 5183VR
TEC 5184VR
TEC 5580VR
TEC 5581VR
TEC 5582VR
TEC 5583VR
TEC 5584VR
TEC 5590VR
TEC 5591VR
TEC 5592VR

Contents

Section 1 - General Specifications & Notes

Colour system	PAL CCIR 625 line		
	SECAM V or H *		
Sound system	FM 5,5MHz (B/G/H) or 6MHz (I)		
Tuning range	VHF Band I	48-106MHz	
		Ch E2-E4	Europe
		Ch A-C	Irish
		Ch S1	Cable
	VHF Band III	115-297MHz	
		Ch E5-E12	Europe
		Ch D-K	Irish
		Ch S3-S20	Cable
	UHF Band	474-858MHz	Channels 21-69 UK
Antenna	75 ohm unbalanced		
Picture tube	PIL 90° pin cushion free		
Power supply	160-264V ~ AC 50Hz		
Audio output	5W RMS @ 10% THD		(8 ohm)
	2W RMS @ 10% THD		(16 ohm)
	Frequency response		25Hz - 12KHz (-3dB)
AV inputs *	Video 1V peak 75 ohm		
	Audio 250mV 10K ohm		
Teletext *	WST625 (English/German/Swedish)		

* Optional features

Parts Lists Abbreviations

Resistors	CF	Carbon film
	FR	Fusible
	MO	Metal oxide
	MF	Metal film
	SR	Safety
	WW	Wire wound
Presets	HRZ	Horizontal mounting
	VRT	Vertical mounting
Capacitors	CER	Ceramic
	ELC	Electrolytic
	MKT	Philips 'MKT' type
	MKS	Philips 'MKS' type
	MKT-P	Philips 'MKT-P type
	FKP1	Wima 'FKP1' type
	FKP2	Wima 'FKP2' type
Tolerances	F	+/- 1%
	G	+/- 2%
	J	+/- 5%
	K	+/- 10%
	M	+/- 20%

Section 2 - Safety and Servicing Precautions

READ THESE SAFETY WARNINGS BEFORE SERVICING THIS CHASSIS.

This television receiver is manufactured to comply with the International Safety Standard IEC65 or its variants (BS415-UK, VDE-GERMANY etc).

WARNING - High voltage. Servicing should only be performed by suitably qualified and experienced personnel.

WARNING - Use an isolation transformer. Although the chassis is isolated from the mains supply, areas of the main PCB are at mains potential. Use a 250-500VA transformer when servicing.

WARNING - Read the following instructions before attempting any repairs or adjustments.

Safety components

Many electrical and mechanical parts in this chassis have special safety-related characteristics which may pass unnoticed by visual inspection. The protection afforded by them cannot necessarily be obtained by using replacement components rated for higher voltage, wattage, etc. The fitting of non-approved components may cause a hazard resulting in electric shock or fire. Replacement parts which have special safety characteristics are identified by the following symbol in this manual and its supplements.

Before replacing any of these components, read the parts list in this manual carefully.

X-ray radiation

This receiver is designed so that X-ray radiation is kept to an absolute minimum. Since certain malfunctions or service-work may generate potentially hazardous radiation with prolonged exposure at close range, the following precautions should be observed.

- While repairing, ensure that the high voltage does not exceed 26KV (at a beam current of 1 mA).
- For normal operation, the receiver should require only 24.5KV +/–1.5KV (at a beam current of 1 mA)
- The only source of X-RAY RADIATION in this TV receiver is the picture tube. For continued X-RAY RADIATION protection, the replacement tube must be of the same type tube as that specified in the parts list.

High voltages

- Potentials as high as 25,000 volts are present when this receiver is operating. Operation of the receiver outside the cabinet or with the back cover removed presents a shock hazard.
- Servicing should not be attempted by anyone who is not thoroughly familiar with the precautions necessary when working on high-voltage equipment.

- Always discharge the picture tube anode to the chassis ground to remove shock hazard before disconnecting the anode cap. Use a lead with a 10K series resistor.
- Completely discharge the high potential of the picture tube before handling. The picture tube is highly evacuated and if broken, glass fragments will be violently expelled.

Fuses, fusible resistors and power resistors

- In the event of fuse or fusible resistor replacement they must be replaced with the type specified in the parts list.
- Power and fusible resistors should be mounted the same distance above the circuit board as the original.

General Servicing Precautions

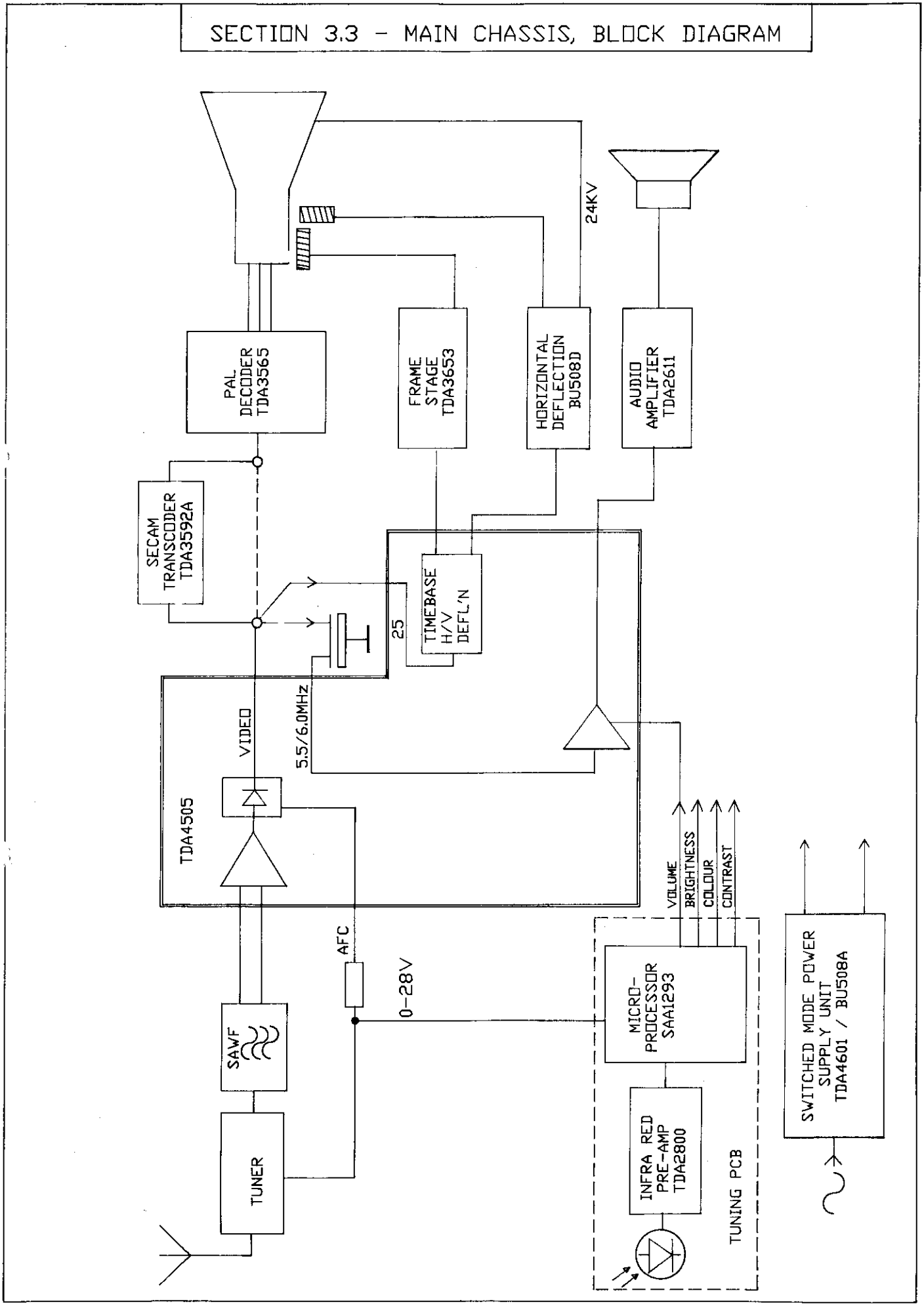
- Disconnect the television from the mains supply before discharging the picture tube anode or before removing or refitting any component, circuit board, module or connector.
- Fitting a wrong part or incorrect polarity of electrolytic capacitors may result in an explosion.
- Test high voltage only with a high voltage meter or a multi meter equipped with a suitable high voltage probe. Do not test high voltage by "drawing an arc".
- Do not spray any chemicals on or near this instrument or any of its assemblies.
- Ensure that all power transistors and integrated circuits have their heatsinks correctly fitted before connecting power. Use heatsink compound where necessary.
- Electrostatically sensitive (ES) devices. Some integrated circuits in the tuning and teletext circuits can be easily damaged by static eletricity. Ensure that no power is applied to the chassis or circuit. Do not remove a replacement ES device from its protective package until you are ready to install it. Do not use freon-propelled chemicals since these can generate electrical charges sufficient to damage ES devices.

Before returning the television to the customer

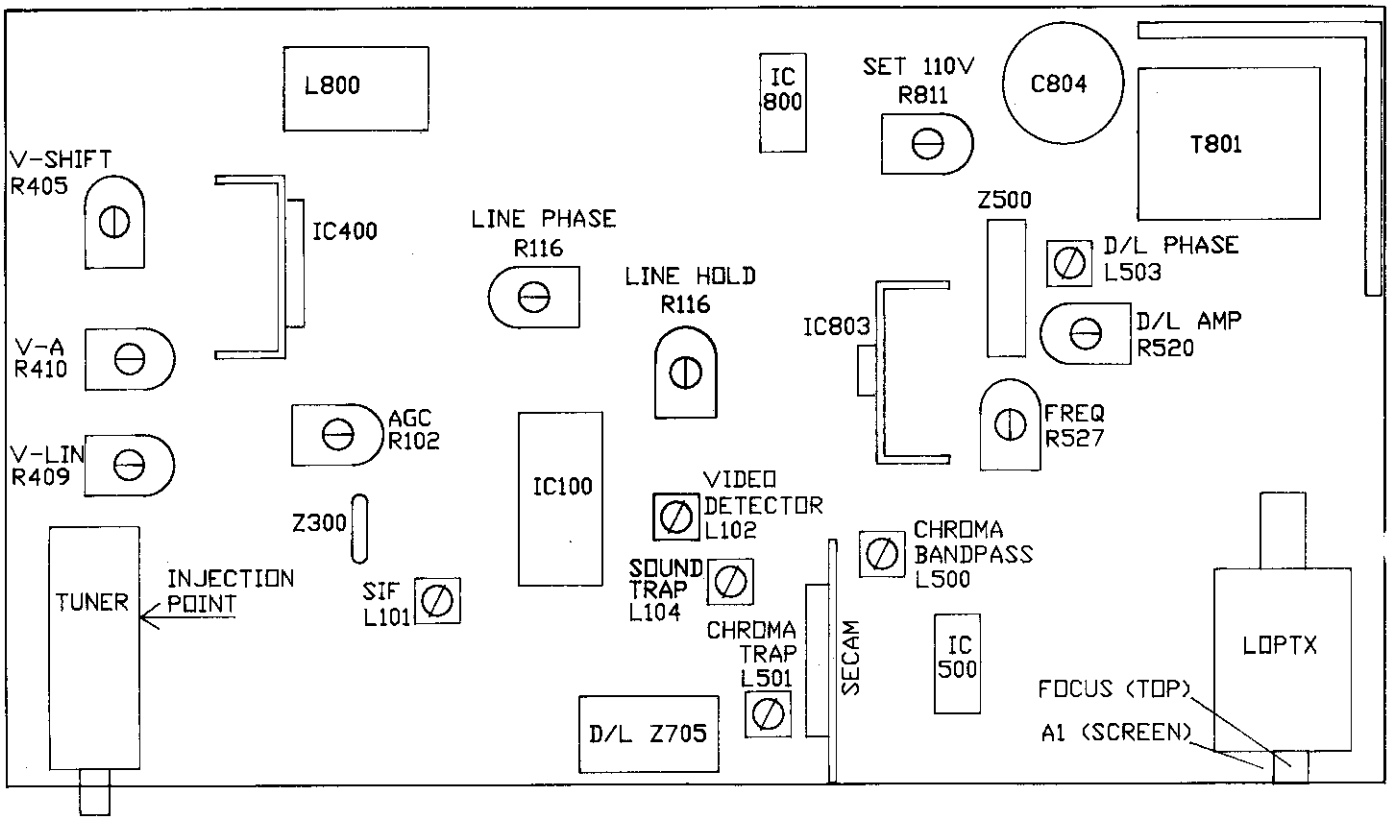
After servicing is completed, carry out the following safety checks.

- Inspect lead dress to make certain that leads are not pinched or damaged.
- Ensure that no loose parts are lodged within the receiver.
- Inspect and ensure that all protective devices such as non-metallic control knobs, insulators, cabinet backs, adjustment and compartment covers and shields, isolation resistors, capacitor networks, mechanical insulators are refitted correctly.
- If a mains plug is not fitted, ensure that the mains connection label is fitted.
- Perform flash, insulation and load tests using a suitable appliance tester.

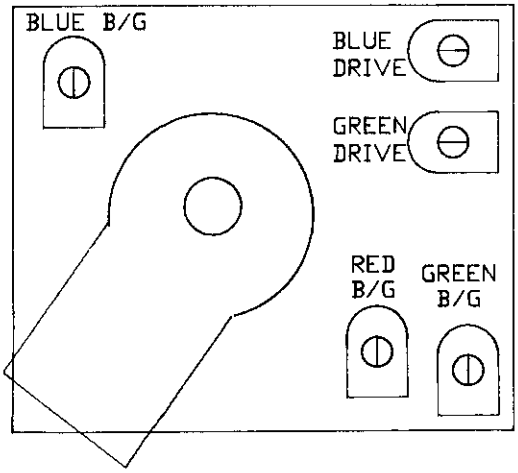
SECTION 3.3 - MAIN CHASSIS, BLOCK DIAGRAM



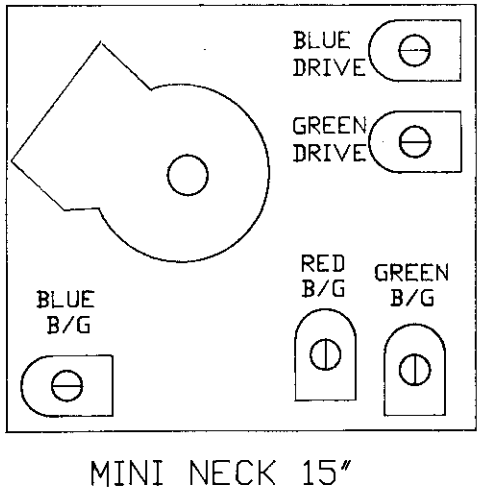
SECTION 3.5 MAIN CHASSIS & CRT BASE PCB ALIGNMENT POINTS



MAIN CHASSIS



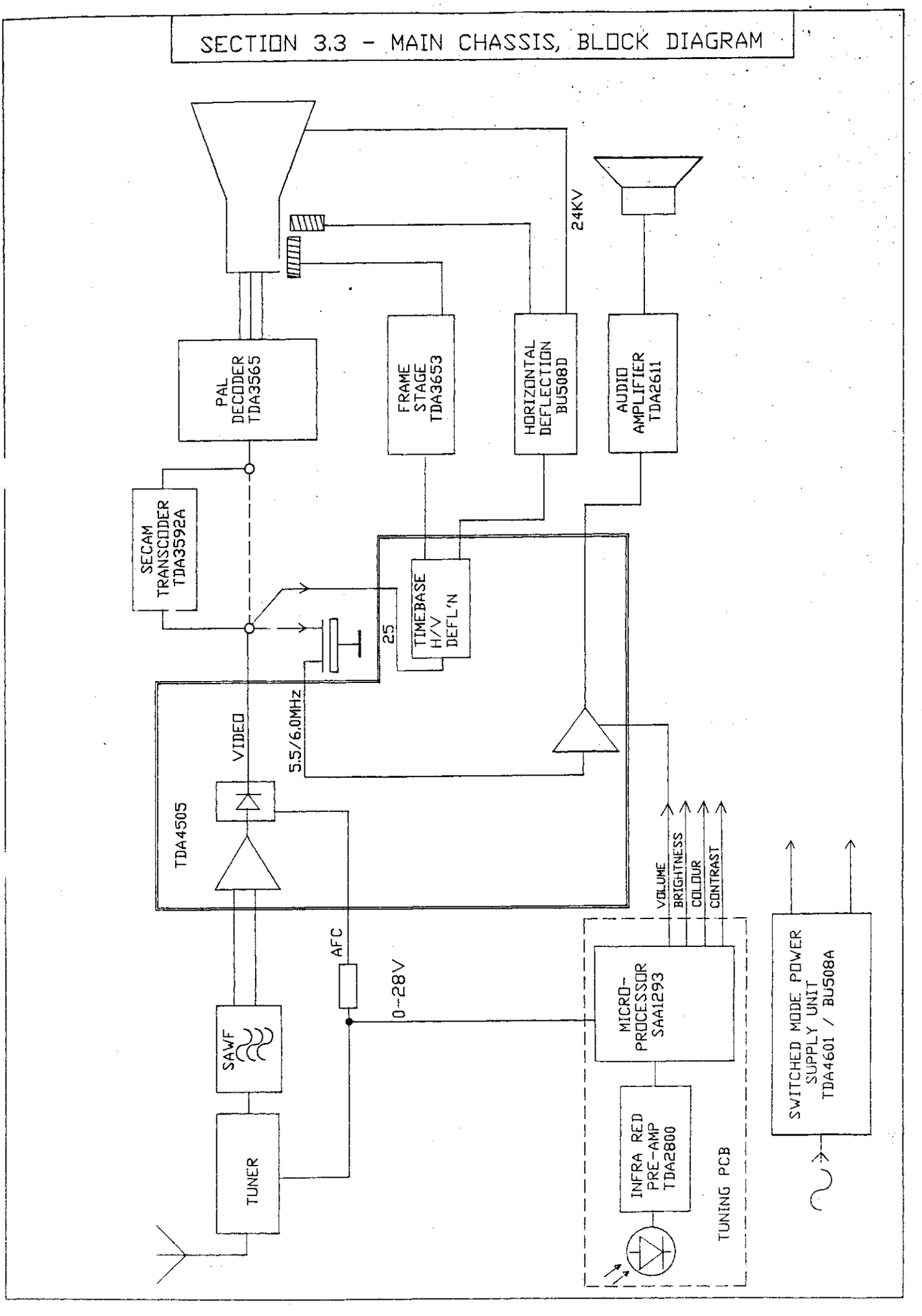
STANDARD NECK
14", 20" & 21"



MINI NECK 15"

Note B/G = Background = Cut off

CRT BASE PCB


SECTION 3.3 - MAIN CHASSIS, BLOCK DIAGRAM
24KV
PAL DECODER TDA3565
FRAME STAGE TDA3653
HORIZONTAL DEFLECTION BU508D
AUDIO AMPLIFIER TDA2611
SECAM TRANSCODER TDA3592A
TIMEBASE H/V DEFL'N
25
5.5/6.0MHz
VIDEO
TDA4505
AFC
0-28V
SAWF
TUNER
MICRO-PROCESSOR SAA1293
VOLUME
BRIGHTNESS
COLOUR
CONTRAST
INFRA RED PRE-AMP TDA2800
TUNING PCB
SWITCHED MODE POWER SUPPLY UNIT TDA4601 / BU508A

Section 3.4 - Main Chassis, Description

The TDA 4505 combines all the small signal functions (except colour decoder and tuner) necessary for a colour TV receiver. Only output amplifiers for horizontal and vertical deflection and sound are required.

Tuner

Three different tuners may be fitted :-
Type 1604UEC for UHF only
Type 3010UEC for UHF only
Type 1604KKC for VHF/UHF (including cable bands)

The tuners incorporate a preamplifier which is capable of driving the SAW filter directly.

Vision IF and detector

The IF amplifier has a symetrical input (pins 8,9) and gain controlled stages. Gated AGC is used.

A 90 degree phase shift network is used together with the synchronous video demodulator to provide both AFC and video detection. Only one reference coil (L102) is required.

With very weak input signals the AFC signal can become noisy and errors occur. To prevent this the AFC detector is switched off during no or weak signal conditions.

Sound IF and Audio stages

The composite video output from pin 17 also contains the intercarrier sound signal which passes through the filter Z101 and enters the sound IF stage at pin 15.

The FM signal from the AV board can also be injected here. After FM limiting the signal is demodulated by a quatrature demodulator (L101).

The volume level is controlled by a DC control voltage on pin 11; sound muting also occurs at this stage.

The audio signal from pin 12 is then amplified by a TDA2611A power amplifier.

Horizontal Deflection

The horizontal synchronisation circuit has 2 control loops to enable accurate sand castle timing and to compensate for storage time delays in Q601. Automatic loop time constant switching and sound muting are also included.

Synchronisation pulses are generated by the synch separator (pin 25) which receives video (FBAS) signals from either the video output (pin 17) or external signals via the AV board (K100 pin 5).

In the first control loop the RC oscillator is synchronised with the synchronising pulses from the synch separator.

The phase detector produces an error voltage on pin 24 which controls the frequency of the RC oscillator (pin 23).

The coincidence detector and logic circuits select the correct time constant for weak or strong signals. The circuit also detects signals from a VCR or video disk player and selects the correct time constant.

Picture centring (horizontal shift) is achieved by applying a DC potential from the R116 to the second phase detector circuit (pin 28).

The line (horizontal) output stage Q601, Q600 and T600, T601 are of conventional design.

Pin 27 serves as an input for flyback pulse to sychronise the line (horizontal) oscillator as well as generating a sandcastle pulse for the PAL and SECAM decoders. The flyback pulse from C606 is clamped by diode D604 to produce a 10V square wave. The 4 levels required for the complete sandcastle pulse (frame/vertical blanking, horizontal blanking, colour burst gating and unblanked) are produced by pin 27 clamping the flyback pulse at the required level.

Vertical (frame) deflection.

The vertical deflection circuit consists of a ramp generator, digital divider/counter, controlling logic and an external power amplifier.

No adjustment for vertical frequency is required; 50 or 60Hz signals are selected automatically.

The TDA3565 power amplifier acts as a voltage to current converter amplifying the ramp output from pin 3 of the TDA4505.

The ciruit has 2 feedback paths. The voltage across R412 is proportional to the deflection current (and height) and provides AC feedback to pin 4 of the TDA4505. DC feedback is via R407.

AV switching

Transistor Q101 mutes the vision IF and de-activates the AGC and AFC circuits when its base (K001 pin 3) is grounded. The audio mute circuit does not function under this condition.

Standby On/Off

When the standby ON command is received transistor Q809 is turned off allowing the control pin of the regulator IC803 to rise. The regulator turns on providing a 12V supply to the TDA4505 enabling the horizontal oscillator to start. The switch mode power supply operates at all times.

Colour decoder

The PAL decoder integrated circuit (IC500) TDA3565 contains all functions required for identification and demodulation of PAL signals. The RGB output signals from the decoder are fed to the video amplifiers.

SECAM transcoder

The transcoder IC700 converts SECAM signals into PAL which can then be decoded by the PAL decoder TDA3565. For further details see section 6.

Video output amplifiers

These are conventional class A amplifiers.

Switch mode power supply (SMPS)

A free running switch mode power supply ensures good regulation with a wide range of input voltages as well as providing isolation from the mains supply. The control circuit uses a TDA4601D (an improved version of the TDA4600) and incorporates short circuit and overvoltage protection.

A PTC thermistor R802 is used to provide an initial supply to pin 9 of the TDA4601 to allow fast starting.

Section 3.5 - Main Chassis, Adjustments and Alignment.

Equipment required

Digital voltmeter
Oscilloscope
PAL pattern generator

Preparation

Check that all components are fitted and the high voltage leads are connected,

Ensure that the grounding leads between the picture tube ground (aquadag), the CRT base socket and the main chassis are correctly connected.

Set all preset potentiometers in the mid position except R811, which must be set fully anticlockwise.

IMPORTANT. The antenna socket is not isolated from the main chassis. When using test equipment that is grounded a conductive path may exist via the antenna socket.

Power supply (set HT)

Connect a mains supply voltage of 220-240V to the power supply input. Connect DVM between TP13 and chassis ground.

Switch the receiver on and adjust preset potentiometer R811 (HT) for 115V. Turn down brightness so screen is dark then re-check voltage.

Re-adjust R811 if necessary for 115V +/–0.5V.

Horizontal frequency (Line hold)

Tune to test card or CCIR standard signal.

Connect pin 25 of TDA4505 (IC100) to +11V (TP20).

Adjust the preset potentiometer R126 (H-F) for minimum rolling of the picture.

Horizontal shift

Centre picture with preset R116 (H-SH) control.

Horizontal width and linearity

Not adjustable.

Tuner AGC take over point

Method 1.

Tune to a CCIR standard signal with a level of between 5 and 20mV.

Connect an oscilloscope that has a frequency response of at least 60MHz to the input of the SAW filter Z100 (pin 1). Use a low capacitance probe (2pf, X10).

Adjust preset potentiometer R102 (AGC) for a voltage of 1V p-p.

Method 2.

Tune to a CCIR signal with a level of 1.5mV.

Turn R102 anticlockwise until snow appears or contrast reduces slightly. Rotate R102 clockwise until the snow just disappears.

Increase signal level to 30mV and check that overloading or sound buzz does not occur.

Vertical (frame) height and linearity

Adjust pre-set potentiometer R410 (V-A) for 6% over scan.

Adjust pre-set potentiometer R409 (V-Lin) for best linearity.

Adjust pre-set potentiometer R505 (V-shift) for correct vertical position.

Colour reference oscillator

Tune to a PAL colour bar pattern.

To override the colour killer, connect pin 11 of IC500 (TP29) to +11V (TP25).

Connect TP32 and TP33 together.

Adjust potentiometer R527 (FREQ) for minimum rolling of colour bars.

PAL matrix adjustment

Tune to a TV PAL signal that has anti PAL (colourless) areas.

Method 1

Connect an oscilloscope to the BLUE output (K501 pin 3).

Adjust delay line amplitude (DL-AMP) preset R502 and delay line phase (DL-P) coil L503 to minimise the alternating (double image) waveforms. See Figs 1 and 2)

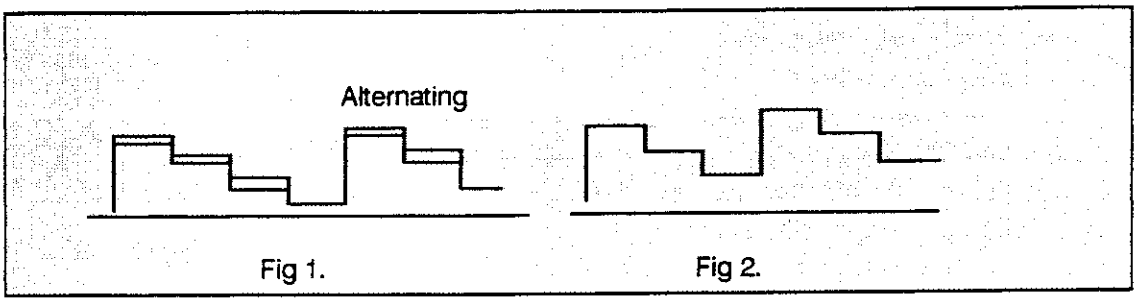


Fig 1. Fig 2.

Method 2

Connect an oscilloscope that has X and Y inputs to the RED and BLUE outputs.

(X to K501 pin 4 RED) (Y to K501 pin 2 BLUE).

Adjust the colour, brightness and contrast controls to produce a vector display on the oscilloscope.

Adjust the delay line amplitude (DL-AMP) preset R520 to reduce the amplitude of the small vectors (Hannover blind errors) (see Fig 3), and the delay line phase (DL-P) coil L503 to superimpose the outer vectors (see Fig 4).

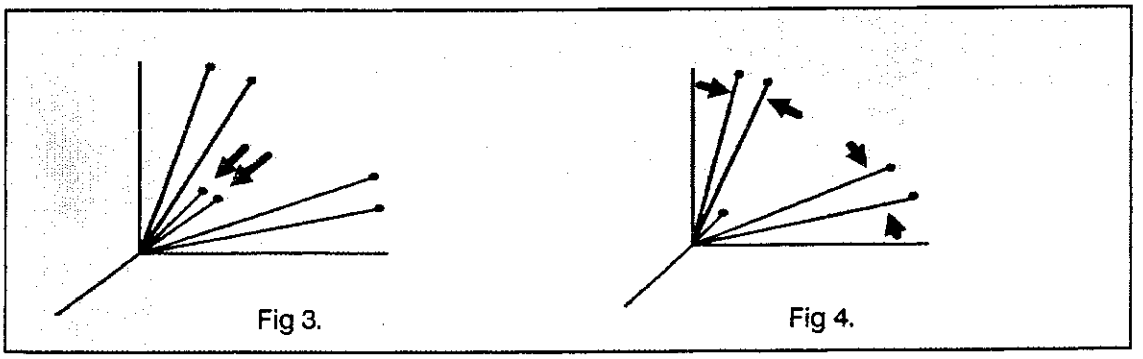


Fig 3. Fig 4.

Note: some of the test patterns may not produce clearly defined vectors. In such cases method 1 should be used.

Picture tube greyscale

Tune to an unmodulated test pattern (blank or white raster).

Turn brightness, colour and contrast to minimum.

Set the drive presets R703 (G-DR) and R705 (B-DR) to mid position.

Set the background (cut-off) presets R713, R725, R727 and the A1 (screen) control to minimum.

Method 1

Open jumper J403 to cut supply of vertical output stage.

Connect TP34 (sandcastle) to TP21 (+12V).

Connect oscilloscope to the RED cathode pin 8 on CRT.

Adjust pre-set potentiometer R713 for required cut-off voltage on pin 8 of CRT. Adjust screen grid control for minimum light and re-adjust with R713 for correct cut-off voltage. Afterwards do not change R713.

Adjust pre-set potentiometer R725 and R727 to obtain a just visible white line.

Remove interconnection TP34 and TP21 and close jumper J403.

Check CRT data for cut-off voltage recommended for optimal performance of CRT.

Tune to greyscale (staircase) pattern.

Set contrast control to maximum.

Adjust pre-set potentiometers R703 and R705 until best white balance is obtained.

Method 2

Disconnect plug K400 (vertical).

Turn the A1 (screen) control until a coloured line appears. Note colour.

Turn the A1 control down until the line is extinguished.

Adjust the background presets for the remaining two colours to produce a coloured line before turning each preset anticlockwise to extinguish the line.

Reconnect plug .K400 and tune to a grey scale (staircase test pattern.

Set contrast to a high level.

Adjust the DRIVE presets R703 and R705 for correct white balance on the highlights.

ALIGNMENT

Alignment frequencies

SYSTEM	VISION IF	SAW FILTER	SOUND IF	
B/G	38.9MHz	SY177	5.5MHz	PAL/SECAM-V
H	38.9MHz	SY177/SY178	5.5MHz	PAL/SECAM-H
I (UK)	39.5MHz	SY153A	6.0MHz	PAL
I (IRELAND)	38.9MHz	SY453A	6.0MHz	PAL

Video detector

Inject IF signal (38.9 or 39.5MHz) modulated with staircase (greyscale) waveform into tuner IF injection point..

The television should be switched to UHF band if a VHF/UHF model.

Connect voltmeter to TP4 (AFC) and an oscilloscope to the video output K100 pin 1.

The AFC voltage will change from 0 to 12V as the AFC tuning point is passed.

Adjust L102 for approximately 6V.

Note: Several false tuning points may be obtained; only the correct point will produce a linear staircase (step) video waveform.

Sound detector

Tune to a signal with a test tone.

Connect an oscilloscope to pin 12 of IC100 or across the loud speaker (see note on ground path).

Set volume control in mid position.

Adjust the detector coil L101 for good symmetrical sine wave.

A FM signal generator connected via a 1nF capacitor to the junction of L103 and R143 may be used if a CCIR signal is not available.

Set the generator to the correct frequency (5,5 or 6,0MHz), 50KHz deviation, 10mV amplitude and 1KHz modulation.

Sound trap

As the AFC cannot be defeated, the conventional method of tuning the television off frequency slightly to produce an increased sound carrier cannot be used.

Method 1

Inject a monochrome signal with FM sound into the IF injection point..

The video carrier frequency should be 200-300kHz higher than the standard IF frequency

e.g. 39.2MHz for B/G (38.9MHz), 39.8MHz for I (39.5MHz).

Connect an oscilloscope to video output on K100 pin 1.

Adjust L104 for minimum sound carrier on the video signal.

Method 2

Tune to an unmodulated signal (blank raster) with no sound carrier.

Connect a signal generator 5.5Mhz (or 6MHz) CW to pin 17 of the TDA4505.

Connect an oscilloscope to the video output on K100 pin 1.

Adjust L104 for minimum sound carrier on the video waveform.

Chroma trap

Method 1.

Tune to a TV PAL signal.

Connect oscilloscope to R to B or G signal connector K501 pins 2, 3 or 4.

Adjust L501 for minimum colour sub-carrier on the R, G or B signals.

Method 2.

Inject a 4,433MHz signal into pin 7 of the SECAM socket.

Adjust L501 as in method 1.

Chroma band-pass

Method 1.

Tune to a PAL colourbar test pattern.

Connect oscilloscope via a probe (smaller than 2pF loading) to pin 3 of IC500.

Adjust with L500 for maximum amplitude of the chromanence waveform and optimum square wave signals at the output on K501.

Method 2.

Connect a sweep generator (wobbulator) to pin 8 of the SECAM socket.

Connect the detector via a high impedance oscilloscope probe to pin 3 of IC500.

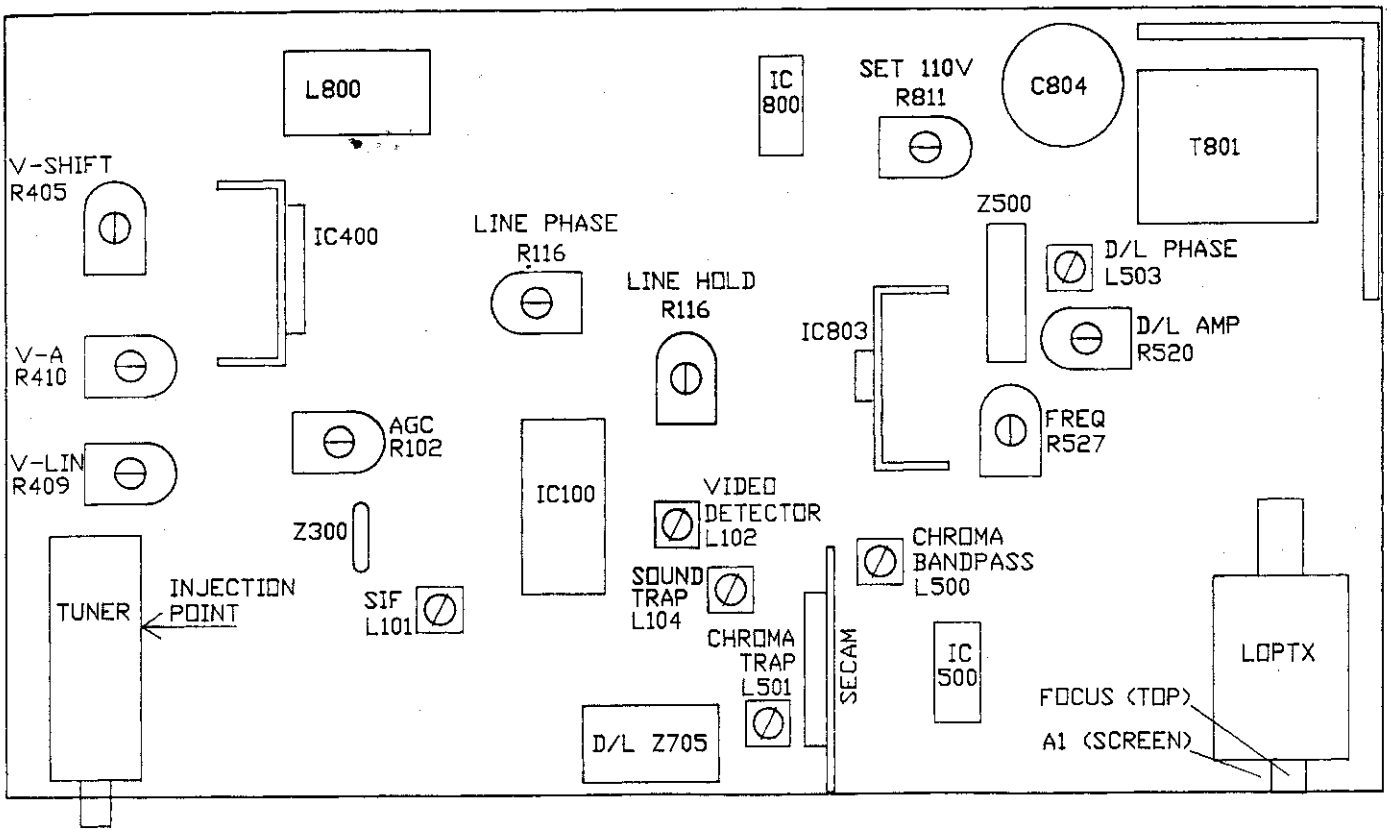
System B/G

Set the generator to 4,43MHz centre frequency and 50mV amplitude.
Adjust coil L500 for maximum amplitude at 4,43MHz.

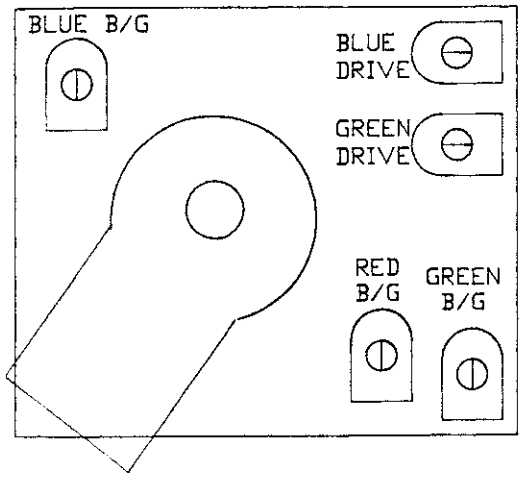
System I

Set centre frequency to 5MHz. Adjust coil L500 so that the 4,43MHz marker is 2dB from top.

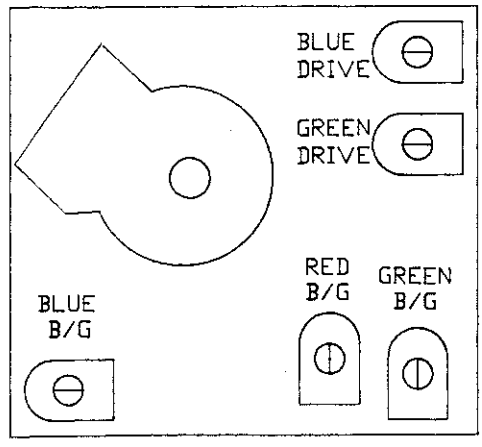
SECTION 3.5 MAIN CHASSIS & CRT BASE PCB ALIGNMENT POINTS



MAIN CHASSIS



STANDARD NECK
14", 20" & 21"



MINI NECK 15"

Note B/G = Background = Cut off

CRT BASE PCB

Section 3.6 - Main Chassis, Fault Guide

Dead. (No sound, raster or programme indicator.)	Noise (squeal) from power supply.	Check D804, D808, Q600, C813, C601,C602, C600, C604.
	No output from power supply. (115V, 25V, 17V)	Check F800, IC800, R802, R805, R808.
	115V o.k.	Check IC300, IC302. (Remote control PCB)
No sound or raster (horizontal stage not working).Standby indicator lit.	Programme numbers and tuning functions not working.	See fault guide in section 4.5
	No 12V on TP21.	Check IC803, Q809, R844, K804 pin 2 low (0V).
	TP21 (12V) o.k.	Check 12V on IC100 pin 7, IC100, Q601, R600, R605.
No raster. Horizontal stage OK. (Note: sound will be muted if set not tuned to signal.)	Turn A1 (screen) control up.	
	Horizontal line visible	Check IC400, IC100 and periferal components.
	Raster visible.	Check Q702, IC500 pin 1 (12V) pin 9/TP28 (2-4V).
No picture. (Sound may be muted.)	Sound not muted even if tuned off station.	Check Q101, C120, AV PCB.
	Sound appears when tuned to station.	Check AV and SECAM modules Q103, IC500.
No sound	Picture synchronised.	Check IC200, IC100 pin 12 (AF) pin 11 (0-6V), Alignment of L102.
	Picture not synchron-ised.	Check IC100 pin 25 (FBAS), AV module.
No colour. (PAL decoder only.)	Overide colour killer. (TP26 to +12V)	
	No colour.	Check IC500 pin 3 (chroma), pin 16 (8.86MHz), Pin 7 (Sandcastle).
	Coloured bands	Check alignment of R527 (freq).
No colour. (PAL/SECAM.)	No SECAM, PAL ok.	Check alignment/components in SECAM module.
	No SECAM or PAL colour.	Check PAL decoder, SECAM module.

IMPORTANT Discharge C809 before replacing IC800.

Section 3.7 - Main Chassis, Parts List

Circuit Ref	Description					Part Number	Comment
R001	RESISTOR	MO	15K	2W	J	112188	
R002	RESISTOR	CF	150K	0.25W	J	104151	
R010	RESISTOR	CF	2M2	0.25W	J	105221	
R011	RESISTOR	CF	47K	0.25W	J	103475	
R012	RESISTOR	CF	100K	0.25W	J	104110	
R013	RESISTOR	CF	100K	0.25W	J	104110	
R014 ⚠	RESISTOR	CF	10R	0.25W	J	100107	
R015	RESISTOR	CF	68K	0.25W	J	103686	
R016	RESISTOR	CF	1K2	0.25W	J	102126	
R017	RESISTOR	CF	68K	0.25W	J	103686	
R018	RESISTOR	CF	12K	0.25W	J	103122	
R019	RESISTOR	CF	470K	0.25W	J	104470	
R100	RESISTOR	CF	2M2	0.25W	J	105221	
R101	RESISTOR	CF	15K	0.25W	J	103155	
R102	PRESET	HRZ	47K	5x10mm		133470	
R103	RESISTOR	CF	6K8	0.25W	J	102685	
R104	RESISTOR	CF	2M7	0.25W	J	105272	
R105	RESISTOR	CF	33K	0.25W	J	103336	
R107	RESISTOR	CF	12K	0.25W	J	103122	
R108	RESISTOR	CF	10R	0.25W	J	100107	
R109	RESISTOR	CF	4K7	0.25W	J	102479	
R110	RESISTOR	CF	10K	0.25W	J	103116	
R111	RESISTOR	CF	3K3	0.25W	J	102338	
R114	RESISTOR	CF	47K	0.25W	J	103475	
R115	RESISTOR	CF	82K	0.25W	J	103825	
R116	PRESET	HRZ	47K	5x10mm		133470	
R117	RESISTOR	CF	2M7	0.25W	J	105272	
R119	RESISTOR	CF	1K5	0.25W	J	112156	
R120	RESISTOR	CF	10K	0.25W	J	103116	
R125	RESISTOR	CF	30K	0.25W	J	103305	
R126	PRESET	HRZ	10K	5x10mm		133141	
R129	RESISTOR	CF	1K8	0.25W	J	102189	
R131	RESISTOR	CF	4K7	0.25W	J	102479	20" & 21" MODELS ONLY
R132	RESISTOR	CF	3K3	0.25W	J	102338	
R133	RESISTOR	CF	22K	0.25W	J	103224	PAL B/G AND SECAM MODELS ONLY
R134	RESISTOR	CF	680K	0.25W	J	104681	
R135	RESISTOR	CF	22K	0.25W	J	103224	
R136	RESISTOR	CF	100K	0.25W	J	104110	
R140	RESISTOR	CF	2K2	0.25W	J	102227	
R141	RESISTOR	CF	330R	0.25W	J	101331	
R142	RESISTOR	CF	680R	0.25W	J	101683	
R144	RESISTOR	CF	4K7	0.25W	J	102479	
R145	RESISTOR	CF	100R	0.25W	J	101106	
R200 ⚠	RESISTOR	FR	4R7	1W	J	129470	
R202	RESISTOR	CF	6R8	0.25W	J	109680	
R400	RESISTOR	CF	1K 0	0.25W	J	102101	
R401 ⚠	RESISTOR	FR	4R7	1W	J	129470	
R402	RESISTOR	CF	3K9	0.25W	J	102397	
R403	RESISTOR	CF	10K	0.25W	J	103116	
R404	RESISTOR	CF	470R	0.25W	J	104470	
R405	PRESET	HRZ	10K	5x10mm		133141	
R406	RESISTOR	CF	270R	0.25W	J	101274	
R007	RESISTOR	CF	56K	0.25W	J	103561	
R408	RESISTOR	CF	10K	0.25W	J	103116	
R409	PRESET	HRZ	4K7	5x10mm		132474	
R410	PRESET	HRZ	100R	5x10mm		131102	
R411	RESISTOR	CF	22K	0.25W	J	103224	
R412 ⚠	RESISTOR	CF	1R8	0.25W	J	109180	
R413	RESISTOR	CF	1K 0	0.25W	J	102101	

Circuit Ref	Description					Part Number	Comment
R500 ⚠	RESISTOR	FR	4R7	0.25W	J	129480	
R502	RESISTOR	CF	100R	0.25W	J	104110	
R503	RESISTOR	CF	2K2	0.25W	J	102227	
R504	RESISTOR	CF	1K0	0.25W	J	102101	
R505	RESISTOR	CF	560R	0.25W	J	101562	
R507	RESISTOR	CF	1K0	0.25W	J	102101	
R508	RESISTOR	CF	1K2	0.25W	J	102126	
R510	RESISTOR	CF	6K8	0.25W	J	102685	NON-TELETEXT MODELS ONLY
R511	RESISTOR	CF	75K	0.25W	J	103752	NON-TELETEXT MODELS ONLY
R512	RESISTOR	CF	15K	0.25W	J	103155	NON-TELETEXT MODELS ONLY
R513	RESISTOR	CF	120K	0.25W	J	104123	NON-TELETEXT MODELS ONLY
R514	RESISTOR	CF	330K	0.25W	J	104332	NON-TELETEXT MODELS ONLY
R515	RESISTOR	CF	68K	0.25W	J	103686	NON-TELETEXT MODELS ONLY
R519	RESISTOR	CF	1K2	0.25W	J	102126	NON-TELETEXT MODELS ONLY
R520	PRESET	HRZ	1K0	5x10mm		132100	NON-TELETEXT MODELS
R521	RESISTOR	CF	390R	0.25W	J	101395	NON-TELETEXT MODELS ONLY
R522	RESISTOR	CF	1K	0.25W	J	102101	NON-TELETEXT MODELS ONLY
R523	RESISTOR	CF	470K	0.25W	J	101470	NON-TELETEXT MODELS ONLY
R527	PRESET	HRZ	1K0	5x10mm		113141	NON-TELETEXT MODELS ONLY
R528	RESISTOR	CF	1M0	0.25W	J	105106	NON-TELETEXT MODELS ONLY
R529	RESISTOR	CF	2K7	0.25W	J	102273	
R600	RESISTOR	WW	2R7	4W	K	129227	
R601	RESISTOR	MO	10K	2W	K	113102	
R603	RESISTOR	SR	220K	0.25W	K	104222	
R604	RESISTOR	CF	47K	0.25W	J	102479	
R605 ⚠	RESISTOR	MO	5K6	2W	J	112564	
R606	RESISTOR	CF	1K8	0.25W	J	102189	
R607	RESISTOR	CF	4K7	0.25W	J	102479	
R608	RESISTOR	CF	330K	0.25W	J	101331	
R609	RESISTOR	CF	10K	0.25W	J	103116	
R610 ⚠	RESISTOR	MF	1K0	1W	J	112108	
R611	RESISTOR	CF	8K2	0.25W	J	102825	
R612	RESISTOR	MO	3M3	1W	K	115330	21" VIDEOCOLOR A51EBV CRT ONLY
OR	LINK						ALL OTHER MODELS
R800	RESISTOR	CF	220K	0.25W	J	104222	
R801 ⚠	RESISTOR	WW	2R7	4W	K	129227	
R802 ⚠	THERMISTOR	2322 672 96009				154214	PTC
R803 ⚠	RESISTOR	MF	2K7	1W	J	112270	
R804 ⚠	THERMISTOR	2322 662 98009				154213	DEGAUSS
R805	RESISTOR	MF	0R82	0.25W	J	119824	
R806	RESISTOR	CF	27R	0.25W	J	100271	
R808	RESISTOR	CF	100K	0.25W	J	104110	
R809	RESISTOR	CF	270K	0.25W	J	104273	
R810	RESISTOR	CF	15K	0.25W	J	103155	
R811	PRESET	HRZ	4K7	5x10mm		132474	
R812	RESISTOR	MO	47R	1W	K	110470	
R813 ⚠	RESISTOR	FR	0R22	1W	J	129228	
R814	RESISTOR	CF	10K	0.25W	J	103116	
R815	RESISTOR	CF	1K2	0.25W	J	102126	
R816	RESISTOR	CF	220R	0.25W	J	101223	
R817 ⚠	RESISTOR	SR	4M7	0.5W	K	125470	
R844 ⚠	RESISTOR	FR	4R7	1W	J	129470	
R845	RESISTOR	CF	390R	0.25W	J	101395	
R846	RESISTOR	CF	3K3	0.25W	J	102338	
R847	RESISTOR	CF	10K	0.25W	J	103116	
C001	CAPACITOR	CER	1n0	50V	K	224108	
C007	CAPACITOR	MKT	100n	100V	M	214137	
C008	CAPACITOR	CER	10n	50V	K	223135	
C009	CAPACITOR	ELC	1u0	16V		233131	
C010	CAPACITOR	ELC	4u7	50V		239488	
D100	DIODE	BAW62				302964	PAL BG & SECAM MODELS ONLY
D101	DIODE	BAW62				302964	PAL BG & SECAM MODELS ONLY
D011	CAPACITOR	CER	10n	50V	K	224108	

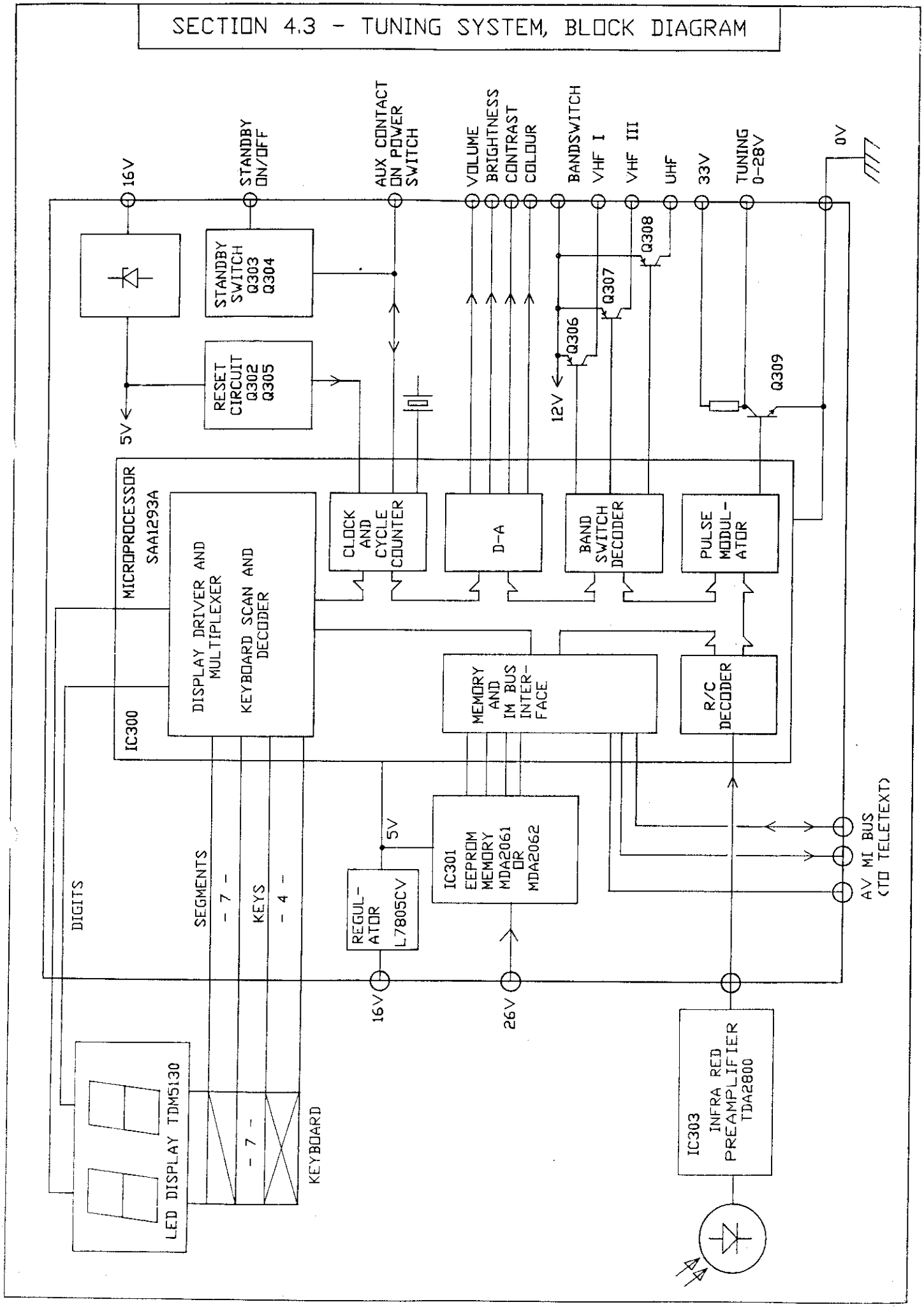
Circuit Ref	Description					Part Number	Comment
C012	CAPACITOR	ELC	1u0	16V		233131	
C013	CAPACITOR	CER	10n	50V	K	224108	
C014	CAPACITOR	ELC	1u0	16V		233131	
C015	CAPACITOR	ELC	68u	16V		230681	
C016	CAPACITOR	CER	10n	50V	K	224108	
C017	CAPACITOR	CER	10n	50V	K	224108	
C019	CAPACITOR	ELC	1u0	63V		239119	
C100	CAPACITOR	MKT	220n	63V	K	214226	
C101	CAPACITOR	ELC	22u	16V		231258	
C102	CAPACITOR	CER	1n0	50V	K	224108	
C103	CAPACITOR	ELC	330u	16V		232331	
C104	CAPACITOR	CER	2n2	50V	K	222238	
C105	CAPACITOR	CER	1n2	50V	K	222151	
C106	CAPACITOR	CER	1n0	50V	K	224108	
C107	CAPACITOR	ELC	1u0	35V		233132	
C108	CAPACITOR	ELC	22u	16V		231258	
C109	CAPACITOR	CER	22n	50V	M	223247	
C110	CAPACITOR	CER	68p	50V	M	220701	PAL BG & SECAM MODELS
	CAPACITOR	CER	39p	50V	M	220399	PAL I MODELS
C111	CAPACITOR	CER	22n	50V	M	223247	
C112	CAPACITOR	MKT	100n	100V	M	214137	
C113	CAPACITOR	CER	150p	50V	J	221172	
C114	CAPACITOR	MKT	22n	63V	K	214226	
C115	CAPACITOR	ELC	10u	16V		230143	
C116	CAPACITOR	PYF	2n7	160V	G	212274	
C117	CAPACITOR	ELC	1u0	50V		239128	
C118	CAPACITOR	MKT	470n	63V	M	214485	
C119	CAPACITOR	MKT	220n	63V	J	214226	
C120	CAPACITOR	ELC	1u0	35V		239128	
C121	CAPACITOR	MKT	100n	100V	M	214137	
C122	CAPACITOR	ELC	100u	16V		232161	
C123	CAPACITOR	CER	150p	50V	J	221172	
C125	CAPACITOR	CER	150p	50V	J	221173	PAL BG & SECAM MODELS
	CAPACITOR	CER	120p	50V	J	221174	PAL I MODELS
C126	CAPACITOR	CER	560p	50V	K	221560	
C127	CAPACITOR	CER	68p	50V	J	220702	
C128	CAPACITOR	CER	15p	50V	J	220170	
C200	CAPACITOR	CER	22n	50V	M	223247	
C201	CAPACITOR	ELC	1000u	35V		233132	
C202	CAPACITOR	MKT	100n	100V	M	214137	
C203	CAPACITOR	CER	10n	50V	K	223135	
C204	CAPACITOR	CER	22n	50V	M	223247	
C205	CAPACITOR	MKT	100n	100V	M	214137	
C206	CAPACITOR	MKT	100n	100V	M	214137	
C207	CAPACITOR	ELC	330u	25V		232333	
C400	CAPACITOR	CER	4n7	50V	K	222480	
C401	CAPACITOR	CER	4n7	50V	K	222480	
C402	CAPACITOR	CER	470p	50V	K	221501	
C403	CAPACITOR	ELC	100u	50V		232164	
C404	CAPACITOR	ELC	220u	35V		232254	
C405	CAPACITOR	MKT	100n	100V	M	214137	
C406	CAPACITOR	MKT	100n	100V	M	214137	
C407	CAPACITOR	ELC	1500u	35V		233155	
C408	CAPACITOR	ELC	2u2	50V		239235	
C500	CAPACITOR	ELC	100u	25V		232163	
C501	CAPACITOR	CER	22n	50V	M	223247	NON-TELETEXT MODELS ONLY
C502	CAPACITOR	CER	82p	50V	M	220833	
C503	CAPACITOR	ELC	4u7	25V		239488	NON-TELETEXT MODELS ONLY
C504	CAPACITOR	CER	270p	50V	K	221280	
C505	CAPACITOR	CER	10n	50V	K	223135	NON-TELETEXT MODELS ONLY
C506	CAPACITOR	CER	68p	50V	J	220702	
C507	CAPACITOR	MKT	330n	63V	K	214336	NON-TELETEXT MODELS ONLY
C509	CAPACITOR	CER	150p	50V	J	221172	

Circuit Ref	Description					Part Number	Comment
C511	CAPACITOR	MKT	220n	63V	K	214226	
C512	CAPACITOR	ELC	1u0	50V		239128	NON-TELETEXT MODELS ONLY
C513	CAPACITOR	ELC	10u	16V		230143	NON-TELETEXT MODELS ONLY
C514	CAPACITOR	ELC	1u0	50V		239128	NON-TELETEXT MODELS ONLY
C517	CAPACITOR	MKT	100n	100V	M	214137	NON-TELETEXT MODELS ONLY
C519	CAPACITOR	CER	10n	50V	K	223135	NON-TELETEXT MODELS ONLY
C527	CAPACITOR	CER	10p	50V	J	220112	NON-TELETEXT MODELS ONLY
C528	CAPACITOR	ELC	1u0	50V		239128	NON-TELETEXT MODELS ONLY
C529	CAPACITOR	CER	270p	50V	K	221280	NON-TELETEXT MODELS ONLY
C530	CAPACITOR	CER	270p	50V	K	221280	NON-TELETEXT MODELS ONLY
C600	CAPACITOR	ELC	10u	250V		231161	
C601	CAPACITOR	ELC	1u0	250V		215106	
C602	CAPACITOR	ELC	22u	160V		231259	
C603	CAPACITOR	MKT	47n	100V	K	231487	
C604 ⚠	CAPACITOR	MKP10	470n	250V	M	214486	14" & 20" MODELS
⚠	CAPACITOR	MKP10	330n	250V	M	214342	15" & 21" MODELS
C605 ⚠	CAPACITOR	FKP1	7n5	1.5kV	J	213750	14" & 20" MODELS
⚠	CAPACITOR	FKP1	6n8	1.5kV	J	212689	21" MODELS ONLY
⚠	CAPACITOR	FKP1	5n6	1.5kV	J	212566	15" MODELS ONLY
C606	CAPACITOR	MKT	100n	100V	M	214137	
C607	CAPACITOR	MKT	220n	100V	K	214227	
C608	CAPACITOR	CER	1n0	50V	K	224108	
C609 ⚠	CAPACITOR	ELC	1u0	160V		239129	
C800	CAPACITOR	CER	1n0	1KV	K	222169	
C801	CAPACITOR	CER	1n0	1KV	K	222169	
C802	CAPACITOR	CER	1n0	1KV	K	222169	
C803	CAPACITOR	CER	1n0	1KV	K	222169	
C804 ⚠	CAPACITOR	ELC	150u	385V		232160	
C805 ⚠	CAPACITOR	MKT-P	470n	250V	M	214487	
C806 ⚠	CAPACITOR	MKT-P	150n	250V	M	214161	
C807 ⚠	CAPACITOR	MKT-P	100n	250V	M	214139	
C808	CAPACITOR	CER	330p	1KV	K	221351	
C809	CAPACITOR	ELC	100u	25V		232163	
C810	CAPACITOR	ELC	100u	16V		232161	
C811	CAPACITOR	FKP1	5n6	1KV	J	232565	
C812	CAPACITOR	CER	330p	1KV	J	221351	
C813 ⚠	CAPACITOR	ELC	100u	160V		232165	
C814	CAPACITOR	FKP2	6n8	100V	K	212688	
C815	CAPACITOR	ELC	1000u	35V		233132	
C816	CAPACITOR	CER	100p	50V	J	221174	
C817	CAPACITOR	CER	330p	1KV	J	221351	
C818	CAPACITOR	ELC	2200u	25V		233241	
C819	CAPACITOR	ELC	100u	10V		232164	
C820	CAPACITOR	ELC	1u0	100V		239125	
C821	CAPACITOR	FKP2	4n7	100V	K	212487	
C822 ⚠	CAPACITOR	CER	4n7	4KV		222480	CSF VDE / BS415
C834	CAPACITOR	MKT	330n	63V	K	214336	
C835	CAPACITOR	MKT	330n	63V	K	214336	
C836	CAPACITOR	ELC	1000u	16V		233131	
C837	CAPACITOR	MKT	330n	63V	K	214336	
C838	CAPACITOR	ELC	100u	16V		232161	
L100	COIL	CHOKE 0u68				052690	
L101	COIL	SOUND DET 421				052691	
L102	COIL	VIDEO REF 185				052692	
L103	COIL	CHOKE 6u8				052733	
L104	COIL	SOUND TRAP 191				052693	
L500	COIL	CHROMA PASS 384				052694	
L501	COIL	CHROMA TRAP 412				052695	
L503	COIL	PAL DELAY PHASE 412				052695	NON-TELETEXT MODELS ONLY
L504	COIL	CHOKE 12u				053321	NON-TELETEXT MODELS ONLY
L601 ⚠	COIL	LINEARITY AT4042/90				052697	14" & 20" MODELS
⚠	COIL	LINEARITY AT4042/91				052728	15" MODELS
⚠	COIL	LINEARITY AT4042/34				052725	21" MODELS

Circuit Ref		Description			Part Number	Comment
L800 !	COIL	MAINS FILTER		27mH	052698	
L801	COIL	CHOKE	4u7		052699	
L802	CORE	FERRITE	47u		055137	
L803	COIL	CHOKE	150u		052700	
L808	CORE	FERRITE			055553	
L809	CORE	FERRITE			055552	
L810	COIL	CHOKE	4u7		052699	
L811	CORE	FERRITE			055552	
T600	TRANSFORMER	DRIVER	AT4043/01		051550	
T601 ⚠	TRANSFORMER	FBT	AT2079/10		051551	
T801 ⚠	TRANSFORMER	SMPS	AT3010/110C1		051552	
D001	DIODE	ZTK33			302950	
D002	DIODE	1N4148			302289	
D400	DIODE	1N4004			302947	
D600	DIODE	BA157			300305	
D602	DIODE	1N4148			302289	
D603	DIODE	BA157			300305	
D604	DIODE	ZPD 10V			302951	
D800	DIODE	1N4007			302948	
D801	DIODE	1N4007			302948	
D802	DIODE	1N4007			302948	
D803	DIODE	1N4007			302948	
D804	DIODE	BY398			302949	
D805	DIODE	1N4007			302948	
D806	DIODE	BY298			302295	
D807	DIODE	BA157			300305	
D808	DIODE	BY298			302295	
D809	DIODE	BA157			300305	
Q001	TRANSISTOR	JC501			400921	
Q101	TRANSISTOR	JC501			400921	
Q102	TRANSISTOR	JA101			400920	
Q103	TRANSISTOR	JC501			400921	
Q600	TRANSISTOR	BU508DR			400922	
Q601	TRANSISTOR	BC639			400337	
Q800	TRANSISTOR	BU508A			400923	
Q809	TRANSISTOR	JC501			400921	
IC100	I.C.	TDA4505-N4			451340	
IC200	I.C.	TDA2611A/N4			451341	
IC400	I.C.	TDA3653			451342	
IC500	I.C.	TDA3565			451343	NON-TELETEXT MODELS ONLY
C800	I.C.	TDA4601B			451344	
IC803	I.C.	LM317T			451345	
F800 ⚠	FUSE	T1.6A/250V			054205	
	FUSE HOLDER				030306	
ET1	TUNER	1604UEC OR 3010UEC			597136	PAL I MODELS
	TUNER	1600KKC			599136	PAL BG & SECAM MODELS
Z100	SAW FILTER	SY153			056733	PAL I MODELS
	SAW FILTER	SY177			056727	PAL BG & SECAM MODELS
Z101	CERAMIC FILTER	6.0MB			056734	PAL I MODELS
	CERAMIC FILTER	5.5MB			056728	PAL BG & SECAM MODELS
Z500	DELAY LINE	DL701			052701	NON-TELETEXT MODELS ONLY
Z501	DELAY LINE	DL470			052702	
X500	CRYSTAL	8.867 MHz			056729	NON-TELETEXT MODELS ONLY
	PCB, COMPLETE				{	14" PAL I
	PCB, COMPLETE				{	14" PAL BG
	PCB, COMPLETE				{ QUOTE	15" PAL I
	PCB, COMPLETE				{	15" PAL BG
	PCB, COMPLETE				{ MODEL	20" PAL I
	PCB, COMPLETE				{	20" PAL BG
	PCB, COMPLETE				{	21" PAL I
	PCB, COMPLETE				{	21" PAL BG

CRT Base PCB

Circuit Ref	Description					Part Number	Comment
R700	RESISTOR	CF	470R	0.25W	J	104470	
R701	RESISTOR	CF	3K3	0.25W	J	102338	
R702	RESISTOR	CF	1K2	0.25W	J	102126	
R703	PRESET	HRZ	2K2	5x10mm		132226	
R704	RESISTOR	CF	3K3	0.25W	J	102338	
R705	PRESET	HRZ	2K2	5x10mm		132226	
R706 ⚠	RESISTOR	CF	220R	0.25W	J	104222	
R707	RESISTOR	CF	3K3	0.25W	J	102338	
R708	RESISTOR	CF	4K7	0.25W	J	129480	
R709	RESISTOR	CF	4K7	0.25W	J	129480	
R710	RESISTOR	CF	1K2	0.25W	J	102126	
R712	RESISTOR	CF	820R	0.25W	J	101820	
R713	RESISTOR	CF	2K2	5x10mm		132226	
R714 ⚠	RESISTOR	MF	10K	1W	G	113103	
R715 ⚠	RESISTOR	SR	220K	0.5W	J	124220	
R716	RESISTOR	CF	470R	0.25W	J	101470	
R717 ⚠	RESISTOR	MF	1R0	1W	G	119105	14" MODELS
⚠	RESISTOR	MF	2R2	1W	G	118225	15" MODELS
⚠	RESISTOR	MF	1R0	1W	G	119105	20" MODELS
⚠	RESISTOR	MF	1R0	1W	G	119105	21" VIDEOCOLOR A51EBV CRT
⚠	RESISTOR	MF	2R2	1W	G	118225	21" PHILIPS A51EAL CRT
R718	RESISTOR	MO	1K5	0.5W	K	112156	
R719	RESISTOR	MO	1K5	0.5 W	K	112156	
R720	RESISTOR	MO	1K5	0.5W	K	112156	
R721	RESISTOR	CF	820R	0.25W	J	101820	
R722 ⚠	RESISTOR	MF	10K	1W	G	113103	
R724	RESISTOR	CF	470R	0.25W	J	101470	
R725	PRESET	HRZ	2K2	5x10mm		132226	
R726	RESISTOR	CF	820R	0.25W	J	101820	
R727	PRESET	HRZ	2K2	5x10mm		132226	
R728 ⚠	RESISTOR	MF	10K	1W	G	113103	
R730	RESISTOR	CF	470R	0.25W	J	101470	
R731 ⚠	RESISTOR	FR	100R	0.25W	J	101106	
C701	CAPACITOR	CER	220p	50V	K	221245	
C702 ⚠	CAPACITOR	CER	10n	1KV	K	223134	
C703	CAPACITOR	ELC	150u	16V		232166	
C705	CAPACITOR	CER	220p	50V	K	221245	
C706	CAPACITOR	MKT	47n	100V	K	213487	
C708	CAPACITOR	CER	220p	50V	K	221245	
C709	CAPACITOR	ELC	10u	250V		231161	
D700	DIODE	1N4148				302289	
D701	DIODE	1N4148				302289	
D702	DIODE	1N4148				302289	
T700	TRANSISTOR	BF869				400924	
T701	TRANSISTOR	BF869				400924	
T702	TRANSISTOR	JA101				400920	
T703	TRANSISTOR	BF869				400924	
⚠	SOCKET	CRT				031763	14", 20" & 21" MODELS
⚠	SOCKET	CRT				031779	15" MODELS
	PCB, COMPLETE					577165	14" MODELS
	PCB, COMPLETE					569165	15" MODELS
	PCB, COMPLETE					597165	20" & 21" MODELS


SECTION 4.3 - TUNING SYSTEM, BLOCK DIAGRAM
16V
STANDBY ON/OFF
AUX CONTACT ON POWER SWITCH
VOLUME
BRIGHTNESS
CONTRAST
COLOUR
BANDSWITCH
VHF I
VHF III
UHF
33V
TUNING 0-28V
0V
STANDBY SWITCH Q303 Q304
RESET CIRCUIT Q302 Q305
5V
12V
Q306
Q307
Q308
Q309
MICROPROCESSOR SAA1293A
IC300
DISPLAY DRIVER AND MULTIPLEXER
KEYBOARD SCAN AND DECODER
CLOCK AND CYCLE COUNTER
D-A
BAND SWITCH DECODER
PULSE MODUL-ATOR
MEMORY AND IM BUS INTER-FACE
R/C DECODER
IC301 EEPROM MEMORY MDA2061 OR MDA2062
REGUL-ATOR L7805CV
5V
16V
26V
DIGITS
SEGMENTS
- 7 -
KEYS
- 4 -
LED DISPLAY TDM5130
KEYBOARD
IC303 INFRA RED PREAMPLIFIER TDA2800
AV MI BUS (TO TELETEXT)

Section 4.4 - Tuning System, Description

Central Processor SAA 1293A

The SAA 1293A is a single chip microcomputer in n-channel MOS technology and together with an EEPROM can perform all the operating and tuning functions of a TV receiver.

Most important features of the SAA 1293 are :

- voltage synthesized tuning system
- storage of up to 55 stations
- four analog outputs for volume, brightness etc
- last used analogue levels memorised
- normalised (ideal) analogue levels can be preset
- 2 digit display indicates station (programme) number, tuning scale, band switch etc
- direct interfacing with teletext system
- programmable tuning options (not accessable to customer)

Power on reset.

The circuit D301, Q302, Q305 etc forces the reset line (pin 4) high once the 5 and 12V supplies are above a certain level.

Standby on/off.

Pin 5 is a bidirectional input/output port. In standby mode the output is high turning Q303 off. If the mains switch is operated, the auxillary (wiping) contact shorts pin 5 to ground, this input is read by the microcomputer which then holds pin 5 low.

Standby and ON commands from the remote control also control pin 5.

Tuning voltage.

Pulses of variable width from pin 13 drive the switching transistor Q309. The waveform at the collector (33V peak square wave) is averaged and filtered by a RC Network to produce a DC tuning voltage.

This voltage (0-28V) is proportional to pulse width and pulse shape.

Analog outputs

Pins 10, 11, 33 and 34 produce variable width pulses of 12V amplitude; filtering by the RC networks R319/C304 etc produces a DC control voltage.

Pin 34 is intended for volume control and is clamped by D310 to prevent the control voltage rising excessively. A voltage above 10V will affect the horizontal oscillator function.

Band switching

Transistors Q306 to 308 are used to decode and buffer the 2 bandswitch pins (29 and 30).

Pin 29	Pin 30	VHF I	VHF III	UHF
LO	LO	---------- not valid ----------		
LO	HI	X		
HI	LO		X	
HI	HI			X

Display Indicator

The 2 seven segment displays are driven in a multiplexed mode with the segme... digitals addressed sequentially.

The segments are controlled by pins 14-19, 21 and 22; the digits by pins 23 and 24.

To light a segment (eg. digit 1 segment C), pin 23 (digit enable) and pin 16 (segment C) must both be at 'low'.

Keyboard

The segment control lines that address the display are also used to scan the keyboard. When a key switch is pressed the closed contact is detected by the lines to pins 36-39.

Memory EEPROM

Various parameters such as tuning and bandswitch data, analogue settings as well as system options are stored in the EEPROM IC301. Either the MDA2061 or MDA2062 may be used.

The microcomputer SAA1293 communicates with EEPROM via a 3 wire IM bus. Data is transmitted or received in serial form and is stored as an 8 bit word. Total memory is 1024 bits (128 words).

An area of memory is protected and cannot be re-written unless pin 6 is high. This area is used for the operating options to ensure that false information or interference does not alter the operating system.

Infra-red preamplifier

The preamplifier module consists of a Infra-red PIN photodiode and a wideband preamplifier.

The TBA 2800 IC has four main parts: A gain controlled amplifier, 2nd stage amplifier, pulse separating amplifier and an inverter/driver. No adjustment is required.

Remote Control Transmitter

The SAA1250 IC transmits commands in the form of a 10 bit word. A total of 14 pulses are used for each word (activate, start, word and stop.) The time between pulses is used to signify the status of the bit (short delay '0', long delay for '1'). To provide immunity against interference the SAA1293 receiver must receive at least 2 identical words in sequence (the SAA1250 will continue to send the same word for as long as the key is pressed.)

When not transmitting the current consumption is kept to a minimum by the use of C-MOS technology.

Teletext control

A 2 line MI bus is used for data transmition and reception.

As the teletext decoder required a 3 line IM bus the AV switching output is programmed to operate as the IDENT line.

Section 4.5 - Tuning System, Fault Guide

1.	In standby, no display, no tuning functions	No 16V supply Faulty 5V regulator IC302.
2.	Operating, no display, no tuning functions	No 12V supply reset line low (pin 4 SAA1293A) [Q302, Q305, D301]
3.	In standby, bar displayed, no tuning functions	Crystal X300 faulty.
4.	Displays (.1.) or (.2.), no programme memory	EEPROM IC301 faulty.
5.	Not memorising tuning positions or analogue settings All other functions normal	No 20V supply [D302, D303,C303]
6.	Not tuning. All other functions normal	No 33V [D001] - Q309
7.	Tuning functions or display characters incorrect	Programmable tuning options not set.

IMPORTANT. The operating and tuning characteristics are pre-programmed in the EEPROM. A suitably programmed EEPROM is only available from the service agents.

Section 4.6 - Tuning System, Parts List

Circuit Ref	Description					Part Number	Comment
R300	RESISTOR	CF	10K	0.25W	J	103116	
R301	RESISTOR	CF	1K0	0.25W	J	102101	
R302	RESISTOR	CF	10K	0.25W	J	103116	
R303	RESISTOR	CF	330R	0.25W	J	101331	
R304	RESISTOR	CF	10K	0.25W	J	103116	
R305	RESISTOR	CF	12K	0.25W	J	103122	
R306	RESISTOR	CF	3K9	0.25W	J	102397	
R307	RESISTOR	CF	10K	0.25W	J	103116	
R308	RESISTOR	CF	3K3	0.25W	J	102338	
R309	RESISTOR	CF	10K	0.25W	J	103116	
R310	NOT USED						
R311	RESISTOR	CF	10K	0.25W	J	103116	
R313	RESISTOR	CF	4K7	0.25W	J	102479	
R315	RESISTOR	CF	1K0	0.25W	J	102101	
R316	RESISTOR	CF	1K5	0.25W	J	102157	
R317	RESISTOR	CF	3K3	0.25W	J	102338	
R318	RESISTOR	CF	4K7	0.25W	J	102479	
R319	RESISTOR	CF	68K	0.25W	J	103686	
R320	RESISTOR	CF	330K	0.25W	J	104332	
R321	RESISTOR	CF	47K	0.25W	J	103475	
R322	RESISTOR	CF	22K	0.25W	J	103224	
R323	RESISTOR	CF	22K	0.25W	J	103224	
R324	RESISTOR	CF	22K	0.25W	J	103224	
R325	RESISTOR	CF	22K	0.25W	J	103224	
R326	RESISTOR	CF	22K	0.25W	J	103224	
R327	RESISTOR	CF	47K	0.25W	J	103475	
R328	RESISTOR	CF	470K	0.25W	J	104470	
R329	RESISTOR	CF	10K	0.25W	J	103216	
R330	RESISTOR	CF	10K	0.25W	J	103116	
R331	RESISTOR	CF	15K	0.25W	J	103155	
R332	RESISTOR	CF	39K	0.25W	J	103392	
R333	RESISTOR	CF	47K	0.25W	J	103475	
R334	RESISTOR	CF	2K2	0.25W	J	102227	
R335	RESISTOR	CF	220K	0.25W	J	101223	
R336 ⚠	RESISTOR	MF	33R	1W	J	110331	
R337	RESISTOR	CF	1M0	0.25W	J	105106	
R338	RESISTOR	CF	4K7	0.25W	J	102479	
R339	RESISTOR	CF	4K7	0.25W	J	102479	
R340	RESISTOR	CF	220R	0.25W	J	101223	
R341	RESISTOR	CF	220R	0.25W	J	101223	
R342	RESISTOR	CF	220R	0.25W	J	101223	
R343	RESISTOR	CF	220R	0.25W	J	101223	
R344	RESISTOR	CF	220R	0.25W	J	101223	
R345	RESISTOR	CF	220R	0.25W	J	101223	
R346	RESISTOR	CF	220R	0.25W	J	101223	
R347	RESISTOR	CF	220R	0.25W	J	101223	
R348	RESISTOR	CF	2K7	0.25W	J	105272	
R349	RESISTOR	CF	1K8	0.25W	J	102189	
R350	RESISTOR	CF	1K5	0.25W	J	102157	
R356	RESISTOR	CF	4K7	0.25W	J	102479	
C300	CAPACITOR	MKT	470n	63V	M	214485	
C301	CAPACITOR	ELC	10u	50V		230143	
C302	CAPACITOR	MKT	47n	100V	M	213485	
C303	CAPACITOR	ELC	1u0	63V		239119	
C304	CAPACITOR	MKT	100n	100V	M	214137	
C306	CAPACITOR	MKT	100n	100V	M	214137	
C307	CAPACITOR	MKT	100n	100V	M	214137	
C308	CAPACITOR	CER	68n	50V	K	223682	
C309	CAPACITOR	CER	68n	50V	K	223682	

Circuit Ref	Description					Part Number	Comment
C310	CAPACITOR	MKT	330n	63V	K	214336	
C311	CAPACITOR	MKT	330n	63V	K	213336	
C312	CAPACITOR	CER	470p	50V	K	221501	
C313	CAPACITOR	MKT	470n	63V	M	214485	
C314	CAPACITOR	MKT	220n	63V	M	214226	
C315	CAPACITOR	MKT	100n	100V	M	214137	
C316	CAPACITOR	CER	100p	50V	M	221175	
C322	CAPACITOR	ELC	330u	16V		232331	
C323	CAPACITOR	ELC	100u	16V		232161	
L300	COIL	CHOKE	10u			052732	
D300	DIODE	1N4148				302289	
D301	DIODE	ZPD5V6				302953	
D302	DIODE	ZPD 20V				302954	
D303	DIODE	1N4148				302289	
D303	DIODE	1N4148				302289	
D304	DIODE	1N4148				302289	
D305	DIODE	1N4148				302289	
D306	DIODE	1N4148				302289	
D309	DIODE	1N4148				302289	
D310	DIODE	ZPD 2V7				302448	
Q300	TRANSISTOR	JA101				400902	
Q301	TRANSISTOR	JA101				400902	
Q302	TRANSISTOR	JA101				400902	
Q303	TRANSISTOR	JA101				400902	
Q304	TRANSISTOR	JC501				400921	
Q305	TRANSISTOR	JC501				400921	
Q306	TRANSISTOR	JA101				400922	
Q307	TRANSISTOR	JA101				400922	
Q308	TRANSISTOR	JA101				400922	
Q309	TRANSISTOR	BF240				400926	
IC300	I.C.	SAA1293A				451347	
IC301	I.C.	MDA2062				451348	
IC302	I.C.	L7805CV				451349	
X300	CRYSTAL	4.43MHz				056730	
	PCB, COMPLETE					597185	
Control board PCB							
R349	RESISTOR	CF	39K	0.25W	J	103392	
R351	RESISTOR	CF	240K	0.25W	J	104244	
R353	RESISTOR	CF	33K	0.25W	J	103336	
	LED DISPLAY	TDSR5130				302956	
	SWITCH	TIP1550-600				010710	
	PCB, COMPLETE					577172	
Pre-amplifier PCB							
R354	RESISTOR	CF	100R	0.25W	J	101106	
R355	RESISTOR	CF	10K	0.25W	J	103116	
C316	CAPACITOR	ELC	22u	16V		231260	
C317	CAPACITOR	ELC	2u2	50V		239235	
C318	CAPACITOR	CER	1n2	50V	J	222151	
C319	CAPACITOR	CER	10n	50V	J	223138	
C320	CAPACITOR	CER	10n	25V	J	223138	
D308	DIODE	BPW41				302952	
IC303	I.C.	TBA2800				451346	
	PCB. COMPLETE					597186	

Section 5.5 - AV Interface, Parts List

Circuit Reference	Description					Part Number	Comment
R220 ⚠	RESISTOR	CF	100R	0.25W	J	101106	
R221	RESISTOR	CF	10K	0.25W	J	103116	
R222	RESISTOR	CF	10K	0.25W	J	103116	
R223	RESISTOR	CF	470R	0.25W	J	101470	
R224	RESISTOR	CF	470R	0.25W	J	101470	
R225	RESISTOR	CF	470R	0.25W	J	101470	
R230 ⚠	RESISTOR	CF	100R	0.25W	J	101106	
R231	RESISTOR	CF	10K	0.25W	J	103116	
R233	RESISTOR	CF	22K	0.25W	J	103224	
R234	RESISTOR	CF	4K7	0.25W	J	102479	
R235	RESISTOR	CF	3K3	0.25W	J	102338	
R236	RESISTOR	CF	100R	0.25W	J	101106	
R237	RESISTOR	CF	470R	0.25W	J	101470	
R238	RESISTOR	CF	680R	0.25W	J	101683	
R239	RESISTOR	CF	75R	0.25W	J	100751	
C220	CAPACITOR	ELC	47u	16V		230509	
C221	CAPACITOR	ELC	10u	16V		230143	
C222	CAPACITOR	CER	10n	25V	M	223138	
C231	CAPACITOR	CER	10n	25V	M	223138	
C232	CAPACITOR	MKT	100n	100V	M	214137	
C233	CAPACITOR	CER	33p	50V	J	220247	
C234	CAPACITOR	CER	4n7	50V	K	222480	
C235	CAPACITOR	CER	120p	50V	J	221173	
C236	CAPACITOR	CER	270p	50V	J	221279	
C237	CAPACITOR	CER	470p	50V	J	221494	
D230	DIODE	BB329				302693	
K220	SOCKET AV	S101-A				031777	
S220	SWITCH AV	TK1				010711	
L230	COIL	CHOKE	10u			052726	
L231	COIL	421				052691	
Q220	TRANSISTOR	JC501				400921	
Q221	TRANSISTOR	JA101				400920	
Q230	TRANSISTOR	JC501				400921	
	PCB, COMPLETE					597175	

Section 5.3 - AV Interface, Description

Transistors Q220 and Q221 form a non-inverting amplifier with a gain of 2. A standard 1v p-p video signal is thus amplified to the same level as produced by the vision IF stage.

To allow the volume control to vary sound level, the audio from the AV socket must first be modulated (FM) so that it can be detected by the sound detector stages.

Transistor Q230 and inductor L231 form a Hartley oscillator which oscillates at the sound IF carrier frequency (5,5 or 6,0MHz).

The audio signal applied to the varicap diode D230 changes its capacitance and thus frequency modulates the oscillator circuit.

TV/AV switching is performed by the switch S220. In the AV mode transistor Q101 is turned on, connecting pin 19 (AGC detector) of TDA4505 to ground. This mutes the vision IF, however the sound IF remains unmuted.

Incoming video from Q220/Q221 is fed via pin 4 (K100) to the blocking capacitor C122.

Video for the synch detector passes through R138.

Video for the colour decoder returns through pin 5 and S220 to pin 1.

Section 5.4 - AV Interface, Alignment

Fitting/Removal

The module is connected to sockets K100 and K200. Remove or cut link J63 near Q103.

Note. Socket K100 is a 7 pin socket, 2 pins are used for ground (both marked pin 2).

Socket K200 is a 5 pin socket.

The 2 pin plug from the AV board must be fitted to the right side (pin 4 is input, pin 5 ground).

Alignment

Method 1.

Switch unit to AV.

Short circuit Audio input socket.

Connect frequency counter to R238 or plug K200 pin 4.

Adjust coil L231 for 5,5MHz (system B/G/H) or 6MHz (system I)

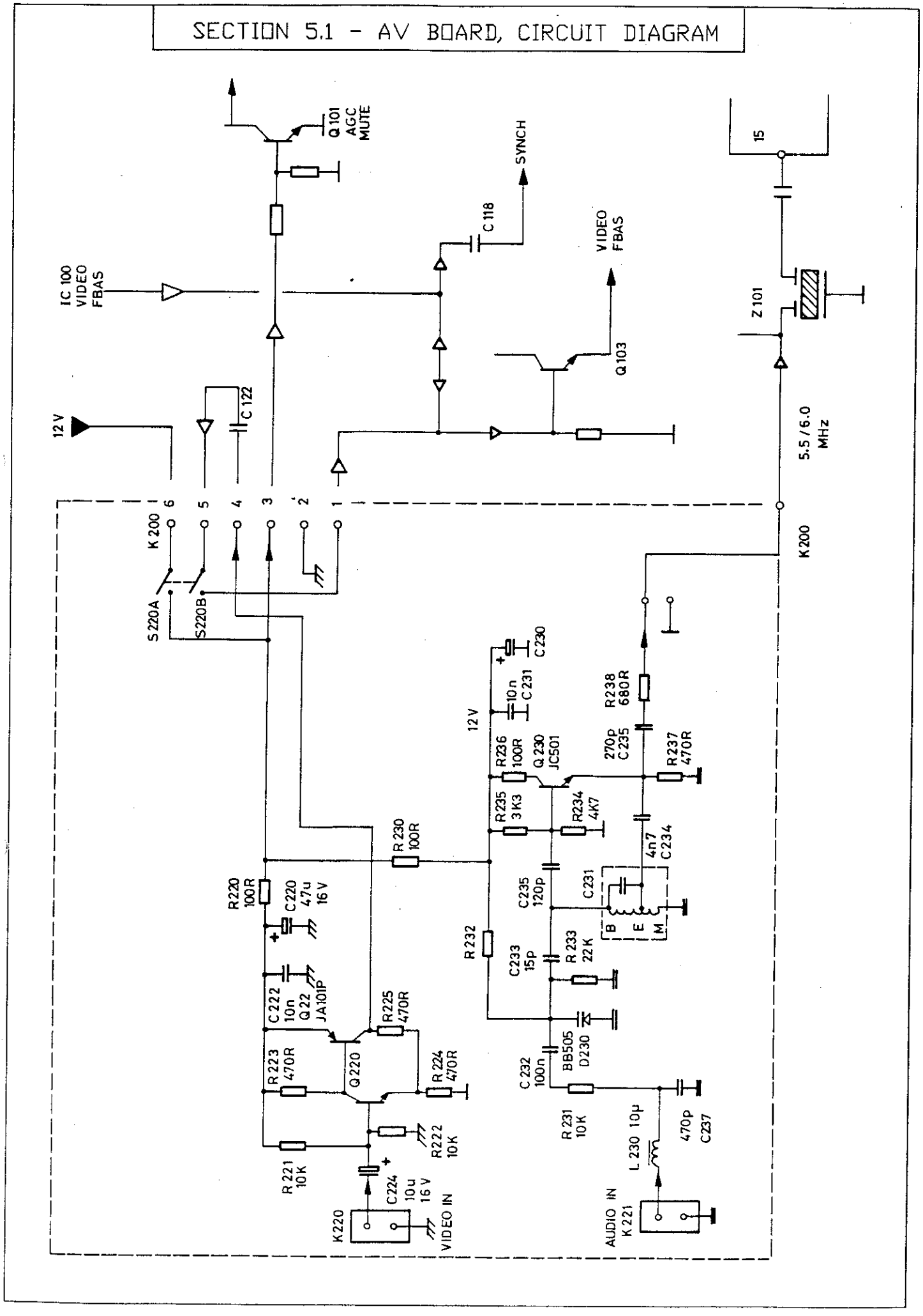
Method 2.

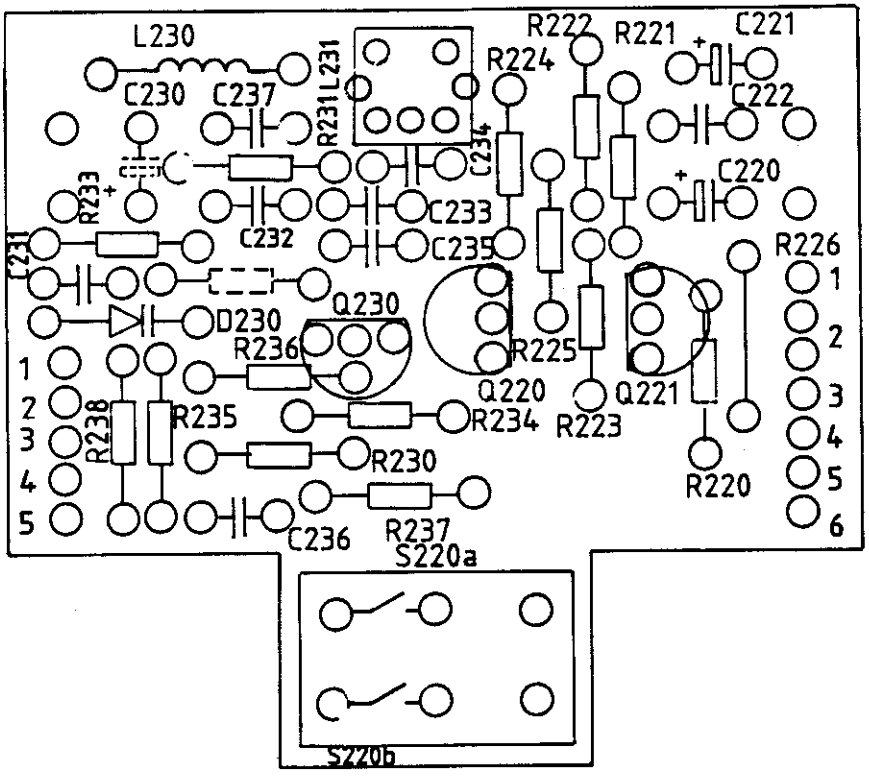
Inject a 1KHz 200mV audio signal into the AV socket.

Connect an oscilloscope to the loudspeaker.

Adjust L231 for maximum undistorted sound.

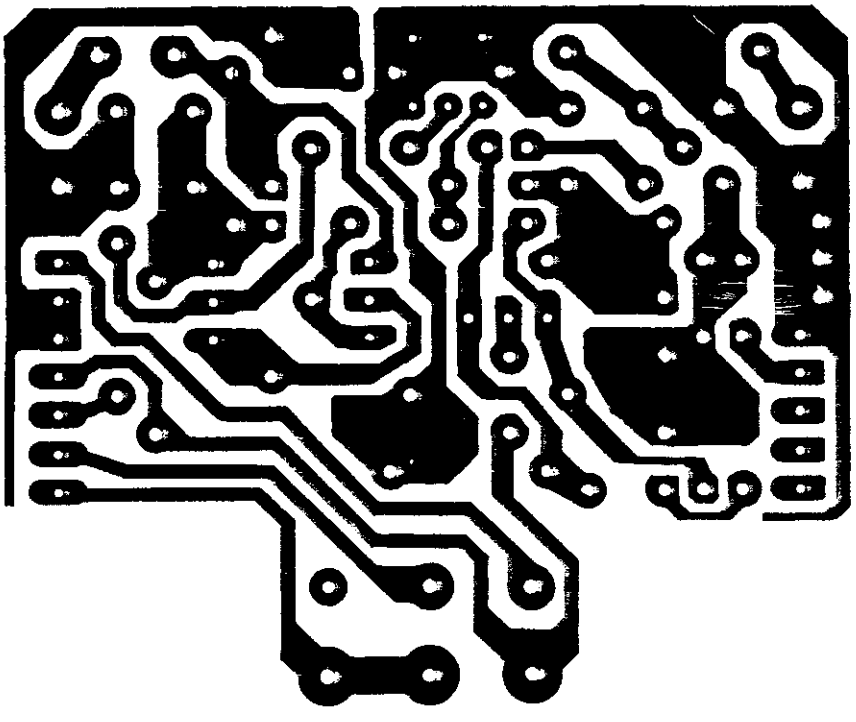
Increase the audio input level until distortion increases again, then readjust L231 for minimum distortion.


SECTION 5.1 - AV BOARD, CIRCUIT DIAGRAM
Q101 AGC MUTE
SYNCH
C118
VIDEO FBAS
IC 100 VIDEO FBAS
Q103
15
Z101
5.5/6.0 MHz
12 V
C122
K200
K200 6 5 4 3 2 1
S220A
S220B
C230
10n C231
R238 680R
270p C235
R237 470R
R236 100R
Q230 JC501
R235 3K3
R234 4K7
4n7 C234
R230 100R
C235 120p
C231
B E M
R220 100R
C220 47u 16V
R232
C233 15p
R233 22K
C222 10n
Q22 JA101P
R225 470R
Q220
R223 470R
R224 470R
C232 100n
BB505 D230
R222 10K
R231 10K
L230 10µ
470p C237
R221 10K
C224 10u 16V
K220
VIDEO IN
AUDIO IN K221

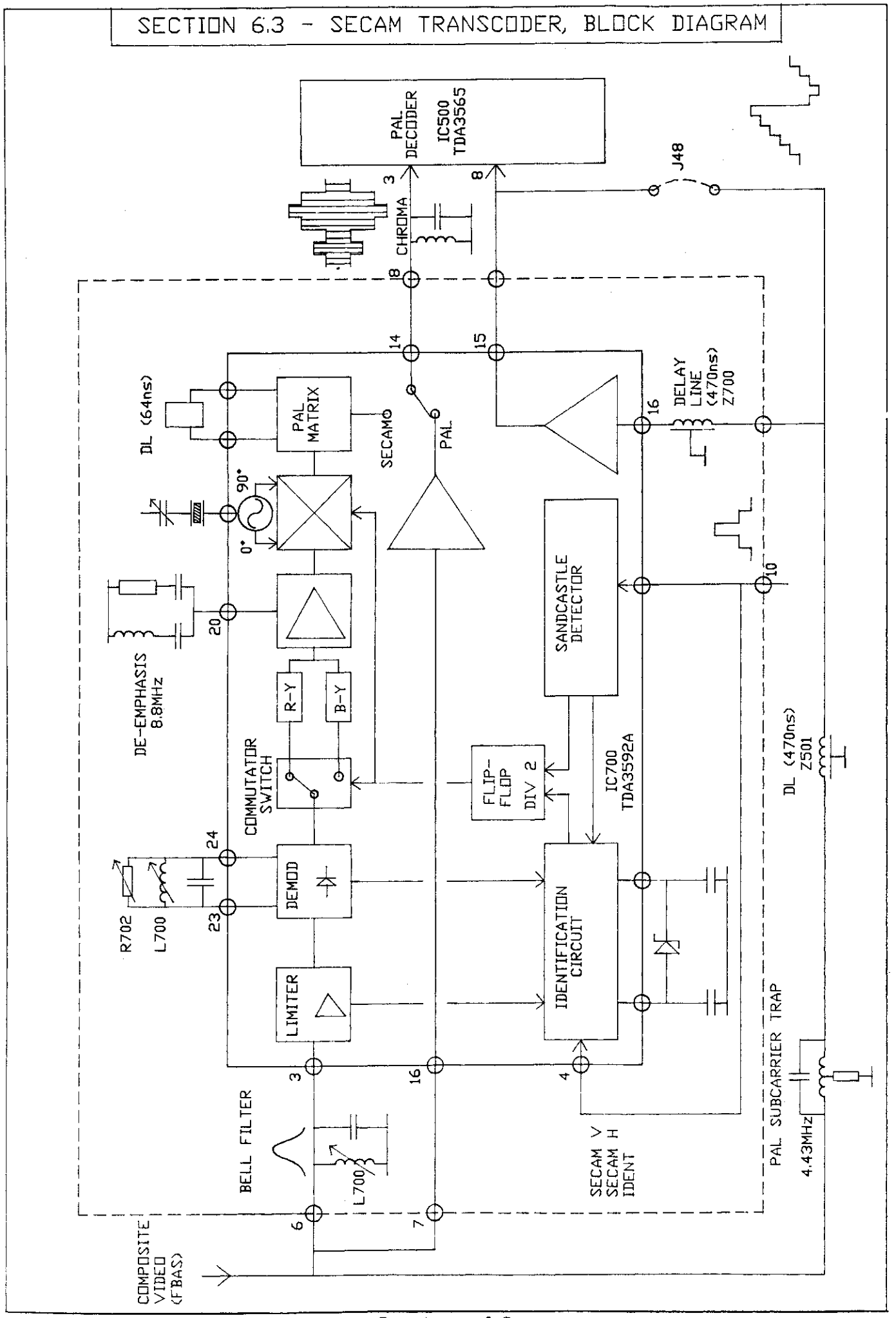


INSERTION DIAGRAM

AV - BOARD



COPPER PATTERN


SECTION 6.3 - SECAM TRANSCODER, BLOCK DIAGRAM
PAL DECODER
IC500 TDA3565
J48
CHROMA
DL (64ns)
PAL MATRIX
SECAMΦ
PAL
90°
0°
DELAY LINE (470ns) Z700
SANDCASTLE DETECTOR
DE-EMPHASIS 8.8MHz
R-Y
B-Y
COMMUTATOR SWITCH
FLIP-FLOP DIV 2
IC700 TDA3592A
DL (470ns) Z501
DEMOD
R702
L700
LIMITER
IDENTIFICATION CIRCUIT
BELL FILTER
L700
PAL SUBCARRIER TRAP
4.43MHz
SECAM V
SECAM H
IDENT
COMPOSITE VIDEO (FBAS)

Section 6.4 - SECAM Transcoder, Description

The TDA3592A integrated circuit consists of a SECAM decoder, PAL encoder and automatic PAL/SECAM switching.

If a SECAM signal is detected it is decoded as (R-Y) and (B-Y) signals before being re-encoded as PAL.

For any other signal which is not SECAM (ie PAL, Monochrome, NTSC or no signal) the IDENTICATION circuit allows the signal to pass through the transcoder without any processing.

SECAM signals with vertical identification (SECAM-V) or with horizontal identification (SECAM-H) can be decoded.

The SECAM system transmits colour information as FM modulated colour difference signals. The signals are sequential; (R-Y) for one horizontal line and (B-Y) for the next. To enable the colour difference signals to be identified the (R-Y) signal has a centre frequency of 4,406MHz and the (B-Y) signal 4,25MHz.

The SECAM signal passes through the Bell (cloche) filter to pin 3. The Bell filter is tuned to approximately 4,43MHz and equalises the amplitude of the 2 signals. Some compensation for frequency response errors in the vision IF stages is also possible.

The SECAM signal passes through a FM limiting amplifier before being demodulated. To allow black level clamping the (R-Y) and (B-Y) signals must be separated by the commutating switch. After clamping the signals are recombined in an amplifier which has an external de-emphasis circuit. Pin 20.

The (R-Y) and (B-Y) signals are used to amplitude modulate the 2 subcarrier (4,43MHz) signals.

As the (B-Y) and (R-Y) +/-90 signals still alternate line by line the delay line DL701 and PAL matrix are used to produce a normal PAL signal.

Section 6.5 Secam Transcoder, Alignment

FITTING/REMOVAL

Break links T49 (chroma) and J48 (Luma), fit transcoder to socket and secure with screw.

Refit links if transcoder is to be removed.

ALIGNMENT

Bell filter

Tune to a SECAM colourbar signal.

Connect an oscilloscope via a low capacitance probe (<2.5pF) to pin 3.

Adjust the bell filter L702 so that the amplitudes of the R-Y (4,406MHz) and B-Y (4,25MHz) signals are equal. (See fig 1.)

Another method is to view the signal at pin 20 on the oscilloscope and adjust for optimum step response.

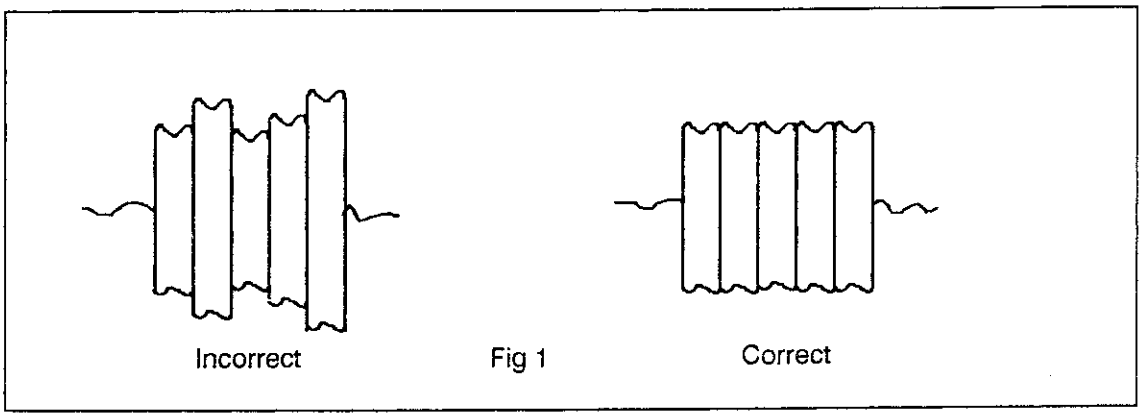


Fig 1

PAL reference oscillator

Method 1:

Connect a frequency counter via a low capacitance probe to pin 8.

Adjust the trimmer capacitor C717 for a frequency of 4.433619MHz +/–50Hz.

Method 2:

Overide the colour killer and ident circuits of the PAL decoder to put the oscillator in the free running mode. (See section on PAL decoder alignment.)

Tune to a PAL colour bar signal.

Adjust the oscillator of the PAL decoder for stationary colours.

Change the PAL signal for a SECAM signal.

Adjust trimmer capacitor C717 for stationary colours again.

SECAM demodulator reference circuit

Use a SECAM chrominance signal without colour modulation. (Unmodulated 4,406 and 4,25MHz).

Connect an oscilloscope via a low capacitance probe to IC700 pin 9.

Align L700 and R702 for minimum amplitude modulation of the signal.

Chromanence delay line

Note. The PAL decoder, the BELL filter (L702) and the demodulator circuit must be correctly aligned before adusting the delay line.

Method 1:

This method makes use of a SECAM generator which is able to modulate the B-Y carrier only.

Adjust the potentiometer (R717) amplitude and the coils L702 and L704 (delay line phase) for a minimum (R-Y) signal in the PAL decoder.

Method 2:

Connect a PAL vectorscope to the output of the transcoder (pin 8).

Ensure correct PAL vector graticule is fitted.

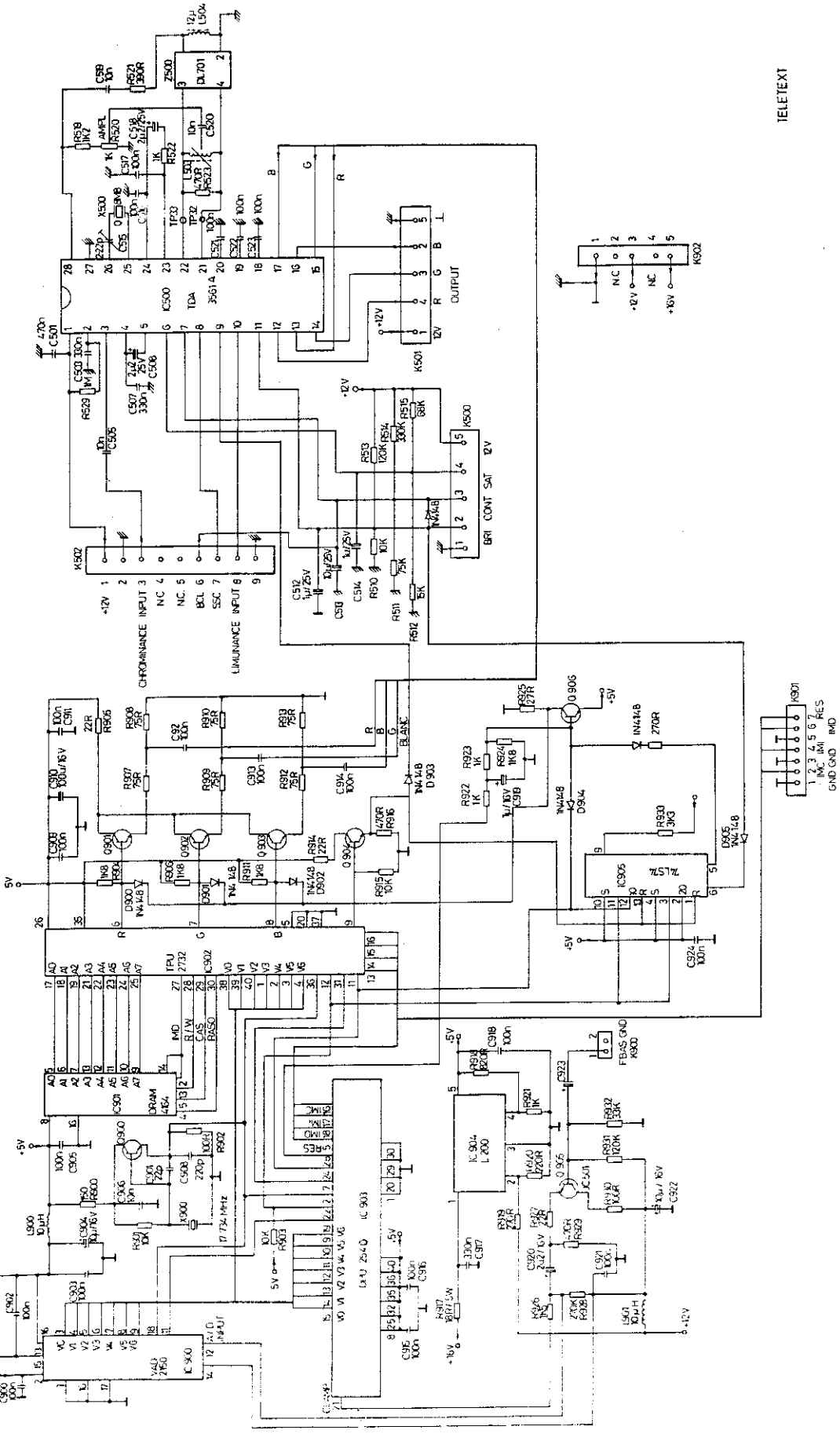
Supply a SECAM colour-bar signal to the input circuit of the IC.

Adjust coils (L702 and L704) and preset potentiometer R711 amplitude until the vectors are of correct phase and amplitude. Use the BLUE signal as the reference vector.

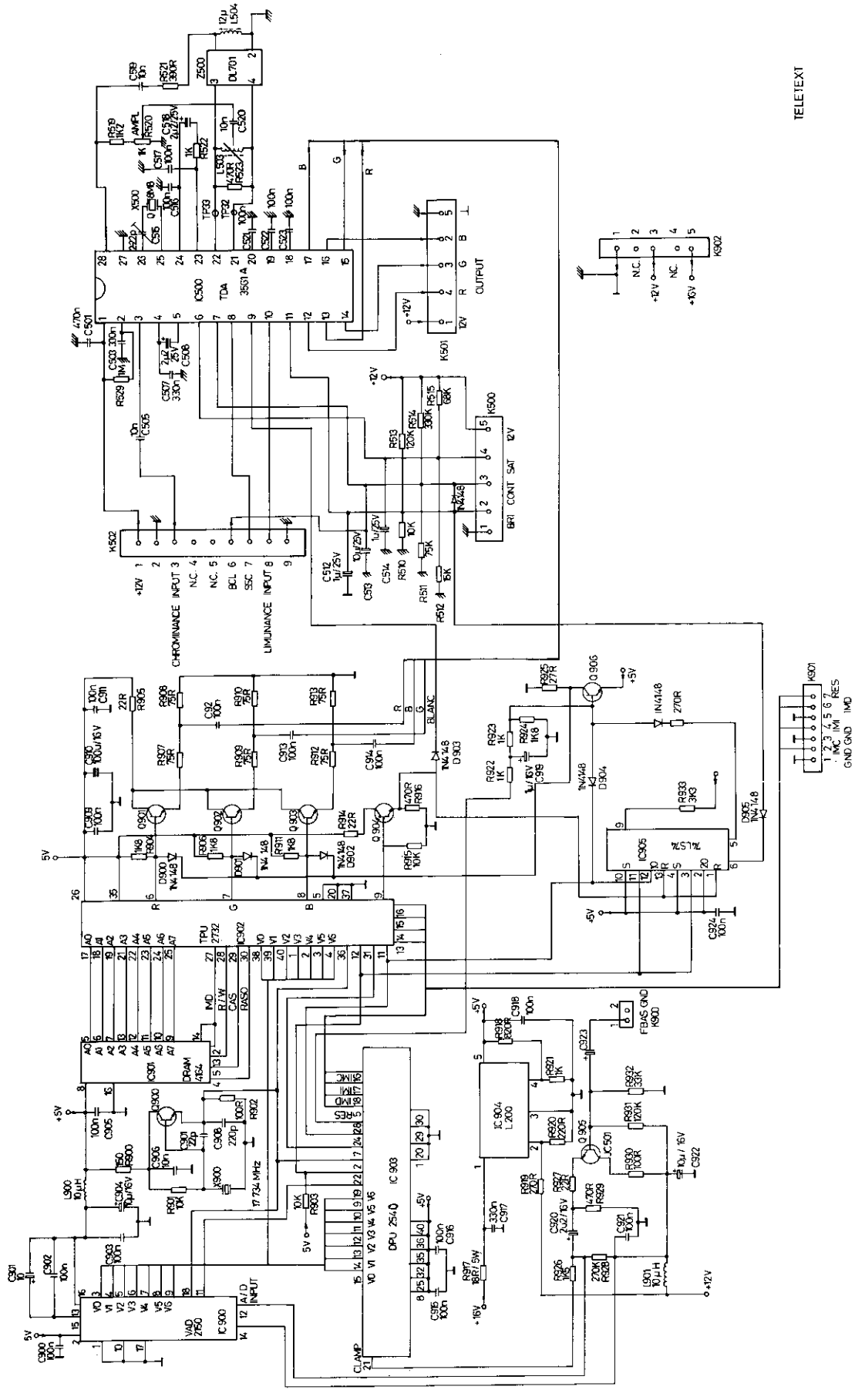
Section 6.6 - SECAM Transcoder, Parts List

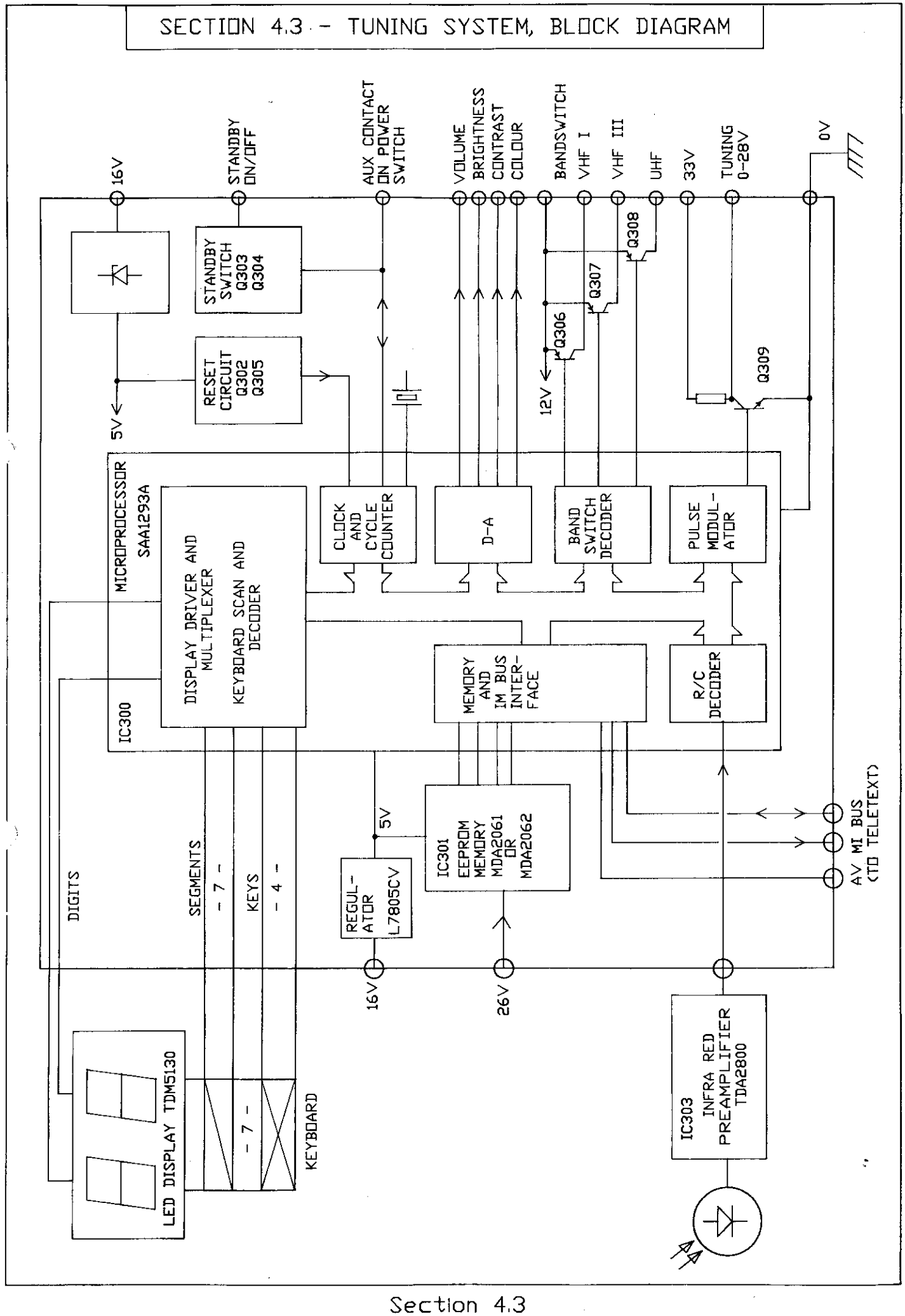
Circuit Reference	Description				Part Number	Comment
R700	RESISTOR	CF	1K0	0.25W	J 102101	
R701	RESISTOR	CF	1K0	0.25W	J 102101	
R702	PRESET	HRZ	1K0	5x10mm	132100	
R703	RESISTOR	CF	560R	0.25W	J 101562	
R704	RESISTOR	CF	2K0	0.25W	J 000000	
R705⚠	RESISTOR	CF	10R	0.25W	J 100107	
R708	RESISTOR	CF	2K0	0.25W	J 111111	
R709	RESISTOR	CF	1K0	0.25W	J 102101	
R710	RESISTOR	CF	390R	0.25W	J 101395	
R711	PRESET	HRZ	1K 0	5x10mm	132100	
R712	RESISTOR	CF	680R	0.25W	J 101683	
C700	CAPACITOR	PYF	180p	63V	G 221192	
C701	CAPACITOR	MKT	100n	100V	M 214137	
C702	CAPACITOR	MKT	100n	100V	M 214137	
C703	CAPACITOR	CER	1n0	50V	K 224108	
C704	CAPACITOR	CER	33p	50V	K 220347	
C705	CAPACITOR	ELC	1u0	50V	239128	
C706	CAPACITOR	ELC	10u	16V	230143	
C707	CAPACITOR	CER	22r	50V	M 223247	
C710	CAPACITOR	CER	100p	50V	M 221175	
C711	CAPACITOR	PYF	390p	63V	G 221391	
C712	CAPACITOR	MKT	100n	100V	M 214137	
C713	CAPACITOR	MKT	100n	100V	M 214137	
C714	CAPACITOR	MKT	100n	100V	M 214137	
C715	CAPACITOR	TANT	1u0	25V	M	
C716	CAPACITOR	ELC	1u0	50V	239128	
C717	CAPACITOR	TRIMMER	22p	7.5mm	260225	
C718	CAPACITOR	CER	10n	50V	K 223135	
C719	CAPACITOR	CER	1n0	50V	K 224108	
C720	CAPACITOR	CER	1n0	50V	K 224108	
C721	CAPACITOR	CER	1n0	50V	K 224108	
L700	COIL	566			052703	
L701	COIL	CHOKE	10u		052726	
L702	COIL	564			052133	
L703	COIL	CHOKE	12u		053321	
L704	COIL	CHOKE	12u		053321	
Z700	DELAY LINE	DL470			052702	
Z701	DELAY LINE	DL701			052701	
X700	CRYSTAL	4,43 MHz			056730	
D700	DIODE	BAW76			302955	
IC700	I.C.	TDA3592A			451350	
	PCB, COMPLETE				597158	

SECTION 7.1 - TELETEXT SYSTEM, CIRCUIT DIAGRAM

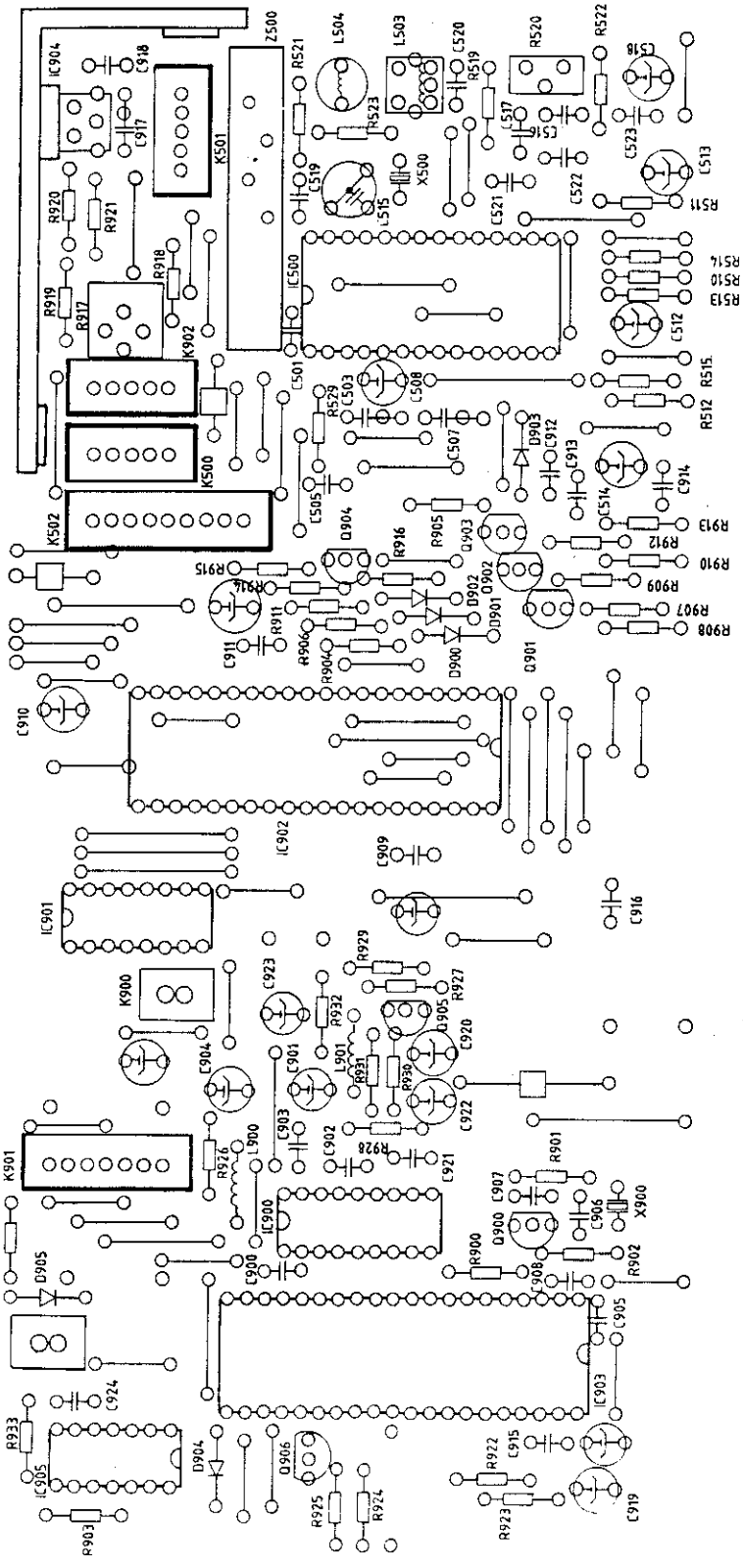


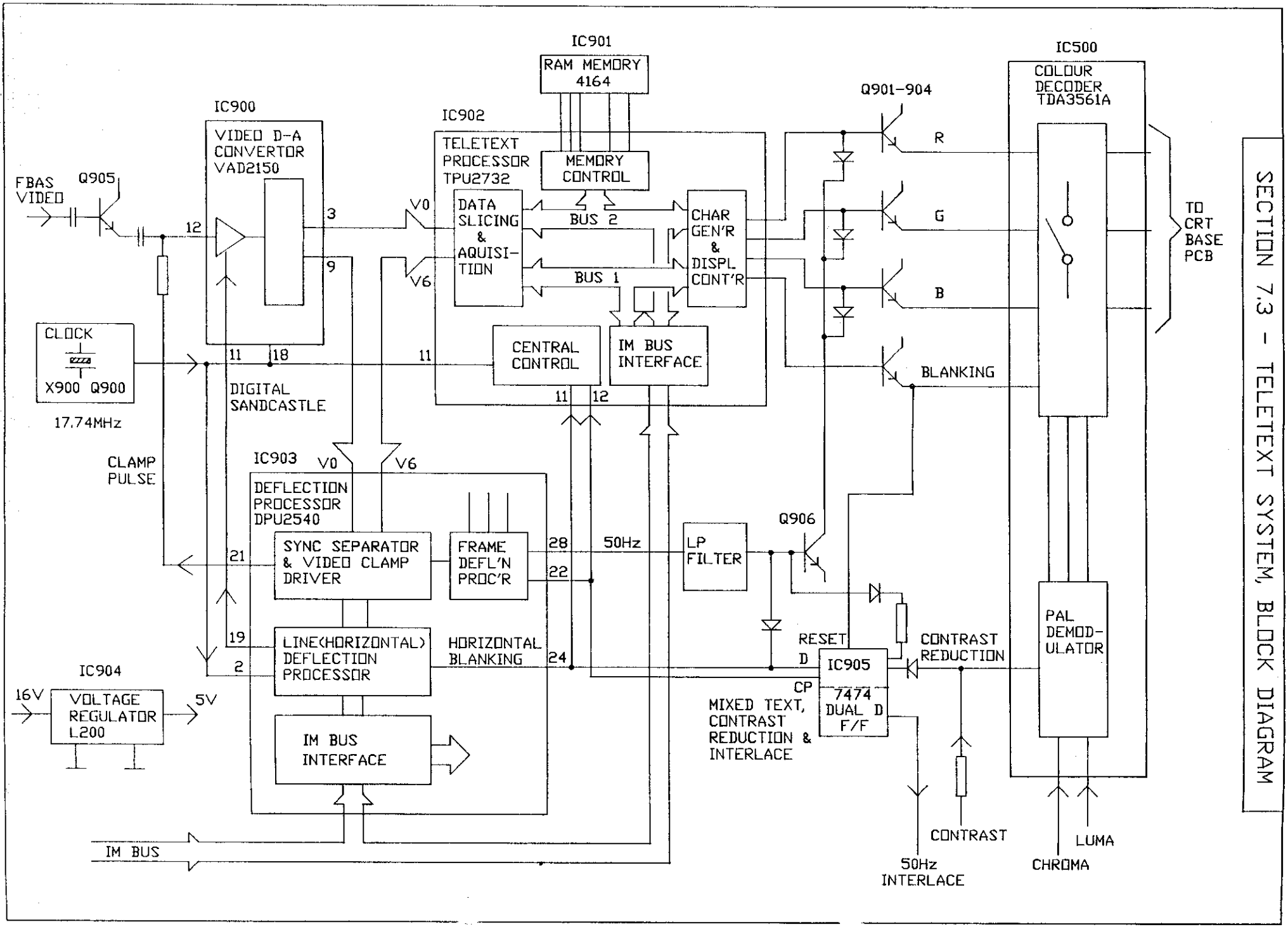
SECTION 7.1 - TELETEXT SYSTEM, CIRCUIT DIAGRAM




SECTION 4.3 - TUNING SYSTEM, BLOCK DIAGRAM
16V
STANDBY ON/OFF
AUX CONTACT ON POWER SWITCH
VOLUME
BRIGHTNESS
CONTRAST
COLOUR
BANDSWITCH
VHF I
VHF III
UHF
33V
TUNING 0-28V
0V
STANDBY SWITCH Q303 Q304
RESET CIRCUIT Q302 Q305
5V
12V
Q306
Q307
Q308
Q309
MICROPROCESSOR SAA1293A
IC300
DISPLAY DRIVER AND MULTIPLEXER
KEYBOARD SCAN AND DECODER
CLOCK AND CYCLE COUNTER
D-A
BAND SWITCH DECODER
PULSE MODUL-ATOR
MEMORY AND IM BUS INTER-FACE
R/C DECODER
REGUL-ATOR L7805CV
IC301 EEPROM MEMORY MDA2061 OR MDA2062
16V
26V
AV MI BUS (TO TELETEXT)
DIGITS
SEGMENTS
- 7 -
KEYS
- 4 -
LED DISPLAY TDM5130
KEYBOARD
IC303 INFRA RED PREAMPLIFIER TDA2800

SECTION 7.2 - TELETEXT SYSTEM, COMPONENT LOCATION




SECTION 7.3 - TELETEXT SYSTEM, BLOCK DIAGRAM
IC901
RAM MEMORY 4164
IC500
COLOUR DECODER TDA3561A
Q901-904
IC900
VIDEO D-A CONVERTOR VAD2150
IC902
TELETEXT PROCESSOR TPU2732
MEMORY CONTROL
FBAS VIDEO
Q905
12
3
9
V0
V6
DATA SLICING & AQUISI-TION
BUS 2
BUS 1
CHAR GEN'R & DISPL CONT'R
R
G
B
BLANKING
TO CRT BASE PCB
CLOCK
X900 Q900
17.74MHz
11
18
11
CENTRAL CONTROL
IM BUS INTERFACE
11
12
DIGITAL SANDCASTLE
CLAMP PULSE
IC903
V0
V6
DEFLECTION PROCESSOR DPU2540
SYNC SEPARATOR & VIDEO CLAMP DRIVER
FRAME DEFL'N PROC'R
28
50Hz
22
21
LP FILTER
Q906
19
LINE(HORIZONTAL) DEFLECTION PROCESSOR
HORIZONTAL BLANKING
24
2
RESET
D
IC905
7474 DUAL D F/F
CP
CONTRAST REDUCTION
PAL DEMOD-ULATOR
IC904
16V
VOLTAGE REGULATOR L200
5V
IM BUS INTERFACE
MIXED TEXT, CONTRAST REDUCTION & INTERLACE
IM BUS
CONTRAST
50Hz INTERLACE
LUMA
CHROMA

Section 7.4 - Teletext System, Description

For teletext models the existing colour decoder on the main PCB is replaced with a new decoder on the teletext PCB.

Circuit description

The composite (FBAS) video signal is converted into a 7bit digital signal by the A to D flash convertor IC900 (VAD2150). Transistor Q905 provides a low impedance drive for the convertor's input (pin12) as well as preventing the clamp pulses from IC903 entering the video signal line.

A digital sandcastle pulse from IC903 is used to blank the synchronising pulses and colour burst (pin 11).

All the teletext decoding and character generation is performed within the teletext processor IC902 (TPU2732). No adjustments or alignment are necessary.

For mixed text mode the vertical deflection circuit is provided with a fully interlaced 50Hz signal via a bistable (flip-flop) in IC905.

Contrast reduction is also necessary to prevent the beam current limiter circuit acting when in mixed text mode. This is achieved by triggering another bistable in IC905.

Note: Fitting a teletext board to a non teletext chassis may contravene safety regulations and will invalidate the guarantee.

Section 7.5 - Teletext system, Alignment

Teletext decoder

No alignment necessary.

Colour decoder

Colour reference oscillator

Tune to a PAL colour bar pattern.
Connect test points TP32 and TP33 together. (Pins 21and 22 of IC500)
Connect pin6 (SAT) to +12V to override the colour killer.
Adjust trimmer capacitor C515 for minimum rolling of colour bars.

PAL matrix adjustment

Tune to a PAL colour bar signal that has anti PAL (colourless) areas.

Method 1

Connect an oscilloscope to the BLUE output (connector K501 pin 2).
Adjust the delay line amplitude (DL-AMP) preset R520 and delay line phase (DL-P) coil L503 to minimise the alternating (double waveform. (see figs 1 and 2 section 3.5)

Method 2

Connect an oscilloscope with X and Y inputs to the RED and BLUE outputs.
(X to K501 pin 4 RED, Y to K501 pin 2 BLUE)
Adjust colour,brightness and contrast controls to produce a vector display on the oscilloscope (see Fig 3 section 3.5).
Adjust DIL-AMP preset to reduce the amplitude of the small vectors (hannover blind errors), and the DL-PHASE coil to superimpose the output vectors (see fig 4 section 3.5).
Note: Some test patterns may not produce clearly visible vectors.

Chroma band pass filter L500

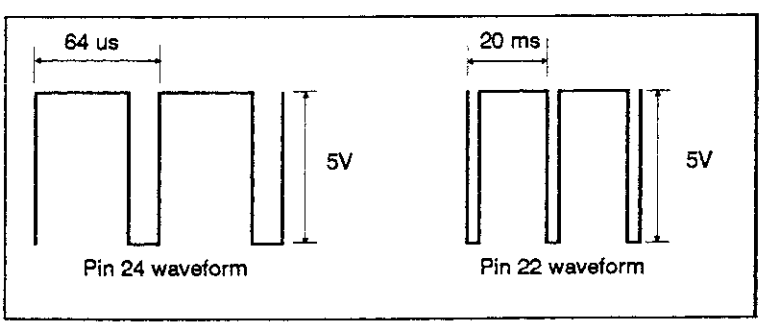
See alignment details in non teletext version (section 3.5)

Chroma trap L501.

See alignment details in non teletext version (section 3.5)

Section 7.6 - Teletext System, Fault Guide

System does not enter into the text mode.	Check power supply (IC904). Check clock circuit (Q900). Check blanking output (Q904). Check RAM memory (IC901). Check colour decoder (IC500). Check teletext operating options. *
System enters into an unidentified mode. (Neither teletext nor TV mode)	Check/replace TPU2732 (IC902). Check/replace 4164 (IC901). Check teletext operating options. *
System enters into teletext mode but does not display teletext information.	If no page header: Check R,G,B outputs,and IC902.. If page header ok but no other information : Check video input, Q905 and IC903. Check teletext operating options. *
Text displayed on the screen is not synchronised.	Check waveforms and sychronisation signal outputs (pins 22 and 24 of IC903 DPU2540. Note: There is no after hours synch (AHS). Text will not be synchronised unless a TV signal is being received.



Errors, faulty characters or decoding errors.	Check 'clock cracker' pages from several different stations. If pages vary significantly or are random check: I.F. alignment. Level of video (FBAS) signal at base of Q905 Clamp pulses from IC903 pins 19 & 21. Check/replace IC900 & IC903. If errors remain constant or characters distorted check/replace IC901 or IC902..

Excessive contrast of teletext characters.	Check the voltage level (4V) at pin 28 of IC903 and Q906. Check value of R924 (1k5-2k2). Check EEPROM (IC300) program.
Excessive contrast of teletext character in mixed text mode.	Check pin 5 of IC905. (Low in TV or mixed text mode.
Interlace flicker on text display.	Check the waveform at pin 9 of IC905. (25Hz square wave when in teletext mode) Note: No output when in TV or mixed text mode.

* Teletext operating options (teletext system, language, contrast level etc) are stored in the tuning system EEPROM IC300.

Section 7.7 - Teletext System, Parts List

Circuit Reference	Description					Part Number	Comment
R510	RESISTOR	CF	10K	0.25W	J	103116	
R511	RESISTOR	CF	75K	0.25W	J	103752	
R512	RESISTOR	CF	15K	0.25W	J	103155	
R513	RESISTOR	CF	120K	0.25W	J	104123	
R514	RESISTOR	CF	330K	0.25W	J	104332	
R515	RESISTOR	CF	68K	0.25W	J	103686	
R519	RESISTOR	CF	1K2	0.25W	J	102126	
R520	PRESET	HRZ	1K	5x10mm		132122	
R521	RESISTOR	CF	390R	0.25W	J	101395	
R523	RESISTOR	CF	1K0	0.25W	J	102101	
R524	RESISTOR	CF	470R	0.25W	J	104470	
R900	RESISTOR	CF	150R	0.25W	J	101154	
R901	RESISTOR	CF	10K	0.25W	J	103116	
R902	RESISTOR	CF	100R	0.25W	J	101106	
R903	RESISTOR	CF	10K	0.25W	J	103116	
R904	RESISTOR	CF	1K8	0.25W	J	102189	
R905	RESISTOR	CF	22R	0.25W	J	100224	
R906	RESISTOR	CF	1K8	0.25W	J	102189	
R907	RESISTOR	CF	75R	0.25W	J	100751	
R908	RESISTOR	CF	75R	0.25W	J	100751	
R909	RESISTOR	CF	75R	0.25W	J	100751	
R910	RESISTOR	CF	75R	0.25W	J	100751	
R911	RESISTOR	CF	1K8	0.25W	J	102189	
R912	RESISTOR	CF	75R	0.25W	J	100751	
R913	RESISTOR	CF	75R	0.25W	J	100751	
R914	RESISTOR	CF	22R	0.25W	J	100224	
R915	RESISTOR	CF	10K	0.25W	J	103116	
R916	RESISTOR	CF	470R	0.25W	J	104470	
R917 ⚠	RESISTOR	WW	18R	5W	K	120180	
R918	RESISTOR	CF	820R	0.25W	J	101820	
R919	RESISTOR	CF	270R	0.25W	J	101274	
R920	RESISTOR	CF	220R	0.25W	J	101223	
R921	RESISTOR	CF	1K0	0.25W	J	102101	
R922	RESISTOR	CF	1K0	0.25W	J	102101	
R923	RESISTOR	CF	1K0	0.25W	J	102101	
R924	RESISTOR	CF	1K8	0.25W	J	102189	
R925 ⚠	RESISTOR	CF	27R	0.25W	J	100271	
R926	RESISTOR	CF	1K5	0.25W	J	102157	
R927	RESISTOR	CF	22R	0.25W	J	100224	
R928	RESISTOR	CF	270K	0.25W	J	104273	
R929	RESISTOR	CF	470R	0.25W	J	104470	
R930	RESISTOR	CF	100R	0.25W	J	104110	
R931	RESISTOR	CF	120K	0.25W	J	104123	
R932	RESISTOR	CF	33K	0.25W	J	103336	
R933	RESISTOR	CF	3K3	0.25W	J	102338	
R934							Replaced by link
R935	RESISTOR	CF	270-820R	0.25W	J	101274	Value sets mixed teletext contrast level
C501	CAPACITOR	MKT	470n	63V	K	214494	
C503	CAPACITOR	MKT	330n	63V	K	214336	
C505	CAPACITOR	CER	10n	50V	K	223135	
C507	CAPACITOR	MKT	330n	63V	K	214336	
C508	CAPACITOR	ELC	2u2	50V	K	239235	
C512	CAPACITOR	ELC	1u0	50V		293128	
C513	CAPACITOR	ELC	10u	16V		230143	
C514	CAPACITOR	ELC	1u0	50V		239128	
C515	CAPACITOR	TRIM	22p	7.5mm		260225	
C516	CAPACITOR	MKT	100n	100V	M	214137	
C517	CAPACITOR	MKT	100n	100V	M	214137	
C518	CAPACITOR	ELC	2u2	50V		239235	
C519	CAPACITOR	CER	10n	50V	K	223135	
C520	CAPACITOR	CER	10n	50V	K	223135	

Circuit Reference	Description				Part Number	Comment
C521	CAPACITOR	MKT	100n	100V M	214137	
C522	CAPACITOR	MKT	100n	100V M	214137	
C523	CAPACITOR	MKT	100n	100V M	214137	
C900	CAPACITOR	MKT	100n	100V M	214137	
C901	CAPACITOR	ELC	10u	16V	230143	
C902	CAPACITOR	MKT	100n	100V M	214137	
C903	CAPACITOR	MKT	100n	100V M	214137	
C904	CAPACITOR	ELC	10u	16V	230143	
C905	CAPACITOR	MKT	100n	100V M	214137	
C906	CAPACITOR	CER	10n	50V M	223135	
C907	CAPACITOR	CER	22p	50V J	220246	
C908	CAPACITOR	CER	220p	50V M	221245	
C909	CAPACITOR	MKT	100n	100V M	214137	
C910	CAPACITOR	ELC	10u	16V	230143	
C911	CAPACITOR	MKT	100n	100V M	214137	
C912	CAPACITOR	MKT	100n	100V M	214137	
C913	CAPACITOR	MKT	100n	100V M	214137	
C914	CAPACITOR	MKT	100n	100V M	214137	
C915	CAPACITOR	MKT	100n	100V M	214137	
C916	CAPACITOR	MKT	100n	100V M	214137	
C917	CAPACITOR	MKT	330n	63V K	214336	
C918	CAPACITOR	MKT	330n	63V K	214336	
C919	CAPACITOR	ELC	1u0	50V	239128	
C920	CAPACITOR	ELC	2u2	50V	239235	
C921	CAPACITOR	MKT	100n	100V M	214137	
C922	CAPACITOR	ELC	10u	16V	230143	
C923	CAPACITOR	ELC	1u0	50V	239128	
C924	CAPACITOR	MKT	100n	100V M	214137	
C925	CAPACITOR	CER	10n	50V M	223135	
D900	DIODE	1N4148			302289	
D901	DIODE	1N4148			302289	
D902	DIODE	1N4148			302289	
D903	DIODE	1N4148			302289	
D904	DIODE	1N4148			302289	
D905	DIODE	1N4148			302289	
D906	DIODE	1N4148			302289	
D907	DIODE	1N4148			302289	
D908	DIODE	1N4148			302289	
Q900	TRANSISTOR	JC501			400920	
Q901	TRANSISTOR	JC501			400920	
Q902	TRANSISTOR	JC501			400920	
Q903	TRANSISTOR	JC501			400920	
Q904	TRANSISTOR	JC501			400920	
Q905	TRANSISTOR	JC501			400920	
Q906	TRANSISTOR	JC501			400920	
IC500	I.C.	TDA3561A			451390	
IC900	I.C.	VAD2150			451393	
IC901	I.C.	DRAM 4164			451396	
IC902	I.C.	TPU2732			451394	
IC903	I.C.	DPU2540			451395	
IC904	I.C.	L200CV			451391	
IC905	I.C.	74LS74			451392	
L503	COIL	PAL DELAY PHASE 412			052695	
L504	COIL	CHOKE 12u			053321	
L900	COIL	CHOKE 10u			052726	
L901	COIL	CHOKE 10u			052726	
Z500	COIL	PAL DELAY LINE DL701			052701	
X500	CRYSTAL	8.867MHz			056729	
X900	CRYSTAL	17.73447MHz			056860	
	PCB, COMPLETE				597196	

Section 8 - CRT Purity and Convergence

IMPORTANT.

The purity and convergence have been pre-aligned and should not normally require adjustment.

If purity or convergence is incorrect check the operation of the degaussing coil and thermistor R804 before attempting any adjustment.

The Philips tube has the purity and convergence preset by magnetised rings within the picture tube neck. Do not allow magnetised objects, external degaussing coils or magnets near the tube neck otherwise purity or convergence may be affected permanently.

Alignment procedures vary according to the size and make of tube. Before commencing any adjustment demagnetise the tube and cabinet with an external degaussing coil. Allow the receiver to operate for 15 minutes.

Conventional PIL Tube

14inch (37cm) Samsung 3708B22

20inch (51cm) Samsung 5109B22

Colour Purity and Centre Convergence

1. Obtain a green raster by turning down the RED (R) and BLUE (B) background (cut off) presets or by selecting a green test pattern.

2. Loosen the clamp screw holding the yoke and slide the yoke backward to provide vertical green bar (zone) in the picture screen. (Fig. 2.)

3. Remove the rubber wedges. (If fitted).

4. Rotate and spread the tabs of the purity (P) magnet (Fig. 1.) until the green bar is in the centre of the screen. At the same time, centre the raster vertically.

5. Move the yoke slowly forward until a uniform green screen is obtained. Place a rubber wedge in the uppermost position (D). Lightly tighten the clamp screw of the yoke.

6. Check the purity of the red and blue rasters by adjusting the background (cut off) presets.

7. Adjust the background (cut off) presets for a white raster.

8. Select crosshatch pattern on signal generator. Adjust the BRIGHTNESS, CONTRAST and FOCUS controls for a well defined pattern.

9. Turn the green gun off with the background (cut off) preset.

10. Adjust the two tabs of the 4-pole magnets to converge the red and blue vertical lines in the centre of the picture screen. (Fig 4.)

Turning both tabs together moves the red and blue lines vertically.

Turning each tab in opposite directions moves the red and blue lines horizontally.

11. Turn the green gun on. Adjust the two tabs of 6-pole magnets to converge the red/blue and green lines.The 6 pole magnets move the red/blue and green lines the same way as the 4 pole magnets.

12. Repeat the convergence and purity adjustments bearing in mind that the adjustments interact to some extent.

Periferal (dynamic) Convergence

1. Remove any wedges that may be fitted.

2. Tilt front of the deflection yoke up or down to obtain best convergence at the edge of the screen (Fig .5). Place a wedge at the uppermost position (D). Do not remove the adhesive backing paper from the wedge.

3. Place the other wedge at the bottom position (B) removing the backing paper to stick.

4. Tilt front of the yoke right or left to obtain best convergence of parallel lines. (Fig. 6.)

5. Keep the yoke position steady and put another wedge in either upper position (A or C). Remove backing paper and stick the wedge on the picture tube.

6. Remove the temporary wedge and fit it in the other upper position. Stick it to the picture tube to secure the yoke.

7. After fixing the three wedges, recheck overall convergence and purity. Tighten the screw firmly to fix the yoke and check the yoke is firm.

8. Secure the wedges with additional tape, silicon rubber or other flexible adhesive.

FST (S5) Picture Tube

21inch (53cm) Videocolor A51EBV12X

Purity and static convergence are adjusted by the magnetic ring on the tube neck. The ring can be rotated or moved along the neck.

PERIFERAL (DYMANIC) CONVERGENCE

1. Retract the 3 adjustment screws by rotating them anti clockwise.

2. Obtain a green raster by turning down the red (R) and blue (B) background (cut off) presets or selecting a green test pattern.

3. Move the yoke backwards or forwards until a uniform green screen is obtained. Tighten the clamp screw lightly.

4. Adjust the background controls for a white raster.

5. Select a crosshatch pattern and check that the lines are converged correctly at the centre of the screen. The position of the yoke may have to moved slightly to obtain optimum purity and convergence.

6. Periferal convergence procedure is similar to that for the PIL tubes.

Move the yoke in the horizontal or vertical plane to converge the red/green/blue lines at the edges of the screen. (Figs. 5 & 6.)

7. Rotate the adjustment screws clockwise until they touch the glass.Tighten the clamp screw firmly.

8. Using a plastic adjustment tool, tighten the screws gradually to obtain best convergence and to prevent the scan coil moving. Do not over tighten otherwise the yoke will move backwards affecting purity.

9. Secure the ends of the adjustment screws to the glass with silicon rubber or other flexible adhesive.

FST (45AX) Picture Tube

15inch (38cm) Philips A36EAM00X01

21inch (53cm) Philips A51EAL00X

No purity or convergence adjustments are necessary.

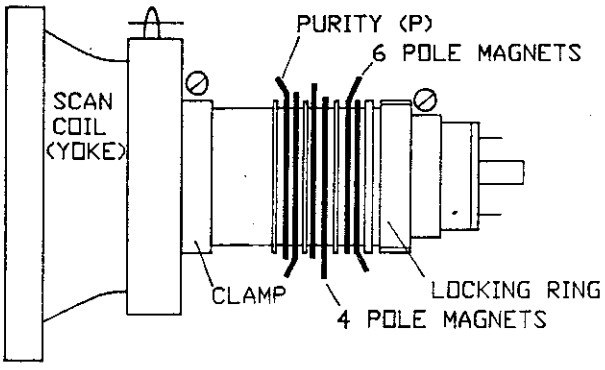


FIG 1

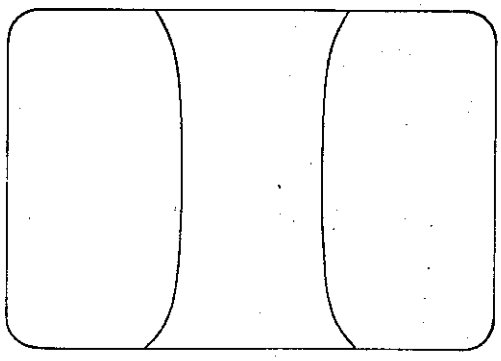
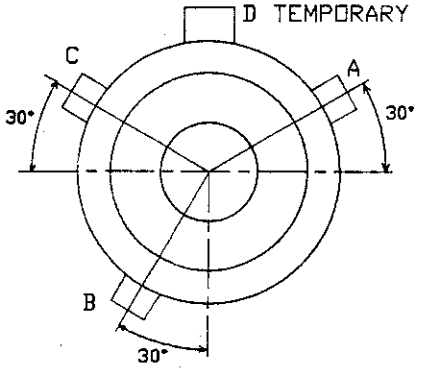


FIG 2



WEDGE POSITION

FIG 3

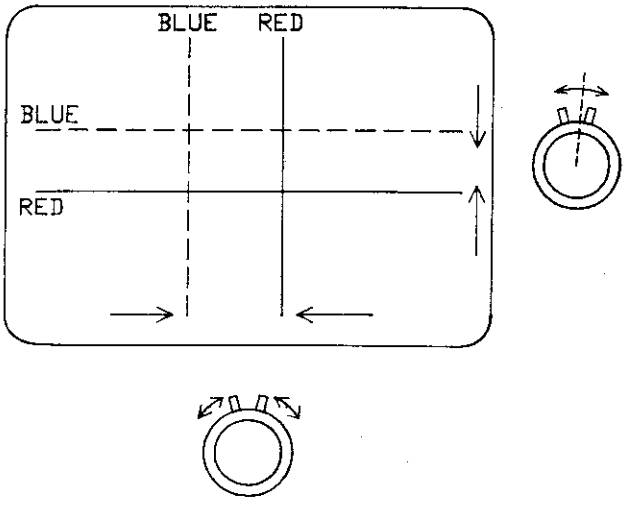


FIG 4

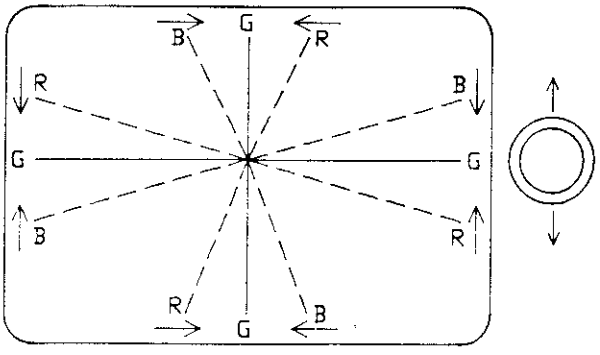


FIG 5

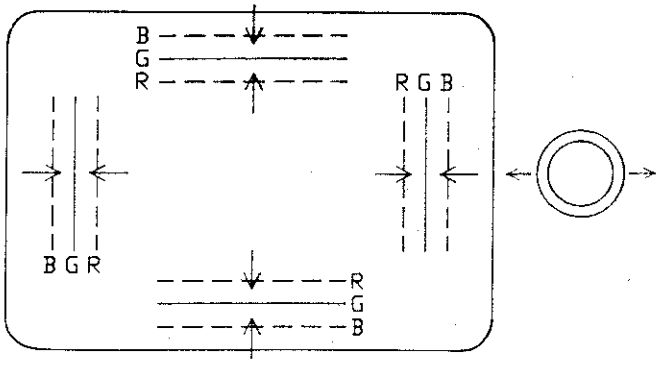


FIG 6

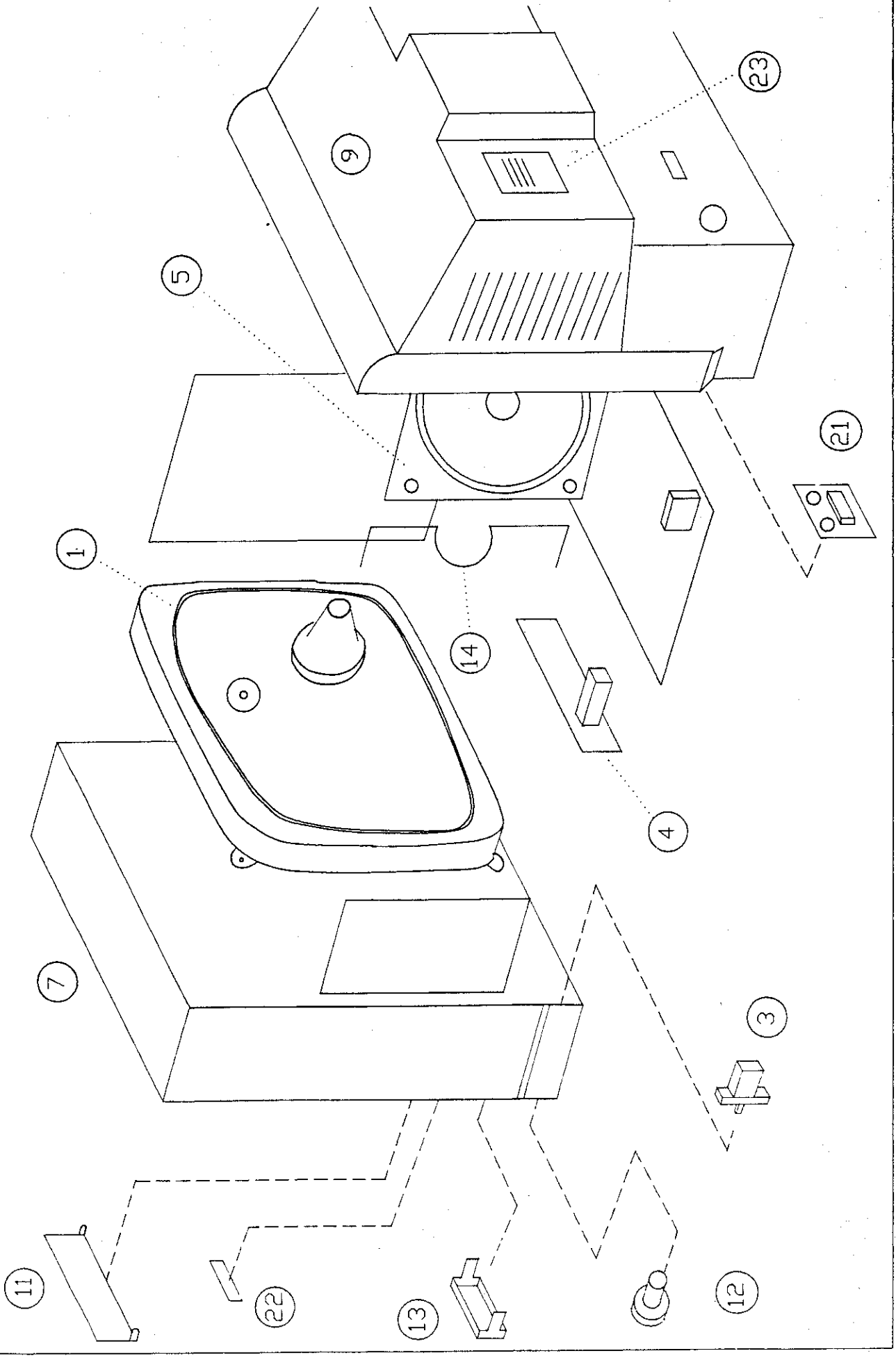
Section 9, Cabinet & Miscellaneous Parts List

Ref	Description	Part Number	Comment
CPT	⚠3708B22-TC COMPLETE WITH DEFLECTION YOKE	056737	14" MODELS
(1)	⚠DEGAUSS COIL	577166	14" MODELS
CPT	⚠A36EAM00X01 COMPLETE WITH DEFLECTION YOKE	056738	15" MODELS
(1)	⚠DEGAUSS COIL	569166	15" MODELS
CPT	⚠5109B22-TC COMPLETE WITH DEFLECTION YOKE	056736	20" MODELS
(1)	⚠DEGAUSS COIL	597166	20" MODELS
CPT	⚠A51EBV12X01 COMPLETE WITH DEFLECTION YOKE	056735	21" MODELS (VIDEOCOLOR CRT)
OR	⚠A51EAL30X01 COMPLETE WITH DEFLECTION YOKE		21" MODELS (PHILIPS CRT)
(2)	⚠DEGAUSS COIL (ASSEMBLY)	589166	21" MODELS
L602	HORIZONTAL WIDTH COIL		21" VIDEOCOLOR TUBE ONLY (Fitted on deflection yoke)
(3)	⚠SWITCH, MAINS 1753-504	010712	ALL MODELS
(4)	PCB,CONTROL	577195	ALL MODELS
	SWITCH, TIP (KEYBOARD)	010710	ALL MODELS
(5)	SPEAKER 4" 16 Ohm	577107	14" & 15" MODELS
(6)	SPEAKER 3 X 4" 16 Ohm	597107	20" & 21" MODELS
(7)	CABINET, FRONT	633252	14" MODELS
(7)	CABINET, FRONT	637252	15" MODELS
(8)	CABINET, FRONT	597252	20" MODELS
(8)	CABINET, FRONT	589252	21" MODELS
(9)	CABINET, BACK	577205	14" & 15" MODELS
(10)	CABINET, BACK	597205	20" & 21" MODELS
(11)	DOOR, CONTROL PANEL	577214	ALL MODELS
(12)	BUTTON, MAINS SWITCH	577261	ALL MODELS
(13)	GLASS, REMOTE WINDOW	577210	ALL MODELS
(14)	CLIP, SPEAKER FIXING		14" & 15" MODELS
(15)	CLIP, SPEAKER FIXING	597315	20" & 21" MODELS
(16)	FEET, CABINET	530228	20" & 21" MODELS
(17)	CABINET, WOODEN (CASE)	632109	20" & 21" MODELS
(18)	MASK, FRONT	597262	20" MODEL ONLY
(18)	MASK, FRONT	855252	21" MODEL ONLY
(19)	BRACKET, MAIN PCB	597316	20" & 21" MODELS
(20)	BRACKET, TELETEXT PCB	885201	20" & 21" MODELS ONLY
(21)	PCB, AV	597175	
(22)	LOGO (BADGE)		
(23)	LABELS,REAR (SET)		
	AERIAL, LOOP	569901	14" & 15" PAL I MODELS
	AERIAL, ROD	577901	14" & 15" PAL B/G MODELS
	REMOTE CONTROL HANDSET	597187	MODELS WITHOUT TELETEXT
	REMOTE CONTROL HANDSET	803187	MODELS WITH TELETEXT
	STYROFOAM (A) TOP 1 PAIR	577805	14" & 15" MODELS
	STYROFOAM (B) BOTTOM 1PAIR	577806	14" & 15" MODELS
	STYROFOAM (A) TOP 1 PAIR	597805	20" & 21" MODELS
	STYROFOAM (B) BOTTOM 1 PAIR	597806	20" & 21" MODELS
	CARTON BOX	577800	14" MODELS
	CARTON BOX	569800	15" MODELS
	CARTON BOX	599800	20" MODELS
	CARTON BOX	589800	21" MODELS

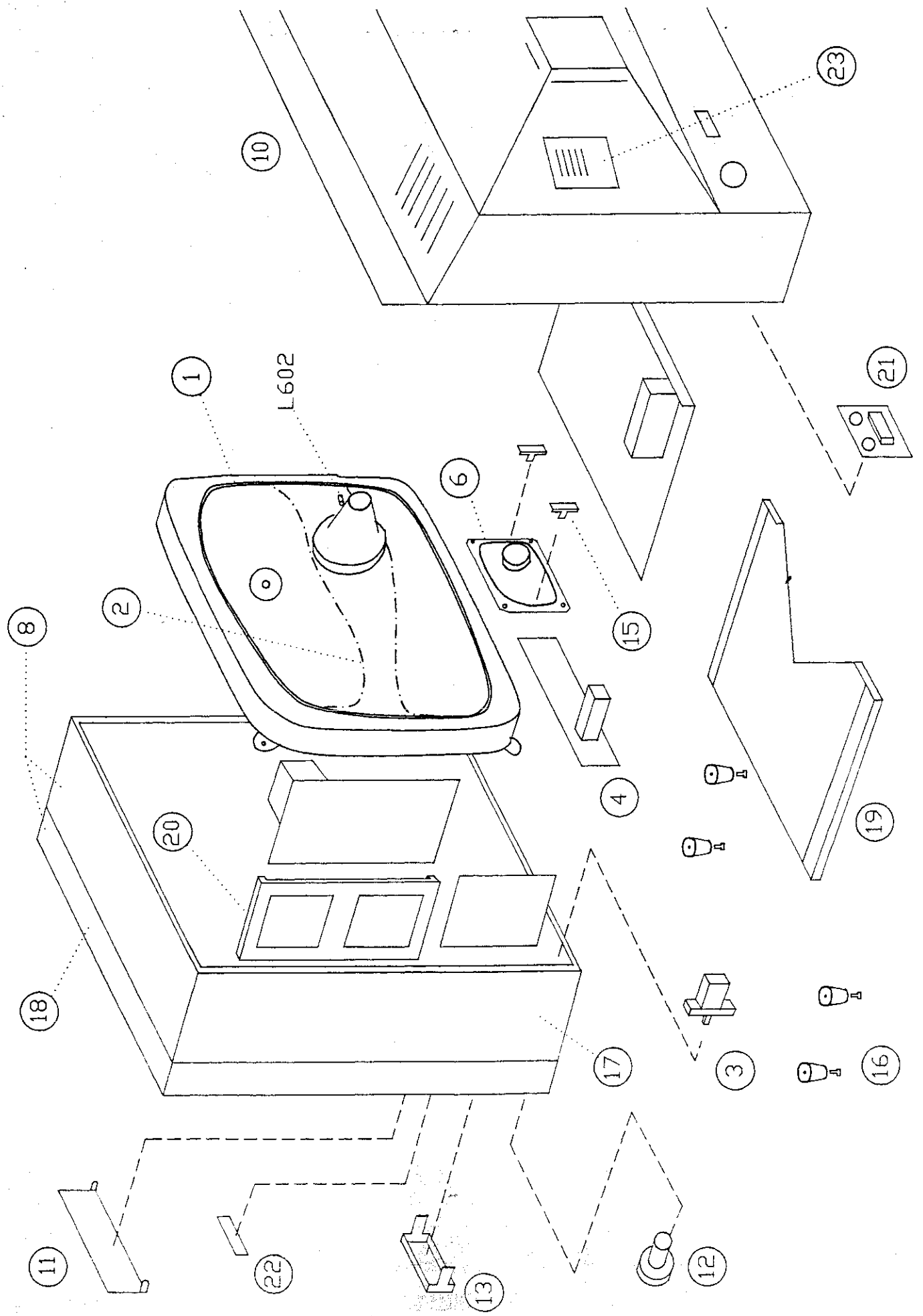
Teletext PCB brackets must be ordered separately when ordering cabinets for the 20" & 21" models

( ) Exploded view reference number.

SECTION 9 - CABINET PARTS, 14 & 15 INCH



SECTION 9 - CABINET PARTS, 20 & 21 INCH



Amendment Sheet

AMD 1.1 Section 3.4 Page 1

Line	6	Change to read	Type 1604UEC or 3010UEC for UHF only
Line	7	Delete	
Line	8	Change to read	Type 1604KKC or 2000KHC for VHF/UHF (including cable bands).

AMD 1.2 Section 3.5 Page 1

Tuner AGC take over point. Method 1
Replace all text with following.

Tune to a CCIR standard signal with a level of 1mV
Connect a voltmeter to TP19
Adjust preset potentiometer R102 (AGC) until the AGC voltage just begins to drop by 5-10mV.
Increase the signal to 1.5mV and check that the AGC voltage is approximately 2.5V below its initial value.

AMD 1.3 Section 3.5 Page 4

Video detector
After 'The television ..... VHF/UHF model, add the following:

The 2000KHC tuner does not have an injection point.
In this case remove the tuner.
If the connection between the tuner and the SAW filter is assymetrical inject a 100mV signal into the input of the SAW filter Z100.
If the connection is symetrical ground one input to the SAW filter and inject the signal into the other input.

After 'Adjust L102 for approximately 6V.' add '(6.6V if Q001 is filtted.),.

AMD 1.4 Section 3.7

CHANGE	R012	RESISTOR	CF	220K	0.25W	J	104222
CHANGE	R013	RESISTOR	CF	220K	0.25W	J	104222
DELETE	R133						
CHANGE	R603	RESISTOR	MO	68K	1.6W	J	133681
CHANGE	R809	RESISTOR	CF	270K	0.5W	J	144272
DELETE	D100						
DELETE	D101						
CHANGE	C606	CAPACITOR	CER	330p	500V	M	211311
ADD	C610	CAPACITOR	MKT	100n	160V	M	214137
CHANGE	C822	CAPACITOR	CER	4n7	4kV		222480
CHANGE	ET1	(2nd line)					VDE/BS415
		TUNER	1600KKC or 2000 KKC				599136

(Changes are underlined for clarity only.)

AMD 1.4 (Continued)
Insert - Circuit diagram

Change values of R012, R013, R603, C606 to those given above.
Delete R133, D100, D101
Add C610 between T601 Pin 7 and ground.

AMD 1.5 Section 4.4 Page 2
Line 34 change 'transmition' to 'transmission'.

AMD 1.6 Section 6.6
CHANGE C715 CAPACITOR TANT 1u0 25v M 239131
(Change is underlined for clarity only.)

AMD 1.7 Section 7.1 and 7.7 Page 1
Section 7.7 Teletext System Parts List.
CHANGE R902 RESISTOR CF 180R 0.25W J 101106
(Change is underlined for clarity only.)

Section 7.1 Teletext System Circuit Diagram
Change value of R902 as above.

AMD 1.8 Section 9 Page 1

ADD MAINS CORD WITHOUT PLUG	033129 UK
ADD MAINS CORD WITH STANDARDT PLUG	599500 EURO NON-FTZ
ADD MAINS CORD WITH FILTERED PLUG	54C500 EURO FTZ

AMD 1.9 Insert Component overlay
Control board
Delete words 14" and 15"

END

	PAL I	PAL BG
Z 100	SY 153 UHF	SY 177 UHF/VHF
Z 101	SFE 6.0 MB	SFE 5.5 MB
C 125	120PJ 50 V	150PJ 50 V
C 110	39 PK 50 V	68PK 50 V
ET1	1600 UEC	1600 KKC

	L601	C604	C605	R717	R115	L602	R353	R349	R612	CRT
21"	AT4042 /90	330NK 250V	6.8NJ 1.5KV	1R0 1W	39K	L602	33K	100K	3M3 1W	VIDEO COLOR
21"	AT4042 /90	330NK 250V	6.8NJ 1.5KV	2R2 1W	39K	—	33K	100K	LK	PHILIPS
20"	AT4042 /90	470NK 250V	7.5NJ 1.5KV	1R0 1W	56K	—	130K	39K	LK	SAMSUNG
15"	AT4042 /90	330NK 250V	5.6NJ 1.5KV	2R2 1W	56K	—	—	—	LK	PHILIPS
14"	AT4042 /90	470NK 250V	7.5NJ 1.5KV	1R0 1W	56K	—	—	—	LK	SAMSUNG

SECAM

FREQUENCY

COLOUR DECODER

CRT

TP34 SSC

VERTICAL

IC 400 TDA 3653

HORIZONTAL

ON/OFF

COMPONENTS MARKED WITH SYMBOL ⚠ ARE CRITICAL FOR SAFETY AND MUST ONLY BE REPLACED BY PARTS SUPPLIED OR APPROVED BY THE MANUFACTURER

10 µS / DIV

20µS / DIV

20µS / DIV

10 mS / DIV

10 µS / DIV

20µS / DIV

10mS / DIV

5 -10 µS / DIV

10 µS / DIV

20µS / DIV

10 mS / DIV

SOUND

VOLUME AUDIO IN TONE

TUNER

TFK 1600 KHC

▲1604 UEC

PIF- SIF

TDA 4505

SSC

IC 700 TDA 359

MAINS INPUT

220 V AC

FUSE 1,6 AT

DEGAUSSING

PTC

TDA 460LD

IC800

+310 / 340V

WARNING
THIS AREA LIVE

POWER SUPPLY

CONTROL BOARD II

LED- DISPLAY

Brt+ Brt- Col+ P- P+ V- V+

Cont+ Cont- Col-

CHANNEL CHANNEL MEMO BAND

REMOTE CONTROL

KEY BOARD

IC303

PRE AMP II

IC300 SAA 1293 A

MDA 2062

IC301 (EEPROM)

RESET

I²C BUS

MAIN SWITCH

ON/OFF

AV SWITCH

STD SWITCH

ML-BUS

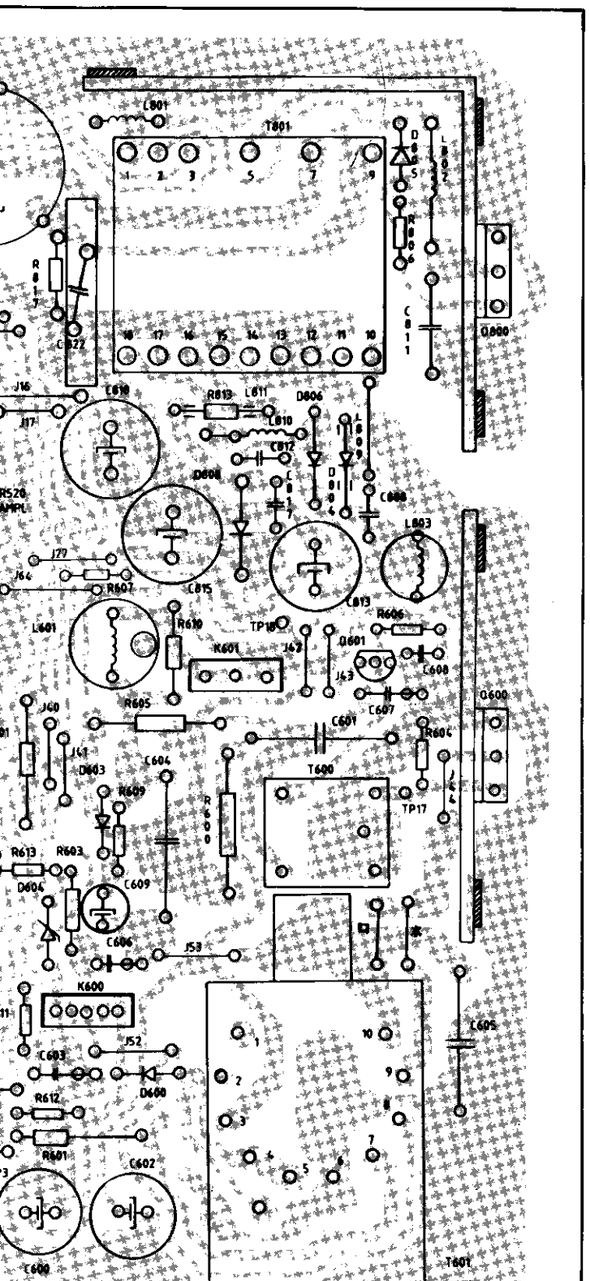
REMOTE BOARD I

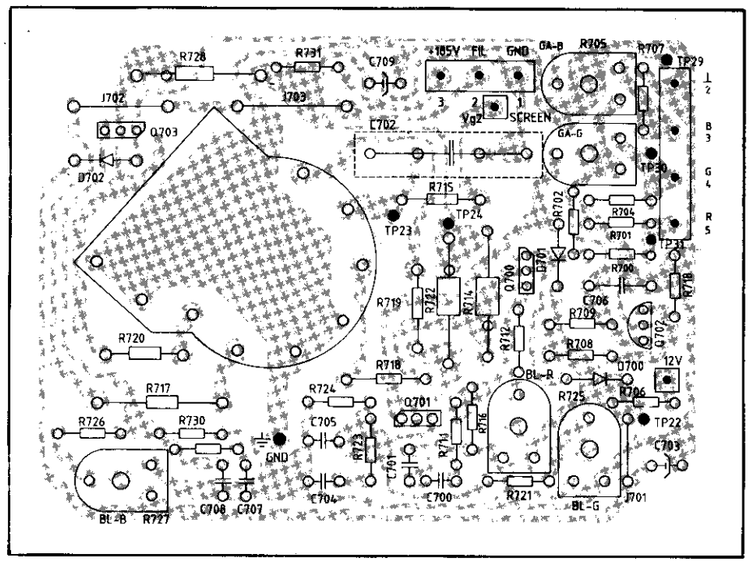
IMPORTANT

5 - 10 µS/

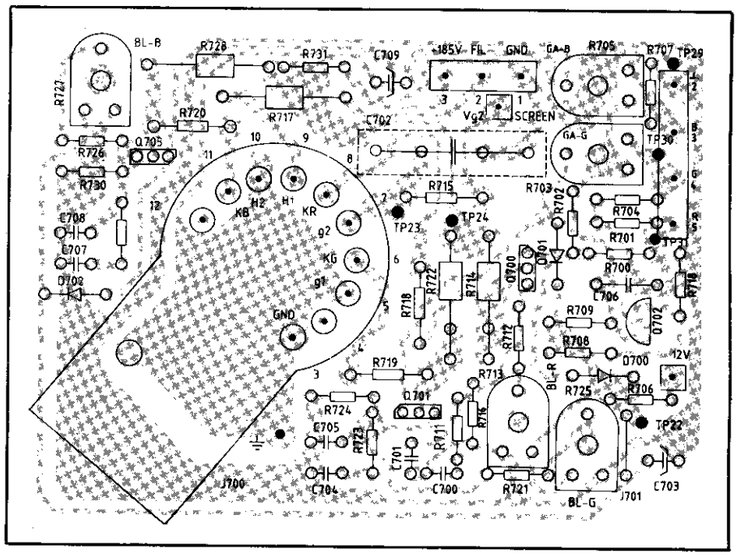
10 µS / DI

10µS / DIV

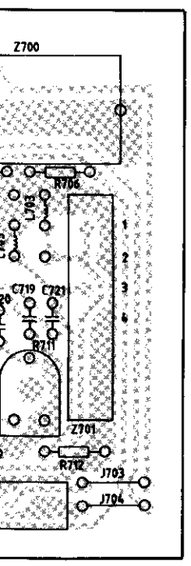




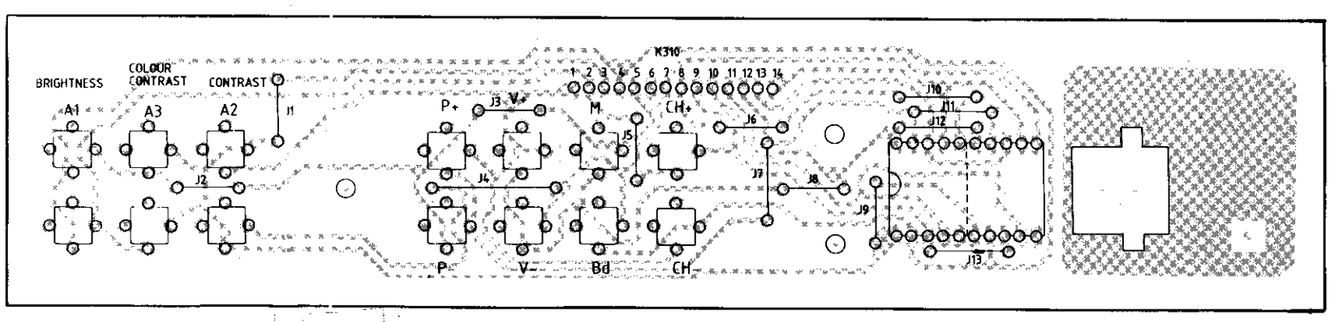
MINI NECK 15''



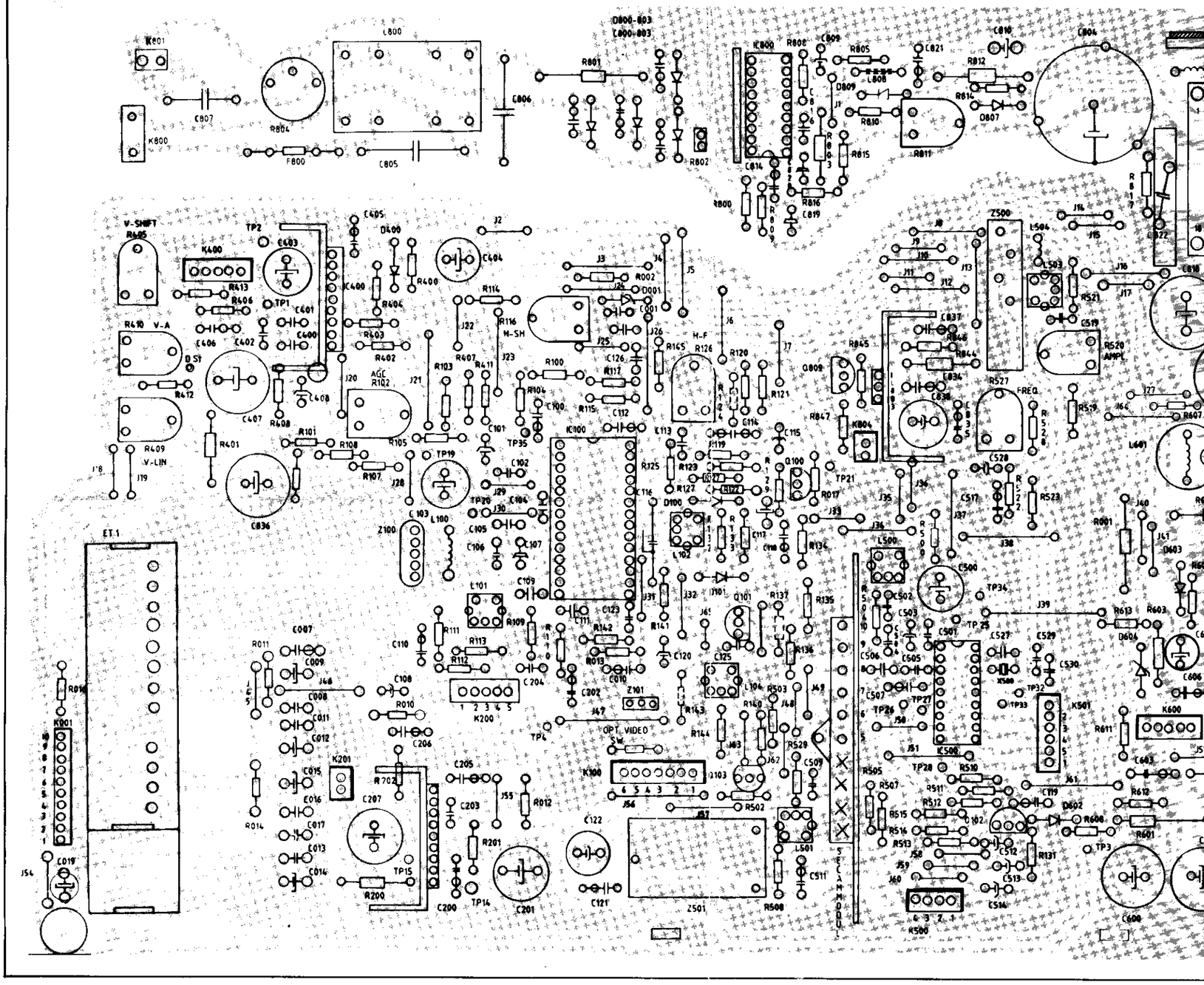
NARROW NECK CRT



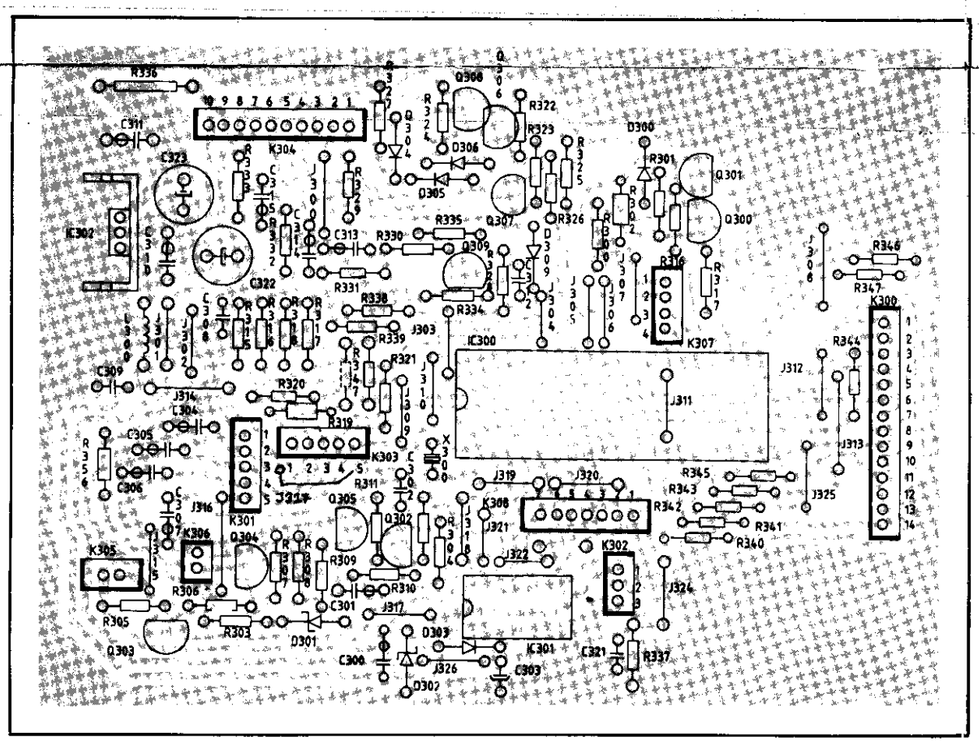
RDER



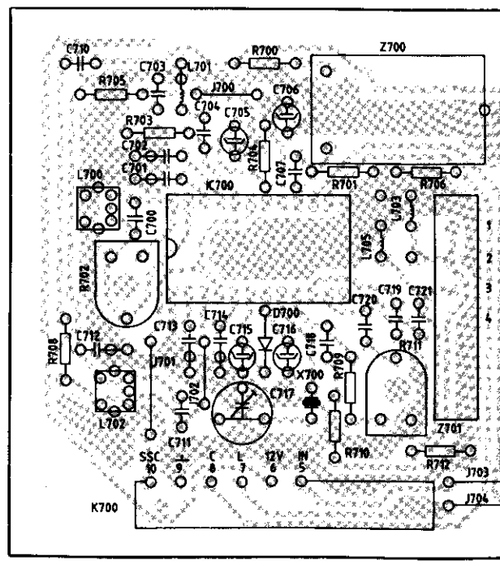
CONTROL BOARD



MAIN CHASSIS



REMOTE BOARD



SECAM TRANSCORDER