SERVICE MANUAL

CHASSIS CTU-AA

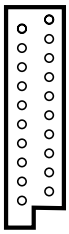
1. Technical specifications

CHASSIS CTU - AA

Mains voltage	: 220 - 240 V ± 10% AC; 50 Hz (±5%)
Power cons. at 220V~	: 35 W (14''), 50W (20''/21''), 3W (Stand-By)
Aerial input impedance	: 75 Ω - coax
Min. aerial input VHF	: 30µV
Min. aerial input UHF	: 40µV
Max. aerial input VHF/UHF	: 180mV
Pull-in range colour sync.	: ± 300Hz
Pull-in range horizontal sync.	: ± 600 Hz
Pull-in range vertical sync.	: ± 5 Hz
Picture tube range	: 14" / 20'' / 21''
	: Mono: 25∧ 1W (14''), 16∧ 2W (20''/21'')
	: Stereo : 2x16∧ 2x4W (21''))+
TV Systems	: PAL BG
	: PAL I
	: PAL BG / SECAM BG DK
	: PAL BG I / SECAM BG L L'
Indications	: On screen display (OSD) green and menu
	: 1 LED (red in ON and blinking red in stand-by)
VCR programs	: 99
Tuning and operating system	: VST
UV1315A / IEC (VST)	: VHFa: 48 - 168 MHz
	: VHFb: 175 - 447 MHz
	: UHF: 455 - 855 MHz
U1343A / IEC (VST)	: UHF: 455 - 855 MHz
Local operating functions	: Vol/Prog, +, -, contrast, colour, brightness and sharpness (and hue on program AV with NTSC signal).

2. Connection facilities

Euroconector:



1 - Audio	R (0V5 RMS ó 1K).	
2 - Audio	R (0V2 - 2V RMS ò 10K).	
3 - Audio	L (0V5 RMS ó 1K).	
4 - Audio		
5 - Blue		
6 - Audio	L (0V2 - 2V RMS ò 10K).	
7 - Blue	(0V7pp/75W).	
8 - CVBS status 1	(0-2V int., 10-12V ext.).	
9 - Green		
10 - -		
11 - Green	(0V7pp/75W).	
12 - -		
13 - Red		
14 - -		
15 - Red	(0V7pp/75W).	
16 - RGB status	(0-V4 int.) (1-3V ext. 75W).	
17 - CVBS		
18 - CVBS		
19 - CVBS	(1Vpp 75W).	
20 - CVBS	(1Vpp/75W).	
21 - Earthscreen.		

Head phone:

8 to 600Ω. Mono : 25mW at 32Ω
Stereo : 2x 6mW at 32Ω. 3,5mm ø.

3. Mechanical instructions

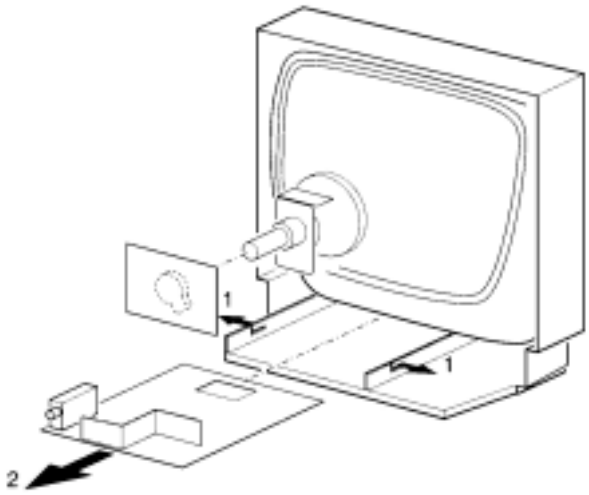
For the main carrier two service positions are possible (3.1).

A: For faultfinding on the component side of the main carrier.
B: For (de) soldering activities on the copper side of the main carrier.

Position A can be reached by first removing the mains cord from it's fixation, then loosen the carrier lips (1) and then pulling the carrier panel (2) for approximately 10cm.

Position B can be reached from position A after disconnecting the degaussing cable. Put the carrier on the line transformer side.

Fig. 3.1



A

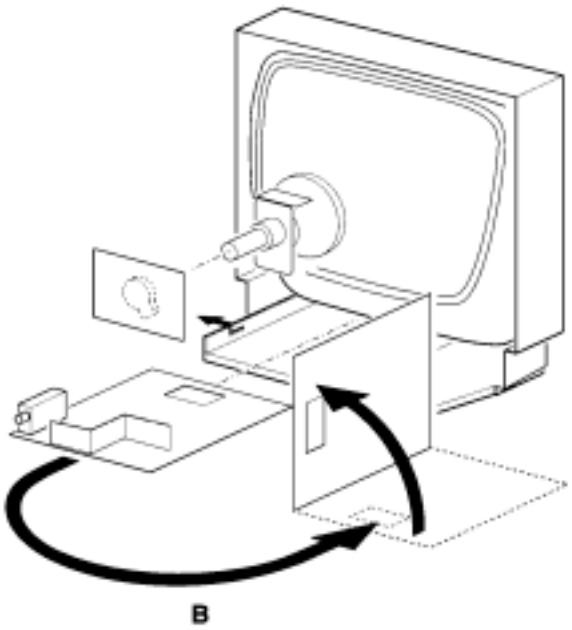
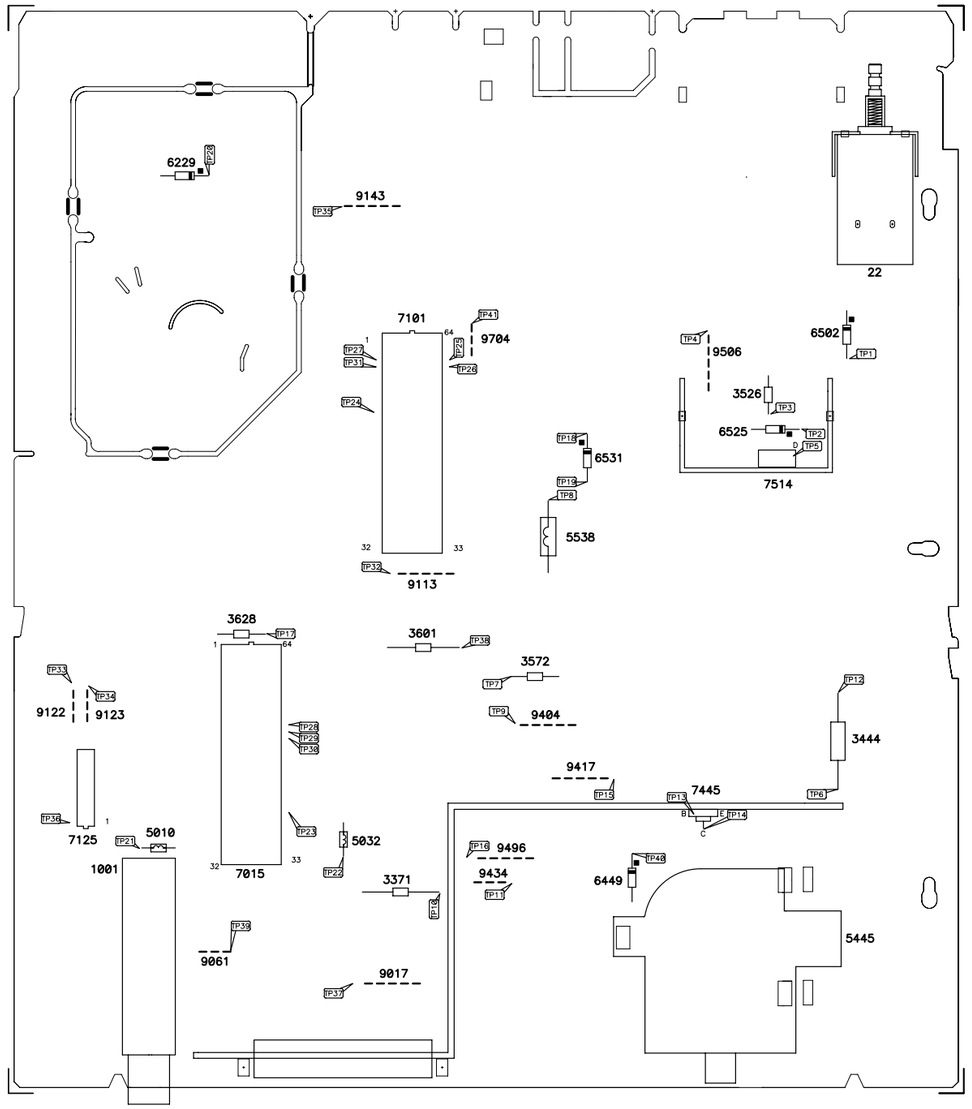


Fig. 3.2

4. Oscillograms



TP1 ⓘ
50V / div DC 10ms / div

TP2 ⓘ → 27V4 DC
TP2 ⏱ → 11V5 DC

TP3 ⓘ
1V / div 5µs / div

TP3 ⏱
1V / div 2ms / div

TP4 ⓘ
0.2V / div 20ms / div

TP4 ⏱
0.2V / div 2s / div

TP5 ⓘ
0.1kV / div 5µs / div

TP5 ⏱
0.1kV / div 200ms / div

TP6 ⓘ → 100V7 DC
TP7 ⓘ → 3V4 DC
TP8 ⓘ → 13V4 DC

TP9 ⓘ
0.5V / div 20µs / div

TP10 ⓘ
2V / div 20µs / div

TP11 ⓘ
0.2V / div 5ms / div

TP12 ⓘ
5V / div 20µs / div

TP13 ⓘ
0.2V / div 20µs / div

TP14 ⓘ
0.2kV / div 20µs / div

TP15 ⓘ
10V / div 5ms / div

TP16 ⓘ
1V / div 5ms / div

TP17 ⓘ
1V / div 5ms / div

TP18 ⏱
0.5 / div 2µs / div

TP18 ⓘ → 2V4 DC
TP19 ⓘ → 0V DC
TP20 ⓘ → 175V DC

TP21 ⓘ
0.5V / div DC 20 µs / div

TP22 ⓘ
1V / div 20µs / div

TP23 ⓘ
1V / div 10µs / div

TP24 ⓘ
0.1V / div 1µs / div

TP25 / TP26 ⓘ
0.5V / div 2ms / div

I2C BUS TDA987X :
TP27 ⓘ → SCL
TP31 ⓘ → SDA

TP28 ⓘ
1V / div 20µs / div

TP29 ⓘ
1V / div 20µs / div

TP30 ⓘ
1V / div 20µs / div

TP32 ⓘ (SOLO MONO)
0.5V / div 0.5ms / div

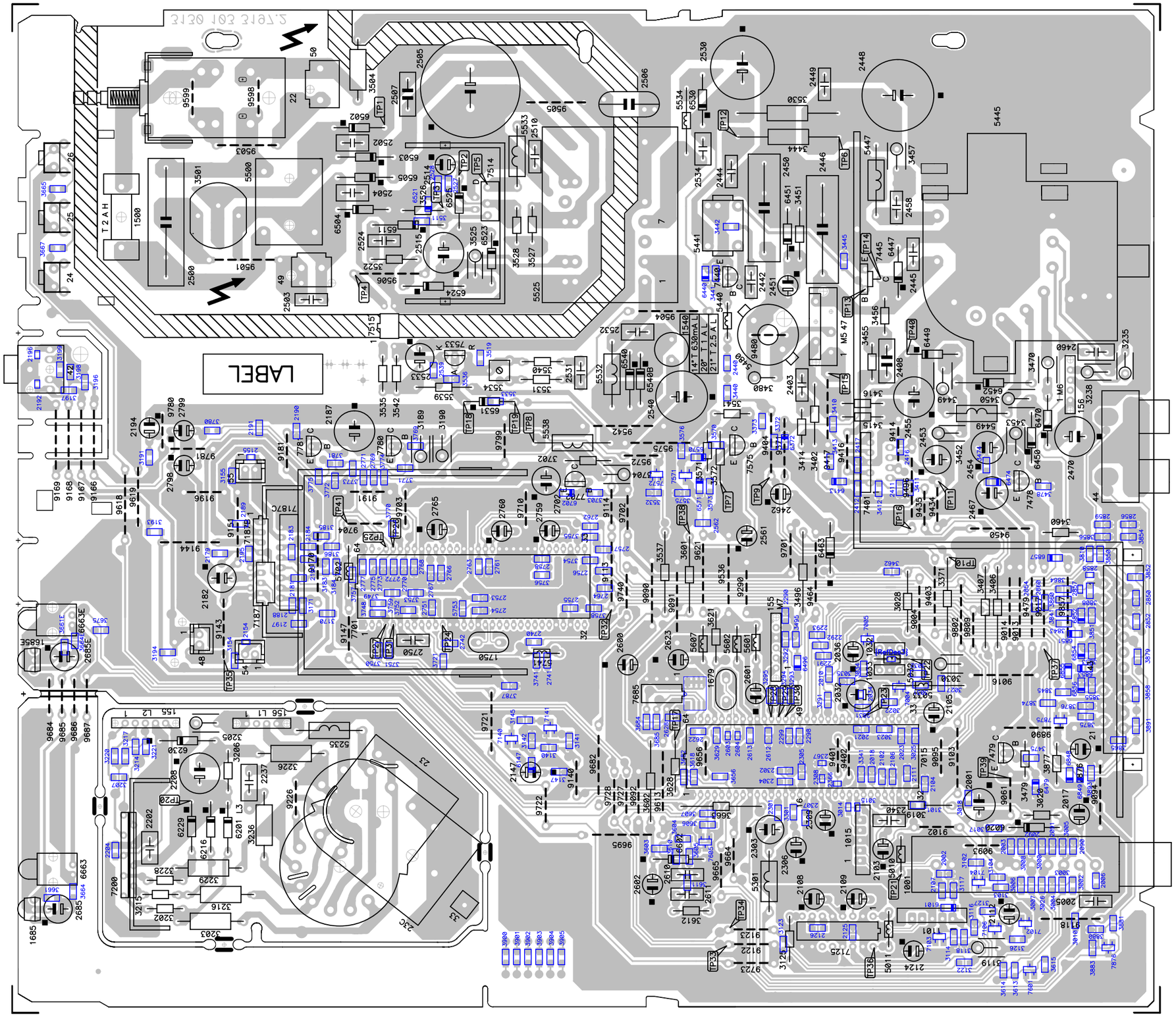
TP35 ⓘ
2V / div 5ms / div

TP36 ⓘ
0.2V / div 1µs / div

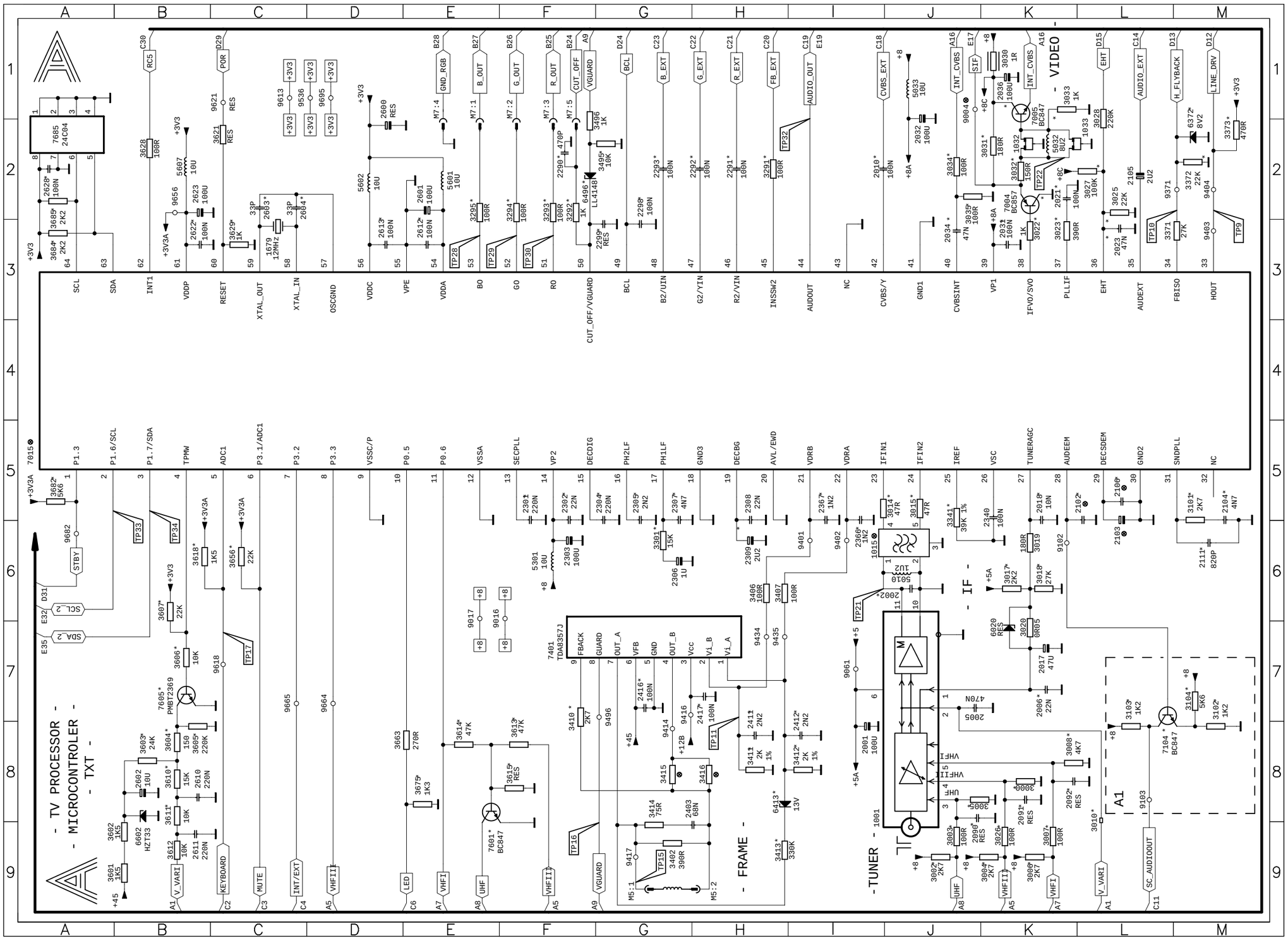
TP40 ⓘ
2V / div 5ms / div

TP37 ⓘ → 8V2 DC
TP38 ⓘ → 45V DC
TP39 ⓘ → 5V DC
TP39 ⏱ → 0V DC
TP40 ⏱ → 0V DC
TP41 ⓘ → 5V DC
TP41 ⏱ → 0V DC

5. Print Board Layout

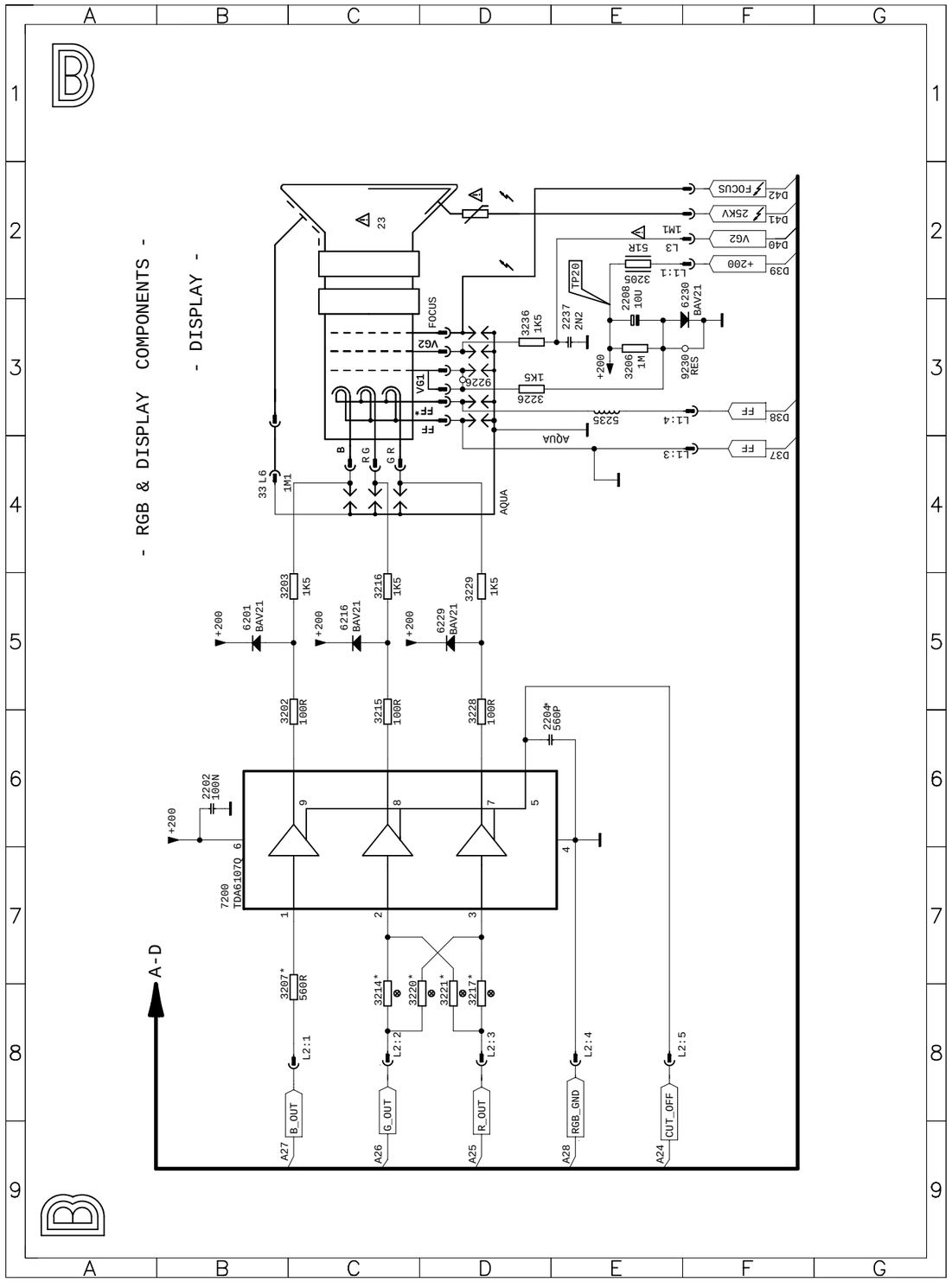


6. Electrical Diagram



1001	J7	3104	M7
1015	J6	3291	H2
1032	K2	3292	F2
1033	K2	3293	F2
1679	C3	3294	F2
2001	I8	3295	E2
2002	J6	3301	G6
2005	J7	3341	J5
2006	K7	3371	M3
2010	I2	3372	M2
2017	K7	3373	M2
2018	K6	3402	G9
2021	K2	3406	H6
2023	L3	3407	H6
2031	K3	3410	F7
2032	J2	3411	H8
2034	J3	3412	I8
2036	K1	3413	H9
2090	J8	3414	G9
2091	K8	3415	G8
2092	K8	3416	H8
2102	L6	3495	G2
2103	L6	3496	F2
2104	M6	3601	B9
2105	L2	3602	B9
2106	L5	3603	B8
2111	M6	3604	B8
2290	F2	3605	B8
2291	H2	3606	B7
2292	H2	3607	B6
2293	G2	3610	B8
2298	G3	3611	B8
2299	G3	3612	B9
2301	F6	3613	F8
2302	F6	3614	E8
2303	F6	3615	F8
2304	G6	3618	B6
2305	G6	3621	C2
2306	G6	3628	B2
2307	G6	3629	C3
2308	H6	3656	C6
2309	H6	3663	E8
2340	K5	3675	E8
2366	I6	3682	A5
2367	I6	3684	A3
2403	H9	3685	A2
2411	H8	5010	J6
2412	I8	5032	K2
2416	G7	5033	J1
2417	H7	5301	F6
2600	D2	5601	E2
2601	E2	5602	D2
2602	B8	5607	B2
2603	C2	6020	K7
2604	C2	6372	M2
2610	B8	6413	H8
2611	B9	6496	F2
2612	E3	6602	B8
2613	D3	7004	K2
2622	B3	7005	K1
2623	B2	7015	G4
2628	A2	7104	L7
3000	K8	7401	G7
3002	J9	7601	E8
3003	J9	7605	B7
3004	K9	7685	A2
3005	J8	9004	J1
3006	K9	9016	F6
3007	K9	9017	E6
3008	K8	9061	I7
3010	L9	9102	K6
3014	I5	9103	L8
3015	J5	9371	M2
3017	K6	9401	I6
3018	K6	9402	I6
3019	K6	9403	M3
3020	K7	9404	M2
3022	K3	9414	G8
3023	K3	9416	G7
3025	L2	9417	G9
3026	K9	9434	H7
3027	L2	9435	H7
3028	L2	9496	G7
3030	K1	9536	D1
3031	K2	9613	C1
3032	K2	9618	C7
3033	K1	9621	C1
3034	J2	9656	B2
3035	J2	9664	D7
3101	M6	9665	C7
3102	M8	9682	A6
3103	L8	9695	D1

6. Electrical Diagram



2202 B6
2204 D6
2208 E3
2237 E3
3202 C6
3203 C5
3205 E2
3206 E3
3207 C8
3214 C8
3215 C6
3216 C5
3217 D8
3220 D8
3221 D8
3226 D3
3228 D6
3229 D5
3236 D3
5235 E3
6201 B5
6216 C5
6229 D5
6230 F3
7200 C6
9226 D3
9230 F3

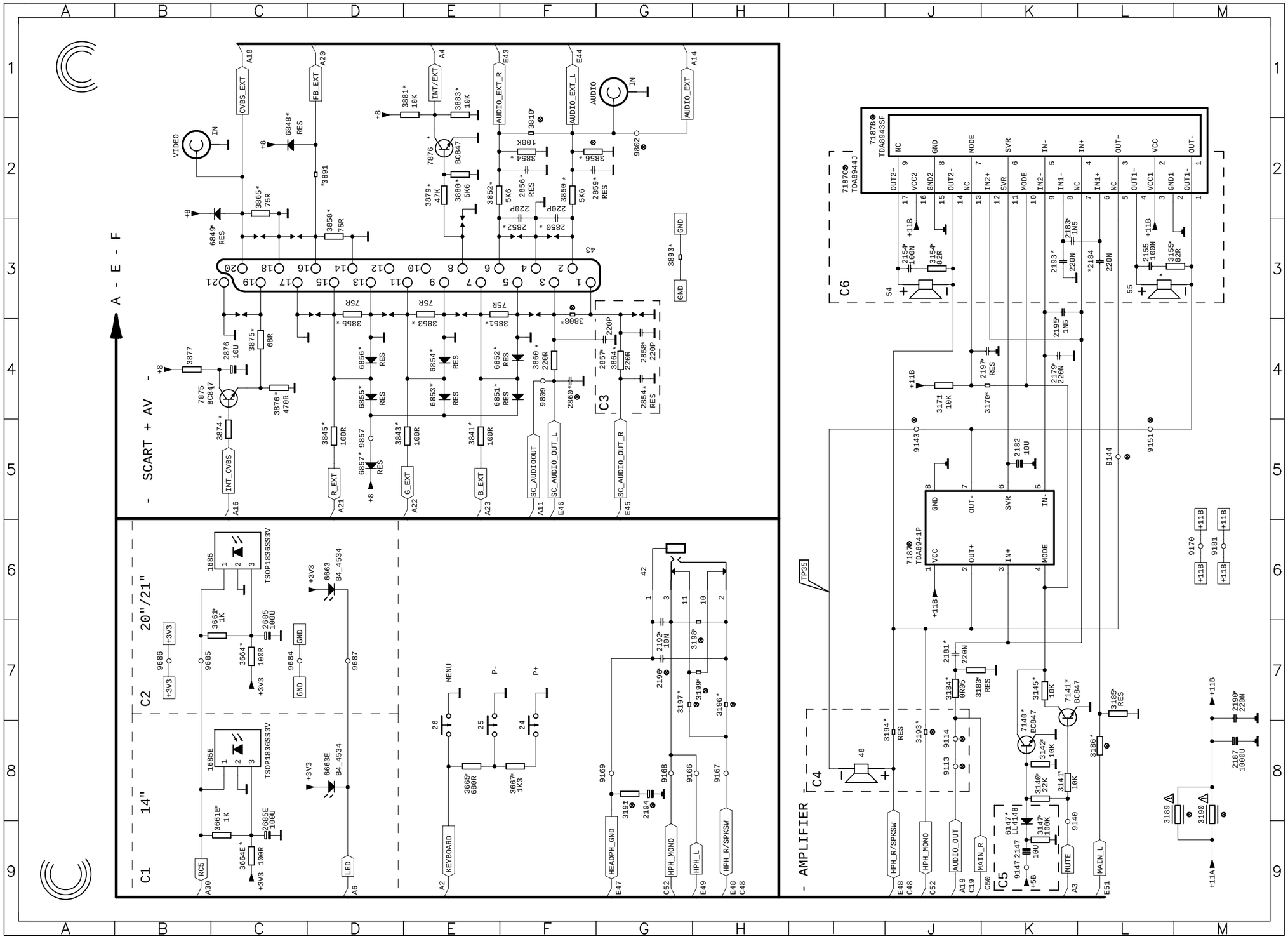
Pos	Pal BG Mono	Pal I Mono	Pal BG Stereo	Pal I Stereo
1015	G1963	J1952	G1984	J1981
1032	5.5	6.0	5.5	6.0

Pos	Mono	Stereo
A1	YES	--
C3	--	YES
C4	YES	--
C5	--	YES
C6	--	YES
E	--	YES
2102	3N3	33P
2103	10U	--
2105	2U2	--
2106	--	22N
2194	100U	--
2196	--	10N
2860	4N7	--
3186	--	0R05
3191	68R	--
3196	--	0R05
3197	0R05	--
3198	0R05	--
3199	0R05	--
3808	JMP	--
3810	JMP	--
3856	--	100K
5538	JMP	FERRITE
9004	--	JMP
9143	JMP	--
9144	JMP	--
9151	JMP	--
9450	--	JMP
9802	JMP	--
9809	YES	--

Pos	MONO 1W	MONO 3W	STEREO 4W+4W
1540	T630mA	T1A	T2.5A
2187	220U	220U	1000U
2540	680U	680U	1500U
3189	--	--	1R
6450	BYT42M	BYT42M	BYW32
6540	BYT42M	BYT42M	BYV98
7187	TDA8941P	TDA8943SF	TDA8944J

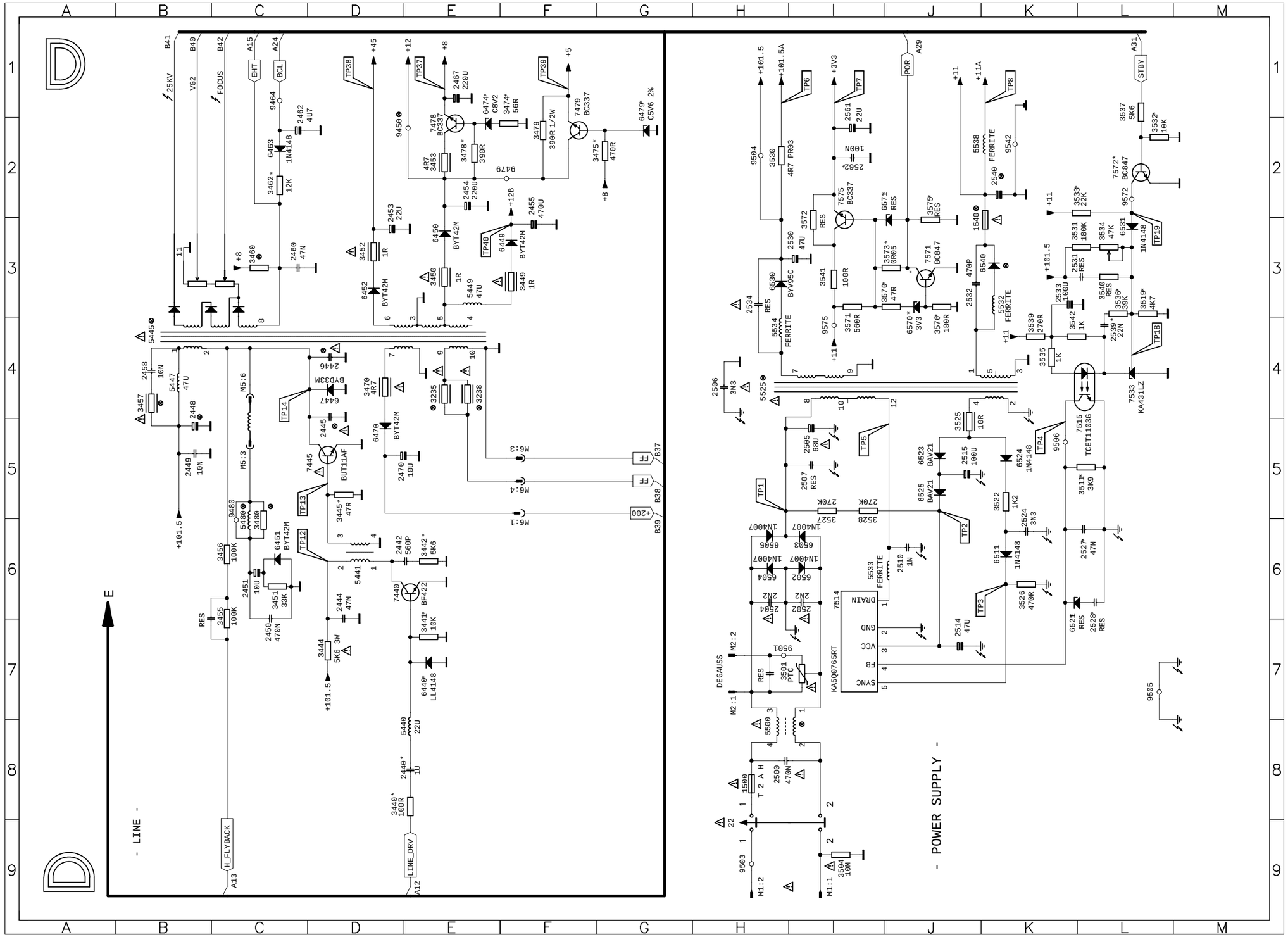
Pos	14"	20"/21"
C1	YES	--
C2	--	YES
23	MINI	NARROW
2445	--	220P
2446	8N2	9N1
2448	10U	47U
3189	--	1R
3214	560R	--
3217	560R	--
3220	--	560R
3221	--	560R
3415	4R7	3R3
3416	4R7	3R6
3444	5K6 2W	5K6 3W
3235	1R 0.3W	1R 0.5W
3457	27R 0.5W	47R PR01
3460	7K5	6K2
3480	--	1K
5445	LOT 14"	LOT 20"
5480	--	57331
5500	CU15	CU15D3
5525	SOPS 14"	SOPS 20"
9480	JMP	--

6. Electrical Diagram



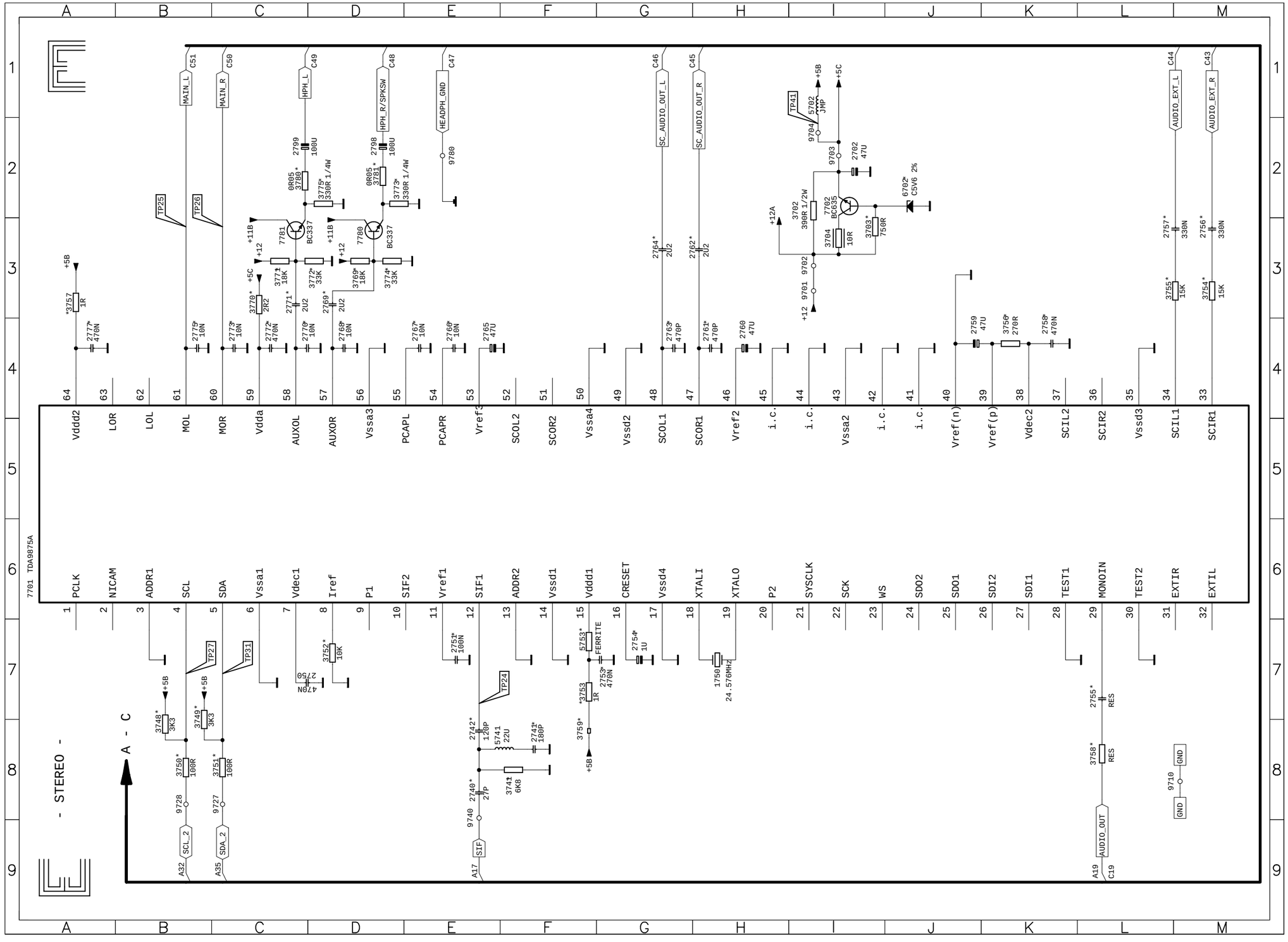
1685	C6	6663	D8
1685	C8	6848	C2
2147	K9	6849	C2
2154	J3	6851	F4
2155	L3	6852	F4
2179	K4	6853	E4
2181	J7	6854	E4
2182	K5	6855	D4
2183	K3	6856	D4
2184	L3	6857	D5
2187	M8	7140	K8
2190	M8	7141	K8
2192	G7	7187	K6
2193	K3	7187	K3
2194	G8	7875	C4
2195	K3	7876	E2
2196	G7	9113	J8
2197	K4	9114	J8
2685	C7	9140	K9
2685	C9	9143	J5
2850	F3	9144	L5
2852	F3	9147	K9
2854	G4	9151	L5
2856	F2	9166	H8
2857	G4	9167	H8
2858	G4	9168	G8
2859	F2	9169	G8
2860	F4	9170	M6
2876	C4	9181	M6
3140	K8	9684	C7
3141	K8	9685	B7
3142	K8	9686	B7
3145	K7	9687	D7
3147	K9	9802	G2
3154	J3	9809	F4
3155	M3	9857	D5
3170	K4		
3171	J4		
3183	J7		
3184	J7		
3185	L7		
3186	L8		
3189	M8		
3190	M8		
3191	G8		
3193	J8		
3194	J8		
3196	H7		
3197	G7		
3198	H7		
3199	H7		
3661	C7		
3661	C9		
3664	C7		
3664	C9		
3665	E8		
3667	F8		
3808	F3		
3810	F2		
3841	E5		
3843	E5		
3845	D5		
3850	F2		
3851	E3		
3852	E2		
3853	E3		
3854	F2		
3855	D3		
3856	F2		
3858	D3		
3860	F4		
3864	G4		
3865	C2		
3874	C5		
3875	C4		
3876	C4		
3877	B4		
3879	E2		
3880	E2		
3881	E1		
3883	E1		
3891	D2		
3893	G3		
6147	K9		
6663	D6		

6. Electrical Diagram



1500	H8	3572	I3
1540	K3	3573	J3
2408	B7	3575	J3
2440	E8	3576	J3
2442	E6	5440	E8
2444	D7	5441	D6
2445	D5	5445	D4
2446	D4	5447	B4
2448	B5	5449	E3
2449	B5	5480	C6
2450	C7	5500	H8
2451	C6	5525	J4
2453	D3	5532	K3
2454	E2	5533	J6
2455	F3	5534	H4
2458	B4	5538	K2
2460	C3	6440	E7
2462	C2	6447	D4
2467	E1	6449	F3
2470	D5	6450	E3
2500	H8	6451	C6
2502	I6	6452	D3
2503	H7	6463	C2
2504	H6	6470	D5
2505	I5	6474	E2
2506	H4	6479	G2
2507	I5	6502	I6
2510	J6	6503	I6
2514	J7	6504	H6
2515	J5	6505	H6
2524	K6	6511	K6
2527	L6	6521	K6
2528	L6	6523	J5
2530	I3	6524	K5
2531	L3	6525	J5
2532	J3	6530	H3
2533	K3	6531	L3
2534	H3	6540	K3
2539	L4	6570	J3
2540	K2	6571	J3
2561	I2	7440	E6
2562	I2	7445	D5
3235	E4	7478	E2
3238	E4	7479	F2
3440	E8	7514	J7
3441	E7	7515	L4
3442	E6	7533	L4
3444	D7	7571	J3
3445	D5	7572	L2
3449	F3	7575	I3
3450	E3	9450	E2
3451	C6	9464	C1
3452	D3	9479	F2
3453	E2	9480	C6
3455	C7	9501	H7
3456	C6	9503	H9
3457	B4	9504	H2
3460	C3	9505	L7
3462	C2	9506	K5
3470	D4	9542	K2
3474	F2	9572	L2
3475	G2	9575	I4
3478	E2		
3479	F2		
3480	C6		
3501	I7		
3504	I9		
3511	L5		
3519	L3		
3522	K5		
3525	J5		
3526	K6		
3527	I5		
3528	I5		
3530	H2		
3531	L3		
3532	L2		
3533	L2		
3534	L3		
3535	K4		
3536	L3		
3537	L1		
3539	K4		
3540	L3		
3541	I3		
3542	K4		
3570	J3		
3571	I3		

6. Electrical Diagram



1750 H7
2702 I2
2740 E8
2741 F8
2742 E8
2750 C7
2751 E7
2753 G7
2754 G7
2755 L7
2756 M3
2757 M3
2758 K4
2759 J4
2760 H4
2761 H4
2762 H3
2763 G4
2764 G3
2765 E4
2766 E4
2767 E4
2768 D4
2769 D3
2770 C4
2771 C3
2772 C4
2773 C4
2775 B4
2777 A4
2798 D2
2799 C2
3702 I2
3703 I3
3704 I3
3741 F8
3748 B8
3749 B8
3750 B8
3751 C8
3752 D7
3753 F7
3754 M3
3755 M3
3756 K4
3757 A3
3758 L8
3759 F8
3769 D3
3770 C3
3771 C3
3772 D3
3773 D2
3774 D3
3775 D2
3780 C2
3781 D2
5702 I1
5741 F8
5753 F7
6702 J2
7701 G5
7702 I2
7780 D3
7781 C3
9701 I3
9702 I3
9703 I2
9704 I2
9710 M8
9727 C8
9728 B8
9740 E9
9780 E2

7.- CIRCUIT DESCRIPTION

7.1 SMALL SIGNAL &MICROCONTROLLER/TEXT(Diagram A)

The small signal is processed by IC 7015. This IC called Ultimate One Chip (UOC) also has an embedded microcontroller.
The CTU-AA chassis is designed to accept 2 different ICs in the position 7015, TDA9350 for TXT models and TDA9380 for no TXT. The associated circuitry is the same.
The small signal part includes IF detection, video processing, chroma decoder, RGB , sync processor and sound decoder (mono sets). It is fully controlled by the embedded microcontroller.
The microcontroller contains an specific program that assures all the functions of the appliance, including 2 menus, one to control the set (see Instructions Manual) and another for Service Mode (see Service Instruct. chapter 8.).
For stereo models sound decoder (IC 7101) is controlled also for IC 7015 by I2C bus.
The IC for TXT sets (TDA9350) contains a teletext decoder, including the following functions: TXT on/off, reveal, freeze, temporary cancellation, clock, subcode, zoom, index, flof, page +/-, X/26 and 8/30 packet decoding (station identification and start-up page).

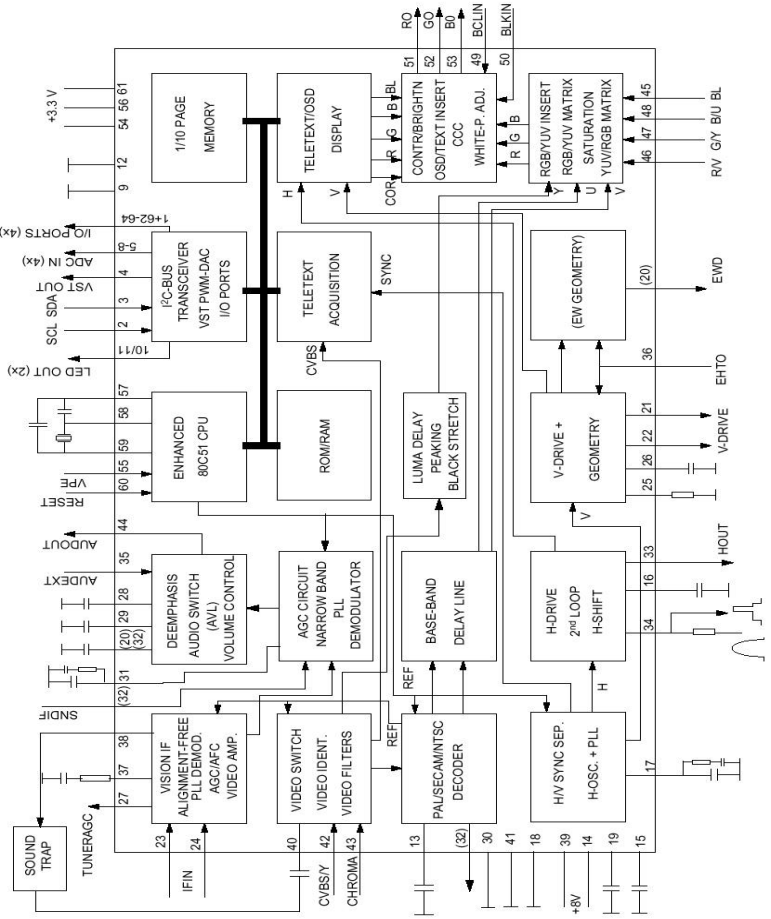


Fig. 7.1 TDA 93XX block diagram

7.1.1 IF detection
IF detection is intercarrier type, that means sound and picture are detected in the same circuit (PIF).
- IF amplifier (pins 23, 24): The IF signal coming from pin 11 of the tuner (1001) is filtered by the IF SAW filter (1015) and applied to IF amplifier of IC7015 by means of pin 23 and 24 input. The IF bandpass characteristic is determined by the SAW (Surface Acoustic Wave) filter.

- PLL demodulator (pins 37, 58, 59): The IF-signal is demodulated with the help of a PLL detector, which one is used to regenerate the IF reference signal. Reference signal is determined by the PLL loopfilter pin 37 and calibrated by microcontroller x-tal (pins 58, 59). It is alignment free.
Demodulation is achieved by multiplying reference signal with the incoming IF-signal.
- AGC (pin 27): The IF AGC time constant is internally fixed. The tuner AGC voltage (pin 27) is applied to pin 1 of the tuner and adjusted by microcontroller (see chap. 8.4).
- Video output (pin 38) : This baseband CVBS signal with 2.5Vpp (sync inclusive) of nominal amplitude, contains the FM intercarrier sound signal. Sound is filtered out by a ceramic trap (1032 or 1033) which frequency can be different depending on the system: 5.5 MHz for Pal BG and 6.0 MHz for Pal I.

7.1.2 Sound processor
Mono sets:

- FM demodulation (pins 31, 29): FM sound is filtered from CVBS (pin 38) by a loopfilter (pin 31) and demodulated. Decoupling sound demodulator is made by a capacitor on pin 29.
- De-emphasis and audio out (pin 28): De-emphasis is made by C2102 at pin 28. The signal at this pin is drived to the euroconnector sound output (see Diagram C) by transistor 7104 .
- External audio in (pin 35): External audio proceeding of pins 2,6 of euroconnector is applied to this pin. Selection between internal or external is done by an internal switching controlled by I2C (see INT/EXT, chapter 7.6).
- Audio out (pin 44): After a volume control (by I2C), this output is drived to the input IN+ of the final sound amplifier IC7187 (Diagram C).

Stereo sets:

SIF signal (pin 38): Video signal containing sound signal is drived to sound stereo processor IC7101 (see chapter 7.6 and diagram E)

7.1.3 Video processing
- Video switches (pins 40, 42): The internal CVBS signal proceeding of pin 38 is now fed to pin 40 of 7015. External CVBS proceeding from pin 20 of Euroconnector is present on pin 42 of 7015. The IC switches between internal and external are controlled by I2C bus (see INT/EXT, chapter 7.1.8).
The selected CVBS signal is internally supplied to the synchronization , teletext acquisition circuits and the video identification circuit for IF ident.
- Luminance processor: CVBS is also internally applied to luminance processor, which is composed of chrominance trap filter, luminance delay line and peaking circuits. Sharpness control modifies peaking by I2C.

7.1.4 Chroma processing
This circuit is an internal (no pins associated) automatic decoder for Pal and NTSC systems commanded by I2C bus.
- ACC and chroma filter: Video signal coming from video switches is supplied to PAL/NTSC chroma bandpass filter via a variable gain amplifier which is controlled by ACC and ACL detection circuits.
The dynamic range of the ACC is 26dB and detects only the burst amplitude. The ACL is a chroma amplitude detector and is active when the chroma/burst ratio exceeds approximately 3. It ensures that CVBS signal to chroma bandpass filter is limited for large.
- PLL/DCO: Chroma PLL is integrated and it operates during the burstkey period; the DCO (digital controlled oscillator) generates a subcarrier signal Fsc in phaselock with the incoming burst signal. The reference signal for the DCO (Fref.) is derived from the crystal oscillator (1679). Different colour frequencies are internally switched by I²C. The hue control rotates the DCO reference phases (H0, H90) from -40 to 40 degrees for NTSC signal via I²C bus.
- PAL/NTSC demodulation: The 0ª & 90ª signals are supplied to the burst demodulator circuits to obtain (B-Y) and (R-Y) respectively. Chroma delay lines used in demodulators are internal.

7.1.5 RGB processor
- External RGB inputs (pins 46, 47, 48): RGB inputs coming from euroconnector (see diagram C), are AC coupled (C2291/92/93) and converted internally in YUV signals. Then are switched with internal YUV (YUV SWITCH) by fast blanking.
- Fast blanking external (pin 45): When fast blanking is high external RGB is displayed, only if TV is in external AV (program 0). Fast blanking can switch signals for full screen (by a DC voltage) or for a part of the screen (by a pulse voltage).
- Matrix: After switching, YUV signals are converted to R-Y, G-Y and B-Y in the internal MATRIX circuit. Saturation control is received by I2C bus.
- Black stretcher: Internally the luminance signal is connected to the YUV select circuit and via the input clamps it is supplied to the black stretcher. The black stretcher circuit, fully integrated, extends the grey signal level . This extension is dependent upon the difference between actual black level and the darkest part of the incoming video.
RGB adder: RGB signals are obtained in this circuit by adding R-Y, G-Y and B-Y proceeding from matrix and Y proceeding from black stretcher.
- RGB OSD: RGB inputs for OSD and TXT are internally inserted to RGB signals. Fast blanking used is also internal. 45).

- Beam current limiter (pin 49): The beam current limiter circuit functions as an average beam current limiter (BCL) as well as peak white limiter (PWL). Both functions reduce the contrast and brightness of RGB signals.
Contrast reduction begins when Vpin 49 < 3.1V and brightness reduction begins when Vpin 49 < 1.8V.
BCL: Average beam current present at pin8 of 5445 (Diagram D) is feedback to pin 49. When beam current is high, voltage of C2462 is lower, D6462 conducts and Vpin 49 decreases.
PWL: This circuit is an internal detection circuit, which comes into action if the difference between measurement DC level and white level exceeds approximately 2.6V. Then a current of 200µA is internally produced to discharge 2298 and Vpin 49 decreases.
- RGB output circuit (pins 51, 52, 53): RGB outputs are drived to RGB amplifier (Diagram B).
- Continuous Cathode Calibration (CCC) (pin 50): This circuit is an auto-tuning loop which stabilizes the black level (offset) as well as the cathode drive level (gain) of each gun. Pulses in 3 consecutive lines R, G and B (pins 51, 52, 53) at the end of frame blanking are used on alternating fields, one field for black level, following for cathode drive level.
Cathode currents of 8mA for black level and 20mA for cathode drive level are stabilized. Cathode current is present at pin5 of IC7200 (Diagram B) and measured on pin 50. RGB outputs are adapted to keep cathode currents measured, for example when VG2 voltage is adjusted, DC level of RGB outputs is automatically corrected.
- Warm-up detection circuit (pin 50): At the start up a DC voltage of 2.5V is present in the RGB outputs (pins 51, 52, 53). As soon as beam current is detected on pin 50, RGB circuit starts in normal operation. If RGB circuit is damaged or grid 2 is low, the RGB circuit could not start (black picture) due to current is not detected.

7.1.6 Horizontal synchro
- Start up: The horizontal oscillator starts is commanded by microcontroller. During start up circuit provides a softer operating horizontal output with a higher frequency.
- Hor. sync. separator: Fully integrated sync. separator with a low pass filter, slicing level at 50% of the synchronized pulse amplitude.
- Horizontal Phi 1 detector (pin 17): This circuit locks the internal line frequency reference on the CVBS input signal. It is composed of a phase comparator and an internal VCO of 25MHz (1600*15625). The free running frequency is stabilized using the 12 MHz reference of the X-tal oscillator.
Phi 1 detector filter is made by external components at pin 50. Phi 1 time constant is automatically controlled by software for broadcasting signals. For video signals (AV and program 99) constant is always fast to prevent top bending on the screen.
- LBF (pin 34): Line Fly Back input, is obtained by the network R3456/55 (Diagram D) and R3371/T7372.
- Sand Castle (pin 34): Sand Castle output obtained at this pin is used only internally. Levels of sandcastle pulse are 5.3V for burst detection, 3V for line blanking and 2V for frame blanking.
- Horizontal Phi 1 detector (pin 16): The flyback position respect line blanking on TRC cathode is controlled by this circuit. Phi 1 detector filter is made by C2305 pin 16. Horiz. shift can be adjusted by I2C (see chapter 8)
- HOUT (pin 33): Horizontal output is an open collector which one drives the horizontal driver stage (T7440 diagram D).

7.1.7 Vertical synchro and vertical drive
- Vert. sync. separator: It is an internal integrator to separate frame sync. pulses from CVBS.
- Vertical divider system: The divider system uses a counter that delivers the timing for the vertical ramp generator in the geometry processor. The clock is derived from the horizontal line oscillator. Mode used is automatic 50/60Hz identification with 50Hz priority.
- Vertical sawtooth generator (pin 25, 26): A reference current of 100mA is realized at pin 25 by means of an internal reference voltage (3.9V) and resistor R3341. This 100mA reference current is used to derive a
16mA current to charge C2340 (pin 26) during vertical scan. The charge current can be adjusted with the I²C bus control, (VERT. SHIFT). The external capacitor is discharged during vertical retrace by the vertical divider system.
- Vertical geometry processor: The saw tooth signal that is derived from the sawtooth generator can be controlled by I²C bus. Control adjustments are: S-CORRECT, VERT.SLOPE, VERT.AMP and VERT.SHIFT (See chapter 8).
- Vert. output stage (pins 21, 22): The vertical geometry processor has a differential current output to drive a DC coupled frame deflection (7401).
- EHT compensation (pin 36): A voltage inversely proportional of beam current, proceeding of pin 8 of line transformer (5545 diagram D) is applied to pin 36 to stabilize vertical amplitude from EHT variations.
- Vertical guard input (pin 50): A vertical retrace pulse proceeding from pin 8 of IC7401, is added to cut-off voltage at pin 50 (this pin has 2 separated functions, cut-off function see chapter 7.1.5). If there is not pulse or its level is not correct (should be above 3.65V, 0.8msec.), the set goes to standby mode. (See chapter 7.7.1 Protections).

7.1.8 Microcontroller/ Text
Following there is an explanation of the different functions of the microcontroller indicating pins number assigned:
- Tuning (pin 4): The unit has a VST (Voltage Synthesized Tuning) system. This system works by tuning to a station on the tuner through a linear variation of the tuning voltage (V-VARI) from 0V to 33V applied on pin 2 of the tuner. It is generated on pin 4 of the µC and converted to an adequate level for the tuner using T7605.
While searching, µC are always reading internally AFC (Automatic Frequency Control) and video identification signals. When video signal is identified, µC stops searching and do a fine tuning to reach a right AFC value.

- Control key (pin 5): Pin 5 is activated by a DC voltage. When control keys are not activated, a voltage of 3V3 is produced by R3618. If one control key is activated, this pin is connected to ground directly or by a resistor R3665, R3667 (Diagram C), decreasing its voltage.
There are 3 voltage levels depending of the key used: 0V for MENU, 1V for P- and 1.9V for P+.
- Mute output (pin 6): This pin is a 3 state output used to control the sound amplifier (see chapter 7.4). States are 0V, open and Vcc (3.3V).
- INT/EXT input (pin 7): The set can switch to external (AV on the screen) by remote control (selecting program 0) or by rise edge at pin 8 of euroconnector (see diagram C). The IC switches internally video and audio to external. In both cases the user can switch to internal changing the channel.
- Band switching (pin 8, 11): There are 2 outputs for band switching pin 11 for VHFI and pin 8 for VHFIII. The µC controls the channel band in the tuner by a voltage of +5V at the correspondent output. UHF band is controlled by means of transistor 7601. If the set is in VHF, one of the pins 8 or 11 are high and transistor conducts in such a way the UHF voltage is 0V. If the set is in UHF, pins 8 and 11 are low, transistor is cut and the set is in UHF.
- LED (pin 10): The LED (D6663 diagram C) lights up with a low current when the television set is ON and with a high current when the set is on Standby. While the set is receiving a remote control signal, the led is blinking.
- Picture controls (brightness, contrast, colour, sharpness) are processed internally by I2C bus.
- Sound controls (pins 2, 3):
    Mono sets: Sound controls are processed internally by I2C bus
    Stereo sets: All information necessary to control stereo functions including sound controls, are processed by a communication I2C bus between the µc and the stereo decoder (IC 7101 pins 4, 5).
- Standby (pins 1, 33): When the set is switched to stand by, line stops (pin 33). In addition to this, pin 1 switch to low level to make Power Supply in burst mode (see stand by 7.5.3).
- OSD outputs: The RGB and fast blanking signals used for On-Screen Display (OSD) and also for TXT are internally inserted to RGB outputs (pins 51, 52, 53).
- Oscillator (pins 58, 59): A 12-MHz oscillator is determined by a 12-MHz crystal (1679) between pins 58 and 59.
- P.O.R (pin 60) . : Power on reset (POR) is internal, activated when the set is switched on. If the µC shows abnormal behaviour it is advisable to reset it switching off/on the set. Reset can be done also by a short circuit between pins 60 and 61.
- RC5 (pin 62): The commands transmitted by the remote control handset are received by infrared receiver (1685) and passed to the microcontroller for decoding.
- EEPROM (pins 63 and 64): The microcontroller is connected to non-volatile memory IC7685 (EEPROM) via bus I2C. The following information are stored in the memory:
    - Channel data including tuning voltage and band of all the channels.
    - Personal preferences (PP), menu mix and child lock on user menu.
    - All settings included on Service Menu.

7.1.9 Supplies and decoupings
- Small signal analog supply (pins 14, 39): The same +8V supply coming from line deflection is connected to pins 14 and 39 for small signal processing. A separated supply (C2036) feeds video and sound traps circuit.
If +8V supply is not present at pin 39 or pin 14 during the first 4 seconds after switch ON the TV set, the microprocessor goes to Standby mode (See chapter 7.7 Protections).

- Digital supply (pins 54, 15): A +3V3 supply is used for digital circuit of TV processor (pin 54). A decoupling capacitor for this supply is present at pin 15 (C2301). Pin 54 is used also to supply the µC.
- Bandgap decoupling (pin 19): The bandgap circuit provides a very stable and temperature independent reference voltage of 4.0 V which one is used specially in the analogue video processor part.
- µC supplies (pins 54, 56, 61): The µC has several +3V3 supplies,
    – Pin 54: Analogue supply (Oscillator, ADC).
    – Pin 56: Digital supply to µC core.
    – Pin 61: Supply to all output ports of the µC.
When the set is in stand by, the µC switch to stand by mode, only 3V3 supplies are present but consumption is reduced.

7.2 RGB AMPLIFIERS (diagram B)

The RGB signals available at pins 51, 52 and 53 of IC7015 (Diagram A) must be amplified and inverted in order to reach the level required for driving the tube. The integrated circuit IC7200 (TDA6107) is used for this purpose.
RGB inputs (pins 2, 3, 1): These signals are connected to negative inputs of internal operational amplifiers. There is and internal reference voltage of 2.5V for the amplifiers. Negative feedback of amplifiers are internal resistors.
RGB outputs (pins 8, 7, 9): These outputs are applied to the RGB cathodes of the tube. Clamping diodes to +200V (6201, 6216, 6229) and 1K5 series resistors (3203, 3216, 3229) are added for flash-over protection.

- Continuous Cathode Calibration (CCC) (pins 50): This circuit is an auto-tuning loop which stabilizes the black level (offset) as well as the cathode drive level (gain) of each gun. Pulses in 3 consecutive lines R, G and B (pins 51, 52, 53) at the end of frame blanking are used on alternating fields, one field for black level, following for cathode drive level.

Cathode currents

- Cathode current feedback (pin 5): Cathode current used in Continuous Cathode Calibration circuit (See 7.1.5) is obtained at this pin and feedback to pins 50 of IC7015 (Diagram A)
- White adjustment: Gain and cut-off point of RGB amplifiers can be adjusted by I2C in the service menu (See chapter 8)
- Anti-spot circuit: When the set is switched off, the capacitor 2208 keeps charged and a negative voltage is put at VG1 of the tube.

7.3 DEFLECTION (Diagrams A, D)

7.3.1 Frame deflection (Diagrams A)

Full bridge vertical deflection output performed by the integrated circuit TD8357J (7401).

- Frame supplies (pins 3, 6): There are 2 supply voltages, +12V (pin 3) is the main supply and +45V (pin 6) is used to supply the output stage during flyback time.
- Vertical inputs (pins 1, 2): (pins 21, 22): The output currents proceeding from pins 21, 22 of IC7015 are converted to voltages by resistors R3411/12 in such a way that 2 inverted sawtooth are present in the differential inputs of amplifier (pins 1, 2).
- Vertical outputs (pins 4, 7): Vertical output is DC coupled to deflection coil. That means linearity adjustment is not necessary. HF loop stability is achieved by a damping resistor R3413.
- Feedback input (pin 9): A voltage proportional to current deflection is present in R3415/16 and a feedback to pin 9.
- Vertical flyback: This signal is internally added to vertical output (pin 7) using supply voltage at pin 6.
- VGUARD circuit (pin 8): This circuit generates a high level during flyback period, and is used to protect the TV set in case of a vertical failure. (See protections, chapter 7.7)

7.3.2 Line deflection (Diagram D)

The final line transistor is driven by the transformer 5441, whose primary winding is driven by the transistor T7440 connected to the line drive output of IC7015 (pin 33).

The horizontal deflection stage is carried out in a conventional way, with the deflection transistor (T7445) and line transformer (5445).

Beam current info (BCI) is present at C2460.

There are the following supply voltages obtained from line transformer (5545):

- Frame supply (+12B):Main frame supply present at capacitor C2455.
- Flyback frame supply (+45): Flyback frame supply present at capacitor C2455.
- +8V stabilizer: +8V for small signal is made from +12V (C2454) by D6474 and T7478
- +5V stabilizer: And additional voltage of +5V for small signal is made also from +12V (C2454) by D6479 and T7479.
- Stereo supply (only stereo models): +12V from C2454 is drived to 7702 (Diagram E) to stabilize +5V for stereo decoder (7101.
- FF : The heather voltage is reduced by R3235/38 and 5235 (Diagram B) to obtain 6.3Veff at the CRT .

7.4 SOUND AMPLIFIER (Diagram C)

Sound amplifier is a Bridge Tied Load (BTL) amplifier including short circuit protection, mute and stand by mode.

IC used can be TDA8941P for 14" and 17" models, TDA8943SF for 20" and 21" models or TDA8944J for stereo models. Behaviour is the same for 3 models. TDA8944J is a double amplifier, that means 2 supplies, 2 inputs and 2 outputs.

- Supply (Vcc, SVR): Main supply (Vcc) is taken from +11V of Power Supply (C2540 diagram D). The IC creates internally a half supply, present in SVR pin and decoupled by 10uF capacitor (C2182).
- Sound input (IN+): Amplifiers have differential inputs (IN+,IN-). Audio input is connected to IN+ decoupled by 220nF capacitor (C2181/84) and IN- is decoupled to ground by other 220nF capacitor (C2179/93). To avoid oscillations there is a 1n5 (C2183/95) capacitor connected between both inputs.
- Mode input (MODE): This input is commanded by mute signal proceeding from the µC (pin 6 of 7015 diagram A) and has three modes depending of the voltage level:
  - Standby mode (Vmode = Vcc): Consumption is very low (used during stand by).
    In this case Vmute=0V, T7657 and T7659 are cut, MODE signal is high
  - Mute mode (2.5V<Vmode<Vcc): No sound output (used when the set is switched on/off, there is no signal, channel search, change of program, etc.)
    In this case pin 6 of 7015 is open T7659 conducts (by resistor divider), T7657 are cut, MODE voltage is 5,5V.

- Operating mode: (Vmode<0.5V): Sound output present (normal operation).
  In this case Vmute=3V3 both transistors conduct, mute signal is low.
- Sound output (OUT+/OUT-): Amplified sound is drived to the loudspeakers.

Mono sets:
Headphones output has been connected in such a way that when headphones are connected, loudspeakers are switched off.
Stereo sets:
Headphones output are coming directly from pins 57 and 58 of stereo decoder IC7101 (see chapter 7.6 and diagram E).

7.5 POWER SUPPLY (Diagram D)

Mains isolated switched mode power supply (SMPS). controlled in variable frequency mode.
IC7514 (KA5Q075RT) includes control circuit and output MOSFET. Output feedback is done by means of an optocoupler (7515).
- Switching behaviour: The switching period is divided in on-time, when energy is extracted from the mains into the primary winding (8-12 of 5525), off-time, when energy in the transformer is supplied to the loads via secondary windings of 5525 and dead-time when no energy is extracted or supplied.
- Standby mode: Output voltages are present when the set is in stand by. Standby is done cutting line deflection and making the supply in burst mode in such a way that power consumption is very low.

7.5.1 Degaussing and Rectifier
- Degaussing: R3501 is a dual PTC (2 PTC's in one housing). After switch on set, PTC is cold so low-ohmic and so degaussing current is very high. After degaussing, PTC is heated so high-ohmic, so in normal
operation degaussing current is very low.
- Rectifier: Mains voltage is filtered by L5500, full wave rectified by diodes D6502-D6505 and smoothed by C2505 (300V DC for 220V AC mains).

7.5.2 Regulation
- Power MOSFET (pin 1): Power stage is done by an internal MOSFET between pin1 and ground. Current is sensed by an internal resistor and limited to 5A peak. (See chapter 7.7.2 Protections)
- Start up and supply (pin 3): When the set is switched on, a current via R3527 and R3528 is applied to pin 3. When C2514 is charged to 15V, the power supply starts and the internal MOSFET conducts. A voltage across transformer windings is built up. The voltage across winding 4-2 is rectified by diodes D6523/25 and used to supply the IC on pin 3.
Voltage of pin3 depends on the output voltage and is about 28V. If Vpin3 is lower than 9V supply stops and if it is higher than 32V, output voltage is limited. (See chapter 7.7.2 Protections)
- Sync (pin 5): A pulse voltage proceeding from winding 4-2 is applied to this pin. A delay is added by means of C2524, R3522 and R3526 to synchronize starts conduction of MOSFET at minimum Vds voltage.
- Secondary feedback (pin 4): Line supply feedback is obtained at pin 4 by divider R3531/34/19, the differential amplifier (IC7533) and the optocoupler (IC7515). Voltage at this pin is about 1.1V
- Output regulation: IC7514 stabilizes output voltage by controlling T-on and so the frequency and the duty cycle. Output control is done by the following way:
  If line output is higher, current input of the differential amplifier (IC7533) is higher (amplifier has a reference voltage of 2.5V).
  Current in IC7533 and also in the optocoupler (IC7515) is higher.
  Voltage in pin 4 is lower, T-on is internally reduced and output is reduced.
  Output voltage of supply can be adjusted by R3518.

7.5.4 Secondary side
- Line supply: Line supply present at capacitor C2530 should be adjusted to the correct value (depending on the TRC) by means of P3534.
- Sound supply (+11V): This supply is used for sound output amplifier and to feed 3V3 stabilizer.
- µC supply (+3V3): +5V3 is regulated by T7575, D6570 and T7571.

7.5.3 Stand by:
When the set is put in standby, line driver (pin33 of IC7015, diagram A) stops and deflection supply is not loaded. Only a reduced load to supply the µC (+3V3) is necessary.
To reduce more the power consumption, during standby T7572 is cut by STBY signal (pin1 of IC7015, diagram A), then current in IC7533 is increased by means of D6531 and output voltages are reduced.
As a consequence of this, the supply switch to burst mode operation. During working time C2514 is charged till 12V, then supply stops and C2514 is discharged till 11V.

7.6 STEREO DECODER

The CTU Stereo chassis is based in the TDA9875A chip. This is a single-chip Digital TV Sound Processor for analog and digital multichannel sound systems in TV sets.

In the stereo chassis the sound part in the IC7015 (TDA9350) is disabled. All sound signal, analog and digital is processed in IC7101 (TDA9875A).

The TDA9875A decodes NICAM signals (B/G and I standard) and two-carrier FM modulation A2 signals (B/G standard).

- Control bus (pins 4, 5): Stereo is fully controlled for the µC of IC7015 (Diagram A) via I2C-bus. Status information present in internal registers of IC7101 is read by µC to determine whether any action is required. Control is exercised by the µC also, writing in other internal registers of IC7101. This control includes volume, balance, bass, treble, pseudo stereo, spatial, and Automatic Volume Level (AVL).
- Oscillator (pins 18, 19): The circuitry of the crystal oscillator is fully integrated, only a external 24.576 MHz crystal is needed.

- SIF input (pin 12): SIF signal is filtered from video signal coming from pin 38 of IC7015 (Diagram A) by a passband 5.5MHz to 6.5Mhz filter (C2740/41/42 and L5741).
- AGC, ADC: SIF is passed through an AGC circuit and then digitized by an 8-bit ADC operating at 24.576 MHz. The gain of the AGC amplifier is controlled from the ADC output. Then signal is separated in 2 ways, one for FM and other for NICAM.
- FM demodulation: FM signal is fed via a band-limiting filter to a demodulator. If signal is stereo A2, decoder recovers the left and right signal channels from the demodulated sound carriers. A stereo identification signal is sent to the µC.
- NICAM demodulation: NICAM signal is transmitted in a DQPSK code at a bit rate of 728 kbit/s. NICAM demodulator performs DQPSK demodulation and feeds the resulting bitstream and clock signal onto the NICAM decoder. A timing loop controls the frequency of the crystal oscillator to lock the sampling rate to NICAM decoder: The device performs all decoding functions in accordance with the “EBU NICAM 728 specification”.
- Audio processing: After demodulation, digital signal is selected (FM, A2 or NICAM) and processed according µC control. Following functions are provided: Forced mono, stereo, channel swap, channel 1, channel 2, spatial effects, Automatic Volume Level (AVL), volume, balance, bass and treble.

- DACs (pins 54, 55): Then signals are transformed to analog by DACs and sent to the outputs. Post filter capacitors for DACs are at pins 54 and 55.

- Sound outputs (pins 60, 61): After a volume control (by I2C), sound outputs (MAIN R and MAIN L) are drived to the inputs IN+ (pins 12 and 6) of the final sound amplifier IC7187C (Diagram C).
- Headphone outputs (pins 57, 58): Headphone outputs are drived by followed emitters 7780 and 7781 to the headphones. These outputs are independent of loudspeakers outputs and controls are separated.
- External audio out (pins 47, 48): Signal at these pins are drived directly to the euroconnector sound outputs (see Diagram C).
- External audio in (pins 33. 34): External audio (R and L) proceeding of pins 6 and 2 of euroconnector (Diagram C) is applied pins 33 and 34 of IC7101 and digitalized by an ACD circuit. Selection between internal or external is done from the µC (IC7015) by I2C bus (see INT/EXT, chapter 7.6).
- External audio out (pins 47, 48): Signal at these pins are drived directly to the euroconnector sound outputs (see Diagram C).

- +5V stabilizer: +5V supply for stereo processor is obtained from +12V (C2454 diagram D) by D6702 and 7478. This voltage comes to supply voltages of IC1701 (pins 59, 15, 64)
- Digital supplies (pins 15, 64): +5V supplies at pins 15 and 64 are used for digital circuits of stereo processor.
Power ON reset (pin 16): When the set starts, C2754 is slow charged by an internal 50K resistor to +5V. When digital supplies are present and oscillator is working, reset is done if pin 16 is low (Vpin16<1.5 V).
- Analog supply voltage (pin 53, 59): There is a +5V supply for analog outputs (DACs and operational amplifiers) at pin 59. A 50% reference voltage (2.5V) for these circuits is present at pin 53.
- ADC supply voltage (pins 38, 39, 40, 46): A 3.3V supply voltage is obtained internally and decoupled on pin 38 by C2758. Positive and negative reference voltage for ADC is present at pins 39 and 40. A 50% reference voltage (1.65V) for ADC is present at pin 46.
- Front-end supply (pins 7, 8, 11): A separated 3.3V supply voltage (decoupled on pin 7 by C2750) is necessary for SIF demodulator. By means of a 200mA current generator at pin 8, a 2V reference voltage is produced at pin 7.

7.7 PROTECTIONS

If TV does not start or it switches to stand by, try to start again in a few minutes and if problem remains check protection pins explained following.

7.7.1 Protections in IC7015 (Diagram A)

- Pins 14, 39:
If +8V supply is lower than 6V (pin 39 or pin 14) during the first 4 seconds after switch ON the TV set, the microprocessor goes to Standby mode (See also chapter 7.1.9).

- Pin 50:
If the vertical retrace pulse at this pin is not correct (should be above 3.65V, 0.8msec) during the first 4 seconds after switch ON the TV set, the vertical guard blanks the RGB outputs and the TV switch to Standby (See also chapter 7.1.7).
This protection operates in the following situations:

- When the vertical deflection fails and there is no pulse.
- When the vertical retrace pulse is higher than 0.9msec. (for example vertical amplitude is too high)
- An extra protection is obtained when there is too much current in the CRT (for example +200V supply is missing), because in this case, DC level of pulse is lower by means of cut-off signal. (See fig. 7.7.1)

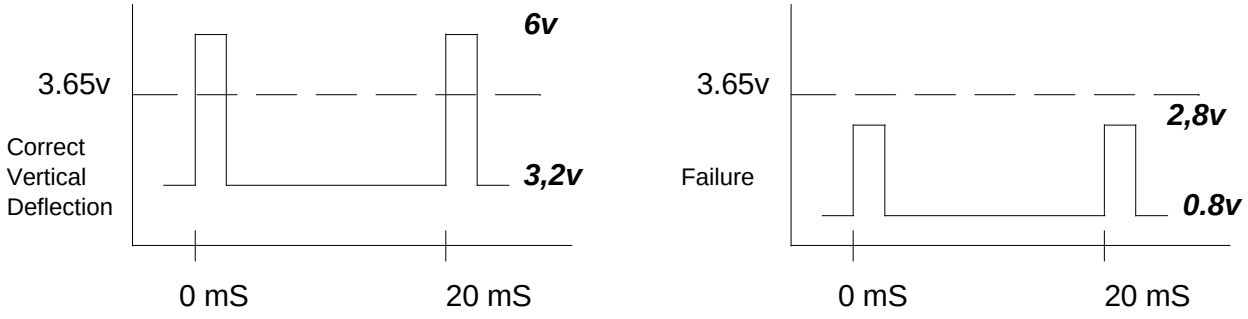


Fig 7.7.1 Vertical guard protection

To repair the set more easily, Vguard protection can be disabled, in this case the vertical guard blanks the RGB outputs, but TV does not enter in Standby mode. To disable Vguard, item 8 of Service menu MANUAL C-O should be 01 (See chapter 8.1).
Due to a change in MANUAL C-O is difficult to do if the set switch to Standby, Vguard can be disabled also connecting a diode (1N4148) in series with a 2K2 resistor between pins 10 and 7 of IC7015 (Anode at pin 10). Be careful to disconnect this network after the set is repaired.

7.7.2 Protections in IC7514 (Diagram D)

- Pin 1:
Primary current is sensed by an internal resistor for the IC. If this current is increased to 5A peak, supply works in a intermittent way (ON and OFF). That can be provoked for a short circuit on secondary outputs.

- Pin 3:
If Vpin3 is lower than 9V the under voltage protection stops the supply.
If Vpin3 is higher than 32V over voltage protection limits output voltage.

8.- ELECTRICAL ADJUSTMENTS

8.1 Service mode

The signal processor IC7015 is fully controlled by I2C, so that the most of adjustments of the set can be made by service menu.

- Enter in Service mode:
  - Select program 75 and press at the same time OSD key (+) on RC and MENU key on local key board during 4 seconds.

Service mode is indicated by a S symbol on the down left corner of the screen.
Note : Controls (volume, contrast, brightness and saturation) will be pre-adjusted to the mid position.
- Display Service Menu : When the set is in service mode it is possible to display Service Menu by OSD key (+) on RC. Using P+, P- keys of remote control the different items can be displayed (see table 8.1):

ITEM		Value	ITEM		Value
Nº	Description	Hexa	Nº	Description	Hexa
1	ADJUST VG2	PRG	13	R GAIN	20H
2	CATH.DRIVE	0CH	14	G GAIN	20H
3	TXT V-SHIFT	02H	15	B GAIN	20H
4	TXT H-SHIFT	02H	16	S-CORRECT	20H
5	V-GUARD DISA	PRG	17	VERT.SLOPE	20H
6	AGC START	25H	18	HOR.SHIFT	20H
7	RESERVED		19	VERT.AMP	20H
8	MANUAL C-O	01H	20	VERT.SHIFT	20H
9	R CUT-OFF	20H	21	SYS OPTIONS	00H
10	G CUT-OFF	20H	22	MENU OPTIONS	00H
11	BRIGHTNESS	PP	23	READ STATUS	PRG
12	CONTRAST	PP	24	RESERVED	00H

Table 8.1. Service menu. Settings are hexadecimal values

- Pre setting values: When E2PROM is replaced, pre-setting values indicated on table 8.1 are stored by the µC. (see 8.7 E2PROM).
- Adjust by Service Mode: When a item is selected, using V+, V- keys of remote control it can be adjusted. Items 2, 5, 23 and 24 have fixed values = pre setting values, rest of items see 8.2 to 8.6.

- Remove service menu: There are 2 ways to remove service menu
  - Saving the new settings: Using OSD (+), MENU or INSTALL keys on RC.
  - Keeping the old settings: Switching the TV to stand by. Service mode continues active.

- Remove Service Mode: Switching off the TV

8.2 Power supply and focusing:

- Power supply voltage:
  - Adjust brightness and contrast controls at minimum.
  - Connect a DC voltmeter across C2530 (Diagram D).
  - Adjust R3534 for a required voltage depending on the model and the TRC used (see table 11, page 23).
- Focusing:
  - Adjust with the potentiometer placed on the line output transformer.

8.3 AGC Adjustment

- Connect a pattern generator to the aerial input with RF signal amplitude = 1mV.
- Adjust the value of AGC start (item 6 of Service menu) so that voltage at pin 1 of the Tuner (1001) is 3.7V.

8.4 White D

8.4.1 Manual cut-off:

Item 8 of adjusting values should be 00 (see table 8.1), that means set is in automatic cut-off. However it is possible that RGB do not start (black picture), due to grid 2 is not adjusted. In this case we recommend to change to Manual cut-off (Item 8 = 01), pre-adjust grid 2 to have a good picture and change to automatic cut-off (Item 8 = 0) before continue adjusting (see warm-up detection circuit in 7.1.5)

8.4.2 Grid 2:

- Connect a white pattern generator.
- Adjust contrast at 00 and brightness at 36. (00 and 24 in the service menu because hexadecimal values are used
- Put parameter 1 of the service menu ADJUST VG2 = 1. An arrow will be displayed on the left upper corner.
- Adjust VG2 potentiometer (in line transformer) till the arrow will be transformed to a square.
- In a few seconds, arrow will be disappear and ADJUST VG2 parameter will be come back to 00.

8.4.3 White checking:

- Connect pattern generator containing grey scale
- Adjust the set to normal operation and reduce the saturation control to minimum.
- Allow the set to warm up about 10 minutes and check visually if the grey scale has correct colour.
- If not, enter to Service menu and adjust G and B gain (items 14 and 15) until a desired grey is obtained. In the case that adjusting is difficult, start again with the setting values of table 8.1 (items 9, 10, 13, 14, 15).

8.6 Geometry

- Connect a circle pattern generator with the controls at nominal conditions and enter to service menu.

Adjust to have picture centred in vertical position by service menu item 16.

- Horizontal shift:

Adjust to have picture centred in horizontal position by service menu item 18.

- Vertical amplitude:

Adjust picture height to cover the screen by service menu item 19.

Adjustments only if necessary:

- TXT Shift:

Vertical and horizontal shift of OSD or TXT can be adjusted by items 3 and 4 of service menu.

- Vertical slope:

When item 17 is selected, only upper part of the screen can be seen. Vertical slope is adjusted when centre line of the pattern is just visible.

- Vertical S correction:

S correction can be adjusted by item 20 of service menu.

8.7 Options:

The type of chassis is defined by items 21 and 22 of service menu. The following alternatives are available:

SYSTEM OPTIONS (Item 21)	**VALUE**
PAL B / G	00
PAL - I	01

MENU OPTIONS (Item 22)	**VALUE**
16 Languages menu	00
English bars menu	01
Global menu (without languages).	03

Important note: All the chassis have identification sheet when the chassis type is indicated:
"Cod. service: SXXMXX", where SXX means the option of system and MXX means the option of menu

Example: S01M00 means system = 01 (Pal I) and menu = 00 (13 Languages menu)

When the chassis or the EEPROM (IC7685) have to be replaced, be careful to keep the same type of chassis, setting correctly the chassis options.

8.8 Error messages

The microcomputer also detects errors in circuits connected to the I^2C (Inter IC) bus. These error messages are communicated via OSD (On Screen Display) :

Error message	Error description	Component
F2	Eprom communication error	IC7685
F3	µC internal error (RA M)	IC7015 (µC)
F4	Internal bus communication	IC7015
F5	SDA2/ SCL2 bus wrong communication	IC7101 (stereo)
No sound menu	SDA2/ SCL2 bus no communication	IC7101 (stereo)
F6	Eprom data error	IC7685
F7	Not allowed options *	Item 21,22 service menu.
F8	Vertical guard	pin 50, IC7015

* If SYS OPTIONS or MENU OPTIONS are not possible in this chassis, the µC change to allowed options and first time TV set is switch on F7 message is displayed. Options should be checked (see 8.7)

9. Safety instructions, maintenance instructions, warning and notes

Safety Instructions for Repairs

1. Safety regulations require that during a repair:
- The set should be connected to the mains via an isolating transformer.
- Safety components, indicated by the symbol ⚠ should be replaced by components identical to the original ones
- When replacing the CRT, safety goggles must be worn.

2. Safety regulations require also that after a repair:
- The set should be returned in its original condition.
- The cabinet should be checked for defects to avoid touching, by the customer, of inner parts.
- The insulation of the mains lead should be checked for external damage.
- The mains lead strain relief should be checked on its function
- The cableform and EHT cable are routed correctly and fixed with the mounted cable clamps in order to avoid touching of the CRT, hot components or heat sinks
- The electrical resistance between mains plug and the secondary side is checked. This check can be done as follows:
  - Unplug the mains cord and connect a wire tween the two pins of the mains plug.
  - Switch on the TV with the main switch.
  - Measure the resistance value between the pins of the mains plug and the metal shielding of the tuner or the aerial connection on the set. The reading should be between 4.5 M and 12 M.
  - Switch off the TV and remove the wire between the two pins of the mains plug.
  - Thermally loaded solder joints should be oldered.

-This includes components like LOT, the line utput transistor, fly-back capacitor.

Maintenance Instructions

It is recommended to have a maintenance inspection carried out periodically by a qualified service employee.
The interval depends on the usage conditions.
- When the set is used in a living room the recommended interval is 3 to 5 years. When the set is used in the kitchen or garage this interval is 1 year.
- During the maintenance inspection the above mentioned "safety instructions for repair" should be caried out. The power supply and deflection circuitry on the chassis, the CRT panel and the neck of the CRT should be cleaned.

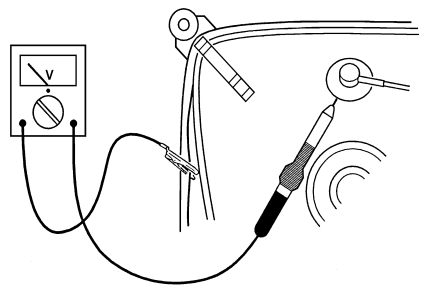


FIG. 9

Warnings

1. In order to prevent damage to IC's and transistors any flash-over of the EHT should be avoided. To prevent damage to the picture tube the method, indicated in Fig. 9, has to be applied to discharge the picture tube.
Make use of an EHT probe and a universal meter is 0V (after approx 30s).

2. ESD.
All IC's and many other semi-conductors are sensitive to electrostatic discharges (ESD). Careless handing during repair can reduce life drastically. When repairing, make sure that you are connected with the same potential as the mass of the set via wrist wrap with resistance. Keep components and tools on the same potential.

3. Proceed with care when testing the EHT section and the picture tube.

4. Never replace any modules or any other parts while the set is switched on.

5. Use plastic instead of metal alignment tools. This will prevent any short circuits and the danger of a circuit becoming unstable.

6. Upon a repair of a transistor or an IC assembly (e.g. a transistor or IC with heatsink and spring) remounting should be carried out in the following order:
1. Mount transistor or IC on heatsink with spring.
2. Resolder the joints.

Notes

1. After replacing the microcomputer first solder the shielding before testing the set. This is needed as the shielding is used for earth connection. If this is not done the set can switch into protection mode (see description of the SMPS).

2. Do not use heatsink as earth reference.

3. The direct voltages and waveforms should be measured relative to the nearest earthing point on the printed circuit board.

4. Voltages and oscillograms in the power supply section have been measured for both normal operation (⏻) and in the stand-by mode (⏻). As an input signal a colour bar pattern has been used.

5. The picTure tube PWB has printed spark gaps. Each spark gap is connected between and electrode of the picture tube and the Aguadog coating.