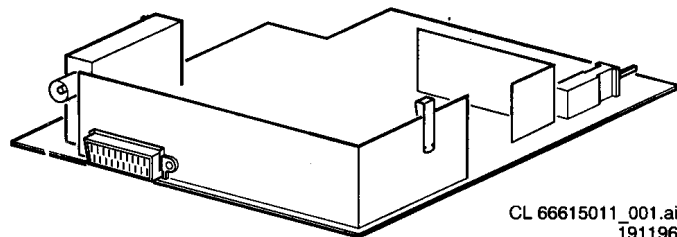


Service
Service
Service

L7.1A
AA



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Service Manual

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
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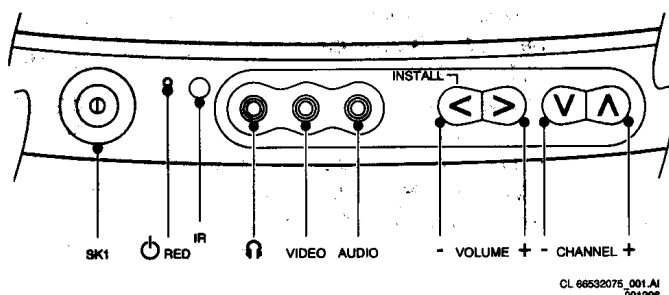
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1. Technical specifications

Mains voltage	150 - 276V AC; 50/60 Hz	
	90 - 276V 50/60 Hz (full range)	
Power cons. at 220V~	14" 43W (stand-by ≤ 10W)	
	20" 52W (stand-by ≤ 10W)	
Aerial input impedance TV	75Ω - coax	
Max. aerial input VHF/UHF	100dBμV	
Pull-in range colour sync	± 300Hz	
Pull-in range horizontal sync	± 600Hz	
Pull-in range vertical sync	45 - 64.5 Hz	
Picture tube range	14"	All tubes are universal tube
		A34EDJ01X024 - LATAM
		A34JXV70X /67
		A34JFQ40X(W) /59 /50 /71 /97 /75 /73 /93
		370KSB22 - SYB - /57 /58
	20"	Universal tubes
		A48EEB05X020 - LATAM
		A48KXR98X /75 /73 /58B
	20"	Northern tubes
		A48JRK10X /67
		510UFB22 TC69(DPY) /59 /50 /97 /71 /57 /58
	14" mono	16Ω 4W front firing loudspeaker
	20" mono	16Ω 3W front firing loudspeaker
TV Systems	/50 /67	PAL B/G
	/75	PAL B/H
	/73 /57	PAL I
	/58 /59	PAL B/GI & SECAM B/G D/K
	/77 /97	NTSC M
	/93	PAL D/I & SECAM D/K
Indications	On Screen Display (OSD) green/red	
	1 LED (⊕ red high intensity, ⊖ red low intensity, "RC5" and error codes blinking red)	
VCR programs	Any program numbers.	
Tuning and operating system	 VST / PLL	
UV1335 /IEC (VST)	Band I	48.25 - 93.25 MHz
	Band III	168.25 - 216.25 MHz
	UHF	471.25 - 863.25 MHz
UV1336 (PLL)	Band I	55.25 - 83.25 MHz
	Band III	175.25 - 211.25 MHz
	UHF	471.25 - 801.25 MHz
Local operating functions	VOLUME + / PROGRAM + /	




2. Connection facilities

Cinch:

- ⊙ CINCH CVBS ⊖ (1V pp +/- 3dB 75 Ω max 2V DC)
- ⊙ CINCH AUDIO ⊖ (500mV RMS < 1K Ω max 2Volt RMS)

Head phone:

- ⊙  8 -600Ω/5mW

3. Safety instructions, Maintenance instructions, Warnings 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 that **after** a repair the set must be returned in its original condition. In particular attention should be paid to the following points:
 - As a strict precaution, we advise you to resolder the solder joints through which the horizontal deflection current is flowing, in particular:
 - all pins of the line output transformer (LOT);
 - fly-back capacitor(s);
 - S-correction capacitor(s);
 - line output transistor;
 - pins of the connector with wires to the deflection coil;
 - other components through which the deflection current flows.

Note:

This resoldering is advised to prevent bad connections due to metal fatigue in solder joints and is therefore only necessary for television sets older than 2 years.

- The wire trees and EHT cable should be routed correctly and fixed with the mounted cable clamps.
- The insulation of the mains lead should be checked for external damage.
- The mains lead strain relief should be checked for its function in order to avoid touching the CRT, hot components or heat sinks.
- The electrical DC resistance between the mains plug and the secondary side should be checked (only for sets which have a mains isolated power supply). This check can be done as follows:
 - unplug the mains cord and connect a wire between the two pins of the mains plug;
 - set the mains switch to the on position (keep the mains cord unplugged!);
 - 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 MΩ and 12 MΩ;
 - switch off the TV and remove the wire between the two pins of the mains plug.
- The cabinet should be checked for defects to avoid touching of any inner parts by the customer.

Maintenance instructions

It is recommended to have a maintenance inspection carried out by a qualified service employee. The interval depends on the usage conditions:

- When the set is used under normal circumstances, for example in a living room, the recommended interval is 3 to 5 years.
- When the set is used in circumstances with higher dust, grease or moisture levels, for example in a kitchen, the recommended interval is 1 year.

The maintenance inspection contains the following actions:

- Execute the above mentioned 'general repair instruction'.
- Clean the power supply and deflection circuitry on the chassis.
- Clean the picture tube panel and the neck of the picture tube.

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. 3.1, has to be applied to discharge the picture tube. Make use of an EHT probe and a universal meter (position DC-V). Discharge until the reading of the meter is 0V (after approx. 30s).

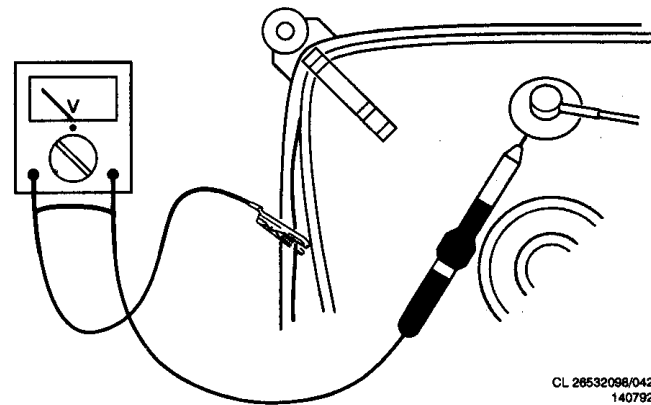


Fig. 3.1

2. ESD ▲

All ICs and many other semiconductors are susceptible to electrostatic discharges (ESD). Careless handling during repair can reduce life drastically. When repairing, make sure that you are connected with the same potential as the mass of the set by a wristband with resistance. Keep components and tools also at this same potential.

Available ESD protection equipment:

anti-static table mat large 1200x650x1.25mm	4822 466 10953
anti-static table mat small 600x650x1.25mm	4822 466 10958
anti-static wristband	4822 395 10223
connection box (3 press stud connections, 1 M ohm)	4822 320 11307
extension cable (2 m, 2 M ohm; to connect wristband to connection box)	4822 320 11305
connecting cable (3 m, 2 M ohm; to connect table mat to connection box)	4822 320 11306
earth cable (1 M ohm; to connect any product to mat or connection box)	4822 320 11308
complete kit ESD3 (combining all 6 prior products - small table mat)	4822 310 10671
wristband tester	4822 344 13999

3. Together with the deflection unit and any multipole unit, the flat square picture tubes used form an integrated unit. The deflection and the multipole units are set optimally at the factory. Adjustment of this unit during repair is therefore not recommended.

4. Proceed with care when testing the EHT section and the picture tube.
5. Never replace any modules or any other parts while the set is switched on.
6. Use plastic instead of metal alignment tools. This will prevent any short circuits and the danger of a circuit becoming unstable.
7. 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.

4. Mechanical instructions

For the main carrier two service positions are possible (Fig. 4.1):

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

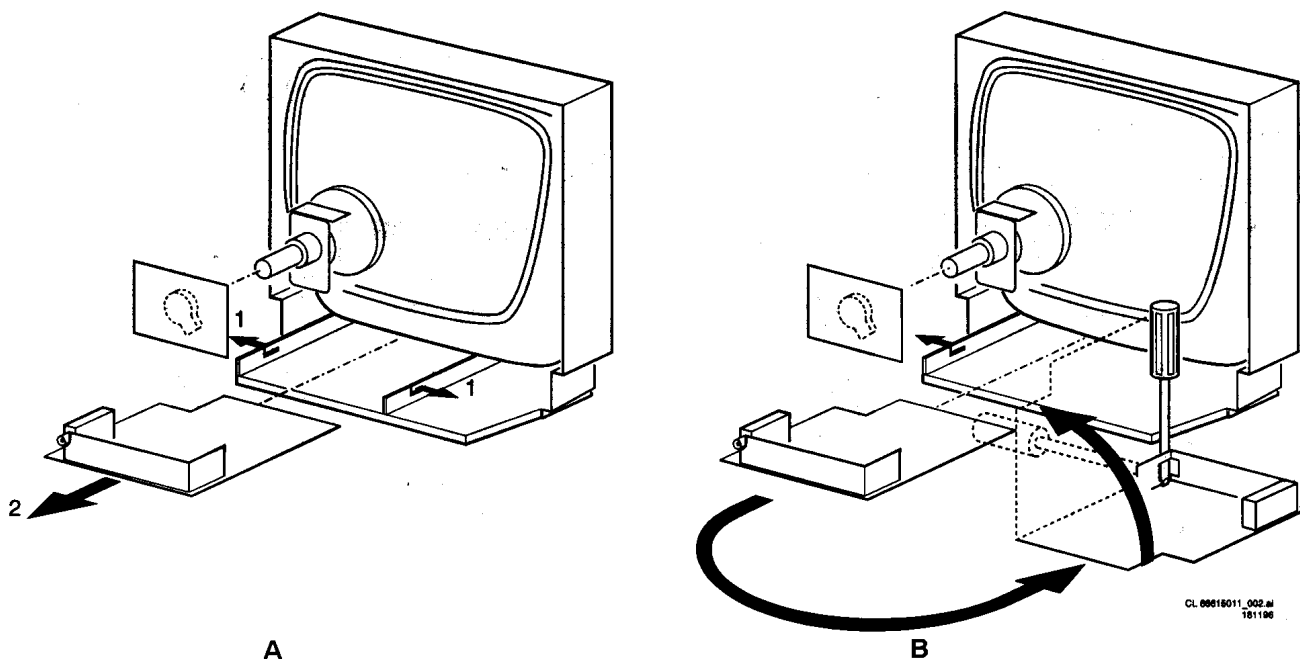


Fig. 4.1

Notes

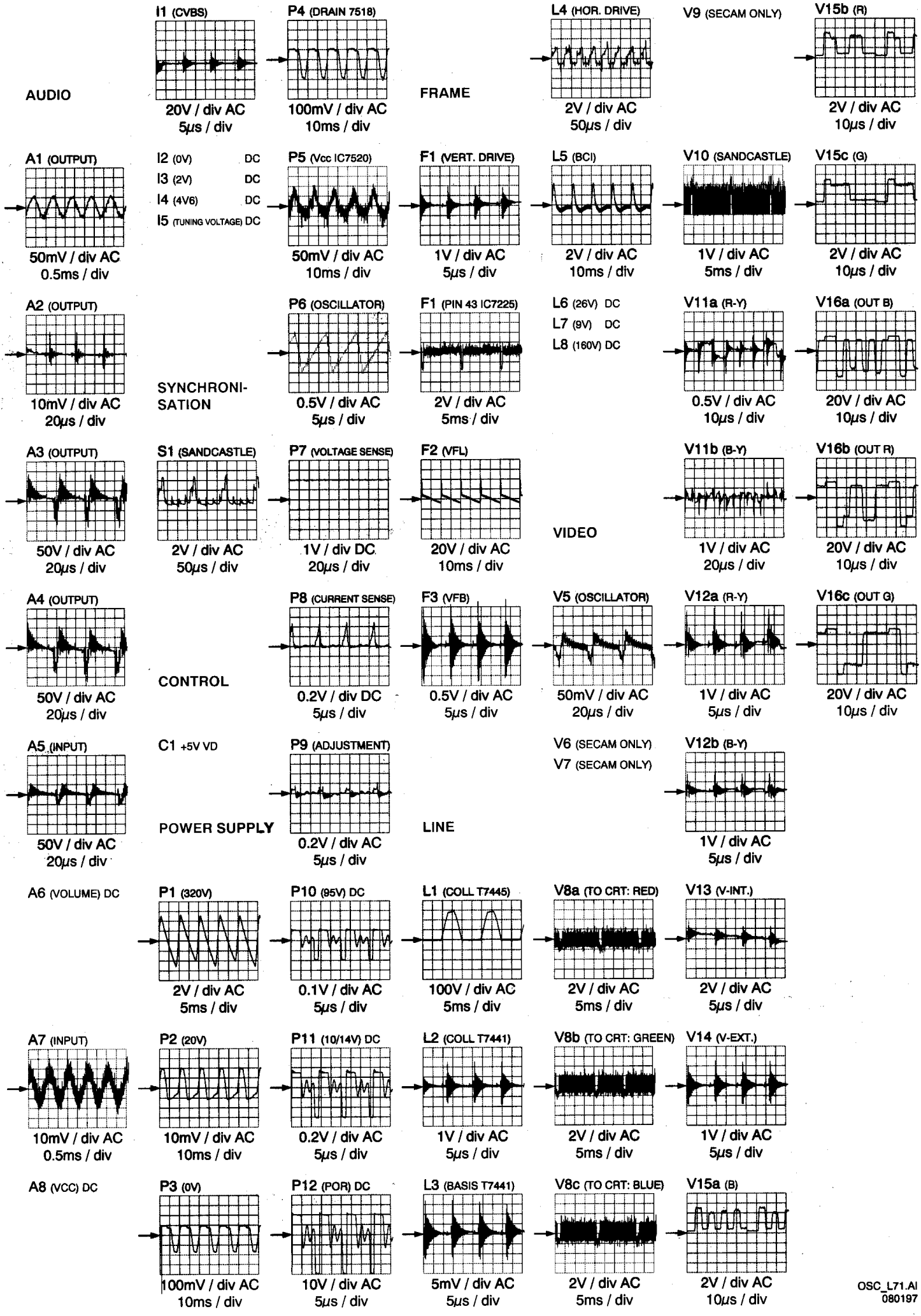
1. Do not use heatsinks as earth reference.
2. The direct voltages and oscillograms should be measured with regard to the tuner earth (\perp), or hot earth (\perp with lightning bolt) as this is called.
3. The direct voltages and waveforms are measured in the Service Default Mode (see chapter 8). Use a colour bar pattern of a pattern generator (e.g. PM5518).
4. The DC voltages and oscillograms are where necessary measured with (\sqcap) and without (\times) aerial signal (settings as in Service Default Mode; see chapter 8). Voltages and oscillograms in the power supply section have been measured for both normal operation ($\textcircled{1}$) and in the stand-by mode ($\textcircled{0}$). 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 an electrode of the picture tube and the Aquadag coating.

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

Position B can be reached from position A after disconnecting the degaussing cable. Put the carrier on the line transformer side and if wanted use a screwdriver for an extra stable service position (see figure below).

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5. Overview oscillograms / Übersicht Oszillogramme / Vue d'ensemble des oscillogrammes



Survey of testpoints / Übersicht über die Teststellen / Presentation des points à tester

MAIN CARRIER (Component side)

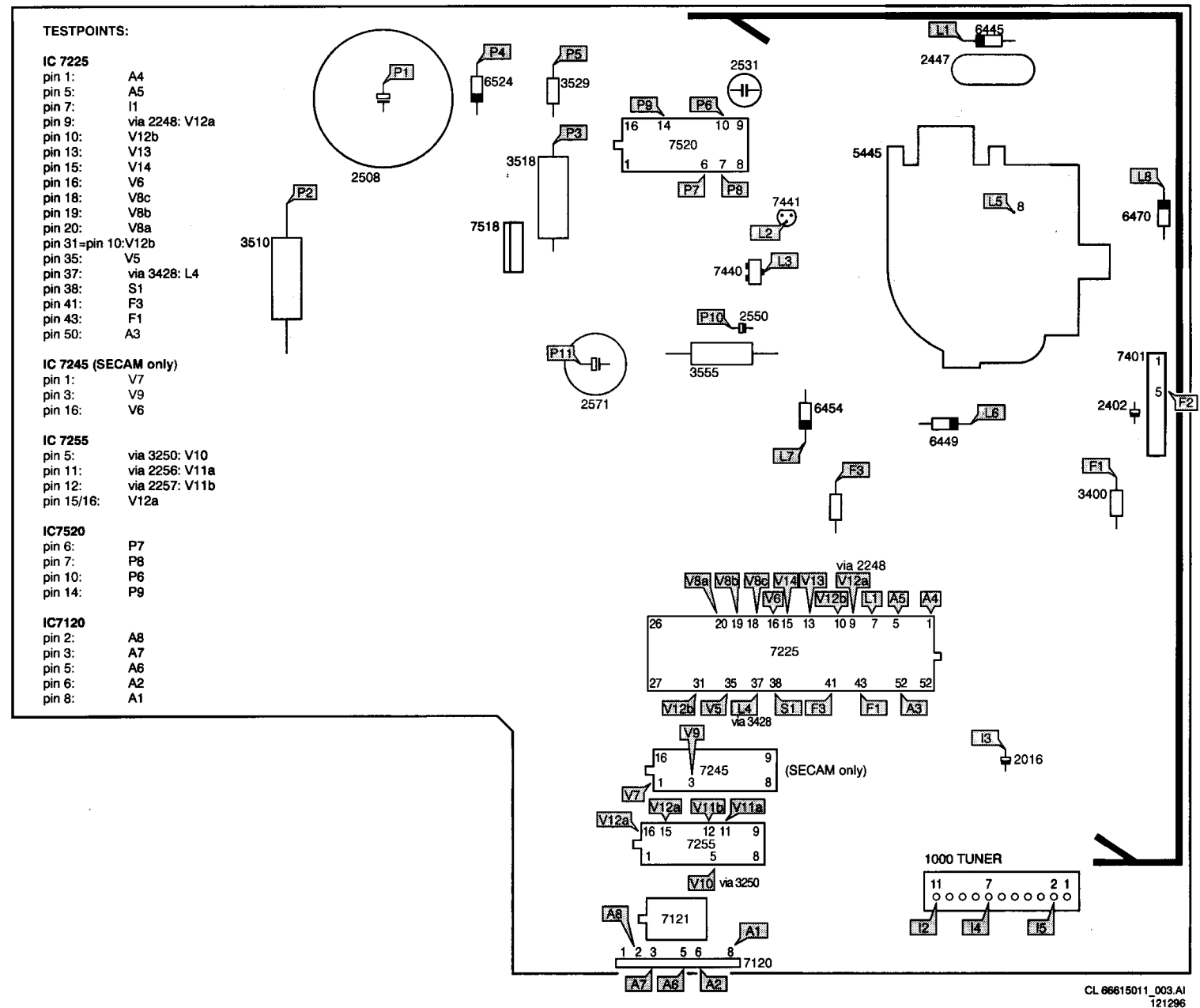


Fig. 5.1

CRT PANEL

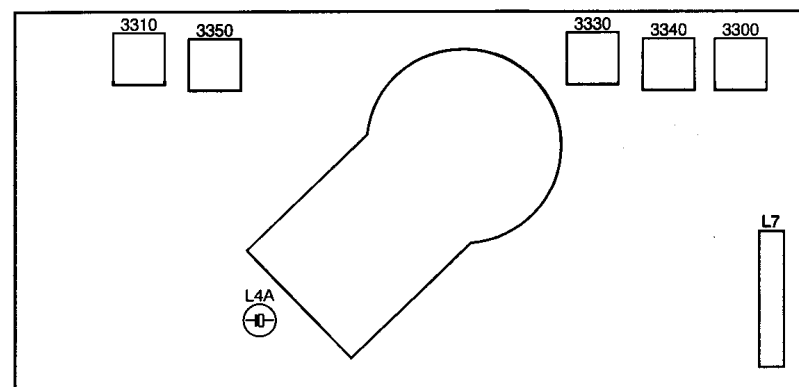
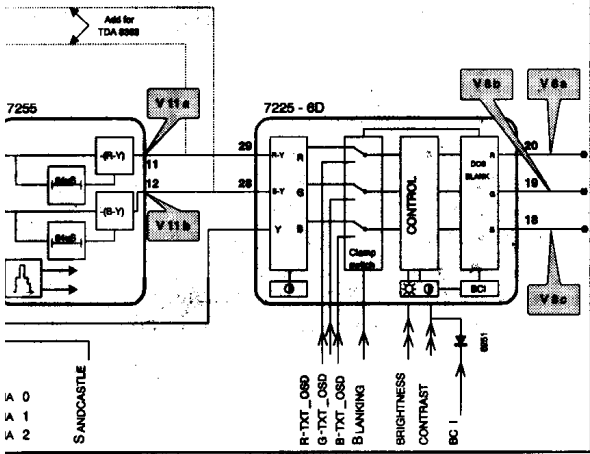


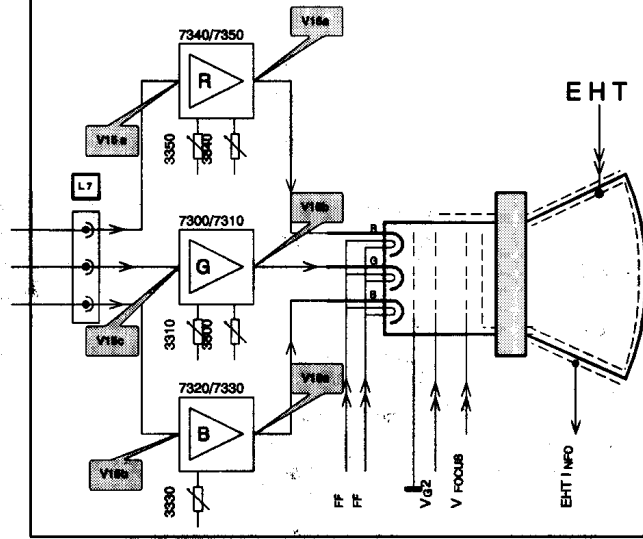
Fig. 5.2

Diagramme synoptique

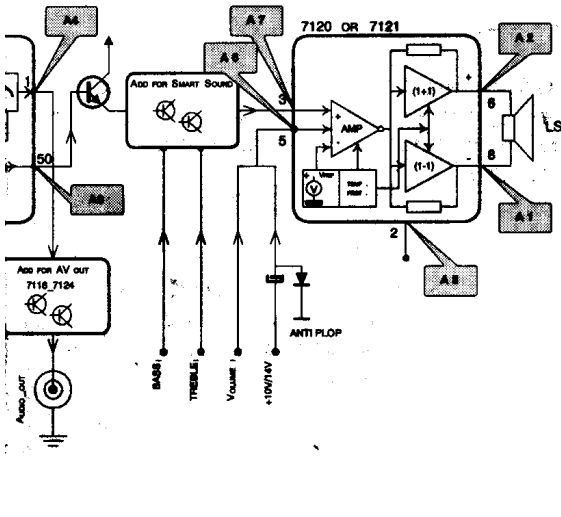
VIDEO & CHROMA PROCESSING A7

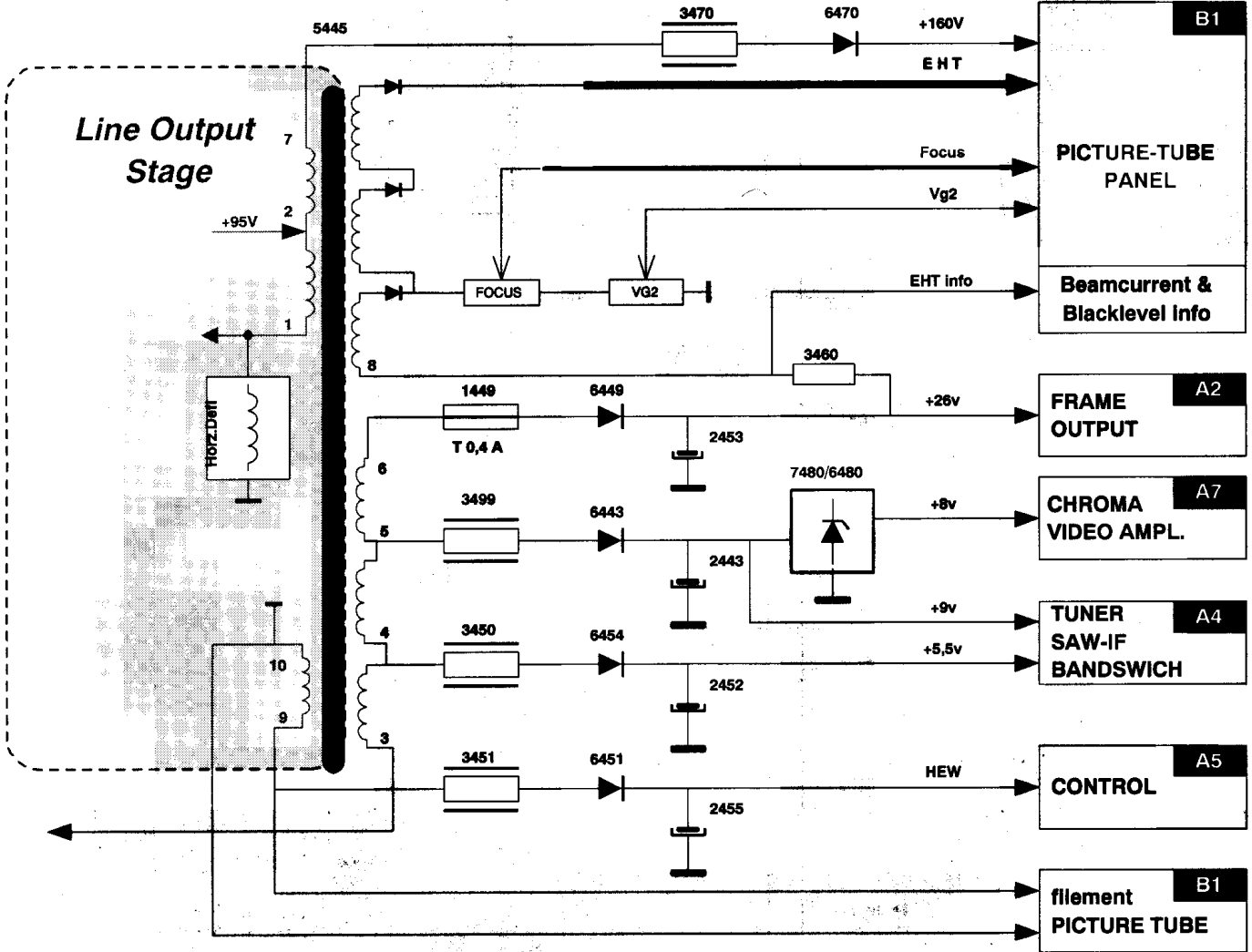
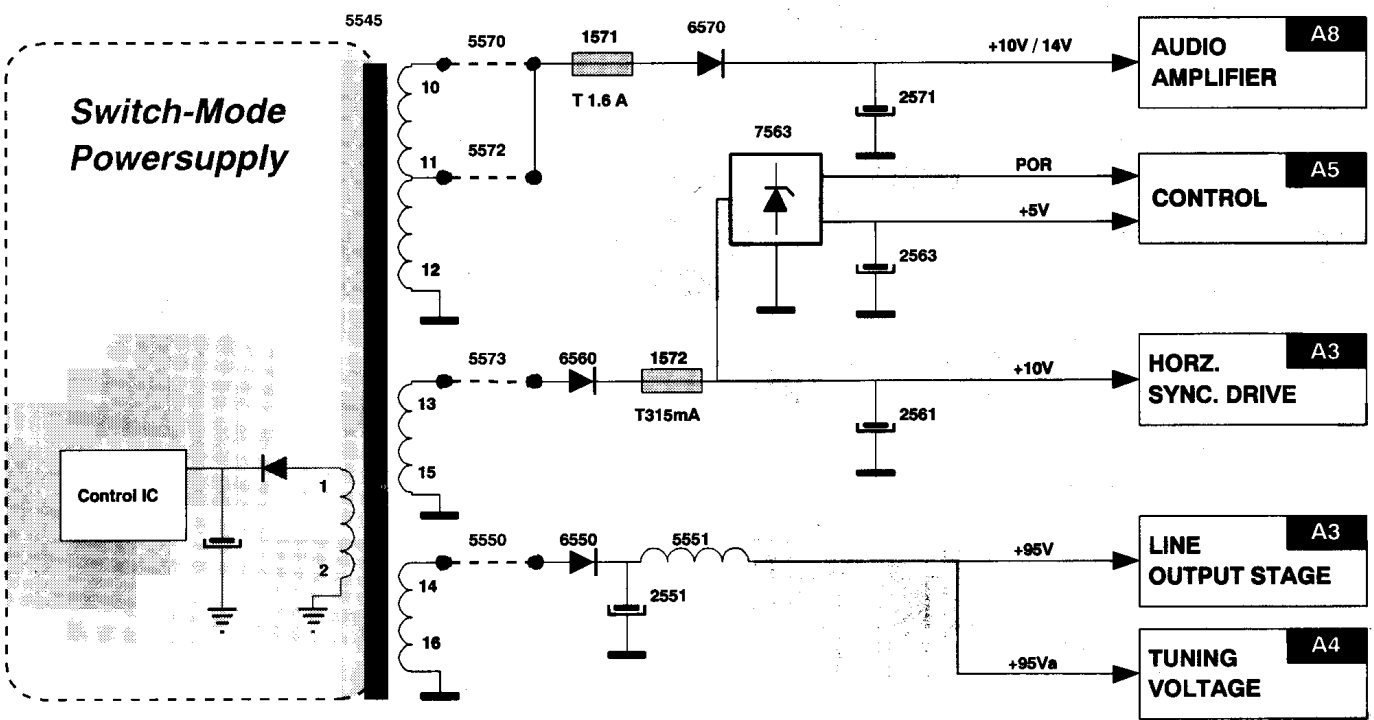


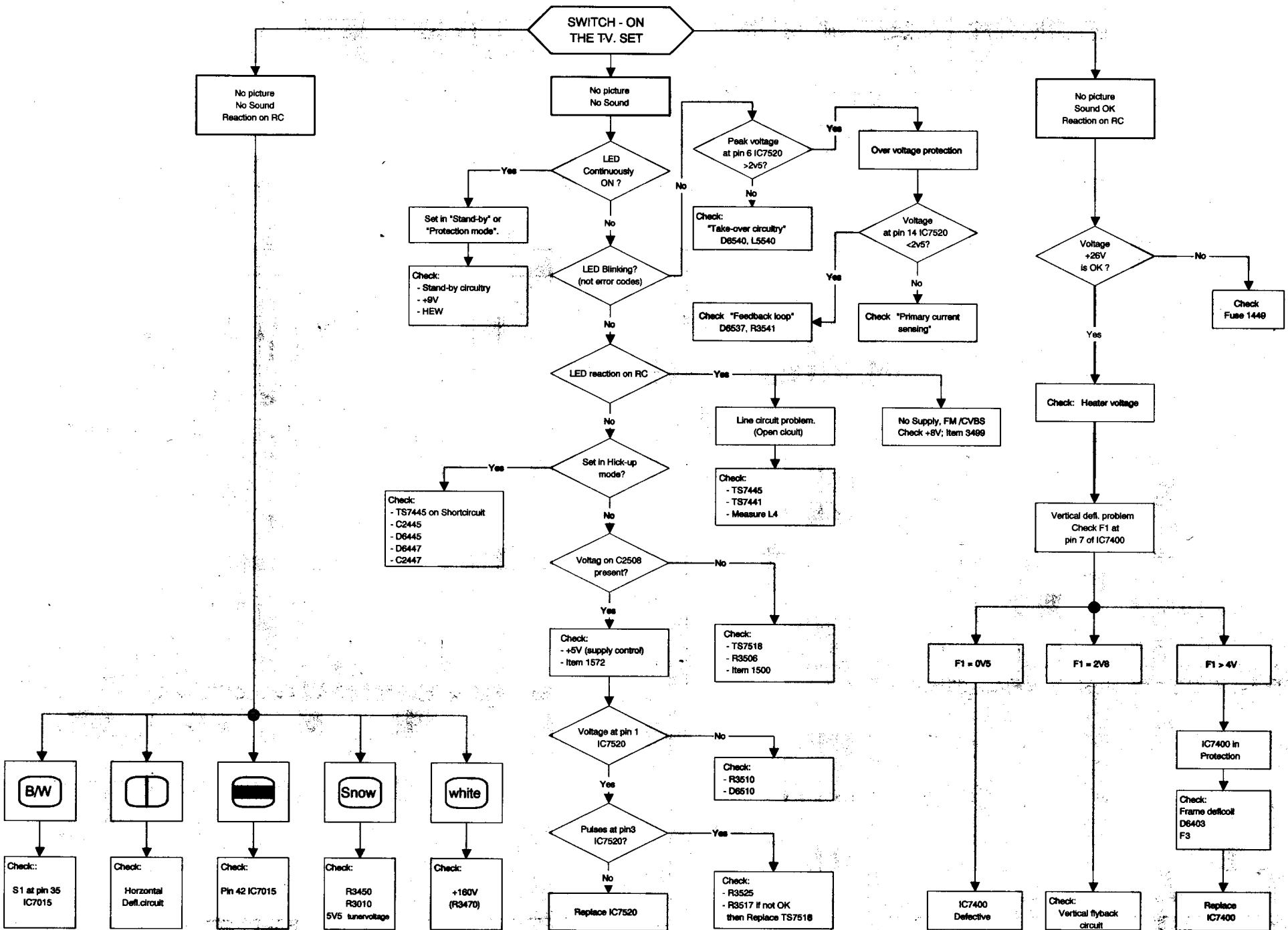
B1 CRT MODULE



SOUND AMPLIFIER A8







Repair facilities

6.1 Functional blocks

On both the service printing on the copper and the component side, functional blocks are indicated by lines and text.

6.2 Test points

The L7.1 chassis is equipped with test points in the service printing on both sides of mono-board. These test points are referring to the functional blocks as mentioned above:

- * P1-P2-P3, etc.: Test points for the power supply
- * L1-L2-L3, etc.: Test points for the line drive and line output circuitry
- * F1-F2-F3, etc.: Test points for the frame drive and frame output circuitry
- * S1-S2-S3, etc.: Test points for the synchronization circuitry
- * V1-V2-V3, etc.: Test points for the video processing circuitry
- * A1-A2-A3, etc.: Test points for the audio processing circuitry
- * C1-C2-C3, etc.: Test points for the control circuitry
- * T1-T2-T3, etc.: Test points for the teletext processing circuitry

The numbering is done in a for diagnostics logical sequence; always start diagnosing within a functional block, in the sequence of the relevant test points, for that functional block.

6.3 Service mode

The service mode can be split into two parts: Service Default Mode (SDM) and Service Alignment Mode (SAM). For L7.1 these modes will be replaced by a combined mode, called SDAM.

The control system offers some features, which can be used by the service.

To entry the Service mode you have two possibilities:

- SDAM entry by Dealer Service Tool
- Short-circuit service pins M24 and M25 on PCB and switch power-on.

To leave the Service mode push the stand-by button; the error buffer will be cleared !!

Features are:

- Service settings after entry
- Service (sub)menu selection
- Error buffer display
- Software version & identification display
- Life timer (run timer) display

6.3.1 The initial state after switching on in service mode is:

System:

- For Multi-Europe sets PAL-BG
- For Multi-France sets SECAM-L
- For Bi-Norma and Tri-Norma sets PAL-M

Tuning:

- For sets with VST tuning:
Programme number 1 is selected and the system will be tuned at the tuning data (for programme 1) read from EEPROM
- For sets with PLL tuning:
Tune to a frequency of 475.25 MHz.

Further settings:

- The automatic switch off (no IDENT) timer and the sleep timer will be ignored.
- The child lock will be disabled.
- If the TV set was in hotel mode, this mode is disabled as long as the TV is in service mode.
- Brightness, saturation, sharpness, contrast and balance are initialised on 50% level.
- The volume is set to 25% level.
- After initialisation the TV set is normally controllable.
- To indicate that the TV is in service mode an "S" will be displayed (in green) in the top right corner of the screen. All other OSD will be in red.
- All displayed text strings in service mode are in English.
- The TV set will remain in SDAM after switching of by main switch; with stand-by you will leave this mode.

6.3.2 Other features

RAM test

At every start up of the TV, a read after write test for the complete RAM will be performed. If this check fails, the appropriate error number will be written in the error buffer. The patterns will be chosen in such a way that every bit of all bytes, will be written high and low.

Life timer (run timer)

During the life time cycle of the TV set a life timer is kept. This life timer only counts the normal operation hours, not the stand-by hours. Also at every switch on the life timer is incremented by one.

Error buffer

The last five errors, remembered from the EEPROM, are shown in the service main menu. This is called the error buffer. An error will be added to the buffer if this error differs from the last error in the buffer. The last found error is displayed on the left.

Example: Suppose the display shows:
3 4 1 3 1. This means the last found error is error number 3; the last found error but one is error number 4, and so on.
30000
43000
34300

6.4 Error codes

The following error numbers have been defined:

- 0 = No error
- 1 = Internal RAM error
- 2 = General I²C error
- 3 = EEPROM Configuration error (Checksum error)
- 4 = I2C error (TDA9840 / TDA9852)
- 5 = I2C error (TDA8374/75) (NOT IN L7.1)
- 6 = EEPROM error
- 7 = I²C error (PLL tuner)

Repair facilities

6.5 SDAM mode

This menu is being displayed whenever SDAM is entered. In this menu the error buffer can be inspected, and the option byte(s) can be (re)programmed. The overview of the menu is shown below:

Explanation:

02031	The hexadecimal representation of the option byte contents.
3427	The hexadecimal value of the life timer.
2.2.1	The software identification, version and cluster.
S	The character "S" to indicate that the TV set is in service mode.
OP	A two character short name for the option to be selected.
VALUE	The value of the selected option.

OPTION CODE	OPERATION	SOFTWARE	S
02031	HOURS	VERSION	
	3427	2.2.1	
ERROR		34300	
OP		VALUE	

The MENU UP/DOWN command can be used to select the next/previous option; the MENU LEFT/RIGHT command can be used to change the option value.

The possible options are listed in the following table:

Table: Options description for L7 versions

Europe version

Full option name	Option name abbreviation	Value range	Available for
Virgin mode	VI	0 = off, 1 = on	Asian Pacific, Latin America, USA Bit 7 of byte 0
Hotel mode	HO	0 = not present, 1 = present	Asian Pacific PAL, Latin America Bit 6 of byte 0
Volume status	VS	0 = stored for all, 1 = stored per channel	Asian Pacific PAL Bit 5 of byte 0
Child lock	CL	0 = not present, 1 = present	Asian Pacific, Latin America, USA Bit 4 of byte 0
Hue	HU	0 = not present, 1 = present	Asian Pacific PAL Bit 3 of byte 0
AV source	AV	0 = not present, 1 = present	Asian Pacific, Latin America, USA Bit 2 of byte 0
UHF only	UH	0 = not present, 1 = present	Asian Pacific PAL Bit 1 of byte 0
Smart sound	SS	0 = not present, 1 = present	Asian Pacific PAL Bit 0 of byte 0
Smart picture	SP	0 = not present, 1 = present	Asian Pacific PAL Bit 7 of byte 1
Auto scan	AS	0 = not present, 1 = present	Asian Pacific, Latin America, USA Bit 6 of byte 1
60/80 programmes	PR	0 = 60 programmes, 1 = 80 programmes	Asian Pacific PAL Bit 5 of byte 1
Magnavox	MV	0 = not Magnavox, 1 = Magnavox	Asian Pacific PAL Bit 4 of byte 1
National brand	NB	0 = not National brand, 1 = National brand	Asian Pacific PAL Bit 3 of byte 1
Europe	EU	0 = not Europe, 1 = Europe	Asian Pacific PAL Bit 2 of byte 1
System	SY	0 = Single system (AP PAL, LatAm Tri-Norma), 1 = LA_BINORMA (LatAm Tri-Norma), 2 = LA_TRINORMA (LatAm Tri-Norma), 3 = AP-Multi, 4 = AP-Dual	Asian Pacific PAL, Latin America Tri-Norma Byte 2 is 0000 Byte 2 is 0001 Byte 2 is 0010 Byte 2 is 0011 Byte 2 is 0100

LATAM version

Full option name	Option name abbreviation	Value range	Available for
Virgin mode	VI	0 = off, 1 = on	Bit 7 of byte 0
Child lock	CL	0 = not present, 1 = present	Bit 6 of byte 0
AV source	AV	0 = not present, 1 = present	Bit 5 of byte 0
Manual skip	SK	0 = not present, 1 = present	Bit 4 of byte 0
Vol limiter	VL	0 = not present, 1 = present	Bit 3 of byte 0
Auto scan	AS	0 = not present, 1 = present	Bit 2 of byte 0
System	SY	0 = Single system (AP PAL, LatAm Tri-Norma), 1 = LA_BINORMA (LatAm Tri-Norma), 2 = LA_TRINORMA (LatAm)	Byte 2 = 0000 Byte 2 = 0001 Byte 2 = 0010

USA version

Full option name	Option name abbreviation	Value range	Available for
Virgin mode	VI	0 = off, 1 = on	Bit 7 of byte 0
Child lock	CL	0 = not present, 1 = present	Bit 6 of byte 0
Wake timer	WU	0 = not present, 1 = present	Bit 5 of byte 0
AV (ext)	AV	0 = not present, 1 = present	Bit 4 of byte 0
Vol limiter	VL	0 = not present, 1 = present	Bit 3 of byte 0
Auto scan	AS	0 = not present, 1 = present	Bit 2 of byte 0
Auto Cable detect	AC	0 = disable , 1 = enable	Bit 1 of byte 0

LATAM close caption

Full option name	Option name abbreviation	Value range	Available for
Virgin mode	VI	0 = off, 1 = on	Bit 7 of byte 0
Child lock	CL	0 = not present, 1 = present	Bit 6 of byte 0
AV source	AV	0 = not present, 1 = present	Bit 5 of byte 0
Manual skip	SK	0 = not present, 1 = present	Bit 4 of byte 0
Vol limiter	VL	0 = not present, 1 = present	Bit 3 of byte 0
Auto scan	AS	0 = not present, 1 = present	Bit 2 of byte 0

NTSC-AP

Full option name	Option name abbreviation	Value range	Available for
Virgin mode	VI	0 = off, 1 = on	Bit 7 of byte 0
Child lock	CL	0 = not present, 1 = present	Bit 6 of byte 0
AV source	AV	0 = not present, 1 = present	Bit 5 of byte 0
Auto scan	AS	0 = disable, 1 = enable	Bit 4 of byte 0
Auto Cable detect	AC	0 = disable, 1 = enable	Bit 3 of byte 0

The format of the option-code is the following:

```

7 6 5 4 3 2 1 0   7 6 5 4 3 2 1 0   7 6 5 4
x x x x x x x x   x x x x x x x x   x x x x
byte 0             byte 1             byte 2

```

All option-codes are presented hexadecimal in the service mode and not used bits are always 0.

Example: Option code C 0 1 0 4 in an Europe set means:
binary 1100 0000 0001 0000 0100

This is a set with the following configuration:

- Virgin mode on
- Hotel mode present
- Magnavox set
- System PAL-I / PAL DK

If the EEPROM is replaced by a new one the set has to be installed according the option code.

6.6 Dealer remote used as a Dealer Service Tool (DST)

The purpose of the dealer remote is to enter the Service Alignment Mode or the Service Default Mode of the L7 chassis, simply by pressing respectively the ALIGN or the DEFAULT key of the DST.

DEFAULT key of the DST.

The main features are:

- Entering the dealer mode and executing commands in this mode must be done by RC5 remote control.
- Entry of the dealer mode is possible in all states, except from stand-by.
- Read the error buffer even if the OSD is not working at all. This is done via the blinking LED procedure (see 6.6).
- All software is suspended till the dealer remote mode is left.

The dealer mode is left if:

- The stand-by command is received

6.7 Blinking LED procedure

Via the DIAGNOSE 1 (for error 1) through the DIAGNOSE 5 (for error 5) commands of the DST, the error buffer can be made visible via the blinking LED. This is useful if the screen is not working properly.

The method is to use the LED pulses with as many pulses as the error number, followed by a time period of 3 seconds in which the LED is off.

E.g. error code 4 will result in four times the sequence LED on for 0.25 seconds / LED off for 0.25 seconds. After this sequence the LED will be off for 3 seconds.

6.8 Downloading of tuning data with the DST

Downloading of tuning data (programme number, frequency and system) via the DST will be made possible.

This downloading is only possible in the version containing PLL tuning for Europe.

6.9 Hotel-mode and the hospital mode

The L7 chassis has one special mode, called the hotel mode.

Hotel mode:

- Installation menu cannot be entered.
- When entering the hotel mode the maximum volume will be the current value.
- The set will always switch to a selectable channel when the set is switched on.

Entering the hotel-mode:

- Select channel 38
- Push the menu button on the local keyboard and the OSD-button of the RC simultaneously for 3 seconds.

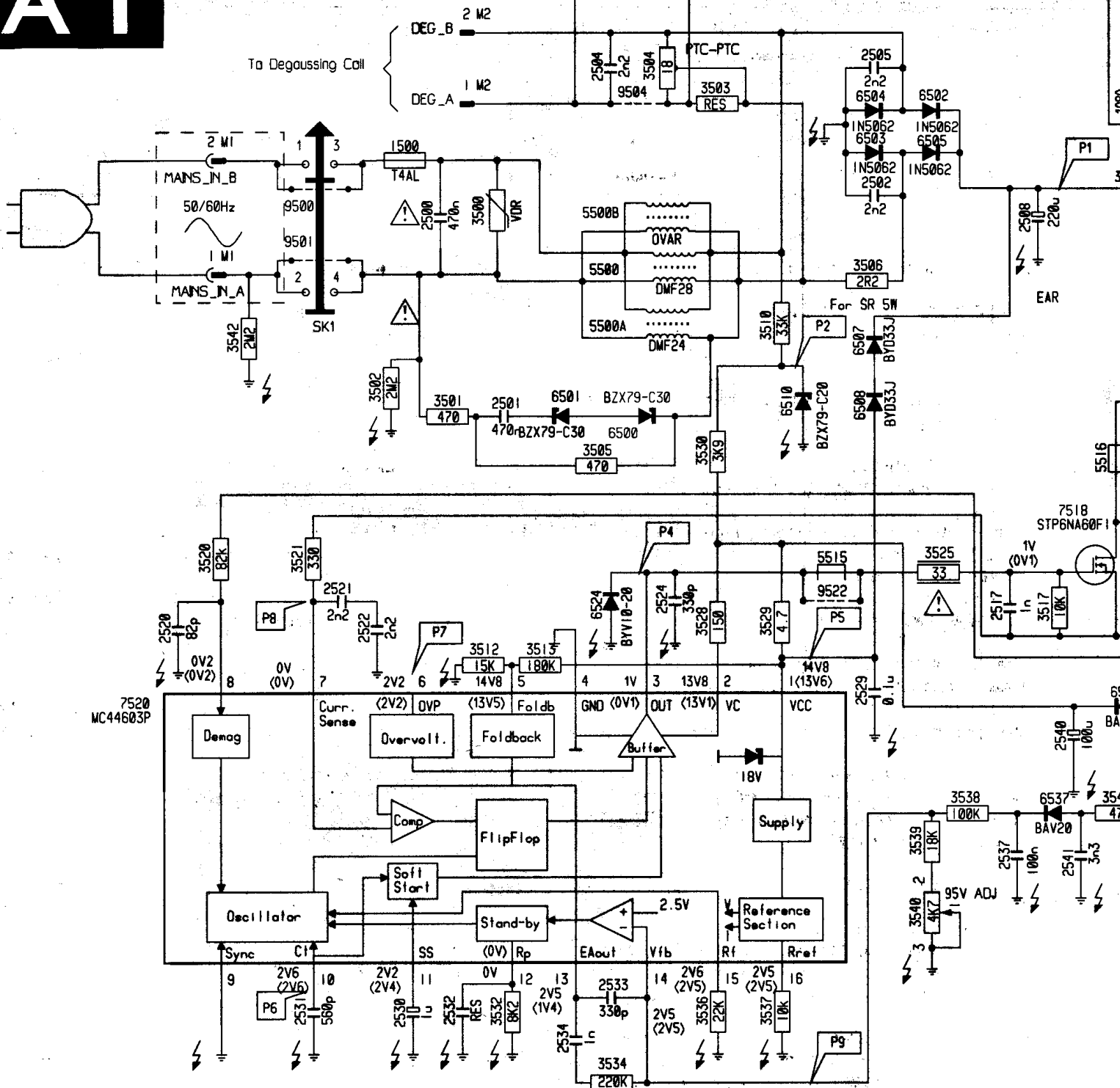
Leaving the hotel mode:

- Same as entering the hotel mode.

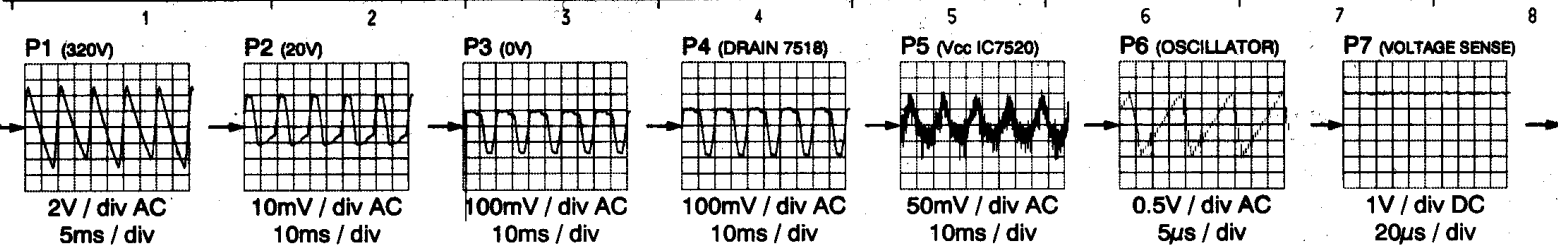
OSD will tell if hotel mode is on or off.

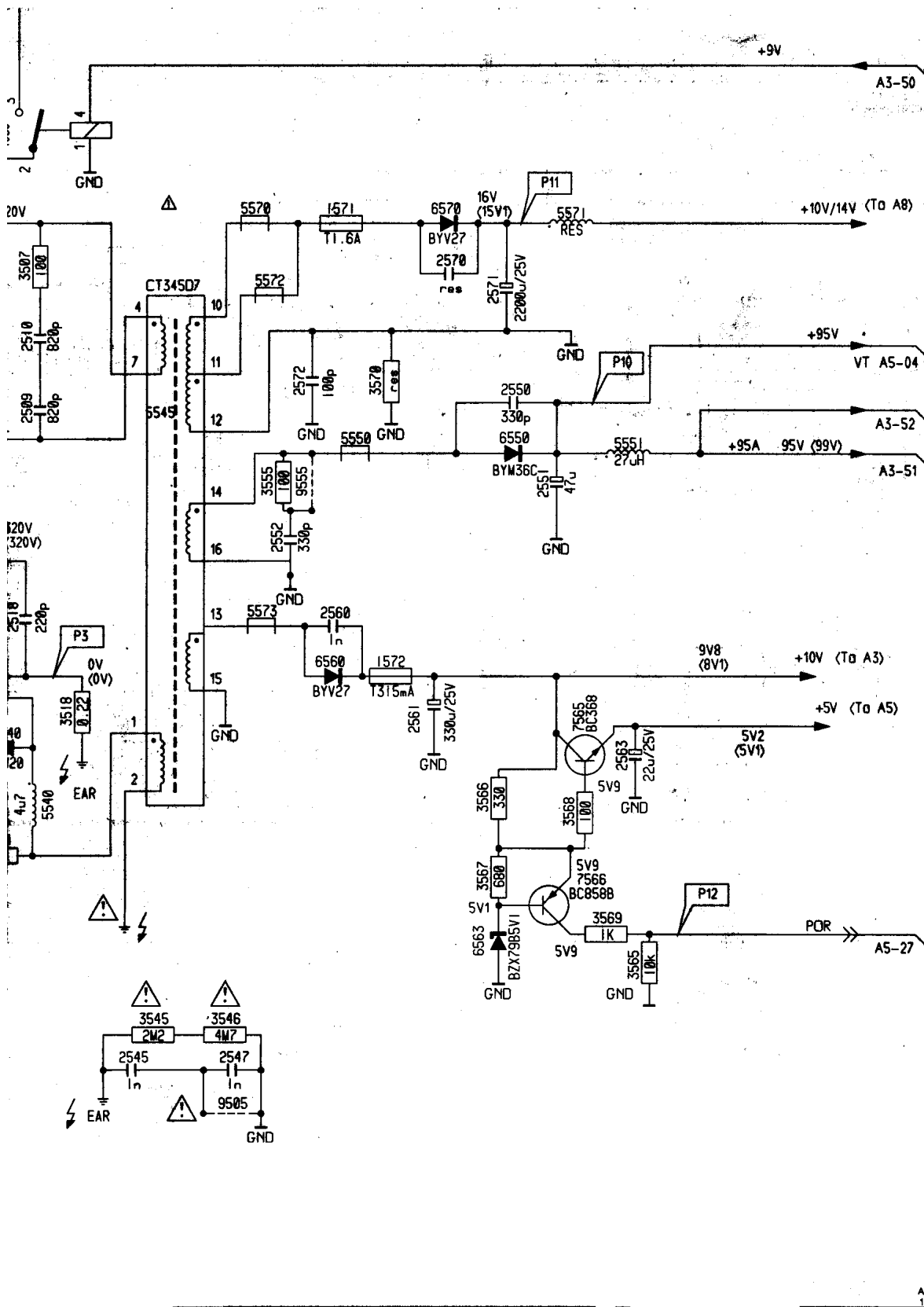
A1

POWER SUPPLY

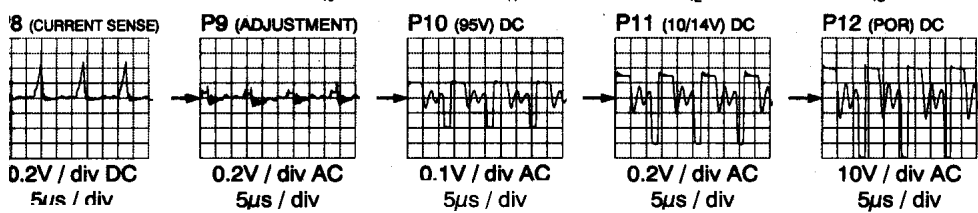


..V Operation Mode
 (.V) Standby Mode
 ⚡ HOT GROUND





1080	B 8	6550	D12
1500	B 3	6560	E10
1571	B11	6563	G12
1572	E11	6570	B11
2500	B 3	7518	D 8
2501	B D 4	7520	F 1
2502	B 6	7565	F12
2504	A 5	7566	G12
2505	A 6	9500	B 2
2508	B 8	9501	C 3
2509	B 8	9504	A 5
2510	C 8	9505	H10
2517	F 7	9522	E 6
2518	F 7	9555	D10
2520	F 7	M1	C 2
2521	F 7	M1	B 2
2522	F 7	M2	A 4
2524	F 7	M2	A 4
2529	F 7	M2	A 4
2530	F 7	SK1	C 3
2531	H 2		
2532	H 4		
2533	H 5		
2534	H 4		
2537	G 7		
2540	G 8		
2541	H 9		
2545	H 9		
2547	H10		
2550	C12		
2551	D12		
2552	D10		
2560	E11		
2561	F11		
2563	F13		
2570	B11		
2571	C12		
2572	C10		
3500	C 4		
3501	D 4		
3502	D 4		
3503	D 4		
3504	D 4		
3505	D 4		
3506	D 4		
3507	D 4		
3510	D 4		
3512	D 4		
3513	D 4		
3517	D 4		
3518	D 9		
3520	D 9		
3521	D 9		
3525	D 9		
3528	D 9		
3529	D 9		
3530	D 9		
3532	H 4		
3534	H 5		
3536	H 5		
3537	H 6		
3538	F 7		
3539	F 7		
3540	G 7		
3541	F 8		
3542	C 2		
3545	H 9		
3546	H10		
3555	D10		
3566	G13		
3567	F12		
3568	G12		
3569	F12		
3570	G12		
5500	C11		
5500A	C15		
5500B	B 5		
5515	D 8		
5516	D 8		
5540	C 9		
5545	C 9		
5550	D11		
5551	D13		
5570	B10		
5571	B12		
5572	C10		
5573	E10		
6500	D 5		
6501	D 4		
6502	B 7		
6503	B 6		
6504	B 6		
6505	B 7		
6507	C 6		
6508	D 6		
6510	D 6		
6524	F 6		
6537	F 6		
6540	F 6		

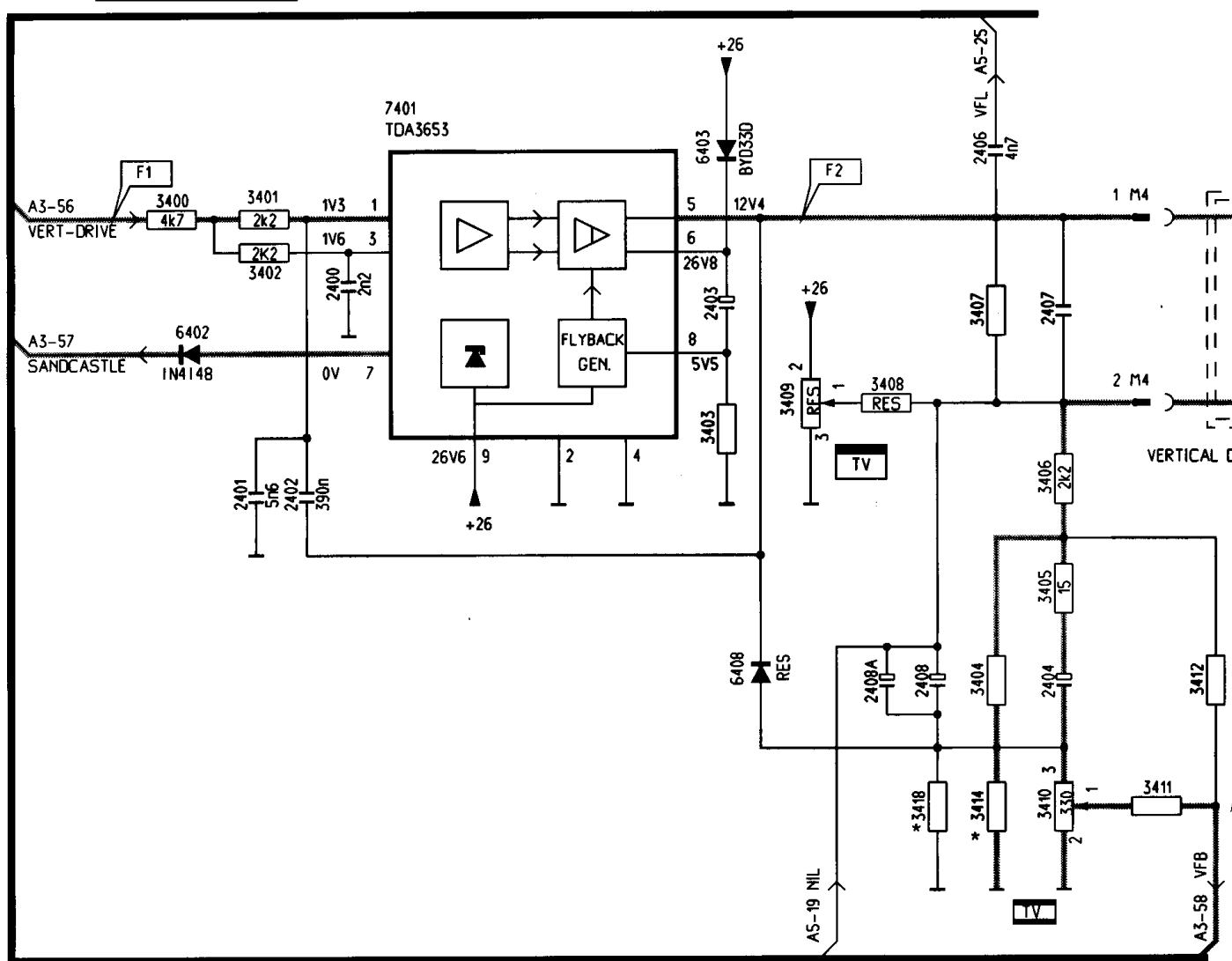


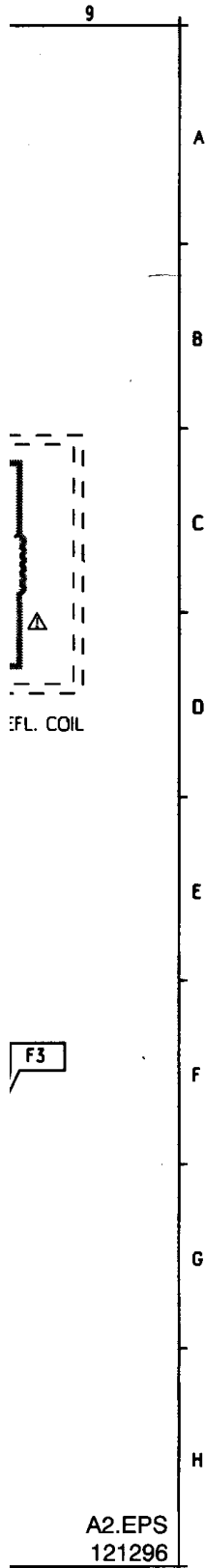
OSC_A1.AI
080197

2400	C 3	2403	C 5	2407	C 7	3400	C 2	3403	D 5	3406	D 7	3409	D 6	3412	E 8	6402	C 2	7401	B 4
2401	D 3	2404	F 7	2408	F 7	3401	C 3	3404	F 7	3407	C 7	3410	F 7	3414	F 7	6403	B 5	M4	C 8
2402	D 3	2406	B 7	2408A	E 6	3402	C 3	3405	E 7	3408	D 6	3411	F 8	3418	F 7	6408	F 6	M4	D 8

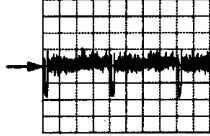
A2

FRAME-OUTPUT



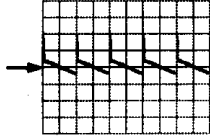


F1 (PIN 43 IC7225)



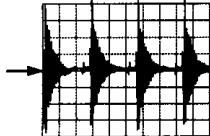
2V / div AC
5ms / div

F2 (VFL)



20V / div AC
10ms / div

F3 (VFB)

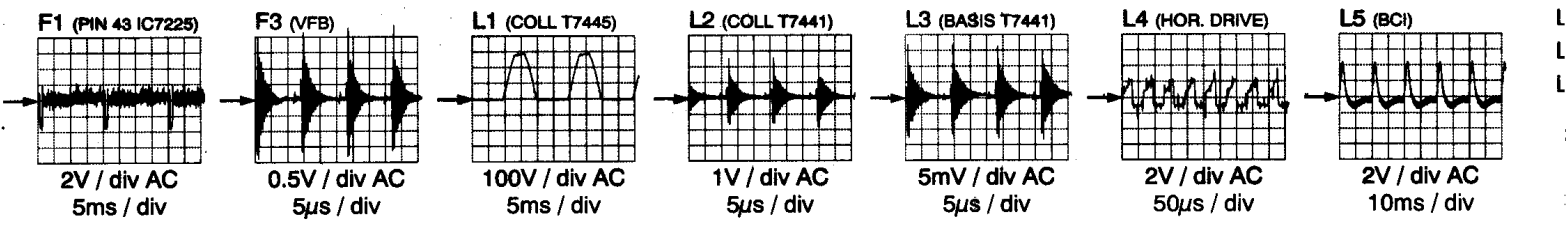
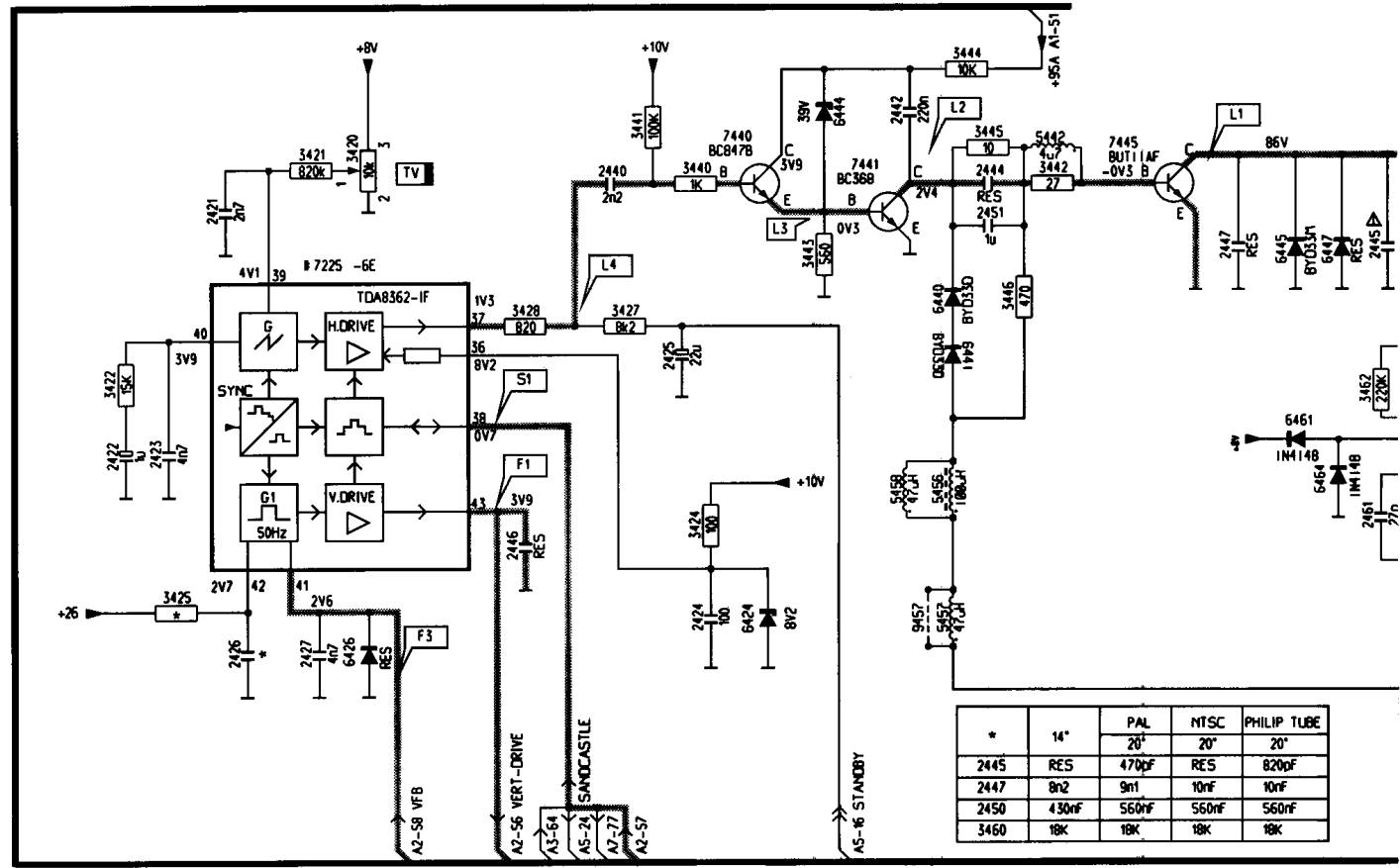


0.5V / div AC
5μs / div

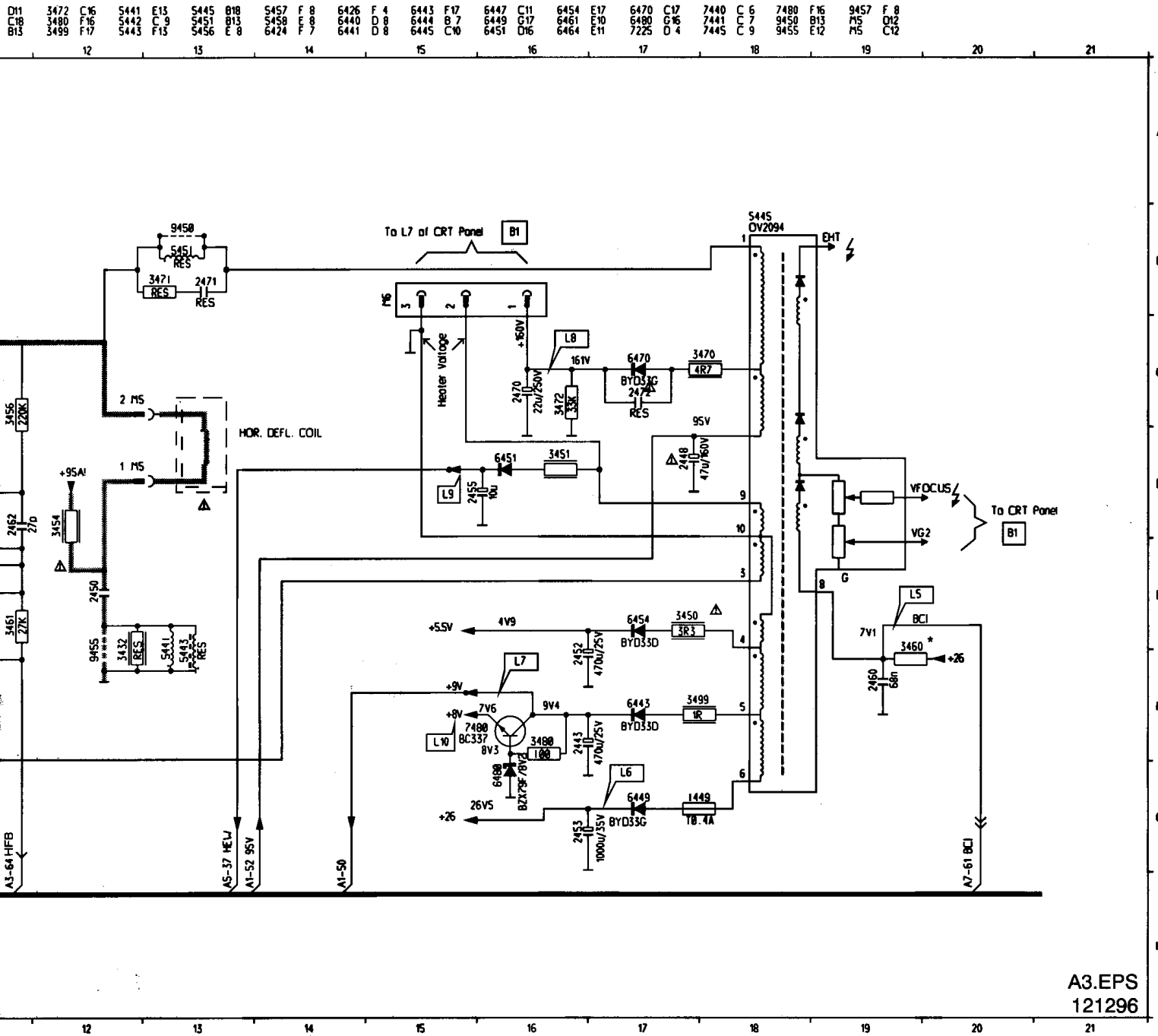
OSC_A2.AI
101296

1449 C17 2423 F 2022 2426 F 3 2442 B 8 2445 C11 2448 D17 2452 F16 2460 F19 2470 C16 3420 C 4 3424 F 6 3428 D 5 3441 C 6 3444 B 8 3450 F17 3456 C11 3462
 2421 C 3 2424 F 2022 2427 F 4 2443 F16 2446 C10 2450 E12 2453 D16 2461 E11 2471 B13 3421 C 4 3425 F 6 3429 D 6 3442 C 6 3445 B 8 3451 D16 3456 F18 3470
 2422 E 2 2425 D 6 2440 C 8 2444 C 8 2447 C10 2451 C 8 2455 D15 2462 D11 2472 C17 3422 D 2 3425 F 6 3440 C 6 3443 C 6 3446 D 8 3454 D12 3461 E11 3471

A3 SYNC+LINE DRIVE+HOR. DEFL+LOT



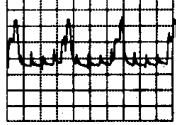
Synchronisierung + Ablenkung / Synchronisation + déviation



A3.EPS
121296

- 6 (26V) DC
- 7 (9V) DC
- 8 (160V) DC

S1 (SANDCASTLE)

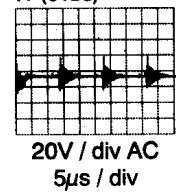
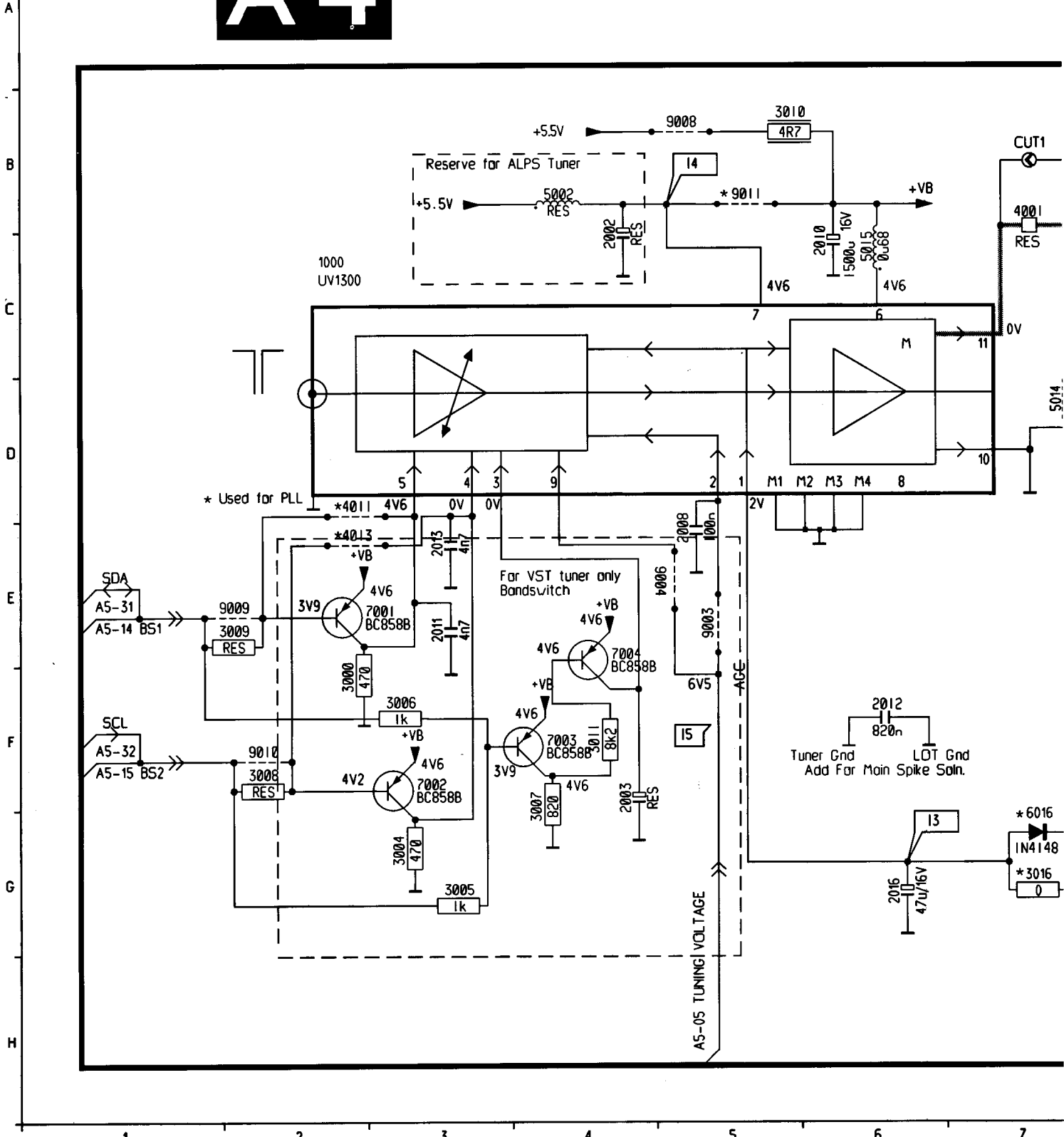


2V / div AC
50µs / div

OSC_A3.A1
080197

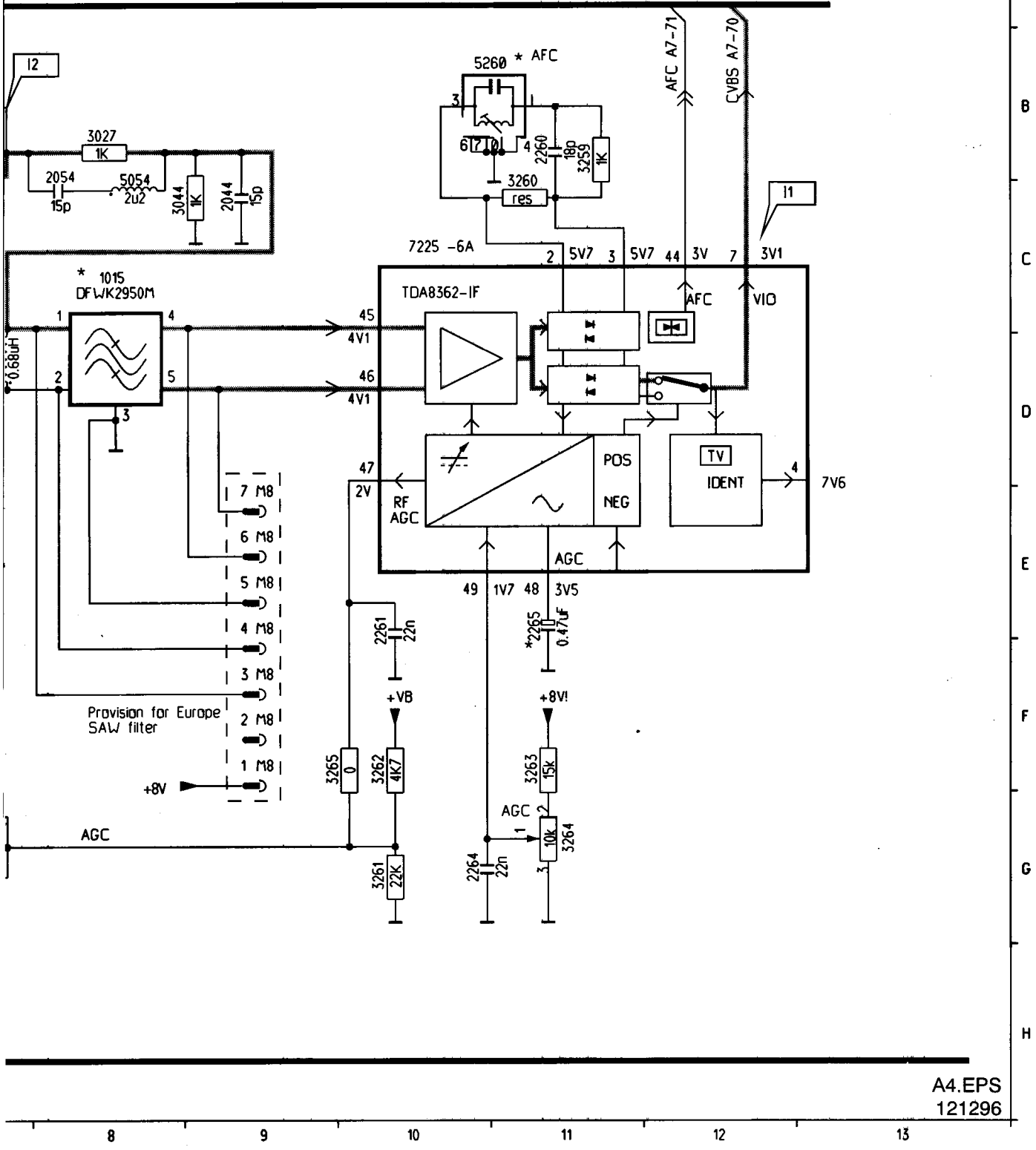
1000	C 2	2003	F 4	2011	E 3	2016	G 6	2260	B11	2265	E11	3005	G 3	3008	F 2	3011	F 4	3044	C 8	3261	G10
1015	C 8	2008	E 5	2012	F 6	2044	C 9	2261	E10	3000	F 2	3006	F 3	3009	E 2	3016	G 7	3259	B11	3262	F10
2002	C 4	2010	C 6	2013	E 3	2054	C 8	2264	G10	3004	G 3	3007	F 4	3010	B 5	3027	B 8	3260	C11	3263	F11

A4 TUNER+IF

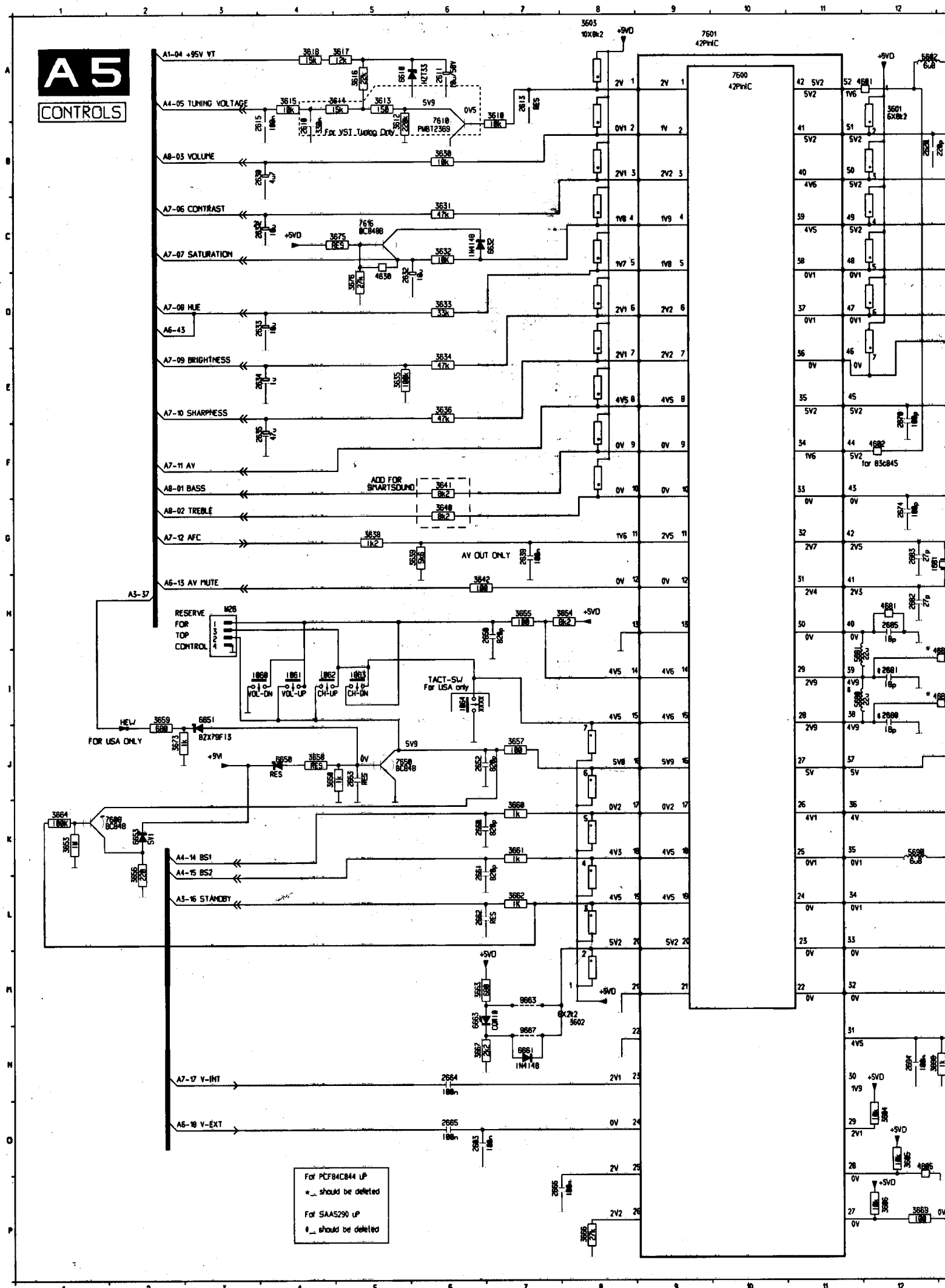


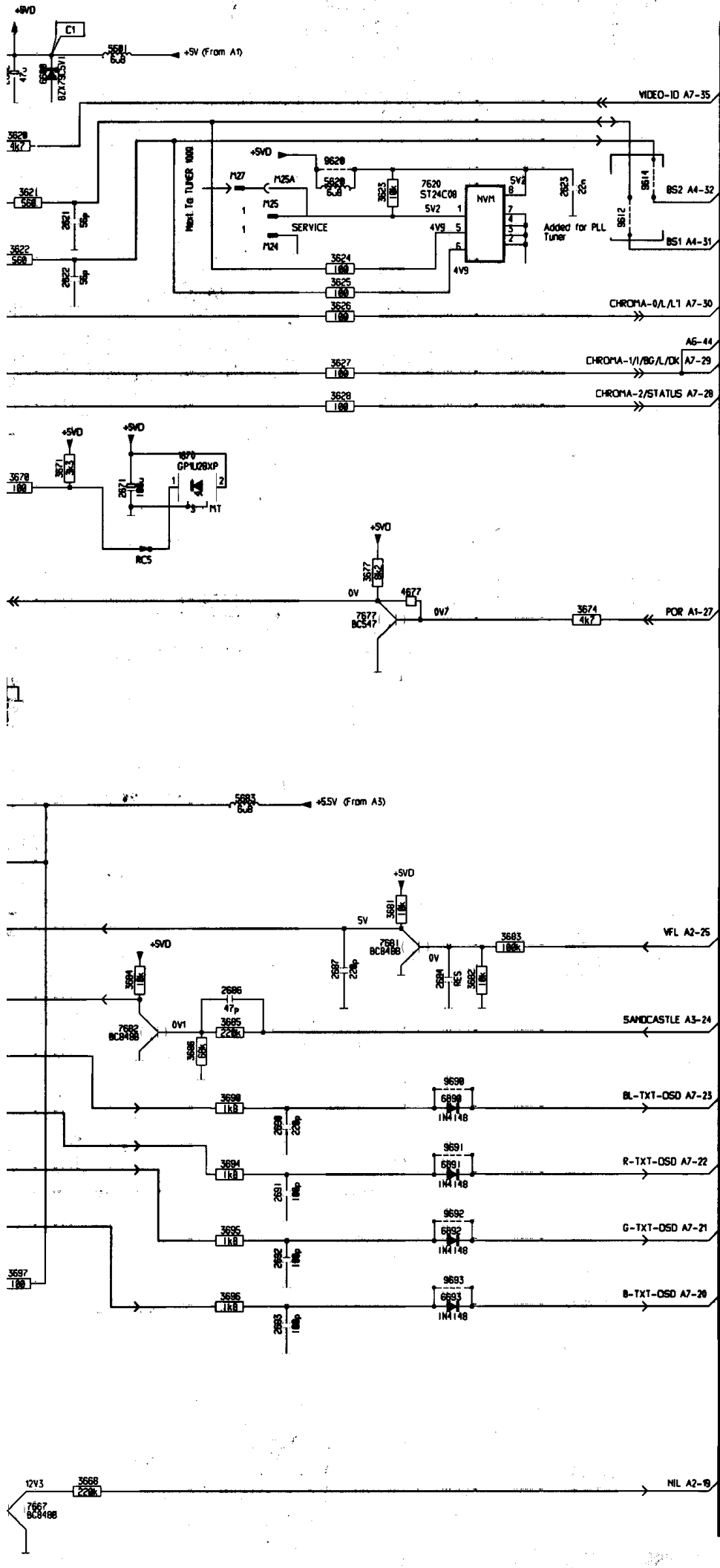
OSC_A4.AI
121296

3264	G11	4011	D 2	5014	D 7	5260	B10	7002	F 3	7225	C10	9008	B 5	9011	B 5	M8	F 9	M8	F 9
3265	F 9	4013	E 2	5015	C 6	6016	F 7	7003	F 4	9003	F 5	9009	F 2	M8	F 9	M8	F 9	M8	F 9
4001	B 7	5002	B 4	5054	C 8	7001	E 2	7004	E 4	9004	F 5	9010	F 2	M8	F 9	M8	F 9	M8	F 9
	8			9		10		11		12		13							



A5
CONTROLS



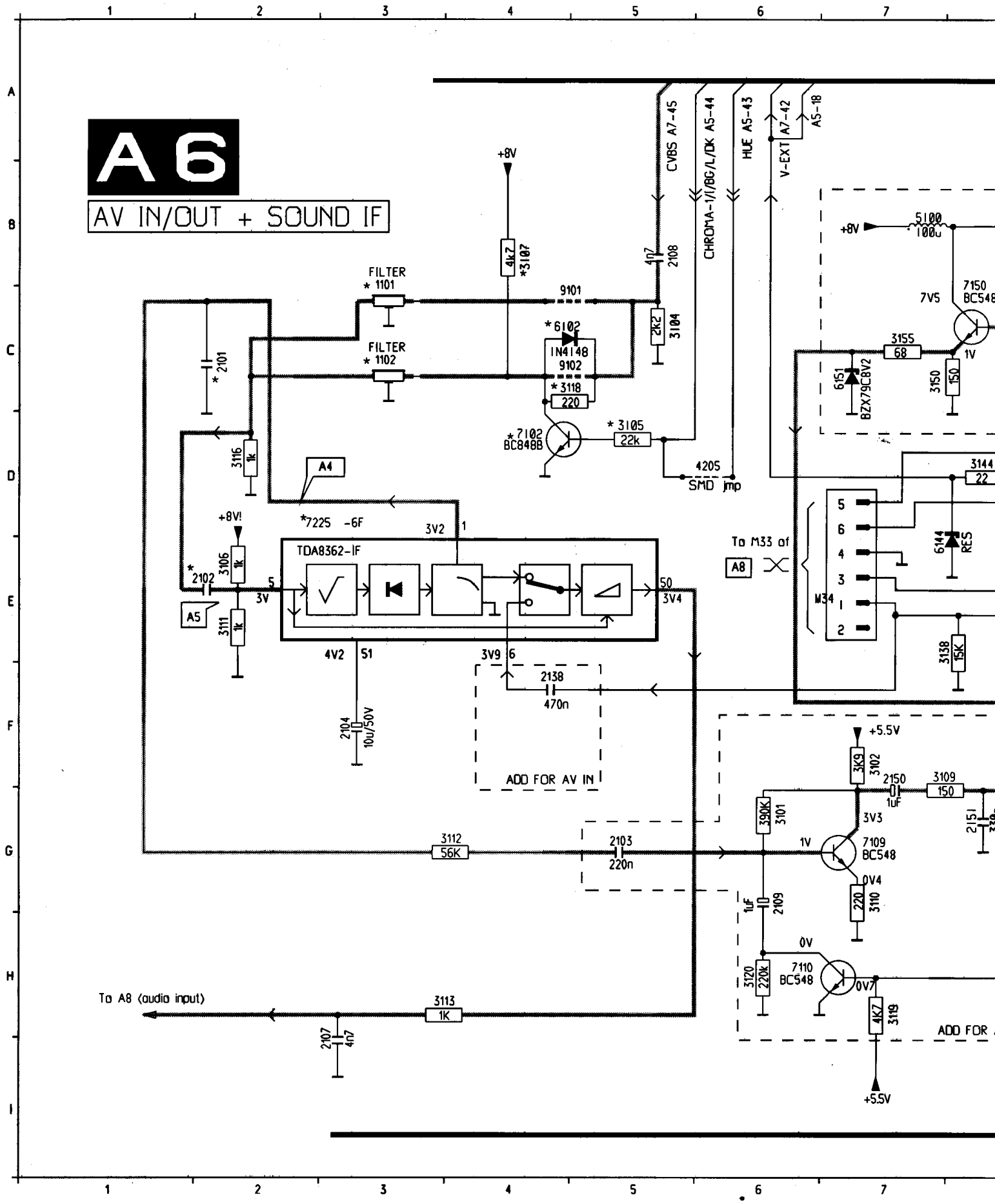


A5.EPS
171296

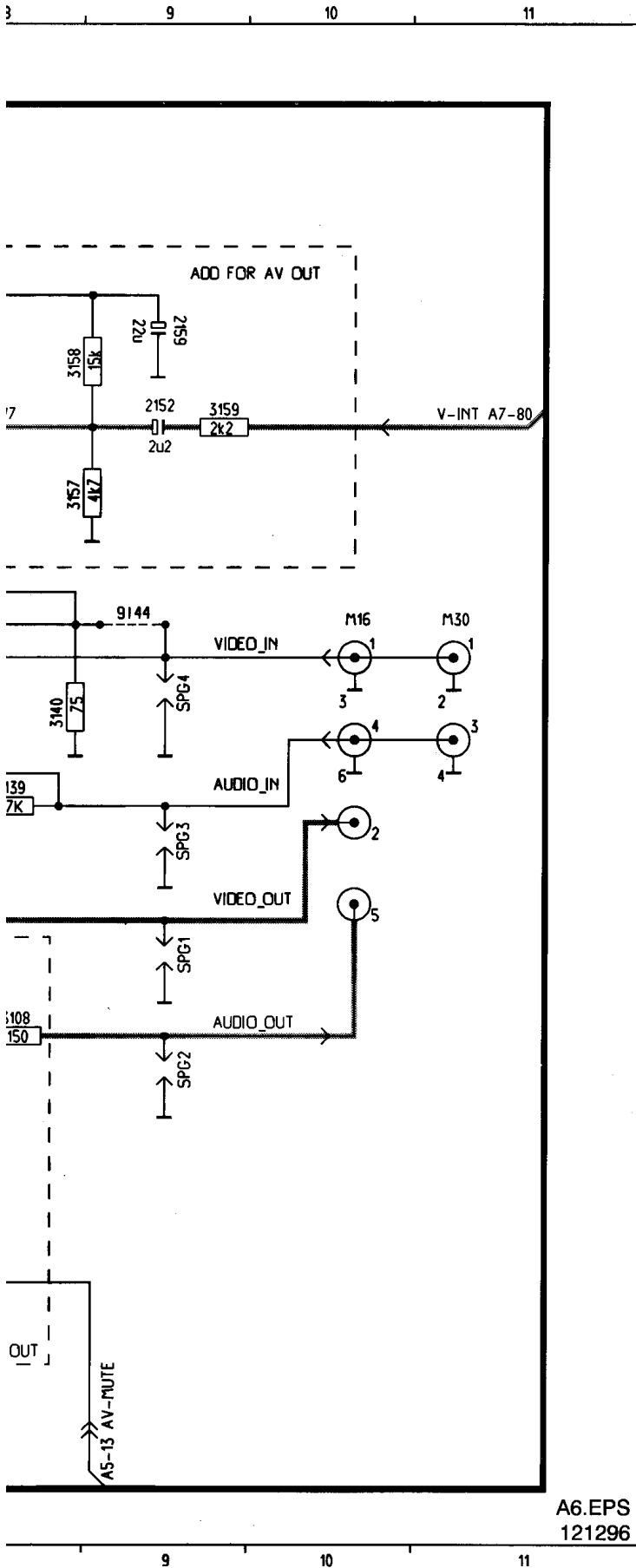
1	660	E4
2	661	A4
3	662	B4
4	663	A5
5	664	B5
6	665	C5
7	666	D5
8	667	E5
9	668	F5
10	669	G5
11	670	H5
12	671	I5
13	672	J5
14	673	K5
15	674	L5
16	675	M5
17	676	N5
18	677	O5
19	678	P5
20	679	Q5
21	680	R5
22	681	S5
23	682	T5
24	683	U5
25	684	V5
26	685	W5
27	686	X5
28	687	Y5
29	688	Z5
30	689	AA
31	690	AB
32	691	AC
33	692	AD
34	693	AE
35	694	AF
36	695	AG
37	696	AH
38	697	AI
39	698	AJ
40	699	AK
41	700	AL
42	701	AM
43	702	AN
44	703	AO
45	704	AP
46	705	AQ
47	706	AR
48	707	AS
49	708	AT
50	709	AU
51	710	AV
52	711	AW
53	712	AX
54	713	AY
55	714	AZ
56	715	BA
57	716	BB
58	717	BC
59	718	BD
60	719	BE
61	720	BF
62	721	BG
63	722	BH
64	723	BI
65	724	BJ
66	725	BK
67	726	BL
68	727	BM
69	728	BN
70	729	BO
71	730	BP
72	731	BQ
73	732	BR
74	733	BS
75	734	BT
76	735	BV
77	736	BW
78	737	BX
79	738	BY
80	739	BZ
81	740	CA
82	741	CB
83	742	CC
84	743	CD
85	744	CE
86	745	CF
87	746	CG
88	747	CH
89	748	CI
90	749	CJ
91	750	CK
92	751	CL
93	752	CM
94	753	CN
95	754	CO
96	755	CP
97	756	CQ
98	757	CR
99	758	CS
100	759	CT
101	760	CU
102	761	CV
103	762	CW
104	763	CX
105	764	CY
106	765	CZ
107	766	DA
108	767	DB
109	768	DC
110	769	DD
111	770	DE
112	771	DF
113	772	DG
114	773	DH
115	774	DI
116	775	DJ
117	776	DK
118	777	DL
119	778	DM
120	779	DN
121	780	DO
122	781	DP
123	782	DQ
124	783	DR
125	784	DS
126	785	DT
127	786	DU
128	787	DV
129	788	DW
130	789	DX
131	790	DY
132	791	DZ
133	792	EA
134	793	EB
135	794	EC
136	795	ED
137	796	EE
138	797	EF
139	798	EG
140	799	EH
141	800	EI
142	801	EJ
143	802	EK
144	803	EL
145	804	EM
146	805	EN
147	806	EO
148	807	EP
149	808	EQ
150	809	ER
151	810	ES
152	811	ET
153	812	EU
154	813	EV
155	814	EW
156	815	EX
157	816	EY
158	817	EZ
159	818	FA
160	819	FB
161	820	FC
162	821	FD
163	822	FE
164	823	FF
165	824	FG
166	825	FH
167	826	FI
168	827	FJ
169	828	FK
170	829	FL
171	830	FM
172	831	FN
173	832	FO
174	833	FP
175	834	FQ
176	835	FR
177	836	FS
178	837	FT
179	838	FU
180	839	FV
181	840	FW
182	841	FX
183	842	FY
184	843	FZ
185	844	GA
186	845	GB
187	846	GC
188	847	GD
189	848	GE
190	849	GF
191	850	GG
192	851	GH
193	852	GI
194	853	GJ
195	854	GK
196	855	GL
197	856	GM
198	857	GN
199	858	GO
200	859	GP
201	860	GQ
202	861	GR
203	862	GS
204	863	GT
205	864	GU
206	865	GV
207	866	GW
208	867	GX
209	868	GY
210	869	GZ
211	870	HA
212	871	HB
213	872	HC
214	873	HD
215	874	HE
216	875	HF
217	876	HG
218	877	HH
219	878	HI
220	879	HJ
221	880	HK
222	881	HL
223	882	HM
224	883	HN
225	884	HO
226	885	HP
227	886	HQ
228	887	HR
229	888	HS
230	889	HT
231	890	HU
232	891	HV
233	892	HW
234	893	HX
235	894	HY
236	895	HZ
237	896	IA
238	897	IB
239	898	IC
240	899	ID
241	900	IE
242	901	IF
243	902	IG
244	903	IH
245	904	II
246	905	IJ
247	906	IK
248	907	IL
249	908	IM
250	909	IN
251	910	IO
252	911	IP
253	912	IQ
254	913	IR
255	914	IS
256	915	IT
257	916	IU
258	917	IV
259	918	IW
260	919	IX
261	920	IY
262	921	IZ
263	922	JA
264	923	JB
265	924	JC
266	925	JD
267	926	JE
268	927	JF
269	928	JG
270	929	JH
271	930	JI
272	931	JK
273	932	JL
274	933	JM
275	934	JN
276	935	JO
277	936	JP
278	937	JQ
279	938	JR
280	939	JS
281	940	JT
282	941	JU
283	942	JV
284	943	JW
285	944	JX
286	945	JY
287	946	JZ
288	947	KA
289	948	KB
290	949	KC
291	950	KD
292	951	KE
293	952	KF
294	953	KG
295	954	KH
296	955	KI
297	956	KJ
298	957	KL
299	958	KM
300	959	KN
301	960	KO
302	961	KP
303	962	KQ
304	963	KR
305	964	KS
306	965	KT
307	966	KU
308	967	KV
309	968	KW
310	969	KX
311	970	KY
312	971	KZ
313	972	LA
314	973	LB
315	974	LC
316	975	LD
317	976	LE
318	977	LF
319	978	LG
320	979	LH
321	980	LI
322	981	LJ
323	982	LK
324	983	LM
325	984	LN
326	985	LO
327	986	LP
328	987	LQ
329	988	LR
330	989	LS
331	990	LT
332	991	LU
333	992	LV
334	993	LW
335	994	LX
336	995	LY
337	996	LZ
338	997	MA
339	998	MB
340	999	MC
341	1000	MD

A6

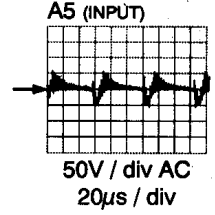
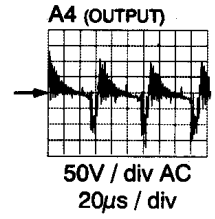
AV IN/OUT + SOUND IF



AV entrée/sortie + FI son



1101	C	3
1102	C	3
2101	F	3
2102	F	3
2103	G	5
2104	F	3
2107	I	3
2108	B	5
2109	G	6
2138	F	4
2150	F	7
2151	G	8
2152	C	9
2159	B	9
3101	G	6
3102	F	7
3104	C	5
3105	D	5
3106	E	2
3107	B	4
3108	F	7
3109	F	7
3110	G	7
3111	E	2
3112	G	4
3113	H	4
3116	D	2
3118	C	5
3119	H	7
3120	H	6
3138	E	8
3139	E	8
3140	E	8
3144	D	8
3150	C	7
3155	C	7
3157	C	8
3158	B	8
3159	C	9
4205	D	6
5100	B	7
6102	C	4
6144	E	7
6151	C	7
7102	D	4
7109	G	7
7110	H	6
7150	C	8
7225	D	2
9101	C	5
9102	C	5
9144	D	9
M16	D	10
M30	D	11
M34	F	7
SPG1	F	9
SPG2	F	9
SPG3	F	9
SPG4	F	9

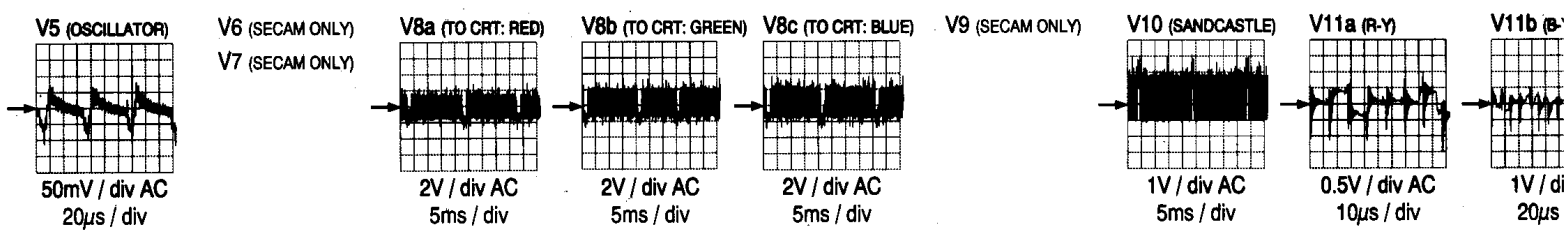
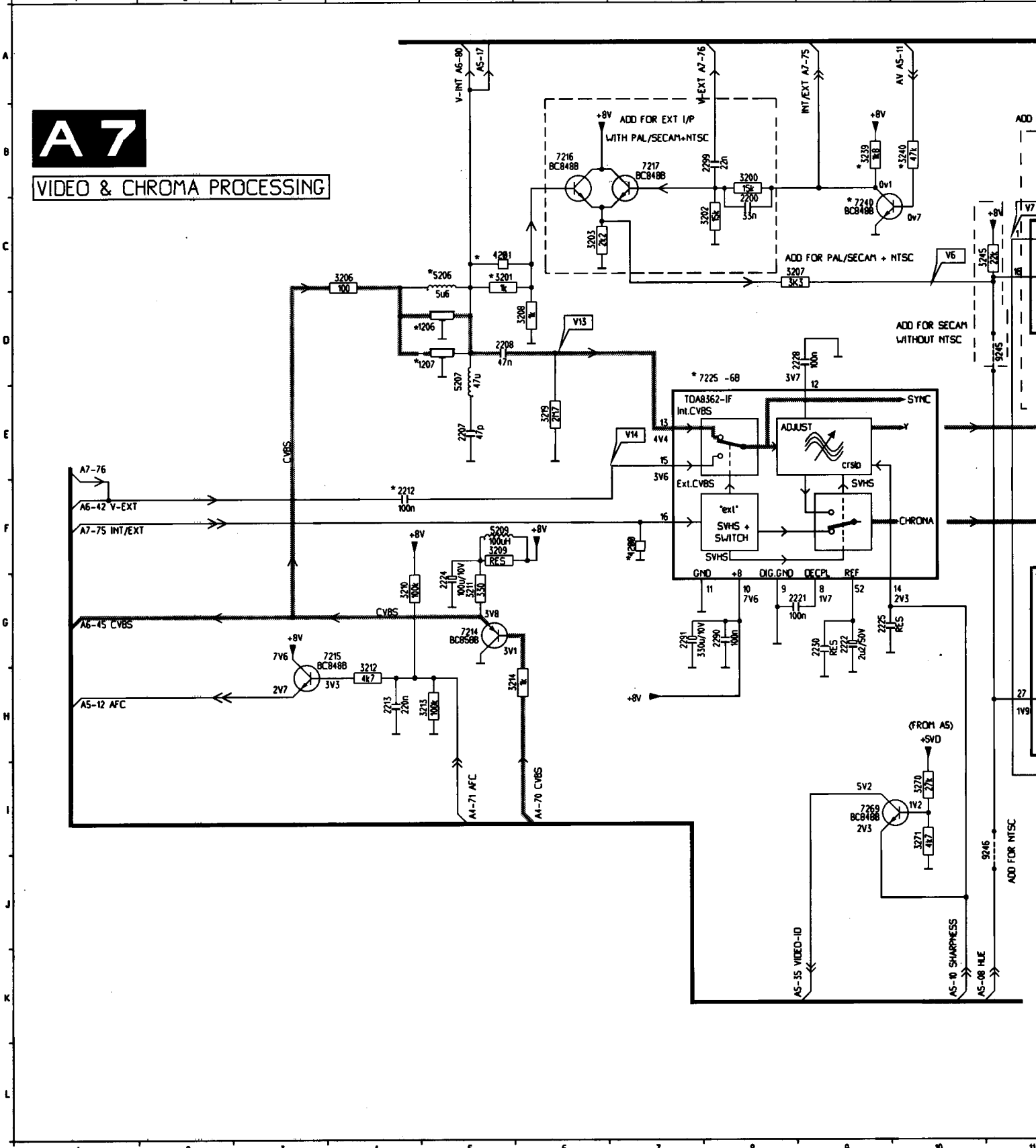


A8 (VCC) DC
OSC_A6.AI
121296

1206	D 4	1278	I15	2208	D 5	2222	G 9	2230	G 9	2246	D12	2254	B17	2271	F14	2277	I13	2281	I15	2285	E17	2290	G 8	3201	C 5	3207	C 8	3211	G 5	3219	F 6	3243	J17
1207	D 4	1279	I14	2212	F 4	2224	G 5	2231	B16	2248	C14	2256	C16	2272	I14	2278	I13	2282	I16	2286	H19	2291	G 7	3202	C 6	3208	D 6	3212	H 4	3219	F 6	3244	J17
1275	I12	2200	C 8	2213	H 4	2225	G 9	2243	B12	2249	C14	2257	C16	2273	I14	2279	I14	2283	I17	2287	H19	2299	G 8	3203	C 6	3209	F 5	3213	H 5	3240	B10	3245	C11
1277	I13	2207	E 5	2221	G 9	2228	D 9	2245	D12	2251	A15	2270	G14	2275	I12	2280	F17	2284	E17	2288	H20	3200	B 8	3206	C 4	3210	G 4	3214	H 6	3242	J16	3248	B14

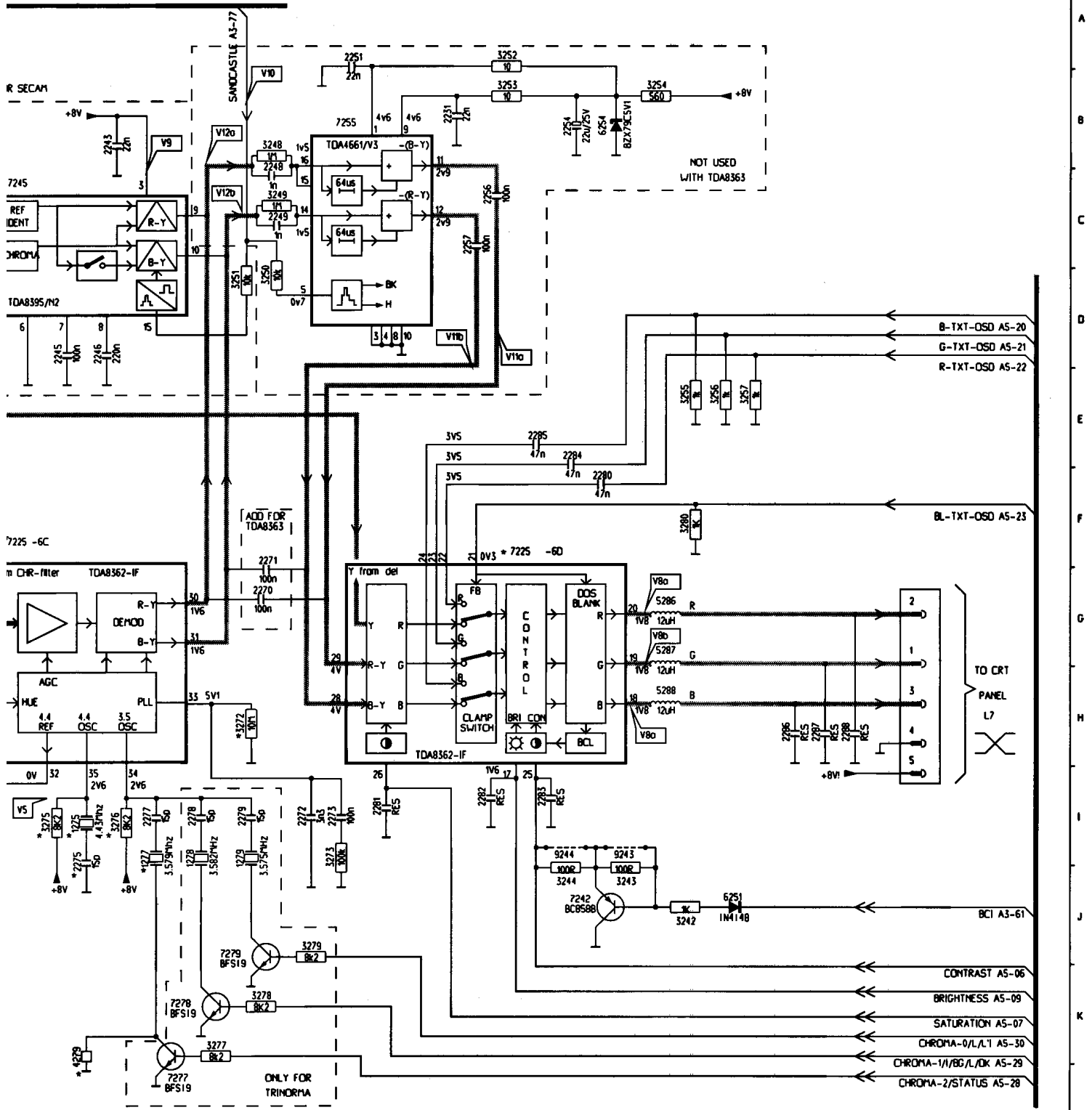
A7

VIDEO & CHROMA PROCESSING

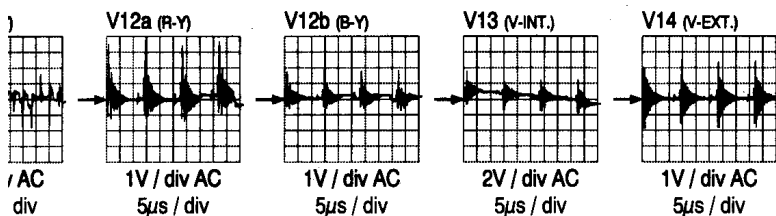


Video & Chroma Verarbeitung / Vidéo & traitement chroma

3249 C14	3253 B16	3257 E19	3273 I14	3278 K14	4201 C 5	5209 F 5	6251 J18	7216 B 6	7225 F16	7255 B14	7279 J15	9246 I11
3250 D14	3254 B18	3270 I19	3275 I12	3279 J14	4279 K12	5286 G18	6254 B17	7217 B 7	7240 C 9	7269 I 9	9243 I17	
3251 D14	3255 C18	3271 I10	3276 I13	3280 F 7	5287 C 5	6257 G18	7214 C 5	7225 F11	7242 J17	7277 L13	9244 I17	
3252 A16	3256 C18	3272 H14	3277 K13	4200 F 7	5288 H18	6258 H18	7215 C 4	7225 F11	7245 C11	7278 K13	9245 D11	
12	13	13	14	14	15	16	16	17	17	18	19	21

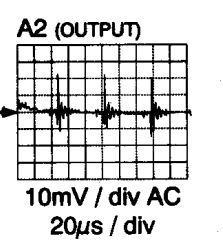
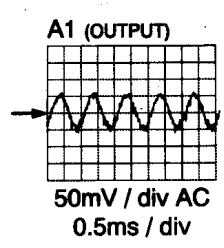
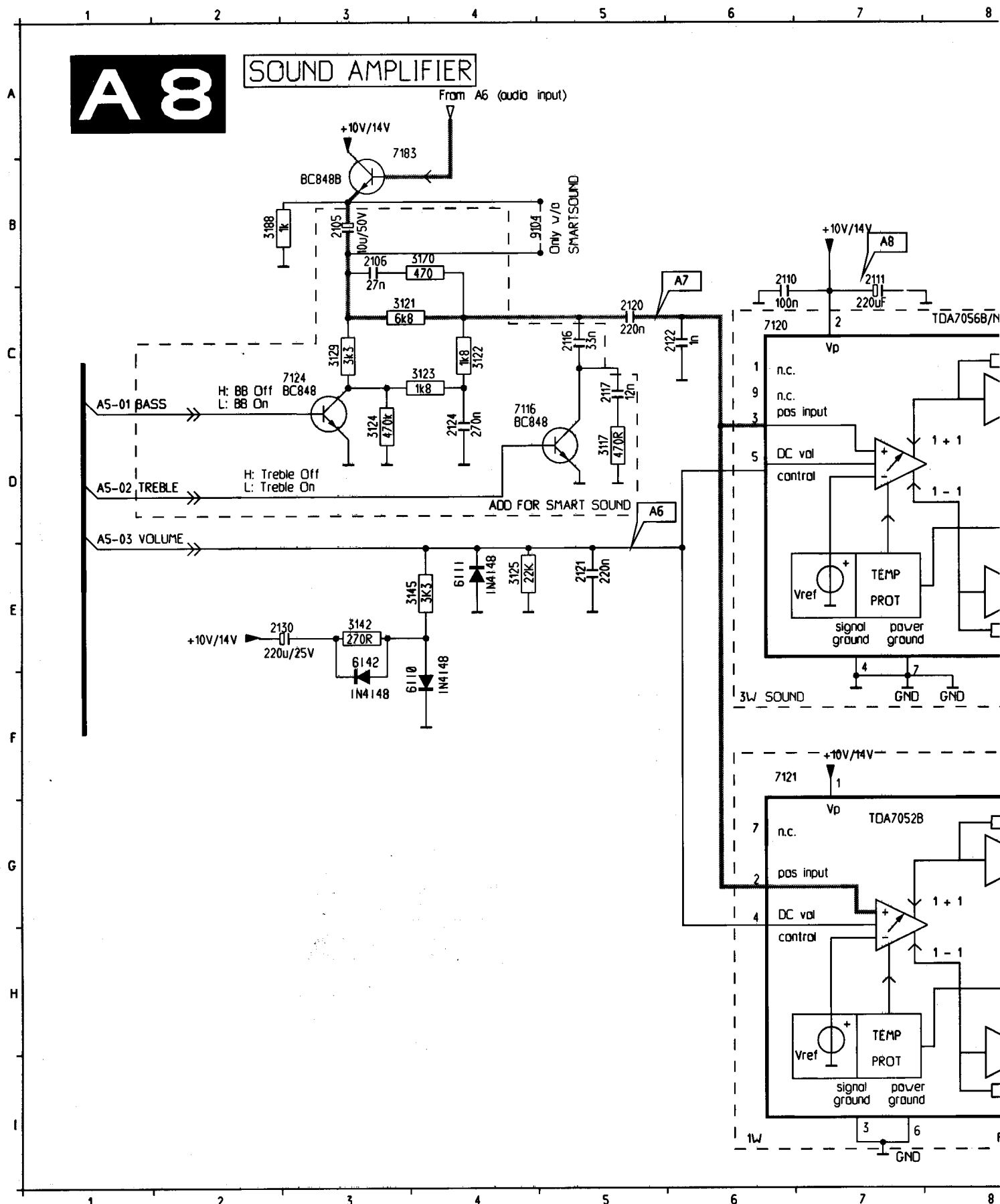


A7.EPS
121296

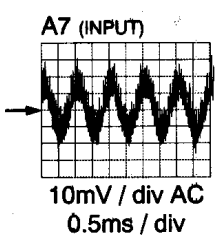


A8

SOUND AMPLIFIER



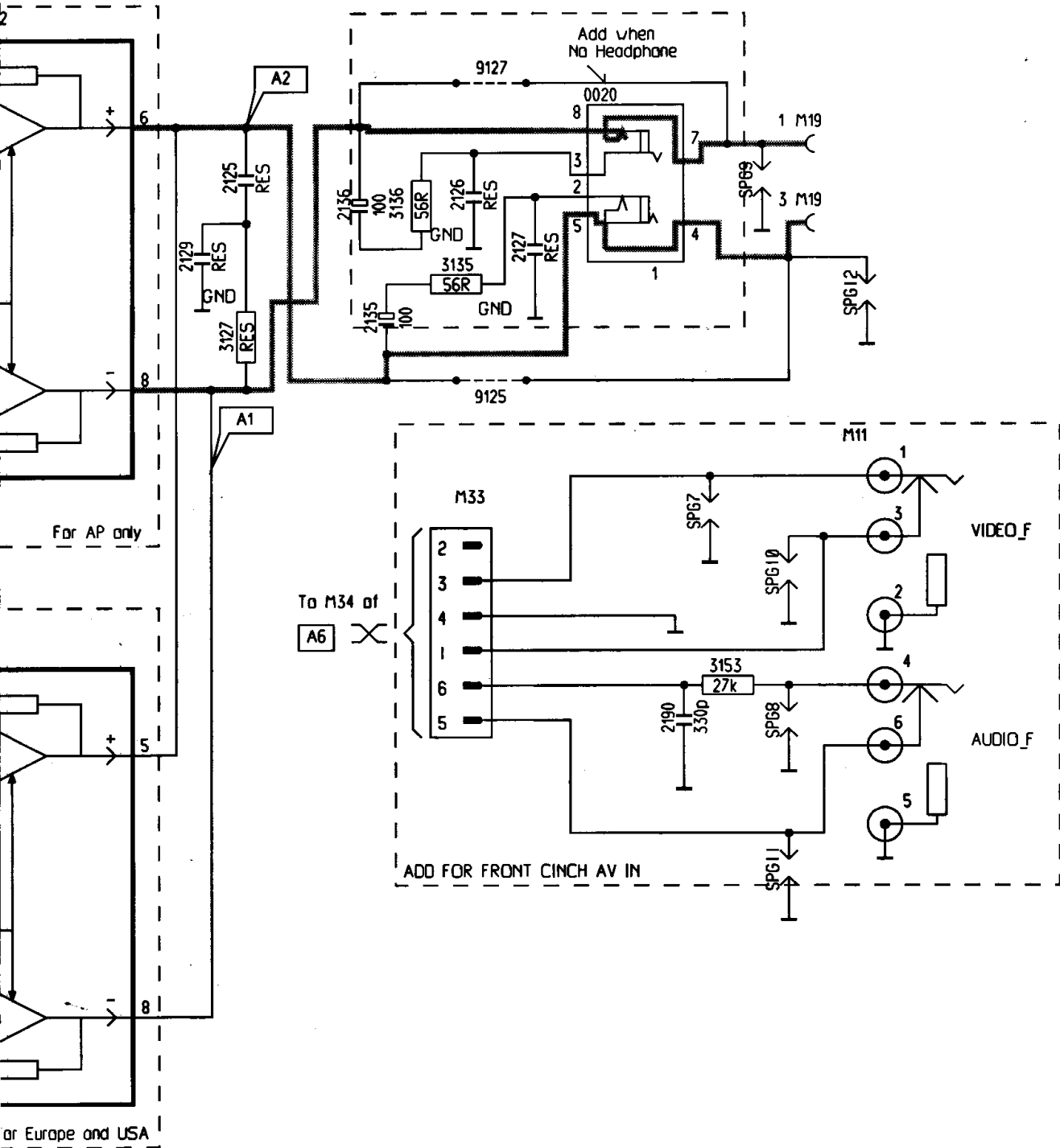
A6 (VOLUME) DC



A8 (VCC) DC

Amplificateur son

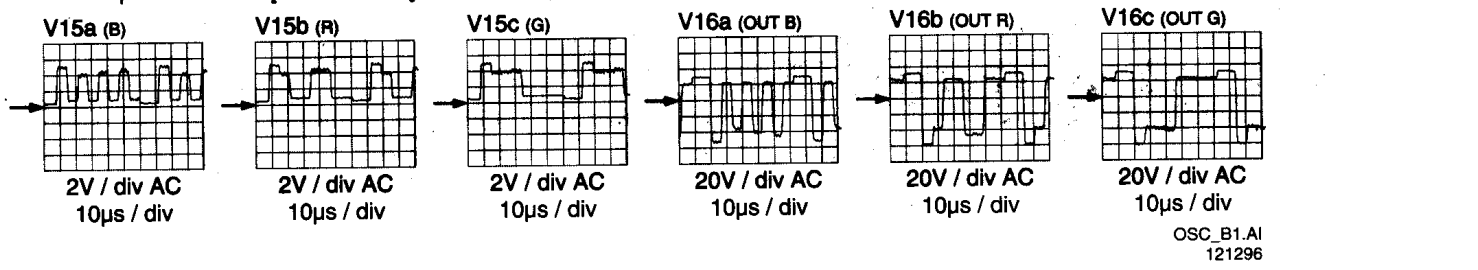
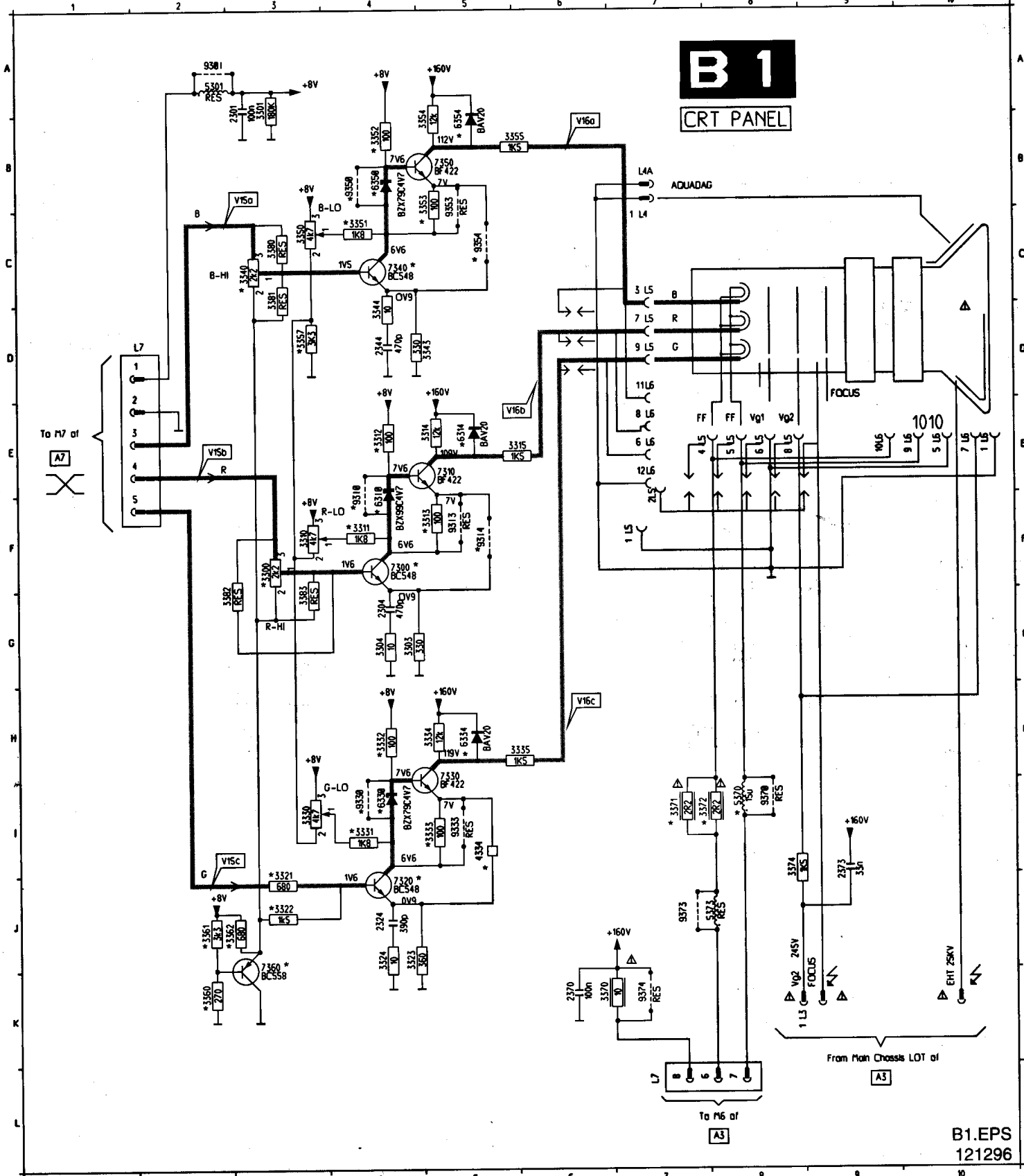
9 10 11 12 13 14



0020	C11
2105	B 3
2106	B 3
2110	B 6
2111	B 7
A 2116	C 5
2117	C 5
2120	C 5
2121	F 5
2122	F 6
2124	D 4
2125	D 9
2126	D 11
2127	D 11
2129	D 9
2150	F 3
B 2135	D 10
2136	D 10
2190	G 12
3117	D 5
3121	C 3
3122	C 4
3123	C 4
3124	D 3
3125	F 4
3127	F 9
C 3129	C 3
3135	D 11
3136	D 10
3142	F 3
3145	F 4
3153	G 12
3170	B 4
3188	B 2
6110	F 4
6111	F 4
6142	F 3
D 7116	C 4
7120	C 6
7121	C 6
7124	C 3
7183	A 4
9104	B 4
9125	E 11
9127	C 11
M11	E 13
M19	C 13
M19	D 13
E SPG10	F 13
SPG11	H 13
SPG12	D 13
SPG7	F 12
SPG8	G 13
SPG9	D 12

9 10 11 12 13 14

2301	A 3	3301	A 3	3314	1 4	3321	1 4	3324	1 4	3325	1 4	3326	1 4	3327	1 4	3328	1 4	3329	1 4	3330	1 4	3331	1 4	3332	1 4	3333	1 4	3334	1 4	3335	1 4	3336	1 4	3337	1 4	3338	1 4	3339	1 4	3340	1 4	3341	1 4	3342	1 4	3343	1 4	3344	1 4	3345	1 4	3346	1 4	3347	1 4	3348	1 4	3349	1 4	3350	1 4	3351	1 4	3352	1 4	3353	1 4	3354	1 4	3355	1 4	3356	1 4	3357	1 4	3358	1 4	3359	1 4	3360	1 4	3361	1 4	3362	1 4	3363	1 4	3364	1 4	3365	1 4	3366	1 4	3367	1 4	3368	1 4	3369	1 4	3370	1 4	3371	1 4	3372	1 4	3373	1 4	3374	1 4	3375	1 4	3376	1 4	3377	1 4	3378	1 4	3379	1 4	3380	1 4	3381	1 4	3382	1 4	3383	1 4	3384	1 4	3385	1 4	3386	1 4	3387	1 4	3388	1 4	3389	1 4	3390	1 4	3391	1 4	3392	1 4	3393	1 4	3394	1 4	3395	1 4	3396	1 4	3397	1 4	3398	1 4	3399	1 4	3400	1 4	3401	1 4	3402	1 4	3403	1 4	3404	1 4	3405	1 4	3406	1 4	3407	1 4	3408	1 4	3409	1 4	3410	1 4	3411	1 4	3412	1 4	3413	1 4	3414	1 4	3415	1 4	3416	1 4	3417	1 4	3418	1 4	3419	1 4	3420	1 4	3421	1 4	3422	1 4	3423	1 4	3424	1 4	3425	1 4	3426	1 4	3427	1 4	3428	1 4	3429	1 4	3430	1 4	3431	1 4	3432	1 4	3433	1 4	3434	1 4	3435	1 4	3436	1 4	3437	1 4	3438	1 4	3439	1 4	3440	1 4	3441	1 4	3442	1 4	3443	1 4	3444	1 4	3445	1 4	3446	1 4	3447	1 4	3448	1 4	3449	1 4	3450	1 4	3451	1 4	3452	1 4	3453	1 4	3454	1 4	3455	1 4	3456	1 4	3457	1 4	3458	1 4	3459	1 4	3460	1 4	3461	1 4	3462	1 4	3463	1 4	3464	1 4	3465	1 4	3466	1 4	3467	1 4	3468	1 4	3469	1 4	3470	1 4	3471	1 4	3472	1 4	3473	1 4	3474	1 4	3475	1 4	3476	1 4	3477	1 4	3478	1 4	3479	1 4	3480	1 4	3481	1 4	3482	1 4	3483	1 4	3484	1 4	3485	1 4	3486	1 4	3487	1 4	3488	1 4	3489	1 4	3490	1 4	3491	1 4	3492	1 4	3493	1 4	3494	1 4	3495	1 4	3496	1 4	3497	1 4	3498	1 4	3499	1 4	3500	1 4
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B1.EPS
121296

8. Electrical adjustments

8.1 Settings on the carrier panel

8.1.1 +95V supply voltage

Connect a multimeter (DC) across C2531. Set brightness at mid position and contrast at maximum. Apply a pattern generator with a colour bar. Adjust potentiometer **R3540** to $+95V \pm 0.5V$ DC.

8.1.2 Horizontal centring

Is adjusted with potentiometer **R3420**.

8.1.3 Vertical centring

Can be adjusted with **R3409**.

8.1.4 Picture height

Is adjusted with potentiometer **R3410**.

8.1.5 Focusing

Is adjusted with the focusing potentiometer in the line output transformer 5445 (if necessary set brightness at minimum and contrast at maximum for focus adjustment).

8.1.6 RF AGC adjustment

Connect a pattern generator (e.g. PM5518) to the aerial input with RF signal amplitude = 1 mV. Connect a multimeter (DC) at pin 1 of tuner. Adjust **R3264** so that voltage at pin 1 of tuner is $3.3 \pm 0.2V$ DC.

8.1.7 Picture demodulator adjustment

Connect a pattern generator (e.g. PM5518) with a cross hatch. Connect an oscilloscope (1ms/div) to pin 7 of IC7225-6A and adjust **L5260** so that the overshoot response is minimum, see Fig. 8.1. Select a colour bar signal and verify if the picture is all right.

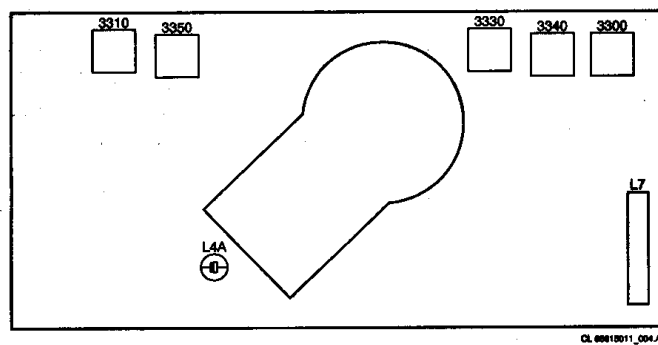


Fig. 8.1

8.2 Settings on the CRT panel

8.2.1 Vg2 cut off adjustment

Connect a pattern generator (e.g. PM5518) and set it to white raster pattern. Set contrast and the Vg2 potentiometer (in line output transformer) minimum. Adjust with brightness control the top video level at pin 4L7 to the same voltage level of the emitter of transistor 7360.

Pre-adjust the black level preset potentiometer **R3310** and **R3350** fully counter-clockwise. Adjust Vg2 potentiometer of LOT 5445 until green just becomes visible. Adjust the other two guns with their potentiometer: **R3350** for blue and **R3310** for red. All three colour shall give the same reading for a white picture.

8.2.2 White-D adjustment

Use the same signal as prescribed in 2.1. Adjust contrast to such a level that red is good visible. Adjust potentiometers **R3340** (B) and **R3300** (G) to have a correct White-D picture.

9. Circuit description new circuitries

Power supply (diagram A1)

9.2.2 Start up and take over

Start-up: Via the start-up circuitry R3530 and R3529 one side of the 220V AC mains is used to start-up IC7520 via the supply pin (V_{pin1}). As long as V_{pin1} has not reached 14V5, IC7520 does not start up and only sinks 0.3 mA; As soon as V_{pin1} reaches the 14V5, IC7520 starts (FET 7518 into conduction) and pin 1 sinks a typical supply current of 17 mA. This supply current can not be delivered by the start-up circuit, so a take-over circuit has to be available. If no take-over takes place, the voltage on pin 1 will decrease and IC7520 switches off. In that case the restart will start again. Note; This power supply is a SMPS (Switched Mode Power Supply) but not a SOPS (Self Oscillating Power Supply).
Take over of IC7520: During start-up a voltage across winding 1 - 2 is built up. At the moment the voltage across winding 1 - 2 reaches approx. +12V, D6540 starts conducting and takes over the supply voltage V_{pin1} of IC7520 (take over current is approx. 17 mA).

9.1 Introduction

9.1.1 General

The L7 switched mode power supply (SMPS) is mains isolated. The control IC7520 (MC44603P) gives the pulses for driving FET 7518 with duty cycle control at a fixed frequency of nominal 70 kHz in normal operation (in standby, slow-start and overload situation the SMPS runs at other frequencies than these 70 kHz). This SMPS works with a switching FET, no opto-coupler and no thyristor switching windings on the secondary side.

IC7520 is featured with a slow-start circuitry and has over- and undervoltage-protection of the secondary supply voltages. Unload and overload (short-circuit) protection is also included. In case the load decreases under a certain threshold level the SMPS will switch into standby-mode (in standby the SMPS is in the so called "reduced frequency mode"; nominal 20 kHz).

The +VBATT output gives a stabilised +95V for 14" and +100V for 21" in normal operation and approx. 115V DC in standby mode (the supply voltage +8V is "down", so the line output is shut "down").

9.1.2 Output voltages

- +10V / 14V for the audio amplifier
- +5V for the control part
- +10V for the horizontal synchronisation drive
- +95V for the line output stage

9.1.3 Duty cycle and T-on, T-off, T-dead

The duty cycle of the power supply depends on T-on of FET TS7518 which is controlled by pin 3 of IC7520. The IC detects the variations of the +VBATT (the secondary side of T5545) via sensing-winding 1-2 at the primary side of T5545. The switching period of FET 7518 is divided in three main areas; T-on, T-off and T-dead (see Fig. 9.1).

- During **T-on** FET 7518 conducts and so the energy which is extracted from the mains, is stored into the primary winding 4-7 of transformer T5545 with a linear increasing primary current (slope depends on the voltage across C2508). Via T-on regulation by pin 3 IC7520 the duty cycle of the SMPS and so the +VBATT is controlled.
- During **T-off** FET 7518 does not conduct and so all energy "inside" the transformer is supplied to the load via secondary windings of T5545 and the secondary diodes (D6550, D6560 and D6570). The current through the secondary side of the transformer decreases with a linear slope (slope depends on the voltage at the secondary side of T5545).
- During **T-dead** FET 7518 does not conduct and so no energy is extracted or supplied (I_{sec} is zero).

9.2 Primary side

9.2.1 Mains input and degaussing

Mains voltage is filtered by L5500, full wave rectified by a diode bridge and smoothed by C2508 to the DC input voltage for the SMPS at pin 7 of T5545 (e.g. 300V DC for 220V AC mains).

Degaussing: R3504 is a dual PTC (2 PTC's in one housing). After switching "on" the set, the PTC is cold so low-ohmic and so the degaussing current is very high. After degaussing, the PTC is heated, so high-ohmic, so in normal operation the degaussing current is very low.

9.3 Control circuitry

9.3.1 IC7520 control mechanisms

IC7520 controls the T-on of FET 7518 in all operation modes by 3 mechanisms:

- "Secondary-output-voltage-sensing" controls the secondary output voltages (via the feedback voltage V_{pin14}).
- "I-prim current sensing" controls both the secondary output voltages and the maximum I-prim (via the current sense voltage V_{pin7}).
- "Demagnetisation control" prevents the transformer T5545 from going into saturation via the so called "DEMAG" function at pin 8 (this causes slow-start operation).

9.3.2 Secondary output voltages feedback (pin 14 of IC7520)

Winding 14 - 12 has the same polarity as the secondary windings which are supplying the load. During T-off the secondary windings and so winding 14 - 12 are positive. D6537 conducts and so charges C2537; the DC level across C2537 is a reference for the secondary output voltages (e.g. the +VBATT). Via R3538, R3539 and potentiometer R3540 (for adjusting the +VBATT) this DC-voltage is brought to the required level for the error amplifier in IC7520 at pin 14. This voltage V_{pin14} is called feedback voltage and is used to control the secondary output voltages.

9.3.3 I-prim sensing (pin 7 of IC7520)

The current sense voltage V_{pin7} is a measure for the I-prim through FET 7518. The I-prim is converted into a voltage by R3518. The current sense voltage V_{pin7} is used to control both the secondary output voltages and the maximum I-prim (see peak current limiting).

9.3.4 Demagnetisation control (via pin 8 of IC7520)

Winding 1 - 2 has the same polarity as the secondary windings which are supplying the load. As a result the voltage across this winding is negative during T-on, positive during T-off and oscillating during T-dead. The so called demagnetisation (block "DEMAG" in IC7520) function at pin 8 of IC7520 is used for blocking the output V_{pin3} during the time that there is still energy in the transformer (I_{sec} not zero).

This is realised by delaying the T-on until the demagnetisation is completely finished. In this way the currents and voltages at the moment of switching "on" the FET are controlled.

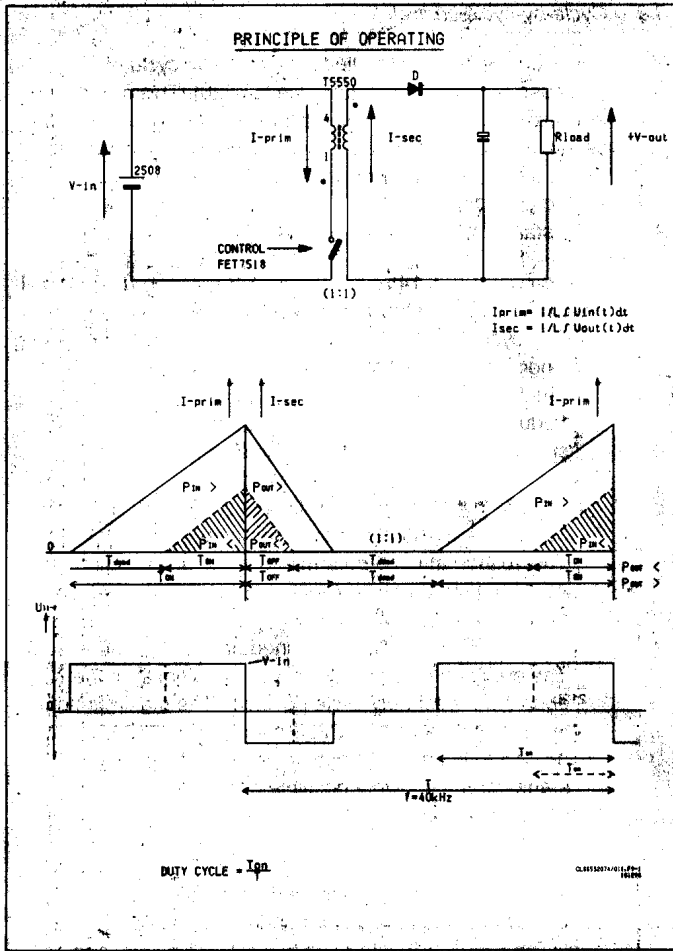


Fig. 9.1

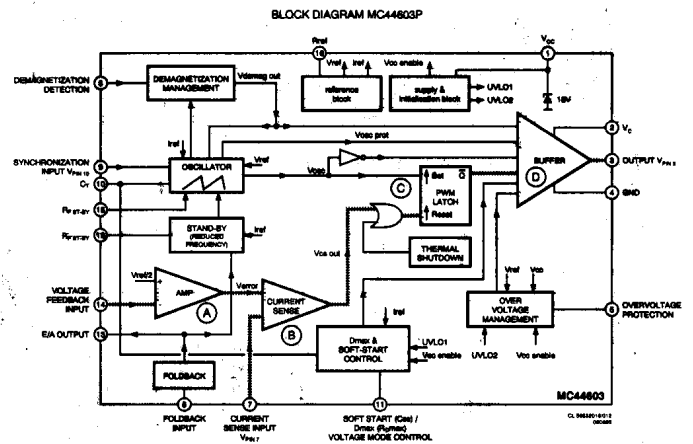


Fig. 9.2

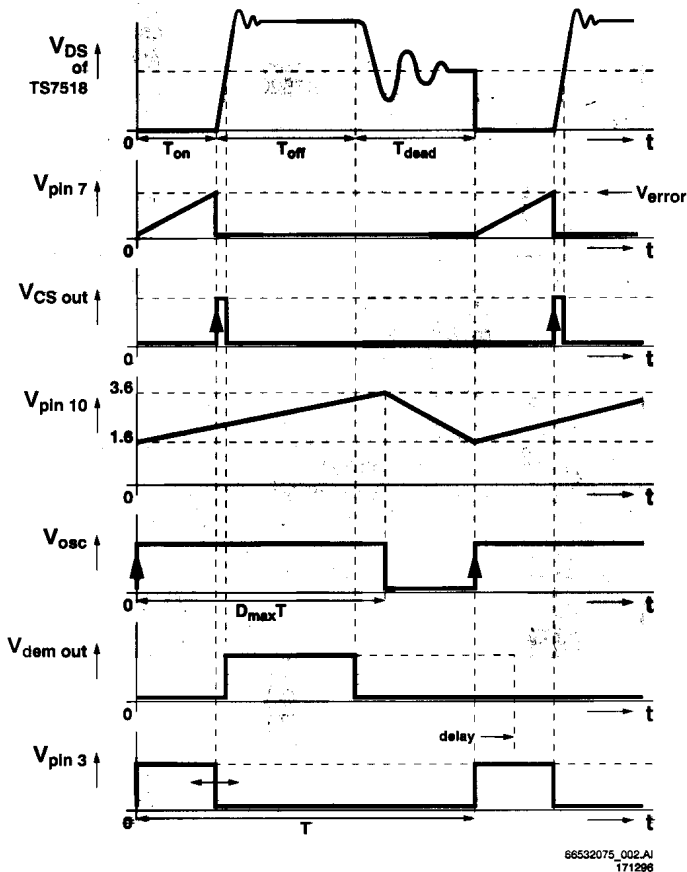


Fig. 9.3

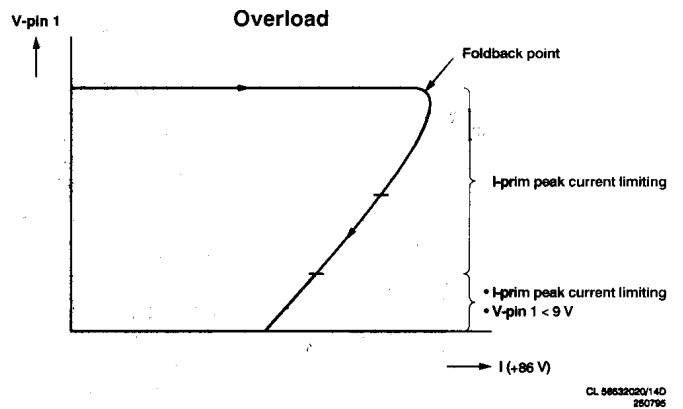


Fig. 9.4

9.3.5 IC7520 control (see Fig. 9.2 and Fig. 9.3)

The error amplifier (block A in Fig 9.2) compares the feedback voltage V_{pin14} with an internal reference voltage of 2V5. The output voltage $V_{error-out}$ of this error amplifier is fed to another comparator (block B in Fig 9.2). This comparator compares the $V_{error-out}$ and the current sense voltage V_{pin7} . As soon as the current sense voltage V_{pin7} becomes higher than the output-voltage of the error amplifier $V_{error-out}$, the comparator B gives a spike (the output of comparator B is the so called current sensing output-voltage $V_{cs out}$).

9.3.6 Flip flop

Flip flop (block C in Fig 9.2) drives the output pin 3 (V_{pin3}) via a buffer amplifier (block D). The flip flop is set by positive edge of the output of the oscillator (V_{osc}) and reset by the spike $V_{cs out}$. As a result the pulse V_{pin3} becomes "high" (T-on starts) by the positive edge of V_{osc} from the internal oscillator and "low" (T-on stops) by the spike of $V_{cs out}$ (the T-on start will be delayed in case the transformer is not yet demagnetised; see the slow-start procedure).

9.3.7 Stable load and increasing / decreasing load (see Fig. 9.3);

In case of a **stable load**, the feedback voltage V_{pin14} (and so also the maximum current sense voltage V_{pin7}) remains the same. As a result the T-on and so the duty cycle will remain the same.

In case of an **increasing load**, the secondary output voltages decreases. The voltage on pin 14 would like to decrease which causes $V_{error-out}$ to increase. As a result comparator B will give the pulse later; V_{pin3} will be "high" for a longer period (longer T-on so the duty cycle increase) and so the secondary output voltages will be increased (corrected). This will give a new balance of feedback voltage V_{pin14} and the internal 2V5 reference voltage, at a new larger duty cycle.

As a result of the longer T-on, the maximum I-prim increases, so more energy can be stored in the transformer. In this way more energy will be supplied to the load.

In case of a **decreasing load**, the secondary output voltages increases. The voltage on pin 14 would like to increase which causes $V_{error-out}$ to decrease. As a result comparator B will give the pulse earlier; V_{pin3} will be "high" for a shorter period (shorter T-on so the duty cycle decrease) and so the secondary output voltages will be decreased (corrected).

This will give a new balance of feedback voltage V_{pin14} and the internal 2V5 reference voltage, at a new smaller duty cycle.

As a result of the shorter T-on, the maximum I-prim decreases, so less energy can be stored in the transformer. In this way less energy will be supplied to the load.

In case the demagnetisation of the transformer is not finished, the positive edge from the oscillator, which will start a new cycle, will be overruled (via buffer block D) as being the starting point of T-on. As a result the T-on will be delayed and so the frequency of the SMPS will go down. This procedure is used during start-up.

9.3.8 Peak current limiting

Peak current limiting is realised by an internal clamp at V_{pin7} at 1V DC. Via this clamp the V_{pin7} can never exceed 1V DC and so the **maximum** value of I-prim (maximum current through FET 7518) is determined.

In case the load needs more than the maximum power, by then the I-prim is already at his maximum level so the SMPS will go in overload protection (see foldback principle explained at overload protection).

9.3.9 Cycle-by-cycle control

The T-on control is controlled on a cycle-by-cycle basis (because of the flip flop block C in IC7520). This means that in every cycle the T-on is determined again. By doing so the secondary voltages control, peak current limitation and all protections can be very accurate and fast.

9.3.10 Slow-start

As soon as $V_{pin1} > 14V5$ DC the SMPS will start-up. This will be done by a slow-start procedure (both the frequency and the duty cycle will be built up during slow-start). The following 3 phenomena's take place during start-up:

- The frequency will slowly increase up to the nominal frequency (70 kHz for normal operation and 20 kHz for standby). This is realised via the demagnetisation function at pin 8; via this "DEMAG" function, FET 7518 will only be driven into conduction (T-on will only become "high") when T5545 is totally demagnetised.
- The voltage at pin 5 determines the foldback point. As during start-up this V_{pin5} is gradually built-up, the foldback point will also gradually increase (see foldback principle explained at overload protection).
- The duty cycle will slowly increase beginning at the absolute lowest duty cycle possible. The **maximum** duty cycle is determined by C2530 at pin 11 IC7520; as C2530 is uncharged at start-up, the power supply starts up at the lowest possible duty cycle.

9.3.11 Standby mode

In standby mode the load decreases (see description of standby on the secondary side) under a certain threshold level. The SMPS will determine this threshold level and so switch to the so called "reduced frequency mode" at 20 kHz. This minimal load threshold level is determined by R3532 at pin 12 (in the L7 the SMPS does not have a burst mode in standby, only a reduced frequency mode). 70 kHz; In normal operation mode the internal oscillator gives 70 kHz. This frequency is controlled by C2531 at pin 10 IC7520 and by R3537 pin 16 IC7520. 20 kHz; In standby mode the internal oscillator gives 20 kHz. This frequency is controlled by R3536 at pin 15 IC7520.

9.3.12 FET 7518 gate regulation

D6524 prevents pin 3 of IC7520 from becoming negative (this will destroy the IC) due to stray inductance in the gate part. The safety resistor R3525 limits the drive current to the gate of FET 7518.

9.3.13 Typical values for the L7 chassis

In a stable situation V_{pin14} is typical 2V5.

Mains Voltage:	110V
	220 - 240V
	150 - 276V
	90 - 276 V
Mains frequency:	50 Hz
	60 Hz
Power Consumption	
in normal mode:	14": 43 W +/- 10%
	20": 52 W +/- 10%
	21": 57 W +/- 10%
Power Consumption	
in stand-by mode:	< 10W
	< 3W option.

9.4 Protections

9.4.1 Overvoltage protection of the secondary voltages

After start-up is the supply voltage V_{pin1} taken over by positive winding 1-2, and so after start up V_{pin1} is a measuring point for the secondary output voltages. After start-up (via an internal switch) this V_{pin1} is internally tapped (voltage divided) to a voltage which can be measured at pin 6 (so V_{pin6} is also a measuring point for the secondary output voltages).

As soon as the voltage $V_{pin6} > 2V5$, the logic in IC7520 will shut down the output at pin 3. This 2V5 threshold at V_{pin6} , is equivalent to a V_{pin1} of 16V DC which is equivalent to a voltage at the supply voltage +VBATT of approx. 108V DC (normal operation) and 130V DC (standby). After switching "off" because of overvoltage protection, the IC starts up again (see slow-start).

→ In case an overvoltage situation is sensed at the secondary output voltages, the SMPS will go in overvoltage protection. In case the overvoltage situation remains present, the SMPS will give overvoltage protection, slow-start, overvoltage protection, slow-start, etc. → a very good audible hick-up mode.

9.4.2 Undervoltage protection of the secondary voltages

If the supply voltage $V_{pin1} < 9V$ DC the output pulse at pin 3 will be shut down. As soon as $V_{pin1} < 7V5$, the IC7520 will be totally shut "off". V_{pin1} of 9V DC is equivalent to a voltage at +VBATT of approx. 70V DC (normal operation) and 95V DC (standby), V_{pin1} of 7V5 is equivalent to a voltage at +VBATT of approx. 55V DC (normal operation) and 65V DC (standby).

→ In case an undervoltage is sensed at the secondary output voltages, the SMPS will first switch "off" the pulse and then switch "off" the complete IC7520.

In case the IC7520 is switched "off", the SMPS will switch "off". In case the undervoltage situation remains present, the SMPS will give undervoltage protection, slow-start, undervoltage protection, slow-start, etc. → a very good audible hick-up mode.

9.4.3 Unload protection

In case the load goes down (e.g. the line goes down because of standby mode or some failure in the line) this is detected by IC7520 via I-prim and secondary output voltages sensing. In case the load decreases below a certain threshold the SMPS will switch in "reduced frequency mode" of 20 kHz (this threshold is determined by the voltage level at pin 12 IC7520);

→ In case of an unload situation the set will switch to "low frequency mode" or standby mode.

Whether this unload situation of the SMPS is caused by the standby command or by a failure (e.g. in the line), can only be determined by switching on the set again which the remote control; in case of standby mode the TV will switch "on" again, in case of an unload situation the set will not switch "on".

9.4.4 Overload (short-circuit) protection (see Fig. 9.4)

If the secondary load becomes too high, I-prim becomes too high which is sensed by the current sense voltage V_{pin7} . This voltage V_{pin7} is not allowed to exceed 1V DC by IC7520 and so gives current limiting. As the I-prim is limited, the secondary output voltages will also drop and so supply voltage V_{pin1} will drop. As soon as $V_{pin1} < 9V$ DC the driving pulse at pin 3 will stop.

As a result of these 2 mechanism in case of an overload the secondary voltages will drop very fast. This is called the foldback mechanism; the foldback point can be adjusted by pin 5 IC7520 (for the L7 this point is adjusted to a maximum tolerable output power of 85W at 90Vac and 165W at 276VAC).

After this foldback, the IC starts up again (see slow-start). In case the overload situation remains present, the SMPS will give foldback again, slow-start, foldback, slow-start, etc.;
→ As a result in case of a short-circuit (or overload) the TV will be in a very good audible hick-up mode.

9.5 Secondary side

9.5.1 Output voltages

See 9.1.2 for output voltages.

9.5.2 Protections

No protections are available at the secondary side.

General: IC7225 (TDA836X) is a single-chip video processor with built in IF-detector, luminance-chrominance-synchronisation separator, PAL chrominance decoder, video controller, horizontal & vertical synchronisation processor en FM sound-decoder. IC7225 has 4 possible executions:

- TDA8360 is for PAL-only sets without external switch (no AV cinches)
- TDA8361 is for PAL-only sets with external switch (with AV cinches)
- TDA8362 is for PAL/SECAM multi sets with external switch (with AV cinches)
- TDA8363 is for NTSC only.

Deflection and synchronisation (diagram A2 and A3)

9.6 Horizontal synchronisation IC7225-6E and the line output stage

9.6.1 Synchronisation

Start up of the horizontal oscillator via the +10V gives a start-up current into pin 36; if the voltage on pin 36 exceeds 5V6 the horizontal oscillator starts running at approx. 25kHz. Only when the supply pin of IC7225 (pin 10 at IC7225-6B in diagram A7) becomes 8V the line frequency changes to 15625 Hz.

Horizontal synchronisation separator separates horizontal pulses out of CVBS and so synchronises the free-running horizontal sawtooth generator.

Horizontal oscillator sawtooth is converted into square wave voltage with variable duty cycle. This square wave on pin 37 is fed to the line output stage. The time constant of the synchronisation circuit is automatically internally determined by IC7225-6E.

Circuit description new circuitries

Pin 38 is both SANDCASTLE output and HORIZONTAL FLYBACK input and PROTECTION input. Selection between input and output is automatically determined by the values of the current by R3456, R3462 and R3461:

- The SANDCASTLE has an output current a few mA; the amplitudes of sandcastle pulse; burst 5V3, line blanking is 3V, frame blanking 2V.
- When the input acts as a HORIZONTAL FLYBACK pulse, the input has a current of 100-300 mA. This horizontal flyback pulse compares phase of flyback pulse with phase of the horizontal oscillator. If the phase is not correct the duty cycle of horizontal oscillator will be adjusted.
- The PROTECTION signal from the frame amplifier (pin 7 IC7401 diagram A2) will be constantly "high" (see description frame amplifier) in case of no vertical deflection current. This constant "high" level will overrule the "normal" SANDCASTLE signal and so the picture will become "black".

9.6.2 The line output circuitry

In principal the line output stage is the same as used in the Anubis S: Pin 37 IC7225-6E drives the line output stage, TS7445 and transformer 5445 via drivers TS7440-7441.

The line output stage supplies the deflection current and the following supply voltages (see also the power supply block diagram in chapter 5):

- EHT, +160, Vg2, focus and ff for the picture tube.
- +5V5 for the tuner and to create +VB for band switching.
- +9V for making the supply voltage +8V and +8VI.
- +8V and +8VI for the supply of the IC7225.
- +26V for the frame amplifier and the IC7225.

9.6.3 Principle working of the line output stage (see Fig 9.5)

The voltage across C2450 is constantly +95V DC. C2450 is charged by the +95V from the power supply via the primary winding 2-1 of the LOT (5445) and via R3454.

- **Second half of the scan (t1-t2):** During the second half of the scan the control voltage of TS7445 is positive, so TS7445 conducts. The horizontal deflection coil by then is switched in parallel with C2450 (constant +95V DC). As a result of this constant +95V DC a linear current is flowing through the horizontal deflection coil and TS7445. As soon as the control voltage of TS7445 becomes negative, TS7445 will not conduct any more and the second half of the scan is finished.
- **First half of the flyback (t2-t3):** During the first half of the flyback TS7445 does not conduct any more. The current which flows through the horizontal deflection coil, would like to remain flowing and so flows via C2445 bringing energy from the horizontal deflection coil to C2445. The current through the deflection coil will drop and the voltage across C2445 will rise sinusoidally.
- **Second half of the flyback (t3-t4):** During the second half of the flyback TS7445 still does not conduct. All energy which has been stored from the deflection coil into C2445 (during t2-t3) will be recovered to the deflection coil again during t3-t4. In other words, all energy in C2445 will be fed back to the horizontal deflection coil, so the voltage across C2445 drops and the current through the deflection coil will drop further (negative by now) sinusoidally.

- **First half of the scan (t4-t5):** At the end of the flyback (t4), the voltage at the cathode of the diodes D6445//D6447 parallel to TS7445 wants to become negative, so these diodes will conduct. Again the horizontal deflection coil by then is switched in parallel with C2450 (constant +95V DC). As a result of this constant +95V DC a linear current is flowing through the horizontal deflection coil and diodes D6445//D6447.

At the end of the first half of the scan the voltage at the cathodes of the diodes D6445/D6447 will become 0V, so this diodes will stop conducting. Because of that, already before the end of the first half of the scan the control voltage U_{BE} of TS7445 must be "high" again.

Horizontal flyback; The horizontal flyback pulse is brought to the correct DC level by R3456, R3462 and R3461.

D6461 prevents the pulse from becoming higher than 8V by clamping.

Horizontal S-correction to correct errors in horizontal linearity via C2450.

9.7 Vertical synchronisation IC7225-6E and the frame amplifier IC7401

9.7.1 Synchronisation

Vertical synchronisation separator separates frame synchronisation pulses from CVBS signal and synchronises frame oscillator. The amplitude of the sawtooth on pin 43 is controlled via pin 41 (VFB vertical feedback) which looks at the vertical scan across R3410.

Pre-amplifier in IC7225-6E amplifies sawtooth (pin 43 of IC7225-6E).

9.7.2 Frame amplifier

In principal the frame output stage is the same as used in the Anubis A: IC7401 (TDA3653) is used for the vertical deflection. This IC is controlled on pins 1 and 3 by the vertical control signal of IC7225-6E and a deflection current is generated on pin 5. The picture centring is set with the resistor 3409 and the picture amplitude can be set using potentiometer 3410. The vertical flyback signal is generated on pin 8 of the IC.

- During the scan the +26V supply voltage is used for the deflection current.
- During the flyback a flyback generator is used for the high di/dt . During the scan, pin 8 IC7401 is 0V and so C2403 is charged to +26V. During flyback IC7401 gives a +26V pulse on pin 8 IC7401 and so pin 6 IC7401 has a $26+26=52V$ pulse during flyback. As a result D6403 is blocked during flyback. Since the flyback pulse at output pin 5 IC7401 is slower than at the input pin 1 IC7401 because of the self-inductance of the vertical deflection coil, a negative voltage is formed on pin 1 IC7401 during flyback. This negative voltage drives IC7401 to maximum, so the full 52V occurs on pin 5 IC7401 during flyback.
- **Protection:** In case of no deflection current, by then the flyback generator can not make +52V. As a result pin 8 will drop under 2V DC. If pin 8 drops under 2V DC the protection circuit inside IC7401 will be activated making the protection signal line on pin 7 IC7400 constant "high". This constant "high" protection will overrule the "normal" SANDCASTLE signal; the constant "high" SANDCASTLE signal will block the chrominance decoders (IC7225-6D and IC7245 in diagram A7) and so the picture will become "black".

Vertical S-correction; C2404 gives a parabolic voltage during the scan. A part of this voltage is integrated by R3418 and C2408 causing a superimposed "S-shaped" current over the deflection current which corrects the vertical linearity of the scan.

For teletext non-interlaced mode (so 25 Hz frame) is required. For that a 25 Hz block-shaped NIL signal from the teletext decoder to the frame amplifier to ensure that odd & even frames coincide.

Video processing (diagram A4, A7 and B1)

9.8 Tuning system

The tuner U1000 can be of a VST or a PLL type. In both cases the tuner is controlled by the μ C:

- The VST tuner is controlled via V_TUNE, AFC and the BS1 and BS2 band switching signals.
- The PLL tuner is fully I²C controlled.

9.9 IF demodulation IC7225-6A

IC7225-6A contains the IF amplifier and the IF detector. The IF signal is present at the output pin 11 of the tuner.

9.9.1 IF band pass filter

The IF band pass characteristic is determined by the band pass of the SAW filter 1015:

- For PAL BG sets a SAW filter with 5.5 MHz bandwidth is used (33.4 to 38.9 MHz).
- For PAL I sets a SAW filter with a bandwidth of 6.0 MHz is used (32.9 to 38.9 MHz).
- For PAL BGI/SECAM BGLL' sets a SAW filter with 6.5 MHz bandwidth is used to enable BGILL' reception (33.9 to 40.4 MHz).
- For PAL BG/SECAM BGDK sets a SAW filter with a bandwidth of 6.5 MHz is used (32.4 to 38.9 MHz).
- IF-demodulator

After the band pass filter the IF signal is supplied to the IF-detector IC7225-6A pins 45 and 46. IF-demodulation is performed via the demodulation reference circuit 5260 on pins 2 and 3 IC7225-6A.

Delayed AGC control via the AGC voltage on pin 47 (AGC control is used for decreasing the amplification of the tuner-amplifiers in case the incoming signal on pin 45-46 IC7225-6A becomes too high (above the take-over level)). This take-over level can be adjusted on pin 49 by R3264. AFC (Automatic Frequency Control) signal on pin 44 is obtained from the reference signal of the IF-detector.

9.10 IF source select, luminance-chrominance separation IC7225-6B

9.10.1 Sound trap

The baseband CVBS signal of pin 7 IC7225-6A (nominal amplitude of 2V_{pp}) also contains the FM sound signal (FM intercarrier sound). This sound signal is filtered out with a ceramic filter (1206 resp. 1207) giving V-INT which is used for further video processing (IC7225 and IC7245), AV video out and teletext processing.

9.10.2 Luminance-chrominance separation

Chrominance signal is filtered (-20dB) by a luminance notch filter which is internally calibrated at the subcarrier frequency (4.43 or 3.58 MHz). CVBS information is also fed to the horizontal and vertical synchronisation separator in IC7225-6E.

9.10.3 CVBS source select

The V-INT signal is fed to pin 13 IC7225-6B to the source selector switch in IC7225-6B. Pin 16 is used for source select control:

- Pin 16 = 0V gives internal CVBS mode, so V-INT from pin 13 IC7225-6B
- Pin 16 = 8V gives external CVBS mode, so V-EXT from pin 15 IC7225-6B (from the video-in cinch).
- Pin 16 is DC controlled via the INT/EXT signal from buffer TS7240 which is controlled by the AV-signal of the μ C; so AV is "high" for internal CVBS and "low" for external CVBS.

9.10.4 Sharpness control

Sharpness control is realised via input pin 14 IC7225-6B (2V5-5V). Pin 14 is used as an input pin for sharpness control and an output pin for TRANS_ID (transmission identification).

- If IC7225-6E has horizontal synchronisation (video identification), pin 14 > 0V3 and by then is input pin for sharpness control by controlling the gain of the internal luminance signal. As pin 14 > 0V3 TS7269 does not conduct and TRANS_ID is "high" via pull-up resistor R3601 in the control part.
- If IC7225-6E has no horizontal synchronisation (no video identification), pin 14 is output pin < 0V3 so TS7269 conduct so TRANS_ID becomes "low"

9.11 Chrominance decoding IC7225-6C and IC7245

PAL and NTSC chrominance decoding is inside IC7225-6C and SECAM chrominance decoding is in IC7245. PAL or NTSC processing is determined automatically by the burst demodulator inside IC7225-6C. The reference crystals for demodulation for IC7225-6C are present at pin 34 and/or pin 35 of IC7225-6C.

- PAL/NTSC mode if voltage at pin 27 < 5V5; If IC7225-6C detects PAL, the voltage at pin 27 makes no sense. If IC7225-6C detects NTSC the voltage at pin 27 is used for hue control (0-5V). For NTSC sets jumper 9246 is added.
- For Tri-Norma sets the set selects (auto or forced) one of the three different crystals for PAL M, PAL N and NTSC M at pin 34 of IC7225-6C; For Tri-Norma sets pin 26 of IC7225-6D has a double function: Saturation control (normal input pin) or Tri-Norma system select (output pin) during system search.
- PAL/NTSC/SECAM mode if voltage at pin 27 of IC7225 is 5V5; IC7225-6C searches for PAL and IC7245 searches for SECAM. Via a bi-directional communication line between pin 32 of IC7225-6C and pin 1 of IC7245, both IC's know whether a PAL/NTSC or a SECAM signal is detected. The following signals are present on the communication line:

- ⇒ 4.43 MHz signal for locking the PLL and chrominance cloche filter of IC7245.
- ⇒ SECAM or PAL/NTSC operation switching signal (DC-controlled) to do an automatic selection between the output of IC7225-6C and IC7245.
If IC7225-6C has detected PAL or NTSC, pin 32 of IC7225-6C becomes 1V5 and the output becomes available at pin 30 and 31. If no PAL/NTSC is detected, pin 32 of IC7225-6C becomes 5V and the output will be disabled.
If a SECAM signal is detected pin 1 of IC7245 becomes "low". This will sink current from pin 32 of IC7225-6C. In this way IC7225-6C knows that a SECAM signal is present and will disable the IC7225-6C output.

9.12 Video controller IC7015-6D

RGB-de-matrixing de-matrixes the -(R-Y), -(B-Y) and the Y signals to RGB signals; the sandcastle pulse coming internally from IC7225-6E synchronises the RGB de-matrixing and suppresses the RGB signals during line and frame flyback.
Analogue controls by the μC for contrast (0-4V5), brightness (0-4V5) and saturation (0-4V5).
Fast blanking and RGB-source select; Via the BL_TXT_OSD signal on pin 21 of IC7225-6D both the fast blanking and the RGB source select is realised via the BL_TXT_OSD fast blanking signal from the teletext + OSD part of the μC ; this signal is "high" (> 1V) to switch the RGB source select switch into external mode to display teletext and OSD (via pins 22, 23 and 24 IC7225-6D).
BCI; If the beam current increases, the BCI-signal (Beam Current Info) decreases. If the beam current is too high, the CONTRAST control signal is pulled down to reduce the contrast (pin 25 of IC7225-6D).

9.13 AV input cinches (diagram A6)

AUDIO-IN is an incoming audio signal from the audio-in cinch. This signal goes to source select of IC7225-6F.
AUDIO-OUT is an outgoing audio signal from pin 1 of IC7225-6F to the audio-out cinch.
VIDEO-IN becomes V-EXT and is the incoming CVBS-signal from the video-in cinch to the external input pin 15 IC7225-6B and the teletext processing.
VIDEO-OUT is coming from V-INT and is an outgoing CVBS-signal taken from after the sound trap (so after the IF detector IC7225-6A) which is fed to the video-out cinch.
The V-INT signal from the IF-detector is buffered by TS7150 before fed to the audio-out cinch .

9.14 CRT panel

RGB amplification by TS7300, TS7310 - TS7320, TS7330 - TS7340, TS7350 respectively
Cut off point adjustment for adjusting the R, G and B guns to start and stop emitting at the same correct level. Via R3350, R3310 and R3330 the DC level of the collectors TS7340, 7300 and 7320 and so the DC level of the guns are adjusted.
White D adjustment for adjusting the correct balance between R, G and B signal.

- Via R3340 and R3300 the amplitude of B and R signal can be adjusted to the amplitude of G
- Via TS7360 the R3340 and R3300 adjustment is de-coupled from influencing the G-amplification; the base DC-voltage of the RGB-amplifiers is equal to the black level of the RGB signals

Picture tube flash protection:

- Spark gaps in the PWB of the picture tube panel
- Resistors in series with the RGB electrodes 3355, 3215 and 3335 limiting the current through the guns

- Diodes 6354, 6314 and 6334 conduct at flash-over and so do not allow a higher voltage at the guns as approx. 160V
Peak beam current limiter; If the beam current is too high, the current through resp. R3352, 3312 and 3332 is high. The diodes 6350, 6310 and 6330 conduct and so TS7350, 7310 and 7330 can not supply more current to the guns and so the beam current is limited.

Audio processing (diagram A6 and A8)

9.15 FM and AM demodulation

Two sound paths can be determined:

- For BG, I, DK, M and N systems FM modulated inter-carrier sound (sound extracted from baseband CVBS from IF detector)
- For LL' systems AM modulated quasi-split sound (sound extracted directly from the tuner).

9.15.1 FM demodulation

For FM modulated sound the sound signal is filtered through filter 1101 or 1102 from the baseband CVBS signal.

Input characteristic; By the switching signal CHROMA_1/I/BG/L/DK transistor 7102 can be switched on/off.

- In case CHROMA_1/I/BG/L/DK is "low", TS7102 does not conduct and filter L1102 is switched in parallel to L1101.
- In case CHROMA_1/I/BG/L/DK is "high", L1102 is not in parallel with L1101 any more. The frequency of the filters is mentioned on it.

FM-mono sound demodulation takes place in IC7225-6F. No adjustment is required for BG or I demodulation as automatic PLL tuning (4.2 to 6.8 MHz) is used. Pin 1 of IC7225-6F is used as:

- input for defining the sound frequency characteristic by de-emphasis C2101
- output for feeding the FM demodulated sound.

Source select between FM sound or AUDIO IN sound (pin 6 IC7225-6F) is done via pin 16 IC7225-6B (diagram A7).

9.15.2 AM demodulation

AM-sound is for the moment not applicable. If in the future AM-sound becomes available this will be described.

9.16 Audio control and amplification

Bass and treble are directly controlled by the micro-controller. The bass signal is "low" for switching the bass amplification on. The treble signal is "low" for switching the treble amplification on. If bass amplification is "off", 7124 is short-circuiting resistor 3124. If treble amplification is "off" resistor 3117 and capacitor 2117 are short-circuited by 7116.
Audio amplification is realised via the sound-amplifier 7120 or 7121 (depending on the version). The only difference is the output power.

Control and teletext (diagram A5):

9.17 Teletext

In the L7 two microprocessors can be used; one with and one without teletext.

- In case of TXT, this teletext function is integrated together with the control part in one and the same μC . This μC is drawn in the diagrams with the external pin numbering.
- In case of no TXT another μC is used with less pins. This μC is drawn in the diagrams with the internal pin numbering.

In the description below, the pin numbers mentioned are the numbers mentioned outside the housing of IC7601, so for the μC with integrated TXT functionality. In case of the μC with integrated teletext function, the CVBS-signal is fed to pin 23 or 24 depending on the fact if it is the internal or external CVBS-signal (V_INT or V_EXT). In this way teletext can be used both on the internal or the external signal. The TXT and OSD-information is combined at pins 32-33-34.

9.18 Control

Following description explains the functionality of the μC pins anti-clockwise for the outern pinning numbers.

- Control-voltage outputs (pin 1-7 and pin 9-10); These pins are PWM (Pulse Width Modulated) output pins used for volume, contrast, saturation, hue, brightness, sharpness, bass and treble and tuning control (only for VST).
 - ⇒ The V-TUNE varies between 0-30V and is derived from the +95V supply from the power supply.
 - ⇒ The saturation pin 4 has two functions; output pin for saturation control and input pin for auto system search in case of Bi- and tri-norma sets (-/77 sets).
 - ⇒ Bass and treble functionality is only used in case of sets with the "smart sound" feature.
- AV (pin 8); Output switching signal "high" for internal CVBS-mode and "low" for external mode (AV-mode, so cinch mode).
- AFC (pin 11); Input pin for AFC-control.
- AV_MUTE (pin 12); Output switching signal used for muting the audio output cinch. This signal is "high" in case of mute.
- Functional switch (pin 15); For USA ,sets do not have a mains switch but a functional switch. If pin 15 is connected to ground by means of 1064, the set is switched to stand-by.
- Protection (pin 16); This pin is an input pin for protections. If this pin is connected to ground, the set is switched in protection. By this protection the voltages +9V and HEW are monitored to check if they become to high. If the +9V drops, this is monitored by the circuit around 7608. The emitter becomes "low" (0V7 lower than the base voltage) if the +9V drops. This will force pin 16 of the μC "low" and will switch the set in protection.
- BS1 and BS2 (pin 17-18); Switching signals used for band switching of a VST tuner.

	BS1	BS2
VHF1	0	1
VHF2	1	0
UHF	1	1

- STANDBY (pin 19); Output pin "high" for normal operation and "low" for standby.
- LED-drive (pin 20); Signal to drive the LED
 - ⇒ In standby, the LED lights continuously by pulling pin 20 "low"
 - ⇒ In normal operation the LED does not light by not pulling pin 20 "low"
 - ⇒ During RC5 reception pin 20 is pulled "low" time by time, resulting in a pulsing LED
- Ground (pin 21); Ground of the power-supply.
- Test pin (pin 22); Used for test purposes in the factory
- CVBS-inputs (pin 23-24); These pins are used as input for teletext-sources. Pin 24 is used as input for the external CVBS-signal (VIDEO-IN input cinch) and pin 23 for the internal CVBS-signal of the set.
- NIL (pin 27); Signal to generate a DC-current through the deflection coil to create a non interlaced mode during TXT-mode.

- TXT/OSD-signals (pin 32-33-34); These output pins are used to create TXT and OSD information in different colours.
- BL-TXT-OSD (pin 35); Output signal (BL_TXT_OSD) used to indicate the video controller that there is OSD or Teletext information. So this signal blanks the video information.
- SANDCASTLE (pin 36); Pin to inform the μC that horizontal flyback takes place. This information is needed to place the TXT and OSD correctly on the picture.
- VFL (pin 37); This pin is used to tell the μC that vertical flyback takes place. This information is needed to place the TXT and OSD correctly on the picture.
- OSD-generator (pin 38-39-40); The components connected these pins determine the frequency of the OSD-generator. This is approx. 8 MHz.
 - ⇒ In a non TXT set, the OSD generator is formed by C2680, C2681, L5680 and L5681 (4682 and 4683 are not mounted).
 - ⇒ In a TXT set, C2680, C2681 and L5680 are not present but 4682 and 4683 are mounted.
- 12 MHz oscillator (pin 41-42); The frequency of the oscillator of the μC is determined by this crystal 5600.
- POR (pin 43) ; At switching on the set with the mains switch the signal at pin 43 becomes "high" and holds the μC . The μC waits until the signal at pin 43 becomes "low". In this way the μC knows that the supply-voltage is high enough to be able to perform well.
- TXT / no TXT (pin 44); In case jumper 4602 is present, the software "knows" as a no-TXT set (PCF84C44). In case jumper 4602 is not present, the software "knows" as a TXT set (SAA5290).
- IR-input (pin 45); Input for the remote-control commands
- Video system selections (pin 46-47-48); These three outputs can be used in different ways depending on the region where the set is produced for:
 - ⇒ For Asian Pacific sets the CHROMA1_I/BG/L/DK signal is used for sound crystal selection in the FM sound demodulation part . In case I/BG/L/DK signal is "low" L1102 is switched in parrallel to L1101.
 - ⇒ For Latin America a so called Bi-Norma (PAL-M and NTSC-M) or Tri-Norma (PAL M/N and NTSC M) is configured by using the CHROMA_0, CHROMA_1 and CHROMA_2 switching signals. For these Bi- and Tri-Norma sets the SATURATION output pin 4 is also used as an input pin for the Tri-Norma automatic system selection.

	CHROMA_0	CHROMA_1	CHROMA_2
PAL M	0	1	
PAL N	1	0	
NTSC M	1	1	

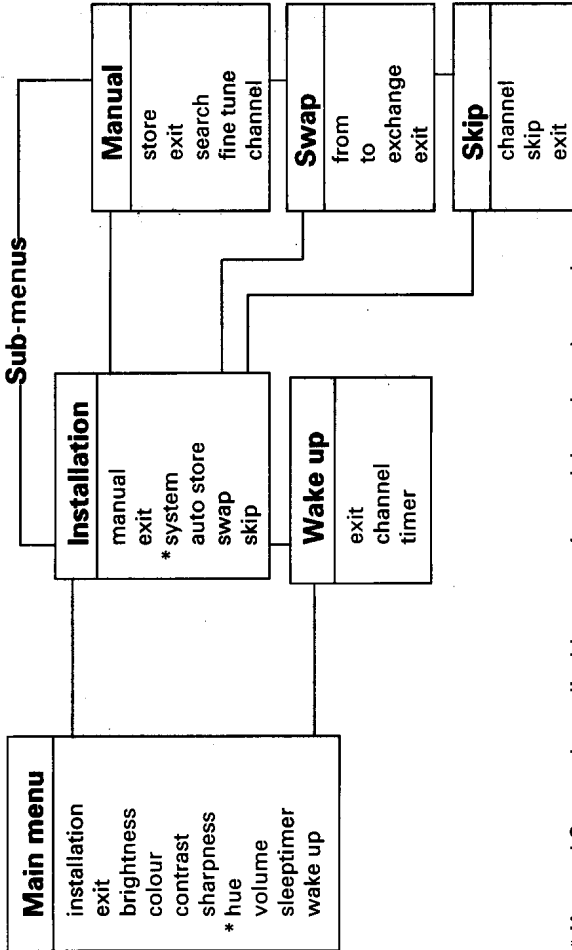
- I²C-Bus (pin 49-50); This bus is used to communicate with all used I²C devices.
 - ⇒ Non Volatile Memory (EEPROM) in which the settings are stored. In case pin 1 of this NVM is shorted while switching on the set with the mains switch, the SDAM (Service Default Alignment Mode); see chapter 6.
 - ⇒ In case of a PLL tuner, the I²C-Bus is used via the copper tracks of BS1 and BS2 (these copper tracks are used for band switching in a VST set).
- VIDEO_ID (video identification; pin 51); Pin 51 is "high" in case a video signal is detected and "low" in case no video signal is detected. This signal is coming from pin 14 IC7225-6B.
- Supply voltage (pin 52); If this voltage is present and the Power On Reset (POR) signal at pin 43 is "low" the μC will start.

10. Directions for use

Installation

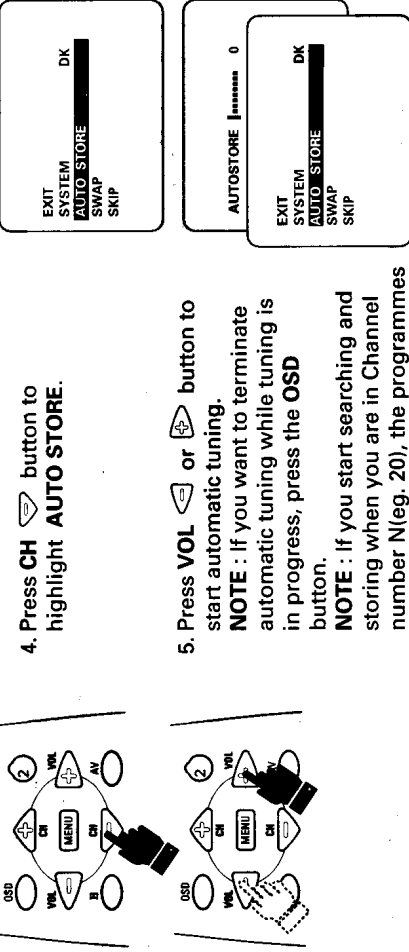
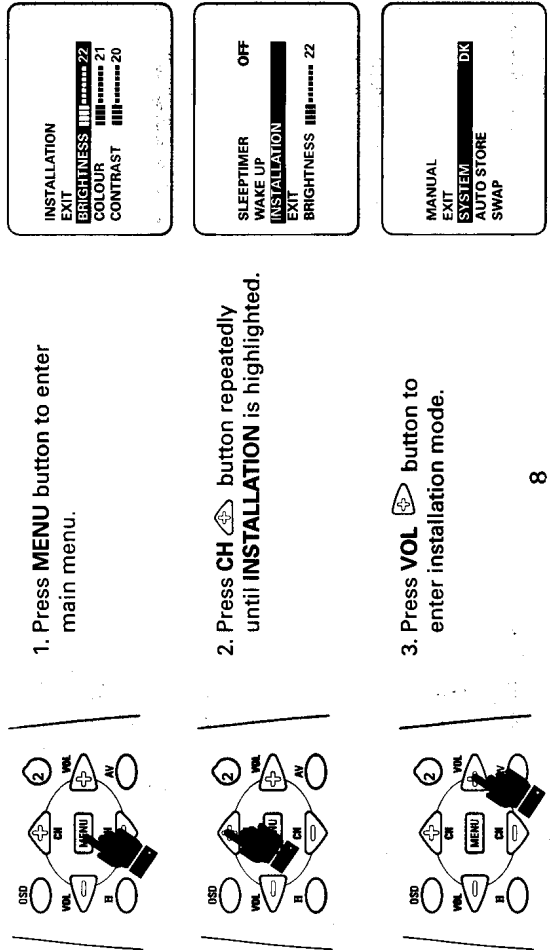
Operating instructions generally explain the operation of the TV set using the buttons on the remote control handset unless otherwise stated.

Overview of main menu and sub-menus



* Hue and System is applicable to certain models and versions only.

How to start Automatic Installation (Auto Store)



4. Press CH button to highlight **AUTO STORE**.

5. Press VOL or button to start automatic tuning.

NOTE : If you want to terminate automatic tuning while tuning is in progress, press the **OSD** button.

NOTE : If you start searching and storing when you are in Channel number N (eg. 20), the programmes found will start storing from Channel N + 1 (eg. 21) onwards.

NOTE : Searching and storing stops at the last channel (Channel 79).

6. Once automatic tuning is completed, press **OSD** button to exit from menu.

* To get back to main menu, you need to select "EXIT" on the sub-menu and press VOL or button to exit. If necessary, repeat the above procedure until main menu appears.

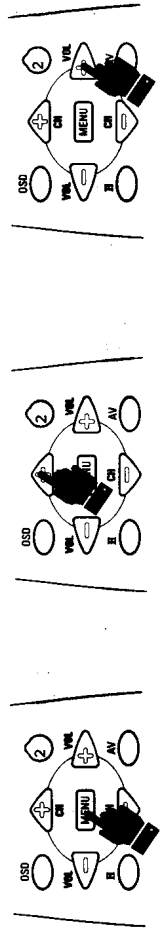
NOTE

(Applicable to certain models/versions only)

- If you hear any "noisy" sound on any channel after automatic tuning is completed, repeat **step 1** to **3**.
- Press VOL or button to select **PAL I** or **PAL DK**.
- Press OSD button to exit from menu.

How to start Manual Installation

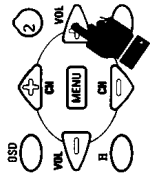
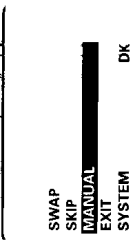
You can also do installation manually by the **SEARCH** method. Manual installation allows you to select your preferred channel number for every available station



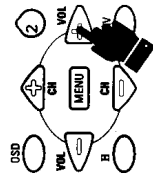
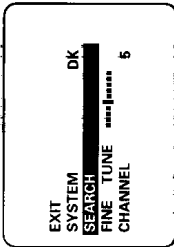
Installation



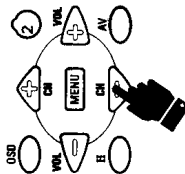
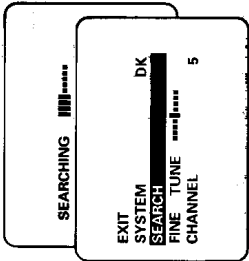
4 Press **CH** button repeatedly until **MANUAL** is highlighted.



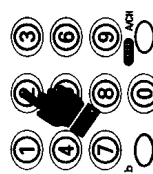
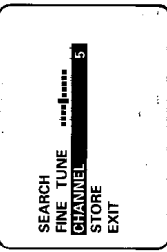
5. Press **VOL** button to enter manual mode.



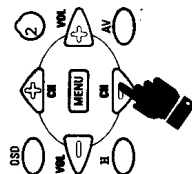
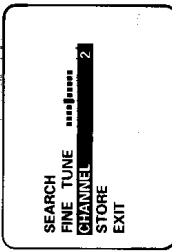
6. Press **VOL** button to activate **SEARCHING** mode. Searching stops once a station is available. If you decide to store the available station, proceed to the next step. However, if you decide to continue searching for another station, press **VOL** button again until another station is found.



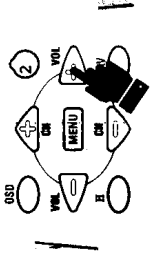
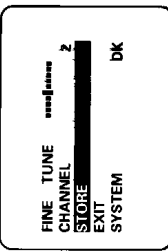
7. Press **CH** button repeatedly until **CHANNEL** is highlighted.



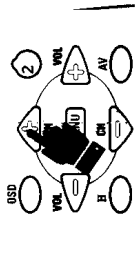
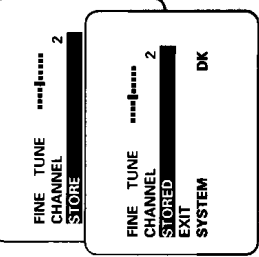
8. Key in desired channel number by the **DIGIT (0 - 9)** button.



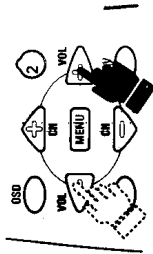
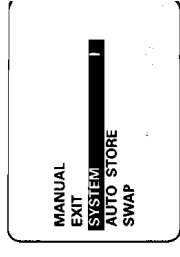
9. Press **CH** button to highlight **STORE**.



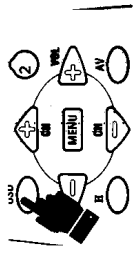
10. Press **VOL** button to store the channel.



11. If you hear any "noisy" sound after manual installation is completed, press **CH** button to highlight **SYSTEM**. (Applicable to certain models and versions only).



12. Press **VOL** or button to select **PAL I** or **PAL DK**. (Applicable to certain models and versions only).

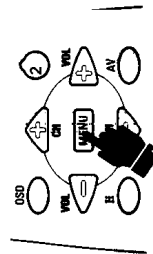


13. Press **OSD** button to exit from menu.

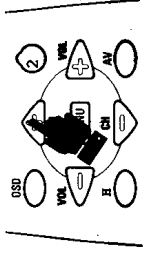


How to Swap Channels

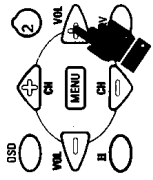
This feature allows you to change the channel number to your choice for a particular TV station.



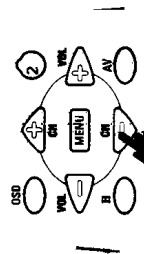
1. Enter main menu.



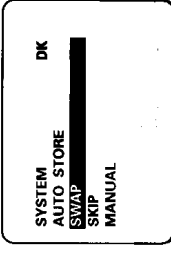
2. Highlight **INSTALLATION**.



3. Enter installation mode.



4. Press **CH** button repeatedly until **SWAP** is highlighted.



11. List of abbreviations (incl. all signal names)

+160V	+16V supply voltage from the LOT to the picture tube panel
+95V	+95V supply voltage from the SOPS to the line output stage and the tuning circuit
+26V	+26V supply voltage from the LOT to the frame amplifier IC7401
+10V/14V	+xxV supply voltage from the SOPS to supply the audio amplifier
+10V	+10V supply voltage from the SOPS to the line drive stage (A3)
+9V	+9V supply voltage from the LOT to the relais of the degaussing coil and to the supply voltages +8V and +8VI
+8V/+8VI	+8V supply voltage from the LOT to supply IC7225
+5V5	+5V5 supply voltage from the LOT for the tuner and to create VB for bandswitching
+5V	+5V supply voltage from the SOPS to supply the control part
μ C	Microcomputer
AFC	Automatic Frequency Control
AGC	Automatic Gain Control
AUDIO_IN	AUDIO-IN signal from audio cinch; this signal is fed to IC7015-6F for source select
AV	Switching signal from the μ C to select between internal and external video/audio
AV-MUTE	Signal to mute the sound on the Audio-out cinch
AQUA	Aquadag on the rear side of the picture tube to pin 8 of the LOT
AUDIO_OUT	Outgoing audio signal from pin 1 of IC7225-F to audio_out cinch
B_TXT_OSD	Blue input signal from the μ C to the video controller IC7015-6D
BS1	Switching signal from μ C for band switching to tuner 1000
BS2	Switching signal from μ C for band switching to tuner 1000
BCI	Beam Current Info; If beam current increases the BCI signal decreases. BCI is used for contrast reduction (if beam current is too high)
BL-TXT-OSD	Fast blanking signal to IC7225-6D to display OSD and TXT
BRIGHTNESS	Control signal (from μ C, but on DC level via RC network) for brightness control of the video controller IC7015-6D (0-5V)
CHROMA	Chrominance part of the video signal
CHROMA-0_L/L'/I	Signal to select the correct system in case of trinorma
CHROMA-1_I/BG/L/DK	Signal from the μ C to select the correct sound x-tal. In case of trinorma to select the correct system
CHROMA-2/STATUS	Signal to select the correct system in case of trinorma
CONTRAST	Control signal (from μ C, but on DC level via RC network) for contrast control of the video controller IC7015-6D
CVBS	Colour Video Blanking Synchronisation
V-EXT	Incoming CVBS signal from cinch video_in to the external input pin 15 IC7015-6B
V-INT	Outgoing CVBS signal from sound trap on pin 7 IC7015-6A (IF detector) to the video_out cinch
EEPROM	Electrical Erasable Programmable Read Only Memory
ESD	Electrical Static Discharge
ff	Filament (heater voltage) from LOT to the picture tube
FM	FM demodulated sound from the FM-demodulator IC7015-6F to smart sound
G-TXT-OSD	Fast blanking signal to IC7225-6D to display OSD and TXT
HUE	Signal from the μ C to control the hue of the video signal
HEW	X-ray detection. If this signal is too high, X-ray could occur so the set is switched in protection
HOR. FLYBACK	Horizontal flyback pulse (15625 Hz) used for locking the horizontal oscillator in IC7015-6E
I ² C	Digital control bus of the microcomputer
VIDEO-ID	Status signal from IC7015-6B; "low" for no CVBS signal (horizontal sync not present), "high" in case CVBS signal is present (horizontal sync present) from the IF-detector IC7015-6B to the μ C
IF	Intermediate frequency signal from the tuner
NIL	Non Inter Laced; 25 Hz block-shaped signal from teletext to the frame amplifier for coinciding the odd & even frames
POR	Power On Reset; ensures the μ C starts up its software only if the power supply of the μ C itself is high enough
PP	Personal Preference
PROT	Protection signal from frame IC7401; in case the vertical flyback generator in IC7401 is not activated, the voltage on pin 8 IC7401 becomes < 2V. By then the protection circuit in IC7401 will make pin 7 "high" overriding the HOR FLYBACK and SANDCASTLE. The constant "high" sandcastle will cause the picture to become "black"
R_TXT_OSD	Fast blanking signal to IC7225-6D to display OSD and TXT
RAM	Random Access Memory
ROM	Read Only Memory
SANDCASTLE	Sandcastle signal from IC7015-6F to delay line IC7255 and SECAM chrominance decoder IC7245
SATURATION	Control signal (from μ C, but on DC level via RC network) for saturation control of the video controller IC7015-6D (0-2V5)
SAW	Surface Acoustic Wave; high precision band pass filter
SCL	Clock line of the I ² C-bus
SDA	Data line of the I ² C-bus
SAM	Service Alignment Mode; Service mode for doing alignments.
SDM	Service Default Mode; predefined mode for faultfinding (see chapter 8)
SDAM	Service Default Alignment Mode; Combined mode of SAM and SDM.
SHARPNESS CONTROL	Control signal on DC level (0-5V) from μ C to IF-detector IC7015-6B) for sharpness control

List of abbreviations (incl. all signal names)

Chassis L7.1A

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SMART SOUND	Bass and treble control before the sound amplifier.
STANDBY	Switching signal from μC ; "low" for standby (power supply will be switched to stand-by mode), "high" for normal operation
INT/EXT	Switching signal derived from the AV-signal for internal or external audio + video switching ("low" for internal and "high" for external)
VT	Tuning voltage from which the signal TUNING VOLTAGE is derived to tune the tuner
VERT DRIVE	Vertical drive signal from IC7225-6E to frame amplifier IC7401
VFB	50 Hz vertical flyback pulse used for locking the vertical oscillator in IC7225-6E
VFL	50 Hz vertical flyback pulse used to inform the μC that flyback takes place. This is important for OSD and TXT.
Vg2	Voltage on grid 2 of the picture tube
VOLUME	Control signal (from μC , but on DC level via RC network) for volume control of sound processing in IC7225-6F
Y	Luminance part of the video signal

Main carrier [A]

Various

Table with columns for part number, description, and quantity. Includes items like SPRING CONN. 2-P MALE, MAIN SWITCH, FILTER 45MHZ, etc.

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Table with columns for part number, description, and quantity. Includes items like 100nF 10% 16V, 220nF 20% 50V, etc.

Table with columns for part number, description, and quantity. Includes items like 100uF 20% 50V, 100nF 10% 16V, etc.

Main body table with columns for part number, description, and quantity. Includes various electronic components and their specifications.

Table with columns for part number, description, and quantity. Includes items like 560pF 1% 400V, 330pF 5% 50V, etc.

Main body table with columns for part number, description, and quantity. Includes various electronic components and their specifications.

Main body table with columns for part number, description, and quantity. Includes various electronic components and their specifications.

