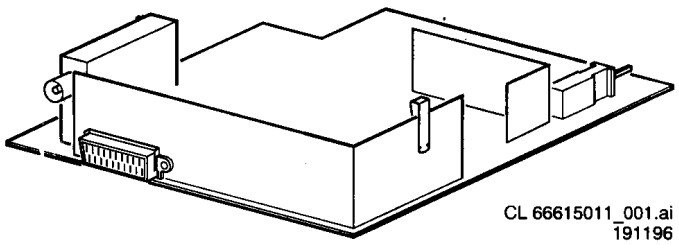
Service
Service
Service

L7.1A
AA



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Service Manual

Table of contents

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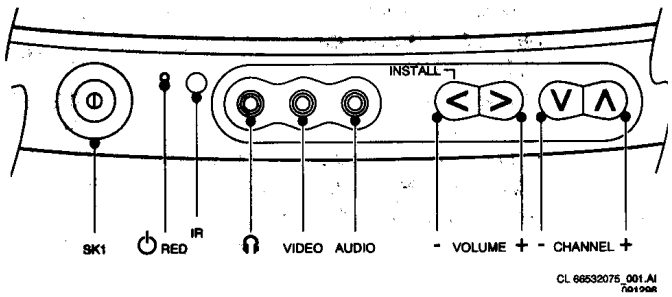
PCS 82 404 GB

PHILIPS

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).

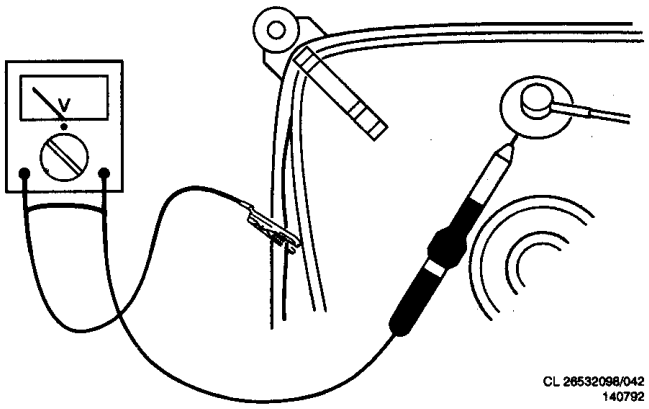


Fig. 3.1

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.

Notes

1. Do not use heatsinks as earth reference.

2. The direct voltages and oscillograms should be measured with regard to the tuner earth (⊥), or hot earth (⊥) 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 (⊤) and without (⊁) 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 (⏻) and in the stand-by mode (⏻). As an input signal a colour bar pattern has been used.

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

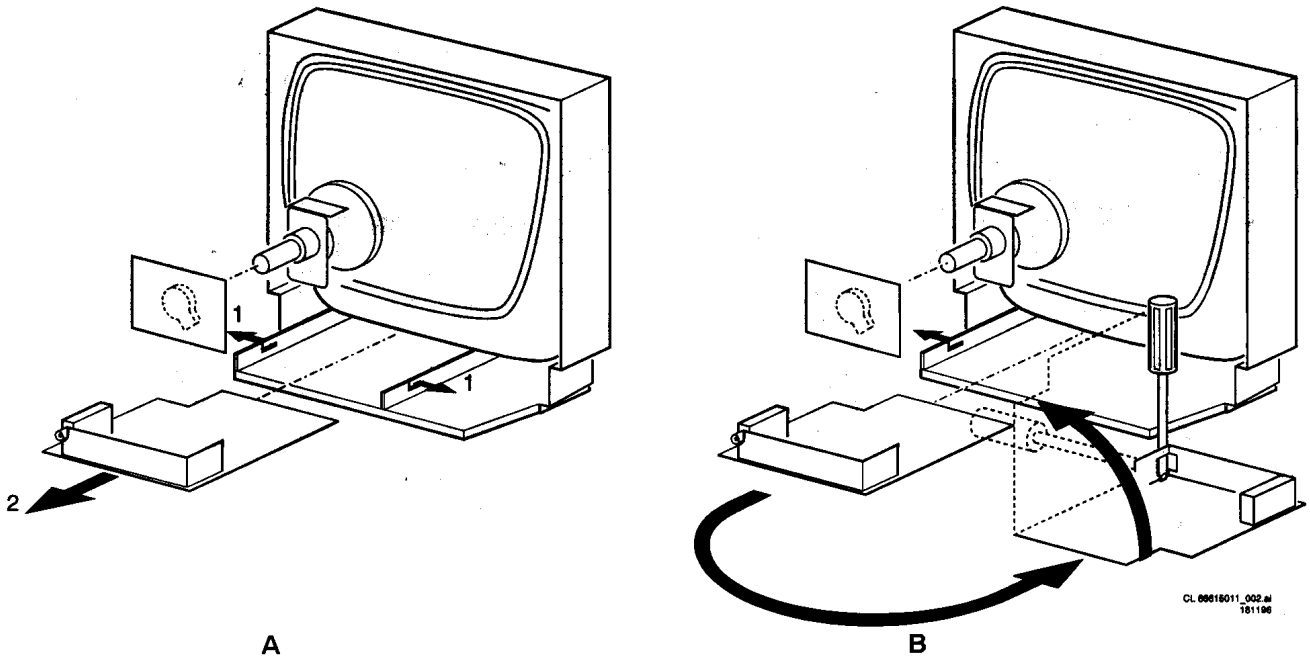
4. Mechanical instructions

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

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

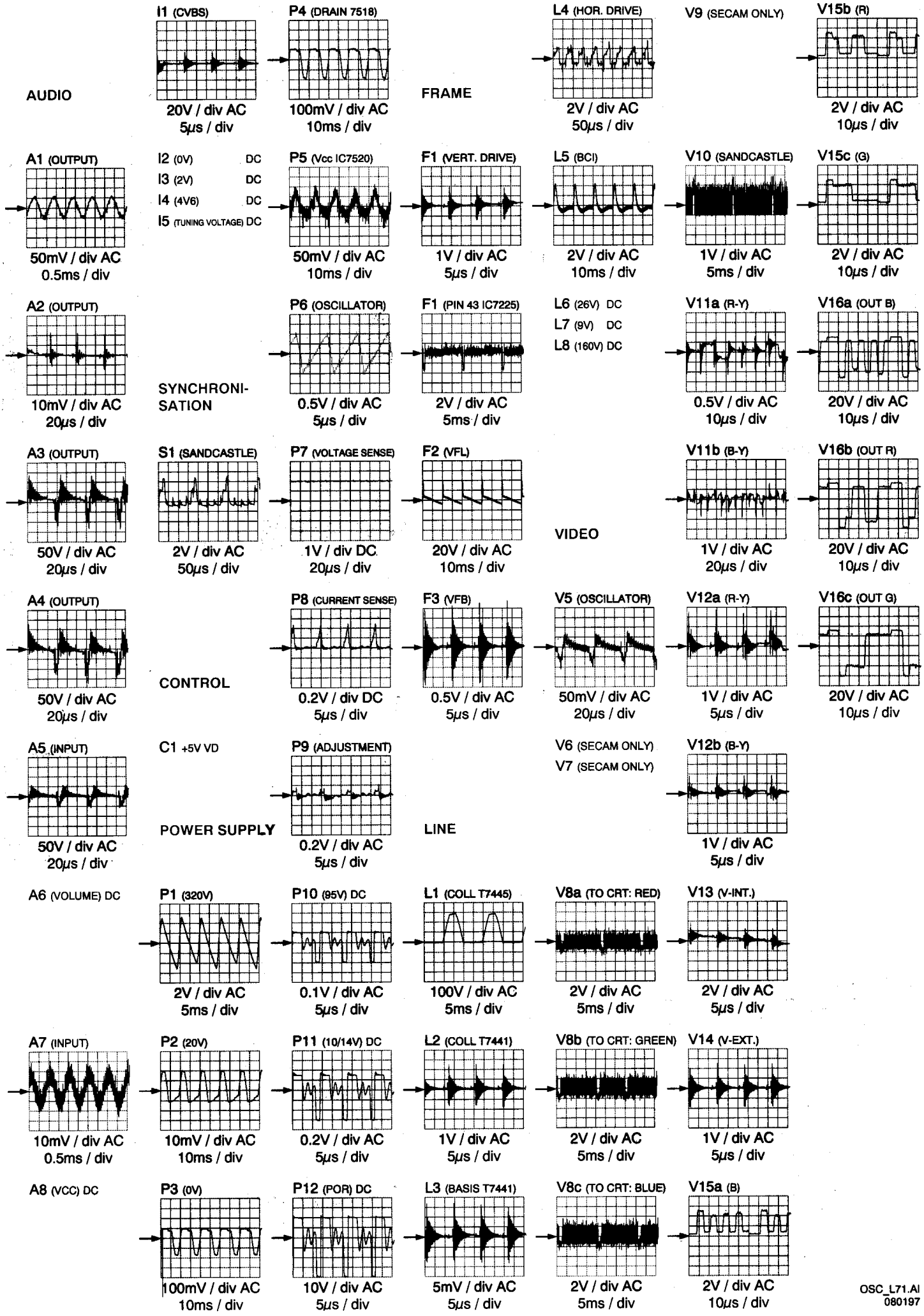
Position B can be reached from position A after disconnecting the degaussing cable. Put the carrier on the line transformer side and if wanted use a screwdriver for an extra stable service position (see figure below).



A B

Fig. 4.1

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)

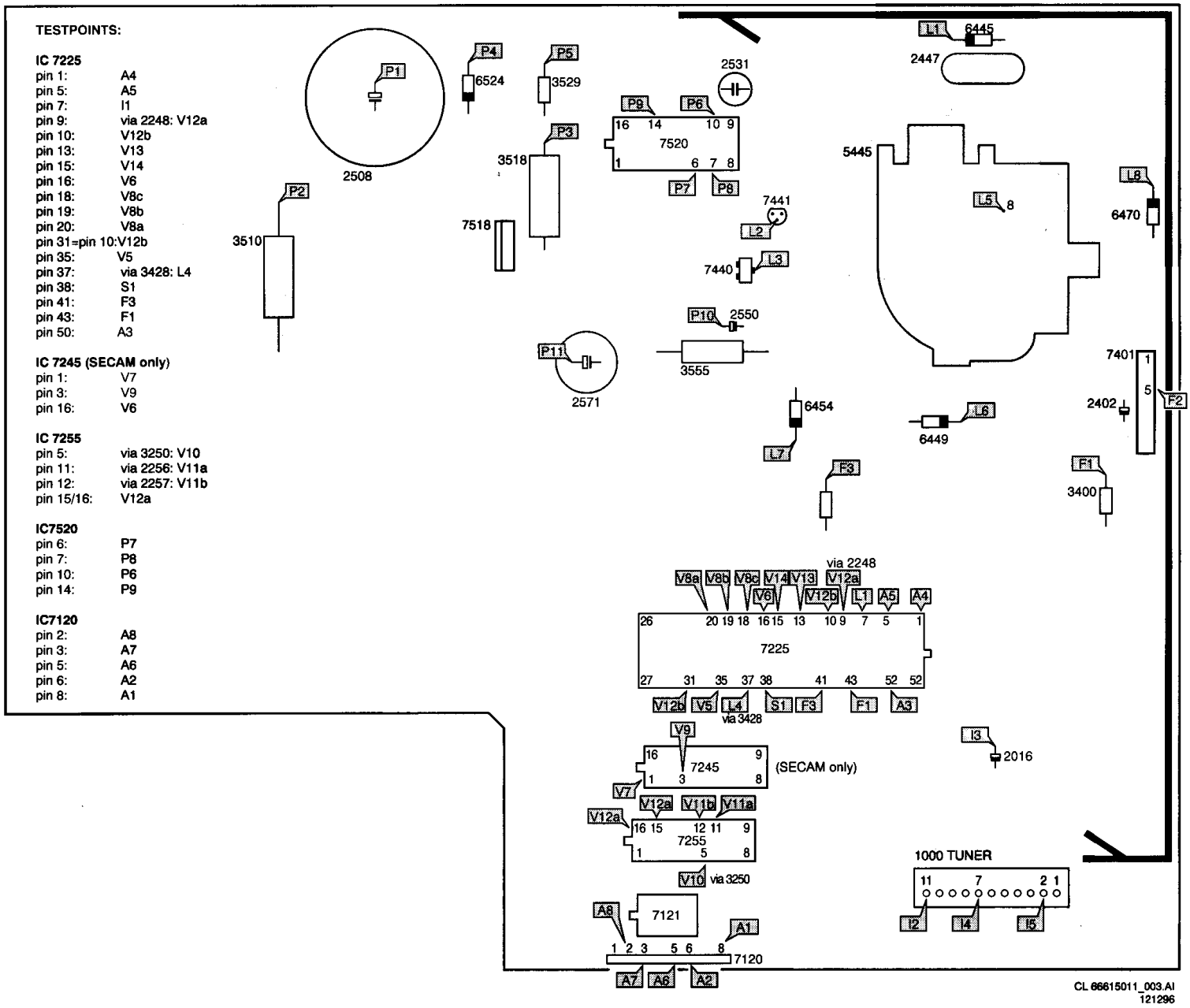


Fig. 5.1

CRT PANEL

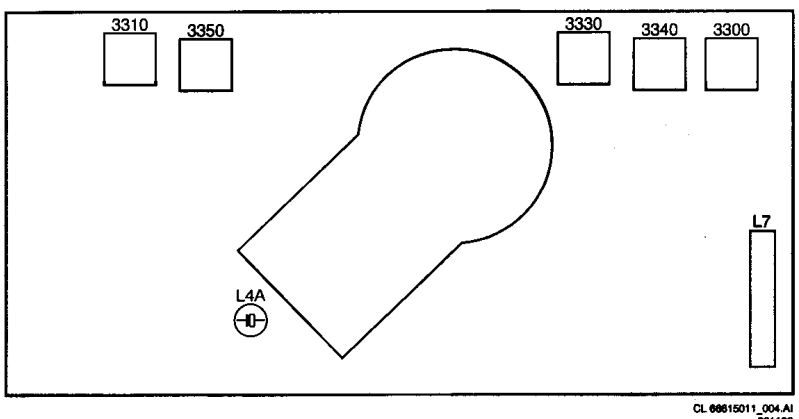
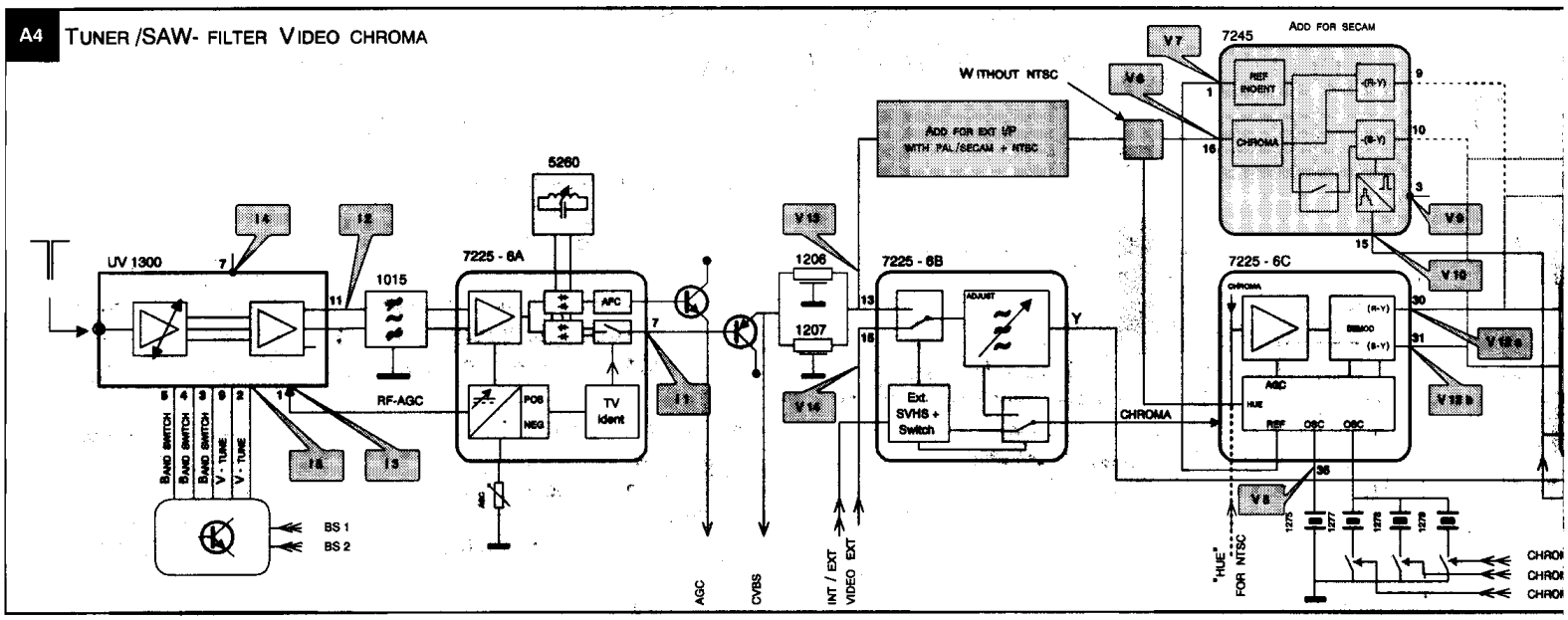
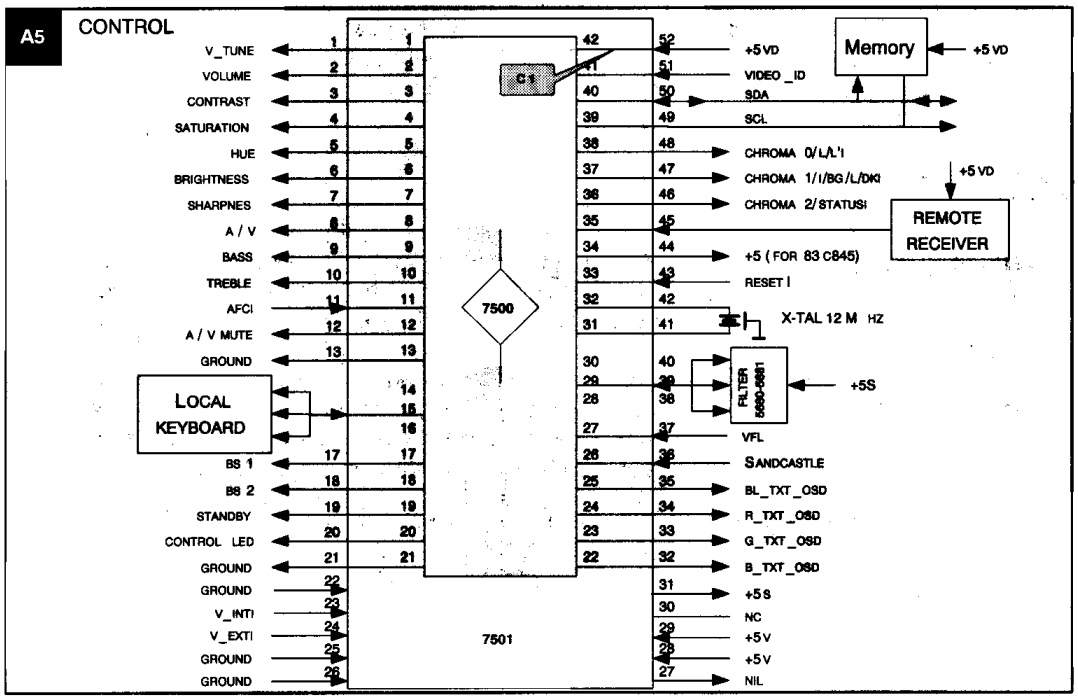
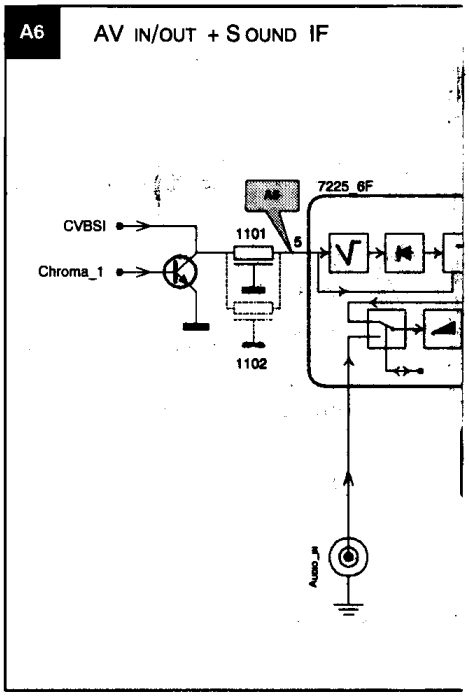


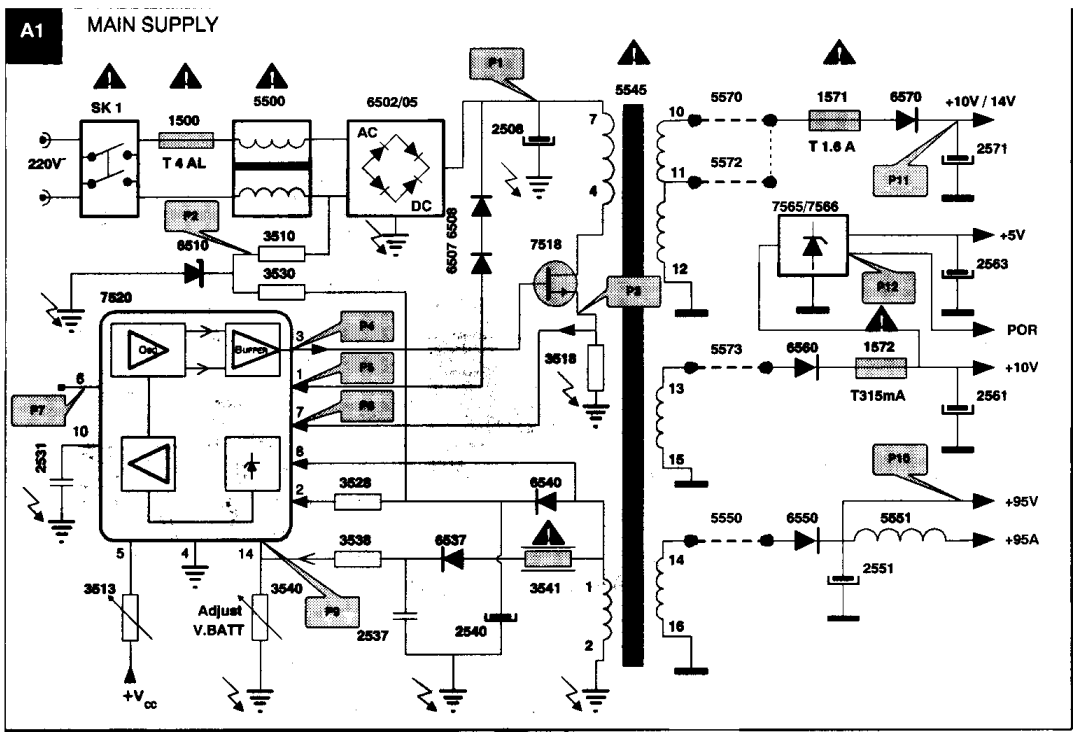
Fig. 5.2

Block diagram / Blockschaltbild /









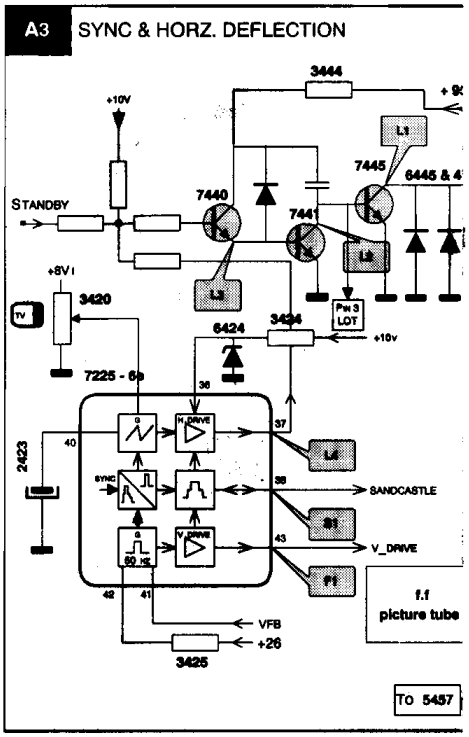
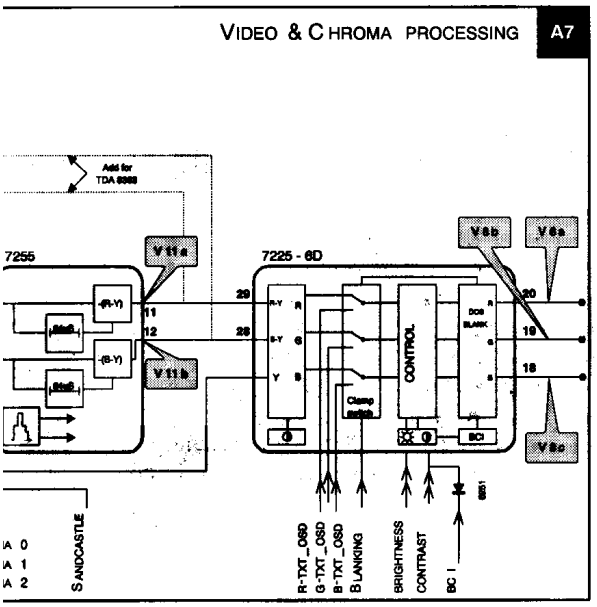
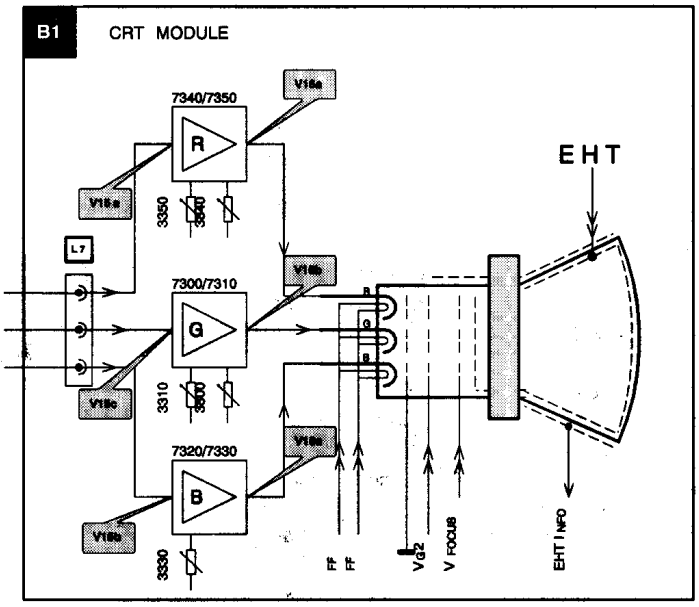
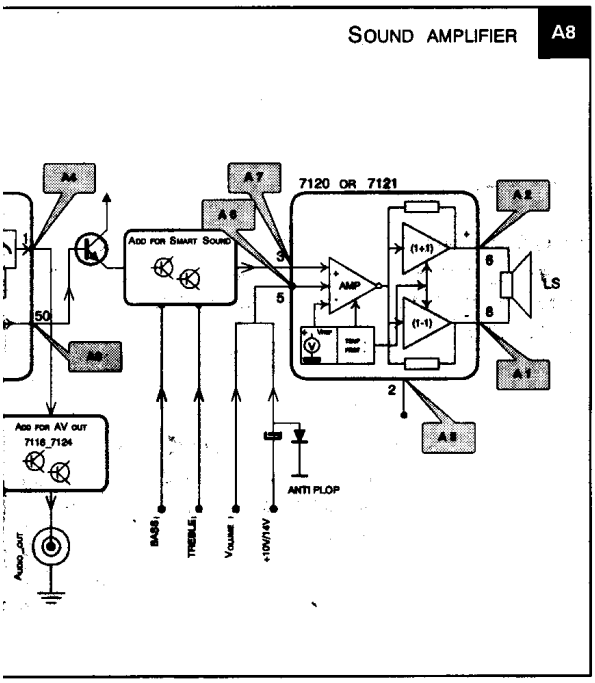
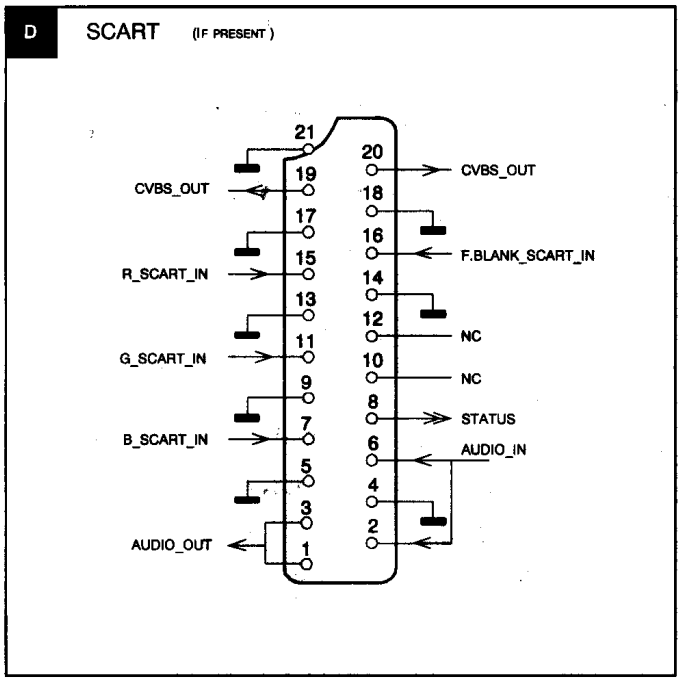


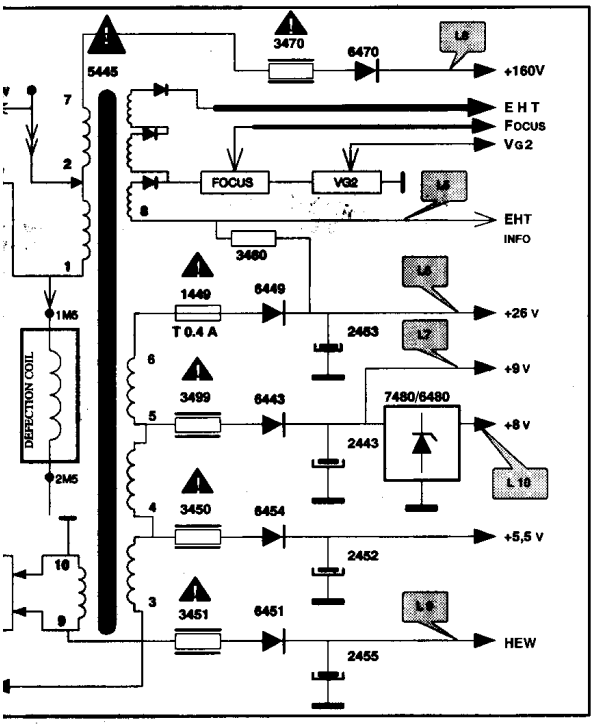
Diagramme synoptique

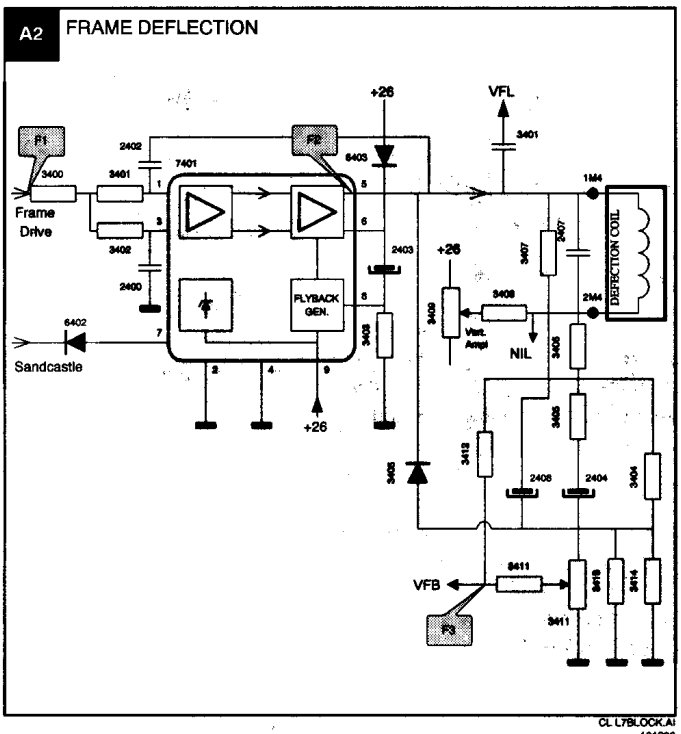












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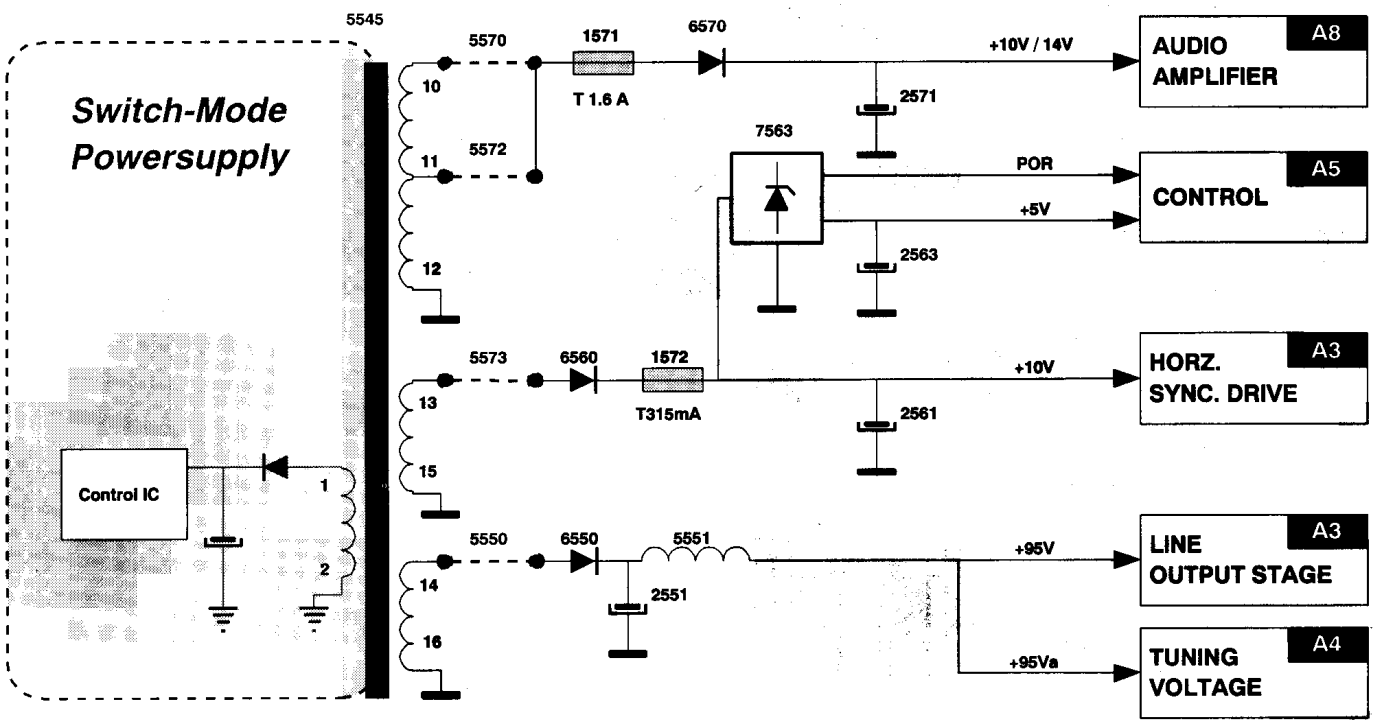
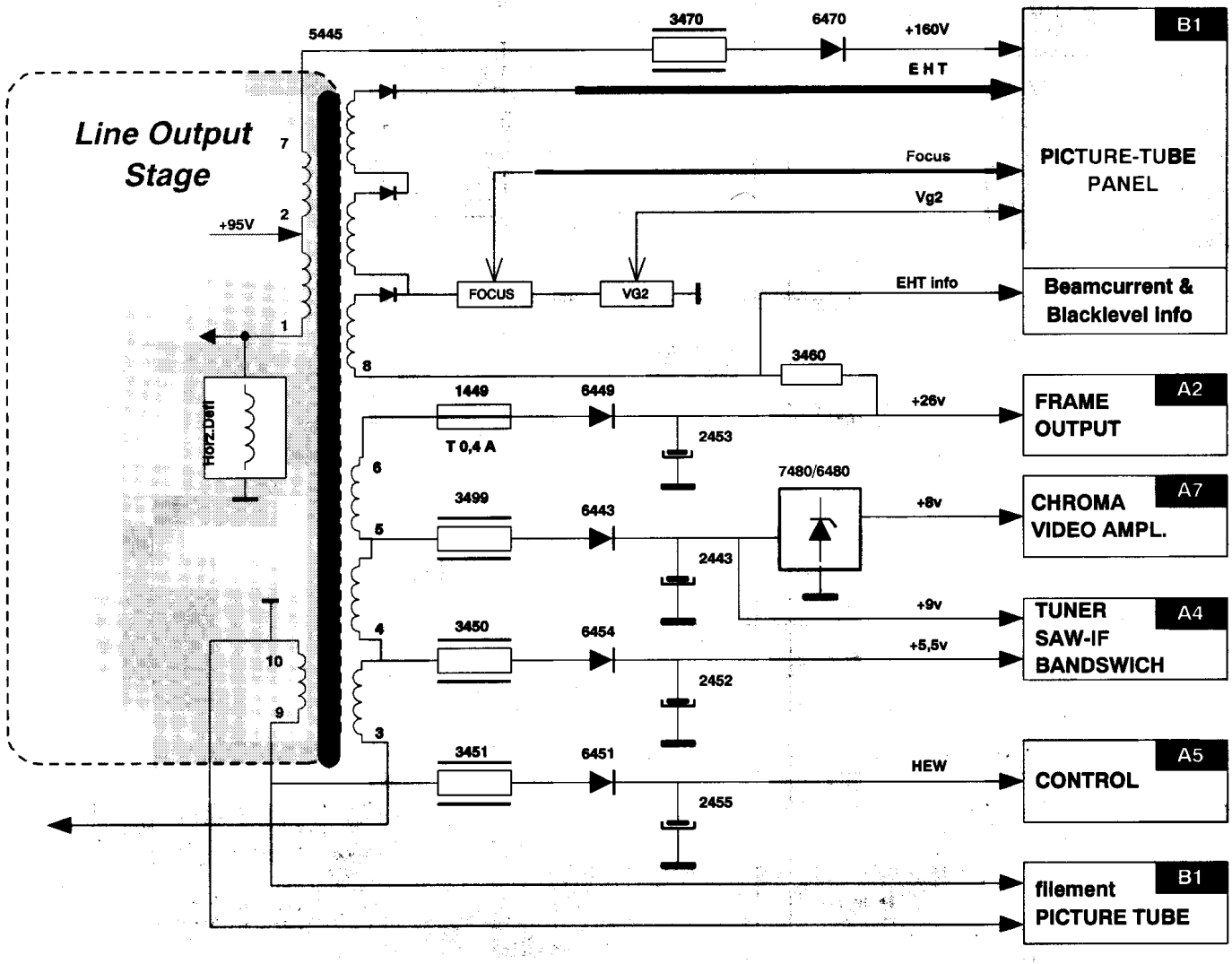
Block diagram / Blockschaltbild / Diagramme synoptique





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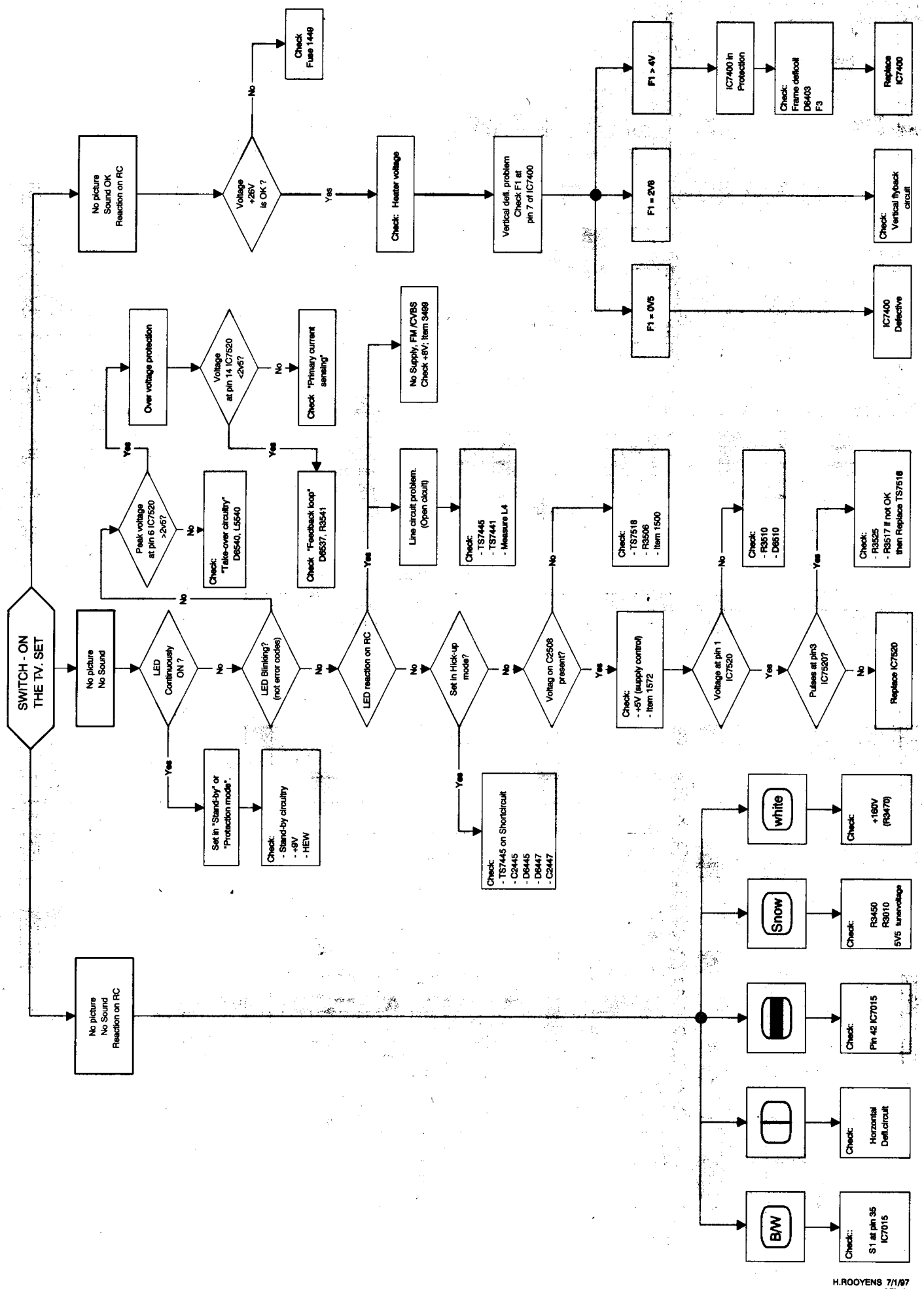
6. Fault finding tree & Repair facilities / Fehlersuchbaum & Reparaturhinweise / Aide au depannage & Conseils pour la réparations



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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 I ^{2}C 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 = I ^{2}C 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:

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

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.

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

Repair facilities

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 limitter	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 limitter	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 limitter	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

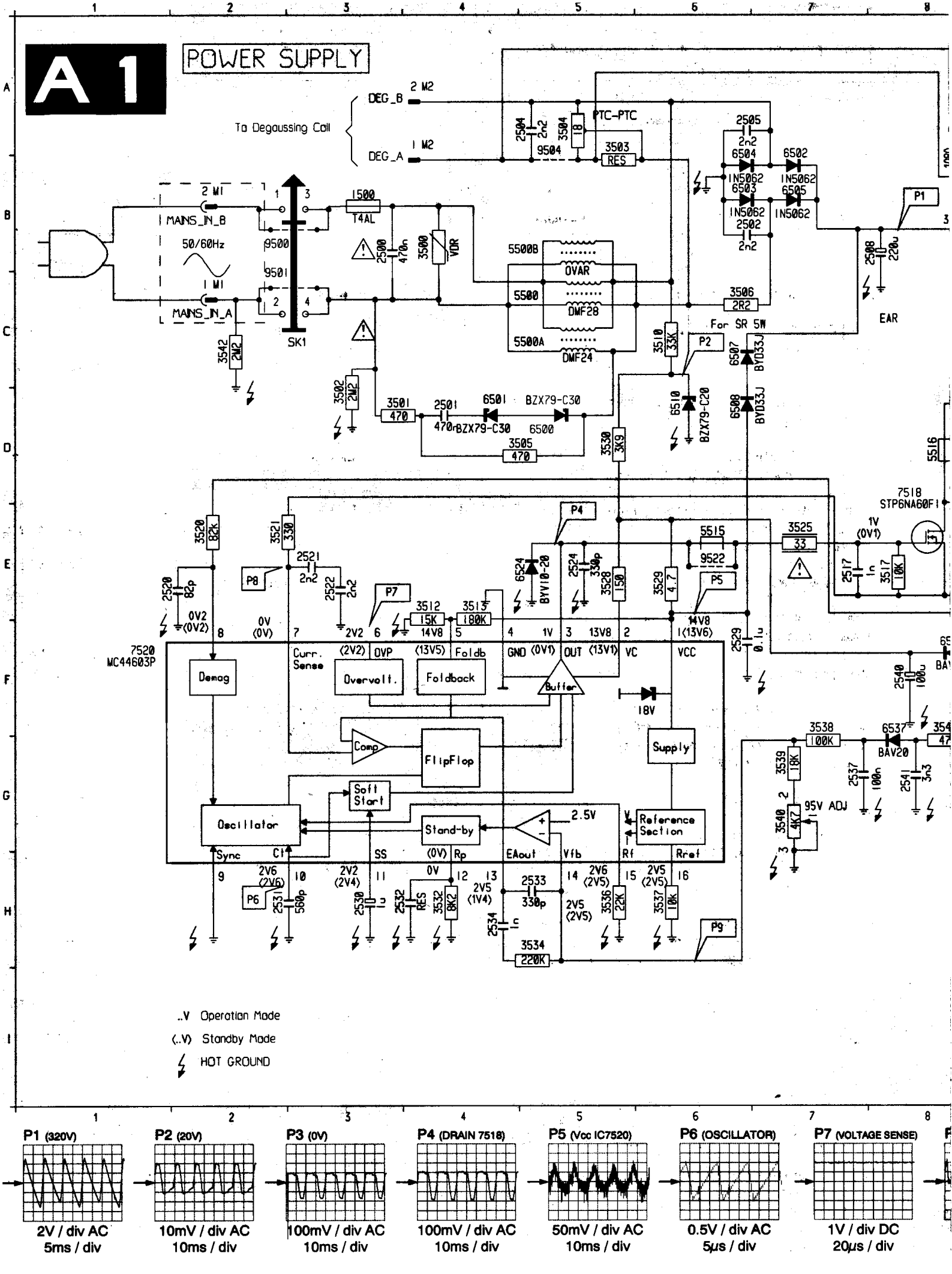
The L7 chassis has one special mode, called the hotel mode.

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.

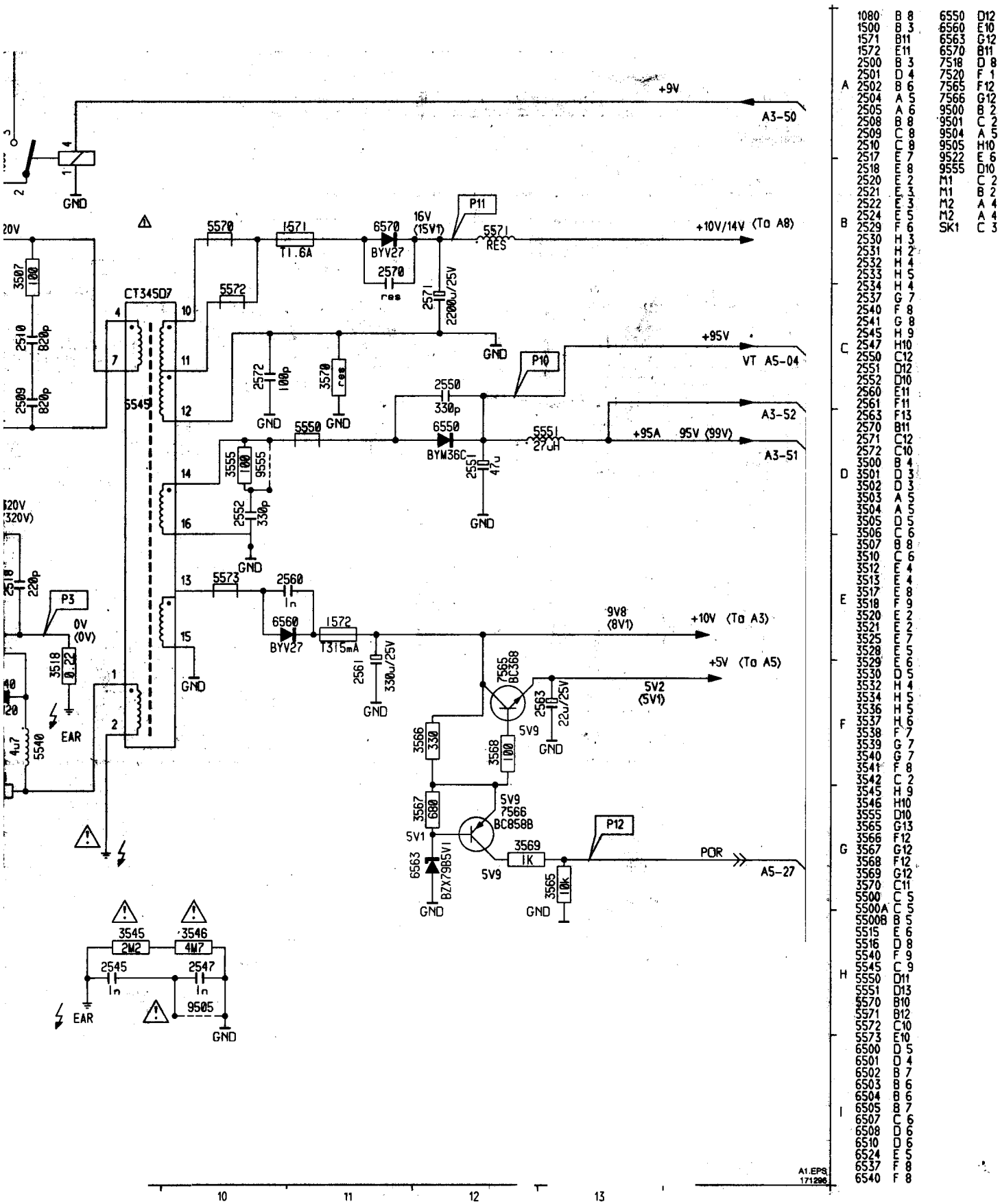
Entering the hotel-mode:
- Select channel 38
- Push the menu button on the local keyboard and the OSD-button of the RC simultaneously for 3 seconds.

Leaving the hotel mode:
- Same as entering the hotel mode.

OSD will tell if hotel mode is on or off.

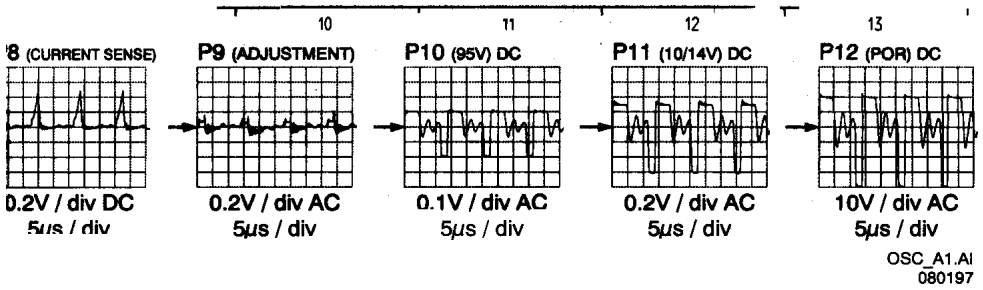

A 1
POWER SUPPLY
To Degaussing Coil
DEG_B
DEG_A
2 M2
1 M2
PTC-PTC
RES
MAINS_IN_B
MAINS_IN_A
50/60Hz
T4AL
VDR
SK1
OVAR
DMF28
DMF24
For SR 5W
EAR
BZX79-C30
BYD33J
BZX79-C20
IN5062
7520
MC44603P
Curr. Sense
Overvolt.
Foldback
Buffer
Demag
Comp
FlipFlop
Supply
Soft Start
Oscillator
Stand-by
Reference Section
2.5V
95V ADJ
BAV20
STP6NA60FI
BYV10-20
Sync
Ct
SS
EAout
Vfb
Rf
Rref
GND
OUT
VC
VCC
..V Operation Mode
(..V) Standby Mode
HOT GROUND

P1 (320V)
2V / div AC
5ms / div
P2 (20V)
10mV / div AC
10ms / div
P3 (0V)
100mV / div AC
10ms / div
P4 (DRAIN 7518)
100mV / div AC
10ms / div
P5 (Vcc IC7520)
50mV / div AC
10ms / div
P6 (OSCILLATOR)
0.5V / div AC
5µs / div
P7 (VOLTAGE SENSE)
1V / div DC
20µs / div



	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	D 4	7520	F 1
A	2502	B 6	7565	F12
	2504	A 5	7566	G12
	2505	A 6	9500	B 2
	2508	B 8	9501	C 2
	2509	C 8	9504	A 5
	2510	C 8	9505	H10
	2517	E 7	9522	E 6
	2518	E 8	9555	D10
	2520	E 2	M1	C 2
	2521	E 3	M1	B 2
	2522	E 3	M2	A 4
B	2524	E 5	M2	A 4
	2529	F 6	SK1	C 3
	2530	H 3		
	2531	H 2		
	2532	H 4		
	2533	H 5		
	2534	H 4		
	2537	G 7		
	2540	F 8		
	2541	G 8		
	2545	H 9		
C	2547	H10		
	2550	C12		
	2551	D12		
	2552	D10		
	2560	E11		
	2561	F11		
	2563	F13		
	2570	B11		
	2571	C12		
	2572	C10		
	3500	B 4		
D	3501	D 3		
	3502	D 3		
	3503	A 5		
	3504	A 5		
	3505	D 5		
	3506	C 6		
	3507	B 8		
	3510	C 6		
	3512	E 4		
	3513	E 4		
	3517	E 8		
E	3518	F 9		
	3520	E 2		
	3521	E 2		
	3525	E 7		
	3528	E 5		
	3529	E 6		
	3530	D 5		
	3532	H 4		
	3534	H 5		
	3536	H 5		
F	3537	H 6		
	3538	F 7		
	3539	G 7		
	3540	G 7		
	3541	F 8		
	3542	C 2		
	3545	H 9		
	3546	H10		
	3555	D10		
	3565	G13		
	3566	F12		
G	3567	G12		
	3568	F12		
	3569	G12		
	3570	C11		
	5500	C 5		
	5500A	C 5		
	5500B	B 5		
	5515	E 6		
	5516	D 8		
	5540	F 9		
	5545	C 9		
H	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		
I	6507	C 6		
	6508	D 6		
	6510	D 6		
	6524	E 5		
	6537	F 8		
	6540	F 8		

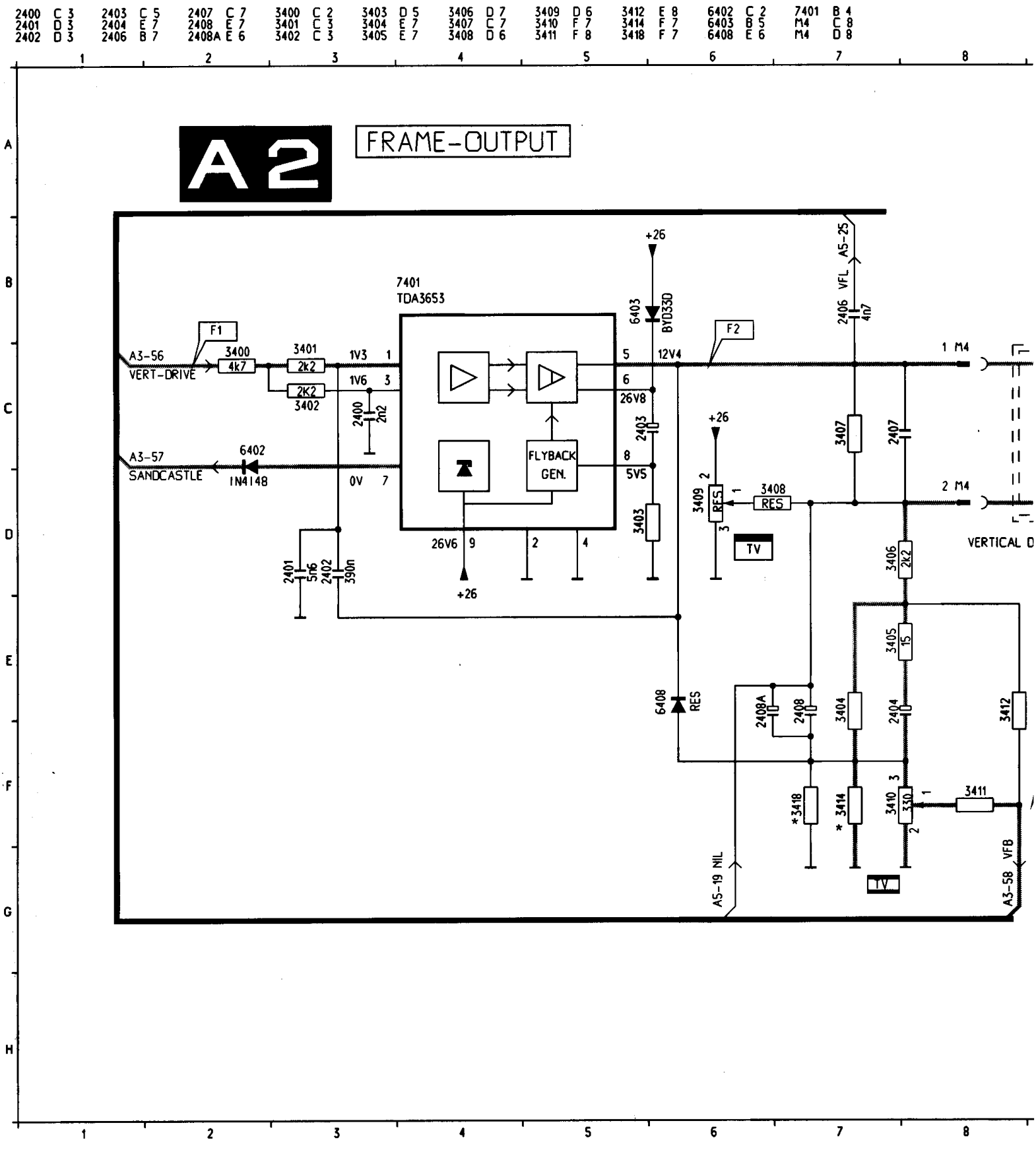
A1.EPS 171296

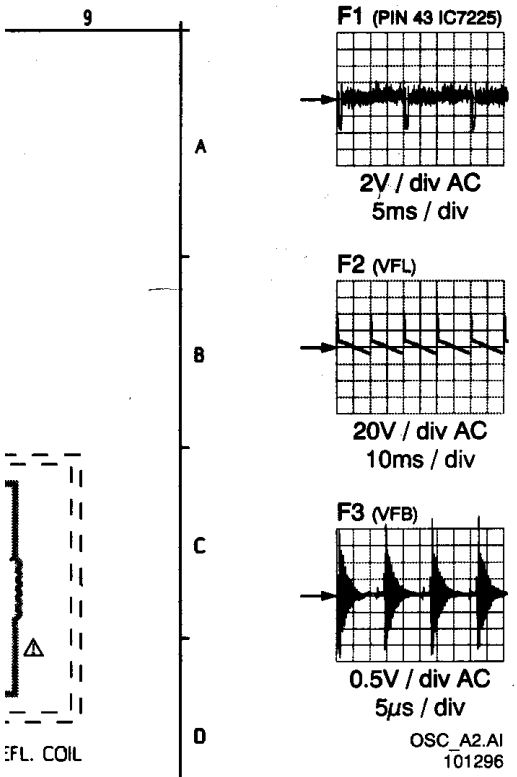


OSC_A1.AI 080197

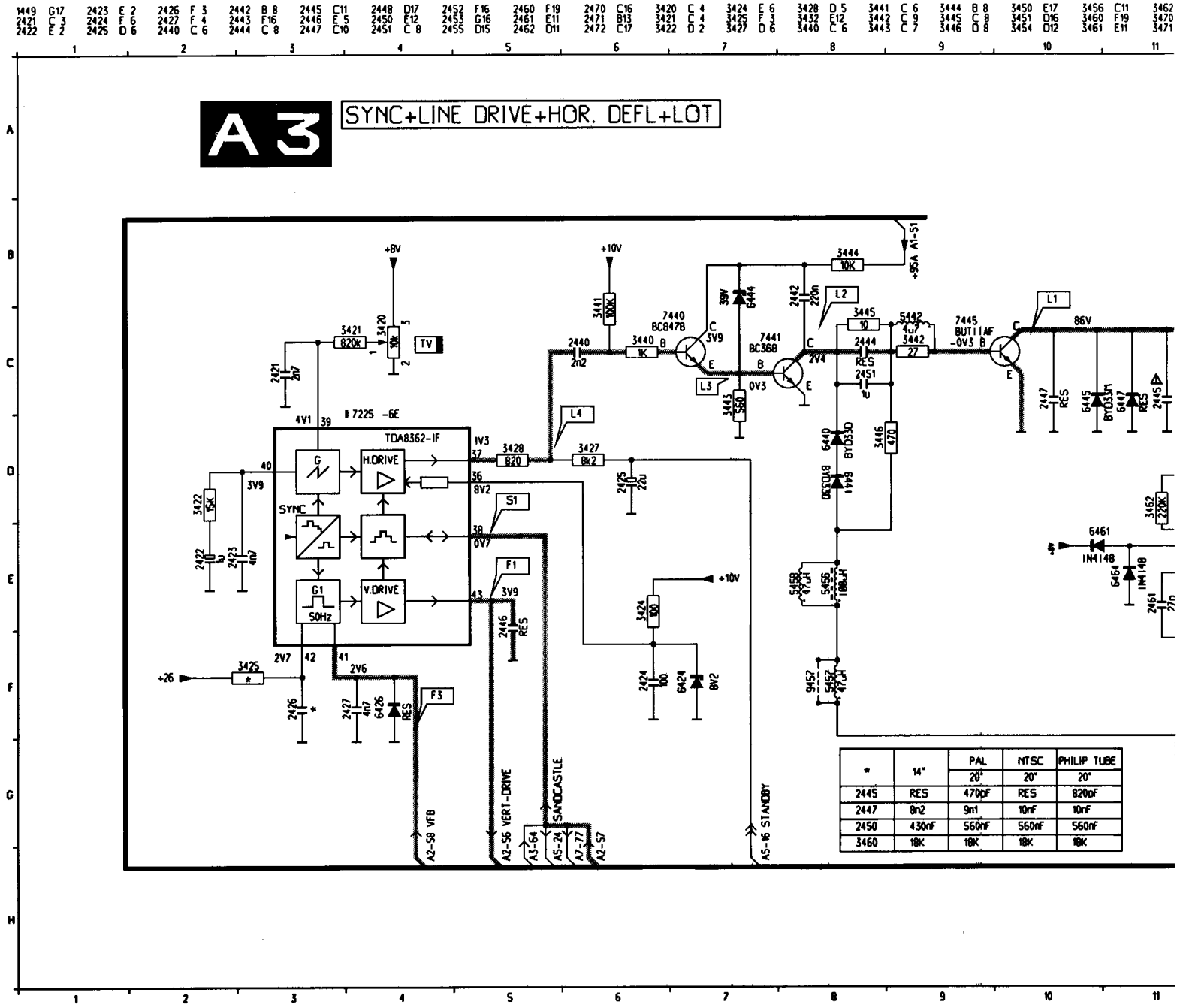
Frame output / Raster Ausgang / Sortie trame

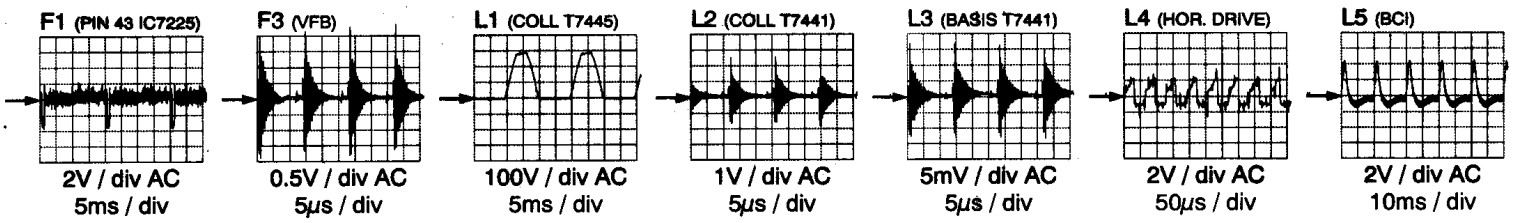
2400	C 3	2403	C 5	2407	C 7	3400	C 2	3403	D 5	3406	D 7	3409	D 6	3412	E 8	6402	C 2	7401	B 4
2401	D 3	2404	E 7	2408	E 7	3401	C 3	3404	E 7	3407	C 7	3410	F 7	3414	F 7	6403	B 5	M4	C 8
2402	D 3	2406	B 7	2408A	E 6	3402	C 3	3405	E 7	3408	D 6	3411	F 8	3418	F 7	6408	E 6	M4	D 8



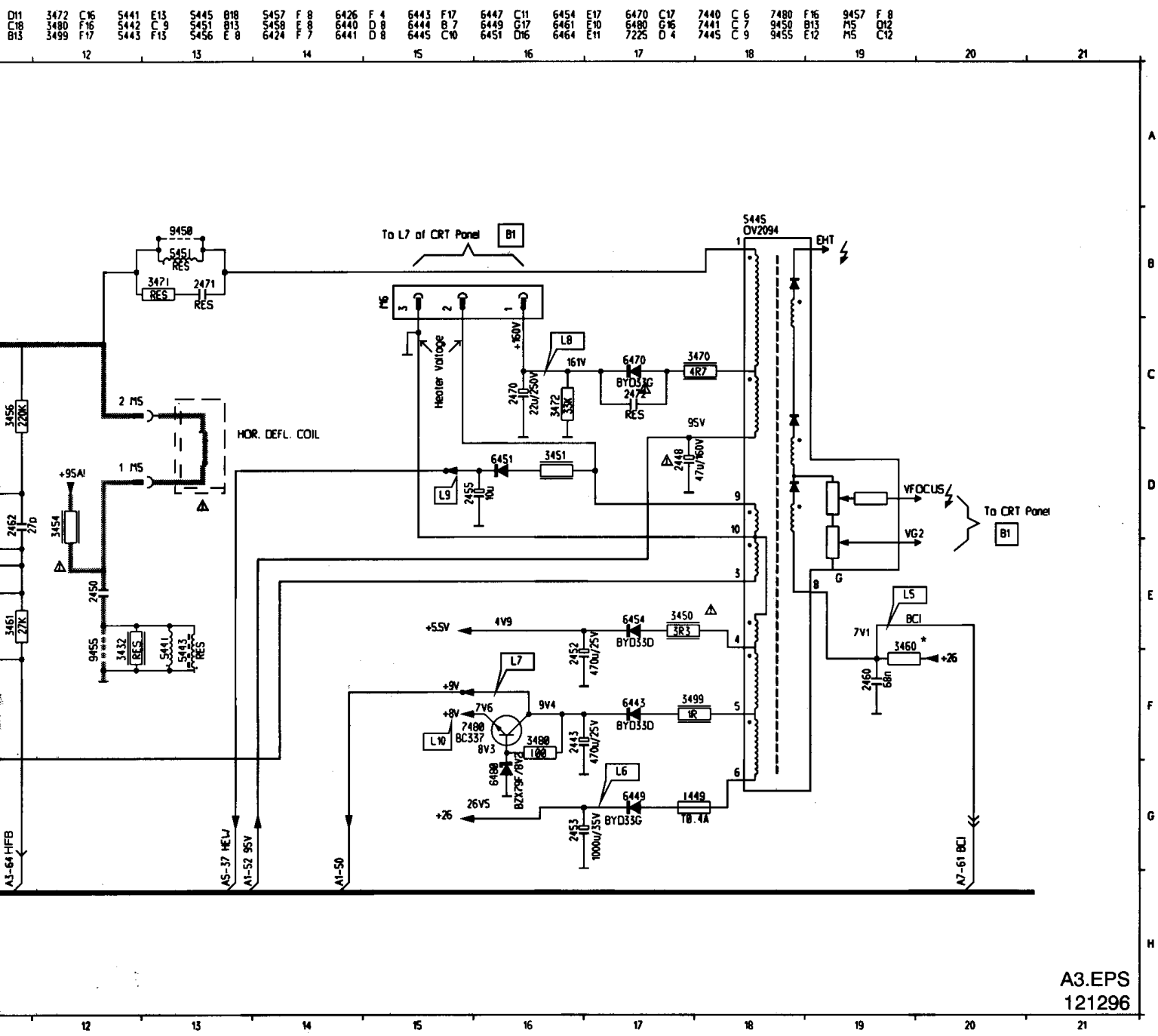

9
A
B
C
D
E
F
G
H
F1 (PIN 43 IC7225)
2V / div AC
5ms / div
F2 (VFL)
20V / div AC
10ms / div
F3 (VFB)
0.5V / div AC
5µs / div
OSC_A2.AI
101296
:FL. COIL
F3
A2.EPS
121296
9

Synchronisation + deflection /



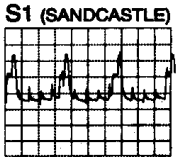


Synchronisierung + Ablenkung / Synchronisation + déviation



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

S1 (SANDCASTLE)

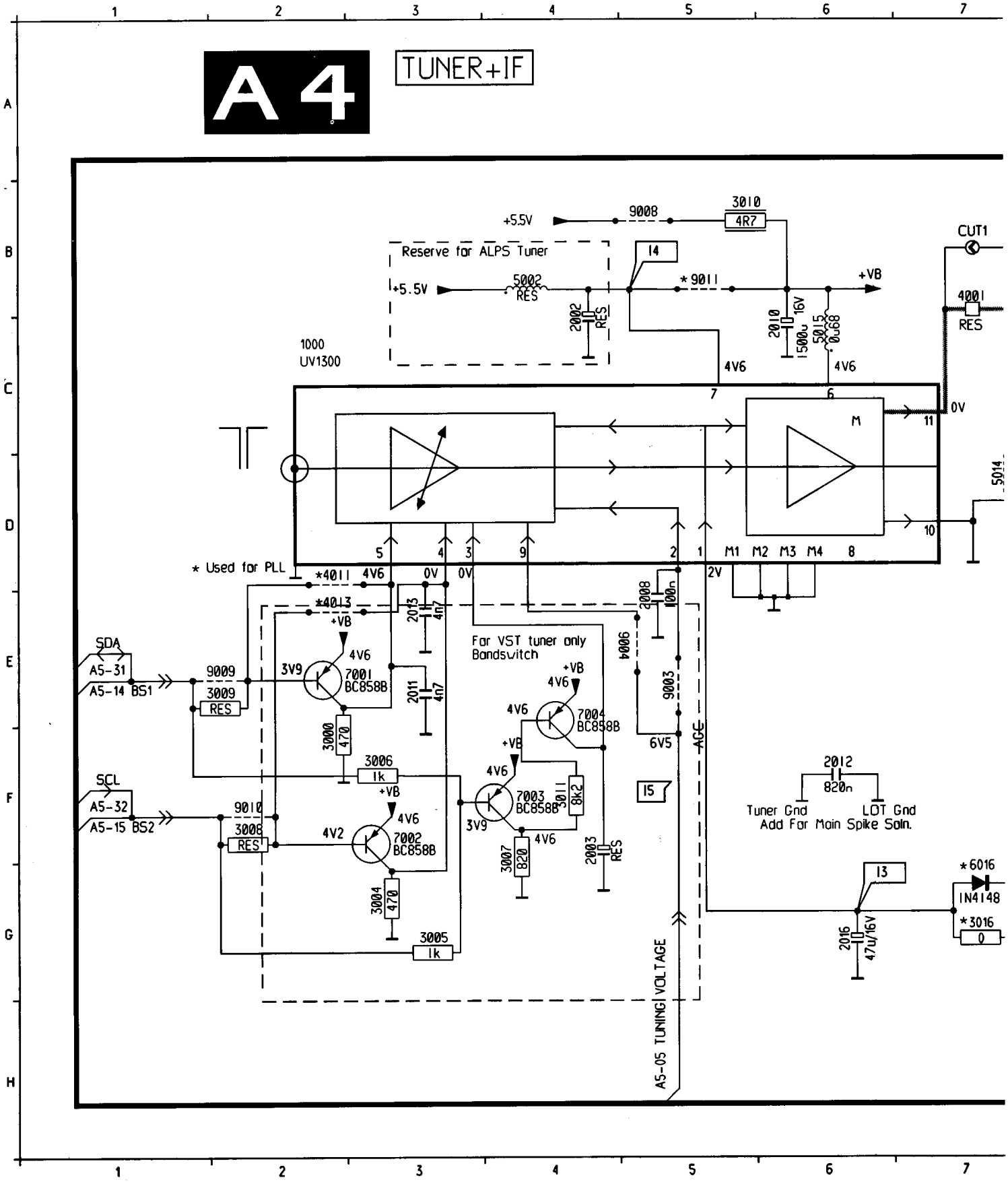


2V / div AC
50µs / div

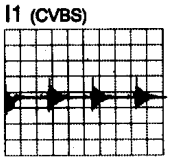
OSC_A3.AI
080197

Tuner + IF / Tuner + ZF / FI + syntoniseur

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



I1 (CVBS)

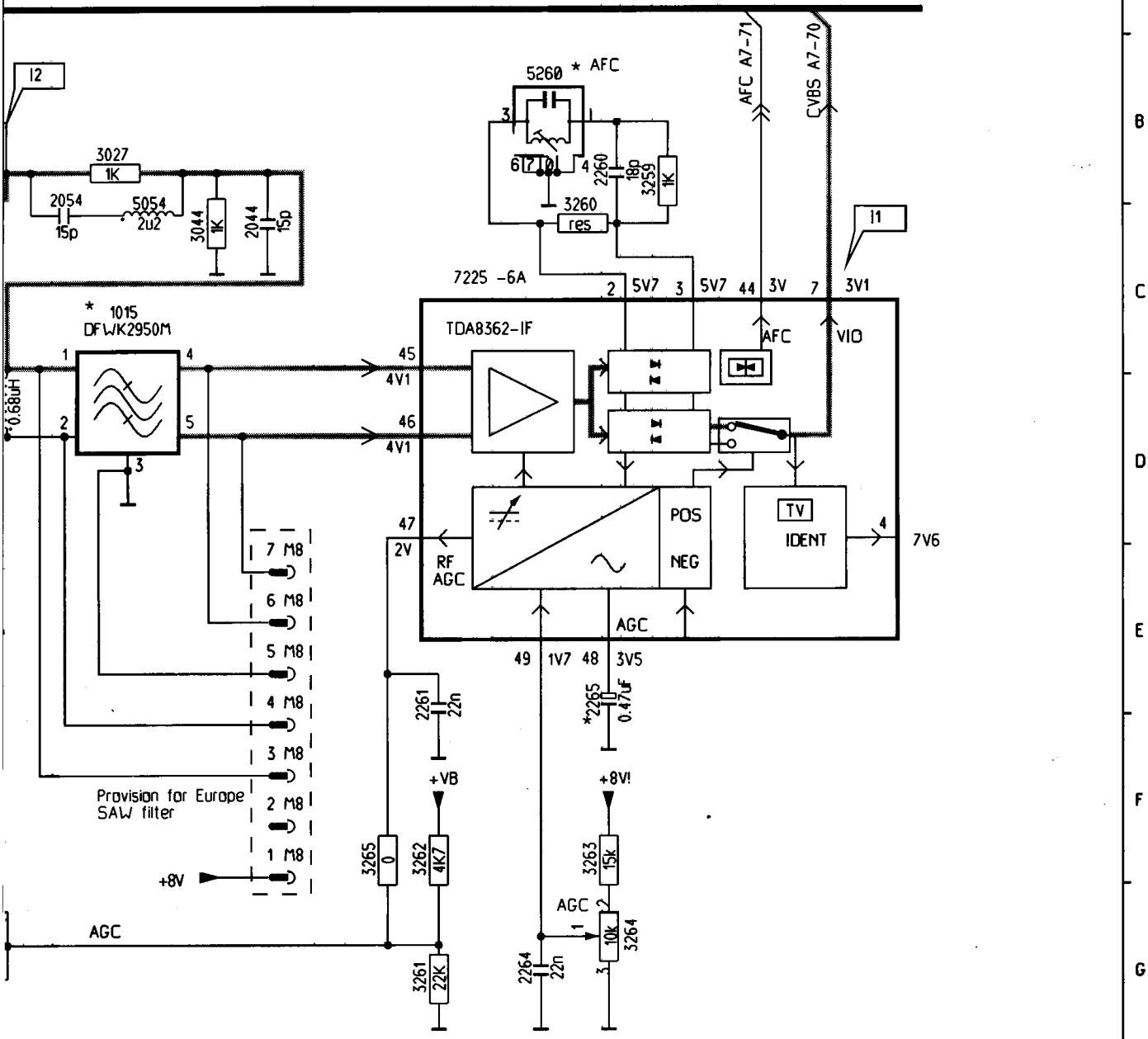


20V / div AC
5µs / div

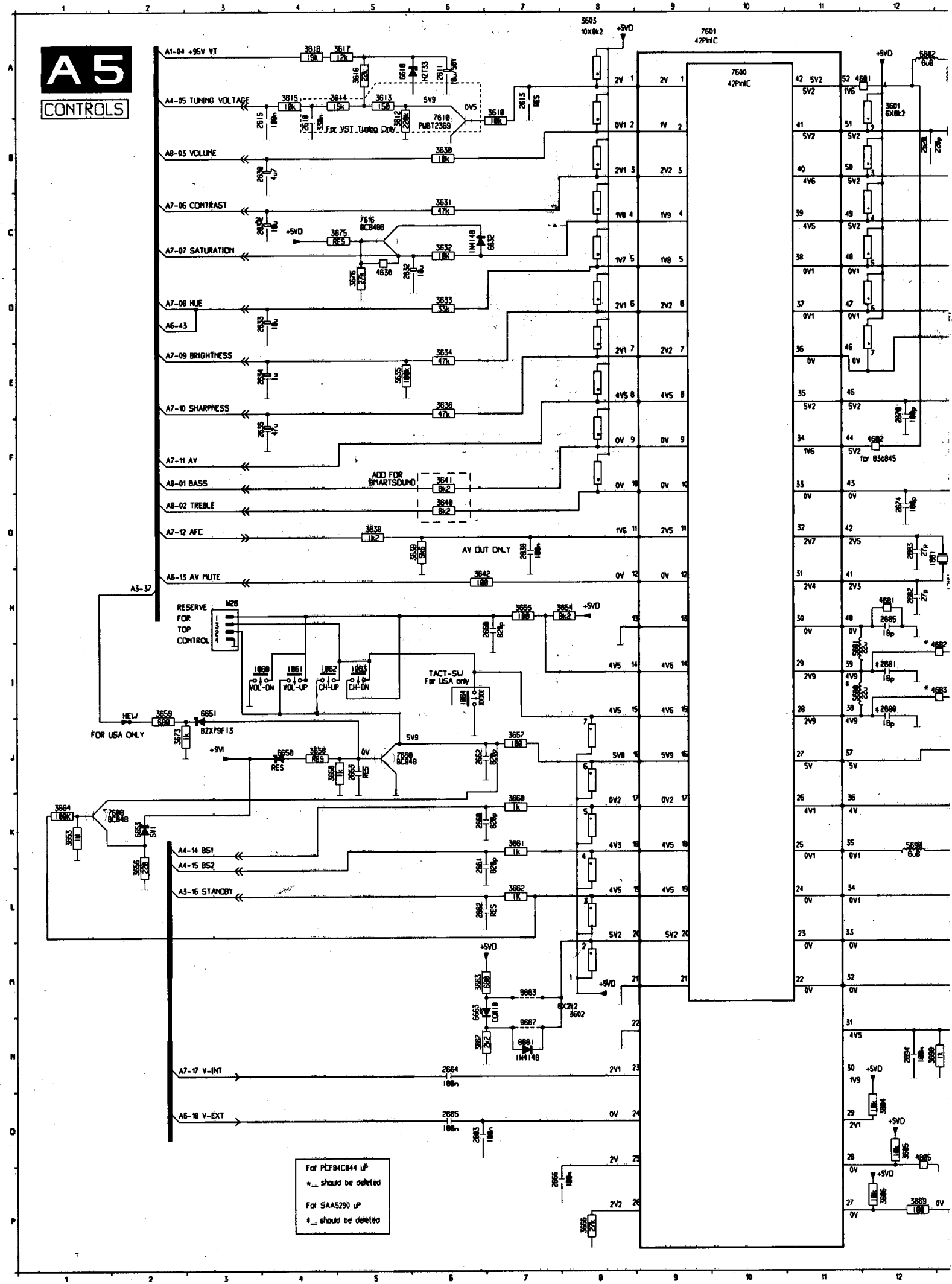
I2 (0V)	DC
I3 (2V)	DC
I4 (4V6)	DC
I5 (TUNING VOLTAGE)	DC

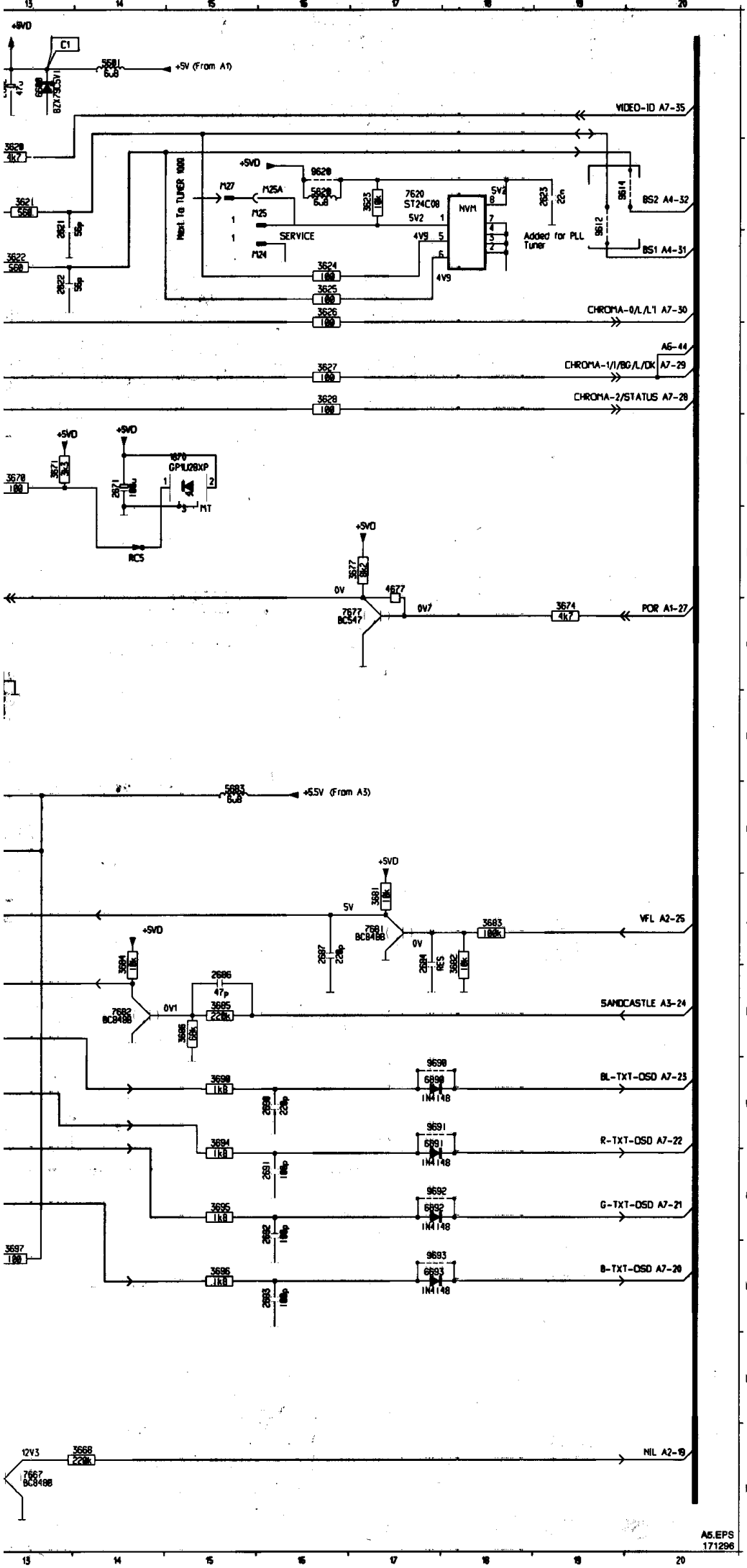
OSC_A4.AI
121296

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 E 9
3265 F 9 4013 E 2 5015 C 6 6016 F 7 7003 F 4 9003 E 5 9009 E 2 M8 F 9 M8 E 9 M8 E 9
4001 B 7 5002 B 4 5054 C 8 7001 E 2 7004 E 4 9004 E 5 9010 F 2 M8 F 9 M8 E 9

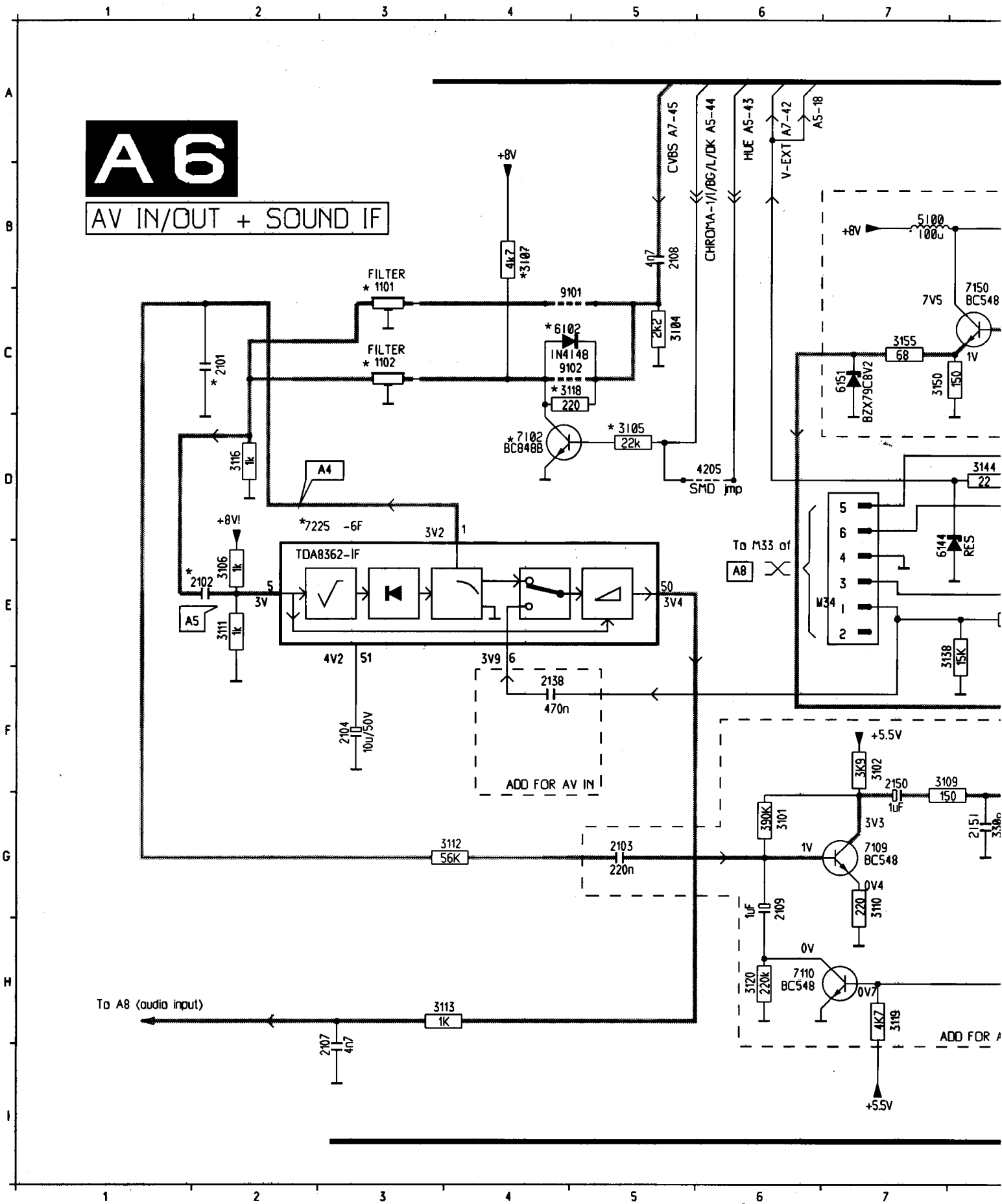


A4.EPS
121296

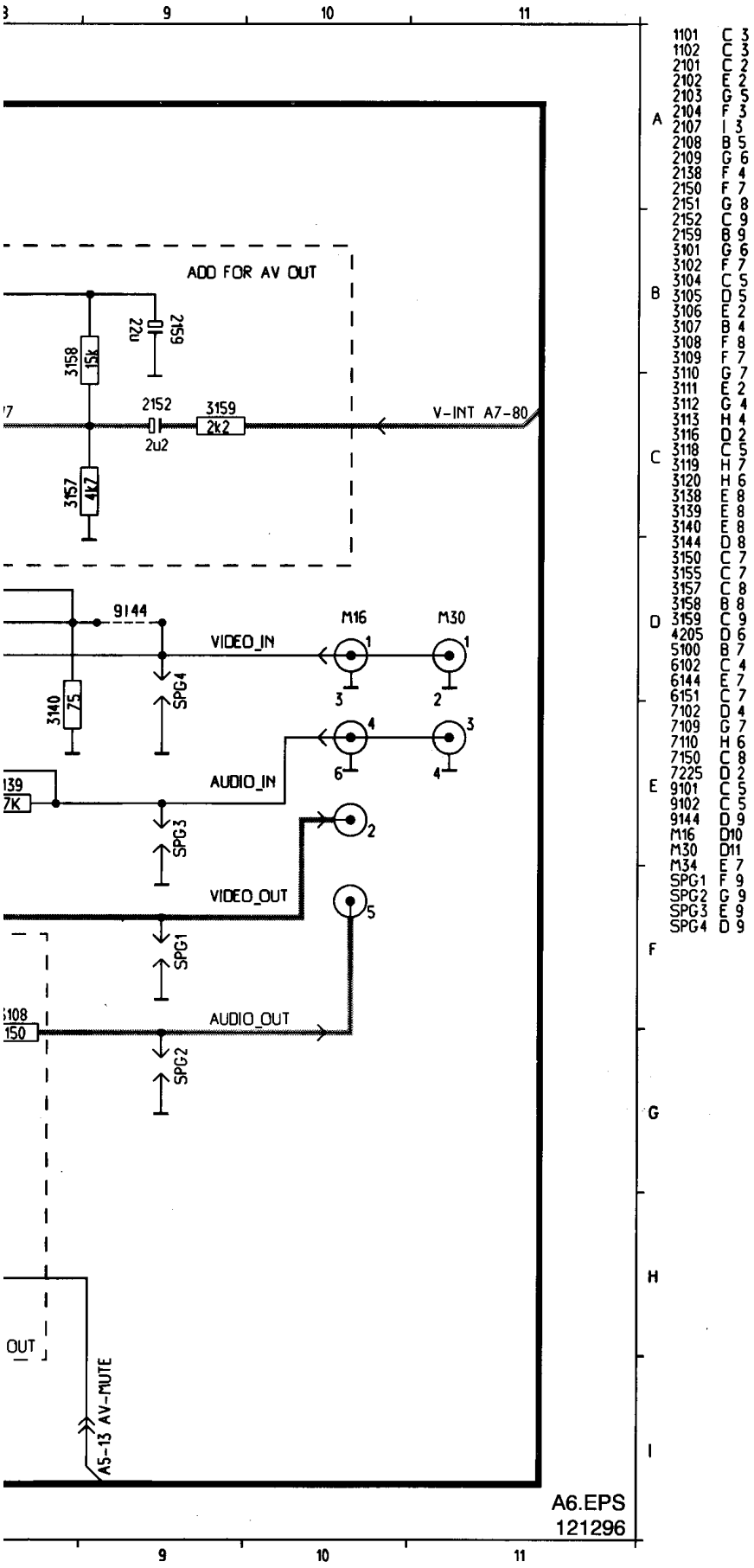

A5
CONTROLS
A1-04 +95V VT
A4-05 TUNING VOLTAGE
For VSI Tuning Only
A8-03 VOLUME
A7-06 CONTRAST
A7-07 SATURATION
A7-08 HUE
A6-43
A7-09 BRIGHTNESS
A7-10 SHARPNESS
A7-11 AV
A8-01 BASS
A8-02 TREBLE
A7-12 AFC
AV OUT ONLY
A6-13 AV MUTE
A3-37
RESERVE FOR TOP CONTROL
ADD FOR SMARTSOUND
TACT-SW For USA only
HEW FOR USA ONLY
A4-14 BS1
A4-15 BS2
A3-16 STANDBY
A7-17 V-INT
A6-18 V-EXT
7601 42PinIC
7600 42PinIC
For PCF84C844 uP
*_ should be deleted
For SAA5290 uP
#_ should be deleted


+5V (From A1)
VIDEO-ID A7-35
BS2 A4-32
BS1 A4-31
CHROMA-0/L/L'1 A7-30
CHROMA-1/I/BG/L/DK A7-29
A6-44
CHROMA-2/STATUS A7-28
POR A1-27
+5.5V (From A3)
VFL A2-25
SANDCASTLE A3-24
BL-TXT-OSD A7-23
R-TXT-OSD A7-22
G-TXT-OSD A7-21
B-TXT-OSD A7-20
NIL A2-19
Added for PLL Tuner
SERVICE
A5.EPS
171296

AV in/out + sound IF / AV Ein/Aus + Ton ZF /

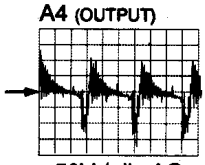


AV entrée/sortie + FI son



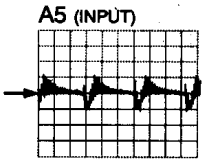
	1101	C 3
	1102	C 3
	2101	C 2
	2102	E 2
	2103	G 5
A	2104	F 3
	2107	I 3
	2108	B 5
	2109	G 6
	2138	F 4
	2150	F 7
	2151	G 8
	2152	C 9
	2159	B 9
	3101	G 6
	3102	F 7
	3104	C 5
B	3105	D 5
	3106	E 2
	3107	B 4
	3108	F 8
	3109	F 7
	3110	G 7
	3111	E 2
	3112	G 4
	3113	H 4
	3116	D 2
C	3118	C 5
	3119	H 7
	3120	H 6
	3138	E 8
	3139	E 8
	3140	E 8
	3144	D 8
	3150	C 7
	3155	C 7
	3157	C 8
	3158	B 8
D	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
E	9101	C 5
	9102	C 5
	9144	D 9
	M16	D10
	M30	D11
	M34	E 7
	SPG1	F 9
	SPG2	G 9
	SPG3	E 9
	SPG4	D 9
F		
G		
H		
I		

A4 (OUTPUT)



50V / div AC
20µs / div

A5 (INPUT)

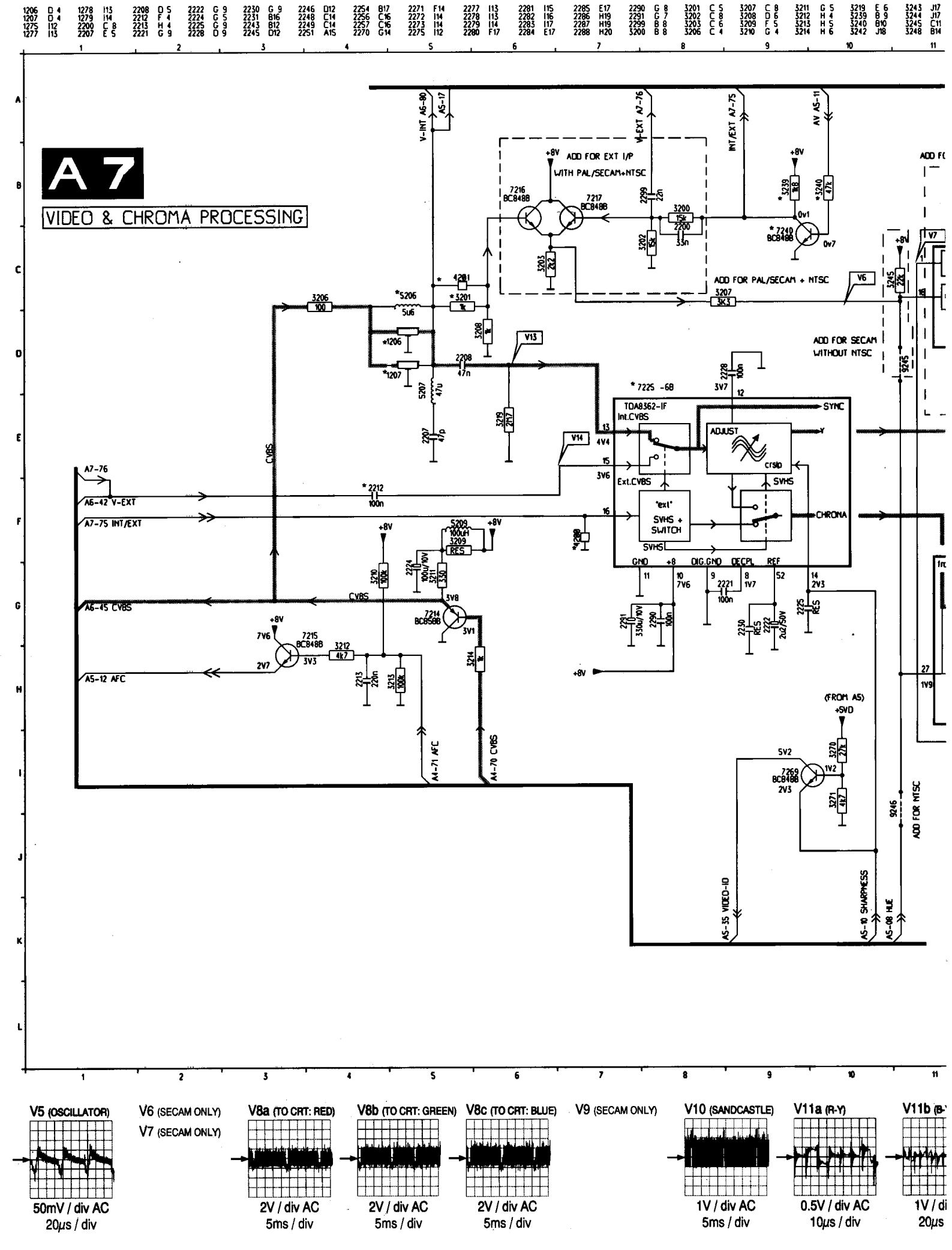


50V / div AC
20µs / div

A8 (VCC) DC

OSC_A6.AI
121296

Video & chroma processing /



V5 (OSCILLATOR)
50mV / div AC
20µs / div

V6 (SECAM ONLY)
V7 (SECAM ONLY)

V8a (TO CRT: RED)
2V / div AC
5ms / div

V8b (TO CRT: GREEN)
2V / div AC
5ms / div

V8c (TO CRT: BLUE)
2V / div AC
5ms / div

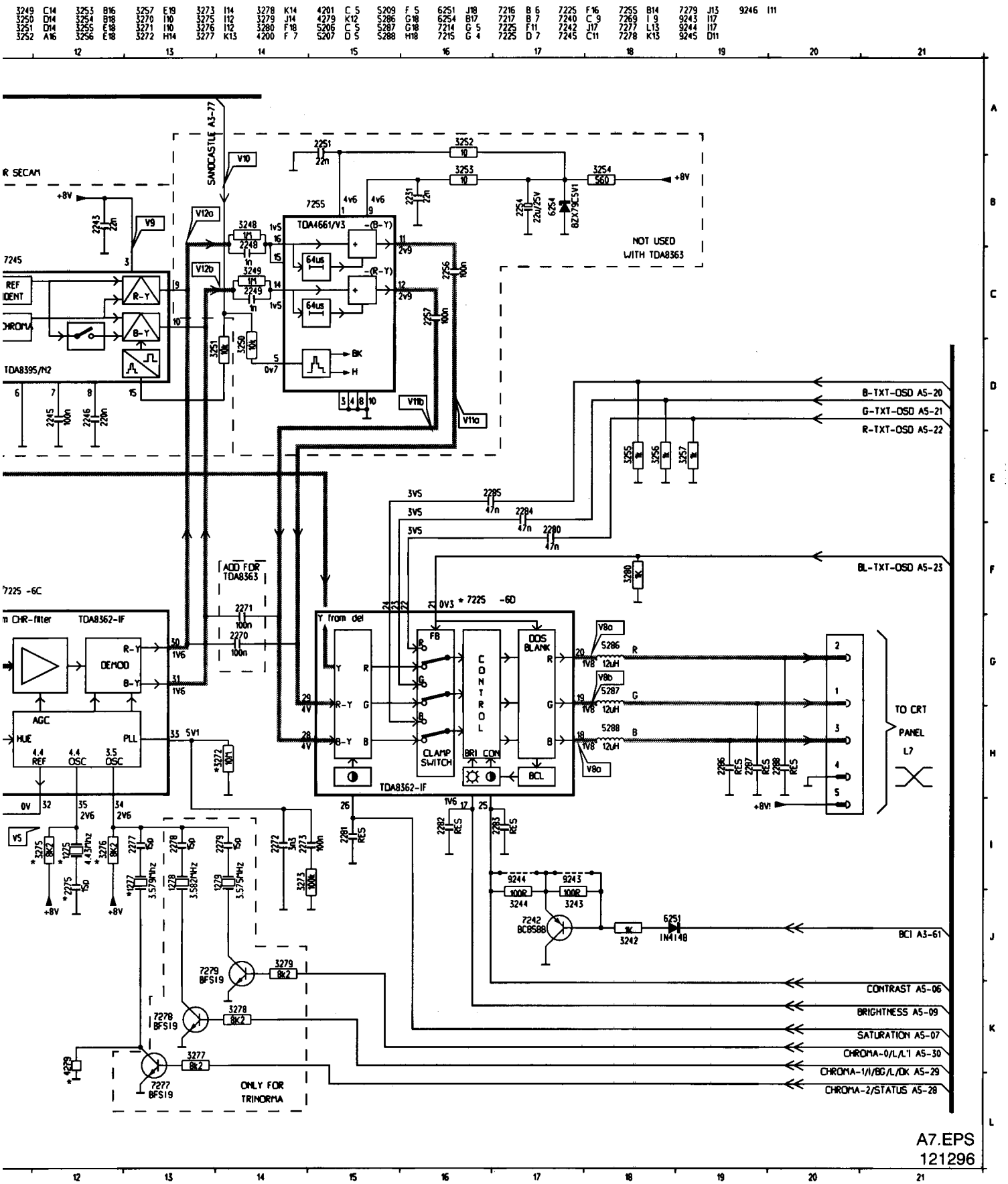
V9 (SECAM ONLY)

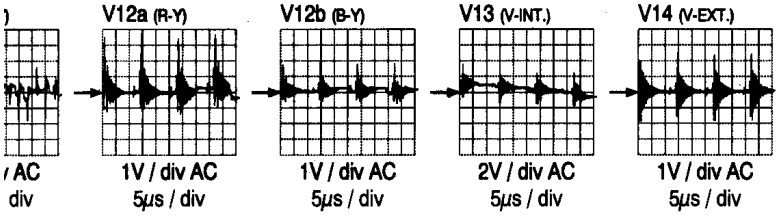
V10 (SANDCASTLE)
1V / div AC
5ms / div

V11a (R-Y)
0.5V / div AC
10µs / div

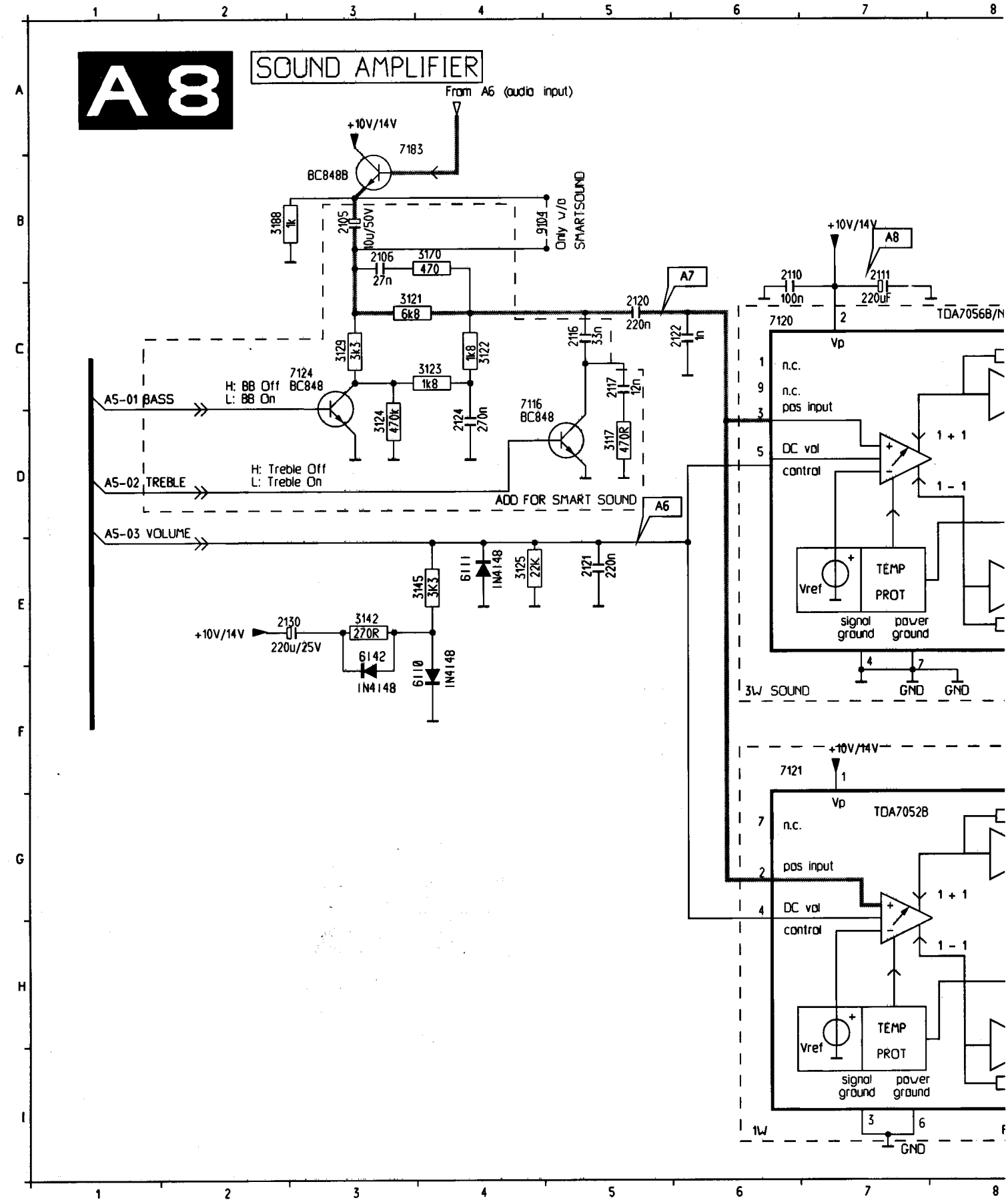
V11b (B-Y)
1V / div
20µs

Video & Chroma Verarbeitung / Vidéo & traitement chroma

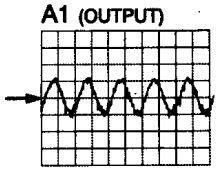




Sound amplifier / Ton verstärker /

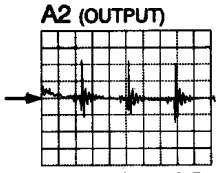


A1 (OUTPUT)



50mV / div AC
0.5ms / div

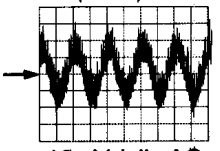
A2 (OUTPUT)



10mV / div AC
20µs / div

A6 (VOLUME) DC

A7 (INPUT)

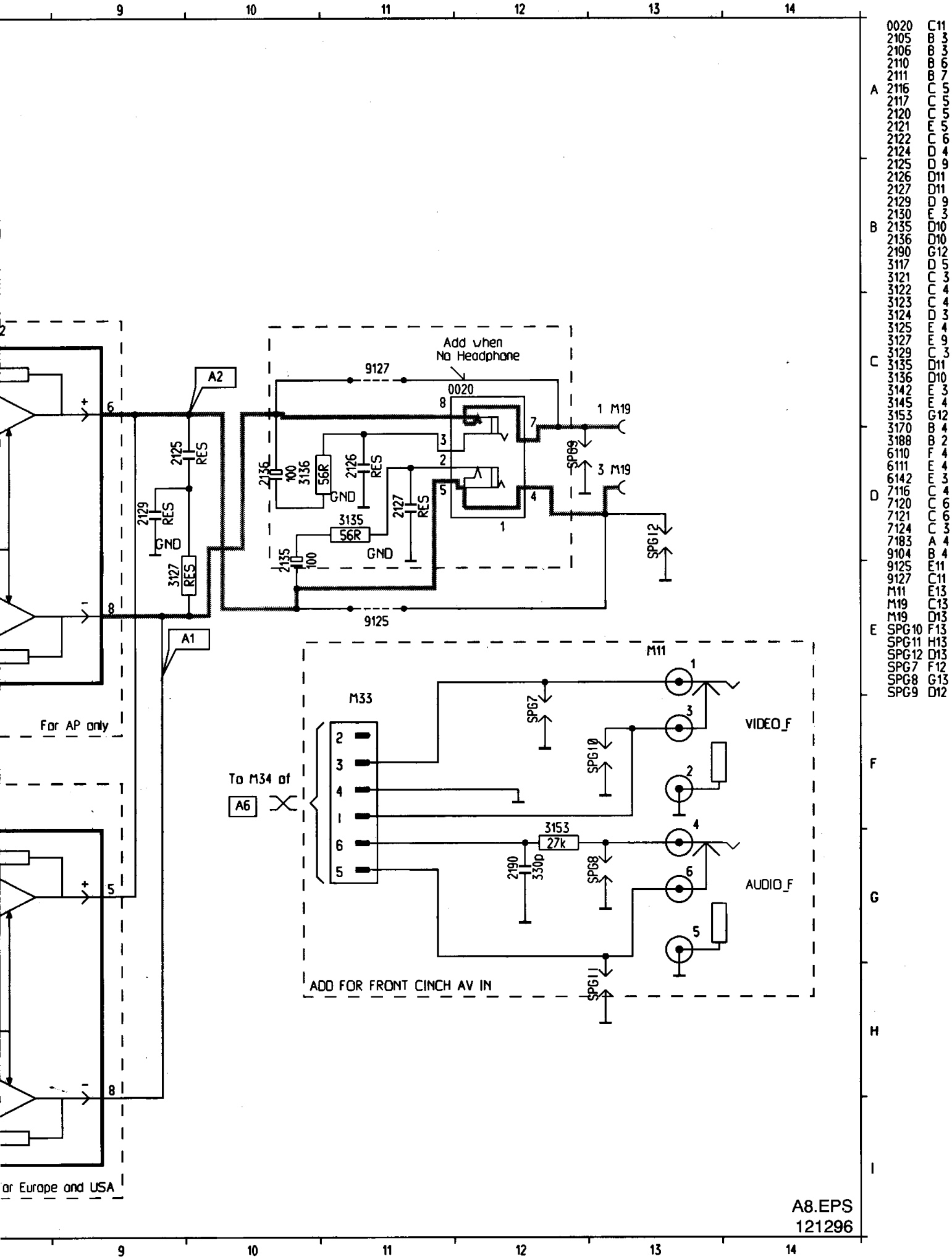


10mV / div AC
0.5ms / div

A8 (VCC) DC

OSC_A8.AI
101296

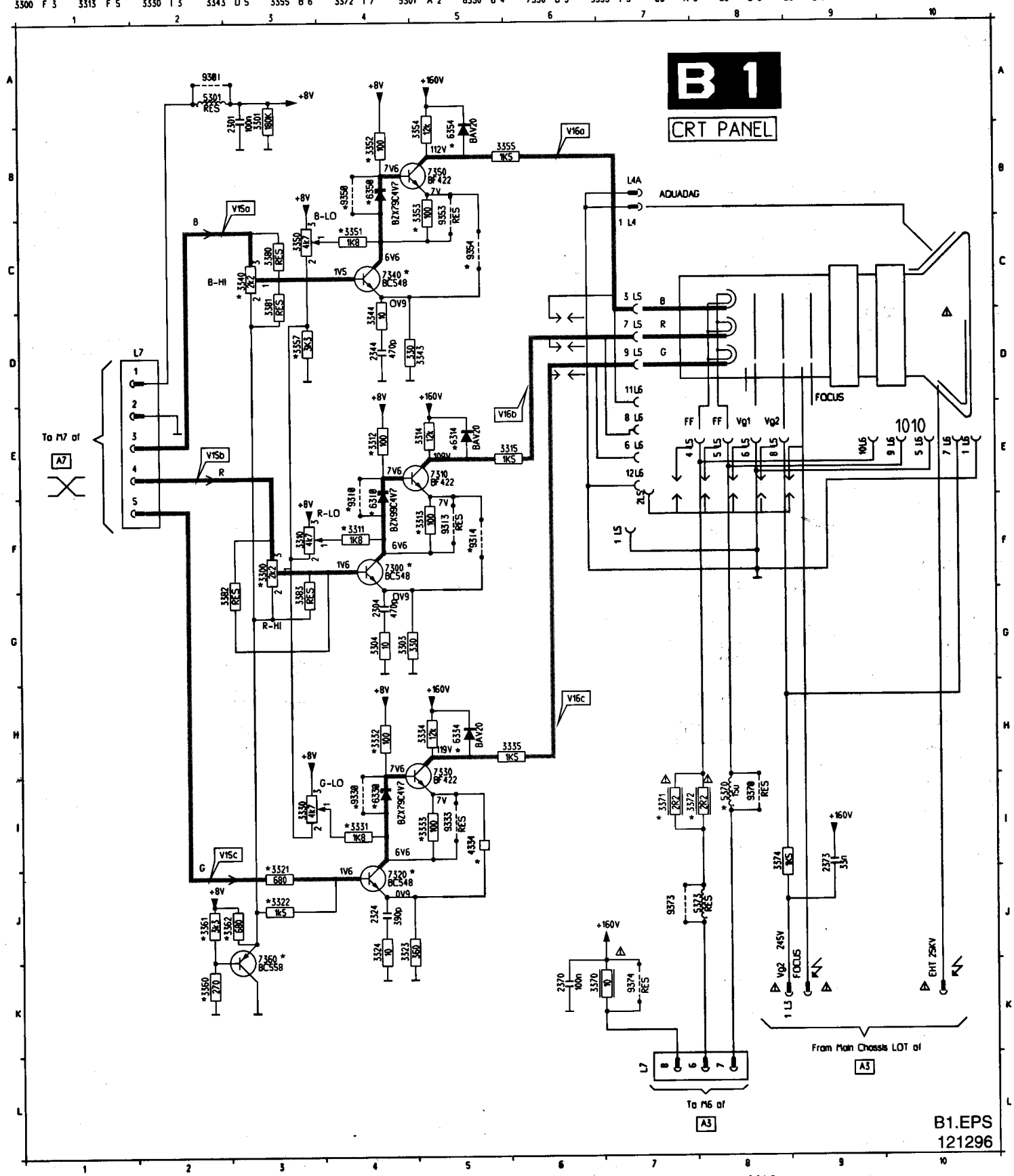
Amplificateur son



	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	E 5
	2122	C 6
	2124	D 4
	2125	D 9
	2126	D11
	2127	D11
	2129	D 9
	2130	E 3
B	2135	D10
	2136	D10
	2190	G12
	3117	D 5
	3121	C 3
	3122	C 4
	3123	C 4
	3124	D 3
	3125	E 4
	3127	E 9
	3129	C 3
C	3135	D11
	3136	D10
	3142	E 3
	3145	E 4
	3153	G12
	3170	B 4
	3188	B 2
	6110	F 4
	6111	E 4
	6142	E 3
D	7116	C 4
	7120	C 6
	7121	C 6
	7124	C 3
	7183	A 4
	9104	B 4
	9125	E11
	9127	C11
	M11	E13
	M19	C13
	M19	D13
E	SPG10	F13
	SPG11	H13
	SPG12	D13
	SPG7	F12
	SPG8	G13
	SPG9	D12

CRT panel / CRT-Platine / Platine tube cathodique

2301	A 3	3301	A 3	3314	E 5	3331	I 4	3344	D 4	3357	D 3	3374	I 8	5370	I 8	6354	B 5	7360	J 5	9350	B 4	L4	C 7	L5	D 7	L6	E 7
2304	G 4	3303	G 4	3315	E 6	3332	H 4	3350	C 3	3360	K 2	3380	C 3	5373	J 8	7300	F 4	9301	A 2	9353	B 5	L4A	B 7	L5	E 8	L6	E10
2324	J 4	3304	G 4	3321	J 3	3333	I 5	3351	C 4	3361	J 2	3381	C 3	6310	F 4	7310	E 5	9310	E 4	9354	C 5	L5	F 7	L5	D 7	L6	E 9
2344	D 4	3310	F 3	3322	J 3	3334	H 5	3352	B 4	3362	J 2	3382	G 3	6314	E 5	7320	J 4	9313	F 5	9370	I 8	L5	C 7	L6	E10	L6	D 7
2370	K 6	3311	F 4	3323	J 4	3335	H 6	3353	B 5	3370	K 6	3383	G 3	6330	I 4	7330	H 5	9314	F 5	9373	J 7	L5	E 7	L6	E10	L6	E 7
2373	I 9	3312	F 4	3324	J 4	3340	C 3	3354	B 5	3371	I 7	4334	I 5	6334	H 5	7340	C 4	9330	I 4	9374	K 7	L5	E 8	L6	E 7		
3300	F 3	3313	F 5	3350	I 3	3343	D 5	3355	B 6	3372	I 7	5301	A 2	6350	B 4	7350	B 5	9333	I 5	L3	K 8	L5	E 8	L6	E10		



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 ± 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 ± 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.

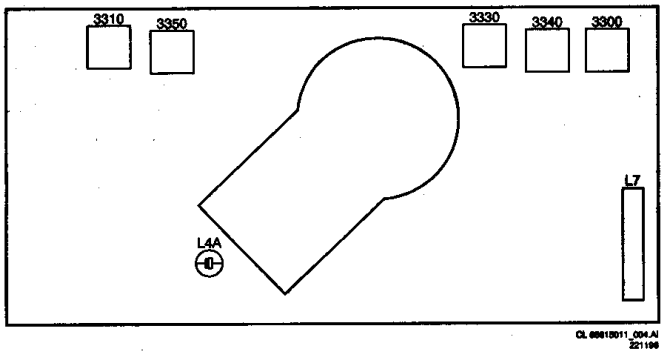


Fig. 8.1

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)

9.1 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.

9.2.2 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).

9.3 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.

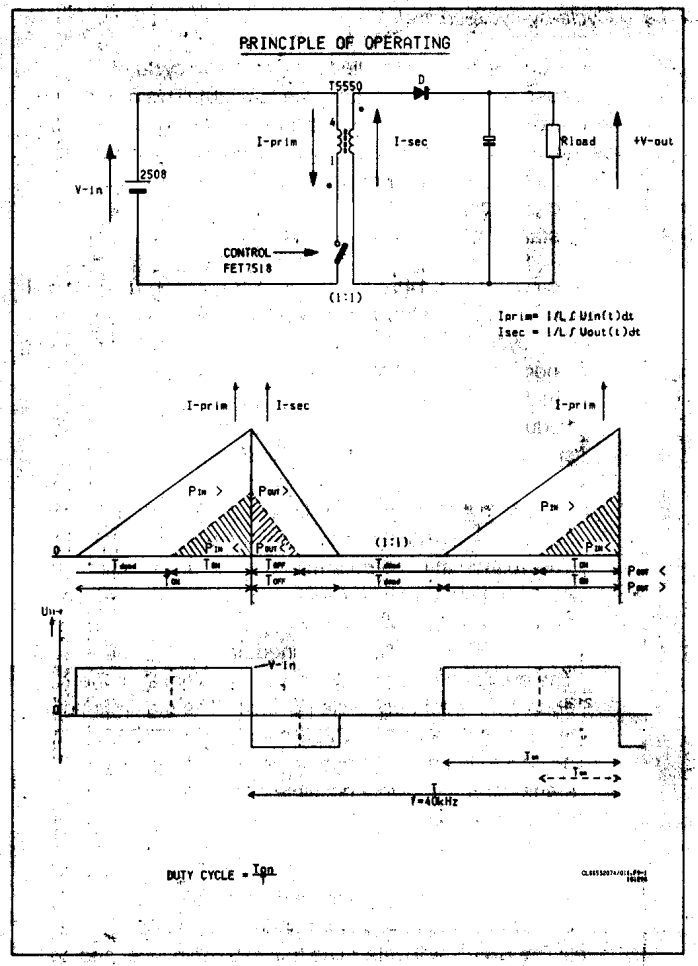


Fig. 9.1

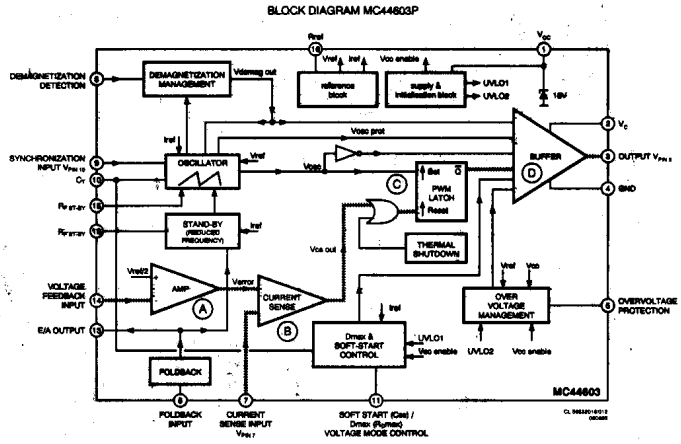


Fig. 9.2

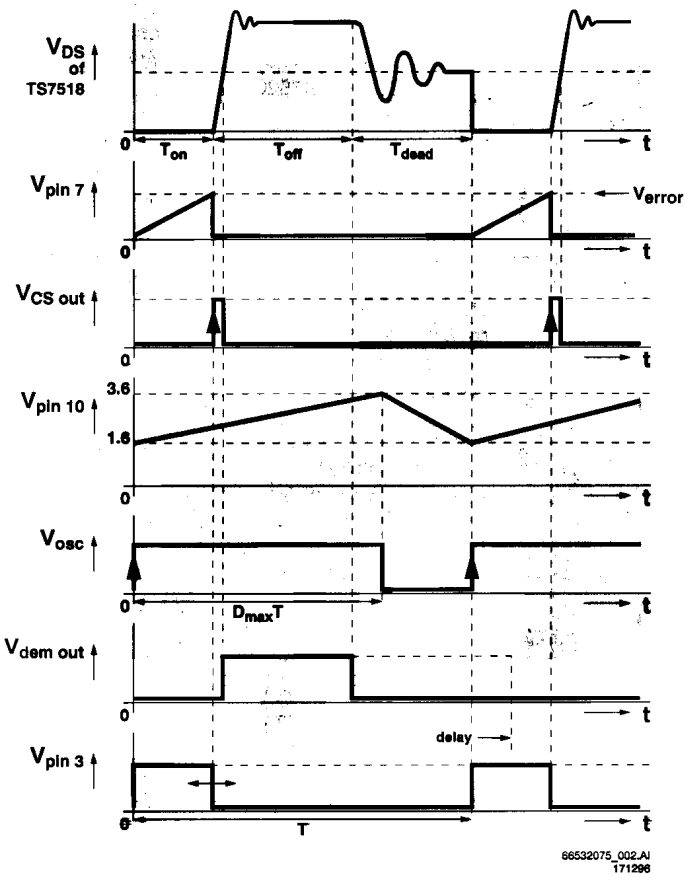


Fig. 9.3

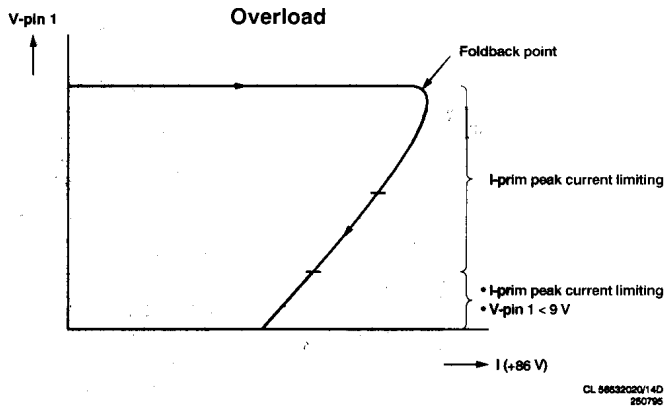


Fig. 9.4

Circuit description new circuitries

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 $V_{error\text{-}out}$ of this error amplifier is fed to another comparator (block B in Fig 9.2). This comparator compares the $V_{error\text{-}out}$ and the current sense voltage V_{pin7}. As soon as the current sense voltage $V_{pin\ 7}$ becomes higher than the output-voltage of the error amplifier $V_{error\text{-}out}$, 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 $V_{error\text{-}out}$ 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 $V_{error\text{-}out}$ 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 $V_{pin\,1}$ < 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 $V_{pin\,7}$ 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.

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 though the deflection coil will drop and the voltage across C2445 will rises 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 though 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 μC:

- The VST tuner is controlled via V_TUNE, AFC and the BS1 and BS2 band switching signals.
- The PLL tuner is fully I^2C 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 seperator 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 μC; 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:

Circuit description new circuitries

⇒ 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 7225-6F 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 though 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 outern 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 arround 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 parralel 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.

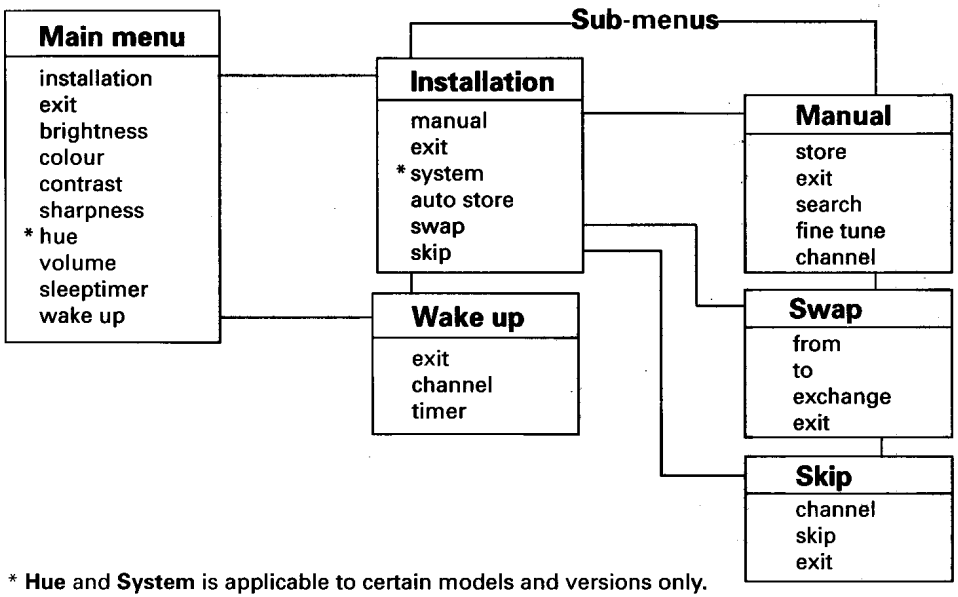
	CHROMA_0	CHROMA_1	CHROMA_2
PAL M	0	1	
PAL N	1	0	
NTSC M	1	1	

- I^2C-Bus (pin 49-50); This bus is used to communicate with all used I^2C 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 I^2C-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.

Installation

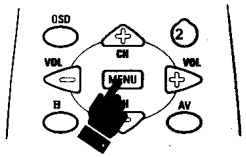
Operating instructions generally explains the operation of the TV set using the buttons on the remote control handset unless otherwise stated.

Overview of main menu and sub-menus

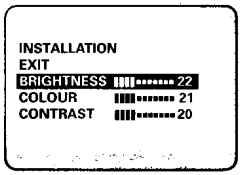


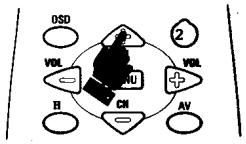
* **Hue** and **System** is applicable to certain models and versions only.

How to start Automatic Installation (Auto Store)

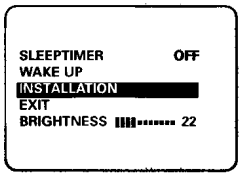


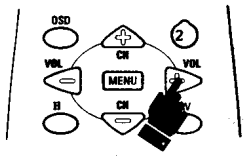
1. Press **MENU** button to enter main menu.



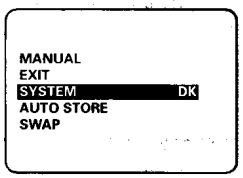


2. Press **CH** button repeatedly until **INSTALLATION** is highlighted.

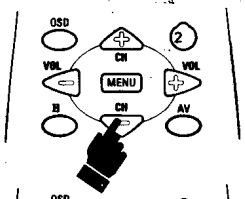




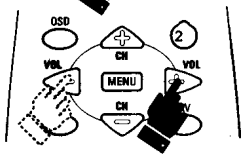
3. Press **VOL** button to enter installation mode.



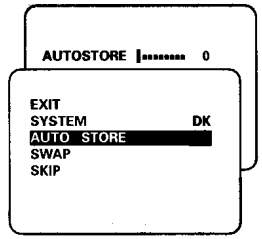
Installation

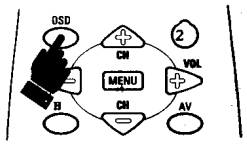


4. Press **CH** button to highlight **AUTO STORE**.



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).





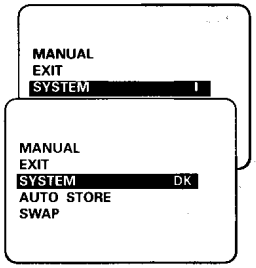
6. Once automatic tuning is completed, press **OSD** button to exit from menu.

* **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

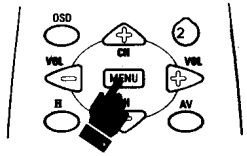
(Applicable to certain models/versions only)

- 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.

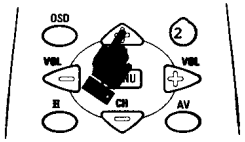


How to start Manual Installation

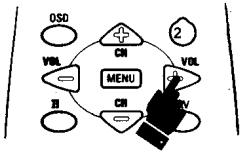
You can also do installation manually by the **SEARCH** method. Manual installation allows you to select your preferred channel number for every available station



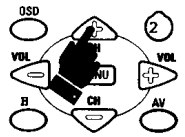
1. Enter main menu.



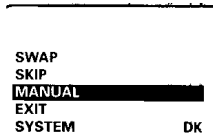
2. Highlight **INSTALLATION** .

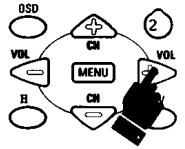


3. Enter installation mode.

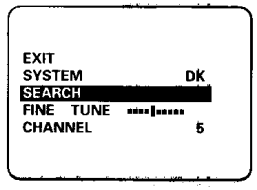


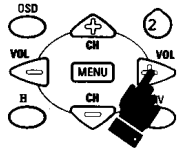
4 Press **CH** ⏶ button repeatedly until **MANUAL** is highlighted.



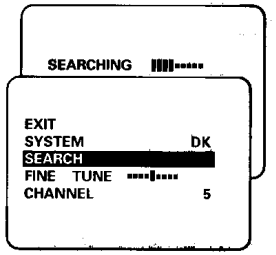


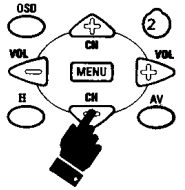
5. Press **VOL** ⏵ button to enter manual mode.



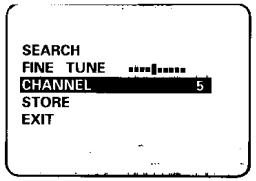


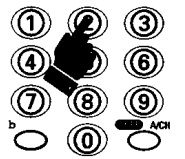
6. Press **VOL** ⏵ button to activate **SEARCHING** mode. Searching stops once a station is available. If you decide to store the available station, proceed to the next step. However, if you decide to continue searching for another station, press **VOL** ⏵ button again until another station is found.



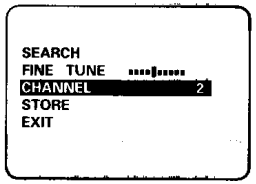


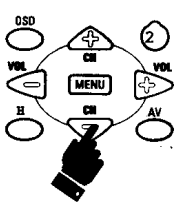
7. Press **CH** ⏷ button repeatedly until **CHANNEL** is highlighted.



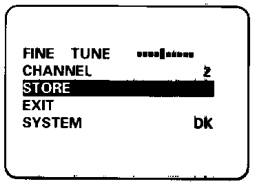


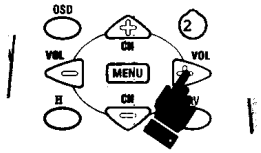
8. Key In desired channel number by the **DIGIT (0 - 9)**button.



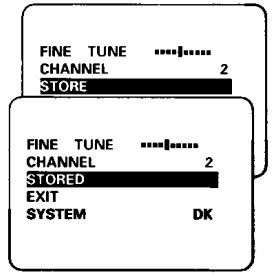


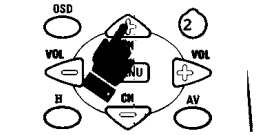
9. Press **CH** ⏷ button to highlight **STORE** .



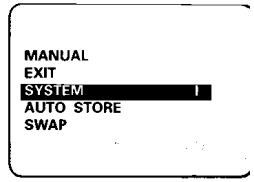


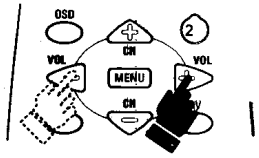
10. Press **VOL** ⏵ button to store the channel.



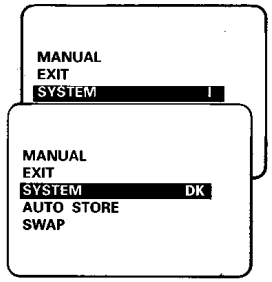


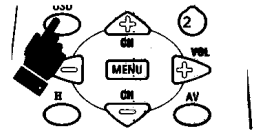
11. If you hear any **"noisy"** sound after manual installation is completed, press **CH** ⏶ button to highlight **SYSTEM**. **(Applicable to certain models and versions only).**





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

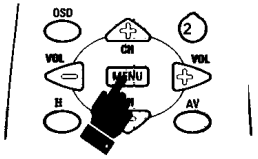




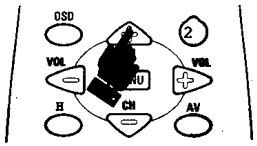
13. Press **OSD** button to exit from menu.

How to Swap Channels

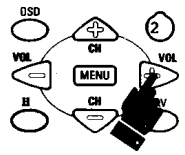
This feature allows you to change the channel number to your choice for a particular TV station.



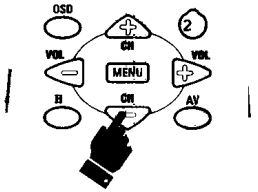
1. Enter main menu.



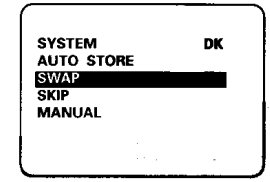
2. Highlight **INSTALLATION** .



3. Enter installation mode.



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



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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
µC	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 µC 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 µC to the video controller IC7015-6D
BS1	Switching signal from µC for band switching to tuner 1000
BS2	Switching signal from µC 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 µC, 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 µC 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 µC, 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 µC to control the hue of the video signal
HEW	X-ray detection. If this signal is too high, X-ray could occure so the set is switched in protection
HOR. FLYBACK	Horizontal flyback pulse (15625 Hz) used for locking the horizontal oscillator in IC7015-6E
I^2C	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 µC
IF	Intermediate frequency signal from the tuner
NIL	Non Inter Lace; 25 Hz block-shaped signal from teletext to the frame amplifier for coinciding the odd & even frames
POR	Power On Reset; ensures the µC starts up its software only if the power supply of the µC 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 µC, 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^2C-bus
SDA	Data line of the I^2C-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 µC to IF-detector IC7015-6B) for sharpness control

List of abbreviations (incl. all signal names)

SMART SOUND	Bass and treble countrol 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

	4822 492 70788	SPRING
	4822 265 20689	CONN. 2-P MALE
▲	4822 492 70289	SPRING
▲	4822 265 20439	CONNECTOR 2-P
▲	4822 276 13603	SWITCH,MAINS
▲	4822 256 92053	PLASTICHOLDER
▲	4822 265 20723	CONNECTOR 2-P
	4822 256 10336	LED HOLDER
	4822 157 11166	EMI FILT. 40MHz
	4822 267 10538	CONN.3-P MALE
	4822 267 31014	PHONE CONN.
	4822 267 10549	CONN.4-P FEM
	4822 265 10481	CINCH CONN 2-P
	4822 441 11878	CINCH HOUSING
▲	4822 276 13603	MAIN SWITCH
▲	4822 256 92053	FUSE HOLDER
	4822 157 11166	EMI FILT.40MHZ
	4822 267 10538	CONN. 3-P MALE
1000	4822 210 10737	TUNER UV1355/I
1015	4822 242 72197	FILTER 38MHz
1015	4822 242 73792	FILTER 45MHz
1060	4822 276 13775	SWITCH
1061	4822 276 13775	SWITCH
1062	4822 276 13775	SWITCH
1063	4822 276 13775	SWITCH
1101▲	4822 242 10316	FILTER 6,5MHz
1102	4822 242 10314	FILTER 5,5MHz
1102	4822 242 10362	FILTER 6,0MHz
1102	4822 242 10363	FILTER 4,5MHz
1206	4822 242 81572	FILTER 6,0MHz
1206	4822 242 81712	FILTER 5,5MHz
1206	4822 242 81978	FILTER 4,5MHz
1207	4822 242 81301	FILTER 6,5MHz
1275	4822 242 10356	X-TAL 4,433MHz
1277	4822 242 10355	X-TAL 3,579MHz
1449▲	4822 071 54001	FUSE 400mA
1500	4822 070 34002	FUSE 4A
1571▲	4822 071 51602	FUSE 1.6A
1572▲	4822 071 53151	FUSE 315mA
1670	4822 218 11573	IR RECEIVER
1681	4822 242 10694	X-TAL 12MHz
1681	5322 242 73686	FILTER 12MHz

⊣⊢

2008	4822 126 13296	100nF 10% 16V
2008▲	5322 122 34123	1nF 10% 50V
2010	4822 124 11582	2200µF 20% 16V
2011	5322 122 32452	47pF 5% 63V
2013	5322 122 32452	47pF 5% 63V
2016▲	4822 124 40433	47µF 20% 25V
2101▲	5322 126 10223	4.7nF 10% 63V
2101	5322 126 10465	3.9nF 10% 63V
2102	4822 121 43897	1nF 5% 400V
2102	4822 126 13498	82pF 5% 50V
2102	4822 126 13644	47pF 5% 63V
2103	4822 126 13061	220nF 20% 25V
2104	4822 124 40248	10µF 20% 63V
2105	4822 124 81108	0.47µF 20% 50V
2106▲	4822 122 33342	33nF 10% 63V
2107▲	5322 126 10223	4.7nF 10% 63V
2108	4822 122 33515	82pF 5% 63V
2108	4822 126 13693	56pF 1% 63V
2108	5322 122 32452	47pF 5% 63V
2109	4822 124 41576	2.2µF 20% 50V
2110▲	4822 126 13838	100nF 20% 50V
2111	4822 124 81028	220µF 20% 25V
2116	4822 121 51379	82nF 5% 63V
2117▲	5322 122 32654	22nF 10% 63V
2120	4822 121 42868	220nF 5% 50V
2121	4822 126 13061	220nF 20% 25V
2122	5322 126 10511	1nF 5% 50V
2124	5322 121 42386	100nF 5% 63V
2130	4822 124 11566	47µF 20% 50V
2135	4822 124 81033	100µF 20% 50V
2136	4822 124 81033	100µF 20% 50V
2138▲	4822 121 43823	470nF 5% 50V
2150	4822 124 81022	1µF 20% 50V
2152	4822 124 41576	2.2µF 20% 50V
2190	4822 126 13512	330pF 10% 50V
2208	4822 126 13751	47nF 10% 63V
2212	5322 121 42386	100nF 5% 63V
2213	4822 126 13561	220nF 10% 16V
2221▲	4822 126 13838	100nF 20% 50V
2222	4822 124 41576	2.2µF 20% 50V
2224	4822 124 41584	100µF 20% 10V
2228	4822 126 13296	100nF 10% 16V
2231▲	5322 122 32654	22nF 10% 63V
2243▲	5322 122 32654	22nF 10% 63V
2245▲	4822 126 13838	100nF 20% 50V
2246	4822 126 13628	220N 20% 50V
2248▲	5322 122 34123	1nF 10% 50V
2249▲	5322 122 34123	1nF 10% 50V
2251▲	5322 122 32654	22nF 10% 63V
2254	4822 124 81164	22U 20% 25V
2256▲	4822 126 13838	100nF 20% 50V
2257▲	4822 126 13838	100nF 20% 50V
2260	4822 126 13689	18pF 1% 63V
2260	5322 122 33869	15pF 5% 63V
2261▲	5322 122 32654	22nF 10% 63V
2264▲	5322 122 32654	22nF 10% 63V
2265	4822 124 41576	2.2µF 20% 50V
2265	4822 124 81108	0.47µF 20% 50V
2270	4822 126 13296	100nF 10% 16V
2271	4822 126 13296	100nF 10% 16V
2272	5322 122 33446	3.3nF 10% 63V
2273	4822 126 13296	100nF 10% 16V
2275	5322 122 33869	15pF 5% 63V
2277	5322 122 33869	15pF 5% 63V
2280	4822 126 13751	47nF 10% 63V
2284	4822 126 13751	47nF 10% 63V
2285	4822 126 13751	47nF 10% 63V
2290▲	4822 126 13838	100nF 20% 50V
2291	4822 124 40849	330µF 20% 16V
2299	4822 122 40606	22nF 20% 50V
2301	5322 121 42386	100nF 5% 63V
2304	4822 126 10334	470pF 10% 50V
2324	4822 122 33528	390pF 5% 50V
2324	5322 122 32336	560pF 10% 100V
2344	4822 126 10334	470pF 10% 50V
2370	4822 121 41689	100nF 10% 250V
2373	4822 121 41926	33nF 5% 630V
2400	4822 122 33127	2.2nF 10% 63V
2401	4822 122 32646	5.6nF 10% 50V
2402	4822 122 33528	390pF 5% 50V
2403	4822 124 41596	22µF 20% 50V
2403	4822 124 81033	100µF 20% 50V
2404	4822 124 40248	10µF 20% 63V
2404	4822 124 41596	22µF 20% 50V
2406	4822 121 43901	4.7nF 5% 50V
2407	4822 121 51399	47nF 10% 50V
2407	5322 121 42386	100nF 5% 63V
2408	4822 124 11582	2200µF 20% 16V
2408	4822 124 81039	3300µF 20% 25V
2421	4822 122 32627	2.7nF 10% 50V
2422	4822 124 81022	1µF 20% 50V
2423▲	5322 126 10223	4.7nF 10% 63V
2424▲	4822 126 13838	100nF 20% 50V
2425	4822 124 81164	22U 20% 25V
2426	5322 121 42386	100nF 5% 63V
2427▲	5322 126 10223	4.7nF 10% 63V
2440	4822 121 43925	2.2nF 5% 50V
2442	4822 126 13628	220N 20% 50V
2443	4822 124 40198	470µF 20% 16V
2444	4822 121 51319	1µF 10% 63V
2445▲	4822 121 70618	12nF 5% 1600V
2445	4822 121 70649	9.1nF 5% 1.6KV
2448	4822 121 43368	47µF 20% 160V
2450	4822 121 10506	560N 5% 250V
2450	4822 121 10507	470N 5% 250V
2451	4822 121 51319	1µF 10% 63V
2452	4822 124 81165	470U 20% 10V
2453	4822 124 11771	1000µF 20% 35V
2460	4822 121 43245	68nF 10% 100V
2460	4822 121 43378	82nF 10% 100V
2461	4822 126 13645	27pF 5% 50V
2462	4822 126 11824	100pF 10% 1KV
2470▲	4822 124 11508	22µF 20% 250V
2471	4822 121 41856	22nF 5% 250V
2500▲	4822 126 13589	470N 20% 275V
2501	4822 121 70141	33nF 5% 400V
2502	4822 126 12793	2.2nF 10% 2KV
2504	4822 126 12793	2.2nF 10% 2KV
2505	4822 126 12793	2.2nF 10% 2KV
2508	4822 124 11907	100µF 20% 400V
2508	4822 124 41748	220µF 20% 400V
2509▲	4822 122 50116	470pF 10% 1KV
2510▲	4822 122 50116	470pF 10% 1KV
2517▲	5322 122 34123	1nF 10% 50V
2518▲	4822 126 12426	330pF 10% 1KV
2520	4822 122 33515	82pF 5% 63V
2521	4822 122 33127	2.2nF 10% 63V
2522	4822 122 33127	2.2nF 10% 63V
2529▲	4822 126 13838	100nF 20% 50V
2530	4822 124 81022	1µF 20% 50V
2531	4822 121 10646	560pF 1% 400V
2533	5322 122 31863	330pF 5% 50V
2534	5322 126 10511	1nF 5% 50V
2537	5322 121 42386	100nF 5% 63V
2540	4822 124 81029	100µF 20% 25V
2541	4822 121 43872	3.3nF 5% 50V
2545▲	4822 126 14049	1.5nF 20% 250V
2550▲	4822 126 12426	330pF 10% 1KV
2551	4822 124 42336	47µF 20% 160V
2552	4822 126 13597	330pF 10% 500V
2561	4822 124 40198	470µF 20% 16V
2563	4822 124 41596	22µF 20% 50V
2571	4822 124 11908	2200µF 20% 25V
2572	5322 122 32531	100pF 5% 50V
2602▲	4822 124 40433	47µF 20% 25V
2610	4822 126 13628	220N 20% 50V
2611	4822 124 40248	10µF 20% 63V
2615	4822 126 13628	220N 20% 50V
2620	5322 126 10184	680P 5% 50V.
2621	4822 122 33515	82pF 5% 63V
2622	4822 122 33515	82pF 5% 63V
2623▲	5322 122 32654	22nF 10% 63V
2630	4822 124 40248	10µF 20% 63V
2631	4822 124 40248	10µF 20% 63V
2632	4822 124 40248	10µF 20% 63V
2633	4822 124 40248	10µF 20% 63V
2634	4822 124 81022	1µF 20% 50V
2635▲	4822 124 40433	47µF 20% 25V
2639▲	4822 126 13838	100nF 20% 50V
2650	5322 126 10184	680P 5% 50V.
2652	5322 126 10184	680P 5% 50V.
2653	5322 122 34098	10nF 10% 63V
2662	5322 126 10184	680P 5% 50V.
2664▲	4822 126 13838	100nF 20% 50V
2665▲	4822 126 13838	100nF 20% 50V
2666▲	4822 126 13838	100nF 20% 50V
2670	5322 122 32531	100pF 5% 50V
2671	4822 124 81029	100µF 20% 25V
2674	5322 122 32531	100pF 5% 50V
2680	4822 126 13689	18pF 1% 63V
2681	4822 126 13689	18pF 1% 63V
2682	5322 122 31946	27pF 5% 63V
2683	5322 122 31946	27pF 5% 63V
2687	4822 122 33575	220pF 5% 50V
2690	4822 122 33575	220pF 5% 50V
2691	5322 122 32531	100pF 5% 50V
2692	5322 122 32531	100pF 5% 50V
2693	5322 122 32531	100pF 5% 50V
2694▲	4822 126 13838	100nF 20% 50V

⊏□

3000	4822 050 11002	1k 1% 0.4W
3004	4822 050 11002	1K 1% 0.4W
3005	4822 050 11002	1k 1% 0.4W
3006	4822 050 11002	1k 1% 0.4W
3007▲	4822 051 20102	1k 1% 0.4W
3008	4822 050 11002	1k 1% 0.4W
3009	4822 050 11002	1K 1% 0.4W
3010▲	4822 052 10478	4Ω7 5% 0.33W
3011	4822 051 20822	8k2 1% 0.4W
3101	4822 051 20394	390k 5% 0.1W
3102	4822 050 13902	3k9 1% 0.4W
3104	4822 117 11449	2k2 1% 0.1W
3105	4822 051 20223	22k 5% 0.1W
3106▲	4822 051 20102	1k 5% 0.1W
3107▲	4822 051 20472	4k7 5% 0.1W
3108	4822 116 83868	150Ω 5% 0.5W
3109	4822 117 10353	150Ω 1% 0.1W
3110	4822 117 11503	220Ω 1% 0.1W
3111▲	4822 051 20102	1k 5% 0.1W
3112	4822 050 15603	56k 1% 0.4W
3113	4822 050 11002	1k 1% 0.4W
3116▲	4822 051 20102	1k 5% 0.1W
3117	4822 051 20471	470Ω 5% 0.1W
3119	4822 116 52283	4k7 5% 0.5W
3120	4822 051 20224	220k 5% 0.1W
3121	4822 117 11507	6k8 1% 0.1W
3122	4822 051 20182	1k8 5% 0.1W
3123	4822 051 20182	1k8 5% 0.1W
3124	4822 051 20474	470k 5% 0.1W
3125	4822 051 20223	22k 5% 0.1W
3129▲	4822 051 20332	3k3 5% 0.1W
3135	4822 116 52228	680Ω 5% 0.5W
3136	4822 116 52228	680Ω 5% 0.5W
3138▲	4822 051 20153	15k 5% 0.1W
3142	4822 117 11504	270Ω 1% 0.1W
3144▲	4822 051 20229	22Ω 5% 0.1W
3145	4822 050 13302	3k3 1% 0.4W
3150	4822 117 10353	150Ω 1% 0.1W
3153	4822 116 83961	6k8 5%
3155	4822 116 52228	680Ω 5% 0.5W
3157▲	4822 051 20472	4k7 5% 0.1W
3158▲	4822 051 20153	15k 5% 0.1W
3170	4822 051 20471	470Ω 5% 0.1W
3188▲	4822 051 20102	1k 5% 0.1W
3200	4822 050 11503	15k 1% 0.4W
3201	4822 050 11002	1k 1% 0.4W
3202▲	4822 051 20153	15k 5% 0.1W
3203	4822 117 11449	2k2 1% 0.1W
3206	4822 051 20101	100Ω 5% 0.1W
3206	4822 117 11448	180Ω 1% 0.1W
3207	4822 050 13302	3k3 1% 0.4W
3208▲	4822 051 20102	1k 5% 0.1W
3208	4822 117 11454	820Ω 1% 0.1W
3210	4822 051 20104	100k 5% 0.1W
3211	4822 051 20331	330Ω 5% 0.1W
3212▲	4822 051 20472	4k7 5% 0.1W
3213	4822 051 20104	100k 5% 0.1W
3214▲	4822 051 20102	1k 5% 0.1W
3219	4822 051 20275	2M7 5% 0.1W
3239	4822 116 52249	1k8 5% 0.5W
3240	4822 117 10834	47k 1% 0.1W
3242▲	4822 051 20102	1k 5% 0.1W
3248	4822 051 20105	1M 5% 0.1W
3249	4822 051 20105	1M 5% 0.1W
3250	4822 117 11846	10k 5% 1/16W
3251	4822 050 11003	10k 1% 0.4W
3252▲	4822 051 20109	10Ω 5% 0.1W
3253▲	4822 051 20109	10Ω 5% 0.1W
3254	4822 051 20561	560Ω 5% 0.1W
3255	4822 050 11002	1k 1% 0.4W
3256▲	4822 051 20102	1k 5% 0.1W
3257▲	4822 051 20102	1k 5% 0.1W
3259▲	4822 051 20102	1k 5% 0.1W
3261	4822 051 20223	22k 5% 0.1W
3262	4822 116 52283	4k7 5% 0.5W
3263	4822 050 11503	15k 1% 0.4W
3264	4822 101 11191	10k 30% 0.1W
3270▲	4822 051 20153	15k 5% 0.1W
3271	4822 116 52283	4k7 5% 0.5W
3273	4822 051 20104	100k 5% 0.1W
3275	4822 051 20822	8k2 5% 0.1W
3276	4822 051 20822	8k2 5% 0.1W
3280▲	4822 051 20102	1k 5% 0.1W
3303	4822 116 52219	330Ω 5% 0.5W
3304	4822 050 11009	10Ω 5% 0.5W
3310	4822 117 11684	4k7 LIN POTM
3314	4822 117 12156	15k 5% 3W
3315	4822 117 11896	1k5 20% 0.5W
3323	4822 116 52221	360Ω 5% 0.1W
3324▲	4822 051 20109	10Ω 5% 0.1W
3330	4822 117 11684	4k7 LIN POTM
3334	4822 117 12156	15k 5% 3W
3335	4822 117 11896	1k5 20% 0.5W
3344	4822 050 11009	10Ω 5% 0.5W
3350	4822 117 11684	4k7 LIN POTM
3354	4822 117 12156	15k 5% 3W
3355	4822 117 11896	1k5 20% 0.5W
3370▲	4822 052 11109	10Ω 5% 0.5W
3371▲	4822 052 10108	1Ω 5% 0.33W
3372▲	4822 052 10108	1Ω 5% 0.33W
3374	4822 117 11896	1k5 20% 0.5W
3400	4822 116 52283	4k7 5% 0.5W
3401	4822 050 12202	2k2 1% 0.4W
3402	4822 050 12202	2k2 1% 0.4W
3403	4822 117 11681	820Ω 5%
3403	4822 117 12646	390Ω 5% 2W
3404	4822 050 11002	1k 1% 0.4W
3404	4822 050 11502	1k5 1% 0.4W
3405	4822 050 11509	15Ω 5% 0.4W
3405	4822 050 14709	47Ω 1% 0.4W
3405	4822 116 52193	39Ω 5% 0.5W
3406	4822 050 12002	2k 1% 0.4W
3406	4822 050 12202	2k2 1% 0.4W
3407▲	4822 050 12201	220Ω 1% 0.4W
3407	4822 050 13901	390Ω 1% 0.4W
3410	4822 100 11391	330Ω 30% 0.1W
3411	4822 050 12703	27k 1% 0.4W
3411	4822 050 13303	33k 1% 0.4W
3412	4822 050 12203	22k 1% 0.4W
3414	4822 111 31051	3Ω3 5%
3414	4822 116 81755	2Ω2 0.25W
3418	4822 111 31051	3Ω3 5%
3418	4822 116 81755	2Ω2 0.25W
3420	4822 101 11191	10k 30% 0.1W
3421	4822 051 20824	820k 5% 0.1W
3422▲	4822 051 20153	15k 5% 0.1W
3424	4822 117 12648	100Ω 5% 2W
3425	4822 053 20335	3M3 5% 0.25W
3427	4822 051 20822	8k2 5% 0.1W
3428	4822 117 11454	820Ω 1% 0.1W
3440▲	4822 051 20102	1k 5% 0.1W
3441	4822 051 20683	68k 5% 0.1W
3442	4822 050 12209	22Ω 1% 0.4W
3443	4822 051 20561	560Ω 5% 0.1W
3444	4822 117 12649	10k 5% 2W
3445	4822 117 12624	10Ω 5% 2W
3446▲	4822 116 83749	680Ω 1/4W
3450▲	4822 052 10398	3Ω9 5% 0.33W
3454	4822 052 10821	FUSE RST 820Ω
3454	4822 052 11152	1k5 5% 0.5W
3456	4822 053 20224	220k 5% 0.25W
3460	4822 050 12703	27k 1% 0.4W
3460	4822 111 20433	20k 5%
3461	4822 050 12703	27k 1% 0.4W
3462	4822 050 22204	220k 1% 0.6W

3470▲	4822 052 11478	4Ω7 5% 0.5W	
3471	4822 117 12651	22Ω 5% 2W	
3480	4822 117 12648	100Ω 5% 2W	
3499▲	4822 052 10108	1Ω 5% 0.33W	
3500▲	4822 117 12164	430V - 710V	
3501	4822 117 12181	470Ω 20% 0.5W	
3503	4822 116 40204	30Ω 30%	
3504▲	4822 116 40277	PTC 9Ω S 100R	
3506	4822 116 82776	2Ω2	
3507	4822 117 12654	100Ω 5% 5W	
3510	4822 117 12647	33k 5% 3W	
3512	4822 117 12652	1k5 5% 2W	
3513▲	4822 051 20008	0Ω JUMPER	
3517	4822 117 11846	10k 5% 1/16W	
3518▲	4822 116 83027	R22 5% 3W	
3518	4822 117 10422	0.33Ω 5% 3W	
3520	4822 117 11149	82k 1% 0.1W	
3521	4822 116 52219	330Ω 5% 0.5W	
3525▲	4822 052 10229	22Ω 5% 0.33W	
3528	4822 116 83868	150Ω 5% 0.5W	
3529	4822 117 11778	4Ω7 5%	
3530	4822 050 13902	3k9 1% 0.4W	
3532▲	4822 051 20008	0Ω JUMPER	
3534	4822 051 20224	220k 5% 0.1W	
3536	4822 051 20393	39k 5% 0.1W	
3537	4822 117 11846	10k 5% 1/16W	
3538	4822 050 11004	100k 1% 0.4W	
3539	4822 116 52251	18k 5% 0.5W	
3540	4822 101 11189	4.7k 30% 0.1W	
3541	4822 117 12653	47Ω 5% 2W	
3542▲	4822 053 21475	4M7 5% 0.5W	
3545▲	4822 053 21225	2M2 5% 0.5W	
3546▲	4822 053 21475	4M7 5% 0.5W	
3565	4822 117 11846	10k 5% 1/16W	
3566	4822 051 20331	330Ω 5% 0.1W	
3567	4822 051 20681	680Ω 5% 0.1W	
3568	4822 051 20101	100Ω 5% 0.1W	
3569▲	4822 051 20102	1k 5% 0.1W	
3601	4822 116 90885	8k2 X 6	
3602	4822 117 12168	2k2 X 6	
3603	4822 116 90884	8k2 X 10	
3610	4822 117 11846	10k 5% 1/16W	
3612	4822 051 20224	220k 5% 0.1W	
3613▲	4822 051 20008	0Ω JUMPER	
3614▲	4822 051 20109	10Ω 5% 0.1W	
3614▲	4822 051 20153	15k 5% 0.1W	
3615▲	4822 051 20109	10Ω 5% 0.1W	
3615	4822 117 11846	10k 5% 1/16W	
3616▲	4822 051 20109	10Ω 5% 0.1W	
3616	4822 051 20223	22k 5% 0.1W	
3617	4822 050 11203	12k 1% 0.4W	
3618	4822 050 11503	15k 1% 0.4W	
3620	4822 050 11001	100Ω 1% 0.4W	
3621	4822 051 20561	560Ω 5% 0.1W	
3622	4822 051 20561	560Ω 5% 0.1W	
3623	4822 117 11846	10k 5% 1/16W	
3624	4822 051 20101	100Ω 5% 0.1W	
3625	4822 051 20101	100Ω 5% 0.1W	
3626	4822 050 11001	100Ω 1% 0.4W	
3627	4822 050 11001	100Ω 1% 0.4W	
3628	4822 051 20101	100Ω 5% 0.1W	
3630	4822 051 20822	8k2 5% 0.1W	
3630	4822 117 11383	12k 1% 0.1W	
3631	4822 117 10834	47k 1% 0.1W	
3632	4822 051 20333	33k 5% 0.1W	
3633	4822 051 20333	33k 5% 0.1W	
3634	4822 117 10834	47k 1% 0.1W	
3635	4822 051 20154	150k 5% 0.1W	
3636	4822 117 10834	47k 1% 0.1W	
3638	4822 050 11202	1k2 1% 0.4W	
3638	4822 116 52249	1k8 5% 0.5W	
3639	4822 051 20562	5k6 5% 0.1W	
3640	4822 050 18202	8k2 1% 0.4W	
3641	4822 050 18202	8k2 1% 0.4W	
3642	4822 050 11001	100Ω 1% 0.4W	
3650	4822 117 11449	2k2 1% 0.1W	
3653	4822 051 20105	1M 5% 0.1W	
3654	4822 051 20822	8k2 5% 0.1W	
3655	4822 050 11001	100Ω 1% 0.4W	
3656	4822 117 11503	220Ω 1% 0.1W	
3657	4822 050 11001	100Ω 1% 0.4W	
3658	4822 051 20681	680Ω 5% 0.1W	
3660	4822 050 11001	100Ω 1% 0.4W	
3661	4822 050 11001	100Ω 1% 0.4W	
3662	4822 050 11002	1k 1% 0.4W	
3663	4822 051 20681	680Ω 5% 0.1W	
3664	4822 051 20104	100k 5% 0.1W	
3666	4822 051 20273	27k 5% 0.1W	
3668	4822 051 20224	220k 5% 0.1W	
3669	4822 051 20101	100Ω 5% 0.1W	
3670	4822 050 11001	100Ω 1% 0.4W	
3674	4822 116 52283	4k7 5% 0.5W	
3676	4822 050 12703	27k 1% 0.4W	
3677	4822 050 18202	8k2 1% 0.4W	
3681	4822 117 11846	10k 5% 1/16W	
3682	4822 117 11846	10k 5% 1/16W	
3683	4822 050 11004	100k 1% 0.4W	
3684	4822 117 11846	10k 5% 1/16W	
3685	4822 116 83884	47k 5% 0.5W	
3686▲	4822 051 20153	15k 5% 0.1W	
3690	4822 051 20182	1k8 5% 0.1W	
3690	4822 117 11454	820Ω 1% 0.1W	
3694	4822 051 20562	5k6 5% 0.1W	
3695	4822 051 20562	5k6 5% 0.1W	
3696	4822 051 20562	5k6 5% 0.1W	
3697	4822 116 52213	180Ω 5% 0.5W	
3698▲	4822 051 20102	1k 5% 0.1W	
3996▲	4822 051 20153	15k 5% 0.1W	
3996	4822 117 11846	10k 5% 1/16W	
3997	4822 051 20154	150k 5% 0.1W	
3997	4822 051 20223	22k 5% 0.1W	
3997	4822 051 20562	5k6 5% 0.1W	
3997	4822 051 20683	68k 5% 0.1W	
3997	4822 117 10834	47k 1% 0.1W	

5014	4822 157 63065	0.68µH 10%	
5015	4822 152 20547	0.68µH 10%	
5100▲	4822 157 53941	100µH 10%	
5206	4822 157 53303	12µH 10%	
5206	4822 157 53634	5.6µH 10%	
5209	4822 157 52333	100µH 10%	
5260	4822 157 70704	38.9 MHz	
5260	4822 157 70942	45.75MHz	
5286	4822 157 53303	12µH 10%	
5287	4822 157 53303	12µH 10%	
5288	4822 157 53303	12µH 10%	
5442	4822 157 53139	4.7µH 10%	
5445▲	4822 140 10612	L.O.T.	
5451	4822 158 10549	12µH 10%	
5457	4822 157 11167	47µH 5%	
5458	4822 157 11167	47µH 5%	
5500	4822 157 10999	LINE FILT.30mH	
5500	4822 157 11163	LINE 22mH	
5515	4822 157 60171	EMI FILT.100MHz	
5516	4822 157 60171	EMI FILT.100MHz	
5540	4822 157 52007	4U7 10%	
5545▲	4822 146 10716	S.M.TRAFO	
5550	4822 157 60171	EMI FILT.100MHz	
5551	4822 157 71157	27µH 5%	
5570	4822 157 60171	EMI FILT.100MHz	
5571▲	4822 157 51462	10µH 10%	
5573	4822 157 60171	EMI FILT.100MHz	
5601	4822 157 60123	6.8µH 10%	
5602	4822 157 60123	6.8µH 10%	
5620	4822 157 60123	6.8µH 10%	
5680	4822 157 52983	22µH 10%	
5683	4822 157 60123	6.8µH 10%	
5690	4822 157 60123	6.8µH 10%	

6102▲	4822 130 30621	1N4148	
6110▲	4822 130 30621	1N4148	
6111▲	4822 130 30621	1N4148	
6144	4822 130 34382	BZX79-C8V2	
6151	4822 130 34382	BZX79-C8V2	
6251▲	4822 130 30621	1N4148	
6254	4822 130 34233	BZX79-C5V1	
6402▲	4822 130 30621	1N4148	
6403	4822 130 42488	BYD33D	
6424	4822 130 34382	BZX79-C8V2	
6440	4822 130 42488	BYD33D	
6441	4822 130 42488	BYD33D	
6443	4822 130 42488	BYD33D	
6444	4822 130 34145	BZX79-B39C	
6445▲	4822 130 32896	BYD33M	
6449▲	4822 130 42489	BYD33G	
6454	5322 130 31938	BYV27-200	
6461▲	4822 130 30621	1N4148	
6464▲	4822 130 30621	1N4148	
6470▲	4822 130 42489	BYD33G	
6480	4822 130 34382	BZX79-C8V2F	
6500	4822 130 34328	BZX79-B30	
6501	4822 130 34328	BZX79-B30	
6502	4822 130 31083	GP15K-16	
6502▲	4822 130 80858	1N5062	
6503	4822 130 31083	GP15K-16	
6503▲	4822 130 80858	1N5062	
6504	4822 130 31083	GP15K-16	
6504▲	4822 130 80858	1N5062	
6505	4822 130 31083	GP15K-16	
6505▲	4822 130 80858	1N5062	
6507	4822 130 42606	BYD33J	
6508	4822 130 42606	BYD33J	
6524▲	4822 130 31631	BYV10-20	
6537	4822 130 30842	BAV21	
6540	4822 130 30842	BAV21	
6550	4822 130 10807	BYM36C	
6560	5322 130 31938	BYV27-200	
6563	4822 130 34233	BZX79-C5V1	
6570	5322 130 31938	BYV27-200	
6600▲	4822 130 34173	BZX79-C5V6	
6610	4822 130 34142	BZX79-B33	
6610	4822 130 82037	HZT33	
6650	4822 130 30862	BZX79-C9V1	
6653	4822 130 34233	BZX79-C5V1	
6663▲	4822 130 82029	LTL307P	

7001	5322 130 41983	BC858B	
7002	5322 130 41983	BC858B	
7003	5322 130 41983	BC858B	
7004	5322 130 41983	BC858B	
7102▲	5322 130 41982	BC848B	
7109▲	5322 130 41982	BC848B	
7110▲	5322 130 41982	BC848B	
7116▲	5322 130 41982	BC848B	
7120	4822 209 90462	TDA7056B	
7124▲	5322 130 41982	BC848B	
7150▲	5322 130 41982	BC848B	
7183▲	5322 130 41982	BC848B	
7214	5322 130 41983	BC858B	
7215▲	5322 130 41982	BC848B	
7216▲	5322 130 41982	BC848B	
7217▲	5322 130 41982	BC848B	
7225	4822 209 15105	TDA8363	
7225	4822 209 15106	TDA8361E	
7225	4822 209 15251	TDA8362E	
7225	4822 209 15285	TDA8360E	
7240▲	5322 130 41982	BC848B	
7245	4822 209 90129	TDA8395P	
7255	4822 209 12635	TDA4665	
7269▲	5322 130 41982	BC848B	
7310	4822 130 41782	BF422	
7330	4822 130 41782	BF422	
7350	4822 130 41782	BF422	
7401	4822 209 60955	TDA3653B	
7440	4822 130 60511	BC847B	
7441	5322 130 44647	BC368	
7445	4822 130 10206	BUT11AX	
7480	4822 130 40855	BC337	
7518	4822 130 10806	STP6NA60FI	
7518	4822 130 63787	STP4NA60FI	
7520▲	4822 209 90025	MC44603P	
7565	4822 130 40937	BC548B	
7566	5322 130 41983	BC858B	
7600	4822 209 14646	SAA5290ZP	
7608▲	5322 130 41982	BC848B	
7610▲	4822 209 73852	PMBT2369	
7620	4822 209 90962	ST24W04B1	
7650▲	5322 130 41982	BC848B	
7667▲	5322 130 41982	BC848B	
7677	4822 130 42705	BC847	
7681▲	5322 130 41982	BC848B	
7682▲	5322 130 41982	BC848B	

Picture tube panel [B1]

Various

▲	4822 255 10355	CRT SOCKET
▲	4822 255 70293	CRT SOCKET 14"
1010	4822 212 11132	CRT PANEL 14"
1010	4822 212 11133	CRT PANEL 20"

2304	4822 126 13461	680pF 10% 50V
2344	4822 126 13461	680pF 10% 50V

3300	4822 117 11683	2k2 LIN POTM	
3303	4822 116 52219	330Ω 5% 0.5W	
3303	4822 116 83883	470Ω 5% 0.5W	
3304	4822 051 20129	12Ω 5% 0.1W	
3304	4822 051 20189	18Ω 5% 0.1W	
3311	4822 116 83883	470Ω 5% 0.5W	
3311	4822 050 18201	820Ω 1% 0.4W	
3312	4822 050 11001	100Ω 1% 0.4W	
3313	4822 050 11001	100Ω 1% 0.4W	
3321▲	4822 116 83749	680Ω 1/4W	
3322	4822 050 11502	1k5 1% 0.4W	
3323	4822 116 52219	330Ω 5% 0.5W	
3323	4822 116 83883	470Ω 5% 0.5W	
3324	4822 051 20569	56Ω 5% 0.1W	
3324	4822 051 20339	33Ω 5% 0.1W	
3331	4822 116 83883	470Ω 5% 0.5W	
3331	4822 050 18201	820Ω 1% 0.4W	
3332	4822 050 11001	100Ω 1% 0.4W	
3333	4822 050 11001	100Ω 1% 0.4W	
3340	4822 117 11683	2k2 LIN POTM	
3343	4822 116 52219	330Ω 5% 0.5W	
3343	4822 116 83883	470Ω 5% 0.5W	
3344▲	4822 051 20109	10Ω 5% 0.1W	
3344	4822 051 10159	15Ω 2% 0.25W	
3351	4822 116 83883	470Ω 5% 0.5W	
3351	4822 050 18201	820Ω 1% 0.4W	
3352	4822 050 11001	100Ω 1% 0.4W	
3353	4822 050 11001	100Ω 1% 0.4W	
3357	4822 117 11449	2k2 1% 0.1W	
3357	4822 051 20122	1k2 5% 0.1W	
3360	4822 051 20561	560Ω 5% 0.1W	
3361	4822 050 13302	3k3 1% 0.4W	
3362	4822 051 20681	680Ω 5% 0.1W	

5370	4822 157 51157	3.3µH 10%	
5370	4822 157 50961	22µH 10%	

6310	4822 130 34174	BZX79-C4V7	
6314	4822 130 30842	BAV21	
6330	4822 130 34174	BZX79-C4V7	
6334	4822 130 30842	BAV21	
6350	4822 130 34174	BZX79-C4V7	
6354	4822 130 30842	BAV21	

7300	4822 130 40938	BC548	
7320	4822 130 40938	BC548	
7340	4822 130 40938	BC548	
7360	4822 130 40941	BC558	