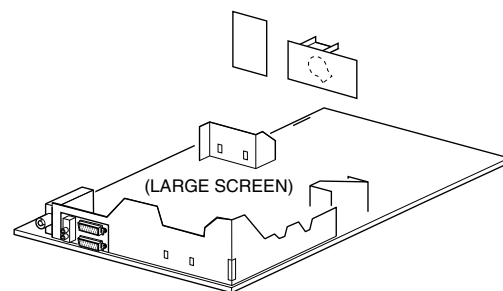


Service
Service
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Service Manual

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PHILIPS

1. Technical Specifications, Connections and Chassis Overview

Note: Described specifications are valid for the *whole* product range.

1.1 Technical Specifications

1.1.1 Reception

Tuning system	: PLL
Colour systems	: PAL B/G, D/K, I : SECAM B/G, L/L'
Sound systems	: FM/AM-mono : FM-stereo (2CS) : NICAM : FM radio (10.7 MHz)
A/V connections	: PAL BG : SECAM L/L' : PAL 60 (playback only)

Channel selections

IF frequency

Aerial input

: NTSC 3.58
(playback only)
: NTSC 4.43
(playback only)
: 100 channels
: UVSH
: 38.9 MHz
: 75 Ω , Coax

1.1.2 Miscellaneous

Audio output (RMS)

Mains voltage

Mains frequency

Ambient temperature

Maximum humidity

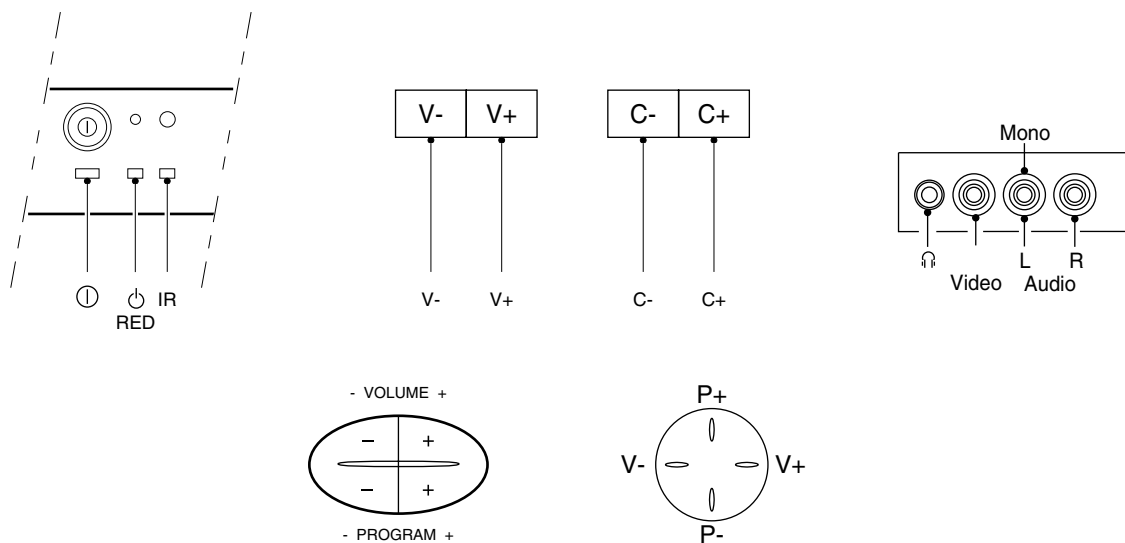
Power consumption

Standby Power consumption

: 2 x 5 W stereo
: 2 x 10 W stereo
: 220 - 240 V
($\pm 10\%$)
: 50 / 60 Hz ($\pm 5\%$)
: + 5 to + 45 deg. C
: 90 % R.H.
: 58 W (21") to
: 100 W (33")
: < 3 W

1.2 Connections

1.2.1 Side (or Front) Connections and Top (or Front) Control

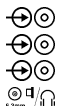


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Figure 1-1

Audio / Video In

1 - Video	CVBS (1 Vpp / 75 Ω)
2 - Audio	L (0.5 Vrms / 10 k Ω)
3 - Audio	R (0.5 Vrms / 10 k Ω)
4 - Headphone	3.5 mm (8 - 600 Ω / 4 mW)



1.2.2 Rear Connections

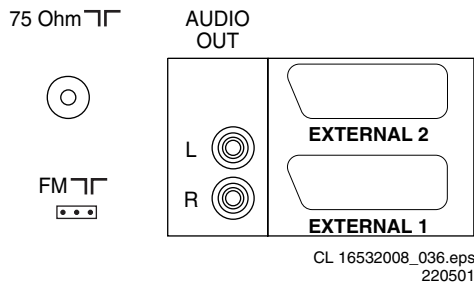


Figure 1-2 .eps

TV Aerial In

Aerial input : 75 Ω , Coax (IEC-type)

FM Radio In

Aerial input : via 'coax-to-3 pins' adapter
: 'cable' or 'wire' antenna

Audio In

1 - Audio L (0.5 Vrms / 10 k Ω)
2 - Audio R (0.5 Vrms / 10 k Ω)

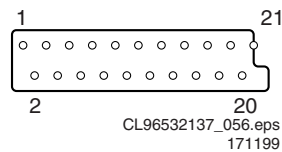
External 1: RGB/YUV in + CVBS in/out

Figure 1-3

1 - Audio	R (0.5 Vrms / 1 k Ω)	⊕
2 - Audio	R (0.5 Vrms / 10 k Ω)	⊕
3 - Audio	L (0.5 Vrms / 1 k Ω)	⊕
4 -	GND	⊥
5 -	GND	⊥
6 - Audio	L (0.5 Vrms / 10 k Ω)	⊕
7 - Blue / U	(0.7 Vpp / 75 Ω)	⊕
8 - CVBS-status	0 - 2.0 V: INT 4.5 - 7 V: EXT 16:9 9.5 - 12 V: EXT 4:3	
9 -	GND	⊥
10 -		
11 - Green / Y	(0.7 Vpp / 75 Ω)	⊕
12 -		
13 -	GND	⊥
14 -	GND	⊥
15 - Red / V	(0.7 Vpp / 75 Ω)	⊕
16 - RGB-status	0 - 0.4 V: INT 1 - 3 V: EXT / 75 Ω	
17 -	GND	⊥
18 -	GND	⊥
19 - CVBS	(1 Vpp / 75 Ω)	⊕
20 - CVBS	(1 Vpp / 75 Ω)	⊕
21 - Earth	GND	⊥

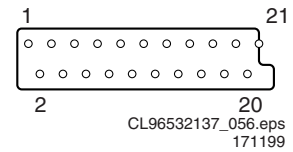
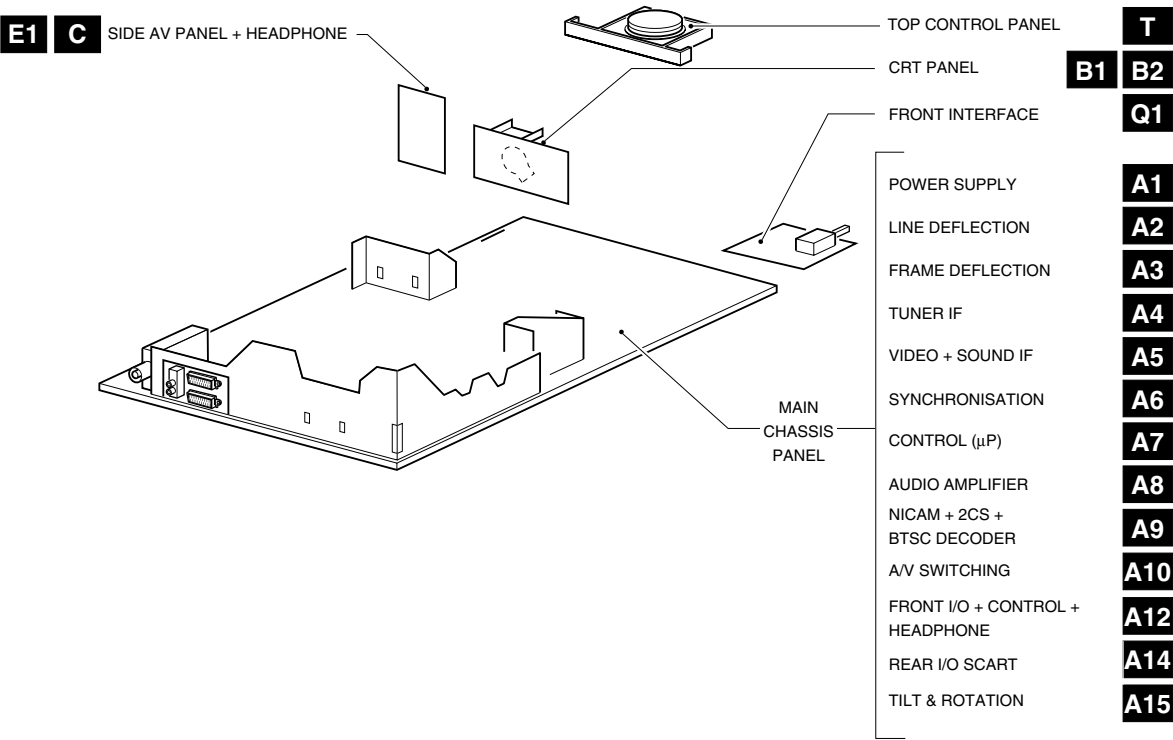
External 2: YC in + CVBS in/out

Figure 1-4

1 - Audio	R (0.5 Vrms / 1 k Ω)	⊕
2 - Audio	R (0.5 Vrms / 10 k Ω)	⊕
3 - Audio	L (0.5 Vrms / 1 k Ω)	⊕
4 -	GND	⊥
5 -	GND	⊥
6 - Audio	L (0.5 Vrms / 10 k Ω)	⊕
7 -		
8 - CVBS-status	0 - 2.0 V: INT 4.5 - 7 V: EXT 16:9 9.5 - 12 V: EXT 4:3	
9 -	GND	⊥
10 -		
11 -		
12 -		
13 -	GND	⊥
14 -	GND	⊥
15 - C	(0.3 Vpp / 75 Ω)	⊕
16 -		
17 -	GND	⊥
18 -	GND	⊥
19 - CVBS	(1 Vpp / 75 Ω)	⊕
20 - Y / CVBS	(1 Vpp / 75 Ω)	⊕
21 - Earth	GND	⊥

1.3 Chassis Overview



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Figure 1-5

5. Service Modes, Error Codes and Fault Finding

Index of this chapter:

1. Test points.
2. Service Modes.
3. Problems and Solving Tips (related to CSM).
4. ComPair.
5. Error Codes.
6. The Blinking LED Procedure.
7. Protections.
8. Repair Tips.

5.1 Test Points

The chassis is equipped with test points printed on the circuit board assemblies. These test points refer to the functional blocks:

TEST POINT OVERVIEW L01		
Test point	Circuit	Diagram
A1-A2-A3-.....	Audio processing	A8, A9 / A11
C1-C2-C3-.....	Control	A7
F1-F2-F3-.....	Frame drive	A3
I1-I2-I3-.....	Tuner & IF	A4
L1-L2-L3-....	Line drive	A2
P1-P2-P3-.....	Power supply	A1
S1-S2-S3-.....	Synchronisation	A6
V1-V2-V3-.....	Video processing	A5, B1

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Figure 5-1

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

Perform measurements under the following conditions:

- Service Default Mode.
- Video: colour bar signal.
- Audio: 3 kHz left, 1 kHz right.

5.2 Service Modes

Service Default Mode (SDM) and Service Alignment Mode (SAM) offer several features for the service technician, while the Customer Service Menu (CSM) is used for communication between dealer and customer.

There is also the option of using ComPair, a hardware interface between a computer (see requirements) and the TV chassis. It offers the ability of structured trouble shooting, error code reading and software version readout for all L01 chassis.

Minimum requirements: a 486 processor, Windows 3.1 and a CD-ROM drive. A Pentium Processor and Windows 95/98 are also acceptable (see also paragraph 5.4).

SW cluster	SW name	UOC-type	Diversity	Remark
2EU0	L01ET0 x.y	TDA9555	West Europe, 1 page TXT	All Service Modes
2EU9	L01ET9 x.y	TDA9555	East Europe, 1 page TXT	All Service Modes
3EU1	L01EF1 x.y	TDA9565	West Europe, 10 page TXT	All Service Modes
3EU2	L01EF2 x.y	TDA9563	East Europe, 10 page TXT	All Service Modes

Abbreviations: E= Europe, F= Full TXT, M= mono, T= 1 page TXT

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Figure 5-2

5.2.1 Service Default Mode (SDM)

Purpose

- To create a predefined setting to get the same measurement results as given in this manual.
- To override SW protections.
- To start the blinking LED procedure.

Specifications

- Tuning frequency:
 - 475.25 MHz for PAL/SECAM (Europe and AP-PAL).
 - 61.25 MHz (channel 3) for NTSC-sets (NAFTA, LATAM and AP-NTSC).
- Colour system:
 - PAL-M for LATAM BI/TRI/FOUR-NORMA.
 - SECAM L for France.
 - NTSC for NAFTA and AP-NTSC.
 - PAL-BG for Europe and AP-PAL.
- All picture settings at 50 % (brightness, colour contrast, hue).
- Bass, treble and balance at 50 %; volume at 25 %.
- All service-unfriendly modes (if present) are disabled, like:
 - (sleep) timer,
 - child/parental lock,
 - blue mute,
 - hotel/hospitality mode
 - auto switch-off (when no 'IDENT' video signal is received for 15 minutes),
 - skip / blank of non-favorite presets / channels,
 - auto store of personal presets,
 - auto user menu time-out.

How to enter SDM

Use one of the following methods:

- Use a standard customer RC-transmitter and key in the code '062596' directly followed by the MENU button or
- Short wires 9631 and 9641 on the mono carrier (see Fig. 8-1) and apply Mains power. Then press the power button (remove the short after start-up).

Caution: Entering SDM by shorten wires 9631 and 9641 will override the +8V-protection. Do this only for a short period. When doing this, the service-technician must know exactly what he is doing, as it could lead to damaging the set.

- Or via ComPair.

After entering SDM, the following screen is visible, with SDM at the upper right side for recognition.

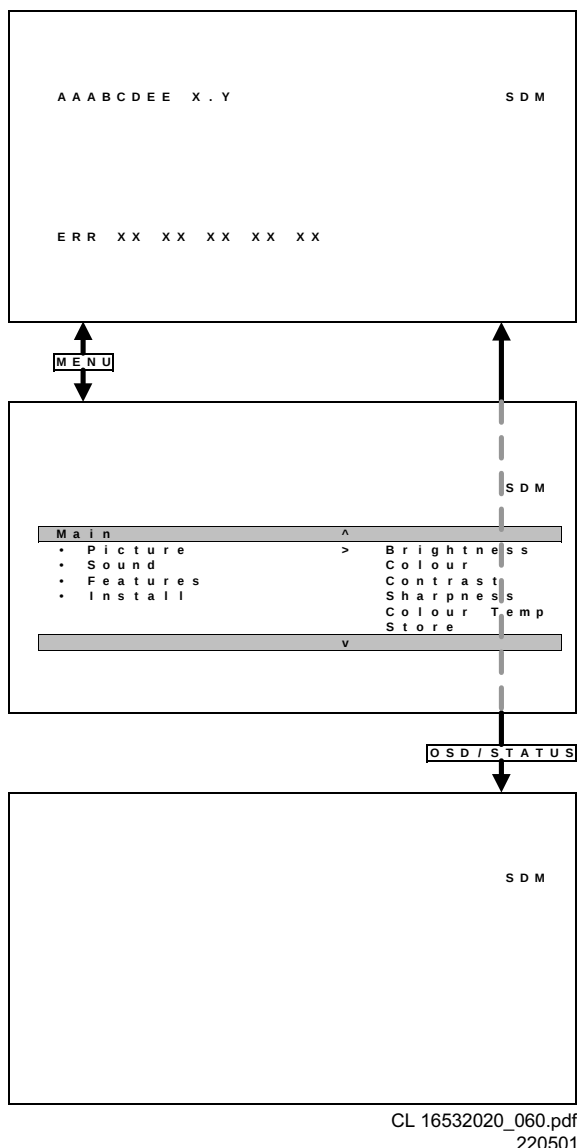


Figure 5-3

How to navigate

Use one of the following methods:

- When you press the MENU button on the remote control, the set will switch between the SDM and the normal user menu (with the SDM mode still active in the background). Return to the SDM screen with the OSD / STATUS button.
- When you press the OSD / STATUS button on the remote control, the menu will show or hide the error buffer. This feature is available to prevent interference during waveform measurements.
- On the TV, press and hold the 'VOLUME down' and press the 'CHANNEL down' for a few seconds, to switch from SDM to SAM and reverse.

How to exit

Switch the set to STANDBY by pressing the power button on the remote control transmitter (if you switch the set 'off' by removing the Mains power, the set will return in SDM when Mains power is re-applied). The error buffer is cleared.

5.2.2 Service Alignment Mode (SAM)

Purpose

- To perform alignments.
- To change option settings.
- To display / clear the error code buffer.

Specifications

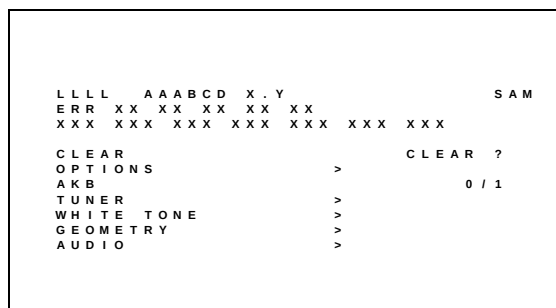
- Operation hours counter.
- Software version.
- Option settings.
- Error buffer reading and erasing.
- Software alignments.

How to enter

Use one of the following methods:

- Use a standard customer RC-transmitter and key in the code '062596' directly followed by the OSD / STATUS button or
- Via ComPair.

The following screen is visible, with SAM at the upper right side for recognition.



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Figure 5-4

- LLLL** This is the operation hours counter. It counts the normal operation hours, not the standby hours.
- AAABCD-X.Y** This is the software identification of the main micro controller:
 - A = the project name (L01).
 - B = the region: E = Europe, A = Asia Pacific, U = NAFTA, L = LATAM.
 - C = the software diversity: D= DVD, F= full TXT, M= mono, T= 1 page TXT.
 - D = the language cluster number.
 - X = the main software version number.
 - Y = the sub software version number.
- SAM** Indication of the actual mode.
- Error buffer** Five errors possible.
- Option bytes** Seven codes possible.
- Clear** Erase the contents of the error buffer. Select the CLEAR menu item and press the CURSOR RIGHT key. The content of the error buffer is cleared.
- Options** To set the Option Bytes. See chapter 8.3.1 for a detailed description.
- AKB** Disable (0) or enable (1) the 'black current loop' (AKB = Auto Kine Bias).
- Tuner** To align the Tuner. See chapter 8.3.2 for a detailed description.
- White Tone** To align the White Tone. See chapter 8.3.3 for a detailed description.
- Geometry** To align the Geometry. See chapter 8.3.4 for a detailed description.
- Audio** To align the Audio. See chapter 8.3.5 for a detailed description.

How to navigate

Use one of the following methods:

- In SAM, select menu items with the CURSOR UP/DOWN key on the remote control transmitter. The selected item will be highlighted. When not all menu items fit on the screen, move the CURSOR UP/DOWN key to display the next / previous menu items.
- With the CURSOR LEFT/RIGHT keys, it is possible to:
 - (De)activate the selected menu item.
 - Change the value of the selected menu item.
 - Activate the selected submenu.
- When you press the MENU button twice, the set will switch to the normal user menus (with the SAM mode still active in the background). To return to the SAM menu press the OSD / STATUS button [i+].
- When you press the MENU key in a submenu, you will return to the previous menu.

How to exit

Switch the set to STANDBY by pressing the power button on the remote control (if you switch the set 'off' by removing the Mains power, the set will return in SAM when Mains power is re-applied). The error buffer is **not** cleared.

5.2.3 Customer Service Mode (CSM)

Purpose

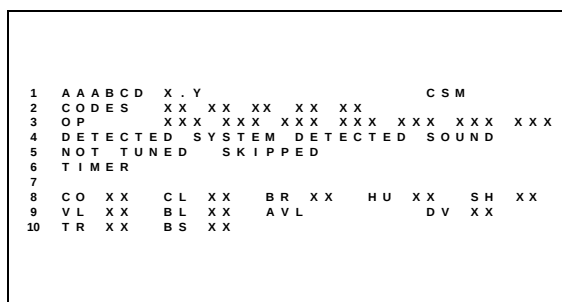
When a customer is having problems with his TV-set, he can call his dealer. The service technician can then ask the customer to activate the CSM, in order to identify the status of the set. Now, the service technician can judge the severeness of the complaint. In a lot of cases he can advise the customer how to solve the problem, or he can decide if it is necessary to visit the customer.

The CSM is a read only mode, therefore modifications in this mode are not possible.

How to enter

The CSM will be turned on after pressing the MUTE key on the remote control transmitter and any of the control buttons on the TV for at least 4 seconds **simultaneously**. This activation only works if there is no menu on the screen.

After switching ON the Customer Service Mode, the following screen will appear:



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Figure 5-5

1. Software identification of the main micro controller (see paragraph 5.2.2 for an explanation).
2. Error code buffer (see paragraph 5.5 for more details). Displays the last seven errors of the error code buffer.
3. In this line, the Option Bytes (OB) are visible. Each Option Byte is displayed as a decimal number between 0 and 255. The set may not work correctly when an incorrect option code is set. See chapter 8.3.1 for more information on the option settings.
4. Indicates which color and sound system is installed for the selected pre-set.
5. Indicates if the set is not receiving an 'IDENT' signal on the selected source. It will display 'Not Tuned'.

6. Indicates if the sleep timer is enabled.
7. Indicates if the V-chip feature is enabled.
8. Value indicates parameter levels at CSM entry. CO= CONTRAST, CL= COLOR, BR= BRIGHTNESS, HU= HUE, SH= SHARPNESS
9. Value indicates parameter levels at CSM entry. VL= VOLUME LEVEL, BL= BALANCE LEVEL, AVL= AUTO VOLUME LEVEL LIMITER, DV= DELTA VOLUME
10. Value indicates parameter levels at CSM entry (only for stereo sets). TR= TREBLE, BS= BASS

How to exit

Use one of the following methods:

- After you press 'any' key of the remote control transmitter with exception of the CHANNEL and VOLUME keys.
- After you switch-off the TV set with the Mains power switch.

5.3 Problems and Solving Tips (Related To CSM)

5.3.1 Picture Problems

Note: Below described problems are all related to the TV settings. The procedures to change the value (or status) of the different settings are described.

No colours / noise in picture

Check CSM line 4. Wrong colour system installed. To change the setting:

1. Press the MENU button on the remote control.
2. Select the INSTALL sub menu.
3. Select the MANUAL STORE sub menu.
4. Select and change the SYSTEM setting until picture and sound are correct.
5. Select the STORE menu item.

Colours not correct / unstable picture

Check CSM line 4. Wrong colour system installed. To change the setting:

1. Press the MENU button on the remote control.
2. Select the INSTALL sub menu.
3. Select the MANUAL STORE sub menu.
4. Select and change the SYSTEM setting until picture and sound are correct.
5. Select the STORE menu item.

TV switches 'off' (or 'on') or changes the channel without any user action

(Sleep)timer switched the set 'off' or changed channel. To change the setting:

1. Press the MENU button on the remote control.
2. Select the FEATURES sub menu.
3. Select the TIMER sub menu.
4. Select and change the SLEEP or TIME setting.

Picture too dark or too bright

Increase / decrease the BRIGHTNESS and / or the CONTRAST value when:

- The picture improves after you have pressed the 'Smart Picture' button on the remote control.
- The picture improves after you have switched on the Customer Service Mode

The new 'Personal' preference value is automatically stored.

White line around picture elements and text

Decrease the SHARPNESS value when:

- The picture improves after you have pressed the 'Smart Picture' button on the remote control.
- The picture improves after you have switched on the Customer Service Mode

The new 'Personal' preference value is automatically stored.

Snowy picture

Check CSM line 5. If this line indicates 'Not Tuned', check the following:

- No or bad antenna signal. Connect a proper antenna signal.
- Antenna not connected. Connect the antenna.
- No channel / pre-set is stored at this program number. Go to the INSTALL menu and store a proper channel at this program number.
- The tuner is faulty (in this case the CODES line will contain error number 10). Check the tuner and replace / repair if necessary.

Snowy picture and/or unstable picture

- A scrambled or decoded signal is received.

Black and white picture

Increase the COLOR value when:

- The picture improves after you have pressed the 'Smart Picture' button on the remote control.
- The picture improves after you have switched on the Customer Service Mode

The new 'Personal' preference value is automatically stored.

Menu text not sharp enough

Decrease the CONTRAST value when:

- The picture improves after you have pressed the 'Smart Picture' button on the remote control.
- The picture improves after you have switched on the Customer Service Mode

The new 'Personal' preference value is automatically stored.

5.3.2 Sound Problems**No sound or sound too loud (after channel change / switching on)**

Increase / decrease the VOLUME level when the volume is OK after you switched on the CSM. The new 'Personal' preference value is automatically stored.

5.4 ComPair**5.4.1 Introduction**

ComPair (Computer Aided Repair) is a service tool for Philips Consumer Electronics products. ComPair is a further development on the European DST (service remote control), which allows faster and more accurate diagnostics. ComPair has three big advantages:

- ComPair helps you to quickly get an understanding on how to repair the chassis in a short time by guiding you systematically through the repair procedures.
- ComPair allows very detailed diagnostics (on I²C level) and is therefore capable of accurately indicating problem areas. You do not have to know anything about I²C commands yourself because ComPair takes care of this.
- ComPair speeds up the repair time since it can automatically communicate with the chassis (when the microprocessor is working) and all repair information is directly available. When ComPair is installed together with the SearchMan electronic manual of the defective chassis, schematics and PWBs are only a mouse click away.

5.4.2 Specifications

ComPair consists of a Windows based faultfinding program and an interface box between PC and the (defective) product. The ComPair interface box is connected to the PC via a serial or RS232 cable.

In case of the L01 chassis, the ComPair interface box and the TV communicate via a bi-directional service cable via the

service connector (located on the Main panel, see also figure 8-1 suffix D).

The ComPair faultfinding program is able to determine the problem of the defective television. ComPair can gather diagnostic information in two ways:

- Automatic (by communication with the television): ComPair can automatically read out the contents of the entire error buffer. Diagnosis is done on I²C level. ComPair can access the I²C bus of the television. ComPair can send and receive I²C commands to the micro controller of the television. In this way, it is possible for ComPair to communicate (read and write) to devices on the I²C busses of the TV-set.
- Manually (by asking questions to you): Automatic diagnosis is only possible if the micro controller of the television is working correctly and only to a certain extend. When this is not the case, ComPair will guide you through the faultfinding tree by asking you questions (e.g. Does the screen gives a picture? Click on the correct answer: YES / NO) and showing you examples (e.g. Measure test-point I7 and click on the correct oscillogram you see on the oscilloscope). You can answer by clicking on a link (e.g. text or a waveform picture) that will bring you to the next step in the faultfinding process.

By a combination of automatic diagnostics and an interactive question / answer procedure, ComPair will enable you to find most problems in a fast and effective way.

Beside fault finding, ComPair provides some **additional features** like:

- Up- or downloading of pre-sets.
- Managing of pre-set lists.
- Emulation of the (European) Dealer Service Tool (DST).
- If both ComPair and SearchMan (Electronic Service Manual) are installed, all the schematics and the PWBs of the set are available by clicking on the appropriate hyperlink.

Example: Measure the DC-voltage on capacitor C2568 (Schematic/Panel) at the Monocarrier.

Click on the 'Panel' hyperlink to automatically show the PWB with a highlighted capacitor C2568.

Click on the 'Schematic' hyperlink to automatically show the position of the highlighted capacitor.

5.4.3 How To Connect

1. First install the ComPair Browser software (see the Quick Reference Card for installation instructions).
2. Connect the RS232 interface cable between a free serial (COM) port of your PC and the PC connector (marked with 'PC') of the ComPair interface.
3. Connect the Mains power adapter to the supply connector (marked with 'POWER 9V DC') on the ComPair interface.
4. Switch the ComPair interface OFF.
5. Switch the television set OFF (remove the Mains power).
6. Connect the ComPair interface cable between the connector on the rear side of the ComPair interface (marked with 'I²C') and the ComPair connector on the mono carrier (see figure 8-1 suffix D).
7. Plug the Mains power adapter in the Mains power outlet and switch on the interface. The green and red LEDs light up together. The red LED extinguishes after approx. 1 second while the green LED remains lit.
8. Start the ComPair program and read the 'introduction' chapter.

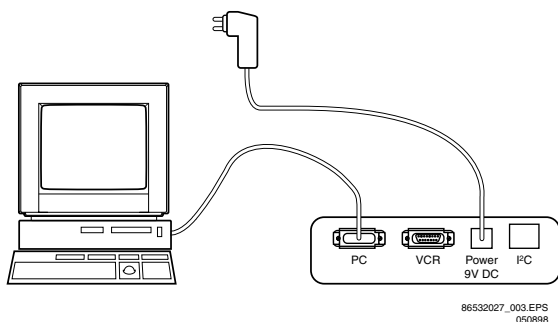


Figure 5-6

5.4.4 How To Order

ComPair order codes:

- Starter kit ComPair + SearchMan software + ComPair interface (excluding transformer): 4822 727 21629
- ComPair interface (excluding transformer): 4822 727 21631
- Starter kit ComPair software (registration version): 4822 727 21634
- Starter kit SearchMan software: 4822 727 21635
- ComPair CD (update): 4822 727 21637
- SearchMan CD (update): 4822 727 21638
- ComPair interface cable: 3122 785 90004

5.5 Error Buffer

The error code buffer contains all detected errors since the last time the buffer was erased. The buffer is written from left to right. When an error occurs that is not yet in the error code buffer, it is written at the left side and all other errors shift one position to the right.

5.5.1 How to Read the Error Buffer

Use one of the following methods:

- On screen via the SAM (only if you have a picture).
Examples:
 - ERROR: **0 0 0 0 0** : No errors detected
 - ERROR: **6 0 0 0 0** : Error code 6 is the last and only detected error
 - ERROR: **9 6 0 0 0** : Error code 6 was first detected and error code 9 is the last detected (newest) error
- Via the blinking LED procedure (when you have no picture). See next paragraph.
- Via ComPair.

5.5.2 How to Clear the Error Buffer

The error code buffer is cleared in the following cases:

- By activation of the CLEAR command in the SAM menu:
- When you exit SDM / SAM with the STANDBY command on the remote control (when leaving SDM / SAM, by disconnecting the set from Mains power, the error buffer is not reset).
- When you transmit the command DIAGNOSE-99-OK with ComPair.
- If the content of the error buffer has not changed for 50 hours, it resets automatically.

5.5.3 Error Codes

In case of non-intermittent faults, clear the error buffer before you begin the repair. These to ensure that old error codes are no longer present.

If possible, check the entire contents of the error buffer. In some situations, an error code is only the result of another error code and not the actual cause (e.g., a fault in the protection detection circuitry can also lead to a protection).

ERROR CODE TABLE				
Error	Device	Error description	Def. item	Diagram
0	Not applicable	No Error		
1	Not applicable	X-Ray/overvoltage protection (USA only)	2465, 7460	A2
2	TDA8359/TDA9302	Horizontal protection	7460, 7461, 7462, 7463, 6467	A2
		Vertical protection	7861, VlotAux+13V	A2, A3
3	Reserve			
4	MSP34X5 / TDA9853	MSP I²C identification error	7831 or 7861	A9 or A11
5	TDA95xx	POR 3V3 / +8V protection	7200, 7560, 7480	A5, A6, A7, A1, A2
6	I²C bus	General I²C bus error	7200, 3624, 3625	A7
7	AN7522/3	Power down (over current) protection	7901 / 7902, 7561	A8, A1
8	Not applicable	E/W protection (Large Screen)	7400, 3405, 3406, 3400	A2
9	M24C08	NVM I²C identification error	7602, 3611, 3603/04	A7
10	Tuner	Tuner I²C identification error	1000, 7482	A4, A2
11	TDA6107/8	Black current loop protection	7330, RGB amps, CRT	B1, B2
12	M65669	PIP I²C identification error	7803	P

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210501

Figure 5-7

5.6 The Blinking LED Procedure

Via this procedure, you can make the contents of the error buffer visible via the front LED. This is especially useful when there is no picture.

When the SDM is entered, the LED will blink the contents of the error-buffer.

Error-codes ≥ 10 are shown as follows:

- a long blink of 750 ms (which is an indication of the decimal digit),
- a pause of 1.5 s,
- n short blinks ($n = 1 - 9$),
- when all the error-codes are displayed, the sequence finishes with a LED blink of 3 s,
- the sequence starts again.

Example of error buffer: **12 9 6 0 0**

After entering SDM:

- 1 long blink of 750 ms followed by a pause of 1.5 s,
- 2 short blinks followed by a pause of 3 s,
- 9 short blinks followed by a pause of 3 s,
- 6 short blinks followed by a pause of 3 s,
- 1 long blink of 3 s to finish the sequence,
- the sequence starts again.

the same time, measure the '+8V'. If this voltage is missing, check transistor TS7480.

- **Set is non-stop in hiccup mode** Set is in over current mode; check the secondary sensing (opto coupler 7515) and the 'MainSupply' voltage. Signal 'Stdbby_con' must be logic low under normal operation conditions and goes to high (3.3 V) under standby and fault conditions.
- **Set turns on, but without picture and sound** The screen shows snow, but OSD and other menus are okay. Blinking LED procedure indicates error 11, so problem is expected in the tuner (pos. 1000). Check presence of supply voltages. As 'Vlotaux+5V' at pin 5 and 7 are okay, 'VT_supply' at pin 9 is missing. Conclusion: resistor 3460 is defective.
- **Set turns on, but with a half screen at the bottom. Sound is okay** Blinking LED (set in SDM mode) indicates error 3. Check 'Vlotaux+11V' and '+50V'. If they are okay, problem is expected in the vertical amplifier IC7471. Measure with a scope the waveform on pin 17 of the UOC. Measure also at pin 1 of IC7471. If here the signal is missing, a defective resistor R3244 causes the problem.

5.7 Protections

If a fault situation is detected an error code will be generated and if necessary, the set will be put in the protection mode. Blinking of the red LED at a frequency of 3 Hz indicates the protection mode. In some error cases, the microprocessor does not put the set in the protection mode. The error codes of the error buffer can be read via the service menu (SAM), the blinking LED procedure or via ComPair. The DST diagnose functionality will force the set into the Service-standby, which is similar to the usual standby mode, however the microprocessor has to remain in normal operation completely.

To get a quick diagnosis the chassis has three service modes implemented:

- The Customer Service Mode (CSM).
- The Service Default Mode (SDM). Start-up of the set in a predefined way.
- The Service Alignment Mode (SAM). Adjustment of the set via a menu and with the help of test patterns.

See for a detailed description Chapter 9 paragraphs Deflection and Power Supply.

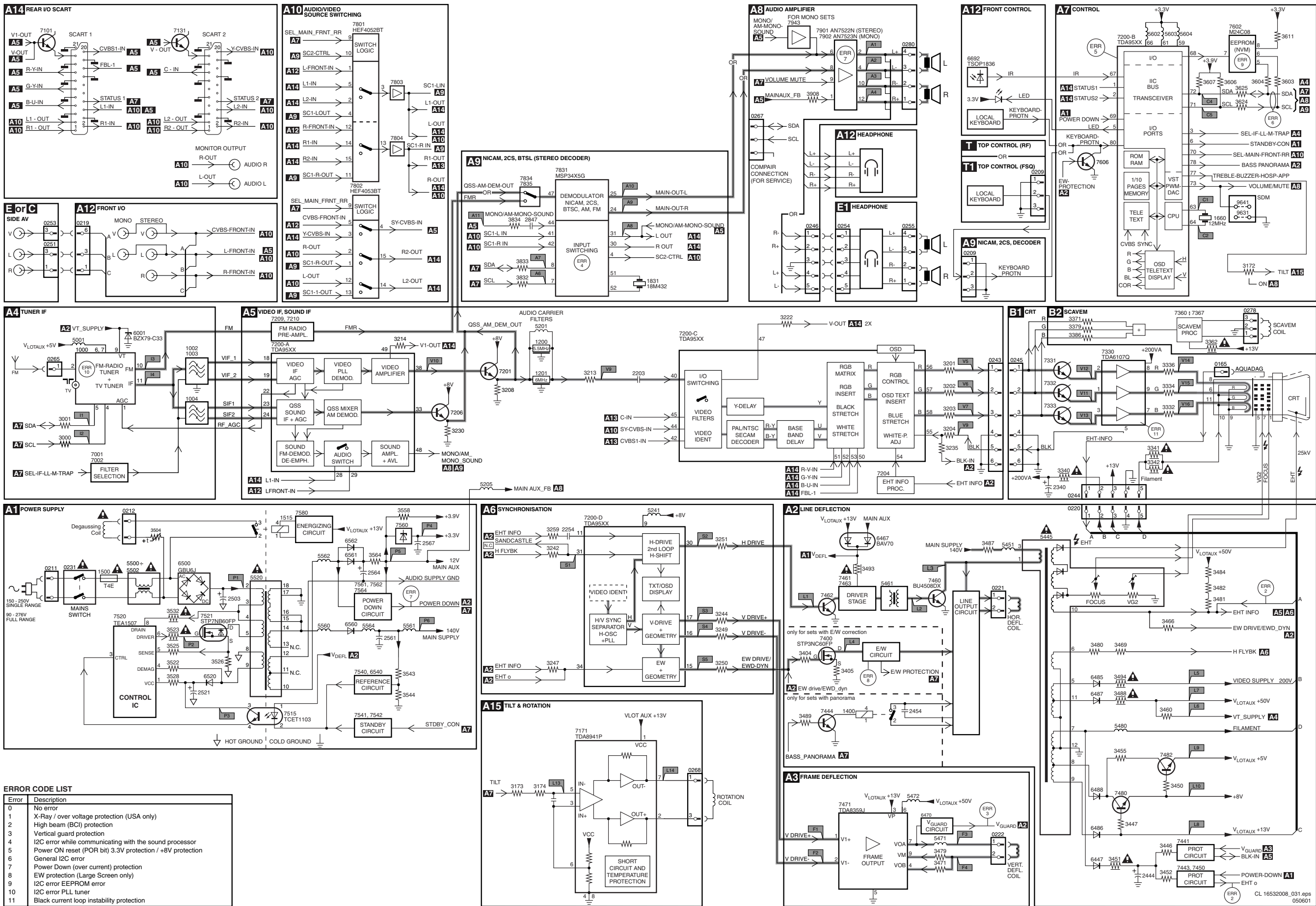
5.8 Repair Tips

Below some failure symptoms are given, followed by a repair tip.

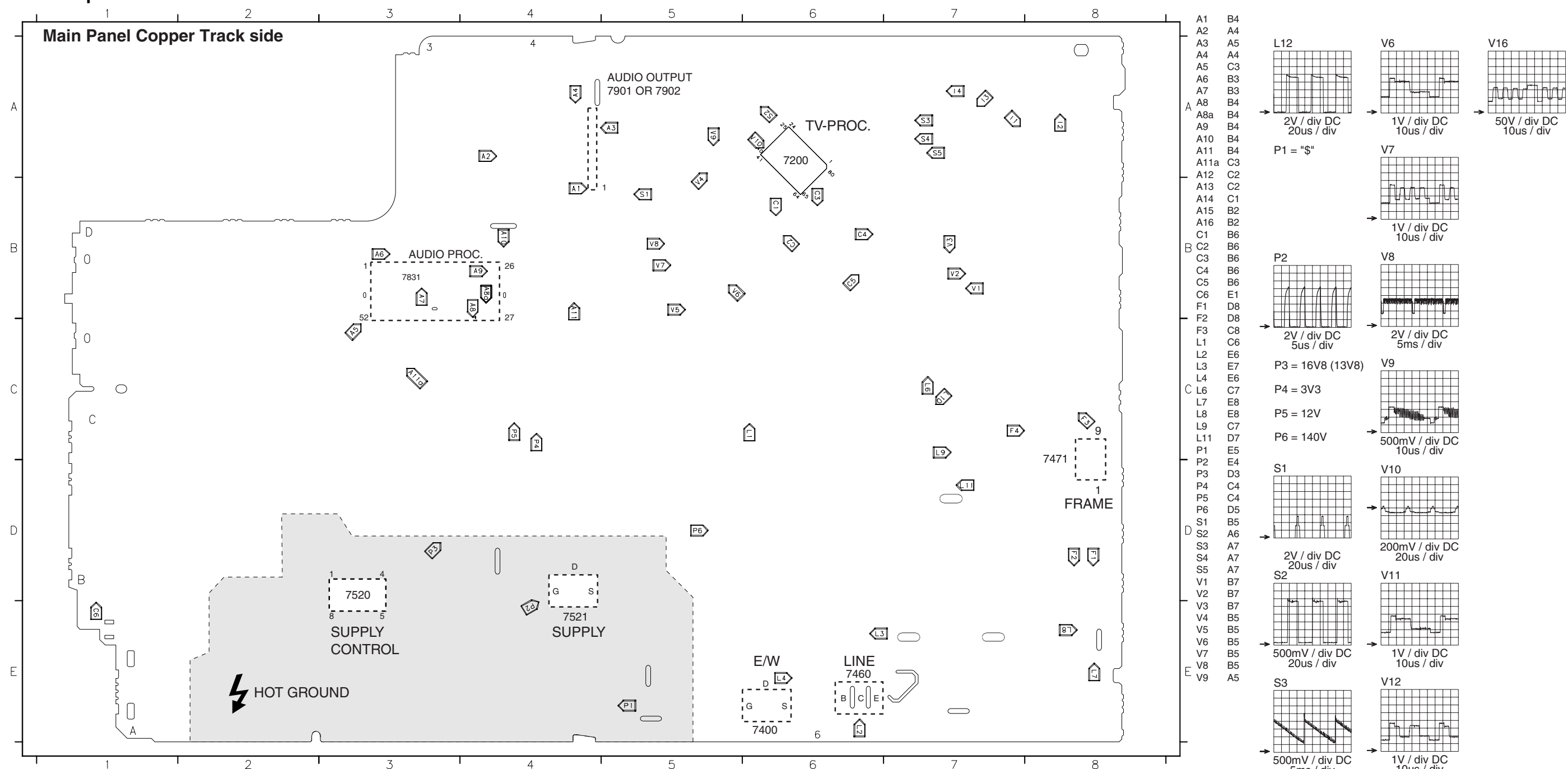
- **Set is dead and makes hiccuping sound** 'MainSupply' is available. Hiccuping stops when de-soldering L5561, meaning that problem is in the 'MainSupply' line. No output voltages at LOT, no horizontal deflection. Reason: line transistor 7460 is defective.
- **Set is dead, and makes no sound** Check power supply IC7520. Result: voltage at pins 1, 3, 4, 5 and 6 are about 180 V and pin 8 is 0 V. The reason why the voltage on these pins is so high is because the output driver (pin 6) has an open load. That is why MOSFET TS7521 is not able to switch. Reason: feedback resistor 3523 is defective. **Caution:** be careful measuring on the gate of TS7521; circuitry is very high ohmic and can easily be damaged! (first connect ground to measuring equipment, than the gate).
- **Set is in hiccup mode and shuts down after 8 s.** Blinking LED (set in SDM mode) indicates error 5. As it is unlikely that μP 'POR' and '+8V protection' happen at

6. Block Diagram, Testpoints, I²C and Supply Voltage Overview

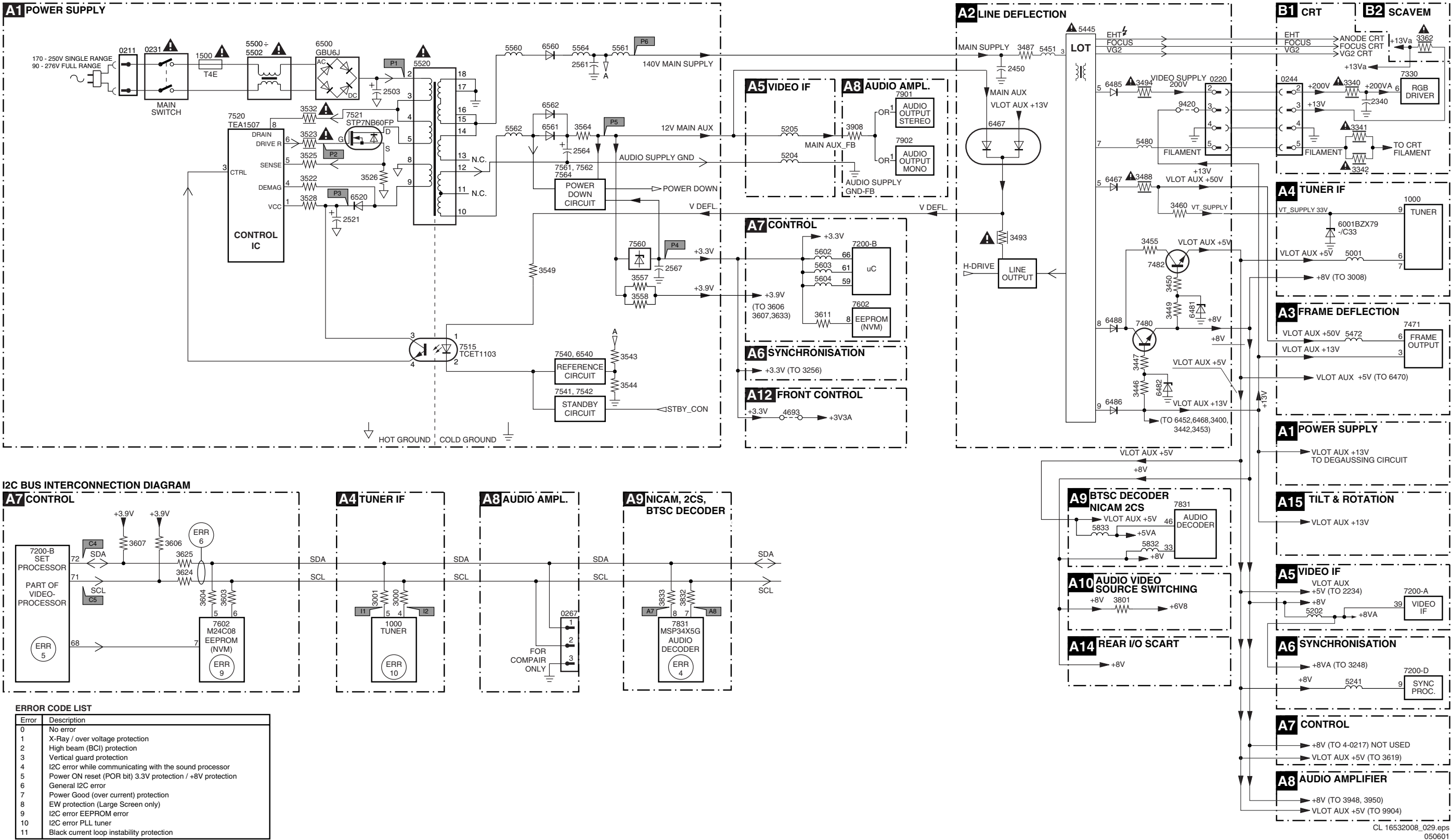
Block Diagram



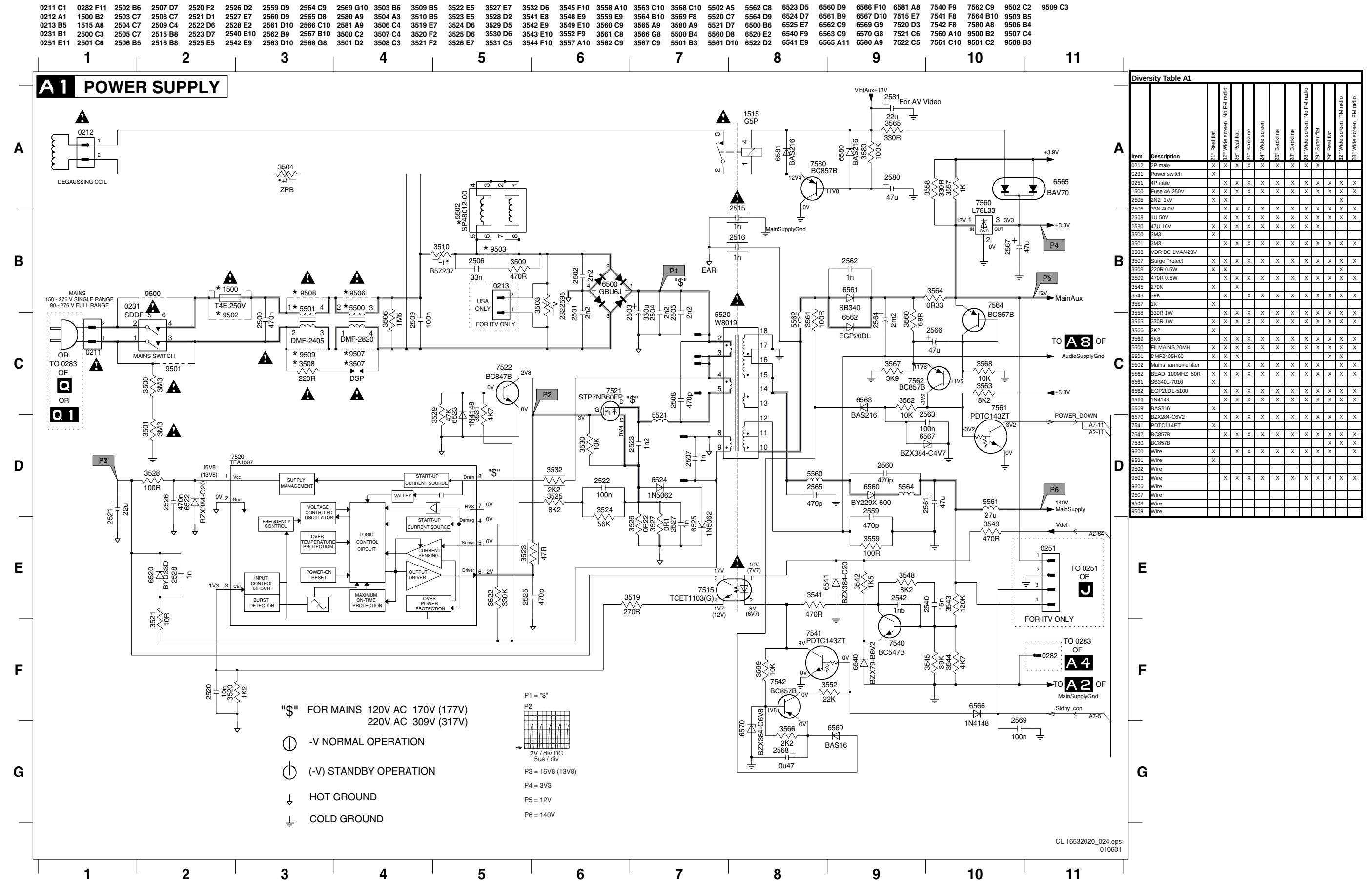
Testpoint Overview



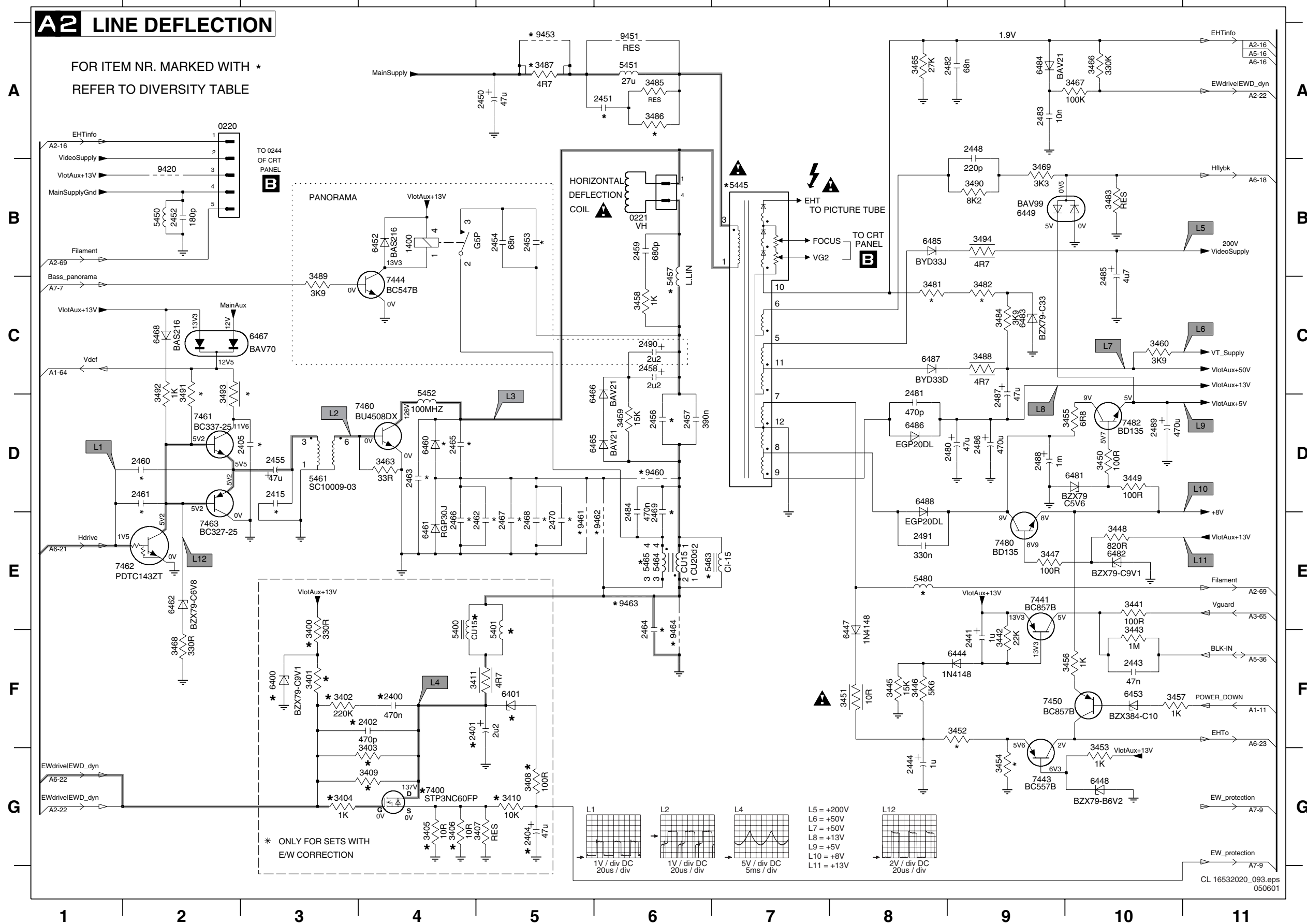
I²C and Supply Voltage Diagram



Large Signal Panel: Power supply



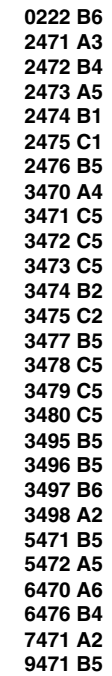
0220 A2	2402 F4	2443 F10	2452 B2	2457 D6	2462 E5	2467 E5	2481 D8	2486 D9	2491 E8	3404 G3	3409 G4	3443 F10	3449 D10	3454 G9	3459 D6	3467 A10	3483 B10	3488 C9	3493 C2	5450 B2	5463 E6	6401 F5	6452 B4	6465 D6	6482 E10	6487 C8	7444 C4	7463 E2	9453 A5
0221 B6	2403 G5	2444 G8	2453 B5	2458 C6	2463 D4	2468 E5	2482 A9	2487 D9	3400 E3	3405 G4	3414 G5	3445 F8	3450 D10	3455 D10	3460 C10	3468 F2	3484 C9	3489 C3	3494 B9	5451 A6	5464 E6	6444 F9	6453 F10	6466 C6	6483 C9	6488 D8	7450 F9	7480 E9	9460 D6
1400 B4	2405 D3	2448 A9	2454 B5	2459 B6	2464 E6	2469 E6	2483 A9	2488 D9	3401 F3	3406 G4	3411 F5	3446 F8	3451 F8	3456 F10	3463 D4	3469 B9	3485 A6	3490 B9	5400 E4	5452 D4	5465 E6	6447 E8	6460 D4	6467 C3	6484 A9	7400 G4	7460 D3	7482 D10	9461 E5
2400 F4	2415 D3	2450 A5	2455 D3	2460 D2	2465 D4	2470 E5	2484 D6	2489 D10	3402 F3	3407 G5	3441 E10	3447 E9	3452 F9	3457 F10	3465 A8	3481 C8	3486 A6	3491 C2	5401 E5	5457 B6	5480 E8	6448 G10	6461 E4	6468 C2	6485 B8	7441 E9	7461 D2	9420 B2	9462 E6
2401 F4	2441 F9	2451 A6	2456 D6	2461 D2	2466 E4	2480 D9	2485 B10	2490 C6	3403 G4	3408 G5	3442 F9	3448 E10	3453 G10	3458 C6	3466 A10	3482 C9	3487 A5	3492 C2	5445 B7	5461 D3	6400 F3	6449 B9	6462 E2	6481 D10	6486 D8	7443 G9	7462 E1	9451 A6	9464 E6
1			2			3			4			5			6		7		8		9		10		11				



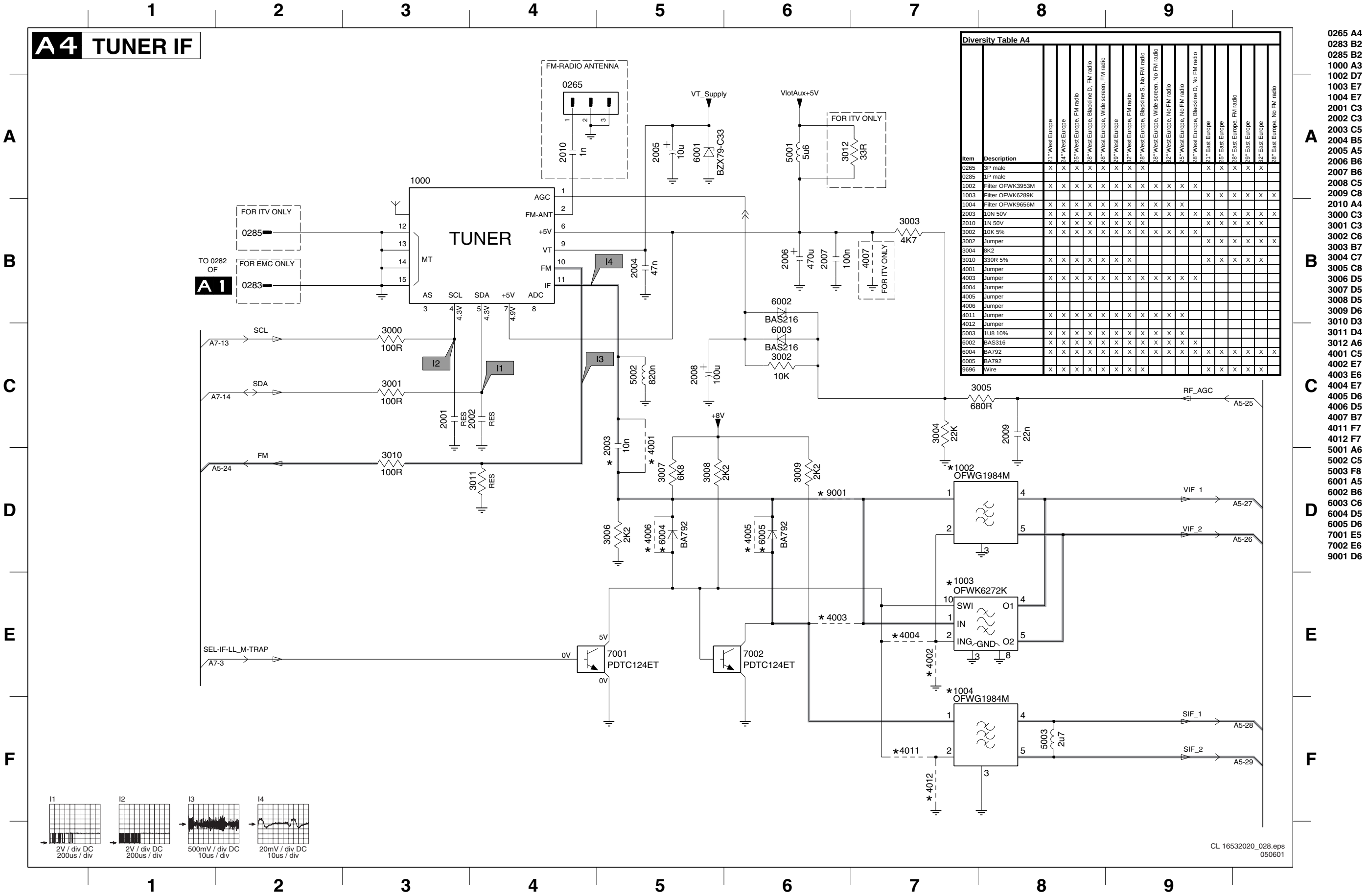
Diversity Table A2															
		28" Wide screen, No FM radio	28" Wide screen, FM radio	32" Wide screen	24" Wide screen	21" Blackline	25" Blackline D	25" Blackline S	25" Real flat	28" Stereo 5W, Blackline S	28" Stereo 3W	28" Stereo 5W, Blackline D	29" Super flat	21" Real flat	29" Real flat
Item	Description														
3468	47R 5% 1/6W				X					X					
3468	100R 5% 1/6W			X											
3468	180R 5% 1/6W	X	X				X							X	
3468	82R 5%					X									
3481	10K	X	X		X										
3481	12K						X		X		X	X	X		
3481	15K			X				X		X					X
3481	18K					X								X	
3482	10K					X		X							
3482	12K								X	X			X		
3482	24K	X	X		X		X				X	X			
3482	6K8														X
3482	8K2			X										X	
3486	33R	X	X	X	X	X	X	X	X	X	X	X	X	X	
3486	22R 3W														X
3487	4R7														
3489	3K9 5% 1/6W	X	X	X	X										
3491	10K 5% 1/6W					X								X	X
3491	27K 5% 1/6W	X	X	X	X		X	X		X	X	X	X		
3492	1K 5% 1/6W			X		X		X					X	X	X
3492	12K 5% 1/6W						X				X	X			
3492	1K5 5% 1/6W									X					
3492	2K7 5% 1/6W				X										
3492	4K7 5% 1/6W	X	X												
3492	470R 5% 1/6W								X						
3493	Fuse 3R9 5%												X		
3493	Fuse 6R8 5%	X	X	X	X	X	X	X	X	X	X	X		X	X
5400	Choke coil	X	X	X	X										
5400	CU15						X	X		X	X	X	X		
5401	1000U					X			X					X	X
5445	TFM LOT PSL0T 1FH			X										X	
5445	TFM LOT PSL0T 29"RF														X
5445	TFM LOT SLOt								X					X	
5445	TFM LOT USLOt+S	X	X		X	X	X				X	X			
5445	TFM LOT USLOt+U						X		X						
5451	22U														X
5451	33U	X	X	X	X	X	X	X	X	X	X	X	X	X	
5457	C907-01 Y			X											
5457	COI LINCOR DC12						X								
5457	COI LINCOR DRUM	X	X		X				X						X
5457	COI LINCOR DRUM DC12													X	
5457	Linearity corrector coil							X		X	X	X			
5457	Linearity corrector coil					X									
5461	SRW0913DR-T01					X								X	
5461	SRW0913DR-T02	X	X		X		X	X		X	X	X		X	
5461	SRW0913DR-T06			X					X				X		
5463	C957-02Y					X								X	
5463	CU15								X						X
5464	C946-01 Y	X	X	X	X										
5465	CU15						X				X	X			
5465	U-20D												X		
5465	UU15							X		X					
5480	22U													X	X
5480	33U	X	X		X										
5480	39U			X			X	X	X		X	X			
5480	47U					X				X				X	
6400	1K			X			X	X	X	X	X	X	X	X	X
6401	BZX79-C39					X	X	X	X	X	X	X		X	X
6401	BZX79-C47													X	
6401	BZX79-C68	X	X	X	X										
6452	BAS316	X	X	X	X										
6460	BY228/24	X	X		X	X	X	X	X	X	X	X	X	X	X
6460	DG3-7005L			X											
6462	BZX79-C10	X	X		X									X	X
6462	BZX79-C12					X			X						
6462	BZX79-C8v2						X								
6462	BZX79-C9v1			X						X	X	X	X		
7444	BC547B	X	X	X	X										
9420	Wire		X	X					X	X		X	X	X	X
9424	Wire												X		
9451	Wire														
9453	Wire	X	X	X	X	X	X	X	X	X	X	X	X	X	X
9460	Wire					X			X					X	X
9461	Wire														
9462	Wire	X	X	X	X		X	X		X	X	X	X		
9463	Wire					X			X					X	
9464	Wire	X	X	X	X		X	X		X	X	X	X		X

Diversity Table A12														
Item	Description	21" Real flat	29" Super flat	21" Blackline	25" Real flat	28" Blackline, FM radio	25" Blackline	28" Blackline, No FM radio	28" Wide screen, FM radio	29" Real flat	32" Wide screen, FM radio	32" Wide screen, No FM radio	28" Wide screen, No FM radio	24" Wide screen
0214	5P male								X	X	X			
0215	3P male													
0218	3P female													
0219	6P male	X	X	X	X	X	X		X	X	X	X	X	X
0227	6P male													
0229	7P male													
0232	Phone socket							X						
0239	3P male	X	X	X					X	X	X	X	X	
0242	5P male													
0259	5P male													
0278	3P male	X	X		X	X			X	X	X	X		
1600	Switch				X	X	X	X						X
1601	Switch				X	X	X	X						X
1602	Switch				X	X	X	X						X
1603	Switch				X	X	X	X						X
1606	Switch													
2181	50V 22P													
2182	50V 330P													
2183	50V 330P													
2184	4U7 10V	X	X	X	X	X	X	X						
2691	10U 50V	X	X	X	X	X	X	X				X	X	X
2981	10U 50V							X						
2982	470P 50V							X						
2983	10U 50V							X						
2984	470P 50V							X						
3181	1/6W 75R													
3182	1/6W 100R													
3183	1/6W 150R													
3184	47K													
3185	1/6W 150R													
3186	47K													
3681	390R				X	X	X	X						X
3682	3K3				X	X	X	X						X
3683	390R				X	X	X	X						X
3684	560R				X	X	X	X						X
3685	560R				X	X	X	X						X
3686	1K5				X	X	X	X						X
3691	330R	X	X	X	X	X	X	X				X	X	X
3693	220R	X	X	X	X	X	X	X				X	X	X
3694	4K7	X	X	X	X	X	X	X	X	X	X	X	X	X
3695	330R													
3981	270R							X						
3982	270R							X						
4101	Jumper													
4102	Jumper													
4104	Jumper													
4691	Jumper	X	X	X	X	X	X	X	X	X	X	X	X	X
4693	Jumper	X	X	X	X	X	X	X	X	X	X	X	X	X
6681	BAT85				X	X	X	X						X
6691	LTL-10224WHCR	X	X	X	X	X	X	X				X	X	X
6692	TSOP1836UH3V	X	X	X	X	X	X	X				X	X	X
9181	Wire	X	X	X	X	X	X		X	X	X	X	X	X

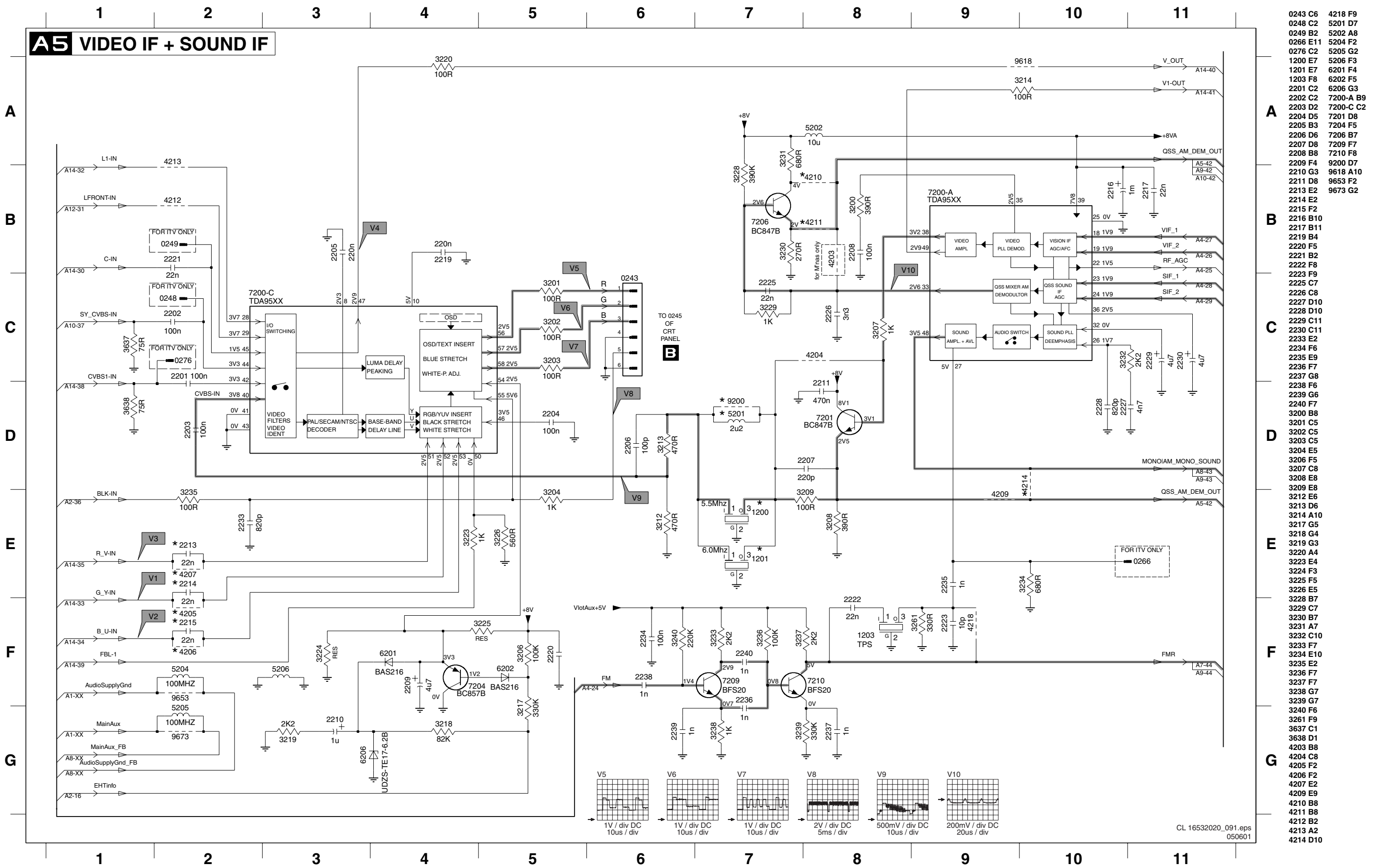
A3 FRAME DEFLECTION

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Large Signal Panel: Tuner I/F



Large Signal Panel: Video IF + Sound IF

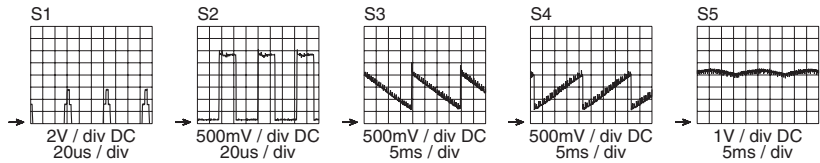


Large Signal Panel: Synchronisation

Diversity Table A5																						
Item	Description	21" Blackline S, 21" Real flat	24" Wide Screen	25" Blackline D & 25" Blackline S, West-Europe	25" Real flat, West Europe	28" Blackline D, West-Europe	29" Super Flat & 29" Real Flat West-Europe	32" Wide Screen, FM-Radio, West-Europe	21" Real flat, East-Europe	25" Blackline D & 25" Blackline S, East-Europe	25" Real flat, East Europe	28" Blackline D, Front I/O, East-Europe	28" Blackline S, East-Europe	28" Wide Screen, East-Europe	29" Real Flat, East-Europe	32" Wide Screen, East-Europe	25" ARISTONA, SBR, RADIOLA	28" Wide Screen, West-Europe	28" Blackline D, Side AV East-Europe	32" Wide Screen, No-FM Radio, West-Europe	28" Blackline D, East-Europe	28" Blackline D, Front I/O, West-Europe
1200	FIL 5M5/5M74 TPWA04	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
1201	FIL 5M5/5M7/6M5 TPT0								X	X	X	X	X	X	X	X	X	X	X	X	X	
2201	100N 25V	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2202	100N 25V	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2212	470N 16V								X	X	X	X	X	X	X	X	X	X	X	X	X	
2213	22N 50V	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2214	22N 50V	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2215	22N 50V	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2220	470N 50V	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2221	22N 50V	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2230	4U7 50V	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2234	100N 25V	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
2238	1N 50V	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
2239	1N 50V	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
2240	1N 50V	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
3208	150R 5%								X	X	X	X	X	X	X	X						
3208	390R 5%	X	X	X	X	X	X	X									X	X	X	X	X	
3214	100R 5% 1/6W	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
3220	100R 5% 1/6W	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
3223	100R 5%	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
3229	820R 5%	X	X	X	X	X	X	X									X	X	X	X	X	
3230	270R 5%	X	X	X	X	X	X	X									X	X	X	X	X	
3231	560R 5%	X	X	X	X	X	X	X									X	X	X	X	X	
3233	820R 5%	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
3236	150K 5%	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
3237	1K2 5%	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
3238	560R 5%	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
3239	270R 5%	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
3240	100K 5%	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
4205	Jumper																					
4206	Jumper																					
4207	Jumper																					
4209	Jumper																					
4210	Jumper	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
4211	Jumper																X	X	X	X		
4212	Jumper																					
4213	Jumper																					
4214	Jumper																					
5201	2U2 5%								X	X	X	X	X	X	X	X						
5201	4U7 5%	X	X	X	X	X	X	X									X	X	X	X	X	
7200	TDA9555H/N1/3																					
7200	TDA9563H/N1/5								X	X	X	X	X	X	X	X						
7200	TDA9565H/N1/5	X	X	X	X	X	X	X									X	X	X	X	X	
7206	BC847C	X	X	X	X	X	X	X									X	X	X	X	X	
7209	BFS20	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
7210	BFS20	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						
9200	Wire																					
9618	Wire	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

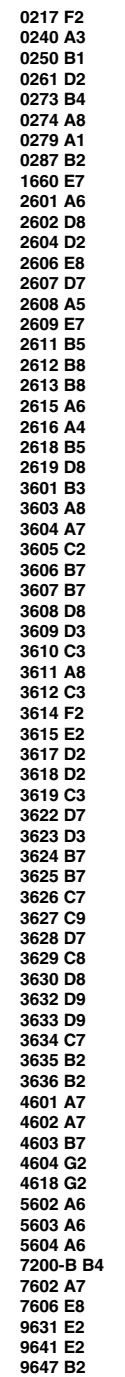
A6 SYNCHRONISATION

Diversity Table A6		24" Wide screen	25" Blackline S	28" Wide screen	25" Blackline D	21" Blackline	25" Real flat	28" Blackline	29"	21" Real flat	32" Wide screen
3247	680K 5%	X	X	X	X	X	X	X	X	X	X
3247	270K 5%	X	X	X	X	X	X	X	X	X	X
3247	560K 5%	X	X	X	X	X	X	X	X	X	X
3250	1K 5% 1/6W	X	X	X	X	X	X	X	X	X	X
3250	8K2 5% 1/6W			X	X	X	X	X	X	X	X
3254	1M 5%			X	X	X	X	X	X	X	X



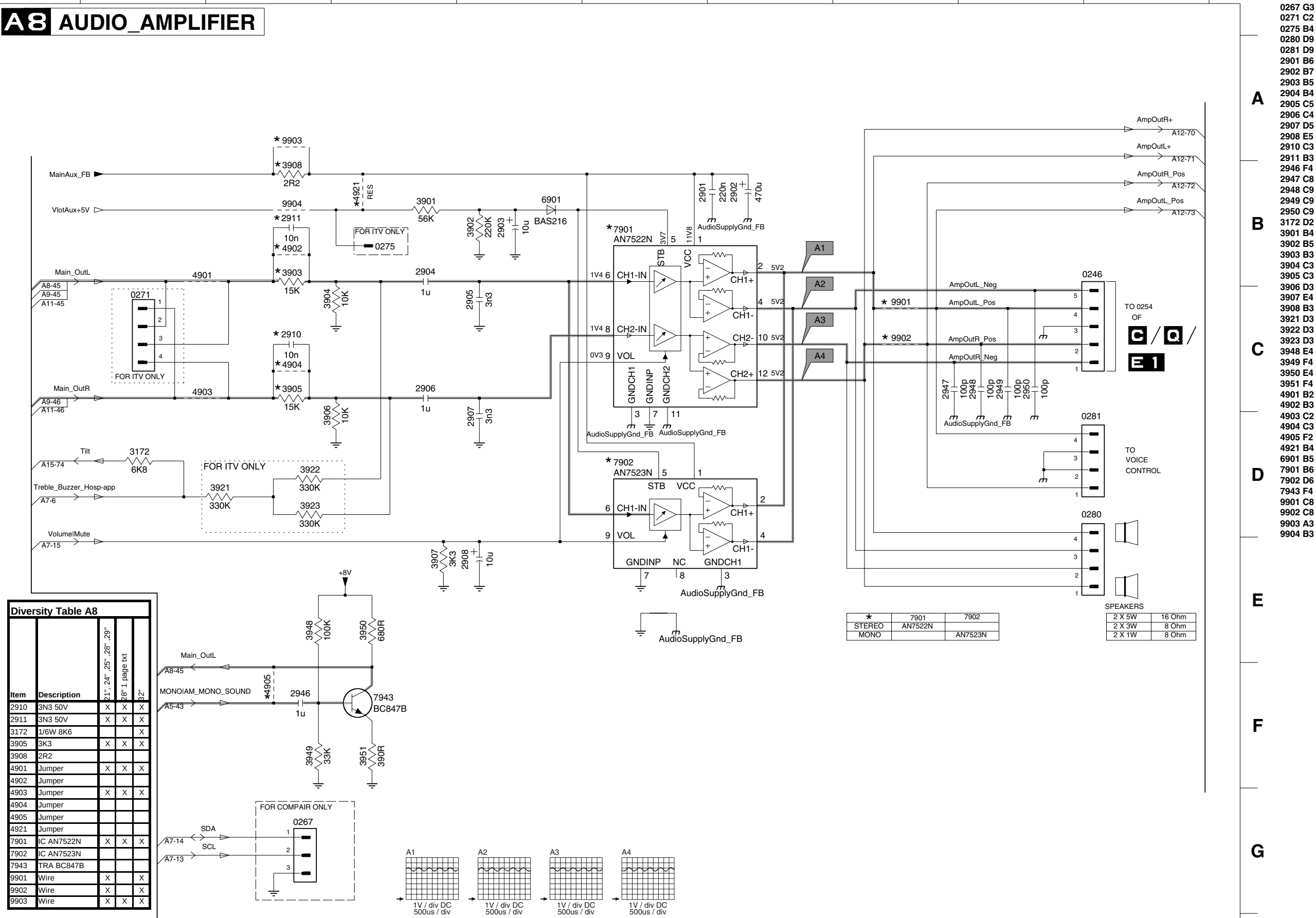
- 2241 E3
- 2242 E2
- 2243 B3
- 2244 E4
- 2245 E4
- 2246 D6
- 2247 B5
- 2248 B5
- 2249 C3
- 2250 C2
- 2252 C6
- 2253 D6
- 2254 B2
- 3241 D3
- 3242 C2
- 3244 C6
- 3245 E4
- 3246 E4
- 3247 E5
- 3248 D5
- 3249 C6
- 3250 D6
- 3251 C5
- 3254 B4
- 3256 B6
- 3257 B3
- 3258 B2
- 3259 B2
- 5241 A6
- 5242 C6
- 7200-D C3

A7 CONTROL

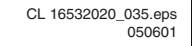
[illegible]

Large Signal Panel: Audio Amplifier + Mono Sound Processing

A8 AUDIO_AMPLIFIER

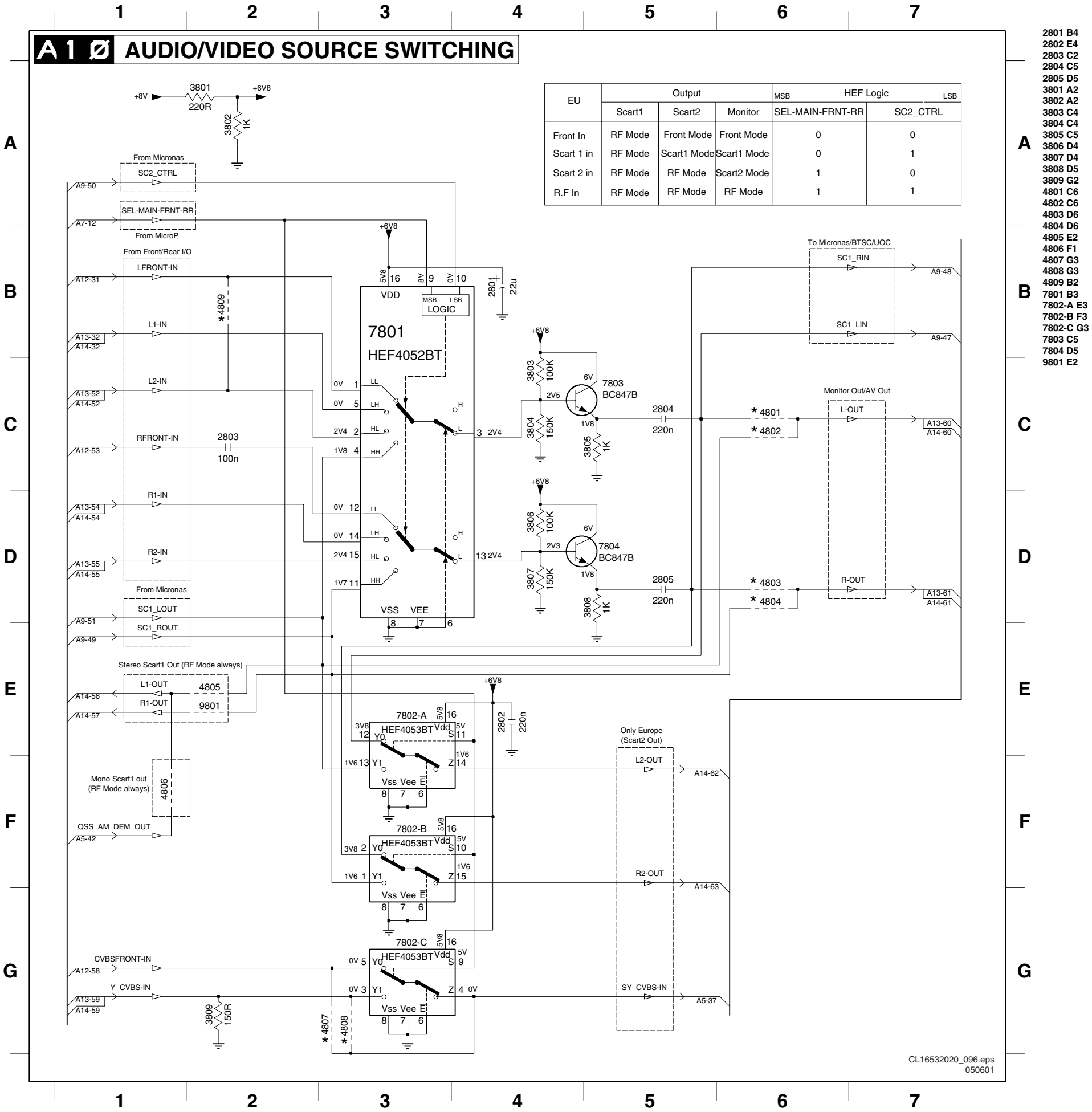


A9 NICAM + 2CS + BTSC (STEREO/SAP) DECODER



Large Signal Panel: Audio / Video Source Switching

Diversity Table A10											
Item	Description	21"	25"	28" Blackline	29" Super flat	28" Wide screen, FM radio	29" Real flat	32" Wide screen, FM radio	24" Wide screen	28" Wide screen, No FM radio	32" Wide screen, No FM radio
2801	22U 50V	X	X	X	X						
2806	10V 2U2										
2861	25V 220N										
2862	10V 2U2										
2864	50V 2U2										
2865	50V 2U2										
2866	10V 2U2										
2867	50V 3N3										
2868	50V 150P										
2869	50V 47N										
2870	50V 47N										
2871	50V 150P										
2872	50V 3N3										
2873	10V 2U2										
2874	25V 100U										
2875	25V 100U										
2876	50V 4U7										
2877	50V 10U										
2878	50V 1U										
2879	50V 4N7										
2880	50V 22N										
2883	16V 470U										
2884	50V 2U2										
2885	50V 220N										
2886	25V 220N										
2892	Jumper										
2893	Jumper										
4801	Jumper				X	X	X	X	X	X	X
4802	Jumper										
4803	Jumper				X	X	X	X	X	X	X
4804	Jumper										
4807	Jumper										
4808	Jumper										
4809	Jumper										

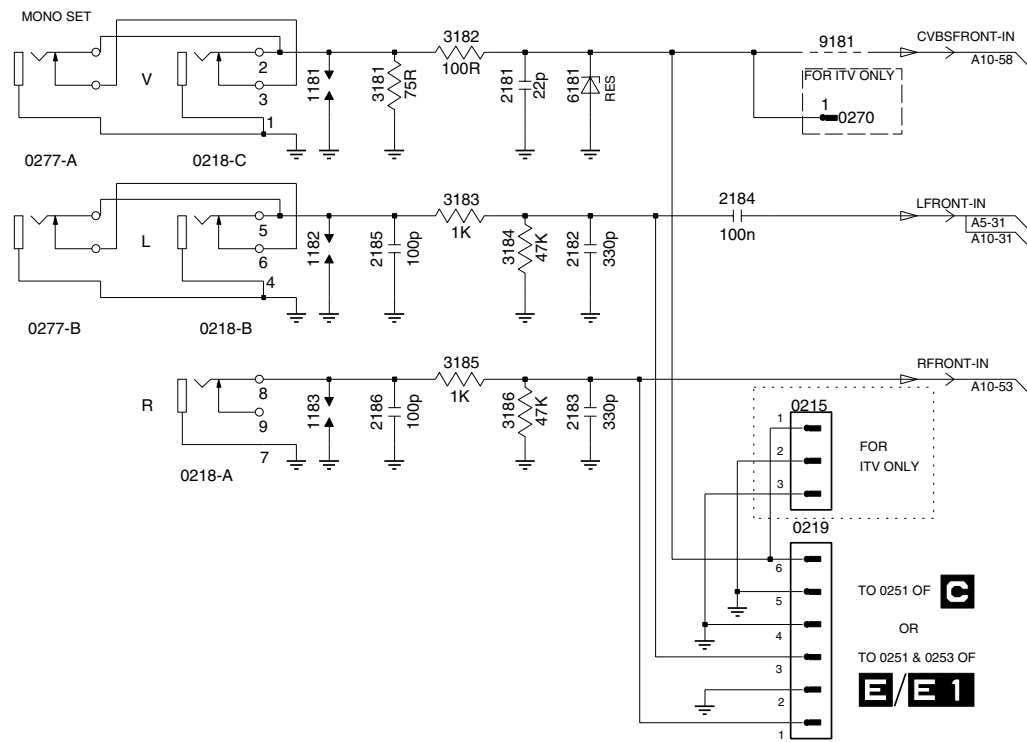


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050601

A12 FRONT IO + FRONT CONTROL + HEADPHONE

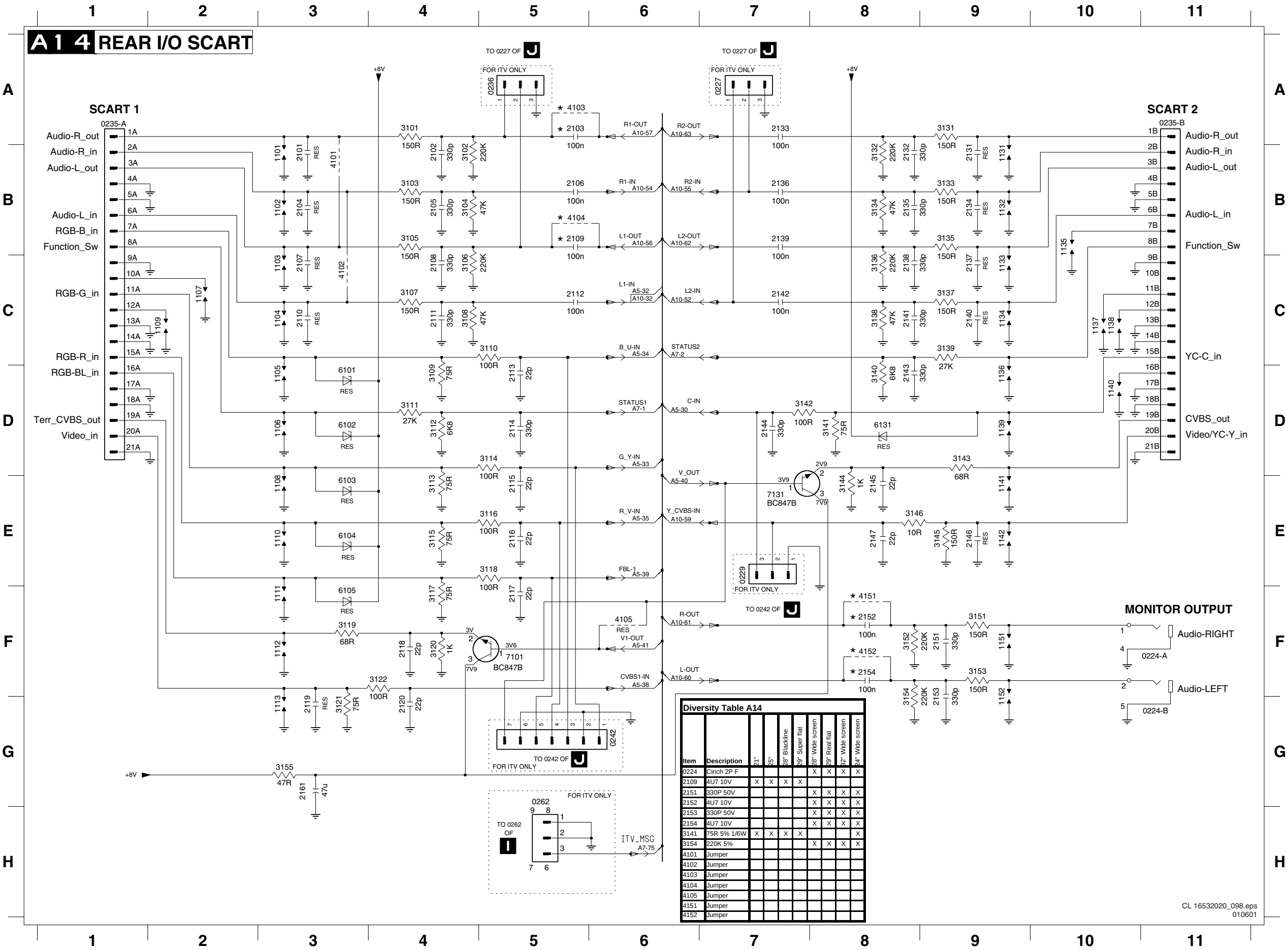
FRONT CINCH



4694

0214 F9
0215 C4
0218-A C2
0218-B C2
0218-C B2
0219 D4
0232 F5
0259 F10
0270 B5
0277-A B1
0277-B C1
0278 F7
0286 F7
0292 E4
1181 B2
1182 B2
1183 C2
1600 C9
1601 B8
1602 B8
1603 B7
1606 B7
2181 B3
2182 B4
2183 C4
2184 B4
2185 B3
2186 C3
2691 E10
2692 E8
2693 G8
2694 G8
2695 G8
2696 G8
2981 F2
2982 F3
2983 G2
2984 G3
3181 B3
3182 A3
3183 B3
3184 B3
3185 C3
3186 C3
3681 A8
3682 A9
3683 A7
3684 A8
3685 A7
3686 C8
3691 C9
3692 E8
3693 D10
3694 D9
3695 D7
3981 F3
3982 G3
4691 E8
4692 D7
4693 E7
4694 H1
4695 D9
6181 B4
6681 B8
6691 D8
6692 D9
9181 B5
9982 F2

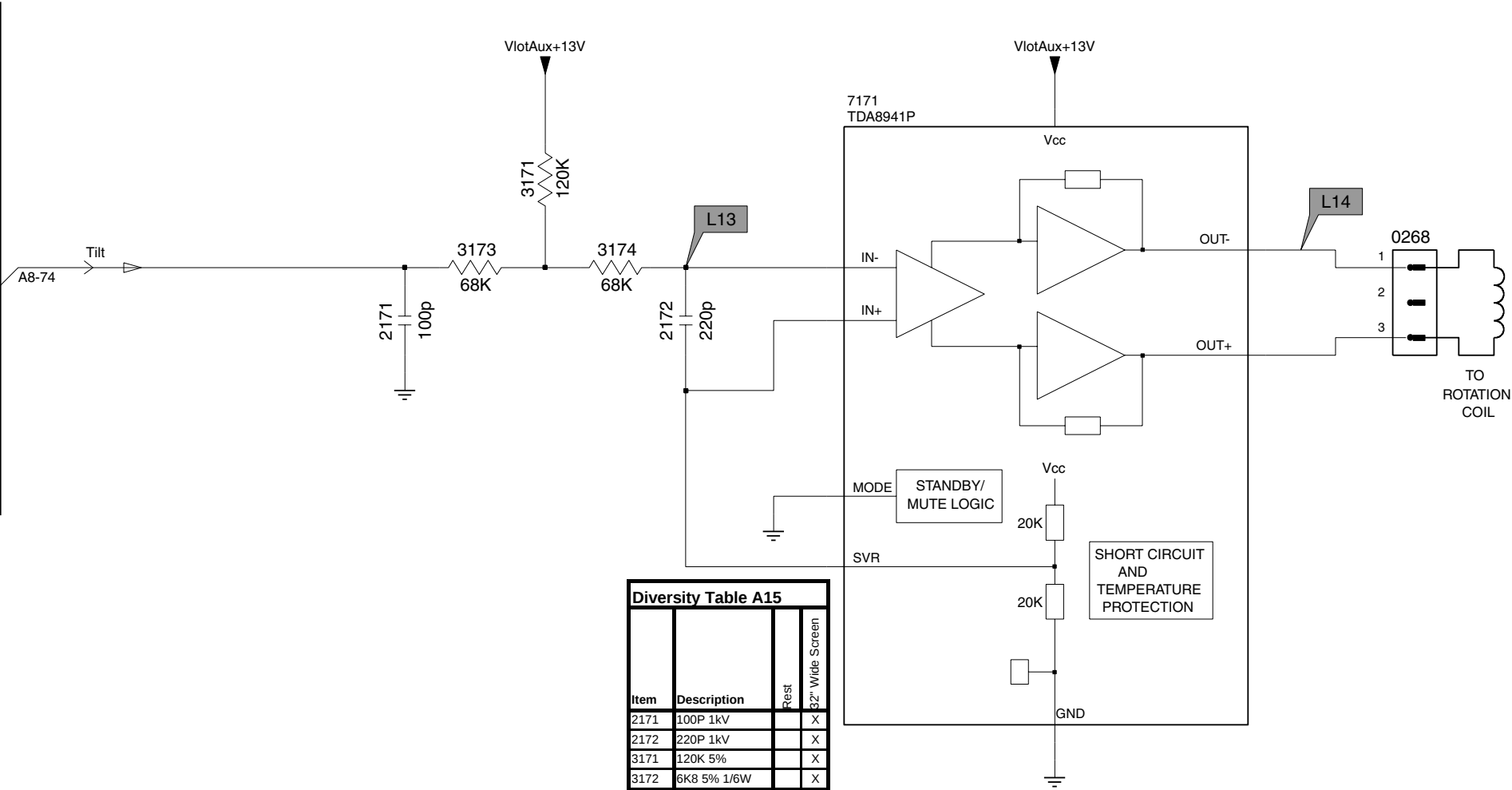
Large Signal Panel: Rear I/O SCART



- 0224-A F11
- 0224-B G11
- 0227 A7
- 0229 E7
- 0235-A A1
- 0235-B A11
- 0236 A5
- 0242 G6
- 0252 G5
- 1101 B3
- 1102 B3
- 1103 C3
- 1104 C3
- 1105 D3
- 1106 D3
- 1107 C2
- 1108 E3
- 1109 C2
- 1110 E3
- 1111 F3
- 1112 F3
- 1113 G3
- 1131 B9
- 1132 B9
- 1133 C9
- 1134 C9
- 1135 B10
- 1136 D9
- 1137 C10
- 1138 C10
- 1139 D9
- 1140 D10
- 1141 E9
- 1142 E9
- 1151 F9
- 1152 F9
- 2101 B3
- 2102 B4
- 2103 A5
- 2104 B3
- 2105 B4
- 2106 B5
- 2107 C3
- 2108 C4
- 2109 B5
- 2110 C3
- 2111 C4
- 2112 C5
- 2114 D5
- 2115 E5
- 2116 E5
- 2117 F5
- 2118 F4
- 2119 G3
- 2120 G4
- 2131 B9
- 2132 B8
- 2133 A7
- 2134 B9
- 2135 B8
- 2136 B7
- 2137 C9
- 2138 C8
- 2139 B7
- 2140 C9
- 2141 C8
- 2142 C7
- 2143 D8
- 2144 D7
- 2145 E8
- 2146 E9
- 2147 E8
- 2151 F9
- 2152 F8
- 2153 F9
- 2154 F8
- 2161 G3
- 3101 A4
- 3102 B4
- 3103 B4
- 3104 B4
- 3105 B4
- 3106 C4
- 3107 C4
- 3108 C4
- 3109 D4
- 3110 C5
- 3111 D4
- 3112 D4
- 3113 E4
- 3114 D5
- 3115 E4
- 3116 E5
- 3117 F4
- 3118 E5
- 3119 F3
- 3120 F4
- 3121 G3
- 3122 F4
- 3131 A9
- 3132 B8
- 3133 B9
- 3134 B8
- 3135 B9
- 3136 C8
- 3137 C9
- 3138 C8
- 3139 C9
- 3140 D8
- 3141 D8
- 3142 D7
- 3143 D9
- 3144 E8
- 3145 E9
- 3155 G3
- 4102 B3
- 4103 B3
- 4104 B5
- 4105 F6
- 4151 F8
- 4152 F8
- 6101 D3
- 6102 D3
- 6103 E3
- 6104 E3
- 6105 F3
- 6131 D8
- 7101 F5
- 7131 E7

Large Signal Panel: Tilt and Rotation Panel

A15 TILT & ROTATION



Diversity Table A15			
Item	Description	Rest	32" Wide Screen
2171	100P 1kV		X
2172	220P 1kV		X
3171	120K 5%		X
3172	6K8 5% 1/6W		X
3173	68K 5% 1/6W		X
3174	68K 5% 1/6W		X
7171	BC857B		

0268 B8
2171 B4
2172 B5
3171 B4
3173 B4
3174 B5
7171 B6

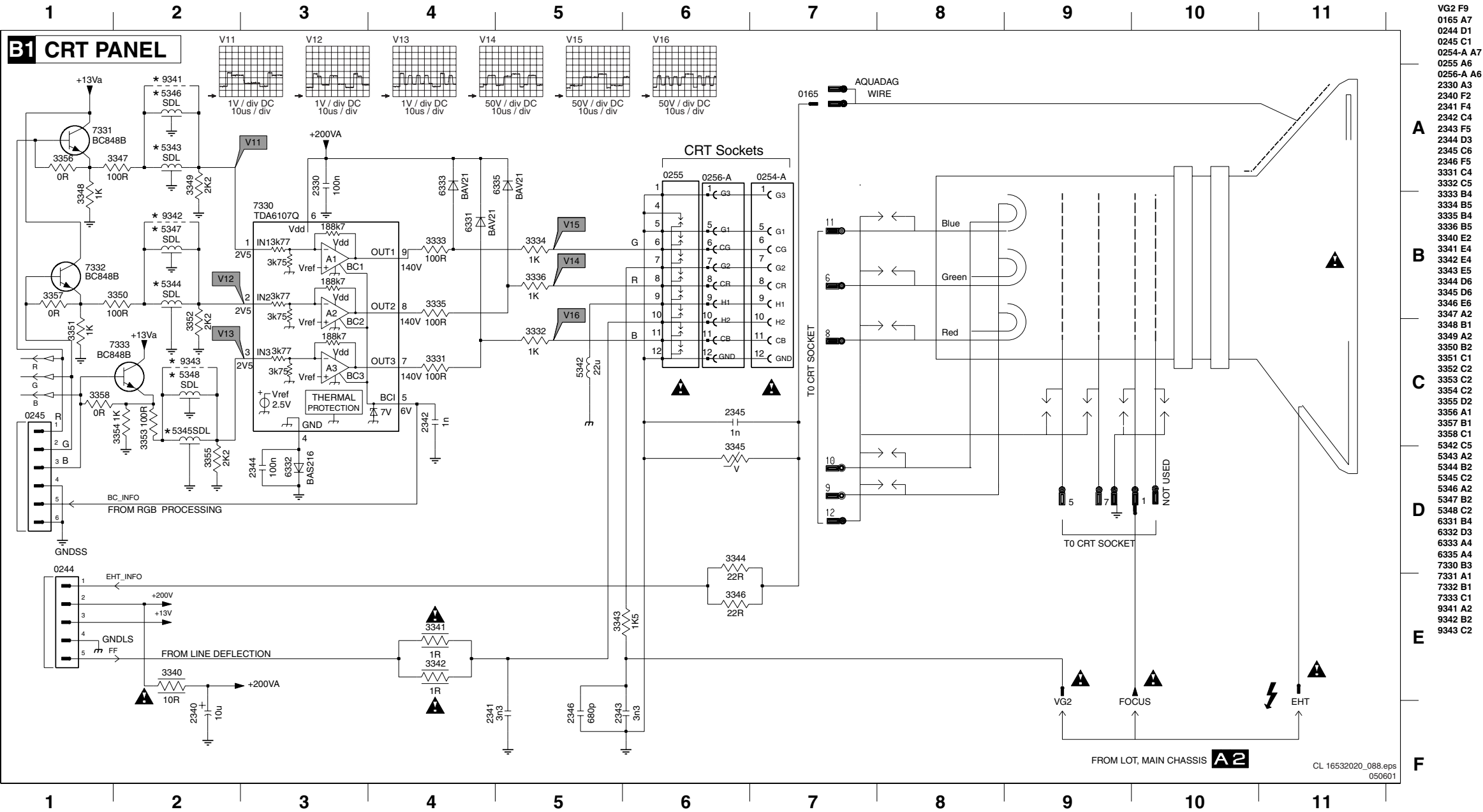
A

B

C

D

CRT Panel

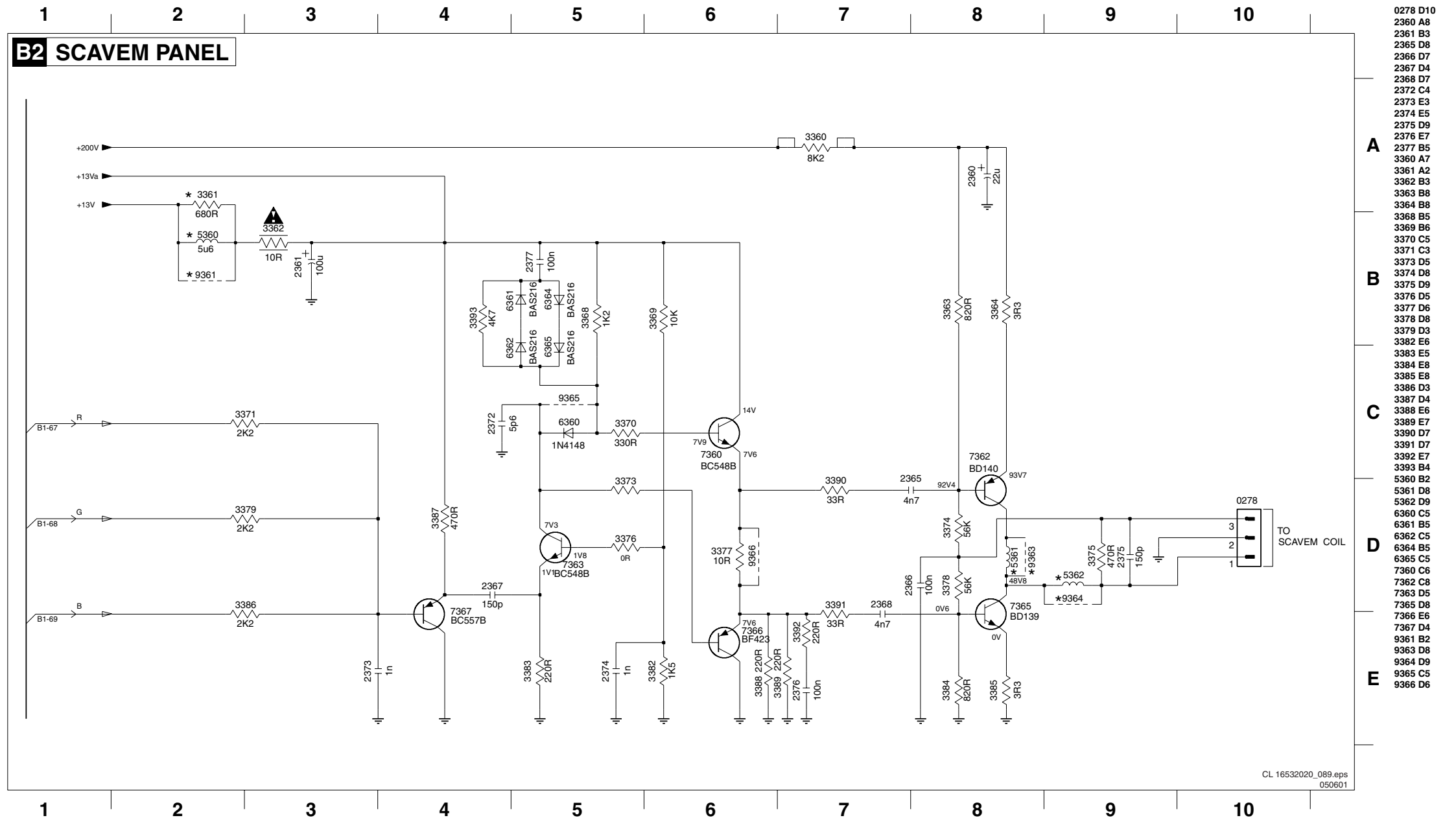


Diversity Table B1													
Item	Description	29" Super flat	21" Real flat	28" Blackline S	25" Real flat	21", 25" Blackline S	28" Wide screen, No FM radio	28" Wide screen, FM radio	28" Blackline D, FM radio	25" Blackline D	28" Blackline D, No FM radio	24" Real flat	32" Wide screen, No FM radio
0254	CON 9P F N-NECK	X	X	X	X	X	X	X	X	X	X	X	X
0254	CON 9P F SEMI-DAF												
2343	3N3 2kV	X	X	X	X	X	X	X					
2344	100N 25V	X	X	X	X	X	X	X	X	X	X	X	X
2344	Jumper												
2345	500V 1N												
2346	1N2 2kV								X	X	X		X
2346	220P 2kV											X	
2346	470P 2kV												
3341	Fuse 1R	X	X	X	X	X			X	X	X	X	X
3341	Fuse 1R5						X	X					
3341	Fuse 1R8												
3342	Fuse 1R	X	X	X	X	X			X	X	X	X	X
3342	Fuse 1R5						X	X					
3342	Fuse 1R8												
3347	1K							X					X
3347	Jumper	X	X	X	X	X	X	X	X	X	X	X	X
3348	1K								X				X

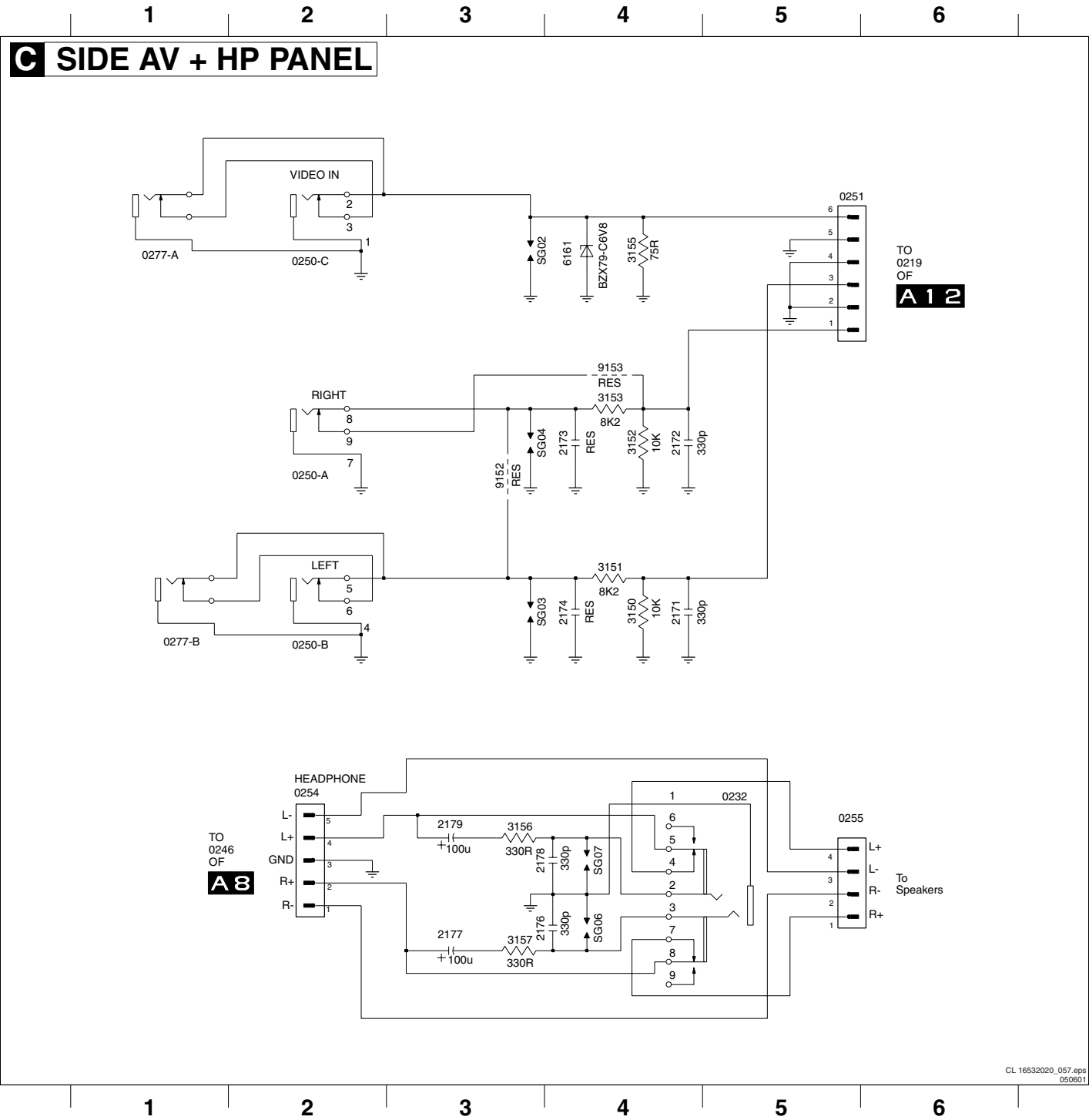
Diversity Table B1													
Item	Description	29" Super flat	21" Real flat	28" Blackline S	25" Real flat	21", 25" Blackline S	28" Wide screen, No FM radio	28" Wide screen, FM radio	28" Blackline D, FM radio	25" Blackline D	28" Blackline D, No FM radio	24" Real flat	32" Wide screen, No FM radio
3350	1K												
3350	Jumper	X	X	X	X	X	X	X	X	X	X	X	X
3351	1K							X					X
3353	1K							X					X
3353	Jumper	X	X	X	X	X	X	X	X	X	X	X	X
3354	1K							X					X
3356	Jumper	X	X	X	X	X	X	X	X	X	X	X	X
3357	Jumper	X	X	X	X	X	X	X	X	X	X	X	X
3358	Jumper	X	X	X	X	X	X	X	X	X	X	X	X
4311	Jumper	X	X	X	X			X	X	X	X	X	X
5342	15U								X	X	X		
5342	18U	X										X	X
5342	22U		X	X		X	X	X					
5342	3U9				X								X
5343	Delay line 160ns							X					X
5344	Delay line 160ns							X					X
5345	Delay line 160ns							X					X
5346	SDL												X

Diversity Table B1													
Item	Description	29" Super flat	21" Real flat	28" Blackline S	25" Real flat	21", 25" Blackline S	28" Wide screen, No FM radio	28" Wide screen, FM radio	28" Blackline D, FM radio	25" Blackline D	28" Blackline D, No FM radio	24" Real flat	32" Wide screen, FM radio
5347	SDL												
5348	SDL												
6332	BAS316	X	X	X	X	X	X			X	X	X	X
7330	TDA6107Q/N2	X	X	X	X	X	X			X	X	X	X
7330	TDA6108JF/N1						X						X
7331	BC847B						X						X
7332	BC847B						X						X
7333	BC847B						X						X
9312	Wire						X						X
9341	Wire	X	X	X	X	X	X			X	X	X	X
9342	Wire	X	X	X	X	X	X			X	X	X	X
9343	Wire	X	X	X	X	X	X			X	X	X	X

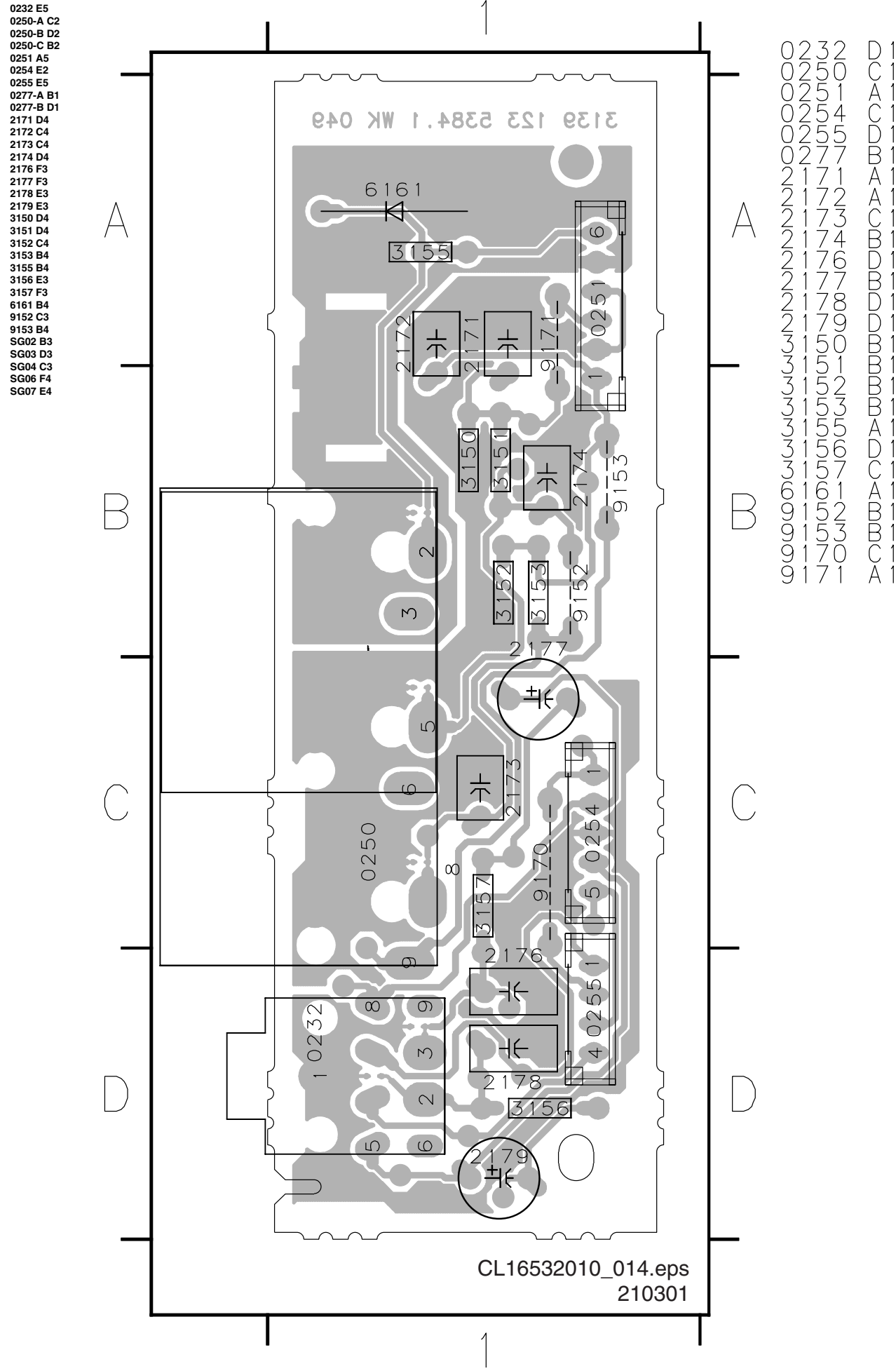
Diversity Table B2													
Item	Description	21" Real flat	25" Super flat	28" Blackline, FM radio	32" Wide screen, No FM radio	29" Real flat	28" Wide screen, FM radio	32" Wide screen, FM radio	21" Blackline	24" Wide screen	25" Blackline	28" Blackline, No FM radio	28" Wide screen, No FM radio
2365	22N 250V	X	X	X									
2366	100N 100V	X	X	X	X	X	X	X					
2367	47P 50V	X	X	X									
2367	56P 50V				X	X							
2367	150P 50V						X						
2367	180P 50V							X	X				
2368	22N 50v	X	X	X	X	X	X	X					
2372	5P6 50V	X	X	X	X	X							
2373	56P 50V							X	X				
2375	100P 50V	X	X	X	X	X							
2375	330P 50V						X	X					
2376	100N 25V						X	X	X				
2377	100N 25V						X	X	X				
3360	8K2 5W	X	X	X	X	X	X	X	X				
3361	680R												
3362	Fuse 10R	X	X	X	X	X	X	X	X				
3363	820R	X	X	X	X	X	X	X	X				
3364	1R8							X	X	X			
3364	3R3	X	X	X	X	X							
3368	2K7	X	X	X	X	X	X	X	X				
3369	10K	X	X	X	X	X	X	X	X				
3370	220R						X	X	X				
3370	330R	X	X	X	X	X							
3371	10K	X	X	X	X	X							
3371	4K7						X	X	X				
3373	220R						X	X	X				
3374	56K	X	X	X	X	X	X	X	X				
3375	150R						X	X	X				
3375	220R					X							
3375	470R	X	X	X	X	X	X	X	X				
3376	Jumper	X	X	X	X	X	X	X	X				
3377	10R					X							
3377	4R7						X	X					
3378	56K	X	X	X	X	X	X	X	X				
3379	10K	X	X	X	X	X							
3379	4K7						X	X	X				
3382	1K5	X	X	X	X	X	X	X	X				
3383	470R	X	X	X	X	X	X	X	X				
3384	820R	X	X	X	X	X	X	X	X				
3385	1R8						X	X	X				
3385	3R3	X	X	X	X	X							
3386	10K	X	X	X	X	X							
3386	4K7						X	X	X				
3387	470R	X	X	X	X	X	X	X	X				
3388	220R	X	X	X	X	X							
3389	220R	X	X	X	X	X							
3390	10R						X	X					
3390	33R	X	X	X	X	X	X						
3391	10R						X	X					
3391	33R	X	X	X	X	X	X						
3392	220R						X	X	X				
3393	4K7						X	X	X				
5360	5.												



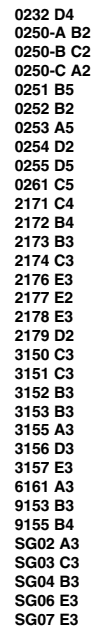
Side AV + HP Panel



Layout Side AV + HP Panel (Top View)



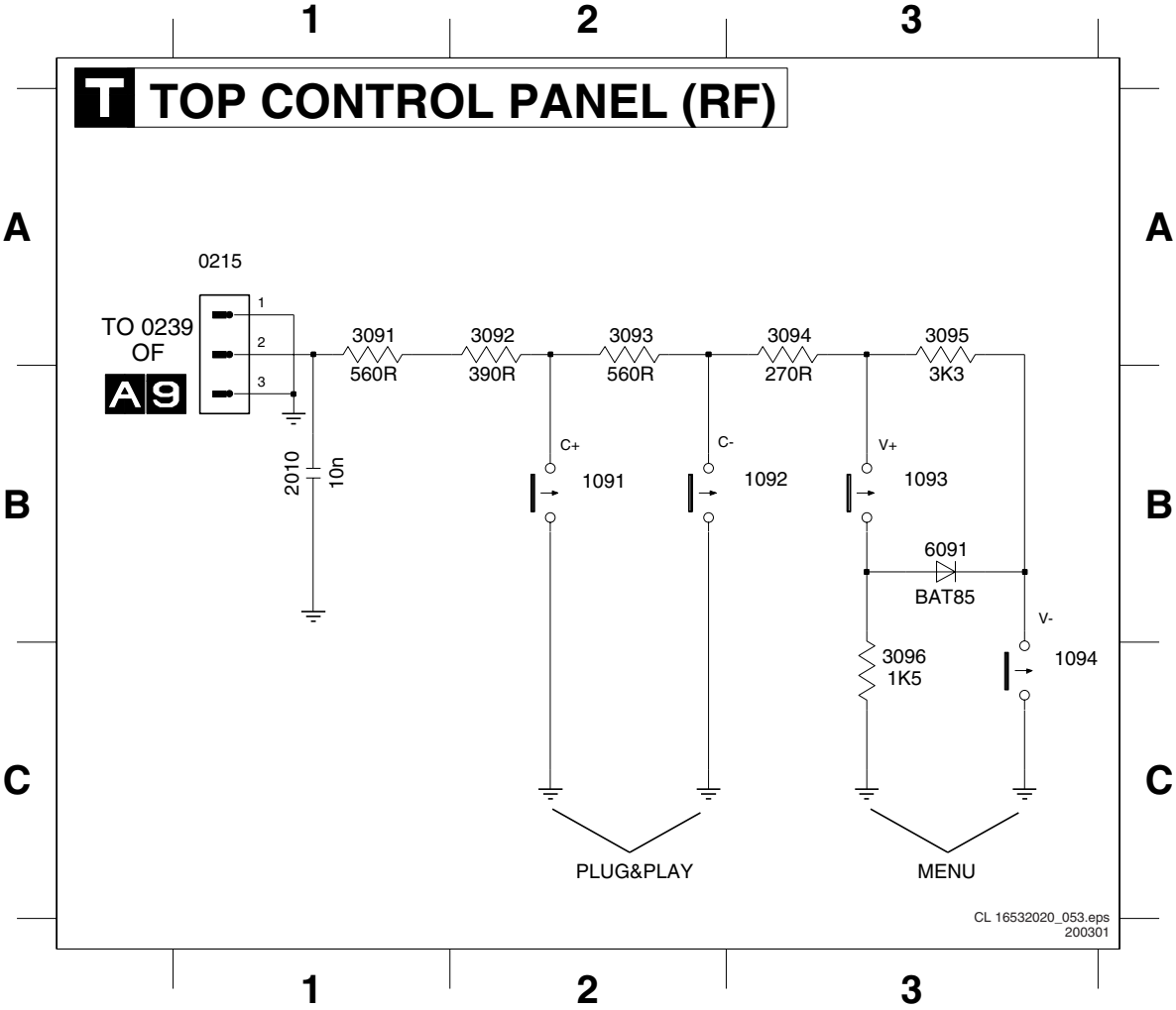
E 1 SIDE AV PANEL & HEADPHONE



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210301

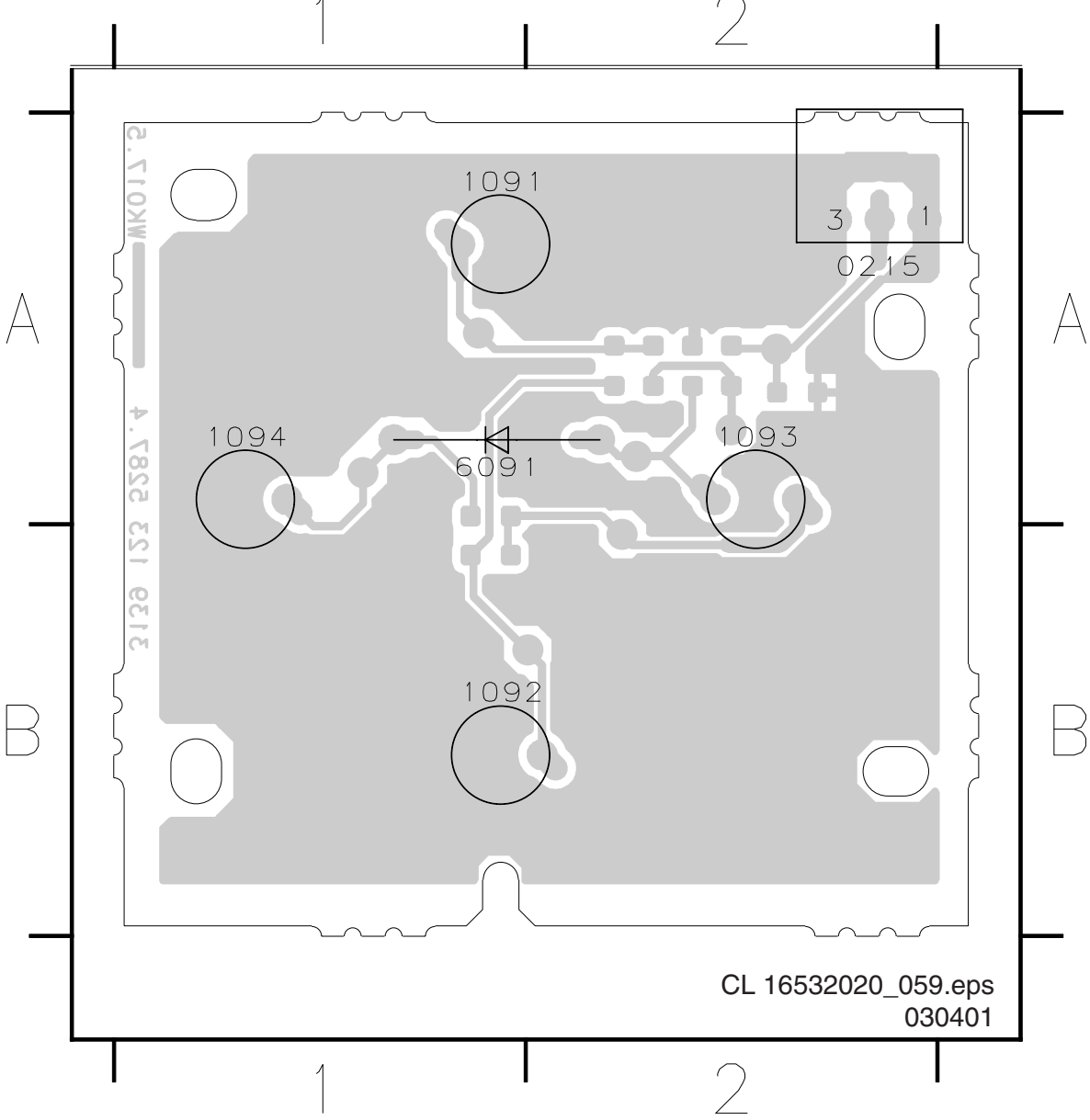
0	0	0	0	0	2	2	2	2	2	2	3	3	3	3	3	3	5	6	9	9	9	9
2	2	2	2	2	5	5	5	5	5	6	1	1	1	1	1	1	1	1	1	1	1	1
5	5	5	5	5	0	1	1	1	1	1	5	5	5	5	5	5	0	6	1	1	1	1
0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
M	C	C	A	A	A	A	B	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B
1	2	2	3	3	1	2	2	3	2	2	1	2	3	3	3	1	3	1	2	3	3	3
6	2	3	2	1	2	1	2	2	3	2	0	1	2	3	3	5	1	1	2	3	3	3

Top Control Panel (RF)



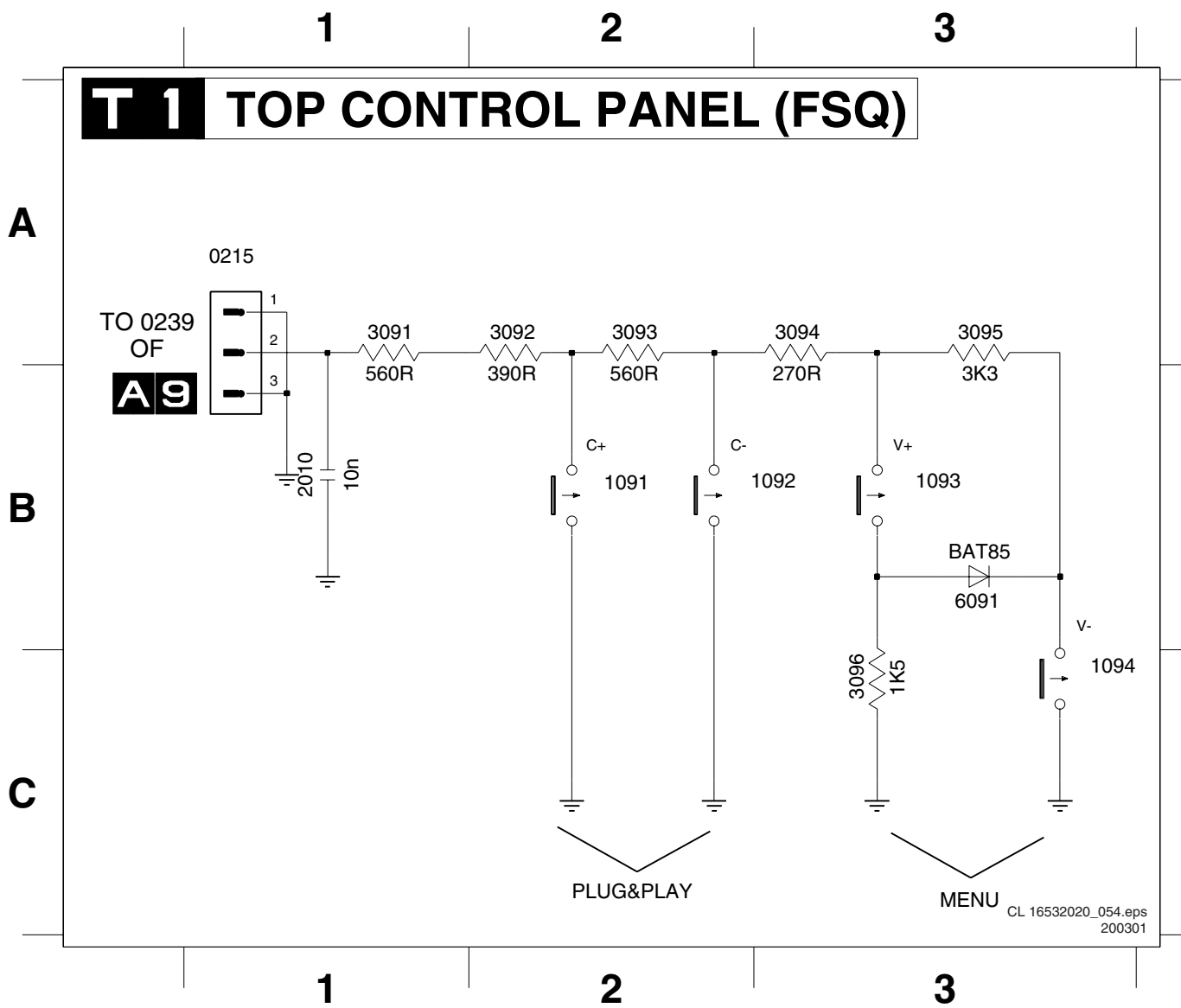
0215 A1
1091 B2
1092 B3
1093 B3
1094 C3
2010 B1
3091 A1
3092 A2
3093 A2
3094 A3
3095 A3
3096 C3
6091 B3

Layout Top Control Panel (RF)

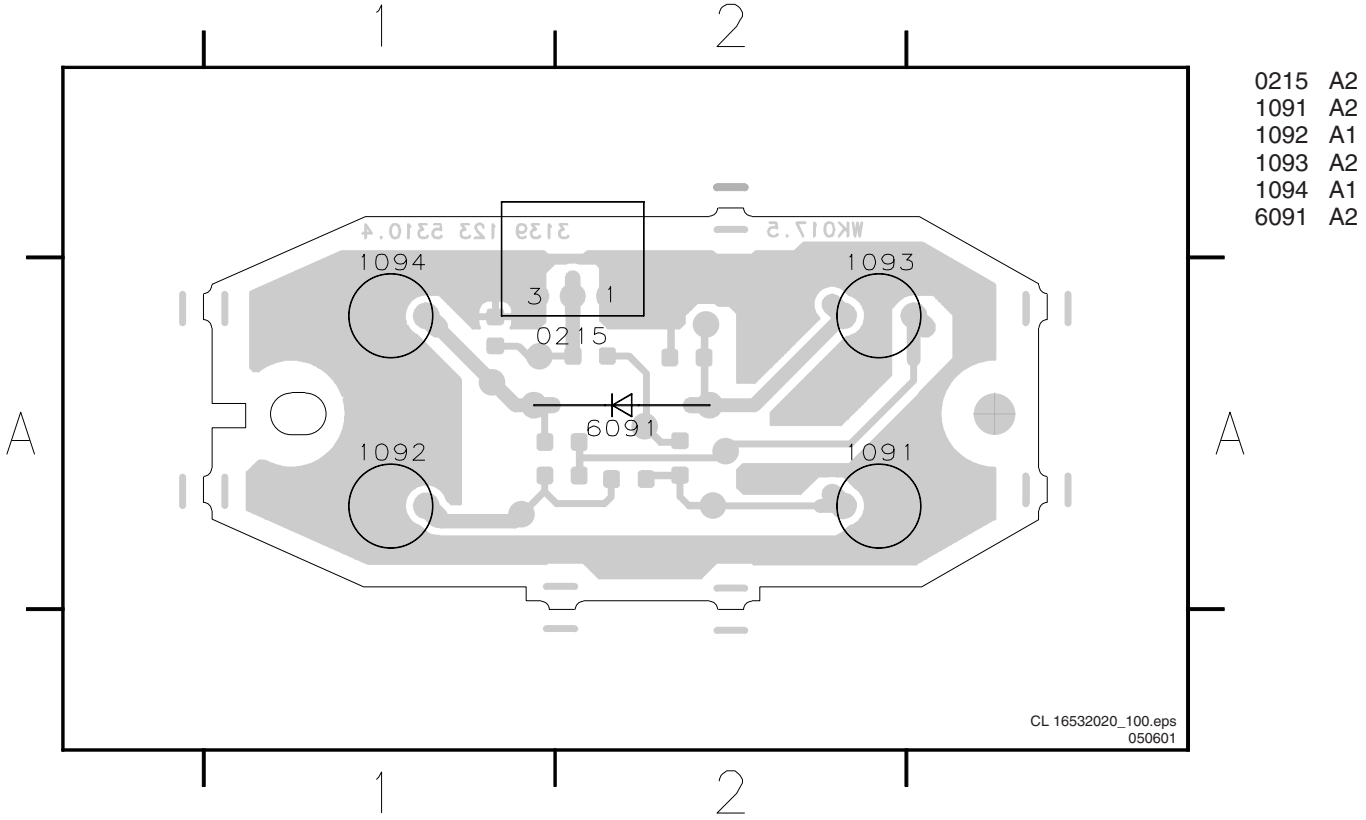


1091 A1
1092 B1
1093 A2
1094 A1
6091 A1

Top Control Panel (FSQ)



Layout Top Control Panel (FSQ)



8. Alignments

Index of this chapter:

1. General Alignment Conditions
2. Hardware Alignments
3. Software Alignments and Settings

Note: The Service Default Mode (SDM) and Service Alignment Mode (SAM) are described in chapter 5. Menu navigation is done with the 'CURSOR UP, DOWN, LEFT or RIGHT' keys of the remote control transmitter.

8.1 General Alignment Conditions

Perform all electrical adjustments under the following conditions:

- Mains voltage and frequency: according to country's standard.
- Connect the set to the Mains via an isolation transformer.
- Allow the set to warm up for approximately 20 minutes.
- Measure the voltages and waveforms in relation to chassis ground (with the exception of the voltages on the primary side of the power supply). Never use the cooling fins/plates as ground.
- Test probe: $R_i > 10 \text{ M}\Omega$; $C_i < 2.5 \text{ pF}$.
- Use an **isolated** trimmer/screwdriver to perform the alignments.

8.2 Hardware Alignments

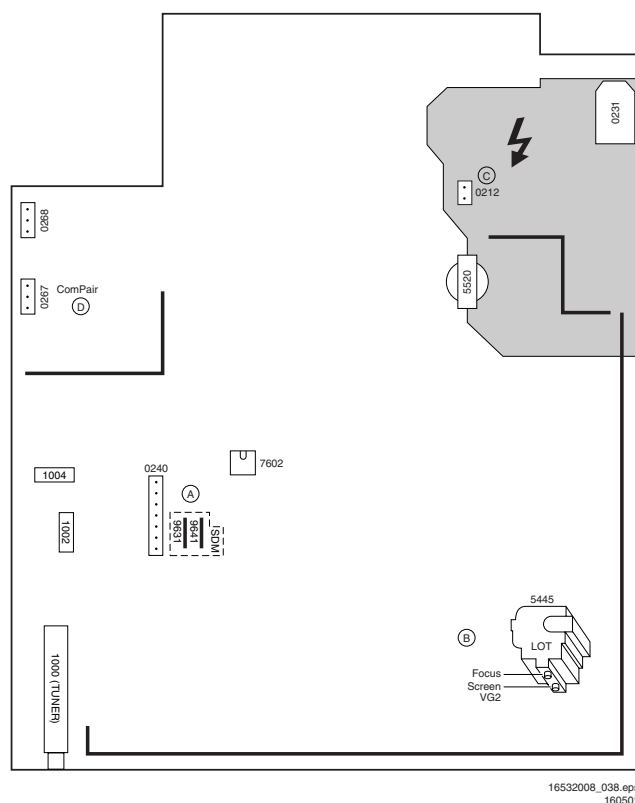


Figure 8-1

8.2.1 Vg2 Adjustment

1. Activate the SAM.
2. Go to the WHITE TONE sub menu.
3. Set the values of NORMAL RED, GREEN and BLUE to 40.
4. Go, via the MENU key, to the normal user menu and set – CONTRAST to zero.

- BRIGHTNESS to minimum (OSD just visible in a dark room).
5. Return to the SAM via the MENU key.
 6. Connect the RF output of a pattern generator to the antenna input. Test pattern is a 'black' picture (blank screen on CRT **without** any OSD info).
 7. Set the channel of the oscilloscope to 50 V/div and the time base to 0.2 ms (external triggering on the vertical pulse).
 8. Ground the scope at the CRT panel and connect a 10:1 probe to one of the cathodes of the picture tube socket (see diagram B).
 9. Measure the cut off pulse during first full line after the frame blanking (see Fig. 8-2). You will see two pulses, one being the cut off pulse and the other being the white drive pulse. Choose the one with the lowest value, this is the cut off pulse.
 10. Select the cathode with the highest V_{DC} value for the alignment. Adjust the V_{cutoff} of this gun with the SCREEN potentiometer (see Fig. 8-1) on the LOT to the correct value (see table below).
 11. Restore BRIGHTNESS and CONTRAST to normal (= 31).

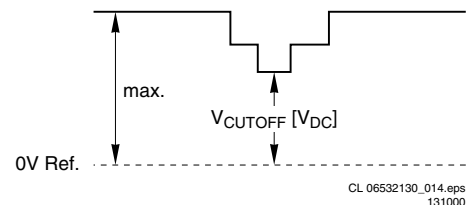


Figure 8-2

CUT-OFF VOLTAGE (L01 LARGE)	
Screen size	Cut-off [V]
21"	125 ± 4
24", 25", 27", 28", 29", 32", 35"	145 ± 10

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220501

Figure 8-3

8.2.2 Focusing

1. Tune the set to a circle or crosshatch test pattern (use an external video pattern generator).
2. Choose picture mode NATURAL (or MOVIES) with the 'SMART PICTURE' button on the remote control transmitter.
3. Adjust the FOCUS potentiometer (see Fig. 8-1) until the vertical lines at 2/3 from east and west, at the height of the centreline, are of minimum width without visible haze.

8.3 Software Alignments and Settings

Enter the Service Alignment Mode (see chapter 5). The SAM menu will now appear on the screen.

Select one of the following alignments:

1. Options
2. Tuner
3. White Tone
4. Geometry
5. Audio

8.3.1 Options

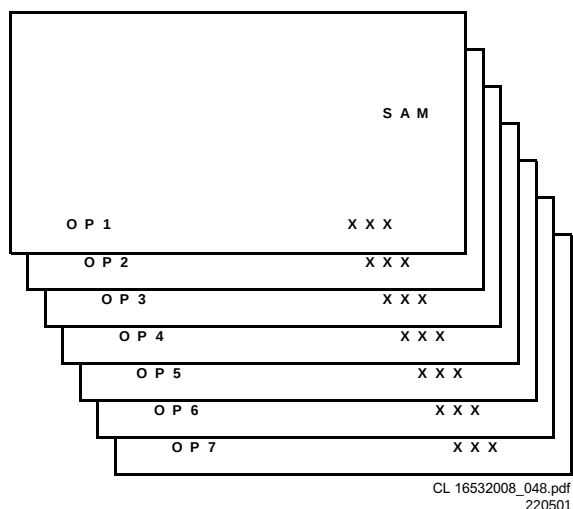


Figure 8-4

Options are used to control the presence/absence of certain features and hardware.

How to change an Option Byte

An Option Byte represents a number of different options. Changing these bytes directly makes it possible to set all options very fast. All options are controlled via seven option bytes. Select the option byte (OB1.. OB7) with the MENU UP/DOWN keys, and enter the new value.

Leaving the OPTION submenu saves changes in the Option Byte settings. Some changes will only take effect after the set has been switched OFF and ON with the Mains switch (cold start).

How to calculate the value of an Option Byte

Calculate an Option Byte value (OB1 .. OB7) in the following way:

1. Check the status of the single option bits (OP): are they enabled (1) or disabled (0).
2. When an option bit is enabled (1) it represents a certain value (see first column 'value between brackets' in first table below). When an option bit is disabled, its value is 0.
3. The total value of an Option Byte is formed by the sum of its eight option bits. See second table below for the correct option numbers per typenumber.

Bit (value)	OB1	OB2	OB3	OB4	OB5	OB6	OB7
0 (1)	OP10	OP20	OP30	OP40	OP50	OP60	OP70
1 (2)	OP11	OP21	OP31	OP41	OP51	OP61	OP71
2 (4)	OP12	OP22	OP32	OP42	OP52	OP62	OP72
3 (8)	OP13	OP23	OP33	OP43	OP53	OP63	OP73
4 (16)	OP14	OP24	OP34	OP44	OP54	OP64	OP74
5 (32)	OP15	OP25	OP35	OP45	OP55	OP65	OP75
6 (64)	OP16	OP26	OP36	OP46	OP56	OP66	OP76
7 (128)	OP17	OP27	OP37	OP47	OP57	OP67	OP77
Total:	Sum	Sum	Sum	Sum	Sum	Sum	Sum

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Figure 8-5

Typenumber	OB1	OB2	OB3	OB4	OB5	OB6	OB7
21PT5306/01	220	246	193	184	244	54	67
21PT5506/01	220	246	225	184	244	54	67
21PT5506/05	220	246	225	184	244	54	67
21PT5506/58	220	246	225	184	244	54	65
24PW6006/01	220	246	159	184	244	54	67
24PW6006/05	220	246	159	184	244	54	67
25PT4457/01	220	246	225	56	244	2	67
25PT4457/05	220	246	225	56	244	2	67
25PT4457/58	220	246	225	56	244	2	65
25PT5107/01	220	246	225	184	244	54	67
25PT5107/05	220	246	225	56	244	2	67
25PT5107/58	220	246	225	184	244	54	65
25PT5506/01	28	174	129	152	128	32	67
25PT5506/58	28	174	129	152	128	32	65
28PT4406/58	4	196	224	40	228	0	65
28PT4406/01	4	196	224	40	228	0	67
28PT4457/01	220	246	225	56	244	2	67
28PT4457/05	220	246	225	56	244	2	67
28PT4457/58	220	246	225	56	244	2	65
28PT5107/01	220	246	225	184	244	54	67
28PT5107/05	220	246	225	184	244	2	67
28PT5107/58	220	246	225	184	244	54	65
28PW5407/01	28	214	158	40	244	2	67
28PW6006/05	220	246	159	184	244	54	67
28PW6006/01	220	246	159	184	244	54	67
28PW6006/58	220	246	158	40	244	54	65
29PT5306/01	220	246	225	184	244	54	67
29PT5306/58	220	246	225	184	244	54	65
29PT5506/01	220	246	225	184	244	54	67
29PT5506/58	220	246	225	184	244	54	65
32PW5407/01	28	222	158	40	244	2	67
32PW6006/01	220	254	159	184	244	54	67
32PW6006/05	220	254	159	184	244	54	67
32PW6006/21	220	254	159	184	244	54	67
32PW6006/25	220	254	159	184	244	54	67
32PW6006/48	28	246	158	40	244	0	67
32PW6006/58	28	246	158	40	244	0	65
63TA5216/03	28	22	224	40	244	0	67
63TA5216/11	28	22	224	40	244	0	67
63TA5216/18	28	22	224	40	244	0	67
70WA6216/03	28	22	158	40	244	0	67
70WA6216/11	28	22	158	40	244	0	67
70WA6216/18	28	22	158	40	244	0	67
82PW6216/18	28	30	158	40	244	0	67

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Figure 8-6

Option Bit Assignment

Following are the option bit assignments for all L01 software clusters.

- **Option Byte 1 (OB1)**
 - OP10: CHINA
 - OP11: VIRGIN_MODE
 - OP12: UK_PNP
 - OP13: ACI
 - OP14: ATS
 - OP15: LNA
 - OP16: FM_RADIO
 - OP17: PHILIPS_TUNER
- **Option Byte 2 (OB2)**
 - OP20: HUE
 - OP21: COLOR_TEMP
 - OP22: CONTRAST_PLUS
 - OP23: TILT

- OP24: NOISE_REDUCTION
- OP25: CHANNEL_NAMING
- OP26: SMART_PICTURE
- OP27: SMART_SOUND
- **Option Byte 3 (OB3)**
 - OP30: AVL
 - OP31: WSSB
 - OP32: WIDE_SCREEN
 - OP33: SHIFT_HEADER_SUBTITLE
 - OP34: CONTINUOUS_ZOOM
 - OP35: COMPRESS_16_9
 - OP36: EXPAND_4_3
 - OP37: EW_FUNCTION
- **Option Byte 4 (OB4)**
 - OP40: STEREO_NON_DBX
 - OP41: STEREO_DBX
 - OP42: STEREO_PB
 - OP43: STEREO_NICAM_2CS
 - OP44: DELTA_VOLUME
 - OP45: ULTRA_BASS
 - OP46: VOLUME_LIMITER
 - OP47: INCR_SUR
- **Option Byte 5 (OB5)**
 - OP50: PIP
 - OP51: HOTEL_MODE
 - OP52: SVHS
 - OP53: CVI
 - OP54: AV3
 - OP55: AV2
 - OP56: AV1
 - OP57: NTSC_PLAYBACK
- **Option Byte 6 (OB6)**
 - OP60: Reserved (value = 0)
 - OP61: SMART_TEXT
 - OP62: SMART_LOCK
 - OP63: VCHIP
 - OP64: WAKEUP_CLOCK
 - OP65: SMART_CLOCK
 - OP66: SMART_SURF
 - OP67: PERSONAL_ZAPPING
- **Option Byte 7 (OB7)**
 - OP70: SOUND_SYSTEM_AP_3/
MULTI_STANDAR_EUR/SYSTEM_LT_2
 - OP71: SOUND_SYSTEM_AP_2/WEST_EU/
SYSTEM_LT_1
 - OP72: SOUND_SYSTEM_AP_1
 - OP73: COLOR_SYSTEM_AP
 - OP74: Reserved (value = 0)
 - OP75: Reserved (value = 0)
 - OP76: TIME_WIN2
 - OP77: TIME_WIN1

Option bit definition

OP10: CHINA

0 : Tuning is not for China set, or this option bit is not applicable,
 1 : Tuning is for China set,
 Default setting : 0.

OP11: VIRGIN_MODE

0 : Virgin mode is disabled or not applicable,
 1 : Virgin mode is enabled. Plug and Play menu item will be displayed to perform installation at the initial start-up of the TV when VIRGIN_MODE is set to 1. After installation is finished, this option bit will be automatically set to 0,
 Default setting : 0.

OP12: UK_PNP

0 : UK's default Plug and Play setting is not available or not applicable,
 1 : UK's default Plug and Play setting is available. When UK_PNP and VIRGIN_MODE are set to 1 at the initial set-up, LANGUAGE = ENGLISH, COUNTRY = GREAT BRITAIN

and after exiting from menu, VIRGIN_MODE will be set automatically to 0 while UK_PNP remains 1,
 Default setting : 0.

OP13: ACI

0 : ACI feature is disabled or not applicable,
 1 : ACI feature is enabled,
 Default setting : 0.

OP14: ATS

0 : ATS feature is disabled or not applicable,
 1 : ATS feature is enabled. When ATS is enabled, it sorts the program in an ascending order starting from program 1,
 Default setting : 0.

OP15: LNA

0 : Auto Picture Booster is not available or not applicable,
 1 : Auto Picture Booster is available,
 Default setting : 0.

OP16: FM_RADIO

0 : FM radio feature is disabled or not applicable,
 1 : FM radio feature is enabled,
 Default setting : 0.

OP17: PHILIPS_TUNER

0 : ALPS/MASCO compatible tuner is in use,
 1 : Philips compatible tuner is in use,
 Default setting : 0.

OP20: HUE

0 : Hue/Tint Level is disabled or not applicable,
 1 : Hue/Tint Level is enabled,
 Default setting : 0.

OP21: COLOR_TEMP

0 : Colour Temperature is disabled or not applicable,
 1 : Colour Temperature is enabled,
 Default setting : 0.

OP22: CONTRAST_PLUS

0 : Contrast+ is disabled or not applicable,
 1 : Contrast+ is enabled,
 Default setting : 0.

OP23: TILT

0 : Rotate Picture is disabled or not applicable,
 1 : Rotate Picture is enabled,
 Default setting : 0.

OP24: NOISE_REDUCTION

0 : Noise Reduction (NR) is disabled or not applicable,
 1 : Noise Reduction (NR) is enabled,
 Default setting : 0.

OP25: CHANNEL_NAMING

0 : Name FM Channel is disabled or not applicable,
 1 : Name FM Channel is enabled,
 Default setting : 0.
Note: Name FM channel can be enabled only when FM_RADIO = 1.

OP26: SMART_PICTURE

0 : Smart Picture is disabled or not applicable,
 1 : Smart Picture is enabled,
 Default setting : 1

OP27: SMART_SOUND

0 : Smart Sound is disabled or not applicable,
 1 : Smart Sound is enabled,
 Default setting : 1

AP30: AVL

0 : AVL is disabled or not applicable,
 1 : AVL is enabled,
 Default setting : 0.

OP31: WSSB

0 : WSSB is disabled or not applicable,
 1 : WSSB is enabled,
 Default setting : 0. **Note:** This option bit can be set to 1 only when WIDE_SCREEN = 1.

OP32: WIDE_SCREEN

0 : Software is used for 4:3 set or not applicable,
 1 : Software is used for 16:9 set,
 Default setting : 0.

OP33: SHIFT_HEADER_SUBTITLE

0 : Shift Header/Subtitle is disabled or not applicable,
 1 : Shift Header/Subtitle is enabled,
 Default setting : 0. **Note:** This option bit can be set to 1 only when WIDE_SCREEN = 1.

OP34: CONTINUOUS_ZOOM

0 : Continuous Zoom is disabled or not applicable,
 1 : Continuous Zoom is enabled,
 Default setting : 0. **Note:** This option bit can be set to 1 only when WIDE_SCREEN = 1.

OP35: COMPRESS_16_9

0 : COMPRESS 16:9 selection is not applicable. Item should not be in the FORMAT menu list,
 1 : COMPRESS 16:9 selection is applicable. Item should not be in the FORMAT menu list,
 Default setting : 0.

OP36: EXPAND_4_3

0 : Expand 4:3 selection is not applicable. Item should not be in the FORMAT menu list,
 1 : Expand 4:3 selection is applicable. Item should be in the FORMAT menu list,
 Default setting : 0.

OP37: EW_FUNCTION

0 : EW function is disabled. In this case, only Expand 4:3 is allowed, Compress 16:9 is not applicable.
 1 : EW function is enabled. In this case, both Expand 4:3 and Compress 16:9 are applicable.
 Default setting : 0.

OP40: STEREO_NON_DBX

0 : For AP_NTSC, chip TDA 9853 is not present,
 1 : For AP_NTSC, chip TDA 9853 is present,
 Default setting : 0.

OP41: STEREO_DBX

0 : For AP_NTSC, chip MSP 3445 is not present,
 1 : For AP_NTSC, chip MSP 3445 is present,
 Default setting : 0.

OP42: STEREO_PB

0 : For AP_PAL, chip MSP3465 is not present,
 1 : For AP_PAL, chip MSP3465 is present,
 Default setting : 0.

OP43: STEREO_NICAM_2CS

0 : For EU and AP_PAL, chip MSP 3415 is not present,
 1 : For EU and AP_PAL, chip MSP 3415 is present,
 Default setting : 0.

OP44: DELTA_VOLUME

0 : Delta Volume Level is disabled or not applicable,
 1 : Delta Volume Level is enabled,
 Default setting : 0.

OP45: ULTRA_BASS

0 : Ultra Bass is disabled or not applicable,
 1 : Ultra Bass is enabled,
 Default setting : 0.

OP46: VOLUME_LIMITER

0 : Volume Limiter Level is disabled or not applicable,
 1 : Volume Limiter Level is enabled,
 Default setting : 0.

OP47: INCR_SUR

0 : Incredible Surround feature is disabled,
 1 : Incredible Surround feature is enabled,
 Default setting : 1

OP50: PIP

0 : PIP is disabled or not applicable,
 1 : PIP is enabled,
 Default setting : 0.

OP51: HOTEL_MODE

0 : Hotel mode is disabled or not applicable,
 1 : Hotel mode is enabled,
 Default setting : 0.

OP52: SVHS

0 : SVHS source is not available,
 1 : SVHS source is available,
 Default setting : 0.
Note: This option bit is not applicable for EU.

OP53: CVI

0 : CVI source is not available,
 1 : CVI source is available,
 Default setting : 0.

OP54: AV3

0 : Side/Front AV3 source is not present,
 1 : Side/Front AV3 source is present,
 Default setting : 0.

OP55: AV2

0 : AV2 source is not present,
 1 : AV2 source is present,
 Default setting : 0.
Note: For EU, when AV2=1, both EXT2 and SVHS2 should be included in the OSD loop.

OP56: AV1

0 : AV1 source is not present,
 1 : AV1 source is present,
 Default setting : 0.

OP57: NTSC_PLAYBACK

0 : NTSC playback feature is not available,
 1 : NTSC playback feature is available,
 Default setting : 0.

OP60: Reserved

Default setting : 0.

OP61: SMART_TEXT

0 : Smart Text Mode and Favourite Page are disabled or not applicable,
 1 : Smart Text Mode and Favourite Page are enabled,
 Default setting : 1.

OP62: SMART_LOCK

0 : Child Lock and Lock Channel are disabled or not applicable for EU,
 1 : Child Lock and Lock Channel are enabled for EU,
 Default setting : 1.

OP63: VCHIP

0 : VCHIP feature is disabled,
1 : VCHIP feature is enabled,
Default setting : 1.

OP64: WAKEUP_CLOCK

0 : Wake up clock feature is disabled or not applicable,
1 : Wake up clock feature is enabled,
Default setting : 1.

OP65: SMART_CLOCK

0 : Smart Clock Using Teletext and Smart Clock Using PBS is disabled or not applicable,
1 : Smart Clock Using Teletext and Smart Clock Using PBS is enabled. For NAFTA, menu item AUTOCHRON is present in the INSTALL submenu,
Default setting : 0.

OP66: SMART_SURF

0 : Smart Surf feature is disabled or not applicable,
1 : Smart Surf feature is enabled,
Default setting : 0.

OP67: PERSONAL_ZAPPING

0 : Personal Zapping feature is disabled or not applicable,
1 : Personal Zapping feature is enabled,
Default setting : 0.

OP70: MULTI_STANDARD_EUR

0 : Not for Europe multi standard set, or this option bit is not applicable,
1 : For Europe multi standard set.
Default setting : 0.

Note: This option bit is used to control the SYSTEM selection in Manual Store : If MULTI_STANDARD_EUR = 1 then SYSTEM = Europe, West Europe, East Europe, UK, France otherwise SYSTEM = 'Europe, West Europe, UK for West Europe' (WEST_EU=1) or SYSTEM = 'Europe, West Europe, East Europe for East Europe' (WEST_EU=0)

OP71: WEST_EU

0 : For East Europe set, or this option bit is not applicable,
1 : For West Europe set,
Default setting : 0.

OP71 and 70: SYSTEM_LT_1, SYSTEM_LT_2

These two option bits are allocated for LATAM system selection.

00 : NTSC-M
01 : NTSC-M, PAL-M
10 : NTSC-M, PAL-M, PAL-N
11 : NTSC-M, PAL-M, PAL-N, PAL-BG
Default setting : 00

OP70, 71 and 72: SOUND_SYSTEM_AP_1, SOUND_SYSTEM_AP_2, SOUND_SYSTEM_AP_3

These three option bits are allocated for AP_PAL sound system selection.

000 : BG
001 : BG/DK
010 : I/DK
011 : BG/I/DK
100 : BG/I/DK/M
Default setting : 00

OP73: COLOR_SYSTEM_AP

This option bit is allocated for AP-PAL colour system selection.

0 : Auto, PAL 4.43, NTSC 4.43, NTSC 3.58
1 : Auto, PAL 4.43, NTSC 4.43, NTSC 3.58, SECAM
Default setting : 0

OP74: Reserved

Default setting : 0.

OP75: Reserved

Default setting : 0.

OP77 and 76: TIME_WIN1, TIME_WIN2

00 : The time window is set to 1.2s
01 : The time window is set to 2s
10 : The time window is set to 5s
11 : not in use

Default setting : 01

Note: The time-out for all digit entries depend on this setting.

8.3.2 Tuner

Note: Described alignments are only necessary when the NVM (item 7602) is replaced.

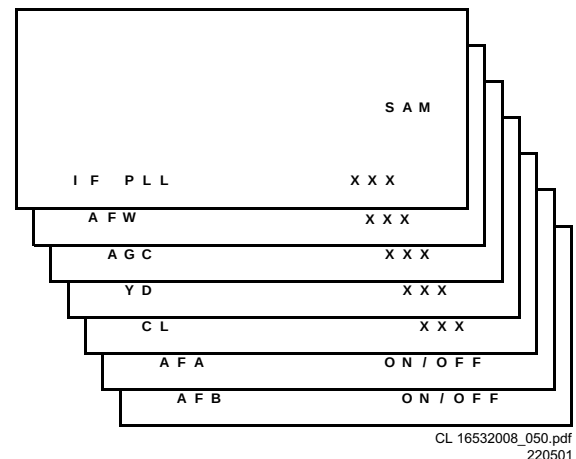


Figure 8-7

IFPLL

This adjustment is auto-aligned. Therefore, no action is required.
Default value is 30.

AFW (AFC window)

Select the lowest value.

AGC (AGC take over point)

Set the external pattern generator to a colour bar video signal and connect the RF output to aerial input.
Set amplitude to 10 mV and set frequency to 475.25 MHz (PAL/SECAM) or 61.25 MHz (NTSC).
Connect a DC multi-meter to pin 1 of the tuner (item 1000 on the main panel).

1. Activate the SAM.
2. Go to the TUNER sub menu.
3. Select AFW with the UP/DOWN cursor keys and set to ON.
4. Select AGC with the UP/DOWN cursor keys.
5. Adjust the AGC-value with the LEFT/RIGHT cursor keys until the voltage at pin 1 of the tuner lies between 3.8 and 2.3 V. Default value is 28.
6. Select AFW with the UP/DOWN cursor keys and set to OFF.
7. Switch the set to STANDBY.

YD (Y-delay adjustment)

Fixed value is 7.

CL (Cathode drive level)

Fixed value is 8.

AFA/AFB

Read only bit, for monitoring purpose only.

8.3.3 White Tone

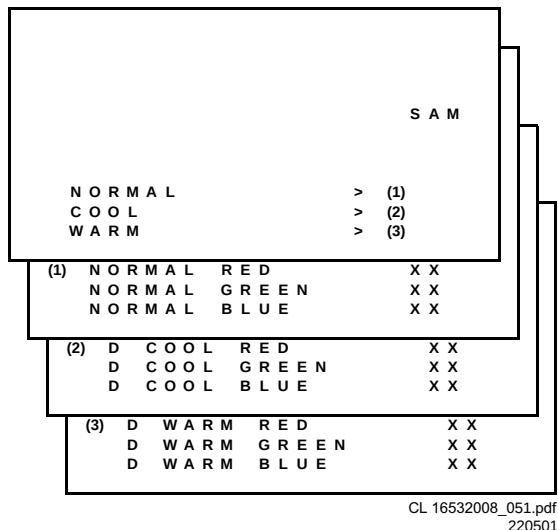


Figure 8-8

In the WHITE TONE sub menu, the values of the black cut off level can be adjusted. Normally, no alignment is needed for the WHITE TONE. You can use the given default values. The colour temperature mode (NORMAL, COOL and WARM) and the colour (R, G, and B) can be selected with the UP/DOWN RIGHT/LEFT cursor keys. The value can be changed with the LEFT/RIGHT cursor keys. First, select the values for the NORMAL colour temperature. Then select the values for the COOL and WARM mode. After alignment, switch the set to standby, in order to store the alignments.

Default settings:

1. **NORMAL** (colour temperature = 10500 K):
 - NORMAL R = 26
 - NORMAL G = 32
 - NORMAL B = 27
2. **COOL** (colour temperature = 14000 K):
 - DELTA COOL R = -3
 - DELTA COOL G = 0
 - DELTA COOL B = 5
3. **WARM** (colour temperature = 8200 K):
 - DELTA WARM R = 2
 - DELTA WARM G = 0
 - DELTA WARM B = -6

8.3.4 Geometry

The geometry alignments menu contains several items to align the set, in order to obtain a correct picture geometry.

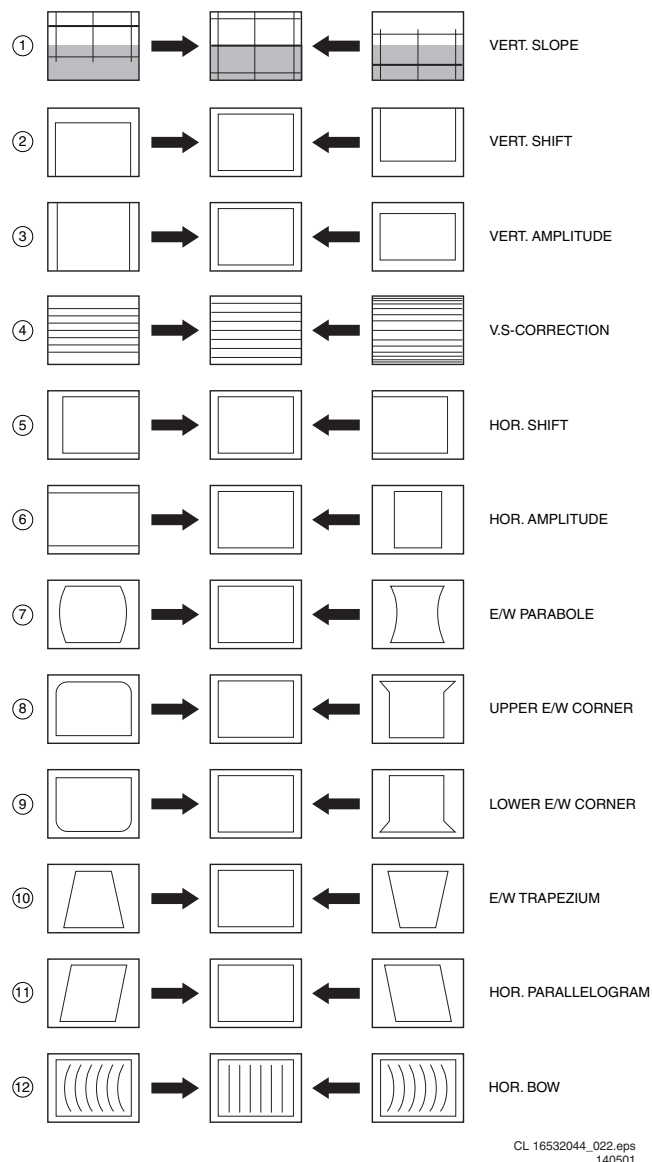


Figure 8-9

How to align

Connect an external video pattern generator to the aerial input of the TV-set and input a crosshatch test pattern. Set amplitude to at least 1 mV and set frequency to 475.25 MHz (PAL/SECAM) or 61.25 MHz (NTSC).

1. Set 'Smart Picture' to NATURAL (or MOVIES).
2. Activate the SAM menu (see chapter 5).
3. Go to the GEOMETRY sub menu.
4. Choose HORIZONTAL or VERTICAL alignment

Now you can perform the following alignments:

Horizontal alignment

- **Horizontal Parallelogram (HP)**. Align straight vertical lines in the top and the bottom; vertical rotation around the centre.
- **Horizontal Bow (HB)**. Align straight horizontal lines in the top and the bottom; horizontal rotation around the centre.
- **Horizontal Shift (HSH)**. Align the horizontal centre of the picture to the horizontal centre of the CRT.
- **East West Width (EWW)**. Align the picture width until the complete test pattern is visible.
- **East West Parabola (EWP)**. Align straight vertical lines at the sides of the screen.
- **Upper Corner Parabola (UCP)**. Align straight vertical lines in the upper corners of the screen.

- **Lower Corner Parabola (LCP).** Align straight vertical lines in the lower corners of the screen.
- **East West Trapezium (EWT).** Align straight vertical lines in the middle of the screen.

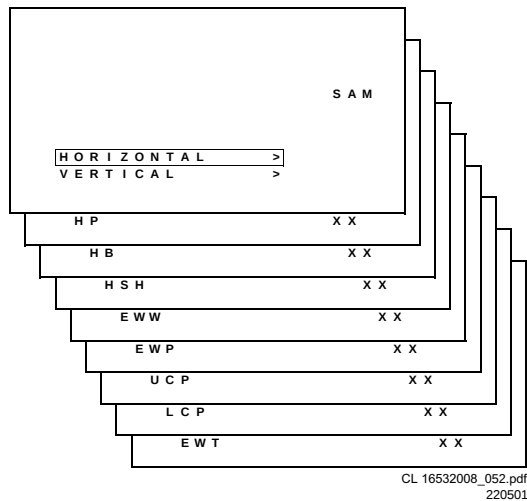


Figure 8-10

Vertical alignment

- **Vertical slope (VSL).** Align the vertical centre of the picture to the vertical centre of the CRT. This is the first of the vertical alignments to perform. For an easy alignment, set SBL to ON.
- **Vertical Amplitude (VAM).** Align the vertical amplitude so that the complete test pattern is visible.
- **Vertical S-Correction (VSC).** Align the vertical linearity, meaning that vertical intervals of a grid pattern must be equal over the entire screen height.
- **Vertical Shift (VSH).** Align the vertical centring so that the test pattern is located vertically in the middle. Repeat the 'vertical amplitude' alignment if necessary.
- **Vertical Zoom (VX).** The vertical zoom is added in for the purpose of development. It helps the designer to set proper values for the movie expand or movie (16x9) compress. Default value is 25.
- **Service blanking (SBL).** Switch the blanking of the lower half of the screen ON or OFF (to be used in combination with the vertical slope alignment).
- **H60.** Align straight horizontal lines if NTSC input (60 Hz) is used i.s.o. PAL (50 Hz).
- **V60.** Align straight vertical lines if NTSC input (60 Hz) is used i.s.o. PAL (50 Hz).

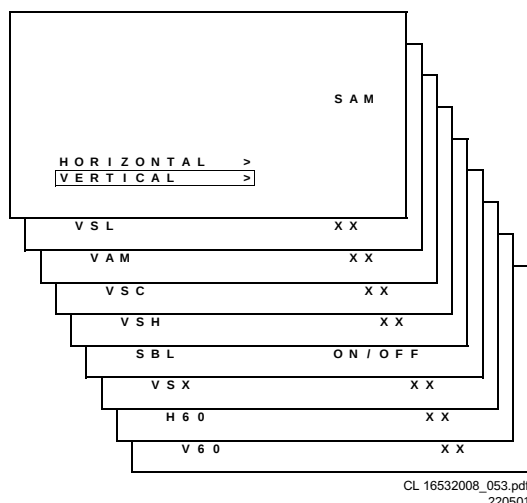


Figure 8-11

In the table below, you will find the GEOMETRY default values for the different sets.

DEFAULT GEOMETRY VALUES (L01 LARGE SCREEN)								
Alignment	Description	21" (4:3)	24" (16:9)	25" (4:3)	28" (4:3)	28" (16:9)	29" (4:3)	32" (16:9)
HP	Hor. Parallelogram	31	32	31	31	32	32	32
HB	Hor. Bow	31	32	31	31	32	32	32
HSH	Hor. Shift	35	27	35	35	27	27	27
EWV	East West Width	34	36	34	34	36	48	39
EWP	East West Parabola	33	20	33	33	20	20	20
UCP	Upper Corner Parabola	35	20	35	35	23	24	20
LCP	Lower Corner Parabola	35	25	35	35	25	28	25
EWT	East West Trapezium	35	28	35	35	28	28	28
VSL	Vert. Slope	33	37	33	33	37	37	37
VAM	Vert. Amplitude	26	30	26	26	30	39	30
VSC	Vert. S-correction	23	20	23	23	20	32	20
VSH	Vert. Shift	31	31	31	31	31	31	31
VX	Vert. Zoom	25	25	25	25	25	25	25
H60	Hor. Shift offset (60 Hz)	9	9	9	9	9	9	9
V60	Vert. Shift offset (60 Hz)	4	4	4	4	4	4	4

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Figure 8-12

8.3.5 Audio

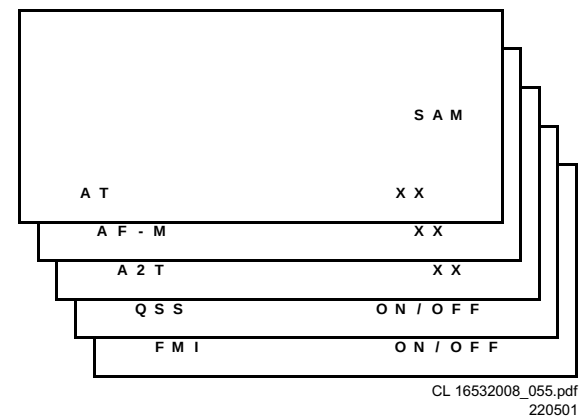


Figure 8-13

No alignments are needed for the audio sub menu. Use the given default values.

AT (Attack Time)

Default value is 8.

AF-M

Default value is 301.

A2T

Default value is 250.

QSS

OFF for mono sets, ON for stereo sets.

FMI

Fixed setting is OFF.

9. Circuit Description

Index of this chapter:

1. Introduction
2. Audio Signal Processing
3. Video Signal Processing
4. Synchronisation
5. Deflection
6. Power Supply
7. Control
8. Abbreviations

Notes:

- Figures can deviate slightly from the actual situation, due to different set executions.
- For a good understanding of the following circuit descriptions, please use the block diagram in chapter 6, or the electrical diagrams in chapter 7. Where necessary, you will find a separate drawing for clarification.

9.1 Introduction

The L01 chassis is a global TV chassis for the model year 2001 and is used for TV sets with screen sizes from 14" - 21" (small screen) to 21" - 32" (large screen). The standard architecture consists of a Main panel, a Picture Tube panel, a Side I/O panel (not al executions) and a Top Control panel. The Main panel consists primarily of conventional components with hardly any surface mounted devices.

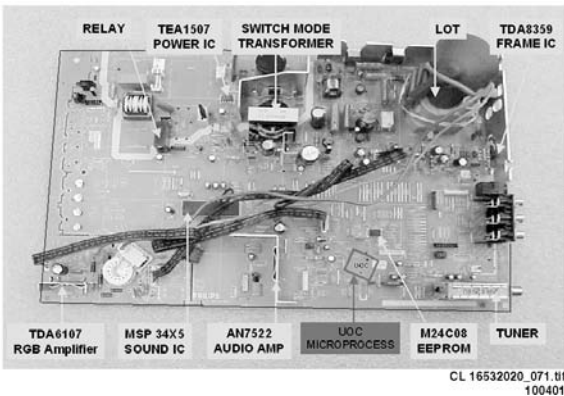


Figure 9-1

The functions for video processing, microprocessor (μP) and teletext (TXT) decoder are combined in one IC (TDA958xH), the so-called Ultimate One Chip (UOC). This chip is (surface) mounted on the copper side of the main panel.

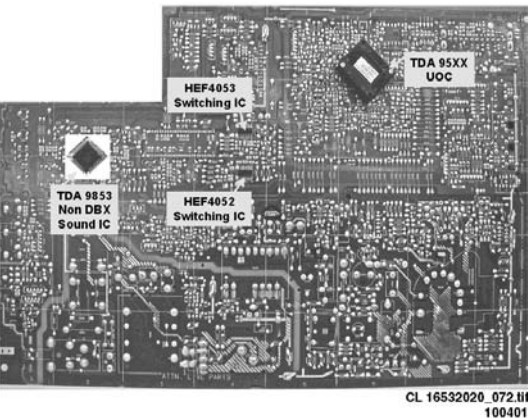


Figure 9-2

The L01 is divided into 2 basic systems, i.e. mono and stereo sound. While the audio processing for the mono sound is done in the audio block of the UOC, an external audio processing IC is used for stereo sets.

The tuning system features 100 video channels with on-screen display. The main tuning system uses a tuner, a microcomputer, and a memory IC mounted on the main panel. Also, in some type numbers, an FM radio is implemented with 40 pre-set channels. The microcomputer communicates with the memory IC, the customer keyboard, remote receiver, tuner, signal processor IC and the audio output IC via the I²C bus. The memory IC retains the settings for favourite stations, customer-preferred settings, and service/factory data. The on-screen graphics and closed caption decoding are done within the microprocessor, and then sent to the signal processor IC to be added to the main signal.

The chassis uses a Switching Mode Power Supply (SMPS) for the main voltage source. The chassis has a 'hot' ground reference on the primary side and a cold ground reference on the secondary side of the power supply and the rest of the chassis.

9.2 Audio Signal Processing

9.2.1 Stereo

In stereo sets, the signal goes via the SAW filter (position 1004 in case of QSS demodulation and 1003 in case of Inter-carrier demodulation), to the audio demodulator part of the UOC IC7200. The stereo audio output on pin 33 goes, via TS7201, to the stereo decoder 7831. The switch inside the stereo decoder 7831 selects (via I²C) either the internal decoder or an external source. The NICAM + 2CS AM/FM stereo decoder is an ITT MSP34X5. The output is fed to the audio amplifier (AN7522 at position 7901). The volume level is controlled at this IC (pin 9) by a control line (VolumeMute) from the microprocessor. The audio signal from 7901 is then sent to the speaker/headphone output panel.

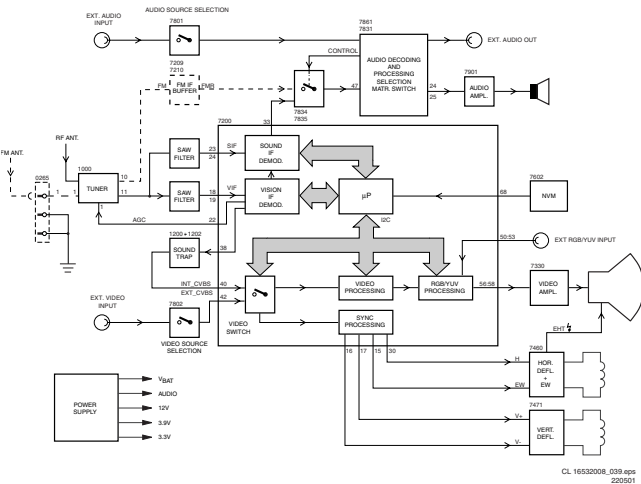


Figure 9-3

9.2.2 Mono

In mono sets, the signal goes via the SAW filter (position 1004 in case of QSS demodulation and 1003 in case of Inter-carrier demodulation), to the audio demodulator part of the UOC IC7200. The audio output on pin 48 goes directly, via the smart sound circuit (7941 for Bass and 7942 for Treble) and buffer (7943), to the audio amplifier (AN7523 at position 7902).

The volume level is controlled at this IC (pin 9) by a 'VolumeMute' control line from the microprocessor.

The audio signal from IC7902 is then sent to the speaker/headphone output panel.

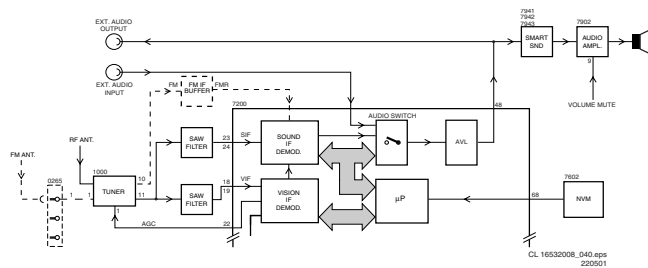


Figure 9-4 .eps

9.2.3 FM radio (if present)

The FM radio uses the 10.7 MHz concept. This SIF frequency is available at pin 10 of the tuner. Via a pre-amplifier (TS7209 and TS7210), the signal is fed for demodulation to either the UOC (for mono FM radio) or by the Micronas MSP34X5 (for stereo FM radio).

9.3 Video Signal Processing

9.3.1 Introduction

The video signal-processing path consists of the following parts:

- RF signal processing.
- Video source selection.
- Video demodulation.
- Luminance/Chrominance signal processing.
- RGB control.
- RGB amplifier

The processing circuits listed above are all integrated in the UOC TV processor. The surrounding components are for the adaptation of the selected application. The I²C bus is for defining and controlling the signals.

9.3.2 RF Signal Processing

The incoming RF signal goes to the tuner (pos. 1000), where the 38.9 MHz IF signal is developed and amplified. The IF signal then exits the tuner from pin 11 to pass through the SAW filter (position 1002 in case of QSS demodulation and 1003 in case of Inter-carrier demodulation). The shaped signal is then applied to the IF processor part of the UOC (pos. 7200).

Tuner AGC (Automatic Gain Control) will reduce the tuner gain and thus the tuner output voltage when receiving strong RF signals. Adjust the AGC take-over point via the Service Alignment Mode (SAM). The tuner AGC starts working when the video-IF input reaches a certain input level and will adjust this level via the I²C bus. The tuner AGC signal goes to the tuner (pin 1) via the open collector output (pin 22) of the UOC. The IC also generates an Automatic Frequency Control (AFC) signal that goes to the tuning system via the I²C bus, to provide frequency correction when needed. The demodulated composite video signal is available at pin 38 and then buffered by transistor 7201.

9.3.3 Video Source Selection

The Composite Video Blanking Signal (CVBS) from buffer 7201 goes to the audio carrier trap filters (1200 and 1201) to remove the audio signal. The signal then goes to pin 40 of IC7200. The internal input switch selects the following input signals:

- Pin 40: terrestrial CVBS input
- Pin 42: external AV1 CVBS input
- Pin 44: external Side I/O CVBS or AV2 Luminance (Y) input
- Pin 45: external AV2 Chrominance (C) input

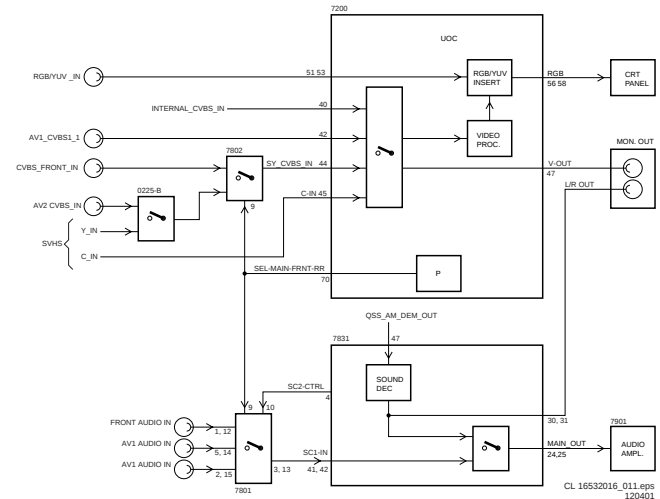


Figure 9-5

Once the signal source is selected, a chroma filter calibration is performed. The received colour burst sub-carrier frequency is used for this. Correspondingly, the chroma band pass filter for PAL processing or the cloche filter for SECAM processing is switched on. The selected luminance (Y) signal is supplied to the horizontal and vertical synchronisation processing circuit and to the luminance processing circuit. In the luminance-processing block, the luminance signal goes to the chroma trap filter. This trap is switched 'on' or 'off', depending on the colour burst detection of the chroma calibration circuit.

The group delay correction part can be switched between the BG and a flat group delay characteristic. This has the advantage that in multi-standard receivers no compromise has to be made for the choice of the SAW filter.

9.3.4 Video Demodulation

The colour decoder circuit detects whether the signal is a PAL, NTSC or SECAM signal. The result is made known to the auto system manager. The PAL/NTSC decoder has an internal clock generator, which is stabilised to the required frequency by using the 12 MHz clock signal from the reference oscillator of the microcontroller/teletext decoder. The base-band delay line is used to obtain a good suppression of cross colour effects. The Y signal and the delay line outputs U and V are applied to the luminance/chroma signal processing part of the TV processor.

9.3.5 Luminance/Chrominance Signal Processing

The output of the YUV separator is fed to the internal YUV switch, which switches between the output of the YUV separator or the external YUV (for DVD or PIP) on pins 51-53. Pin 50 is the input for the insertion control signal called 'FBL-1'. When this signal level becomes higher than 0.9 V (but less than 3 V), the RGB signals at pins 51, 52 and 53 are inserted into the picture by using the internal switches.

Also some picture improvement features are implemented in this part:

- **Black stretch** This function corrects the black level of incoming signals, which have a difference between the black level and the blanking level. The amount of extension depends upon the difference between actual black level and the darkest part of the incoming video signal level. It is detected by means of an internal capacitor.
- **White stretch** This function adapts the transfer characteristic of the luminance amplifier in a non-linear way depending on the average picture content of the luminance signal. It operates in such a way that maximum stretching is obtained when signals with a low video level are received. For bright pictures, stretching is not active.
- **Dynamic skin tone correction** This circuit corrects (instantaneously and locally) the hue of those colours which are located in the area in the UV plane that matches the skin tone. The correction is dependent on the luminance, saturation and distance to the preferred axis.

The YUV signal is then fed to the colour matrix circuit, which converts it to R, G and B signals.

The OSD/TXT signal from the microprocessor is mixed with the main signal at this point, before being output to the CRT board (pins 56, 57 and 58).

9.3.6 RGB Control

The RGB control circuit enables the picture parameters contrast, brightness and saturation to be adjusted, by using a combination of the user menus and the remote control. Additionally automatic gain control for the RGB signals via cut-off stabilisation is achieved in this functional block to obtain an accurate biasing of the picture tube. Therefore this block inserts the cut-off point measuring pulses into the RGB signals during the vertical retrace period.

The following additional controls are used:

- **Black current calibration loop** Because of the 2-point black current stabilisation circuit, both the black level and the amplitude of the RGB output signals depend on the drive characteristics of the picture tube. The system checks whether the returning measuring currents meet the requirements, and adapt the output level and gain of the circuit when necessary. After stabilisation of the loop, the RGB drive signals are switched on. The 2-point black level system adapts the drive voltage for each cathode in such a way that the two measuring currents have the right value. This is done with the measurement pulses during the frame flyback. During the first frame, three pulses with a current of 8 μA are generated to adjust the cut off voltage. During the second frame, three pulses with a current of 20 μA are generated to adjust the 'white drive'. This has as a consequence, that a change in the gain of the output stage will be compensated by a gain change of the RGB control circuit. Pin 55 (BLKIN) of the UOC is used as the feedback input from the CRT base panel.
- **Blue stretch** This function increases the colour temperature of the bright scenes (amplitudes which exceed a value of 80% of the nominal amplitude). This effect is obtained by decreasing the small signal gain of the red and green channel signals, which exceed this 80% level.
- **Beam current limiting** A beam current limiting circuit inside the UOC handles the contrast and brightness control for the RGB signals. This prevents the CRT from being overdriven, which could otherwise cause serious damage in the line output stage. The reference used for this purpose is the DC voltage on pin 54 (BLCIN) of the TV processor. Contrast and brightness reduction of the

RGB output signals is therefore proportional to the voltage present on this pin. Contrast reduction starts when the voltage on pin 54 is lower than 2.8 V. Brightness reduction starts when the voltage on pin 54 is less than 1.7 V. The voltage on pin 54 is normally 3.3 V (limiter not active). During set switch 'off', the black current control circuit generates a fixed beam current of 1 mA. This current ensures that the picture tube capacitance is discharged. During the switch-off period, the vertical deflection is placed in an over-scan position, so that the discharge is not visible on the screen.

9.3.7 RGB Amplifier

From outputs 56, 57 and 58 of IC7200, the RGB signals are applied to the analogue output amplifiers on the CRT panel. The R-signal is amplified by a circuit built around transistors TS7311, 7312 and 7313, which drives the picture tube cathodes.

The supply voltage for the amplifier is +160 V and is derived from the line output stage.

9.3.8 SCAVEM (if present)

The SCAn VELOCITY Modulation (SCAVEM) circuitry is implemented in the layout of the picture tube panel. It is thus not an extra module. This circuit influences the horizontal deflection as a function of the picture content. In an ideal square wave, the sides are limited in slope due to a limited bandwidth (5 MHz).

SCAVEM will improve the slope as follows:

At a positive slope, a SCAVEM current is generated which supports the deflection current. At the first half of the slope, the spot is accelerated and the picture is darker. At the second half of the slope, the spot is delayed and the slope becomes steeper.

At the end of the slope, the SCAVEM-current decays to zero and the spot is at the original position. An overshoot occurs which improves the impression of sharpness.

At the negative slope, the SCAVEM-current counteracts the deflection. During the first half of the slope, the spot is delayed and the slope becomes steeper. During the second half the spot accelerates, the SCAVEM-current is zero at the end of the slope.

Via the three resistors R3371, R3379 and R3386, Red, Green and Blue are added together, buffered and offered to the emitter of TS7363. On the collector of this transistor, configured in a common base, the sum of these 3 signals is obtained. Via the emitter follower formed with TS7360, this signal is conveyed to the differentiator C2376 and R3392. Only the high frequencies are differentiated (small RC-time). The positive and negative pulses of this signal drive respectively TS7365 and TS7362 into conductivity. The DC setting of the output stage is set by R3363, R3374, R3378 and R3384. The working voltage of the transistors is settled at half the supply voltage.

At the positive section of the pulse, the current flows through TS7365 and the SCAVEM coil. At the negative section of the pulse, the current flows through TS7362 and the SCAVEM coil.

9.4 Synchronisation

Inside IC7200 (part D), the vertical and horizontal sync-pulses are separated. These 'H' and 'V' signals are synchronised with the incoming CVBS signal. They are then fed to the H- and V-drive circuits and to the OSD/TXT circuit for synchronisation of the On Screen Display and Teletext (or Closed Caption) information.

9.5 Deflection

9.5.1 Horizontal Drive

The horizontal drive signal is obtained from an internal VCO, which is running at twice the line frequency. This frequency is divided by two, to lock the first control loop to the incoming signal.

When the IC is switched 'on', the 'Hdrive' signal is suppressed until the frequency is correct.

The 'Hdrive' signal is available at pin 30. The 'Hflybk' signal is fed to pin 31 to phase lock the horizontal oscillator, so that TS7462 cannot switch 'on' during the flyback time.

The 'EWdrive' signal for the E/W circuit (if present) is available on pin 15, where it drives transistor 7400 to make linearity corrections in the horizontal drive.

When the set is switched on, the '+8V' voltage goes to pin 9 of IC7200. The horizontal drive starts up in a soft start mode. It starts with a very short T_{ON} time of the horizontal output transistor. The T_{OFF} of the transistor is identical to the time in normal operation. The starting frequency during switch on is therefore about 2 times higher than the normal value. The 'on' time is slowly increased to the nominal value in 1175 ms. When the nominal value is reached, the PLL is closed in such a way that only very small phase corrections are necessary.

The 'EHTinformation' line on pin 11 is intended to be used as a 'X-ray' protection. When this protection is activated (when the voltage exceeds 6 V), the horizontal drive (pin 30) is switched 'off' immediately. If the 'H-drive' is stopped, pin 11 will become low again. Now the horizontal drive is again switched on via the slow start procedure.

The 'EHTinformation' line (Aquadag) is also fed back to the UOC IC7200 pin 54, to adjust the picture level in order to compensate for changes in the beam current.

The filament voltage is monitored for 'no' or 'excessive' voltage. This voltage is rectified by diode 6413 and fed to the emitter of transistor 7405. If this voltage goes above 6.8 V, transistor 7405 will conduct, making the 'EHT0' line 'high'. This will immediately switch off the horizontal drive (pin 30) via the slow stop procedure.

The horizontal drive signal exits IC7200 at pin 30 and goes to 7401, the horizontal driver transistor. The signal is amplified and coupled to the base circuit of 7402, the horizontal output transistor. This will drive the line output transformer (LOT) and associated circuit. The LOT provides the extra high voltage (EHT), the VG2 voltage and the focus and filament voltages for the CRT, while the line output circuit drives the horizontal deflection coil.

9.5.2 Vertical Drive

A divider circuit performs the vertical synchronisation. The vertical ramp generator needs an external resistor (R3245, pin 20) and capacitor (C2244, pin 21). A differential output is available at pins 16 and 17, which are DC-coupled with the vertical output stage.

To avoid damage of the picture tube when the vertical deflection fails, the 'V_GUARD' output is fed to the beam current limiting input. When a failure is detected, the RGB-outputs are blanked. When no vertical deflection output stage is connected, this guard circuit will also blank the output signals.

These 'V_DRIVE+' and 'V_DRIVE-' signals are applied to the input pins 1 and 2 of IC 7471 (full bridge vertical deflection amplifier). These are voltage driven differential inputs. As the driver device (IC 7200) delivers output currents, R3474 and R3475 convert them to voltage. The differential input voltage is compared with the voltage across measuring resistor R3471 that provides internal feedback information. The

voltage across this measuring resistor is proportional to the output current, which is available at pins 4 and 7 where they drive the vertical deflection coil (connector 0222) in phase opposition.

IC 7471 is supplied by +13 V. The vertical flyback voltage is determined by an external supply voltage at pin 6 (VlotAux+50V). This voltage is almost totally available as flyback voltage across the coil, this being possible due to the absence of a coupling capacitor (which is not necessary, due to the 'bridge' configuration).

9.5.3 Deflection Corrections

The Linearity Correction

A constant voltage on the horizontal deflection coil should result in a sawtooth current. This however is not the case as the resistance of the coil is not negligible. In order to compensate for this resistance, a pre-magnetised coil L5457 is used. R3485 and C2459 ensure that L5457 does not excite, because of its own parasite capacitance. This L5457 is called the 'linearity coil'.

The Mannheim Effect

When clear white lines are displayed, the high-voltage circuit is heavily loaded. During the first half of the flyback, the high voltage capacitors are considerably charged. At that point in time, the deflection coil excites through C2465. This current peak, through the high-voltage capacitor, distorts the flyback pulse. This causes synchronisation errors, causing an oscillation under the white line.

During $t_3 - t_5$, C2490//2458 is charged via R3459. At the moment of the flyback, C2490//2458 is subjected to the negative voltage pulses of the parabola as a result of which D6465 and D6466 are conducting and C2490//2458 is switched in parallel with C2456//2457. This is the moment the high-voltage diodes are conducting. Now extra energy is available for excitation through C2465 and the line deflection. As a consequence, the flyback pulse is less distorted.

The S-Correction

Since the sides of the picture are further away from the point of deflection than from the centre, a linear sawtooth current would result in a non-linear image being scanned (the centre would be scanned slower than the sides). For the centre-horizontal line, the difference in relation of the distances is larger than those for the top and bottom lines. An S-shaped current will have to be superimposed onto the sawtooth current. This correction is called finger-length correction or S-correction.

C2456//2457 is relatively small, as a result of which the sawtooth current will generate a parabolic voltage with negative voltage peaks. Left and right, the voltage across the deflection coil decreases, and the deflection will slow down; in the centre, the voltage increases and deflection is faster. The larger the picture width, the higher the deflection current through C2456//2457. The current also results in a parabolic voltage across C2484//2469, resulting in the finger length correction proportionally increasing with the picture width. The east/west drive signal will ensure the largest picture width in the centre of the frame. Here the largest correction is applied.

East/West Correction

In the L01, there are three types of CRTs, namely the 100°, 110° and wide screen CRTs. The 100° CRT is raster-correction-free and does not need East/West correction. The 110° 4:3 CRT comes with East/West correction and East/West protection.

The wide screen TV sets have all the correction of the 110 4:3 CRT and also have additional picture format like the 4:3 format, 16:9, 14:9, 16:9 zoom, subtitle zoom and the Super-Wide picture format

A line, written at the upper- or lower side of the screen, will be larger at the screen centre when a fixed deflection current is used. Therefore, the amplitude of the deflection current must be increased when the spot approaches the centre of the screen. This is called the East/West or pincushion correction.

The 'Ewdrive' signal from pin 15 of IC7200 takes care for the correct correction. It drives FET TS7400. It also corrects breathing of the picture, due to beam current variations (the EHT varies dependent of the beam current). This correction is derived from the 'EHTinformation' line.

Two protections are built-in for the E/W circuit: over-current and over-voltage protection. See paragraph Power Supply.

Panorama

The panorama function is only used in 16:9 sets. This is a function to enable the 4:3 and Super-Wide feature. It drives the 'Bass_panorama' line, to activate relay 1400. When this relay is switched on, the capacitors 2453//2454 are added in parallel to the default S-correction capacitors 2456//2457. This results in an increased capacitance, a lower resonance frequency of the line deflection coil and the S-correction capacitors and therefore a less steep S-corrected line deflection current.

9.5.4 Rotation (only present in widescreen sets)

To cope with the different earth magnetism situations in the world, a rotation coil is added in widescreen sets. This coil is controlled by the rotation circuitry (see diagram A15).

The amount of frame rotation is user controlled via the the PWM output (pin 77) of the UOC.

With the tilt setting at '-10', the PWM duty cycle is 0.1 (leftmost tuning).

With the setting at '+10', the duty cycle is 0.9 (rightmost tuning).

The output of amplifier IC7171 is a DC-voltage in the range from 0 (user setting = -10), via 6 V (user setting = 0) to 12 V (user setting = +10).

9.6 Power Supply

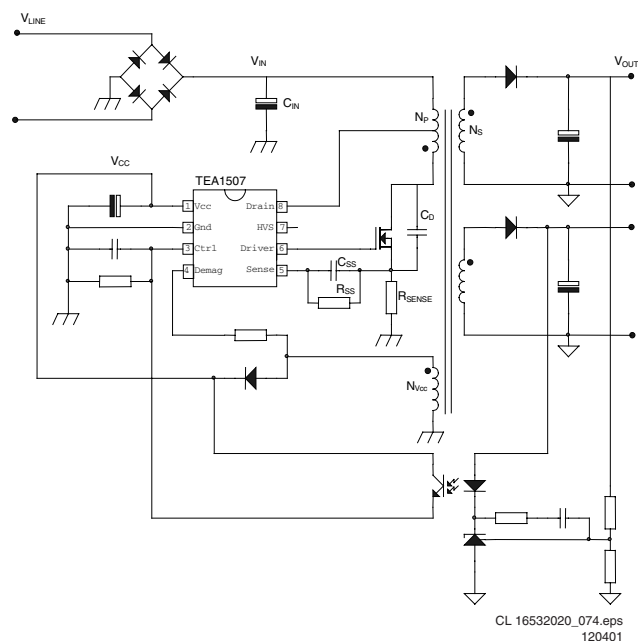


Figure 9-6

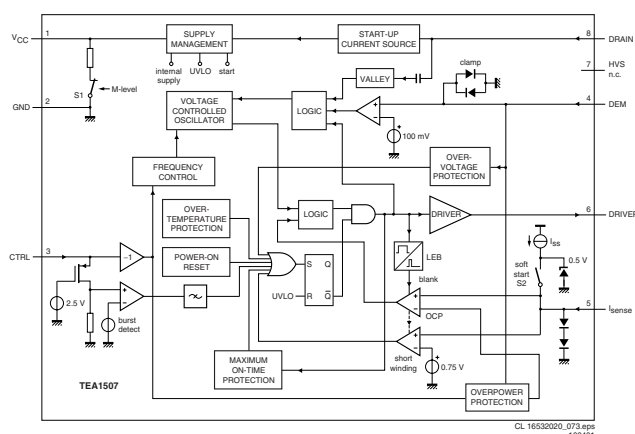


Figure 9-7

9.6.1 Introduction

The supply is a Switching Mode Power Supply (SMPS). The frequency of operation varies with the circuit load. This 'Quasi-Resonant Flyback' behaviour has some important benefits compared to a 'hard switching' fixed frequency Flyback converter. The efficiency can be improved up to 90%, which results in lower power consumption. Moreover the supply runs cooler and safety is enhanced.

The power supply starts operating when a DC voltage goes from the rectifier bridge via T5520, R3532 to pin 8. The operating voltage for the driver circuit is also taken from the 'hot' side of this transformer.

The switching regulator IC7520 starts switching the FET 'on' and 'off', to control the current flow through the primary winding of transformer 5520. The energy stored in the primary winding during the 'on' time is delivered to the secondary windings during the 'off' time.

The 'MainSupply' line is the reference voltage for the power supply. It is sampled by resistors 3543 and 3544 and fed to the input of the regulator 7540/6540. This regulator drives the feedback optocoupler 7515 to set the feedback control voltage on pin 3 of 7520.

The power supply in the set is 'on' any time AC power goes to the set.

Derived Voltages

The voltages supplied by the secondary windings of T5520 are:

- 'MainAux' for the audio circuit (voltage depends on set execution, see table below),
- 3.3 V and 3.9 V for the microprocessor and
- 'MainSupply' for the horizontal output (voltage depends on set execution, see table below).

Other supply voltages are provided by the LOT. It supplies +50 V (only for large screen sets), +13 V, +8 V, +5 V and a +200 V source for the video drive. The secondary voltages of the LOT are monitored by the 'EHTinformation' lines. These lines are fed to the video processor part of the UOC IC7200 on pins 11 and 34.

This circuit will shut 'off' the horizontal drive in case of over-voltage or excessive beam current.

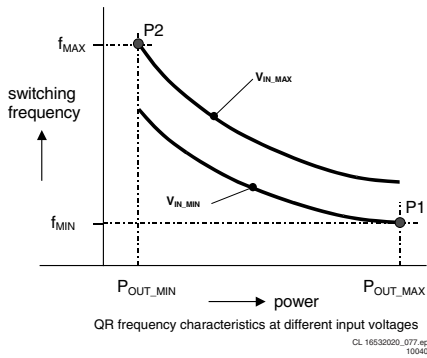


Figure 9-11

Point P1 is the minimum frequency f_{MIN} that occurs at the specified minimum input voltage and maximum output power required by the application. Of course the minimum frequency has to be chosen above the audible limit (>20 kHz).

Start-up Sequence

When the rectified AC voltage V_{IN} (via the centre tap connected to pin 8) reaches the Mains dependent operation level (Mlevel: between 60 and 100 V), the internal 'Mlevel switch' will be opened and the start-up current source is enabled to charge capacitor C2521 at the V_{CC} pin as shown below.

The 'soft start' switch is closed when the V_{CC} reaches a level of 7 V and the 'soft start' capacitor C_{SS} (C2522, between pin 5 and the sense resistor R3526), is charged to 0.5 V.

Once the V_{CC} capacitor is charged to the start-up voltage $V_{\text{CC-start}}$ (11 V), the IC starts driving the MOSFET. Both internal current sources are switched 'off' after reaching this start-up voltage. Resistor R_{SS} (3524) will discharge the 'soft start' capacitor, such that the peak current will slowly increase. This to prevent 'transformer rattle'.

During start-up, the V_{CC} capacitor will be discharged until the moment that the primary auxiliary winding takes over this voltage.

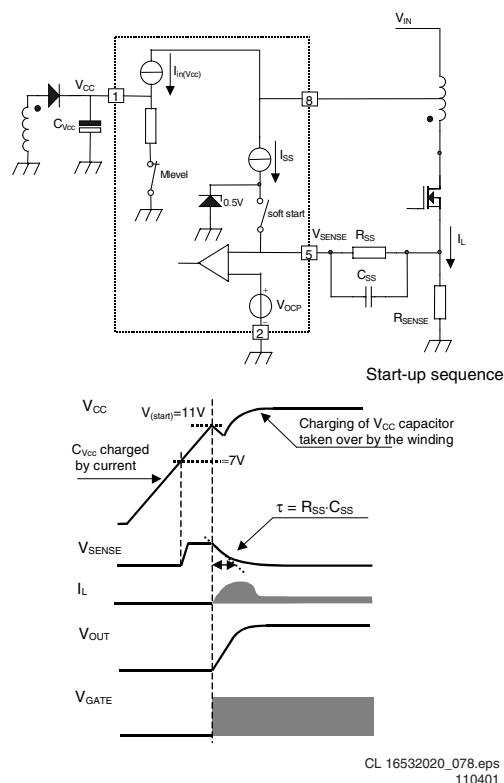


Figure 9-12

The moment that the voltage on pin 1 drops below the 'under voltage lock out' level ($UVLO = \pm 9 \text{ V}$), the IC will stop switching and will enter a safe restart from the rectified mains voltage.

Operation

The supply can run in three different modes depending on the output power:

- Quasi-Resonant mode (QR) The QR mode, described above, is used during normal operation. This will give a high efficiency.
- Frequency Reduction mode (FR) The FR mode (also called VCO mode) is implemented to decrease the switching losses at low output loads. In this way the efficiency at low output powers is increased, which enables power consumption smaller than 3 W during stand-by. The voltage at the pin 3 (Ctrl) determines where the frequency reduction starts. An external Ctrl voltage of 1.425 V corresponds with an internal VCO level of 75 mV. This fixed VCO level is called $V_{\text{VCO,start}}$. The frequency will be reduced in relation to the VCO voltage between 75 mV and 50 mV (at levels larger than 75 mV, Ctrl voltage < 1.425V, the oscillator will run on maximum frequency $f_{\text{osch}} = 175 \text{ kHz}$ typically). At 50 mV ($V_{\text{VCO,max}}$) the frequency is reduced to the minimum level of 6 kHz. Valley switching is still active in this mode.
- Minimum Frequency mode (MinF) At VCO levels below 50 mV, the minimum frequency will remain on 6 kHz, which is called the MinF mode. Because of this low frequency, it is possible to run at very low loads without having any output regulation problems.

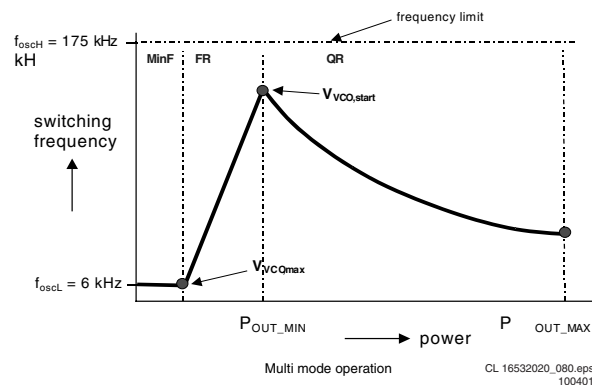


Figure 9-13

Safe-Restart Mode

This mode is introduced to prevent the components from being destroyed during eventual system fault conditions. It is also used for the Burst mode. The Safe-Restart mode will be entered if it is triggered by one of the following functions:

- Over voltage protection,
- Short winding protection,
- Maximum 'on time' protection,
- V_{CC} reaching UVLO level (fold back during overload),
- Detecting a pulse for Burst mode,
- Over temperature protection.

When entering the Safe-Restart mode, the output driver is immediately disabled and latched. The V_{CC} winding will not charge the V_{CC} capacitor anymore and the V_{CC} voltage will drop until UVLO is reached. To recharge the V_{CC} capacitor, the internal current source ($I_{\text{(restart)}}(V_{\text{CC}})$) will be switched 'on' to initiate a new start-up sequence as described before. This Safe-Restart mode will persist until the controller detects no faults or burst triggers.

Standby

The set goes to Standby in the following cases:

- After pressing the 'standby' key on the remote control.

- When the set is in protection mode.

In Standby, the power supply works in 'burst mode'. Burst mode can be used to reduce the power consumption below 1 W at stand-by. During this mode, the controller is active (generating gate pulses) for only a short time and for a longer time inactive waiting for the next burst cycle. In the active period the energy is transferred to the secondary and stored in the buffer capacitor C_{STAB} in front of the linear stabiliser (see Figure below). During the inactive period, the load (e.g. microprocessor) discharges this capacitor. In this mode, the controller makes use of the Safe-Restart mode.

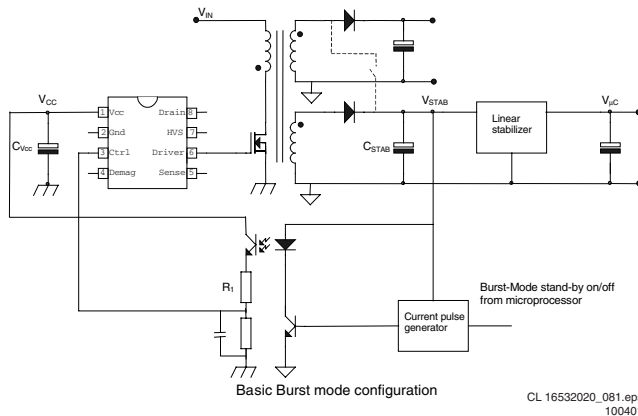


Figure 9-14

The system enters burst mode standby when the microprocessor activates the 'Stdby_con' line. When this line is pulled high, the base of TS7541 is allowed to go high. This is triggered by the current from collector TS7542. When TS7541 turns 'on', the opto-coupler (7515) is activated, sending a large current signal to pin 3 (Ctrl). In response to this signal, the IC stops switching and enters a 'hiccup' mode. This burst activation signal should be present for longer than the 'burst blank' period (typically 30 μ s): the blanking time prevents false burst triggering due to spikes. Burst mode standby operation continues until the microcontroller pulls the 'Stdby_con' signal low again. The base of TS7541 is unable to go high, thus cannot turn 'on'. This will disable the burst mode. The system then enters the start-up sequence and begins normal switching behaviour.

For a more detailed description of one burst cycle, three time intervals are defined:

- t1: Discharge of V_{CC} when gate drive is active During the first interval, energy is transferred, which result in a ramp-up of the output voltage (V_{STAB}) in front of the stabiliser. When enough energy is stored in the capacitor, the IC will be switched 'off' by a current pulse generated at the secondary side. This pulse is transferred to the primary side via the opto coupler. The controller will disable the output driver (safe restart mode) when the current pulse reaches a threshold level of 16 mA into the Ctrl pin. A resistor R_1 (R3519) is placed in series with the opto coupler, to limit the current going into the Ctrl pin. Meanwhile the V_{CC} capacitor is discharged but has to stay above V_{UVLO} .
- t2: Discharge of V_{CC} when gate drive is inactive During the second interval, the V_{CC} is discharged to V_{UVLO} . The output voltage will decrease depending on the load.
- t3: Charge of V_{CC} when gate drive is inactive The third interval starts when the UVLO is reached. The internal current source charges the V_{CC} capacitor (also the soft start capacitor is recharged). Once the V_{CC} capacitor is charged to the start-up voltage, the driver is activated and a new burst cycle is started.

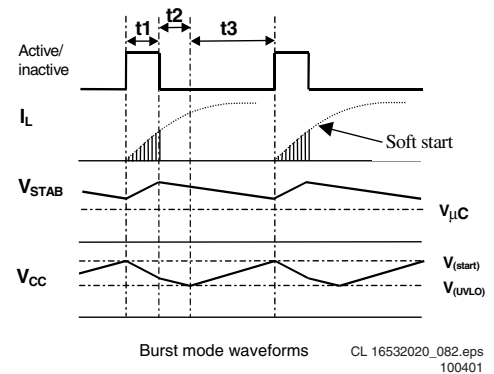


Figure 9-15

9.6.3 Protection Events

The SMPS IC7520 has the following protection features:

Demagnetisation sense

This feature guarantees discontinuous conduction mode operation in every situation. The oscillator will not start a new primary stroke until the secondary stroke has ended. This is to ensure that FET 7521 will not turn on until the demagnetisation of transformer 5520 is completed. The function is an additional protection feature against:

- saturation of the transformer,
- damage of the components during initial start-up,
- an overload of the output.

The demag(netisation) sense is realised by an internal circuit that guards the voltage (V_{demag}) at pin 4 that is connected to V_{CC} winding by resistor R_1 (R3522). The Figure below shows the circuit and the idealised waveforms across this winding.

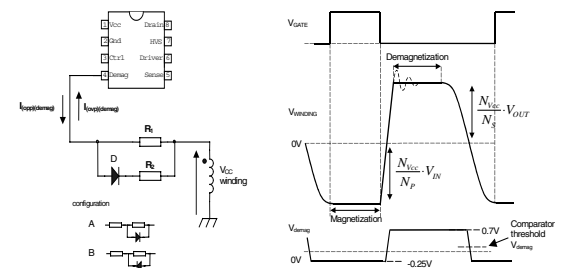


Figure 9-16

Over Voltage Protection

The Over Voltage Protection ensures that the output voltage will remain below an adjustable level. This works by sensing the auxiliary voltage via the current flowing into pin 4 (DEM) during the secondary stroke. This voltage is a well-defined replica of the output voltage. Any voltage spikes are averaged by an internal filter.

If the output voltage exceeds the OVP trip level, the OVP circuit switches the power MOSFET 'off'.

Next, the controller waits until the 'under voltage lock out' level ($UVLO = \pm 9$ V) is reached on pin 1 (V_{CC}). This is followed by a safe restart cycle, after which switching starts again. This process is repeated as long as the OVP condition exists. The output voltage, at which the OVP function trips, is set by the demagnetisation resistor R3522.

Over Current Protection

The internal OCP protection circuit limits the 'sense' voltage on pin 5 to an internal level.

Over Power Protection

During the primary stroke, the rectified AC input voltage is measured by sensing the current drawn from pin 4 (DEM). This current is dependent on the voltage on pin 9 of transformer 5520 and the value of R3522. The current information is used to adjust the peak drain current, which is measured via pin I_{SENSE} .

Short Winding Protection

If the 'sense' voltage on pin 5 exceeds the short winding protection voltage (0.75 V), the converter will stop switching. Once V_{CC} drops below the UVLO level, capacitor C2521 will be recharged and the supply will start again. This cycle will be repeated until the short circuit is removed (safe restart mode). The short winding protection will also protect in case of a secondary diode short circuit.

This protection circuit is activated after the leading edge blanking time (LEB).

LEB time

The LEB (Leading Edge Blanking) time is an internally fixed delay, preventing false triggering of the comparator due to current spikes. This delay determines the minimum 'on' time of the controller.

Over Temperature protection

When the junction temperature exceeds the thermal shutdown temperature (typ. 140° C), the IC will disable the driver. When the V_{CC} voltage drops to UVLO, the V_{CC} capacitor will be recharged to the $V_{(start)}$ level. If the temperature is still too high, the V_{CC} voltage will drop again to the UVLO level (Safe-Restart mode). This mode will persist until the junction temperature drops 8 degrees typically below the shutdown temperature.

Mains dependent operation enabling level

To prevent the supply from starting at a low input voltage, which could cause audible noise, a mains detection is implemented (Mlevel). This detection is provided via pin 8, that detects the minimum start-up voltage between 60 and 100 V. As previous mentioned, the controller is enabled between 60 and 100 V.

An additional advantage of this function is the protection against a disconnected buffer capacitor (C_{IN}). In this case, the supply will not be able to start-up because the V_{CC} capacitor will not be charged to the start-up voltage.

9.7 Control

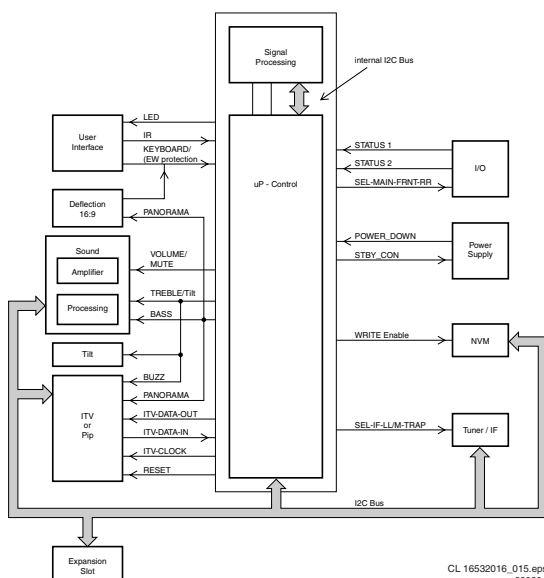


Figure 9-17

9.7.1 Introduction

The microprocessor part of the UOC has the complete control and teletext on board. User menu, Service Default Mode, Service Alignment Mode and Customer Service Mode are generated by the μP . Communication to other ICs is done via the I²C-bus.

9.7.2 I²C-Bus

The main control system, which consists of the microprocessor part of the UOC (7200), is linked to the external devices (tuner, NVM, MSP, etc) by means of the I²C-bus. An internal I²C-bus is used to control other signal processing functions, like video processing, sound IF, vision IF, synchronisation, etc.

9.7.3 User Interface

There are two control signals, called 'KEYBOARD_protn' and 'IR'. Users can interact either through the Remote Control transmitter, or by activation of the appropriate keyboard buttons.

The L01 uses a remote control with RC5 protocol. The incoming signal is connected to pin 67 of the UOC.

The 'Top Control' keyboard, connected to UOC pin 80, can also control the set. Button recognition is done via a voltage divider.

The 'KEYBOARD_protn' line, also serves to detect faults in the E/W circuit, which would require the μP to shut down the set (by forcing the power supply in standby mode).

The front LED (6691) is connected to an output control line of the microprocessor (pin 5). It is activated to provide the user information about whether or not the set is working correctly (e.g., responding to the remote control or fault condition)

9.7.4 Sound Interface

There are three control signals, called 'Volume_Mute', 'Treble_Buzzer_Hosp_app' and 'Bass_panorama'.

The 'Volume_Mute' line controls the sound level output of the audio amplifier or to mute it in case of no video identification or from user command. This line also controls the volume level during set switch 'on' and 'off' (to prevent audio pop). The 'Treble' and 'Bass' lines are used (in mono 4:3 sets) to switch between different smart sound modes. For other set executions (e.g. stereo, widescreen), they have another functionality:

- The 'Bass_panorama' line is used to switch the panorama mode in widescreen sets (to fit 4:3 pictures into a 16:9 display, it is possible to apply a panoramic horizontal distortion, to make a screen-fitting picture without black sidebars or lost video).
- The 'Treble_Buzzer_Hosp_app' is used in ITV applications for other features, and in widescreen sets to enable the 'Tilt' feature (via R3172 on diagram A8) in the deflection part.

9.7.5 In- and Output Selection

For the control of the input and output selections, there are three lines:

- **STATUS1** This signal provides information to the microprocessor on whether a video signal is available on the SCART1 AV input and output port.
 - 0 to 2 V: INTERNAL 4:3
 - 4.5 to 7 V: EXTERNAL 16:9
 - 9.5 to 12 V: EXTERNAL 4:3
- **STATUS2** This signal provides information to the microprocessor on whether a video signal is available on the SCART2 AV input and output port (signal is low). For sets with an SVHS input, it provides the additional

information if a Y/C or CVBS source is present (signal is high). The presence of an external Y/C source makes this line 'high' while a CVBS source makes the line 'low'.

- 0 to 2 V: INTERNAL 4:3
- 4.5 to 7 V: EXTERNAL 16:9
- 9.5 to 12 V: EXTERNAL 4:3

- **SEL-MAIN-FRNT-RR** This is the 'source select control' signal from the microprocessor. This control line is under user control or can be activated by the other two control lines.

9.7.6 Power Supply Control

The microprocessor part is supplied with 3.3 V and 3.9 V both derived from the 'MainAux' voltage via a 3V3 stabiliser (7560) and a diode.

Two signals are used to control the power supply:

- **Stdbby_con** This signal is generated by the microprocessor when over-current takes place at the 'MainAux' line. This is done to enable the power supply into standby burst mode, and to enable this mode during a protection. This signal is 'low' under normal operation conditions and goes to 'high' (3.3 V) under 'standby' and 'fault' conditions.
- **POWER_DOWN** This signal is generated by the power supply. Under normal operating conditions this signal is 'high' (3.3 V). During 'standby' mode, this signal is a pulse train of approx. 10 Hz and a 'high' duration of 5 ms. It is used to give information to the UOC about the fault condition in the Audio amplifier supply circuit. This information is generated by sensing the current on the 'MainAux' line (using voltage drop across R3564 to trigger TS7562). This signal goes 'low' when the DC-current on the 'MainAux' line exceeds 1.6 - 2.0 A. It is also used to give an early warning to the UOC about a power failure. Then the information is used to mute the sound amplifier to prevent a switch off noise and to solve the switch-off spot.

9.7.7 Tuner IF

Pin 3 of the UOC (SEL-IF-LL'_M-TRAP), is an output pin to switch the SAW-filter to the appropriate system.

- If UOC pin 3 is 'low', the selected system is:
 - West Europe: PAL B/G, I, SECAM L/L'
 - East Europe: PAL B/G
 - Asia Pacific: NTSC M
- If UOC pin 3 is 'high', the selected system is:
 - West Europe: SECAM L', L'-NICAM
 - East Europe: PAL D/K
 - Asia Pacific: PAL B/G, D/K, I

Note: For West Europe, two separate SAW filters (1002 and 1004) are used for video and audio (Quasi Split Sound demodulation). For East Europe, one SAW filter (1003) is used for both (Inter-carrier demodulation).

9.7.8 Protection Events

Several protection events are controlled by the UOC:

- **BC protection**, to protect the picture tube from a too high beam current. The UOC has the capability of measuring the normal back level current during the vertical flyback. So if for some reason the CRT circuit is malfunctioning (i.e. high beam current), the normal black current will be out of the 75 μ A range, and the UOC will trigger the power supply to shut down. However, this is a high beam-current situation, the TV screen will be bright white before the set is shut down.
- **I²C protection**, to check whether all I²C IC's are functioning.

In case one of these protections is activated, the set will go into 'standby'. The 'on' and 'standby' LEDs are controlled via the UOC.

9.8 Abbreviation list

2CS	2 Carrier (or Channel) Stereo
ACI	Automatic Channel Installation: algorithm that installs TV sets directly from cable network by means of a predefined TXT page
ADC	Analogue to Digital Converter
AFC	Automatic Frequency Control: control signal used to tune to the correct frequency
AFT	Automatic Fine Tuning
AGC	Automatic Gain Control: algorithm that controls the video input of the featurebox
AM	Amplitude Modulation
AP	Asia Pacific
AR	Aspect Ratio: 4 by 3 or 16 by 9
ATS	Automatic Tuning System
AV	External Audio Video
AVL	Automatic Volume Level
BC-PROT	Beam Current Protection
BCL	Beam Current Limitation
B/G	Monochrome TV system. Sound carrier distance is 5.5 MHz
BLC- INFORMATION	Black current information
BTSC	Broadcast Television Standard Committee. Multiplex FM stereo sound system, originating from the USA and used e.g. in LATAM and AP-NTSC countries
B-TXT	Blue teletext
CC	Closed Caption
ComPair	Computer aided rePair
CRT	Cathode Ray Tube or picture tube
CSM	Customer Service Mode
CTI	Colour Transient Improvement: manipulates steepness of chroma transients
CVBS	Composite Video Blanking and Synchronisation
DAC	Digital to Analogue Converter
DBE	Dynamic Bass Enhancement: extra low frequency amplification
DBX	Dynamic Bass Expander
D/K	Monochrome TV system. Sound carrier distance is 6.5 MHz
DFU	Direction For Use: description for the end user
DNR	Dynamic Noise Reduction
DSP	Digital Signal Processing
DST	Dealer Service Tool: special remote control designed for dealers to enter e.g. service mode
DVD	Digital Versatile Disc
EEPROM	Electrically Erasable and Programmable Read Only Memory
EHT	Extra High Tension
EHT- INFORMATION	Extra High Tension information
EU	Europe
EW	East West, related to horizontal deflection of the set
EXT	External (source), entering the set via SCART or Cinch
FBL	Fast Blanking: DC signal accompanying RGB signals
FILAMENT	Filament of CRT
FLASH	Flash memory
FM	Field Memory
FM	Frequency Modulation

HA	Horizontal Acquisition: horizontal sync pulse coming out of the HIP	SAM	Service Alignment Mode
HFB	Horizontal Flyback Pulse: horizontal sync pulse from large signal deflection	SAP	Second Audio Program
HP	Headphone	SC	Sandcastle: pulse derived from sync signals
Hue	Colour phase control for NTSC (not the same as 'Tint')	S/C	Short Circuit
I	Monochrome TV system. Sound carrier distance is 6.0 MHz	SCAVEM	Scan Velocity Modulation
I2C	Integrated IC bus	SCL	Serial Clock
IF	Intermediate Frequency	SDA	Serial Data
IIC	Integrated IC bus	SDM	Service Default Mode
Interlaced	Scan mode where two fields are used to form one frame. Each field contains half the number of the total amount of lines. The fields are written in "pairs", causing line flicker.	SECAM	SEquence Couleur Avec Memoire. Colour system mainly used in France and East Europe. Colour carriers = 4.406250 MHz and 4.250000 MHz
ITV	Institutional TV	SIF	Sound Intermediate Frequency
LATAM	Latin America	SS	Small Screen
LED	Light Emitting Diode	STBY	Standby
L/L'	Monochrome TV system. Sound carrier distance is 6.5 MHz. L' is Band I, L is all bands except for Band I	SVHS	Super Video Home System
LNA	Low Noise Amplifier	SW	Software
LS	Large Screen	THD	Total Harmonic Distortion
LS	Loudspeaker	TXT	Teletext
LSP	Large signal panel	μP	Microprocessor
M/N	Monochrome TV system. Sound carrier distance is 4.5 MHz	UOC	Ultimate One Chip
MSP	Multistandard Sound Processor: ITT sound decoder	VA	Vertical Acquisition
MUTE	Mute-Line	VBAT	Main supply voltage for the deflection stage (mostly 141 V)
NC	Not Connected	V-chip	Violence Chip
NICAM	Near Instantaneous Compounded Audio Multiplexing. This is a digital sound system, mainly used in Europe.	VCR	Video Cassette Recorder
NTSC	National Television Standard Committee. Colour system mainly used in North America and Japan. Colour carrier NTSC M/N = 3.579545 MHz, NTSC 4.43 = 4.433619 MHz (this is a VCR norm, it is not transmitted off-air)	WYSIWYR	What You See Is What You Record: record selection that follows main picture and sound
NVM	Non Volatile Memory: IC containing TV related data e.g. alignments	XTAL	Quartz crystal
OB	Option Byte	YC	Luminance (Y) and Chrominance (C) signal
OC	Open Circuit		
OSD	On Screen Display		
PAL	Phase Alternating Line. Colour system mainly used in West Europe (colour carrier = 4.433619 MHz) and South America (colour carrier PAL M = 3.575612 MHz and PAL N = 3.582056 MHz)		
PCB	Printed Circuit board		
PIP	Picture In Picture		
PLL	Phase Locked Loop. Used for e.g. FST tuning systems. The customer can give directly the desired frequency		
POR	Power-On Reset		
Progressive Scan	Scan mode where all scan lines are displayed in one frame at the same time, creating a double vertical resolution.		
PTP	Picture Tube Panel (or CRT-panel)		
RAM	Random Access Memory		
RC	Remote Control handset		
RC5	Remote Control system 5, signal from the remote control receiver		
RGB	Red Green Blue		
ROM	Read Only Memory		

10. Spare Parts List

Mono carrier

Various

0127▲	4822 265 11253	Fuse holder
0129	3139 120 10151	NTC holder
0136	4822 492 70788	Fix IC
0137	3139 121 27001	Spring
0138	4822 492 70788	Fix IC
0139	3122 121 24785	Spring for bracket
0141	4822 492 70788	Fix IC
0150▲	3104 311 02201	4P 560mm
0152	3104 301 08411	6P 480mm
0152	3104 301 09421	6P 400mm
0153	3104 301 08381	Cable assy
0153	3104 311 00681	5P 560mm
0211▲	4822 265 20723	2P
0212▲	4822 267 10774	2P male (red)
0219	2422 025 15849	6P male
0220	4822 265 30735	5P
0221▲	4822 267 10966	2P
0222▲	2422 025 10646	2P male
0224	4822 267 10982	2P
0235	2422 025 16745	Scart 42P female
0235	4822 267 10771	Scart 42P female
0243	2422 025 04854	6P female
0244	4822 265 30735	5P
0245	2422 025 04854	6P female
0250	4822 265 11606	3P
0251	2422 025 15849	6P male
0254▲	2422 500 80053	9P female
0265▲	4822 267 10748	3P
0267	4822 267 10735	3P
0268	4822 267 10735	3P
0278	4822 267 10735	3P
1000▲	2422 542 90111	TUN V+U PLL IEC BGDK B
1000▲	3139 147 17401	Tuner UR1316R/A I-3
1002	4822 242 81436	Filter OFWK3953M
1003	4822 242 11055	Filter OFWK6289K
1004	2422 549 44341	Filter OFWK9656M
1200	4822 242 81712	TPWA04B
1201	4822 242 10315	TPT02B-TF21
1400▲	2422 132 07478	Relay 5A 10V
1500▲	2422 086 10914	Fuse 4A 250V
1515▲	2422 132 07444	Relay 5A 12V
1515▲	4822 280 10367	Relay 5A 12V
1660	2422 543 01203	Chrystal 12MHz
1831	4822 242 10769	Chrystal 18.432MHz

-II-

2001	5322 122 32658	22pF 5% 50V
2002	5322 122 32658	22pF 5% 50V
2003	4822 122 33177	10nF 20% 50V
2004	4822 126 13751	47nF 10% 63V
2005	4822 124 40248	10μF 20% 63V
2006	4822 124 80791	470μF 20% 16V
2007	4822 126 14585	100nF 10% 50V
2008	4822 124 40207	100μF 20% 25V
2009	5322 122 32654	22nF 10% 63V
2010	5322 126 10511	1nF 5% 50V
2101	4822 122 33172	390pF 5% 50V
2102	4822 122 33172	390pF 5% 50V
2103	2020 552 96305	4U7 20% 10V
2104	4822 122 33172	390pF 5% 50V
2105	4822 122 33172	390pF 5% 50V
2106	2020 552 96305	4U7 20% 10V
2107	4822 122 33172	390pF 5% 50V
2108	4822 122 33172	390pF 5% 50V
2109	2020 552 96305	4U7 20% 10V
2110	4822 122 33172	390pF 5% 50V
2111	4822 122 33172	390pF 5% 50V
2112	2020 552 96305	4U7 20% 10V
2113	5322 122 32658	22pF 5% 50V
2114	5322 122 32658	22pF 5% 50V
2115	5322 122 32658	22pF 5% 50V
2116	5322 122 32658	22pF 5% 50V
2117	5322 122 32658	22pF 5% 50V
2118	5322 122 32658	22pF 5% 50V
2120	5322 122 32658	22pF 5% 50V
2131	4822 122 33172	390pF 5% 50V
2132	4822 122 33172	390pF 5% 50V
2133	2020 552 96305	4U7 20% 10V
2134	4822 122 33172	390pF 5% 50V
2135	4822 122 33172	390pF 5% 50V
2136	2020 552 96305	4U7 20% 10V
2137	4822 122 33172	390pF 5% 50V
2138	4822 122 33172	390pF 5% 50V

2139	2020 552 96305	4U7 20% 10V
2140	4822 122 33172	390pF 5% 50V
2141	4822 122 33172	390pF 5% 50V
2142	2020 552 96305	4U7 20% 10V
2143	5322 122 31863	330pF 5% 63V
2144	5322 122 31863	330pF 5% 63V
2145	5322 122 32658	22pF 5% 50V
2147	5322 122 32658	22pF 5% 50V
2151	5322 122 31863	330pF 5% 63V
2152	2020 552 96305	4U7 20% 10V
2153	5322 122 31863	330pF 5% 63V
2154	2020 552 96305	4U7 20% 10V
2161	4822 124 12392	47μF 20% 16V
2171	4822 126 13682	100pF 5% 1kV
2171	5322 122 32311	470pF 10% 100V
2172	4822 126 12263	220pF 10% 2kV
2172	5322 122 32311	470pF 10% 100V
2173	5322 122 32311	470pF 10% 100V
2174	5322 122 32311	470pF 10% 100V
2184	2020 552 96305	4U7 20% 10V
2201	4822 126 14585	100nF 10% 50V
2202	4822 126 14585	100nF 10% 50V
2203	4822 126 14585	100nF 10% 50V
2204	4822 126 14585	100nF 10% 50V
2205	4822 126 14076	220nF 25V
2206	5322 122 32531	100pF 5% 50V
2207	4822 126 13694	68pF 1% 63V
2208	4822 126 14585	100nF 10% 50V
2209	4822 124 40769	4.7μF 20% 100V
2210	4822 124 21913	1μF 20% 63V
2211	4822 126 13482	470nF 80/20% 16V
2213	5322 122 32654	22nF 10% 63V
2214	5322 122 32654	22nF 10% 63V
2215	5322 122 32654	22nF 10% 63V
2216	4822 124 81144	1000μF 16V
2217	5322 122 32654	22nF 10% 63V
2219	4822 126 14076	220nF 25V
2220	4822 121 51252	470nF 5% 63V
2221	5322 122 32654	22nF 10% 63V
2230	4822 124 40769	4.7μF 20% 100V
2234	4822 126 14585	100nF 10% 50V
2238	5322 126 10511	1nF 5% 50V
2239	5322 126 10511	1nF 5% 50V
2240	5322 126 10511	1nF 5% 50V
2241	4822 126 13344	1.5nF 5% 63V
2242	4822 126 14043	1μF 20% 16V
2243	4822 122 33177	10nF 20% 50V
2244	5322 121 42386	100nF 5% 63V
2245	4822 126 14076	220nF 25V
2247	4822 124 81144	1000μF 16V
2248	5322 122 32654	22nF 10% 63V
2249	5322 122 32654	22nF 10% 63V
2250	4822 124 22652	2.2μF 20% 50V
2252	5322 126 10511	1nF 5% 50V
2253	5322 126 10511	1nF 5% 50V
2254	4822 051 20008	Jumper
2330	4822 121 51473	470nF 20% 63V
2340	4822 124 11565	10μF 20% 250V
2341▲	4822 126 13599	3.3nF 10% 500V
2342▲	5322 122 31647	1nF 10% 63V
2344	4822 051 20008	Jumper
2344	4822 126 14585	100nF 10% 50V
2345▲	4822 122 31175	1nF 10% 50V
2346▲	4822 126 14237	470pF 10% 2kV
2360	4822 124 40764	22μF 100V
2361	4822 124 40207	100μF 20% 25V
2365	4822 121 40516	22nF 10% 250V
2366	4822 121 40334	100nF 10% 100V
2367	4822 122 33575	220pF 5% 63V
2367	4822 126 13693	56pF 1% 63V
2368	5322 122 32654	22nF 10% 63V
2372	5322 122 32967	5.6pF 10% 63V
2375	5322 122 32531	100pF 5% 50V
2376	4822 126 14585	100nF 10% 50V
2377	4822 126 14585	100nF 10% 50V
2401	4822 124 12438	2.2μF 20% 100V
2401	5322 124 41179	2.2μF 20% 50V
2402▲	4822 122 31177	470pF 10% 500V
2404	4822 124 41751	47μF 20% 50V
2405	5322 126 10511	1nF 5% 50V
2420	4822 126 14043	1μF 20% 16V
2421	4822 126 14043	1μF 20% 16V
2421	5322 122 32268	470P 5% 63V
2422	4822 126 14043	1μF 20% 16V
2423	4822 126 14043	1μF 20% 16V
2441	4822 124 21913	1μF 20% 63V
2443	4822 126 13751	47nF 10% 63V
2444	4822 124 21913	1μF 20% 63V
2450	4822 124 11575	47μF 20% 160V

2451	4822 121 41856	22nF 5% 250V
2451	4822 121 51305	15nF 10% 50V
2454	2222 479 90133	68nF 5% 250V
2454	5322 121 40323	100nF 10% 100V
2455	4822 124 40433	47μF 20% 25V
2456	4822 126 14097	680nF 5% 250V
2457▲	4822 121 43888	360nF 5% 250V
2457▲	4822 126 14096	560nF 5% 250V
2458	4822 124 12438	2.2μF 20% 100V
2459▲	4822 126 13185	680pF 10% 500V
2460	5322 122 32531	100pF 5% 50V
2463▲	4822 126 11503	820pF 10% 2kV
2463▲	4822 126 13435	1.2nF 10% 2kV
2463▲	4822 126 14138	680pF 10% 2kV
2464	4822 121 10739	2.2μF 5% 160V
2465▲	2222 375 90157	13nF 5% 1.6kV
2465▲	4822 121 70618	12nF 5% 1.6kV
2467▲	2222 375 90424	9N1 5% 1kV
2467▲	2222 375 90429	15nF 5% 1kV
2467	4822 121 40483	10nF 10% 400V
2468▲	2222 375 90424	9N1 5% 1kV
2468	5322 121 42532	18nF 10% 400V
2469	4822 126 14097	680nF 5% 250V
2471	5322 121 42386	100nF 5% 63V
2472	4822 121 41854	150nF 5% 63V
2473	5322 121 42386	100nF 5% 63V
2474	4822 122 33127	2.2nF 10% 63V
2475	4822 122 33127	2.2nF 10% 63V
2476	5322 126 10223	4.7nF 10% 63V
2480	5322 121 10472	47μF
2481▲	4822 122 31177	470pF 10% 500V
2482	2222 479 90051	120nF 5% 250V
2482	4822 121 40482	68nF 10% 250V
2484	4822 121 10781	470nF 5% 250V
2485	4822 124 12265	4.7μF 20% 250V
2486	2020 021 91577	470μF 20% 16V
2487	4822 124 80604	47μF 20% 50V
2488	4822 124 81145	1000μF 20% 16V
2489	2020 021 91577	470μF 20% 16V
2490	4822 124 12438	2.2μF 20% 100V
2491	4822 122 31175	1nF 10% 500V
2500▲	4822 126 13589	470nF 275V
2501▲	4822 126 14153	2.2nF 10% 1kV
2502▲	4822 126 14153	2.2nF 10% 1kV
2503	4822 124 12415	220μF 20% 400V
2505▲	4822 126 14153	2.2nF 10% 1kV
2506	4822 121 70141	33nF 5% 400V
2507	5322 122 34099	470pF 10% 63V
2508	4822 122 50116	470pF 10% 1kV
2509	4822 121 10711	100nF 20% 275V
2515▲	4822 126 14049	1.5nF 20% 250V
2516▲	4822 126 13867	330P 20% 250V
2520	4822 126 14585	100nF 10% 50V
2521	4822 124 81151	22μF 50V
2522	4822 126 14585	100nF 10% 50V
2523▲	4822 126 13862	1.5nF 10% 2kV
2525	5322 122 34099	470pF 10% 63V
2526	4822 126 13482	470nF 80/20% 16V
2527	4822 122 33127	2.2nF 10% 63V
2528	5322 122 31647	1nF 10% 63V
2540	4822 122 33177	10nF 20% 50V
2560	4822 126 14152	680pF 10% 1kV
2561	2020 021 91496	100μF 20% 160V
2562	5322 122 32331	1nF 10% 100V
2563	5322 121 42386	100nF 5% 63V
2564	2020 012 93057	2200μF 20% 16V
2566	4822 124 23432	100μF 20% 10V
2567	4822 124 40433	47μF 20% 25V
2568	4822 124 21913	1μF 20% 63V
2580	4822 124 81286	47μF 20% 16V
2581	4822 124 81151	22μF 50V
2601	4822 126 14076	220nF 25V
2602	5322 122 32531	100pF 5% 50V
2606	5322 126 10511	1nF 5% 50V
2607	5322 122 32659	33pF 5% 50V
2608	4822 126 14043	1μF 20% 16V
2609	5322 122 32659	33pF 5% 50V
2611	4822 126 14043	1μF 20% 16V
2612	4822 126 13694	68pF 1% 63V
2613	4822 126 13694	68pF 1% 63V
2615	5322 126 10511	1nF 5% 50V
2618	4822 126 14043	1μF 20% 16V
2619	4822 126 14043	1μF 20% 16V
2801	4822 124 81151	22μF 50V
2802	4822 126 14076	220nF 25V
2803	2020 552 96305	407 20% 10V
2804	2020 552 96305	407 20% 10V
2805	2020 552 96305	407 20% 10V
2831	5322 122 32447	10F 5% 63V

2832	5322 122 32447	1pF 5% 63V
2833	4822 126 13692	47pF 1% 63V
2834	5322 122 32268	470P 5% 63V
2835	4822 122 33575	220pF 5% 63V
2836	4822 126 13344	1.5nF 5% 63V
2837	4822 124 40769	4.7μF 20% 100V
2840	4822 126 14585	100nF 10% 50V
2841	4822 124 40248	10μF 20% 63V
2842	4822 126 14585	100nF 10% 50V
2843	4822 124 40248	10μF 20% 63V
2844	4822 124 40248	10μF 20% 63V
2845	4822 126 14585	100nF 10% 50V
2846	4822 124 40207	100pF 20% 25V
2849	5322 126 10511	1nF 5% 50V
2850	5322 126 10511	1nF 5% 50V
2851	2020 552 96305	4U7 20% 10V
2852	5322 126 10511	1nF 5% 50V
2853	2020 552 96305	4U7 20% 10V
2854	5322 126 10511	1nF 5% 50V
2855	4822 122 30045	27pF 2% 100V
2856	4822 126 13486	15pF 2% 63V
2857	5322 122 33538	150pF 2% 63V
2858	5322 126 10511	1nF 5% 50V
2859	5322 126 10511	1nF 5% 50V
2860	4822 126 13693	56pF 1% 63V
2894	4822 122 33575	220pF 5% 63V
2895	5322 116 80853	560pF 5% 63V
2897	4822 122 33172	390pF 5% 50V
2898	4822 122 33177	10nF 20% 50V
2902	4822 124 11767	470μF 20% 25V
2903	4822 124 21913	1μF 20% 63V
2904	4822 126 13482	470nF 80/20% 16V
2905	5322 122 31647	1nF 10% 63V
2906	4822 126 13482	470nF 80/20% 16V
2907	5322 122 31647	1nF 10% 63V
2908	4822 124 40248	10μF 20% 63V
2910	4822 122 33891	3.3nF 10% 63V
2911	4822 122 33891	3.3nF 10% 63V



3000	4822 116 52175	100Ω 5% 0.5W
3001	4822 116 52175	100Ω 5% 0.5W
3002	4822 051 20008	Jumper
3002	4822 117 10833	10k 1% 0.1W
3003	4822 117 11139	1k5 1% 0.1W
3005	4822 116 52175	100Ω 5% 0.5W
3006	4822 117 11449	2k2 5% 0.1W
3007	4822 117 11507	6k8 1% 0.1W
3008	4822 117 11449	2k2 5% 0.1W
3010	4822 117 13577	330Ω 1% 1.25W
3101	4822 116 83868	150Ω 5% 0.5W
3102	4822 117 13579	220k 1% 0.1W
3103	4822 116 83868	150Ω 5% 0.5W
3104	4822 117 10834	47k 1% 0.1W
3105	4822 116 83868	150Ω 5% 0.5W
3106	4822 117 13579	220k 1% 0.1W
3107	4822 116 83868	150Ω 5% 0.5W
3108	4822 117 10834	47k 1% 0.1W
3109	4822 116 52201	75Ω 5% 0.5W
3110	4822 116 52175	100Ω 5% 0.5W
3111	4822 116 52264	27k 5% 0.5W
3112	4822 117 11507	6k8 1% 0.1W
3113	4822 116 52201	75Ω 5% 0.5W
3114	4822 116 52175	100Ω 5% 0.5W
3115	4822 116 52201	75Ω 5% 0.5W
3116	4822 116 52175	100Ω 5% 0.5W
3117	4822 116 52201	75Ω 5% 0.5W
3118	4822 116 52175	100Ω 5% 0.5W
3119	4822 116 52199	68Ω 5% 0.5W
3120	4822 051 10102	1k 2% 0.25W
3121	4822 116 52201	75Ω 5% 0.5W
3122	4822 116 52176	10Ω 5% 0.5W
3131	4822 116 83868	150Ω 5% 0.5W
3132	4822 117 13579	220k 1% 0.1W
3133	4822 116 83868	150Ω 5% 0.5W
3134	4822 117 10834	47k 1% 0.1W
3135	4822 116 83868	150Ω 5% 0.5W
3136	4822 117 13579	220k 1% 0.1W
3137	4822 116 83868	150Ω 5% 0.5W
3138	4822 117 10834	47k 1% 0.1W
3139	4822 116 52264	27k 5% 0.5W
3140	4822 117 11507	6k8 1% 0.1W
3141	4822 116 52201	75Ω 5% 0.5W
3142	4822 116 52175	100Ω 5% 0.5W
3143	4822 116 52199	68Ω 5% 0.5W
3144	4822 051 10102	1k 2% 0.25W
3145	4822 116 83868	150Ω 5% 0.5W
3146	4822 116 52176	10Ω 5% 0.5W
3150	4822 116 83884	47k 5% 0.5W
3151	4822 116 83868	150Ω 5% 0.5W
3152	4822 116 83884	47k 5% 0.5W
3152	4822 117 13579	220k 1% 0.1W

3153	4822 116 83868	150Ω 5% 0.5W
3154	4822 117 13579	220k 1% 0.1W
3155	4822 116 52195	47Ω 5% 0.5W
3155	4822 116 52201	75Ω 5% 0.5W
3171	4822 050 11204	120k 1% 0.4W
3172	4822 116 83961	6k8 5%
3173	4822 116 52297	68k 5% 0.5W
3174	4822 116 52297	68k 5% 0.5W
3200	4822 116 83881	390Ω 5% 0.5W
3201	4822 116 52175	100Ω 5% 0.5W
3202	4822 116 52175	100Ω 5% 0.5W
3203	4822 116 52175	100Ω 5% 0.5W
3204	4822 050 21003	10k 1% 0.6W
3206	4822 051 20333	33k 5% 0.1W
3207	4822 050 11002	1k 1% 0.4W
3208	4822 051 20391	390Ω 5% 0.1W
3208	4822 117 10353	150Ω 1% 0.1W
3209	4822 117 11373	100Ω 1%
3212	4822 051 20471	470Ω 5% 0.1W
3213	4822 051 20561	560Ω 5% 0.1W
3214	4822 116 52175	100Ω 5% 0.5W
3217	4822 051 20334	330k 5% 0.1W
3218	4822 117 11149	82k 1% 0.1W
3219	4822 117 11449	2k2 5% 0.1W
3220	4822 116 52175	100Ω 5% 0.5W
3223	4822 117 11373	100Ω 1%
3226	4822 051 20561	560Ω 5% 0.1W
3229	4822 117 11454	820Ω 1% 0.1W
3230	4822 117 11504	270Ω 1% 0.1W
3231	4822 051 20561	560Ω 5% 0.1W
3233	4822 117 11454	820Ω 1% 0.1W
3235	4822 116 52175	100Ω 5% 0.5W
3236	4822 051 20154	150k 5% 0.1W
3237	4822 051 20122	1k2 5% 0.1W
3238	4822 051 20561	560Ω 5% 0.1W
3239	4822 117 11504	270Ω 1% 0.1W
3240	4822 117 10837	100k 1% 0.1W
3241	4822 051 20223	22k 5% 0.1W
3242	4822 051 20273	27k 5% 0.1W
3244	4822 116 52231	820Ω 5% 0.5W
3245	4822 051 20393	39k 5% 0.1W
3246	4822 117 10833	10k 1% 0.1W
3247	4822 051 20564	560k 5% 0.1W
3247	4822 051 20684	680k 5% 0.1W
3248	4822 051 20333	33k 5% 0.1W
3249	4822 116 52231	820Ω 5% 0.5W
3250	4822 050 11002	1k 1% 0.4W
3250	4822 116 52303	8k2 5% 0.5W
3251	4822 116 52175	100Ω 5% 0.5W
3256	4822 051 10102	1k 2% 0.25W
3257	4822 051 20106	10M 5% 0.1W
3258	4822 117 10837	100k 1% 0.1W
3259	4822 051 20474	470k 5% 0.1W
3331	4822 116 52175	100Ω 5% 0.5W
3332	3198 013 01020	1k 2% 0.5W
3333	4822 116 52175	100Ω 5% 0.5W
3334	3198 013 01020	1k 2% 0.5W
3335	4822 116 52175	100Ω 5% 0.5W
3336	3198 013 01020	1k 2% 0.5W
3340▲	4822 052 11109	10Ω 5% 0.5W
3341▲	4822 052 10188	1Ω8 5% 0.33W
3342▲	4822 052 10188	1Ω8 5% 0.33W
3343	3198 013 01520	1k5 2% 0.5W
3344	4822 116 52186	22Ω 5% 0.5W
3345	4822 117 13016	1M
3346	4822 116 52186	22Ω 5% 0.5W
3347	4822 051 20008	Jumper
3347	4822 117 13577	330Ω 1% 1.25W
3348	4822 051 10102	1k 2% 0.25W
3350	4822 051 20008	Jumper
3350	4822 117 13577	330Ω 1% 1.25W
3351	4822 051 10102	1k 2% 0.25W
3353	4822 051 20008	Jumper
3353	4822 117 13577	330Ω 1% 1.25W
3354	4822 051 10102	1k 2% 0.25W
3356	4822 051 20008	Jumper
3357	4822 051 20008	Jumper
3358	4822 051 20008	Jumper
3360	4822 117 13424	8k2 5% 5W
3362▲	4822 052 10109	10Ω 5% 0.33W
3363	4822 116 52231	820Ω 5% 0.5W
3364	4822 116 81039	1Ω8 5% 0.5W
3364	5322 116 53564	3Ω3 5% 0.5W
3368	4822 117 12955	2k7 1% 0.1W
3369	4822 117 10833	10k 1% 0.1W
3370	4822 117 11503	220Ω 1% 0.1W
3370	4822 117 13577	330Ω 1% 1.25W
3371	4822 051 20472	4k7 5% 0.1W
3371	4822 117 10833	10k 1% 0.1W
3373	4822 117 11503	220Ω 1% 0.1W
3374	4822 116 52291	56k 5% 0.5W
3375	4822 116 83883	470Ω 5% 0.5W
3376	4822 051 20008	Jumper
3377	4822 116 52176	10Ω 5% 0.5W

3378	4822 117 11148	56k 1% 0.1W
3379	4822 051 20472	4k7 5% 0.1W
3379	4822 117 10833	10k 1% 0.1W
3382	4822 117 11139	1k5 1% 0.1W
3383	4822 051 20471	470Ω 5% 0.1W
3384	4822 117 11454	820Ω 1% 0.1W
3385	4822 116 81039	1Ω8 5% 0.5W
3385	5322 116 53564	3Ω3 5% 0.5W
3386	4822 051 20472	4k7 5% 0.1W
3386	4822 117 10833	10k 1% 0.1W
3387	4822 051 20471	470Ω 5% 0.1W
3388	4822 116 83872	220Ω 5% 0.5W
3389	4822 116 83872	220Ω 5% 0.5W
3390	4822 051 20339	33Ω 5% 0.1W
3391	4822 051 20339	33Ω 5% 0.1W
3392	4822 117 11503	220Ω 1% 0.1W
3393	4822 051 20472	4k7 5% 0.1W
3400	4822 116 52219	330Ω 5% 0.5W
3401	4822 050 23303	33k 1% 0.6W
3401	4822 116 83874	220k 5% 0.5W
3403	4822 116 52234	100k 5% 0.5W
3403	4822 116 52304	82k 5% 0.5W
3404	4822 050 11002	1k 1% 0.4W
3405	4822 050 24708	4Ω7 1% 0.6W
3405	4822 116 52176	10Ω 5% 0.5W
3406	4822 050 24708	4Ω7 1% 0.6W
3406	4822 116 52176	10Ω 5% 0.5W
3407	4822 050 24708	4Ω7 1% 0.6W
3408	4822 050 11002	1k 1% 0.4W
3408	4822 116 52175	100Ω 5% 0.5W
3410	4822 050 21003	10k 1% 0.6W
3411▲	4822 052 10478	4Ω7 5% 0.33W
3441	4822 117 11373	100Ω 1%
3442	4822 117 11507	6k8 1% 0.1W
3443	4822 051 20105	1M 5% 0.1W
3445	4822 116 52244	15k 5% 0.5W
3446	4822 116 52289	5k6 5% 0.5W
3447	4822 116 52213	180Ω 5% 0.5W
3448	4822 116 52231	820Ω 5% 0.5W
3449	4822 116 52199	68Ω 5% 0.5W
3450	4822 116 52191	33Ω 5% 0.5W
3451▲	4822 052 10109	10Ω 5% 0.33W
3452▲	4822 050 24703	47k 1% 0.6W
3453▲	4822 050 11002	1k 1% 0.4W
3454▲	4822 050 21503	15k 1% 0.6W
3455	4822 053 11688	6Ω8 5% 2W
3456	4822 051 20008	Jumper
3457	4822 051 20008	Jumper
3458	4822 050 11002	1k 1% 0.4W
3459	4822 053 11153	15k 5% 2W
3460	4822 116 52276	3k9 5% 0.5W
3463	4822 116 52191	33Ω 5% 0.5W
3465	4822 050 22703	27k 1% 0.6W
3468	4822 116 52175	100Ω 5% 0.5W
3468	4822 116 52195	47Ω 5% 0.5W
3468	4822 116 52213	180Ω 5% 0.5W
3469	4822 116 52269	3k3 5% 0.5W
3470	4822 051 20154	150k 5% 0.1W
3470	4822 051 20334	330k 5% 0.1W
3471	4822 050 23308	3Ω3 1% 0.6W
3471	4822 050 25608	5Ω6 1% 0.6W
3472	4822 050 23308	3Ω3 1% 0.6W
3472	4822 050 23308	3Ω3 1% 0.6W
3473	4822 050 23308	3Ω3 1% 0.6W
3473	4822 050 24708	4Ω7 1% 0.6W
3473	4822 050 26808	6Ω8 1% 0.6W
3474	4822 050 22202	2k2 1% 0.6W
3475	4822 050 22202	2k2 1% 0.6W
3477	4822 116 83868	150Ω 5% 0.5W
3478	4822 116 83868	150Ω 5% 0.5W
3479	4822 117 12955	2k7 1% 0.1W
3480	4822 116 80676	1Ω5 5% 0.5W
3481▲	4822 050 21003	10k 1% 0.6W
3481▲	4822 050 21503	15k 1% 0.6W
3482▲	4822 050 22403	24k 1% 0.6W
3482▲	4822 050 26802	6k8 1% 0.6W
3482▲	4822 050 28202	8k2 1% 0.6W
3484	4822 116 52276	3k9 5% 0.5W
3486	4822 053 12229	22Ω 5% 3W
3486	4822 053 12339	33Ω 5% 3W
3488▲	4822 052 11478	4Ω7 5% 0.5W
3489	4822 116 52276	3k9 5% 0.5W
3490	4822 116 52303	8k2 5% 0.5W
3491	4822 050 21003	10k 1% 0.6W
3491	4822 116 52264	27k 5% 0.5W
3492	4822 050 11002	1k 1% 0.4W
3492	4822 116 52263	2k7 5% 0.5W
3492	4822 116 52283	4k7 5% 0.5W
3493▲	4822 052 10688	6Ω8 5% 0.33W
3494▲	4822 052 11478	4Ω7 5% 0.5W
3495	4822 051 20223	22k 5% 0.1W
3496	4822 117 10837	100k 1% 0.1W
3497	4822 117 10837	100k 1% 0.1W
3498	4822 117 11383	12k 1% 0.1W

7831	9322 160 79682	MSP3415G-PO-B8 FM
7832	4822 130 60511	BC847B
7833	4822 130 60511	BC847B
7834	4822 130 60511	BC847B
7835	4822 130 60511	BC847B
7901	9322 158 65667	AN7522N

CRT panel

Various

0141	4822 492 70788	Fix IC
0244	4822 265 30735	5P
0245	2422 025 04854	6P
0254▲	2422 500 80053	CRT 9P female
0254▲	2422 500 80067	CRT 9P female
0278	4822 267 10735	3P

—II—

2330	4822 121 51473	470nF 20% 63V
2340	4822 124 11565	10μF 20% 250V
2341▲	4822 126 13599	3.3nF 10% 500V
2342▲	5322 122 31647	1nF 10% 63V
2343▲	4822 126 12278	3300pF 10% 2kV
2344	4822 051 20008	Jumper
2345▲	4822 122 31175	1nF 10% 500V
2346▲	4822 126 12263	220pF 10% 2kV
2346▲	4822 126 14237	470pF 10% 2kV
2360	4822 124 40764	22μF 100V
2361	4822 124 40207	100μF 20% 25V
2365	4822 121 40516	22nF 10% 250V
2366	4822 121 40334	100nF 10% 100V
2367	4822 122 33575	220pF 5% 63V
2368	5322 122 32654	22nF 10% 63V
2376	4822 126 14585	100nF 10% 50V
2377	4822 126 14585	100nF 10% 50V

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3331	4822 116 52175	100Ω 5% 0.5W
3332	3198 013 01020	1k 2% 0.5W
3333	4822 116 52175	100Ω 5% 0.5W
3334	3198 013 01020	1k 2% 0.5W
3335	4822 116 52175	100Ω 5% 0.5W
3336	3198 013 01020	1k 2% 0.5W
3340▲	4822 052 11109	10Ω 5% 0.5W
3341▲	4822 052 10108	1Ω 5% 0.33W
3341▲	4822 052 10158	1Ω5 5% 0.33W
3341▲	4822 052 10188	1Ω8 5% 0.33W
3342▲	4822 052 10108	1Ω 5% 0.33W
3342▲	4822 052 10158	1Ω5 5% 0.33W
3342▲	4822 052 10188	1Ω8 5% 0.33W
3343	3198 013 01520	1k5 2% 0.5W
3344	4822 116 52186	22Ω 5% 0.5W
3345	4822 117 13016	1M
3346	4822 116 52186	22Ω 5% 0.5W
3347	4822 117 13577	330Ω 1% 1.25W
3348	4822 051 10102	1k 2% 0.25W
3350	4822 117 13577	330Ω 1% 1.25W
3351	4822 051 10102	1k 2% 0.25W
3353	4822 117 13577	330Ω 1% 1.25W
3354	4822 051 10102	1k 2% 0.25W
3360	4822 117 13424	8k2 5% 5W
3362▲	4822 052 10109	10Ω 5% 0.33W
3363	4822 116 52231	820Ω 5% 0.5W
3364	4822 116 81039	1Ω8 5% 0.5W
3368	4822 117 12955	2k7 1% 0.1W
3369	4822 117 10833	10k 1% 0.1W
3370	4822 117 11503	220Ω 1% 0.1W
3371	4822 051 20472	4k7 5% 0.1W
3373	4822 117 11503	220Ω 1% 0.1W
3374	4822 116 52291	56k 5% 0.5W
3376	4822 051 20008	Jumper
3377	4822 116 52176	10Ω 5% 0.5W
3378	4822 117 11148	56k 1% 0.1W
3379	4822 051 20472	4k7 5% 0.1W
3382	4822 117 11139	1k5 1% 0.1W
3383	4822 051 20471	470Ω 5% 0.1W
3384	4822 117 11454	820Ω 1% 0.1W
3385	4822 116 81039	1Ω8 5% 0.5W
3386	4822 051 20472	4k7 5% 0.1W
3387	4822 051 20471	470Ω 5% 0.1W
3390	4822 051 20339	33Ω 5% 0.1W
3391	4822 051 20339	33Ω 5% 0.1W
3392	4822 117 11503	220Ω 1% 0.1W
3393	4822 051 20472	4k7 5% 0.1W
4xxx	4822 051 10008	0Ω 5% 0.25W
4xxx	4822 051 20008	0Ω 5% 0.25W

5342	4822 157 50961	22μH
5342	4822 157 63788	18μH 10%
5346	2722 122 00263	Delay line 60ns
5347	2722 122 00263	Delay line 60ns
5348	2722 122 00263	Delay line 60ns
5360	4822 157 51216	5.6μH

→|←

6331	4822 130 30842	BAV21
6333	4822 130 30842	BAV21
6335	4822 130 30842	BAV21
6360	4822 130 30621	1N4148
6361	4822 130 11397	BAS316
6362	4822 130 11397	BAS316
6364	4822 130 11397	BAS316
6365	4822 130 11397	BAS316

ⓧ

7330	9352 561 40112	TDA6108
7331	4822 130 60511	BC847B
7332	4822 130 60511	BC847B
7333	4822 130 60511	BC847B
7360	4822 130 40959	BC547B
7362	9322 166 55682	2SA1358
7363	4822 130 40959	BC547B
7365	9322 166 56682	2SC3421
7366	4822 130 41646	BF423
7367	4822 130 44568	BC557B

Side AV panel

Various

0232▲	4822 267 31014	Headphone socket
0246	4822 267 10734	5P
0250	4822 265 11606	3P
0251	4822 267 10735	3P
0253	2422 025 16382	3P male
0254	4822 267 10734	5P
0255	4822 267 10565	4P
1831	4822 242 10769	Chrystal 18.432MHz

—II—

2171	5322 122 32311	470pF 10% 100V
2172	5322 122 32311	470pF 10% 100V
2173	5322 122 32311	470pF 10% 100V
2174	5322 122 32311	470pF 10% 100V
2176	5322 122 32311	470pF 10% 100V
2177	4822 124 40248	10μF 20% 63V
2178	5322 122 32311	470pF 10% 100V
2179	4822 124 40248	10μF 20% 63V
2234	4822 126 14585	100nF 10% 50V
2238	5322 126 10511	1nF 5% 50V
2239	5322 126 10511	1nF 5% 50V
2240	5322 126 10511	1nF 5% 50V
2831	5322 122 32447	1pF 5% 63V
2832	5322 122 32447	1pF 5% 63V
2833	4822 126 13692	47pF 1% 63V
2834	5322 122 32268	470P 5% 63V
2835	4822 122 33575	220pF 5% 63V
2836	4822 126 13344	1.5nF 5% 63V
2837	4822 124 40769	4.7μF 20% 100V
2840	4822 126 14585	100nF 10% 50V
2841	4822 124 40248	10μF 20% 63V
2842	4822 126 14585	100nF 10% 50V
2843	4822 124 40248	10μF 20% 63V
2844	4822 124 40248	10μF 20% 63V
2845	4822 126 14585	100nF 10% 50V
2846	4822 124 40207	100μF 20% 25V
2849	5322 126 10511	1nF 5% 50V
2850	5322 126 10511	1nF 5% 50V
2855	4822 122 30045	27pF 2% 100V
2856	4822 126 13486	15pF 2% 63V
2857	5322 122 33538	150pF 2% 63V
2858	5322 126 10511	1nF 5% 50V
2859	5322 126 10511	1nF 5% 50V
2860	4822 126 13693	56pF 1% 63V
2894	4822 122 33575	220pF 5% 63V
2895	5322 116 80853	560pF 5% 63V
2897	4822 122 33172	390pF 5% 50V
2898	4822 122 33177	10nF 20% 50V

3010	4822 117 13577	330Ω 1% 1.25W
3150	4822 116 83884	47k 5% 0.5W
3151	4822 116 83868	150Ω 5% 0.5W
3152	4822 116 83884	47k 5% 0.5W
3153	4822 116 83868	150Ω 5% 0.5W
3155	4822 116 52201	75Ω 5% 0.5W
3156	4822 116 52206	120Ω 5% 0.5W
3157	4822 116 52206	120Ω 5% 0.5W
3233	4822 117 11454	820Ω 1% 0.1W
3236	4822 051 20154	150k 5% 0.1W
3237	4822 051 20122	1k2 5% 0.1W
3238	4822 051 20561	560Ω 5% 0.1W
3239	4822 117 11504	270Ω 1% 0.1W
3240	4822 117 10837	100k 1% 0.1W
3831	4822 117 10834	47k 1% 0.1W
3832	4822 116 52175	100Ω 5% 0.5W
3833	4822 116 52175	100Ω 5% 0.5W
3840	4822 051 20472	4k7 5% 0.1W
3841	4822 051 20822	8k2 5% 0.1W
3842	4822 051 10102	1k 2% 0.25W
3843	4822 117 11449	2k2 5% 0.1W
3849	4822 051 20471	470Ω 5% 0.1W
4xxx	4822 051 10008	0Ω 5% 0.25W
4xxx	4822 051 20008	0Ω 5% 0.25W

5831	4822 157 11139	6.8μH 5%
5832	4822 157 11139	6.8μH 5%
5833	4822 157 11139	6.8μH 5%
5835	3198 018 31290	12U 10%

→|←

6161	4822 130 34278	BZX79-B6V8
6831	4822 130 30621	1N4148

ⓧ

7209	5322 130 42718	BFS20
7210	5322 130 42718	BFS20
7831	9322 160 79682	MSP3415G-PO-B8
7834	4822 130 60511	BC847B
7835	4822 130 60511	BC847B

Front interfac

Various

0038	3139 124 33011	Power button
0157▲	3139 131 01251	5P 400mm
0177▲	3139 131 01471	2P 340mm
0211▲	2422 025 16268	2P
0212▲	2422 025 16268	2P
0214	2422 025 06353	5P
0231▲	2422 128 02972	Switch
0239	4822 267 10735	3P
1600	4822 276 13775	Switch
1601	4822 276 13775	Switch
1602	4822 276 13775	Switch
1603	4822 276 13775	Switch

—II—

2691	4822 124 40248	10μF 20% 63V
2698	5322 121 42386	100nF 5% 63V

—□—

3500▲	4822 053 21335	3M3 5% 0.5W
3501▲	4822 053 21335	3M3 5% 0.5W
3681	4822 051 20391	390Ω 5% 0.1W
3682	4822 051 20332	3k3 5% 0.1W
3683	4822 051 20391	390Ω 5% 0.1W
3684	4822 051 20561	560Ω 5% 0.1W
3685	4822 051 20561	560Ω 5% 0.1W
3686	4822 117 11139	1k5 1% 0.1W
3691	4822 116 52219	330Ω 5% 0.5W
3691	4822 117 13577	330Ω 1% 1.25W
3693	4822 116 83872	220Ω 5% 0.5W
3693	4822 117 11503	220Ω 1% 0.1W

→|←

6681	4822 130 31983	BAT85
6691▲	9322 050 99682	LTL-10224WHCR

6692 9322 127 54667 TSOP1836UH1

Top control pa**Various**

0141 4822 492 70788 Fix IC
0158 3139 131 00842 3P 1000mm
0158 3139 131 01771 3P 1000mm
0214 4822 267 10734 5P
0215 4822 267 10748 3P
0239 4822 267 10735 3P
0244 4822 265 30735 5P
0245 2422 025 04854 6P
0254▲ 2422 500 80053 9P female
1091 4822 276 13775 Switch
1092 4822 276 13775 Switch
1093 4822 276 13775 Switch
1094 4822 276 13775 Switch

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2330 4822 121 51473 470nF 20% 63V
2340 4822 124 11565 10μF 20% 250V
2341▲ 4822 126 13599 3.3nF 10% 500V
2342▲ 5322 122 31647 1nF 10% 63V
2343▲ 4822 126 13435 1.2nF 10% 2kV
2345▲ 4822 122 31175 1nF 10% 500V

—□—

3091 4822 051 20561 560Ω 5% 0.1W
3092 4822 051 20391 390Ω 5% 0.1W
3093 4822 051 20561 560Ω 5% 0.1W
3094 4822 051 20391 390Ω 5% 0.1W
3095 4822 051 20332 3k3 5% 0.1W
3096 4822 117 11139 1k5 1% 0.1W
3331 4822 116 52175 100Ω 5% 0.5W
3332 3198 013 01020 1k 2% 0.5W
3333 4822 116 52175 100Ω 5% 0.5W
3334 3198 013 01020 1k 2% 0.5W
3335 4822 116 52175 100Ω 5% 0.5W
3336 3198 013 01020 1k 2% 0.5W
3340▲ 4822 052 11109 10Ω 5% 0.5W
3341▲ 4822 052 10108 1Ω 5% 0.33W
3342▲ 4822 052 10108 1Ω 5% 0.33W
3343 3198 013 01520 1k5 2% 0.5W
3344 4822 116 52186 22Ω 5% 0.5W
3345 4822 117 13016 1M
3346 4822 116 52186 22Ω 5% 0.5W

—⌒—

5342 4822 156 21125 3.9μH 10%

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6091 4822 130 31983 BAT85
6331 4822 130 30842 BAV21
6333 4822 130 30842 BAV21
6335 4822 130 30842 BAV21