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. They refer to the diagram letters. 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 Mode (CSM) is used for communication between a Philips Customer Care Centre (P3C) and a customer.

There is also the option of using ComPair, a hardware interface between a computer (see requirements below) and the TV chassis. It offers the ability of structured troubleshooting, test pattern generation, error code reading, software version readout, and software upgrading.
Minimum requirements: a Pentium processor, Windows 95/98, and a CD-ROM drive (see also paragraph 5.4).

5.2.1 Service Default Mode (SDM)

Purpose
- To create a pre-defined 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.
- Colour system: SECAM L for France or PAL B/G for the rest of Europe.
- All picture settings at 50 % (brightness, colour, contrast).
- All sound settings at 50 %, except volume at 25 %.
- All service-unfriendly modes (if present) are disabled, like:
  - (Sleep) timer.
  - Child/parental lock.
  - Blue mute.
  - Automatic volume limiter (AVL).
  - Auto switch-off (when no video signal was received for 10 minutes).
  - Skip/blank of non-favourite pre-sets.
  - Smart modes.
  - Auto store of personal presets.
  - Auto user menu time-out.

How to enter SDM
Use one of the following methods:
- Use the standard RC-transmitter and key in the code '062596', directly followed by the 'MENU' button.

Note: It is possible that, together with the SDM, the main menu will appear. To switch it off, push the 'MENU' button again.
- When you shorten for a moment the two solder pads on the 'external part' of the SSB print, with the indication SDM. Activation can be performed in all modes, except when the set has a problem with the main-processor. **Caution**: If the SDM is entered via the pins, all the software-controlled protections are de-activated.
- Use the DST-emulation feature of ComPair.
- Use the 'DEFAULT' button on the Dealer Service Tool (RC7150).

After entering this mode, 'SDM' will appear in the upper right corner of the screen.

How to navigate
When you press the 'MENU' button on the RC transmitter, the set will toggle between the SDM and the normal user menu (with the SDM mode still active in the background).

How to exit SDM
Use one of the following methods:
- Switch the set to STANDBY via the RC-transmitter.
- Press the 'EXIT' button on the DST.
- Via a standard customer RC-transmitter: key in '00'-sequence.

5.2.2 Service Alignment Mode (SAM)

Purpose
- To perform (software) alignments.
- To change option settings.
- To easily identify the used software version.
- To view operational hours.
- To display (or clear) the error code buffer.

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

How to enter SAM
Use one of the following methods:
- Via a standard RC transmitter: key in the code '062596' directly followed by the 'OSD [i+]' button
- Short for a moment the two solder pads on the 'external part' of the SSB print, with the indication SAM.
- Use the DST-emulation feature of ComPair.
- Press the ALIGN button on the DST while the set is in the normal operation

After entering this mode, 'SAM' will appear in the upper right corner of the screen.

Contents of SAM:
- **Rom Version.** Displays the date of the software and the software version of the ROM
  (**example**: EM5EU1-1.0_01234= AAABBC-X.Y_NNNNN).
  - AAA= the chassis name (EM5).
  - BB= the region: EU= Europe, AP= Asia Pacific PAL/Multi, AN= Asia Pacific NTSC, US= USA, LT= LATAM.
  - C= the language cluster number.
  - X.Y= the software version, where X is the main version number (different numbers are not compatible with one another) and Y is the sub version number (a higher number is always compatible with a lower number).
  - NNNNN= last five digits of 12nc code software.

- **Operation Hours.** Displays the accumulated total of operation hours (not the standby hours).
- **Errors** (followed by maximal 10 errors). The most recent error is displayed at the upper left (for an error explanation see paragraph 5.5).
- **Defect. Module.** Here the module that generates the error is displayed. If there are multiple errors in the buffer, which are not all generated by a single module, there is probably another defect. It will then display the message 'Unknown' here.
- **Reset Error Buffer.** When you press the 'OK' button, the error buffer is reset.
- **Alignments.** This will activate the 'Alignments' sub-menu.
- **Dealer Options.** Extra features for the dealers.
- **Service Options.** Extra features for Service.
- **Initialise NVM.** When an NVM was corrupted (or replaced) in the former EM3 chassis, the microprocessor replaces the content with default data (to assure that the set can operate). However, all pre-sets and alignment values are gone now, and option numbers are also not correct. So, this was a very drastic way.
  In the EM5 chassis, the procedure is implemented in another way: The moment the processor recognises a corrupted NVM, an extra line will be added to the SAM menu: '**Initialise NVM**'.
  Now, you can do two things (dependent of the service instructions at that moment):
  – Save the content of the NVM via ComPair for development analysis, **before** initialising. This will give the Philips Service department an extra possibility for diagnosis (e.g. when Development asks for this).
  – Initialise the NVM (same as in the past, however now it happens conscious).
- **Store Options.** All options are stored when pressing the 'OK'-button
- **Functional Test.** All devices are tested via the 'OK' button. Eventual errors are displayed in the error buffer. The error buffer is not erased, the content returns when this test is terminated.
- **Broadcast Info.** The purpose of this menu is to debug the broadcast, NOT the TV. The menu gives an overview of what is received on the current preset related to Time extraction, CNI codes, and NexTView transmission. Following items are displayed:
  – **Preset.** Shows the preset number.
  – **Local.** Local date and time from the selected preset.
  – **UTC** (Coordinated Universal Time). Extracted from the selected preset.
  – **LTO** (Local Time Offset). Extracted from the selected preset.
  – **CNI** (Country and Network Identification). Extracted from the current preset (displayed as a four digit hexadecimal number. The CNI number identifies the broadcaster.
  – **NexTView service** (optional). This item gives information about the type of NexTView service that is available for the current preset. The possible strings are:
    1. NexTView provider.
    2. NexTView data available from preset xx (where xx is the preset number).
    3. No NexTView data available.
  – **CNI Linking** (optional). 'Link' refers to the connection between the broadcasted NexTView programme information and the preset number. The possible strings are:
    1. Data available for preset xx xx xx (where xx xx xx is a list off all presets for which a CNI link is available).
    2. 'Automatic link' or ' Manual link', depending on what is read from the broadcast and from the CNI table in the NVM. 'Automatic' means that the link has been made based on broadcasted information, without user-interaction. 'Manual' means that the user has established this link by selecting a preset

in the pop-up menu that you get after setting a reminder/recording/lock/watch in EPG. Erase a wrong 'Manual link' by entering the Manual Installation menu and (without changing anything) activate 'Store'.
    3. Nothing is shown.

How to navigate
- In SAM, you can select the menu items with the CURSOR UP/DOWN key on the RC-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.

How to exit SAM
Use one of the following methods:
- Press the 'MENU' button on the RC-transmitter, or
- Switch the set to STANDBY (⏻) via the RC-transmitter, or
- Press the 'EXIT' button on the DST.

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 than ask the customer to activate the CSM, in order to identify the status of the set. Now, the service technician can judge the severity of the complaint. In many 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 CSM
Use one of the following methods:
- Press the 'MUTE' button on the RC-transmitter **simultaneously** with the 'MENU' button on the TV (top control) for (at least) 4 seconds.
- Key in the code '123654' via the standard RC transmitter.

Note: Activation of the CSM is only possible if there is no (user) menu on the screen!

How to navigate
By means of the 'CURSOR-DOWN/UP' knob on the RC-transmitter you can navigate through the five menus.

Contents of CSM

Customer Service Menu 1
- **Software version (example: EM5EU1-1.0_01234).** Displays the build in software version. In case of field problems related to software, software flash-RAM pos.7006 must be changed by a new one. Do this via soldering. You will find details of the software versions in the chapter 'Software Survey' of the 'Product Survey - Colour Television' publication. This publication is generated four times a year.
- **Feature Box.** The 12NC-number of the build in Feature Box software
- **Set Type.** This information is very helpful for a helpdesk/ workshop as reference for further diagnosis. In this way, it is not necessary for the customer to look at the rear of the TV-set.
- **Code 1.** Gives the last 5 errors of the error buffer. As soon as the built-in diagnose software has detected an error the buffer is adapted. The last occurred error is displayed on the leftmost position. Each error code is displayed as a 3-digit number. When less than 10 errors occur, the rest of

the buffer is empty ('000'). See also paragraph 5.5 for a description.

- **Code 2.** Gives the first 5 errors of the error buffer. See also paragraph 5.5 for a description.
- **Volume.** Gives the last status of the volume as set by the customer. The value can vary from 0 (volume is minimum) to 100 (volume is maximum). Volume values can be changed via the volume key on the RC-transmitter.
- **Brightness.** Gives the last status of the brightness as set by the customer. The value can vary from 0 (brightness is minimum) to 100 (brightness is maximum). Brightness values can be changed via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter after pressing the 'MENU' button and selecting 'PICTURE' and 'BRIGHTNESS'.
- **Contrast.** Gives the last status of the contrast as set by the customer. The value can vary from 0 (contrast is minimum) to 100 (contrast is maximum). Contrast values can be changed via 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter after pressing the 'MENU' button and selecting 'PICTURE' and 'CONTRAST'.
- **Colour.** Gives the last status of the colour saturation, as set by the customer. The value can vary from 0 (colour is minimum) to 100 (colour is maximum). Colour values can be changed via 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter after pressing the 'MENU' button and selecting 'PICTURE' and 'COLOUR'.
- **Hue.** Only relevant for NTSC-signals (e.g. some NTSC-DVD-discs).

Customer Service Menu 2
- **Sharpness.** Gives the sharpness value. The value can vary from 0 (sharpness is minimum) to 7 (sharpness is maximum). In case of bad antenna signals, a too high value of the sharpness can result in a noisy picture. Sharpness values can be changed via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter after pressing the 'MENU' button and selecting 'PICTURE' and 'SHARPNESS'.
- **Headphone volume.** Gives the last status of the headphone volume, as set by the customer. The value can vary from 0 (volume is minimum) to 100 (volume is maximum). Headphone volume values can be changed via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys on the RC-transmitter after pressing the 'MENU' button and selecting 'SOUND' and 'HEADPHONE VOLUME'.
- **Dolby.** Indicates whether the received transmitter transmits Dolby sound ('ON') or not ('OFF'). Attention: The presence of Dolby can only be tested by the software on the Dolby Signalling bit. If a Dolby transmission is received without a Dolby Signalling bit, this indicator will show 'OFF' even though a Dolby transmission is received.
- **Surround Mode.** Indicates the by the customer selected surround mode (or automatically chosen mode). In case the set is a Non-Dolby set there will be displayed '0'. If it is a Dolby-set then is displayed: 'Stereo', '3 Stereo', '3D Surround', 'Dolby Pro Logic', 'Dolby Digital', 'Hall' or 'MPEG Multi-channel'. These settings can be influenced after pressing the 'MENU' button and selecting 'SOUND' and 'SOUND MODE'. It can also have been selected automatically by signalling bits (internal software).
- **Tuner Frequency.** Indicates the frequency the selected transmitter is tuned to. The tuner frequency can be changed via the 'CURSOR LEFT' and 'CURSOR RIGHT' keys for fine tune after opening the installation menu and selecting 'INSTALL' and 'MANUAL INSTALL'.
- **Front L Trim.** Indicates the difference between main volume and volume of front left speaker. Change via: 'MENU', 'SETUP', 'SPEAKERS', and 'FRONT LEFT VOLUME'. The value can vary from '-10' to '+10'
- **Front R Trim.** Indicates the difference between main volume and volume of front right speaker. Change via: 'MENU', 'SETUP', 'SPEAKERS', and 'FRONT RIGHT VOLUME'. The value can vary from '-10' to '+10'

- **Digital Option.** Gives the selected digital mode, '100 HZ', 'Digital Scan', 'Natural Motion', 'Double Lines', or 'Pixel Plus'. Change via 'MENU', 'PICTURE', 'DIGITAL OPTIONS'.
- **Centre Trim.** Indicates the difference between main volume and volume of centre speaker. Change via: 'MENU', 'SETUP', 'SPEAKERS', and 'CENTRE VOLUME' (not available when 'Surround Mode' is set to 'STEREO' or 'HALL'). The value can vary from '-10' to '+10'
- **TV System.** Gives information about the video system of the selected transmitter.
  – BG: PAL BG signal received.
  – DK: PAL DK signal received.
  – I: PAL I signal received.
  – L: SECAM L signals received.
  – M38.9: NTSC M signal received with video carrier on 38.9 MHz.

Customer Service Menu 3
- **Balance.** Indicates the balance settings, between '-50' and '+50'. Change via 'MENU', 'SOUND', and 'BALANCE'. Not applicable for Dolby Pro Logic sets.
- **Centre mode.** Indicates if centre mode is set 'ON' or 'OFF'. When centre mode is on, all TV speakers are used as one centre speaker. Change Centre mode via 'MENU', 'SETUP', 'SPEAKERS', and 'CENTRE MODE'.
- **DNR.** Gives the selected DNR setting (Dynamic Noise Reduction), 'OFF', 'MINIMUM', 'MEDIUM', or 'MAXIMUM'. Change via 'MENU', 'PICTURE', 'DNR'
- **Noise figure.** Gives the noise ratio for the selected transmitter. This value can vary from 0 (good signal) to 127 (average signal) and to 255 (bad signal).
- **Source.** Indicates which source is used and the signal quality of the selected source. Source: 'TUNER', 'EXT1', 'EXT2', 'EXT3', 'EXT4', or 'SIDE'. Signal Quality: 'VIDEO/ STEREO', 'VIDEO/NICAM', 'VIDEO/SPDIF', 'S-VIDEO/ STEREO', 'S-VIDEO/NICAM', 'S-VIDEO/SPDIF', 'RGB/ STEREO', 'RGB/SPDIF', '480P/STEREO', '576P/ STEREO' or '1080i/STEREO'.
- **Audio System.** Gives information about the audio system of the selected transmitter: 'Analogue Mono', 'Analogue Stereo', 'PCM 2/0', 'DD 1/0', 'DD 2/0 LtRt', 'DD 2/0 L0R0', 'DD 2/1', 'DD 2/2', 'DD 3/0', 'DD 3/1', 'DD 3/2', 'DD 1+1', 'MPEG 1/0', 'MPEG 2/0', 'MPEG 2/0 LtRt', 'MPEG 2/1', 'MPEG 2/2', 'MPEG 3/0', 'MPEG 3/1', 'MPEG 3/2', 'MPEG 1+1' or 'MPEG 2+2'.
- **Tuned bit.** Gives information about the tuning method of the stored pre-set. If a channel is found via 'automatic installation', you will see the value 'Off'. When you change this (automatically found) frequency via 'fine tune' adjustment (installation menu - manual installation), the displayed value will change to 'On'. Therefore, when you see the value 'On' in this line, it is an indication that the received channel is a non-standard signal (e.g. of a VCR).
- **Surround Speakers.** Indicates if the surround speakers are set 'ON' or 'OFF'. Change via 'MENU', 'SETUP', 'SPEAKERS', and 'SURROUND SPEAKERS'.
- **On Timer.** Indicates if the 'On Timer' is set 'ON' or 'OFF' and if the timer is 'ON' also displays start time, start day and program number. Change via 'MENU', 'TV', 'FEATURES', and 'ON TIMER'.
- **Preset Lock.** Indicates if the selected preset has a child lock: 'LOCKED' or 'UNLOCKED'. Change via 'MENU', 'TV', 'FEATURES', 'CHILD LOCK', and 'CUSTOM LOCK'.

Customer Service Menu 4
- **Child Lock.** Indicates the last status of the general child lock: 'UNLOCK', 'LOCK', or 'CUSTOM LOCK'. Change via 'MENU', 'TV', 'FEATURES', 'CHILD LOCK', and 'LOCK'.
- **Age Lock.** Indicates the last status of the EPG rating for child lock: 'OFF', '4 years', '6 years', '8 years', '10 years', '12 years', '14 years' or '16 years'. This is only displayed if child lock is set to 'CUSTOM LOCK'

- **Lock After.** Indicates at what time the child lock is set: 'OFF' or e.g. '18:45' (lock time). This is only displayed if child lock is set to 'CUSTOM LOCK'
- **Category Lock.** Indicates the last status of the EPG theme childlock: 'MOVIES', 'NEWS', 'SHOWS', 'SPORTS', 'CHILDREN', 'MUSIC', 'CULTURE', or 'SERIES'. This is only displayed if child lock is set to 'CUSTOM LOCK'. It is possible that more than one value is shown.
- **Program Category.** Indicates the theme of the selected transmitter: 'MOVIES', 'NEWS', 'SHOWS', 'SPORTS', 'CHILDREN', 'MUSIC', 'CULTURE', or 'SERIES'.
- **SW Code 1.** Not applicable.
- **SW Code 2.** Not applicable.
- **TV Ratings Lock.** Only applicable for US.
- **Movie Ratings Lock.** Only applicable for US.
- **V-chip TV Status.** Only applicable for US.

Customer Service Menu 5
- **V-chip Movie Status.** Only applicable for US.
- **Options 1.** Gives the option codes of option group 1 as set in SAM (Service Alignment Mode).
- **Options 2.** Gives the option codes of option group 2 as set in SAM (Service Alignment Mode).

SW Event-log
This item contains 'software event logging' information that can be delivered to the development centre on special request.

How to exit CSM
Use one of the following methods:
- After you press a key on the RC-transmitter (with exception of the 'CHANNEL', 'VOLUME' and digit (0-9) keys), or
- After you switch the TV-set 'OFF' with the mains switch.

5.3 Problems and Solving Tips (related to CSM)

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 above. New value(s) are automatically stored.

5.3.1 Picture Problems

Snowy/noisy picture
1. Check line 24 'Noise Figure'. In case the value is 127 or higher, and the value is also high on other programs, check the aerial cable/aerial system.
2. Check lines 11 'Sharpness' and 24 'Noise Figure'. In case the value of line 11 is 3 or 4 and the value of line 24 is high (127 or higher), decrease the 'Sharpness' value.

Picture too dark
1. Press 'Smart Picture' button on the RC-transmitter. In case the picture improves, increase the 'Brightness' or the 'Contrast' value. The new value(s) are automatically stored (in 'personal' pre-set) for all TV channels.
2. Check line 7 'Brightness' and 8 'Contrast'. If the value of line 7 is low (< 10) or the value of line 8 is low (< 10), increase the 'Brightness' or the 'Contrast' value.

Picture too bright
1. Press 'Smart Picture' button on the RC-transmitter. In case the picture improves, decrease the 'Brightness' or the 'Contrast' value. The new value(s) are automatically stored (in 'personal' pre-set) for all TV channels.
2. Check lines 7 'Brightness' and 6 'Contrast'. If the value of line 7 is high (> 40) or the value of line 8 is high (> 50). Decrease the 'Brightness' value or increase the 'Contrast' value.

White line around picture elements and text
1. Press 'Smart Picture' button on the Remote Control. In case the picture improves, decrease the 'Sharpness' value. The new value is automatically stored (in 'personal' pre-set) for all TV channels.
2. Check line 11 'Sharpness'. Decrease the 'Sharpness' value. The new value is automatically stored for all TV channels.

No picture
Check line 27 'Tuned bit'. In case the value is 'On', install the required program again. Open the installation menu and perform manual installation.

Blue picture
1. No proper signal is received. Check the aerial cable/aerial system.

Blue picture and/or unstable picture
1. A scrambled or decoded signal is received.

Black and white picture
Check line 9 'Colour'. In case the value is low (< 10), increase the 'Colour' value. The new value is automatically stored for all TV channels.

No colours/colour lines around picture elements or colours not correct or unstable picture
1. Check line 20 'TV System'. If a 'strange' system pop's up, something has gone wrong during installation. Re-install the channel.
2. In case line 20 is 'L', the installed system for this pre-set is 'France', while 'West Europe' is required. Install the required program again: open the installation menu and perform manual installation. Select system 'West Europe'.

Menu text not sharp enough
1. Press 'Smart Picture' button on the RC-transmitter. In case picture improves, decrease the contrast value. The new value(s) are automatically stored for all TV channels.
2. Check line 8 'Contrast'. The value of line 8 is high (> 50). Decrease the contrast value.

5.3.2 Sound Problems

No sound from left and right speaker
Check line 6 'Volume'. The value is low. Increase the value of 'Volume'. The new value(s) are automatically stored (in 'personal' pre-set) for all TV channels.

Sound too loud for left and right speaker
Check line 6 'Volume'. The value is high. Decrease the value of 'LS Volume'. The new value(s) are automatically stored (in 'personal' pre-set) for all TV channels.

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 I^2C level) and is therefore capable of accurately indicating problem areas. You do not have to know anything about I^2C 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 EM5E chassis, the ComPair interface box and the TV communicate via a bi-directional service cable via the service connector.

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 I^2C level. ComPair can access the I^2C bus of the television. ComPair can send and receive I^2C 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 I^2C 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 extends. When this is not the case, ComPair will guide you through the faultfinding tree by asking you questions (e.g. *Does the screen give 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 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 Mono-carrier*.
  - 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 Stepwise Start-up / Shut-down

Under normal circumstances, a fault in the power supply, or an error during start-up, will switch the television to protection mode. ComPair can take over the initialisation of the television. In this way it is possible to distinguish which part of the start-up routine (hence which circuitry) is causing the problem.

Stepwise start- up explanation
This is realised via ComPair and is very helpful when a **protection** is activated (see also chapter 5.7).

Table 5-1 Stepwise start-up table

State	Description mode	Display LED (Red)	Enabled protection
0	Low power stdby: 5V2/3V3 present, uP in stdby-mode	On	None
1	High power Stdby: TV-set in stdby-mode	Wait 1s, flash 1 x	None
2	SSB is powered by std-by-supply (5V/8V). Degaussing (12 s) has been activated.	Wait 1s, flash 2 x	1, 4, 5, 6 & 18
3	Semi stdby-mode: HIP, HOP, MSP and Tuner initialized leading to semi stdby-mode.	Wait 1s, flash 3 x	
4	All ICs are initialized, HOP activates the main supply, EHT-generation starts, black current stabilization is on	Wait 1s, flash 4 x	Plus 2 & 16
5	TV On: TV-set operates, un-blanked picture.	Wait 1s, flash 5 x	

Stepwise shut-down explanation
In the stepwise shutdown mode, state 2 and 4 are skipped.

Table 5-2 Stepwise shut-down table

State	Description mode	Display LED (Red) (*)	Disabled protections
5	TV On: TV-set operates, un-blanked picture	Wait 1s, flash 5 x	-
3	Semi stdby-mode: SSB is powered by the stdby-supply	Wait 1s, flash 3 x	2 & 16
1	High power stdby: TV-set in stdby-mode	Wait 1s, flash 1 x	1, 4, 5, 6 & 18
0	Low power stdby: 5V2/3V3 present, uP in stdbymode	On	

Note (*): When the set is in stepwise mode and, due to stepping-up, a protection is activated, the set will really go into protection (blinking LED). The set will not leave the stepwise-mode however. By stepping up, the set can be activated again, until state X where the protection was activated. At state (X-1) diagnostic measurements can be performed.

5.4.4 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 adapter to the supply connector (marked with 'POWER 9V DC') of the ComPair interface.
4. Switch the ComPair interface 'OFF'.
5. Switch the television set 'OFF' with the mains switch.
6. Connect the ComPair interface cable between the connector on the rear side of the ComPair interface (marked with 'I^2C') and the ComPair connector at the rear side of the TV (situated just below the tuner input, see also chapter 4).

7. Plug the mains adapter in a mains outlet, and switch the interface 'ON'. The green and red LEDs light up together. The red LED extinguishes after approx. 1 second while the green LED remains lit.
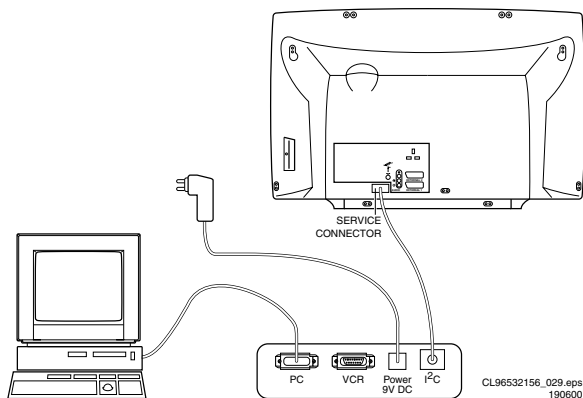8. Start the ComPair program and read the 'Introduction' chapter.

SERVICE CONNECTOR

PC   VCR   Power   I²C
9V DC

CL96532156_029.eps
190600

Figure 5-1 ComPair Interface connection

5.4.5   How To Order

ComPair order codes:
- Starter kit ComPair32/SearchMan32 software and ComPair interface (excl. transformer): 3122 785 90450.
- ComPair interface (excluding transformer): 4822 727 21631.
- Starter kit ComPair32 software (registration version): 3122 785 60040.
- Starter kit SearchMan32 software: 3122 785 60050.
- ComPair32 CD (update): 3122 785 60070.
- SearchMan32 CD (update): 3122 785 60080.
- ComPair interface cable: 3122 785 90004.

5.5   Error Codes

5.5.1   Introduction

The error code buffer contains all detected errors since the last time the buffer was erased. The buffer is written from left to right, new errors are logged at the left side, and all other errors shift one position to the right.
When an error has occurred, the error is added to the list of errors, provided the list is not full or the error is a protection error.
When an error occurs and the error buffer is full, then the new error is not added, and the error buffer stays intact (history is maintained), except when the error is a protection error.
To prevent that an occasional error stays in the list forever, the error is removed from the list after 50+ operation hours.
When multiple errors occur (errors occurred within a short time span), there is a high probability that there is some relation between them.

5.5.2   How to read the Error Buffer

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

5.5.3   How to clear the Error Buffer

Use one of the following methods:
- By activation of the 'RESET ERROR BUFFER' command in the SAM menu.
- With a normal RC, key in sequence 'MUTE', followed by '062599' and 'OK'.
- When you transmit the commands 'DIAGNOSE' - '99' - 'OK' with ComPair (or with a DST).
- If the content of the error buffer has not changed for 50+ hours, it resets automatically.

5.5.4   Error Codes

In case of non-intermittent faults, clear the error buffer before you begin the repair. This to ensure that old error codes are no longer present. Before clearing the buffer, write down the content, as this history can give you significant information.
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).
There are various errors:
- I^2C device errors.
- I^2C bus errors.
- Protection errors.
- Errors not related to I^2C device, but of importance:
  – Black Current Loop Error (error 28): detection of a continuous fail of the black current stabilisation loop of the HOP.
  – FALCONIC Error (error 26): at start-up, after initialisation of the PICNIC, the presence of the FALCONIC can be checked.
  – Eagle Error (error 27): at start-up, after initialisation of the PICNIC, the presence of the Eagle can be checked.

Table 5-3 Error Table

Error	Device	Description	Def. item	Defect. module indication	Diagram
1	M24C32	NVM, spontaneous blinking 1-1-1..	7011	NVM	B5
2	Hfail Protection	Horizontal Flyback protection	7301	HFB protection	B4
3	SAA4978	PICNIC	7713	PICNIC	B3a
4	Supply 5V	5V2 protection		5V Protection	B5
5	Supply 8V	8V6 protection		8V Protection	B5
6	Slow I²C bus blocked				B5
7	TDA9330/HOP	High-end Output Processor	7301	HOP video control/geometry	B4
8	TDA9320/HIP	High-end Input Processor	7323	HIP I/O-video processing	B2
9	PCF8574	Wireless Expander	7501	Wireless Expander	H
11	Reserved				
12	TDA9178		7302	TOPIC (LTP Peaking)	B4
13	UV1316/ TEDE9		1200	Tuner Protection	A8
14	MSP3411/3412/3452		7651	ITT sound processor	B6
15	Reserved				
16	FBX			Feature Box Protection	B3
17	Reserved				
18	Fast I²C bus blocked				B5
19	TDA8444		7500	Auto Scavem DAC	SC1
26	SAA4992	FALCONIC	7718	Falconic	B3b
27	T8F24EF	Eagle	7724	Eagle device	B3c
28	Black current loop			Black current loop	
30	PCF8574T/PCF8584T	only for DVD models	7150	DVD Interface	
31	--	only for DVD models		DVD Engine	
32	M29W400BT	Flash Ram (EPG)	7012	Flash Ram (EPG)	B5

Note: Error codes 1, 6 or 18 are protection codes and in this case, supplies of some circuits will be switched off. Also, in protection, the LED will blink the number of times equivalent to the most recent error code.

5.6 The Blinking LED Procedure

5.6.1 Introduction

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

When the SDM is entered, the front LED will show (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 (where '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: Error 12 9 6 0 0.
After activation of the SDM, the red front LED will show:
– 1 long blink of 750 ms (which is an indication of the decimal digit) 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.

Note: If errors 1, 6 or 18 occur, the LED always gives the last occurred error even if the set is NOT in service mode.

5.6.2 How to Enter

Use one of the following methods:

• Enter the SDM (only via soldering pads marked 'SDM' on SSB). The blinking red front LED will show the entire contents of the error buffer (this works in 'normal operation' mode and in 'protection' mode).
• Transmit the commands 'MUTE' - '062500' - 'OK' with a normal RC. The complete error buffer is shown. This works only in 'protection' mode.
• Transmit the commands 'MUTE' - '06250x' - 'OK' with a normal RC (where 'x' is a number between 1 and 5). When x= 1 the last detected error is shown, x= 2 the second last error, etc.... This works only in 'protection' mode.

5.7 Protections

5.7.1 Introduction

The EM5E has only one microprocessor (OTC), which remains active during Standby. This because power of the microprocessor and the attached memory chip set is coming from the 3V3 supply, which is derived from the 5V Standby-circuitry. So, in both Power-on as in Standby mode, the microprocessor is connected to this power supply.
If a fault situation is detected, an error code will be generated and if necessary, the set is put in protection mode. The protection mode is indicated by the blinking of the red front LED at a frequency of 3 Hz (or by a coded blinking in special cases). In some error cases however, the microprocessor does not put the set in the protection mode (this is the case with the - hardware - loudspeaker protection of the audio amplifier).
The content of the error buffer can be read via the service menu (SAM), the blinking LED procedure or via DST/ComPair. The DST/ComPair 'diagnose' functionality will force the set into the 'Service Standby', which is alike the usual Standby, however the microprocessor remains completely in normal operation. To get a quick diagnosis, the EM5E 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). In this mode, items of the set can be adjusted via a menu and with the help of test patterns.

You can enter both SDM and SAM modes via the 'service pads' on the SSB, via an RC-transmitter (DST or standard RC), or via ComPair. It is not possible to enter the SAM in 'standby'; the TV has to be in 'normal operation' mode.
The EM5E 'Protection Diagram' shows the structure of the protection system. See diagram below.
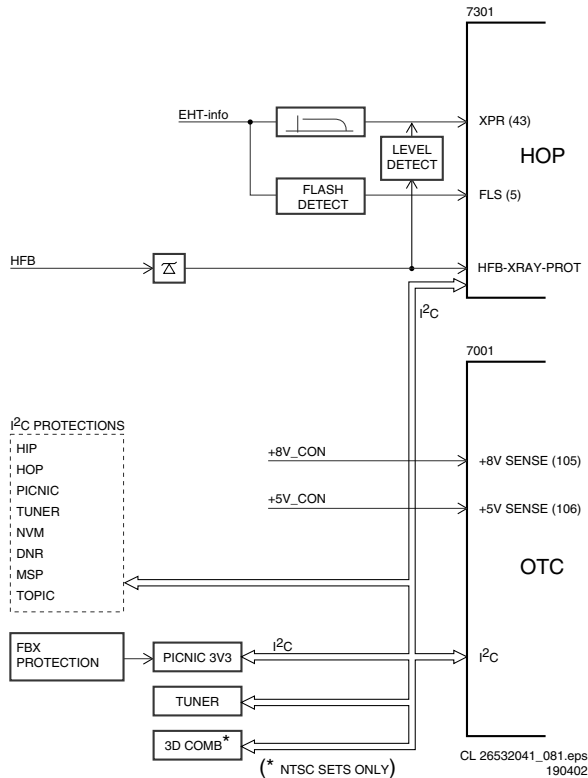

Figure 5-2 Protection diagram

There are several types of protections:
- I²C related protections.
- OTC related protections (via polling on I/O pins or via algorithms).
- HOP related protections (mainly for deflection items).
- Hardware errors that are not sensed by the OTC (e.g. vertical flyback protection, bridge coil protection, E/W protection, arcing protection).
All protections are explained below.

5.7.2 I²C Related Protections

In normal operation, some registers of the I²C controlled ICs are refreshed every 200 ms. During this sequence, the I²C busses and the I²C ICs are checked.
An I²C protection will take place if the SDA and SCL lines are short-circuited to ground, or to each other. An I²C error will also occur, if the power supply of the IC is missing (e.g. FBX_PROT (error 16)).

5.7.3 OTC Related Protections

If a protection is detected at an OTC input, the OTC will start to scan all protection inputs every 200 ms for 5 times. If the protection on one of the inputs is still active after 1 s, the P will put the set in the protection mode. Before the scanning is started, a so-called 'ESD refresh' is carried out. This is done, because the interrupt on one of the inputs is possibly caused either by a flash or by ESD. As a flash or ESD can influence IC settings, the HOP, HIP, MSP, PICNIC, NVM, and Tuner are

initialised again, to ensure the normal picture and sound conditions of the set.

8 V and 5 V protection: The μP senses the presence of the 8 V and 5 V (via the '+5V_CON' and '+8V_CON' lines). If one (or both) of these voltages is (are) not present, an error code is stored in the error buffer of the NVM, and the set is put in the protection mode.

5.7.4 HOP Related Protections

Every 200 ms, the status register of the HOP is read by the OTC (via the I²C bus). If a protection signal is detected on one of the inputs of the HOP, the relevant error bit in the HOP register is set to 'high'. If this error bit is still 'high' after 1 s, the OTC will store the error code in the error buffer of the NVM and, depending on the relevancy of the error bit, the set will either go into the protection mode or not.

The following protections are implemented:
- **HFB (Horizontal Flyback):** If the horizontal flyback is not present, this is detected via the HOP (HFB_X-RAY_PROT). One status bit is set to 'high'. The error code is stored in the error buffer and the set will go into the protection mode.
- **XPR (X-ray protection):** If the HFB pulses are too low (level detection), the HOP will detect this via the XPR-bit. The error will be logged in the error buffer and the set will go into protection mode.

Note: Both errors will be logged as HFB-failure.

5.7.5 Hardware Related Protections

Due to the architecture ('hot' deflection), some protections cannot be sensed by the microprocessor. Three of these protections will lead to a protection on set level (Standby mode and blinking LED), while another will only lead to a circuit protection.

TV-set Protection
The following fault conditions will lead to a 'complete' set protection:
- **BRIDGECOIL protection:** This is sensed via the 'EW' signal going to the base of TS7652 (via R3495 and D6499). In a normal situation, the voltage on C2498 (diagram A4) is high and TS7652 is conducting. When bridge coil 5422 (diagram A3) is short circuited, the voltage on C2498 changes to low, which will block TS7652. In this case, also TS7641 will block and the voltage on 2642 will rise until TS7443 is forced in conduction. The 'SUP-ENABLE' signal (in normal operating condition -20 V) is shorted now to ground level, which will force the Main Power Supply to Standby mode.
- **ARC protection:** If there are 'open' connections (e.g. bad solder joints) in the high-energy deflection circuitry, this can lead to damaging effects (read: fire). For that reason, the E/W current is sensed (via 3479//3480). If this current becomes too high, the 'thyristor' circuit (TS7653 and TS7654) is triggered. TS7442 is switched 'on' and TS7443 is forced into conduction. . The 'SUP-ENABLE' signal is shorted now to ground level, which will force the Main Power Supply to Standby mode.
- **NON_VFB (No vertical Flyback) protection:** If the frame stage generates no pulses, TS7641 will block. TS7443 is now switched 'on', which will lead to Standby mode. So, in normal operation condition, TS7641 and TS7652 are conducting, while TS7443 is blocked.

Circuit Protection
The following fault condition will lead to a 'partly' set protection:
- **PROT1 (DC) protection:** When a DC-voltage (positive or negative) is sensed on one of the loudspeaker outputs, the protection circuit (TS7704, 7705, 7706 and 7707 in

diagram A6) will put the IC7700 in Standby mode (via tri-state input pin 6). For more details, see chapter 9.

5.8 Repair tips

5.8.1 Miscellaneous

The relay you hear when you switch the set 'on' (from Standby or via the mains switch), is from the degaussing circuitry. It is not used for switching the Power Supply (as done in the MG-chassis).

Take care not to touch the 'hot' heatsink while disconnecting the SSB, despite the fact that the mains cord is out of the mains socket. There can still be an annoying rest-voltage on the heatsink for a short while. This, because the discharge resistors 3502 and 3503 (on the LSP between hot and cold part) are not stuffed for Europe. Instead, discharge resistors 3066 and 3057 on the Mains Switch panel are used, but because they are located before the Mains switch, they only discharge when this switch is 'on'.
Advice: when you remove the SSB, disconnect the Mains cord, but keep the Mains Switch 'on'.

Do not try to measure on the SSB side, which is facing the 'hot' heatsink. This is dangerous. Most service test points are guided to the 'tuner' side and are indicated by the 'service' printing. Where the circuitry was too 'crowded' for this printing, you can find the correct location on the 'test point overviews' in this manual (chapter 6).

A very large part of the LSP is **'hot'**, such as:
– The primary part of the Standby Supply.
– The whole Main supply (except for the secondary Audio supply).
– And the complete deflection circuitry (so notice that the deflection coil is hot!!).
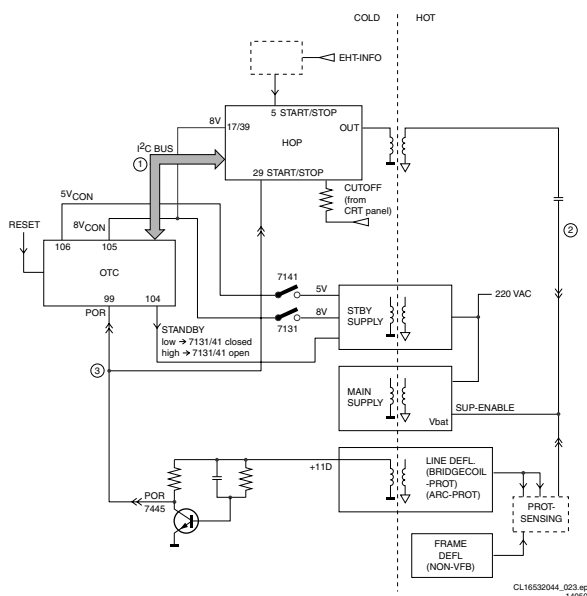
5.8.2 Start-up Sequence

Figure 5-3 Start-up circuitry

The start up sequence differs from other sets (e.g. MG-sets or EM2E-sets), but is same as in EM3E-set):
1. When the set is switched 'on', the 5 and 8 V lines ('+5V_CON' and '+8V_CON') of the standby power supply are activated.
2. After the OTC senses them, the µP will address the HOP via the I²C-bus, to start the drive [1].

3. Via the 'SUP-ENABLE' signal, the Main Supply is switched 'on' and will deliver the V_{BAT} to the Line deflection stage [2].
4. EHT generation is now started.
5. The OTC will un-blank the picture.
6. When you switch 'off' the set, this is done in a controlled way via the POR signal [3].

Note: Standby is not directly achieved via the Standby line of the microprocessor, but indirectly via the HOP circuitry.

5.8.3 ComPair

This chassis does not have an IR transmitting LED (as in MG-sets). Therefore, a 'Service' (ComPair) connector is implemented at the rear side of the set, which is directly accessible (as in A10-, EM2E- and EM3E-sets). In addition to this, there is also a blinking LED procedure to show the contents of the error buffer.

When you use ComPair, you have the possibility to activate a 'stepwise start-up' mode. With this mode, you can initiate the start-up sequence step by step. This also means that in certain steps, some protections are not activated. This is sometimes very convenient during repair (see also paragraph 5.4.3).

5.8.4 Protections

There are 'service pads' implemented on the SSB (items 9005 and 9006, outside the shielding), to force the set in SAM or SDM (see also figure: 'SSB removal (part 3)' in Chapter 4). This will overrule the processor-controlled protections, but not the hardware protections. This means, that the A/D-input protections (5 and 8 V) and the I²C 'not-acknowledging' info of the feature box (FBX) and of the Tuner are overruled.
Caution: When doing this, the service technician must know what he is doing, as it could lead to damaging the set.

The 'ARC'- and/or 'BRIDGECOIL' protection are hardly ever triggered, however:
When you suspect the 'ARC' protection, look for bad solder joints and smell. By interrupting resistor 3497, this protection is disabled (special attention needed!).
When you suspect the 'BRIDGECOIL' protection, which can also be due to a too wide picture amplitude, shorten G and S of the E/W MOSFET 7480. This will disable the protection. You will now have minimal horizontal amplitude. Re-align the horizontal amplitude in the SAM menu and remove the G/S short of TS7480.

5.8.5 Main Supply

The simplest way is, to replace the components of the Main Supply with repair kit (3122 785 90310)

More detailed way:
1. Replace FET 7504 and zener 6505.
2. Remove the SSB panel.
3. Short B and E of TS7529, in order to put the Main Supply in 'on'-mode (TS7529 is blocking then). Caution: To prevent that R3403 and TS7443 will be damaged, first disable the HW-protection of the deflection circuit. Therefore short circuit C2642 on the LSP (diagram A4).
4. Attach a load of 500 Ω to V_{BAT} capacitor C2515 (the supply can not work without a minimum load).
5. Use a variac, and slowly increase the VMAINS. Measure over sensing resistors R3514//15 if a nice sawtooth voltage becomes available.
6. Also measure the V_{BAT}. This may never exceed +141 V. If it does, there is something wrong in the feedback circuitry (e.g. regulator 7506).

Note: Be careful when measuring on the gate of FET TS7504. This circuitry is very high ohmic and can easily be damaged

(first connect ground to measuring equipment, than measure the gate).

5.8.6 Standby Supply

The simplest way is to replace the components of the Standby Supply with repair kit 3122 785 90460.

5.8.7 Line Deflection

The simplest way is to replace the components of the Line Deflection circuitry with repair kit 3122 785 90330.

5.8.8 Frame Deflection

Caution: When the Frame Deflection circuitry is suspected, one must be careful. Because there is a DC-voltage on the

frame deflection, the beam current could damage the CRT neck, leading to a defective CRT.

- Best thing to do is:
- Interrupt the resistors 3403 and 3404 on the CRT panel (diagram F1), in order to remove the 'filament' voltage from the tube (no beam current, so no chance of destroying the CRT).
- Interrupt resistor 3403 on the LSP (diagram A4) to disable the 'SUP-ENABLE' line.
- Measure with a multi-meter, or better with a oscilloscope, the functionality of the Frame stage.
- After you have found the cause, exchange the defective component (e.g. TDA8177), and re-solder the interrupted resistors.

Table 5-4 Repair tips

Phenomenon	Possible Cause	Repair tip
No picture, no LED.	Standby Supply defective.	Measure circuitry (see diagram A2). Start at test-point A19.When the Mains switch is 'on', this voltage must always be available
No picture, no LED.	Bad connection of SSB in SIMM-connector.	In case of a bad connection, it can happen that there is no picture, and that the Standby LED is not controllable. Re-place the SSB.
No picture, red LED blinking at 3 Hz.	Set is in protection due to various causes. For error codes see error-code list.	You have no picture, so: Read the error buffer via ComPair (error buffer is accessible when set is in protection, compare-file will guide you to this) Read the blinking LED information via standard remote command <mute>06250X<ok> Or you read the error code sequence via standard remote command <mute>062500<ok>. When you have found the error, check the circuitry related to the supply voltage and I^2C-communication or the circuitry that triggers the protection.
No picture, red LED blinking with code 6-6-6 or 18-18-18.	No communication on slow I^2C- or fast I^2C-bus.	As processor cannot communicate with one of the 2 busses it the standby-led spontaneously starts blinking 6-6-6 . . . or 18-18-18 . . .. If in the error buffer somewhere is an error 6 or 18, these will have the highest priority starting the mentioned blinking. Measure dependent of the error on the I^2C-bus which device is loading the bus. (Use I^2C -overview)
No picture, red LED blinking with code 1-1-1.	No communication on NVM-I^2C bus to the µP.	As the µP cannot communicate with the NVM I^2C bus, it spontaneously starts blinking 1-1-1. Note: when there is no access to the NVM, a lot of picture setting can go wrong.
No picture, no sound. Set is making audible squeaking sound	Supply is possibly in hiccup-mode, which is audible via a squeaking supply transformer.	Possible causes: V_{BAT} is shorted (caused by short circuited line transistor 7421), or Sound winding is shorted (amplifier is shortening the power supply lines), or D6514 is shorted (due to a too high V_{BAT}). Remove excessive load, to see what causes the failure, or check feedback circuit. See repair tip 'Main Power Supply' (supply needs a minimal load).
No picture, no sound. Green LED works fine	Supply does not work correctly.	If e.g. V_{BAT} is only about 90 V, it is possible that the regulator IC (7506) is defective.
No RC-reception. Red LED does not echo RC-commands.	µP circuitry or RC-receiver is defective.	In case the set does react on a local keyboard operation, you must check the RC-receiver circuitry (diagram E).
Relay (degaussing) is not audible, when set is switched from 'off' or 'standby' to 'on'.	µP is not working correctly.When pin 115 is low, the degaussing must be activated.	Check RESET-circuitry on diagram B5. Check the level on pin 115 when you switch the set 'on'. Signal must be low initially and go to high after approx. 12 µs.
No sound, only picture.	Measure A7/A8 on diagram A1. Possibly the audio amplifier is defect (but not shorted), or the 'sound enable' line is high (diagram A5). Further, measure the audio signal path (HIP-MSP-Switch ICs-Amplifier).	In ComPair, a beep test can determine where the signal stops (use loudspeakers or headphone).Possible cause is also the 'PROT1' protection (see diagram. A6). This is a loudspeaker DC protection, which the µP cannot sense. Via circuitry 7701/7707, this signal can put audio amplifiers 7700 and 7702 in standby mode (tri-state input). Warning: Find out, which amplifier is causing the problem, because it is possible, that the other one is OK.

Phenomenon	Possible Cause	Repair tip
No sound at headphone output.	HP amplifier (7681) on diagram B10, or the supply to it, malfunctions.	Measure on pin 3 input left and pin 1 output left, repeat this for pin 3 (input right) and pin 7 (output right), and the supply line (+8V_AUD) on diagram B10.
Picture is rotated.	Rotation circuitry on diagram A5, or related supply to it, malfunctions.	Measure test points A52 and A53 on diagram A5.
Picture is continuously switching 'off' and 'on', showing heavy 'switch' spots (set does not go into protection).	200 V is missing on CRT panel.	Probably a bad connection from LSP connector 1424 to CRT connector 1224 (diagram F1), or an interruption of the 200 V supplies line (e.g. R3341 on circuit F1 is interrupted).
Picture is not sharp.	Focus is possibly mis-aligned or SCAVEM-circuitry does not work correctly.	Re-align the 'focus' potmeter on the Line Output Transformer, or check the SCAVEM circuitry on the CRT-panel (diagram F2). It is also possible that the DAF circuitry is defective (see diagram I). Check the Vdc values.
Picture is not synchronised.	The sync is derived in the HIP from xtal 1305 and/or 1308.	Maybe the crystals 1305 and/or 1308 are making a bad contact.
Picture is distorted.	Check video-path in Service Default Mode.	Investigate whether there is an error code present in the error buffer. In case there is one, check the I^2C-bus and/or supply lines (see overview supply lines).Measure and check signal path Tuner-HIP-PICNIC-HOP-RGB amplifier.In case it is a geometry issue, check on diagram A4 opto-coupler 7482, OpAmps 7440/7450 and the Frame circuitry alignments or a possible corrupted NVM (7011) on diagram B5.
Picture with horizontal stripes.	Pixel Plus processing is malfunctioning	Check functionality on circuitry (B3a, B3b, and B3c) of PICNIC (7713), FALCONIC (7718, EAGLE (7724) and/or field memories (7714, 7717, 7719, 7722 and 7723.Tip the whole Pixel Plus chipset (3 ICs + 5 Field Memories can be diagnosed very good via ComPair.
No menu, no OSD.	Probably a defective µP.	Measure test points B61to B64 on diagram B5.
No NextView (EPG).	IC7012 defective or not powered.	Check circuitry around IC7012.
No Teletext.	IC7007 defective or not powered.	Check circuitry around IC7007. Check also B61to B64 around µP on diagram B5.
Strange switch 'off' behaviour	TS7445 possibly defective.	Check, with a multi-meter, whether transistor TS7445 is well functioning. (diagram A3).
Various symptoms, due to missing local supply voltage.	An interrupted fuse, NFR-resistor or connection.	When no symptom or error code leads you to a specific circuitry, use the supply lines overview (see chapter 6), for a quick scan of all supply lines.