

# BEKO

## COLOUR TELEVISIONS

823

BEKO

AT-2 CHASSIS

1922 INX

11225 T

15225 T

16228 T/NX

12220/T

10214

ALSO ≡

GOLDSTAR

SAMSUNG

ORION

HITACHI

TOSHIBA

PHILIPS

VIDEOCOLOUR

NOKIA

WF

Servicio  
Manual

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## GENERAL SERVICING PRECAUTIONS

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- Disconnect the TV from the mains supply before discharging the picture tube anode or before removing or refitting any component, circuit board, module or connector.
- Fitting a wrong component or with incorrect polarity of electrolytic capacitors may result in an explosion.
- Measure high voltage only with a high voltage meter or a multimeter equipped with a suitable high voltage probe, do not test high voltage by drawing an arc.
- Do not spray any chemicals on or near this instrument or any of its assemblies.
- Ensure that all power transistors and integrated circuits have their heat sinks correctly fitted before connecting power. Use heatsink compound where necessary.

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# SAFETY INSTRUCTIONS

## SAFETY-PRECAUTIONS

WARNING: The following precautions should be observed.

1. Although the chassis is isolated from the mains supply, some areas of the main PCB are at mains potential. An isolation transformer (250-500 VA) should therefore be connected between the mains and the receiver before service is attempted.
2. Do not install, remove, or handle the picture tube in any manner unless safety goggles are worn. People not equipped should be kept away while picture tubes are handled. Keep the picture tube away from the body while handling.
3. When replacing chassis in the cabinet, ensure all the protective devices are put back in place, such as: barriers, non-metallic knobs, adjustments and compartment cover or shields, isolation resistor-capacitor, etc.
4. When service is required note the original lead locations and anchor points. Ensure all leads, especially in areas of high voltage, are routed/anchored in their correct locations when reassembling the receiver.
5. Always use the manufacturer's replacement component. Always replace original spacers and maintain lead lengths. Especially critical components which should not be replaced by other makers. Furthermore where a short circuit has occurred, replace those components that indicate evidence of overheating.
6. Before returning a serviced receiver to the customer, the service technician must thoroughly test the unit to be certain that it is completely safe to operate without danger of electrical shock, and be sure that no protective device built into the instrument by the manufacturer has become defective, or inadvertently damaged during servicing. Therefore, the following checks are recommended for the continued protection of customers and service technicians.

## INSULATION

Insulation resistance should not be less than 10M at 500V DC between the mains poles and any accessible metal parts.

Also, no flashover or breakdown should occur during the dielectric strength test applying 3kV AC or 4.25kV DC for two seconds between the main poles and accessible metal parts

## HIGH VOLTAGE

High voltage should always be kept at rated value of the chassis and no higher. Operating at higher voltage may cause a failure of the picture tube or high voltage supply and also, under certain circumstances could produce x-ray radiation moderately in excess of design levels. The high voltage must not, under any circumstances exceed 26 kV on the chassis.

## X-RAY RADIATION

TUBES: The primary source of x-ray radiation in this receiver is the picture tube. the tube utilised for the above mentioned function in this chassis is specially constructed to limit x-ray radiation for continued x-ray radiation protection, replace tube with the same type as the original BEKO approved type.

## PRODUCT SAFETY NOTICE

Many electrical and mechanical parts in BEKO television receivers have special safety related characteristics. These characteristics are often not evident from visual inspection nor can the protection afforded by them necessarily be obtained by using replacement components rated for higher voltage, wattage, etc.

Replacement parts which have these special safety characteristics are identified by marking with a  $\triangle$  on the schematics and replacement parts list in this Service Manual.

The use of a substitute replacement component which does not have the same safety characteristics as the BEKO recommended replacement one, shown in the parts list in this Service Manual, may create electrical shock, fire, X-radiation, or other hazards.

## TUBE DISCHARGE

The line output stage can develop voltages in excess of 25kV; if the E.H.T. cap is required to be removed, discharge the anode cap to chassis via a high value resistor, prior to its removal from the tube.

# DISASSEMBLY INSTRUCTIONS

## (See also Exploded Views)

### BACK COVER REMOVAL (For 20"-21" Models)

1. Remove 2 screws at the bottom of the back cover
2. Push in 4 side locks by pushing with a screw driver and pull back the cover carefully. Taking care not to pull the speaker cable.
3. Disconnect the speaker cable from the chassis and take out the power cord from the cable way at the bottom of the back cover. Figure 1

### (FOR 14" - 15" Models)

1. Remove 4 screws holding the back cover.
2. Remove the screw fixing the power cord holder to the back cover.
3. Pull back the cover carefully, taking care not to pull the speaker cable.
4. Disconnect the speaker cable from the chassis.

#### NOTE!

When reassembling the back cover, take care to slide the main chassis board into the guideways located on the back cover on both sides. Figure 2

### SPEAKER ASSEMBLY REMOVAL (For 20"-21" Models)

1. Remove the 2 screws fixing the speaker assembly to the back cover.
2. Release the four locks and push the assembly out.
3. Remove the 4 screws holding the speakers on the speaker assembly. Figure 4

### SPEAKER REASSEMBLY (For 14"-15" Models)

1. Place the speaker on the speaker assembly; the speaker terminals should be placed towards the front of the TV set.
2. Slide the locks on the assembly through the holes of the back cover until hearing a "click" sound which means that the assembly has fitted in place.
3. Attach the screws (2 pcs) fixing the speaker assembly to the back cover. Figure 3

### MAIN CHASSIS REMOVAL (FOR 20"-21" Models)

1. Open two guide locks on both sides of the chassis and pull the chassis out.
2. Take the cables, connected to the power switch, out from the chassis frame.
3. Pull the chassis back carefully.

### (For 14"-15" Models)

1. Pull the chassis back carefully.

### CPT REMOVAL

1. Disconnect power (ST01, 02), degaussing (ST101) and control unit cables (ST03,04) from the chassis.
2. Discharge the tube and disconnect the E.H.T. cap as told in Safety Instructions.
3. Disconnect the tube earthing cable coming from the CPT board.
4. Disconnect the ST802 connector on the chassis, and cable ties holding the cables of ST802 and ST801.
5. Disconnect the CPT board from the neck of the tube, taking care not to damage the tube pins.
6. Place the front cover on soft material so as not to mar the front surface or damage the controls.
7. Remove 4 screws securing the picture tube brackets to the front cover.
8. Carefully separate the CPT from the front cover.

### CAUTION

Great care must be taken when handling the picture tube.

Always lift the picture tube by holding it firmly around the face plate. DO NOT LIFT THE BY ITS NECK. The picture tube must not be scratched or subjected to excessive pressure.

## DISASSEMBLY INTRUCTIONS

### 20"-21" Models

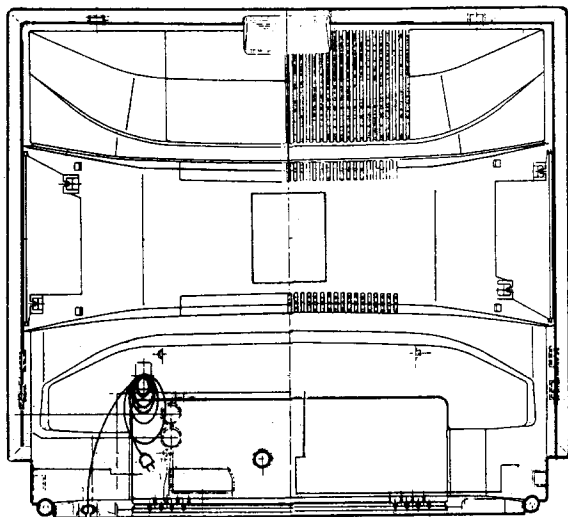
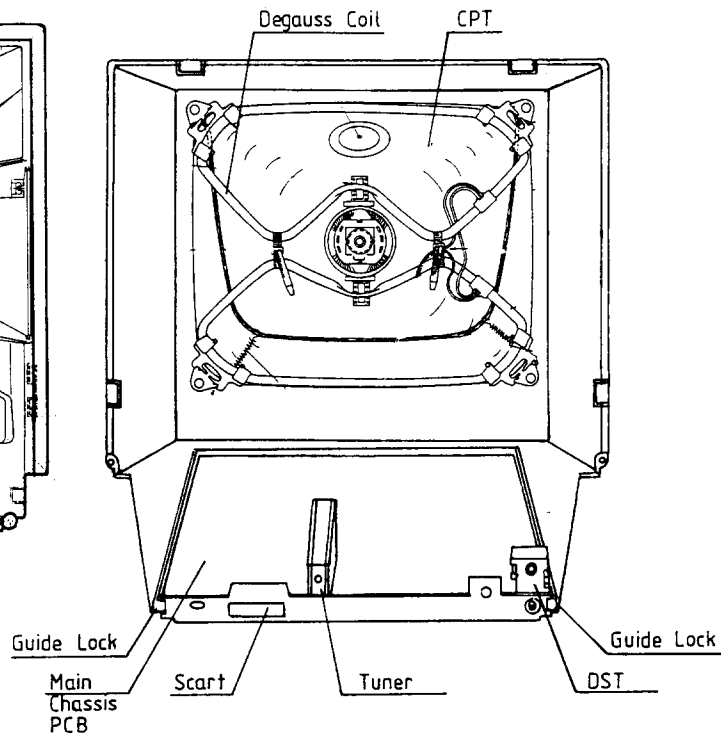


Figure 1



### 14"-15" Models

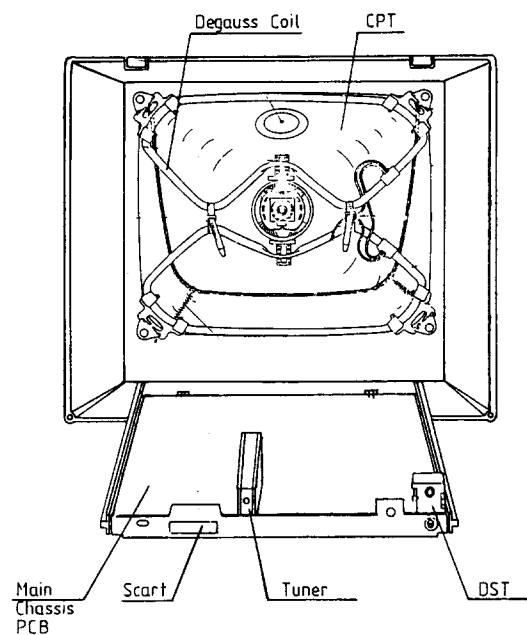
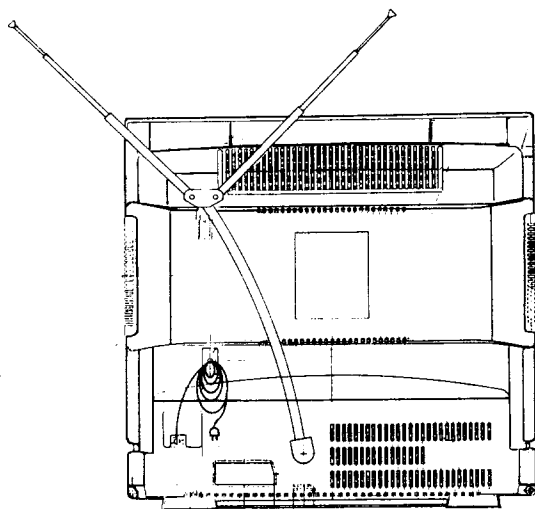


Figure 2

# EXPLODED VIEW

(14"-15" MODELS)

| NO | PART NO         | DESCRIPTION             | QTY |
|----|-----------------|-------------------------|-----|
| 38 | 056.060         | CPT. 15"                | 1   |
| 37 | 056.737         | CPT. 14"                | 1   |
| 36 | 64A.214         | CHASSIS FRONT BRACKET-2 | 1   |
| 35 | 64A.213         | CHASSIS FRONT BRACKET   | 1   |
| 34 | 033.929         | SHIELD WIRE             | 1   |
| 33 | 011.360         | SCREW 3.9x13            | 2   |
| 32 | 50V.188         | TELETEXT MODULE         | 1   |
| 31 | 54K.208         | HOLDER TELETEXT         | 1   |
| 30 | 54G.203         | HOLDER, TX ASSY         | 2   |
| 29 | 011.814         | SCREW 2.9x9.5           | 2   |
| 28 | 833.215         | POWER CORD HANGER       | 1   |
| 27 | 60U.903         | RUBBER CONTACT          | 1   |
| 26 | 60U.207         | PLATE FUNCTION          | 1   |
| 25 | 011.956         | SCREW 3.9x13            | 1   |
| 24 | 64A.204         | POWER CORD HANGER       | 1   |
| 23 | 60U.203         | LENS LED                | 1   |
| 22 | 51A.301         | SPRING POWER KNOB       | 1   |
| 21 | 64A.211         | PLATE REMOTE CONTROL    | 1   |
| 20 | 60U.206         | PLATE FUNCTION I        | 1   |
| 19 | 60U.210         | PLATE FUNCTION II       | 1   |
| 18 | 60U.212         | DECO PANEL              | 2   |
| 17 | 64A.206         | CONTROL UNIT DOOR       | 1   |
| 16 | 60U.202         | LED COVER               | 1   |
| 15 | 60U.208         | POWER KNOB              | 1   |
| 14 | 64A.202         | PANEL                   | 2   |
| 13 | 60U.902         | RUBBER CONTACT-II       | 1   |
| 12 | 60U.901         | RUBBER CONTACT-I        | 1   |
| 11 | 011.814         | SCREW                   | 5   |
| 10 | 64A.172         | CONTROL UNIT            | 1   |
| 9  | 110             | CHASSIS PCB             | 1   |
| 8  | 50S.220         | CHASSIS BRACKET         | 1   |
| 7  | 011.507         | SCREW CPT (EJOT)        | 1   |
| 6  | 011.507         | SCREW CPT (EJOT)        | 4   |
| 5  | 710.107         | SPEAKER                 | 1   |
| 4  | 011.950         | SCREW 3.9x13            | 4   |
| 3  | 64A.203         | HOLDER, BACK COVER      | 1   |
| 2  | 64A.205         | BACK COVER              | 1   |
| 1  | 65A.201/64A.201 | FRONT FRAME 15"x14"     | 1   |

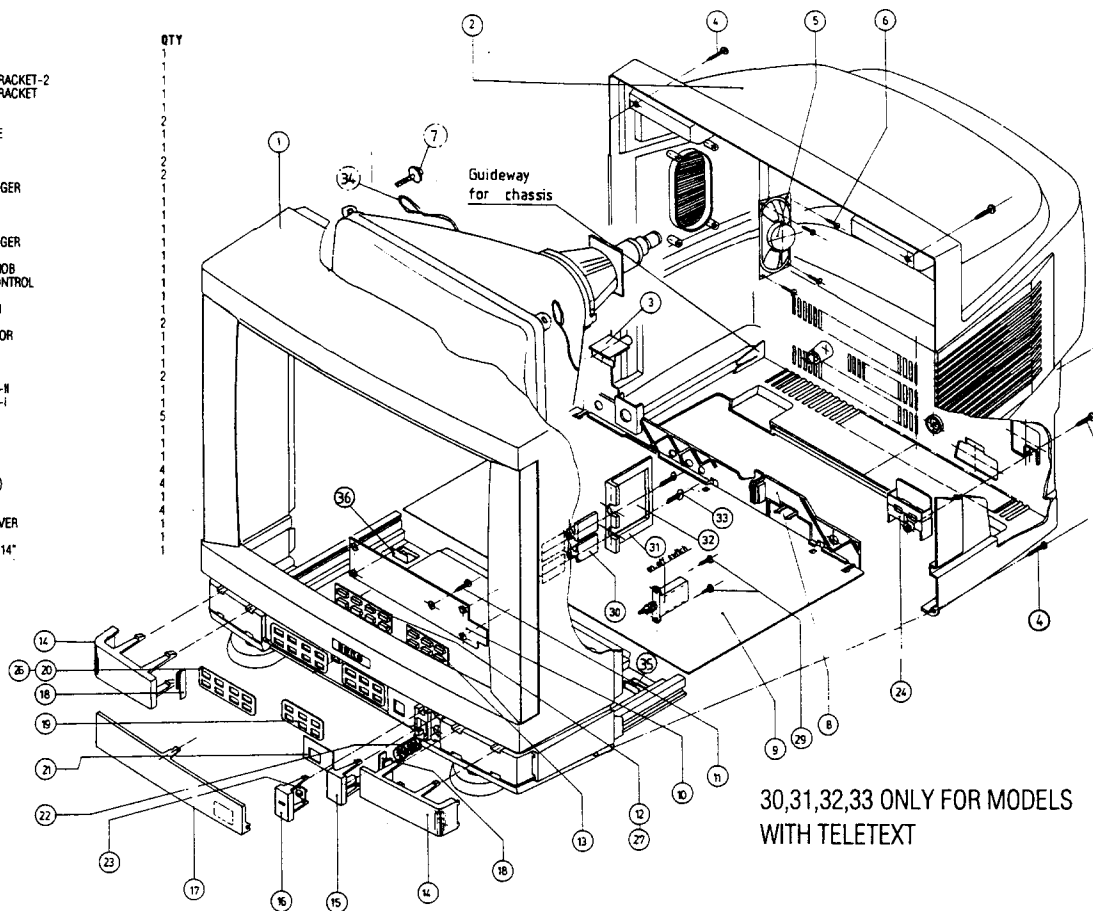


Figure 3

27,28,29 ONLY FOR MODELS WITH TELETEXT  
28 ONLY FOR 21" MODELS

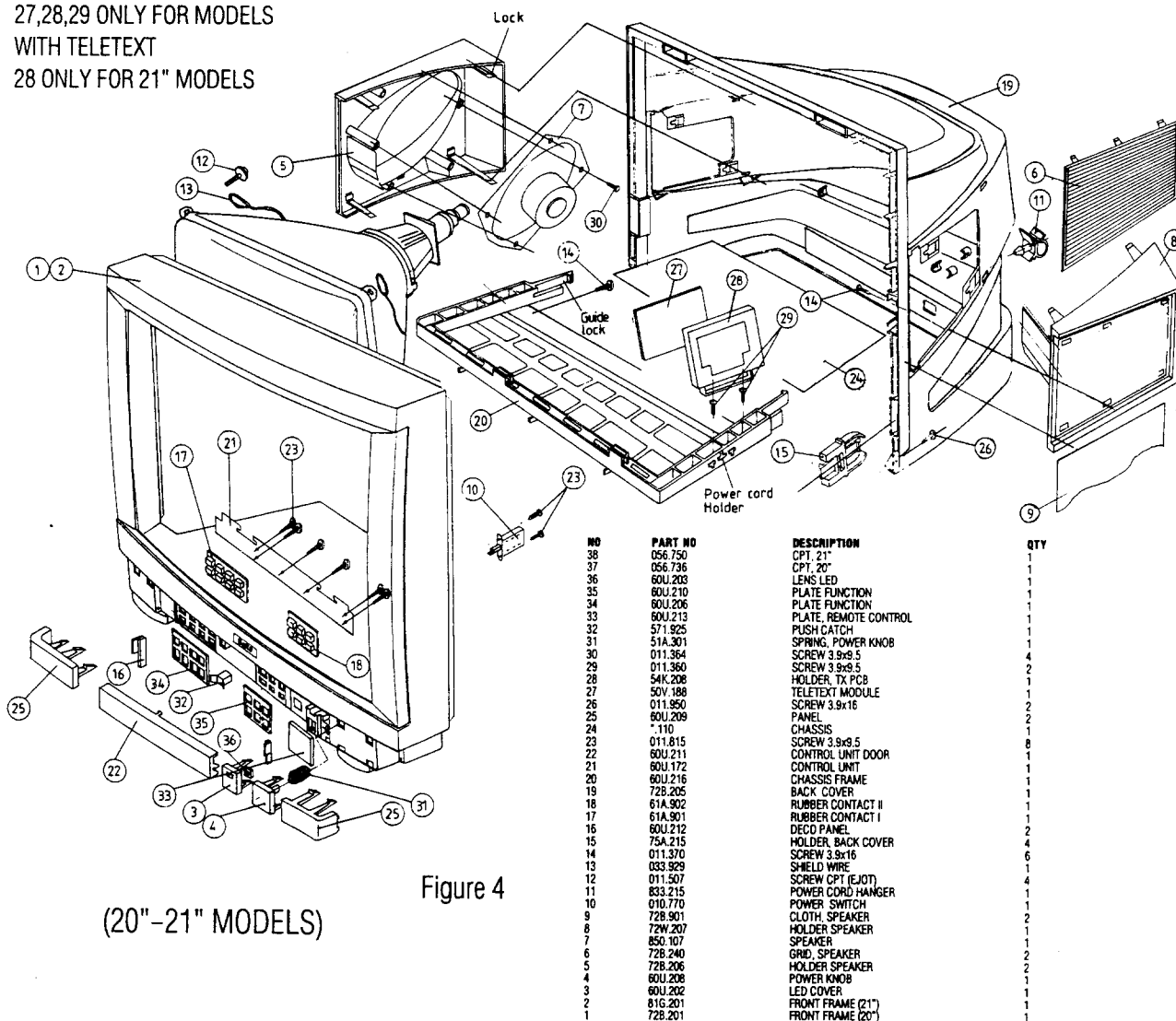


Figure 4

(20"-21" MODELS)

| NO | PART NO | DESCRIPTION           | QTY |
|----|---------|-----------------------|-----|
| 38 | 056.750 | CPT. 21"              | 1   |
| 37 | 056.736 | CPT. 20"              | 1   |
| 36 | 60U.208 | LENS LED              | 1   |
| 35 | 60U.210 | PLATE FUNCTION        | 1   |
| 34 | 60U.206 | PLATE FUNCTION        | 1   |
| 33 | 60U.213 | PLATE, REMOTE CONTROL | 1   |
| 32 | 571.825 | PUSH CATCH            | 1   |
| 31 | 51A.301 | SPRING, POWER KNOB    | 1   |
| 30 | 011.364 | SCREW 3.9x9.5         | 4   |
| 29 | 011.360 | SCREW 3.9x9.5         | 2   |
| 28 | 54K.208 | HOLDER, TX PCB        | 1   |
| 27 | 50V.188 | TELETEXT MODULE       | 1   |
| 26 | 011.950 | SCREW 3.9x16          | 2   |
| 25 | 60U.209 | PANEL                 | 2   |
| 24 | 110     | CHASSIS               | 1   |
| 23 | 011.815 | SCREW 3.9x9.5         | 8   |
| 22 | 60U.211 | CONTROL UNIT DOOR     | 1   |
| 21 | 60U.172 | CONTROL UNIT          | 1   |
| 20 | 60U.216 | CHASSIS FRAME         | 1   |
| 19 | 72B.205 | BACK COVER            | 1   |
| 18 | 61A.902 | RUBBER CONTACT II     | 1   |
| 17 | 61A.901 | RUBBER CONTACT I      | 1   |
| 16 | 60U.212 | DECO PANEL            | 2   |
| 15 | 75A.215 | HOLDER, BACK COVER    | 4   |
| 14 | 011.370 | SCREW 3.9x16          | 6   |
| 13 | 033.929 | SHIELD WIRE           | 1   |
| 12 | 011.507 | SCREW CPT (EJOT)      | 4   |
| 11 | 833.215 | POWER CORD HANGER     | 1   |
| 10 | 010.770 | POWER SWITCH          | 1   |
| 9  | 72B.901 | CLOTH, SPEAKER        | 2   |
| 8  | 72W.207 | HOLDER, SPEAKER       | 1   |
| 7  | 850.107 | SPEAKER               | 1   |
| 6  | 72B.240 | GRID, SPEAKER         | 2   |
| 5  | 72B.206 | HOLDER, SPEAKER       | 2   |
| 4  | 60U.208 | POWER KNOB            | 1   |
| 3  | 60U.202 | LED COVER             | 1   |
| 2  | 81G.201 | FRONT FRAME (21")     | 1   |
| 1  | 72B.201 | FRONT FRAME (20")     | 1   |

## WIRING DIAGRAM

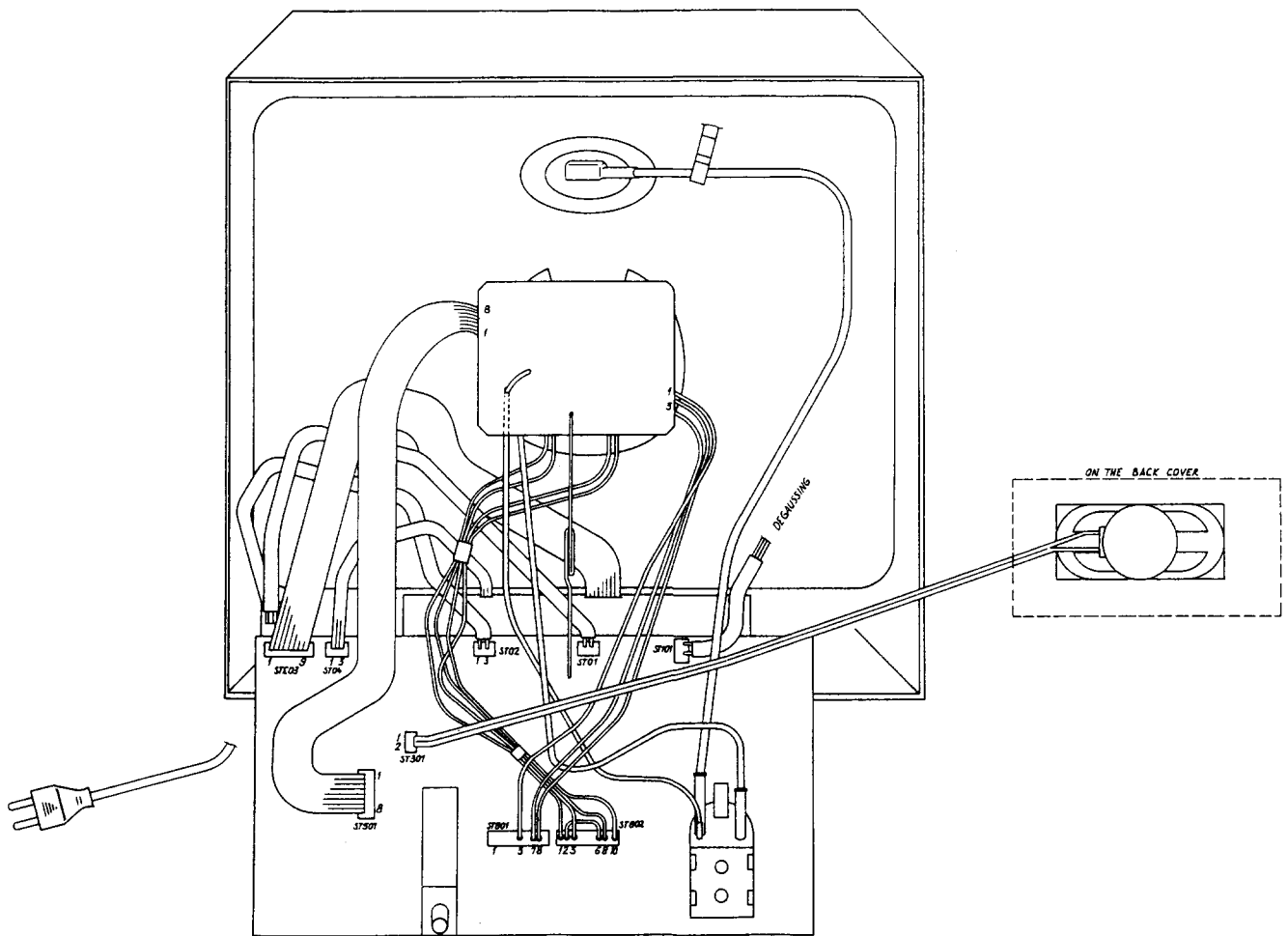


Figure 5

# TECHNICAL SPECIFICATIONS

## 1. OPERATING CONDITIONS

|     |                           |                                |
|-----|---------------------------|--------------------------------|
| 1.1 | POWER SUPPLY              | 140 TO 265 VAC                 |
| 1.2 | NOMINAL OPERATING VOLTAGE | 220 VAC                        |
| 1.3 | TEMPERATURE RANGE         | 0 TO 45 DEGREES C              |
| 1.4 | HUMIDITY RANGE            | YEAR'S MEAN = 75%<br>MAX = 95% |

## 2. RF SECTION

### 2.1 RECEIVING CHANNELS FOR VHF/UHF BAND

| CCIR      |           |       | OIRT      |         |                   |
|-----------|-----------|-------|-----------|---------|-------------------|
| VHF BAND  |           |       | VHF       |         |                   |
| BAND I    | CHANNEL   | 2-4   | Band I    | Channel | 1-4               |
| BAND III  | CHANNEL   | 5-12  | Band III  | Channel | 5-12              |
| CABLE CH  | CABLE CH. | 81-99 | Cable Ch. |         | S1-S19<br>S20-S41 |
|           |           |       | UHF       |         |                   |
| BAND IV-V | CHANNEL   | 21-69 | Band IV-V | Channel | 21-69             |

|                                 | MIN       | NOM             | MAX | UNIT    |
|---------------------------------|-----------|-----------------|-----|---------|
| 2.2 GAIN LIMITED SENSITIVITY    |           |                 |     |         |
| INPUT SIGNAL LEVEL FOR          |           |                 |     |         |
| STANDARD VIDEO OUTPUT VOLTAGE   |           |                 |     |         |
| BAND 1/3                        | —         | 20              | —   | dB (μV) |
| BAND 4/5                        | —         | 23              | —   | dB (μV) |
| 2.3 NOISE LIMITED SENSITIVITY   |           |                 |     |         |
| INPUT SIGNAL LEVEL FOR 30 dB    |           |                 |     |         |
| (S+N)/N-RATIO, WEIGHTED, CCIR   |           |                 |     |         |
| REC 567                         |           |                 |     |         |
| BAND 1/3/4/5                    | —         | 30              | —   | dB (μV) |
| 2.4 SELECTIVITY HF+IF           |           |                 |     |         |
| 2.4.1 IF FREQUENCIES            |           |                 |     |         |
| PICTURE CARRIER                 | B/G       | D/K             |     |         |
| SOUND CARRIER                   | 38.9 MHz  | 38.9            |     |         |
| COLOUR CARRIER                  | 33.4 MHz  | 32.4            |     |         |
|                                 | 34.47 MHz | 34.47 MHz       |     |         |
| 2.5 VOLTAGE STANDING WAVE RATIO | MIN       | NOM             | MAX | UNIT    |
| BAND 1/3                        | —         | 2               | 4   | —       |
| BAND 4/5                        | —         | 2               | 4   | —       |
| 2.6 MAXIMUM INPUT SIGNAL LEVEL  |           |                 |     |         |
| BAND 1/3                        |           | 100 dB μV (MAX) |     |         |
| BAND 4/                         |           | 100 dB μV (MAX) |     |         |

## 3. VIDEO OUTPUT SECTION

|                                     | MIN | NOM | MAX | UNIT |
|-------------------------------------|-----|-----|-----|------|
| 3.1 VIDEO OUTPUT VOLTAGE            |     |     |     |      |
| (measured on cathode with           |     |     |     |      |
| lowest output level, contrast       |     |     |     |      |
| control and drive control at        |     |     |     |      |
| max.                                | 90  | 100 | —   | V    |
| 3.2 FREQUENCY RESPONSE              |     |     |     |      |
| a) INPUT AERIAL STANDARD, HF SIGNAL |     |     |     |      |
| STANDARD B/G : D/K                  | —10 | —7  | —   | dB   |
| b) INPUT: SCART PIN 20              |     |     |     |      |
| STANDARD B/G : D/K                  | —8  | —6  | —   | dB   |

## 4. CHROMA SECTION

|                                |                    |      |    |         |
|--------------------------------|--------------------|------|----|---------|
| 4.1 PAL/SECAM                  |                    |      |    |         |
| 4.1.1 COLOUR CAPTURE RANGE     | ±300               | ±500 | —  | HZ      |
| 4.1.2 PHASE ERROR OF REFERENCE |                    |      |    |         |
| CARRIER                        | —                  | ±5   | 10 | DEGRESS |
| 4.1.3 COLOUR KILLER            | 30 dB μV (NOMINAL) |      |    |         |

## 5. SOUND SECTION

|                                      | MIN               | NOM | MAX | UNIT |
|--------------------------------------|-------------------|-----|-----|------|
| 5.1 SCART OUTPUT                     |                   |     |     |      |
| 5.1.1 S/N RATIO                      | 40                | 45  | —   | dB   |
| 5.1.2 NOISE LIMITED SENSITIVITY      | 38 dB/V (NOMINAL) |     |     |      |
| 5.1.3 AM SUPPRESSION RATIO           | 60 dB (NOMINAL)   |     |     |      |
| AM MODULATION=30%                    |                   |     |     |      |
| 5.1.4 HARMONIC DISTORTION            | 10%               |     |     |      |
| f <sub>m</sub> =1 KHz                |                   |     |     |      |
| 5.2 POWER OUTPUT (at 10% distortion) | 4.0 Wrms          |     |     |      |
| f <sub>m</sub> =1 KHz                |                   |     |     |      |



## 6. SYNCHRONISATION

|     |                                  |   |          |
|-----|----------------------------------|---|----------|
| 6.1 | LINE FREQUENCY LOCKING RANGE     | : | +—300 HZ |
| 6.2 | VERTICAL FREQUENCY LOCKING RANGE | : | +—5 HZ   |

## 7. PICTURE TUBE DRIVE SECTION

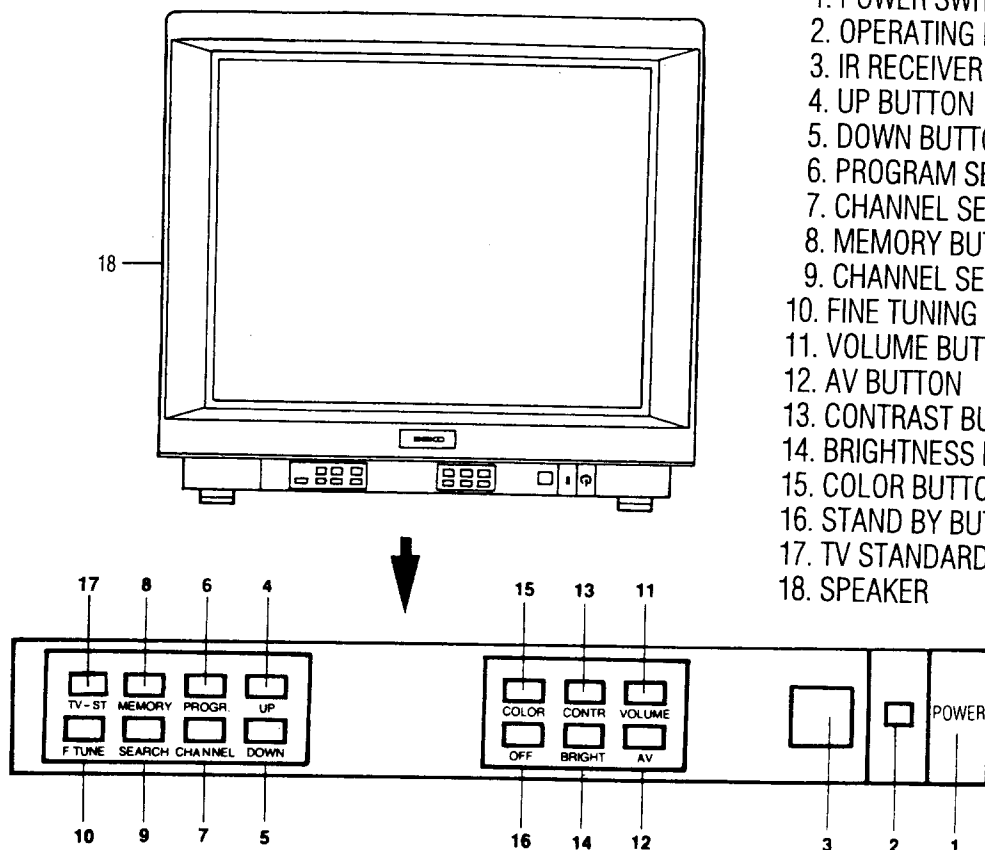
|      |                                    |   |                          |                  |
|------|------------------------------------|---|--------------------------|------------------|
| 7.1  | B+ SUPPLY VOLTAGE<br>(AT $I_b=0$ ) | : | 20" / 21"<br>125+— 1 VDC | 14" / 15"<br>— — |
| 7.2  | EHT                                | : | 25.0+—0.5 KV             | 23.0—0.5 KV      |
| 7.3  | FOCUS VOLTAGE                      | : | MIN 25.6%<br>MAX 28%     | — —              |
| 7.4  | GRID 2 VOLTAGE RANGE               | : | MIN 300 V<br>MAX 1350 V  | — —              |
| 7.5  | HEATER VOLTAGE                     | : | 6.2+—0.2 Vrms            | — —              |
| 7.6  | FRAME OUTPUT VOLTAGE               | : | 250+—8 Vpp               | — —              |
| 7.7  | 200V OUTPUT                        | : | 200+—5VDC                | — —              |
| 7.8  | 12V OUTPUT                         | : | 12.0+—0.5 VDC            | — —              |
| 7.9  | 17.5V OUTPUT                       | : | 17.5+—0.5 VDC            | — —              |
| 7.10 | 21V OUTPUT                         | : | — —                      | — —              |
| 7.11 | 5V OUTPUT                          | : | 5.0+—0.5 VDC             | — —              |
| 7.12 | RETRACE TIME                       | : | 11.0+—0.5 VDC            | — —              |

## 8. OTHERS

|     |                               |   |  |
|-----|-------------------------------|---|--|
| 8.1 | AMBIENT OPERATING TEMPERATURE | : | 0—45 DEGRESS C   |
| 8.2 | STORAGE TEMPERATURE           | : | —10 TO + 85 DEGRESS C                                    |
| 8.3 | POWER CONSUMPTION             | : | 90 W (14")<br>90 W (20")<br>90 W (21")<br>10 W (Standby) |
| 8.4 | SAFETY                        | : | IEC 65   |
| 8.5 | X-RAY RADIATION               | : | ACC. IEC 65  |

Components and specification are subject to change for improvment.

## LOCATION OF CONTROLS



1. POWER SWITCH
2. OPERATING INDICATOR
3. IR RECEIVER WINDOW
4. UP BUTTON
5. DOWN BUTTON
6. PROGRAM SELECTION BUTTON
7. CHANNEL SELECTION BUTTON
8. MEMORY BUTTON
9. CHANNEL SEARCH BUTTON
10. FINE TUNING BUTTON
11. VOLUME BUTTON
12. AV BUTTON
13. CONTRAST BUTTON
14. BRIGHTNESS BUTTON
15. COLOR BUTTON
16. STAND BY BUTTON
17. TV STANDARD SELECTION BUTTON
18. SPEAKER

Figure 6

## REMOTE CONTROL UNIT

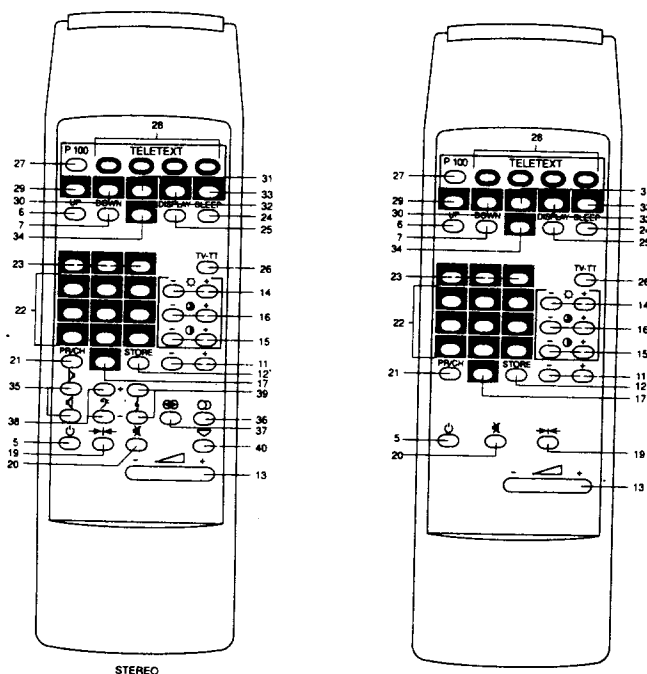


Figure 7

- 1-Power switch
- 2-Ir indicator
- 3-Operating indicator
- 4-Ir receiver
- 5-Stand-By button
- 6-Up button
- 7-Down button
- 8-Channel search button
- 9-Programme selection button
- 10-Channel selection button
- 11-Fine tuning button
- 12-Memory button (press twice to store)
- 13-Volume adjustment button
- 14-Brightness adjustment button
- 15-Contrast adjustment button
- 16-Colour adjustment button\*
- 17-AV button
- 18-Speakers
- 19-Normalization button
- 20-Mute button
- 21-Programme/channel selection button
- 22-Ten key buttons
- 23-Two digit buttons
- 24-Sleep timer button
- 25-Display button
- 26-Teletext selection button\*
- 27-Index page button (P100)\*
- 28-Colour linket buttons\*
- 29-Reveal\*
- 30-Subpage\*
- 31-Double height\*
- 32-Update\*
- 33-Clock\*
- 34-Stop\*
- 35-Balance buttons\*\*
- 36-Quasi-Stereo\*\*
- 37-Space Wide\*\*
- 38-Bass Controls\*\*
- 39-Treble Controls\*\*
- 40-Stereo/Mono (Dual/A-Dual/B)\*\*

\* These buttons are for TELETEXT use only  
 \*\* These buttons are for STEREO function only.

# OPERATION INSTRUCTIONS

## CONNECTIONS

Connect the mains plug into the mains socket, 220V AC, 50/60 Hz.

Connect the aerial lead to the aerial socket (75 ohm coaxial) at the back.

## ON SCREEN DISPLAY

This function is automatically displayed on the TV screen whenever a control is pressed. It shows you what is happening by a series of graphics moving left (decrease) or right (increase). If you wish the setting to become permanent (normal), press the "MEMORY" button, a prompt message "MEMORY ?" will be displayed on the screen, to confirm, press the "MEMORY" button twice then setting new levels.

## TV STANDARD SELECTION

Press the TV-Standard . PAL/SECAM, SECAM DK etc. will be displayed on the screen. After selection press the MEMORY button, a prompt message "MEMORY ?" will be displayed, press MEMORY button once more (Within four seconds) and the selected standard will be stored.

## TUNING

### METHOD 1:

To select a program, first press SEARCH button and either UP or DOWN buttons. The tuner will automatically search and locate all valid channels being broadcast. To store these individual channels press the button marked MEMORY, a prompt message "MEMORY ?" will be displayed on the screen : Press MEMORY button once more (within four seconds) and that individual channel will be stored in the memory. Repeat operation until all channels have been found and stored.

### METHOD 2:

If the channel numbers are known, obtain "C.." at the upper right corner of the screen by either pressing PR/CH on Remote Control Handset or CHANNEL button on TV set. Select the channel number with Remote Control handset by using ten Key buttons. Press the MEMORY button, a prompt message "MEMORY ?" will be displayed, press MEMORY button once more (within 4 seconds) and that individual channel will be stored in the memory.

## FINE TUNING

The button marked "F TUNE" on the television or the handset will allow you to manually gain the optimum reception within the bandwidth, should the auto search facility not tune the channel to your satisfaction.

## PICTURE ADJUSTMENTS

The following 3 controls should be used in conjunction with each other to give you a well balanced picture without any glare.

### Contrast

Press the button marked "CONTRAST" to adjust light and dark shades.

### Brightness

Press the button marked "BRIGHT" to ensure overall clarity of definition.

### Colour

Press the button marked "COLOUR" to ensure all objects are seen in their natural colours.

## VOLUME CONTROL

Press the button marked "VOLUME" on the handset or "volume + up" on the control panel to increase the volume. By pressing the button marked "volume" or "volume + down", will decrease the volume.

## DECADAL CONTROL

The buttons marked "1-", "2-", "3-", are to be used if you require to go to a programme exceeding number 9, ie should you require programme 23, press "2- +3" and it will instantly take you to programme 23.

## **DISPLAY**

The button marked "DISPLAY" on the handset, will show the programme number that you are currently viewing, in the top right corner of the television screen.

## **SLEEP/TIMER**

Adjacent to the display button is the TIMER. This will give you the option of automatically switching the television to STANDBY after a period of 30, 60, 90 or 120 minutes. When the word "OFF" is displayed on screen or if the receiver is switched OFF/STANDBY, the timer settings will be cancelled.

## **MUTE**

The button marked "MUTE" on the handset, will prevent any sound being emitted from the speakers, and the word "MUTE" will be displayed on screen until this button has been pressed again, whereupon previous volume levels are restored.

## **NORMAL SETTINGS**

When the receiver is first switched ON or whenever the "NORMAL" button is pressed, all picture and sound adjustments should be as you prefer them—this is provided that you have initially adjusted them to your satisfaction and stored these settings in the electronic memory. They will always revert to these settings even if temporarily altered to suit unusual reception conditions etc (provided the temporary settings have not been memorised).

## **MEMORY / STORE**

This button, when pressed twice (within 4 seconds), will override any previous control setting if used in conjunction with a particular control. To memorise any alteration, press the "MEMORY" BUTTON once, the receiver will advise it will accept this command by displaying "memory?", to confirm press "MEMORY" once more. This new setting will then be regarded as permanent or normal.

## **STANDBY**

The button marked "⏻" allows you to switch the television to "standby". This control shuts down all functions except a sensory circuit. To return to television programmes either press the standby button again or key in a valid programme number by using the numeric pad on the handset. It should be noted that the television is "not" switched off in this mode. If you are not going to use the television for long periods of time, it is recommended that you switch the power on the television to "OFF" and remove the mains plug from the socket.

## **AUDIO VIDEO CONNECTIONS**

When the button marked "AV" is pressed, it enables you to connect most types of VCR's, Computers and Satellite Receivers to this television, either directly to the aerial socket or by the SCART connector.

## **SCART – EURO SOCKET**

The term SCART or Eurosocket is a 21 pin connector, recognised by International Standards, which will allow you to connect any relevant equipment, regardless of make or country or origin, to this television and will operate according to manufacturers specification.

## **VIDEO CONNECTION**

This television has been produced so that a video recorder can be connected direct to the aerial socket, by using the standard co-axial lead supplied with all makers V.C.R.

Follow the instructions from the VCR to connect the 2 units together and switch on the VCR's test signal or play a pre-recorder video cassette. Tune the television to the signal from the VCR. This will usually be either channel 36 or 37, however, check the information plate at the rear of the VCR. Although you can store the video tuning position to any channel, we suggest that you store the video on channel "0", to prevent any confusion of possible new channel additions.

It should be noted that some makers of VCR's, Computers and Satellite receivers etc, will automatically switch the television into "AV" mode. If this happens then you must obviously disregard the previous instruction to manually select "AV".

# CIRCUIT DESCRIPTIONS

## 1.1 GENERAL

Chassis AT-2 has a modular designed frequency synthesis tuning and control system which can be used in a wide range of TV receivers. The system involves frequency tables of standards B/G-D/K channels. The basic system, providing 40 permanently stored programmes, local control of main TV functions and display of programme, channel number and analogue values on the screen (OSD) can be realized with only four integrated circuits:

Microcontroller        SDA 20160

Nonvolatile memory    SDA 2526

OSD-IC (NEC)         6142

IR remote control of all TV functions is possible if two additional ICs are used:

IR TRANSMITTER       SDA 2208

IR PREAMPLIFIER      SDA 4050B

Teletext function may be included by using the following devices:

Data slicer            SDA5231

Teletext decoder      SDA5243

Memory device        8k\*8

## 1.2 SALIENT FEATURES

Frequency synthesis tuning (62.5kHz steps)

Channels corresponding to standard B/G - D/K.

Software protection against tube flashovers

40 programs selectable by directly entering a programme number or by up/down function.

Channel selection by directly entering a channel number or up/down function.

Channel search function in two directions.

Nonvolatile memory for 40 programme and optimal analogue values.

128 step fine tuning.

Local control (14/13 Keys)

IR remote control

Control lines for AV (programmes 0,AV,39)

Display of programme number, channel number, analogue values, mute illustrated by OSD (On screen display).

Automatic muting if no carrier detected.

Automatic switch-off when carrier disappears for more than 5 minutes

Sleep-timer (30,60,90, 120 min)

Full teletext control

Linked page control (row 27)

Pin programmable tuner-selection

Broadcasting standard selection.

## **1.3 CONTROL COMPONENTS**

In the following sections abbreviated reference data of the control components is given. For more detailed information use corresponding data sheets.

### **1.3.1 MICROCONTROLLER SDA 20160**

The SDA20160 is an one-chip microcontroller with an 8 bit CPU, 16 kByte code memory (ROM), 256 byte data memory (RAM), two independent 16 bit timers/counters, a five-source/two-priority-level nester interrupt structure and four on chip D/A converters. Manufactured in NMOS silicon gate technology and working with a single 5 Volt supply voltage it has a cycle time of 1  $\mu$ s (crystal frequency 12MHz) with one, two or four cycles per instruction. A total of up to 34 digital I/O lines are available, configured as four 8 bit ports (port0 to port3) and the serial IIC bus interface with clock (SCL) and data (SDA) line. Port 3 is a multifunction port. All special functions can be enabled/disabled by software. P3.0 input is able to process signals modulated with approx. 30 kHz. It contains a digital demodulator deriving the envelope curve from a modulated digital signal and can be used as an input for infrared transmitter signals. Further port3 includes two interrupt inputs and two counter inputs. Port 1 also contains four multifunction lines which can be used either as normal port input/output or as PWM (pulse width modulated) outputs, controlled by the four on-chip D/A converters. For the application a special software has been located in the microcontroller ROM. Fig1 shows a pinning diagram of the SIESTA-OSD microcontroller, named SDA 20160. The SDA 20160 microcontroller is housed in a DIP 40 package.

### **1.3.2 NONVOLATILE MEMORY SDA 2516/2526**

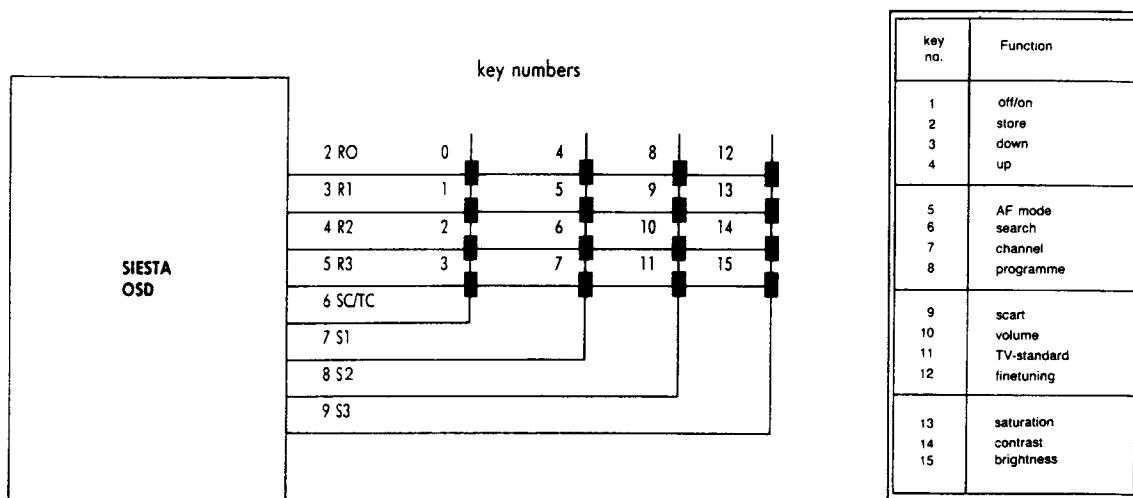
The SDA 2516 and SDA 2526 are nonvolatile, electrically programmable and erasable memory devices 128 \* 8 bit resp. 256 \* 8 bit (SDA 2526) memory size. Data transfer is done via an IIC bus interface. Programming time is typically 15ms. Data retention is unlimited and independent of power-on or power-off status. The number of reprogramming cycles per address is greater than 1000. SDA 2516 and SDA 2526 are manufactured in MOS technology and mounted in a DIP 8 case.

### **1.3.3 INFRARED PREAMPLIFIER TDA 4060**

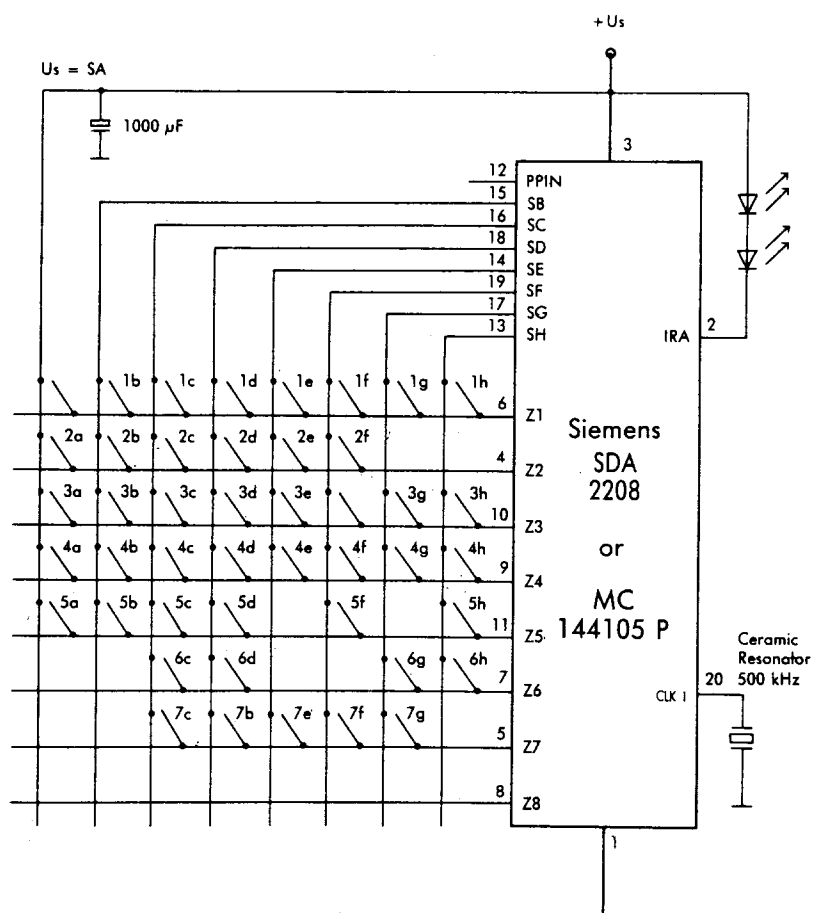
The bipolar integrated circuits TDA 4060 is designed for universal use as preamplifier for infrared remote control signals. The TDA 4060 uses only a single 5V supply.

### **1.3.4 IR TRANSMITTER SDA 2208**

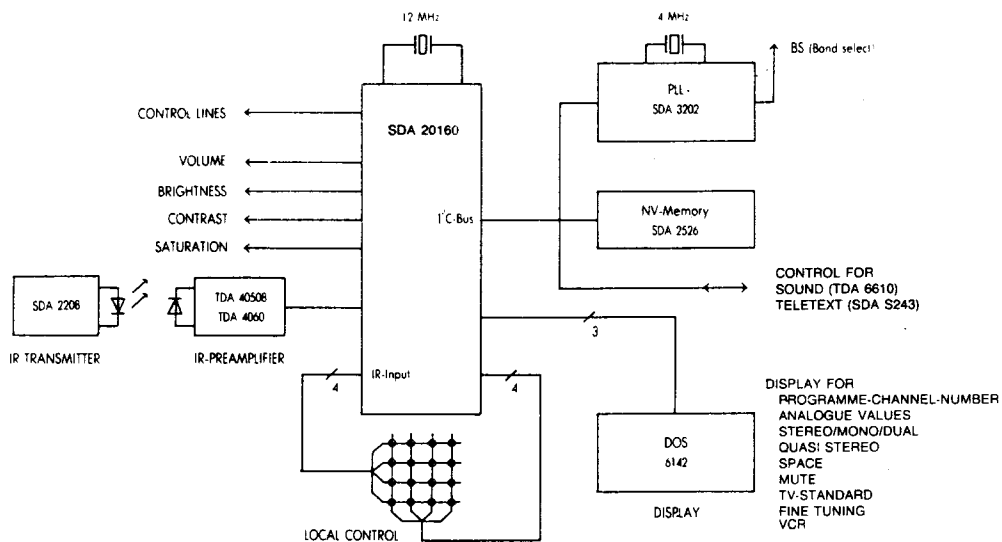
The IR transmitter circuit SDA 2208, manufactured in a bipolar technology converts instructions obtained from an 8\*8 keyboard matrix to a 9 bit bipolar phase code. The keyboard matrix could be enlarged to an 8\*64 array by means of shift keys or additional working, so a total of 512 different instructions could be transmitted. As including an on-chip IR diode driver, the IR transmitter diode (s) are directly connected to the SDA 2208. The keyboard is completely locked against multiple closure. The internal oscillator is controlled by an AM-IF ceramic resonator or by an existing clock signal (430..530kHz). Current consumption during operation is typically 10mA (supply voltage 4...10V) When no key on the board is pressed (standby) the SDA 2208 is produced in a DIP 20 case.



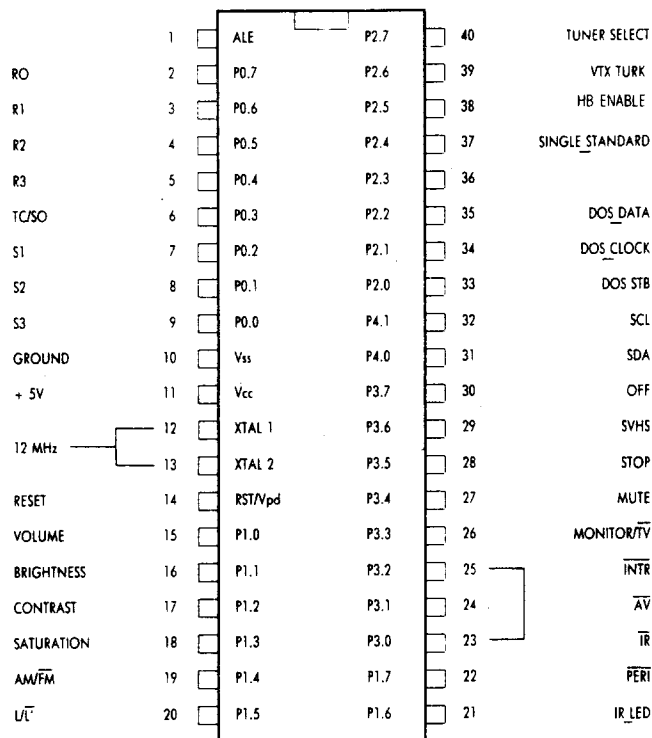
**LOCAL CONTROL BLOCK DIAGRAM**



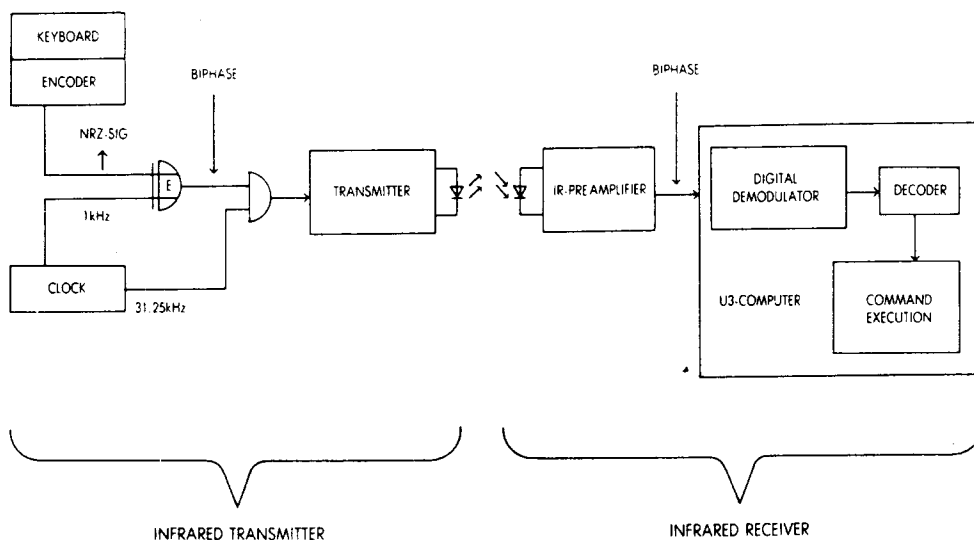
**CIRCUIT FOR IR TRANSMITTER SDA 2208**



**SYSTEM BLOCK DIAGRAM**



**MICROCONTROLLER PIN CONFIGURATION**

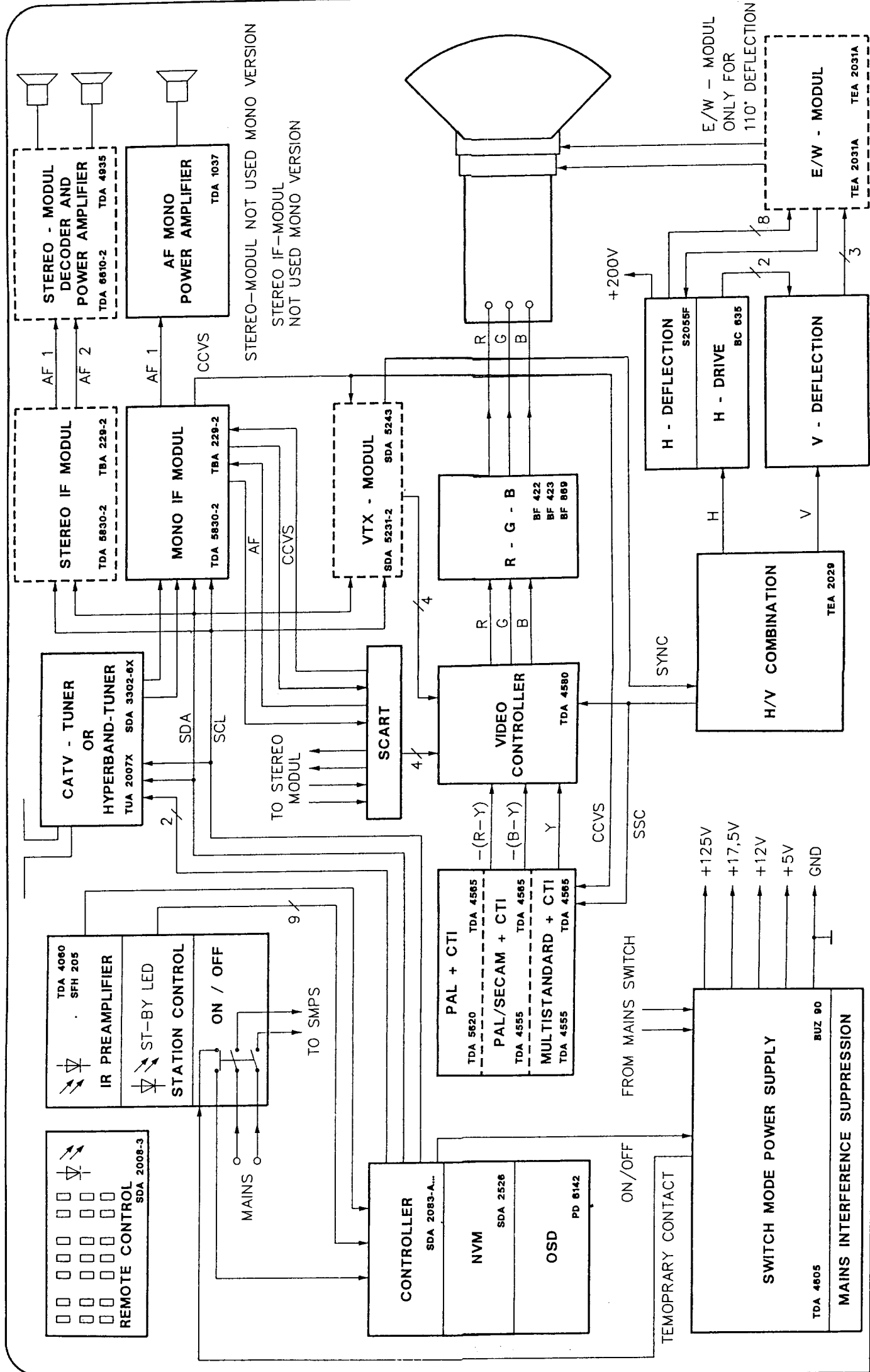


**IR REMOTE CONTROL BLOCK DIAGRAM**



# CHANNEL TABLE FOR STANDARD B/G (CCIR)

| Channel number (display) | Channel design. | Centre frequency (MHz) | Oscillator frequency (MHz) | Division ratio PLL (decimal) | Channel number (display) | Channel design. | Centre frequency (MHz) | Oscillator frequency (MHz) | Division ratio PLL (decimal) |
|--------------------------|-----------------|------------------------|----------------------------|------------------------------|--------------------------|-----------------|------------------------|----------------------------|------------------------------|
| 01                       | AU 0            | 46.25                  | 85.125                     | 1.362                        | 61                       | K61             | 791.25                 | 830.125                    | 13.282                       |
| 02                       | K2              | 48.25                  | 87.125                     | 1.394                        | 62                       | K62             | 799.25                 | 838.125                    | 13.410                       |
| 03                       | K3              | 55.25                  | 94.125                     | 1.506                        | 63                       | K63             | 807.25                 | 846.125                    | 13.538                       |
| 04                       | K4              | 62.25                  | 101.125                    | 1.618                        | 64                       | K64             | 815.25                 | 854.125                    | 13.666                       |
| 05                       | K5              | 175.25                 | 214.125                    | 3.426                        | 65                       | K65             | 823.25                 | 862.125                    | 13.794                       |
| 06                       | K6              | 182.25                 | 221.125                    | 3.538                        | 66                       | K66             | 831.25                 | 870.125                    | 13.922                       |
| 07                       | K7              | 189.25                 | 228.125                    | 3.650                        | 67                       | K67             | 839.25                 | 878.125                    | 14.050                       |
| 08                       | K8              | 196.25                 | 235.125                    | 3.762                        | 68                       | K68             | 847.25                 | 886.125                    | 14.178                       |
| 09                       | K9              | 203.25                 | 252.125                    | 3.874                        | 69                       | K69             | 855.25                 | 894.125                    | 14.306                       |
| 10                       | K10             | 210.25                 | 249.125                    | 3.986                        | 70                       | EX              | 863.25                 | 902.125                    | 14.434                       |
| 11                       | K11             | 217.25                 | 256.125                    | 4.098                        | 71                       | EX              | 871.25                 | 910.125                    | 14.562                       |
| 12                       | K12             | 224.25                 | 263.125                    | 4.210                        | 72                       | EX              | 879.25                 | 918.125                    | 14.690                       |
| 13                       | A               | 53.75                  | 92.625                     | 1.482                        | 73                       | EX              | 887.25                 | 926.125                    | 14.818                       |
| 14                       | B               | 62.25                  | 101.125                    | 1.618                        | 74                       | EX              | 69.25                  | 108.125                    | 1.730                        |
| 15                       | C               | 82.25                  | 121.125                    | 1.938                        | 75                       | EX              | 76.25                  | 115.125                    | 1.842                        |
| 16                       | D               | 175.25                 | 214.125                    | 3.426                        | 76                       | EX              | 83.25                  | 122.125                    | 1.954                        |
| 17                       | E               | 183.75                 | 222.625                    | 3.562                        | 77                       | EX              | 90.25                  | 129.125                    | 2.066                        |
| 18                       | F               | 192.25                 | 231.125                    | 3.698                        | 78                       | EX              | 97.25                  | 136.125                    | 2.178                        |
| 19                       | G               | 201.25                 | 240.125                    | 3.842                        | 79                       | 20I             | 59.25                  | 98.125                     | 1.570                        |
| 20                       | H               | 210.25                 | 249.125                    | 3.986                        | 80                       | 50I             | 93.25                  | 132.125                    | 2.114                        |
| 21                       | K21             | 471.25                 | 510.125                    | 8.162                        | 81                       | S1              | 105.25                 | 144.125                    | 2.306                        |
| 22                       | K22             | 479.25                 | 518.125                    | 8.290                        | 82                       | S2              | 112.25                 | 151.125                    | 2.418                        |
| 23                       | K23             | 487.25                 | 526.125                    | 8.418                        | 83                       | S3              | 119.25                 | 158.125                    | 2.530                        |
| 24                       | K24             | 495.25                 | 534.125                    | 8.546                        | 84                       | S4              | 126.25                 | 165.125                    | 2.642                        |
| 25                       | K25             | 503.25                 | 542.125                    | 8.674                        | 85                       | S5              | 133.25                 | 172.125                    | 2.754                        |
| 26                       | K26             | 511.25                 | 550.125                    | 8.802                        | 86                       | S6              | 140.25                 | 179.125                    | 2.866                        |
| 27                       | K27             | 519.25                 | 558.125                    | 8.930                        | 87                       | S7              | 147.25                 | 186.125                    | 2.978                        |
| 28                       | K28             | 527.25                 | 566.125                    | 9.058                        | 88                       | S8              | 154.25                 | 193.125                    | 3.090                        |
| 29                       | K29             | 535.25                 | 574.125                    | 9.186                        | 89                       | S9              | 161.25                 | 200.125                    | 3.202                        |
| 30                       | K30             | 543.25                 | 582.125                    | 9.314                        | 90                       | S10             | 168.25                 | 207.125                    | 3.314                        |
| 31                       | K31             | 551.25                 | 590.125                    | 9.442                        | 91                       | S11             | 231.25                 | 270.125                    | 4.322                        |
| 32                       | K32             | 559.25                 | 598.125                    | 9.570                        | 92                       | S12             | 238.25                 | 277.125                    | 4.434                        |
| 33                       | K33             | 567.25                 | 606.125                    | 9.698                        | 93                       | S13             | 245.25                 | 284.125                    | 4.546                        |
| 34                       | K34             | 575.25                 | 614.125                    | 9.826                        | 94                       | S14             | 252.25                 | 291.125                    | 4.658                        |
| 35                       | K35             | 583.25                 | 622.125                    | 9.954                        | 95                       | S15             | 259.25                 | 298.125                    | 4.770                        |
| 36                       | K36             | 591.25                 | 630.125                    | 10.082                       | 96                       | S16             | 266.25                 | 305.125                    | 4.882                        |
| 37                       | K37             | 599.25                 | 638.125                    | 10.210                       | 97                       | S17             | 273.25                 | 312.125                    | 4.994                        |
| 38                       | K38             | 607.25                 | 646.125                    | 10.338                       | 98                       | S18             | 280.25                 | 319.125                    | 5.106                        |
| 39                       | K39             | 615.25                 | 654.125                    | 10.466                       | 99                       | S19             | 287.25                 | 326.125                    | 5.218                        |
| 40                       | K40             | 623.25                 | 662.125                    | 10.594                       | 00                       | S20             | 294.25                 | 333.125                    | 5.330                        |
| 41                       | K41             | 631.25                 | 670.125                    | 10.722                       | 00                       | S21             | 303.25                 | 342.125                    | 5.474                        |
| 42                       | K42             | 639.25                 | 678.125                    | 10.850                       | C1                       | S22             | 311.25                 | 350.125                    | 5.602                        |
| 43                       | K43             | 647.25                 | 686.125                    | 10.978                       | C2                       | S23             | 319.25                 | 358.125                    | 5.730                        |
| 44                       | K44             | 655.25                 | 694.125                    | 11.106                       | C3                       | S24             | 327.25                 | 366.125                    | 5.858                        |
| 45                       | K45             | 663.25                 | 702.125                    | 11.234                       | C4                       | S25             | 335.25                 | 374.125                    | 5.986                        |
| 46                       | K46             | 671.25                 | 710.125                    | 11.362                       | C5                       | S26             | 343.25                 | 382.125                    | 6.050                        |
| 47                       | K47             | 679.25                 | 718.125                    | 11.490                       | C6                       | S27             | 351.25                 | 390.125                    | 6.242                        |
| 48                       | K48             | 687.25                 | 726.125                    | 11.618                       | C7                       | S28             | 359.25                 | 398.125                    | 6.370                        |
| 49                       | K49             | 695.25                 | 734.125                    | 11.746                       | C8                       | S29             | 367.25                 | 406.125                    | 6.498                        |
| 50                       | K50             | 703.25                 | 742.125                    | 11.874                       | C9                       | S30             | 375.25                 | 414.125                    | 6.626                        |
| 51                       | K51             | 711.25                 | 750.125                    | 12.002                       | CC                       | S31             | 383.25                 | 422.125                    | 6.754                        |
| 52                       | K52             | 719.25                 | 758.125                    | 12.130                       | E0                       | S32             | 391.25                 | 430.125                    | 6.882                        |
| 53                       | K53             | 727.25                 | 766.125                    | 12.258                       | E1                       | S33             | 399.25                 | 438.125                    | 7.010                        |
| 54                       | K54             | 735.25                 | 774.125                    | 12.386                       | E2                       | S34             | 407.25                 | 446.125                    | 7.138                        |
| 55                       | K55             | 743.25                 | 782.125                    | 12.514                       | E3                       | S35             | 415.25                 | 454.125                    | 7.266                        |
| 56                       | K56             | 751.25                 | 790.125                    | 12.642                       | E4                       | S36             | 423.25                 | 462.125                    | 7.394                        |
| 57                       | K57             | 759.25                 | 798.125                    | 12.770                       | E5                       | S37             | 431.25                 | 470.125                    | 7.522                        |
| 58                       | K58             | 767.25                 | 806.125                    | 12.898                       | E6                       | S38             | 439.25                 | 478.125                    | 7.650                        |
| 59                       | K59             | 775.25                 | 814.125                    | 13.026                       | E7                       | S39             | 447.25                 | 486.125                    | 7.778                        |
| 60                       | K60             | 783.25                 | 822.125                    | 13.154                       | E8                       | S40             | 455.25                 | 494.125                    | 7.906                        |
|                          |                 |                        |                            |                              | E9                       | S41             | 463.25                 | 502.125                    | 8.034                        |

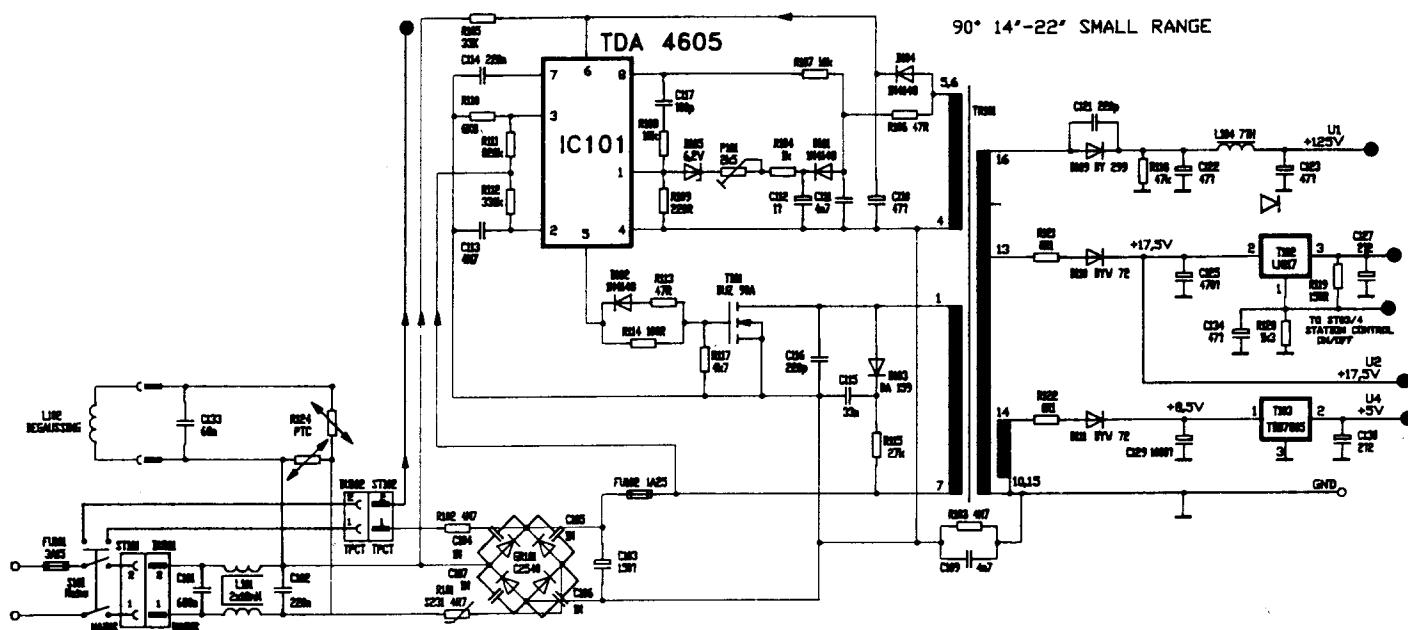
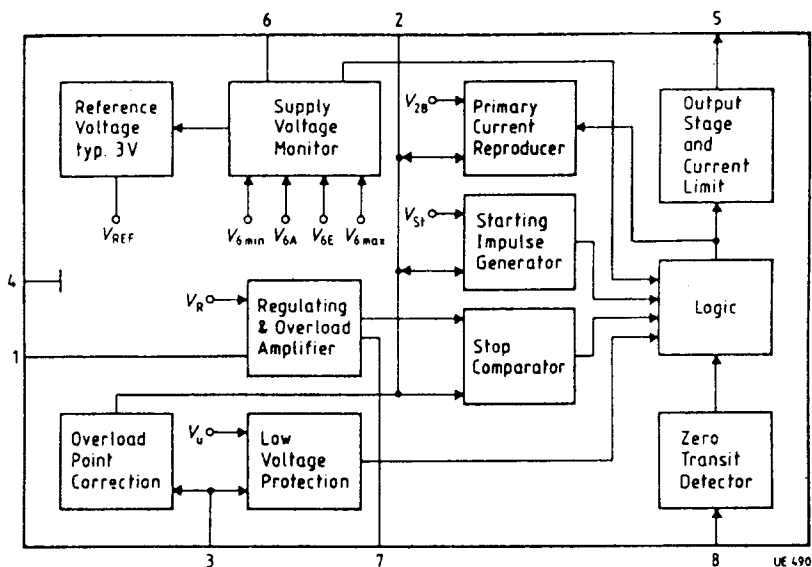


## POWER SUPPLY

# TDA 4605

## Control IC for Switched-Mode Power Supplies using MOS Transistors

### Block Diagram



## START UP

When TV is switched ON a start voltage (9V) is generated over R105 at pin 6 of IC 101, TDA4605. IC101 produces a 50 kHz squarewave, which is supplied to the base of T101, BUZ90A over D102, R113 and R114. Collector of T101 is connected to 330 V with switch mode transformer TR101. 330 V is chopped at primary side of the transformer. This generates various voltages at pins 5, 6, 13, 14, 16 of the secondary side of the transformer TR101.

## NORMAL OPERATION

Voltage from pin 5, 6 of transformer TR101 is rectified with D104 and applied to pin 6 of IC101. When this stable voltage 12 V DC reaches pin 6, start voltage is interrupted.

## VOLTAGE REGULATION

**VOLTAGE REGULATION**  
Voltage obtained from D104 goes over D101, R104, P101, D105 6.2 zener diod to pin 1 of IC101, TDA 4605. This circuit regulates the main supply voltage U1 125V. Pin 8 of IC101 is connected over R107 to pin 8 of TR101, which performs automatic voltage control.



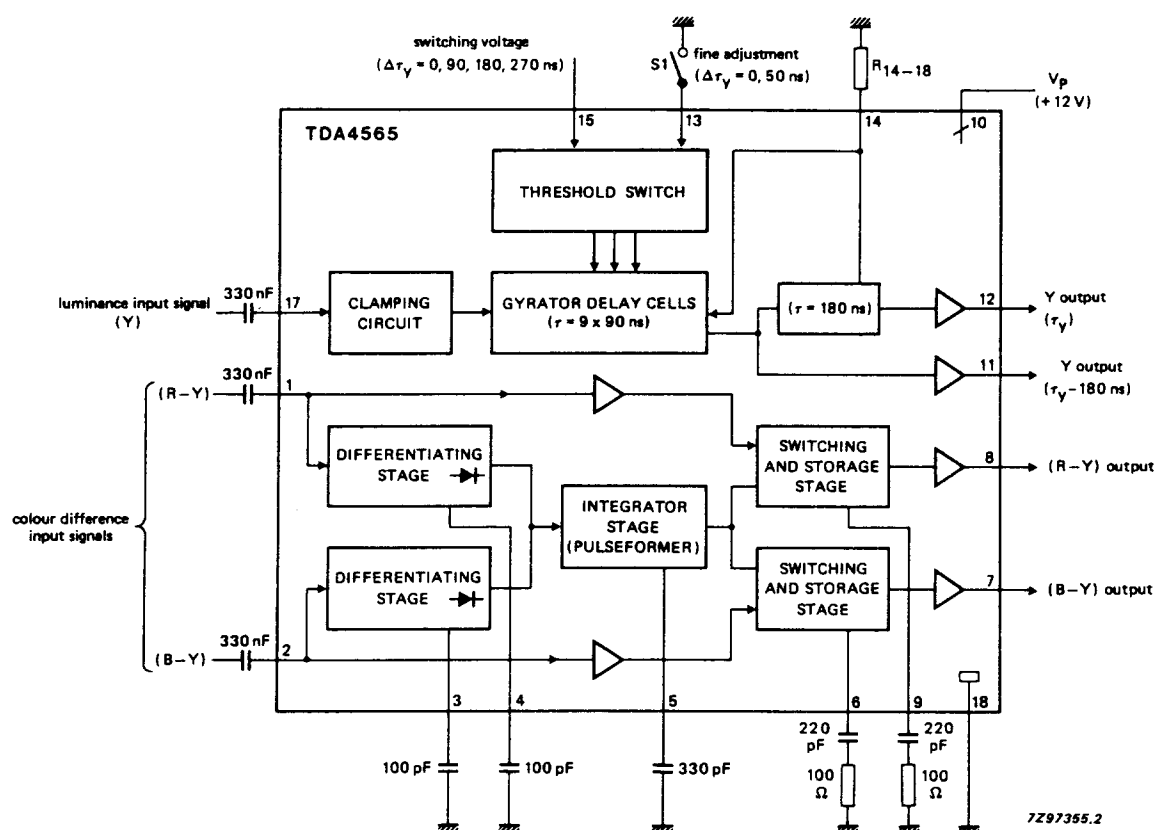
- c
- Figure 6 shows the effect of the concentration of the monomer on the polymerization rate. The rate increases with increasing monomer concentration, as expected from the kinetic equation.

[illegible]

# TDA 4565 COLOUR TRANSIENT IMPROVEMENT CIRCUIT

## GENERAL DESCRIPTION

The TDA 4565 is a monolithic integrated circuit for colour transient improvement (CTI) and luminance delay line in gyrator technique in colour television receivers.

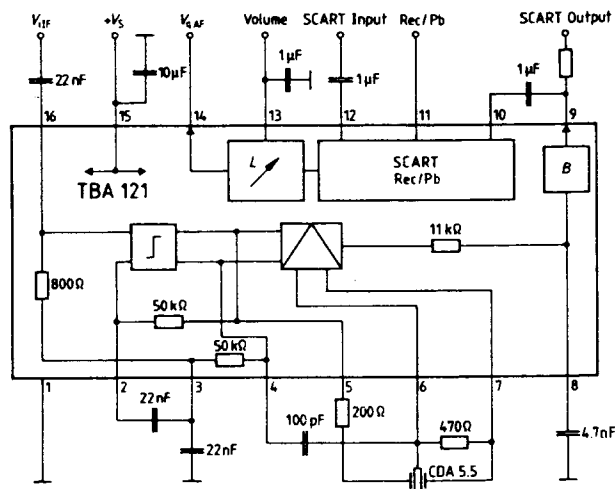


## Features

- Colour transient improvement for colour difference signals (R-Y) and (B-Y) with transient detecting, store- and switching stages resulting in high transients of colour difference output signals.
- A luminance -signal path (Y) which substitutes the conventional Y-delay coil with an integrated Y-delay line.
- Switchable delay time from 730 ns to 1000 ns in steps of 90 ns and additional fine adjustment of 50 ns
- Two Y output signals; one of 180 ns less delay

## TBA 121 FM Sound IF with SCART Switch and Volume Control

### Blok Diagram



### Features

- Outstanding limiting qualities
- Few external components
- Integrated deemphasis resistor
- Low harmonic distortion factor

### PIN FUCTIONS

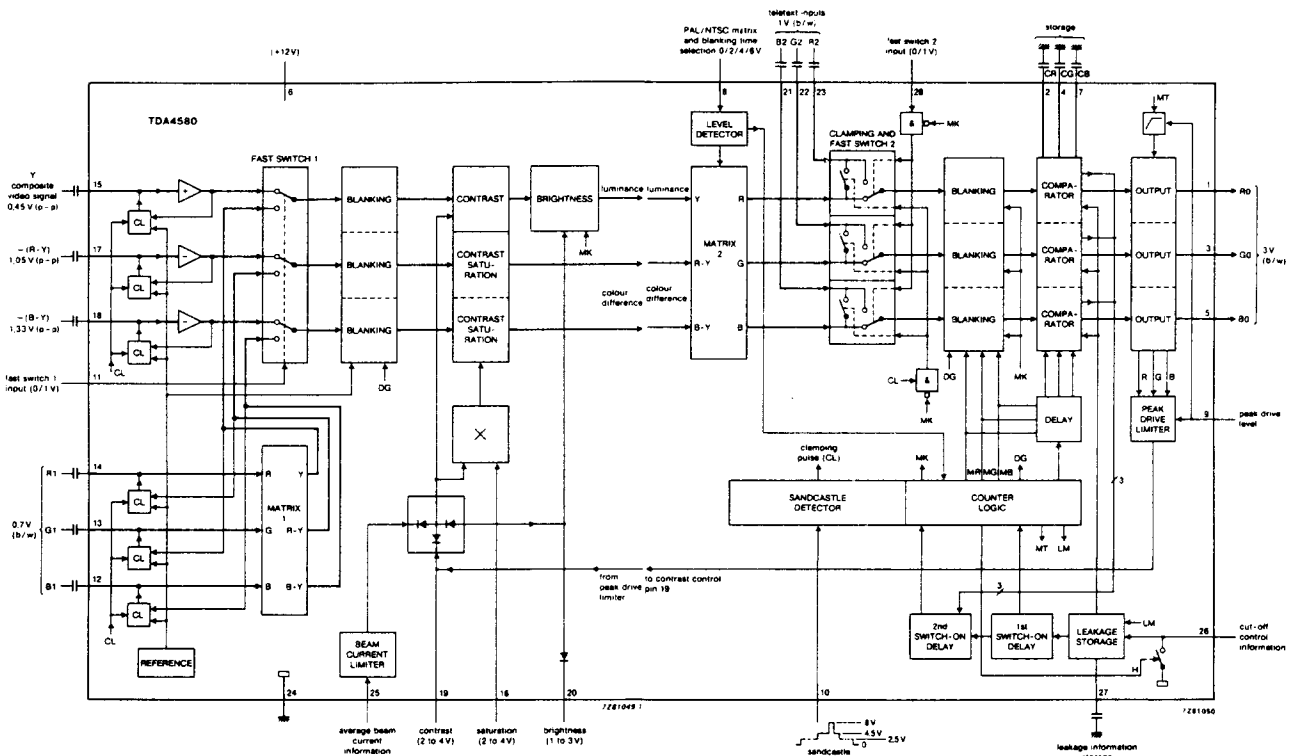
#### Pin No. Function

|     |  |
|-----|--|
| 1.  | Ground   |
| 2.  | Limiter amplifier operating point feedback                                     |
| 3.  | Limiter amplifier operating point feedback and low end                         |
| 4.  | IF amplifier output (emitter follower)   |
| 5.  | IF amplifier output (emitter follower)   |
| 6.  | Demodulator input with high impedance input and internal 15 kΩ supply resistor |
| 7.  | Demodulator input with high impedance input and internal 15 kΩ supply resistor |
| 8.  | Connection for deemphasis capacitor  |
| 9.  | AF output of the SCART interface   |
| 10. | AF input 1 of the SCART interface (IF branch)                                  |
| 11. | Rec/Pb switch input  |
| 12. | AF input 2 of the SCART interface (SCART input)                                |
| 13. | Volume control   |
| 14. | IF output (emitter follower)   |
| 15. | Supply voltage   |
| 16. | IF input   |

In its FM section the device incorporates an eight-stage-balanced limiter amplifier followed by a coincidence demodulator. The AF section includes an analog switch for the SCART record/playback function and an analog volume control with AF output..

# TDA4580 VIDEO CONTROL COMBINATION CIRCUIT

## With automatic cut-off control

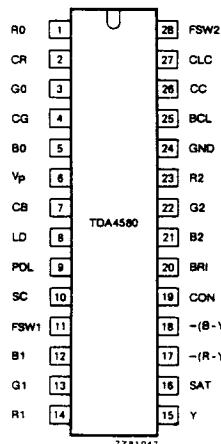


## GENERAL DESCRIPTION

The TDA4580 is a monolithic integrated circuit which performs video control functions in television receivers with a colour difference interface. For example it operates in conjunction the multistandard colour decoder TDA4555. The required input signals are: luminance and negative colour difference  $-(R-Y)$  and  $-(B-Y)$ , and a 3-level sandcastle pulse for control purposes. Analogue RGB signals can be inserted from two sources. One with full performance adjustment possibilities. RGB output signals are available for driving the video output stages. This circuit provides automatic cut-off control of the picture tube.

## Features

- Capacitive coupling of the colour difference, luminance and RGB input signals with black level clamping
- Two sets of analogue RGB inputs via fast switch 1 and fast switch 2
- First RGB inputs and fast switch 1 in accordance with peritelevision connector specification
- Saturation, contrast and brightness control acting on first RGB inputs.
- Brightness control acting on second RGB inputs.
- Equal black levels for television and inserted signals.
- Clamping, horizontal and vertical blanking, and timing of automatic cut-off, controlled by a 3-level sandcastle pulse
- Automatic cut-off control with compensation for leakage current of the picture tube
- Measuring pulses of cut-off control start immediately after end of vertical part of sandcastle pulse
- Three selectable blanking intervals for PAL, SECAM and NTSC/PAL-M
- Two switch-on delays for run-in without discolouration
- Adjustable peak drive limiter
- Average beam current limiter
- G-Y and RGB matrix coefficients selectable for PAL/SECAM and NTSC (correction for FCC primaries)
- Bandwidth 10 MHz (typ.)
- Emitter-follower outputs for driving the RGB output stages

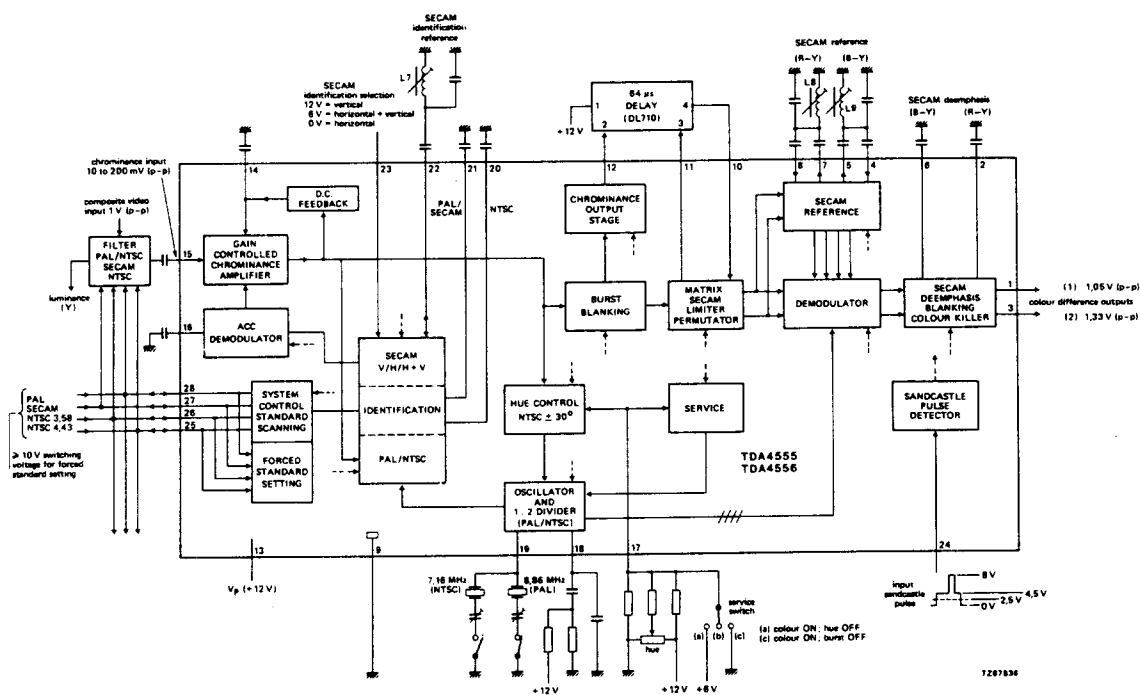


## PINNING

| pin no. | mnemonic | description  |    |        |                                       |
|---------|----------|--|----|--------|---------------------------------------|
| 1       | RO       | Red output   | 15 | Y      | Luminance input                       |
| 2       | CR       | Red storage capacitor for cut-off control              | 16 | SAT    | Saturation control input              |
| 3       | GO       | Green output   | 17 | -(R-Y) | Colour difference input-(R-Y)         |
| 4       | CG       | Green stroge capacitor for cut-off control             | 18 | -(B-Y) | Colour difference input-(B-Y)         |
| 5       | BO       | Blue output  | 19 | CON    | Contrast control input                |
| 6       | Vp       | Positive supply voltage                                | 20 | BRI    | Brightness control input              |
| 7       | CB       | Blue storage capacitor for cut-off control             | 21 | B2     | Teletext blue input                   |
| 8       | LD       | PAL/NTSC matrix and blanking time level detector input | 22 | G2     | Teletext green input                  |
| 9       | PDL      | Peak drive limiting input                              | 23 | R2     | Teletext red input                    |
| 10      | SC       | Sandcastle pulse input                                 | 24 | GND    | Ground                                |
| 11      | FSW1     | Fast switch 1 for Y, CD and RGB inputs                 | 25 | BCL    | Average beam current limiting input   |
| 12      | B1       | Blue input (external signal)                           | 26 | CC     | Automatic cut-off control input       |
| 13      | G1       | Green input (external signal)                          | 27 | CLC    | Storage capacitor for leakage current |
| 14      | R1       | Red input (external signal)                            | 28 | FSW2   | Fast switch 2 for teletext inputs     |

## TDA 4555 MULTISTANDART DECODER

The TDA4555 is a monolithic integrated multistandard colour decoder for PAL, SECAM, NTSC 3.58 MHz and NTSC 4.43 MHz standard.



## FEATURES

**Crominance part** includes gain controlled chrominance amplifier and ACC rectifier circuits for PAL, SECAM and NTSC. Crominance output stage drives the 64  $\mu$ s glass delay line (Pal, Secam). There are SECAM permutator and limited stages for direct and delayed SECAM SIGNAL.

**Demodulator part** PAL switch, internal PAL matrix, de-emphasis, two quadrature demodulators with external reference tuned circuits (SECAM). Flyback blanking incorporated in the two synchronous demodulators (PAL, NTSC), and residual carrier is filtered internally.

**Identification part** performs automatic standard recognition by sequential inquiry, delay for colour-on and scanning-on. SECAM identification is reliable by PAL priority circuit. Forced switch-on is possible. IC includes two identification circuit for PAL/SECAM (H/2) and NTSC and PAL/SECAM flip-flop. Crystal oscillator includes divider stages and PLL circuitry (PAL, NTSC) for double colour subcarrier frequency.

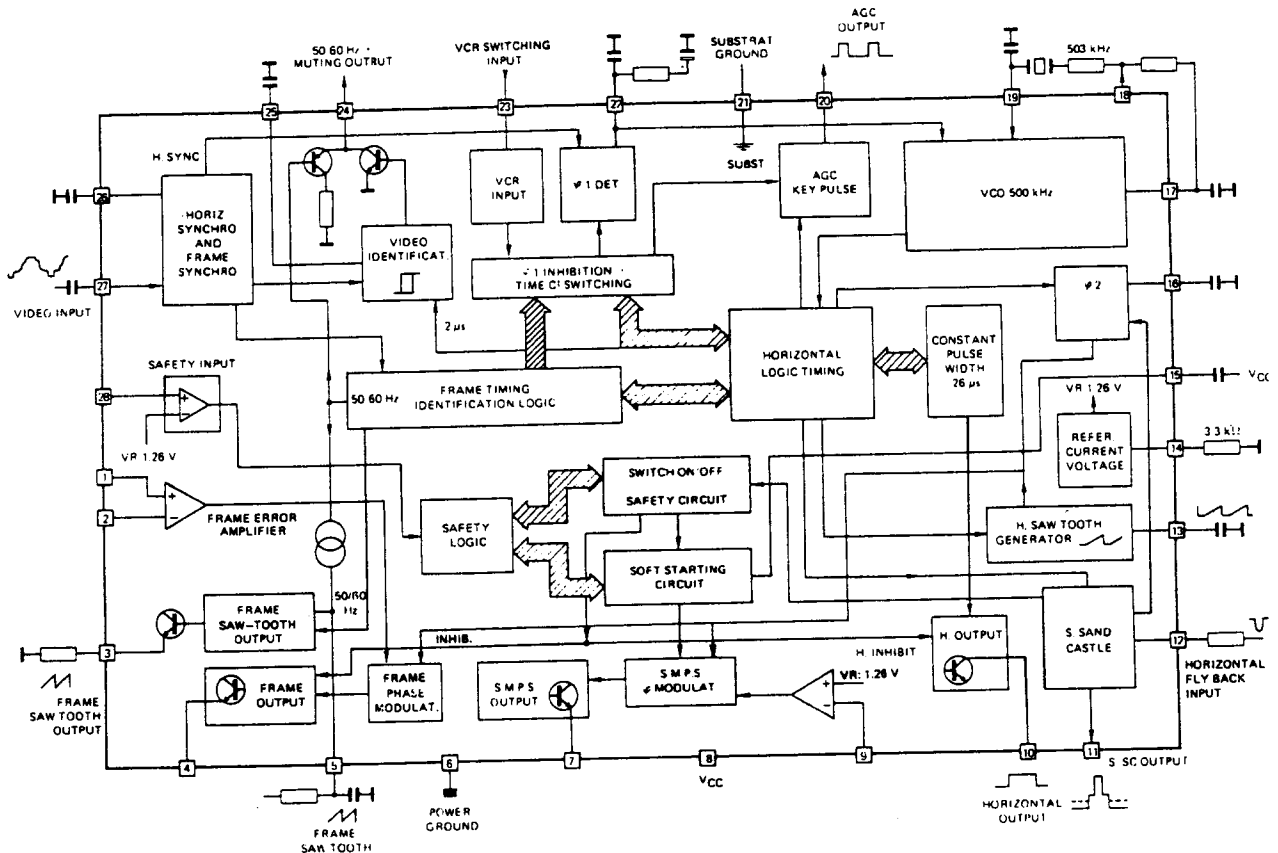


# TEA2029 C COLOUR TV SCANNING AND POWER SUPPLY PROCESSOR

## DESCRIPTION

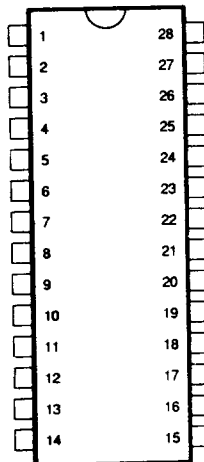
The TEA2029 is a complete (horizontal and vertical) deflection processor with secondary to primary SMPS control for color TV sets.

## BLOCK DIAGRAM



## PIN CONNECTIONS

+ INPUT FRAME AMPLIFIER  
 - INPUT FRAME AMPLIFIER  
 FRAME SAW-TOOTH OUTPUT  
 FRAME OUTPUT  
 FRAME RAMP GENERATOR  
 GROUND POWER  
 SWITCH MODE POWER SUPPLY OUTPUT  
 Vcc  
 B.M.P.S. INPUT REGULATION  
 HORIZONTAL OUTPUT  
 SUPER SANDCASTLE OUTPUT  
 HORIZONTAL FLY-BACK INPUT  
 HORIZONTAL SAW-TOOTH  
 CURRENT REFERENCE



SAFETY INPUT  
 VIDEO INPUT  
 HORIZONTAL SYNCHRO CAPACITOR (tip level)  
 VIDEO IDENTIFICATION CAPACITOR  
 MUTING +50/60Hz IDENTIFICATION OUTPUT  
 V.C.R. INPUT  
 PHASE COMPARTOR 01 CAPACITOR  
 GROUND SUBSTRAT  
 A.G.C. KEY PULSE OUTPUT  
 V.C.O. INPUT  
 V.C.O. OUTPUT  
 V.C.O. 90° REFERENCE  
 PHASE COMPARTOR 02 CAPACITOR  
 STARTING AND SAFETY CAPACITOR

## GENERAL DESCRIPTION

This integrated circuit uses  $I^2L$  bipolar technology and combines analog signal processing with digital processing.

Timing signals are obtained from a voltage-controlled oscillator (VCO) operating at 500KHz by means of a cheap ceramic resonator. This avoids the frequency adjustment normally required with line and frame oscillators.

A chain of dividers and appropriate logic circuitry produce very accurately defined sampling pulses and the necessary timing signals.

The principal functions implemented are:

- Horizontal scanning processor.
- Frame scanning processor. Two applications are possible:
  - **D Class** Power stage using an external thyristor.
  - **B Class** Power stage using an external power amplifier with fly-back generator such as the TDA8170
- Secondary switch mode power regulation. The SMPS output synchronizes a primary I.C. (TEA2164 or TEA2260/61) at the mains part. This concept allows ACTIVE STANDBY facilities.
- Dual phase-locked loop horizontal scanning.
- High performance frame and line synchronization with interlacing control.
- Video identification circuit.
- Super sandcastle.
- AGC key pulse output..
- Automatic 50-60Hz standard identification.
- VCR input for PLL time constant and frame synchro switching.
- Frame saw-tooth generator and phase modulator.
- Switching mode regulated power supply, comprising error amplifier and phase modulator.
- Security circuit and start-up processor.
- 500KHz VCO.

The circuit is supplied in a 28 pin DIP case.

$V_{cc} = 12V$ .

## SYNCHRONIZATION SEPARATOR

**Line synchronization separator** is clamped to black level of input video signal with synchronization pulse bottom level measurement.

The synchronization pulses are divided centrally between the black level and the synchronization pulse bottom level, to improve performance on video signals in noise conditions.

## FRAME SYNCHRONIZATION

**Frame synchronization** is fully integrated (no external capacitor required).

The frame timing identification logic permits automatic adaptation to 50 - 60 Hz standard or non-interlaced video.

An automatic synchronization window width system provides:

- fast frame capture (6.7 ms wide window).
- good noise immunity (0.4ms narrow window).

The internal generator starts the discharge of the saw-tooth generator capacitor so that it is not disturbed by line fly back effects.

Thanks to the logic control, the beginning of the charge phase does not depend on any disturbing effect of the line fly-back.

A 32 $\mu$ s timing is automatically applied on standardized transmissions, for perfect interlacing.

In VCR mode, the discharge time is controlled by an internal monostable independent of the line frequency and gives a direct frame synchronization.

## HORIZONTAL SCANNING

The horizontal scanning frequency is obtained from the 500kHz VCO.

The circuit uses two phase-locked loops (PLL):

the first one controls the frequency, the second one controls the relative phase of the synchronization and line fly-back signals.

The frequency PLL has two switched time constants to provide:

- capture with a short time constant.
- good noise immunity after capture with a long time constant.

The output pulse has a constant duration of 26 $\mu$ s, independent of Vcc and any delay in switching off the scanning transistor.

## VIDEO IDENTIFICATION

The horizontal synchronization signal is sampled by a 2 $\mu$ s pulse within the synchronization pulse. The signal is integrated by an external capacitor.

The identification function provides three different levels:

- 0V : no video identification
- 6V : 60Hz video identification
- 12V : 50Hz video identification

This information may be used for timing research in the case of frequency or voltage synthesizer type receivers, and for audio muting.

**SUPER SANDCASTLE** with 3 levels : burst, line flyback, frame blanking.

In the event of vertical scanning failure, the frame blanking level goes high to protect the tube.

Frame blanking time (start with reset of Frame divider) is 24 lines.

## VCR INPUT

This provides for continuous use of the short time constant of the first phase-locked loop (frequency).

In VCR mode, the frame synchronization window widens out to search window and there is no delay of frame fly-back (direct synchronization).

## FRAME SCANNING

**FRAME SAW-TOOTH GENERATOR.** The current to charge the capacitor is automatically switched to 60Hz operation to maintain constant amplitude.

Frame phase modulator (With two differential inputs). The output signal is a pulse at the line frequency, pulse width modulated by the voltage at the differential pre-amplifier input.

This signal is used to control a thyristor which provides the scanning current to the yoke. The sawtooth output is a low impedance, however, and can therefore be used in class B operation with a power amplifier circuit.

## SWITCH MODE POWER SUPPLY (SMPS) SECONDARY TO PRIMARY REGULATION

This power supply uses a differential error amplifier with an internal reference voltage of 1.26 and a phase modulator operating at the line frequency. The power transistor is turned off by the falling edge of the horizontal saw-tooth.

The "soft start" device imposes a very small conduction angle on starting up, this angle progressively increases to its nominal regulation value.

The maximum conduction angle may be monitored by forcing a voltage on pin 15. This pin may also be used for current limitation.

## SECURITY CIRCUIT AND START UP PROCESSOR

When the security input (pin 28) is at a voltage exceeding 1.26V the three outputs are simultaneously cut off until this voltage drops below the 1.26 V threshold again. In this case the switch mode power supply is restarted by the "soft start" system.

If this cycle is repeated three times, the three outputs are cut off definitively. To reset the safety logic circuits, Vcc must be zero volt.

This circuit eliminates the risk to switch OFF the TV receiver in the event of a flash affecting the tube.

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# TELETEXT MODULE

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## 1.3.5 TELETEXT DATA SLICER SDA 5231

The SDA 5231 data slicer is used in the teletext decoding section to separate the teletext data signal from the CVBS signal. Information consists of eight bits, where the most significant bit is a parity bit, followed by seven data bits. The teletext signal amplitude is reduced to 50 percent of its incoming value by the SDA 5231 to reduce the possibility of interference from other sources. A phase shifting circuit together with a crystal oscillator regenerate the data synchronous clock. So clock and data signal can be supplied to the teletext decoder device.

A synchronous separator generates line and field sync pulses. The line sync signal is used to control an on-chip 6MHz oscillator which passes on the clock signal to the teletext decoder.

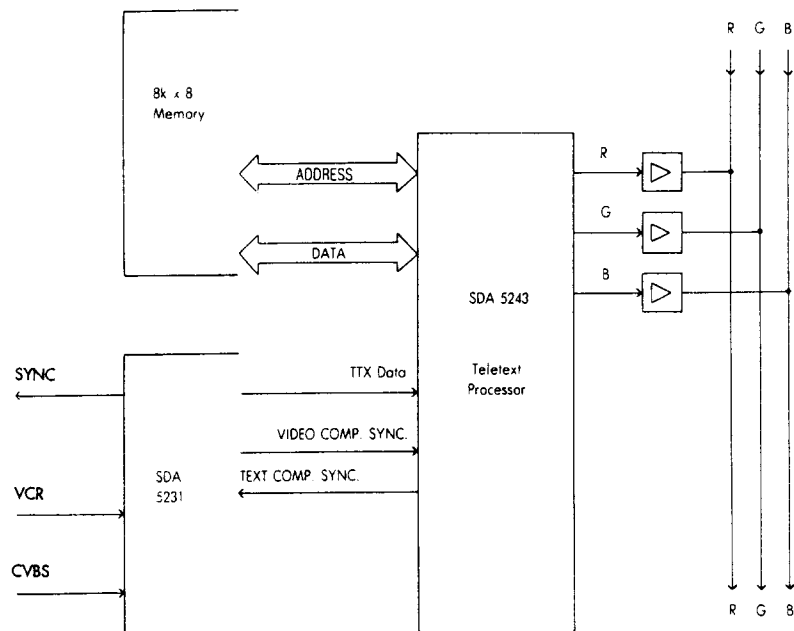
After attaining line frequency (15,625kHz), the signal is transmitted to the slicer. Here a phase comparator synchronizes the, 5.5MHz oscillator rigidly to the video signal so that, if video signal quality is sufficient, fading in a text into a TV picture (e.g. subtitles) is possible synchronous to CVBS signal. The SDA 5231 is manufactured in bipolar technology and housed in a DIP 28 case.

## 1.3.6 THE TELETEXT PROCESSOR SDA 5243

The teletext processor SDA 5243 and IIC bus controlled devices to process all functions which are necessary to use the teletext service of broadcasters, only in 6 foreign languages as English, German, French, Turkish, Spanish, Italian.

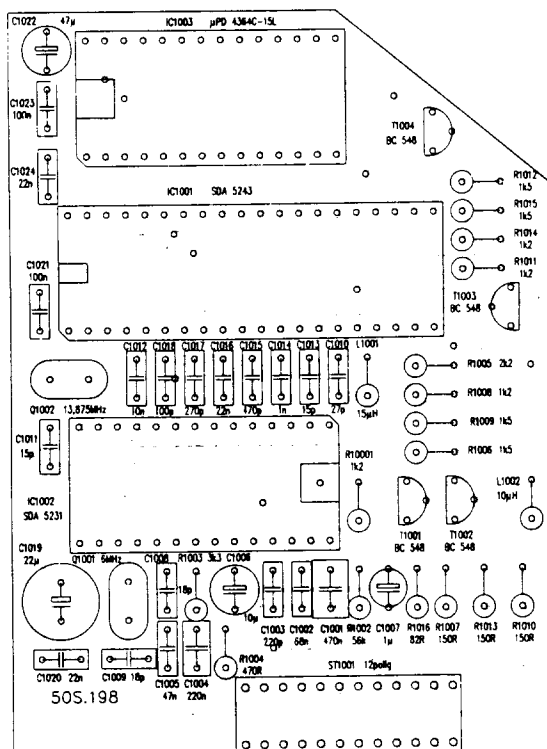
Serial teletext data is received from the SDA 5231 data slicer. Four independent acquisition circuits are responsible for selecting the requested data. After acquisition the data is loaded via a memory interface to an external RAM. Each received page occupies 1kByte of ram (2kByte if ghost rows are received). The external RAM is read out cyclically and the data is processed in a character generator into R-, G-, B- information. Further a blanking signal, a contrast reduction signal and a Y-signal to control a black and white monitor are generated. Via the IIC bus interface 12 registers can be loaded by the microcontroller and one register can be read and written too.

The SDA 5243 is mounted in a 40 pin DIP case.

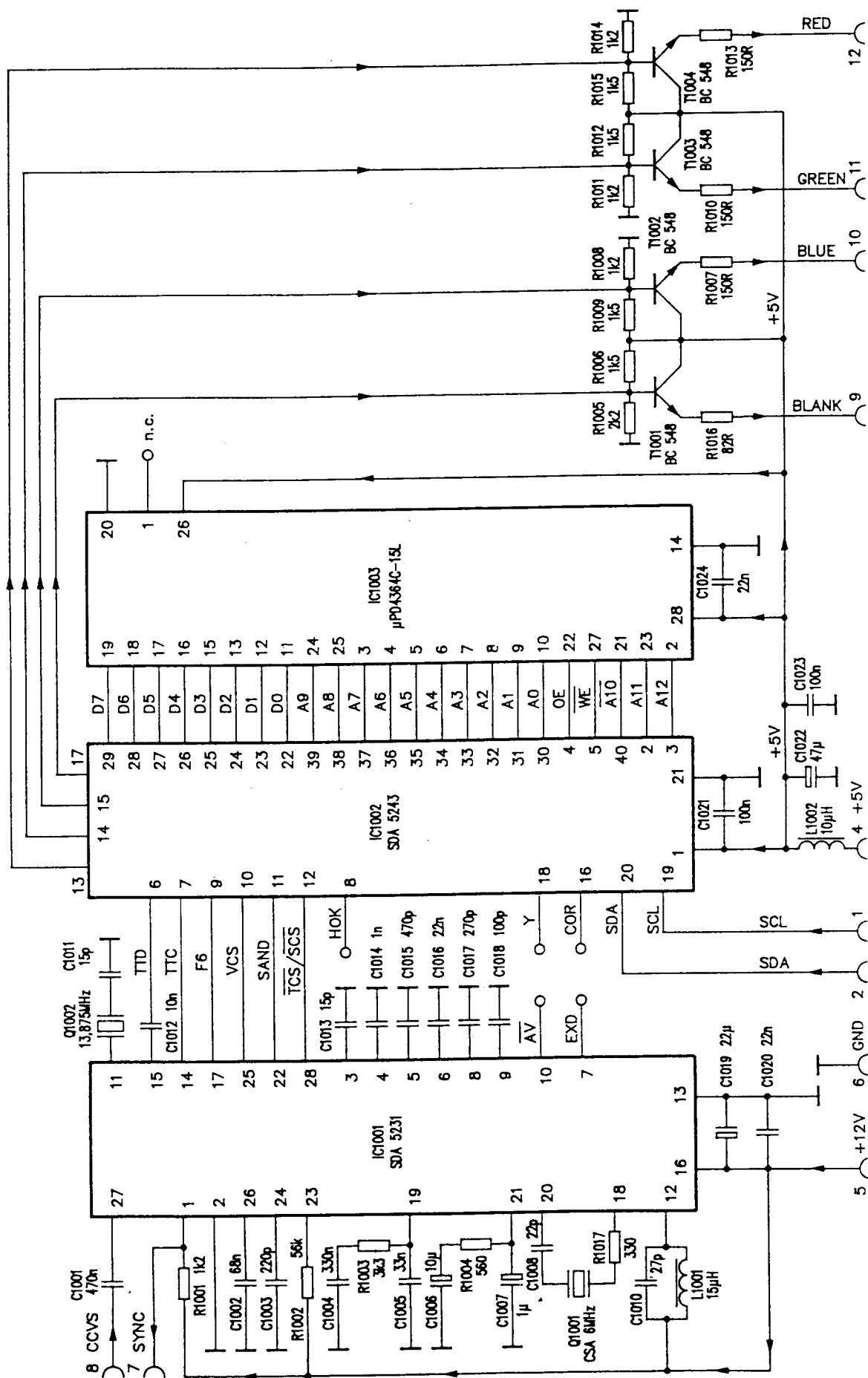


**TELETEXT DECODER BLOCK DIAGRAM**

## TELETEXT MODULE PATTERN DRAWINGS



# TELETEXT MODULE



# NICAM MODULE

## BRIEF DISCRIPTION OF SAA 7280

The SAA 7280 is a CMOS integrated circuit that fully conforms to the EBU NICAM 728 specification. This device takes as input a NICAM 728 encoded signal data stream from the DQPSK demodulator, then performs the descrambling, de-interleaving and reformatting functions required to recover the original sound samples. The SAA 7280 contains an I<sup>2</sup>C bus transceiver enabling microcomputer control of the IC, and has automatic decoding and output configuration depending upon transmission:

- digital stereo
- digital mono+data
- two independent mono signals

Other features include: on board RAM for de-interleaving and 10 to 14 bit word expansion, 7 sample interpolator for erroneous samples, selectable 3x digital oversampling filter, and I<sup>2</sup>S sound bus output format. The on-chip 3x oversampling filter reduces the components needed for external analogue filtering.

## D/A conversion - TDA 1543

The TDA 1543 is a monolithic integrated dual 16-bit digital-to-analogue converter (DAC), which was originally developed for compact disk players. It combines ease and economy of application with good digital audio performance levels. The TDA 1543 takes in digital sound data in I<sup>2</sup>S format from the decoder and provides analogue left and right channel audio outputs. There is no requirement for external deglitcher circuitry due to fast settling output current, and few external components are required. A resistor, is used to set an output current bias to optimally bias the output operational amplifiers.

## AUDIO OUTPUT STAGE

The audio output stage converts the current source outputs of the TDA 1543 DAC into an audio output voltage on connectors X2 and X3 for power amplification. The output stage performs the following two functions:

- De-emphasis according to J-17 recommendation.
- Low pass filtering to remove sampling images from the 3X oversampling digital filter.

Two dual operational amplifiers (NE 5532) are included (one for each channel) on the application board to perform the above functions. One of the amplifiers in each package is used to perform the de-emphasis and first order low pass filtering. The second amplifier is used to realise a Sallen and Key 2nd order low pass filter. The overall response is a 3rd order Chebyshev low pass filter with a ripple bandwidth of 15KHz (ripple 0.25dB).

## FM-MONO I-STANDARD

| TV-Transmitter-Mode | Display on Screen | Remote Control          |
|---------------------|-------------------|-------------------------|
| mono                |                   |                         |
| all modes           | Mono              | AF-Mode<br>(force mono) |

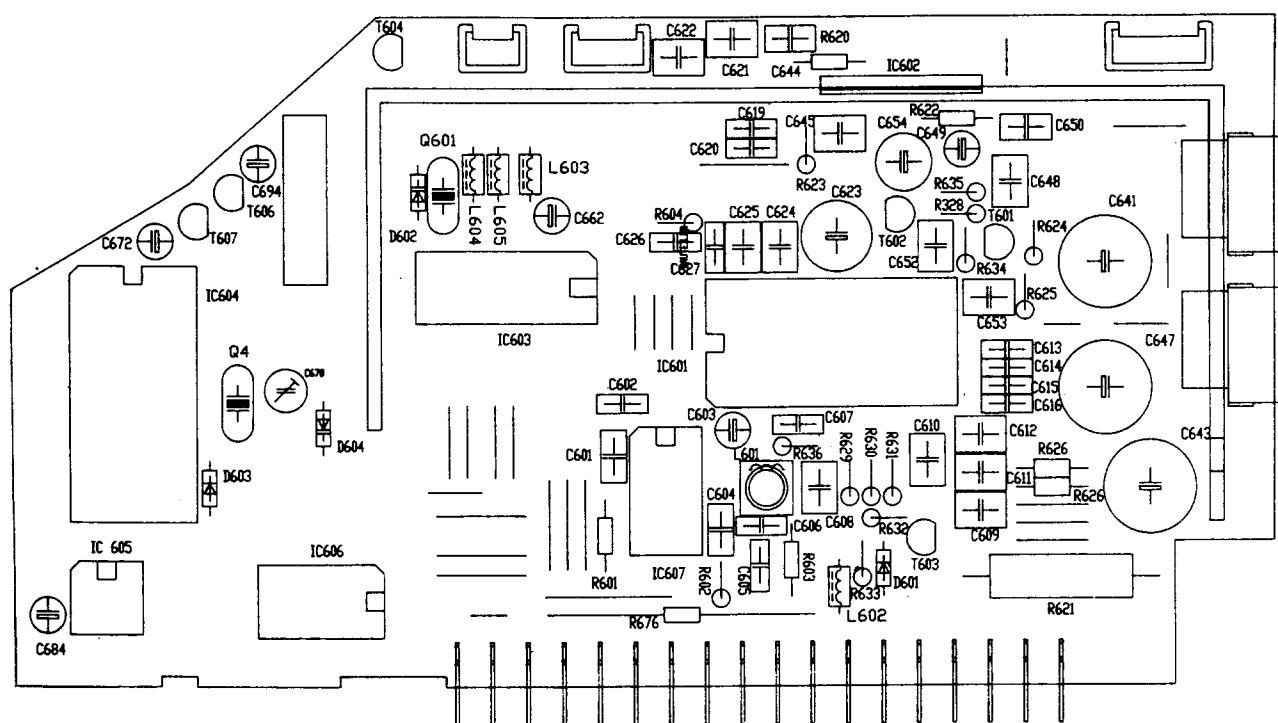
## NICAM I-STANDARD

| TV-Transmitter-Mode | Display on Screen            | Remote Control                |
|---------------------|------------------------------|-------------------------------|
| Mono                | NICAM                        |                               |
| dual                | NICAM Dual A<br>NICAM Dual B | AF - Mode                     |
| stereo              | NICAM Stereo                 |                               |
| all modes           | Mono                         | AF - Mode (*)<br>(force mono) |

(\*) In the mode force-mono the status NICAM is changing to FM-Sound and the display on screen NICAM will flash.

When the FM-Signal is not carrying the same sound program as the NICAM stereo or mono signal the display on screen is (NICAM) and the FM-Sound is priority.

## NICAM MODULE PATTERN DRAWING

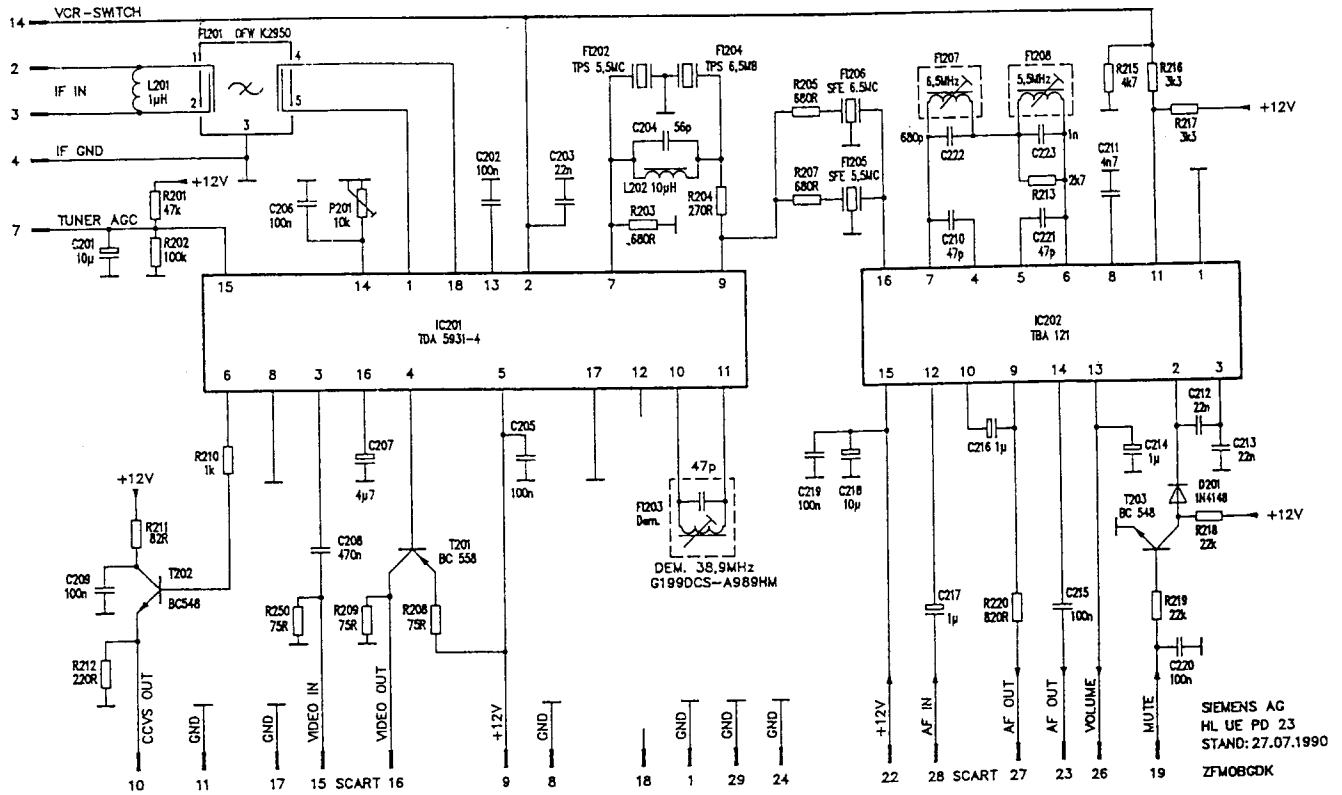




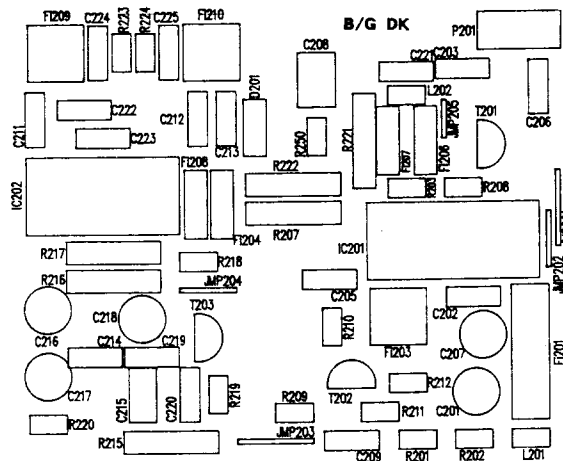
## NICAM - DECODER



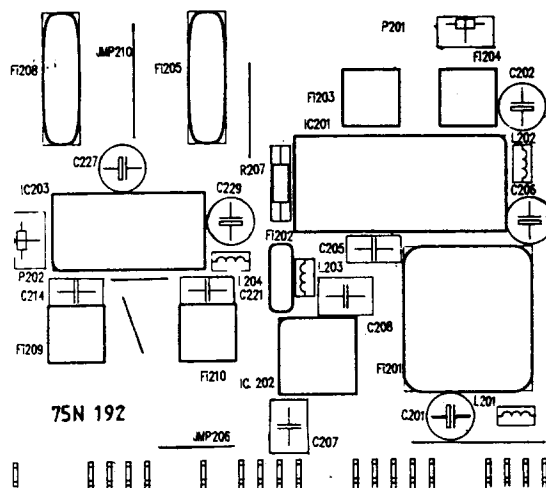
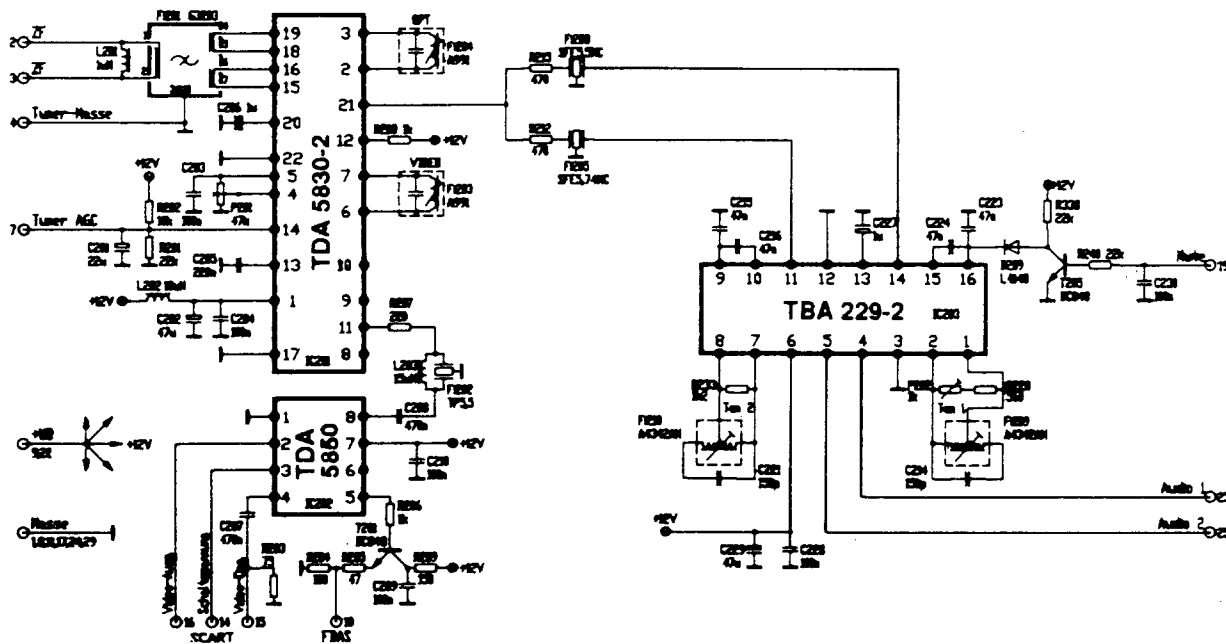
## MONO IF MODULE BG/DK



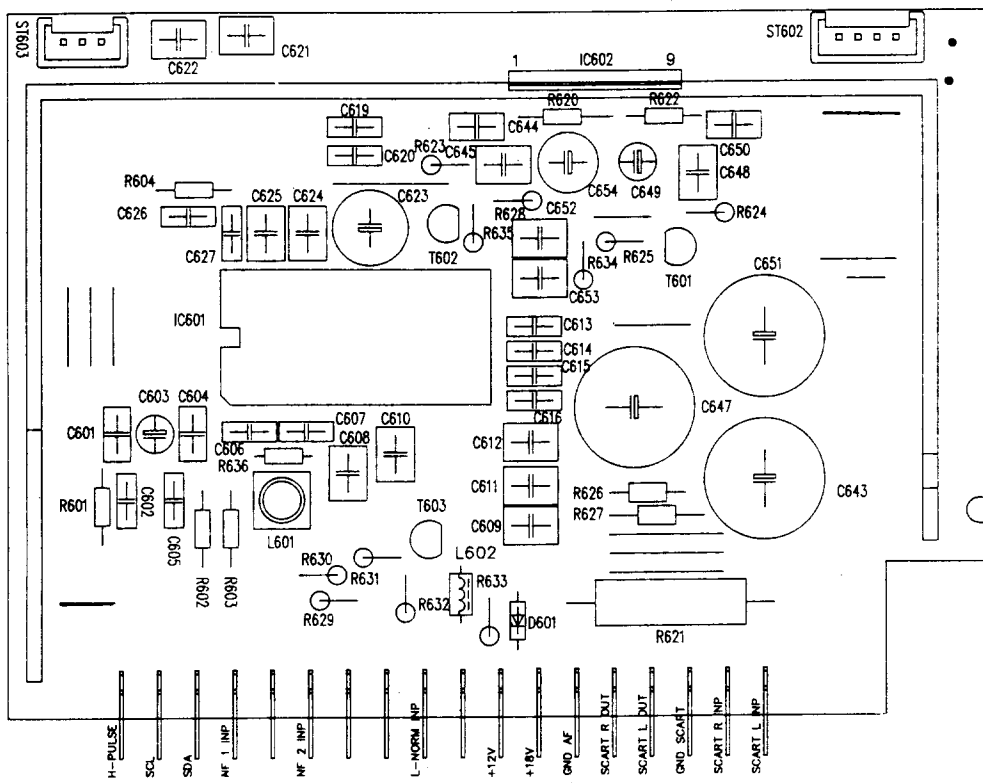
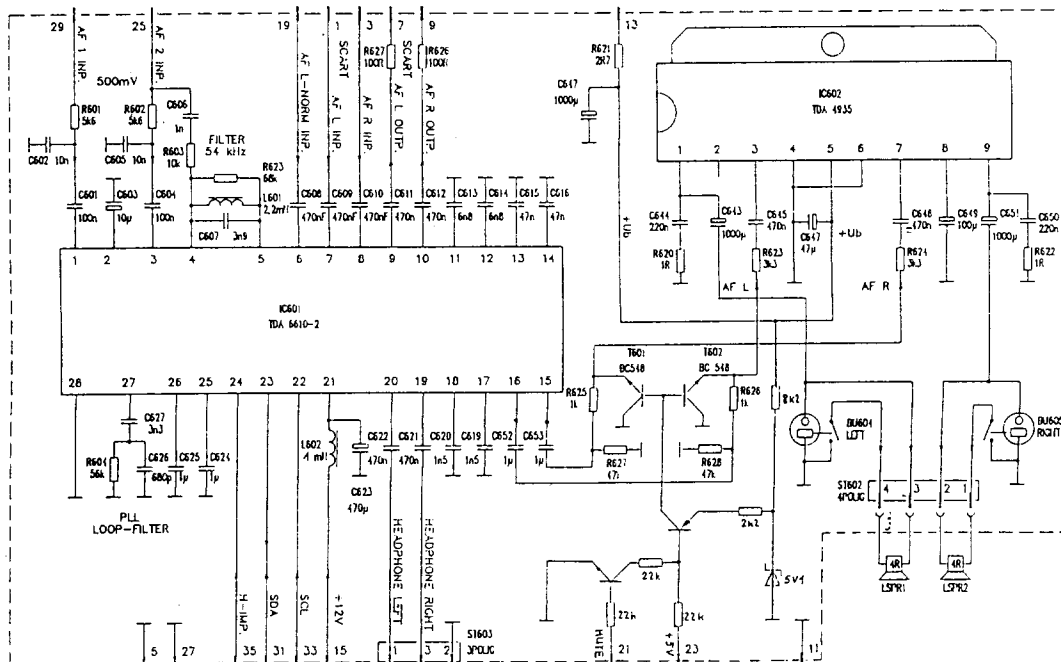
## MONO IF MODULE PATTERN DRAWING



**STEREO IF MODULE  
PATTERN DRAWING**

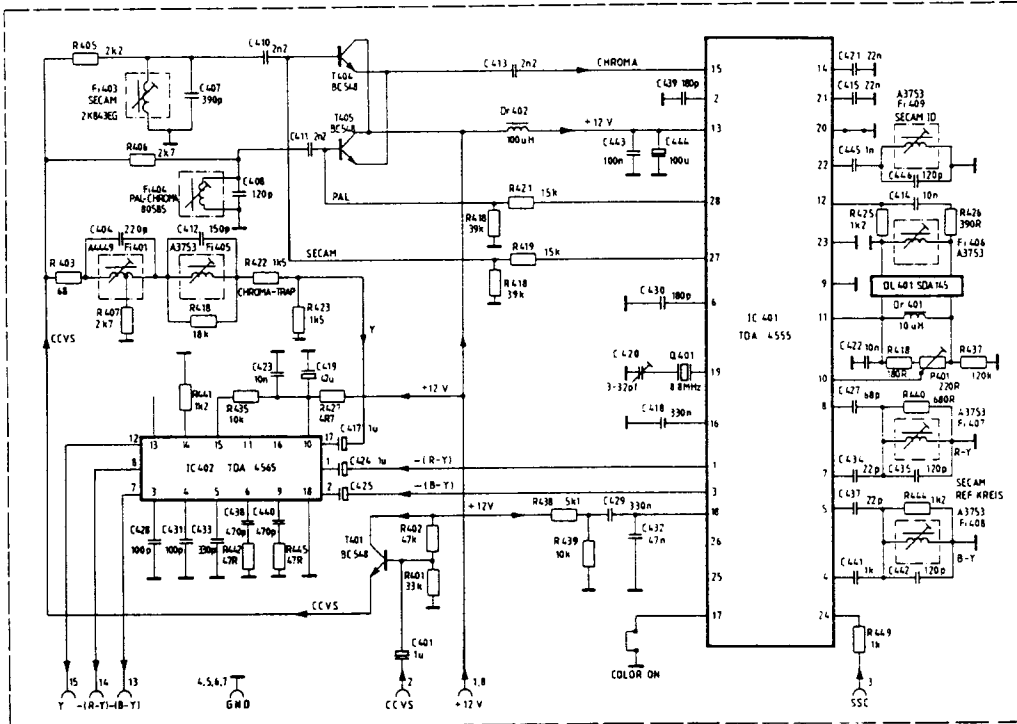


# STEREO AF MODULE WITH DECODER AND POWER AMPLIFIER

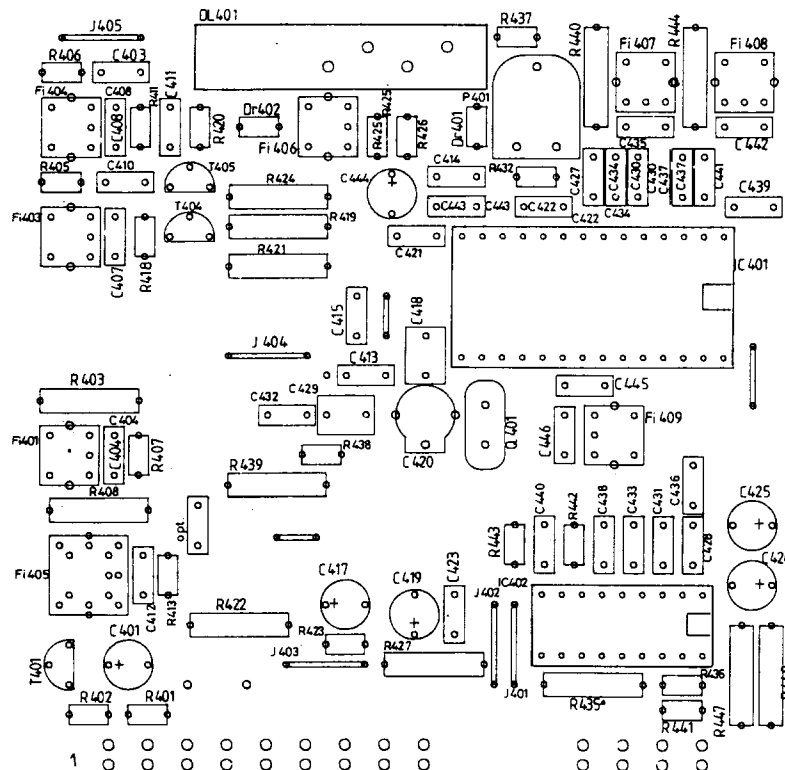


## STEREO DECODER PATTERN DRAWING

# **PAL/SECAM DECODER WITH CTI**

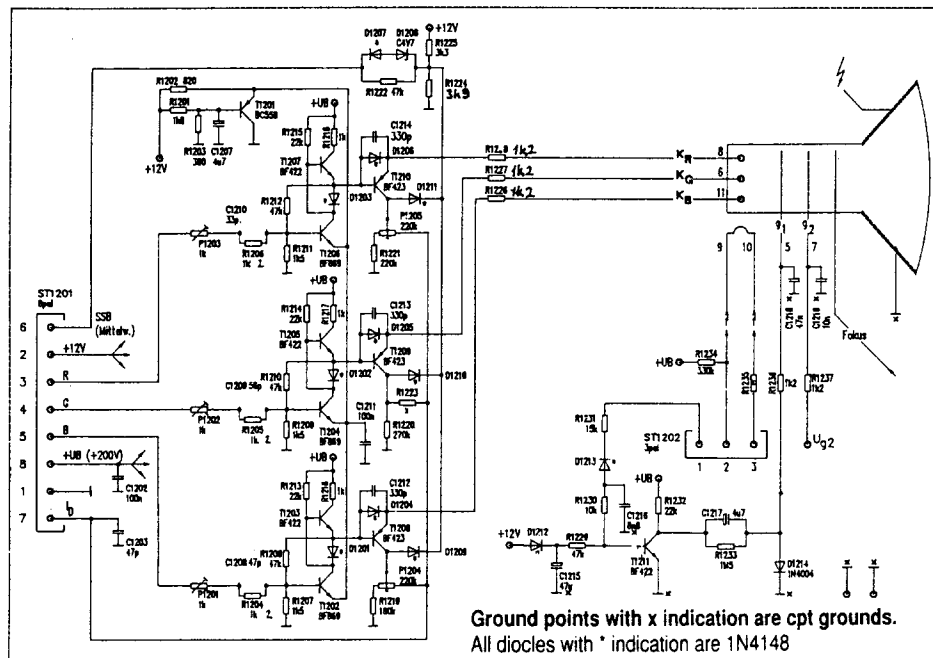


## **PAL/SECAM MODULE PATTERN DRAWING**



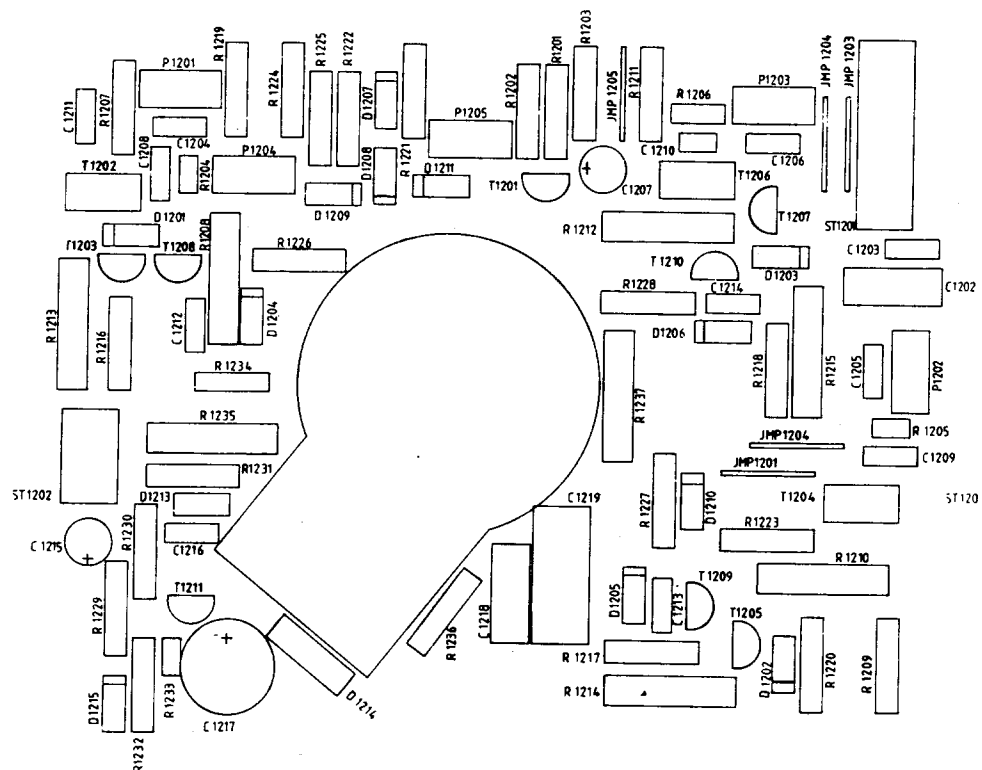
## **PAL/SECAM**

## CRT MODULE

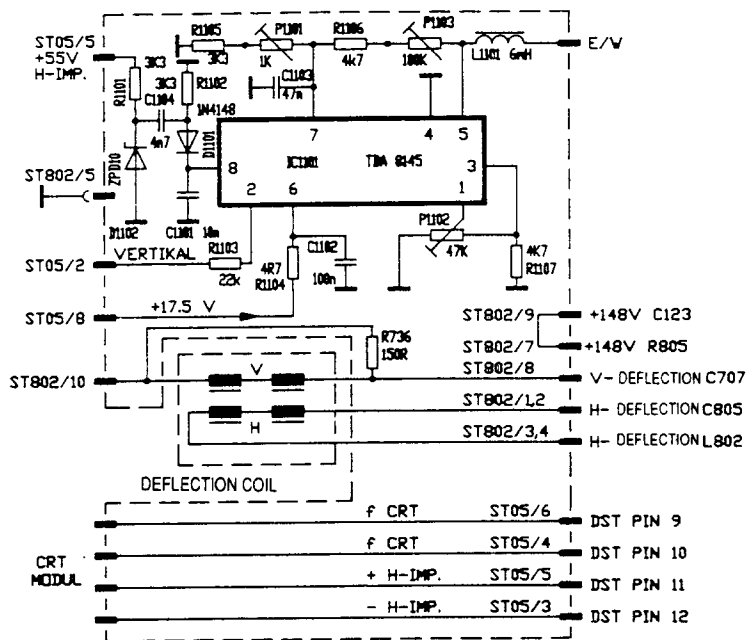


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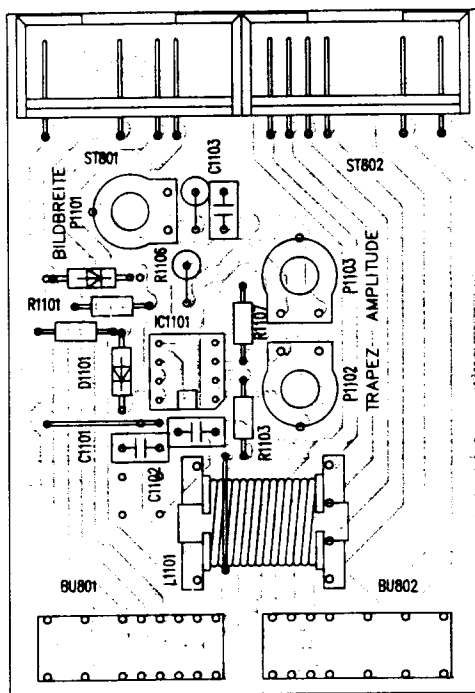
## CRT MODULE PATTERN DRAWING

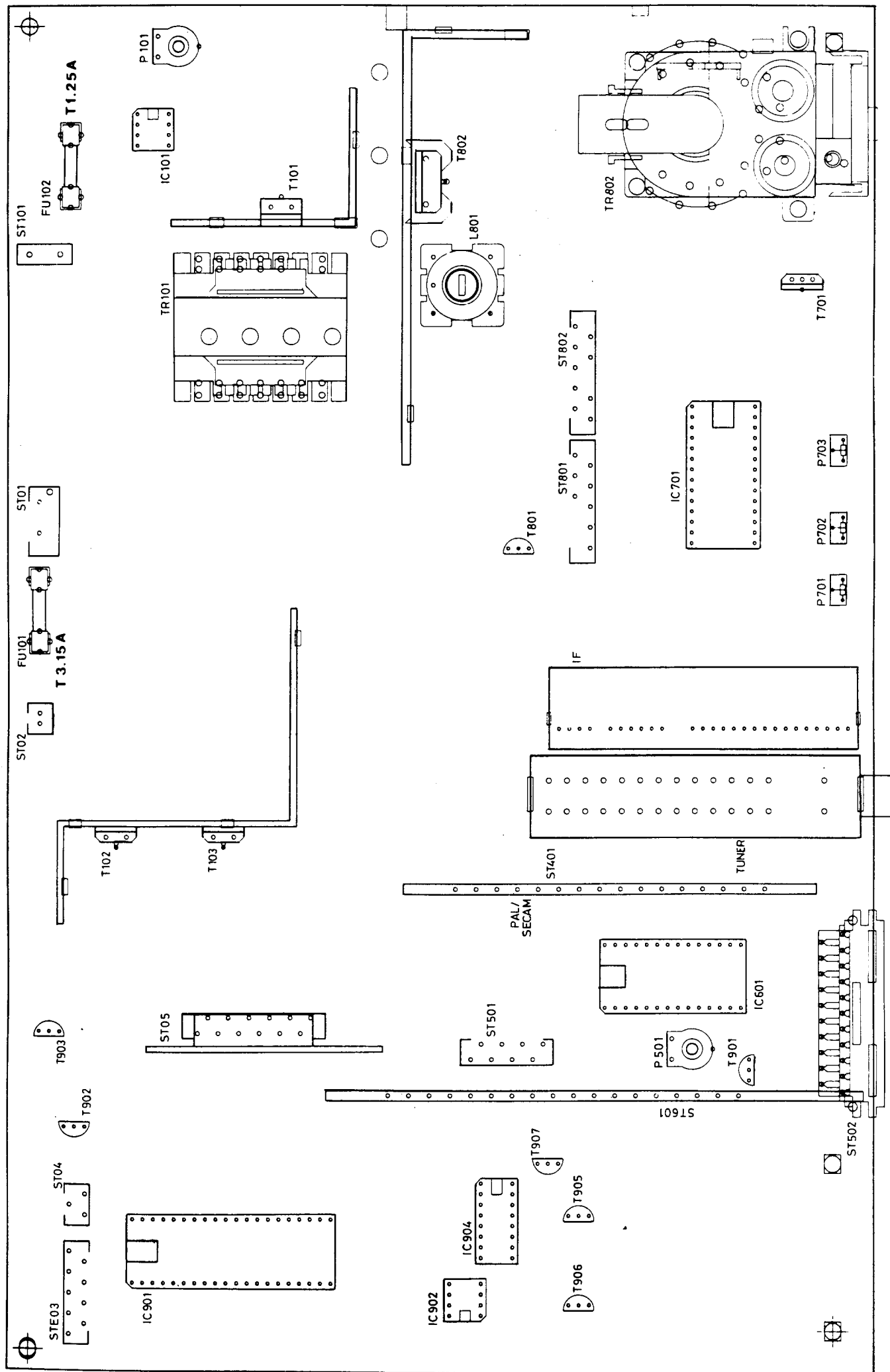


## EAST/WEST MODULE



## EAST/WEST MODULE PATTERN DRAWING





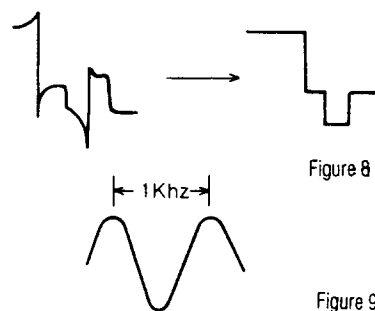
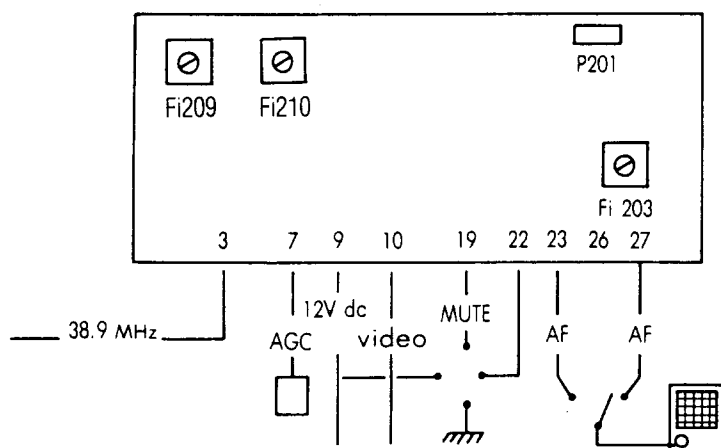
**LOCATION DIAGRAM OF PARTS ON THE MAIN CHASSIS**



# SERVICE ADJUSTMENTS

## INTERMEDIATE FREQUENCY BOARD ADJUSTMENT AND CONTROL:

- 1— Apply 12V DC to 9th and 22nd pins of IF board.
- 2— Apply 38.5 MHz signal modulated with video signal (step or 2T) and 1kHz sound signal to 2nd or 3rd pins of IF board.
- 3— After connecting 7th pin of IF board to a voltmeter, see the AGC output change between 0 and 7.5V by adjusting P201 clockwise or counter clockwise. Leave it at its maximum level.
- 4— Adjust F 1203 until obtaining the wave form in Figure 8.  
— Apply a voltage of changing between 0.3V and 4.6V DC to 26th pin of the IF board and see the wave shape in Figure 8 from the 27th pin of the board.
- 5— After grounding 19th pin of the board, see the muting on oscilloscope.
- 6— Apply 38.9 MHz signal modulated with video signal and 1kHz (6.5 MHz carrier) to pin 3. Adjust Fi209 for optimum waveform on pin 23 or 27 (standard D/K)
- 7— Apply 38.9 MHz signal modulated with video signal and 1kHz (5.5 MHz carrier) to pin 3. Adjust Fi210 for optimum waveform on pin 23 or 27. (Standard B/G)



## SUPPLY VOLTAGE ADJUSTMENT:

- 1— While all controls are set to minimum, P101 is adjusted, so that the voltage difference between ground and R805 or D109 is 125 V DC+1V. (148 VDC + 1V for 110° Sets)
- 2— After P501 is adjusted to medium position, screen potentiometer on DST is adjusted until snowy picture is just obtained. Depress the NORMAL button on the Remote Control to obtain the average contrast, brightness and colour settings.
- 3— Using a Philips pattern generator or other suitable signal, adjust P701 (horizontal adjustment) and P703 (vertical adjustment) to correctly position the picture. Adjust vertical amplitude with P702 and horizontal amplitude with L901.

## AGC ADJUSTMENT:

Input a color test pattern, the signal input voltage should be 1.5mV=64 dBuV+2dBuV, AGC voltage is observed. While adjusting P201 on IF board by rotating it clockwise, see the increase in DC level. After obtaining maximum DC value approximately at 8V, adjust P201 until DC level drops 1V and becomes approximately 7Vdc.

## SCREEN ADJUSTMENT:

All potentiometers, on CRT PCB are adjusted to their medium positions. Additionally P501 on main board must also be at medium position. Contrast, Brightness and screen potentiometer are set to minimum.

AV position is selected on TV.

The oscilloscope is connected to the highest test points (either 154, 155 or 156) on CRT.

P501 is adjusted till the wave shape in Figure 5 is obtained.

Screen potentiometer is adjusted, so that the "X" length is 135V (158 Vdc for 110° chassis) and check the same shape for other test points too. Figure 10

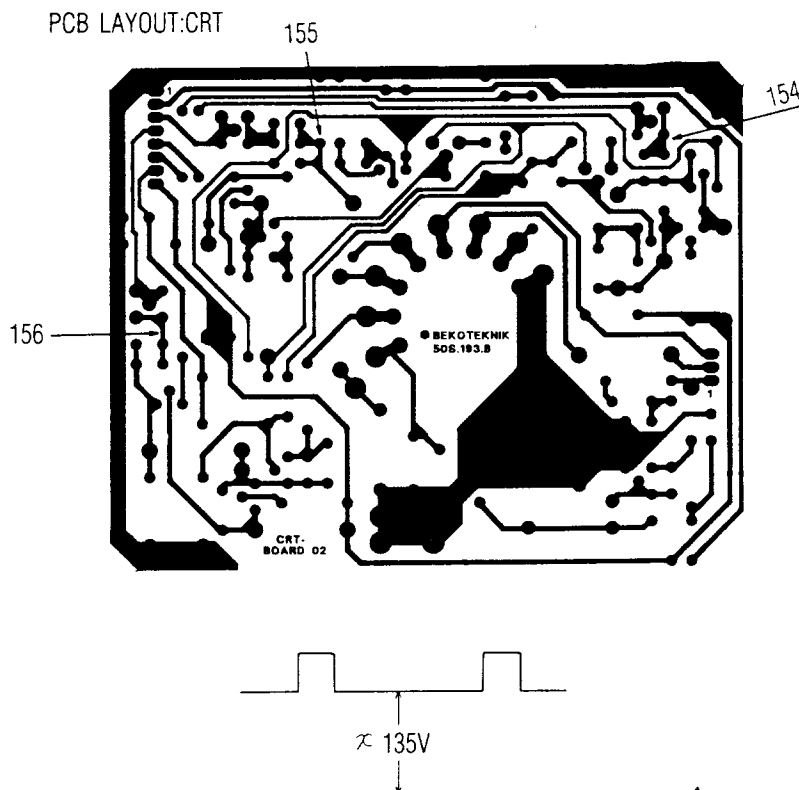


Figure 10

## WHITE BALANCE ADJUSTMENT

### a) HIGH LUMINANCE ADJUSTMENT

After selecting "White Pattern" colour minimized. Adjust the brightness and contrast to obtain a bright picture  $Y=60 \pm 5$  nits (with Minolta Colour Analyser) which corresponds % 80 of max. luminance level. P1203 (Red), P1202 (Green) and P1201 (Blue) are adjusted to obtain best white level and coordinates which corresponds to 8600 deg K.

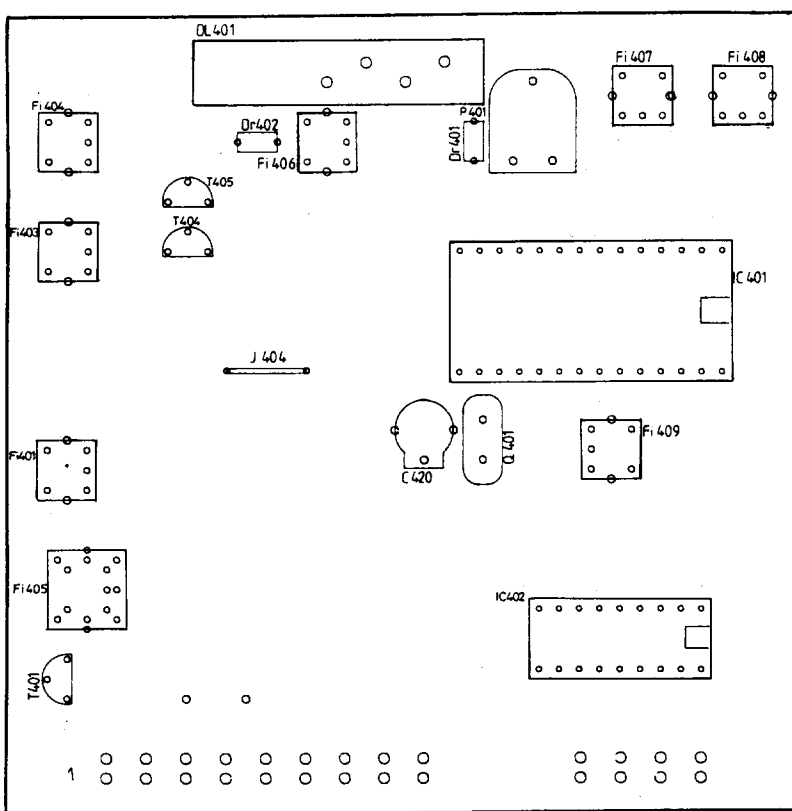
### b) LOW LUMINANCE ADJUSTMENT

Adjust the brightness and contrast to obtain  $Y=8 \pm 3$  nits a dark picture which corresponds appr. % 20 of max. luminance level, for low level white balance. P1205 (Red) and P1204 (Blue) are adjusted to obtain best white level which corresponds to 8600 deg. K.

8600 deg K  $\Rightarrow X=287, Y=308$

High and low level white balance adjustments have to be repeated once more, because of the inter action of high and low level white balance adjustments.

## PAL/SECAM BOARD ADJUSTMENT AND CONTROL



### PAL ADJUSTMENT:

1— FBAS-Color Bar signal-is applied to 2nd pin of the board.

2— While the signal on the emitter of T 405 is observed on the oscilloscope, color carrier is adjusted to its maximum value with Fi 404.

### REFERENCE OSCILLATOR ADJUSTMENT:

1— The 17th pin of the TDA4555 is grounded.

2— Color flow on screen is minimized with C 420.

## LUMINANCE ADJUSTMENT

- 1— Color carrier or 15th pin of the board is minimized with Fi401.

PCB LAYOUT: CRT

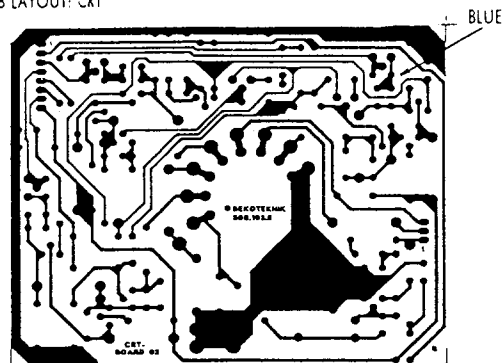


Figure 11

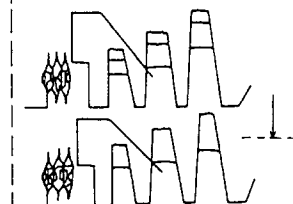


Figure 12

## PAL ADJUSTMENT:

- 1— Oscilloscope probe is connected to the end of "Blue" Potentiometer which is connected to R1204. And Fi 406 is adjusted as seen in Figure 11.
- 2— Philips DEM test signal is applied to the 2nd pin.
- 3— The gaps at speaks are adjusted so that they inserted as shown in Figure 12. Then check with 4.43 MHz section on Philips DEM pattern.

## SECAM ADJUSTMENT:

### CHROMA ADJUSTMENT:

- 1— Color bar signal is applied to the second pin at the board
- 2— The signal at the emitter of T404 is observed on oscilloscope. The peaks are adjusted with F1403-Bell filter-as shown in Figure 13.

## SECAM IDENTIFICATION ADJUSTMENT

- 1— A multimeter with high internal resistance (10M) is connected between 21st pin of TDA4555 and ground.
- 2— The potential difference is adjusted to its maximum value with F1409.

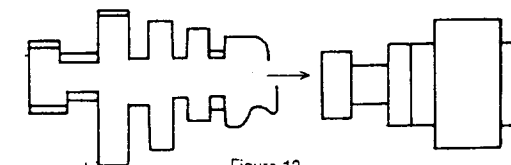


Figure 13

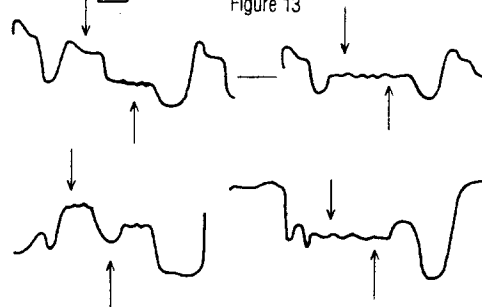


Figure 14

## SECAM COLOR TRAP ADJUSTMENT:

- 1— Y Signal is observed from 15th pin of the board and color carrier signal is adjusted to its minimum level with F1405.

## SECAM DISCRIMINATOR ADJUSTMENT:

- 1— The (R-Y) and (B-Y) signals are observed from the 14th and 15th pin of the board.
- 2— The signals which are indicated with arrows in Figure 14 are adjusted so that they come to same level.

## CONVERGENCE ADJUSTMENTS

**Note:** Before attempting any convergence adjustments, the receiver should be operated for at least fifteen minutes.

### • Centre Convergence Adjustment

1. Receive crosshatch pattern with a colour bar signal generator.
2. Adjust the BRIGHTNESS and CONTRAST Controls for well defined pattern.
3. Adjust two tabs of the 4-Pole Magnets to change the angle between them (See figure 16.) and superimpose red and blue vertical lines in the centre area of the picture screen. (See figure 17.)
4. Turn the both tabs at the same time keeping the constant angle to superimpose red and blue horizontal lines at the centre of the screen. (See figure 17. )
5. Adjust two tabs of 6-Pole Magnets to superimpose red/blue line and green one. Adjusting the angle affects the vertical lines and rotating both magnets affects the horizontal lines.
6. Repeat adjustments 3,4,5 to ensure best convergence, the adjustment must be undertaken with great care because of the interaction between 4 and 6 pole magnets.

### • Circumference Convergence Adjustment

1. Loosen the clamping screw of deflection yoke to allow the yoke to tilt.
2. Put a wedge as shown in figure 15 temporarily. (Do not remove cover paper on adhesive part of the wedge.)
3. Tilt front of the deflection yoke up or down to obtain better convergence in circumference. (See figure 17. ) Push the mounted wedge into the space between picture tube and the yoke to fix the yoke temporarily.
4. Put other wedge into bottom space and remove the cover paper to stick.
5. Tilt front of the yoke right or left to obtain better convergence in circumference. (See figure 17.)
6. Keep the yoke position and put another wedge in either upper space. Remove cover paper and stick the wedge on picture tube to fix the yoke.
7. Detach the temporarily mounted wedge and put it in another upper space. Stick it on picture tube to fix the yoke.
8. After fixing three wedges, recheck overall convergence. Tighten the screw firmly to fix the yoke and check the yoke is firm.
9. Stick 3 adhesive tapes on wedges.

### CONVERGENCE COMPENSATOR

Compensators L462A and L462B are used to correct misconvergence (Red-Green) at the top center or bottom center on screen, when the misconvergence is still evident even though the yoke adjustment is tried. Compensator L462C is also used to correct misconvergence (Vertical shift of Red or Blue) at four corners on screen.

1. To correct horizontal misconvergence (Red-Green), put compensator L462A on the yoke back (see figure right) to find a position for minimizing misconvergence. Mark the position and remove protective paper on the rear of L462A to stick it in place. Apply adhesives on both of yoke and L462A.
2. To correct vertical misconvergence (Red-Green), put the tips of compensator L462B into either of holes on the yoke core and apply adhesives.
3. To correct up or down shift of Red at top right or bottom right corner, put compensator L462C at the point 1 or 2 on the picture tube (see figure right.) to find a position for minimizing misconvergence. Mark the position and remove protective paper on the rear of L462C to stick it in place.

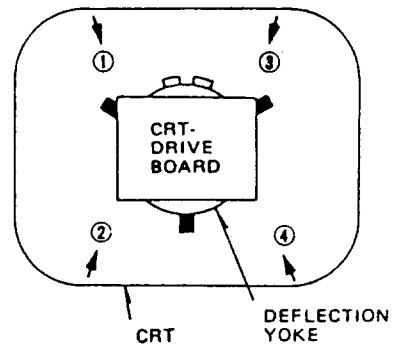
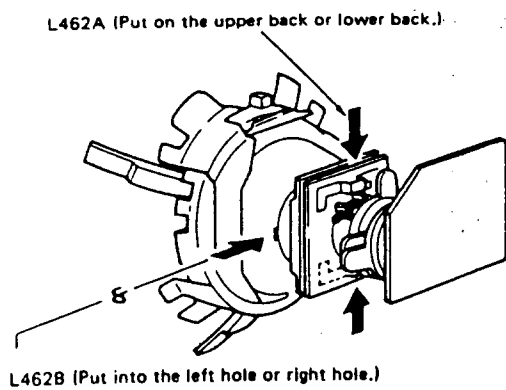


Figure 15.

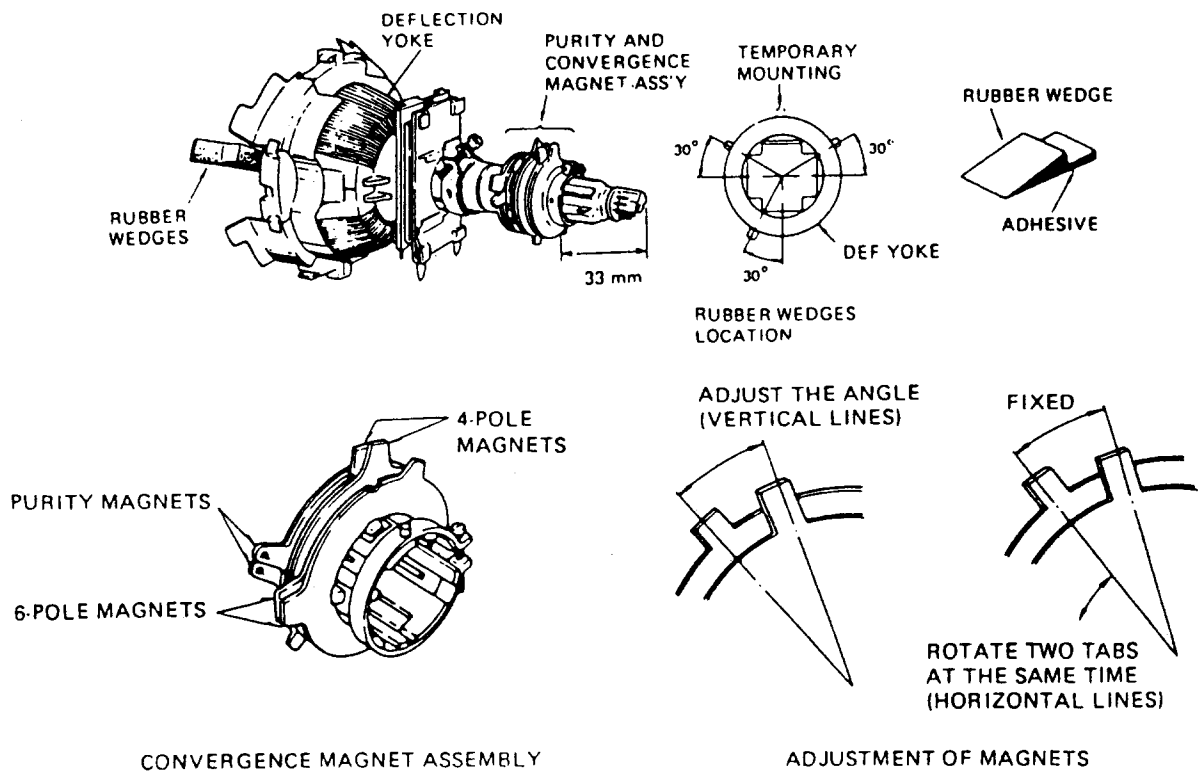
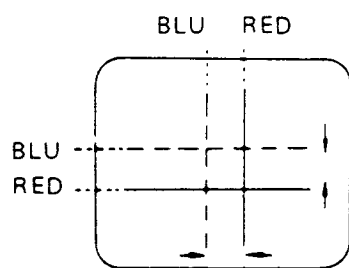
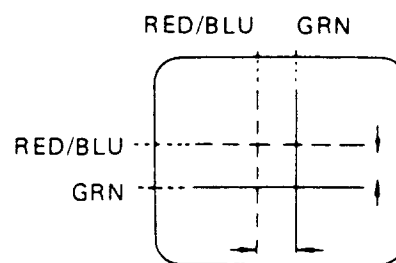


Figure 16.

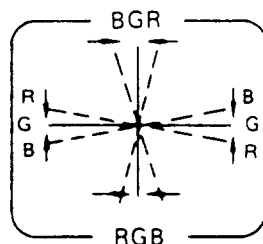


4-POLE MAGNETS MOVEMENT

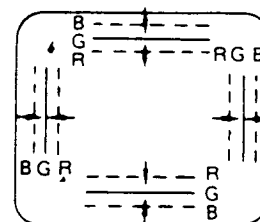


6-POLE MAGNETS MOVEMENT

Centre Convergence by Convergence Magnets



INCLINE THE YOKE UP (OR DOWN)



INCLINE THE YOKE RIGHT (OR LEFT)

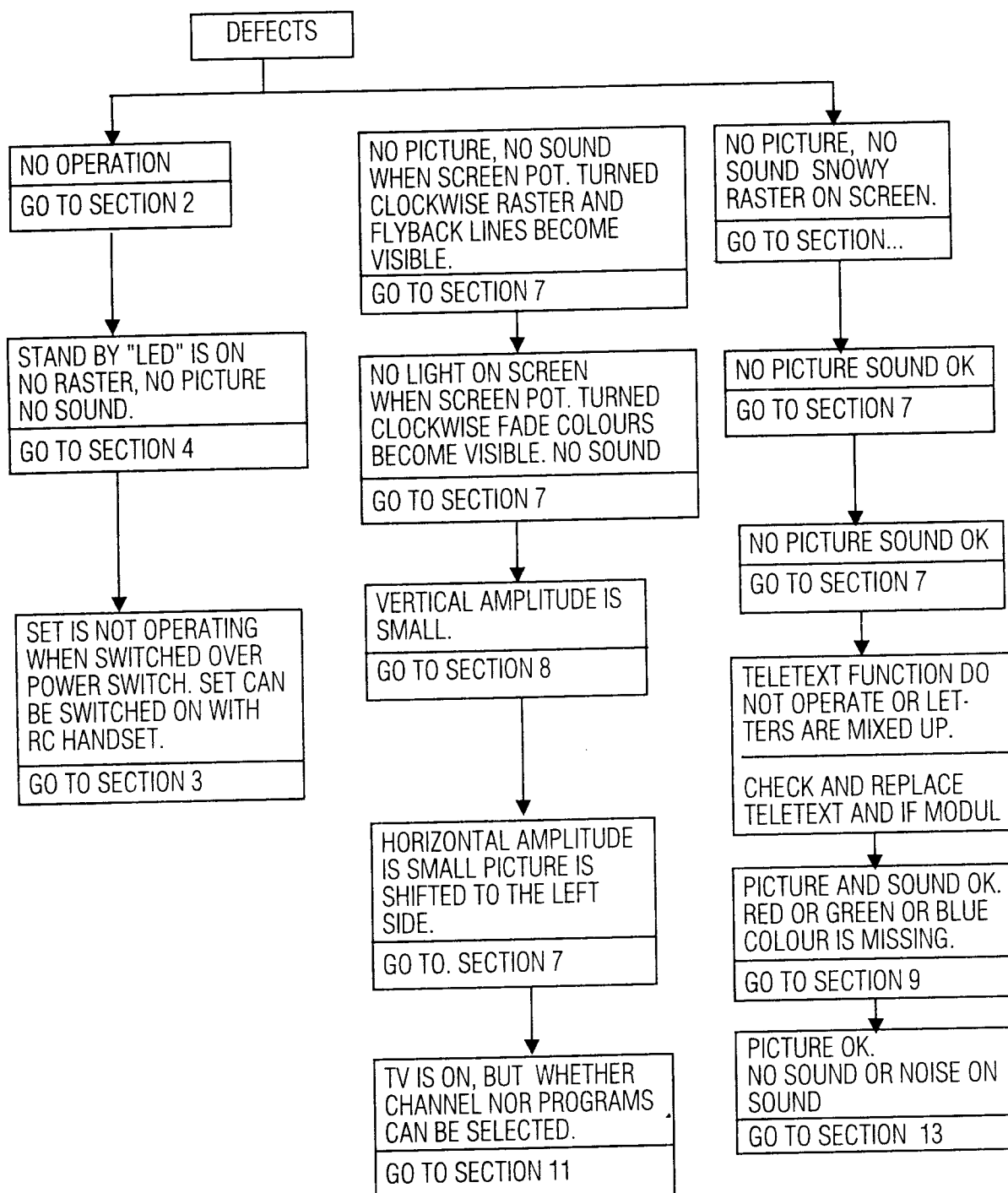
Circumference Convergence by DEF Yoke

| CHSASIS<br>CPT<br>MANUFACTURES | SCREEN<br>SIZES                       | 14"               | 15" | 20"               | 21"                | 25"  | 28"  |
|--------------------------------|---------------------------------------|-------------------|-----|-------------------|--------------------|--|--|
| GOLDSTAR                       | A34 KCQ 12XX01 (T)<br>370 HUB 22-TC01 |                   |     | A48 KCS 12XX27    | A51 KAK 12XX05 (T) |  |  |
| SAMSUNG                        | 37 GGA 85X-TC01<br>3708B              |                   |     | A51 GGD95X-TC     | 54 HGB 99X-TC      |  |  |
| ORION                          | A343 LL70X23                          | A36 JSW 90X01     |     | A48 ELL 90X01 (T) |                    |  |  |
| HITACHI                        |                                       | A36 JUF60X06      |     | A48 JSK61X01 (T)  | A51 JFC 61X13      |  |  |
| TOSHIBA                        |                                       | A36 JAR 40X03 (T) |     |                   | A51 JRU 40X01 (T)  |  |  |
| PHILIPS                        |                                       | A36 EAM 00X01 (T) |     |                   | A51 EAL 06X01      |  |  |
| VIDEOCOLOR                     |                                       |                   |     |                   | A51 EBV 13XX01     | A59 ECY 13X38<br>R1235: 1 OHM, 1W<br>L810: 90 uH | A66 ECY 13X38<br>R1235: 1 OHM, 1W<br>L810: 70 uH |
| NOKIA                          |                                       |                   |     |                   | A51 ECQ 00X01      | A59 ECF 10X05<br>R1235: 2.2 OHM, 1W.             | A66 ECF 10X05<br>R1235: 2.2 OHM, 1W              |
| WF                             |                                       |                   |     | A48 ECR 11X01     |                    |  |  |

R1235 IS FOR ALL CRT's with 90° DEFLECTION ANGLE IS 0.1 OHM FUSEABLE TYPE RESISTOR.

## TROUBLE SHOOTING

- 1 -TROUBLE SHOOTING GUIDE
- 2 -GENERAL POWER SUPPLY DEFECTS
- 3 -POWER I-POWER SUPPLY DEFECTS
- 4 -POWER II-POWER SUPPLY DEFECTS
- 5 -SWITCH MODE TRANSFORMER DEFECTS
- 6 -PROTECTION CIRCUIT DEFECTS
- 7 -DEFECTS RELATED TO DARK SCREEN
- 8 -DEFLECTION CIRCUIT DEFECTS
- 9 -TEA 2029 AND PERIPHERAL DEFECTS
- 10 -COLOUR DECODER DEFECTS
- 11 -CRT DRIVE BOARD AND IC501 DEFECTS
- 12 -MICROPROCESSOR DEFECTS
- 13 -SOUND CIRCUIT DEFECTS

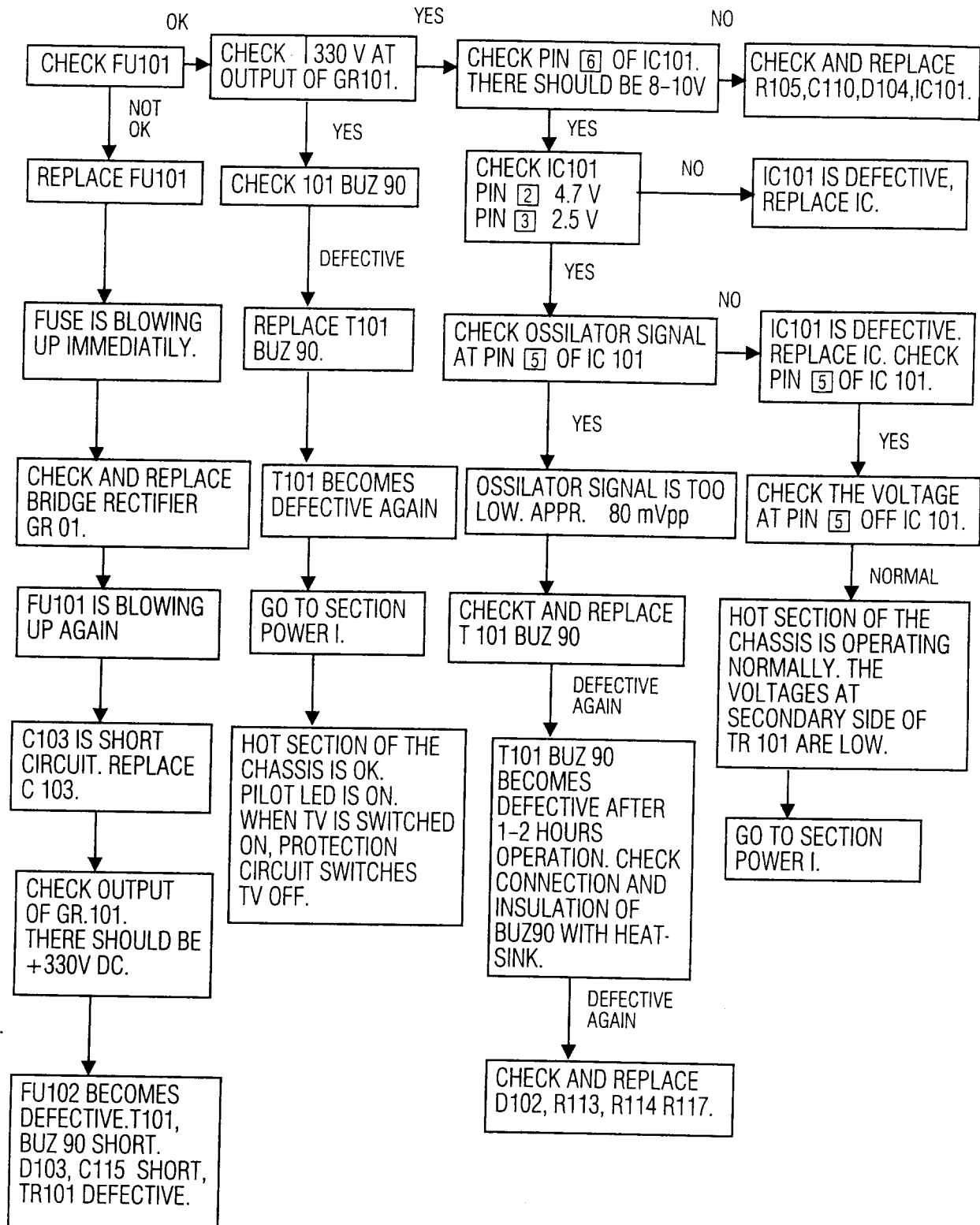


**NOTE:** ALL ANALOG CONTROL (LUMINANCE, CONTRAST, COLOUR, VOLUME), SHOULD BE AT MEDIUM LEVEL.

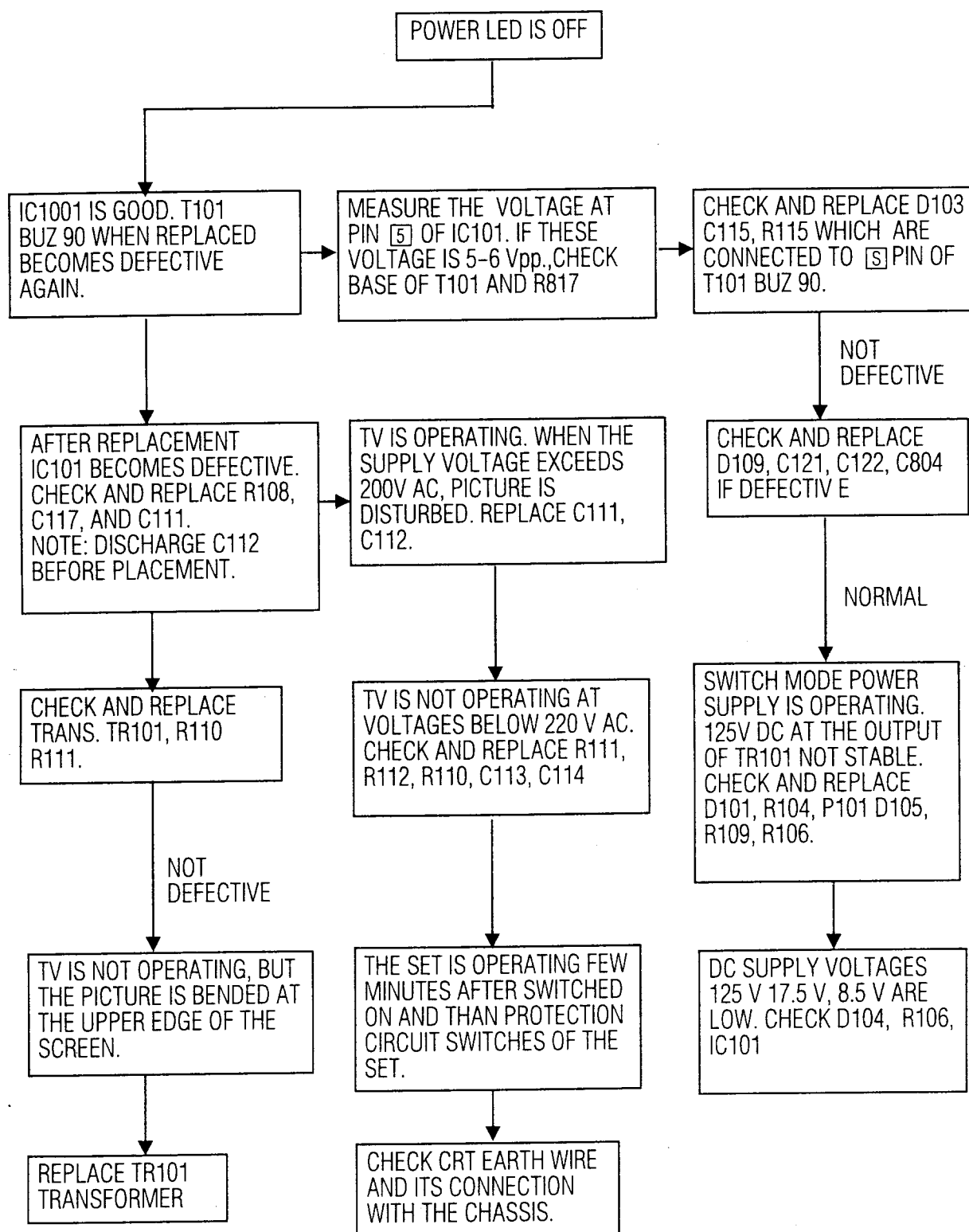


## 2 NO OPERATION

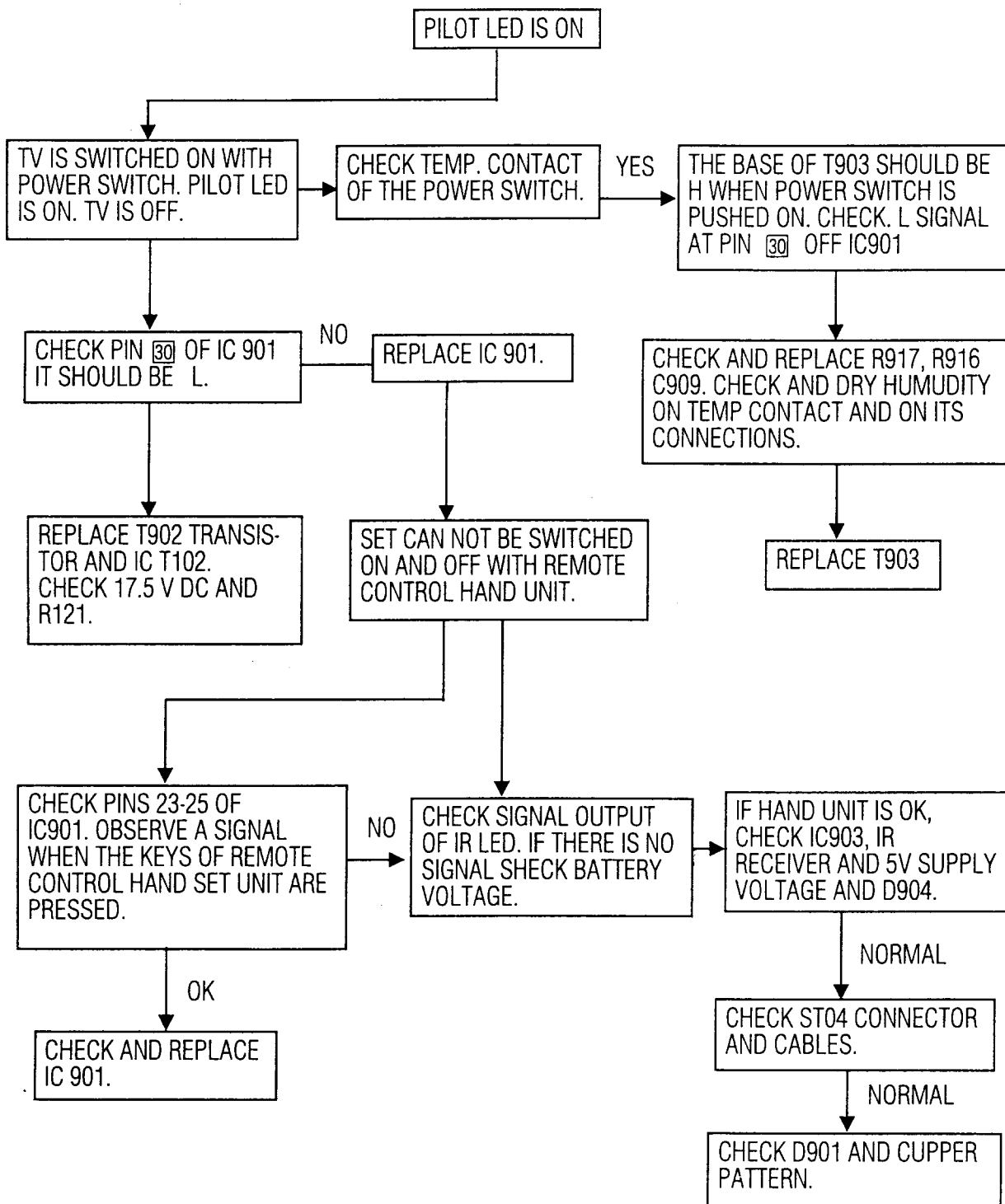
STAND BY LED IS OFF



### 3 POWER I DEFECTS

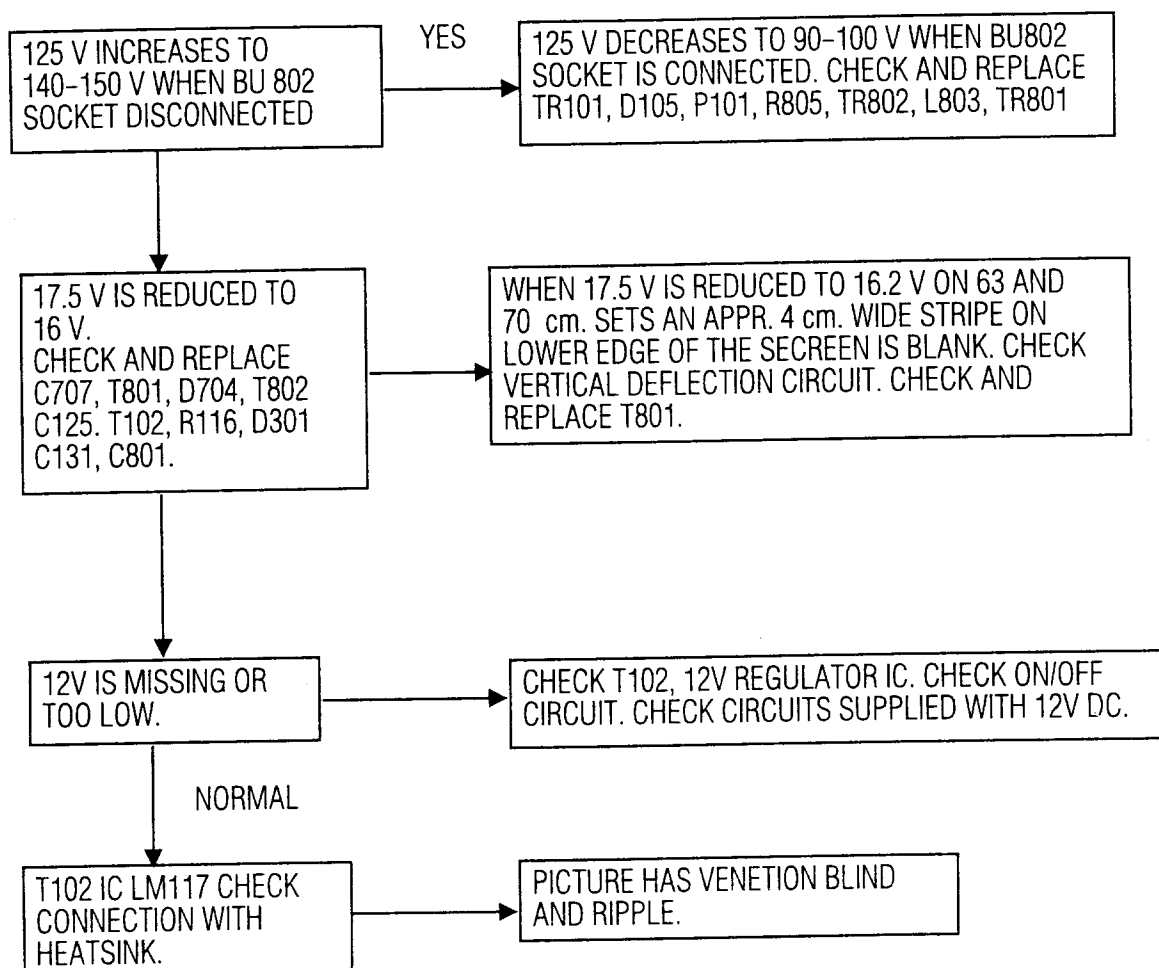


## ④ POWER II DEFECTS



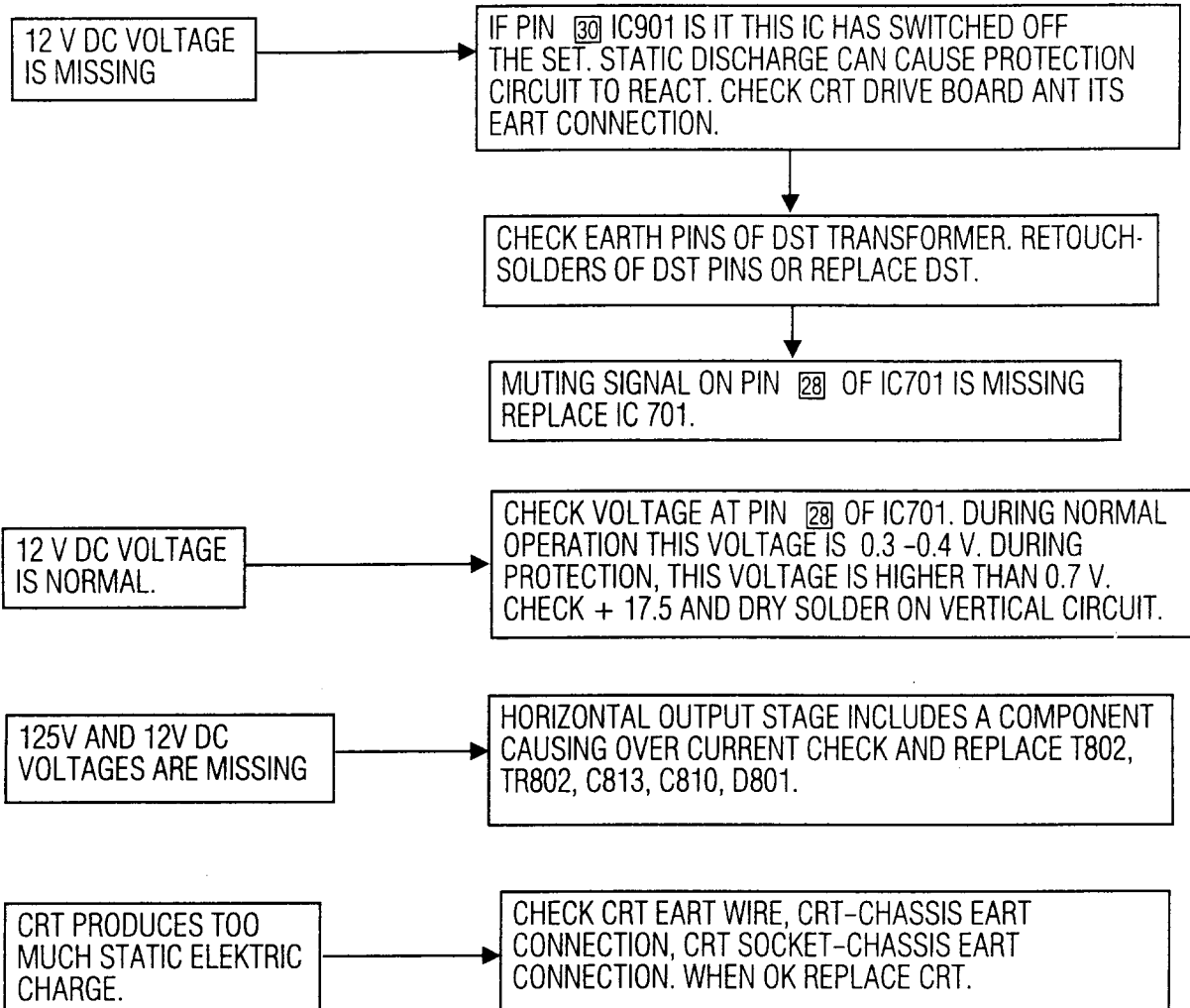
5

## SWITCH MODE TRANSFORMER TR101 AND PERIPHERAL DEFECTS



6

## SET GOES TO STANDBY DURING OPERATION



NOTICE: MAINS VOLTAGE OUTLETS IN COSTUMER HOUSE HAS TO BE CHECKED, BEFORE STARTING ANY OFF ABOVE MENTIONED MEASUREMENTS.

7

SCREEN IS DARK. WHEN SCREEN POTENTIOMETER TURNED CLOCKWISE RASTER AND FLYBACK LINES APPEAR ON SCREEN.

CHECK SDA AND SCL SIGNALS AND 4V DC AT PINS [31], [32] OF IC 901.

IF ONE OF SDA OR SCL IS MISSING.

IN MONO SETS SDA AND SCL SIGNAL LINES ARE SEPARATED FROM TELETEXT BOARD TUNER AND MEMORY IC. THIS WAY SHORT CIRCUIT OF THIS SIGNALS CAN BE LOCALIZED. IN STEREO SETS SDA AND SCL SIGNAL LINES ARE SEPARATED FROM STEREO BOARD OR IF BOARD. SHORT CIRCUIT CAN BE LOCALIZED, AND DEFECTIVE MODULE CAN BE REPLACED.

SDA-SCL SIGNALS ARE NORMAL, SCREEN IS DARK.

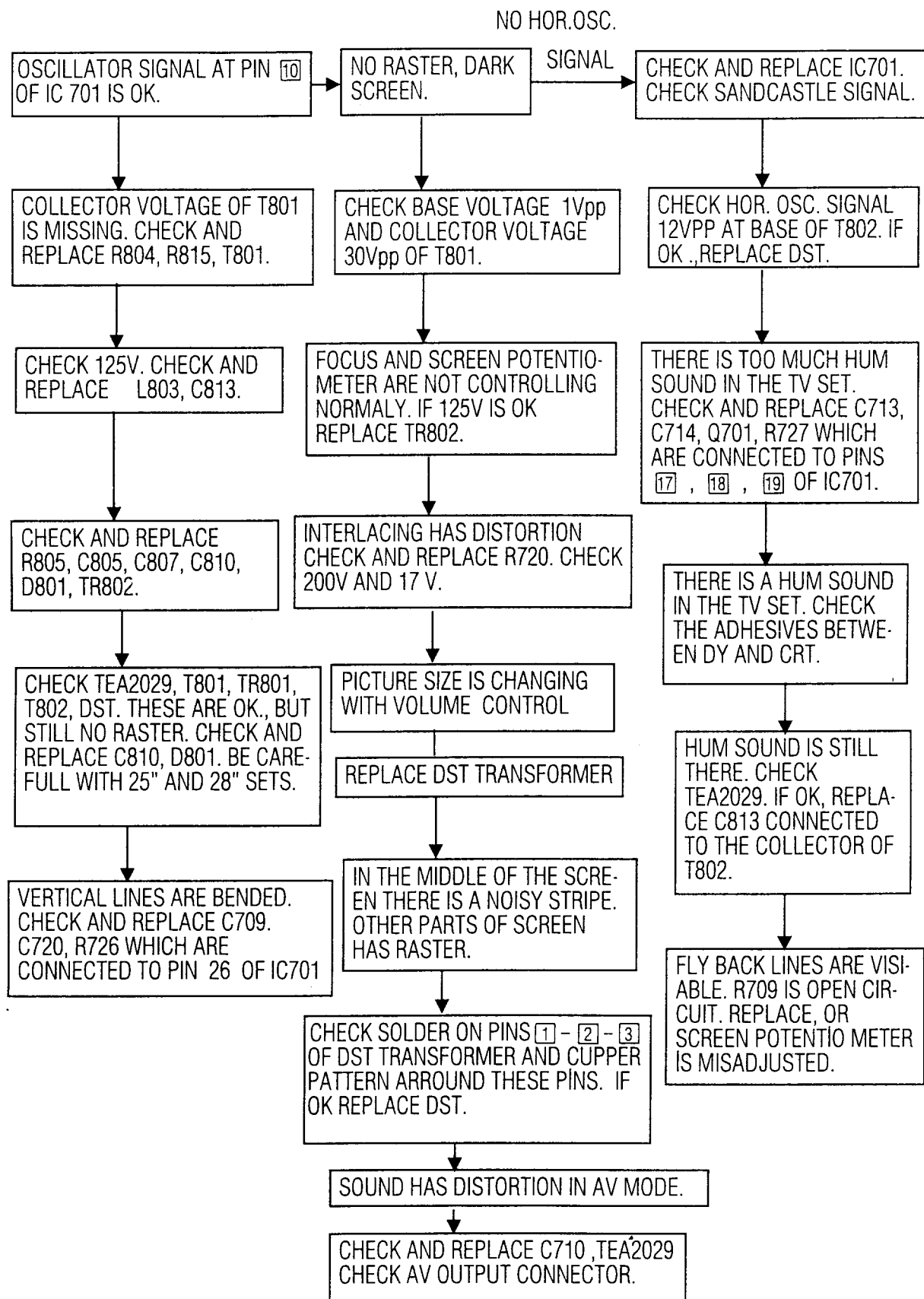
CHECK PIN VOLTAGES AND SURROUND COMPONENTS OF IC501. CHECK 1 V AT PIN [26]. PINS [19], [20] ARE FOR CONTRAST AND BRIGHTNESS. CHECK VOLTAGES AT THESE PINS VARIING BETWEEN 1-4.5 V. CHECK 12V DC AT PIN [6]. CHECK Y-LUMINANCE SIGNAL ON PIN [15]. IF ALL ITEMS ARE NORMAL, IC501 OR CRT DRIVE BOARD IS DEFECTIVE.

REPLACE CRT DRIVE BOARD. CHECK AND REPLACE D501, D503, C503. CHECK VOLTAGE AT PIN [9] OF IC501.

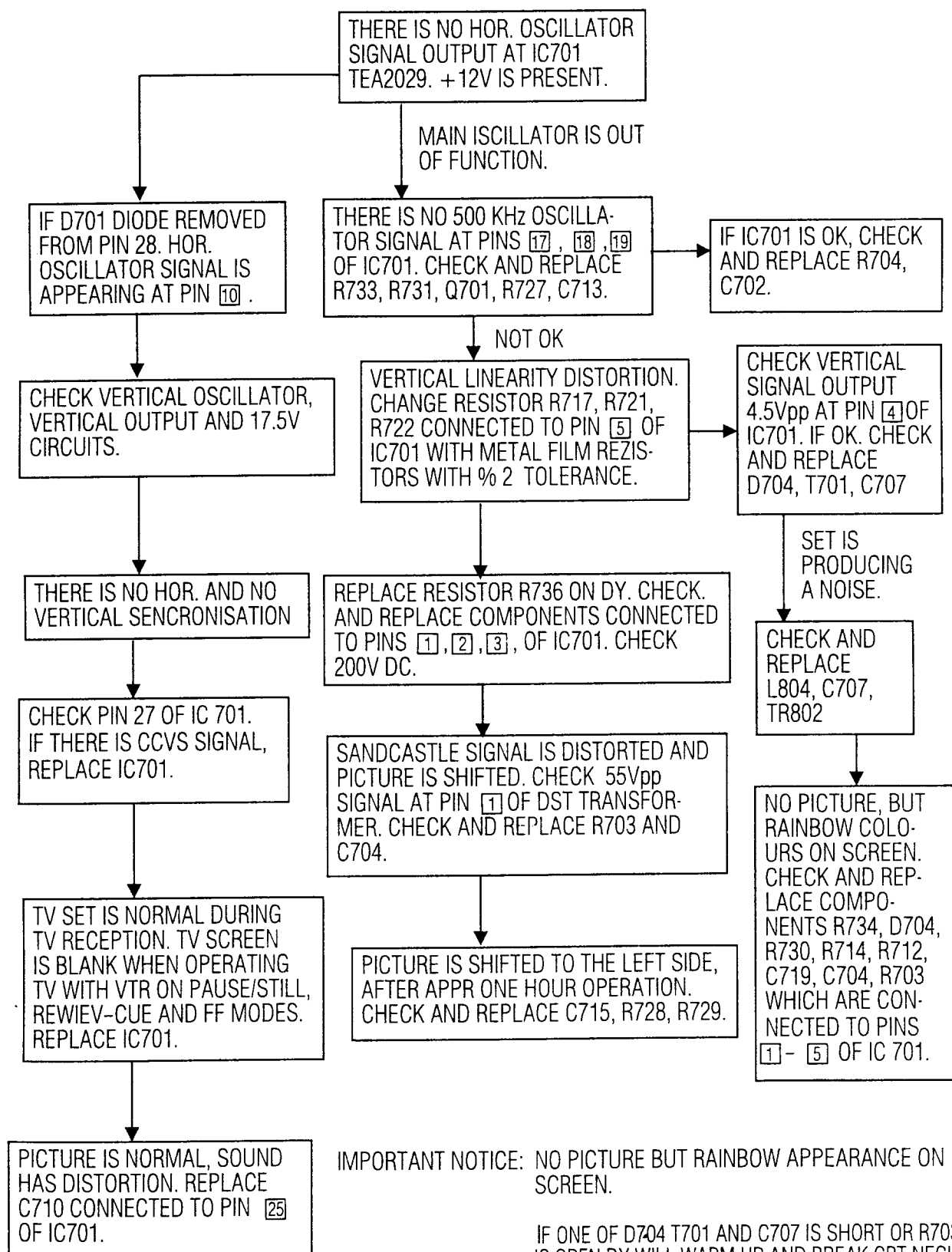
SCREEN IS DARK. RASTER IS AVAILBLE.

PUSH AV BUTTON ON REMOTE CONTROL HAND UNIT. CHECK SQUARE WAVE ON PIN [15] OF IC 501. IF OK, CHECK SQUARE WAVE AT PINS [1], [3], [5]. IF OK, CRT DRIVE BOARD IS DEFECTIVE. IF NOT, REPLACE IC501.

# VERTICAL-HORIZONTAL OUTPUT AND DST CIRCUIT DEFECTS



## TEA 2029 AND PERIPHERAL CIRCUIT DEFECTS





THERE ARE COLOURED LINES AT UPPER EDGE OF THE SCREEN, IF VERTICAL AMPLITUDE IS INCREASED WITH P703. OSCILLATOR FREQUENCY CAN BE HEARD.

CHECK AND REPLACE T701, D704 WHICH ARE CONNECTED TO PIN 4 OF IC701.

PICTURE HAS DISTORTION AND IS FLICKERING. HORIZONTAL LINES ARE SEPARATED.

CLEAN THE GAP BETWEEN PINS 16 - 17 OF IC701 WITH ALCOHOL. CHECK AND REPLACE C712, C711.

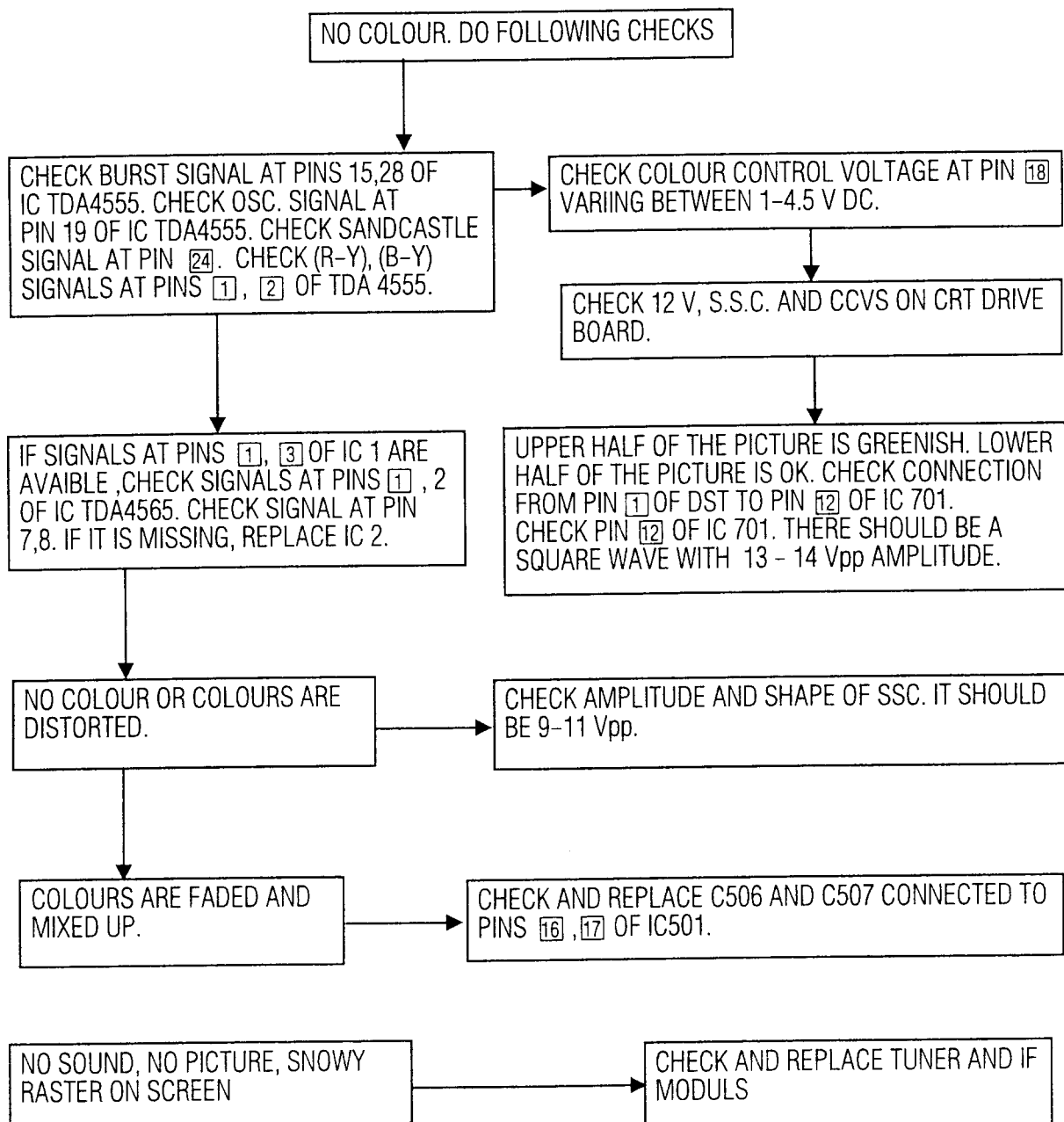
AT MAX VOLUME VERTICAL AMPLITUDE OF THE PICTURE DECREASES. SAME EFFECT IS OBSERVED AT ZAPPING.

CHECK AND REPLACE R121 AND 17V RECTIFIER DIODE D110. IF DEFECT REMAINS SAME REPLACE DST. CHECK AND REPLACE R815 22R.

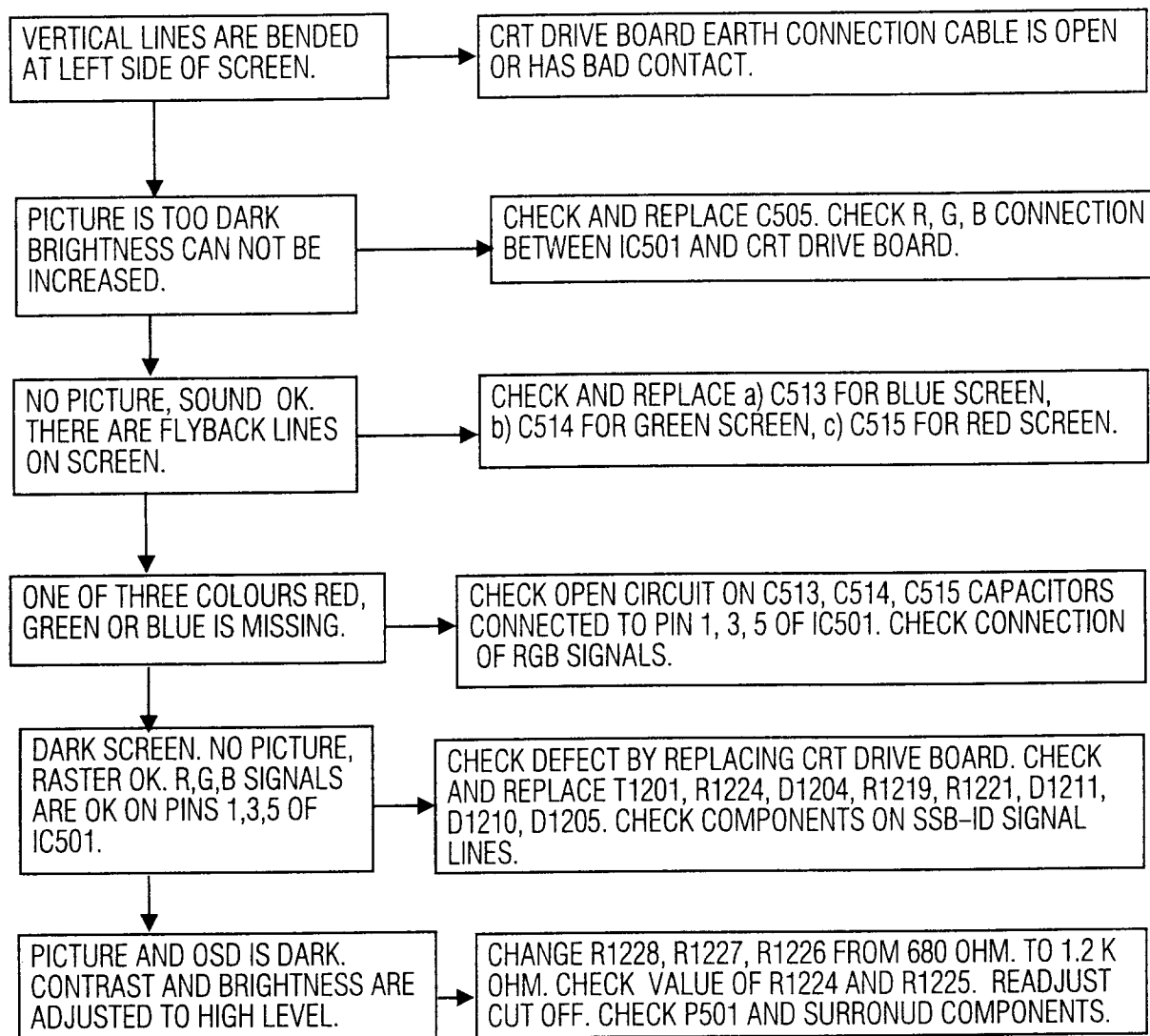
HORIZONTAL LINES ARE SCROLLING.

CHECK AND REPLACE Q701, C723. IF NOT OK. CHECK AND REPLACE C703, R734, C719

## 10 COLOUR DECODER DEFECTS

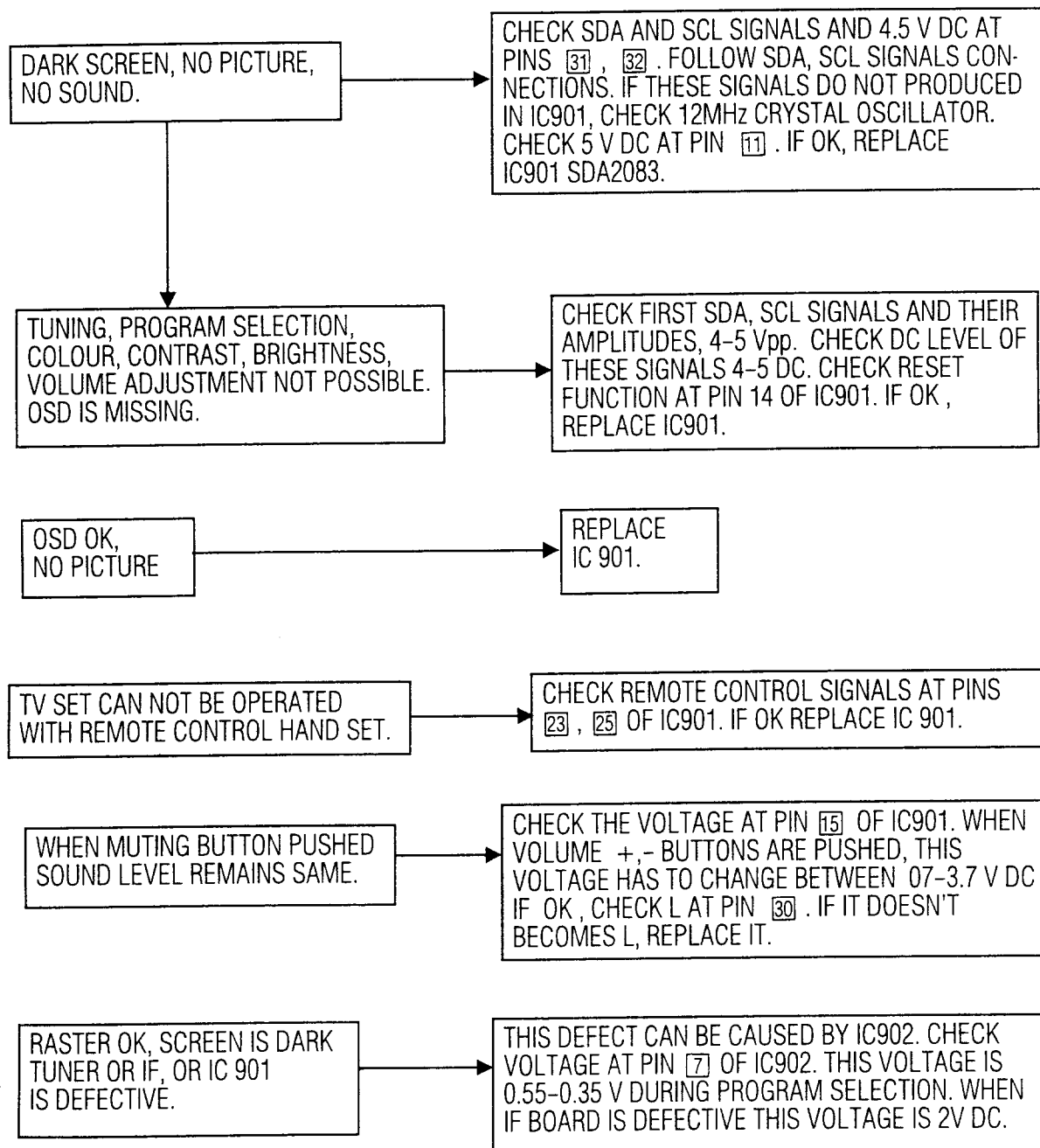


## CRT DRIVE BOARD AND IC501 DEFECTS

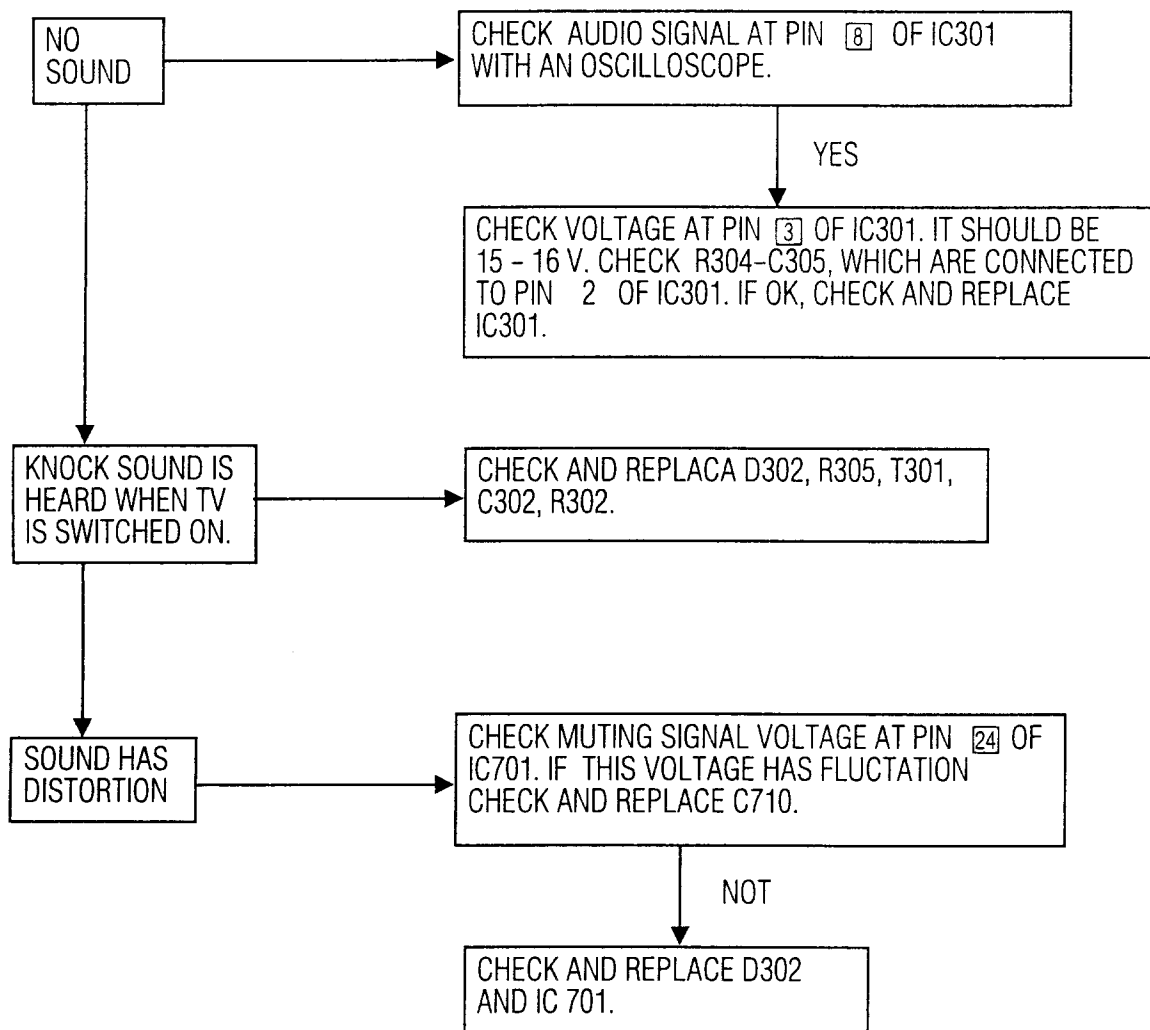


12

## MICROPROCESSOR IC 901 AND PERIPHERAL CIRCUITRY DEFECTS



**13**  
**SOUND CIRCUIT DEFECTS**



# SPARE PARTS

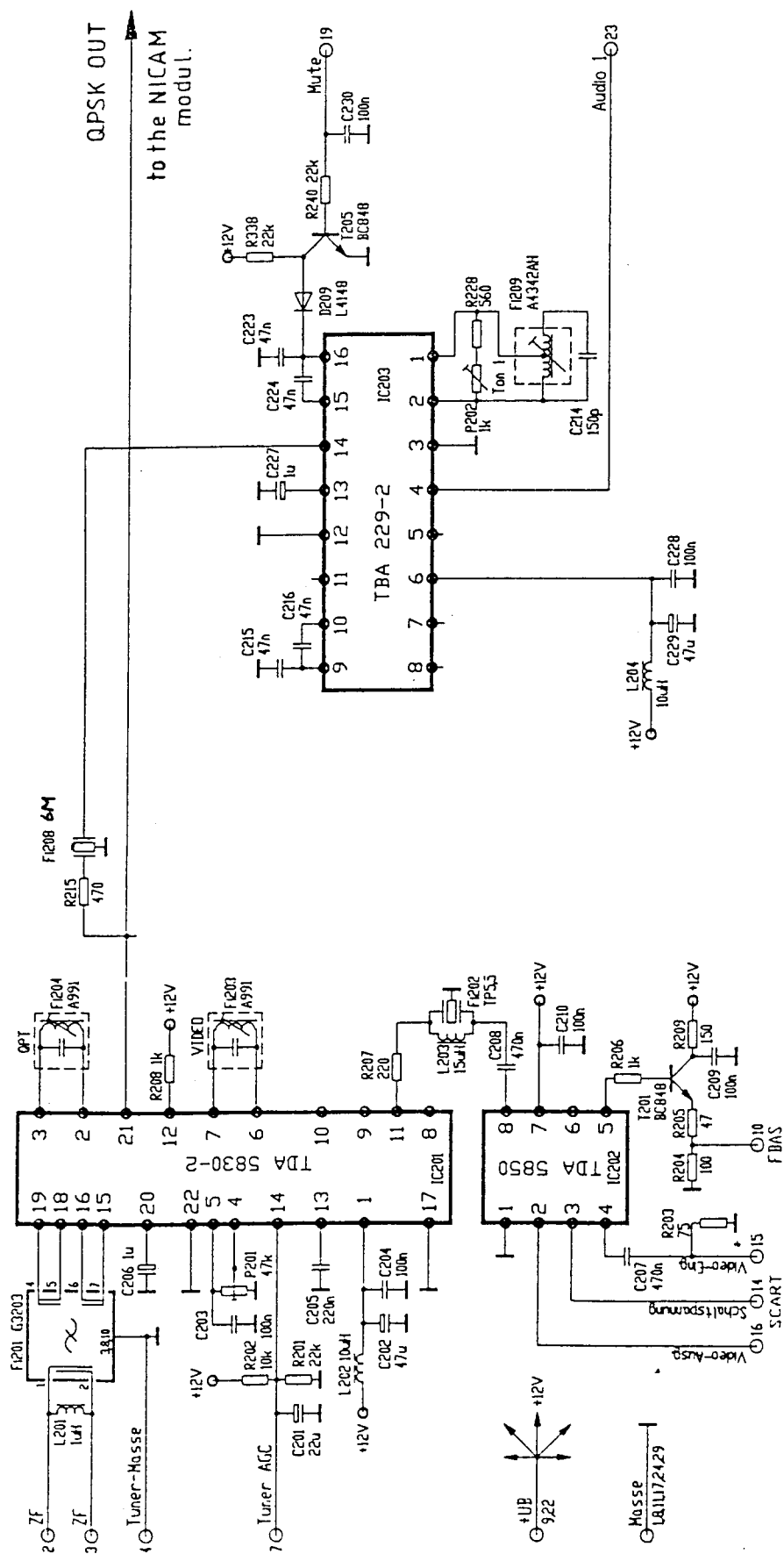
| PART<br>NUMBER | DISCRIPTION                 | POSITION                      | PART<br>NUMBER | DISCRIPTION               | POSITION                      |
|----------------|-----------------------------|-------------------------------|----------------|---------------------------|-------------------------------|
| 010770         | POWER SWITCH ME5-S2         | —                             | 102563         | CFR 5.6K J 1/4W           | R940                          |
| 031228         | PERI SOCKET                 | ST502                         | 102685         | CFR 6.8K J 1/4W           | R110 R112                     |
| 031960         | CRT SOCKET (B10227 TYPE)    | —                             | 102825         | CFR 8.2K J 1/4W           | R909                          |
| 038905         | POWER CORD L=2400           | —                             | 103116         | CFR 10K J 1/4W            | R901 R903 R905 R907 R911 R937 |
| 051581         | DST AT2 90                  | TR802                         |                |                           | R939 R439                     |
| 051583         | LINE FILTER 27UH            | L101                          | 103155         | CFR 15K J 1/4W            | R926 R927 R928 R929 R930 R931 |
| 051584         | COIL H-AMPL                 | L801                          |                |                           | R932 R933 R419 R421           |
| 051585         | COIL H-LIN                  | L802                          | 103224         | CFR 22K J 1/4W            | R306 R509 R703                |
| 051587         | DRIVER TRANSFORMER          | TR801                         | 103273         | CFR 27K J 1/4W            | R938                          |
| 051609         | SMPS AT2 90 II              | TR101                         | 103475         | CFR 47K J 1/4W            | R1222 R1229 R922              |
| 051610         | COIL CHOKE VERTICAL 500UH   | L804                          | 103561         | CFR 56K J 1/4W            | R510 R511 R512 R941           |
| 052495         | COIL ANTENNA SW             | L201                          | 104110         | CFR 100K J 1/4W           | R920 R921                     |
| 053498         | COIL 1.2UH                  | L803                          | 104151         | CFR 150K J 1/4W           | R925                          |
| 053499         | COIL 7UH                    | —                             | 104185         | CFR 180K J 1/4W           | R1219                         |
| 053500         | COIL 10UH K                 | L106 L410                     | 104222         | CFR 220K J 1/4W           | R1221                         |
| 053501         | COIL 330UH                  | L502                          | 104273         | CFR 270K J 1/4W           | R1220                         |
| 053502         | COIL 22UH                   | L501                          | 104332         | CFR 330K J 1/4W           | R1234                         |
| 053505         | FILTER SFE5.5MC             | F204                          | 104470         | CFR 470K J 1/4W           | R807                          |
| 053506         | COIL DEMOD                  | F203                          | 105106         | CFR 1M J 1/4W             | R722                          |
| 053508         | COIL TPC 5.5MC              | F202                          | 106100         | CFR 10M J 1/4W            | R916 R917                     |
| 053511         | DELAY LINE 5DL145           | DL401                         | 109106         | CFR 1R J 1/4W             | R304                          |
| 053512         | COIL 8128-A3753             | FI205 FI406 FI407 FI408 FI409 | 109224         | CFR 2.2R J 1/4W           | R701                          |
| 053513         | COIL CHROMA 4.4MHZ          | FI404                         | 109473         | CFR 4.7R J 1/4W           | —                             |
| 053523         | COIL A4449                  | FI401                         | 1113222        | CFR 22K J 1/4W            | R1213 R1214 R1215             |
| 053525         | COIL 2K843EG                | FI403                         | 113270         | RMO 27K J 2W              | R115 R61                      |
| 053529         | COIL 100UH                  | DR402                         | 113330         | RMO 33K J 2W              | R105                          |
| 053547         | COIL 3UH                    | L301 L302                     | 113477         | RMO 47K J 2W              | R118 R1208 R1210 R1212        |
| 053600         | COIL DISKR. 6.5MHZ          | F202                          | 114330         | RMO 330K J 1.5W           | R112                          |
| 053601         | COIL DISKR. 5.5 MHZ         | F205                          | 114820         | RMO 820K J 1.5W           | R111                          |
| 053633         | COIL 10UH (RAD)             | DR401 L202                    | 115473         | RM 4.7M %1. 1W            | R102 R103                     |
| 054230         | FUSE 3.15AT                 | FU101                         | 119475         | RMO 4.7R J 1.5W           | R715                          |
| 054275         | FUSE 1.25A (DELAY)          | FU102                         | 121153         | RW 150R J 2W              | R803                          |
| 056065         | SAW FILTER OFW K2950        | F201                          | 122112         | RW 1K J 1.5W              | —                             |
| 056066         | CER.FILTER TPS 6.5MB        | FI207                         | 129109         | RW 1R J .75W              | R121 R122 R123 R808 R1225     |
| 056067         | CER.FILTER SFE6.5MC         | FI208                         | 129273         | RW 2.7R J 4W              | —                             |
| 056736         | CRT SS 5109B22TC-DSE-1992JL | —                             | 129486         | RW 4.7R J 11W             | R805                          |
| 056946         | CRYSTAL 12MHZ               | Q901                          | 131224         | R-VAR 220R                | P401                          |
| 056947         | CRYSTAL 500KHZ              | Q701                          | 131250         | R-VAR 250R                | P703                          |
| 056955         | CRYSTAL 8.8MHZ              | Q401                          | 132129         | R-POT 1K                  | P1201 P1202 P1203             |
| 100224         | CFR 22R J 1/4W              | R713                          | 132252         | R-VAR 2.5K (V)            | P101                          |
| 100473         | CFR 47R J 1/4W              | R106 R113                     | 132253         | R-VAR 2.5K (H)            | P702                          |
| 100684         | CFR 68R J 1/4W              | R403                          | 132475         | R-VAR 4.7K                | P501                          |
| 100751         | CFR 75R J 1/4W              | R516                          | 133147         | R-VAR 10K                 | P201                          |
| 101106         | CFR 100R J 1/4W             | R1901 R114 R945 R947 R924     | 133253         | R-VAR 25K                 | P701                          |
| 101154         | CFR 150R J 1/4W             | R944                          | 134234         | R-POT 220K                | P1204 P1205                   |
| 101223         | CFR 220R J 1/4W             | R109 R731                     | 154213         | PTC DEGAUSSING COIL 98009 | R124                          |
| 101274         | CFR 270R J 1/4W             | R801 R802                     | 154216         | 4.7R S234                 | R101                          |
| 101395         | CFR 390R J 1/4W             | R1203                         | 200222         | CC 22PF J 100V            | C434 C437                     |
| 101470         | CFR 470R J 1/4W             | R733                          | 200331         | CC 33PF J 63V             | C906 C907 C920 C1210          |
| 101562         | CFR 560R J 1/4W             | R934 R935 R936                | 200472         | CC 47PF J 63V             | C913 C915                     |
| 101683         | CFR 680R J 1/4W             | R207                          | 200473         | CC 47PF J 63V             | C501 C1203 C1203              |
| 101820         | CFR 820R J 1/4W             | R1202                         | 200564         | CC 56PF J 63V             | C1209                         |
| 102101         | CFR 1K J 1/4W               | R104 R705 R740 R448 R210 R923 | 200682         | CC 68PF                   | C427 C441                     |
| 102126         | CFR 1.2K J 1/4W             | R1236 R1237 R444              | 201102         | CC 100PF J 63V            | C914                          |
| 102157         | CFR 1.5K J 1/4W             | R1207 R1209 R1211 R408 R422   | 201104         | CC 100PF J 63V            | C117 C924 C210                |
| 102189         | CFR 1.8K J 1/4W             | R1201                         | 201105         | CC 100PF K 63V            | C428 C431                     |
| 102198         | CFR 1.3K J 1/4W             | R120                          | 201124         | CC 120PF K 63V            | C408 C435 C442 C446           |
| 102227         | CFR 2.2K J 1/4W             | R942 R943 R424                | 201151         | CC 150PF J 63V            | C802                          |
| 102338         | CFR 3.3K J 1/4W             | R1225 R216 R217               | 201152         | CC 150PF                  | C412                          |
| 102479         | CFR 4.7K J 1/4W             | R117 R732 R902 R904 R906 R908 | 201181         | CC 180PF K 63V            | C714 C430 C439                |
|                |                             | R910 R919 R915 R946 R215      | 201222         | CC 220PF                  | C404                          |

| PART<br>NUMBER | DISCRIPTION              | POSITION                       |        |                            |                               |
|----------------|--------------------------|--------------------------------|--------|----------------------------|-------------------------------|
| 201223         | CC 220PF 2KV             | C121 C809                      | 302626 | DIODE SFH205 IR            | D904                          |
| 201331         | CC 330PF K 63V           | C433                           | 302638 | DIODE BY299                | D109 D801                     |
| 201332         | CC 330PF J 63V           | C1212 C1213 C1214              | 302939 | DIODE 1N4002               | D301 D701                     |
| 201391         | CC 390 PF                | C 407                          | 302947 | DIODE 1N4004               | D1214                         |
| 201471         | CC 470PF 2KV             | C807                           | 302984 | DIODE BYW72                | D110 D111 D112                |
| 201472         | CC 470PF K 63V           | C438 C440                      | 303085 | DIODE BZX55-C30            | D61                           |
| 201560         | CC 560PF K 63V           | C306                           | 303086 | DIODE Z. BZX85-C6V2        | D105                          |
| 202105         | CC 1NF 1KV               | C135 C136 C137 C138            | 303087 | DIODE C2540 BRIDGE         | GR101                         |
| 202106         | CC 1NF 100V              | CR701 C713 CT102 CT103 C720    | 303093 | DIODE BA159                | D103                          |
|                |                          | C721 C722                      | 303104 | DIODE BZX83 C4V7           | D1208                         |
| 204106         | CC 100NF 63V             | C724                           | 303900 | LED ROT                    | D903                          |
| 209680         | CC 6.8PF J 63V           | C921                           | 400338 | TRN BF422                  | T1203 T1205 T1207 T1211       |
| 213684         | C-PEM 68NF 250V          | C133                           | 400339 | TRN BF423                  | T1208 T1209 T1210             |
| 240470         | TAN.CAP. 4.7UF M 10V     | C918 C919                      | 400987 | TRN BC548                  | T301 T901 T902 T903 T905 T906 |
| 250105         | EC 1UF 100V              | C112 C502 C417 C424 C425 C214  |        |                            | T907 T401 T404 T405           |
|                |                          | C216 C217                      | 400989 | TRN BC558                  | T1201 T201 T203 T904          |
| 251115         | EC 10UF 25V              | C503 C717 C905 C910 C912 C201  | 400990 | TRN BF869G                 | T1202 T1204 T1206             |
|                |                          | C218                           | 400991 | TRN BUZ90A                 | T101                          |
| 251116         | EC 10UF                  | C401                           | 400993 | TRN BC635                  | T801                          |
| 251225         | EC 22UF16V               | C516                           | 401003 | TRN S2055F                 | T802                          |
| 251478         | EC 47UF 16V              | C134 C1215 C419                | 410015 | THRY SCRESM740             | T701                          |
| 251479         | EC 47UF 25V              | C110                           | 451463 | IC TDA4605                 | IC 101                        |
| 251480         | EC 47UF 250V             | C122 C123 C810                 | 451464 | IC TDA5931-4               | IC 201                        |
| 252112         | EC 100UF 16V             | C444                           | 451465 | IC SDA 2526                | IC902                         |
| 252113         | EC 100UF 25V             | C304                           | 451467 | IC TBA121                  | IC202                         |
| 252152         | EC 150UF 385V            | C103                           | 451468 | IC TDA1037                 | IC301                         |
| 252225         | EC 220UF 25V             | C801                           | 451469 | IC TDA4060                 | IC903                         |
| 252476         | EC 470UF 25V             | C301 C701                      | 451508 | IC TDA4580                 | IC501                         |
| 252477         | EC 470UF 40V             | C125 C126                      | 451509 | IC UPD6142                 | IC904                         |
| 253108         | EC 1000UF 25V            | C131                           | 451510 | IC TEA2029                 | IC701                         |
| 259223         | EC 2.2UF 63V             | C127 C130                      | 451512 | IC TDA4565                 | IC402                         |
| 259477         | EC 4.7UF 40V             | C505 C712 C1207 C207           | 451516 | IC TDA4555                 | IC401                         |
| 259478         | EC 4.7UF 250V            | C1217                          | 451517 | IC TDB7805CT (T0220CASE)   | T103                          |
| 260140         | C-TRIM 332PF             | C420                           | 451518 | IC LM317T (T0220CASE)      | T102                          |
| 271220         | C-MFP 220PF 1600V        | C116                           | 451765 | IC SDA20160                | IC901                         |
| 271683         | C-STRY 680PF %2 160V     | —                              | 500265 | WASHER PLST 6*3*2.5        | —                             |
| 272101         | C-PEM 1NF 63V            | C445                           | 50S158 | PAL/SECAM PLATE ASSY       | —                             |
| 272151         | C-PEM 1.5NF K 63V        | C713                           | 50S164 | CRT PLATE ASSY             | —                             |
| 272221         | C-PEM 2.2NF K 63V        | C309 C310 C410 C411 C413       | 50S221 | BRACKET LED                | —                             |
| 272330         | C-PEM 3.3NF K 63V        | C307 C703                      | 50S305 | HEAT SINK HORIZONTAL       | —                             |
| 272471         | C-PEM 4.7NF K 63V        | C111 C113 C91 C211             | 50S306 | HEAT SINK REGULATOR AT2    | —                             |
| 272472         | C-PEM 4.7NF K 400V       | C719                           | 50S307 | HEAT SINK SOUND AT2        | —                             |
| 272681         | C-PEM 6.8NF K 63V        | C1216 C414 C422                | 50S308 | HEAT SINK POWER AT2        | —                             |
| 273102         | C-PEM 10NF K 63V         | C504 C506 C507 C508 C509 C510  | 520304 | SPRING CRT EARTH LEAD      | —                             |
|                |                          | C511 C512 C925                 | 52N820 | CIRCUIT DIAGRAM 90 PS/BG   | —                             |
| 273103         | C-PPM 10NF K 250V        | C808                           | 52P110 | CHASSIS 20" PS B/G-D/K     | —                             |
| 273104         | C-PPM 10NF J 1500V       | C813                           | 52P140 | IF B/G-D/K ASSY            | —                             |
| 273108         | C-POL 10NF K 400V        | C517 C518 C519                 | 530307 | CRT EARTHING HOOK          | —                             |
| 273110         | C-MKP 10NF K 1000V       | C1219                          | 571925 | PUSH CATCH NEW TYPE        | —                             |
| 273150         | C-PEM 15NF K 63V         | C711                           | 597166 | DEGAUSSING COIL 20"        | —                             |
| 273222         | C-PEM 22NF K 250V        | C909                           | 597317 | HEAT SINK 2-IC200          | —                             |
| 273224         | C-PEM 22NF K 63V         | C710 C415 C421 C203 C212 C213  | 60U172 | CONTROL UNIT ASSY          | —                             |
| 273331         | C-PPM 33NF J 1000V       | C115                           | 60U203 | LENS LED                   | —                             |
| 273471         | C-PEM 47NF K 63V         | C803 C423 C432                 | 60U805 | STROPOR TOP 20SI-BK00      | —                             |
| 273474         | C-PEM 47NF K 250V        | C1218                          | 60U806 | STROPOR BOTTOM 20SI-BK00   | —                             |
| 273681         | C-PEM 68NF K 63V         | C715                           | 60U902 | RUBBER CONTACT-II 6KEY     | —                             |
| 274104         | C-PEM 100NF K 63V        | C305 C901 C1211 C443 C202 C205 |        | 20SI-BK00                  | —                             |
|                |                          | C206 C209 C215 C219            | 60U903 | RUBBER CONTACT-II 7KEY     | —                             |
| 274106         | C-PEM 100NF K 250V       | C1202                          |        | 20SI-BK00                  | —                             |
| 274222         | C-PEM 220NF K 63V        | C909                           | 70P258 | KNOB POWER PAINTED         | —                             |
| 274224         | C-PEM 220NF 250V         | C710                           | 71S320 | NAME PLATE BEKO2           | —                             |
| 274330         | C-PEM 330NF J 250V       | C804                           |        | D.C 49.9*11.2*0.5          | —                             |
| 274332         | C-PEM 330NF K 63V        | C418 C429                      | 72W205 | BAÇK COVER                 | —                             |
| 274470         | C-PEM .47UF J 200V (MPP) | C805                           | 72W251 | FRONT COVER                | —                             |
| 274471         | C-PEM 470NF K 63V        | C705 C208                      | 72X136 | TUNER TFK 2201 PKC-3x8630  | —                             |
| 274680         | C-PEM 680NF 250V         | C101                           | 72X261 | CU DOOR PAINTED            | —                             |
| 275100         | C-PPM 1UF J 250V         | C707                           | 72X800 | GIFT BOX                   | —                             |
| 300305         | DIODE BA157              | D704                           | 850107 | SPEAKER FOSTER             | —                             |
| 302289         | DIODE 1N4148             | D101 D102 D104 D501 D503 D901  | 880187 | R/C HANDSET ASSY BEKO-2 TX | —                             |
|                |                          | D902 D201                      |        |                            |                               |





IF (NICAM)



## NICAM DROP OUT ALIGNMENT PROCEDURE

Nicam drop out can occur on TV switch on or may occur when the CTV has thoroughly warmed up.

In either instances the procedure for correcting the problem is as follows:-

1. Equipment required : Digital volt meter and non metallic trimmer
2. Remove back cover, connect up receiver to power supply and a good Nicam aerial signal.
3. Switch the receiver on to obtain picture and sound

The following alignment procedure should be carried out within 5 minutes of switch on, on a good quality Nicam transmission.

### Alignment procedure for drop out after TV warm up

- A. Connect the volt meter to Pin 1 of IC603 (TDA 8732).
- B. C678 (variable capacitor and located on the Nicam PCB) should be carefully adjusted until the voltage on Pin 1 IC603 measures 2.8/2.9V (DC).

NOTE: C678 rotates through 360° and so a careful and slow adjustment is required.

### Alignment procedure for drop out on switch on

If Nicam drop out happens on switch on the voltage reading on Pin 1 of IC603 will be inaccurate and cannot be used for the setting up procedure.

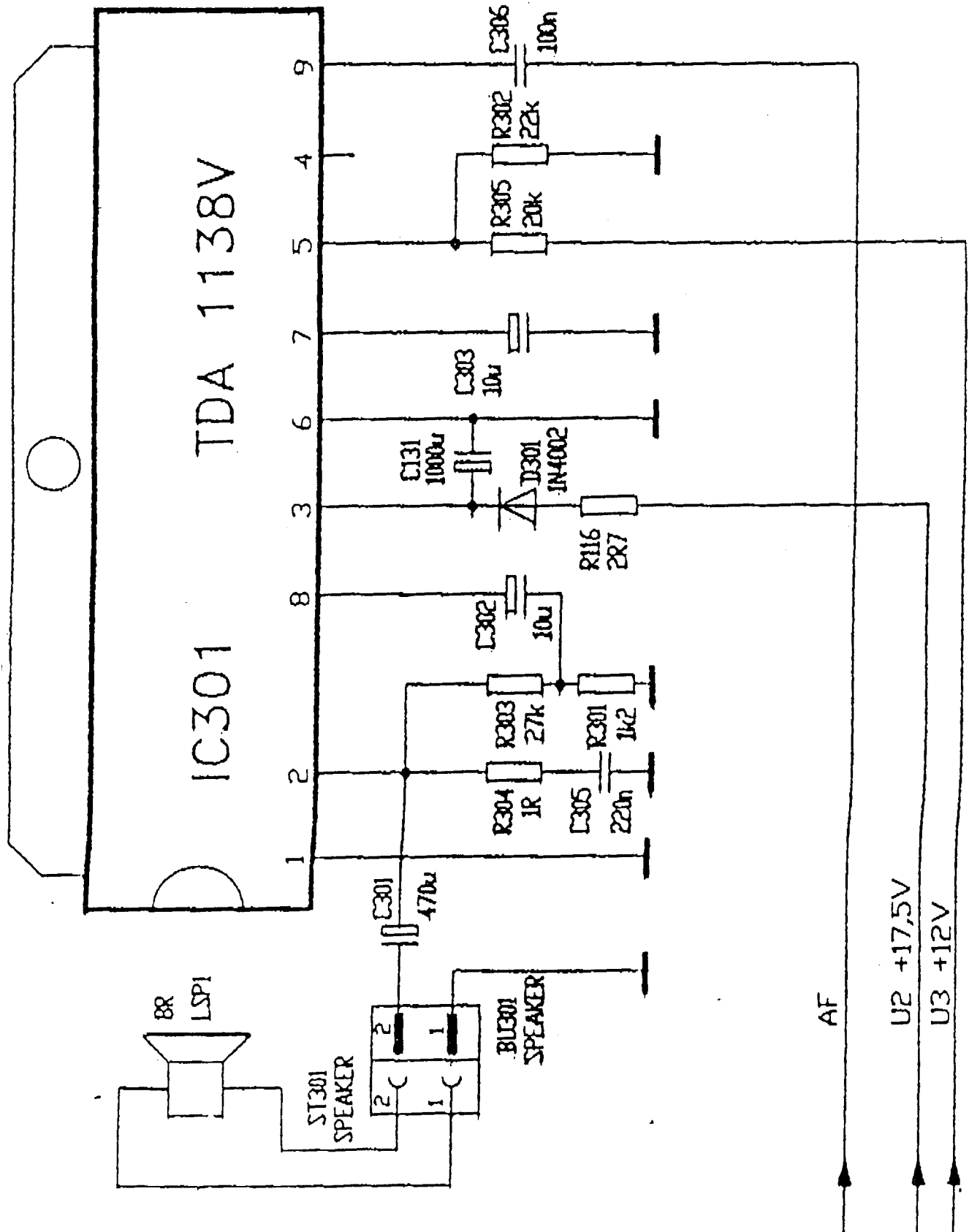
In this instance C678 must be adjusted slowly and until the Nicam OSD flashing stops.

When the Nicam OSD flashing has ceased proceed as directed above, sections 'A' and 'B'.

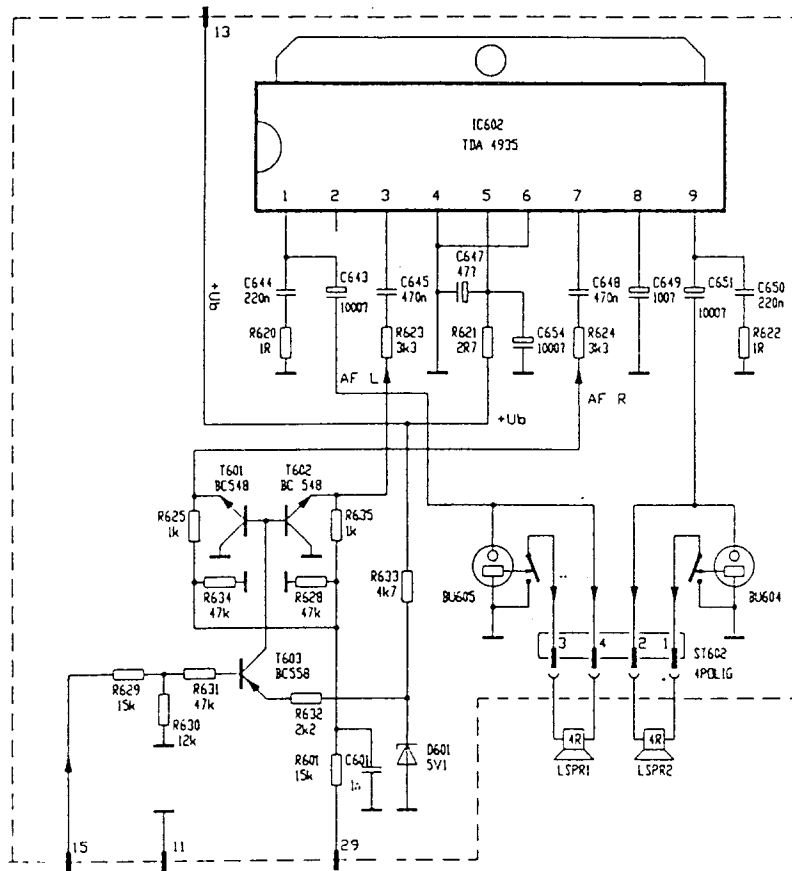
### Other

1. The voltage varies on Pin 1 of IC603 as the receiver "warms up" and normally the voltage drops. Therefore if the voltage is measured again after about 30 minutes it will have fallen below the set level (2.8/2.9V). The capacitor **must not** be readjusted. The fact the voltage has varied is a normal part of receiver operation process.
2. If the problem recurs after the TV has warmed up, or if the setting up voltage can not be achieved, replace crystal Q4 and re-set C678.

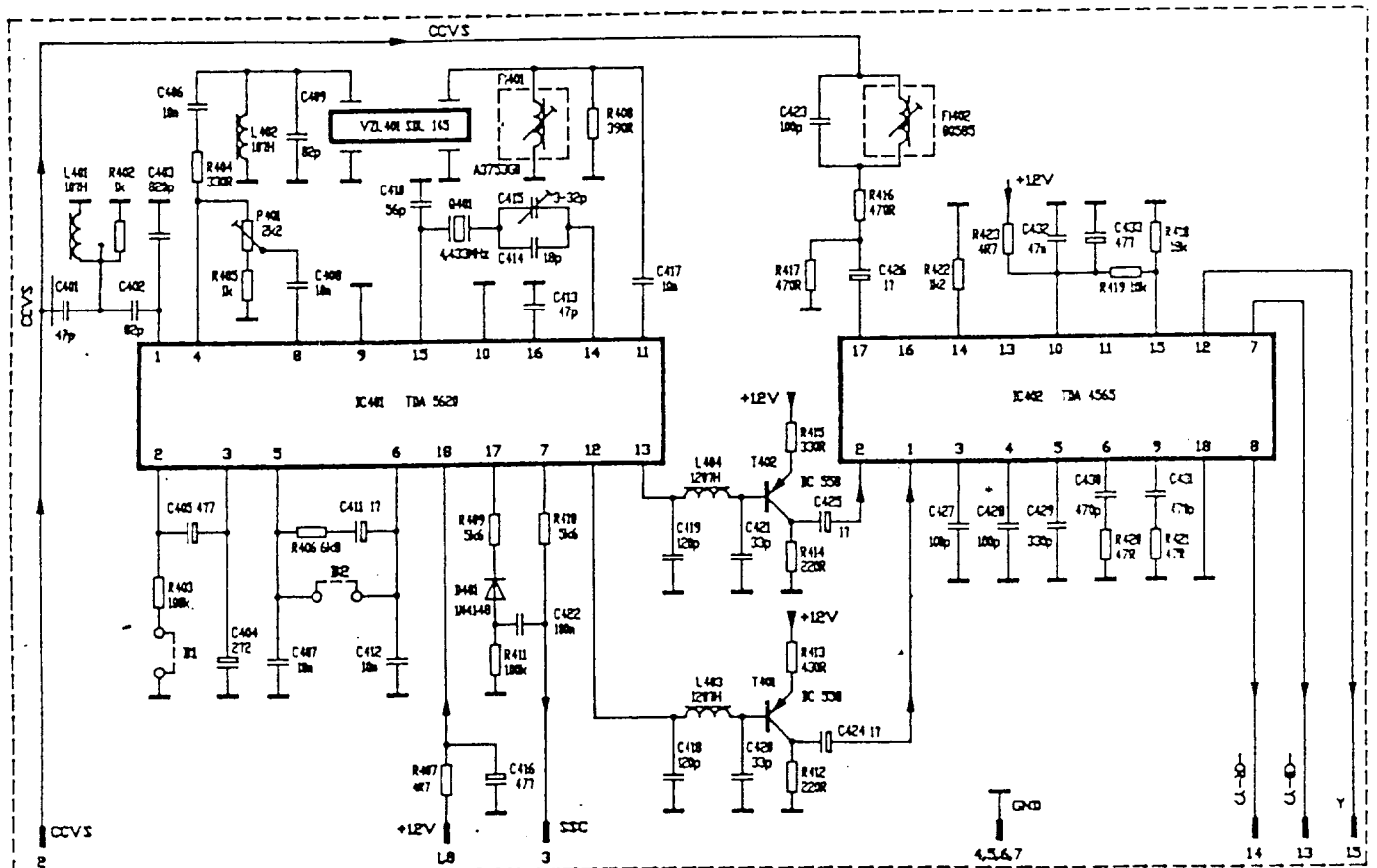
## ALTERNATIVE AUDIO CIRCUITRY FOR 90° 14"-21" CTV'S

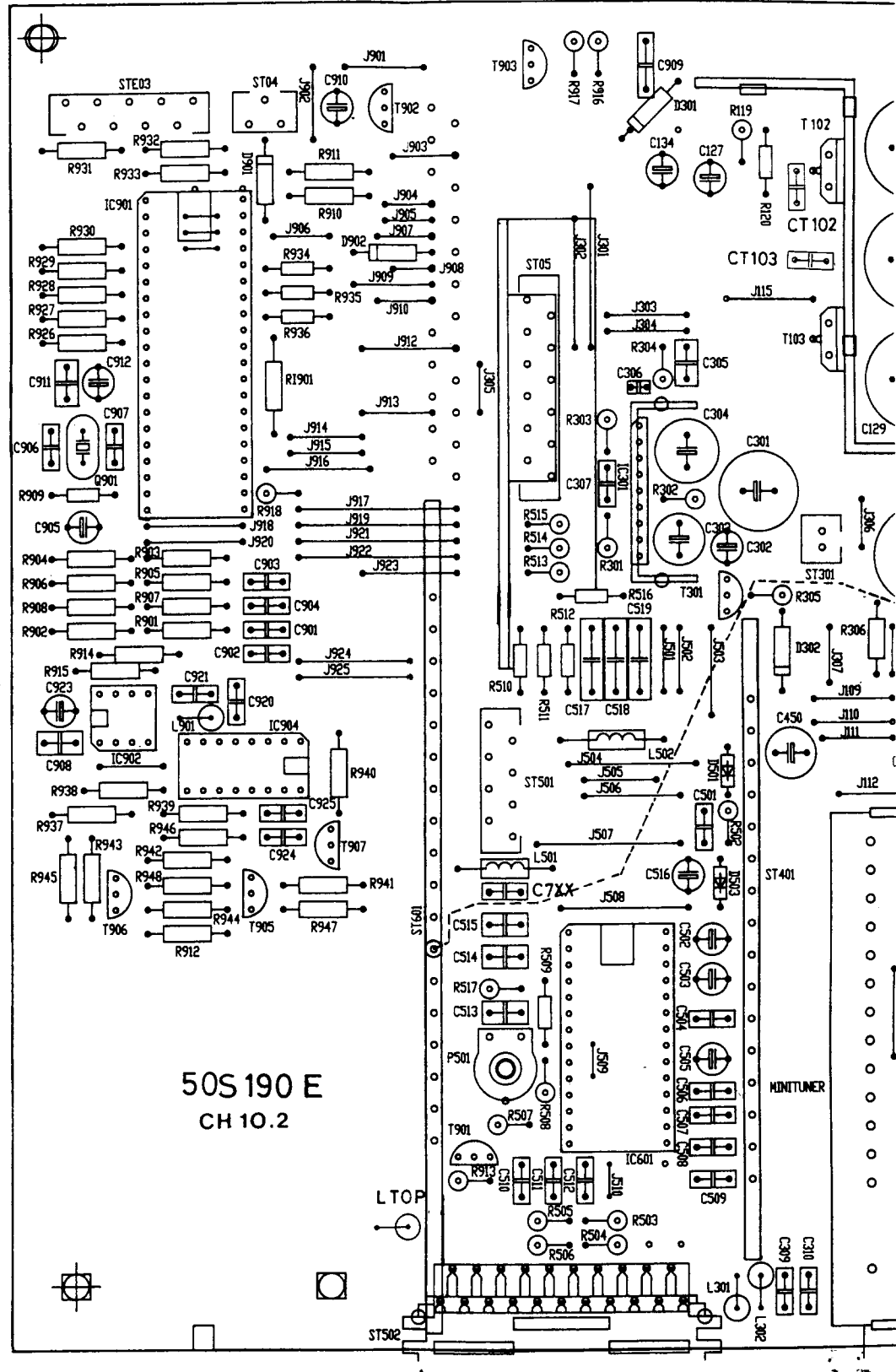


## AF POWER AMPLIFIER FOR TV MODEL 11225T/15225T/16228T



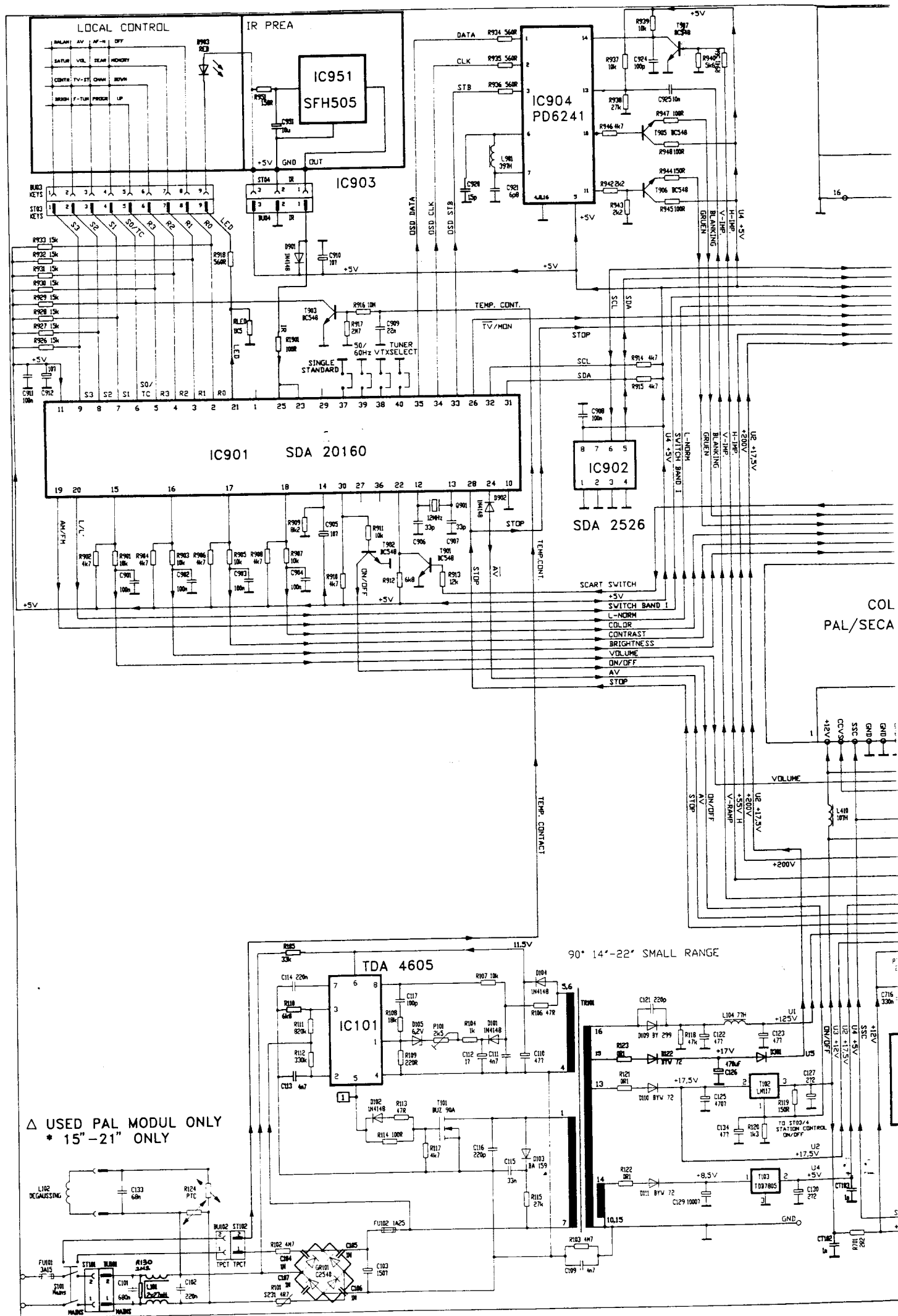
## PAL DECODER



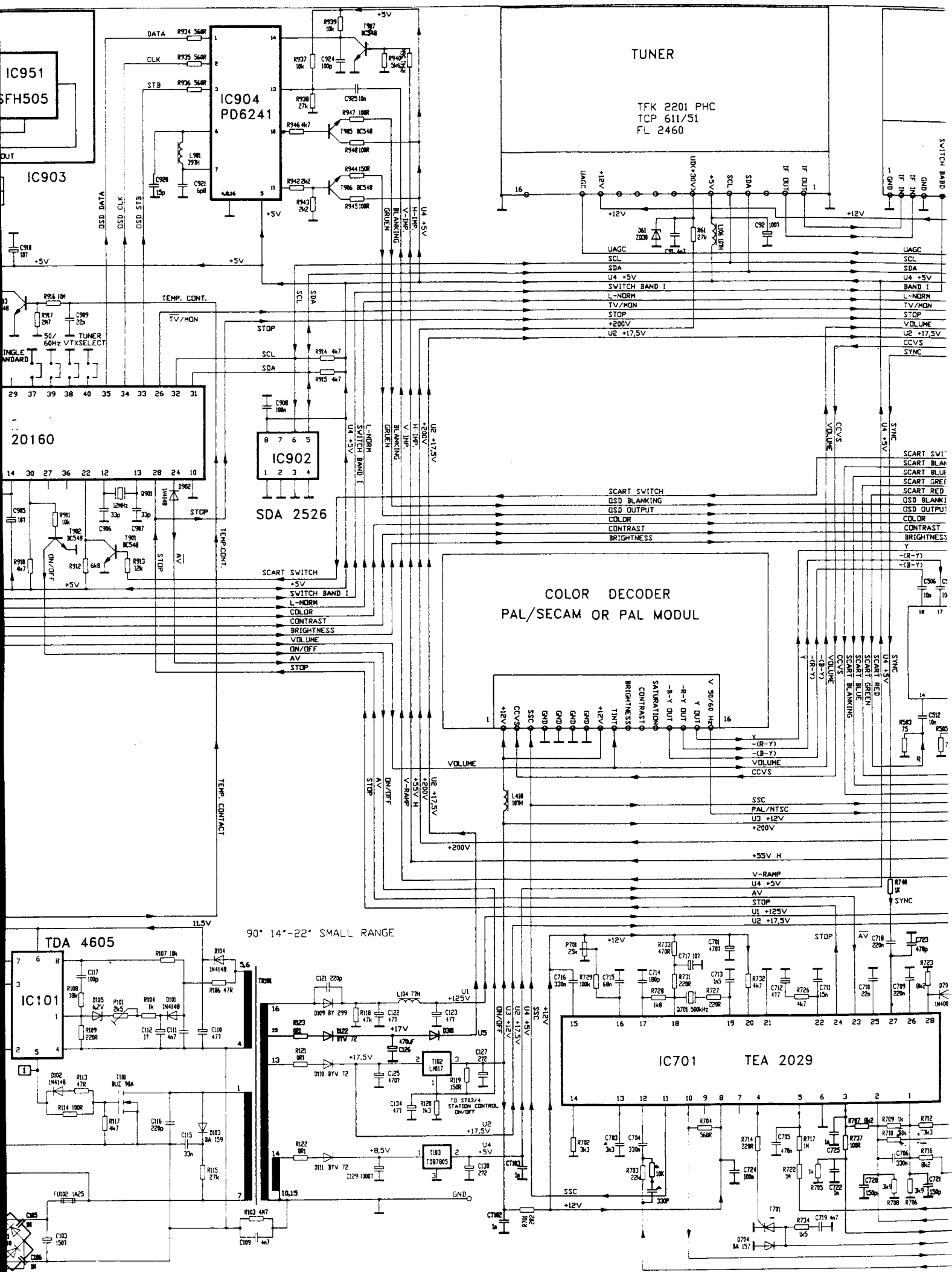


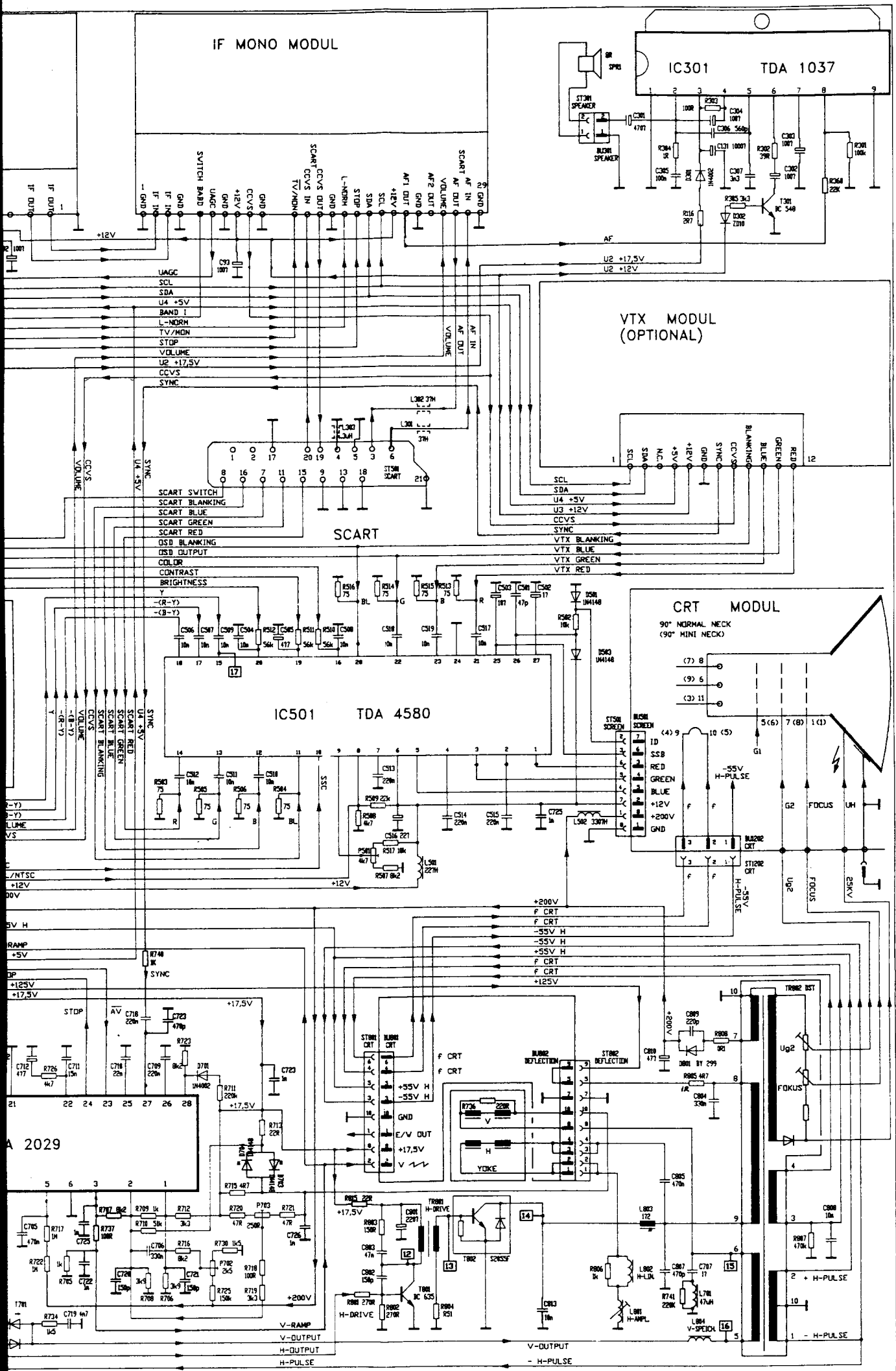


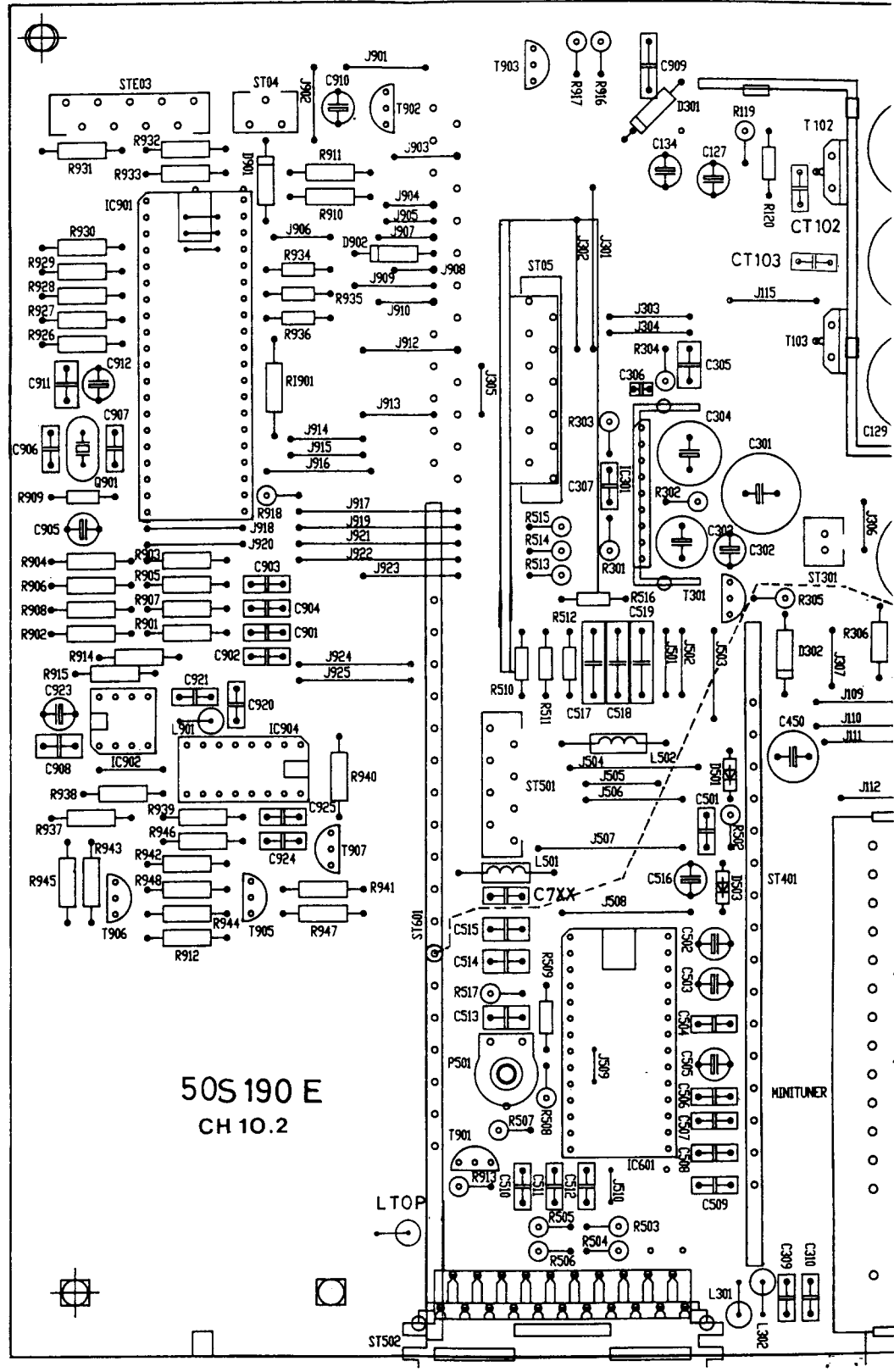




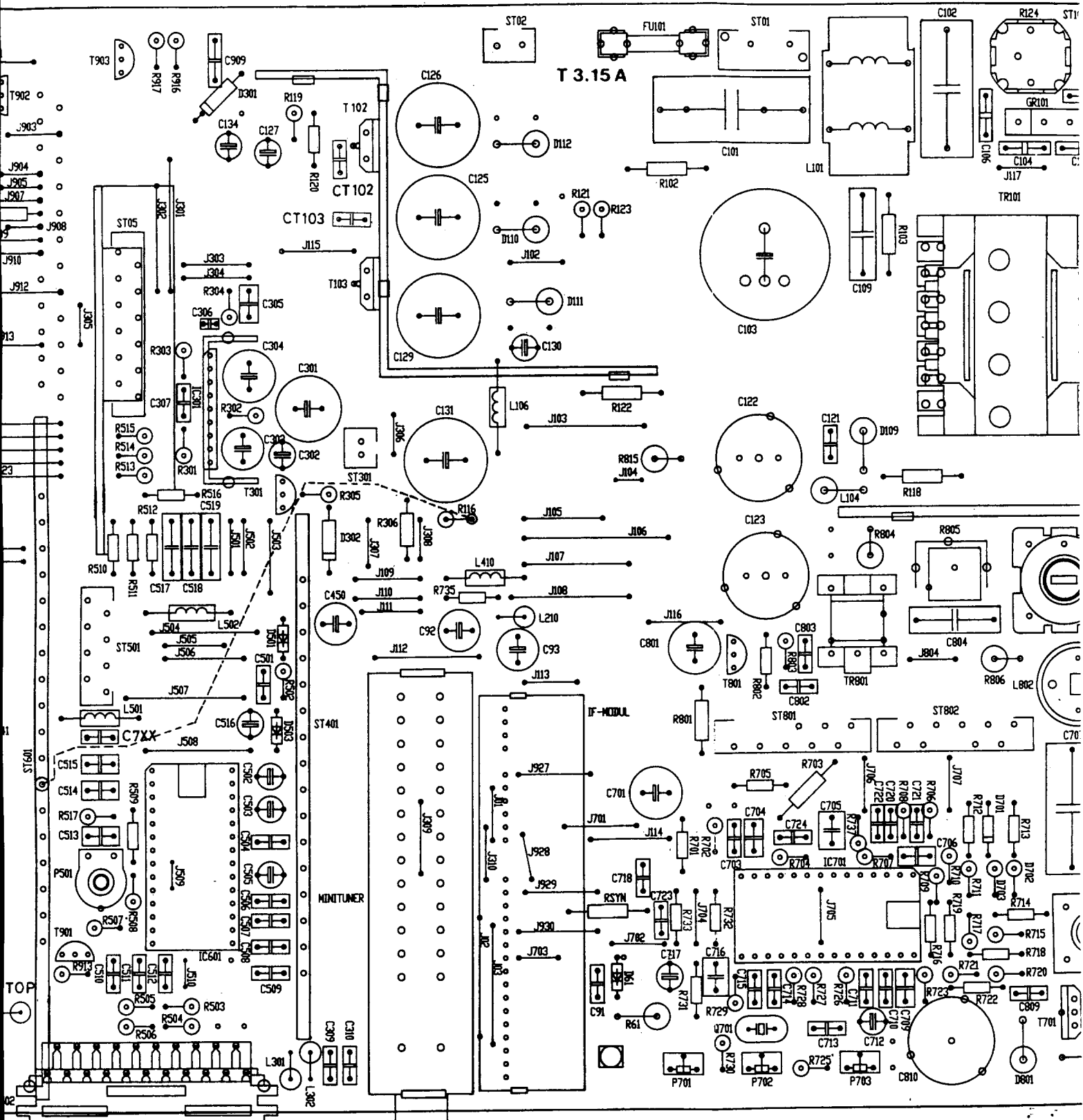


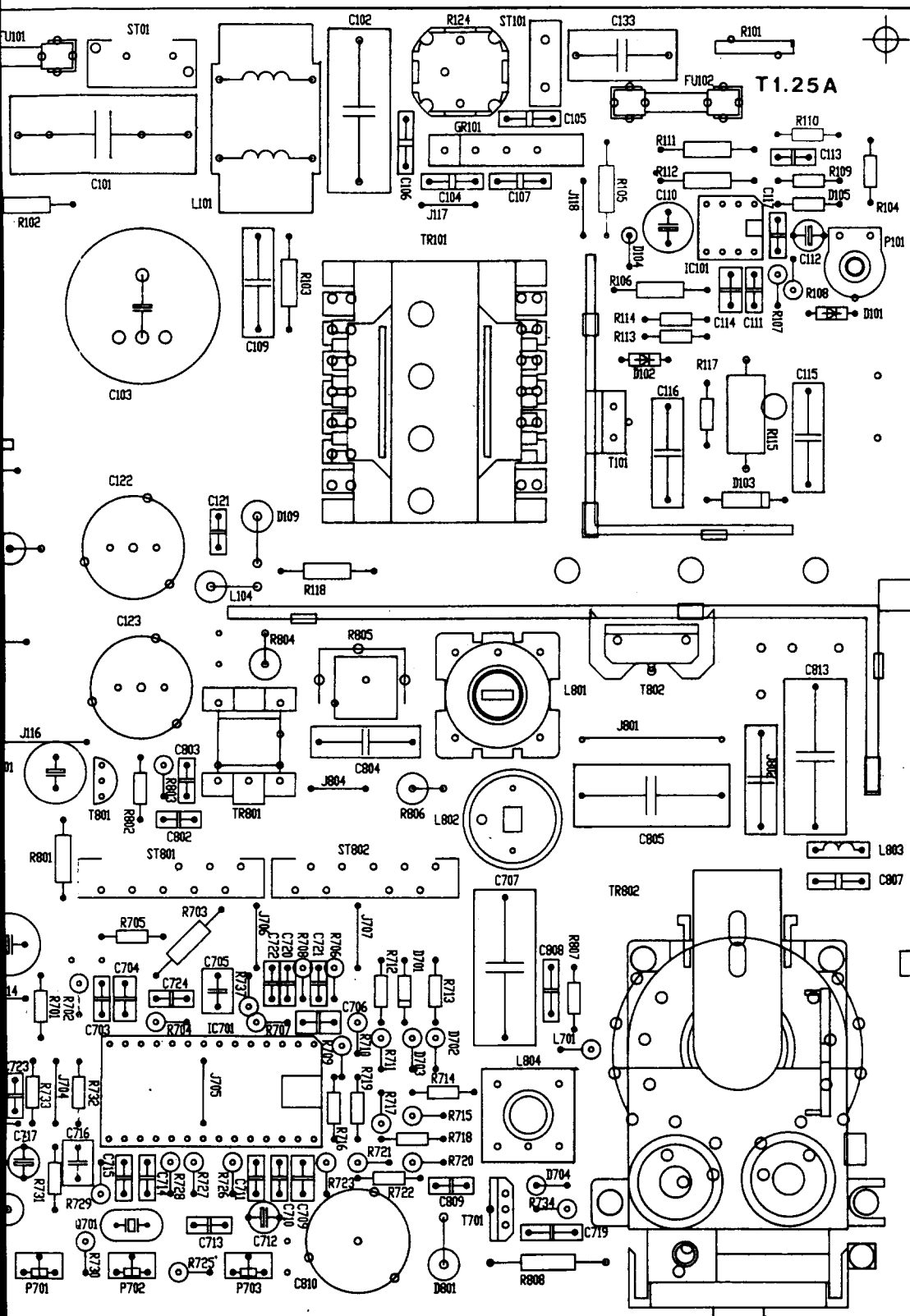






# MAIN CHASSIS 90°





# MAIN CHASSIS 110° STEREO

