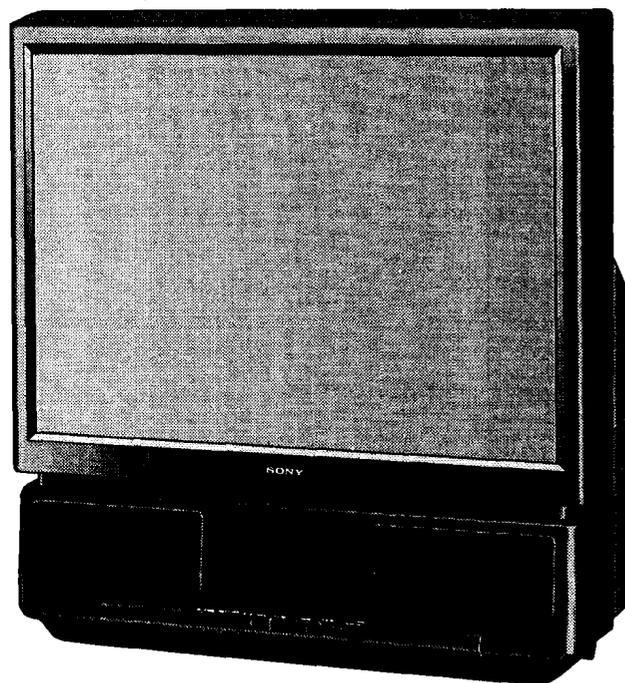


Projection Television



Circuit Description and Troubleshooting

Course: TVP-07R1

Course Description and Troubleshooting: KP-41T35, KP-46C36, KP-48S35, KP-53S35, KP-61S35, KP-48V45, KP-53V45 & KP-61V45

Prepared by: National Training Department
Sony Service Company
A Division of Sony Electronics Inc.

Course presented by _____

Date _____

Student Name _____

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Introduction

The 1997 projection TV product line consists of eight new models available in 41", 46", 48", 53", and 61" sizes. These models use the new RA-2 chassis design. All of these models use the following optical system:

- ◇ A MICRO-BEAM™ CRT which features a shorter neck and a wider 150° deflection angle.
- ◇ Advanced PRO-OPTIC™ system. This system contains a short-focus 4-element hybrid lens assembly, color calibrated lenses, and an improved dual component screen which contains both a TFF (Thin Film Fresnel) screen and a fine pitch lenticular screen. The green color calibrated lens has been placed into the CRT assembly as was already the case with the red and green tubes in the RA-1 chassis.

Model Features

The models available are: KP-41T35, 46C36, 48S35, 53S35, 61S35, 48V45, 53V45 and 61V45. The following features are common to all models.

- ◇ Wideband VIF
- ◇ Auto white balance
- ◇ Dynamic Picture
- ◇ Dynamic Focus
- ◇ New Picture Stabilizer
- ◇ Auto pedestal clamp
- ◇ Advanced Velocity Modulation
- ◇ Shading Compensation
- ◇ TFF Screen with 150° view angle.
- ◇ Matrix Surround
- ◇ MTS
- ◇ PIP position, swap, freeze.
- ◇ Program palette
- ◇ SAVA Control *
- ◇ XDS
- ◇ Caption Vision
- ◇ Programmable Timer
- ◇ Multi Language
- ◇ Fixed/Variable Audio Output
- ◇ Monitor Output

* SAVA Control refers to controlling the amplified speakers that come with a Sony Maximum Television System. These speakers model numbers begin SAVA. They are controlled through a Control S type connection.

Horizontal Resolution (Theoretical)

KP-41T35 = 790 lines.

All 48" models = 930 lines

KP-46C36 = 890 lines.

All 53" models = 1020 lines

All 61" models = 1180 lines

Features and Functions

	KP46C36	KP48S35 KP53S35 KP61S35	KP41T35	KP48V45 KP53V45 KP61V45
Audio Power 10W x 2	*	*	*	
Audio Power 15W x 2				*
Matrix Surround	*	*	*	*
Fixed and Variable Outputs	*	*	*	*
2 Tuner PIP	*	*	*	*
A/V Inputs	2	2	3	3
Front A/V Inputs			*	*
S Video In	2	1	1	2
Monitor Out	*	*	*	*
RF Inputs	2	2	2	2
To Converter Outputs	*	*	*	*
Control S Out	*	*	*	
S Link				*
Digital Comb Filter			*	*
First Surface Mirror				*
High Contrast Screen	○	○	*	*

○ = Optional accessory

*= Available in this model

Board Descriptions

All of these models contain a total of 9 circuit boards. The two main boards (A and G) are mounted on a plastic chassis which is separate from the CRTs. The P board is mounted on the A board. Five boards are mounted to the CRT assemblies and the last board is mounted on the speaker grille assembly.

The table below describes the circuits found on each board. It can be used with the diagram on the facing page which illustrates the locations of each board.

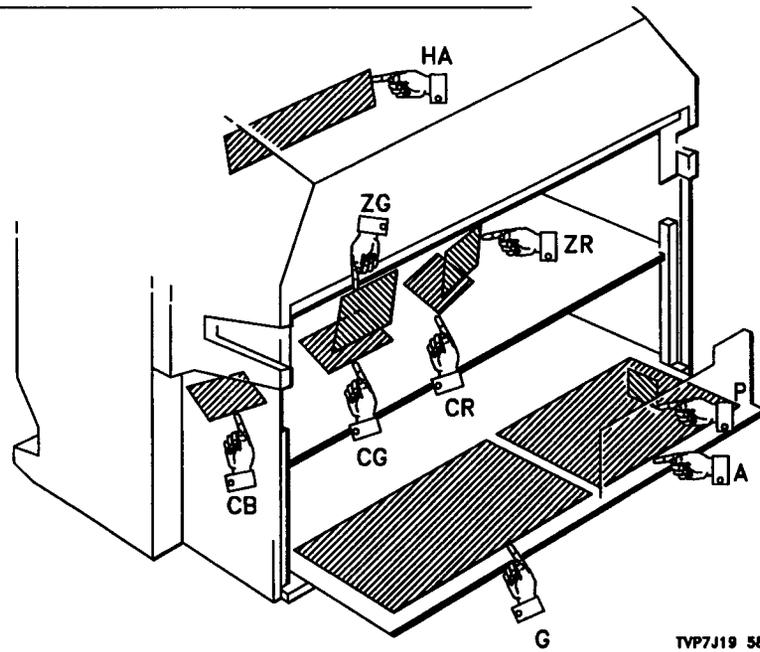
Name	Description
A	Tuner, A/V switching, Y/C jungle, Audio and Vertical Out, Syscon
CR,CB,CG	CRT drive and IK feedback.
ZR,ZG	Hor. and Vert. deflection and sub-deflection coils, VM
G	Power supply, Horiz., Wave Gen., Sub-deflection, High voltage
HA	Front panel controls, SIRCS.
P	Picture in Picture

The P board may be called PS, PV or PT depending on the model you are servicing and when it was produced. Although they are functionally the same the P and PS boards use different components. A supplement will be issued to show the differences between the two.

Format of the book

This book is intended to help in the speedy repair of the Sony RA-2 chassis projection televisions on the bench and in the home. It is laid out so that a general overview is given for each section. Then more detailed information is given in the form of simplified schematics and diagrams. There are also pictures intended to show key IC's and test points in the unit. Finally, troubleshooting can be discussed in each section as well as in the troubleshooting section.

Note: Connectors shown with a dotted line through the center indicate that the connector used is a snap type connector. Those without dotted lines indicate that standard connectors are used.



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CIRCUIT BOARDS LOCATION

Overall Block Diagram

The simplified block diagram accompanying this text shows you the main components associated with the circuits in the RA-2 projection television chassis. Below are listed the main components and a brief description of how they operate.

IC003 Reset

When the set is first plugged in the system control IC is reset by IC003. This IC holds the reset line low until a voltage of 4.3 volts is reached on the Standby 5V line. An additional delay is added by a capacitor connected to ground on the reset line. If the Standby 5V never goes above 4.3 volts the reset line will be held low preventing the unit from operating.

IC001 System Control

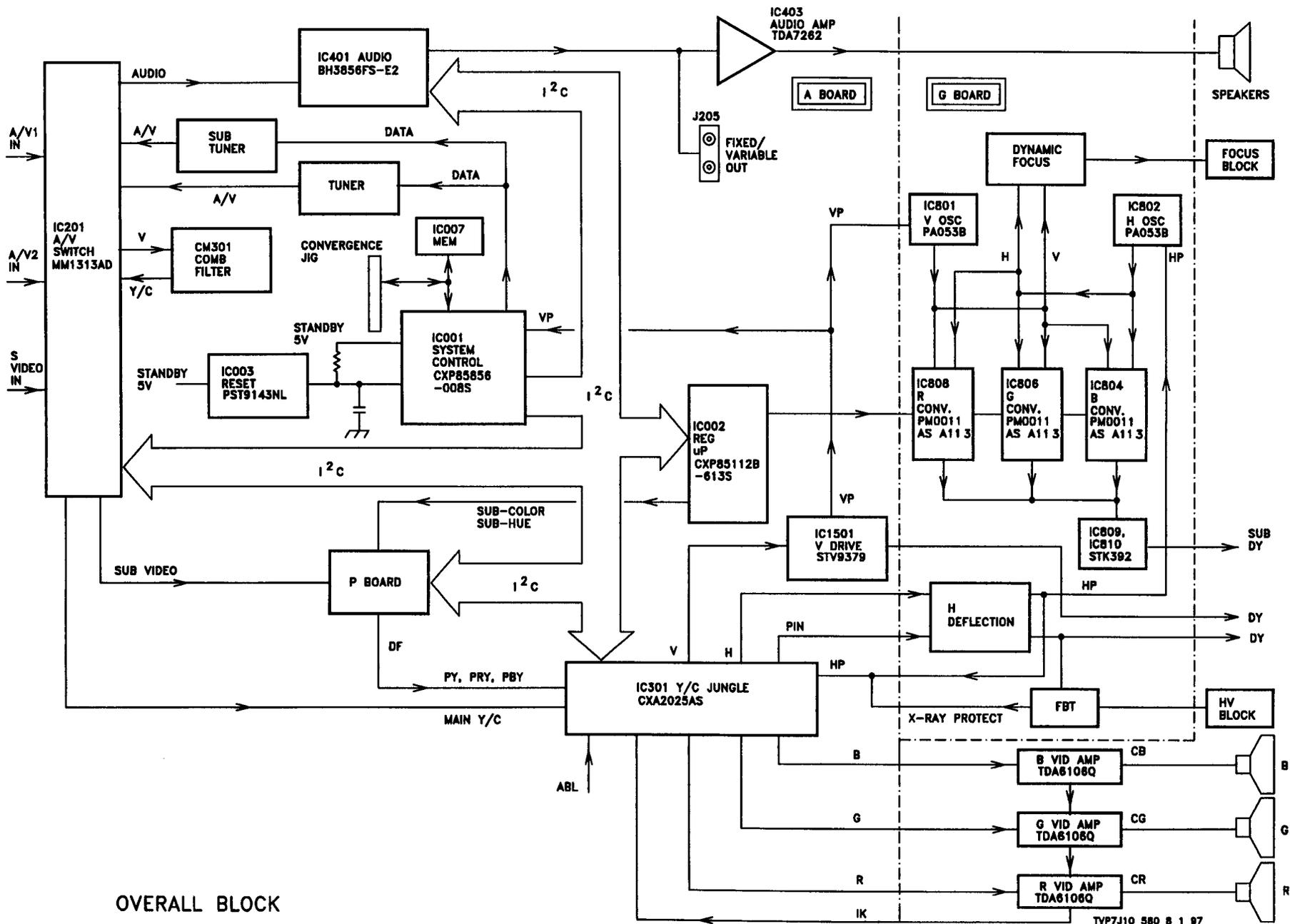
The System Control IC or Tuning Microprocessor is responsible for executing all of the customers external controls , controlling the tuner and sub-tuner as well as sending instructions to other IC's to operate the set. These instructions are sent via the I²C data bus. The I²C bus consist of a data and clock line that run directly to each of these IC's. It is a bi-directional bus so that System Control can be aware of the condition of other IC's while performing its functions.

- **IC007 Memory** - This IC is an EEPROM that takes data from System Control and stores it so that it can be recalled later. This IC stores user settings and service adjustment data. Since this contains all the data for a particular set, if this IC or the A board is changed all of the data should be retrieved from the old IC and transferred to the new.
- **IC002 Registration Microprocessor** - The registration IC's main function is to take the 2 line I²C data and convert it to 3 line data for use by the convergence IC's. It also outputs a DC voltage to the P board for sub-hue and sub-color adjustments.

- **IC201 A/V Switcher** - This IC switches the incoming audio and video to the appropriate point.
- **IC401 Audio Processor** - This IC receives data that tells it how to set the audio controls such as volume, bass, treble, surround and others.
- **IC301 Y/C Jungle** - Data sent to the Y/C Jungle is for setting the video parameters. Besides this, bi-directional communication is necessary for the status of the IK circuit. When the set is first turned ON the Y/C Jungle holds the data bus in a busy state keeping the set blanked and the timer light flashing. When the Y/C Jungle receives the necessary condition it sends a status update to System Control IC001 which in turn stops the timer light from flashing. If there is no communication between these two IC's, system control will cycle the power relay continuously turning the set OFF and ON.
- **P Board** - The P board contains the picture in picture circuitry. Data is sent here regarding position, box size and other related PIP functions.

Audio

The audio path is as follows. Incoming audio from the tuners or the line inputs is switched by IC201 A/V Switcher to IC401 Audio Processor. After going through audio processing the audio is routed either to the audio amp or to the fixed/variable output. If sent to the audio output it is amplified and sent to the speakers.



OVERALL BLOCK

TYP7J10 580 8 1 97

Overall Block Diagram

Y/C Jungle

The Y/C Jungle IC is basically responsible for the signals to three main circuits. They are video drive, horizontal deflection and vertical deflection.

Video

Video signals from the tuner and line inputs are input to IC201 A/V Switcher. After the correct source is selected it is output to the Comb Filter CM301 where Y and C are separated and input back to IC201. These signals now exit the A/V Switcher and are applied to the Y/C Jungle IC301. IC301 takes the inputs of Y and C and converts them to RGB outputs to be input to their respective C boards. Before outputting to the C boards it outputs an IK pulse to each of the video drive circuits while monitoring the IK return line. When it is determined that each circuit has the necessary beam current, video is output.

Horizontal Drive

The Y/C Jungle IC301 contains the horizontal oscillator. The oscillator is locked to the incoming horizontal sync signal. A horizontal drive signal is created here and output to the horizontal drive amplifier. From there this signal is amplified and applied to the horizontal yokes to control beam scanning. This signal is also applied to the Flyback Transformer T504 to develop high voltage. Also a sample of the horizontal output is taken and returned to the Y/C Jungle IC301. This pulse called HP is used to phase lock the horizontal drive signal to the deflection circuit.

The horizontal circuit also needs a pincushion correction signal. This signal is a vertical parabola waveform that is used to keep the sides of the picture straight. It is output from the Y/C Jungle IC301.

Vertical Drive

The Y/C Jungle IC301 also contains a vertical oscillator that is locked to the vertical sync input. A vertical sawtooth signal is output from the Y/C Jungle IC and input to the vertical drive circuits. This signal is amplified and used to drive the yokes which control beam scan. A sample of the vertical output pulse is taken (VP) and sent to System Control IC001. This pulse is used by the I²C bus to determine when data can be sent. Data is only sent during vertical blanking intervals. If there is a problem with the vertical drive circuit no data can be successfully sent on the I²C bus.

Registration

Registration or convergence is done by taking data from EEPROM IC007 and sending it via IC001 and IC002 to the red, green and blue convergence IC's. These IC's are D/A converters and the data lets each of them know how much of the reference waveforms are to pass on to the sub deflection amplifiers. There are 8 waveforms applied to these IC's, 4 vertical and 4 horizontal. The resulting signal is applied to the sub convergence amplifiers and eventually to the sub yoke assemblies of each picture tube.

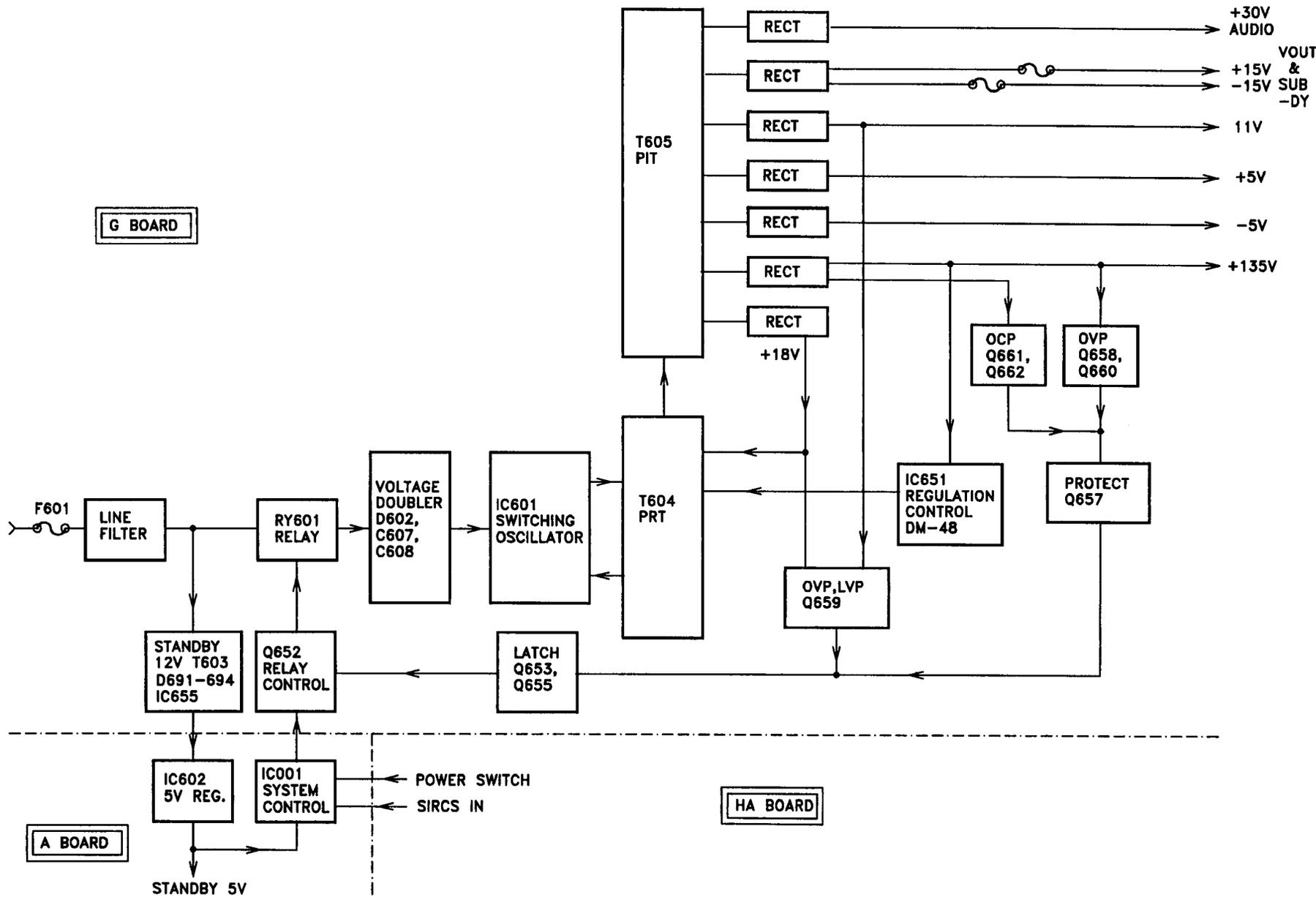
Power Supply

The RA-2 chassis uses a switching regulator power supply located on the G board. The switching regulator IC601 uses two tuned tank circuits fed by a voltage doubler to produce a 300Vp-p 100kHz signal under normal load. These voltages are with respect to hot ground IC601/Emitter #2. A Power Input Transformer T605 is used to produce the secondary voltages. Secondary voltages are regulated by a Power Regulating Transformer T604 and a Regulator IC651 DM-48 which monitor variations in the 135V supply to control the frequency of the switching regulator tank circuits. Variations in the tank frequency vary the switching regulator's output voltages.

There are four protect circuits located on the G board, to detect over-voltage and over-current conditions. These circuits are connected to a latch circuit consisting of Q653 and Q655 to turn OFF relay control transistor Q652 when needed.

The power supply can be divided into four sections. Each of these sections is listed below and described on the following pages using separate diagrams.

1. Standby Operation
2. Switching Regulator operation
3. Power supply regulation
4. Protect circuits



POWER SUPPLY BLOCK DIAGRAM

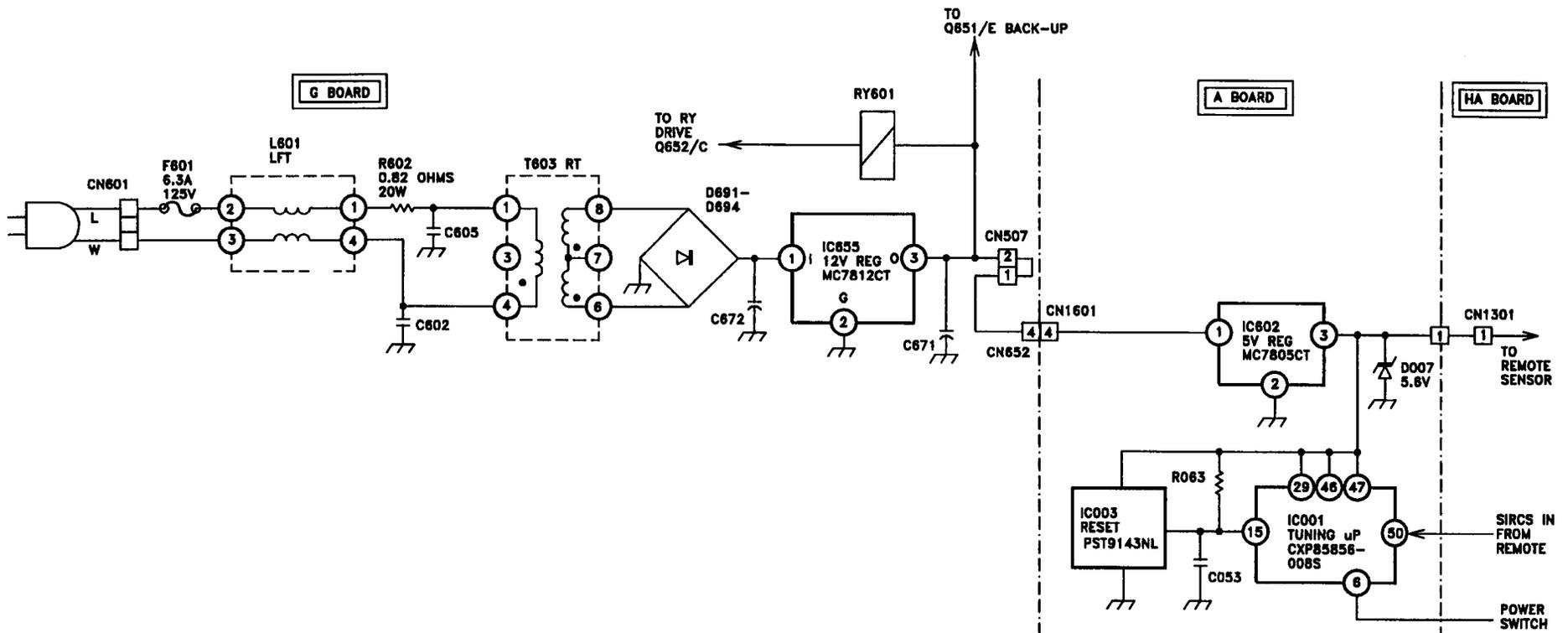
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STANDBY POWER SUPPLY

When the unit is plugged in, the only voltage that is developed on the G board is the 12V Standby voltage. Line AC is applied to Transformer T603/pins 1 and 4. T603 drops the line voltage and applies it across the Bridge Rectifier D691 - D694 which outputs 22V to the 12V Regulator IC655/pin 1. Regulated 12V from IC655/pin 3 is sent to three circuits.

1. **The 5V Regulator on the A Board.** The purpose of having the Standby 12V sent to the 5V Regulator IC602/1 on the A Board is to develop the operating voltages for System Control IC001 and the Sircs Receiver and switches on the HA Board. These circuits must always be ON in order to receive and execute Power On commands from the front panel or remote commander.

2. **Reset.** When the set is first plugged in IC001 System Control is reset by IC003. This IC holds the reset line low until a voltage of 4.3 volts is reached on the Standby 5V line. An additional delay is added by the RC network consisting of R063 and C053. If the Standby 5V never goes above 4.3 volts the reset line will be held low preventing the unit from operating.
3. **Power ON Relay RY601.** During standby, Power ON Relay RY601 is OFF. 12V from the 12V Regulator IC655/pin 3 is applied to it, but the ground return path via Relay Drive Transistor Q652/C is open. (Q652 is OFF).
4. **Backup Q651.** Regulated 12V is also applied to Q651/E. Q651 will supply the initial 12V that is used along with the soft start circuit to initially control regulation when the set is first turned ON. Q651 is OFF during standby operation.



STANDBY POWER

Switching Power Supply -

Primary Rectifier

When the set is turned ON System Control IC001/62 places a high on the base of Q652 Relay Drive. Q652 turns ON and provides the ground return path for Power Relay RY601. With the relay closed, AC is applied to a voltage doubler circuit comprised of bridge rectifier, D602 and two capacitors, C607 and C608. This produces 300V at R608 with respect to **Hot Ground**.

IC601

The switching transistors in previous power supply circuits have been replaced by an IC in this chassis. Basically this IC is two transistors fabricated on the same piece of silicon. This gives us the advantage of having the gain and other electrical characteristics matched. In addition there is a zener diode and a regular diode across the base emitter junction for protection purposes.

Oscillator

IC601-1, C615, C618 and the winding between T604/4 and 5 form one section of the oscillator for the switching regulator. IC601-2, C616, C617 and the winding on T604 between pins 2 and 3 form the other leg. T604 is the Power Regulating Transformer (PRT). The arrangement of the circuit can be considered a "Dual Tank Oscillator". The operating frequency is determined by the two LC circuits: C618, and the T604 winding between pins 4 and 5; C617, and the T604 winding between pins 2 and 3. IC601-1 and IC601-2 share in producing the oscillator signal. IC601-2 is ON during the positive half, and IC601-1 is ON during the negative half. The oscillator frequency is 97kHz when the TV produces a white raster, and at 103kHz with a black raster.

Start Up

The current path for initial start-up of the oscillator is through IC601-2, through the winding of pins 2 and 1 of T604, the winding of pins 6 and 5 of T605 and then through C621. When current flows through this path a magnetic field is created in the windings of T604. This field continues to grow until C621 is fully charged. After C621 is fully charged the magnetic fields begin to collapse. This induces a voltage at T604/3 that turns OFF IC601-2 through C616 and R613. While this is occurring a voltage is induced at T604/4 that turns IC601-1 ON. When this occurs it provides a discharge path for C621. Once C621 is discharged it allows the whole cycle to repeat itself.

As the circuit oscillates it produces a 300Vp-p waveform at Power Input Transformer T605/6. This waveform is induced into the secondary windings of the T605, producing all of the secondary voltages.

Regulation

The power supply is regulated by the control winding of PRT T604/7 and 8, in the following manner:

An increase in voltage across the control winding will reduce the inductance of T604 therefore increasing the oscillator frequency. When the oscillator frequency increases it moves further away from the resonant frequency of T605, reducing the voltage at the secondary outputs. The opposite occurs when the voltage across pins 7 and 8 decreases.

A correction voltage is produced by IC651/4 which varies inversely proportional to the 135V line. Pin 8 of the transformer control winding is connected to the correction voltage. The other leg of the control winding (pin 7) is connected to the +18V line by D660. The voltage differential across the control winding causes a dc current to flow through the winding.

Switching Power Supply

Regulation (cont'd)

The frequency of the power supply is dependent on the load that it sees. When the picture brightness increases the load increases which lowers the voltage across T604/7 and 8. When this occurs the frequency of the oscillator decreases which allows T605 to supply more current to the secondary windings which keeps the 135V line from lowering in voltage. Since the 135V line is the only one regulated there will be about a +/- 5% variation in the other supply voltages.

The following chart shows what occurs with different loads on the supply. Note that the oscillator frequency changes but the 135V line remains constant.

Location	White Raster	No Input
V across pins 7+8/T604	2.58V	2.73V
Freq. ,at IC601/E2	97Khz	103Khz
V at CN653	135V	135V

Soft Start

The soft start circuit prevents discharged capacitors on the secondary lines from drawing excessive current during power "start up" and shorting the oscillator transistors. The soft start circuit brings the secondary voltages up slowly.

At power ON, C666, which is discharged, has a 0V potential at its + terminal. This biases Q654 ON, via R696. With this transistor ON, it allows standby 12V from Q651/E to be applied across pins 7 and 8 of T604. This increases the oscillator frequency and reduces efficiency. Therefore, the start up secondary voltages will be reduced considerably. The Standby 12V is switched through Q651 when Q652 Relay Drive turns ON.

As soon as a secondary voltage is produced, C666 starts charging. This causes the voltage at the positive capacitor terminal to rise, causing Q654 to decrease conduction, less dc current flows through the transformer control winding; the oscillator frequency decreases, and the secondary voltage increases further.

C666 continues to charge and the secondary voltages continue to rise until the capacitor charges to the point that its voltage potential is the same as Q654/E, at this point the transistor stops conducting allowing IC651 to control the regulation process.

Limit

Limit transistor has two functions:

- It acts as a non latching voltage limiter.
- It is a soft start reset. It discharges C666 when the unit is turned OFF, preparing it for the next turn ON.

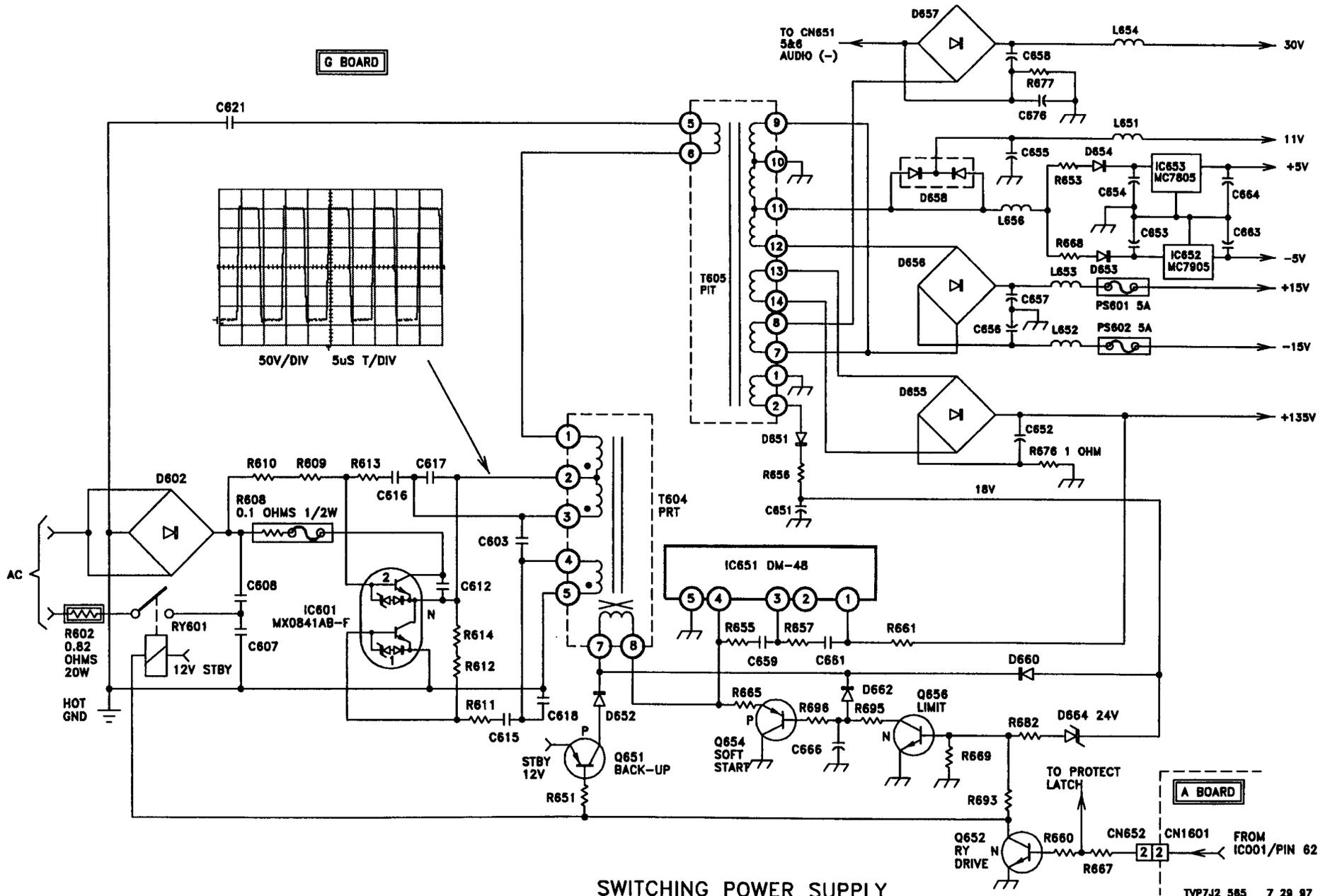
Voltage Limiter

Zener D664 is a 24V zener that is connected between Q656/B and the 18V line. During normal operation, the potential across the zener is lower than the zener voltage. Therefore, the zener is OFF and cannot supply a base voltage to Q656 therefore Q656 will be OFF. Should a defect cause the 18V line to rise above 24V the zener diode breaks over and applies bias to Q656/B, turning it ON. This turns Q654 ON, the voltage across the transformer control winding increases (T604/8 drops to 3.7V) and the oscillator frequency increases. The end result is a decrease in transformer efficiency and a drop in the secondary voltages.

Soft Start Reset

Relay RY601 is powered by 12V produced by the Standby power supply and the relay is turned ON by Q652.

Q652 is OFF when the unit is turned OFF. This removes the ground path from the relay, opening it up. It also allows the 12V from the relay to flow through the relay coil, through R693, to Q656/B. This turns the transistor ON, and discharges C666.



SWITCHING POWER SUPPLY

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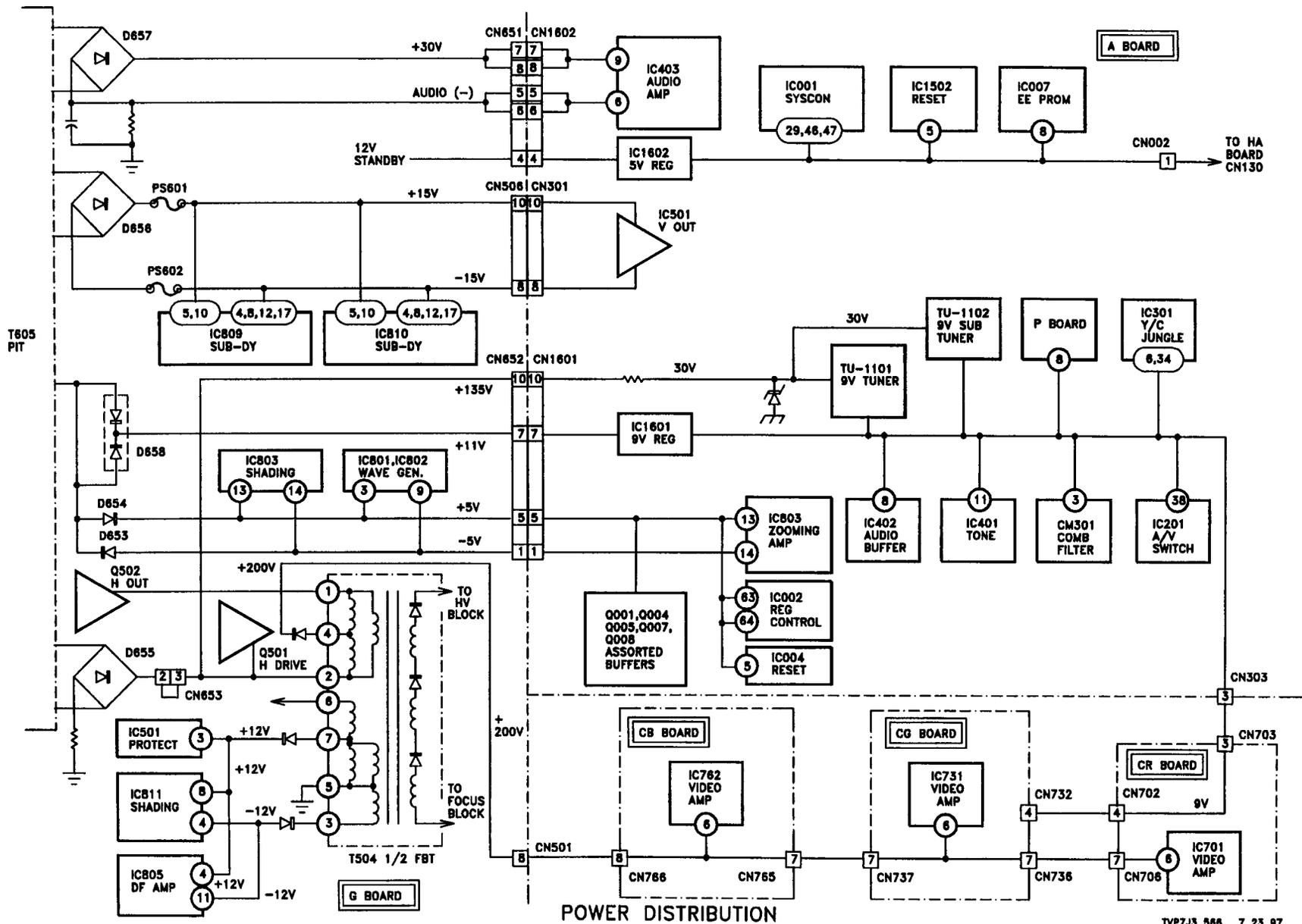
Switching Power Supply

Troubleshooting

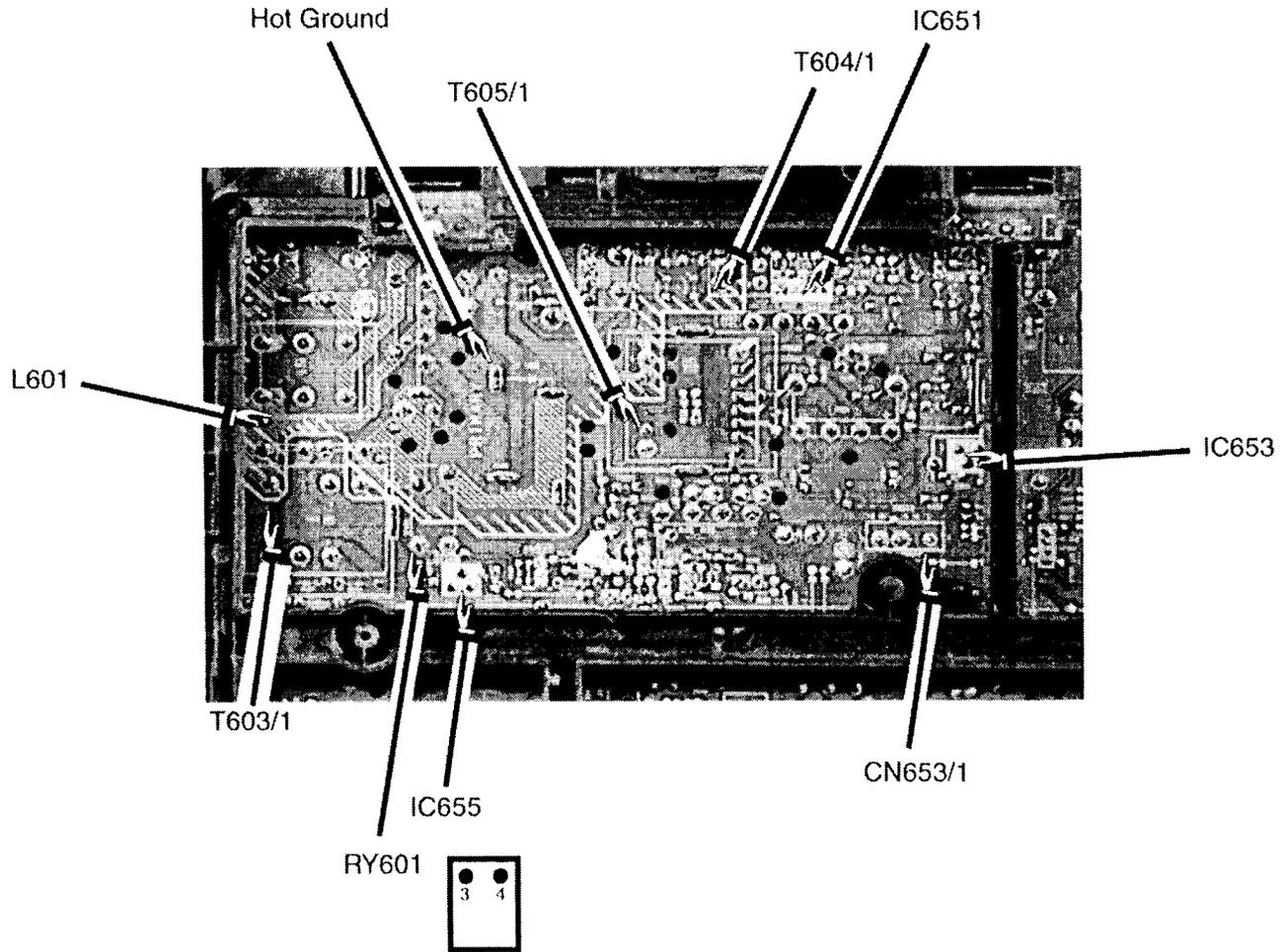
In cases of power supply failure it is often necessary to isolate the power supply from the rest of the circuit. This cannot be done with the set using full AC power. An additional problem with the RA-2 chassis is that the power supply section is on the same board with other circuits and cannot be completely isolated. However the biggest concern in this process is the +135V line. It can be isolated by removing CN653. CN653 is a loop through connector for the +135V line located on the G board.

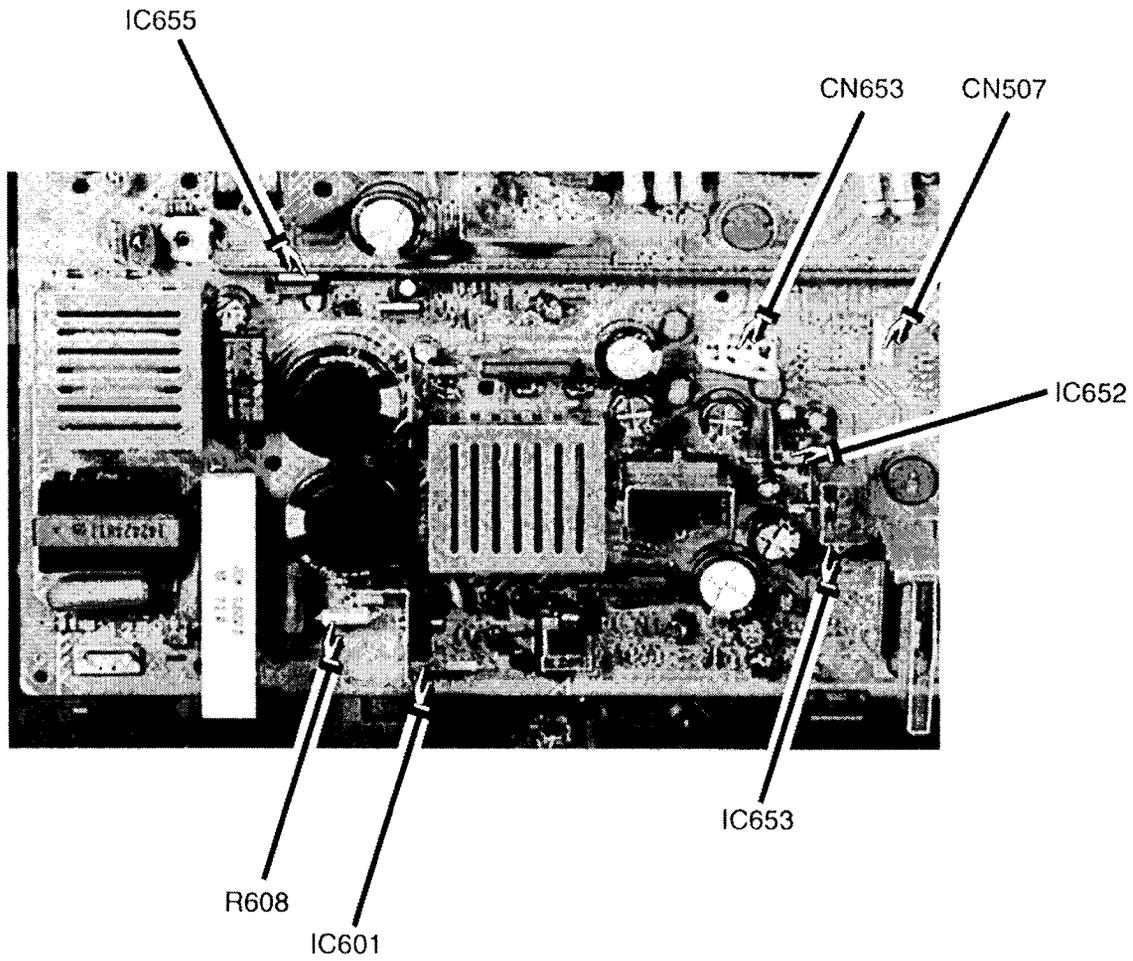
The following tables can help you in isolating whether you have a power supply problem or another problem. These voltages were taken by first shorting pins 3 and 4 on RY601 and slowly bringing up the AC line voltage using a variable AC power supply. There are three tables that show the power supply voltages at various stages of unloading. The first is with the supply fully unloaded which means the connectors between the A and G boards are disconnected and CN653 has been removed. The second table was made with the A and G boards disconnected but CN653 is in place. The third table was made with everything connected. It is very important when bringing the set up slow that the AC input voltage not be brought above 50Vac. Also anytime you have found IC601 shorted or R608 open you should follow the above procedure.

RA-2 Chassis Power Supply Output Voltages - CN653 and A Board Unplugged										
Primary (Gnd = D602 neg end)			Secondary (Gnd = Ground rail on G Board)							
Variable AC Input	Oscillator Voltage	Oscillator Frequency	135	30	15	-15	11	5	-5	Stand by 12V
20Vac	50 Vp-p	72 kHz	48.7V	14.5V	5.0V	-3.6V	4.5V	2-1V	-.35V	2.7V
30Vac	70 Vp-p	84 kHz	63.0V	18.5V	5.8V	-3.7V	5.8V	2.5V	-.60V	4.6V
40Vac	90 Vp-p	100 kHz	63.2V	20.0V	6.3V	-3.8V	6.1V	2.8V	-.80V	7.2V
50Vac	120 Vp-p	117 kHz	69.0V	22.2V	6.8V	-3.8V	6.9V	3.0V	-.90V	9.1V
RA-2 Chassis Power Supply Output Voltages - CN653 plugged in and A Board Unplugged										
Primary (Gnd = D602 neg end)			Secondary (Gnd = Ground rail on G Board)							
Variable AC Input	Oscillator Voltage	Oscillator Frequency	135	30	15	-15	11	5	-5	Stand by 12V
20Vac	50 Vp-p	72 kHz	40.0V	12.1V	5.0V	-3.6V	4.1V	1.9V	-.2V	2.5V
30Vac	70 Vp-p	84 kHz	48.0V	15.2V	5.8V	-3.8V	5.1V	2.4V	-.7V	4.7V
40Vac	90 Vp-p	100 kHz	50.6V	16.0V	6.8V	-3.9V	5.2V	2.7V	-.9V	7.0V
50Vac	120 Vp-p	117 kHz	54.8V	17.7V	6.6V	-4.0V	5.8V	2.9V	-1.0V	9.3V
RA-2 Chassis Power Supply Output Voltages -Everything Connected										
Primary (Gnd = D602 neg end)			Secondary (Gnd = Ground rail on G Board)							
Variable AC Input	Oscillator Voltage	Oscillator Frequency	135	30	15	-15	11	5	-5	Stand by 12V
20Vac	45 Vp-p	72 kHz	38.0V	7.3V	4.4V	-3.3V	3.1V	1.6V	-.20V	2.4V
30Vac	70 Vp-p	84 kHz	44.5V	8.3V	4.8V	-3.6V	3.5V	2.1V	-.50V	3.5V
40Vac	92 Vp-p	104 kHz	46.3V	8.8V	5.0V	-3.7V	3.8V	2.3V	-.80V	4.5V
50Vac	118 Vp-p	124 kHz	49.2V	9.2V	5.3V	-3.6V	4.1V	2.4V	-1.0V	5.6V



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TVPO/GPSTOP

Power Supply Protection

There are 4 shutdown protection circuits for the power supply on the G board. They are:

- 135 OCP
- 135 OVP
- +11V LVP
- +18V OVP

The +/- 15 volt lines are protected by circuit protectors PS601 and PS602.

Shut Down

Shut down occurs whenever a condition in the protect circuits causes Latch Q653/B to go HIGH. A HIGH on Q653/B turns it ON, causing it to also turn ON Q655. This drops the drive voltage to Relay Drive Q652/B, turning it OFF. This removes the ground return path for RY601 and the unit shuts OFF. During shutdown the latch is maintained by the voltage from CN652/2 which comes from System Control IC001/62 on the A board. This voltage is normally 5 volts but drops to 3.3 volts when the unit is in shutdown.

+135V Supply Over Voltage Protection

The OVP for the 135V line is done by taking a sample voltage from the 135V line and applying it to the base of Q662. This voltage is compared with a reference voltage that is applied to Q662/E. The reference voltage is developed by regulating the 18V line to 5V using D659. This 5V is used

to create the 2.3V reference using Q661 and associated components. If a voltage over 150V is present on the 135V line it causes Q662 to turn ON which in turn turns Q657 ON. This places 5V on Q657/C which turns the latch circuit ON and turns OFF the relay drive.

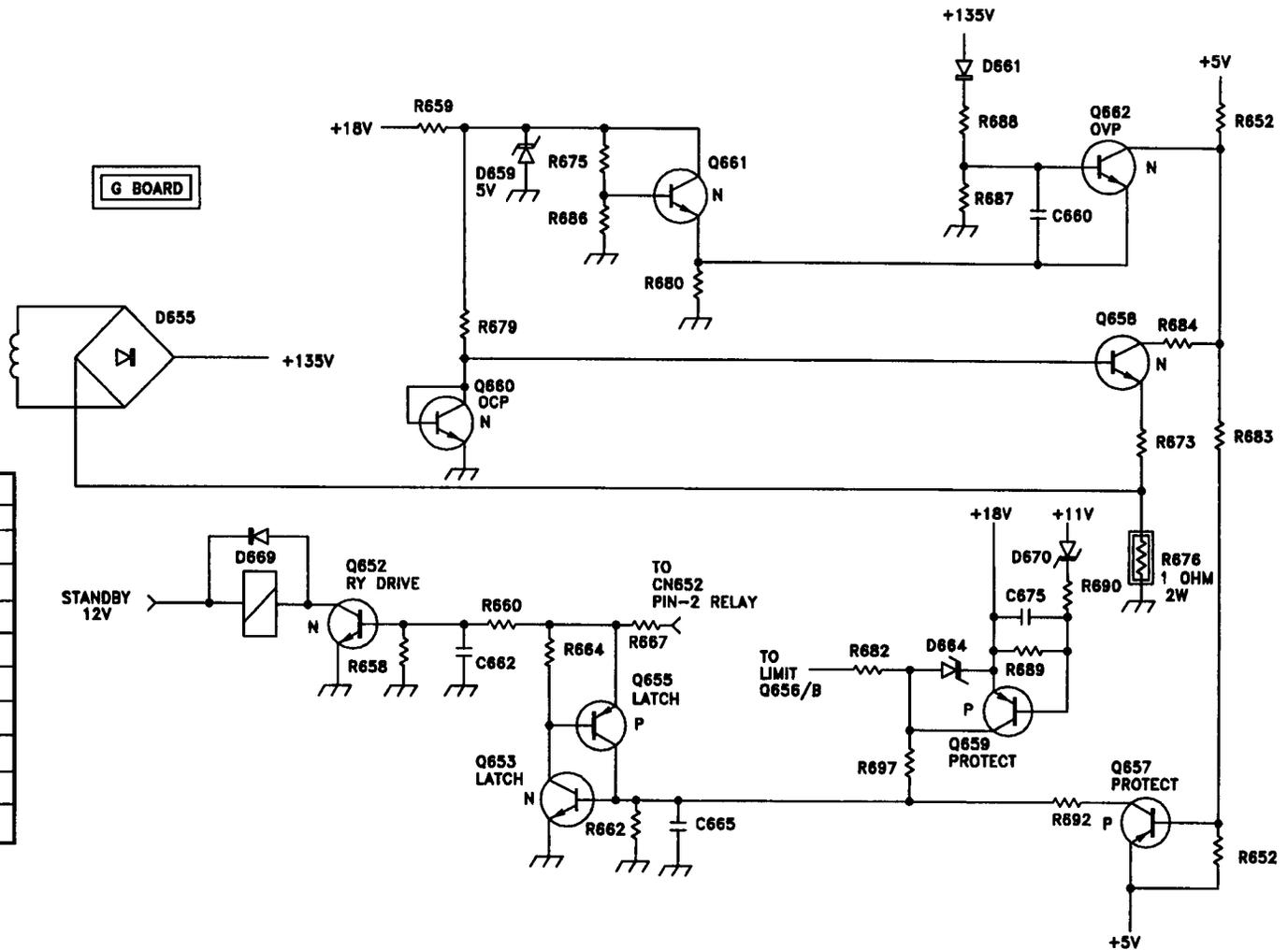
135V Over Current Protection

Over Current Protection (OCP) is provided by R676, Q658 and the associated components. All of the 135V line current flows through R676, setting up a voltage potential across the resistor proportional to the current flow. During normal operation the B-E potential of Q658 is only 0.1V not enough to turn the transistor ON. An over current condition on the 135V line increases the negative voltage drop across R676, and turns Q658 ON. With Q658 ON, a LOW is brought to Q657/B which activates the latch circuits that turn OFF Relay Drive Q655.

11V Low Voltage Protection and 18V Over Voltage Protection

Q659, D670 and associated components make up the 11V LVP and 18V OVP. Normally, D670, a 13V zener, operates below its zener point and is OFF. Therefore, bias is not available to Q659 and it will be OFF. A severe drop or loss of the 11V line, will cause the zener to break over and conduct, causing Q659 to turn ON and activating the protection latch circuit. Also any rise in the 18V line that causes D670 to conduct will also turn ON Q659 and in turn the latch circuit.

G BOARD



NORMAL VOLTAGES			
	E	B	C
Q652	1.6	1.6	0
Q653	0	0	1.6
Q655	1.6	1.6	0
Q657	4.9	4.9	0
Q658	0.4	0.5	4.9
Q659	16.4	16.2	0
Q660	0	0.58	0.58
Q661	2.2	2.9	4.9
Q662	2.3	2.6	4.9

POWER SUPPLY PROTECTION

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Deflection Block

The deflection block contains three sections:

- Horizontal Deflection and Pincushion
- Vertical Deflection
- Convergence (Sub-Deflection)

Horizontal Deflection and Pincushion

The horizontal deflection circuit is responsible for controlling the beam scan horizontally. This is done by taking the horizontal drive signal from IC301 Y/C Jungle and applying it to Horizontal Drive Transistor Q501. It is then applied to the Horizontal Drive Transformer T501 and coupled to Q502 the Horizontal Output. The output of the Horizontal Output is applied to the three yokes. The return side of the yokes is controlled by the pincushion circuit.

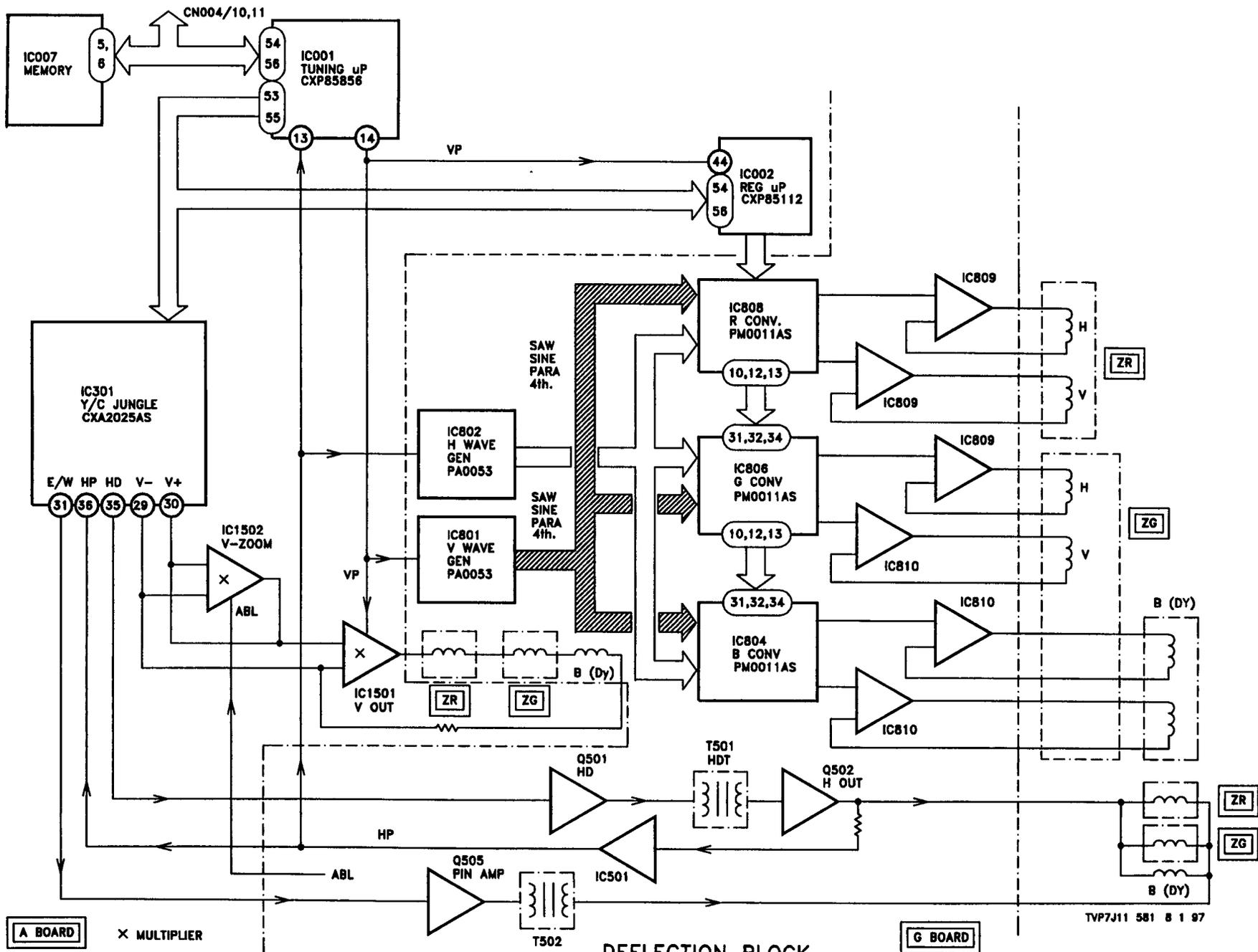
The pincushion circuit is needed so that we have a uniform picture width on the screen. The E/W output from the Y/C Jungle IC301/31 is applied to the Pincushion amplifier circuit. When we control the conduction of T502 Pincushion Modulation Transformer we control the amount of current through the horizontal yokes. This keeps the picture at a uniform width from top to bottom.

Vertical Deflection

The vertical deflection circuit is used to control the beam scan vertically. This is done by taking the vertical drive signals from pins 29 and 30 of the Y/C Jungle and applying them to the Vertical Drive Amp IC1501. The vertical drive signals are also applied to the V Zoom Amp IC1502, here they are multiplied with the ABL signal and applied to the inputs of IC1502 Vertical Drive Amp. This is necessary to compensate for lack of high voltage regulation. The output from IC1501 is applied to the three yokes which are in series. Therefore if there is a problem with one of the yokes the whole circuit will not function.

Convergence

Since a projection television uses three different picture tubes to project the picture it is important that tubes pictures line up right on top of each other. This is the reason for the sub deflection circuitry. Sub deflection is controlled by taking samples of the vertical and horizontal drive signals and using them to control the frequency of IC801 and IC802 Wave Generators. The wave generators each produce 4 signals for their frequency. These signals are applied to the three convergence IC's IC808, IC806 and IC804. These IC's are used along with the Registration Microprocessor IC002 to control the amount of each of the 8 waveforms that are to be applied to the sub deflection amplifiers IC809 and IC810. The outputs of IC809 and IC810 are then sent to the horizontal and vertical sub deflection yokes of each tube.



Horizontal Deflection

Overview

The horizontal deflection circuit has two main functions:

- Control horizontal scanning of the CRT beams.
- Along with the flyback transformer create high voltage for the picture tubes.

Horizontal Scanning

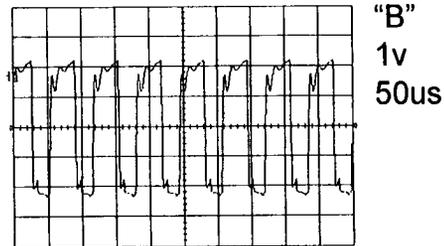
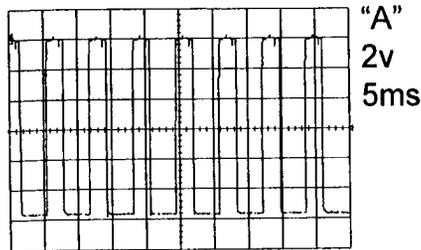
There are 3 circuits used to control Horizontal beam scan:

- Horizontal Drive
- Pincushion
- Centering

Horizontal Drive

When +9V line is applied to the Y/C Jungle IC301 X304 begins to oscillate. This is a 32fh signal that is used as a reference for the horizontal oscillator inside the Y/C Jungle. When the Y/C Jungle IC confirms communication with System Control IC001 it begins to output 8vp-horizontal drive pulses at pin 35. (See Waveform "A")

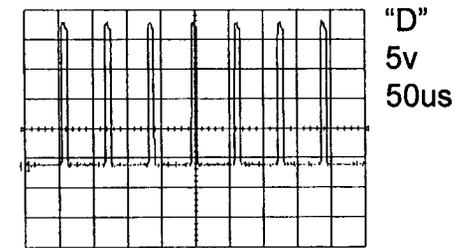
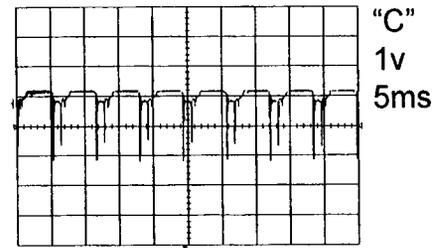
These pulses are input to the base of Q501 and then a 90 vp-p signal is output at the collector and applied to T501 the Horizontal Drive Transformer. (See Waveform "B")



T501 induces a 12 vp-p signal onto its secondary which is connected to the base of Q502 Horizontal Output. (See Waveform "C")

Q502 and associated components amplify and waveshape the signal so that 1000 vp-p spikes are output and applied to the yokes and Flyback Transformer T504.

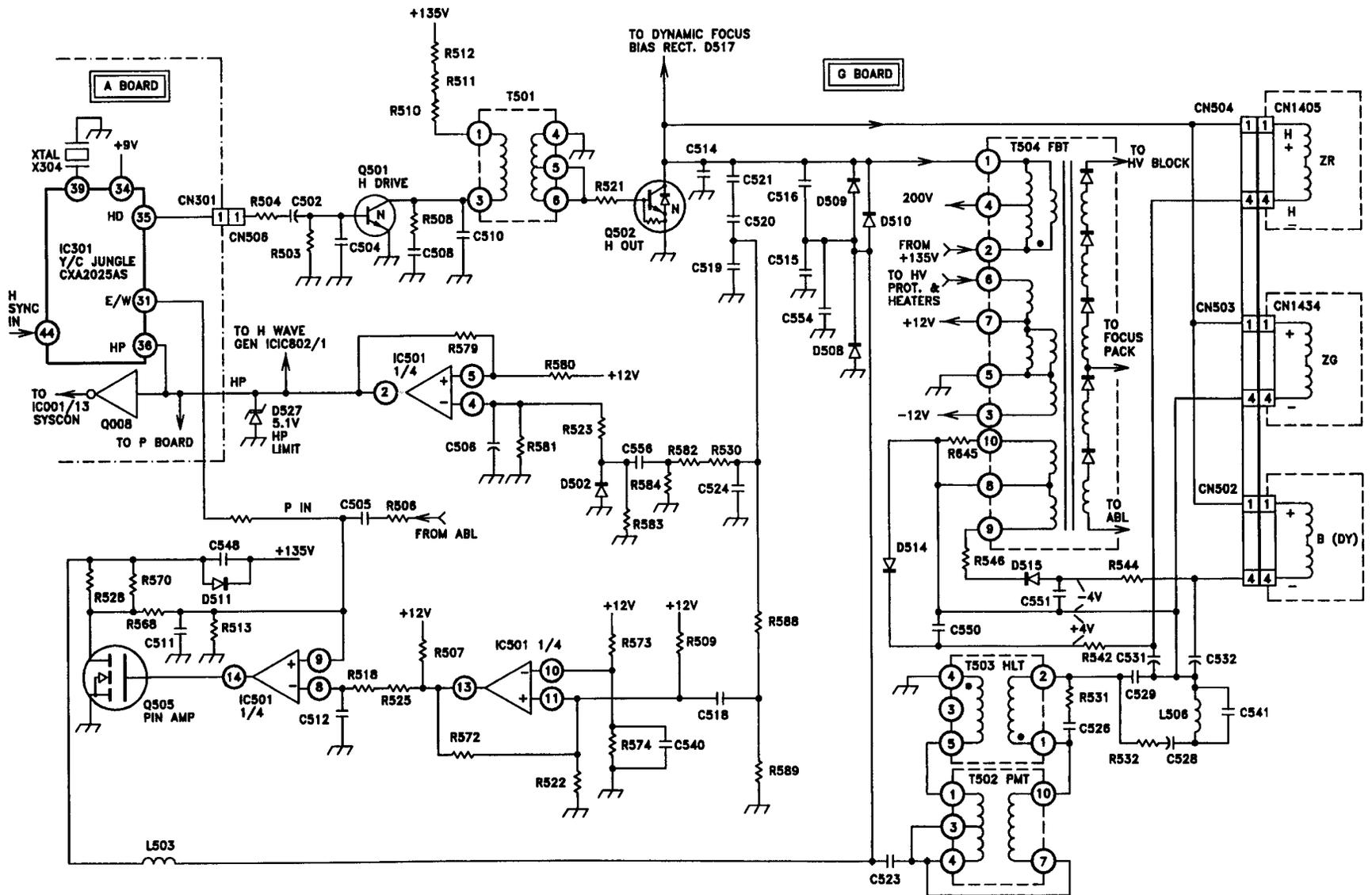
Also a sample of this pulse is sent back to the Y/C Jungle IC301/36 HP/Hoff. This pulse is compared to the reference created by X304 for phase correction of the horizontal oscillator. The HP pulse is also sent to IC001 System Control for OSD positioning and IC802 Wave Generator. (See Waveform "D")



Pincushion

The purpose of the pincushion circuit is to correct for deflection distortion. This distortion occurs because of the yokes inability to create a linear beam scan. The result would be a picture bowed at the sides, top and bottom. We compensate for this problem by using pincushion correction circuits. Pincushion correction for horizontal scanning in this set is described below.

Pincushion correction is achieved by modulating the horizontal scan current with a vertical parabola. The resulting signal causes the horizontal scan current to be least at the top of the raster, but to gradually increase to maximum as the beam reaches the vertical center of the screen. As the beam continues to move towards the bottom of the screen, the horizontal scan current gradually decreases. The result is a raster with straight sides.

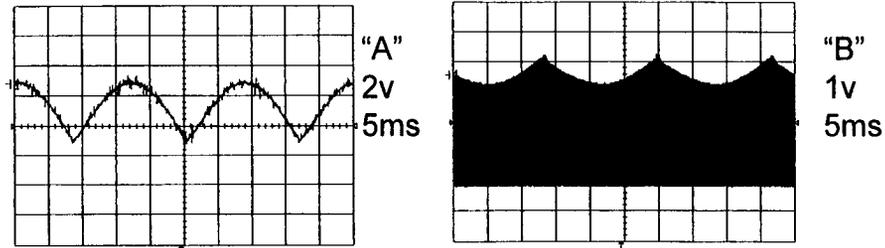


HORIZONTAL DEFLECTION

TVPJ1 584 8 1 97

In the RA-2 chassis a vertical parabola signal is output from IC301/31 to IC501/9. (See Waveform "A")

At IC501 H pulses at pin 8 are pulse width modulated by the vertical parabola signal at pin 9. The result is output to and amplified by Q505.



When the above signal (Waveform "B") is applied to T502 PMT and T503 HLT it controls the return path of the horizontal yokes by inducing a voltage that causes more or less current to flow in accordance with the waveform. This keeps the sides of the picture straight.

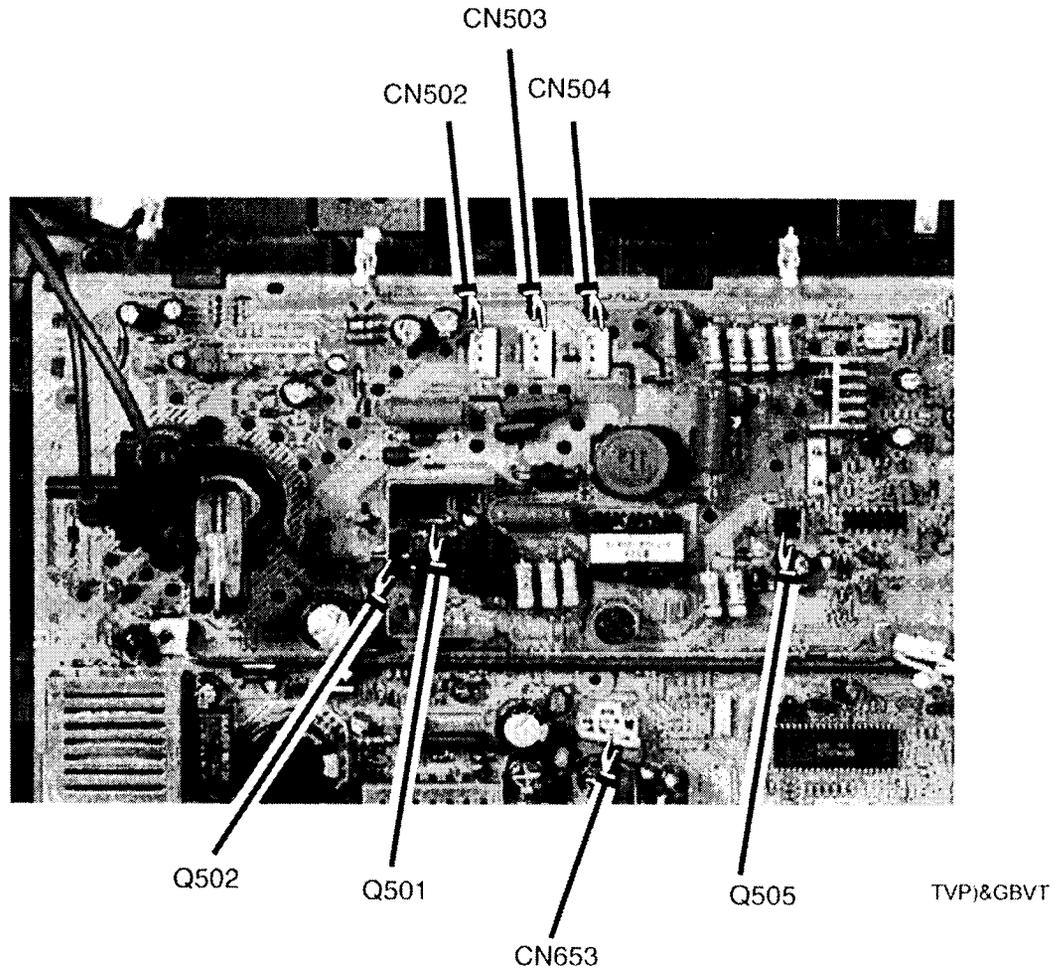
Centering

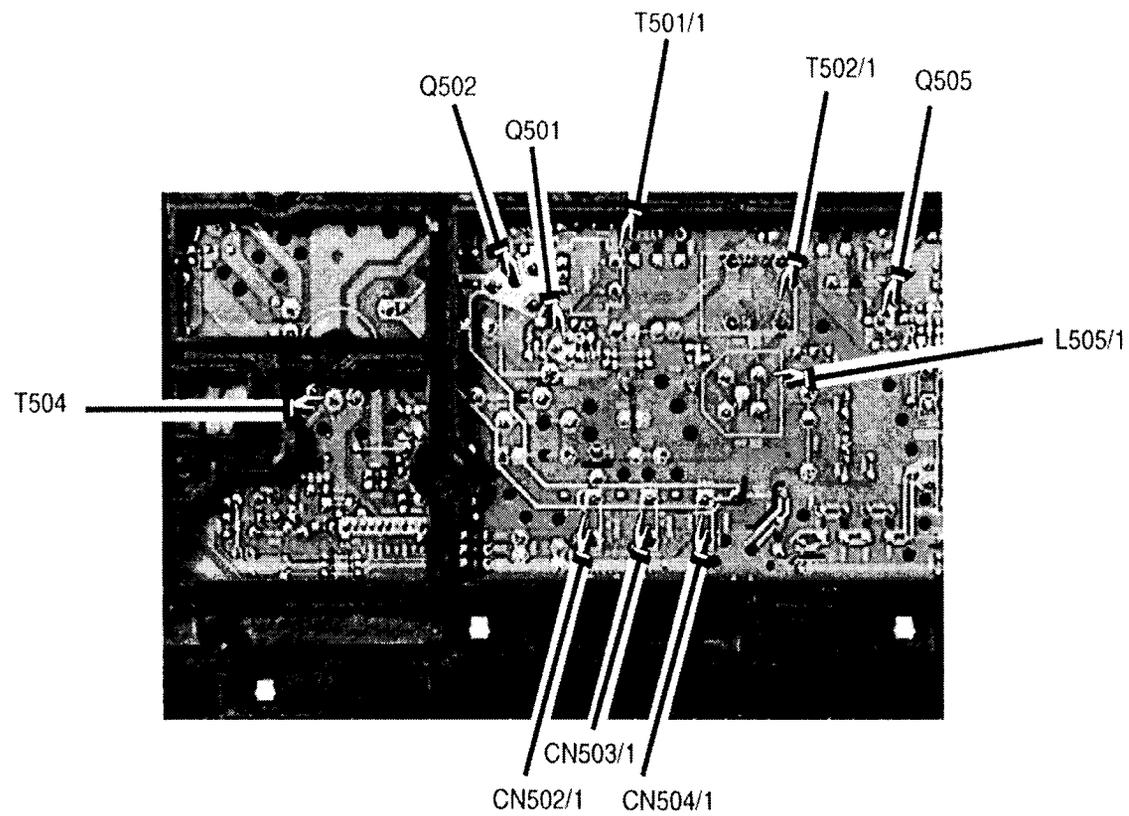
It should be noted here that centering of the horizontal yokes is done by using one of the secondary coils of FBT T504 and attaching its center tap to the return of the Green yoke. The other windings are connected through rectifiers to the other yokes. Horizontal centering is necessary because the red and blue tubes are at opposite angles to the screen in reference to the green tube which is straight. Therefore by applying DC voltages of opposite polarities with reference to the center tap we are centering red and blue to green. If you place the negative lead of your DVM to pin 8 of T504 FBT and the positive lead on D514 Cathode or D515 anode you should read +4V and -4V respectively.

High Voltage Development

High voltage is developed by taking the horizontal output pulses and applying them to the Flyback Transformer T504. The Flyback Transformer T504 steps up the horizontal pulses and rectifies them. This produces 31Kv at its output. This voltage goes to the high voltage block where it is distributed to the three picture tubes.

This is where the RA-2 chassis differs from the previous Sony projection television sets. This chassis has no high voltage regulation. However there have been various steps taken to compensate for this fact.





TVP07GBHV

HV Protect

Overview

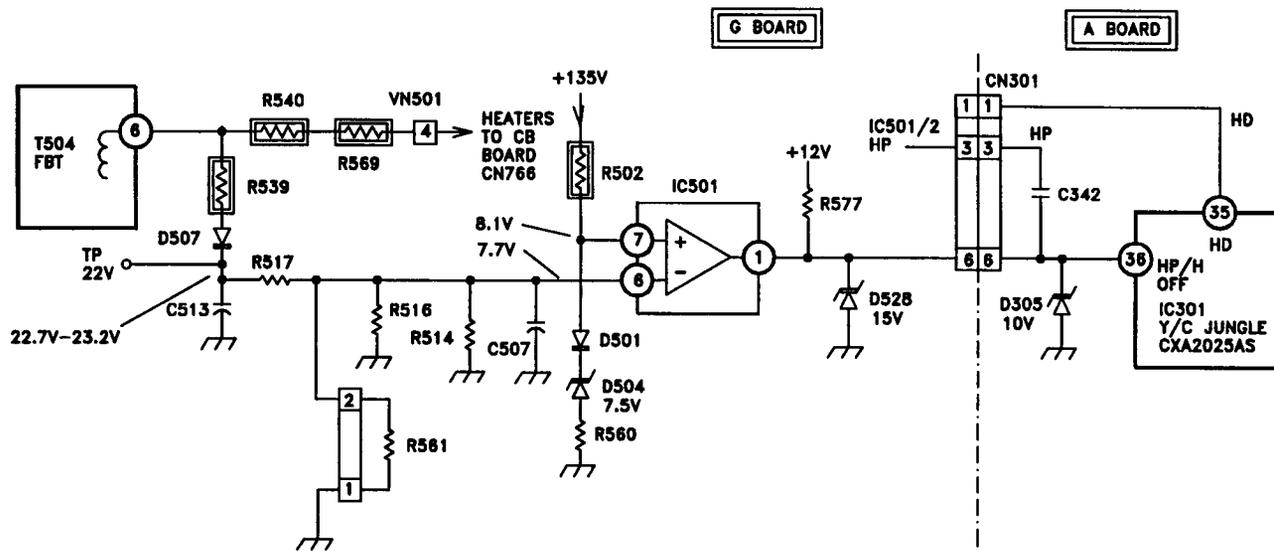
HV protection or x-ray protection as it is sometimes called is necessary because if the high voltage to the 2nd anode becomes too high the tube will begin to emit harmful x-rays. The x-rays emissions occur when the acceleration of electrons from the cathode is too great or when the sudden deceleration, caused by the electrons hitting the phosphor coating, is too great. In order to prevent this televisions employ some kind of HV protection.

HV Protection

The HV protection circuit in the RA-2 chassis is done by taking the output from the secondary winding at pin 6 of the Flyback Transformer T504, rectifying it and comparing it to a reference. Also note that T504/6 is used for the heater voltages as well.

The AC signal from pin 6 of T504 is rectified by D507 and then applied to IC501/6 through R517. The voltage at the cathode of D507, the TP22V test point varies depending on the picture brightness. It is normally between 22.7 and 23.2 volts. As long as this voltage is not high enough to place more than 8.1 volts onto IC501/6 the set will operate normally. The trip point is 8.1 volts because of the biasing network attached to IC501/7. Since IC501 is an inverting comparator any voltage more positive than the reference will cause the negative supply voltage to be placed on the output. Therefore if IC501/6 is above 8.1 volts, the output at pin 1 will be zero since the negative supply input is tied to ground.

The output at IC501/1 is connected to IC301/36 the HP/Hoff input of the Y/C Jungle. IC301/36 has 2 functions the first is to receive the HP pulse for horizontal phase control. The second is for HV shutdown. If the DC voltage of IC301/36 is lower than 1 volt for more than 7 vertical intervals, the horizontal drive output at IC301/35 HD will be disabled and latched, shutting down the high voltage.



HV PROTECT

TVP7J17 587 7 24 97

VERTICAL DEFLECTION

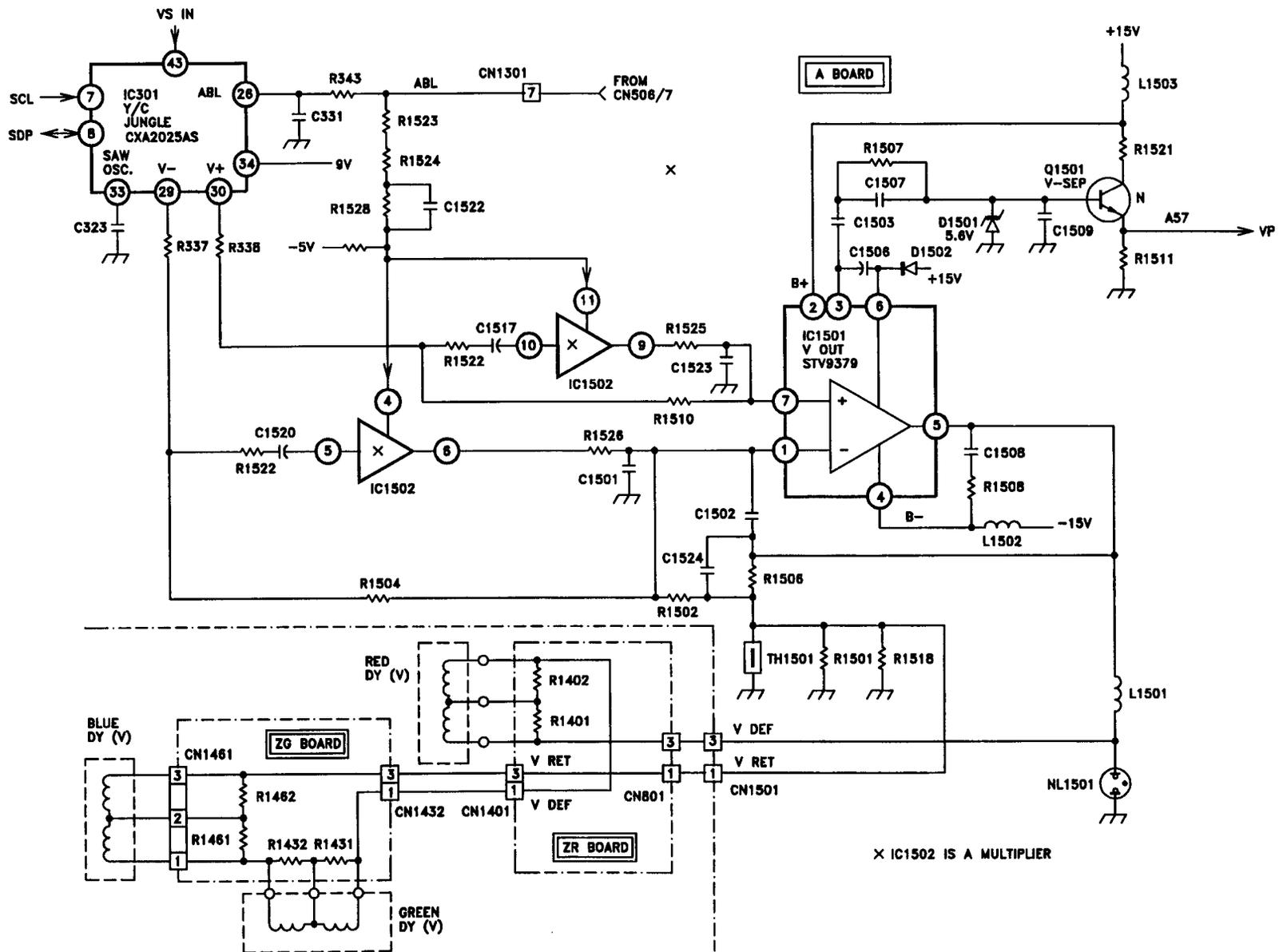
Vertical Drive

IC301 Y/C Jungle contains a vertical oscillator whose frequency is determined by C323 which is connected to IC301/33. This oscillator is used to create the drive signal for vertical deflection. It free-runs at approximately 60Hz to maintain a raster under no signal conditions. When a video signal is present it is locked to the video's vertical sync pulse which is input at IC301/43.

IC301 Y/C Jungle uses the vertical oscillator to generate two vertical drive signals which are output at pins 29 and 30. These signals are sawtooth waves and are 180 degrees out of phase. They are shown in Figures 1 and 2. These signals are then input to IC1501 V Out where they are amplified and output to the vertical yokes. You also notice that IC301 pins 29 and 30 are input to the Vertical Zooming Amp IC1502. There they are multiplied with a sample of the ABL signal. This is done to compensate for vertical size changes due to lack of high voltage regulation. The outputs from IC1502 are then summed with the vertical drive signals at Vertical Output IC1501/1 and 7. The vertical drive signal output from pin 5 is about 55Vp-p. This is possible because IC1501 contains a voltage boost circuit. IC1501/3 is used as a flyback supply and boost the positive supply on the output to 45V. A sample of this pulse is used to create VP. The output signal swings from -10V to 45V. The vertical drive signal is then sent through L1501 to the three deflection coils via CN1501. The coils are connected in series. The return path to ground for the signal is through TH1501, R1501 and R1518. The return signal also applies negative feedback to the input via C1524, C1502 and R1506.

Protection

Since a loss of vertical deflection will damage the CRTs, protection is provided in the event of deflection loss. Since there is no return of VP to the Y/C Jungle we need another way to blank the set if we lose vertical deflection. Since the VP pulse does go back to System Control IC001 to control data timing this line is used. When the VP pulse is not present at IC001 the data and clock signals between System Control and the Y/C Jungle are incorrect. Any time there is no communication on the data bus between System Control IC001 and the Y/C Jungle IC301, System Control cycles the power relay line pin 62 OFF and ON. Therefore any failure that causes loss of Vertical deflection will cause the set to continuously power OFF and ON.



VERTICAL DEFLECTION

Convergence

Overview

The RA-2 chassis uses an electronic convergence system that is very similar to the RA-1. It uses three D/A converters, IC804, IC806 and IC808. These IC's are controlled by the Registration Microprocessor IC002. Eight waveforms are input to the D/A converters from IC801 and IC802 Wave Generators. The D/A converters then use the data from IC002 to create the six correction waveforms, three vertical and three horizontal, which drive the sub-deflection coils. The data for the correction is stored in Memory IC007 and processed through IC001 System Control to IC002 Regi-Micro. This data is daisy chained to the three D/A converters. The diagram below only shows the red convergence circuit since the other two are identical in function.

This section covers two convergence topics:

- Circuit description
- Adjusting convergence using the remote and the Registration Adjustment Jig.

Circuit Description

This convergence circuit description can be broken down into three sections:

- Data Communications
- Wave Generation
- Correction

Data Communications

When the set is plugged in, reset occurs, the next operation the System Control IC001 does is read IC007 Memory. This is done via the data and clock lines. These data and clock signals are a form of I²C data. The memory IC stores data for two things. The first is the customer settings and second is the adjustment data for the set. Once this data is read by System Control IC001 it is stored inside the IC's internal memory.

When the set is turned on, data is sent from System Control to the other IC's on the I²C bus. When this is done convergence data is sent to IC002 Regi-Micro. The main purpose of the Regi-Micro is to convert the data from the 2 line I²C format protocol to the three line format used by the convergence D/A converters IC804, IC806 and IC808. This data contains the parameters for the different convergence adjustments. The three lines output by IC002 Regi-Micro to the Red Convergence IC808 are called chip enable, data, and clock. These signals are output from IC002 pins 24, 30 and 31 respectively. It should be mentioned here that the clock level at IC002/31 is only .8 vp-p instead of the normal 5vp-p. It is amplified to 5Vp-p by Q001. They are input to pins 31,32 and 34 of IC808. These signals are output from pins 13, 12 and 10 and are daisy chained to IC806 and IC804, the other convergence IC's. This data is used by these IC's to manipulate the 8 incoming waveforms that will be discussed in the next section.

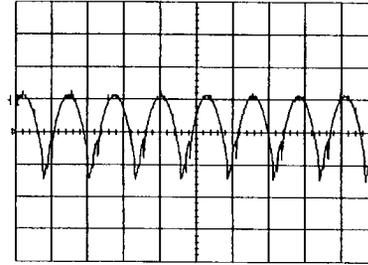
Convergence

Wave Generation

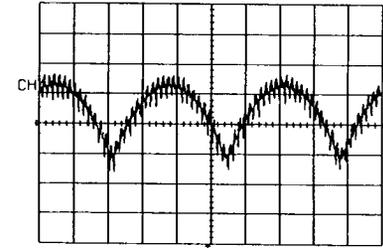
The D/A converters have 8 signals input to them that they manipulate by using the data from IC002 to give us the necessary correction for sub deflection. These signals are generated by IC801(Vertical Wave Generator) and IC802(Horizontal Wave Generator). There are 4 types of signals created at the vertical and horizontal rate They are locked to the HP and VP signals from the deflection circuits. The four wave types are saw, parabola, sine and 4th. These signals are then input to each of the three convergence IC's. The eight waveforms are pictured on this page.

Correction

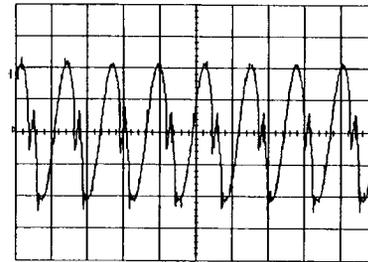
Correction is done inside of the three D/A converters. Using the data that is input to each of the IC's they determine how much of each signal or combination of signals to be output. These complex waveforms are then output from pin 40 for horizontal correction and pin 41 for vertical correction. There are no pictures here of these waveforms because they are very complex and offer little aid in troubleshooting. They are then applied to the sub-deflection driver IC809. IC 810 is used by the green and blue convergence sections as a driver. These IC's amplify the signals. They are then applied to the sub-deflection yokes which along with the main yokes, place our pictures in the correct position on the screen.



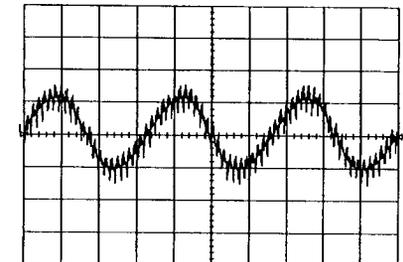
1V 50us IC802/5



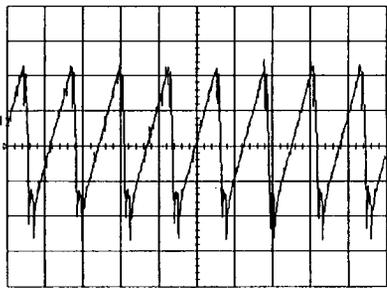
1V 5ms IC801/5



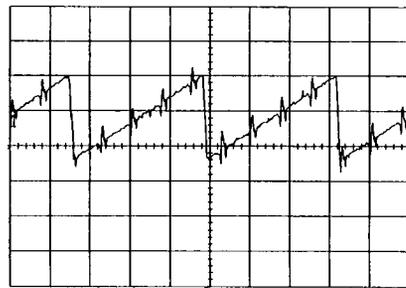
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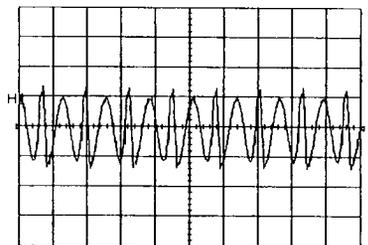
1V 5ms IC801/6



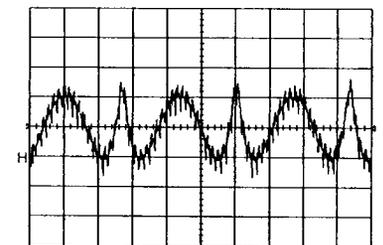
5V 50us IC802/4



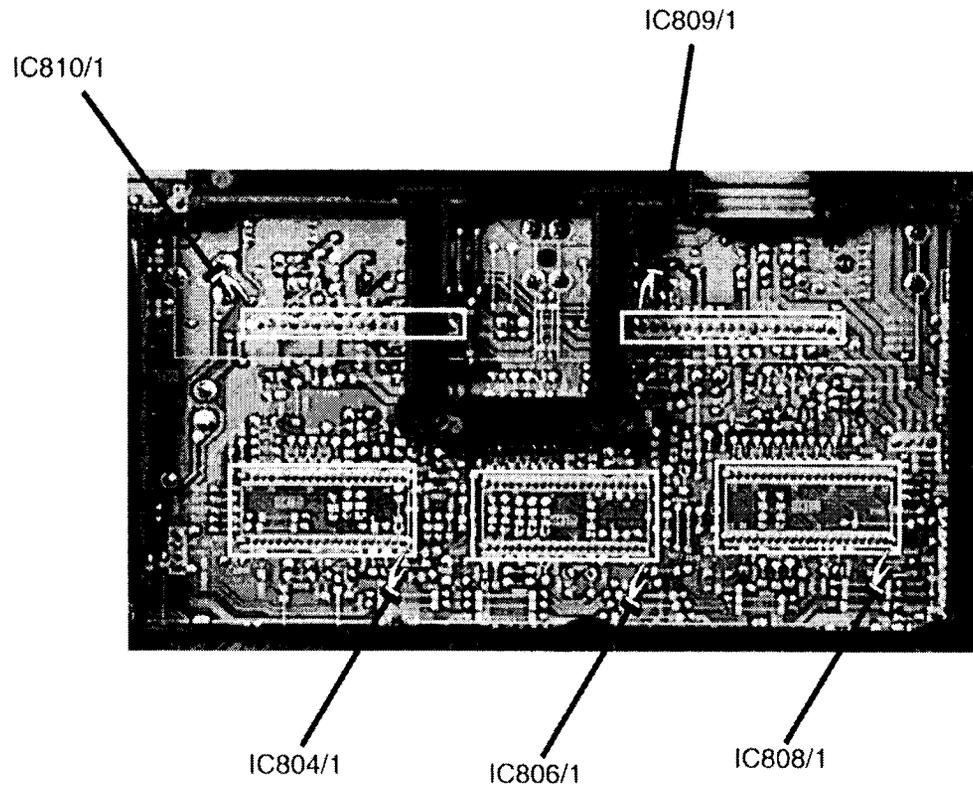
1V 5ms IC801/4



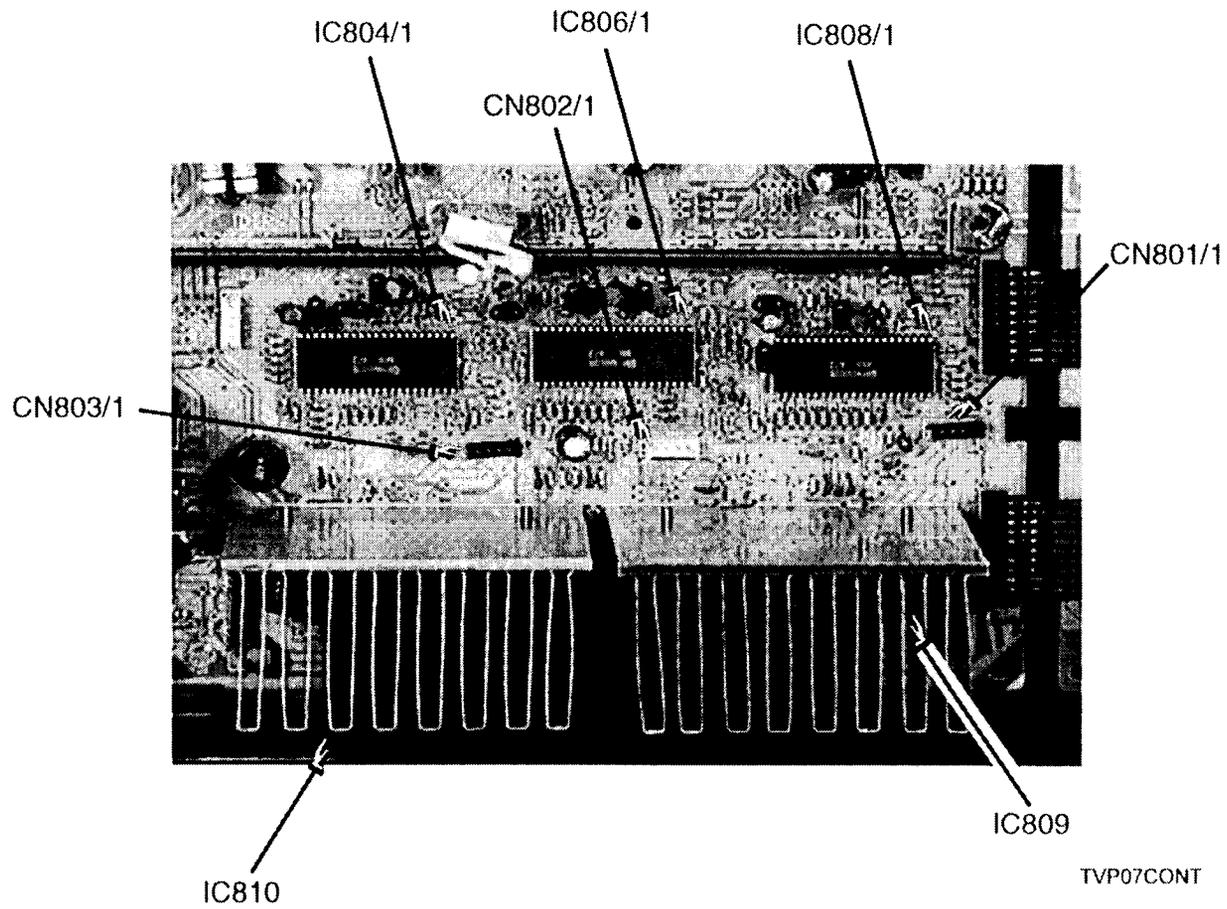
1V 50us IC802/7



1V 5ms IC801/7



TVP07GBCONV



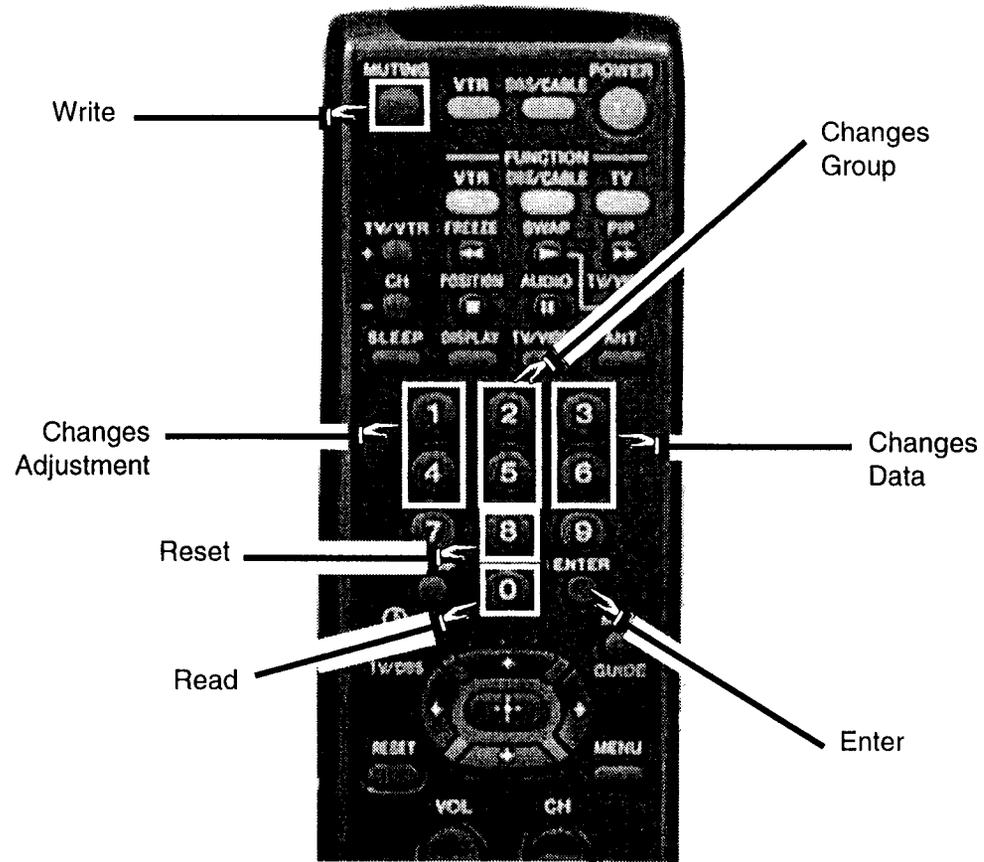
Convergence

Adjustment

Adjustment of the set can be done by either using the remote control in the Service Mode or by using the Registration Control Jig. Before doing any convergence adjustments you should reset the customer controls since the customer does have some control over centering of red and blue. You do this by first entering the Service Mode. With the set off press the **Display**, **5**, **Vol +** and **Power** buttons in sequence on the remote control. Once in the Service Mode press the **8** and **Enter** buttons. This shuts the set down, powers it back up and resets all customer controls. **NOTE:** This clears all user presets. An alternative is to use the convergence setup in the menu, check the range and then center inside the range.

Remote Adjustment

Once in the Service Mode you can move around the various sections of adjustments by using the **2** or **5** buttons. Adjustments for convergence are contained in the **RG** section. You can then move to the various adjustments and change the data. To move to adjustments press the **1** or **4** buttons. To change the data press the **3** or **6** buttons. Once you are satisfied with the adjustments you have made you can save them by pressing the **Muting** and **Enter** buttons in sequence.



TVPREM

Convergence

Registration Adjustment Jig

The Registration Adjustment Jig (T-9985-723-1) that was used with the RA-1 chassis can also be used with RA-2. However, in order to work correctly you must first install an updated EEPROM. The EEPROM is not available at the time of this printing but a Service Bulletin will be released on how to obtain one. Once you receive the update you will no longer need to use the RA1/XBR switch on the jig. It will be selected automatically. Excerpts from Service Bulletin #305 on the following pages will instruct you on how to use the jig. Following the Service Bulletin are two pages that show the layout of the keys for the jig and what each adjustment does.

General Description

The Registration Control Jig can be used to adjust sub-deflection on the RA-1 and RA-2. The jig communicates to the Regi-Micro IC002 and IC007 memory through the I²C Serial Bus. The jig can be powered from a 9V DC battery or external 9V AC adapter (Center positive type, 100 mA output required). Before beginning the adjustment, the rear cover of the TV must be removed in order to connect the control cable to the unit. The interface of I²C Serial Bus connector is located near the back bottom right hand corner of the unit.

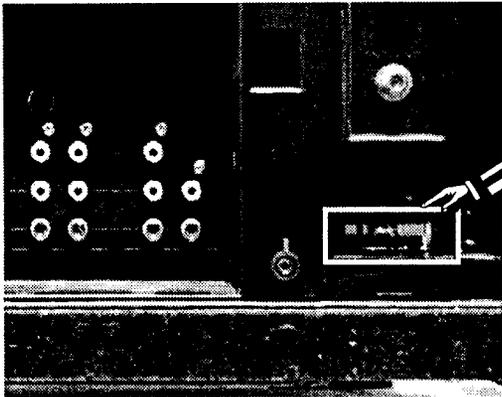
Use of the Interrupt Switch

The interrupt switch is used to drive the interrupt line to the unit low. When the unit is interrupted, you can not change channels, Video input, Volume, etc. The unit is effectively disabled from user control. Therefore, it is recommended to have the video input selected and on the screen before connecting the registration control jig to the unit. The interrupt switch can be placed in the non-interrupt position after adjustment procedure has begun. However it will cause the following:

- The interrupt line to the unit is released and the interrupt line returns to normal high condition (+ 5V DC). **Caution:** If adjustments have been made, perform a save beforehand otherwise releasing the interrupt will wipeout the adjustments and return the unit to its pre-adjusted condition.
- Any time the interrupt line is released the unit does a complete non volatile memory update. This means that the unit reads Memory IC007 data and refreshes the set.

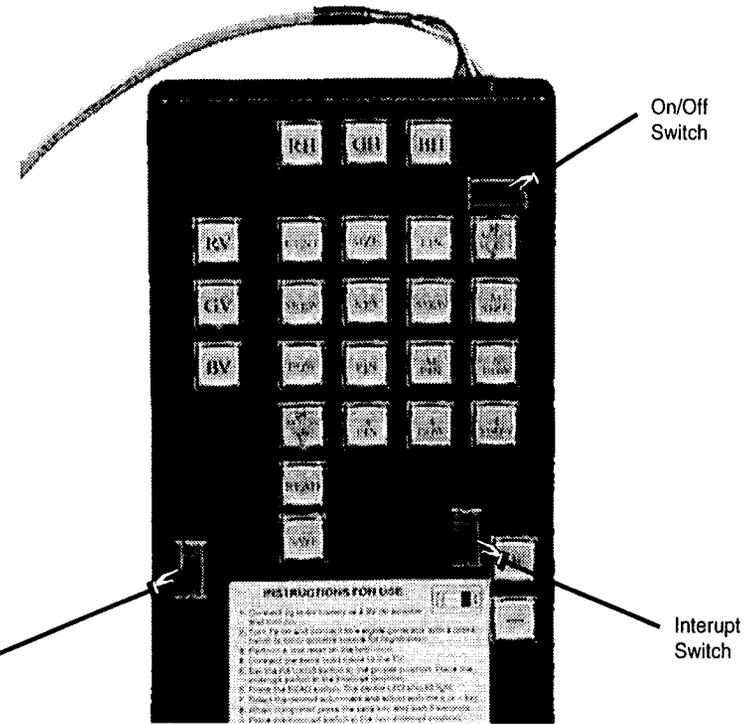
After the interrupt line has been released you can change channels, video input, go into service mode, etc. The unit operates in its normal non-interrupt condition. You then have two options, you can return the interrupt switch to the interrupt position to do more adjustments or you can disconnect the control cable from the unit and discontinue your registration adjustment. If you return the interrupt switch to interrupt position the jig will do the following:

- Delay for approximately 3 seconds. This delay is necessary in order to complete the refresh cycle.
- Re-read the registration data from the unit. The jig does not know if you saved the data before you released the line. Therefore, it re-reads the data back just in case some changes were made and the data was not saved. This insures the jig's registration data is the same as the unit's data.
- The Red horizontal and Center LED's lights up. This is the starting point for the registration jig.



I²C Connector

PIC0008



On/Off Switch

RA-1/XBR Switch
No longer needed

Interrupt Switch

TVPJIG

Use of Read Switch

The primary function of the read switch is the initial reading of the registration data from the television. It can however be used to re-read the registration data back from the unit after you have begun adjusting the set. This could be useful in a case where you begun adjusting registration and you do not like your adjustments. You can re-read the data and start again from the original condition. Pressing the read key does the following:

- Release the interrupt line and allows the unit to do a non volatile memory refresh. This is necessary in order to return the screen to its original condition.
- Delay for 3 seconds. This is done because a complete refresh after an interrupt takes approx. 3 seconds.
- Drive the interrupt line low and re-read all the registration data from the unit into the jig.
- Light the Red horizontal and Center LED's. This is the starting point for registration adjustment.

Basic Procedure:

1. Connect a signal generator to the Video 1 input and set it to a cross hatch pattern.. Set the picture level to 25% of maximum.
2. Turn OFF the TV. Place the TV into the service mode by pressing the "Display", "5", "Volume +" and "Power" keys in sequence on the Remote.
3. Center the user convergence adjustments by pressing the "8" and "Enter" key in sequence while in the service mode or using the Menu. The unit will automatically shut off and turn on again with tuner reception and PIP. Turn OFF PIP screen from the remote and re-select the Video 1 input. Reset the picture level to 25% if you performed a system reset. This is necessary because the jig does not read the user convergence adjustment. It assumes that they are set at 0 (Zero). If the user convergence adjustment was on one end of the range, it would limit the users range after the registration adjustment was complete.

4. Turn the jig ON before connecting it to the unit. **Caution:** Connecting and Disconnecting the jig from the unit with the power off can cause errors or lockup the registration control. They can be corrected by disconnecting the jig and cycling the AC power to the TV (Unplug and plug-in the AC cord).

5. Connect the control cable between the jig and unit.

7. Set the interrupt switch on the jig to INT position and press the Read switch. If the switch is in the Non-interrupt position, the jig will wait until the switch is placed in the Interrupt position. If the switch is in the Interrupt position the jig will drive the interrupt line low. It then reads the unit's existing registration data into the jig. The Red horizontal and Center LED's key will light after the registration data is read into the jig.

8. You can now adjust Red horizontal center or select any of the 90 possible adjustments. Adjustments can be made by pressing the Plus key (+) to move right or up or press the minus (-) key to move down or to the left.

9. If you are satisfied with your adjustments you can press the save key and the data will be saved to the non volatile memory on the A board. The entire save routine takes approx. 3 seconds.

Caution: Do not touch any key on the jig, remote or unit while Jig is saving your adjustment data. Also note that the save key on the jig does not illuminate.

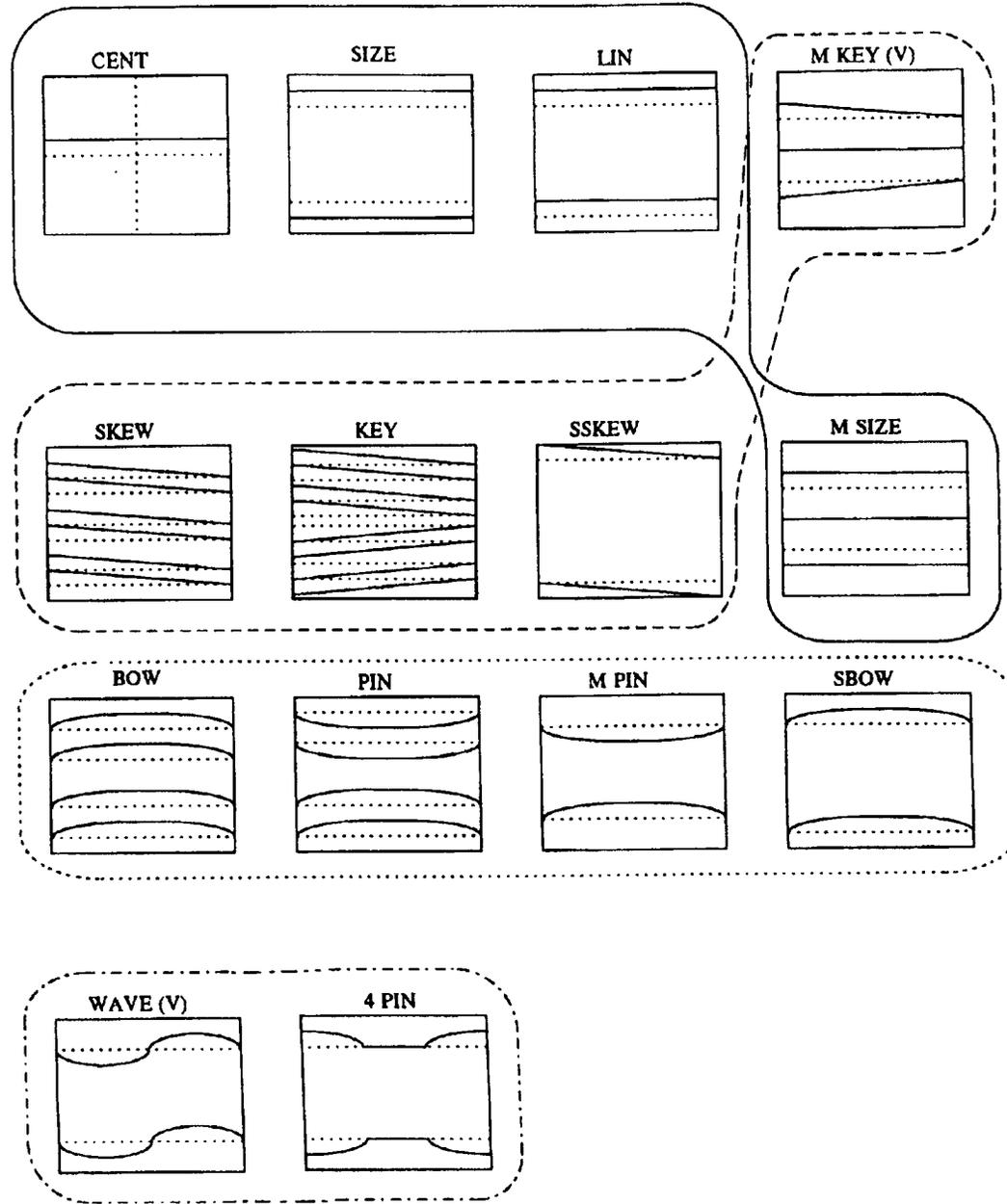
10. If you are not satisfied with the adjustment, do not press the save key. Continue with your adjustment or move the interrupt switch to the Non-interrupt position. If you move the Non-interrupt switch the TV will wipeout your adjustment and return to original condition. Repeat adjustment process from #7.

11. Before disconnecting the control cable from the TV, it is recommended to move the interrupt switch to the non-interrupt position. This releases the interrupt line so that it will not bounce when disconnecting the cable from the unit.

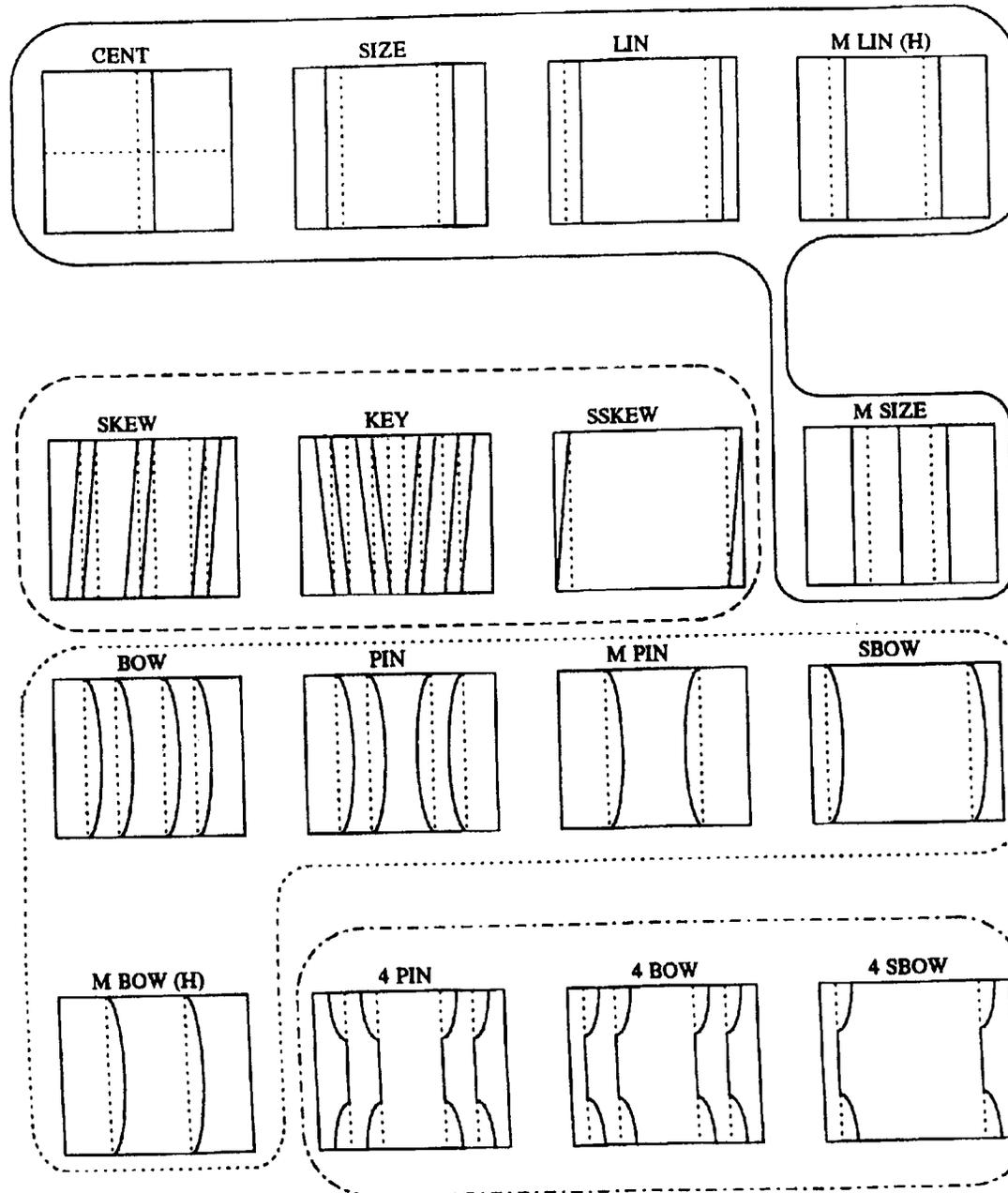
The following two pages contain diagrams of the key layout for the Registration Adjustment Jig. There are separate pages for horizontal and vertical adjustments since there are some differences. The dotted lines around the keys indicate families of adjustments. This means that combinations of adjustments in that family are usually required to fix problems.

NOTES

Key Layout (V)



Key Layout (H)



VIDEO PROCESSING

Tuner

The tuners require several inputs to operate:

- 1) +5V
- 2) +9V Sw for basic operation
- 3) +30V for tuning voltage (from 135Vdc B+).
- 4) Data and clock inputs from microprocessor IC001/10 and 11. These are positive-going pulses which are present as long as the set is turned ON, whether you're on video input or TV operation.
- 5) The enable or latch signals from System Control IC001/4 are also present when the set is ON.

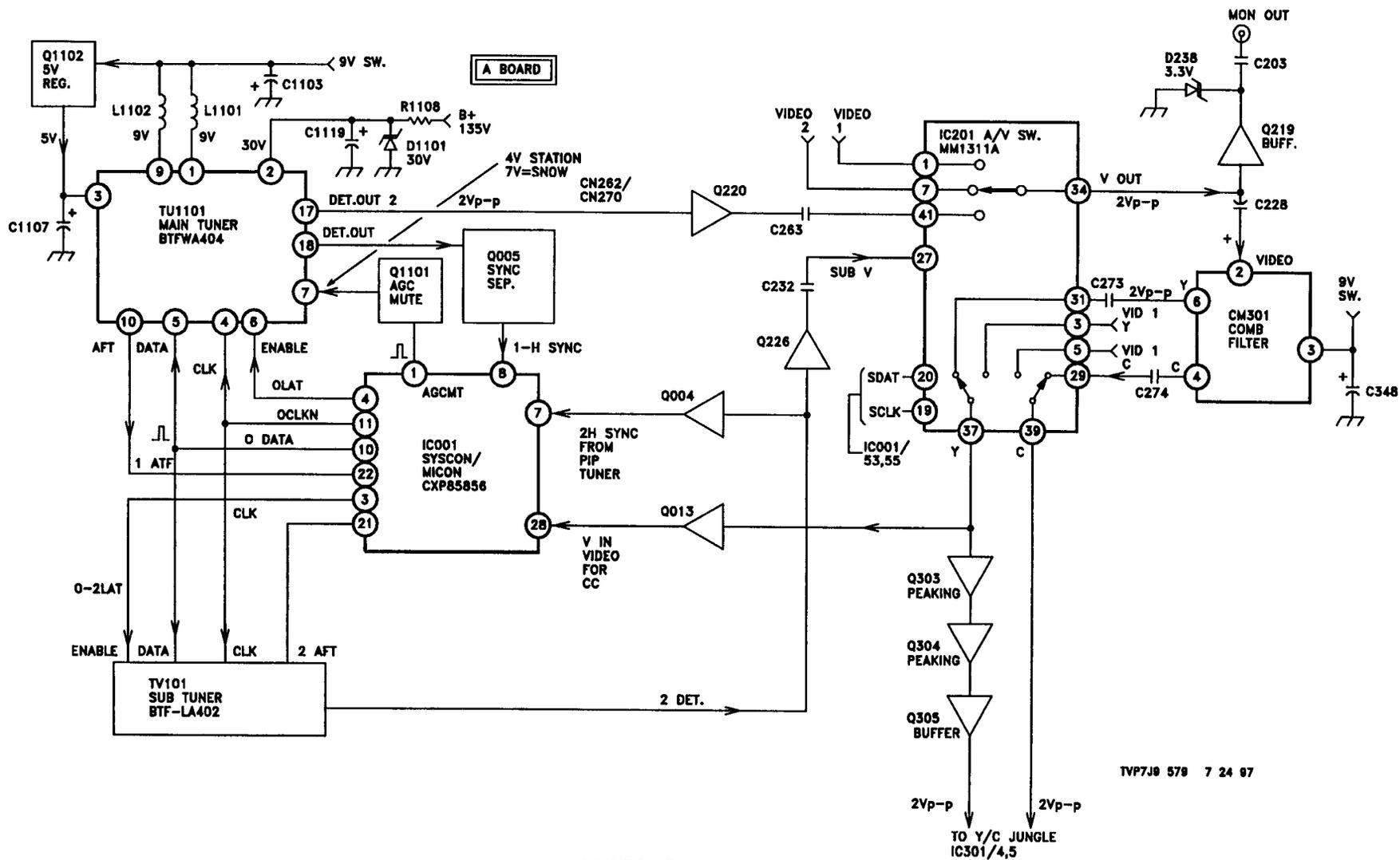
When the channel up or channel down button is pressed, IC001 System Control receives that command and changes the data output IC001/10. This data causes the main the tuner TU1101 to change to the new station. At the same time, an AGC mute HIGH is output at System Control IC001/1. This is used to momentarily ground out the AGC section within tuner, permitting it to drop down to minimum gain so the tuner's AFC doesn't hold onto the current station in the process of changing stations. Therefore, the voltage at the tuner's AGC terminal remains at approximately 4 to 5V when switching from station to station instead of going to 7 or 8V which represents the highest gain when there is snow present. This pulse only lasts about one second. A defect in this stage although rare, would cause weak reception or it would take a little longer to get to the next station when using channel up/down.

Once switched to the new station, the station's center frequency is identified using the AFT signal that enters System Control IC001/22 from the tuner. It uses this signal to identify the presence of a station, but since this AFT section can be fooled easily, the location of the station is also identified with the video's horizontal sync pulses that enter IC001/8. Therefore a station is identified, using AFT and horizontal sync.

The sub tuner uses the same data and clock lines however it does have its own enable and AFT lines. The sub tuner is always responsible for the child picture. If a PIP "swap" function is performed both tuners are retuned.

Signal Flow

The signal from the main tuner TU1101 is a composite video signal that leaves the detector out terminal through buffer Q220 to the A/V Switcher IC201/41. Pin 41 is one of several inputs to the A/V switch. The other inputs (three video inputs and the sub tuner) can be selected to output at pin 34. The third video input is not shown. 2Vp-p of composite video enters IC201/41 and leaves at pin34. This video signal enters the Comb Filter CM301/4 and exits as luminance at pin 6 and chroma at pin 4. The 2Vp-p chroma not only contains the chroma, but also luminance. The luminance and chroma signals reenter the A/V Switcher IC201/31 and 29 and are output at pins 37 and 39 unless the S-video input is selected. These signals go to the Y/C Jungle IC301 as the main signal to be mixed with the Picture in Picture signal and output to the picture tube cathodes.



VIDEO PROCESSING

TVP7J0 570 7 24 87

Video Drive/IK Blanking

Overview

When troubleshooting a blanking problem you must first understand the video drive and IK blanking circuit and how they interrelate. Second by applying the troubleshooting techniques in this book you must determine if blanking is caused by the video drive circuit or IK.

Video Drive

- The video signal enters IC301 Y/C Jungle as Y and C at pins 4 and 5. It exits at pins 20, 22 and 24 as R, G and B.
- The RGB signals pass through buffers and enter the CR board at CN703. All three signals are clamped by Q702 at about 1.2V above the 9V line.
- The G and B signals are passed on to the CG board while the R signal is applied to Video Amp IC701/3. An inverted video signal is output at pin 8 and is applied to cathode of the red tube. The signal level on the cathode varies between 70V and 170V with a standard color bar input. The lower the input voltage to the tube the brighter the tube.

Current is sensed at Video Amp IC701/5 and applied to the IK buffer which develops a voltage that is applied to the IK input of the Y/C Jungle. The higher the current draw of the tube the higher the voltage at Video Amp IC701/5.

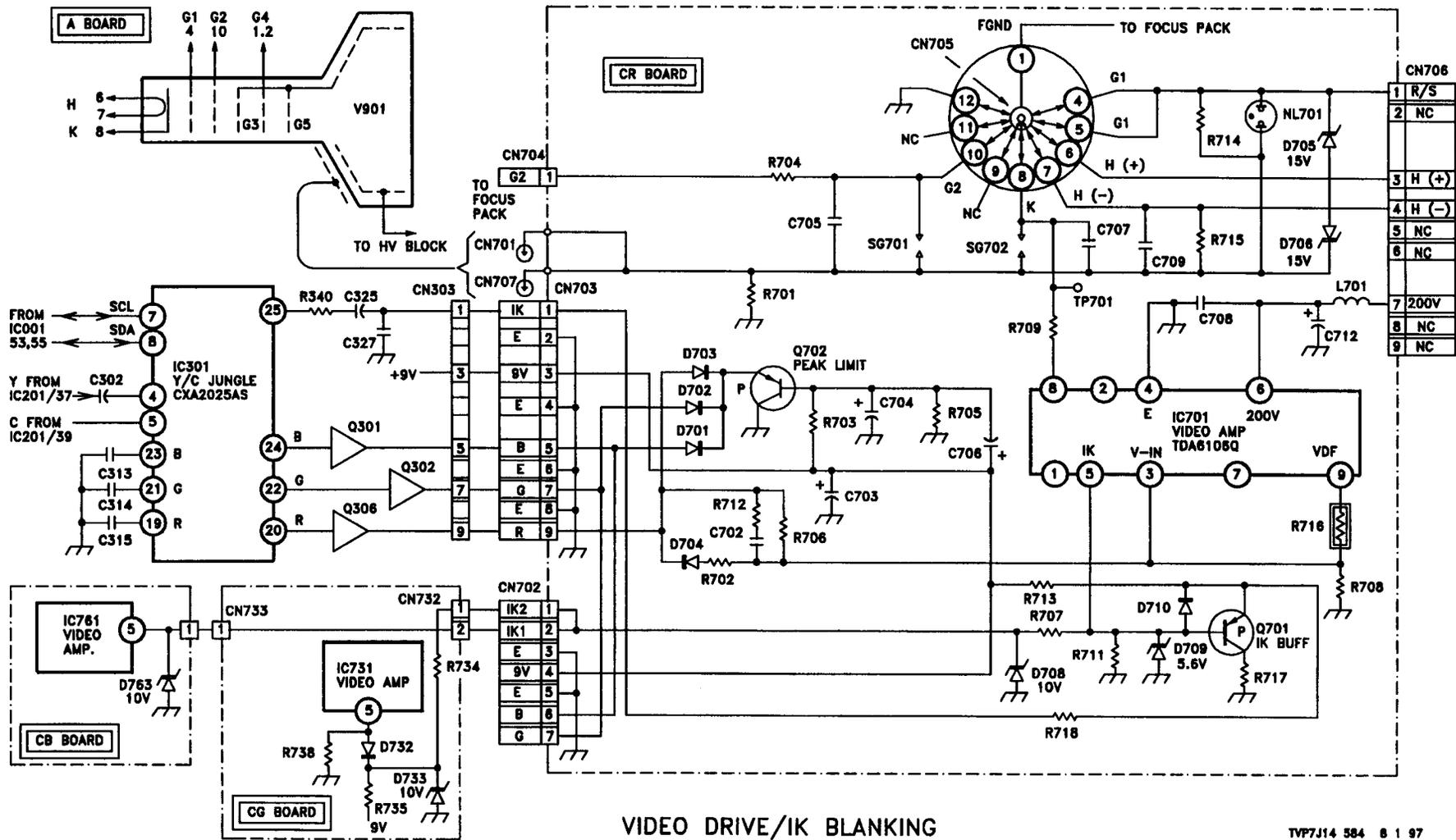
IK (Automatic Cathode Bias)

The purpose of the AKB or IK circuit is to keep the pictures white balance correct by controlling the bias or input level at the picture tubes cathode.

When serial data is present at the Y/C Jungle IC301 the IK circuit begins operation. Three 4 Vp-p pulses are output, one at each of the RGB outputs, during vertical blanking. These pulses turn the tubes fully on. The beam current is sensed at pin 5 of each video amp and applied to the IK buffer. This signal is sent to Y/C Jungle IC301/25 IK which is the reference return for the loop. The RGB output voltage level is determined by this input.

If the voltages of the pulses returned are not within a certain window the video signal will be blanked. Internally these three pulses are applied to their own sample and hold circuit. These circuits all contain an external capacitor which is connected to pins 19, 21 and 23 respectively. The voltage at these pins corresponds to the efficiency of each cathode.

When a normally working set is first turned on you will notice that the timer light blinks for approximately 8 to 10 seconds. This is because the Y/C Jungle is holding the data bus in a busy state. When the voltages at IC301/19, 21 and 23 are between 2.5 and 7 volts the Y/C Jungle IC will signal the micro that it is no longer in a busy state and unblank the set. When IC301 unblanks the set it outputs RGB of approximately 2 Vp-p from pins 20, 22 and 24. If there is a problem the timer light will continue to flash. If a problem occurs during operation of the set which causes the picture to blank the timer light will not flash. It will only flash when the set is turned on.



VIDEO DRIVE/IK BLANKING

TVP7J14 584 8 1 97

Video Drive/IK Blanking

Troubleshooting Blanking

Unlike most Sony television sets the RA-2 does not have the VP pulse feedback to the Y/C Jungle. Therefore loss of vertical does not cause blanking. However it does cause problems with the I2C bus since it is dependent on VP pulses for timing. Any problem that causes loss of vertical will put the set in a condition where the timer light on the front panel flashes and the power relay continuously turns ON and OFF. Along the same lines any loss of data or clock between System Control IC001 and the Y/C Jungle IC301 will cause the same symptom as above.

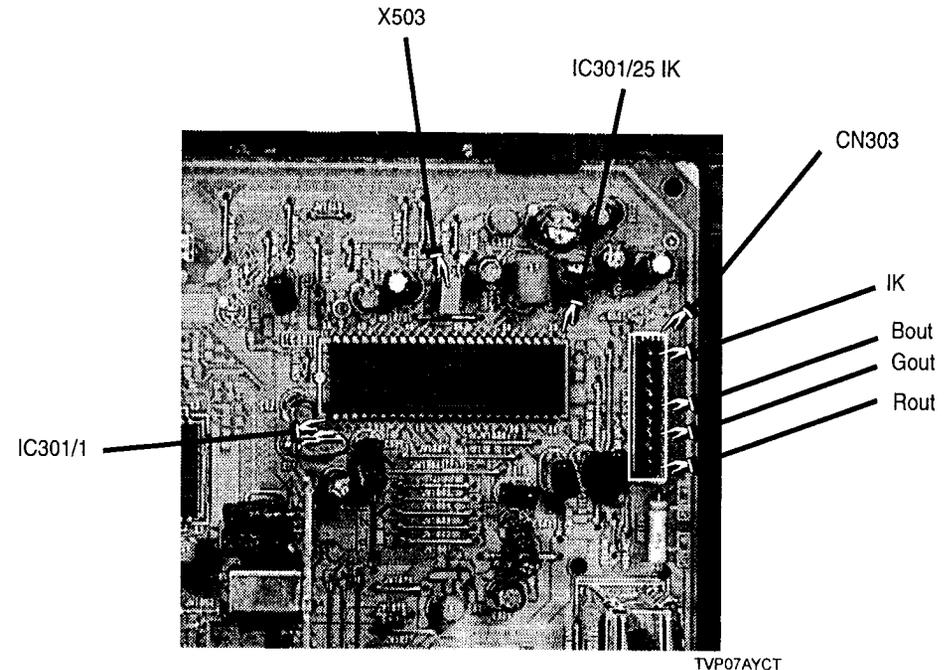
The first thing that must be determined is if the problem is with the video drive or the IK return. There are several ways to determine if the IK pulse is driving the tube. The quickest way to do this is to take a mirror and place it at about a 45 degree angle above and behind the tube and look for a bright horizontal line at the top of the tube (this would be at the bottom of the mirror). Remember the IK pulse is done during vertical blanking so although it can't be seen on the screen it can be seen in the tube. If one of the lines is missing or is significantly dimmer than the other 2, that color has the problem. Check that color's output from the Y/C Jungle to decide if the Y/C Jungle or the video drive circuit is at fault. If the video drive circuit is at fault the IK pulse can be followed to signal trace the circuit.

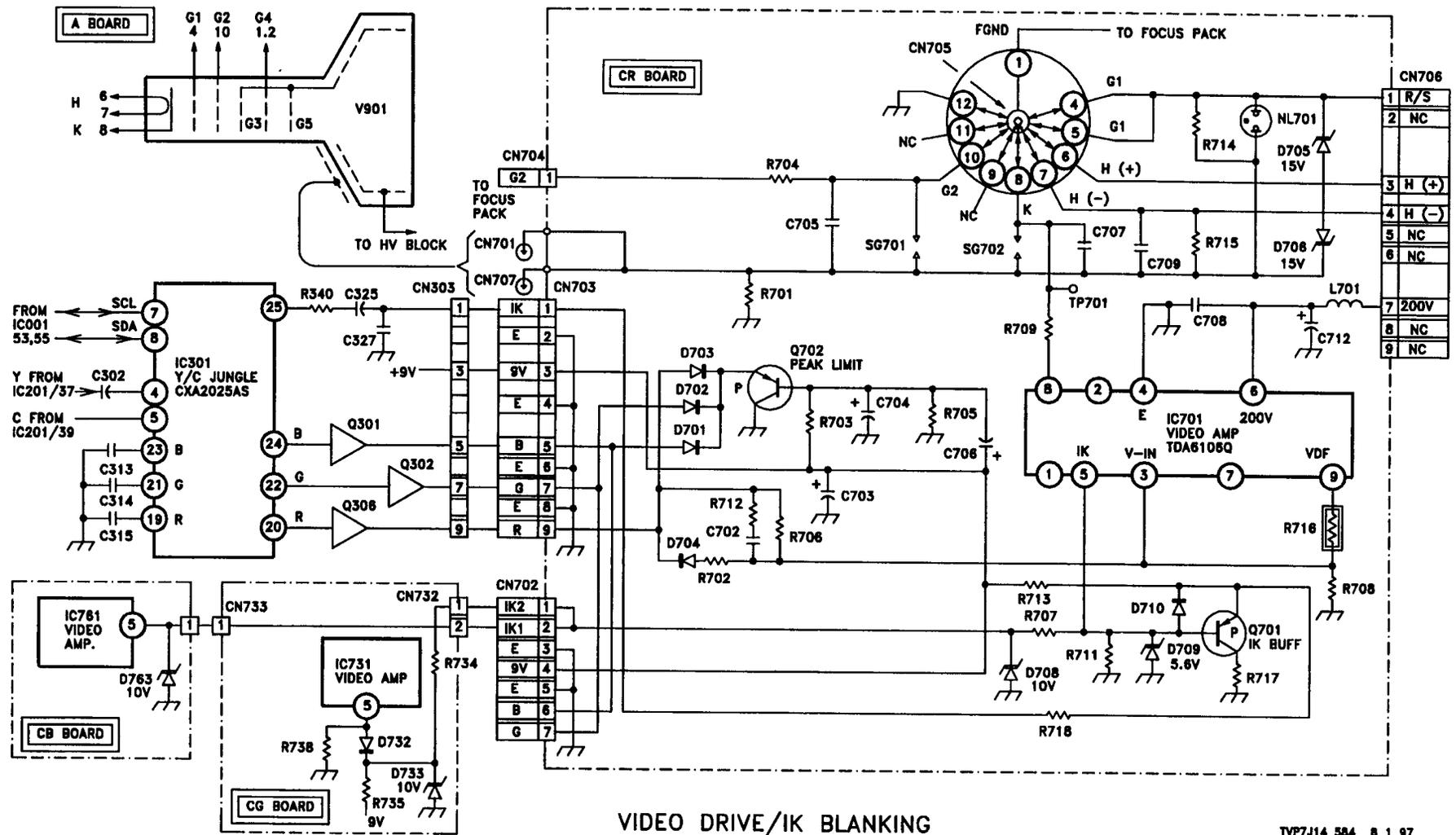
If all three lines can be seen then you can check the sample and hold voltages at IC301/19, 21 and 23 to see if the IK pulses are being returned. These voltages are normally around 6 Vdc but any voltage between 2.5 and 7 volts should not cause blanking. If all three lines are seen and the S/H voltages are correct suspect the Y/C Jungle IC301. However when one of the S/H voltages is incorrect there are a few possibilities.

- The screen control is misadjusted. I would recommend that you check this first except for the fact that the front panel and cover must be removed. Simply turn the screen adjustment up or down, if this is the problem the set should unblank before the adjustment brings the tube to retrace.
- A defect with the IK buffer could also cause a blanking problem. If the voltage on the base of Q 701 is between approximately 1.8 and 3 V

the set should be operational. In the event that the voltage is between these voltages suspect Q701.

- If the voltage at Q701B is not within the levels mentioned above, there could be a problem with that picture tube or its biasing. The voltage at Q701 base depends on the voltages output by each pin 5 on the video drive IC's. If there is a problem with the tubes current draw you may have bad tube biasing or a bad tube.





VIDEO DRIVE/IK BLANKING

TVPJ14 584 8 1 97

PICTURE IN PICTURE PROCESSING

Overview

The purpose of the Picture in Picture circuitry on the small P board is to digitally compress the normal 525 line transmitted picture into a small picture 1/9 its original size. To do this, the PIP processor IC must first take the analog luminance and color information, convert it to digital format. Then, using the vertical and horizontal sync pulses, this IC eliminates information, making the picture smaller. The remaining information is then stored into memory. When PIP is called for by the customer, the memory picture is then converted from digital back to analog before leaving the PIP Processor IC3303 as Y, R-Y, and B-Y.

Most of this child picture processing is being done in IC3303, which makes troubleshooting simpler. The other main IC is a chroma decoder, IC3301 that converts the incoming "sub V" video into Y, R-Y, and B-Y for the PIP Processor IC3303. The color level and hue of this child picture information is adjusted by IC3301 so it matches that of the main picture.

Processing

The Picture in Picture circuit board needs the following signals to operate. These signals are present all the time, when the set is ON, whether the Picture in Picture section is being turned on or not. These signals are:

- 1) Serial data and clock signal at connector CN305/19 and 20.
- 2) +9V at CN305/8, which becomes +5Vdc on the board.
- 3) Input video signal at CN305/5 = 2Vp-p.
- 4) The P board uses the child pictures sync to sample and store the child picture. The main picture's vertical and horizontal pulses are used to determine where the beam is at any given moment, so the Picture in Picture can be output for main picture insertion at the right location. These input timing signals are approximately 5Vp-p.

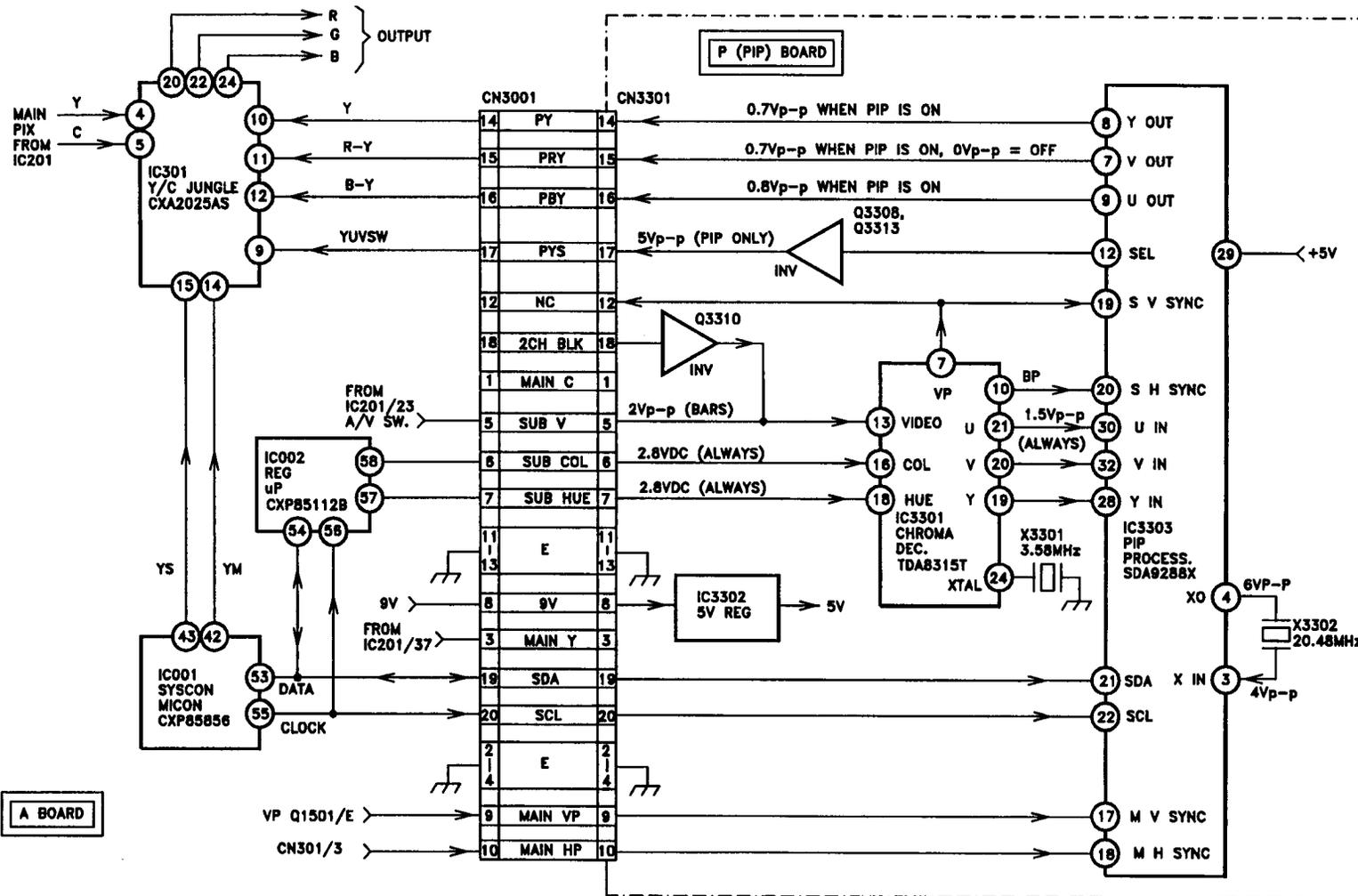
The Y, R-Y, and B-Y output the P board, when PIP is turned ON has to be switched into the main picture at the right time. That is the purpose of the YUV (or PYS) switching signal that is output at pin 17, when the child picture is output. This signal YUV to Jungle IC301/9 selects the main picture when LOW and the Picture in Picture when HIGH. Therefore, when Picture in Picture is called for from the remote control, all four Picture in Picture inputs to the Jungle IC301/ 9, 10, 11 and 12 will be active. Basically, these signals cut a hole in the picture in which the child picture is inserted.

Signal Flow

The sub V or child picture that enters the Picture in Picture board is a 2Vp-p video signal that is input to the Chroma Decoder IC3301. IC3301 outputs the video as Y, R-Y and B-Y labeled as Y, V, & U at IC3301/19, 20 and 21. (The simpler labeling of Y, V, & U in place of Y, R-Y and B-Y has been used in Europe for years now.)

The 2.8Vdc at CN305/6 & 7, is fed to the chroma decoder IC3301 and used for determining the color and hue of the child picture. The source of this color control voltage is serial data from System Control IC001/53 and 55. The Regi-Micro IC002 receives this data at turn ON and outputs a constant 2.8Vdc at pins 57 and 58, as long as the set is turned ON.

The Picture in Picture processor IC3303 outputs child picture information when serial data (SDA, SCL) is input and calls for that feature. At that time, only when PIP is turned ON does the child picture information output from IC3303's Y, V, and U output terminals.



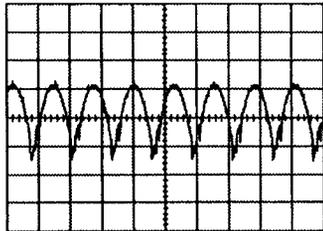
PICTURE IN PICTURE

TVP7J18 588 7 24 97

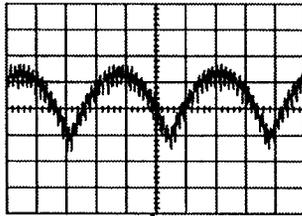
DYNAMIC FOCUS

Dynamic Focus is necessary to maintain beam focus in areas that are near the edges of the screen. To achieve this, the focus voltage is dynamically changed as the beam scans to and from the center of the screen.

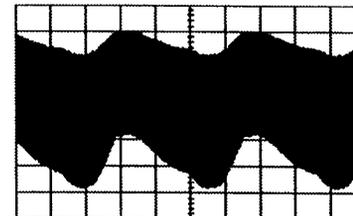
Q507 and Q506 form a variable load on the 640V Dynamic Focus line. The conduction of these transistors, and therefore, the load, is controlled by the V and H parabola signals from the V and H wave generators IC801 and IC802. These signals are amplified by IC805 along with a signal from the HV regulation tap on the HV block. As stated earlier since there is no HV regulation, we use the sample from the HV block to compensate for picture changes because focus is so dependent upon the level of high voltage. This signal is applied to Q506/Base via R550 and C537. This varies the conduction of DF Pre-Drive Q506, which in turn controls the conduction of DF Main Drive Q507, causing the Dynamic Focus voltage to vary. The dynamic focus signal is fed to the focus pack. Inside the pack, the signal is capacitively coupled to the dc focus voltage causing it to be modulated by the dynamic focus signal, in sync with the beam scan.



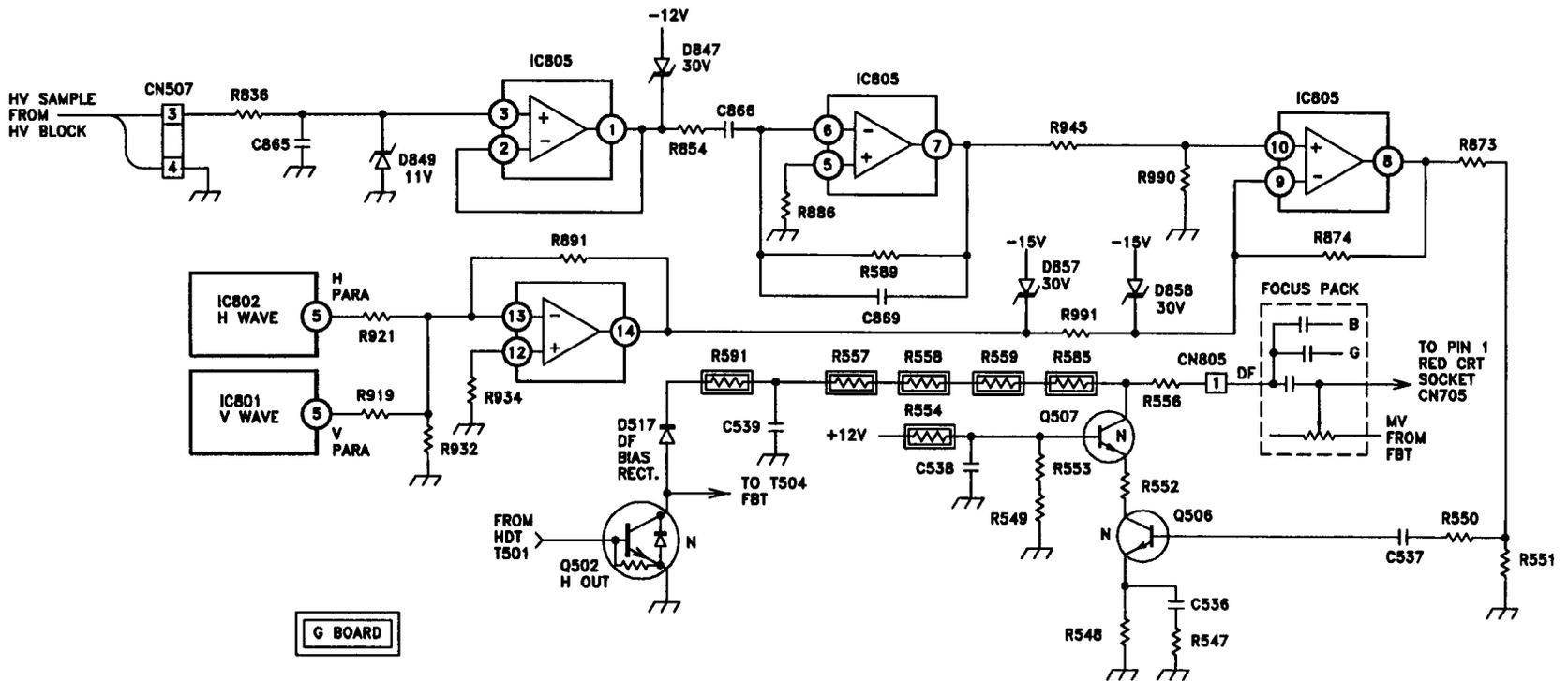
IC802/4 H PARA 1 V/DIV 50 μ S T/DIV



IC801/5 V PARA 1 V/DIV 5ms T/DIV



Q507/C DYNAMIC FOCUS OUT 500 V/DIV 5ms T/DIV



G BOARD

DYNAMIC FOCUS

TV7J13 583 8 1 97

Shading Compensation

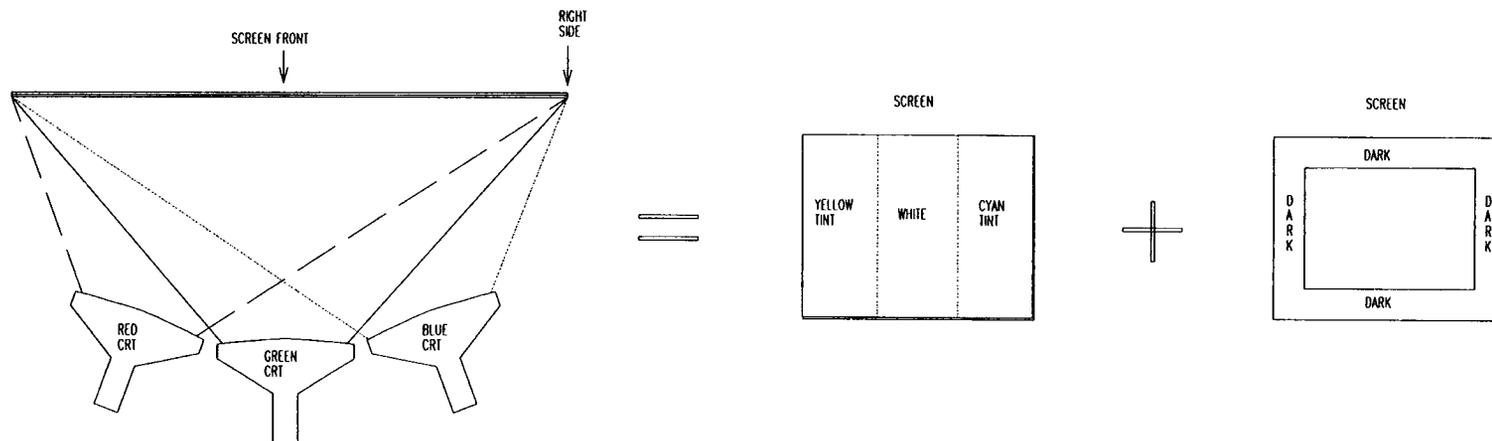
Overview

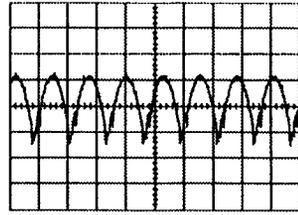
All Sony projection televisions contain some shading compensation circuitry. Shading compensation is needed because the red and blue CRT's are mounted on angles to the front of the screen. The result of this is that if you are viewing an all white screen the left side would have a yellowish tint and the right side would have a cyan tint. Also the edges of the picture would be darker because there is less light intensity from the red and blue CRT's due to their angle.

In the RA-2 chassis the V parabola, H parabola and H sine waves from IC801 and IC802 Wave Generators are applied to the inputs of IC803. The resulting signal is output from pin IC803/3 to IC803/4. A sample of the ABL voltage is used to control the gain of IC803. It is applied to IC803/5 through Q802 Inverter and Q805 Buffer. This is done because

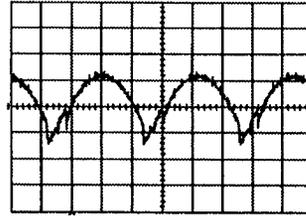
as the picture becomes brighter there is more of a need for shading compensation. This gives us uniform shading balance regardless of the brightness level. When the signal is output from IC803/6 it is split to 2 amplifiers one inverting the other one non-inverting. These two signals are output at IC811/1 and 7 respectively and applied to the G1 of the red and blue tubes.

G1 is the control grid of the CRT. The bias between G1 and the cathode controls the number of electrons going from the cathode to the phosphors which in turn varies the intensity of the light emitted from the CRT. G1 on the green CRT is connected by a 1K resistor to ground. Its potential is at 0V. Its voltage is constant because it is not at an angle to the screen and does not need shading compensation.

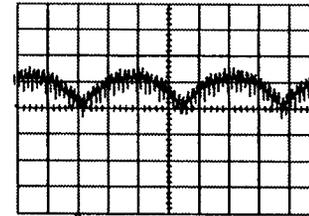




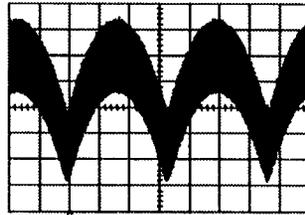
R813 H SINE 0.5 V/DIV 20µs T/DIV



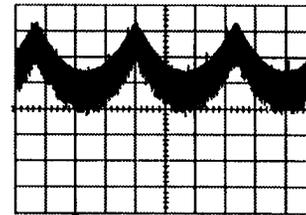
R812 H PARA 1 V/DIV 20µs T/DIV



IC803/1 V PARA 1 V/DIV 5ms T/DIV

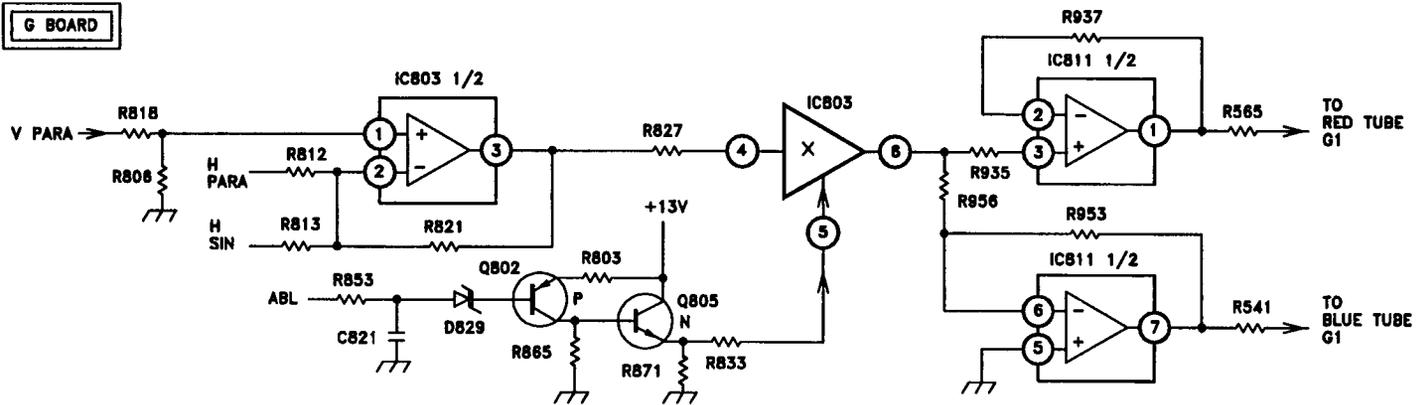


BLUE G1 COMPENSATION WAVEFORM
1 V/DIV 5ms T/DIV



RED G1 COMPENSATION WAVEFORM
1 V/DIV 5ms T/DIV

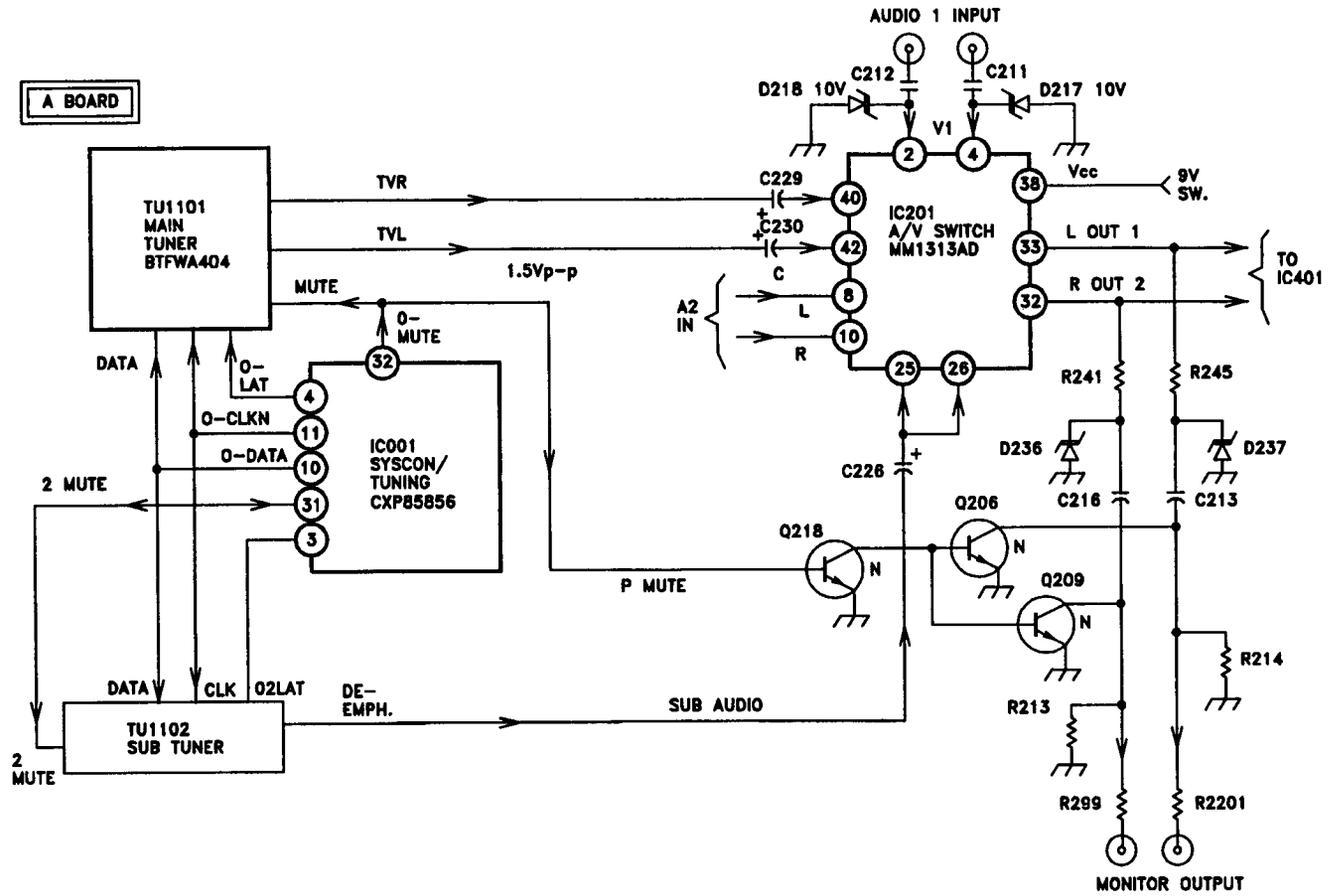
G BOARD



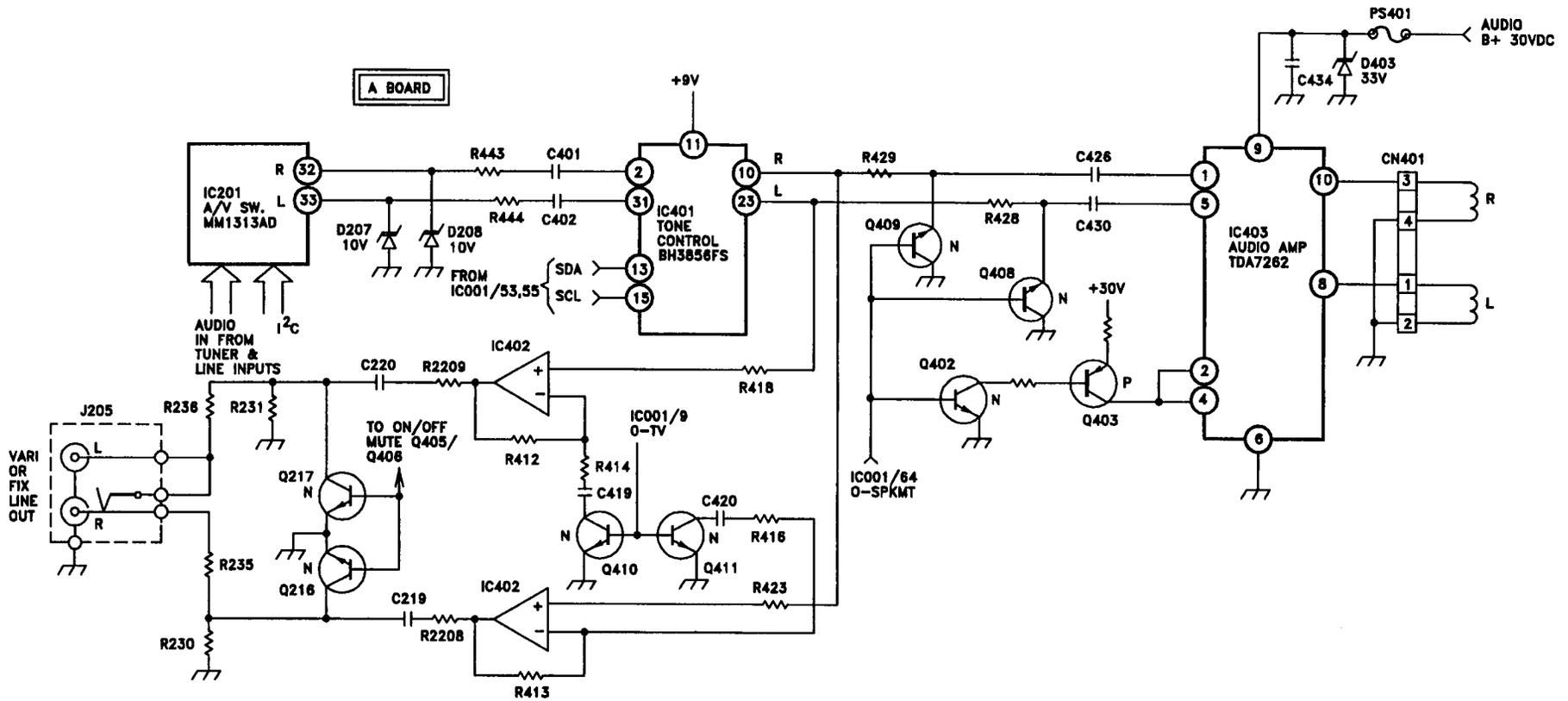
X IC803 IS A MULTIPLIER

SHADING COMPENSATION

TVP7J16 586 8 1 97

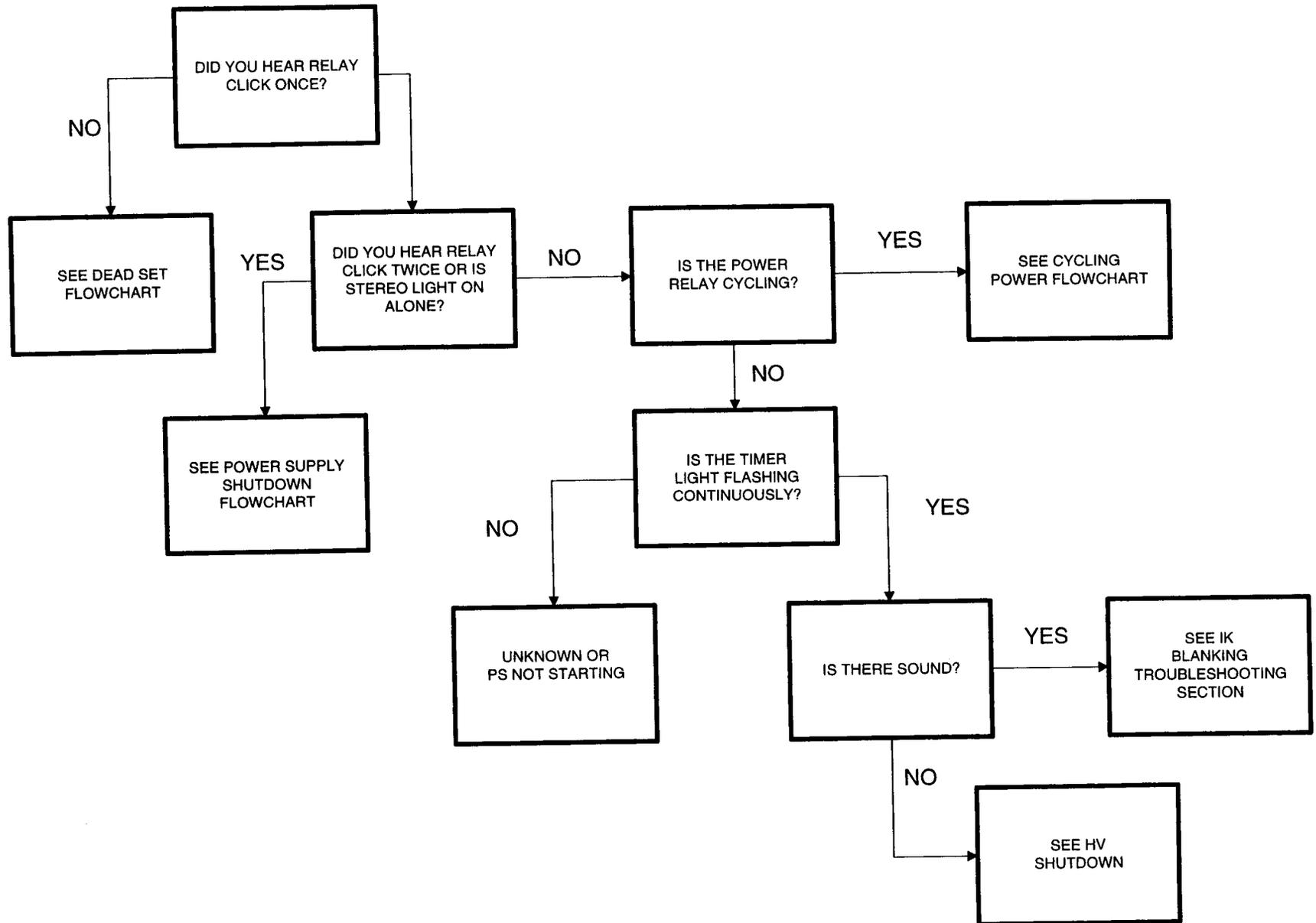


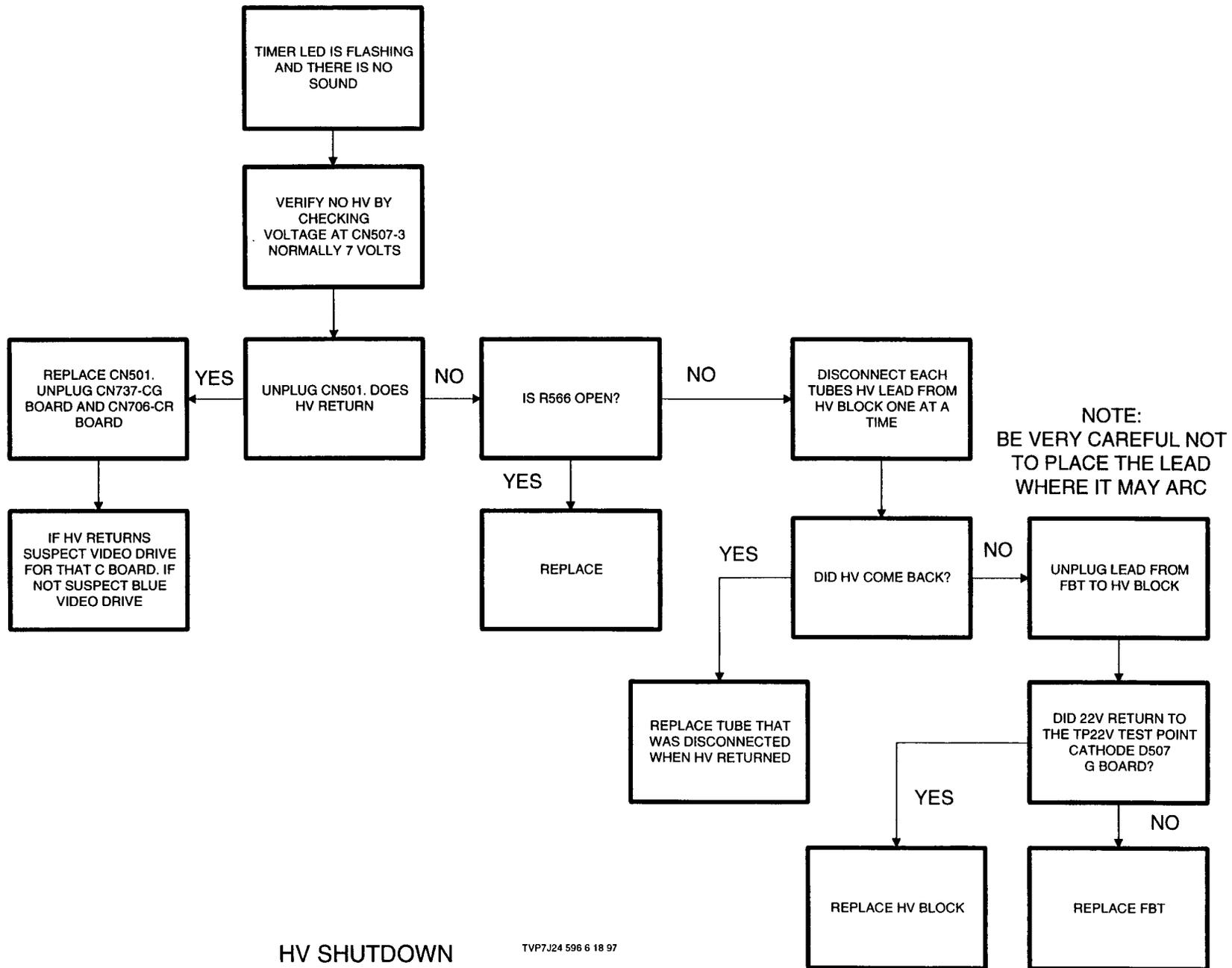
AUDIO PROCESSING



AUDIO OUTPUT

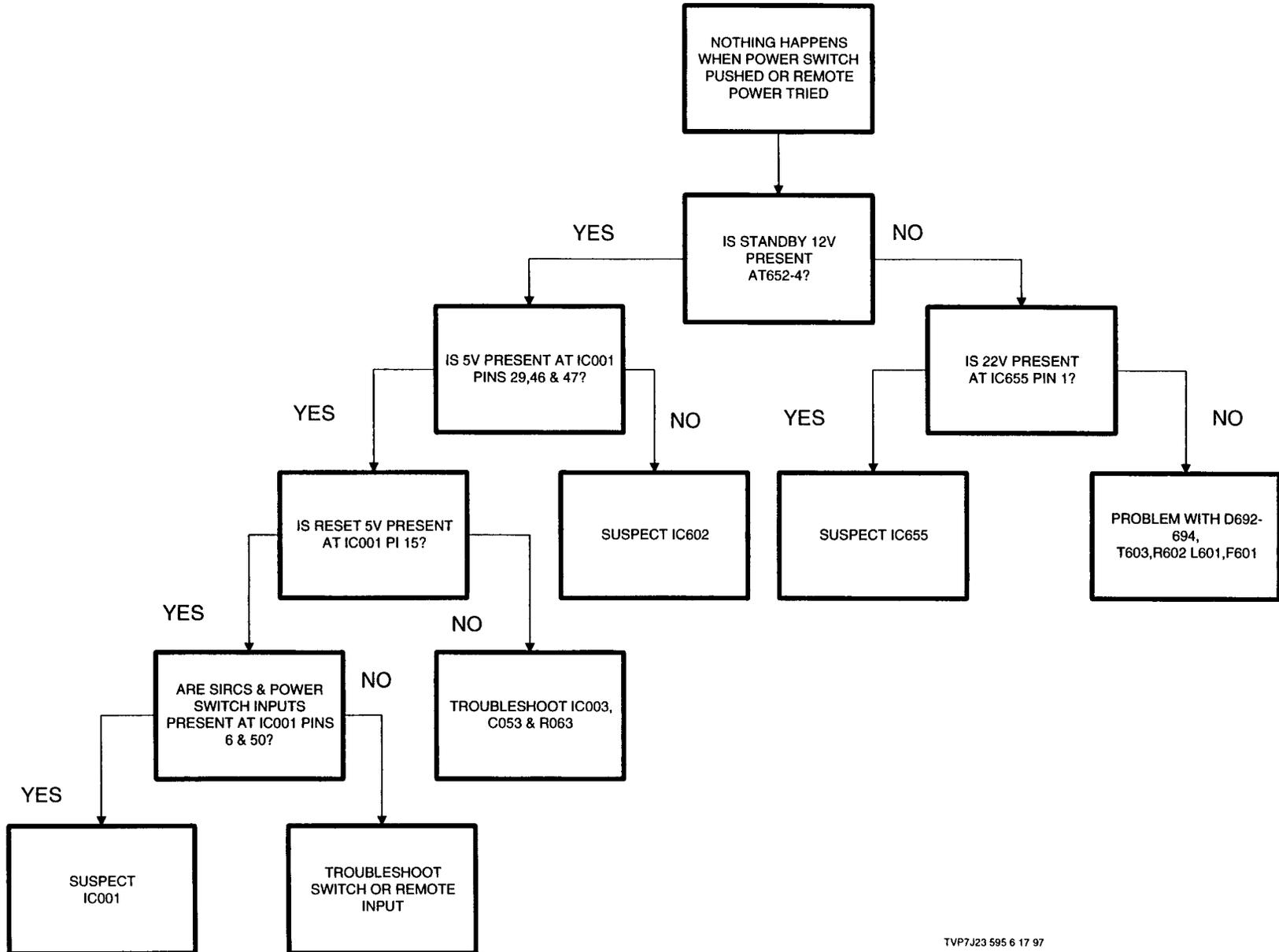
TV7J12 582 7 28 97



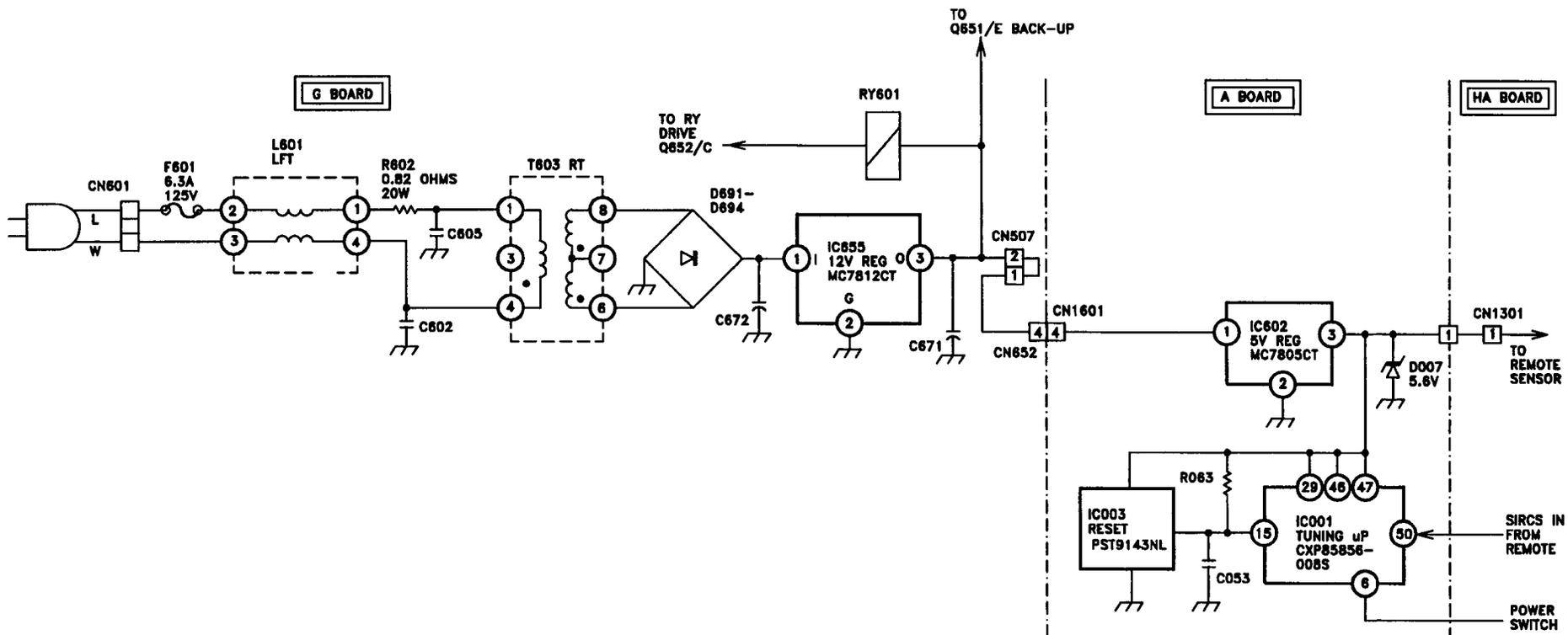


HV SHUTDOWN

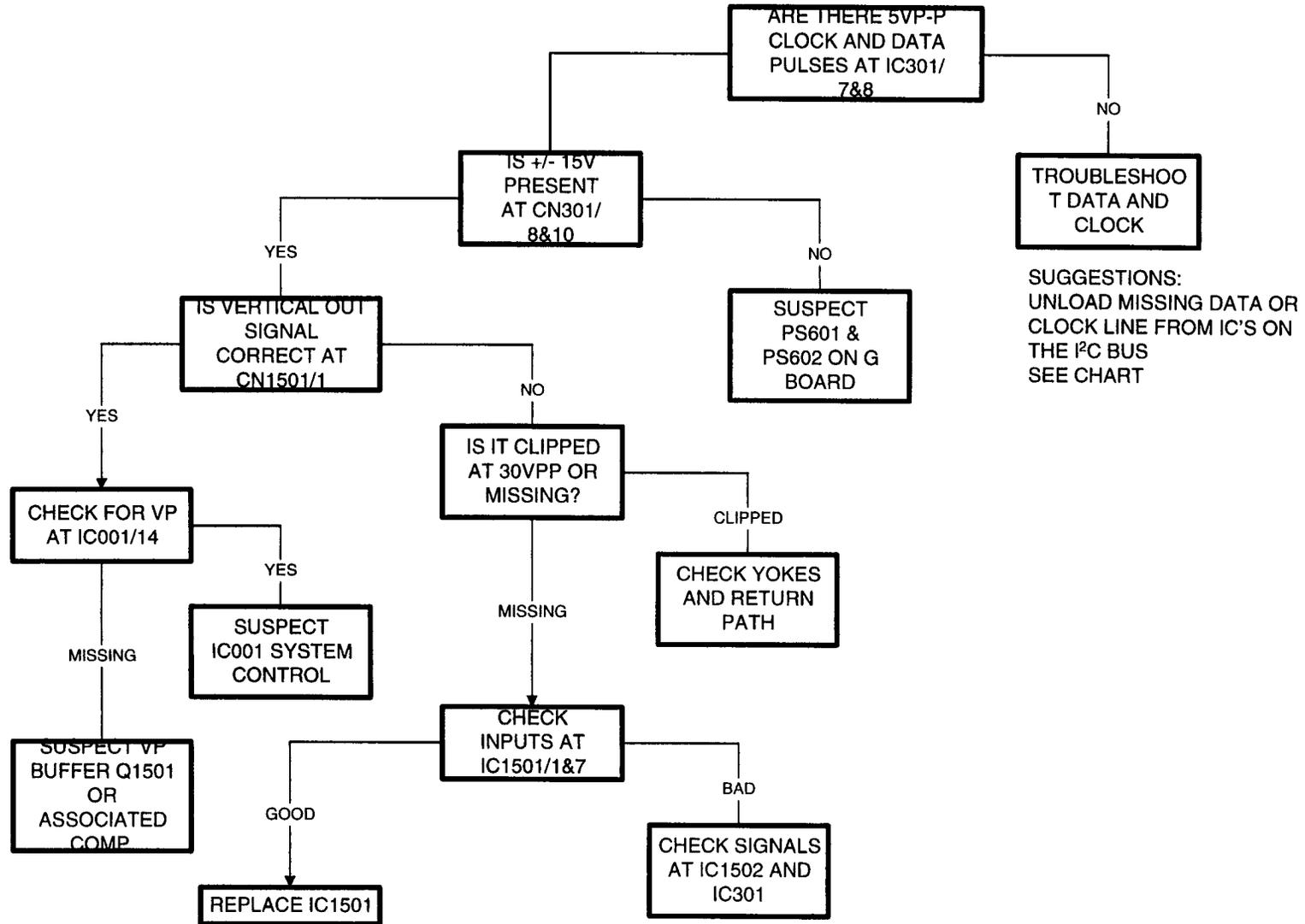
TVP7J24 596 6 18 97

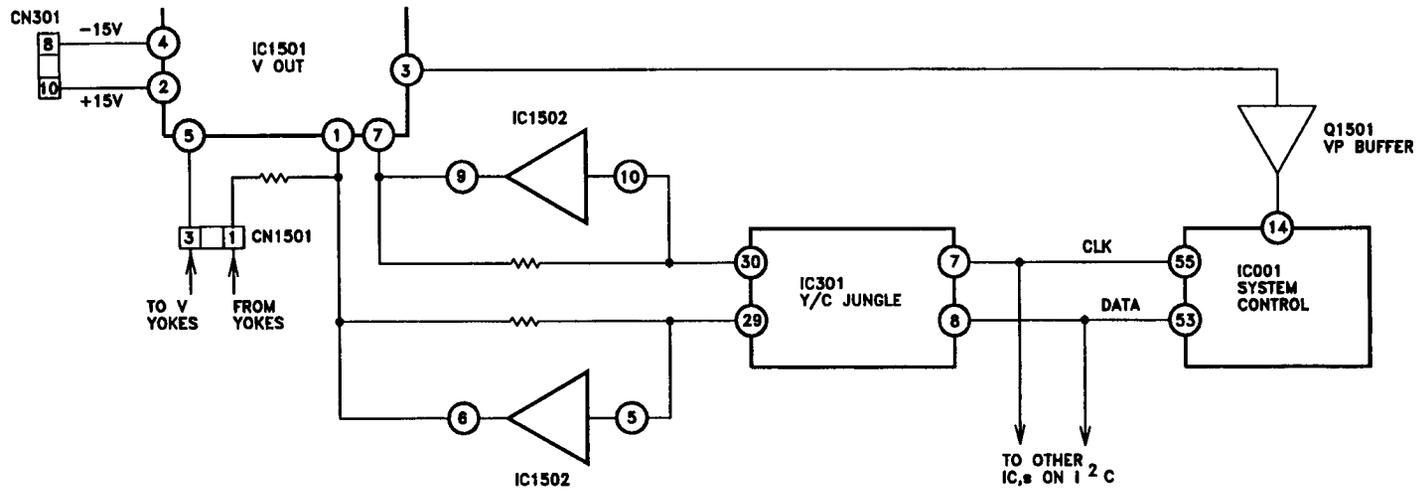


DEAD SET



DEAD SET

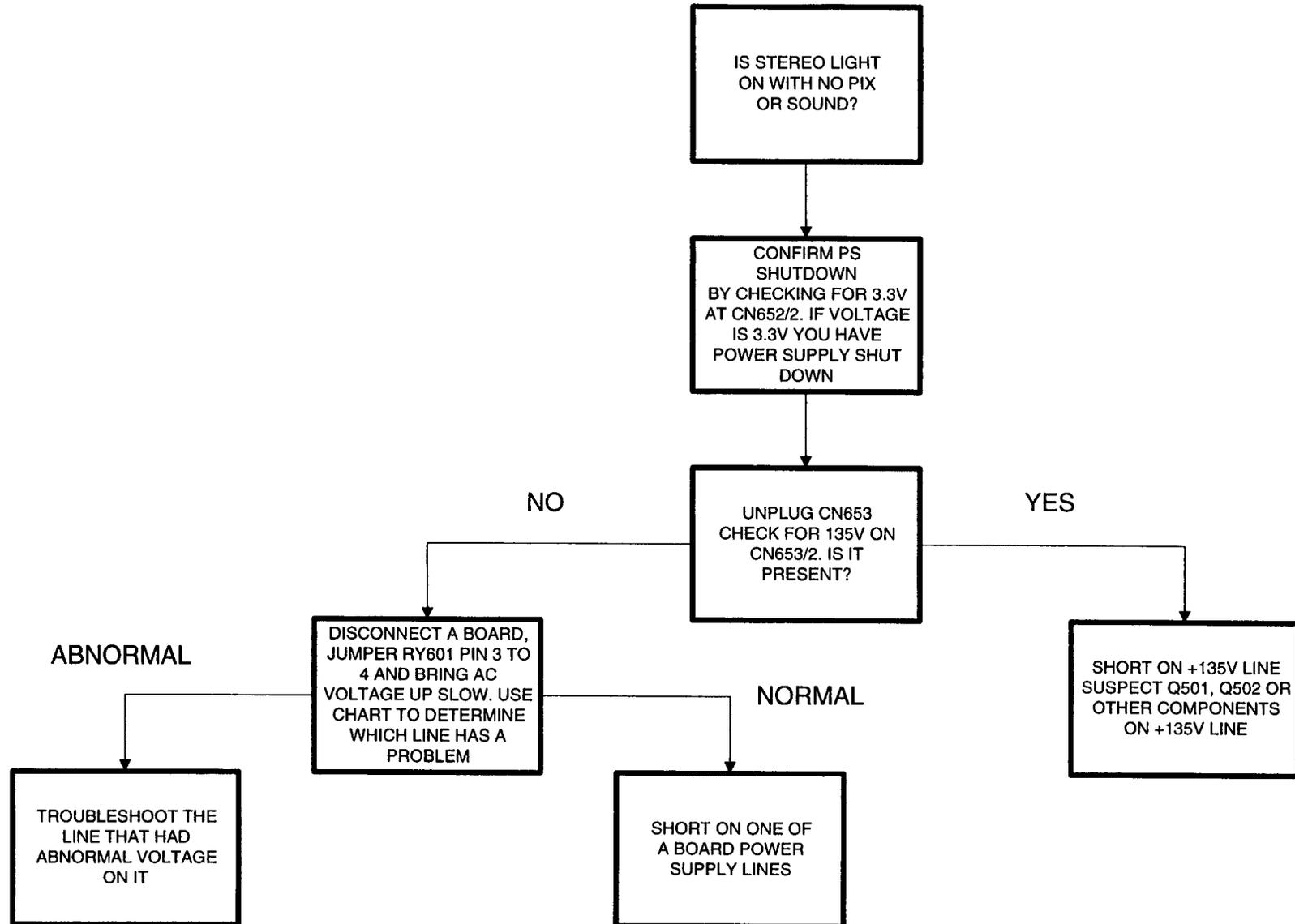




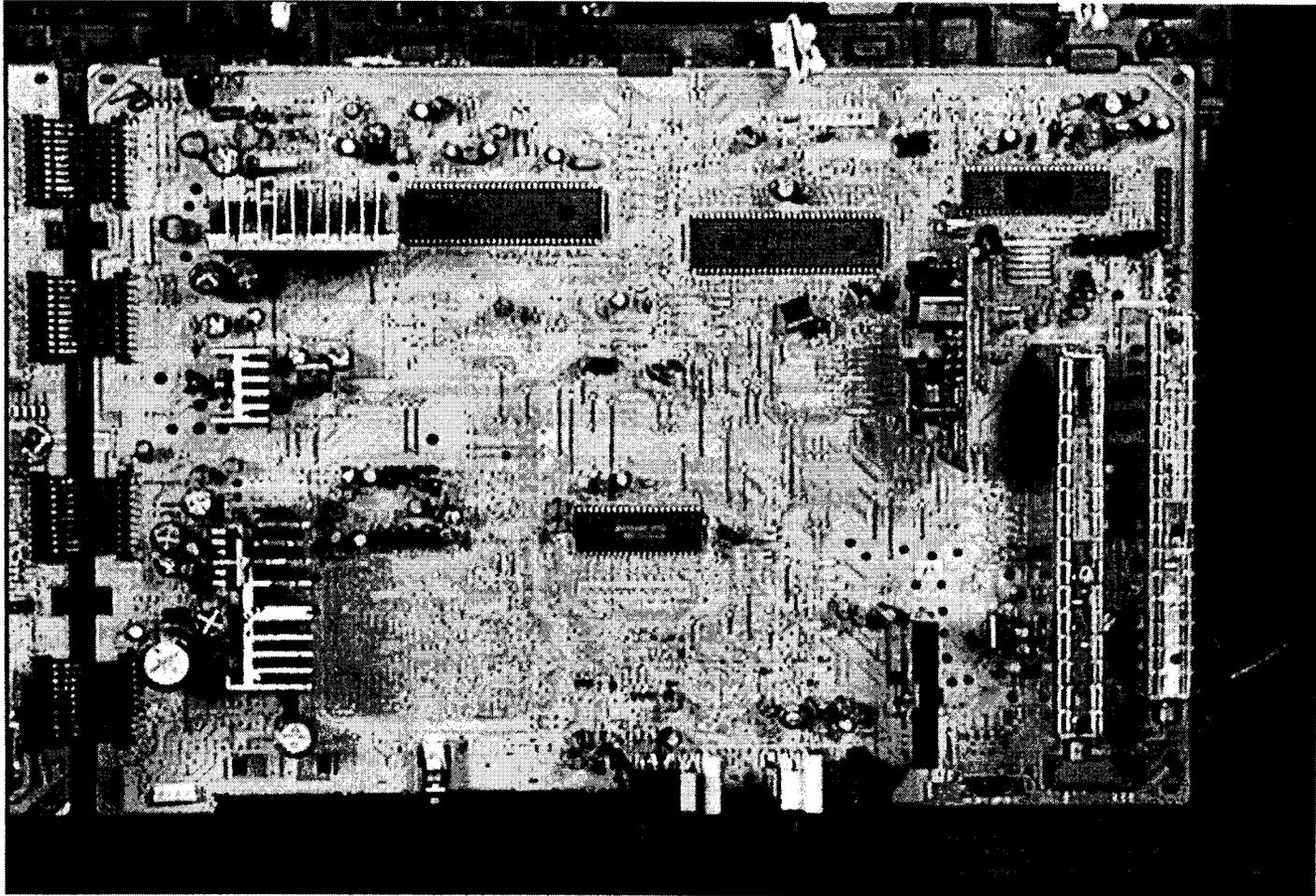
A BOARD

CYCLING POWER

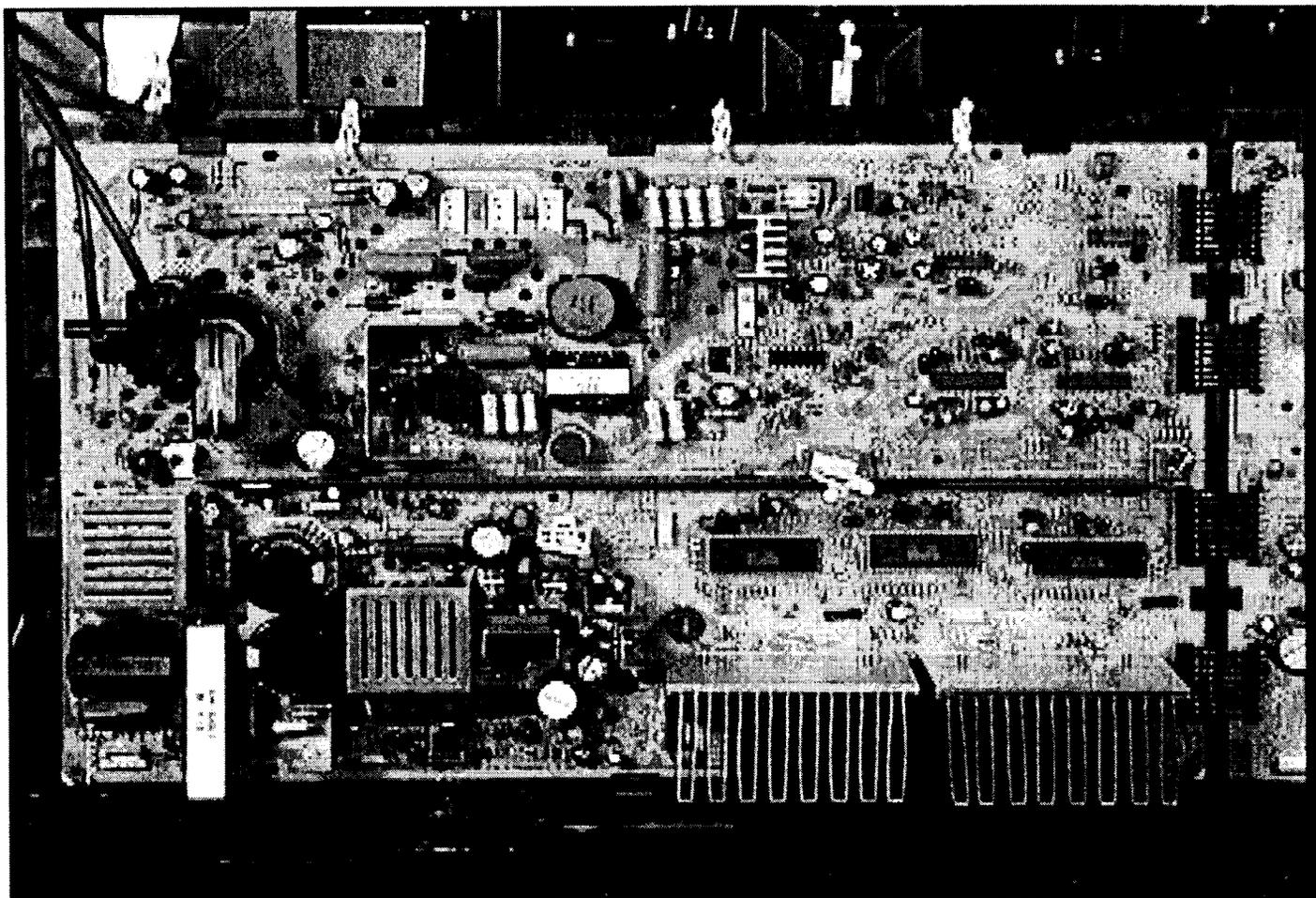
TVP7J27 588 7 25 97



Power Supply Failure Symptoms		
Voltage Line	Short Symptom	Open Symptom
+12V	No pincushion R566 opens	HV shutdown
-12V	No shading or dynamic focus R567 opens	Same as short
200V	HV shutdown	IK blanking
9V	HV shutdown	HV Shutdown
11V	Power supply shutdown	HV shutdown
30V	No audio	No audio
15V	Fuse blows, then same as open -15V fuse may blow	Set cycles off and on
-15V	Fuse blows, then same as open 15V fuse may blow	Set cycles off and on
5V	Set cycles off and on	Same as short
-5V	No convergence	Same as short
Stand by 12V	Dead set	Same as short



ATOP



GTOP