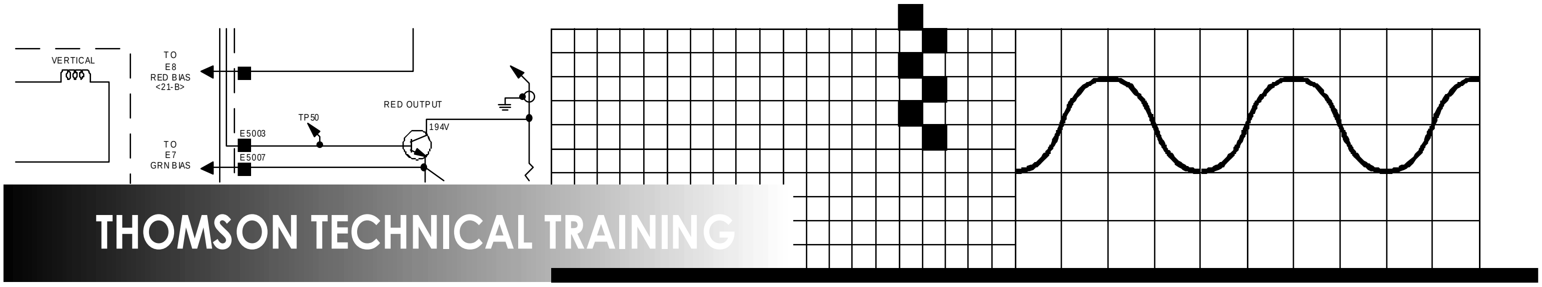


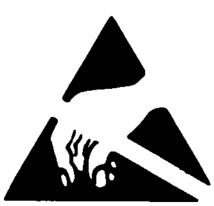
FOREWORD

This publication is intended to aid the electronic technician in servicing the CTC185 television chassis. It explains the circuit theory of operation of the prominent or otherwise new and different circuits associated with the digitally controlled chassis. This manual covers power supply, system control, horizontal deflection, vertical deflection, tuner, IF, video signal processing and audio. It includes practical, proven troubleshooting methods that are designed to help the technician become more familiar with the chassis layout, increase confidence and improve overall efficiency in the servicing the product.

Note: This publication is intended to be used only as a training aid. It is not intended to replace service data. Thomson Consumer Electronics Service Data for these instruments contains specific information about parts, safety and alignment procedures and must be consulted before performing any service. The information in this publication is as accurate as possible at the time of publication. Circuit designs and drawings are subject to change without notice.

SAFETY INFORMATION CAUTION

Safety information is contained in the appropriate Thomson Consumer Electronics Service Data. All product safety requirements must be compiled with prior to returning the instrument to the consumer. Servicers who defeat safety features or fail to perform safety checks may be liable for any resulting damages and may expose themselves and others to possible injury.



All integrated circuits, all surface mounted devices, and many other semiconductors are electrostatically sensitive and therefore require special handling techniques.

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First Edition 9624 - First Printing

Printed in U.S.A.

RCA GE PROSCAN®

Contents

CTC185 Main Regulator

Introduction

The power supply in the CTC185 is a non-isolated switching power supply that uses a MOSFET (Metal Oxide Semiconductor Field Effect Transistor) as the switching device. The supply uses a winding on the IHVT to provide a voltage boost and a series PWM controlled MOSFET to regulate the output voltage to 130 volt DC. The supply has no alignments because it uses a precision 1% voltage reference IC (U4103). The control circuit is synchronized to the horizontal oscillator by using a flyback pulse as a timing reference for a sawtooth ramp generator. When the chassis is in standby mode, Q4114 is kept on by a drain to gate resistor which forces the output voltage to be equal to the RAW B+ voltage.

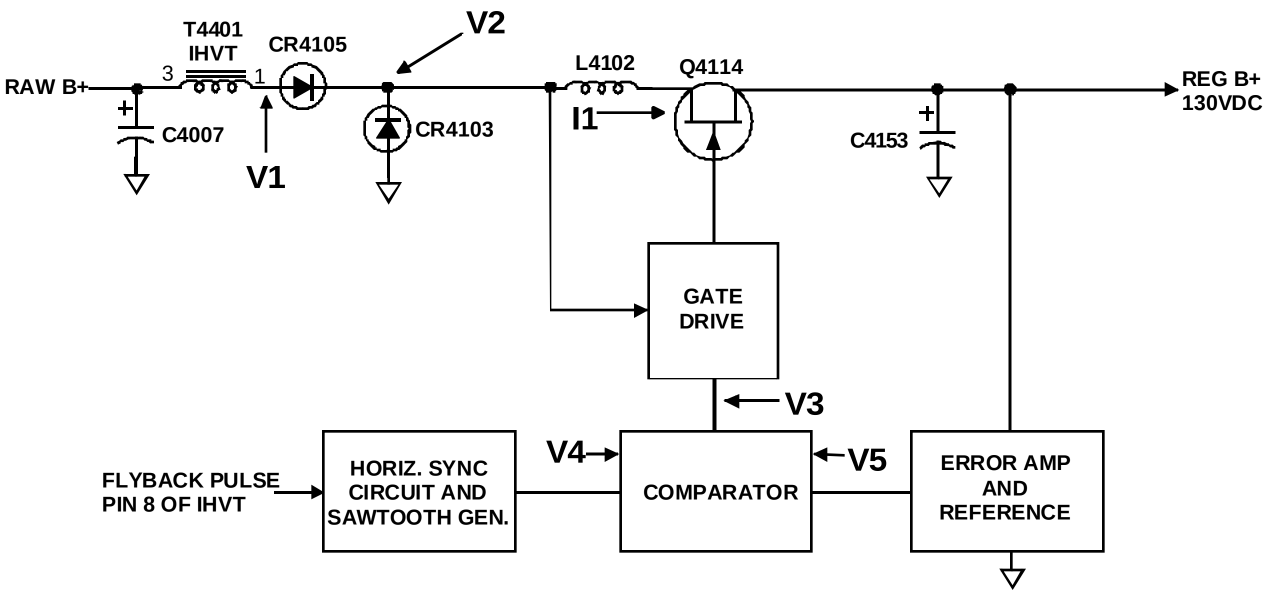


Figure 1, Main Regulator Block Diagram

The winding on the IHVT at pins 1 and 3 sums an inverted retrace pulse on the RAW B+ (V1 in figure 1). This provides the pre-boost so the supply will regulate even when RAW B+ falls below 130 volts (figure 2). The number of turns on the winding determines the lowest voltage at which the supply will regulate. The 25 and 27 inch chassis will regulate the +130V with as little as 95 volts AC RMS and the 19 and 20 inch chassis with as little as 90 volts AC RMS.

After the pre-boost, the supply acts as a buck converter in that the output voltage is equal to the input voltage times the duty cycle. When Q4114 is turned on, current flows through CR4105, L4102 and Q4114 charge up C4153 . When retrace begins, the voltage on the anode of CR4105 begins to drop but the current I 1 (figure 3) continues to flow through it because of inductor L4102 . When the voltage V2 (figure 3) decreases to -0.7 volts, CR4105 turns off and CR4103 turns on and conducts I 1 until it drops to zero. During this time Q4114 remains on to conduct the current I1 until it drops to zero. The timing of the turn off of Q4114 can be seen in figure 3. The falling edge of voltage V3 is the signal that turns off Q4114. The turn off time of Q4114 is fixed and the turn on time varies in response to the PWM (Pulse Width Modulator) control circuit.

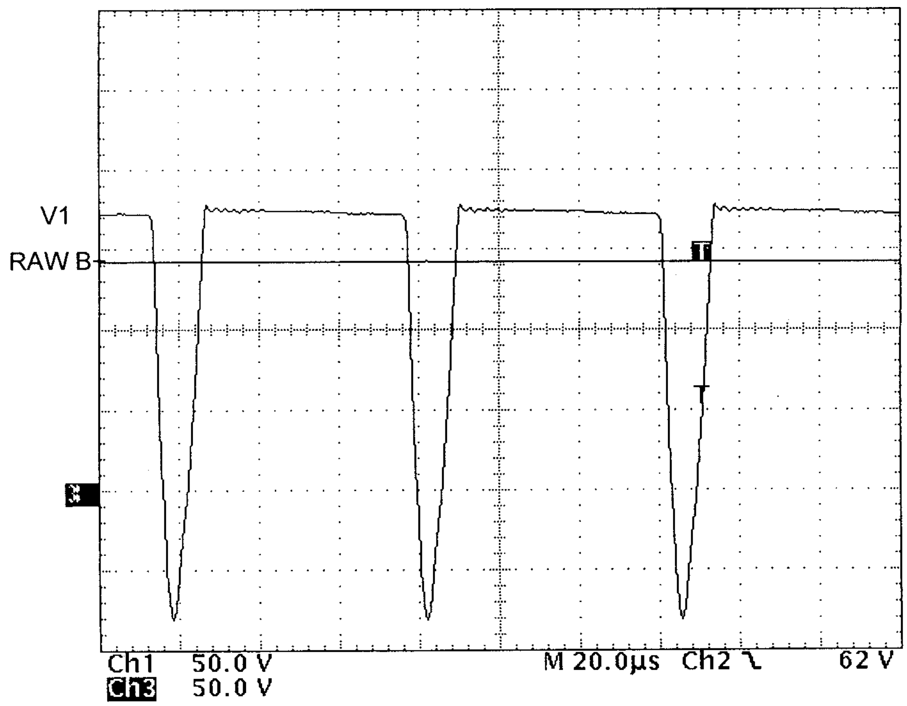


Figure 2

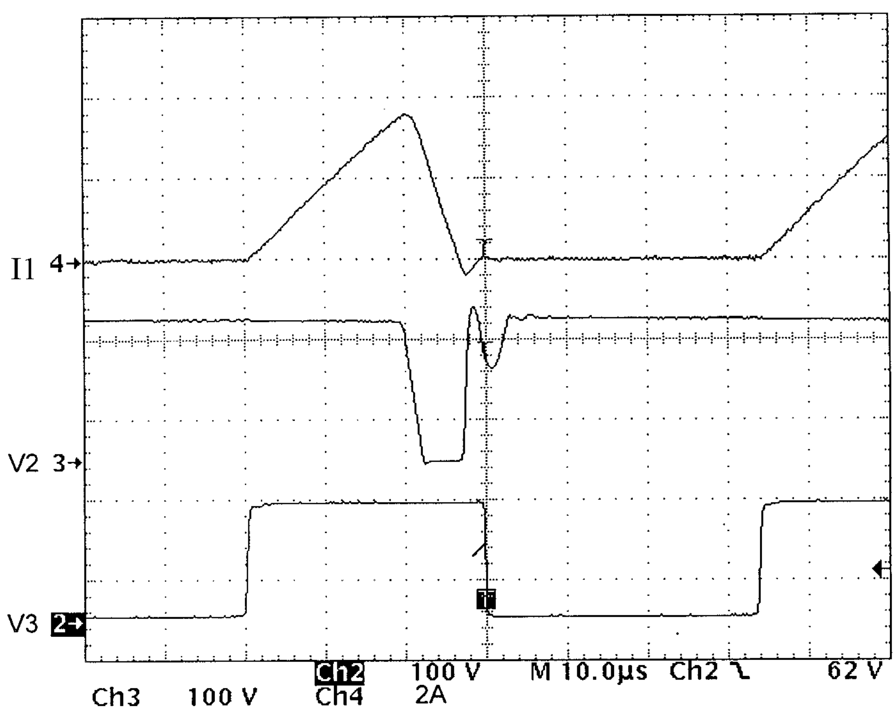


Figure 3

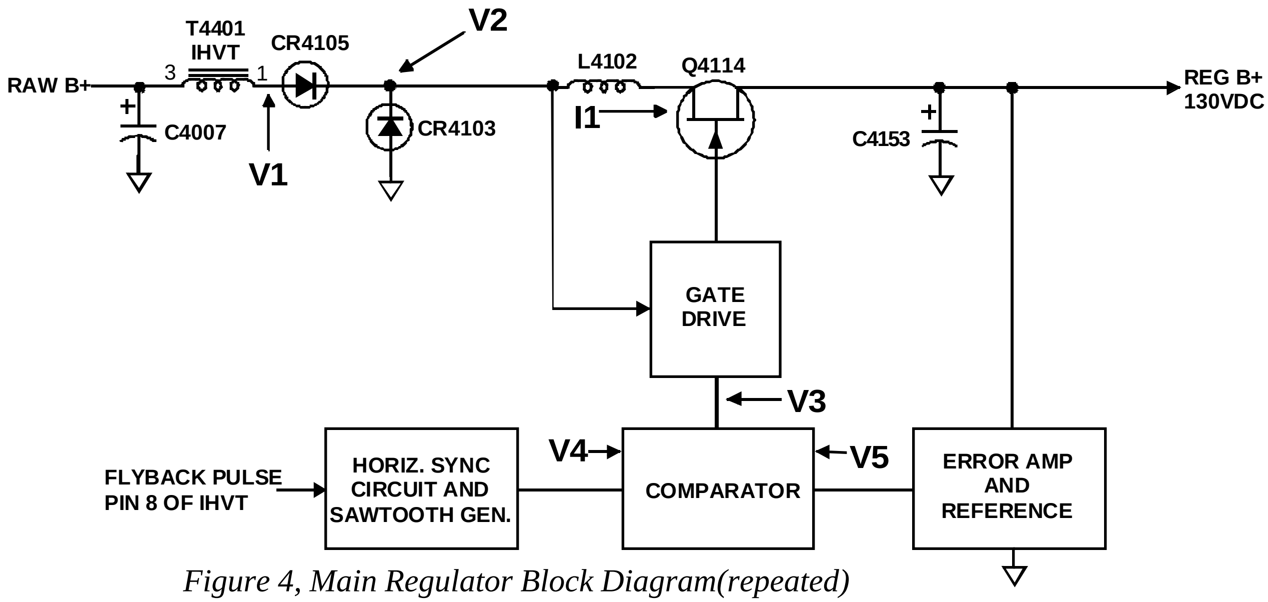


Figure 4, Main Regulator Block Diagram(repeated)

The PWM is made up of the horizontal sync circuit and sawtooth generator block, the comparator block, and the error amp and reference block (figure 4). The horizontal sync and sawtooth block generates a sawtooth voltage V4 (figure 5). This signal and the error voltage V5 from the error amp block are fed into the comparator block which generates the gate drive voltage V3. There is a small time delay after voltages V4 and V5 cross and a state change in V3 occurs. This is due to the slow response of the comparator block.

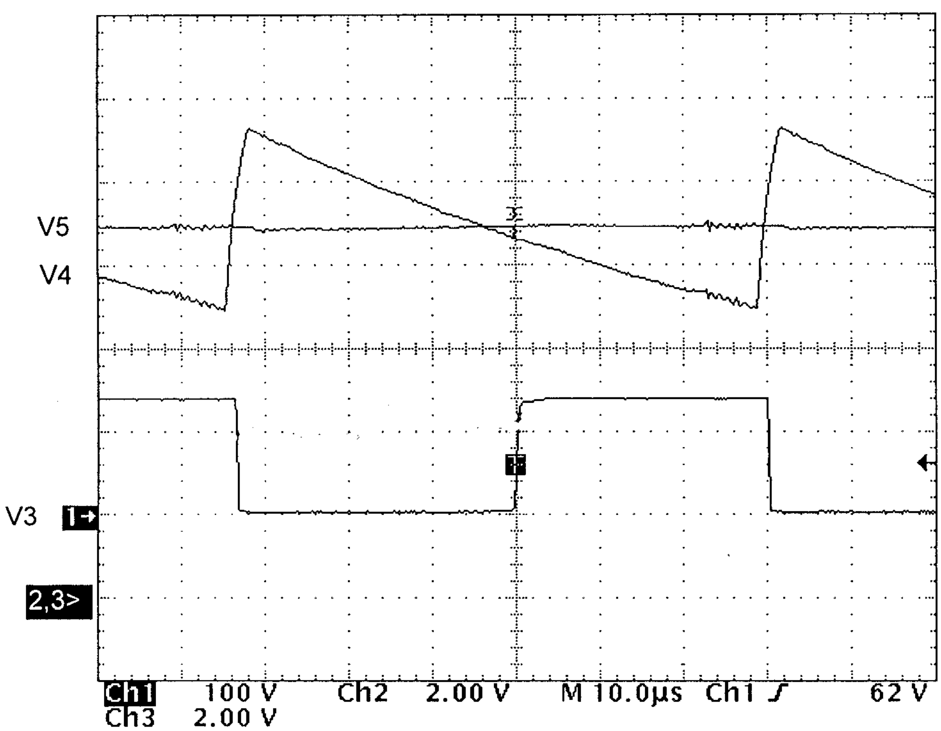


Figure 5

The gate drive block generates a 9 volt supply which floats above Reg B+. This voltage is needed to switch Q4114 on. The floating supply is generated using a charge pump coupled to the cathode of CR4105. When V2 is negative, charge is stored on a C4138 and when V2 rises after the retrace interval, this charge is dumped to the floating 9 volt supply.

Circuit Description

Raw B+ comes from a full wave bridge rectifier (not shown) and filter capacitor C4007. R4172 is a bleeder to discharge C4007 when the ac power is disconnected. Capacitors C4104, C4122, C4124, C4134, and C4135 are for RFI suppression. R4146 and C4137 form a snubber for MOSFET Q4114. R4103 is a current limit resistor for Q4114. It limits the gate drive by reducing the 9 volt gate supply with respect to the source terminal of Q4114. R4108 provides gate drive when the chassis is in standby. CR4106 is a protection diode for the gate of Q4114.

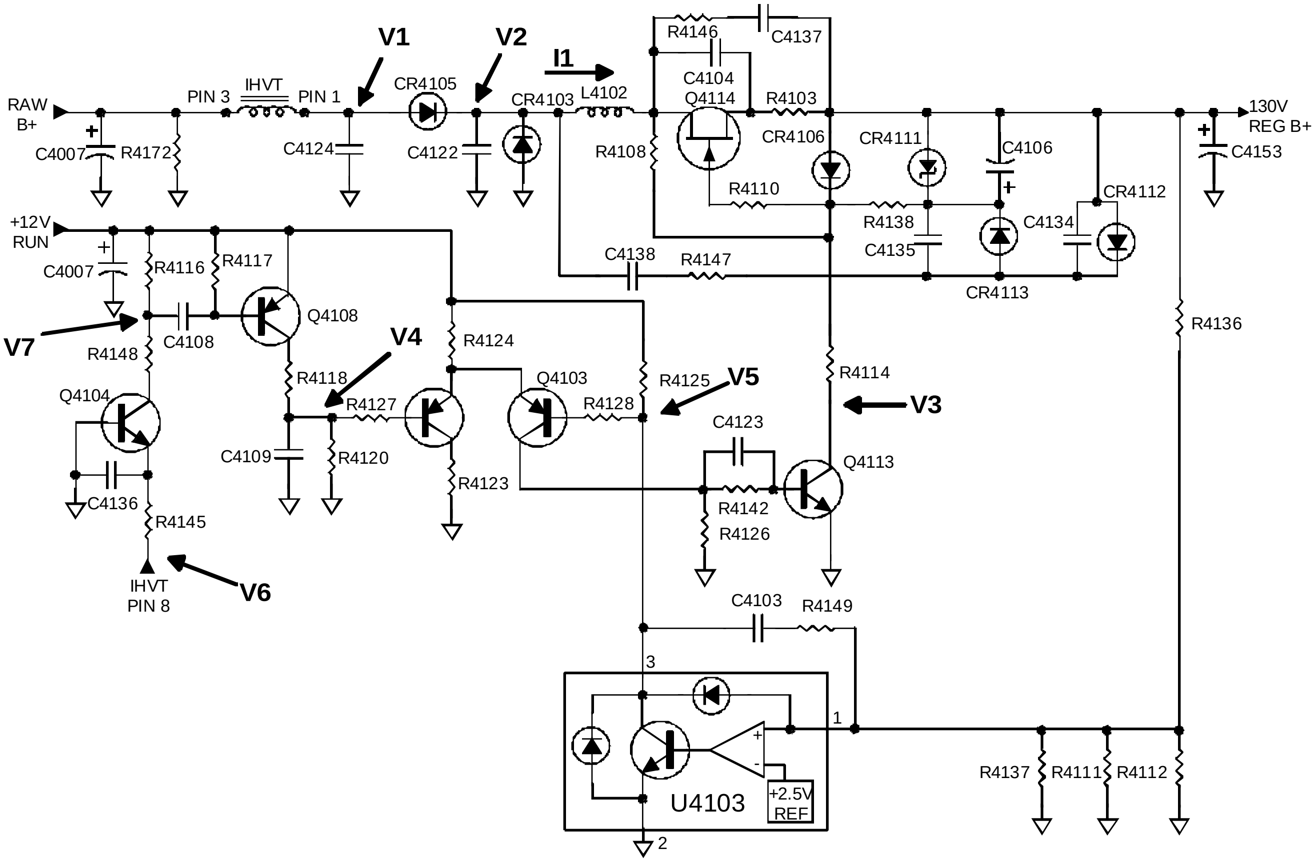


Figure 6, CTC185 Main Regulator Circuit

The 9 volt gate supply consists of C4106 and CR4111. The charge pump is C4138, R4147, CR4113, and CR4112. C4138 is charged through CR4112 during retrace, and discharged into C4106 during trace through CR4113. MOSFET Q4114 is switched on though R4138 and is turned off by Q4113 turning on and bleeding the gate charge off through R4114.

The comparator block consists of Q4102 and Q4103. The inputs to the comparator are the bases of the two transistors. Q4113 serves as a high voltage buffer to switch Q4114. Once input is fed from the error amp and reference block which is formed by U4103 and the voltage sense resistors R4136, R4137, R4111, and R4112, the parallel combination allows the output voltage of the supply to be trimmed to exactly 130 volts. U4103 contains a 1 % voltage reference and the error amplifier in a three lead TO-92 package. C4103 and R4149 provide the gain compensation for the error amp to ensure the power supply is stable into any expected load.

The horizontal sync circuit and sawtooth generator is comprised of two transistors (Q4104 and Q4108). Q4104 provides the time delay which is necessary to keep the MOSFET on until the current through it has dropped to zero. The collector voltage V7 is shown in figure 7 along with the flyback pulse V6 which drives the emitter to illustrate the time delay. The collector is capacitively coupled into the base of Q4108 to provide a short duration pulse which charges C4109. C4109, Q4108, R4118 and R4120 form the ramp generator. The short duration pulse from Q4108 charges C4109 quickly and R4120 discharges C4109 at a slower rate.

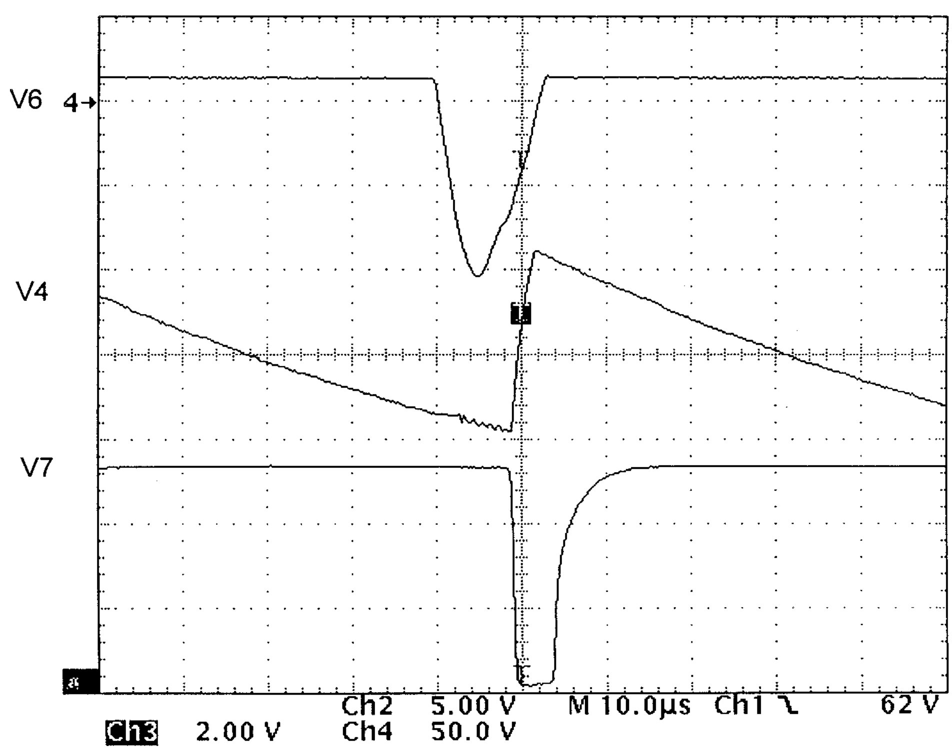


Figure 7

Troubleshooting

Troubleshooting of the power supply can be somewhat difficult because the supply will not operate unless horizontal deflection is working and horizontal deflection will not work unless the power supply is operational. The solution is to bypass the regulator circuit to power deflection and then check the waveforms and DC voltages in the power supply.

1. Apply a short across the drain and source terminals of Q4114 and use a variac on the AC line to control the regulated B+ voltage. If the regulated B+ is allowed to get too high, the XRP circuit will shut off the horizontal oscillator. Therefore, in order to get the chassis to turn on, the variac must be set so as to provide between 90 and 95 volts AC RMS to the chassis.

2. After the chassis is operational use the variac to set the regulated B+ voltage as close as possible to 130 VDC.

3. Use the supplied voltages and waveforms to check the various stages of the power supply for proper operation.

TECH TIP

Two parts that are more likely to fail than others are Q4114 and U4103. U4103 fails most often from excessive voltage on one of its pins. Q4114 failure is most often caused by applying an excessive load to the output. If the horizontal output transistor (Q4401) were to short, Q4114 will also short and blow the fuse.

TECH TIP

Do not de-energize any power supply or yoke lead by directly shorting it to ground. If it is necessary to de-energize any point on the chassis or deflection yoke, do so by grounding that point through a 1K ohm resistor. The reason is that discharging power supply or yoke leads directly to ground can cause a failure of the regulator output transistor Q4114.

This does not apply when discharging the CRT anode. In that case, discharge by directly shorting to the CRT ground braid.

CTC185 Standby Power Supply

Overview

The standby power supply in the CTC185 is derived from a dropping resistor connected to a three terminal 12 volt regulator IC (U4102). The power comes directly from the half wave rectified AC line. The microprocessor turns off the T4-Chip (U1001) in the standby mode to remove the load from the standby supply. This is to conserve power because the standby supply cannot continually supply the power needed to operate the T-Chip. The standby supply timing for the T4-Chip is important because the current needed to run the micro and the T4-Chip together is derived from C4154 until the +26V run supply supplements it. When the charge stored on C4154 is depleted, the +12V standby supply will drop and the T4-Chip will be turned off automatically.

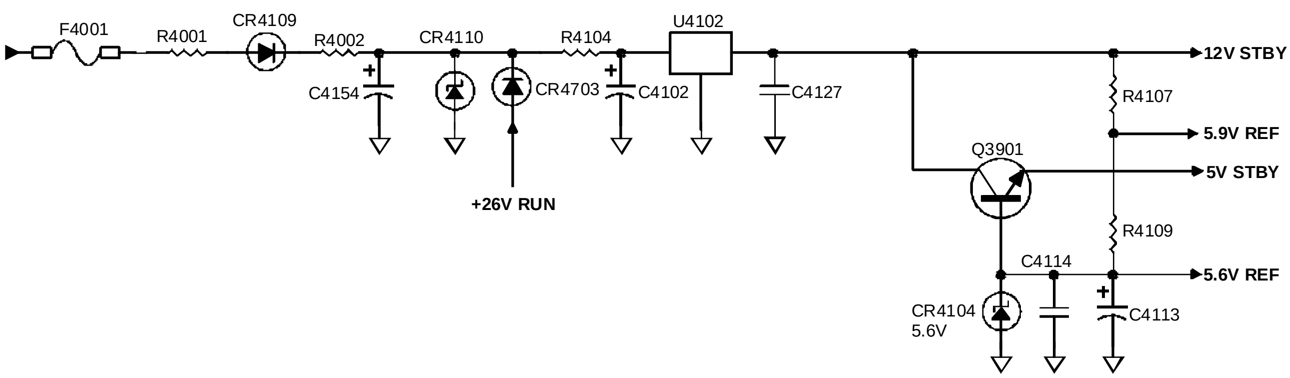


Figure 8, CTC185 Standby power Supply

Circuit Description

The AC power line is rectified by CR4109 and CR4004 and fed through R4002 to filter capacitor C4154. Zener diode CR4110 limits the voltage to 27 volts so that regulator U4102 is not damaged by excessive voltage. Diode CR4703 supplements the standby power supply when the chassis is running from the +26V run supply. The power necessary to run the chassis during turn-on comes from C4154. U4102 provides a regulated 12 volt output to run the standby loads in the chassis. Zener diode CR4104 is used to provide a 5.6V and 5.9V reference for the system control circuitry.

The T4-Chip power control circuit consists of Q4115, R4143, R4144, and the microprocessor. The signal labeled as STBY_SW is a pin on the microprocessor which is pulled low to turn on Q4115 and apply power to the chassis.

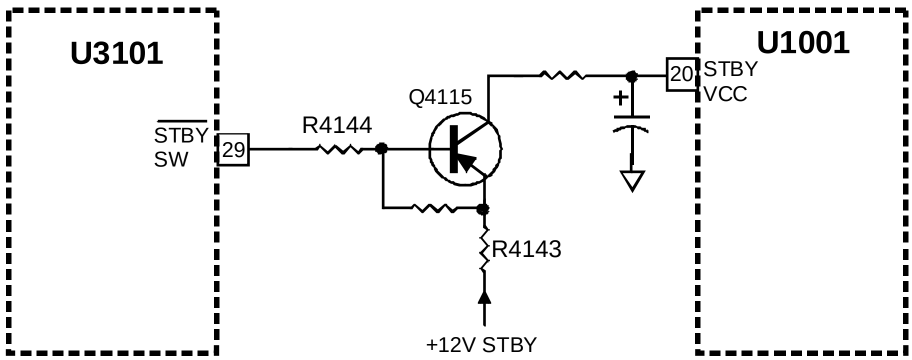


Figure 9, T4-Chip Power Control

Troubleshooting

Dead Set

The turn on sequence for the T4-Chip requires precise timing. Recall that C4154 only stores enough charge to get the set going. The scan derived +26 volts is necessary to re-supply the voltage to keep the T4-Chip powered.

1. Measure the output of U4102 for +12 volts. If it is not present, verify that the T4-Chip (U1001) is not turned on by measuring pin 20 for any voltage greater than zero. If there is, the switch transistor (Q4115) is turned on causing the standby supplies to pulled down.

2. The standby supply can be supplemented with an external +26 volts applied to the cathode of CR4703. This will provide a constant supply so the T4-chip can run.

System Control

The system control circuit in the CTC185 chassis is responsible for controlling all functions in the TV. Like the CTC177 and CTC179, the CTC185 control system includes a microprocessor (U3101), a signal processing IC, referred to as the T4-Chip (U1001), the Electrically Erasable Programmable Read-Only Memory (U3201), and the tuner PLL IC (U7401).

The microprocessor receives input from the infrared remote receiver (IR3401) and the front keyboard and executes instructions to control the television based on those inputs. The EEPROM is a storage device that stores data such as alignment values, T4-Chip register values and the channel scan list. It is non-volatile, meaning that it stores its contents even with power removed. The tuner PLL controls the frequency synthesizer of the tuner in order to tune the various channels. The T4-Chip is the heart of the television and controls all aspects of the deflection and signal processing. The T4-Chip is discussed in more detail in the signal processing section of this manual.

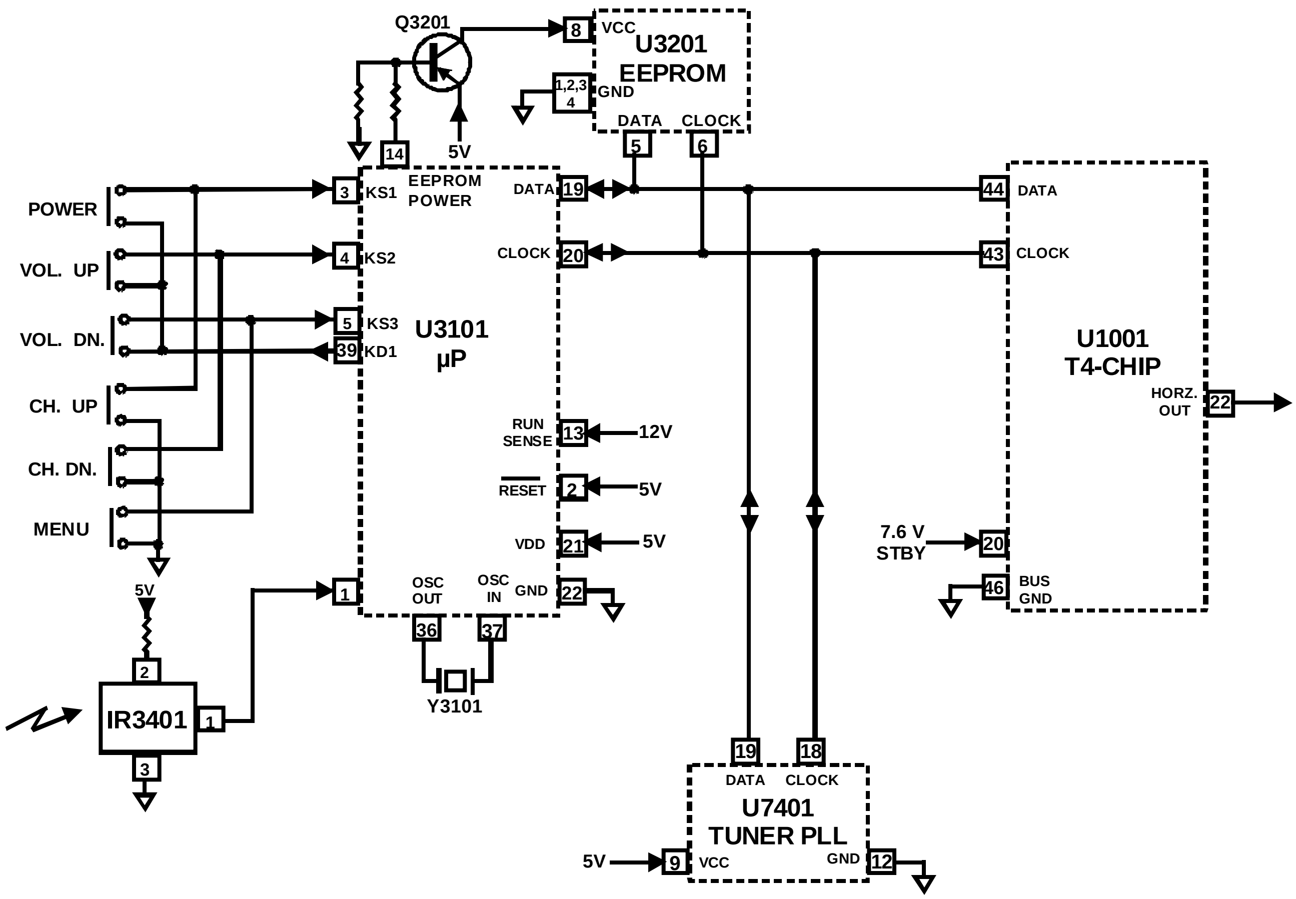


Figure 10, CTC185 System Control block Diagram

Data Communications

Data communications are carried via the two wire I^{2}C ("I Squared C") bus. All four devices, U3101, U3201, U1001 and U7401, communicate using the data and clock lines related to this bus.

After reset, the microprocessor loads some initial configuration data from the EEPROM (U3201). If it can't read fom the EEPROM, the micro continues to try to get a response from the EEPROM. This can be seen as constant data activity on the data line. The microprocessor also turns power off to the EEPROM and then back on repeatedly, via Q3201, in an attempt to reset the EEPROM. Once EEPROM has been read succesfully, the data bus is quit while the TV is in the standby mode.

When a power button is pressed or an ON command from the remote control is received, data activity begins. The CTC185, like the CTC177/187, reads status information back from U1001. The status register reports back the following information:

• Power-On-Reset (POR)
• X-ray Protection Fault (XRP)
• Horizontal Lock Detector
• Automatic Fine Tuning (AFT)

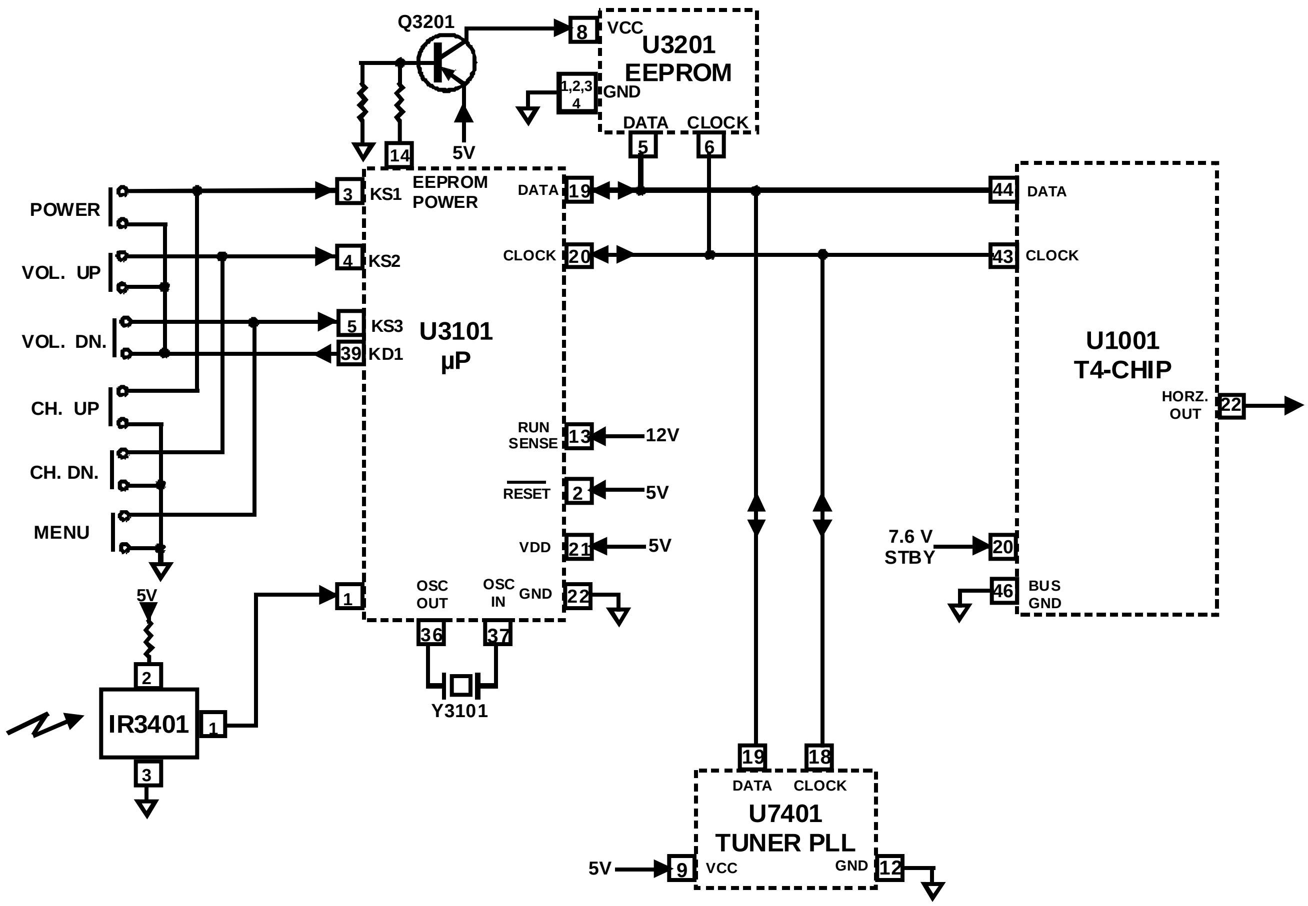


Figure 11, CTC185 System Control block Diagram

POR (Power-ON-Reset)
U1001 has a standby power monitor called POR. This circuit detects when the Standby Vcc has dropped below approximately 6 volts and shuts the IC off by stopping both the PWM and horizontal outputs.

The POR circuit output is latched and reset on the OFF to ON transition of the ON/OFF bit. This means when the TV is ON and a standby transient occurs that triggers the POR circuit, it is necessary to send an OFF command followed by an ON command to get the set started again. If the Standby Vcc is still too low when an ON command is received, the IC will stay in the OFF mode requiring the process to be repeated.

XRP
Although there is an XRP bit in the status register sent back from the T4-Chip, the run sense line (U3101 pin 13) informs U3101 when an XRP or POR condition has occurred When the XRP input is above the reference value, the comparator's output will turn the TV off by stopping both the PWM and Horizontal outputs.(See the XRP circuit in the Horizontal Deflection section of this manual.)

The XRP bit is latched internally and gets reset at the ON to OFF transition of the ON/OFF bit. This means to restart the TV after an XRP trip, the microprocessor must first send an OFF command followed by an ON command.

Horizontal Lock Detector
This detector compares the position of the flyback pulse with the sync of the video signal. While this detector can be used to detect the presence of an active channel, it is not used for tuning. A separate sync pulse input is applied to pin 12 of U3101 for that purpose.

Periodic Updates
In addition to reading the status register, the microprocessor continually updates the registers in U1001 approximately once every second with data stored in the EEPROM. In other words, alignment information stored in the EEPROM is constantly being loaded into the T4-Chip. This prevents electrical disturbances such as kine arcs from corrupting the information in U1001. This updating does not take place, however, when the TV is in the service mode.

Run Sense
U3101 pin 13 monitors the presence of the run 12V. This is a scan derived supply from pin 8 of T4401, the IHVT (Integrated High Voltage Transformer). If this supply is not present, the micro will place the TV in the off mode and try to re-start the set. If there are three failed attempts in one minute, the micro places the television in the off mode. The ON command from the front keypad or remote control must be initiated again to start the process over.

Keyboard Interface

The keyboard interface is similar to the other schemes used on the color television chassis. The POWER, VOL. UP and VOL. DN switches short their corresponding sense line to the drive line, which is normally held low. The other three switches pull KS1, KS2 and KS3 to ground. When U3101 detects a low on any sense line, this indicates a key has been pressed. The drive line is then raised to determine which particular key. If the active sense line remains low, the key pressed was the one shorting to ground. U3101 will then initiate the appropriate function based on which key was pressed.

IR Input

Infrared remote signals are demodulated and amplified by IR3401 and appear at U3101 pin 1 as 5 Vp-p negative going data pulses. When no IR is received, the DC level at U3101 pin 1 is 5V. IR3401 is powered by the 5V standby supply.

Reset Circuit

The reset circuit starts the microprocessor at a known place in its program. U3101 reset is an active low to pin 2. When AC power is first applied, the reset line will remain low a minimum of 12ms once the 5V STBY supply reaches 4.5 volts. This allows the internal clock of the microprocessor to come up and stabilize before carrying out instructions. The reset circuit also monitors the condition of the 12 volt standby supply. If the 12 volt standby supply drops below 10 volts, the reset circuit activates and holds the microprocessor in a reset state.

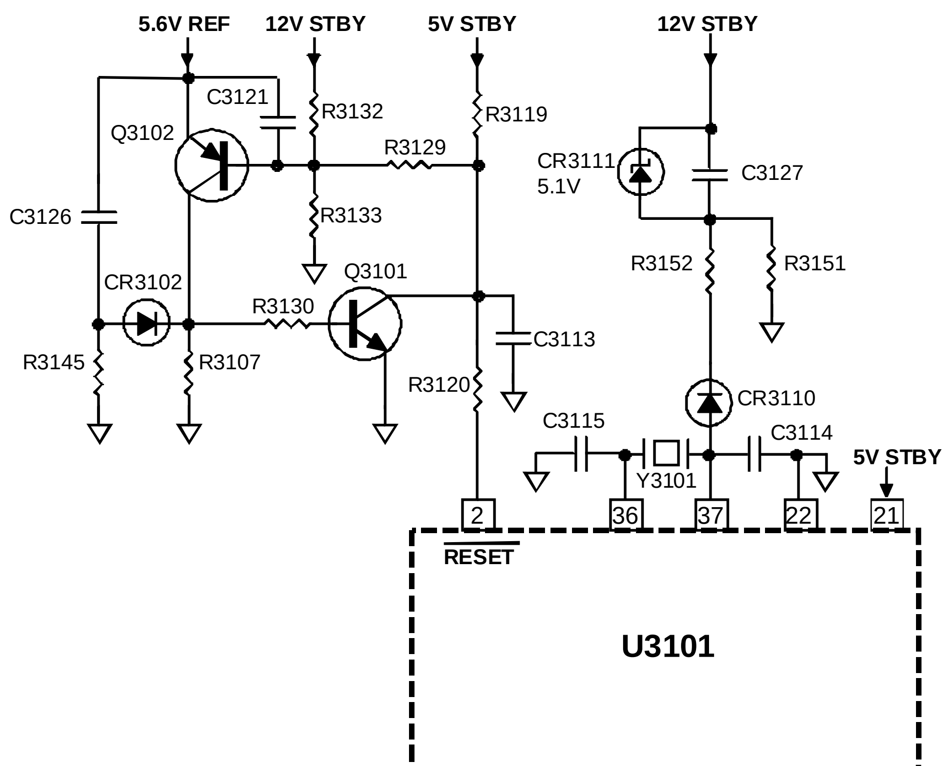


Figure 12, Reset Circuit

A stable 5.6 volt reference is applied to the emitter of Q3102. The 12 volt standby supply is divided by R3132 and R3133 so approximately 6 volts is applied to the base of Q3102. The collector of Q3102 is tied to the base of Q3101. The collector of Q3101 is connected to the 5 volt standby supply and to the reset pin 1 of U3101. Under normal operating conditions, the voltage on the base of Q3102 is at 6 volts which is high enough to keep Q3102 off. If the 12 volt standby supply drops far enough to allow the voltage on the base of Q3102 to drop to 5 volts, Q3102 will turn on. When Q3102 turns on, Q3101 will also turn on pulling the reset line to ground initiating a reset to U3101.

The 8MHz crystal oscillator is also disabled by grounding it through CR3110 and R3151. This ensures that the standby supplies are up and stable before the oscillator is allowed to run. When the 12V STBY rises sufficiently to overcome the 5.1 volt zener voltage of CR3111, CR3111 begins to conduct, raising the voltage on R3151. This will reverse bias CR3110, allowing the oscillator to start

On Screen Display (OSD)

The CTC185 uses the same OSD circuitry configuration as the CTC177 chassis. Red, green and blue outputs from U3101 (pins 17, 16 and 15) drive the red, green and blue OSD inputs on U1001 (pins 34, 35 and 36) producing a full color OSD.

Horizontal and vertical sync are input to pins 26 and 27 of U3101 and are used to control the position of the OSD on the screen.

The Fast Switch (FSW) signal from U3101 pin 18 is an active high signal that switches U1001's RGB signal path to the OSD signal. This switching signal is only present during the time interval that OSD is being displayed. If this signal should ever become "stuck" high, a *no video* symptom would result.

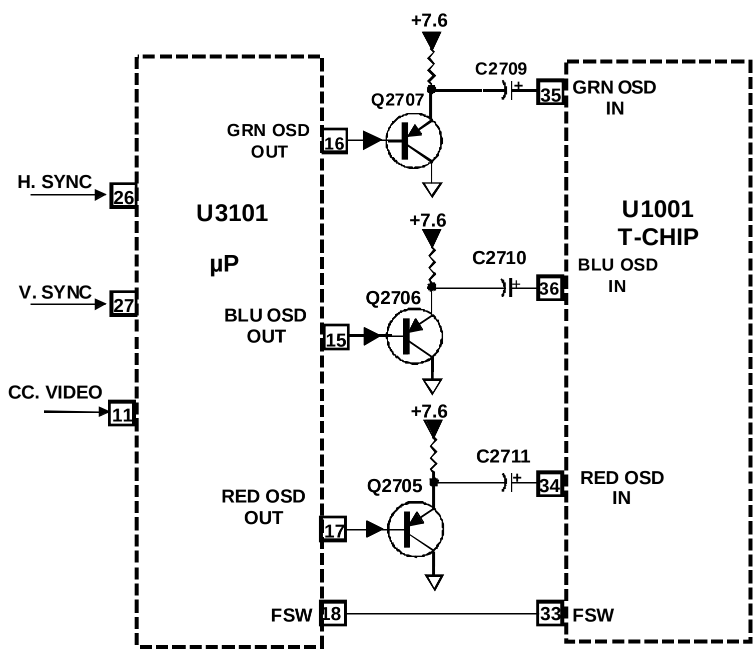


Figure 13, On Screen Display Circuit Block Diagram

Power On Sequence

The power on sequence timing diagram for the CTC185 is shown in figure 14. When the television is first plugged in, the microprocessor "awakens" and goes into the standby mode within 20ms. The micro will then wait for a keyboard button press or IR input from the remote control. Also, when the micro comes on line, it turns the power to the EEPROM off for approximately 50ms and then back on to start the EEPROM in a know state. The EEPROM power is also switched off/on when there is an acknowedgement problem with the EEPROM in an attempt to reset it.

When an ON command is received from the keyboard or remote control, the standby switch line on pin 29 of U3101 goes low. This turns on Q4115, which supplies power to the T4-Chip (U1001) turning it on. Video and Audio are muted in the T4-Chip; the 12V run supply is detected; the T4-Chip registers are initialized with data from the EEPROM (U3201). About the time the run supply is detected, CRT degaussing takes place for approximately 1.5 sec while vertical deflection is killed for approximately .75 sec. Once degaussing is complete, the speaker mute is turned off along with the video and audio mute in the T4-Chip.

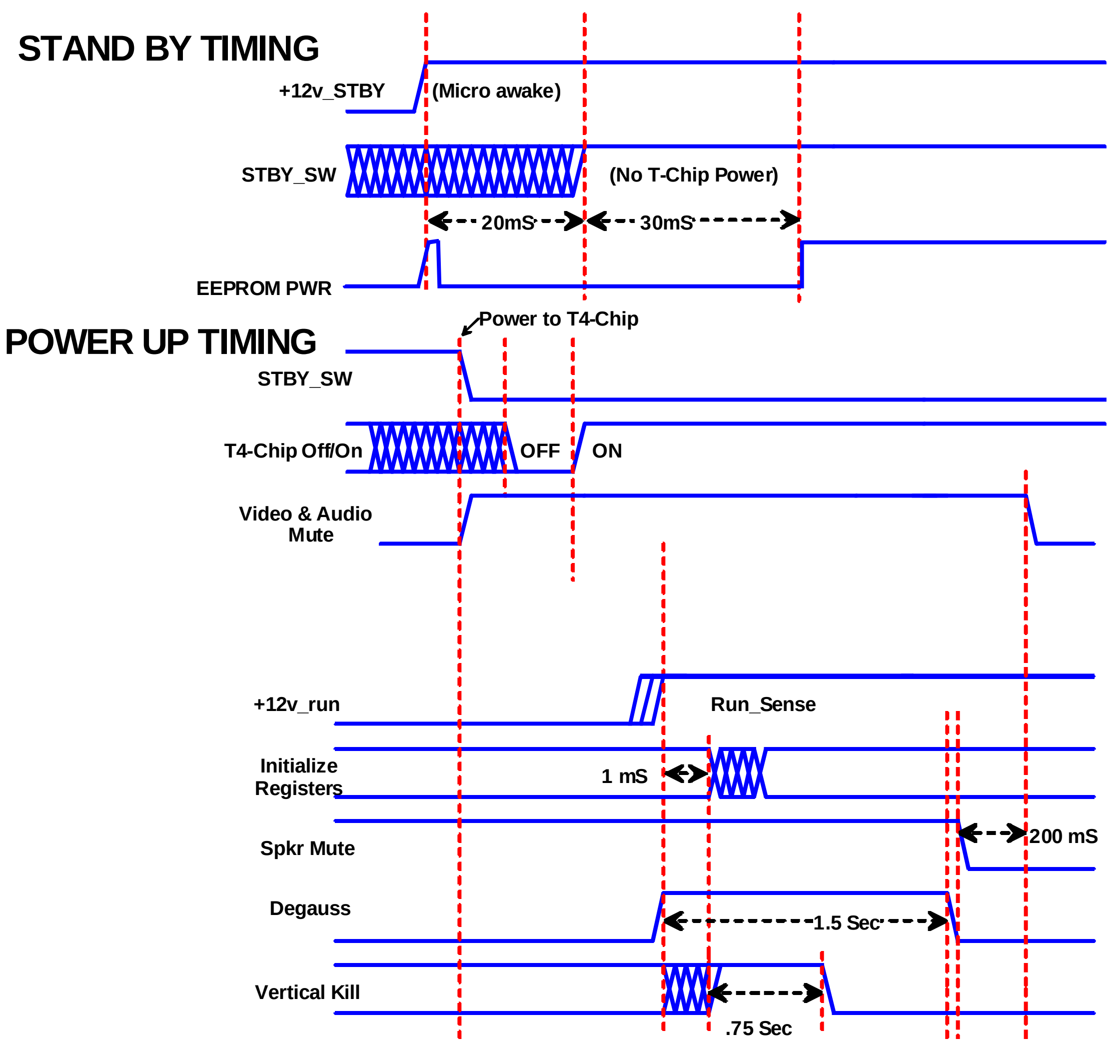


Figure 14, CTC185 Power On Sequence

Troubleshooting

The system control circuit controls every function of the TV. A failure in this circuit will cause the entire TV to malfunction. Because U3101 and U1001 are so interrelated, there is a lot of overlapping in troubleshooting procedures. A failure of U3101, U1001, U3201, or U7401 can make the television completely inoperative. It is important to follow a systematic isolation approach to localize the problem. Because U3101 turns the TV *ON* via a serial data bus command to U1001, a failure in the system control circuit can result in a DEAD SET condition.

Dead Set

1. Make sure the standby power supplies are working. (12, 7.6 & 5). Remember that the standby supplies only have enough charge to start the set. Re-supply current from CR4703 is necessary to keep the set going. An external +26V can be used to hold the voltage up.

2. Check for horizontal drive pulses out of pin 22 of U1001 when the power button is pressed. If the pulses are there *even momentarily*, system control is working and the problem is in the deflection circuits or the 12V run supply. If the pulses do not appear, check the 7.6 volt standby voltage on pin 20 of U1001. Place an external +26V on the cathode of CR4703 to provide this voltage. If the supply is not present on pin 20, unsolder the pin and see if the supply comes up on the pad. If it does, U1001 is defective. If it does not, trace the supply back to its source. If 7.6 volts is present on U1001 pin 20 in circuit with the +26V applied, go to the next step.

3. Check for standby 5 volts on pin 21 of U3101. If it is missing, check the power supply. If present, go to the next step.

4. Check the reset pin 2 of U3101 for 5 volts. If it is low or missing, check the reset circuit. If it is, go to the next step.

5. Check pins 36 and 37 of U3101 for a 5 Vpp oscillator. If the signal is not 5 Vpp, check Y3101 and its peripheral components. If the signal is completely absent, suspect U3101 or Y3101. If the 8 MHz signal is present, go to the next step.

6. Monitor pins 19 and 20 of U3101. There should be no data activity in the standby mode. When the power button is pressed, 5 Vpp (5VDC pulsing low) data pulses should appear. If no pulses appear when the power button is pressed, unsolder pins 19 and 20 and check the pins for constant data activity.

   Note: When U3101 is reset, it loads intialization data from U3201. Under normal conditions, it immediately receives this data and ceases data activity . With the data and clock lines disconnected, U3101 continues data activity looking for U3201. This is normal and indicates U3101 is working.

   TECH TIP

   If no data activity is seen on U3101 pins 19 and 20 with the pins out of circuit, U3101 is probably defective. If data activity is present, reconnect the pins and go to the next step.

7. Having confirmed data activity on pins 19 and 20 of U3101 out of circuit, disconnect pins 5 and 6 of U3201. Check for data activity in the standby mode on the circuit board copper side of U3201 pins 5 and 6. If data activity is present on the pads for those pins with the IC out of circuit, check U3201 and re-initialize it with Chipper Check™. If no data activity is seen on the circuit board with U3201 out of circuit, connect the IC and go to the next step.

8. Unsolder pins 43 and 44 on U1001. Check to see if the data pulses are present on the copper pads. If data pulses are present, U1001 is most likely defective. If no data pulses appear, suspect an open connection or resistor, or possibly a leaky capacitor on the data bus.

9. Once the problem is isolated and repaired, do not forget to re-connect any parts that may have been unsoldered during troubleshooting.

TECH TIP

Dead Set - "Clicking On and Off"
If the tuner PLL IC fails to acknowledge once the set is turned on, the micro will turn the set off, then back on in order to try to clear a fault on the bus. This will continue indefinately causing the degausing relay to "click" at about a 2 Hz rate.

1. Check the 5 volts to pin 9 of U7401. If it is present, suspect a defective U7401. If the supply is not there once the set is turned on, troubleshoot the 5 volt run supply.

Chipper Check

The CTC185 chassis supports the use of the Chipper Check™ servicing software. Although it is possible to align the chassis using the built-in front panel service menu (see the CTC185 service data for information regarding the service menu alignments), Chipper Check™ is a more comprehensive and powerful alignment tool and is the preferred method. Chipper Check™ connects to the chassis at J3101, figure 15. The chassis must be placed into the service mode before connecting the Chipper Check™ interface. This is done by holding down the menu button, and pressing POWER, and then VOL+ while the menu button is being held down (TV front panel only. The remote control cannot be used for this.) This will bring up the initial alignment menu. Next, release the menu button and use the VOL- button change the number on the far right to “200”. Then press the CHANNEL UP or DOWN button to enter the service mode. Note that once the television is in the service mode, the front keyboard and remote control will not function and it will be necessary to remove AC power to exit the service mode. Once the television is in the service mode, the Chipper Check™ interface can be connected. Follow the electronic documentation in the help files that comes with the Chipper Check™ software. The help files are updated regularly and contain the latest information regarding Chipper Check™.

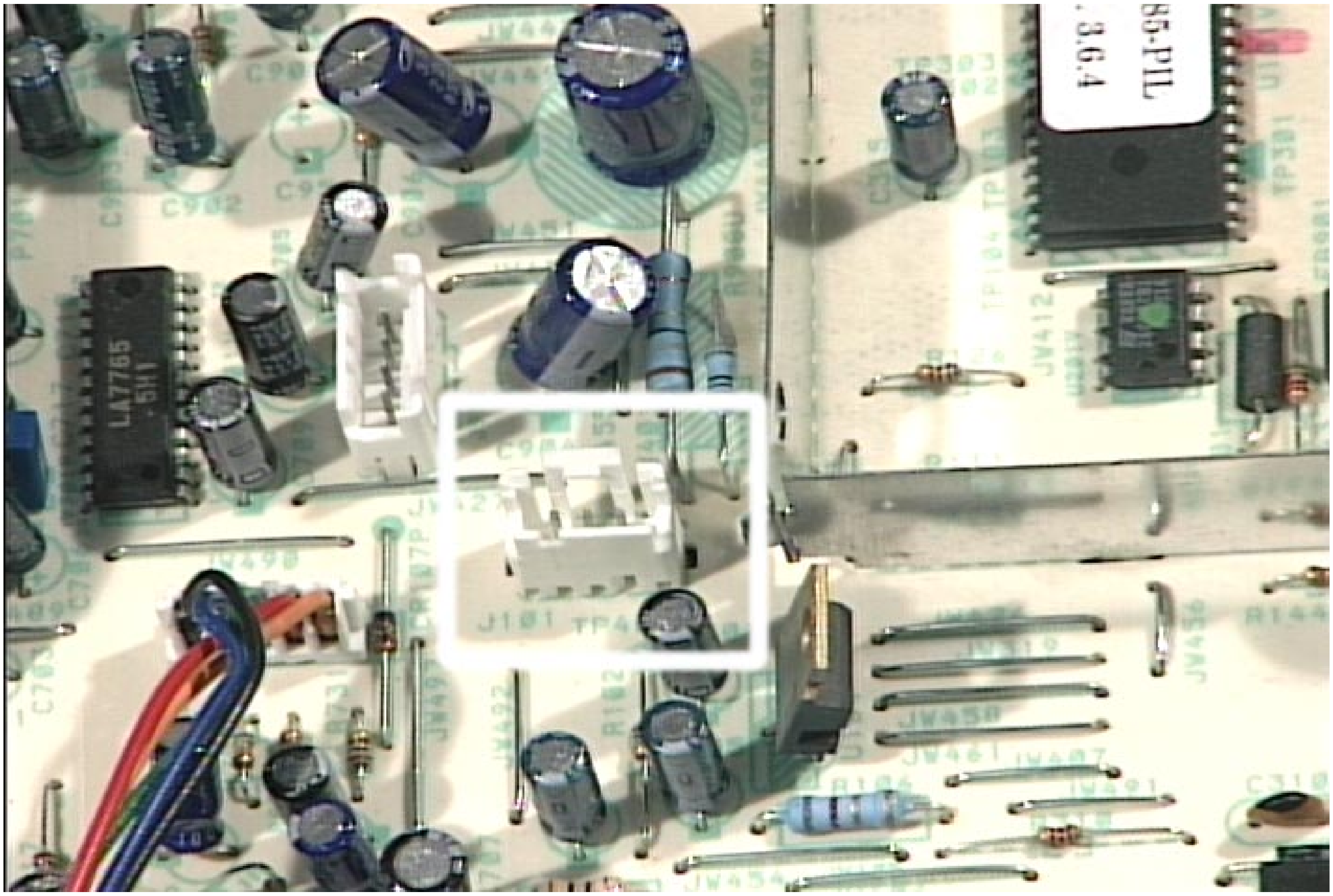


Figure 15, Chipper Check Connector

Horizontal Deflection

The horizontal deflection circuitry is responsible for generating a current ramp through the horizontal windings of the yoke to deflect the electron beam from left to right. In addition, the horizontal output circuitry generates the high voltage necessary to bias the CRT.

U1001 (T4-Chip) performs low level horizontal processing. The functions performed in U1001 are very similar to previous chassis such as the CTC177. Most functions are controlled via the I^2C serial data bus. The horizontal processing circuits contained in U1001 are:

- Horizontal Automatic Frequency Control (AFC)
- Horizontal Automatic Phase Control (APC)
- Horizontal Drive
- East West (EW) Pincushion Correction
- X-ray Protection
- Horizontal Vcc Standby Regulator

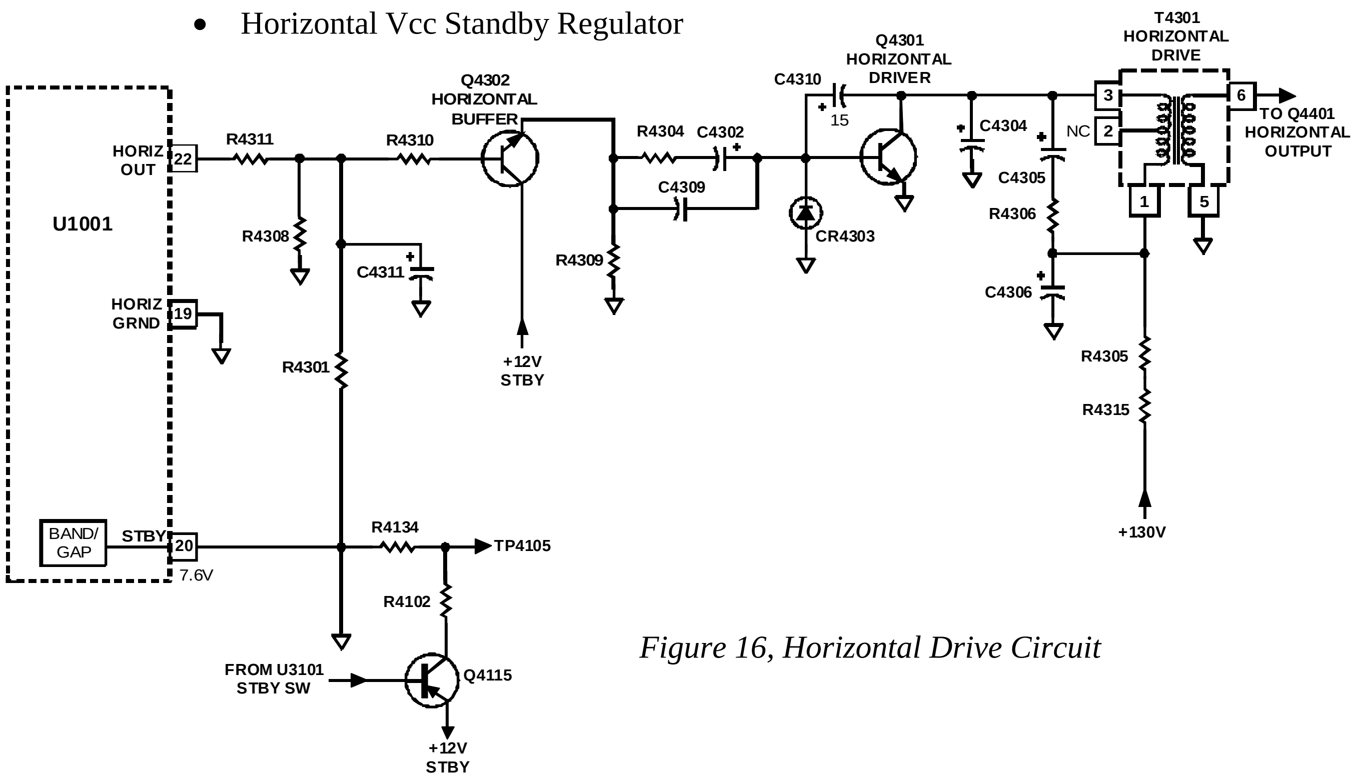


Figure 16, Horizontal Drive Circuit

The horizontal drive and output circuits are conventional in design. The horizontal drive section of U1001 is similar to the CTC177. The output at pin 22 is an open collector that is low (on) when horizontal drive is on. The pulse width is adjustable from 32µsec to 36µsec via serial bus commands to T4-Chip register H. Duty (Horizontal Duty). This is set at the factory and is not adjustable in the field.

Q4302 is the horizontal drive buffer that capacitively couples the drive signal to the horizontal driver Q4301. Q4301 drives the primary of T4301, the horizontal drive transformer, to provide the current step-up needed to produce about 1 amp of base drive to the horizontal output transistor, Q4401.

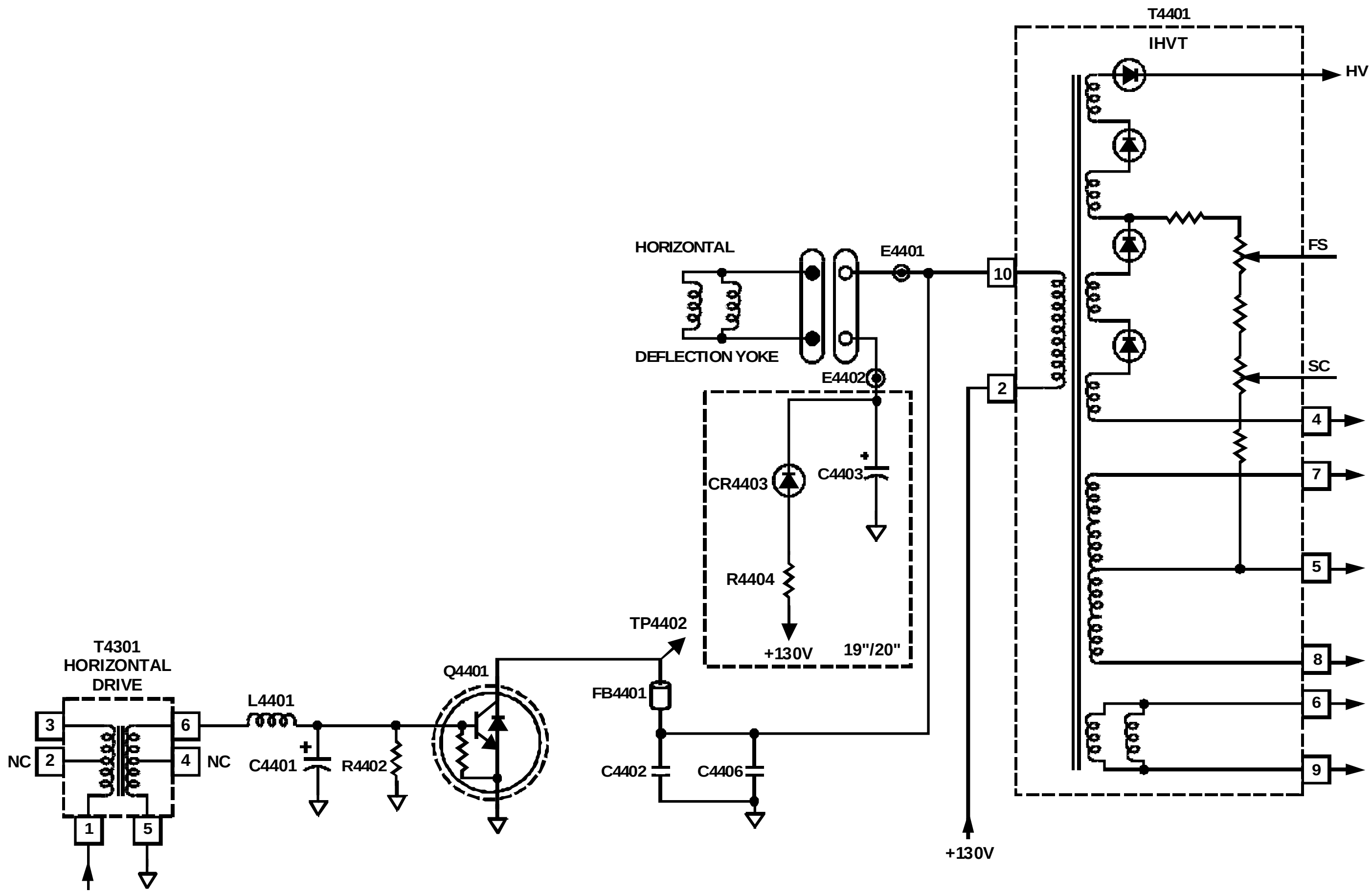


Figure 17, 19" and 20" Horizontal Output Circuit

Q4401 is an integrated transistor/damper diode package used as the horizontal output transistor. The collector of Q4401 is connected to pin 10 of T4401, the IHVT. The 130 volt B+ is input on pin 2 and the horizontal yoke is connected to pin 10 of T4401. The switching action of Q4401 will cause the yoke and retrace capacitor, C4402, to resonate creating a 1000 Vpp retrace pulse. The retrace pulse induces a voltage in the secondary of the IHVT to create the high voltage and scan derived power supplies. The electron beam is scanned across the screen by the resulting current sawtooth through the yoke. There are slight variations in circuitry between the small screen components and the large screen. These differences are shown in figures 17 and 18.

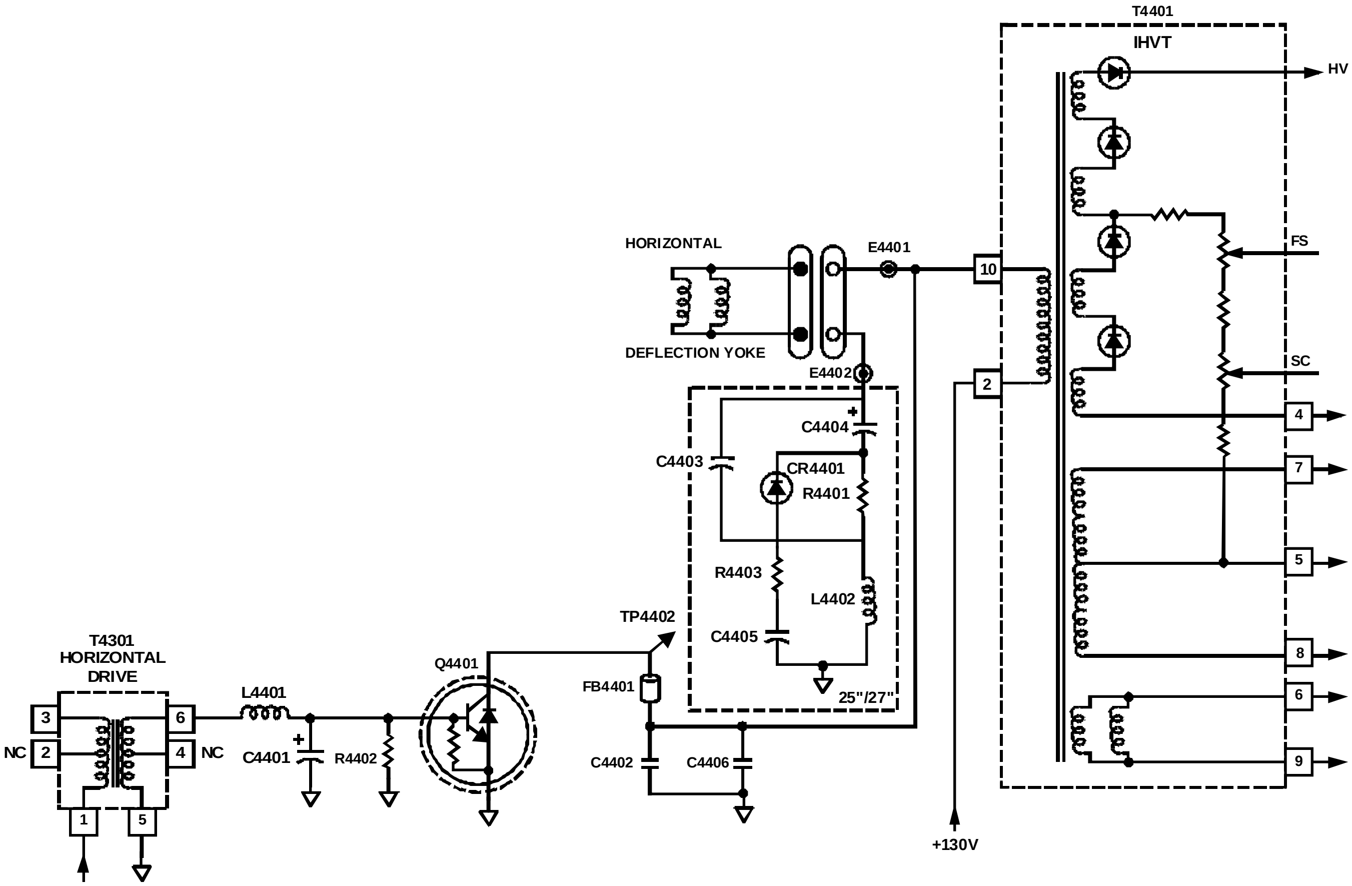


Figure 18, 25" and Larger Screen Horizontal Output Circuit

Horizontal AFC and APC

The purpose of the AFC and APC is to maintain proper synchronization between horizontal scan and the incoming sync signal. The T4-Chip employs a “two-loop” approach to accomplish this task. The first loop is the AFC and second loop is the APC. The AFC phase locks the horizontal oscillator to the incoming sync signal. The APC locks the phase of the horizontal output to the phase of the horizontal oscillator. This type of frequency control system is similar to the one used in the CTC149 and is superior to the single loop system seen in the CTC159 and CTC169 family of chassis. This is because it is adjustable for good noise immunity in the presence of noisy signals and can track rapid phase changes in signals from VCR’s. There is a one bit register in the T4-Chip that is adjusted to obtain optimum performance. The register is called AFC Gain. This register is adjusted at the factory and cannot be aligned in the field. The external circuit at pin 21 of U1001 is the loop filter for the phase lock loop (PLL) and is used to optimize the frequency response of the AFC loop.

The APC loop is used to track out the phase errors due to variable delays in the horizontal driver and output circuit. The APC has a two bit register (APC Gain) that controls the gain of the APC loop. APC Gain like AFC Gain is preset at the factory and cannot be adjusted by the service technician. The reference signal for this loop is a flyback pulse applied to an RC network and input to U1001 pin 23.

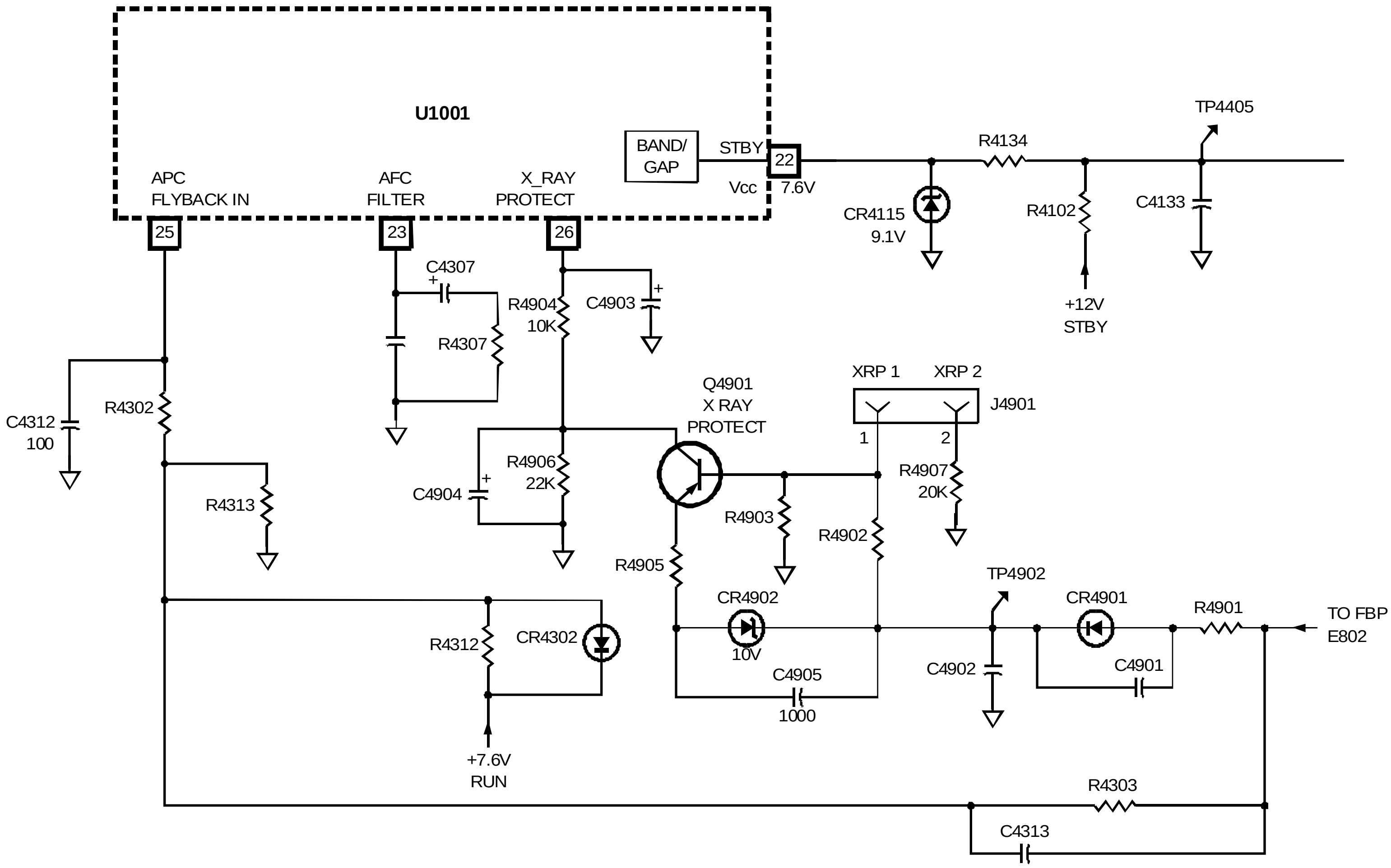


Figure 19, Horizontal APC/AFC and XRP Circuit

Horizontal Alignments

Although AFC and APC Gain are fixed adjustments at the factory, one horizontal alignment is accessible to the service technician:

- Horizontal Phase

Horizontal Frequency Adjustment

There is no servicer accessible provision to adjust the horizontal frequency.

U1001 also has a four bit register to control sync to flyback phase. This is accessible to the servicer through the service menu and is used to center the video on the CRT.

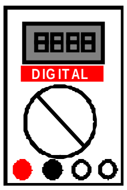
Horizontal Phase

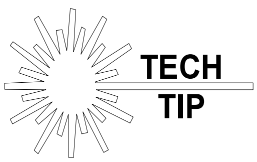
1. Set service menu to alignment #01.
2. Adjust value range to center picture left to right.

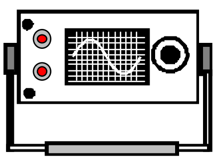
Troubleshooting

Dead Set

A failure in the horizontal circuitry will most likely cause a dead set symptom.







1. Check the collector of Q4401 for +130 volts. If missing, check for a shorted Q4401 and troubleshoot the power supply. If present, go to the next step.

   Note: On the CTC185 chassis if the horizontal output transistor is shorted, check for a shorted Q4114 in the power supply. It is likely a shorted horizontal output transistor will take out the regulator.

2. Check for 7.6 volts on pin 20 of U1001. If it is not there, check the 12 volt standby supply. If it is there go to the next step.
3. Check pin 22 of U1001 for horizontal drive pulses when the power button is pressed. If no pulses are seen, see dead set troubleshooting in the “System Control section of this publication. If they are present, go to the next step.
4. Check for horizontal drive pulses on the emitter of Q4302 and the collector of Q4301. If they are missing, check the corresponding stages. If they are there, go to the next step.
5. Check the drive to signal to the base of the horizontal output transistor, Q4401. If it is present, suspect a defective Q4401. If it is not, suspect a defective T4301

No Horizontal Sync

1. Check for the APC feedback signal to pin 23 of U1001. If missing, trace it back to T4401, the IHVT. If the signal is present at pin 25, go to the next step.

X-ray Protection

The XRP (X-ray Protection) circuit shuts the TV down before high voltage climbs high enough to pose an x-ray hazard. The circuit rectifies a flyback pulse at CR4901 and applies the voltage to the base of Q4901 through a voltage divider and to the cathode of a zener diode, CR4902. Q4901 is a PNP transistor that is off under normal operating conditions. When high voltage rises high enough to overcome the 10 volt zener diode, CR4902 conducts and applies a positive voltage to the emitter of Q4901, turning it on. This applies a positive voltage to U1001 pin 24, causing horizontal drive to shutdown. The shutdown is a latching shutdown and will reset when the voltage on pin 24 is removed; however, the system control circuit will toggle the set to the “off” state if the set fails to start after three tries. The power on/off button will have to be pressed to attempt to re-start the set again.

Troubleshooting

A failure in the XRP circuit can shut the TV down and/or keep the set from turning on completely.

XRP Shutdown

1. If the set tries to start three times and then stays off (noticeable by the degaussing relay clicking), the set is in XRP shutdown. Also, monitor pin 24 of U1001 with an oscilloscope while pressing the power button. If DC voltage (>.6V) appears momentarily as the set shuts down, the set is going into XRP shutdown. If no voltage appears at pin 24 and the set fails to turn on, XRP shutdown is not the problem.
2. Check Q4901 and CR4902. **Note: all the components in the XRP circuit are safety critical components and must be replaced with the exact originals.** Follow the guidelines set forth in the service data.

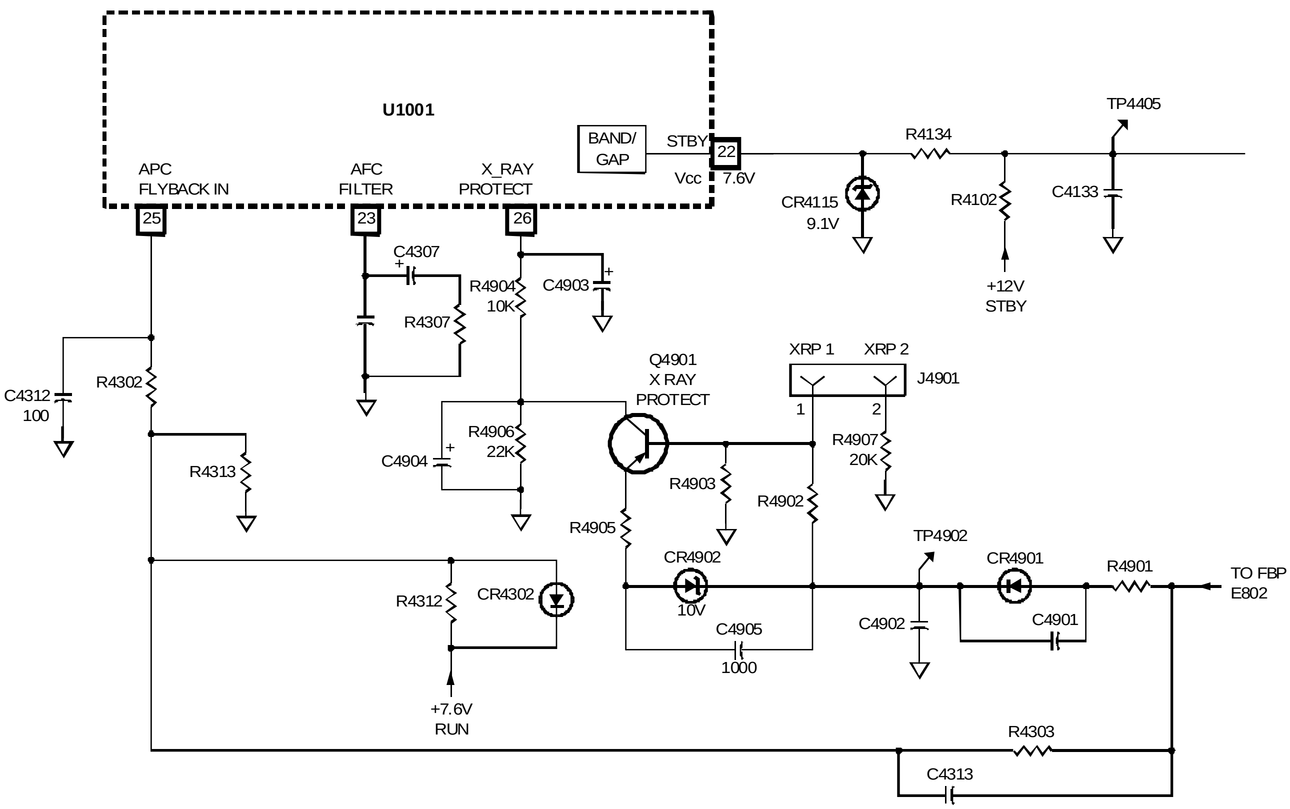


Figure 20, Horizontal APC/AFC and XRP Circuit (repeated)

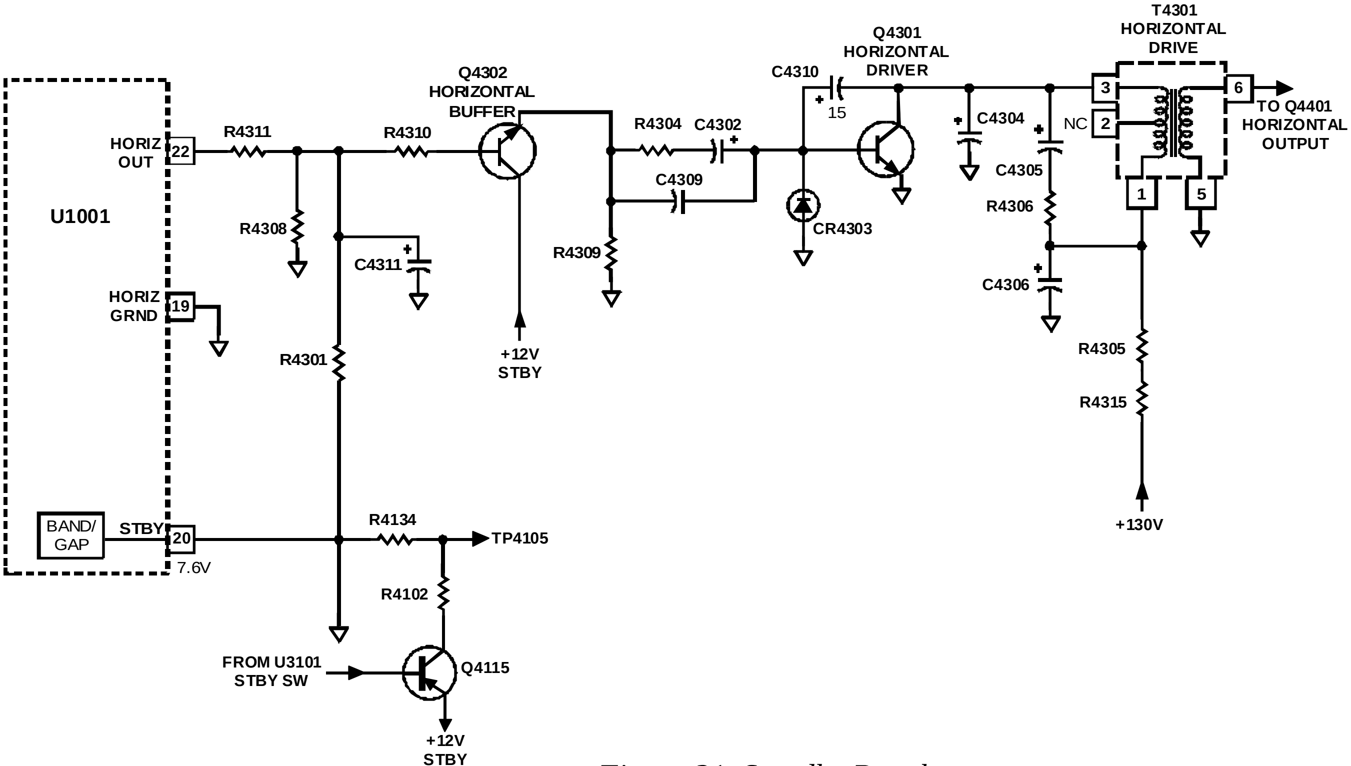
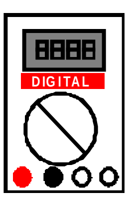


Figure 21, Standby Regulator

Horizontal Standby Regulator

The 7.6 volt standby supply is regulated by an internal regulator at pin 20 of U1001. This supply is used by the horizontal drive circuits to start the set from the standby mode.

Troubleshooting



The television will not operate without the 7.6 volt standby voltage on pin 20 of U1001.

No 7.6 volt Standby

1. Check the 12 volt standby supply.
2. Check for a shorted or open Q4115 and associated components.
3. Check for an internal short or a leaky pin 20 to ground (if 7.6V < 7.3V). If it is leaky or shorted, U1001 will have to be replaced and completely realigned.

Vertical Deflection

The vertical circuit in the CTC185 is very similar to the previous linear vertical circuits using a vertical output IC. One important difference to point out is this vertical circuit is DC coupled instead of capacitively AC coupled. The DC coupled circuit has advantages of fewer parts, lower cost and less dependence of linearity on electrolytic capacitor tolerance and aging. The “S” correction is accomplished inside the T-chip, U1001.

Because of DC coupling, the DC level of the vertical reference ramp from U1001 pin 15 affects vertical centering. This provides a new adjustment, Vertical DC (vertical centering), to be included in the digital alignments. It compensates for tolerances in the reference ramp DC voltage.

The vertical circuit acts as a voltage to current converter. It converts the vertical rate DC ramp out of the T-Chip to a current ramp through the yoke to deflect the electron beam from top to bottom on the CRT. U4501 is an inverting amplifier that sinks current at pin 5 when pin 1 is high and sources current from pin 5 when pin 1 is low. U4501 is supplied by the 26 volt run source from the IHVT.

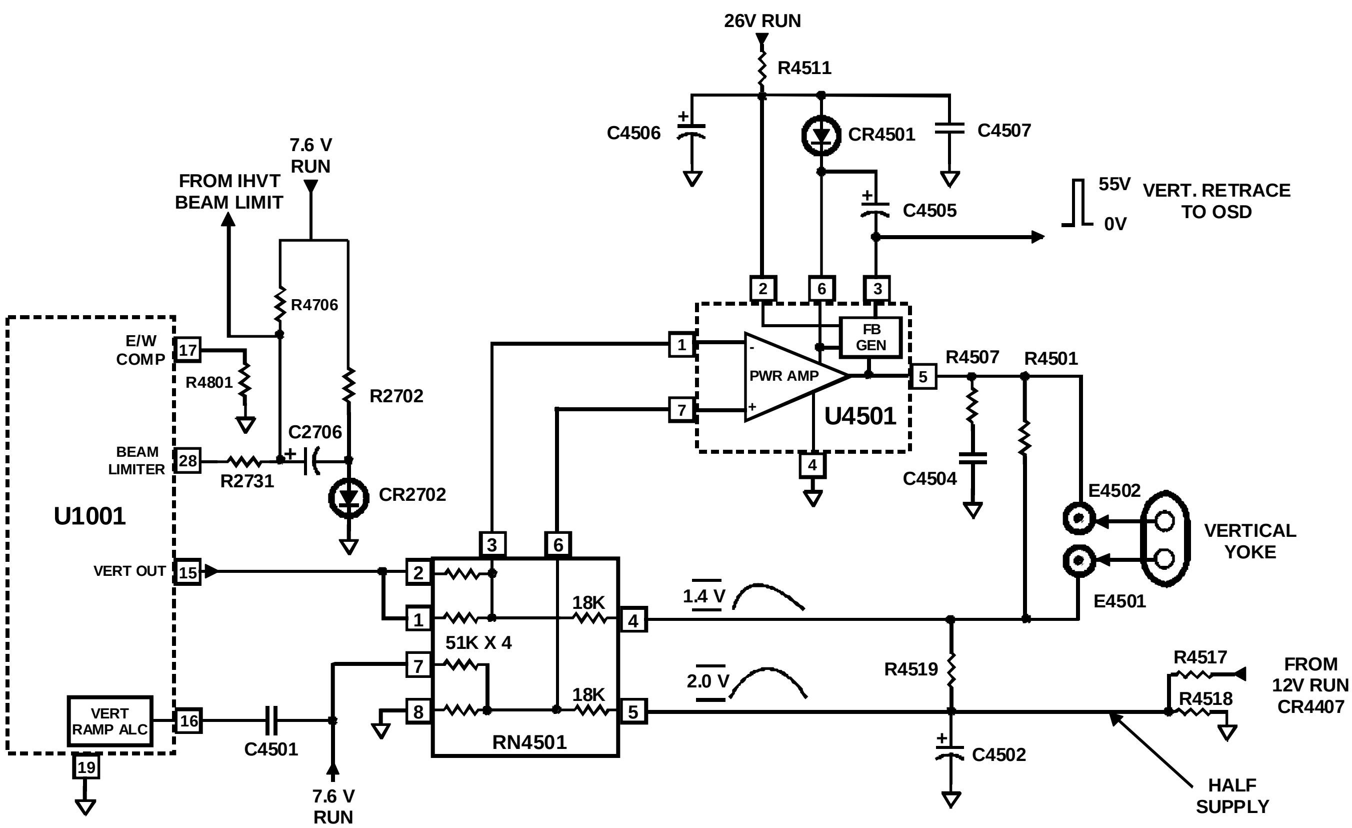


Figure 22, Vertical Deflection Circuit

The low side of the yoke connects to a “half supply” (approximately half of the 26 volt supply) developed from the 12 volt run supply. R4517 limits the current in the yoke to keep the beam from deflecting off the screen if U4501 shorts to ground or to the 26 volt source. R4518 adjusts the circuit for different screen sizes. C4502 is used as a filter for the 12 volt run supply and with R4518 helps reduce the vertical rate ripple current on the 12 volt run supply. R4519 is a current sense resistor that develops a voltage drop across it proportional to the yoke current. A fraction of this voltage from the “half supply" is input to pin 5 of RN4501 and an equal fraction of voltage is input to pin 4 of RN4501. Both signals feed back equally to the inverting and non-inverting inputs of U4501 resulting in no error output. This cancels any parabola signal resulting from vertical rate current on C4502. The quality of the canceling effect is determined by the match of the resistors in RN4501 which in this case are matched to .5 percent.

Pin 15 of U1001 provides the vertical sawtooth to pins 1 and 2 of RN4501. The average DC level of the ramp is set via bus control inside the T-chip. The ramp can be adjusted +/- 150mV via the Vertical DC adjustment. The vertical ramp and the error signal riding on the 12 volt "half" supply from the current sense resistors, R4519 and R4502, are added together and input to the inverting input, pin 1, of U4501. The 7.6 volt supply is input to pin 7 of RN4501 where it is divided down to half VCC. It is then added to the error signal riding on the 12 volt half supply from the current sense resistors, output at pin 6 of RN4501 and applied to the non-inverting input, pin 7, of U4501. The average DC voltage on pin 7 is approximately 9 volts during normal operation.

When the vertical ramp is at the bottom of the slope, pin 5 of U4501 sources current from the 26 volt supply through the yoke to the 12 volt "half supply" deflecting the electron beam to the top of the screen. As the ramp climbs in voltage on pin 1, the current source from pin 5 proportionally decreases lowering the voltage across the yoke, deflecting the beam towards the center of the screen. When the voltage on pin 1 of U4501 reaches the same voltage as pin 7, pin 5 is at approximately half the 26 volt supply. Because the low side of the yoke is tied to the 12 volt "half supply," there is no current through the yoke resulting in the electron beam being at the center of the screen. As the voltage on pin 1 of U4501 rises higher than pin 7, pin 5 begins to sink current. This causes the current to flow from the 12 volt "half supply," through the yoke to pin 5. Because the current flow reverses, the beam is deflected towards the bottom of the screen. During retrace, the ramp resets causing pin 5 of U4501 to go high, deflecting the beam back up to the top of the screen. The extra current required to deflect the beam from the bottom to the top of the screen is produced by C4505.

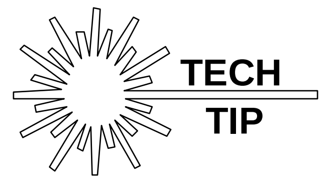
During scan time, the negative lead of C4505 is grounded through pin 3 of U4501. The positive lead is charged to 26 volts. At retrace, the flyback generator inside U4501 connects pin 3 to pin 2 applying 26 volts to the negative side of C4505. The charge stored on C4505 plus the 26 volts on the negative terminal produce 52 volts on pin 6. The increased B+ quickly retraces the beam to the top of the screen.

Vertical size compensation with varying beam current is now achieved inside the T-chip. As beam current increases toward the beam limiter threshold, a point is reached when the beam sense line will begin pulling down the internal reference voltage, reducing vertical scan slightly. This prevents the picture from blooming vertically during high beam current scenes.

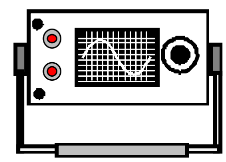
U1001 pin 16 is the vertical ramp ALC (automatic level control) that maintains the vertical ramp at a constant level, even if the vertical interval changes, as with a non-standard signal. C4501 sets the time constant of this amplitude regulating servo circuit. If the total capacitance were too small, vertical linearity would be affected. In extreme cases, field-to-field vertical jitter can be seen.

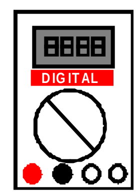
Troubleshooting

The vertical circuit is direct DC coupled and does not rely on capacitors for S-shaping and feedback. As a result, vertical troubleshooting can be accomplished with a digital volt meter and an oscilloscope.



Warning: Do not try to check the DC operation of U4501 by grounding pin 1 or applying 26 volts. Damage to U4501 or any of the direct coupled stages may result.





No Vertical Deflection

1. Check for the presence of the 26 volt supply on pin 6 of U4501. If it is not present, suspect R4511 being open, possibly as the result of a shorted U4501. If it is correct, go to the next step.

2. Check for the half supply of approximately 12 volts at E4501. If it is not there, check for an open R4517. If it is there, go to the next step.

3. Check for a 2 Vpp vertical parabola on pin 1 of U4501. If it is not there, check pin 15 of U1001 for a 2 Vpp vertical ramp signal. If the ramp signal is present, suspect a defective U4501. If it is not present, go to the next step.

4. Check for 7.6 volts on pin 26 of U1001. If it is not there, trace it back to the scan derived supplies. If the voltage is correct, check pin 16 of U1001 for approximately 3.8 volts. If the voltage is wrong suspect a defective C4501 or U1001.

Tuner

The CTC185 tuner is very similar to the CTC175 tuner. The tuner utilizes TOB (Tuner On-board) topography surrounded by a zinc alloy tuner wrap. The primary differences include:

- A new PLL IC (U7401) with internal DAC's (Digital to Analog Converters) eliminates the need for the U7501 interface circuitry found in the CTC175 chassis.
- New generation mixer IC (U7301)
- Elimination of the SAW (Surface Acoustic Wave) filter preamp.
- Re-designed Hot/Cold isolation barrier
- Self-biased dual gate MOSFETS (Metal Oxide Semiconductor Field Effect Transistors

Because the tuner on-board is part of the main chassis, the tuner must be repaired to the component level rather than replacing the tuner as a complete assembly. Although repairing the tuner may be new for some, it is no different than working on other discrete sections of the TV. A basic knowledge of tuner theory and a good voltmeter will enable the technician to repair most tuner on-board malfunctions. For a review of tuner fundamentals, refer to the following technical training manuals: T-CTC179/189-1, T-177/187-TSG and T-CTC175/6/7-1.

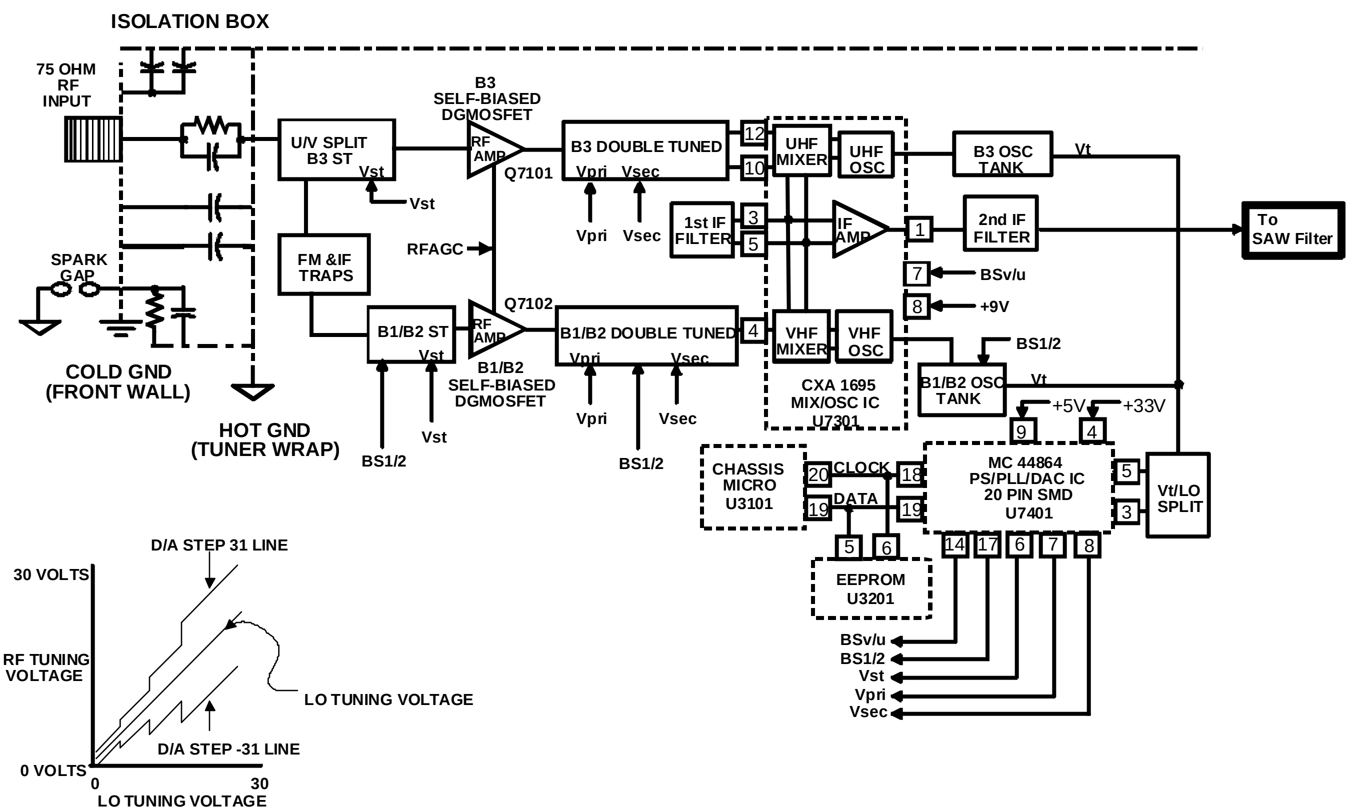
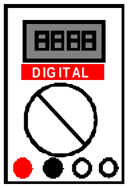


Figure 23, CTC185 Tuner Block Diagram

Figure 23 shows a block diagram of the CTC185 tuner. RF from the antenna terminal is applied to the UHF/VHF splitter network through the isolation block. The isolation block provides a barrier between the hot chassis and the RF connector to prevent the consumer and other equipment from coming in contact with the AC line. This is a safety critical part and must not be defeated.

The RF signal is then split and sent to respective UHF and VHF tuning networks where the single tuned filter selects the desired band and channel frequency. Dual gate MOS FET's (Metal Oxide Semiconductor Field Effect Transistors) amplify the RF. The RF AGC voltage from the IF circuitry is input to G2 on the transistors to adjust the gain of the tuner for varied signal strengths. The amplified signal is then applied to the double tuned filter where the signal is more selectively filtered and impedance matching to the latter stages of the tuner is performed.

The UHF and VHF signals are input to U7301 where respective UHF/VHF mixer and oscillator circuits heterodyne the necessary frequency with the RF signal to produce the 6MHz wide IF (intermediate frequency) signal with the video signal located at 45.75 MHz. The oscillator frequencies are under the control of U7401, the PLL (Phase Locked Loop) IC. This IC receives logic from U3101 to perform the necessary frequency division to form a frequency synthesizer. The loop filter out of pin 5 and 3 of U7401 produces the tuning voltage that controls the VHF and UHF local oscillator circuits. Unlike the CTC175 tuner PLL IC, U7401 also includes DAC (Digital to Analog Converters) outputs that control the tuning of the varactors in the single tuned, and the primary and secondary of the double tuned filters. Band switching for bands 1, 2 and 3 is also controlled from this IC. Alignment values stored in the EEPROM (U3201) for 18 "data channels" provide the settings for the single tuned, primary and secondary filter outputs from U7401. Linear interpolation is used to adjust the voltages for these tuning networks across the entire range of channels tuned by this system. The alignment of these 18 "data channels" is critical. See the CTC185 service data for specific alignment instructions. The effect the alignments have on the tuning voltage is shown on the graph in figure 19. The higher the tuning voltage, the more effect the alignments have on the tuning voltage. This is because it takes more voltage change at higher tuning voltages to get the same change in capacitance in the varactor diode. This is a characteristic of varactor diodes.



Troubleshooting the tuner is best accomplished with a digital multimeter. By making voltage and resistance checks, tuner failures can be isolated in a reasonable amount of time. Certain precautions should, however, be observed. Always put the shields back on after servicing and solder them if they were unsoldered. Make sure none of the coils in the tuner are moved or in any way repositioned (this will prevent making painstaking coil alignments later). Solder connections should be clean and smooth. Do not use more solder than is necessary.

If any of the varactor diodes are replaced in either the VHF circuits (CR7106, CR7107, CR7108, CR7111, CR7113 and CR7302 or UHF circuits (CR7101, CR7102, CR7103, CR7114, CR7301 and CR7304), all the diodes in the respective circuit must be changed. The replacement diodes are matched for capacitance characteristics and come as a set. If these guidelines are not followed, the tuner cannot be aligned correctly and will tune channels poorly. The stock number for the diode kit containing the matched diodes is 215494.

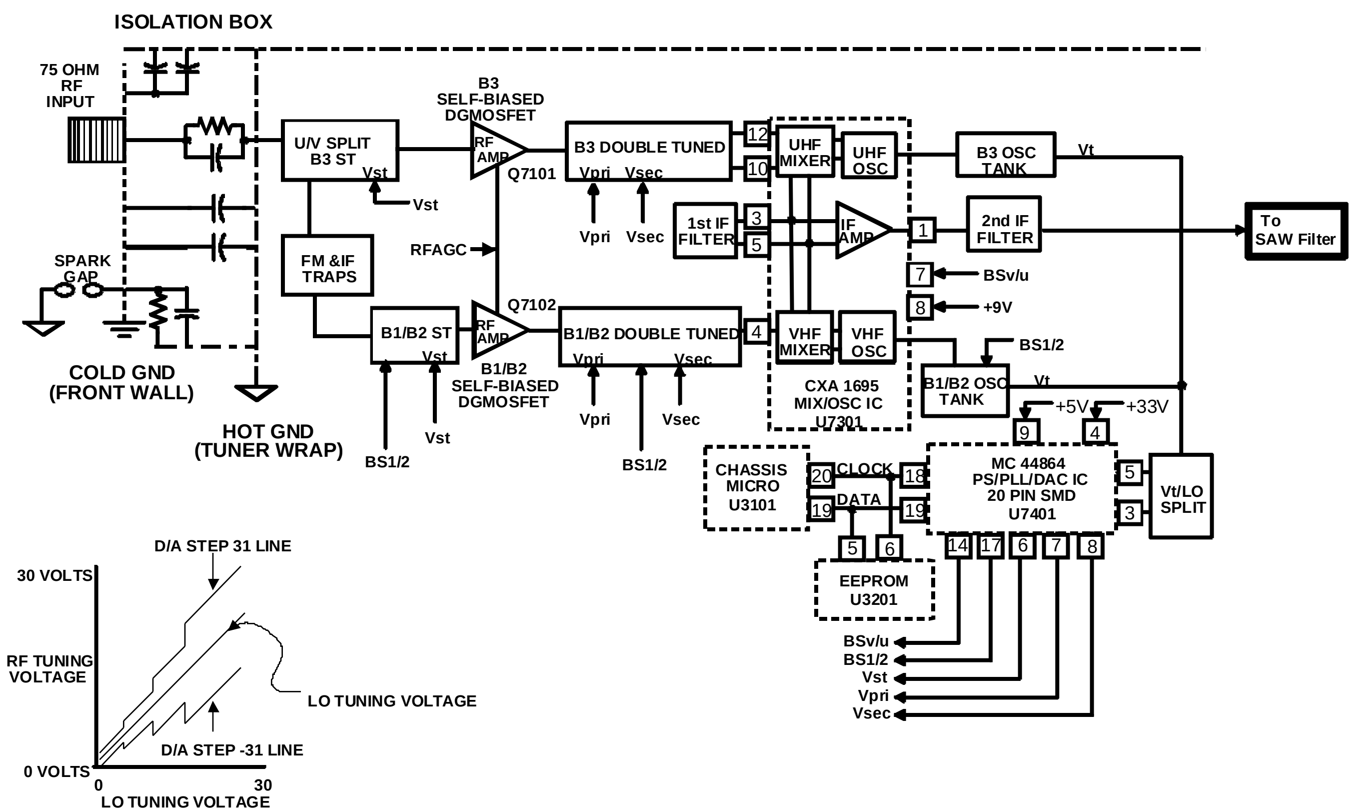


Figure 23, CTC185 Tuner Block Diagram (repeated)

One Band Inoperative

If the tuner will tune channels on all bands but one, limit troubleshooting to the band specific circuitry. Obviously, if one band is functional, U3101, U3201, U7401 and at least part of U7301 are working properly.

1. Check the plus and minus 12 volt supplies. See CTC185 service data “System Control Schematic” location 58-F

2. Check the biasing on the respective RF amplifier MOSFET(Q7101-UHF, Q7102-VHF). See CTC185 service data “Tuner Schematic” location 68-B&E

3. If the problem is only VHF low (2- 6) or VHF hi (7 -13), make sure the band switching voltage from the collector of Q7402 turns on (or off) CR7112, CR7105, CR7109, and CR7110. See CTC185 service data “Tuner Schematic”.

Picture Present But Not Good

1. Check the AGC voltage

2. Check all the supply voltages to the tuner: +5V, +12V, -12V and +33V.

3. Check single tuned, primary and secondary tuning voltages (see voltage charts on page 43 and 44).

4. Check for the correct voltages on U7401 (see voltage charts on page 43 and 44).

5. Check for the correct EEPROM values by trying to improve one channel by realigning the D/A’s (make sure to <u>record</u> the original value in order to restore it if alignment does not fix the problem).

6. Go to number 7 on the “No Tuning” symptom below.

No Tuning

1. Verify channel numbers change on the screen. If the OSD does not respond to channel change commands, the problem lies in the *system control circuit and not in the tuner*.

2. Check all the supply voltages to the tuner: +5V, +12V, -12V and +33V. See CTC185 service data “System Control” schematic around U7401.

3. Check for the correct band switching voltage on pins 14, 15, 16 and 17 of U7401, pin 7 of U7301, and the collector of Q7402 (see voltage charts on page 43 and 44).

4. Check the tuning voltage on U7401 pin 5 and compare it to the voltage chart. *Note: If the tuning voltage is stuck HI or LO, there is a problem in the PLL loop. Check for a 4MHz oscillator signal on Y7401. Depending on the loading of the oscilloscope, it should be around 1Vpp with a X10 probe*

5. Check the LO voltage at the varactors CR7301, CR7304, and CR7302. The voltage should increase as channels go up in number and decrease and channels come down in number. If the voltage is missing, check the path between U7401 pin 5 and varactors. Also check for a leaky or shorted CR7301, 2, & 4.

6. Check the single tuned, primary and secondary varactor diode tuning voltages (see voltage chart on page 35).

7. Check the RF AGC response. Attenuate service modulator output. RF AGC voltage should increase.

8. Check the MOSFET bias on Q7101 and Q7102 (see voltage charts on page 43 and 44).

9. Check IF output on pin 1 of U7301.

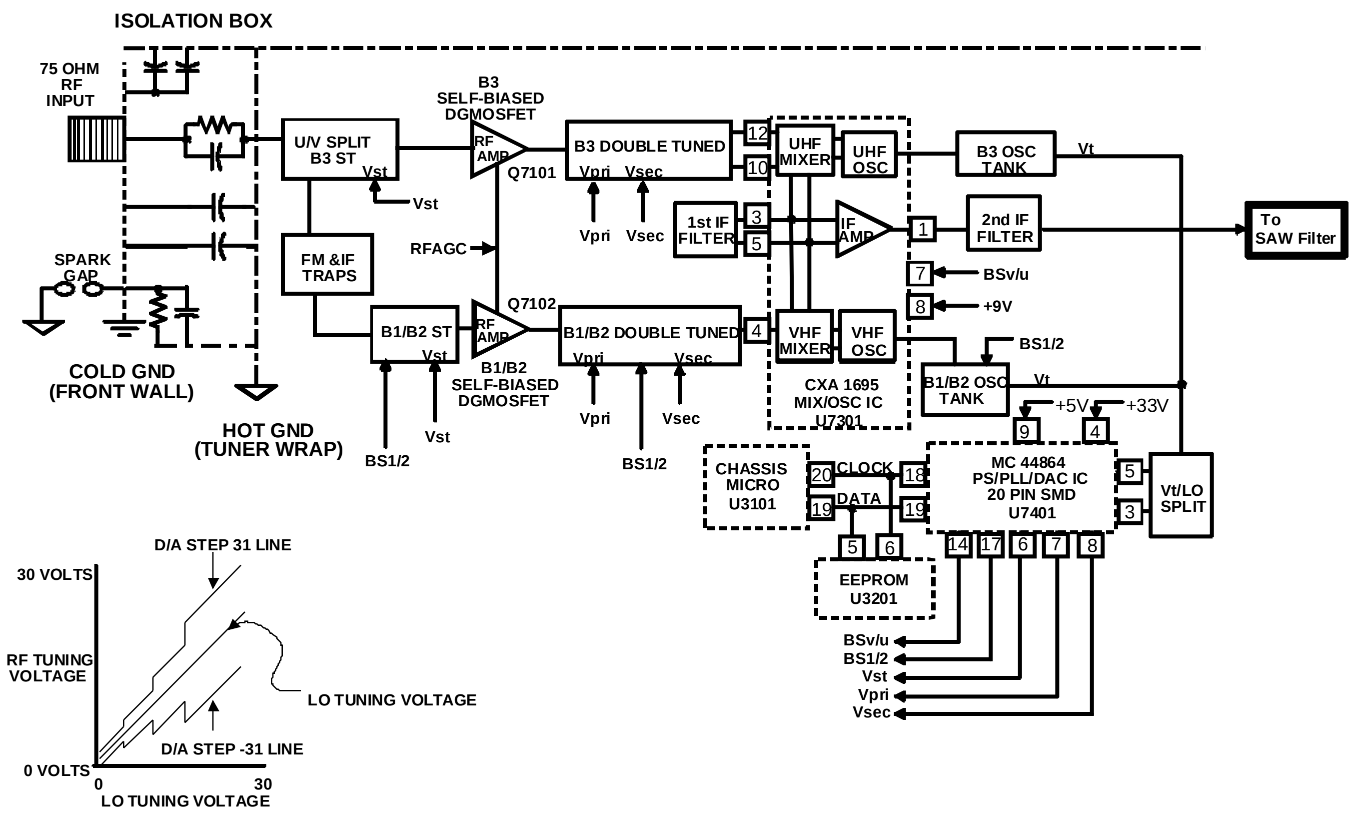


Figure 24, CTC185 Tuner Block Diagram (repeated)

CABLE CHANNEL		PIX FREQ.	SOUND FREQ.	LO FREQ.
BAND 1	2	55.25	59.75	101.00
	3	61.25	65.75	107.00
	4	67.25	71.75	113.00
	1	73.25	77.75	119.00
	5	77.25	81.75	123.00
	6	83.25	87.75	129.00
	98	109.25	113.75	155.00
	99	115.25	119.75	161.00
	14	121.25	125.75	167.00
	15	127.25	131.75	173.00
	16	133.25	137.75	179.00
	17	139.25	143.75	185.00
BAND 2	18	145.25	149.75	191.00
	19	151.25	155.75	197.00
	20	157.25	161.75	203.00
	21	163.25	167.75	209.00
	22	169.25	173 75	215.00
	7	175.25	179 75	221.00
	8	181.25	185.75	227.00
	9	187.25	191.75	233.00
	10	193.25	197.75	239.00
	11	199.25	203.75	245.00
	12	205.25	209.75	251.00
	13	211.25	215.75	257.00
	23	217.25	221.75	263.00
	24	223.25	227.75	269.00
	25	229.25	233.75	275.00
	26	235.25	239.75	281.00
	27	241.25	245.75	287.00
	28	247.25	251.75	293.00

CABLE CHANNEL		PIX FREQ.	SOUND FREQ.	LO FREQ.
BAND 2	29	253.25	257.75	299.00
	30	259.25	263.75	305.00
	31	265.25	269.75	311.00
	32	271.25	275.75	317.00
	33	277.25	281.75	323.00
	34	283.25	287.75	329.00
	35	289.25	293.75	335.00
	36	295.25	299.75	341.00
	37	301.25	305.75	347.00
	38	307.25	311.75	353.00
	39	313.25	317.75	359.00
	40	319.25	323.75	365.00
	41	325.25	329.75	371.00
	42	331.25	335.75	377.00
	43	337.25	341.75	383.00
	44	343.25	347.75	389.00
	45	349.25	353.75	395.00
	46	355.25	359.75	401.00
	47	361.25	365.75	407.00
	48	367.25	371.75	413.00
	49	373.25	377.75	419.00
	50	379.25	383.75	425.00
BAND 3	51	385.25	389.75	431.00
	52	391.25	395.75	437.00
	53	397.25	401.75	443.00
	54	403.25	407.75	449.00
	55	409.25	413.75	455.00
	56	415.25	419.75	461.00
	57	421.25	425.75	467.00
	58	427.25	431.75	473.00

CABLE CHANNEL		PIX FREQ.	SOUND FREQ.	LO FREQ.
BAND 3	59	433.25	437.75	479.00
	60	439.25	443.75	485.00
	61	445.25	449.75	491.00
	62	451.25	455.75	497.00
	63	457.25	461.75	503.00
	64	463.25	467.75	509.00
	65	469.25	473.75	515.00
	66	475.25	479 75	521.00
	67	481.25	485.75	527.00
	68	487.25	491 75	533.00
	69	493.25	497.75	539.00
	70	499.25	503.75	545.00
	71	505.25	509.75	551.00
	72	511.25	515.75	557.00
	73	517.25	521.75	563.00
	74	523.25	527.75	569.00
	75	529.25	533.75	575.00
	76	535.25	539 75	581.00
	77	541.25	545 75	587.00
	78	547.25	551.75	593.00
	79	553.25	557.75	599.00
	80	559.25	563.75	605.00
	81	565.25	569.75	611.00
	82	571.25	575 75	617.00
	83	577.25	581.75	623.00
	84	583.25	587.75	629.00
	85	589.25	593.75	635.00
	86	595.25	599.75	641.00
	87	601.25	605.75	647.00
	88	607.25	611.75	653.00

CABLE CHANNEL		PIX FREQ.	SOUND FREQ.	LO FREQ.
BAND 3	89	613.25	617.75	659
	90	619.25	623.75	665
	91	625.25	629.75	671
	92	631.25	635.75	677
	93	637.25	641.75	683
	94	643.25	647.75	689
	95	91.25	95.75	137
	96	97.25	101.75	143
	97	103.25	107.75	149
	98	109.25	113.75	155
	99	115.25	119.75	161
	100	649.25	653.75	695
	101	655.25	659.75	701
	102	661.25	665.75	707
	103	667.25	671.75	713
	104	673.25	677.75	719
	105	679.25	683.75	725
	106	685.25	689.75	731
	107	691.25	695.75	737
	108	697.25	701.75	743
	109	703.25	707.75	749
	110	709.25	713.75	755
	111	715.25	719.75	761
	112	721.25	725.75	767
	113	727.25	731.75	773
	114	733.25	737.75	779
	115	739.25	743.75	785
	116	745.25	749.75	791
	117	751.25	755.75	797
	118	757.25	761.75	803

CABLE CHANNEL		PIX FREQ.	SOUND FREQ.	LO FREQ.
BAND 3	119	763.25	767.75	809
	120	769.25	773.75	815
	121	775.25	779.75	821
	122	781.25	785.75	827
	123	787.25	791.75	833
	124	793.25	797.75	839
	125	799.25	803.75	845

AIR CHANNEL		PIX FREQ.	SOUND FREQ.	LO FREQ.
BAND 3	14	471.25	475.75	517.00
	15	477.25	481.75	523.00
	16	483.25	487.75	529.00
	17	489.25	493.75	535 00
	18	495.25	499.75	541.00
	19	501.25	505.75	547 00
	20	507.25	511.75	553.00
	21	513.25	517.75	559.00
	22	519.25	523.75	565.00
	23	525.25	529.75	571.00
	24	531.25	535.75	577.00
	25	537.25	541.75	583.00
	26	543.25	547.75	589.00
	27	549.25	553.75	595.00
	28	555.25	559.75	601.00
	29	561.25	565.75	607.00
	30	567.25	571.75	613.00
	31	573.25	577.75	619.00
	32	579.25	583.75	625.00
	33	585.25	589.75	631.00
	34	591.25	595.75	637.00
	35	597.25	601.75	643.00
	36	603.25	607.75	649.00
	37	609.25	613.75	655.00
	38	615.25	619.75	661.00
	39	621.25	625.75	667.00
	40	627.25	631.75	673.00
	41	633.25	637.75	679.00
	42	639.25	643.75	685.00
	43	645.25	649.75	691.00

AIR CHANNEL		PIX FREQ.	SOUND FREQ.	LO FREQ.
BAND 3	44	651.25	655.75	697
	45	657.25	661.75	703
	46	663.25	667.75	709
	47	669.25	673.75	715
	48	675.25	679.75	721
	49	681.25	685.75	727
	50	687.25	691.75	733
	51	693.25	697.75	739
	52	699.25	703.75	745
	53	705.25	709.75	751
	54	711.25	715.75	757
	55	717.25	721.75	763
	56	723.25	727.75	769
	57	729.25	733.75	775
	58	735.25	739.75	781
	59	741.25	745.75	787
	60	747.25	751.75	793
	61	753.25	757.75	799
	62	759.25	763.75	805
	63	765.25	769.75	811
	64	771.25	775.75	817
	65	777.25	781.75	823
	66	783.25	787.75	829
	67	789.25	793.75	835
	68	795.25	799.75	841
	69	801.25	805.75	847

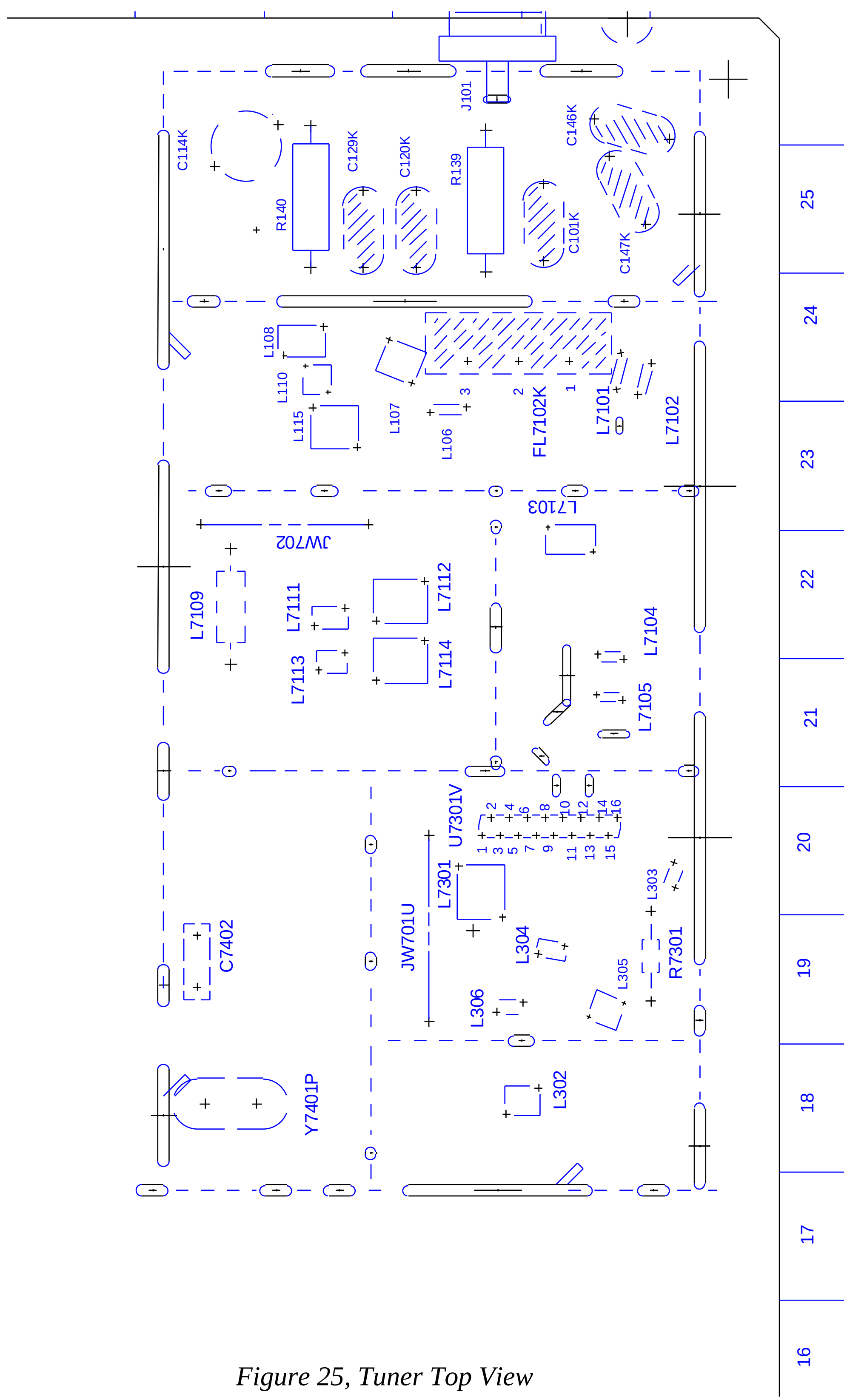


Figure 25, Tuner Top View

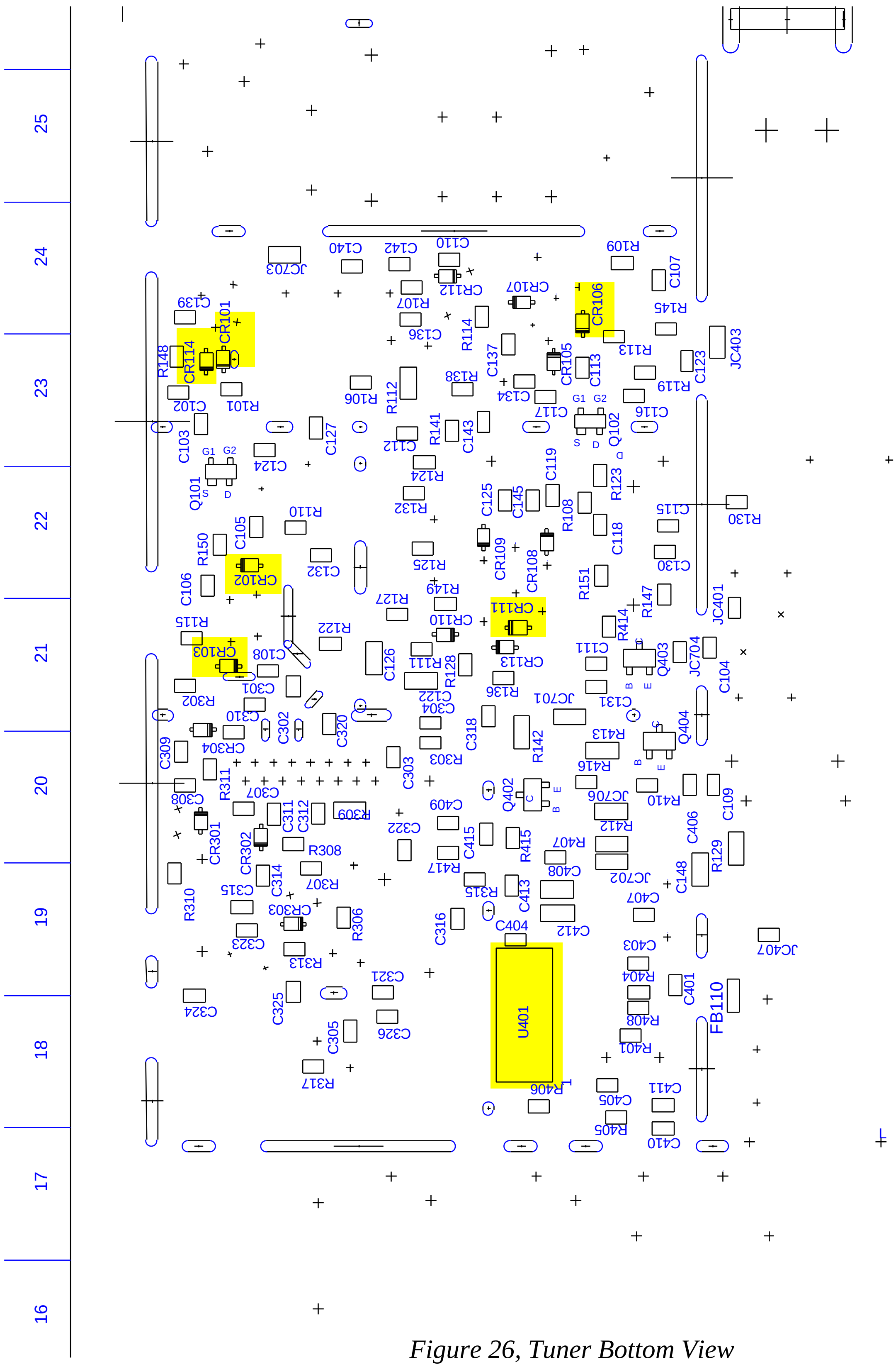


Figure 26, Tuner Bottom View

BAND SWITCHING AND TUNING VOLTAGE CHART								
CABLE CHANNEL		**U401-14**	**U401-17**	**U401-8**	**U401-7**	**U401-6**	**U401-5**	**U401-3**
BAND 1	2	11.5	12.2	1.8	1.6	1.3	2.3	2.6
	3	11.5	12.2	2.9	2.6	2.5	3.0	2.6
	6	11.5	12.2	7.4	6.8	7.2	5.9	2.6
	98	11.5	12.2	12.4	12.3	10.6	9.9	2.6
	15	11.5	12.2	17.0	17.8	215.7	14.5	2.6
	17	11.5	12.2	23.1	28.3	21.7	20.9	2.6
BAND 2	18	11.3	.1	2.4	2.1	2.4	2.5	2.6
	9	11.3	.1	5.7	5.3	5.7	5.1	2.6
	29	11.3	.1	10.5	9.7	10.6	8.9	2.6
	39	11.3	.1	15.9	15.6	15.9	13.6	2.6
	46	11.3	.1	21.3	23.6	21.8	19.2	2.6
	50	11.3	.1	26.3	33.0	28.7	26.5	2.6
BAND 3	51	.2	.1	.4	.7	.6	.6	2.6
	61	.2	.1	2.6	3.1	2.7	2.9	2.6
	75	.2	.1	6.7	7.1	6.6	7.1	2.6
	101	.2	.1	12.5	12.8	12.6	12.8	2.6
	114	.2	.1	17.1	17.3	17.3	17.3	2.6
	122	.2	.1	21.5	21.5	21.6	21.6	2.6
	125	.2	.1	23.8	23.6	23.8	23.7	2.6

Varactor Diode Data Channel Tuning Voltage Chart				
CABLE CHANNEL		**CR106 CR7107**	**CR108**	**CR111**
BAND 1	2	1.3	1.6	1.7
	3	2.4	2.6	2.8
	6	7.1	6.8	7.2
	98	10.5	12.3	12.2
	15	15.6	17.8	16.7
	17	21.7	28.2	22.7
BAND 2	18	2.3	2.1	2.4
	9	5.6	5.3	5.6
	29	10.5	9.7	10.3
	39	15.8	15.6	15.6
	46	21.7	23.6	20.8
	50	28.9	32.9	25.8
CABLE CHANNEL		**CR101 CR7114**	**CR102**	**CR103**
BAND 3	51	.6	.7	.4
	61	2.6	3.0	2.5
	75	6.6	6.9	6.5
	101	12.4	12.5	12.2
	114	17.1	16.9	16.6
	122	21.3	21.0	20.9
	125	23.4	23.1	23.1

Note: Voltages are aproximate cathode voltages only and will vary from set to set. This chart is supplies as a basic guide for typical voltages on the alignment channels. DO NOT USE THESE VOLTAGES AS A BASIS FOR TUNER ALIGNMENT.

Video / Audio IF

Most of the picture and sound IF (Intermediate Frequency) circuits are essentially the same as those in the CTC177/187 chassis. However, the following are new in the CTC185 chassis: Analog AFT with a status register and Auto-tuned Quadrature FM detector.

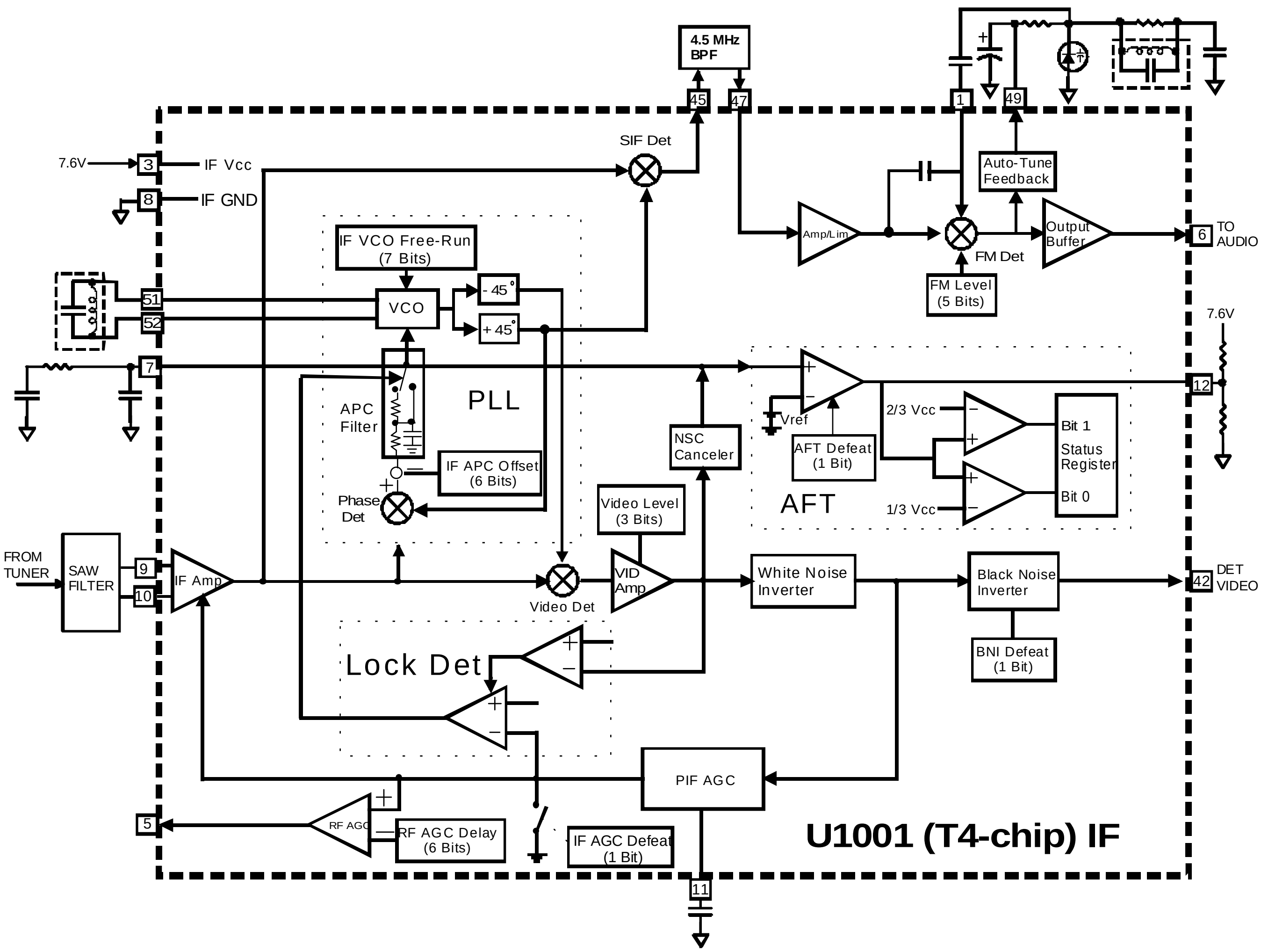


Figure 27, Video/Audio IF Circuit Block Diagram

The IF signal at the output of the tuner is applied to the inputs of the SAW filter. The PIF then passes through the SAW filter to U1001 pins 9 and 10. A PIF AGC loop controls the gain of the PIF amplifier. A VCO (Voltage Controlled Oscillator) is phase-locked to the picture carrier at the output of the PIF amplifier and provides the 45.75 MHz reference signal for the video and SIF detectors. The PLL's APC detector output voltage is used as the IF frequency indicator for AFT. This voltage is amplified by the AFT amplifier, whose gain is determined by the resistors connected to pin 12, and applied to a window comparator with a 2-bit status register. The chassis microprocessor, U3101, adjusts the tuner LO (Local Oscillator) and then reads the AFT status register to determine if the IF signal frequency is correct.

After the video detector, the PIF channel provides some baseband signal processing including black and white noise inverters for impulse noise immunity. The composite baseband video output signal at pin 42 is sent to the eexternal video amp circuitry and then on to the luminance and chrominance section of the T4-Chip for further processing.

The 4.5 MHz output of the SIF detector (pin 45) is passed through an external 4.5MHz BPF (Band Pass Filter CF1201) before being applied to the input of the FM (Frequency Modulation) detector (pin 47). The voltage on pin 49 controls the varactor's capacitance and thus the tuning of the phase shift network connected to pin 1. The recovered wide-band audio signal (L+R, L-R and SAP) is output at pin 6 and sent to the stereo decoder.

All IF alignments are electronically controlled and are basically the same as the CTC177/187 except: A 6-bit APC offset adjustment was added and the VCO free-run control was changed from 6-bits to 7-bits for the new analog AFT system; The RF AGC Delay control was changed from 5-bits to 6-bits. Because of these differences, the digital alignment procedures are slightly different than the CTC177/187, so refer to the appropriate service data for the correct procedures.

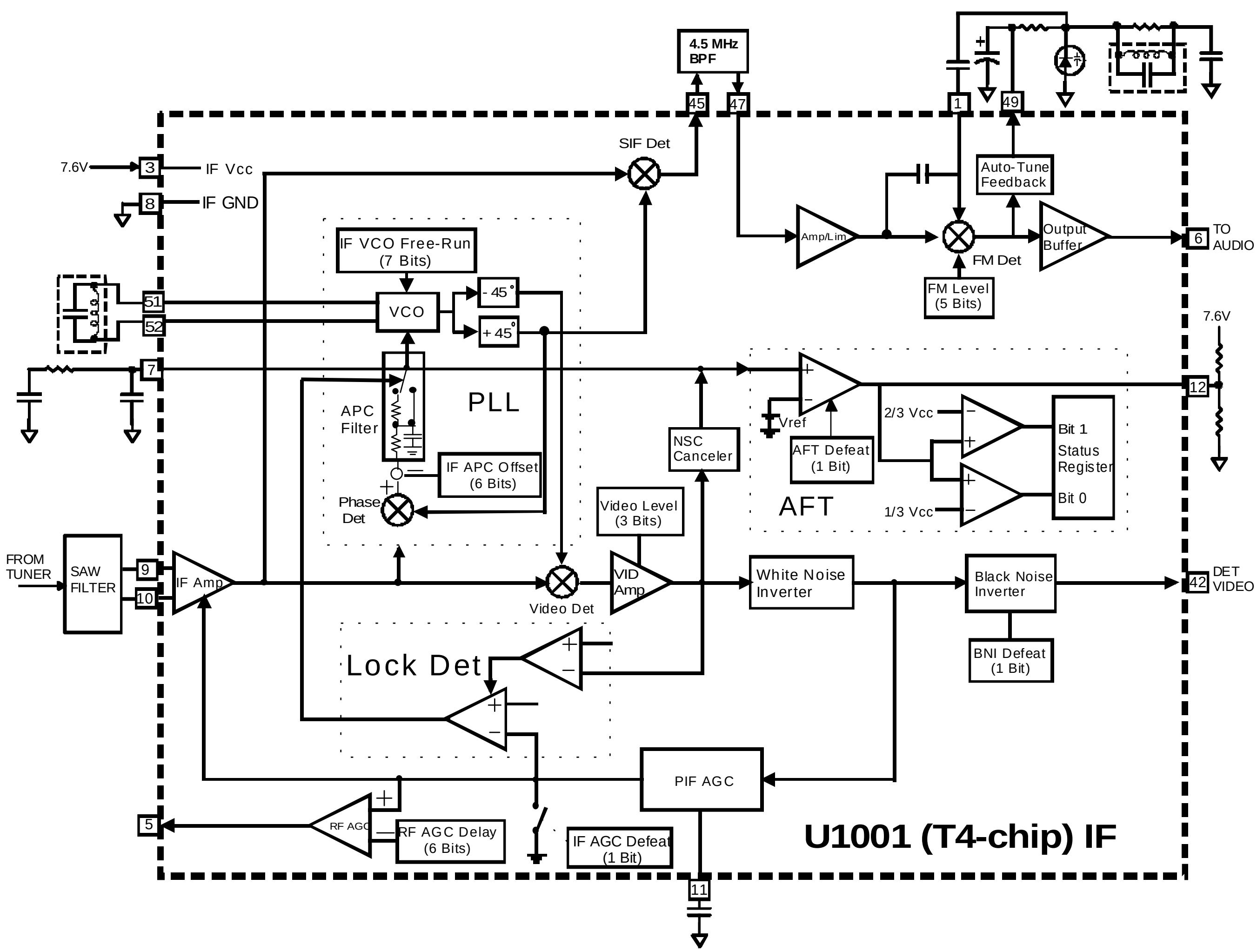


Figure 28, Video/Audio IF Circuit Block Diagram (repeated)

Video Processing

Processed luminance from the IF and video amp circuitry is input to pin 38 of U1001. The luminance is then passed through filtering and coring and applied to an internal black stretch circuit. The DC voltage at pin 37 can place the IC in an RGB mode of operation by turning off the luminance path. The voltage on pin 47 must be approximately 1.5 volts or greater to enable luminance. Luma is then input to the internal/external switch which selects between OSD and video. R-Y and B-Y from the internal chroma circuitry is also applied to this switch.

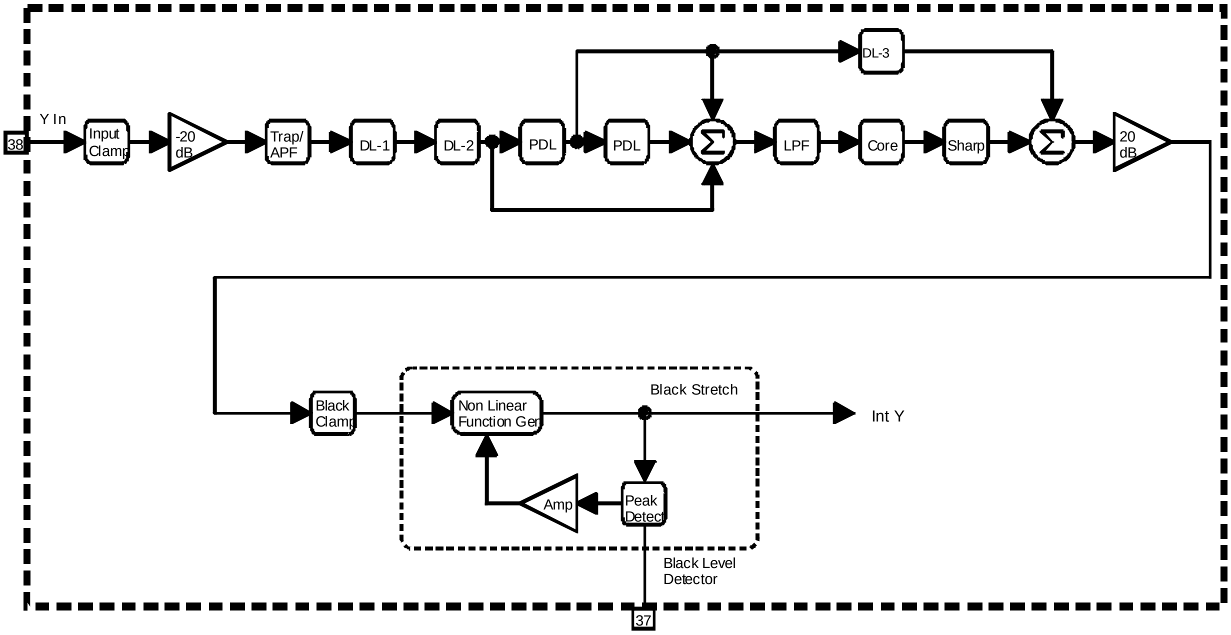


Figure 29, T4-Chip Luminance Processing Block Diagram

OSD from U3101 is applied to pins 34, 35 and 36. These are the red, green and blue OSD inputs. The fast switch input at pin 33 controls whether OSD or video is switched out: HI (>2.5V) = External Video (OSD) or LO (<2.5V) = Internal Video.

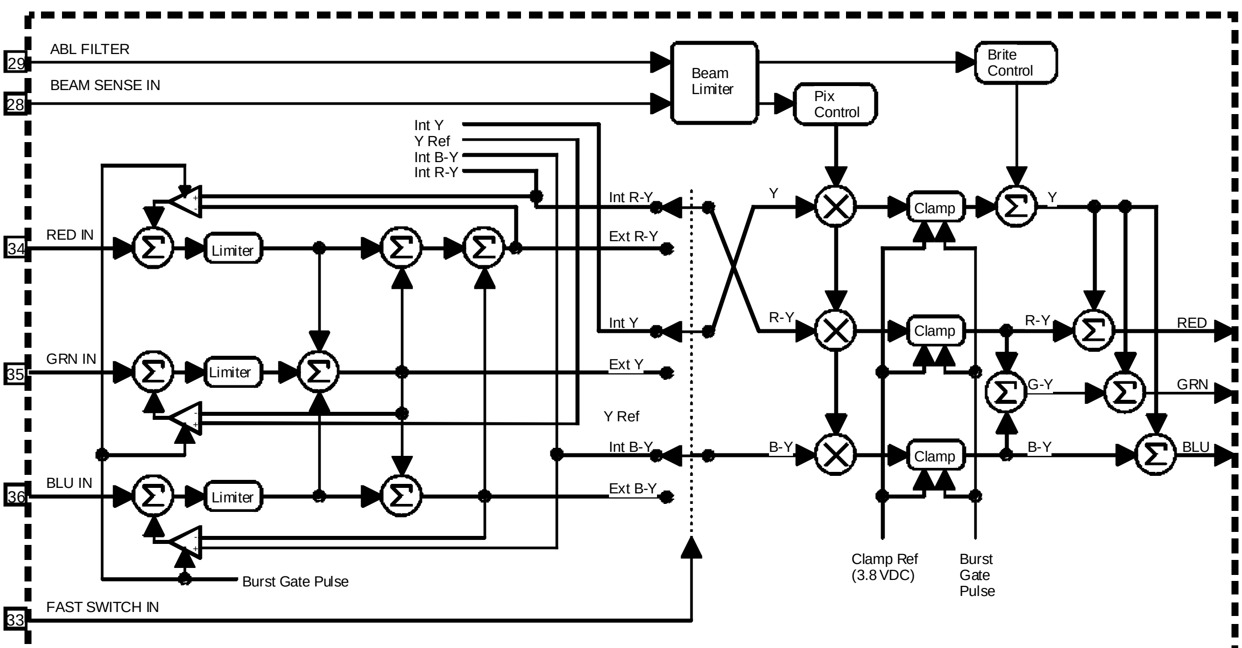


Figure 30, T4-Chip RGB Processing Block Diagram

The output of the Internal/External switch produces Y, R-Y and B-Y. The three signals are sent through their respective contrast and clamp controls. These stages are controlled over the serial bus. The luminance is sent to the brightness control while the component chroma signals are matrixed and then summed with the luminance. The summed red, green and blue signals are then sent to the RGB processing circuitry.

The RGB circuitry in U1001 is used to adjust the red, green and blue drives for the CRT. The bias controls are set at fixed values at the factory and are adjustable with the service menu or Chipper Check™. Buffered red, green and blue signals are output at pins 30, 31 and 32 respectively and sent to the kine drive circuits.

The beam sense input is at pin 28 and is used to reduce brightness and contrast during high beam current scenes to keep the CRT from "doming" and the picture from "blooming." The circuit is active below approximately 6 volts.

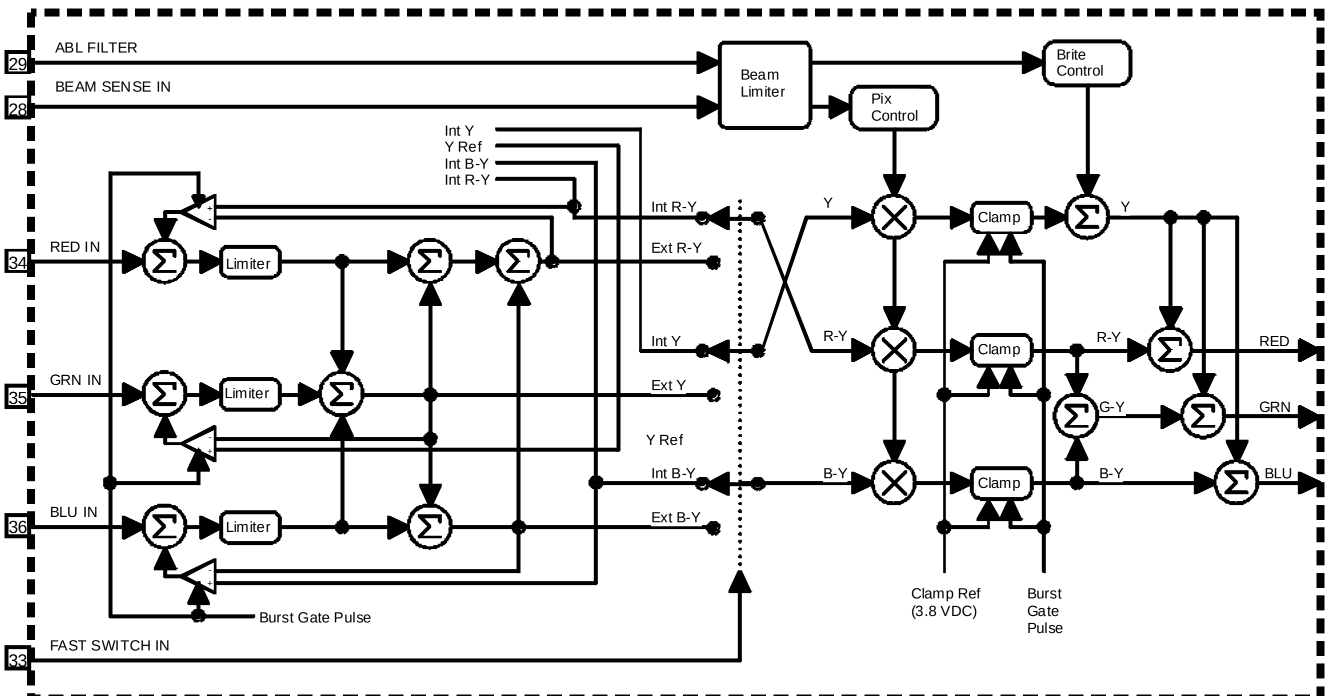
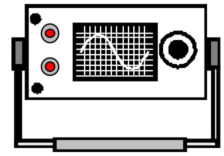
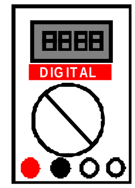


Figure 31, T4-Chip RGB Processing Block Diagram (repeated)

Troubleshooting





No Luminance

1. Check the brightness and contrast controls from the user menu. If the menu is not visible, push “reset” on the remote.

2. Check the input signal at U1001 pin 38. It should be approximately 1Vp-p, sync to 100 IRE.

3. Check the beam limiter control voltage at pin 31. The circuit is active below 6.2 volts.

4. Check the Fast Switch input at pin 33. A voltage greater than 2.5 volts will blank the video to let OSD through.

5. Check the RGB mode switching on pin 37 of U1001. Luminance is enabled above 1.5 VDC.

Chrominance Processing

Chroma processing in U1001 is performed in much the same fashion as in the past. Pin 40 is the chroma input to the IC. The incoming chroma is applied to a filter block. There are two filters in this block. The peaker is used to peak up the chroma to compensate for the high end roll-off of the IF circuit. The symmetrical filter band passes the chroma and is used for Aux and S-Video chroma (not currently supported in the CTC185). The chroma is then sent to the 2nd chroma amp stages. Here, color saturation is controlled by the serial bus. The chroma signal is mixed with the 0 and 90 degree phase shifted 3.58 MHz to demodulate R-Y and B-Y. The burst signal is used in the ACC and APC circuits to control color phase and color killer circuit. Pin 39 is 3.8 volts or greater with a color signal present and low when burst is not detected. *The color killer can be defeated by applying 3.8 volts DC to pin 39.*

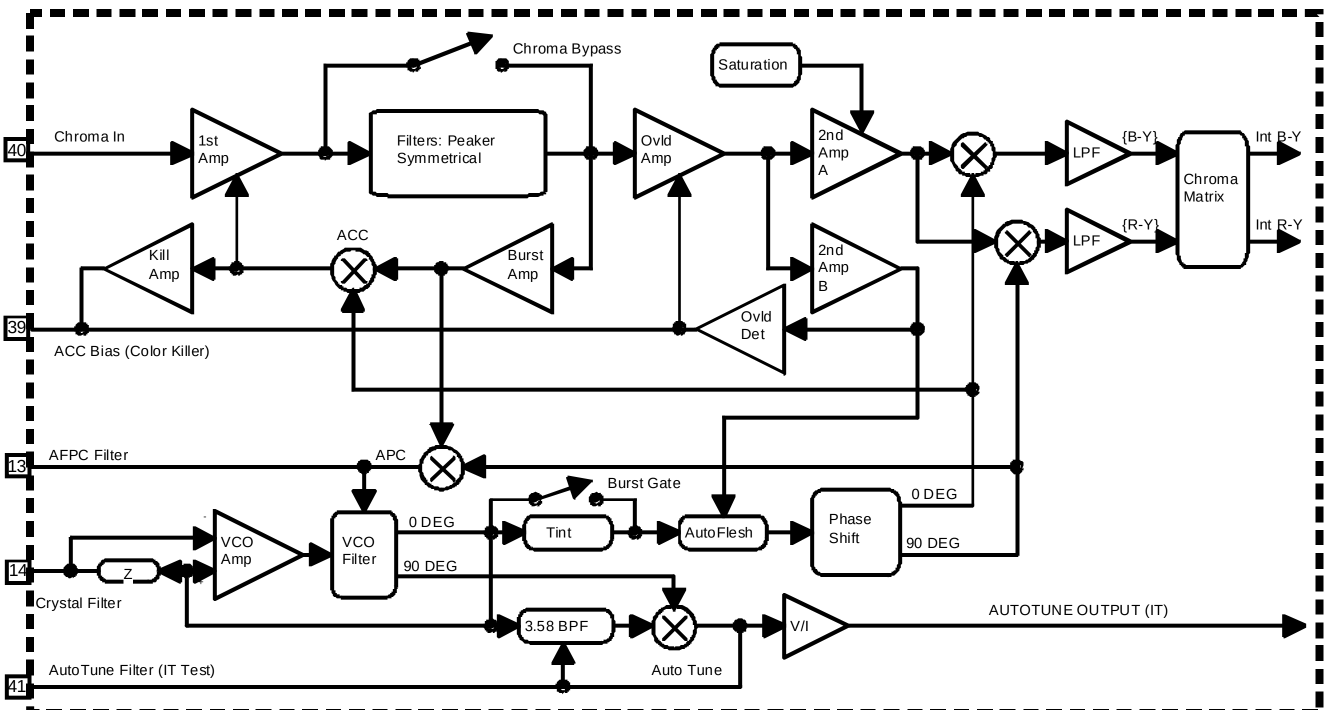


Figure 32, T4-Chip Chrominance Processing Block Diagram

The biggest difference with the chroma circuit, as compared to conventional circuits, is the 3.58 MHz oscillator at pin 14 of U1001. The crystal is in series with the comparator circuit. When the oscillator is locked on frequency, no oscillator voltage is present on pin 14. *This means the 3.58 MHz oscillator cannot be viewed outside the IC with an oscilloscope as in the past.* The oscillator is used to recreate the chroma carrier to demodulate the R-Y, G-Y and B-Y. The oscillator is also used as a reference for other oscillators inside U1001. A problem with the 3.58MHz oscillator can cause tuning and/or IF type problems if the frequency is not correct. The tint and auto flesh controls affect the phase of this signal to correct fleshtones. The signal is then shifted

90 degrees and sent to the R-Y demodulator while the 0 degree signal is sent to the B-Y demodulator. The output of the chroma circuit is sent to the Internal/External switch where it is switched with the OSD (see *Luminance Processing*) and matrixed to form G-Y.

The demodulated red, green and blue video signals are passed throught bus controlled bias and drive circuits andthen output at pins 30, 31 and 32 of U1001. The other circuitry shown in figure 33 is for AKB (automatic kine bias) which is not presently used on the CTC185 chassis.

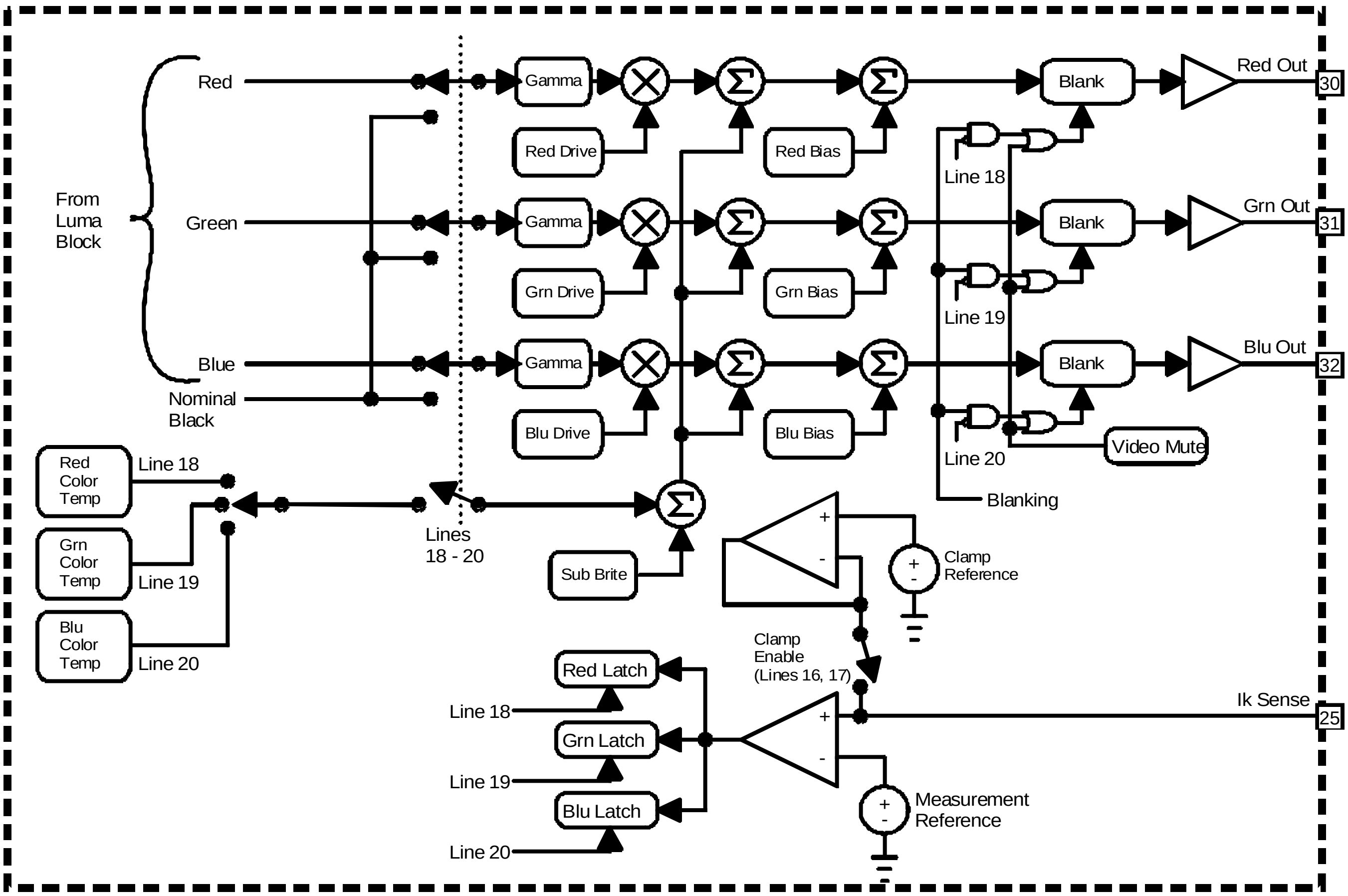
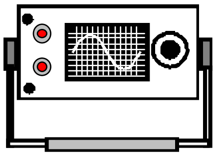


Figure 33, T4-Chip Kine Drive Processing Block Diagram

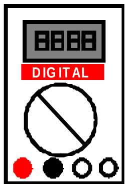
Color problems can best be diagnosed using an oscilloscope and a digital voltmeter.



No Chroma

1. Check the Color and Tint controls from the user menu.

2. Check the chroma input level at U1001 pin 40. It should be approximately 300 mVp-p.



3. Defeat the Color Killer circuit by applying approximately 4 volts DC to pin 39 of U1001. Free running chroma should be viewable on the screen (barber pole) if the 3.58 MHz oscillator is running.

Autocolor / Autoflesh Confirmation

Turn Auto color on and off from the video menu while viewing an NTSC color bar signal.

- The magenta bar should shift towards red.

- Chroma saturation should reduce slightly.

Note: The value of the resistors connected to U1001 pin 39 (R2804, R2802 and R2801) are critical for proper color saturation.

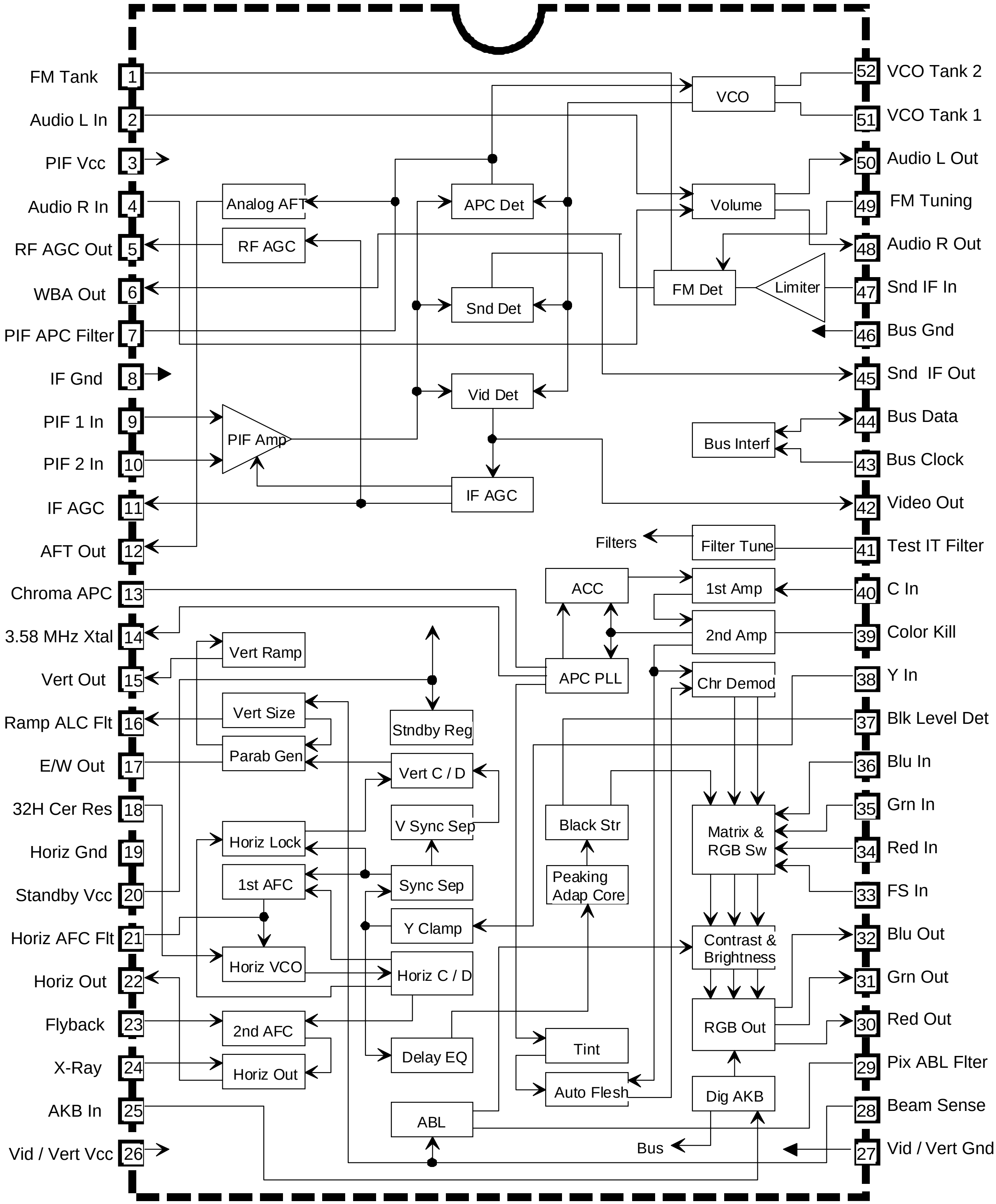


Figure 34, T4-Chip Overall Block Diagram

Audio Processing

The audio circuits of the CTC185 chassis family are of two types: Mono and Stereo. In the Mono sets, wide band audio from the IF circuit is output at pin 6 of U1001 and looped back to pin 4. The right channel of the audio circuitry serves as the mono channel. The audio signal is output at pin 48 and sent to the audio amplifier, U1950 and out to the speakers.

For stereo sets, wideband audio is output from U1001 pin 6 and applied to U1701 pin 5. There are no external switching IC's and volume control is accomplished in U1001. The left and right audio signals are then output from pins 50 and 48 sent to pins 5 and 1 of the stereo amplifier IC, U1901 and out to the TV's speakers.

U1701 informs U3101, the system control microprocessor, of the presence of a stereo broadcast with a LO out of pin 20. U3101 can then select Stereo or Mono with a LO or HI from pin 8.

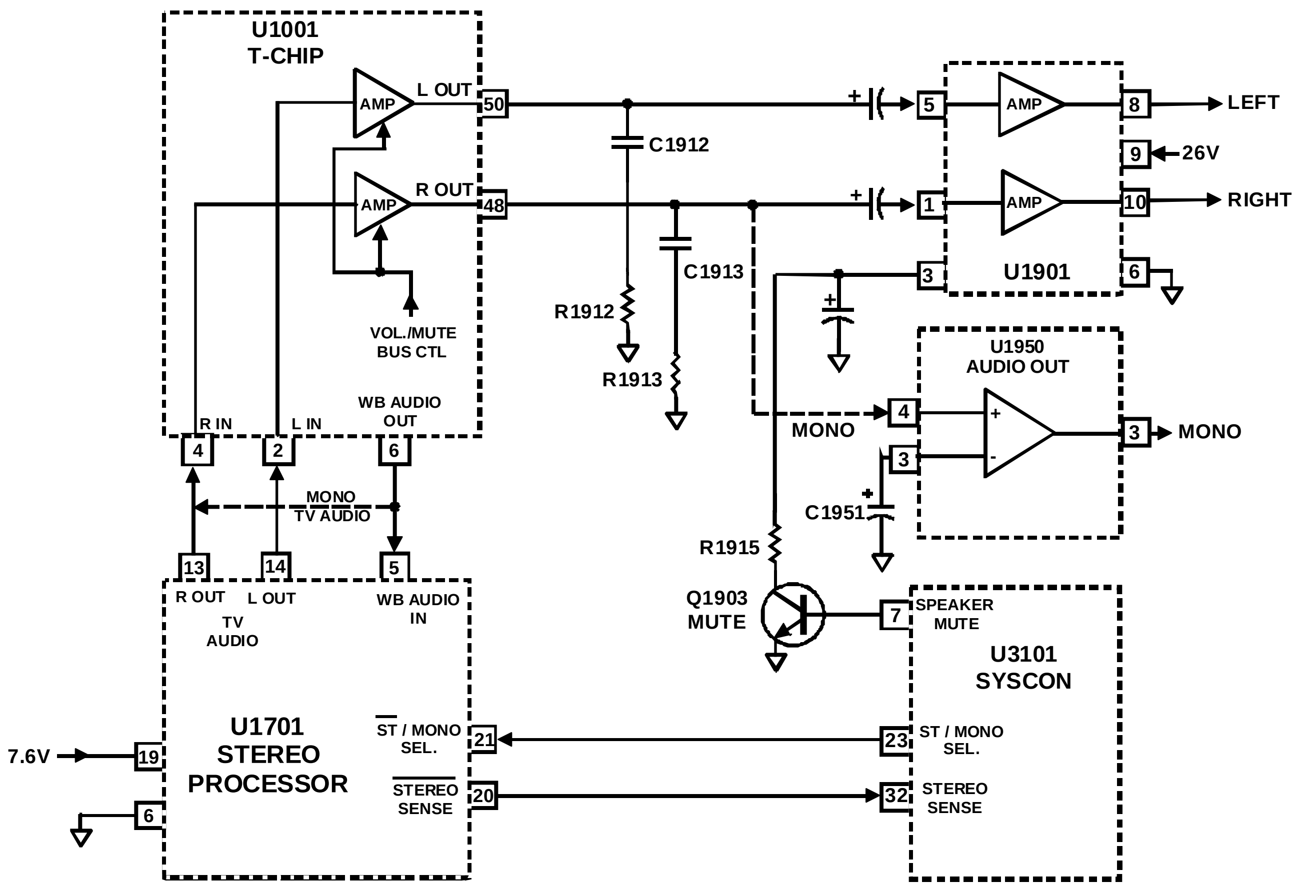
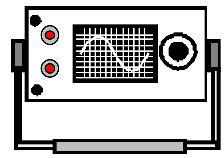


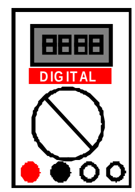
Figure 35, Audio Circuit Block Diagram

Pin 7 of U3101 outputs a HI to Q1903 which pulls pin 3 of U1901 LO to mute the speakers during power on. The normal Mute function on the remote control is controlled inside U1001 via the data bus. There are no Tone adjustments. Tone compensation is set by an RC network consisting of C1918, C1913 and R1913 on the right channel and C1917, C1912 and R1912 on the left. Volume control for the audio is accomplished inside U1001 via the serial bus.

Troubleshooting

The best approach in troubleshooting audio is to signal trace with an oscilloscope. Once the circuit area causing the problem is located, voltage and resistance checks can localize the defective components.





No Audio

1. Check pin 6 on U1001 for wideband audio out. This is a good midpoint in the circuit to start. If no audio is present, the problem may be related to the IF circuit. Confirm by connecting an audio source to the Aux input jacks (on sets that have them). If audio is present at pin 48 and 50 of U1001, go to the next step.
2. Check for audio out of pins 13 and 14 of U1701, the stereo decoder. If no audio is present, suspect U1701, the supply to pin 19 or a defective coupling capacitor in the decoder circuit. If the audio is present, go to the next step.
3. Check for audio on pins 48 and 50 of U1001. If audio is not present, but is present at U1001 pins 2 and 4, suspect U1001. If it is present, go to the next step.
4. Check for audio in and out of U1901 on pins 5 and 1 for the input, and 8 and 10 for the output. If audio is coming out of the IC, check the signal path out to the speakers. If audio is going in to the IC but not coming out, go to the next step.
5. Check the 23 volts to U1901 at pin 9 and the mute voltage on pin 3. Approximately 12 volts should be on pin 3 when the speakers are not muted.

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