TROUBLESHOOTING HINTS

Troubleshooting Overview

CAUTION: The primary circuit of the Switched Mode Power Supply uses a "HOT" chassis configuration in all versions of this chassis series. Always use a Isolation Transformer when servicing this chassis.

When troubleshooting the B+ regulator circuit, it is necessary to remember that there are two distinct modes of operation. The switching regulator is used to provide both the standby and run supplies. If the standby operation is not functioning correctly, the the run mode cannot be checked. If the cold (isolated) ground regulator control circuit fails to operate, the regulator tries to provide the proper outputs using the standby control circuit, however the regulator can not respond quickly enough. The set will operate, but the picture size will change depending on the scene content.

Most problems in the switching regulator circuit will result in a dead set symptom. If the fuse is blown suspect a shorted chopper output transistor. When the chopper output is found to be shorted, it is necessary to check all of the secondary supplies for shorts to ensure that the replacement part does not fail as soon as power is applied.

If the standby supplies are present, a dead set symptom could still be caused by either the on/off circuit and system control microcomputer, or the horizontal deflection circuit.

B+ Regulator Standby Circuit

Dead Set

A quick check of the chopper power supply operation is to check the +5 volt standby supply. If this supply is present, the power supply is probably operating normally and the problem is located elsewhere on the chassis.

Standby Supply Missing–If the standby supplies are missing, first check the raw B+ input, line fuse and surge resistor.

Raw B+ Missing–If the raw B+ is missing at the collector of the chopper output transistor, the line fuse or the surge resistor is probably open. The usual cause is a shorted chopper output transistor. If the chopper transistor is shorted, check the current sense resistor, R4110, before restoring power to the instrument. In addition check the resistance of the secondary supply lines of T4102. The resistance to ground from the cathode of all secondary supplies except the +15 volt line should be greater than 100K ohms. The resistance from the cathode of the +15 volt supply (CR4118) should be greater than 4K ohms. If any resistance measurement is less than prescribed, correct the problem on that supply line before restoring power to the instrument.

Raw B+ Present–If the raw B+ is present at the collector of the chopper transistor but the standby supplies are missing, the problem could be overcurrent shutdown, overvoltage shutdown or a malfunction in the regulator control IC and associated components.

1. Measure the DC voltage to "HOT" ground at pin 5 of U4101. If the voltage is greater than 2.5 volts, the IC is in the overcurrent shutdown mode.

2. Measure the DC voltage to "HOT" ground at pin 16 of U4101. If the voltage is greater than 15 volts, the IC is in the overvoltage shutdown mode.

3. If the voltage at pin 16 of U4101 is greater than 10.5 volts and less than 15.0 volts, the IC should begin operation. An overcurrent condition could exist which does not cause the IC to latch off. Measure the voltage at pin 3 of U4101. The voltage is nominally less than 0.6 volts during normal operation. If the voltage is between 0.6 and 0.9 volts, the regulator cycles on and off. If the voltage is greater than 0.9 volts, the IC latches off until AC power removed.

Overcurrent Shutdown–An overcurrent shutdown condition is normally caused by a shorted or leaky component on one of the regulated power supply secondary supply lines. For example, a shorted horizontal output transistor or "S" shaping capacitor causes an overcurrent shutdown condition. Check the resistance of the secondary supply lines (T4102) to determine which supply line is defective. See *Raw B+ Missing* section for proper resistance measurements.

Overvoltage Shutdown–U4101 enters an overvoltage shutdown mode if the input Vcc at pin 16 rises above 15 volts. The IC stays off until AC power is removed.

Overvoltage conditions can be caused by an open in the standby adjust voltage input to the error amplifier or a spike on the Vcc line due to insufficient filtering. Remove AC power and discharge C4118. Check CR4106, C4102, R4117. R4102, R4113 and R4104. Restore AC power and check for normal operation. If the input voltage is still too high, suspect R4149 (defective or wrong value).

No Output from U4101–If there is no output from U4101 and there is no overcurrent or overvoltage condition, use an external power supply to confirm operation of the IC. Remove AC power and connect an external DC supply to pin 16 of U4101. Connect oscilloscope to pin 14 of U4101. Raise DC supply above +10.5 volts (DO NOT exceed +15 volts) and check for output waveform. If waveform is present check for drive pulse at base of chopper output transistor Q4101. As DC input voltage is varied between +10.5 and +15 volts the duty cycle of the output (drive) pulse should change.

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If the output (drive) pulse is missing check for the 20kHz clock signal at pins 10 and 11 of U4101. If the clock signal is not present suspect defective C4107, R4105 or U4101.

Regulator Control Circuit–Confirm proper operation of the Standby circuit before attempting to diagnose a problem in the regulator control circuit.

If a problem in the regulator circuit is suspected, confirm the presence of the PWM feedback signal at pin 2 of U4101. If the signal is present, the regulator circuit is probably operating normally and the problem is in some other circuit area. If the PWM signal is missing check for the 26V p-p horizontal rate ramp at the base of Q4106. If the ramp is missing suspect a problem in the horizontal deflection circuit. If the ramp is present, check the DC voltage at the emitter of Q4106. If the voltage is Lo, suspect a defective Q4109 or a malfunction in the on/off circuit. Also the reference voltage circuit could be defective. If the voltage is approximately 5.0V suspect a malfunction in Q4106, Q4107 or the primary circuit of T4101.

X-Ray Protection Circuit

In this chassis the fault detector circuit, incorporated in the microcontroller (U3101), counts the number of times the fault detect input at pin 2 of the micro goes Lo. If the signal at pin 2 of the micro goes Lo three times within one minute, the micro keeps the set turned off until AC power is removed from the instrument.

A shutdown symptom can also be diagnosed as a dead set symptom. In addition, the fault detect circuit monitors the 10-watt per channel audio circuit for malfunctions in the audio output stage. A problem in the 10-watt per channel audio circuit can cause the same symptom as an X-Ray shutdown condition.

Begin troubleshooting by removing AC power from the instrument to reset the system control micro. Reapply AC power, turn the instrument on and listen for the high voltage to come up. In most cases of X-Ray shutdown, it is possible to hear the high voltage come up before the set shuts down. Shutdown malfunctions can be caused by an open retrace capacitor, a fault in the X-Ray detect circuit or a problem in the regulator circuit causing the reg. B+ to rise. The regulated B+ can be checked in the standby mode. It should be approximately 145 volts, if it is much higher correct the problem in the regulator circuit before trying to correct a malfunction in the horizontal deflection circuit.

If you suspect the set is shutting down due to a fault in the 10-watt per channel audio circuit, place the Int/Surr switch in the Ext/Surr position and disconnect any external speakers. Ground the base of Q1907 and turn the instrument on. If shutdown continues the fault is not in the audio circuit. If shutdown stops, immediately turn the set off and check the audio output stage for shorts or defective components. Before returning the instrument to the customer, be sure to place the Int/Surr switch in the internal position.

Pincushion Correction

Most malfunctions in the pincushion correction circuit result in the same symptom, the raster goes to maximum width and appears to be bowed out in the center. Begin troubleshooting by varying the settings of both the width and the E/W pin amp controls while observing the screen. If there is no change in the picture, the malfunction is most likely to be located after the pin amplifier IC (U4801). Suspect a shorted pin output transistor Q4802. If the picture changes but the raster cannot be set to the correct width or always appears bowed, suspect a malfunction in the vertical parabola, either Q4801, Q4803 or a leaky CR4805.

Vertical Deflection

Malfunctions in the vertical circuit can be grouped into two major categories, no vertical deflection and incorrect vertical deflection. The malfunctions covered in incorrect vertical deflection are; insufficient height, poor linearity and symmetry (vertical centering is off so the top half of scan is larger or smaller than the bottom half of scan).

No Vertical Scan–NOTE: Applying power to the instrument without the yoke attached will result in excessive power in the resistor (R4523) across the yoke, causing it to open. Always make sure the yoke is connected during troubleshooting.

Any malfunction which results in no gate drive to the SCR or an open SCR causes an overvoltage condition to C4503. There can be up to 160 volts across a part rated at 35 volts. Begin troubleshooting a malfunction of this type by removing jumper wire JW312 and replacing C4503. Connect an external DC power supply, adjusted to about 13 volts, to the high side of the vertical yoke winding (E4502). Apply AC power to the instrument and turn the set on. Connect oscilloscope probe to the gate of SCR501. Gate drive pulses should be present when the external power supply is at 13 volts. The gate drive pulses should stop when the external supply is reduced to about 10 volts, and should be continuous when the supply is adjusted above 13 volts. If these conditions can be achieved, suspect a defective SCR. If not, Suspect a defective component in the vertical ramp generator or horizontal ramp generator circuits. When the defective components have been located and the operating conditions with the external DC supply have been achieved, reconnect JW312 and remove the external power supply.

Insufficient Height–Problems in the height setting can be caused by either the power supply used to drive the vertical ramp circuit, the vertical ramp generator or the horizontal rate ramp at pin 2 of U4501. Check for change of the DC level at the cathode of CR4502 as the height control is rotated from minimum to maximum. It should vary between 22 and 33 volts as the height control is rotated. If the voltage is missing or incorrect, suspect R4522, CR4502 or C4504. If the DC voltage is correct, check for a vertical rate ramp signal at pin 3 of

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U4501. If the signal is missing or incorrect suspect Q4506, C4518 and C4519. Also check for horizontal pulse at pin 2 of U4501. If this pulse is missing or incorrect suspect defective CR4501, CR4512 or Q4507.

Linearity–Problems in linearity are most apparent when viewing a crosshatch pattern. For problems in linearity suspect C4503, C4520 and R4512.

Symmetry–Problems in symmetry appear as vertical centering problems. The raster is offset so that the top half of the raster is either larger or smaller than the bottom half. Suspect R4513, R4521 or R4525.

System Control

There are only a few quick checks to verify operation of the System Control Micro, U3101.

1. Check 4MHz oscillator at pins 39 and 40.
2. Check for a high on the reset line at pin 1.
3. Check for activity on the Clock line at pin 15. This line synchronizes the transfer of data between devices. The Clock line is not a continuous signal, it is only active during data transmissions. The line should pulse Lo about 4 times every second when no functions are activated. The activity should vary when a local or remote function is activated.
4. Check for activity on the Data line at pin 14. This line conveys the command or status information sent between the various devices on the bus while the rest of the signals are used for timing and directing the data transfer. The viewable activity on this line is very similar to the activity seen on the Clock line.
5. Check for activity on the Enable line at pin 13. Before commands can be sent to a specific bus device, the system control micro sends the address of the desired device to inform it that it is going to be receiving a command. A Lo on the enable line signifies that device information is being transmitted on the Data line while a Hi signifies command data. The viewable activity is about the same as seen on the Clock and Data lines.

Video IF

No Video, Audio OK–Since audio is taken from Q2302, you can assume that circuits prior to this stage are functioning properly. Check for video before and after the 4.5MHz trap, CF2301. If present, check for video at the emitter of Q2701. If present, the problem must lie beyond this circuit.

No Video or Audio–Check for video at the base of Q2302. If present, check for video at the collector and emitter of Q2302. If signal is not present, suspect defective Q2302.

If signal is not present at the base of Q2302, Check for 300 mV p-p signal at pin 3 of the tuner. If present, check for 140 mV p-p signal at pins 9 and 10 of U1001. If signal is not present suspect defective Q2301 or SF2301. If signal is present, check DC voltage at pin 1 of the tuner (AGC). It must be greater than 2.0 volts. If AGC voltage is greater than 2.0 volts suspect defective U1001.

Luminance Processing

No Video–Check for -Y signal at emitter of Q2906. If signal is not present, check for composite video input at pin 1 of the analog comb filter IC, U2601. If present, trace composite video signal from pins 2 and 3 of U2601 through 1H delay line to pin 5 of U2601. If present check for Y and C signal output from U2601 at pins 7 and 8 respectively. If present, check for luminance at pins 43 and 40 of U1001. Make sure the Sync Kill line is not active except during channel change. If present, trace the luminance signal from pin 38 of U1001 to pin 35 of U1001. Check brightness and contrast control lines (DC level should be variable). Make sure that pin 19 of U1001 is not stuck Lo (Blnk).

Chroma

No Color–Since most problems in the chroma stages result in the loss of Chroma, DC voltage and signal variation is the best way to troubleshoot this stage.

Check for R-Y, G-Y and B-Y outputs at pins 15, 17 and 18 of U1001. If not present, check for chroma input as well as DC offset at pin 31 of U1001. If present, check for burst key pulse at pin 21, color killer voltage at pin 30 and leaky or open APC Filter, C2802, at pin 12. Also check the 3.58 MHz oscillator.

Digital Audio

No Audio–Make sure volume level is not set at minimum. Connect a external audio source to one of the external audio input jacks at the rear of the instrument. If audio is present, check the wide band audio circuit coming from pin 52 of U1001.

If no audio is present from either internal or external source, check for audio at pins 20 and 21 of U1600. If present, the problem most likely is in the power amp stage. If audio is not present at pins 20 and 21, check for audio at pins 23 and 24 of U1600. If audio is present, the problem most likely is in the volume control section of U1600.

OSD Stereo never indicates Stereo on known Stereo Station–Select Mono mode in audio menu and connect a frequency counter to pin 15 of U1600 through a 10X low cap probe. Frequency should be 11,014,000 Hz ± 500 Hz. If not, suspect defective C1613 or C1614. Also check for 2.5 volts DC bias at pin 14 of U1600.

Poor Stereo Separation–Check wide band audio input level adjustment.