

S.E.R. FAQ **NotTaR of Television Sets** : [Safe troubleshooting techniques for line..](#)

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Safe troubleshooting techniques for line powered TVs

TVs are particularly dangerous with respect to troubleshooting due to the fact that a substantial portion of their circuitry - sometimes all of it - is directly line connected. Even if your are working in a totally unrelated area like the sound circuits, awareness of the general design and location of the line-connected circuits can prove to be a life saver.

These designs may take several forms:

Separate switchmode power supply (SMPS). In this case, only the primary side of the power supply is line connected. The remainder of the TV is usually isolated from the line by the high frequency transformer and feedback device (transformer or optoisolator) of the switchmode power supply.

1. On-board SMPS - a portion of the circuitry on the mainboard is directly line-connected. In the best case, this is restricted to the area around the power cord connections and well marked on both top and bottom but don't count on it. Again, the rest of the TV may be isolated but avoiding hazardous areas is more difficult especially in cramped quarters.
2. Flyback derived power supply - a non-isolated linear (usually) power supply provides B+ to the horizontal deflection (and startup circuit). All other system power is derived from secondary windings on the flyback transformer. Similar comments to (2) above apply.

(1) to (3) may be found in TVs with A/V inputs and outputs.

4. Full hot chassis - a bridge rectifier/filter capacitor/linear regulator provides some voltages including B+. The flyback secondaries provide the remaining voltages. All share a common return which is at the intersection of two of the diodes of the bridge rectifier. There is no isolation.

This type of design will usually not be found in a TV where there are external connections (other than the RF antenna/cable connector which can be capacitively isolated and you may actually get an AC reading or even sparks between the RF shield and an earth ground due to this capacitance.)

WARNING: Never attempt to add A/V inputs or outputs to such a TV as the signals and shields will be electrically live.

However, some TVs with A/V inputs/outputs actually had a live chassis and used an isolated means of coupling the signals from/to the external jacks:

(From: Bill Coffel (bc@datamix.com).)

The late 70's and early 80's Sony CVM 1250/1750/2150 (12"/17"/21") monitors (TV) have a HOT chassis. In fact they are kV-1201/1701/2101 TV sets in larger cabinet With a 3 prong plug!!!! The inputs and outputs are isolated via opto couplers and transformers on an additional circuit board (about 6" by 8" and powered by a small transformer) the connector panel is the only part grounded via the third prong.

If someone thinks its not a live chassis they are in for quite a shock.

Always use an isolation transformer, whatever kind of design is used in the equipment you are troubleshooting. There are very few situations in which an isolation transformer will hurt. If you use it automatically, you will never have a chance to screw up.

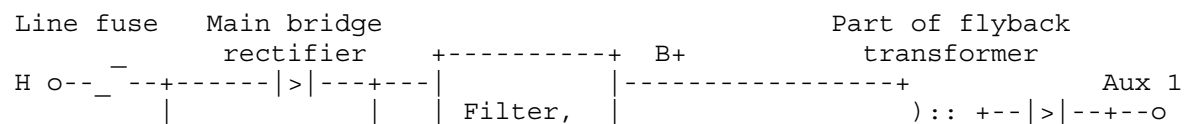
Identify the appropriate ground point (return) for your multimeter or scope. These should be marked in the Sams' Photofact or service manual. There may be several such returns such as: non-isolated, signal, and CRT. Selecting the wrong one - even momentarily connecting to it - can ruin your whole day.

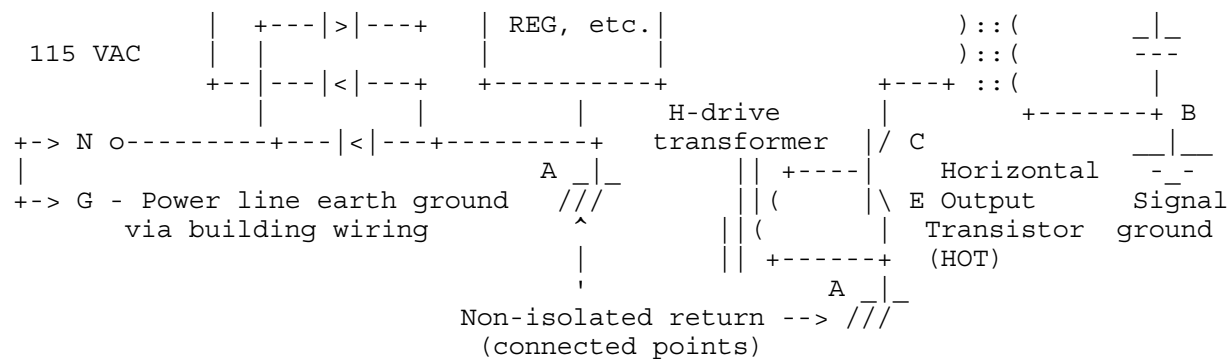
If you are not using an isolation transformer (a no-no), connecting your scope to the wrong ground point can result in (1) blown fuses and/or blown parts, and a very dangerous situation and (2) readings that don't make sense generally with distorted power line frequency signals of high amplitude.

- Use the non-isolated ground (A) (with your isolation transformer on the TV **ONLY** for measurements of voltage on the line-connected power supply.
- Use the signal ground (B) for all measurements of tuner, IF, video, and sound circuits.

Whenever you get a reading or waveform that is grossly wrong, confirm that you are using the proper ground point! Note that failures of fusable resistors in the **RETURN** of the HOT or power supply chopper or elsewhere can also result in points that should be near ground floating at unexpected voltage levels.

The general arrangement of components for a typical TV using a linear B+ supply with isolated auxiliary supplies for the signal circuits is shown below including the (linear) line-connected power supply, horizontal deflection output (drive, horizontal output transistor, flyback), and a typical Aux power supply output.





For this power supply, what if?:

1. You connect your scope ground clip to the non-isolated ground (A) and you are **NOT** using an isolation transformer?

Answer: you blow the line fuse and/or melt your scope probe ground lead. Other parts may be damaged as well. In effect, you have just shorted across the bottom diode of the bridge.

2. You attempt to monitor a video signal with your scope ground connected to the non-isolated ground (A)?

Answer: you see only a highly distorted power line waveform of roughly 100 V p-p. In effect, you are measuring across one of the diodes of the bridge rectifier, stray capacitance, etc.

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