

Aug.-Sept. 1968 • Volume 11/No. 8-9

Safety After Service

RCA Consumer Electronics Products are designed and produced with safety in mind. All instruments are subjected to manufacturing tests to positively insure the product will be safe. It is very important that the technician assure that the instrument is safe before it is returned to the customer. The safety check procedures outlined in this article should serve as a guide to determine if the repaired product is safe to use.

Transformerless Chassis

Many portable instruments feature direct power line operation, in which case one side of the 120 volt AC power line is connected to the ground side (chassis) of the circuit. Protection to the user is afforded by electrically insulating the chassis from all cabinet components. Safety devices such as insulation inserts, shields and screens are designed into instruments to prevent accidental customer contact with the chassis.

The service technician must properly replace all protective devices when reinstalling a chassis in its cabinet. The instrument should then be checked for shock hazards.

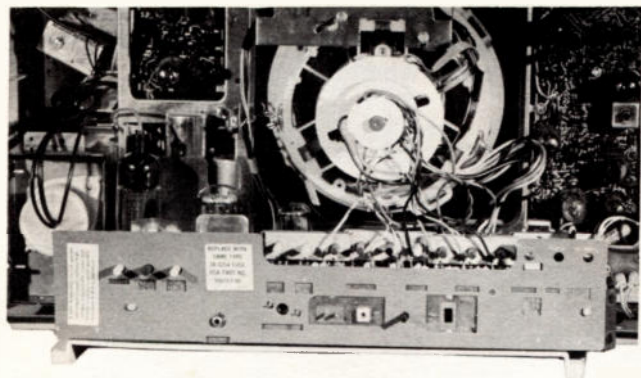


Figure 1—Rear View CTC 36 Chassis
Insulation Paper Location

A good check is to connect a low resistance AC voltmeter between all exposed metal cabinet parts (including metallic coated knobs) and a known earth ground—such as a cold water pipe. Touch the voltmeter test probe to all the exposed metal parts, then reverse the instrument line cord and repeat the test. A zero reading indicates no hazardous potentials exist, and the instrument is safe to use. In the event voltage is measured, it is the duty of the servicing technician to locate the problem and correct it before returning the instrument to its owner.

Power Transformer Chassis

Although additional safety is provided by the isolating effect of a power transformer, it is still possible for a circuit malfunction to place hazardous voltages on this type chassis. This could result from a breakdown in the primary-to-sec-

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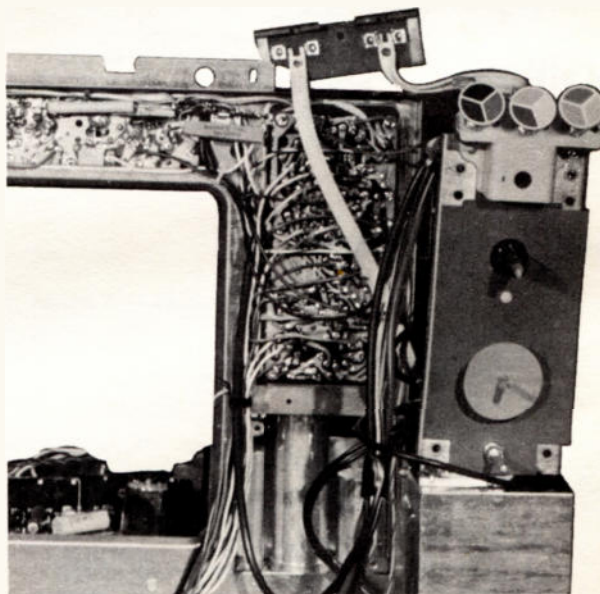


Figure 2—Protective Insulation (CTC 36 TMA)



Troubleshooting Video Stages

Experienced radio technicians use a signal injection technique for troubleshooting audio amplifiers that can be readily adapted to servicing video stages. This technique is a simple and quick method for troubleshooting either transistor or tube type video amplifier circuits.

The troubleshooting procedure begins by injecting a 60 Hz test signal at the input of the first video amplifier stage as illustrated in Figure 3. The absence of a hum-bar on the screen indicates a video amplifier problem. Next inject the signal at the input of each following stage until a hum-bar is produced on the screen. Obtaining a hum-bar indicates that the stages following the injection point are passing signal and the problem is located in the stage preceding the injection point.

Obtaining Injection Signal

The filament winding of transformer-powered sets provides a handy point to obtain a 60 Hz injection signal of the necessary amplitude. When servicing series filaments chassis, a 5–8 volt 60 Hz signal can be obtained by selecting a point near the chassis common end of the filament line. (The tuner filament point is at this potential in many sets.)

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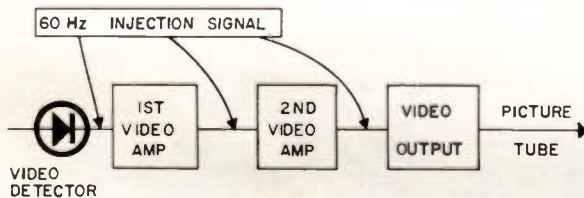


Figure 3—Signal Injection Points

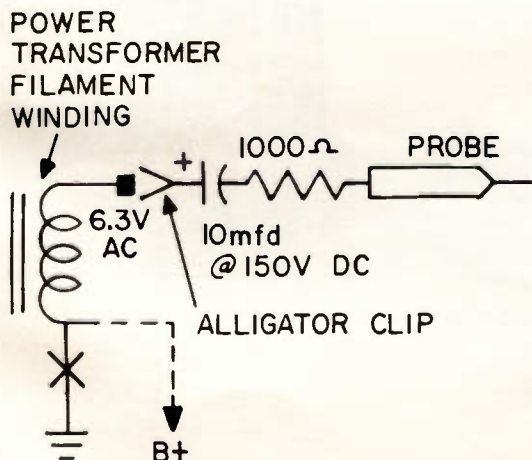


Figure 4—Signal Injection Probe

Signal Attenuator Pads

Though it would seem that the best in color television reception would be experienced in strong-signal areas, this is not always true. An exceptionally strong signal can actually distort or even completely cancel color signal reception; excessive signal can cause two effects in a color television receiver that will not affect its black-and-white reception too seriously, but can result in real problems in color reception. First, the bias developed by the excessive strength of the RF signal causes the RF amplifier response to change. When the RF response changes to the point where frequencies carrying color information are attenuated, color will be weak or missing altogether. Secondly, the standing-wave ratio on the transmission line becomes higher. Standing waves are particularly troublesome when the ratio becomes high enough to reduce portions of the signal.

Both of these conditions can be eliminated by reducing the signal input to the receiver. It is strongly recommended that a matching and attenuating pad be installed in all areas where the signal level is very high. Try several attenuator pads with different values of attenuation ranging up to 10 db (or even more in locations where the signal is very strong). Connect the pad between the transmission line and the receiver, preferably at the input terminals on the RF tuner in order to minimize direct pickup of signal on leads between the pad and the tuner. The use of a pad is also helpful in cases where the receiver does not terminate the transmission line properly, since it tends to reduce standing waves. The resistors in the pads should be of the carbon-composition type, **not wire-wound**.

For convenience, Figure 5 shows schematic layouts and values of the carbon resistors used in attenuating pads that will produce respectively, ten-to-one, (20 db) three-to-one (10 db) and two-to-one (6 db) reduction in signal strength. Don't let a strong signal throw you; use appropriate attenuator pads whenever necessary.

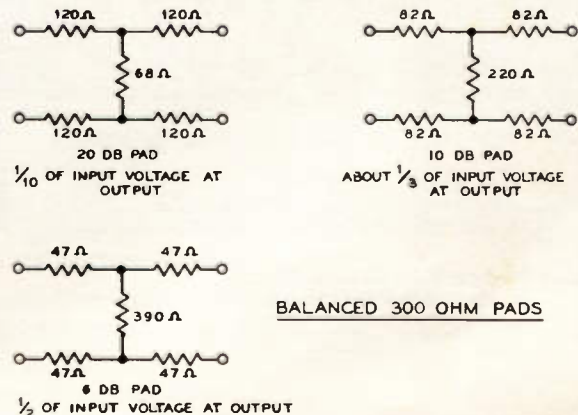


Figure 5—300-Ohm Attenuator Pads



MOS-FET RF Amplifier Stage

An MOS-FET is featured in the RF amplifier stage of the new KRK 142 VHF tuner. This tuner (used in solid-state CTC 40) with the exception of the RF stage, is nearly identical to the KRK 140 featured in the hybrid CTC 38 chassis.

The RF amplifier stage of the KRK 142 is unique because it uses a dual-gate FET. This device is the combination of two separate transistors within a common case. The individual transistors are connected as a cascode amplifier circuit—similar to that illustrated in Figure 7. Referring to Figure 7, transistor Q1 is a **common source** amplifier. Signal from the tuned antenna circuit is applied to the input (gate-G1 of transistor Q1). This transistor directly drives transistor Q2, which is connected in a **common gate** configuration. The amplified signal output is taken from the drain circuit of transistor Q2.

The cascode circuit has the characteristics and advantages of its vacuum tube counterpart. Internal feedback capacity (in conventional RF stages will cause amplifier instability or oscillation making it require neutralization) is loaded by the relatively low input impedance of the common gate stage—transistor Q2. This loading eliminates the need for RF stage neutralization in the VHF frequency range.

Tuner RF AGC is obtained by varying the gate bias of both Q1 and Q2. As illustrated in Figure 7, the AGC line is connected via a voltage divider network to the gates of both transistors.



Figure 6—KRK 142 Tuner Showing MOS-FET

Figure 8 illustrates the actual circuit utilized when the separate transistors (Q1 and Q2) are combined by use of integrated circuit techniques. The illustration also details the actual signal path and bias conditions used in the KRK 142 tuner. Signal from the antenna is applied to a balun circuit located on the antenna terminal board—as it is in the CTC 38. The 75-ohm output from the balun is applied to the tuned RF input circuitry of the tuner and then coupled to the signal gate of the MOS-FET. AGC, which ranges from -5 volts on extremely strong signals to $+6.7$ volts under no signal conditions, is applied through the voltage divider consisting of R17, R16, and R3 to both gates of the RF amplifier transistor. B+ voltage is applied via L27 and the mixer transformer to the drain circuit. Amplified RF signal is taken from the drain and coupled through the mixer transformer to the input of the cascode mixer circuit.

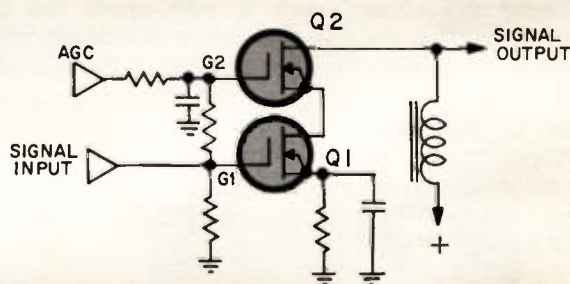


Figure 7—Cascode Configuration

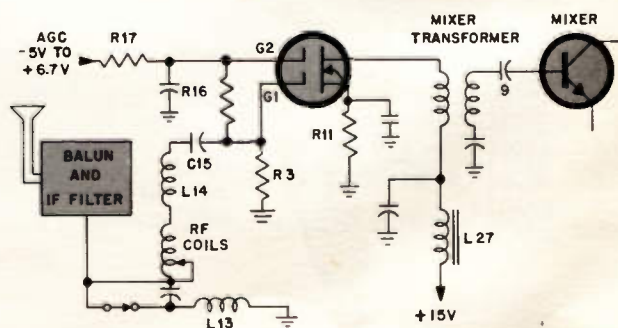


Figure 8—Basic KRK 142 RF Stage

Safety After Service

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ondary insulation in the power transformer. Another possibility would be accidental mis-dress of leads or misconnection of leads, and other such accidental errors, during service could cause an isolated chassis to be "hot". Therefore, power transformer equipped instruments should also be checked before they are returned to the customer.

Safety For The Technician

Although the primary consideration of this article is the safety of the consumer after servicing, technicians should consider their own safety when servicing these products. Obviously when the chassis is removed from the cabinet all of the protective insulation is removed and all potential shock hazards are exposed. Anytime a transformerless chassis is removed from its cabinet a potential shock hazard condition exists because the chassis is connected to one side of the line.

Care In Soldering

Soldering is usually thought of as one of the least expensive functions involved in servicing a television receiver. With due care, this should be so; but when carelessness creeps into the picture, soldering can become very expensive. For instance, a splash of solder gone unnoticed on a peaking coil, see Figure 9, can upset the performance of a receiver—such a condition might readily result in an expensive recall. If the splashed solder is hidden, it may even lead into a perplexing and time consuming circuit analysis. A short circuit in the filament or B+ circuitry caused by splashed solder can result in excessive damage to the receiver or in a perturbing case of intermittent operation.

Always use care in soldering; avoid the possibility of creating uncalled for problems. Employ good soldering techniques at all times—don't let soldering become an expense.

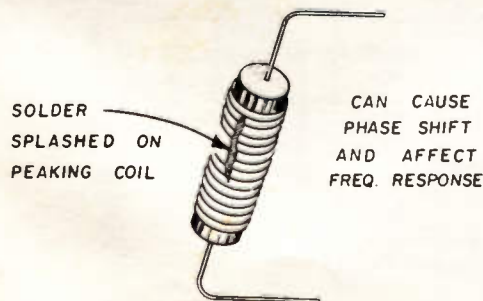


Figure 9—Solder Splashed on Peaking Coil Affects Receiver Alignment



Figure 10—RCA WP-25A Isotap

Three things will afford the technician added safety. The first is a rubber mat to stand on when servicing these chassis. The second is to connect the line cord so that the chassis is at AC line ground. The third, and the best choice for protection against potential shock hazard, is the use of an **isolation transformer** such as the RCA WP-25A TV Isotap. This transformer, in addition to providing protection when servicing "hot chassis" instruments, also supplies a series of switch-selected output voltages. This feature is a helpful servicing aid since service data voltages are measured with a nominal 120-volt line input. In areas where line voltage is above or below the nominal value, the WP 25A can be switched up or down as required to provide a 120-volt output.

Troubleshooting Video Stages

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The test signal should be coupled to the chassis by using an electrolytic capacitor and a resistor as illustrated in Figure 4. The values of these components are not critical—a good combination is a 10 mfd capacitor and a 1000 ohm resistor. A word of caution however; the picture tube filament winding of many color sets operates at a relatively high DC potential, and since an electrolytic capacitor is used to couple the injection signal, polarity must be observed. Also the DC voltage rating of the capacitor should be at least 150V.

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Product Performance—Technical Training

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