RCA
Plain Talk
and Technical Tips

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Color Television Workshop 14 Servicing XL-100 Signal Processing Circuitry

Starting in March of 1975, RCA Consumer Electronics Distributors will be offering the new, half-day Color Television Workshop 14 program entitled, **"Servicing XL-100 Signal Processing Circuitry."** Workshop 14 is another in the continuing series of television servicing workshops that have been presented by RCA Consumer Electronics Distributors since 1968.

In addition, Workshop 14 is the second of a special two-part XL-100 color television training package. As many will recall, Workshop 13, the first part of this package, taught the operation and servicing procedures pertaining to the SCR horizontal-deflection and high-voltage circuitry of XL-100 chassis. Workshop 14 complements the previous program by presenting the operation and servicing aspects of the XL-100 signal processing circuitry.

Although most of the XL-100 signal processing circuitry is contained on nine plug-in modules (plus the UHF and VHF tuners), some amount of additional circuitry exists off the modules. Problems with the off-the-module "auxiliary" circuitry are difficult to diagnose for two basic reasons:

- Because of the ease of service afforded by module replacement, the operation of the auxiliary circuitry as part of the overall system is not fully understood by many service technicians.
- The effect of auxiliary circuits on normal module operation complicates symptom isolation.

The result of these two factors is that problems with off-the-module circuitry, although relatively few in number, tend to be "dogs" in the eyes of many technicians.

Technicians who attend Workshop 14 will learn how the auxiliary circuits support the modules in a complete circuit "system," and how to most

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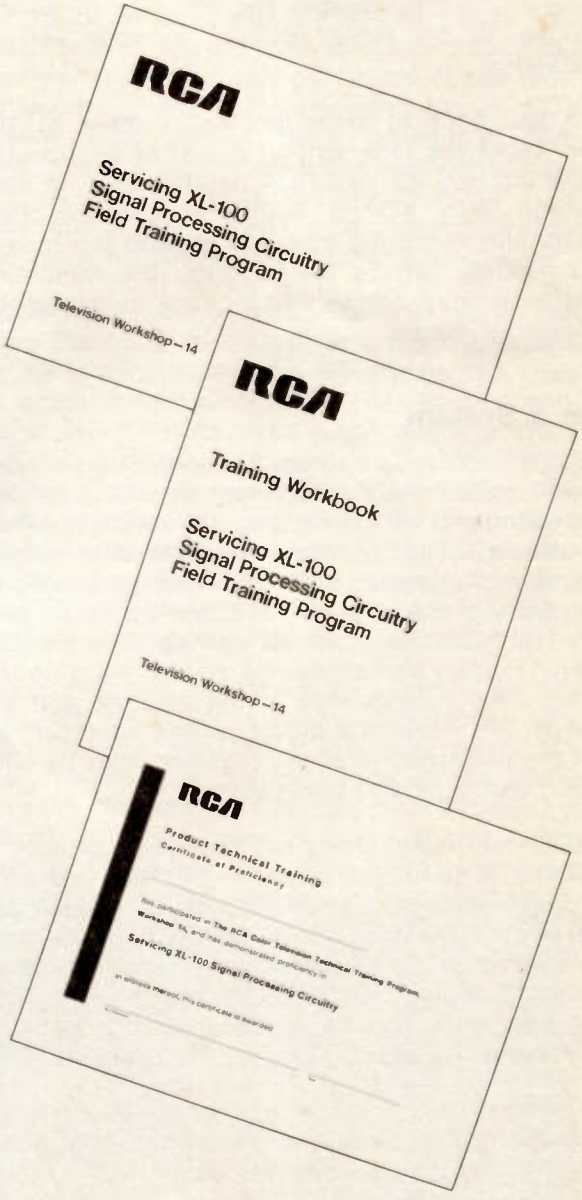

Figure 1—Workshop 14 Materials

A publication for the service industry prepared by RCA Consumer Electronics

Efficient XL-100 Color TV Service

Today over 67% of all U.S. households have one or more color TV sets. This conservatively represents around 49-million sets that will very possibly sometime require service. Because of these sheer numbers, there is a chronic shortage of qualified Color TV Technicians, and those available often have a backlog of sets to service. Manufacturers have realized the dilemma of the service industry, and have responded by designing sets to be as serviceable as possible; yet even this is not enough. The long-term answer seems to be to somehow attract more young people into a service career. In the meantime, the backlog on the floor of your shop must someway be eliminated. You can take steps yourself to improve the situation by simply learning to be more efficient in your service operations.

RCA has gone to great lengths to make XL-100 color receivers rank among the most serviceable in the industry. Quality RCA Service Data, in conjunction with XL-100 Technical Training Programs and reference manuals provide the means to efficiently service the product; the remaining hindrance may simply be lack of a systematic service technique.

Use a System

When a systematic approach to servicing is used, XL-100 color television receiver servicing can be interesting and very rewarding. For example, when a customer calls for service be certain to obtain, record, and organize all information pertaining to the nature of the problem. In other words, be prepared to make the call, so service may be performed quickly and efficiently. Before entering the house, take a quick look at the antenna and the lead-in. Since antenna problems can adversely affect the performance of the receiver, note its condition, age, type and orientation.

Once in the home, check the customer controls of the set to determine if all are responding properly, before removing the back. Do not change the adjustment of the rear-apron set-up controls until a diagnosis of the receiver performance has been made. Changing set-up adjustments may hide symptoms that can be of considerable value in diagnosing the exact cause of the problem.

We all know that basically a color chassis is nothing more than a black-and-white chassis with circuitry added to process the color signal. This means the receiver must provide a good black-and-white picture before it can produce a good color picture. So, the first logical step toward analyzing improper operation of a color receiver is to observe its performance on black-and-white reception by turning down the **COLOR** control.

Check Black-and-White Reception

Abnormalities seen on the screen of a color receiver displaying a black-and-white picture will reveal the condition of the majority of the circuits within the receiver. For example:

- General operating defects such as, no picture; no brightness; no sync; distorted picture; no sound; etc., reveal faults common to both black-and-white and color reception.
- Color fringing on a black-and-white picture indicates improper operation or adjustment of the convergence circuits.
- Color shading in sections of the background of an otherwise normal black-and-white picture indicates impurity in the primary color fields—a possible degaussing circuit problem.
- An overall color cast (red, blue, or green) over the entire background of the picture indicates improper color balance. This can be caused by improper set-up adjustment or a malfunctioning MAD module, MAE module, screen circuit, or picture tube.

As a matter of fact, if a normal black-and-white picture is produced, it is a good indication that the following circuits are in proper working order:

- Low-voltage power supply (MAB module)
- High-voltage power supply
- Horizontal and vertical deflection circuits (MAH and MAG modules)
- Sound IF and audio circuits (MAA and MAN modules)
- Video-amplifier circuits (MAL and MAD modules)
- AGC circuits
- Convergence circuits
- Picture tube and all associated controls

The tuners and picture IF (MAK) module might also be added to this list, but there are occasions when they could affect color reception without a noticeable effect on black-and-white reception. This condition could occur when the RF or IF circuits are misaligned to the extent that the chrominance information is lost or greatly attenuated. Keep in mind that improper antenna characteristics or orientation can also cause poor reception of color signals even though black-and-white reception may appear unaffected.

Color Performance

Color performance should be considered only after good black-and-white performance is confirmed. This, for all practical purposes, isolates color deficiencies to the chroma circuits. Color symptoms generally fall in three categories: no color; no color lock (sync); and improper color rendition. Localization of any of these conditions in XL-100

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MOV Protection

A new protective component is used in the AC-line input circuit of the CTC 72 chassis and all "T-Line" color remote chassis that use a triac for AC power switching. Known as a "metal-oxide varistor," or "MOV™," the device is electrically equivalent to a pair of back-to-back zener diodes. For several years, computers and complex industrial circuits have used back-to-back zener diodes in a clipper

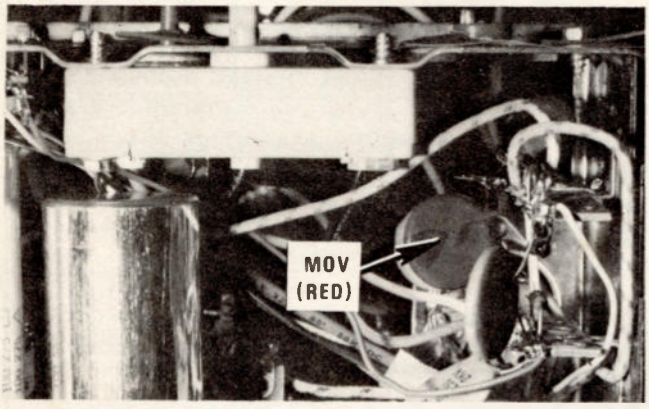

Figure 2—Protective MOV

circuit (illustrated in Figure 3) to protect sensitive electronic components from damage by over-voltage spikes that may occur on AC power lines. Unfortunately, this protection was denied consumer products because of the costly high-voltage, high-power zener diodes needed for the clipper circuit.

In the 1950's, a component known as the silicon-carbide varistor—also known as a "VDR"—became available. This device was a nonlinear resistance, in that its resistance decreased with increasing voltage. Some use was made of the VDR as a power-supply transient protective device. However, its performance was not entirely satisfactory for a couple of reasons. Most noteworthy was the inability of the manufacturers to maintain

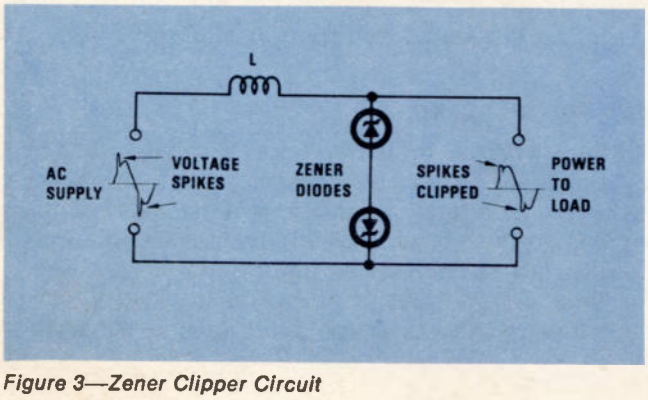

Figure 3—Zener Clipper Circuit

tight control of the nonlinear resistance characteristics, and secondly, due to the nature of silicon carbide, a sharp "knee" of resistance change (conduction) was unattainable. This meant that not only was the clipping action not "sharp" enough to provide protection, but the VDR continuously dissipated power under normal line voltage conditions.

Recently, the new MOV became available which displayed nearly the same ideal characteristics of back-to-back zener diodes at a far lower cost. This device, made of inexpensive specially processed zinc oxide, has the closely controlled characteristics needed for the voltage-clipper circuit. RCA engineers quickly realized the advantages of utilizing this device to protect sensitive semiconductors from over-voltage spikes and began using it for rectifier diode and triac-AC-power switch protection in many model-year 1975 color instruments.

The operation of the MOV circuit is easily explained. The MOV used displays a high resistance when the terminal voltage is lower than about 375 volts, which is equivalent to the peak-to-peak voltage of a 132-volt RMS input supply voltage. Thus, the MOV is in its high resistance state for all expected input line voltages, and consequently draws little power from the source. In the event of a power-line transient (voltage spike), the instantaneous voltage applied to the MOV exceeds 375 volts; the device switches to its low resistance state and the spike is absorbed by the series inductor (L).

Shown in Figure 5 are schematic sections for two RCA XL-100 chassis that use MOV protection. Notice that in each, the MOV (designated as RV 101 on the schematic) is connected across the power input to the chassis. The CTC 72 schematic section clearly shows the current-limiting inductor (L101, line-input choke) in series with RV 101. Although

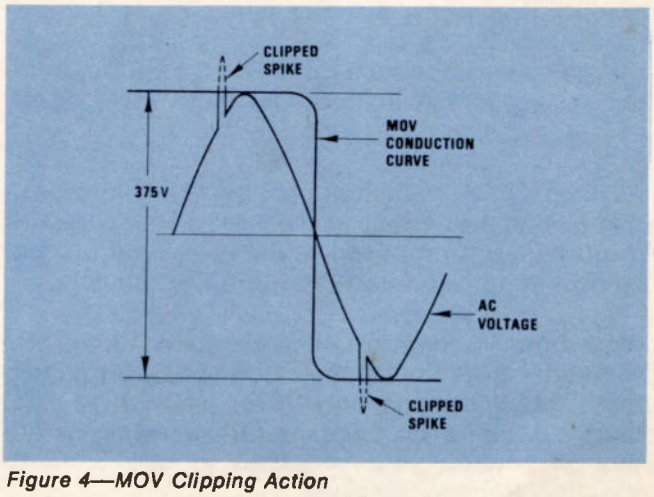

Figure 4—MOV Clipping Action

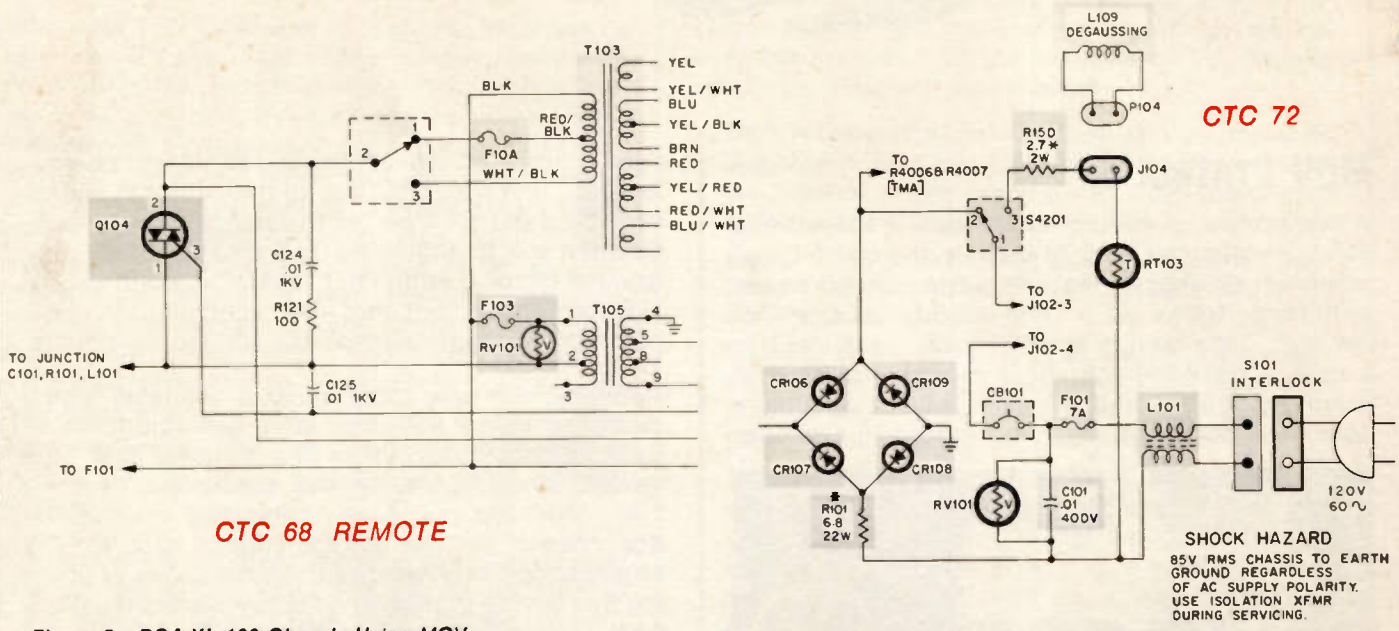

Figure 5—RCA XL-100 Chassis Using MOV

not shown in the CTC 68 remote schematic section, a similar inductor (line-input choke) is in series with that MOV also. From the standpoint of servicing, the MOV is a very reliable component and should normally last the life of the set; however, if it does fail and must be replaced, it is very important to use only the device called for by Stock Number in RCA Service Data.

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Workshop 14

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efficiently diagnose and repair off-the-module circuitry. During the workshop presentation, the instructor will discuss the signal-circuit operation and servicing, aided by simplified diagrams and demonstrations. Attending technicians will then practice the newly learned servicing techniques on "bugged" chassis. Strong emphasis will be placed on waveform analysis, and the various servicing procedures will incorporate the oscilloscope as a prime diagnostic tool.

As in past RCA Technical Training Workshops, reference manuals detailing the servicing techniques discussed and practiced in the workshop presentation will be given each attending technician.

Workshop 14 sessions are scheduled to be presented by RCA Consumer Electronics Distributors from March through July 1975. Be sure to contact your local RCA Consumer Electronics Distributor to confirm your invitation to one of these valuable training sessions.

Color TV Service

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chassis is relatively simple since nearly all circuitry involved is contained on the two color modules—MAC and MAE.

In the case of no color or weak color, module MAC should be substituted in the home as a first step before more extensive service is performed. Symptoms of no color are also associated with MAC malfunctions.

Improper color can be caused by malfunctions of both the MAC and MAE modules. As in conventional (non-modular chassis), the color circuits might simply need to have the color AFPC reset. So, before changing modules, try AFPC set-up.

In summary, remember, RCA XL-100 servicing is no more difficult than servicing black-and-white receivers—in many cases it's even simpler, because of modular construction and the abundance of Service Data and Training Programs available. See your local RCA Consumer Electronics Distributor for information on his current Technical Training Programs and plan to attend—Today!

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