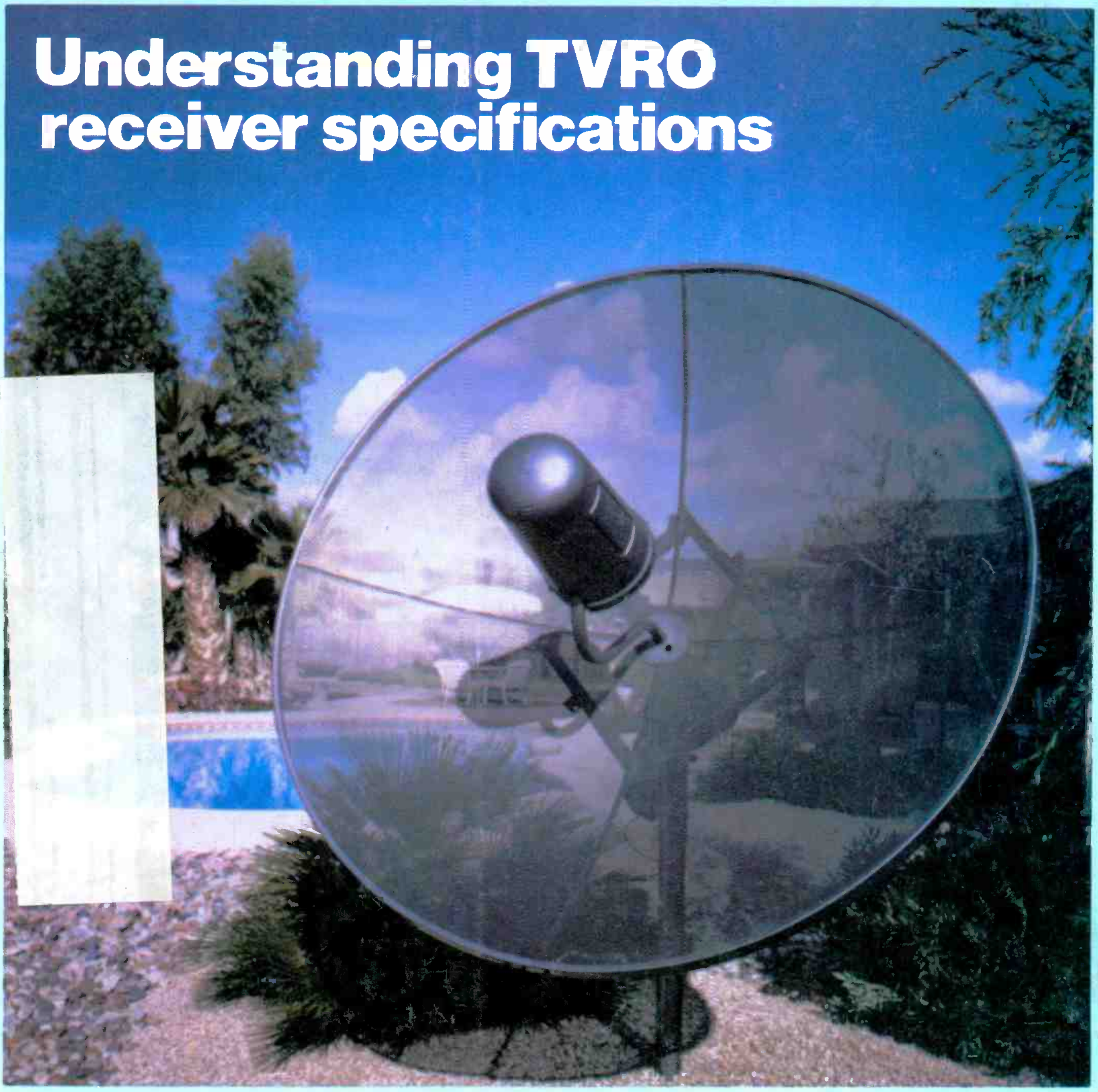
ELECTRONIC

Servicing & Technology

JULY 1985/$2.25

Sylvania Superset II—part 4 • Opening the door to microwave oven servicing

What do you know about electronics?—padders, SCRs, snubbers



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ELECTRONIC
Servicing & Technology

Volume 5, No. 7 July 1985

Departments:

The design of a satellite receiver is uniquely different from conventional TV-broadcast receivers. *(Photo courtesy of the Winegard Company.)*

Automated tests are simplified by technological advancements. *(Photo courtesy of Tektronix.)*

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Editorial

Electronic products--some booby prizes

By the time this editorial is published, another summer Consumer Electronics Show (CES) will have come and gone in Chicago. The show is truly awesome, filling, as it does, two huge halls. All manner of electronics products are on display, from televisions to TVRO systems, from credit card size radios to megawatt-per-channel stereos, and from $9.95 throwaway telephones to cellular radio. More than 100,000 people were expected to attend.

The summer CES is the showcase of new and improved electronics products that the manufacturers hope to encourage retailers to buy and to place on their shelves for the Christmas gift-buying season. In recent years, such advances in consumer electronics technology as the compact digital audio disc, TVRO systems, consumer-purchased telephones... newest of the new, they have been previewed and ballyhooed at the summer CES.

Many of the new products shown at the CES are genuine advances of the state-of-the-art: The digital audio disc, for example, represents a giant step forward in high fidelity. High-fidelity audio for videocassette recorders, both Beta and VHS, represents a significant advance in video technology. And if you need to keep in touch with the world at all times, cellular radio will make your life a lot better.

On the other side of the coin, though, some of what is shown at CES is silly, absurd or of questionable value. Here are some of my candidates for the CES product booby prize:

The stereo vest or jacket: When I first saw this one, I couldn't believe it. It's a vest with several speakers sewn into it in the vicinity of the shoulders. You put your portable earphone stereo into a special pocket and plug the cord into the earphone jack and voila! You're a boom box. It's fun to conjure up a picture of a group of people at a cocktail party each wearing one of these tuned to a different station. And how about when the vest or jacket needs repairs? Do you bring it to a servicing technician or a tailor?

The calculator/watch/pen: The Swiss Army knife is a wonderful gadget with all its many and sundry blades if you're out camping, but it has inspired a number of silly electronic combination products. The calculator/watch/pen is one. For one thing, the buttons are so tiny you can't really operate them with a finger. So what do you do? Well, you carry around another pen to operate the buttons. Hmm. And now you have another product that needs a battery.

Hand-held televisions: These products really are fun. They fit in your shirt pocket and don't cost very much and give you a TV program in the palm of your hand. But given the value of most of today's TV programs, is it necessary or even wise to have television with you wherever you go? And the picture quality really isn't great anyway.

Shower radios: These days you can buy a little radio that you can stick up on the shower wall, or one that's attached to a rope that can hang from the shower head. They're put together with special sealants to keep water out. Whatever happened to singing in the shower?

The advance of electronics has made our lives more fulfilling, more comfortable and more enjoyable. But because of its unique nature, electronics has led to some absurdities that couldn't have been achieved otherwise.

Another time we'll discuss the computerized sneaker.

Nils Conrad Persson

ELECTRONIC
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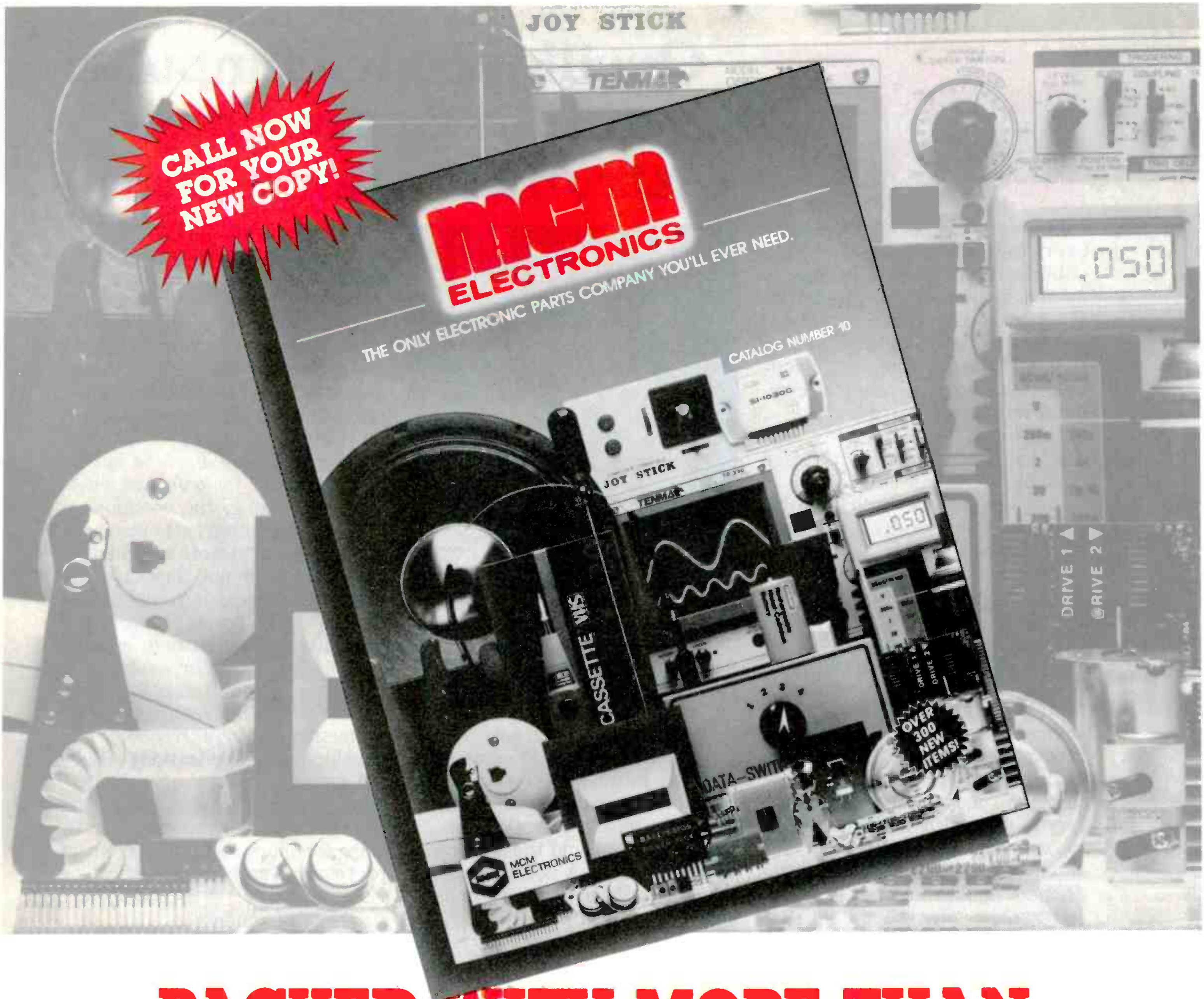

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Technology

Oscilloscope/computer marriage provides instrumentation control

In recent issues of **Electronic Servicing & Technology** we have published articles on the use of microcomputers in electronic instruments and other electronic products to enhance their operation, and the development of software that turns a personal computer into a test instrument.

Tektronix has recently announced a new software package that allows engineers to link a digital oscilloscope with an IBM personal computer. This combination allows the user to perform functions not possible with the oscilloscope alone. According to the report, the new software communication package links the 14GHz 7854 plug-in oscilloscope to the IBM PC for instrumentation control. Known as TekMAP (Tektronix Measurement Applications Programs), 7854/IBM PC Communication and Control Software, the new package capitalizes on easy-to-use features of the IBM PC to simplify 7854 operation for automated tests and other measurement applications.

Using the software and an IBM PC, users can take advantage of the oscilloscope's powerful waveform processing features and generate simple application programs with a single-keystroke, command-driven menu. The IBM PC also allows waveform storage for further analysis or data logging.

Figure 1. A software communication package links an oscilloscope to a personal computer for instrument control.

Store, retrieve waveforms

The software uses a National Instruments GPIB interface board. Developed to link the IBM PC to test and measurement instruments, it provides programs in BASIC that allow the user to store and retrieve waveforms as well as 7854 application programs.

Also, users can send commands and text, graph-stored waveforms, and automatically send numeric data and measurement results to the oscilloscope and the computer. For measurement documentation, the PC's printer can provide hard copy printouts of waveforms showing time/volts per division, graticules, user comments and other pertinent information.

The package also includes a compiled BASIC routine that allows programs to run 10 times faster than uncompiled routines. If the user needs to modify a program, he simply makes changes on the uncompiled routines and compiles them again.

The new software allows users to take advantage easily of the oscilloscope's many features. By entering a string of commands into the computer, a user can generate a simple applications program to execute a sequence of tests. A sample program might acquire a waveform channel 1, measure peak-to-peak amplitude, measure RMS voltage, differentiate, store that waveform, and print it for documentation.

Because the oscilloscope has its own computer for on-board waveform processing, the communication utility programs primarily allow the user to store and retrieve data. They do not duplicate the waveform processing capabilities of the oscilloscope, but rather capitalize on the storage capabilities of the PC. For example, a user may use the scope to gather data and results over many measurements (as in a research and development application). With the communication software, the data is automatically stored on diskette. Waveform analysis software for more in-depth waveform processing, such as statistical or Fourier analysis, is available from a variety of vendors.

Besides the illustrated manual, there is an on-line HELP function to explain the 7854 commands and facilitate programming tasks. The utilities are also available in application note form, which describes the installation and configuration of the GPIB interface card and the BASIC programs. In the future, Tektronix will offer a library of applications programs that will become a resource for 7854/IBM PC Communication Software users.

Image sensor gives sharper images, doesn't need finer electrode pattern

Researchers have made a new type of solid-state image sensor for generating TV picture signals. The new sensor has twice as many light-sensitive elements per unit area as previous sensors. This has been achieved without the need for a finer pattern for the electrodes applied to the sensor surface by IC technologies. The improvement is achieved by a different method of distributing the potentials over the electrodes developed by scientists at the Philips Research Laboratories, Eindhoven, The Netherlands. In the new method, a row of picture elements is located under every two electrodes, whereas four electrodes were previously required for each row. The availability of only two electrodes per picture element makes the transfer of the image information from the *camera* section to the *memory* section (*frame transfer*) rather more complicated. The potential hills that separate the information coming from the different individual elements are now stretched out one by one and then compressed again, like the bellows of an accordion.

In a solid-state image sensor, and also in a CCD (charge-coupled device) shift register, narrow parallel channels of n-type material are located in a layer of p-type silicon. On the surface there are linear electrodes, which are perpendicular to these channels. The electrodes are insulated from each other and from the silicon surface. If the silicon surface is exposed to light – through the electrodes – then electrons are released in the silicon. If suitable potentials are applied to the electrodes, electrons will build up charge packets under the positive electrodes in the n channels.

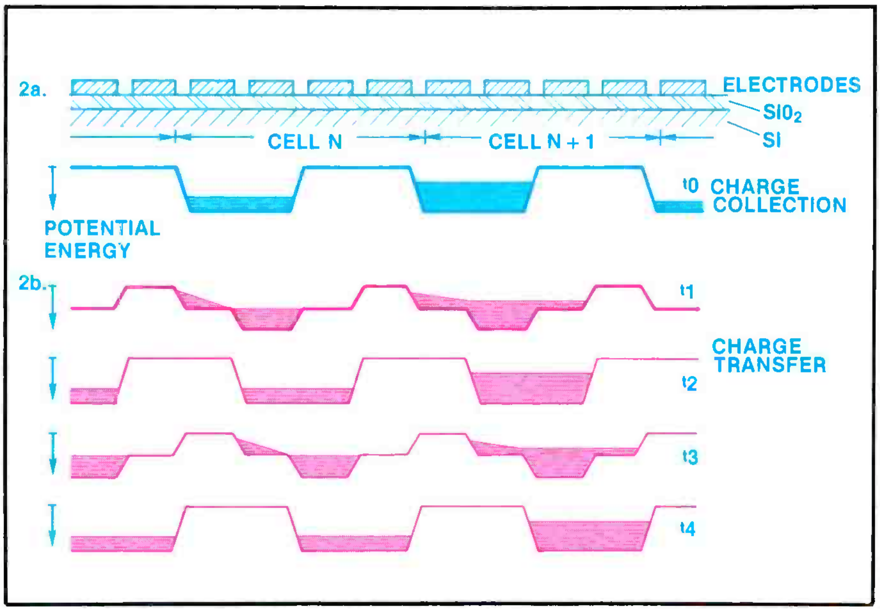


Figure 2.
a) At the top is a schematic cross-section of the electrode structure of a solid-state image sensor, in the longitudinal direction through an n-type silicon channel. One cell covers four electrode widths. Below the cross-section, the potential distribution during the recording of a picture is shown. The charge packets in the potential wells are indicated schematically.
b) Sequence of potential distributions for transferring the image information.

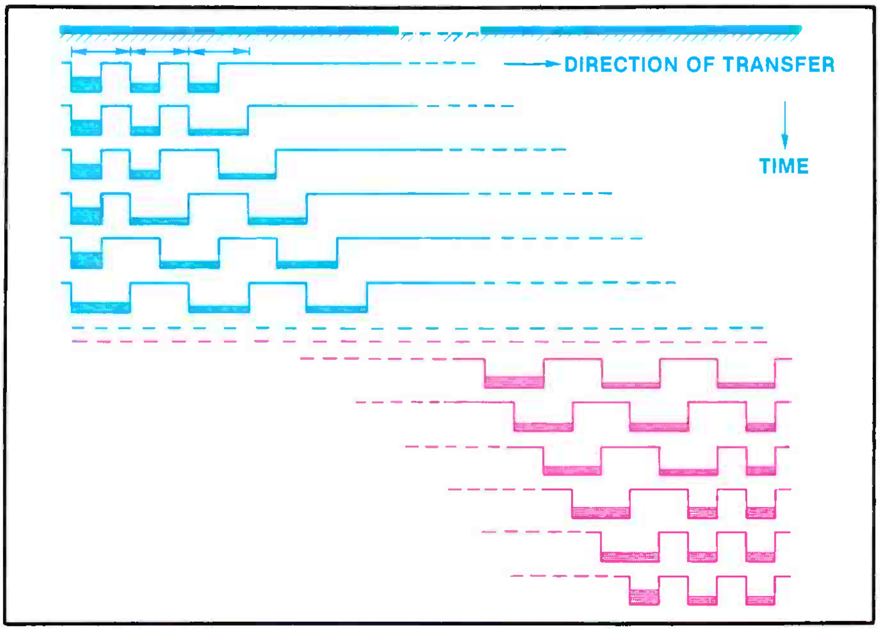


Figure 3. At top left, the first information leaves the image section. The picture elements that initially cover two electrode widths are one by one stretched out over four electrodes: The accordion is pulled open. At bottom right, the first information arrives at the far end of the storage section. The information for one image point is once again accommodated in a storage element two electrodes wide: The accordion is squeezed shut again.

Charge transfer from image

Next, during the read-out phase, the electrode potentials are varied in such a way that the potential hills and valleys execute a *peristaltic* motion (Figure 1b), which transfers the charge packets from the image section to a storage section. From there they are read out line by line so as to supply the video signal. During the following scanning period, the potential pattern on the electrodes in the image section is shifted by two electrode widths to give the usual TV interlacing. Although three electrodes per cell would be sufficient for transfer of the collected charge, four electrodes per cell are generally used, as indicated in Figure 1. This provides simpler control and correct interlacing.

The accordion principle

Two electrodes per cell are in principle sufficient for collecting the charge, although with this arrangement, charge transfer is not as simple as before, so another technique has been devised. Instead of transferring all of the image information to the storage section at the same time, each charge packet is temporarily spread out in the space beneath two electrodes, and separated by a potential barrier two electrodes wide, beginning at the bottom edge of the image section. The conventional method of charge transfer can then be used, and the image information is peeled off line by line. The temporary stretching out of the information disappears again when the charge packets reach the bottom edge of the storage section, so that in the storage section a row of picture elements again comes beneath two electrodes. All this is shown schematically in Figure 2. As the final read-out proceeds line by line at the bottom edge of the storage section, it automatically creates the space re-

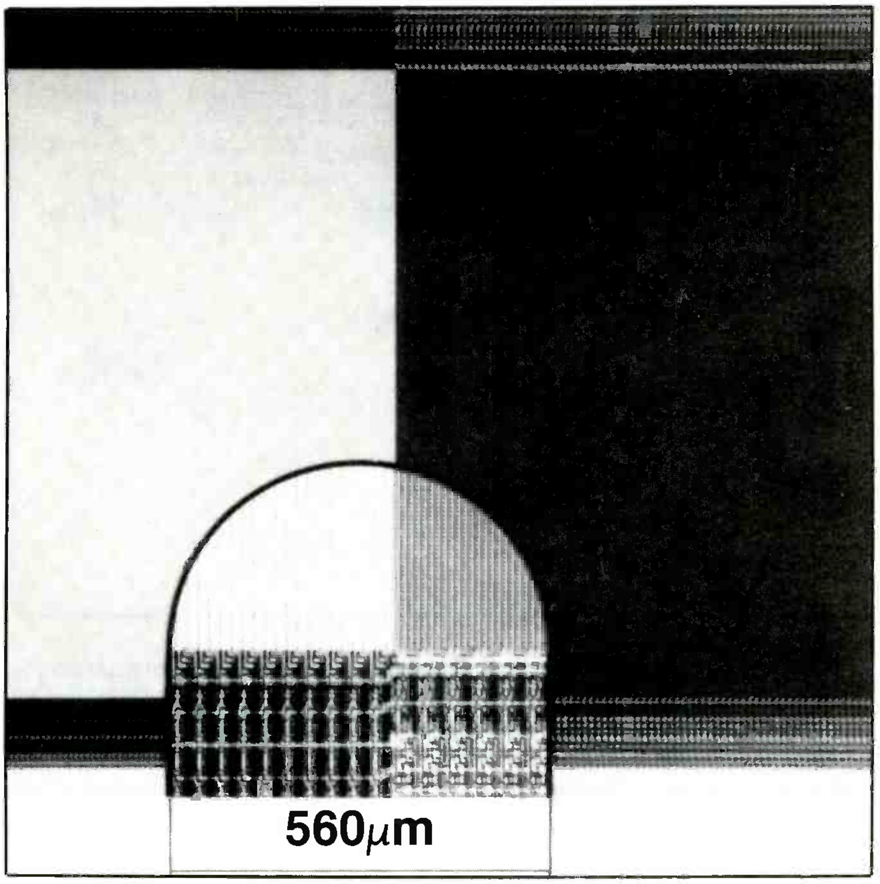


Figure 4. The accordion image sensor. The image section (dark) and the storage section (light) are at the center. The electronic circuitry for generating the electrode voltages is shown along the edges. Inset: enlarged view at the transition from image section to storage section.

quired for the accordion process to repeat.

In this way, much smaller cell dimensions can be achieved with the same production method, the 3.5μm technology: a total of 604 x 588 light-sensitive elements can be located on an area of 38.2mm^2. With this method, it is also possible to reduce considerably the area of overlap between the electrodes. If the width of the electrodes is also reduced locally, the sensitivity is improved, particularly in the blue. Figure 3 shows the complete image sensor described here, with part of the picture enlarged.

***Note:** The results described here refer purely to laboratory research; they in no way imply the manufacturing or marketing of new products at the present time.*

Faster than a speeding bullet...? Access time of 60ns proclaimed world's fastest for 1M chip.

Developed by the Toshiba Corporation, the new megabit (one million bits) CMOS (complementary metal oxide semiconductor) dynamic random access memory (d-RAM) not only accesses in 60 nanoseconds (world's *fastest* information availability), but requires as little as 30mA during operation–the world's *lowest* power consumption figure for a 1M chip. During standby: 0.3mA. It incorporates a static column mode function that makes possible an access time of 25 nanoseconds.

A 1M d-RAM chip can store as much information as four pages of text in a leading newspaper. More than 130,000 alphanumeric characters (1,048,576 bits of information: an alphabet character is memorized by using eight bits of information) comprise the capacity of this new device–a figure four times greater than the memory capabilities of a 256K d-RAM chip.

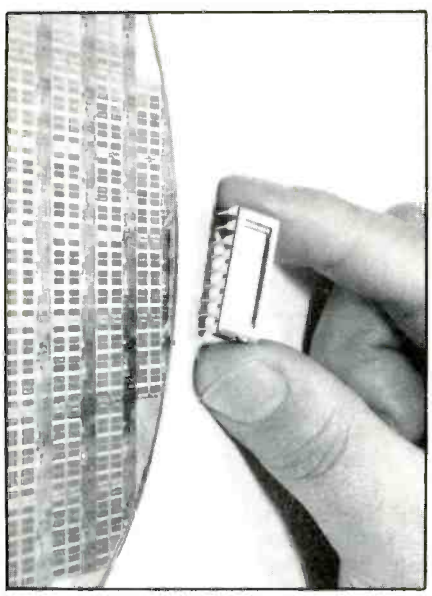


Figure 5. This 1M d-RAM chip can store as much information as four pages of text in a leading newspaper.

The new prototype 1M CMOS chip operates at higher speed (about 1.5 times) using less electric power (about 0.75 less) than a standard 256 kilobit NMOS d-RAM chip now on the market. Also the new chip has an improved rate of *soft error*–unexpected change of stored information caused by alpha particles from the package to the chip–compared to 256K memory. It integrates approximately 2.2 million elements (like capacitors and transistors) on a 5.0mm x 12.5mm chip. Because of its large memory capacity, high speed and low power consumption, the 1M d-RAM chip will be used as a data storage device in a wide range of computers, automation equipment and portable electronic equipment.

Research and development on both NMOS (n-type metal oxide semiconductor) and CMOS versions is being carried out by semiconductor manufacturers around the world. ES&T

PART 4

Analyzing the Sylvania Superset Two

By Carl Babcoke, CET

Detailed coverage in part four for the Sylvania Superset-Two model RXS198WA with a 19C4-03AA chassis includes the vertical-sweep system, major signal paths for RF, video and audio, the remote/tuner-control power supply, and the scan velocity modulation circuit, which increases picture sharpness in the horizontal-sweep circuit, not in the video stages.

Vertical deflection

The complete vertical-sweep system (Figure 1) except for the deflection yoke is on the signal board, the largest of the circuit boards. Vertical-size and vertical-hold controls are the only adjustments. IC200 includes the vertical oscillator, Q212 is the driver transistor, while Q208 and Q210 are the vertical-output power transistors. Locations of several major components are shown in the Figure-2 photograph.

Positive feedback necessary for oscillation comes from the emitters of Q208 and Q210, the vertical-output transistors, traveling through low-pass filters R213/C209 and R216/C210 to IC200 pin 11. If R213 or R216 opens or if C209 or C210 develops significant leakage, the vertical oscillator cannot operate. Vertical-hold control VR270 varies the time-constant at IC200 pin 12 to change the oscillator frequency, thus allowing locking with the vertical sync.

Composite sync comes from IC200 pin 15 and is integrated by R278/C280 and R276/C276 before it is sent to IC200 pin 13. The R275/R274 voltage divider from the +12V supply prevents pin 13 from producing excessive negative voltage from the positive-going vertical-sync pulses.

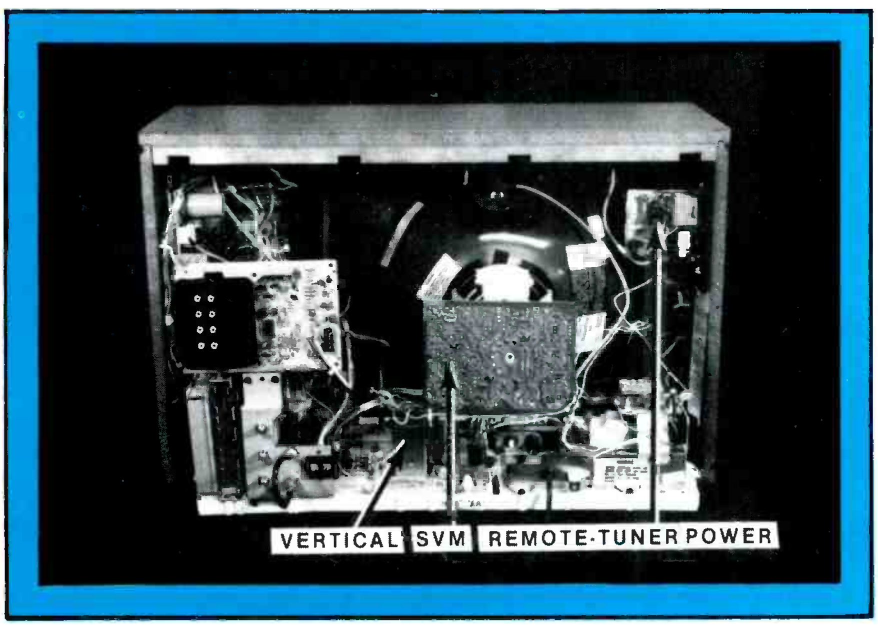
Height adjustments and automatic linearity signals enter IC200 at pin 10. VR230, the vertical-size control on the signal board, adjusts the dc voltage at pin 10 to accomplish height corrections. C218/R224, C216/R222 and R231 form an "S" filter to reduce the height slightly at the extreme top and bottom of the raster (this is necessary with wide-angle picture-tube deflection). Also, C222 brings a sample of the vertical-yoke current waveform (developed across R227) for automatic correction of linearity with height changes.

Vertical drive for Q212 exits IC200 at pin 9. Usually, this waveform should be checked first when there is no height. Q212 drives the bases of Q208 (NPN) and Q210 (PNP), which are connected in complementary-symmetry push-pull circuit with the vertical drive for the yoke coming from their emitters. A single +43V supply powers the outputs, so coupling capacitor C204 is needed to keep out of the yoke. C208 is connected between Q208 base-supply resistors R212 and R214 to reduce distortion in the output stage. Vertical output from R208 and R210 current-limiting resistors is through large capacitor C204 (1000μF) to the yoke and the "S" filter. Two-ohm R227 is connected between the yoke's cold end and ground to provide automatic linearity.

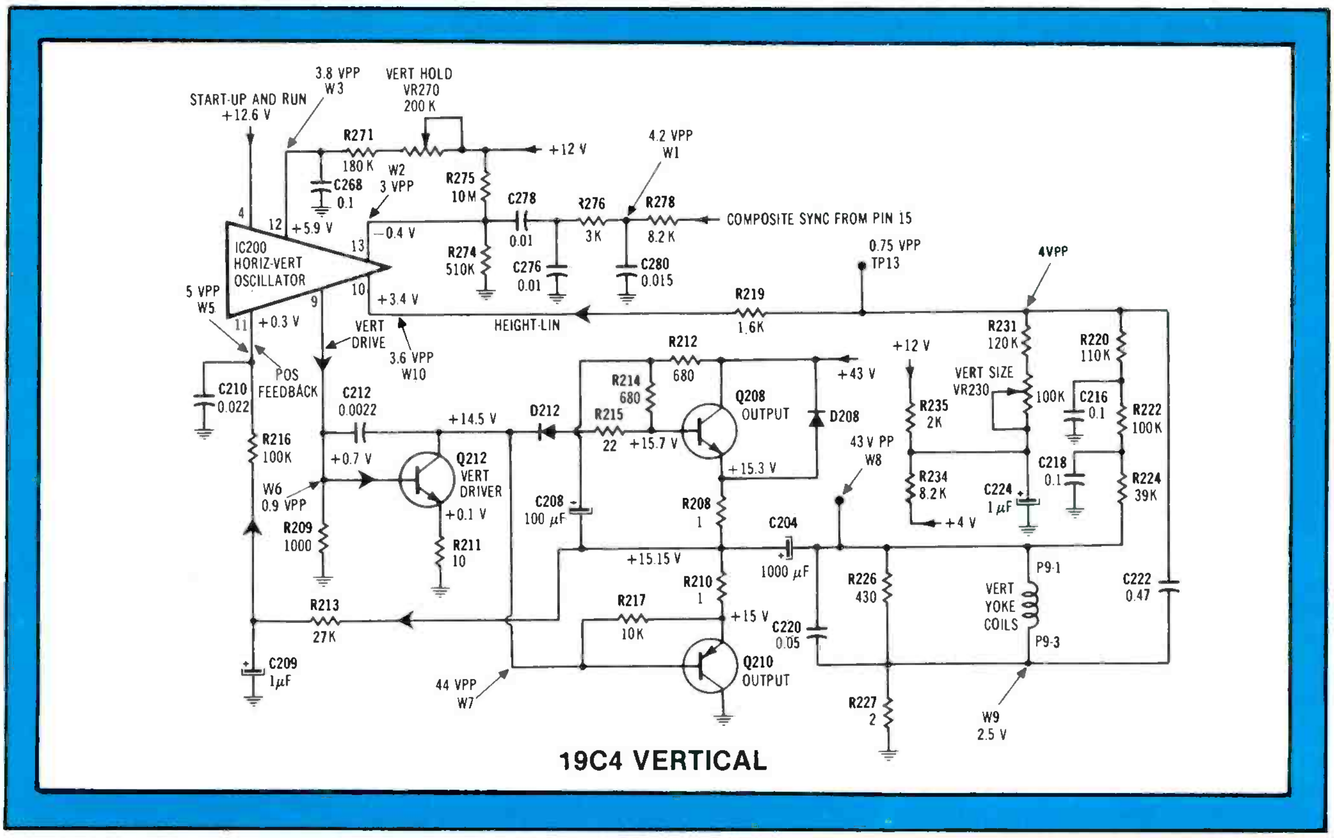
Because of the automatic-linearity action, an open yoke (or other defect that eliminates the sweep without shorting out the B+ supply) will produce an incorrect waveform at the IC200 pin 9 drive signal for Q212. Of course, if the Q208/Q210 output stage is completely dead, the oscillator will not function because the positive feedback is missing. Therefore, troubleshooting is very different than in models that count down horizontal and vertical from a common oscillator, or others that do not depend on the output stage for positive feedback.

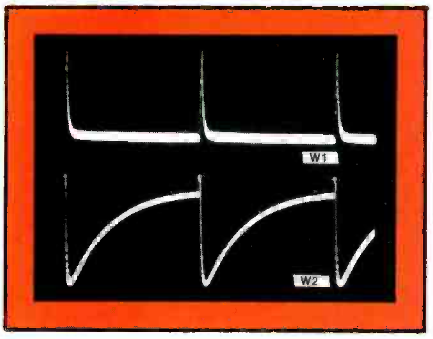
Where is "zero volts?"

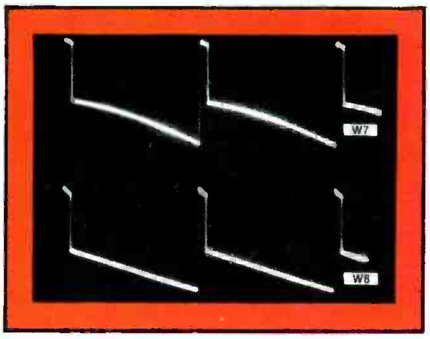
Technicians who are highly experienced in waveform analysis might question the W6 waveform in Figure 1. Most of the amplitude is in the negative-going pulses, which would position the average-voltage line near the top. With a total amplitude of only 0.9VPP, that would not be sufficient to drive the transistor, unless some

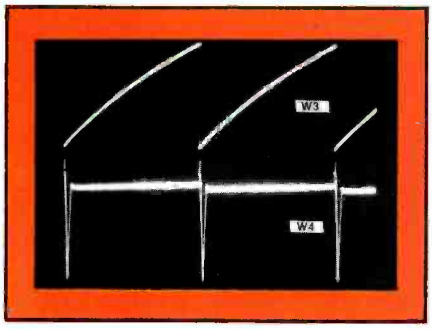


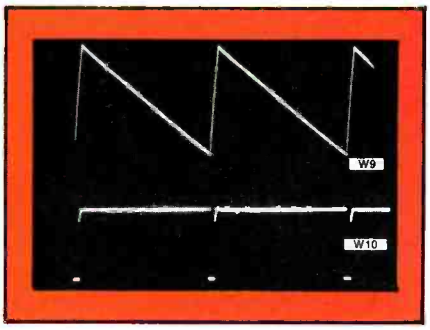
Vertical sweep, remote/tuner-control power supply and an unusual SVM circuit are discussed for the Sylvania 19C4-03AA chassis Superset II.











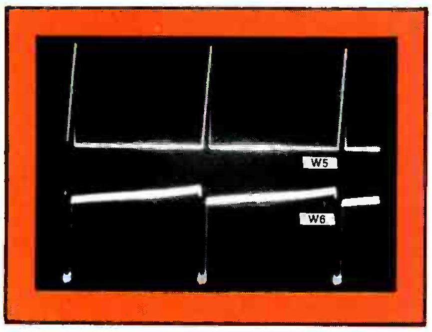


Figure 1. All oscillators must have positive feedback to start and sustain oscillation. A sample of the output signal at the Q208/Q210 emitters is filtered and fed to IC200 pin 11 where it is positive feedback for the internal oscillator. If the output stage is dead, there will be no vertical-drive signal emitted from pin 9. Variations of dc voltage at pin 12 via the vertical-hold control are used to lock the vertical sweep.

dc voltage is added to it by IC200, or these are dc pulses.

All these questions can be answered by adding zero-voltage lines by the scope to dual-trace waveforms of the base and emitter signals (Figure 3). In the base waveform, zero voltage is at the bottom of the negative pulses. Therefore, the entire waveform is positive, and this accounts for the meter reading of +0.7V at the base. Of course, the emitter waveform never can become negative, so 0V again is at the negative pulse tips.

Note attenuated base pulses

Notice, however, that the large negative base pulses (top waveform in Figure 3) are greatly attenuated in the emitter waveform (bottom trace). The reason is simple: The transistor cannot draw collector/emitter current until the base voltage exceeds the emitter voltage by about +0.6V. All parts of the input waveform below that voltage are ignored by the transistor. In this specific case, most of the input pulse amplitude is used only to elevate the useful range (+0.6V to +0.9V) up to the point where the proper maximum collector current is drawn.

Operation of many complex cir-

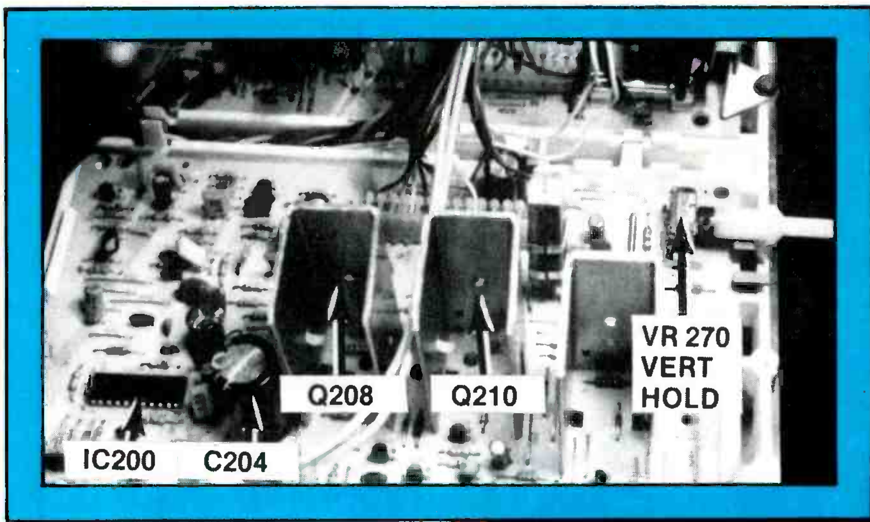
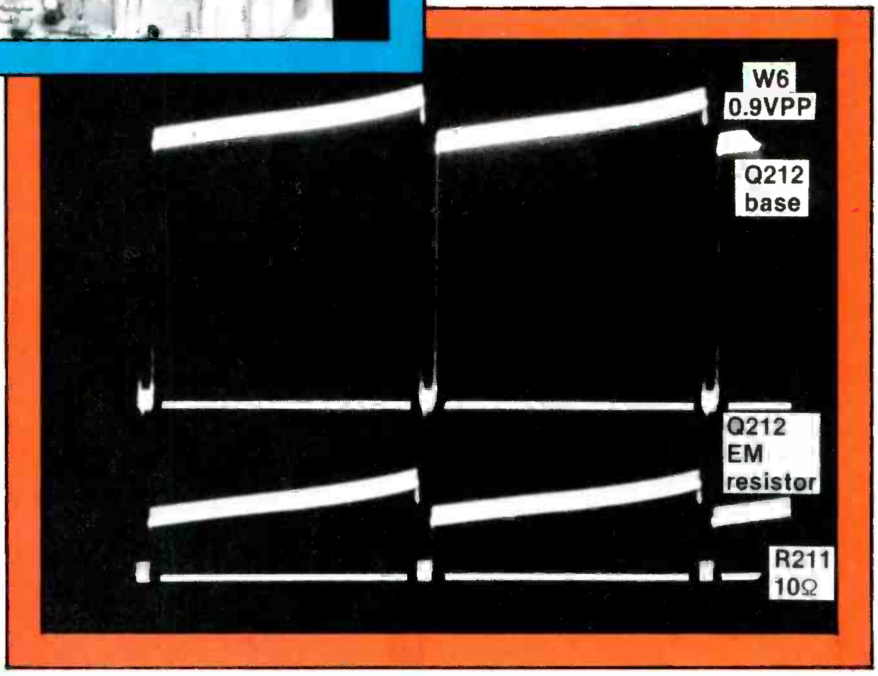


Figure 2. Arrows point to the locations of several major components in the vertical-deflection system. All vertical components except the deflection yoke are on the signal board in this general area.

Figure 3. Adding zero-voltage horizontal lines to the vertical-driver transistor base and emitter waveforms helps us to understand the relationships between ac vs. dc voltage drive, and why some pulse amplitude is ignored by transistors.



cuits will be made more clear by adding average-voltage or zero-voltage lines to certain waveforms. This is easily done by any dc-coupled scope. Change the ac/dc switch from ac to ground (which eliminates the waveform) and the resulting horizontal line will rest at the average-voltage position. Or change the switch from dc mode to ground (giving a horizontal line if automatic mode is used) to produce a horizontal line that traces the zero-voltage points of the waveform previously displayed as seen in Figure 3.

Signal paths

With the old tube-equipped black-and-white TV receivers, it was easy to locate all the major areas (even without a schematic) by the appearances of tubes and other larger components. An experienced technician could look at the chassis and trace with his eyes the tuner, IFs, video, vertical and horizontal sections. This is virtually impossible with the new high-tech top-of-the-line color receivers. There are small boards plugged into large boards and several shielded boxes whose purpose is not evident at a glance. Only the horizontal sweep with its flyback and power-output device can be identified with certainty.

Know major signal paths

Before individual functions and circuits of the Sylvania 19C403 are given any further analysis, it is necessary to show the major signal and control-signal paths as given in Figure 4. Even if boards and boxes are replaced without any other troubleshooting, these signal paths must be known to identify the origin of the problem.

Keep-alive dc-voltage power from the remote power supply (Figure 5) is applied constantly (as long as the ac cable is plugged into a source of ac power) to the remote receiver and the tuner control. Therefore, the receiver is ready to be turned on either by the remote control hand unit or by the power button on the receiver's panel. Remember, the remote unit can perform all functions of the panel push-buttons except time setting.

Although VHF and UHF antennas can be connected to terminals going directly to the tuner, most customers will choose to use the RF-switching feature that selects one at a time of three external RF signals and applies the selected one to the tuner. Switching these signals (and displaying the one in use) is performed by dc *high* and *low* voltages coming from the computer IC in the tuner-control circuit (a separate shielded box). Electronic operation of the diode-switching circuits is analyzed later.

Function of SAW filter

IF output of the tuner is sent to the video/sound IF module (another shielded box). Following amplification by one transistor, the IF signal passes through a surface acoustic wave (SAW) filter that has one output for the video detector (this output has the conventional flat-topped curve) and another output with a double peak, one at the sound-carrier frequency and the other at the picture-carrier frequency. These two carrier frequencies are beat together inside IC2 to produce the required 4.5MHz FM carrier. A filtered sample of this 4.5MHz carrier exits the module at J22 and is sent to the stereo-decoder module (a large shielded box, nearest the cabinet's side). Again, the stereo decoder will be analyzed later. Also, conventional FM detection produces a monaural audio signal that exits the IF module at J10-8 (used in receivers without the stereo decoder).

IC1 amplifies and demodulates the video IF signal which has the 4.5MHz beat trapped, the response equalized in one transistor circuit, and the impedance reduced by an emitter follower before the video signal exits at J10-5 and is sent to the audio-video in-out board, usually abbreviated AVIO. Then either this TV video or video from an external source (VCR, etc.) is sent to the comb filter where the luminance and chrominance signals are separated. From the comb filter, the luminance video goes to IC300 on the large signal board for processing including being combined with the demodulated color, followed by power amplification that drives the CRT cathodes.

Meanwhile, we left the 4.5MHz FM carrier at the stereo-decoder input. In a very sophisticated circuit, the various stereo and SAP carriers are extracted from the

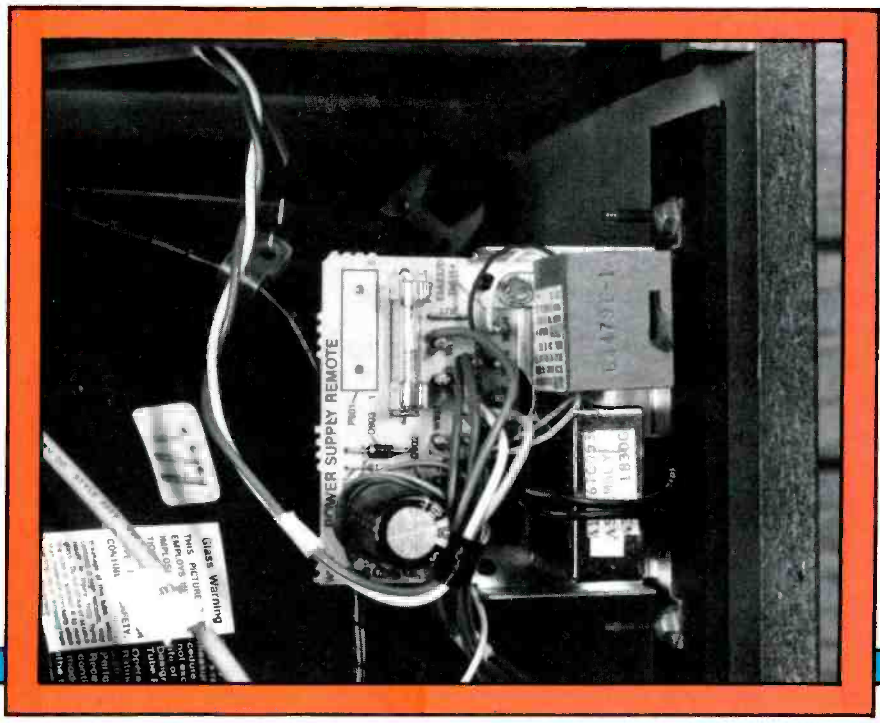


Figure 4. The keep-alive power supply that provides voltage for the remote receiver and the tuner-control system is located in the upper right corner of the cabinet (when you are facing the rear of the machine). Also, the relay that controls 120Vac power to the television is located on this supply. Nothing operates if the keep-alive supply is dead.

Figure 5. Paths of the RF, video and audio circuits are shown in this block diagram, along with other interconnections that are difficult to find on the individual schematics. A knowledge of these signal paths can help in determining which circuit board had the defect, even when servicing is performed merely by exchanging boards.

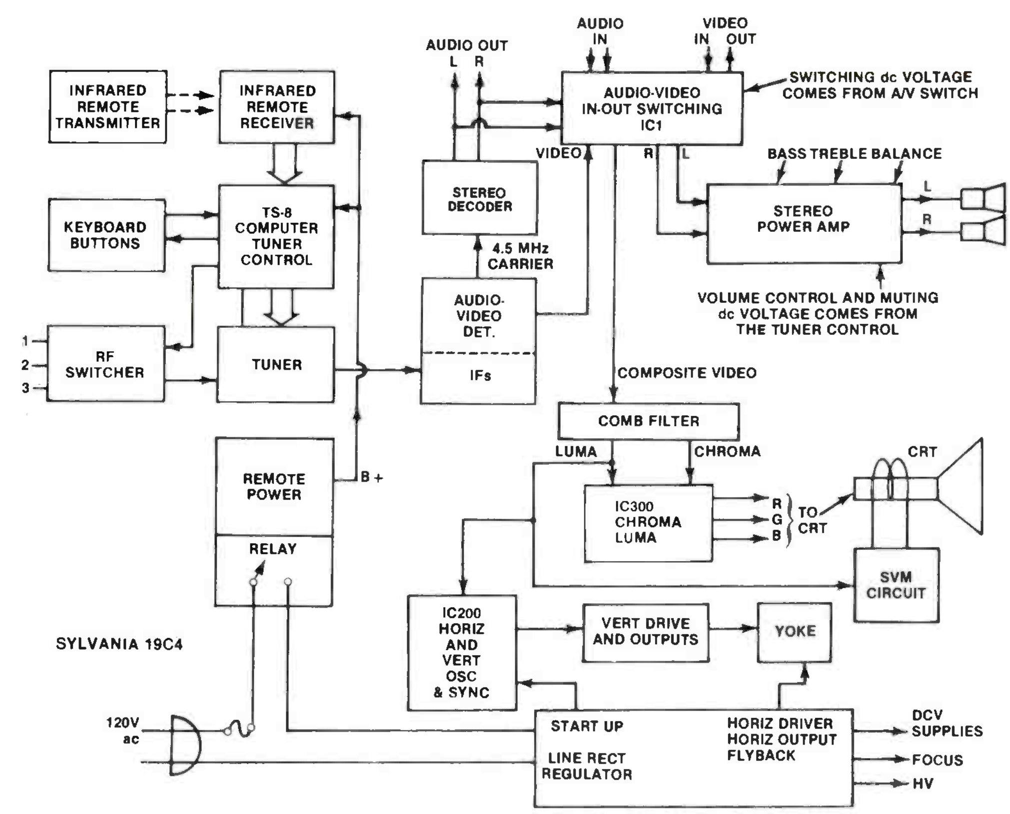


Figure 4.

4.5MHz FM carrier. If the audio is broadcast in stereo, the output of the stereo decoder to the AVIO board will be in stereo. (Of course, a switch under the door on the front panel selects MONO/STEREO/SAP.) This audio can be taken for external use from two jacks on the rear jack panel. Separately, the same audio can be switched to the power amplifiers with their tone and balance controls. One point that is difficult to trace through the many cables and schematics is the origin of muting and where it is applied. The muting dc voltage originates on the tuner-control board where it is combined with the variable dc voltage that controls the volume of the internal power amplifiers. During each station selection, or when the front-panel mute button is pressed, the muting voltage is dominant, bringing the volume down to inaudibility. Notice that sound sent externally via the jack panel does not have muting or volume control of any kind.

All horizontal and vertical deflection paths should be clear in Figure 4, and not require any further explanations. However, the SVM circuit is new and fairly complicated, so it will be described separately.

As additional circuits and systems are examined, check Figure 4 to see where they belong in the block diagram.

Remote power supply

Although the remote-receiver/tuner-control power supply is small and not complicated, it is very important because it supplies power for the brain of the receiver. Also, a small relay on this power supply turns *on* and *off* the power to the TV low-voltage supply. So, without the remote supply, the receiver does nothing. The power supply is in the upper right corner of the receiver (Figure 5), as you face the receiver's rear.

T901, a small power transformer, has a single center-tapped winding that produces 60Hz ac voltage for the time display that is seen on screen. Also, the winding feeds two diodes in a full-wave capacitor-input dc-voltage supply of about +11V that is the keep-alive supply for the tuner-control circuits and the remote receiver. Some of this voltage is applied to the power-relay coil (Figure 6) so a digital low (near 0Vdc) at J7-1 will energize the relay that in turn applies 120Vac power to the low-voltage rectifier and regulator circuits in the television, thus starting all TV functions. Diodes D903 and Z901 (zener) damp out the negative ringing pulses that otherwise would be produced by the relay coils each time the coil dc voltage was switched *off*.

Remember that this +11Vdc source is the only supply operating when the TV power is switched *off* by the relay.

Sharpness from peaking

Perhaps the most interesting and least understood circuit in the Sylvania 19C4 chassis is the scan-velocity modulated (SVM) system that sharpens the picture without increasing the visible snow and noise.

Before SVM operation is described, it must be stated emphatically that the *effect is not obtained by video peaking.* All video-peaking circuits provide better picture sharpness by increasing the high-frequency response of the video stages. Sometimes this is done by bypassing an emitter resistor with a small-value capacitor, or by using peaking coils (which resonate with stray capacitance to give the effects of parallel-tuned or low-pass with resonance before roll-off).

Carefully designed peaking circuits along with a variable control perhaps called *sharpness* or *peaking* can improve the sharpness somewhat, but the snow and noise with the picture also are outlined and become more objectionable.

Excessive peaking produces damped ringing that appears as a white and then a black outline around the right side of a black object (or a black outline and a fainter white outline around the right side of a white object). This ringing is undesirable, and in some cases resembles *close* ghosts.

The 19C4 chassis has a sharpness control that varies a dc control voltage at IC300; also the dc-voltage output of the automatic sharpness circuit is added in parallel to this sharpness-control, manually adjusted dc voltage. Both of these sources affect the video bandwidth and the picture sharpness.

There are few video peaking coils in the 19C4. None are in the video-switching section of the audio/video input/output board. Therefore, operation of the sharpness control in the maximum position does not introduce any noticeable ringing. But the snow on most cable channels becomes intolerable when the sharpness

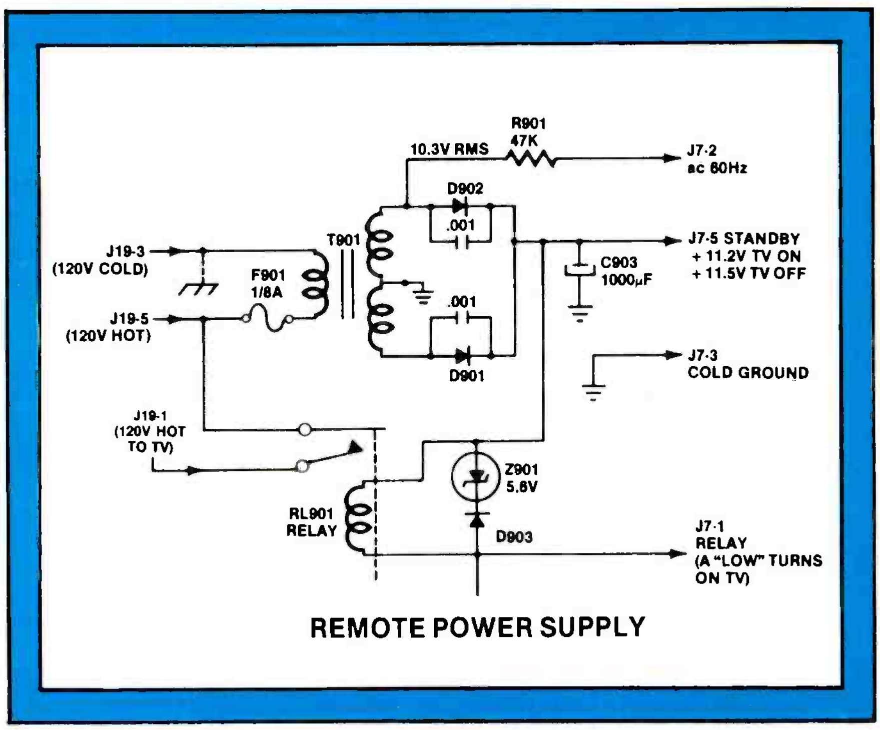


Figure 6. The schematic of the remote/tuner-control power supply is simple, but its correct operation is vital.

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control is advanced more than slightly. Some videocassette tapes, however, have little or no visible snow, and these benefit from a higher setting of the sharpness control.

Incidentally, operation of the sharpness control does not affect the SVM operation because the SVM video sample is extracted prior to the sharpness circuit.

SVM—speeding or slowing the scanning

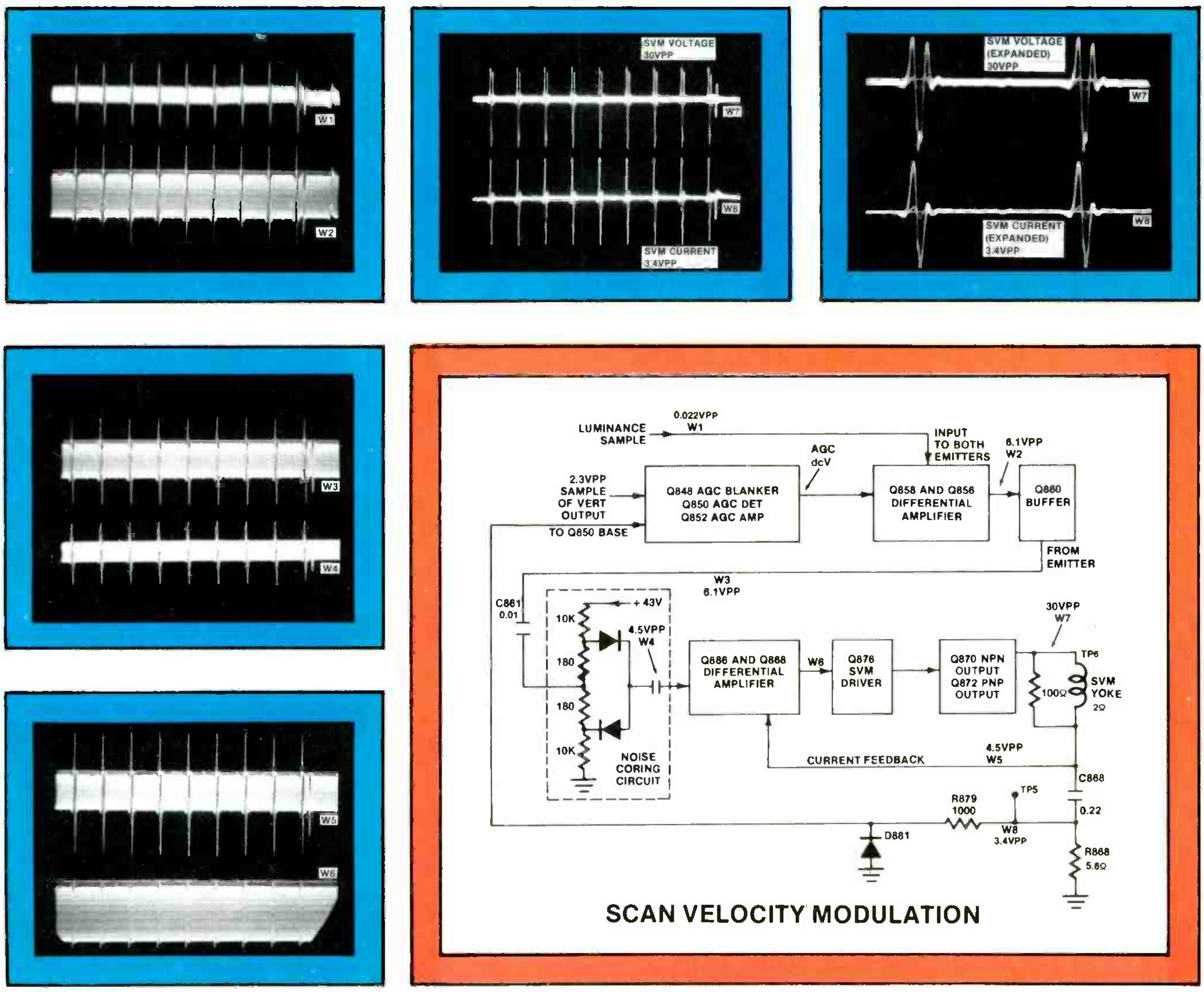
All picture transitions from black-to-white (or white-to-black) on a TV screen are made by the video signal turning *off* or *on* the picture-tube electron current flow. Ideally, these transitions should require zero time. If such were the case, the sharpness would be excellent, and limited only by the diameter of the round spot made by electrons striking the inside of the screen.

Unfortunately, conventional video has rising and falling edges that are not straight up and down with sharp corners, but the edges are tilted and have rounded corners. These are the parts of luminance (without chroma) video that are improved by the SVM operation. However, notice that the improvement never appears in the video signal, even the combined color/luminance at the picture-tube cathodes. Instead, the sharpness improvement takes place *inside* the picture tube, and it can be evaluated visually only from the picture-tube screen. Scope waveforms can show only the currents and voltages involved.

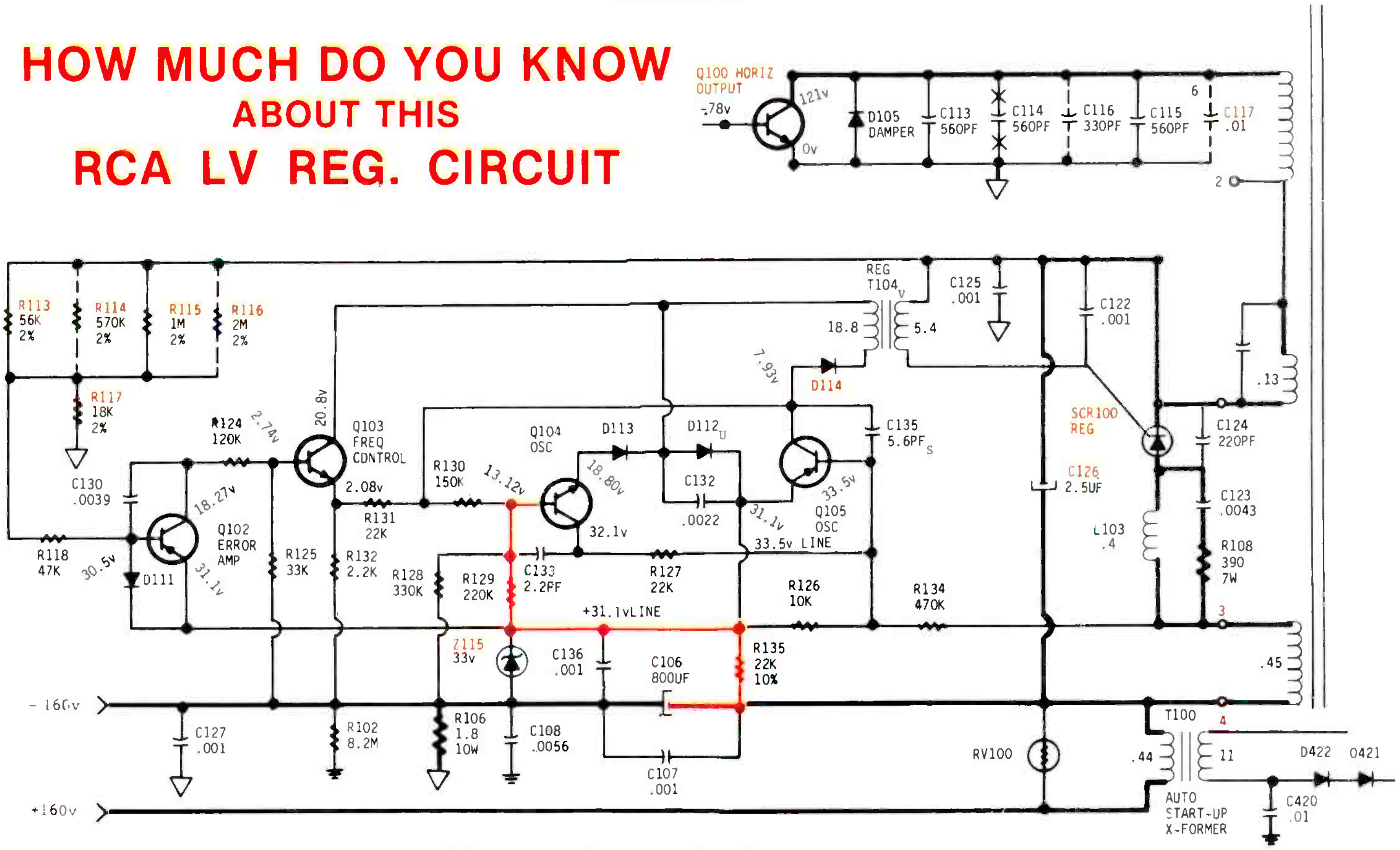
How SVM circuit operates

Stated most simply, here is how the SVM circuit operates: Luminance video (without chroma) is differentiated and amplified in several stages (Figure 7) until the video is stripped away, leaving only positive-going pulses located laterally (on the scope waveform) where rising edges of the video waveform formerly were located, and negative-going pulses located laterally on the scope base line where falling edges in the video formerly were located (this is verified by dual-trace waveforms). Eleven transistors (on the CRT-socket board in Figure 8) amplify and shape the SVM pulses that finally are applied to the SVM yoke (a coil of wire without a core) that is placed around the picture-tube neck *under* the purity and convergence adjustable magnets where the coil is difficult to see (Figure 9 photograph).

Figure 7. These waveforms and the block diagram show all essentials of the SVM system for improving picture sharpness. Evidently, the circuit designer has taken great pains to keep the gain constant (notice the AGC circuit), and to minimize drift (two sets of differential amplifiers). Basically, the circuit provides gain, differentiation (several stages with 0.01μF coupling capacitors) and sufficient power current at the output to properly drive the SVM yoke coil, which has a dc resistance of only 2Ω.



HOW MUCH DO YOU KNOW ABOUT THIS RCA LV REG. CIRCUIT



Typical of RCA CTC 85 thru 108 LV Regulator Circuits

Schematic by Diehl Engineering

How many of these questions can you answer?

(1) Every circuit has a beginning and an ending. Where does this circuit begin?
(2) Specifically, what is the purpose of this circuit?
(3) What turns it on? What turns it off, or does it ever really turn off?
(4) Does this circuit have a shut down feature? If so, which components are involved?
(5) What would happen if Q103 were to become shorted E to C?
(6) What purpose does Z115 serve?
(7) What would happen if D114 became shorted?
(8) What purpose does C126 serve? What will happen if C126 becomes open?
(9) Is the winding between terminals 3 and 4 of the flyback a primary or a secondary winding?
(10) What purpose does C117 serve? Exactly what does it do, and exactly how does it do it?
(11) Exactly what do resistors R113, 114, 115, 116, and 117 do? What happens if they change value?
(12) What occurs that causes this circuit to produce an initial start up pulse?
(13) Why does this entire circuit become shorted and begin to destroy horiz output transistors if the regulator SCR becomes shorted?
(14) There is exactly one safe and practical method of circumventing this LV regulator circuit for test purposes. This technique does not involve a variac. Instead, you must disconnect one wire then connect a jumper wire from terminal #4 directly to .... Which wire do you disconnect and where do you connect the other end of your jumper wire?
(15) If SCR100 is shorted, this circuit will still "eat" horiz output transistors even if you are using a variac. Why?
(16) Why does this circuit use a floating ground?

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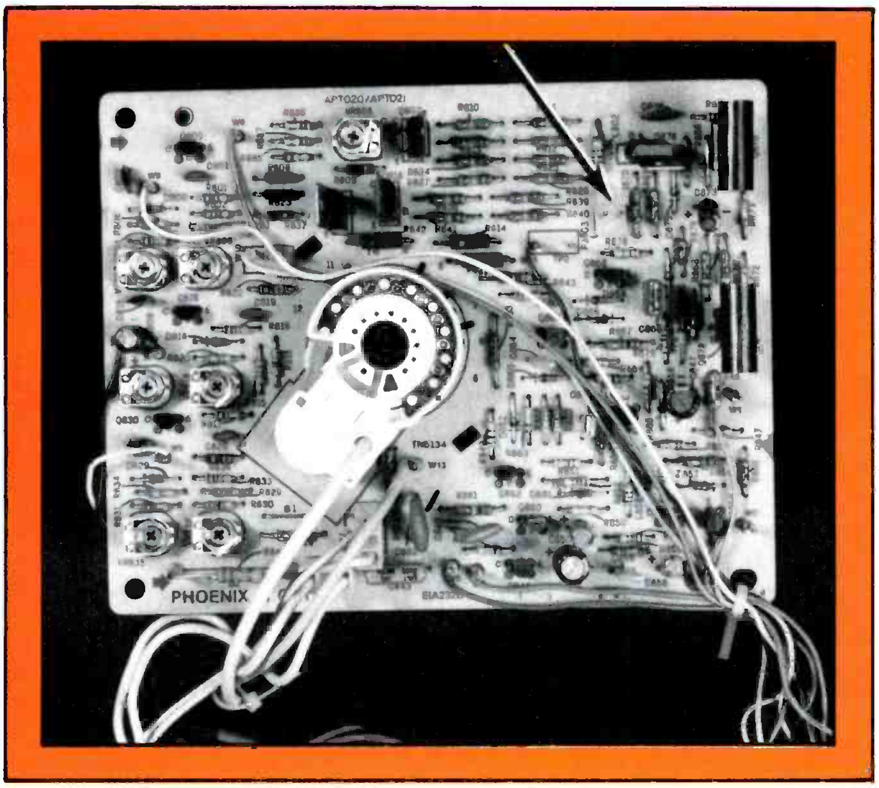


Figure 8. Transistors, capacitors and resistors of the scan velocity modulation system are scattered along one side (the right side in this picture, which shows the front side of the CRT-socket board). An arrow points to the 2-pin male plug for the SVM output signal to the SVM yoke.

These positive and negative pulses of *current* increase the speed of beam travel inside the picture tube, or they slow it back to normal speed. The lateral locations of these current pulses are determined by the locations of the video edges that produced the current pulses, and the amplitude of the pulses is in proportion to the height of the edge that produced it. These statements will be verified by waveforms later.

In Figure 7, several components are conspicuous by their absence. There are no tuned circuits or peaking coils, and no adjustable controls or tweaking adjustments. Also, no switch is supplied to turn off the SVM circuit. SVM operation has definite advantages and no drawbacks, so it operates full time on all video signals (including VCR video from outside) that are viewed on the screen. Part of the value not yet explained is the *coring* circuit that eliminates low-level noise from the SVM signal, *so snow or noise is not sharpened* by SVM operation.

Showing SVM operation

A crosshatch pattern (with nine vertical bars) was used to produce the Figure 7 waveforms. Because most shops have a generator with a crosshatch pattern, it is recommended as the signal source during *SVM troubleshooting*. However, the pattern is not best for analyzing and understanding the SVM theoretical operation. If your scope has excellent locking stability and an X5 or X10 width multiplier switch, an expanded horizontal-retrace section of luminance *video* will show SVM operation. (See Figure 10 waveforms.)

The bottom waveform in Figure 10C photograph is the usual two lines of horizontal-frequency luminance video without chroma (taken from TP25, at the junction of L304 and C307 on the signal board). That cable channel shows news and stock market reports, so the waveform is more stable. By chance, the blanking and sync pulses show overpeaking that gives strong SVM operation. In the upper trace (the SVM coil current scoped at TP5 and R868), narrow pulses from the letters on the cable digital readout can be seen. Notice that the blanking and sync pulses are completely gone except for narrow pulses marking the former positions of the rising and falling edges of the blanking and sync pulses. Compare with the luminance waveform of the bottom trace. These waveforms show the SVM operates only with very narrow pulses from rising and falling edges, but increased detail is needed so the same waveform should be expanded about 10 times horizontally.

The bottom trace of Figure 10D is the same luminance video as in 10C but expanded horizontally by the scope. SVM *yoke current* is shown by the center waveform with *negative-going* pulses of yoke current for *falling* edges of blanking and sync pulses, and *positive-going* pulses of yoke current for *rising* edges. SVM *yoke voltage* waveform is shown by the top trace. Notice each pulse is double (where the current pulse was single), with one positive and one negative together. Where the yoke current pulse is negative, the yoke voltage begins with a negative pulse followed by a positive one. Where the yoke current pulse is positive, the yoke voltage waveform begins with a positive pulse followed by and connected to a negative pulse.

There is a good reason for the double voltage-waveform pulses. In all deflection yokes, the current

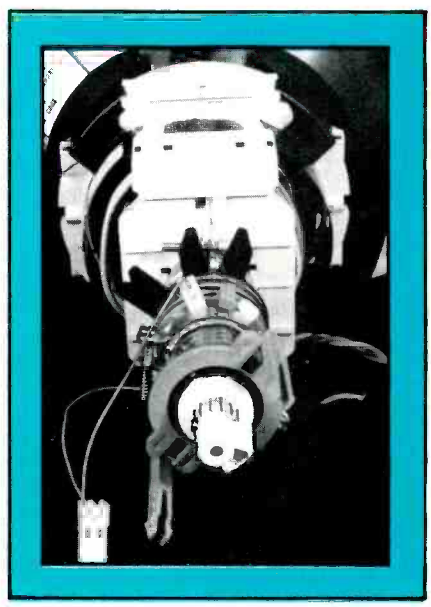
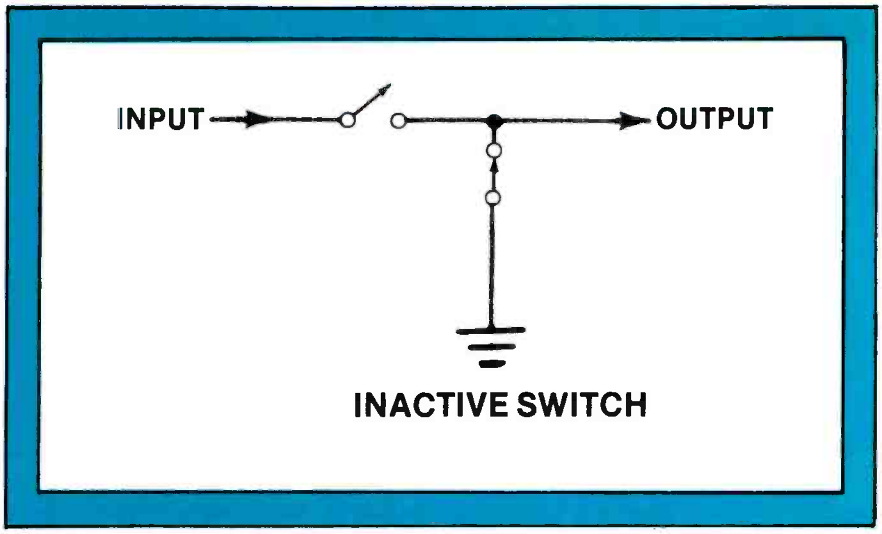


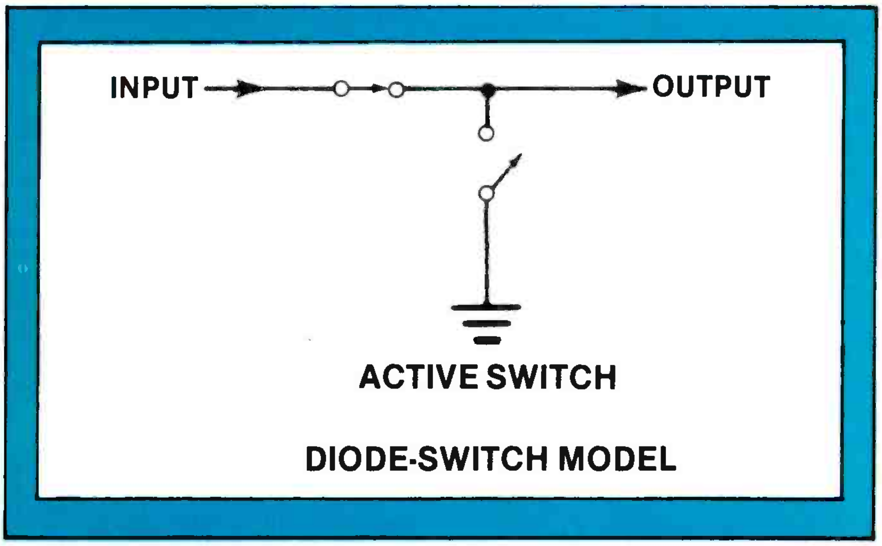
Figure 9. The two wires and the white female plug at the left of the CRT base connect to the SVM yoke coil which is placed underneath the assembly that includes three sets of adjustable magnets. This SVM yoke coil is difficult to see because only a small amount protrudes out beyond the magnet assembly.

is the most important driving force, and the voltage is developed by the collapsing magnetic field of the yoke. This is true also for the SVM yoke. Current pulses are generated by the driving circuit. When a negative-going current pulse passes through the yoke, a negative-going voltage pulse is formed across the yoke. But when the current reverses direction, as it does when the waveform begins to rise from the negative tip toward the zero base line (although still negative, it is becoming less so), a positive-going voltage pulse is produced across the yoke. Remember that only *changing* dc currents produce an ac waveform. And a maximum negative current that begins flowing in the opposite direction as it becomes weaker, acts to an inductance as if it is an increasing positive current.

Proof of this in the SVM operation is shown by the normal Figure 10B waveforms compared to the Figure 10F waveforms. For the Figure 10F waveforms, the SVM coil was unplugged, thereby removing the inductive coil from the circuit. Notice that now the voltage waveform (top trace) is nearly identical to the current waveform (center trace) because both have single pulses without any double tips. This proves that the driving forces are pulses of current, and coil inductance produces the voltage pulses.

Horizontal blanking and sync pulses in the luminance signal are





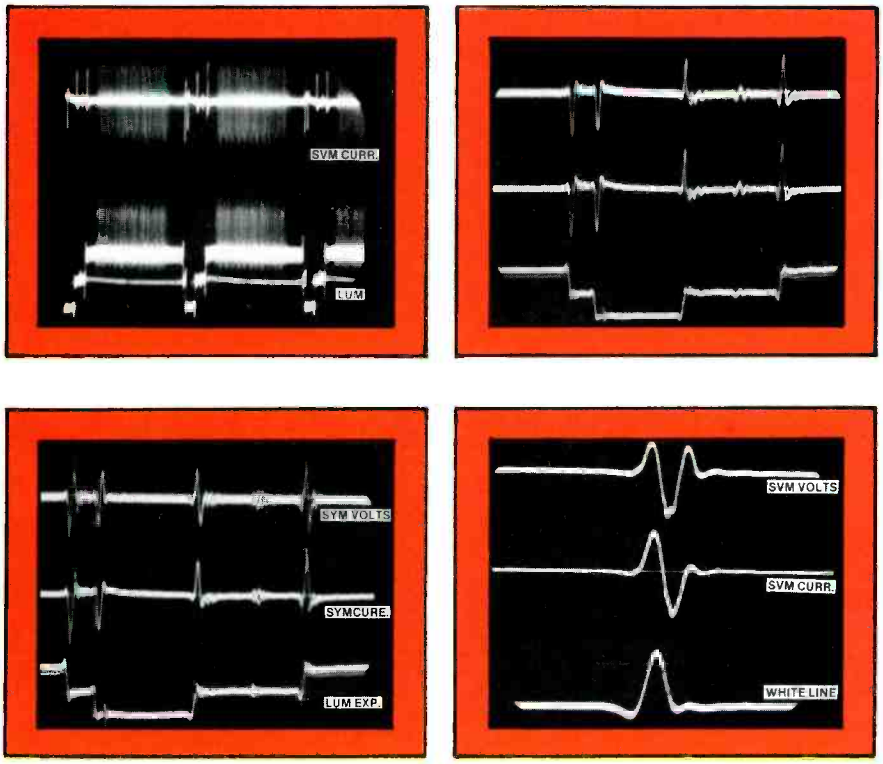


Figure 10. The scope-expanded horizontal retrace section of the luminance video signal illustrates the basic principle of SVM. C) The lower trace is luminance video (without chroma) from a cable program that exhibits many fast-rising edges and fast-falling edges that can be seen in the top trace which shows the current through the SVM yoke. D) For better details, look at the D scope traces. From top to bottom they are: ac voltage from SVM output to ground; SVM *current* pulses scoped across R868 (5.6Ω); and the expanded blanking and sync pulses. The SVM operates to increase the scanning beam speed and immediately to decrease it to normal with one pulse of current. Alternately, it decreases and then increases the scanning speed to normal. See the text for the remainder of that explanation. E) These are the same waveforms as in D, but with the SVM yoke unplugged. F) These waveforms show why vertical crosshatch lines are not a suitable explanation of the exact operation of the SVM system.

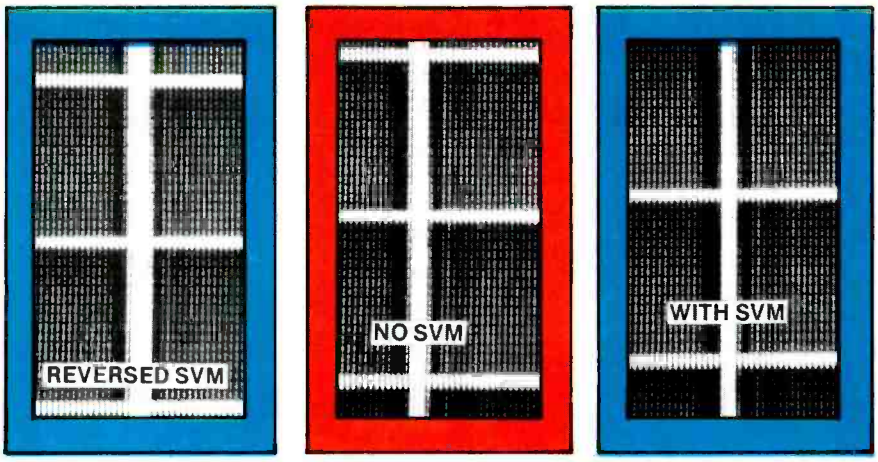


Figure 11. Photographs of the TV screen show the effects of SVM on a crosshatch pattern with white lines. Notice the apparent sharpness and width of the vertical line. A) The SVM plug was reversed so the SVM action was reversed. Of the three test conditions, this one produced the broadest vertical line. B) With the SVM circuit disabled, the line has moderate sharpness and width. C) With the SVM plug inserted correctly, the white vertical line definitely is narrower and sharper than the other two. Another advantage of the SVM operation is that the apparent focus is improved, as if the dot of light that paints the picture had been made smaller.

better for this analysis than are vertical crosshatch lines because there is more than enough room between the rising and falling edges for the SVM operation to be completed before the next one arrives. Unfortunately, the rising and falling edges of a crosshatch vertical line are so close they interfere with the other's pulses.

This is illustrated by the three Figure 10F traces. A single white vertical line is represented by the pulse on the bottom trace. Center trace is the SVM current and the top trace shows the SVM voltage. (These have been expanded more than were the previous luminance waveforms.)

A problem arises if we attempt to use the vertical crosshatch waveforms to analyze the SVM operation. The current center trace shows a positive-going and a negative-going pulse connected together, while the voltage waveform appears to be an inverted and overpeaked copy of the crosshatch line (top waveform). The problem occurs because the crosshatch line has the rising and falling edges too close to each other. Therefore, the positive-current pulse from the rising edge meets the negative-current pulse from the falling edge. It is difficult to understand, unless you already know what is happening. The voltage waveform is even more misleading. Initial and the final positive-going pulses are not much affected, but the two center negative-going pulses connect together creating one larger pulse.

For these reasons, we advise the use of the crosshatch pattern for servicing and troubleshooting, but not for understanding the SVM operation.

Can the SVM improvement be seen?

The three Figure 11 photographs of a crosshatch pattern on the Sylvania screen should dispel all doubts about the SVM circuit's ability to sharpen narrow vertical lines. Because the SVM yoke (on the CRT neck) is connected via two wires and a female socket to a 2-pin male plug on the CRT-socket board and the SVM circuitry, it is easy to disconnect the plug and socket, thus stopping all SVM action. No damage will result because the SVM plug is paralleled with about 100Ω.

Figure 11A shows the wider vertical line caused by reversing the SVM plug. Of course, this reverses the SVM operation, making the picture less sharp. Figure 11B photograph was taken with the same conditions of receiver and camera, but with the SVM yoke disconnected to remove all SVM operation. This is the normal non-SVM width of the crosshatch vertical line. Finally, the SVM was plugged in correctly (Figure 11C) and the vertical line was narrower and sharper when the SVM operated as designed.

SVM comments

Performing accurate tests on the picture changes from SVM operation is very frustrating when special generators are not available. As pointed out previously, a crosshatch pattern is not suitable. Video from a TV station can be used. But to obtain sharp rising or falling edges spaced properly apart requires extreme horizontal expansion by using 2μS/CM scope sweep multiplied by at least X5 width. When that is done the waveforms are borderline at best, with instability, low brightness and critical locking.

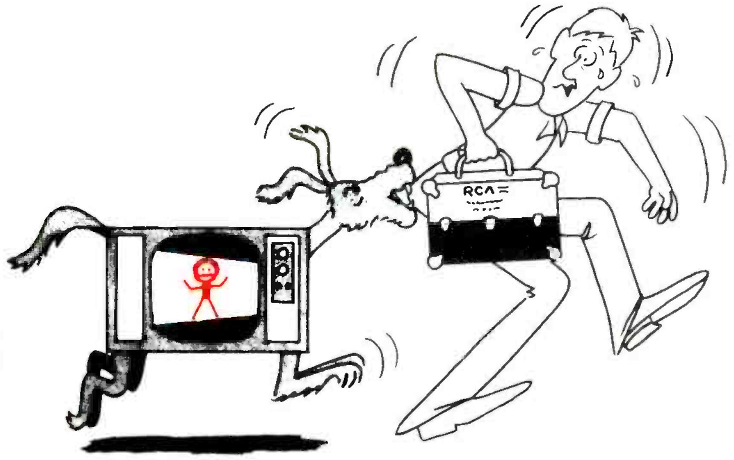
After those tests were performed in the best possible manner considering the problems, the next step was viewing results from the picture-tube screen. There is no suitable picture that remains on the screen longer than perhaps five seconds, so there is a constant search for suitable picture material. When it is found, there is a flurry of activity with plugging and unplugging the SVM yoke plug and observing any change of width, contrast or brightness on any suitable vertical lines.

The unscientific results include vertical white lines becoming narrower with SVM. This slightly improves the contrast of darker or black areas near the white lines. Dark or black vertical lines become wider with SVM. In fact, all black areas become slightly wider, but the effect is difficult to see when the area is wider than a narrow line. Of course, vertical lines of all shades suffer the most degradation from limited bandwidth, so they are the ones benefiting most from SVM.

The NAP technical training manual for the C4 chassis does not describe the principles or operation of the SVM system except to say the picture is sharpened by first speeding up and then slowing down the velocity of the scanning beam as it moves across the screen during a black-to-white picture transition, with an opposite action taking place during white-to-black transitions.

Can any of our readers take the Figure-10 waveforms and the basic principles given in the previous paragraph and produce a drawing of the SVM operation? Send your drawings to the editor.

How Many Times Do You Intend To Let "THE SAME DOG" Bite You ?



★ How many times have you worked all day long trying to diagnose the hi-voltage / LV regulator circuit of a set that is in shut down only to eventually find that a **shorted** video, color, vertical, tuner, AGC, or matrix circuit was causing the set to shut down and, to find that the hi-voltage / LV regulator circuit was working flawlessly all the time?

★ How many times have you spent the day looking for a **short** that was causing the set to shut down, only to eventually find that an **open** vertical, video, matrix circuit or, an **open** HV multiplier was to blame?

★ How many times have you worked all day on the same TV set, only to find out that the set's flyback transformer was defective?

★ How many flyback transformers have you replaced only to find that the original flyback was **not** defective?

★ How many horiz output transistors and Sony SG 613 **SCRs** have you destroyed while simply trying to figure out whether the flyback was good or bad?

★ How many times have you been deceived by your flyback "ringer"? Can you even count the number of hours that your "ringer" has caused you to waste?

★ How many times have you condemned a flyback, only to find that a shorted scan derived B+ source was causing the flyback to "appear" as though it were defective?

★ How many hours have you wasted, working on a TV set, only to find that the CRT had a dynamically shorted 2nd anode (to primary element)?

★ How many new sweep transformers have you unknowingly destroyed because a short existed in one of the scan derived B+ sources?

★ How many times have you said to yourself, "I could fix this - - - -thing if I could only get it to fire up long enough to lite the screen? - - - without blowing an output transistor or a fuse."

★ How many additional bench jobs could you have gotten, had you been able to give an accurate, "on the spot" estimate on sets that were either in shut down or, not capable of coming on long enough for you to analyze them?

If you had been using our all new Super Tech HV circuit scanner, you would have had an accurate evaluation concerning all of the above in about one minute, at the push of **just one** single button.

It's true! Push just one test button and our HV circuit scanner will (1) Accurately prove or disprove the flyback, (2) Check for any possible shorts in any circuit that utilizes scan derived B+, (3) Check the scan derived power supplies themselves for shorted diodes and / or electrolytic capacitors, (4) Check for primary B+ collector voltage and, (5) Check the horiz output stage for defects.

Our HV circuit scanner works equally well on sets with integrated or outboard HV multipliers. It will diagnose any brand, any age, solid state TV set including Sony. The only exceptions are sets which use an SCR for trace and, another for retrace (i.e., RCA CTC 40 etc.). Our scanner will not work on these sets.

In plain English, our HV circuit scanner is even easier to operate than a "plain vanilla" voltmeter.

First off, when you're using a scanner, you **do not** remove the flyback in order to check it. In fact, you don't even unhook any of the wires that are connected to the flyback! All you do is:

(1) Remove the set's horiz output device, plug in the scanner's interface plug, then make one single ground connection. That's all you do to hook it up.

(2) If the primary LV supply is functional and, assuming that the emitter circuit of the horiz output stage has continuity, the scanner will tell you that it is ready to "scan" by illuminating the "ready" light, which is the white button on the test / run switch.

(3) Press the spring loaded (test) side of the test / run switch and the scanner will "look" for any type of a **short** that might exist anywhere on the secondary side of the flyback, including the HV multiplier, any circuit that relies on flyback generated B+ and, including the flyback itself (both primary and all secondary windings). It will simultaneously check for a shorted LV regulator device HV multiplier, or an open or "partially" open safety capacitor.

If a short or, an "excessive load" exists on one secondary winding, all other secondary windings will have "normal" output voltage in spite of the short. Only the shorted winding itself will have zero volts on it. This makes shorted scan derived B+ sources incredibly easy to isolate. During this test, the 2nd anode voltage is being limited to approx 5 kv by the scanner.

If a short is present, the red "flyback" light will either lite, or flash (at various speeds), depending on which type of a short exists. If no shorts exist, the "flyback" light will be green.

Assuming that the "flyback" light is green, no **shorts** exist and, it is now time (and safe), to begin looking for **open** circuits which might be causing the set to shut down due to flyback run-a-way. It only stands to reason that if no shorted conditions exist, then one (or more) circuits will have to be open, otherwise, the TV set would be working!

(4) Now that you know that no **shorts** exists, push the "run" side of the test / run switch (the side that latches). Provided all of the other circuits in the TV set are functional, the scanner will now put a picture on the set's CRT screen that has full vertical and horiz deflection, normal audio, video and color.

Keep in mind that during this test, your scanner is:

(1) Circumventing all horiz osc/driver related shut down circuits,

(2) Limiting the set's 2nd anode voltage to approx 20-25 kv,

(3) Substituting the set's horiz osc/driver circuit and, as a result, eliminating any need that the set might have for an initial start up or B+ resupply circuit for the osc/driver.

Wait about 15 seconds for its filaments to warm up, then look at the CRT. Any circuits that are **"open"** will now produce an obvious symptom on the screen. Because the scanner has circumvented all of the set's shut down features, you can now use your old reliable "symptom to circuit analysis" technique to troubleshoot the problem, i.e., if the picture has no blue in it - - - repair the blue video or blue matrix circuit. If the picture has only partial vertical deflection - - - repair the vertical circuit, and so on. The scanner has effectively removed all of the stumbling blocks that would normally prevent you from diagnosing the problem, i.e., start up and shut down features, and allowed you to repair the TV set by using conventional techniques.

When you're using a scanner, all start up, shut down, dead set problems are easy to solve. You don't need anyone to tell you just how difficult these problems can be for those who don't have a scanner!!

Our Super Tech HV circuit scanner normally sells for only $\$495^{00}$. Beginning July 4, 1985 thru August 31, they are on sale for only $\$395^{00}$.

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Since the Scanner only has two buttons to press, most technicians never need it but, our "Hot Line" is available to assist new owners in the operation of their scanner. Phone (806) 359-0320.

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Understanding TVRO Receiver Specifications

Viewer satisfaction depends on choosing the right satellite receiver for the job.

Manufacturers of TVRO receivers publish specifications for two principal reasons: 1) It permits the manufacturer to describe concisely the receiver's performance, its capabilities and features; and 2) it provides the technician, dealer or purchaser with a means to compare and finally select a receiver that will fulfill certain applications and installation requirements.

Intrinsic differences of TVROs

The design of a satellite receiver is different in many respects from a conventional TV-broadcast receiver. First, the signal frequencies fall between 3.7 and 4.2GHz. These are considered microwave frequencies in the "C" band.

Second, there are as many as two dozen channels available from a single satellite.

Third, the picture carrier instead of being amplitude modulated is frequency modulated. This is necessary in order to capture the extremely weak signals "broadcast" from a tiny battery-powered transmitter located more than 22,300 miles into outer space.

Fourth, the receiving antenna must employ a large (typically 8- or 10-foot diameter) parabolic dish-shaped reflector. This reflector intercepts the signal and focuses it into a feed horn that effectively gathers the signal and directs it to the tiny dipole antenna elements–each less than an inch long–for the frequency band of 3700 to 4200MHz. The reflector, in order to be efficient, must be parabolic, extremely uniform and accurately pointed at the source of signals, i.e. at one of many satellites. There are approximately 17 domestic satellites carrying television that are in an arc directly over the earth's equator and approximately 22,300 miles above it.

Geostationary orbit

The distance between the satellite and the earth is important in order for the satellite to maintain equilibrium between the centrifugal force wanting to carry it farther out into space and the earth's gravitational pull in the opposite direction. The satellite's geostationary orbit is thus achieved. To an observer here on earth, the satellites appear to maintain a stationary position in the sky so that once the antenna is pointed at a given satellite, no further positioning is required to maintain a continuing source of signals.

Fifth, an extremely low-noise antenna preamplifier called an LNA, for low-noise amplifier, must connect electrically to the antenna dipoles and physically connect to the feed-horn assembly so that no signal is lost between the antenna dipoles and the amplifier input. Because of the microwave frequencies involved, the transistors in the LNA are a very special and expensive breed employing gallium arsenide instead of silicon to achieve a very low noise figure in the range of 1.0 to 1.5dB.

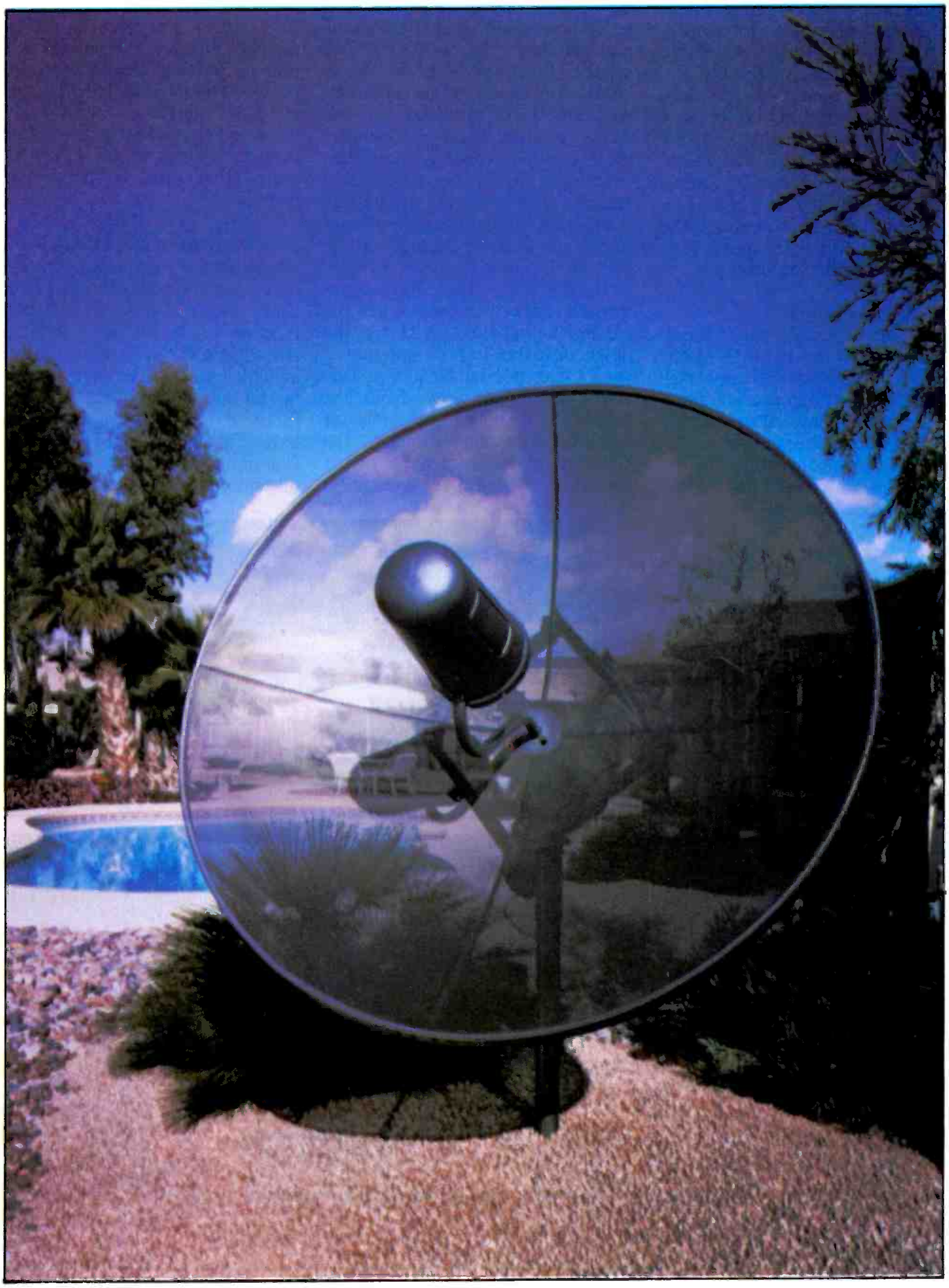
Temperature instead of decibels

Because the noise-figure numbers are getting so small in this application, it becomes more convenient to deal in equivalent absolute temperatures rather than decibels. TVRO LNAs are generally rated from 85K (degrees Kelvin) to 120K covering a very small range of noise figures from 1.12dB to 1.50dB. There is a logarithmic relationship between the absolute temperature in degrees Kelvin compared to room temperature (290K) and the noise figure of an amplifier; at absolute zero temperature (0 K) the noise figure of an amplifier goes to zero. If a noiseless transistor could be made, the amplifier temperature ideally could approach zero.

From the low-noise amplifier, the signals pass to the downconverter that simply converts them to a lower more manageable frequency. Most important is the ability to use inexpensive, commonly available, low-loss coaxial cable to transmit the signals over the long run from the antenna to the indoor receiver. Cable losses increase with frequency so downconverting the signal frequency has a big advantage. Arriving at the indoor TVRO receiver, the signals typically enter the input jack at the 70MHz IF.

Understanding TVRO receiver specifications, then, becomes the key to choosing the right receiver for the right job. Poor choices result in viewer dissatisfaction.

TVRO receiver specifications fall into three general categories: 1) physical 2) electrical and 3) functional. Physical specifications are the easiest to understand and include such things as the overall



dimensions, weight, finish, color, accessories, provisions for mounting and the material of which the case or cabinet is constructed.

Electrical specifications are equally important, generally more complex, more confusing and consequently more difficult to understand. Typical of such specifications are tuning methods, input/output impedance, voltage and signal levels, VSWR, video performance and audio performance.

Inputs

The input signals to a TVRO receiver could be at the C-band satellite-transponder frequencies (3.7 to 4.2GHz) or, more likely at some intermediate frequency if supplied from the output of an antenna downconverter. Downconverters, commonly located at the antenna, convert-down the transponder frequency to some lower intermediate frequency. The signals then can be transmitted over long runs of commonly available coaxial cable (RG-59) to the receiver without experiencing excessive cable losses.

Most home-type receivers have a 70MHz input. This has become the accepted IF frequency in the consumer TVRO industry. The receiver input jack most likely will be a 75Ω impedance type-F connector and labeled "Input-70MHz." A tunable downconverter having a 70MHz IF output can be used with such a receiver provided that the tuning scheme it uses is compatible. To work properly, the downconverter must be electrically tunable across the 3.7 to 4.2GHz band. This is usually accomplished by means of a dc tuning voltage sent up the cable from the receiver to the downconverter. The preprogrammed receiver determines the tuning voltage required by the downconverter to tune any one of the 24 transponder frequencies arriving at the antenna from the satellite. By choosing a particular satellite transponder using the controls on the front panel of the receiver, the proper voltage is selected that tunes the downconverter to the transponder frequency of choice, thereby selecting and outputting that transponder program on its 70MHz IF frequency. The 70MHz IF is then sent down the coaxial cable and indoors to the receiver at the input jack where the signal is further processed.

Receiver sensitivity

One of the electrical specs that may cause consternation to the user is input threshold. This term is used to define the carrier-to-noise ratio (C/N) in FM receivers at which substantial improvement in the output signal-to-noise ratio (S/N) of the video signal is realized. This FM improvement is a function of the square of the modulation index of the transmitted

Figure 1. Front panel view of TVRO receiver with an infrared hand-held transmitter effective up to 20 feet.

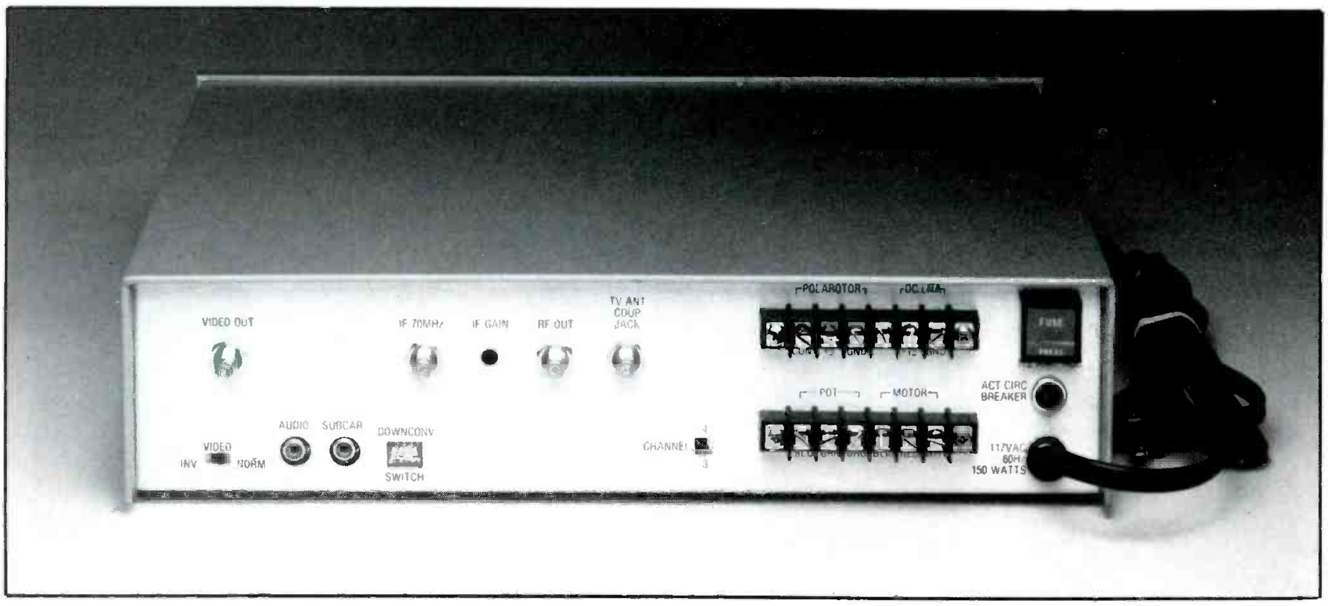


Figure 2. Rear-panel view of TVRO receiver showing input/output jacks, switches and remote-power connections.

Figure 3. This TVRO receiver incorporates an infrared hand-held transmitter that enables the operator to control power *on/off*, polarity, satellite selection and channel selection—all from the easy chair.

signal. In our TVRO wide-band FM system, the FM improvement is 38.5dB. The improvement is clearly impressive and around the transition point (threshold), the picture may be visible one minute and gone the next. Normally, threshold occurs at a 13dB carrier-to-noise ratio (C/N). Using threshold extension techniques, the threshold can be reduced substantially, permitting use of a smaller reflector dish and/or a less expensive LNA having a higher noise-temperature rating.

Demodulation/remodulation

In the receiver, the 70MHz signal must be demodulated to extract the video and audio information. After suitable processing, the video signals are then amplitude-modulated and the audio signals, frequency modulated, per NTSC format at either of the NTSC channel 3- or 4-carrier frequencies. These crystal-controlled frequencies emanate from an RF output jack and are then fed to a standard television receiver. Some TVRO receivers may have a TV antenna coupling jack. This feature allows the user to connect an outdoor TV antenna, VCR, cable TV input or other RF source to the receiver so that when the receiver is turned off, the source will automatically be coupled through to the RF output jack and on to the TV receiver.

Outputs

Thus, a typical TVRO receiver will have in addition to a 70MHz input connector, a channel 3/4 output "F" type connector to feed a TV receiver. Composite video also may be available separately at a video output "F" jack to feed a monitor, a VCR, a modulator and the like.

Audio signals also will be available after being tuned and demodulated in the receiver. They usually will be available at an RCA jack on the back panel of the receiver. Because there may be several audio subcarriers accompanying the video carrier, those RF subcarriers may be brought out to a separate jack on the back panel marked "subcarrier" and made available for tuning by the user, if desired, using a separate unit called a stereo processor or audio adapter.

Functional specs

Functional specs include such things as controls, switches, the operating modes and the sort of operating features that the receiver may have available.

In addition to the input/output connections on the back panel of a receiver, there will be some function switches that will need to be positioned. For example, the user will need to select either channel 3- or 4-output frequency depending on which of the two is unused in the local area. Also, the polarity of the video signal needs to be determined and a switch appropriately positioned; some video signals may be inverted although this is unlikely today, and the future switch function may be an unnecessary addition to the back panel.

Extra functions, extra circuits

Where the TVRO receiver system comes equipped with a Polarotor or similar device, and/or an automatic remote-positioning mechanism, additional electrical connections will be found on the back panel of the receiver. The Polarotor is a device that, when coordinated with the receiver circuits, automatically rotates the antenna elements 90 degrees as the receiver switches from a horizontally polarized transponder to one that is vertically polarized (or vice versa). When this function is included in the receiver, there must be additional electrical circuits provided between the receiver and the antenna to control the rotor position and provide dc power to the LNA with corresponding electrical connections on the receiver back panel.

Satellite selector requires cable

The same is true if the receiver functions include circuits that control the position of the large reflector dish. An electromechanical linear actuator (satellite selector) attached between the antenna mount and the reflector dish rotates the antenna to point at the desired satellite. When this function is included, an electrical cable from the actuator must be connected to the back panel of the receiver. Often a 6-screw barrier-type terminal strip is provided for connecting the multiconductor cable. The cable must carry a plus-and-minus voltage and ground in addition to three wires from a feedback potentiometer that senses the position of the actuator and controls its motion. Because considerable power is involved, a separate fuse or circuit breaker should be provided in the receiver to protect the motor and drive circuits in the event of a jam caused either by an obstacle in its path or by icing up.

Polarity switch needed

Because some satellites use a different convention of numbering transponders for horizontally and vertically polarized signals, there must be a polarity switch on the receiver for inverting the sequence of odd and even numbers that designate those transponders that are vertically polarized from those that are horizontally polarized.

Finally, in some products a multisection DIP switch on the back panel must be programmed to insure optimum matching of the downconverter VCO to the receiver-generated tuning voltages.

Front panel controls

Front panel functions include such things as remote control, channel scanning, satellite selector, polarity and skew control, variable audio tuning and relative level.

Starting with remote control, this function allows the user to turn the receiver *on* or *off*, change channels, change satellites and switch polarity.

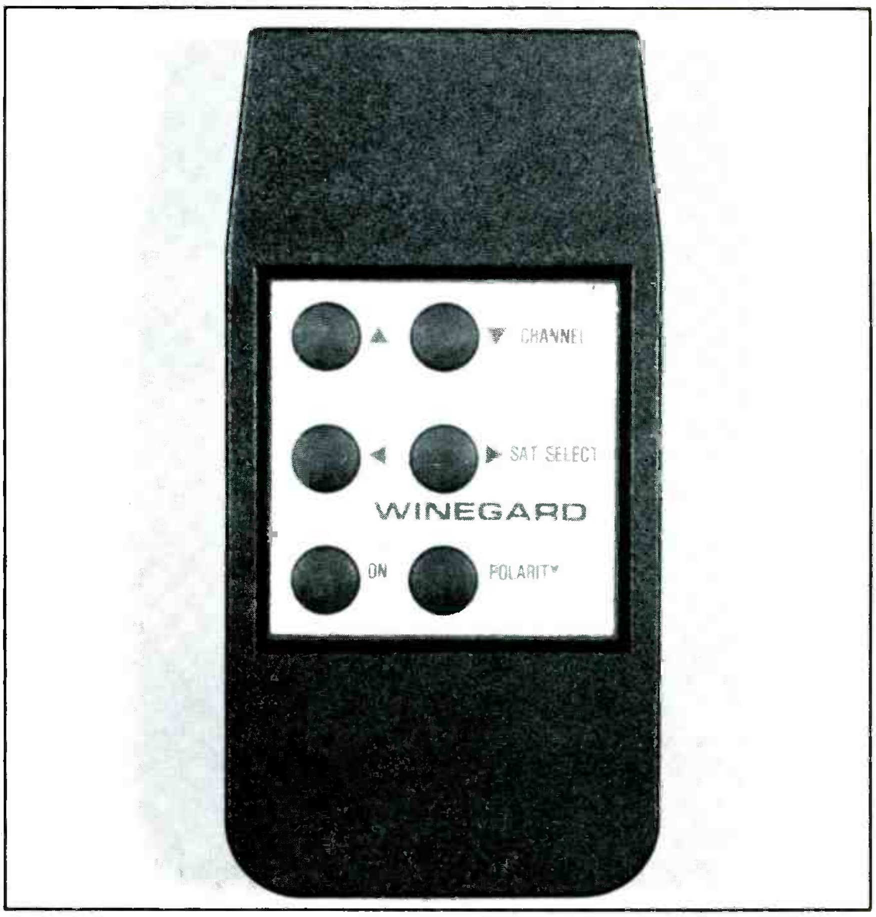


Figure 4. Closeup view of hand-held, battery-operated infrared transmitter.

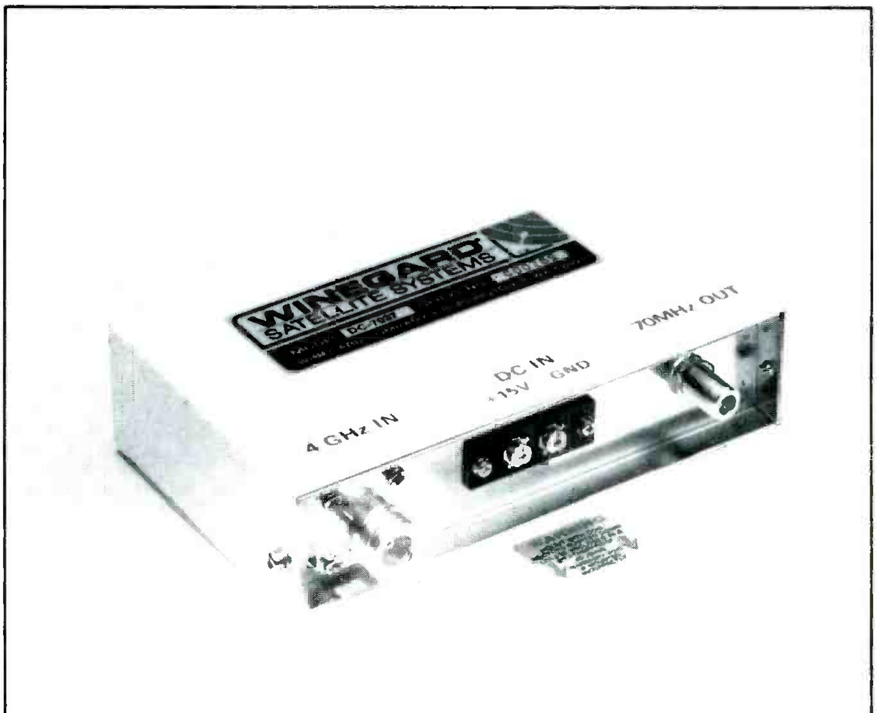


Figure 5. Voltage tunable, single-channel downconverter showing input (4GHz) and output (70MHz) connectors plus dc power cable connections.

Channel scanning is controlled from a front-panel *on/off* switch. Rapid scanning runs through all 24 channels in approximately one second. It is used to detect satellites during repositioning of the antenna by watching the TV screen.

The satellite selector turns the dish either left or right on its polar mount to cause it to scan an arc in the sky corresponding to the geostationary satellite orbit. Left or right movement is controlled by a pair of push-buttons on the front panel or, if fitted with remote, on the hand-held transmitter.

Polarity is switched by a single push-button on the front panel and on the remote-control transmitter. It switches the polarity rotor between the two formats available on the various satellites.

The skew control is a continuously adjustable control on the front panel allowing fine adjustment or tuning of the polarity rotor often necessary when looking at satellites positioned near the extreme east or west limits of the orbital arc.

An audio tune knob on the front panel provides continuous tuning of the audio subcarriers in the range of 5.5 to 8.0MHz. Most of the audio subcarriers are at 6.8MHz which can be obtained when the tuning knob is positioned at "12 o'clock."

To facilitate antenna positioning and indicate relative signal strength from the various transponders, a relative signal-level indicator will be found on the front panel where it can be viewed by the user while controlling the actuator.

Video/audio specs

A few specs that were not mentioned in the discussion were the video and audio outputs. We can cover those quickly by saying that the video output should have an impedance of 75Ω, a flat frequency response from 20Hz to 4.2MHz, a minimum output level of 1VPP and conform to the CCIR de-emphasis curve No. 405-1 for 525-line systems. Transmitted dispersion, which causes a jittery picture, should be attenuated at least 40dB or more.

Audio frequency response should be at least 50Hz to 15kHz with a standard 75-μsec de-emphasis and less than 2 percent total harmonic distortion (THD). The output level should be at least 0dBm at an impedance of 600Ω when properly tuned by the control on the front panel.

Antennas—a separate subject

I deliberately avoided a discussion of antennas, feeds, LNAs and downconverters; these points should be covered in a separate article that will be deferred until a later issue.

In this article, we have covered most of the significant specs for a TVRO receiver, therefore, you should be more knowledgeable about most electrical and functional characteristics. Some items apply to all receivers while others are merely optional features; however, it is important to have a clear understanding of all of them when selecting a TVRO receiver.

Test your electronic knowledge

By Sam Wilson

1. The maximum amount of power that can be dissipated by R_L in the circuit shown in Figure 1 is 1.8W. What is the value of R_L?
R_L = ______________________Ω

2. Which of the following oscillators does not use inductance?
A.) Phase shift
B.) Colpitts
C.) Hartley
D.) Armstrong

3. In the circuit of Figure 2, the transformer has a turns ratio of

$$\frac{Np}{Ns} = \frac{6}{1}$$

The value of V_{out} should be about
A.) 0V. C.) 120V.
B.) 100V. D.) 140V.

4. In a dark room, the neon lamp of Figure 3 flashes at a rate of 80 pulses per second. If you take it into a brightly lighted room, the number of flashes per second will be
A. higher.
B.) the same.
C.) lower.

5. To accurately measure a resistance less than 1Ω you should use a
A). Maxwell bridge.
B.) slide wire bridge.
C.) Wheatstone bridge.
D.) Kelvin bridge.

6. The circuit of Figure 4 is used
A.) to obtain a high input impedance to the source at point A.
B.) to obtain a low input impedance to the source at point A.

7. Which of the following is the name of an instrument used to measure voltage?
A.) Divider
B.) Potentiometer
C.) Tallyometer
D.) Megger

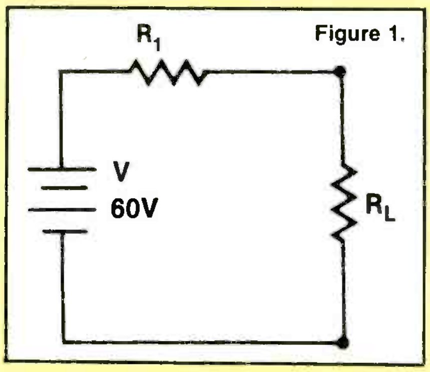


Figure 1.

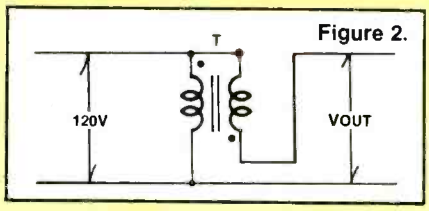


Figure 2.

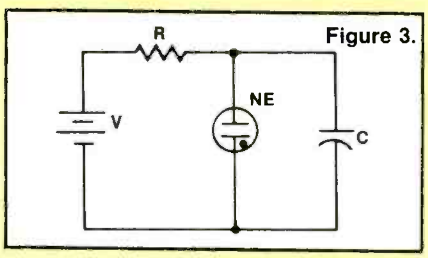


Figure 3.

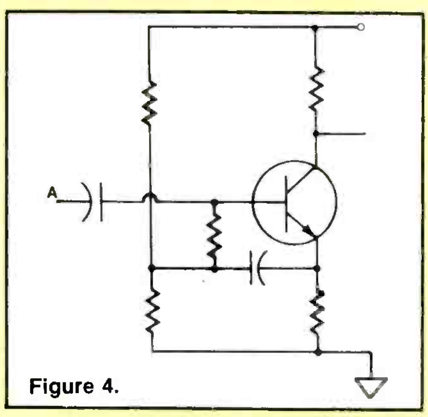


Figure 4.

8. If you magnetize a bar of iron,
A.) it becomes shorter.
B.) it does not change its length.
C.) it becomes longer.

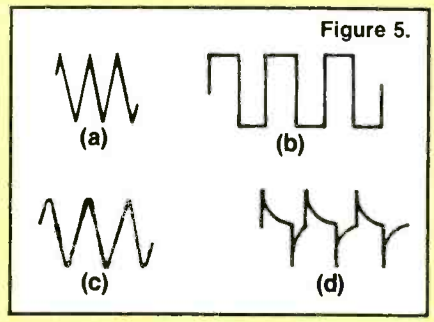


Figure 5.

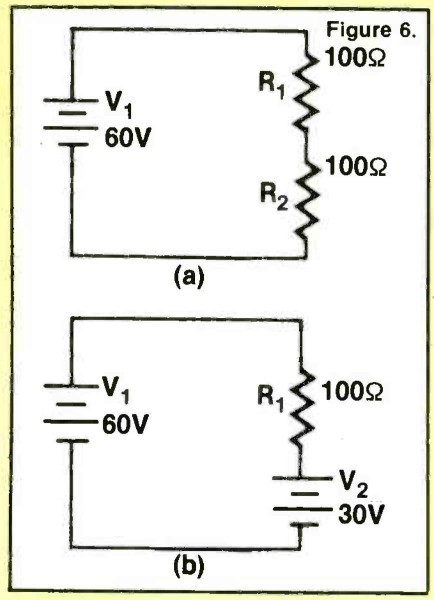


Figure 6.

9. Refer to Figure 5. With a pure sinewave input to a differentiating circuit, the output should have a waveform like the one shown in
A.) (a) C.) (c)
B.) (b) D.) (d)

10. Disregard, for a moment, the effects of reverse current and internal resistance in a battery. The current through R_1 is
A.) greater for the circuit in (a) of Figure 6.
B.) the same for both of the circuits in Figure 6.
C.) greater for the circuit in (b) of Figure 6.

Answers on page 45

Books

Editor's note: *Periodically **Electronic Servicing & Technology** features books dealing with subjects of interest to our readers. Please direct inquiries and orders to the publisher at the address given, rather than to us.*

The Encyclopedia of Electronic Circuits, by Rudolf F. Graf, Tab Books, $29.45 paperback.

There are nearly 1300 detailed circuit schematics – more than 750 pages – that include the author's concise explanations of the circuit configurations and functions whenever clarification seems necessary.

There are nearly 100 circuit categories, both analog and digital, each with a wealth of individual circuits designed for long-lasting applications potential. To achieve this, Rudolf Graf sought out nearly 100 top electronics sources for the best circuits for accomplishing virtually every possible electronics task. Hobbyist, technician, student and design professional will consider this a unique reference tool.

Tab Books, Blue Ridge Summit, PA 17214

Handbook of Digital Logic... with Practical Applications, by Sam Cowan, Prentice-Hall, $29.95.

This practical guide sets forth methods, guidelines and illustrations for understanding and applying digital logic. In a clear, straightforward manner, it covers everything from encoding schemes for magnetic recording to circuits used for implementing error correction codes, and to details on the most popular T^2L logic chips.

Find answers to questions regarding Boolean algebra, logic circuits, microprocessors and memory chips. This reference also provides methods for building counters for use in any base system, examples of CMOS, ECL, I^2L...a complete list of the instruction codes for the 8080 and 6800 microprocessors and many detailed applications. There are 216 illustrations and photographs.

Prentice-Hall, Englewood Cliffs, NJ 07632

The 555 IC Project Book, by Robert J. Traister, Tab Books, $11.45 paperback.

An IC metronome, a clip-on transistorized amplifier, even an electronic organ, are some of the 33 different projects readers can make using the popular and versatile 555 timer. The 555 timer is an ideal choice for the novice just beginning to work with integrated circuits, yet it is so powerful and multifaceted that it is used in the most sophisticated industrial frequency counters and microcomputers.

Leading off with a look at integrated circuits in general, the author outlines the different packages ICs come in: the DIP (dual in-line package) and the TO-5 unit that is shaped like a tiny tin can. The various components used with the 555 timer also are discussed: FETs (field-effect transistors) and SCRs (silicon-controlled rectifiers) are two examples. A full chapter on logical IC troubleshooting techniques, a listing of schematic symbols, and connection diagrams are included.

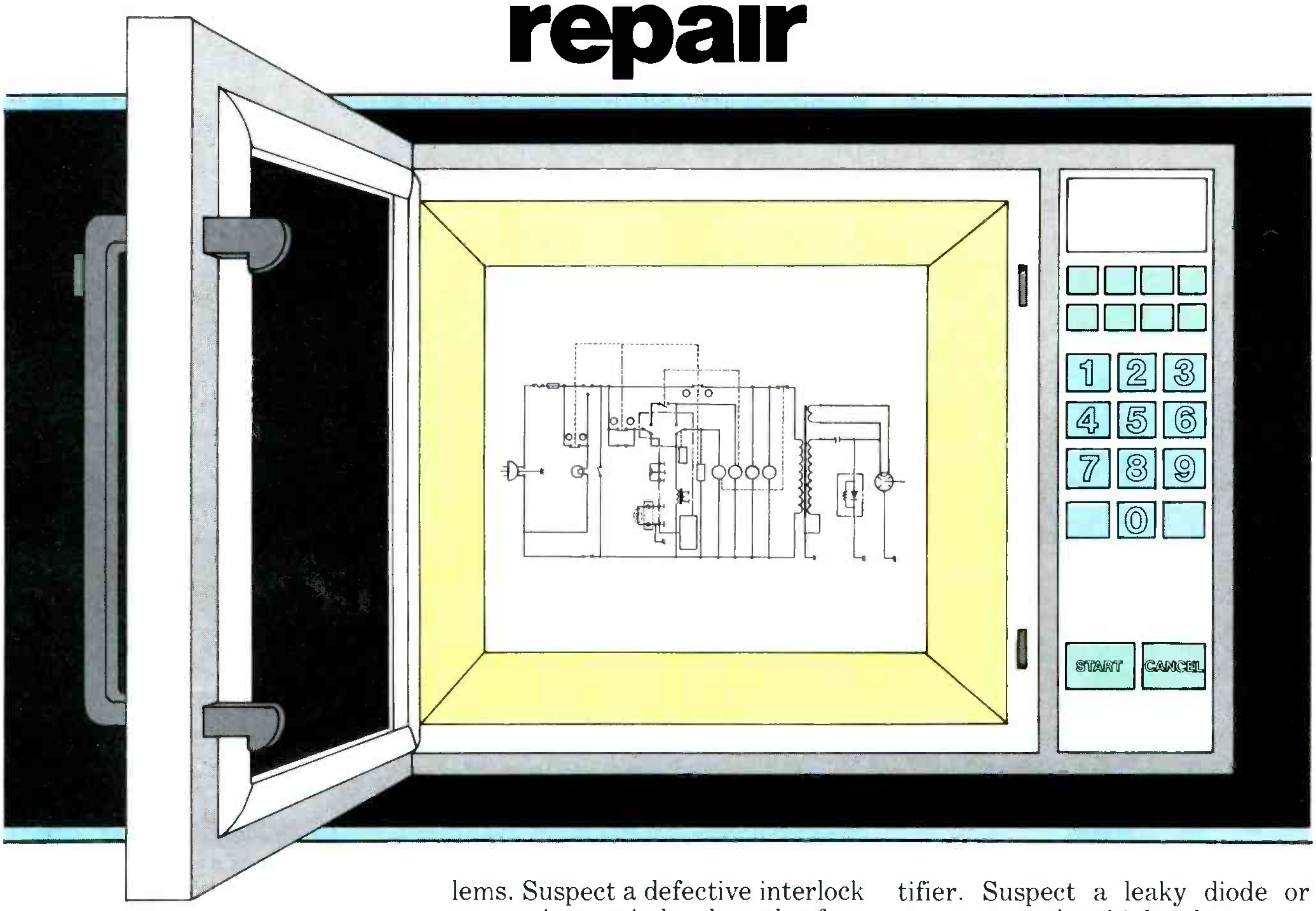
Tab Books, Blue Ridge Summit, PA 17214

Standard Radio Communications Manual: with Instrumentation and Testing Techniques, by R. Harold Kinley, Prentice-Hall, $29.95.

The thrust of this book is to apprise communication technicians of numerous test and measurement procedures that can help them to analyze more effectively the performance level of communications equipment. Along with detailed procedures, there are illustrations showing how to set up the equipment, alternative methods of performing the tests, and examples and diagrams that show how to analyze and interpret the test results. How to use the *Bessell Zero* method to set the deviation of an FM transmitter, how to use the *Autopeak* modulation monitor, how to measure harmonic distortion in SSB transmitter, using either a spectrum analyzer or an SSB receiver and a distortion meter, are just some of the specific procedures described.

Prentice-Hall, Englewood Cliffs, NJ 07632

Opening doors to microwave oven repair



Look for these 12 common problems when servicing microwave ovens, and remember how the problems were solved.

By Homer L. Davidson

The most common malfunctions found in microwave ovens are a blown fuse, defective interlock switches, leaky magnetron tube and high voltage rectifiers.

The interlock switch, a safety device designed to prevent operation of the oven when the door is open, is a frequent cause of problems. Suspect a defective interlock or monitor switch when the fuse opens as the door is closed after cooking (Figure 1). Erratic or intermittent oven operation may be caused by a poor contact inside the interlock switch. Check each switch with the low ohm scale of the VOM or DMM as the door is opened and closed.

The magnetron, the tube that generates the microwaves, may be the cause of faulty operation. A magnetron tube may become weak, producing poor heat or cooking operation. A leaky magnetron may cause the fuse to open or it may cause a no-heat symptom. Erratic or slow cooking may be the result of poor heater terminal connections. Magnetrons suspected of malfunctions may be tested with a Magnameter test instrument or voltage and current measurements (Figure 2).

Another cause of a blown fuse may be a leaky high voltage rectifier. Suspect a leaky diode or magnetron when high voltage cannot be measured at the anode terminal of the rectifier. Check the HV with a good high voltage tester. Do not try to measure the HV with the VOM or DMM. Visually, inspect the rectifier after discharging the HV capacitor. Check the body of the rectifier for burned or overheated marks. A normal HV rectifier will operate while a leaky one may run quite warm. *Always discharge the HV capacitor before servicing the microwave oven.*

Servicing the microwave oven is relatively simple compared with servicing of other electronic products: there are fewer parts to contend with than in even the ordinary radio or tape player. Determining what components fail and how to locate them will be discussed in this article, along with 12 case histories of experience in servicing several brands of microwave ovens.

No cooking

The no-heat or no-cooking symptom may be the result of a defective magnetron or improper voltage applied to the magnetron tube. Check for correct voltage and operating current with a Magnameter. Higher than normal voltage may indicate that the magnetron heaters are open or that the tube is defective (Figure 3). Absence of current indicates a defective magnetron or absence of high voltage to the tube.

Notice if the magnetron lights up. This will confirm that the heaters are operating inside the caged area. After discharging the filter capacitor, remove the heater cables and inspect for poor connections. Usually, hot air blowing across the magnetron indicates the magnetron is operating. Suspect a defective magnetron when high voltage is normal but you measure no current.

No heat/no cooking was the symptom of a Thermador MC17 microwave oven. High voltage was normal but there was no current. Heater continuity checked out good on the DMM with the high-voltage capacitor discharged and heater cables removed. A new L5261A microtron tube solved the no-cooking problem. In this model, the power transformer and HV capacitor must be loosened so the fan cage may be lowered in order to remove and install the new tube.

No cooking—leaky capacitor

Besides a defective magnetron, a no-cooking symptom may be the result of improper high voltage applied to the tube. To check this, pull the power cord, discharge the HV capacitor and take a resistance reading from the heater terminal to oven chassis or where the HV diode is grounded. If the resistance measurement is low, suspect a leaky rectifier or magnetron. The next step is to disconnect both heater terminals from the magnetron and take another measurement. The tube is leaky if any resistance is found between heater and ground. Remember the plate cavity of the magnetron is at ground potential.

Now check the resistance across the HV diode. A leaky diode or magnetron may cause the 15A

Figure 1. The major oven components are located in the right side of the oven.

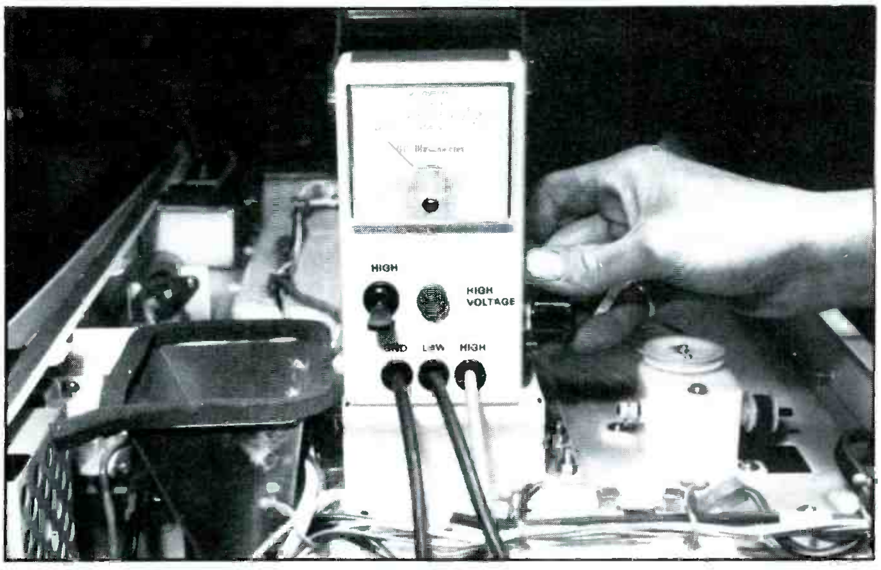


Figure 2. A defective magnetron may be detected by taking voltage and current measurements with the microwave oven Magnameter.

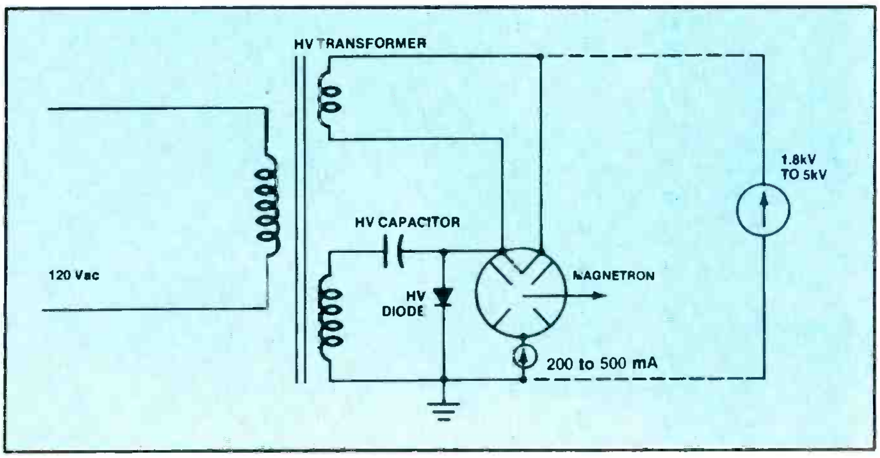


Figure 3. A higher than normal HV working voltage may indicate an open magnetron. Extremely high current measurement may be caused by a leaky tube.

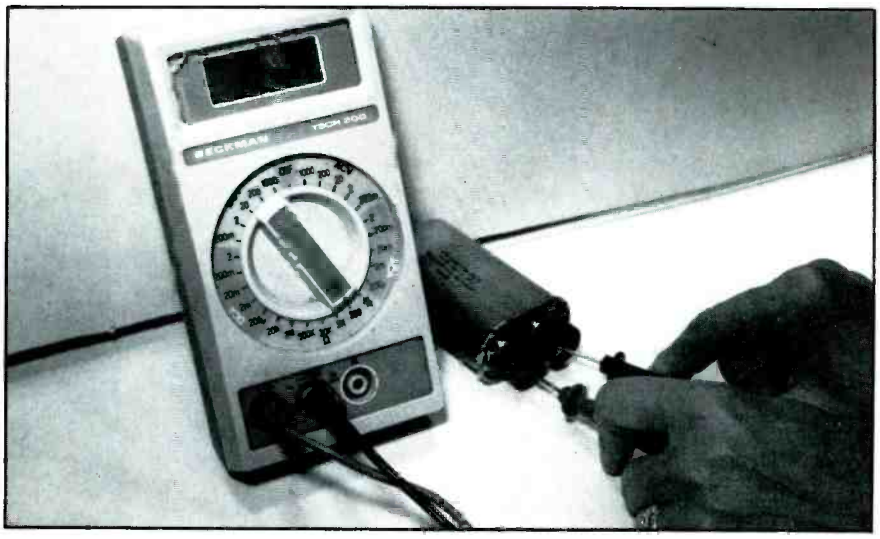


Figure 4. In this Norelco MCS7100 oven, only 105Ω were measured between the HV capacitor terminals. A normal capacitor will have infinite resistance.

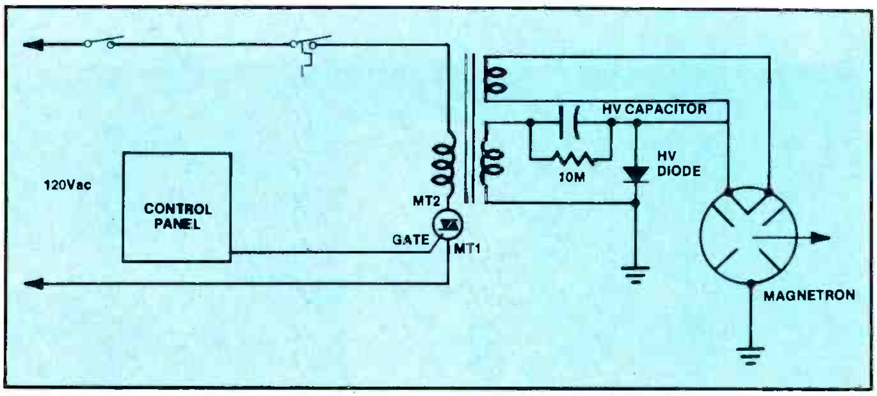


Figure 5. Before the triac assembly functions, a gate voltage must be furnished by the control panel. The triac assembly is found in some ovens instead of a relay.

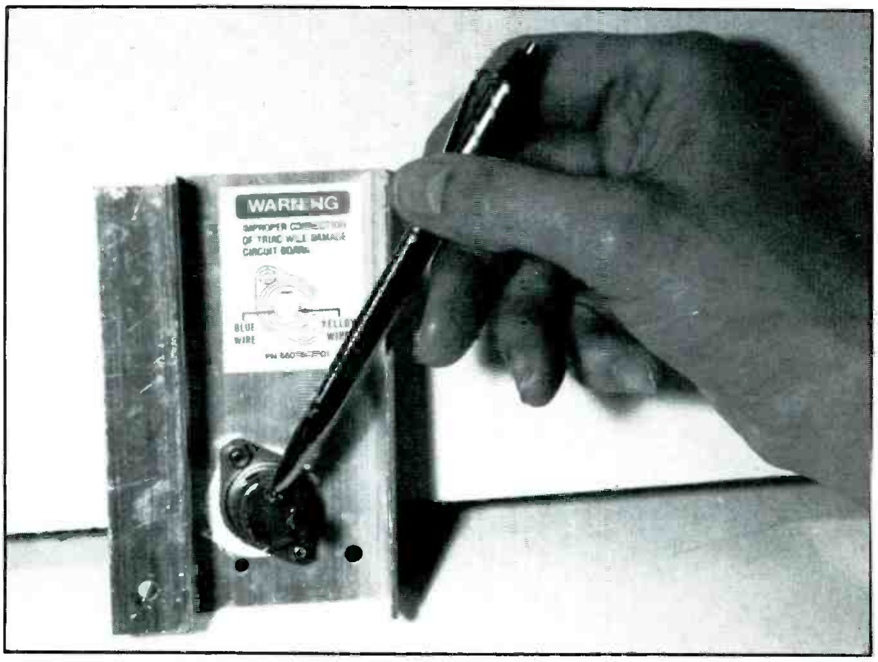


Figure 6. Although the triac component operates the same in most ovens, replace with the original part number.

fuse to blow. Disconnect one end of the diode to determine if the diode is leaky. If a low resistance is still measured with the diode out of the circuit, suspect a leaky filter capacitor.

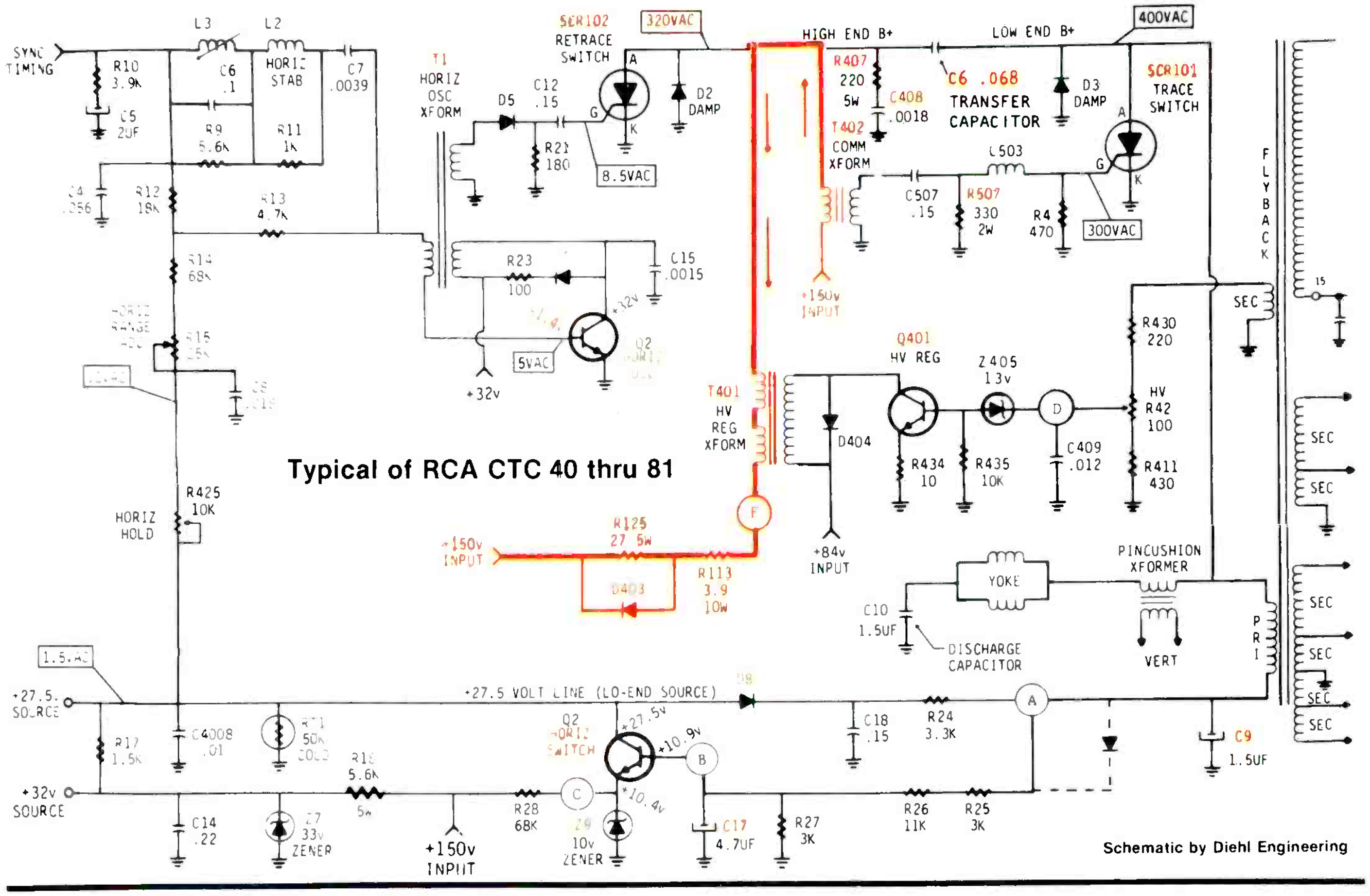
A no-heat, no-cook symptom in a Norelco MCS7100 model was found to be caused by a leaky HV capacitor (Figure 4). The oven cycled properly with no high voltage at the magnetron tube. A leakage of 1.3Ω was measured across the capacitor terminals, where a normal capacitor would have infinite resistance across the terminals. Replacement of this HV capacitor, completed easily because it is installed with plug-in clip terminals, solved the problem.

Erratic cooking

Intermittent or erratic cooking may be caused by a defective magnetron, a defective thermal cutout switch, poor interlock contacts or improper heater voltage. The defective magnetron may intermittently go open or draw excessive current. If the oven operates for a couple of hours and will not heat, suspect a defective thermal cutout switch. Check each interlock for proper operation.

A container of water was placed inside a malfunctioning Sharp R9310A oven. The water was barely warm after three minutes of operation. Further testing revealed that the oven might operate normally next time for five or six hours. I checked the heater terminals for poor crimped connections and found that they showed signs of overheating, suggesting very poor contact. The cure was to remove the heater cables, clean off both connections and heater terminals, then slip the cables in place and solder the crimped connections to the heater terminals.

Another Sharp R7710 model exhibited intermittent operation. The Magnameter was connected to the magnetron while monitoring voltage and current measurements. When the oven was intermittent, the high voltage on the magnetron increased to 3.5kV (too high for this oven). Then the voltage would drop to 2.2kV. In this case, replacing the magnetron cured the intermittent and erratic cooking operation.


SYNC TIMING
HORIZ STAB
SCR102 RETRACE SWITCH
320VAC
HIGH END B+
LOW END B+
400VAC
T1 HORIZ OSC XFORM
D2 DAMP
8.5VAC
R407 220 5W
C408 .0018
T402 COMM XFORM
C6 .068 TRANSFER CAPACITOR
D3 DAMP
SCR101 TRACE SWITCH
L503
C507 .15
R507 330 2W
R4 470
300VAC
FLYBACK
+150v INPUT
Q401 HV REG
Z405 13v
T401 HV REG XFORM
D404
R434 10
R435 10K
C409 .012
HV R42 100
R411 430
R430 220
Typical of RCA CTC 40 thru 81
HORIZ HOLD
R425 10K
R125 27 5W
R113 3.9 10W
D403
+84v INPUT
YOKE
PINCUSHION XFORMER
VERT
C10 1.5UF
DISCHARGE CAPACITOR
+27.5 VOLT LINE (LO-END SOURCE)
+27.5 SOURCE
+32v SOURCE
Q2 HORIZ SWITCH
C18 .15
R24 3.3K
C9 1.5UF
C14 .22
Z7 33v ZENER
+150v INPUT
R28 68K
Z9 10v ZENER
C17 4.7UF
R27 3K
R26 11K
R25 3K
SEC
PRI
Schematic by Diehl Engineering

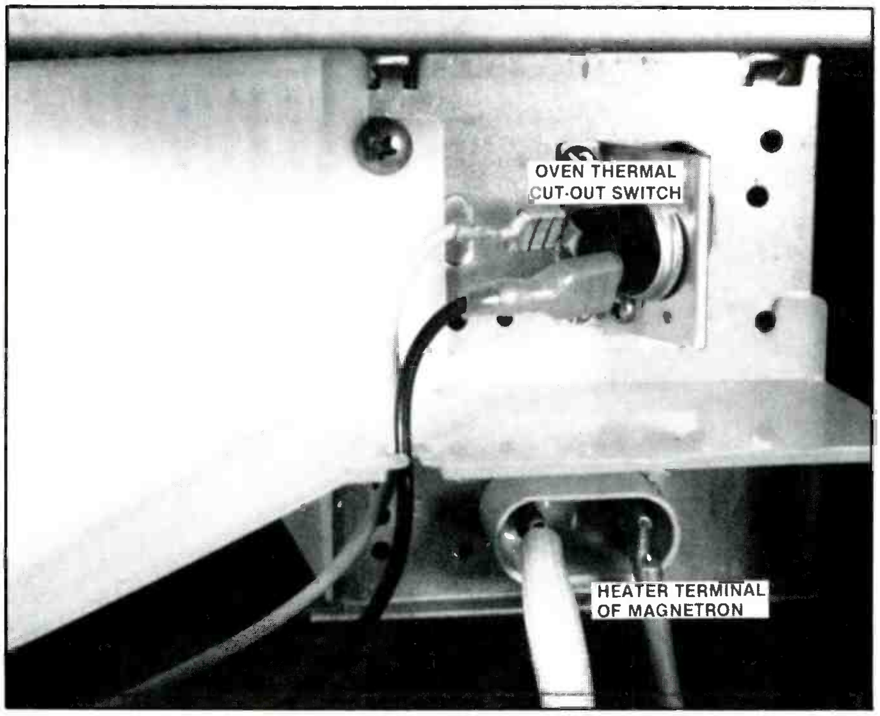


Figure 7. A defective or overheated magnetron may trip the thermal cutout assembly and stop the cooking process.

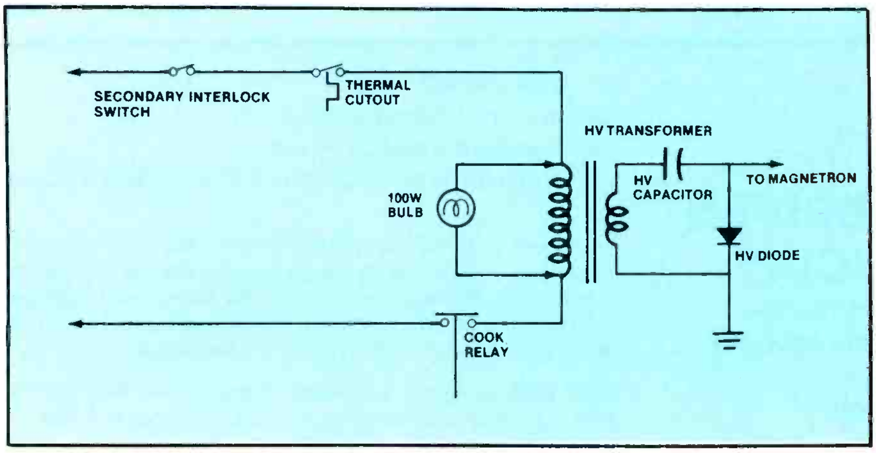


Figure 8. To determine if all components are working, check for voltage with a 100W bulb, or monitor the voltage across the primary winding of the HV transformer.

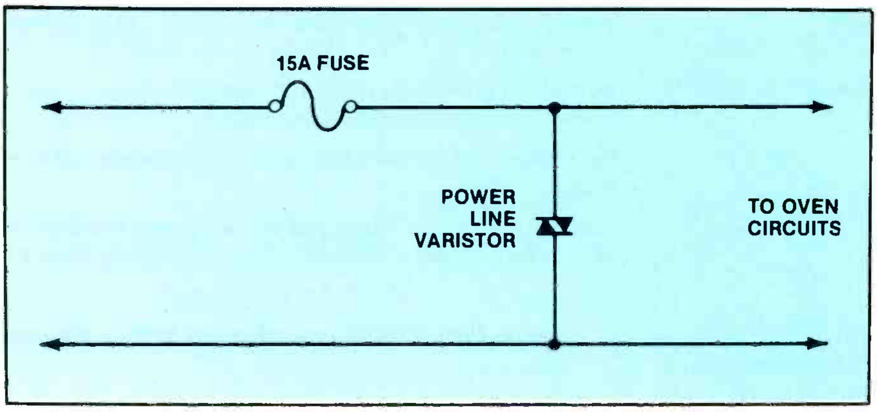


Figure 9. A burned power-line varistor in a Quasar MQ-6620 TW oven caused the fuse to blow when the power cord was plugged in. These varistors are added to protect the oven circuit and components from lightning or power line surge conditions.

Oven starts spontaneously

Some microwave oven defects produce bizarre symptoms, such as causing the oven to operate spontaneously when it is plugged in, without operating any of the controls. If you encounter a situation such as this, notice whether the oven turns off after opening the oven door. The oven should stop with the door open if the interlock switches are operating properly.

In normal operation, the control panel supplies a trigger voltage to the gate terminal of the triac assembly (Figure 5) in ovens that use a triac assembly instead of an oven relay. A leaky triac assembly may start the oven without any outside gate voltage. The leaky transformer triac was replaced in a Norelco MCS8100 oven when the oven could not be controlled, using a triac with an 811-000-00005 original part number (Figure 6).

Oven stops cooking

When the oven appears to continue to operate but the cooking process has stopped, the likely fault is a defective magnetron, thermal magnetron or oven cutout assembly. Check for fan rotation when the oven stops cooking. The magnetron thermal-cutout assembly may stop the oven cooking process with an overheated magnetron tube caused by a stopped fan (Figure 7). Often, you can heat it when the magnetron stops; the oven becomes quieter because the transformer hum is not as great with no power being supplied to the magnetron.

A quick voltage and current test of the magnetron may determine if the tube is operating. Absence of supply voltage to the magnetron may point to an open thermal cutout switch in the 120V supply circuit. Monitor the ac voltage across the primary winding of the transformer with the DMM or a 100W bulb (Figure 8). If the bulb does not light, indicating an open in the 120V switch, clip the bulb across the thermal switch. If the switch is open, the bulb may light.

The oven would stop cooking in a Norelco MCS8100 model when the fan stopped; the thermal cutout was normal. Further investigation revealed that a 24V relay, controlled from the control panel, would not energize. Correct voltage was measured at the solenoid terminals. A continuity measurement with the low ohm scale of the VOM indicated that the solenoid winding was open. Replacement of the oven relays with the exact replacement part–in this case, 8100-000-00010–restored normal operation in this particular model.

Keeps blowing fuses

Almost any component within the primary or secondary stages of the microwave oven may cause the fuse to open. The most common cause is the monitor interlock switch, which may cause the fuse to blow when the oven door is closed. The monitor switch, designed to open the fuse when other interlock switches become defective, protects the user from accidental exposure to microwave radiation.

A leaky magnetron or HV diode may cause the 14A fuse to open. These components may be checked out by disconnecting one primary lead of the HV transformer. If the oven still blows the fuse after you disconnect the transformer and check all interlock switches, suspect a defective control board, fan motor or light bulb. Check the light bulb glass for extreme black areas. In one Sharp R5380 oven we serviced, a shorted 20W light bulb caused the fuse to blow as the oven was turned on.

In another case, a Quasar MC-6620M oven, the fuse would open as the power cord was plugged in. A thorough diagnosis revealed that a power line varistor had arced over, protecting the oven circuits from a lightning strike or other source of voltage surge. Often, lightning damage or a power line surge destroys the power line varistor and fuse. You may locate a power line varistor protection device on the control board of some ovens.

Open fuse with oven shut off

The fuse may blow when the oven door is closed or at the end of the cooking cycle. When this happens, suspect a defective monitor switch. In a Litton model 465, the fuse would blow each time the oven shut off after operating for a long period of time. Replacing the leaky triac, M16D56, solved this.

Smoking transformer

The 15A fuse would open after several minutes of operation in a Sharp R7704A model. Some smoke appeared above the noisy power transformer. A quick ohmmeter test from the heater of the magnetron to ground indicated a leakage of 48.7Ω (Figure 10). The leaky magnetron was replaced.

Although the oven began to cook, smoke again appeared above the HV transformer. The secondary lead from the HV capacitor was removed to eliminate the high voltage components. The transformer still ran excessively warm after the secondary cables were removed. A resistance measurement across the primary of the transformer was 59.5Ω. Replacing the HV transformer with a primary measurement of 95.5Ω solved the smoking problem. No doubt the shorted magnetron had caused the power transformer to overheat and short out some coil windings.

Fan operates after oven shut-off

Any oven operation after the oven is shut off, either manually or at the end of the cooking cycle, is caused by a defective control board or triac assembly. In a Sharp R-8320 oven, the complaint was that the convection oven operated intermittently and sometimes the fan stayed on after the oven shut off. The microwave section of the oven continued to operate normally.

The convection lights and control panel seemed to operate properly except that at times when the cook pad was touched, nothing happened. Replacing the control panel cured the problem of the fan operating after oven shut-off. Several more days of frustrations with the oven cooking normally one hour and dead the next revealed that a grease covered oven thermistor unit was the cause of the intermittent operation of the convection unit. Because the thermistor unit was saturated with grease, a new one was ordered.

The defective thermistor, located at the top of the oven, had a resistance of 68 to 35k between common and low terminals with a measurement of 322Ω to 165kΩ between high and common terminals. Of course, this reading changed as the oven operated. The resistance of the new component (right out of the box) had a resistance measurement of 1285Ω from low to common terminals with a resistance of 265kΩ upon the high and common terminals.

Loud roaring noise

There are many strange noises created inside the microwave oven. Sometimes when the fan rotates you may hear a clicking sound indicating a blade is out of line or the fan motor mounting assembly is missing a bolt. A constant buzzing noise may be caused by loose particles inside the large HV transformer.

A loud roaring hum noise came from a Roper 2969000 oven when it was first turned on. I shut it down immediately, pulled the power plug, removed the back cover and discharged the HV capacitor. A Magnameter showed no high voltage or current readings. Closer inspection revealed a burned area on the back side of the HV diode. The shorted rectifier was loading down the high voltage circuit causing the transformer to hum. Replacement of the rectifier restored proper operation.

Another magnetron

Because the magnetron is a main component within the oven, various service problems are encountered with a defective magnetron tube. In addition to the no-cook or erratic cooking symptoms already discussed, a defective magnetron may burn food and pull excessive current. A defective magnetron may cause hot spots in the oven cavity.

In one oven, I replaced a defective magnetron that caused food to burn. With the replacement installed, the oven would not cook at all. I checked several components in the neighborhood of the magnetron to see if transformer cables had been left or pulled off. Everything checked out but still the oven failed to cook. No high voltage or current was measured at the terminals of the replacement. Using the procedures discussed earlier, I measured the magnetron's resistances and found low resistance between heater terminal and chassis. The new

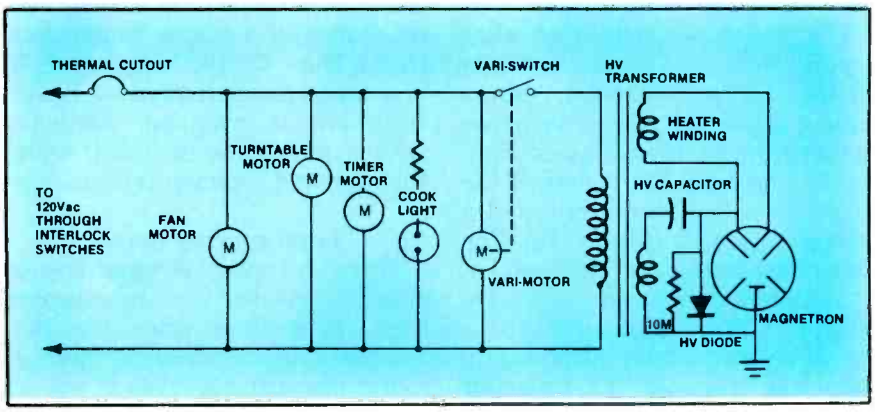


Figure 10. The power transformer smoked when overloaded by a shorted magnetron in a Sharp R 7704A microwave oven.

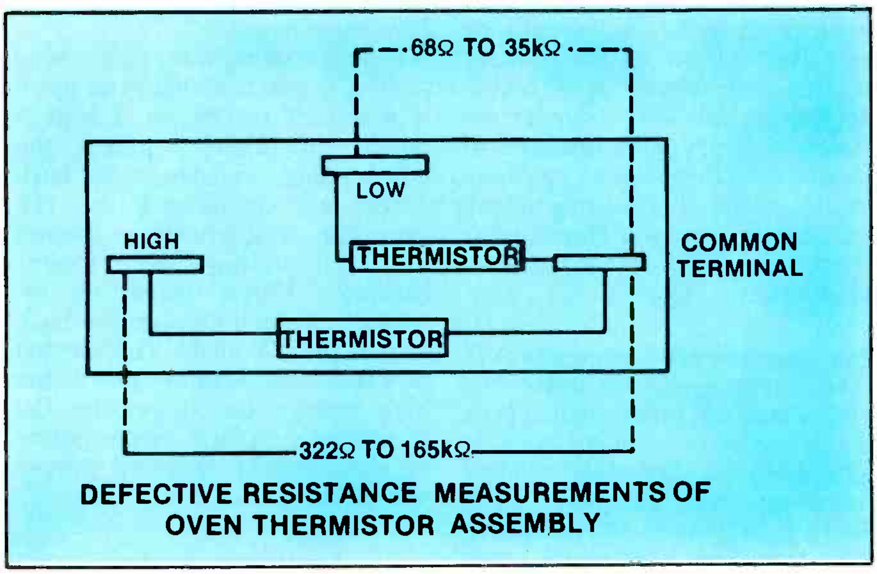


Figure 11. A defective triac and oven cutout assembly caused intermittent cooking and operation of the fan after shutoff in a Sharp R 8320 oven.

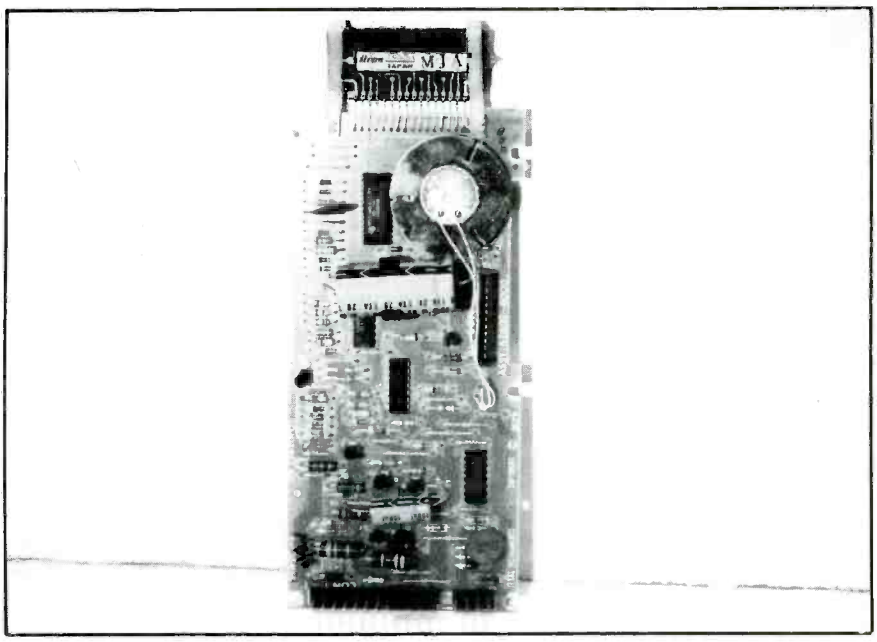


Figure 12. Here is the back view (component side) of a control panel. The control panels may be damaged when lightning strikes the power line nearby.

magnetron had internal leakage. It's not a bad idea to check to be sure that key components are operating properly before installing them.

Unusual oven problems

A very unusual operating condition occurred in a Norelco MCS8100 oven. The display would go out intermittently during normal operation. The oven cooked and shut off normally, but the digital numbers would come and go. A new control panel was installed with the same results (Figure 12).

I checked the flat ribbon cable contacts with the ohmmeter for continuity and everything checked out. The cable was then flexed as the oven operated, but this had no effect on the digital display. Sometimes the numbers would remain and operate for several hours. Replacing the touch panel assembly with correct part number (8100-000-00006) solved the problem. As it turned out, the original control panel checked out good and was installed back into the oven.

When checking out microwave ovens, remember...

Resistance, voltage and current measurements of the high voltage components solve most microwave oven problems. The resistance measurement of heater terminals of the magnetron is less than 1Ω with the cable leads removed. The normal resistance measurement between heater terminal and ground is infinite. No high voltage at the heater terminals may indicate a defective HV component or magnetron. Low or fluctuating current measurements may point to a defective magnetron tube.

Remember, even new parts may be defective. Replace the suspected interlock or thermal cutout switch when more than 1Ω is measured across the switch contacts. Replace all components with original part numbers. After all oven repairs, take a leakage test with a government approved leakage survey meter.

Check all vents for excessive lint and dirt. A closed vent may cause the oven to overheat and quit. Make sure all metal screws are replaced in the top cover. ES&T

Answers to the Quiz

Questions on page 28

1. 500Ω. When maximum power is being dissipated Ri = R_L, so, half of the applied voltage is across R_L.

$$P = \frac{V^2}{R}\text{; and,}$$

$$R = \frac{V^2}{P} = \frac{(30)^2}{1.8} = 500\Omega$$

2. A. This circuit uses an R-C phase shifting network to return the output signal to the input. The network causes the feedback signal to be in phase with the output signal. Oscillation is the result.

3. D. The transformer secondary produces 20V that are added to the line voltage.

4. A. The light ionizes the neon and lowers its firing potential. Because it fires sooner each time, the frequency is higher.

5. D. In a Kelvin bridge the resistances of the terminals are balanced out.

6. A. This is called a bootstrap circuit.

7. B. There are two uses of the word potentiometer.

8. A. The phenomenon is called magnetostriction.

9. C.

10. B. You can exchange a voltage source for a voltage drop (and, vice versa) according to the *compensation theorem*. This is a mathematical tool that is sometimes used to solve network problems.

What do you know about electronics?

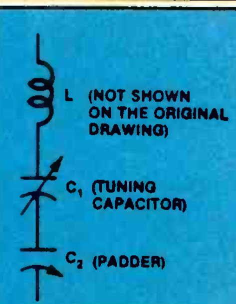
Padders, SCRs and snubbers

By Sam Wilson

Reference: "Test Your Electronic Knowledge," February 1985, Question 3.

In Figure 1, Capacitor C_2 (a padder) will have the greatest effect on oscillator frequency at the
A) highest frequency.
B) lowest frequency.

The answer to that question was A).



I have received a very professional letter from a reader in Bloomfield, NJ. He wants more information on padders that are variable capacitors connected in *series* with tuning capacitors. When I researched the information for this article, I found that you can get a number of different viewpoints on padders – depending upon the date of the publication and the viewpoint of the author.

Many years ago the TRF (tuned radio frequency) receiver was popular. Figure 2 shows the system in block diagram form. In this receiver, one or two RF stages were simultaneously tuned to the desired station.

In the receiver of Figure 2, a ganged capacitor with two sections would be used to tune the input and output of the RF amplifier. Because the input and output frequencies are the same, the two sections of the ganged capacitors are the same size.

Once upon a time...

When superheterodyne receivers first became popular, the same ganged capacitors were used. A padder was connected in series with one of the ganged sections to lower its capacity, and, therefore, make it easier to tune to the higher oscillator frequencies. Later, this was accomplished by making the oscillator section physically smaller than the RF section.

Now, I wasn't around to see all of that. This information was provided by an older friend. It does seem to be a reasonable explanation of the use of padders in early receivers. If any readers can enhance our knowledge about those early padders, I would be glad to pass the information along.

Auxiliary capacitor/padder

My knowledge of padders and my reference for the answer in the quiz, come from an excellent book titled "Essentials of Communication Electronics" by Slurzberg and Osterheld (McGraw-Hill, Third Edition, 1973). Here is a direct quote from that book:

"In order that a desired frequency range may be obtained, it is sometimes desirable to restrict the maximum capacitance of the tuning circuit without greatly exchanging its minimum value. To accomplish this, an auxiliary capacitor, C_2 (of Figure 1) is connected in series with the secondary coil L and the tuning capacitor C_1. This capacitor, called a padder, is also made adjustable *so that the minimum capacitance of the tuning circuit can be kept fairly constant."*

Lower frequency affected

As the reader pointed out, and as verified in the preceding reference, the padder has little effect on the upper-frequency adjustment, but has a great effect on the lower frequency.

Two examples are shown in Figure 3. Two important points are obvious from this illustration. *First,* changing the capacity of the padders has very little effect on the upper frequency of the tuned circuit, but it changes the lower end of the frequency band over a wide range.

Frequency range control

Second, the most important effect that the padder has is to vary the *range of frequencies* that the tuned circuit can resonate with. In fact, the padder is (normally) used to control the *range* of frequencies the tuned circuit can adjust. It is *not* – as some books suggest – used for tracking.

The best way to adjust the padder would be to set it to obtain the proper *range* of frequencies for the oscillator. By using both a padder and a trimmer, it is possible to get the best possible compromise between the range of frequencies and tracking at the high and low ends of the band. This method of adjustment wasn't given for the question. In fact, since there was no mention of a trimmer *it can't be assumed that one is used in the circuit being adjusted.*

By adjusting the padder at the high end you would be assured that the oscillator is tracking at the high end, and, also, that the best possible range has been obtained. The answer given for the question was correct based upon this idea and based upon the aforementioned reference.

However, nothing written here is incised in stone. The answer was based on what is generally true for a tuned circuit having a padder but no trimmer. There are probably cases where it would be better to adjust the padder for the low end of the oscillator range.

The transistor circuit of Figure 4 will behave like an SCR. In fact before SCRs were popular, at least one manufacturer recommended this circuit for applications where an SCR normally would be used.

By studying the circuit of Figure 4, you can get a very good idea of SCR operation.

The terminal marked G represents the SCR gate. The anode and cathode are represented by A and K respectively. It will be assumed that both transistors are cut off at the start of this discussion. Also, SW is open.

The base current for Q_1 is obtained through Q_2; and, the base current for Q_2 is obtained through Q_1. Since both of the transistors are cut off, no base current is flowing, so, neither transistor can get started.

A momentary operation of switch SW will deliver enough current to the base of Q_2 to drive it to saturation. That, in turn, drives the base of Q_1 and that transistor also goes into saturation.

When the switch is released, both transistors remain saturated because current is flowing in both base circuits.

The best way to shut the current off is to lower the voltage across the transistor combination to the point where the bases are no longer saturated.

The overall result is that the lamp in the circuit of Figure 4 will come on when the switch is closed. It will remain on even after the switch is opened.

Automatic shut-off, using Vac

If an ac voltage is used for operating the lamp (in place of V_2), the voltage across the transistors will go to zero at the end of each positive half cycle. That will automatically shut off both transistors.

Symcures Wanted

Electronic Servicing and Technology needs a broader variety of television Symcures. Especially needed are reports of Quasar, General Electric, Sylvania (or Philco), Sony, Sears and Magnavox.

Symcures are, by definition, solutions to problems that have been encountered during the repair of *more than one* television set of the same make and model, and that may reasonably be expected to be a source of *recurrent* failure.

Please give the brand, model number, Photofact number, a brief description of the symptoms, a rough hand-drawn schematic of the area containing the defect, and a short description of the cure (including whether the defective component was open, leaky, shorted or intermittent).

ES&T editors will adapt the material to the Symcure format and have Photofact-style schematics prepared.

Send seven Symcures each time. Only six will be published, but the extra gives the editor a spare for one already printed in the past (or otherwise not suitable to the format). $30 will be paid for each page of six actually published (remember to include full name and address).

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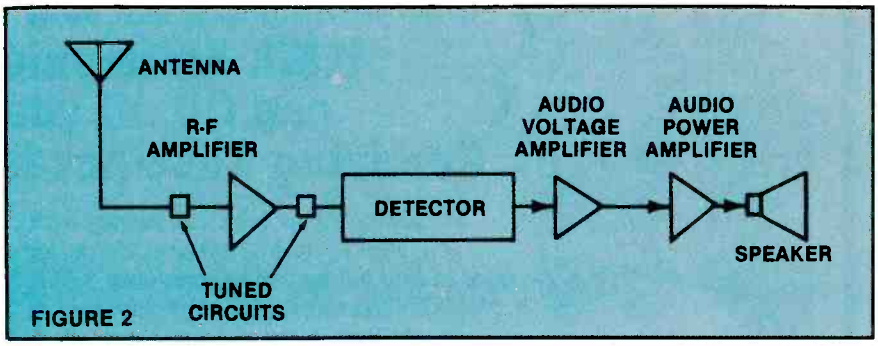


FIGURE 2

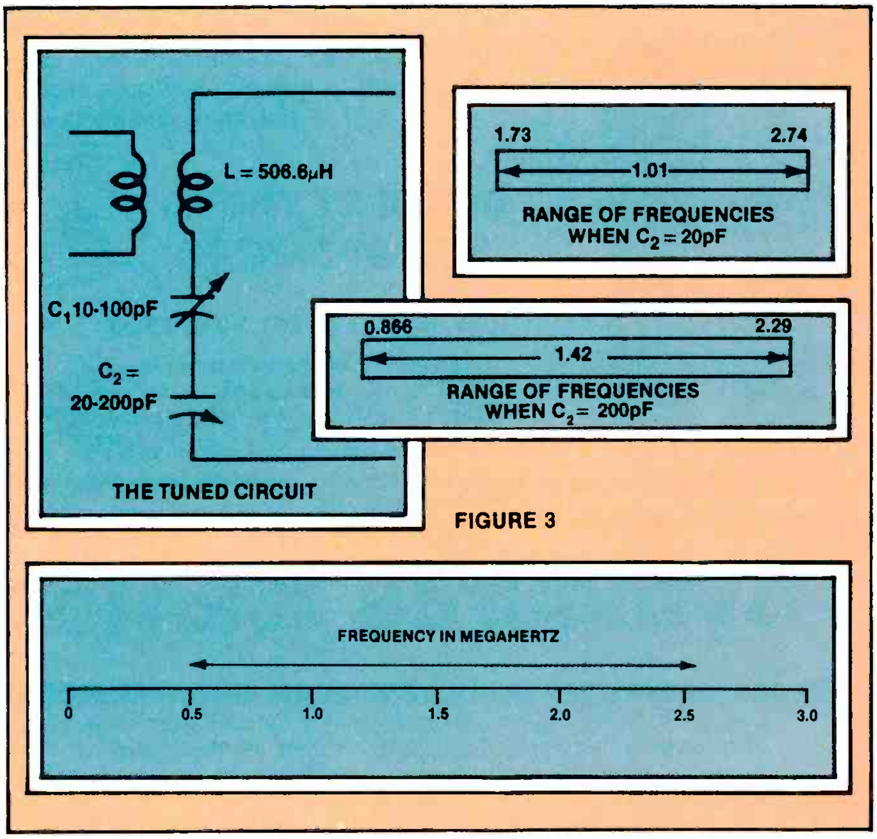


FIGURE 3

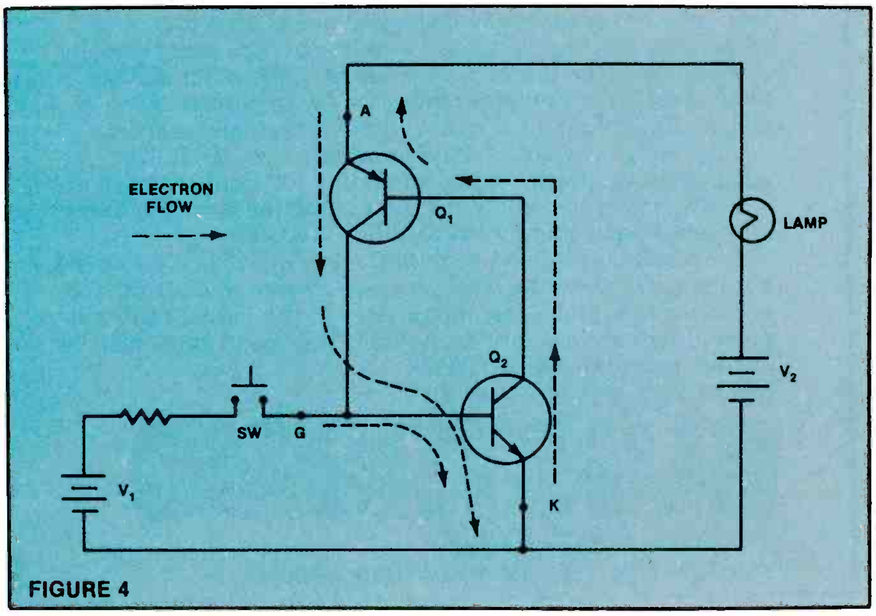


FIGURE 4

In that case, the lamp will be on while the switch is closed, but it will go off at the end of the next positive cycle after the switch is opened.

There is a rather strange characteristic of SCRs related to rapid-rise times in the applied voltage of the anode-cathode circuit. The model of Figure 4 can be used to illustrate what happens.

A rapid rise in the voltage on the anode (such as might occur on the leading edge of a square wave) will cause a positive-going voltage to be coupled through the emitter-collector capacitance of Q_1. Remember that the voltage across a capacitor cannot change instantaneously. So, the rapid increase in voltage at A will be delivered instantly to the base of Q_2.

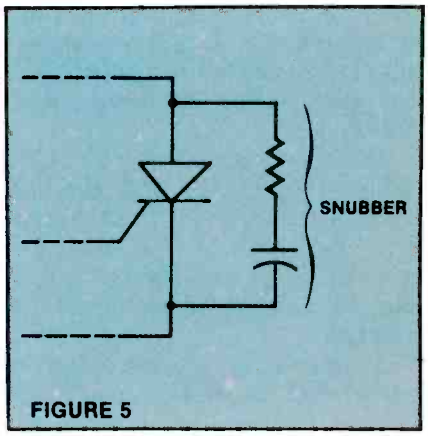


FIGURE 5

The positive-going transient-voltage at Q_2 turns it on, and both transistors are immediately driven into saturation. The result is that the device has been turned on without an input signal to the gate.

Averting undesired turn-on

In the world of SCR circuits a *snubber* is used across the SCR to eliminate this undesirable turn on. Figure 5 shows the connection for the snubber. Now, if a rapid rise time occurs across the SCR, the snubber circuit has the effect of bypassing it from the anode to the cathode. This prevents the SCR from being turned on without an input signal to the gate.

In practice, the rapid rise time of the voltage across the SCR can be caused by line transients or an inductive kick-back from a load circuit. ES&T

News

Study warns of unforeseen surface-mount difficulties

Revolutionary advantages are being proclaimed for surface-mount techniques by the semiconductor vendors, but potential users already are experiencing unforeseen difficulties, warns a new study from Benn Electronics Publications (BEP).

Provisional research findings by Product Assessment, the authors of the study *Surface-Mount Semiconductors* indicate that existing system designs are often poorly partitioned for surface-mount realization, and that this factor is delaying the introduction of such techniques by original equipment manufacturers (OEMs).

The problems stem from the current practice of including a mixture of control and associated higher dissipation interface circuits on PCBs. These higher power components still are unavailable in surface-mount, leaving the designer with the choice of either using the unpopular mixed print board ("unpopular" because two costly soldering operations are required instead of one, and the risk of dry joints is multiplied) with a combination of through-hole and surface-mount devices, or repartitioning the design into surface-mountable and through-hole boards.

"Such repartitioning represents a major design investment that is difficult to justify for an existing system and, therefore, tends to restrict the use of surface-mount techniques to new systems," concludes the study.

With much ballyhoo being made of the advantages surface-mount techniques can bring to equipment production, including savings in the cost, weight and size of the finished product, the study provides a timely, authoritative assessment of the technical and commercial factors involved in realizing a practical surface-mount project.

Technical conclusions will investigate current package options, the outlines available, their use, thermal performance, standardization and the alternatives for devices not yet in surface-mount production, including hybrid and custom packaging. A further technical consideration examined will be the impact this technology will have on board testability.

EIA/CEG analyzes audio ownership, buying patterns

The third in a series of studies on ownership levels and the public's buying patterns of home, car and portable audio equipment was released by the Electronic Industries Association's Consumer Electronics Group.

The new survey consisted of a Basic Trend Study as well as a Recent Buyer and New Product Study. The Basic Trend questionnaire was sent to a nationally representative sample of 3000 households, nearly 62 percent of which responded. The Recent Buyer and New Product questionnaire involved 25,000 households and elicited a 59 percent response. Both questionnaires were circulated during November and December 1984.

The data were collected and analyzed in a broad range of audio categories, including compact systems, components, car audio, headset audio, portable combinations, and clock radios with telephones.

The new survey provides a number of insights, including the following:

- Ownership of component systems increased from 31 percent of all U.S. households in 1982 to nearly 38 percent in 1984.
- Households with compact systems rose from 44 percent in 1982 to 51 percent in 1984.
- Individual components showing the greatest increases in household penetration were cassette decks and receivers.
- Only one car audio product category – radios with cassettes – showed substantial increases in ownership.
- Nearly 35 percent of American households owned a radio with cassette last year, up from 21 percent in 1982.
- Nineteen percent of households bought component products since 1982, with receivers, speakers and cassette decks purchased most frequently.
- Compact disc players were purchased by 0.2 percent, AM/FM stereo receivers with video tuners by 2.3 percent of U.S. households the past two years.
- Rack systems accounted for 57 percent of total single-brand systems, an increase of 38 percent over 1982.

While this study was prepared primarily for EIA/CEG member companies, the 70-page document is available to the interested public at a cost of $150 per copy. Checks or money orders should be made payable and sent to: Electronic Industries Association, 2001 Eye Street N.W., Washington, D.C. 20006. Specifically request the "EIA Audio Industry Consumer Study" published in March 1985.

The Electronic Market Data Book 1985

The Electronic Industries Association's (EIA) "Electronic Market Data Book 1985," the single most comprehensive source of statistics on the U.S. electronic industries, is available through the association's marketing services department.

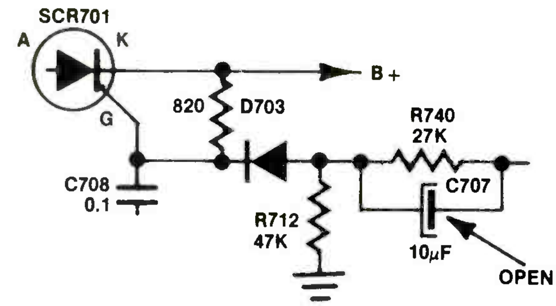
Presenting an in-depth profile of each of the major industry groups: communications, computers and industrial electronics, consumer electronics, electronic components and government electronics, "...Data Book 1985" has more than 150 pages that include more than 100 important tables, charts and graphs. There are detailed sales and production figures through 1984, historical data and projections that provide a complete picture of the industries' performance. Data are collected from the U.S. government, private sources, industry experts and EIA's marketing services department's statistical programs.

Cost of the book is $80. All orders must be accompanied by full payment in U.S. dollars or charged to VISA or MasterCard. Add 6 percent sales tax to Washington, DC purchases. All sales final. Send orders to: EIA Marketing Services Department, 2001 Eye St., N.W., Washington, DC 20006. To charge by phone, call 202-457-4957. ES&T

Symcure

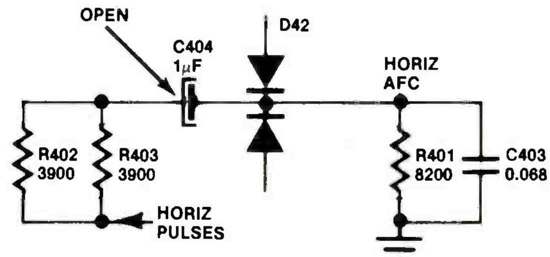
Symptoms and cures compiled from field reports of recurring troubles

Chassis—Ward's Airline GEN12927A 1
PHOTOFACT—1644-2



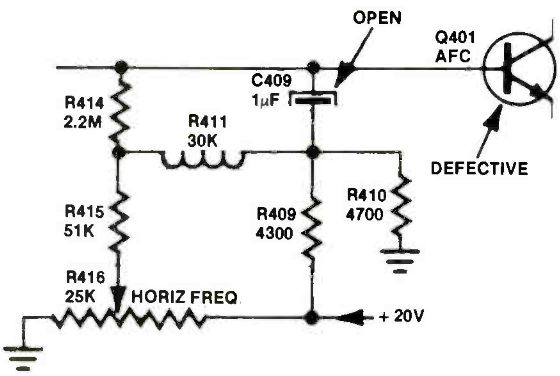
Symptom—No sound, raster or regulated voltage.
Cure—Check capacitor C707, and replace it if open.

Chassis—Panasonic B2W TR-559 2
PHOTOFACT—1497-1



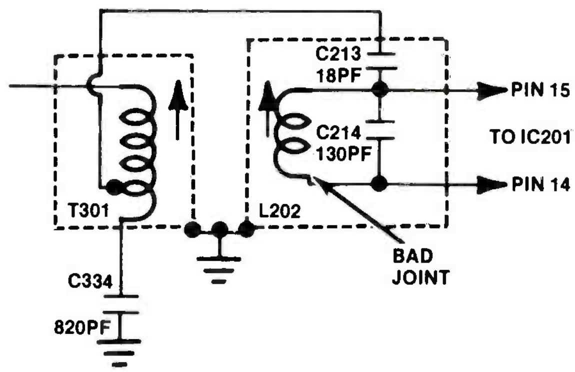
Symptom—Horizontal will not lock.
Cure—Check capacitor C404, and replace it if open (or shorted).

Chassis—RCA CTC108 3
PHOTOFACT—1937-3



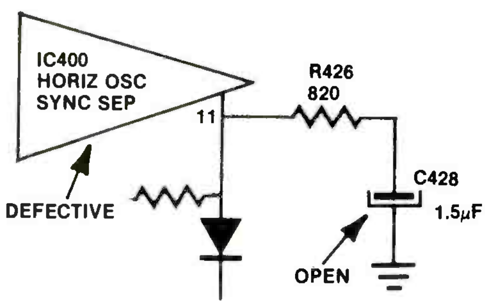
Symptom—Horizontal will not lock.
Cure—Check Q401 and C409, and replace, if defective.

Chassis—JC Penney 685-4201G Z-83 4
PHOTOFACT—2134-1



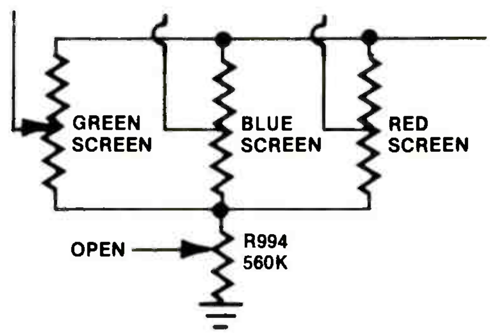
Symptom—Sound is distorted, often intermittently.
Cure—Locate and resolder bad connection at L202.

Chassis—Philco E-25-7 5
PHOTOFACT—1888-2



Symptom—Horizontal will not lock (there is no sync).
Cure—Check capacitor C428, and replace it if open.

Chassis—Philco C2947MWR 6
PHOTOFACT—2023-1



Symptom—Picture is too bright; cannot be reduced by screen controls.
Cure—Check resistor R994, and replace it if open.

Literature

Ungar products for soldering, desoldering and circuit board repair are described in a 24-page, full-color catalog available from the **Ungar Division** of **Eldon Industries**.

In addition to listing specifications for each product, the catalog includes a product selector guide to help match the modular handles, heaters, tips and other products to the job.

Circle (125) on Reply Card

The AEMC Bouncer model 7000 is described in a 6-page full color brochure available from **AEMC**. This multimeter features an integral housing of waffle-textured rubber that provides a sure grip as well as extra protection against rough handling in the field. Safety features include both the non-conductive molded rubber housing and a blown fuse indicator lamp. A single selector switch flips readily between the five color-coded functions: Vac to 750V; Vdc to 1000V; ac current to 10A; dc current to 10A; resistance to 1MΩ. With the use of optional accessories, additional measurement capabilities are possible.

Circle (126) on Reply Card

Vaco Products introduces its 100-page, 4-color catalog of hand tools, solderless connectors, special fastening devices and special application tools. Each section is color coded. There are complete descriptions and illustrations for more than 2000 products.

Circle (127) on Reply Card

A 24-page booklet from **AT&T** is intended to help homeowners choose the right supplies and accessories needed when installing a telephone extension. It also provides directions and helpful hints to assist in the planning and installation of new telephones. Included in the booklet are drawings and descriptions of each product, a step-by-step outline of installation procedures, complete diagrams on how to wire a home for one or more extensions, and a list of helpful hints and guidelines.

The new line of AT&T supplies and accessories described in the booklet are designed to snap together like building blocks. In many cases, a telephone extension can be installed in less than one-half hour.

Circle (128) on Reply Card

The Distributor and Special Markets Division of **Philips ECG**, a subsidiary of North American Philips, has added 157 3W-, 5W- and 10W-non-inductive, metal film types to the ECG Flameproof Resistor line for replacement applications. Descriptions of these are included in the 20-page illustrated brochure that provides information as to packaging, stock numbers, product specifications and technical data on the full line. The new film resistors are particularly suitable for use in video, pulse, high frequency ac and RF circuits where frequency response is critical.

Circle (129) on Reply Card

"Statguard Floor Finish Facts & Info" answers the most frequently asked questions about this **Charleswater Products** floor treatment. Formulation, ESD protection and application requirements are discussed. Developed to inform potential users about alternatives to conventional conductive mats and tiles, this pamphlet provides a comparison and summary of advantages, including static control properties.

Circle (130) on Reply Card

RCA has updated its guide of parts recommended for in-home service of RCA Color TV Unitized Chassis. The guide, "Recommended Parts for In-Home Service," cross references individual chassis series and circuit symbol numbers to RCA stock numbers. With this reference, it is possible to go directly from a symbol number on a chassis circuit board to the RCA replacement. ES&T

Circle (131) on Reply Card

Using a computer to adjust color purity

By Brad Hohenbrink

Anyone involved with television probably knows that modern shipping companies treat today's intricate TV receivers with all the gentleness of a wrecking crew. Consequently, new sets often end up with purity spots that must be removed by adjustment. The procedure of shutting off the blue and green guns and raising the red, though simple, is inconvenient. After the purity adjustment is complete, the guns must be reset for good gray scale and black and white.

What I felt I needed was an instrument that gave a red screen through the antenna terminals, thus eliminating the gun adjustment. I did not wish to purchase another instrument for several hundred dollars, so I looked around for a solution that was much less expensive. I use a home computer for keeping shop records, and it occurred to me that any decent computer can change the color of the color television or monitor used as a display.

A short program later, I had an instrument that could give me a red, green or blue screen at the touch of a key. The only adjustment to the TV set was to raise the color level to nominal after purity had been adjusted. Using this program has made the removal of purity spots on older repaired sets, as well as new sets, a breeze. The program listed is for a VIC 20, but it can be adapted to any computer.

When I have a set with a purity spot, I follow this procedure. First, I hook up the computer to the antenna terminals of the TV set. For the sake of convenience, I use an extension piece of coax with the female RCA phono plug on one end and a standard RG59 connection on the other with a matching balun. This allows me to test any set without moving the computer. I set the television to channel 3 and load the program into the computer. Because I use red for purity adjustment, the following instructions are for using red.

When the program is loaded, run it and the display will show the screen of Figure 1. Type in the numeral 1 and press *return* and the screen will turn red. Advance the color control for maximum color, and adjust the brightness control to obtain the best red intensity. Occasionally, adjustment of the

tint control may be necessary to obtain a true red. This procedure makes purity spots stand out very well. So well, in fact, that the computer has uncovered purity spots that were too subtle to be noticed.

When the spot is showing up very well, I degauss the set. If the spot disappears when the set is degaussed, the procedure is finished. If the spot remains, adjust it out with the purity adjustment. This adjustment will vary, depending on the brand of TV set. Just to be sure everything is exactly right, rerun the program for green and then blue to make certain those colors are correct.

```
8   POKE 36879,25
9   PRINT "[SHIFT] [CLR HOME]": PRINT "[CTRL] [BLACK]"
10  PRINT "1 = RED": PRINT: PRINT "2 = GREEN":
    PRINT: PRINT "3 = BLUE"
15  PRINT
20  INPUT "WHAT COLOR"; A
30  IF A = 1 THEN 100
40  IF A = 2 THEN 200
50  IF A = 3 THEN 300
100 PRINT "[SHIFT] [CLR HOME] [CTRL] [RED]": POKE 36879,42
110 END
200 PRINT "[SHIFT] [CLR HOME] [CTRL] [GREEN]": POKE
    36879,93
210 END
300 PRINT "[SHIFT] [CLR HOME] [CTRL] [BLUE]": POKE
    36879,110
310 END
```

SYMBOL EXPLANATION
POKE 36879,25 – WHITE SCREEN
POKE 36879,42 – RED SCREEN
POKE 36879,93 – GREEN SCREEN
POKE 36879,110 – BLUE SCREEN

SHIFT – SHIFT KEY
CLR HOME – CLEARS THE SCREEN, SENDS CURSOR TO HOME
CTRL – COLOR CHANGE KEY
BLACK – COLOR KEY

PRINT " [SHIFT] [CLR HOME] [CTRL] [RED] "

PRESS SHIFT FIRST, THEN CLR HOME. THIS TELLS COMPUTER TO CLEAR THE SCREEN. IT PRODUCES THIS SYMBOL ♥

PRESS CTRL, THEN COLOR KEY TO CHANGE LETTER COLOR TO MATCH THE SCREEN, MAKING A PURE SCREEN.

Products

Attache-case oscilloscope

North American SOAR Corporation announces its 20MHz dual trace digital storage oscilloscope that uses a large flat panel dot matrix LCD screen, yet is small enough to fit in an attache case. Model 1020 measures 12¼" x 6¼" x 2⅝" and weighs 6⅔ pounds.

This mini oscilloscope uses four regular D-size batteries, or operates on an external ac adapter. Alphanumerics in the LCD screen indicate the peak-to-peak voltage value, period and dc component. Screen size is approximately 5½" x 3½"; the cursor allows VPP time measurements with Delta time.

Circle (75) on Reply Card

Volt-ohmmeter

The model 3525-A Digi-Probe volt-ohmmeter introduced by *Triplett Corporation (a Penril Company)* now includes extended resistance ranges of 200Ω and 20MΩ plus an additional 200mVdc

voltage range and improved accuracy. The shirt-pocket-sized tester features a 3½-digit, 12mm LCD with visual indication of function, overrange, units, polarity, decimal and low battery. A data-hold capability facilitates readings in confined situations or in low ambient light; auto-ranging provides 1-hand touch-and-test readings. An instant-tone continuity test includes actual resistance measurements. Volts, ohms and continuity are selected with a simple function switch.

Circle (76) on Reply Card

Ac power supply

Instrumentation and Control Systems (ICS) Electro-Pac Division offers the Lifeline uninterruptible ac power supply designed to furnish the microcomputer market with full power for one hour or longer (when an external battery is used to extend operation). The no-break power feature provides voltage regulation and line filtering at all times; an inverter supplies power only during power outages. There is no interruption to the critical load – a maintenance-free internal battery handles the full power of the system for five or 10 minutes.

Plug the Lifeline into a normal 120Vac wall outlet; the critical load is plugged into the dual convenience outlet on the UPS. Output power: 200VA, 600VA, 1000VA.

Circle (77) on Reply Card

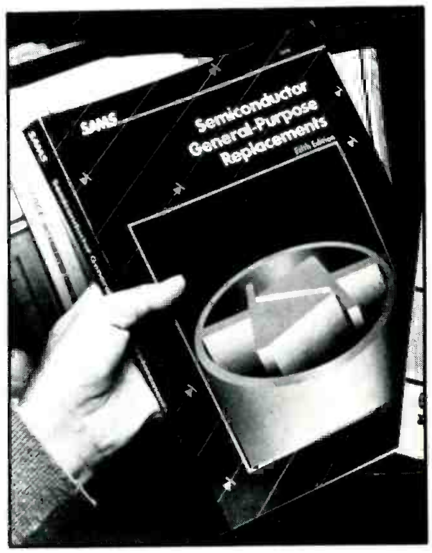
Self-contained service center

Ungar Division of Eldon Industries announces the Ungar 4924 Service Center that incorporates all the features of the previously presented model 4624 electronically controlled, variable temperature soldering/desoldering station plus a built-in power supply and four plugs that provide outlets for powering other circuit board repair tools. The hand-held motor, macro-sized soldering handle, desoldering handle, cleaning tool, sponge and tray are standard equipment. An optional accessory kit includes the other tools useful in circuit board repair, a foot pedal, assortment of pads and traces for board repair and assorted, interchangeable soldering iron tips.

Circle (78) on Reply Card

Replacement part guide

Howard W. Sams & Company, has released the fifth edition of a long-time reference among consumer electronics service technicians and other electronic repair personnel. "Semiconductor General-Purpose Replacements" (ISBN 0-672-22418-6) means alternate parts that can be used if a direct replacement for a faulty semiconductor unit is not available. This usually means a faster



repair made at less cost to all concerned.

The 368-page guide covers transistors, ICs, diodes, rectifiers and other semiconductor devices found in most U.S. and foreign electronic equipment.

Circle (79) on Reply Card

Solder products

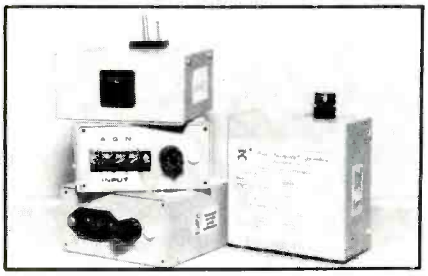
A new line of triple-core wire and bar solder is now available from the *Distributor and Special Markets Division* of *Philips ECG, a North American Philips Company.* The triple-core construction of the wire solder was developed to ensure rapid flux flow and more thorough fluxing action for stronger, dependable connections. Offered in 60/40 alloy, the wire can be obtained in 1-pound and ½-pound spools in choice of 21-, 18- or 16-gauge thickness. Bar solder is available in 1-pound ingots in 50/50, 60/40 or 63/37 alloys.

Circle (80) on Reply Card

Surge suppressors

Some transient voltage and surge problems require more than single-component suppressors. *Power Integrity Corporation* provides a total suppression system using an EMI/RFI inductor/capacitor filter, fast-acting zener diodes, metal oxide varistors and a gas discharge tube.

Pictured are the ZTAP, ZTAS and ZTAC (from top) next to a ZTAP. The ZTAP model plugs directly into standard wall outlets. The ZTAS comes equipped with terminal strips for hard-wire applications, and the ZTAC is for cord-mounted installations. All of



these units are connected in series with the power bus or power line, and dissipate 220 joules of transient energy, eliminate overshoot, filter EMI and RFI and operate bidirectionally. They come equipped with a 15A user-accessible fuse for overcurrent protection, and a fuse-condition monitor lamp. Dimensions are 4" x 4" x 2"; weight is 1¼ pounds.

Circle (81) on Reply Card

8-pin Dip Clip

A molded barrier between each contact that prevents accidental shorting of adjacent contacts is one of the features of the 8-pin Dip Clips introduced by *ITT Pomona Electronics*. These dual-in-line test clips come in the standard model 5108, designed for normal part spacing, and the high-density model 5208, for use with tightly spaced components. Both are designed for hands-free testing while positive electrical connections are ensured. The glass-filled nylon insulation can withstand temperatures up to +102°C (+216°F).

Circle (82) on Reply Card

Plated-thru-hole board repair

Instead of discarding unusable PC boards, repair them with the FuseSet system for installing a variety of eyelets and funnelets. The system operates within a broad range of hot fusing and cold setting conditions, and eliminates solder blowout—a problem associated with other eyeletting techniques according to *Pace*. The design promotes unfailing, flat-set fusing and repairs that are consistent in quality. Weighing 15

pounds, the compact FuseSet is self-contained and free-standing.

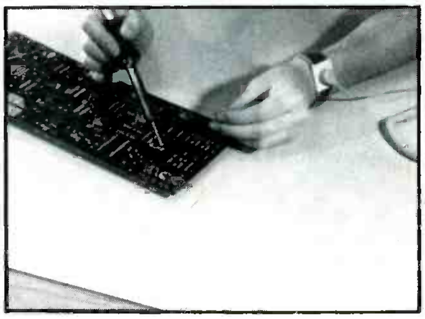
Circle (83) on Reply Card

Antistatic work surface

A portable electrically conductive work surface that is impervious to the solders and solvents found in electronic assembly areas is presented by *Charleswater Products*. The Micastat portable pads feature $10^8\Omega$/sq. surface resistivity with uniform conduc-

Circle (17) on Reply Card

tivity to provide rapid, non-sparking charge dissipation. The work surface exceeds NEMA standards for abrasion resistance and can be used on existing non-conductive work benches. Offered in

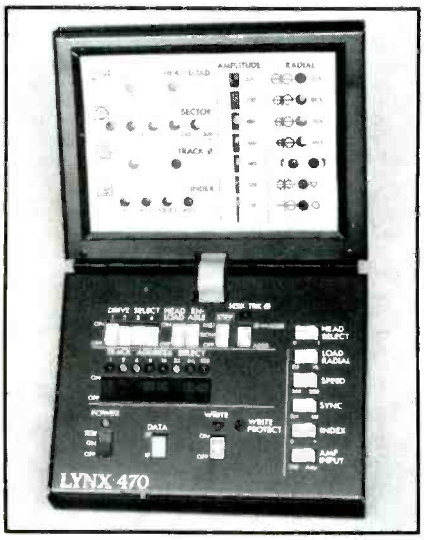


two sizes and seven standard colors, the Micastat pads have no exposed carbon and are clean-room safe. They come equipped with a ground cord and dual snap fastener that accepts conductive wrist straps.

Circle (84) on Reply Card

Disk drive alignment tester

The Lynx 470 alignment tester from *Jensen Tools* services disk drives without "drive swapping." On-site alignment of every make of 3½-inch and 5-inch disk drive can be performed with 100 percent accuracy. All standard alignment



and exercising functions are within the Lynx 470's capabilities, and all ranges are incorporated that are required for amplitude, radial, index, track, head load and sector testing. The device is completely portable and takes its power from the disk drive being tested. No power pack is necessary.

Circle (85) on Reply Card

Hand-held torch

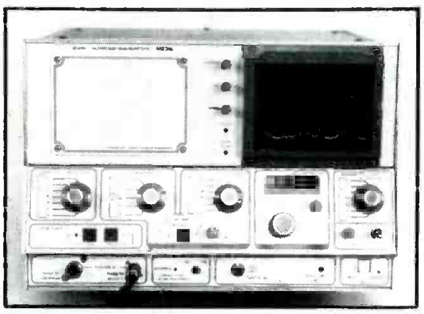
A portable, hand-held refillable butane torch is available from *Blazer Products.* The torch produces a flame of 1300°C, 2500°F, which is hot enough to silver solder, for example. A piezo electronic unit lights the torch instantly without matches or lighters. The rubber cushioned grip is designed for firm, safe handling. Fill from any multiple-head butane gas lighter refill container. The unit is made of brass with a non-corrosive chrome-plated body. For hands-off operation, there is a removable base stand.

Circle (86) on Reply Card

TVRO spectrum analyzer

For the TVRO industry, there is the MSA-85 spectrum analyzer introduced by *AVCOM.* The MSA-85 offers wideband coverage of 4 to 1500MHz and 3.6 to 5.1GHz, including satellite receiver IF frequencies, block downconverter outputs, with 12GHz downconverters, and actual satellite frequencies.

Separate inputs for low and high frequency bands save connector-changing time when working with signals in both bands. LNAs and BDCs can be powered by a switch that uses internal dc power inserters on both inputs. Span and resolution bandwidth controls are automatically coupled, a feature with push-button override when



independent selection is desired. With this spectrum analyzer, BDC systems may be quickly checked for signal balance and component performance.

Circle (87) on Reply Card

Clamp-on probe

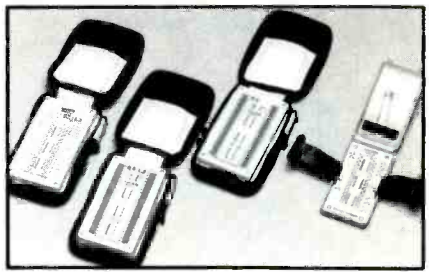
A clamp-on ac current probe that can be used with almost any ac ammeter or digital multimeter to measure current up to 150A is announced by *B&K Precision, Industrial Electronics Products Group of Dynascan Corporation.* Designated model CP-1, this probe can be used to measure current on any conductor up to 7/16-inch diameter. The conductor remains electrically isolated from the meter.

Current measurement displays at 1/1000 of the value being measured: 3A = 3mA, for example. Range for model CP-1 is 2A to 150A, working voltage is 600Vac maximum, dielectric withstanding voltage is 2kVrms and the frequency range is 48Hz to 10kHz.

Circle (88) on Reply Card

Breakout-box line

The *Instrumentation Products Division of Beckman Industrial Corporation* has introduced a breakout box product line called *Easy BOB* that features dual-gender connectors and full



RS232C breakout.

The shirt-pocket model 720 is line powered, has switches to open and close any line, and jumper posts and wires to reconfigure the interface. There are 12 pairs of red and green LEDs assigned to 12 primary signals, making four state signal status (mark/space/clocking/off) available at a glance. There are 50 test points.

The model 730 is self-powered (battery) for high impedance and sensitivity, also has 12 pairs of red and green LEDs plus a dual pulse trap to catch glitches or detect intermittent signals. There are 49 probe points; voltage is conveniently available on the faceplate to simulate control signals or force leads high and low.

The unpowered model 750 and powered model 770 provide additional features that include 50 pairs of red and green LEDs. All units carry a 10 year warranty.

Circle (89) on Reply Card

Mini power conditioner

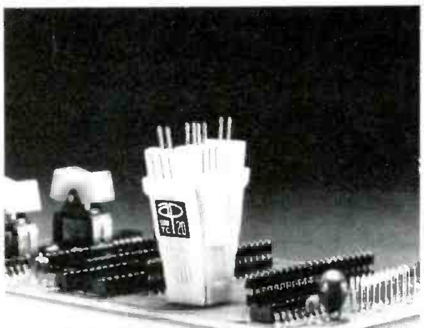
Latest from *RTE Deltec* is the MPC series mini power conditioner. These compact devices operate at 60Hz in the 500VA to 2kVA range and are recommended for small business applications. 50Hz models will be available in September; UL Listing is pending on all models.

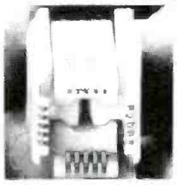
The new series features an enhanced tap-switching design that maintains output voltage regulation between 110Vac and 126Vac, with an input range from 90Vac to 135Vac. Voltage regulation and noise attenuation characteristics will eliminate the effects of at least 90 percent of the problem-causing power disturbances. To further protect the critical load, low voltage shutdown and overvoltage protection are also included.

Circle (90) on Reply Card

Surface-mount test clip

An innovative action-wedge design enables all four sides of this test clip to open simultaneously, providing safer, more reliable connections to plastic leaded chip carrier (PLCC) integrated circuits. The 20-conductor size test clip introduced by *AP Products* has a narrow body design that allows



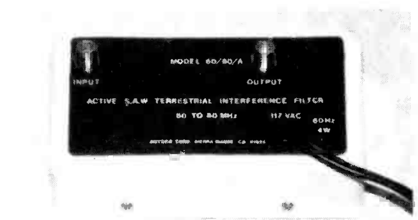


components to be tested with as little as 0.100 inch lead-to-lead spacing. It is side stackable to 0.200 inch lead-to-lead spacing. A helical compression spring and insulating contact combs ensure integrity in contact when testing.

Circle (91) on Reply Card

TVRO bandpass SAW filter

Alaun Engineering announces the bandpass SAW filter for use with TVRO receivers. The SAW6080A was designed to help eliminate interference from edge-of-channel sources in the 4GHz area of the TVRO band, inserting a high loss into the offending interferences at the edge of the band



beyond 80MHz and below 60MHz. A steep-skirted SAW filter, the unit attenuates unwanted frequencies by approximately 60dB in the indicated range. Amplification is included, resulting in a net gain of 2dB to allow additional coax length (about 100 feet of extra RG59) to be used. The SAW6080A allows LNA power to go through, and includes its own power supply.

Circle (92) on Reply Card ES&T

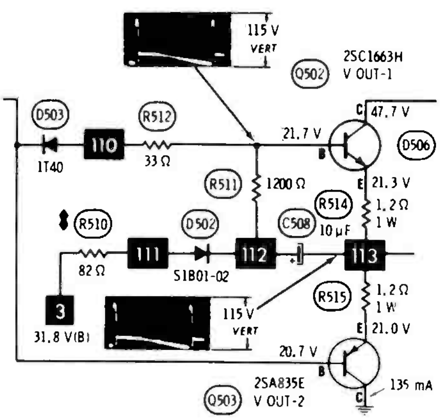
Troubleshooting Tips

Dead color television
Sony KV-2101
(Photofact 1658-1)

When the color receiver arrived in the shop, the only symptoms were no sound or picture and the line fuse blew each time it was replaced. However, that was just the tip of the iceberg, for occasional times of troubleshooting over a week were required to obtain start-up. An almost endless series of horizontal problems had to be solved.

After the horizontal was operating, I found the vertical height was one narrow green line on the screen. Of course, the vertical-deflection system then came under suspicion. While checking the vertical driver and output transistors, I found output Q503 was bad. A new replacement NTE-189 was installed, but without improvement. This time, Q502 checked bad. It too was replaced with no improvement. Now, I began to check the yoke and other components of the vertical-deflection circuit. Finding nothing amiss, I installed another pair of output transistors. Each pair installed would develop a short almost as soon as the power was switched on. One shorted so violently that the case exploded!

Finally, I decided to look up specifications of the original Sony transistors vs. the replacements I had been using, and there found the answer to the failures. Sony uses a 2SC1663H or Q502 and a 2SA835E for Q503, and they are rated at 140V for V_{ceo}. Photofact listed six replacement brands recommended by the transistor manufacturers as suitable substitutes, but the V_{ceo} rating of these transistors ranged between 80V to 100V. I used GE, NTE, SK and ECG, and all shorted.



On the schematic, Q502 has a supply voltage of +47.7V and there is an output peak-to-peak signal from the emitters of 115VPP. Evidently, the American replacements cannot stand the large signal voltage, so they short.

I was determined to use the correct transistors, but they are difficult to find. The universal parts houses were out of stock, or they stocked one and not the other. This condition was true also with the Sony distributors I tried. *After the 2SC1663H and 2SA835E transistors were finally located and installed, the receiver operated like new.*

Previously, I have repaired many Sony televisions without much difficulty, but this one appeared to have gone through a self-destruction sequence; the problems were almost endless. Although the component costs were so huge that I made no profit on this repair, the educational value was high and I learned a great deal. I hope my experiences will encourage other technicians to stick with those impossible repairs because of the knowledge they bring.

Gary A. Green
Richmond, IN

Failure to tune TV channels
General Electric EC-C chassis
(Photofact not available)

When the General Electric console TV receiver was brought to the shop, the complaint was a snowy raster without a picture. The correct channel number would be displayed by the digital LED readout, but only snow was received.

Three modules are employed in the electronic-tuner system: an electronic-tuner module; a tuner-control panel; and a smaller tuner-synthesizer module. At first, I attempted to find the problem in the electronic tuner-control module, because the tuning voltage at the tuners stayed at +2.05Vdc for each channel of all three bands. However, if I applied a substitute variable voltage for the source of the tuning voltage, the tuner would bring in all the channels. When I checked the three transistors that are associated with the tuning voltage in the tuner-control module, they were not defective. All dc-voltage measurements in the tuner-control circuits were incorrect, according to the schematic.

Finally, I replaced the phase-locked-loop (PLL) integrated circuit (EP84X61), but there was no improvement. After more testing and thinking, I was still certain the control panel was bad because the tuning voltage was missing. Next, I replaced the microprocessor IC (EP84X86). Again there was no change.

From the GE parts house, I bought a new electronic-control panel (EP93X171). Or, I tried to buy one, but they sold me an EP93X219 replacement. After it was installed, the symptoms were the same.

My next move was to obtain a new tuner panel and try it, thinking something might be loading down the tuning voltage. The symptoms did not improve.

By this time, my investment in components probably exceeded the estimated $150 repair charge. There was no possiblity of any profit from this job.

Finally, I made another trip to GE and bought the synthesizer panel (EP93X175), and *installation of it restored proper tuning for all channels.* I vowed never to accept another GE that has a similar tuner problem. But just a few weeks later, a second GE with the identical symptoms came my way, and I accepted the challenge.

For the second repair, however, I opened the defective synthesizer panel, removed the suspected integrated circuit and replaced it. That restored normal tuning operation, and my cost was about $25.

Two weeks later an identical chassis with a Hitachi nameplate and the same tuning problem came to the shop. This, also, was repaired easily by replacement of one integrated circuit.

Evidently, the IC failure is recurrent, so when I need an EP93X175 synthesizer panel, I obtain an EP84X79 integrated circuit and install it to repair the panel.

There were times during the first repair when I was tempted to return it unrepaired to the customer. Now I am glad I was persistent enough to find the defective component and discover how easy it is to replace.

I believe that any module (at least those in reasonably good condition) can be repaired in the shop. Afterward, the repaired module can be sold as a rebuilt module, providing increased profits from reduced inventory while giving faster service to the customers.

Additional GE tips

The electronic tuner in some General Electric models can develop erratic operation, similar to those of a switch tuner with corroded contacts. Tapping the tuner box starts the intermittent condition. Or, one or more segments of the LED digital readout can become intermittent. Usually the cure is easy: just remove both shield covers and look carefully for a row of loose connections. Resolder all suspected joints to stop the intermittent problems.

GE tuners with a knob selector and LED-channel readout also can develop intermittent LED segment flicker or failure to light. Again, a row of loose soldered connections can be seen when the module covers are removed. Resolder all bad joints. Usually the switch contacts are not the problem.

Some 0.0051μF 1200V capacitors connected from the horizontal-output transistor collectors to ground become open internally. An open capacitor will greatly increase the high voltage and often the horizontal-output transistor will short between collector and emitter followed by the blowing of a fuse. Replace any open retrace-tuning capacitor with one of these original components:

- 0.0051μF 1200V EP25X60; or
- 0.0056μF 1200V EP25X69.

Whenever the horizontal-output transistor is shorted in GE AA, AB, AC, EC or YA chassis. I recommend that the retrace-tuning capacitor also be replaced, even when it tests good. Remember that many otherwise excellent capacitors will operate too warm (or hot) with these pulses. Do not substitute!

Donald P. Hopkins
Sandy, UT

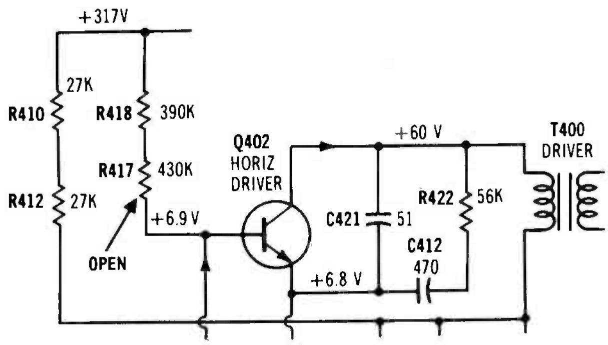
No raster, picture or sound
Magnavox 19C301-BA (NAP 19C3)
(Photofact not available)

The color receiver had been operating normally, but now would not produce sound or picture. Because there was no Photofact listed (the television had been manufactured about one an one-half years ago) and the chassis was not familiar to me, I exiled the receiver to a corner of the shop.

Later, while I searched recent issues of **Electronic Servicing & Technology** for information about the RCA CTC108 chassis, I found Stan Vittetoe's article about this 19C3 chassis in the August 1984 issue. Shortly afterward, I noticed the schematic in our file of Profax schematics. After studying both, I moved the television back to the bench.

By following the article's recommended troubleshooting procedure, I found the following conditions:

- The receiver was not in shut-down mode.
- The +317V doubler circuit was normal, with +335V measured.
- The horizontal-oscillator start-up voltage at IC500 pin 16 was there (+8Vdc).
- A normal 1VPP horizontal-oscillator output signal was present at IC500 pin 11.



However, all was not well at the Q402 driver transistor because:

- At the collector where +60V was expected, I found +330V.
- The Q402 base voltage measured only +1.9V instead of the normal +6.9V.
- Instead of Z400-zener-regulated +6.8V at the emitter, only +1.1V was found.

These measurements indicated a loss of base forward bias. In-circuit resistance measurements indicated that Q402 and Z400 zener were not open or shorted. Out-of-circuit resistance measurements showed R418 (390K) was normal, but R417 (430K) was completely open. These series resistors were only ¼W types, as many others in this receiver were. I replaced both with correct-value ½W resistors to prevent a recurrence of the problem.

When power was applied, the receiver began operating perfectly without any additional repairs or adjustments.

By the way, I found the following mistakes in the "Servicing NAP CE TV chassis" article in August, 1984 **ES&T:**

- In the Figure 7 schematic on page 42, D402 (one of the doubler diodes) is shown with the polarity reversed.
- In the same schematic, the diode marked D404 (near D402) should be identified as D400.
- Number two and number three of the page 46 troubleshooting sequence should state that the start-up dc voltage is applied to IC500 pin 16 (not pin 10).

Alan Scott Dodge
Albertson, NY

Readers' Exchange

Wanted: Dual trace model CA preamp plug-in unit for Tektronix model 545A oscilloscope. *Jim Smith, 2141 15th, Carroll, IA 51401.*

Wanted: Two books, "Practical CB Radio Troubleshooting and Repair," by David F. Norman; "Modern CB Radio Servicing." Also, other books on CB troubleshooting and repair, and stethotracer and accessories by Don Bosco Electronics. *Murray's Repair Service, 8842 Orange Hill Road, Sauquoit, NY 13456; 315-737-7192.*

Wanted: Good used or new picture tube 20UP4 for Zenith model 1Y21B55. Also vertical output transformer for Emerson model 35P04, part No. 987939 (T W39). *Charles E. Hess, 201 S. Oak St., Buchanan, MI 49107.*

For Sale: Sencore VA48, with TR219 1:1 horizontal; isolation transformer and AT 218 TRAP IF attenuator, all leads and manuals. Excellent condition, $699. *Martin Neuman, 122 W. Broadway, Anaheim, CA 92805; 714-774-3290.*

For Sale: CCRTs No. 18VBKP22, 18VAJP22, MV18VAJP22, MV19VBDP22 (two), 19VCNP22, 490BKB22. Make reasonable offer. **Needed:** Horizontal output transformer, Sylvania No. 50-3015344-2, 50-3015344-1. *Chuck Kelly, 3336 Chatham, Waukegan, IL 60087; 312-623-2597.*

For Sale: Sams Television Tube Location Guide, volumes 1 to 6 (TGL-1 to TGL-6). Send s.a.s.e. *Troch's Television, Radio, Appliances, 290 Main St., Spotswood, NJ 08884; 201-251-3042.*

Wanted: Power transformer for model SC30 Commercial Trades Institute oscilloscope. *Ray Tweedale, P.O. Box 132, Belgium, WI 53004.*

For Sale: Sencore SG165 stereo generator analyzer, all leads and manual. Perfect, $800, includes shipping. *John Morris, 66 Wheeler Road, Central Island, NY, 11722; 516-582-6276.*

Needed: Schematic and parts list for foot-pedal Musitronics MU-Tran. Also, Bruno echo chamber. Will pay for copies. *Arthur R. Vickery, P.O. Box 742, Torrington, CT 06790.*

For Sale: Superior electric Powerstat, type 1256C-2D, 120/240V, 3-phase, 28A, $275, plus UPS/c.o.d. charges; Superior electric Powerstat, type 912050, 240V, 3-phase, 7.5A, $100, plus UPS/c.o.d. charges. *Roger Angell, 20 McLaughlin Drive, Limerick, PA 19468.*

For Sale: Sencore frequency counter, model FC51; Sencore capacitor inductor analyzer, model LC53; Sencore ac Powerite, model PR57 (variable isolation transformer); B&K Precision oscilloscope, model 1477; Simpson digital multimeter, model 260 7 VOM; 420 function generator (audio). Service department closing, all in excellent condition. *Holton's, 334 Blowing Rock Road, Boone, NC 28607; 704-264-3600.*

Needed: B&K 2801 DVMs, Knight 83y135 signal tracer with manual. *C.T. Huth, 130 Hunter St., Tiffin, OH 44883.*

For Sale: B&K multimeter 290, $75; B&K capacitor analyzer 801, $50; NRI VCR course, $100. *Stan Hayman, 19707 Turnberry Way, North Miami Beach, FL 33180; 305-944-5674.*

For Sale: Two new Beckman DMMs, both with instruction book and leads: HD-100, $125; Tech 330, $165, or best offer. *Stan Todorow, G8468 Belle Bluff Drive, Grand Blanc, MI 48439.*

For Sale: Sencore SG165 stereo signal generator. New condition, complete with all new accessories and service and operation manual. *Dan, P.O. Box 220, Elbridge, NY 13060; 315-689-3493.*

Needed: Schematics for power supply and preamp printed boards for Craig model 6108 Viewfinder camera made by Victor of Japan. *David Parkinson, Claire Zellerbach Saroni Tumor Institute, Mount Zion Hospital and Medical Center, P.O. Box 7921, San Francisco, CA 94120.*

Wanted: Admiral *on/off* switch part No. 77A167-2 from Admiral chassis 3G1357-1. *Richard Monastesse, 139 Woodbury St., Pawtucket, RI 02861.*

For Sale: Sencore TC162 tube tester, $175; Keithley 130A DMM, $95; Keithley 1600A 40K HV probe, $40; OK PRB-1 digital logic probe, $25; Hickok 216 transistor tester, $75; 30 Sams Photofacts and 12 TV repair manuals, all complete, $100. All, excellent condition. *TelCom Systems, c/o G.A. Ward, 201-5 Villas Drive, New Castle, DE 19720; 302-328-4598.*

Wanted: Schematics/parts lists for Dynaco preamplifier, stereo control, Dynakit Mark III 50/60W amplifier, and Dynaco 50/60W tube-type equipment. Will pay for copies and postage, or copy and return. *George Seim, 1375 High Site Drive, No. 310, Eagan, MN 55121; 612-454-3447 (evenings).*

For Sale: Telephone tester B&K Precision model 1045, as new, includes manual, $100. Also, Prospector 8200 Telemarketing computer, $1250. *Gerald Karr, 798 Main St., Venice, CA 90291.*

Wanted: Instruction booklet for Rider Chanalyst. *Tony Kray, Main St., Putney, VT 05346.*

Needed: Instruction manual for Tektronix 315-D scope. Will gladly pay for copy and any other costs. *Herbert Gold, Back Up Electronics, 1540 Broadway, 16th floor, New York, NY 10036; 212-382-3737.*

For Sale: Tektronix/Sony model 305 oscilloscope-digital portable DMM, dual trace, carry case and accessories, two months old – includes warranty, $800 or best offer; SOAR model 1500 cable length checker, sonar measurement of undetermined cable or wire lengths from 1 to 100 meters, never used, $295 or best offer; B&K Precision model 1045 telephone tester, includes digital number dialed display readout, handset check and simulated line condition testing for two telephones, $195 or best offer. *Tim Valczack, P.O. Box 2680, Des Plaines, IL 60018; 312-298-6335, days.*

For Sale: Sams Photofacts 1 to 745 complete, (might be able to deliver on summer vacation); miscellaneous CB and AR Sams. Send s.a.s.e. for list. Sencore SM158, FE160, FE20 and CG10, best offer any or all items. *Hefner Electronics, P.O. Box 218, Coleridge, NE 68727; 402-283-4338.*

For Sale: Sencore SC61 waveform analyst, two years old, like new, updated April '85, includes all cables and cover, $1850 firm. Will pay UPS, insured. *Cecil Mott, Box 222, Mobil Land Court, Bloomington, IL 61701; 309-827-6867, after 6 p.m.*

Needed: Manual for Hickok tube tester, model 538. Fluke or Keithley DVM. *Kenneth Miller, 10027 Calvin St., Pittsburgh, PA 15235.*

For Sale: Sams Photofacts 1 to 700, make offer. Wanted: Sams Photofacts 1760 to 1823, and 1890 up. *Contact John Peters, Route 1, Box 129-F, Port Lavaca, TX 77979; 512-552-4398.*

Wanted: "1-2-3-4 Servicing Transistor Color TV," by Forrest H. Belt, book No. 20777. *Meek's TV Service, 116 N. Oak, Sheridan, AR 72150.*

For Sale: Two Beckman DMMs, model HD100, $125; model 330, $175. *Cathy Johnson, 4106 Thorn Ridge Drive, Grand Blanc, MI 48439.*

For Sale: Synchros, many types, high quality Navy salvage (excellent beam position indicators). Send s.a.s.e. to *Ted, 3134 Fruitvale Ave., Oakland, CA 94602.*

Wanted: RCA remote control hand unit for RCA color television, 1973 model ER 475WR, chassis No. CTC-59. Remote part No. 143352 (CRK18A) or 143363 (CRK20A). Remote has two rocker-type buttons on top for channel *up/down* and volume *up/down; on/off* push-button on side. Will pay $15. *James Young, 5922 Lorelei Ave., Lakewood, CA 90712; 213-925-5802.*

For Sale: New Beckman model 330 DMM, true RMS, $180. New Fluke DMM model 77, $95. New Viz senior voltomyst model WV-98-C, $120 or best offer. *Stan Todorow, G8468 Belle Bluff Drive, Grand Blanc, MI 48439.*

For Sale: B&K model 1604 isolation transformer, circuit-breaker protected, with owner's manual, still under warranty, and Radio Shack 33W soldering iron, all for $71 or best offer, plus UPS/c.o.d. charge. *M.W. Dawson Sr., 233 16th St., Apt. 109, Jersey City, NJ 07302; 201-798-2084.*

Wanted: Power transformer for RCA oscilloscope WO 91, or old WO 91 for parts. *Perry Cole, 170 Chapman St., Greenfield, MA 01301; 413-772-0457.*

Needed: Schematic and parts list for Knight kit 32W stereo amplifier, vacuum-tube type (11 tubes). Will pay for copy, plus postage. *Raul Lugo, P.O. Box 7160, Jersey City, NJ 07307.*

Needed: Microprocessor HA1179 for Admiral model 17C988, chassis Y-3. *Kaz Glista, Elmwood TV Inc., 136 Market Square, Newington, CT; 203-666-1990.*

Needed: Flyback transformer for Broadmoor TV model 3513, part No. 09270776M or TCF11; flyback transformer for Sears color television model 528-42002502, part No. 80-164-3G. State price. *George Saylor, 2319 Parrish St., Philadelphia, PA 19130.*

For Sale: Hickok Universal TV-FM alignment signal generator, model 610A, with manual, $60; Philco wideband oscilloscope amplifier, $20; one box of TV, radio repair and electronic books and manuals, $20. Three boxes of used TV yokes, $75 for all. Prices plus shipping. *John Brouzakis, R.D. 3, Box 602B, Charleroi, PA 15022; 412-483-3072.*

Continued on page 62

Photofact

These Photofact folders for TV receivers and other equipment have been released by Howard W. Sams & Co. since the last report in ES&T.

GENERAL ELECTRIC
Chassis 13AC-F, 13AC-H 2337-1

HITACHI
CT13C1, CT13C2, CT1341, CT1342 2335-1

HITACHI
CT19A7, CT1947 2336-1

HITACHI
CT19A6, CT1946 2339-1

MAGNAVOX
Chassis 19C30100AA/BA/CB, 302-00AA/BA/CA/DA/EB/FB/GB/HB/GC/HC, 303-00AA/BA, 304-00AA/BA, 305-00AA/BA, 306-00AA/BA/CB/DB/DC/ED/FE/GE/HE, 307-00AA/BA, 308-00AA/BA, 309-00AA/BA, 310-00AA/BA, 311-00AA/BA/CA/DA/EB/FB/GB/HB/GC/HC, 312-00AA/BA, 313-00AA/BA, 314-00AA/BA 2335-2

MGA/MITSUBISHI
CS-1340R, CS-1341R 2338-1

MITSUBISHI
CS-1352 2334-1

MITSUBISHI
CS1952, CS1952R 2337-2

PANASONIC (VCR)
PV-1780 2340-1

QUASAR (VCR)
VH5623UW 2340-2

QUASAR
WU9610XS, WU9624XS, WU9628XP 2339-2

SEARS
562.40720350, 562.40720351 2334-2

ZENITH
A1908W1, A1996W4 2336-2

ZENITH
A2512K, A2512NK, A2514M, A2514PN, A2516P, A2584P 2338-2

Computerfact

APPLE
A9M0303 .... CP8

EPSON
RX-80 .... CP9

Troubleshooting Tips Wanted

Electronic Servicing and Technology needs additional consumer-product Troubleshooting Tips. Most types of case histories are suitable, especially those with unique, puzzling or misleading symptoms.

List the brand, model and Photofact number followed by a narrative telling the original conditions or symptoms, the various troubleshooting steps, and the components replaced to restore the original performance. Please include a simple hand-drawn schematic of the stage that has a defect.

$10 will be paid for each Troubleshooting Tips published. Your name and city will be listed, unless you ask to remain anonymous.

Send all Troubleshooting Tips to:

Troubleshooting Tips Department
Electronic Servicing and Technology
P.O. Box 12901
Overland Park, KS 66212

Continued from page 60

Wanted: Sencore LC-53 Z-meter, Sencore Cricket. Send price, name, address, phone number to *Bob, c/o J&B, 10991 W. 44th Ave., Wheat Ridge, CO 80033.*

For Sale: *Electronic Technician Dealer* and electronic magazines. April 1974 through June 1983. *Biff Henley, 3118 N. John Marshall Drive, Arlington, VA 22207.*

Wanted: Hewlett Packard 3221 marker plug-in for 3211A sweep oscillator. Any reasonable suggestions regarding possible sources also will be appreciated. *D.W., P.O. Box 151, Poway, CA 92064.*

Wanted: Schematic or address to acquire one for Luxman model 4-309 audio amplifier. Will copy and return. *Patrick Wells, CET, 449 S. Canyon Drive, Redmond, OR 97756.*

Needed: Owner's manual and service manual for EICO audio generator model 377. *Syed Kazim, c/o J. Varas, 429 Piaget, Route 46, Clifton, NJ 07011.*

For Sale: Obsolete and old tubes 100-70, 100-77, XXFM 7Y4, 7Z4, 43, etc. New and pullouts. Write your needs. *Earl Shulenberger, owner, Fiegelist Radio and TV, 529 W. State St., Fremont: OH 43420.*

For Sale: B&K TV analyst, model 1075, $75; EICO flyback and yoke tester, model 944, $75; Jackson TV signal generator, model TVG2, no instruction book, $50. Prices plus shipping. Best offers considered. Send s.a.s.e. *Ed Barlow, Box 29, Tweed, Ontario, Canada, K0K3J0.*

Wanted: Mark IV tuner-subber, ac/dc; Viz WP25A isolation transformer; Sams Photofact folders, 900 to recent. All, at reasonable prices. *David Muratore, 27 Clarkview Road, New Windsor, NY 12550; 914-562-2805.*

For Sale: B&K 2040 CB generator, B&K 1040 CB test, both in excellent condition, $250 for both, or best offer. B&K 1470 dual trace scope, $100 or best offer (needs some work). Will consider trade against Sencore VA48. *Marty Rosenzweig, 30700 CR #35, Steamboat Springs, CO 80477; 303-879-4128.*

For Sale: B&K 1251 NTSC signal generator, never used. List $995, sell $450 or offer. *Stu Abraham, 8302 Garland Ave., #1, Takoma Park, MD 20912; 301-587-9014.*

For Sale: Atwater Kent model 435, best offer. *John Carpenter, Sandhills Community College, Route 3, Box 182-C, Carthage, NC 28327.*

Needed: USAF military manuals (i.e., AFM 52-8 or training manuals relating to AFSC 303x1, solid-state devices) and microprocessors. Also need programs or information for obtaining programs that can be used to convert Commodore C-64 computer to an oscilloscope, spectrum analyzer etc., and programs of graphing, electronics formulas, etc. *Bill Byerly, P.O. Box 15584, Pensacola, FL 32514.*

For Sale: Sams Photofacts 1 to 1000, 50 cents each; 1001 to 1640, $1 each. *Joe Barrett, Barrett's TV Repair, 13 Newland Drive, Troy, PA 16947; 717-297-3607.*

Wanted: Sams Photofact folders 1500 to near-current, must be complete and reasonably priced. *Paul Crouch, 1823 Queen Palm Drive, Edgewater, FL 32032; 904-427-5303.*

Wanted: Unrepaired, working D board (vert/horiz) for Sony KV 1920A, SCC100 A-A chassis. *Radio Age, 636 Cambridge Road, Augusta, GA 30909.*

For Sale: EICO model 480 10MHz scope, $100; EICO model 369 FM sweep/marker generator, $90; EICO model 710 grid-dip meter, $25; EICO model 955 in-circuit capacitor checker, $30. All in excellent condition. *Electronics Service, 1566 Grand Blvd., Monessen, PA 15062; 412-684-4860, between 5 and 8 p.m.*

Wanted: Sams book "Transistor Circuit Design," by Okley. Please quote price. *Steve's Radio Service, P.O. Box 168, Wickes, AR 71973.*

Wanted: Sencore SG165 stereo analyzer and Sencore CB42 analyzer. *Coast Communications, 116 Main St., Tillamook, OR 97141; 503-842-4329.*

Wanted: Good deal on LC-53 Z-meter in good condition. *Anthony D. Spatto, Box 141, Remsen, NY 13438.*

For Sale: Tektronix and Hewlett Packard oscilloscopes and plug-ins, $100 or best offer. Send s.a.s.e. *Jim Corliss, 2446 Vista Drive, Upland, CA 91786; 714-985-9967.*

Wanted: Lectrotech RCT-10 remote control tester. *Ray Mackie, Box 1155, Kodiak, AK 99615-1155.*

For Sale: Sencore PS163 scope, $150; Sencore VA48, $800; Sencore CB41 tester, $100; EICO 667 tube tester, $100; Sencore DVM56, $500. *Bill Bechtold, 7429 Frederick, Omaha, NE 68124; 402-397-2461.*

For Sale: Six picture tube adapters to interchange all b/w picture tubes, $12; four type P-R crystals to align IF in old TV sets, 21.25KC, 25.75KC, 27.25KC, 400KC, $8; EICO signal tracer model 147A, with manual, $40; EICO RF probe model P75, $10; Speco-Capohmist to "substitube" condensers and resistors, $35. *Al Crispo, 3225 Chipmunk Drive, New Port Richy, FL 33552.*

Wanted: Working, dual trace oscilloscope, 35MHz preferred. State condition, years of usage and price. *Casey Shooper, 2236 Clarence Ave., Berwyn, IL 60402; 312-749-3716.*

Needed: Manual or schematic for dc power supplies of Universal Electronics model LO35, 15A; Kepco model SM-36-5M, 5A; Deltron model H36-15, 15A. Will buy or copy and return. Write or call collect. *Patrick Keller, 9404 Good Luck Road, Lanham, MD 20706; 301-577-4027.*

Wanted: One UHF dial calibrated knob, 1 to 83, for Zenith color television, model E-4001W1, chassis 19EC22 portable. Will accept good used or new. *Joseph A. Gontarz, JAG's Radio & TV, 14 Rudolph Road, Forestville, CT; 203-583-7532.*

For Sale: TV/radio servicing course (National Technical Institute), 105 lesson booklets, complete, $30; Micronta, digital logic probe, $10. Postage paid. *J. Ferriola, 2360 Maple Ave., Croydon, PA 19020.*

Needed: One No. 281 tube for Sparton radio, model 89A; substitute tube No. 81. *Sherman Austin, 2845 Monogram Ave., Long Beach, CA 90815, 213-429-3838.*

Wanted: Dual trace scope, 10MHz or better. *John Davis, 415 Mountainview Ave., Staten Island, NY 10314; 718-698-3690.*

For Sale: (Retiring) New tubes – more than 250 – 1940 to latest, in good assortment, $350; 1G57A Heath post marker generator with attenuator and leads, $50; 1M-4110 frequency counter, Heath 110MHz, includes calibrator, $100; EICO flyback tester, $25; 12V20A Knight power supply, $25; old 4.5MHz Heath scope (O.K.), $25. Manuals for all, everything just slightly used. Add $5 per item for shipping, or take all with shipping prepaid. Send s.a.s.e. for more information. *W. James Tyger, formerly of Tyger's TV Service, R.D. 1, Box 32, Commodore, PA 15729.*

For Sale: B&K model 1580 dual trace oscilloscope purchased in July 1984 for $1264.95. Must sell because of serious illness, asking $1000 or best offer. Will pay freight. *S.J. Speno, 881 Maple St., Wethersfield, CT 06109; 203-529-4626.*

Wanted: Original or copy of tube chart for Mercury model 2000 tube tester. Will pay fee. *Jim Duane, 3637 E. 7800 South, Salt Lake City, UT 84121; 801-943-7888.*

For Sale: Carbon resistors, never used. Best offer for a total of 27,000 resistors in very odd quantities. Lot made up of ¼-, ½-, 1-, 2W resistors. *Donald Rector, 215 10th St., North Wales, PA 19454; 215-699-5407.*

For Sale: Sencore model SG-165, like new, $900. Will pay shipping. *Robert F. Nestor, 3407 Arlington Ave., Riverside, CA 92506; 714-684-9393.*

Wanted: NRI model 45 voltohmmeter, NRI model 35 signal tracer and NRI model 7E radio. *William P. Jarvis, 1214 Fifth Ave., Beaver Falls, PA 15010.*

Wanted: Kraco model 4010 CB radio in good working condition. Will pay reasonable price and postage. *Chuck Dartany, 2151 E. Fifth St., Brooklyn, NY 11223; 718-339-4611.*

For Sale: Sencore models VA48, $700, CR70, $450, LC53, $450, PR57, $200 and TF46, $200. All like new and include optional accessories. Must sell. *Frank Ward, Route 2, Box 406, Woodville, MS 39669; 601-888-4986.*

Needed: Schematic diagram for Fisher stereo model 534. Will copy or pay. Send postcard with price. *Andrej's Electronics, 56-56 136 St., Flushing, NY 11355-5029.*

Editor's note: Reader's Exchange items are published in the order they are received. We are happy to offer this service at no charge to you, our readers, but ask that:

- Items are legibly written or typed.
- Your name and address are included on the same page as your item (envelopes and contents often become separated). Phone numbers also may be included. Using your peel-off label is a good idea.
- You limit any item to no more than three units.

Please understand that **ES&T** is in production six weeks to two months *ahead* of publication date. An item you mailed June 28, for example, may not be *received* by us soon enough even to appear in the September issue if there is a large backlog of prior ad requests.

Coming in...

AUGUST

Servicing E30-series NAP color televisions— Efficient troubleshooting of color-TV receivers requires a knowledge of all unusual circuits plus a list of the most common component failures. These important servicing tools are provided for the E32 Magnavox specifically, and for all E30-series NAP color receivers in general.

What do you know about electronics?— Meeting the measurement challenge. Sam Wilson tells readers that understanding test equipment is the surest way to minimize distortion of measurements when the distortion results from testing and measuring techniques. Even when measurements are accurate, they may not be precise because of errors introduced by the measurement process.

The video repair series—Beginning with videotape recorders, Neil Heller describes the complex interrelationship between the electronic dynamism of this equipment and the tape-transport function that, while mechanical, is electronically driven. The author recommends preventive maintenance to forestall breakdown of this deceptively simple mechanism, and presents the basic foundation for understanding videotape recorder problems.

New circuitry—Look for information about the Schotz-FM stereo noise-reduction system, as well as an account of other new circuits such as the integrated circuit op-amp—a brand-new generation of ICs.

Classified

Advertising rates in the Classified Section are 75 cents per word, each insertion, and must be accompanied by payment to insure publications.

Each initial or abbreviation counts a full word.

Minimum classified charge is $15.00.

For ads on which replies are sent to us for forwarding (blind ads), there is an additional charge of $25.00 per insertion to cover department number, processing of replies, and mailing costs.

Classified columns are not open to advertising of any products regularly produced by manufacturers unless used and no longer owned by the manufacturer or distributor.

FOR SALE

FOR SALE (CONT.)

TUBES FOR TV AND RADIO—35¢ ea. Washington TV Service, 1330 E. Florence Ave., Los Angeles, CA 90001. 11-84-12t

SENCORE EQUIPMENT—never used, best offer all or part, asking: VA48 $695, SC60 $995, PR57 $245, LC53 $445, DVM56 $445, CR31A $345, FC51 $495, SG165 $495, TC162 $145. S. Cole, P.O. Box 210835, Dallas, Tx. 75211, 214-681-3966. 7-85-1t

WANTED

INVENTIONS, IDEAS, NEW PRODUCTS wanted for presentation to industry and exhibition at national innovation exposition. Call free 1-800-528-6050. 6-85-3t

BOUGHT/SOLD: Sams photofacts, gold & silver coins, VHS movies, all ratings, IBM/Apple computer software. Astro, Rt. 9W, Stony Point, N.Y. 10980, 914-942-2173. 6-85-4t

WANTED: To buy well established TV-video repair shop in Brooklyn or Manhattan boroughs of New York City. For offer call: (718) 336-9573. 7-85-1t

HELP WANTED

ELECTRONIC TECHNICIANS—Part time for field service and preventive maintenance. Openings nationwide. Must have own transportation and some equipment. $15.00 per hour. Send Resume to Service Supervisor, Best Power Technology, P.O. Box 280, Necedah, WI 54646. 6-85-2t

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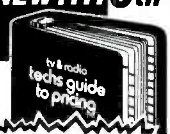

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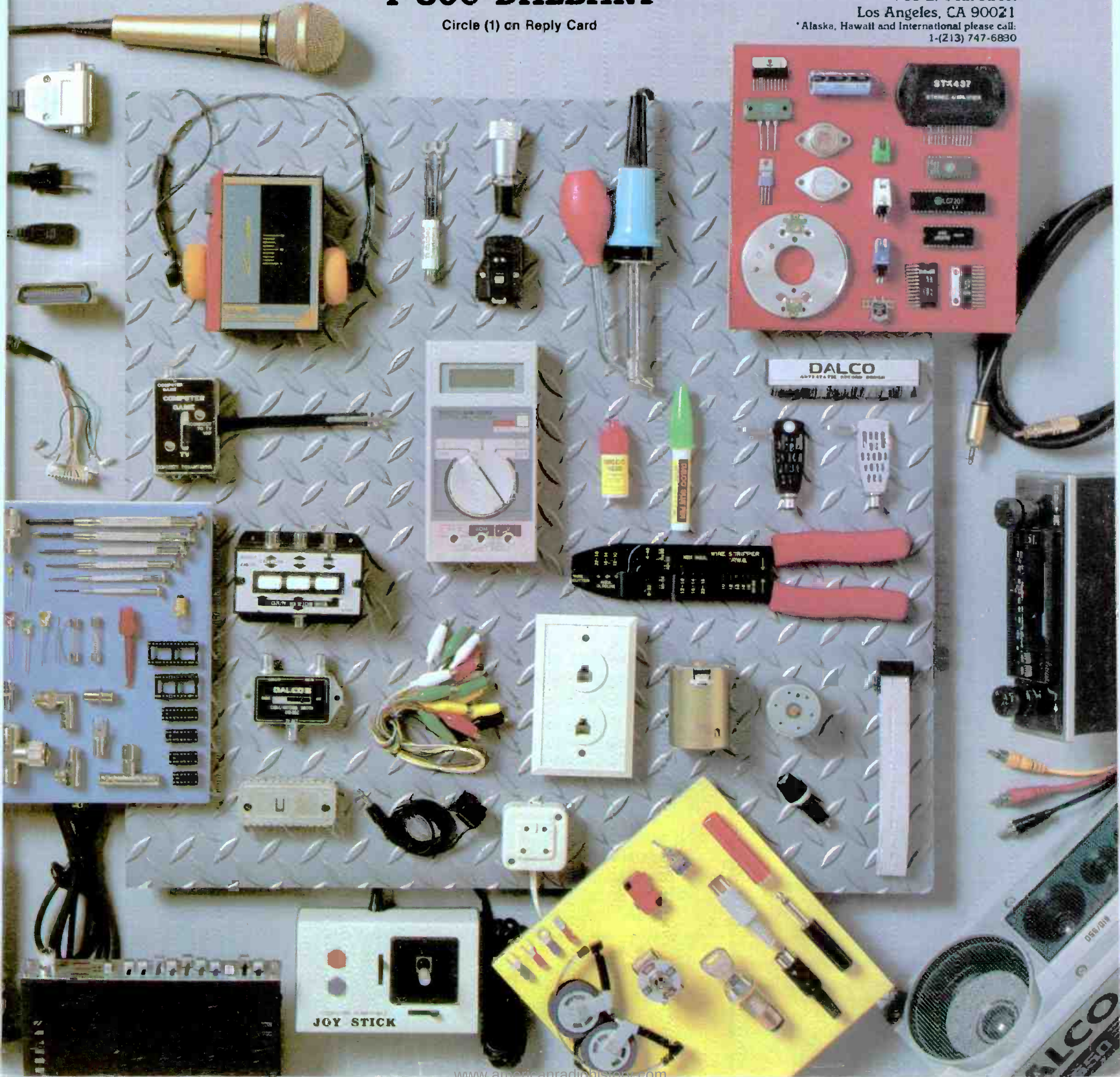

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