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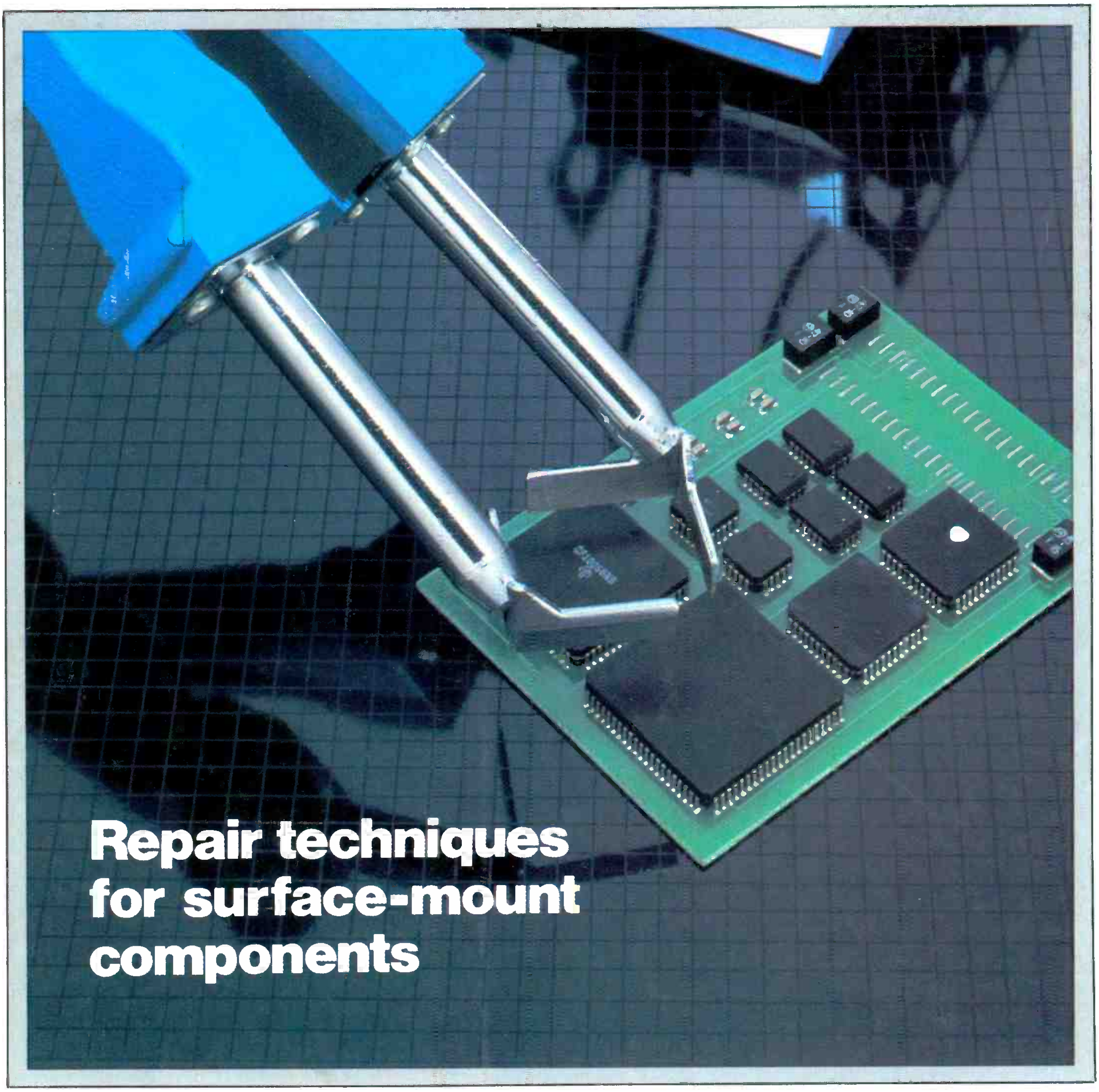
Servicing VCRs, part 3 • preventive maintenance

Sylvania Superset Two, part 5 • The video connection, part 5



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Servicing & Technology

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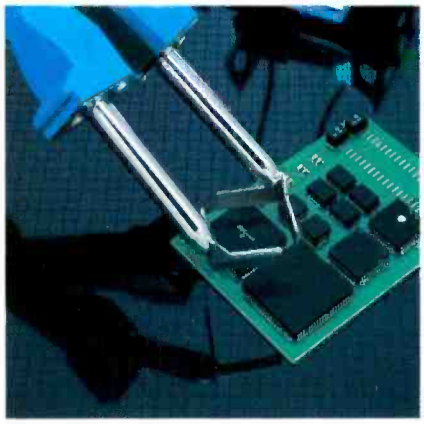

A new replacement and repair technique has surfaced. Details begin, page 22.

This display technology sandwiches neon gas between glass panels to create a glowing image. Page 6. *(Photo courtesy of Panasonic Industrial.)*

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Circle (5) on Reply Card

Editorial

May I have a word with you?

The operation of electronic circuits consists of complex, frequently abstruse, phenomena that occur in a realm denied to the human senses. A good grasp of what's going on in a circuit, therefore, requires clear precise language and vivid descriptions.

Much of the language of electronics is clear and descriptive and enhances an understanding of circuit operation. And electronics scientists have come up with some creative terms that sum up what's going on in just a few words or sentences. One of my favorites is *bucket-brigade device:* an electronic device in which charges are passed from one domain to another on the device in much the same way as buckets are passed from person to person in a fire-fighting bucket brigade. No detailed description is necessary with creative terminology such as that; the term is self-descriptive.

In describing waveforms, the electronics geniuses have again found terms that are precise and descriptive. Sine wave, square wave, sawtooth – they all conjure up vivid images of the phenomena they describe. Someone even managed to sum up the description of a complex waveform in a few words: *cash-register waveform.* This waveform bears an uncanny resemblance to the profile of one of those old-fashioned rounded-front cash registers.

Unfortunately, not all of the terms used in electronics are so descriptive. In fact, some electronics terms are so ill chosen that they serve as stumbling blocks to someone trying to fathom the depths of electronics.

Take the term *carrier,* for example: that radio frequency, which AM transmitters generate, that modulates with the information frequency (voice) to send out over the airwaves. Intuitively, the term appeals to the intellect. The *carrier* frequency *carries* the information from the transmitting station to the receiver.

As radio technology advanced, however, some of the advancements began to make it abundantly clear that the term *carrier* was not well chosen. Ultimately, some AM transmitters did away with the carrier frequency altogether and transmitted only a sideband, and as it turns out, this *suppressed carrier* transmission system is far more efficient. In fact, the carrier wasn't "carrying" anything. It was actually taking an audio frequency and converting it upward in frequency into the radio-frequency range so that it would propagate as a radio wave.

There are other terms, just as obscure, that are aptly chosen, but the referent is obscure. For example, an RC circuit in which the output is taken across the capacitor is an *integrator.* Now where, pray tell, did that term come from? As it turns out, the input voltage to an integrator creates a current in the circuit. In the capacitor, the action performed on that current is to create a voltage that is proportional to the sum of all the current that has flowed through the capacitor. In mathematics, summing such as this is called *integration,* hence the term.

It's too bad that in a discipline that's already as recondite as electronics, poorly chosen terms should be impedimenta. It's up to all of us to encourage clear precise language and to try to keep the language of electronics as free as possible from obfuscation.

Nils Conrad Persson

ELECTRONIC Servicing & Technology

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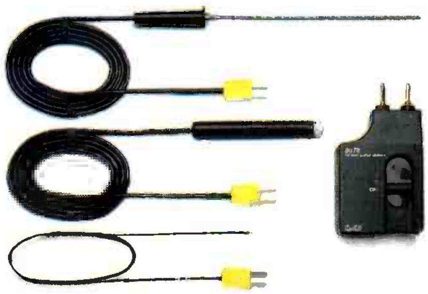

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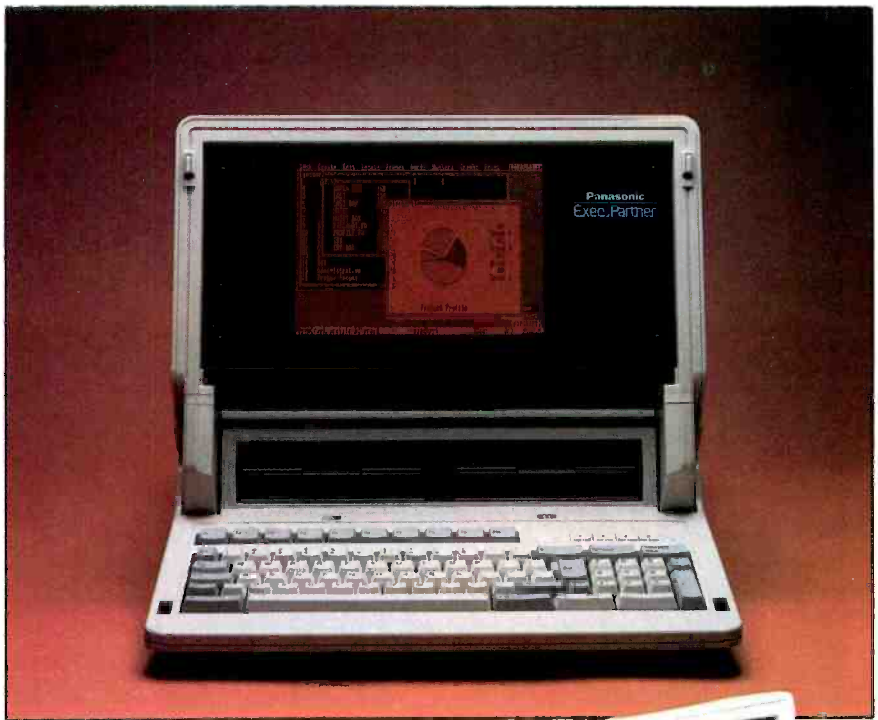
Circle (1) on Reply Card

Technology

High-resolution plasma display



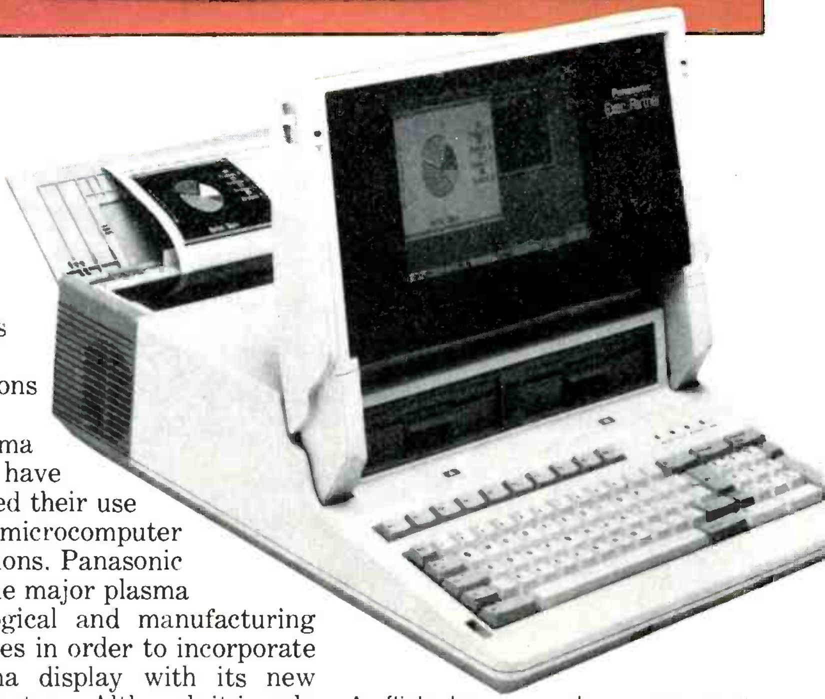
Unlike conventional cathode-ray tube (CRT) monitors, the gas-plasma display of the Panasonic Exec. Partner computer is a flat screen offering size, weight and performance advantages for microcomputer applications. The display contains neon gas that is held at low pressure between glass panels. When the gas is excited by ac voltage, a bright orange plasma forms at each pixel, creating a glowing image on the screen.

One of the three kinds of flat-screen displays in use today, the gas-plasma display's estimated lifetime is up to four times longer than its more commonly used flat-screen alternative, the liquid crystal display (LCD). Another alternative, the electroluminescent display (ELD), is about half as bright as the plasma display, requiring much higher voltage levels for equivalent operation, according to March 1985 *Byte* magazine.

The primary benefits of gas-plasma technology are flicker-free display and fast response time, both of which stem from the inherent memory characteristics of the technology. To ensure flicker-free viewing, the glowing image of the bright orange plasma is maintained constant by an ac *keep alive* voltage. Display flickering is avoided because there is no need to refresh the image constantly with a more powerful ac *exciting* voltage.

In order to change the image on the display, the ac keep alive voltage is removed, while the ac exciting voltage is reapplied, simultaneously. The old image fades from the display within 2μs to 3μs. Most LCDs require constant image refreshing, and as a result, have much slower response times, typically 150,000μs.

Up to now, the relatively high power consumptions, manufacturing costs and size restrictions of ac gas-plasma displays have prevented their use in most microcomputer applications. Panasonic overcame major plasma technological and manufacturing challenges in order to incorporate a plasma display with its new Exec. Partner. Although it is only 2-inches thick, the 11-inch (CRT equivalent) screen displays 25 lines by 80 columns of high-resolution viewing.



A flickerless, non-glare neon-orange display now is possible because of a breakthrough in plasma display technology that has reduced manufacturing costs. *(Photos courtesy of Panasonic Industrial Corporation.)*

New power-driver IC improves TV/monitor deflection

An unconventionally designed power IC capable of reducing dissipation and improving reliability in the horizontal deflection stages of all color TV and monitor designs has been designated the TDA8140 deflection device. Problems associated with conventional designs have been eliminated, according to Serban Coss, linear product marketing manager of SGS Semiconductor Corporation, the parent firm.

According to Coss, the horizontal output transistor is driven by a medium-power transistor and a transformer in conventional drivers. Therefore, the drive circuit must be optimized for each application in order to ensure saturation of the power transistor. This causes higher-than-necessary dissipation because the conventional circuit cannot supply the ideal base current. When the chassis is turned *on* or *off*, the power transistor is stressed. Reliability is compromised as a result.

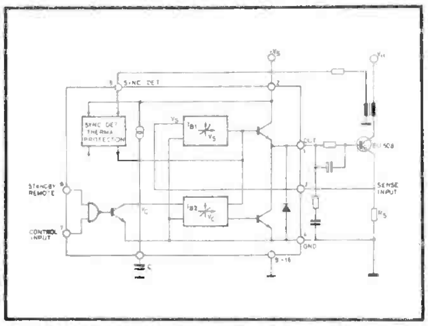


Figure 1. The circuit design of the TDA8140 has been simplified, yet current dissipation has been reduced. Control/protection functions are built in.

The SGS TDA8140 addresses these problems. It is a small power IC capable of adapting to different application requirements to supply the optimal charge and discharge currents. By optimizing the base current, dissipation is reduced to a minimum.

This IC also simplifies circuit design. Control and protection functions are built in. When the chassis is turned *off*, for example, it ensures that the power transistor is driven correctly.

Also the device has the internal capability to protect itself, as well as the external power transistor, against overload conditions.

Technology enhances traffic reports

Two Dallas/Ft. Worth radio stations – KVIL-FM, 103.7, and KPLX-FM, 99.5 – now are among an increasing number of North American FM stations broadcasting their traffic reports with a technological assist from the Automatic Radio Information (ARI) system. That system, developed by Blaupunkt, a division of the Robert Bosch Corporation, to improve traffic flow, enables the stations to enhance reporting of pertinent and timely traffic information to Dallas/Ft. Worth motorists.

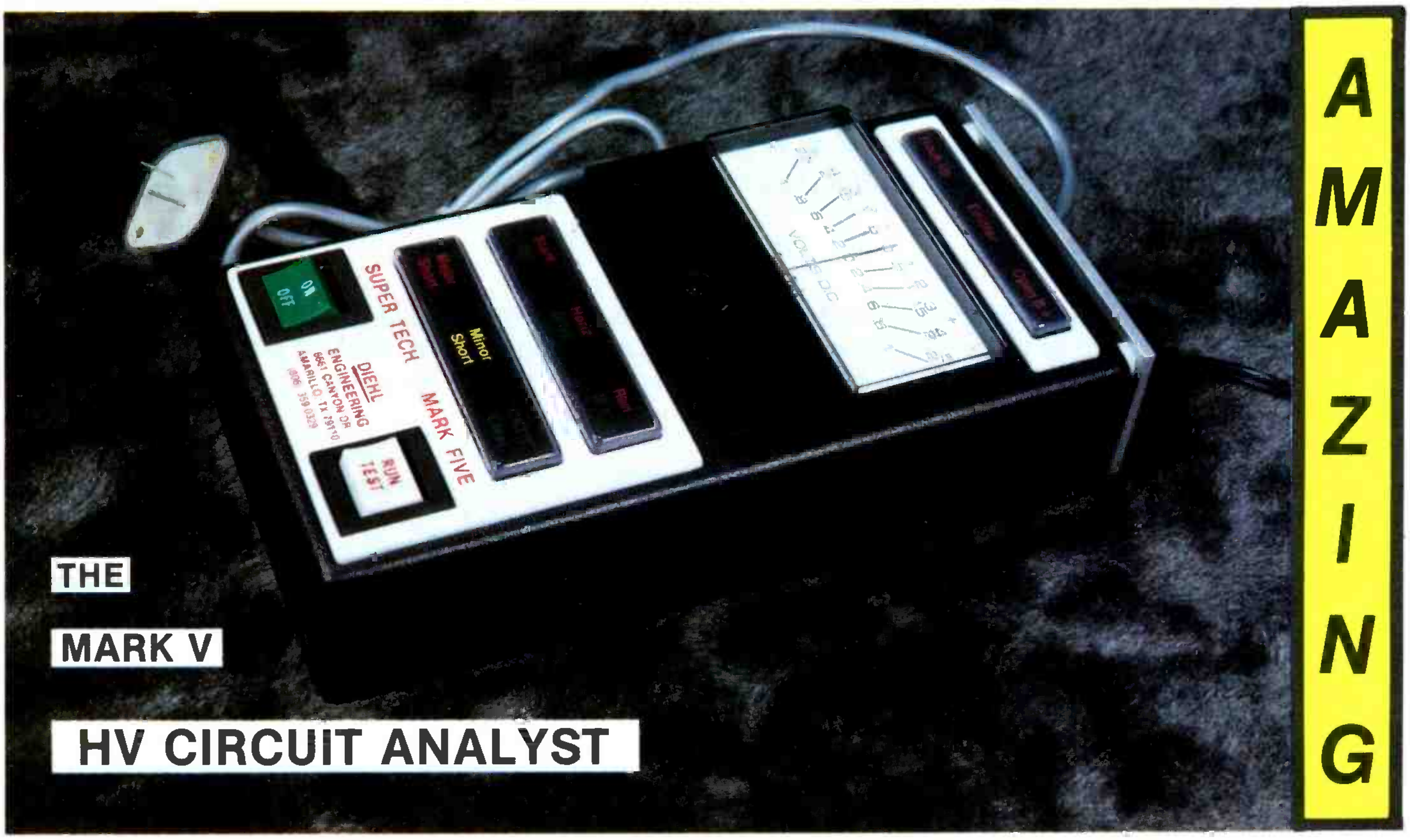
This is an outstanding example of the way that *electronic* technology can ease the problems humanity suffers as the result of some other technology. In the crowded portions of the developed world – despite highways, freeways, mass transit systems and sophisticated traffic controls – rush-hour traffic crawls along because there simply are too many cars for the roads.

With ARI, an inaudible tone is broadcast that activates special car radios to draw zone-specific traffic reports to the attention of the driver. As long as the commuter's ARI-equipped FM radio is *on* and tuned to the designated stations for one of two Metroplex traffic zones, the volume of the needed bulletins is boosted to distinguish the reports from other drive-time programming. Additionally, the ARI-encoded traffic bulletins will be heard even if the radio's volume is off or a cassette is playing.

Only those FM car radios with ARI decoders can differentiate among zones and have volume-boosting and cassette-override capabilities. In the United States, such radios now are available exclusively from Blaupunkt, however, a plan is pending for more generalized manufacturing.

FM radio stations enhancing their traffic reporting with ARI are in an East Coast corridor that extends from Southern Connecticut to Northern Virginia; Southern California; metropolitan Detroit and Greater Toronto. By the end of 1985, ARI service is expected to be available in other major Canadian markets and in the top 20 U.S. urban centers.

In West Germany, where nationwide ARI coverage has been provided since 1974, virtually every car radio now sold is equipped with the ARI function.



- ★ Checks the horiz output stage for opens / shorts,
- ★ Checks flyback, yoke, PC, and HV mult,
- ★ Checks all scan derived B+ sources,
- ★ Checks for open safety capacitors
- ★ Checks for open ground path for horiz output stage
- ★ Checks for open primary LV supply,
- ★ Checks for error in interface connections,
- ★ Checks for proper LV regulation,
- ★ Checks for proper start up circuit operation,
- ★ Checks for shorted horiz driver transistor,
- ★ Checks the operation of the horiz osc / driver circuits,
- ★ Checks B+ "run" supply for the horiz osc / driver circuits,
- ★ Checks all circuits in the TV set that rely on scan derived B+,
- ★ Automatically circumvents all start up circuits and horiz drive related shut down circuits.

HOOK UP: (Identical to Mark III)

OPERATION: Turn the Mark V on, turn the TV set on, then, simply look at the lights.

RED "HOOK UP" LIGHT means that you have made an error in hook up. No damage has been done, correct the problem then continue.

RED "EMITTER" LIGHT means that the ground path for horiz output stage is open. Correct the problem then continue.

RED "B+ OPEN" LIGHT means that the primary LV supply in the TV set is open. Correct the problem then continue.

No "top row lights" equals normal.

Look at the middle row of lights

RED "START UP" LIGHT means that the start up circuit in the TV set is not working (no start up pulse).

GREEN "START UP" LIGHT means the start up circuit in the TV set is working normally. Yes, it is 100% accurate. Even on Zenith's single pulse start up circuit !

RED "HORIZ DRIVE" LIGHT with a green start up light means that the horiz driver transistor in the TV is shorted (E to C).

GREEN HORIZ DRIVE LIGHT means that the horiz oscillator and driver circuits are operational.

READ THE DC VOLTAGE METER THEN,

PUSH THE TEST BUTTON

If the meter comes up to, or, falls back to, factory specified DC collector voltage, the LV regulator circuit is working. If it fails to do so, it is not working!

RED "B+ RUN" LIGHT means that the B+ source that normally keeps the horiz osc / driver circuits running after the start up B+ pulse has been consumed has become open.

GREEN "B+ RUN" LIGHT means that the B+ resupply voltage (scan derived) is being provided. All is normal if all three lights are now green.

The scan circuit short detector in the Mark V is identical in all ways to that which is used in the Mark III. Operation is also identical. Both units are virtually indestructable when simple directions are followed. Both units carry a full year's warranty against defects in materials and workmanship (parts and labor). Either unit can be easily repaired by almost any technician in his own shop.

If the green "circuits clear" light is now lit

It is now safe to push the "run" button and examine the symptoms that appear on the CRT screen, for the purpose of isolating any "open" circuits.

Except for hook up and CRT filament warm up time, this test can easily be completed in two to five seconds!

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Part 5

Analyzing the Sylvania Superset Two

By Carl Babcoke, CET

Convenient electronic switching of three RF inputs and electronic switching of internal or external video and audio signals are some of the special features not found in "plain vanilla" color-TV receivers.

Most previously analyzed circuits of the Sylvania Superset Two (model RXS198WA, chassis 19C4-03AA) basically are similar to those found in many comparable new models of other brands. (One exception is the scan-velocity modulation circuit. Few models have that feature, described in the July issue.)

The next circuits and functions are not so well known. They include electronic switching of three RF sources, video input and output signals with electronic switching, and a stereo amplifier with volume, bass, treble and balance adjustments controlled by variations of dc voltages (Figure 1).

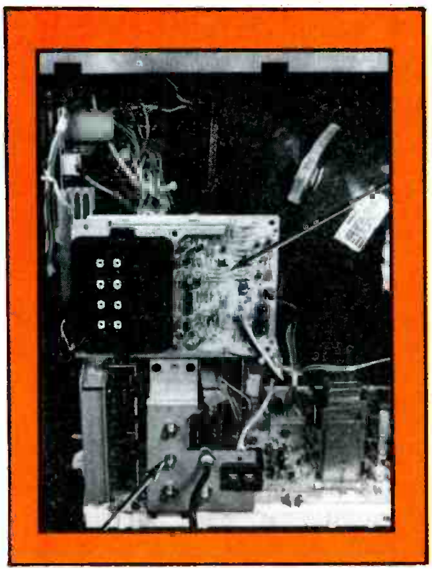


Figure 1. Arrows point to the RF-switching box (at bottom) and to the audio/video / input/output (AVIO) circuit board. These circuits will be studied.

Figure 2. These open and closed switch contacts illustrate the basic RF switching performed by diodes. (A) With switch *A* open, no signal passes to the output (except some through the switch's stray capacitance). Even that small amount of signal is reduced by shorted switch *B*. (B) a shorted switch *A* passes all the RF signal to the output, and this strong signal is not reduced by open switch *B* (except by stray capacitance). The actual circuit uses forward bias to short a diode and reversed bias to open as required. Also, more than two diode switches are used to further attenuate unwanted signals.

Figure 3. This is the complete RF-switching system (less only some B+ details). The dc voltages shown were measured with the ACC1 signal passing through (active) and the other two blocking their RF signals (inactive). A digital *low* activates the ACC1 channel (P6-5 pin), while digital *highs* (+11.8V) applied to P6-4 and P6-3 force the other channels to be inactive. These control dc voltages are produced by an IC on the tuner-control board.

RF switching with diodes

Any simple single-pole, single-throw switch can be connected to turn *on* and *off* a radio-frequency (RF) signal. But there is a serious problem: The stray capacitance across the switch mechanism internally continues to pass a considerable amplitude of RF even when the contacts are open. Low-capacitance switches can be manufactured, of course, at greater expense. Or a combination of transistor driver and low-capacitance relay can be devised. However, the design problems and expense become serious when two or three RF signals are to be switched in sequence, without any mixing of the signals. Electronic switching can solve these problems.

Figure 2 shows the basics of electronic switching. Two switches are operated together to minimize RF signal leak-through. One switch always is closed and the other open, but the closed and open conditions alternate. When switch *A* is open (left schematic), most of the RF amplitude is kept from the output at switch *B*. Then the remainder of the unwanted signal is removed by closed switch *B* that grounds the stray signal.

When the switch conditions are reversed (right schematic), the full RF amplitude passes through closed switch *A*, while switch *B* is open (except for stray capacitance) so most of the RF-signal amplitude passes on to the output. This is the method used in the Sylvania Superset Two, *except the switches are replaced by diodes and multiple stages are used.*

Figure 3 shows the entire 3-channel RF-switching circuit, complete with *measured* dc voltages. My first intention was to calculate the diode dc voltages for active (signal passing) and inactive (signal blocking) conditions, but the many paralleled paths made the mathematical solution so complex that I chose to measure the voltages instead. If you enjoy real puzzles such as this, calculate *all* dc voltages and then compare them with the schematic voltages measured with a DMM.

Remember, a reverse-biased diode is an open circuit (except for leakage that can be ignored and stray capacitance), while a strongly forward-biased diode (about 0.8V) is a low resistance (a few hundred ohms).

Switching voltages for the diodes are produced in the Sylvania by the tuner-control circuit. Therefore, the RF signal can be selected either by pushing the front-panel ACC button (or the remote-unit ACC button) until the desired signal is obtained.

Active switching

Operation of the ACC1 switcher (top in Figure 3) in the active mode (which passes the signal to the

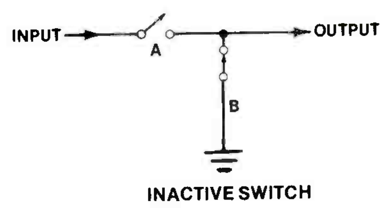


Figure 2A.

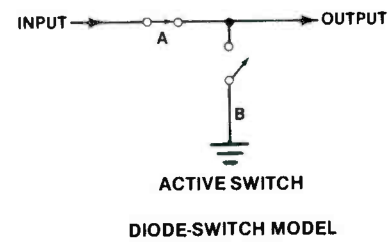
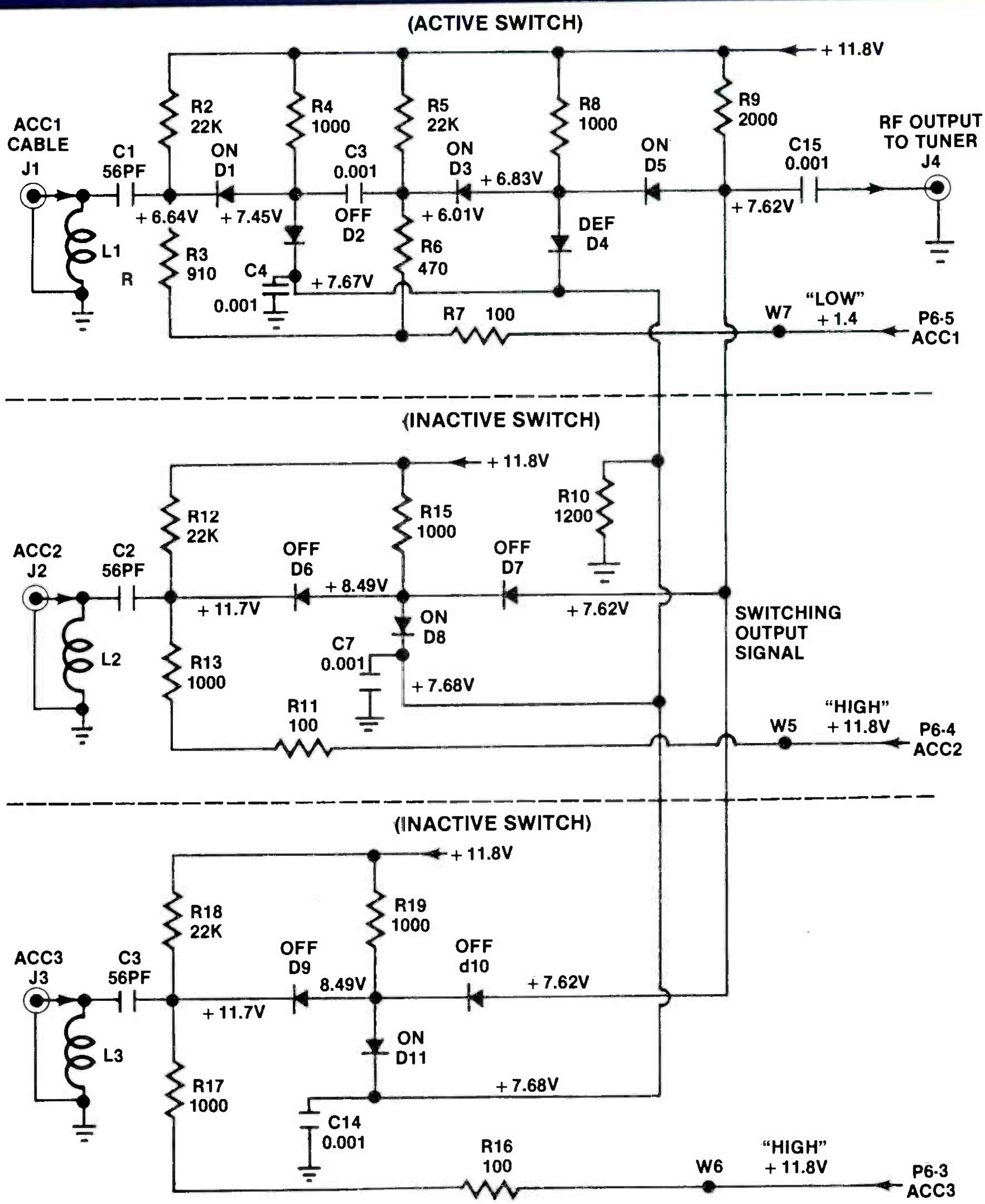


Figure 2B.



19C4 RF SWITCHING

Figure 3.

tuner) is as follows:

- The +1.4V digital *low* at pin P6-5 decreases the D1 cathode voltage, so D1 has a forward bias of about 0.8V and conducts strongly (about 180Ω) to bring the RF signal to C3 and D2.
- D2 has a high internal resistance from the 0.2V reversed bias, so it does not attenuate the signal that is passed through C3 to the second switching stage.
- In the same way, the signal passes with only slight attenuation through the 0.82V forward-biased D3, while D4 is reverse biased and does not attenuate the signal.
- From the D3 anode, the signal is sent to the D5 cathode. D5 has about 0.8V of forward bias, so the resulting internal low resistance allows the RF signal to pass through D5 with little attenuation. From there, the signal passes through C15 to the output jack.
- Because the series diodes have low resistances and the paralleling diodes have infinite (nearly open) resistance, attenuation of the desired RF signal is low. Therefore, the selected RF signal appears at the output jack, from where it is sent to the tuner.

Inactive switching

Operation of the ACC2 switcher (Figure 3 center schematic) in the inactive mode can be analyzed by these steps:

- A +11.8V *high* at pin P6-4 applies a reverse bias to diode D6 by raising the cathode voltage, thus increasing its internal resistance to a very high value. When the J2 signal reaches D6, none passes through D6 except by stray capacitance.
- The weak signal at the D6 anode is further attenuated by conduction of diode D8 (0.81V of forward bias) that passes the RF through D8 to its cathode at which point it is bypassed to ground by capacitor C7.
- The weak RF signal at the D6 and D8 anodes also is applied to the D7 cathode, but D7 has a reversed bias of about 0.8V. Consequently, the D7 internal resistance is high and little signal strength passes through, except by stray capacitance. Therefore, the RF output at C15 and J4 is virtually zero.
- In the inactive mode, all the series diodes have high resistances and the shunt diodes have low resistances. Almost zero signal passes through the switcher.

Operation of the ACC3 switcher (Figure 2 bottom schematic) is identical to that of ACC2, just discussed. This switcher schematic is included only because of the diode currents that must be considered if the operations are calculated mathematically.

Operation hint

The RF input marked ACC1-CABLE on the receiver's back and in the Figure 3 schematic should be used for whatever signal is present *at all times*. Therefore, connect the cable, indoor antenna wire or outdoor-antenna downlead to that ACC1 input. The other two inputs can be used for RF from a video game, a computer or a VCR.

These connections are recommended because ACC1 has five diodes in two and one-half switching stages while the other two have three diodes in one and one-half switching stages. Thus, the two inputs having only three diodes might allow enough RF leakage to cause interference. (A VCR or video game could cause interference or be interfered with only while in use. A cable or antenna has signals at all times, so these signals must not bleed through at any time.)

Other switcher facts

An arrow in the Figure 4 photograph shows where the RF switcher box is located during normal operation. It is wedged in between the tuner-control box (at left) and the IF board at the right.

Good shielding is necessary in an RF switcher (Figure 5), both with the top and bottom covers and internally. The square holes on top were left after metal springs were formed. These springs contact internal partition shields for better grounding and RF shielding.

Five shielded compartments inside the switcher box are shown in Figure 6. Three compartments are

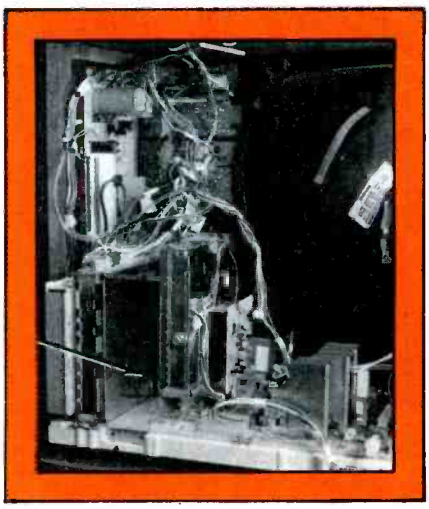


Figure 4. The RF-switching box, the AVIO board and the metal mounting plate have been removed for this photograph. An arrow points to the usual location of the RF-switcher box.

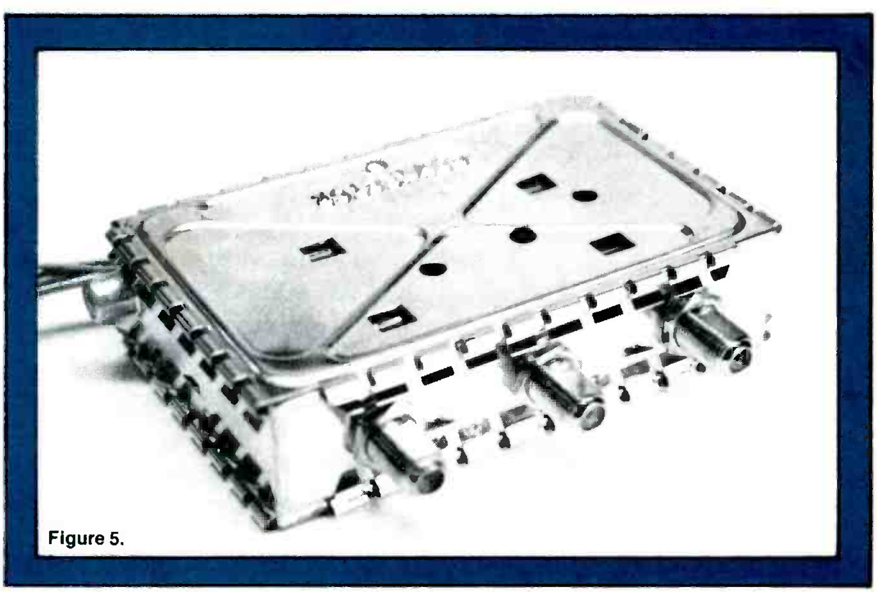
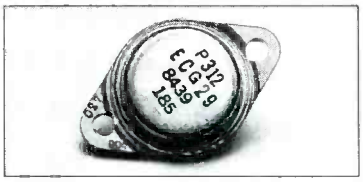


Figure 5. The RF-switching box is shown here without its mounting bracket, but with top and bottom shields intact. In the top shield, the square openings mark where the metal has been formed into springs that touch the internal partitions for better shielding.

ECG® IC's for Zenith "Z" Chassis

Philips ECG has replacement integrated circuits for the 221-175, -179 and –190 in the Zenith System 3 "Z" chassis. They are the ECG873, 874 and 875. Just three of the hundreds of integrated circuits available from Philips ECG to replace literally thousands of part numbers. All are manufactured to meet OEM specs so you know they fit and they work.

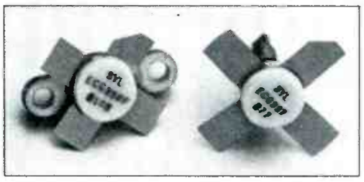
Circle (6) on Reply Card



ECG® Bipolar Transistors

Philips ECG replacement leadership is obvious again. The ECG 29, bipolar transistor, used as a replacement in the fan motor control system of Cadillacs, has been added to the Philips ECG line. (The ECG29 replaces Delco part numbers 139DDF and 7391-BT). There are 322 other bipolar transistors in the Philips ECG line that replace thousands of other domestic and foreign transistor types.

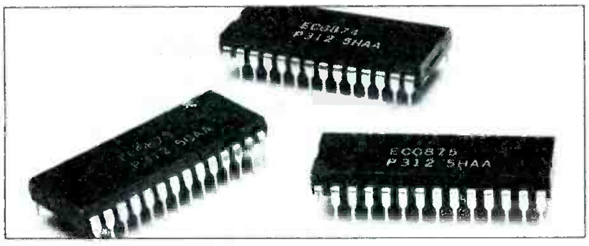
Circle (7) on Reply Card

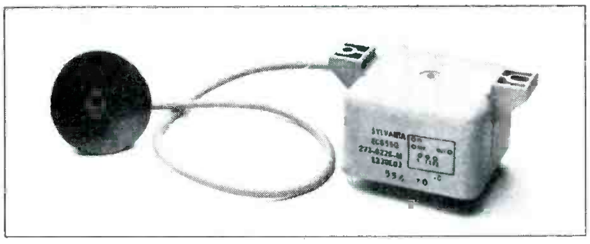


ECG® RF Power Transistors

Philips ECG power transistors are the ideal replacement RF power output devices for fire, police and taxi radios. They are suitable for transmitters and drivers up to 100 Watts RF power. They cover frequencies from the 13 to 30 MHz band to the UHF 806 to 870 MHz band. Most dealers will be happy to learn that Philips ECG replacement RF power transistors are designed to replace units in Asian and European equipment as well as domestic types. So, if it's ECG, it fits and it works... worldwide. Philips offers a selection of over 65 RF transistors that replace literally hundreds of domestic and foreign transistors in a broad range of frequencies.

Circle (8) on Reply Card





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Circle (9) on Reply Card

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Circle (10) on Reply Card

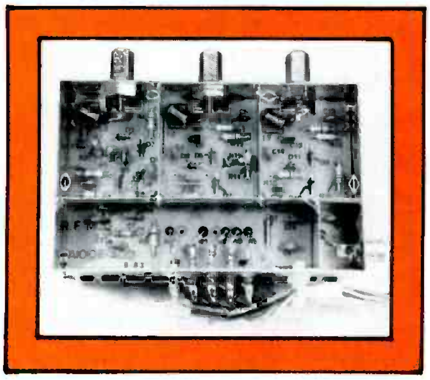


Figure 6. When the RF-switcher top shield is removed, the internal partition shields that divide the circuits into five isolated areas are as easy to see as shown in the above photograph. Not only must there be no stray-capacitance path between any input and the common output circuit, but care must be taken that there is no signal leakage between the various switching circuits.

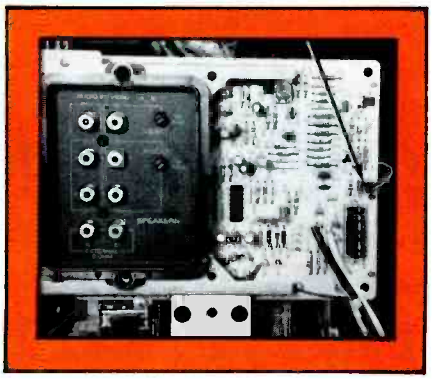


Figure 7. An arrow shows where J23 is located. The digital *high* and *lows* for J23 are produced by the *A/V off* and *A/V on* positions. One control voltage always should be zero and the other about +11.8V. *These control voltages simultaneously supply switching for video and audio signals.* If J23 is removed, the TV sound is missing and there apparently is AGC overload.

for the three RF switcher circuits (no mixing of the signals is allowed). The small one shields the output plug, and the one with the feed-through insulators and wires is used for B+ connections and the control voltages.

The three threaded rods atop the switcher box are the 75Ω inputs from coax cable to the diode-switching circuit.

Video electronic switching

Jacks and electronic switching for incoming and outgoing video and stereo audio are on the audio/video/input/output board (photograph in Figure 7). Switching of both video and audio is performed simultaneously by digital *high* and *low* dc voltages from the audio/video (A/V) *on/off* switch that is under the door on the cabinet's front. These controlling dc voltages are obtained at the 2-pin small jack, J23, and they are applied simultaneously to video-switching and audio-switching circuits.

Ten transistors are used in the video-switching section of the audio/video / input/output (AVIO) board (Figure 8). With the audio/video switch at the *off* position, the internal TV video is routed back to the receiver's video circuit for normal TV reception. At the same time, the station video is available from the J1 jack of the AVIO jack panel, for any uses external to the receiver. (Also, TV sound is heard from the receiver's speakers.) During this time, any video simultaneously entering at the J2 input jack is prevented from reaching the receiver's video system.

When the A/V *on/off* switch is changed to the *on* position, any audio coming in the stereo input jack is heard in the speakers, and whatever video is entering at the J2 incoming-video jack is seen on the screen. This is the way to watch a previously recorded VCR tape, for example. Alternately, an audiocassette player or recorder can be connected to supply audio to the stereo input jacks, but without any video at J2. In that event, the audio will be heard, but the screen will be black (or very dim) without any picture or snow.

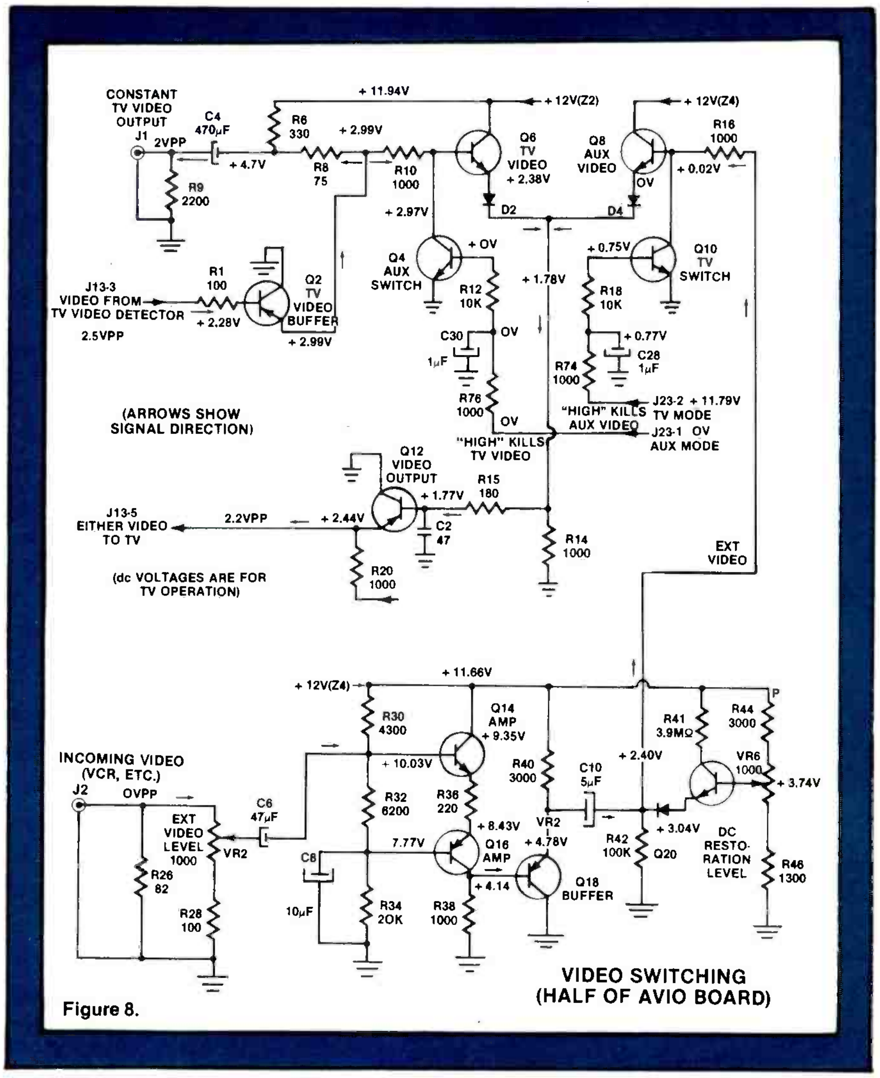
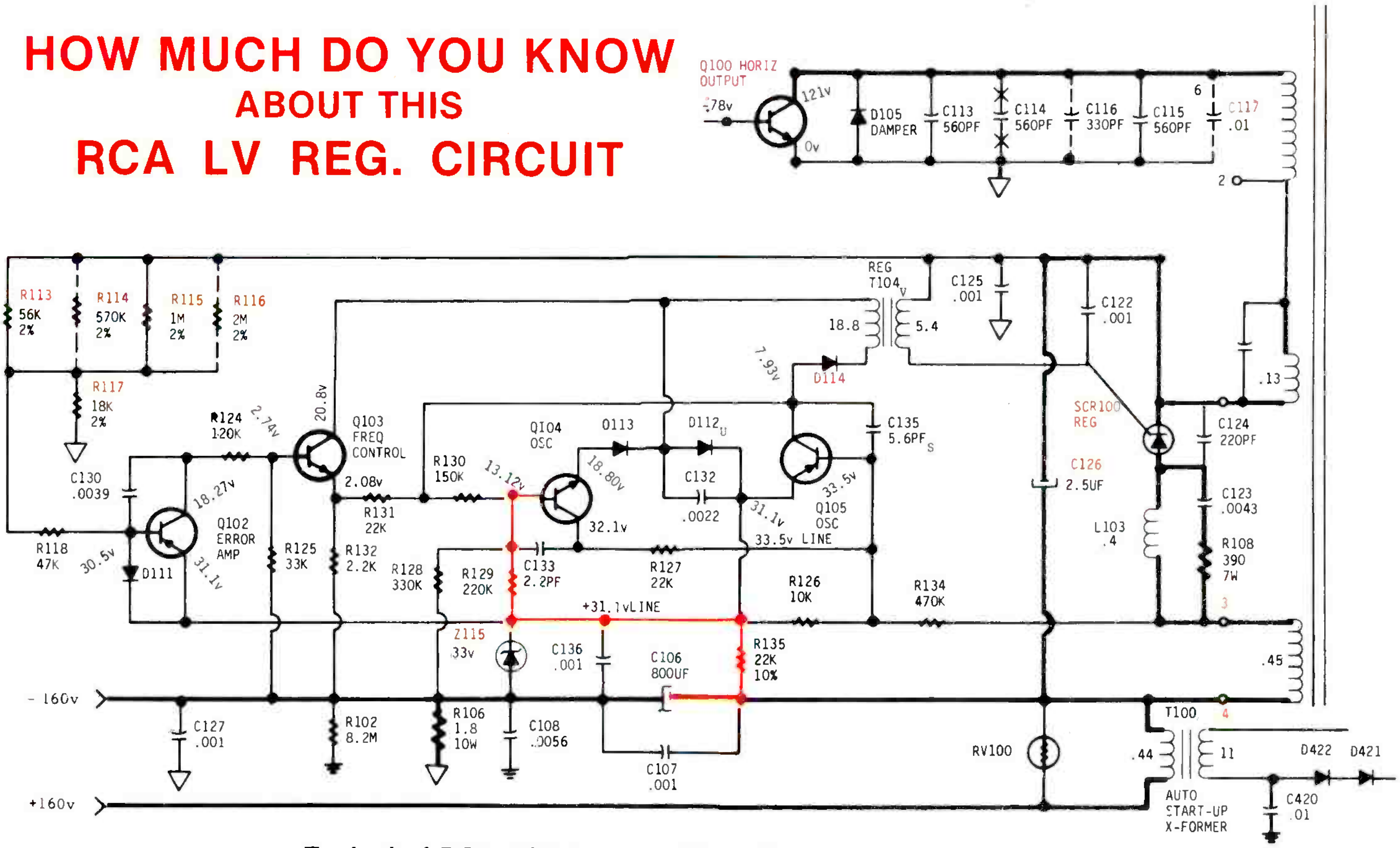


Figure 8. This is the complete video-switching circuit. Q4 is saturation biased to ground the Q6 base when external video is to be watched on the TV screen. Or Q10 is biased to saturation that removes the Q8 base bias when conventional TV video is to be viewed on the screen. Arrows show the signal paths. There is a station video signal at the J1 TV-video output jack as long as a station is tuned in by the tuner-control and tuner system. While external video is watched, station video is still at J1.

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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TV-video operation

For conventional TV operation, J23-1 must have 0V and J23-2 must have +11.8V for the Q4 and Q10 switching transistors.

Receiver video enters at J13-3 (Figure 8) and is passed through Q2, R8 and C4 to J1, the TV-video output jack. Also from the Q2 emitter, some video goes through R10 to the Q6 base (Q4 is not active because J23-1 has no voltage), exits Q6 at the emitter, travels through D2 (which is forward biased by Q6's emitter current) and R15 to the Q12 base. Q12 is an emitter follower, so the signal appears at the Q12 emitter and finally exits the board at J13-5 on its way to the receiver video and the picture tube. During this time, Q10 has had saturation forward bias from the +11.8V at J23-2, and the Q10 C/E conduction has removed all signal and base bias from Q8, so that the channel is dead, preventing any external video from interfering.

External video switching

Switching from the TV-video mode to the external-video mode is accomplished by pushing the A/V switch to *on* position that reverses the switching voltages. J23-2 now has 0V and J23-1 has +11.8V.

Incoming video at jack J2 goes first to level-control VR2 for manual amplitude correction. From VR2, the video passes through C6 to the Q14 base. Notice that Q14 and Q16 are connected in a cascode circuit (the Q14 emitter is connected to the Q16 emitter, while the Q16 base has bias but is bypassed to ground for video) that provides a high input impedance with low noise. Output of the cascode stage is from the Q16 collector that is tied to the Q18 base, with video output from Q18's emitter through C10 and diode D6 to the Q20 emitter. Actually, the base/emitter junction of Q20 plus D6 are used as a diode dc-restoration device that clamps the negative peaks to ground. The collector/emitter path also supplies dc voltage that helps provide the correct positive voltage for the Q8 base.

Video from the Q18 emitter (through C10) is sent to the Q8 base. We must pause to state that J23-2 has a 0V *low*, so Q10 is cut off and does not reduce the Q8

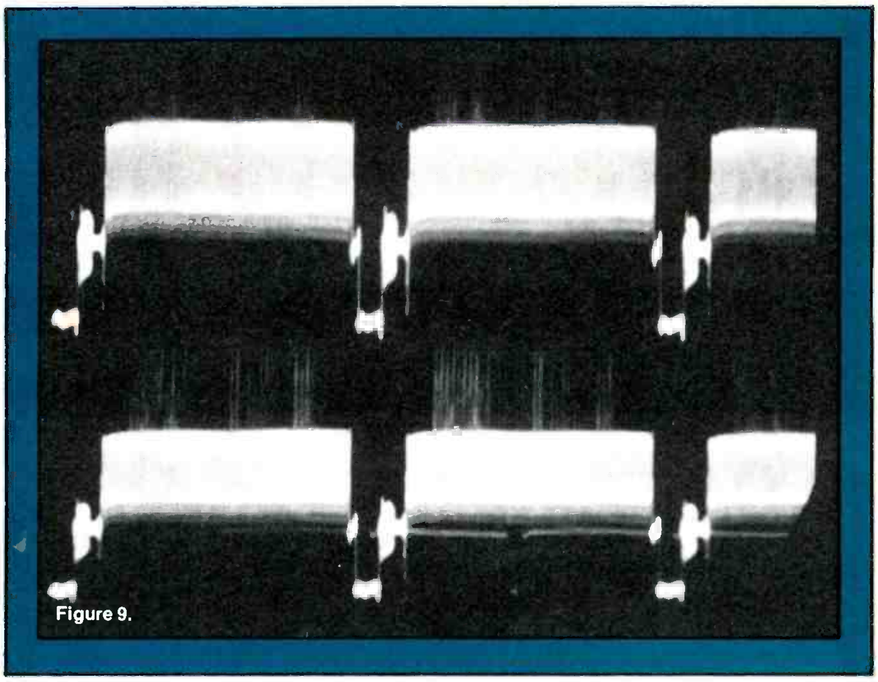


Figure 9.

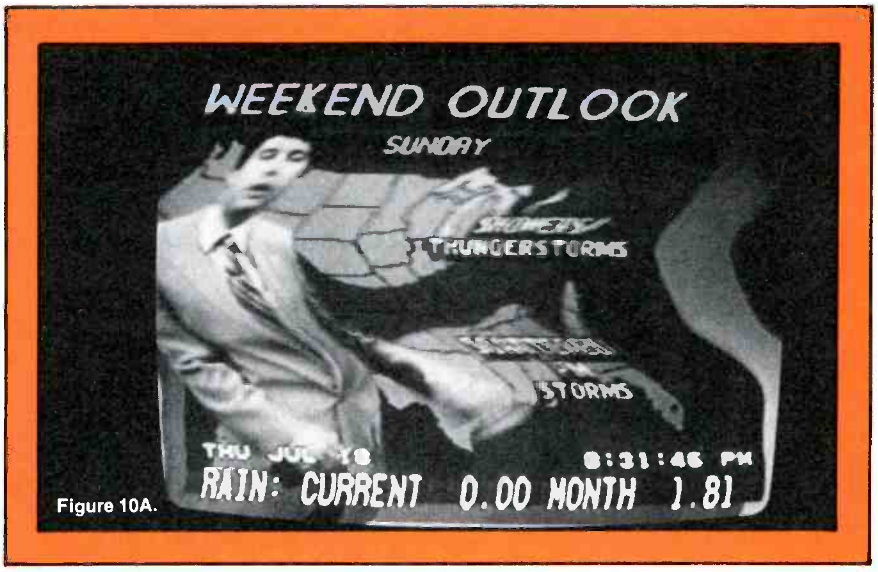


Figure 10A.

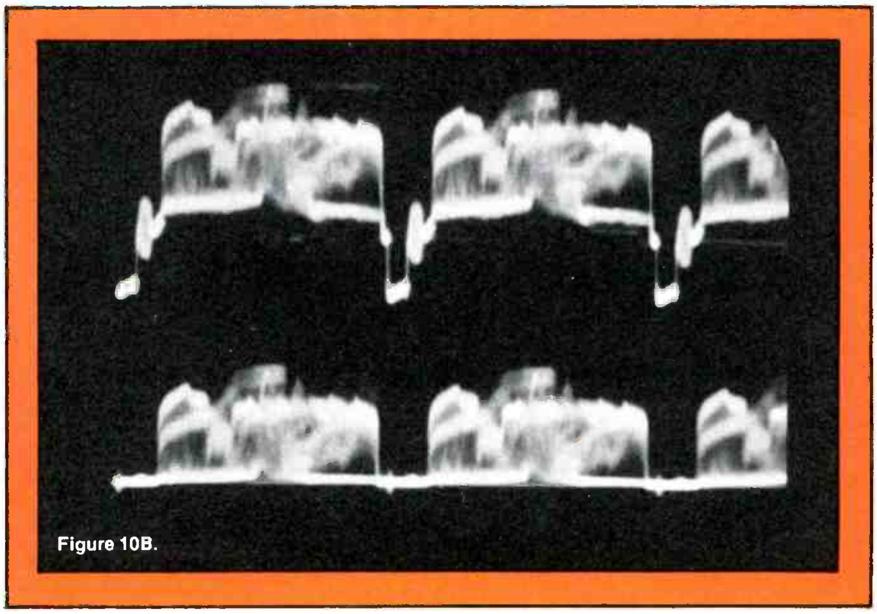


Figure 10B.

base voltage. Therefore, the video signal appears at the Q8 emitter, passes through D4 (which is forward biased by Q8's emitter current) and finally reaches the Q12 base. Q12 also is an emitter follower, so the video exits Q12 at the emitter and is sent to J13-5 and the receiver's video system. The video produces a picture on the screen.

Now the normal TV video from the video detector must be traced under the same switching conditions. J13-3 pin brings in the receiver-detector video to the Q2 base. Q2 is an emitter follower so the same video appears at the Q2 emitter. From there it is sent in two directions. First, through R8 and C4, the video is sent to external video jack J1. (Notice that video was there during the previous mode when TV video was viewed on the screen. *Receiver-detector video is available at the J1 video-output jack at all times* when a station is tuned in by the tuner system. That's why the J1 jack in Figure 8 is labeled "Constant TV video output." This was verified by scope waveforms, such as Figure 9.)

Figure 9. The top trace shows normal TV station video at J13-3 input pin when the A/V switch was at the *off* position that showed this video on the screen. An identical waveform, with slightly reduced amplitude, as shown by the bottom trace, was found at J1, the TV-video output jack. When the A/V switch was *on* (for external audio and video), the same bottom-trace waveform remained at J1.

Figure 10. Photograph A shows the picture-tube screen when the positive control voltage failed to reach J23 pin 2. There was no sound, the color was weak and erratic (sometimes missing), the picture had extreme bending (on some channels, the horizontal hold was lost), and vertical and horizontal locking were erratic. Most experienced technicians would take one look and declare the problem to be caused by AGC overload. (B) But the scope waveforms identify the area of the problem. The top trace is the incoming receiver video, while the bottom trace shows the negative-clipped waveform at D2's cathode. The expected +11.8V *high* at J23-2 should have saturated Q10, which then would have grounded the Q8 base, cutting off all Q8 emitter current so D4 also would be an open circuit, thus not interfering with the Q6 circuit. However, the *loss* of *high* at J23-2 allowed *both Q8 and Q6 to conduct simultaneously*. The Q8 current through D4 developed a positive voltage at R14 and the D2 cathode. Before the Q6 waveform can pass through D2, the signal amplitude must exceed this incorrect positive voltage. Therefore, the negative part of the Q6 waveform did not pass through D2. The waveform at the D2 cathode was missing all negative waveform tips, which included the vital sync tips. Lack of sync tips gave the poor horizontal locking and other symptoms. The analysis was proved when a jumper wire was connected across D2 and the picture and sound became perfectly normal. The solution was to repair J23 to thus obtain correct A/V switching.

Also, the receiver video passes through R10 to the Q6 base, but a +11.79V *high* is present at J23-1, giving Q4 a saturating forward bias of almost 0.8V. The resulting Q4 collector-to-emitter short grounds the Q6 base with its dc bias and ac signal. Q6 has no forward bias and no input signal, thus it has no C/E current. D4 already is conducting the Q8 emitter current; therefore, D2 is reverse biased into an open circuit. The only signal reaching Q12 is the external video from Q8. This external video forms the picture on the CRT screen.

In summary, saturating dc voltages are applied to Q4 and Q10 bases as needed to force them into shorting out undesired video signals. Also, the J1 TV-video jack on the panel always has a station video signal (regardless of the A/V *on/off* switch position) as long as the tuner system is tuned to a TV station while there is an antenna or cable to supply a proper RF signal.

A quick switching test

After I became familiar with the Figure-8 switching circuit and its normal waveforms, I wondered what would happen if J1 TV video-output jack was connected to the J2 incoming-video jack (remember J1 always has a normal video waveform when a station is tuned in – whether or not it is viewed on the screen). In that case, the signal would go from the video detector and Q2 to J1 and then through a shielded cable to J2 and the external video channel (Q14, Q16, Q18 and Q20). From Q18, the signal would go to Q8, then to Q12 and finally exit at J13-5 to the receiver's video amplifiers, chroma system, etc, and finally the picture tube.

In practice, this is an excellent and rapid test of virtually all stages in the video-switching system. With the A/V switch in the *off* position, the video goes from J13-3 through Q2, Q6 and Q12 before it leaves the switching board by way of J13-5 on its way to the receiver's video/chroma system and the picture tube-screen. This is normal TV operation.

With the A/V switch in the *on* position (for external video), the video signal enters at J13-3, goes through Q2 and exits at J1 output. *The shielded test cable connects the J1 signal with J2,* the incoming-video jack. From J2, the signal passes through the entire external-video chain including Q14, Q16, Q18, Q8 and Q12 before exiting at J13-5, which connects to the input of the video/chroma system that supplies the picture tube.

When the A/V switch still is in the *on* position (for external video), adjust the VR2 external video gain control (which is located beside J2) until the contrast is the same as it is with the switch in the *off* position (the one for TV reception).

As you operate the *on/off* A/V switch slowly, watch the picture carefully. Immediately following each mode change of the A/V switch, the screen brightness increases and then returns to normal. Ignore that; it is only coupling capacitors charging. Notice if there is any change of picture quality as the switch is changed from *on* to *off* to *on* to *off*, etc. In the sample 19C4 receiver, no change of quality could be seen, either on the TV screen or in scope waveforms.

This test has great value because it tests the entire circuit, including the paths of both internal and external video to the picture tube. Any degradation of picture quality in either the external or the external test (A/V switch *on* or *off*) indicates a problem and shows approximately where it is located.

Strange symptoms

Switching circuits that are controlled by dc voltages (and especially circuits that use switching diodes) can produce some strange symptoms from certain defects. In fact, the symptoms can be so illogical that normal troubleshooting procedures are almost useless. For example, an intermittent open in the switching dc voltage to the diode-operated RF switcher might cause an interfering signal to fade in or out slowly

as a capacitor charged or discharged.

Perhaps these are a few reasons that NAP recommends the diode RF-switcher box be replaced rather than repaired. However, it is possible to prove or disprove whether an RF switcher has a defect just by disconnecting it and cabling the RF inputs one at a time direct to the tuner input.

Repairs in audio-switching and video-switching circuits are less critical than in RF-switching circuits, partially because these circuits are more immune to interferences. Therefore, less shielding is necessary. But the symptoms can be equally mysterious.

For example, when the Sylvania first was unpacked, it did not operate correctly. There was no sound. The picture had horizontal pulling and often rolled vertically or lost horizontal locking occasionally. Except for the missing sound, it appeared to be a classic example of severe AGC overload. By the time the back was removed and troubleshooting could have been started, the sound and picture were normal, and tapping and probing around the receiver did not trigger the problem. During the following weeks while the receiver was being studied and measured, it lost sound and started picture instability several times. Unfortunately, the problem did not continue long enough to be identified.

Finally, the dead sound and unstable picture occurred, and was not sensitive to the slightest movement, as it had been before. By working carefully, I found certain groups of connecting wires (bound together with plastic ties) that would start or stop the problem when the bound wires were moved a small distance in a certain direction. After considerable searching, I found maximum sensitivity to slight movements of a small 2-wire cable that connected the front-panel switches with J23 on the audio/video switching and input/output circuit board. Examination of J23/P23 with a magnifying glass showed the metal inside the female jack (on the cable) was not positioned correctly. When pin 2 of the jack was repaired by moving the metal into position (where it locked in place) and the jack attached to the plug on the board, the intermittent was corrected.

Later, to verify the facts and obtain the Figure 10 photograph and waveforms, I pulled off the J23 jack and then plugged in only pin 1. The resulting symptoms were exactly as described: no sound, weak and intermittent color, erratic vertical and horizontal locking, and horizontal pulling of the picture. Tracing with a scope showed clipping of the negative-going sync occurred in diode D2. Because the +11.79V was not available at J23 pin 2, Q10 did not remove the base bias from Q8. Therefore, the Q8 emitter current passed through diode D4, producing a positive voltage at the D4 and D2 cathodes. The Q6 signal and dc emitter voltage was forced to overcome this positive voltage before the video could pass through D2. Thus the clipping. (A test lead connected across D2 brought correct operation, which proved the previous statement.)

This is just one example of the strange symptoms that can develop from single defects in these switching circuits. I value scopes, DMMs and other high-tech test equipment for troubleshooting, but there is a time for doing simple things, such as finding what component or wire can trigger an intermittent from the least amount of force or movement. Just be prepared to begin using sophisticated equipment if the simple tests don't work within a short time.

Comments about RF switching

Technicians are more familiar with solid-state diodes as detectors or demodulators. Therefore, questions about Figure 3 might arise. Why don't the diodes rectify the RF signals, perhaps causing intermodulation problems? How much loss of signal occurs in these electronic switches? Is there 0.8V loss for each diode?

First, the signals are not rectified because the dc voltages prevent it. Before a reverse-biased diode can rectify, the signal amplitude must exceed the reverse voltage plus the 0.7V or so needed to overcome the diode's reluctance to rectify. And a diode with 0.8V of forward bias has an effective internal resistance in the low hundreds of ohms (depending on the current). No, these limitations vs. the very low amplitudes of the RF carriers prevent rectifications.

I suppose signal loss could be calculated, given all pertinent data. But I used a field-strength meter, measuring the input level (separate from the switcher) and then the switcher's output level. Channels 4 and 6 showed about 2dB loss through ACC1 (the switcher with two extra diodes), while the ACC2 and ACC3 switchers measured about 1.5dB loss. It is difficult to be more precise, for the video carrier reading varied according to picture modulation.

In visual tests, no difference could be noticed when comparing direct cable operation with the same cable through ACC1 switcher, probably because of considerable snow from the cable amplifiers. I would not recommend electronic diode switching for fringe-area reception.

Interference between the three switching inputs was evaluated by applying a strong cable signal to ACC1 and an equally strong, different cable signal to ACC2. Watching on ACC3, there were no carriers or any interference on lowband channels 2 through 6. But on highband channels (7 through 13) faint station signals could be seen through the heavy snow with strong co-channel horizontal lines on each channel. These co-channel lines evidently were produced by weak signals leaking from ACC1 and ACC2 to ACC3. However, any reasonable carrier strength at the ACC3 input probably would have masked this small leakage.

All factors considered, RF switching is an excellent feature for all but fringe-area locations.

Next month

I have delayed coverage of TV stereo audio while hoping a local station would begin broadcasting with stereo so a report on listening quality could be included. However, the local NBC station does not know when it will install a new sound transmitter.

The next part will cover the Sylvania Superset Two stereo audio system, from the special stereo decoder, the stereo electronic switcher, twin power amplifiers with balance and tone controls operated by dc voltages, and the separate twin speakers.

News

Switches and relays basics on latest training program

NEDA's Electronic Distribution Education Foundation and the Electronic Representatives Association announce the latest videotape training program on electronic components: "The Basics of Switches and Relays." This one hour program provides a thorough review and definition of the terminology specific to switches and relays, load parameters, major switch and relay families and operations methods. General application information is provided for each type of switch and relay.

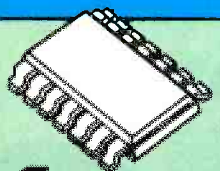
Previous programs include "An Introduction to Passive and Electromechanical Components" (an overview of these component categories), "An Introduction to Semiconductors" and "The Basics of Microprocessors." For further information contact Mary Sue Lyon, executive director of NEDA's Electronic Distribution Education Foundation, 35 East Wacker Drive, Suite 3202, Chicago, IL 60601, 312-558-9114.

Hybrid circuits boosted by new technology

New techniques in hybrid technology – a method of assembling electronic circuits using a substrate with interconnecting tracks, onto which components such as semiconductor chips can be attached – will expand the European market for hybrid circuits to a degree that it will grow fivefold by 1989.

"The Hybrid Circuit Market in Europe," a new study by Frost & Sullivan, says growth in the field will average nearly 35% a year, rising from $663 million in 1983 to $813 million in 1984, to $1 billion by 1985 (in current dollars) and to $3.9 billion by 1989.

Surface mount techniques (SMT), an emerging technology that uses an adhesive to bond the circuit together temporarily before subsequent soldering, will have a profound effect on the market. ES&T



Repair techniques for surface-mount components

By Christopher H. Fenton

State-of-the-art surface-mount components are rapidly replacing standard leaded components that have wire leads which are inserted through plated holes in a printed circuit board and then soldered. As a result, the need has arisen for servicing equipment and repair techniques designed specifically for removing and resoldering failed surface-mount components in the fastest, most cost-effective and professional way possible.

Unlike leaded components, surface-mount components have short, winged leads for solder attachment of the component to the surface of a printed circuit board, allowing components to be spaced closer together. Increased circuit density and the smaller size of surface-mount components may reduce the overall size of a printed circuit board by as much as one-third.

Caution

CAUTION: Before removing a surface-mount component (or any kind of IC) from a printed circuit board, you should ground the printed circuit board to avoid possible electrostatic discharge damage. This must be done because it is often difficult to recognize components that are susceptible to degradation or destruction without knowing the history of every component on the board. Therefore, it must be assumed that all components are vulnerable. The printed circuit board must be grounded at all times during the repair operation and you should be grounded too, by means of a wrist strap device, which drains electric buildup away before it can discharge through the circuit board.

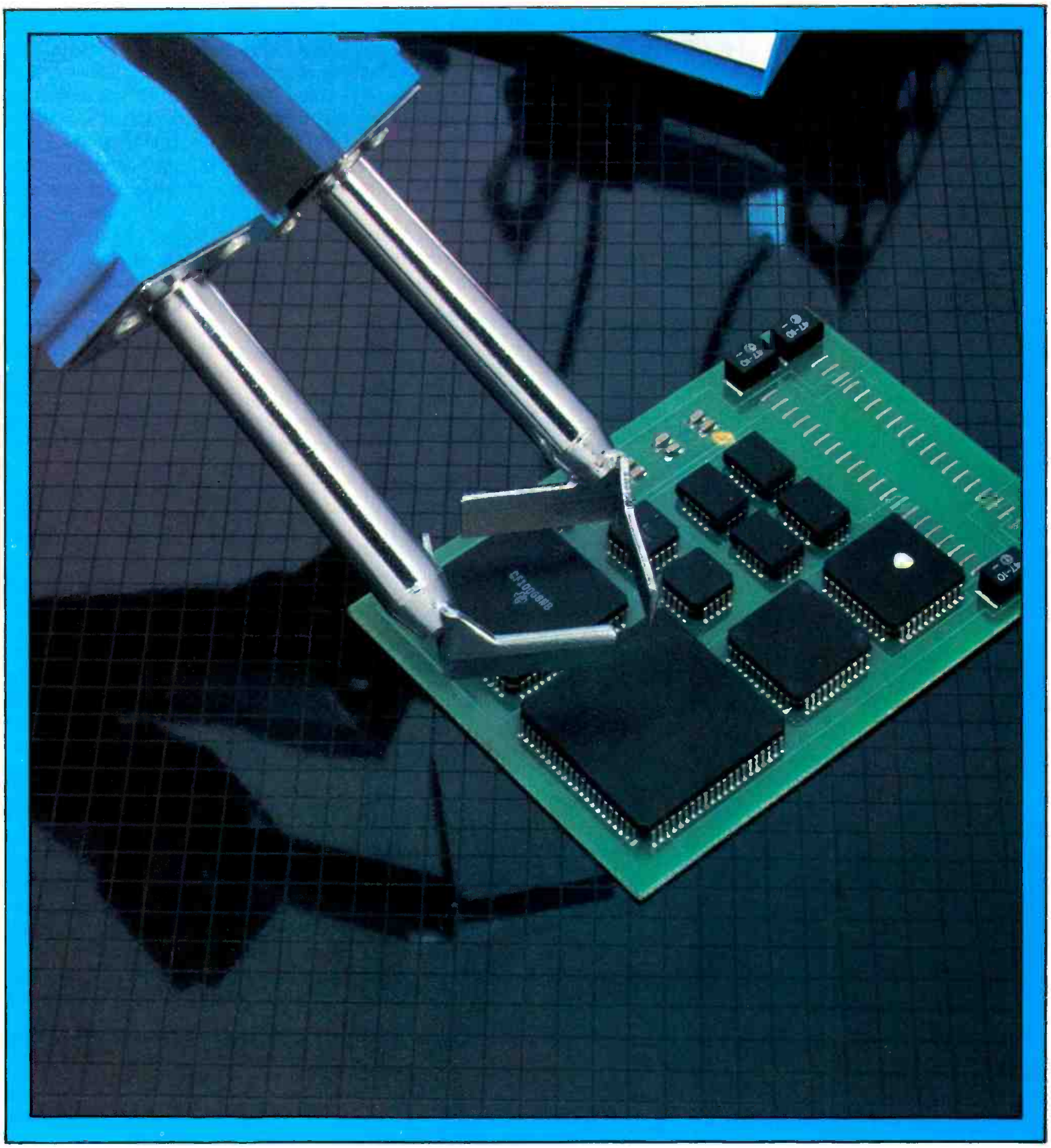
Without through-hole leads, and with multiple-lead contacts spaced closely together holding the component to the surface of the printed circuit board, the problem with removing/resoldering a surface-mount component is simply stated: A surface-mount component may only be removed when all the solder connections between the component's contacts and the printed circuit board have reflowed. Conversely, in order to reattach a new device, all solder connections for the new component must be made at the same time. With some surface-mount packages requiring as many as 75 solder connections for a single component package, the problem is obvious: How does a technican solder all of these connections simultaneously? It sounds impossible, but it can be done quickly and efficiently. Currently there are two methods of removing and replacing a failed surface-mount device: conductive heating and convection heating. Conductive heating uses a direct contact approach to remove and to resolder a surface-mount component. Convection heating uses hot air to remove and resolder a surface-mount component.

Conductive heating

Conductive heating is identical to using a soldering iron to remove and to resolder components, except that all component connections are soldered at the same time. After a failed device has been located, a hand-held heated probe is used to remove and to resolder it. The heated probe has two L-shaped nickel tips, each of which is designed to contact and to reflow solder joints on all four sides of the component simultaneously. The heating tips are mounted at the ends of two short metal tubes containing heating elements and are connected to a hinged handle similar to a pair of tongs. This tong action allows the operator to align the tips of the heated probe to all four sides of the component package. Heated probes are available in sizes ranging from 0.185-inches to 1.5-inches in square or rectangular shapes. Anyone who has occasion to replace surface-mount components on a regular basis should have several heated probes of various sizes and tip configurations.

Fast and effective component

removal/replacement depends on the amount of heat transferred between the component's solder joints, substrate material and the heat source. The idea is to transfer the greatest amount of heat from the heat source in the shortest amount of time to reflow solder connections quickly and efficiently. Inspect the solder fillets at the component's contact tabs and footprint junction on the board. A solder fillet is the concave junction formed by the solder between the footprint pads and the component contact tabs. If the solder fillets are small or are void of solder, solder should be added to the connection. Solder paste used sparingly is sufficient. Solder is added to the solder fillet so that when it comes in contact with the heated probe, the solder joint should conduct as much heat as possible to the rest of the solder joint. This immediately floods the portion of the solder fillet that is bonded to the footprint pad, resulting in a fast and efficient exchange of heat. With some components, especially those with lead contact narrower than the footprint pad, the solder fillet helps spread the heat to the outer edges of the solder joint. Efficient heat transfer is imperative to minimize the risk of ruining a



component by lingering too long on the component with the heated probe.

Circuit boards with ceramic substrates and boards with large heat sinks should be preheated before component removal. Preheating must be done in order to reduce the heat draining effects of heat sinks and to reduce localized thermal expansion that may crack a ceramic substrate.

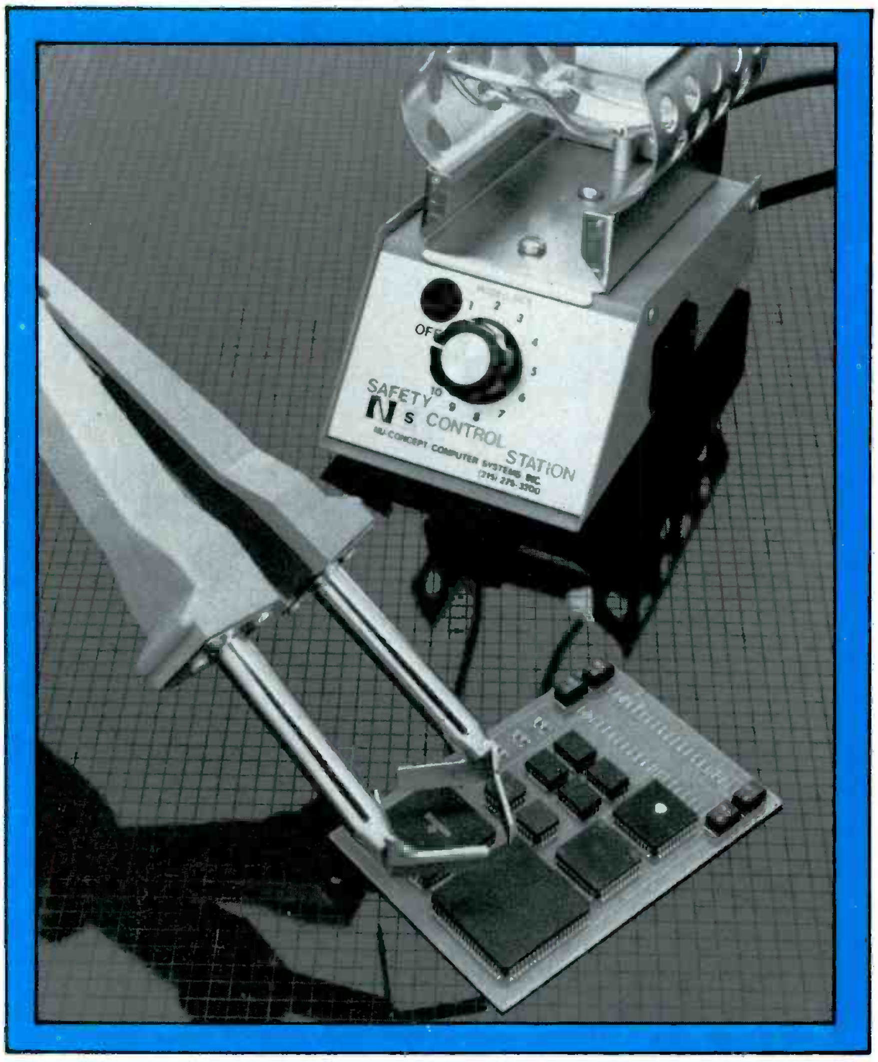
Removing the surface-mount component

To remove a surface-mount component, the board should be secured in a grounded holder or placed on a grounded surface. The heated probe then is plugged into a controller unit. This unit enables the technician to vary the temperature range of the heated probe for different types of component packages and other applications.

Liquid flux then is applied to all solder points on all sides of the component. This not only improves the heat transfer characteristics of the solder fillets but, also, provides a clean surface on the board's footprint pads for soldering a new component.

Position the tips of the heated probe around the edges of the failed component, parallel with the board's substrate. Firmly grasp the component with the tips of the heated probe so that they contact all four sides of the failed component simultaneously. After the solder has reflowed on all solder joints, raise the heated probe with the failed component in between the tips of the heated probe. The inside dimensions of the tips are less than the outside dimensions of the failed component when the tips of the heated probe are closed, allowing the heated probe to pick up the failed component.

To remove/replace a chip capacitor, resistor or other passive components, a different type of heated probe, having parallel tips, is used. This type of heated probe is available with various length tips for removing and resoldering components that have multiple lead contacts on parallel sides of a component. The procedure for removing and resoldering a component is the same.



The L-shaped tips of the heated probe allow the probe to grasp all four sides of the component and reflow all solder connections for the component at the same time. (*Photo courtesy of Nu-Concept Computer Systems*)

Installing the replacement component

Before resoldering a new component, pre-tin the component's contacts in order to ensure good solder flow between the component and substrate. Pre-tinning also replaces solder left on the failed device when it was removed from the printed circuit board to the board's footprint pads. The board footprint pad should be examined for a clean solder surface and for consistently sized solder beads. Any solder bridges that may have formed during the removal procedure should be removed before resoldering a new component. If more solder is required on the footprint pads, solder paste should be applied sparingly. Too much solder paste may result in unwanted solder bridges and too little may result in an open or weak connection.

The new component is placed in position and aligned by hand with the board's footprint pads. Then position the tips of the heated probe against the component's lead contacts and push lightly against the substrate surface. When the solder has reflowed evenly on all connections, remove the tips of the heated probe and allow the surface tension of the molten solder to pull the component into final alignment with the solder fillet.

Fast and effective, the heated probe is the simplest way to remove a surface-mount component package. It requires very little training and takes an average of four seconds to remove a defective component. Resoldering a new component takes about the same amount of time. It does, how-

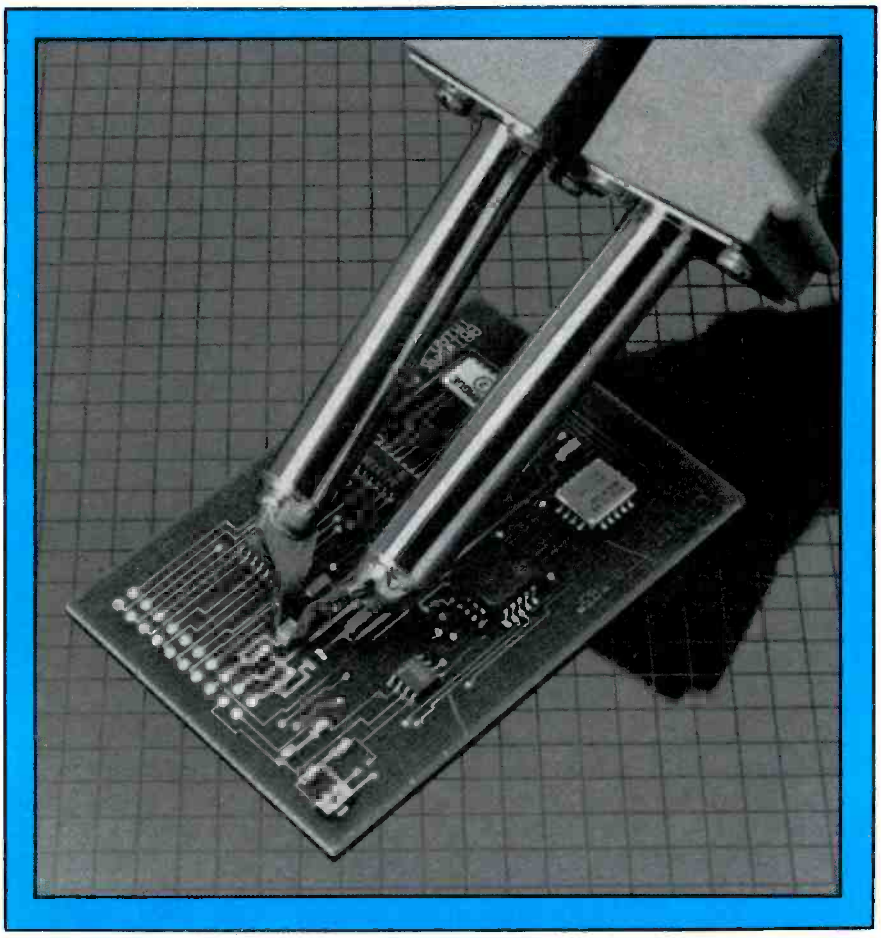
ever, require a little more dexterity than the removal procedure.

Heated probes have a limitation. Their use is limited on circuit boards with high component densities because it is impossible to operate the heated probe without room to open and to close the probe's tips. For boards with high component densities, there is another method of removing/replacing surface-mount components called convection heating.

Convection heating

Convection heating uses hot air to remove and replace a failed component from the surface of a printed circuit board. Using a machine called a HART (for hot air repair terminal), the convection method preheats the printed circuit board before reflowing the solder connections for component removal/resoldering.

The convection system uses low



Passive components and components with leads on two parallel sides of a component require a heated probe with two parallel tips for component removal/resoldering. (*Photo courtesy of Nu-Concept Computer Systems*)

A Basic Surface-Mount Glossary

With the ever-changing state of electronics technology, it sometimes helps to know exactly what you're talking about. The following is a basic primer on some of the terms associated with surface-mount technology.

Contacts: the wing-shaped leads protruding from the component package body that are electrically conductive and are used for solder attachment.

DIP: dual in-package – an integrated circuit that has two rows of pins for through-hole mounting along the two longest parallel sides of the component.

Fillet: a junction formed by solder between the board footprint pads and the component's contacts.

Footprint: the group of board contacts corresponding to the leads of the component package to which it is soldered.

L.C.C.C.: leadless ceramic chip carrier – a component package containing an IC, which is mounted to a printed circuit board as a surface-mount component. Made from a ceramic material, it is hermetically sealed and can withstand high temperatures. Instead of wire leads, it has contact tabs around the perimeter of the component package for solder attachment.

Pads: lead contacts – the individual contacts of a printed circuit board's footprint.

Pre-tinning: applying solder to the component's contacts or tabs and to the board's footprint pads to improve solderability characteristics before soldering a new component in place.

SMC: surface-mount component – a component that is mounted to the surface of a printed circuit board's substrate, instead of being soldered through plated holes as in a standard printed circuit board.

SOIC: small outline integrated circuit – a component package that houses an integrated circuit chip for surface-mounting; approximately one-third smaller than conventional integrated circuit packages.

Solderability: the capability of solder to reflow and wet the circuit board footprint pads and the component leads during component removal and resoldering.

Solder reflow: the point at which solder paste applied to both the component contacts and the board substrate footprint pads, melts or reflows. The solder from both the component and substrate contacts reflows to form or to break the solder fillets depending on the repair operation.

Substrate: the material that forms the base of the printed circuit board – usually made from a fiber-glass-epoxy composite or a ceramic material.

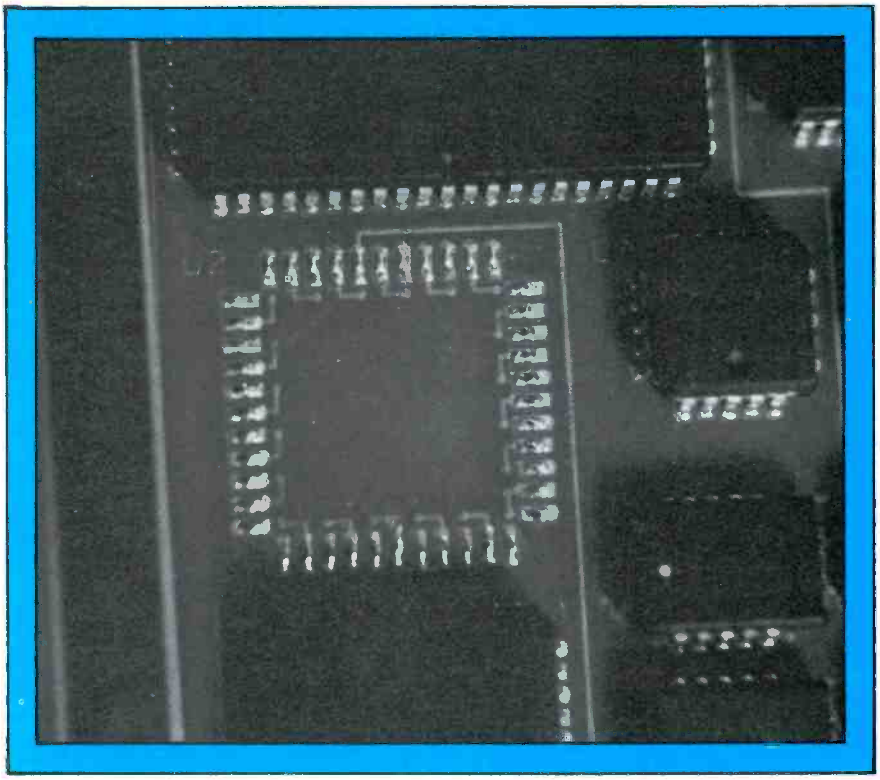
TCE: thermal coefficient of expansion – the rate at which a component and substrate expand when exposed to heat, expressed in parts per million per Celsius degree (ppm/°C). The TCE of the component must be matched to the TCE of the substrate in order to minimize thermal stress from warping or cracking the printed circuit board.

Through-hole board: a printed circuit board that has plated holes through its substrate in which wire leads are inserted and then soldered to the other side. Currently the industry standard.

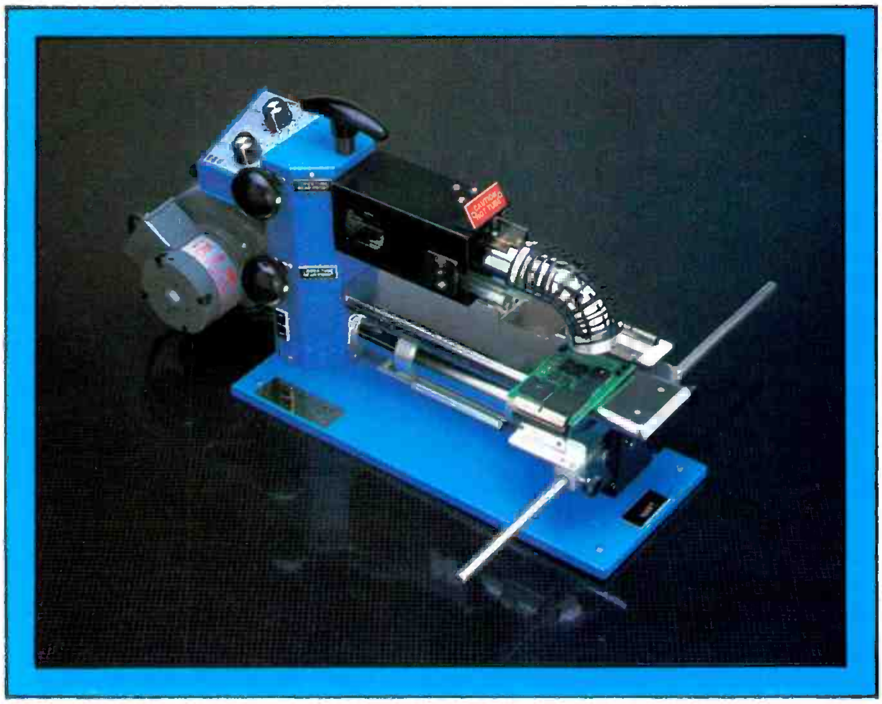
pressure hot air directed toward the failed component and the area surrounding the component to reflow all solder connections simultaneously. There is no direct contact between the heat source and component and board surface.

The printed circuit board is clamped into a platform between two air tubes that are connected to a blower. The top tube provides hot air to reflow the solder connections and the bottom tube directs a flow of cooler air onto the bottom surface of the printed circuit board to prevent the circuit board from overheating, which could ruin components. The platform can be adjusted so that the component to be replaced is directly placed in the hot air flow. The desired temperature is set on the desoldering machine, or a temperature-indicating liquid is applied to the top of the failed component. A temperature-indicating liquid is a milky colored fluid that becomes clear when it is heated to within 1% of its given temperature. This is the most reliable indicator of solder reflow.

After the circuit board has been secured in the platform of the machine, the platform is adjusted to place the component directly in the flow of hot air from the upper



Evenly sized solder fillets are essential for effective component removal/replacement. (*Photo courtesy of Nu-Concept Computer Systems*)



The HART (hot air repair terminal) uses hot air to reflow all of a surface-mount component's connections at the same time. There is no direct contact between the heat source and the component. This reflow soldering technique uses only hot air. (*Photo courtesy of Nu-Concept Computer Systems*)

tube when the machine is turned *on*. Components adjacent to the failed component are not susceptible to degradation or damage because the removal temperature used does not exceed the reflow temperature used during the manufacturing process.

After the machine has warmed up for a few minutes and after the temperature-indicating fluid has gone clear, the solder fillets are molten and the failed component can be removed with a pair of tweezers. Circuit boards with large heat sinks may require more time in the air flow to compensate for the thermal-draining effects of heat sinks. The average component removal time is approximately 25 seconds.

In order to reattach a new component, the board's footprint should be examined for evenly sized solder beads and for solder bridges. If more solder is required, solder paste can be used in the way described previously. Solder bridges should be removed at this point in the operation.

As with conductive heating, a pre-tinned component should be used to ensure good solder flow between the component and the board's footprint pads. Components can be pre-tinned by applying solder paste to the component's contacts and then placing them upside down on the platform directly in the hot air flow.

Liquid flux then is applied to the board's footprint pads. Next, the component is placed in the liquid flux by hand and generally aligned. When the component is soldered, the surface tension of the solder will float the component package, pulling the component into final alignment with the footprint pad.

If the circuit board has been removed from the platform after the component removal operation, reposition the circuit board so that the failed device is directly in the hot air flow. After setting the temperature or after having applied temperature-indicating liquid to the top of the new component, turn the machine on. When the indicating liquid has gone clear, the resoldering process is complete. If the component has failed to line up correctly, the component may be repositioned with a pair of tweezers while the component's solder joints are still molten.

With the increasing use of surface-mount components in the computer, automotive, and consumer electronics industries, a technician must know how to effectively remove and resolder surface-mount components in the most efficient way possible.

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Part 3

Servicing videocassette recorders

Preventive maintenance for a VCR

By Neil R. Heller

In the second article in this series, we covered the methods used to troubleshoot and to adjust the videotape recorder properly. In this article, the last of the series on VTRs, we will concentrate on preventive maintenance. The purpose behind preventive maintenance is to preserve the usability of the recorder throughout its life. This means that the operator shouldn't wait until the unit fails to perform maintenance, but should perform maintenance at regular intervals when scheduling permits. The key components of the recorder that require maintenance are those which are in constant contact with the videotape. Basically, these key recorder components are the video head and the rubber drive elements. Preventive maintenance is a combination of both component replacement and recorder cleaning.

Preventive maintenance—why?

Preventive maintenance is required because of the abrasive nature of videotape. Regardless of manufacturer, the oxide particles on the tape surface, which are abrasive, rub against the video head and rubber drive element, wearing them down like extremely fine grade sandpaper. The effect is similar to polishing an object. In the case of the video head, the wearing down of the head surface means a gradual loss of head-to-tape contact. This, in turn, shows up as a loss of recording and playback signal. Worn rubber components lose their capability to make proper contact with their associated drive components. As a result, functions such as timing, which require accurate tape motion, become inaccurate. Also, rubber components and video heads deteriorate, harden, crack and flake off over a period of time. Outside contaminants, such as dust and dirt, can contribute to the deterioration of recorder performance.

Preventive maintenance—when?

Preventive maintenance begins with exercising care when the recorder is installed. Long usage under poor environmental conditions can affect both performance and lifespan of the unit. The environment should be dust free and maintain reasonable temperature conditions. Large swings in temperature can cause rubber components to contract and expand, causing them to lose their original shape. Even in units operating under constant air conditioning with low humidity conditions, the rubber may crack due to dryness. In general, recorders like outside temperatures in the 60° to 70° range with a reasonable amount of humidity. Most manufacturers recommend that recorders not be operated in temperatures greater than 40°C (104°F). Remember that this condition is not just dependent on outside temperature conditions. The recorder's internal electronics, particularly the power transformer, generate heat. The recorder's operating condition must take into account both the external and internal temperature conditions.

The drive idler system

The drive idler system is primarily responsible for the loading and the movement of tape. As such, these parts are constantly under a great amount of stress. In early VHS designs, the functions of *rewind, fast forward* and *play* were done by a series of main and intermediate idlers. Newer designs, especially those found in low-cost units, have placed these multiple responsibilities on a single idler drive. Low-cost recorders are

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a result of cost-down designs. While this is an advantage for the consumer, it has created a need to pay even greater attention to the requirements of preventive maintenance.

When considering the need for preventive maintenance, you must take into account that wear factors due to environmental conditions are also present when the unit is not operating. In fact, "not operating" your recorder for long periods of time can create problems. Most of the recorder's drive idlers are made of rubber. During prolonged periods of inactivity, these rubber idlers melt into each other. When this occurs, the rubber idlers can slip against each other causing a failure of the tape-loading system. At other times after the loading cycle is finished, deformed play idlers can result in irregular tape movement. Either incomplete tape loading or movement within any five-to-eight second period, can result in the activation of the recorder's fail-safe system, withdrawing the tape into the cassette. Manufacturers recommend that maintenance be performed on the drive idlers every 500 to 1,000 hours. Ordinarily this procedure consists of component replacement. However, when replacement parts are not readily available try cleaning the idlers with cotton or a soft cloth dampened with alcohol. Cleaning dirt from the idlers will help to generate greater amounts of take-up and drive torque. This solution is temporary, and replacement eventually will be required.

The capstan pressure roller and drive belt

Another important rubber component is the capstan pressure roller. It controls the smooth movement of tape by pressing the tape against the capstan shaft. As previously noted, the constant movement of the videotape against the rubber polishes its surface. This causes slippage, resulting in jerky tape movement that prevents consistent contact with the audio/control track head. This in turn leads to reduced audio response and to servo instability. As this condition worsens, the pressure roller will meet the capstan shaft at an angle, forcing the tape to ride up over the post and destroy the tape. Inspecting the pressure roller is a simple matter of using your eyes. When the surface in contact with the tape appears polished, replace the roller.

On the other side of the tape from the pressure roller is the capstan shaft. Although this a fixed metal shaft, in cases where it is not directly driven by a motor (direct drive capstan motor), the lower section of the shaft is mounted to a flywheel that is connected to a drive motor by a belt. As the capstan belt wears, it will take on the same characteristics as the worn pressure roller. The section of the belt in contact with the capstan flywheel and motor roller will become shiny. This also is an indication that the belt has become stretched out and can no longer transmit the speed changes from the motor to the capstan flywheel. As in the case of the pressure roller, this condition looks like a servo problem.

The brake system

The recorder's brake system consists of arms to which are attached soft pads that press against

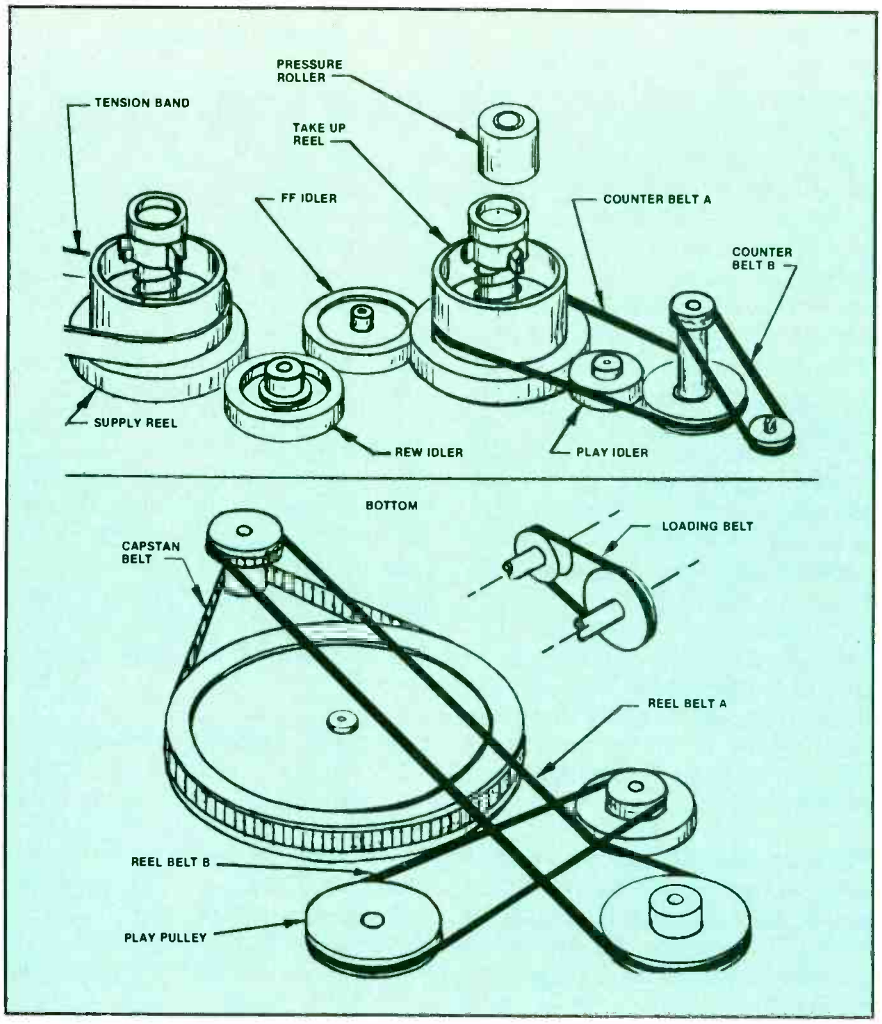


Figure 1. In the early VCR designs, the functions of *rewind, fast forward* and *play* were done by a series of main and intermediate idlers. This more costly scheme spread the stress over a greater number of components.

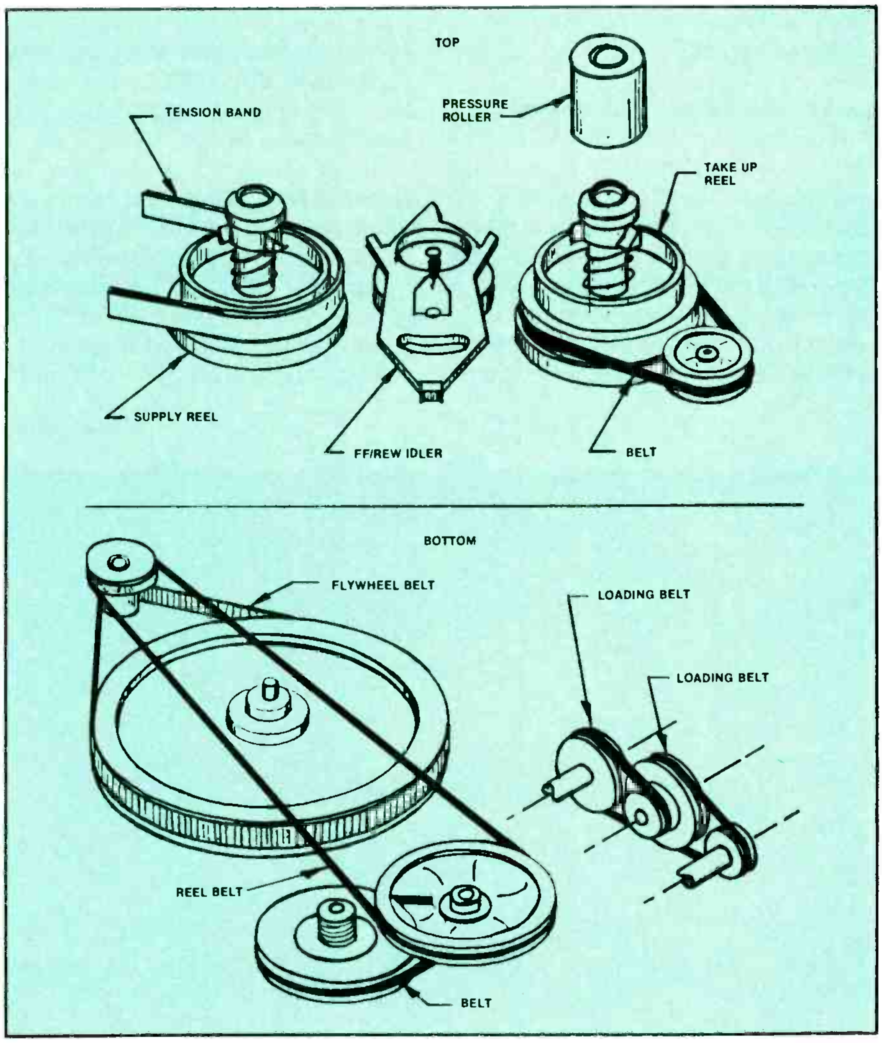


Figure 2. Today's low-cost units have placed great responsibility on a single idler drive. This costs less to manufacture, but is subject to earlier failure.

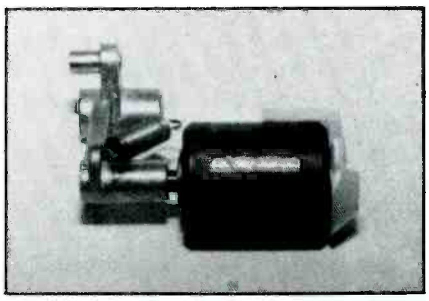
the supply or take-up reels, depending on the mode of operation. In the *stop* mode, the brake is applied to the supply reel to hold it firmly in place while the take-up reel continues to turn to load the tape coming off the video heads. Brake pressure not only is applied to the reel tables in the *stop* mode but during *ff, rew, search* and *cue* modes, the brake system provides back tension to the supplying reel. As the brakes wear, this retaining tension lessens. The effect is particularly noticeable in high speed modes because much tape slack is produced. If the recorder is left unattended in one of these modes, enough tape can spill into the mechanical section of the recorder to jam and cause the unit's fail-safe system to activate. When this occurs, the result usually is a damaged tape. Part of the 1,000 hour preventive maintenance check should include the removal of the cassette compartment in order to check the condition of the brakes.

The back-tension band

Another important component that uses the same type of material as the brake pads is the back-tension band. This is attached to a metal band that is wrapped around the supply reel. The tape tension post is located at one end of the metal band. As tape is moved from the supply to the take-up reel, the back tension decreases. The tension post and back tension band system is designed to maintain constant back tension regardless of tape load. As the back-tension band wears, the surface of the pad becomes smooth and is unable to keep its grip on the supply reel. When this occurs, more pressure will be required in order to maintain the same amount of tension found under normal conditions.

Symptoms of a worn back-tension band usually will show up in the TV picture when a tape is played. As back tension changes during the playback of a prerecorded tape, so does the angle of the video tracks. The pitch of the video tracks will determine the timing of the reading horizontal sync by the video heads. The playback monitor expects to see horizontal at set periods that correspond to the scanning rate of its beam. When the horizontal sync pulses from the playback tape are displaced, the monitor attempts to correct itself. The time it takes to do this depends upon the individual monitor's horizontal automatic frequency control (HAFC). This results in a large bend known as skew, starting at the top of the picture. The degree of skew error will be a combination of the amount of back tension band wear and the speed of the monitor's HAFC circuitry. Skew error is less noticeable on the playback of a self-recorded tape because the pitch of the recorded and playback video tracks are the same.

Most recorder manufacturers recommend the use of a Tentelometer for checking and setting up recorder back tension. Using a standard length cassette, (for example, for VHS a standard length cassette would be a T-120) check to see that constant back tension is maintained at the beginning, middle and end of the cassette. As each tape format has its own back tension requirement, it is necessary to refer to the individual manufacturer's service manual for details.



The shiny area indicates roller wear.

Servicing videocassette recorders

The video head

Probably the most commonly replaced recorder part is the video head. Although manufacturer's specifications indicate that a video head will fall out of spec after approximately 1,000 hours of use, the difference in the quality of recording probably will not be noticeable to the average video user. It is more likely that replacement will be required before the head actually wears out as a result of mistreatment. Like the rubber components, video head preventive maintenance begins with proper handling. Environment plays a key factor. Dust and dirt pinned between the rotating heads and the moving tape not only impede the head-to-tape signal transfer, but the abrasive nature of these substances can accelerate wear. The second consideration is videotape. Since tape is in constant contact with the video head, the quality of tape will have a direct effect on life. Stay with the recognized brands. Saving a dollar on a low-priced special could cost you a head replacement. Treat your tape in the same manner as your recorder.

–Avoid storing tape under adverse conditions.

–Even the best quality tape has a limited life span. Keep a record of each time the tape is used. As the tape approaches 200 passes, dub the signal onto a fresh tape.

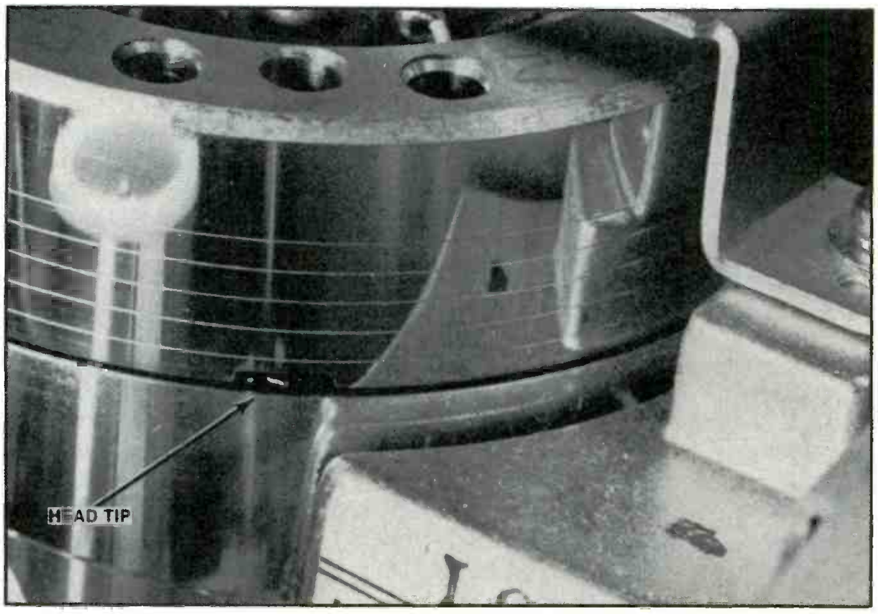
Avoid the urge to clean the heads too frequently. Any direct contact with the video head can lead to the possibility of head damage. Head-cleaing cassettes eliminate the human-contact factor. They operate by wiping dirt from the head surface. Overuse actually can promote wear, while misuse can destroy the head. Clean heads only when the playback picture is noisy. Avoid excessive head cleaning by preventing the conditions that lead to dirty or clogged heads.

Cleaning the video heads

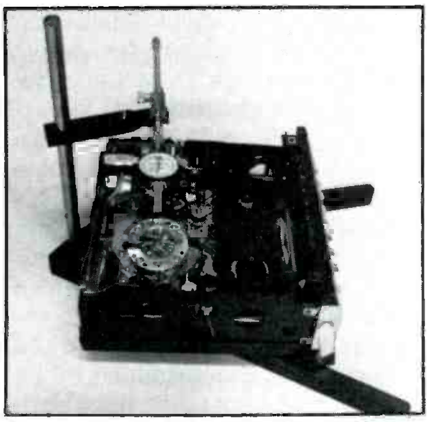
To clean the heads use a lint-free material dampened with a freon compound. Many video stores sell video head-cleaning tabs. A Q-tip also can be used but be sure to twist its end so the fibers will compress. A freon solution is required because it evaporates under low-temperature conditions and leaves no residue. Using alcohol is *not* recommended because it can leave moisture, that could cause the tape to seize around the video cylinder and destroy both the tape and heads.

Clean the head by moving the cleaning stick across the face of the video head in one direction only. Back-and-forth movement can scrape the cleaning tab and leave residue. Cleaning movement should be across the face of the head and not up and down. The video head is

Adjusting tape tension on a Sony U-matic Type V unit. *(Photo courtesy of Tentel.)*



Close-up of head tip in VHS tape recorder. The head tip (arrow) is very fragile in the vertical direction, quite strong in the radial direction. *(Photo courtesy of Tentel.)*



Head protrusion gauge, HPG-1, with accessory stand for checking head protrusion on a portable VHS deck. *(Photo courtesy of Tentel.)*

very fragile up and down and quite strong in the radial direction.

Replacing the video head

Regardless of how well it's cared for, at some point in the life span of the recorder, the head will have to be replaced. This usually occurs when the playback picture has become so noisy as to be unusable or when the head breaks. Any attempt to replace the head should be preceded by a head cleaning. If the cleaning results in a playback beginning with a clean picture and then turning to noise, chances are that a crack has developed in an area of the head other than the gap. When this happens, the sharp edges around the crack scrape oxide away from the tape. These loose particles become wedged in the head gap, shorting out the head signal.

The head replacement process begins by having the correct tools. Your work will consist of a complicated interrelated series of mechanical and electronic adjustments. An oscilloscope, a protrusion or concentricity gauge and the manufacturer's test tape and service manual are necessities.

Follow the manufacturer's instructions for removing the old head, treating it with care. You never can be sure that the video head is the source of your problem until you have successfully completed changing the head. There always is the possibility that the problem is something other than the head. Rough treatment during removal of the old head can damage a head that proves to be still serviceable.

Begin by desoldering the wire leads that connect the video heads to the lower cylinder. Next release the head-set screws and, using your fingers, pull the head straight up. Make sure that you position your fingers away from the heads to prevent the possibility of breaking them.

Mount the new head by positioning it on the lower cylinder. Don't force it. If the fit feels tight, rock the cylinder back and forth. Be careful not to apply too much pressure to any one side of the cylinder as you can force a head against the lower section and break the head. Set the head-mounting screws in the same manner. Alternate tightening of each of the screws so that both sides of the cylinder fall into place evenly. Fasten the head

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wires and move onto the adjustment procedures.

The video head cylinder is built at the factory with care taken to see that each of the heads is set to have the same protrusion and height because the mounting process may have caused changes in these parameters. Regardless of how tight the head cylinder feels around the center, minor changes in its positioning can result in protrusion differences. Variations greater than 3mm can mean large dB signal losses. Some of these head-signal differences can be corrected by adjusting the video head amplifier. In reality, the mix adjustment is a mid-range frequency boost. Using it to balance the output from the heads can result in a difference of frequency response. On the TV monitor, playing back a tape with frequency-unbalanced heads will produce a beating in the playback picture.

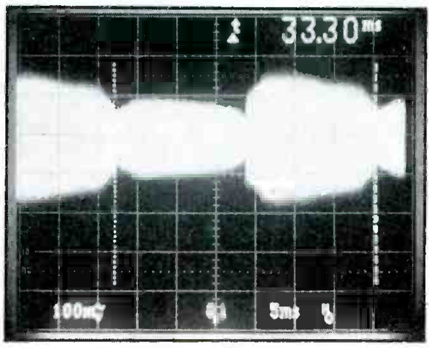
Proper adjustment of head protrusion can be done by using a gauge that checks the concentricity of the head cylinder. The ideal position would show a difference of no greater than ± 1.5mm.

After adjusting protrusion, the next step is to set head height. Playing back a tape with misaligned head height will give a signal on the scope similar to a protrusion problem. The differences between protrusion and head-height problems show up when the playback tape is placed in the *pause* mode. When the height of the two heads differs, the position where each head crosses from the video track to noise also will differ. On the playback picture, the paused tape will exhibit two guard bands. On the oscilloscope, the RF waveform, which is shaped like a diamond in the still mode, will show a difference in the occurrence of each head's peak and valley. In addition, the amplitude of one of the patterns will be reduced because of the lack of head-to-tape contact.

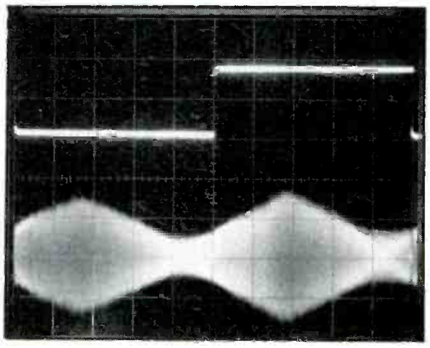
To set proper head height, start with one of the heads. It's a good idea to mark the head so as not to get confused. With the recorder in the *stop* mode, adjust one of the hex screws located above the head. Be careful to turn the screw no more than a quarter-turn at a time, using minimal pressure. Too much force can drive the head into a position from which it cannot recover. Place the tape in the *still playback* mode and observe the monitor picture and the oscilloscope to see if the guard bands are moving closer together. Repeat the adjustment until the guard bands overlap, remembering to adjust only one head.

The final requirement for mechanically setting up the video heads is the 180° adjustment. While head-height adjustments are required because the video heads contact the track at different positions, 180° misadjustment is due to the heads contacting the tape at the wrong times. On the TV monitor, the playback of a tape with a 180° misadjusted head cylinder would display a vertical line as two separate lines converging at some point in the active scan. This results from the monitor seeing horizontal sync occurring at a different time as two separate lines converging at some point in the active scan. This results from the monitor seeing horizontal sync occurring at a different time from each of the video heads shortly after they switch. The exact recovering point on the monitor will be determined by its HAFC time-constant. Head-cylinder manufacturers provide a set of holes to the left and right side of each individual head. These holes are used in conjunction with special tools to push the head into the proper position. As in the case of head height, adjust only one of the heads to match the other. Remember to mark the head to avoid confusion.

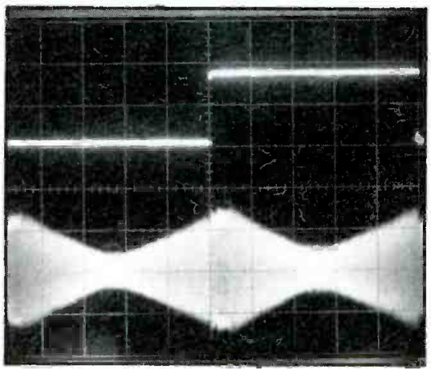
This third article has dealt with the needs and requirements of preventive maintenance. The key elements involve the replacement of rubber components as well as the video head. The need to perform preventive maintenance primarily will be determined by



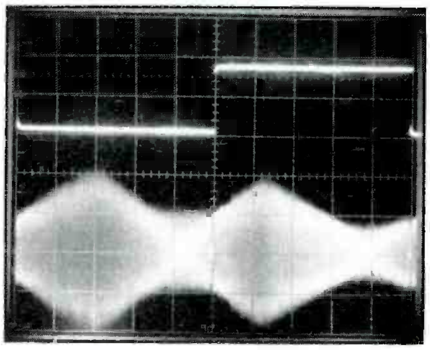
Loss of signal from one head is an indication of loss of head protrusion.



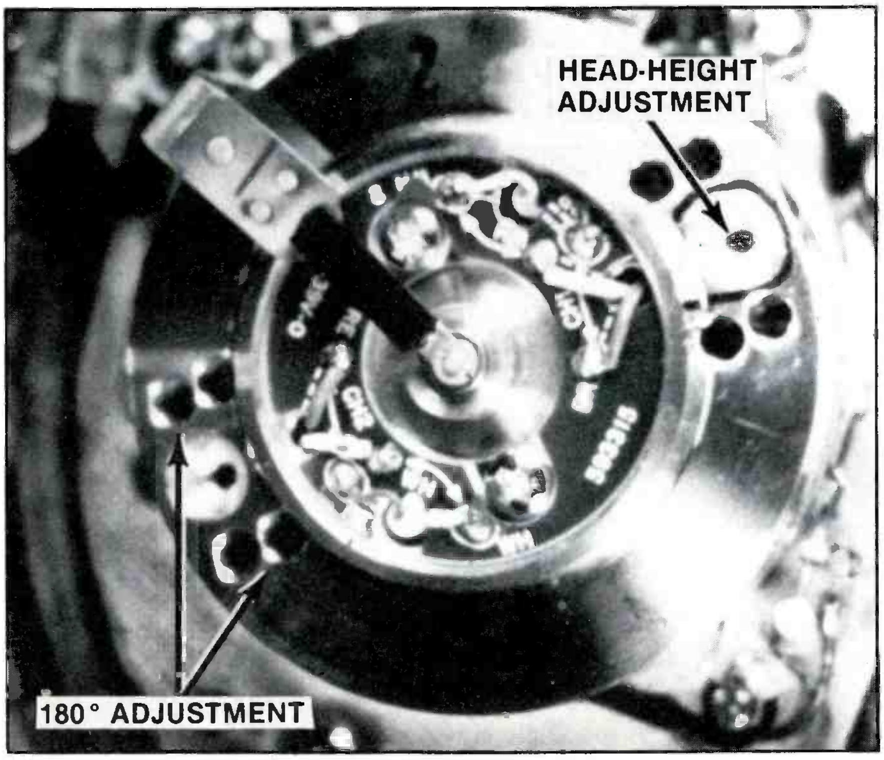
Unit in still mode showing peaks equidistant from start of new field.



Unit in still mode showing valleys equidistant from new field.



Scoped, misaligned head heights show that peaks are different distances from start of new field.



Hole on top of head is used for head-height adjustment. Holes on either side of head are used for 180° adjustment. It is important to mark the head you are adjusting in order to avoid confusion.

outside factors such as environmental conditions and quality of tape. Regardless of the care lavished on the tape recorder, these components will need to be replaced at some point. It is up to the user to determine if this work takes place at a convenient time.

This series of articles has been designed to offer a general understanding of the problems and solutions found in troubleshooting and repairing videotape recorders. While the theories and concepts presented can be applied to any recorder regardless of format or manufacturer, they are no substitute for the manufacturer's service manual. The greatest asset is you. Prior to taking any action, use your eyes to observe the problems, and your mind to think about all the possible solutions. Think before you act, and don't be afraid to ask questions. Many manufacturers have trained personnel whose function is to provide the answers for anything about VCRs that you need to know. ES&T

What do you know about electronics?

FORBIDDEN WORDS

By Sam Wilson

I have noticed it more in the last five years. Maybe it's the company I'm keeping. There are some things you just don't talk about in polite technical circles. Try some of the words in this article on your technical friends. Use the openers provided at the end of the article. *WARNING! The use of these words in technical circles may be hazardous to your reputation.*

A remotely operated switch

In 1960, I read an article that stated definitely that there would be no more relays in operation by the end of the decade. In 1970, they were selling more relays than ever before.

One reason for the bad reputation of relays is that they had been used in applications where a manual switch would have been better and cheaper. I remember visiting an automated potato chip factory in 1968. There was a relay logic system used to bag the potato chips, seal the bag, and load the bag onto a conveyer. It was awesome.

This system was one and one-half stories high. It was built into a lattice of metal pipes. *Inside* the machine was a man – moving at lightning speed – back and forth and up and down. He was holding a rubber hammer that he used with high dexterity.

The owner of the company proudly announced that this man was the only one of his kind in the business. When a relay would stick, according to the owner, this man could detect a difference in the sound of the system like an orchestra leader and zero in on a bad note. Then, using just the right amount of persuasion with the rubber hammer, the technician was able to restore the system to full operation.

I can't remember the man's name, but, I was told that before this great automated system was installed he was the one who bagged the potato chips by hand.

Equipment like that gave relays

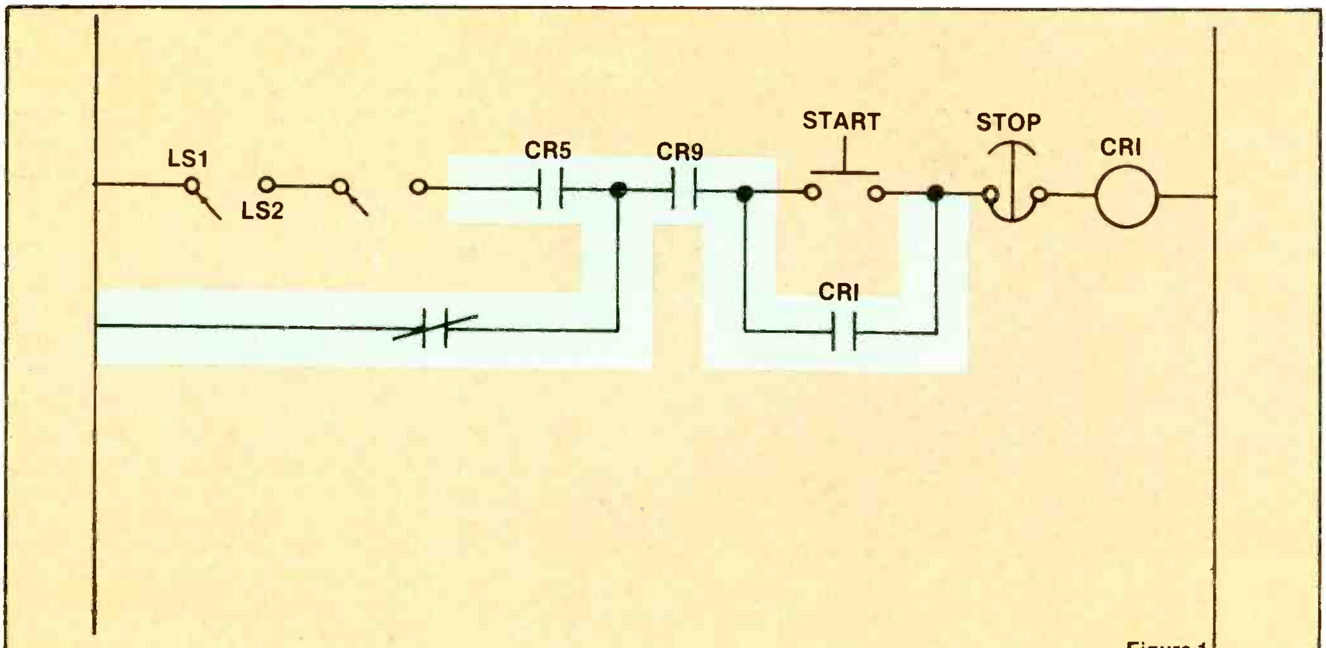


Figure 1.

a bad name. But, relays are *still* the best components available for certain jobs. They have an enormous power gain. With a 100mW input, a relay can easily control an output circuit of 100W.

Relays can have a very high fan *in* and fan *out*. It takes a lot of costly and complicated multiplexing and demultiplexing to match them.

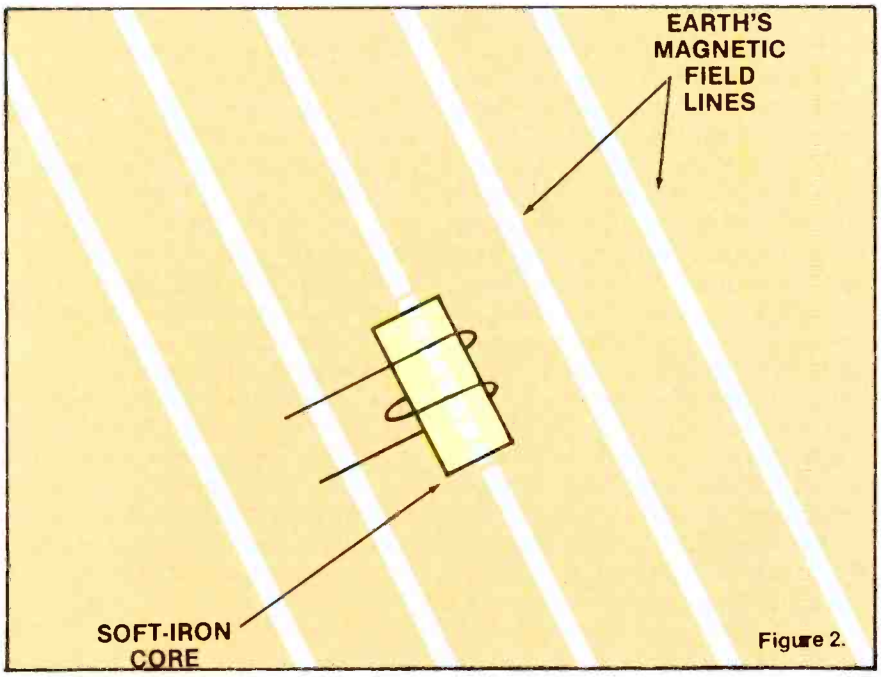


Figure 2.

The isolation between the input and output is nothing short of fantistic. Also, they can be made highly reliable.

They have one fault that seems to make them totally useless in an electronic system. Something inside actually *moves*.

Bidirectional relay uffishness

Let's not forget that the relay people have their own clan. A *programmable controller* is the electronic answer to the monstrosity mentioned above. It can do the job efficiently in a box the size of a typewriter.

When the electronics engineers proudly announced the existence of this system, they were disappointed in the response. It went over like an iron dirigible. People who had spent most of their working years in relay systems did not take readily to the new programming techniques that had to be learned for the electronic system.

To get around this problem, the electronics engineers changed the

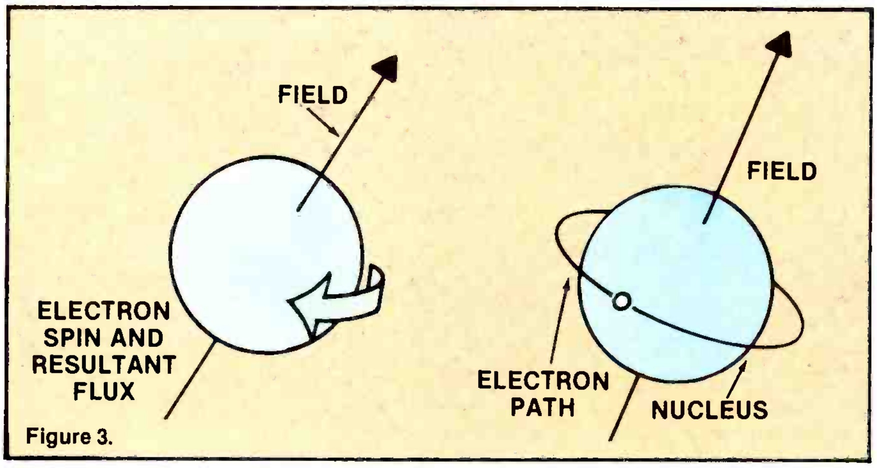


Figure 3.

electronic controller so that it could be programmed with relay logic. The relay equivalent circuit is actually displayed for the progammer. Figure 1 shows a typical display. Thus, school people who have totally eliminated relays from their curriculum in an effort to appear more modern have made it impossible for their students to understand one of the modern electronic systems.

Nuclear, but not NUCLEAR

There is something about the words *nuclear* and *radioactive* that strikes fear and dread in the hearts of technicians. As far as the general public is concerned, these words can provoke both fear and anger. I want to tell you how that unreasonable fear has made it difficult to use a medical electronic system that is not related to either word. First, I want to explain how it works.

After a submarine has been submerged in the ocean for two or three days, it becomes permanently magnetized by the Earth's magnetic field. Then, the submarine's field – added to the fact that the submarine offers a low reluctance to magnetic flux lines – results in a *magnetic anomaly* around the *boat.*

An anomaly is something that appears to be true but isn't true. If you could see the magnetic flux lines above a submarine, they would have a different pattern compared to the normal flux lines of the Earth. It would appear that the Earth's lines were out of step. Actually, it is the presence of a submarine under the surface of the ocean that is causing the anomaly.

During World War II, the navy hunted submarines with *magnetic anomaly detectors.* Figure 2 shows the principle. A coil is wound on a soft iron core. This core is aligned with the Earth's flux lines, and an ac current is passed through the coil.

On one half-cycle, the coil's field and the Earth's field combine to saturate the core. On the next half-cycle, the fields oppose and greatly reduce the flux in the core.

When the fields are in the same direction, the coil has little inductive reactance. Because the core is saturated, the changing current in the coil cannot produce the changing flux in the core that is necessary for producing a counter voltage (formerly, counter EMF). On the next cycle of ac input, there is a high reactance.

The overall result is to produce an ac signal that has a higher amplitude on one half-cycle than on the other half-cycle. When you fly this gizmo over a submarine, the anomaly causes an even greater difference between half cycles. The change is sensed by electronic equipment and the aircraft crew knows that there is a submarine or a bridge below. Before dropping any depth charges, a certain amount of visual input is highly desirable.

Great strides have been made since the simple device of Figure 2. Magnetic anomaly detectors are now put into satellites to check for ore deposits. That gives you an idea of their high sensitivity. The new systems use a technique called (unfortunately, as you will see) *nuclear resonance.*

"That kind" of resonance

Nuclear resonance – despite its unfortunate name – has absolutely nothing to do with atomic energy, or the bomb, or anything like it.

To understand how it works, you must remember that all electrons spin on their axes as shown in Figure 3. Every electron has a magnetic field produced by that spin. Likewise, the nucleus of an atom has its own magnetic field. This also is shown in Figure 3.

If you put a gas, such as hydrogen, into a non-magnetic container, the magnetic fields of the atoms can be aligned by a fixed magnetic field from a coil. See Figure 4. Then, if you turn the coil current *off,* the atoms will align with any other source of magnetic flux that is nearby, such as the Earth's magnetic field. By measuring the time it takes for them to align from the known field to the unknown field, you can compute the strength of that unknown field. What you have is a *nuclear precession magnetometer.*

You also can get the nuclear magnetic fields of the atoms to vibrate back and forth between two fields: one of known strength and the other unknown. Depending upon their relative field strengths, you can get them to vibrate at some particular frequency. That's nuclear resonance.

Change the field strength of one of the fields and you change the resonant frequency. Measure that change in frequency and you can calculate the strength of an unknown field. Now you have an extremely sensitive method of measuring magnetic field strength.

A similar device is now being used in medicine. It can detect the weak magnetic fields around a

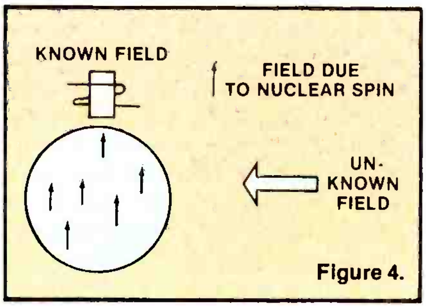


Figure 4.

human head. These fields are caused by the ever-present brain currents. Places where there are no currents can mean bad trouble.

One of the most important things about this technique is that it is relatively passive. The patient might have to eat some candy to sugar up the brain, but it is a much safer way to scan the brain than using X-rays.

Doctors are running into a problem with this device. As soon as the patient hears the word nuclear, the conversation is over.

The name may have to be changed to protect the innocent (equipment).

Further into the realm of the forbidden

I am now going to proceed to get myself into some serious trouble. I'm going to mention a 4-letter word that has been banned from some technical publications. It is not permitted in most proper electronics schools. The word is *tube*.

What I'm going to tell you about it is absolutely true. I call it *DeForest Phobia*.

DeForest Phobia is the fear of mentioning that word "tube." It is mainly an affliction of technicians over the age of 40. Apparently, people in that age group fear that the very mention of the word will cause them to be exposed immediately as being old, obsolete and unemployable.

Last spring, I conducted a 3-day seminar at an electronics school. The purpose of the seminar was to prepare students for taking the associate-level CET test. At the end of the first day, I invited the students to ask questions. They wanted to know how a vacuum tube works! They said their instructors refused to talk about them.

I wonder what they are supposed to do if they run across some equipment that needs repairs and they come face to face with a tube. A *tube*!?

In another case, I submitted some highly technical material to a committee of older technicians. These technicians are the country's best. But, they rejected the work because 2.6% of it was about tubes.

According to the *Wall Street Journal,* there are *now* (1985) 25 manufacturers of audio equipment that use only tubes in their designs. The article didn't explain how future technicians would be able to repair them.

If you think you are suffering from DeForest Phobia, get yourself some immediate help. Start by looking directly at the cathode ray tube.

For those who want to live on the edge

Here are the conversation openers I told you about. Don't say you weren't warned!

"I just got a new relay catalog. There are some interesting new developments in it."

"I have been studying a new audio circuit that uses tubes."

"I've been experimenting with a nuclear precession magnetometer similar to the ones they use in satellites." ES&T

Test your electronic knowledge

By Sam Wilson

Unlike the Jack of all trades, the supertech is master of all fields of electronics. These questions are for the supertech.

1. Which of the following will conduct with the lowest forward voltage?
A.) 3-layer diode
B.) 4-layer diode
C.) neon lamp
D.) LED
E.) Schottky diode

2. Which of the following is the true shape of a bubble in a bubble memory?
A.) triangle
B.) circle
C.) cylinder
D.) paraboloid
E.) epicycle

3. For the circuit of Figure 1, the output will be negative for:
A.) 360° of the input signal.
B.) more than 180°, but less than 360°.
C.) exactly 180°.
D.) more than 0°, but less than 180°.
E.) (None of these choices is correct.)

4. Which of the following is not a diode?
A.) Esaki
B.) Schottky
C.) magnetron
D.) laser
E.) (All of these choices are correct.)

5. When using a Variac as an isolation transformer,
A.) always adjust it for maximum voltage before connecting a load.
B.) always adjust it for minimum voltage before connecting a load.
C.) (Neither choice is correct.)

6. Disregard the carry when answering this question. Which of the following is not correct binary addition?
A.) 11 + 11 = 00
B.) 01 + 00 = 01
C.) 01 + 01 = 10
D.) 01 + 10 = 11

7. You have two batteries: one is 12V and the other is 6V. Connect them to get a voltage of −3V. Use as many 100Ω resistors as you need, but be sure your circuit has the minimum possible cost.

8. If you know the power factor, you can
A.) convert from average power to frequency.
B.) convert from apparent power to true power.
C.) convert from VARS to the period of the power cycle.
D.) find the circuit-effective power.
E.) (None of these choices is correct.)

9. Which of the following would you expect to generate the least amount of noise in a TV RF amplifier?
A.) a pentode
B.) NPN bipolar transistor
C.) PNP bipolar transistor
D.) MOSFET
E.) neon lamp

10. The circuit of Figure 2 will work as
A.) an inverter.
B.) a non-inverting buffer.
C.) a relaxation oscillator.
D.) the equivalent of a unijunction transistor.
E.) the equivalent of a Schottky transistor.

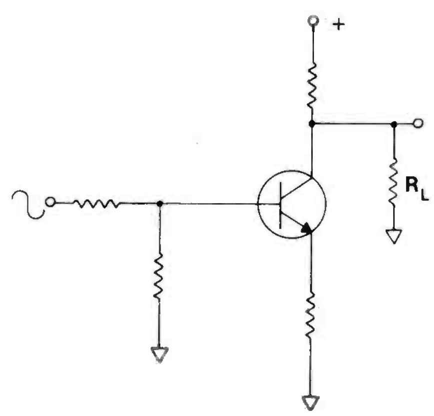


Figure 1.

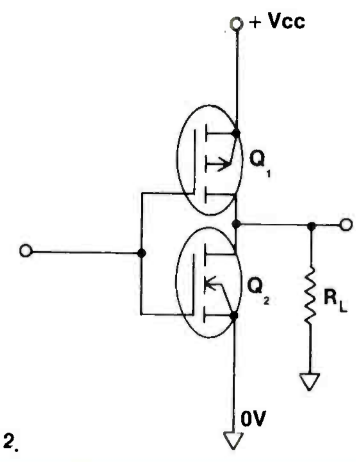


Figure 2.

Answers to the Quiz

1. E.

2. C.

3. E. The output is never negative.

4. D.

5. C. *Never use a variac as an isolation transformer*! A variac is an autotransformer, so, it has no isolation between the primary and secondary.

6. A. The answer should be 10 (with a carry of 1).

7. See Figure 3.

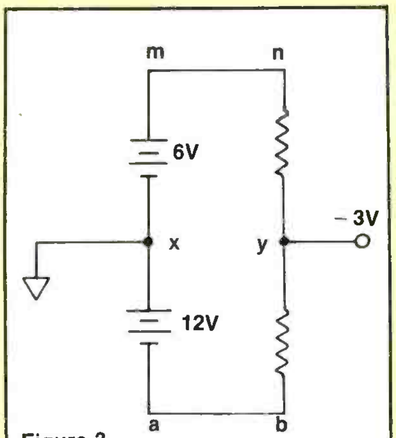


Figure 3.

8. B. *True power = apparent power x power factor.*

9. D.

10. A. A positive input pulse turns Q2 *on* and that puts the output terminal at the common voltage level (0V). A 0V input turns Q1 *on* and Q2 *off.* That places a +Vcc on the output terminal. So, a low input *in* gives a high *out;* and, a high input gives a low *out.* The circuit is an inverter.

PART 5

The VIDEO CONNECTION

By Martin Clifford

Connections for home entertainment electronic systems are moving in two directions: The first is emphasis on video only; but the other is even more complicated and is a move toward interconnecting the different systems of broadcast television, satellite television and high-fidelity. Considered from the rear apron of all the components, there is no way in which the interconnections are going to be user-friendly. And without a switcher, there is no way in which the front panels of the combined systems will be user-friendly either. Even connecting the power cords of all the gear, once just a matter of "plug it in," takes some deliberation and thought.

Figure 1 shows a component video system using a switcher for signal source selection. With the exception of the downlead from the antenna, all the interconnections use coaxial cable with F connectors. The number of additional components that can be included is determined by the switcher. Not included in the drawing are connections for one or more video preamps. A single such amplifier could be right at the antenna with another (or more) put on-line between the switcher and the TV set.

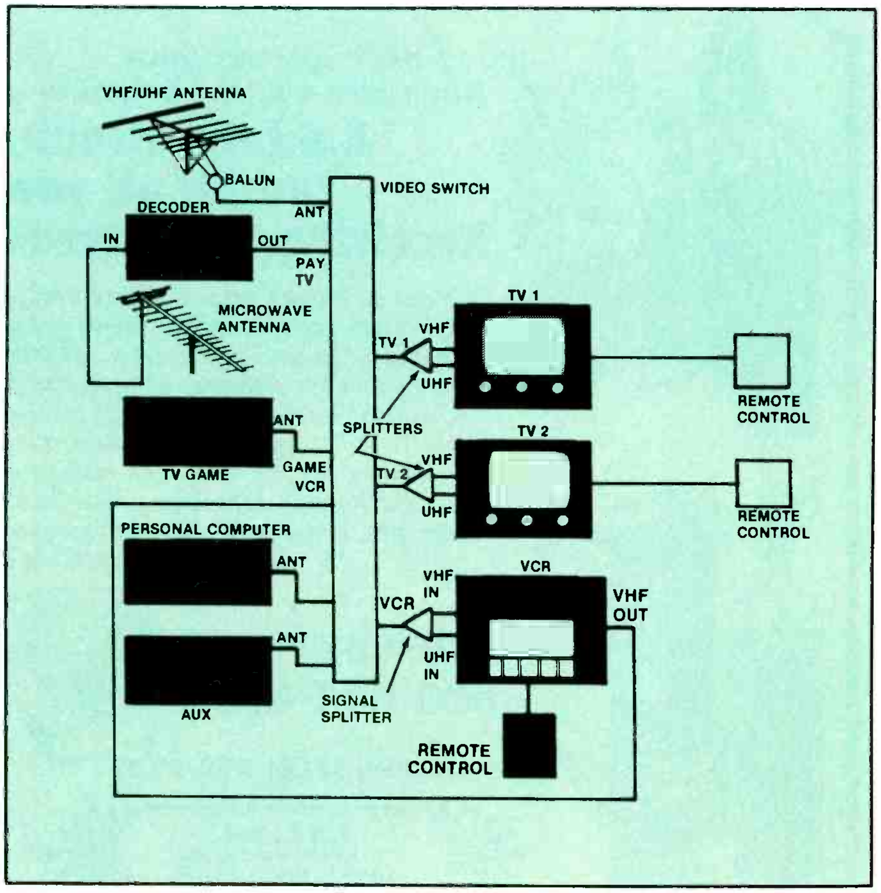


Figure 1. As the demand escalated, component TV systems became complex.

The audio-video home system

Figure 2 shows the connections for a home entertainment setup. This is by no means a limited arrangement because it still can be expanded. For example, it does not include a compact disc player or a videodisc player. It does not have a source selector, a signal switcher for the sound, although there is one for video. The system may require a video pre-amplifier. It does not show the use of cable television, nor does it show a satellite TV system. In short, although it may look complex, it should be regarded as a beginning approach, an elementary system that may require expansion.

To make matters even more complicated, some home entertainment systems now are using the TV set for the reception and display of telephone messages, and for use with a personal computer or a video game.

Three types of cables are needed for making the connections for the system in Figure 3. These include 300Ω line and 75Ω coaxial cable for the video side and audio cable for the audio side. Of the three, only 300Ω twinlead does not require special plugs. Even so, most 300Ω line connections are made by wrapping the stripped ends around machine screws or by inserting the squared-off end of twinlead into *biting* screws that cut through the plastic, making contact with the conductors.

For video coaxial cable, most of the connectors are via F-type plugs, usually connected by crimping. Audio cable is a form of coaxial for its construction is similar to that of video coax. Like coax, it has a center *hot* lead, covered with plastic, which, in turn, is surrounded by shield braid. The shield braid is a signal conductor just as much as the center wire, but in addition helps minimize unwanted signal-to-noise pickup. The connec-

tors used with these cables are nearly always RCA plugs, shown in Figure 4. The *hot* lead is the center pin; the ground or *cold* connection consists of four leaves surrounding the center pin.

Cable problems

From a servicing viewpoint, the most attention has been paid to the components of a system, but it is time to start thinking of cables and their connectors, their plugs and jacks, as being equally important. Cable problems can lead to any one of the troubles that afflict components: It won't work, it works poorly, it works intermittently only, it produces more noise than signal, and it doesn't work as well as it did when new. All of these complaints are applicable not only to cables and their connectors, but the cable wiring may be the problem source.

Because with video connectors the plugs are usually crimped on, we have a connection that is purely mechanical. If the plug does not make good contact with the shield braid, the problems can range from intermittent to no operation. For audio cables, the problem is one of creeping paralysis. The plugs corrode, become rusty. This gradually reduces the surface area of contact between the plug and jack causing problems ranging from poor sound, distorted sound to no sound at all. It is not worthwhile to try to salvage the cable by replacing the plugs. When you put in new plugs, rotate them by about one turn to get a cleaner contact.

The drawing in Figure 3 can be misleading if you think of each of the connecting lines as representing a single conductor. Each of those lines is a cable and a cable always has a minimum of two leads, even if one of those is the wire braid.

To work with a wiring diagram of this kind, and especially with those that are even more complex, consider the diagram as consisting of sections: one for video, another of audio. And then break these two main groups into subsections: turntable connections; tape deck connections; VCR connections; TV set connections, etc.

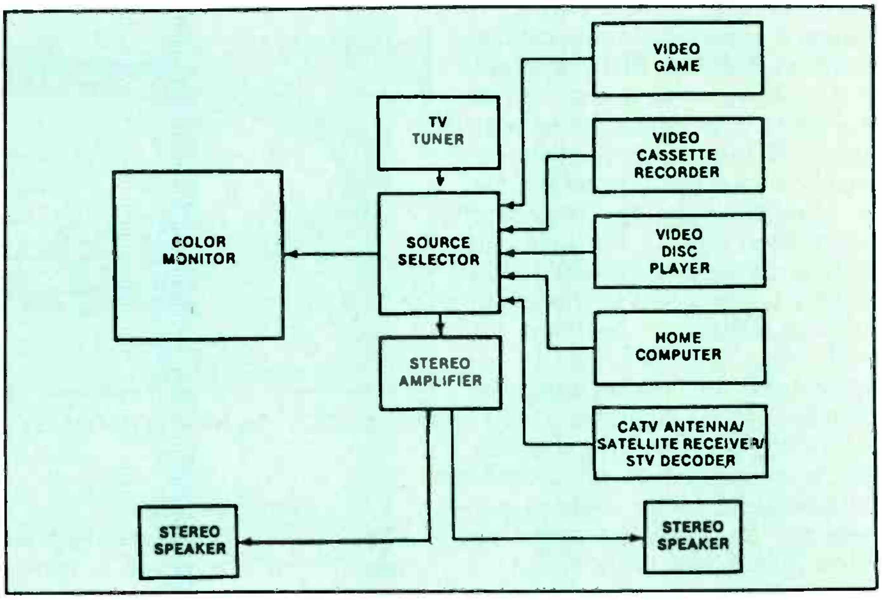
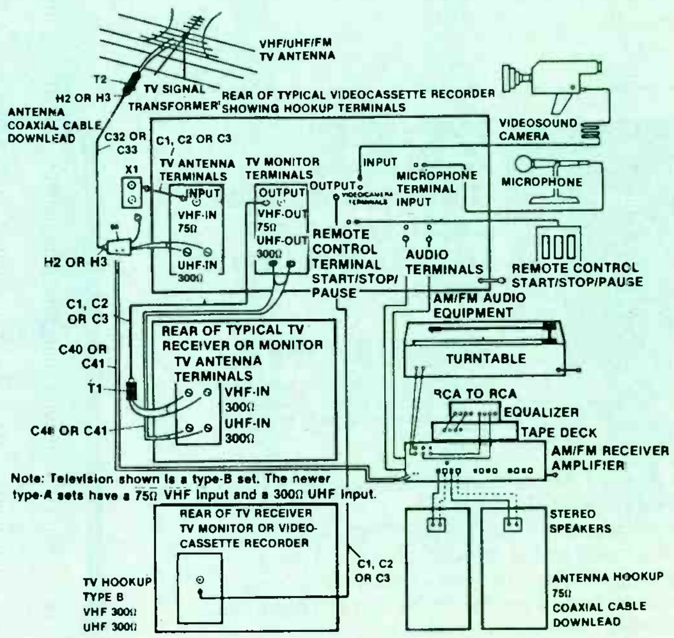


Figure 2. Combined video/audio systems. *(Courtesy Zenith Radio Corp.)*



QUANTITY	CODE	COMPONENTS REQUIRED
1	B8	75-Ω TO 75/300-Ω TRANSFORMER (BALUN) AND VHF/UHF BAND SEPARATOR WITH FM TAP
2	C1, C2 OR C3	3-FOOT, 6-FOOT OR 12-FOOT 75-Ω COAXIAL CABLES WITH F-TYPE PLUGS ON BOTH ENDS
1	C32 OR C33	25-FOOT OR 50-FOOT BULK 75-Ω COAXIAL DOWNLEAD CABLE (WITHOUT CONNECTORS)
2 OR	H2	F-TYPE CRIMP-ON PLUGS FOR 75-Ω COAXIAL CABLE (ABOVE)
2	H3	F-TYPE TWIST-ON PLUGS FOR 75-Ω COAXIAL CABLE (ABOVE)
	C40 OR C41	50-FOOT OR 75-FOOT BULK 300-Ω FOAM-FILLED TWINLEAD DOWNLEAD CABLE CONNECTS FM TAP ON B8 WITH ANTENNA TERMINALS ON FM/AM RECEIVER
1	T2	300-Ω TO 75-Ω TRANSFORMER (BALUN) FOR OUTSIDE USE
10		PHONO PLUG (RCA TYPE) TO PHONO PLUG (RCA TYPE) CONNECTOR CABLES
2	12, 14 OR 16 GAUGE 2-STRAND SPEAKER WIRE	CUT TO REQUIRED LENGTH. CONNECT STEREO SPEAKE WITH FM/AM RECEIVER

Figure 3. Wiring arrangement for a video/audio system. *(Courtesy GC Electronics.)*

Video camera connections

The system shown earlier in Figure 3 includes a video camera using an in-home VCR. For outdoor shooting with a camera that is not a camcorder but uses a portable VCR, remember that cameras usually have a boom-mounted mic, but also have a jack for connecting an external mic. In the field, the VCR is battery operated; in the home it is connected to the ac line via an ac adapter. In the home, the portable VCR becomes the equivalent of a permanently mounted VCR. And like component system VCRs, this combination is connected to an antenna and should follow the antenna connections described in earlier articles. (See **ES&T**, May 1985.)

In situations where a monitor is used instead of a TV set, the equivalent of a TV receiver is obtained by using the tuner in the tuner/timer for TV signal pickup because the monitor does not have a signal selection capability.

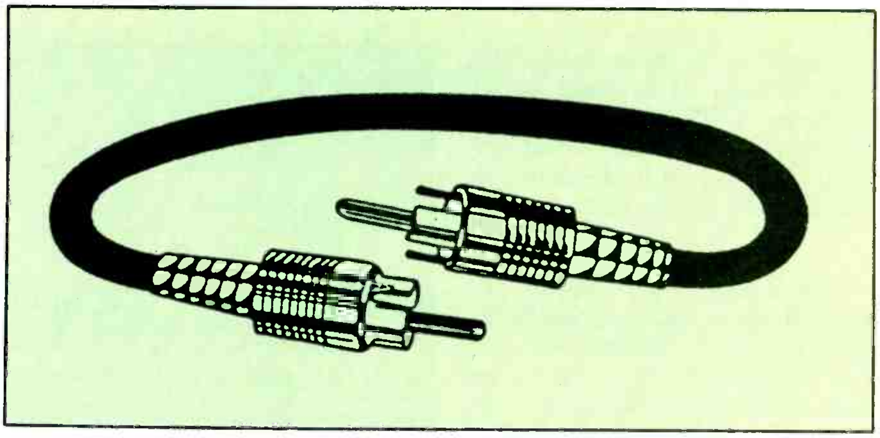


Figure 4. RCA plug wired to RCA plug. *(Courtesy Recoton Corp.)*

Camera cables

The type of VCR used in the home will determine if a video camera and its accompanying portable VCR will be either a VHS or a Beta type. If the video camera is to be used with a VHS portable VCR, the connection between the two will be through a 10-pin, quick-fit connector. If a Beta format portable VCR is to be used, then the connector will be a 14-pin type. In VHS recorders, the power supply terminal is a 7-pin DIN (Deutsche Industrie Normen), meaning German Industry Standard connectors. The camera terminal is a round 10-pin connector.

One of the problems involving cameras and portable VCRs is the

fact that the connecting cable plugs may fit into their respective jacks on the camera and the portable VCR, but this does not automatically mean the connectors and the cables are the right ones to use. The difficulty is lack of standardization and the fact that manufacturers can assign the various wires in the cable to different circuits, as they wish. This is common on both 10-pin and 14-pin connectors. Further, even if the wiring is correct, the connectors may require an adapter.

Connecting projection TV

The usual direct view TV set has only one pair of inputs and these are the VHF and UHF terminals on the antenna block. Projection television (PTV) sets are different, as shown in Figure 5. If separate downleads are used, then these can be brought into a band combiner as indicated in the drawing. If an all-band antenna is used, the downlead can be 300Ω twinlead, with a VHF/UHF band separator at the antenna input block. Although a drawing such as Figure 5 can supply general guide lines, the actual connectors will be determined by whether an all-band or separate antennas are used, the impedance of the antenna or antennas, whether coaxial cable is preferred to twinlead, whether a pre-amplifier is to be used at the antenna, and the impedance of the connectors at the antenna terminal block.

Figure 5, then, shows just one possible set of connections, and while manufacturers often supply directions and pack these in with their components, they have no way of knowing the details of every possible installation.

Figure 5 shows the use of components such as a videodisc player, a VCR, and an audio system. Two types of cables are used: twin coaxial (that is, two coaxial cables joined) and audio cables equipped with RCA plugs.

Connecting the satellite TV system

As shown in Figure 6, video signals from a satellite are transmited to earth, striking a dish, a structure having a parabolic shape. The dish is sometimes incorrectly called an antenna but it is simply a passive reflector. The actual antenna, quite small and measuring only about one inch, is at the end of a round or rectangular hollow tube called a waveguide, a type of transmission line. From the antenna, the signal is fed to a high-gain low noise amplifier (LNA), and then to a downconverter whose output frequency could be 70mHz. The signal is brought from the downconverter, positioned on the dish structure via coaxial cable to a satellite receiver in the home, and from that recevier to a monitor or TV set.

At one time, dishes were rotated manually so as to line up with different satellites. Today, however,

most dishes are motorized with the motor electrically controlled from inside the home. One type of connecting wire arrangement is called Siamese cable, shown in Figure 7. The signal carrying portion is RG-59 unbalanced coax. The dc operating voltage for the dish motor, and also for the LNA, is carried by three separate wires: two hot leads usually color coded white and one ground lead coded black.

Still another type is messenger cable, shown in Figure 8. As usual, the coaxial cable is used for carrying the signal from the output of the downconverter on the dish to the input of the satellite receiver in the home. A single wire is included and this is the hot lead for dc for the LNA and the dish motor. The shield braid is the common ground lead, used both as a signal ground and the dc voltage ground.

Figure 5. PTV connections. *(Courtesy Kloss Video Corporation)*

Figure 6. Components of a satellite TV system. *(Courtesy McCullough Satellite Equipment)*

Figure 7. Siamese cable. *(Courtesy Precision Satellite Systems)*

Figure 8. Messenger cable. *(Courtesy Precision Satellite Systems)*

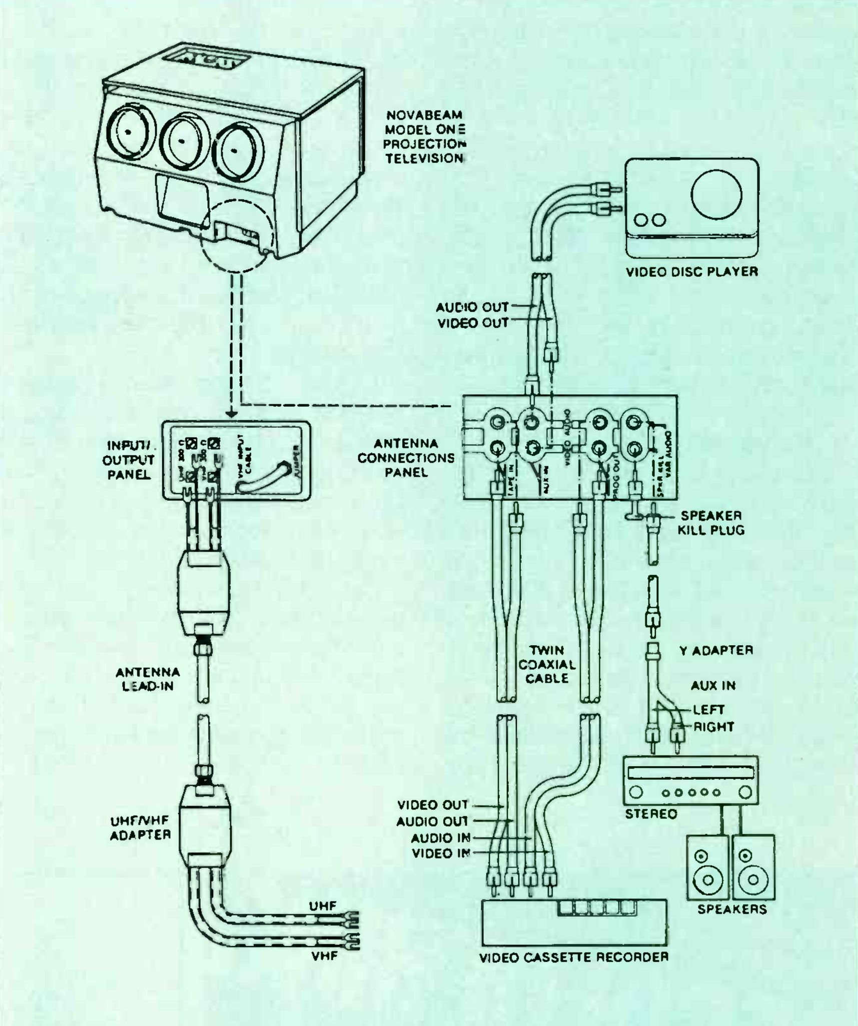


Figure 5

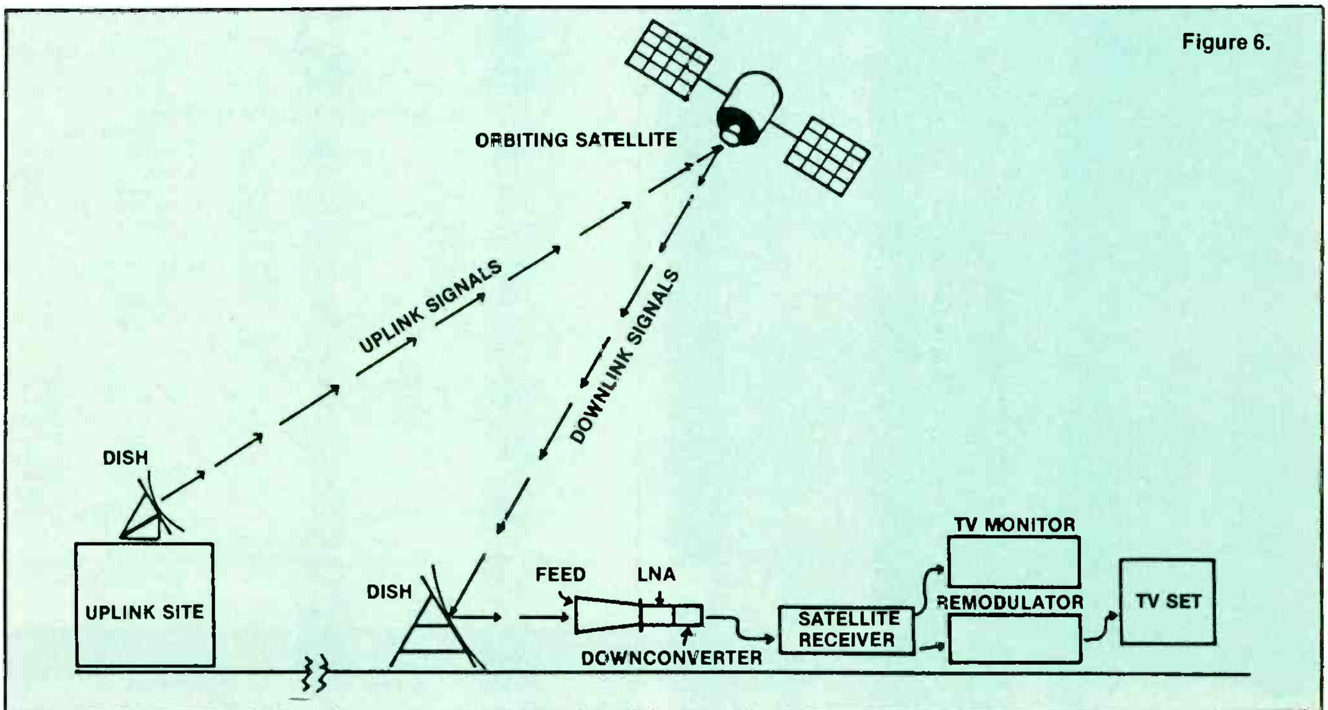


Figure 6.

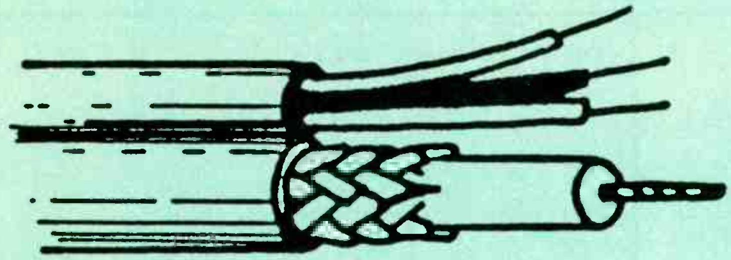


Figure 7.

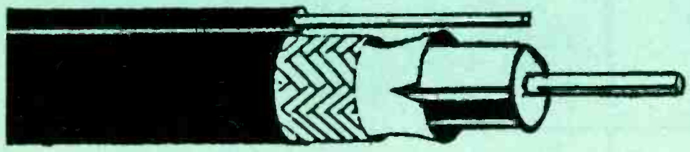


Figure 8.

And still another connection

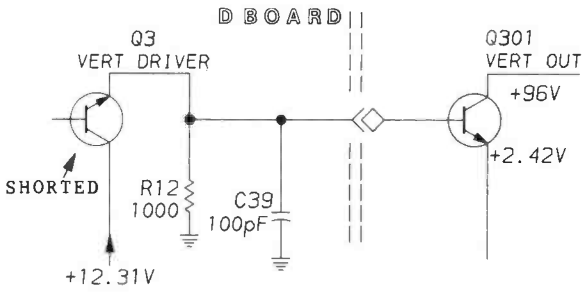
Ultimately, the satellite signal must find its way to the antenna terminal board of the TV receiver. Whether that receiver is a direct view or PTV, the fact remains that its input facilities are limited. This means a video selector is essential, and if an elaborate audio system is used, a signal source selector is needed for it as well.

There also is gradual acceptance of a *home minder* system for using the video system to turn lights *on* and *off*, for controlling house temperatures, for turning a microwave unit *on* and *off*, and for acting as a home security system. Combining all these systems that can include broadcast television, cable television and/or satellite television, a high fidelity system and a security system means a technician must install them, change them, repair them. All are going to be part of the service technician's job, and an essential part at that. ES&T

Symcure

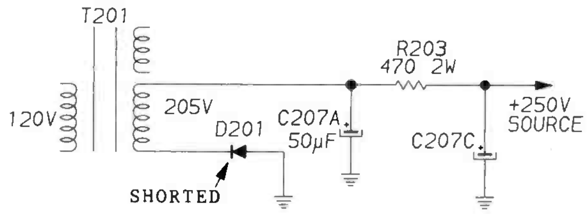
Symptoms and cures compiled from field reports of recurring troubles

Chassis—Magnavox T979 1
PHOTOFACT—1329-1



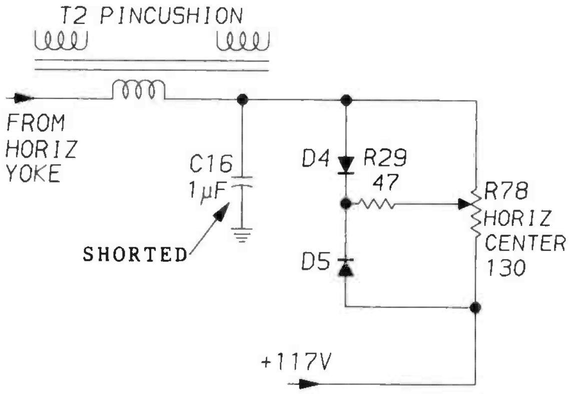
Symptom—Very little height; Q301 collector has only +12V.
Cure—Test driver transistor Q3, and replace it if shorted C/E.

Chassis—Magnavox T979 2
PHOTOFACT—1329-1



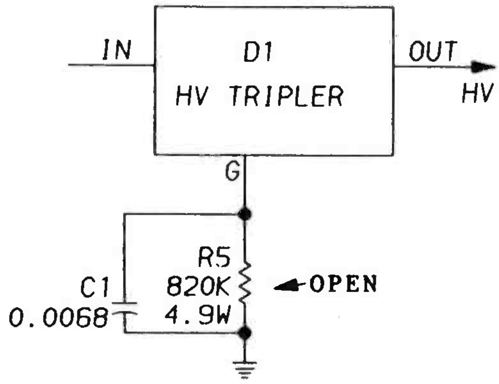
Symptom—Circuit breaker trips; +117V source measures about +10V.
Cure—Check rectifier D201, and replace it if shorted.

Chassis—Magnavox T979 3
PHOTOFACT—1329-1



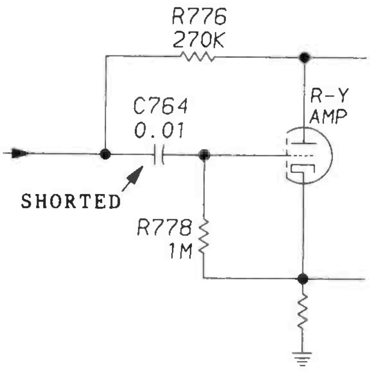
Symptom—No sound or picture; circuit breaker trips.
Cure—Check yoke-coupling capacitor C16, and replace it if shorted.

Chassis—Magnavox T995-02 4
PHOTOFACT—1700-1



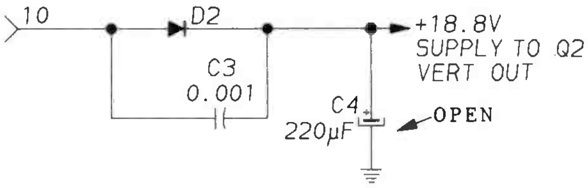
Symptom—Picture is very dark.
Cure—Check R5, and replace it if open or increased in value.

Chassis—Magnavox T962-08 5
PHOTOFACT—1253-2



Symptom—No red in raster or color picture.
Cure—Check coupling capacitor C764, and replace it if shorted.

Chassis—Magnavox T989 6
PHOTOFACT—1418-2



Symptom—Loss of all height, or poor vertical linearity
Cure—Check filter capacitor C4, and replace it if open.

Literature

New literature covering its standard line of test prods and patch cords is available from **E. F. Johnson Company Components Division.** The 8-page catalog 117-2

announces Johnson's RF patch cords, as well as listing in detail the manufacturer's more than 150 other configurations of these two types of electronic equipment.

Circle (125) on Reply Card

CRC Chemicals Electrical Products Division has developed an effective tool in the recovery of electrical equipment suffering the effects of water contamination resulting from rain, flooding, broken water pipes and fire fighting measures. This procedure is described in a flood restoration manual that covers cleaning, water displacement, lubrication, corrosion protection and testing of water damaged electrical/electronic components and assemblies.

Correct flood restoration procedures can significantly reduce water-related damage and many times lead to complete equipment recovery.

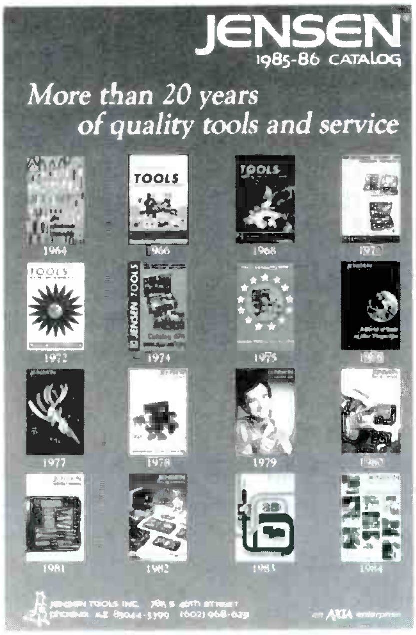
Circle (126) on Reply Card

Electronic Specialists is offering a 40-page color catalog, No. 851, describing power line problems such as noise and high voltage spikes. Damaging and disruptive effects on various types of high-tech equipment are described.

Typical laboratory, commercial and office problems and suggested solutions are included. Protective and interference cure products are described.

Circle (127) on Reply Card

A 160-page catalog of tools, service kits and test equipment has been published by Jensen Tools. Illustrated in color, it contains more than 1,000 items of interest to engineers, technicians, mechanics and hobbyists.



Featured are dedicated and general maintenance kits including the JTK-47 *Site-Master* in zipper case, the JTK-68 Process Controls Service Kit, the JTK-39 Automotive Diagnostic Kit, and the JTK-91 Kong Kit for major installation/maintenance requirements.

Other major categories cover test equipment, soldering supplies, power and hand tools, drafting supplies, computer/telecom service equipment, circuit board cases, accessories and miscellaneous. Many items could be classified as "hard-to-find." ES&T

Circle (128) on Reply Card

Circle (21) on Reply Card

Circle (22) on Reply Card

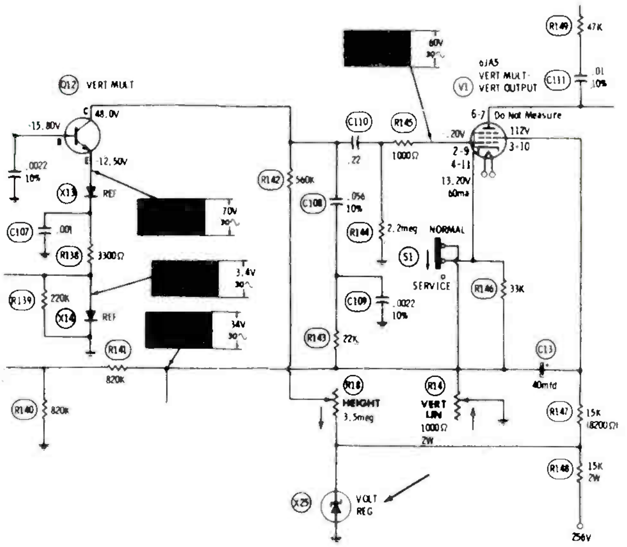
Troubleshooting Tips

Intermittent vertical height and no color
Zenith 19DC22
(Photofact 1296-3)

When power first was switched *on*, the height lacked about 2 inches at top and bottom. After about a minute, the picture snapped to full size, but with linearity expansion at the top. Adjustments of size and linearity controls produced a fairly normal height except with some expansion at the top.

However, after the receiver was switched *off* and allowed to cool before power was applied again, the entire sequence occurred again. I attempted to make dc voltage measurements before and after the major size and linearity changes, but no significant voltage variations were found. Good solid vertical locking was obtained at all times, so the oscillator did not appear to be the source. I replaced the vertical-oscillator transistor (Q12) and the 6JA5 output tube. Although the stretched linearity at the top was slightly better, neither of the old components was defective. However, I left the new 6JA5 in the socket because the old tube was 12 years old, and thus not dependable.

Next, I applied a 60Hz sawtooth waveform (from my Sencore SS137 sweep-circuit analyzer) to the 6JA5 control grid. Full height was obtained, without any erratic operation. This proved the problem was in the oscillator stage or its supply voltage. Because the oscillator transistor had been replaced already, the next suspect was all the zener diodes in the circuit. X25 voltage regulator was the only zener in this circuit, so I disconnected one end and connected by clip leads a zener of similar ratings. When power was applied, the height was fine, and it did not change with time. An exact replacement is recommended for X25, so a 103-206 Zenith zener was soldered in place. After the usual height and linearity adjustments were made, the linearity and size were correct and did not vary with time.



Color problems can be time-consuming when traced stage by stage, so I decided to check some known troublemakers first. After a new 9-37 chroma module was installed, the color came in strong and stable; therefore, the defect was on that module. Checking further, I found IC221-43 on 9-37 was not operating correctly. After a new integrated circuit was installed on the original 9-37 module, and the module re-installed in the receiver, the color again was stable and of strong amplitude.

After several long heat runs over a period of several days failed to show further problems, the receiver was returned to the customer.

H. Havener
Ardsley, NY

Photofact

These Photofact folders for TV receivers have been released by Howard W. Sams since ES&T's last report.

HITACHI
CT1344, CT1347, CT13C7 2348-1

JC PENNEY
685-2093-00, 685-2093-10 2350-1

JC PENNEY
685-2045K/45-20/51K/51-20/2500K/00-20/
4018K/18-00/19K/19-00/20K/20-00 2351-1

PANASONIC
CT-2012 2351-2

QUASAR
Chassis ADC125 2349-1

SAMSUNG
BT-317TK 2353-2

SANYO
Chassis A7G-10000 2349-2

SEARS
562.40420450 2353-3

SONY
SCC-548M-A 2348-2

SYLVANIA
RAD139SL 2352-1

ZENITH
SA2501W, SA2505NK, SA2509P, SA2511PN 2350-2

ZENITH
Chassis 5NB6X 2352-2

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.*

This month, the books reviewed could be the basis of a projects library for those of you whose interests veer toward actually building electronic devices.

Build a Personal Earth Station for Worldwide Satellite TV Reception—2nd edition, by Robert J. Traister, Tab Books, $14.45 paperback.

Here is a step-by-step earth station assembly guide: selecting the proper site, choosing equipment to suit individual needs, assembling, troubleshooting, eliminating interference and locating and tuning in on specific satellites. Of interest is the author's treatment of TVRO antennas, comparing various types and configurations that include commercially available models. Also examined are commercial LNAs, receivers and modulators, and TVRO systems currently on the market. There is information about costs and tips for obtaining surplus components.

Tab Books, Blue Ridge Summit, PA 17214

The Satellite Experimenter's Handbook, by Martin R. Davidoff, K2UBC, The American Radio Relay League, $10, USA; $11, Canada and elsewhere.

This text focuses on spacecraft built by, and for, radio amateurs. It also contains information on weather, TV-broadcast and other satellites of interest. Part 1 (chapters 1 to 3) tells the story of hams in space. Those starting out in satellite communications will find this subject covered in part 2 (chapters 4 to 7). For serious experimenters, including those who want to *build* spacecraft, the author presents reference material on special topics in chapters 8 to 13, part 3. However, no matter how impatient they are to build, readers are advised not to skip the basic technical information beginning with chapter 1. Appendices present spacecraft profiles, tracking masters and tables, geostationary azimuth and elevation chart, conversion factors and constants, and FCC rules and regulations. The glossary will be useful.

The American Radio Relay League, Newington, CT 06111

The Build-It Book of Electronic Projects, by Rudolf F. Graf and George J. Whalen, Tab Books, $9.95 paperback.

For those whose electronics proclivities hover closer to earth, these authors detail practical plans for equipment as diverse as for home and auto, security devices, games, gadgets, horticulture and hunting treasure. Each project includes instructions that are easy to follow and that are supported by detailed drawings, schematics and a list of parts that will be needed. Every device can be made inexpensively from available components and the authors attest that all the projects have been tested and proved so that readers can be sure that—once built—they really perform as promised.

Tab Books, Blue Ridge Summit, PA 17214

Digital Electronics Projects by Harry M. Hawkins, Tab Books, $11.95 paperback.

Among the 14 useful digital projects described in this hands-on learning book are several innovative devices that should be interesting to both novice and experienced experimenter. According to the author, anyone can build a deluxe code oscillator, a digital game called *Climb-the-Mountain,* an alarm clock, a metric measuring wheel, a modulator decade counter and a 14-note music generator. These and other projects are explained, illustrated and planned in minute detail. Readers are advised of sources of other project ideas, and informed about basic breadboarding and the technical aspects of commonly used ICs.

Tab Books, Blue Ridge Summit, PA 17214

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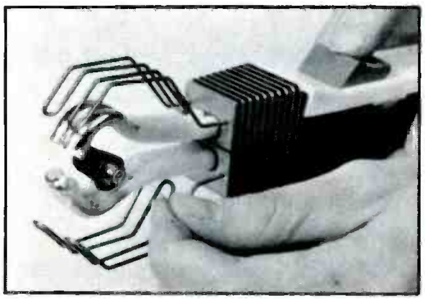
Products

Reduced-size Glo-Ring element

The *Eraser Company* announces the ½-inch diameter elements for use on its Glo-Ring infrared heat tools. The Glo-Ring is used in the electrical and electronics industry for applications requiring flameless heat, including heat shrinking, plastic tube bending, soldering, adhesive curing and solder preforms.

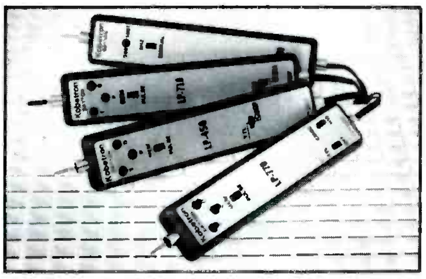


The unit incorporates quartz encapsulated heating elements that open and close like a thumb and forefinger, to encircle the work piece with instant infrared heat, variable in temperature up to 1500°F. The interchangeable plug-in elements are gold plated to focus heat toward the center of the work piece. They are available in 1-inch, 2-inch, 3-inch and now, in the new ½-inch diameters that are suitable for small work pieces.

Circle (75) on Reply Card

Probes for mixed-logic families

Kobetron designed these logic probes to test integrated circuits in any small or large complex system with mixed-logic families



(HTL, DTL, TTL, CMOS) to detect common digital faults such as open circuits, tri-state modes, nodes stuck at high or low, intermittent and/or normal pulse activity. The probes afford pulse detecting capability of 10ns with memory and pulse hold, high speed testing capability of 100MHz, buffered inputs and outputs for reverse polarity and high voltage protection, stainless steel probe tips and dual-threshold operation.

Circle (76) on Reply Card

Transient voltage surge suppressors

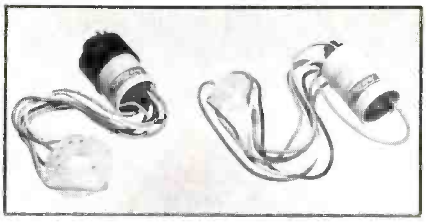
Line voltage protection devices from *Philips ECG*, a part of *North American Philips Corporation*, now includes model EMF-33 (shown in center foreground). The EMF-33 is a 3-prong polarized plug unit with 3-outlet capacity that plugs into the ac line between the power outlet and equipment being protected. The device

clamps high voltage surge or *spikes* to a safe level below 400V thereby protecting electronic equipment from damage that can be caused by such transient surges. Normal current flow is not impeded nor are costs increased. If the surge suppressor is overstressed by a powerful spike, an internal fuse is designed to open and remove ac power from the equipment. Model EMF-315, also shown, has an added RF noise suppression feature.

Circle (77) on Reply Card

Color CRT brighteners

Fly-Brites are *Telematic's* color CRT brighteners for Sony and other-make televisions that operate the picture tube off flyback filament, and cannot use conventionally designed boosters. Universal isolation-type model CR-263 permits choice of three condi-



tions—no boost, low boost and high boost. Two specifically Sony models (CR-261 for 19-inch and CR-262 for 25-inch CRTs) require *no* splicing. Standard-boost model CR-264 is designed for all other brands.

Circle (78) on Reply Card

TVRO books and videotapes

Books and videotapes describing TVRO system installation and solving terrestrial interference are available from *Microwave Filter Company*.

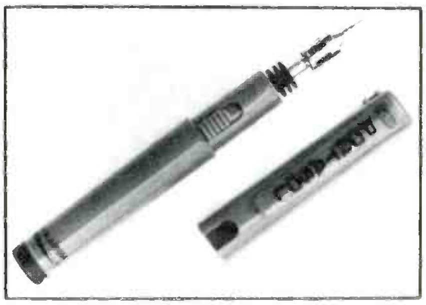
Two books and one videotape among the offerings were produced at MFC. "ASTI," the avoidance and suppression of terrestrial interference, is a 260-page book that describes techniques for avoiding, diagnosing and curing terrestrial interference (TI) at the earth station. A chapter from "ASTI" on selecting proper TVRO sites and using natural and artificial shielding to reduce or eliminate TI was made into a handbook, "Use of Artificial Shielding." The "TI Seminar," a videotape, expands the theories of "ASTI" through demonstrations.

Other videotapes, produced by Shelburne films, are "Installing Satellite Antennas," which explains TVRO system installation, and "Satellite TV Basics."

Circle (79) on Reply Card

Portable soldering iron

P.K. Neuses has announced the Portasol portable soldering iron, a compact, self-contained soldering tool that doesn't require a separate power source and has a pocket clip



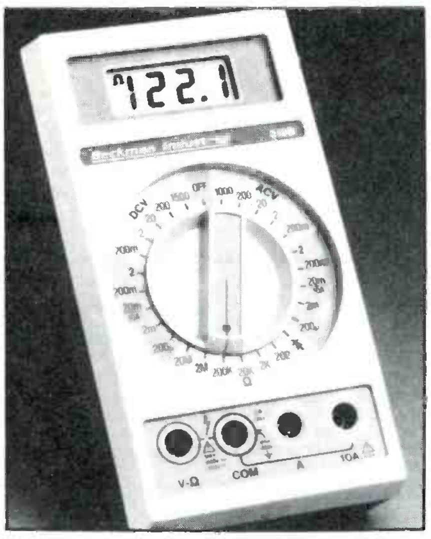
for portability.

The Portasol iron is butane powered and reaches desired temperature in 25s. The temperature is adjustable according to application and provides a range of 10W to 60W for soldering sensitive components. Static-free and CMOS safe for electronics applications, this portable soldering iron operates for 60 minutes without refilling and may be returned to the toolbox immediately without cooling.

Circle (80) on Reply Card

100ms-response MM

The Instrumententation Products Division of *Beckman Industrial Corporation* adds model 310B to its 300 series of professional digital multimeters. An audible continuity beeper for technicians who perform repeated



continuity checks is a feature; the meter can signal continuity with a 100ms-response time.

Model 310B also features a 10A (for ampere) current range, 0.25%Vdc accuracy, diode test function, 10kHz bandwidth, and a 2,000-hour battery life. The patented single rotary function/range selector switch eliminates the friction wear that reduces the life of meters using typical rotary switches.

Circle (81) on Reply Card

13 ranges of dial gauges

A wide choice of measurements from 10g to 4,000g is available in the 13 ranges of tension dynamometers introduced by *Jonard*.

Dynamometers are necessary for adjustment of pressure, starting torque or spring tension, where accuracy is required for proper operation. The tension gauge is simple to operate, measurements can be made in both directions – clockwise and counterclockwise. All gauges are equipped with maximum reading pointers.

The measuring instrument calibrates pressure, or power, needed to actuate spring tensions of all electro-mechanical devices. It is produced in two sizes.

Circle (82) on Reply Card

Tools line for terminals/conductors

A line of cable terminal and connector tools and kits has been introduced by *Xcelite* for the electronic, electrical and telecommunications fields for crimping, cutting and stripping operations.

Six crimper conformations (MIC/MAC) cover RG58-59 BNC/TNC connectors and AWG 22-14 and 22-10 insulated terminals, and a series of coax-strippers (CSK/CS 5962-5859) in pre-adjusted and interchangeable cassette models will remove dielectric, braid, and outside insulation simultaneously or in any combination.

A flat cable cutter (64-FCC) with a single-piece, solid blade features an aluminum inlay in the anvil that eliminates constant replacement.

Circle (83) on Reply Card

Lightning protector

Vicon Industries offers a lightning protector, model V15-LP, as an effective means of guarding the circuitry of today's sophisticated video components from lightning-induced power surges. This low-cost unit is installed in series between the video input cable and the video component using the *BNC* connector supplied.

The V15-LP's low internal capacitance assures excellent signal transmission, while the voltage-suppression circuitry provides complete spike protection. Moreover, the tiny device is required only on inputs that may be threatened by lightning.

A silicon transient suppressor that has positive surge capability and fast response time allows the V15-LP to protect video equipment from repeated lightning strikes.

Circle (84) on Reply Card

Readers' Exchange

Wanted: Horizontal output transformer for Penncrest model 2887A. New, or in good condition. See Sams Photofact folder 1218 – part No. TLF5013. Cannot locate from any supplier. *Joseph S. Grishin, 976 Ray Road, Wantagh, NY 11793; 516-785-8298.*

For Sale: Model 107B professional precision geiger counter in original box, make offer. Amateur radio parts: Motorola P6044-A5, Mu299A, Mu300, Mu330-3. Electronic parts for SBM 1100-R Speed-O-Print multicopier. *D.J. Aijala, 50 Fir Circle, Babbitt, MN 55706.*

Wanted: Schematic and service manuals for Sony AVC-3400 video camera, Sony AV-8400 videotape recorder, AC-1000 ac adapter. Will pay, or copy and return. Also need Sony 330AB22 CRT, new or good/used – state price. *George Nutzul, RD 1, Box 262, West Hurley, NY 12491.*

Needed: Information as to the approximate age and value of the following items that are **For Sale:** Thomas A. Edison phonograph and Cameo Ediphone phonograph, both using disc-type, 1½"x6" cylinders. *E.A. Jenkinson, 1415 Poplar, Pine Bluff, AR 71601; 501-536-6126.*

Needed: Information regarding downconverter, model channel-2 Make Test, Van Nuys, CA. Will pay for a copy of schematic. *William Duxbury, 327 Armstrong Ave., Black River Falls, WI 54615.*

Wanted: Sencore LC53; PR56; Sams Photofact 1000 up. Call or write price and condition. *Elmer's TV Service, 496 Kings Road, Apollo, PA 15613-8917; 412-478-3949.*

For Sale: VIZ Senior Voltohmyst model WV-98-C, like new, $100; new Fluke 8020-B, never used, $170; new B&K 1805MHz counter with probe, never used, $300. All prices plus c.o.d. shipping. *Stanley Todorow, G8468 Belle Bluff Drive, Grand Blanc, MI 48439.*

For Sale: Sencore VA48 video analyzer updated, recalibrated with AT218 and TR219, $775; Leader dual trace 20mHz scope, $350; Sencore CA55 analyzer with SCR224, $325; Sencore TF46 transistor tester, $150; Sencore PR57 variable isolation transformer, $290. Equipment used in part-time business; prices include shipping via UPS. *Jim Christoffersen, 32 Black Horse Lane, Belle Mead, NJ 08502; 201-359-2632 after 8 p.m.*

Needed: Operator's manuals for the Amphenol 865 Color Commander and B&K 960 transistor analyst. *Dan's TV, 316 East Avenue E, Hutchinson, KS 67501; 316-662-1868.*

Wanted: Test equipment catalogs, 1950 to present, Hewlett Packard, Tektronix, Fluke, Lambda, etc. Prefer full-line catalogs. For my offer, send detailed list and price. *Paul, 3947 Excelsior Blvd., Minneapolis, MN 55416.*

Wanted: NRI service manual vol. 2, NRI VOM model 240 and NRI tube tester model 71. *William P. Jarvis, 1214 Fifth Ave., Beaver Falls, PA 15010.*

Needed: Horizontal output transformer for Emerson 30M2001 chassis, manufacturer's part No. 79A163-2 or 79A136-1. *Thomas Carey, TC's TVs, 403 Geiger, Goldsboro, NC 27530; 919-778-8345.*

Needed: EPROM or listing for Centronics 737-1 printer. *Ray Chandos, P.O. Box 556, Trabuco Canyon, CA 92678.*

Needed: Schematic diagram and owner's manual for Webcor model EP2721-1 stereo reel-to-reel recorder. Amplifier No. 14X522, mechanism No. 11X3307-1. Will copy or buy. *Mary Jo Stanton, Rear 1725 Lafayette St., Scranton, PA 18504.*

Wanted: Book, "Semiconductors, Diode Lasers," by Forrest Mims, published 1972 by Howard W. Sams. Also, any other information on lasers: he/ne lasers, diode lasers, laser optics, etc. *Armando Petrinelli, P.O. Box 548, Newport, VT 05855; 802-334-70704, 9 a.m. to 5 p.m.; 802-334-2495 after 5 p.m.*

For Sale: Sound Technology model 1700B distortion analyzer, excellent condition with less than 20 hours of use, $2300 or *serious* offer. Will consider partial trade with late model amateur radio transceiver (Kenwood 520S, 820S, ICOM, etc.). Also, large collection Sams TR, AR, TSM, MHF and CB series – send s.a.s.e. for list; General Instrument 650A impedence bridge, make offer. *Mountain High Technology, P.O. Box 1045, Steamboat Springs, CO 80477; 303-879-7063.*

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FOR SALE

AUTOMOBILE RADIO and tape replacement parts. Delco, Chrysler, Philco-Ford, Motorola, Panasonic and many others. Large inventory. Laran Electronics, Inc., 3768 Boston Road, Bronx, NY 10469. (212) 881-9600. National (800) 223-8314, NY State (800) 446-4430. 1-85-tfn

BOOTLEGGERS BIBLE for CB Modification $12.95, CB Radio Repair $10.95. Linear Amplifier Planbook $14.95, kits, etc. Catalog $1.00 refundable – APS, POB 263 Newport, R.I. 02840 401-846-5627. 12-84-tfn

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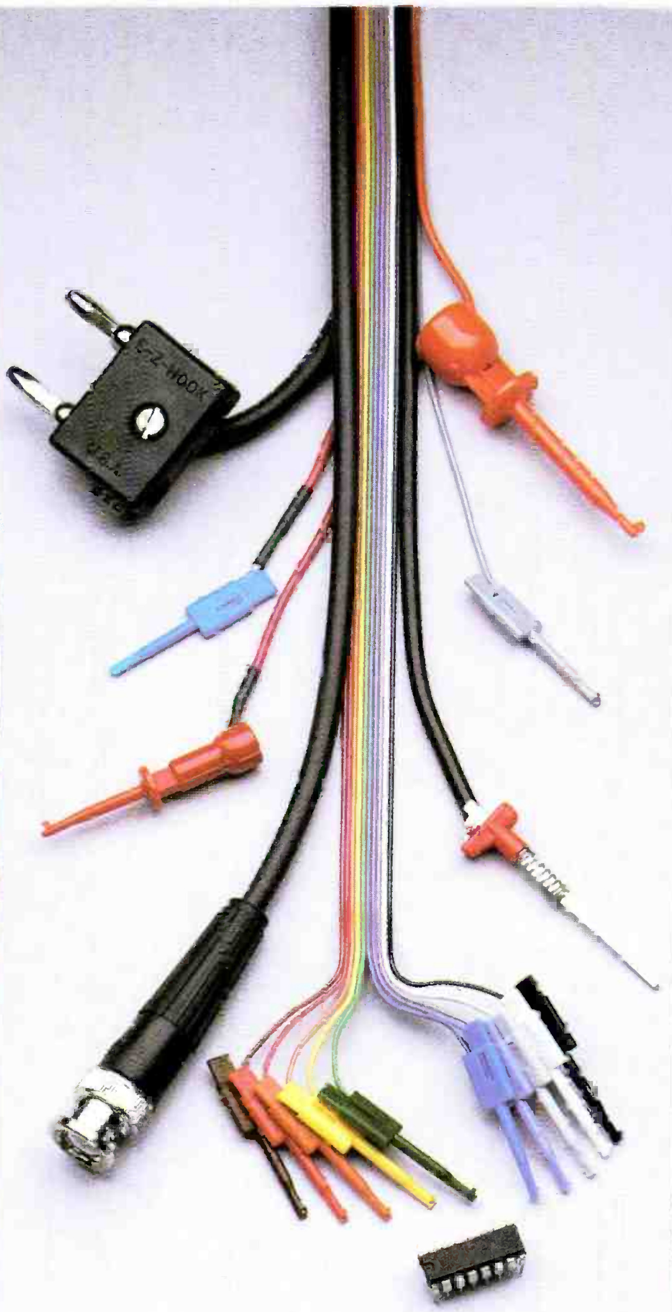

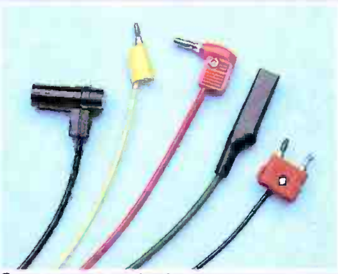
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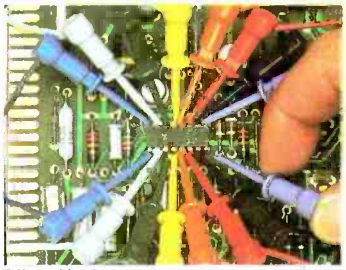
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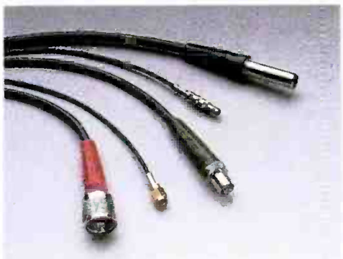
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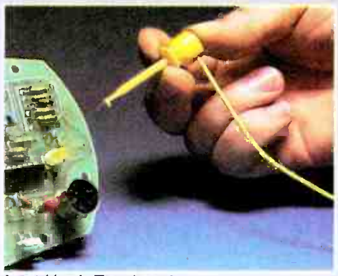
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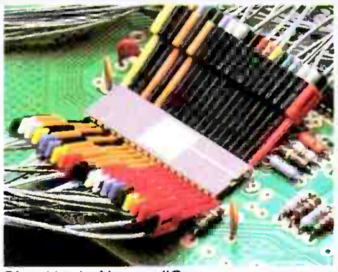
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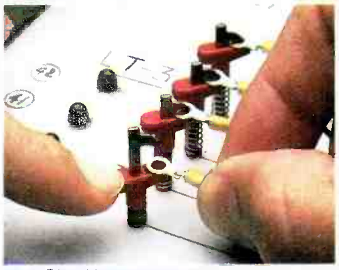
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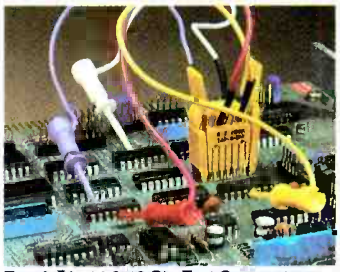
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