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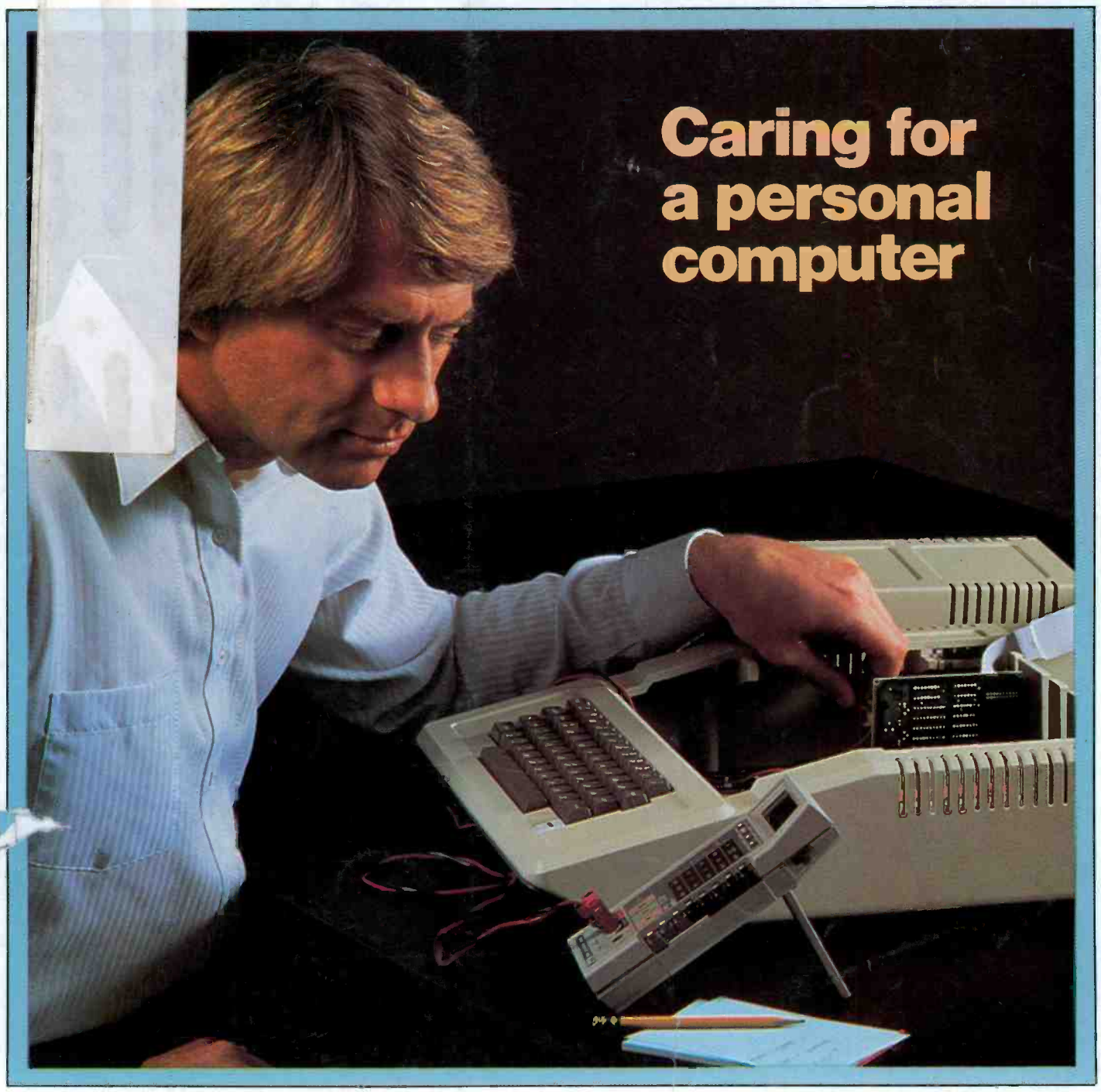
Sylvania Superset II—part 3 • Servicing computers?...Sources for parts

What do you know about electronics?—A very poor heat sink design



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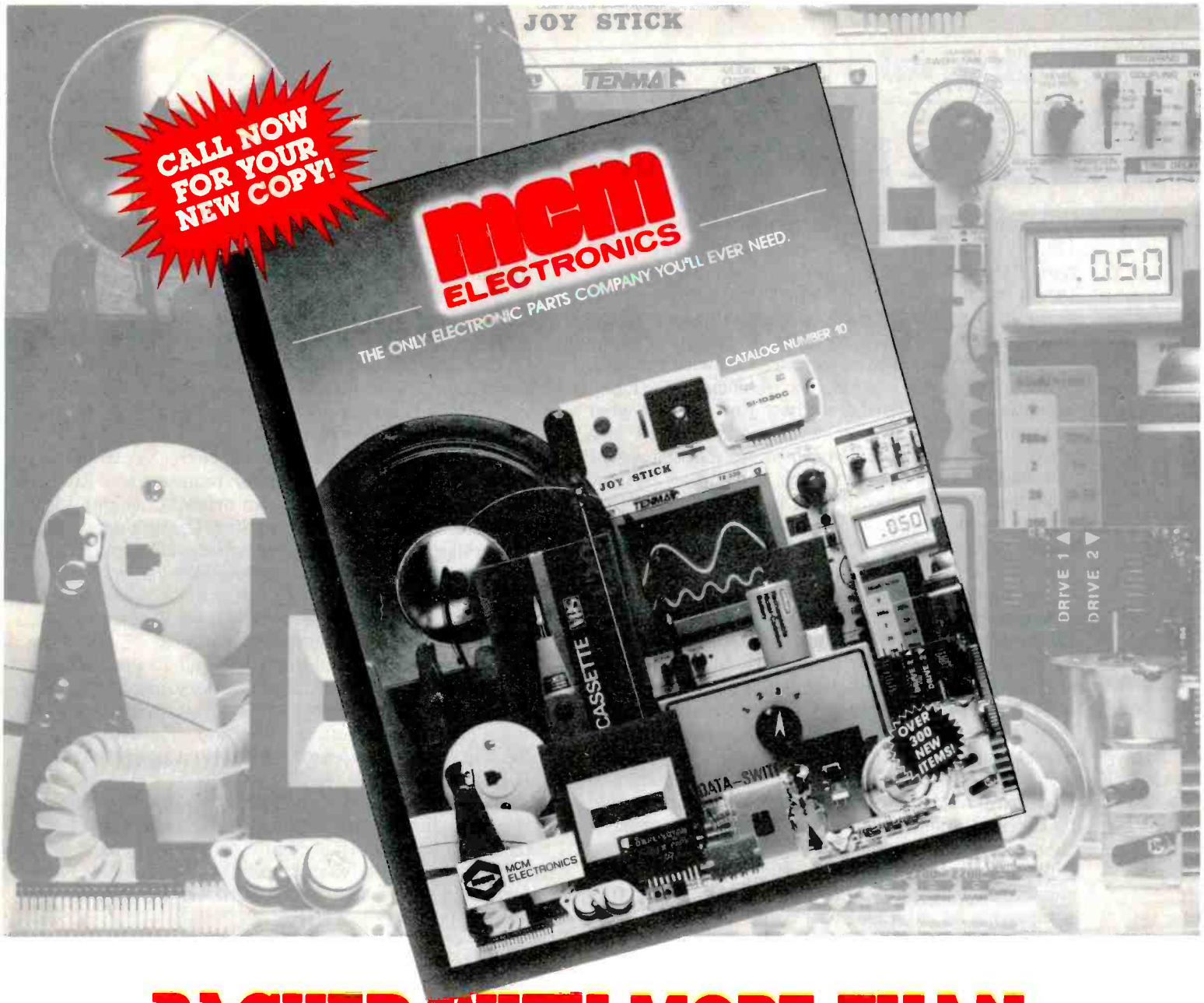
ELECTRONIC
Servicing & Technology

Volume 6, No. 6 June 1985

Caring for the personal computer, page 42. *(Photo: courtesy John Fluke Mfg. Co., Inc.)*

Technology, page 6, describes a new way to reduce wetting and to improve circuit performance.

Departments:



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Editorial

The Orient⇄USA electronic express

In recent years, the electronics industry in the United States has grown rapidly. Just a few years ago, the average home had maybe a television or two, a radio and a stereo. In just the past few years, many households have added such things as VCRs, audio/cassette decks, cordless telephones, home computers, electronic calculators and watches.

The Electronic Industries Association (EIA), recently commissioned a study to find out just what economic impact this growth has had. Here is a quote from a report called *Consumer Electronics; A $40 Billion American Industry:* "Until now, no one has attempted to quantify the full contribution that consumer electronics makes to the U.S. economy. How much business does it generate? How many jobs does it create?"

The report reveals some fascinating trends. For example, here's a fact that probably comes as no surprise to anyone: "All VCR manufacturing occurs overseas," according to the report, and "All VCRs sold in the United States for home use during 1983 were imported from Japan." Although most of us at least suspected that this was the case, the EIA report provides confirmation.

Concerning television, the report states, "Brand leadership in the U.S. color TV marketplace is held by three companies that manufacture some or all of their product lines domestically. If North American Philips (Sylvania, Magnavox, Philco), the U.S. subsidiary of Europe's largest consumer electronics company is added, these four companies are responsible for approximately 60 percent of the sets sold in the United States. These companies plus the U.S. companies that lead the industry – RCA, Zenith and General Electric – import a substantial portion of the subassemblies and components they use."

In a later paragraph the report states, "Another group of participants in the color TV business includes the major Japanese TV manufacturers (Mitsubishi and JVC), and several Taiwanese and Korean TV manufacturers (Tatung, Sampo and Gold Star). These foreign-owned companies each have color TV production or assembly facilities in the United States, and source and assemble many components in U.S. plants."

Typically then, if I understood correctly, whether a television has a solid American name such as RCA, GE, Sylvania or Zenith, or an oriental designation such as Sony, Hitachi or Gold Star, the unit probably will consist of a combination of imported and U.S. made components and subassemblies assembled in U.S. plants. Of the 12 consumer electronics categories studied, color television remains the largest category, accounting for almost 37 percent of the total economical impact for all 12 groups.

Interestingly, almost all of the personal computer hardware is manufactured in the United States with some components sourced overseas. Virtually all of the software in the less than $1000 category is from U.S. companies.

The report concludes that the consumer electronics industry in the United States represents $40 billion dollars to this country's economy and accounts for almost 1.5 million full-time jobs. Not bad for an industry that appears to be dominated by foreign products.

Nils Conrad Persson

ELECTRONIC Servicing & Technology

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Technology

Test equipment giving strange results?
Maybe it's moisture

Silicone-based fluid reduces wetting of electronic components, improves circuit performance.

Back in the old days of vacuum tubes, you had to warm up a piece of test equipment for a considerable length of time before its temperature and, therefore, its operating characteristics stabilized. Until the equipment was warmed up, any readings were meaningless.

Since solid-state components have replaced vacuum tubes, there doesn't seem to be a need for a "warm-up" period, yet experience shows that the operating characteristics, even of a solid-state scope, can vary between the time the scope is turned on and the time it reaches stable operation.

Research by Tektronix has shown that moisture is one reason for aberrations in the cold-temperature operation of a piece of test equipment.

Portable instruments vulnerable

Tektronix' main concern in this area has been with its portable testing instruments. These products are subjected to extreme environmental conditions – from arctic cold to desert heat. Moving an oscilloscope from the trunk of a cold vehicle into a room with a high relative humidity causes water vapor to condense on the electronics. During warm-up, when the instrument is still below room temperature, response distortion results if the oscilloscope parts are untreated and adsorption occurs. Instead of an expected square wave, for instance, there might be *overshoot* on the trace.

Aberrations in the response of high-impedance circuits have been a problem in electronics for many years, but now, as electronics become more miniaturized, response distortion becomes more pronounced.

Product reduces wetting

Laboratory research conducted by the Hybrid Components Operation's engineering staff in Tektronix' industrial complex near Beaverton, OR, revealed that a product manufactured by Dow Corning, typically used as a water repellent on metals, plastics, paper and fabrics, reduces wetting of substrate materials as well. This property provides consistently higher operating performance regardless of relative humidity. The discovery may lead to wetting repellent applications involving printed circuit boards and high-impedance integrated circuits.

Wetting angle roughly doubled

This product, Dow Corning 1107, works much like a car wax by increasing the *wetting angle* on object surfaces. For instance, water will form a thin layer on an unwaxed car. However, if the car's surface is waxed, the wetting angle is sharp and spread is limited. Similarly, when 1107 is applied to a circuit the wetting angle is roughly doubled by the treatment, minimizing component value drift due to adsorption of water. The result is a repeatable response in all environmental conditions, regardless of relative humidity.

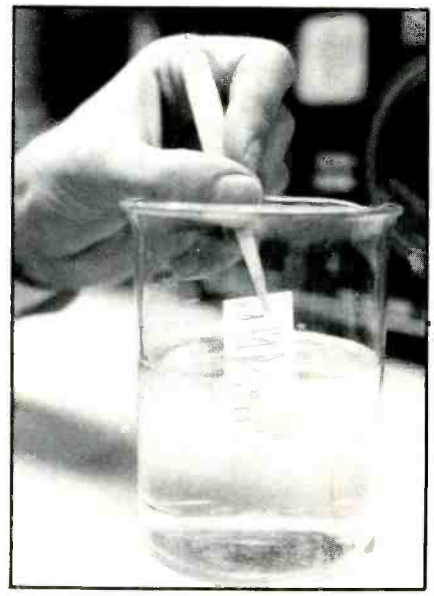


Figure 1. Signal distortion on high-performance electronics is limited by dipping the circuit into Dow Corning 1107 fluid. The component is cured for 15 minutes at 150°C. Improving wetting characteristics of parts reduces the impact of relative humidity on circuitry. In turn, that enhances operating performance of equipment.

Response affected, but why?

Tektronix first tested Dow Corning's colorless, essentially nontoxic fluid about two years ago. The fluid had a positive impact on electrical response, but Tek's engineering staff wanted to know why. Considerable time was spent looking beyond electrical response to consider chemical properties of the surface and material in electrical components.

Tektronix engineers discovered that any change in relative humidity, including blowing on the part,

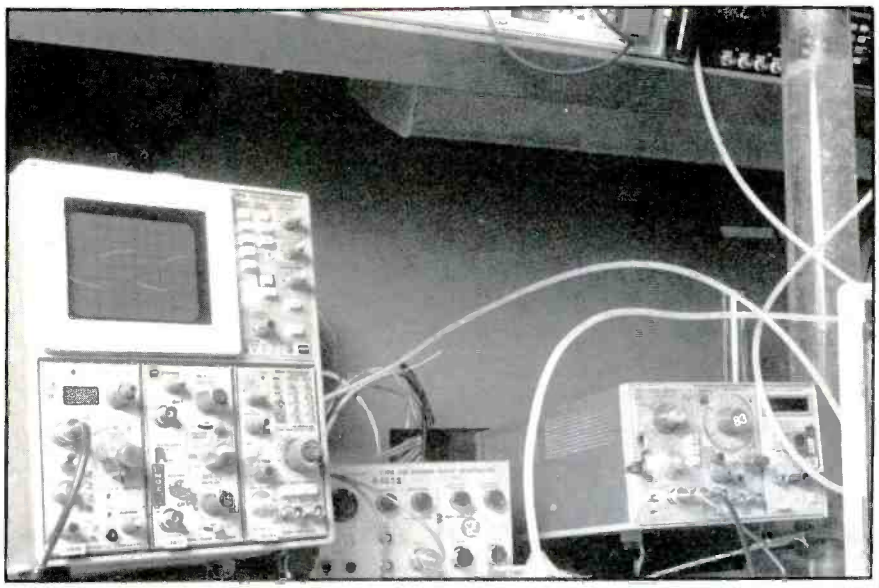


Figure 2. Signal distortion on thick film capacitors is measured by mixing dry gas with saturated gas to control relative humidity, and oscilloscope and square-wave generator to read response. Study revealed that capacitors coated with Dow Corning 1107 fluid consistently perform better, regardless of relative humidity.

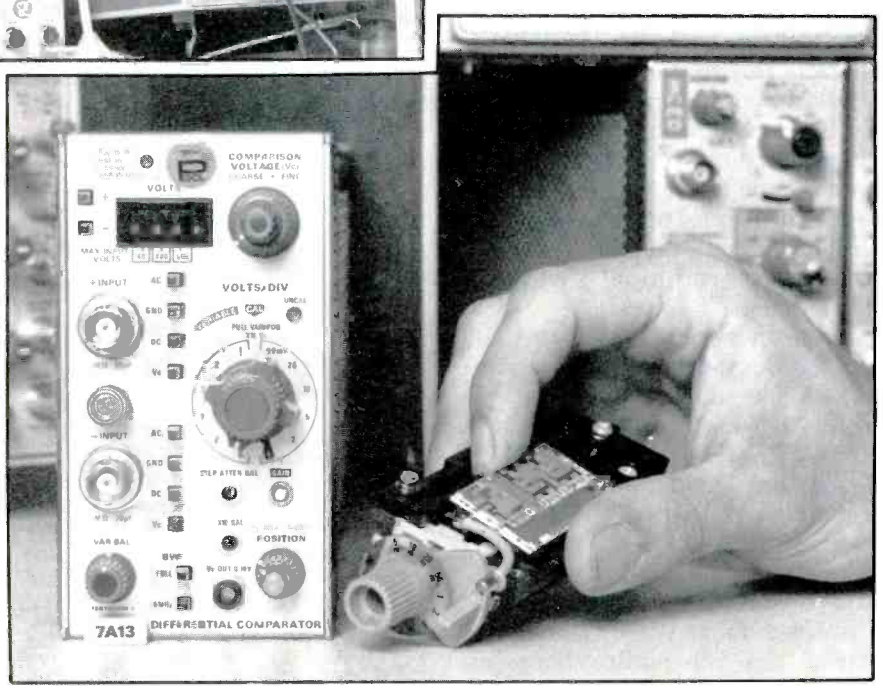


Figure 3. Attenuators treated with Dow Corning 1107 fluid have a superior performance rating to reduce signal aberration according to tests conducted by Tektronix, Inc. Changing the wetting surface of parts causes water molecules to bead up, much like they do on a freshly waxed car, rather than spreading out and building up a path of electrical conductivity.

would cause an aberration in response distortion. Their objective was to devise a standardized method of testing by controlling relative humidity.

Lab procedure described

By mixing dry and saturated gas in a sample chamber – coupled to an oscilloscope, square-wave generator and charge amplifier to compare impedance of the sample to a reference capacitor – Tek's engineers were able adjust relative humidity on the tested circuitry.

The hybrid circuits were dipped in the fluid, one part Dow Corning 1107 mixed with 99 parts solvent (chlorethene), and allowed to cure at 150° C for 15 minutes. Adding a dye enabled the engineers to see the consistency of surface coverage.

Individual measurements were then collected on thick-film capacitors and thick-film attenuators. Results bore out the theory that silicone-coated parts deliver greater performance based on an ability to withstand fluctuations in humidity. For example, various untreated materials will adsorb different levels of water at 80 percent relative humidity. As circuits adsorb more water, electrical response aberration increases as the water molecules are polarized, thus creating a distortion in the electrical loss of fidelity in incoming signal.

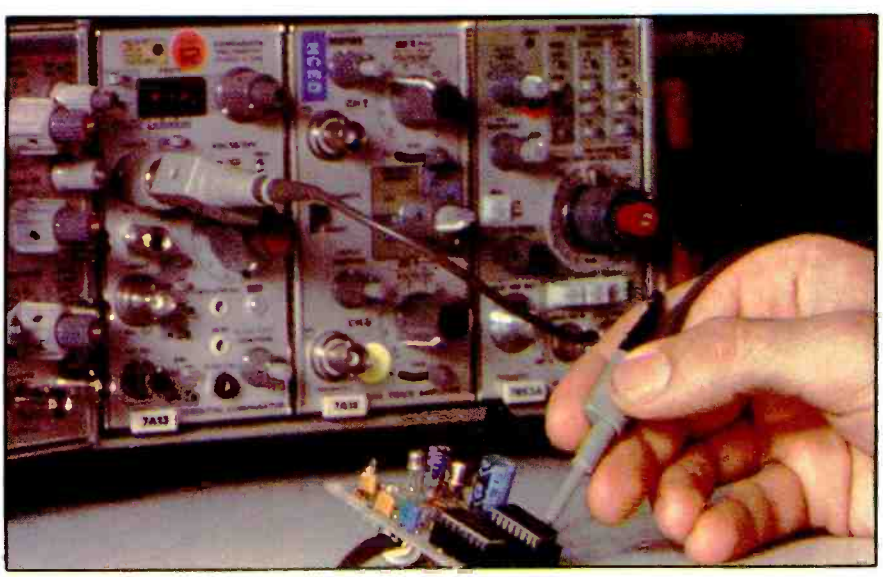


Figure 4. The capacitor and resistor in each end of a Tektronix P6131 probe, marketed with 2465 portable oscilloscope, are treated with Dow Corning 1107 fluid to prevent signal distortion. The P6130 and P6131 probes are the first Tektronix products made available with the silicone fluid. Future plans at Tektronix may include application of the water repellent treatment on a variety of electronic parts.

PART 3

Analyzing the Sylvania Superset Two

By Carl Babcoke, CET

Horizontal sweep operation from the oscillator to the flyback is covered throughly, including some interesting features of the horizontal pre-driver stage. Circuit operation and troubleshooting of the shut-down safety circuit are discussed in detail.

Part two of this series explained operation of the line-rectified power supply and the SCR voltage-regulator circuit in Sylvania model RXS198WA with its 19C4-03AA chassis. Horizontal pulses are required for proper operation of the +110V regulated circuit, providing turn-off for the SCR and sync for the timing. Therefore, the regulator cannot operate correctly without normal horizontal sweep, which is the principal subject of this article.

IC200 horizontal oscillator IC and Q248 pre-driver transistor are on the signal board (Figure 1) while the horizontal driver and output stages with flyback transformer are located on the power/horizontal board near the regulator circuit described previously.

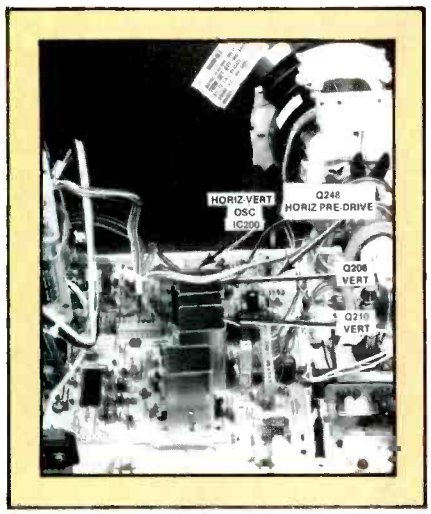


Figure 1. Arrows point out several solid-state components on the signal board. The IC200 horizontal/vertical-oscillator IC is out of sight behind the Q208 heat sink. Q248 horizontal pre-driver transistor is in the corner. Q208 vertical output is on the signal board below its heat sink that is pointed out by an arrow. Also, the Q210 vertical output is on the board below its heat sink. The third heat sink is for Q285, which regulates the +12.5V supply.

Horizontal oscillator and driver

In the sidebar titled "Horizontal drive," the schematic shows all essential circuits of the horizontal-sweep circuit, less the flyback and yoke wiring. Notice how the start-up dc voltage is routed, with D503 and D600 acting as switches.

Although the Q248 pre-driver stage appears to be a simple emitter-follower, it has some variations that make the operation difficult to analyze. Because a thorough knowledge of circuit operation is essential for efficient troubleshooting at the component level, you should study the explanations in the paragraphs and illustrations under the heading: "Increasing horizontal drive."

Arrows in the photograph of Figure 2 show the locations of some start-up, driver and horizontal-output components.

Suggestions about grounds

Notice the ground symbols in the horizontal drive illustrations, page 16. The usual symbol for *cold* grounds is used for all stages except the Q601 output where the *hot* ground symbol is found. To protect customers from electric shock, these two grounds *should not* be connected together permanently. However, during some test procedures, it is helpful to have both grounds connected together *temporarily* at the two metal plates (around two sides of the flyback).

If highest accuracy is not needed at that moment, time can be saved and mistakes avoided by connecting meter or scope common lead to both metal plates. There are several reasons for this recommendation. Dual-trace waveforms where one should have a cold ground and the other a hot ground are not practical; for example, the driver base signal and the output-transistor base signal.

The same precaution applies

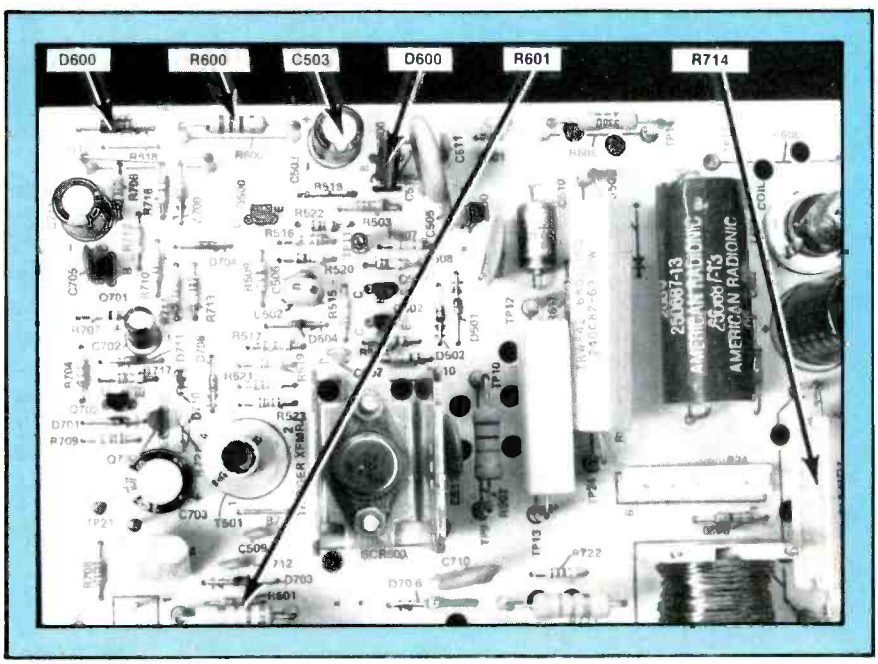
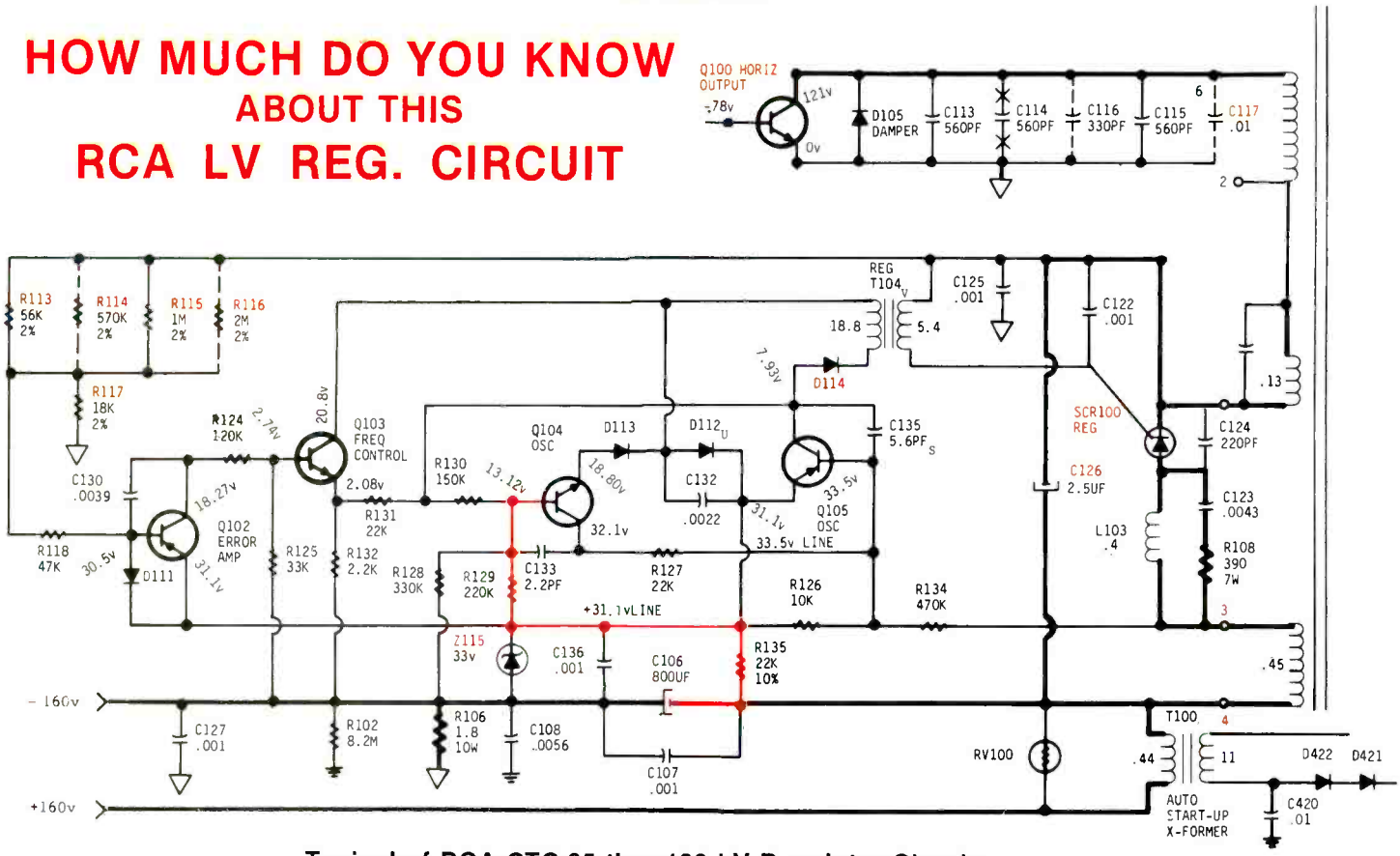


Figure 2. Arrows point out several important components of the start-up, driver and horizontal-output stages.

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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when trying to obtain scope external locking from a signal of one ground and viewing waveforms having the other ground. Unrecognizable scope waveforms result when connecting the low-capacitance probe to the +150V supply (perhaps to check the ripple) but forgetting to move the ground clip from cold ground. Alternatively, scoping the horizontal-oscillator signal (cold ground) will probably show only a distorted 60Hz sinewave when the ground clip is attached to hot ground (perhaps from a previous test). All these mistakes and more can be avoided by connecting together the grounds temporarily.

Time can be saved during dc-voltage tests, also, because the connected dual grounds can be used for almost all measurements.

Use a test lead with alligator clips at both ends to connect the two grounds together. The visible wire will make it impossible to forget about removing the temporary connection after all testing is completed.

When the best accuracy is desired, a universal ground is not recommended. Transistors and ICs operate with such low signal and supply voltages that the voltage drops across the etched copper wires of the board can introduce significant errors. For example, horizontal pulses of about 1VPP usually can be obtained by connecting a scope probe to a ground point and then connecting the scope's ground wire to another ground point several inches away. Another problem is the pickup of flyback pulses when scoping low-level signals elsewhere.

Where possible, *accurate tests with scope or DMM should be made as near the point of interest as practical.* For example, the base signal of a low-level stage should be scoped with the probe at the base (or a resistor connecting to the base) while the common lead is connected to the emitter ground. Also, the probe should be moved around (as much as space permits) while the waveform is examined. Try to position the probe where the interference from flyback pulses is minimum.

Some interesting technical subjects are ignored because they seem obvious. One of those deceptively simple circuits involves the two diodes indicated by arrows in the "Increasing Horizontal Drive" schematic. Another is the origin of the dc voltage measured at the collector of the horizontal-output transistor. A person might say it obviously comes from the supply voltage; after all the two are nearly identical and they are separated only by the flyback primary. In the 19C4 chassis, a DMM measured +111V at the input of R714, and slightly above +109V at the Q601 case in the schematic illustrating horizontal drive, page 16.

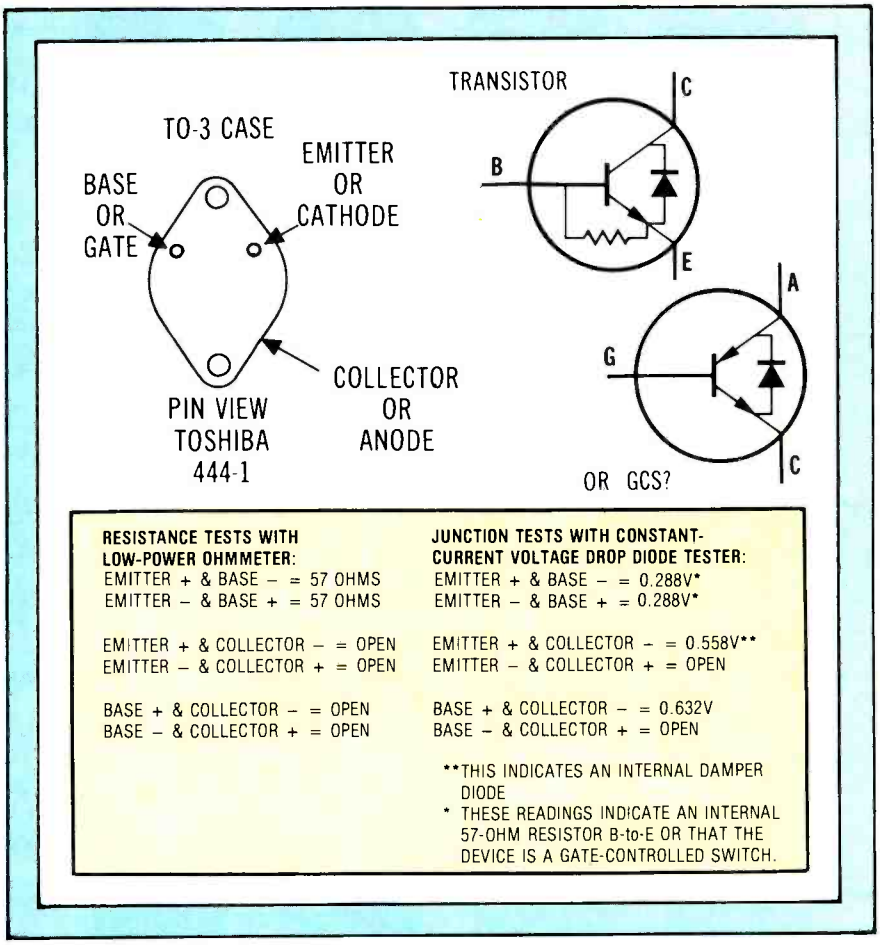

Figure 3. According to these resistance and junction voltage-drop measurements, Q601 either is a power transistor with an internal base-to-emitter resistor plus a damper diode, or it is a GCS with a damper diode.

Q601 collector voltage

A technician who is adept at making Ohm's Law calculations and is familiar with transformer-coupled circuits would say with confidence that the 2V difference is the voltage drop produced by the current flowing through R714 and the flyback primary. Perhaps this complacency might be dented by the news that the dc voltage at Q601's case is about 1Vdc for about 81 percent of the time. Specifically, for about half of the 81 percent scan time of each horizontal cycle, the 1V is positive and the other half of scan time, it is negative. (Remember that an output transistor draws a gradually increasing current for the second half of scanning, while the damper diode draws a gradually decreasing negative current for the first half of scanning.)

If the +110V source voltage is at the Q601 case for 19 percent of the time, the average voltage should be only +20.9V, which is far below the measured +109V.

Obviously, some important factors have not been discussed until now. The missing item is *resonant ringing,* which produces large positive-going pulses. These are dc pulses because the negative peak as it tries to form, is removed by damper-diode conduction, while the B+ voltage is removed by

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Q601 conduction. (Because of the flyback winding and R714, the two conductions bring the voltage at those times to about 1V during the entire scan time.) The base line between pulses is zero voltage so the pulses *must* be positive.

The next question is this: how can a meter measure +109V at Q601? Parts of the puzzle now begin to fall into place.

These positive dc pulses have an amplitude of slightly over 1000VPP. If the pulses had straight sides and flat tops, the Q601 case would measure nearly +190V. (The duty cycle is 19 percent, so according to the dc-pulse integration mathematics in the May issue "...Sylvania Superset, part two," the average dc voltage equals the amplitude times the duty cycle.) But the waveform is not square-cornered, so the average dc voltage of these dc pulses measures about +110V on a dc-coupled scope or about +109V on a digital multimeter.

In summary, *when you measure the dc voltage at the horizontal-output collector, you actually are measuring the average dc voltage of the pulses, not the dc-supply voltage.* Usually, however, there is a close relationship between the two voltages. It is recommended that measuring the case dc voltage should be a regular step in horizontal troubleshooting.

If the horizontal-sweep system is dead, the dc voltage measured at the horizontal-output case is a steady dc voltage (in those receivers that retain some voltage when the horizontal is not operating). With the 19C4, loss of horizontal also eliminates all dc voltages in the television circuits.

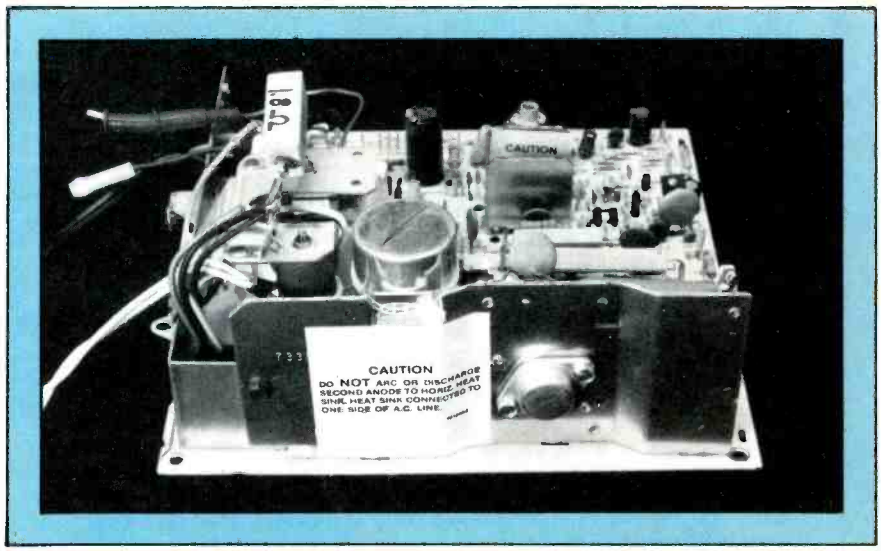


Figure 4. This end view of the power/horizontal board shows horizontal-output Q601, the horizontal output transistor, mounted with screws in a socket on the metal heat sink. The Q601 heat sink is connected to hot ground, while the other metal panel (at the left) is connected to cold ground.

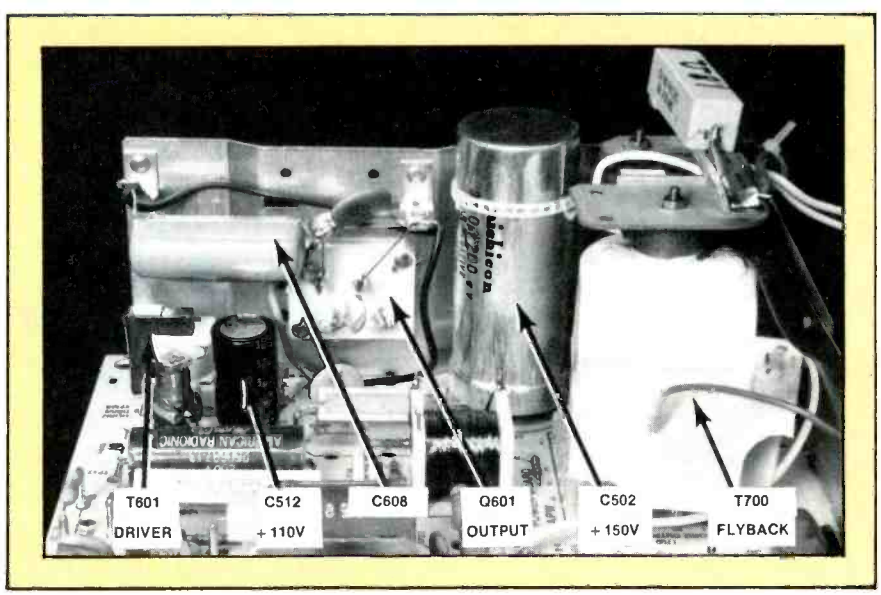


Figure 5. Several power-supply and horizontal-deflection components are located by arrows. Notice the plastic band around C502 and a section of the heat sink. This provides increased strength and rigidity to the assembly.

Inside Q601—transistor or GCS?

When the power/horizontal board was checked visually against the Sylvania drawing, no damper diode could be found, although the Sylvania schematic called for one. At first, a diode near Q601 was assumed to be the damper, but it was finally identified by the actual board wiring as D503, the start-up diode (although it was not shown or identified on the board). Q601 was removed from its socket to determine whether or not the damper was inside the Q601 case. Apparently, it was and is, for a diode-junction tester showed the proper voltage drop when the base was negative relative to the emitter (cathode?) pin.

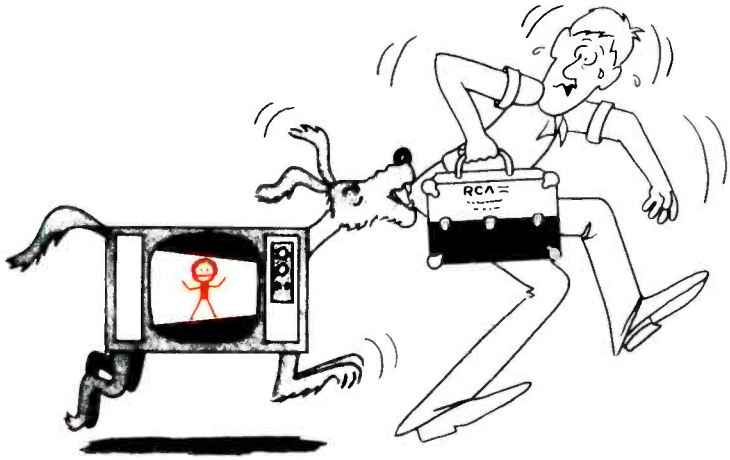
However, neither polarity of base-to-emitter voltage drops was correct for a transistor (Figure 3). According to those readings, Q601 in this individual machine either is a transistor with damper diode and a base-to-emitter resistor in it, or it is a GCS (gate-controlled switch) with damper diode. A GCS is a specialized type of SCR. It will be interesting to find out if this is a production change or a mistake on the preliminary schematic.

The Figure 4 photograph shows Q601 on its metal heat sink that doubles as hot ground for the line-rectified and regulated dcV supplies. Arrows in the photograph of Figure 5 show locations of many major components in this area.

Power from the flyback

All dc power in the 19C4 chassis (except the +110V supply and the remote-control power supply) comes from rectification of the Q601 collector/anode pulses or pulses from various flyback wind-

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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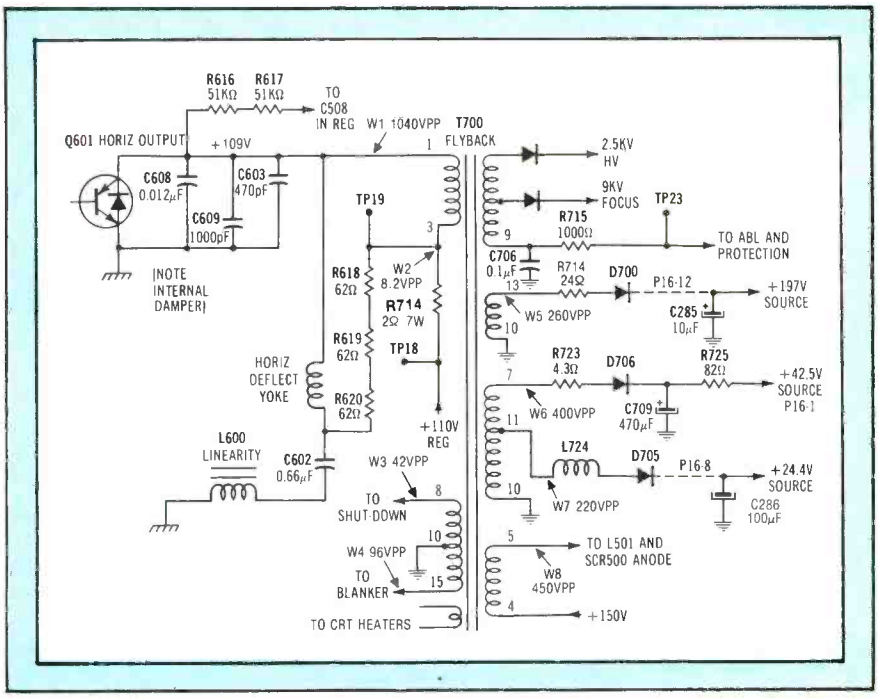
Circle (9) on Reply Card



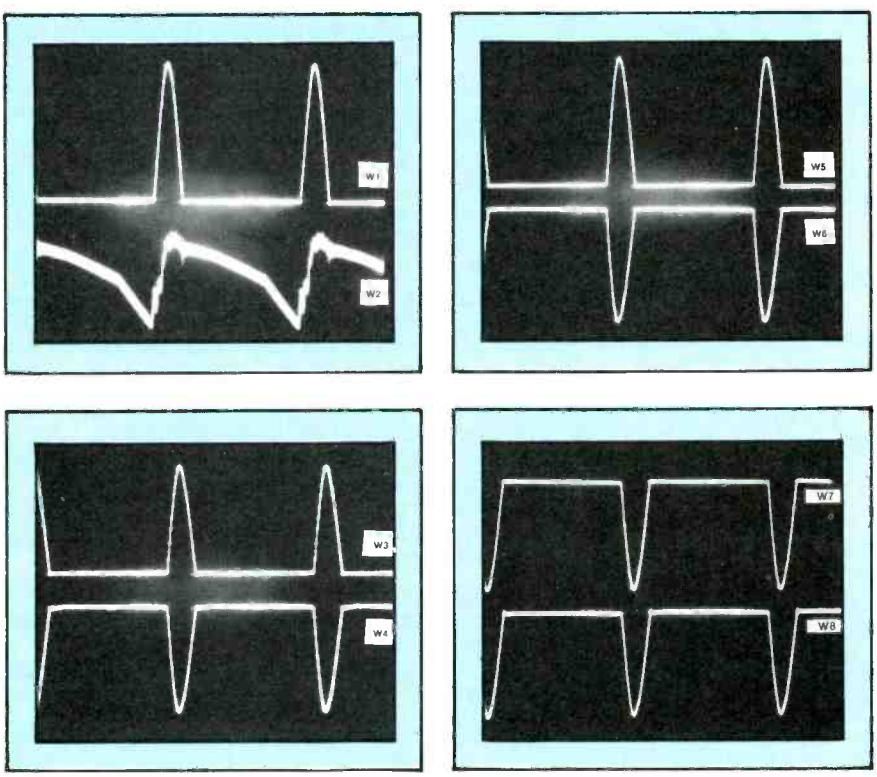


Figure 6. In addition to the usual high voltage and focus dc voltages, the flyback has other windings for the +197V source, the +42.5V source and the +24.4V source. Terminal 8 supplies pulses for the overvoltage shutdown circuit, terminal 15 supplies horizontal for the blanker function, terminals 4 and 5 are required for the SCR500 regulator, and another single-turn winding supplies the picture-tube heaters. Power is taken from Q601 to drive the horizontal-yoke coils, and a sample of the pulses is sent to C508 in the regulator to synchronize its operation. Notice that C285 of the +197V source and C286 of the +24.4V source are mounted on the signal board.

ings (Figure 6). Notice that the input or peak-reading filter capacitors for two dc supplies are located on the signal board, while the diodes are on the power/horiz board. C286 filters the +24V supply, receiving its power from P16-8. The +197V supply goes via P16-12 to the signal board and filter capacitor C285. From the signal board, the +197V supply goes through P15-1 to the picture-tube board.

Resistors R616 and R617 (upper left, Figure 6) deliver positive-going horizontal pulses from the Q601 collector (anode?) to the regulator circuit for synchronization with the horizontal frequency.

Correction of horizontal linearity is accomplished by the C602/L600 series-tuned circuit between the cold end of the horizontal yoke windings and hot ground. In addition, three resistors in series (R618, R619 and R620) partially connect together the cold end of the yoke and the cold end of the flyback's primary winding. Evidently, the circuitry does its work well, for the distorted combined current of the Q601 output device and the internal damper diode (Figure 7) is changed to a sawtooth yoke current of excellent linearity.

Through a 0.33Ω resistor, an unnumbered 1-turn winding on the flyback provides heater power for the picture tube. The CRT cathodes will not glow when the horizontal-deflection system is dead.

It is difficult to gain access to some pins of the flyback. So, to scope those signals, find a resistor or diode that is connected to the desired pin and attach the scope probe there. Use the component-and-wiring drawing to find these emergency testpoints.

Safety circuits

When they are triggered, Q700 and Q701, shown in the schematic,

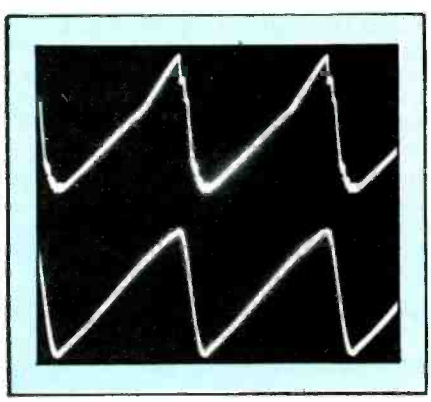
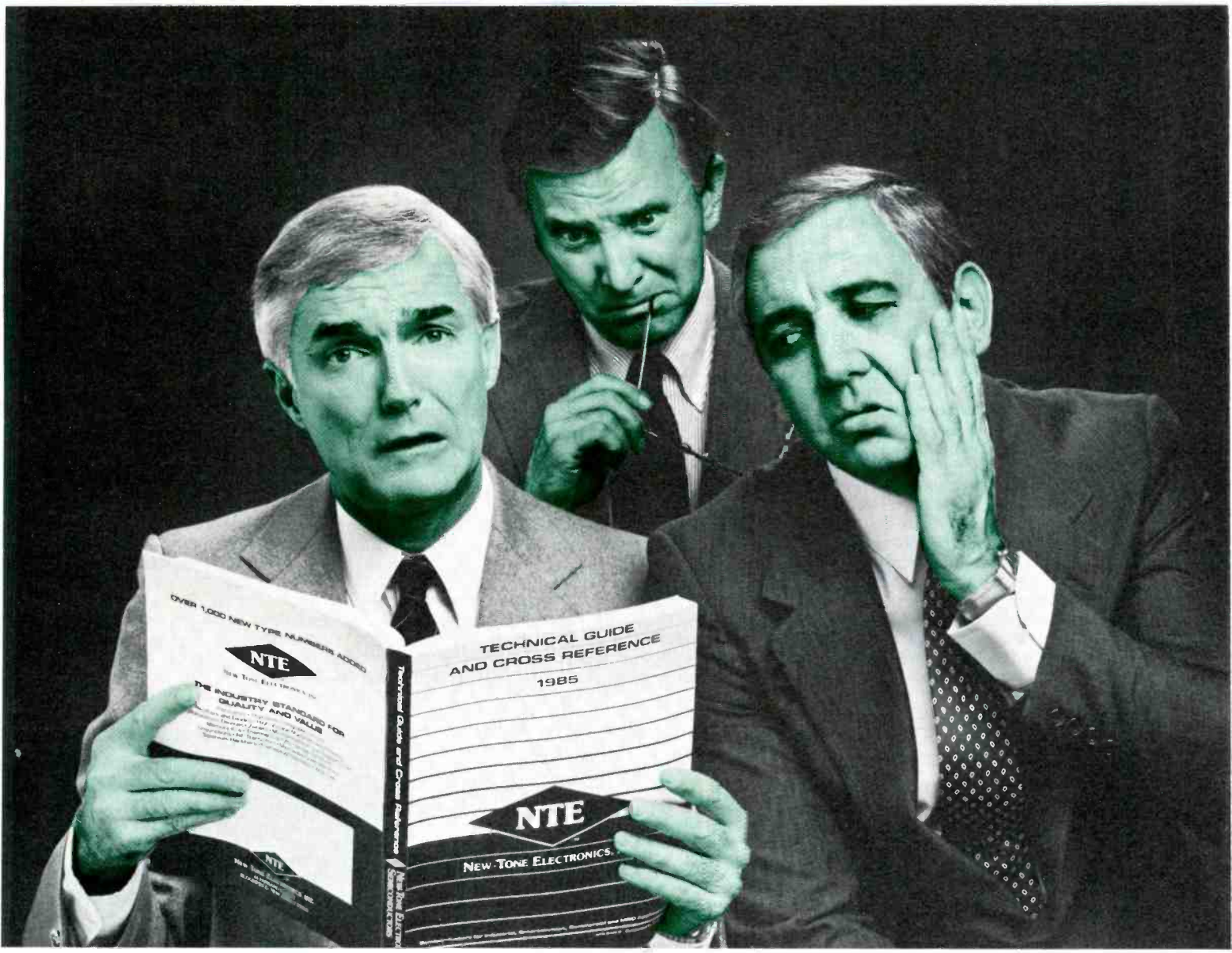


Figure 7. The top trace of the waveform is the combined currents of the output device and the damper diode inside Q601. After it has been affected by the horizontal-linearity circuitry, the horizontal-yoke current has an excellent sawtooth waveshape proving good linearity.



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Circle (10) on Reply Card

Horizontal drive

All essential horizontal-sweep circuits are shown except those for the yoke and flyback. The start-up circuit is complete from the T500 secondary (the primary operation was covered in the May issue's Part Two).

When the receiver is switched on, the peak-reading capacitor for the +150V unregulated source (C502) is uncharged, so heavy charging current flows for several cycles through the primary winding, inducing ac pulses in the secondary winding, then those pulses are rectified by D503, filtered and stored by C503 and sent to the oscillator (via R253), the pre-driver transistor through R250, and finally to T601 primary winding and the Q600 collector. Q601 has some voltage from the +110V supply, so the horizontal-sweep system begins to operate.

When full-power operation is attained, +24V is more positive than the start-up voltage (which, by now, is beginning to decrease sharply), so diode D600 is forward biased and conducts the +24V to C503 and the three loads, while D503 is reverse biased, becoming an open circuit that disconnects the start-up dc voltage from the +24V supply. Start-up now is finished.

IC200 has the internal active devices for sync-separator, phase-comparator, vertical-oscillator and horizontal-oscillator functions. Horizontal pulses exit at pin 6, then pass through R248 and C252 before reaching the base of Q248, the horizontal pre-driver transistor.

The Q248 stage appears to be a simple impedance-matching emitter-follower circuit with input at the base and output from the emitter. Some interesting questions about this stage are answered in the section titled "Increasing Horizontal Drive."

Positive-going horizontal pulses from the Q248 emitter are current-limited by 330Ω R601 before they reach the Q600 driver-transistor base at about 1.4VPP. If the safety shut-down circuit is activated, a larger positive dc voltage is applied to the Q600 base, driving it into saturation and eliminating all Q600 gain. Without Q600 gain, the collector has no horizontal signal, so the horizontal-deflection system stops all operations.

The +24V supply that operates the 120Vac *on/off* relay is eliminated when the horizontal sweep stops. Therefore, the relay contacts open, the 120Vac television power is lost and the +150V and +110V supplies have no voltage. In fact, there is no dc voltage anywhere in the receiver except in the remote-control power supply that remains in operation as long as the power cable is plugged in.

If the defect that triggered the safety circuit is gone by next time the receiver is switched on, normal start-up and continuous operation is possible. Refer to the safety-circuit discussion later.

In normal operation, Q600 collector current produces pulses across the primary winding of the T601 driver transformer, which has a large step-down ratio. The T601 secondary winding drives the Q601 base (or gate), and the T700 flyback transformer and the horizontal deflection yoke are driven by the Q601 collector (or anode) current. Diodes for rectification of high voltage are inside T700.

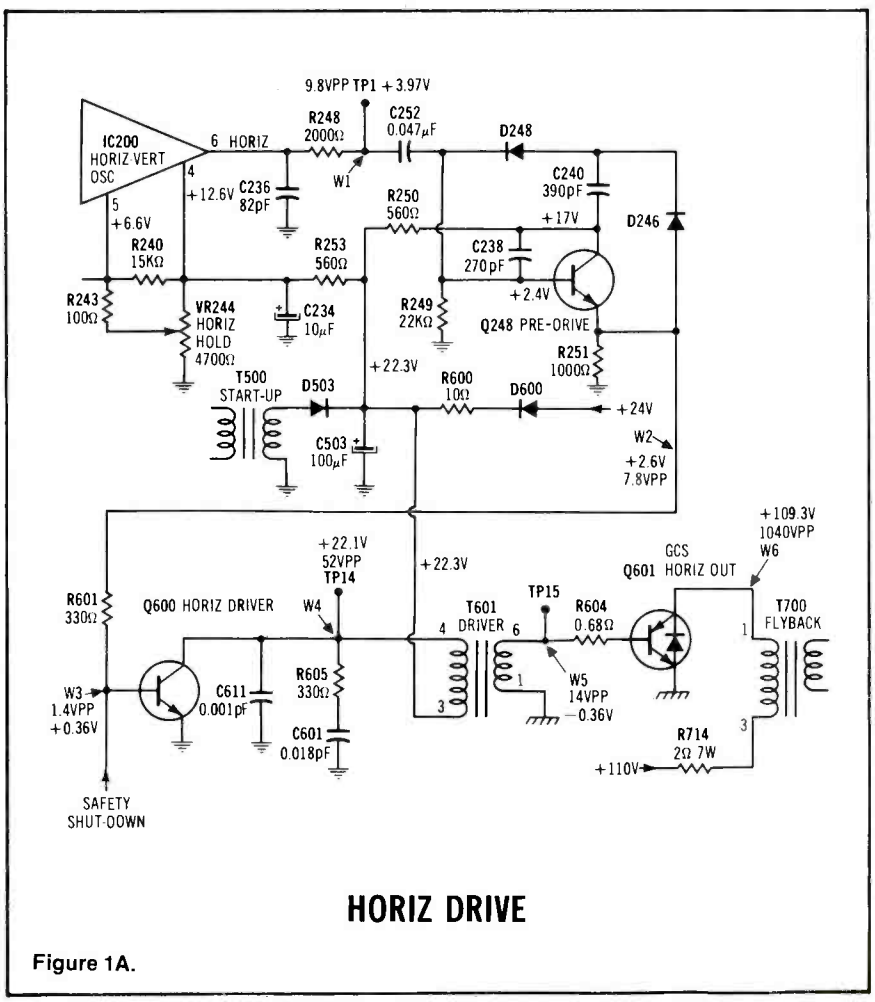
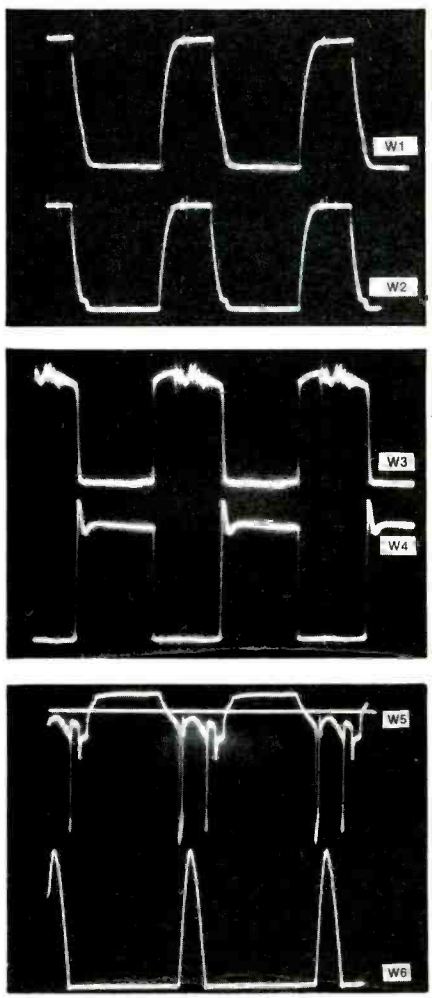


Figure 1A.



Increasing horizontal drive

The first question concerns the Q248 base dc voltage, because the base returns to ground through resistor R249. Some circuits apply a small positive voltage via a resistor between B+ and the base. There is no B+ added here. Normally, when signal biasing is employed from a signal through an input coupling capacitor (C252, in this case) and the base returns to ground through a fairly high value resistor, the base-to-emitter junction acts as a diode with its anode at the transistor base and its cathode at the transistor emitter (See Figure 2a, schematic A). Therefore, the signal is clamped with zero volts at the positive tips of the incoming pulses and the remainder of the pulse amplitude is negative.

This will measure as negative dc of a value determined by the duty cycle of the pulses. According to the dc voltages at the transistor, it is cut off by reverse bias. However, it draws base current on the positive tips of the signal so it amplifies and has collector/emitter current at those times. Such a signal condition can drive a grounded-emitter type of transistor circuit very well, if the pulses have sufficient amplitude. However, this Sylvania uses Q248 as a high-impedance-to-low-impedance device by wiring it as an emitter follower, and emitter followers require far more base ac-signal amplitude because of the emitter

According to the actual dc voltages and waveforms of the Q248 circuit, something in the circuit produces better drive than I anticipated. One proof was the readings that showed the Q248 base only 0.2V less positive than the emitter.

The next question involves the two diodes (D246 and D248) that are connected in series between base and emitter. They do not appear to have any practical purpose. Of course, a single diode (of polarity opposite the transistor junction) sometimes is connected between a transistor's base and emitter to prevent excessive reverse bias (the reverse bias is thus limited to about 0.7V). Why are two diodes used? And why is C240 added between the collector and the common point between the two diodes?

Answers to these questions might have been found merely by disconnecting D246 and D248 and making new measurements. However, damage could have occurred if the deletion reduced the horizontal drive enough to cause failure of Q601.

Because of danger to the receiver, another method was used. The components of schematic A, Figure 2a, were connected by tack soldering. When the two diodes were connected as shown (without the transistor base), clamping occurred near the negative tips, Figure C, producing a positive waveform that measured +4.27V. After the two diodes were disconnected and another added to simulate the base/emitter junction of Q248, the clamping placed zero near the positive tips, so virtually all of the pulse amplitude was negative, measuring −7.35V on a DMM. (The differences in reading are due to the almost 37 percent duty cycle of the waveforms.)

Next, an attempt was made to simulate an emitter follower by feeding some of the input pulses through a variable resistor to the 1000Ω "emitter" resistor. This was not successful. Apparently, there was no method to simulate the driver circuit by using only diodes.

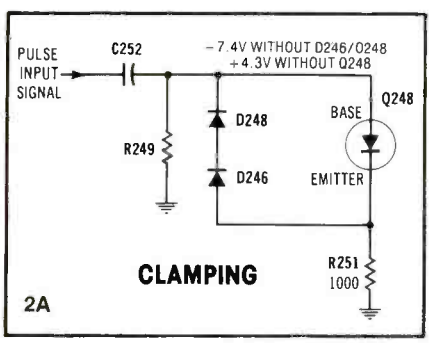
Finally, the imitation Q248 stage of schematic B, Figure 2a, was breadboarded, and powered by a variable-voltage supply. Although base and emitter voltages were slightly different than those in the Sylvania, the circuit did operate correctly using generator pulses as input at about 10VPP. Experiments with the two diodes were repeated.

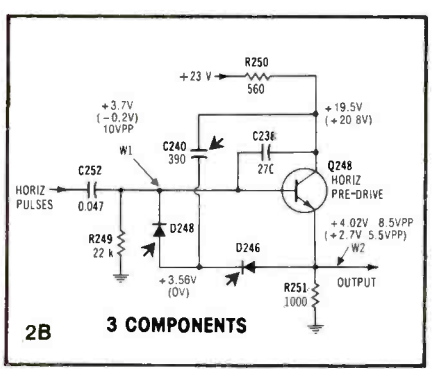
Figure 2c shows the real Sylvania pulses with zero line added to the top one (base waveform). Zero line for the emitter waveform (bottom trace) was precisely on the base line, so was omitted for clarity.

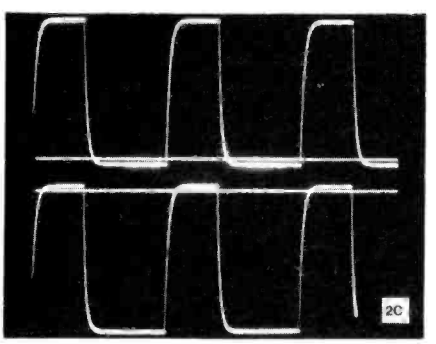
Figure 2d shows the same two waveforms from the breadboarded circuit, remarkably accurate for simulations.

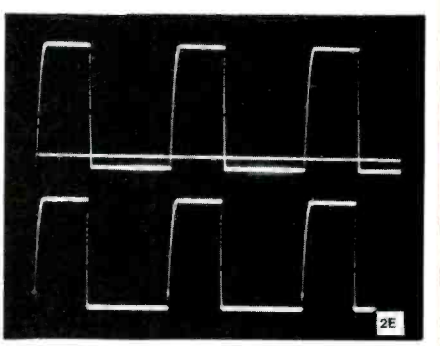
Then, D246 and D248 were disconnected from Q248 base and emitter (which disconnected C240). The changes are shown in the F photograph waveforms. The zero line in the base signal has moved upward. Because the transistor operates only on the positive peak, this had the effect of greatly decreasing the input signal amplitude. Proof is shown by the bottom trace in Figure 2e that has decreased about 35 percent compared to the previous emitter amplitude in Figure 2d.

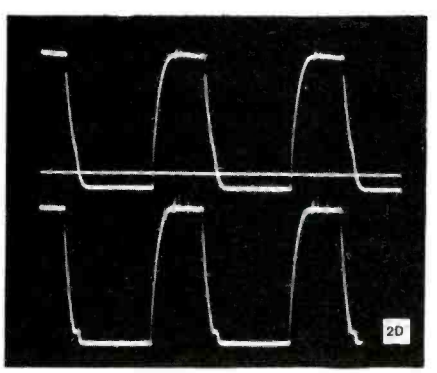
In another test, not shown by waveforms, the diodes were connected, but C240 was removed. The zero-voltage line in the base signal went up slightly higher and the emitter waveform amplitude decreased by perhaps 10 percent. Therefore, *C240, D246 and D248 are all essential for the production of sufficient emitter signal amplitude from Q248.*

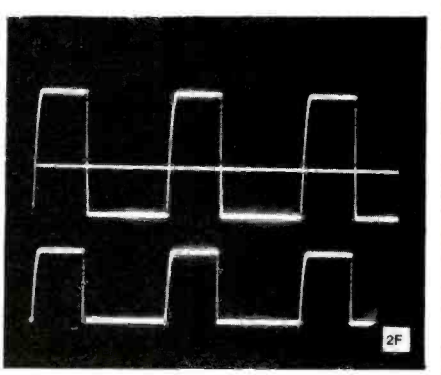












"Safety Circuits," page 20, form a regenerative latching circuit, and this sends the Q700 collector voltage through a resistor and two diodes to the Q600 driver-transistor base. This high forward bias saturates Q600, which eliminates the drive at Q601 and stops all horizontal sweep. The sequence is called *shut-down.*

One safety circuit triggers shut-down when the amplitude of the flyback pulses exceeds a certain value. The other safety circuit triggers shut-down when the picture-tube current exceeds a maximum. Because there are separate sensor circuits, one will trigger easier if the other is above normal. For example, a 20 percent excessive CRT current might not trigger the shut-down alone, but combined with a moderate amount of excessive high voltage, shut-down can occur more readily. This provides

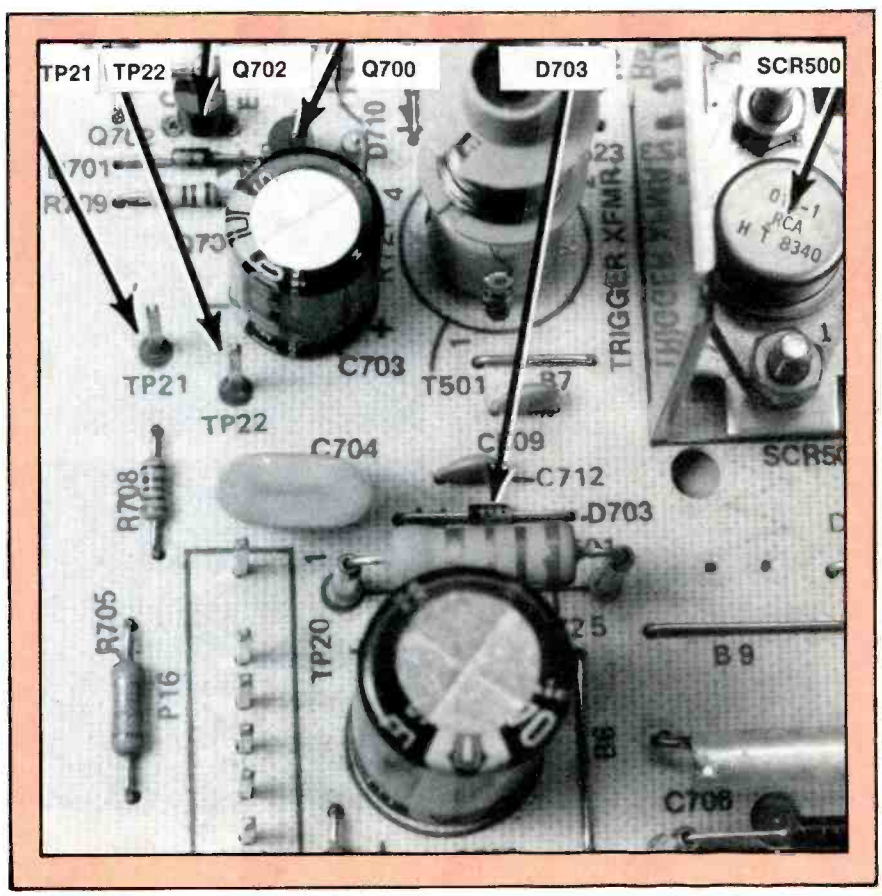


Figure 8. Arrows show the locations of testpoints TP21, TP22 and other safety-circuit components on the power/horizontal board.

greater protection from X-rays and receiver damage.

Several of the safety-circuit components are identified and located by arrows in Figure 8.

Instructions in the NAP Technical Training Manual say to test the operation of the shut-down circuit by connecting a 1000Ω resistor between TP21 and TP22. Total shut-down should take place immediately, if the shut-down latching circuit is operating correctly. (The 19C4 schematic shows a 4.7K resistor in series with TP21, which would make the 1000Ω resistor unnecessary, but that must be for an older version; no such resistor is on the circuit board.)

Remember that all dc voltages in the receiver (except the remote-control power supply) are eliminated by any of these three conditions: failure to start-up; a successful start-up followed instantly by shut-down; or a shut-down after some time of normal operation.

Unfortunately, there are no measurements that can be made on the chassis that can prove whether or not shut-down occurred. Perhaps the best method is to disconnect the safety circuit completely and check the performance without it. Of course, the receiver must be protected in case there is a defect that causes excessive high voltage.

Therefore, disconnect the safety circuit by unsoldering one end of D704, supply the receiver with ac power from a variable-voltage transformer that is adjusted for about 90Vac. Measure the high voltage at the picture tube and the +110V supply. Because of the low ac voltage, the high voltage should be slightly lower than usual, and the +110V source should measure about +103V. If the +110V supply voltage is higher than +103V there is a defect in the regulator circuit and the higher flyback amplitude is triggering the shut-down. If the regulated supply is about +103V but the high voltage is higher than is normal for 120Vac operation, the regulated supply is operating correctly, but the horizontal-output system is producing excessive pulse amplitude and high voltage, perhaps because C608 has become open or a lead wire has broken.

After repairs are made and operation appears to be correct at 90Vac line power, resolder D704 and test the receiver at 120Vac. If it operates normally through a heat run, check the shut-down operation by connecting a 1000Ω resistor between TP21 and TP22. The receiver should shut down instantly, but when the power is switched off for a couple of minutes and then turned on again, the receiver should start up and operate normally.

Any serious deviation from these expected responses to the shut-down tests indicates further defects and the need for additional repairs.

Comments

The Figure 9 photograph shows one of the minor physical features of the 19C4 chassis boards that is worthy of favorable comments. Near the top is R605, a 330Ω 1W resistor that is mounted about one-half inch above the power board on two hollow pins. The resistor leads

The synergism of safety circuits in effecting shut-down

Q700 and Q701 form a regenerative latching circuit when Q700 is made conductive. Q702 and its circuitry monitor the picture-tube current and trigger the Q700/Q701 latch when the current is excessive. Diode D703 rectifies pulses from one flyback winding. When the pulse amplitude is excessive the precision-divided output of the D703 dc voltage increases the Q700 emitter voltage, starting shut-down.

During normal operation with rated high voltage, Q701 has zero bias because the emitter is grounded and its base voltage comes from the Q700 collector that also has zero voltage now.

PNP Q700 has reversed bias. Its base voltage is held at a constant +5.54V by the Z700 zener-regulated supply, while the Q700 emitter has a lower positive voltage produced by D703 and a precision voltage divider with the voltage stored in C703, a 1000μF capacitor. Therefore, both latching transistors have no forward bias, no gain and no collector current. There is no positive voltage at the Q700 collector to eliminate the Q600 gain, so the safety circuit does not interfere with normal operation of the TV receiver.

Now, assume a defect in the horizontal-deflection system has increased the flyback pulses by about 15 percent. The Q700 emitter voltage is forced to rise about 0.6V above the fixed base voltage. This is partial forward bias that produces some conduction which applies a positive voltage to the Q701 base, R713 and the two diodes. Although the Q701 base voltage is not sufficient for saturation it does produce some collector current which reduces the +5.53V zener regulated voltage slightly.

The decrease of the regulated voltage at the Q700 base increases Q700's forward bias, thus increasing its conduction, which increases the positive forward bias at Q701's base. Q701 also draws increased collector current that reduces Q700's base voltage thus increasing the forward bias, and so on. This regenerative condition goes from beginning to saturation in a few microseconds, ending with both Q700 and Q701 saturated.

The Q700 dc collector voltage is large enough to overcome the 2V or so of the two diodes and the Q600 B/E junction and supply saturation forward bias to Q600 driver transistor. Saturation bias eliminates all gain, so Q601 has no drive and the horizontal-sweep operation stops immediately. This is shut-down. *Excessive picture-tube current also can cause shut-down.*

Pin 9 of the flyback is the cold end of the high-voltage winding. Higher CRT current produces higher negative voltage at pin 9. Of course, the negative voltage is obscured by positive voltage added in the picture-limiter buffer stage. Increased CRT current decreases the positive voltage at flyback pin 9.

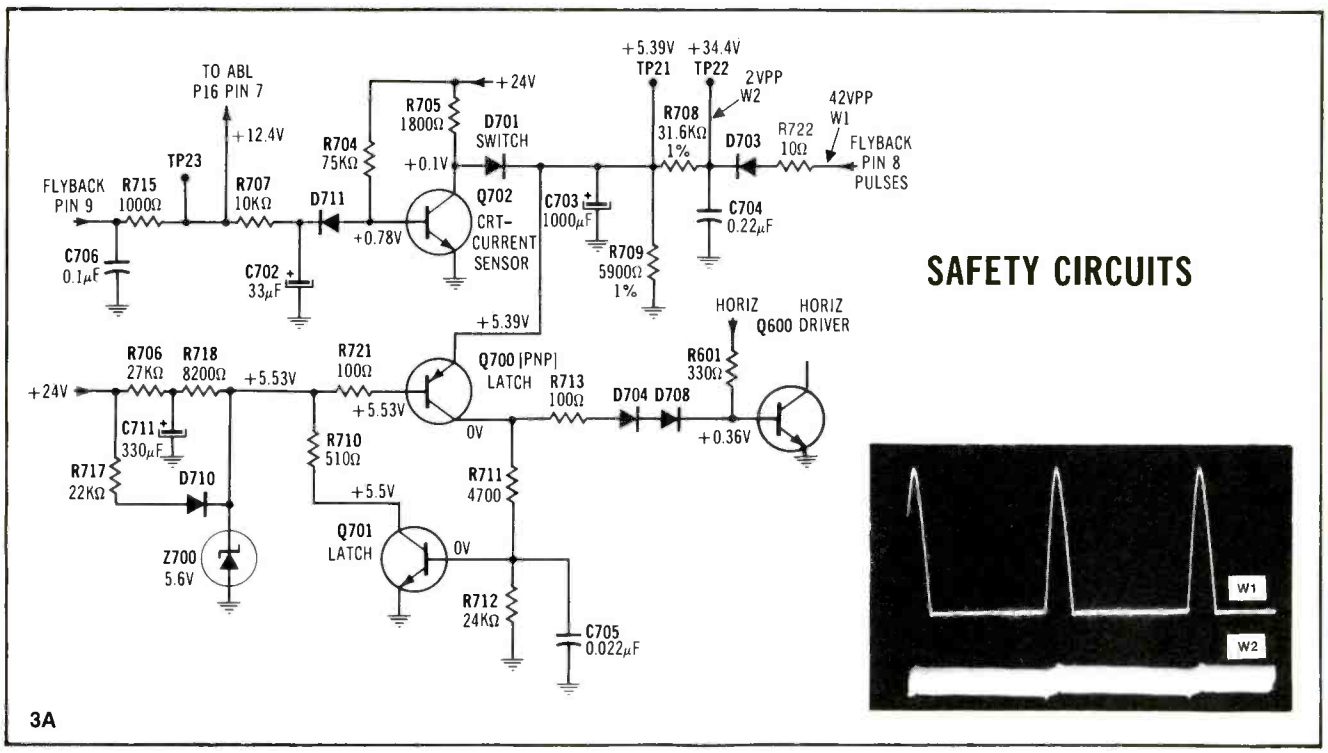
Diode D711 is used as a voltage-controlled switch. Its anode is connected to the Q702 base that measured +0.78V in the sample receiver. Q702's emitter is grounded, so Q702 normally is saturated, which accounts for the +0.1V collector voltage.

D701 is reverse biased, having +5.39V at its cathode and almost zero at its anode. Therefore, D701 disconnects the current-sensor circuit from the shut-down circuit when picture-tube current is normal.

If the CRT current becomes excessive, the increased negative voltage from flyback pin 9 will overcome the circuit's positive voltage and force the D711 cathode negative. Because D711's anode is slightly positive, D711 is fully conductive now, transferring the negative voltage to the Q702 base where it forces Q702 to become non-conductive.

When Q702 stops drawing collector current, its collector voltage rises toward +24V which is applied to the D701 anode, forward biasing it (the cathode originally had +5.39V) and passing voltage and current through D701 to the Q700 emitter. Of course, the Q700 emitter voltage does not rise to +24V since R705 gives current limiting, but it does increase enough to trigger the latching effect of Q700 and Q701, saturating Q600 and producing complete shut-down.

Operation of a safety circuit that is not interfering with the horizontal deflection can be tested by connecting TP21 and TP22 together by a 1000Ω resistor. Shut-down should occur immediately. To restore normal operation, wait for a couple of minutes and switch the power on. Start-up and correct operation should follow.



3A

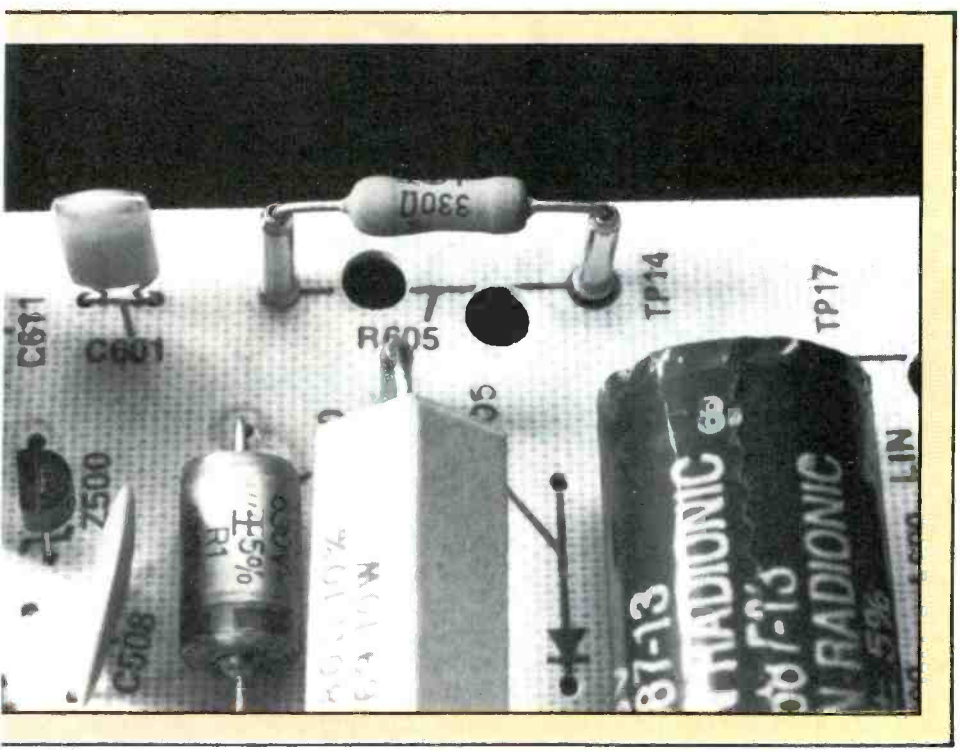


Figure 9. Mounting all hot or heavy components on hollow pins (that are soldered at the bottom of the board) is one example of the care Sylvania has used to prevent all possible damage to components and boards from heat and vibration.

go down through the pins and are soldered to the copper wiring on the board's bottom. All resistors that operate warm or hot are mounted this way to prevent carbonizing the board material. The larger tubular capacitors are mounted the same way because the pins give better mounting strength and rigidity.

Components are mounted on the board's top side, and most have identification numbers close by. All "printed" wiring (called that in error during previous years) is on the bottom side of the board. There are no rivets connecting top wiring with bottom wiring, since no top wiring is supplied.

Nothing about these boards should produce an undue number of intermittent problems. That is good news for active technicians.

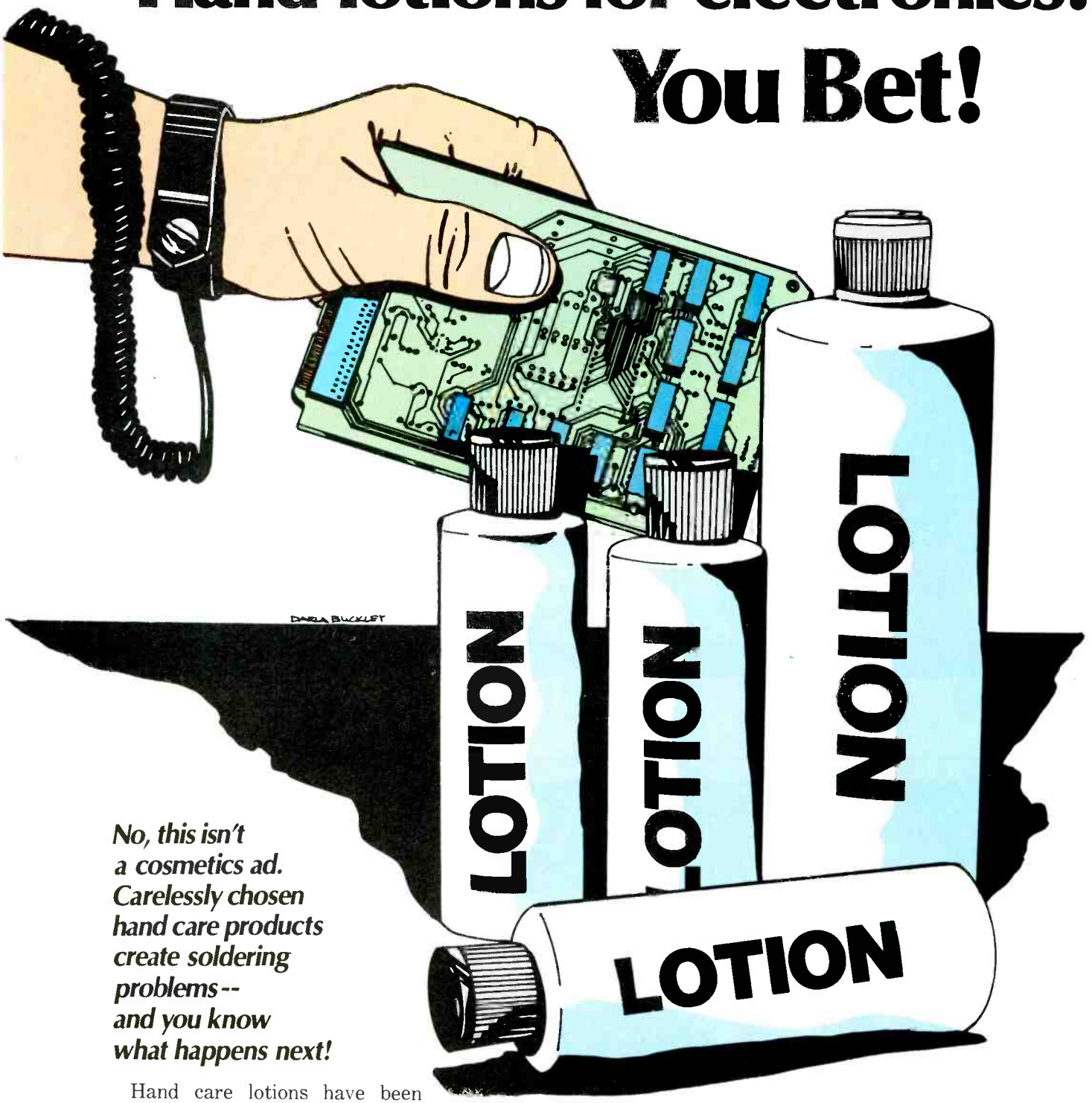
Next article

The vertical-sweep system and other important stages will be studied in detail next time.

ES&T

Hand lotions for electronics?

You Bet!



No, this isn't a cosmetics ad. Carelessly chosen hand care products create soldering problems -- and you know what happens next!

Hand care lotions have been developed exclusively for the electronics industry because the use of ordinary products, regardless of price, can cause circuit contamination devastating to the solderability of an electronic assembly.

Almost everyone uses skin care products in one form or another. Men's hands can suffer from exposure to corrosive chemicals and biting weather. So do women's. The use of soothing lotions, therefore, is not limited to either sex. Men's lotions have less perfume and more masculine-sounding names, but the basic ingredients are the same as in the lotions favored by the ladies. Indiscriminate use by electronics technicians of any of the popular hand care products can be responsible for those undefined solderability problems that you, our readers, may experience from time to time.

As you well know, electronics-assembly soldering requires meticulous awareness of possible contaminants – the life expectancy and intended function of the assembly depend heavily on the reliability of its soldered connections. One faulty solder joint can cause the entire assembly to malfunction. Problems created by poor soldering are time consuming and often phantomlike. They are

difficult to locate and to repair.

There are many factors involved in producing a quality solder connection; the condition of the surfaces to be joined is one of the most important. These surfaces must be clean and free of contamination. Although flux is an integral part of all soldering operations, and is used for the purpose of cleaning the surfaces to be joined, its cleaning ability should not be overestimated.

The types of flux most often used in electronics are derived from rosin. Rosin-type fluxes are the safest to use, but are relatively poor cleaners. Their intended purpose is to remove minor oxidation only. Therefore, they cannot be relied on for removing contamination caused by mishandling of components, including removal of residue from undesirable skin care products.

Silicon, lanolin and mineral oil may be found in substantial amounts in the formulations of conventional lotions. These are known deterrents to solderability. When found in familiar products, such as silicon grease and machine oils, you, as a trained technician or knowledgeable hobbyist, would recognize the potential problems and make every effort to prevent their coming in contact with a surface to be soldered. However, when these same materials are found in skin care products, they often are overlooked as being the same type of hazard.

Although silicon, lanolin and mineral oil are the most common types of contaminants found in hand lotions or creams, they are by no means the only ones. Other ingredients that cause solderability problems are the wide variety of vegetable and animal fats used in these products. The problems they cause are in direct ratio to the amount of these undesirable ingredients and the frequency with which the lotions are applied.

I.C. Lotion is a skin care product that is totally free of soldering deterrents. It was especially formulated for R & R Lotion, Tempe AZ, when the need was recognized for a non-contaminating and soothing hand lotion that could be used by anyone associated with electronics. I.C. Lotion is available in an 8-ounce size for use in the field or at the bench, or there is a wall-dispenser size if larger quantities are required.

Circuit contamination resulting from hand contact is not limited to the use of conventional hand care products. Often food contamination is just as damaging. Potato chips, for example, contain oils and salts that are corrosive and impede solderability. There also is a wide variety of other contaminants that can be picked up on the hands and transmitted to the circuits. Clean hands are, of course, the responsibility of each individual. If you are using a harsh hand soap in the belief that "harsher" is more cleansing, you may be defeating your purpose. Harsh hand soaps have such a drying effect on the hands that they actually discourage thorough hand cleansing. Having a lotion dispenser handy should help solve this problem.

If you would like to obtain more information about I.C. Lotion, formulated for R & R Lotions, Tempe, AZ, circle 150 on your Reader Reply card.

Test your electronic knowledge

By Sam Wilson

The day of the super technician is coming fast. A super technician is not only an expert in electronics, but he also knows much about the related fields of hydraulics, fluidics, mechanics, etc. This is a test for the super tech. If you can answer at least half of these questions, consider yourself to be a super tech!

1. An accumulator can be described as:
A.) a memory location for temporary storage of information in microprocessors.
B.) a type of buffer used in hydraulic systems to compensate for changes in flow demand due to varying loads.
C.) Both of the above descriptions apply to an accumulator.
D.) Neither of the above descriptions apply to an accumulator.

2. Figure 1 shows three friction-drive wheels. Wheel *A* has a diameter of ¾ inch and turns at a speed of 10 rpm. Wheel *B* has a diameter of 1 inch, and it drives wheel *C*. If the diameter of wheel *B* is reduced to 0.8 inch, the speed of wheel *C* will
A.) increase.
B.) decrease.
C.) not change.

3. Of the following components, the one most likely to generate undesirable partition noise would be:
A.) MOSFET
B.) a bipolar junction transistor.
C.) JFET
D.) VDR

4. The address of the next instruction in a microprocessor is found in the:
A.) program counter.
B.) accumulator.
C.) index register.
D.) instruction decoder.

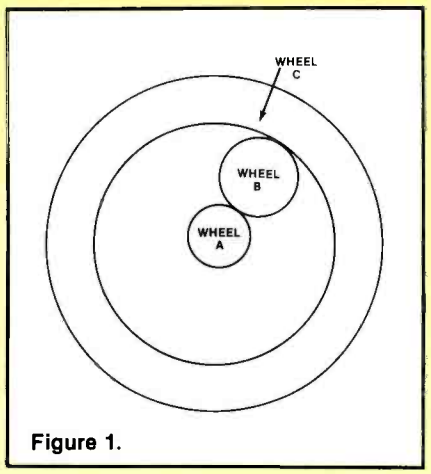
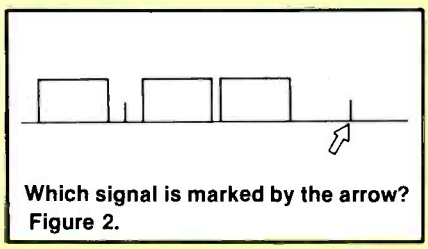
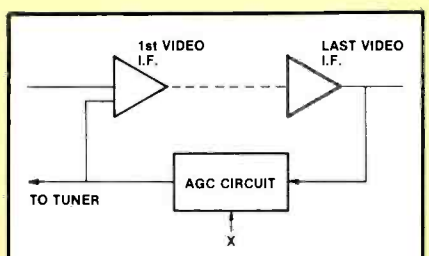


Figure 1.


Which signal is marked by the arrow?
Figure 2.



Where does the "X" signal come from?
Figure 3.

5. A compiler is used to:
A.) list the locations of instructions in memory.
B.) translate a high-level to a low-level language.
C.) hold instructions during execution of a program.
D.) combine two or more instruction codes.

6. Which of the following is used as a short-term memory in a microprocessor?
A.) BUS
B.) ALU
C.) CPU
D.) None of the above.

7. To match a balanced transmission line to an unbalanced line, you would use:
A.) an impedance coupling.
B.) a quadrature coil.
C.) a Q strap.
D.) None of these answers is correct.

8. In the composite FM multiplex signal of Figure 2 the arrow points to:
A.) the FM carrier.
B.) the SCA carrier.
C.) the left channel carrier.
D.) the pilot signal.

9. In an FM broadcast signal, an increase in audio volume produces:
A.) an increase in signal amplitude.
B.) a greater number of times that the signal crosses the center frequency each second.
C.) a greater deviation from the center frequency.
D.) a change from a sinusoidal waveform to a cosine waveform in the carrier.

10. The voltage drop across an LED should be about:
A.) 0.2V.
B.) 0.7V.
C.) 1.5V.
D.) 2.5V.

Bonus question

If you get this one right, count it as two questions.

In the keyed AGC system shown in Figure 3 you would expect the input at *x* to come from:
A.) the sync separator.
B.) the flyback transformer.
C.) the vertical oscillator output.
D.) the chroma demodulator.

Answers are on page 50.

Servicing computers?

Here are some sources for parts and information

By David McLanahan

Once upon a time, long, long ago, electronic service was relatively simple and straightforward. The few circuits in common use were quickly learned and easily trouble-shot, and the parts variety was small and usually available at a neighborhood radio store.

Then came television and color television, with their increased complexity and sophistication. Designers became clever (sometimes too clever), increasing circuit obscurity, and the large production quantities encouraged the use of custom-made (and hard to locate) parts.

A small information industry arose purely to provide good, useful service literature. The quality of these manufacturers' "factory manuals" has steadily improved to the point where, much as we may cuss specific omissions and errors, we admit that quality and usefulness of service documentation are basically adequate.

The seek 'n find parts game

On the other hand, the television parts situation seems to have gotten worse. Local parts stores have been gone so long they aren't even memories. Also, the proportion of custom-made "failable" parts has increased to the point where even large, well-stocked television repair shops have a substantial slush of customer sets waiting for parts special-ordered from the manufacturer or a distant distributor.

Surprisingly, the parts situation for microcomputers and other digital electronics seems better. Neglecting video monitors (which are analog–TV receivers with no tuners, if, or audio), and keyboards and disk drives (heavily mechanical), most failure-prone parts are integrated circuits (ICs) that usually bear industry-standard part numbers.

Chip numbers clue to function

This is more of a boon to the digital service person than it might first seem. Because digital integrated circuits are complex, even if they are "generic," the more sophisticated ICs usually have a single purpose and method of operation regardless of where they are used. Thus it is sometimes possible to divine the function of a part of a circuit just from chip numbers, and it is often possible to test an integrated circuit in operation on the board without total understanding of the equipment.

As with analog equipment, service literature can be divided into two parts: technical device literature covering individual component parts, and equipment service literature devoted to specific computers and peripherals. Also as in analog, there is a wide range of tutorial texts explaining the basic principles and operation of typical components, circuits and entire equipments.

Of course, a major problem for a person first breaking into digital service from analog service is that one tends to forget the time and money that went into the Sams file cabinets, the pile of catalogs and all the transistor manuals. Digital may not be quite as bad, but a good digital literature library still represents a serious investment in time and money that must be slanted toward your particular needs and interests.

Manufacturers' device literature

The most prolific and definitive source of integrated circuit device literature is, of course, the device manufacturers. In addition to individual device data sheets, the larger IC makers issue series of books, one for each "family" in their product line. As a frame of reference, my digital device data library, which is a bit spotty, occupies about six feet of shelf space.

A complete listing of possible IC families is out of the question, but some families are fundamental. As examples, I'll mention some of the books from National Semiconductor, but offerings from other large manufacturers will be similar. These books are available from either the manufacturer or his distributors as well as from the retail mail order people. (Several

Servicing computers?

retail firms will photocopy data on individual integrated circuits for a small charge.)

- TTL – Standing for "Transistor-Transistor-Logic," TTL is the oldest and most ubiquitous "small and medium scale" integrated (SSI and MSI) logic in use today. TTL ICs are identified by a number system like XX74nn where the "XX" is two letters (sometimes omitted) denoting manufacturer and "nn" is a two-or-three digit number that defines the actual function and pin-outs of the IC.

Most TTL ICs are industry standard, although there are a few three-digit specials. (A parallel "5400" number system is used for military temperature range chips, and is rarely seen in consumer products.) There is a big booby trap here: most manufacturers mark ICs with a date code consisting of the last two digits of the year and two digits for the week. (Thus a date code of 8234 would be the 34th week of 1982.) ICs made during 1974, therefore, bear a four-digit date code starting with 74....

There are several non-TTL variants on the 7400-series that usually correspond, pin-for-pin, with the TTL equivalent and perform the same logic functions: L, low-power; C, complementary metal-oxide semiconductor; H, high-speed; S, Schottky; LS, low-power Schottky; AS, advanced Schottky; and ALS, advanced low-power Schottky. These are identified by the letter(s) between the 74 and the following number as 74LS04 or 74C90.

Old TTL books do not die

There may be analog-type incompatibilities of signal level, speed, or impedance between these families, but these present design as opposed to service problems. For the repair person, the single TTL book usually covers all. National Semiconductor calls this its *Logic* book, with some of the newer families covered in additional manuals. Note that new TTL configurations are few so old TTL books are still valuable.

- Memory – There are a number of memory types. Read/write memory called RAM (for random access memory) comes in both static and dynamic versions with various storage capacities and access times. The trickier one is the Read Only Memory, ROM (which is random access also) that comes in two types.

The masked ROM (programmed when the chip was formed) will probably have the equipment manufacturer's part number (a "house" number) on it, representing the contained program as well as the device. Replacements are available only from the manufacturer of the equipment.

Look for the quartz window

The Erasable Programmable ROM (EPROM) is recognized by a quartz window in the top (that may be covered by a label). Although it bears a generic number, the EPROM IC will have been programmed individually by the equipment manufacturer, and a replacement from an integrated circuit distributor will come unprogrammed. Unless you have a copy of the program and a "PROM burner," you will always have to special order this part from the equipment manufacturer. (You cannot tell by looking whether a ROM has been programmed unless the vendor has tagged it with a program number; assume that any EPROM found in equipment will have been specially programmed.) Like RAMs, ROMs come in many flavors, capacities and speeds. National has both *Memory* and *Memory Applications* books.

- Linear ICs – By definition, these are not "digital" but we'll mention them because they are essential to digital circuitry. They include the common three-terminal series-pass voltage regulators, the more exotic switching regulators, operational amplifiers and voltage comparators, analog to digital (A/D or ADC) and digital to analog (D/A or DAC) converters, and a multitude of other rare beasties that defy catagorization. Again, National's *Linear* book is augmented by a *Linear Applications* manual with a separate book for the ADCs and DACs.
- Interface and communications – These ICs include transmission-line drivers and receivers (for RS-232 and similar protocols), peripheral and printer-hammer drivers, and decoder drivers for LED (Light Emitting Diode) displays. In communications, we have "Universal Synchronous or Asynchronous Receiver/Transmitters" (USARTs) that do low-level parallel/serial conversions for serial data transmission and reception.
- Microprocessors – Each of the common integrated circuit microprocessor families: Z-80, 6502, 6809, 68000, and 8085, to name a few, is usually covered along with several support chips in a separate manual. Some vendors even publish separate hardware and software books on each of their microprocessors. Obviously, you'll need only those you expect to work on, and it may take a bit of detective work to learn which chip a particular microcomputer uses.

Which chip for which computer?

To get you off to a start, Timex/Sinclair, Radio Shack TRS-80 (except Model 100 and Color Computer), MicroMate, Morrow Decision, Osborne, Kaypro, and most other machines that run CP/M-80 all use the Z-80. The Radio Shack 100 uses an 80C85 and the Color Computer a 6809. Apple, Commodore, and Atari use the 6502. Apple Lisa and MacIntosh use the 68000, and IBM-PC, XT, and PCjr use the 8088. (Several of these microprocessors add letters after the number to denote maximum operating speed [clock frequency].)

- IC Microcomputers – Not to be confused with consumer microcomputers (such as those listed above), the IC microcomputer is

The list of semiconductor manufacturers and home office addresses below is intended to be relatively complete, but may contain errors and omissions.

AEG-Telefunken	P.O. Box 3800	Somerville	NJ 08876
Advanced Micro Devices	901 Thompson Place	Sunnyvale	CA 94086
American Microsystems	3800 Homestead Ave.	Santa Clara	CA 95051
Analog Devices	Route 1 Industrial Park	Norwood	MA 02062
Electronic Arrays	550 E. Middlefield Road	Mountain View	CA 94043
Exar Integrated Systems	750 Palomar Ave.	Sunnyvale	CA 94086
Fairchild Semiconductor	464 Ellis St.	Mountain Veiw	CA 94043
Ferranti Electric	87 Modular Ave.	Commack	NY 11725
Fujitsu America	910 Sherwood	Lake Bluff	IL 60044
General Instrument	600 W John St.	Hicksville	NY 11802
Hitachi America	1800 Bering Drive	San Jose	CA 95112
Hitachi America	707 W. Algonquin Road	Arlington Hts	IL 60005
Intel Corporation	3065 Bowers Ave.	Santa Clara	CA 95051
Intersil Inc.	10710 N. Tantau Ave.	Cupertino	CA 95014
Monolithic Memories	1165 East Arques Ave.	Sunnyvale	CA 94086
Mostek Corporation	1215 West Crosby Road	Carrollton	TX 75006
Motorola Semiconductor	P.O. Box 20912	Phoenix	AZ 85036
National Semiconductor	2900 Semiconductor Drive	Santa Clara	CA 95051
Plessey Semiconductors	1641 Kaiser Road	Irvine	CA 92714
Precision Monolithics	1500 Space Park Drive	Santa Clara	CA 95050
RCA Solid State Division	P.O. Box 3200	Somerville	NJ 08876
SGS-ATES Semiconductor	240 Bear Hill Road	Waltham	MA 02154
Signetics	811 East Arques Ave.	Sunnyvale	CA 94086
Siliconix Inc.	2201 Laurelwood Road	Santa Clara	CA 95054
Sprague Semiconductor	115 Northeast Cutoff	Worcester	MA 01606
Standard Microsystems	35 Marcus Blvd.	Hauppauge	NY 11787
TRW LSI	P.O. Box 1125	Redondo Beach	CA 90278
Teledyne Semiconductor	1300 Terra Bella Ave.	Mountain View	CA 94043
Texas Instruments	P.O. Box 225012 M/S 308	Dallas	TX 75265
Toshiba America	2151 Michelson Drive	Irvine	CA 92715
Zilog	10400 Bubb Road	Cupertino	CA 95014

Jameco Electronics, 1355 Shoreway Road, Belmont, CA 94002; 415-592-8097 (superfast service).
Digi-Key, Highway 32 South, Thief River Falls, MN 56701; 800-346-5144.

Hi Tek Sales, 119 Foster St., Peabody, MA 01961; 617-532-2323.

a single device containing a central processing unit (CPU), program ROM, scratchpad RAM, and provision for input/output. The IC microcomputer provides "the smarts" for low-volume, intelligent products such as test equipment, machine or process controllers, and printers. (If you are making 2.7 skillion identical television receivers or microwave ovens, you don't have to worry about "stock" integrated circuits. You can make your own or have someone make them for you.) IC microcomputers are also covered by "family books" devoted to specific microcomputer groups.

Very Large Scale Integration (VLSI)—is a much more difficult problem, as many of these integrated circuits are made by only one firm, and will not be shown in general or competing literature. These proprietary chips may be very complex and special purpose (even if widely used): floppy disk controllers,

Servicing computers?

communications protocol generators, memory management devices, and so forth. By the same token, one of these chips is apt to be the core of a piece of equipment, and detailed knowledge of it will be important to efficient service of that equipment.

Independent device literature

In addition to manufacturer's literature, there are two device-oriented publications from independent publishers that are worth having if the cost can be justified. The first is *IC Master,* published yearly in two volumes (with quarterly updates) by United Technical Publications, 645 Stewart Ave., Garden City, NY 11530.

IC Master contains a reference for every manufacturer's integrated circuit number giving, at least, the name(s) of manufacturer(s) and a one-line description of function. Complete data sheets are included for a number of the newer integrated circuits, and there are short abstracts of all extant manufacturer's application notes. Addresses for both main and field offices of manufacturers are shown along with the same information for distributors and representatives.

IC Master probably won't give you much technical information on an unfamiliar integrated circuit, but the one-line statement of function is often invaluable when you don't have board-level service material, and the book will provide the names and phone numbers of both the manufacturer and distributor from whom you can get complete technical information or a replacement part.

Possible problems pointed out

The second independent work is also a two-volume set, *An Introduction to Microcomputers,* Volumes 2 and 3, from Osborne/McGraw Hill, 2600 Tenth St., Berkeley, CA 94710. The only problem with these loose-leaf books is that the updates stopped coming in 1980, but for the integrated circuit microprocessors and peripheral support chips that they do cover, these books are hands-down best.

Unlike manufacturers' literature, Osborne provides good direct comparisons between comparable chips. Secondly, their descriptions of the integrated circuits and, particularly, how they are used, are generally clearer and more lucid than those from the makers. Thirdly, Osborne often mentions problems encountered in using specific integrated circuits, a subject that the manufacturer's literature would prefer to sweep under the nearest carpet.

Specific microcomputer service literature

As I write this, Sams is moving into the area of microcomputer service literature, but beyond their offerings, the manufacturer of the unit is probably the only source. In many cases, more than one manufacturer is represented. Many Motorola video monitors and Shugart disk drives, for example, are "embedded" in other peoples' computers. Both Motorola and Shugart provide excellent service literature.

Manufacturers' service manuals are variable in quality and depth, but some manufacturers present block diagrams and operating theory in their user documentation. Depending on the specific complaint, it is often possible to troubleshoot successfully, based on this material, a physical inspection of the board(s) and the detailed integrated circuit information in the device books.

Parts sources

It's just possible that, after he gets the hang of it, the digital technician may have fewer parts-procurement troubles than his analog counterpart. To generalize dangerously, active digital devices seem to be cheaper than active analog devices, and with more components generically marked, "out on a limb" substitutions are less often necessary.

Thus, the digital repairer can keep a more comprehensive active-device bench stock for the same dollar investment. Passive devices – resistors and capacitors – are the same for either type of electronics, although – with the exception of noise-reducing 0.1 MFd capacitors on the power lines and pull-up resistors (often in IC-like packages) – digital circuitry uses far fewer passive components.

When you need to buy an IC there are two common types of sources: the retail (hobbyist) mail order house and the industrial distributor. Each has its place. For day-to-day stock orders of common devices in the quantities that would be used by a small service business, the retail house is it. It has low (or no) minimum orders and reasonable shipping charges. It often maintains 800 number telephone lines and accepts charge cards for quick shipment. Some stock in great depth, and Jameco Electronics, in particular, gives super-fast service (but doesn't have an 800 number).

When the need is for speed

However, when an exotic and expensive integrated circuit has blown and needs fixing in a hurry, the industrial people are often the best source. Most have 800 numbers also and in an emergency will ship singles of expensive chips c.o.d. almost instantly.

It's also worth keeping track of local hamfests and electronic flea markets. (See calendars in QST, Ham Radio, 73 or CQ magazines on the newsstand.) New ICs are usually available at prices to make you drool (half price down to pennies on the dollar), although this is not a place to expect to find everything you are seeking.

As a last resort, retail chains such as Radio Shack often stock common ICs in bubble pack, but prices are apt to be high, quality dubious, and availability spotty. Still, on Saturday night when all else fails....

Photofact

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

GENERAL ELECTRIC
Chassis 10AB-E, 10AB-F, 10AB-H 2331-1

HITACHI
CT19A2, CT1942 2331-2

JCPenney
685-4125-00, 685-4216-00 2327-1

JCPenney
685-4203-00, 685-4203-10 2330-1

JCPenney
685-2089-00 2332-1

MAGNAVOX
Chassis 13C301-00AA/BA/CA/302-00AA/BA/CA/DA/EA/FA/303-00AA/BA/CA/DA/EA/FA/GA/HA/304-00AA/BA/CA/DA/EA/FA/GA/305-00AA/BA/CA/DA/EA/306-00AA/307-00AA/309-00AA/BB/311-00AA/312-00AA/BB/CC/313-00AA/BB/CC/314-00AA/315-00AA 2333-1

QUASAR
Chassis ADC119 2329-1

QUASAR
Chassis EC119 2332-2

RADIO SHACK
16-106A 2328-2

SEARS
562.42272450 2327-2

SEARS
564.43030350 2333-2

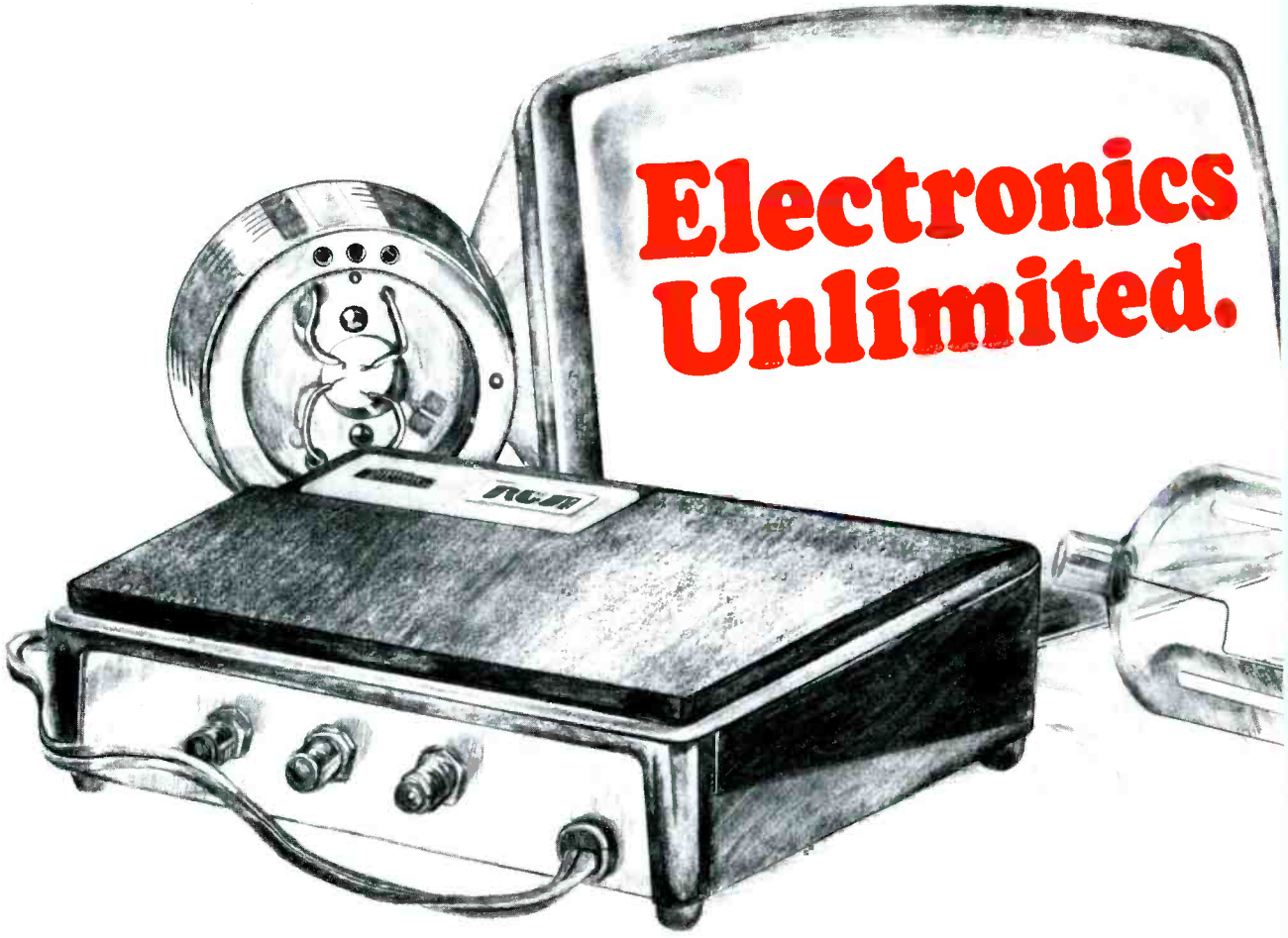
SONY
KV-1970R, KV-1971R, KV-1992R, KV-1993R 2330-2

SONY
KV-2601 2331-3

SONY
KV-2602 2331-4

ZENITH
SZ2523NK/NK3/25CH/CH3/27P/P3/33PN/PN3/35K/K3/37K/K3/X/X3/39X/X3/51NK/NK3/NK73/NK77/71CH/CH3/CH73/CH77/73NK/73NK3/NK73/NK77/75P/P3/P73/P77/77P/P3/P73/P77/79X/X3/X73/79X77 2328-2

ZENITH
A2500W/4NK/8P/10PN/12K/12NK/14M/14PN/16P/82P 2329-2



News

ETAI certification option for satellite television

The Electronic Technicians Association, International has devised a new journeyman option in its Certified Electronics Technicians program. The new satellite TV option covers the technology of dishes, waveguides, low-noise-amplifiers, downconvertors, satellite receivers, and electronics basic to all the fields of technical electronics work.

Ron Crow said, "Because of the large number of satellite installations throughout the country, ETAI has developed an exam to certify technicians as to their knowledge in this unique field of electronics work."

Technicians interested in this field or any other certification options including computer option, consumer options, MATV option, VTR option, industrial option, biomedical option, and communication options should contact Ron Crow at Box 1258, ISU Station, Ames, Iowa 50010.

RCA Service Company to provide service for Commodore

RCA Service Company announced that it has been selected to provide nationwide warranty service on Commodore International, Ltd. computers, disk drives, and color monitors. Under the terms of the agreement, RCA Service Company will provide service for Commodore computer equipment that is covered by the Commodore warranty.

RCA Service Company, with more than 2500 field service technicians, also will provide after-warranty service and offer long-term service contracts on Commodore equipment.

The Third-Party Maintenance (TPM) agreement is part of a major reorganization and expansion of Commodore's customer service and support system. This agreement also represents part of a national expansion of the current computer service program in existence at RCA Service Company.

"As the role of computers continues expanding – in the workplace, at home, and in our schools – the need for quality service is expanding, too," said RCA Service Company President, Donald M. Cook.

A walk-in facility for Commodore customers and non-servicing retailers will be located in each of RCA Service Company's 158 branches in the United States for delivery and pickup of equipment. Covered under the agreement are the Commodore models C16, C64, Plus 4, and VIC 20 computers; C1541 disk drive; and C 1702 color monitor.

For further information, contact: Ted Pensiero, RCA Service Company, Route 38, Cherry Hill, NJ 08358. Phone 609-338-6437.

Technical seminars at NPEC 1985

Electronics technicians will have the opportunity to attend three different all-day seminars and an electronics instructors' five-day series of technical seminars at the 1985 National Professional Electronics Convention. The convention is being held in Hartford, CT, Aug. 5-10.

On Tuesday, Aug. 6, Eddie Motokane of Hitachi will present an all-day seminar, "Servicing the Laser Audio (compact) Disc." Mr. Motokane presented an introductory seminar on compact discs at the 1984 NPEC and will this year delve into the in-depth servicing of the product.

On Saturday, Aug. 10, two separate all-day seminars will be held. Dr. Elmer Poe, CET, will present a hands-on seminar, "Digital Microprocessor." A VCR seminar will be presented jointly by Jim Ott of Sharp Electronics, Jack Dodgson of Sony. This seminar will cover circuits common to all three brands of VCRs.

Electronics instructors are invited to attend the five-day series of seminars specifically designed to help them teach their students more effectively. The series will include discussions of job entry-level skills, digital microprocessor technology and competency-based training using symptom diagnosis methods. Murray Barlowe, CET, chairman of the Instructors Group, is coordinating this technical seminar series.

A product introductory seminar will also be presented by Ted Zrebiec on Sony's new 8mm video cassette recorders.

Other events scheduled include management seminars, the annual trade show, many sponsored meals and a special children's program.

The tax-deductible registration for NPEC '85 is $140 per person and $110 for each additional person from the same family or business. Registration after June 30 or at the convention door is $150 single and $120 for additional registrants. The daily registration fee is $40.

For more information and registration forms, contact NPEC '85, 2708 West Berry Street, Fort Worth, TX 76109; 817-921-9061 or 921-9101.

First-quarter VCR sales jump 77 percent

Led by videocassette recorders (VCRs) and projection television, home video products posted another solid sales month in March, according to the Electronic Industries Association's Consumer Electronics Group.

VCR sales to dealers topped one million units in March, making it the second-biggest month for VCRs on record. For the first quarter of 1985, VCR sales totaled nearly 2.5 million units, a 77 percent jump over first-quarter 1984.

Projection TV sales totaled some 21,000 units in March, a 51 percent increase over the same month a year ago. On a year-to-date basis, more than 51,000 projection televisions have been sold to dealers, a one-third improvement as compared with 1984's first quarter.

Color TV sales rose in March as well, up nearly 7 percent to some 1.6 million units. During the first quarter, color TV sales kept pace with the first quarter of 1984, the biggest sales year in color TV history. However, quarterly sales of monochrome television were off.

Caring for a pe

Editor's note

Take a walk through almost any department store, discount store, specialty store, toy store, and you'll find a display featuring computers: IBM, AT&T, Apple, Commodore, Radio Shack, Atari. There is a thriving market in these devices. In fact, according to the study performed by Arthur D. Little for EIA/CEG and discussed on this month's editorial page, "approximately 4.7 *million* home computers with an estimated factory value of $1.9 *billion* were sold in the United States during 1983. Approximately 32 *million* home computer software units with a factory value of $800 *million,* and 13 *million* blank floppy disks for home use with a factory value of $26 *million* were sold during the year."

Some readers have complained in the past about the computer-related articles we have run. For those readers and others who are concerned that **ES&T** might become "just another computer magazine," we'd like to assure you that this will NOT happen. **ES&T**'s continued coverage of television, video, radio, stereo and other electronic equipment should serve as assurance of our multifaceted focus. But *millions* of computers sold to the tune of *billions* of dollars cannot be ignored. These devices are electronic in nature and require servicing. Hence, we will cover them in **ES&T.**

The accompanying article deals with computers from an operation and maintenance standpoint: how to keep a personal computer operating properly, and how to perform routine cleaning and minor adjustments. Future articles in **ES&T** will deal with specific servicing procedures on specific brands and models of computers.

One of the worst enemies of the computer may just be the operator. And of course its environment. Just think about it. In the early days of computing (not much more than 30 years ago) computers were delicate things, if huge, that needed to have a controlled environment. Computer rooms were white, austere and cold, kept constantly clean by people wielding brooms, mops and other cleaning devices.

When you entered a computer room, you learned that no one was allowed to eat, drink or smoke in there: a crumb of food, a drop of coffee or a wisp of smoke might damage the delicate equipment. After entering, the next element you noticed was that the air was decidedly chilly – and dry – and you could hear that constant hum of air-handling equipment. Because of its delicate nature, the computer was being treated to its own controlled environment. Temperature was kept below certain levels, humidity, kept low and filters were trapping all but the minutest particles of dust.

Many of today's large computer installations are still placed in such environmentally controlled areas. They generate a lot of heat and so must be kept cool. There are close tolerances on the parts so they must be kept clean.

Personal computers are abused.

By comparison, most personal computers lead a miserable life. They sit on someone's desk or computer table in the home or office in an environment that may become dry as a desert in winter or steamy as a tropical rain forest in the summer. If the operator smokes, where is the ashtray? You guessed it: right over there near the disk drive where smoke can stream into it. And over there near the keyboard is a half-cup of cold coffee. And what's that in the discarded cellophane wrapper? Why, a few Twinkie crumbs!

All of these elements that really don't belong anywhere near the computer are potential sources of problems, even disaster.

This article discusses external factors that cause malfunctions in a personal computer, preventive measures that will prolong normal operation, and simple adjustments and repairs that will remedy minor malfunctions.

Providing the right environment.

The average office or home provides an environment that is adequate for a personal computer, but hardly ideal. There are, however, a number of steps that you can take to keep a computer operating properly longer.

1) Don't smoke near the computer:

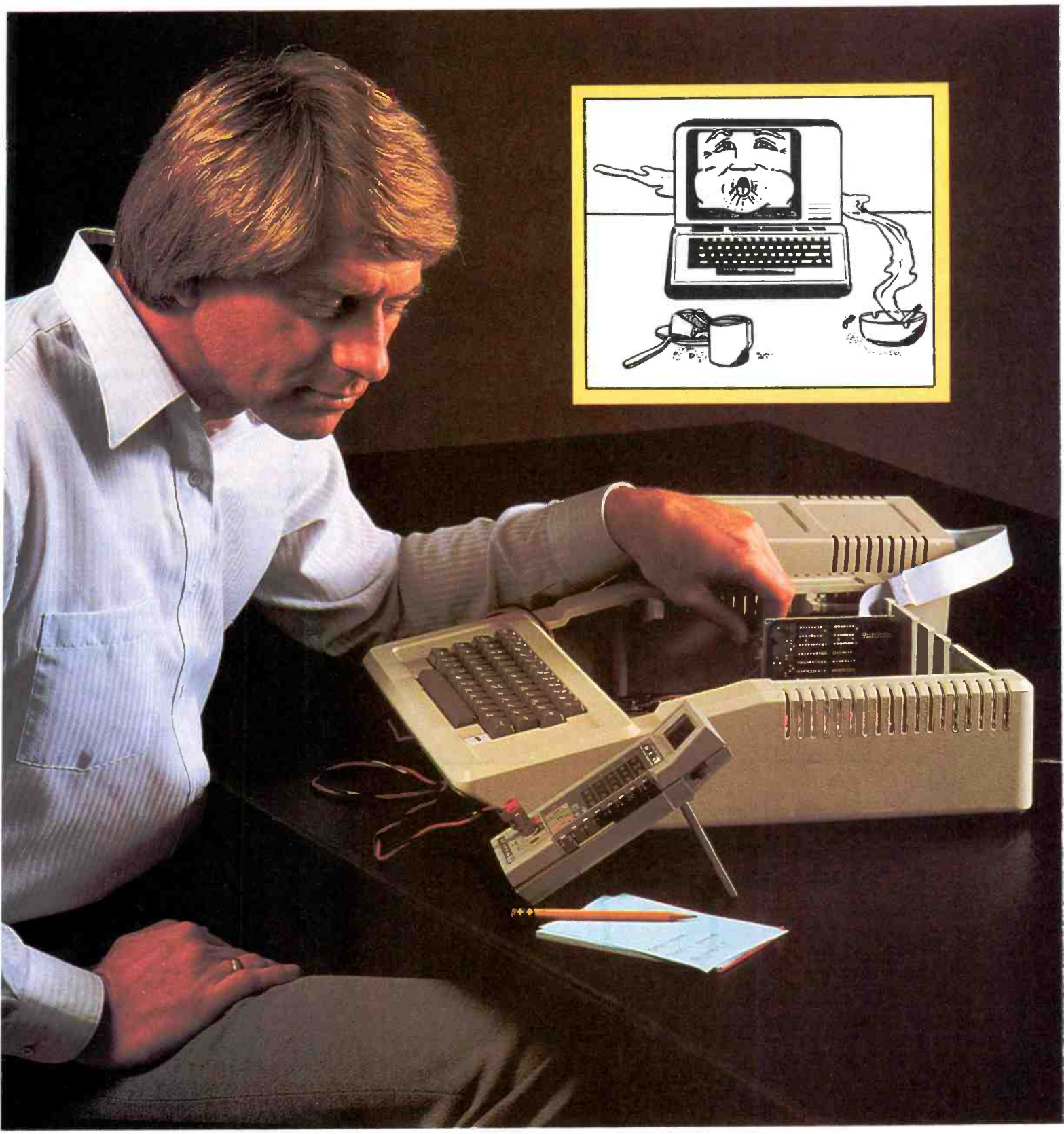
Obviously, a lot of people smoke at their computers, and the computer continues to operate just fine. That's true, of course, but the chance of dropping some ashes in the keyboard or onto a magnetic disk is there, and should smoke be pulled into the disk drive it can contaminate the head. And, of course, a few ashes dropped inadvertently on the magnetic media of a disk would probably make an excellent abrasive material to scrape away some of the disk's surface, to say nothing of its effect on the head.

2) Keep the computer system out of direct sunlight:

When something is kept in direct sunlight, especially in summer when the sun's rays are striking the earth at a straight angle, it can become uncomfortably hot to the touch. If that something happens to be a computer, the result might be warping of structural components so they no longer fit together correctly; misalignment of drive components causing data read/write errors; excessive tem-

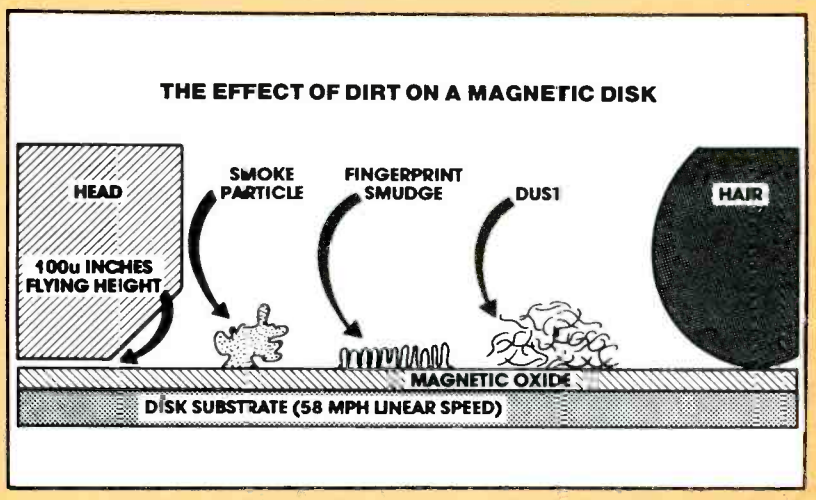
Figure 1. Smoke, dust, food crumbs, heat and humidity—even spilled liquids—are some environmental stresses inflicted on personal computers.

sonal computer



These are the important points to remember when maintaining a personal computer:

1. Don't smoke near the computer.
2. Keep the computer system out of direct sunlight.
3. Keep the computer cool.
4. Guard against extremes of humidity.
5. Keep it covered.



perature of electronic components accelerating them to failure; stretching and gumming of rubber parts such as belts. It makes good sense not to put the computer in direct sunlight.

3) Keep the computer cool:

Besides keeping the computer out of direct sunlight, it is a good idea to make sure it's not getting overheated in some other way. For example, if all the computer components are crowded together with a few pieces of paper sitting on top for good measure, and it's warm in the room where the computer is being used, temperatures soon soar. Give the computer plenty of breathing room.

Even if you make sure the computer has plenty of space, if the room gets too warm, unfavorable temperatures may occur. We know of one computer owner who began getting garbage on the monitor screen. He felt the power supply and found it was very warm to the touch. After he shut the computer down and the power supply had returned to a comfortable temperature, he turned it back on. The symptoms had disappeared, only to return when the power supply overheated again. The solution? He plugged in his 20-inch box fan. It blows a stiff breeze across the components and keeps the heat from building. It might sound like overkill, but it works.

4) Guard against extremes of humidity:

Extremes of humidity are detrimental to computers. When it's too dry, it's easy to generate a charge of static electricity that can wipe out an IC. So when you receive a painful shock whenever you walk across a room and touch equipment that's grounded, you will be wise to take precautions, such as touching a ground before touching the computer, or placing the computer on an antistatic pad, or similar actions.

When the humidity is very high, corrosion and other moisture-related problems can occur. It might not be a bad idea during that hot, damp summer weather to turn the system on for an hour or so every few days if you're not going to be using it for a prolonged

period of time, just to dry out the moisture.

5) Keep it covered:

To help keep contaminants away from the delicate moving parts of the computer, keep it covered when not in use. That way, dust and dirt, cigarette smoke and even accidental spills won't infiltrate.

Routine maintenance:

Providing a proper environment will extend the useful life of a computer, but routine maintenance also will help a great deal. Running a cleaning disk in the disk drive from time to time may aid immensely in eliminating read/write errors. A little of the right kind of cleaner can clean the dust and grime off of the video screen and keep it from coming back. And running a diagnostic disk while the drive is still operating properly might help you *keep* it operating in satisfactory condition.

Figure 2. There are a number of excellent computer cleaning aids on the market. One of these, Miller-Stephenson MS-260 cleaner, comes in both aerosol spray and pre-moistened pad. It is formulated for non-streaking use on computers, oscilloscopes, electronic equipment screens and similar sensitive devices.

Clean the disk drive head

According to information published by Perfect Data Corporation, a manufacturer of computer care products in Chatsworth, CA, perhaps the most common problem caused by computer contamination occurs when dirt,

dust or oil from the user's hands are transferred onto the read/write heads of a computer's floppy disk drive unit. Actually this form of contamination occurs when a user mishandles a disk by either touching the media itself or dropping it on the floor. Contaminants in the air such as cigarette smoke also can contaminate media. This dirt, grease and grime is then transferred to the read/write heads of the disk drive unit as the disk is read in the same manner as contaminants that are transferred from a cassette tape to the tape heads in a home or car stereo system.

When dirt or dust particles come between the head of the disk drive unit and the magnetic media – the microscopic particles of iron or chrome oxide on the memory disk that actually store information – the result is data loss. As a result, memory retrieval can become less efficient, or at the very worst, entire files can be lost.

A contaminated head can cause a host of other problems. The read/write head inside the disk drive unit must be completely cleaned – a potentially expensive proposition if a service call is required – but the user will also suffer the inconvenience and aggravation of system *downtime* while the system is being serviced. Once the system is operational again, the information lost in the crash will have to be restored, resulting in further loss of time, dollars, patience – or a combination of all three.

Inexpensive maintenance kits available

There are inexpensive and easy ways to properly maintain computers and their peripherals. Several types of cleaning kits are available at most retail computer outlets, and their regular use can limit the number of expensive service calls and prevent the catastrophies mentioned earlier.

Perfect Data, for example, manufactures and markets a "Micro Maintenance Kit" for personal home computers, word processors and office automation equipment. Retailing for about $40, the kit includes cleaning fluid, lint-free cloths, flexible cleaning wands, and a head cleaning diskette that is used in much the same manner as a head cleaner for a stereo cassette deck. The entire cleaning procedure takes only a few minutes.

Contaminated components

Although a contaminated read/write head inside the disk drive is probably the most dangerous problem – and possibly the most expensive – there are several other problems to expect if dirt, dust or other residue are allowed to accumulate on the other components of the system.

The printer, for example, uses the two messiest supplies in the computer room (ink and paper), and if it's dirty, the final document will fall well below "letter quality" standards. The printer's platen, or "black roller," is often contaminated with fingerprints and these too can be easily transferred to the final document.

The computer's video screen is another component that can get dirty readily. Too much residue on the screen can lead to a build-up of static electricity and can strain the user's eyes. Regular monitor screen maintenance is growing increasingly important as manufacturers introduce more "touch screen" and light pen programs.

And of course there's the keyboard, by far the most-touched component of any computer system. The keyboard easily can get "gummed up" from accumulated dust, oil or grease from the user's hands and all the particles of food and beverages that should never be consumed near a computer, but usually are.

Manufacturers of computer-care products make cleaning kits for printers, video screens and keyboards. Prices start at about $7, and the kits are a solid investment.

Minor servicing

Providing the right environment and performing routine maintenance will go a long way toward keeping a personal computer operating properly. However, the day will come when some servicing procedures will be required. Fortunately, many of these malfunctions can be corrected, using readily available equipment and techniques.

Figure 3. The Read/Right Dot Matrix Cleaning Kit manufactured by The Texwipe Company uses a non-alcohol-based organic solvent to clean and protect printer rollers. Other items in the kit cover the platen, remove dust, clean printer housing, users' hands and surrounding work area. Effective for daisy-wheel, Selectric or thimble printers too.

Figure 4. TEACO (Terry Electronic Assembly Company) is introducing the 6420 Drive Alignment Aid, which is designed to assist in radial head alignment of the 1451 drives of Commodore 64 and VIC 20 computers. Hookup with either a single channel or dual channel scope.

Diagnostics

One of the advantages of servicing a computer, assuming it is not completely dead, is that the computer can be used to diagnose itself. At the most basic level, if you suspect a certain RAM IC, for example, you can address it directly from the keyboard, setting and reading specific bits. A more thorough diagnosis can be performed with a diagnostic program. Diagnostics are available that will perform tests on the many segments of the computer's circuitry: ROM, RAM, disk drive speed and alignment.

A few checks

When a computer malfunctions, the reason might be something serious requiring a thorough troubleshooting procedure to isolate, or it might be something as simple as a loose connector or a broken conductor. When a computer fails to behave as expected, there are a number of simple procedures that can help to isolate the source of the problem.

Divide and conquer

If the computer fails to operate, either properly or entirely, one of the first steps to take is to shut the system down and disconnect all the peripherals *then* turn the computer back on. If the computer alone works correctly, then the problem was obviously in one of the peripherals. Now the peripherals can be connected one at a time, and when the computer malfunction symptoms return, you've isolated the problem unit.

If, on the other hand, when all of the peripherals are disconnected, the computer itself malfunctions, you know that the problem is in the computer.

Future computer-servicing articles

Personal computers have been around for a few years now, and the number in use is increasing steadily. We have corresponded with several people who have done servicing on computers and expect in the near future to be publishing articles on specific servicing procedures for specific brands and models of computers. ES&T

For additional information about products mentioned in this article, circle the indicated numbers on your Reader Reply card.

MS-260 cleaner, circle 151.
Read/Right Dot Matrix cleaning kit, circle 152.
Teaco Drive Head Alignment Aid, circle 153.

What do you know about electronics?

A very poor heat sink design

By Sam Wilson

Whenever two different kinds of metal are inserted into an acid or alkali solution, a voltage is produced across the metals. This is the basic principle upon which batteries are made. The difference between one battery and another is in the types of metals and in the types of fluids (or electrolytes) used for their manufacture.

A battery is a combination of cells. For example, the 12V battery used in a car is made of six 2V cells connected in series.

Take a piece of coat hanger wire that is made of iron (because it rusts), and a piece of copper wire. Stick them into a lemon as shown in Figure 1. You will have a reasonably good battery. Use the microammeter of a VOM and you should be able to measure the current produced by the potential.

The amount of voltage depends somewhat upon the condition of the lemon. That is another way of saying it depends upon how much acid the lemon has.

When I taught basic electronics courses, I always had students bring lemons, grapefruit or other fruits and vegetables to make cells and batteries in class. The highest voltage we were able to generate with this method was obtained by using an onion. The ultimate goal of the experiment was to make a battery strong enough to power a small transistor radio.

The reason I am describing the experiment in this article is to remind you there are some undesired effects that can result from the same principle.

At one time – many years ago – I lived on the Atlantic sea coast in New Jersey. I had a very nice 2-story bungalow near the ocean where I thoroughly enjoyed the sea air.

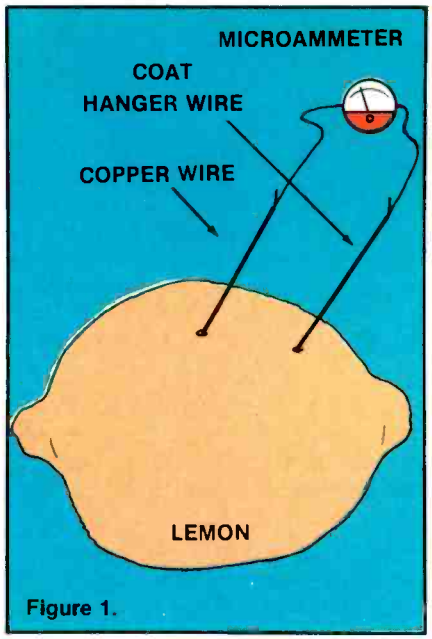


Figure 1.

This battery is a lemon, but you can't get your money back.

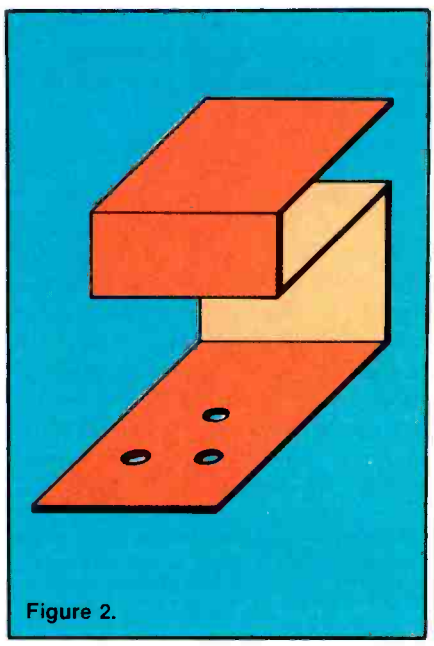


Figure 2.

The author recommends careful selection of metals.

One of my neighbors backed into his downspout that, as in most early homes, was made of copper. He replaced it with one made of aluminum that he force-fitted into the copper rain gutter.

When I saw him do this I explained to him that I didn't think it was a good idea. Before I could explain why, he explained to *me* where the lot line was. Within three weeks, there was a large white ball of material surrounding the interface of the two metals.

Naturally, if you hook the copper and aluminum together you have two dissimilar metals. In a very salt-like atmosphere, a voltage will be produced. That voltage caused circulating currents that usually are referred to as *galvanic action.*

The overall result was a great and rapid deterioration of the downspout.

As an electronic technician, you probably won't have much occasion to talk to neighbors about their downspouts. But, you *are* very likely to make the same mistake on a much smaller basis. Connecting two dissimilar metals together with a replacement screw that is made of a third metal can produce the undesired galvanic action. When you disassemble a piece of equipment and lose one of the screws, you could introduce a new kind of trouble to the equipment by using a carelessly selected substitute.

As a technician I have always been aware of the problem. However, being aware of the problem isn't always enough. I was constructing a power supply of my own (superior) design that employed a 10A Darlington power amplifier. Because I was constructing this project on a breadboard, I reasoned that I

would need an additional heat sink for the power transistor. I very cleverly (?) fabricated one out of a tin can. Figure 2 shows my design. It seemed to work very well. As with other bread-boarded parts equipment, I never bothered to put it into a case. I used it for a year—on and off—whenever I needed a dc voltage. Eventually the power transistor burned out and when I removed the heat sink, I found there was a great amount of undesirable corrosion between the tin can and the metal interface. Home-built heat sinks are not the best way to go.

Capacitor soakage

Have you ever heard the term *soakage* in reference to capacitors?

Soakage is a term that once was used in place of what is now called *dielectric* absorption. The term was based on the idea that a capacitor is something like a sponge. It is illustrated in Figure 3. It is difficult to remove all of the electricity that is stored in a capacitor. If you squeeze out a sponge, and then squeeze it again, it usually is possible to get just a little bit more moisture out of it. Likewise, if you discharge a capacitor with a short circuit, and then remove the short circuit, you might be surprised to find there is a voltage across the capacitor again.

In the old days (they tell me) oil-filled capacitors were notorious for this. You could discharge them with a short circuit then remove the short circuit and get a very uncomfortable shock from the capacitor.

Most capacitors have the same characteristics, but some types have greater dielectric absorption. As a matter of fact, a capacitor may charge up to 10 percent of the

Answers to the Quiz

continued from page 24

1. C.

2. C. *B* is called an idling wheel. Its size does not affect the speed of wheel *C*.

3. B. The voltage dependent resistor and the field effect transistors will produce noise but not partition noise.

4. A.

5. B.

6. D. Short term memories are called registers or accumulators.

7. D. You would use a balun for this application.

8. B.

9. C. The number of times the signal crosses the center frequency is determined by the audio modulating frequency.

10. C.

Bonus question

B. The signal is called a keying pulse. In some cases it can come from other locations, none of which is listed in the question.

original voltage after the short circuit is removed.

Where does that voltage come from?

In a previous article, it was explained that a capacitor is charged by aligning dipoles in the dielectric. What happens is that some of the dipoles do not get out of alignment when you short circuit the capacitor. Therefore, when you remove the short circuit there is still some voltage present.

When you buy capacitors, one of the specifications the manufacturer makes available is dielectric absorption. Certain types, such as teflon and NPO types, are known for having very little dielectric absorption. This is a desirable characteristic because *dielectric absorption prevents the capacitor from following the signals in the circuit.*

Zero crossing detectors, filter circuits and RC coupled amplifiers (Figure 4) are especially susceptible to the undesirable effects of dielectric absorption. When you replace capacitors in those circuits, you must not use one with a lot of soakage.

Vacuum and air dielectric capacitors

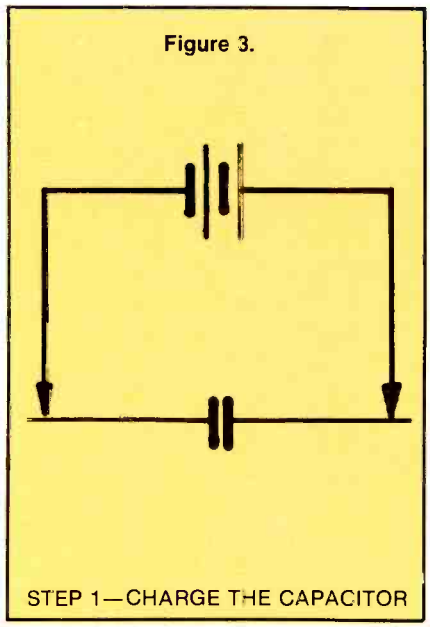
I have received a number of letters from readers who have asked questions about air dielectric and vacuum dielectric capacitors. The questions usually go like this: *If it is true that a capacitor is charged by aligning dipoles in a dielectric, then how does a vacuum dielectric capacitor work?*

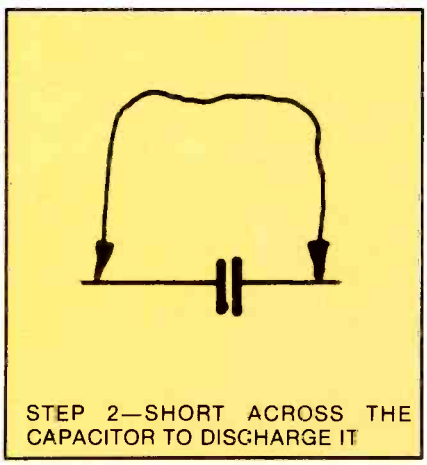
There certainly are no dipoles to be aligned. The problem here is defining what we mean by charging a capacitor.

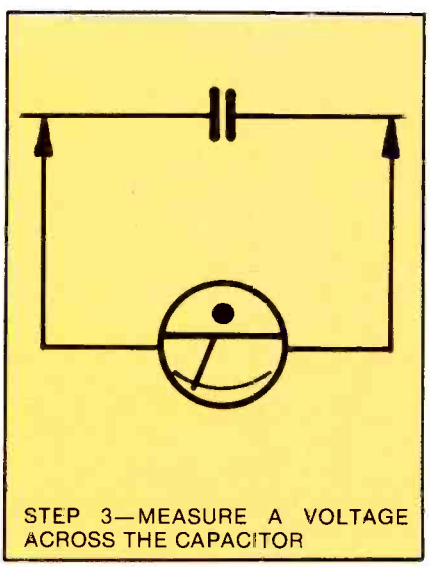
I always think of a charged capacitor as being one that will hold an electric charge for some period of time. That is really not a good definition of a charged capacitor.

Technically, a capacitor is charged when there is energy stored in it. In a capacitor with a vacuum or air dielectric, the

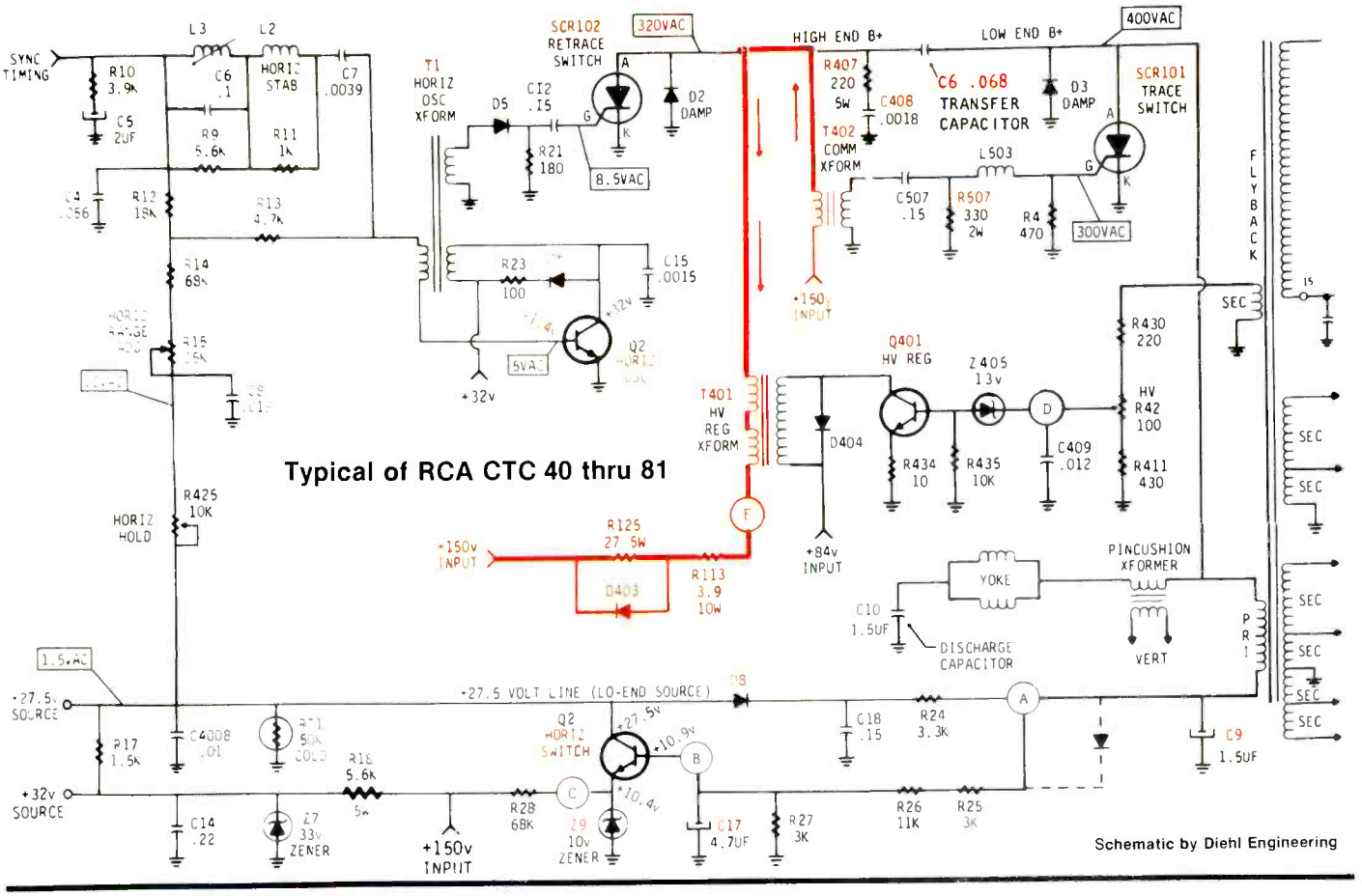
Figure 3.







Demonstration of capacitor soakage.



Typical of RCA CTC 40 thru 81

Schematic by Diehl Engineering

TEST YOUR KNOWLEDGE

THIS IS AN SCR DRIVEN HI-VOLTAGE CIRCUIT

RCA, Philco, Catalina, Truetone, Bradford, Coronado

How many of these questions can you answer ?

(1) What turns the horiz oscillator transistor on ?
(2) Why is the base voltage of the horiz osc negative ?
(3) What purpose does D6 serve ?
(4) When does the horiz switch transistor turn on ?
(5) What purpose does C9 serve ?
(6) Where does the 320 AC volts on the anode of SCR 102 come from ? Why is it 320 AC volts ? Why not 150 AC volts ?
(7) What would cause SCR 102 to repeatedly fail ?
(8) Why does SCR101 invariably become open ?
(9) Which specific component failures would cause this circuit to "Christmas Tree" ?
(10) What does C6 do ?
(11) What purpose does C17 serve ?
(12) Why is R113 a ten watt resistor ?
(13) Which is the primary winding of T-1 ?
(14) Which is the primary winding of T401 ?
(15) Which is the primary winding of T402 ?
(16) When will Q401 turn on ? What causes Q401 to turn on ?
(17) Exactly when does SCR102 turn on ? What happens when it does ? When does SCR102 turn off ? What turns it off ?
(18) Exactly when does SCR101 turn on ? What happens when it does ? When does SCR101 turn off ? What turns it off ?
(19) What purpose does C408 serve ?
(20) What happens if R407 becomes open ?
(21) What does R507 do ?
(22) What if D8 becomes shorted ?
(23) What purpose does Z9 serve ?
(24) What turns on first, SCR102 or SCR101 ? Why is this so ?

We publish a manual that will tell you everything there is to know about this circuit. It starts out by breaking one complete cycle down into a step-by-step "sequence of events". This SCR driven hi-voltage circuit has ten "actions" that take place during each cycle. The one depicted above (in red) is the ninth action in the sequence.

After establishing the sequence of events, we then explain every aspect of each individual action, in the sequence in which it occurs during each cycle. We even explain the function of each component in that particular portion of the overall circuit. Once all of this has been thoroughly explained, we then show you how to troubleshoot each individual "action".

When we are finished, you should be able to answer any question that anyone could think of to ask about this circuit or, about **any variation** of this circuit.

We have an entirely new method of teaching circuitry, - - - we actually explain it, using common everyday English.

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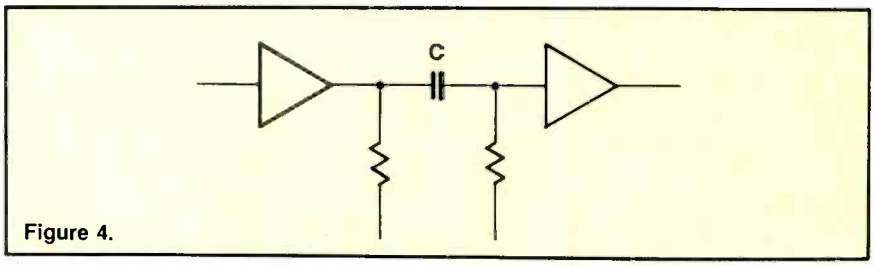

Figure 4.

In this application, the capacitor should have a low dissipation factor.

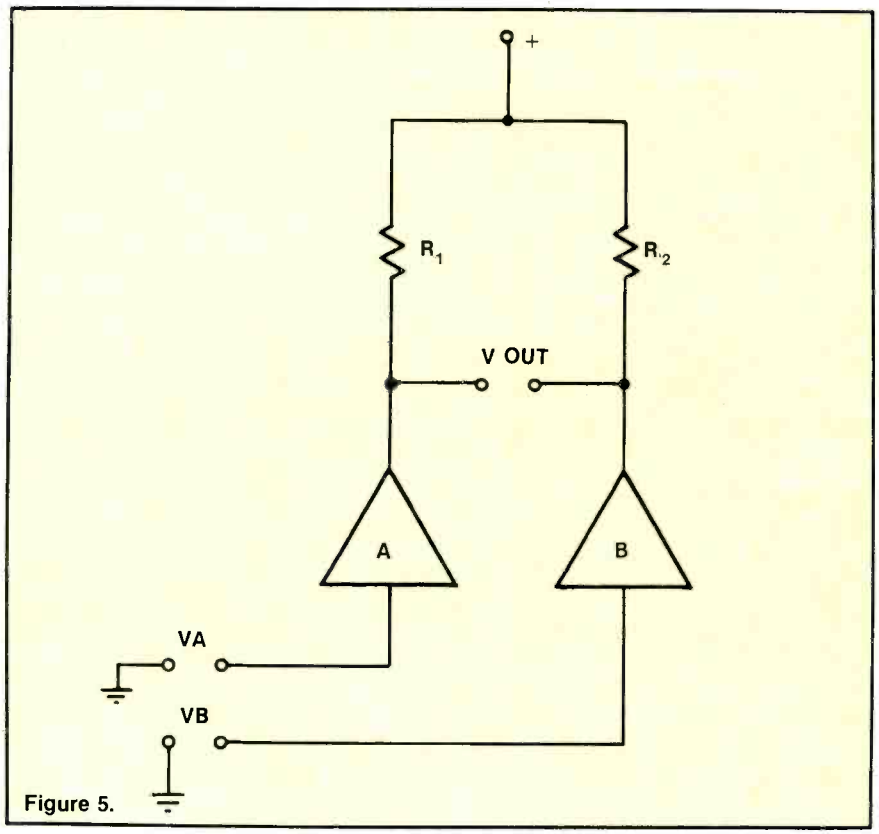

Figure 5.

Model of a differential amplifier.

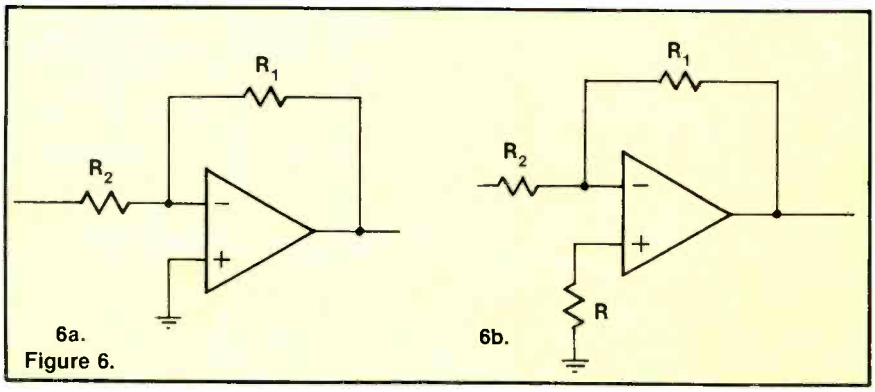

Figure 6.

Two ways to connect an operational amplifier.

energy is stored in the form of electrostatic field lines between the plates. Because there are no dipoles to be aligned *it is not possible to charge these capacitors.* They will not hold a voltage for any period of time.

If you remove the charging voltage from an air or vacuum dielectric capacitor, there is no charge on that capacitor. To prove this, try to charge an air dielectric capacitor such as the tuning capacitor in an AM radio.

Differential balancing resistors

Traditionally, the input circuit of an op amp is made with a differential amplifier. The model for this amplifier is shown in Figure 5.

If the two input terminals are grounded there will be identical voltage drops across R_1 and R_2. (This assumes the amplifiers are identical.) In practice, there are always small differences between the amplifiers; there is a small output voltage when the input terminals are grounded. This is called the *offset voltage.*

Figure 6 shows methods of connecting an op amp as an amplifier. The non-inverting terminal (+) is grounded in the circuit of Figure 6a. Normally, this will produce a certain amount of voltage offset. In many cases it can be disregarded. However, it is important to avoid this offset voltage in certain dc instrument amplifiers (and in some other applications).

Figure 6b shows how the offset can be avoided by connecting a resistor between the non-inverting input terminal and common. The value of this resistor is easily calculated as follows:

$$R = \frac{R_1 \times R_2}{R_1 + R_2}$$

If you need to replace this resistor use a metal film type. Carbon-composition types can introduce undesirable noise into the system.

ECG® LED Lamps

Philips ECG has LED lamps in shapes and sizes for virtually any application. They're available in round, rectangular, triangular and square shapes. They come in red, yellow, green, or even in two colors. And there's a choice of clear and diffused reds. Some have jewelled lenses. And some are even available as flashing LEDs with the flasher circuit built in.

In addition, long-life, shock-resistant, vibration-resistant, LED replacements for incandescent cartridge indicator lamps are also available in red, yellow or green.

Common applications: All LED indicator applications. LED cartridges are ideal replacements for cartridge-type incandescent lamps.

Circle (20) on Reply Card

ECG® High-Voltage Rectifier and Voltage Divider Network

Philips ECG's ECG568 is a high-voltage rectifier used in Sanyo and Sears TV sets to supply high voltage to the picture tube. It also contains a voltage divider network which supplies focus voltage to the picture tube.

Common applications: For use in television service and repair.

Circle (21) on Reply Card

EMF® Transient Voltage and RF Interference Suppressors

EMF transient voltage surge suppressors by Philips ECG clamp voltage spikes on 120 VAC line to levels safe for all electronic equipment. They can handle up to 40% greater surge current than other suppressors. Single outlet suppressors are available in both two- and three-prong versions.

The multiple outlet EMF315 incorporates both a spike suppressor and a PI filter to suppress RF interference on the AC line. RF interference causes audio and video degradation and causes digital equipment to function imperfectly.

Common applications: Electronic equipment such as hi-fi and television, stereo, computers or other line-operated electronic equipment subject to voltage surges and radio frequency interference from the AC line.

Circle (22) on Reply Card

ECG® A-STAT Material

Philips ECG has two sizes of anti-static foam that will prevent damage to semiconductors from static electricity. The A-STAT 12 measures 12" x 12" and is perfect for bench use. The A-STAT 2 measures 3" x 5" and can be carried in the tool box. When semiconductors are kept in A-STAT foam, static electricity is shunted through the foam instead of into the semiconductor, where it could have caused damage.

Common applications: Essential for semiconductor protection on the workbench or in the field.

Circle (23) on Reply Card

The one thing we make that you have to replace every year.

The new and expanded ECG® Semiconductors Master Guide.

Your new Master Guide will be looking as dog-eared as the old one before long. Because this year the Master Guide has been expanded to include more than 400 new products and almost 25,000 new cross references. The Master Replacement Guide for 1985. 656 pages. Over 3,500 different ECG devices that provide replacement coverage for more than 227,000 industry types. And everything in the book is cross-referenced so you can find what you're looking for fast, and be sure it fits. Plus, everything we make meets or exceeds the original JEDEC or application specs. So it works. It's the only book you'll need. But you'll need a new one every year.

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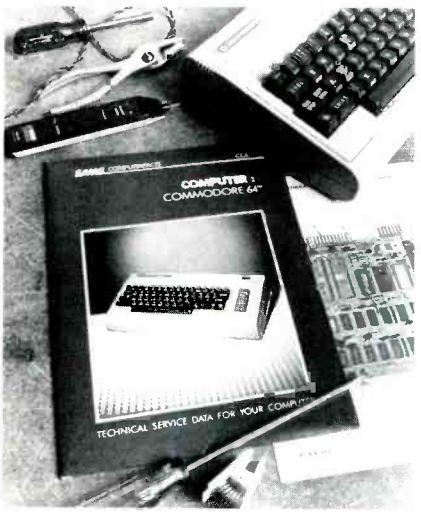
Circle (24) on Reply Card

Products

Computer equipment repair

Howard W. Sams, Indianapolis, IN, now offers "Computerfacts" to make it easier to comprehend the inner workings of inoperative microcomputers, monitors, printer and disk drives. The wiring diagrams, photographs, disassembly instructions, parts lists, troubleshooting techniques and other repair data make computer equipment repair a valuable asset to the servicing technician.



Computerfacts covers 31 of the most popular products from 15 different manufacturers, figures scheduled to double by the end of 1985. Presently included are microcomputers from Apple, IBM, Commodore, Texas Instruments, Atari, Osborne and Franklin; monitors by Amdek, Hitachi, Panasonic, Sanyo and Zenith. There are repair data for Epson, Commodore and NEC printers, and for disk drives by Commodore and Rana.

Circle (75) on Reply Card

Power line conditioning

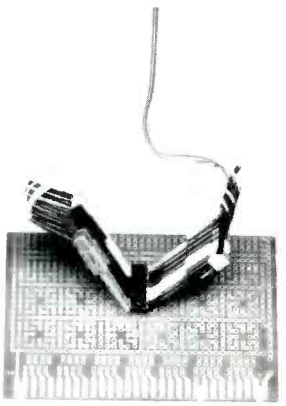
To overcome the effects of electrical power line disturbances, *Technipower,* Danbury, CT, has devised three Powerline Conditioners that are available in a choice of 250VA, 500VA and 1000VA models. The Powerline models have been engineered to protect microprocessor-based equipment from line voltage noises, sags, transients and surges that can cause inaccurate readouts, damaged circuits and memory loss. Specifications include 100dB minimum common mode noise rejection; 3000V peak, maximum transient input; −20°C to +50°C operating temperature range; short circuit plus overload protection.

Circle (76) on Reply Card

Hook up, plug on

The E-Z Hook P-25 "Pico Hook" adaptor introduced by the Arcadia, CA, division of *Tektest,* features an ultra-thin blade and housing to allow connector stacking and ease of use, and the flexibility of plugging onto an independent wire and cable assembly.

Incorporated into the design is a one-piece, gold-plated beryllium copper conductor and hook for signal accuracy qualified to MIL-G-45204. The P-25 permits connection to .025 inch square or .030 inch round push-on jumpers and can connect directly to a single leg of a DIP or other components with a maximum diameter of .025 inch.



A barrier on the tip prevents shorting between DIPs. The light weight and "fingereze" action permit hook-up to delicate wires where weight and leverage may otherwise damage components.

Circle (77) on Reply Card

Semiconductor inventory

The problem of managing semiconductor inventories has been addressed by *Graceful Software,* Austin, TX, with SCbase, a sorting system that does not separate related parts and also ignores insignificant leading and trailing letters when it is ordering the file.

SCbase stores the rate of use, variation in rate, last three vendors and prices for each part. From this information, for user's optional choice, there is an auto-order feature that remains visible while orders are prepared. Minimum usage rates for each part can be user-specified, so that slow movers can be identified and removed from stock.

SCbase can do searches based on electrical specifications for diodes and transistors, as well as for specific categories of all parts. In addition to printouts of search results, the program prints listings showing either descriptive or inventory information.

Circle (78) on Reply Card

Hand-held analog/DMMs

John Fluke Manufacturing, Everett, WA, introduces the 20 series of heavy-duty analog/digital multimeters that combine digital

accuracy with analog measurement capabilities. Two models are shown; both built to withstand drops, shock, vibration, contaminants, moisture and other harsh conditions. Operation is guaranteed by the manufacturer from −15°C to +55°C and to −40°C for 20 minutes. Typical continuous operation is from −20°C to +60°C. Fused 10A and a separate battery/fuse door are safety features. Order either model 25 or model 27 in safety yellow or charcoal gray; other models are available in this series.

Circle (79) on Reply Card

Improved telephone tester

Designated the Four-in-One, the multifunction telephone loop tester presented by *Penril subsidiary, Triplett Electrical Instrument Corporation,* Bluffton, OH, includes revised and optional programmable frequencies, and accuracy improved in accordance with the industry standard, AT&T Publication 55020. The instrument is compatible with AT&T or privately installed systems, measur-

ing power influence, circuit noise, circuit loss or line milliamp checks and loop-around. Also designed into the tester are a tone generator transmission test set and volt-ohmmeter.

Circle (80) on Reply Card

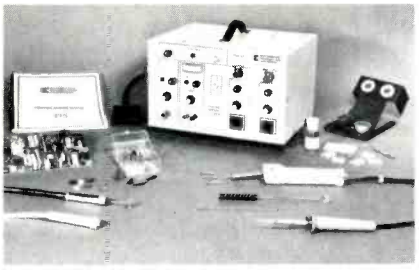
Bright, electroless plating

Tinnit is a dry chemical mix that plates bright tin on copper, brass and steel, using no electricity. *The Datak Corporation,* Guttenberg, NJ, points out that Tinnit mixes with water–no acid is needed–and has almost no odor. Plating is done at 100°F to 130°F, and a maximum plating thickness of 0.0004 inches is reached after 15 minutes in a fresh solution. Although primarily developed to plate bare copper circuit boards, it has other plating uses.

Circle (81) on Reply Card

Repair, rework station

This model PRS 475 multi-function circuit board repair and rework station can be utilized in field or at the bench. A product from *Automated Production Equipment Corporation,* Medford, NY, model PRS 475 provides hands-free desoldering capabilities, a controlled temperature pencil soldering iron, provisions for drilling, cutting, deburring, etc., a Thermtool heater that provides up to 50W controlled-pulse heat output (for removing coatings or circuit removal and replacement), tech manual and other repair-rework equipment.



Circle (82) on Reply Card

Ionized air blower

Producing less than .01 ppm ozone, this portable, ionized air blower from *Charleswater Products,* West Newton, MA, neutralizes static charges on plastic, film, glass and other dielectrics. The Statfree model CP902 is on a stand that rotates a full 360 degrees, protecting an area from 3 to 8 feet. Measuring 10"x10"x5", it weighs 9.5 pounds and operates on 110Vac.

Circle (83) on Reply Card

Compact and low-cost MM

An analog multimeter, model 117, for use by technicians, hobbyists, experimenters and service personnel has been introduced by

B&K-Precision, Industrial Electronic Products Group of Dynascan Corporation, Chicago. It measures 1 3/16"x2 3/8"x3 1/2" for pocket portability, comes with test leads, batteries and instruction

manual and carries an attractive price tag. The small unit measures dc voltage with 2000Ω/V sensitivity and ±4 percent full-scale accuracy. Similar, dc voltage measurements are provided with ±5 percent accuracy.

Circle (84) on Reply Card

Economical all-circuit evaluator

AP Products Incorporated, Mentor, OH, has added a new solderless breadboard, ACE 118, to its 100 series of all-circuit evaluators. Coming fully assembled, the ACE 118 offers features that belie its size and price, such as its four standard 5-way binding posts (a feature usually found on larger boards). Attached to the base plate, these posts make connections to power supplies, signal generators or other equipment.

There are 1280 terminal tie points, and a universal matrix of 1824 solderless plug-in tie points accommodating up to 18 14-pin DIPS or 16 16-pin DIPS. All DIP sizes and wide variety of discrete components are acceptable.

Circle (85) on Reply Card

Strip small cable in seconds

Now available from *All Tech Industries,* Deerfield, IL, is a coax stripping tool from Germany that will strip–in seconds–cable

smaller than RG8U (shield diameters–outer conductors–from 4.5 to 7.5 mm and inner conductors from 0.4 to 1.4 mm). The surgical steel blades have a useful life of at least 2000 cuts, according to All Tech, and will never need changing or adjustment in order to strip variously sized cable. The plastic hand-held tool is about the size of a business card.

Circle (86) on Reply Card

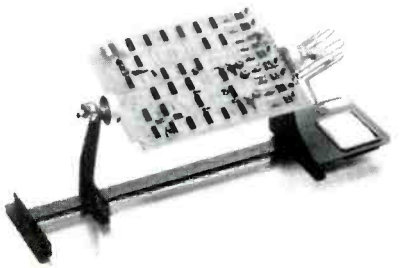
Surge protection, noise filter

Kalglo Electronics, Bethlehem, PA, announces the In-Line Power Cord transient voltage suppressor and EMI/RFI noise filter designed to replace detachable computer power cords. The unit features a 3-staged surge suppression network and synergistic 3-staged noise filtering network that provide six stages of total protection to any electronic or electrical equipment furnished with a detachable CEE-22 power cord. The In-Line's 7-foot cord allows convenient access to wall outlets.

Circle (87) on Reply Card

Board holder frees hands

Model PCBH-50, from *Davle Tech Inc.,* Fair Lawn, NJ, is a holder and solder station for printed circuit boards. The self-



locking end support slides easily to suit board width. Board holders are spring loaded for easy removal and replacement of circuit boards without readjustment. Boards may be rotated 360 degrees, and may be locked at any angle. A specially designed soldering iron holder and tip cleaning sponge are included. The unit is freestanding, or may be mounted to the bench.

Circle (88) on Reply Card

Power line monitor

An intermediate-model power line monitor with printer, model GS2X, introduced by *Sola,* a unit of General Signal, Elk Grove Village, IL, features many of the same capabilities of Sola's deluxe power line monitor at half the price. It allows continuous, unattended analysis of line power quality, and produces a detailed thermally printed record of each disturbance as it occurs: date, time and value. The monitor can be set to signal audibly the first appearance of any power disturbance; disturbance thresholds are user-adjustable. To prevent tampering, a lock button disables the keyboard until it is reactivated by an authorized user.

Circle (89) on Reply Card

No fall out here

Hook 'n Hang is a tool organizer that features assorted hooks that will not wobble or fall out according to the *Disstim Corporation,* Deptford, NJ. The polypropylene hooks snap into position, but can be removed easily and repositioned. They are available to fit standard pegboard. The Hook 'n Hang total system, however, utilizes 16" x 24" modular pegboard panels that can be mounted vertically or horizontally for a variety of configurations, or in a cabinet for security.

Circle (90) on Reply Card

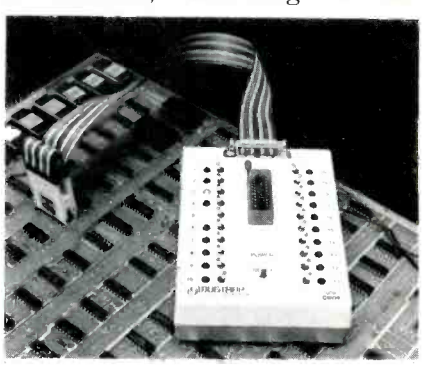
Single outlet surge suppressor

The Kiwi introduced by *Electronic Protection Devices,* Waltham, MA, is a single outlet ac surge suppressor designed to keep powerline transients from damaging sensitive electronic equipment and disrupting microprocessor memory functions. Two LEDs verify proper operation of this industrial grade device that exceeds IEEE 587 standards, and comes with a 5-year warranty.

Circle (91) on Reply Card

Hand-held logic comparator

Bugtrap Instrumentation, Sunnyvale, CA, presents model 2000C CMOS logic comparator to test 14-, 16-, 18- and 20-pin digital CMOS ICs with a supply voltage range of +5Vdc to +15Vdc. Tristate CMOS also may be tested. The device tests ICs dynamically, in circuit, at system speed under actual operating conditions. A malfunctioning IC will cause one or more LEDs to light and latch. Time spent on troubleshooting situations can be reduced from hours to minutes, according to the



manufacturer. Only a "known good" IC that matches the IC being tested is required.

Circle (92) on Reply Card

Compact service center

Versatility and low price combine to make the model 4624 soldering/desoldering service center suitable for both production and service operations. *Ungar Division, Eldon Industries,* Compton, CA, reports that plug-in soldering and desoldering handles and a two-position switch permit performing each operation singly, or in simultaneous combination.

Temperatures of the soldering and desoldering modes are controlled electronically and separately. The soldering mode ranges between 450°F and 850°F. Desoldering is temperature-controlled from 500°F and 1000°F. Eight standard Ungar tips may be used with the desoldering handle; 12 tips are available for the micro- or macro-sized soldering iron.

Circle (93) on Reply Card

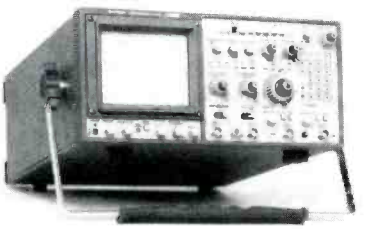
Pocket pen DMM

From *Extech International,* Waltham, MA, comes the Pen DMM that is only slightly larger than the familiar fountain pen, yet affords full autoranging capabilities for ac/dc, volt, ohm and continuity test work. Features include LCD display with autopolarity and autozeroing, battery-low indicator and dimensions of 6" x 1" x ½". A protective case, clip and batteries are included.

Circle (94) on Reply Card

Portable oscilloscope

According to *Hitachi Denshi America, Ltd.,* Test and Measurement Division, Woodbury, NY, the



V-1100A is the "world's first intelligent 100MHz portable oscilloscope." A CRT readout that displays frequency counter and DVM functions, as well as constant ground level display, is one of many features. Using the built-in microprocessor circuits, the full-function V-1100A displays the measurement of voltage value between ground level and reference cursor(s) and the time difference between two points. It then determines and displays panel settings by means of 30 characters consisting of alphabet, numerals and special symbols.

Circle (95) on Reply Card

Dual-in-line test clips

Two styles of 20-pin Dip Clip dual-in-line test clips have been introduced by *ITT Pomona Electronics,* Pomona, CA. Model 5120 has been designed for normal part spacing. The high density version, model 5220, will test tightly spaced components; its reduced thickness across the contacts allows testing of packaged DIPs as close together as 2.54 millimeters (.100 inch). On both, beryllium copper contacts are gold plated, and are serrated on each end to assure a good connection.

Circle (96) on Reply Card

Circle (26) on Reply Card

Signal level meter

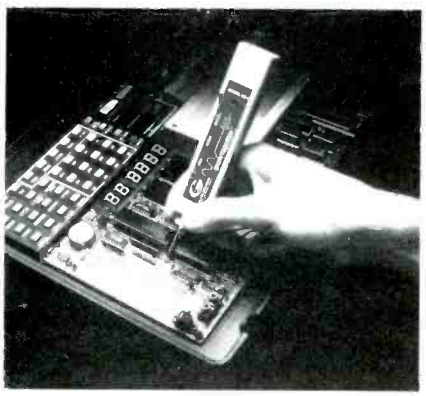
Comlink Systems, Ajax, Ontario, Canada, recommends British-made model SL84 as a signal level meter designed for measuring VHF and television signals. Key features include ±1dB accuracy over the 7-860 MHz correction

charts, peak detection circuits indicated on a meter calibrated in RMS of peak carrier, input signal level 300V to 1V FSD, digital frequency readout within ±0.1MHz and AM and FM sound detection. Nicad batteries provide seven hours operation per charge.

Circle (97) on Reply Card

Ohmmeter

Model SQ-1 Shortsqueek, *Global Specialties,* New Haven, CT, emits a tone in the presence of a short. As the tip of the hand-held probe moves over the clad surface of a bare or loaded PC board, the tone pitch rises or falls according to its proximity to the invisible problem.



This miniature tone ohmmeter is expected to be used throughout the PC board manufacturing, assembly and troubleshooting processes. Another function: locating short circuits in discrete wiring.

Circle (98) on Reply Card

Anti-glare TV screen spray

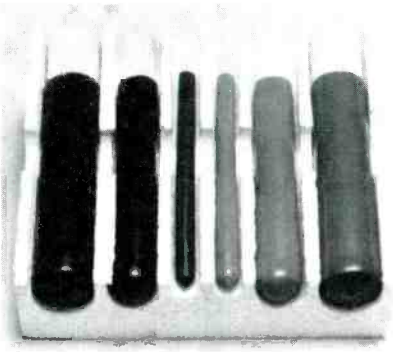
Telefix aerosol spray introduced by *LeRep,* Santa Cruz, CA covers glass with crystals to create a non-reflective surface, Mirror reflections are eliminated. Glare either disappears or, in the case of intense light sources, is greatly reduced. The improved contrast extends the useful life of older picture tubes. The coating is permanent under normal use conditions, requires no special curing and can be cleaned like glass. To remove, use a nitrogen dissolvent such as common nail polish remover.

Resolution and image quality are not noticeably affected. The 5 percent decrease in transmission of blue wavelengths compared to red is visually insignificant, and the Telefix film shows no absorption bands.

Circle (99) on Reply Card

Stick brush kit

The Eraser Company, Syracuse, NY, announces the Rush Industrial BR FybRglass Stick Brush Kit for cleaning, polishing and burnishing both large and small



workpieces. The kit contains three different size stick brushes in both coarse- and fine-grade FybRglass. There is one brush in each grade, with cleaning tip diameters of ¼-inch, ⅝-inch and 1-inch. All are 6-inches long, and the full length of the brush may be used. The fine-grade brushes provide a gentle cleaning and polishing application, while the coarser brushes are used when more aggressive cleaning action is required.

Circle (100) on Reply Card

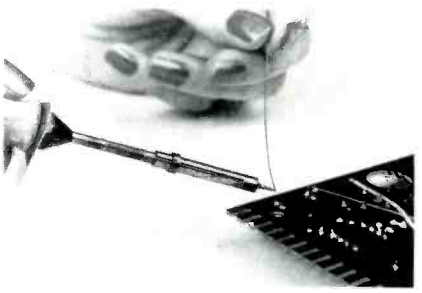
Cleaning kit for 3½-inch drive

The 3½-inch, Read/Right Heads & Screens cleaning kit for the drives popularized by manufacturers of portable computers is available from *The Texwipe Company,* Upper Saddle River, NJ. Use to remove dust and oxide build-up from microcomputer read/write heads, and to clean and control static on CRT terminal screens. The kit is comparable in price to kits that clean only heads. Each kit contains a head-cleaning diskette for either single or dual-sided drives, a bottle of cleaning solution and 10 Kleen & Dry Twinpaks for cleaning and static control of the screen.

Circle (101) on Reply Card

Soldering iron

The Antec model G/3U miniature soldering iron features a No. 9I needlepoint tip that heats up to 800°F in 45 seconds, and is directly grounded for precision electronics assembly and field service



repair. It weighs three-fourths ounce, and is being introduced by *M.M. Newman,* Marblehead, MA. The tip tapers to 0.10-inch diameter and slides on directly over the heating element.

Circle (102) on Reply Card

Octopus troubleshooter

Newly available from *Jensen Tools,* Phoenix, AZ, is this device designed to provide a fast, efficient method of troubleshooting electronic assemblies to the component level, both in and out of circuit. Use in conjunction with any dual trace oscilloscope having *X-Y* function, or with a single trace scope that accepts *external horizontal sweep output.* The Octopus will generate sinusoidal test signals of approximately ±3Vpp at 60Hz. When applied to the component under test, it will display that component's current/voltage response on the oscilloscope. By comparing a suspect component's trace to a good component's trace, the bad component can be identified quickly. Size: 4"x3"x2".

Circle (103) on Reply Card

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.*

Commodore 64 Troubleshooting and Repair Guide, by Robert C. Brenner, Howard W. Sams & Co., $18.95.

"The Commodore 64 Troubleshooting and Repair Guide" shows electronically minded readers how to avoid tedious downtime and high repair bills by performing their own Commodore 64 maintenance and repair procedures.

The 176-page guide takes users step-by-step through proper diagnostic techniques, detailing specific Commodore 64 malfunctions in charts organized by computer subsystem. After an overview, the complete machine is broken out in block diagrams and operational data, followed by a short course in basic troubleshooting and then by specific troubleshooting and repair procedures. Chapters are informatively illustrated.

Howard W. Sams & Company, 4300 W. 62nd St., Indianapolis, IN 46268

Electronics: Circuits and Systems, by Swaminathan Madhu, Howard W. Sams & Co., $39.95.

"Electronics: Circuits and Systems" is an unusual book in that it is directed toward engineers in non-electronic disciplines and to other technical people with no background in electronics. Object: to provide non-electronic engineers, scientists and others with a thorough enough grasp of electronics to open the way to valuable contributions and insights that might otherwise have been denied the industry. Author Swaminathan Madhu is professor of electrical engineering at Rochester Institute of Technology where he also serves as associate dean of graduate studies at the College of Engineering.

Howard W. Sams & Company, 4300 W. 62nd St., Indianapolis, IN 46268

How to Design Circuits Using Semiconductors, by Mannie Horowitz, Tab Books, $10.95 paperback.

The author intends this book for realistic workbench use—it's long on practical details of today's semiconductor technology, less intense in theory and, possibly, superfluous data. Readers should be able to locate facts needed to design power supplies, transistor switching circuits, low frequency small signal and power amplifiers, coupled circuits, feedback circuits, digital electronic circuits...all the specific semiconductor circuits required for personal experiments and design applications.

The 225 pages are illustrated with drawings, diagrams and circuit schematics that enhance the author's ability to provide hands-on help needed to work comfortably and enjoyably with most non-industrial electronics projects.

Tab Books, Blue Ridge Summit, PA 17214

Principles and Practice of Electrical and Electronics Troubleshooting, by Daniel R. Tomal and David V. Gedeon, Tab Books, $14.95 paperback.

A comprehensive, easy-to-follow sourcebook for the home handyman, hobbyist and even the apprentice technician, this recently released book is arranged in a series of short chapters that makes self-teaching of troubleshooting fundamentals less difficult than readers might imagine.

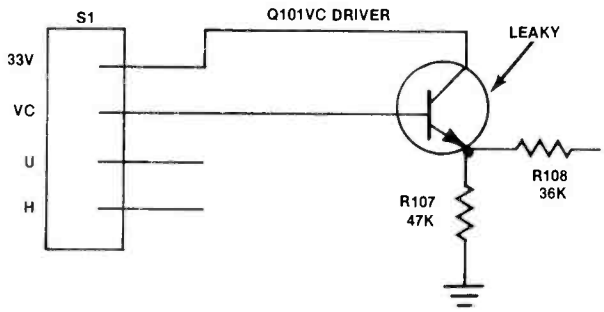
There is a complete, non-technical look at the most commonly used test equipment from the voltohmmeter to oscilloscopes, CRT restorers, signal level meters and more. And readers will gain an understanding of how and when each is to be used. From there, the authors take readers into the theory and repair of electric motors. This leads to chapters devoted to troubleshooting and repair of residential and industrial wiring, and all types of household appliances.

Tab Books, Blue Ridge Summit, PA 17214

Symcure

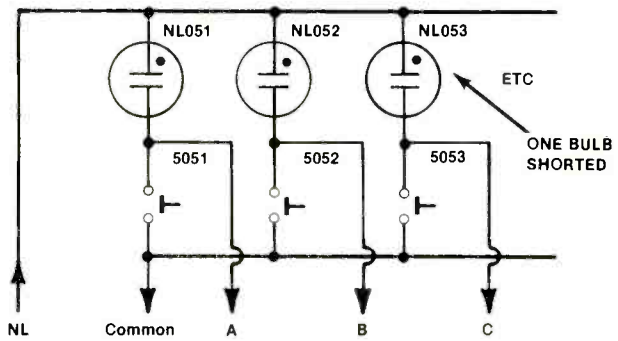
Symptoms and cures compiled from field reports of recurring troubles

Chassis – Sony KV-1515 (SCC-350A-A chassis) 1
PHOTOFACT – 2041-3



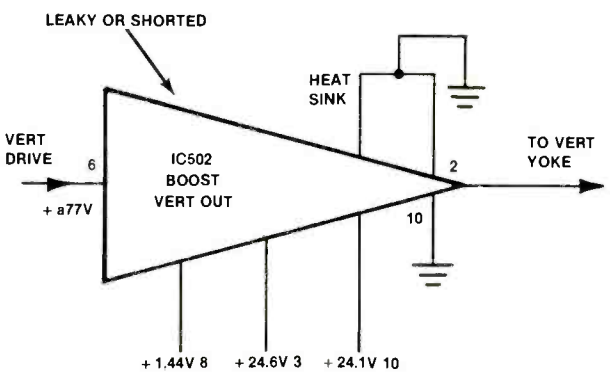
Symptom – Pressing channel buttons changes the lights, but only channel 2 can be tuned in.
Cure – Check VC-drive transistor Q101, and replace it if leaky

Chassis – Sony KV-1515 (SCC-350A chassis) 2
PHOTOFACT – 2041-3



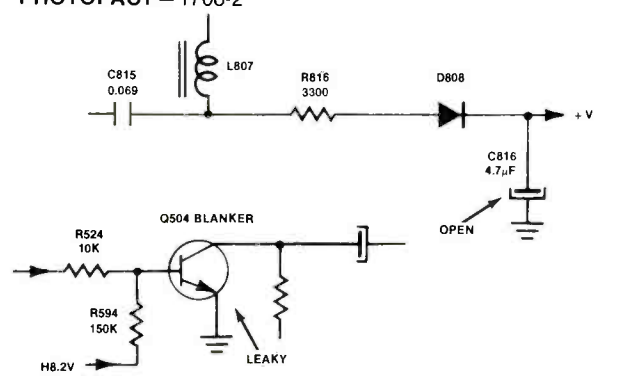
Symptom – Only one channel lamp is lighted at all times; can't change channels
Cure – Remove the neon bulb that lights, and replace it if shorted

Chassis – Sony KV-1515 (SCC-350A chassis) 3
PHOTOFACT – 2041-3



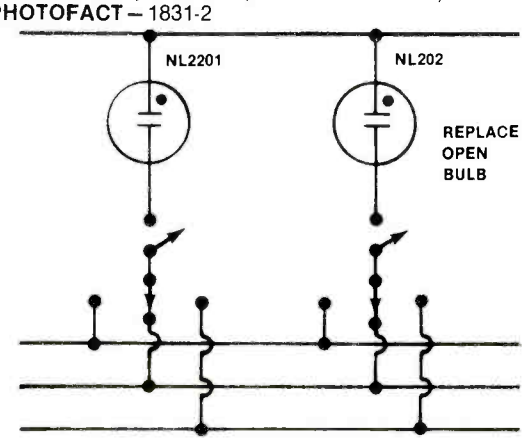
Symptom – Video and CRT circuits are normal, but screen does not light
Cure – Check vertical output IC502, and replace it if shorted or leaky

Chassis – Sony KV-1920D (SCC-100F-A chassis) 4
PHOTOFACT – 1708-2



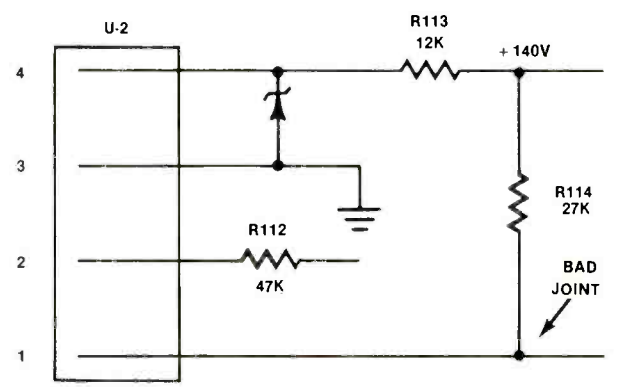
Symptom – Left side of screen is black (or has vertical black bars)
Cure – If C816 (in the horiz-output circuit) is open, replace it. If blanker transistor Q504 checks leaky, replace it.

Chassis – Sony KV-1922 (SCC-171B chassis) 5
PHOTOFACT – 1831-2



Symptom – All channels work normally except one.
Cure – Check the neon bulb of the channel that doesn't work, and replace it if open or broken

Chassis – Sony KV-1922 (SCC-171A chassis) 6
PHOTOFACT – 1831-2



Symptom – No channel bulbs light; screen has only snow without stations
Cure – Check for a bad solder joint at resistor R114.

Literature

A 16-page, full product line short-form catalog has been published by **Global Specialties,** an **Interplex Electronics Company,** New Haven, CT, to briefly describe the company's instruments and components for electronic testing and design.

This booklet (#99-02-0326) is divided into instruments, frequency counters, logic monitors, logic probes, solderless breadboarding, Data Routers, Data Directors and instrument enclosures.

Circle (125) on Reply Card

New audio, video and telephone test instruments are featured in a full line 60-page catalog (BK-85) from **B&K Precision,** Industrial Electronic Products Group of **Dynascan Corporation,** Chicago. Complete specifications and feature comparison charts also are provided for B&K-Precision oscilloscopes, digital and analog multimeters, function generators, multifunction counters, power supplies, capacitance meters, CRT restorer/analyzers, as well as semiconductor testers, probes and accessories.

Circle (126) on Reply Card

Contact East, Burlington, MA, is offering an electronic tool and test instrument catalog, featuring over 5000 quality technical products for assembling, testing and repairing electronic equipment.

Products include precision hand tools, test instruments, tool kits, soldering supplies, plus a new, full selection of telecommunication tools and instruments and a complete range of static protection products.

Circle (127) on Reply Card

The 176-page edition of the **Mouser Electronics** catalog offers over 17,000 items to anyone needing quick access to product data and pricing of standard stocked industrial electronic components. Potentiometers, capacitors, resistors, transformers, lamps, switches, battery holders, jacks, plugs, speakers, knobs, fuses, semiconductors, hardware, tools, test equipment, relays, cabinets, meters and more.

Circle (128) on Reply Card

From **Tucker Electronics,** Garland, TX, comes a catalog that contains specifications and prices for more than 4000 items. Included are reconditioned test instruments, as well as factory-new instruments, and a selection of handbooks on EMC-EMI technology. Many items are available for short-term rental. Equipment categories include top companies' amplifiers, analyzers, avionics and telecommunication test, frequency measuring, generators, bridges, calibration and laboratory standards, meters, oscilloscopes, power supplies, RFI/EMI, microwave components.

Circle (129) on Reply Card

"The AEMC Multi-Multimeter and the Add-a-Function Concept" is an 8-page brochure **AEMC Corporation,** Boston, has released, concurrent with their 1985 product catalog. Full-color photographs, charts and prose, provide concise explanations of the Multi-Multimeter, its interchangeable *Add-a-Function* modules, and *Interface Adapters.*

The Multi-Multimeter (both average-sensing and true RMS versions) is presented along with a detailed chart of measurement ranges and complete specifications. An overall review of the Add-a-Function modules follows, including function descriptions and photos of each module.

Circle (130) on Reply Card

In view of the growing importance of VCR servicing, **RCA Distributor and Special Products Division,** Deptford, N.J. has published a chart of the "Fastest Moving VHS VCR Parts."

This new chart cross references identification/stock numbers of Magnavox, NAP, Panasonic, Philco and Sylvania to RCA stock numbers to expedite selection of parts for 100 of the industry's fastest-moving mechanical and electrical replacement parts for portable and table-model VHS instruments.

Circle (131) on Reply Card

Troubleshooting Tips

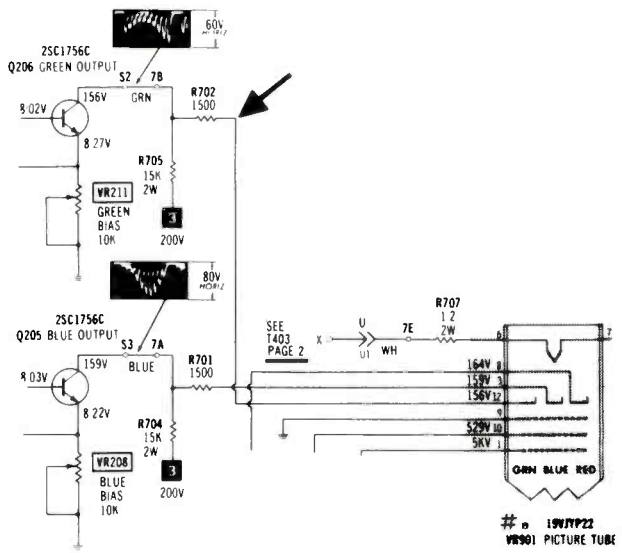
Erratic green picture
Sears 564-42221900
(Photofact 2008-1)

The customer's complaint against the Sears color receiver was that the first one or two minutes of normal operation was followed by a change to a bright green raster having low-contrast video. Before the problem could occur, I quickly checked the dc voltages at the red, green and blue wires (from collectors of the color-output transistors) between the main circuit board and the CRT-socket board. All measured within a few volts of +150V.

When the green raster appeared, the dc voltage at the green-wire terminal on the main chassis dropped to about +10V, while the red- and blue-terminal voltages increased to about +165V. Since these voltages are applied to the appropriate CRT cathodes, they increase the green brightness while decreasing the red and blue brightness in the raster.

While the green raster was displayed, I carefully pulled off the CRT circuit-board/socket assembly. The green-terminal voltage jumped up to +150V as the red and blue voltages went down to +150V.

After testing several times with consistent results, I was sure the picture tube had an internal short. I had no adapter for this CRT, since my rejuvenator is an old model, so I wondered if the short could be burned out by an improvised procedure.



With the TV power unplugged, I located resistor R702 (connected between Q206 collector and the CRT cathode pin 12) and unsoldered the end opposite the CRT cathode. I pierced the insulation of the focus wire near the CRT board with a straight pin. A test lead with a probe in its insulated handle at one end and an alligator clip on the other end was selected to switch the voltage. After the alligator clip was connected to the pin-12 end of R702, I powered the TV and waited. At first the TV operated normally, except the picture was reddish magenta because of the missing green. Then the CRT shorted, giving the usual green screen with little picture. I touched the probe tip to the focus voltage at the straight pin several times for about one-fourth second each application. The video returned along with the reddish magenta color.

I turned off the power, removed the test probe and straight pin and resoldered R702 to the circuit board. When the receiver was operated for an extended heat run, it operated perfectly with no signs of the erratic green screen.

Frederick Jones
Niceville, Florida

Editor's Note: *Rejuvenation of any picture tube always carries some risk of ruining the tube or making the condition worse. A rejuvenation procedure such as this improvised one should be considered a last-ditch measure, with no regrets if the tube is damaged beyond reclamation.*

Troubleshooting Tips Wanted

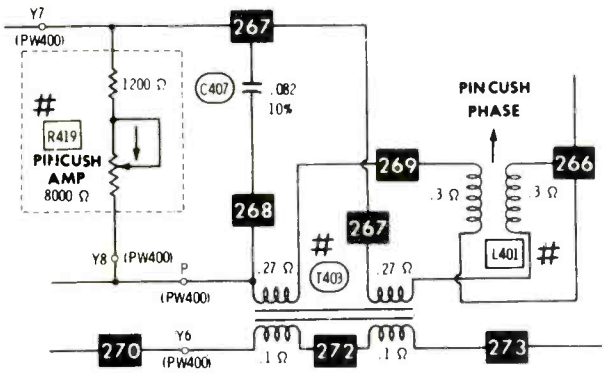
Electronic Servicing and Technology needs additional consumer-product Troubleshooting Tips. Most types of case histories are suitable, especially those with unique, puzzling or misleading symptoms.

List the brand, model and Photofact number followed by a narrative telling the original conditions or symptoms, the various troubleshooting steps, and the components replaced to restore the original performance. Please include a simple hand-drawn schematic of the stage that has a defect. **ES&T** will pay $10 for each Troubleshooting Tips published. Your name and city will be listed, unless you ask to remain anonymous. Send all Troubleshooting Tips to:

Conrad Persson, Editor
Electronic Servicing & Technology
P.O. Box 12901
Overland Park, KS 66212

Black semi-circle
RCA CTC-70BC
(Photofact 1468-2)

When this RCA hotel/motel-type television was turned on in my shop, I discovered a black area shaped somewhat like a semi-circle at the top of the screen. It resembled uncompensated pincushion distortion at the top only, but with much greater effect. Slightly below the vertical center of the screen was an area that looked like a wrinkle or foldover; it was whiter than the surrounding screen area.



In the past, I have seen similar but not exact symptoms when the yoke had missing pincushion magnets or had a loose or cracked core. I borrowed a yoke from a friendly technician who had junked one of those models, but it did not improve the symptoms when installed temporarily.

Because of the similarity to a pincushion-correction problem, I began to check the pincushion circuit carefully. Rotation of the pincushion-amplitude potentiometer (see schematic) produced no visible effect on the screen until one end of the control was reached. Then the two visible problems decreased greatly, but not completely. Subsequent tests proved the R419 pincushion-amplitude control was open, although it showed no physical signs of mechanical or electrical overloads.

Replacement of R419 and a touchup of convergence and pincushion-correction produced an excellent picture without black and white unwanted areas.

Phillip M. Jones, CET
Martinsville, Virginia

Readers' Exchange

Wanted: One audio output transformer No. P420004, or a substitute for Nippon booster equalizer NEQ 360, serial No. 30209479. Appreciate any information about obtaining part. *Jean Ketel Mathieu, 218-31 105th Ave., Queens Village, NY 11429.*

For Sale: Sencore model VA62 analyzer accessories as follows: Sencore NT64 NTSC pattern generator; Sencore VCR test accessory; Sencore EX231 accessory expander. Total lot, $600. All like new, instruction manuals included. Send s.a.s.e. for complete listing. *Clarence G. McKee, 9516 Zion Rd., Rives Junction, MI 49277; 517-569-3139.*

For Sale: B&K 290 EMM, PR-23 RF probe, FP-6 clip leads, boxes, manuals. All mint, $150 for all, free freight in U.S.A. Beckman 310, Sencore YF-33 and more. Send s.a.s.e. for complete list, prices. *R. Evans, 200 Gibbons. Toledo, OH 43609; 419-385-2701.*

Need: Motorola/Quasar flyback No. 24D69828B02-185. Also, an old 24AP4 metal bulb type CRT. *Rub-A-Dub Technical Services, 4215 Buechner Ave., Cleveland, OH 44109; 216-351-4446.*

Need: Horizontal output transformer for Broadmoor television, part No. TCF-11. *George Saylor, 2319 Parrish St., Philadelphia, PA 19130.*

For Sale: Bell & Howell microfiche readers (3)—perfect for viewing schematics. $100 each. *Don Ivener, 8901 N. Kildare Ave., Skokie, IL 60076; 312-676-0864.*

Need: Schematic, parts list and specifications for Tapcoelectronic crossover, model CP-X. *Arthur R. Vickery, P.O. Box 742. Torrington, CT 06790.*

Wanted: Tech data for ICC 40+ data display system; either the keyboard, monitor (Motorola XM440-11) or both. Any information helpful, especially input pin identifications. Will pay for tech data, or copy and return. *Ken Maurer. K M Electronics, 2107 Whitted Drive, Omaha, NE 68123.*

Need: XAM brand, model 13CPZB color television, manufactured 8-1978 by Samsung Electronics, pix tube 370CUB22. Distributed by Korvettes Department Stores. *Technitronics Servicenter, 1830 Fremont Ave., South Pasadena, CA 91030.*

For Sale: Used chassis parts for televisions—Zenith 19 EC/FC 45; RCA CTC 22, 36, 59, 74; Admiral K10, K19, 4M10 and many RCA KCS 171, 174 and 183. Yokes, flys, tuners, etc. *D.J. Aijala, 50 Fir Circle. Babbitt, MN 55706.*

Wanted: Sencore CA 55 capacitance analyzer or Sencore LC 53 Z meter. Good condition, reasonable. *Desmond Mordant, P.O. Box 1776. Hickory, NC 28603; 704-322-5794, evenings.*

For Sale: Old Ryder's manuals for radios, volumes 1 through 5, abridged, volumes 6 through 21; automatic record changers and volume 1 P.A. manual. Good condition, all for $200 plus shipping, or reasonable offer. Some indexes. *Albert Balzum, Route 1, Box 421. Pequot Lakes, MN 56472.*

For Sale: 1969 to 1979 Tekfax T.V. schematics. Make offer. *B. Thompson. Box 308, Eagle, CO 81631.*

For Sale: Sams Photofact folders 1248-2235 and 29 miscellaneous 879 to 2143; CB-11 through CB-200. Make offer. *Douglas Stamm, Route 1, Box 40. Eddyville, NE 78834.*

Needed: CRT tester, B&K model 465-467 or 470. Pay cash or trade 100s of new 8-track tapes, or color yokes, tuners. **For Sale:** 8-track tape player, with 40 8-track tapes. All tapes are new originals. $40 postpaid. *S. Troch. 290 Main St., Spotswood, NJ 08884.*

Needed: Schematics and technical information for Sony model TC-250A tape recorder. Will pay for copying or will copy and return. *Jack D. Hortman. P.O. Box 456, Biglerville, PA 17307.*

Wanted: Horizontal output transformer for Penncrest model 2880. New, or in good condition. See Sams Photofact folder 1386—part No. 24226279 (TFB2008) or 24226230 (AZ91220). Cannot locate from any supplier. *Charles R. Boller. 3108 NW 91st. Seattle, WA 98117.*

For Sale: Sams Photofact folders, radio tubes, service manuals, parts and test equipment. *Florian A. Rogowski, 25103 Cunningham, Warren, MI 48091.*

Wanted: HV rectifier assembly, part No. 1-453-046 (1-453-046-41 in Sams 1455-2) for Sony model KV-1920 television. *M.B. Gembala, 4 Golf Ave., Maywood, NJ 07607; 201-845-5660.*

Wanted: Service manual for Beckman universal EPUT timer model 7350; schematic/manual for auto radio, Audio-Communication Systems of America (ACSA) model 410-8MF; service manual for Shugart floppy disk drive model 400. *Charles R. Wells, 2085 Barcelona Drive, Florissant, MO 63033.*

Needed: Various items of TV test equipment in exchange for Heathkit 2kW linear amplifier model SB220, Vic 20 Commodore color computer, and five different Simpson 260 adapters. *Kenneth Miller, 10027 Calvin St., Pittsburgh, PA 15235; 412-242-4701.*

Wanted: Sencore VA48, reasonable, digital frequency counter and flyback for a Sanyo color part No. F1119 chassis 91C62. *Richard Salazar, 10940 Sunnyslope Drive, Riverside, CA 92505.*

Wanted: Phonograph motor and turntable. Rheem Califone model C-5.C or equivalent. This is a strobe selector variable speed direct drive. *Jim Ince, Route 2, Box 67. Milton-Freewater, OR 97862.*

For Sale: Leader LSW-333 all-channel, sweep marker generator with all cables, etc., like new, $600. NLS portable dual trace oscilloscope with probes and carrying case, excellent condition, $300. *Neil Sherwood, 2352 Danby Road, Willseyville, NY 13864; 607-273-9264.*

For Sale: 820 B&K capacitance meter, used less than five hours. $125, includes shipping. Complete with manual, no test leads. *Alfred Weiss, Route 2, Box 25. Moffat, CO 81143; 202-256-4262.*

For Sale: Hickok universal TV-FM alignment signal generator model 610A, $60; Philco wideband oscilloscope amplifier model 8300, no manual, $25; accurate instrument tube tester, $40. All prices plus shipping. Other items. *John Brouzakis. RD 3, Box 602B, Charleroi, PA 15022; 412-483-3072.*

Wanted: ESR capacitance meter and Beltran picture tube tester, rejuvenator. *V.Izzo, A.V.I. TVs. P.O. Box 338, Cohoes, NY 12047.*

Needed: Sams TSM-157 for Zenith transoceanic radio model 700-1. Service manuals for Tennelec memory scanner model Ms-2, Heathkit alignment generator Ts4a, TV analyst B&K model 1076 and Heathkit capaciter checker IT-11. Will buy or copy. Will pay shipping. *Irvin Griffin, 4511 Rokeby Road, Baltimore, MD 21229; 301-624-0361.*

For Sale: B&K model 1077B TV analyst, tube-type unit, $325; Delco model 10420 dc variable power supply 0-16Vdc, 8A max., $85; Simpson model DM461, digital voltmeter, with adapter, niCads, $115. All used. Shipping additional or F.O.B. Homestead, PA. Other items. *Mike Terrick, 809 Amity St., Homestead, PA 15120; 412-462-8720.*

Needed: Schematic, operation and maintenance manuals for standard test set model 505 by Measurement Corporation. *William Hendricks, 616 W. Lincoln Road, Stockton, CA 95207.*

Needed: Troubleshooting Tips and Techniques manuals for *all* televisions, vintage years 1975-1985. *James E. Gregorich, 117 2nd St. North, Virginia, MN 55792; 218-749-4355.*

For Sale: Sencore SC61 scope, $2800; B&K 1077B analyst, $280; both like new. *Phil Del Vecchio, 3848 N. Division St., Davenport, IA 52806; 319-391-5454.*

For Sale: Dual record charger model 1009, with Shure stereo cartridge and manual, $30. *Al Crispo, 3225 Chipmunk Drive, New Port Richey, FL 33552.*

For Sale: N.o.s. round color CRT (RCA), $20. Many n.o.s. b&w CRTs and radio vibrators, $10 each. S.a.s.e. for list. *Jim Farago, P.O. Box 65701, St. Paul, MN 55165.*

For Sale: From estate, Sencore VA48, SM152, PS148, TC162, CR161, CG159; multimeters, signal/color generators, scopes, miscellaneous test equipment, Sams Photofact folders 1-2000. All located in Cotati, CA. Best offers. S.a.s.e. for complete list. *H.L. Clark, P.O. Box 978, Crystal Bay, NV 89402; 415-897-3976.*

Needed: T801, horizontal right blue lines coil part No. 22VZ13005, mounts on convergence board of a Bradford color TV model 6911C. Please state price. *James E. Higley, 1460 Cypress Ave., Hanover Park, IL 60103; 312-837-3492, evenings.*

For Sale: Sencore SM158 sweep and marker generator/cables, excellent condition. Asking $125 plus shipping. Curve tracer with built-in test speaker, asking $10 plus shipping. Send s.a.s.e. with correspondence. *Ronald Kolasa, 4942 E. Flower Ave., Mesa, AZ 85206.*

Wanted: Hickok model 276 semiconductor analyzer in good condition. *Paul Capito, 637 W. 21 St., Erie, PA 16502.*

For Sale: All service data books with binders for RCA videocassette recorders and RCA disc players; five Sams VCR books for units manufactured before 1984. *E&J Radio and TV, 303 West 24th St., Holland, MI 49423; 616-392-2291.*

For Sale: Sylvania CK3000 bench jig and 64 adapters for six major brands; Hickok 230 tube tester; B&K 1248 color bar generator; Simpson 380m M/W leakage tester; Leader LSW 330 sweep generator; B&K 1827 frequency counter and B&K TR 110 Isopack. All near new, working, with manuals and leads. Other items, send s.a.s.e. for list. Best offer, any or all. *Gramco Electronics, Route 2, Box 155, Bogue, KS 67625; 913-839-4333.*

For Sale: Telephone Wescom modules, seven new, five used; nine boards of PC2A CpLR: 1692-4L1; four boards of 8AT 856/20TC; one power supply model 5861-1; one ring generator 30Hz 5871-1L2, many 48V relays; 34 McGraw Hill *Electrical Construction and Maintenance* magazines, $187 list, make offer. Other items. *D.J. Aijala, 50 Fir Circle, Babbitt, MN 55707.*

For Sale: B&K 3010 function generator, B&K 2050 RF generator, Telematic UHF/VHF tuner substitution box, $300 for all. Sencore model SG165 AM/FM stereo analyzer, excellent condition and in original box. *John A. Toth, 501 Village Green Pkwy., #24, Bradenton, FL 33529; 813-778-9281, after 5 PM.*

Needed: Service manual and/or schematics for Akai model AA8500 FM/AM multiplex stereo tuner amplifier, and Harmon-Kardon stereo, tape cassette model CAD4. Will pay for copies and postage. *Norm Pedersen, 13499-126th Ave. N., Largo, FL 33545; 813-596-5667. Collect calls accepted, if available.*

Wanted: 510JUB22 or 19VJCP22 for Sears 564.4220701. New or used, good condition. Will pay shipping. Also, schematic for B&K 1076 analyst. *Dan's TV, 316 East Ave. "E", Hutchinson, KS 67501; 316-662-1868.*

For Sale: Hewlett-Packard test oscillators 200CD, 202C and 202A, $50 each plus $8 UPS shipping. Timex Sinclair 1000 computer with 16K RAM and accessories, $45 plus $5 UPS. Multitude of used flybacks, yokes, PC boards, tubes, transistors, tuner combos, Sams Photofacts folders and more. Send No. 10 size s.a.s.e. for list. *Frederick Jones, Box 693, Niceville, FL 32578; 904-678-1803.*

Wanted: Sams Photofact folders No. 2054 to present. Also, VCR and MHF series wanted. *Goetsch Electronic Servicing, 12698 Shorewood Drive SW, Seattle, WA 98146; 206-241-0507.*

For Sale: Sencore VA48 video analyzer used in part-time business, $700; Sencore high voltage probes; Simpson probes of all kinds. *Carlos Jayne, 21 Knollcrest, Chatham, IL 62629; 217-483-4964.*

For Sale: Epson MX-80 F/T printer with Graftrax-plus and manual print-control commands (MXPLUS), $290, shipping prepaid. *W. Shevtchuk, WB2VJF, 1, Lois Avenue, Clifton, NJ 07014; 201-471-3798.*

For Sale: Heath IO-4101 vectorscope/generator, $100; Heath 10-4235 35Mz dual trace oscilloscope, $700; Sencore VA48 TV alignment generator, 90-day factory warranty, $850. All, with 90-day parts and labor warranty. Will ship c.o.d. UPS, or send company check. Shipping is extra. *David A. Knapp, Dave's Northwoods Electronics, P.O. Box 159, Lac du Flambeau, WI 54538; 715-588-3674.*

For Sale: Bell and Howell model 34 scope; HP model 2300B UHF signal generator, 10 to 500MHz. $500 for both, in good working order. Will pay shipping to your door. *Mechanical and Electronic Repair, 8 Manchester St., Laconia, NH 03246.*

For Sale: Jerrold Starbase 3-cable converter, $99. **Needed:** The turn-on information for Jerrold 450 model DRZN-3A cable converter. *R. Stigney, 8400 Eastwood Road, Minneapolis, MN 55432.*

For Sale: Like new Sencor model CB42 CB analyzer, all accessories, $550; B&K model 1050 telephone analzyer, used six months, $950 or best offer. *Video Lab, 3840 Broadway, Rockford, IL 61108; 815-398-0560.*

Needed: Schematic-assembly instruction book for 1950s Heathkit condenser checker. Uses 1-1626 and 1-CRC1629 tubes. Please help. *E.F. Schwanke, 1136 N. 45th St., Milwaukee, WI 53208. 414-344-7143.*

Needed: Schematic and/or manual for Cimron DVM model 7630; plug-in No. 5251 and 5265 plus manual and/or schematics for HP frequency counter model 5245L; service manual and/or schematic for Cobra CB model 21GTL. *Donald H. Nash, 1249 Pulaski St., Port Charlotte, FL 33952.*

For Sale: Zenith "X" chassis dealer kit, 800-902. In original carton, never been opened, $125. Will ship, money order or certified check. *James T. Cleek, Route 2, Box 62, Church Hill, TN 37642.*

Needed: Schematic and/or service data for Commodore personal computer, PET 2001/8K. Will buy or copy or return, or pay for copy. *Curtis Williams, Route 2, Box 147-32, Elsa Ave., Waldorf, MD 20601.*

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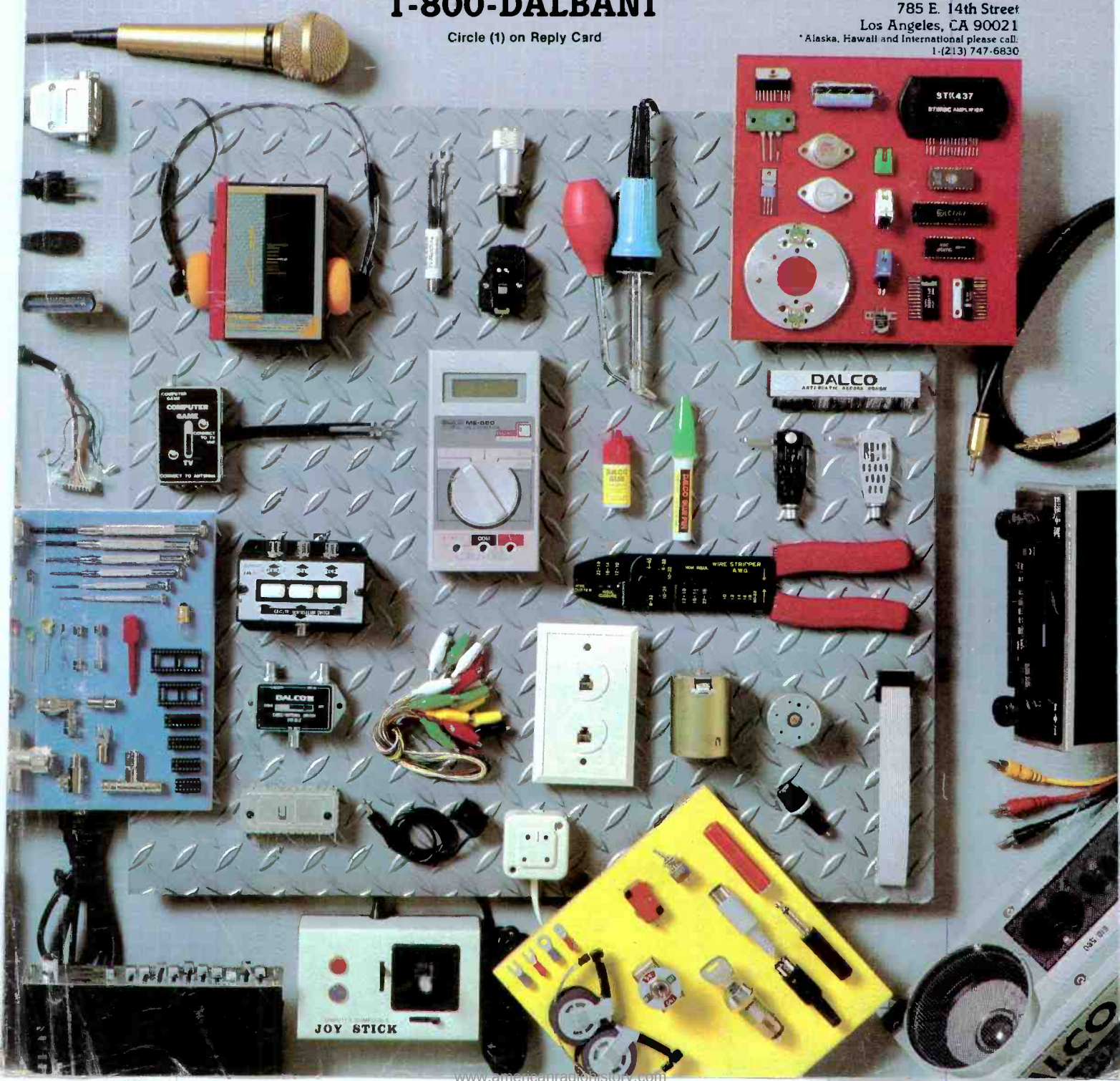

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