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The how-to magazine of electronics...

ELECTRONIC
Servicing & Technology

Volume 6, No. 4 April 1986

page 8
There are a number of convenience features on new oscilloscopes, not the least of which being a printed record of on-screen displays. (*Photo courtesy of BBC-Metrawatt/Goerz.)*

page 12
Proper equipment and a well-organized test bench can reduce technicians' frustrations and save time when testing TV color cameras.

Departments:

TECHNICAL QUESTIONS?

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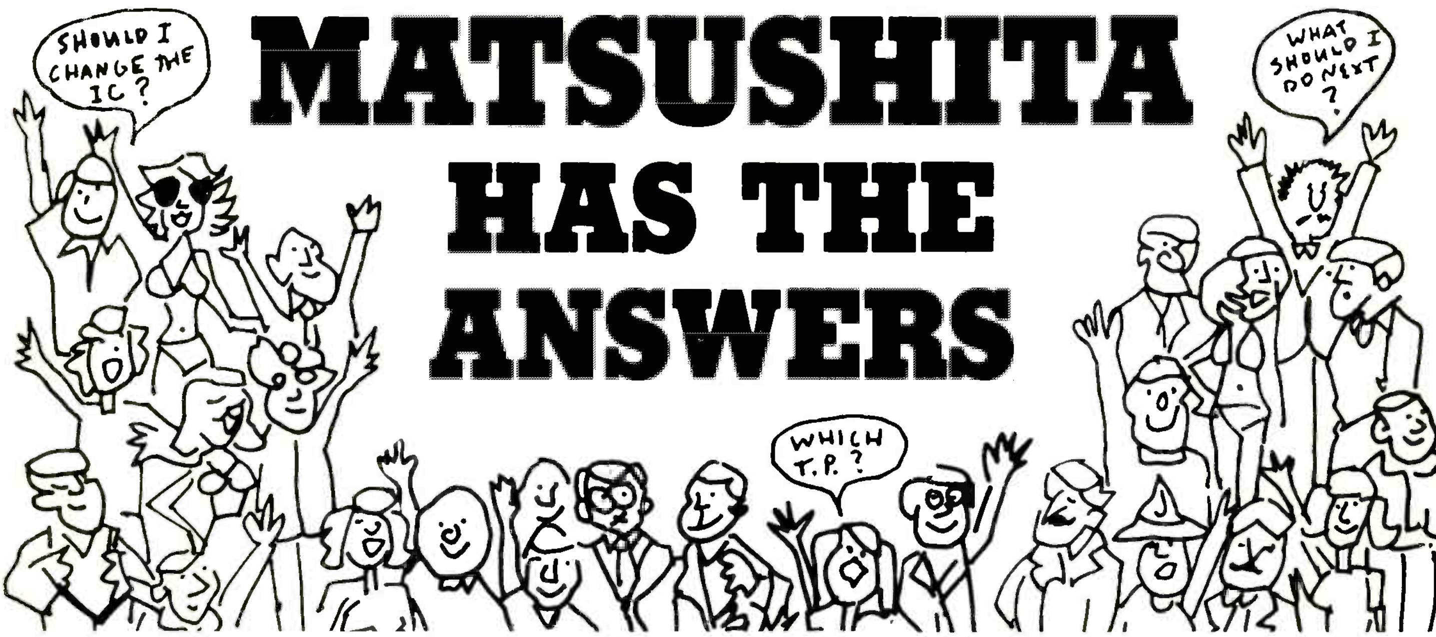

The questions asked by service technicians concerning today's higher technology products need answering now! Over the past few years, the technological advances made by MATSUSHITA in the areas such as video, audio, telephone, office products, home appliances and the like have been astounding, and will continue to be so!

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Editorial

Practice makes perfect

There's an old joke about a young violinist who was scheduled to perform at Carnegie Hall. He was walking to get there and became hopelessly lost. As the time for his performance came closer, he became increasingly agitated. In desperation, he approached an old derelict and asked, "How do I get to Carnegie Hall?" The unfortunate one looked at the musician and said without hesitation, "Practice, my boy, practice."

It may be a dumb joke, but it's excellent advice, and it's advice that's followed every day. Musicians and other performing artists practice every day, frequently for hours on end. Golfers, whether professional or amateur, may be seen anywhere they can find a few square yards of grass, or even carpet, practicing their putts. It's generally true that the more performers practice, the better they'll be and the greater their chances of success.

What's true of performers is also true of technicians. The more technicians practice their craft, intelligently, the better practitioners they'll be.

Perhaps it is stretching things a bit to compare a technician's oscilloscope with the violinist's violin, or the golfer's set of clubs. Still, the oscilloscope is the technician's most versatile instrument and his most valuable tool, just as the violin is the musician's instrument and the golf clubs are the golfer's tool set.

But how many technicians take the time to practice using the oscilloscope under known conditions so they'll be prepared to apply it when they face a faulty unit? How many technicians take the time to experiment with all of the controls, and study the instructions so that they know all the *functions* of all the controls, and are truly capable of a virtuoso performance? Not many, we would guess.

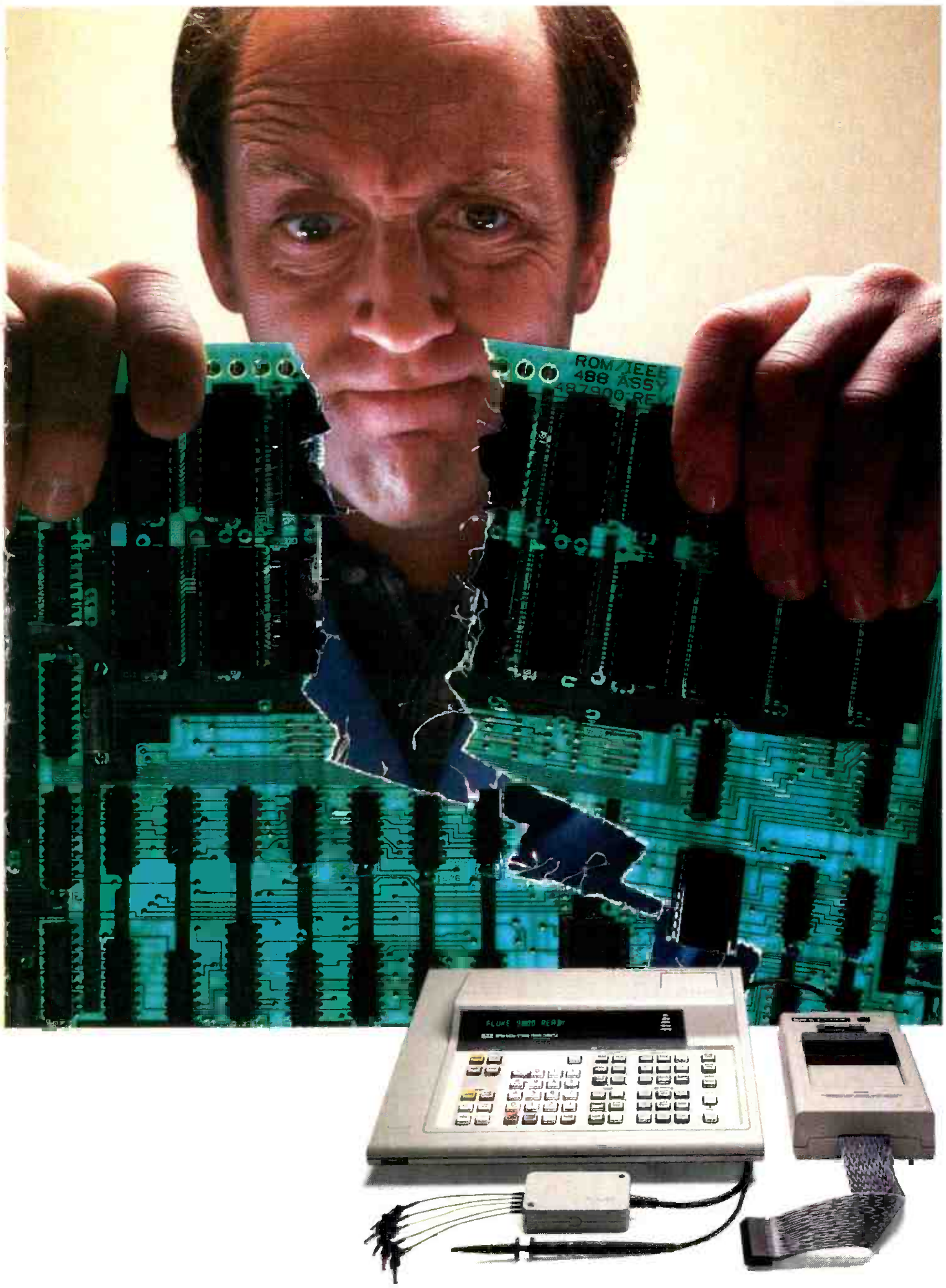
At this moment, the world of test equipment, and oscilloscopes in particular, is changing. Paradoxically, oscilloscopes are becoming both easier and harder to use. Some of today's more sophisticated oscilloscopes include a digital readout that tells the operator what the peak, average and RMS values of the waveform are, making it unnecessary for the operator to count graticule divisions and perform the elementary calculations to determine the waveform's parameters.

On the other hand, some of today's oscilloscopes are more complex to use and to understand simply because they can do so much more than the earlier models. Digital storage oscilloscopes, for example, can store a waveform indefinitely, and later return it to the screen where the operator can manipulate it in a number of ways to determine the condition of the circuit under study *at the time the waveform was stored.*

Golfers practice wherever they can find a flat surface, musicians practice constantly to be the best that they can be, football players, baseball players, writers, singers and many more experts practice constantly so that they will be at their best when they perform. Should we ask less of electronics servicing technicians?

Nils Conrad Persson

If you can't fix your board with the enhanced 9000 Series, it's beyond repair.



Introducing a new dimension of test capabilities for the Fluke 9000 Series Micro-System Troubleshooter line.

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News

President Reagan cites Electronics Technicians

Electronics technicians were honored nationally on March 4 with the inauguration of the first National Electronics Technicians Day. This special day recognizes the 20th year of the certification program, which is sponsored by the International Society of Certified Electronics Technicians, and the certification of the 20,000th electronics technician.

In his proclamation announcing National Electronics Technicians Day, President Reagan saluted the high standards of performance and excellence maintained by professional technicians and by ISCET in its 20 years of distinguished service to the electronics industry. He paid tribute to the vital part that electronics technicians play in helping to assure our country's continued technological and economic leadership as a formidable international competitor. In extending his personal congratulations to technicians who have met the demanding criteria for certification, he recognized the individual skills, talent and expertise that make electronics technicians one of the country's most important technological resources.

In citing ISCET's significant growth and professionalism, ISCET Chairman Jim Parks applauded the many dedicated individuals who have devoted countless hours of their time to honor electronics technicians in a very tangible way. "The instructors, certification administrators, and the general membership of ISCET have, in their own way, honored the technician; ISCET's day of honor is only a small step toward recognizing their work," Parks said.

ISCET set aside March 4 as a national testing day for certification of electronics technicians. Many of the volunteer corps of ISCET test administrators used that day to encourage technicians all over the nation to demonstrate their own professionalism by taking the CET exam.

In order to make National Electronics Technicians Day an official commemorative holiday, people involved in the electronics industry are asked to contact their senators and representatives to request their support for House Joint Resolution 507 (HJRes507) introduced by Representative Martin Frost, D-TX.

For more information on National Electronics Technicians Day or House Joint Resolution 507, contact the ISCET offices at 2708 W. Berry St., Fort Worth, TX 76109; 817-921-9101.

1985 outstanding for VCR sales

With sales of videocassette recorders topping 1.9 million units in December (the equivalent of more than 60,000 per day), VCR sales during 1985 soared to 11.8 million units, a 55% jump over 1985's 7.6 million. That total surpassed EIA's forecast that 11.5 million would be sold to dealers in 1985. At Winter Consumer Electronics Show in Las Vegas, EIA predicted that, in view of the fact that VCRs are now in 30 percent of American households, sales in 1986 are expected to grow at a more modest rate, to approximately 12.5 million units.

Color TV sales in 1985 numbered nearly 17 million units, easily the best year in the 32-year history of that product. With 5.7% growth, color TV sales far exceeded the 16.1 million unit figure posted in 1984.

Projection television registered even more dramatic growth last year, increasing 36% to about 266,000 units. ES&T

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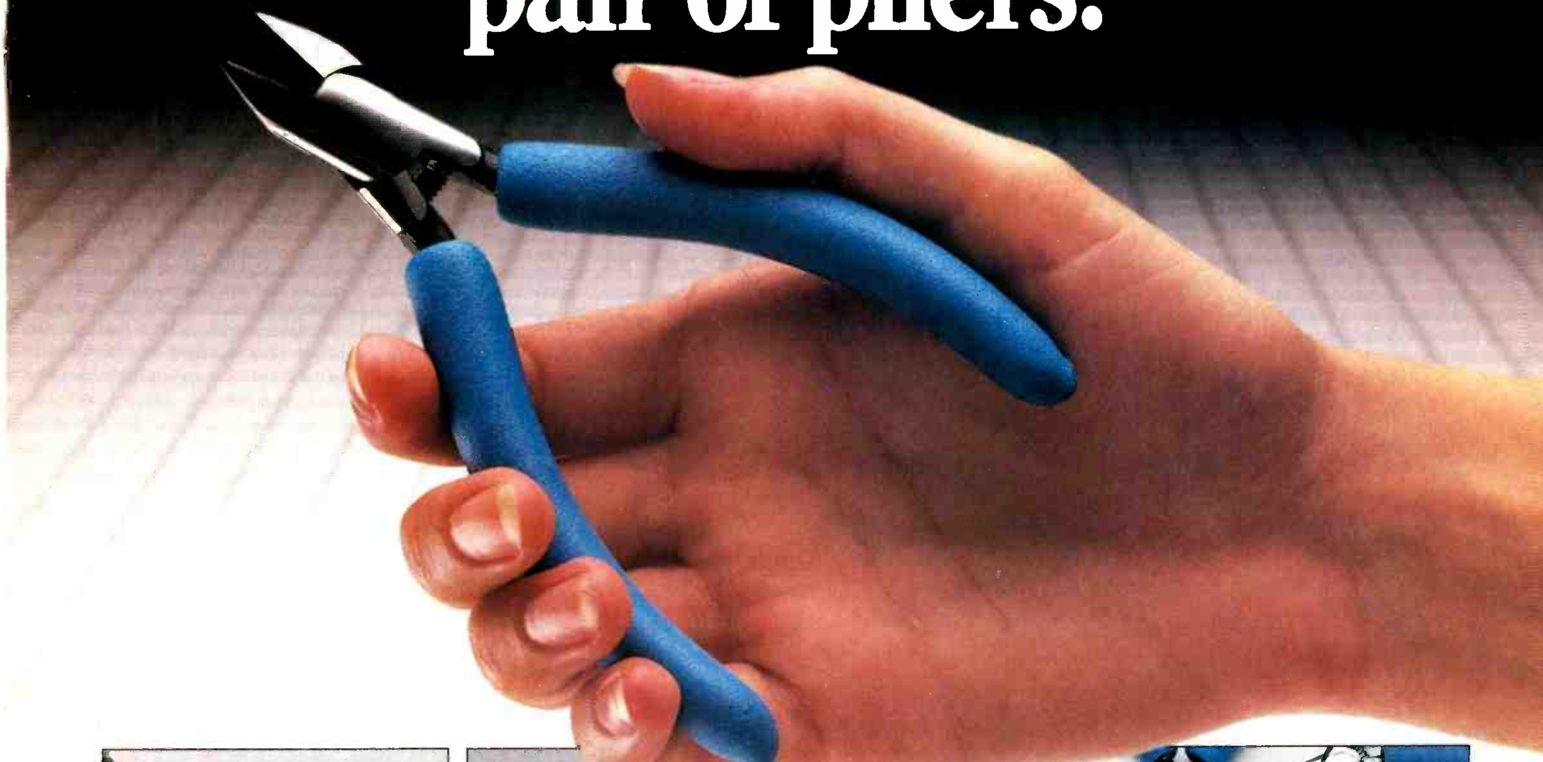

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BACK AMERICA

Technology

Digital oscilloscope gives paper copy of information on scope face

Oscilloscopes have undergone considerable change and improvement in the last few years. Bandwidths have increased greatly, trace rise times have become even smaller, the addition of digital circuitry has made it possible to capture a waveform and store it for any length of time, manipulate it, compare it with other waveforms and learn just about everything there is to know about it.

Other recent innovations have made the oscilloscope easier to use. On-screen or meter displays give readings directly in volts, time or frequency, eliminating the need to count graticule divisions, factor-in control settings and calculate parameters.

A recently introduced oscilloscope provides many innovations such as these and *in addition:* A.) makes it possible to display logic timing signals instead of, or in addition to, analog signals, B.) will give a paper hard copy of what was displayed on the scope face and C.) store the information in a non-volatile memory for later recall.

The SE 571 Digitalscope by BBC-Metrawatt/Goerz is a 2-channel oscilloscope when used to analyze signals. When digital circuits are encountered it will function as an 8-channel logic timing analyzer.

Because this is a digital oscilloscope, a number of convenience features have been made possible. For example, the amplifier sensitivity and timebase are automatically selected based on the nature of the waveform to be studied. In addition, there are two cursors that are used to determine waveform values.

If you want to determine voltage between two points on the waveform, for example, you merely

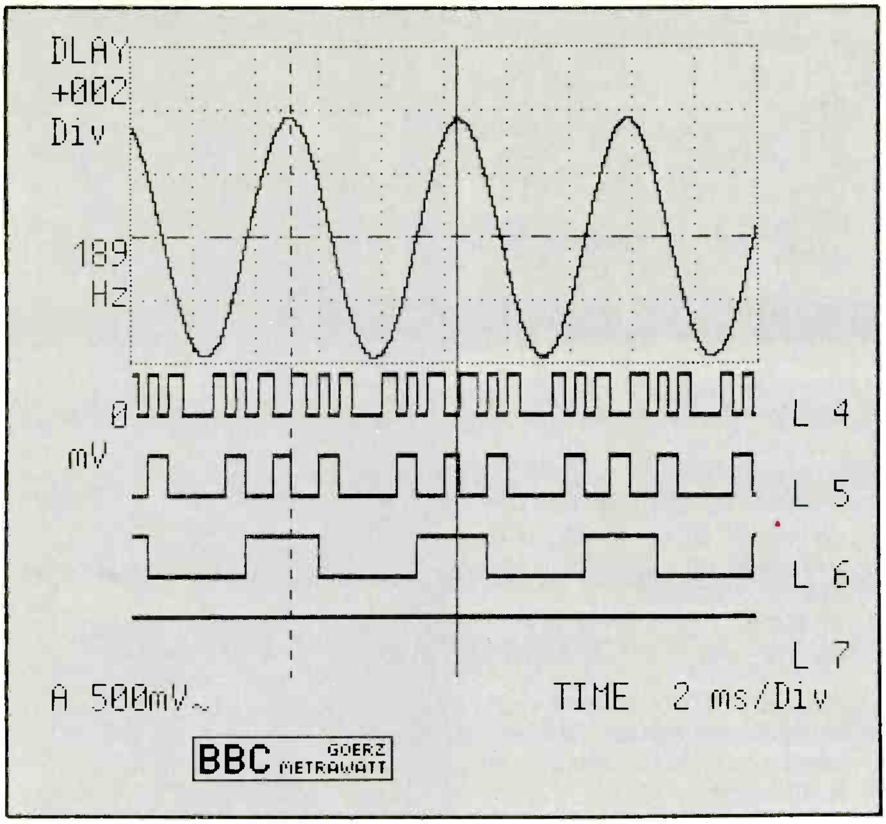


Figure 1. Oscilloscope paper copy looks like this. All information displayed on the screen is printed out on paper. This same information may be stored in a non-volatile memory. The paper copy requires about 10 seconds to produce.

place the reference cursor on one of the points of interest, move the main cursor to the other point and observe the numerical readout on the scope face. The readout will give you voltage difference and the time difference (or frequency) between the two cursors, and the voltage at the main cursor.

The display can be selected in a number of ways, depending on the circuitry to be tested. For analog signals only, the unit may be set up as a dual trace scope, allowing the user to examine a single waveform or to compare two waveforms. For examining digital circuits, the unit can be used to view up to eight logic timing diagrams. If the circuit under test requires analysis of both analog and digital waveforms at the same time, the instrument will display an analog signal on the A channel and the timing diagrams of up to four digital circuits.

When it becomes desirable to make a paper copy of the waveform and other information displayed on the scope face, all that's necessary is to select this feature, and in about 10 seconds the thermal printer produces an exact copy of what is on the scope face along with the date and time.

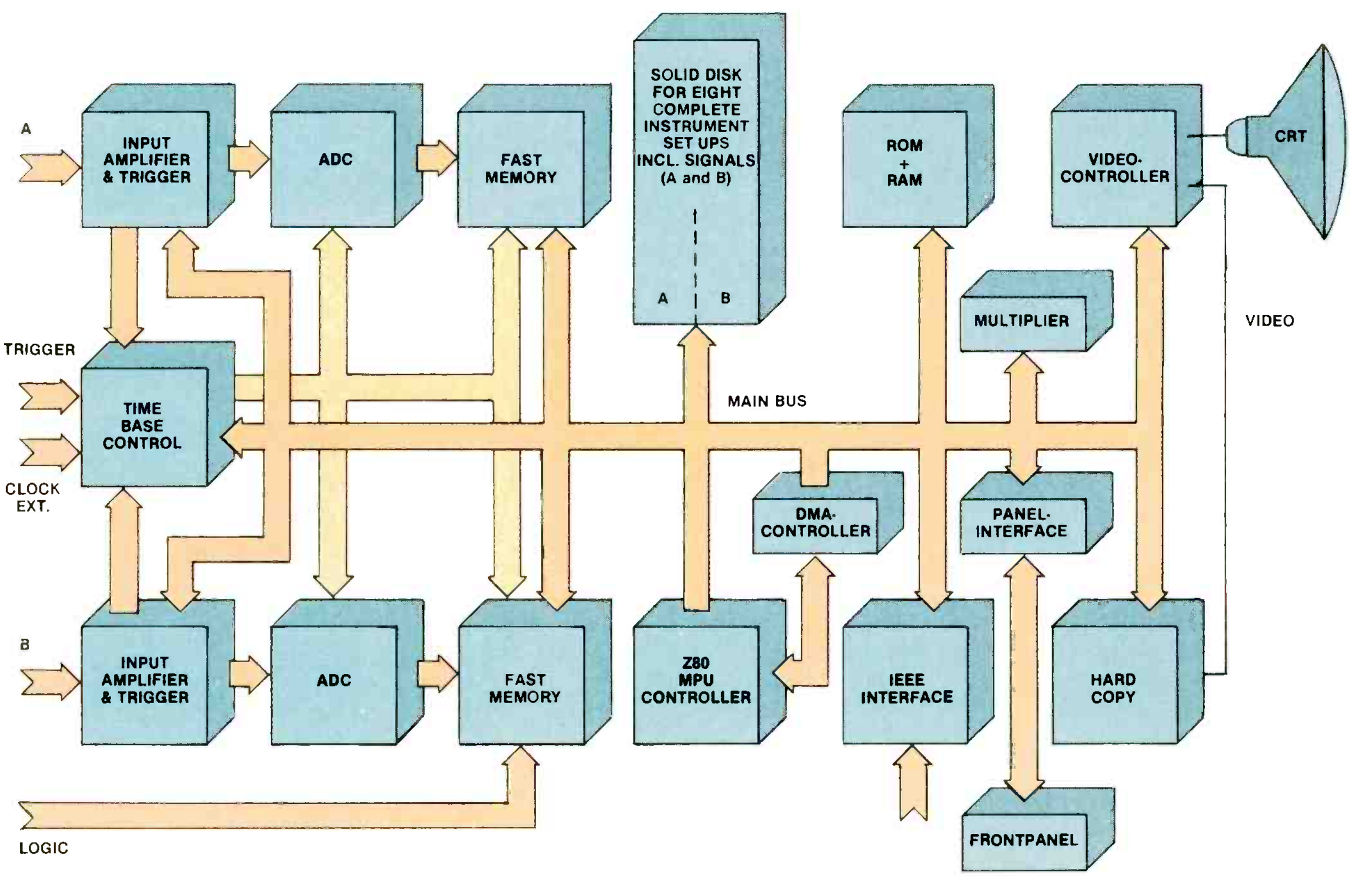


Figure 2. Block diagram shows major subsystems of printing digital oscilloscope.

TV camera test bench

A setup to speed checks and adjustments

By Gerald P. McGinty

TV cameras, especially those made for the consumer market, are forbidding to servicing technicians in terms of the wealth of technology packed into an extremely small package. A lot of time is wasted searching for test points; a job that is doubled in many cases because the service manual directs the technician to a second TP for scope trigger purposes. Some important routine checks like the accuracy of the subcarrier frequency may not be made simply because the sync generator board is fully shielded or difficult to get to.

Much of the frustration associated with camera checks and adjustments can be eliminated if test equipment is used to the fullest. This article discusses using the scope, pattern generator, vectorscope, frequency counter and picture monitor to speed and simplify the job.

The video route

Figure 1 shows a block diagram of a suggested route for video from the camera to the picture monitor. Let's look at each of the components in the chain. The signal is first bridged to one of the vertical inputs of a dual-trace scope. The scope must be near the camera so it is nearest along the signal path. I use Channel 2 for this purpose and route video in via a BNC T connector. From the T the signal is routed to the picture monitor and terminated there.

Trigger the scope from CH-2 at all times. The camera puts out composite sync even when the lens is capped so a positive source for line and field-rate triggering is present whenever power is turned *on* at the camera. The scope should have H and V TV-sync separators so that you can change from H-rate to V-rate waveforms simply by flipping the sync coupling switch on the scope and making

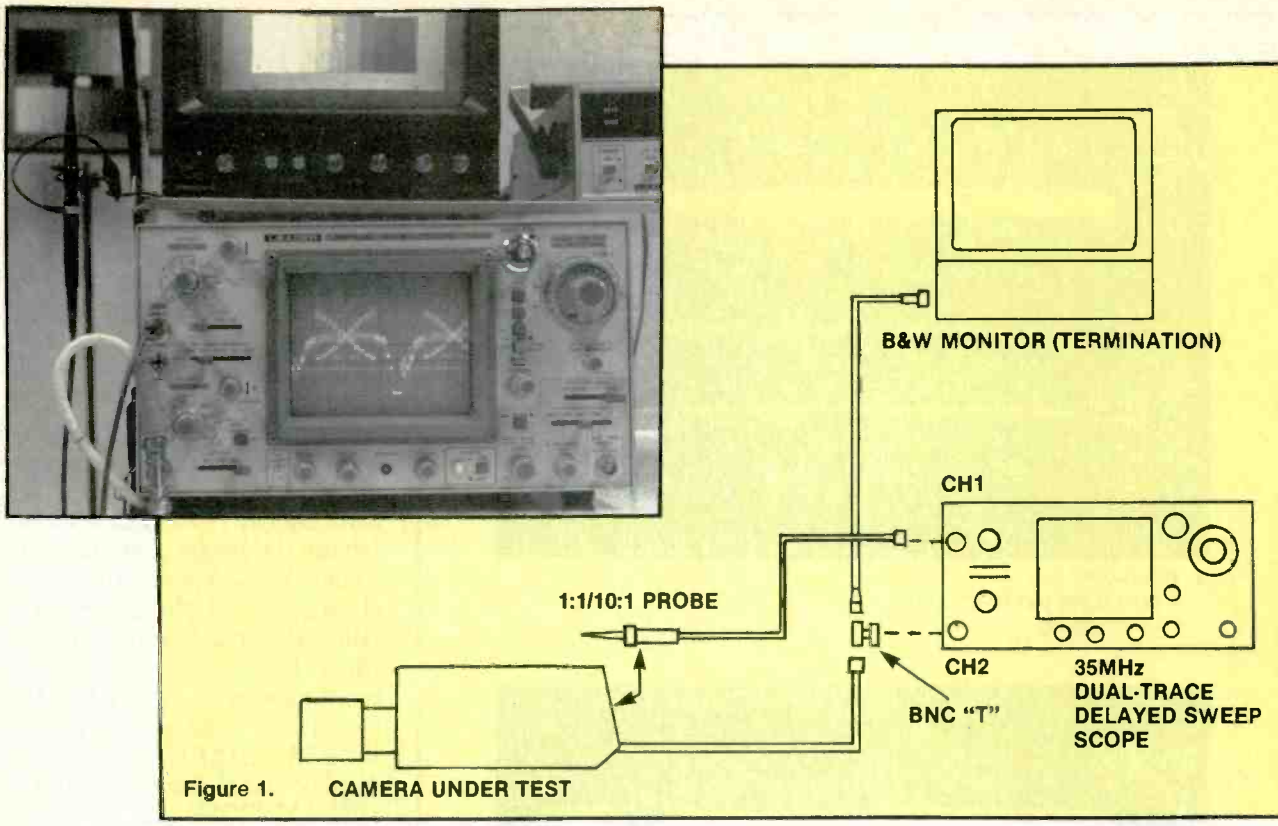


Figure 1. When you're setting up a video camera test bench, connecting video test equipment as shown here results in efficient testing with a minimum of frustration.

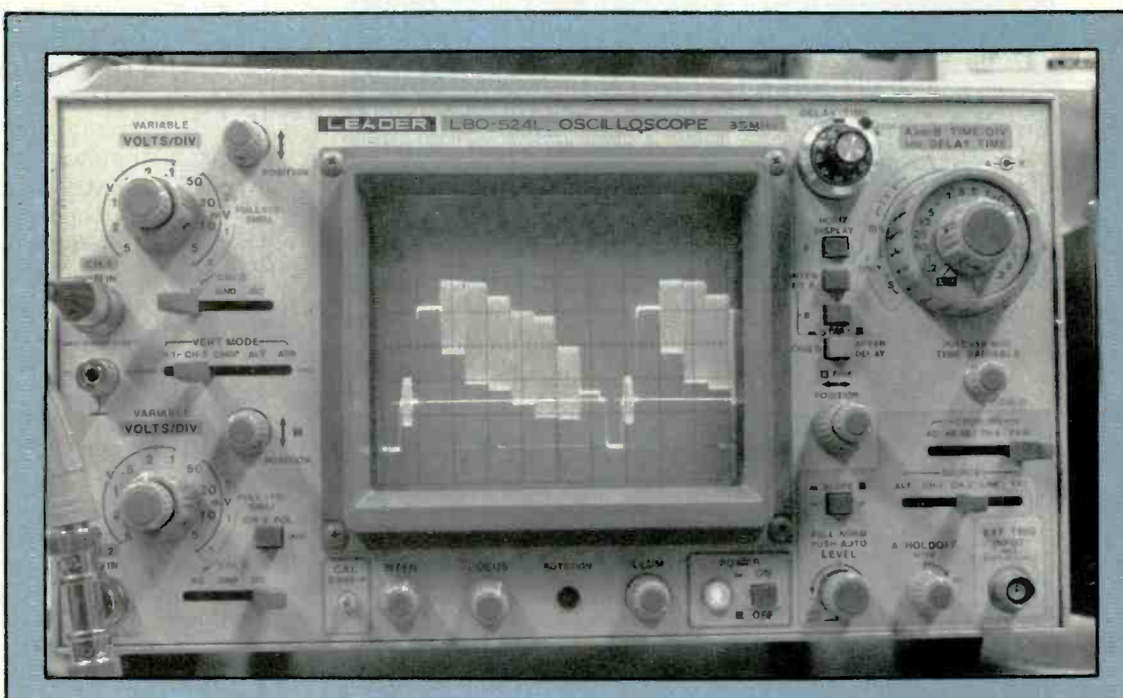


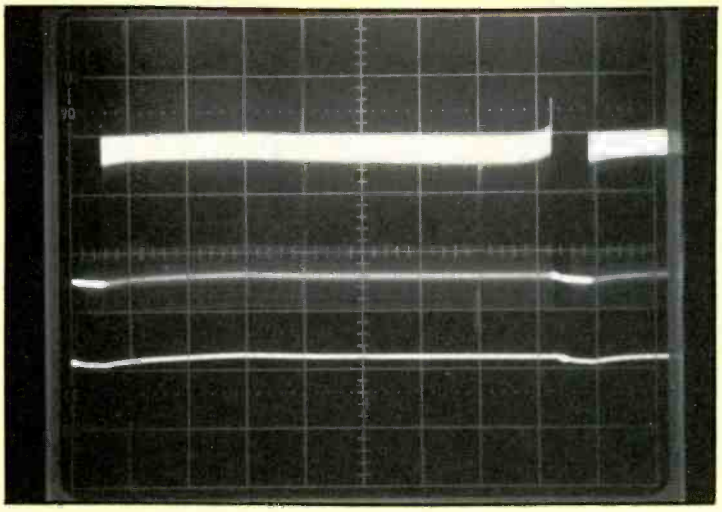
Figure 2. Connecting the scope in this manner (see text for details) gives you a source of positive trigger without having to search. It also makes it easy to switch back and forth from internal- to camera-output waveform.

the necessary change on the time-base selector (2ms/cm for V and 10μs/cm for H-rate displays).

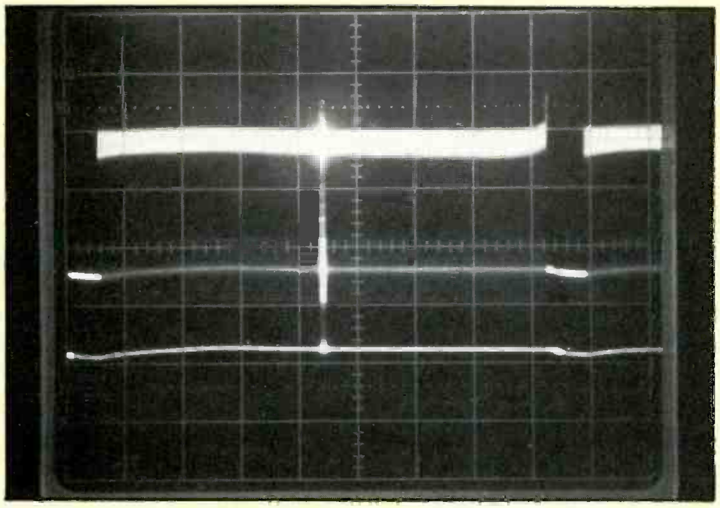
Connect a switchable 10:1/1:1 probe to the CH-1 input jack. Use this probe for all camera internal waveform checks, but continue to trigger from CH-2 for all H and V related signals. See Figure 2.

With this setup, you always have positive trigger with no need to search for a separate trigger source. Furthermore, you easily can switch back and forth from internal waveforms to the camera output waveform by flipping the VERT MODE switch. And, of course, you can view both waveforms simultaneously.

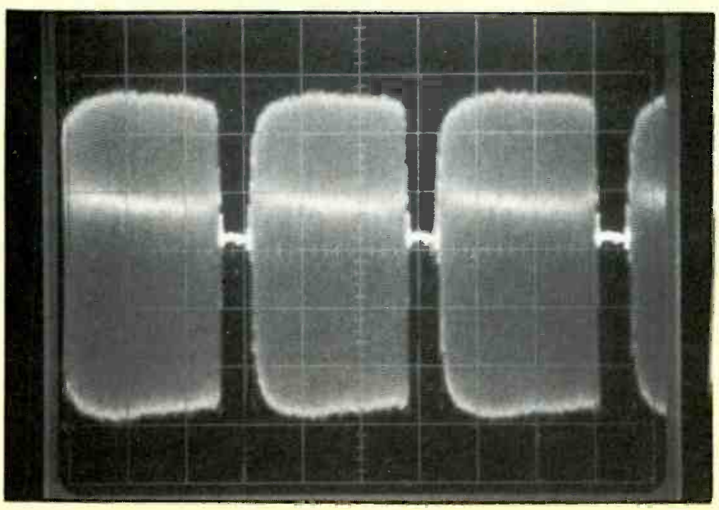
Delayed sweep is needed for many adjustments in single-tube color cameras because it is necessary to look at one or two raster lines in the vertical center



a. Video out
A time base set to 2ms/cm
TV-V coupling



b. Video out
A intensified by B
B time base set to 20μs/cm



c. B time base
Camera pre-amp output
Camera framed on white card

Figure 3. Steps in viewing three raster lines near the center of the picture.

of the picture. Figure 3 shows the steps involved in viewing three lines in the vertical center of the raster. In this case, the waveform is pre-amp output.

Start by observing video output by setting the scope's VERT MODE switch to CH-2. Trigger the scope as usual from CH-2. Set the COUPLING switch to TV-V, and set the A time base to 2 ms/cm. See Figure 3a. Now set the HORIZ DISPLAY for A intensified by B, and set the B time base to 20μs/cm. A bright vertical line representing the B time base will appear on the waveform. Adjust the DELAY TIME control to center the bright zone midway between the vertical sync pulses as shown at b of the figure. At this point you can connect the CH-1 probe to the pre-amp output test point, and set the VERT MODE switch to view CH-1. Reset the HORIZ DISPLAY switch to display the B time base and reset DELAY TIME as needed. The final waveform, three raster lines in the vertical center of the picture, is shown in Figure 3c.

Do you need a waveform monitor?

Not in my opinion. The waveform monitor is certainly convenient, but it is basically a special-purpose scope. Your 35MHz (or better), dual-trace delayed-sweep scope will do everything a waveform monitor will do except facilitate certain operational uses. What the waveform monitor cannot do for you is go inside the camera. It is made to handle standard level (1Vp-p) signals at 75Ω. One thing the waveform monitor *does* do is read out in IRE units for standard level signals. If levels are given in the service data in IRE units, you will have to convert them to volts for scope readings. This is done with the formula:

$$Vx = \text{Value in IRE}/140$$

Table 1 lists some key video voltage values for equivalent IRE values.

Adding a vectorscope

Although a waveform monitor can be left out of the setup, there really is no substitute for a vectorscope. The vectorscope is needed to adjust the camera color encoder. It provides a polar display

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in which the phase angle of each of the color bars (except white) is shown as an angle measured from burst and amplitude as the length of the vector measured from the origin. For color bars generated from electronic color-bar generators built into the camera, the display shows up as bright spots that should be within the small targets on the vectorscope graticule. See Figure 4. The small targets represent a tolerance of ±2.5° in phase and ±1.5 IRE units in amplitude. The encoder is aligned to place each of the primary and complementary dots as well as the dots for burst at the designated locations on the vectorscope graticule. The vectorscope shown in Figure 4 makes use of electronically generated targets as well as a conventional, internally etched graticule. However, the electronic targets make encoder-alignment much easier because they are unaffected by centering controls and can be seen from a distance. It is usually necessary to fuss with centering controls and align your eye with the long axis of the CRT when using many vectorscopes.

For consumer cameras that do not use built-in electronic color-bar generators, the service data usually specifies angle and amplitude data for the color bars obtained when the camera is framed on a specified reflective or transparent color-chip test chart. In this case, the graticule targets cannot be used. Fully saturated colors cannot be obtained from any sort of test chart, so you have to use the phase angle and amplitude data published in the service data. Phase is measured CCW from the B-Y axis (burst is at 180°). The large increments on the outer graticule scale are 10°. Amplitude is somewhat more difficult because there are no scale readings outwards from the origin. To solve this problem, some manufacturers specify vector length in terms of the length of the burst vector. This amplitude is marked in the −(B-Y) axis. A particular vector can thus be identified as a specific phase angle (with a tolerance given) and length with respect to burst. A color amplitude of 1.5B should read 1.5 times the length of the burst vector measured outwards from the origin. On the graticule of my

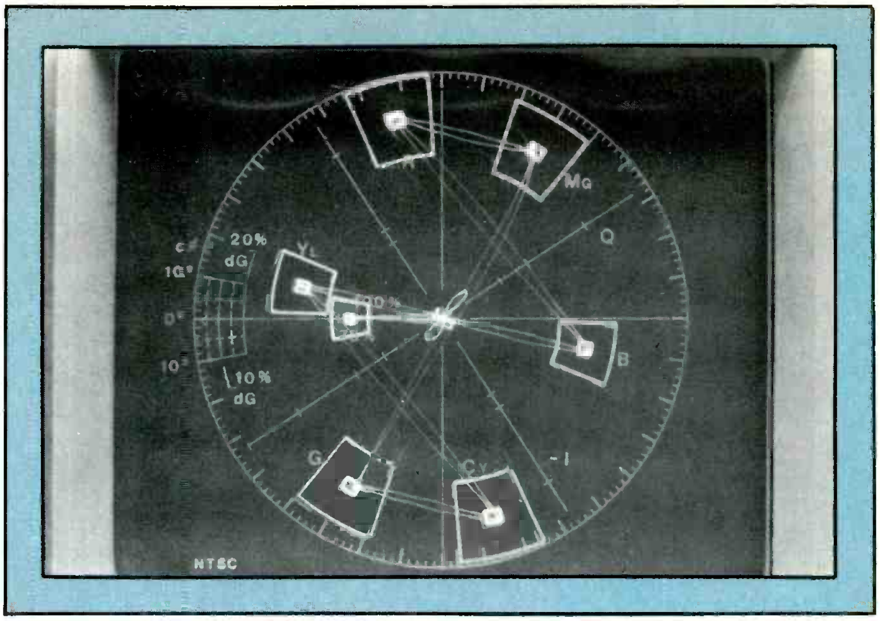

Figure 4. The vectorscope provides a polar display in which the phase angle of each of the color bars is shown as a dot at an angle measured from burst, and an amplitude of the length of the vector measured from the origin.

vectorscope, the burst vector is 15mm long, so it's easy enough to use a metric scale to measure vector amplitudes.

The vectorscope also helps when white-balancing the camera. This is done by making red and blue equal to green when the camera is framed on a neutral gray scale chart illuminated by quartz-iodine lamps (3200K). When the three primaries are equalized, the color signals R-Y/B-Y or I and Q go to zero. Because the modulators in the encoder are balanced, subcarrier output disappears on all steps

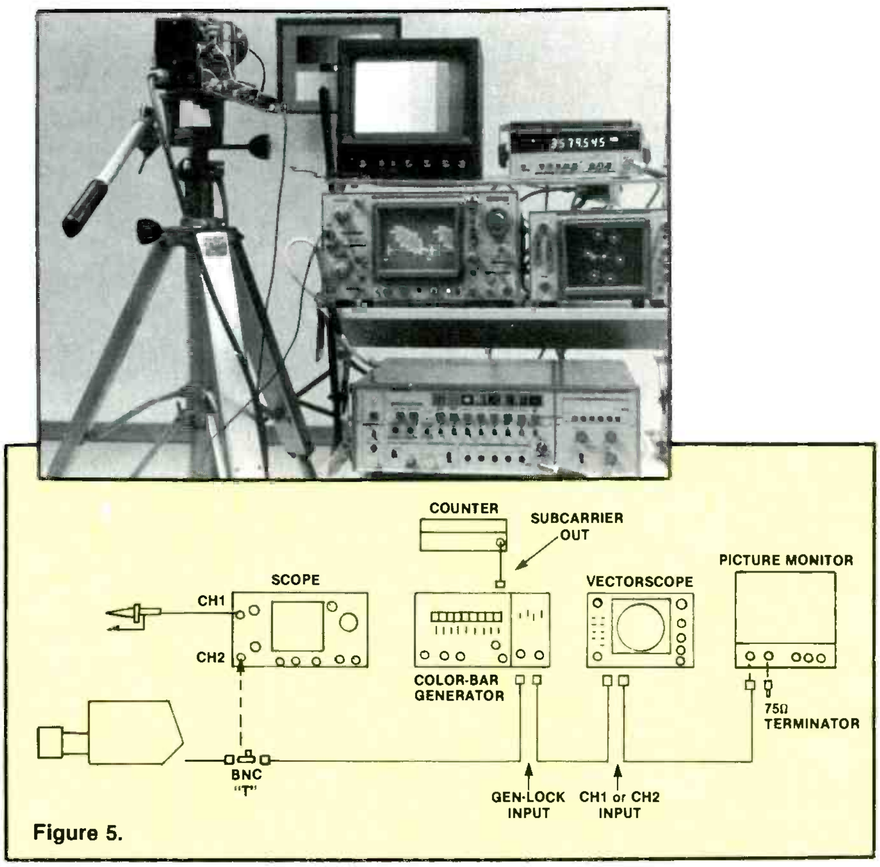

Figure 5. This more elaborate test setup provides for maximum versatility and efficiency for consumer color camera maintenance.

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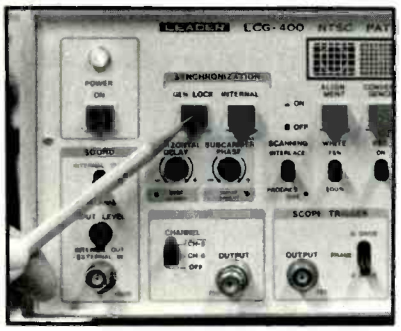

Figure 6. The GEN-LOCK feature on this pattern generator allows the generator's signal to be locked to the subcarrier frequency of the camera being tested, enabling you to check and adjust this signal without going inside the camera.

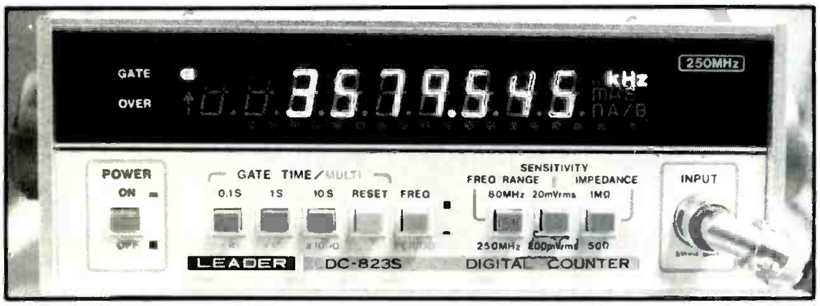

Figure 7. This frequency counter shows the reading from the color-bar generator locked to the camera output.

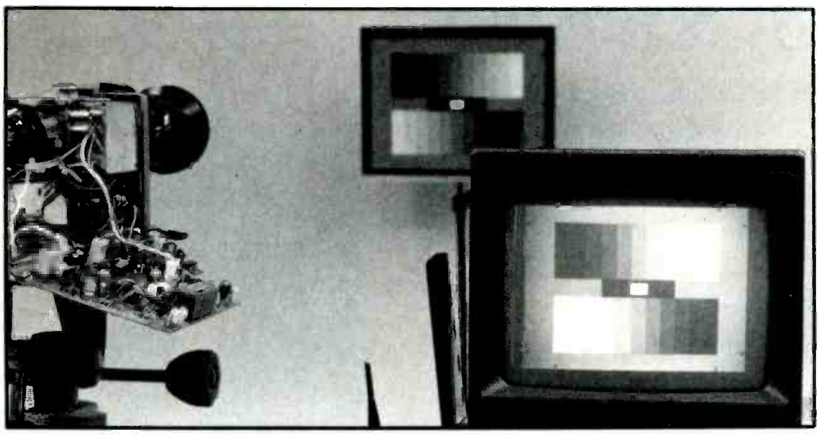

Figure 8. Picture monitor underscans for test-chart accuracy.

of the output waveform. On the vectorscope, deflection collapses to the origin.

The vectorscope is added to the test setup as shown in Figure 5 by making use of CH-1 or CH-2 *loop-through* connectors. A gen-lock pattern generator is also added in the figure. Here's why.

Measuring subcarrier frequency the easy way

Before any camera departs the shop, the frequency of its subcarrier oscillator should be checked and adjusted if necessary. A large error will prevent the monitor from locking to it. Even a small error will result in phase (hue) errors on the color monitor. The easiest way to check subcarrier frequency is to make use of the gen-lock facility found in some pattern generators. Camera output is looped through the gen-lock jacks on the pattern generator as shown in Figure 5, and the generator set for GEN LOCK operation (the internal subcarrier clock is not used). See Figure 6. Now the generator phase locks to the burst signal produced by the camera under test. CW subcarrier output, available from a jack on the rear panel of the generator, then can be used to drive a frequency counter. In this way, the subcarrier frequency of the camera under test can be read and adjusted without going inside the camera for a CW feed. There is no reason to avoid this check. You can even do it with all the camera covers in place. See Figure 7.

There's a bonus from the hookup shown in Figure 5. That is, you can use off-air decoded video output of a VCR in place of a camera video to check the accuracy of your counter. By setting the tuner in the VCR to a network channel, you have a source of subcarrier frequency as accurate as ABC, CBS or NBC: 3.579545MHz on the nose. This makes it easy to know exactly where your counter is; you can check it as often as you like.

The picture monitor

The last item in the chain shown in Figure 5 is the picture monitor. Oddly enough, it should be a B&W monitor with a wideband video system. This permits accurate optical and electrical focus adjustments. (For single-tube cameras, electrical focus is extremely critical, and usually is set for maximum coded output from the pre-amp. The frequency of this signal, which carries the color information, is determined by the pitch of the color stripes on the faceplate of the pick-up tube.).

One prime requirement of the picture monitor is that it must be capable of *underscanned* operation. This makes the true sides, top and bottom of the visible (unblanked) raster visible. For the camera test charts to have any meaning, the test chart must be framed in the camera's field of view so that those arrows on the sides of the test pattern just touch the visible edges of the raster on the monitor screen. See Figure 8. The monitor shown in Figure 8 also has pulse cross-operation, which permits the sync and blanking signals to be observed. This also is handy for checking VCR video head switching points that usually are set for three lines above the start (top edge) of vertical blanking.

Since the picture monitor is the farthest from the camera along the cable route, it must terminate the line. Put a 75Ω terminator in the unused loop-through connector or switch on the internal terminator. All other equipment in the setup should be unterminated.

Video output from consumer cameras

The source of CH-2 signals described so far has been camera video output. This is easy to find in

Table 1.

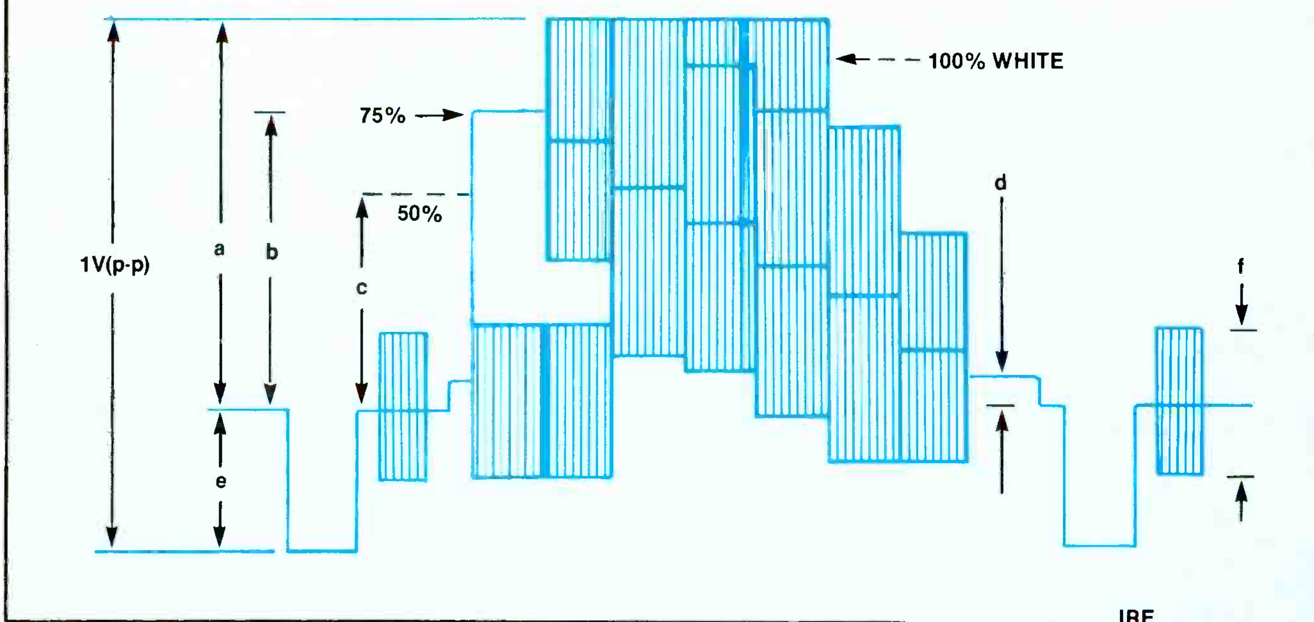

Table 1. Some key video voltage values for equivalent IRE unit values.

	ITEM	IRE UNITS	mV
a	100%	100	714
b	75%	77	550
c	50%	54	384
d	SETUP	7.5	54
e	SYNC	40	286
f	burst p-p	40	286

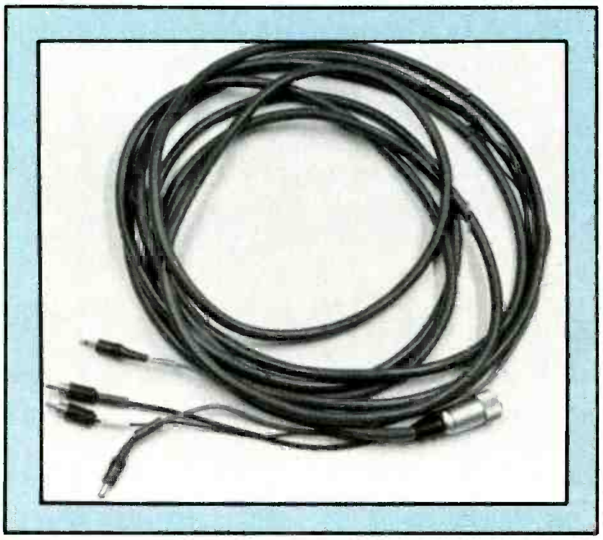

Figure 9. Camera cable branch-out provides separate output lines for video, audio and VCR control (pause) as well as 12Vdc input.

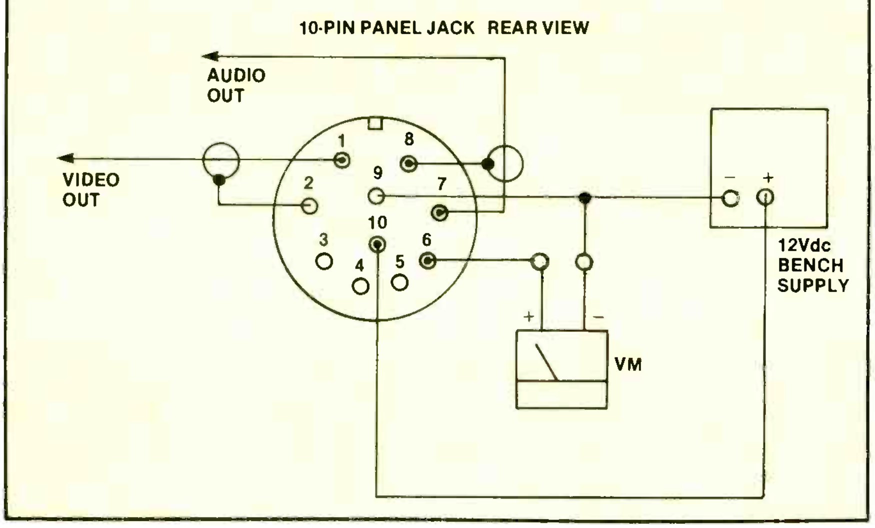

Figure 10. A test jack wired like this provides video and audio out, dc power and a check of the camera VCR record stop-start system.

broadcast/industrial color cameras. They all have BNC VIDEO OUT connectors. For consumer-grade cameras it's not so easy: You have to make provision to branch out from the multi-pin connector at the end of the camera cable.

The simplest way to get video output from consumer cameras is to connect the camera cable to a matching VCR and take the video feed from the video out jack on the VCR. The VCR also supplies power (+12Vdc) in this case. However, the signal does pass through some processing in the VCR (video AGC) and this masks proper adjustment. An alternative is a branch-out cable like the one shown in Figure 9. These are available from the camera manufacturers. A separate 12Vdc supply is needed to supply power. Separate camera power supplies are available that output video directly (Ambico Model V-0605). An alternative is a test jack wired as shown in Figure 10. This provides video and audio out, dc power and a check of the camera VCR record stop-start system. The unit accommodates most VHS-compatible cameras. ES&T

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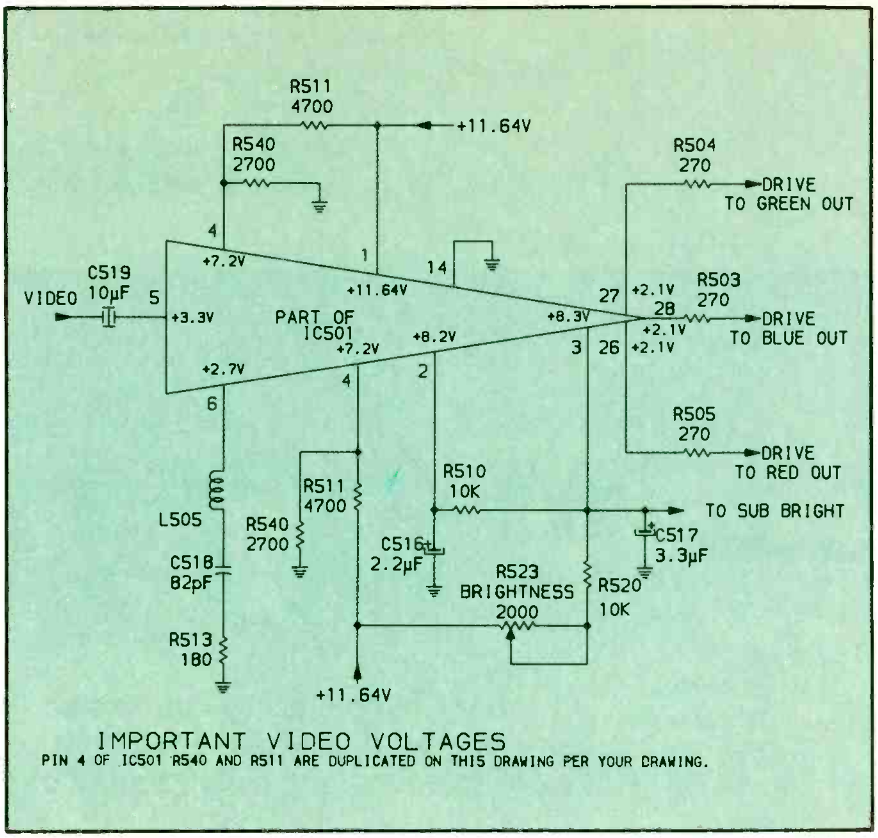


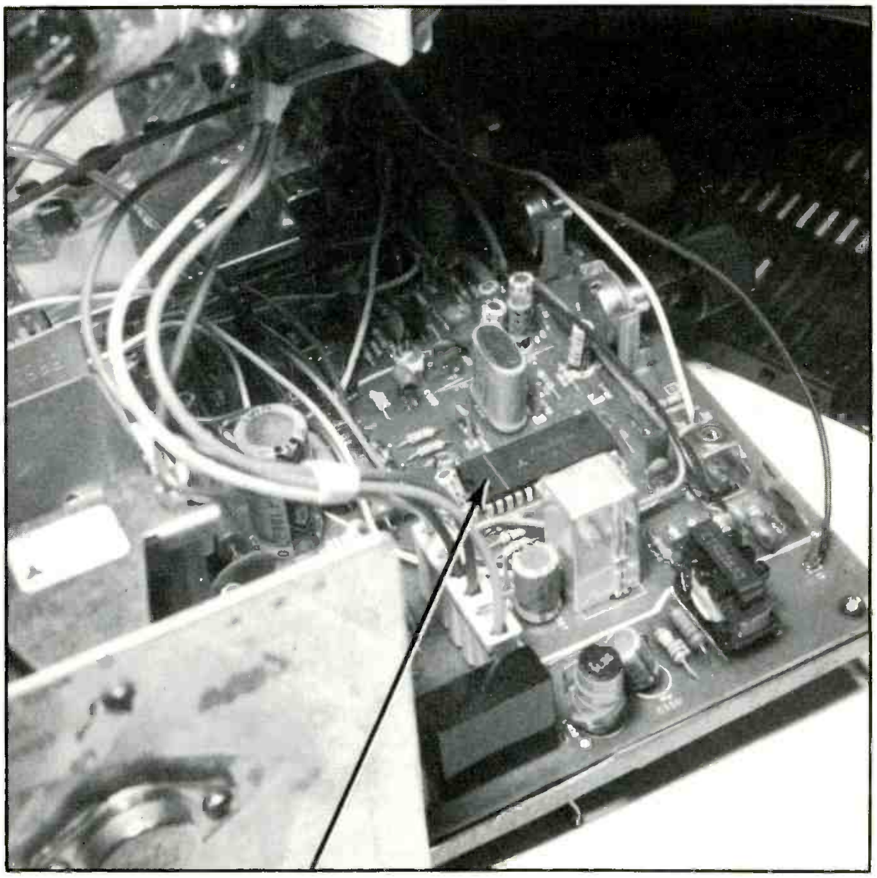
Figure 2. Video (luminance) enters IC501 at pin 5, and (except for being scoped at the pin 6 trap) is never found again without chrominance. Base signals for the red, blue and green color-output transistors come from IC501 pins 26, 28 and 27.

Any device that performs so many functions might be suspected of experiencing more than than the usual amount of failures, and that is true here. A defective IC501 might cause loss of color, false color bars, loss of video, incorrect screen colors or a bright raster with retrace lines.

In early JC Penney 685-2039 models, replacing IC501 cured most luminance problems. However, the cure lasted only 30 days or so before IC501 went bad again, ruined by picture-tube arcs. A modification kit of zener diodes is available to protect the new IC501. This is described later.

My method of removing video/chroma IC501 is with solder wick and a 250W soldering gun. Suck up the solder from the rows of terminals along the IC's two sides. Look for bent terminals that might be holding the pins to the board. With some stubborn pins, try to slide a small knife blade under the pin as you apply heat to the pin's top. Finally, flick the end of each terminal with the small blade of a pocket knife or screw driver to make sure each terminal is loose before lifting off the IC.

After the IC is removed from the board, clean off all excess solder from the pads using solder wick. *Note: it is physically possible to in-*



An arrow points to the location of IC501 on the JC Penney circuit board. IC301 is under the IF shield, in the upper left corner of the photograph.

stall this large IC backwards. Be careful not to do so or the result will be catastrophic failure. Check for correct positioning of terminal 1. Solder all terminals with a low-wattage soldering iron to prevent heat damage to the new IC. A battery-operated iron is fine if it becomes hot enough. (Insufficient heat requires the iron to be on the joint too long, thereby transferring excessive heat to the IC's internal components.

Troubleshooting video

When the picture tube shows no picture, check for good or bad video and luminance stages by taking a scope waveform at IC501 pin 5. No waveform indicates defective video. If the pin 5 waveform is normal, the tuner, picture-IF stages, AGC circuits and video detector are performing correctly.

When there is no picture, check for operating or non-operating video stages in IC301 by scoping IC501 pin 5. If the pin 5 waveform is normal, the tuner, picture-IF stages, AGC circuits and video detector in IC301 must be working correctly. An absence of pin-5 waveform indicates a defect in those stages just mentioned. Check the AGC-control voltage at pin 25; it should be between +4.7V and +7V depending on strength of the signal being received. The tuner AGV is at IC301 pin 5, and it should measure between +2V and +10V. As in Figure 1, modulated-RF signals can be injected at pin 28, pin 9 or pin 18 and the output viewed by scope at IC101 pin 19 or IC501 pin 5.

If the problem is IC501, the difficulties for testing are multiplied, because very few color or video signals are brought out to the pins until the three color signals exit at pins 26, 27 and 28. However, much useful information can be obtained by checking the dc voltages and the signal waveforms at IC501 pins 5, 13, 6, 19, 20 and 24 plus the three color-drive signals at pins 26, 27 and 28. All waveforms can be checked against those in Photofact 2145-1.

Pin 1 and TP59 bring the +11.64V supply into IC501. If this voltage is low, suspect leakage in zener D504 (that regulates the voltage) or in IC501.

If the three color-drive waveforms are normal at pins 26, 27 and 28, and there is no picture on the screen, suspect problems in one or more of the three color-output amplifiers or the picture tube. Scope all three collector waveforms. Perform in-circuit transistor tests of each power transistor. If one or more of the color amplifiers is defective, these tests should find it. However, a single defective color-output transistor usually will provide clear evidence in a B&W picture with one color missing.

Bright retrace lines

When the raster is extremely bright and has bright retrace lines, or the brightness cannot be reduced enough with the brightness control, suspect IC501. Check the voltage and waveforms at terminals 1 through 6, 10 and 24. Sometimes this high brightness will drive the circuits into shutdown. Of course, you must get the receiver to operate in order to make dynamic tests, such as voltage tests.

Be certain pin 1 has adequate voltage (+11.64V). Measure the dc voltages at all luminance pins. If any voltages are too low, check the components connected to those pins. Check R510, R520, R514 and R516 for correct resistance. Test capacitors C516 and C517 in-circuit using a capacitance meter.

In a case when all active components and dc voltages appear to be normal, but the problem still persists, replace IC501.

Unusual luminance problem

To confuse the technician, some TV receivers develop more than one problem at one time. In one 2039 chassis, the brightness and retrace lines could not be turned down with the R523 brightness control. We automatically replaced the IC501, which corrected the brightness problem but brought to light a second one: The tuner could not tune in one station.

Accurate voltage tests on the tuner's memory board showed the +23.5V source had dropped to +13.6V. No negative pulses from the flyback were scoped at PA105 on selector board PWB (Figure 3). Tests of the +23.5V-source com-

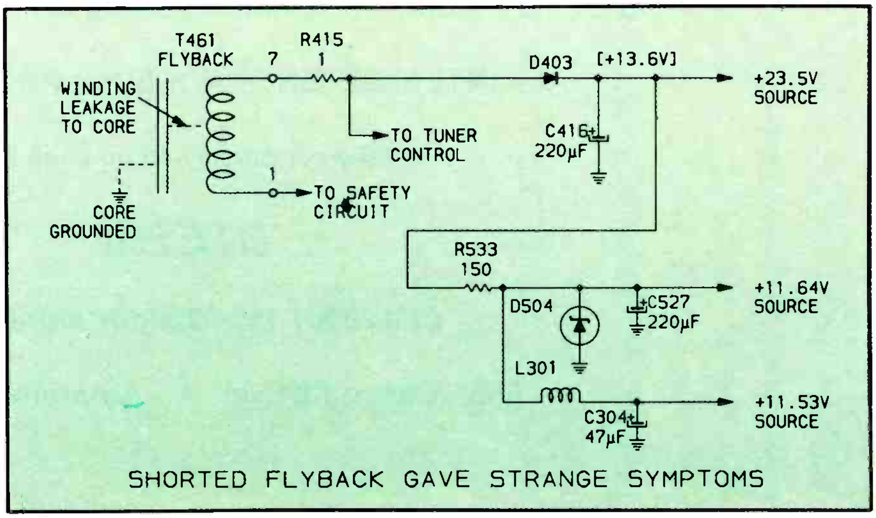


Figure 3. The +23V source is rectified from the pin-7 flyback signal, then the other two voltages are stabilized by D504 zener. In this receiver, a short between the flyback winding and the core grounded the winding incorrectly, thus reducing the dc-voltage output from D403. This interfered with the tuner station selection. The flyback was replaced.

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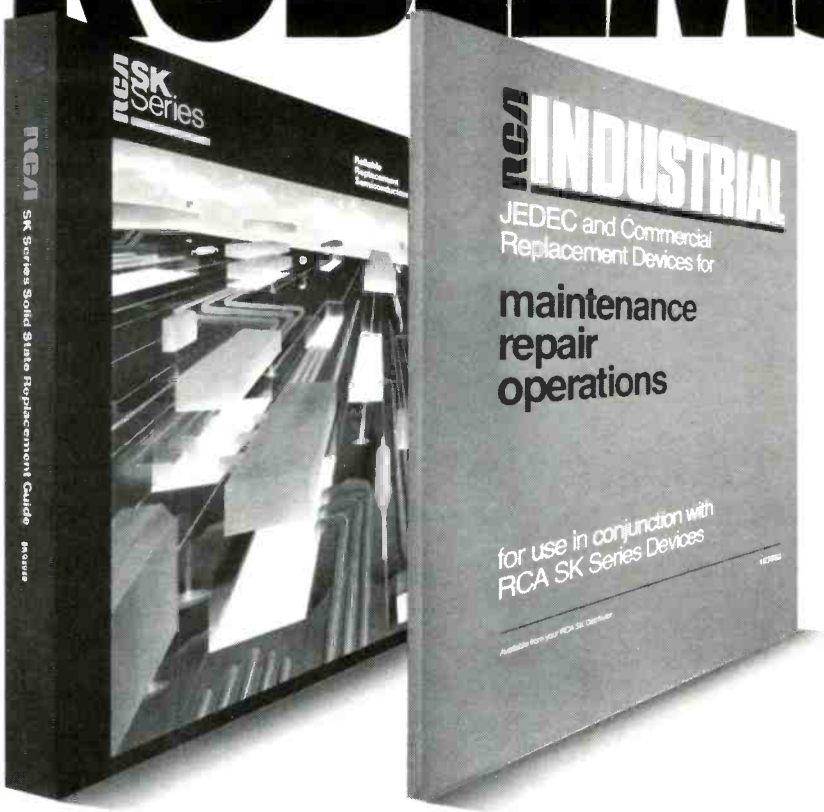

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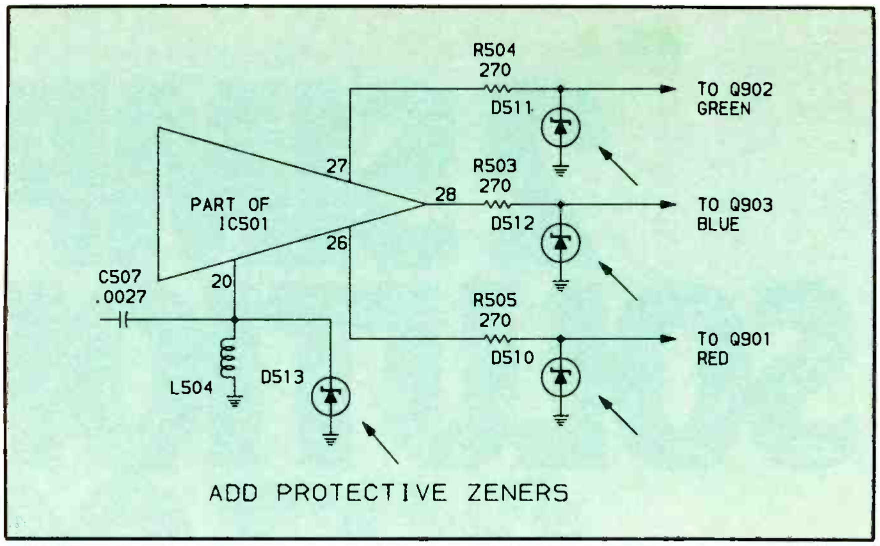


Figure 4. A 1206-8565 kit containing a new AN531OM IC and four zener diodes can be ordered from JC Penney stores or the RCA Service Company. These zeners are soldered to the foil side of the circuit board, and they absorb the transients that are produced when the picture tube arcs internally, thus protecting the IC. This should be done whenever a replacement IC501 has not operated more than a few weeks before failure.

ponents showed D403 and R415 were normal, and C416 (220μF) filter capacitor was paralleled with a similar capacitance but without any improvement.

The next possibility was that some overload on the +23.5V source was dragging down the voltage. With all loads disconnected from the supply, the voltage increased only to about +16V; not enough to be significant.

Resistance of the flyback winding was 21Ω, which apparently is normal. But a dead short existed either from pin 1 or pin 7 to chassis ground. All wires on pin 1 and pin 7 were removed, but the short remained at the flyback pins.

Installation of a new flyback (part No. 1177-1557) solved the problem with the tuner.

Kit for modification

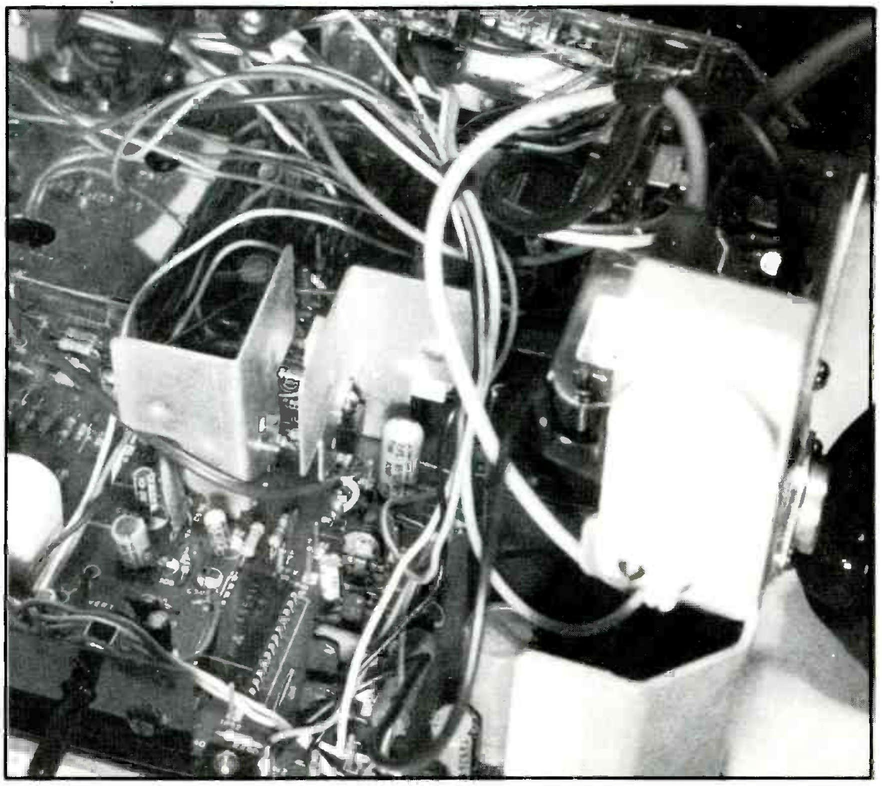
Because the secondary effects of picture-tube internal arcs can destroy IC501, a modification kit was designed to eliminate the problem. The 1206-8565 kit can be ordered through JC Penney stores or the RCA Service Company (which now is doing warranty repairs for the JC Penney stores).

The kit includes a new AN531OM IC and four zener diodes. As shown in the Figure 4 schematic, solder three zeners on the foil side of the board from terminal 26 to ground, 27 to ground and 28 to ground. The last zener must be connected between the ground foil and pin 20. *Remember, all zener anodes go to ground.* Locate the curved ground foil and scrape away the green coating where the new zeners should be soldered. Grasp the wire lead of the zener in pliers, or a soldering heat sink as it is being soldered to minimize the possibility of heat damage to the diode.

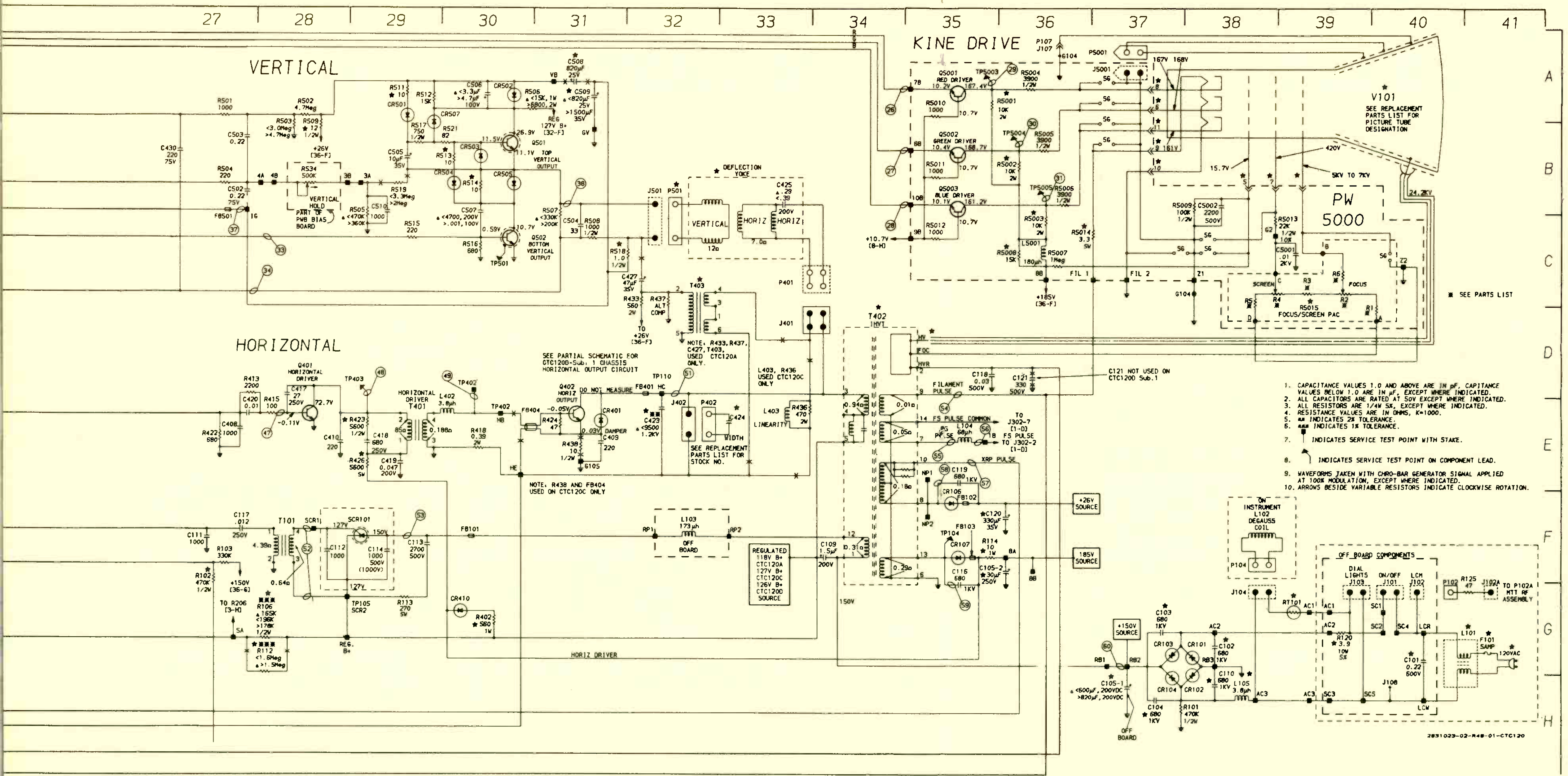
Loss of height

When the vertical sweep has collapsed into one horizontal line, scope the IC301 pin 17 waveform expecting to find about 1.3Vp-p. If it is there, the cause of loss of height must be in the vertical output or yoke stages. If it is missing or is weak or distorted, check pin 20 for the +11.53V source voltage. A loss of this voltage changes the next test to the power supplies. If the sources voltage at pin 20 is correct, inject a vertical test signal

Continued on page 50



The two right-angle pieces of metal near the photograph's center are the heat sinks for Q301 and Q302; Q302 is on the left, and Q301 is on the right. The IC at the lower center in the photograph is IC301.



Product safety should be considered when component replacement is made in any area of a receiver. The shaded areas of the schematic diagram designate the components in which safety is of special significance. It is recommended that only exact cataloged parts be used for replacement of these components.

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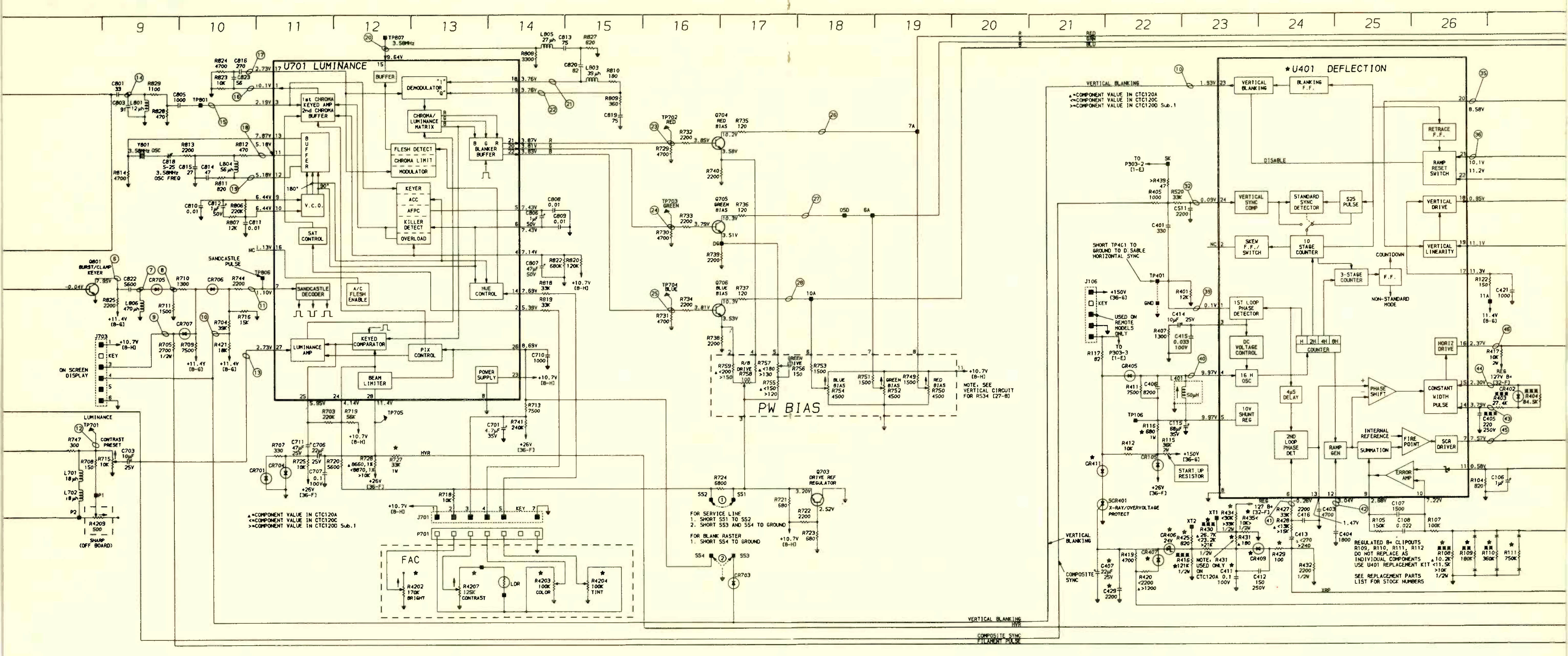

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GE
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Color TV

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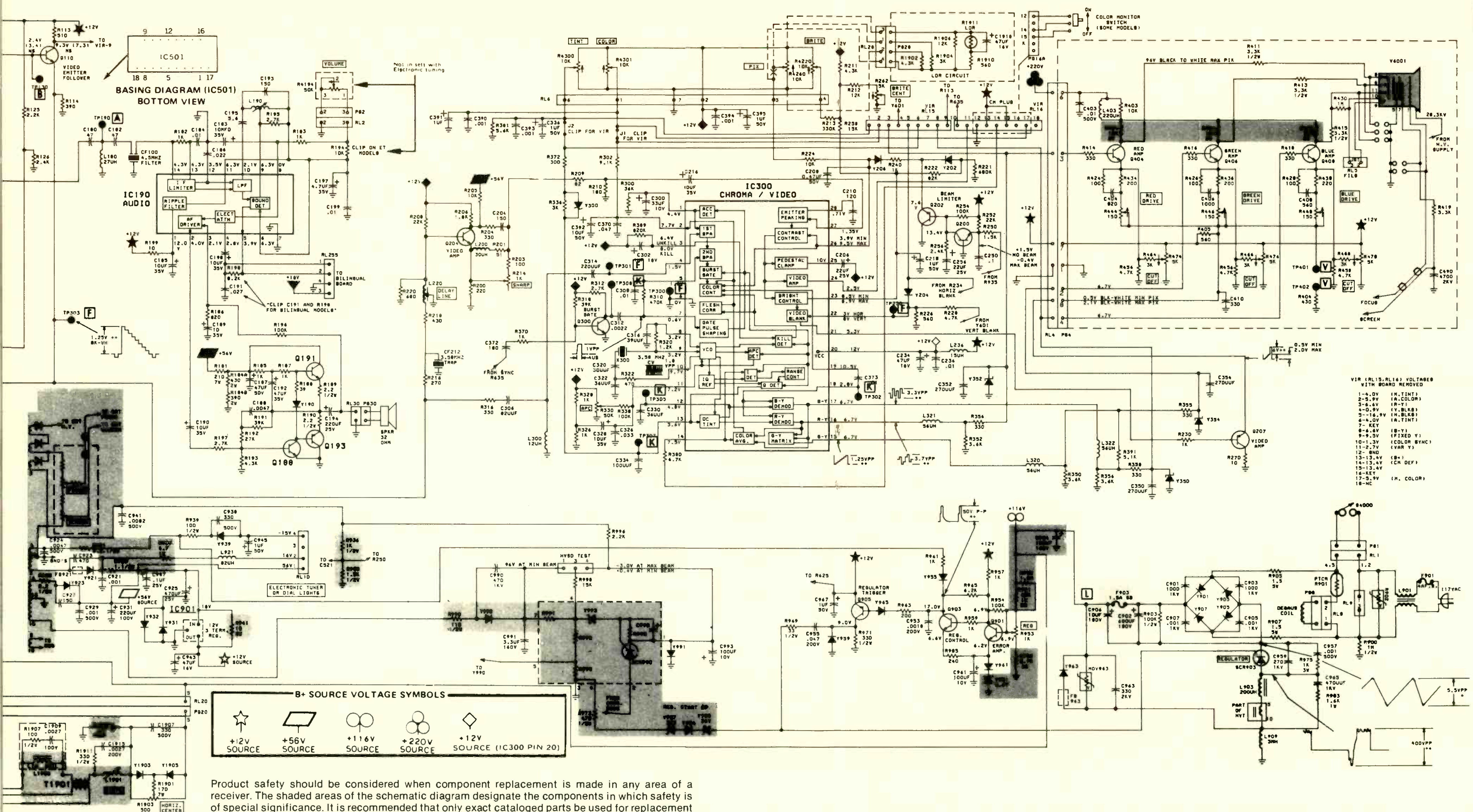

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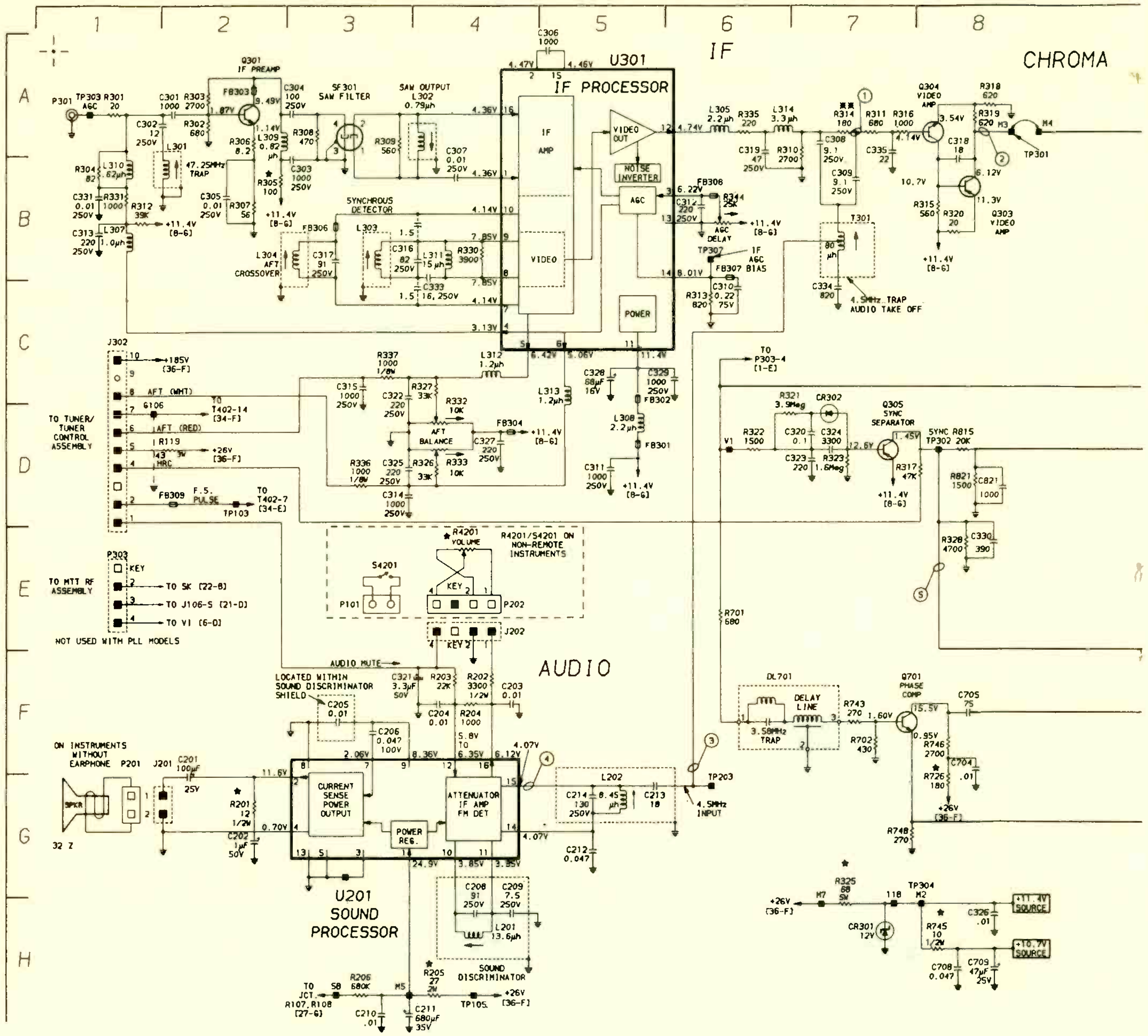

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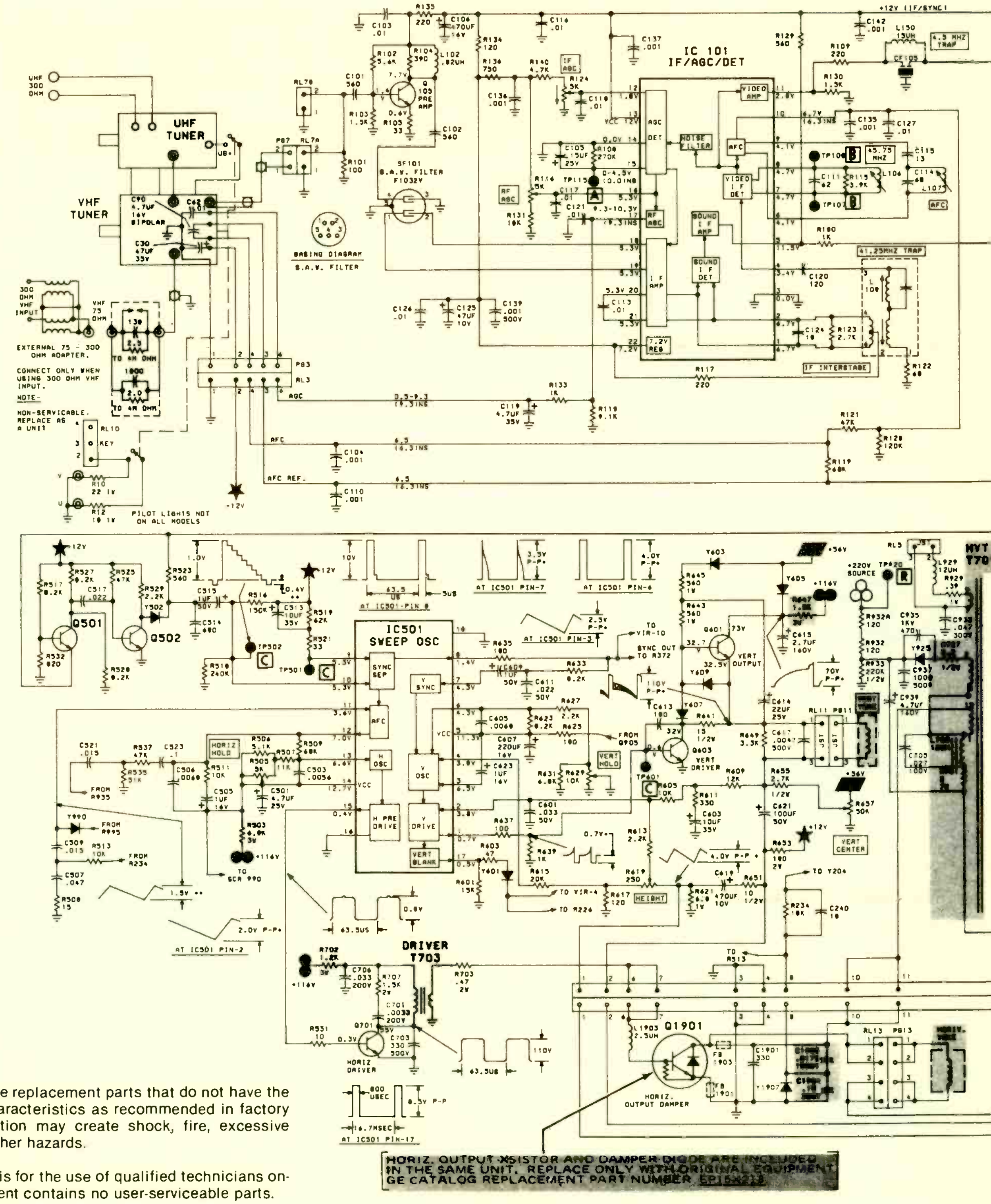
Schematic No.	
GE 25PC—J Color TV	2082
RCA CTC120 Color TV	2083



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Answers to the Quiz

By Sam Wilson

1. C. **ES&T**, December 1985, page 7.

The tone arm carriage is driven across the record by a servo motor. The LED scanning system tracks the disc. Variations in groove spacing are reported to a microcomputer for controlling the carriage drive servo motor.

2. D. **ES&T**, November 1985, page 4.

3. D. **ES&T**, October 1985, page 6.

4. A. **ES&T**, September 1985, page 20.

Begin with the rough adjustments and use the scope to fine tune. Never use electronic adjustments to compensate for mechanical problems.

5. B. **ES&T**, August 1985, page 42.

The letters stand for Schotz Noise Reduction.

6. C. **ES&T**, July 1985, page 48.

7. A. **ES&T**, June 1985, page 23.

Rosin-type fluxes are safest to use, but are relatively poor cleaners. Their intended purpose is to remove only minor oxidation.

8. D. **ES&T**, May 1985, page 5.

9. C. **ES&T**, April 1985, page 51.

See Figure 1.

10. D. **ES&T**, March 1985, page 16.

The questions are on page 10.

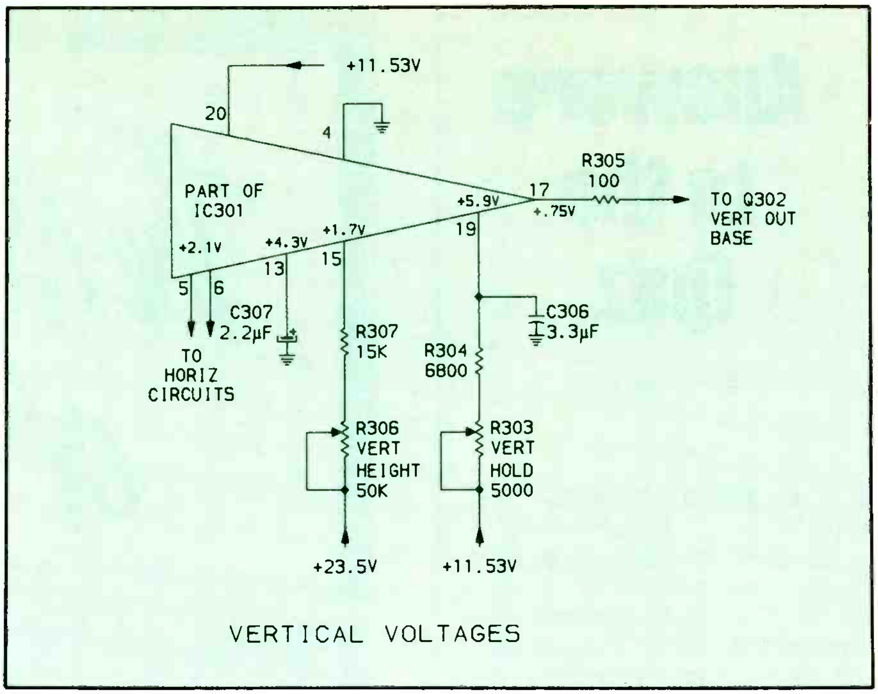


Figure 5. IC301 contains the vertical oscillator and driver stages. Vertical hold and vertical height controls are supplied, but there is no need for a vertical linearity control. The signal at pin 14 is produced by the vertical yoke current flowing through resistor R317, and this gives excellent linearity without adjustments. Scope pin 17 to determine whether or not IC301 is giving out the vertical-drive signal. If you verify that it is not, inject a vertical test signal there. It should give vertical deflection if the Q302 and Q301 stages are normal.

Continued from page 28

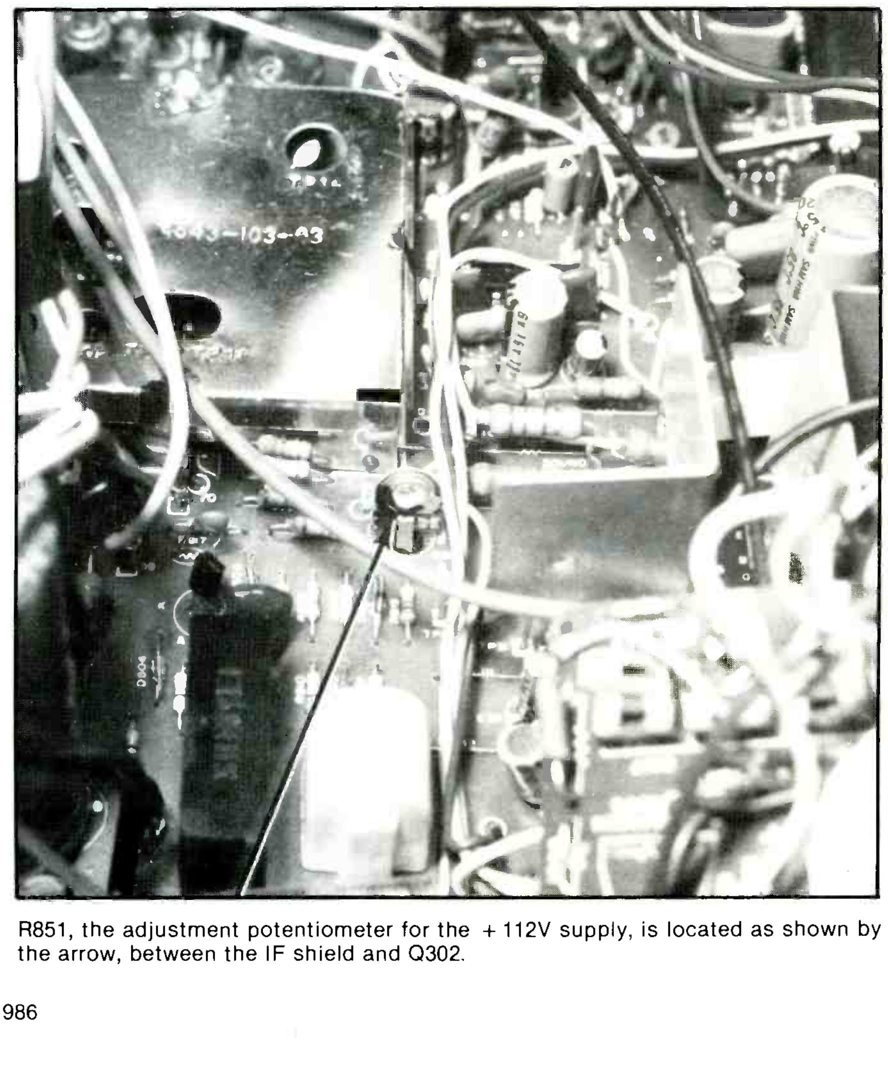
at pin 17 of IC301. If the IC is bad, but the following circuits are normal, a test pattern should appear on the TV screen and on the scope (Figure 5).

Very low voltage at pin 20 might indicate either a leaky IC301 or a defect in the power supply. Measure the resistance from pin 20 to chassis ground. If the reading is below 450Ω, disconnect pin 20 from the circuit board. Now measure pin 20 alone. The resistance will be low if IC301 is leaky internally. If so, IC301 must be replaced.

A normal sawtooth waveform at pin 17, but no height on the screen or waveform at C310 (Figure 6), changes suspicion to the vertical-output circuit. Vertical outputs Q301 and Q302 have a history of failures. First, take dc voltage measurements of Q301 and Q302. If that doesn't reveal anything significant, check both transistors in-circuit.

If the in-circuit tests give questionable results, remove the transistor from the circuit and from the heat sink and test thoroughly. If either check shorted, also test R308 or R309 because the overload usually causes the emitter resistor to become open.

A technician can go through a complicated series of dc voltage tests with calculations to show which resistors are open or have changed value, but this is seldom necessary in these circuits. Figure 6, for example, shows only nine



R851, the adjustment potentiometer for the + 112V supply, is located as shown by the arrow, between the IF shield and Q302.

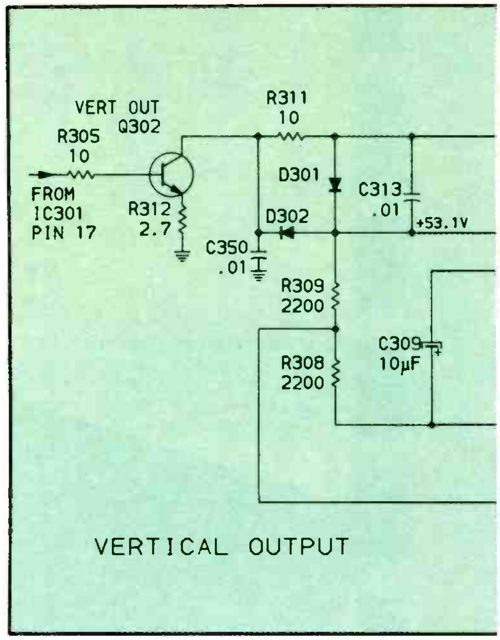
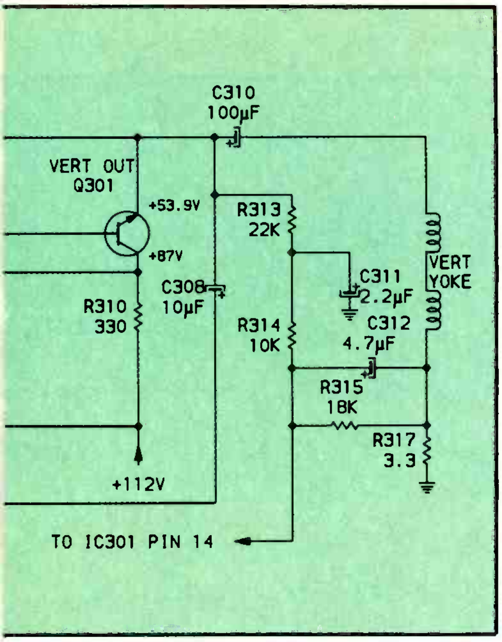


Figure 6. There are a few components in the Q301/Q302 vertical-output stage. If necessary, test all of them. The sawtooth of vertical yoke current across R317 is modified by C312 and R315 and again by the "S" filter R313, C311, and R314 before the shaped waveform is sent to IC301 pin 14 where it automatically corrects the linearity. These values are fairly critical.

resistors (including the first base resistor, the S filter resistors and the yoke-return resistor). Only five resistors are vital to the output stage, so just test them while the transistors are out of the chassis. Measure each with the test leads in one polarity and then exchange the test leads and make the measurement again. The higher reading probably is the correct one. If the reading swings (from some capacitor charging), just hold the probes there a little longer.

Resistances of R312, R310, R308 and R309 are critical, so tolerance should be a consideration when replacements are selected.

An open C310, R317 or L462 (vertical-yoke coils, Figure 6) removes all vertical sweep from the picture tube. R317 is a large part of the automatic linearity system and must not be tampered with. A quick test is from the negative terminal of C310 to



ground; a normal receiver will show about 5.3Ω. Another 100µF capacitor can be paralleled across C310 temporarily as a test for an open capacitor. (Turn off the ac power before adding the capacitor.)

Insufficient height

Scope waveforms can be very helpful in identifying stages with defects. For example, a weak drive voltage (should be 1.3Vp-p) at IC301 pin 17 might be caused by a defective IC301 integrated circuit or an insufficient +11.53V supply voltage. Also check (to find if Q302 is loading down the drive signal) by disconnecting the emitter terminal of Q302 and trying the test again. A normal drive signal indicates excessive loading. No change proves IC301 is not operating correctly, and should be replaced.

Measure the +11.53V source at pin 20 and the +23.5V source at

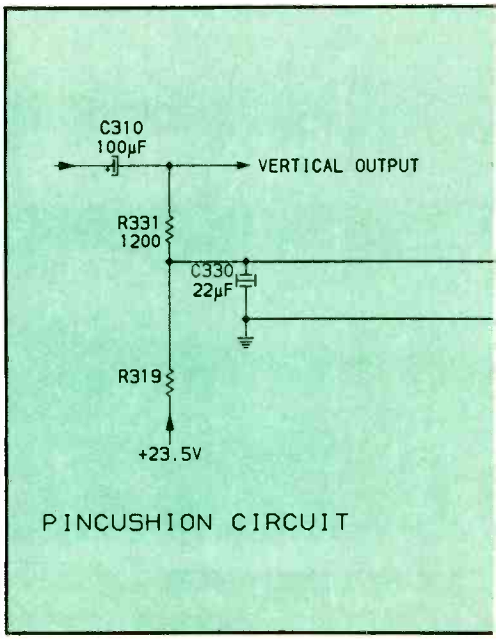
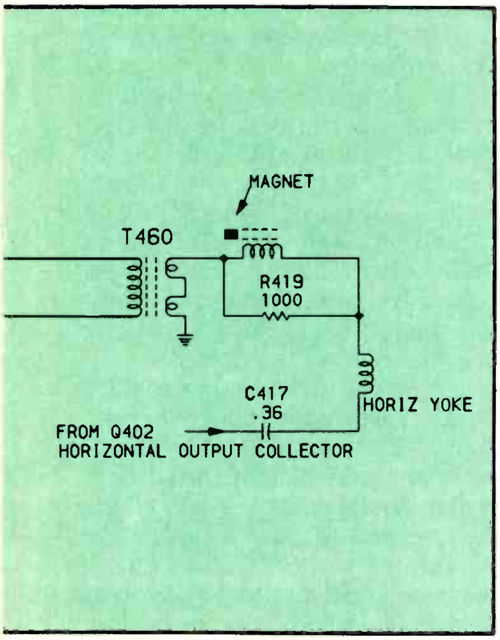


Figure 7. Side pincushioning is corrected by sending the horizontal yoke current through the secondary of T460 whose inductance is varied by the ac and dc voltages at the primary. R331 and R319 apply some of the vertical-sweep output, C330 filters it before it reaches the T460 primary. R319 also brings in dc offset current to move the primary inductance where it operates best.

the height control, and make power supply repairs if either is low. Check for correct waveforms at pins 14, 15, 18 and 19 of IC301, and be certain R306, R307, R304 and R303 have the correct resistance.

Check these components when the sweep is insufficient: R312, R308, R310, Q301, Q302, C309 and C310. Replace any that are defective or questionable. C309 or C310 also can be checked as stated before by paralleling a similar capacitor across it during operation. If the paralleled capacitor produces a large improvement, it is clear the original capacitor is open.

Do not overlook the pincushion-transformer circuits (Figure 7) for vertical height (or horizontal width) problems. There are just a few components there; check them all and be certain. Also, the P/J401



yoke plug might be another possible source of mysterious intermittent problems. Keep it in mind.

Vertical foldover

Most cases of foldover and poor vertical linearity originate in the vertical-output circuit. So first check both output transistors for leakage. Test diodes D301 and D302 for leakage or being shorted. If all other tests fail, replace Q302 and Q301, in that order. (A universal transistor replacement chart is included in this article.) Use a capacitance meter to check in-circuit these capacitors: C307, C308, C309, C311 and C312. Replace or temporarily substitute any that are low in capacitance.

Intermittent height

With a dual-trace scope, monitor the IC301 pin 17 signal with one probe and the output signal at C310 with the other probe. Then wait until the intermittent occurs, or until you can find a way to trigger it. Several dc voltages also could be monitored, such as IC301 pins 15 and 20, and +87V at the Q301 collector.

The components most likely to produce intermittent height (vertical deflection) are IC301, Q301 and Q302. Remember that canned coolant sometimes triggers an intermittent *on* or *off* when sprayed on the offending part. Just be sure that only one component at a time is cooled if you want to be sure that the test will be accurate.

If a waveform remains at C310 but the screen shows only one horizontal line, suspect a defective yoke, the yoke plug or the wires to these components. Poor socket connections at pins 4 and 5 can cause the open circuit and loss of vertical. Incidentally, the vertical yoke coils should measure 56Ω.

COMPONENT	NUMBER IC	MFG. NUMBER	RCA	PHILIPS
IC301	AN-5411	1177-1169	SK-9314	ECG-1417
IC501	AN-5310	1177-1151	SK-9016	ECG-1410
Q301 & Q302	2SC-2073	1178-7538	SK-3929	ECG-375

Table 1. These replacements have been tested and found satisfactory for use in the JC Penney model 685-2039.

Vertical voltage sources

A complete loss of height, intermittent height or insufficient height can be caused by abnormal conditions in any or all of the three voltage sources. The +112V source supplies the horizontal-output transistor and Q301, plus the base voltage for Q401, the horizontal-driver transistor. Therefore, any significant increase of this voltage would produce shutdown and remove all power; this would remove the voltage and all danger to Q301. A reduced +112V source voltage probably would produce a picture with reduced width and height.

When the +11.53V at IC301 pin 20 is missing, check for an open R415 (1Ω fuseable surge resistor) and a shorted or open D403 diode rectifier (Photofact 2145-1). If the +11.53V source is higher than usual, check zener diode D504; it might be open. Or in the opposite direction, leakage in D504 can produce excessive heat and reduce the voltage source.

Remember that insufficient vertical height and rolling problems might be caused by a defect in the low-voltage supply circuits.

Comments

This JC Penney's 685-2039 model is somewhat typical of many that extensively use integrated circuits. Questions arise during troubleshooting because very few stages are brought out to external pins. Therefore, the usual resistance and dc voltage tests cannot always identify a defective IC. Sometimes it is necessary to replace the integrated circuit. That's costly and time consuming, but necessary in many cases.

We hope the suggestions in this article will help the technicians, and result in avoiding unnecessary IC replacements. ES&T

Coming in...

MAY

Ups and downs of vertical sweeps—Homer L. Davidson describes 10 vertical problems that exemplify the wide variety of malfunctions commonly occurring in several color-TV-receiver brands. Although most vertical problems are easy to repair, a few require persistent, sometimes creative, testing. The author recommends using a good VOM or DMM with your scope, and points out that a schematic or Photofact is necessary reinforcement.

Test components and ICs with your scope—According to the author, Al Kovalsky, a component test feature is found on some scopes. Jacks on the scope provide output of low-current sine wave voltage that can be applied across component contacts. With a single-channel scope, the input is accepted and the trace displayed from one source. For comparison testing, as detailed in the article, a dual-channel scope is required.

Field-strength meter or signal-level meter?—The characteristics and purposes of these two testing devices are dissimilar, although they frequently are confused even by experienced technicians. James Kluge explains why the two meters are not interchangeable.

What do you know about electronics?—Visual modulation. Oscilloscopes, certainly the best instrument to use when visualizing waveforms, unfortunately show the waveforms as 2-dimensional when, in reality, waveforms have three dimensions: amplitude, frequency and time. These can be displayed graphically today with a personal computer, a great advance from the *granddaddy* 3-dimensional display described by the author.

What do you know about electronics?

Constant-current generators

By Sam Wilson

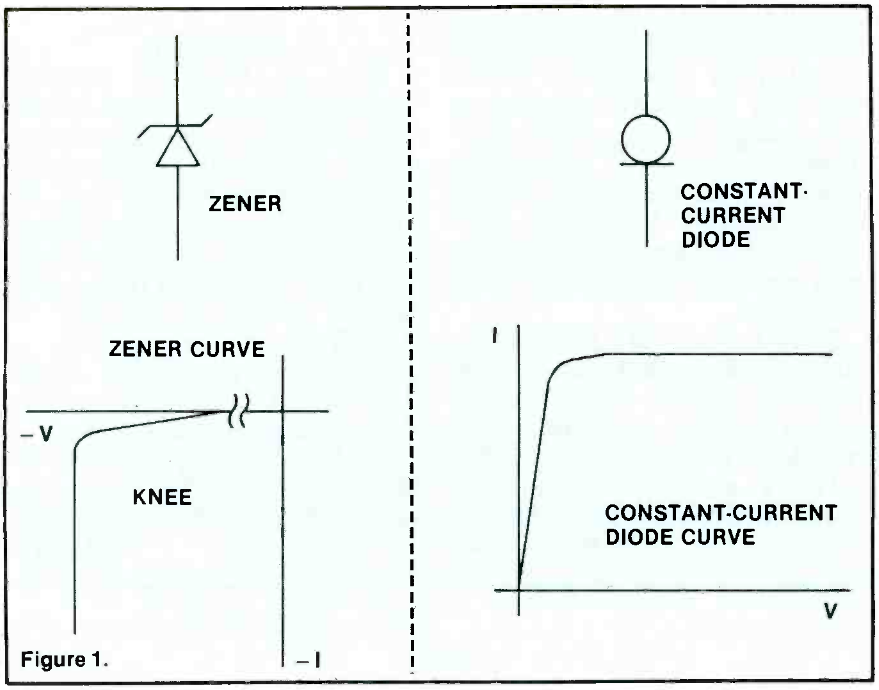


Figure 1. These are the symbols and the characteristic curves for the constant-voltage and constant-current diodes.

The idea of a constant-voltage generator, one that produces a fixed value of voltage across a load regardless of the amount of the load's resistance, is widely understood. Today's stiffly regulated power supplies can approximate closely a constant-voltage generator within a given range of output currents.

A less familiar concept is the constant-current generator. It produces current through a load resistance even though that load resistance may change. The constant current also can be simulated using electronic control circuitry.

The simplest component that can be used for constant-*voltage* generation is the zener diode. There also is a constant-current *diode* available. It maintains a constant-current flow despite variations in applied voltage or load resistance. The constant-voltage and constant-current diode symbols and their characteristic curves are shown in Figure 1.

The author is indebted to Motorola for much of the technical information presented in this article.

Use in network analysis

The concept of constant-voltage and constant-current generators existed before electronic components could be made to approximate their characteristics. As a matter of fact, they were considered to be imaginary generators used in Thevenin's and Norton's theorems. These theorems are still used to simplify circuit calculations. The following statements of the theorems are applicable to dc circuits. (Resistances must be replaced with impedances in ac systems.)

THEVENIN'S THEOREM: *Any two-terminal network composed of linear bilateral circuit elements and one or more sources of voltage can be replaced with a simple constant-voltage generator in series with a resistor.*

NORTON'S THEOREM: *Any two-terminal circuit composed of linear bilateral circuit elements and one or more sources of voltage*

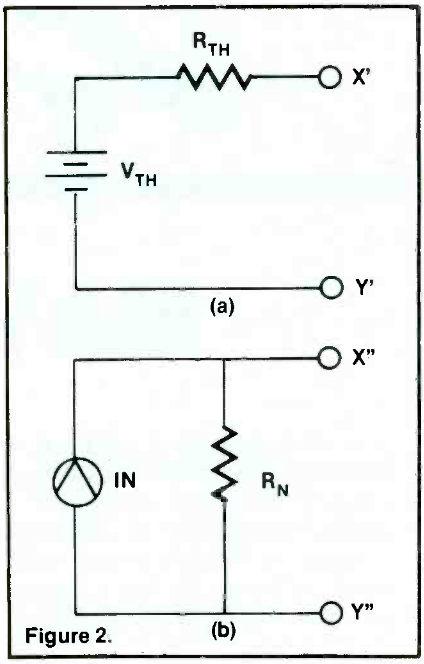


Figure 2. In network analysis, these simple circuits, the Thevenin and Norton generators, can be used to replace more complex combinations of sources and resistances.

can be replaced with a constant-current generator in parallel with a resistor.

Figure 2 shows Thevenin's (a) and Norton's (b) generators as they usually are depicted.

Figure 3 shows a complex dc circuit consisting of linear, bilateral circuit elements (resistors) and several sources of voltage. This circuit, according to Thevenin's and Norton's theorems, can be replaced with either of the two circuits shown in Figure 2. It follows that if either of the circuits in Figure 2 can be used to replace the circuit of Figure 3, as far as calculations of load voltage and load current are concerned, then the two circuits also must be equivalent to each other.

We are more interested here in the concept of the constant-current generator (Im). But let's first

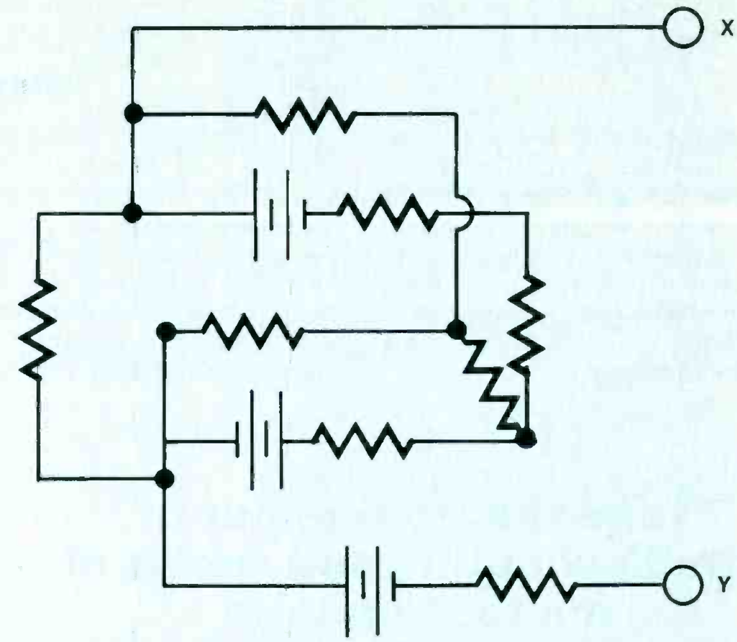


Figure 3.

Figure 3. This circuit, according to Thevnin's and Norton's theorems, can be replaced with either of the two circuits shown in Figure 2.

look at the circuit of Figure 2(a). This Thevenin generator has a constant voltage source (Vth) in series with the Thevenin equivalent resistance. If you are looking into terminals X' and Y', you will see an open-circuit voltage that is identical to the open-circuit voltage in Figure 3.

Also, if you short the sources of voltages, then the resistance looking into the Thevenin's generator will be identical to the resistance looking into the circuit of Figure 3.

Because of the way the equivalent Thevenin generator circuit is calculated, it is necessary that the internal resistance of Vth must be zero. If the resistance was any other value, then the voltage would change under varying load current conditions and it would no longer be a constant-voltage generator.

For the constant-current generator of Figure 2(b), it is also necessary to see the same terminal voltage and the same resistance looking into terminals X" and Y". The Norton resistance (Rn) is numerically equal to Rth and it is calculated in the same way.

A moment's reflection will show that if Rn and Rth are equal, then it is necessary that the internal resistance of In must be infinite. If this were not so, the resistance of In would be in parallel with Rn. That would reduce the resistance as seen looking into terminals X" and Y".

The Thevenin constant-voltage source can be very closely approached by using a closed-loop voltage regulator. Likewise, the Norton generator can be simulated using electronic circuitry. Later in this article, we will discuss an electronic constant-current generator.

The constant-current diode

Figure 4 compares the constant-current diode with the simplest JFET construction used to make such a diode. Note that the JFET gate is connected to the source so

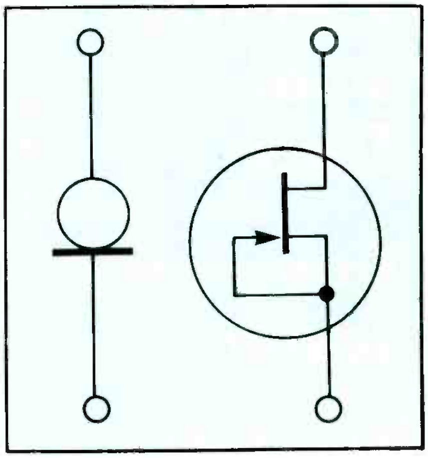
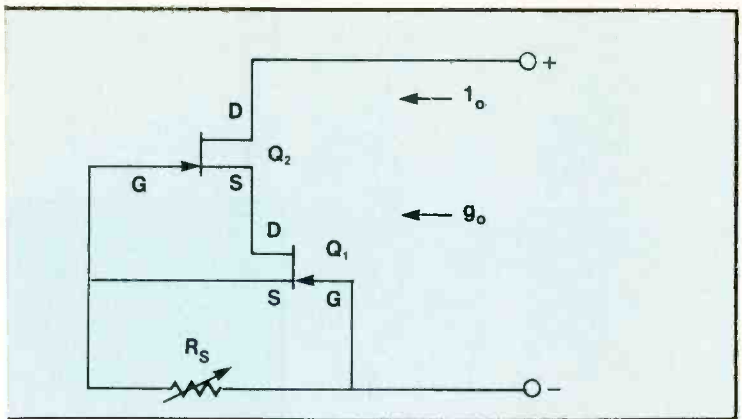


Figure 4. The symbol for the ideal constant-current diode along with the simplest JFET (junction field-effect transistor) construction of an actual device with a characteristic that approaches that of the ideal device.



:her constant-current device, this circuit using two FETs has the advan-
ȝ a higher impedance.

you could make your own constant-current diode by using a saturated JFET. It is only necessary to pick the right JFET with the right saturating current. The real problem is that the current may not be related to the actual current that you desire.

A better version is shown in Figure 5. With this arrangement, it is possible to select the desired operating current. Another version is shown in Figure 6. It uses two JFETs and it has the advantage of having a higher impedance. Also, it is adjustable. When experimenting with this constant-current generator, you must be sure that both JFETs are conducting when the circuit is in operation.

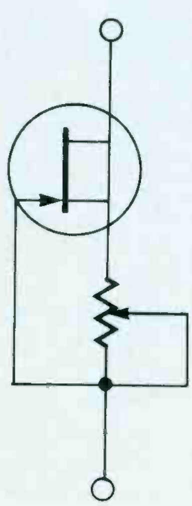


Figure 5.

Figure 5. This arrangement yields a nearly constant current that may be selected by varying the resistance.

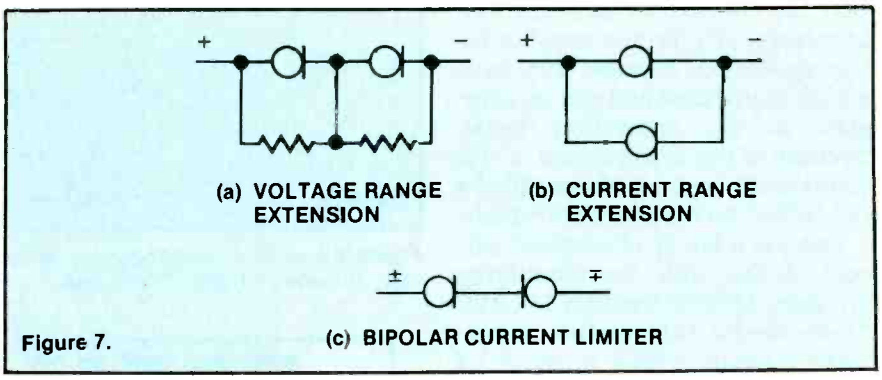


Figure 7. Constant-current diodes can be connected in series to extend the voltage range, or in parallel to extend the current range.

The very earliest electronic constant-current generators used pentode vacuum tubes because of their high impedance and constant-current output after the saturation point has been reached. Pentodes, of course, have the disadvantage that they require filaments and additional electrode connections. So, it was not possible to buy off-the-shelf constant-current diodes similar to the ones now available with JFETs. An additional advantage of using JFETs is that there are both N-channel and P-channel devices. Therefore, it is possible to use either (with corresponding changes in polarities).

Circuits

Constant-current diodes can be connected in parallel to increase the current rating, or in series to increase the voltage rating. (See Figure 7.) When connected in series, it is necessary to use parallel resistors across each diode to assure that they are all operating under identical voltage conditions.

Some practical applications of constant current diodes are shown in Figure 8. For the application shown in (a), a constant-current diode is used to produce a linear charging voltage on the capacitor. This causes any sawtooth waveform at the base of the UJT (unijunction transistor) to have a linear ramp. Without the constant-current diode, the sawtooth ramp will be a time-constant curve.

Figure 8(b) shows how the constant-current diode can be used in conjunction with a zener diode to produce a very accurate reference voltage. This circuit utilizes diodes that have a zero temperature coefficient so that the output voltage does not change as a result of changes in operating temperature. This circuit configuration also is

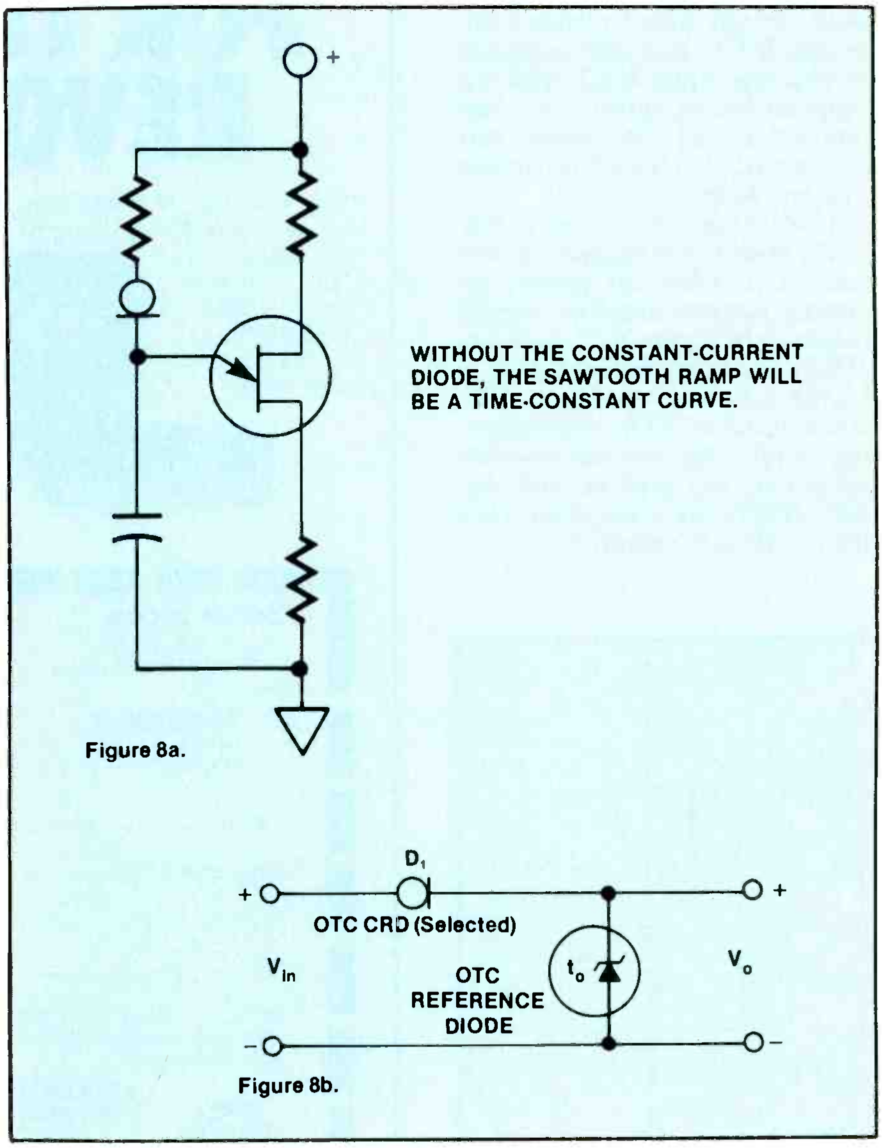


Figure 8. In (a), the constant-current diode in the circuit will cause any sawtooth waveform appearing at the base of the UJT to have a linear ramp rather than a time-constant curve. In (b), a constant-current diode in conjunction with a zener diode produces a highly accurate reference voltage.

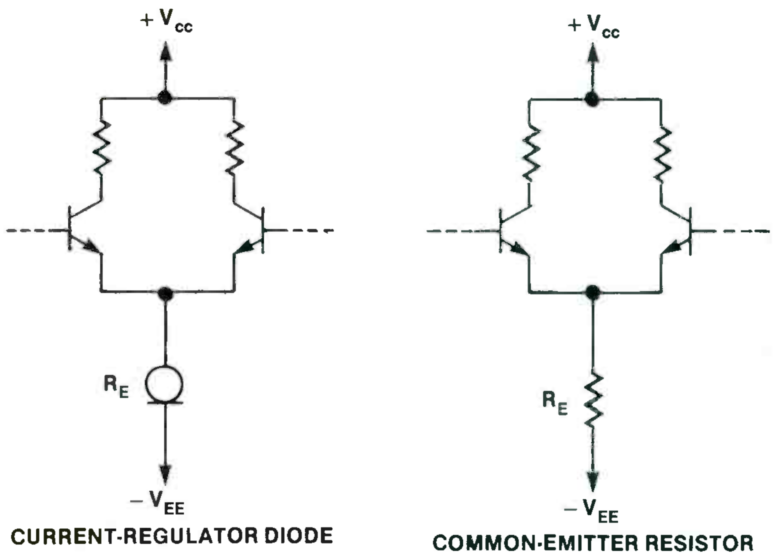


Figure 9.

Figure 9. A differential amplifier must be fed a constant current in order to operate properly. This may be accomplished by using a large-value resistance, or, preferably, a constant-current diode.

effective for removing noise and ripple voltages from the input voltage. An attenuation of about 100dB can be attained for frequencies up to several hundred kilohertz!

Figure 9 shows the use of a constant-current diode for the current sourcing of a differential amplifier. In order to operate effectively, a differential amplifier must be fed a constant current to the emitter junction. The constant current diode is ideal for this application. You will sometimes see a large resistance value being used to simulate a constant-current source. A good example of this application is evidenced when a high resistance is substituted for the constant-current diode. This also is shown in Figure 9. A simple Ohm's Law analysis will show how this works. (See Figure 10.)

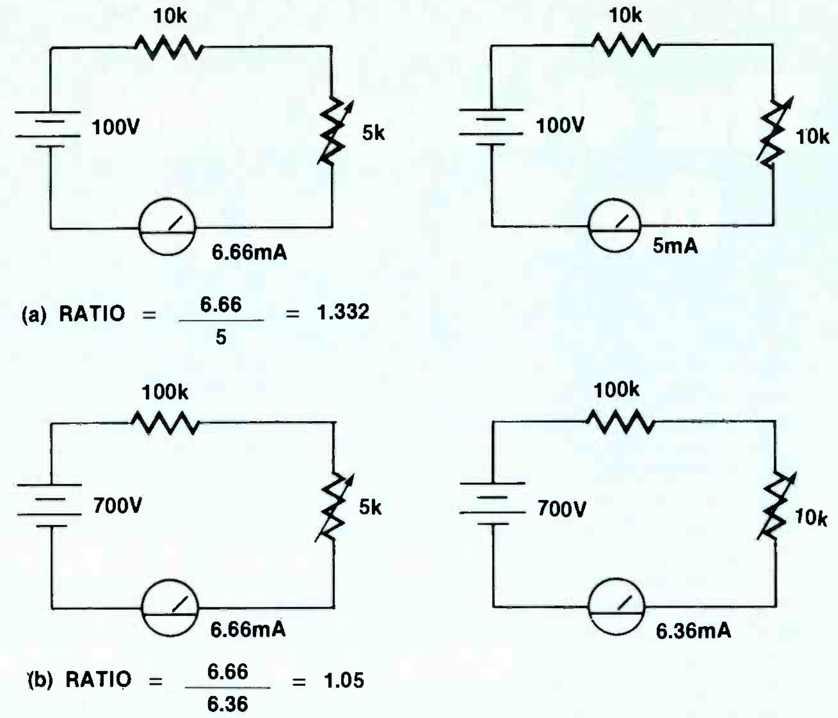


Figure 10. Analyzing this circuit in terms of Ohm's law explains why use of a large series resistance provides relatively constant current.

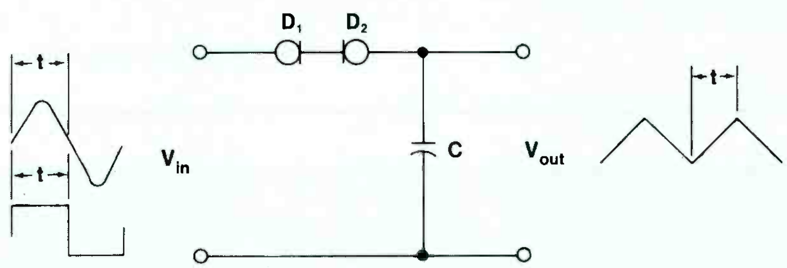


Figure 11.

Figure 11. Two constant-current diodes connected back-to-back yield a very linear triangular output waveform with an input of a sine or square wave.

In Figure 10(a), there is a 100V supply in a series with a 10k resistor. The resistance across the source is varied from 5k to 10k. Note that this causes the output current to vary from 6.66μA to 5μA. The ratio of maximum to minimum current in this case is 1.332.

When the series resistance is increased to 100k, as shown in Figure 10(b), it is necessary to use a voltage of 700V so that the maximum current (6.66μA) will be the same as for the circuit of Figure 10(a). Now when the resistance is changed from 5k to 10k, the ratio of maximum-to-minimum current is only 1.05.

Clearly, the higher resistance results in a more nearly constant current. If the resistance is raised even higher–above 100k–it will be more effective in producing a regulated output current.

This simple problem helps to explain why high-impedance devices such as pentodes and JFETs are preferred for constant-current work. It also shows why a high resistance value may be used in place of a constant-current diode.

Figure 11 shows how two constant-current generators, connected back-to-back, can be used to make a linear triangular output waveform. Either a sine wave or a square wave can be used as the in-

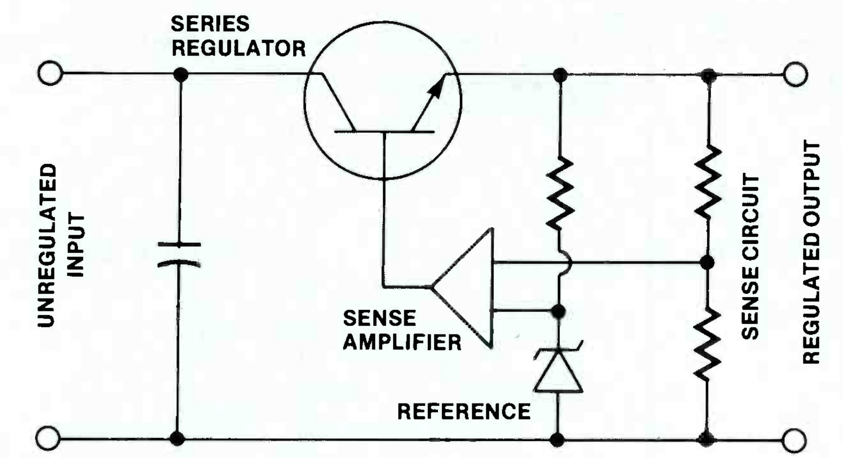


Figure 12.

Figure 12. A zener diode can be used to make a constant-voltage regulator when connected like this.

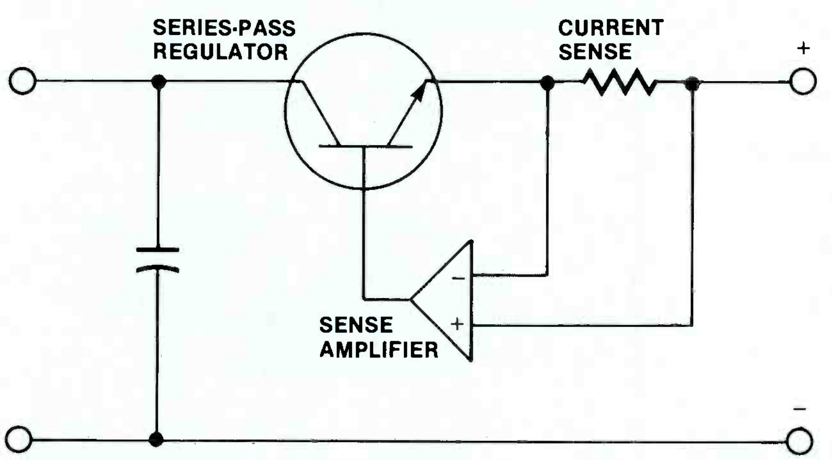


Figure 13.

Figure 13. In this constant-current regulator, the voltage drop produced by the current is sensed and used to control the output current.

put waveform. This circuit is useful for making an inexpensive function generator.

Of course, there are many other applications of constant-current devices and supplies. When you see the diode symbol, think of a high-impedance device that holds the current constant over a range of values stipulated by the manufacturer.

An electronic constant-current generator

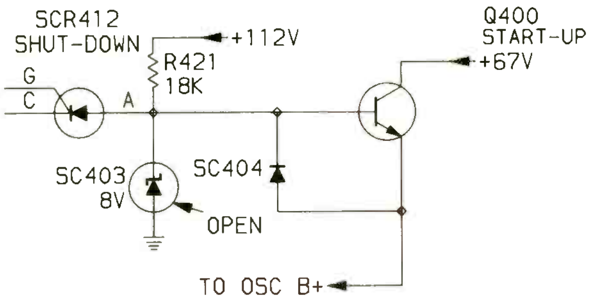
To make a constant-voltage supply, it is necessary to use a sense circuit to monitor the output voltage. This sense circuit often is made of two or three resistors in series across the supply output. This is shown in Figure 12. The sensed voltage is compared with the reference voltage, and a correction is made when the voltages are not the same.

Figure 13 shows how an electronic constant-current regulator is made. In this case the current being regulated flows through a series resistor. The drop across the resistor represents the supply current. That voltage drop is amplified and used to control the series regulator. A change in current is sensed by R and used to correct the output current. The overall effect is to hold the output current constant. ES&T

Symcure

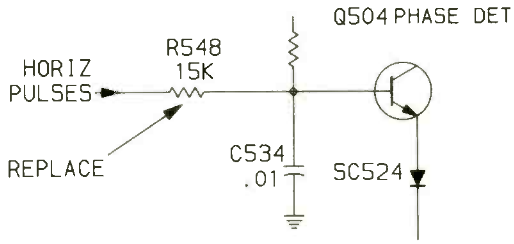
Symptoms and cures compiled from field reports of recurring troubles

Chassis—Magnavox E31 1
PHOTOFACT—2257-2



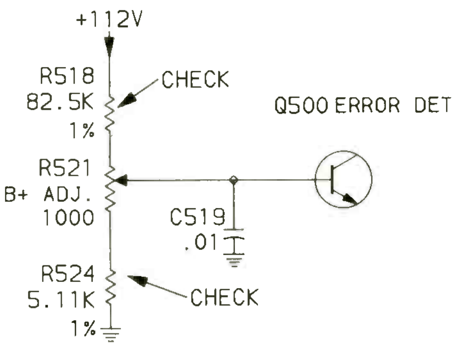
Symptom—Horizontal foldover and/or slow or no start-up
Cure—Check 8V zener SC403, and replace it if open.

Chassis—Magnavox E31 2
PHOTOFACT—2257-2



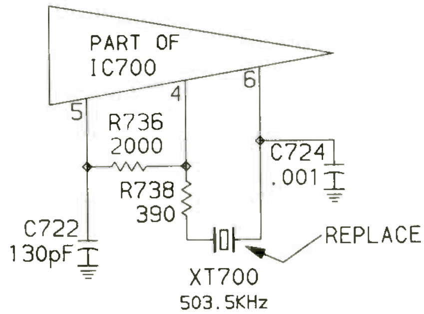
Symptom—Erratic shut-down
Cure—Check R548, and replace it with a 15k 1W carbon-film resistor.

Chassis—Magnavox E31 3
PHOTOFACT—2257-2



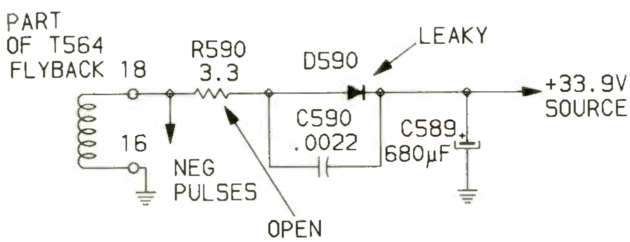
Symptom—Regulated B + is high, sometimes triggering shutdown
Cure—Check R518 and R524, and replace any that are out of the 1% tolerance.

Chassis—Magnavox E31 4
PHOTOFACT—2257-2



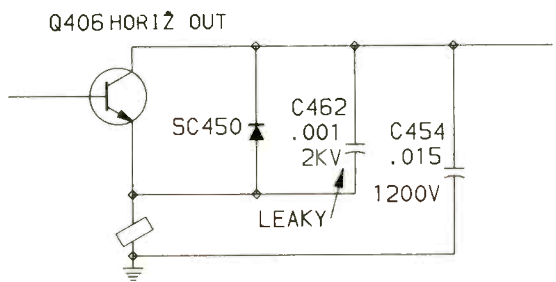
Symptom—Intermittent start-up, shutdown or loss of horizontal locking
CURE—Replace resonator XT700.

Chassis—Magnavox 13C2 5
PHOTOFACT—1940-1



Symptom—Constant shutdown
Cure—Check R590 and D590 and replace both, if the resistor is open and the diode is leaky or shorted.

Chassis—Magnavox E51 6
PHOTOFACT—2189-2



Symptom—Immediate shutdown
Cure—Check capacitor C462 and replace it if leaky or shorted.

Products

Hand-held dual trace scope

Soar Corporation is introducing model 1000 Soar Scope that may be hand-held, is small in size and can be used in a variety of light ambients including bright sunshine. There is a built-in battery back-up memory and a 128x160 dot LCD with variable contrast

control and 6 hours battery operation. This scope features dual trace with 10mV per division sensitivity, ± 3dB or less for dc 200kHz and has a sampling rate of 3.2MHz.

Circle (75) on Reply Card

Floppy disk drive repair tool

The model 803XP exerciser/alignment scope by *AVA Instrumentation* incorporates the functions of an oscilloscope and a programmable drive exerciser in

one portable instrument that is dedicated to floppy drive head alignment. All alignment information is presented pictorially and numerically on a solid-state flat panel LCD display. All parameters necessary for proper alignment are displayed, with 1-button operation.

The built-in programmable exerciser is compatible with all sizes of floppy drives, including 8-, 5¼- and 3½-inch, and can be programmed to test in any sequence of steps.

This repair tool was designed to help technicians perform drive preventive maintenance without any additional test equipment.

Circle (76) on Reply Card

Analog oscilloscope conversion

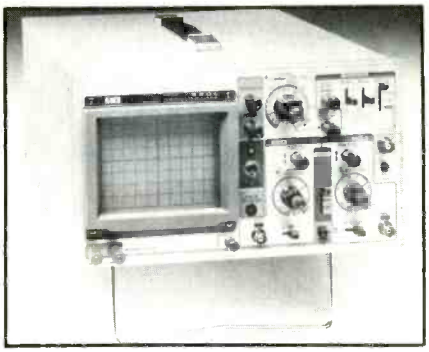
Sibex is offering the model 602 Scope Memory, an add-on device that converts an analog oscilloscope into a dual channel digital storage scope. Connect to any standard dual channel scope; the unit is an alternative for users who

cannot justify the expense of purchasing a complete new scope. The model 602 stores both analog and digital signals in a single sweep. It features 18 selectable sample times with a 1.4MHz maximum sampling rate. Each input is selectable in eight ranges. A comparison mode is an additional feature.

Circle (77) on Reply Card

Built-in Component Checker

The model 620C oscilloscope by *A.W. Sperry Instruments* incorporates a special built-in circuit called the Component Checker that is designed to test single or multiple components, in or out of circuit.



The display obtained will show component faults, size and characteristics, thus allowing troubleshooting and tests of solid-state circuits and components without circuit power.

Component Checker specifications include maximum 9Vac at terminal, no load, maximum 2mA current, with terminal shorted. Internal resistance: 4.7kΩ.

Circle (78) on Reply Card

Dual trace portable scope

Ballantine Laboratories' enhanced model 1024B Travelscope, a dual trace portable oscilloscope, is a field instrument with laboratory and bench instrument applications.

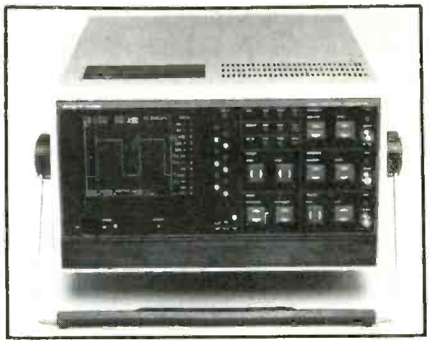
This bright, high acceleration, high resolution scope uses a flat-face CRT with a built-in internal graticule to help eliminate parallax. Further, the 1024B's

CRT is a post-accelerated type with total accelerating voltage raised to 2kV, providing a brighter, higher resolution trace than mono-accelerated types. The 25MHz frequency response extends the 1024B's use to fast signals and the passive delay line permits display of the leading edge of fast rise time signals and pulses.

Circle (79) on Reply Card

Digital storage, auto setup scope

Model 4500 digital oscilloscope from *Gould Electronics* is controlled exactly like a conventional oscilloscope, using familiar volts and seconds per division control terminology. The automatic setup mode finds repetitive signals on an input and sets sensitivity, offset and sweep speed to display several repetitions of the signal. After automatic setup is complete, the

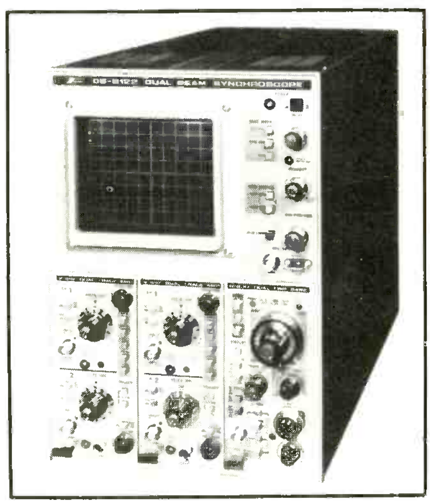


user can modify the settings as required. There is a floppy disk option in use any time waveforms must be logged.

Circle (80) on Reply Card

Dual-beam oscilloscope mainframe

The *Iwatsu* dual-beam 100MHz oscilloscope mainframe, model DS-8122, was designed to accept up to three plug-in units. A 1-gun, 2-beam system makes it possible to observe two high-speed single-shot phenomena simultaneously or to observe four traces at the same time when two vertical dual-input units are plugged in. The mainframe itself incorporates a character generator to display the data from the plug-in units on a 6-inch dome-mesh, high luminance CRT.



Continued on page 70

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.

ADC
Chassis M9C2-1K1, M9C2-1K2, M9C2-1K 2391-1

MAGNAVOX
Chassis 19C112-00BA, 19C122-00CA, 19C123-00CA, 19C124-00CA 2390-1

MAGNAVOX
Chassis 19C501 through 19C519-00AA/BA 2394-1

PRODUCTION CHANGE BULLETIN
RCA
FKR485S, FKR485W, GKR637PR, GKR639P, GKR650T, GKR654H, GKR658P, GKR671TR, GKR696PR 2391-3

SEARS
564.42610450 2392-1

SEARS
564.42680450 2395-1

SHARP
19J79, 19J81 2390-2

SHARP
13J330 2392-2

SHARP
19J69 2393-1

SHARP
25J01 2394-2

SHARP
13J41 2395-2

SONY
Chassis SCC-548P-A/Q-A/S-A/T-A 2391-2

SONY
Chassis SCC-595A-A 2393-2

VIDEO CASSETTE RECORDERS

SANYO
Models VCR3900/II, VCR4000/-2

SEARS
S64.53110250

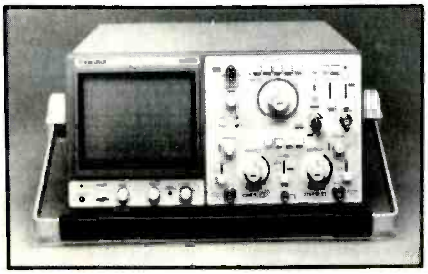
Continued from page 68
Signal output terminals also are provided for outputs of vertical signals, timebase signals, gate signals and calibration voltages, which extend the versatility of the model DS-8122.

Circle (81) on Reply Card

Analog/digital storage scope

Kikusui International announces its 40MHz dual-channel, portable analog/digital storage scope. The DSS 5040's sine interpolation capability offers the user a higher single-occurrence capture capability: 10MHz. Most scopes in this range use linear techniques, resulting in 2MHz to 4MHz.

The function selection controls are identical to those on an analog scope. The only additional controls are a push-button selector for sine or pulse interpolation, and the push-button controls for store, erase and reference memory. Circuitry within the scope eliminates the multistep, function-select sequence. Kik cameras attach easily for photographic records.



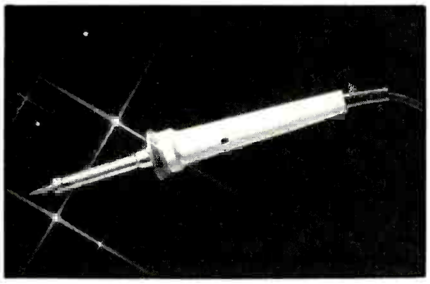
Constant resetting of the trigger level is eliminated by a patented level-lock circuit that controls the trigger signal and automatically adjusts the trigger level. To simplify triggering on complex waveforms, a variable trigger hold-off function is available.

Circle (82) on Reply Card

Soldering iron's cermet element

Oryx has introduced an electronically controlled soldering iron, the Oryx Platinum 45, which incorporates a thick film cermet element and an ultra stable platinum resistance temperature sensor, together with miniaturized electronic control circuitry. The control circuit is built into the handle of the iron.

This soldering iron runs direct from a 115V supply. It is rated at 45W and is supplied with a burnproof power cord and molded 3-pin plug. Its tip temperature is controlled to within ±5°F over the range 490°F to 750°F. The operating temperature is adjustable by the user.

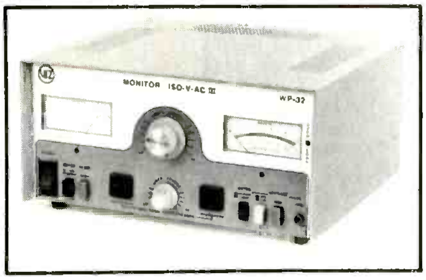


The electronic control circuitry features zero-point switching to ensure spike-free operation of the heating element, and temperature overshoot is avoided by means of a proportional control circuit.

Circle (83) on Reply Card

Isolated ac power source

VIZ Test Equipment, a division of *VIZ Manufacturing* introduced model WP-32, Monitor ISO-V-AC III that provides isolated ac output from 0V to 150V and 10A continuous output to a maximum 1,300VA, at 60Hz. This isolated ac power source is designed to provide isolated power to equipment in fixed or variable output voltages. These features offer safety to individuals and equipment, and provide a broad range of output voltages should input vary. The WP-32 can be used in incoming or outgoing quality control testing, in-line and final production environments, and in maintenance and service of a variety of electronic products. Additional uses include circuit design work when checking operation at voltages higher or lower than normal. This technique also can be used to help detect intermittent circuit defects.

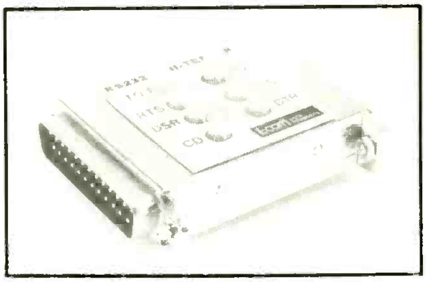


Circle (84) on Reply Card

Data line monitor

A pocket size monitoring tool provides a means of determining the status or condition of the RS-232 communication ports. This advanced model has bipolar LEDs that indicate *red* or *green* to show if the signal is high, low, or *off*, if in an illegal condition.

The Mark II data line monitor, *L-com Data Products,* installs in series between the terminal and the CPU equipment. The seven LEDs allow continuous sources of trouble in about 95% of the problems associated with data communication networks, according to the company.



No external power is required as the DLMS-2 derives its power from the RS-232 interface. Each LED draws a nominal 3mA and operates with signals as low as 3V to 26V. Equipped with male/-female RS-232 connectors. Size: $2\frac{1}{2}$"x$2\frac{1}{8}$"x$\frac{3}{8}$".

Circle (85) on Reply Card

One tube radio kit

A one tube radio kit providing the experimenter or antique radio buff the opportunity to experience early radio construction and operation is available from *Antique Electronic Supply.*

The kit comes complete with breadboard, tube and other parts. Batteries and headphones are optional. A 20-page catalog covering parts such as tubes, parts and books is included.

Circle (86) on Reply Card.

Test equipment update

Huntron Instruments has introduced improved models of its Tracker 1000 and 2000 test instruments. The most notable new features are redesigned carrying cases and modernized front panels. A stronger, reinforced carrying handle that doubles as an adjustable tilt bail also has been added. The front panel layout has been simplified, and color coding added. LEDs are used to identify the test range selected.

This equipment tests boards or

components without system power being applied, generating a current limited sine wave that is injected across two points of any device under test, creating a unique current vs. voltage signature that is displayed on the CRT.

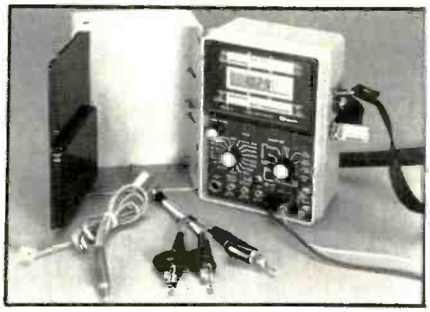
Circle (87) on Reply Card

Telephone loop tester

The new model 5, three-in-one local loop tester, introduced by *Triplett (a Penril Company),* has an LCD display with a front panel color-coded guide to transmission test limits. The tester provides local loop test capabilities most often needed by installation and repair personnel plus an ac/dc voltohmmeter and multitone generator.

Constructed per AT&T Subscriber Loop Transmission Test Set publications 41009 and 55020, model 5 utilizes a tone generator and transmission test set to measure power influence, circuit noise, circuit loss or line milliamp checks on telephone company or privately installed telephone lines.

The tone generator has 15 switch-selectable frequencies.

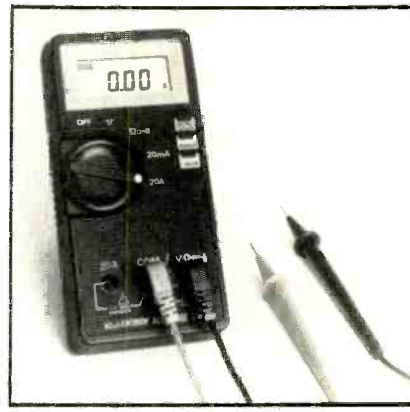


Two other frequencies may be obtained with an optional kit that includes precision resistors to achieve any tone between 100Hz and 5kHz.

Circle (88) on Reply Card

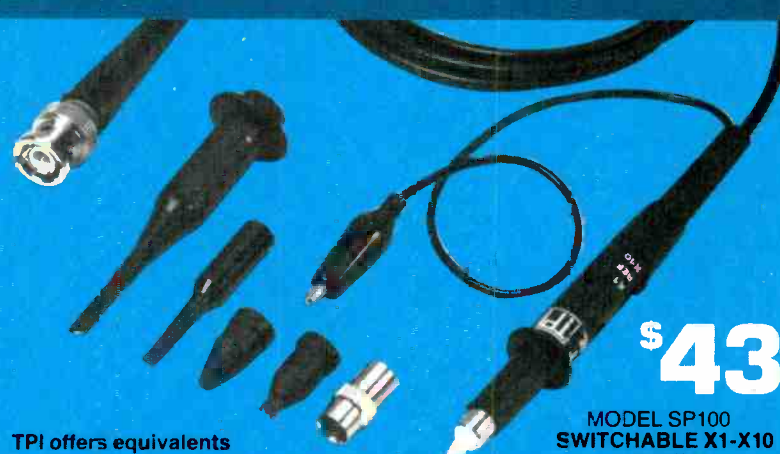
Autoranging DMM with memory

EXTECH introduces its rotary dial digital multimeter with large LCD display that measures Vdc, Vac, dcA, acA resistance and diodes. Features include instant autoranging range hold and manual ranging when required; autopolarity auto-zero accuracy and resolution. This DMM with memory is housed in a sturdy soil-resistant case, and powered by a 9V battery. Eighteen ranges, including five Vdc and ohm ranges, and four Vac and low power ohm



ranges with 2,000 counts per range, improve resolution. Pressing the MEM key stores the last two significant digits and subtracts them from subsequent measurements.

Circle (89) on Reply Card ES&T



Literature

New-Tone Electronics offers literature on its new line of NTE static control products. Included are descriptions for a field service kit, wrist straps, mats and anti-static foam. Also available is the Technical Guide and Cross-Reference manual, which cross-references more than 3,200 parts to 220,000-plus industry part numbers.

Circle (125) on Reply Card

Tools and test equipment expressly for servicing electronics and telecommunications equipment, including computers, is described according to category in the **W.S. Jenks & Son's** 1986 catalog. The 96 pages and four-color cover are profusely illustrated and more than 1,000 manufacturers are represented.

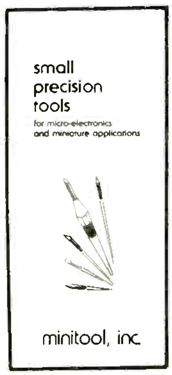
Circle (126) on Reply Card

Technical information is combined with cartoon-style characters in the **PTI Industries** Datashield booklet, which emphasizes the need for protection against dirty power.

Circle (127) on Reply Card

Five major product categories of automatic cord control reel products highlight the **Cordomatic** catalog, which contains comprehensive descriptions and full-color illustrations of the company's complete product line.

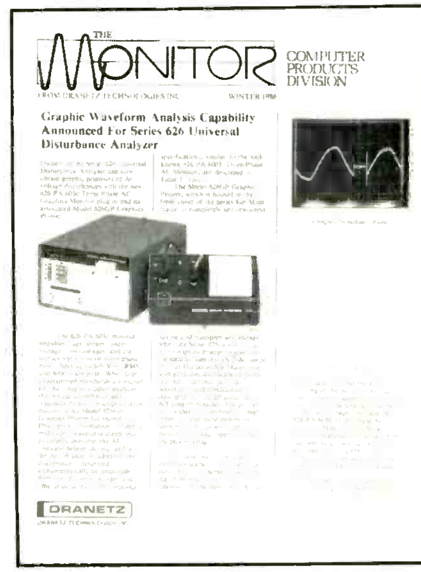
Circle (128) on Reply Card



Minitool offers a folder showing precision miniature hand tools for fine assembly work, delicate deburring, and printed circuit design and repair. The folder includes technical data as well as prices and ordering information.

Circle (129) on Reply Card

"The Monitor," a quarterly newsletter, is available from **Dranetz Technologies.** Covering a range of topics from monitoring and analysis of power line problems, complex operations and processes, to effective energy cost reduction techniques, this publication includes ap-



plication information, new product announcements and service and maintenance techniques.

Circle (130) 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.*

Electronic Techniques: Shop Practices and Construction, third edition, by Robert S. Villanucci/Alexander W. Avtgis, William F. Megow; Prentice-Hall; 619 pages; $32.95 hardbound.

The progression of new devices for high-density packaging of electronic systems requires that today's technicians develop more sophisticated construction and packaging techniques. This edition of two previous, familiar texts has been designed to reduce the gap between industry and the educational environment as well as to provide a possible update for technicians already in the field. Clear, detailed explanations for laying out and fabricating electronic systems are accompanied by 500-plus visual and graphic aids. No prerequisite knowledge of electronic circuits is necessary, according to the authors, but a deeper insight of the material presented may be realized if the technician has a fundamental background in electronics.

Published by Prentice-Hall, Englewood Cliffs, NJ 07632.

The CLR200 "ProWonder" Camcorder Technical Training Manual, by RCA; RCA Technical Training; $7.95 paperback.

Anyone expecting to service RCA's newest video product will consider this training manual a useful tool. The manual is illustrated with simplified schematics, block diagrams and circuit board photos that show component and test point locations. Explanations of how circuits and systems function are included, as well as descriptions of common trouble symptoms and their most probable causes. The manual addresses these major topics in detail: tape transport mechanism; microcomputer system control; servo system; signal processing and color camera overview.

Published by RCA Technical Training, 1-450, P.O. Box 1976, Indianapolis, IN 46206.

Designing IC Circuits...with Experiments, by Delton T. Horn; Tab Books; 364 pages; $16.45 paperback, $24.95 hardbound.

The ability to design integrated circuits will significantly increase the capabilities for building advanced electronics devices that promise customized usefulness beyond the usual kit projects. The author has avoided heavy emphasis on theoretical rhetoric and complex mathematical equations, stressing, instead, practical applications of the basic concepts used in IC technology. The reader is guided into designing practical circuits, using op amps, 555 timers, voltage regulators, linear ICs, digital ICs and other commonly available IC devices.

Published by Tab Books Inc., Blue Ridge Summit, PA 17214.

Readers' Exchange

Wanted: Supremes' TV-1, TV-2, TV-16 and R-1 manuals; also Knight 83YX137 AF generator, and RF generator, with manuals; 83Y135 signal tracer manual. *C.T. Huth, 229 Melmore St., Tiffin, OH 44883.*

For Sale or Trade: Telematic jig adaptors: SYA-885, 887, 888, 889, 891 and YA-35, never used, still in original package. Sell or trade for RCA 10J....series adaptors. *Dan Schafer, 4215 Buechner Ave., Cleveland, OH 44109; 216-351-4446.*

Wanted: Test adaptor socket end for small-diameter-neck CRT: 7 GR basing plug end, 12L duo-decal-basing, Pomona Electronics model 2713 or its equivalent. *Joseph A. Gontarz, JAG's Radio & TV, 14 Rudolph Road, Forestville, CT 06010; 203-583-7532.*

Needed: RCA manual for CTC chassis 72C. Please send price and ship to *Leo E. Smith, P.O. Box 945, Veteran's Home Section J, Yountville, CA 94599.*

Wanted: Manuals on B&K Precision models 650 and 1075, Sencore TC131 and CG153, RCP804A. **For Sale:** B&K model 1076, $100, model 415, $200; Heath IO-101 vectorscope, $75, IG-28 color-bar generator, $50; Tektronix model 545 oscilloscipe, $100. *Jim Corliss, 2446 Vista Drive, Upland, CA 91786; 714-985-9967.*

For Sale: Sams AR volumes–AR19, 20, 26, 28, 30, 31, 33, 35, 36, 50, 83, 96, 184, 185, 186, 190, TSM 72–$4 each prepaid. **Need:** 243, 262, 266, 293, 299 through 311. **Wanted:** Tube-type TV sound tuners. *Jim Farago, P.O. Box 65701, St. Paul, MN 55165.*

Wanted: Broken Telequipment D54 oscilloscope for parts; must be intact. Also need Tekfax manuals from *E.T.D.* magazine, and a Sylvania D16-05 color TV classic. *M.T. Shelton, 2708 May Drive, Burlington, NC 26215; 919-227-2908.*

Wanted: For VCR repair–tape tension and spindle gauge, VCR service manuals, Panasonic 12-inch picture tube No. A26JA531X, Diehl Mark III, IV or V. *Ed Herbert, 410 N. Third St., Minersville, PA 17954.*

For Sale: (Clarification of previous ad) Sams Photofact folders in the 600s, 700s, 800s and 900s, $1 each, postage not included. Send s.a.s.e. for exact numbers. *David Muratore, 27 Clarkview Road, New Windsor, NY 12550.*

Needed: High school electronics program needs donations of equipment, parts, Photofacts, ham gear, etc. All donations tax deductible. Please ship to *Payson High School Electronic Dept., 1050 South Main St., Payson, UT 84651, or call Robert Strange, K7VVU, 801-465-2568, ext. 117.*

Needed: Schematic for Foxx Company sound-effects pedal, Foxx Fuzz-WA-Volume. *P. Wells, 449 S. Canyon Drive, Redmond, OR 97756.*

For Sale: B&K Precision model 415 sweep and marker generator, excellent-plus condition. $350 plus shipping, or will trade for Sencore model TF46 transistor tester in same condition. *Paulmer L. Williams, 322 N. Court St., Lewisburg, WV 24901; 304-647-5414.*

For Sale: Service manuals, textbooks, magazines and assorted parts; 1,000 tubes, 85% off list price. Send large s.a.s.e. for list. *M. Seligsohn, 1455 55th St., Brooklyn, NY 11219.*

For Sale: Old tubes and parts, too many to list. Send s.a.s.e. to *Doc's Music Center, 72-5 Greenville St., Newnan, GA 30263.*

Needed: Horizontal output transformers No. 77x35 for General Electric 19YA chassis, new or used, in working condition. *Larry Huckeba, 6 Buchanan St., Newnan, GA 30263; 404-253-6566.*

For Sale: Sencore PR57 variable isolation transformer and safety analyzer, 1 year old, $300; Telematic VHF-UHF tuner sub- and digital generator, $30; Heathkit VTVM 1M5228, $40; Sams Photofact folders, miscellaneous, 1037-2254, 100 total, $500; NRI Master Course video-audio books, $100. *City Radio & TV, 135 S. Second, Rogers City, MI 49779; 517-734-4300, 517-734-4325.*

Needed: New or used–Panasonic ESB11500S24T control; Panasonic *on/off* switch, model RF-850HB; Sony green dial bulb, model 8FC-69WA radio; cartridge EO511-A1 (or similar); Delmonico SRC-6(4), 246, 642. *V.C. Williams, TV Central, 870 Pio Nono Ave., Macon, GA 31204; 912-743-1451.*

ES&T

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

SCRAMBLED TELEVISION, encoding/decoding. New book. Theory/circuits, $9.95 plus $1 shipping. Workshop, Box 393ES, Dept. E, Bethpage, NY 11714. 1-85-tfn

TV TROUBLE ANALYSIS TIPS. Over 300 symptoms/remedies by circuit area; tough ones over the years. Save time and money. Send $12.50 to CHAN TV, 8151 Grandview Rd., Chanhassen, MN 55317. 1-85-tfn

CABLE CONVERTERS. Lowest price. Dealer inquiries accepted. Quantity Discounts. FREE CATALOG. P.G. Video Corp, 61 Gatchell St., Dept. ES&T, Buffalo, NY 14212. 5-85-tfn

CABLE TV CONVERTERS & EQUIPMENT. Plans and parts. Build or buy. Send S.A.S.E. C&D Electronics, P.O. Box 1402, Dept. ES&T, Hope, Arkansas 71801. 1-86-tfn

CONVERT ANY SCOPE into a spectrum analyzer/receiver. Send stamp, self-addressed envelope for details. Workshop, Box 393ES, Bethpage, N.Y. 11714 03-86-3t

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INDIVIDUAL PHOTOFACT FOLDERS (not sets) #1 to #1400, $3.00 first-class postpaid. Loeb, 414 Chestnut Lane, East Meadow, NY 11554. 4-86-3t

REPAIR OF ZENITH CIRCUIT BOARD 9-160-ALL; with dud exchange $33.00. One year guarantee. Kinirral Electronics, 68-26 64th Place, Glendale, N.Y. 11385. (718) 366-3859. 4-86-3t

VCR VIDEO HEAD TEST. Use standard shop equipment to thoroughly check VCR video heads and associated circuitry. For complete details send $5.00 to: APG ELECTRONIC SERVICE, Box 7, Whitehall, NY 12887. 4-86-1t

TUBES: $2.49, many discontinued types, SASE brings lists. Old Photofacts, to #1000, $4.00. Binders, $3.50. EDNF, 6690 7 Mile, S. Lyon, MI 48178. 4-86-1t

BUSINESS OPPORTUNITIES

3 HOURS FROM SAN FRANCISCO! Town of paradise in pine forested foothills. Electronic repair business. Building/shop/equipment/7 room residence with large garden. $165K, (916) 872-1962. 12-85-tfn

FT. LAUDERDALE. Diversified electronic business located in busy shopping center. Old established with steady clientele. Reasonably priced for quick sale. $85,000. Call 305-776-4941. 4-86-2t

ELECTRONICS REPAIR SHOP. TV, stereo, VCR, microwave repair. Established 10 years in Wichita. $20,000. Will trade. Eugene Faber, 2527 W. Pawnee, Wichita, KS 67213. 4-86-2t

3 HRS FROM SAN FRANSISCO in pine forested foothills, electronic repair business. Poor health forces sale. Bldg./shop/equipmt. & 7 rm. residence w/lg. garden, was $165K, now $155K. (915) 872-1962. 4-86-1t

TV SALES & SERVICE RCA-Equipment, parts, truck & customer records. $40,000/yr. net potential, asking $20,000. Owner retiring after 30 years serving Tampa Bay Area. Showroom, work shop & house $140,000. Call Jim Wolfston, CENTURY 21 G.M. GROUP, INC. 813-535-4646. 04-86-1t

HELP WANTED

CAMERA-VIDEO Technicians needed. Top pay and benefits for well trained and experienced technicians who are expert with consumer and/or industrial cameras and VCR's. Training by manufacturers such as Sony, Hitachi, Panasonic, etc., are necessary for job experience. Come to sunny Florida and enjoy your work & leisure time. Write or call ATLANTIC ELECTRONICS INC., 1881 NE 26 St., Ft. Lauderdale, FL 33305. (305) 564-8274 10 AM to 6:30 PM. Ask for Dave or Joe. 8-85-tfn

HELP WANTED (CONT.)

TELEVISION TECHNICIAN NEEDED. Must be experienced with American & Japanese televisions. Excellent benefit package and incentive plan. Send resume to P.O. Box 894, Union, N.J. 07083. 4-86-2t

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UNIVERSITY DEGREES- Economical home study for Bachelor's, Master's, Doctorate. Prestigious faculty counsels for independent study and life experience credits. Free information – Richard Crews, M.D. (Harvard), President, Columbia Pacific University, 1415 Third St., Dept. 2B84, San Rafael, CA 94901; Toll Free: 800/227-0119; California: 800/552-5522; or 415/459-1650. 4-86-1t

ELECTRONIC TECHNICIANS AVAILABLE: The Willmar Area Vocational-Technical Institute will graduate Electronic Service Technicians in June, 1986. Graduates have received training in consumer electronic equipment, such as VCR's, satellite television, and television receivers. In addition, the graduates have received the PACE training program on soldering and PC board repair. Their training involves hands-on experience of analyzing and troubleshooting, and repairing microcomputers, disk drives, printers, and video monitors. Training covers operation of recent model personal computers, microprocessors, digital electronics, data communications systems, and BASIC programming. For further information, contact Fred Hanson, Placement Coordinator, Willmar AVTI, P.O. Box 1097, Willmar, MN 56201, telephone (612) 235-5114, extension 118. 4-86-2t

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RCA Distributor and Special Products	43,44		
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Tentel	29,30		800/538-6894
Test Probes, Inc.	71	38	800/368-5719
Viz Test Equipment	49	17	800/523-3696
Wahl Clipper Corp.	73	33	815/625-6525
Zenith	BAC		

Go for 'em! Solid margins year-around! They're yours in the video aftermarket! With this new VCR Care Kit by Zenith!

You bet there's a VCR aftermarket out there! A sizeable one. Perhaps as big as *twenty million plus* households. So that capitalizing on it with VCR accessories like this beautifully packaged Zenith VCR Care Kit can be very, very profitable.

Look and see for yourself!

Inside this kit, latest in a long line of Zenith video accessories – and available separately, too – are a great new VCR Head Cleaner. A T-120 VHS Blank Video Tape. A VCR Dust Cover. And a clear VHS Tape Storage Cover. All proudly bearing and backed by Zenith, a name renowned for superb product performance and reliability.

They are at your Zenith distributor's place now, these new Universal VCR Care Kits, ready for immediate delivery to heads-up service techs alert to the money to be made in the overall video aftermarket.

Actually, there's more in store than ever before in this expanding line of Zenith video accessories. More than just this new Universal VHS VCR Care Kit. Solid margins, for example. The kind that can turn some 6, 7 or 8 feet of your floor space into a video accessory profit center right before your eyes.

So hurry! Quit second-guessing yourself! Neither this video accessory business nor VCR aftermarket is going to wait for you.

Call your Zenith distributor's Parts & Accessories Sales Manager!

Besides being an integral part of Zenith's new VCR Care Kit, this VCR Head Cleaner is also available separately as Model T-HC from your Zenith distributor.

the Smart Choice
ZENITH
Electronic Accessories

Zenith Service, Parts & Accessories
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