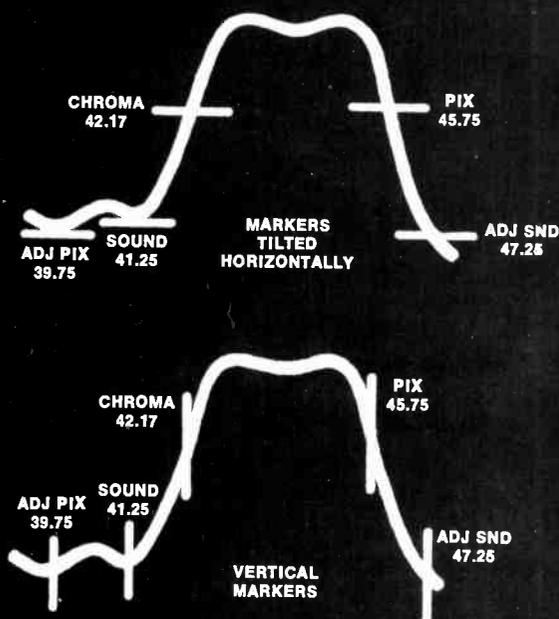


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"Silent Partner" Model 415 Sweep/Marker Generator



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On the 415 Sweep/Marker Generator, the IF bandpass and chroma bandpass are simulated on the front panel. For absolute accuracy, eleven individual crystal-controlled markers can be used separately or simultaneously. The exclusive marker tilt and marker amplitude feature readily identifies positioning of marker and insures positive trap and IF alignment. Markers can be tilted horizontally or vertically.

The B&K Model 1450 Oscilloscope/Vectorscope is the ideal scope for marker display. However, the 415 can be used with any scope; because it has internal compensation for low frequency distortion that may be present in other oscilloscopes.

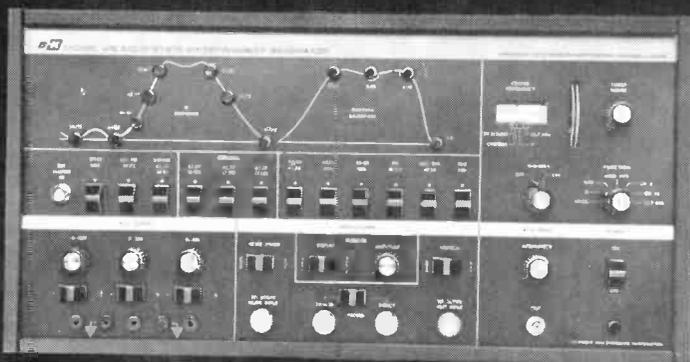
A complete accessory package is included with the 415 at no extra cost. This includes RF cable, RF demodulator probe, IF loading blocks, ground and bias leads, and shielded cable with banana plugs and MIC connectors.

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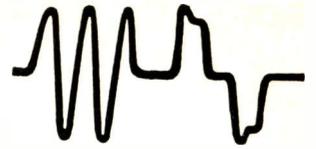


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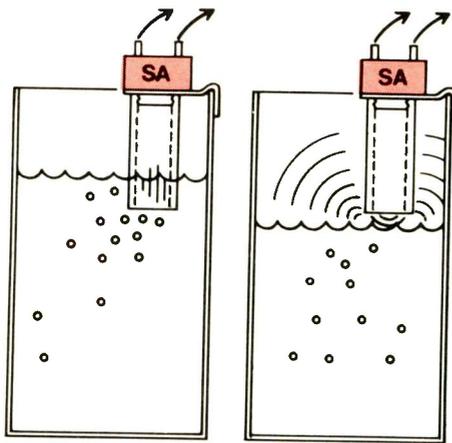


Fig. 1—Trapped Sound System



Fig. 2—Mechanical System

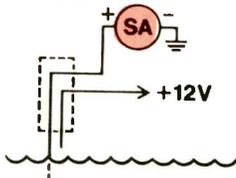


Fig. 3—Simple Electronic System

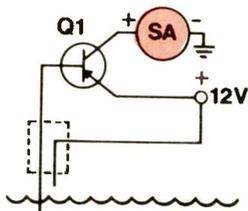


Fig. 4—High Output Electronic System

Crank up your inventive powers and put them to work with Sonalert®, the low-drain, solid-state tone signal that gives a big sound with just a few milliamp drive. More than likely you can come up with some great ideas for your shop, home or car. Ideas for fun, safety—and, perhaps, profit.

Just to give you a few clues, let's take a look at the way would-be Edisons turned Sonalerts into interesting ideas. We've picked four ways in which others have used this new signaller for one application: liquid level alarm.

One of the simplest is a compact system that requires no trigger circuits or complex mechanical devices. All you have to do is install a glass or plastic tube on the unit's nose cone, and hook the Sonalert to a power source. (See figure 1.) Insert the tube into the liquid to the level required for alarm. Since the tube is immersed, no sound can escape. Once the fluid falls below the critical level, out comes a loud, clear, unmistakable signal. Here's an ideal system for use in explosive atmospheres; Sonalert produces no arcs or sparks.

Figure 2 shows a mechanically actuated system—float and switch. It's made up by mounting a float ball on a lever arm that actuates a plunger switch in series with the Sonalert and power source. Reliability might be a problem because of mechanical failures.

For greater reliability, the simple electronic system (figure 3) is hard to beat. Fluid acts as the switch to close the circuit between Sonalert and the source. Just one problem presents itself. The sound level from Sonalert is proportional to current flow. If the liquid is not a good conductor, current flow may be too low.

To overcome this limitation, a high output electronic signal system was developed (refer to figure 4). Here transistor Q1 acts as a low resistance switch; and current flow to the Sonalert is maximum as long as there is enough base current flowing through the fluid to hold Q1 ON.

Here are four variations on one theme. Bet you can come up with some great ideas on your own. Try. If you can't, we've got more tips for you in booklet No. 9-406 that's yours for the asking at your Mallory Distributor's. It's chock-full of information: how Sonalert works, ratings, specs, mounting instructions and more tips. You can write for a copy, if you prefer. Mallory Distributor Products Company, a division of P. R. Mallory & Co. Inc., Indianapolis, Indiana 46206.

DON'T FORGET TO ASK 'EM— *“What else needs fixing?”*

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NOVEMBER 1969 • VOL. 90 NO. 5

43 TEKLAB REPORT ON 1970 TV

Part two concludes our preview of the latest in television receivers for 1970 with a brief circuit description and highlights of each.

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53 TEST INSTRUMENT REVIEW

A special roundup of service equipment available to the TV, radio and audio technician including a complete listing of all available specifications.

66 TESTLAB REPORT ON COMMANDER MODEL 830

This month our Electronic Technician/Dealer lab technicians will evaluate the Commander Model 830 FET tester complete with circuit description, specifications and operation.

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Cover

Color TV is as common as meat and potatoes, but good color is dependent upon many factors including a stable ac line voltage which can be regulated by an external unit as shown on this month's cover.

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ET/D

EDITOR'S MEMO

Only the Beginning

In the busy shuffle of parts, order blanks, bills and anxious customers, it is difficult to find time to read or keep up with all that's new in our industry. That's where ELECTRONIC TECHNICIAN/DEALER comes in. It's our job to keep you informed and to do it in a manner that makes the facts readily available so you don't have to wade through ten pages of copy to find what is important to you.

In case you haven't already taken a good look, we are featuring a special roundup of test instruments which starts with part one this month. Part two in next month's issue will wind it up. But this type of informative, concise reference feature is only the beginning of a stronger program designed to keep you the best informed readers in the industry. If there are any special subjects of interest, products or servicing information which you would like to see given more attention, let us know. Like the man says, "Keep those cards and letters coming, friends."

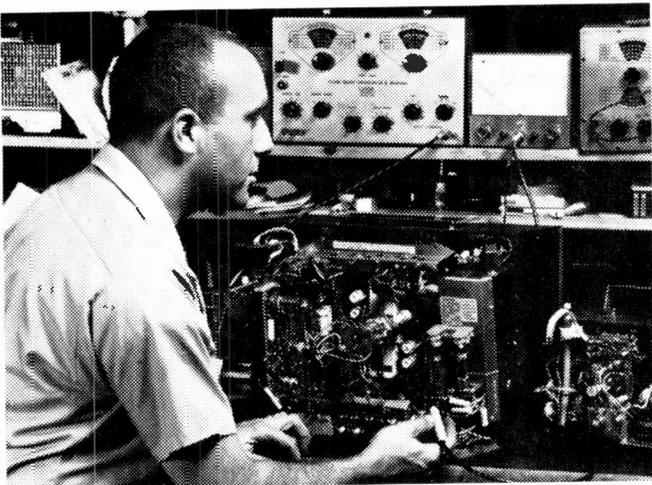
This month wraps up a two-part survey of new color TV receivers for 1970. Because of this review we did not include the Teklab Report, but it will be back in December with an inside look at Philco Ford's 14in. portable. Remember, too, the special December issue will include a complete index of articles, Tekfax schematics, Colorfax and Tech Digest featured in ELECTRONIC TECHNICIAN/DEALER during 1969. Watch for bigger and better things, and above all, stay informed—read.



Paul A. Horvick

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FM ANTENNA 700

Monitor line includes total of 14 models

Announced is the addition of four new mobile configurations to a line of monitoring antennas. The "quick-grip" unit, used in both professional and citizens radio services, comprises a stainless steel cup base employing a clamp-on device for the trunk lip which requires no drilling of holes. The cup conceals the cable, creating the effect of a permanent installation without damage to the vehicle. Model MON-13 covers all frequencies from 25 to 174MHz; Model MON-14 is designed for low-band operation. An all-band cowl-mount model is available as MON-10 (shown in photo). For temporary applications, the maker has added a stainless steel gutter clamp antenna, Model MON-12 for multi-band use. The all-band models can reportedly be used to receive all business and public safety frequencies from 25 to 174MHz including the popular FM broadcast and aircraft bands. The monitor line now includes 14 models, four for base station application and ten for mobile use. Antenna Specialists.

ACCU-LOG VOM 701

Eliminates need for readings at high end of the scale



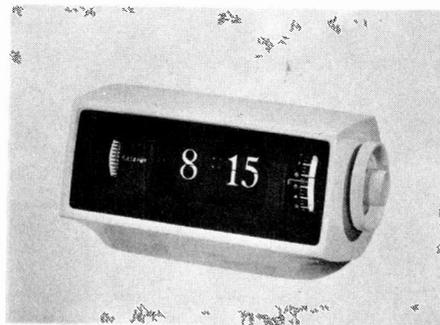
Introduced is the Model 202 ACCU-LOG VOM reportedly eliminating the need to keep readings at the high end of the scale, or worry about "percent of full scale" accuracy readings. The quasi-logarithmic scale gives consistent "percent of reading" accuracy reportedly at ± 2 percent for dc values and ± 3 percent for ac values. Zero adjustment is made on a linear portion of the low end of the scale.

This instrument has 6 dc voltage ranges, 4 ac voltages, 5 dc current ranges and 5 resistance ranges. Two of the resistance ranges are designated for low-power testing: Rx1, (4Ω center, 2.7 mw maximum load) and Rx10 (40Ω center, 0.27 maximum load). Ranges overlap to let the operator place the value being measured nearer mid-scale. The 7in. antiparallax mirror scale reduces reading error. The taunt band movement is overload-protected, shock-resistant and self-shielding. Simpson.

702

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Alarm can be preset 24 hours ahead



Housed in a case of Cyclac plastic (the same material as is used in a telephone), the Caslon Model 701 features a noiseless precision motor said to insure long life and concise timekeeping. Its space-age styling is designed

to enhance the decor of home, office or shop. Its alarm features a buzzer that rings for 10 seconds and is off for 50 seconds for a period of one hour or until turned off, and the alarm can be set 24 hours ahead. The clock is available in avocado green, charcoal grey and frosty white. It also features a built-in neon lamp, which is claimed to never need replacing. The unit is UL-approved and carries an 18-month warranty. Ropat.

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PAGES 68 & 78**

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Hum 60 dB below 400 mW, 105-132 VAC, 50/60 Hz, 5VA. HWD: 7½", 8½", 5". 6 lbs.

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5 fundamental bands 100 kHz to 54 MHz. Vernier control 0-100%. Output 300,000 μ V into 50-Ohm load. External signal modulation or internal 400 Hz, 0 to 100%. 105-132 VAC, 50/60 Hz, 1.7 VA. HWD: 7½", 8½", 5". 5 lbs.

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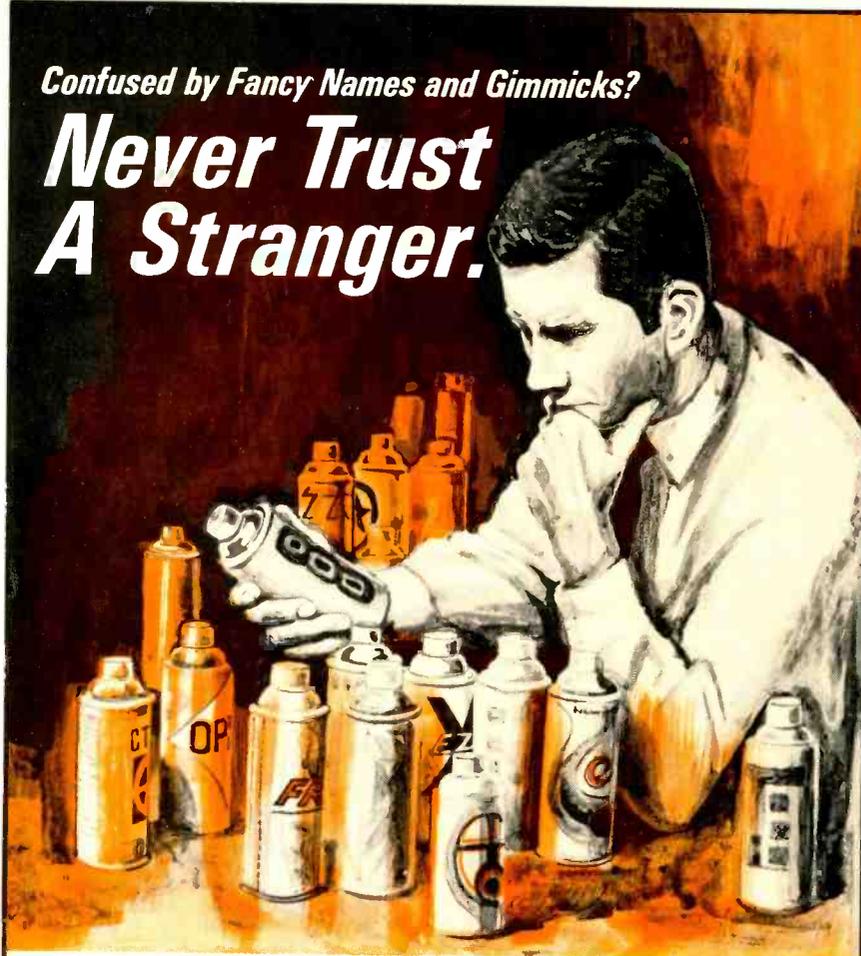


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ET/D BOOK REVIEWS

CB RADIO SERVICING GUIDE, by Leo G. Sands, published by Howard W. Sams & Co., 160 pages, 5 1/2 x 8 1/2. \$3.95 soft cover.

This book is written as a guide to CB servicing for the CB user and for the professional service technician. It discusses various types of transmitter circuits, the test equipment necessary to service them as well as useful tips on building special test aids. Troubleshooting procedures are also described in depth to help the technician arrive at a rapid solution to problems in many receiver-transmitters with schematics and analysis of individual circuits.

ZENITH COLOR TV SERVICE MANUAL, by Robert L. Goodman, published by TAB Books, Inc., 160 pages, 8 1/2 x 11. \$7.95 vinyl cover, \$4.95 paperbound.

The technician who spends much of his time servicing Zenith chassis will find this manual a handy reference source. It covers 28 chassis from the 27KC20 to the 14Z8C50 including schematics. The first seven chapters of the manual are devoted to general servicing information. The first chapter covers setup and troubleshooting techniques, followed by servicing hints on the tuner, IF, AGC, chroma, deflection, high voltage and power supply circuits. Chapters 8 through 19 are service notes on the various chassis, giving the tube, transistor and diode complement for that series. Also included in an area called "Troubleshooting Case Histories," which lists various circuit problems and their causes. Also provided are factory modification notes describing circuit changes in detail. The manual is large and easy to follow with fold out schematics of all the chassis mentioned, useful, one source reference on Zenith color receivers.

MOVING?

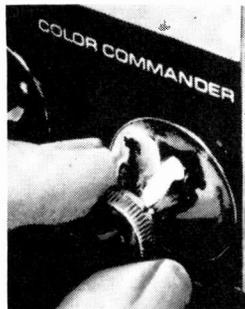
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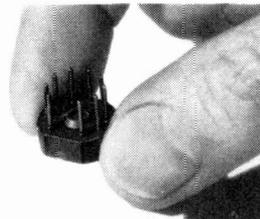
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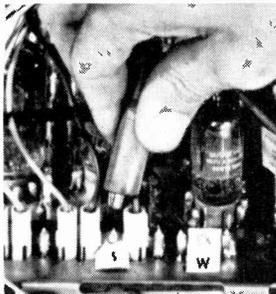
2

ADVANCED SIMPLIFIED CIRCUITRY. Zenith's Chromatic Brain in the exclusive Zenith solid-state Dura-Module has the first integrated circuit ever used to produce a color TV picture. It incorporates the equivalent of 19 transistors, 2 diodes and 24 resistors. And it plugs in easily!



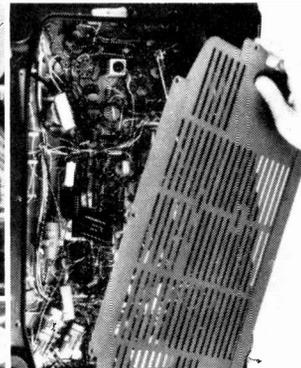
3

TEST POINTS FLAGGED AND CODED. Easily seen numbers and flags identify chassis check points. They help you make a fast, accurate diagnosis. No "road map" needed.



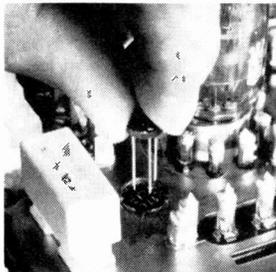
4

EASY ACCESSIBILITY TO ALL CHASSIS PARTS. Zenith's quickly removable "Easy Service" plate and horizontal chassis layout permit easy access and faster servicing. Up to 90% of the circuitry is accessible even with the chassis remaining in the cabinet.



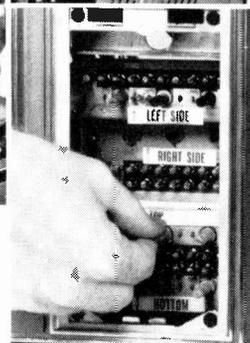
5

PLUG-IN TRANSISTORS AND MODULES. In Zenith Chromacolor, all transistors are either plug-in or part of a module. And every module is a plug-in.



6

SIMPLIFIED ADJUSTMENT. Initial adjustment is easier. Zenith's easy-access front-mounted convergence panel assembly helps make adjustment quicker and more accurate.



ZENITH

The quality goes in
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COMPLETE SERVICE ON ALL MAKES OF TV TUNERS

Maximum Time to Shop 24 Hrs.

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\$9.95



Black &
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or Color

VHF or
UHF

UV Combo's \$16.50

Price includes all labor and parts except Tubes, Diodes & Transistors. If combo tuner needs only one unit repaired, disassemble and ship only defective unit. Otherwise there will be a charge for a combo tuner. When sending tuners for repair, remove mounting brackets, knobs, indicator dials, remote fine tuning arrangements and remote control drive units.

All tuners must have remote control units and/or mounting brackets removed before tuner can be cleaned and repaired. Please remove these accessories before shipping, as we will not be responsible for loss or damage.



All tuners are serviced by **FACTORY TRAINED TECHNICIANS** with years of experience in this specialized field. All tuners are **ALIGNED TO MANUFACTURER'S SPECIFICATION** on crystal controlled equipment and air checked on monitor before shipping to assure that tuner is operating properly.

GEM CITY TUNER REPAIR SERVICE

Box 6D Dabel Station
2631 Mardon Drive
Dayton, Ohio 45420

ET/D

LETTERS TO THE EDITOR

Sams Sets For Sale

I have a Sams Photofact, sets 250 through 850 in perfect condition. The price is \$500.

W. D. HAY

6505 Long view Rd.
Kansas City, Mo. 64134

Tekfax for Sale

I have been an ELECTRONIC TECHNICIAN/DEALER subscriber for many years and it has helped me tremendously. But all good things must finally end. I have kept the Tekfax since 1960 and anyone interested can have them at a reasonable price by writing to me.

H. A. YENNEY

1819 1/2 Fremont Ave.
South Pasadena, Calif. 91030

Finneburgh Speaks Out

Color television will in all probability be among the fast-moving dynamic features of the coming year. We anticipate (even in the face of a generally conservative attitude toward 1970) a big year for color TV, specialized TV antennas, and field service work equal to the maximum efforts of the service dealer technician group.

However, the over-all picture, in our opinion, does not indicate this optimism. We see many disturbing factors that we believe will tend to slow down the economy.

The indecision of the federal government on important problems, such as Vietnam, taxes, Federal Trade Commission policy, continued growth of federal control and influence, all call for caution, and in turn caution creates a hesitancy to buy, sell and create.

As long as we shall face a lack of decision and accomplishment in Vietnam, we shall be affected in economic stability. In our opinion, a firm decision to do, or not to do, in this area is mandatory. The economy then can shape its future by intelligent decisions based upon facts not assumptions.

Happily (if we dare use this term in fact of world problems), the electronic industry as a whole can and will prosper under either a continued war-time economy, or a return to a peacetime tempo. Electronics today is the eyes, the ears and the voice of tomorrow. We are actually living in the embryonic stages of the electronic age. Surely the future holds nothing less than

fantastic accomplishments in research, design, engineering and performance throughout the electronic world. War, peace, or a combination of them, in any fashion, will build a breathtaking future in our industry.

Regardless of our electronics industry optimism, we would be derelict in our responsibilities if we did not reiterate our often-expressed fear that in face of this great growth pattern, there can, and no doubt will, be an inexcusably high percentage of failure at the manufacturer, distributor and service dealer levels. Why? Because many of us fail to study, to think, to plan and to be cautious in our quest for "volume" at the price of "loss of profit." Some of us are living in a "profitless prosperity" that will be disastrous.

If we in "electronics" do not lose sight of "good judgment" and "sound economics," not only 1970, but many years to come, will spell happiness and progress. But a return to a bit more somber, conservative and "prove-to-me;" attitude by management could be a most valuable hedge against what seems to be a possible general slowdown in the national economy next year.

Electronics can be the favored son and, by the way, a cutback to a more conservative and realistic credit policy is a must in 1970! It will take more than that if we are to avoid what today looks like very dangerous "over liberal" or "over extended" credit! The outlook for 1970 is good. . . not great. But there are definite dangers. . . "Caution" is the best word!!

MORRIS L. FINNEBURGH, SR.

Finney Co.
34 W. Interstate St.
Bedford, Ohio 44146

Simpson Serves Hawaii Reader

My "girl Friday" spotted a letter from A. P. Sargent of Hawaii in the July issue of ELECTRONIC TECHNICIAN/DEALER requesting a manual for our Model 340. I don't know if the offer of "something from Hawaii" inspired her to place Mr. Sargent's request at the top of my paper pile for two days in a row, but at any rate, we were lucky. Scrounging around our production engineering department finally turned up a manual which we sent to Mr. Sargent.

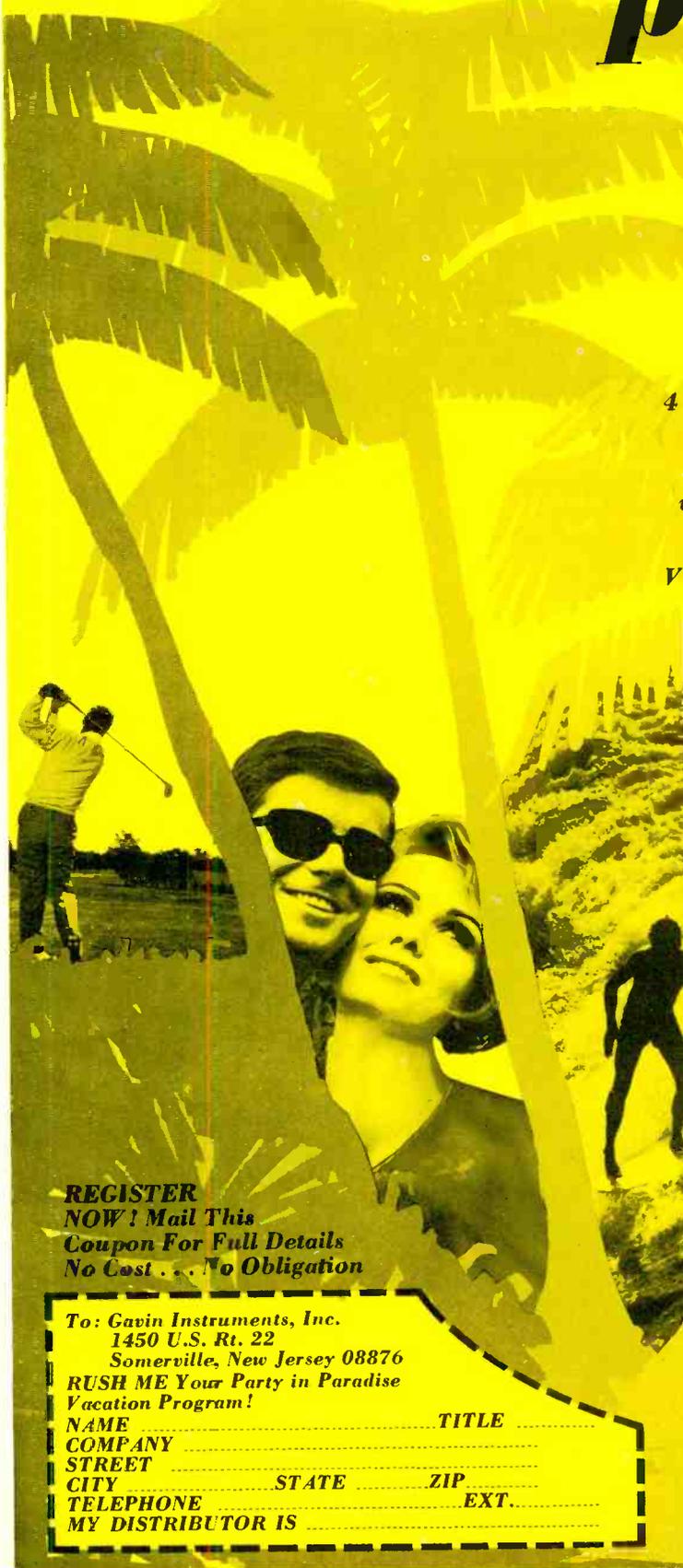
The Model 340 signal generator was last produced by us in 1952, therefore, well past out 10-year maintenance policy. Fortunately, 95 percent of the service ever required on this unit can be done with off-the-shelf parts. I have no doubts that Mr. Sargent's generator will be pounding out signals for many more years.

Our thanks to the editors of ELEC-

continued on page 32

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It's overnight to most locations from our plants!

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**10
9
hours***

*Tuners received this morning sent back late this afternoon!



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A full 12 months' protect - you and your customer take no risk! No worry over parts failures or defective workmanship from normal use.

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LOOKING FOR ACCURACY?



LETTERS
TO THE EDITOR

continued from page 28

TRONIC TECHNICIAN/DEALER for their fine publication and the service they offer through their "Letters to the Editor" column. We were able to help Mr. Sargent, to make him happy and since ELECTRONIC TECHNICIAN/DEALER offered us the opportunity to serve—we are happy.

R. E. FOX

National Service Manager

Simpson Electric Co.
5200 18 W. Kinzie St.
Chicago, Ill.

Readers' Aid

Perhaps an ELECTRONIC TECHNICIAN/DEALER reader can help me locate a schematic diagram for a DOSS Pioneer 250 Horizontal Sweep Analyst built in 1959 or 1960 by Doss Electronic Research, Inc., of Kansas City, Mo. I have written to them but they are out of business.

MAURICE DUBREUIL

1740 Notre-Dame
Lavaltrie, Que.
Canada

I would like to know if any ELECTRONIC TECHNICIAN / DEALER reader might have available an FM/AM drop-in tuner for an old Zenith stereo, Model SFD220R.

C. G. SPARKS

404-12th St.
Bristol, Tenn. 37620

I'm writing to you to see if you can help me. I have a Model #111/111M Precise tube checker and need a new chart for the latest tubes. I wrote to Precise Electronics, Coltronic, and Precision-Dynascan B&K Co. They all say they can't furnish me with a new roll chart as they no longer supply one for this model. Is there any one who knows where I can get one? How long are manufacturers supposed to supply charts? I paid around \$200 for it a few years ago in new condition and don't want to have it obsolete. Is there a formula I could use to figure out the tests for the new tubes using the tube manual? If so, where can I obtain it?

MYRON G. BENCK

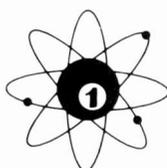
RFD#1
Fremont, Neb. 68025



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Want more? Look a little closer. An exclusive true zero center scale starting at $\pm .5V$ DC, DC current ranges from $100\mu A$ to 1-amp, complete meter and circuit overload protection, mirror back scale, built-in battery check, rugged vinyl clad all steel case, and . . . that's it. If you still want a closer look, you'll have to buy it. Remember the name **FIELD EFFECT METER**. Only Sencore makes them. Your Distributor has them in stock at \$84.50—less than the cost of a good VOM or VTVM.



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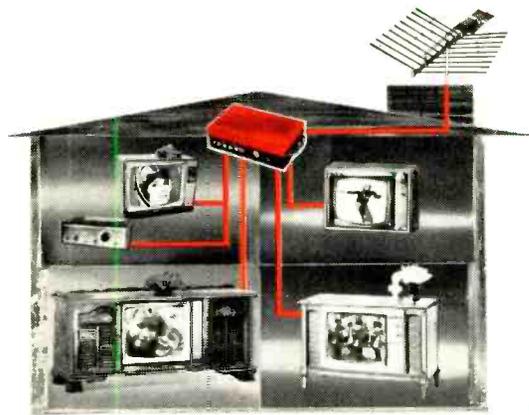
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... for more details circle 127 on Reader Service Card

The material used in this section is selected from information supplied through the cooperation of the respective manufacturers or their agencies.

MOTOROLA AM/FM Hi Fi Chassis IC350

The IC350 chassis with the AM/FM and amplifier is contained in a single chassis with no sub chassis.

The receiver employs the dual in-line packaged IC (integrated circuit) stereo FM decoder. This IC provides FM stereo demodulation, FM noise mute, stereo kill and stereo indicator.

This chassis contains nine diodes, one Zener, 21 bipolar transistors, five field-effect transistors and two IC solid-state devices.

Customer features include: slide-rule audio controls, flywheel tuning, push-button function selector, two stages of FM RF amplification, FM mute, J-FET (junction field effect) employed in the FM receiver, FM AGC, tuning eye for AM/FM tuning, stereo FM indicator light, FM stereo "IC" decoder, "J-FET" audio preamplifier and 350w instantaneous peak power output (EIA music power output rating 175w).

The complete unit lifts out from the top of the cabinet by simply removing back cover, connecting plugs, knob, earphone nut and screw under tuning knob, snap off escutcheon and four chassis bolts.

After the unit is removed, virtually everything is accessible for service and the side portion of the chassis swings out on hinges. The circuit boards are legended on both sides for circuit tracing. All leads on the AM/FM tuner are plug-in for easy removal. The chassis is transformer powered with a regulated 12v supply voltage.

AGC and Stereo Decoder

The AGC amplifier (Q5) and stereo decoder circuit are shown in the schematic.

FM AGC voltage for the 2nd FM RF amplifier is derived from the AGC amplifier (Q5) collector.

The 3rd FM IF signal is sampled through capacitor C11. Diode E2 converts the FM signal to a + dc voltage. The voltage varies with the received signal strength. This + dc biases the NPN AGC amplifier.

At the collector between resistor R29 and R30 a negative going AGC voltage is developed for the 2nd RF amplifier.

Since the AGC amplifier emitter voltage varies with signal strength, a customer tuning meter is connected here as a tuning aid.

A regulated +12v from the power supply is the IC source voltage at pins number 1 and 9. Pin number 8 receives a 4.7v bias derived from the same source through R33.

The signal flow to and from the IC is as follows:

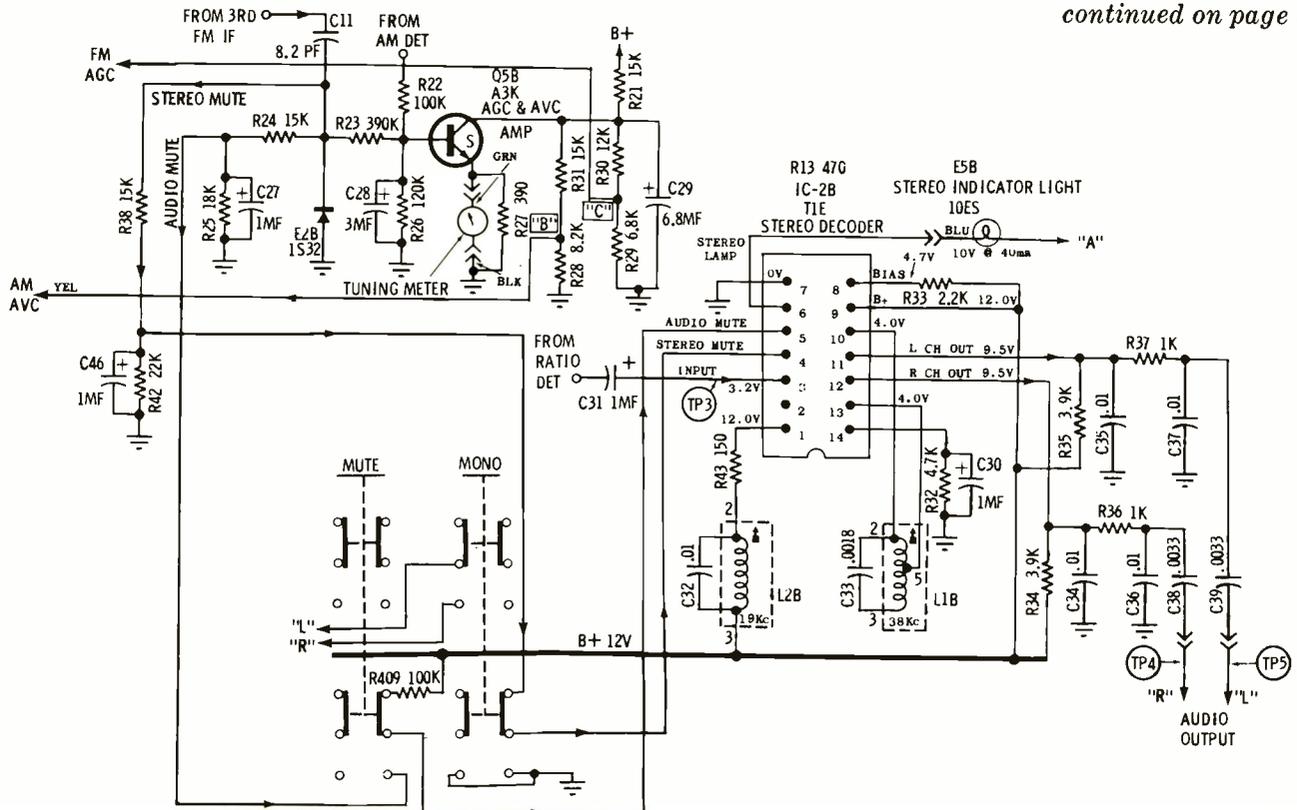
Audio input: (pin number 3) Monaural audio (L-R) enters the IC input (pin 3) and is fed to the right and left audio channels from pins number 11 and 12.

Stereo information (pin number 3): L-R sidebands (23kHz to 53kHz) at the IC input (pin 3) are decoded into audio; added to the monaural signal (L+R) to reproduce the left (pin 11) and right (pin 12) stereo audio signals.

19kHz pilot (pin number 1): The 19kHz pilot transformer (L2) and 38kHz reinserted-stereo-carrier transformer (L1) are external to the IC. These are the only adjustments related to the IC.

Stereo light (pin number 6): During a stereo broadcast,

continued on page 38



"My shop's been loaded since I got my FCC License...and I could kick myself for not getting it sooner. I'm pulling in all kinds of mobile, marine and CB business that I couldn't touch before; have even had some calls to work on closed-circuit television. I've hired two new men to help out and even with them, I'm two weeks behind."

And so it goes. Once you have that FCC ticket, you open the door to all kinds of new business. And that's not all. The knowledge you need to pass the FCC exam gives you a fundamental understanding of *all* electronics. You'll find you can do more work in less time...work on almost *any* kind of electronics gear.

What's the best way to get a Commercial FCC License...and still keep up with your work? Thousands of men will tell you, "Cleveland Institute of Electronics."

Men like August E. Gibbemeyer, for example. He was in radio-TV repair work before studying with CIE and getting his 1st Class FCC License. Now, he writes, "We are very happily in the marine and two-way radio business...servicing police and fire departments in three communities, as well as cab

companies...and our trade has grown by leaps and bounds."

Ed Dulaney is another example. He started his own part-time service business after training with CIE and passing the FCC License exam. This worked out so well that he then opened a full-time business. Today, he reports, "I manufacture my own two-way radio equipment, with dealers who sell it in seven states, and have seven full-time employees."

CIE has been preparing men like these for FCC License exams since 1934. What's more, CIE backs its Home-Study Licensing Programs with this remarkable money-back offer:

A CIE home-study FCC License course will quickly prepare you for a Commercial FCC License. If you fail to pass the FCC examination after completing your course, CIE will refund all your tuition. You get an FCC License...or your money back!

And only CIE offers you new, up-to-the-minute lessons in all these subjects: Advanced Troubleshooting Techniques, How To Work With Transistors, Microminiaturization, Pulse Theory and Application, and many more.

Send bound-in postpaid card today for CIE's FREE informative book "HOW TO GET A COMMERCIAL FCC LICENSE." With it, we'll include a second FREE book, "HOW TO SUCCEED IN ELECTRONICS." If card is missing, use the coupon below. Cleveland Institute of Electronics, 1776 East 17th Street, Cleveland, Ohio 44114.

NEWS FOR VETERANS: New G.I. Bill may entitle you to Government-paid tuition for CIE courses if you had active duty in the Armed Forces after Jan. 31, 1955. Check box in coupon for complete information.

CIE
Cleveland Institute of Electronics

1776 East 17th Street, Cleveland, Ohio 44114

Please send FREE book, "How To Get A Commercial FCC License." Also include your second FREE book, "How To Succeed In Electronics."

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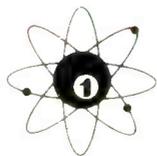


FASTEST, EASIEST GENERATOR TO USE. ONLY THREE CONNECTIONS FOR ANY TEST.



FREE WITH YOUR SWEEP AND MARKER:

80 full color reproductions direct from Sencore technical training film clearly depicts alignment from beginning to end using SM152. Pictures are numbered so you can review a section at a time if you are in trouble. 35 minute LP record direct from film clearly leads you all the way. Also packed with each SM152. Numbers are announced for each picture so you can review a section when necessary.



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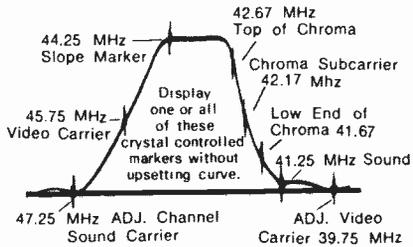
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ONLY GENERATOR THAT GIVES YOU A COMPLETE IF, CHROMA, ALL CHANNEL VHF, UHF AND FM ALIGNMENT SIGNALS IN ONE UNIT

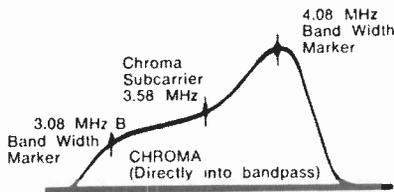
complete IF SWEEP AND CRYSTAL CONTROLLED MARKERS



View the complete IF response curve with full 15 MHz sweep width (competition has only 12 MHz, restricting view on RF and some solid state receivers that have extra traps). Press one or all of the crystal controlled marker push buttons without upsetting response curve. Post injection is used all the way to prevent overloading the TV receiver. Crystal markers are provided for all critical check points as shown on the response curve. Also sweeps 20 MHz IFs as found on older sets and new import color sets. Major competition does not cover these frequencies. Special spot align position converts the sweep generator to a regular signal generator for spot alignment or dipping odd traps. Only Sencore goes all the way.

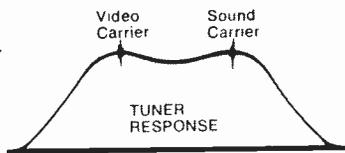
Note that Sencore has a base line giving you a reference to zero. Competitive models do not.

complete CHROMA SWEEP AND CRYSTAL CONTROLLED CHROMA MARKERS



You can inject the chroma signal directly into the chroma amplifiers as shown here or through the IF amplifiers for a flat response. You are equipped to follow manufacturer's recommendation either way. Injection directly into the chroma amplifiers is a must for fast trouble shooting of color circuits.

complete ALIGNMENT SIGNALS FOR VHF TUNER OR OVERALL ALIGNMENT



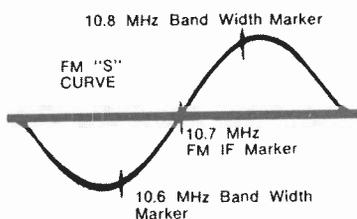
The SM 152 sweeps all of the VHF channels for complete tuner check from channel 2 through 13. Competitive models sweep only two VHF channels. Push button markers are provided for channels 4, 5, 10 and 13 for both the video carrier and the sound carrier. The second low and high channels are available in case you have a station operating on the same channel . . . which will cause the patterns to be upset. You want to align on an unused channel and check it on the channel in operation for best results. Only Sencore goes all the way.

complete UHF SWEEP FROM CHANNEL 14 THROUGH 82



After completely aligning a TV set, you'll want a complete check on the UHF tuner to be sure that it is operating on all channels. Markers aren't necessary as you just view the RF or over-all curve to see that the curve looks the same as the VHF and output remains reasonably constant. Only Sencore has UHF output; all new tuners are required to cover all UHF channels and you will come up short if you own any other alignment generator than the SM152. A UHF sweep generally costs hundreds of dollars more.

complete FM SWEEP AND CRYSTAL CONTROLLED MARKERS



You won't be stopped with just TV alignment. You can align the IF amplifiers of the FM receivers with the 10.7 MHz crystal for maximum as indicated in service manuals. Then, throw on the scope and sweep the amplifiers and view the "S" curve if you have stereo. Two markers, 100 KHz above and below the 10.7 MHz mark the limits of the curve for good stereo. You can align the front end of the receiver too. Competitive units cover only the IFs and you find the job only half done.

There are other features too numerous to mention that makes the Sencore SM152 the most complete sweep and marker generator on the market. Ultra linear sweep, covering all frequencies that you need, from 10 MHz to 920 MHz, exclusive calibrated sweep

width that is constant on all channels and RF calibrated output for circuit trouble shooting are only a few of the things that places the SM152 in a class by itself. Dare compare and you'll see your distributor today for a good look at the SM152.

continued from page 34

pin number 6 is grounded through the IC switch action to turn on the stereo indicator light (E5).

Audio mute (pin number 5): To eliminate the normal "rushing" noise between FM stations, the mute switch is depressed.

If the mute voltage at pin number 5 of the IC drops below a predetermined level (approximately +.9v), all signals are blocked from passing through the IC.

With the mute switch depressed (on), the IC pin number 5 is connected to the FM rectified signal (Junction C27, R25, R24). This rectified dc signal varies with signal strength. Between stations, the voltage drops below the mute threshold (+.9v) and the IC is cut off and we have mute between stations and on undesirable weak stations. This action is similar to "squench" used in two-way radio.

The mute feature is defeated when the mute switch is released (off). A fixed voltage (approximately +1.1v) is connected to the IC audio mute input (pin 5) through resistor R409.

Stereo Mute (pin number 4): The stereo information is blocked if the voltage at pin number 4 drops below .9v. Since this voltage is derived from the rectified FM signal through R38, this voltage will reduce with signal strength. On weak noisy stereo stations, the voltage drops below the .9v threshold point; all stereo information with the noise is blocked. The monaural signal is not affected.

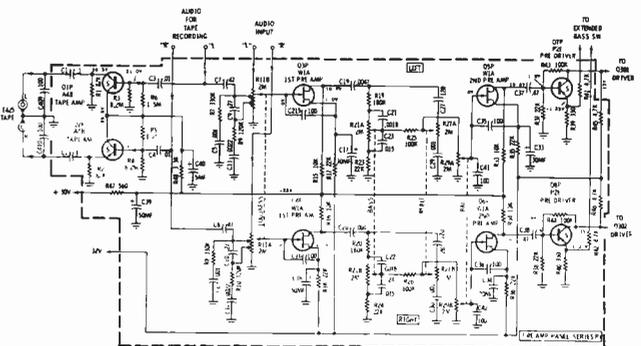
Monaural switch: The monaural switch is depressed if for some reason stereo is not desired. This grounds the 38kHz stereo carrier at the IC pin number 4.

Left and right output (pin numbers 11 and 12): Each output channel from the IC is bypassed to permit only audio to pass (30-15kHz). Frequencies above 15kHz are attenuated.

Audio Preamp

The complete preamp pre-driver and tape amplifiers are contained on the preamp panel (P) and are shown in the schematic. Since both audio channels are identical, only one channel will be explained.

Junction Field Effect Transistors (J-FETs) are used for the 1st and 2nd preamplifiers to increase the signal-to-noise

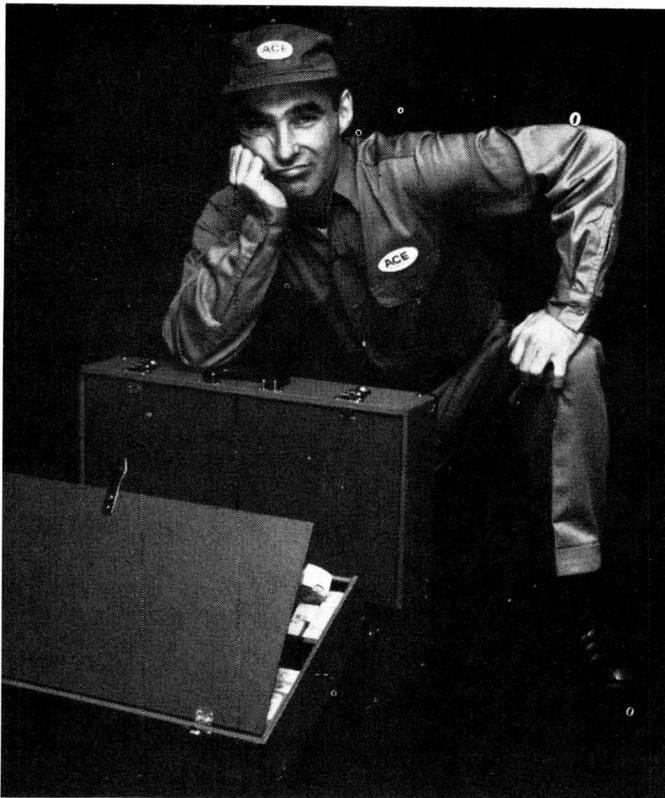


ratio and improve reliability by using smaller valued coupling capacitors. The high supply voltage for the amplifiers, +25v for the source leads and -32v for the drains (57v total). This supplies a high degree of self-bias for each stage through the bias resistors R17 and R35. With such a large self-bias voltage, consistent class "A" operation is realized over a wide tolerance range of J-FETs.

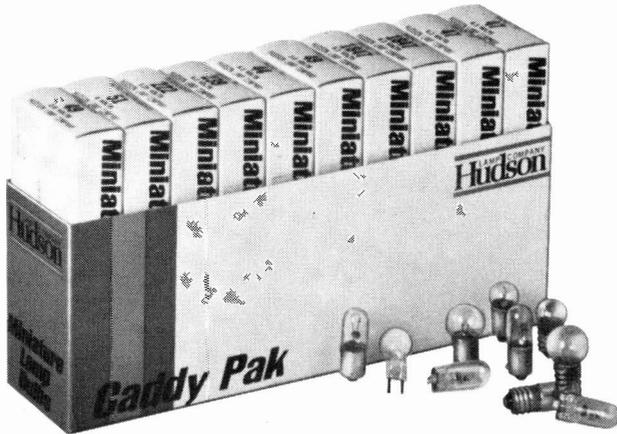
Both preamp (Q3 and Q5) are connected as "common source"

continued on page 40

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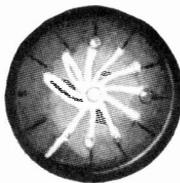
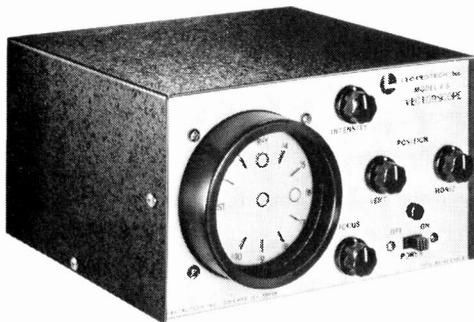


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TECHNICAL DIGEST

amplifiers (same as common cathode). The source leads are common to both input and output signals.

Audio from the selected function (phono, tape, AM or FM) is capacitive coupled to the LOUDNESS CONTROL input (R11). While there are no coupling capacitors shown from the phono and tape inputs, the cartridge or tape head acts like a coupling capacitor in that no dc voltage is generated.

Two taps and associated components on the LOUDNESS CONTROL compensate for a loss of bass and treble at low audio settings. Treble boost is provided by high frequency pass capacitors C7 and C9. The bias is boosted by high frequency-cut capacitors C5 and C11.

A full range of tone control is provided by completely separate bass and treble tone-control networks.

Making up the BASS CONTROL network are R19, R21, C21, C23 and R23. Capacitor C21 and C23 are effective short circuits for the high frequencies! Bass boost occurs when the BASS CONTROL (R21) slider are shorts across C21. Bypass capacitor C23 provides attenuation for the high frequencies but is an open circuit for lows. Therefore, the bass is said to be "boosted."

In the bass-cut position, the BASS CONTROL offers maximum resistance to the bass signal. Notice that in this position, the control slider arm short circuits capacitor C23. With the high frequency pass capacitor C21 now across the tone control, the high frequencies go around the control and receive less attenuation than the lows.

The TREBLE CONTROL network is made up of C27, R27 and C29 (see Fig. 16). In the treble-boost position, the TREBLE CONTROL connects high-frequency pass capacitor C27 directly to the control slider arm. High frequencies now bypass both tone controls for a direct path to the subsequent amplifiers.

Treble-cut occurs when the TREBLE CONTROL slider arm moves away from capacitor C27. This added resistance reduces the action of the capacitor thus cutting the high frequencies.

A BALANCE CONTROL (R29) acts as a reciprocal volume control between the left and right audio channels. From the BALANCE CONTROL the audio is presented to the 2nd preamp gate. Capacitor C37 couples the signal from the drain to the pre-driver base (Q7).

Audio leaves the preamp panel (P) at the pre-driver collector and is directly coupled to the NPN emitter-follower driver.

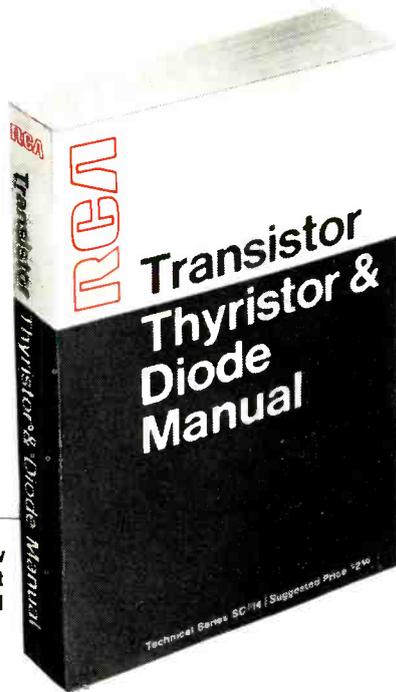
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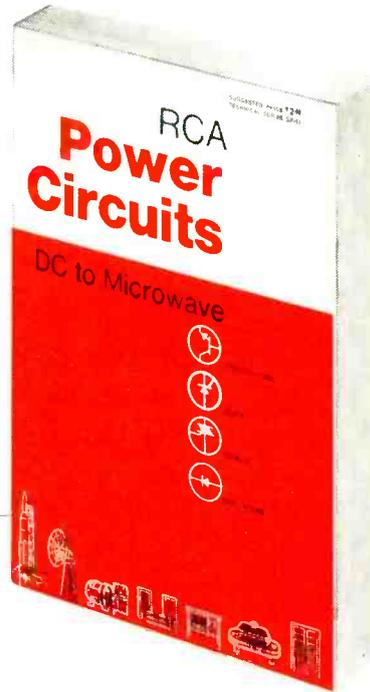
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What You Can Expect in 1970 Television Sets

Plug-in modules, remote controls with UHF search tune functions and non-mechanical varactor diode type tuners are some of the features found on the new television sets

■ In the coming year we will find the small screen portables taking even a higher percentage of the total color sets sold. Also, they will be more compact and lighter with features making them easier to service such as plug-in modules.

Of great interest is Electrohome's non-mechanical varactor diode type tuner which eliminates cleaning dirty tuner contacts and mechanical problems.

Last month we reviewed some of the important features found on the Admiral, General Electric, Magnavox, Motorola and Philco-Ford television sets. We will continue with coverage of circuits and features found on other new sets for the coming year.

ELECTROHOME

Electrohome's color TV Chassis C8 combines all the features of the C6 with a new solid-state touch tuning system. The UHF and VHF tuners are the non-mechanical varactor diode type eliminating dirty tuner contacts. Instant finger-touch selection of any one of 12 VHF and six customer preset UHF channels is provided.

The complete control head can be operated in the cabinet control panel in the conventional manner or removed, unplugged, then plugged into an extension ribbon cable and operated from the viewer's chair, remote from the set. The unit gives remote control of channel selection, col-

or, tint, off/on, volume and AFT/manual electric fine tuning.

The chassis is completely serviceable in the cabinet and hand wired. The control head and varactor tuner circuitry is completely solid-state and on easily accessible fiber-glass printed boards.

RCA VICTOR

B/W television receivers for 1970 employ 11 different chassis. Six are familiar types and used in units which were introduced in March 1969. Two continuing chassis are featured in "June" models.

The B/W television line also includes three new chassis. Some of the important circuits and features will be reviewed.

The continuing KCS156 chassis using a 23HUP4 CRT appears this year in both table and console models.

The KCS156 chassis is a transformer powered, horizontal chassis with most of the circuitry on a single circuit board; the power transformer includes a 128v tap for use in areas with higher than average line voltage.

This year's B/W television line features two hybrid chassis, which are physically and electrically very similar. The KCS176 is used in instruments that are equipped with 9in. diagonal picture tubes. Larger screen receivers (12in. diagonal) employ the KCS177 chassis which has circuit modifications to permit driving the larger picture tube.

Both chassis feature three

plug-in circuit boards containing solid-state circuitry similar to that used in the KCS169 chassis. The first board is referred to as the "pix module." This unit contains the picture IF amplifiers, picture detector, video driver stage and the AGC circuits.

The second plug-in board designated as the "video module" includes the video output stage together with the AGC and sync separator circuits.

The third board is the "sound module." It features the familiar integrated circuit sound system employed in many RCA color receivers. The audio output from the "IC" drives a 12FX5 audio output stage.

The plug-in pix IF module is designed to be used in either the KCS176 or KCS177. Interchangeability is carried one step further: As the picture IF stages are pre-aligned (without the tuner), IF response does not depend upon aligning the mixer output coil and IF input (link) circuit as a unit.

The input to the pix module is through a 75Ω resistor, coupled to an emitter follower stage. The emitter follower, in addition to providing high input impedance at the base and low output impedance at the emitter, also isolates the tuned circuits of the IF stages from the tuner link input circuit.

Shown in the illustration Fig. 1 is the IF emitter follower circuit. The mixer stage of the tuner contains a double-tuned transformer whose secondary is tapped by a capacitive voltage divider in the familiar "low-side C" configuration. The low impedance tuner output matches the resistive 75Ω input of the IF circuit, making it possible to pre-align the tuner for optimum response by substituting a 75Ω load resistor for the IF input.

The IF stages are aligned by inserting a sweep frequency signal across the 75Ω tuner terminating load.

Output from the emitter of Q402 drives a two-state transistor IF system that is very similar to the circuits used in the KCS169.

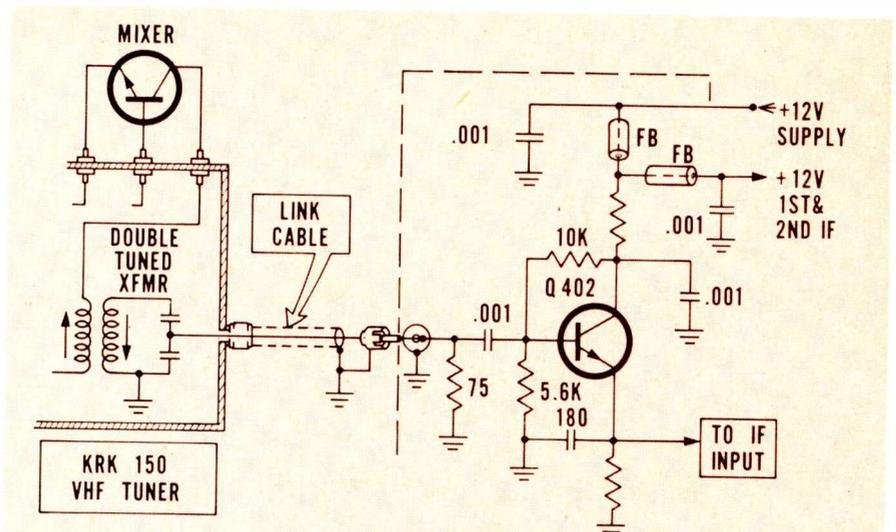


Fig. 1--Schematic of the IF emitter follower circuit employed in RCA's KCS176 and KCS177 chassis.

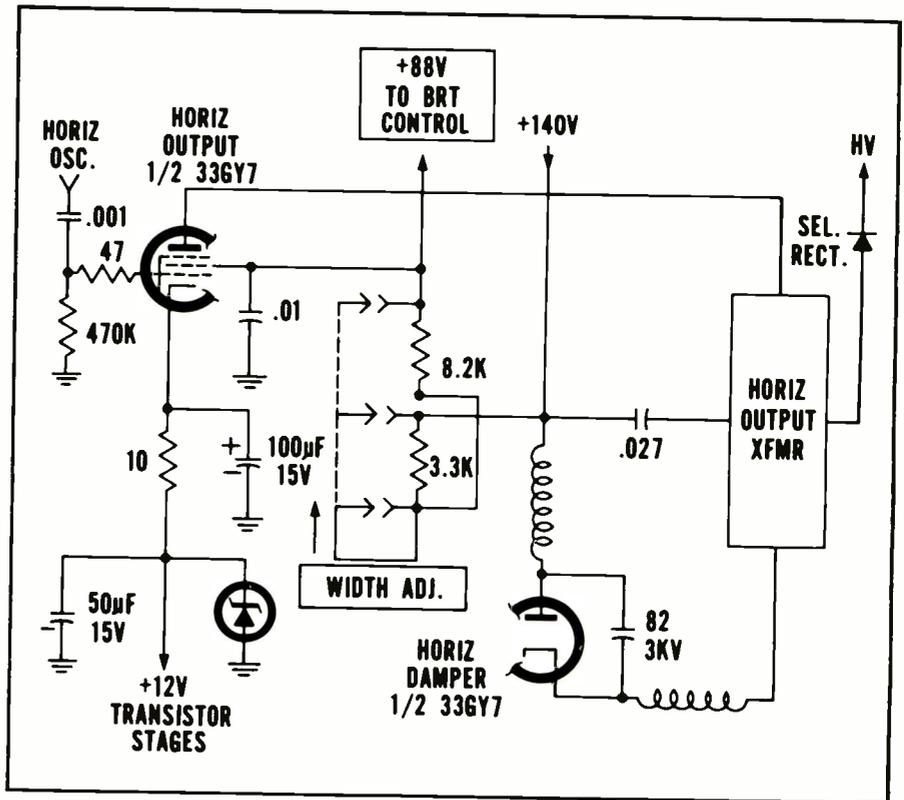


Fig. 2--The deflection circuitry of the RCA KCS176 and KCS177 chassis is similar with minor component changes to drive the large or small CRT. The basic circuitry is similar to the KCS169 chassis.

The picture detector circuit, low-level video driver stage and part of the AGC system are also located on the pix module. These circuits are similar to those used in the KCS169.

The video output stage, sync and AGC keyer circuits are located on the plug-in "video module." Except for the plug-in fea-

ture, the circuitry in this area is similar to that of the KCS169 chassis.

One difference between the KCS176 and KCS177 is in the voltage divider network that couples the video output stage to the cathode of the picture tube. Because the larger 12DFP4 picture tube requires different

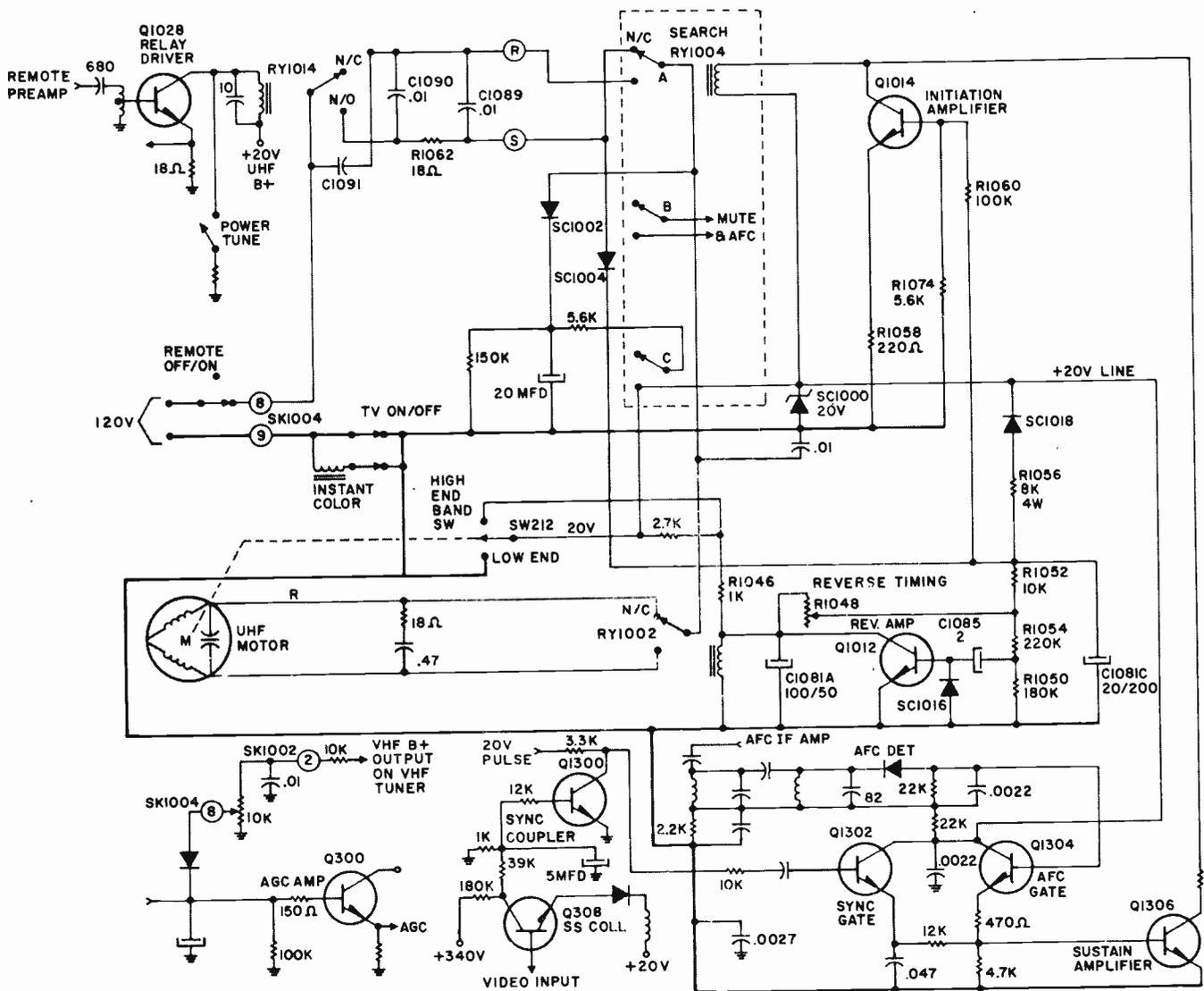


Fig. 3--Sylvania's UHF search tune circuit.

bias conditions, changes in the brightness control circuitry are necessary.

The deflection circuitry of the KCS176 and KCS177 are similar with minor component changes to drive either the small or large picture tube. The basic circuitry of both chassis follows the KSC169 design.

The horizontal oscillator and discharge tube is an 8FQ7/8CG7. The horizontal output and damper functions are combined in a 33GY7 dual-purpose tube. The high-voltage rectifier is a selenium "stick" assembly which includes the 2nd anode connector. This component is identical to the unit first used, in the

KCS169 chassis. (See Fig. 2.)

The KCS176 and KCS177 are "low B+ chassis." All tube circuitry in these chassis (horizontal deflection, vertical deflection and audio output) operate from a 140v supply derived from a half-wave rectifier and filter system. The transistor circuitry on the plug-in modules operates from

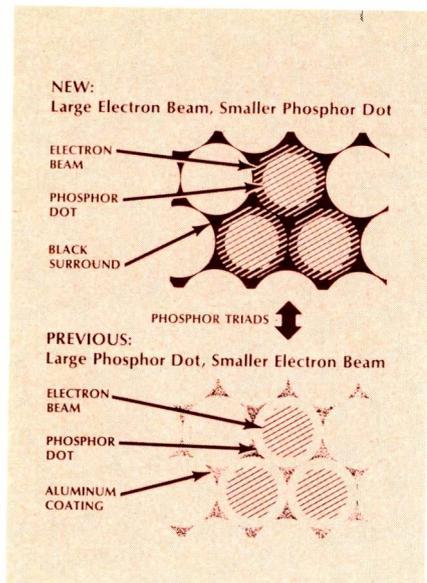


Fig. 4—Zenith's Chromacolor picture tube employs smaller color phosphors and surrounds them with jet-black material which absorbs ambient room light to improve contrast.

12v. This 12v supply is one area in which there is a significant difference between the two chassis.

The KCS 177 derives its 12v supply through a bleeder from the 140v line. This is accomplished by connecting a 15K (15w) resistor and a 12v zener diode.

The KCS176 chassis uses the 33GY7 horizontal output tube as the "dropping resistor" from 140v. The smaller picture tube requires less power from the horizontal deflection circuits, thus the output tube can be used for this application. The cathode of the horizontal output tube in the KCS176 (normally returned directly to ground) is connected through a 10Ω decoupling resistor to a 12v zener diode and the voltage at this point is a stable 12v. The cathode of the horizontal output stage is a signal grounded by a 100μf capacitor.

The circuit arrangement has an interesting feature: as the 12v supply is derived from the horizontal output stage (furnishes power for all low-level stages), it is possible for the receiver to be completely inoperative with failure of the horizontal output tube. The service technician would be wise when encountering a "dead" KCS176 chassis to check

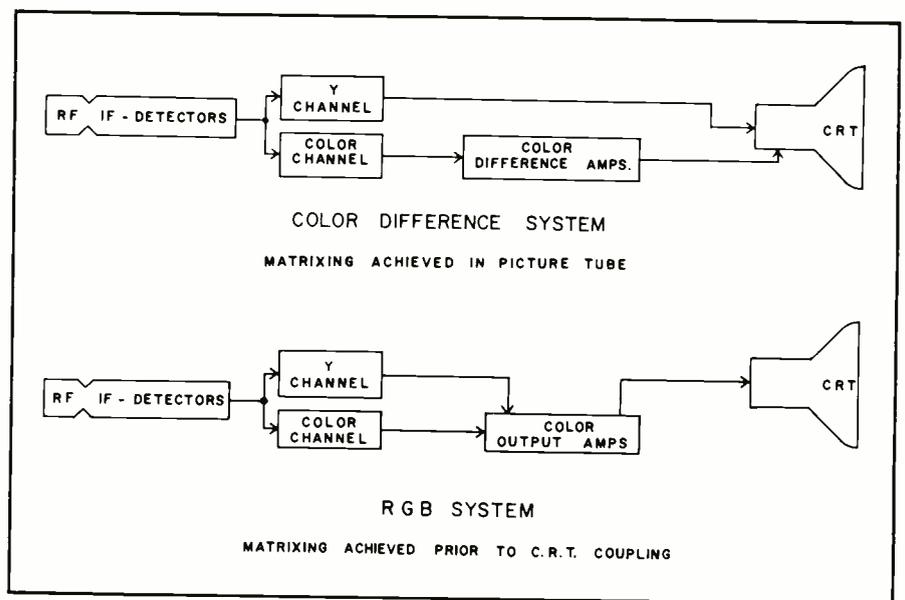


Fig. 5—A block diagram showing a simplified comparison between Zenith's RGB system and the previous color difference systems.

first for 12v at the cathode of the zener diode.

Filament power for the three series-connected tubes (plus picture tube) is supplied by a half-wave rectifier circuit similar to that used in the KCS169.

The plug-in module represents a significant advance in chassis design. It is possible, by placing a large part of the circuitry on plug-in boards, to construct a smaller "main" circuit board, and consequently a smaller cabinet than has been possible with past chassis designs.

The 1970 "M" line of color television receivers employs the familiar CTC22, CTC27X, CTC36 and CTC38 chassis that were reintroduced in March of this year. Many additional color models will use the solid-state CTC40 chassis featuring the tilt-out customer control panel first introduced on this year's CTC38 chassis.

SYLVANIA

Sylvania's color television line includes a new Instant-Color feature and a chair-side control unit for remote tuning of UHF and VHF bands.

The Instant-Color feature reportedly assures a picture within five seconds and uses less stand-

by power by employing solid-state devices.

The solid-state control unit includes a button which permits the viewer to search up or down the 82 channels on the ultra high frequency band for active stations. The control also includes buttons for on/off, volume, VHF channel selection, color tint and color level.

The bi-directional search feature is obtained by using a time sensing circuit Q1012, SC1016, C1085, SC1004, R1052, R1054, R1050, in the remote chassis. (Fig. 3)

Actuating the UHF transmitter or power tune button for half a second or less initiates search in the high channel direction, one second or longer toward lower channels. No action takes place until the button is released.

The UHF function transmitter generates the proper frequency to produce an output from the UHF detector circuit, energizing RY1014 relay. This relay feeds 120vac to rectifier SC1004. The rectified dc in conjunction with a 20v Zener regulator energizes the search initiation amplifier Q1014 and relay RY1004.

The rectified dc is also fed through a timing circuit R1048, R1054, C1085 to the reverse amplifier

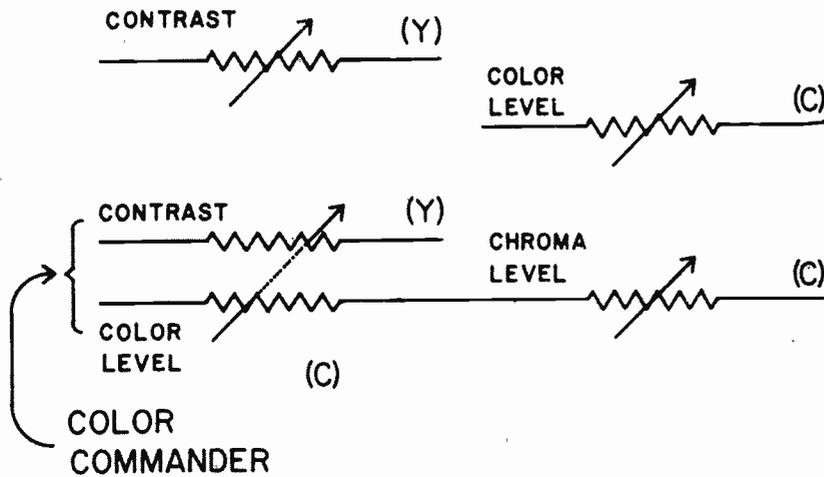


Fig. 6—The color Commander control employed in Zenith's 12A12C52 chassis permits color level tracking with contrast level by using a ganged CONTRAST and COLOR LEVEL control.

Q1012. The time constant is adjusted for about 3/4 of a second delay before the reverse relay closes providing the means for directional control.

The search direction is established by the length of time the UHF detector Q1028 is energized. The UHF detector relay RY1014 is de-energized by releasing the button; its contacts close providing power to a second 20v rectifier SC1002 and the tuner drive motor. The search relay R1004 closed contacts activate the search function.

Opening the detector relay RY1014 removes power from the 120v rectifier and the base circuit of the search initiation amplifier Q1014. However, the discharge of C1091C through R1074, R1060 is long and will hold the search amplifier Q1014 in conduction until the motor moves the tuner off the station.

When there is no sync or carrier signals existing at the second detector, the search sustaining amplifier Q1306 turns on keeping the search relay RY1004 closed and tuner motor energized. (Fig. 3.)

The search sustaining amplifier Q1306 is controlled by two parallel switching amplifiers; Q1304 the AFC gate and Q1302

the sync gate. Conduction by either or both is sufficient to sustain the search function.

Q1304 AFC gate switching amplifier is controlled by the carrier detector, shutting off the sustaining amplifier Q1306 when a carrier is present. The sync gate switching amplifier Q1302 is controlled by a sync detector Q1300 operating from the collector of the sync separator Q308 in the TV chassis. When sync is present, it is switched off. Since both sync and carrier are necessary to switch off Q1306 and open the search relay contacts, the system ignores spurious carriers and sound carriers, stopping only when picture carrier sync information is present.

Switch SW512 is electrically located at each end of the UHF dial, at the high end of the dial the switch increases the B+ on the search relay pulling it in, reversing the search function. At the low end of the band, the switch shorts out the 20v supply, opening the search relay RY1004 and stopping the search function. To initiate search again, the transmitter or power tune button is activated.

A sense control R1072 is adjusted to reduce the sensitivity of the receiver on UHF allowing the

search system to bypass undesired image and spurious signals. This control is important in areas where the signals are very strong. The search system has difficulty leaving a strong signal because its energy is present in the adjacent channels. The sensitivity is reduced placing an adjustable fixed bias on the AGC bus to the UHF B+.

One set of contacts on the search relay provides sound muting and AFC override during search. The sound muting is accomplished by increasing the impedance in the B+ source for the sound IC to a point where the IC becomes inoperative by the active dropping impedance Q1308.

The override of the AFC is done by switching on a pair of clamping transistors, Q1310 and Q1312, establishing a fixed manual bias for the tuner at low impedance overriding the output from the AFC amplifier.

Without AFC override, the search system tends to stop too soon and the UHF AFC may not pull the oscillator in as desired.

The 47 television models, eight home entertainment centers and two color slide theaters employ Sylvania's Color Bright 85 picture tube and the Gilbralter color chassis is featured in most of the large screen sets.

ZENITH

Zenith's line of color TV sets offer a choice of five rectangular screen sizes in the following basic models: 23in. diagonal—four table models, 26 consoles and four console combinations; 20in. diagonal—four table models and one console; 18in. diagonal—three table models; 16in. diagonal—two portables; 14in. diagonal—two portables.

The new Chromacolor picture tube reportedly delivers a picture twice as bright and with more than 25 percent greater contrast as compared with previous 23in. diagonal color TV tubes. This is accomplished by employing smaller color phosphor dots and surrounding the dots with jet-black material which absorbs ambient room light to

improve picture contrast, permitting use of higher-transmission glass in the tube face. In the Chromacolor CRT, the electron beams striking the TV screen are larger than the phosphor dots as shown in illustration.

The 12A12C52 color TV chassis incorporates several new circuit features while retaining circuits similar to the previous chassis. This chassis employs a new "plug-in" module (dura-module) containing the circuitry of the 2nd color amplifier and integrated circuit (IC) demodulator.

An interesting feature of this chassis is contained in the circuitry involving color and Y signal matrixing (adding). The monochrome video (Y) signal is matrixed with the (R-Y), (G-Y) and (B-Y) color difference signals prior to coupling to the picture tube. The signal voltages coupled to the picture tube which represent R,G and B color eliminate matrixing in the picture tube. This circuit design is called the RGB system.

In the RGB system, the R,G and B signal voltages are coupled

to the R,G and B cathodes of the picture tube respectively. The control grids of the picture tube are at fixed dc potentials.

The (Y) signal is matrixed with the color difference signals of (R-Y), (G-Y) and (B-Y) in the color amplifier stages.

In the color difference system the Y signal voltage is coupled to the three cathodes of the picture tube and (R-Y), (G-Y) and (B-Y) signal voltages are coupled to the Red, Green and Blue control grids respectively.

The (Y) signal is matrixed with the color difference signals of (R-Y), (G-Y) and (B-Y) in the picture tube gun structure.

The matrixing principle of both systems is shown in Fig. 5.

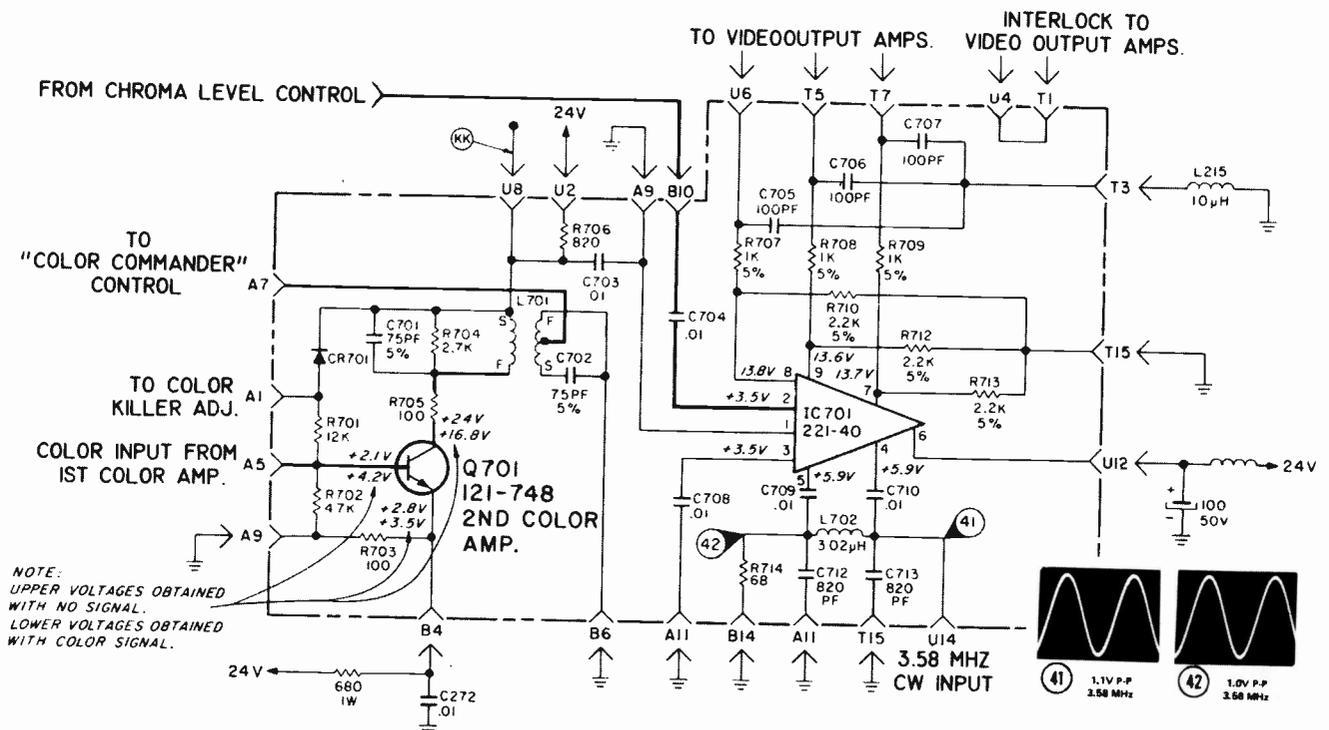
Another feature of this chassis is a "Color Commander" control which permits color level tracking with contrast level. Normally, if it is desired to lower the contrast for a particular program transmission, the color level control must also be lowered for proper "tracking" between the B&W and color information. Since

the "Color Commander" is essentially a contrast control and is ganged with a color level control on this chassis, both contrast and color level are adjusted simultaneously as shown in Fig. 6. On monochrome transmissions, the "Color Commander" control is used for contrast settings. A separate COLOR LEVEL control (Chroma Control) is in series with the "Color Commander" control and permits adjustment for optimum "tracking" between contrast and color level when using the Color Commander control only.

The first color amplifier and color killer circuit are similar in function to the circuit used in the 14A9C51 chassis. However, the 2nd color amplifier and demodulator circuits are contained on a plug-in module. The module circuitry is shown within the heavy dashed line in the diagram of Fig. 7. Note the points of connections to the module such as U6, T5, A5, etc. These combinations of "letters and numbers" on the schematic correspond to the same

continued on page 95

Fig. 7--Schematic of the 2nd color amplifier and demodulator circuit employed in the Zenith 14A9C51 color chassis.



Rotator Maintenance

In many instances, the best way to handle a defective rotator is to return it to the manufacturer. But if the unit is out of warranty or the customer wants immediate results, a little practical rotator know-how may prevent any possible 'downtime'

■ Suppose you sell a new color TV and tell the customer that his old antenna should also be replaced for best reception. You go out to the job and get ready to put the new antenna in place when the customer suddenly remembers that his rotator hasn't been used in years. Would you please fix it while you're up there? At this point, you quietly kick yourself for not checking the system out beforehand and for not asking "what else needs fixing?"

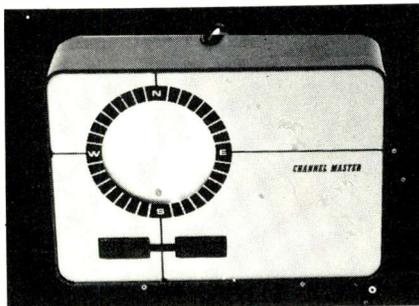
Rotators are electro-mechanical units that can go sour like anything else. Fortunately, they are built to stand the elements and normally operate for years requiring no service at all. But with the increased TV sales, antenna installations, home MATV systems and the like, your chances of selling and servicing more rotators are greater. Rotator manufacturers differ in their respective warranty programs, but most of them prefer to have a defective unit returned for replacement or service. For this reason they do not stress a strong field service program. This does not mean that you cannot do a maintenance job on it—if you know what makes a rotator system tick. The rotator is not going to turn into a confused mass of gears and bolts because you dared to open it. So don't be afraid of it. A certain amount of system knowledge is necessary to provide proper maintenance and that's what this article is all about.

ROTATOR SYSTEMS

Rotators fall into three classes: manual, semi-automatic and automatic. Each has three parts consisting of the control console, inter-connecting cable and the



Alliance Model C-225. Automatic system features selective load circuit for transistor operation of more than one control relay, sequential selection of the on-off circuit and of the directional operation circuit.



Channel Master Model 9513 semi-automatic system uses a three-wire cable and a second motor in the control unit in place of a meter for better synchronization.

RCA Model 10W707 automatic rotator system provides full synchronization with control unit through a balanced bridge circuit with transistor amplifier control.



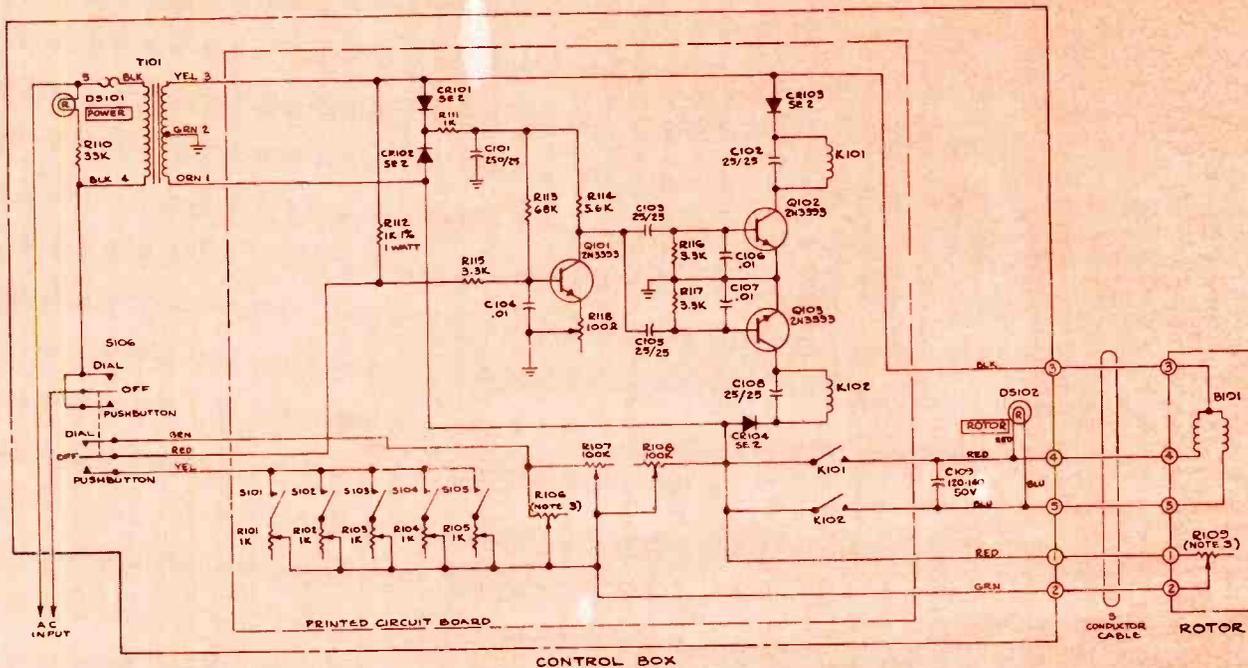
rotator or drive unit. The console, of course, is what the customer uses to select the direction of the antenna. The inter-connecting cable is the four or five wire cable carrying the signal voltages to the antenna drive unit.

In a manual rotator system, a button or switch is depressed on the control unit to move the rotator drive either clockwise or counterclockwise. The antenna is turned only while the button is depressed. The control unit usually has a pointer or indicator light which shows the antenna direction. The control unit in this system is marked to show N-E-S-W direction. The pointer is actually a meter wired across the drive motor windings and calibrated to indicate direction.

Semi-automatic systems are much like manual units in basic operation except that the control console provides a full 360deg compass type indicator for more accurate antenna direction. The fully automatic systems are designed for complete ease of operation. The control console also indicates the full 360deg compass points, but unlike the other systems, it can be preset to any position on the compass and the rotator will turn to that position. When the antenna reaches the preset position, it will stop rotating. This type of system sometimes employs the two motor-driven mechanisms, one in the drive unit and one in the console, which are synchronized for accurate direction control.

These units are normally designed to allow for field synchronization if necessary as explained later in this article.

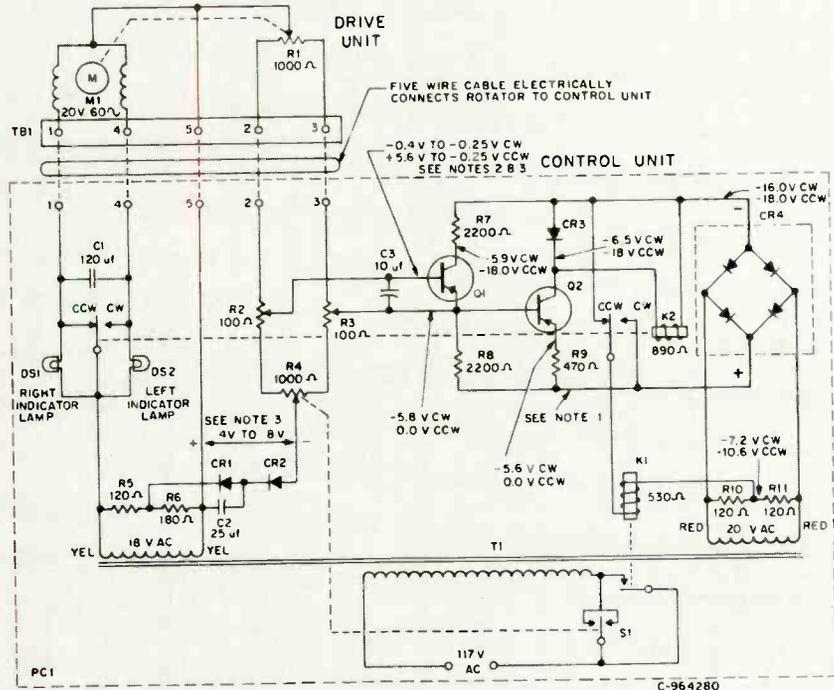
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- NOTES:
1. ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED.
 2. ALL CAPACITORS ARE IN MICRO FARADS.
 3. RESISTORS, R101 THRU R105 ARE $\pm 1\% \pm 20\%$. RESISTORS, R106 & R107 ARE: 1,020 OHMS $\pm 20\%$, 15 OHMS.

Fig. 3--Schematic diagram of the Cornell-Dubilier Model AR33 automatic rotator.

Fig. 4--Schematic diagram of the RCA Model 10W707 rotator system.



- NOTES:
1. REFERENCE FOR ALL VOLTAGE MEASUREMENTS, EXCEPT AS NOTED.
 2. VOLTAGE MEASURED ACROSS C3 WITH EMITTER REFERENCE.
 3. VOLTAGE DEPENDS ON POSITION OF BRIDGE POTENTIOMETERS.

ly come down. Check your local fire ordinances for regulations on this.

ROTATOR-CONSOLE CIRCUITS

The schematic diagrams of several popular rotator systems are shown in Fig. 1 to 4. Let's briefly go through a circuit and see how it works. Referring to Fig. 4, the automatic unit in the schematic can be broken down into four circuits:

1. Motor and balance bridge power supply — includes the power transformer T1, resistors R5 and R6, capacitor C2 and diode rectifiers CR1 and CR2.

2. Transistor and holding relay power supply — includes transformer T1, resistors R10 and R11, and bridge rectifier CR4.

3. Balanced bridge and transistor switching circuits — include resistors R1, R2, R3, R4, R7, R8 and R9; capacitor C3, diode CR3, transistors Q1 and Q2 and relays K1 and K2.

4. Drive motor circuit — includes

the motor windings, starting capacitor C1, relay K2 and indicator lamps DS1 and DS2.

In this unit, when the rotator is not operating, all power to the rotator is off. Moving the control knob to the desired direction causes the main power switch, S1, to close and the balanced bridge to become unbalanced. With power on, holding relay K1 will immediately close allowing power to stay on until the control knob is released. When the bridge is unbalanced in the counter clockwise direction, the transistors are biased off. Relay K2 contacts remain in the CCW (rest) position. When the bridge is unbalanced in a clockwise direction, the transistors are biased on. Relay, K2, is energized and the CW contacts close.

With K1 contacts holding the power on, the motor will rotate in the desired direction. As the motor rotates, potentiometer R1 in the drive unit also rotates. When the motor and R1 have rotated to the desired direction, the bias voltage developed across the bridge will approach -0.25 vdc. At this level, the transistors



Cornell-Dubilier Model AR33. Autorotor automatic system which can be preset to any of five different directions is rated to support a dead weight of 150 lb.

will begin to conduct or stop conducting depending on whether the direction of rotation was counter clockwise or clockwise. In either case, the change in the conducting state of the transistors will cause the contacts of the relay K2 to switch to the opposite contact position. During the "fly-time" of the relay contacts, the dc circuit to the coil of K1 is momentarily opened. The contacts of K1 quickly open, power is turned off and all action stops until the next time the control knob is moved.

ROTATOR TROUBLESHOOTING

Rotator troubleshooting is like any other kind of service pro-

cedure. It involves first checking the system to determine exactly what the symptoms are. Then with a logical, practical application of system know-how, you isolate the defective stage or component. Rotator manufacturers have helped simplify the procedure by providing a list of problems and possible causes in their rotator instructions. The troubleshooting chart here is only a general list of symptoms and causes but it will serve as a guide for the most common types of malfunction. Part two of this series will continue with actual troubleshooting and adjustment procedures of the Alliance, Channel Master, CDR and RCA rotators. ■

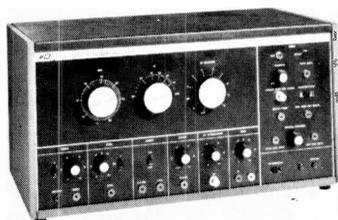
TROUBLESHOOTING CHART

Symptom	Possible Cause
Drive unit will not rotate	AC power cord not plugged in. Open leads in rotator control cable. Rotor cable incorrectly wired. Defective motor windings. Defective power transformer. Control switch contacts. Motor relay defective. Motor starting capacitor open or shorted.
Rotates only in one direction	Rotator cable wiring incorrect or shorted. Defective motor relay. Bridge circuit open on one leg. Check motor power supply rectifiers.
Rotator and control indicator inoperative	Check cable connections. Check control unit connection to 115vac. Check power transformer. Check control circuit switch contacts.
Rotator inoperative but control indicator seems normal	Check control unit for open motor circuit. Check power transformer. Check for motor binding.
Rotator operation normal but control unit indicator does not show antenna position	Check power transformer secondary windings. Check control unit switch contacts.

TEST INSTRUMENTS—PART I

The specifications given in part one of this series reflect the latest in test instruments to give you a better idea of what is available for upgrading your present equipment inventory

ANALYZERS



B&K Model 1077 TV Analyst

■ Designed for analyzing color and black-and-white television receivers with VHF, UHF tube or transistor circuits, this unit is considered by the manufacturer to be primarily a service bench instrument. It also features signal substitution techniques with low impedance outputs for transistor circuits.

Specifications: Input Power, 100w, 117vac, 60Hz; IF Output, 20 to 48MHz, 0 to 70,000 μ v min. at 75 Ω ; VHF Output, channels 2 to 6, 0 to 12,000 μ v min. at 75 Ω , and channels 7 to 13, 0 to 6000 μ v min.; UHF Output, channels 14 to 83, 0 to 1000 μ v min. at 75 Ω ; Video Output, composite signal, 0 to 2.5v P-P min. at 1000 Ω positive or negative polarity; Sync Output, 0 to 50v P-P log variable impedance, 10K at 50v, 1K at 10v positive or negative polarity; 4.5 MHz Output Frequency Modulation by 1kHz audio tone at 25kHz deviation at 180 Ω ; 1kHz output, at least 1v P-P across 300 Ω ; Color Output, crystal control 3,563,795 Hz, 1/2 to 5v P-P, 100 Ω at min. volts, 1000 Ω at max. volts; Bias Power Supply, positive or negative polarity, 0 to 25v into infinite load, 0 to 150mA at 50 Ω ungrounded; Vertical Grid Drive Output, 60Hz, 0 to 15v P-P; Horizontal Grid Drive Output, crystal controlled

15,750Hz \pm 0.5 percent, 150v P-P min.; AGC Keying Pulse Output, 15,750Hz, 400v P-P at 30K; Vertical Plate Drive Output, sufficient to drive all vacuum tube circuit vertical transformers; Horizontal Plate Drive Output, sufficient to drive all vacuum tube circuit flyback transformers; Dimensions, 9 3/4 x 18.6 x 12in. Weight 26 lb. Price, \$379.95 net.



Heath Model IM-48 Audio Analyzer

An audio intermodulation analyzer, this unit combines the functions of an AC-VTVM, wattmeter and IM analyzer for testing monaural or stereo equipment. It includes built-in non-inductive load resistors.

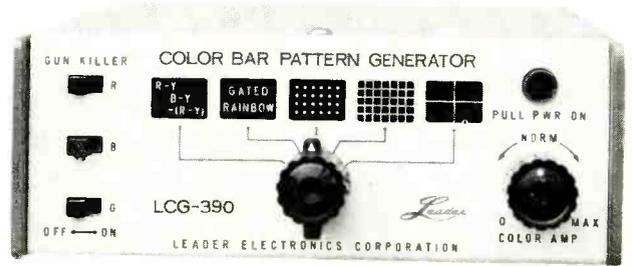
Specifications: Frequency Response, AC-VTVM, -10Hz to 50 kHz \pm 1dB; IM Analyzer High Pass Filter, 2000 to 12,000Hz; IM Analyzer Low Pass Filter, 10 to 600Hz. AC-VTVM Ranges—.01, 03, .1, .3, 1, 3, 10, 30, 100 and 300v rms full scale, dBm ranges, -40, -30, -20, -10, 1, +10, +20, +30, +40 and +50, reads from -65 to +52dBm. Wattmeter Ranges-0.15 μ w, 1.5mw, 15mw, 150mw, 1.5w, 15w and 150w full scale, maximum continuous power is 25w, intermittent power to 50w. IM Analyzer Ranges-1, 3, 10, 30 and 100 percent full scale. Input

Impedance— AC-VTVM-1M, 4, 8, 16 or 600 Ω switch selected, IM Analyzer-1M, 4, 8, 16 or 600 Ω switch selected, Wattmeter 4, 8, 16 or 600 Ω internal load and 10,000 Ω across external load. Output Impedances— low and high frequency—3000 Ω (600 Ω when shunted with 750 Ω resistor). Internal Generator Frequencies— low frequency: 50/60Hz, high frequency: approximately 6kHz. AC-VTVM and wattmeter accuracy within 5 percent of full scale and IM Analyzer within 10 percent of full scale. Power Requirements—105-125 or 210-250v at 50/60Hz, 20w. Dimensions: 13 x 8 1/2 x 7in. Kit price \$69.



Lectrotech Model SCA-300 Sweep Circuit Analyzer

The Model SCA-300 is a TV signal injection troubleshooting instrument specifically designed for transistorized TV receiver vertical and horizontal deflection circuits. The unit allows individual test observations on the TV set's picture tube screen. It will not drive vacuum tube stages. Operating controls include a VERTICAL/HORIZONTAL SELECTOR and an OUTPUT LEVEL control. The unit requires two test leads, one for ground and one for signal injection. Dimensions 6 3/4 x 5 1/4 x 3in. Weight, 3 lb. Price \$39.50. *continued*



COLOR BAR GENERATORS

Mfg.	Model	Operating Channels	RF Output	Video Output	Sync Output
Allied	1. KG-685	3,4,5	10,000 μ v	± 2 vP-P	-2v
B & K	2. 1245	3,4,5	5000 μ v	---	---
Conar	3. 680	2 or 3 as ordered	50,000 μ v into 300'	---	---
EICO	4. 385	3	10,000 μ v	---	---
Heath	5. IG-28	2 - 6	50,000 μ v	+1vP-P	3.5vP-P
Leader	6. LCG-390	5,6	10,000 μ v	---	---
RCA	7. WR-502A	3	10,000 μ v	---	---
Sencore	8. CG19	---	---	---	---



Pattern Capability	Additional Features & Comment	Dimensions (HWD inches)	Price
Color bars, purity tracking and crosshatch; dots	Solid-state, 22 transistors, 8 diodes. Comes with RF cables, polished metal mirror and service light	4 5/8 x 9 5/8 x 12	\$79.95 (Kit)
Color bars, horiz. and vert. lines, crosshatch and dots	Solid-state; 15 transistors, 11 diodes, 1 zener	8 7/8 x 2 7/8 x 8 3/8	\$139.95
Single dot, cross, vert. line and horiz. line; full dot, crosshatch, vert. line, horiz. line and rainbow color patterns	Solid-state, uses 16 IC circuits, plus transistors and diodes. Has 4 crystal controlled osc. AC or bat. operated	10 x 3 x 9	\$89.50 (Kit)
8 color bars, 7 horiz and 8 vert lines, 56 dots	Solid-state, operates from six series connected "C" cells. Will fit into standard tube caddy	8 1/2 x 3 x 8 1/2	\$79.95 (Kit) \$109.95 (Wired)
12 patterns: color bars, shading bars, 3x3 color bars, 3x3 shading dots, crosshatch, 3x3 dot, 3x3 crosshatch, horiz. bars, vert. bars, 3x3 horiz., 3x3 vert.	Solid-state, uses 15J-K flip-flop circuits and gates for count down operation	3 1/2 x 5 1/2 x 8	\$79.95 (Kit) \$114.95 (Wired)
Gated rainbow color bars, crosshatch of 21 vert. and 15 horiz. lines, R-Y, B-Y, and (R-Y) single cross centered on raster	Solid-state, uses modular PC board construction with flip-flop logic circuits. Also has adj. chroma level from 0 to 200 percent	2 1/4 x 5 7/8 x 7 3/4	\$119.50
Color bars with variable chroma level dots, crosshatch, horiz. and vert. lines, blank raster	Solid-state, operates from 4.2v mercury battery, with provision for alternate battery through selector switch	6 1/2 x 7 1/2 x 4	\$148.50
Color bars, crosshatch, dots vert. and horiz. lines	Solid-state, operates from two 5.6v batteries in series. Increased timer range	-----	\$84.50

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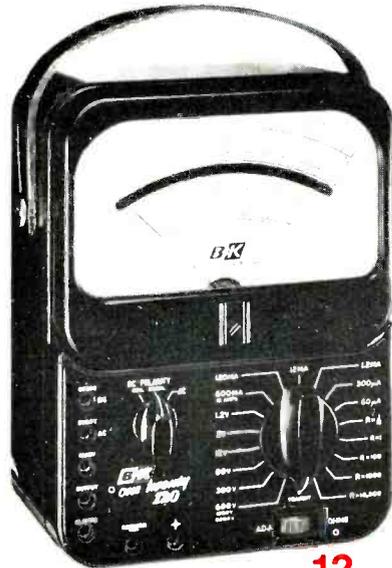
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METERS (VOM/VTVM & FET)

Mfg.	Model	Type	Meter Ranges			
			DC Volts	AC-RMS	AC (P-P)	Resistance
9.	Allied KG-625	VTVM	0-0.5, 1.5, 5, 15, 50, 150, 500, 1500	1.5, 5, 15, 50, 150, 500, 1500	4.2, 14, 42, 140, 420, 1400, 4200	0-1000, 10K, 100K, 1M, 10M, 100M, 1000M
10.	Allied KG-640	VOM	0-8, 1.6, 8, 16, 40, 80, 200, 400	2, 4, 8, 16, 40, 80, 200, 400, 800, 1600, 2000, 4000	-----	0-1000, 10K, 10M
11.	B & K 177	VTVM	0-.5, 1.5, 5, 15, 50, 150, 500, 1500	1.5, 5, 15, 50, 150, 500, 1500	.4, 14, 40, 140, 400, 1400, 4000	0-1000(X1), 10K (X10), 1M (X1000), 100K (X100), 10M (X10K), 100M(X100K), 1000M(X1M)
12.	B & K 120	VOM	0-0.3, 1.2, 3, 12, 60, 300, 600, 1200, 6000	1.2, 3, 12, 60, 300, 600, 1200, 6000	-----	0-200, 2000, 200K, 2M, 20M
13.	Conar 211UK	VTVM	3, 12, 30, 120, 300, 1200	3, 12, 30, 120, 300, 1200	3, 12, 30, 120, 300, 3200	RX1, X10, X1K, X10K, X100K, X1M



11.



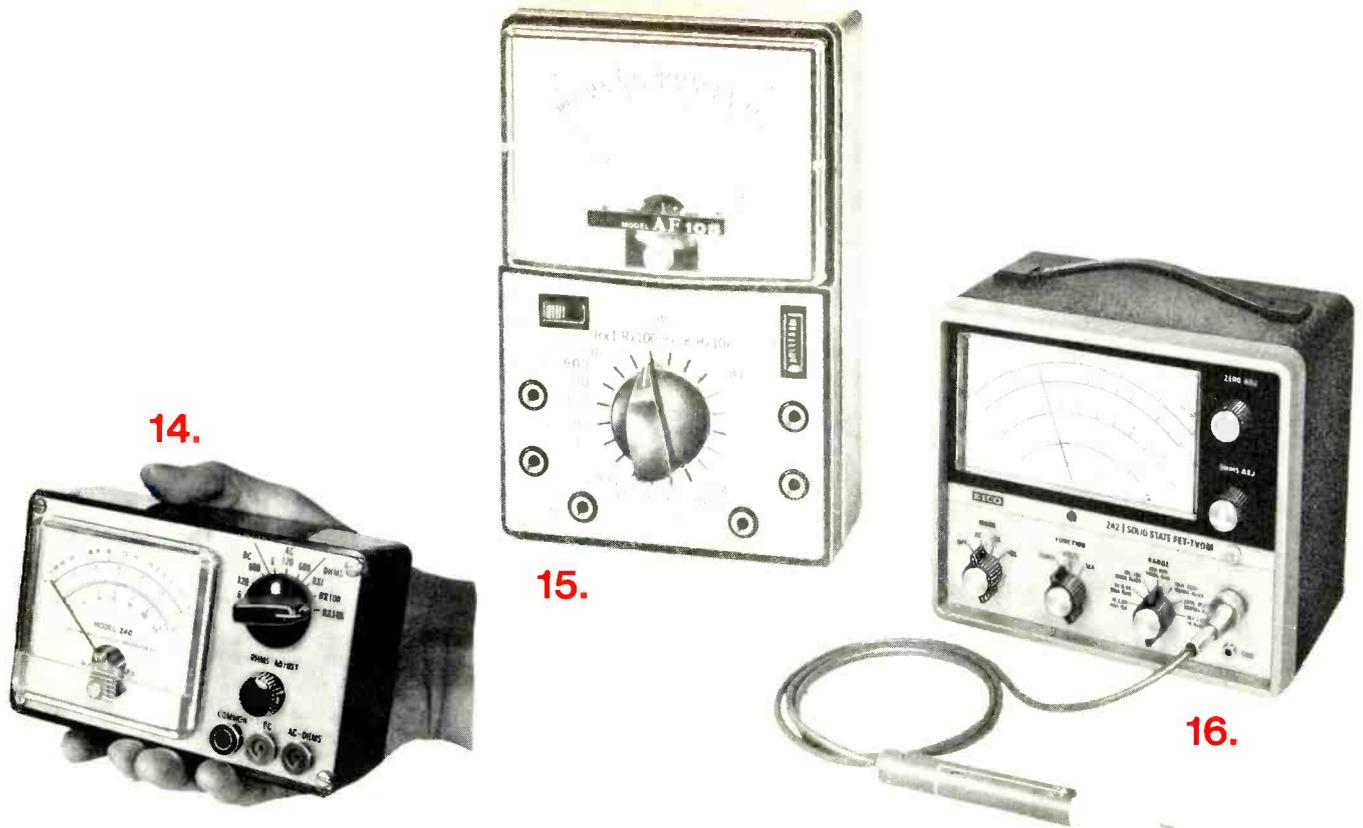
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DC Current	Decibels	Additional Comments	Price
-----	-----	Comes with battery and test probe	\$39.95 (Kit)
0-80, 160, 400, 800 μ a, 8, 16, 200, 400 ma, 8, 16a	- 12 to + 74 on 12 ranges	Has 0.8vdc range for transistor work. Comes with batteries and test leads	\$39.95 (Kit)
-----	- 6 to + 16, + 4 to + 26, + 14 to + 36, + 24 to + 46, + 34 to + 56, + 44 to + 66	Has 0.5vdc range for transistor work. No battery is needed for resistance readings	-----
0-60, 300 μ a, 1.2, 12, 120, 600 ma, 12a	- 20 to + 77 on 8 ranges	59 ac and dc ranges read on mirrored scale. DC polarity reverse switch. DC scale as low as .005v/div	-----
-----	-----	Restyled version of Model W-VTVM. Two test leads for all tests. Optional HV probe.	\$29.95 (Kit)

continued



METERS (VOM/VTVM & FET) *continued*

Mfg.	Model	Type	Meter Ranges			
			DC Volts	AC-RMS	AC (P-P)	Resistance
Conar 14.	240UK	VOM	3,120,600, 30kv with HV probe	6,120,600	-----	0-1000,100K 10M
Comp. Spec. 15.	AF-105	VOM	0-0.3,3,12, 60,120,300, 600,1200	6,30,120, 300,600, 1200	-----	0-10K, 1M, 10M, 100M
EICO 16.	242	FET- VOM	0-1,3,10,30, 100,300,1000	1,3,10,30, 100,300, 1000	2.8,8.5,28, 85,280,850, 2800	0.2 to 1000M 7 ranges
Heath 17.	IM-28	VTVM	0-1.5,5,15, 50,150,500, 1500	1.5,5,15, 50,150, 500,1500	-----	10Ω scale center X1, X10,X100, X1000,X10K, X100K,X1M
Heath 18.	IM-25	VOM	.15,.5,1.5, 5,15,50,150, 500,1500	0-.15,.5, 1.5,15,50, 150,500, 1500	-----	10Ω scale center X1, X10,X100, X1000,X10K, X100K,X1M
Leader 19.	LV-76A	VTVM	1.5,5,15, 50,150,500, 1500	1.5,5,15, 50,150, 500,1500	4.2,14,42, 140,420, 1400,4200	10,100,1K, 10K,100K, 1M,10M
Leader 20.	LV-77	FET VOM	0.5,1.5,5, 15,50,150, 500,1500	1.5,5,15, 50,150, 500,1500	4.2,14,42, 140,420, 1400,4200	Midscale: 10,100,1K, 10K,100K, 1M,10M



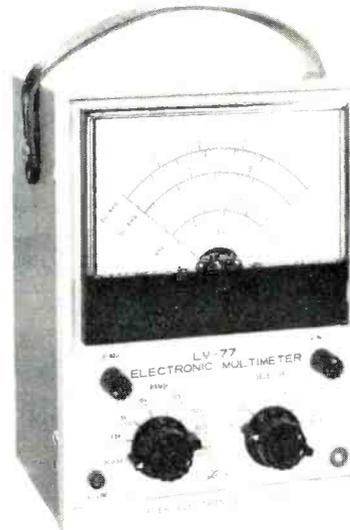
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DC Current	Decibels	Additional Comments	Price
-----	-----	Operates from two 1.5v batteries. (Included)	\$19.95 (Kit)
0-3 μ a,6ma, 60ma,300ma, 12a	-20 to +77	Will read to 30,000v with accessory HV. Probe. Also has .3vdc range for transistor work	\$44.95
0-1,3,10, 30,100, 300,1000ma	-----	Has ac current ranges same as ac RMS volts. Also accessory probe to read HV to 30,000vdc. Operates ac or dc on 3-9v batteries and 1-1.5v battery	\$59.95 (Kit)
-----	-----	The 1.5 and 5vac ranges are read on separate scales	\$39.95 (Kit)
0-.015,.05, .15,.5,1.5, 5,15,50,150, 500,1500ma	-----	ac current range same as dc combination probe included	\$85 (Kit)
-----	- 10 to + 66	One probe switchable for ac or dc. AC range usable to 4MHz	\$54
-----	- 10 to + 16	Frequency response is 25Hz to 1MHz	\$89.50

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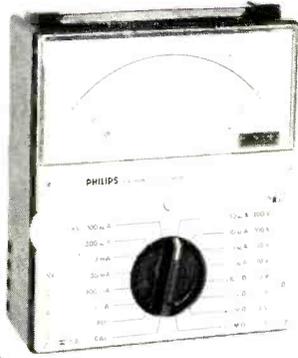
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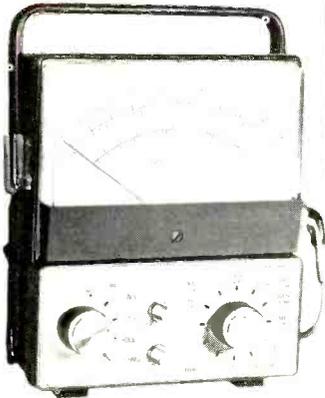
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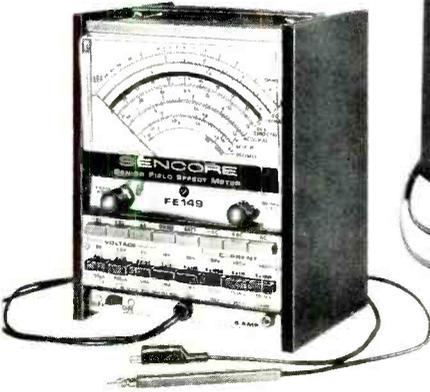
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METERS (VOM/VTVM & FET) continued

Mfg.	Model	Type	Meter Ranges			
			DC Volts	AC-RMS	AC (P-P)	Resistance
21. Mercury	4000	VTVM	0.3,1,3,10, 30,100,300, 1000	1,3,10,30, 100,300, 1000	-----	10 Ω center X1,X10,X100, X1000,X10K, X100K
22. Phillips	PM2400	VOM	0.1,0.3,1,3, 10,30,100,300, 1000	0.1,0.3,1,3, 10,30,100, 300,1000	-----	20,2K,200K,2M Midscale
23. RCA	WV-98C	VTVM	.5,1.5,5,15, 50,150,500, 1500	1.5,5,15, 50,150, 500,1500	4,14,42, 140,420, 1400,4200	Seven ranges to 1000M
24. RCA	WV-500B	VOM	.5,1.5,5,15, 50,150,500, 1500	1.5,5,15, 50,150, 500,1500	14,42,140, 420,1400, 4200	Seven ranges to 1000M
25. Sencore	FE149	FET	.5,1.5,5,15, 50,150,500, 1500	.5,1.5,5, 15,50,150, 500,1500	1.4,4.5, 14,45, 140,450, 1400,4500	600,6000,60K, 600K,6M,60M, 600M,6000M
26. Sencore	FE14	FET VOM	1,3,10,30,100 300,1000	1,3,10,30, 100,300, 1000	2.8,8.4, 28,84, 280,840, 2800	1000,10K,100K, 1000M
27. Weston	80(type R)	VOM	0.25,1,2.5, 10,25,100, 250,1000, 2500	2.5,10,50, 250,500, 1000,5000	-----	2K to 20M FS 20 to 200K center scale
28. Weston	980	VOM	1.6,8,40,160 400,800,4000	1.6,8,40, 160,400, 1600	-----	Five ranges from 1K to 10M FS, 25K to 250K center scale

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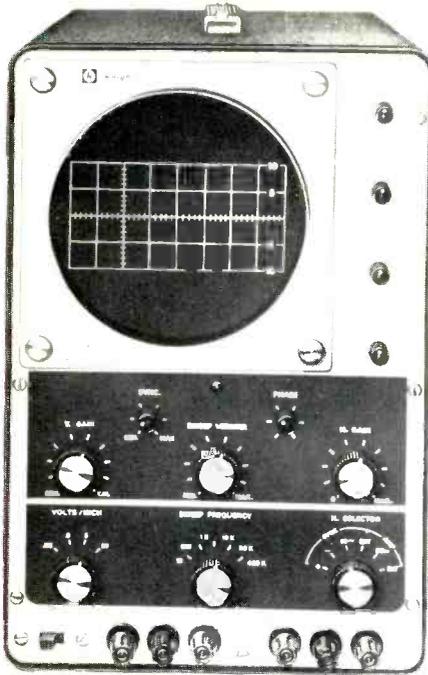
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DC Current	Decibels	Additional Comments	Price
0.3, 1, 10, 100, 1000ma	-----	Solid-state unit for ac or dc operation	\$79.95
ac and dc ranges: 1, 3, 10, 30, 100, 300ma; 3a	-----	Battery-operated—allows automatic ac-dc measurements. Has built-in calibration facility	NA
-----		dc/ac-ohms probe included with unit, also battery and instructions	\$88.50
0- .5, 1.5, 5, 15, 50, 150, 500, 1500ma		Uses 3-9v batteries and 1-1.5v "C" cell. Comes with batteries, probe and instructions	\$79
0 - 150, 500 μ a, 1.5, 5, 15, 50, 150, 500ma; 5a	-10, 0, +10, 20, 30, 40, 50, 60	Has 15M input on ac and dc. Power requirements are 1-1.5v "D" cell and 1-9.6v battery (not furnished)	\$149.50
100 μ a; 1, 10, 100ma; 1a	-----	Frequency response to 10MHz—also has a zero center scale of 1/2v	\$69.95
50 μ a; 1, 10, 100ma; 1, 10amps	- 10 to + 10	Multirange VOM fits standard 19in. rack mount. Reg. Model 80 (not type R) is available in portable case	NA
80 μ a; 1.6, 8, 80, 800ma; 8a	- 15 to + 54 in six ranges	Spring back jewels for maximum shock resistance	NA

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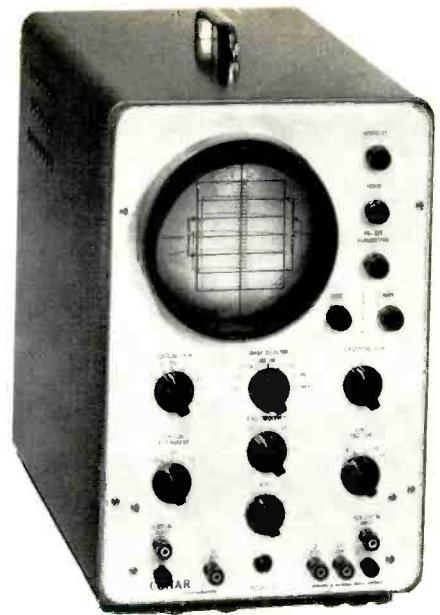
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OSCILLOSCOPES & VECTORSCOPES

Mfg.	Model	Vertical				Horizontal		
		Sens.	Response	RiseTime	Imped.	Sens	Response	Imped
29.	Allied KG-635 5in.	17mv RMS/in.	±1.5dB, dc to 5.2MHz	70μsec	3M shunted by 35pf	0.6v RMS/in.	1.5dB, 1Hz to 400kHz	7M shunted by 25pf
30.	B & K 1450 5in. diag. scope	25mv RMS/in.	5Hz to 4.5MHz (±1.0dB), -3dB at 5.5MHz	120μsec max.	3M shunted by 47pf	15v RMS/in. or better	2Hz to 750kHz ±3dB	5.0M shunted by 30pf
31.	Conar 250 5in.	.023v RMS /in.	13Hz to 2.5 MHz, down .05dB, at 11Hz, down 1.5dB at 3.58MHz, down 3.5dB at 4.5MHz	-----	-----	1.0v RMS	20Hz to 90kHz	-----
32.	EICO 465 5in. scope/ vector- scope	-----	-----	-----	-----	-----	-----	-----
33.	Heath 10-18 5in.	70mv P-P/in. at 1kHz	±1dB, 8Hz to 2.5MHz; ±1.5 to -5dB 3Hz to 5MHz. -2.2dB at 3.58MHz	0.08μsec or less	2.7M at X1, 3.3M at X10 & X100	0.85v P-P/in. at 1kHz	±1dB, 1Hz to 200kHz; ±3dB, 1Hz to 400kHz	4.9M at 1kHz
34.	Jackson CRO-3 5in.	.018v RMS/in.	±1 db, 20Hz to 5MHz	-----	-----	-----	-----	-----

32.



33.



34.

Time Base Ranges	Sync	Comments	Price
10-100Hz, 100-100Hz, 1-10kHz, 10-90kHz, 90-400kHz	Internal (+) or (-) 60Hz, ext.	Graticule scale has X and Y linear grids for easy measurement. Probes are available as accessories	\$119.95 (Kit)
5Hz to 500kHz	Auto, int. (+) or (-) line, ext	Features intermittent analyzer with adjustable triggering sensitivity. Freq. resp. 20Hz to greater than 5MHz. Probes supplied	\$279.95
10Hz to 500kHz	Int. (+),(-) Ext. line	Wideband unit contains built-in fly-back tester and two-stage retrace blanking. Accessory probes available	\$99.90 (Kit)
-----	-----	-----	\$179.95 (Kit)
10Hz to 500Hz in 5 steps, variable plus 2 selected preset frequencies	Auto lock- in	Features automatic lock-in with a self-limiting synchronizing cathode follower	\$92.50 (Kit)
20Hz to 50kHz	(+) or (-) internal	Features include 10vP-P calibrating voltage and direct connection to defl. plates. HV/low cap. probe and demod. probe included	\$254.95

continued

35.



37.



36.



OSCILLOSCOPES & VECTORSCOPES *continued*

Mfg.	Model	Vertical				Horizontal		
		Sens.	Response	RiseTime	Imped.	Sens	Response	Imped
Leader 35.	LBO-53B 5in.	10mv,P-P/ cm or better	DC to 10MHz at -3dB;2Hz to 10MHz at -3dB (ac- coupled)	----	----	300mv, P-P/cm or better	DC to 500kHz at -3dB, 2Hz to 500kHz at -3dB	----
Lectro- tech 36.	TO-50 5in. scope/ vector- scope	.02v/div. to 50v/div in 2-5 step seq.	DC to 10MHz min.	35 μ sec	1M shunted by 30pf	.5v/div	DC to .5MHz	----
Mercury 37.	3000 5in. scope/ vector- scope	4.6mV RMS/cm	10Hz to 5MHz \pm 3dB	0.08 μ sec	-----	-----	5Hz to 500kHz \pm 3dB	3.2M shunted by 20pf
Phillips 38.	PM3200 4in.	24 div	DC to 10MHz (-3dB); 2Hz to 10MHz (-3dB) (ac- coupled)	35 μ sec	1M shunted by 30pf	-----	10Hz to .1MHz (-3dB)	.1M shunted by 25pf
RCA 39.	WO-91C 5in. Dual Band	.053v RMS; .15vP-P Wide Band .018v RMS; .05vP-P High sens	Wideband 10Hz to 4.5MHz, +1dB Narrow 10Hz to .5MHz -1dB 10Hz to 1.5MHz-6dB	0.1 μ sec (4.5MHz) 0.5 μ sec (1.5MHz)	1M shunted by 40pf	.18v RMS/in.	10Hz to 500MHz -6dB	2.2M shunted by 30pf
Sencore 40.	PS148 5in. scope/ vector- scope	.017v RMS/in.	10Hz to 5.2 \pm 1dB	.055 μ sec	-----	-----	10Hz to 650kHz	----



38.



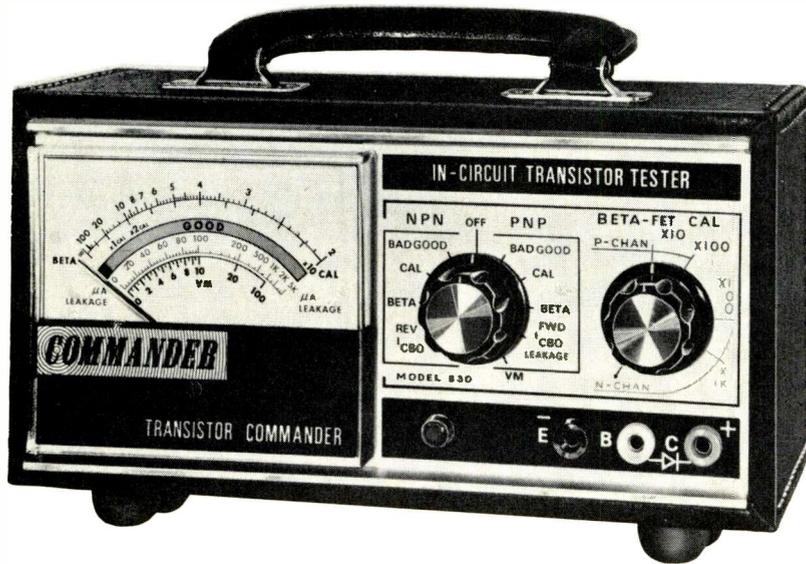
39.



40.

Time Base Ranges	Sync	Comments	Price
1Hz to 200kHz in six steps HTV at 15.75kHz/2	Internal (+) or (-) ext. & line	Solid-state with vacuum tube output stages; also has special inputs to allow use as vectorscope	\$229
.02sec/div to 1 μ sec/div in 1-2 steps seq. w/var. contr. 5X magnifier sweep speed inc. to .2 μ sec/div	Int., ext. or line	All solid-state with calibrated vertical atten. Triggered horizontal sweep and automatic sync mode	\$329.50
5Hz to 500kHz cont	Int., ext. or line	Rear panel inputs for vertical and horizontal defl. plates	\$109.95 (Kit)
Int. sweep- 100 μ sec/div to .5sec/div Time base adj 21 cal- ibrated steps	Int., ext. and line	Unit has optional probes and optional battery pack for dc operation	-----
Cont. 10Hz to 100kHz	Int., ext and line	Choice of wide or narrow band (high sensitivity) selected on panel	\$269
-----	-----	Can be used as wide-band scope or plus vectorscope. Input impedance is 27pf shunted using low-C probe	\$229.50

See Part Two in December with complete list of mfgs.



Commander In-Circuit Transistor Tester Model 830

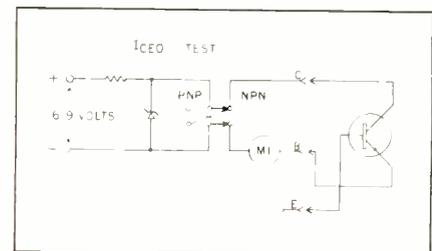
Use the in-circuit transistor
checker to speed servicing
solid-state equipment

■ In the electronic industry we are changing our tube type instrument troubleshooting approach to the hybrid or all solid-state methods and our test instruments are becoming obsolete as new solid-state devices are introduced.

We find some of our transistor testers becoming outdated when we try to test the new Field Effect Transistor (FET).

If you purchased the earlier version of the Model 830 in-circuit transistor tester, a free modification kit is offered to update the instrument to test all transistors including the FET.

An interesting feature is the size, weight and the appearance of the tester. The unit measures 9 1/4 by 5 3/4 by 6 3/8 in. and weighs 3 lb. A luggage-type carrying case is featured with handle and tilt leg for adjusting meter to eye level. A large, 200 μ a Taut band meter and full size control knobs for easy setting of function or bias levels are employed. The meter is color-coded to match switch positions and there is an



Simplified diagram of the dc beta circuit.

integral voltmeter with expanded scale to 100 vdc.

The meter is divided into different scales: (1) Beta (2-100), (2) Beta Cal (IC), (3) leakage current (ICBO and ICEO) (blue in color), (4) dc voltmeter 0-100v (red in color), (5) quality scale (red and green in color).

CIRCUIT DESCRIPTION

The Model 830 measures dc beta of a transistor by applying a pulsating signal between the collector and emitter also between the base and emitter. The ratio of average collector current to average base current as the

transistor conducts current is a measure of the current gain of the transistor and is termed the beta factor of the transistor, or simply beta. The amount of current used in the beta test is adjustable from 0 up to 10ma, by using the BETA CAL control R2. The collector current is set to the desired amount during the CAL BETA TEST position where full scale of X10 is equal to 10ma of current; if a collector current of less than 10ma is needed, the meter is adjusted to that desired level.

When the function switch is set to BETA test, the meter is switched into the base circuit to read the average flow of base current. The beta reading scale is calibrated as to indicate readings in terms of beta rather than current. This enables the operator to obtain an accurate beta measurement of a transistor by multiplying the beta reading by the amount of current that the collector was set to, in CAL hFE test position.

ICBO is the current flow, or leakage, from the collector to the base with the emitter open.

The voltage applied between the collector and base of the transistor is 6 to 9vdc. The meter is connected into the base circuit. Collector-to-base leakage is indicated directly in micro-amperes on the 0-5 μ a leakage scale.

ICEO is the measurement of the leakage current flowing from the collector to the emitter, with base open. A voltage of 6 to 9vdc is applied between the collector and emitter of the transistor; the meter is connected into the emitter circuit. The leakage current is read directly from the leakage scale.

The reading obtained is the product of the collector to base current multiplied by the gain of the transistor.

$$ICEO = ICBO \times (\text{Beta} + 1)$$

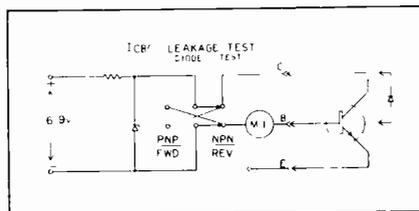
The quality test of transistors is the ability of the transistor to function as an oscillator. This test circuit uses a low frequency Hartley oscillator which has

a link coupled detector circuit in which the meter is connected.

The Model 830 uses two panel jacks for inputs for measuring voltage up to 100vdc. The red or collector jack is marked (+) for the positive voltage input. The black or emitter jack is marked (-) for the negative voltage input.

FETs can be tested in or out of circuit for GM (μ mhos) with this tester. All standard transistors are tested for ac beta.

The transistor tester is easy to use and requires no setup man-



Simplified diagram of the ICBO test.

ual by employing the following method:

1. Connect the test leads as follows: emitter-to-drain, base-to-gate, and collector-to-source of the FET to be tested.

2. Select the NPN beta function for "N" channel FETs and the PNP beta function for "P" channel FETs.

If you are in doubt as to what type the FET is, you may quickly find out by connecting the FET to the tester. In the NPN beta function a "P" channel FET will swing the needle to the left and off scale. In the PNP beta function an "N" channel FET will also swing the needle to the left and off scale.

In addition the needle pointer will swing left and off scale on all FETs with unusually high beta. If this occurs, simply reduce the scale factor setting of the BETA-FET CAL control to obtain an on-scale reading.

3. After the type ("N" or "P" channel) of FET has been determined, set function switch accordingly and read

beta on top scale of the meter.

Multiply beta indication by the scale factor of the BETA FET CAL control for actual Beta.

4. The tester will quickly test all "N" channel FETs and indicate a good-bad condition. Connect leads as instructed in paragraph #1. Set function switch to the NPN BAD-GOOD position and read the red/green scale for FET quality.
5. Dual gate FETs can easily be tested with the Model 830. Simply connect the drain and source leads and check each gate individually while leaving the untested gate disconnected.

SPECIFICATIONS

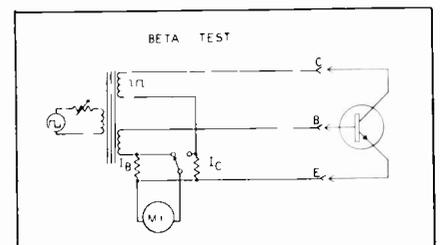
(A) Beta (hFE) Range 1 to 1000 \pm 5%. (B) Collector Current (IC) 0 to 10ma (adjustable). (C) Collector to Base Leakage (ICBO) 0 to 5000 μ a. (D) Collector to Emitter Leakage (ICEO) 0 to 5000 μ a. (E) Quality test for transistors.

DIODE TESTING

(A) In-Circuit check for open or shorted diodes. (B) Out-of-circuit tests for forward-to-reverse current ratio. (C) 10ma limit to protect diodes from accidental damage. (D) Function switch allows forward-to-reverse current measurements without removing diode from tester.

To match transistors and diodes pick transistors or diodes for identical beta and leakage readings. The closer the readings of paired transistors, the better the "match."

Price: \$79.95 ■



Simplified ICEO test circuit.



DEALER SHOWCASE

For additional information on products described in this section, circle the numbers on Reader Service Card. Requests will be handled promptly.

RADIO

Operates on dc or with self-storing cord

Introduced is the Model 2660 six-band portable which offers functional versatility and advanced design features



at a popular price. The radio covers international shortwave, police, fire, U.S. weather, Ham, emergency and business VHF broadcasts, plus the conventional FM and AM bands. Bands tuned: 5-12MHz. Shortwave: 12-24MHz, Shortwave; 30-50MHz, Police/Public Service; 88-108MHz, FM; 147-176MHz, Police/Public Service; 540-1600kHz, AM. Operation is from batteries or 117vac with self-storing cord. A slide-rule dial makes tuning easy and has a momentary-action dial light switch. The fine-tuning control helps separate stations on shortwave and the squelch control silences speaker between calls when monitoring VHF. Switchable Automatic Frequency Control prevents FM drift. A local/distance switch and tone control are other features. The built-in features are a ferrite AM antenna and dual telescoping 27in. FM-SW-VHF antenna. A jack is provided for an external SW antenna for long distance reception. Size is 12 x 16 x 6in. The circuit employs 15 transistors, 8 diodes and 2 rectifiers. Price is \$69.95. Allied.

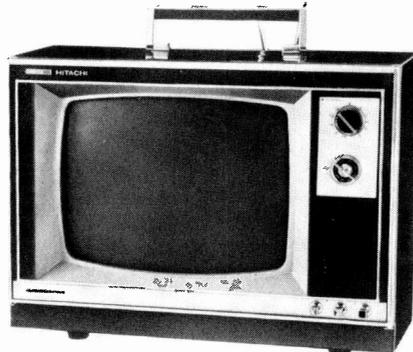
703

tures include: pushbutton channel selectors, solid-state chassis with IC circuits, speaker/mike, mounting bracket, channel nine plug-in crystals and 12v auto cable. The unit is a super-heterodyne receiver with tuned RF stage and three IF stages. Sensitivity is reportedly 0.5 μ v or better. Price is \$69.95. Midland.

PORTABLE COLOR TV RECEIVER

Fully transistorized circuitry

Introduced is a 14in. (diagonal measurement) portable color TV receiver CFA-450 with fully transistorized circuitry for compact size, light weight

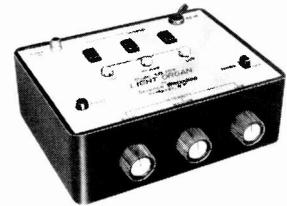


and reliability. The unit measures 20 1/4 x 15 3/4 x 15 1/2in. and weighs 43lb. Fine-tuning is automatic through a memory circuit that adjusts the set to the optimum reception on each channel after an initial setting. Automatic degaussing assures color purity by continuously counteracting residual magnetic flux while the receiver is in use. Regulated power supply prevents shrinking or fluttering of the picture when other appliances are turned on. The television tuner covers the full VHF-TV and UHF-TV bands. There is a built-in telescoping dipole antenna for VHF and a loop antenna for UHF, with provision for the connection of an external antenna. The set also includes instant action. The television is housed in shock-resistant simulated woodgrain cabinet with a built-in carry-handle. An earphone is provided for private listening and controls like the full-size color set is featured. List price \$319.95. Hitachi.

COLOR LIGHT ORGAN 706

Drive nine 150w or 18 75w spot/flood lights

Introduced is the Model L0-104 light organ which translates musical patterns into patterns of throbbing, flash-



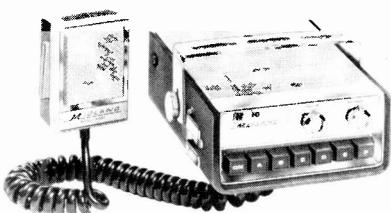
ing lights precisely synchronized to music. High wattage output (500w/channel) provides power sufficient to transform a large room into a total light-sound environment. Three transistorized frequency selective amplifiers divide the audio spectrum into three ranges: low, medium and high. The amplifiers drive high power solid-state switching devices which control the amount of power available at three receptacles mounted on the top panel. Nine 150w or eighteen 75w spot/floodlights can be connected to each unit. Colored bulbs or filters heighten the effect. Plug in your lights, connect to any amplifier output and plug in the ac line cord. There are no other connections to make. Controls include on-off switch and three intensity adjustments. An on-off pilot and three channel indicator lights are provided on the top panel adjacent to the three power receptacles. The channel indicator lights make it easy to remotely control many lights. Specifications: sensitivity—.3v; input impedance—1500 Ω (nominal); power requirement: 110-120vac, 15a max.; power capacity—5a (500w/channel) max.; dimensions—6 3/4 x 6 x 2 3/4in.; weight—approx. 2 lb, 4oz.; price—\$34.95. Science Workshop.

TRANSCEIVER

Solid-state chassis with IC circuits

Introduced is a 5w six channel base mobile transceiver, Model 13-855. Fea-

704



CAPACITORS 707

160C temperature range in aluminum electrolytics

An aluminum electrolytic with a temperature range spanning 160C is introduced. The capacitor line is the newest addition to the growing family of high temperature and broad temperature range aluminum electrolytics. This capacitor features superior temperature stability, low leakage current and long life characteristics. Type UFH

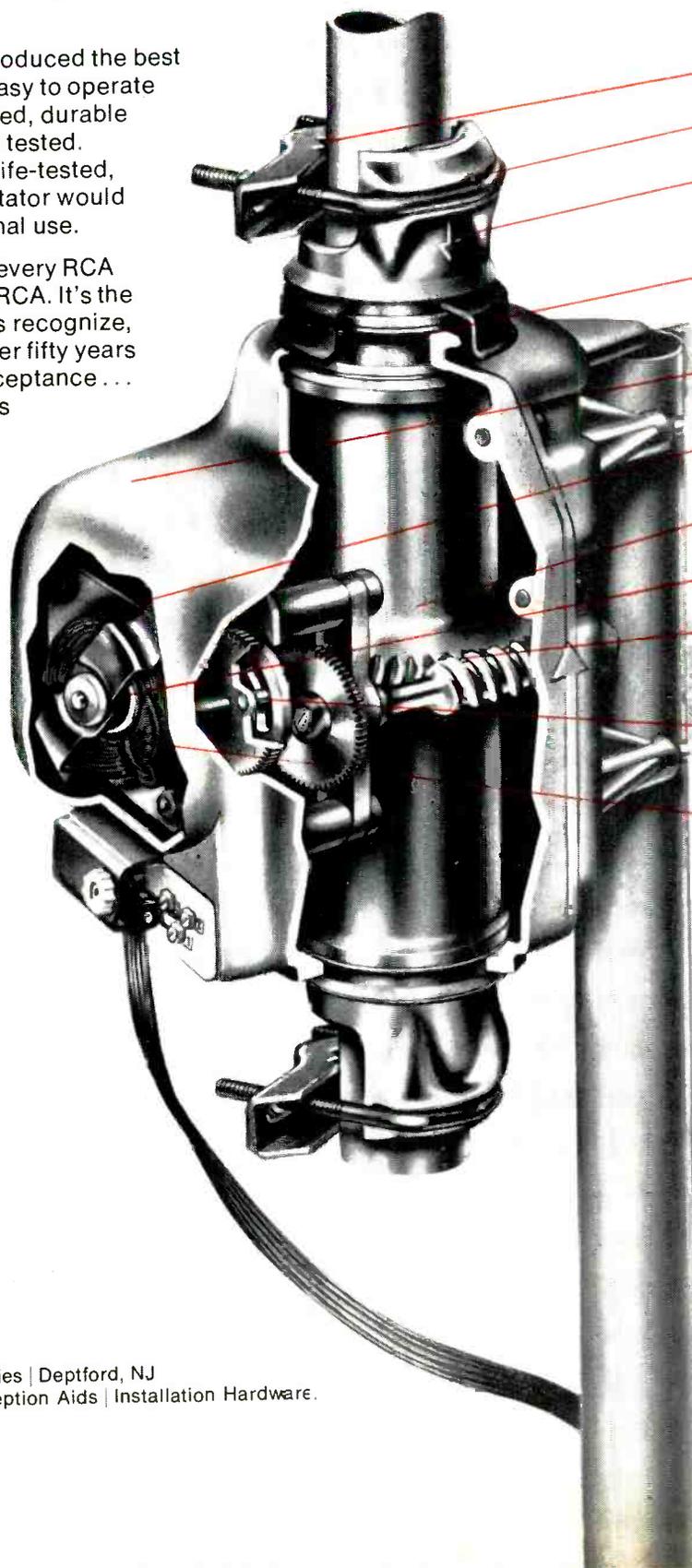
The RCA rotator has many features your customers won't understand. It has one that everyone recognizes: the name, RCA.

RCA engineers have produced the best in rotators. Beautiful, easy to operate control cabinets. Rugged, durable drive units. And they're tested. Continuous operation life-tested, under conditions no rotator would ever encounter in normal use.

The "extra feature" in every RCA rotator is the name . . . RCA. It's the feature your customers recognize, rely upon. It's taken over fifty years to build this kind of acceptance . . . acceptance that means more sales for you.

RCA

Rotators



V-block serrated clamping system locks mast securely.

Reinforced shaft has nested "U" bolt.

Center-position alignment markers speed installation.

Stainless steel bearings are permanently lubricated. No external thrust bearings required.

High-tensile aluminum housing is rugged, lightweight for less inertial loading on mast.

High-temperature insulation on motor allows continuous operation.

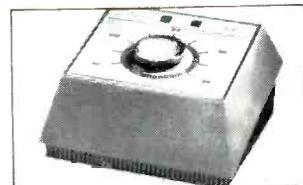
Main drive gear is cast integral to main shaft; can't loosen.

Positive disc brake on motor prevents "overshoot."

Positive worm drive prevents windmilling.

Overtravel clutch permits motor to run before load is engaged—for pre-turning momentum.

High-efficiency motor consumes less power; less voltage drop over long cable runs.



Model 10W707

The RCA fully automatic Rotator has solid state circuitry for positive synchronization. Positive directional indicator lights. Silent operation.



Model 10W505

The RCA positive push-button fingertip control Rotator with 360° indicator dial. Unique design assures precise control with few moving parts. RCA performance and quality at a modest price!

ET/D DEALER SHOWCASE

is ideally suited for applications in communications equipment, computers, power supplies, rapid charge-discharge design and many other critical applications where compactness, lightweight and electrical-mechanical dependability are necessary. These capacitors can also be used to replace banks of etched tantalum foil capacitors at a considerable savings in size, weight and cost. Standard units are available with dual rated voltages from 5 to 150vdcw at



105C, and from 7 to 200vdcw at 85C. Capacitance values are from 190 μ f to 310,000 μ f. All standard units are supplied with a Mylar sleeve. Price is \$2.50 to \$18. Cornell-Dubilier.

AM/FM STEREO RECEIVER

Features electronic protection circuits

708

Announced is the Model 386 AM/FM stereo receiver featuring instant-acting electronic protection circuits and



a regulated power supply. Lights on the front panel indicate reception of AM or FM, stereo or monaural broadcast and also indicate when the receiver is tuned for best reception. A quartz crystal lattice filter is employed reportedly resulting in low distortion and increased selectivity of 40db. The receiver employs an IC-AM front end and an IC multiplex circuit incorporating 31 transistors and 29 resistors. Additional new features include: a line-cord antenna which eliminates the need for an outside antenna except in areas of unusually poor reception; a new muting circuit to cut out noise between FM stations; a new illuminated dial pointer for improved visibility and ease of tuning; and plug-in speaker connectors which eliminate phasing problems. In the technical areas, the receiver employs a silver-plated FET front end. Control features are as follows: dual bass and treble controls; stereo balance control; input selector; tape monitor; speakers #1 on/off; speakers #2 on/off; power on/off; volume control; volume compensation; muting; noise filter; Perfectune automatic tuning indicator; stereo indicator light; AM indicator light; FM indicator light; precision signal strength meter; front panel stereo headphone output; tuning control; stereo/mono mode switch. Specifications: Power (± 1 db) 170w. IHF power specifications (@8 Ω distortion, both channels driven): Dynamic power @ 4 Ω , 67.5w/channel; Continuous power @ 4 Ω , 42w/channel, @ 8 Ω , 35w/channel. Selectivity, 40db; Frequency response ± 1 db, 20-20,000hz; Hum and noise, phono, -65db; Cross modulation rejection, 80db; Usable sensitivity, 1.9 μ v; Tuner stereo separation, 40db; FM IF limiting stages, 9; Capture ratio, 2.5db; Signal to noise ratio, 65db; Phono sensitivity, 3.6mv Scott.

AMPLIFIER

Four 150w power transistor output stage

709

A new solid-state amplifier providing 80w of continuous output is announced. The Model AB-49 is available with an optional isolated 70v line transform-



...Yours When You Reach For Tools By CHANNELLOCK

Whenever you want to hold, cut, strip, drive, grip, bend, pull, twist, straighten, tighten or loosen... man, you need help! The kind of help that not only gets the job done faster now but year after year as well. The kind of help you get only from hand tools by Channellock. Doubt it? Take hold of a Channellock tool.

See and feel the fine-polished drop-forged steel... the precision-machined, smooth-working moving parts... the skillfully hand-honed cutting edges. You'll know then why Channellock is the favorite brand with men who know good tools and won't tolerate less. Men like you.

TOOLS BY
CHAN NEL LOCK
MEADVILLE, PA.

... for more details circle 107 on Reader Service Card

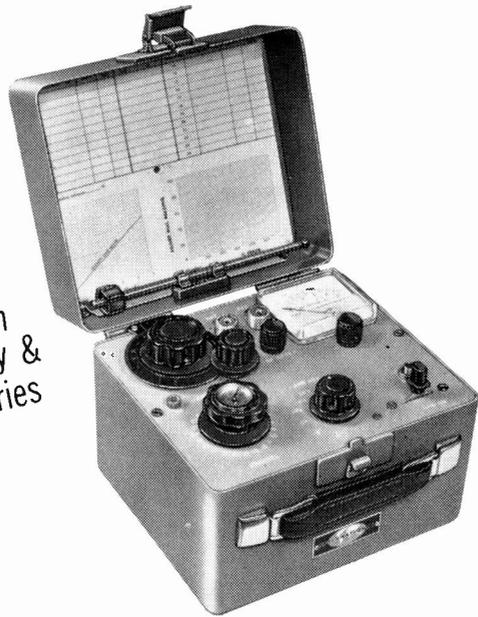
**This car was caught in
a forest fire.
Can you imagine what happened
to the animals?**



Only you can prevent forest fires.



Now With
Solid State Circuitry &
Rechargeable Batteries



ICM FM-2400C frequency meter...

- Completely Portable
- Tests Predetermined Frequencies
25 MHz - 500 MHz

The FM-2400C provides an accurate standard frequency signal for testing and adjustment of mobile transmitters and receivers at predetermined frequencies between 25 and 500 MHz. Up to 24 crystals may be inserted into the meter. The frequencies can be those of the radio frequency channels of operation, and/or of the intermediate frequencies of the receivers between 5 MHz and 40 MHz. Frequency stability (standard) $\pm .001\%$ from $+32^\circ$ to $+122^\circ\text{F}$. Frequency stability with built-in thermometer, calibrated crystals and tempera-

ture corrected charts, $\pm .00025\%$ from $+25^\circ\text{F}$ to $+125^\circ\text{F}$. (.000125% special 450 MHz crystals available)

FM 2400C
(Meter Only) \$445.00
RF Crystals
(with temp. correction)..... \$24.00 ea.
(less temp. correction) 15.00 ea.
IF Crystals.....catalog price

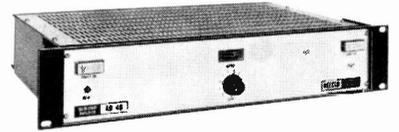
Write for free catalog.



CRYSTAL MFG. CO., INC.
10 NO. LEE • OKLA. CITY, OKLA. 73102

ET/D DEALER SHOWCASE

er for sound distribution and reinforcement systems. The power stage consists of four 150w power transistors in a parallel push-pull configuration,



mounted on an aluminum heat sink with plug-in sockets. A feedback protection circuit measures power dissipation and limits the drive signal to prevent exceeding the rating of the output stage under all signal and load conditions, both transient and steady state. Also featured is a unique locking level control. Melcor.

STEREO AMPLIFIER 710 Damping switch allows speaker matching

Announced is the Model AU555 solid-state integrated stereo amplifier. Featured in the unit is SEPP-ITL-OTL circuitry with an output of 60w music power (IHF), 25w channel RMS power

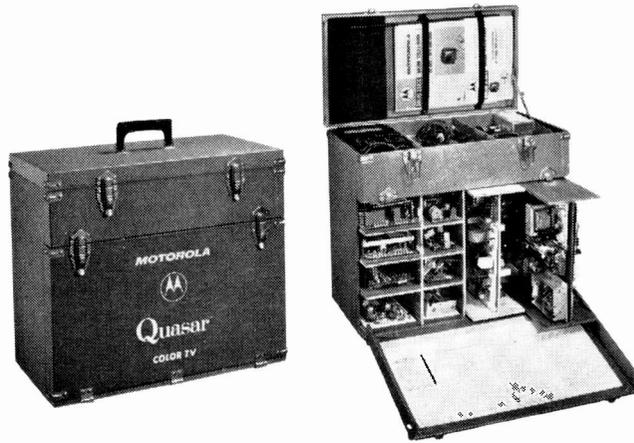


at 4 Ω . The unit adopts a new CE dividing system in which the highest quality silicon transistors are used in the phase reversing circuit reportedly assuring a power bandwidth of 20 to 30,000Hz with less than 0.5 percent harmonic distortion over the entire frequency range. The main amplifier has a frequency response of 20 to 80,000Hz. The preamplifier output has a distortion of less than 0.1 percent at the rated output voltage. The amplifier is equipped with four outputs and seven inputs including: all necessary outputs and inputs for an amplifier; preamp output; tape recording output; two speaker outputs; two phono inputs (47K and 100K); tape head inputs; microphone input plus three auxiliary inputs. The unit has a full control complement including: highly effective CR feed-back low and high filters; loudness control; tape monitor switch which compares the recorded tape with the program source, headphone jack for private listening; muting switch for instant volume suppression; four-position speaker selector switch; and tape recording output. Unit price is \$159.95. Sansui.

... for more details circle 126 on Reader Service Card

What can the works in a drawer mean to you?

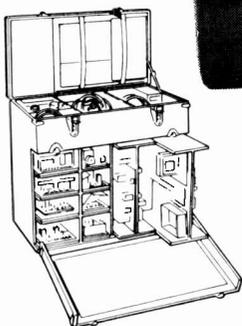
Carry one panel caddy no bigger than a tube caddy



instead of
loading your parts department into a panel truck.



Quasar Color TV's works are plug-in solid-state mini-circuits that fit in a drawer. So, all the at-home replaceable mini-circuits you'll need can be carried in one panel caddy that's no bigger than a tube caddy.



All the reference materials you need to service Quasar Color TV are found in this panel caddy. If you feel you need additional information, call your distributor and he will set up training sessions.

Quasar™ **Color TV**
with the works in a drawer
by MOTOROLA Ⓜ

designed to help the professional be more professional

... for more details circle 132 on Reader Service Card



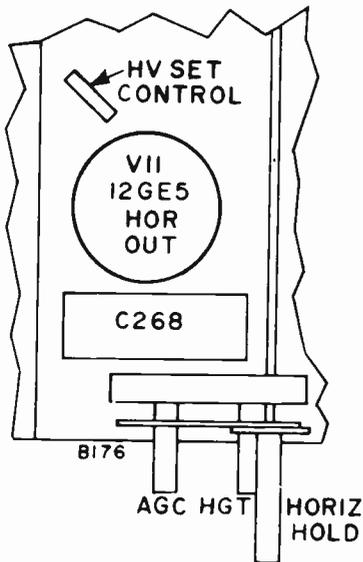
COLORFAX

The material used in this section is selected from information supplied through the cooperation of the respective manufacturers' or their agencies.

GENERAL ELECTRIC

Color TV Chassis H-3 — High Voltage Regulation

In the H-3 chassis series of color television receivers, the high voltage is regulated by controlling the power delivered



to the high voltage transformer. This power is controlled by the horizontal output tube plate current, which, in turn, is controlled by the horizontal output tube control grid bias voltage.

The high voltage regulating circuit monitors a voltage pulse from the high voltage transformer and automatically adjusts the control grid bias voltage according to the amplitude of this pulse.

A voltage dependent resistor (VDR), R272 and capacitor C275 are the principal components of the circuit. The VDR acts as a diode in series with a resistor. When the voltage across the VDR is high (700-1000v), its internal resistance is about 700K. At lower voltages this resistance increases to about 5M. From Pin 6 of the high voltage transformer, a positive going pulse is supplied to the regulation circuit. The amplitude of this pulse varies with the high voltage that is, as high voltage increases, pulse amplitude increases, and vice versa. This pulse, applied to the VDR through C275 and R274, causes the VDR to conduct and C275 becomes charged. Between pulses, C275 discharges through R274 and a parallel network

made up of R265, R270 and R272, R273. The negative voltage developed by this discharge is coupled to the horizontal output tube control grid through R264.

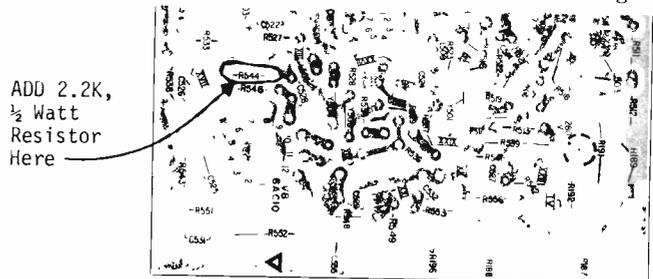
The charge developed across C275 can be increased by either raising the pulse amplitude or reducing the resistance of the VDR. Because of the VDR's characteristics, both of these changes occur at the same time. The result is that larger voltage changes are developed from small pulse amplitude changes than would be the case if the VDR was a simple diode.

Should the pulse amplitude increase (indicating a rise in high voltage), C275 will receive a greater charge, and a more negative bias voltage will be developed and coupled to the control grid. Plate current through the horizontal output tube and the high voltage transformer will be reduced, and the high voltage will return to normal.

The high voltage set control, R273, limits the current flow through the regulation components and limits the charge impressed on C275. The control (shown in diagram) should be adjusted to produce 17.2kv at the CRT second anode when the brightness is at minimum and the receiver is operating with 130vac line input. Increasing the line voltage to 130vac should not cause the second anode voltage to exceed 17.8kv.

Color TV Chassis C-1 — Chroma Noise

A change has been incorporated in late production C-1 chassis receivers to reduce chroma noise in weak signal locations. The value of the matrix resistor, 4R544, has been changed



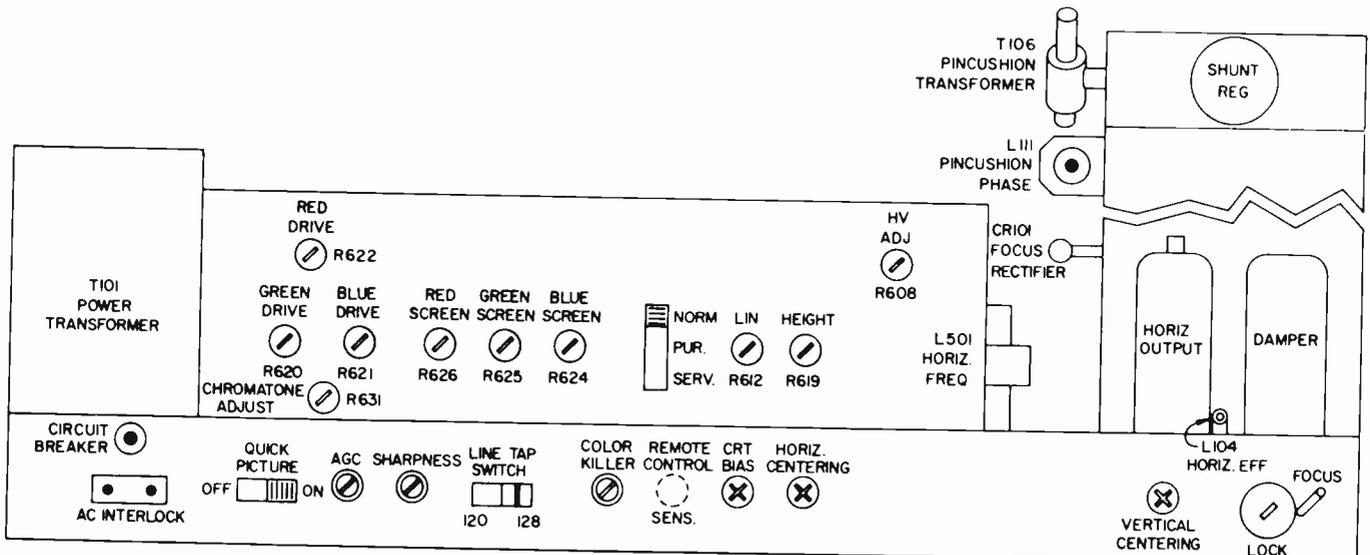
COPPER SIDE

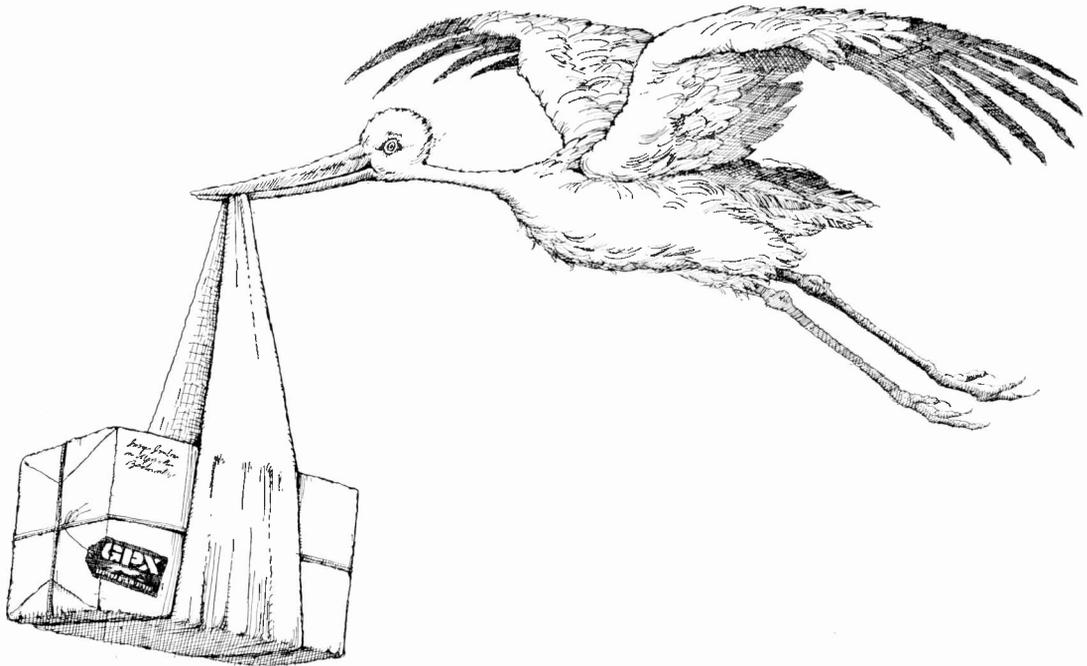
from 2.7K to 1.2K to improve the signal-to-noise ratio in the G-Y color difference amplifier. If needed, this improvement can be incorporated in early production receivers by paralleling the 2.7K resistor with a 2.2K, 1/1w resistor. The 2.2K resistor can be placed on the bottom of the circuit board.

MAGNAVOX

Color TV Chassis T924 — Critical Horizontal Hold or 'Lock-Out'

Horizontal "Lock-Out" is the condition described as follows: The receiver loses horizontal sync when tuned from one channel to another or where tuned off channel and back on chan-





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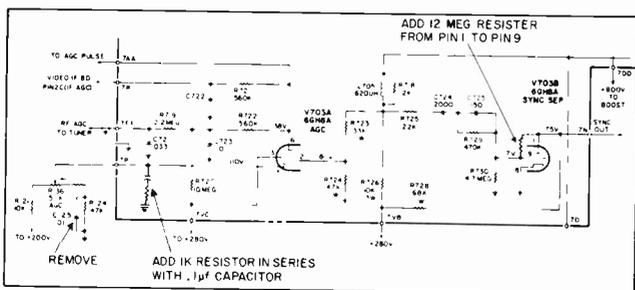
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nel, and sync can be restored only by adjusting the horizontal hold control. The horizontal hold control may be critical in adjustment but no other symptoms of horizontal troubles are presented.

If a T924 chassis has these symptoms, add a 12M, 1/2w,



10% resistor (part number 230104-263) from Pin 1 to Pin 9 of V703, the sync separator.

The recommended correction for hooking at the top of the picture is as follows: (1) Add a 1K, 1/2w resistor in series with a .1µf, 400v capacitor from point 7P on the chroma board (cathode of V703A) to ground. The resistor is to be connected to point 7P and the capacitor to ground. (2) Remove C125 (.01µf, 500v) from the circuit.

Importance of Proper Setup of TAC Models

Proper setup of color temperature, purity and convergence are important on any color television receiver. In the case of models using the T940 chassis with the exclusive total automatic color (TAC) feature, this is even more important be-

cause you will be calling attention to color fidelity in your demonstrations of the Automatic Tint Corrector. When making the color TV set-up adjustments, always be sure that the CHROMATONE switch is in the OFF position. You are also reminded that the chassis includes a RED DRIVE control adjustment in addition to GREEN and BLUE. It has been somewhat standard practice in field adjustment to set the DRIVE controls at or near maximum. With recent improvements in color picture tubes, particularly in the efficiency of the red phosphors, proper setting of these controls is more important. With these newer tubes, proper white balance is obtained in many cases with RED DRIVE at or near midpoint. So when you set the color temperature, be sure to check the RED DRIVE setting to insure proper white balance (tracking) with variation of the BRIGHTNESS control.

To set up the Automatic Tint Corrector (ATC) circuit, tune in a color signal and first set the ATC switch to the OFF position. Adjust the COLOR and TINT controls for good flesh-tones, then set the ATC switch ON and adjust the PREFERENCE control for proper flesh-tones.

With the ATC switch in the FULL-ON position the PREFERENCE control will swing the flesh-tones from green through normal to red, similar to the tint control action. With the ATC switch in the PARTIAL position the PREFERENCE control will have a more limited range.

Several changes have been made in the arrangement of the setup controls on the rear panel of the T940 chassis compared to previous chassis. The rear panel layout is shown on page 74. Note the CHROMATONE control which allows for adjustment to the most pleasing sepia tone on a black and white picture. This control is active only when the CHROMATONE switch is ON. The SHARPNESS control is also on the rear panel and there is a slide switch provided for high line voltage operation. The HIGH VOLTAGE ADJUSTMENT is located on the rear panel.

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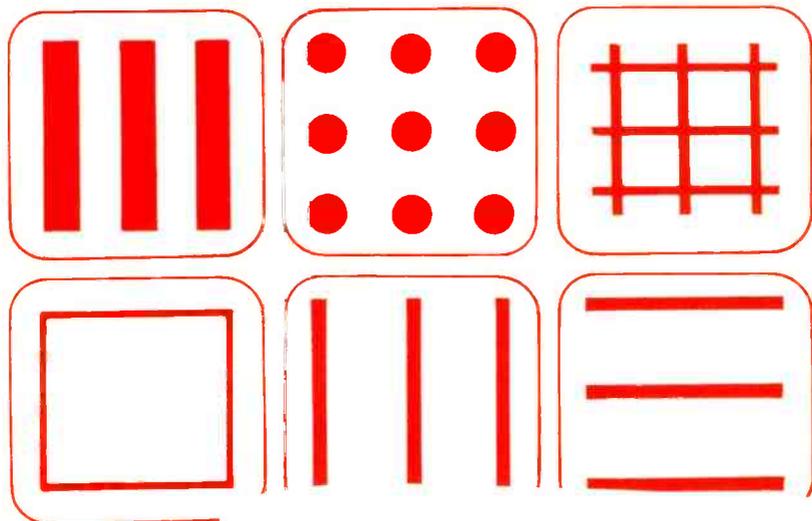
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* Optional Distributor resale price.



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NEW PRODUCTS

For additional information on products described in this section, circle the numbers on Reader Service Card. Requests will be handled promptly.

SOUNDS SYSTEMS

Systems are packaged, pre-matched and wired

Introduced are four packaged "Simple Sound Systems" for easier, faster turnover in the sound marketing field. The new systems are packaged, pre-engi-

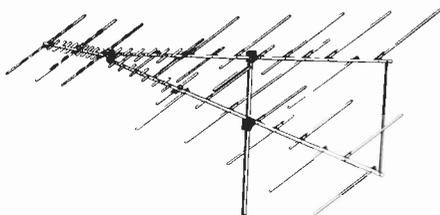


neered, pre-matched and wired at the factory. All the sound installer has to know upon purchase is the space or audience requirement. The systems range from 20w for audiences up to 200 (or up to 20,000sq ft area) to a 100w system for audiences up to 1000 (or up to 110,000sq ft area). All four systems employ the "cardioid" microphone to minimize feedback and distortion, and the six-speaker "sound column" principle for optimum audience coverage, resulting in 120-deg horizontal and 30-deg vertical dispersion. List prices range from \$285 for 20w one-mike, two-column system to \$920 for the largest system consisting of 100w amp with three mikes and six sound columns. All systems have pre-wired, pre-matched components and include lengths of cable. Bell P/A.

ANTENNAS

Twelve Models Serve UHF/VHF needs

Introduced are 12 Golden Arrow models, the wedge-shape type of antennas, 5-VHF models and 7-UHF-VHF



with band splitters. With the addition of this line of antennas, a full line of pre-galvanized, top quality steel telescoping masts is available. They feature

711

the floating guy wire ring and quality locking clamps. The price range of the antennas is \$18 to \$79. Kay-Townes.

SOLDERING KIT

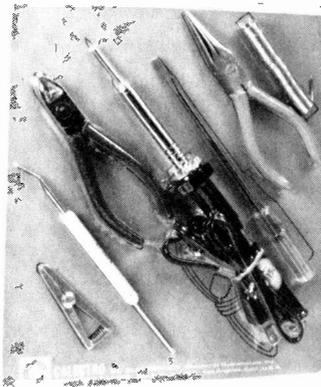
713

Tools in an easy-to see package

An electronic soldering and tool kit in a colorful, easy-to-see package is introduced. The kit, Part No. H3-378, reportedly contains everything

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needed to assemble kits, hobby and science projects. All tools are skin-packed so that each item is easily visible to the customer. The kit carries a resale price of \$7.95, and includes a soldering iron, solder aid tool, solder, screwdriver, long nose pliers, diagonal cutters and a heat sink. GC Electronics.

AUDIO GENERATOR

714

Solid-state unit features FET circuitry, low distortion

The Model LAG-54 solid-state audio generator featuring FET circuitry is introduced. It generates sine and square waves over the frequency range of 20Hz to 200kHz. The sine waves are produced by a Wein-bridge oscillator. A Schmitt trigger shapes the symmetrical, fast rise time square waves. The instrument is useful in industrial and school laboratories and may be used for circuit design, trouble-shooting and instructional purposes. The sine

wave output is 3 RMS with an impedance of 600Ω. Distortion is reportedly less than 0.5 percent at mid-range Am-



plitude is flat to within ± 0.5 dB referred to 1kHz. Square wave output is 5vP-P from 20Hz to 20kHz. Power is 105-125v 50/60Hz @5va. Size is 6 H x 10 W x 6in. D and weighs 5.5 lb. Priced at \$84.50. Leader.

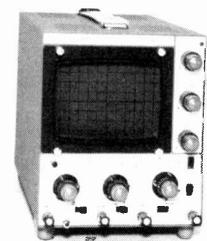
DUAL-BEAM OSCILLOSCOPE

Dual beam and triggered sweep

Made in England

715

Announced is a dual-beam oscilloscope designed and manufactured in England. Features include DC-to-



6MHz bandwidth for Channel 1, DC-to-3MHz bandwidth for Channel 2, deflection factors from 100 mv/cm to 50 v/cm for both channels (X10 gain for 10 mv/cm to 5v/cm at DC-to-2MHz on Channel 1), sweep rates from 1μs/cm to 100 ms/cm in 6 steps, measurement accuracy within 5 percent selectable sweep triggering including TV field, 6 x 10-cm CRT. Dimensions are 9in. high, 7in. wide, 18in. long. Weight is 20 lb. Price is \$345. Tektronix.

COLOR GENERATOR

716

Automatic shutoff prevents battery drain

Announced is the Model CG18 Color Cadet. The unit provides 10 RCA color bars, full line crosshatch, dots and individual vertical and horizontal lines. Snap tuning from channel two through six eliminates co-chan-

A tough customer in each GE tube warehouse makes sure you get the types you need when you need them!

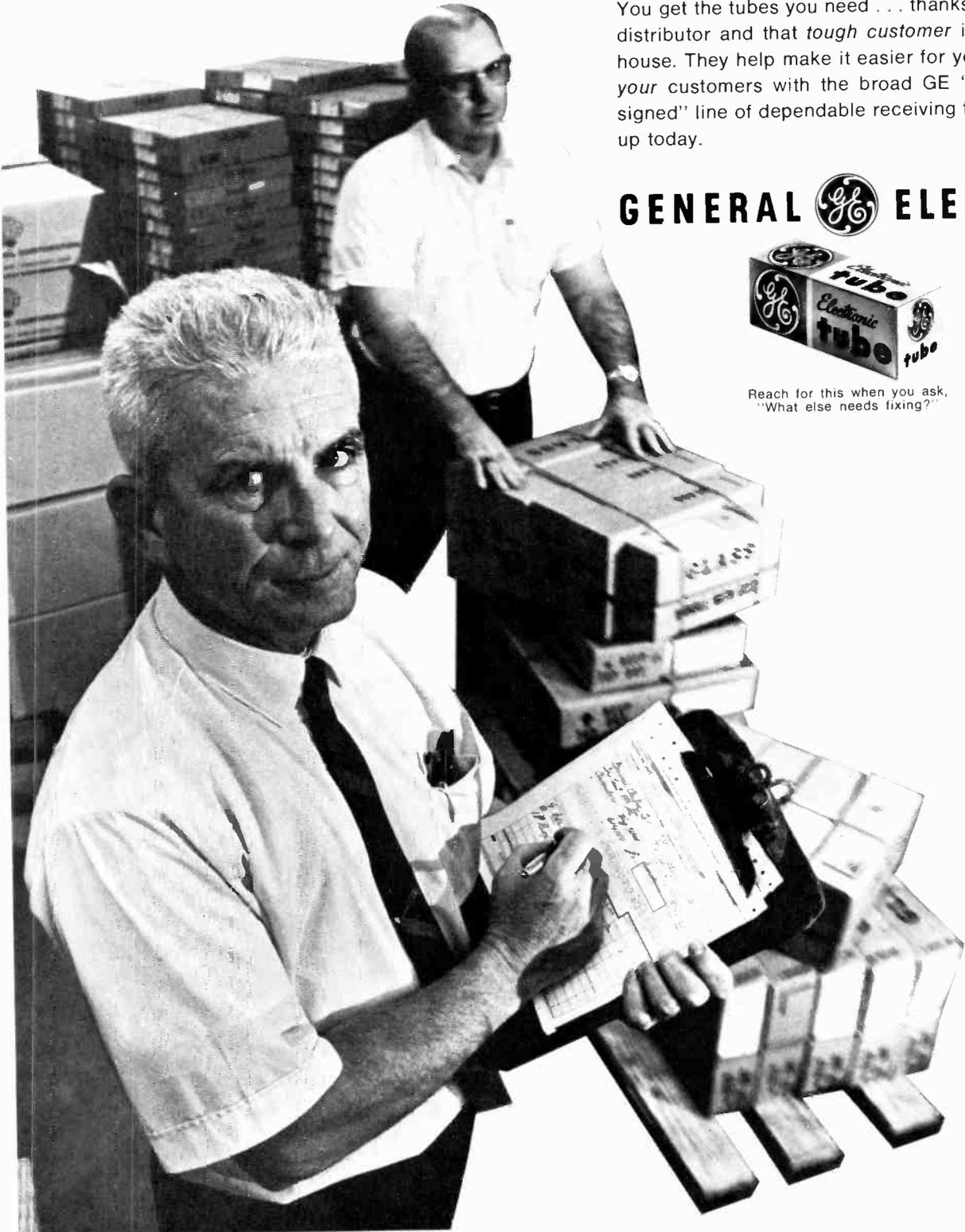
Every GE tube warehouse has a real ramrod like Bill Ralston in charge — a *tough customer* who makes sure the types you need are at your local GE distributor. Even Hard-to-get Off Shore Tubes (H.O.S.T.) for a growing number of imported TV sets are waiting for you. GE keeps tabs on new TV set production to anticipate your needs. Many GE distributors get priority shipments of the newest types sooner than anyone in town. Just ask your GE distributor . . . “what’s new?”. Chances are he’ll tell you about a type he just got in for a TV model that’s only been on the market a short time. You get the tubes you need . . . thanks to your GE distributor and that *tough customer* in our warehouse. They help make it easier for you to satisfy *your* customers with the broad GE “service designed” line of dependable receiving tubes. Stock up today.

288-24

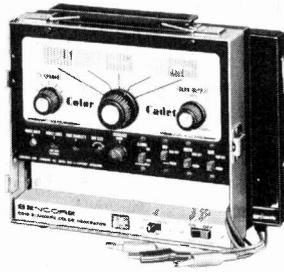
GENERAL  ELECTRIC



Reach for this when you ask,
“What else needs fixing?”



nel interference. Timer controls are on the front panel, and the range has been doubled to make it reportedly impossible for the unit to jump time. Other features include interlace control to prevent dot bounce, crystal controlled sound carrier 4.5MHz for adjusting fine tuning and solid-state battery operation with zener regulated dc power supply for stability. Automatic shutoff when the lid is closed prevents battery



drain if the unit is accidentally left on. The unit is housed in vinyl-clad steel with brushed aluminum trim an unusually compact hardly bigger than a cigar box. The removable protective lid contains a shock-mounted plate glass mirror. Sencore.

TWO-WAY RADIO 717
Tuned for use on each of the 23 CB channels

An all-channel citizens band two-way radio for marine, mobile or base station operation is introduced. Circuit design employing synthesization reportedly eliminates the purchase of additional crystals. The set is factory tuned for immediate use



on each of the CB channels. Solid-state circuitry reduces the size of the transceiver to a compact 2 1/2in. by 6 1/2in. by 9in. deep. Current drain from 12v lines is only 1.2a when transmitting. Instrumentation includes a transmit/receive relative strength meter, backlit channel selector switch and a squelch control. The unit can accommodate a separate speaker. Accessories are available enabling operation on 24 or 32vdc lines or 115 vac vessel or household circuits. Price is \$179. Raytheon.

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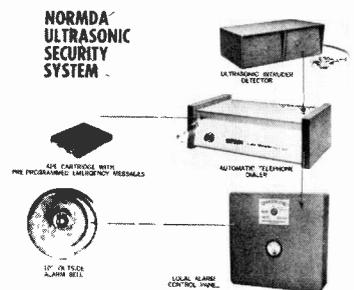
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SECURITY SYSTEM 718
Forms an invisible ultrasonic trap zone

A security system having an ultrasonic intruder detector tied into an automatic telephone dialer with a two-



channel tape cartridge is introduced. The emergency is reported directly to the police or central monitoring service, and a local alarm control panel instantly actuates a 10in. exterior alarm bell. The security package comes with all necessary wiring and can be easily installed, says the firm. The detector plugs into any 110v-115vac outlet and forms an invisible floor-to-ceiling, wall-to-wall ultrasonic trap zone that detects the slightest motion. The automatic telephone dialer is equipped with emergency standby power and is directly compatible with the telephone

continued on page 86

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provide guidance in the use of such equipment for troubleshooting and aligning all types of home-entertainment receivers. A variety of test procedures, using specified generators as the basic tool, are clearly detailed in step-by-step form. Shows how the various instruments work, and how to test and calibrate your own instruments. 240 pps., 182 illus., 16 chapters.

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approach, this up-to-the-minute volume avoids dry, theoretical mathematical explanation—it tells you simply how and why things work . . . backed up by large, clear expository illustrations. More advanced circuits covered are: transistor oscillators, multivibrators, Eccles-Jordan and Schmitt trigger circuits, crystal-controlled generators, counters, power supplies, high-frequency circuits, field-effect transistors, unijunction transistors, tunnel diodes, SCRs, etc. 224 pps., over 185 illus., 15 chapters.

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TV Servicing Guidebook: Problems & Solutions



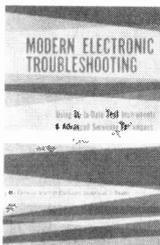
A benchman's handbook detailing shop-proven service procedures which will pinpoint ALL TV circuit troubles—monochrome and color! Calling upon his many years of on-the-job experience, the author describes 30 separate troubleshooting approaches, each predicated on specific symptoms, to help you nail down any TV problem

quickly . . . eliminate waste motion—cut troubleshooting time to the bone. The author has categorized all TV troubles—both color and B & W—into 62 classic symptoms. He then describes the servicing procedures proved most successful in his shops. The text gets to the point quickly, excluding extraneous theory and unrelated facts and figures. In all, there isn't a TV trouble you won't be able to cure with the information presented in this book. 176 pps., over 100 illustrations, including numerous waveform photos, 9 chapters.

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Order No. 484

Modern Electronic Troubleshooting



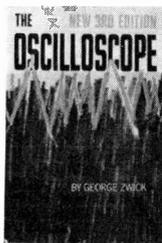
A down-to-earth handbook that deals with today's electronic servicing problems on a practical level, using modern test instruments and advanced troubleshooting procedures to cope with the special problems created by printed boards and solid-state circuitry. It is hard to conceive of a book that encompasses monochrome and color

TV, multiband radio receivers, hi-fi equipment, tape recorders, two-way communications equipment, and test instruments for servicing all this equipment. Yet this book does! By getting right to the subject of how to service the equipment without the usual wordy theoretical discussions of how the circuits work. An all-inclusive servicing guidebook service technicians have been asking for, 256 pps., over 100 illus., 5 big sections, 24 chapters.

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The Oscilloscope



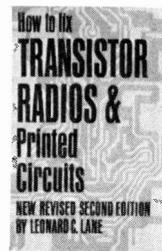
An all-new revised third edition of the classic work on understanding and using oscilloscopes. Completely expanded and updated to include triggered sweeps, dual-trace scopes, electronic switches for multi-waveform displays, DC-to-DC supplies, DC-to-AC inverters, and DC-to-DC converters, this brand-new book is right up-to-date on the current state of oscillography. All the useful data

of the previous edition has been revised to include the latest information in keeping with technology. It is a virtual handbook on the subject, explaining scope operation from the simplest to the most intricate uses. Beginning where the scope manual stops, the author covers basic waveforms (DC, sine, sawtooth, trapezoid, and pulse) clearly detailing their generic characteristics and how they are interpreted in oscillography. 256 pps., over 179 illus., 8 chapters.

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How To Fix Transistor Radios & Printed Circuits



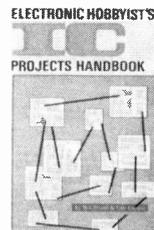
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reference and guide for electronic technicians who need to understand and repair semiconductor circuits efficiently. For those interested in transistor physics, fundamentals are emphasized in the first two chapters. The real "meat" begins in Chapter 3 which will thoroughly familiarize you with amplifier fundamentals, basic circuit configurations, biasing, FETs, JFETs, and IGFETs. The next two chapters will acquaint you with RF and IF amplifiers. 256 pps., over 150 illustrations, 12 chapters.

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Electronic Hobbyist's IC Project Handbook



Here's your chance to become familiar with those fascinating components—integrated circuits—and have fun building some useful devices at the same time. In all, this new book describes 50 different projects, all based on using popular IC's which are inexpensive and available at all parts stores. Some of the devices—such as the 1-watt phono amp and IC power supply—can be built in an evening. More sophisticated projects—like the electronic organ or the RDIAA equalization preamp—offer a greater challenge. You can build practical devices like the tachometer with bulb alert, or the 50-watt amplifier, or some "just for fun" gadgets like the simple memory tester or the miniature adding machine. 160 pages, 50 projects, 100 illus.

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Order No. 464

Logical Electronic Troubleshooting



Designed to provide the electronic technician with the knowledge necessary to deal with almost any troubleshooting situation. Different from the ordinary text in that the pages are "scrambled"; a unit of information is given, followed by a question and three alternative answers. The reader chooses what he believes is the correct

answer. When the right answer is chosen, the page selected presents a new unit of information and a new question. If the reader chooses an incorrect answer, the page he is referred to explains why it is incorrect and directs him to return to the original unit for another answer. Numerous example problems are analyzed and followed through to conclusive solutions, emphasizing logical procedures which can be applied to any system. 320 pps., 72 illus., 5 Chapters, 7½" x 4½". Comb-bound.

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Digital Computer Analysis	List Price \$10.95; Club Price \$7.95
How To Test Almost Everything Electronic	List Price \$5.65; Club Price \$3.95
How to Use Your VOM, VTVM & Scope	List Price \$6.95; Club Price \$4.95
Radio Operator's Q & A Manual	List Price \$8.95; Club Price \$7.50
Zenith Color TV Service Manual	List Price \$7.95; Club Price \$4.95
Installing & Servicing Home Audio Systems	List Price \$7.95; Club Price \$4.95
Microphones	List Price \$12.95; Club Price \$3.95
Electric Motor Test & Repair	List Price \$6.95; Club Price \$2.95
Semiconductors From A to Z	List Price \$7.95; Club Price \$4.95
Industrial Electronics Made Easy	List Price \$8.95; Club Price \$5.95
Audio Systems Handbook	List Price \$7.95; Club Price \$4.95
Motorola Color TV Service Manual	List Price \$7.95; Club Price \$4.95
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Installing Hi-Fi Systems	List Price \$7.95; Club Price \$4.95
FET Applications Handbook	List Price \$12.95; Club Price \$7.95
Handbook of Semiconductor Circuits	List Price \$7.95; Club Price \$4.95
Pinpoint TV Troubles in 10 Minutes	List Price \$6.95; Club Price \$4.95
Easy Way To Service Radios	List Price \$6.95; Club Price \$3.95
Practical Color TV Servicing Techniques	List Price \$7.95; Club Price \$4.95
On the Color TV Service Bench	List Price \$6.95; Club Price \$4.95
Transistor Circuit Guidebook	List Price \$6.95; Club Price \$4.95
Mathematics for Electronics	List Price \$10.95; Club Price \$7.95
Transistor Projects	List Price \$5.95; Club Price \$2.95
Electronic Musical Instruments	List Price \$10.00; Club Price \$7.95

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Black Magic from the Rawn Co.
Tun-O-Foam from Chemtronics

OR YOU CAN BUY THE ORIGINAL

(Nearly copied, but not quite)

The only one field-tested for over 3 years and used for 1½ years all over the country. The only one that's concentrated (it's harder to put a thick concentrate in a spray can) to do the best job possible.

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Canada: Wm. Cohen, Ltd. Montreal
Export: Singer Products, N.Y.C.



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... for more details circle 131 on Reader Service Card

ET/D NEW PRODUCTS

continued from page 80

company's standard coupler or four-prong telephone jack. Each tape cartridge is pre-programmed with up to six emergency messages before shipment. The local alarm control panel operates the outside alarm bell that is supplied as part of the security package. In addition it can be wired to actuate all interior and exterior lights. A remote shunt lock is also provided, which allows authorized entry into the ultrasonic protected areas without notifying police or a central monitoring station. Price is less than \$700. Normda.

OSCILLOSCOPE 719

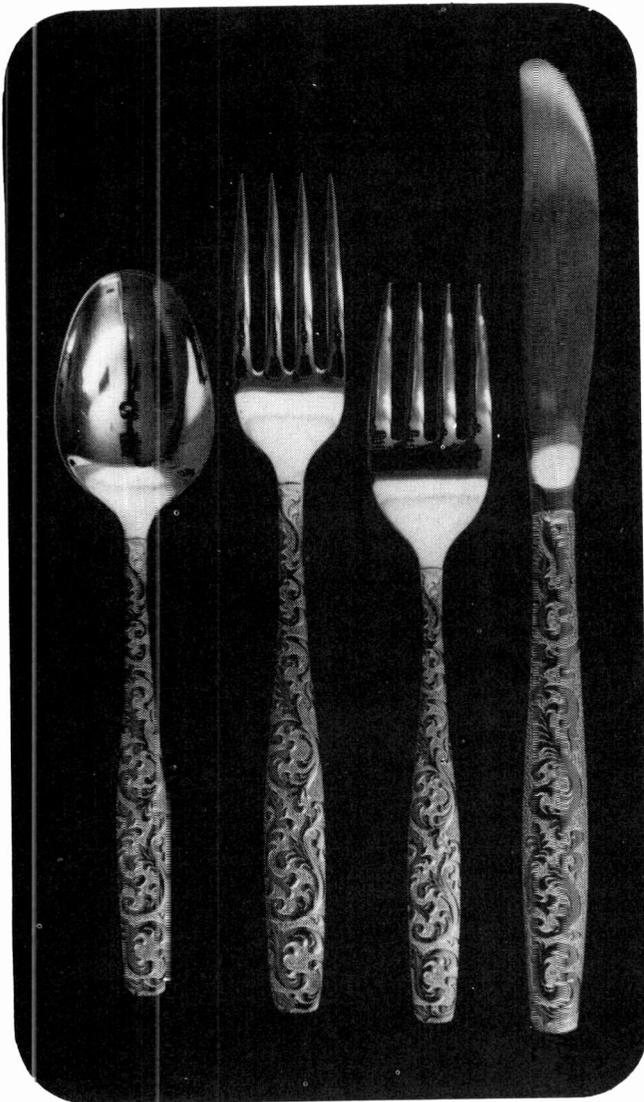
Bandwidth to 10MHz, high sensitivity to 10 mv/cm

Announced is the PM3221 5in. (10 x 8cm useful display area) single beam oscilloscope. A wideband, high sensitivity instrument, the unit offers two



frequency/sensitivity ranges: dc to 10MHz at 10mv/cm and dc to 2MHz at 1mv/cm. A time/cm selector provides for triggering on frame and line signals of all present B/W and color TV systems as well as for horizontal deflection with an external signal (sens. 1 v/cm dc coupled to 1.5MHz.). DC zero reference; calibrating voltage (5vP-P at 8kHz, square wave); and vertical signal magnification of 3x (for 24cm of undistorted vertical deflection), signal delay 100ns, provide easily set up useful features as well as, in the latter case, enhanced performance characteristics for the oscilloscope. The time base generator allows continuous or stepped adjustment of time/cm in a 1, 2, 5, 10 sequence; sweep expansion of 1, 2, or 5x. With solid-state FET input and regulated power supply, the unit is well-suited for many areas of application including slow speed computer work, industrial testing (where its

You get the "Gift of Gold" with every color picture tube made by Griffiths



This elegant four-piece place setting of Golden Flatware will be given Free

A gift of gold is lasting . . . one that can't be equaled. A gift of gold is what the manufacturers of Griffiths' picture tubes offer you. This is your opportunity to receive this most elegant golden flatware by famous International Silver Company. It is unequalled in luxury and practicality.

For a limited time only, with every Griffiths' made color picture tube purchased, you will receive absolutely free a lovely 4-piece setting of Golden Scroll. This 24-karat gold electroplated flatware, unlike sterling silver, never needs polishing, but has the elegance of the most expensive sterling. And it's yours free!

This is your golden opportunity to get gold . . . the lasting gift . . . from the manufacturers of the lasting picture tube . . . Griffiths Electronics, Inc. See your local participating distributor for details. Or call the Griffiths Golden Scroll coordinator — (904) 355-9006 — for the name of your nearest distributor.

Offer good with these popular color picture tube brands: Empire, Theta, Solaray, DuMont, Weltron, Polaris, Major plus many other Griffiths' private brands.

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. . . for more details circle 121 on Reader Service Card

ET/D NEW PRODUCTS

high sensitivity adapts it to the mechanical transducer field) and for video signal and pattern observation. Price: \$670. Phillips.



720 TRANSISTOR/FET TESTER

Offers three leakage tests
 I_{cbo} , I_{ceo} and I_{ces}

In-circuit and out-of-circuit tests are claimed possible without remov-

ing transistors or without change in basic procedure with a transistor/FET tester introduced. The Model 162, also tests diodes, unijunctions, SCRs and triacs. Other features include a special balancing circuit that permits balancing out as low as 6Ω circuit impedance for in-circuit Beta test. It carries

current capabilities up to 1a, a feature that is required in testing power transistors and power FETs. Beta readings are available from 1 to 5000 in five selective current ranges. Front panel sockets for conventional and FET transistors are also provided which are useful for FET tests, as they minimize the possibility of damage caused by static charges. Tests are made under circuit conditions to give more valid readings. It offers three leakage tests: I_{cbo} , I_{ceo} and I_{ces} . All three leakage tests are necessary since a common cause of failure, namely, "avalanche mode breakdown," can be missed if all three tests are not performed. The tester comes with programmed instruction guide which provides instruction on Go-no-Go conditions and leakage. Measuring 9 w x 7 1/4 H x 4 in. d, the dc-operated unit weighs 6 lb. It is battery-operated for portability and is priced at \$99.95. B & K.



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Plus Advanced
Mechanical Design
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- 180K short sensitivity check. Compares each element in the tube against all others for possible shorts.
- Regulated for complete accuracy and assurance on marginal tubes.

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721 TAPE RECORDER

Miniature unit provides
up to 12 hours recording

Announced are miniature tape recorders, the Mark VIII series. These units are miniature, precision units within the instrumentation class. They



are adaptable to a wide variety of recording applications where the need for long duration data recording and small self-contained modular packages are of importance. The recorder unit utilizes an endless tape loop in a replaceable cartridge with sequential programmed channels recording eight tracks upon 1/4 in. tape. In a single channel mode, the continuous recording time capability (12 hours) is an order of magnitude greater than comparable reel to reel or cassette recorders. The recorder fits into a shirt pocket, operates from an internal battery pack and uses a compact tape cartridge. The unit is provided with a playback feature so that the recorded tape may be rerun for field analysis. For discrimination and high intelligibility under a varying background noise, wide dynamic range with AGC action is provided. Specifications: Size 0.9 x 2.9 x 5.1 in., weight - 1 lb, tape speed - 15/16ips, speed deviation - 1%, flutter - 1%, distortion - 3%, S/N ratio - 35db, cross talk - 45db, AGC action - 30dB, freq. resp. ± 3 db from 300 to 5000Hz. Beacon Dynamics.

continued on page 98

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Do you deliver?
How about service?
Is there parking?
What are your hours?
I'm interested in everything
about you when I
look you up in the
Yellow Pages.



**Zenith Launches
'Know How Clinic'**

Zenith Sales Co., a division of Zenith Radio Corp. is launching "Know How Clinic," a new fall sales training program designed to reach over 20,000 dealers, retail salesmen and distributor sales personnel in close to 100 major market cities in the United States and Canada.

"The entire three-hour meeting package is aimed to sharpen the skills of professional sales people by providing them with sound selling techniques and ideas for use in promoting Zenith products," Walter C. Fisher, Zenith Sales Co. president, said.

Through product slides, commentary from Zenith meeting leaders, film strips and audience participation spots, sales personnel will be briefed on how to sell and demonstrate Zenith innovations and the features of the company's new 1970 stereo, tape, B/W and color TV products.

**GE Introduces One Line Concept
For Replacement CRTs**

A new line of high quality replacement color television picture tubes introduced by General Electric's tube department has struck a major blow toward ending the confusing array of spec. screens, glass and guns facing distributors and TV service technicians.

Keying on the philosophy of "few will do," GE's new Ultra-

color line offers distributors and service technicians 13 different CRT types in six basic rectangular tube sizes: 11, 19, 21, 22, 23 and 25in.

GE also offers a 21-in. round tube size featuring six types.

GE's tubes are manufactured to offer all of the essential original equipment specifications. These tubes utilize rare earth phosphor (except for certain older types clearly identified as having sulfide phosphor), have new electron guns, and may or may not utilize used glass and other materials. New and rebuilt tubes are clearly identified.

GE's "Color Tube Quality Assurance" sticker is placed on each Ultracolor tube stating "this tube has been manufactured and tested to meet General Electric's Ultracolor tube high quality standards." Each tube is packed in GE's colorful new carton for point-of-purchase displays.

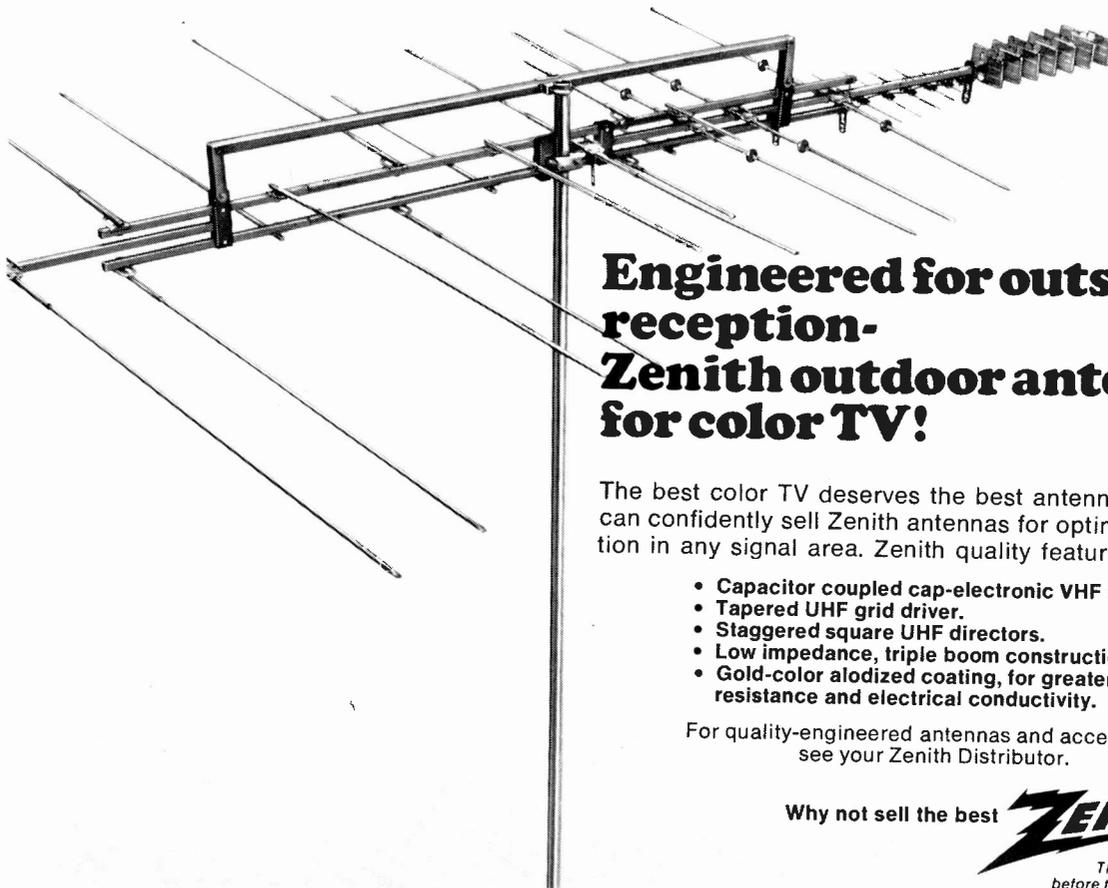
**Sylvania Price Increases
On Most 23in. Color TVs**

Sylvania Electric Products Inc. announced it will raise retail, distributor and dealer prices an average 2 1/4 percent on most of its 23in. color television sets effective Oct. 1. The newly announced picture tube does not contribute to cost increase. Sylvania is a subsidiary of General Telephone & Electronics Corp.

William E. Boss, vice president-marketing for Sylvania Entertainment Products, an operating group of the company, said the rising costs of labor, basic commodities, parts and components necessitated the increases.

Most of the color sets involved in the price changes include a new brighter, higher-contrast picture tube announced by Sylvania Electronic Components, another operating group of the company.

Boss said that manufacturer's suggested list prices on 11 color sets and related Chairside remote control models will



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The best color TV deserves the best antenna. And you can confidently sell Zenith antennas for optimum reception in any signal area. Zenith quality features include:

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For quality-engineered antennas and accessories, see your Zenith Distributor.

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BUT YOU ONLY NEED ONE...AT \$44⁰⁰ THAT'S A BARGAIN



MODEL 310
World's Largest Selling
Volt-Ohm-Milliammeter
(SHOWN ACTUAL SIZE)

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HAND SIZE V-O-M WITH PROVISION FOR ATTACHING AC CLAMP-ON AMMETER.

2

20,000 OHMS PER VOLT DC SENSITIVITY; 5,000 AC.

3

ONE SELECTOR SWITCH MINIMIZES CHANCE OF INCORRECT SETTINGS AND BURNOUTS.

310-C PLUS FEATURES

1

Hand size V-O-M with provision for attaching AC Clamp-on Ammeter.

2

15,000 OHMS per volt AC sensitivity; (20,000 DC same as 310).

3

Single fully enclosed Lever Range Switch, plus DC Polarity Reversing.



MODEL 310-C
Volt-Ohm-Milliammeter

MODELS 100 AND 100-C

Comprehensive test sets. Model 100 includes: Model 310 V-O-M, Model 10 Clamp-on Ammeter Adapter; Model 101 Line Separator; Model 379 Leather Case; Model 311 leads. (\$83.20 Value Separate Unit Purchase Price.)

MODEL 100 — U.S.A. User Net. \$78.00

MODEL 100-C — Same as above, but with Model 310-C, Net. \$88.00



SELF-SHIELDED Bar-Ring instrument; permits checking in strong magnetic fields. FITTING INTERCHANGEABLE test prod tip into top of tester makes it the common probe, thereby freeing one hand. UNBREAKABLE plastic meter window. BANANA-TYPE JACKS—positive connection and long life.

Model 310—\$44.00 Model 310-C—\$56.00 Model 369 Leather Case—\$4.20
All Prices are Suggested U.S.A. User Net, Subject to Change

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A comprehensive training plan for the man who already has a knowledge of monochrome circuits and wants to quickly add Color TV servicing to his skills. DEFINITELY NOT FOR BEGINNERS. It picks up where most other courses leave off — giving you "hands on" experience as you build the only custom Color TV set engineered for training. You gain a professional understanding of all color circuits through logical demonstrations never before presented. The end product is your own quality receiver.

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This NRI course — like all NRI training — is an outgrowth of more than 50 years experience training men for Electronics. NRI has simplified, organized and dramatized home-study training to make it easy, practical, entertaining. You train with your hands as well as your head, acquiring the equivalent of months of on-the-job experience. Demand for Color TV Service Technicians is great and growing. Cash in on the color boom. Train with NRI—oldest and largest school of its kind. Mail coupon. No obligation. No salesman will call. NATIONAL RADIO INSTITUTE, Color TV Div., Washington, D.C. 20016.

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NEWS OF THE INDUSTRY

be increased by \$25. The current price range is \$625 to \$950 with an additional \$100 charge for optional remote control. One model in the price group will be advanced only \$15. Distributors and dealers prices in the group will increase in a range from 2.4 to 3.8 percent.

Twelve color models presently carrying manufacturer's suggested list prices between \$499 and \$625 will be increased \$10, Boss said. Dealers and distributors prices in the group will advance in a range from 1.7 to 2 percent.

Chemtronics Offers Six Month No-Callback Guarantee

Chemtronics Inc. announces a six month no-callback guarantee on its recently introduced Tun-O-Foam lubricant/cleaner.

According to Al Friedman, president of Chemtronics, tuners sprayed with ordinary products cause callbacks 10 to 20 percent of the time.

"Some tuner sprays cause detuning," he said. "Others provide little or no lubrication. And the thick stuff dries out and cakes up."

Friedman pointed out that more than half a million tuners have already been cleaned by the product without "a single report of a callback due to tuner troubles."

It is this experience that has prompted Chemtronics to offer what Friedman calls an industry first—the Tun-O-Foam six-month no-callback guarantee.

Tun-O-Foam is available in 8 oz. cans for \$2.39 dealer net. Chemtronics also makes Tun-O-Wash, a degreaser for especially dirty tuners; Super Frost Aid, a coolant for locating thermal intermittents; and a full line of other chemicals for the electronic servicing industry.

Cinch-Graphik Installs Camera, With One Ten-Thousandth Inch Accuracy

What is believed to be the world's largest camera used in the electronic industry has just been installed in the new plant of Cinch-Graphik, West Coast manufacturer of precision multilayer printed circuit boards for the electronic industry.

The camera weighs six tons and is 28ft long. It has an image accuracy of .0001 in. The copy board for photographing the printed circuit layout image is 60 by 80in.

Only a camera this large offers the necessary control of image accuracy for the most efficient production of precision multilayer printed circuit boards. These circuits are used in computers, aerospace systems and other high reliability applications.

Construction and delivery of the camera required 7 months. (Since the new building housing the camera was almost completed before the camera was delivered, the builders had to leave openings in the wall, until the camera could be moved into position.) A truck-mounted crane was used to install the camera. At one point, the weight of the camera lifted the truck's front wheels off the ground.

To eliminate external vibrations which would affect the .0001 in. accuracy, the camera is mounted on a concrete pad measuring 38 by 17 by 6ft deep requiring 285 tons of concrete!

Housing the multilayer camera requires two rooms in the Cinch-Graphik facility: one for the copy board and a separate room for the lens and focus controls to eliminate any distortion of the image due to the presence of the photograph-

ers. The atmosphere in both of these rooms, and in the developing room, is controlled to within 2 degrees and ± 2 percent relative humidity.

Smaller cameras of this type use a front-lighted copy board. In a camera this large front-lighting would produce uneven light distribution that would affect the sharpness of the image. The camera has a back-lighted copy board with a 6ft deep lighting box containing 32 fluorescent tubes. The tubes as spaced provide even lighting at the lens. At 20ft local distance, the edges of the copy board are 15in. farther from the lens than the center copy board. To compensate for this additional distance, lighting must be increased as one gets closer to the edge of the board.

Capacitor Sales Up 7.4 Percent

U. S. factory sales of capacitors totaled \$195 million during the first five months of 1969, up 7.4 percent from sales of \$182 million during this period in 1968, the marketing services department of the Electronic Industries Assn. reported.

Unit sales climbed 20.5 percent to reach 1.3 billion during the five-month 1969 period.

Dollar sales gains were shown in four of the seven capacitor categories listed in the department report. "All Other Fixed" capacitors which include the fast-growing monolithic types in the accompanying table, climbed 80.7 percent during January-May of this year to reach \$19.7 million. Paper and film dielectric capacitors were up 21.7 percent in dollar sales, while important gains were registered by the aluminum electrolytic and fixed mica dielectric types.

Dollar sales declines were shown for tantalum electrolytic, fixed ceramic dielectric and variable capacitors during the five-month period in 1969.

Blonder-Tongue Names New Manager For CATV Product Sales

The appointment of Wiley E. Steakley as manager-CATV products sales of Blonder-Tongue Laboratories, Inc., was announced by Michael Adamechak, field sales manager of the Newark, N.J., electronics manufacturing corporation.

In his new position, Steakley will be responsible for sales and market development of the company's expanded line of BTV/CATV products.

Steakley has had over 25 years' experience in the service, installation, sales and distribution of electronic

equipment. He has been associated with the promotion and sales of television signal distribution and origination equipment for more than 17 years.

He joined Blonder-Tongue in 1962 as regional sales manager for the Midwest. In 1965 he was promoted to national CATV sales engineer. In 1967 he was appointed to the position of Midwest field sales engineer.

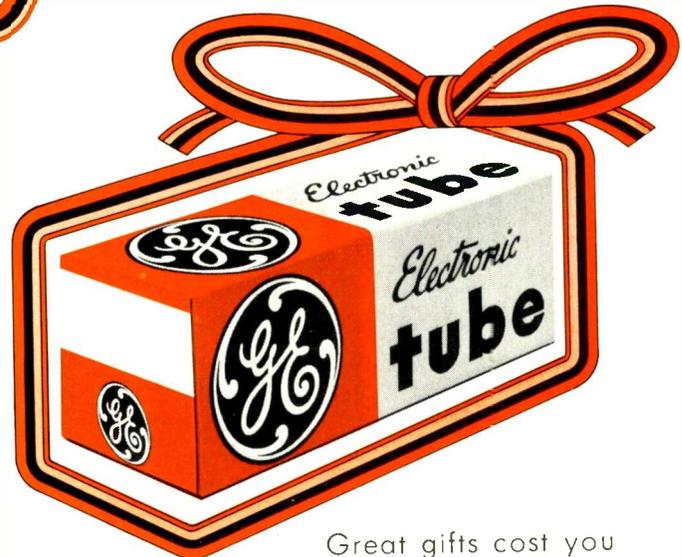
A graduate of Maryville College, Maryville, Tenn., he has held positions in the research laboratories of both the Armco Steel Corp. and the Weirton Steel Corp. In addition he worked as a manufacturers' repre-

sentative for Weller Electronic Sales, Inc., of Worthington, Ohio.

Steakley, a native of Cleveland, Ohio, now resides with his wife and three children in Columbus, Ohio.

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PAGE 101.

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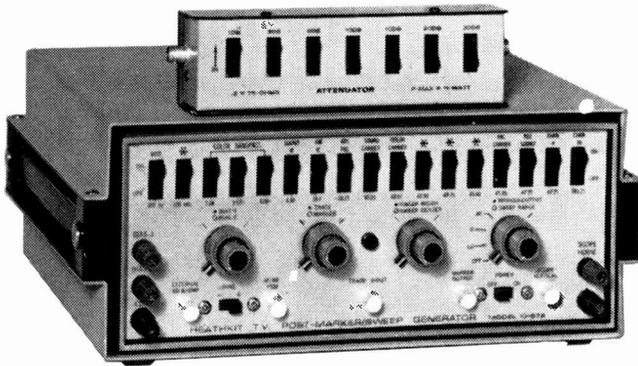


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This New Post Marker/Sweep Generator And A Scope Are All You Need For Complete Alignment Of Virtually Every Color & B&W TV Set On The Market

- Produces all most-used alignment frequencies for IF bandpass, color bandpass, FM IF, channels 4 & 10 • Post-injection marker circuitry • New VSM for alignment without external generators ... without worry about video detector diode load • 15-crystal-controlled markers • Two variable 15 V bias supplies with switchable polarity • Three sweep oscillators cover five most used ranges • Switchable retrace blanking • Adjustable phase control • Unique trace reverse function for proper display • Built-in 400 Hz modulator for easiest trap alignment • Zener regulated power supply • External attenuator with 7 shielded switches provide 1, 3, 6, 10 & 20 dB steps up to 70 dB attenuation • BNC connectors • Comes complete with cables, test leads, connectors & plugs • Includes demod probe • The finest investment you can make in alignment facilities

Add Nothing But A Scope For Complete Alignment Capability. Using a sweep modulated 45.75 MHz picture carrier for the tuner mixer or 67.25 MHz picture carrier for the antenna terminals, you can check overall frequency response from antenna terminals thru the tuner, IF strip, video detector, to the color bandpass amplifier outputs, without worry about video detector diode load. Put this remarkably versatile new instrument on your bench now ... order your IG-57A today.

Kit IG-57A, 14 lbs. \$135.00*
Wired IGW-57A, 11 lbs. \$199.00*

IG-57A SPECIFICATIONS — **Marker frequencies:** 100 kHz. **Marker frequencies, crystal-controlled:** 3.08, 3.58, 4.08, and 4.50 MHz $\pm 0.01\%$. 10.7, 39.75, 41.25, 42.17, 42.50, 42.75, 45.00, 45.75, 47.25, 67.25 and 193.25 MHz $\pm 0.005\%$. **Modulation frequency:** 400 Hz. **Input impedance:** External Marker/Sweep, and Attenuator — 75 ohms. Trace In — 220 k ohms. **Output impedance:** Marker Output, Sweep Output, and Attenuator — 75 ohms. Scope Vert. — 1 k ohms. **Bias Voltage:** Two individually adjustable supplies; Positive or negative polarity. **Type of Marker:** Birdie. **Controls:** Bias controls; Marker/Trace — dual concentric; Sweep Width/Sweep Center — dual concentric; Marker Out — concentric with Sweep Range switch; and Phase. **Switches:** Rocker type — separate switch for each of the above listed frequencies; Blanking, On/Off; Trace Reverse; Modulation On/Off. **Sweep frequency ranges and output voltage:** LO Band — 2.5 to 5.5 MHz ± 1 dB at 0.5 volts RMS (min.) fundamentals, and 10.7 MHz on harmonics. IF Band — 38 to 49 MHz ± 1 dB, at 0.5 volts RMS (min.) fundamentals. RF band — 64 to 72 MHz ± 1 dB at 0.5 volts RMS (min.) fundamentals and 192 to 198 MHz on harmonics. **Attenuator:** Total of 70 dB of attenuation in seven steps — 1 dB, 3 dB, 6 dB, 10 dB, 10 dB, 20 dB and 20 dB. **Power requirements:** 120 volts, 60 Hz AC at 4.5 watts.

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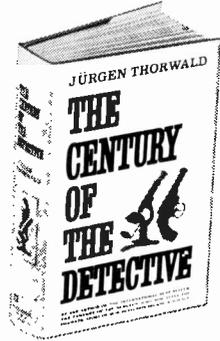
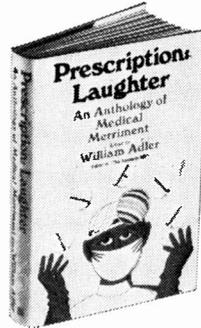
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continued from page 48

"letters and numbers" imprinted on the module which simplifies servicing.

Eleven sets, including six top-of-the-line consoles and a "home-theater" console combination, are equipped with the Ultramatic tuning system. This lets the viewer automatically select as many as 18 pre-tuned channels—12 VHF and 6 UHF—with just the touch of a finger at the set or on a remote hand control on the Space Command "600" models.

Other features include: a positive temperature coefficient thermistor that improves automatic degaussing of the picture tube; an integral brace through the center of the chassis to ensure its ability to withstand rough handling during shipment. Also, on certain models, all of the occasional controls for the set owner—vertical size, color "killer," peak picture, brightness, tone, chroma level, vertical linearity and vertical hold—are grouped together for ready access behind a front panel door located below the set's speaker and front convergence screening panel.

Compactness in cabinetry and solid-state circuitry are features of Zenith's 22 model B/W 1970 television.

The new 19in. solid-state B/W models contain the 22AB55 chassis. The chassis is comprised of six modules that contain 70 percent of the receivers components. The metal enclosed video IF and sound IF modules are similar to those used previously. The four remaining solid-state Dura modules are a new snap-in type with a grid pattern, providing versatility of component layout. ■

**For more information
on New Products and
Dealer Showcase,
see Readers Service,
page 101.**



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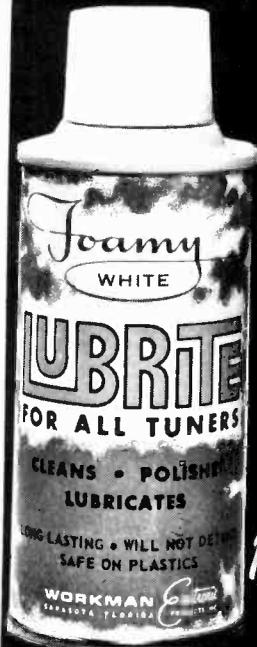


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ELECTRONICS DATA GUIDE

<p>Conversion Factors and Constants</p> <p>$1 \text{ m} = 0.001$ $1 \text{ cm} = 0.01$ $1 \text{ mm} = 0.001$ $1 \text{ in} = 2.54$ $1 \text{ ft} = 0.3048$ $1 \text{ yd} = 0.9144$ $1 \text{ mi} = 1.6093$ $1 \text{ hr} = 3600$ $1 \text{ min} = 60$ $1 \text{ sec} = 1$</p>	<p>Equal Resistors in Parallel</p> <p>$R_{\text{eq}} = \frac{R}{n}$ where n is the number of resistors</p> <p>Resistors in Parallel, General Formula</p> <p>$\frac{1}{R_{\text{eq}}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_n}$</p> <p>Sinusoidal Voltages and Currents</p> <p>Effective value = 0.707 x peak value</p>
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921

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ET/D

CATALOGS & BULLETINS

Solid-State Devices 400

A 48-page catalog gives specific data on more than 1000 solid-state devices: integrated circuits (linear, digital); transistors (bipolar, MOS); thyristors (triacs, SCRs, diacs); silicon rectifiers; tunnel diodes; diodes; optical products (photocells, emitting devices). Special format permits quick selection of a device by a type number, function or application. The catalog includes detailed index, special data charts, recommended applications and special features, and representative photographs shown in approximate actual size. RCA.

IC Stereo Decoder 401

A six-page construction article describing a monolithic integrated FM stereo decoder system is available. Designed around a Motorola MC1304 integrated circuit, the unit provides excellent channel separation across the entire audio range. The 1359 series coils have been incorporated to help assure optimum channel separation characteristics. The article was developed and reproduced by courtesy of Motorola Semiconductor Products, Inc. J.W. Miller.

Audio Accessories 402

A catalog of audio accessories for Hi Fi, stereo and cassette tape recorders and players is available. The illustrated catalog, #116 includes the new, special line of DIN (European Standard), cable assemblies sockets, plugs and universal microphones for the fast growing cassette market. Workman.

Knobs 403

An eight-page catalog describes the complete line of dual concentric instrument knobs. The line has a wide variety of sizes, decorative caps, skirts and flanges. In addition to round concentrics, bar pointer knobs with round knobs are offered. Flanges and tops may be calibrated and worked to customer specifications. Ten standard colors are available at no extra cost. Aluminum inlays may be provided in colors and with index marking. Radial Controls.

Connectors 404

A connector selector slide rule that catalogs 17 Series connectors is available. User places arrow in horizontal window to one of six family types (fixed-contact, high density, encapsulated contact, hard dielectric, Original Poke-

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Home, or power/coax) shown, then reads pin-and-socket connector characteristics by arrow in vertical window. Characteristics included are temperature range, insulator material, contact size, wire sizes accepted, electrical specs and shell material/platings. Slide rule can be turned over and corresponding part number read out directly for ordering purposes. For added versatility, the new connector selector can be used in reverse. User simply aligns vertical window arrows with desired performance characteristics, reads out 17 Series connector family in horizontal window and flips slide rule over for specific parts number. A complete competitive part numbers cross-reference is provided in a convenient vertical format on reverse side. Amphenol.

Electronic Components 405

A British standard scheme for electronic components of assessed quality is about to commence in the United Kingdom. A new booklet "BS9300 and what it means" is available. AEI Semiconductors Ltd.

Electronic Industries Yearbook 406

Electronic Industries Assn's marketing services department announces the publication of its 1969 edition of the Electronic Industries Yearbook. Representing the most comprehensive annual review of the electronic industries, this publication analyzes trends in sales of consumer, industrial, government and component products. Also included are data on foreign trade, employment, and research and development. The edition contains 96 pages, 80 tables and 13 charts, and is available at \$10 per copy (\$6 per copy to EIA member company representatives). Discounted prices are offered on quantity orders. Electronic Industries Assn.

Electronics Catalog 407

A new home entertainment and electronics catalog is available featuring an expanded selection of the firm's own line as well as electronic equipment from other manufacturers. The 68-page catalog features more than 1000 separate listings, including 32 pages devoted to stereo components. Also included is the company's largest assortment of omni-directional speaker systems. New products in the catalog include the first cassette player-recorder deck capable of recording miniature cassettes with lifelike big-reel fidelity, long-distance walkie-talkies with exclusive detachable whip antennas and assemble-yourself audio kits. Expanded offerings include the entire lines of Ampex stereo tape recorders, BSR McDonald turntables, an extensive

line of Sony equipment and products from Harmon-Kardon, Fisher, Scott, Craig and Electrovoice. Sears Roebuck.

408 Neon and Incandescent Readout

An eight-page catalog lists and illustrates the line of miniature readout indicators and the decoder-drivers required for particular models. The ELFIN neon readout indicators have detailed specifications, code tables, dimensional drawings and prices. Other series listed are incandescent types that include the metal incased MS-4000 Series numerical and symbol indicators. Ten types of readouts are listed plus logic modules and special mounting kits. The MS Series single plane mosaic readouts are also described. Useful information is included such as wiring instructions, schematic drawings, quantity pricing and accessories, where required. Alco.

Tape Recorders 409

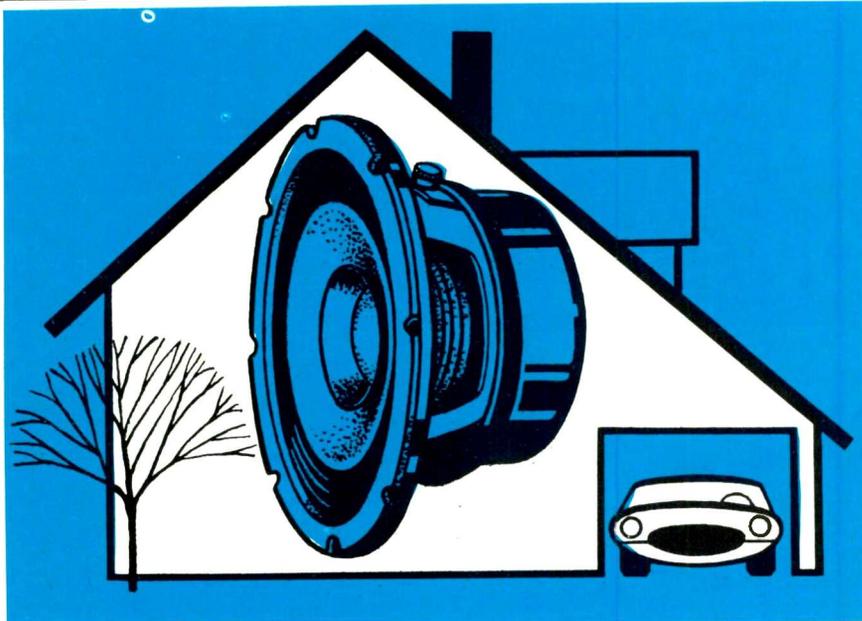
With its applications almost endless, the tape recorder is being used in more and more homes, classrooms, offices and plants. To help and to guide the prospective buyer in his selection from the many types now available, an updated and expanded book about tape recorders has been published in a low-priced paper-back edition. "Using Your

Tape Recorder" (second edition) is written by Harold D. Weiler and Louis M. Dezettel, old hands with audio and recording subjects who know how to present technical material in simple language directed to the non-professional and hobbyist. An added chapter in the new edition describes the various types of recorders and their uses, including the new cassettes and the automatic reversing units. The 112-page book, 5 1/2 x 8 1/2 in. is priced at 75 cents. Allied Radio.

Tools 410

A 24-page catalog, No. 200A, describes over 500 various spring adjusters, gauges, burnishers and miscellaneous precision hand tools, essential for telephone, relays, central-office equipment, precision instruments and business machines. Tools are grouped in 13 classifications and are listed in numerical sequence with detailed drawings including dimensions and specifications. Book also contains a convenient metric to inches conversion chart. Tools are precision-made of carbon steel, nickel-chrome plated, and many are dielectric. Jonard.

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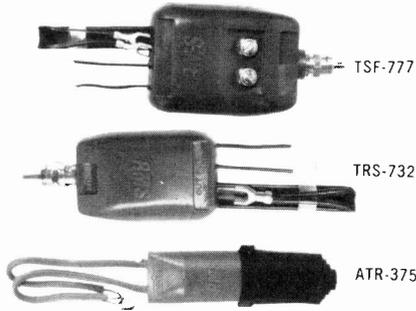
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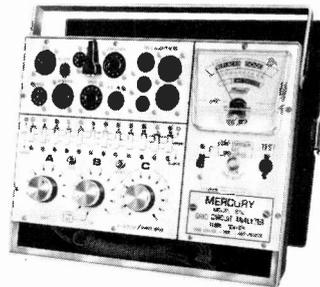
ET/D NEW PRODUCTS

continued from page 88

TUBE TESTER 722

*Weights only 7 lb. and
has built-in VTVM*

Introduced is the Model 1101C grid-circuit analyzer tube tester, with built-in VTVM circuitry. The unit is light

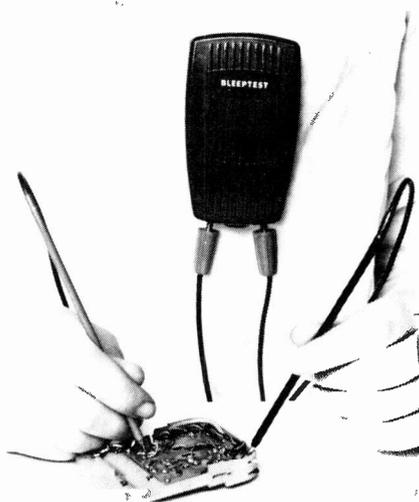


weight and housed in a luggage-type carrying case. It weighs 7 lb, and sequence of operation reportedly reduces tube testing time to a minimum. Up-to-date sockets, with a wide range of filament voltages and eight individual selections of load voltages are said to insure against obsolescence. Tube test data is kept permanently up to date on a year-in/year-out basis. This unit sells for \$69.95, factory-wired. Mercury.

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*Audible tone generated by
sonic signal generator*

Introduced is the Bleeptest, a compact, lightweight circuit continuity tester. This tester will find application



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1. The names and addresses of the publisher, editor and managing editor are: Publisher, Hugh Wallace, 43 East Ohio Street, Chicago, Illinois 60611; Editor, Paul Dorweiler, Harbrace Building, Duluth, Minnesota 55802; Managing Editor, None.

2. The owner is: Harbrace Publications, Inc. a subsidiary of Harcourt, Brace and World, Inc., 757 Third Avenue, New York, New York 10017. Stockholders owning 1 percent or more of stock: (Hold-

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3. The known bondholders, mortgages and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages or other securities are: None.

4. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was 76,724. Free distribution by mail, carrier or other media: 805. Total distribution: 77,529.

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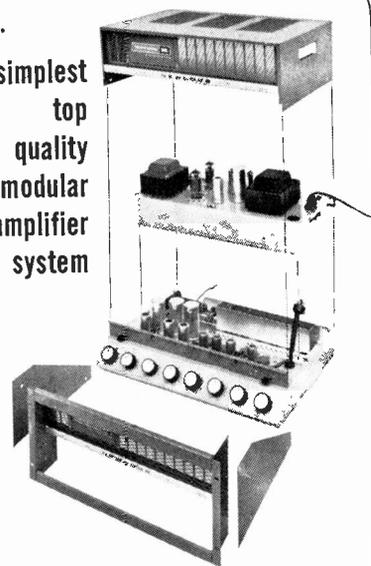
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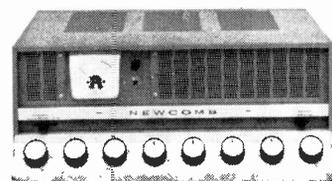
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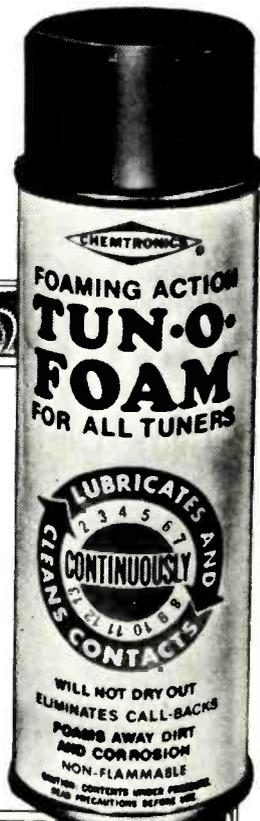
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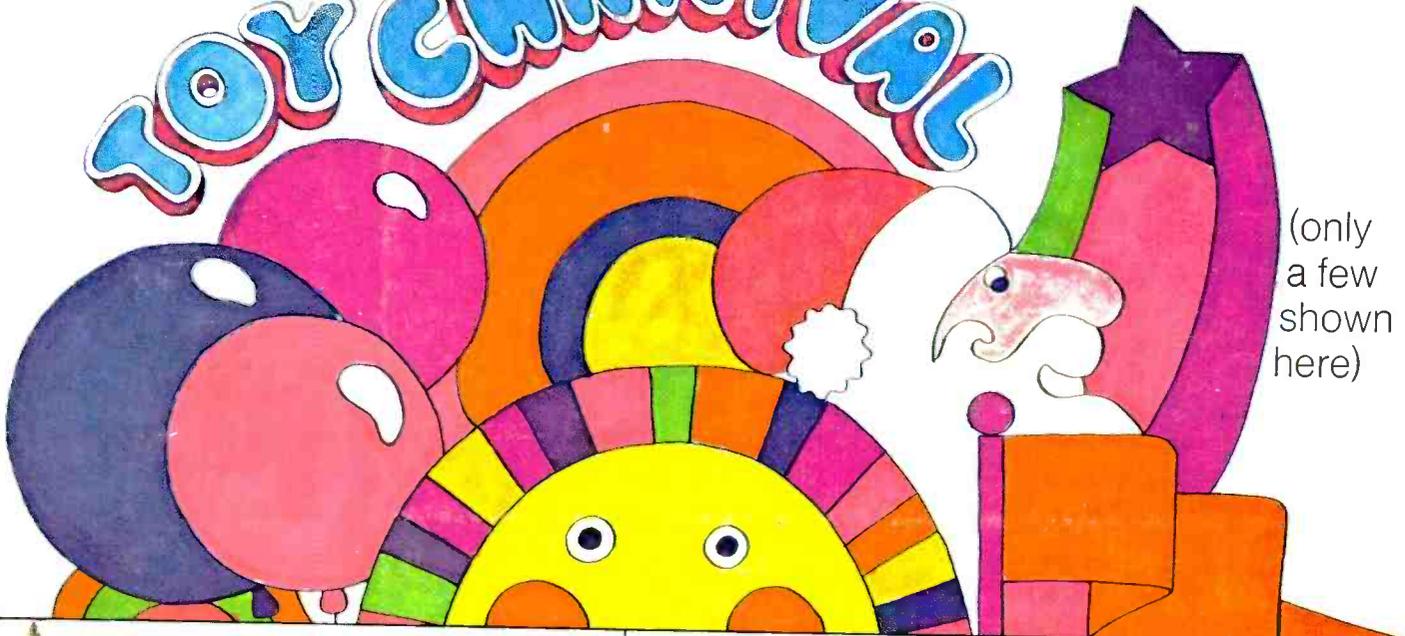
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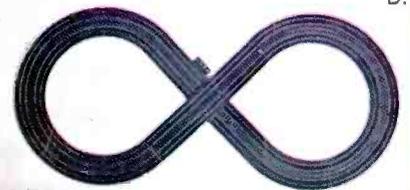
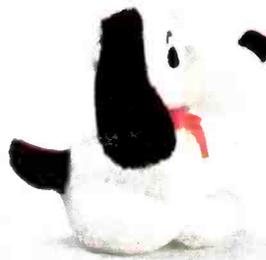
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B.



C.

D.



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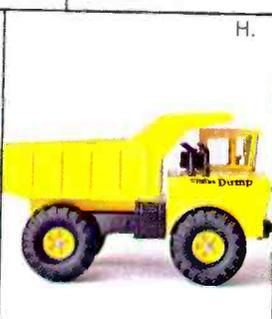
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- C. PLUSH DOG—TC-2262—cute-as-a-button beagle type
- D. ATLAS ROAD RACING-SET—TC-1202—complete with power supply
- E. PARKER "QUBIC" GAME—TC-400—3-dimensional Tic-Tac-Toe
- F. COLLECTOR'S SET AMERICAN SPACE PROGRAM BY REVELL—TC-1839—3 ready-to-assemble models
- G. HORSMAN "BABY BUTTERCUP" DOLL—TC-5301—drinks and wets
- H. MIGHTY-TONKA DUMP TRUCK—TC-3900—a kid can ride it
- I. HORSMAN "BABY TWEAKS"—TC-2570—18" tall, she "coos"

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