

June, 1977 | 75 cents

# Electronic Servicing



A HOWARD W. SAMS PUBLICATION



## Magnavox Modular Circuits



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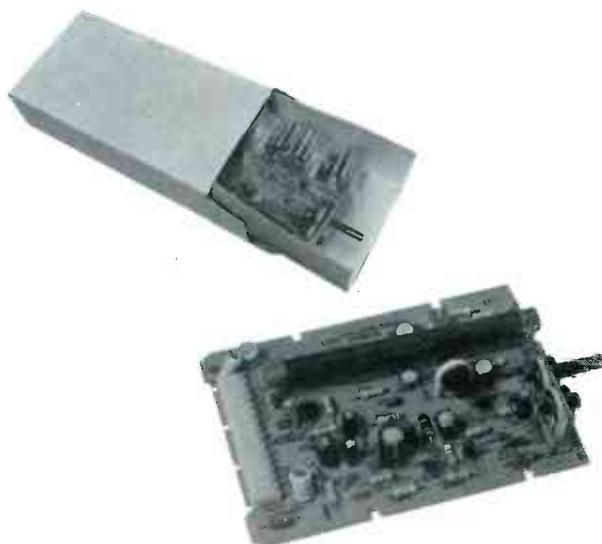
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# Electronic Servicing®

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Walter Cronkite, popular CBS newscaster, symbolizes one kind of programming that can be watched on the Magnavox color TV, shown by the other pictures. Color photo courtesy of CBS.

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ELECTRONIC SERVICING

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# editorial comments

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Probably you noticed that the May issue of Electronic Servicing had more pages than usual, while this June issue has less than the average. **Changes in our printing department make it necessary for us to vary the page count on alternate months.** Total pages for the year should be about the same.

And, while we're thinking about the number of pages, let me add that the formula for magazine pages is brief: **more pages of advertising permits more pages of articles.** Other magazines that have no subscriptions are sent to a controlled list of qualified recipients. Magazines of this type must have a ratio of about 60% advertising to 40% editorial material. Electronic Servicing is supported both by advertising and by subscriptions, so our percentage of editorial is much higher than most non-paid circulation magazines. Our Reader's Exchange and products items (Test Equipment, Audio Systems, Product Report, etc.) are **not** advertising, and we receive no revenue from them. Truth is, we go far beyond the usual rules to give you extra pages of technical information.

Also, a few readers have noticed that the Reader Service Cards (and any other inserts) are numbered the same as regular pages. This is nothing new, nor is it something we originated. Fact is, it's required by U.S. postal regulations. You will find all magazines numbering their pages the same way.

Other readers have asked why we no longer print "Letters To The Editor". The reason is simple: almost zero number of such letters ever reach us. Write them, if you want us to publish them. We get lots of mail, but most of it deals with Reader's Exchange or requests for circuit information.

One reader approved of our "Reports From The Test Lab", but wondered about our comments, which usually are favorable. If we believe they might be important to you, we do mention minor deficiencies of the equipment tested. But equipment that is too bad, or doesn't fulfill the specs, is not described. Notice, however, that we have **NOT** tested all current equipment, so any lack of a report does **NOT** imply a poor product!

Although we are a subsidiary of Howard W. Sams, we are near Kansas City, and Sams is in Indianapolis. Therefore, we do not stock or sell Photofacts or Sams books. Of course, we can supply you with the address, if you request it.

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# electronicscanner

news of the industry

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**The Federal Communications Commission has increased the penalty for CB operators who violate FCC regulations,** according to the **Wall Street Journal**. CBers who transmit above authorized power levels or who use unauthorized frequencies now will be subject to penalties up to \$100 maximum, instead of the previous \$50 fine. Operators transmitting beyond the 150-mile limit imposed by the FCC or using illegal antennas will face penalties up to \$75. The FCC action was prompted by an increasing number of complaints about CB interference. The current annual rate of complaints is 200,000, compared to just 30,000 three years ago.

**The first high-capacity telephone link using laser beams transmitted over hair-thin optical fibers** has been demonstrated in Harlow, England. The light-carrying fibers will run 9 kilometers through normal underground cable ducts between two towns located north of London. Installation of the link will be completed this summer, followed by several months of testing with speech and test signals to assess the system's ability to handle live telephone calls. The new optical fiber links offer greatly reduced bulk and weight compared with copper, far greater capacity, freedom from electrical interference, and near-perfect security.

**Charges that U.S. TV manufacturers have archaic distribution methods and lack marketing expertise** have been called "untruths" by George Konkol, president of GTE Consumer Electronics. The National Retail Merchants Association issued the criticisms against domestic manufacturers seeking import restrictions on Japanese products. Konkol was quoted by **Retailing Home Furnishings** as saying he was not aware of "any fundamental difference in distribution patterns between Japanese and U.S. producers except that the Japanese sell at a lower price."

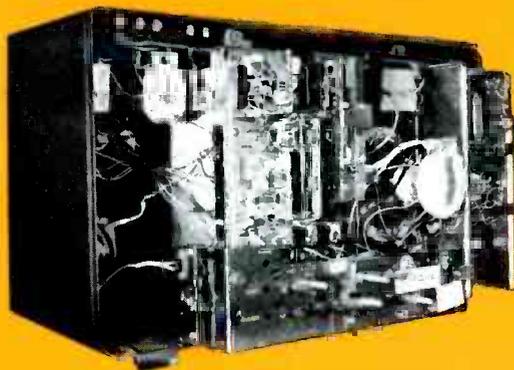
**George F. Knapp, president of ITT World Communications, has called on Congress to "reaffirm the FCC's role as the sole regulatory agency for communications,"** and urged a realignment of the communications responsibilities of the Office of Telecommunications Policy, the Department of Commerce, and the State Department. Knapp told the House Subcommittee on Communications recently that "neither the public interest nor the regulatory process have benefitted from activities of OTP and Commerce and they should be removed from the current regulatory process. Only the FCC as a strong independent regulatory agency can assure equality of competition."

**RCA American Communications has signed a satellite transponder leasing contract for the first phase of the Satellite Business System pre-operational domsat program,** **Electronic News** has reported. SBS will lease one transponder on RCA's 4/6 GHz Satcom-I until the fall of 1977.

*continued on page 8*

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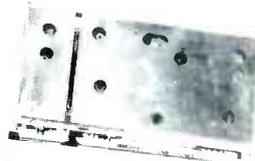
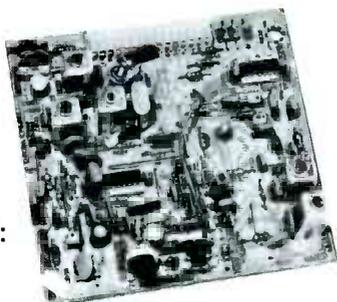
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*continued from page 6*

**Zenith and Sony have reached an out-of-court settlement** in Zenith's suit against several Japanese firms for unfair competitive practices, according to the **Wall Street Journal**. Zenith filed the suit in 1974 against several Japanese consumer-electronics manufacturers for dumping their products on the American market, thereby underselling domestic companies. Zenith will continue to press charges against the other Japanese firms.

**The U.S. Court of Claims has ordered the federal government to pay Tektronix \$4.6 million in damages for patent infringement**, according to **Electronic News**. Tektronix, which filed the suit 16 years ago, had charged the government with infringing upon its Model 535 oscilloscope patent from 1960 through 1969. The final settlement includes \$2.1 million in basic damages and an additional \$2.5 million for the delay in compensating the company.

**This fall, Zenith will offer several video-tape player/recorder units**. These include a separate unit for connection to any TV receiver, several models of large fine-furniture color receivers with video-tape decks, a microphone and B&W camera kit for making home video "movies", and blank cassette tapes. The units are Betamax designs, manufactured by Sony to Zenith specifications, and will be repaired by the Zenith authorized service centers.

**PTS Electronics has purchased the Tune-Rite TV Tuner Company in Wauwatosa, Wisconsin, and consolidated it with their Milwaukee servicenter**. One of 46 company-owned branch locations throughout the United States and Canada, the PTS-Milwaukee servicenter will provide former Tune-Rite customers with complete service. In addition, PTS-Milwaukee provides a module rebuilding/exchange program; maintains a complete inventory of tuners, tuner parts, and modules; and, offers a full line of tuner test instruments and accessories.

**Thordarson-Meissner has taken legal action against General Instrument Corporation**, through its F. W. Sickles Division, for allegedly manufacturing deflection yokes in Taiwan with Thordarson identification numbers and importing them into the United States. Thordarson also claims that such foreign-made parts are "counterfeit" because the Thordarson guide-number system was appropriated, and repair technicians and service dealers purchased the parts in the belief that they were purchasing genuine Thordarson parts.

**Panasonic is planning a 5% price increase on television and consumer audio products by September 1**. **Retailing Home Furnishings** quotes Ray Gates, vice president of consumer electronics, as saying the hike is necessary due to the increased value of the Japanese yen. Gates added, however, that Panasonic does not plan any price increases as a result of the recent U.S. Customs' decision to impose countervailing duties on Japanese imports.

---

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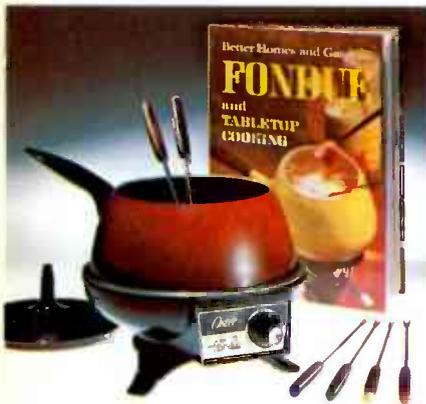
- 1 TAB — For every Sylvania receiving tube box "address" tab
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ET-1869

# SERVICE ASSOCIATIONS

## News From CSEA

The California State Electronics Association (CSEA) has started a Kern County chapter for TV, radio and appliance servicemen in the Bakersfield area, Don Surette, CSEA president, has announced.

Mark Sullivan of Sullivan's TV was named president of the new group. Other officers are Randy Butler, Rawl's TV, vice president; and Kenneth Berry, Busch TV, secretary-treasurer. All are from Bakersfield.

CSEA has reelected Vic Williams, current vice president, for another two-year term on CSEA's board of directors. Williams is the owner of Vic's Radio and TV in Hawthorne, California.

Also reelected for two-year terms were Maury Plante of Plante's TV Service, Fontana and Paul Astry of Sierra Radio and Television, Daly City.

## NESDA-ISCET Serviceability Program

The NESDA-ISCET Serviceability project has helped bring about improvements in receiver design from the standpoint of easier servicing.

Teams of ISCET Certified Electronic Technicians are invited by the manufacturer to spend several days in his plant examining every aspect of the TV receiver from design to production. The team spends a day inspecting a production-run model for its serviceability design, checking for such features as: accessible test points; identification of components; proper layout diagrams, etc. Afterwards, conferences are held with the company's design and technical staff to explain their findings and to gather feedback from the engineers' point of view.



CETs of the ISCET Serviceability Inspection Team examine an RCA CTC 85 chassis during a serviceability check at the Indianapolis RCA plant. From left to right: Paul Dontje, Wheat Ridge, Colorado; Lew Edwards, Trenton, New Jersey; Harold Carter, Charleston, West Virginia; Clarence Saatkamp, Milwaukee; and O. C. Brown, Jeffersonville, Indiana.



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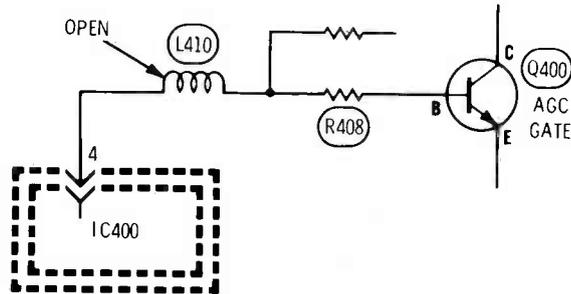
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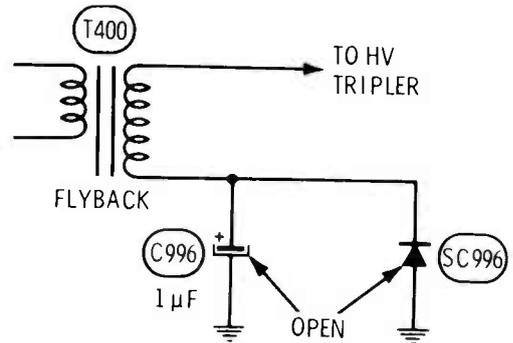
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Chassis—Sylvania E40  
PHOTOFACT—None



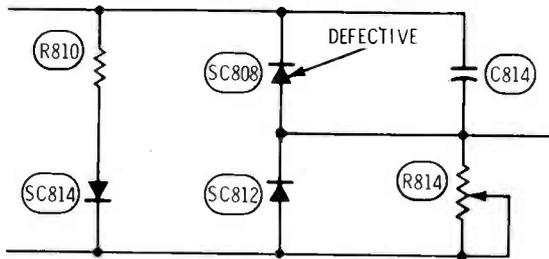
**Symptom**—AGC overload  
**Cure**—Check peaking coil L410, and replace if open

Chassis—Sylvania E21  
PHOTOFACT—1601-2



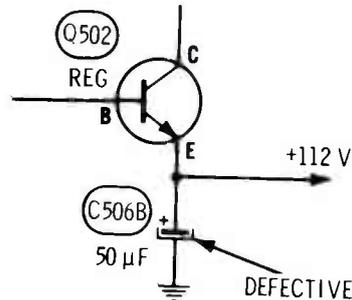
**Symptom**—Dark picture  
**Cure**—Check SC996 and C996, and replace if open

Chassis—Sylvania E21  
PHOTOFACT—1601-2



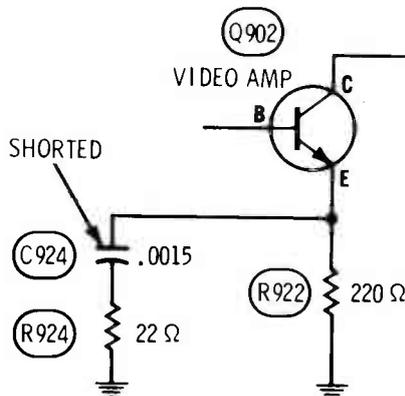
**Symptom**—R/B bottom lines would not converge  
**Cure**—Test diode SC808 by substitution

Chassis—Sylvania E21  
PHOTOFACT—1601-2



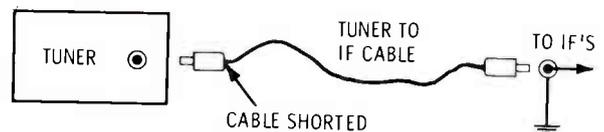
**Symptom**—Insufficient +112-volt supply  
**Cure**—Check capacitor C506B, and replace if defective

Chassis—Sylvania E21  
PHOTOFACT—1601-2



**Symptom**—Little control of brightness  
**Cure**—Check capacitor C924, and replace if shorted

Chassis—Sylvania E21  
PHOTOFACT—1601-2



**Symptom**—Snow in picture; AGC voltage does not change with signal  
**Cure**—Check for a short inside the tuner-to-IF cable

# reader's exchange

There is no charge for listing in *Reader's Exchange*, but we reserve the right to edit all copy. If you can help with a request, write direct to the reader, not to *Electronic Servicing*.

**Needed:** Service information or manual and parts list for Claricon VOM, Model 76-865, No. Q76. Will buy original or a copy. *Hugh G. Wales, instructor, 3000 Evangeline Street, Room 204, Monroe, Louisiana 71201.*

**For Sale:** One Model AK-20 Atwater Kent radio and one King radio (no model). Both radios are 1925 or 1926 vintage; are restorable, but are missing some tubes. Make offer. *James M. Mansfield, 1615 Egan Drive, Orlando, Florida 32807.*

**For Sale:** B&K Model 465 picture-tube checker and rejuvenator, mint condition, with new chart; \$80. Seco tube checker Model 107; \$25. *Ace TV & Electronics, 4018 Lillian Drive, Concord, California 94521.*

**Needed:** Schematic for Gibbs Model 830 8-track car-type player. Will purchase, or copy and return. *Geoffrey Calton, 4 Lynn Place, Pompton Plains, New Jersey 07444.*

**Needed:** Manual and schematic of B&K 1403A scope. Will buy, or copy and return. *Ed Tonrath, 3035 LaSalle Avenue, Rockford, Illinois 61111.*

**For Sale:** B&K Model 1074 TV Analyst, perfect condition, with instruction book, best offer. I'm retiring. *C. H. Daykin, 19 Oxford Place, Geneva, New York 14456.*

**Needed:** One complete VHF channel-selector knob, part number 424-8719, for a Model UN-3532-BE Philco TV. Either new or good used knob is acceptable. *Paul Capito, 637 West 21st Street, Erie, Pennsylvania 16502.*

**Needed:** Schematic and wiring diagram for Knight Kit RF generator. No model number available. Has two tubes (12AT7 and 6C4). Will buy, or copy and return. *Don Keck, 516 S. Lafayette, Millstadt, Illinois 62260.*

**Needed:** 2-year-old Realistic DX-160 radio with matching speaker, in working order. Also, would like operator's manual. *Harvey Pearson, Pearson TV Repair, P.O. Box 104, Greencastle, Missouri 63544.*

**Needed:** Meter movement for Model 221 Eico VTVM, or complete unit if meter is okay. State price. *Smitty's TV, 414 Cleveland Blvd., Ravenna, Ohio 44266.*

*continued on page 14*

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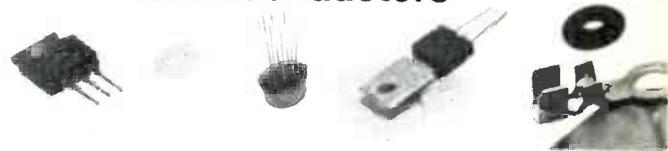
RCA's comprehensive line of replacement transistors, rectifiers, thyristors and integrated circuits is now growing at the rate of 20 new SKs every month. That means there will be around 580 RCA types available by the end of the year — bringing the total of domestic or foreign semiconductors that can be replaced by a high quality RCA SK to over 130,000.

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**RCA**  
SK Replacement Semiconductors



*continued from page 13*

**Needed:** 9WP4 picture tube. Also, B&K 1077B TV analyzer. Will trade antique-radio tubes, or pay cash. *Troch's, 290 Main, Spotswood, New Jersey 08884.*

**Needed:** Operation/service manual for Navy signal generator Model SG-117 URM-26B. *Mike Adams, 1402 West 13th Street, Panama City, Florida 32401.*

**Needed:** Service manual for Superior Instrument Model TV-50A Genometer (signal generator) and Model 76 C/R bridge & signal tracer. Will buy or copy and return. *J. Casper, 3513 Mt. Everest Boulevard, San Diego, California 92111.*

**Needed:** Service manual and schematic for DuMont Model 401 scope. Will pay for a copy, or will copy and return. *Daniel L. Sanders, East 3929 Pratt, Spokane, Washington 99202.*

**Needed:** Deflection yoke for Sylvania Model 19T32-2W. *Larry's TV & Stereo, 4273 Main Street, Vancouver, British Columbia, Canada.*

**Needed:** Schematic and/or power transformer for Webcor stereo Model WFX 157. *Robert Madigan, Remco TV, 728 West Grant Road, Tucson, Arizona 85705.*

**Needed:** Schematic and operating manual for a Model WFX-259 Webcor (division of U.S. Industries) combination AM/FM-stereo radio with record changer and 8-track tape player. *Paul Budnick, 4457 North Avers Avenue, Chicago, Illinois 60625.*

**For Sale:** Two B&K Analytsts, Model 1076; one in excellent condition, the other in good condition; asking \$175 for both. One Fairchild 304A 5-inch oscilloscope, single trace, in good condition; \$60. One Eico Model 368 TV-FM sweep generator in fair condition; \$40. *Loren Miller, Rte. 1, Box 304, Minford, Ohio 45653.*

**Needed:** Schematic for Candle TV by Tokyo Transistor Ind. Co. Ltd., Model MT501A, Serial 0109. *Jim Hewitt, Baseline TV Services, 2827A Sandalwood Drive, Ottawa, Ontario, Canada K1V 7P4.*

**Needed:** Operating manual for a B&K television analyst, Model 1075. *Nick De Bari, 325-41 Street, Union City, New Jersey 07087.*

**Needed:** Operation manual and schematic for a Jackson Model 637 dynamic-output tube tester. Also, would like new address of Jackson Electrical Instrument, if still in business. Will buy, or copy and return. *Dr. Dee W. Pulsipher, 9929 Manchester, Warson Woods, Missouri 63122.*



**Needed:** Schematic and information for a Marlin 8-track tape player, Model P-1194-A. *Capps Radio & TV Service, P.O. Box 11, Kenly, North Carolina 27542.*

**For Sale:** LaVoie Model 265 dual-trace laboratory-quality scope with service manual, \$225. *Lakeshore Electronics, 6 S. State Street, Hart, Michigan 49420.*

**Needed:** Tape head for a Webcor reel-to-reel recorder; part number CP 2502-1. *Bob Wright, 1778 Kaiser Drive, Reynoldsburg, Ohio 43068.*

**For Sale:** Eico Model 460, wideband, direct-coupled 5-inch scope, \$60. *G. C. Pullen, 6722 Botetourt Drive, Oxon Hill, Maryland 20022.*

**For Sale:** Two B&K Model 1076 Analysts, \$150 each; RCA audio signal generator Model WA 44B, \$25; RCA RF signal generator Model WR 49B, \$25; Eico Model 460 scope, \$75; Eico Model 324 VTVM (with new probe), \$50; and B&K Model 360 VOM, \$25. Most equipment has cables and manuals. *Dangerfield Audio & TV, Box 202, North Truro, Massachusetts 02652.*

**For Sale or Trade:** Eico 435 DC scope in excellent condition. Would like dual-trace triggered scope. *F. David Cummings, Ridge Road, RD 4, Cazenovia, New York 13035.*

**Needed:** Schematic and operation manual for Model 7008 Philco Precision Visual Alignment Generator for television and FM. Will buy, or copy and return. *William Bauer, 2404 Pineland Lane, Virginia Beach, Virginia 23454.*

**Needed:** Vertical integrator part 30-6030-8 for B&W Philco TV Model 12J27. Urgently needed. *Anthony J. Wegryn, 39 Maryknoll Drive, Lackawanna, New York 14218.*

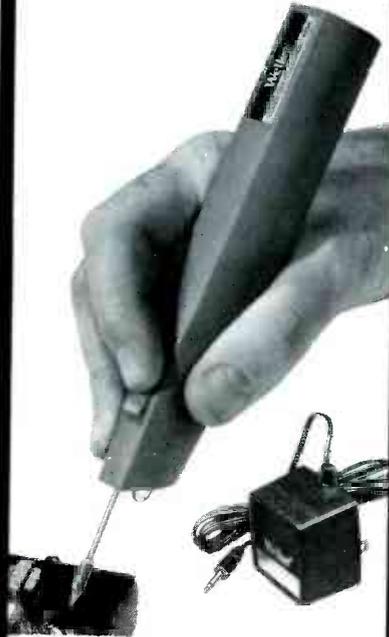
**For Sale:** RCA scope Model WO-535A, DC-10 MHz, RCA transistor/FET tester Model WT-524A, RCA color/b&w picture-tube tester Model WT-509A, RCA hi-sensitivity AC-VTVM Model WV-76A. *W. D. Shevtchuk, 1 Lois Avenue, Clifton, New Jersey 07014.*

**Needed:** Channel selector shaft for Bradford TV, Model WTG-79392A. *Lakeshore Electronics, 6 S. State Street, Hart, Michigan 49420.*

**Needed:** Schematic and operator's manual for B&K television analyst Model 1075. Will buy, or copy and return. *Willie R. Van, 436 Glenwood Avenue, Cincinnati, Ohio 45229.*

**For Sale:** Hickok Model 370 auto-polarity FET multimeter, purchased 8-76, mint condition, \$119. *H. Geller, 12622 NE 3rd Street, Bellevue, Washington 98005.* □

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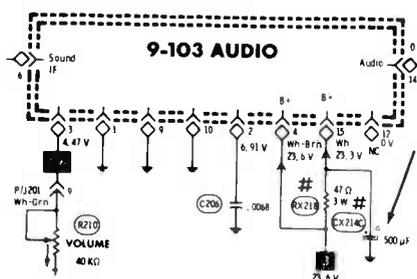
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## troubleshootingtips

Send in your helpful tips—we pay!

### Buzz in sound Zenith 17GC45 chassis (Photofact 1547-2)

The customer described an intermittent buzz in the sound, and scope waveforms showed excessive hash on the 22-volt supply source. When the sound was quiet, the ripple was about 0.02 VPP, but it increased to around 2 volts PP at times.



When I wiggled CX214, the symptoms would change. Apparently, the defect was inside the capacitor, and not in the external ground, because all the joints were okay.

I replaced the multi-section capacitor with a Zenith part 22-7436, and the problem was corrected.

Afterwards, I also encountered the same problem in other "F" and "G" chassis Zeniths.

Gary Steenwyk  
Holland, Michigan

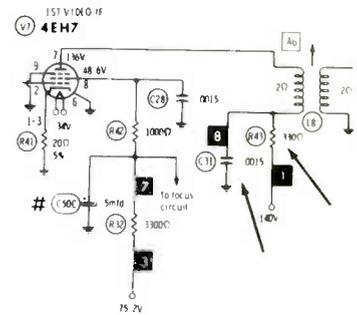
### "Souped-up" chassis Philco 5BL23 chassis (Photofact 1482-2)

Before a family member spilled a cup of soup over the back of the Philco TV, the performance had been normal, reported the customer. Afterwards, the TV smoked, and the picture went black.

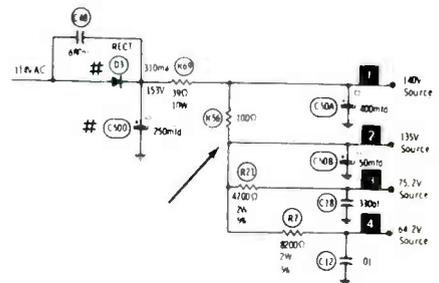
No trace of soup could be seen on the chassis, but R56 (in the power supply) was burned, thus accounting for the smoke.

A 50-ohm short was measured between the +140-volt source and ground. I checked the schematic, finding C31 as the likely suspect

(probably R43 would have been burned and reduced in resistance).



Unfortunately, the short was there after I lifted one end of C31. Without V7 in the socket, the short was gone. I prodded around the V7 socket, and found I could make the short come and go. I replaced both R43, the tube socket, and R56.



When I applied power, I found the 33GY7 horizontal-output tube also needed replacing. Touchup of a few more minor problems brought back normal operation.

John Van Der Wall  
Hawthorne, New Jersey

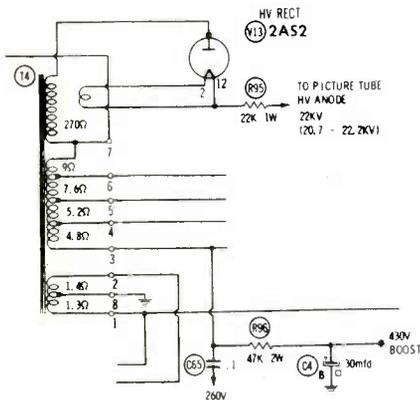
### Blooming Zenith 16N24 chassis (Photofact 821-4)

The picture got larger and darker, when the brightness control was advanced, indicating a reduction of high voltage (blooming) and not a weak horizontal-output stage.

A new HV rectifier tube didn't help at all, so I next suspected a resistor under the HV-rectifier socket. Fortunately, this model has a cage door that can be forced out of its retainers easily, and the removal of two screws makes the bottom of the socket accessible. The 22K resistor (R95) looked okay, but I replaced it anyway. After I put everything back together, the blooming was just as bad as before. Other components in the circuit

checked normal, also.

Finally, as I played with adjustments of the brightness control, I noticed arcing on the picture when the brightness was at maximum. I used an 18" fiber screwdriver with one end against the 2AS2 socket and listened at the other end. There was no arc. My stethoscope likewise could not find an arc around the flyback.



What about a broken connector at the button on the picture tube? I stethoscoped the connector and could hear an arc. I breathed a sigh of relief, and lifted the rubber insulation with an insulated screwdriver, expecting to find a break at the anode lead. Instead, I saw an eighth-inch blue arc **inside** the glass between the metal of the cavity and the internal aquadag. The picture tube had an open second-anode circuit.

In my 25 years of servicing, I had never before seen such an open inside a picture tube. A new 23FN4 stopped the blooming.

Stanley Egelberg  
Eastchester, New York

#### Got A Troubleshooting Tip?

If you've recently run across an unusual trouble symptom, send a thorough description of it and the solution to:

Troubleshooting Tips  
Electronic Servicing  
P.O. Box 12901  
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<table style="width: 100%; border: none;"> <tr> <td style="border: none;">2SK 19 FET</td> <td style="border: none;">2 pcs</td> <td style="border: none;">ZSC 1306</td> <td style="border: none;">4 pcs</td> </tr> <tr> <td style="border: none;">ZSD 235</td> <td style="border: none;">4 pcs</td> <td style="border: none;">ZSC 1239</td> <td style="border: none;">3 pcs</td> </tr> <tr> <td style="border: none;">ZSC 710</td> <td style="border: none;">10 pcs</td> <td style="border: none;">ZSC 1307</td> <td style="border: none;">4 pcs</td> </tr> <tr> <td style="border: none;">ZSC 775</td> <td style="border: none;">4 pcs</td> <td style="border: none;">ZSC 756</td> <td style="border: none;">3 pcs</td> </tr> </table>	2SK 19 FET	2 pcs	ZSC 1306	4 pcs	ZSD 235	4 pcs	ZSC 1239	3 pcs	ZSC 710	10 pcs	ZSC 1307	4 pcs	ZSC 775	4 pcs	ZSC 756	3 pcs	<table style="width: 100%; border: none;"> <tr> <td style="border: none;">ZSC 775</td> <td style="border: none;">ZSC 756</td> </tr> <tr> <td style="border: none;">ZSC 1018</td> <td style="border: none;">ZSC 799</td> </tr> <tr> <td style="border: none;">ZSC 1226</td> <td style="border: none;">ZSC 1239</td> </tr> <tr> <td style="border: none;">ZSC 1306</td> <td style="border: none;">ZSC 1307</td> </tr> </table>	ZSC 775	ZSC 756	ZSC 1018	ZSC 799	ZSC 1226	ZSC 1239	ZSC 1306	ZSC 1307
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ZSA 643	.70	ZSC 183	.59	ZSC 619	.59	ZSC 785	.70	ZSC 1195	.90	ZSC 1750	2.00	ZSK 49	1.30		
ZSA 683	.70	ZSC 184	.59	ZSC 620	.59	ZSC 789	1.00	ZSC 1189	1.40	ZSC 1816	4.25	ZSK 55	1.30		
ZSA 719	.70	ZSC 371	.59	ZSC 668	.59	ZSC 793	2.80	ZIC 1213	.70	ZSC 1908	.59	ZSK 58	1.30		
ZSA 720	.70	ZSC 372	.59	ZSC 696	1.95	ZSC 799	3.60	ZSC 1226	1.00	ZSC 1909	4.40	ZSK 68	1.30		
ZSA 731	.70	ZSC 373	.59	ZSC 696	1.95	ZSC 799	3.60	ZSC 1237	4.25	ZSC 1957	1.20	ZSK 22	2.55		
ZSA 733	.59	ZSC 381	.59	ZSC 710	.59	ZSC 802	3.60	ZSC 1239	3.50	ZSC 1975	4.40	ZSK 35	2.25		
ZSB 54	.59	ZSC 382	.59	ZSC 711	.59	ZSC 815	.59	ZSC 1306	4.40	ZSD 77	1.00	ZSK 39	2.25		
ZSB 54	.59	ZSC 387	.59	ZSC 712	.59	ZSC 828	.59	ZSC 1307	4.90	ZSD 142	2.00	ZSK 40	2.25		
ZSB 75	.59	ZSC 394	.59	ZSC 717	.59	ZSC 829	.59	ZSC 1317	.59	ZSD 180	2.50	ZSK 41	2.50		
ZSB 77	.59	ZSC 403	.59	ZSC 732	.59	ZSC 838	.59	ZSC 1318	.59	ZSD 187	.66	ZSK 45	2.50		
ZSB 186	.59	ZSC 454	.59	ZSC 734	.59	ZSC 900	.59	ZSC 1330	1.50	ZSD 188	3.00	MK 10	2.00		
ZSB 324	.70	ZSC 458	.59	ZSC 735	.59	ZSC 930	.59	ZSC 1359	1.40	ZSD 221	.59				
ZSB 337	1.60	ZSC 460	.59	ZSC 756	2.80	ZSC 943	1.20	ZSC 1364	1.40	ZSD 225	1.00				
ZSB 367	1.50	ZSC 461	.59	ZSC 763	.59	ZSC 945	.59	ZSC 1377	4.90	ZSD 235	1.00				
ZSB 368	2.15	ZSC 481	1.60	ZSC 773	.70	ZSC 1014	1.20	ZSC 1449	1.00	ZSD 313	1.10				
ZSB 405	.70	ZSC 482	1.50	ZSC 774	1.60	ZSC 1017	1.40	ZSC 1475	1.40	ZSD 325	1.10				
		ZSC 495	1.00	ZSC 775	1.95	ZSC 1018	1.20	ZSC 1674	1.55	ZSD 360	1.20				

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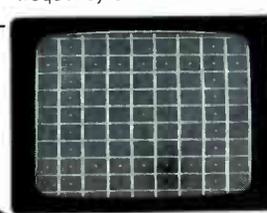
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**Part 1**

# **Servicing Magnavox Modular Color TV**



*By Gill Grieshaber, CET*



**Fig. 1** Only the buttons of the "Touch-Tune" system and a tiny light sensor under the picture tube reveal the special features of this Magnavox that has a T995 chassis.

Before we suggest specific servicing procedures, we'll describe the features and circuits of the T995 chassis Magnavox. Photos show you the appearance and layout; and circuit operations of the low-voltage power supplies are analyzed.

From 20 feet, the new Magnavox color TV seemed similar to other fine-furniture consoles (Figure 1). But when I moved near enough to try the front-panel controls, I saw several unique features. There were no station-selector rotary knobs. And, when the power was off, no channel numbers could be seen. In fact, the control cluster resembled a pushbutton phone more than it did a television set.

Figure 2 shows the controls with the door closed. Two large push-buttons select "Videomatic" (a system of providing color level, tint, brightness, and contrast according to preset controls) and an on/off control. Of course, the preset button is not new, but the on/off

button provided a surprise. The button does not latch. However, if you unplug the power cable while the receiver is operating, the set will not come on when you plug the cable into the outlet again. Instead, you must push the on/off button. This is a fact to remember or you might be embarrassed.

#### Touch-Tune feature

Two of the twelve buttons are for control of the audio volume, and will be explained later. The other ten are numbered from 0 to 9.

For channels with only one number, you must press the 0 button first, and then the channel number. For example, to tune Channel 5, push the 0 (this blanks the old channel number), followed by the 5. There is a flash on the screen, and almost instantaneously the new picture appears, with the corresponding channel number shown by the bright red LED display. Incidentally, Channel 5 is displayed as "5", and not as "05". Channel 13 is selected by pushing the 1, and then the 3.

If the channel you selected has not yet been programmed (only the 12 VHF channels are set at the factory), the channel digits will flash on and off, and the screen will

have only snow.

Two buttons are marked with a "V" for volume. One has an arrow pointing up (louder), and the other has the arrow pointing down (softer). To change the sound volume, push either of the buttons and hold it in until the level reaches the loudness you want. The change is very slow and gradual, and there is little danger of overshooting your choice. If you do adjust too far, just press the other button until the volume suits you.

Incidentally, the volume level stays constant when you turn the set off and on by using the on/off pushbutton. But if you unplug the power cable, later plug it back in again, and push the on/off button for power, the sound is very weak and must be brought up with the proper volume button. That's another unique characteristic for you to remember.

#### Programming the Touch-Tune system

Each new receiver of this model must have the local UHF channels programmed, because they are not preset at the factory. Controls for programming (plus the manual color controls) are exposed by pulling the door out horizontally

*continued on page 20*



Fig. 2 The "Touch-Tune" panel has pushbuttons for "V-Matic" (a one-button preset-color circuit), a non-locking on/off switch that operates from a digital circuit, and 12 buttons for station selection and control of the sound volume. Space is provided for a remote-control microphone. Remote control can be added at any time.



Fig. 3 Pull out on the catch at the extreme top of the tuning-assembly door, and the door can be tilted until it is horizontal. This exposes the manual color controls (the preset controls can be adjusted with a narrow screwdriver through the shafts of the manual controls), the tuning meter that's used for programming the channels, and the various switches for channel programming.

## Magnavox Modular

continued from page 19

(Figure 3), and then adjusting four controls, using the meter to guide you.

Do **NOT** attempt to program any sets with Touch-Tune channel selection until you have read and understood the factory instructions. This system is mostly digital, providing **random access** to as many as 20 channels, and the programming of each channel requires several steps.

For example, a switch must be activated to connect these controls. Then one switch selects a general tuning area, the second finds the desired channel number (display only—not the station), and finally,

the third adjusts for the correct DC voltage to make the varicap diodes in the tuners bring in the station. The meter reads this tuning voltage, to help locate the right channel.

As you can see, the system is not one to be tinkered with, although it is easy to program after you have experience. The Touch-Tune circuits are very important, and will be analyzed thoroughly later in the series of articles.

### Features Of The Magnavox T995

The Magnavox T995 chassis is completely solid-state (except for the picture tube, of course), and has a total of 14 plug-in modules (counting the convergence board)

plus the interconnect board, which is permanently wired to the power transformer.

From the rear (see Figure 4), the modules do not show, because they are on the "front" of the chassis. However, it's necessary only to loosen two screws, and the chassis tilts back at about a 45-degree angle (Figure 5), allowing access to most areas of the "mother" chassis and the modules.

Figure 6 shows the rear of the "Touch-Tune" keyboard, which consists mostly of switches, and the chassis for the "Touch-Tune" digital circuits and the two tuners.

**A remote-control microphone and chassis can be added to these models at any time;** the circuit is arranged to accommodate a remote, without any modifications.

Circuitry of the "Touch-Tune" system is very interesting. For example, memory is maintained (during times the receiver is unplugged) by two batteries. And the control voltage for the varactor diodes in the tuners is produced digitally by filtering pulses. Wider pulses provide higher DC voltages, and narrower pulses produce lower DC voltages.

On the "mother" chassis, many test points are provided, along with clear identifications, plus stencils which show the location of the copper wiring that's on the other side of the board (see Figure 7).

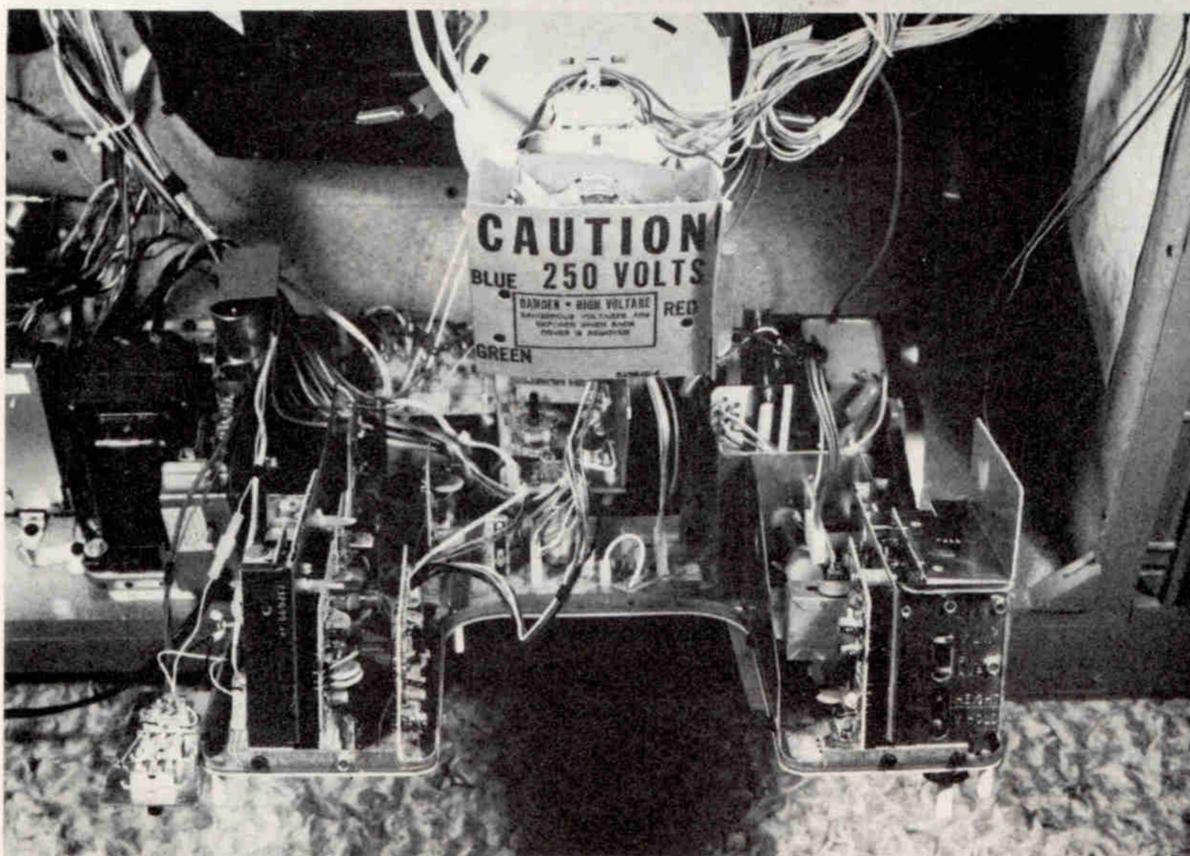
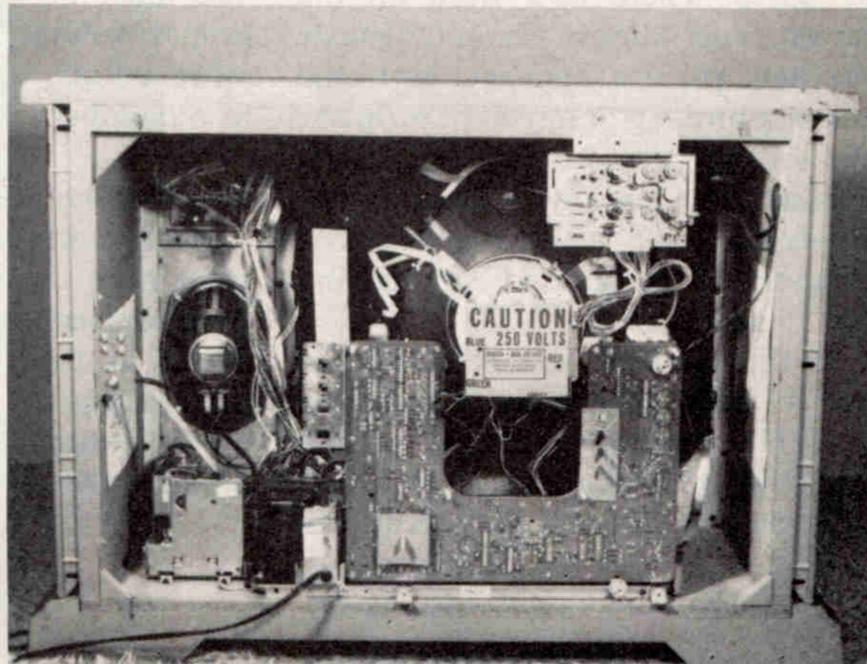
#### Module connectors and mounts

Sturdy pins on the chassis make connections with strip sockets on the modules (Figure 8A). A few modules are held tightly into place by shaped wire springs that slip into slots on the module (Figure 8B). Other modules slip over plastic pins, which expand to keep a snug fit (Figure 8C). The shield of the IF module is bolted to part of the metal frame of the chassis. In a few cases, screws hold the modules to hollow plastic pins.

#### Low-Voltage Power Supplies

Two types of voltage regulation are provided: the AC voltages are stabilized by a Voltage-Regulating Transformer (VRT); and the DC supplies are stabilized by transistorized regulators. In addition, rectification of horizontal-sweep pulses provides several light-duty voltage supplies.

**Fig. 4** Removal of the back exposes the wiring side of the "mother" chassis. To the left of the main chassis is the "Touch-Tune" control unit with the two tuners.



**Fig. 5** Any of the 14 modules can be removed easily after you loosen two screws and lean the chassis backwards at about a 45° angle.

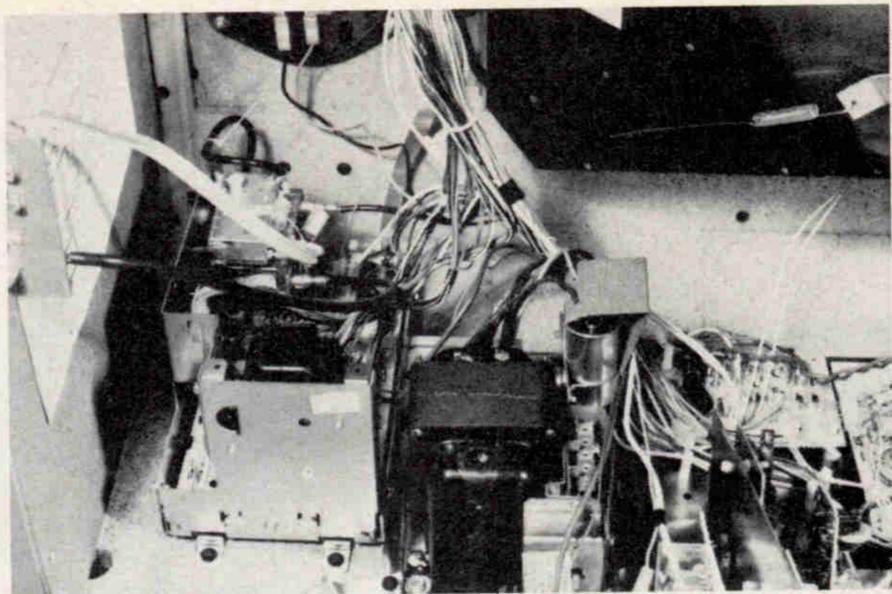
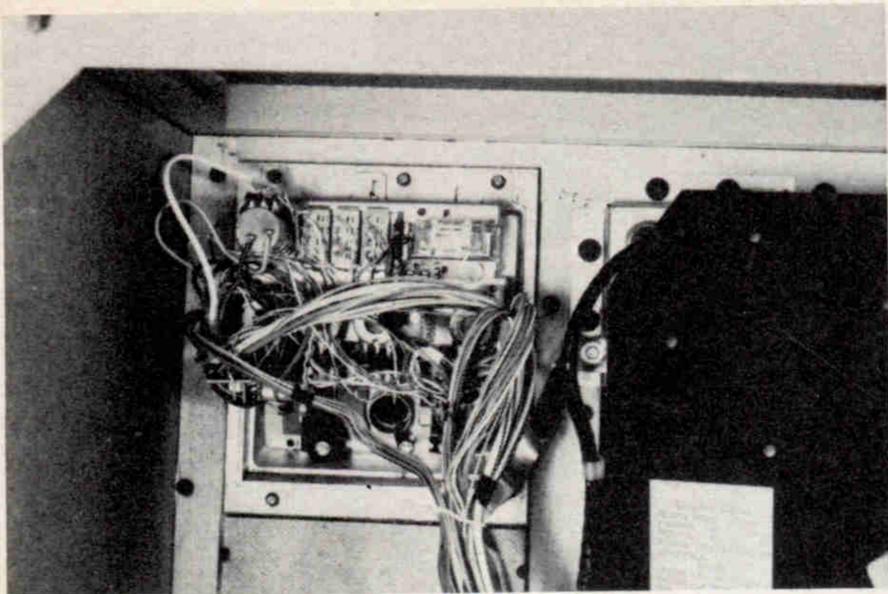


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### VRT

Voltage-regulating transformers have been described before in *ELECTRONIC SERVICING*, so it is not necessary to say much about them now. Each VRT is arranged so the primary does not saturate, but the secondary windings do saturate. This is done with magnetic shunts. Therefore, the normal waveshape from all secondary windings is an approximate square wave.

In Figure 9, the T2 VRT is drawn exactly the same as a conventional transformer. The distinctive thing is the 2  $\mu$ F capacitor that's across the entire secondary. It's there to provide some capacitive current, and it is tuned approximately to the third harmonic (180 Hz) of the line frequency, so the square wave is smoothed, but not eliminated. You see, high "Q" filtering that's tuned to the fundamental (60 Hz) would change the square wave to a sine wave, thus destroying most of the regulation. The principle of the VRT regulation is that a clipped sine wave does not change amplitude (it does change waveshape a bit) as the input voltage is changed.

If tuning capacitor C203 shorts, the resulting overload will trip the circuit breaker (CB201—2.1 amperes), but the drain on the 120-volt AC line will be far less than it would be with a conventional transformer.

If C203 opens, the waveshape from the secondary windings changes drastically (see Figure 10), and the picture is about 1" small

on all four sides. By the way, **DO NOT** replace C203 with an electrolytic, even two back-to-back; any electrolytic probably would explode.

Notice that the heater voltage for the picture tube has the square waveshape. You can check for an open C203 by looking at the CRT heater voltage. The waveshape is about the same from the un-bypassed heater (pin 14) to ground, or across the two heater pins (pins 1 and 14).

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### Regulated supplies

From the diode rectifiers on the interconnect board, the +140-volt and +29-volt unregulated voltage sources go through a three-pin socket to the power-supply module (see Figure 11), which has two separate regulating circuits, and also supplies the side-pincushioning correction.

Circuits of the regulators are shown in Figure 12. When I first looked at the schematic, I thought the regulation of the +24-volt source should be better than that of the +120-volt source. The reasoning was that the +24-volt regulators were in a closed-loop circuit, and a zener was included to bias Q2 more accurately. That prediction certainly came true. This chart tells the

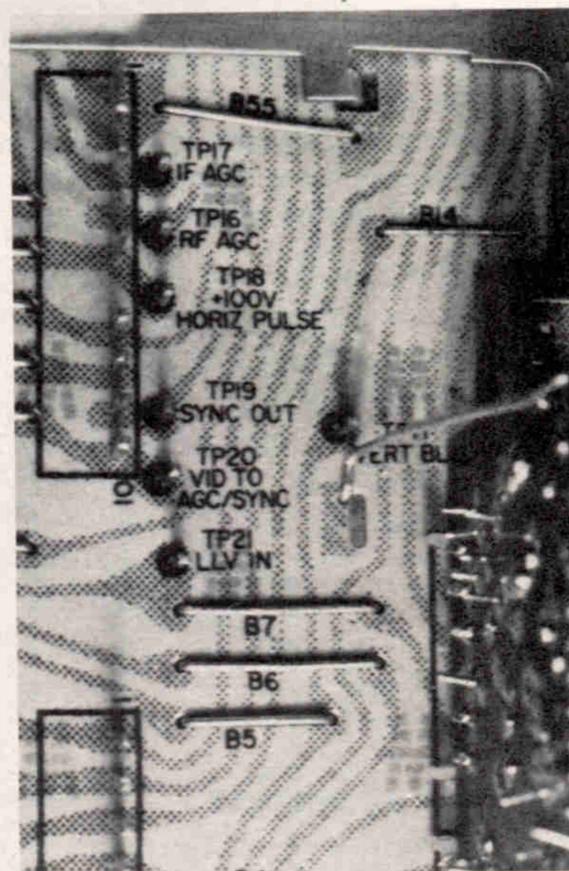


Fig. 7 Dozens of test points are printed on the "mother" circuit board, thus simplifying troubleshooting.

story:

70 V line	+24.1V	+105 V
90 V line	+24.1V	+117.4V
120V line	+24.1V	+120.7V
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Of course, the regulation of the +120-volt supply is entirely satisfactory. On the picture tube, the change of size was barely noticeable when the line voltage was changed suddenly from 90 volts to 125 volts. This is excellent regulation and performance.

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# Magnavox Modular

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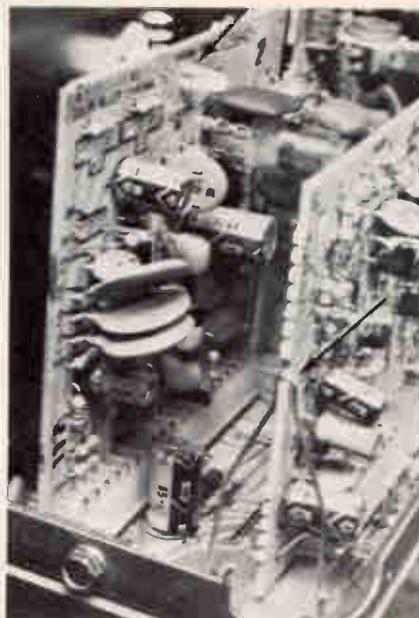
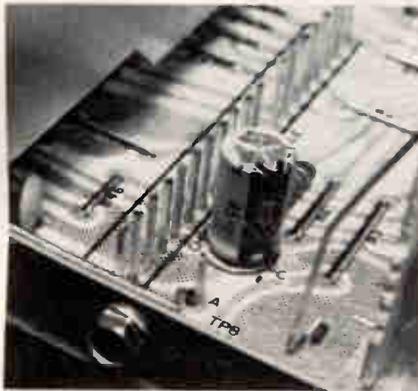


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## 24-volt supply

Q2 in Figure 12 is called an "error amplifier". Z1, the 5.6-volt zener, stabilizes the emitter voltage so long as the current through it is kept within limits. The base voltage of Q2 comes from the +24-volt supply, via a voltage divider that includes R7, which is used to select the desired output voltage.

Now, follow the path from the base of Q2. The base voltage change is amplified and reversed in phase as it reaches the collector of Q2, which is direct coupled to the base of Q1, a power-type larger transistor. Any base voltage of Q1 also appears at its emitter (an

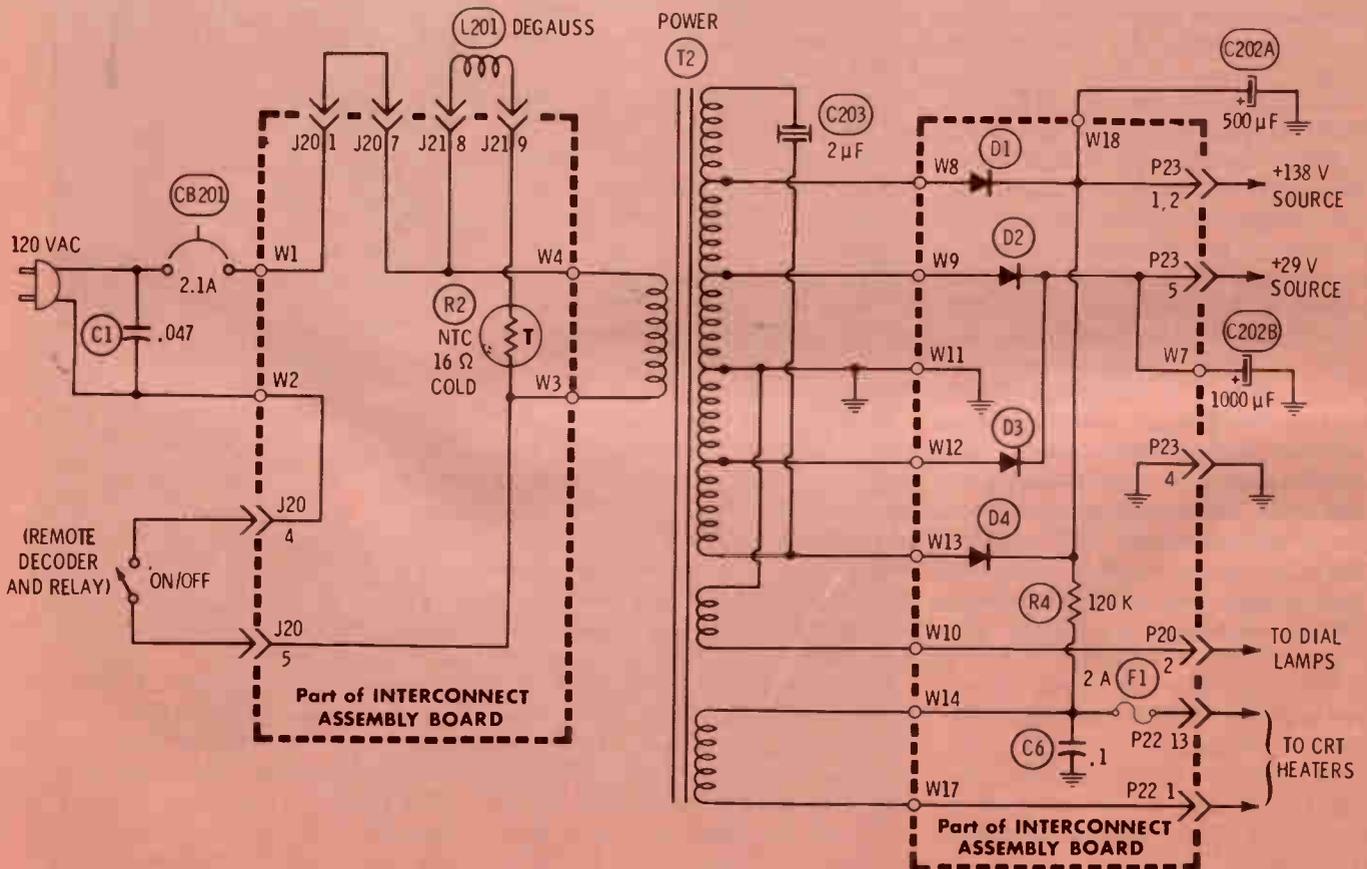


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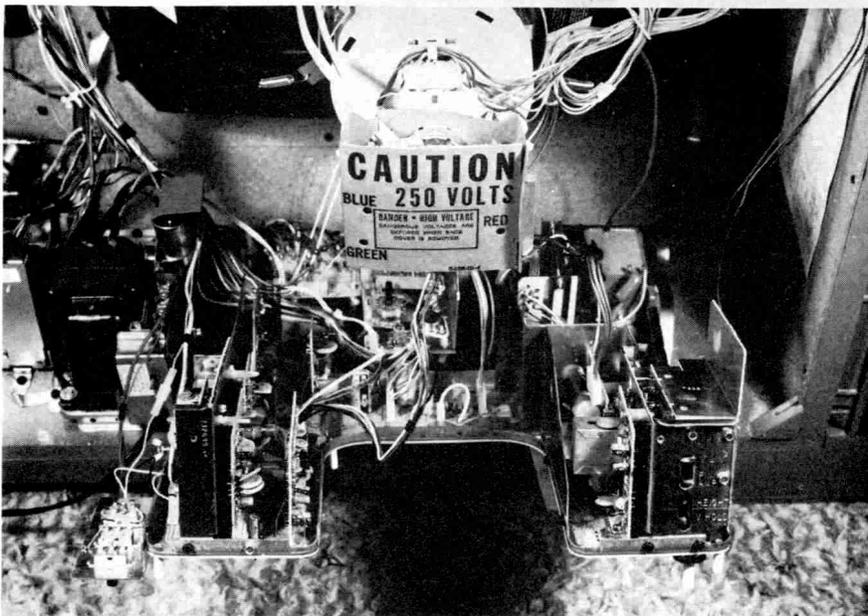
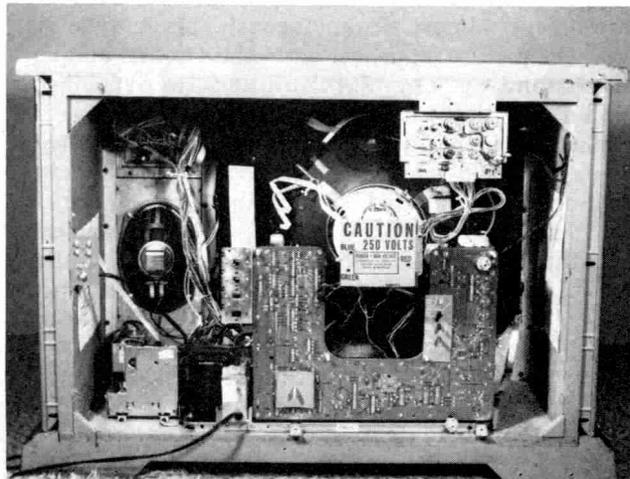
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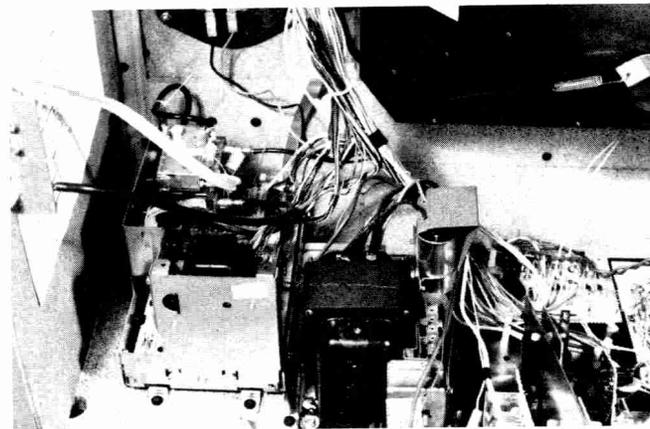
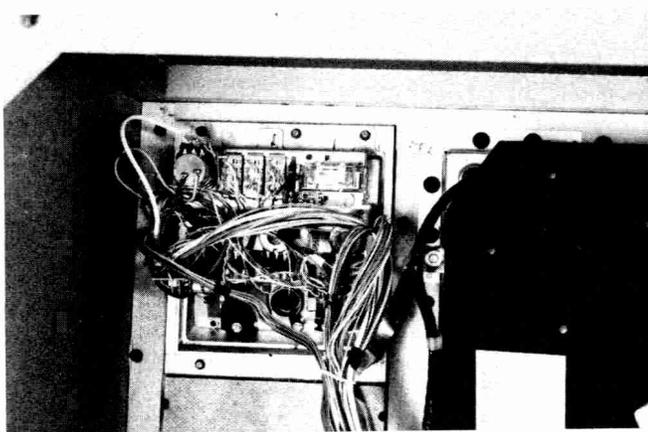


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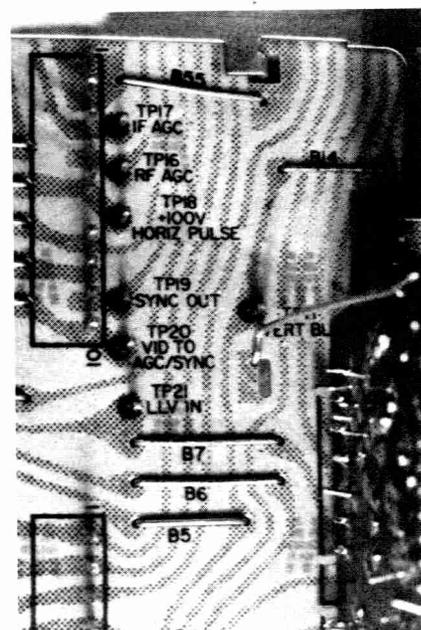


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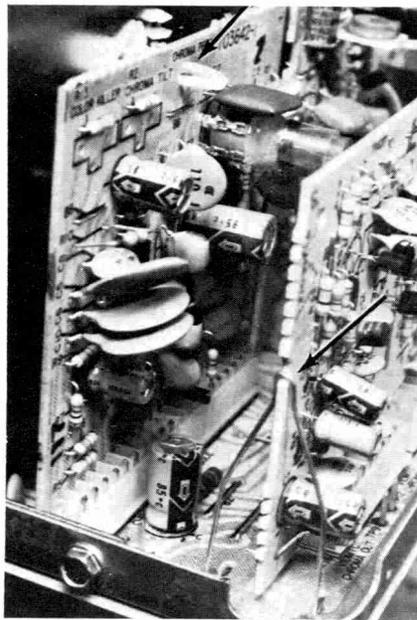
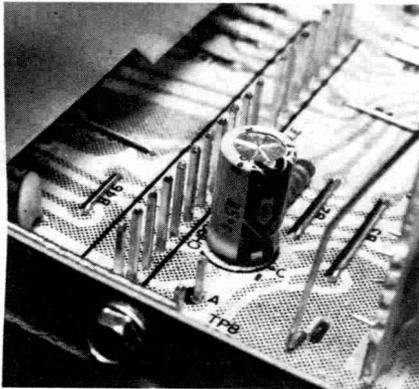
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# Magnavox Modular

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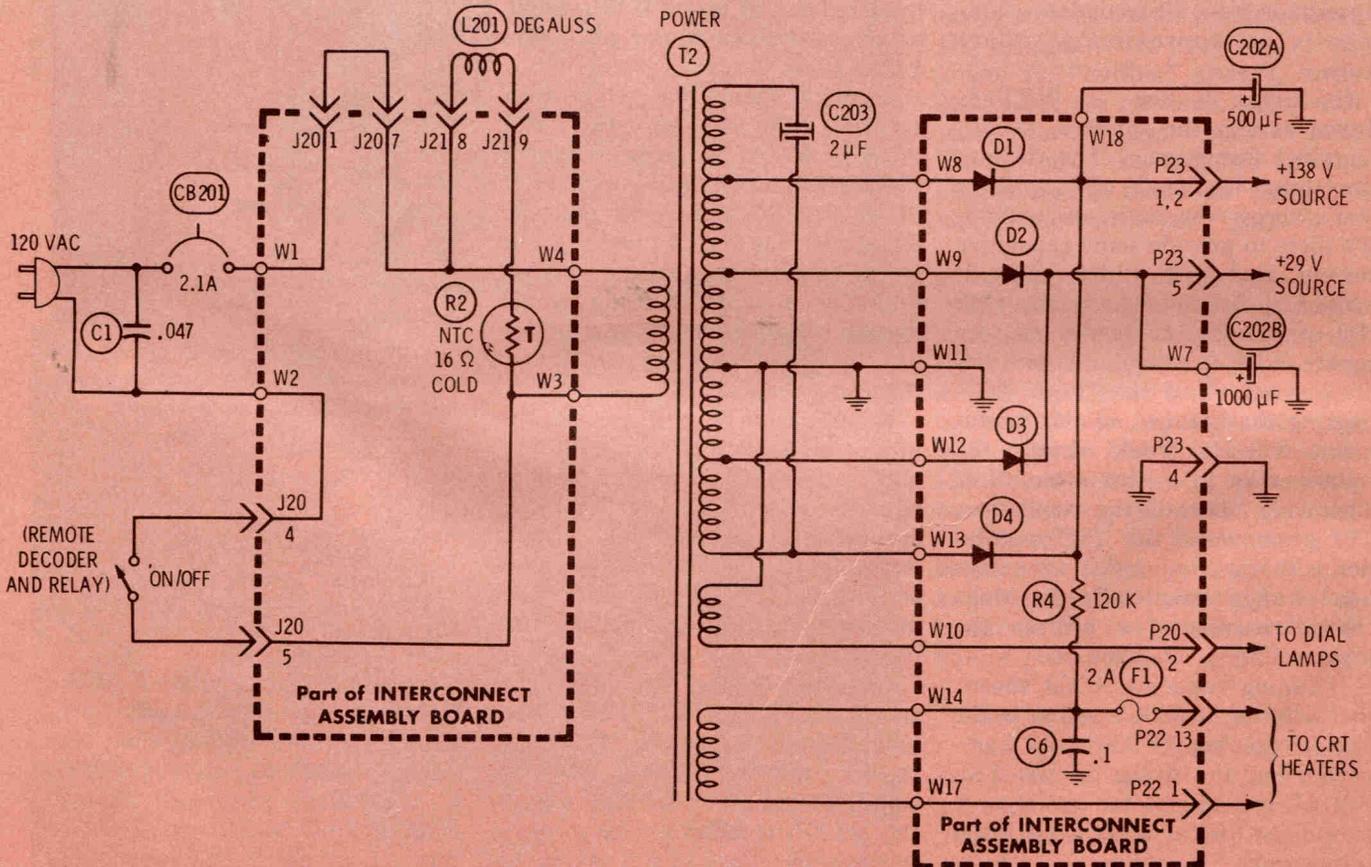
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**Fig. 9** This is the schematic of the power circuits, including the diode rectifiers. The interconnect board is similar to a module, but the wires are attached by soldering. Notice C203. A capacitor of that type and rating

(which is connected in parallel with the total secondary winding) indicates a voltage-regulating power transformer. Such transformers have rounded squarewaves from the secondary windings.

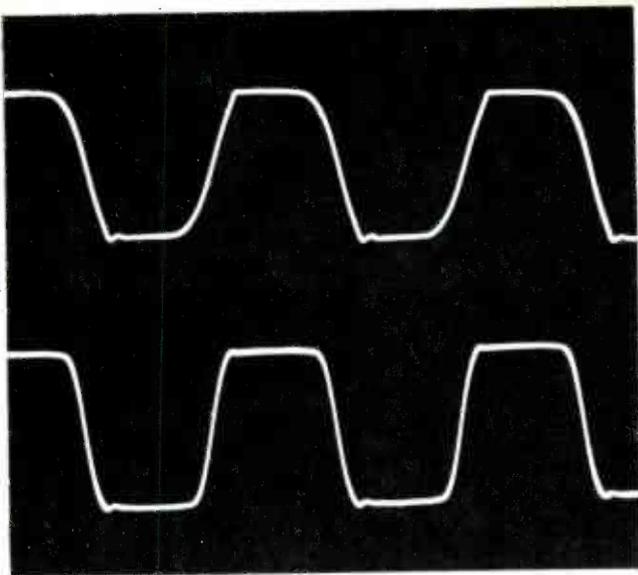
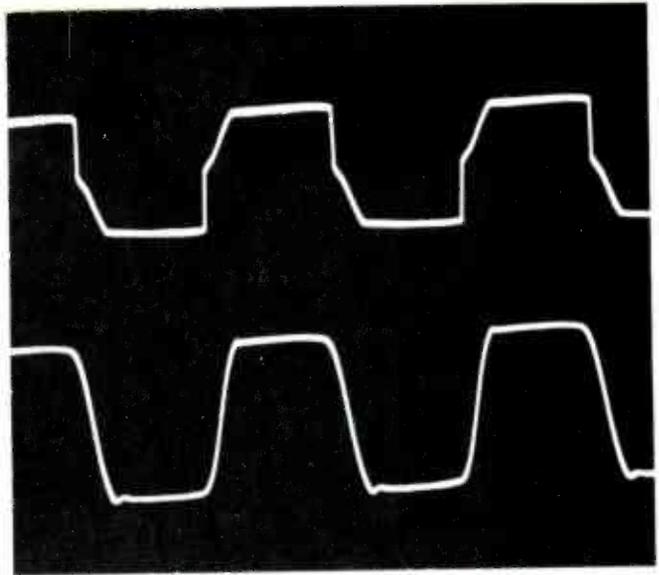


Fig. 10 The top waveform of Picture A is the one found across C203 when the line voltage is reduced to 70 volts, while the normal waveform at a line voltage of 120 is shown below. In Picture B, the top waveform will be found at the terminals of C203 when the capacitor is open (the



picture-tube heater voltage also will have the same waveform). The normal waveform is shown below, for comparison. If C203 is open, the +120-volt supply will be about 20 volts low, and the picture will have about a 1" black border at all 4 sides.

emitter-follower circuit), and the emitter is the source of the +24-volt supply. Of course, that was the beginning and ending of the closed loop; therefore, the circuit is self-adjusting, following the preliminary setting of R7.

Suppose the +24 voltage went down for any reason. This would be less forward bias for Q2, and it would conduct less, thus raising the collector voltage. The collector of Q2 is tied to the base of Q1, so the voltage change is an increase of forward bias for Q2. Q2 conducts more, and this raises the emitter voltage, which is the source of the +24-volt supply. Any increase of the +24 voltage causes a reverse chain of events. Therefore, the circuit compensates for both higher or lower supply voltages.

#### 120-volt supply

Because Q3 is an emitter follower, it merely matches the high impedance of the voltage divider that includes R3 (the 120-volt adjustment) to the low impedance base/emitter path of Q4, the power transistor. Therefore, we can ignore Q3 and obtain a more simple sequence of operation.

Suppose the DC voltage of the +120-volt source decreases because of increased current to the horizontal-output transistor. The base voltage of Q4 is stabilized fairly

well because it comes from the +138-volt source. Therefore, the reduced +120-volt supply from the emitter of Q4 is an increase of forward bias, which produces more conduction in Q4. This brings the supply voltage up almost where it was originally.

The regulation is good, but not perfect, because the bias of Q3 is not stabilized precisely. One more function is performed by the +120-volt regulator.

#### Side pincushion

Correction of the side pincushion raster distortion also is accomplished by the +120-volt regulator circuit. The horizontal-output transistor obtains its B+ voltage from this regulator. Therefore, the side pincushioning can be corrected by reducing the DC supply voltage near the top and bottom of the raster. In turn, this gives less width there. The regulator does this by adding a parabolic 60-Hz waveform to the +120 volts. There is no ready source of a 60-Hz parabolic waveform, so the circuit must create a parabola by filtering.

A 4-volt PP sample of vertical sawtooth is brought to the power-supply module and R14, then on to the base of Q5, the side pincushion amplifier. Figure 13 shows the waveforms at each point. Integrating a sawtooth produces a

parabola; therefore C4 (between emitter and collector of Q5) integrates the amplified sawtooth into a parabolic waveform. C3 couples the parabola to the base of Q3, for application to the base of Q4, where it's passed to the emitter of Q4, the +120-volt source. The result is a 4.5-volt PP parabolic waveform of the vertical-scan frequency that rides on top of the +120 volts. It is not adjustable.

#### Comments

Although the Magnavox T995  
*continued on page 24*



Fig. 11 The power-supply module has two voltage-regulating stages; one is for the +120-volt supply, and the other regulates the +24 volts. Also, Q5 adds a 4.5-volt parabolic waveform to the regulated +120 volts to narrow the picture at the top and bottom (eliminates pincushioning).

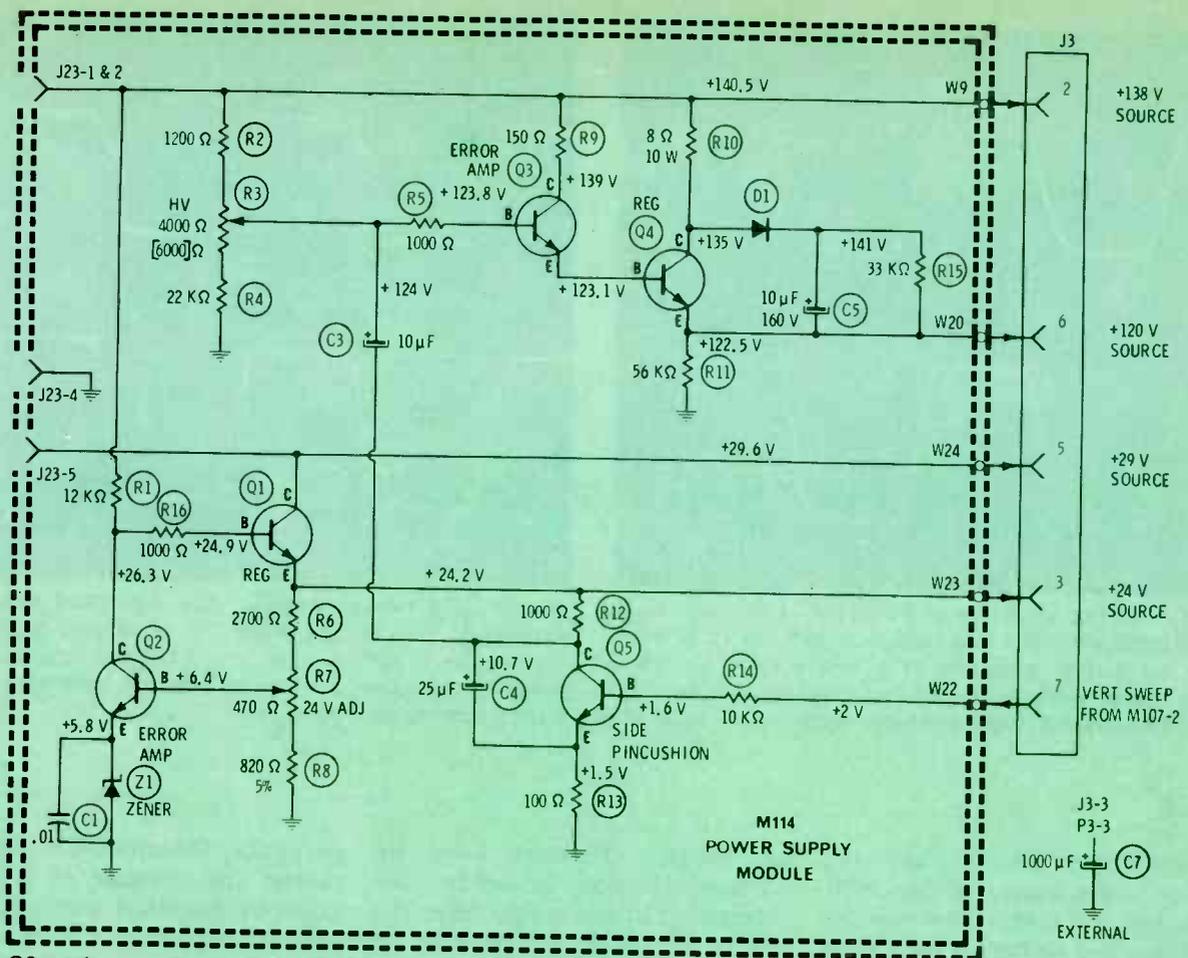
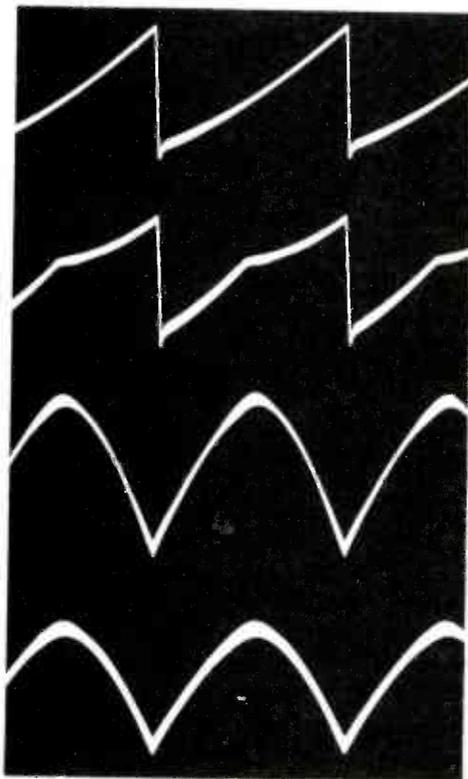


Fig. 12 Q3 and power transistor Q4 provide a moderate amount of voltage regulation for the +120-volt supply. Q5 and C4 change the vertical sawtooth into a parabolic waveform, which goes through C3 to the base of Q3. This adds a parabolic waveform (see Figure 13) to the DC voltage for correction of the side pincushioning. Q2 and power transistor Q1 regulate the +24-volt source. The regulation is excellent, because Q2 amplifies, zener Z1 stabilizes the emitter voltage, and the circuit includes a closed loop.

Fig. 13 By multiple camera exposures, these scope traces show the change of waveform in the Q5 stage. Top waveform is the vertical-oscillator signal that comes in at J3 pin 7; the base waveform of Q5 is shown by the second trace; the parabola of the third trace is the waveform at the collector of Q5 and the base of Q3; and the bottom trace is the 5-volt PP parabola that rides on top of the +120-volt supply. It reduces the supply voltage near the top and bottom of the picture to eliminate side pincushioning.



## Magnavox Modular

continued from page 23

chassis is not totally new (it first came out about two years ago), many minor changes have been made. Most of these changes are on the various modules, which remain interchangeable with earlier ones.

The most important feature is the Videomatic "Touch-Tune" system for tuning in the various channels. I can tell you that (with the exception of two peculiar results from unplugging the power cable) the operation of the "Touch-Tune" system appears to be excellent, with good stability and convenience. It returns to the same channel (at turn-on) that was selected before the set was turned off. In other words, it has a good "memory".

Next month, we'll describe the vertical-sweep circuits, which include a single output transistor with a coupling choke. □

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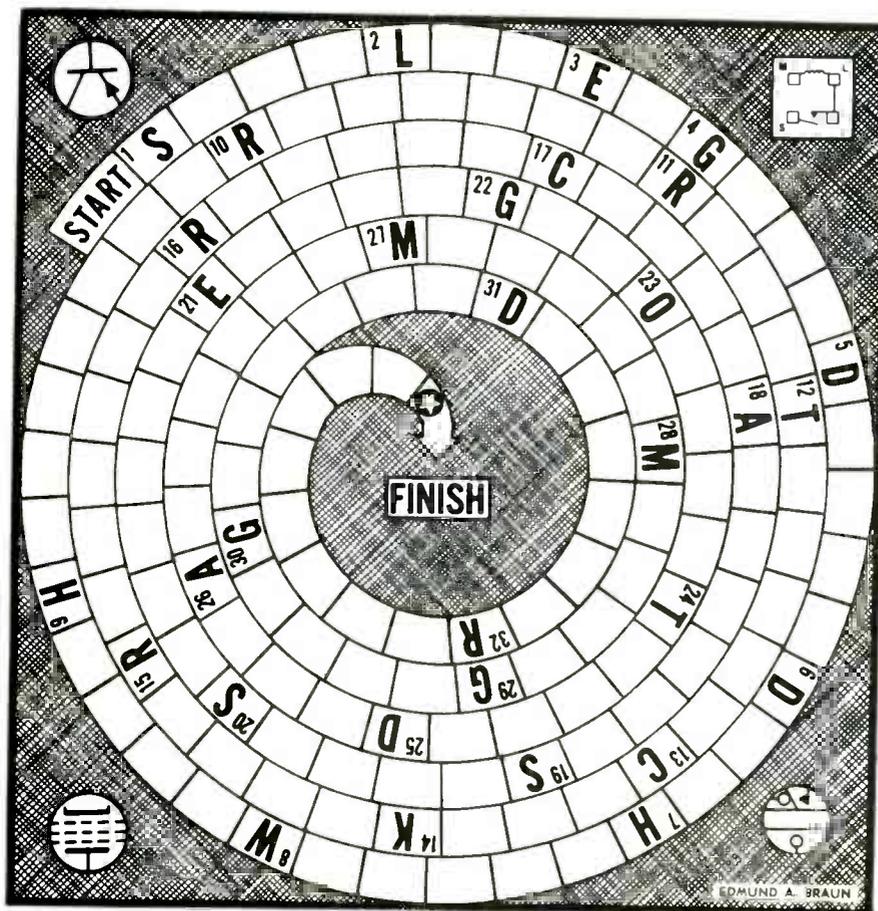
**VALUE LEADERS IN RADIO-TV, 2 WAY AND MRO INSTRUMENTS**

# A Short Circuit Puzzle!

by Edmund A. Braun

If you can spin around a few times without feeling tipsy, you'll have fun solving this Pinwheel Puzzle based on electronics. The last letter of each word is the first letter of the next word. Each correct answer is worth 4 points; a perfect score is 128. It should be fairly easy to get a high rating, except perhaps for someone who thinks "solder" is one who installs a new lawn, or that "bistable" is a house for two horses! So sharpen your pencils, put on your thinking cap, and GO!

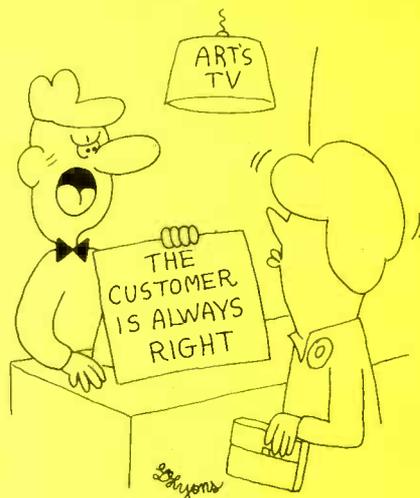
1. A flanged form serving as the foundation on which a coil is wound.
2. Conductor of electrical energy.
3. The absolute centimeter-gram-second unit of energy and work.
4. Any device which protects against injury or loss.
5. Lined with sound-absorbing material to prevent audio echoes.
6. Part of the Morse Code.
7. Tool for cutting metal.
8. Grasping tool for turning bolts, nuts, screw taps, etc.
9. Electrically symmetrical; having equally distributed charges.
10. Transformer with a coupling between primary and secondary that can be varied.
11. To restore a device to a prescribed state.
12. Pertaining to heat.
13. Clamplike device on a drill or lathe.
14. Magnetic conductor placed over ends of a permanent magnet.
15. Device which performs over again or a number of times.
16. Antenna with long wire in a parallelogram with opposite sides equal but no right angles.
17. That quality which characterizes a color without reference to brightness.
18. A non-inflammable material generally used for heat insulation.
19. Needle-like object used in some sound recorders to cut the record grooves.
20. A half step; interval between two sounds.
21. Undesired coloring around different colored objects in a TV picture.
22. Dark mat used to shield the lens of a TV camera from stray lights.
23. Point where current is taken from a wiring system.
24. Covered with a fusing metal to permit easy soldering.
25. Pertaining to the connection in a three-phase system.
26. A silvery, lightweight, metallic chemical element.
27. One-millionth of a unit of resistance.
28. Combining two or more signals.
29. Selecting those portions of a wave which exist during certain intervals or have certain magnitudes.
30. Connected to the earth, or to some conducting body in place of the earth.
31. A coupling unit which allows more than one transmitter to operate on one antenna.
32. Device which converts AC into an unidirectional current.



Now thumb your way to the solution on page 52.

# Customer Relations...

## You Can't "take it or leave it!"



"Yeah! Well, on the other side it says, 'THE TECHNICIAN IS ALWAYS RIGHT!'"

*Suggestions for keeping customers good-natured.*

**By Gill Grieshaber and Michael Scheibach**

Generally speaking, engineers and technicians are "things" people, and salesmen are "people" people. And so long as engineers and technicians deal only with electronic problems, these facts are of little consequence. After all, salesmen **have** to deal with people. They must get the customer to do something: namely, buy their products.

On the other hand, service shops offer a service...and the approach could be "take it or leave it". What difference does it make? If a customer calls on the phone or enters the shop, he's looking for someone to take care of his problems. You don't have to sell him. Right?

Unless you operate in a one-shop town, the answer to this question is "No". The reason often is that the other shop(s) just might have a better public-relations image. And while image can't locate a trouble, it does impress people, and it will get the other shop(s) extra business.

You could say that the other shop(s) advertise, and that's how they get more business. That may be true. After all, their image may come across to the public as, here's

a shop that really **wants** my business.

On the average, your customers will give back to you the same kind of treatment you give them. Of course, customers are a varied lot (just as electronic technicians are). Some are cheerful Pollyannas who trust you implicitly. Others suspect you of being a petty crook, and treat you that way. Most customers have personalities about midway between these extremes.

But remember this: **you** initiate the attitudes of mutual trust and helpfulness. Customers who need repairs to their electronic machines already are upset and worried. They don't understand the mysteries of electronics, and are afraid of the repair price. No one really ever **expects** a malfunction, so each one is a catastrophe to the owner.

I can almost hear some of you thinking, "Why should I baby those so-and-so's, after the mean way they talk to me?" Well, first, **it's good business, and you'll make more money.** Second, it will remove most of the strain of dealing with customers. As a bonus, you might be preventing serious health problems in the future, because you can

work in a more-relaxed atmosphere.

Yes, I know technicians who nearly hate all customers. Maybe this is a form of protection, to shield them against possible unpleasantness. Traditionally, technicians have spent years to learn electronics, and zero time to learn human nature. But, remember **it's the TV owner who pays the bills.** That's reason enough for studying and applying helpful principles of good public relations. If you are convinced of that truth, we'll go on to some practical examples.

Profitable customer relations are based on these three things: your trustworthiness; the customer's respect for you, and your respect for him and his possessions; and the image you project to the people about you.

### Trust

If a man is to be trusted, he first must **appear** to be trustworthy, and next **he must always act in ways that inspire trust.**

Trust begins with your record of dealing with the customer's friends or neighbors. One good report about you is worth many newspaper

*continued on page 32*

## Customer Relations

continued from page 31

ads.

Always do as you have promised. If a service call is scheduled for a specific day, either be there as



"Good news. I can fix it for less than a new set would cost."

promised, or call on the phone just as soon as you know of the change. A customer, who takes off from work and waits for you, is not going to trust you again after you default and don't even call. Look at such situations from the customer's viewpoint.

Don't ever criticize another technician's work. It's a temptation when the other tech did a lousy job. But there is an old cliché about getting tarred with the same brush. It's impossible for you to berate another tech, without suffering a backlash of mistrust yourself.

The same principle applies to any degrading remarks about the brand or model owned by the customer. **He used his best judgment in selecting that particular one.** When you call it a lemon or a troublemaker, you also are insulting the customer.

Do nothing that will cause a customer to mistrust you. This covers many things, from your attitude and tone of voice to showing indecision about the diag-

nosis. Remember the story about the TV tech who had just been charged \$79.50 by a mechanic for the repair of the service van, and then in turn the customer expected a \$79.50 charge for the TV repair. Don't ever give the impression that your charges depend on anything except the work done and the parts used. **An erratic pricing system will destroy trust.**

Leave the old parts with the customer (unless, of course, they're in warranty, or would be dangerous to the customer), and never joke about using old parts in other receivers. Remember the cartoon about the tech who said, "The estimate is \$59.95. Of course, the actual bill will be higher." Customer's don't view such things as jokes; after all it's their money!

### Respect

One certain way to earn respect is to respect the customer and his possessions. For example, clean your shoes before you track dirt or grease on the wall-to-wall carpeting. The same applies to tube or module caddies. Make sure the bottom is clean, or set it on a newspaper.

Use a drop cloth where you place test equipment, tools, or replacement parts. Don't place hot tubes or tools on any polished cabinets. It is much better to place a paper or magazine on the machine rather than run the risk of scratching the cabinet. Also, avoid leaving hand prints in the wax or polish. Let the customer see you take a clean cloth and wipe away any spots.

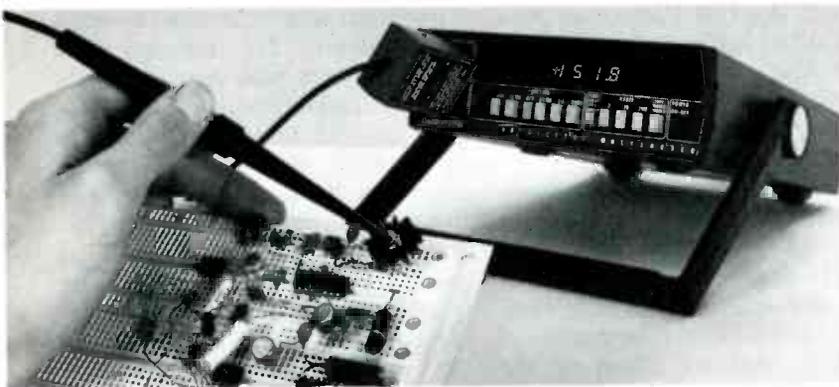
Be careful when moving any knick-knacks. As a precaution, you might ask the customer to move anything delicate or valuable.

For example, not long ago my helper and I were preparing to load a large TV console into the van. We heaved mightily on the cabinet, and slammed it right into a life-sized oil painting that was in a fragile antique frame. Of course the frame shattered into dozens of pieces. I was dumbfounded and conscience stricken. Even worse, the customer first was horrified, and then angry. I still remember some of the things that nice old lady told me.

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June, 1977

as "a reflection of reality". In this business, your image is whatever other people **believe** about you.

What's your image in the community? Think about it, and make a guess. Does your average customer think of you as being competent, cheerful, fair-minded, friendly, and dependable? Or is your image "take it or leave it"?

If you want to have a profitable image start with the words and the tone of voice that follow the ringing telephone at your office. Keep in mind that, "A customer is **not** an **interruption** of your work, but rather is the **provider** of that work." What is your business image, if it were to be based solely on phone conversations with your customers?

Next, think about the image of the technician who makes the home service call. Is he dressed sloppily, have a two-day crop of whiskers, smell like a goat, and act furtively? If so, all of these negatives must be changed.

Even the van or truck should be clean and have clear, attractive lettering, which includes the name of the business.

There are many more suggestions, for image is the total of many things. You'll think of them, when you stop to analyze your image, and that of your business.

**Comments**

If you have not consciously attempted to be pleasant and helpful to customers, remember that it is a good business practice, and start now. After you have made it a habit, probably you will find that it benefits you more than it does the customers. Anger and unhappiness take a serious toll from your health and well-being.

Set aside a time, perhaps at the end of each work week, for reviewing the events of that week, and the details of any customer-relations problems which should have been handled better.

Remember that technical competence and business skills can't bring you success without those customers. And customers **must** be handled with as much skill as you devote to electronic problems. If customers **trust** you and **respect** you, then your **image** must be okay!

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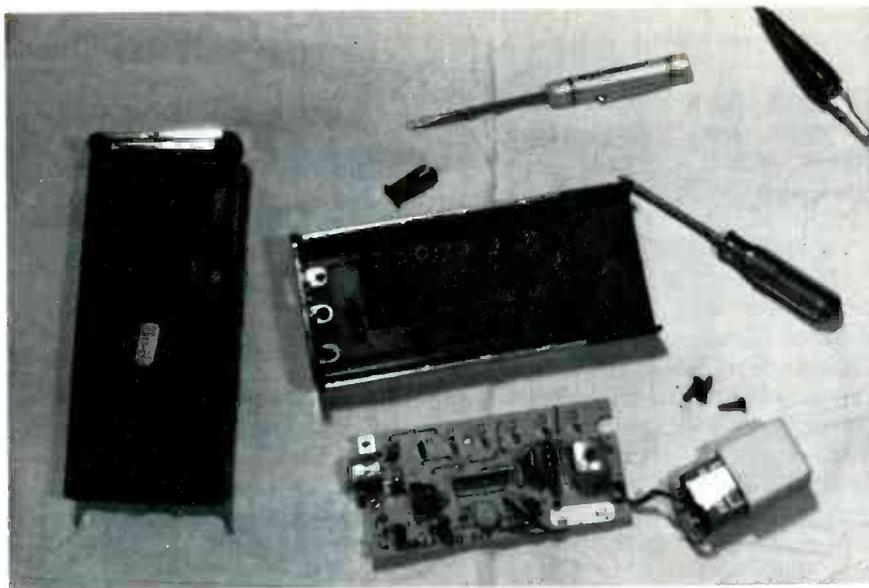


Fig. 1 The Zenith remote-control transmitter is easily disassembled.

# Servicing The Zenith Digital Remote Control

By Robert L. Goodman, CET



*Both analog and digital circuitry is used in this "zoom" remote-control system by Zenith. In addition to the circuit explanations, several modifications are revealed. These sometimes are required because of non-sinewave power-line voltages.*

Whether or not you intend to service the new Zenith remote-control systems, we suggest you study the following information for two reasons. First, part of the circuitry is digital, and we all need education about those kinds. Also, certain distortions of the usual sine waveform of the 60-Hz power line can cause either a loss of all remote operation or erratic and abnormal response to the commands. Such cases require minor modifications of the remote circuitry to permit correct operation under those un-

usual conditions.

## Zenith Remote Systems

A typical Zenith remote system has a transistorized hand-held remote transmitter unit (see Figure 1), a supersonic microphone and amplifier (inside the TV cabinet), as shown in Figure 2, and one of three "Space Command" modules. (Figure 3). Module 9-127-02 is used with the SC1000 system for six functions (including remote zoom), and has an IC for channel selection. A similar module, the 9-128-02,

also has six function, but has a motor for channel changing. The SC600 system supplies four functions, with a channel-changing motor. Most of our coverage will be on the 9-127-02 module and associated circuitry.

The remote unit and the microphone amplifier are not radically different from the preceding models, so we will begin with the module and the IC circuitry.

## Remote module

Heart of the Zenith remote module is IC201 (part 221-92 in Figure 4). It replaces the tuned coils formerly used to identify the specific frequencies for the different functions.

Supersonic frequencies of the 37 KHz to 43 KHz range are picked up by the microphone, amplified by the amplifier, and then are fed to pin 1 of the IC. A 120-Hz clock signal also is supplied to pin 9.

A binary counter inside the IC counts the frequency of any incoming signal, but does so **only** during the enabling time of the 120-Hz clock pulses. This frequency count is stored, and the frequency is counted again. When the signal is noise, and not the desired command from the remote transmitter, the counts are different, and the circuit resets itself. But if the counts have identical frequencies, they are tallied in a "confidence" counter. When 7 counts of the same frequency are tallied, the input signal is allowed to reach the appropriate section of the IC, where it activates the desired function.

Conventional remote controls sometimes are triggered falsely by phone bells, and other unintentional commands. But, 7 confidence counts is proof that the signal is genuine, and not noise or extraneous sounds.

Output pins of IC201 either are "high" (+11 to +12 volts) or "low" (near zero volts) as needed to activate the various functions. Use a voltmeter or a logic probe (see Figure 5) to test for high or low states.

## On/off function

Pressing the on/off button of the hand-held transmitter causes the voltage at pin 5 to go high, which

*continued on page 36*

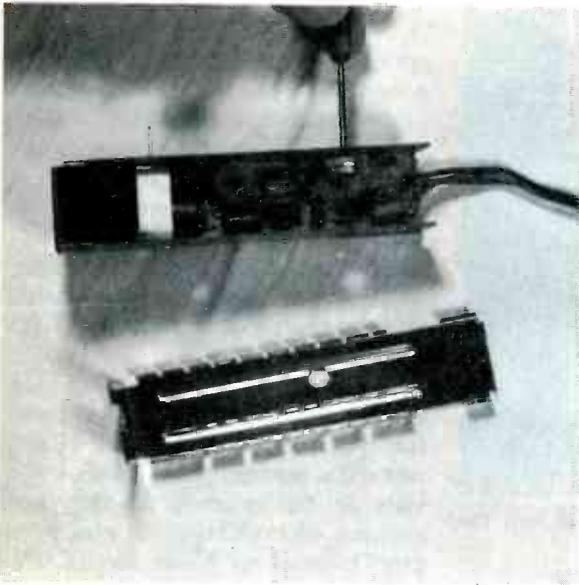


Fig. 2 Adjust the sensitivity control on the remote receiver as low as possible to minimize false functions from noises and horizontal pulses.

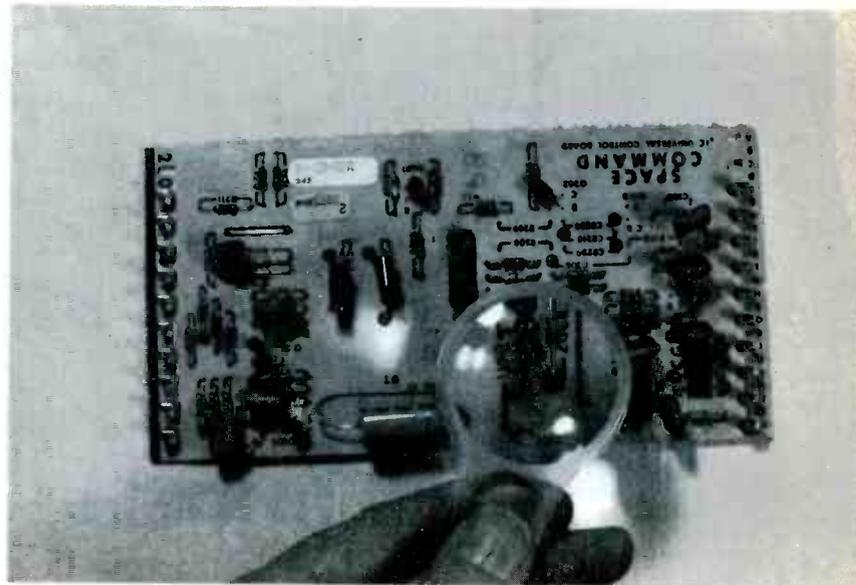


Fig. 3 The magnifying glass shows the area of the remote module where modifications should be made, if the line voltage has a distorted waveform.

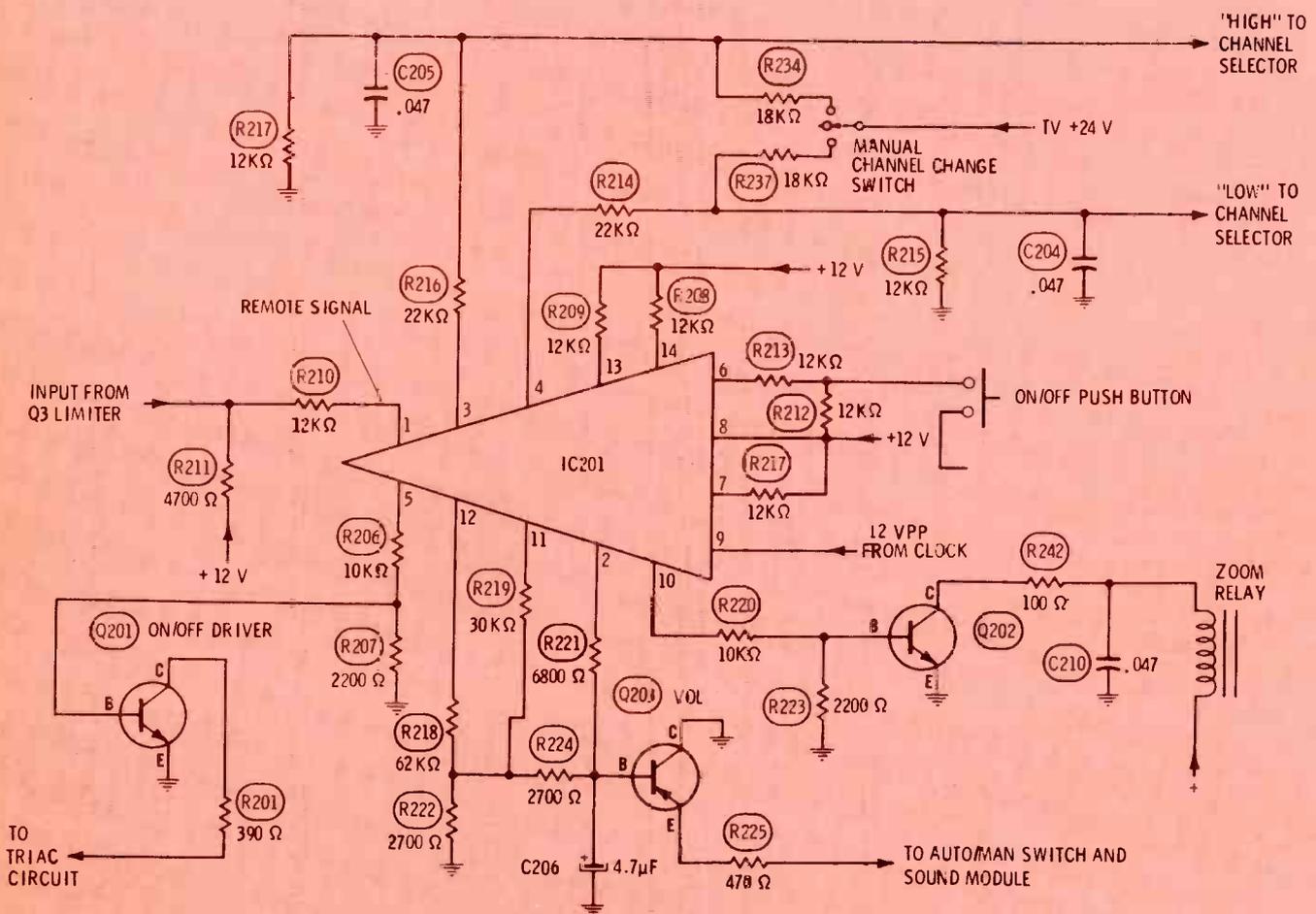


Fig. 4 This is the schematic of the circuits around IC201, on the remote module. The input signal at the junction of R211 and R210 should be about 7 to 11 volts PP, when a remote button is pushed. Although the interior schematic

of the IC is proprietary information, we do know which pins are high or low when the proper remote pushbuttons are activated.

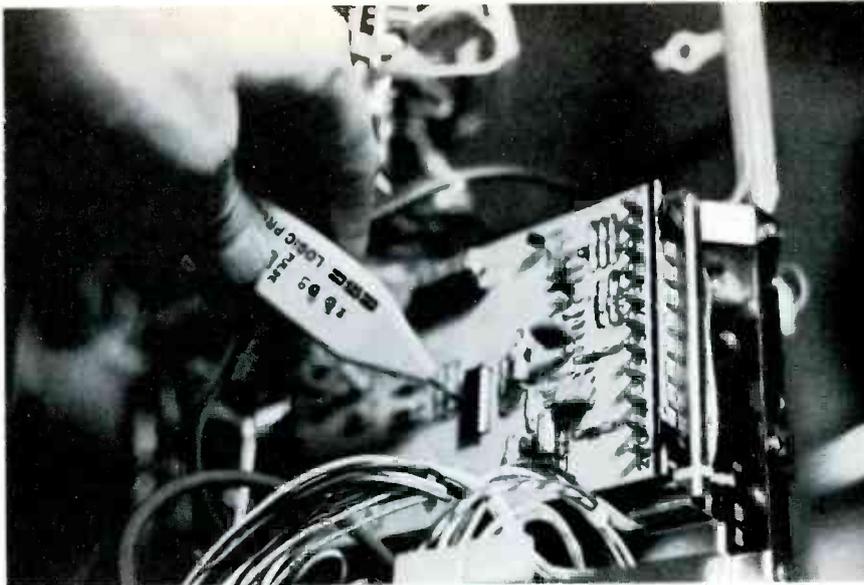


Fig. 5 A logic probe (as shown) or a DC voltmeter should be used to test the "states" of the output pins of IC201.

VOLTAGE		VOLTAGE AT	VOLUME
Pin 11	Pin 12	Q203 BASE	LEVEL
LOW	LOW	0.0	MAX.
LOW	HIGH	0.5	MED.
HIGH	LOW	1.0	LOW
HIGH	HIGH	1.4	MIN.

Chart 1 These are the states of IC201 pins 11 and 12 versus the base voltage of Q203 and the resulting volume level when the remote volume button is pushed four times.

## Zenith remote

continued from page 34

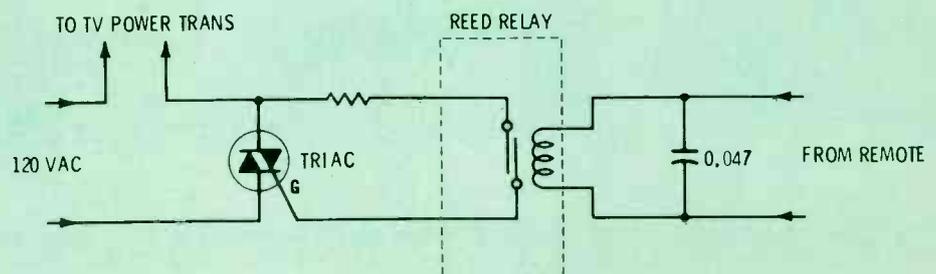
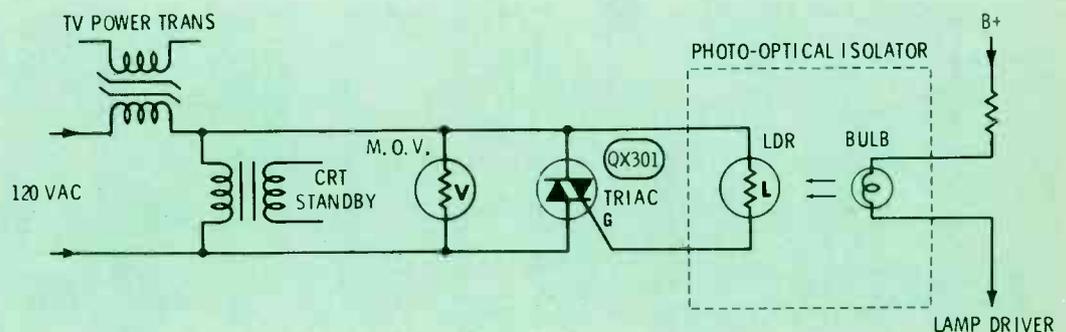
forward biases Q201. Conduction of Q201 lights the lamp in the photo-optical isolator (Figure 6). The light decreases the resistance of the Light-Dependent Resistor (LDR), and it applies turn-on voltage to the gate of QX301 triac, forcing it to conduct during both peaks of the AC. The triac acts as an "on" switch for the TV power transformer. The next press of the button reverses the process, turning off the TV.

The manual on/off button (on the front panel of the TV) reduces the DC voltage at pin 6 of IC201, when it's pushed. This reverses the state of the internal flip-flop and changes the voltage at pin 5 to provide on or off power for the TV.

Certain combinations of triac and isolator do not trigger the triac gate sufficiently, causing the current of one AC peak to be larger than the other. This represents a DC current that's added to the AC, and it forces excessive current through the primary of the power transformer. The high current trips the circuit breaker, removing all power from the TV.

You can test for this possibility by connecting a test lead from anode 1 to anode 2 of the triac. Restoration of normal operation

Fig. 6 Schematic A is the original one. Q201 current lights the bulb in the photo-optical isolator. The light reduces the resistance of the LDR, thus increasing the gate AC voltage of the triac. When the QX301 triac gate has sufficient voltage, the triac conducts both peaks of the line power, thus turning on the TV. Some later-reproduction receivers substitute a magnetic-reed relay (schematic B) to provide better reliability.



proves that either the triac or the photo-isolator is bad. It's difficult to tell which is responsible, so usually it's wise to replace both together.

Of course, a shorted triac does not allow turnoff, except by unplugging the power cable. **Some defective triacs trip the breaker just as the power is turned off.** Now, all triacs conduct positive peaks at a slightly different gate voltage than they do negative peaks, but a bad one will have an excessive differential. Also, the LDR in the photo-isolator increases resistance slowly during turnoff. So, the turnoff is **slow** enough for excessive current to flow (and trip the breaker) during the time that only one peak is being conducted by the triac.

#### Zoom mode

Some Zenith models have a button which increases the height and width (plus special blanking and other features) of the picture. This provides an enlargement of the center of the scene, and is called "zoom".

When the zoom button of the remote is pressed, the signal at pin 1 of IC201 causes the DC voltage at pin 10 to go from low to high. This voltage forward biases Q202 (the zoom-relay transistor), and the collector current closes the relay contacts which switch the required circuits for zoom. The next push of the zoom button turns off the zoom operation, restoring the picture size to normal.

#### Volume-step mode

Digital circuits, of course, have only highs and lows, but a variable DC voltage (or several small steps) is needed to control the gain of the sound IC. Therefore, Zenith has an ingenious solution that adds the DC voltages from two sources of highs and lows, thus producing four steps of voltage for four different levels of audio volume.

Refer to pins 11 and 12 in Figure 4 and to the figures of Chart 1. When pin 11 is low (zero) and pin 12 is low (zero) the forward bias at the base of Q203 is zero, producing a zero emitter voltage that's fed through the auto/manual switch to the sound module where it gives maximum volume. Or, pin 11 low and pin 12 high gives a Q203 base voltage of +0.5, which allows medium volume, and so on until

both pins are high, permitting only low volume.

If the complaint involves sound level on remote operation, check the DC base voltage of Q203 as you press the remote sound button four times. A wrong series of voltages indicates a defective IC201. But, if the voltage changes as shown in Chart 1, IC201 is okay, and the problem might be in Q203, the sound module, or the speaker.

Pressing the "mute" button on the remote silences the sound volume by producing a high at pin 2 of IC201. The voltage is sufficient to saturate Q203 and eliminate all sound. Failure to silence the sound points to a bad IC201 or an open

R221. A second push of the "mute" button restores the sound level.

#### Channel changes

A push of the "Channel Hi" button of the remote transmitter should cause a high at pin 3 of IC201, and the DC voltage is sent to the proper point of the channel-selector circuit. In the same way, the "Channel Lo" button causes a high at pin 4.

For channel selection from the TV panel, the manual channel-change switch either applies to B+ through R234 to the "Hi Channel" circuit, or through R237 to the "Lo Channel" circuit.

*continued on page 38*



Fig. 7 When high, the outputs of IC201 should measure between +11 and +12 volts. This is an important test of the operation.



Fig. 8 The scope waveform is correct for the IC201 input signal at the junction of R210 and R211. The amplitude should be between 7 and 11 volts PP (somewhat less at pin 1 of IC201), when a remote button is held down.

## Zenith remote

continued from page 37

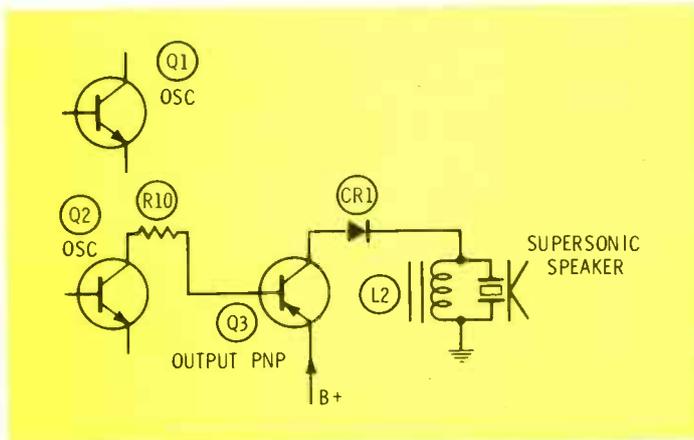


Fig. 9 Two transistors in the remote transmitter are used in the tuned oscillator (6 frequencies), plus an output transistor to drive the speaker.

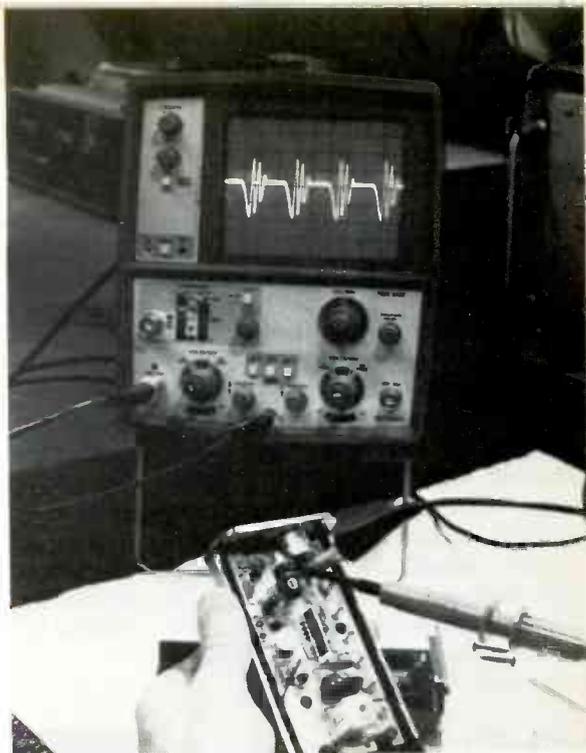


Fig. 10 Scope the output of the remote transmitter at the terminals of the supersonic speaker, as shown. The amplitude should be between 20 and 30 volts PP.

Check out the channel changing first by trying the manual buttons. If manual change is okay, the remote transmitter, mike and amplifier, or the remote module are suspects.

Measure the DC voltages at pins 3 and 4 as you press the channel-change buttons on the remote. Highs should be between +10 and +12 volts, as shown in Figure 7.

If highs are not measured at pins 3 and 4, use a scope to check for a remote signal at pin 1 of IC201 (see Figure 8 for the waveform). The signal should be square waves of 7 to 11 volts PP. If the waveform is normal, probably IC201 is defective. When no waveform (or a wrong one) is at pin 1, check the remote transmitter, the receiving mike, and the mike amplifier.

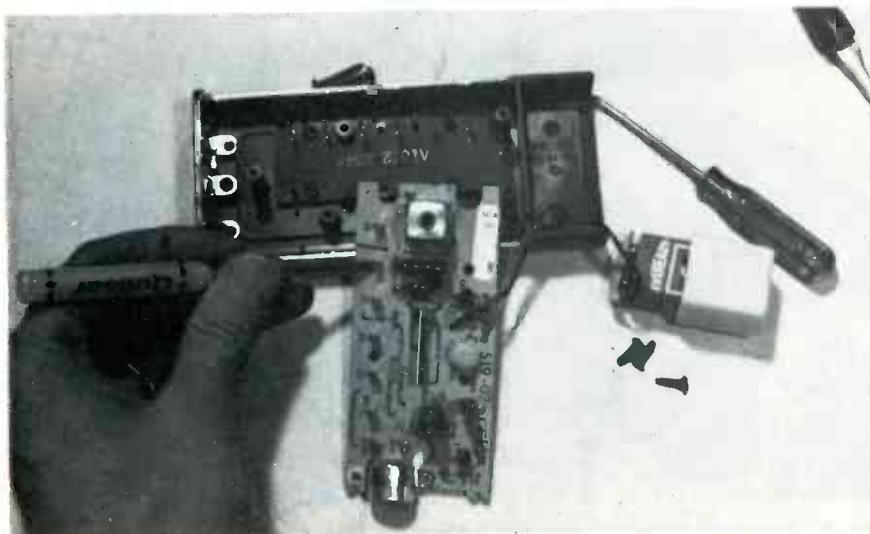


Fig. 11 If the remote-transmitter signal is intermittent, check the pins and connectors between the circuit board and the pushbutton assembly

### Remote Transmitter

Remote transmitter 124-8 has two transistors in the tuned oscillator and an output transistor that drives the supersonic speaker (see the partial schematic in Figure 9). The correct waveform at the speaker and the method of connecting to it are shown in Figure 10.

Taking out three screws permits the removal of the circuit board. Some intermittents have been traced to the connectors between the board and the pushbutton switch assembly (see Figure 11). Also, bad soldering has been found at some of the connector pins.

A 9-volt battery powers the transmitter, so don't forget to check it while you're troubleshooting.

### Receiving Transducer And Preamp

A partial schematic of the modified microphone amplifier is shown in Figure 12. The one tuned coil has been eliminated. A DC polarizing voltage is applied to the microphone.

The coil (in those amplifiers which have it) is located at about the center of the amplifier (Figure 13). Occasionally, the coil must be covered with shielding to reduce the pickup of horizontal-sweep pulses.

In an extreme case of excessive pulses, the mike/amplifier unit can be replaced with a part number A-00937-01 or S-99924-01, which do not have the coil.

A sensitivity control (R8 gain control) is included. If any problems of false triggering are encountered, reduce the setting until the transmitter just barely operates the remote functions from the distance desired.

### Intermittent Or Wrong Operation

Some of possible complaints about the remote operation are these:

- Remote functions will not work, but manual operation is normal.
- The TV receiver can't be turned on by the remote transmitter.
- Some remote functions might be intermittent.
- The receiver can be turned on by the remote, but all other functions (including off) are inoperative.
- Remote functions might be energized by signals other than those from the hand-held transmitter.

### Location affects remote

One type of problem involves a receiver that can be operated normally by the remote when it's in

*continued on page 40*

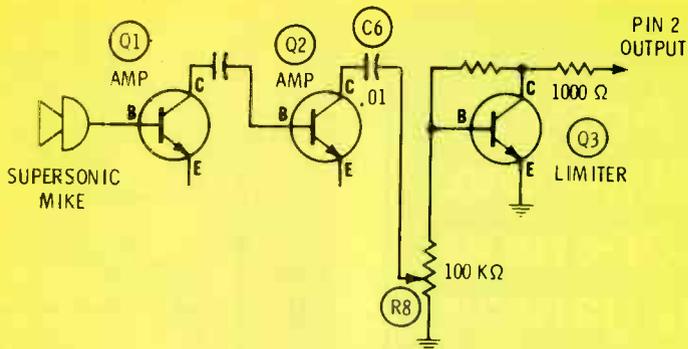


Fig. 12 A supersonic microphone, three transistor amplifiers (the last one limits, making square waves), and a sensitivity control comprise the mike/amplifier assembly, which is mounted inside the TV receiver.

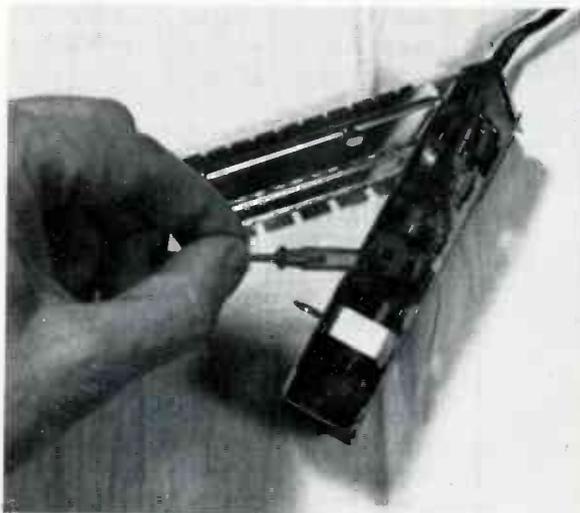
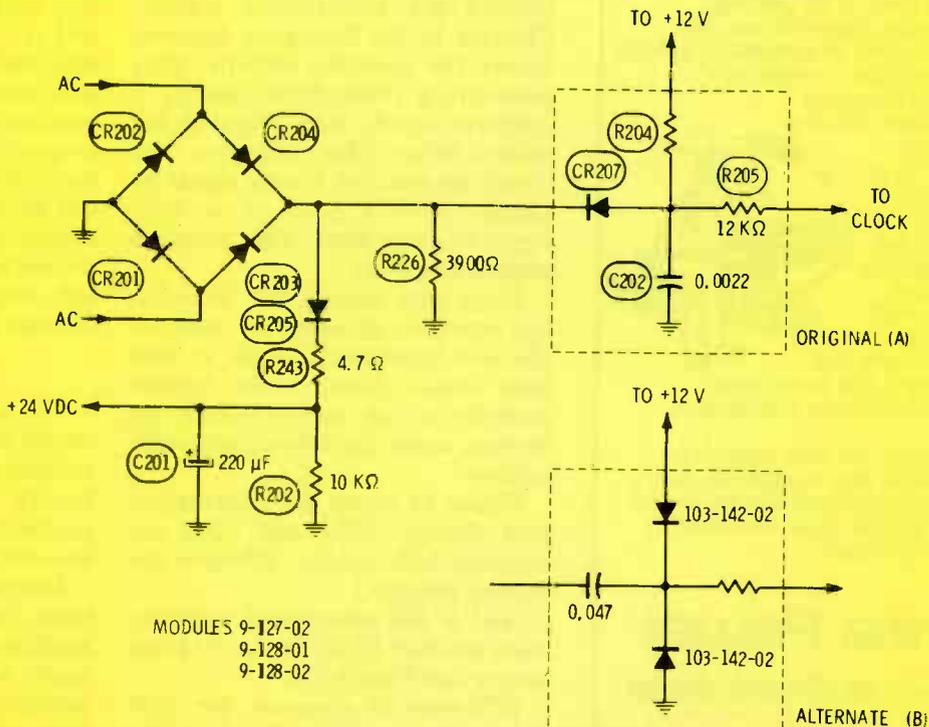


Fig. 13 Some early-production remote amplifiers have one tuned coil (L1). Sometimes the coil picks up an excessive amplitude of pulses from the horizontal-sweep circuit. In such cases, the newer amplifiers without the coil are preferred.

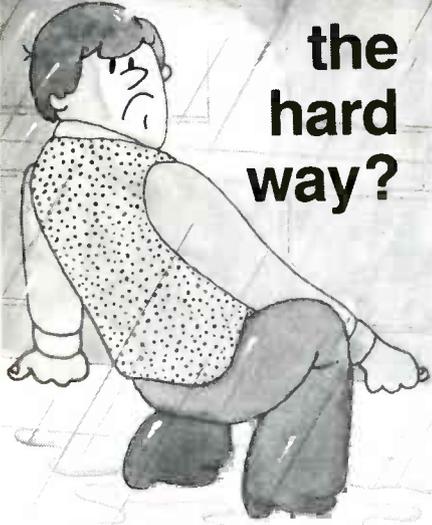
Fig. 14 When improper remote operation is caused by non-sine-wave AC power, change the A circuit to the one shown at B.



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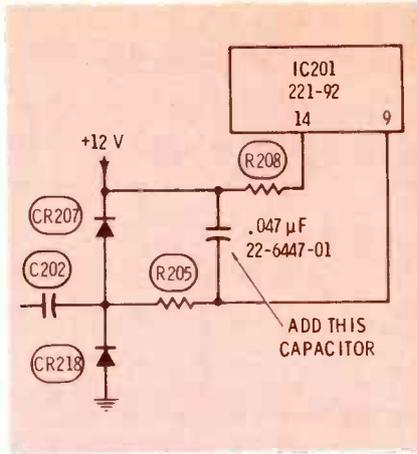


Fig. 15 Another modification to minimize problems from distorted line voltages or certain kinds of noise is to add a .047 microfarad capacitor between +12 volts and pin 9 of IC201.

## Zenith remote

continued from page 39

the shop, but which refuses to work with the remote in the customer's home.

Such problems are caused by variations of the 60-Hz waveform from one half cycle to the next. A sample of the 120-Hz ripple from the power supply is the beginning of the clock signal. Unusual variations of the ripple waveform prevent the consistent production of precise 8.3 millisecond pulses. Changes of the timing or duration upsets the counting circuits, thus preventing them from having 7 identical counts, and stopping the tally. When that happens, the circuit ignores the remote signal as though it were noise or a false signal of some kind. **This stops all remote functions.**

When you suspect the line-voltage waveform of being the cause of the non-functioning, check it with your scope. Then, if the remote module is an early-production version, make the following modifications.

Figure 14 shows the most-important change. R204 and C202 are replaced with diodes. (Observe the correct polarity.)

Add a .047 microfarad capacitor from pin 9 of IC201 to the +12-volt source (see Figure 15).

SCR-type of dimmers for light bulbs are one of the offenders that distort the line-voltage waveform

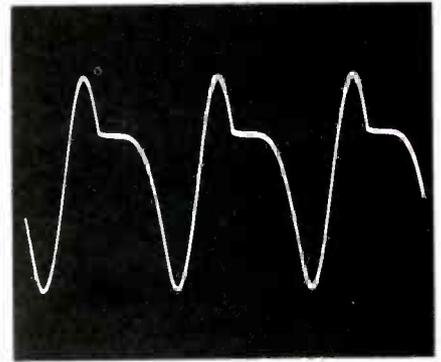


Fig. 16 This is one example of line voltage that's distorted by SCR light controls.

(Figure 16). However, following these two modifications, the remote operation should be reliable.

## Unwanted Remote Operation

Most false triggering of the remote functions is prevented by the counting and comparing of 7 successive samples of the signal. However, a **combination** of horizontal-sweep pulses (picked up by the mike amplifier wiring or the coil L1) and certain kinds of supersonic noise can fool the circuit into accepting the total signal as genuine. Of course, the repetition frequency probably is unstable; therefore, the false remote functions will be random. Sometimes just reducing the setting of the sensitivity control in the microphone amplifier will stop the non-remote channel changes or volume variations.

## Comments

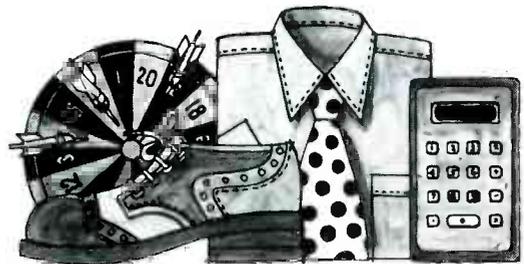
We have not emphasized these circuit modifications because of any mistakes of engineering design. The Zenith remote system performs excellently, where the line-voltage waveform is correct and stable.

Instead, we made these suggestions because **the source of the problem is very obscure**, and you might waste hours before you pinpointed a total loss of remote functions as being caused by a non-sinewave source of power. □

# photofact<sup>TM</sup>bulletin

<b>ZENITH</b> Chassis 12HB1X/2X/3X .....	1641-2
<b>PANASONIC</b> Chassis NMX-P3C, NMX-P3D .....	1649-1
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<b>ZENITH</b> Chassis 25HC50 .....	1650-2
<b>SONY</b> KV-1741R, KV-1941R, RM-302 (Ch. SCC-100B-A/-100C-A) .....	1651-1
<b>WARDS AIRLINE</b> GAI-11657A/-13107A/-13137A/-13147A .....	1651-2
<b>MGA</b> CS-1300 .....	1652-1
<b>SONY</b> KV-5100 (Ch. SCC-105A-A) .....	1652-2
<b>SANYO</b> 21V66 .....	1653-1
<b>SEARS</b> 564.42200500/501/502/503, 564.42201600 .....	1653-2
<b>QUASAR</b> Chassis TS-959 .....	1654-1
<b>SANYO</b> 91C50N (Ch. PL-50N00) .....	1654-2
<b>WARDS AIRLINE</b> GEN-12907A, GEN-12927A, GEN-12937A .....	1644-2
<b>MIDLAND</b> 15-289 .....	1655-1
<b>SEARS</b> 562.50213600, 562.50261600, 562.50333600 .....	1655-2
<b>JCPenney</b> 685-2114(B02, C03), 2114(B02), 855-0261 .....	1656-1
<b>SYLVANIA</b> Chassis E21-8 .....	1656-2
<b>SANYO</b> 21T69A .....	1657-1
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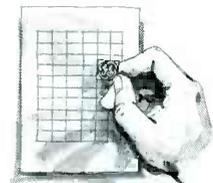
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GENERAL  ELECTRIC

Actual repairs of CB radio transceivers are explained, including the symptoms and methods of troubleshooting.

# Typical Day At The CB Bench, Part 1

By Harold Kinley, CET

## No receive or transmit E. F. Johnson Model 123A (Photofact CB Radio 47)

To verify the symptoms, I hooked up the radio to the cables of the test bench (Figure 1). When I applied power and keyed the transmitter, the output-power meter read 3.5 watts (which is normal for the model). But when I gave a loud whistle into the microphone, the scope showed absolutely no modulation pattern.

Next, I fed a 100  $\mu$ V signal of 30% modulation at the frequency of Channel 11 into the radio. With the set tuned to Channel 11, the "S" meter gave a high indication, showing a strong carrier, but the speaker sounded only a whisper. That faint sound could be brought in or silenced by the squelch control, so apparently the squelch

circuit was okay. Of course, a dead squelch stage would not affect the modulation.

Therefore, it seemed likely the defect was in some audio stage that was common to both transmit and receive. I decided to try signal injection to locate the bad stage.

With the volume control turned up high and the squelch rotated counterclockwise, I injected a tone at the base of transistor Q9 (Figure 2), but there was no sound from the speaker. Neither could I hear the test tone when I reached the base or collector of Q10 (see Figure 3). However, it was not likely that I could hear the signal when injected at the collector of Q10, or at the push-pull output stage.

For that reason, I changed to the signal-tracing method, feeding a strong signal (modulated 30% at

Fig. 1 Harold Kinley's CB bench has many good test instruments, and is arranged for fast operation. On the wall are his diploma from NRI, his CET certificate, and his CB-station license.



1000 Hz) to the receiver coaxial input. Some volume should have been at the base of Q9, and my signal tracer found a normal amplitude there. A louder signal was at the collector of Q9, and an even stronger one was heard at the collector of Q10. Although the T5 interstage audio driver transformer has a slight step-down ratio, a strong tone also was found at the bases of Q11 and Q12. But, no signal could be heard at the collectors of Q11 and Q12. Evidently, the defect was in that stage.

After the bad stage is located, I usually check the voltages there. All of the voltages were about right, except for the voltage at the emitters of Q11 and Q12, which go to ground through the 1-ohm resistor, R42. This reading was about 0.25 volt; that's about 10 times too high.

Most bad resistors will be bulging or have a burned spot on the side, but this one looked okay. The resistor is included for stability instead of bias, so I connected a jumper wire across it. Instantly, the 1000-Hz tone roared from the speaker; **R42 was open**.

After one lead of the resistor had been unsoldered, I could see a small burned spot on the previously-hidden side. Replacement of the

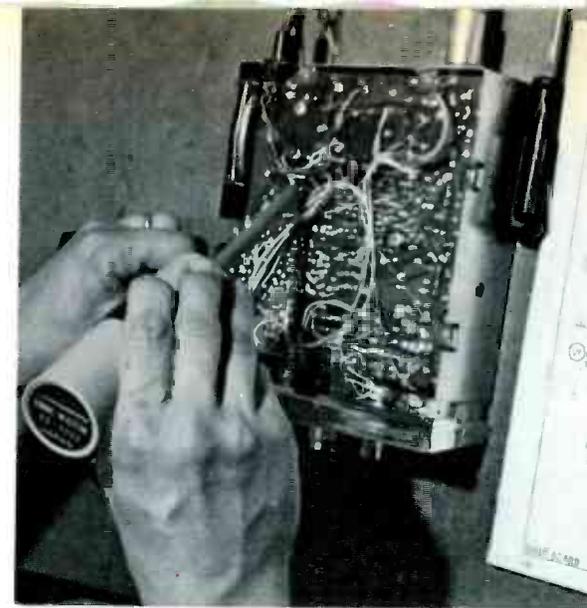


Fig. 2 A small signal-injector instrument is handy for finding dead stages.

resistor brought back receive audio and transmit modulation.

CB radios often have multiple troubles, so I started the usual checkout of functions. I keyed-on the transmitter, and watched the output-power wattmeter as I turned from one channel to the next. Sometimes the power would drop to zero. At first, I suspected an intermittent channel-selector switch. However, as I moved different components, I found that manipulation of the area around the modulation transformer would start and stop the trouble. Finally, I found an unsoldered connection

where the yellow transformer wire went to the circuit board. A shiny solder joint cured the erratic operation.

The charges were \$1 for the resistor and \$15 labor for a job that required about an hour for both repairs.

### No receive or transmit E. F. Johnson Model 123A (Photofact CB Radio 47)

Although the customer complaint was similar to that of the previous case history, the precise symptoms were different. Faint hiss could be

*continued on page 44*

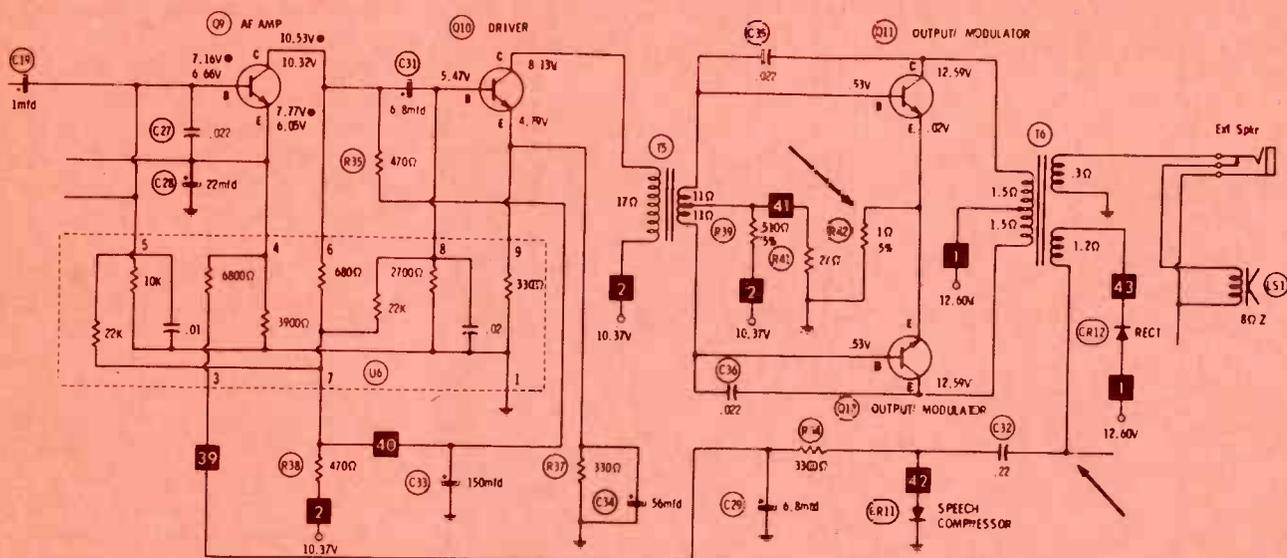


Fig. 3 Signal-injection and signal-tracing methods located the defect to the push-pull output stage, while voltage and ohmmeter readings pinpointed an open R42 in a Johnson Model 123A.

## CB Bench

continued from page 43

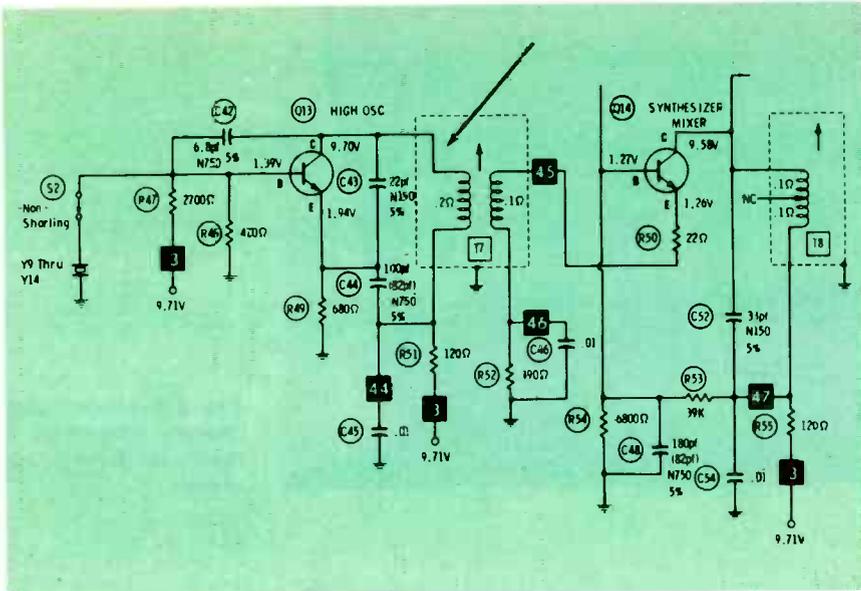


Fig. 4 An open primary winding of T7 killed the "high oscillator".

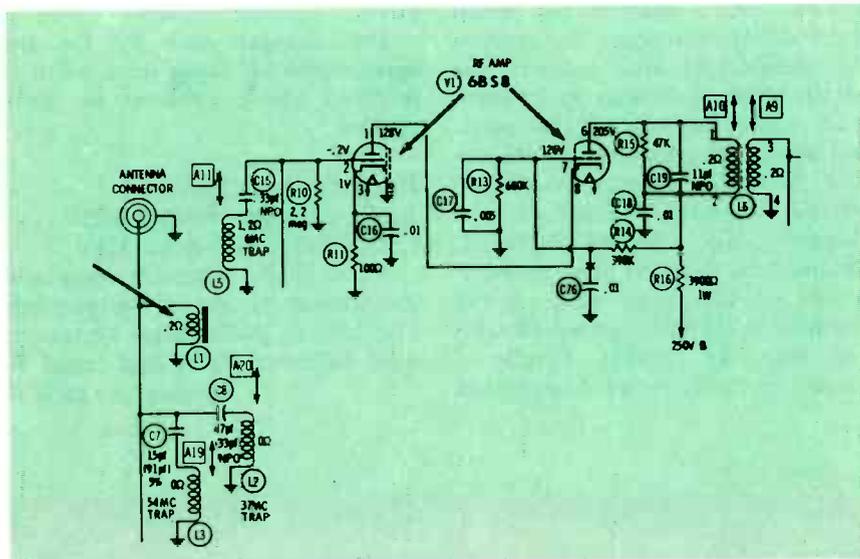


Fig. 5 A wrong tube and an open choke were two of the many troubles in this "Courier 23 Plus" transceiver.

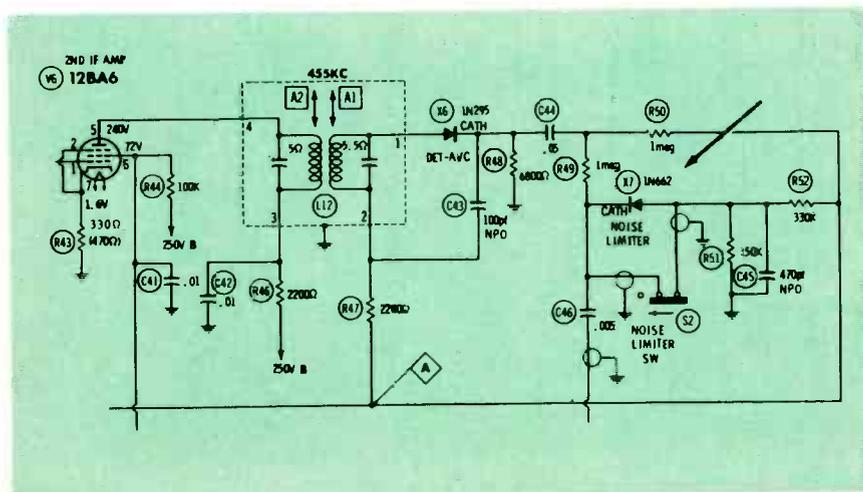


Fig. 6 A defective X7 noise-limiter diode produced distortion in the Courier radio.

heard from the speaker, but it was much weaker than normal.

I tuned both the receiver and the signal generator to Channel 11, and fed in a 30-microvolt modulated signal. There was no reading on the "S" meter. When I keyed the transmitter, no power output was measured.

Perhaps you notice that I failed to mention disconnecting the signal generator to connect the RF wattmeter. With the B&K-Precision Servicemaster, this changeover is automatic when the transmitter is keyed.

Because both transmit and receive functions were not working, it seemed likely that just one defect in a circuit common to both was responsible. I vaguely remembered a similar case where I found a bad high-oscillator transistor (Q13). Therefore, I decided to test Q13 first thing after removing the cover.

Rather than remove the transistor, I checked the performance by the DC voltages (see Figure 4). Where the collector of Q13 should have measured nearly 10 volts, the meter showed about 0.75 volt. The one reading was inconclusive, so I removed the transistor for external testing. It was okay, and while it was still out, I measured the collector point again, finding zero volts. However, at the other end of the T7 winding was the full +9.7 volts. Obviously, this primary winding was open.

Having little to lose but a few minutes time, I removed T7, and an ohmmeter test proved it to be open. When I opened the transformer, I found the wire was broken at the lug, and I was able to resolder it.

After I reinstalled the transformer and transistor, a loud hiss came from the speaker, and the wattmeter showed 3.5 watts when the transmitter was keyed.

Before giving the radio back to the customer, I checked all of the functions, which were okay now, and told him I would replace the transformer without any additional labor charge, if the transformer gave trouble in the future.

The repair time was about one hour, and I charged \$16 for the service.

**Neither transmit nor receive were right**  
**Courier 23 Plus**  
 (Photofact CB Radio 18)

The customer explained that a friend had worked on his CB radio, including the turning of all the alignment adjustments, which made the performance worse. Then the friend supposedly sent the radio back to the factory. After several weeks, the customer got back his radio, but the operation was very poor. At that point, he brought it to me.

Two days passed before I could check the CB radio. I set both the radio and the signal generator to Channel 23, turned up the volume, and opened the squelch. The speaker had a soft hiss, but a 5-microvolt modulated signal could not be heard. A weak tone could be heard, when the level was increased to 1000 microvolts. I removed the set from the cabinet, and began stage-by-stage troubleshooting.

First, I injected a 455-KHz signal at the plate of V4, the second mixer tube, and the signal came through about right. Next, I fed a 6-MHz signal to the plate of the first mixer tube, V2. Again, the signal came through. These tests proved that the major trouble was **not** between the first mixer and the speaker.

Before I go on, let me explain the operation of the 6BS8 RF-amplifier stage. The 6BS8 is a dual triode designed for cascode operation. The signal from the antenna is fed to the grid of the first triode section. The tube tries to amplify, but the plate is connected directly to the cathode of the second triode (see Figure 5), and the impedance of this grounded-grid stage is so low that little gain is possible. However, the second section has high gain; therefore, the overall gain is satisfactory. These circuits have two advantages. No neutralization is needed to prevent self-oscillation, and the triodes provide low-noise operation.

I suspected the 6BS8 stage, but had no new tube to try. Therefore, I attempted signal injection. The signal did not come through. Although I don't rely totally on tube-tester readings, I pulled the tube in preparation for testing. I was surprised to find it was actually a 6GH8, instead of 6BS8! Also, 6GH8 was stamped on the chassis

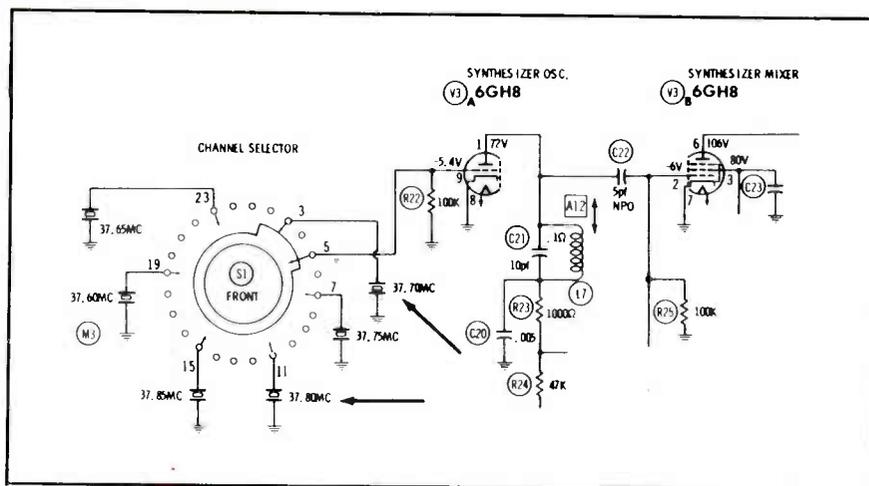


Fig. 7 Two of the Courier crystals caused wrong frequencies on eight channels.

near the socket, although the socket was wired for a 6BS8. There was nothing to do now but order the tube and wait.

After the new tube arrived, a couple of days later, I installed it, and a 1-microvolt signal came through weakly. The sensitivity checked 3.5 microvolt, which is not acceptable. After a few more tests, I decided to do an alignment. All of the other tubes were in the right sockets, and I did a complete alignment. The sensitivity now was satisfactory (about 1 microvolt).

However, when the radio was connected to my shop antenna, the set made howling and squealing noises as though some stage was oscillating. But, operation was normal with the generator. I started looking for components around the input, and noticed L1, which was wired from connector to ground (Figure 5). The resistance across the connector was infinity, indicating an open choke. After I removed it, I could see where it had been burned open.

Well, I didn't have a replacement choke on hand, but my junk box had an old audio-output transformer with the same 22-gauge wire size. I removed wire from the transformer and rewound the choke, trying to duplicate the spacing and number of turns. The completed coil looked okay, and the receiver worked normally, once it was installed.

There seemed no end to the problems. Over-the-air signals were distorted. A new speaker didn't help. I looked at the noise-limiter

circuit, which showed a switch. But this set didn't have the switch to disconnect the limiter diode. I used a jumper wire to short across the diode, and the distortion disappeared. After I replaced the diode, shown in the schematic of Figure 6, the radio sounded fine.

I turned my attention to the transmitter, which put out 3.5 watts on Channel 23, and gradually went down to 2.9 watts on Channel 1. Also, the modulation was too low, and the frequency was out of tolerance on Channels 9, 10, 11, 12, 17, 18, 19, and 20. I decided to go through the transmitter alignment that was outlined in the Photofact CB book. After the alignment, the transmitter had 3.3 watts across the entire band, and the modulation was normal. However, the wrong frequencies would require replacement of the 37.700 MHz and 37.800 MHz crystals (Figure 7).

These crystals would make the total repair total around \$45 to \$50, so I called the customer and explained. He wanted the set repaired all of the way, but wanted to use it on the good channels until the crystals arrived.

For the work performed to that point, the bill was \$27.95. It was apparent the radio had not been repaired by any factory branch.

**Next Month**

Explanations of the equipment and connections to achieve fast servicing will be given next month.

Also, several more typical case histories of CB radio repairs will be presented. □

# Reports from the test lab

By Carl Babcoke

*Each report about an item of electronic test equipment is based on examination and operation of the device in the ELECTRONIC SERVICING laboratory. Personal observations about the performance, and details of new and useful features are spotlighted along with tips about using the equipment for best results.*



Leader Model LAV-190 Audio Tester and Model LDM-170 Distortion Meter, along with a VTVM or DMM and a scope, are recommended for any kind of audio work.

Design of hi-fi audio equipment has been one of my interests for many years. Therefore, I was eager to check out these two items of audio gear from Leader. From my experimental days, I have kept an imitation Hewlett-Packard audio oscillator that I built, a simple homemade distortion meter, and a sensitive millivoltmeter. I was pleased to find the Leader instruments were miles ahead of my old equipment.

Some electronic men believe RF work is complicated, and audio repairs are simple. That is just not true. Skillful audio work demands as much knowledge and accurate test equipment as are needed for any other specialized area. For

example, you will be sadder and wiser after you spend an unreasonable amount of time pinpointing the source of a low-level hum caused by a ground that is common to both an audio stage and the power supply.

First, we'll discuss the Audio Tester.

## Leader Model LAV-190 Audio Tester

Two basic functions are performed by the LAV-190 (Figure 1). On the left half of the panel are the meter and controls for a sensitive AC voltmeter. The large 4¾-inch meter has three calibrated scales. Two scales are linear, with one marked in voltage up to "5", and

the other to a bit past "1.5". Two are provided because the primary emphasis is on decibels, and this allows one scale and then the other to be used for complete and uncrowded readings as the ranges are switched in 10-decibel steps. The third scale is a non-linear one, calibrated in decibels from -20 dB to +6 dB.

Twelve AC-voltage/dB ranges are provided. The most sensitive has a full-scale reading of 1.5 millivolts (0.0015 volts) RMS, thus allowing direct readings of microphone and phono cartridge levels down to 0.05 millivolts (50 microvolts). Top range goes up to 500 volts RMS.

Frequency response and accuracy of meter calibration over the indi-



Fig. 1 Leader Model LAV-190 Audio Tester combines the functions of an AC amplified meter (50 microvolts to 500 volts RMS) and an audio generator of sine waves from 10 Hz to 1 MHz, having precision attenuators.

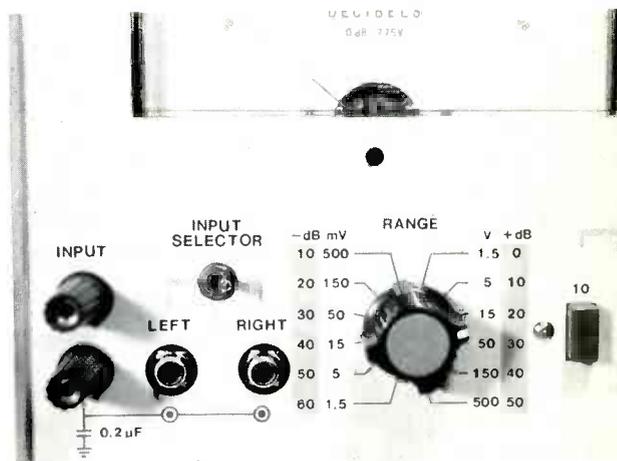


Fig. 2 One handy feature of the LAV-190 is the three-way input circuit. The inputs from the phono sockets can be selected by the toggle switch, for rapid change from one circuit to another.

vidual ranges were better than any other instrument I had to check against. Finally, I checked the meter against the built-in audio generator. Those results will be listed later.

Another feature that proves the designer was experienced in practical troubleshooting is the total of three inputs to the meter (Figure 2). One input is to standard binding posts, which can connect to plain wires or to banana plugs. This input is always connected to the internal amplifier. (Input impedance is 10 megohms.)

In addition, there are two inputs with phono jacks. Above these jacks is a toggle switch to select either input. This is helpful when you compare the levels in two stereo channels, or for other measurements where separate inputs are handy.

The right half of the panel has the controls for the internal audio generator. Five pushbutton-selected ranges are provided to furnish sine waves from 10 Hz to 1 MHz. The 3½-inch dial has calibrations from 1 to 10.

Two outputs are provided. One has binding posts; the other uses a phono jack.

Maximum output voltage is about 7-volts RMS, and three different attenuators are furnished. The "output level" control is uncalibrated, and can be used to adjust the output to a desired voltage. Following that adjustment, four pushbuttons, giving attenuations from 10 dB to 40 dB each (a

total of 70 dB), can be switched in. One of the four buttons is unique, for it provides an attenuation of 40 dB, but at an impedance of 6 ohms (other settings are 600 ohms). In addition, a rotary switch gives a maximum of 10-dB attenuation in 1-dB steps. This can be very useful when you need known levels and don't want to waste time with recalibration.

The tester can be used as a pre-amplifier to drive an external amplifier or earphones by connecting to the "output" socket on the rear of the instrument.

### Leader Model LDM-170 Distortion Meter

Although the main function of the Model LDM-170 (Figure 3) is to measure the Total Harmonic Distortion (THD) of audio sine waves, the instrument also measures AC levels in millivolts and volts, and signal-to-noise ratio (SNR).

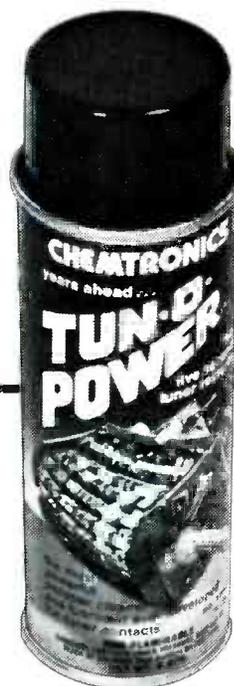
Basically, the THD is determined by setting the level until the meter pointer is over the "CAL" mark while the "CAL" pushbutton is depressed. Then a phasing-out bridge is balanced to eliminate the fundamental frequency. Any waveform voltage remaining is the unwanted harmonics, which are measured by the sensitive AC voltmeter that is calibrated in percentage of distortion. Lowest range reads 0.3% at full scale (or -50 dB SNR).

Nulling the fundamental requires setting the main vernier dial to the

*continued on page 48*



Fig. 3 Leader Model LDM-170 measures percentage of sine wave distortion, and also measures millivolts/volts RMS AC, or signal-to-noise ratio.



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"You say for two cents you'd take your set elsewhere?"



"First of all, don't tell me I need glasses. I know my TV is putting out a poor picture!"

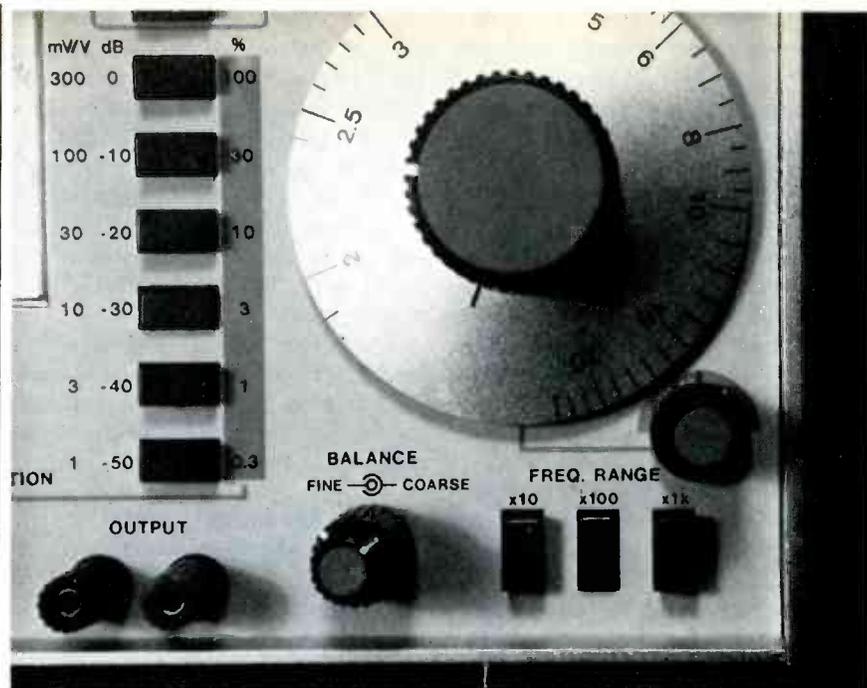


Fig. 4 In addition to the main tuning dial (which has two speeds), a small vernier knob and indicator are provided for distortion tests. Both "fine" and "coarse" balance adjustments are included to make finding the exact null easier.

## Test Lab

*continued from page 47*

approximate frequency, selecting a "frequency range" pushbutton, and then alternately adjusting the small and large frequency knobs and the fine and coarse "balance" knobs (see Figure 4) for minimum distortion reading. When the distortion is very low, these adjustments become very critical, and you will appreciate the vernier adjustments. Incidentally, perfect nulls of less than 1% are so delicate that the normal component drift changes the adjustments a small amount. However, it is necessary only to have the meter pointer swing by the lowest point. You don't have to hold the reading any longer than just the time it takes to notice the percentage.

Three pushbuttons multiply the main frequency dials readings by X10, X100, or X1K, giving a distortion measurement range between 20 Hz and 20 KHz.

## Comments

Accuracies of these instruments was so high that I finished by checking one range and function against another. For example, the audio generator in Model LAV-190 measured about 0.1% distortion at

1,000 Hz on the Model LDM-170 distortion meter.

Model LAV-190 varied perhaps 0.1 dB between low and high ends of all audio ranges, except the highest. At 1 MHz the total rolloff of both the generator and the AC millivoltmeter was only about 1.5 dB. This is excellent performance (many garden variety generators vary as much as 1 dB or more across each range). Also, the amplitude difference when changing between any two of the four lower ranges was only barely detectable. This is one of the few audio generators that you can use for most measurements without checking for generator flatness.

Distortion products removed during the nulling of LDM-170 are brought to "output" binding posts. You can look at the waveform there with a scope to show you much information about the type of noise or distortion.

In summary, these two instruments are fine examples of audio test equipment; therefore, the appearance and performance should make them acceptable even to those customers with "golden ears". □

# test equipment report

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## Transistor/FET Analyzer

Sencore has a new "Cricket" tester especially designed for complete transistor and FET testing on the job or at the bench.



The battery-operated tester automatically turns off after 20 minutes of operation to extend the battery life. Back at the bench, the TF46 plugs into a power adapter which bypasses the power-off feature.

The TF46 automatically determines transistor and FET lead connections, transistor type, transistor polarity, whether the transistor is good or bad, plus all parameter tests such as actual gain and leakages.

For More Details Circle (26) on Reply Card

## CB Test Center

The new C. T. Curtis "CB Test Station" combines five functions for CB transceiver testing. As a "stand alone" unit, it is used by dealers to allow customers to test their own CBs. When augmented with a scope and counter, it becomes a complete technician's station for CB repair.

The Test Station has a regulated, adjustable, metered power supply (with current limiting at 3 amps) to supply power to the unit under test. The second function is a 60-channel signal generator covering 26.905 to 27.495 MHz every 10 KHz. It has five 20 dB switches and a 20 dB variable

control for attenuation. A feature of this generator is the 0.01 to 10,000 microvolt calibrated output, with negligible leakage.



The unit also includes a built-in 12-watt dummy load and an RF power-output meter with a 0-10 watt peak-reading meter for modulation check. The fifth function is a 3½ digit .05% DVM that can be switched to read power-supply voltage, or used externally to read .01 to 19.99 volts for transceiver probing.

The C. T. Curtis Test Station is a compact 8"x12"x8" and has a one-year limited warranty. Model 105 has a list price of \$725.

For More Details Circle (27) on Reply Card

## Frequency Counter

The Model 700 digital frequency counter by Eico indicates frequencies in a range from 5 Hz to 27 MHz with five half-inch LED digits, and operates through all 40 CB channels to spot-check transmit frequency.



Mobile-base switch permits automatic operation in transmit. In stand-by-only, the decimal point of the readout is lit and a current of less than 70 mils is drawn.

For More Details Circle (28) on Reply Card

## Scope Probe

A new oscilloscope probe introduced by B&K-Precision features slim-body construction and 10:1/direct capability. The Model PR-35 probe is designed for any oscilloscope using a BNC connector, having a bandwidth up to 15 MHz and an input capacitance of 10-35 pF.

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# THE CB PROFIT GENERATOR



Hickok introduces the first low-cost RF generator designed specifically for 40 channel CB service.

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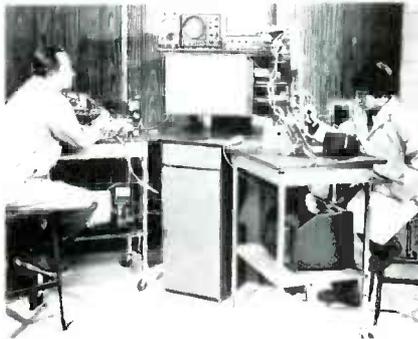
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# productreport

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## Electronic Work Station

GTE Sylvania has introduced a free-standing, self-contained "Electronic Work Station" which provides technicians with an efficient work area. The unit can be operated by one or more technicians, and requires only electrical and antenna connections.



The work station features a microfiche system which projects images of TV schematics and set-servicing information 1½ times actual size on an easy-to-read screen. The station can accommodate a complete microfiche library of basic servicing and other information for all television sources, indexed for easy access.

Also included are independent swivel-mounts for test instruments and the microfiche reader, and a built-in isolation transformer with 1000-watt primary and 350-watt secondaries. Attachable TV carts and test jigs for chassis diagnosis or "cooking" are available as options.

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## CB Servicing Manual

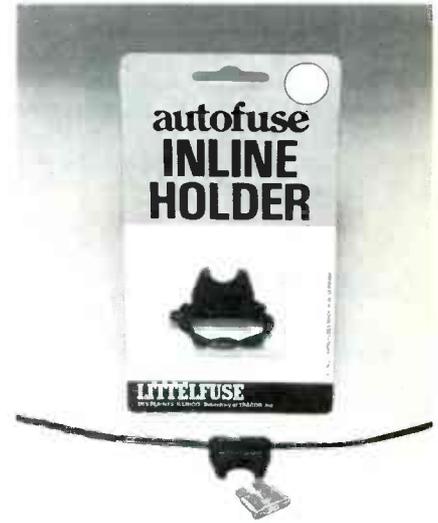
The instruction manuals that are supplied with **B&K-Precision** test equipment have been acclaimed for the helpful and detailed tips and servicing information they contain. B&K-Dynascan now offers the **manual** for the Model 1040 CB Servicemaster for sale separately for \$5 postpaid, including for a limited time, a \$10 discount certificate toward the purchase of a Model 1040. The manual contains suggestions for performance testing, receiver adjustments, and troubleshooting CB transceivers.

For More Details Circle (31) on Reply Card

## In-line Fuseholder

Littlefuse's new in-line fuseholder is designed to accommodate the company's blade-type terminal "Autofuses".

Made of high-temperature PVC and supplied with two 4-inch leads of 16-gauge wire, the universal fuseholder can be used with any Autofuse rated at 20 amperes or less.



The fuseholders are available individually bubble-packed on a colorful green and white display card, or mounted twelve to a 10"x15" display board.

For More Details Circle (32) on Reply Card

## CB Power Supply

A new DC power supply designed for CB servicing has been announced by **Hickok**. The Model 244 Mobil/Comm Power Supply is a compatible, rack-mountable addition to the Hickok CB service system.



The Model 244 has a fully adjustable voltage range of 10.5 to 14.5 volts which is metered on a 2½" meter, with the calibrated standard 13.8-volt setting clearly indicated.

The continuous-duty three-ampere output is protected against short circuits by fold-back current limiting, which is self-recovering.

Suggested price is \$125.

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# audio systems report

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## CB Base Power Mike

GC Electronics has introduced a CB base-station power microphone designed specifically for 23- and 40-channel AM or SSB radios. Microphone 19-002 has a push-to-talk but-



ton, adjustable volume control, and lock switch for free hand operation. It also features automatic compensation for high- or low-impedance sets. An ordinary 9-volt battery (not included) provides approximately 200 transmit hours.

For More Details Circle (34) on Reply Card

## Paging Speaker

Paso Sound Products has two new reflex-horn paging and talk-back



speakers for low-to-medium levels in paging, intercom, and radio receiver applications indoors or outdoors. Dual

swivel support permits continuous vertical and horizontal orientation. The speakers also feature field-replaceable diaphragms.

Model TR9 has a power capacity of 20 watts, impedance of 8 ohms, and a response range of 275-14,000 Hz.

Model TR10/T is similar to TR9, with an additional built-in 25- and 70-volt line transformer, and a rotary impedance selector.

For More Details Circle (35) on Reply Card

## Cassette Tape Winder

A new high-speed handheld winder for cassette tapes is available from Robins Industries. The tape accessory, which attaches temporarily to the individual cassette, permits a person to wind or rewind tapes by



use of a handcrank. The winder also facilitates tape editing and can be used to speed the repair of a broken tape.

The cassette winder is catalog No. 36-006, and has a suggested retail price of \$4.59.

For More Details Circle (36) on Reply Card

## Preamp/Amplifier

Dynaco has introduced the SCA-50, an integrated preamp/amplifier available assembled or in kit form. The kit requires simple tools; most circuitry is factory-wired on circuit boards and pre-tested.

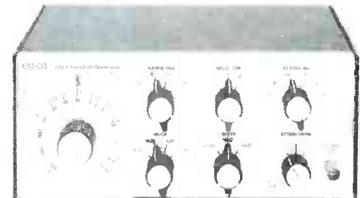


The SCA-50 has an output rating of 25 watts continuous average power per channel, and incorporates an all-solid-state transient-thump suppression circuit.

The SCA-50 has a suggested retail price of \$249 for the factory-assembled unit and \$149 for the kit.

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# TWO NEW GENERATORS FROM EICO®

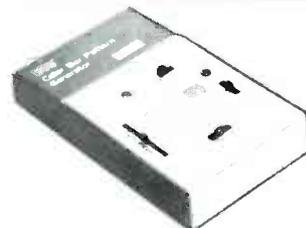


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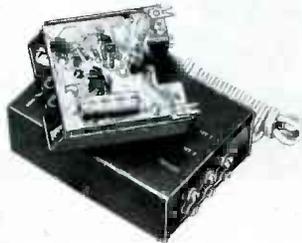
# antenna systems report

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## TV Preamplifiers

Winegard has two new solid-state preamplifiers with built-in two-way splitters which allow two TV sets to be operated from one preamplifier.

The Model AC-2260, a VHF/FM preamplifier, features UHF bypass, switch-selectable FM trap, and a lightning-protection diode. It is 300 ohms in and out. Gain is +14 dB and the noise figure is -3 dB.



For More Details Circle (38) on Reply Card

## Base Station Antenna

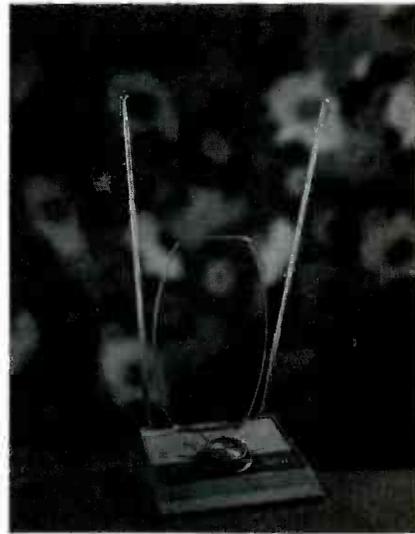
Shakespeare has introduced the "Big Stick II", a lightweight fiberglass base station antenna with full half-wave performance. This 2-section 16-foot antenna comes with coaxial cable and mounting hardware. No ground plant radials are required.

The "Big Stick II" is vertically polarized and has a power rating of 60 watts. It comes pre-tuned from the factory and is suitable for camper and portable operations such as emergency REACT operations. The antenna easily assembles and disassembles.

For More Details Circle (39) on Reply Card

## Indoor TV Antennas

Three new indoor TV antennas have been added to the RCA line. The three models (2SL20, 2SL40, and 2SL60) feature separate UHF/VHF

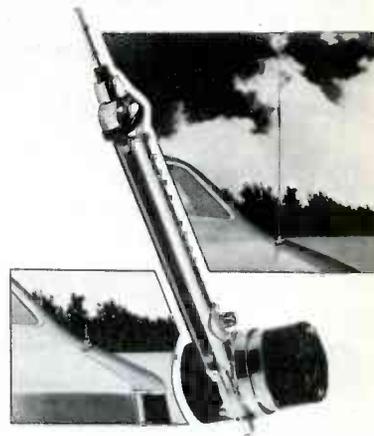


transmission lines, telescoping VHF/FM arms, high-gain UHF loop, and multi-position signal-tuning switch. The 2SL60 offers a double UHF loop with rotator knob and extra-fine tuning.

For More Details Circle (40) on Reply Card

## Motorized CB Antenna

The Archer motorized CB antenna by Radio Shack extends to its full 33" length or retracts into the fender of your car at the flip of a switch, to protect against theft. And, it can be wired to turn the CB radio on automatically when extended, and off when retracted.



The telescoping stainless-steel antenna is powered by an all-steel motor and drive system. It comes complete with a toggle switch for dash mounting, 18-foot coaxial cable and wiring harness, and all mounting hardware.

For More Details Circle (41) on Reply Card

## catalogs literature

Circle appropriate number on Reader Service Card.

**60. Russell**—has published a new six-page "Rubber Duckie" antenna-replacement brochure for two-way radio communications and scanner applications. The brochure includes "Rubber Duckie" antennas for virtually every application and connection for CB, UHF, VHF, ham, business, and scanners. It even anticipates the possible extension of CB to the 900-1,000 MHz band.

**61. Kole**—has a new 88-page catalog of "factory-to-you" corrugated fiberboard filing and retrieval systems, plus mailing and shipping supplies for office and factory. The catalog features more than 32 sizes and styles of the Kole Parts Bin, now imprinted on one side with a "metric conversion table".

**62. Electronic Devices**—offers a new condensed catalog showing its complete range of "Minibridge" bridge rectifiers. The catalog contains information on single phase, doubler, center tapped, and three-phase bridge rectifiers. Fast and standard recovery, and UL component-recognized types are included. Ratings range from 1½ to 35 amperes.

**63. Vaco Products**—has released a 40-page full-color display catalog containing more than 140 merchandising ideas. The "Merchandising Idea Book" covers display arrangements with complete product assortments, from compact shelf and counter merchandisers to a complete 12-foot wall of tools. It lists shelf, counter, wall, and floor-standing displays of Vaco tools, plus soldering connectors and unique problem solvers. In addition, an entire section shows the reseller how to create and organize custom merchandisers for any showroom.

**64. Jerrold**—has a 56-page catalog covering home TV antennas, system antennas, CB antennas, towers, MATV headend equipment, MATV distribution equipment, preampli-

fiers, reception accessories, and remote controls.

**65. B&K-Precision**—presents a new six-page color brochure describing its complete line of semiconductor test instruments for laboratory, industry, maintenance, and service. Instruments featured include the Model 530 lab-quality semiconductor tester with such special features as unity-gain frequency-measurement capability up to 1,500 MHz and non-destructive breakdown voltage testing.

**72. Dana Laboratories**—offers a brochure on the Model 5100 5½-digit multimeter with built-in frequency counter. The four-color, six-page brochure contains information on the instrument's capabilities and functions. Specifications cover DC volts, AC volts, ohms, and frequency.

**91. Belden**—offers a new guide for selecting its CB retractile microphone replacement cords. The pocket-size guide has a calibrated slot for measuring the size of the three-, four-, and five-conductor cord to be replaced. On the back of the guide is a selection table listing Belden replacement part numbers and physical characteristics, including outside diameter, number of conductors, and internal make-up of the conductors.

**94. Norcom Electronics**—has a new four-page brochure describing its line of antenna-tuning systems. The brochure, "The Ultimate in Antenna-Tuning Systems", describes Norcom's antenna tuning instruments called "Isolated-Circuit Tuners", for mobiles, co-phased systems and single- or multiple-antenna base station operations.

**95. Robins Industries**—presents a combination 28-page catalog/price list of its complete line of CB accessories, record and phono-care products, Cannon XLP audio connectors, tape-care products, and patch cords and adapters. The catalog (Number J7609) includes several of Robins' free-standing, counter, and wall-mounted display racks for its line of blister-packaged products for the electronics distributor.

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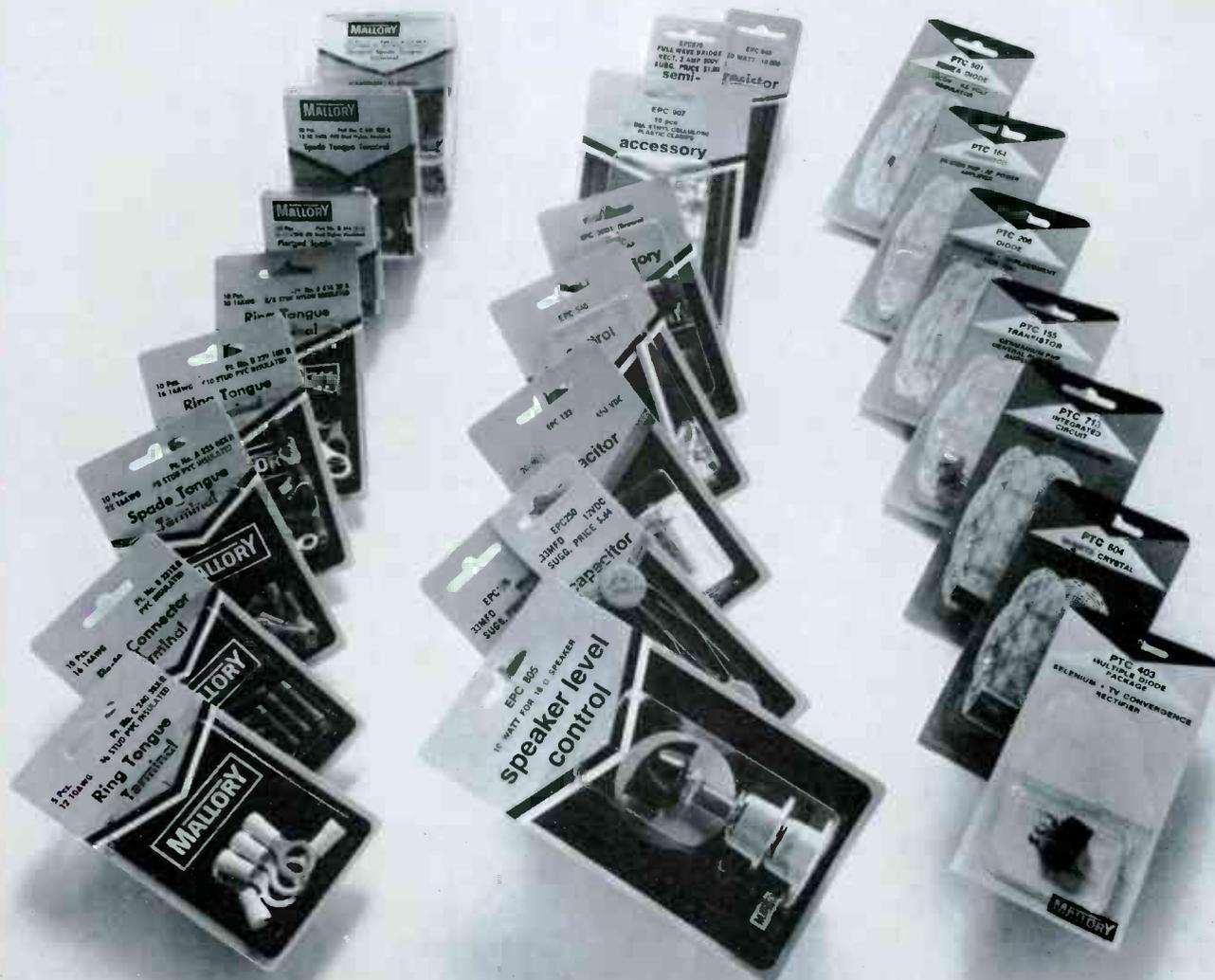
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