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HARCOURT BRACE JOVANOVIĆ PUBLICATION

# ELECTRONIC TECHNICIAN/DEALER

WORLD'S LARGEST TV/RADIO SERVICE & SALES CIRCULATION



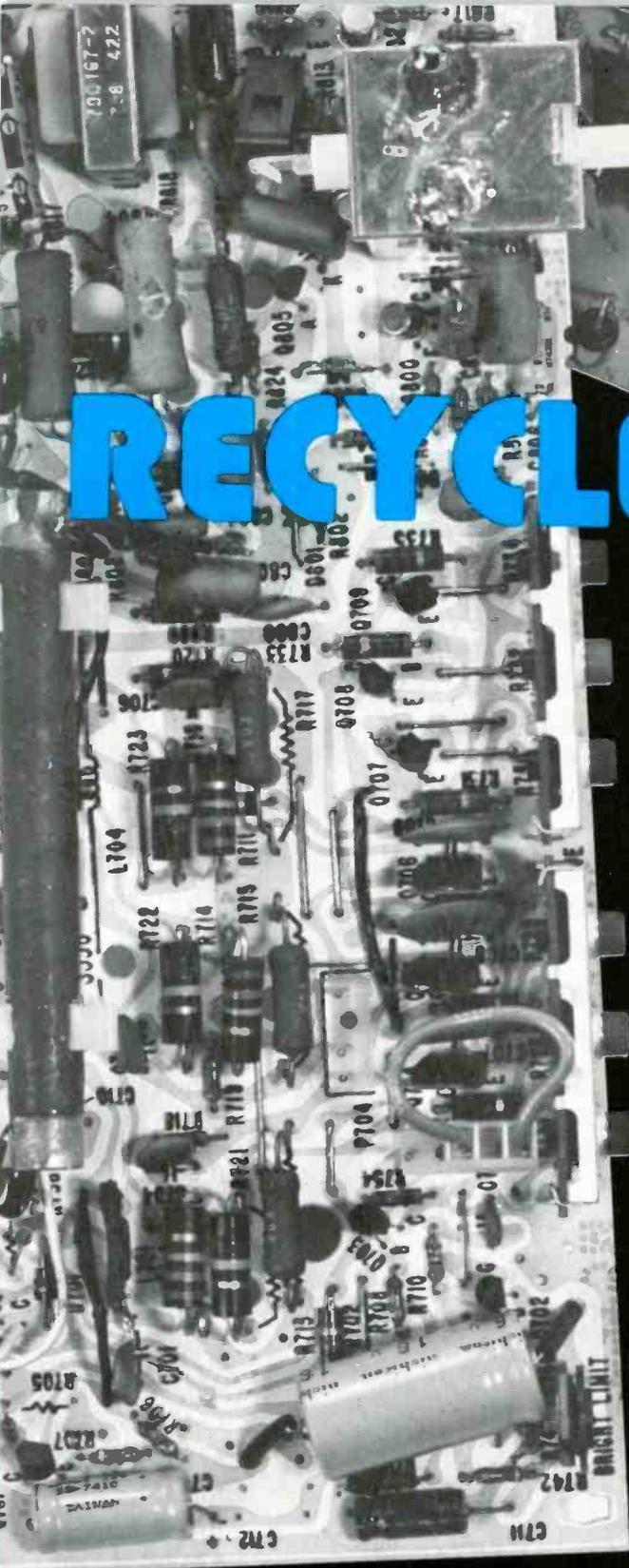
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**Convention Programs For NESDA & NATESA**

**How To Read - and Draw - A Schematic  
A Car Radio That Seeks and Scans  
Finding And Eliminating Those Spurious Noises**



# RECYCLE YOUR DUDS

**9 OUT OF 10  
TV SHOPS HAVE THEM!**

**DOES YOURS?**

TV modules are doing little more than collecting dust in service shops all over the country. Check your shop! Whether you have one or 101, they are worth good money. PTS wants to buy or trade your TV modules for instant cash or credit!

**CREDIT:** With each tuner you send to any PTS Servicenter for repair, include one TV module and get a \$4 credit toward your repair charges.

**CASH:** If you have a quantity of TV modules, send us a list of brand and model numbers and we'll advise you of the value . . . for instant cash!

Acceptable brands are Admiral, GE, Magnavox, Montgomery Ward, Philco, Quasar, RCA, Sears/Warwick, Sylvania and Zenith. Do not include ceramic encapsulated, broken or cannibalized modules. PTS reserves the right to reject any or all modules.



**PTS ELECTRONICS, INC.**  
PRECISION TUNER SERVICE

THE COMPLETE LIST OF ALL PTS SERVICENTERS APPEARS ON THE NEXT PAGE

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# PTS THE WORLD'S LARGEST TUNER REPAIR COMPANY

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**PTS ELECTRONICS, INC.**  
PRECISION TUNER SERVICE

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## LETTERS

### WANTS A RETURN ENGAGEMENT FOR TECH DIGEST

I am inquiring as to why the article "Tech Digest" was dropped from ET/D.

We have kept a library on all the hints and service tips from the articles and found them to be very useful. Will this article again be included? We certainly hope so.

Jo Kobylecky  
Orcutt, California

*We're happy to report that Tech Digest will return to the pages of ET/D soon.*

### PLEASE MAKE TECH DIGEST MORE COLLECTABLE

I wish you would reinstitute the feature called Tech Digest. And if you do, I wish you could put it into a format which is easier to collect.

I would like to suggest that you could perhaps print it in 3 x 5 form on a stiff paper backing, such as your reader service information cards. It appears that you could continue to use the three column format and use two columns for the 3 x 5 form with advertising in the third column.

Incidentally, if you decide to adopt this suggestion I would like to further suggest that the reverse side of the Tech Digest page be used for advertising thereby providing non-interrupted continuity of articles for persons who are not interested in removing the technical digest information.

I find it impossible to keep up with all brand information, most particularly on brands I am not an authorized warrant servicer for, and this format would be a welcome aid to better, quality service for my customers and my own satisfaction.

Wayne R. Svenson, CET  
Lakewood, Colorado

*Thank you for your intriguing suggestions. We'll certainly consider them as we put together the reinstated Tech Digest.*

### DRAWING IS RIGHT— CAPTION WRONG

In the July 1977 issue, on page 22, Fig. 5, I believe the drawing is correct but the caption is wrong. I NEVER use capacitors on the FIELD terminals of generators or alternators (except in extremes, where I use a small .002 Mfd in series with a 3.3 ohm resistor as a last resort). Otherwise, I've used the coaxial capacitor and grounding and

bonding procedures you describe since 1944. A fine article.

Dorsey A. Jordan  
Glen Saint Mary, Florida

*You're right. Caption should read "connected to the armature". Thanks.*

### IN NEED OF OSCILLOSCOPE SCHEMATIC

I am in need of a schematic or a tube layout for a Jackson model CRO-2 scope. Two 8 pin tubes are missing, and I would like to get the scope going. The Jackson Electrical Instrument Company of Dayton, Ohio is out of business. Thank you for any help which you can give me in obtaining the schematic.

John M. Matz  
741 Schuylkill Avenue  
Pottsville, Pa. 17901

*We're sorry we can't help you with information on the Jackson CRO-2. We've searched our files—and no scope. But we are publishing your letter in hopes that maybe another ET/D reader can and will help you.*

### CB SCHEMATICS IN TEKFAK

Because my principal business is servicing CB radios, I would like to know why you don't include CB schematics in ET/D TEKFAK. I think such schematics would be helpful to many ET/D subscribers, particularly now that CB has become so popular.

Barney Lejeune  
Lafayette, Louisiana

*As you are undoubtedly aware, there are about 75 different brands of CB's on the market, with an approximate average of five different models per brand per year.*

*To cover all of these designs on a timely basis in TEKFAK would require more pages per issue than our present subscription rates permit. However, we will consider TEKFAK-type coverage of the ten major CB brands, if a sufficient number of ET/D readers so request.*

### WANTED: YOUR COMMENTS & OPINIONS..

We at ET/D invite you to share with other ET/D readers your comments and opinions about controversial issues and/or business-related problems confronting the electronic service industry. Send them to: LETTERS TO THE EDITOR, ET/D, 1 East First St., Duluth, MN 55802. (Only signed letters will be considered for publication.)

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# **ELECTRONIC TECHNICIAN/DEALER**

**AUGUST 1977 • VOLUME 99 NUMBER 8**

**THE COVER:** This month's cover photo—a typical service bench set-up complete with test instrument, replacement parts, and the ever-present, ever-necessary schematic—is symbolic of the feature on page 24, "How To Read—And Draw A Schematic." Photo courtesy of the John Fluke Company.

## **14 Convention Time—1977**

We welcome those attending this year's electronic service association conventions—NESDA and NATESA—and take a look at the schedule of events.

## **16 A Car Radio That Seeks And Scans**

A look at the mechanical and electronic workings of the new "seek-and-scan" car radios from Aeronutronics-Ford.

By Joseph J. Carr, C.E.T.

## **21 Amplifier Noise**

How to find and eliminate those bothersome spurious noises that occur in amplifier circuits.

By Joseph J. Carr, C.E.T.

## **24 How To Read—and Draw—A Schematic**

A review of two chapters from a TAB BOOK, "TV Schematics: How To Read Between The Lines," by Art Margolis. One chapter tells you what to do when a schematic is not available, and the other tells how to read peak-to-peak voltages.

## **30 R.S. Green & Son: Offering 'A Little More' In West Chester**

How one TV/appliance retailer in Southeastern Pennsylvania uses the 'extras' to bring in the business. By Ted Knight.

### **DEPARTMENTS**

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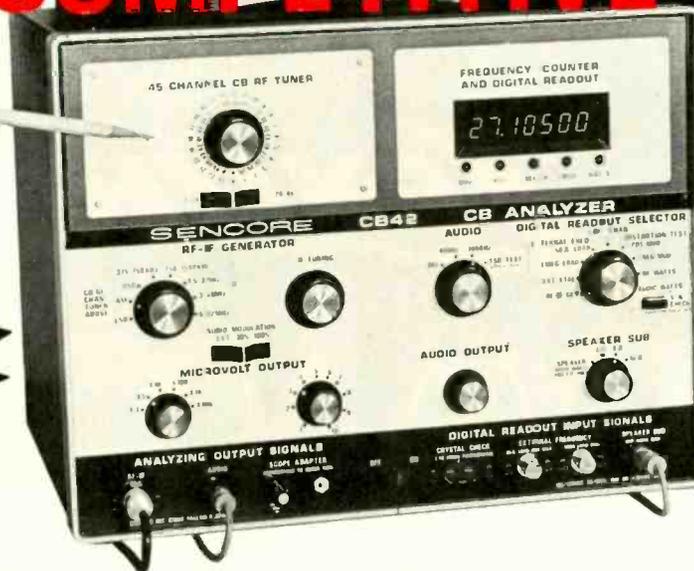
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# BE COMPETITIVE

**40 CHANNEL CAPABILITY**

with exclusive  
Percent Off Channel  
direct readout  
(Patent Pending)



**\$975**

All cables included

## With Everything You Need for Fast CB Service in One Lower Priced, Compact Instrument . . .

AVOID TIME-WASTING MULTIPLE INSTRUMENTS AND CONFUSING CABLE SYSTEMS. GET AT THE PROBLEM IN A JIFFY WITH THE

### SENCORE CB42 AUTOMATIC CB ANALYZER

### It's a CB Profit Center All in One Handsome Instrument

The CB service market is growing and more "on the ball" technicians are getting into the act every day. Competition for the CB business is getting tougher and you'll want to be sure you can compete. Knowledge alone won't be enough. You'll want to get ahead by simplifying your work to get the most jobs out with the least effort. You'll want to concentrate on your troubleshooting and not fiddle with 15 cable connections and 28 knobs on different instruments. So you will want to get an instrument that takes you from antenna input to speaker, and from mike to antenna load in one neat package.

To top that off, the complete CB42 is hundreds of dollars below the nearest competition, and thousands below most. We've got our competition beat, and you'll beat your competition, too, by saving these six ways with this CB42 Profit Center.

IN CANADA: Superior Electronics, Inc.  
1330 Trans Canada Hwy.S.,Montreal,Quebec H9P 1H8

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

...for more details circle 124 on Reader Service Card

#### **\$AVE ON REPAIR TIME:**

One simplified tester in a single case saves time on every test on any CB that comes in your door, including Single Sideband sets; you won't even need a scope.

#### **\$AVE ON READOUT TIME:**

One direct-reading digital readout saves interpretation time and reading errors. You'll know the CB's frequency, generator frequency, Percent Off-Channel, positive/negative modulation and distortion, RF output, and audio output with a simple flick of a switch. Only the CB42 is this simple and complete.

#### **\$AVE ON CHANNEL CHECKING:**

Simply rotate the CB42 and CB selector through all 40 channels and read "percent off center frequency" on the direct-reading digital meter (.005% FCC maximum deviation) in less than two minutes for all 40 channels.

#### **\$AVE ON TIME CONSUMING CONNECTIONS:**

Three cables, provided with your CB42, do the entire job; audio cable, transmitter cable, and receiver cable.

#### **\$AVE ON ANNOYING HOWL:**

Why get a screwdriver in the back from the guy next to you, when you can substitute for that annoying speaker howl? Just plug the built-in, non-grounded speaker sub cable into the transceiver and quietly monitor the audio output on the meter.

#### **\$AVE ON BENCH SPACE:**

The CB42 takes less than one-third the bench space of other equipment. You can even take it to the field with you, for on-the-spot mobile checks, since it is also 12 Volt battery powered.



**SENCORE**

3200 Sencore Drive, Sioux Falls, South Dakota 57107  
Phone (605)339-0100

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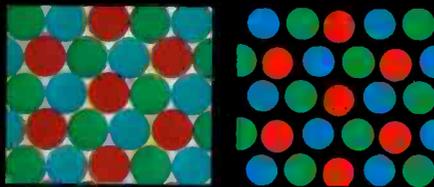
# Chances are you can improve color

## ZENITH<sup>®</sup> CHROMACOLOR<sup>®</sup>

# Replacement Picture Tubes

Before Chromacolor, every large screen color TV picture was made up of thousands of tiny red, green and blue dots on a gray background.

But Zenith found a way to make the dots smaller, surround them with jet black and, for the first time, fully illuminate every dot not only for greater brilliance, but also for dramatic contrast.



The result was the famous Chromacolor picture tube – widely recognized at its introduction as one of the most important breakthroughs in color picture tube technology since the coming of color television.

Today, Chromacolor still represents a significant forward step in the state of picture tube technology...in brightness, contrast, and true-to-life color.

And for reliability, there's no comparison between a Chromacolor picture tube from your Zenith distributor and that you may attempt to re-build yourself. When you get down to it, you simply can't invest man hours in a re-built that will seldom, if ever, measure up to the reliability, the consistency, the integrity of a factory-supplied Chromacolor.

As a result of this reliability, Chromacolor can do a lot for older color TV's...and many not-so-old sets as well. Even those of other makes.

That's why you should check with your Zenith distributor now and stock up with Zenith's 17", 19", 23", and 25" diagonal sizes.

Besides brightening your customers' picture viewing, Chromacolor will brighten your profit picture too! Reliably!

Call your Zenith distributor now.

viewing no matter what make TV  
your customers now have.



**ZENITH**

The quality goes in before the name goes on®

Zenith Radio Corporation/Service, Parts & Accessories Division/11000 Seymour Avenue/Franklin Park, Illinois 60131

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

AUGUST 1977, ELECTRONIC TECHNICIAN/DEALER / 5

# NEWS OF THE INDUSTRY

## **CB Industry Group Endorses FCC Ban on Linear Amps**

A proposed rule by the Federal Communications Commission to ban the manufacture and marketing of "linear amplifiers" has been endorsed by the Citizens Radio section of the Electronic Industries Association (EIA).

"Linear amplifiers" increase the operating power of CB stations above the permitted 4 watts and increase the potential for interference with other electronic equipment.

The EIA group, in their endorsement of the FCC proposal, said that it "considers the removal of unauthorized radio frequency power amplifiers from the Citizens Radio service to be a matter of considerable urgency." The group noted that "the removal of these amplifiers is one step that's necessary to improve the quality of the Citizens Radio Service."

## **CEDA Urges Its Members To Reduce Trade Show Participation**

The Communications Equipment Distributors Association (CEDA) has urged its members to re-evaluate their trade show attendance priorities and to attend no more than two trade shows in the coming year. Their move, they say, is in response to the increasing proliferation of electronic industry trade shows.

According to CEDA president Arthur Z. Guller, St. Louis, the recommendation applies to all CEDA regular distributor and associate manufacturer, dealer and sales representative members.

## **Talks on Now To Cancel PC-78**

Discussions on cancellation of the two-way radio show, PC-78 and merger into the Winter CES show are being held between CES management and PC-78 board members. According to *TV Digest*, agreement is likely. PC board reportedly asked CES for payment of about \$200,000 and treatment at the CES Show to maintain separate identity of CB industry, in return for cancellation of February PC-78 in Las Vegas.

## **RCA To Convert All Color TV To Energy Saving Chassis**



All RCA color TV models will be converted to new low levels of energy consumption that, according to RCA, will reduce average operating costs for the consumer to approximately two cents a day.

The company's new "XtendedLife" chassis which uses only 89 watts of power to operate the 19-inch color TV models is shown by model Rondi Bogwald. Energy consumption of the new chassis will be less than the 100-watt light bulb Rondi holds in her hand.

Roy H. Pollack, vice president and general manager of RCA's Consumer Electronics division, said "complete conversion to the new chassis design will be accomplished by mid-1978."

Earlier RCA tube-type receivers used at least 375 watts. And estimates by the Edison Electric Institute place the electricity requirement of today's average solid state color TV at 145 watts.

## **Raymond E. Johnson Is Named Acting General Manager of EIA**

Chairman of the Electronic Industries Association Board of Governors, John C. Messerschmitt, has announced the appointment of Raymond E. Johnson to the position of acting general manager of the EIA.

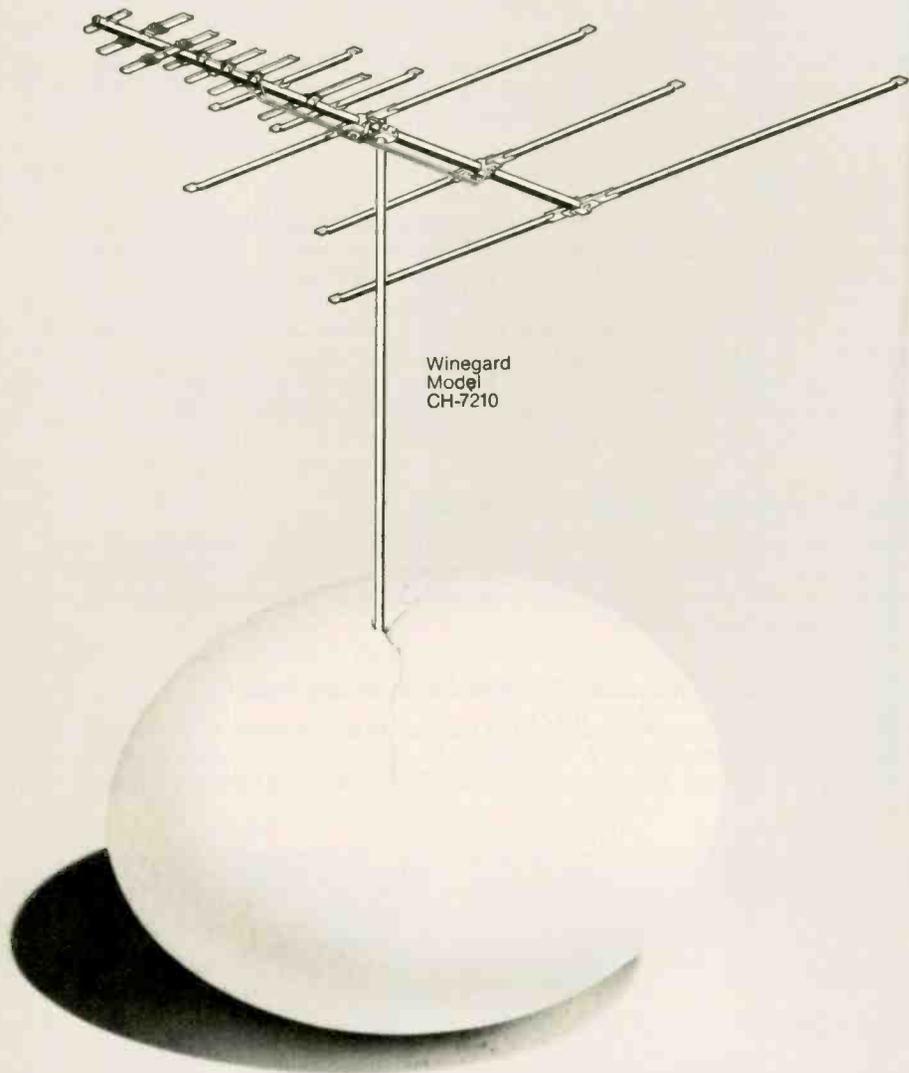
Johnson is general counsel of the EIA. He replaces the departing president, V.J. Adduci.

## **Midcon Convention Nears Exhibit Sellout In Chicago**

Midcon, the new electronics convention in Chicago next November, appears headed for a sellout of exhibit space, it was announced by William C. Weber, Jr., Midcon general manager. Midcon is sponsored by national and regional elements of the Electronic Representatives Association and the Institute of Electrical and Electronics Engineers.

## **Certain NARDA Universal Warranty Claim Forms Not Acceptable by Zenith**

The Zenith Radio Corporation has asked its dealers to watch for NARDA Universal Warranty Claim Forms with Claim Numbers having a triple zero prefix. In a statement issued to Zenith dealers recently, the company stated that "Although we feel NARDA forms have proven to be very successful, please be advised that the forms that originally



## **SOLVE HARD-BOILED GHOSTING PROBLEMS**

Crack the toughest ghost problems with a Winegard CH-7210 Chromstar VHF-UHF antenna, or the CH-4210 VHF model. These "ghost killers" are specially designed, with super sharp directivity and high front-to-back ratio. They reject unwanted "ghost" signals from the sides and rear.

Features include special phasing coupler, rugged construction, and Chromstar line quality, performance and long life. Ideal size for city and suburban installation... even in attics. Ask your Winegard distributor for one of these Winegard antennas and try it on your next problem installation.



# **WINEGARD**

The Winegard Company • 3000 Kirkwood Street • Burlington, Iowa 52601

...for more details circle 130 on Reader Service Card

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were printed with Claim Numbers with a triple zero prefix cannot be used when submitting claims to Zenith dealers. If you have purchased NARDA forms with the triple zero prefix please contact John Gooley at the NARDA office in Chicago and arrange to have them exchanged for forms with Claim Numbers beginning with an alpha prefix."

### **GE TV Will Accept NARDA Warranty Claim Form**

General Electric has announced that it will accept the NARDA Warranty Claim form for all GE TV in-warranty service claims.

"We fully support the goal of minimizing the number of different television warranty claim forms the independent service technician must currently deal with," commented "Dutch" Meyer, manager of Product service for GE.

### **Motorola Enters Solar Arena**

Motorola has initiated within their Discrete Semiconductor Division a new product that they say may, within the next decade, dwarf all existing uses for semiconductor materials. Dr. Arnold Lesk, Motorola manager of solar research & development, said "It will be another 5 to 10 years before solar energy will be cost-effective for all general-purpose applications around the home, but it can be harnessed now, most economically, to supply moderate amounts of energy to a lot of remote locations.

The products being introduced include two solar modules; a 48-cell array and a 36-cell array. Both are intended for energizing remote, unattended equipment such as microwave relays, navigational aids and forestry equipment.

### **Leader Instruments Names New Corporate Vice President**

Leader Instruments Corporation, test instrument manufacturer, has announced the appointment of William L. Brydia as corporate vice president, responsible for marketing, sales and general administration. Brydia has been with RCA, Philco-Ford, Motorola, Harris Corp. and General Instruments.

### **Sales To Dealers Of Consumer Electronics Still Well Ahead of Last Year**

As of the 23rd week of 1977, the week ending June 10th, sales to dealers of all consumer electronic products were well ahead of 1976. Color TV sales showed a 21.1% increase, B & W TV was up 8.6%, and total radio sales were up 26.6%. The rundown of figures from the EIA are as follows:

<b><u>Products</u></b>	<b><u>1977</u></b>	<b><u>1976</u></b>	<b><u>% of Change</u></b>
B & W TV	2,082,000	1,917,522	+8.6
Color TV	3,302,244	2,726,987	+21.1
<b>TOTAL TELEVISION</b>	<b>5,384,244</b>	<b>4,644,509</b>	<b>+15.9</b>
AM/FM or AM or FM radio	11,479,219	8,134,222	+41.1
Automobile Radio	5,700,201	5,438,006	+4.8
<b>TOTAL RADIO</b>	<b>17,179,420</b>	<b>13,572,228</b>	<b>+26.6</b>

### **New Dealer Awards Promotion Program Underway with GTE Sylvania**

GTE Sylvania Incorporated has started the 1977 "Keep Tabs on Sylvania" sales promotion program for color picture and receiving tubes. "The 1977 program is bigger and better than ever," said Richard M. Porter, sales promotion manager. "The program has been expanded to allow dealer and other participants to earn additional tabs through purchases of Sylvania color picture tubes from their distributors," he explained. "In addition to individual address tabs from Sylvania receiving tube cartons, each serial label from Color Bright 85 picture tube cartons is worth 50 tabs and all other Sylvania color picture tube labels can be redeemed for ten tabs each," Porter explained. The program continues through November, 1977.

### **Legal "War Fund" Established by California Electronics Association**

Members of the California State Electronics Association have voted unanimously to raise \$100,000 as a volunteer "war fund" to defray costs of legal actions against TV manufacturers' In-Warranty Service fees. The vote came during CSEA's annual business meeting in San Jose.

The legal actions, one through the State's courts and the other through Federal judiciary are designed to prevent TV manufacturers and their agents from soliciting service shops to perform In-Warranty service for less than the cost of performing the service. Both actions were initiated by CSEA members on their own.

Allegations contained in both law suits involve violations of the California Business

# A lot of things have happened to van design. All from Ford.

Ford's new design Econoline changed van history! Ford moved the engine forward so doors are wide for easy entry. Inside there's room for the driver to step across the van or to the rear.

- Ford's top van payload is over 2½ tons.
- Ford vans are built differently from others, with a strong separate frame. The frame's designed to cushion front impact, another van "first." Rubber mounts insulate the body.
- Econoline has options like swiveling Captain's Chairs and an engine range of 300 Six, 351 and 460 V-8's.



83 out of 100 of all Ford Trucks registered over the last 12 years are still on the job.

...for more details circle 114 on Reader Service Card

**FORD**

FORD DIVISION



and Professional Code, the Song Beverly Warranty Act Federal anti-trust statutes, conspiracy, restraint of trade, unfair competition and other business inhibiting factors. RCA was excluded from the action in both cases.

### Admiral Plans To Add 500 New Dealers

Quoted by *TV Digest*, Admiral marketing vice president Frank DiLeo says that his company, which now has nearly 6,000 dealers, plans to add 500 more. To qualify as Admiral dealer, retailer "must buy at least \$65,000 worth of Admiral consumer electronic products in the first year." Also quoted was Admiral's new vice president and general sales manager James Mills, who said "our color sales are up 50% over last year for 1977's first 5 months, B & W is up 125%, with operating losses down 45%." Newly appointed to the job, Mills will be responsible for all U.S. sales of Admiral products through all distribution channels.

### A Few Interesting Statistics About Citizens Band Radio

Of proof that CB radio is now more than just a fad is the group of statistics released recently by the Electronic Industries Association (EIA).

- Over 9 million CB licenses have been granted by the FCC since 1958.
- More than 22 million citizens band radios are in use by Americans.
- One out of every 10 vehicles is equipped with a CB radio. More specifically, CB is in: 1 out of every 10 passenger cars—3 out of 4 long-haul trucks—4 out of 9 recreational vehicles—and 1 out of 7 pleasure boats.
- Over \$3 billion has been invested in CB equipment by Americans.
- More than 70 firms manufacture or import CB radios.
- Ten million units were sold in 1976—and the same number is expected in 1977.

### FCC Is Flooded With CB License Applications

Through this March, record numbers of CB license applications were flooding the Federal Communications Commission. Approximately 1.8 million applications were received through mid-March. John Sodolski, vice president, EIA, said "If the level of applications continues, the total number for the first quarter of 1977 will exceed 2.2 million applications." The EIA predicts 10 to 12 million units will be sold in 1977.

## Want to cut out a career as a two-way radio technician?

MTI offers the only training for professional FM two-way radio available. Qualified technicians are employed in government, industry, and public service. But training is your key.

You could cut out a career as a two-way radio technician by cutting out this coupon. We'll send you information on how you can learn more about this specialized field, at home.

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I am a veteran or serviceman on active duty. JJ9



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...for more details circle 120 on Reader Service Card



## Seeking Original Japanese Replacement Parts for CB Repair Use?

**CB REPAIR PACKAGE**  
\$77.00 value for only \$59.00  
Now repair almost all CB's with this package of Japanese Transistors

2SK 19 FET	2 pcs	2SC 1306	4 pcs
2SD 235	4 pcs	2SC 1239	3 pcs
2SC 710	10 pcs	2SC 1307	4 pcs
2SC 775	4 pcs	2SC 756	3 pcs

**SPECIAL PACKAGE OF MOST COMMON DRIVERS & FINALS**  
This kit contains 6 each of:

2SC 775	2SC 756
2SC 1018	2SC 799
2SC 1226	2SC 1239
2SC 1306	2SC 1307

**\$140.00 value for Just \$99.95**

### CHECK OUR NEW REDUCED PRICES! COD ORDERS WELCOME Under \$500 no deposit required

#### Original Japanese Transistors, FET, IC, Diodes

TRANSISTORS				FET				DIODES			
ZSB 415	70	ZSC 509	90	ZSC 776	2.65	ZSC 1060	2.25	ZSC 1675	.59	TA 7061AP	1.90
ZSB 463	1.50	ZSC 517	3.95	ZSC 777	3.5D	ZSC 1061	1.40	ZSC 1678	2.25	TA 7062P	1.90
ZSA 495	70	ZSC 535	70	ZSC 778	3.6D	ZSC 1096	1.00	ZSC 1679	4.25	TA 7205P	3.90
ZSA 562	59	ZSC 474	1.20	ZSC 536	59	ZSC 781	2.65	ZSC 1166	.59	BA 511	3.40
ZSA 628	59	ZSC 492	1.00	ZSC 562	2.15	ZSC 784	.58	ZSC 1173	.90	BA 521	3.70
ZSA 634	90	ZSC 183	59	ZSC 619	59	ZSC 785	70	ZSC 1175	.90		
ZSA 640	59	ZSC 184	59	ZSC 620	59	ZSC 789	1.00	ZSC 1189	1.40		
ZSA 643	70	ZSC 371	59	ZSC 668	59	ZSC 793	2.80	ZSC 1213	70		
ZSA 683	70	ZSC 372	59	ZSC 696	1.95	ZSC 799	3.60	ZSC 1226	1.00		
ZSA 719	70	ZSC 373	59	ZSC 710	59	ZSC 802	3.60	ZSC 1237	4.25		
ZSA 720	70	ZSC 380	59	ZSC 711	59	ZSC 815	59	ZSC 1239	3.50		
ZSA 721	70	ZSC 381	.69	ZSC 712	59	ZSC 828	59	ZSC 1306	4.40		
ZSA 733	59	ZSC 387	59	ZSC 717	59	ZSC 829	59	ZSC 1307	4.90		
ZSB 54	59	ZSC 394	59	ZSC 732	59	ZSC 838	59	ZSD 142	2.00		
ZSB 75	59	ZSC 403	59	ZSC 733	59	ZSC 839	59	ZSD 180	2.50		
ZSB 186	59	ZSC 454	59	ZSC 734	59	ZSC 900	59	ZSD 187	.66		
ZSB 324	70	ZSC 450	59	ZSC 735	59	ZSC 930	59	ZSD 188	3.00		
ZSB 337	1.60	ZSC 461	59	ZSC 756	2.80	ZSC 943	1.20	ZSD 227	.59		
ZSB 367	1.50	ZSC 481	1.60	ZSC 773	70	ZSC 1014	1.20	ZSD 234	1.00		
ZSB 368	2.15	ZSC 482	1.50	ZSC 774	1.60	ZSC 1017	1.40	ZSD 235	1.00		
ZSB 406	70	ZSC 495	1.00	ZSC 775	1.95	ZSC 1018	1.20	ZSD 277	.59		

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Cincinnati, OH 45240  
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(513) 874-0223

...for more details circle 115 on Reader Service Card

## TECHNICAL LITERATURE

**More Than 40 Test Instruments** are featured and described in a new 1977/78 catalog from Leader Instruments Corp. The instruments described, along with accessories, are for applications in industry, service, education, communications and quality control. The multi-colored, 48 page presentation details features, applications and specifications of five different product categories, and highlights large, easy-to-read photographic display with specific "call-out" material. The products featured include oscilloscopes, vectorscopes, multimeter and millivolt meter models, audio analyzers, digital frequency counters, signal and sweep marker generators, and color bar generators. It is free from *Leader Instrument*, 151 Dupont Street, Plainview, N.Y. 11803.

A **New CB Antenna Tuner** is the subject of a colorful new catalog published by Norcom Electronics. The new tuner is called the Iso-Tune antenna tuner which is said to be able to reduce SWR in antenna systems to lowest flat readings, even across 40 channels. The new unit is placed in the coax line, between the transceiver and antenna with an SWR meter. Adjustments, described in the brochure, are then made to attain the lowest SWR and peak antenna efficiency. The new catalog is free from *Norcom Electronics, Inc.*, 23611 Chagrin Blvd., Beachwood, Ohio 44122.

A **New Semiconductor Replacement Guide** is now available from GTE Sylvania. The new guide cross references, in alphanumeric order, more than 5000 industry part numbers to the Sylvania ECG line of semiconductor replacement devices for CB transceiver and scanner units. The 28-page guide lists replacement types for diodes, integrated circuits, modules, rectifiers, and transistors used in 73 different brands of CB equipment. In addition to the alphanumeric listing, the guide also contains a section cross referencing equipment brand names and the solid-state devices they contain to the equivalent Sylvania ECG replacements. It's free at *Sylvania distributors*.

**Coaxial Wattmeters, Loads, and RF Attenuators** are described in the latest short-form catalog from Bird Electronics. Listed in the catalog, SF-77—are Thru-line directional wattmeters, coaxial loads, RF termination wattmeters, and attenuators covering

from ½ to 2800 MHz and from milliwatts to 250 kilowatts. The catalog lists current prices of 104 popular models, as well as RF power measurement accessories. Many of the instruments listed are now shipped from stock, and other standard units are available 2 to 12 weeks ARO. The catalog is free from *Bird Electronic Corporation*, 30303 Aurora Road, Cleveland, Ohio, 44139.

**An Audio Connector Brochure** is now available from Switchcraft. The new literature describes in detail a new audio connector with a variety of special features for professional audio

users. The new device described is called the Quick Ground Professional (QGP) Connector. It is actually a complete line of connectors designed for professional uses from rock concerts to studios. The new brochure highlights and describes the benefits of the QGP such as: a non-reflective finish to prevent glare from bright lights, gold-plated contacts and pins, and reinforced plastic insulation. The brochure is free from Sales Dept., *Switchcraft, Inc.*, 5555 No. Elston Ave., Chicago, IL 60630.

**Chemicals For Electronic Application** are described in the latest hand-

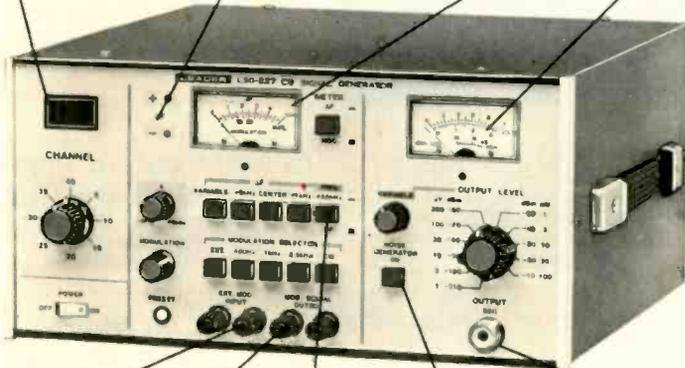
# INTRODUCING THE NEW LEADER 40-Ch PLL CB Signal Generator

40-Ch. Digital Readout  
in FCC Sequence.

±1KHz Program Freq.  
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## Now, service CB with speed and accuracy.

**Model LSG-227 . . . \$549.<sup>95</sup>**

See your distributor or write direct for details.

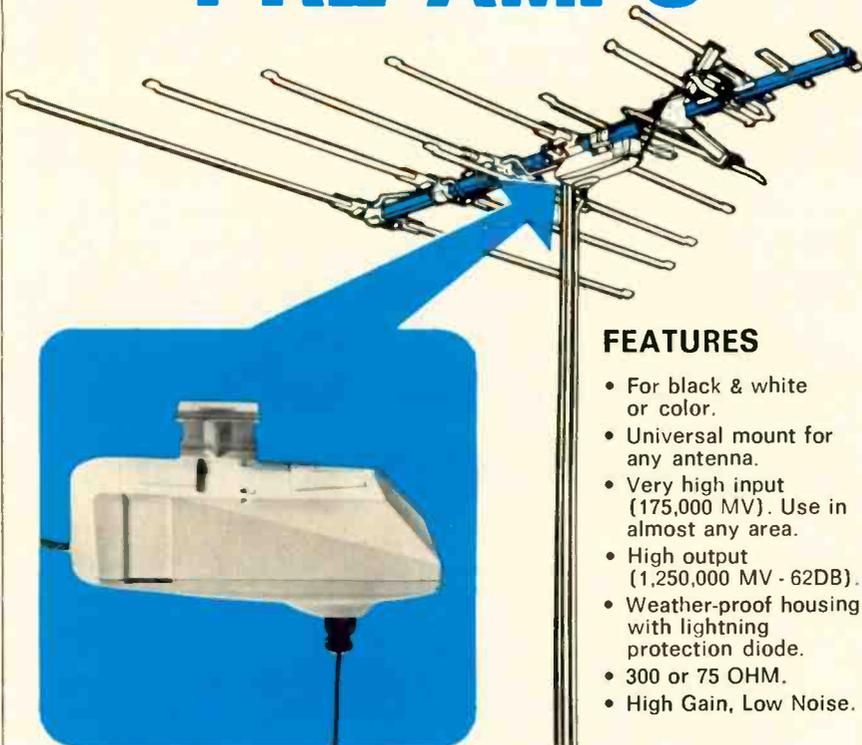
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In Canada: Omnitronix Ltd., Montreal, Quebec

...for more details circle 118 on Reader Service Card

# NEW NEW NEW CHROMA-POWER PRE-AMPS



## FEATURES

- For black & white or color.
- Universal mount for any antenna.
- Very high input (175,000 MV). Use in almost any area.
- High output (1,250,000 MV - 62DB).
- Weather-proof housing with lightning protection diode.
- 300 or 75 OHM.
- High Gain, Low Noise.

### 300 OHM output models

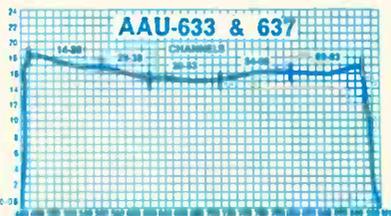
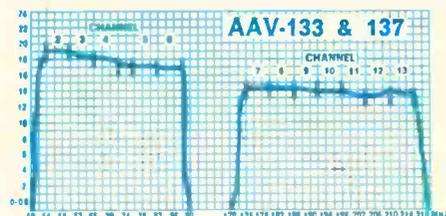
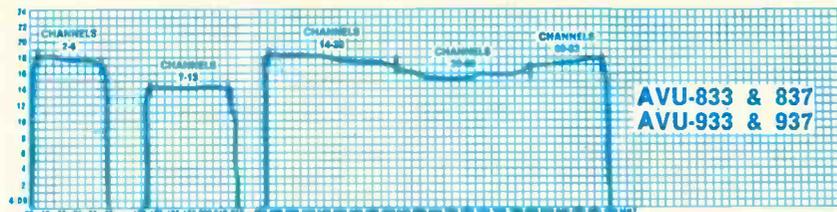
AAV-133 Amplifies VHF Passes UHF  
AAU-633 Amplifies UHF Passes VHF  
AVU-833 Amplifies VHF and UHF  
\*AVU-933 Amplifies VHF and UHF

### 75 OHM output models

AAV-137 Amplifies VHF Passes UHF  
AAU-637 Amplifies UHF Passes VHF  
AVU-837 Amplifies VHF and UHF  
\*AVU-937 Amplifies VHF and UHF

\*Separate Inputs for U and V

### ACTUAL READINGS FROM TEKTRONIX 502 SCOPE



Line up today with **ACA**.

See your distributor or write:

P. O. Box 865,  
Burlington, Iowa 52601

In Canada: Len Finkler, Ltd., Downsview, Ontario M3J 2A6, Tel. (416) 630-9103



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book from GC Electronics. Called a "problem solver" handbook the new literature provides detailed descriptions for the use and application of the firm's 160 "electronic" chemicals. The 53-page handbook provides "in-use" photographs as well as detailed product and container specifications for adhesives, cleaners, coatings, PC chemicals, solvents, thinners and lubricants. Available free from electronic distributors, or from *GC Electronics*, 400 So. Wyman, Rockford, Illinois 61101.

**TV Test Rigs, Brighteners, and Substitute Tuners** are some of the items included in the latest catalog from *TeleMatic*. The new literature lists a universal TV test rig, yoke & convergence adaptors, extension tools, brighteners cross-referenced to tubes, crystal checkers, CRT testers, high voltage probes, curve tracers and power supplies. Also included are TV high voltage repair parts and kits. Available free from *TeleMatic*, 2245 Pitkin Avenue, Brooklyn, N.Y. 11207.

**Attenuation Equipment And Frequency Generators** are described fully in a new convenient "short-form" catalog from *Kay Elemetrics Corporation*. Included are standard in-line attenuators, miniature in-line attenuators, standard and miniature rotary attenuators, programmable and sliding block attenuators and attenuators that are programmable and remote. Also described is the firm's 300 MHz spectrum analyzer, a digital capture and chart recorder for CATV sweep testing, sweep generators that provide a 1 MHz to 1500 MHz sweep and a 500 kHz to 500 MHz sweep, pulsed carrier generators and a sonagraph-audio spectrum analyzer. The catalog is free from *Kay Elemetrics Corporation*, 12 Maple Avenue, Pine Brook, N.J. 07058.

A new "Touch-and-Trigger" Oscilloscope with a 25 MHz bandwidth is described and illustrated in a new brochure from *Philips*. The brochure explains the main features of the instrument, including control layout, triggering possibilities and technical specifications. A life-sized illustration of the new oscilloscope is included in the brochure with full descriptions of all functions. Available free from: p.o. NV Philips Gloeilampenfabrieken, GAD/T&M, TQ III-4, Eindhoven, The Netherlands.

A Filter System Selector Chart for CB reception problems has been prepared by *Cornell-Dubilier Electric*. The chart deals with both mobile and base installations, and is definitive in its recommendations or filters for typical noise problems in the categories of

compact and medium cars, full-size cars, trucks, and heavy-duty farm equipment. Commonly occurring noise problems discussed include: a musical whine from alternators or generators; clicking from turn signals or voltage regulator; and popping noises from ignition. Also covered are the problems of interference from neighboring TVs and radios. The overall chart is on one side of a standard size sheet and multi-colored for fast reference. Available free from Douglas W. Graham, *Cornell-Dubilier Electric*, 150 Avenue L, Newark, N.J. 07101.

**A New Semiconductor Interchangeability Guide** has been released by Raytheon. The new guide, which is a supplement to an earlier guide, lists 22 new transistors, rectifiers, and integrated circuits that have been added to the firms RE semiconductor line. The new devices include ten FM, TV and audio IC's, as well as four types of NPN and PNP silicon transistors, a silicon stick rectifier, two silicon unijunction transistors, and five audio power amplifier modules with outputs of from 8 to 25 watts. The new guide is free from Raytheon distributors, or from *Raytheon Company*, Distributor Products Operation, 4th Avenue, Burlington, Mass. 01803.

**TV, CB And FM Antennas and Accessories** are covered completely in the latest catalog, No. 734, from South River Metal Products. Complete specifications and illustrations are included for: chimney mounts, roof mounts, wall brackets, ladders, trimount roof towers, eave mounts, tripod roof towers, parapet mounts, and many other associated products. The catalog is free from *South River Metal Products Company, Inc.*, South River, N.J. 08882.

**Burglar and Fire Alarm** products are described and illustrated in the latest catalog from Mountain West Alarm. The new 72-page catalog lists over 900 professional grade alarm products ranging from simple door switch, control and bell systems to the latest radar, ultrasonic and infrared detectors. Products are described as to use, principle of operation and specifications. The A-78 catalog is free from *Mountain West Alarm Supply Co.*, 4215 N. 16th St., Box 10780, Phoenix, Arizona 80564.

**A Soldering Irons Catalog**—designated GEP-1545A—is now available from the GE Industrial Heating business department. The new catalog describes the firm's complete line of light- and heavy-duty industrial soldering irons, parts and accessories. It provides graphically detailed illustra-

tions of each soldering iron and available interchangeable threaded tips. Included are specifications on soldering iron operational characteristics; handle and cord sets; tip and heater units and heater units for individual threaded tips; transformers; renewal parts; and a listing of GE sales offices. It is available free from GE industrial heating representatives, or the *General Electric Co.*, Industrial Heating Business Department, 1 Progress Road, Shelbyville, Indiana 46176.

**New Literature on Electrical Maintenance Products** is now available from CRC Chemicals USA. The new

catalog displays and describes the firm's line of products known for their moisture-displacing, rust-preventing and cleaning properties. The products can be applied by spraying, painting or dipping. Included in the catalog is information about CRC 2-26, Lectra-Clean, Co Contact Cleaner, Red Urethane Seal Coat, Zinc-it, Electrical quality Silicone, Heavy Film Lectra-Shield, Cable Clean and the firm's new product, Stor & Lube, a long-term lubricant and rust preventative. The catalog is free from *CRC Chemicals USA*, Electrical Division, Corporate Headquarters, 885 Louis Drive, Warminster, PA 18974.



## How Clean is Your RF?

### Meet The Latest FCC Requirements With Leader Test Gear!

Measure unwanted spurious signals! Set up traps at the proper level to reduce 2nd and 3rd harmonics! You can do it all, efficiently and quickly with this unique new tester from Leader. Until now, it was expensive and time consuming to measure CB harmonic output. The LHM-950 does it all and saves money too. Here's what you get:

- Operates on all 40 channels, plus!
  - $\pm 3$ dB accuracy
  - 20-120dB level range;
- Helps reduce spurious radiation . . . helps set up proper traps.
- Use with our directional coupler for measuring broad levels of harmonic content and modulation.
- Compact, portable, weighs just 5 lbs. \$299.95

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# Convention Time-1977

## A Look At the Programs Planned This Year by NESDA and NATESA

■ It's convention time again for the electronic service industry, with the two national service organizations—NESDA and NATESA—staging their annual conventions within a week of each other, both in August.

Take a look at the programs lined up for NESDA in Orlando, Florida, and NATESA just outside Chicago, and then plan to attend one or both. With business and training seminars, business sessions and the election of officers interlaced with sports events, tours and fun, the attendance costs, including travel, are tax creditable. In other words, it's an ideal chance to combine a business trip with a family vacation, and to meet with your service industry colleagues and industry leaders.

### NESDA MEETS FIRST IN ORLANDO

The National Electronic Service Dealers Association (NESDA), in conjunction with the Florida Electronic Service Association, meets first in convention at the Sheraton Towers Hotel in Orlando, Florida, August 16 through 21. Theme of this year's convention is "The Wonderful World of Service."

Included in the activities will be the "Magic Kingdom of Electronics" Trade Show on Friday, August 19; the first annual "College of Service Knowledge" technical training seminars on Thursday, the 18th, and the second annual Manufacturers/Dealers Golf Tourney, sponsored by ET/D magazine, will kick off the convention activities on Wednesday the 17th.

Included also in this year's program is the NESDA Profitable Service School and several National Service Conference Roundtable Discussions.

The site of this year's convention, Orlando, is in the heart of Florida's many recreational and entertainment attractions such as: The Magic Kingdom of Disney World, Sea World, The Kennedy Space Center, The Stars Hall Of Fame and Cypress Gardens. Organized trips to these attractions have been planned by convention leaders for conventioners and their families, and daily transportation to these various attractions will be available.

The schedule of events, as announced by convention chairman Nolan Boones, is as follows:

### SCHEDULE OF EVENTS

#### **Tuesday, August 16**

Visits to Disney World  
Registration

#### **Wednesday, August 17**

Manufacturers/Dealers Golf Tourney—8 A.M., sponsored by ET/D.  
Sea World and Hall of Fame Tour  
Tennis for the Teens  
Get Acquainted Pool Party—6 P.M.

#### **Thursday, August 18**

Business Management School—8 A.M. till 5 P.M.  
Technical Seminars—8 A.M. till 6 P.M.  
RCA Luncheon—12:30 P.M.  
RCA Disney World Trip (Includes transportation, admission to the park, rides and exhibits, and dinner, with RCA as host)



The current president of NESDA is Everett Pershing, owner of Pershing TV & Radio, Burbank, California.



ET/D will again sponsor the Manufacturers/Dealers Golf Tourney at this year's NESDA convention at Orlando. It will kick off the convention on Wednesday, August 17. Shown is ET/D Publisher Al Menegus, teeing off at last year's convention at San Antonio.



The emblem developed to depict the theme of this year's NESDA convention at Orlando, Florida, "The Wonderful World of Service."

#### **Friday, August 19**

GTE Sylvania Breakfast—8 A.M.  
NESDA Nomination Meeting—9:15 to 10:45 A.M.  
National Electronic Trade Show (NETS)—11 A.M. to 5 P.M.  
GE Luncheon—12 noon  
Teen Bathing Beauty Contest, Poolside—2 P.M.  
Magnavox Dinner—6 P.M.  
ISCET Election of Officers—8 P.M.  
RCA Reception—8 P.M.  
Hospitality Rooms Open—8 to



The present Executive Council of NATESA includes: (front, left to right) Paul J. Kelly, Warwick, R.I., vice president; George J. Weiss, Chicago, president; (back, left to right) Richard Ebare, Essex Junction, Vt., treasurer; Leo E. Cloutier, Los Angeles, secretary general; and Frank J. Moch, executive director.



10 P.M.  
 Teen Room Open—8 to 10 P.M.  
**Saturday, August 20**  
 Admiral Breakfast—8 A.M.  
 National Service Conference—9  
 A.M. to 12 noon  
 Sony Luncheon—12:30 P.M.  
 License Seminar—2 P.M.  
 Association Workshop—2 P.M.  
 House Of Mystery Tour—2 P.M.  
 Zenith Banquet—7 P.M.  
 Dance—9 P.M.  
 Teen Disco Dance—9 P.M.  
**Sunday, August 21**

Panasonic Brunch—9 A.M.  
 NESDA Annual Meeting  
 J.A. "Sam" Wilson Technical  
 Seminar—2 to 4 P.M.  
 Cypress Gardens Tour  
 Howard W. Sams Cocktail Par-  
 ty—6 P.M.  
 Installation Banquet—8 P.M.  
 Teen Farewell Party—8 P.M.  
**Monday, August 22**  
 NESDA Executive Council Meet-  
 ing—9 to 11 A.M.  
 ISCET Annual Meeting—8 to 11  
 A.M.

#### NATESA CONVENES NEXT IN CHICAGO

The National Alliance of Televi-  
 sion and Electronic Service Asso-  
 ciations (NATESA) will hold their  
 annual convention August 25th  
 through the 28th at the Nordic  
 Hills Resort, at Itasca, Illinois, a  
 suburb of Chicago.

This year's convention program  
 includes: a Panel Discussion of  
 Service Practices and Consumer  
 Relations by a panel of industry  
 service directors; a Seminar on  
 Modern Servicing Techniques by  
 Joe Groves of the Howard W. Sams  
 Co.; a Digital Binary Seminar by  
 Leo E. Cloutier, secretary general  
 of NATESA; an Oscilloscope  
 Seminar by representatives of  
 Sencore, Inc.; a CB Seminar by  
 B&K-Precision; and a tour of the  
 modern Quasar TV plant at  
 Franklin Park, Illinois.

The actual time of the above  
 events is to be announced later  
 and will, of course, appear in the  
 convention program available at  
 the time of registration. The  
 schedule of sponsored breakfasts,  
 luncheons and dinners is as fol-  
 lows:

#### SCHEDULE OF EVENTS

**Thursday, August 25—**  
 Golf Tournament, Nordic Hills  
 Course  
 Tour of the Quasar TV plant at  
 Franklin Park, Ill.  
**Friday, August 26—**  
 Brunch, sponsored by GTE Syl-  
 vania  
 Luncheon, sponsored by Mag-  
 navox  
 Hospitality Room, by Zenith  
**Saturday, August 27—**  
 Breakfast, sponsored by General  
 Electric  
 Luncheon, sponsored by RCA  
 Hospitality Room, By RCA  
 Convention Banquet  
**Sunday, August 28—**  
 Brunch, sponsored by Sony.



# Get your **Bottoms Up** premium catalog and get busy!

## **Busy collecting for the '77 GE Tube Flap Award Program. It's better than ever!**

Choose fabulous gifts from GE's Award Catalog or from S&H. Just for using the name your customers trust you'll get awards from the names you trust.

### **Here's how the program works . . .**

Collect the gray bottom flaps with the GE monogram from receiving tube boxes.

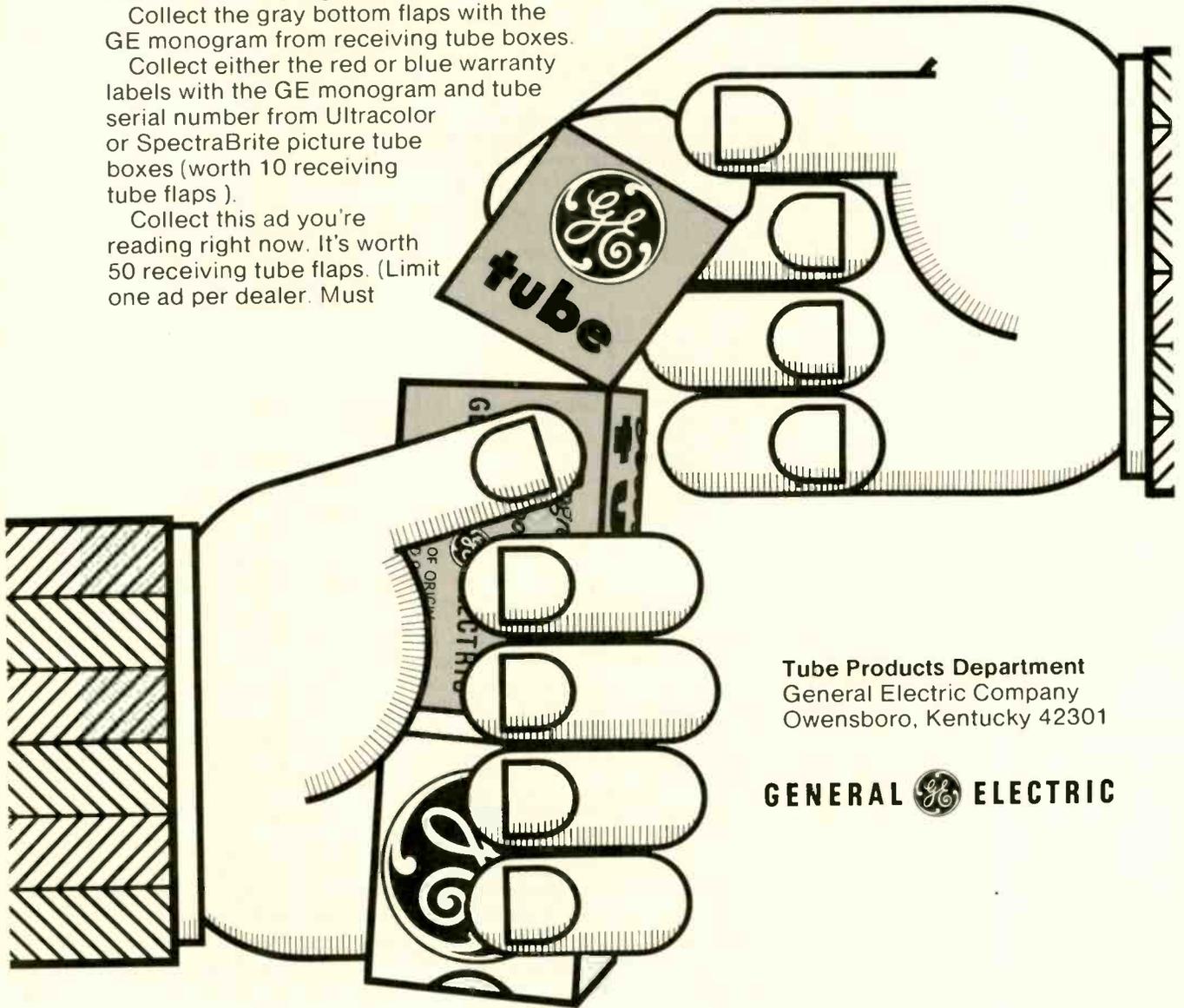
Collect either the red or blue warranty labels with the GE monogram and tube serial number from Ultracolor or SpectraBrite picture tube boxes (worth 10 receiving tube flaps).

Collect this ad you're reading right now. It's worth 50 receiving tube flaps. (Limit one ad per dealer. Must

be accompanied by gray flaps.)

Get full details at your authorized GE tube distributor. He has your official catalog.

Stay busy because the deadline is November 30, 1977.



**Tube Products Department**  
General Electric Company  
Owensboro, Kentucky 42301

**GENERAL  ELECTRIC**

described as "quad, two-input NAND gates." They are cross-connected to form a bistable multivibrator, also called an R-S flip-flop.

In manual operation, the output of GB2 (point A) is high, and the output of GB4 (point B) is low. If the *start* line is grounded—even momentarily—the flip-flop toggles (or changes state) and causes point A to go low and point B to snap high.

Up until this time the search drivers, Q1 and Q2, are inhibited. When the flip-flop toggles, it causes the input of Q1 and Q2 to go to ground, turning off Q1. In turn, this causes the collector of Q1 to go high, and forward bias Q2. When Q2 is turned on, the voltage on the base of the output amp, Q3, drops. This causes Q3 to also be forward biased, and it turns on. This, then, places the collector of Q3 at a high voltage which causes the motor regulator, Q4, to turn on and apply voltage to the motor winding.

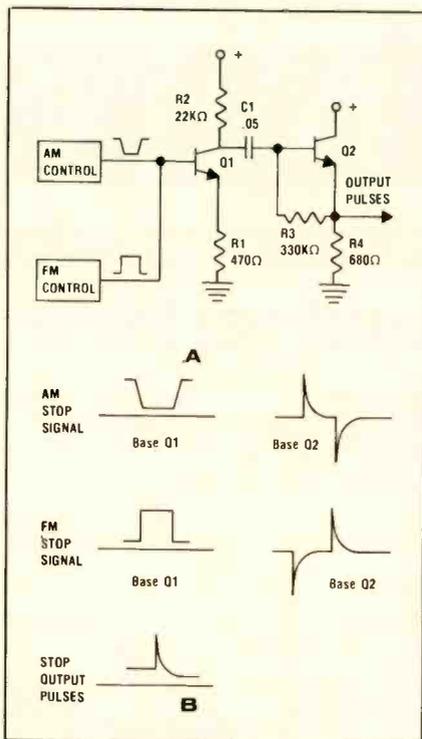


Fig. 4—(A) Circuitry used to produce the AM and FM stop pulse, and (B) waveforms to be expected.

During the "seek-and-scan" for AM signals, transistor Q1 is normally biased "on." When an AM station is encountered, the AM pulse control circuit generates the negative-going stop command pulse which turns Q1 off, and then back on. This transistor operates as an inverter, thus its collector signal is positive-going. Capacitor C1 and resistor R3 form a differentiating network that shapes the leading and trailing edges of the pulse into two spike-like pulses of opposite polarities. Transistor Q2 is normally cut-off, so only the positive-going pulse will pass through to the emitter output.

When the radio is in the FM mode, transistor Q1 is cut off so its collector will remain high. This is opposite from the situation with the radio in the AM mode.

When the positive-going pulse from the FM stop circuit is received, it drives Q1 into conduction and causes a negative-going pulse at its collector. Again, the pulse is differentiated by the C1/R3 network, and applied to the base of Q2. The positive-going spike generated by the differentiating network passes through the emitter follower (Q2) to the output.

### Seek-and-Scan Controlled By Digital Logic

A more complete view of the kind of digital logic circuitry that controls the "seek-and-scan" functions of the Aeronutronics-Ford radios is provided by the diagram in Fig. 5. The start/stop R-S flip-flop arrangement composed of ICs GB2 and BG4 is to the far right of the diagram.

At the moment of 'power turn-on' in digital circuitry some type of pulse circuit reset is usually required to guarantee the logic state of the flip-flops. In these radios, gate GA4 performs that function. Power turn-on produces a surge, or perturbation, on the IC B+ line which is coupled through C409 and R426 to the reset gate, causing a pulse to be propagated through GA2 and GA3 to the "stop" input of the R-S flip-flop. This resets the flip-flop, making the circuit ready for normal manual operation.

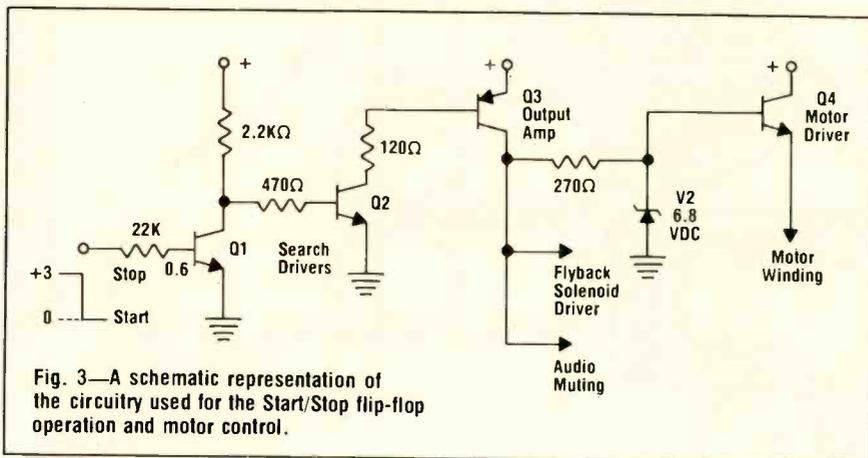


Fig. 3—A schematic representation of the circuitry used for the Start/Stop flip-flop operation and motor control.

When the *stop* input (point A) is grounded, the flip-flop retoggles, causing point A to once again go high. This causes drivers Q1 and Q2 to return to their inhibited state. To further describe the start/stop circuitry, we've included a schematic drawing of the circuit in Fig. 3.

### A Look At Just The Stop Circuit

A schematic of just the stopping circuitry is shown in Fig. 4A. Waveforms to be encountered during the stopping operation are shown in Fig. 4B.

The stop control signals for the

Aeronutronics-Ford radios are developed in the AM and FM IF amplifiers in a manner similar to other signal seeking radios. The AM control is formed from a mixture of the primary and secondary signals from the second AM IF transformer to insure stopping accuracy. This circuitry provides a negative-going pulse at the base of transistor Q1. The FM control uses the detector signal to generate a positive-going squarewave applied at the base of Q1. The FM pulse has somewhat steeper sides and an opposite polarity from that of the AM pulse.

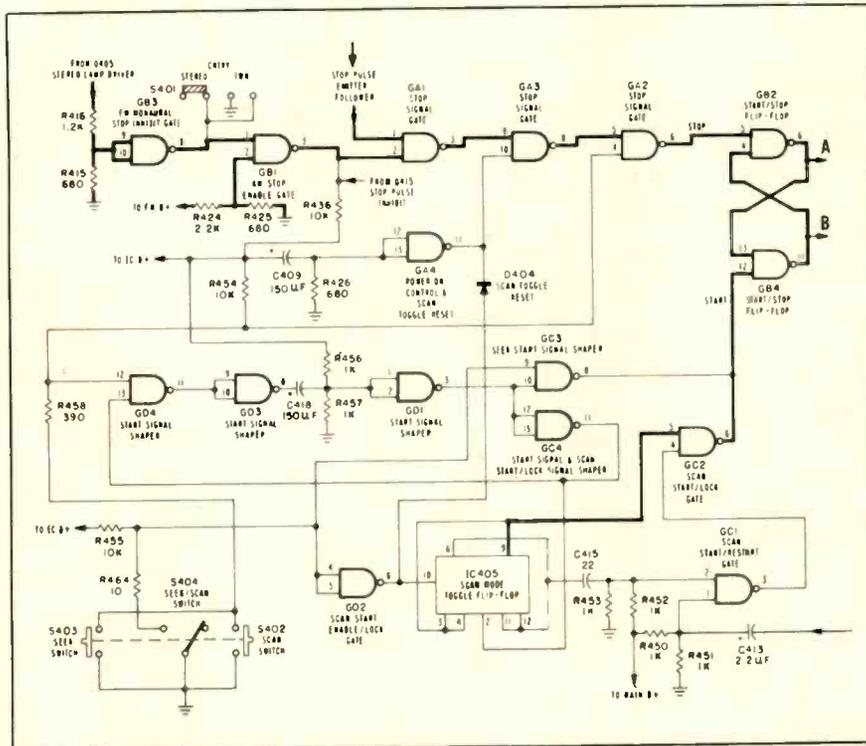


Fig. 5—Diagram illustrates the digital logic method used to control the "seek-and-scan" junctions in the search mode. (Courtesy of Aeronutronics-Ford)

### What Happens When "Seek" Button Is Pushed

As mentioned earlier, when the SEEK button is depressed, the automatic tuning mechanism retunes the radio to the next higher active frequency and stops there. With the SEEK switch closed, a low is placed on pin 12 of Start Signal Shaper GD4, one of four gates, GD4, GD3, GD1 and GC4, which form a one-shot multivibrator with a period greater than 90 milliseconds. The pulse produced is coupled through GC3 to the "start" input of the R-S flip-flop. Then, when the next higher station is encountered, a pulse will be received at pin 1 of Stop Signal Gate GA1 from the stop-pulse emitter, which is shown as Q2 in Fig. 4. This pulse is propagated through the gate chain to the "stop" input of the R-S flip-flop, and tuner motion is halted.

### Scan Mode Uses Flip-flop

The heart of the scan section is a J-K toggle flip-flop, IC405. As previously described, the output of GA4 goes low at initial turn-on. This forward biases diode D404, thereby grounding the DIRECT SET input of IC405. This forces the

Q (reference) output at pin 6 high, and the NOT-Q at pin 9 low. IC405 is then set for the scan operation should it be selected by the operator.

At this point, it is important to understand that the seek/scan switch, S404, closes prior to the closure of the scan switch, S402, and that it remains closed even though S402 is a momentary contact switch.

When S404 is closed, a low is

placed at the input of the Scan Start Enable/Lock Gate, GD2, and on one input of the Seek Start Signal Shaper, GC3. This unlocks the DIRECT SET input of IC405 and forces the "start" input of the R-S flip-flop to remain high. Of course, the R-S will not 'toggle' when its SET input is 'jammed' high.

Immediately after this sequence, the scan switch, S402, closes and triggers the one shot which generates a negative-going 90 ms pulse at the output of GC4.

Since the J-K flip-flop, IC405, is an edge-triggered device, it will toggle on the leading edge of this 90 ms pulse, forcing its Q output low and the NOT-Q high. When this occurs, a negative-going pulse is passed to one input of the Scan Start/Restart Gate, GC1. The output of GC1, a 100 μs negative-going pulse at the "start" input of the R-S flip-flop, initiating the search cycle.

The "search-stop-search-stop" process continues until the operator presses the "scan" button (S402) a second time. When this is done, the one-shot is re-triggered, producing a second negative-going pulse at the toggle input of J-K flip-flop IC405. The J-K will then change state making Q high and NOT-Q low. This places a low on pin 5 of GC2, which becomes a high at pin 6 of GC2. This inhibits the start input of the R-S flip-flop, thereby locking the receiver on station.

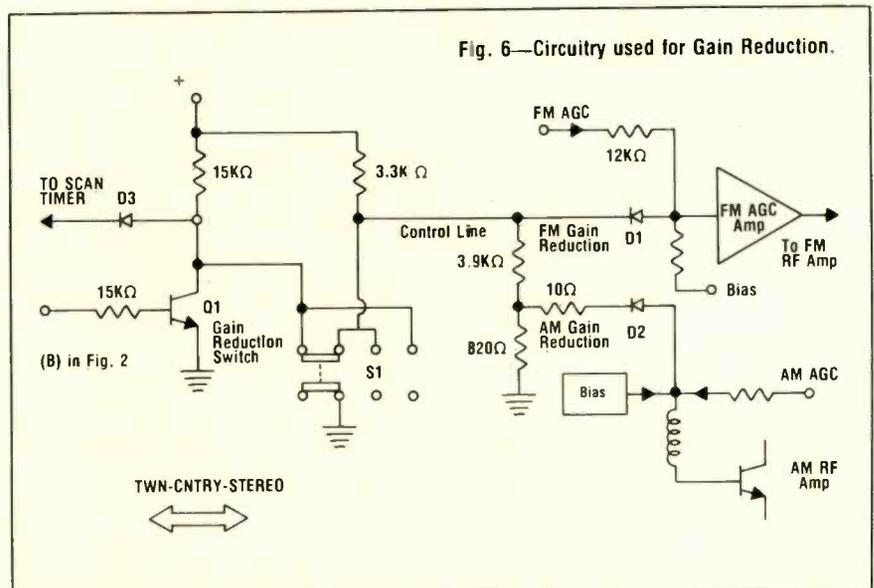
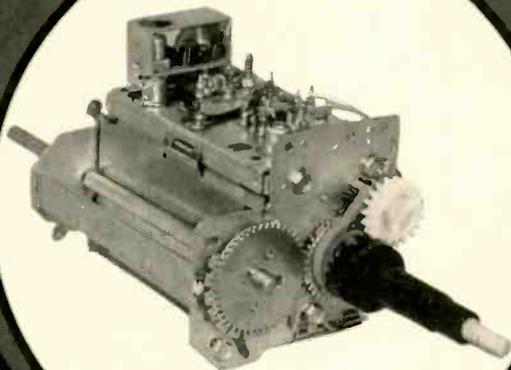


Fig. 6—Circuitry used for Gain Reduction.

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### A Look At The Seek/Scan Switches

The "seek" switch, S403, and the "scan" switch, S402, are worth a little extra attention. Both are momentary contact types, but also drive a fixed switch, S404. If the scan switch is depressed, for example, it will also toggle S404, but will do so prior to closing its own contacts. The same is true with the seek switch. These actions tell the logic circuit whether "seek" or "scan" has been selected by the operator.

Also, because it seems most switch contacts bounce prior to making good electrical and mechanical contact, the GD4-GC4 'one-shot' is used to eliminate the bounce. Without this 'one-shot'-system, the bounce could generate a short train of pulses capable of falsely triggering the digital logic circuit elements. The one-shot is triggered by the first of these pulses, and then generates a pulse whose duration is longer than the time needed for the bounce phenomena to die away.

### Gain Reduction Circuitry

Without special circuitry, a "seek-and-scan" radio could stop on stations too far away from the listener to provide enjoyable listening. In the Aeronutronics-Ford radios, gain reduction is applied whenever a "TOWN-COUNTRY-STEREO" switch is set in either *continued on page 45*

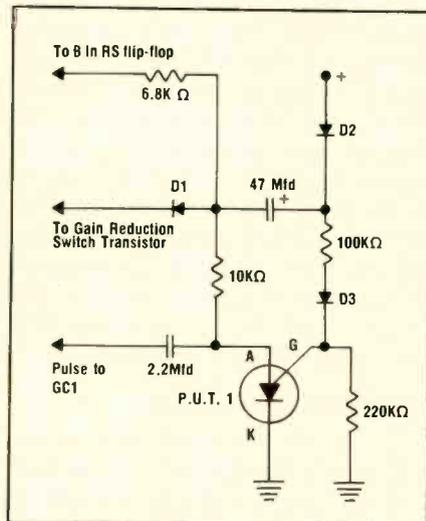


Fig. 7—Schematic of circuitry for the Programmable Unijunction transistor (P.U.T.) that is used to generate a new "scan" cycle every eight seconds.

# Amplifier Noise

Techniques and tools for finding and correcting spurious noises in amplifier circuits

By Joseph J. Carr, C.E.T.

■ Some years ago a stereo service shop customer came in with the complaint: "It sounds like a mouse. It squeaks!" And we knew that we would soon be searching for that common class of electronic equipment malfunction: spurious noises.

The trouble in this case was in a vacuum tube amplifier that used a panel-mounted neon lamp as an "on" indicator. The designer of the amplifier apparently wanted to use it also as a voltage regulator because the normal series resistor was deleted.

As shown in Fig. 1, the circuit contained series resistors R1 and R2 that dropped the voltage to an appropriate level to fire the lamp, and to limit the current through it in order to prevent a massive burn-out.

Capacitors C1, C2, C3, and C4 serve a decoupling purpose while all but C3 also serve to filter the

power supply ripple. Capacitor C3 is of a lower value than the others and is a disc ceramic type.

This technique of using a small value disc or mica capacitor in parallel with a higher value electrolytic is often used in circuits where a high frequency is present. This becomes necessary because the high value electrolytics needed for low frequency decoupling and DC filtering are often found to be ineffective in decoupling the higher frequencies. Part of the problem is series inductance—but most of the troubles are due to the nature of aluminum electrolytics.

Such circuit techniques were sometimes used even in cases of stereo decoders where a supposedly "low" 38 KHZ subcarrier was processed.

In the circuit shown in Fig. 1, the problem was caused by capacitor C4 becoming open. That not

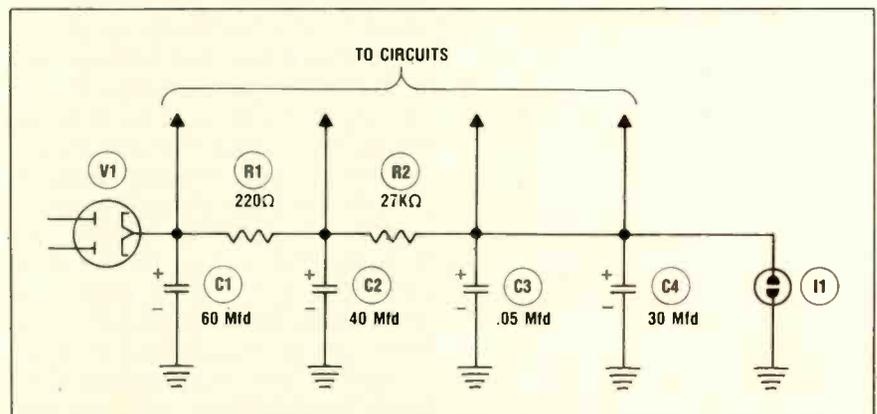


Fig. 1—A neon signal lamp circuit used in a vacuum tube amplifier.

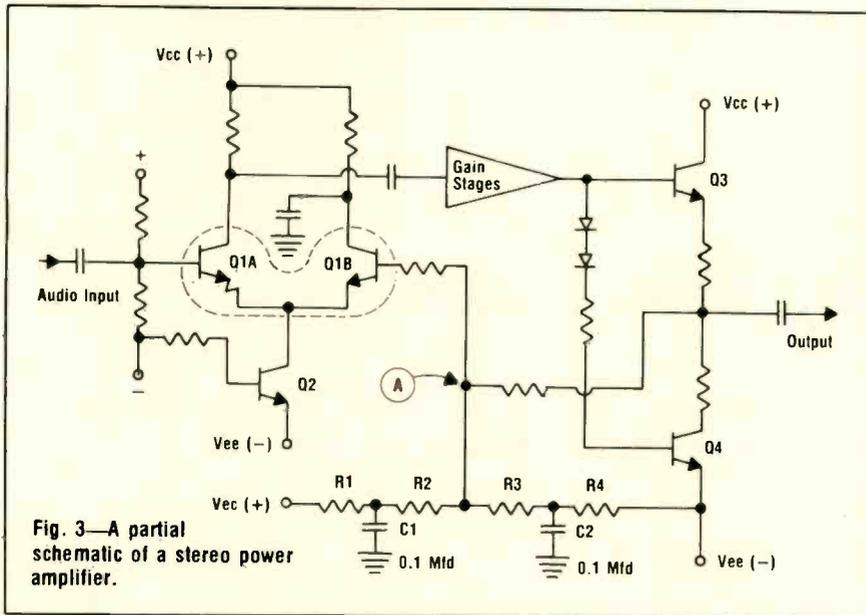
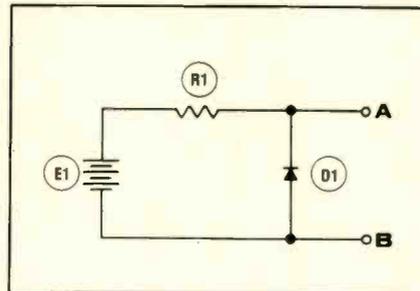


Fig. 3—A partial schematic of a stereo power amplifier.

Fig. 2—A schematic diagram of a test circuit using a diode that is reverse-biased and a series resistor that protects the diode.



only allowed the undecoupled stages to go into 'motorboating' oscillation but also allowed C3-R2-I1 to operate as a high pitched relaxation oscillator with a frequency set by the time constants and the firing potential of I1. This caused the "squeaks" in between each "bupp" of the motorboating.

### Noises In Solid State Circuits

In solid state equipment, the noises are still there, but from different sources. For example, any reverse biased PN junction, whether in a transistor or diode, will create a hiss-like white noise. In the test circuit shown in Fig. 2, we see a diode that is reverse biased by a battery or other voltage source, and a series resistor to protect the diode should its zener point be reached. If an oscilloscope is connected across points A-B (provided it has high gain and wide bandwidth), we should see a lot of "grass" on the CRT screen.

It sometimes also happens that faults in capacitors, resistors and other semiconductors may cause a

certain PN junction to become reverse biased.

Consider the circuit in Fig. 3. Here we see the partial schematic of a stereo power amplifier. Although most recent power amplifier designs are totally DC coupled, this AC coupled circuit may be found in older top quality equipment and current cheap audio equipment.

This circuit operates from dual polarity power supplies (Vcc is positive and Vee is negative), and has a differential input stage. Bias to transistor Q1B is held constant through the action of R1-R5.

In a problem involving this circuit, capacitor C1 became leaky and that reduced substantially the contribution of the Vcc(+) supply to voltage EA. This caused the base-emitter junction of Q1B to become slightly reverse biased. Of course, this turned Q1B into a noise generator with its output coupled to the rest of the stages through Q1A.

This problem might not have been noticed if it had occurred in a higher level stage. It became acute only because the defect occurred in the first amplifier stage in the cascade. After the defect was apparent, some DC measurements were found to be off, and a sinewave on our oscilloscope was noticed to be slightly distorted.

Time and time again we hear 'old hands' giving advice to newcomers about the wisdom of using the DC voltmeter and oscilloscope for amplifier noise troubleshooting. Perhaps it would be wise for us 'old hands' to listen to our own advice and apply it. This problem would have been a little easier to find if we had used meter and scope to check DC voltages and distortion.

### Noisy Transistors

There is always the possibility that a transistor can turn up defective in such a way that it turns into a noise generator. If the transistor is in the circuit position of Q1A, or any other position far back in the cascade chain, then only a slightly noisy transistor will produce a large amount of noise in the output. This is due to the fact that the circuit amplification will increase

the noise amplitude as it would with any other electrical signal.

Because of acute noise problems in the modern high fidelity amplifiers, designers often specify that only low-noise, high reliability transistors and resistors can be used.

If you plow through an engineering textbook on the subject you will note a couple of standard equations that give the RMS value of noise signals. At least one of the equations will demonstrate that noise amplitude is proportional to the ambient temperature, circuit resistance, and the bandwidth. Of these, the circuit resistance and the bandwidth are set by the designer and are either difficult or even irrelevant if varied for troubleshooting.

### Troubleshooting With Temperature

The ambient temperature surrounding an electronic circuit component can be a worthwhile tool in troubleshooting. However, there is a problem to overcome when we attempt to raise or lower ambient temperature for troubleshooting purposes. It seems that almost any technique tends to spread the new temperature over too large an area.

For example, take the common use of a Freon aerosol 'circuit cooler' for troubleshooting. Even with a long, thin nozzle, we find that without certain precautions, the spray covers more components than desired. And the same goes with a heat lamp or other heat source. The cold or heat covers more than just the component being checked, and you can wind up with false indications of trouble or no trouble.

What is needed is something to 'localize' the cold or heat. One solution is shown in Fig. 4—one of those oversized pieces of insulating tubing, sometimes called 'spaghetti'. Simply cut one to three inch lengths of the tubing to fit snugly over transistors or resistors under suspicion. If cooling is your goal, the tubing allows you to concentrate the spray only on the component being tested. For the heat treatment, simply place a small incandescent pilot lamp in the open end of the tubing and

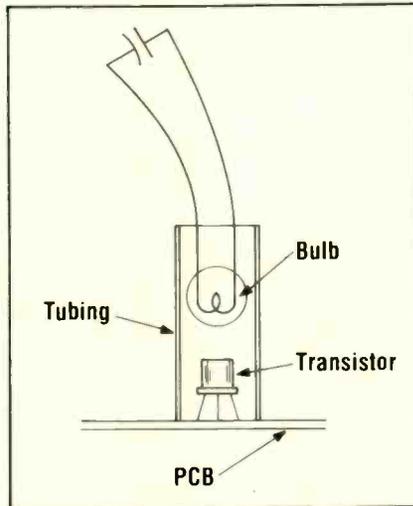


Fig. 4—A heat or cold 'localizer' constructed of insulating tubing, or 'spaghetti'.

connect it to a simple battery or DC bench supply, as shown in Fig. 4. It's been my experience that in most cases any problem that is truly heat-caused will show up in no more than five minutes under the lamp. Many problems will succumb to the heat treatment in less than a minute.

### Resistors Can Be a Source Of Noise

Don't overlook the possibility that resistors can cause noise. A defective resistor often produces a noise that is a mixture of white noise, frying egg sounds and popcorn popping. And with resistors thermal troubleshooting methods will generally reveal the problem.

*Very lightly*, tap suspect resistors while monitoring the output. Look for either a change, up or down, in noise level, or a single "pop-fry" burst of noise as the resistor is tapped. The "pop-fry" burst may not be repeatable, so don't assume that the trouble has disappeared if the burst doesn't repeat itself. You may be sure it will reappear when the customer tries to use the equipment. Simply replace that resistor and consider it cheap callback insurance.

### Internal Component Arcing

Some noises show up in the loudspeaker as a result of internal component arcing—and they can be miserably difficult to locate. One effective technique for locating arcing in components, or even on PC boards, is the use of a long piece of rubber or neoprene tubing,

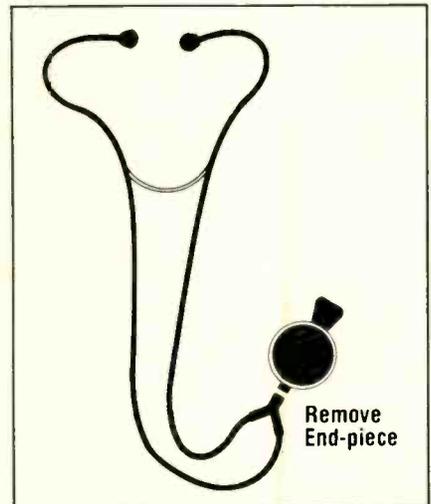


Fig. 5—How to prepare a doctor's stethoscope for use as an electronic trouble-shooting tool.

or even a length of spaghetti tubing. Hold one end of the tubing gently in your ear and use the other end as a probe to find the component that is arcing. The tubing will transmit what is normally a barely audible 'click' in full amplitude to the ear.

Actually, if possible, I prefer to use a modified medical-style stethoscope for this purpose. Although the professional grade of stethoscope used by physicians runs anywhere from 25 to 100 dollars or more, cheaper types are available from many drug stores, and from Edmund Scientific of Barrington, N.J. Most of the low-cost drug store types will cost under \$12—and even a \$2 type from a child's doctor or nurse play-kit will work.

When using the stethoscope method for locating the clicking of an electrical arc, it is best to remove the metal end-piece and use only the tubing end as the probe (Fig. 5). This will serve both to localize the source of the arcing, and will prevent accidental shorts and possible electrical shock from the metal bell or diaphragm if it touches any current carrying points.

It will be necessary to *scan* the whole component in many cases because the small open lumen of the tubing covers only a small area of the part at any one time. In fact, the resolution is so good that, in one case, we were able to tell which *end* of the mylar capacitor contained the short. ■

# TECH BOOK DIGEST

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(From Chapters 14 and 17, "TV Schematics: How To Read Between The Lines," a book by Art Margolis,  
TAB BOOKS, Copyright 1977. A review of the complete book follows this article.)

## How to read—and draw—a schematic

By Art Margolis

■ Whether a beginner or a seasoned electronic technician, you very quickly learn that you have to learn how to read—and understand—those roadmaps of the TV service profession, the schematic diagram. That's the subject of this TAB BOOK, written by Art Margolis.

We've chosen for review this month, two chapters from the book that we think you'll find particularly interesting—How To Draw Your Own Schematic—and How To Test Peak-to-Peak Voltage.

### CHAPTER 14—DRAWING A SCHEMATIC FROM THE CHASSIS

There comes a time in every service technician's career when he encounters a piece of electronic gear and no service notes are available. Unfortunately, this type of occurrence happens frequently. Most of the time, the repair is routine and experience alone permits the repair. Familiarity with circuits and chassis lets you find interrupted circuit breakers, open fuses, charred resistors, defective filter capacitors, bad power supply rectifiers, defunct tubes and transistors, plus other routine failures.

On occasion, though, the trouble on the chassis is not routine. A schematic is needed to trace out circuits. What should the servicer do? He has to bring into play other servicing information. He has to piece together a usable schematic or at least a reasonable facsimile.

Certain types of servicing information are always available. Every servicer has tube manuals, transistor manuals, etc. With these he can begin drawing a schematic that will clear up the confusion and shed some light on the maze of components in the innards of the metal chassis or on the printed circuit board.

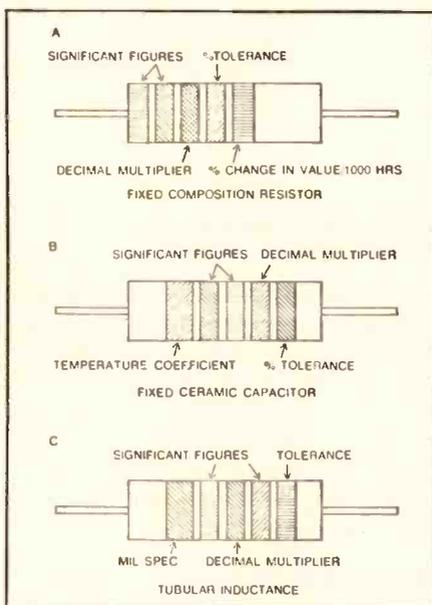


Fig. 1—Every electronic component has typical markings to provide identifications and electrical characteristics.

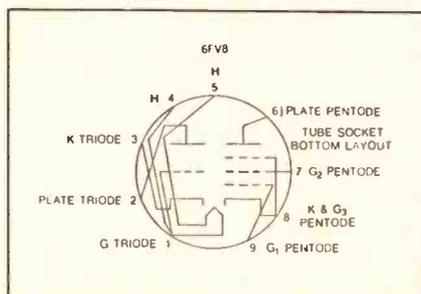


Fig. 2—The tube manual contains most of the information about tubes, including typical operation.

### Partial Schematics

Each and every component is normally marked with some sort of identification, giving the value or current handling information. Virtually every resistor, capacitor, or inductor has markings (Fig. 1). There are actual numbers stamped on some components; a color code might be used on others. Every component can thus be identified for servicing needs.

The tube manual contains the schematic symbol, pin numbers,

and other information. For instance, in Fig. 2, a 6FV8 tube is shown as it appears in the tube manual. It is described as a medium- $\mu$  triode and sharp-cutoff pentode. The manual states that it is a miniature type used in TV receivers as combined oscillator and amplifier. The triode unit is used as a vertical oscillator and the pentode unit is used as vertical output amplifier.

If you suspect this circuit because the TV has vertical sweep trouble, you can immediately begin drawing a partial schematic. Once you draw the tube symbol, you can get typical operating voltages from the tube manual too.

These voltages can now be penciled onto the tube drawing. You thus have the heart of the circuit complete, with the main pin numbers and voltages. Armed with this information, you can start relating intelligently to the hardware. Pin 6 is the plate of the output section. Pin 6 is easy to find on the bottom of the tube socket. You can begin to trace out all the connections on pin 6 and draw them in on your special partial schematic, like that shown in Fig. 2.

Observation of the hardware might reveal that pin 6 is soldered to an oblong piece of foil on the PC board. Also attached to the foil are four other solder connections. One at the bottom, one in the middle, one at the top, and one toward the tube socket connection. The one on the bottom is a lead from a  $0.01 \mu\text{F}$  capacitor; the one on the top to a  $0.0056 \mu\text{F}$  disc at 2 kV; the middle connection is a 370K, 1W resistor; and the one to the tube socket is a 68K, 1W. These four components can be added to the partial schematic in Fig. 3.

Further observation shows that the  $0.01 \mu\text{F}$  capacitor attaches to the end of the board and a wire

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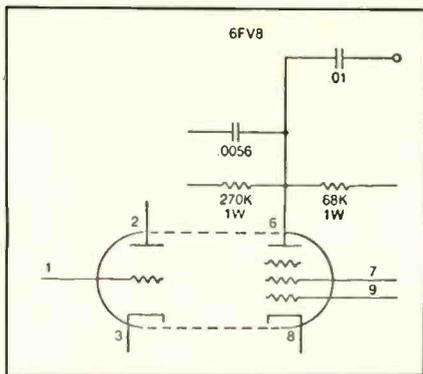


Fig. 3—With the tube as a starting point, you can sketch the components and connections in the vicinity.

leaves for another section. Each component is then traced back and its connections drawn on the schematic. Pretty soon a partial schematic is drawn from the hardware. The schematic allows you to puzzle out the reasons for the defect in conventional symbol form. Then you can go to the hardware for tests and soldering.

It really takes less time to draw such a partial schematic than it does to read about it. A schematic such as I described should not take more than a few minutes. And while you are sketching it, the circuit clears your mind so that you are actually working on the puzzle as you sketch. It is a test technique that quite often leads to the faulty component or circuit element before you even finish your drawing.

### Drawing Transistor Circuits

A tube circuit has the handy tube socket that permits you to make plug-in replacements and to easily find test points. Admittedly, a tube circuit is easier to trace than a transistor circuit. But this is mainly due to the difference in size between the vacuum tube and the transistor. Nevertheless, the very reason that transistors are supplanting tubes has become the major disadvantage for servicing. Get out the bright lights and magnifying glasses, for with these aids the size difference is neutralized.

When you have a transistor repair job in front of you and you do not have the schematic, you can draw a schematic from the chassis to aid your servicing. It is more difficult than drawing a tube schematic, but not much more. Let's take the case of an AM/FM

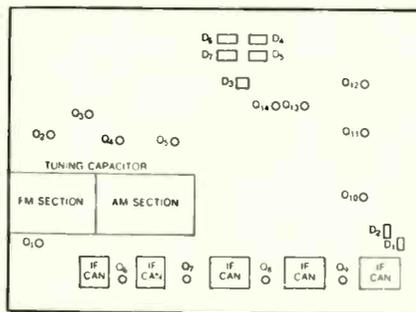


Fig. 4—A transistor location diagram can be drawn from the hardware using your own Q numbers.

tuner that is not performing properly. Where do you start? In your mind's eye, picture the location diagram layout of the typical AM/FM tuner (Fig. 4).

There is a tuning capacitor in two sections: one is for the FM band and one is for the AM band. Each tuning capacitor has to have an RF amplifier, mixer, and oscillator. The FM section in a transistor layout usually has a *separate* transistor for each function. Therefore, there is an FM RF amplifier, FM mixer, and FM oscillator. You can label them  $Q_1$ ,  $Q_2$ , and  $Q_3$ . Then there is an AM RF amplifier you can call  $Q_4$ . The AM mixer/oscillator is typically a converter circuit using only one transistor. Call that  $Q_5$ . That takes care of the tuning section.

Next, there is an IF strip. A typical good AM/FM tuner has four FM IFs and has two AM IFs. The second and third FM IFs can also double for the AM IFs. These four transistors can be labeled  $Q_6$ ,  $Q_7$ ,  $Q_8$ , and  $Q_9$ .

The next section contains the detectors. The FM detector is a discriminator or radio detector, using a dual-diode (D1-D2) configuration. The AM detector is a simple diode (D3) with a resistor-capacitor time-constant network. These three diodes can be blocked in. The AM detector leads directly to the tuner output. The FM detector may go through another block of circuits if the receiver contains a stereo FM multiplex section.

The typical multiplex receiver has a couple of amplifiers that feed into a 19 kHz amplifier and then into a 38 kHz oscillator. The output of the oscillator goes into a dual detection system with four

diodes. The transistors, in order, can be called  $Q_{10}$ ,  $Q_{11}$ ,  $Q_{12}$ ,  $Q_{13}$ , and  $Q_{14}$ . The four diodes are labeled D4, D5, D6, and D7, and their outputs are the FM stereo signals that go to the tuner outputs. There possibly could be more transistors and diodes in the circuitry, but they need not be analyzed until the main area has been checked out.

With only the rough block diagram, some preliminary tests can be made to isolate the trouble. A signal injection or signal tracing device can be used.

Lots of printed circuit boards have "road maps" printed on the top and bottom of the boards. These are mostly helpful; but occasionally the road map can be labeled incorrectly, or secondary signal paths like the AGC omitted entirely. The best bet is to take a bright light behind the board to make the skeletal-like wiring stand out clearly. Then you can trace the circuit from transistor to transistor.

The tuner transistors will be found clustered around the tuning capacitor. The IF strip will be in a line heading away from the tuning capacitor. The multiplex section will typically be on the other side of the board, away from the tuner. The circuit is probably laid out, whenever possible, like writing.

It is a tedious job to draw out the circuit, but lots of times there is no other way to conduct the repair. Once you have the general block diagram, some isolation procedures can be conducted with test equipment to find the trouble area. Suppose you conduct the isolation procedure and it indicates that the third transistor in the multiplex area ( $Q_{10}$ ) is not passing the injected signal you placed on the base of the transistor.

You then examine the transistor closely and find it is a 2N3391A. You look it up in the transistor manual and find it is an NPN silicon transistor. From transistor theory, in order for it to turn on, there must be a bias between the emitter and base of +0.6V. Typical collector voltage, with a coil or transformer load, will be slightly less than the B+.

You begin to draw (Fig. 5) the

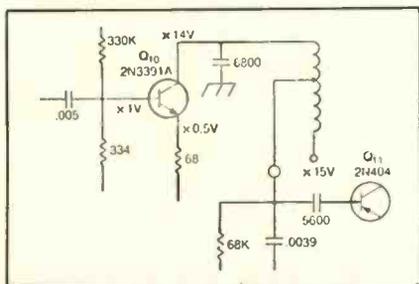


Fig. 5—As you troubleshoot, the hand-drawn schematic takes form. You are actually relating the hardware to the schematic.

NPN transistor first. In the emitter circuit is a resistor to ground, a 68Ω resistor. In the base circuit there is one resistor (33K) and a foil connection to two other little foil islands. The two foil islands each have a component leaving them. The one on the left has a resistor (330K) and the island on the right has a capacitor (0.005 μF). These are drawn in.

The collector has a 6800 pF capacitor to ground, and another leg has a variable coil. These are drawn in. The transistor can now have voltage tests made in an intelligent manner.

From ground, you measure +0.5V on the emitter and +1V on the base. Subtracting +0.5V from +1V gives an acceptable bias, so the transistor is turned on. Thus, the bias and emitter circuits are good and the transistor is conduction.

A reading is now taken at the collector. It has about +14V. This would be approximately right with a +15V supply. The +14V is then traced into the collector coil and out the other end to the +15V supply. The coil has continuity, otherwise the collector voltage would probably be zero. There is a tap on the coil, attached to a small foil island that has four connections on it. The connections go to a test point, two capacitors, and a resistor. The capacitors are 5600 pF and 0.0039 μF; the resistor is 68K. They are penciled onto your sketch. It is then noted that the 5600 pF capacitor goes to the base of the next transistor, the 38 kHz oscillator (Q11) on your layout sketch. The transistor is a 2N404 which your manual says is a PNP, and it is drawn into the picture.

Now you have a partial circuit that you can intelligently service.



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Triad has a series of ten shielded replacement power transformers for use in many kinds of domestic and imported home entertainment equipment—console and portable stereo amplifiers, AM/FM radios, tape decks and recorders, cassette players and other devices where shielding of the transformer is required for reducing 60Hz. hum interference.

They're recommended regularly in Sams Photofact folders and books. So see your Triad distributor for full information. Or write us direct.

Catalog No.	Secondary #1*	Secondary #2
F-170SX	20 VCT @ .200 ADC	6.3V @ .200A
F-171SX	26 VCT @ .200 ADC	6.3V @ .200A
F-172SX	24 VCT @ .400 ADC	6.3V @ .300A
F-173SX	30 VCT @ .400 ADC	6.3V @ .300A
F-174SX	30 VCT @ .500 ADC	6.3V @ .500A
F-175SX	44 VCT @ .400 ADC	6.3V @ .500A
F-176SX	40 VCT @ .800 ADC	6.3V @ .500A
F-177SX	50 VCT @ .800 ADC	6.3V @ 1.000A
F-178SX	60 VCT @ .600 ADC	6.3V @ 1.000A
F-179SX	60 VCT @ 1.000 ADC	6.3V @ 1.000A

\*Secondary #1 current rating with FWCT Rectifier



**TRIAD-UTRAD**

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A scope picture is taken at the test point. Since it is in the output of the 19 kHz oscillator, it should have some continuous wave (CW) signal on it. It does. The CW is then revealed by your sketch to be coupled into the base of the PNP 38 kHz frequency doubler. The scope is touched down on the Q<sub>11</sub> base; but in this case, there is no CW there. The 5600 pF capacitor is not passing it. A new 5600 pF unit is tried. The old one had lost its capacitance, indicating an open circuit. The new 5600 pF disc restores the tuner and it now works fine.

Drawing your own partial schematic is the reverse of relating the schematic to the chassis. You must now relate the chassis to the schematic. You must find landmarks, like tube or transistor bases. You must utilize manuals for information. Then you can trace out the hardware onto a piece of paper, component by component, connection by connection. The technique is valuable in that it sharpens up your understanding of the gear and this speeds the repair.

It is sometimes necessary to draw a layout diagram, like Fig. 4, before you draw the actual suspect circuit. But most of the time, you will never complete the partial schematic, because you will have discovered the defect during the step-by-step drawing.

## CHAPTER 17—PEAK-TO-PEAK VOLTAGE TESTS

Included in most schematic service notes are scope pictures of various signals as they are sampled from test points. The signal is not to be confused with the B voltages that originate in the power supply which activates the equipment. The signal originates in the transmitter (Fig. 6), is processed in the transmitter, flashes through space at the speed of light, produces current in the antenna, and is then processed in the receiver. A signal has many forms, but it basically is an alternating current (AC); B voltages are direct current (DC).

When the signal is viewed on an oscilloscope (Fig. 7), it causes the green dot to appear to move laterally and rise and fall on the scope face, producing a pattern.

The amount of voltage the signal possesses causes the pattern to be larger or smaller in height. One of the main characteristics of the pattern is the peak-to-peak height of the pattern. When measured as a voltage the height of the pattern in centimeters or inches can be converted directly into voltage values. The conversion result is called the peak-to-peak voltage.

There is a zero base line in the pattern (Fig. 8). This zero base line is zero volts. The signal can vary above and below the zero base line. For instance, a sine wave from the electric company can rise to 170V positive, go back to zero, pass through zero, then sink to 170V negative. If you measure the peak-to-peak voltage in this sine wave, from +170V to -170V, the total peak-to-peak voltage is 340V.

### P-P On Oscilloscope

Peak-to-peak is abbreviated p-p and represents the height or *vertical axis* on the scope picture. The width or *horizontal axis* on the picture represents the frequency of the waveform.

If you look at the waveform sketches or photos on the schematic, you'll see a p-p value beneath almost every pictorial. The occasional waveforms that have no p-p value are those that are taken

with loose coupling, or are so tiny a voltage they have to be made into exploded views.

The p-p value of the picture can be measured right on the scope. Some oscilloscopes have a p-p voltmeter attached to the vertical deflection plates of the scopes. Then, as you view the face, the p-p voltage can be read directly from the meter. This is a good feature, but most service shop scopes don't have it.

It takes a bit of setting up to get a p-p voltage from the scope picture if the vertical attenuator is not precalibrated. It can only be accomplished by calibrating the scope picture against a known p-p value. Such a value is the 120V supplied by the electric company. Adjust the sine wave from the wall socket, known to be 120V on the scope. If you have a plastic transparent grid for the scope face, note where the 120V causes the sine wave to appear at its peak-to-peak (Fig. 9) extremes. The p-p voltage is 2.828 times the AC line voltage, so  $2.828 \times 120 = 340V$  p-p. (The AC line voltage is the RMS or effective voltage of the sine wave, not the peak or peak-to-peak voltage.)

After this type of scope has been calibrated, you can then read the peak-to-peak height of the signal waveforms being tested. With the calibrated grid, you can tell what the pattern's p-p voltage is. The

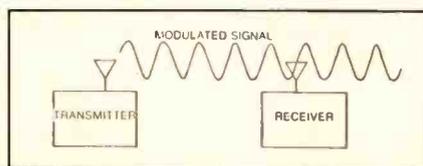


Fig. 6—The transmitted signal is intercepted by the receiver antenna to produce an ac signal voltage for the receiver to process.

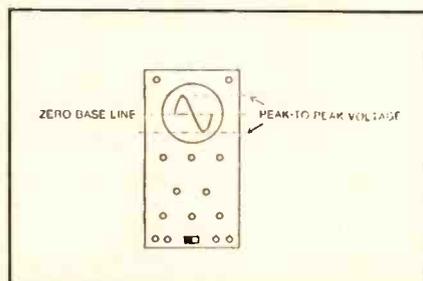


Fig. 7—When viewing a signal on a scope, the signal causes the trace to rise and fall, producing a pattern.

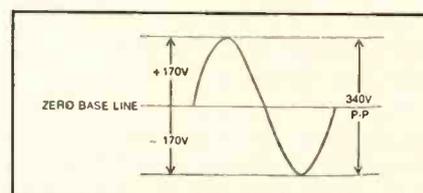


Fig. 8—The electric company 120V line can be viewed on the scope. It appears as a sine wave.

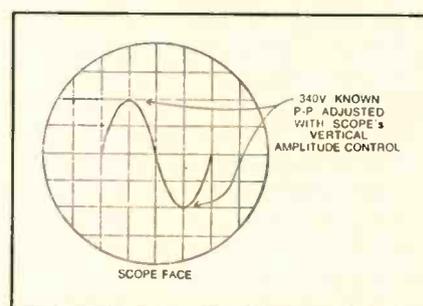


Fig. 9—A known p-p voltage can be used with a transparent grid to determine other p-p voltages.

only problem with such a scope is that every time you change the vertical output control of the scope you must recalibrate the picture. For checking out a number of waveforms, this procedure can be cumbersome. Fortunately, newer scopes have precalibrated vertical controls, which eliminate the need to recalibrate the scope picture each time.

### P-P On The Voltmeter

As mentioned in the last section, a handy device on the scope is an additional voltmeter to measure p-p voltages, for it saves a lot of time. When the scope does not have a p-p meter or precalibrated vertical controls, you can use your multimeter.

Most voltmeters have a p-p scale which is quite accurate. As frequency rises, however, or as waveforms deviate more and more from the sinusoidal ideal, the accuracy is usually reduced; but for most service jobs, the p-p scale accuracy is adequate. The important thing to know is you will lose some accuracy as you get into higher frequencies; but armed with this knowledge, you can take that fact into consideration as you puzzle out the repair problem.

A lot of experienced servicers find it is useful to use the voltmeter on p-p waveform observation instead of the scope most of the time. The ordinary shop voltmeter measures resistance, DC voltages, and AC voltages (including p-p voltages). It is easier for the servicer to test a p-p voltage as he is working with the voltmeter, than to stop and switch over to the scope. Most of the time, it is just as valuable to know the p-p voltage at a test point than to see an actual picture of the signal, especially if a few minutes can be saved by not using the oscilloscope.

The signal can be traced carefully from test point to test point with the p-p scale on the voltmeter. For instance, the signal feeding a TV sync section can be traced with the p-p scale, from the origination at the video detector to the vertical oscillator, test point by test point. If the p-p voltage disappears at any stage, a valid clue is found that bears further investi-

gation.

### Voltmeter Inadequacies

In order to trace a p-p voltage through circuit using only the p-p scale on the voltmeter, the servicer should be quite familiar with the equipment and be leery of the readings. The servicer is actually using his imagination to substitute for the oscilloscope. The scope picture reveals certain information that the voltmeter cannot. First of all, there is the shape of the wave, and the scope displays all. While a sine-wave CW waveform is quite routine, there are many other waveshapes. There are spikes, squiggles, sawtooths, square waves, etc. of infinite variety. If a waveform is distorted, even if its p-p value is about right it might not perform properly in the equipment. Fortunately, it is a rare situation where distortion is present and yet there is a correct value of p-p voltage. When there is a distortion, it is usually in the height of the waveshape rather than the base line or frequency. It does happen though, so keep the possibility in mind as a last-resort check during servicing.

One type of distortion does not occur in waveshapes during transmitting lapses. For instance, when a dark scene is being transmitted during a TV program, the p-p value of the voltage drops (Fig.

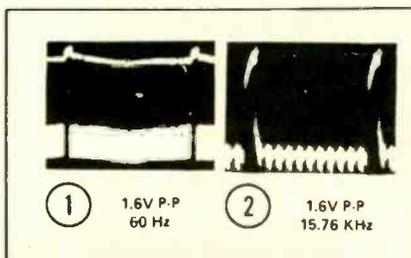


Fig. 10—These scope pictures show CRT brightness. A dark scene lowers the amplitude.

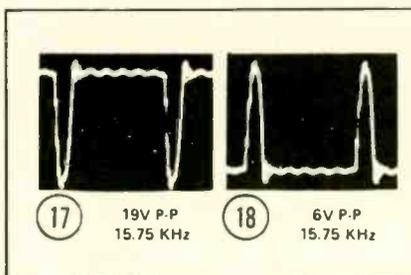


Fig. 11—The voltmeter p-p scale cannot display polarity of the waveform. Be aware of this limitation.

10). The p-p has to do with the brightness of the picture. Should you take a p-p voltage reading during a dark scene, your p-p valve will be way too low. The pictorial on the schematic is usually taken with a strong, bright scene. When you find such a low value on a TV, be sure to look and make sure the scene is bright before concluding you have uncovered a valid clue.

Another characteristic that the voltmeter will not be able to discern is polarity. Complex waveshapes are not necessarily symmetrical, positive and negative, like a sine wave. They usually have different shapes above and below the zero base line.

Suppose that you found a bad coupling transformer in a piece of electronic gear and replaced it. You would then want to test the transformer to make sure that it was passing the prescribed 200V spike. You use your p-p scale on the VOM to take a reading. The scale says 19Vp-p. Do you then assume the job is complete? If the gear is operating, yes. But on occasions you'll find the equipment is still not operating. Before you go ahead and start looking for more trouble, you'll have to check out the transformer with a scope.

It is possible that you have accidentally reversed a pair of wires. Instead of the spike falling 19V below zero, the polarity has been reversed and the spike is now 19V above zero (Fig. 11). This does not permit proper operation of the gear, even though the correct p-p voltage is present. You'll have to reverse the leads to produce the correct polarity spike, in order for the gear to operate. As long as you realize the limitations, the p-p scale on the VOM can be used constantly for most repairs and tests.

### TECH BOOK REVIEW

Title: TV Schematics: How To Read Between the Lines (TAB BOOK No. 738)

Author: Art Margolis

Publisher: TAB BOOKS, Blue Ridge Summit, Pa 17214

Size: 249 pages, 186 illustrations

Price: \$8.95 hardbound.

This technical how-to-do-it book  
*continued on page 43*

# R.S. Green & Son: Offering 'A Little More' In West Chester

By Ted Knight

Although the prices are right, it's the 'extras' that bring in the business for this TV/appliance retailer/servicer in Southeastern Pennsylvania

■ "Most consumers are shoppers—that is, they compare prices.

"But what happens when a shopper finds that he or she can buy the same brand and model of TV, refrigerator or whatever at the same price from two or more retailers in the same market area? What motivates him or her to buy from you?"

"If the price is the same, does the consumer select a retailer on an 'eenie, meenie, minie, moe' basis?"

"No," says Harold F. Green in response to his own rhetorical question, "our experience indicates that consumers will select the retailer who offers them that 'little bit extra.'"

And that, according to Green, is what his firm, R.S. Green & Son, a major TV/appliance store in West Chester, Pennsylvania, has been offering its customers ever since his father founded the business back in 1916.

Green, who is now president of the \$500,000-a-year business, cites the following as examples of the 'extras' which have proven successful in motivating consumers to purchase TV and appliances from him:

## Free Gifts & Premiums...

"Right now, for example, we are featuring a free 30-day membership to a health spa for two with the purchase of any TV or major appliance," relates Green.

"In the past, we have provided free merchandise gifts with such purchases, and we once had excellent results with a premium offer whereby the purchase of any product in our store entitled the customer to buy a synthetic diamond for approximately 25% of its retail value. Customers purchased rings that normally retailed for as much as \$350.

"We are continually making these types of offers to attract customers to our location. This is just the 'little bit more' that we can offer through our advertising program. And we know that it is effective because quite often we receive calls from customers, days and weeks after an offer period has expired, asking if they can still make the purchase or receive the free gift that was offered."

## Nothing Down & Delayed First Payment...

A 'nothing down' policy, with

the first payment delayed as long as 60 or 90 days, has enabled Green to sell during 'tight money' periods.

"Right after Christmas or any other major holiday, for example, it's easy to see that customers are short of cash," explains Green. "They may not have the necessary down payment to make on a purchase or they may feel that they are already saddled down with enough payments from their previous purchases.

"Our nothing down and the delayed first payment helps us to do business when business would ordinarily slump off.

"After all, the customer doesn't have to come up with immediate cash, and they can make their first payment three months later. So why shouldn't they take advantage of a good buy or make a purchase that they need, when they need it?"

"Without question, consumers are more credit conscious today than ever before, and even though it may appear that this offer is a little risky, we have so far been very successful with it. We sell when other retailers can't, and we have found that this policy has helped to bring the same customer back to us for additional purchases time and time again."

## Only 'Sales' Customers Qualify As 'Service' Customers...

Green believes that the ability to provide prompt after-the-sale support is an essential facet of successful selling in today's TV and appliance markets. And to insure that he can continue to provide prompt, proficient servicing of the products he sells, Green services only the TVs and appliances of those who have purchased products from him. This policy is emphasized during the sale.

"Our regular charge for TV service is \$17.95 for the first 30 minutes and \$3.50 for each additional 15 minutes," explains Green, "and our service rates are significantly lower than the averages in our market area."

"We also provide free delivery and installation and, if necessary, we even remove the old TV or appliance for the customer."

## Warranty-Extending Service Contracts...

"Most consumers are aware that



Store front of R.S. Green & Son in the downtown shopping area of West Chester, Pa., a community of about 22,000 located 20 miles west of greater Philadelphia.

the picture tube of a color TV and the compressor of a refrigerator or freezer are the most expensive components to replace in these products. Consequently, we offer parts and labor warranty-extending service contracts on these components at a regular price of \$99.95 and, frequently, at a sale price of \$69.95.

"The color TV picture tube and service contract," explains Green, "guarantees the picture tube for five years, including free labor after the 90-day labor period covered by the manufacturer's warranty."

"The refrigerator/freezer compressor contract covers a 10-year period."

"These optional service contracts are offered only on products purchased from us," states Green. "And whether the customer buys the contract or not, the mere fact that we are willing to back our products to this extent seems to help motivate consumers to buy from us."

"We describe the appropriate warranty-extender contract to the customer at the time he or she is making a product selection, and we point out the two principal ways it can benefit them: First, they know that if and when they ever need a new picture tube or any other type of service, we are here to give it to them. And secondly, with the cost of labor and materials continually increasing, they will never have to pay more than what the current service contract is costing them."

"So even at \$99.95, they have an excellent 'added' value. And when we feature them at \$69.95, the 'extra' value becomes even greater—and often proves to be the added incentive which closes the sale."

Customers who do not purchase the warranty-extender service contract at the time they buy the TV or appliance are given 30 days in which to exercise their option to do so. According to Green, about 20-25% of those who purchase TVs from him also buy the warranty-extender contract.

#### Free Trial Use of TV...

Green says that he and his son, who has joined him in the business, frequently are confronted with consumers who have had a very disappointing experience

with color TV reception and consequently are understandably very cautious about the purchase of another TV receiver. They typically ask: "How can we be sure the new set we purchase from you will provide better reception?"

"We tell these customers to select their set and let us install it for them. They don't pay for it until they decide that they are getting the reception that they should. Only on a few occasions have we had to remove the selected set."

Green has confidence in the receptive quality of the two brands of sets that he merchandises. Often, an old antenna or a bad lead-in wire creates faulty reception even on his sets. (A good antenna is very important in getting good reception in the area served by Green.)

"If the customer's antenna and lead-in are okay, we know that our sets will provide superior reception—which is the reason why we are willing to put them out on loan for the customer to prove it to himself," says Green.

"But if a new or replacement antenna and/or lead-in is needed, we will sell and install either or both at only slightly over our cost."

"This means that the customer buys the TV for even a better price than the one that we have already given them."

"We tell the customer that they should simply consider the additional savings that they will enjoy if we install the antenna and/or lead-in wire at time we install their new set. And if they deduct these additional savings from the price of the set, they will have purchased it for even less than what we or our competitors normally would sell it for."

#### Flexible Store Hours...

The normal business hours for most stores in the downtown area where R.S. Green & Son is located are from 9:30 AM to 5:00 or 6:00 PM, except on Fridays, when most stores stay open later.

"However," points out Green, "we are at the store at 8:30 AM, to be ready for those who prefer to shop early, and although we normally close at 6:00 PM, we will be very happy to remain open later by appointment if a customer so desires."

"Too many independent retailers seem to forget that many, if

not most, people work weekdays until 5:00 PM and therefore are unable to get into the store by 5:30 or 6:00 PM. Although some housewives can, and do, shop during the day, for many families the selection and purchase of a new color TV or major appliance is a decision which wife and husband prefer to make together—which means that you should be willing to accommodate them after normal working hours." ■



Harold F. Green, president of R.S. Green & Son, explains a picture tube replacement/service contract to a color TV purchaser. Between 20-25% of Green's customers elect to also purchase a service contract, which Green offers only to new product purchasers.



Green offers service only to those who buy TV or major appliances from him. Current service rates are \$17.95 for first 30 minutes and \$3.50 for each quarter hour thereafter.



Green demonstrates a new side-by-side refrigerator/freezer to a customer. In addition to two brands of TV—Quasar and Zenith—Green also offers Amana, Kitchen Aid, Kelvinator and White-Westinghouse home appliance lines. "Our policy," explains Green, "has always been to handle two lines in every product category we offer. This provides us both price and model flexibility, without the added cost and confusion that more lines would involve." Green periodically promotes special showroom demonstrations of the Amana Radar Range and includes free in-home instruction with every purchase.



For more information about this test instrument, circle 144 on the Reader Service Card in this issue.

# Fluke model 8020A digital multimeter

■ An intriguing new 3½ digit multimeter that adds a unique measurement function to DMMs has been introduced by the John Fluke Manufacturing Company. The new function offered by the Fluke Model 8020A DMM is that of conductance, the reciprocal of resistance. This function allows the 8020A to measure leakage in capacitors, diodes, transistors, circuit boards and cables.

The Model 8020A features two conductance ranges, the first of which is the 200 nS range. (nS is for nanosiemens. S, or Siemens is the unit of conductance formerly known as the mho.) This first conductance range takes over where the ordinary DMM leaves off at 20 MΩ and extends resistance measuring capability up to 10,000 meg ohms.

The second conductance range (2 mS) measures over the equivalent resistance range from 500Ω to 1 MΩ. This range provides the

ability to measure transistor beta directly with the addition of only a single bias resistor.

Both normal and reverse beta may be evaluated as well as beta change with temperature. Beta matching of several similar devices is also possible.

A total of 24 ranges of dc and ac volts, dc and ac current, and resistance functions make up the balance of the 8020A's measurement capability.

Included is the ability for in-circuit measurement of resistors and junctions. Alternate ohms ranges on the 8020A have sufficient voltage to cause a junction to conduct, so that transistors and diodes can be checked. The other ohms ranges have sufficiently low excitation voltage so as to not turn on junctions. Therefore, resistors may be measured in circuit when paralleled by junctions.

The heart, so to speak, of the 8020A is a custom C-MOS LSI chip

## SPECIFICATIONS FLUKE MODEL 8020A DIGITAL MULTIMETER

<b>ELECTRICAL</b>	The electrical specifications given assume an operating temperature of 18° to 28°C and a 1 year calibration cycle.	
<b>FUNCTION</b>	DC Volts, AC Volts, DC Current, AC Current, Resistance and Conductance.	
<b>DC VOLTS</b>		
Ranges	+200 mV, +2V, +20V, +200V, +1000V	
Accuracy	+(0.25% of reading + 1 digit), all ranges	
Input Impedance	10 MΩ, all ranges	
Overvoltage Protection	1000V dc or peak ac on all ranges	
<b>AC VOLTS</b>		
Ranges	200 mV, 2V, 20V, 200V and 750V rms	
Accuracy		
Input Impedance	10 MΩ capacitance 100 pF, all ranges	
Overvoltage Protection	1000V dc or 750V rms max., 15 seconds max. from 750V ac to 300V ac on 200 mV range.	
<b>RESISTANCE</b>		
Ranges	200Ω, 2 kΩ, 20 kΩ, 200 kΩ, 20 MΩ	
Accuracy		
2Ω, 20 kΩ, 200 kΩ, 2000 kΩ	+(0.2% of reading + 1 digit)	
200Ω	+(0.3% of reading + 3 digits)	
20 MΩ	+(2.0% of reading + 1 digit)	
Full Scale Voltage		
200Ω, 20 kΩ, 2000 kΩ	0.25V dc	
200 kΩ, 20 MΩ	0.7V dc	
2 kΩ	1.0V dc	
Open Circuit Voltage		
2 kΩ	3.5V dc	
All other ranges	1.5V dc	
Diode Test Ranges		
200Ω, 20 kΩ, 2000kΩ	Typical silicon junction will not be turned on by these ranges.	
2 kΩ, 200 kΩ, 20 MΩ	Typical silicon junction will be turned on by these ranges. The 2 kΩ range will supply a typical forward current of 0.6 mA, and is preferred for testing semiconductor junctions.	
Overvoltage Protection	300V dc or 300V rms, on all ranges	
<b>CONDUCTANCE</b>		
Ranges	2 mS, 200 nS	
Accuracy		
2 mS	+(0.3% of reading + 1 digit)	
200 nS	+(2.0% of reading + 10 digits)	
Open-Circuit Voltage	<1.5V dc (both ranges)	
Diode Test	Both ranges will forward bias a typical silicon PN junction.	
<b>DC CURRENT</b>		
Ranges	+2 mA, +20 mA, +200 mA, +2000 mA	
Accuracy	+(0.75% of reading + 1 digit), all ranges	
Burden Voltage		
2 mA to 200 mA Ranges	Full scale 0.25V dc	
2000 mA Range	Full scale 0.7V dc	
Overcurrent Protection	2 amps max on all ranges. Fuse protected when measuring current in circuits with open circuit voltage of 250V or less.	
<b>AC CURRENT</b>		
Ranges	2 mA, 20 mA, 200 mA, 2000 mA	
Accuracy		
2 mA (45 Hz to 450 Hz)	+(2% of reading + 2 digits)	
20 mA, 200 mA, 2000 mA (45 Hz to 1 kHz)	+(1.5% of reading + 2 digits)	
Burden Voltage		
2 mA to 200 mA Ranges	Full scale 0.25V rms	
2000 mA Range	Full scale 0.7V rms	
Overcurrent Protection	2 amps max on all ranges. Fuse protected when measuring current in circuits with open circuit voltage of 250V or less.	
<b>ENVIRONMENTAL TEMPERATURE COEFFICIENT</b>	Less than 0.1 times the applicable accuracy specification per °C.	
<b>OPERATING TEMPERATURE</b>	0° to 50°C	
<b>STORAGE TEMPERATURE</b>	-35° to 60°C	
<b>HUMIDITY</b>	0 to 90% at <35°C 0 to 70% at 35° to 50°C	
<b>GENERAL POWER</b>	9 V alkaline or carbon-zinc battery (NEDA 1604) or accessory battery eliminator Fluke Model A-81.	
Battery Life, Typical	Alkaline, 200 hours. Carbon-Zinc, 100 to 150 hours.	
Battery Indicator	Display reads BT when battery voltage drops below 7.2 volts typically. Approximately 20% of battery life remains.	
Battery Eliminator	Fluke Model A-81. Available as an accessory. Specify local line voltage.	
<b>WEIGHT</b>	368 grams/13 ounces (without battery)	
<b>SIZE</b>	1-1/2 x 3-3/8 x 7-1/8 (H x W x L)	
<b>PRICE</b>	\$169.00	

RANGE	45 Hz to 1 kHz	1 kHz to 2 kHz	2 kHz to 5 kHz
200 mV	±(0.75% of reading +2 digits)	±(1.5% of reading +3 digits)	±(5% of reading +5 digits)
2V			
20V			
200V			
750V	±(1% of reading +2 digits)		

designed by Fluke engineers to perform both analog and digital functions as well as providing direct drive to the Liquid Crystal Display (LCD). The C-MOS chip is said to provide the new instrument with:

- 2,000 counts (+1999) increased resolution and accuracy
- Low power dissipation
- Crystal control clock for near perfect line interference rejection
- Digitally selected 2 volt and 200 mV ranges requiring no external component changes
- True differential input to the chip

- Single, floating, external reference voltage
- Ratio accuracy to within 1 count
- Near zero bias current at all terminals.

In tests performed in the ET/D lab, we found the Fluke 8020A easy to use. With push button selection of functions and ranges, we found it to be a convenient hand-held type of instrument. All controls are located on the left edge of the front panel. Dual functions are built-in on several push buttons, and the instrument is changed from either volts or current mode and vice versa by sim-

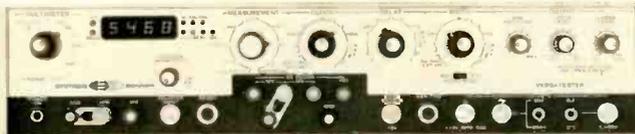
ply moving the appropriate input banana jack. This jack change eliminates the problem encountered in meters with rotary selector switches, where a user going from volts to current may dial through ohms while the unit is still connected to the test point.

Also, the new meter offers auto zero and auto polarity features that eliminate manual adjustments.

The 8020A also seems to be a hardy instrument. It is said it will withstand shocks equivalent to an eight-foot-drop without injury. Its voltage functions are protected against overloads up to a maximum of 1000 volts. Voltage inputs have a metal oxide varistor across them to protect against transient peaks up to 6,000 volts. Current functions are protected by a 2 amp current fuse, and the ohms function is protected against up to 300 V rms on all ranges.

Because of the single IC chip  
*continued on page 43*

# VERSATESTER I™



## What is it? A labstrument\*

VERSATESTER I  Generates Pulses, Sine waves and Square waves to 20MHz  Supplies DC power at +5v, +15v, -15v, ±30v  Digitally Measures frequency from 20Hz to 20MHz, with autoringing; DC and AC volts, 0-500v; Resistance to 5 Megohms.  Complete for only \$1,650!  Contact your nearest Scientific Devices Office for specs or demo or Systron-Donner at 10 Systron Drive, Concord, CA 94518. Phone (415) 676-5000.

\*lab-stru-ment \ˈlab-strə-mənt\ n 1: a complete test lab in one lightweight, portable, 3½" panel height Systron-Donner instrument.

SYSTRON  DONNER

...for more details circle 125 on Reader Service Card

## Survival of the FITTINGEST



## THORDARSON FITS

Thordarson replacements fit exactly. And they are designed and built better than the original. Thordarson gives you the industry's widest selection of replacement flame retardant flybacks and yokes. Accurate, constantly updated cross-reference data makes replacement selection fast and easy. These solid reasons, and more, are why Thordarson has survived when most others have failed.

The next time you need a flyback or yoke for any brand see your independent electronic parts distributor for a Thordarson replacement. You'll be dollars and hours ahead!

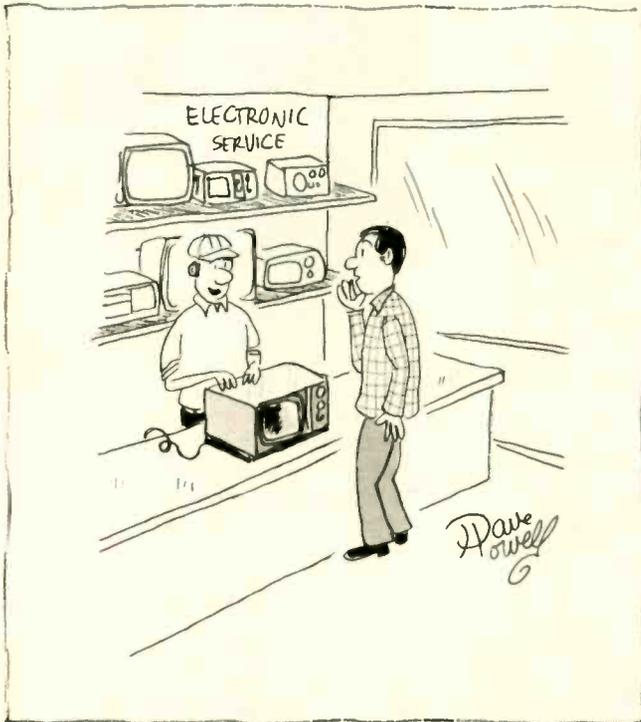
**THORDARSON**

**THORDARSON MEISSNER, INC.**  
Electronic Center  
Mt. Carmel, Illinois 62863

Support your independent parts distributor ... we do! NEDA  Associate Member

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

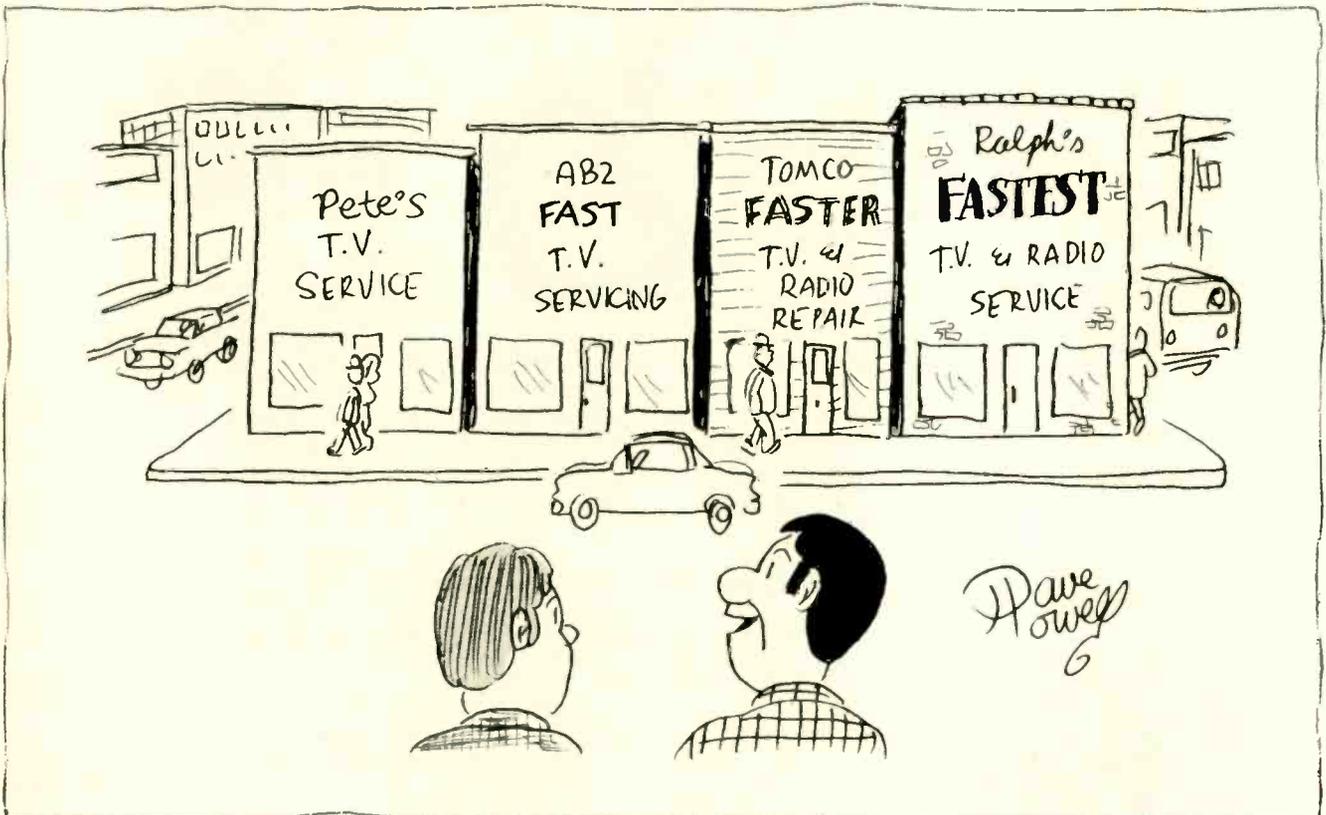
# Laughing It Off...



"I found out why you can't pick up many channels on this, Mr. Crane—it's a *micro-wave oven!*"



"Benson, if you don't quit your bragging, you'll never become a great repairman like me!"



"One thing for sure—this town really has a competitive spirit!"

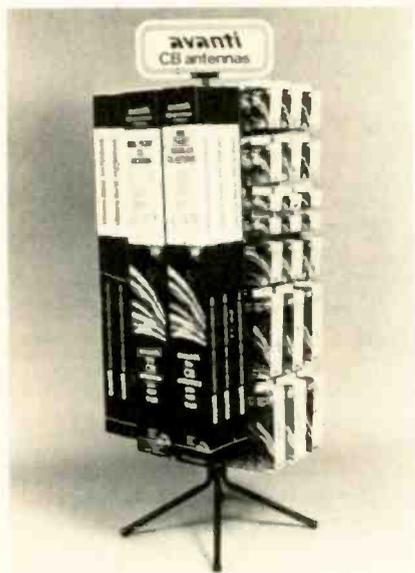
## DEALER SHOWCASE

Descriptions and specifications of the products included in this department are provided by the manufacturers. For additional information, circle the corresponding numbers on the Reader Service Card in this issue.

### CB ANTENNA/ACCESSORY MERCHANDISER

132

A new, self-selling merchandiser taking only 4 square feet of floor space is being offered by *Avanti Research*. Designed to hold a wide assortment of mobile antennas, mounts, co-phasing harnesses and other accessories, the 6-foot high revolving display features



pegboard mounting of individually boxed products. This is said to eliminate the problem of holes being poked in shrink or blister packs. Avanti's new antenna packaging features four-color printing on heavy corrugated cartons for maximum eye appeal. Included with each #300 package are the display merchandiser, 30 x 42 inch satin wall banner and two 24 x 36 inch window posters. The merchandiser is available free with the purchase of the product assortment.

### PCM AUDIO UNIT

133

A new audio unit using Pulse Code Modulation (PCM) has been intro-



duced by *Sony*. The unit digitally encodes a sound source and then converts it into on-or-off pulses similar to the "blips" digital computers use to store and process information. It is light weight and economical, because it utilizes the recording and playback capabilities of a Betamax videocassette recorder or any other American Standard (NTSC) video recorder. The Sony PCM audio unit processes only the digital pulses; thus, it is said, the tape "hiss" is never reproduced. Because of its new circuitry, the new unit is said to achieve a dynamic range of 95dB in playback and 85dB when recording.

### MICROPROCESSOR CONTROLLED MOBILE TELEPHONE

134

A new mobile telephone control head that is controlled by a microprocessor has been introduced by *Motorola*. Called the Pulsar II Car Telephone, the new unit has push-button dialing, abbreviated dialing for as many as ten numbers, on-hook dialing and call processing, recall of last number dialed, telephone number display, channel review and select, chan-



nel number display and an illuminated dial pad. The Push Button Pad is located on the back of the handset to allow the user to dial the number with one hand. Pulsar II features Home, Roam, and Manual modes of operation.

### HOME VIDEO GAME

135

A new TV game system that features an automatic shut-off switch to prevent CRT damage when the unit is accidentally left-on has been introduced by the *Bally Company*. Called the Bally Professional Arcade, the new product features two games—Checkmate and Gunfight—and has a built-in four-function, 10-memory

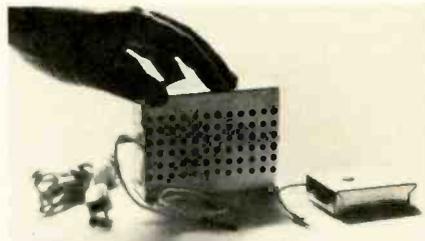


printing calculator. A wide variety of action/skill, sports, educational and strategy games can also be played by plugging in optional cassettes. The built-in calculator is also adaptable to reconciling bank balances, computing taxes and helping children with homework. The Arcade includes hand controls to provide action for from 1 to 4 players.

### TV THEFT ALARM

136

A television receiver alarm that installs out-of-sight inside the TV cabinet is available now from *Mountain West Alarm*. Useful in homes, motels, hotels, hospitals and schools,

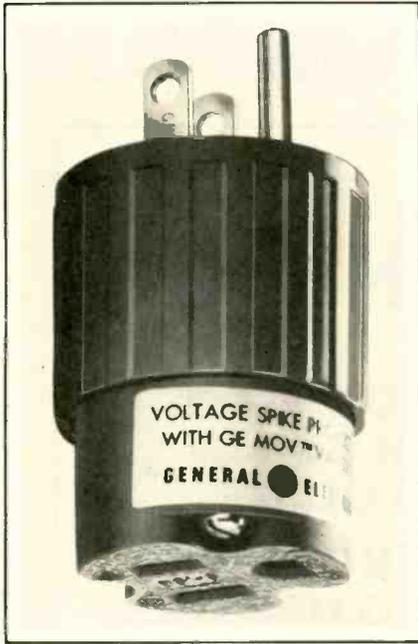


the alarm goes off when the thief unplugs the set and tries to move it. When that happens, a screaming, penetrating wail alarm is set off, audible up to a quarter mile. Only an electronic key will turn off the alarm. Accidental triggering of the alarm is almost impossible as the set must be both unplugged and moved. A sensitive pendulum circuit activates the alarm. It is powered by AA rechargeable nickel-cadmium batteries and sells for \$16.95.

### VOLTAGE SPIKE PROTECTOR

137

A new device designed to limit voltage transients that might damage sensitive electronic circuits is now available from General Electric. Called a GESP-752 Voltage Spike Protector, it absorbs transients before they reach the equipment. It is expected to be a

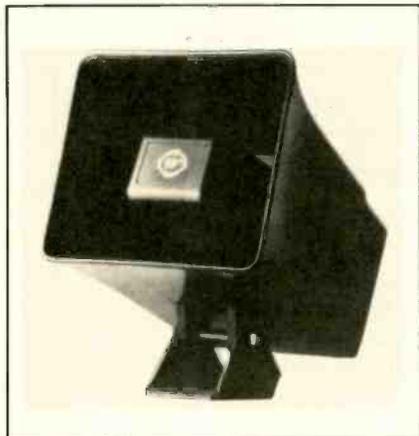


successful point-of-purchase product for electronic service dealers. The new device plugs into a 120-volt grounded receptacle and acts like a safety valve. The heart of the GESP-752 is a GE-MOV varistor, which absorbs the potentially damaging voltage transients and permits only a safe voltage level to enter the protected equipment, but does not interfere with the normal current flow nor add to energy cost.

### PUBLIC ADDRESS SPEAKER FOR CB

138

A new weatherproof public address speaker for CB that mounts almost anywhere is available now from Audiovox Corporation. Labeled Model CBS-20, the new speaker horn has a unique rectangular shape for easy installation. It has a horn range of 4 1/2



inches and bell diameter of 3 1/2 x 3 inches. Although it is compact, it is said that the speaker has the sound output of a full-sized speaker. With a frequency range of 800-6,000 Hz, the speaker has a nominal input of 5 watts and maximum input of 10 watts. A 12

foot cord with a 1/8 inch plug is included along with mounting hardware. Lists for \$11.95.

### AM/FM STEREO RECEIVER 139

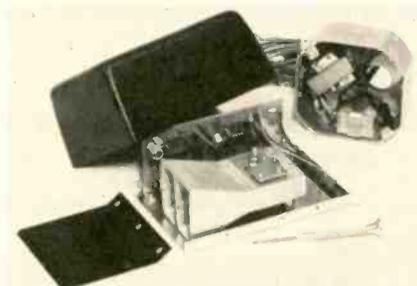
A new AM/FM stereo receiver has been introduced by *Sansui*. Designated the model G-3000, the new receiver features a power amplifier with a differential input using dual PNP transistors, a class-A driver and a



push-pull output in a complementary OCL configuration. Power output is 26 watts per channel, minimum RMS, with both channels driven into 8 ohms from 20 to 20,000 Hz, with a total harmonic distortion of 0.15%. Overall frequency response extends from 10Hz to 50,000 Hz, +1dB, -2dB. The tuner section features a PLL/differential demodulator, plus a Quadrature detector that reduces harmonic distortion to less than 0.18% for mono and 0.25% for stereo. A low pass filter suppresses carrier leakage. Priced at \$280.

### RADAR INTRUDER ALARM 140

A new home burglar alarm that uses radar to detect prowlers on the property has been introduced by *Radar Control Systems*. Called the Lightliter, the new alarm can frighten off intruders by flipping on porch lights or other lights in the house as the intruder approaches. It can also be used to set off music, or an alarm, as well as dialing a telephone number where the absent homeowner can be reached. It will ignore movements of animals, shrubbery and street traffic. The device uses an X-band Doppler radar module that transmits about 15 milliwatts with a range of about 20 feet which is adjustable. The Lightliter draws 1/8 ampere at 12 volts AC or DC. A 12-volt transformer and mounting hardware are supplied.



## T & T VALUE SALE

G. E., SYLVANIA, ZENITH, RCA, ETC.

### 75% OFF LIST NEW JOBBER-BOXED TUBES

<input type="checkbox"/> 3A3	5 for \$7.06	<input type="checkbox"/> 6HA5	5 for \$6.69
<input type="checkbox"/> 5GH8	5 for \$8.25	<input type="checkbox"/> 6JE8	5 for 14.63
<input type="checkbox"/> 6BK4	5 for 13.06	<input type="checkbox"/> 6JS6	5 for 13.00
<input type="checkbox"/> 6FQ7	5 for \$5.31	<input type="checkbox"/> 6LB6	5 for 14.06
<input type="checkbox"/> 6GH8	5 for \$5.50	<input type="checkbox"/> 17JZ8	5 for \$7.25
<input type="checkbox"/> 6DW4	5 for \$6.56	<input type="checkbox"/> 38HE7	5 for 12.81

\* All Tubes Not Advertised, Write In at 75% off list. Sleeves Only. Singles at 72% off list. Special: 100—6GH8's, I.C.C. \$79.00.

### TRANSISTORS EQUIVALENT UP TO 90% OFF LIST

.35 each—Minimum 20 per number		SK ECG	
<input type="checkbox"/> 3018	108	<input type="checkbox"/> 3122	123A
<input type="checkbox"/> 3024	128	<input type="checkbox"/> 3124	123A
<input type="checkbox"/> 3025	128	<input type="checkbox"/> 3132	161
<input type="checkbox"/> 3114	158	<input type="checkbox"/> 3248	186A
<input type="checkbox"/> 3124	192		

Minimum 5 of a Number

<input type="checkbox"/> SK	ECG	ea. 60c
<input type="checkbox"/> 3021	124	ea. 90c
<input type="checkbox"/> 3027	130	ea. 70c
<input type="checkbox"/> 3054	184	ea. 80c
<input type="checkbox"/> 3103	157	ea. 70c
<input type="checkbox"/> 3041	152	ea. \$1.50
<input type="checkbox"/> 3079	162	ea. \$2.75
<input type="checkbox"/> 3115	165	ea. \$2.50
<input type="checkbox"/> 3197	1155	ea. \$2.50
	1058	ea. \$2.50
	235	ea. \$2.00

### IC'S EQUIVALENT TO ECG

\$1.25 each Minimum 5

708	709	710	712
713	714	718	719
722	723	725	731
740	743	748	780
783	788	790	791
793	912	923D	

### YOKES

<input type="checkbox"/> Y-88	<input type="checkbox"/> Y130	<input type="checkbox"/> Y94	<input type="checkbox"/> Y105
<input type="checkbox"/> 95-2779			ea. \$5.75
<input type="checkbox"/> Y153	<input type="checkbox"/> Y182/Y132		ea. \$8.95
<input type="checkbox"/> DY 92C			

### DIODES, RECTIFIERS, EQUIVALENT

<input type="checkbox"/> 6500 PIV Color Focus Rect.	10 for \$4.95
<input type="checkbox"/> 2.5a 1000 PIV IR 170	100 for \$9.00
<input type="checkbox"/> B-1 Boost Rectifiers	20 for \$6.00
<input type="checkbox"/> Syl-Zen, Tripler	ea. \$6.50
<input type="checkbox"/> Admiral Tripler	ea. \$4.95

### AUDIO-CARTRIDGES-NEEDLES EQUIV.

<input type="checkbox"/> Astatic 133	ea. \$1.95
<input type="checkbox"/> Astatic 142	ea. \$1.45
<input type="checkbox"/> BSR SC7	ea. \$1.70
<input type="checkbox"/> BSR SC7M	ea. \$1.90
<input type="checkbox"/> Panasonic EPC 42	ea. \$2.00
<input type="checkbox"/> EV 26 \$1.50	<input type="checkbox"/> EV 5015
<input type="checkbox"/> Tetrad All Numbers	ea. \$1.95
<input type="checkbox"/> N44	<input type="checkbox"/> N75
<input type="checkbox"/> N3	<input type="checkbox"/> N91
	<input type="checkbox"/> V15
	ea. \$1.25

### CB HARDWARE and WIRE

<input type="checkbox"/> SO 239	10 for \$2.90
<input type="checkbox"/> PL 259	10 for \$3.10
<input type="checkbox"/> PL 258	10 for \$3.90
<input type="checkbox"/> 3 ft. RG 58U 2PL259	\$1.25
<input type="checkbox"/> 20 ft. RG 58U 2PL259	\$2.00
<input type="checkbox"/> 20 ft. RG 58U 1PL259 1 spade lug	\$1.70
<input type="checkbox"/> CB Lightning Arrestors	\$1.25
<input type="checkbox"/> 50 ft. 59U Cable, Incl. F conn	\$1.79
<input type="checkbox"/> 100 ft. RG 59U incl. F conn	\$3.49
<input type="checkbox"/> 500 ft. 59U Coax Mill Ends	\$15.00
<input type="checkbox"/> 50 ft. RG 8U	\$7.55
<input type="checkbox"/> 100 ft. RG 8U	\$12.95

### GENERAL

<input type="checkbox"/> 60 Min. Irish Cassette Tapes	8 for \$24.00
<input type="checkbox"/> \$300 Surprise Package	\$10.00
<input type="checkbox"/> 100 Asst. Caps	\$4.00
<input type="checkbox"/> 20 Asst. Belts	\$7.00
<input type="checkbox"/> 500 ft. Speaker Wire	\$5.00
<input type="checkbox"/> 1000 ft. 300 ohm Speaker Wire	\$17.95
<input type="checkbox"/> 300 ohm Signal Splitters	10 for \$7.90
<input type="checkbox"/> TV Lightning Arrestors	10 for \$5.00
<input type="checkbox"/> 25 ft. Telephone Headphone Ext.	5 for \$6.00
<input type="checkbox"/> 75-300 ohm Matching Transformers	10 for \$4.40
<input type="checkbox"/> Deluxe Lock Mounts w/PL 259	\$2.95

WANTED: Electronic Merchandise.

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Letters of credit & all checks placed on deposit with Manufacturers Hanover Trust Bank, N.Y.C. Master Charge—Min. \$100—C.O.D.'s 50% Dep. Minimum Order \$75 FOB Brooklyn, N.Y.

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Phone: (212) 241-5940

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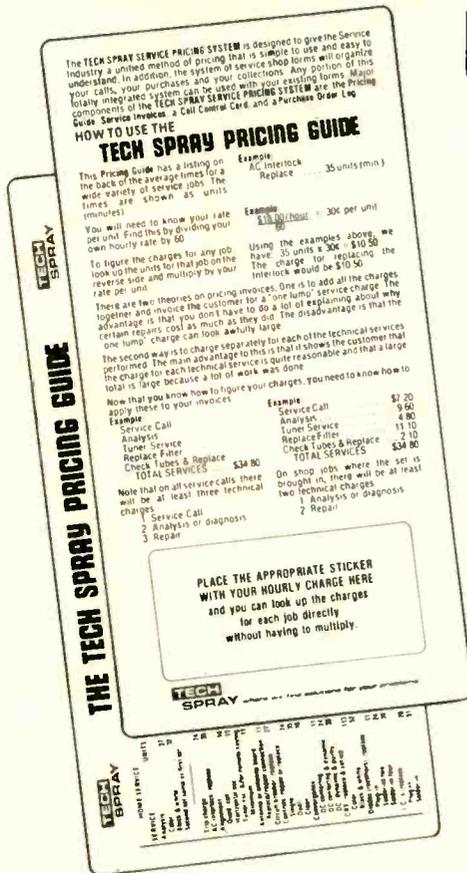
# We goofed in our last ad, it should've said;

## THE SECOND BEST THING

### YOU CAN DO WITH A NEW TECH SPRAY PRICING GUIDE

### IS TO CONVINCE YOUR ~~CUSTOMER~~ TO USE ONE! COMPETITOR

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Use this new Tech Spray Pricing Guide to increase your profitability. It gives you a method to price out all your service jobs uniformly. You get paid what you're worth because it lets you charge for all the repairs performed. Simple to learn and use, it takes ten minutes to understand and seconds to use. Packaged complete with forty-one different Pricing Stickers to fit your own labor rates. Rates range from \$12.00 per hour to \$36.00 per hour. Stock Number 2007, and just \$4.95.



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## TECH

### SPRAY supplying the technician's daily needs... better

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# Makes a difference, doesn't it?

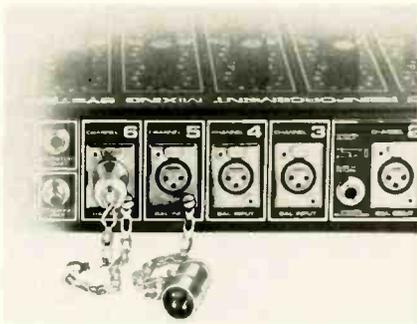
...for more details circle 141 on Reader Service Card

## NEW PRODUCTS

Descriptions and specifications of the products included in this department are provided by the manufacturers. For additional information, circle the corresponding numbers on the Reader Service Card in this issue.

### MICROPHONE SHORTING PLUG 145

A new shorting plug for eliminating hum and noise pick up by unterminated microphone circuits has been introduced by *Switchcraft*. The new "Q-G" plugs, part number N3MS, con-

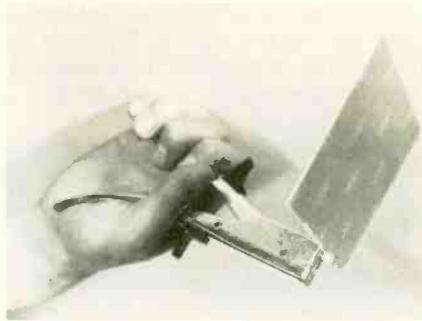


nect directly to female receptacles, shorting circuits together. This feature is said to virtually eliminate hum and noise pickup from any unterminated circuitry. A six-inch chain is provided to anchor the shorting plug,

preventing loss or misplacement. The plug locks firmly to mating receptacles with a special insert screw for efficient grounding.

### NIBBLING TOOL 146

A new nibbling tool that cuts sheet metal like a chassis punch has been introduced by *GC Electronics* for the service technician. The new tool (Cat. No. 805) cuts clean holes of any shape and size in metal or plastic. Starting with a  $\frac{3}{8}$  inch hole, you simply "nibble" to the size needed. The tool is capable of cutting 18 ga. steel of  $\frac{1}{16}$  inch thick copper, aluminum, or plastic. It is said to be ideal for templates, shims



and model parts. And you can use it to trim undersized holes to fit, notch clearance on flanges of cabinets or air ducts.



### TV TUNER CLEANER 147

A new aerosol cleaner and lubricant for TV tuners has been developed by *Chemtronics Inc.* Named Tuner Renu, the new product is said to improve the operation of tuners by cleaning the contacts and depositing a light lubricating film that then protects the contacts and permits smooth detent action. It is non-flammable, causes no drift and is safe for all plastics. Tuner Renu can be sprayed directly onto tuner contacts by removing the tuner shield, or, in some TV sets, it can be

# Built to last

Our new 3½-digit LED autopolarity digital VoltOhmyst® is quality-constructed for long, hard service.



WD-750A  
\$267.00

- Fast and accurate measurement of ac and dc volts, current, and resistance.
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of VIZ Mfg. Co.

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A6645

Formerly  
**RCA**  
Instruments

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sprayed into the tuner through the front of the set. Available in 6 ounce, 16 ounce and 24 ounce sizes.

**EPOXY CABLE TIE MOUNT KITS 148**

A new kit including cable tie mounts, epoxy cup and mixer stick is announced by *Panduit Corp.* The mounting system provides a fast, strong, economical method for securing cables or wires to masonry, steel, aluminum, glass, wood and most other surfaces. Each foil envelope contains three



mounts (EMS-A-O), one cup of epoxy and one mixer stick. The mounts are made of black weather resistant 6/6 nylon and are used with Panduit cable ties for both indoor and outdoor applications. They are said to reduce total installation cost by eliminating the need to drill holes and to install drive anchors or cable clamps.

**MIDGET DRIVER SETS 149**

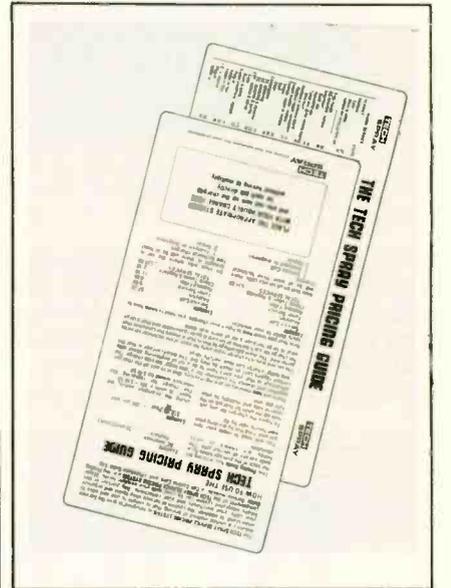
Eight different assortments of midget screwdriver and nutdriver sets and combinations in handy standup plastic cases are now available from *Xcelite*. The series covers driving capability for slotted, Phillips, Allen, Scrulox, and hex screws, and hex nuts. Metrics are available for nutdrivers and hex socket screws. Each set includes the 'piggyback' torque amplifier handle, which is said to give a



larger gripping surface, extended reach and increased driving power. Screwdriver blades are bright nickel chromeplated; nutdrivers feature steel shafts and precision, cold draw case-hardened sockets.

**SERVICE PRICING GUIDES 150**

A new line of service pricing guides, service invoices, purchase order logs and other daily service aids has been introduced by *Tech Spray*. The fully integrated system was developed to fill a need in the service industry for uniform pricing and invoicing. The service invoices are keyed to the service pricing guide with unit pricing numbers printed right on the invoice. The invoices feature a completely flex-



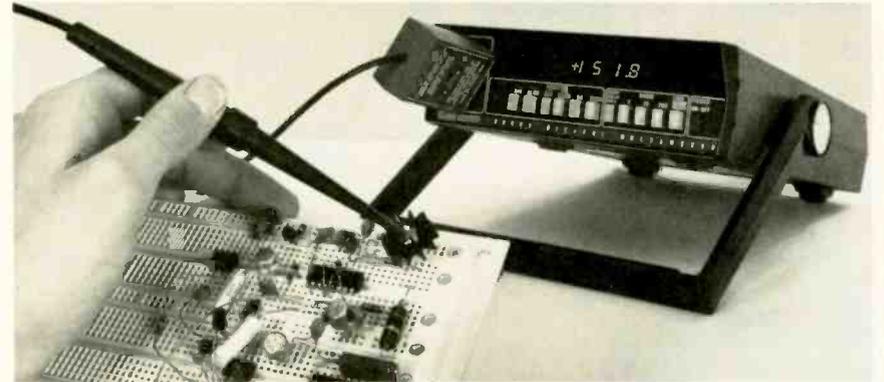
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...for more details circle 121 on Reader Service Card

**Save design, troubleshooting and evaluation time with the Fluke Temperature Probe.**



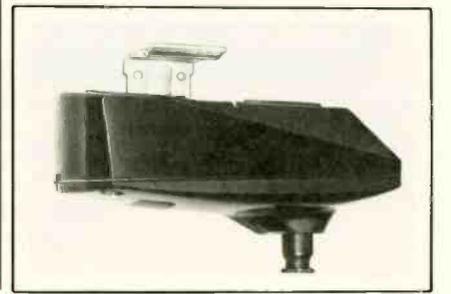
The 80T-150 Temperature Probe can be used with any voltmeter to quickly locate malfunctioning and overstressed components, or to confirm difficult thermal calculations.

The Fluke 80T-150 Temperature Probe easily converts any DVM to a direct reading thermometer (1mV/degree). Range is -50°C to +150°C (or -58°F to +302°F), and the probe can be used in surface, air or liquid applications. Additionally, a 350V standoff allows measurement of live circuits. It is fast responding and battery powered. \$125\*  
Call today—800-426-0361 toll-free—and ask for Application Bulletin AB-28 for information on other ways to make thermal measurements with the 80T-150. Or, write: John Fluke Manufacturing Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043. \*U.S. Price Only

ible warranty, a complete payment schedule for the bookkeeper. The new system also includes a "call control card" that will help the shopowner keep track of the service job right through the call, bench work and delivery.

**VHF-UHF-FM PREAMPLIFIERS 151**

Five new solid-state, high gain, low noise preamplifiers have been added to the Gold-Star line of the *Winegard Company*. They are models GA-3800 (VHF only), GA-4800 (UHF only), GA-8800 (VHF-UHF) and GA-6300 and GA-6700 which are VHF/FM only. The new preamps feature low noise



1806-7014

...for more details circle 112 on Reader Service Card

circuitry of between 3.5 and 4.2dB, and a lightning protection circuit that is said to reduce the possibility of transistor burn-out. Antenna and down-lead connection are internal to protect from corrosion. A fixed FM trap in the VHF circuitry prevents overload from strong FM stations. The preamps can be mounted on the antenna mast or boom. Tough weather-proof housing protects the circuitry. Power requirement is 117VAC 60Hz.

**PORTABLE 3½ DIGIT DMM KIT 152**

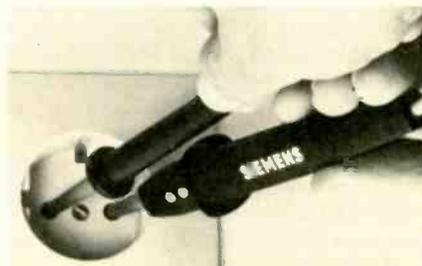
A new 5-function battery-operated digital multimeter has been introduced by *Eico*. Available either in kit form or fully assembled, the new Eico 270 DMM features 3½ digits, with the ability to measure AC and DC volts and current, and resistance in 21 ranges. Polarity indicators and over-



load protection and 0.5 inch LED displays are offered by the new instrument with 0.5% DC accuracy, 10 megohm input impedance, low voltage drop in all current ranges, and an automatically-flashing over-range indicator that operates when input exceeds the value of the range selected. Supplied with test leads and functional tilt stand. It weighs 1-¾ pounds and is priced, in kit form, at \$79.95, and fully assembled, at \$109.95.

**VOLTAGE TESTER WITH LED 153**

A new voltage tester that uses a PTC resistor and two light emitting diodes (LEDs) to test for voltage has been introduced by *Siemens*. The tester will handle voltages from 4.5 to 380 V, and is capable of differentiating between ac and dc voltages. In contrast

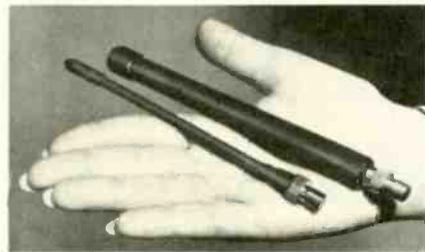


to the conventional neon testers, this new tester also indicates polarity. The new device consists of two black handles connected by a 60 cm cable. The bare test probes protrude from red plastic sleeves. One of the handles contains a ceramic PTC resistor, which is connected in series with two anti-parallel LEDs and very rapidly reduces a test current to a tolerable value at any voltage. Priced at \$14.90.

**FLEXIBLE REPLACEMENT ANTENNAS 154**

A new line of flexible replacement antennas for RCA Tac-Tec portable

transceivers is now available from *Antenna Specialists*. The new models, P-34 for VHF and P-35 for UHF applications, are designed to withstand the rough treatment that often breaks telescopic antennas. The P-34 series



# Intervox miniatures speak quality at unheard of prices.



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are helically-wound copper-plated spring construction while the P-35 series are full ¼-wave flexible cable. Both models are encapsulated in a tough black PVC coating for high impact and abrasion resistance. P-34 and P-35 models are available for the most popular frequency ranges.

### THREE-PIECE CB RADIOS 155

A new remote CB 40-channel transceiver in three pieces for added security has been introduced by RCA. Designated Model 14T275, the three-piece unit consists of a microphone with all operating controls built into it—the main chassis—and mounting bracket.



Controls included on the microphone are: on/off, volume, squelch, channel selector, digital channel read-out, separate microphone element, and separate speaker. The main chassis, with 100% solid state and phase-lock circuitry, mounts in concealed locations such as under the seat, on the fire wall, or in the trunk. The main chassis also has a speaker and speaker jack. The mounting bracket installs under the dash in any position. It also has a switch that allows the user to select which speaker he wants to use. Suggested retail price is \$199.95.

### POWER MIKE FOR CB 156

A new microphone with variable gain control is part of the new line of CB microphones, antennas, accessories, and solid-state replacement parts being offered now by *GTE Sylvania*. Designated the SDX-100, the new microphone features electronic circuitry that processes the user's



voice for maximum amplification without clipping. Up to four decibels increase in effective average modulated power—more than twice possible with conventional microphones—can be achieved with negligible audible distortion. Available with Match-All adapters which eliminate the need for wiring the mike to a transceiver connector.

### SMALL-SHANK ELECTRIC DRILL 157

A compact electric drill that accommodates drills and burrs with a shank size up to .123 (1/8 inches), has been introduced by the *Wahl Clipper Corporation*. Called the ISO-TIP Electronic Technician Drill, the new tool is said to be ideal for prototype development; circuit board revision and redesign; solder removal; lead hole cleaning and a variety of other jobs. Its compact size of less than 5 inches (minus drill bit) allows use of the drill in con-

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fined areas and within cabinetry. It is lightweight and has an extra-long 10 foot cord. On/off switch provides both "intermittent-on" and "locked-on" positions. It operates at approximately 9,000 RPM.

### UNDER-DASH CASSETTE TAPE PLAYER

158

A new under-dash cassette tape player has been introduced by *Arthur Fulmer Co.* Designated the model 15-0738, the new player is distinguished by its small size, measuring less than 5 inches wide, 2-1/8 inches high 7 inches

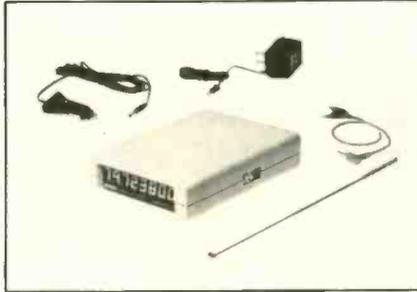


deep. It can be installed in a glove compartment, or out of the way under-dash. Other features include automatic tape eject, slide volume and tone controls, balance control, fast forward and eject. The suggested list price is \$49.95.

### LED-READOUT FREQUENCY COUNTER

159

A new LED-readout, solid state frequency counter has been announced by *Continental Specialties*. Designated the MAX-100, the instrument provides readings from 20Hz to a guaranteed 100 MHz for audio, ultrasonic, RF (AM and FM), video and digital applications. A clip-lead or other input cable or a mini-whip antenna is simply



plugged in, and the unit turned on. The MAX-100 is said to automatically give direct frequency readings on an 8-digit, 0.6 inch LED display. Readout is updated once a second, and overflow signals (above 100MHz) are automatically indicated by a flashing display digit. It weighs less than 1.5 pounds, will operate on six AA cells, 110 or 220 VAC, 12 VDC, or any 7.2-10VDC supply. Priced at \$134.95.

### ISOLATION AUTOTRANSFORMER 160

A new combination isolation and autotransformer for bench use has been announced by *B&K-Precision*. Designated the TR-100, the new unit features three isolated and three direct outlets for high, medium and low (130,115,105 VAC) line voltages. The isolated outlets are rated at 400 VA continuous, while the direct outlets are rated at 500 VA. The TR-100 allows safe testing of transformerless equipment, eliminating a potential shock hazard. In addition, the TR-100 can be used to vary the input line voltage applied to an electrical device or instrument under test. Suggested user price is \$55.

### TEST INSTR. REPORT

*continued from page 34*  
and the large liquid crystal display, the instrument's power needs are reduced to the point where it is said that it can operate up to 200 hours on a single 9V battery. A low battery indication appears as the initials "BT" in the upper left corner of the liquid crystal display when there are 20 hours, or 10% of battery life remaining.

Optional accessories available for use with the 8020A include: a high voltage probe to measure 1kV to 40kV; to RF probes; an ac current transformer; a soft vinyl carrying case; a 10 amp current shunt; and deluxe test leads.

The Fluke Model 8020A DMM measures 7 inches long by 3 1/2 inches wide, and is 1 1/2 inches high. It weighs only 13 ounces, and is priced at \$169.00. ■

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### TECH BOOK DIGEST

*continued from page 29*

will serve as a good beginning for the novice—and a worthwhile refresher for the experienced technician. It will serve as a guide to the most necessary guide of all for the electronic servicer—the manufacturer's service information.

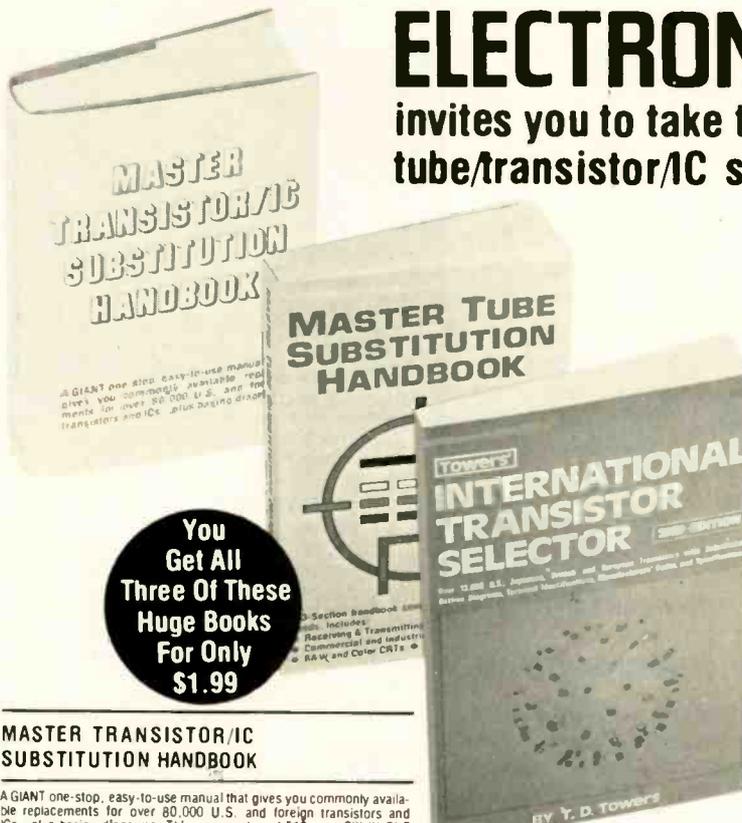
The author has explored, and explains, the service information package from the servicer's point of view. He has used actual factory service notes and has divided these notes into 25 different subject areas.

**CONTENTS:** Common Circuit Elements—Basic Solid-State Devices—Terminals, Wiring, & Switches—Chassis Location Guides—The Block Diagram—Service Precautions—Basing Diagrams and Terminal Information—The Incomplete Schematic—Metal Chassis Schematics—Printed Circuit Schematics—Photo Callouts—Pictorial Diagrams—Relating Schematic to Hardware—Drawing a Schematic From the Chassis—In-Circuit

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## CAR RADIO

*continued from page 20*

the "TWN" or "STEREO" positions. Fig. 6 shows how this is accomplished.

When a "Start" command is received, point "B" snaps high. This forces Gain Reduction Transistor Q1 into conduction, thereby dropping its collector to ground potential. Normally, the voltage at the FM gain reduction line is about +8.5 VDC, and at the AM gain reduction line about +1.5 VDC. This reverse biases diodes D1 and D2, thus isolating the AM RF and FM AGC amplifiers.

When the search function is initiated, transistor Q1 shorts the control line to ground, placing the cathodes of D1 and D2 closer to or

at ground potential. This causes the diodes to be forward biased by the voltage present at the anode ends, and shorts some of this voltage to ground, reducing the available bias for the AM RF and FM AGC amplifiers. In the "COUNTRY" position, radio gain is the same for manual operation of the radio. The collector of Q1 is no longer in the circuit, so gain is not affected.

The gain reduction circuit also contains a diode (D3) that is used to inhibit the action of a timing pulse generator until the collector

of the gain reduction switching transistor (Q1) goes to ground for the search cycle. Generation of the timing pulse is performed by a programmable unijunction transistor (P.U.T.), as shown in Fig. 7. When the collector of Q1 goes to ground, it starts the P.U.T. timer, which produces a 1 ms pulse after a period of 8 seconds, and then applies it to the other input of GC1. The pulse is then coupled to GC2 and the "start" input of the R.S. flip-flop. This initiates the "search" cycle and restarts the mechanism. ■

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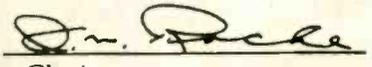
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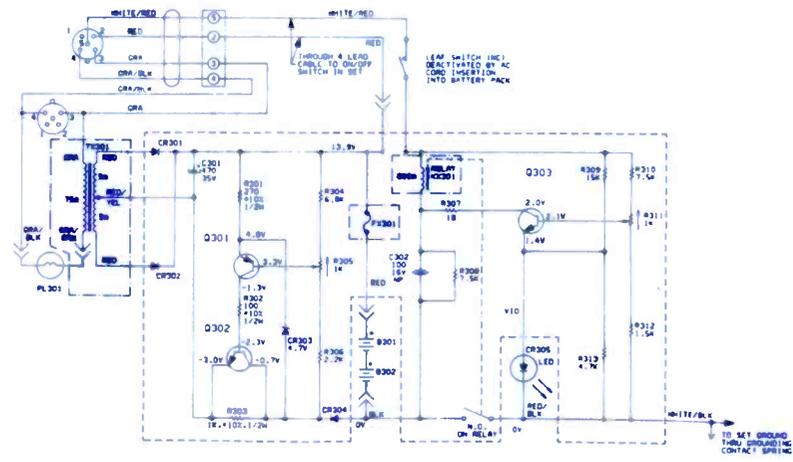
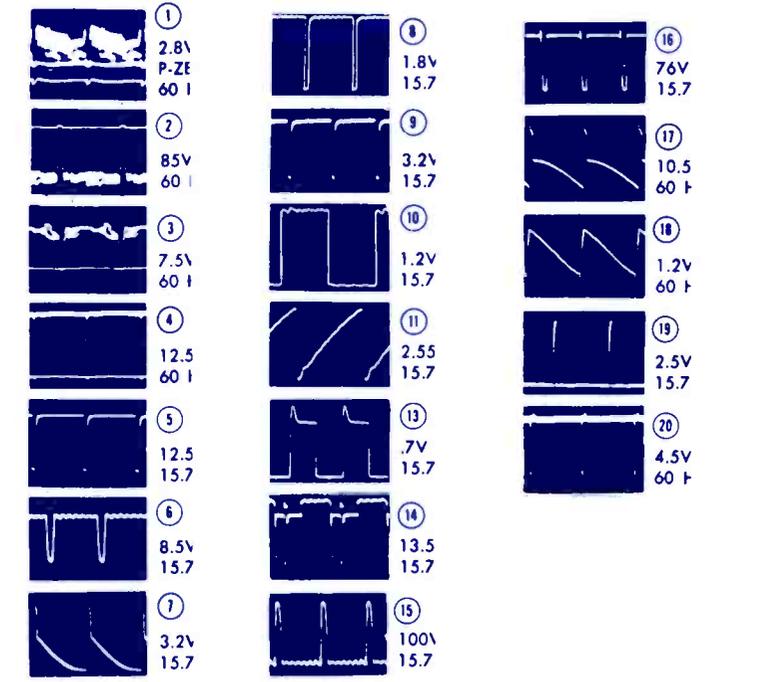
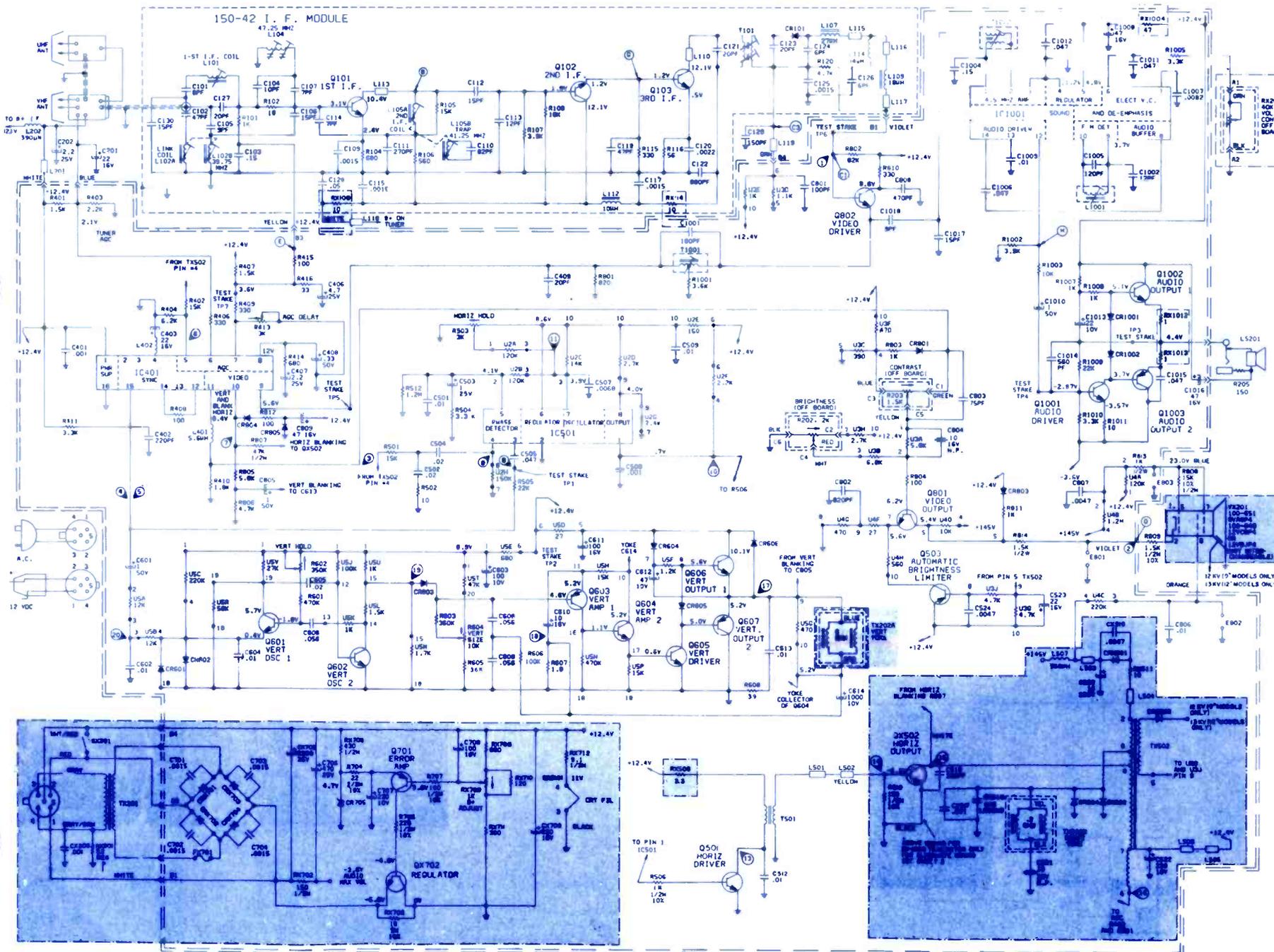
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GROUP  
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	SCHMATIC NO.	SCHMATIC NO.
ADMIRAL Color TV Chassis 4M10D	1707	ZENITH B/W T Chassis 9JB1X
GTE SYLVANIA Color TV Chassis E21-2, -7	1708	ZENITH B/W TV Chassis 12HB1X, 2X, 3X
QUASAR Color TV Chassis TS-945	1709	



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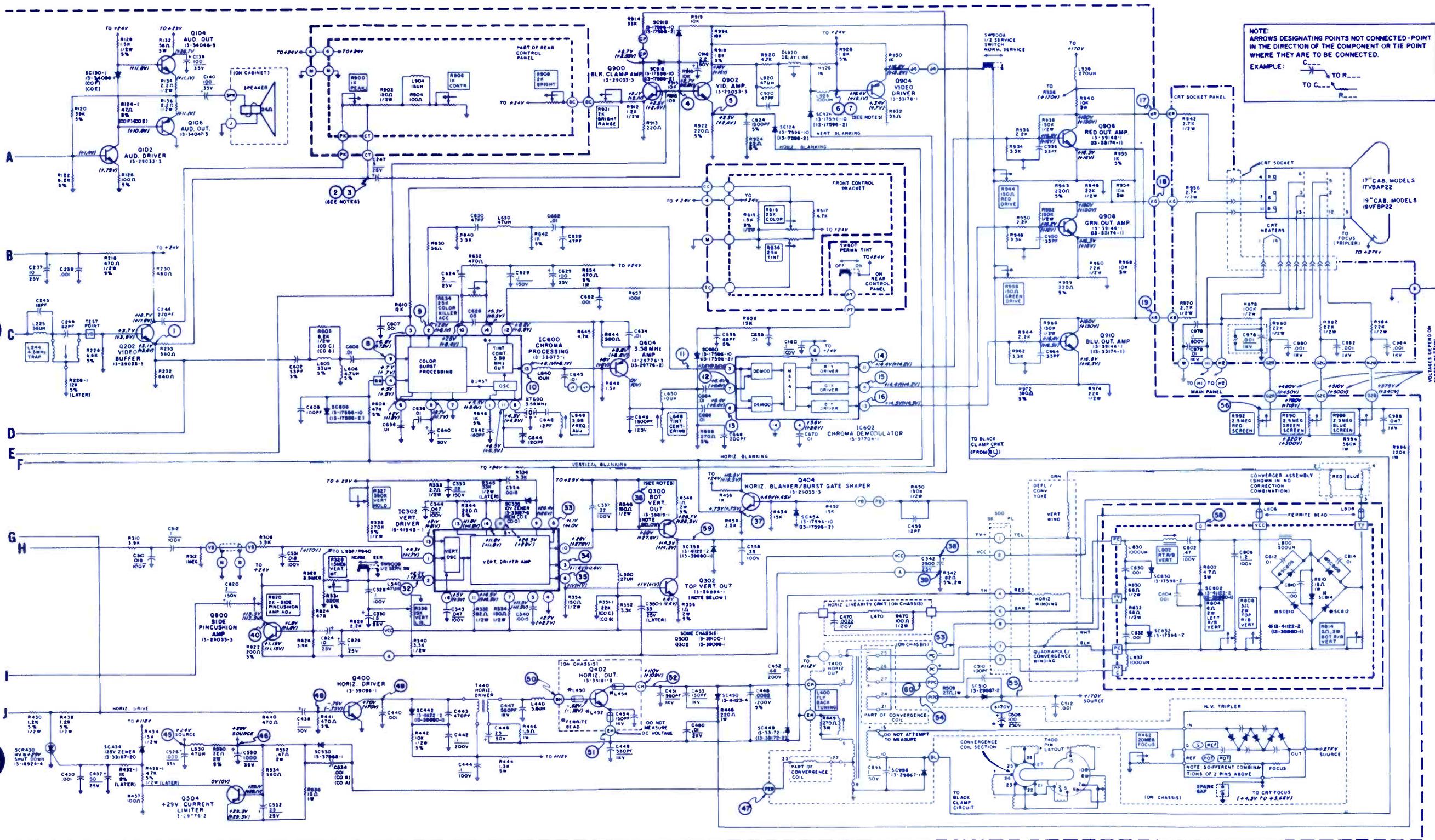
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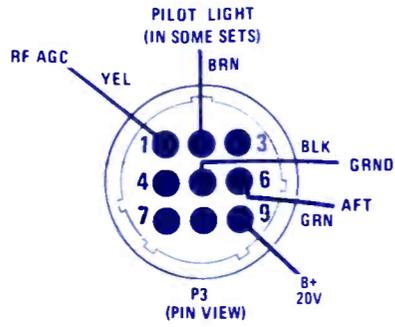
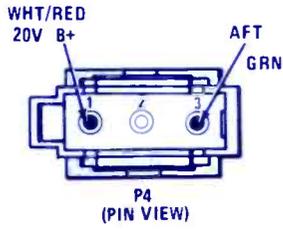


**GTE SYLVANIA**  
Color TV Chassis  
E21-2, -7

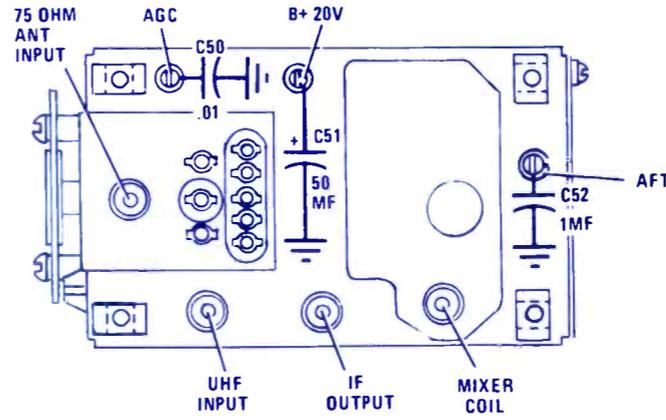
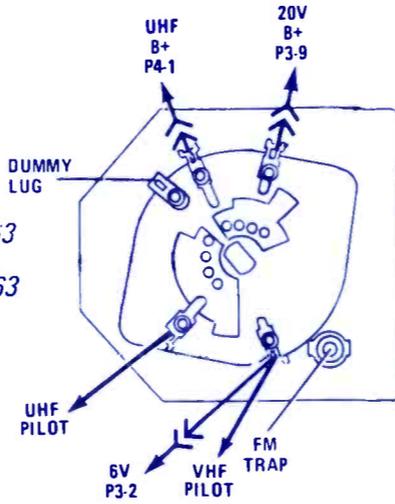




**QUASAR**  
Color TV Chassis  
TS-945



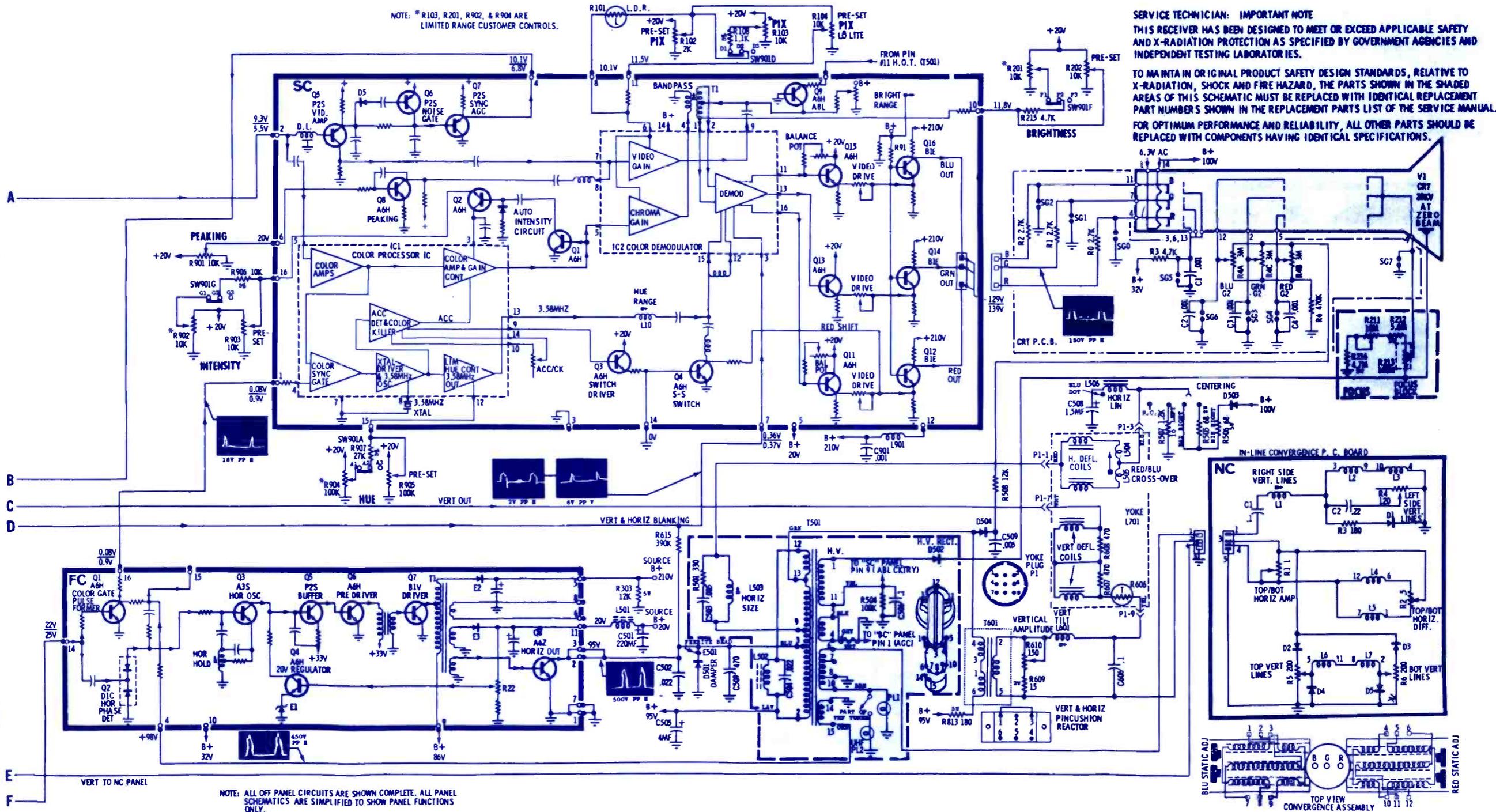
CCPTT-463  
OR  
GCPTT-463



NOTE: \*R103, R201, R902, & R904 ARE LIMITED RANGE CUSTOMER CONTROLS.

**SERVICE TECHNICIAN: IMPORTANT NOTE**  
THIS RECEIVER HAS BEEN DESIGNED TO MEET OR EXCEED APPLICABLE SAFETY AND X-RADIATION PROTECTION AS SPECIFIED BY GOVERNMENT AGENCIES AND INDEPENDENT TESTING LABORATORIES.

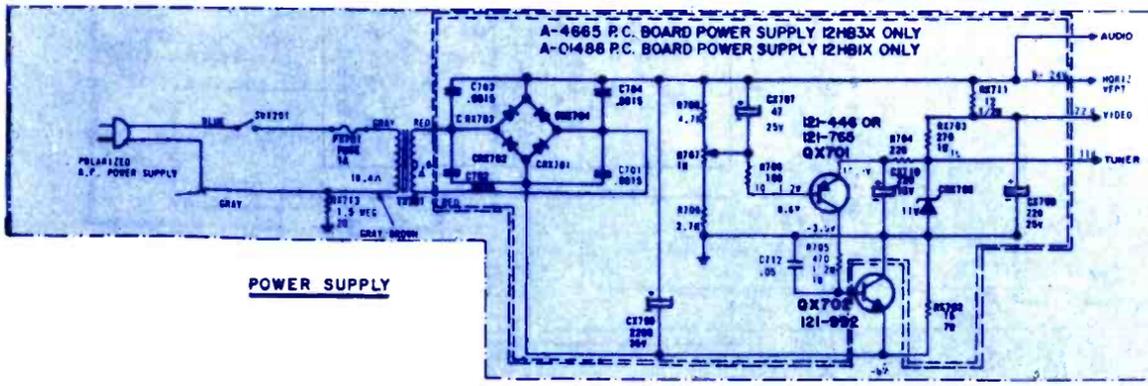
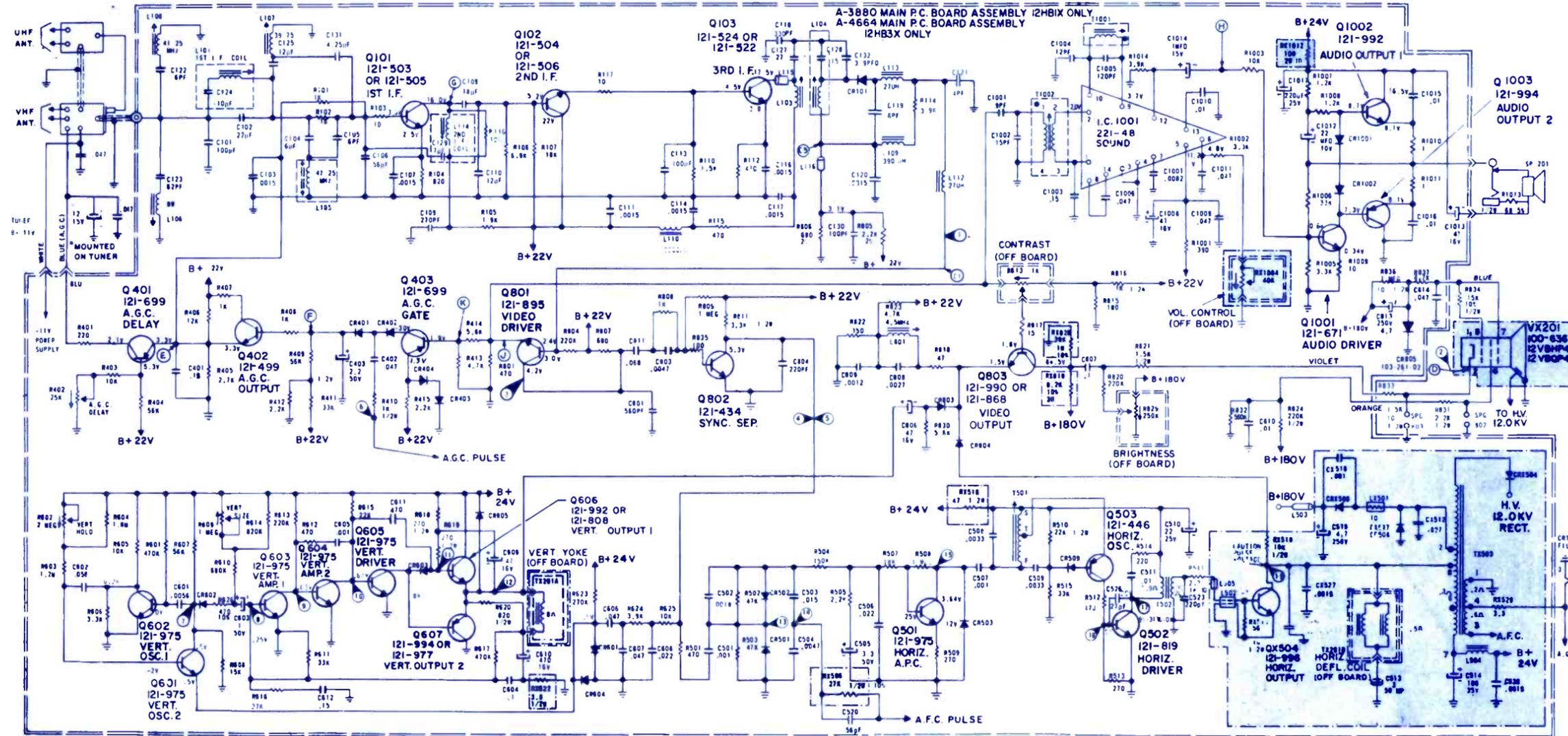
TO MAINTAIN ORIGINAL PRODUCT SAFETY DESIGN STANDARDS, RELATIVE TO X-RADIATION, SHOCK AND FIRE HAZARD, THE PARTS SHOWN IN THE SHADED AREAS OF THIS SCHEMATIC MUST BE REPLACED WITH IDENTICAL REPLACEMENT PART NUMBERS SHOWN IN THE REPLACEMENT PARTS LIST OF THE SERVICE MANUAL FOR OPTIMUM PERFORMANCE AND RELIABILITY, ALL OTHER PARTS SHOULD BE REPLACED WITH COMPONENTS HAVING IDENTICAL SPECIFICATIONS.



NOTE: ALL OFF PANEL CIRCUITS ARE SHOWN COMPLETE. ALL PANEL SCHEMATICS ARE SIMPLIFIED TO SHOW PANEL FUNCTIONS ONLY.

IMPORTANT SAFETY NOTICE

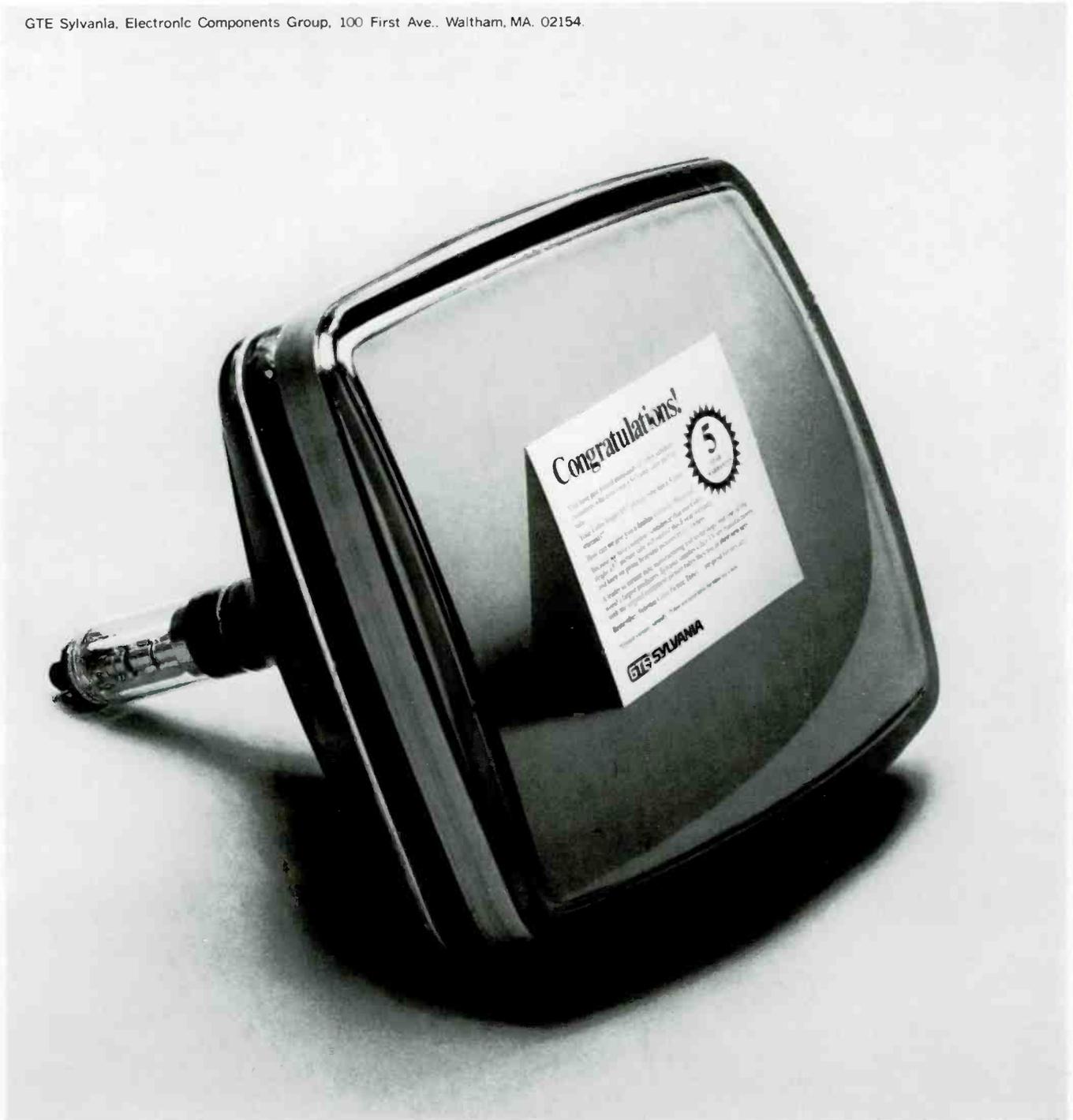
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TEST POINTS  
C1 DETECTOR OUTPUT  
C2 VIDEO BIAS  
C3 SECOND I.F. COLLECTOR  
D VIDEO OUTPUT  
E I.F. A.G.C.  
F A.G.C. OUTPUT  
G 3RD I.F. ALIGNMENT  
H SOUND DISC. OUTPUT  
I VIDEO DRIVER OUTPUT  
J A.C. LINE

- NOTES:  
1. ALL VOLTAGES MEASURED FROM CHASSIS TO POINTS INDICATED.  
2. ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED.  
3. ALL VOLTAGE MEASUREMENTS TO BE MADE WITH NO SIGNAL PRESENT WITH CHANNEL SELECTOR SET TO CHANNEL 7.  
4. ALL RESISTORS ARE 1% PERCENT TOLERANCE, 1/4 WATT UNLESS OTHERWISE SPECIFIED. (SEE NOTE 5).  
5. P INDICATES 5% PERCENT TOLERANCE MAY BE USED.  
6. RESISTANCE MEASUREMENTS SHOWN WITH COILS DISCONNECTED FROM CIRCUIT.  
7. COIL RESISTANCES NOT SPECIFIED ARE UNDER ONE OHM.  
8. ALL CAPACITY VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.  
9. FOR CAPACITY TOLERANCES, SEE LEGEND.  
10. ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION.  
11. MHZ = MEGAHERTZ = 1,000,000 HZ  
12. ⊕ INDICATES CHASSIS GROUND.  
13. ⊖ INDICATES VOLTAGE SOURCE.  
14. ⊙ INDICATES ALIGNMENT OR TEST POINT.  
15. ⊕ INDICATES WAVEFORM.  
16. ALL WAVEFORMS TAKEN ON AIR SIGNAL DEVELOPING 1.5 VOLTS PEAK TO PEAK AT TEST POINT "C1" AND ALL CONTROLS SET FOR NORMAL VIEWING.  
17. TURN POWER OFF BEFORE REPLACING SEMICONDUCTORS.  
18. ⊕ INDICATES OPTICAL CIRCUIT COMPONENT.

- 1 2.6V P-P ZERO 60 Hz
- 2 28V P-P 60 Hz
- 3 4V P-P 60 Hz
- 4 17V P-P 15.75 KHz
- 5 17V P-P 60 Hz
- 6 32V P-P 15.75 KHz
- 7 6.5V P-P 60 Hz
- 8 0.45V P-P 60 Hz
- 9 50MV P-P 60 Hz
- 10 0.65V P-P 60 Hz
- 11 9V P-P 60 Hz
- 12 9V P-P 60 Hz
- 13 9.2V P-P 15.75 KHz
- 14 12.4V P-P 15.75 KHz
- 15 11.2V P-P 15.75 KHz
- 16 1.1V P-P 15.75 KHz
- 17 27V P-P 15.75 KHz
- 18 7.2V P-P 15.75 KHz
- 19 100V P-P 15.75 KHz



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- 5 OHMS
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- 8 AC VOLTS
- 7 OHMS
- 6 Low Power
- JUNCTION TEST

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