

SEPTEMBER 1974

75 CENTS

# ELECTRONIC TECHNICIAN/DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

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## Precision Tuner Service



now available near you

<p><b>ALABAMA:</b> 524 32ND STREET SOUTH BIRMINGHAM, ALA. 35222 TEL. 205, 323-2657</p>	<p><b>CALIFORNIA—NORTH:</b> 4611 AUBURN BLVD. SACRAMENTO, CALIF. 95841 TEL. 916, 482-6220</p>	<p><b>CALIFORNIA—SOUTH:</b> 5111 UNIVERSITY AVE. SAN DIEGO, CALIF. 92105 TEL. 714, 280-7070</p>	<p><b>COLORADO:</b> 4958 ALLISON ST. ARVADA, COLO. 80001 TEL. 303, 423-7080</p>	<p><b>FLORIDA—NORTH:</b> 1918 BLANDING BLVD. JACKSONVILLE, FLA. 32210 TEL. 904, 389-9952</p>	<p><b>FLORIDA—SOUTH:</b> 12934 N.W. 7th AVE. MIAMI, FLA. 33168 TEL. 305, 685-9811</p>	<p><b>HOME OFFICE—INDIANA:</b> 5233 S. HWY. 37 BLOOMINGTON, INO. 47401 TEL. 812, 824-9331</p>	<p><b>KANSAS:</b> 3116 MERRIAM LNE. KANSAS CITY, KANSAS 66100 TEL. 913, 831-1222</p>
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## LET US TAKE CARE OF YOUR TUNER PROBLEMS...

PTS will repair any tuner—no matter how old or new—black & white or color—transistor or tubes—varactor or electronically tuned—detent UHF. 8 hour service is a must!

### ...THIS IS THE SERVICE WE OFFER:

1. Fastest Service—8 hour—in and out the same day. Overnight transit to one of our strategically located plants.
2. Best Quality—Your customers are satisfied and you are not bothered with returning tuners for rework.
3. PTS uses only ORIGINAL PARTS! No homemade or make-do, inferior merchandise (this is why we charge for major parts!). You get your tuner back in ORIGINAL EQUIPMENT condition.
4. PTS is recommended by more TV Manufacturers than any other tuner company.
5. PTS is overhauling more tuners than all other tuner services combined.

**Fast 8 hr. Service!**

**We offer you finer, faster...**

## 1 YEAR GUARANTEE

VHF, UHF	\$10.95
UV-COMBO	17.95
IF-SUBCHASSIS	12.50

Major parts and shipping charged at cost. (Dealer net!)

Over 4000 exact tuner replacements available for \$14.95 up (new or rebuilt)

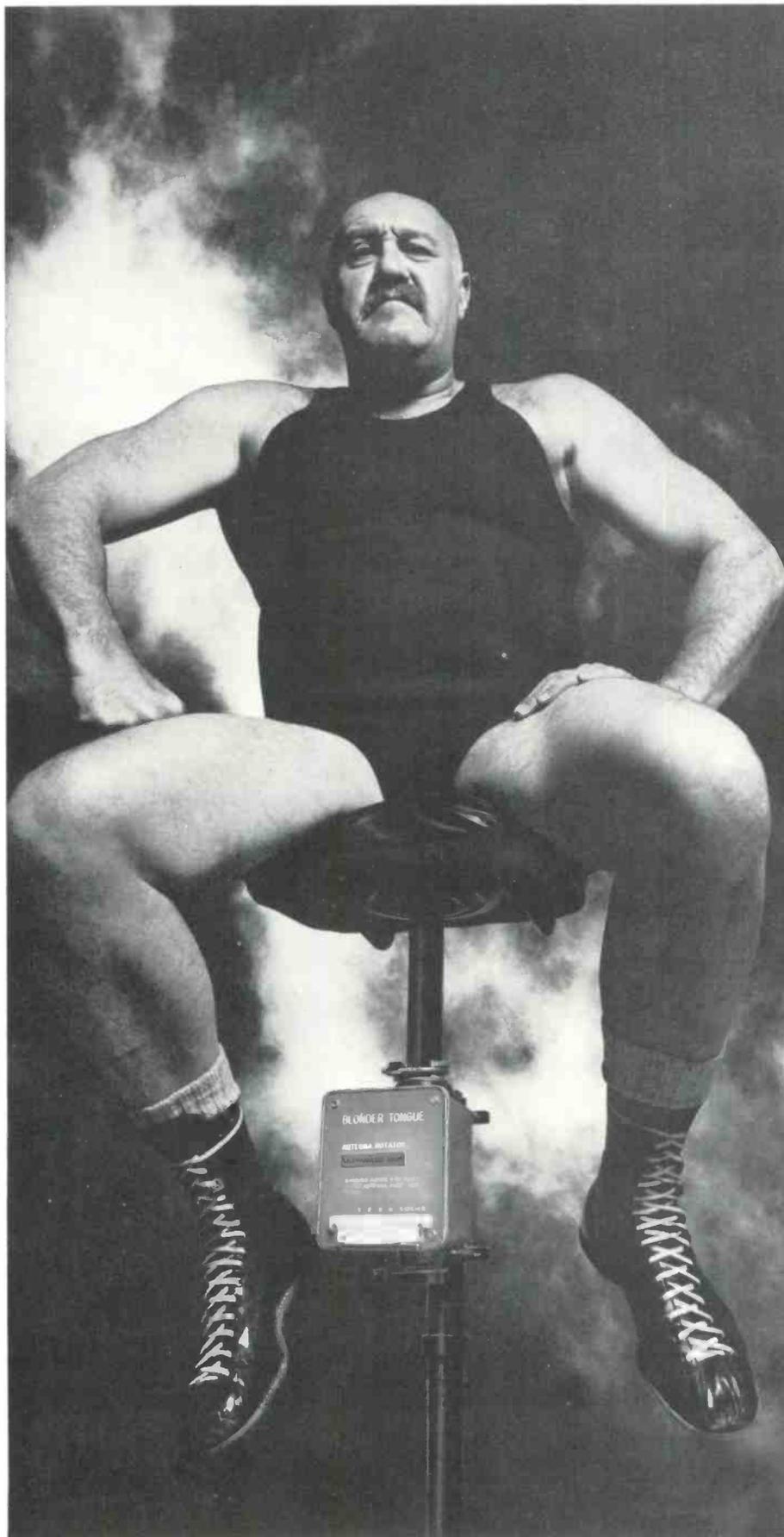
... Precision Tuner Service



ELECTRONICS, INC....

...Number ONE and still trying harder!  
(Not a Franchise Company)

# Think of him as a 250lb. antenna.



We know you don't have a 250lb. antenna.

But when the winds get rough, you need every bit of turning power an antenna rotor can muster. The new, super power Blonder-Tongue ULTRAMATIC 1000 gets the antenna to the precise point for each station, consistently, accurately.

And, by doing this, it gives the best reception by assuring ghost-free color reception and minimum multipath stereo-distortion.

These exclusive features make it all possible:

*Highest starting and running torque* (175 to 200/inch lbs.)  
—motor uses filtered DC power supply.

*Accurate 2-degree resetting*  
—push-to-start silent control; unique direction sensing circuit utilizing five wire control cable; differential servo sensing amplifier with solid-state switching; hermetically-sealed power relay automatically disconnects rotor when not in use.

*Reliability*—weatherproof terminals use foam-filled pad; long-life, self-lubricated Celcon gears; bronze worm gear and high strength sintered steel ring gear lock antenna in position; corrosion-proof cast aluminum housing; fully protected against lightning and power surges; unbreakable plastic control box.

Install the ULTRAMATIC 1000, it performs well under the most adverse conditions and will stand up for years and years.

Blonder-Tongue Laboratories, Inc., One Jake Brown Road, Old Bridge, N.J. 08857.

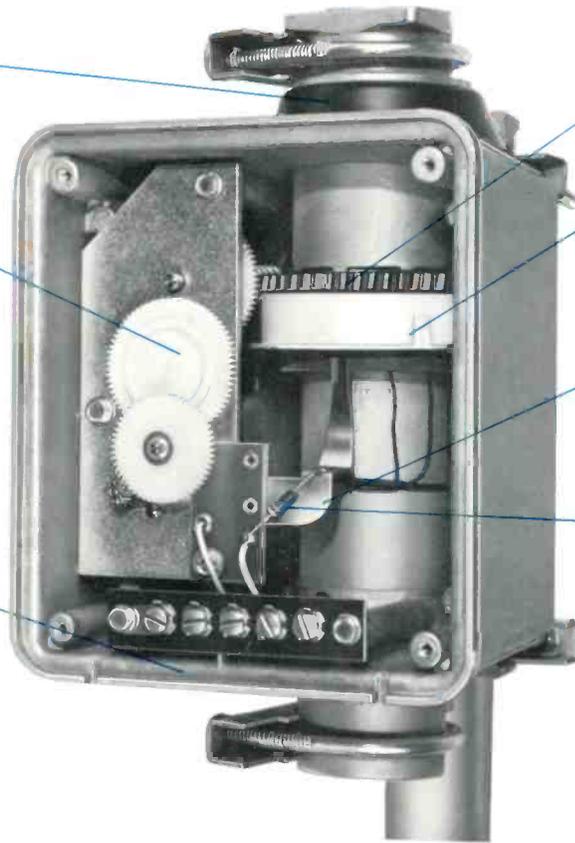


**Blonder-Tongue  
Ultramatic 1000**

Made in U.S.A.

# Blonder-Tongue Ultramatic 1000

- Seamless stainless steel thrust bearings tested for 350-lb. load (no external thrust bearings required).
- Extra strong space age Celcon gears—no lubrication needed.
- Short circuit proof—shorts and/or grounding of terminals will not burn out unit—even on initial installation.
- Built-in strain relief and weather seal gasket.
- Uses 5-wire control cable for true servo-controlled 2° accuracy.



- Naval bronze worm gear for high strength positive drive.
- Epoxy-sealed potentiometer assembly for unsurpassed repeatability and extra long operating life.
- Phosphor bronze contact assembly for high accuracy, superior dependability, and long wear-free operation.
- Rock steady, lifetime direction indicator circuit.
- Temperaturized for operation from -30° F to +140° F.

## Unbreakable Control Box

Decorator styled control box is designed with ease-of-operation in mind. Simply turn the control knob and press it, the antenna automatically turns to the direction selected. The control dial is illuminated during operation and is extinguished when the antenna reaches the selected position. Channel markers are provided to mark the location of TV and FM stations on the dial.



## Installation Information

Mast diameters up to 1½ inches can be accommodated. Mast and control units are connected together with five conductor cable and can be separated by as much as 500 feet when 18 gauge wire is used. Twenty gauge wire can be used for distances up to 200 feet.

### Mechanical Specifications

#### MAST UNIT

**Housing:** die cast aluminum

**Weight:** 4.5 lbs.

**Hardware:** Rust resistant mast-mounting

#### CONTROL UNIT

**Housing:** Beige and brown high impact polystyrene, with brushed gold compass face

**Weight:** 2 lbs.

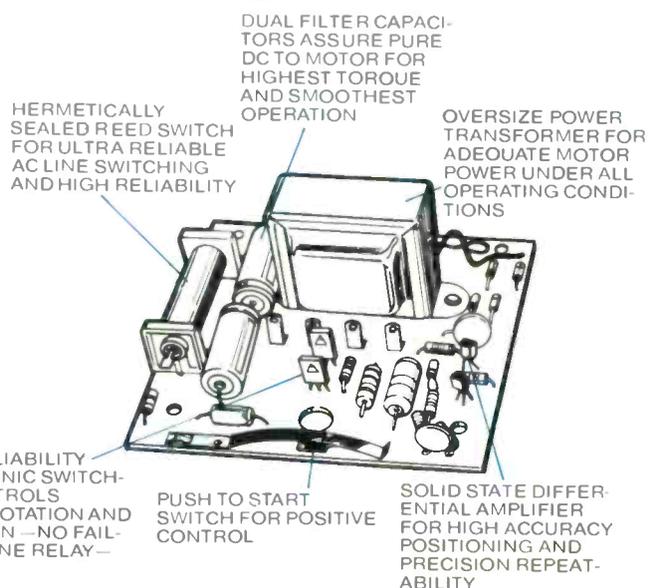
### Electrical Specifications

**Power Requirement:** 117 VAC, 0.3A

**Transistor and diode complement:**

Two transistors, six diodes, two SCR's

**Current on cable between mast and control units:** 1.0 amp, maximum



# Now you can get "XR" glass tubes in our economy line.

You know the EIA guidelines. Replace like with like.

That used to mean that all you could offer in "XR" glass tubes were the all-new, more expensive types.

Now, Sylvania has changed all that.

We've added 19 of the "XR" glass types to our Color Screen 85 economy line, and another 5 types to our medium price Color Bright 85® RE line. You can tell them by the

"V" designation in the type number. For example 23 VANF22. And of course, you've got all types in our Color Bright 85® "XR" new tube replacement line.

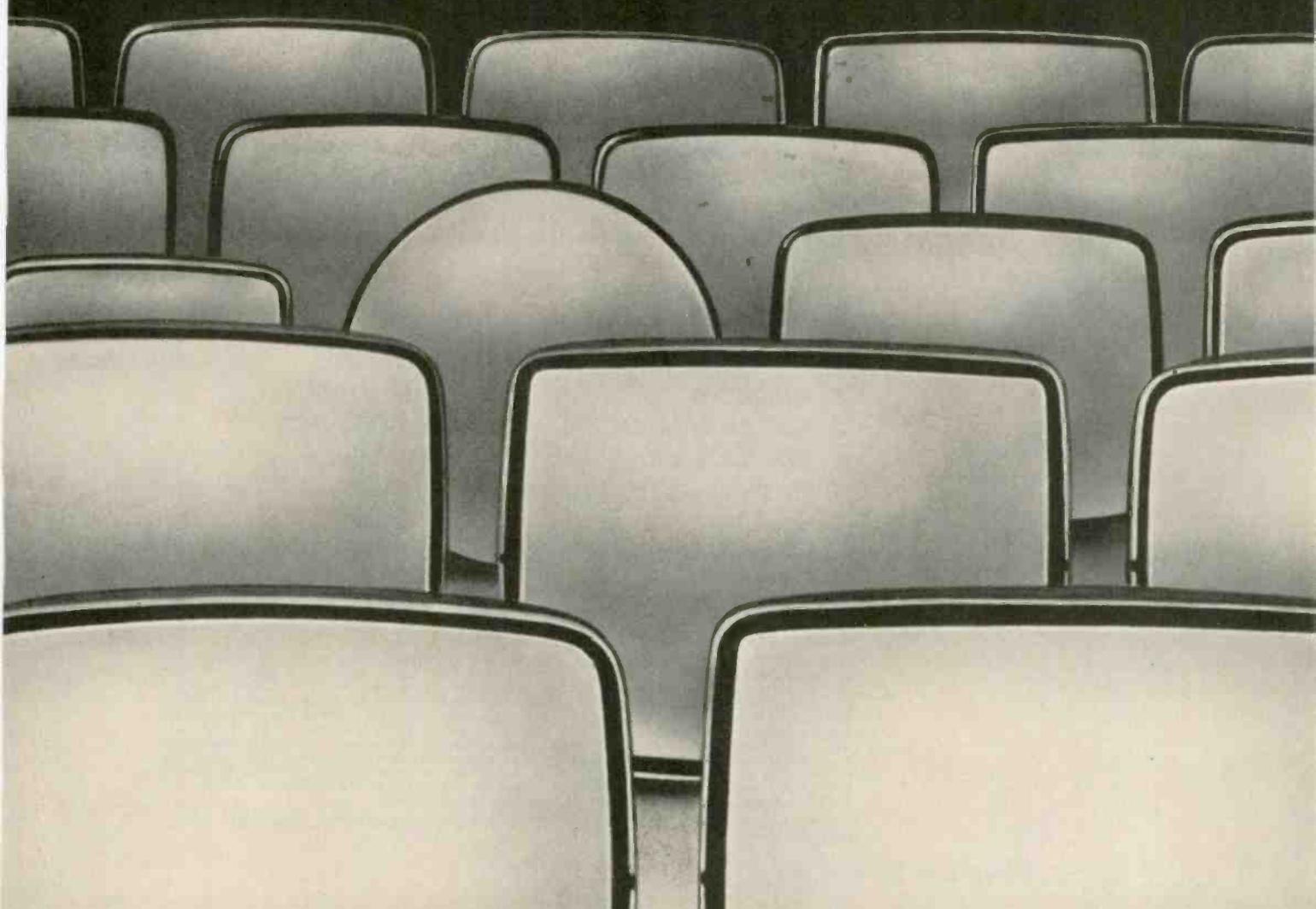
Three lines to offer. Three prices to offer.

That should eliminate a lot of your customer's inhibitions.

Electronic Components Group, GTE Sylvania, 100 First Avenue, Waltham, Mass. 02154.

Another first from the leader

**GTE SYLVANIA**



# ELECTRONIC TECHNICIAN/DEALER

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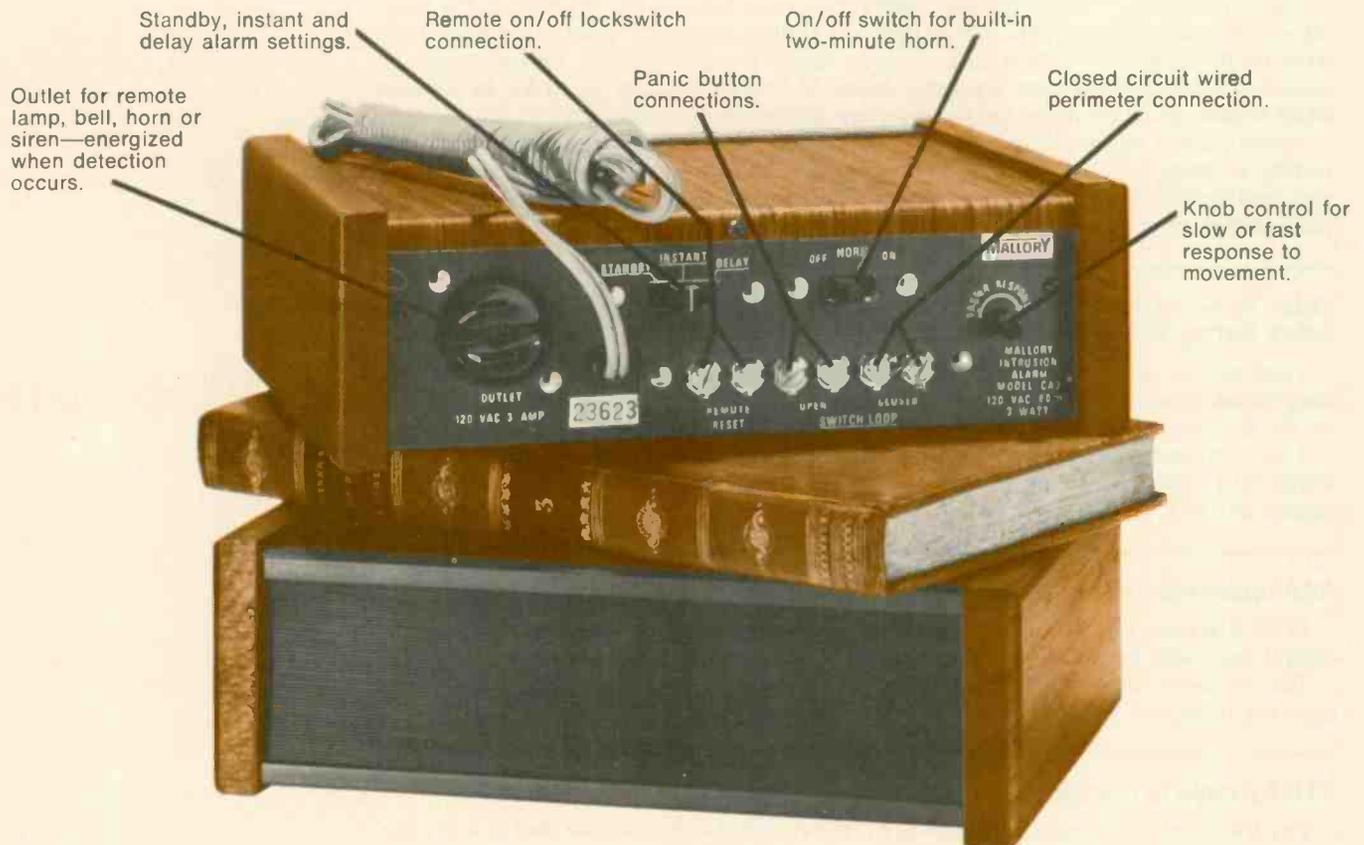
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POSTMASTER: Send form 3579 to ELECTRONIC TECHNICIAN/DEALER, P.O. Box 6016, Duluth, Minnesota 55806.

# The new Mallory CA3 Intrusion Alarm.

## Reliable.



## (And inconspicuous.)

This area-and-perimeter device creates and transmits an ultrasonic wavelength field for detection up to a distance of 20 feet. And because of its modern design and walnut-grain finish, the CA3 is attractive and inconspicuous enough to pass as a radio or stereo tuner.

Virtually any movement by an intruder (or a break in the perimeter circuit) activates the built-in horn and the remote outlet for two minutes. An automatic

reset handles the possibility of a new or renewed intrusion. And special CA3 circuitry guards against false alarms from line transients and insects. A variety of companion indoor or outdoor accessory devices is available.

The Mallory CA3 Ultrasonic Intrusion Alarm. From the manufacturer of the most complete line of do-it-yourself security products. Another sound reason to see your Mallory distributor today.

### MALLORY

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SEPTEMBER 1974, ELECTRONIC TECHNICIAN/DEALER | 5

# NEWS OF THE INDUSTRY

## **NATESA's Executive Director Blasts Warranty Lengths and Rates**

Frank Moch, executive director of the National Alliance of Television and Electronic Service Associations (NATESA), in a speech to conventioning members of the Florida Electronic Service Association in Miami on June 22, voiced strong disapproval of the length of consumer electronic warranties and the service labor rates paid by manufacturers for in-warranty servicing.

In his argument for shorter warranty periods, Moch said, "Studies reveal that TV sets, for instance, are used on the average of at least 500 hours in 90 days, and this should be adequate to reveal inherent problems, and only sets of questionable quality need longer warranties."

Citing reasons for "more realistic" warranty service labor rates, Moch said, "A basic fallacy of warranty purveyors is that they are entitled to special rates that ignore fully costs of doing business. Warranties at least imply that service will be performed by capable craftsmen. How then can rates, based on hourly wages of \$2 to \$3, be justified when routine glass installers, for instance, are getting \$9 plus per hour?"

"Since service businesses must compete with other employers for manpower, anyone worthy of being called a technician should expect rock bottom (pay) of \$5 per hour, and well qualified technicians are worth \$7.50 and up. Under rule of thumb, such (technician) wages project to \$15.00 to \$30.00 per hour at retail."

---

## **Color TV Sales to Dealers Up in June after Sluggish Sales During First Five Months of 1974**

Total market sales of color TV to dealers in June of this year were 3 percent over sales in the same month in 1973, according to statistics compiled and released recently by the Marketing Services Department of the Electronic Industries Association (EIA).

This comparative increase followed a sluggish five-month (Jan.-May) period during which total color TV sales were down 7 percent compared to sales during the first five months of 1973.

---

## **RCA Increases Receiving Tube Prices**

RCA Electronics Components has increased the prices of its entertainment and industrial receiving tubes marked principally for replacement applications.

The increases, which became effective on August 1, average 3.3 percent for entertainment tubes and 13 percent for industrial types.

---

## **GTE Sylvania to Increase Prices of Color CRT's**

The Electronic Components Group of GTE Sylvania has announced that it will raise the prices of replacement color TV picture tubes, effective Sept. 16.

The price increase of \$5.50 per tube is the result of rising costs of labor and materials, according to a GTE Sylvania spokesman. Prices of black-and-white picture tubes are not affected.

---

## **American Home Magazine Advocates Mandatory Licensing of TV and Appliance Technicians**

*American Home* magazine, in an editorial in the August issue, advocated mandatory state licensing of appliance, TV and radio technicians throughout the country.

"Something radical *must* be done to assure that your repair dollars are being well spent—and that when incompetency or fraud is suspected, your complaints, if justified, can quickly turn into legal action," asserted the editorial.

The following requirements for licensing were suggested by *American Home*:

"A service dealer would have to demonstrate competency, submit to an inspection of his facilities, post bond (against possible litigation), pay an annual fee and adhere to standards set by an advisory board (probably representing the consumer interests as well as the appliance and electronic repair industry).

"Also, the repairman would be required to provide a written estimate of the cost of labor and parts, if the customer requested it, and not exceed that estimate without the customer's permission. When the job is completed, the repairman would have to issue an itemized invoice describing all work performed and parts installed, and return replaced parts to the customer.

"The service dealer would be subject to stiff fines and the suspension or revocation of his license, if found guilty of negligence or fraud," the editorial stated. ■

# It's a rip-off.

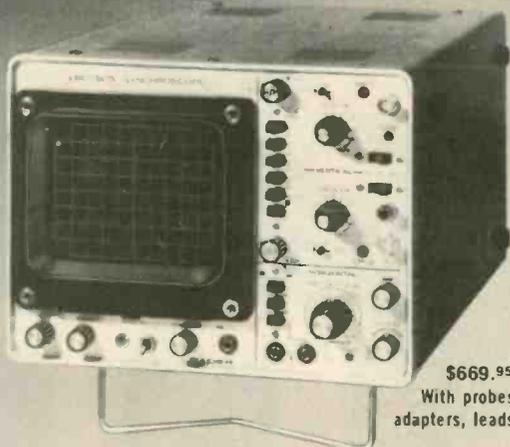


Rip 'em off and save 'em up. Now the "Waltham" address tabs on our entertainment receiving tube boxes are exchangeable for valuable awards. See your Sylvania distributor for details. Or write now to Sylvania SAV-A-TAB Program, Sylvania Award Headquarters, P.O. Box 1000, Fenton, Missouri 63026.

**GTE SYLVANIA**

# LEADER... outduels them all!

LBO-505  
5" DUAL TRACE  
DUAL CHANNEL  
TRIGGERED SCOPE



\$669.<sup>95</sup>  
With probes,  
adapters, leads.

Compact, economical, solid state accuracy. For prod'n, field maintenance, quality control, lab, design & testing.

Features —

- 15MHz bandwidth
- Trig. & auto. sweep — from 100 nanosec/cm (10X mag.) to 0.5sec/cm, 17 steps calibr'd.
- AC/DC coupling per chan.
- Separate or simultaneous sweep display of ch 1 & 2 — alternating, chopped, algebraically added & vector (X-Y).
- 10mVp-p/cm vert sensitivity.
- Cont. scale illumination w/front panel control.
- 7<sup>3</sup>/<sub>8</sub>"H x 9<sup>7</sup>/<sub>8</sub>"W x 15"D, 14 lbs.

"Put us to the test"

**LEADER**  
INSTRUMENTS CORP.

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

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Space contributed to help serve the personal needs of you, our readers.

### Business for Sale

Complete electronic service business with great opportunity for expansion. Complete Sams Photofacts and a number of test instruments. Please write for details.

LARRY'S ELECTRONICS  
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Well equipped TV shop with good business. Large home on the same lot for sale or lease with beauty shop attached. Must sell due to age and health. Write for details.

BEN'S TV SERVICE  
4030 Nile St.  
Bakersfield, Ca. 93306

### Schematic Needed

Schematic for a Musical Intercom System, Model 999.

P. D. LUND  
291 E. Arrow Hwy  
Upland, Ca. 91786

Schematic for Japanese 12-inch, all-solid-state TV, brand name: Sun Mark Model SM-12-TV (SM12-TV).

S. M. PEARLMAN  
25 Wolcott Road  
Lynn, Mass. 01902

### For Sale

Riders TV Manuals 1 through 21.  
ALBERT KAYE  
114A Sumner Ave.  
Brooklyn, N.Y. 11206

Jud Williams Model A Curve Tracer. Will accept any reasonable offer.

JOHN W. BEHRMAN  
212 Meffan Ave.  
Nampa, ID 83651

Sylvania EO1 color TV chassis for sale, with pushbutton tuner, yoke, color convergence board.

CHARLES TV  
2033 McGraw Ave.  
Bronx, N.Y. 10462

Riders Radio Manuals 8 through 23 and Riders TV Manuals 1 through 26 with index. Also, one Simpson Genescope Model 480 with manual.

LANSING RADIO & TV  
3414 Ridge Road  
Lansing, Ill. 60438

# WAHL® QUICK CHARGE CORDLESS SOLDERING IRON

We couldn't make the best better.  
So we made it three times faster.

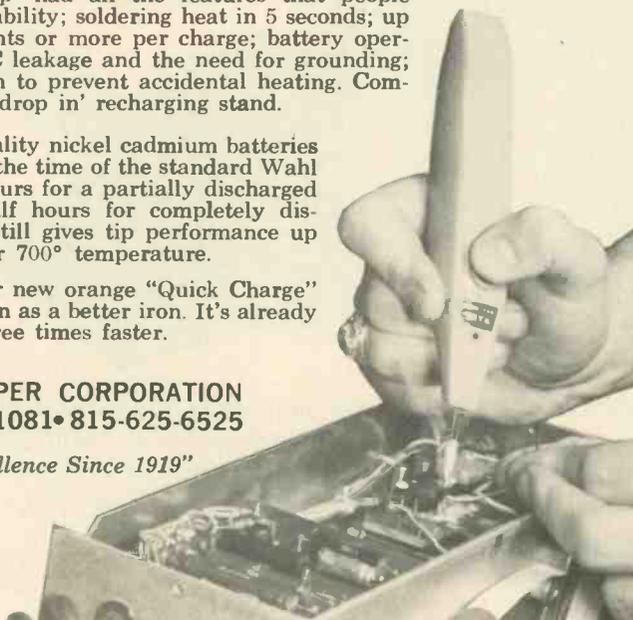
Our original 'Iso-Tip' had all the features that people need: complete portability; soldering heat in 5 seconds; up to 125 electronic joints or more per charge; battery operated to eliminate AC leakage and the need for grounding; and "lock off" switch to prevent accidental heating. Complete with separate 'drop in' recharging stand.

We use premium quality nickel cadmium batteries that recharge in 1/3 the time of the standard Wahl iron — one to two hours for a partially discharged unit, four and a half hours for completely discharged battery. It still gives tip performance up to 50 watts and over 700° temperature.

So don't think of our new orange "Quick Charge" cordless soldering iron as a better iron. It's already the best. It's just three times faster.

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Sterling, Illinois 61081 • 815-625-6525

"Manufacturing Excellence Since 1919"



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Riders Perpetual Troubleshooters Manuals, complete set with indexes, and Riders P.A. Manual Volume 1 with index.

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160 Maple Street  
Brooklyn, N.Y. 11225

Precision VOM Model 844, RCA Voltohmyst Model 65A, Lafayette Transistor Analyzer Model 223, R.C.P. Bench VTVOM Model 662. All complete with leads and instructions.

FRANCIS J. CHAFFERS  
7337 113 St. N.  
Seminole, Fla. 33542

Riders Radio & TV Manuals; also Wallace Telaides for all makes of TV. TROCH's TV  
290 Main Street  
Spotswood, N.J. 08884

### Wanted

Sams Photofacts, Transistor Radio Series.

LEROY E. MARCHAND  
American Lake, Wash. 98493

Power transformer for a Zenith TV chassis 16K302; Zenith Part No. 95-2060.

SID CREACEY  
308 Bond St.  
Redlands, Ca. 92373

Muntz tape players and recorders with the following model numbers: A-12, M-60, AR-500, and HW-512. State price and condition.

S. A. ELOSH, JR.  
231 Gladstone  
Campbell, Ohio 44405

RCA KRK66AM UHF tuner in operating condition with installation notes.

LLOYD E. ST. JEAN  
106 Eddy Drive  
Huntington Sta., N.Y. 11746

### Free Technical Training

Free courses in basic electronics, radio, black and white TV, color TV and solid-state devices, sponsored by the New York City Board of Education, will be offered at the William E. Grady Evening Trade School, located at 25 Brighton 4th Road, Brooklyn, N.Y. 11235, telephone DE 2-5000.

The courses are designed to upgrade the technical competency of adults employed in the electronic field. Persons interested may register at the school on Monday and Tuesday, Sept. 9 and 10, 1974, from 7:00 to 9:00 p.m. ■

# THE ONLY COLOR SET YOU SHOULD TINKER WITH



It takes more than tools to be a TV service technician. It requires know-how, especially with a color TV set. Some "do-it-yourselfers" actually do more harm than good... and wind up paying more money for repairs or adjustments than they would have if they called their local TV technician at that first sign of trouble. So don't play with that color set. Tinkering can be dangerous as well as expensive. Call your independent TV technician for safety as well as satisfaction.

**THIS MESSAGE WAS PREPARED BY SPRAGUE PRODUCTS COMPANY,  
DISTRIBUTORS' SUPPLY SUBSIDIARY OF SPRAGUE ELECTRIC COMPANY, NORTH ADAMS, MASSACHUSETTS FOR ...  
YOUR INDEPENDENT TV-RADIO SERVICE DEALER**

## PUT THIS BUSINESS-BUILDING TRAFFIC-STOPPER ON YOUR SHOP WALL OR IN YOUR WINDOW

See your Sprague Distributor for window-size blow-ups of this message. Or, send 25¢ to Sprague Products Co., 65 Marshall St., North Adams, Mass. 01247 to cover handling and mailing costs. Just ask for Poster RP-42.

THE BROAD-LINE PRODUCER OF ELECTRONIC PARTS

**SPRAGUE**  
THE MARK OF RELIABILITY

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SEPTEMBER 1974, ELECTRONIC TECHNICIAN/DEALER | 9

# Why pay more for the Quantum?

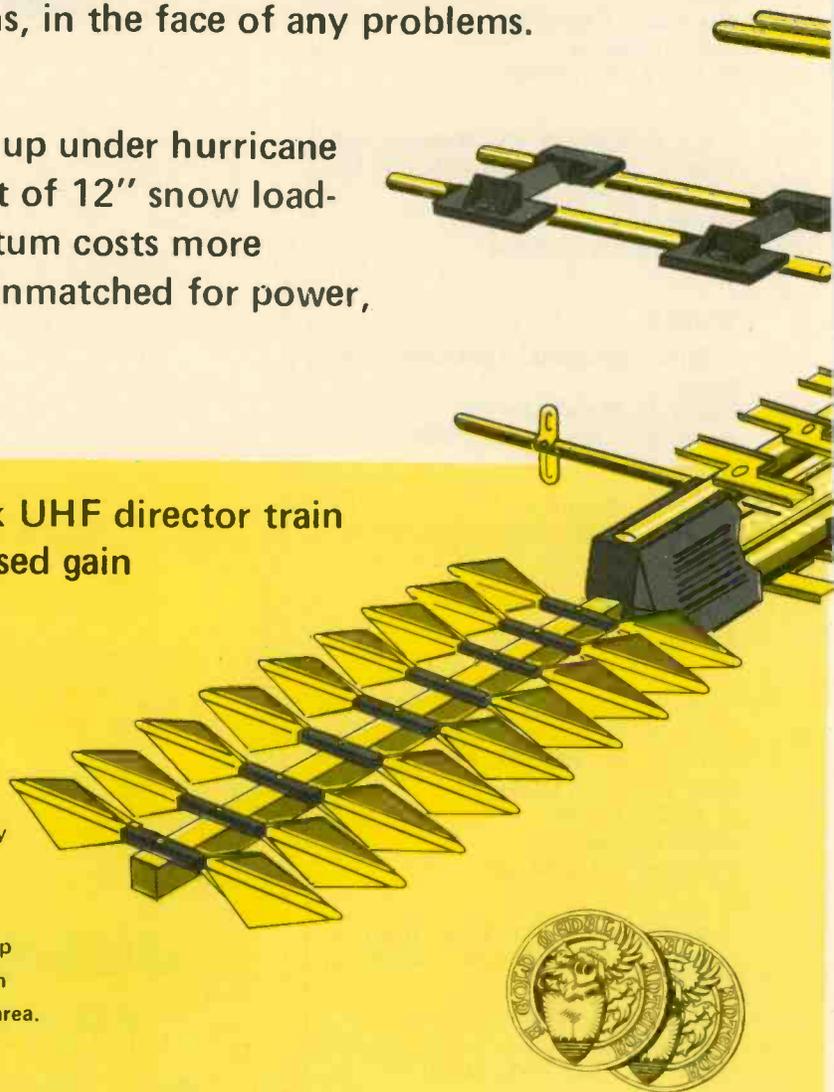
Because the Channel Master Quantum is the most highly engineered reception system available today! It uses the finest state of the art technology to provide superior color and black and white reception under any conditions, in the face of any problems.

Massively engineered to stand up under hurricane force winds and the equivalent of 12" snow loading, the Channel Master Quantum costs more because it delivers more. It's unmatched for power, directivity and flexibility!

The bold new diamond back UHF director train provides significantly increased gain ---along the entire band--- than previous Quantum models did at specific channel settings.

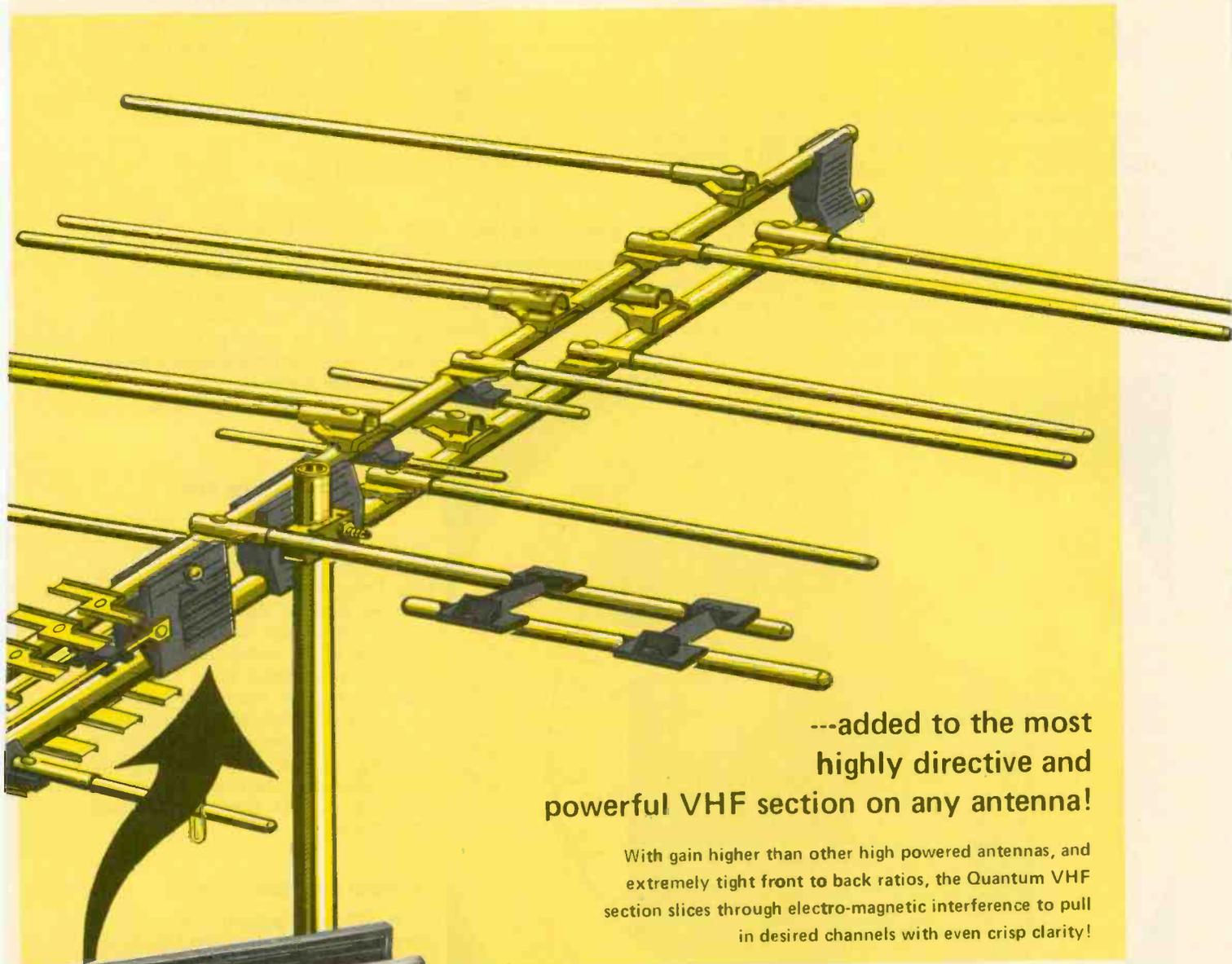
UHF tabs used on VHF directors eliminates any possibility of signal interaction between the two bands.

The result is a sparkling new level of crisp, sharp color and black and white performance through random channel assignments within any given area.



The new *Channel Master* Quantum  
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---added to the most highly directive and powerful VHF section on any antenna!

With gain higher than other high powered antennas, and extremely tight front to back ratios, the Quantum VHF section slices through electro-magnetic interference to pull in desired channels with even crisp clarity!



And for added flexibility... Custom engineered accessories slip into the Quantum's weather protected terminal housing to handle any problem you're likely to face----

- For melting snow in weak signal areas, modular solid state amplifiers provide up to 15dB gain, with switchable FM traps. (models 0093-0096)
- Where FM is a problem, the Quantum's optional solid state FM trap attenuates interfering signals by as much as 25dB (model 0091)
- For 75 ohm mounting, use the Quantum's optional balun/matching transformer. (model 0089)

... for more details circle 105 on Reader Service Card

## TECHNICAL LITERATURE

### Semiconductor Replacements

A 20-page supplement of its ECG semiconductor replacement guide is now available, adding 11,000 type numbers to the total number of units which can be replaced by the ECG line. The line covers every major segment of the entertainment, commercial, and industrial replacement markets and includes transistors, integrated

circuits, diodes and rectifiers, special-purpose devices, and transistor and IC accessories. The supplement brings the total number of foreign and domestic semiconductors cross-referenced to the ECG line to nearly 90,000. The replacement guide may be obtained from GTE Sylvania electronic component distributors.

### Public Address Sound Systems

An illustrated, 6-page catalog describes the complete line of Ampli-Vox equipment covering almost all applications for portable sound systems. Spe-

cializing primarily in flashlight battery operated complete public address systems, it offers seven distinct systems. Also listed is a comprehensive range of accessory items. Perma Power, 845 Larch Ave., Elmhurst, Ill. 60126.

### Wire and Cable

A new, 8-page, 3-color catalog of the complete Jersey line of wire and cable products is now available. Included are illustrations and descriptions of coaxial cable, rotor wires, parallel cord and speaker wire. Details given on each product include AWG, insulation and standard packaging. Jersey Specialty Co., Inc., Burgess Place, Box 248, Wayne, N.J. 07470.

### Electronic Servicing Aids

A 16-page catalog of electronic technician servicing aids—featuring the RCA Industry Compatible Test Jig Program—is now available. This catalog explains the RCA ICTJ program, which can accommodate the majority of TV makes and models that have been marketed since TV became commercial. The manual includes seven pages of photos to help identify the cables and adapters utilized with the test jig, as well as a comprehensive cross-reference chart. RCA Parts and Accessories, P.O. Box 100, Deptford, N.J. 08096.

### General Line Components

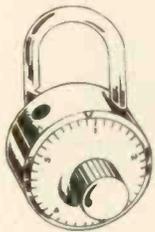
A 52-page general line catalog, designated GL-4, describes broad lines of RF connectors, coaxial connectors, microphone connectors, tube/relay sockets, and plugs. It features a comprehensive page-referencing index to all components described to help make specification and ordering easier than ever before. It also offers detailed information on all featured products, including complete mechanical characteristics, dimensional line drawings and mounting hole dimensions. The catalog is available at Amphenol general line distributors.

### Tool Kits

A 12-page catalog of tool kits designed for maintenance, assembly, and repair of the electronic, electrical, vending, computer, relay, appliance, office machine and similar equipment is now available. It describes 18 different stock, fully equipped tool kits, and shows 13 tool cases that can be ordered empty or custom filled with a choice of tools, meters, parts containers, etc. The catalog provides listings of all the tools that are most useful to



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installers, technicians, and maintenance personnel. Electronic Tool Co., 15 Bertel Ave., Mount Vernon, N.Y. 10550.

### Communications Line

An 8-page catalog, No. 2721-C, describing an entire line of communication microphones is now available and includes several recently developed models. Turner Division of Conrac Corp., 909 17th St., N.E., Cedar Rapids, Iowa 52402.

### Tubes, Semiconductors and IC's

A 64-page, 1974-75 price list covering more than 25,000 types of electron tubes, semiconductors and integrated circuits is available. More than 100 brands are included. Virtually all American types and the most popular proprietary European and Japanese types are listed. JSH Electronics, Inc., 8549 Higuera St., Culver City, Ca. 90230.

### Thyristors and Rectifiers

A completely revised 36-page catalog that describes over 500 RCA thyristors and rectifiers. "Thyristors/Rectifiers," THC-500D, lists RCA thyristors (triacs, SCR's and ITR's), diacs and rectifiers. Data is given for JEDEC (1N- and 2N-) types, other RCA commercial types, and RCA developmental types. This catalog uses the new type-numbers that have been adopted for all non-JEDEC RCA thyristors and rectifiers. For the user's convenience, the "old" numbers are included in the index and a cross-reference guide that relates "old" type numbers to the new numbers that replace them is also provided. RCA Solid-State Division, Box 3200, Somerville, N.J. 08876.

### Electronic Instruments

The free, 208-page, 1974-75 Leasametric Instrument Databook gives spec-by-spec comparisons of over 5,200 electronic test instruments. Over 64 pages have been devoted to rental and lease information wherein one, two and three month rental rates are presented. Used prices are also given and constitute the "blue book" of the used-equipment market. Leasametric, 822 Airport Boulevard, Burlingame, Ca. 94010.

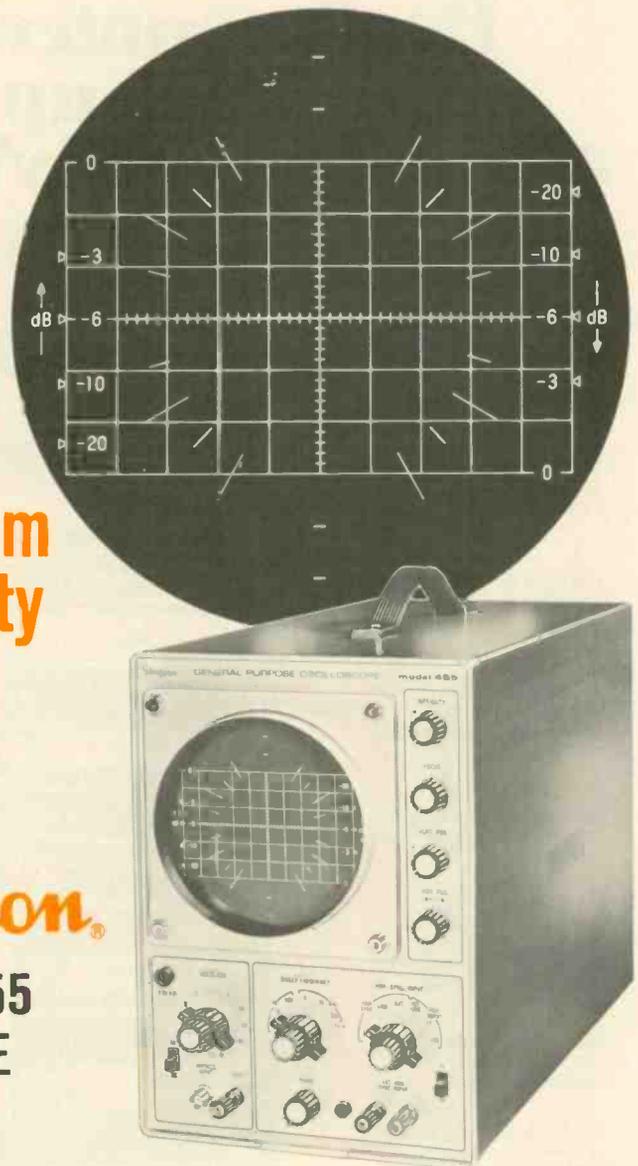
### Security Products

A 16-page catalog covers security products for the home, apartment and auto. Securitex, 831 West 39th St., Kansas City, Mo. 64111. ■

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<p><b>Heath Company</b> Dept. 199-9 Benton Harbor, MI 49022</p> <p><input type="checkbox"/> Please send the new 1975 Heathkit catalog. <input type="checkbox"/> Please send latest Assembled Instruments catalog. <input type="checkbox"/> Enclosed is \$_____ plus shipping. Please send model(s) _____</p> <p>Name _____ Address _____ City _____ State _____ Zip _____ Prices &amp; specifications subject to change without notice. *Mail order prices; F.O.B. factory.</p>	<p>HEATH <b>Schlumberger</b></p>
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## TECHNICAL DIGEST

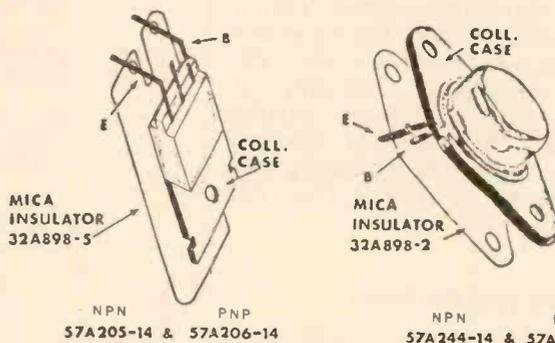
The material used in this section is selected from information supplied through the cooperation of the respective manufacturers or their agencies.

### ADMIRAL

#### Color TV Chassis M24/M25/M30—Vertical-Output Transistors

Vertical-output transistors with two different case styles were used interchangeably in production of the M24, M25 and M30 chassis. There is no electrical difference between the case styles; either may be used to replace the other.

The mica insulator packed with the replacement must be used when replacing one case style with the other. Be sure to apply silicone grease to both sides of the new insulator to insure maximum heat transfer to the sink. Make sure that the insulator is undamaged and that there are no



burrs or foreign particles on any of the mating surfaces that might damage the insulator or prevent proper seating of the transistor.

It is also important that the mounting screw(s) be tightened sufficiently to position the transistor in firm contact with the insulator and, in turn, with the heat sink.

The above precautions apply to all power transistors which are mounted on heat sinks.

### PHILCO-FORD

#### Monochrome TV 19-inch Models—Picture Tube Mounting Ring Removal

The front mounting ring or wire band which holds the 19-inch picture tube to the cabinet front is secured by a coil spring which maintains tension on the ring. This spring must be compressed to relieve the tension during picture tube replacement. However, standard pliers present a problem of slipping off the compressed spring.

Although "special" tools are available with which to compress the spring, such as the type of pliers used to compress automotive brake springs, the following method using readily available hardware can also be used:

Obtain a 3/16-inch nut and a bolt approximately 2 1/2 inches long (hex or slotted head). (The type of bolt used to secure the mounting ring on small-screen sets can be used.) Insert the bolt through the spring from the bottom, mount the nut, and tighten until the spring compresses and the mounting ring is loose. This arrangement also will safely hold the spring compressed during remounting of the new picture tube. ■

## MOVING?

Be sure to let us know your new address. Please enclose a complete address label from one of your recent issues.

## ELECTRONIC ASSOCIATION DIGEST

Information about the activities of national, state and local associations of electronic servicers, dealers and manufacturers. Material for publication in this department should be addressed to: Service Association Digest, ET/D, 1 East First St., Duluth, Minn. 55802.

### NESDA Terminates Contract with Electronic Service Dealer Magazine

The House of Representatives of the National Electronic Service Dealers Association (NESDA), in a special session in San Antonio, Texas, in April, terminated its contract with *Electronic Service Dealer Magazine* (ESD), under which that monthly magazine had functioned as the official publication of NESDA since 1960.

Commenting on the termination in an editorial in ESD, Donald J. Martin, publisher and editor, said: "With the termination of our contract we hope that something will take its place and that there will, indeed, be an organized service industry. Many of the leaders have faded from the picture with time and have been replaced to a certain degree. The exact extent of this replacement, it seems to me, is still suspect. . . . ESD has always been a labor of love and a fight for what is right. It seems the industry, or at least NESDA, doesn't need this help any longer."

NESDA has announced plans to publish a NESDA-owned magazine.

### Conventions

The Arizona State Electronics Association has announced that its second annual convention will be held Sept. 27-29 at the Francisco Grande Hotel in Casa Grande, Arizona.

The Oregon Television Service Association and the Washington State Electronics Council will hold a joint Convention Sept. 27-29 at the Lamplighter Lodge in Spokane, Washington.

### NESDA Business Management Coordinator Resigns

Les Nesvick, Business Management Coordinator for the National Electronic Service Dealers Association (NESDA), has announced his resignation from that post.

The reason for his resignation reportedly is that the NESDA Business Management Program could not financially support a full-time manager.

### NESDA Executive Vice President Testifies Before Federal Commission Examining Causes of Consumer Electronic Fires

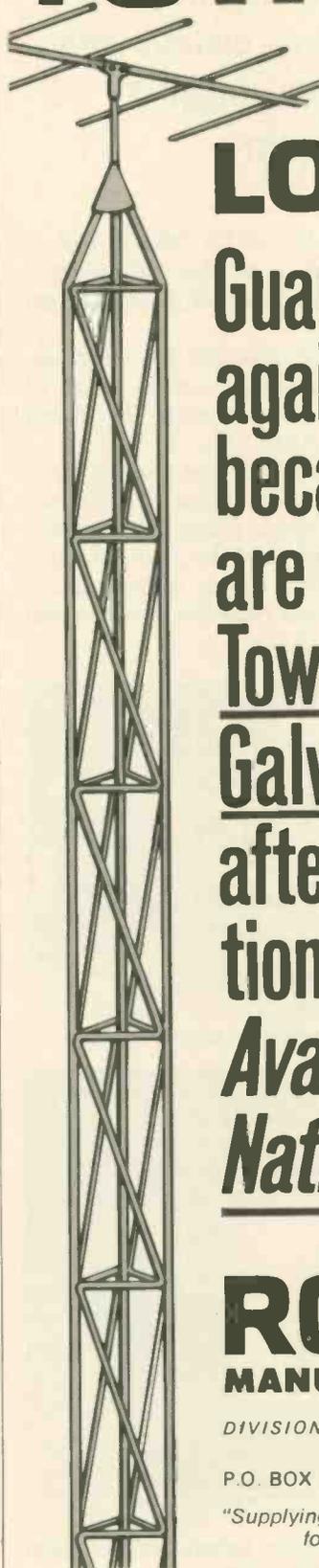
Richard L. Glass, executive vice president of the National Electronic Service Dealers Association (NESDA), recently testified about TV fires before the Consumer Product Safety Commission, which is gathering information on which it will base mandatory rules for the incorporation of safety features in TV receivers.

Glass told the Commission that consumer negligence can sometimes contribute as much to TV fires and shock hazards as the design of the receiver.

Glass also told the Commission that a build-up of grease and dust in older sets can cause fires. Citing other causes not related to design, he told of one case in which a pet monkey dumped a vase of water on a set, causing a fire, which then was spread as "the monkey jumped around setting the drapes on fire."

"Even mice have been known to short out TV receivers," commented Glass. ■

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# New in Color TV for 1975 - Part 1

More all-electronic tuning devices and modular solid-state chassis with in-line picture tubes highlight TV lines for the coming year

■ Despite color TV sales being off for the first part of 1974, predictions are that close to nine million units will be sold by year's end, slightly under the ten million sold last year.

Reflecting the rising costs of labor and raw materials, along with stiffening competition, the retail prices of most color TV sets for 1975 are about 5-10 percent above comparable models of last year.

Only moderate physical and electrical changes have been made in most TV set lines. These changes are most noticeable in the small-screen portable line, which will account for about 40 percent of the units sold during the model year. Many of the deluxe features previously found only in large-screen receivers now are also offered in many portable TV lines.



Fig. 1—Admiral's 1M30 modular all-solid-state color TV chassis.



Fig. 2—Admiral's 25L91 color TV receiver features Electronic Digital Touch Tuning and Color Master Control system.

It is anticipated that the lines of almost all major manufacturers of color TV receivers will be completely all-solid-state by mid 1975.

In this first of a three-part series, the composition and general features of the 1975 color TV lines are presented. Typical features included are:

- Admiral has added electronic touch-tuning, with digital read-out channel numbers

- General Electric has introduced a new "YA" modular, solid-state color TV chassis, which features their third-generation in-line picture tube

- An all-electronic tuning system, called *STAR*, has been introduced by Magnavox; this new system makes local and remote-controlled tuning and adjustment simple, quick and quiet

- Panasonic's new color line includes seven portable sets equipped with the new *Quintrix* picture tube, plus three *Quatrecolor* console sets

- Philco-Ford has introduced 11 consoles with *Invis-A-Tenna*, a dual-loop antenna system built in under the cabinet top

- Quasar Electronics Corporation (successor company to Motorola) has updated the Quasar line with color TV's featuring fewer modules, more IC's and a room light sensor

- RCA this year has become the first domestic TV manufacturer to offer a completely all-solid-state color television line, and has reduced the number of models available

- GTE Sylvania's new line includes a second generation of self-adjusting color TV sets with a new system for automatically adjusting color, contrast and brightness

- Zenith has increased the number of models equipped with varactor tuning.

## ADMIRAL

There are a total of 46 color TV models in the new Admiral line. Approximately 25 of the TV models use all-solid-state modular chassis, and the remaining 21 are equipped with hybrid chassis, which use both tubes and transistors.

The Admiral 1975 color TV line consists of twenty-two 25-inch (diagonal) consoles, twelve 19-inch (diagonal) table models, one 18-inch (diagonal) hybrid table model, five 17-inch (diagonal) portables, two hybrid 16-inch (diagonal) portable, one hybrid 13-inch (diagonal) portable, one hybrid 13-inch (diagonal) table model and two hybrid 12-inch (diagonal) portable.

Most of the 19-inch (diagonal) models feature the *Super-Solarcolor* black matrix in-line picture tube, which utilizes a negative black matrix slot mask. The precision in-line gun reportedly provides increased illumination of the phosphors through the slot mask and, consequently, produces a brighter picture.

The Modular SS1000 series chassis, shown in Fig. 1, are all solid state. Most of the circuitry in these chassis is contained on "satellite" plug-in modules. The main chassis slides out for easy access. Most models include the *Color Master* control, which, when pressed in, switches color, tint, brightness and contrast to factory preset levels. If the factory settings do not please the

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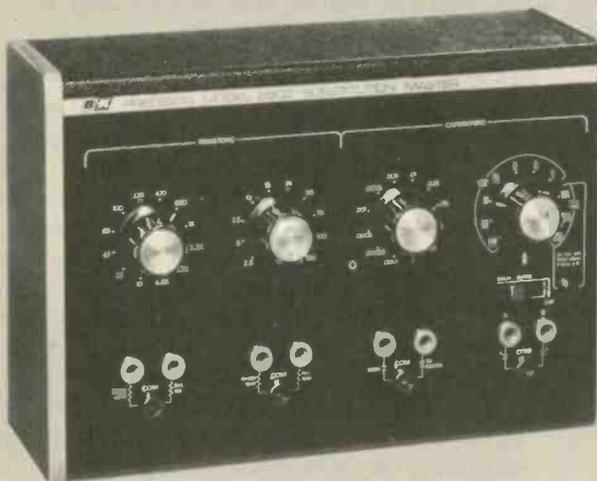
Thus you can make up a simple but complete

power supply circuit, including bleeder and power resistors, filter capacitors, and the rectifier. Or you can make up a voltage divider by selecting the 2 resistors of the desired values. For their capabilities, our Models 2901 and 2902 Substitution boxes are the best values on the market today.

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SEPTEMBER 1974, ELECTRONIC TECHNICIAN/DEALER | 17

viewer, he can easily readjust the controls himself.

Admiral's *Digital Touch Tuning* is featured in two top-of-the-line models. This tuning system comprises seven complete module assemblies, a Sonar remote-control receiver with input transducer, and a channel selector panel called the *Flex-Key Assembly*. (Shown in Fig. 2 is the Model 25L91 with *Digital Touch Tuning*.) Because the system has no moving parts (other than the Sonar relays), mechanical friction and wear are eliminated. The system can be operated either locally or by remote control. Once the system is fine tuned and programmed for each active channel in the user's locality, it requires no further adjustment, unless "external" conditions change.

The *Digital Touch Tuning* system allows presetting of up to 18 channels in the UHF and VHF bands. All VHF channels and up to six UHF channels may be preset at one time; each UHF preset control may be tuned to any UHF channel in the UHF band.

The system also provides an audio mute feature, which is activated only by the remote hand unit. It provides approximately 60 seconds of audio silence, starting from the time the MUTE button on the hand unit is pressed. If at any time during the 60 second interval the MUTE button is pressed again, the MUTE cycle is terminated and sound is restored to normal.

The *Digital Touch Tuning* system uses digital logic circuits and electronic switches.

To change channels, the viewer simply touches the number of the desired VHF or UHF channel on the control panel (all VHF and up to six UHF channels). After the channel change, which is noiseless and instantaneous, the channel number appears on a lighted, digital read-out panel next to the screen.

*Sonar Remote Controls* are available on both portable and console models. This feature is available in two different configurations: a dual-function unit, which turns the set on and off and changes channels, and a four-function unit, which turns the set on and off, adjusts the volume and changes pre-selected channels.

Admiral's lowest priced model is the *Color Playmate* (2427P), a 12-inch (diagonal) portable in a polystyrene cabinet with walnut-grained finish.

All hybrid color TV sets with 19-inch (diagonal) screen sizes or less have a 90-day, carry-in labor warranty.

All-solid-state color TV sets with 19-inch (diagonal) screen or less have a one-year, carry-in labor warranty.

The all-solid-state 25-inch (diagonal) console color TV sets have a one-year, in-home labor warranty.

The hybrid 25-inch (diagonal) console color TV sets have a 90-day, in-home warranty.

All Admiral color picture tubes have a five-year "adjustment" warranty.

## GENERAL ELECTRIC

A total of 82 models are offered in General Electric's 1975 line of color TV receivers. All-solid-state chassis are used in 57 of the models. The remaining 25 are equipped with hybrid chassis.

Screen sizes and types of models in the line are: forty-one 25-inch (diagonal) solid-state consoles, nine

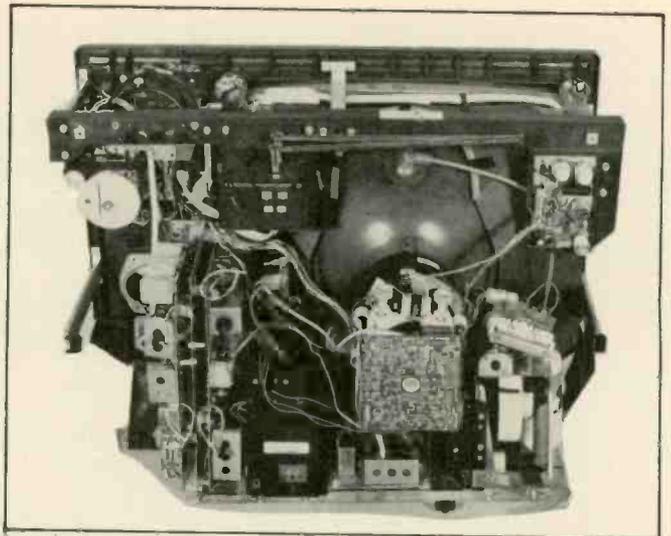


Fig. 3—General Electric's new "YA" modular, solid-state color TV chassis which is used with GE's third generation in-line picture tube.

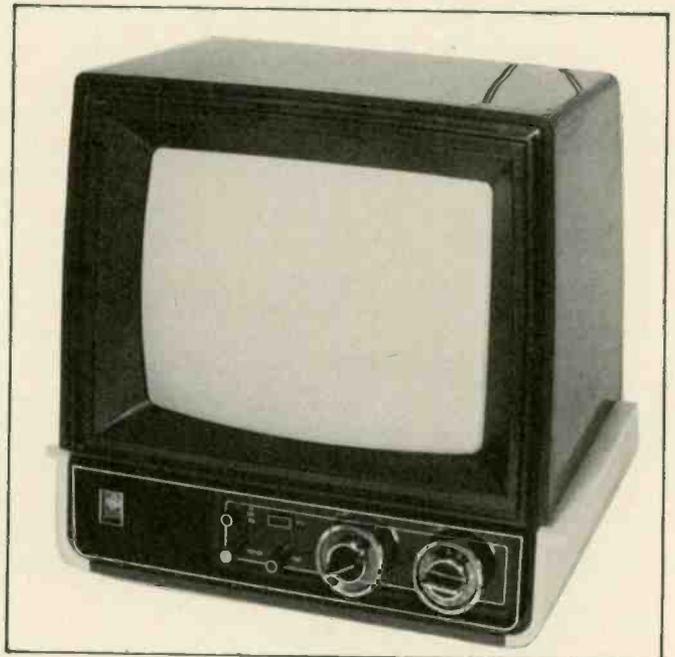


Fig. 4—General Electric's Model YA5508WD color television set with 13-inch (diagonal) in-line picture tube.

19-inch (diagonal) solid-state portables and/or table models, three 17-inch (diagonal) solid-state portables, one 16-inch (diagonal) solid-state portable, three 13-inch (diagonal) solid-state portables, nine 19-inch (diagonal) hybrid portables and/or table models, and sixteen 10-inch (diagonal) hybrid portables.

Six chassis are used in GE's 1975 color line. The YA and MC chassis are new, modular, all-solid-state types. The MB-75 and QB are carry-over all-solid-state chassis with some major changes. Chassis CD and HE are carry-over hybrid types without any significant changes.

The new YA chassis (Fig. 3) is an all-solid-state, modular, swing-away type on which is mounted seven modules. The swing-away design makes all modules and components easily accessible. The YA chassis is used in two models, a 13-inch (Fig. 4) (diagonal) and a 17-inch (diagonal), both of which are equipped with GE's new *Porta-Color MX-2* shortneck, 90-degree, in-line picture tube. The 17-inch version of the MX-2 picture tube requires 27.5kv of second-anode voltage.

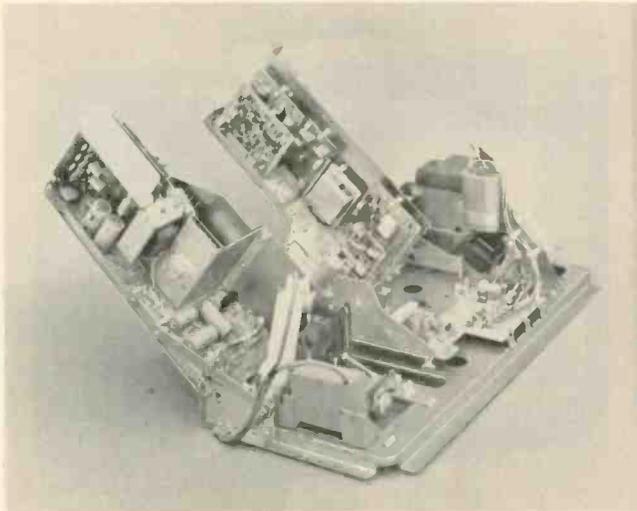


Fig. 5—Magnavox's new solid-state, modular T995 color TV chassis tilts-out, to clear cabinet.



Fig. 6—Magnavox color TV sets equipped with the "STAR" remote-control system display the channel number on the screen in the form of a six-inch-high digit. Shown on right of the photo is the "STAR" remote control unit with a control panel which resembles that of an electronic calculator.

The new MC chassis is an all-solid-state, modular type which is used in a number of 25-inch (diagonal) consoles. The 25VDCP22 picture tube used with the MC chassis requires 30kv of second-anode voltage.

A new *Custom Picture Control* lets the viewer adjust the contrast, brightness, and color simultaneously with a single knob. The pre-set balance remains constant as the viewer adjusts the *Custom Picture Control* to compensate for room light conditions or station signal changes. In addition, an automatic *One Touch Color System*, with pre-set controls, provides a sharp color picture with a touch of the AUTO button. The system incorporates Tint Lock, AFC, and pre-set color, tint and brightness controls. The tint lock has the effect of widening the color demodulation angle by cross-coupling the B-Y and G-Y signals at the output of the chroma demodulator IC. The pre-set controls associated with the One Touch Color System are a set of color, brightness, and tint controls pre-set at the factory.

General Electric's color portable television line offers

a variety of features in 10-, 13-, 17-, and 19-inch (diagonal) models.

Various models employing this chassis feature a wide control panel with side-by-side controls for VHF and UHF channel selection and fine tuning. The *AUTO* button, new *Custom Picture Control* and *Push-On-Set-and-Forget Volume* control are side by side under the channel-selector knobs. All of the other secondary controls are contained in a drawer. The drawer operates with an action like the "AUTO" button—push in to close the drawer, and push in again to open the drawer. The "Manual" COLOR, TINT, and BRIGHTNESS controls plus the VERTICAL HOLD and AFC switch are at the front of the drawer. To operate, grasp and turn each knob with the thumb on top and the fingers underneath the drawer. The *AUTO* pre-set COLOR, TINT, and BRIGHTNESS controls are located underneath the drawer.

The MB-75 chassis is basically an MB chassis with *AUTO* controls, accessible to the customer in the secondary control bin, and the new *Custom Picture Control*. These features allow viewers to set color, tint and brightness to their own taste for the *Auto* operational mode. The *PICTURE* control adjusts the contrast and color levels simultaneously with one control.

The Model MB9200WH is a basic MB chassis with a sophisticated electronic tuning control package, remote control feature and digital channel readout.

The QB color television chassis are the next generation of the QA chassis. New features include increased high voltage (to 29.5kv), an improved *One Touch Color* circuit, defeatable *Insta-Color* circuit, a *Custom Picture Control* and pre-set color, tint, and brightness controls.

All-solid-state GE chassis have a one-year warranty on parts and service.

The hybrid GE chassis have a 90-day labor warranty and one-year parts warranty.

All of the GE color picture tubes carry a two-year warranty.

## MAGNAVOX

Magnavox's 1975 all-solid-state color TV line consists of 43 models featuring modular chassis and offers screen sizes ranging from 13- to 25-inch (diagonal).

Models are: two 13-inch (diagonal) portables with the new T985 chassis, one 15-inch (diagonal) portable with the new T986 chassis, four 17-inch (diagonal) portables with the carry-over T981 chassis, three 19-inch (diagonal) portables with the carry-over T982 chassis, six 19-inch (diagonal) table models with the new T987 chassis, twenty-two 25-inch (diagonal) with the new T995 chassis, and five 25-inch (diagonal) stereo theaters, which are equipped with the new T989 color TV chassis.

All of the 13-, 15-, 17-, and 19-inch models employ negative-matrix, precision in-line picture tubes.

The new vertical, solid-state T-955 chassis, shown in Fig. 5, includes: a MOSFET (field-effect transistor), Video IF circuit, which reportedly provides increased sensitivity for improved reception in fringe areas and a *Chroma Leveling Circuit*, which is used to reduce or eliminate surges of color that sometimes occur when

scenes change. A new video circuit maintains the darker portion of the picture at a constant level, and prevents a "gray shift" during certain scenes. To protect the TV set from power-line surges, a new voltage-regulating transformer is used in the power supply.

There are 14 solid-state modules used in the T-955 chassis. The vertical-framed chassis, into which the modules are plugged, tilts out completely clear of the cabinet. Two tilt-out positions are possible: one at 45 degrees and a second at 20 degrees from the horizontal position.

Almost all Magnavox color TV sets, including the new 13- and 15-inch (diagonal) color TV portables, are equipped with the *Videomatic* one-button color TV tuning system. The *Videomatic* system provides automatic fine tuning and automatic adjustment of color, tint, contrast and brightness. The system also includes an LDR (light dependent resistor), which automatically varies the brightness to compensate for changing room light.

Magnavox's new all-electronic tuning system, called *STAR*, can be activated either locally or remotely. The push-button, remote-control unit used with the system (Fig. 6), resembles an electronic calculator. It provides direct access to all 82 VHF and UHF television channels, which are factory pre-programmed. After each push-button selection, the channel number is displayed in large, easy-to-read, six-inch digits on the picture tube screen. After about three seconds, the channel number fades out, but it can be instantly recalled and redisplayed by touching the recall pushbutton on the remote-control unit. In addition to the two-digit, random-access, channel-selector and channel-recall push-buttons, the remote-control unit also includes on/off push buttons for "infinite" volume up or down and mute functions.

All Magnavox color console, table and portable model TV sets carry a two-year warranty on the color picture tube and one-year warranty on labor and parts.

## PANASONIC

Panasonic has introduced a new line of seven all-solid-state portable models and three 25-inch (diagonal) console models featuring the new *Quintrix* picture tube.

Two of the units, the Model CT-924 (Fig. 7) and CT-934, are *Quatrecolor* sets with 100-percent solid-state, modular chassis which produce a picture tube second anode voltage of 28.5kv. Both of the models are equipped with 19-inch (diagonal) picture tubes.

The remaining portables include two 19-inch (diagonal) units, Models CT-914 and CT-974; one 17-inch set, Model CT-714, and two 13-inch receivers, Models CT-324 and CT-314.

Panasonic's three 25-inch *Quatrecolor* consoles—the CT-2514, the CT-2524 and the CT-2534—feature a negative guard-band black matrix picture tube (30kv) and 100-percent solid-state, modular chassis.

The advanced *Quintrix* tube (Fig. 8) is designed with a negative guard-band black matrix and an additional pre-focus lens for sharper picture detail under higher brightness conditions. Conventional color picture tubes have four electrodes and two electron lenses.

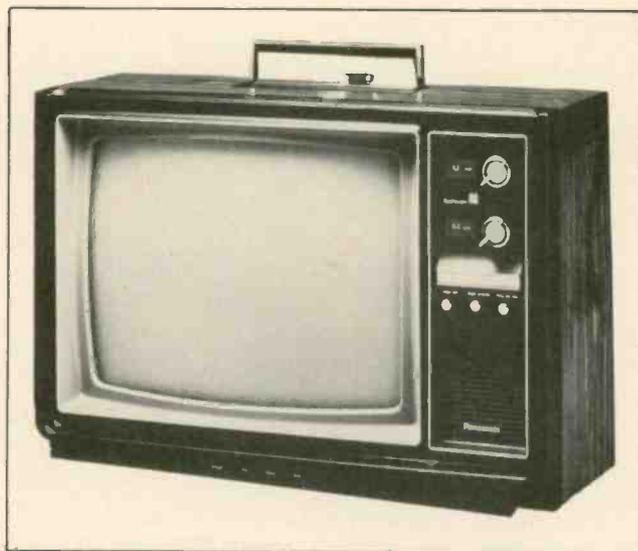


Fig. 7—Panasonic's Quatrecolor TV receiver Model CT-924 is equipped with a solid-state, modular chassis which produces a second anode voltage of 28.5kv.

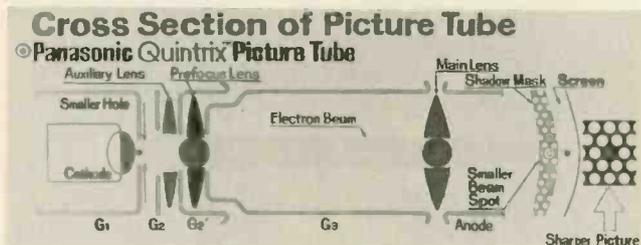


Fig. 8—Cross section of Panasonic's Quintrix color picture tube, which has an additional pre-focus lens, five electrodes and three electron lenses.

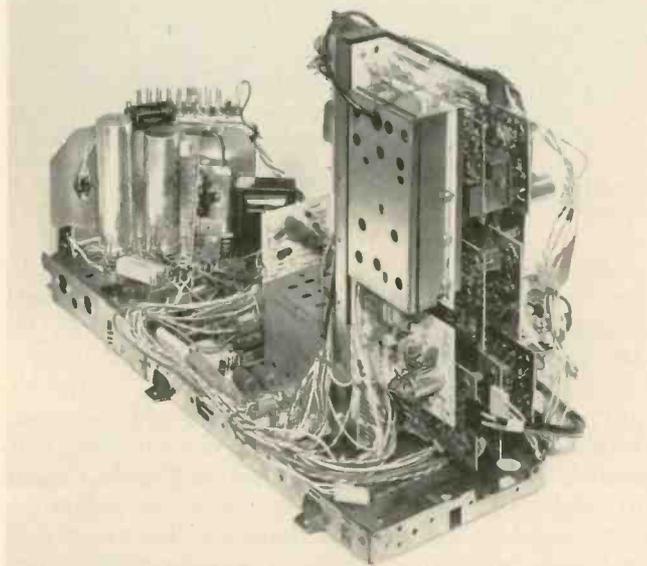


Fig. 9—The Philco-Ford BOSS 300 color TV chassis is equipped with 13 plug-in modules and up to eight IC's, depending on the version.

The *Quintrix* picture tube has five electrodes and three electron lenses. An additional prefocus lens in the *Quintrix* tube reportedly produces a finer, sharper electron beam. And because the condensed electron beam hits each phosphor dot more accurately, picture focus and resolution reportedly are improved.

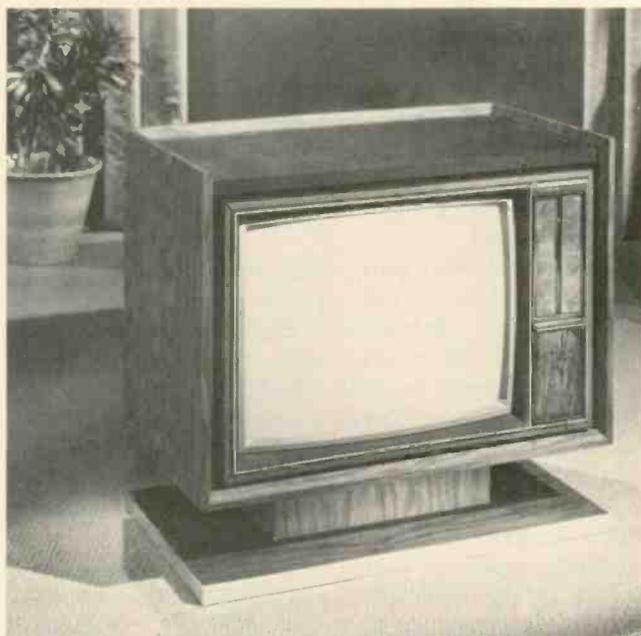


Fig. 10—Philco-Ford Model C2507FPC color TV set is equipped with the BOSS 300 TV chassis.



Fig. 11—Super Insta Matic tuning is employed in Quasar Electronic Corporation's Model WL9210LW color TV. An electronic system keeps brightness, contrast and color intensity in balance and compensates for changes in room brightness.

## PHILCO-FORD

Twenty-four of the 26 new models in Philco's 1975 color TV line are 100-percent solid-state (seven more than last year). Of these, 21 feature an updated version of the BOSS chassis, which was introduced two years ago.

Two models of the redesigned chassis are offered: BOSS and a BOSS 300 (shown in Fig. 9). Both chassis are equipped with 13 plug-in modules and up to eight IC's, and also are equipped with additional voltage-protection and voltage-regulating devices.

Models in the new Philco-Ford color TV line are: a new 13-inch (diagonal), all-solid-state portable featuring an in-line, slot-mask picture tube; two carry-over, 18-inch hybrids; two new 19-inch hybrids; and

five 19-inch and eighteen 25-inch (diagonal) sets, all with 100-percent solid-state chassis.

Three of the 19-inch portables and four 25-inch models have the improved BOSS chassis. (The Model C2507FPC is shown in Fig. 10). The high-performance BOSS 300 is offered in the other fourteen 25-inch sets, including a table model with optional legs or roll-about base, 11 consoles and two home theater combinations.

All 25-inch sets have tilt-front controls, while two of the 19's and 11 of the 25's have hideaway control panel doors.

The 11 consoles with the BOSS 300 chassis feature Philco's exclusive *Invis-A-Tenna*, a dual-loop antenna system built in under the cabinet top. A four-position selector permits adjustment of the antenna for best reception on any channel.

Another feature offered in two 19-inch portables and fourteen 25-inch sets is *Hands Off* tuning, which employs a network of automatic circuits to simplify tuning.

The TV chassis used in most of the 1975 *F Line* 19- and 25-inch models is known as the vertical BOSS. The various versions of the chassis are quite similar. Differences primarily involve picture tube sizes, high-voltage values and special features such as *Philcomatic*, *ACT*, remote control, etc. The following BOSS chassis make up the *F-Line*: 5CS51, 5CS52, 5CS61, 5CS62, 5CS63, 5CY82, and 5CY93.

The signal system of the vertical BOSS chassis is electrically almost identical to the horizontal BOSS chassis used in the "E" line. However, the mechanical layout of the modules on the small-signal "mother" board is entirely different. The power supply, vertical-sweep and horizontal-sweep circuits also are different than those used on the horizontal BOSS chassis.

Color TV consoles with 25-inch (diagonal) screen sizes employing the new BOSS 300 chassis have a two-years' parts and labor (in-home) guarantee.

Other color TV's employing the BOSS chassis carry a one-year (in-home) guarantee on parts and labor.

All color picture tubes in the Philco-Ford 1975 line carry a two-year exchange guarantee.

## QUASAR ELECTRONICS CORPORATION

There are 34 models in the 1975 Quasar color TV line, 21 of which are consoles and 13 of which are portables. Twenty-seven of the 34 models are all-solid-state, the remaining seven are hybrid models.

The line consists of twenty 25-inch (diagonal) consoles, one 23-inch (diagonal) console, eight 19-inch (diagonal) portables, two 18-inch (diagonal) portables, one 17-inch (diagonal) portable, one 14-inch (diagonal) portable and one 12-inch (diagonal) portable.

Two new all-solid-state chassis have been introduced in the Quasar 1975 color TV line. They are the TS-942, which is used in 25-inch (diagonal) console (Fig. 11) and table models, and the TS-941, which is used in portable models. Both chassis, which are similar except for the physical layout and power supplies, are equipped with fewer modules than previous Quasar chassis. Non-remote versions of the new chassis (Fig.

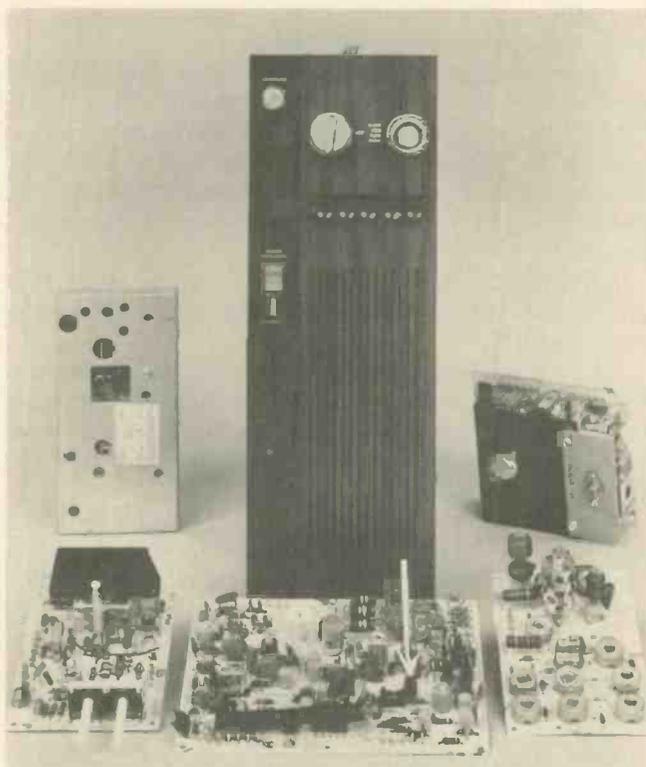


Fig. 12—The number of modules in Quasar Electronics Corporation's new solid-state, modular QS300 color TV chassis has been reduced from eight to five.



Fig. 13—RCA's Model GT803 color TV receiver employs the CTC68 chassis and an electronic digital channel indicator.

12) have only five modules; comparable previous chassis have eight. Remote-controlled versions of the new chassis are equipped with only six modules.

Console versions of the new TS-942 chassis are equipped with a regulated power supply which uses a *Ferro Resonant* power transformer and a full-wave rectifier configuration.

Portable versions of the TS-941 chassis are equipped

with a compact, transformerless, plug-in, regulated, power-supply panel.

Other significant features of the TS-941 and TS-942 chassis are a new twist-lock power supply connector, which eliminates the multiple wire connectors used in previous chassis, and an additional integrated circuit (a total of four, compared to three in previous comparable chassis).

The *Insta-Matic* color tuning system has been updated to a more "total" system called *Super Insta-Matic*, in which the picture is electronically controlled, keeping brightness, contrast and color intensity in balance with changes in room brightness. A honeycomb lens, similar to that used in a light meter, is placed adjacent to the *Insta-Matic* button. Behind the lens is a light dependent resistor (LDR).

All Quasar solid-state color TV units employ a VIDEO PEAKING control, which permits the viewer to select the preferred degree of picture sharpness.

Five of the color TV consoles are equipped with *Satellite* remote-control tuning and *Slumber Sentry*, an added electronic feature that turns-off the receiver shortly after broadcast transmission ends. The all-solid-state QS3000 chassis is used in consoles, table and portable TV sets.

All Quasar table and console model color TV sets in the 1975 line have a one-year (in-home) service labor warranty. All *Super Insta-Matic*-equipped Quasar portable color TV models also have a one-year (in-home) service labor warranty.

In-home service labor for 90 days is provided for 19-inch (diagonal) receivers without *Super Insta-Matic* color tuning. The Quasar portable color TV models with 12-inch (diagonal) through 18-inch (diagonal) screen sizes have a 90-day (carry-in) service labor warranty. The two-year guarantee on color picture tubes and one-year guarantee on other parts continues on all Quasar color TV receivers.

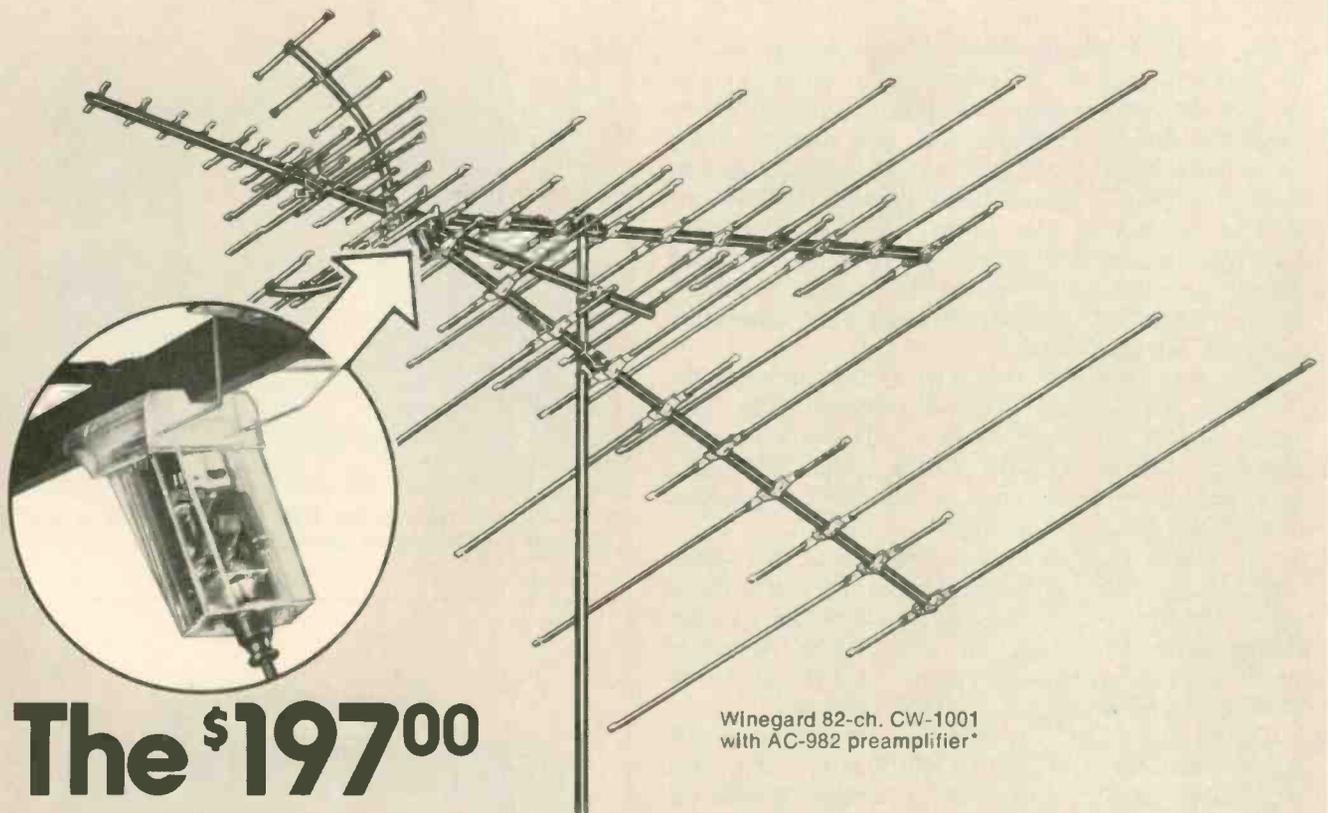
## RCA

RCA's entire 1975 color TV line is equipped with all-solid-state, modular *XL100* series chassis.

(Two "special" series of 14-inch and 18-inch (diagonal) models equipped with carry-over CTC51 and CTC53 hybrid chassis were introduced by RCA earlier this year, but production of these models was terminated shortly after RCA announced that their entire 1975 color TV line would be equipped with all-solid-state chassis.)

Only four chassis are used in RCA's new line, and only one of these, the CTC72, is new. This chassis is an update of the CTC62. The CTC72 is used in models equipped with RCA's precision in-line picture tube. The remaining three chassis—CTC58, CTC68 and CTC71—are carry-over *XL100* chassis.

A total of 33 models are offered by RCA for 1975: twenty-six are 25-inch (diagonal) consoles, one is a 25-inch (diagonal) table model, one is a 19-inch (diagonal) table model and the remaining five are 15- and 17-inch (diagonal) portables equipped with the new CTC72 chassis and precision in-line picture tube, which requires 30kv of second anode voltage.



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The most significant *chassis* design changes involve the elimination of the instant-on feature from all chassis and the introduction of an updated version of the *MAC002 chroma 1* module. The new module, designated *MAC002B*, replaces the *MAC002A* module used previously in most *XL100* chassis. The "B" version of the module uses an IC, closed-loop, voltage-controlled oscillator in place of the IC, injection-locked reference oscillator used in the "A" version. A new IC in the "B" version also has eliminated the color-killer and ACC adjustments.

The most significant new *features* introduced in the 1975 line are a *Digital Channel Indicator* (Fig. 13), which is used in select 25-inch (diagonal) consoles equipped with the *CTC68* chassis, (Fig. 14) and a new tuner design which employs a MOSFET transistor in the mixer stage.

The *Digital Channel Indicator* consists of two, seven-segment, gas-filled, indicator lamps, the segments of which are activated by concentric, segmented switches driven by the VHF and UHF tuner shafts. A pair of neon lamps are used to indicate whether the digital indication is a VHF channel or a UHF channel.

All models in RCA's 1975 line are equipped with tuners which use dual-gate MOSFET mixers. The lower inherent noise of the MOSFET, combined with the ability of the MOSFET to accept stronger signals without overload and resultant cross modulation, reportedly provide improved receiver signal-to-noise ratio. The ability of the MOSFET to handle higher input signal levels without overload permits the application of RF AGC to be delayed, thereby improving the tuner signal-to-noise ratio during reception of moderately weak signals.

The full *XL100* line of color portable, table and console models represents a departure from past RCA product lines in that a number of previous deluxe features are now common to all models, including 100-percent solid-state chassis, automatic fine tuning and negative matrix picture tube.

All models using the *CTC68* chassis have *Automatic Fine Tuning (AFT)*, a 25-inch (diagonal) picture tube, and develop a high voltage of 31kv.

Complementing the *CTC68* chassis and sharing most of its all-solid-state circuits is the *CTC58* chassis. Two versions of this carry-over chassis are continued in the *T-Line*. Both of the chassis versions are electrically identical except for changes in the section of the power transformer circuit that supplies the picture tube filament. Television receivers using the *CTC58* chassis feature *AFT*, a 70-position, detent UHF tuner, and a 25-inch (diagonal) picture tube.

The remote-control system in this year's RCA color TV sets is similar to that used in *R-Line* products. A new mechanical hand unit, the *KRT6B*, operates in conjunction with the carry-over *CTP22* remote receiver circuitry.

All RCA color TV sets carry a one-year parts and labor warranty and a two-year warranty on the color picture tube.

## SONY

Sony's color TV line for 1975 consists of 12 models, available in 5-, 9-, 12-, 15-, 17-, and 19-inch (diag-

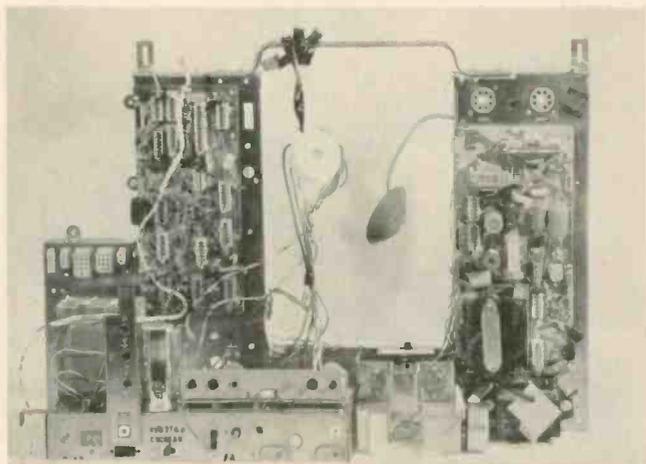


Fig. 14—The RCA top-of-the-line *CTC68* color TV chassis is used in a variety of 25-inch (diagonal) console TV receivers.



Fig. 15—Sony's Model *KV-9200* 9-inch (diagonal) *Trinitron* Color TV weighs only 20 lbs.

onal) screen sizes. Each unit is equipped with the *Trinitron* picture tube. The Sony Model *KV-9200* is shown in Fig. 15.

Model types and screen sizes in the new line are: one 5-inch (diagonal) portable, one 9-inch (diagonal) portable, two 12-inch (diagonal) portables, three 15-inch (diagonal) portables, three 17-inch (diagonal) portables, and two 19-inch (diagonal) portables.

New models are the *KV-9200*, *KV-1203*, *KV-1214*, *KV-1711* and *KV-1910*.

Models carried over from last year are the *KV-5000*, *KV-1500*, *KV-1510*, *KV-1520R*, *KV-1722*, *KV-1730R* and the *KV-1920*.

All *Trinitron* models have one-button control for automatic fine tuning, solid-state circuitry and ear-phones. Four of the models—the *KV-1711*, *KV-1722*, *KV-1910* and *KV-1920*—have Sony's new 114-degree *Trinitron* picture tube. This wider-angle, smaller-neck

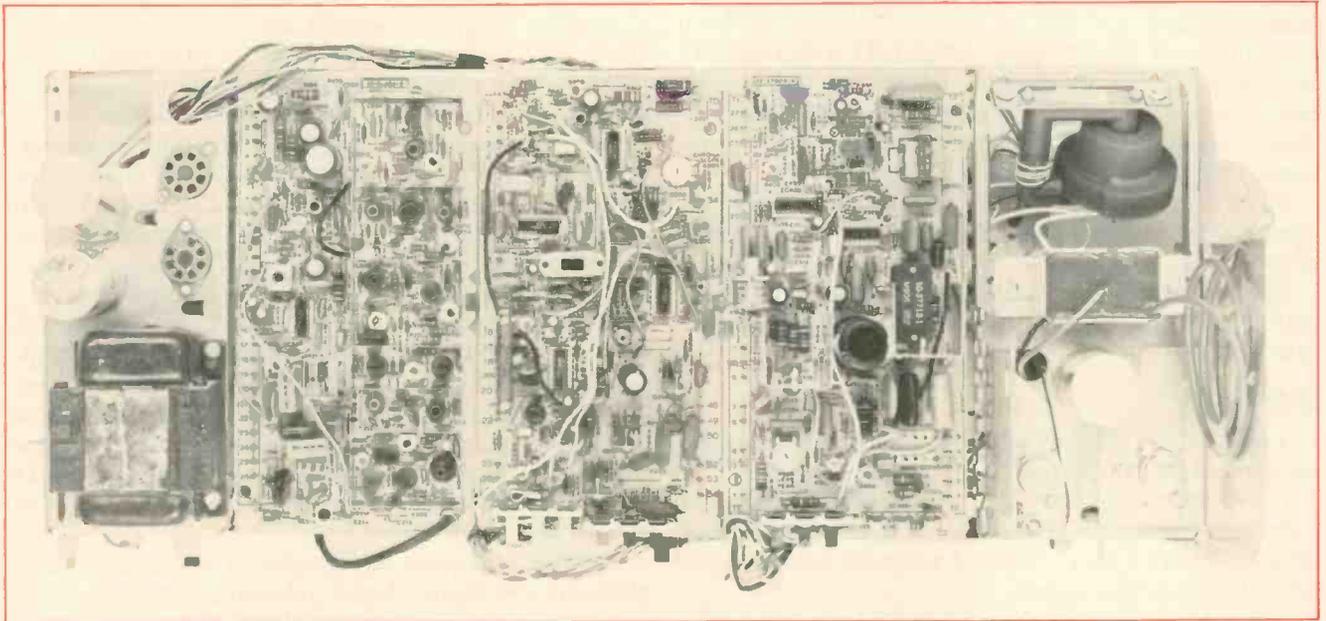


Fig. 16—GTE Sylvania's GT Matic II E10 chassis is equipped with a new IC color system and a new IC auto contrast and brightness system.



Fig. 17—Sylvania's Model 4433K color TV receiver features a 20-channel, electronic, pushbutton UHF/VHF Touch-Tune system and employs the E11-3,4 color TV chassis.

picture tube eliminates about five-inches from the depth of the cabinet.

## SYLVANIA

Fifty-three of the sixty-three new GTE Sylvania color TV sets have chassis that are 100 percent solid-state.

There are 44 *GT-Matic II* color TV sets in the new line; these are available in 25-, 21- and 19-inch (diagonal) screen sizes.

Five models—a 19-inch, a 17-inch, a 15-inch and two 13-inch (diagonal) sets—have *GT Matic Tuning* features but do not include the *GT-Matic II* circuits.

Also included in the Sylvania 1975 color line are seven 25-inch (diagonal) units with 90-percent solid-state chassis, and three TV receivers, a 17-inch and two 19-inch (diagonal) models, with 95-percent solid-state chassis. These chassis are designated the *Gibraltar 90* and the *Gibraltar 95*. The chassis feature plug-

in transistors, a high-voltage multiplier, three-stage IF and integrated-circuit audio system.

A 19-inch, a 17-inch and two 13-inch (diagonal) sets with solid-state chassis but without the *GT Matic Tuning* features were also introduced.

The *GT-Matic II* chassis provides features not included in the simplified tuning system pioneered in original *GT-Matic* sets introduced last year. The *GT-Matic* TV sets have the customer pre-set controls, which include the INTENSITY, TINT, CONTRAST and BRIGHTNESS, locked in a hidden tuning panel on the top rear of the cabinet. The viewer is required only to turn on the set and select a channel. The *GT-Matic II* receivers contain new IC's to make possible the addition of a new automatic color system and a new automatic contrast and brightness system.

In most of the *GT-Matic II* chassis (shown in Fig. 16) updating takes place on the chroma module, which is equipped with three additional IC's. The *GT-Matic II* series include the E09, E10 and E11 chassis. Additional circuit changes appear in the E11 chassis. This top-of-the-line chassis has a new voltage regulating transformer power supply (C.T.V.) and 30kv of second anode voltage.

Sylvania also has introduced a new color picture tube, Dark-Lite 50, which has a negative guard-band black matrix mask and a dark faceplate, which absorbs room light.

Also included in the new line is a 15-inch (diagonal) portable, the first 15-inch set manufactured by the company. It features a Chroma-Line (in-line) picture tube without the dark faceplate.

The portable color TV sets employing all solid-state chassis are designated the GT-110 or GT-101 and are specifically designed for use with Sylvania *Chroma-Line* (in-line) picture tube. The special "swing down" chassis construction makes all components easy to reach.

The 100-percent solid-state *GT 300* chassis is used with the deluxe 25-inch (diagonal) console line of TV sets. This chassis features 30kv of regulated high-volt-

age, four stages of Video IF, and modules designed for easier servicing.

Eighteen of the 25-inch (diagonal) *GT-Matic II* models feature a 20-channel, electronic UHF/VHF pushbutton *Touch-Tune* system. A typical model is shown in Fig. 17. Ten of these models have electronic remote controls and *Dark-Lite 50* picture tube.

Fifteen other *GT-Matic II* (diagonal) models are equipped with a 12-channel VHF and 70-channel UHF detent tuning system.

Sylvania color TV sets carry a one-year full parts and labor warranty and two-year warranty on the picture tube.

## ZENITH

Zenith's 1975 line of color television sets features 52 basic models, with five different screen sizes.

Every set in the new line except one is equipped with a 100-percent solid-state chassis and features Zenith's *Power Sentry* system of magnetic voltage regulation for the power supply.

The color TV line consist of one 16-inch (diagonal) portable, four 17-inch (diagonal) portables, six 19-inch

(diagonal) table models, six 19-inch (diagonal) consoles, one 23-inch (diagonal) table model, six 23-inch (diagonal) consoles, two 25-inch (diagonal) table models, twenty-three 25-inch (diagonal) consoles, and three 25-inch (diagonal) console combinations.

The *Chromacolor II* Models include the *Chromacolor* picture tube, a solid-state *Titan* vertical chassis, the design of which is now the same for 17-, 19-, 23-, and 25-inch diagonal sets, including the protective *Power Sentry* system of voltage regulation. *Chromatic* one-button tuning is also featured throughout the line.

Electronic tuning is used in 23 sets, one of which is shown in Fig. 18. Six non-remote sets now are equipped with this tuning system. The remaining seventeen are equipped with Zenith's *Space Command* remote TV tuning system. This tuning system employs varactor diodes and can be programmed to receive up to 14 VHF and UHF television channels, in any sequence or mix of VHF and UHF.

Although the same basic tuning system is used in all electronically tuned Zenith television receivers, there are some variations between electronic tuning systems of those which are remotely operated with the *Space Command* hand control and those which are non-remote.

In both versions of the electronic tuning system, located behind a panel on the front of the receiver, are 14 different positions, or slots, positioned vertically. To the right and directly on line with each of these positions is a slide-rule dial scale with coarse channel number identification. In the *Space Command* versions, further right and also on the same level is a thumb-wheel for programming and fine tuning each of the 14 positions. In non-remote models, there is a slider switch on a vertical track between the channel positions and the slide-rule dial scale. (Fig. 19) Channel selection is accomplished by moving the slide switch to the position of the desired preprogrammed channel. The programming and fine-tuning control is located behind the selector knob.

The VHF and UHF tuners of the electronic tuning system are controlled by two solid-state "nerve centers" mounted on separate panels located behind the front of the tuner panel.

The new non-remote electronic tuning system is standard equipment in four of Zenith's 25-inch (diagonal) table model sets, and one 17-inch (diagonal) portable set. The *Space Command* remote-controlled version of the electronic tuning system is standard equipment in twelve Zenith 25-inch (diagonal) models, four 19-inch (diagonal) models and one 17-inch (diagonal) model.

A 75-ohm antenna connector is offered in 26 different sets, permitting convenient connection of these receivers to a master antenna television (MATV) system or a community antenna television (CATV) system.

All 51 all-solid-state receivers in the line are covered by Zenith's *Consumer Protection Plan*, which provides a one-year warranty on parts and labor and a two-year warranty on the picture tube. Warranties on the 19-, 23- and 25-inch (diagonal) solid-state sets are covered on an in-home basis. The 16-inch (diagonal) hybrid portable and 17-inch (diagonal) all-solid-state models must be taken to a Zenith servicing dealer or a Zenith distributor-approved service center. ■



Fig. 18—Zenith's Model F4084P is a new 19-inch (diagonal) "decorator compact" console equipped with the Titan 300V chassis.



Fig. 19—Zenith's solid-state electronic tuning system and associated VHF/UHF slide-type channel selector.

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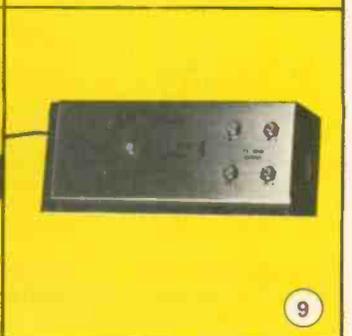
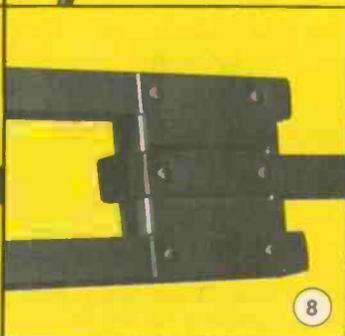
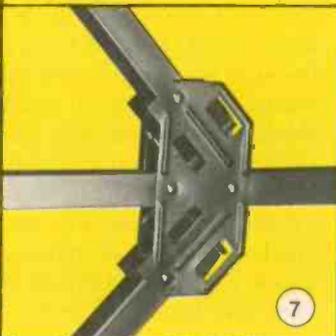
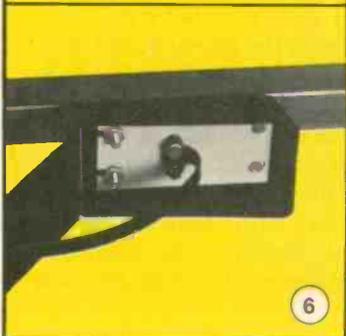
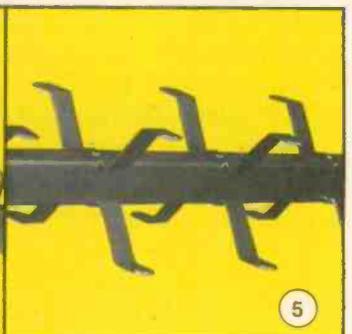
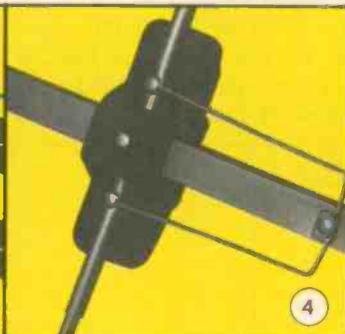
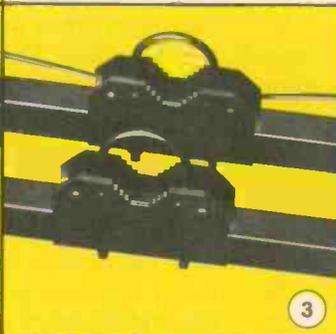
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## MODERN SERVICING TECHNIQUES

# Troubleshooting Solid-State TV Power Supplies

by B. B. Dee

Procedures for isolating defects and tips about selecting replacement components

### LOW-VOLTAGE POWER SUPPLIES

#### Fuses

■ Before the use of semiconductors in TV power supplies, fuses were relatively simple devices. In most cases, selection of a replacement fuse was easy because the only factors you had to consider were voltage and current ratings. Today, however, selection of the proper fuse replacement involves another factor: *time*.

Because semiconductors are damaged by current overloads quicker than tubes, both the *amount* of excessive current and its *duration* must be taken into consideration when a protective device, such as a fuse, is being selected. For these reasons, many manufacturers have begun stating the ratings of fuses for protection

of semiconductor-equipped circuitry in  $I^2T$  (current squared multiplied by time). Modern semiconductor ratings stipulate the levels of repetitive and nonrepetitive current pulses the device can withstand without damage. These ratings usually specify how many amperes of current can be safely handled by the device, and for how many *microseconds*. (Shorts and overloads are considered nonrepetitive current pulses.)

When selecting replacement fuses for protection of semiconductor circuits, be sure you select one which has the correct  $I^2T$  rating, or one which satisfies the requirements for both current rating *and* overload reaction time.

#### Circuit Breakers

The relatively inexpensive thermal-type circuit breaker used in TV receivers has a limited number of "trips" before the end of its useful life is reached. If a customer tells you he has been resetting the circuit breaker to keep the set operating, replace the circuit breaker. It is advisable to tap the reset button lightly to see if the circuit breaker is intermittent—many are after hours of use and repeated trips, and those that have open-construction design can develop dirty contacts.

#### Varistors and Thermistors

Varistors and thermistors are nonlinear resistors; that is, the value of their resistance is changed either by the amount of voltage across it, as is the case of varistors, or by the amount of current through it, as is the case of thermistors.

The degaussing circuits of most older designs of color TV receivers use both of these devices, as shown in Figure 1. Today's color TV receivers use only one, usually in series with the degaussing coil, which itself is connected across the AC source.

Operation of the circuit in Figure 1 is as follows: When the set is switched on, the resistance of VR1, the varistor, drops quickly. The resistance of VR2, the thermistor, increases in a few cycles. With VR2 in series with the coil, and VR1 in shunt, the combined effect allows a large current to flow through the coil for a brief interval, and then the current drops to a negligible value. Because the entire circuit is ahead of the rectifiers, the current flowing through the coil is AC, which demagnetizes the picture tube and its surrounding area.

Because the degaussing coil is mounted *between* the picture tube and its metal shield, the insulation is often damaged, causing a short to the grounded metal magnetic shield. This, in turn, shorts the power transformer through one or more of the rectifiers and nonlinear resistors. The remedy consists of removing the metal shield, locating the hole in the coil insulation, taping it, then replacing the shield and any rectifiers and/or nonlinear resistors which might have been damaged by the overload. Overloaded resistors will have a burned, cracked and/or crumbling appearance. An ohmmeter check will be required to determine if any of the rectifiers have been damaged.

After making these repairs and before applying AC

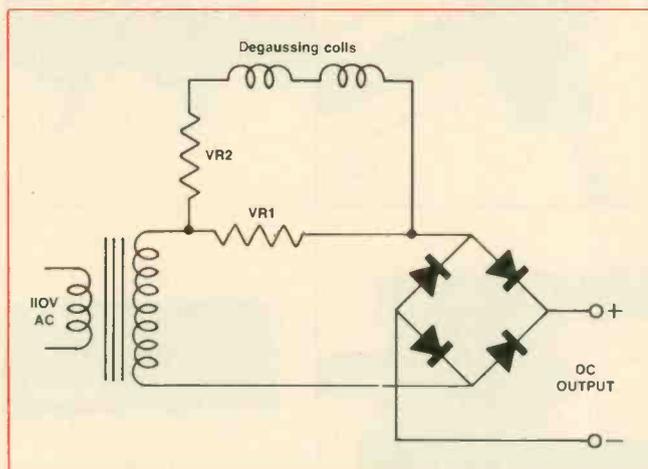


Fig. 1—Simplified circuit diagram of a color TV low-voltage power supply and degaussing circuit showing applications of varistor (VR1) and thermistor (VR2).



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to the receiver, use an ohmmeter to test for any shorts in the power supply—an electrolytic might have been damaged by the AC current.

(*Caution:* Operating some receivers with the degaussing coil disconnected can damage the varistor and/or thermistor.)

### Rectifiers

Replace defective silicon rectifiers with the new 3-amp, 1000PIV types. These types are relatively inexpensive, and the "excessive" rating will provide longer life and less callbacks.

### Electrolytic Capacitors

These capacitors can build up a high internal impedance. Although a particular capacitor might pass "quickie" ohmmeter tests for reverse leakage and ability to charge, it no longer is an effective filter if it has high internal impedance. Usually, however, a capacitor with this defect will cause the visual symptoms of hum bars and/or marginal sync, although it might cause a sync problem without causing any other visual symptoms.

The best method of checking electrolytic capacitors in TV power supplies is to measure the supply voltage(s) and/or test for ripple with a scope. If the voltages are wrong, all branch circuits will have varying degrees of incorrect voltages. The first capacitor in a power supply will usually show five or less volts on the RMS scale of your meter when set on "OUTPUT," or on "AC" with a blocking capacitor in the input. Each following filter section should show less ripple. Even vertical output decoupling capacitors should show only a volt or less ripple; higher readings indicate a defective bypass capacitor. Before assuming a capacitor is defective, always check the ground connection—a large number have bad solder connections.

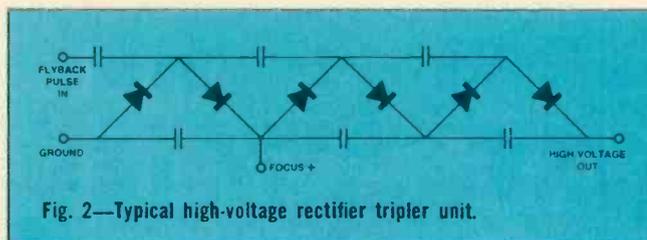


Fig. 2—Typical high-voltage rectifier tripler unit.

## HIGH-VOLTAGE REGULATORS

### Shunt Type

The principal function of the high-voltage regulator circuit in a color TV receiver is to keep the picture tube 2nd anode voltage at a constant level.

Until recently, most color TV receivers have been equipped with vacuum tube shunt-type regulator circuits. This type of circuit provides regulation by maintaining a relatively constant load, or current drain, on the high-voltage rectifier circuit. If picture tube beam current increases, the regulator tube, which effectively is in shunt, or in parallel, with the beam current of the picture tube, draws less current. If the picture tube beam current decreases, the regulator tube draws more current.

Because these shunt-type regulator circuits are relatively simple, the usual defects consist of regulator tube failure, changes in the high-value resistors in the regulator tube grid circuit or capacitor failures. If the HIGH VOLTAGE adjustment produces no change, one or more of the above defects are likely. If the voltage remains high, the regulator tube is probably defective. If the voltage is low, and removal of the anode connector on the picture tube produces no change, the problem is insufficient high voltage, not a defective regulator. If the voltage increases, the problem is in the high-voltage regulator circuit or tube. If the high voltage can be adjusted but not brought into range when the BRIGHTNESS control is turned down, the regulator is probably at fault—but first make sure the picture tube is not defective. This can be determined by removing the picture tube anode connector (put it into a hole cut in a thick rubber ball, to prevent arcing). If the problem still exists, the picture tube can be ruled out as the source. A gassy picture tube can cause weird problems. Usually a gassy picture tube can be spotted by removing the socket from the picture tube while the TV set is in operation. If a high voltage is obtained as the picture tube socket is being removed, the picture tube is a candidate for a gas check.

### Solid-State Types

No where is the proliferation of circuit design more obvious than in the high-voltage regulation systems of all-solid-state color television receivers. A description of all of the various systems in use probably would fill a small book. For the sake of brevity, we shall concentrate on the two general types of regulation systems which are used most often.

One of these systems "senses" the high voltage through a tap in the high-voltage circuitry, and then changes the control grid operating point of the horizontal-output amplifier, which drives the high-voltage transformer. This high-voltage regulator can be checked by rotating the BRIGHTNESS control while monitoring the point where the output of the sensing/regulating circuit section is connected to the horizontal amplifier.

Sets which are equipped with the other general type of regulating system seemingly have no apparent regulation for load changes at all, with only a low-voltage regulator to guard against AC power-line changes. In these designs, the high-voltage transformer is of the saturating type, clipping on the voltage peaks, thus maintaining constant output so long as the frequency remains constant. Fortunately, in normal use, the horizontal frequency is closely maintained, but if the frequency departs from normal, changes in high voltage might be encountered. Adjustment is made by setting the low-voltage regulator which feeds the horizontal-output stage.

Such low-voltage regulators were formerly made of discrete devices such as zeners, transistors, etc., but now they are integrated circuits with built-in overload protection. They require a good bypass capacitor across both input and output, to prevent oscillation. A variety of trouble symptoms can be caused by oscillation, including inadequate regulation, incorrect DC output

voltage, excessive ripple, or appearance of the oscillation frequency in the output voltage. Any or all of these might occur. If oscillation is encountered with an IC regulator, check the bypass capacitors; they have to be placed close to the IC and securely grounded.

IC voltage regulators are usually of the series type because this type seemingly is more efficient, but discrete regulators may be either the series or shunt type. In either case, although it may be possible to vary the output voltage of a defective regulator with the VOLTAGE ADJUSTMENT control, the output voltage still might not be well regulated against changes in line voltages or load. A *shorted series* regulator permits the output voltage to increase towards the input voltage level, while a *shorted shunt* regulator causes a marked reduction in output voltage. An *open series* regulator causes a large drop in output, while an *open shunt* regulator causes the voltage to increase beyond acceptable limits.

Although voltage regulators are not familiar to some TV technicians, they are quite common in industrial equipment, and can be serviced in the same manner as any feedback-type circuit. The only additional component used is a zener diode, or other source of constant reference voltage, which can be readily checked with a meter, except in the case of ICs. All ICs are considered throw-away devices.

The biggest problem associated with the testing of regulators is the possibility of damaging the various loads if the output voltage increases. The best approach is to disconnect these loads and substitute resistors as a dummy load which can be varied to produce the current normally drawn by the loads. Then, if the regulator circuit itself is operating normally, the output will remain constant. For series regulators, this test is contingent upon the input voltage being several volts higher than the desired output. If the input approaches the output required, the device will not regulate.

A point often overlooked is the fact that high ripple fed into the input of the regulator can cause problems because the lowest instantaneous "valley" of the ripple might be too low for the regulator to function properly. Therefore, it is necessary to check both input voltage and ripple.

#### HIGH-VOLTAGE TRIPLERS

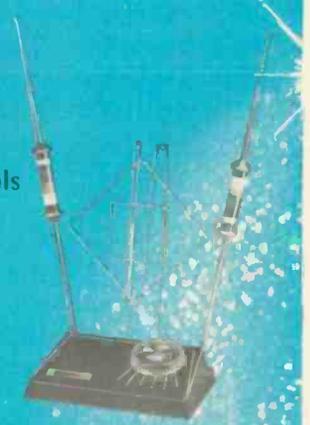
Many recent designs of all-solid-state color TV receivers are equipped with a horizontal-output transformer which develops a much smaller flyback pulse than that developed in tube-type and earlier solid-state receivers. This smaller pulse is rectified and stepped up to the required 25-26 Kv by a voltage-tripler rectifier assembly, which also has a tap at the first rectifier in the tripler, to provide about 8 Kv DC for focus voltage. A typical tripler circuit is shown in Figure 2. The input to these rectifiers is only 8.5 Kv, so if you intend to determine if the rectifier is good by checking input versus output be prepared to measure a smaller input pulse than that found in other types of high-voltage systems.

Because these tripler assemblies are potted, they are nonrepairable, so it is advisable to locate a source of supply, since there are no alternates to the installation of a similar assembly. ■

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be one which has developed a trouble symptom, such as distortion.

### Straight Forward Audio Troubleshooting

Suppose we deliver a spare 20w amplifier to a customer and pick up an old 20w tube-type unit which has a pair of 6V6Gs in the push-pull output and is used mostly for general PA and paging work by a private club. The complaint is "low volume on mike" and "bad distortion."

We remove it from its case, check all tubes and replace one 6V6G. Then we connect it for testing as shown in Fig. 2. (Note: The SPDT switch in Fig. 2 is a convenience item for periodically quick-checking the function generator output.)

Right away we run into a problem. Our particular function generator is an old one, and we can't lower the output to 1mv, which is all we require to drive this high-gain unit through its low-level pre-amp input and driver stages. But we quickly solve this problem as shown in Fig. 3. With the 1000:1 voltage divider across the generator output and the TVOM connected to points 1 and 2, we set up the generator to produce a sine-wave output at 1 kHz, and then adjust the output level control until the meter reads 1v AC. We use a sine wave instead of square wave at this time because it is easier to measure accurately. (If we could measure down to 1mv on our TVOM, then we could check across the 100-ohm resistor instead of across the complete divider.)

Next, we connect a 16-ohm, 40w

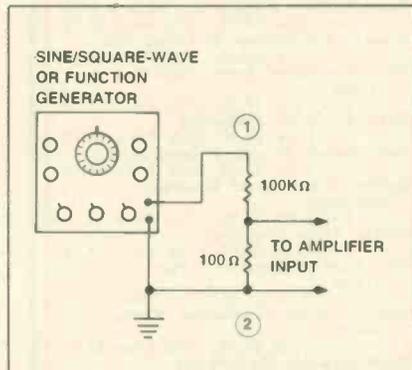


Fig. 3—If the output of your sine/square wave generator cannot be reduced to the level required for testing or if the output level control is not calibrated, you can use a 1000:1 or some other ratio of voltage divider as shown here to obtain the desired level. 1 volt across points 1 and 2 produces 1mv across the 100-ohm resistor.

dummy load across the 16-ohm output taps of the amplifier and set the BASS and TREBLE controls to the "flat" position. We then connect the TVOM across the dummy load resistor and turn up the amplifier VOLUME control to maximum. . . Let's see,  $E=PR$ ,  $20 \times 16=320$ ,  $=17.889v$ . Leaving the amplifier VOLUME control turned all the way to the maximum volume position, we flick the meter to the 10v AC scale. The meter indicates that there is only about 7v AC across the dummy load. And there is nothing resembling a sine wave on the scope, just a slightly curved horizontal line.

We now look under the chassis, and find a charred resistor and shorted coupling capacitor. We change the resistor and capacitor and start again. We again move the amplifier VOLUME control toward maximum volume. At maximum volume, the meter indicates 17.8v.

$$P = \frac{E^2}{R} = \frac{17.8^2}{16} = \frac{316.8}{16} = 19.8W.$$

Good enough. The sine wave on the scope is reasonably good but ex-

hibits a little clipping at this level of output. We reduce the amplifier output slightly. The sine wave is okay now. Switch generator to SQUARE 20 Hz. Recheck, readjust generator output and amplifier voltage across dummy load. The scope waveform we obtain (Fig. 4B) indicates that the low-frequency response (LFR) is reduced. We switch to 100 Hz. A square wave like that in Fig. 4C is produced. We switch to 400 Hz. Normal square wave. (After switching to each higher frequency, we check the generator and amplifier outputs with the TVOM.) Switch to 2 kHz. A square wave about like that in Fig. 4D is produced on the scope. The rounding off of the leading edge to about halfway into the square wave indicates that the response falls off around the 5th harmonic of 2 kHz—or from about 10 kHz upward. We switch to 20 kHz. A square wave like that in Fig. 4E is produced on the scope, indicating that the high-frequency response (HFR) is reduced.

We now check the specs in the *continued on page 59*

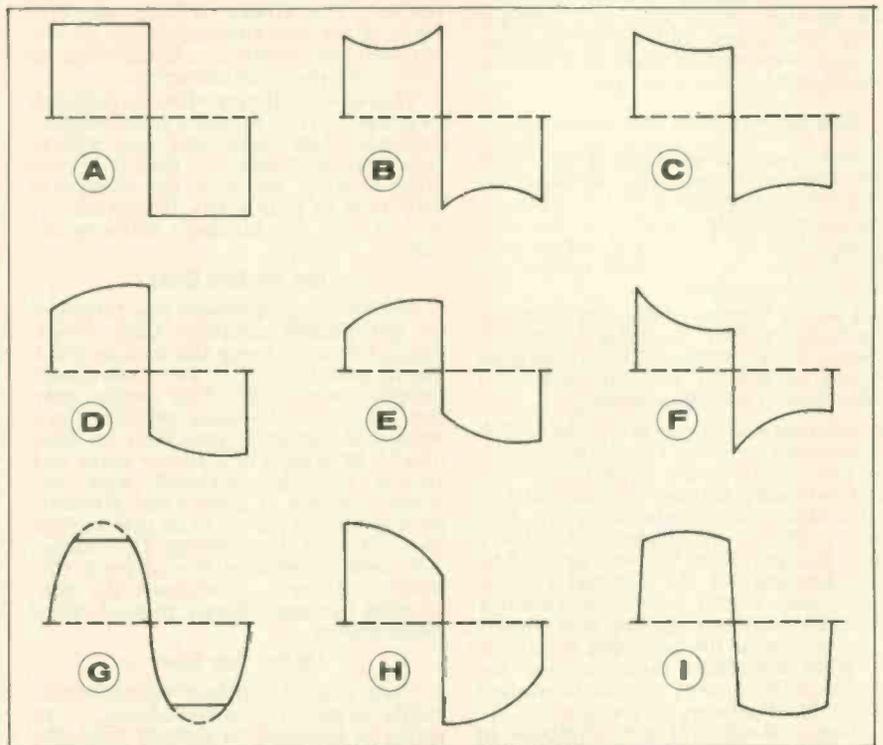


Fig. 4—Various normal and abnormal square and sine waves. A) Normal square wave. B) Reduced low-frequency response near fundamental frequency of square wave. C) Reduced low-frequency response plus leading phase shift. D) Reduced high-frequency response. E) Extreme reduction of high frequencies plus lagging low-frequency phase shift. F) Extreme reduction of low-frequencies plus leading low-frequency phase shift. G) Symmetrical clipping of sine wave caused by push-pull amplifier operating near overload. H) High-frequency attenuation plus low-frequency phase shift near test frequency. I) Excessive low-frequency gain plus high-frequency attenuation.

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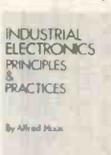
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# Interpreting MATV Amplifier Specs

By James E. Kluge

Which specs are important to the technician or dealer, and what they really reveal about performance

■ Manufacturers of MATV amplifiers publish specifications for two principal reasons: 1) They permit the manufacturer to concisely describe the amplifiers performance and capabilities, and 2) they provide the technician or dealer with a means to compare and finally select an amplifier that will fulfill certain installation requirements.

Understanding amplifier specifications, then, becomes the key to choosing the right amplifier for the right job. Poor choices result in lost profits, costly call-backs, fewer referrals and ultimately, if continued, a general loss of business.

Amplifier specs fall into two general categories: 1) physical and 2) electrical. Physical specs are the simplest to understand, and include such things as overall dimensions, weight, finish, color,

connectors, accessories, provisions for mounting, and material of the case or cabinet.

Electrical specs are equally important, more complex, more easily confused and, consequently, more difficult to understand. Typical of such specs are input/output, gain, VSWR, noise figure and effect of gain control.

## Input/Output (Fig. 1)

Input and output levels are probably the most important and yet the most confusing and least understood specs. This subject is an article in itself and will be treated in detail separately. For now, it is sufficient to say that amplifiers have a limited output-voltage level. Exceeding this level causes amplifier overload, which deteriorates an otherwise good picture.

The maximum allowable input level is com-

puted by *subtracting* the maximum amplifier gain from the maximum output level (Fig. 1).

The gain of the amplifier is either fixed or variable. If variable, the maximum allowable input is increased by the amount that the gain is decreased, provided that the gain control attenuates the signal *ahead* of any amplifier stages. If it does not, then the *input* amplifier might overload before the output does. Although most amplifiers attenuate the signal before it is applied to the input-amplifier stage, don't depend on it. Always verify whether or not it does.

One more point about gain; Gain controls offer a convenience, by allowing you to adjust levels more precisely. However, every dB of gain designed into an amplifier costs dollars—don't waste it by buying an amplifier with more gain than you need and then throwing the money away by attenuating the gain excessively. If you do, the chances are good that you could have bought a less costly amplifier in the first place; one that has the right amount of gain to fit your requirements. Some amplifiers combine high gain and high output capability. If high output is what you need and gain you don't, you may have to

accept the high gain and pad it down, regardless of whether or not it seems wasteful.

## VSWR (Fig. 2)

Voltage-standing-wave-ratio (VSWR), or just standing-wave ratio (SWR), is a figure of merit to indicate, in this case, how well (or how poorly) the input/output impedances of the amplifier have been matched to the cable or system impedance, which usually is 75 ohms. Actually, VSWR is the ratio of the maximum to minimum amplitudes of the voltage wave (Fig. 2) and is therefore always equal to or greater than one. Unity VSWR (1:1) is ideal, but is seldom realized in practice.

Unmatched impedances waste power and produce reflections that cause ghosts, smears and "halo" effects in the TV picture. Just as standing waves can appear on an unterminated coaxial cable, so can standing waves appear if amplifier input and output impedances do not terminate in (match) the characteristic impedance (75 ohms) of the cable connected to them.

Amplifier VSWR is at best a compromise. Other tradeoffs, such as noise figure, gain and frequency

*The author is a technical editor for the Winegard Company.*

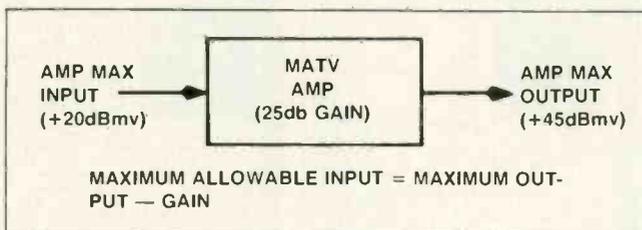


Fig. 1—The three MATV amplifier specs illustrated here—input level, gain and output level—are interdependent. Increasing or decreasing the input level and/or gain of the amplifier changes the output. The maximum allowable input level can be computed by subtracting the maximum amplifier gain from the maximum output level. Input levels in excess of the computed allowable input will cause distortion and cross-modulation, which, in turn, degrade picture quality.

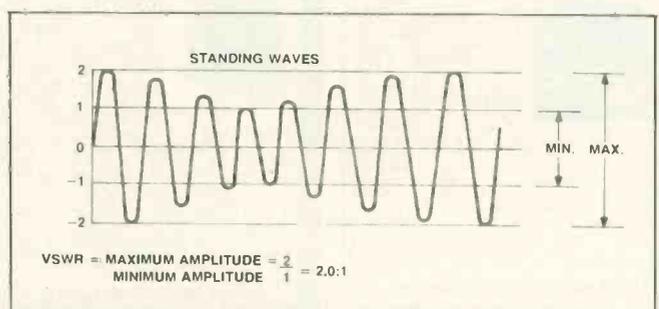


Fig. 2—The voltage standing wave ratio (VSWR) indicates how well impedances in a system are matched. The closer the VSWR is to the ideal ratio of 1:1, the better the impedances are matched and the less are the chances for ghosts, smears and "halo" in the TV picture.

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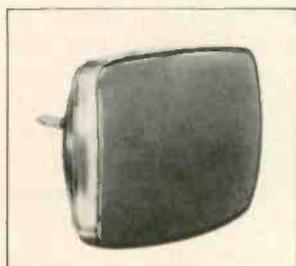
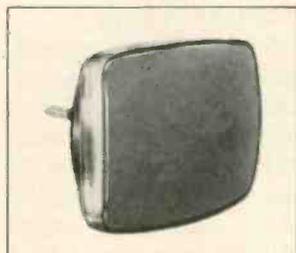
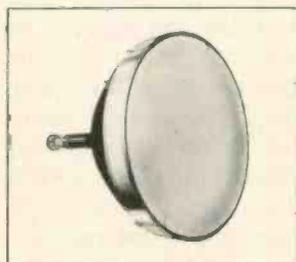
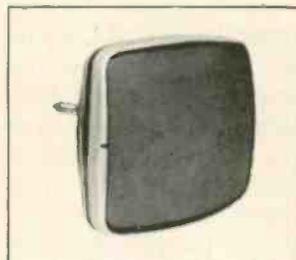
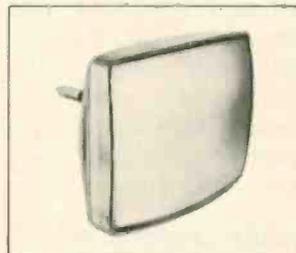
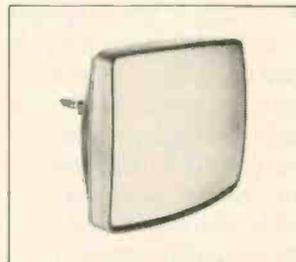
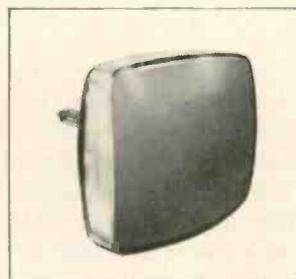
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response, frequently vie for equal or greater importance during the course of designing an amplifier. VSWR is *not* adjustable after the design is fixed and is not always uniform in the frequency band over which the amplifier is designed to operate. It generally is optimized over the total bandwidth and specified as *average-input VSWR*. Backmatch, the match seen by the cable looking back into the amplifier output jack, although important, carries less weight than input match. Consequently, it is not always specified. Typical VSWR specs for good amplifiers will vary from 1.2:1 to 2.0:1.

### Return Loss (Fig. 3)

Some manufacturers prefer to spec the match of their amplifiers in terms of *return loss (RL)* instead of VSWR. Return loss expresses the ratio of incident energy (total) to reflected energy (loss), and is usually expressed in decibels (dB's). Typical values fall between 10 and 16 dB. The more dB's the better the match and the smaller the return loss. A *perfect* match has *infinite* return loss. VSWR and return loss give the same qualitative information, if you're familiar with the numbers.

Sometimes the specifications will list "match" and spec the amplifier in both VSWR and return loss. However, the return loss spec is more useful when expressing small VSWR's between 1.22:1 and 1.02:1. Stated in terms of return loss, this is roughly 20 and 40 dB, respectively. A 1:1 (perfect) VSWR equals an *infinite* return loss.

Return loss is a more common and useful expression in CATV line

amplifiers. Because these amplifiers are cascaded approximately every 0.5 mile over several miles of cable, the VSWR must be kept very small simply because the VSWR accumulates rapidly to reach a value that causes picture deterioration.

### Noise Figure (Fig. 4)

The *noise figure (NF)* of an amplifier tells the prospective customer something about how much noise the amplifier contributes in the process of amplifying the signal. In fact, it specifies, in decibels, the difference between the signal-to-noise ratio (S/N) at the amplifier output and that at the input. The signal-to-noise ratio becomes worse as the signal passes through the amplifier stages, and the noise figure is a measure of *how much worse*. For example, if the S/N is 45 dB at the input terminals of an amplifier that has a NF of 5 dB, the *output S/N* will be reduced to 40 dB (Fig. 4).

An *ideal*, noiseless amplifier would amplify the input signal and the noise at the input *equally*, without adding any noise of its own. In practice, however, amplifiers do add noise to that which is already being amplified along with the signal; this increases the amount of noise at the output. Consequently, the *ratio* of output signal to output noise (S/N) is *reduced*. This effect is especially important in applications in which many line amplifiers are cascaded. In such an application, each of the line amplifiers should have low noise figure, to preserve the over-all signal-to-noise ratio of the system.

Frequently, higher

noise figures are specified for UHF than for VHF (or high-band and low-band VHF). This generally means that the two bands pass through separate amplifiers or that one band (usually higher frequencies) required additional amplifier stages. The higher the frequency, the more difficult it is to achieve low-noise gain; this is the reason for the higher NF for higher frequencies.

### Bandpass

Bandpass specs define the *range* of frequencies an amplifier is designed to amplify. These frequencies are usually included within a band that is specified by either the upper-

and-lower frequency limits, the TV channels or the reception bands. For example, the bandpass of a VHF, broad-band, TV-distribution amplifier might be specified in one of the following ways: VHF-TV channels, channels 2 to 13, 54 to 88 MHz and 174 to 216 MHz, or VHF low band and VHF high band. Another amplifier might be described as "an 82-channel amplifier which covers the VHF low band (54-88 MHz), VHF high band (174-216 MHz) and the UHF band (470-890 MHz)." Such amplifiers may or may not include the FM band (88-108 MHz). Some may include the FM band but provide

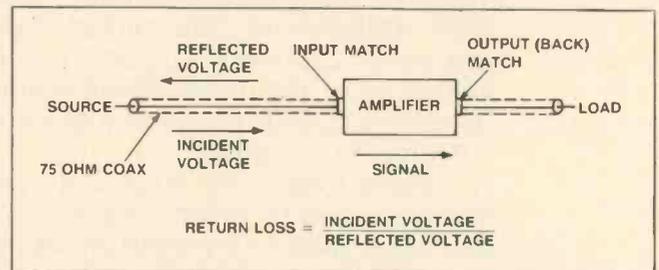


Fig. 3—Return loss is the ratio of incident energy to reflected energy and usually is expressed in dB's. The better the impedances in an MATV system are matched, the smaller the return loss is (and the larger the dB's).

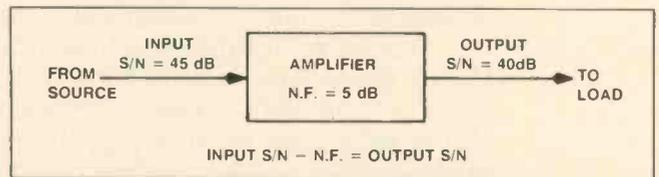


Fig. 4—The noise figure (N.F.) of an amplifier is an indication (in dB's) of how much internally generated noise the amplifier adds to the signal during the amplification process. It is computed as shown here. The signal-to-noise ratio (S/N) is an indication of the relative levels of signal and noise, and usually also is expressed in dB's. For example, a S/N of 45 dB effectively means that the noise is 45 dB below the signal level.

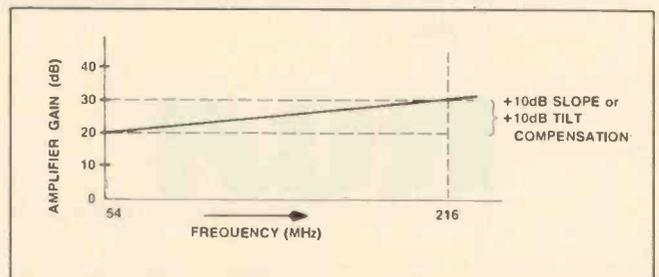


Fig. 5—A coaxial cable attenuates higher frequencies more than lower ones. To compensate for this, the MATV amplifier gain should gradually increase in proportion to the frequency, as shown here.

a fixed or switchable FM trap for attenuating the FM band if it interferes with normal TV reception.

Some distribution amplifiers also are designed to accommodate the CATV bands. For example, the new Winegard Model DA-825B distribution amplifier has a VHF bandpass of 54 to 280 MHz which includes, in addition to the VHF low band (Ch. 2-6), FM and VHF high band (Ch. 7-13), the CATV mid-band channels A thru I (120-174 MHz) and the CATV superband channels J thru S (216-276 MHz). To prevent FM from becoming a problem, the FM band is at-

tenuated by 18 dB. The UHF bandpass (470 to 810 MHz) includes channels 14 thru 69. UHF channels 70 thru 83, allocated for translator use only, are not included.

In many catalog sheets of amplifier specifications you will find additional specifications which haven't yet been mentioned. They all are important and usually necessary, but they generally don't attract the attention that input/output, gain and VSWR do.

### Response

*Response* is one of those specs. It defines how uniform the gain is over the bandpass of the amplifier. In some cases, the

specification may refer only to the response over any 6-MHz channel. Typical specs are  $\pm 1.0$  dB over the bandpass or  $\pm 0.25$  dB per 6-MHz channel. Because you can watch only one channel at a time, the per-channel response will affect picture quality to a larger extent than response over the entire bandpass, which must be equalized for tilt anyway.

### Gain Control

Another minor spec is *gain-control*. It specifies the range (typically 10-15 dB) available to the technician if he wishes to adjust the gain of the amplifier. The adjustment may be continuously variable or simply a switch. Some amplifiers which are equipped with separate VHF and UHF amplifiers have separate gain controls for VHF and UHF.

### Tilt or Slope, Control (Fig. 5)

Coaxial cable attenuates higher frequencies more than lower frequencies. This produces a frequency-response curve that slopes downward toward the high-frequency end. Consequently, to maintain a reasonably flat system response, the amplifier gain must have an equal and opposite slope (Fig. 5). Slope must be incorporated into the gain-frequency characteristics of the amplifiers. When it is, it is called *tilt compensation* or *slope adjustment*, and if it is variable, the amplifier will have a tilt or slope control.

An amplifier for which a slope- or tilt-compensating control spec is given has built-in compensation. It is designed to attenuate the lower-frequency signals more than the higher frequencies. The amount of attenuation

will depend on the length and type of coaxial cable with which it will have to function.

Slope controls, being continuously variable, permit selection of the exact amount of amplifier slope required to compensate for cable-induced tilt. The amount of tilt compensation required depends on the type and length of coaxial cable employed in the system. Fixed tilt compensation may also be built in. If not, fixed tilt compensators, like Winegard's TC series, may be inserted ahead of an amplifier, to provide additional tilt compensation.

It has been common practice in the MATV (and CATV) industry to use the terms "tilt" and "slope" loosely and interchangeably. Understandably, this can cause considerable confusion on the part of those trying to interpret and compare amplifier specs.

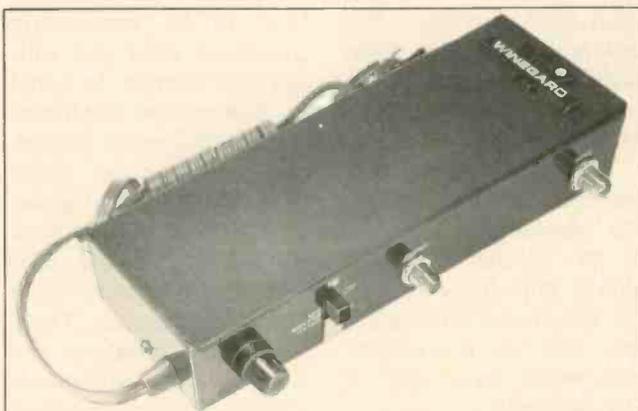
The National Cable Television Association (NCTA) has attempted to define more closely the distinction between these two terms in hopes of reducing the confusion which has existed.

*Tilt*, as the NCTA defines it, refers to the *actual signal levels*, as measured, from channel to channel.

*Slope*, on the other hand, refers to the *amplifier gain* from channel to channel.

If cable attenuation can be considered negative gain, then line amplifiers can be designed to have positive slope equal in magnitude and opposite to the negative slope of the cable or other passive components.

Tilt controls and tilt compensation referred to in amplifier specifications affect the slope of the am-



### Example of MATV Amp Specs

Listed here are the specs for Winegard Model DA-825B Broadband Distribution Amplifier. VHF and UHF sections amplify each band separately after first separating and then later recombining signals. The VHF section, covering 54 to 280 MHz, includes CATV mid band and super band.

SPEC	VHF	UHF
Bandpass:	54-280 MHz	470-810 MHz
Maximum Output* (per channel)	+46 dBmV (7 channels)	+45 dBmV (5 channels)
Gain	26 dB	23 dB
Maximum Input (per channel)	+20 dBmV	+22 dBmV
Input/Output Impedance	75 ohms	
Input VSWR (Average)	1.7:1	1.6:1
Input Return Loss (Avg.)	11.7 dB	12.8 dB
Noise Figure	3.6 dB	6.0 dB
FM Trap	-18 dB	N/A
Frequency Response	$\pm 0.25$ MHz per 6 MHz Channel	
Operating Temperature	-30° to 130° F.	

\*For 0.5% Crossmodulation

plifier by a specified amount. The tilt to be compensated for would be determined from readings taken with a signal-level meter, more commonly (but incorrectly) called a field-strength meter.

### Operating Temperature

The operating temperature spec simply says that the other specs are valid within a specific *temperature range*. Depending on where the unit is installed and how well ventilated the area is, it probably will never be subjected to the *extremes* of the operating temperature spec.

A good operating temperature range is -30 degrees F. to 130 degrees F. In most TV-reception areas of the U.S., outdoor temperatures rarely exceed these limits except perhaps at the time of the day when minimum and maximum temperatures

are reached. In other words, such temperature limits, if ever reached, would not be maintained for more than an hour or so and possibly would occur only a day or two out of a year.

If the amplifier should ever experience such temperature extremes in excess of the limits, the amplifier would not stop working, but would merely realize a slight degradation in performance. In most cases, the effect would not even be noticed by viewers.

### Power Requirements

Power requirements are relatively standard for the United States. Standard line voltage (118v) and line frequency (60Hz) cause about as much concern as they would if you were buying a kitchen refrigerator. The power consumption of most amplifiers is minimal (1 to 10

watts). It is seldom important to know the energy consumed unless you are required to specify electrical requirements to an electrical contractor who must supply your power needs. Chances are, you'll need more electrical power for your installation tools (saw, drill, etc.) than the MATV equipment requires.

### Impedance

The *impedance spec* of most commercial MATV equipment is 75 ohms, in and out. The principal reason for using 75 ohms is that the system components are interconnected via 75-ohm coaxial cable. Coaxial cable minimizes noise and interference pickup as well as simplifying installation with regard to cable routing and equipment placement. Impedances of 300 ohms usually are encountered only in consumer-type MATV products.

The VSWR or return-loss spec tells us *how well* the amplifier is matched to the 75-ohm (or 300-ohm) impedance. Without specifying the impedance, the match specification would have little, if any, meaning.

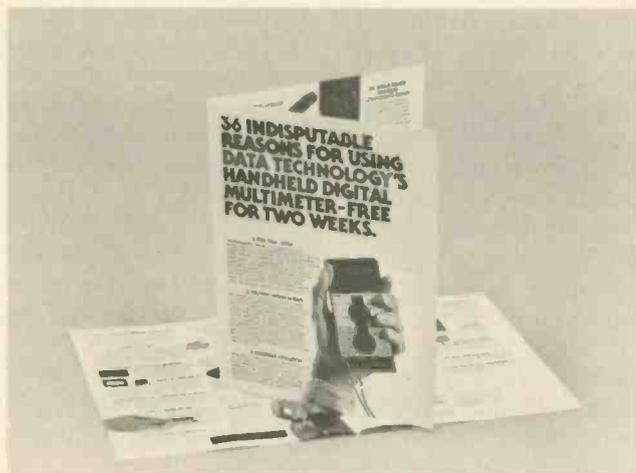
### Line-Amplifier Power

Line amplifiers fre-

quently receive their operating power from the distribution amplifier via the coaxial-cable conductors. The *line-amplifier-power spec* helps the technician determine how many and what type of line amplifiers on the trunk or feeder lines can be powered from the distribution amplifier via the cable conductors. Voltage, current and polarity are generally given. (For example: -12v, 50 mA.)

### Don't Mix Brands

The preceding covers all of the MATV amplifier specs with which you'll usually be concerned. However, if you're going to mix MATV components from different manufacturers (a practice not generally recommended), you will have to be particularly concerned about the voltage and current required to power line-amplifiers, plus input/output impedances, connector types and mounting provisions. You can avoid a lot of trouble by sticking with one manufacturer when you install a system. There are enough variations and subtle design differences among various manufacturers' equipment to possibly compromise system performance. ■



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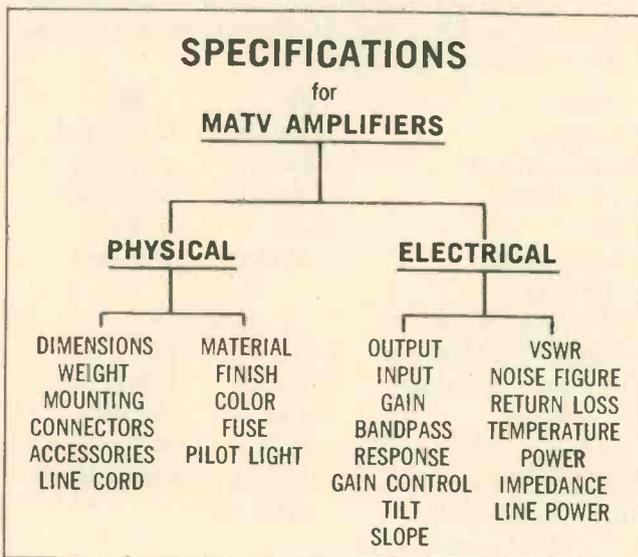
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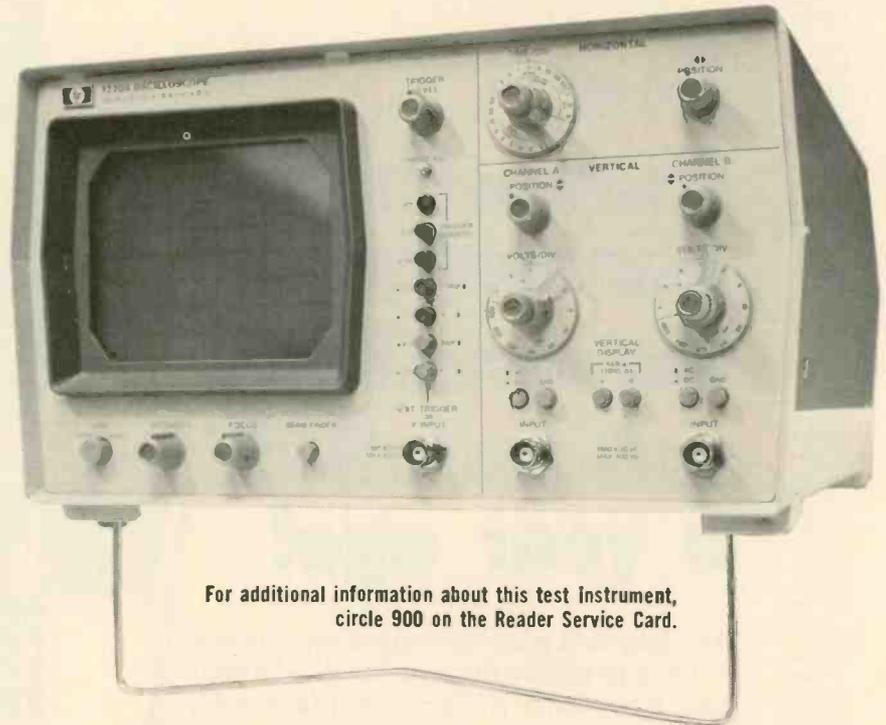


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## Hewlett-Packard Model 1220A Dual-Channel, Triggered-Sweep Scope by J. W. Phipps

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most consumer electronic technicians who are skilled enough to take advantage of the many features of this scope, and who believe that \$695 is a reasonable price to pay for them.

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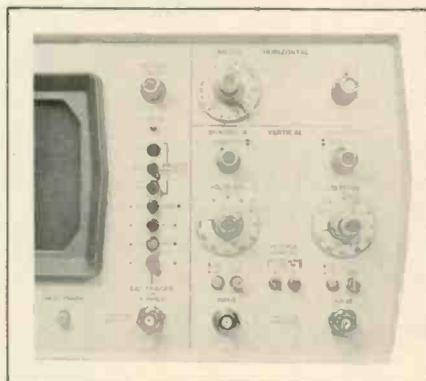


Fig. 1—Close-up view of the most frequently used operating controls of the Model 1220 scope.

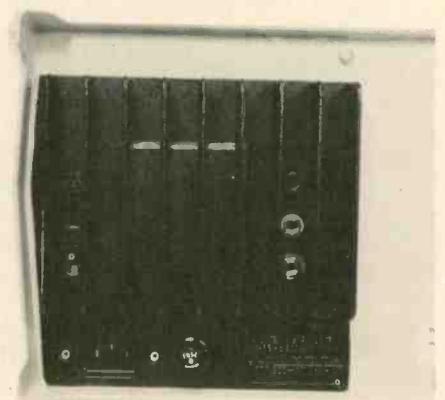


Fig. 2—Close-up view of rear panel of Model 1220.

the Model 1220A is evident from the features and characteristics outlined in the accompanying list of specifications. Many of the following features, which make the scope easy to operate, are not so evident from the specifications list, and consequently, are elaborated on here:

**Logical grouping of color-coded controls and inputs**—As revealed by Fig. 1, the operating controls and BNC-type inputs of the Model 1220A are arranged in a manner which makes it easier for the technician to learn and remember the panel positions and functions of each. For example, the BNC-type input and controls which relate to the triggering function are arranged vertically along the right side of the CRT and, in addition, the trigger-related controls are colored green, for quick "eye-identification." Controls and inputs which are used less frequently are on the back of the instrument, as shown in Fig. 2.

**Easy-to-operate controls**—Most of the front-panel operating controls are either latching-type pushbuttons or concentric knobs with clearly marked position indexes. All of the operating controls are large enough and are spaced far enough apart to be easily manipulated even by those technicians who, like me, are "all thumbs."

**BEAM FINDER**—When pressed in, a nonlatching pushbutton labeled BEAMFINDER, on the front panel bottom beneath the CRT screen, reduces the gain of the vertical and horizontal amplifiers and resets the sweep to the automatic-triggered mode so that the trace is brought back within the viewing area of the CRT screen, regardless of how mis-

adjusted the operating controls are. Then, while continuing to press in the BEAM FINDER button, the technician can readjust the controls in whatever manner is required to produce a viewable trace when the BEAM FINDER button is released.

**Horizontal trace even in absence of trigger signal**—The trigger system of the Model 1220A is designed so that anytime it does not receive a trigger signal within 500ms of the last trigger input it reverts to an automatic, nonsynchronized system which continues to trigger the horizontal sweep ramp generator. Consequently, a horizontal trace is produced even when no input is applied to the trigger system.

### OPERATING CONTROLS AND RELATED FUNCTIONS

The operating controls are identified numerically in Fig. 3. The controls are described in the following paragraphs in the numerical sequence in which they are identified in Fig. 3.

- 1) LINE—Applies power to the scope.
- 2) INTENSITY—Adjusts the brightness of the trace.
- 3) FOCUS—Adjusts the sharpness of the trace.
- 4) BEAM FINDER—Brings beam or trace into viewing area of CRT. When pressed, this pushbutton reduces amplifier gain to a level at which the trace cannot be deflected off-screen. By watching the viewing area as you press this button, you will be able to tell which other beam-positioning controls must be adjusted to bring the trace back on-screen.
- 5) HORIZONTAL POSITION—Adjusts

the movement of the trace from side to side in the viewing area. When the EXPANDER (horizontal vernier gain control) is being used, this control makes it possible for you to view either end of the expanded trace or any point between.

6) HORIZONTAL TIME/DIV.—With the EXPANDER in the calibrated position (fully counterclockwise), the markings on this dial indicate the amount of time it takes for a spot on the CRT to travel one horizontal division. This time ranges from 0.1-microsec to 0.5sec. The setting of this control determines the type of dual-trace display (alternate or chop). For sweep rates of .1 to 50 microsec/div., the dual traces are produced by switching the vertical channel from one vertical input to the other during alternate horizontal sweeps of the trace. For sweep rates of 1 msec/div. to .5sec/div., the dual trace is produced by switching the vertical channel from one vertical input to the other every 5 microseconds.

7) EXPANDER—In effect, the EXPANDER is a horizontal gain vernier. Clockwise rotation allows a selected portion of the trace to be "stretched" up to 10 times its normal size. This has many applications when a particular point on a waveform is of interest. (With the EXPANDER out of the detent (cal) position, sweep speeds do not relate directly to the TIME/DIV control markings.)

8) TRIGGER LEVEL—This control makes it possible to start the sweep at any desired point on the displayed waveform.

9) PROBE ADJ.—An internally generated square wave is available at this "touch point," for adjusting the



Fig. 3—Front view of Model 1220 with operating controls and inputs identified numerically. See text for function of each control.

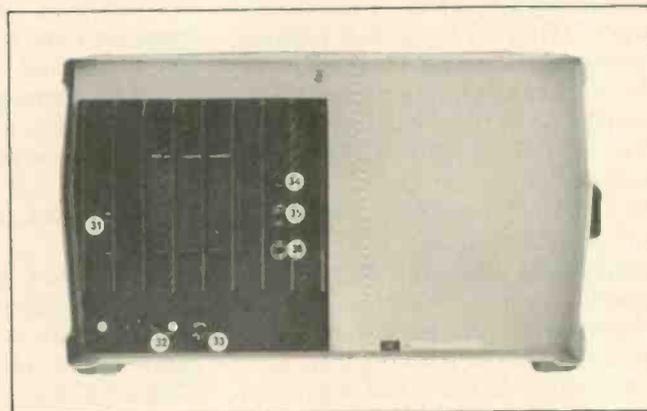


Fig. 4—Rear view of Model 1220 with controls and connections identified numerically. See text for function of each.

frequency compensation of a low-capacitance probe so that it is compatible with the input of the scope.

10) INT—This pushbutton is pressed to select an internally generated sync signal to trigger the sweep. Pressing this pushbutton releases EXT (11) and LINE (12).

11) EXT—When pressed, this pushbutton allows the scope to trigger on an external sync signal applied to EXT TRIGGER INPUT (17). (Pressing this pushbutton releases INT 10 and LINE 12.)

12) LINE—Pressing this pushbutton allows the sweep circuit to trigger on the line power supply frequency. (The known power source frequency may be used as a handy reference for investigating line interference problems.)

13) TV/NORM—In the NORM position (released), this pushbutton disables the TV Sync Separator circuit, and the instrument operates in the normal mode. When pressed in (TV position), the TV Sync Separator is enabled and the oscilloscope triggers on the frame (100 microsec or slower) or line (50 microsec or faster) sync of a video signal applied to the EXT TRIGGER INPUT (17) or to a CHANNEL A (23) or CHANNEL B (29) INPUT.

14) -/+—When this pushbutton is released, the oscilloscope will trigger on the positive-going edge of the applied signal. When pressed in, the negative-going edge will trigger the horizontal sweep.

15) X-Y/SWP (SWEEP)—When set to the SWP position (released), the oscilloscope operates in the normal mode. When set to the X-Y position, the oscilloscope deflects horizontally by an amount proportional to the amplitude of the signal applied to the EXT TRIGGER INPUT connector (17).

16) 1:10/1:1—EXT TRIGGER or X-DEFL signals (17) are attenuated by a factor of 10 when this pushbutton is in the pressed-in position. When the pushbutton is released to the out position, there is no attenuation of the signal applied to input connector (17).

18) CHANNEL A POSITION—Posi-

tions trace vertically. Clockwise rotation moves the trace up, and counter-clockwise rotation moves the trace down.

19) CHANNEL A VOLTS/DIV—Voltages on the dial of this switch show exactly what input voltage is required to deflect the beam vertically one division on the graticule when the vernier control (20) is in the calibrated position (full counter-clockwise). For example, if you apply a 200mv signal to CHANNEL A INPUT (23) and the VOLTS/DIV switch is set to 100mv, the beam will be deflected vertically two divisions.

20) CHANNEL A GAIN VERNIER—This control gives continuous variation within the calibrated settings on the CHANNEL A VOLTS/DIV control (19), and is useful for making voltage comparisons.

21) CHANNEL A GND—When this pushbutton is pressed in, CHANNEL A amplifier is grounded and any signal applied to CHANNEL A INPUT (23) is disconnected. In addition, *automatic trace is automatically applied to the CRT*. This pushbutton is helpful in establishing a zero-volt level during DC measurements.

22) (CHANNEL A) AC/DC—Determines whether the input signal is connected to the preamplifier capacitively (AC) or directly (DC). When the signal is directly coupled (DC), the instrument has a bandwidth response from DC to 15 MHz; when capacitively coupled (AC), the bandwidth response is from 2 Hz to 15 MHz.

24) CHANNEL B POSITION—Performs the same function as (18).

25) (CHANNEL B) VOLTS/DIV—Serves the same purpose as (19).

26) CHANNEL B GAIN VERNIER—Operates in a manner identical to (20).

27) (CHANNEL B) GND—Identical to (21).

28) (CHANNEL B) AC/DC—Identical in function to (22).

30) VERTICAL DISPLAY—When two input signals are applied (one to Channel A, one to Channel B), these pushbuttons determine which channel will be displayed on the CRT.

When VERTICAL DISPLAY A is pressed in, the Channel A input signal is displayed; Channel B input is displayed when B is pressed in. When both pushbuttons are pressed in, both vertical input signals are displayed at the same time. VERTICAL POSITION controls, (18) & (29), position the displays, one above the other, to allow comparison of the two signals. *Under these conditions, the signal at Channel A is internally selected as the sweep trigger. This allows you to compare the characteristics of the two signals.*

### FRONT PANEL INPUTS

17) EXT TRIGGER OR X INPUT—The input signal applied to this BNC-type connection may be used to trigger the sweep (EXT button (11) pushed in) or it can be used to deflect the trace along the horizontal axis of the screen, for X-Y display (X-Y/SWP button (15) pushed in).

23) CHANNEL A INPUT—Signals applied to this BNC-type connector are routed through the Channel A VOLTS/DIV controls, (19) and (20), to the vertical amplifier when VERTICAL DISPLAY A (30) is pushed in.

29) CHANNEL B INPUT—Signals applied to this BNC-type connector are routed through Channel B VOLTS/DIV controls, (25) and (26), to the vertical amplifier when VERTICAL DISPLAY B (30) is pushed in.

### REAR PANEL CONTROLS AND INPUTS

These controls and input connections are identified numerically in Fig. 4 and perform the following functions:

31) LINE SELECTOR SWITCHES—These two switches, which together provide four possible combinations of settings, set up the power transformer to operate from one of four line voltages—100VAC, 120VAC, 220VAC or 240VAC.

32) POWER PLUG RECEPTACLE—This three-prong receptacle, through which line voltage is applied to the scope, provides grounding of the scope chassis, for safe operation.

33) FUSE HOLDER—Accepts standard fuses to provide instrument protection in case of current over-

load. A 0.5-Amp slow-blow fuse must be used when operating from a 100v/120v power source. A 0.25-Amp fuse is used when operating from a 220v/240v power source.

34) z—A banana jack that permits intensity modulation (Z-axis) volt-

ages to be applied. A +5V signal applied to the Z input will blank a trace of any intensity. This feature is helpful in determining signal frequencies. Maximum input at this jack is 7 volts RMS.

35) GROUND CONNECTION—A con-

venient oscilloscope chassis ground point.

36) 12v—This telephone-type jack provides 12VAC for operating the graticule illuminator of the optional Hewlett-Packard Model 10373 Camera Adapter. ■

## SPECIFICATIONS

Hewlett-Packard Model 1220A Oscilloscope

### VERTICAL AMPLIFIER

#### Modes of Operation:

Single Trace—(Channel A or B)

Dual Trace—Channels A and B (automatic selection of either alternate mode of dual trace, for sweep speeds from 1 msec/div. to .5 sec/div., or chopped mode of dual trace, for sweep speeds from .1 microsec/div. to .5 msec/div.)

#### Bandwidth (either one or both channels):

DC coupled—DC to 15MHz

AC coupled—2Hz to 15MHz

Sensitivity: 2 mv/div. to 10v/div., in 12 ranges in 1, 2, 5 sequence

#### Accuracy:

± 3 percent on 10mv/div. to 10v/div. ranges with vernier in calibrated position

± 5 percent on 2mv/div. and 5mv/div. ranges

Input Impedance: 1 megohm shunted by approximately 30pf

Types of Input Coupling: AC, DC and Grounded. (Grounded coupling disconnects input signal and grounds amplifier input.)

Maximum Input: ±400 v (DC + peak AC)

### TIME BASE (Horizontal Sweep)

Type: Triggered, either from internal or external sources. (Horizontal trace automatically displayed when triggering signal not applied.)

Sweep Ranges: .1 microsec/div. to .5 sec/div. in 21 ranges in 1, 2, 5 sequence

Sweep Accuracy: ± 4 percent with EXPANDER (horizontal vernier) in calibrated position

Magnification: EXPANDER (horizontal vernier) control magnifies sweep a minimum of 10X. (Usable maximum sweep speed is approximately 20 nsec.)

### TRIGGERING (For Time Base)

#### Types:

Internal—Approximately 2Hz to 15MHz response with trigger input signals producing 1 division or more of vertical deflection

External—Approximately 2Hz to 15MHz response with input signals of .1vp-p or more amplitude

Line—Internally generated line frequency (60Hz)

TV Sync—An internal sync separator circuit automatically separates and provides TV sync triggering at either frame (.5 sec/div. to 100 microsec/div.) or line (50 microsec/div. to .1 microsec/div.) rates. Separator also can be used as a low-pass filter

#### Level and Slope:

Internal—Adjustable to any point on the + or - slope of the displayed waveform

External—Continuously variable from + .5v to - .5v

on each slope of the trigger waveform. (With 20dB (1:10) attenuator activated, triggering is variable from +5v to -5v.)

### EXTERNAL HORIZONTAL INPUT

Bandwidth: DC to 1MHz

#### Sensitivity:

Horiz. Vernier (EXPANDER) Ext. Attenuator Sensitivity

Completely clockwise 1:1 100 mv/div.

Cal. Position (CCW) 1:1 1 v/div.

Cal. Position (CCW) 1:10 10 v/div.

(Continuously adjustable between ranges by Expander)

Impedance: 1 megohm shunted by approximately 30pf

X-Y Phase Shift: Less than 3 degrees at 100KHz

### CRT

Type: 2kv accelerating potential, P31 phosphor

Size: 8 x 10 cm (5 inch), internal graticule with .2 subdivisions on major horizontal and vertical graticule lines

### BEAM FINDER

When pressed in, returns trace to CRT screen regardless of setting of horizontal and vertical controls

### PROBE ADJUST OUTPUT

2KHz square wave at approximately .5vp-p

### INTENSITY MODULATION (Z) INPUT

Input Level Required: +5v, 2Hz to 1MHz blanks trace of any intensity

Maximum Input: 7v RMS

Impedance: 1.5 K ohm, approximately

### POWER REQUIREMENTS

Power transformer input adjustable to operate from AC line voltages of 100, 120, 220 or 240 VAC (+5 to -10 percent), 48 to 66 Hz

### WEIGHT

16.25 lbs.

### SIZE

7.1 inches high x 12.7 inches wide x 16.1 inches deep

### ACCESSORIES FURNISHED

Power cord, blue light filter, fuses for 100/120VAC and 220/240VAC operation, operating service manual

### PRICE

\$695.00

### ACCESSORIES OPTIONAL

10:1 Voltage Divider Probe (Model 10013A), \$30

Rack Mounting Kit (Model 10119A), \$55

Dual Banana Plug-To-BNC Adapter (Model 10110A), \$7

Front Panel Cover, for protection and probe storage (Model 10117A), \$18

Camera Adapter, (Model 10373A), for Model 123A camera, Price N/A

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## 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.

### OSCILLOSCOPE

700

*Triggered sweep and a DC-to-15 MHz bandwidth*

A solid-state, oscilloscope, Model 459, with a 5-inch CRT and triggered sweep, is introduced by Simpson Electric Co. The vertical sensitivity of the scope is continuously variable through eleven calibrated steps from 10 mv/cm to 20 v/cm; bandwidth is DC to 15 MHz, with a corresponding square-wave response of less than 5 percent aberration for a rise-time of 24



nsec. Input impedance is a constant 1 megohm, 35 pf. A slim, low-capacitance (15 pf) probe is optional. Sweep speed is adjustable from 0.5 sec/cm to 0.2  $\mu$ sec/cm in 20 calibrated steps, plus special TV-H and TV-V settings. A 5 X magnifier extends the sweep speed to 40 nsec/cm. Any one of three sweep modes can be selected; automatic, normal or free-running. Horizontal sensitivity is 250 mv/cm with a bandwidth from DC to 1 MHz. Three 1-KHz square-wave signal levels—50 mv, 0.5 v and 5 v peak-to-peak—are provided for checking vertical calibration, external circuit testing and adjustment of the low capacitance probe. The unit accepts standard scope camera or light hood and has an illuminated 8 cm by 10 cm filtered graticule with both amplitude and vector indexes. The X and Y vector inputs are on the front panel, the Z input on the rear. The price is \$435.

### DIGITAL MULTIMETER

701

*Full multimeter capability plus BCD output*

A new 20,000 count ( $4\frac{1}{2}$ ) digit instrument is designed to provide full multimeter capability plus BCD output for systems applications. The Model 41 has 24 ranges: four ac voltage ranges with 100 $\mu$ v resolution; five dc voltage ranges with 10 $\mu$ v resolution; five resistant ranges with 100M resolution and five ac and dc current ranges with 10na resolution. The TTL compatible BCD output of reading, function, range and polarity enables

the unit to be used in conjunction with printers and/or other digital output devices. The instrument is housed in high impact-resistant polycarbonate plastic with aluminum top and bot-

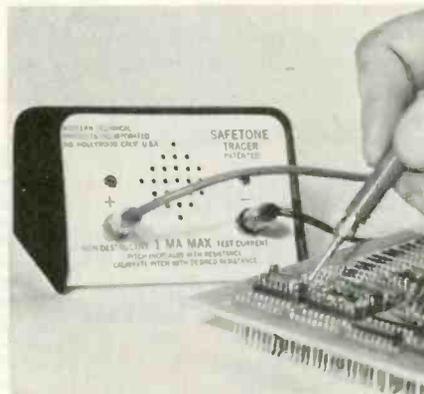


tom covers. The readouts are .515-in. high and the instrument weighs 6.4 lb. Data Technology Corp.

### CIRCUIT TESTER 702

*Completely self-contained audible tester*

A current-limited (1 mA), audible circuit tester which is self-contained is introduced by Western Technical Products. The Safetone Tracer is designed for rapid tracing or troubleshooting of circuits, IC's, semiconductors, logic



components, harnesses, pots, relays and any other delicate components. Unlike some ohmmeters, test lights, buzzers and high-current testers, it is completely safe and cannot degrade or damage components. While listening to the tone pitch (which increases with resistance), the user is able to sweep rapidly across circuits with complete eye and body freedom. The unit is powered by two standard size D batteries.

### AMPLIFIER CHECKER 703

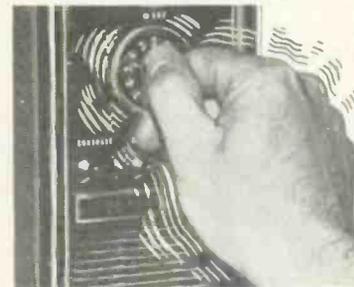
*A combination transistor and tube tester in one unit*

A new concept in transistor and tube testing, with both being tested in one simplified unit, is announced by Sencore. The tester, Model TC28 Hybrider, checks transistors, field-effect  
*continued on next page*

## HOW TO RESTORE TV TUNERS



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## NEW PRODUCTS...

transistors, voltage amplifying tubes and power tubes. The checker is a combination of Sencore's Mighty Mite and the new Cricket transistor tester. It is a tube tester on the left of the test function switch and a transistor tester on the right half. Layout is simplified



by running the two separate units into a common meter. There are no lights for short indications, everything is now read on one large meter. Price is \$220.00.

## SOLDERING IRON HOLDER 704

Made of high-carbon steel with chrome plating

The Wolo pencil soldering iron holder, introduced by Wolo Manufacturing Corp., is made of high-carbon, .120-inch thick steel finished with heavy chrome plating. Mounts easily to work bench via a heavy steel bracket.



## SEMICONDUCTOR TESTER 705

Test results are indicated on an LED readout

Krystal Kits introduces the Jinni-I Semiconductor Tester. The tester will check transistors, diodes, SCR's and other semiconductors. Any transistor



(low, medium or power) may be tested automatically for type "P" or

"N," transistor gain, open or shorted junctions, with one press of the test switch. The test results are indicated on a solid-state, LED seven-segment readout. Price is \$49.95.

## MOBILE ANTENNAS 706

Field tuneable from 144 MHz through 174 MHz

The Antenna Specialists Co. announces a new series of high-band VHF mobile antennas designed for performance under demanding field conditions. Known as the ASP-800 series, the antennas feature 200 w ratings, assuring reliable operation despite high RF power requirements or adverse duty cycles.

The whips used on the antennas are heavy .125-inch diameter, 17-7 PH stainless steel and are taper ground to reduce wind loading. The antennas are field tuneable to the exact operating frequency, from 144 MHz through 174 MHz. The coils used are shock resistant and are encased in PVC jackets for weatherproofing. Electrically, they are shunt-fed and operate at DC ground. The new, low-loss, waterproof band and UHF antennas made by the



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## DIGITAL MULTIMETER 707

*Employs plug-in IC's, LED's and circuit boards*

DigiTec is introducing the Model 2210 Digital Multimeter, a full 4½ digit, bi-polar instrument with push-button convenience. A total of 13 pushbutton-selected measuring ranges are offered, covering the basic functions of DC volts, AC volts and resistance. DC and AC voltages are cov-



ered in four ranges extending from 1.9999 v full scale to 1000 v with basic accuracy of 0.01 percent of reading. Resistance can be measured over 5 ranges extending from 1.9999 K

ohms full scale to 19.999 megohms full scale with accuracy of 0.07 percent of reading. The display employs large, easy-to-read Monsanto MAN 72 LED's. The compact, half-rack cases, of extruded and diecast aluminum, are easily rack mounted in either single or double configurations. Price is \$525.00.

## VOM 708

*AC volt and AC amp measurements can be made almost simultaneously*

The Model 265 VOM, introduced by Simpson Electric Co., has a high AC and DC current measuring capability and the ability to make AC volt and AC amp measurements almost simultaneously. This is achieved by isolation of the AC current ranges from the voltage ranges, plus adjacent switch positions which allow switching from the volts range to the amps position. The VOM is housed in the familiar Simpson 260 style case, with a single central range switch and convenient Adjust-A-Vue handle, which doubles



as a meter stand. Accessories include a spring-loaded, retractable probe; AC and DC 5,000 volt probes; a 30,000-v DC high-voltage probe; and a selection of carrying cases.

## PARTS/STORAGE BINS 709

*Constructed of corrugated fiberboard and available in eye-catching colors*

Parts and storage bins by Kole makes it easier to keep parts, tools, orders, invoices, mail, etc., separate for quick and easy identification for storage, re-



trieval and inventory. The bins are constructed of corrugated fiberboard and are available in 32 sizes in a mottled white finish and in six sizes in five colors. They are designed with a special cut-down front to enable the user to see in and insert or remove contents without taking the bin off the shelf. ■

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## 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.

### MICROPHONE

710

*Designed for two-way communication use by truckers*

A noise-cancelling, power microphone for citizen's band application, the first designed exclusively for two-way communication use by truckers and the first amplified microphone in this field, is announced by The Astatic Corp. The microphone has an adjustable output. Called the "Trucker," it achieves its noise cancelling ability because its design is sensitive to spherical shaped sound waves as opposed to flat waves. Sound waves of speech about one-quarter inch from the lips are curved and are accepted by this special microphone cartridge and diaphragm. Its output is adjustable over a 40-dB range, with control knob furnished or with a small screwdriver.



because its design is sensitive to spherical shaped sound waves as opposed to flat waves. Sound waves of speech about one-quarter inch from the lips are curved and are accepted by this special microphone cartridge and diaphragm. Its output is adjustable over a 40-dB range, with control knob furnished or with a small screwdriver.

Output impedance is under 5,000 ohms, and recommended load is 100 ohms and up to open circuit. The unit measures 3 3/8 inch high, 2 3/8 inch wide, and 1-19/32 inch deep and the weight is 10 3/4 ounces with cable.

### SPEAKERS

711

*Blends bookshelf design with acoustic suspension*

Benjamin Electronic Sound Co. introduces their Models CS-10 and CS-20 bookshelf speaker systems. The speaker features include an air-suspension-type, 8-inch woofer system for low dis-



tortion; acoustic "transformer" cabinet design, which provides high velocity acoustic energy at the vent slot for low-frequency control while obtaining

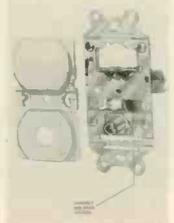
high efficiency characteristics of the back relieved enclosure; and a tweeter with damping and control of frequency response. Both speakers can be used with amplifiers that produce as little as 5 to 8 w rms per channel. The power handling capacity of the CS-10 is 40 w and that of the CS-20 is 80 w. The units are equipped with an L/C cross-over network. The Model CS-10 is priced at \$89.95 and the CS-20 is \$119.95.

### MATV TAPOFF

712

*Isolation can be adjusted between 12 and 23 dB*

An MATV tapoff whose isolation can be adjusted to any value between 12 and 23 dB is added to the Versatap MATV line of **Blonder-Tongue Labs.** The Model V-4897 Versatap eliminates the need for stocking several different values of fixed-isolation tapoffs, and prevents errors caused by the installation of incorrect tapoffs by inexperienced personnel. The unit mounts in a standard electrical wall box and can be covered with standard wall plates. The tap output connector is a



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NO RESIDUE • NON-FLAMMABLE  
NON-TOXIC • NON-CONDUCTOR

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## The Wayne Model WT2A

- makes YOU money
- saves much time
- makes troubleshooting easier

Patent 3,778,713

A new concept in transistor testing based on proven methods of circuit analysis. A current limited AC voltage is applied to each semiconductor junction under test. The resulting DC voltage is monitored while the rectifying junction is passing normal rated current. Abnormalities are easily identified.

- Indicates PNP or NPN
- Measures relative gain
- Test leads applied without prior basing knowledge
- Locates base and collector during test
  - Indicates silicon or germanium
  - Indicates transistor non-linearity
- In-circuit tests with shunt impedance down to THREE ohms
- Performs all of above and more in less than ten seconds

## WAYNE ELECTRONICS

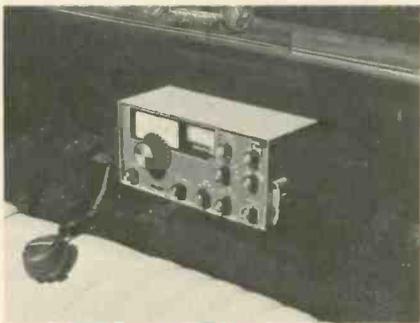
5412 Nordling St./Houston, Texas 77022

single, 75-ohm, F-type female. A matching F-type male connector is supplied with each tap. Thru-line match values range from 16 dB at SUB-channel to 10 dB on UHF with the tapoff set for minimum isolation. At 23 dB isolation, the figure is 22 dB at SUB and VHF frequencies, and 12 dB on UHF. Thru-line insertion loss is under 2 dB at all frequencies and isolation settings. Price is \$5.75.

**SSB/CW TRANSCEIVER 713**

*A complete desk-top or under-the-dash/hump-mounted receiver*

A new version of the FPM-300 "Safari" SSB/CW amateur transceiver,



the Mark II, is introduced by the Halli-

crafters Division of Wilcox Electric, Inc. The transceiver, like its predecessor, provides reception of single-sideband (SSB) and continuous wave (CW) operation in the 80-, 40-, 20-, 15-, and also 10- to 11-meter domestic and international amateur bands. The transceiver is a hybrid system which uses solid-state and tube circuitry. The unit is intended for both domestic and international markets and has a built-in power supply for operation from 117/234 v AC and 12 v DC power sources. Price is \$625.

**B/W TV POWER SENTRY SYSTEM 714**

*Magnetic Voltage Regulator System now available in B/W TV sets*

Zenith Radio Corporation introduces four new 19-inch (diagonal), black-and-white, all-solid-state receivers with the Power Sentry system of magnetic voltage regulation. The system works with the solid-state chassis to automatically stabilize voltage in the television set. It reduces stress and excess heat on components from household voltage surges and reduces the amount of electricity needed to operate solid-state TV sets. The sets employing the system are Models F2070X, F2050J, F2055W and F2060W.

**MONITOR RECEIVER 715**

*Available with special dealer introductory program*

Electrosonics is introducing Electro-Monitor, a complete line of FM monitor receivers for professionals and hobbyists, through a complete dealer in-



troductory package. They are designed to monitor any two FM carrier frequencies, high or low, at the same time, to enable the listener to hear simultaneously police, marine, fire, civil defense or weather or hear both sides of a duplex communication. The monitor receives VHF 25-54 MHz, VHF 140-180 MHz or UHF 430-512 MHz  
*continued on next page*

**4 Money-saving reasons to buy EICO's Solid State Test Equipment.**



**EICO 242 FET-TVOM.** Peak-to-peak measurements of AC volts and milliamps. 6 1/2" meter. 7 non-skip ranges. High input impedance. Low 1 volt scale. DC/AC Multi-Probe. AC or battery operated. Kit \$89.95, Wired \$129.95.

**EICO 379 Sine/Square Wave Generator.** Simultaneous sine and square wave outputs. Covers 20 Hz to MHz in five ranges. Low distortion sultzer feedback circuit. Square wave rise time better than 0.1 microseconds. Kit \$89.95. Wired \$129.95.

**EICO 330 RF Signal Generator.** 5 bands cover a range from 100 kHz to 54 MHz. Calibrated modulation adjustment control. 400 Hz audio output. Provision for modulating RF with internal or external signal source. Kit \$79.95, Wired \$119.95

**EICO TR-410 Triggered Sweep Scope.** 100% solid state. OC to 10MHz bandwidth. Sweep synchronized gate output. Z-Axis input. Use as vectorscope for color TV servicing. One probe for direct and 10:1 measurements. Wired \$439.95.

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*South River's* New Improved **EAVE MOUNTS**

**SOUTH RIVER METAL PRODUCTS CO., INC.**  
SOUTH RIVER, NEW JERSEY 08882

# DUST

## STICKS TO OIL, SILICONE, GREASE.

Dust sticks to every protective lubricant used in every tuner cleaner/lubricant on the market today - including our *BLUE STUFF*, *KLEEN-IT* and *COLOR RID OX*.

*We thought it would be a real help if we could make one that refused to collect dust. \**

# HASSLE

## IS WHAT YOU NEED LESS OF

Up until now, either you had to be super careful where you sprayed the tuner cleaner/lubricant you used or it went all over everything and soon collected dust and contamination. If you wanted to do the best job - you pulled the tuner, - so you could keep the lubricant away from sensitive areas.

*We thought it would be a help to design a tuner cleaner/lubricant just for house calls, one that would make your tuner cleaning on house calls easier, safer and more thorough, one where you wouldn't have to pull the tuner to do the best job.*

**We've  
Done Both  
And It's  
Called**

\* Test it yourself. take your present tuner cleaner/lubricant. spray a spot on a smooth surface next to a spot of *TUNER CARE*. let them both dry and sprinkle cigarette ashes over both spots. Then wipe gently. The ashes will stick to your present tuner cleaner/lubricant and won't stick to the *TUNER CARE*.

**AT YOUR  
FAVORITE  
DISTRIBUTORS**

**TECH  
SPRAY'S DUST HATER**

# TUNER

# C A R E

## FOR HOUSE CALLS

**FOR PROFESSIONALS ONLY**  
No. 1670-85 • Net Wt. 8 Ozs.

from **TECH  
SPRAY**

*where we find solutions for your problems*

## DEALER SHOWCASE...

and features a single on/off volume control, triple pushbutton selector/switch to monitor one, two or both channels, adjustable squelch control, four watts peak audio output power, carrying handle, antenna and comes complete with crystals and one-year factory warranty. The special dealer introductory program features a full-color countertop display, demo unit and sales literature package.

### ELECTRIC SIGN 716

*Useful for retailers who want to conserve energy*

An electric motion sign is offered to its retailers by BSR. It is part of a pro-



gram to gain in-store point-of-sale dominance for BSR turntables. A light control gives the effect of the record rotating on the changer. The sign is particularly useful for retailers who are reducing night illumination to conserve energy. The sign produces a bright, wide-angle illumination from its white plastic surface.

### UHF ANTENNA 717

*Exact replicas of the car manufacturers' mounts*

The Antenna Specialists Co. is introducing a new series of high-performance UHF communications antennas for security-related operations. The antennas feature a 5/8-wavelength design that produces 2.5 dB of gain, compared with conventional 1/4-wave designs. Also featured is a special high-conductivity copper-nickel plating



which reduces power losses and delivers more signal. The antennas are rated for use with up to 100 watts of power, and stub tuning allows a wide 3-MHz bandwidth for multichannel operation. Frequency ranges available are 406-420 MHz and 450-512 MHz. The antennas have been designed to give the exact appearance of conven-

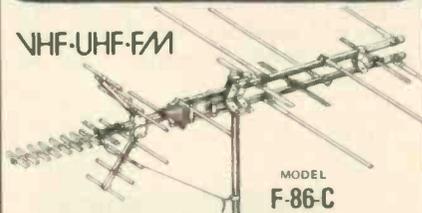
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# new! FINCO® '80 Series COLOR SPECTRUM™ TV/FM ANTENNAS

Capture the TRUE  
COLOR...



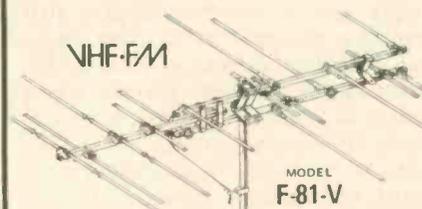
VHF-UHF-FM



MODEL  
F-86-C

- MODEL F-89-C  
54 Elements VHF-UHF-FM  
CX-F-89-C (75 OHM)
- MODEL F-88-C  
47 Elements VHF-UHF-FM  
CX-F-88-C (75 OHM)
- MODEL F-87-C  
33 Elements VHF-UHF-FM  
CX-F-87-C (75 OHM)
- MODEL F-86-C  
27 Elements VHF-UHF-FM  
CX-F-86-C (75 OHM)
- MODEL F-85-C  
21 Elements VHF-UHF-FM  
CX-F-85-C (75 OHM)

VHF-FM



MODEL  
F-81-V

- MODEL F-84-V  
34 Elements VHF-FM  
CX-F-84-V (75 OHM)
- MODEL F-83-V  
28 Elements VHF-FM  
CX-F-83-V (75 OHM)
- MODEL F-82-V  
20 Elements VHF-FM  
CX-F-82-V (75 OHM)
- MODEL F-81-V  
14 Elements VHF-FM  
CX-F-81-V (75 OHM)

Write for Catalog No. 20-658, Dept. ETD-9-74

**The FINNEY Co.**  
34 West Interstate Street  
Bedford, Ohio 44146

... for more details circle 111 on Reader Service Card

tional broadcast antennas, including exact replicas of the car manufacturers' mounts. The ASP-820, ASP-821 and ASP-822 antennas can be used with the new Model ASP-829 UHF/AM broadcast coupler. The coupler allows simultaneous use of both the UHF communications system and a standard AM broadcast receiver.

## ELECTRONIC PRODUCTS 718

Fast-moving products  
packed in a durable cooler

Five Mallory Desert Deals are introduced which represent selections of fast-moving products packed in a quality, durable IGLOO cooler. The cooler is free with each selection pur-



chased, and it holds one gallon liquid or six 12-ounce cans. The five Desert Deals are: popular can type filter capacitors for color TV; 2.5 amp., 1000 v rectifiers; Duracell alkaline batteries; PTC diode/rectifiers; PTC transistors.

## 8-TRACK PLAYER 719

Portable unit operates on  
six "C" batteries or AC line

Panasonic is introducing the latest in tape listening fun with its Dynamic-8



portable 8-track player. With an eye-catching "detonator" design in red,  
*continued on next page*

## T & T VALUE SALE

RAY, I.C.C., RCA, SYL.  
FAMOUS MAKE, NEW JOBBER (BOXED) TUBES  
80% OFF LIST

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<input type="checkbox"/> 3HA5 5 for \$4.30	<input type="checkbox"/> 6JS6 5 for \$8.30
<input type="checkbox"/> 5G8 5 for \$5.30	<input type="checkbox"/> 6KA8 5 for \$5.50
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<input type="checkbox"/> 6CG3 5 for \$4.40	<input type="checkbox"/> 6KE8 5 for \$6.85
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<input type="checkbox"/> 6GH8 5 for \$3.55	<input type="checkbox"/> 17J28 5 for \$4.05
<input type="checkbox"/> 6GF7 5 for \$5.95	<input type="checkbox"/> 23J9 5 for \$5.35
<input type="checkbox"/> 6EJ7 5 for \$3.40	<input type="checkbox"/> 33GY7 5 for \$7.20
<input type="checkbox"/> 6GK5 5 for \$5.20	<input type="checkbox"/> 38HE7 5 for \$8.20

I.C.C. ODDBALLS-NEW JOBBER (BOXED)

<input type="checkbox"/> 5E7 5 for \$3.70	<input type="checkbox"/> 6MB8 5 for \$4.60
<input type="checkbox"/> 5MB8 5 for \$4.60	<input type="checkbox"/> 12MD8 5 for \$6.35
<input type="checkbox"/> 6A3 5 for \$4.45	<input type="checkbox"/> 16AQ3 5 for \$3.40
<input type="checkbox"/> 6DW3 5 for \$4.50	<input type="checkbox"/> 21HB5 5 for \$6.20
<input type="checkbox"/> 6EM4 5 for \$10.75	<input type="checkbox"/> 31J56 5 for \$9.35
<input type="checkbox"/> 6HB5 5 for \$6.00	<input type="checkbox"/> 36MC6 5 for \$11.75

TRANSISTORS XACT. REPLACEMENT (BOXED)

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<input type="checkbox"/> SK3024 5 for \$3.15	<input type="checkbox"/> SK3042 5 for \$6.20
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<input type="checkbox"/> SK3026 5 for \$3.00	<input type="checkbox"/> SK3114 5 for \$2.40
<input type="checkbox"/> SK3027 5 for \$5.25	<input type="checkbox"/> Hep 707
	5 for \$15.00
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2N4077 and 2N4078	4 pairs for \$7.80

AUDIO

<input type="checkbox"/> 84 Min. 8 Track Irish Tape	3 for \$3.00
<input type="checkbox"/> 60 Min. Cassette tape Irish	6 for \$2.50
<input type="checkbox"/> AC Adaptor 117V to 9V DC	ea. \$1.50
<input type="checkbox"/> Exact Replacement Needles	
<input type="checkbox"/> Shure N44, N75, N77, N91	ea. \$2.95
<input type="checkbox"/> Pickering V15	ea. \$2.95

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<input type="checkbox"/> RCA 120B18 \$1.95	<input type="checkbox"/> RCA 135932 \$2.95
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<input type="checkbox"/> Y107 70" 21" Color	2 for \$10.00
<input type="checkbox"/> Y109 CY95ACb wo/b/c	3 for \$10.00
<input type="checkbox"/> Syl. ED1 51-29978-1	2 for \$15.00
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<input type="checkbox"/> UHF-VHF tuner inc. 3GK5, 5LJ8	ea. \$4.95
<input type="checkbox"/> Syl. tuner 54-35055-4 inc.	
<input type="checkbox"/> 3 transistors	2 for \$15.00
<input type="checkbox"/> Curtis Mathes 07A025-000 inc.	
<input type="checkbox"/> 3GK5, 6CG8	2 for \$7.00
<input type="checkbox"/> G.E. tuner 23C225055-1 inc.	
<input type="checkbox"/> 6LJ8, 6GK5	2 for \$7.00

ANTENNA SUPPLIES

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GENERAL

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<input type="checkbox"/> 21" Color Boosters	3 for \$11.00

EQUIPMENT

<input type="checkbox"/> TV Tuner Subber Mark 1V	\$39.95
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<input type="checkbox"/> TV Master Subber Mark V	\$144.95

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21	Prizes each month		\$1,200.00 each month

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2. Fill Out Entry Form\*\* and Have Countersigned by Sales Person. (Distributor Salesman Will Submit Your Entry and Your Form Will Be Included Upon Receipt for That Month and Succeeding Months Drawings. Example: Forms Received By Sept. 29 Will Be Eligible For All 3 Drawings)

\*\*One Per Service Company/Location.

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# BOTTOMS UP



Start saving the gray bottom flaps with the GE monogram from GE entertainment receiving tube cartons. They're worth valuable awards to independent service dealers and technicians in a fabulous gift bonanza program from General Electric.

The gift list includes some 43 items ranging from sporting equipment to home appliances, from diamond jewelry

to distinctive luggage, from globes and books to calculators and Attend-a-Phones. It even includes the much prized Polaroid SX-70 camera and American Experience weekend vacations at any one of 101 prestigious resorts.

**BOTTOMS UP!!!** Redeem your flaps by November 30, 1974. Full details at your authorized distributor.

TUBE PRODUCTS DEPARTMENT  
 GENERAL ELECTRIC COMPANY  
 OWENSBORO, KENTUCKY 42301

GENERAL  ELECTRIC

yellow, or blue, the lightweight player makes it easy to play 8-track cartridges anywhere. The plunger doubles as a rotating carrying handle and a program selector. The tape program number appears in a big easy-to-read window. All the user has to do is slide in an 8-track cartridge and adjust the volume control. The solid-state player operates on six "C" size batteries and comes complete with an AC cord for household use. Price is \$39.95.

### CAR STEREO DISPLAY 720

*With built-in power supply and a switching system*

Channel Master is introducing the one-stop Car Stereo Center, an illuminated merchandising rack which displays the company's auto radios, 8-track auto players and speakers. The display, designed to stand on either floor or



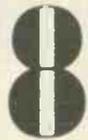
counter, comes with built-in power supply and a switching system that permits a customer to compare stereo and 4-channel sound, up to nine different radios and tape players, and a variety of speakers. The display, measuring 36 inches wide by 40 inches high, is made of vinyl-covered flake board, and features pilfer-proof product mounting.

### COLOR TV REPLACEMENT PICTURE TUBE 721

*Uses the latest X-radiation attenuation glass bulb*

The RCA "Colorama A" line of totally remanufactured color television picture tubes, with used X-radiation attenuation glass, latest all-new rare earth phosphors and a new electron gun assembly, is introduced by RCA Electronic Components. Seven tube types that cover 92 percent of the industry color picture tube replacement sales are included in the line. Three of these

The right  
replacement, faster  
with



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KITS**

from your Centralab  
Distributor



**KITS AVAILABLE:**

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- Miniature Wirewound Controls
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- Portable, with convenient handles.
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For complete details,  
see your Centralab Distributor  
or send for descriptive brochure.

DISTRIBUTOR PRODUCTS



**CENTRALAB**  
Electronics Division  
GLOBE-UNION INC.

5757 NORTH GREEN BAY AVENUE  
MILWAUKEE, WISCONSIN 53201

tube types are Matrix tubes. The new tube line carries a free 18-month in-boarded "factory" warranty, with an optional 12-month add-on warranty for a nominal charge.

**STEREO TURNTABLE 722**

Features a DC  
direct drive motor

JVC America, Inc., introduces a direct-drive turntable designed to produce better standards in record reproduc-



tion. It features a vibration-free, DC direct-drive motor that results in a wow and flutter of only 0.05% WRMS, and a S/N ratio of better than 60dB. The dynamic balanced arm is of special low mass, low friction design for better tracking and CD-4 reproduction. The motor and 12-inch die cast aluminum turntable are mounted in a specially designed, resonance-free, beechwood base. The Model JL-B44 unit has a hinged dust cover and is styled to compliment any decor. Price is \$349.95.

**TELEPHONE ANSWERER  
DISPLAY 723**

Three-dimensional, with self-selling demonstration tape cassette

BSR has introduced a three-dimensional sight and sound display for deal-



ers of their Phone Butler telephone answerer. The display features a three-dimensional cut-out of the British  
*continued on next page*

**DELUXE DIGITAL COLOR  
CONVERGENCE GENERATOR**

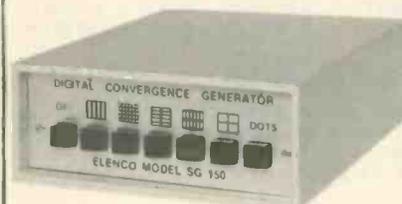
NOW AT A PRICE EVERYONE  
CAN AFFORD

- ROCK SOLID PATTERNS
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- QUARTZ CRYSTAL OSCILLATORS
- 2 FULL YEARS' WARRANTY



**MODEL  
SG-200 \$79.95**  
reg. \$99.95

10 Patterns: Full & Gated Rainbow, 4 Crosshatch, 4 Dot Die Casted 1/8" Aluminum Case.



**MODEL  
SG-150 \$59.95**  
reg. \$74.95

10 Patterns: B&W Bars, White Field, 4 Crosshatch, 4 Dot.



**MODEL  
SG-100**

ONLY  
**\$47.95**  
reg. \$59.95

2 Patterns: 20 x 16 Crosshatch, 320 Dots, weight only 17 oz.

**SPECIAL PRICE LIMITED TIME ONLY  
FULL 15 DAYS MONEY  
BACK GUARANTEE**

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- My check or money order enclosed.
- COD—Add \$2.50 mailing & handling.

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3A3	5 for \$5.10	6JE6	5 for \$11.15
3AT2	5 for \$4.90	6JS6	5 for \$9.30
3GK5	5 for \$4.85	6JU8	5 for \$5.50
3HA5	5 for \$4.80	6KA8	5 for \$6.10
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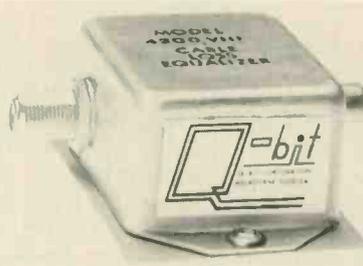
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## Square Wave Testing . . .

*continued from page 33*

service manual for the amplifier. It says: "FR essentially flat from 200 Hz to 10 kHz." So, the amplifier has checked out close to normal. Not bad for voice intelligibility. That's what it was primarily designed for. The clipping observed near full load was disregarded because the amplifier seldom runs at more than 15 watts in its present application. We will check it again after it is operated for a few hours.

### Interpreting Distorted Square Waves

Like all symptomatic analyses in electronic troubleshooting, there are few clear-cut, absolutes—with the exception of a blown pilot lamp. The most expert audio technicians employing the techniques described previously maintain voluminous notes and waveform drawings on every job. There are innumerable variations of distorted sine and square waves. If all are recorded along with notes about the related symptoms and faults, you will soon accumulate a wealth of valu-

able information for on-the-job daily reference. Moreover, the sine/square-wave (or function) generator and scope can be used as a point-to-point signal injecting and indicating combination for checking key portions of all amplifier stages under passive (nonoperating) conditions. It should be understood, however, that sine waves will pass through nonlinear amplifiers with little, or no, perceptible distortion, whereas a square wave will be distorted. For this reason, the use of sine waves is usually limited to amplitude measurements in these particular procedures.

Passive stage checking requires a scope with sensitive, calibrated vertical deflection, usually between 10 and 20mv PP deflection over one centimeter. When an overall frequency-response check of an amplifier under dynamic (normal operating) conditions reveals square-wave distortion or attenuation in any area of the amplifier's specified passband where distortion or attenuation is not supposed to be, switch the amplifier off and feed

square waves in at key input points, while moving the scope from point-to-point following the injected signal. After isolating a fault to a particular area, you can then isolate a defective RC network or a faulty capacitor in the network.

When checking small-signal transistorized circuitry under passive conditions, use the lowest possible square-wave injection-signal voltage that will produce a useable scope indication.

The distorted square waves in Fig. 4 are only a small, generalized collection of the almost infinite variety encountered during audio amplifier testing. ■

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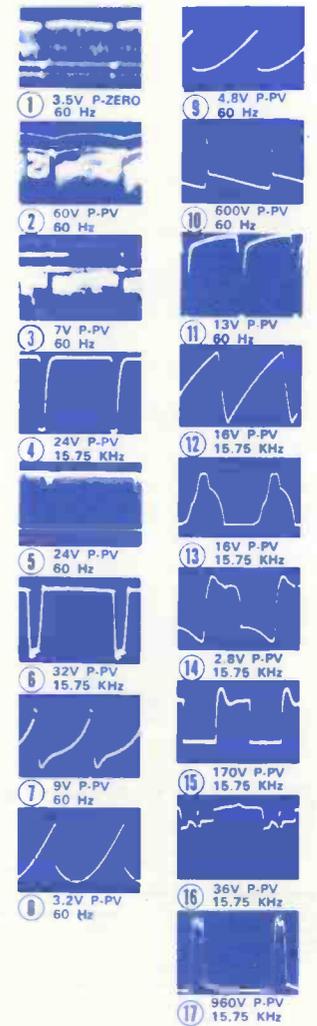
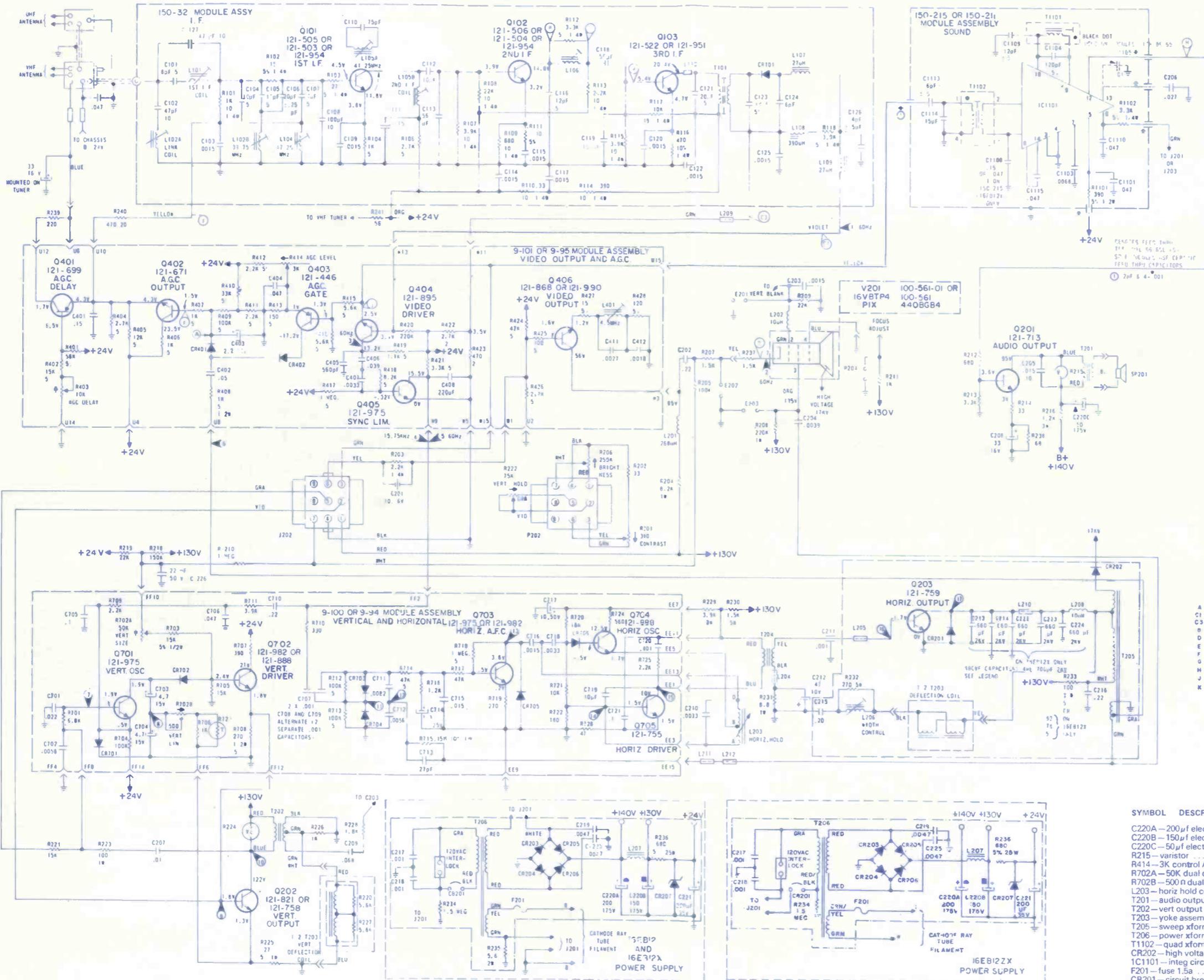
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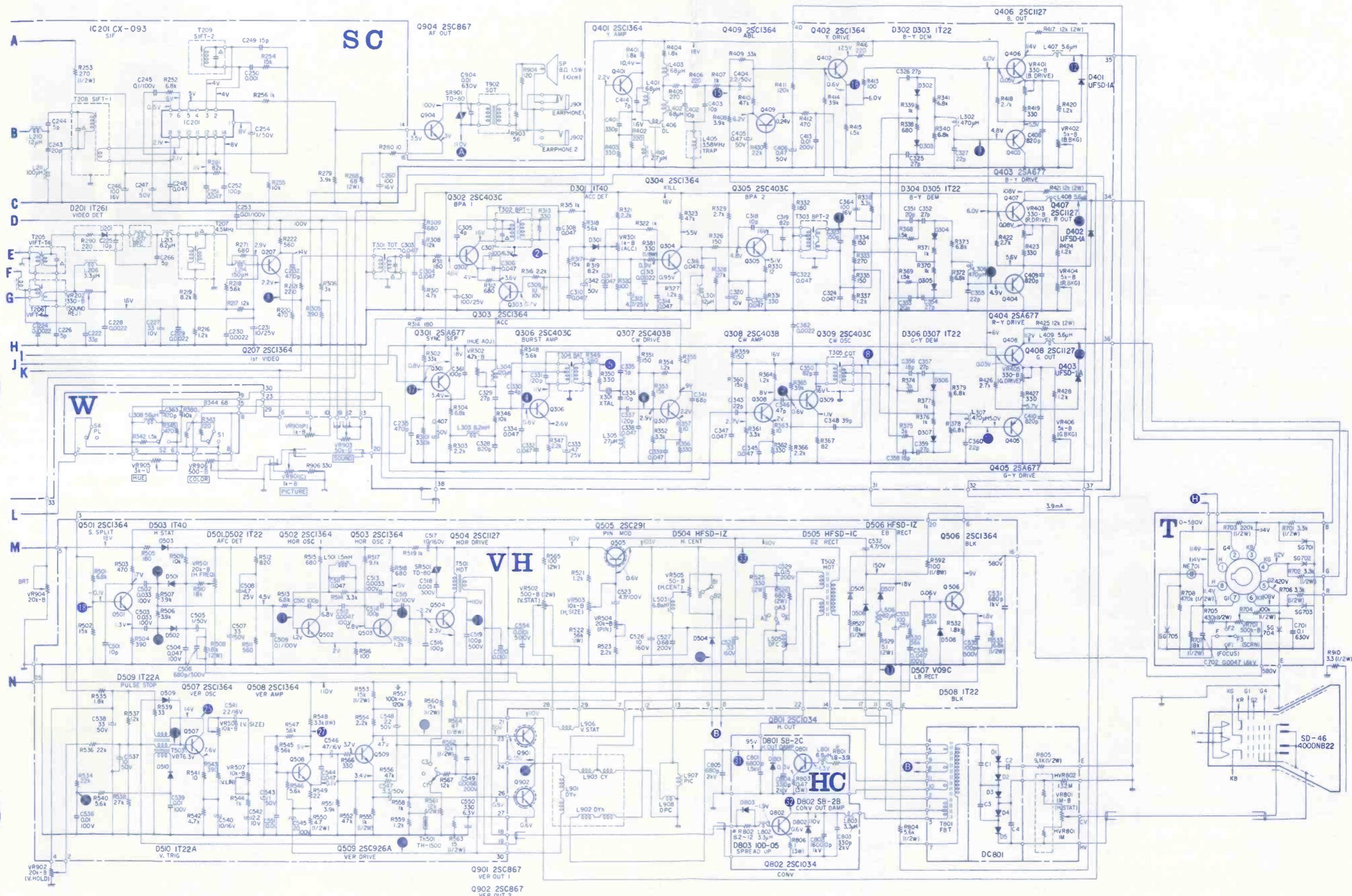
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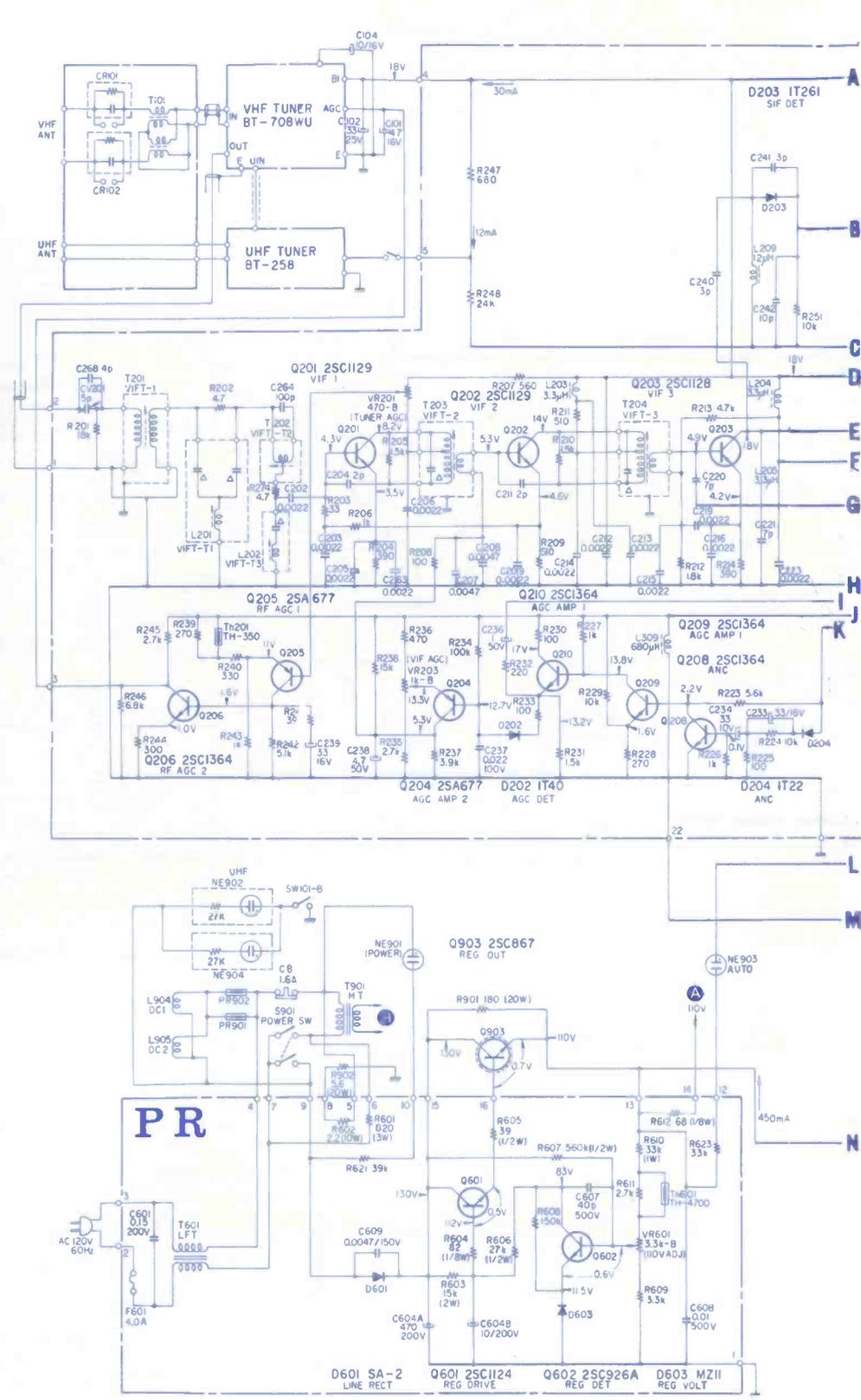
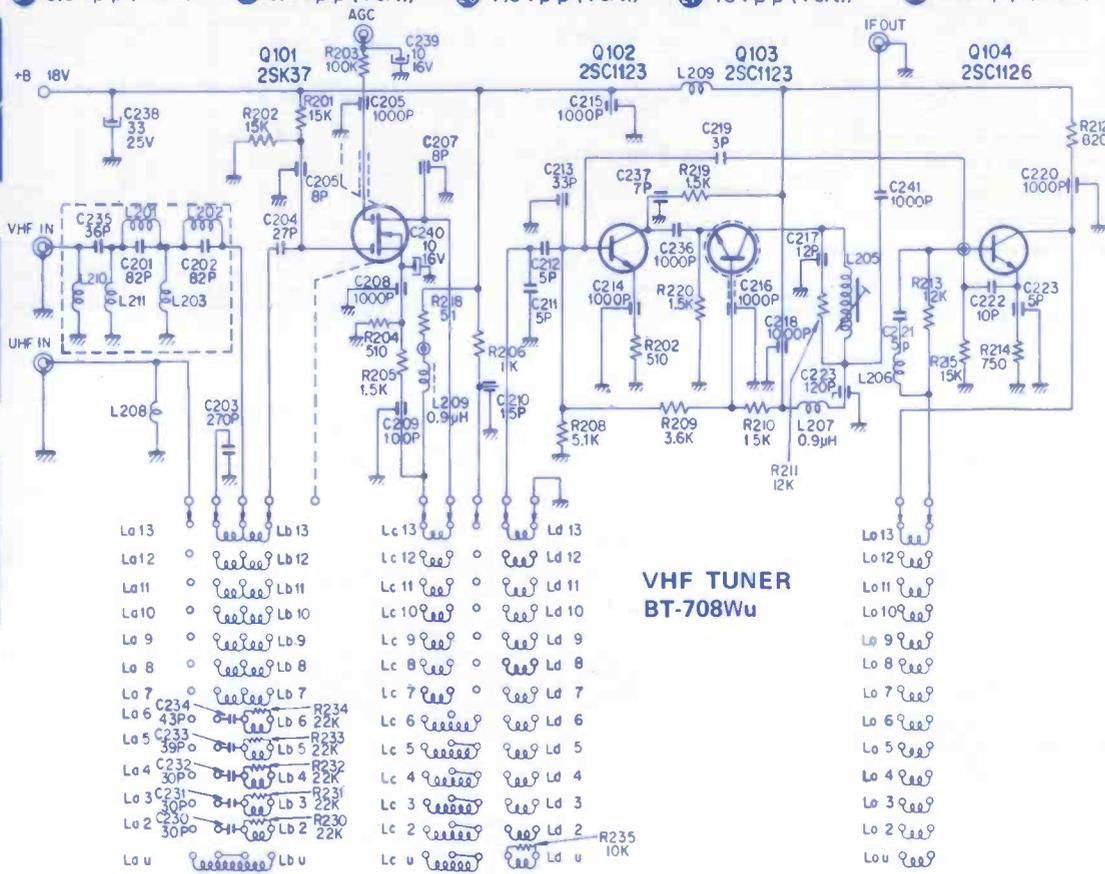
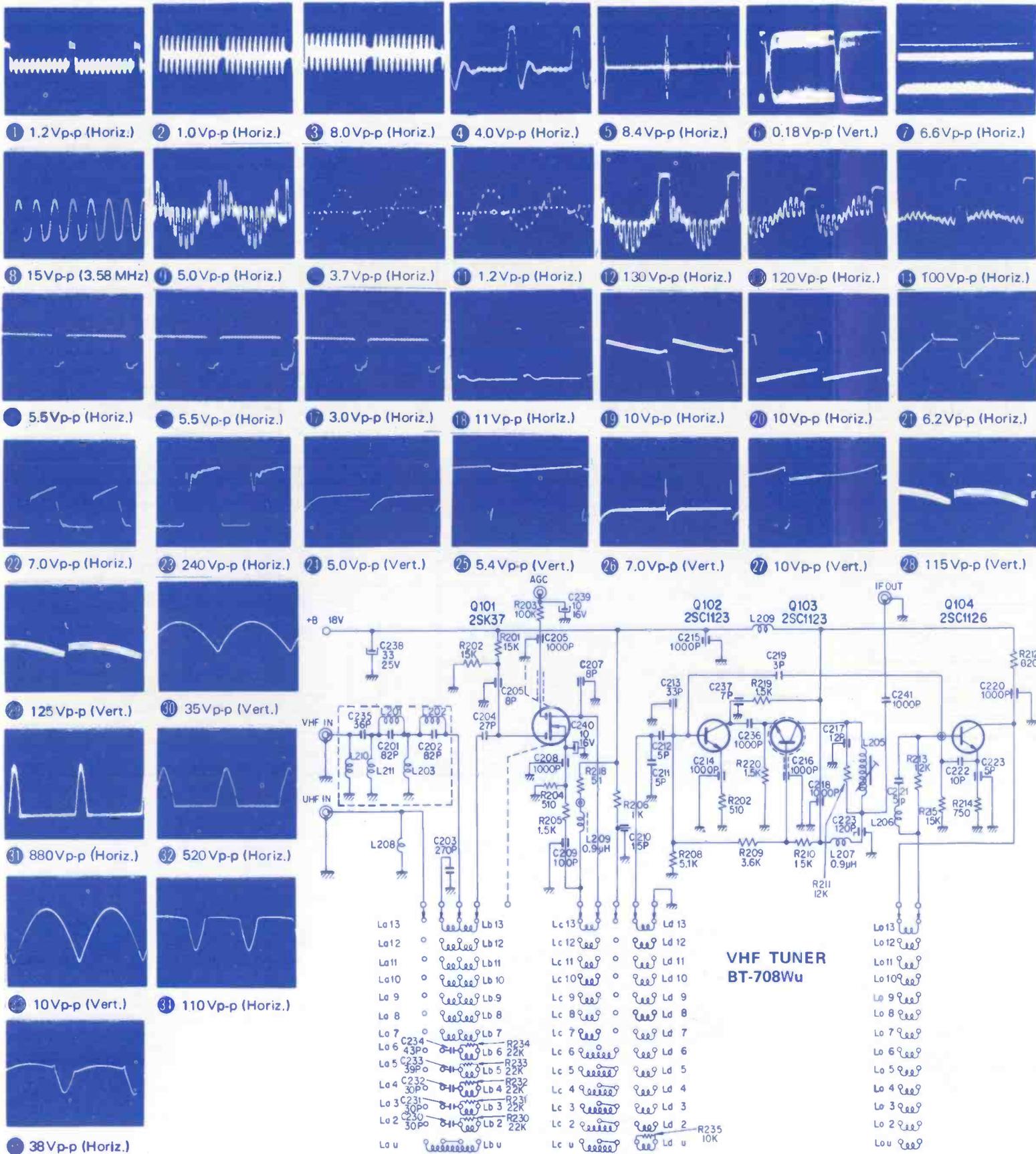
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C220A	200µf electrolytic cap 175v	22-7201
C220B	150µf electrolytic cap 175v	22-7201
C220C	50µf electrolytic cap 175v	22-7201
R414	varistor	63-5440
R702A	3K control AGC level	63-10148
R702B	50K dual control vert size	63-10225-01
L203	500 n dual control vert lin.	63-10225-01
L203	horiz hold coil	95-3100
T201	audio output xformer	95-3120
T202	vert output xformer	95-3094
T203	sweep output xformer	95-3126
T205	yoke assembly	S-94357
T206	power xformer	95-3131
T1102	quad xformer	95-2789
CR202	high voltage rectifier	103-239-02
1C1101	integ circuit	221-48
F201	fuse 1.5a	136-29
CB201	circuit breaker 1.2a	85-976-03



SYMBOL	DESCRIPTION	SONY PART NO.
L405	—3.58MHz coil wave trap	1-409-193-00
T207	—4.5MHz xformer wave trap	1-409-146-00
T304	—xformer burst amp	1-405-372-00
T502	—xformer horiz output	1-439-113-00
T503	—xformer vert osc	1-435-008-00
T801	—flyback xformer assembly	1-439-121-00
T902	—xformer sound output	1-427-307-00

VR202	—330-B sound reject	1-222-515-00
VR301	—1 k-B ACC control	1-222-517-00
VR302	—4.7k-B hue adjust	1-222-518-00
VR501	—20k-B horiz frequency	1-222-725-00
VR503	—10k-B horiz size	1-222-512-00
VR505	—50-B horiz centering	1-222-017-00
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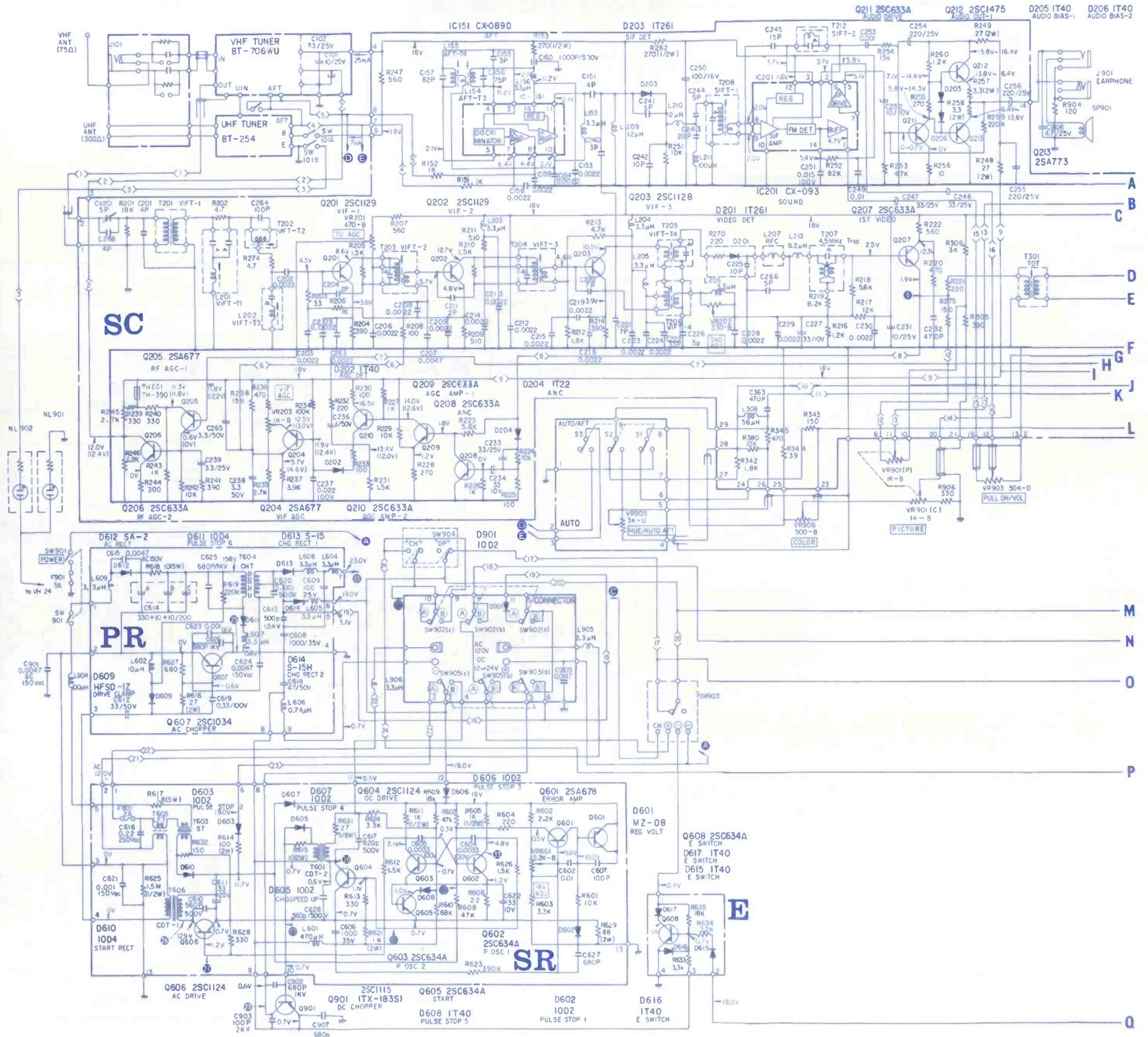
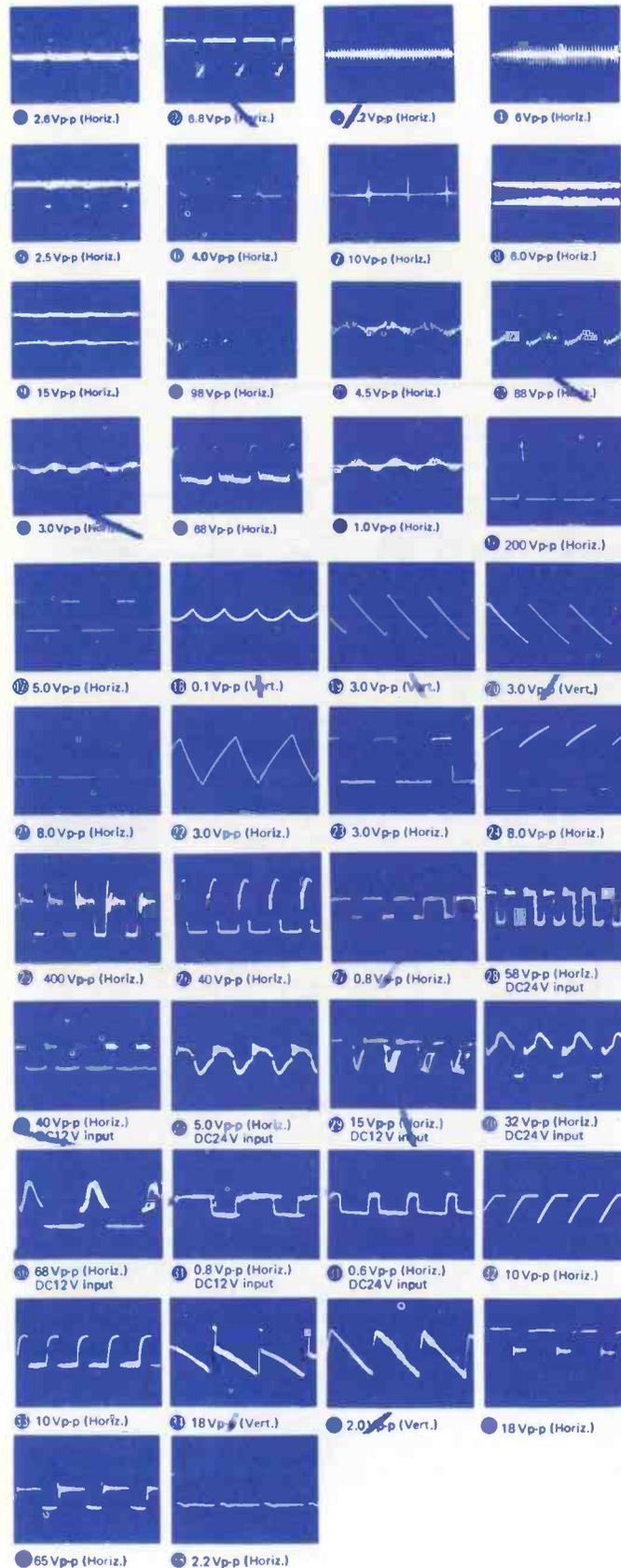
VR901	—1k-B picture control	1-222-383-00
VR902	—20k-B vert hold	1-222-388-00
VR903	—50k-D volume control	1-222-686-00
VR904	—20k-B brite control	1-222-388-00
VR905	—3k-U hue control	1-222-387-00
VR906	—500-B color control	1-222-386-00
	defect yoke	1-451-081-00
CB	—1.6a circuit breaker	1-515-168-00







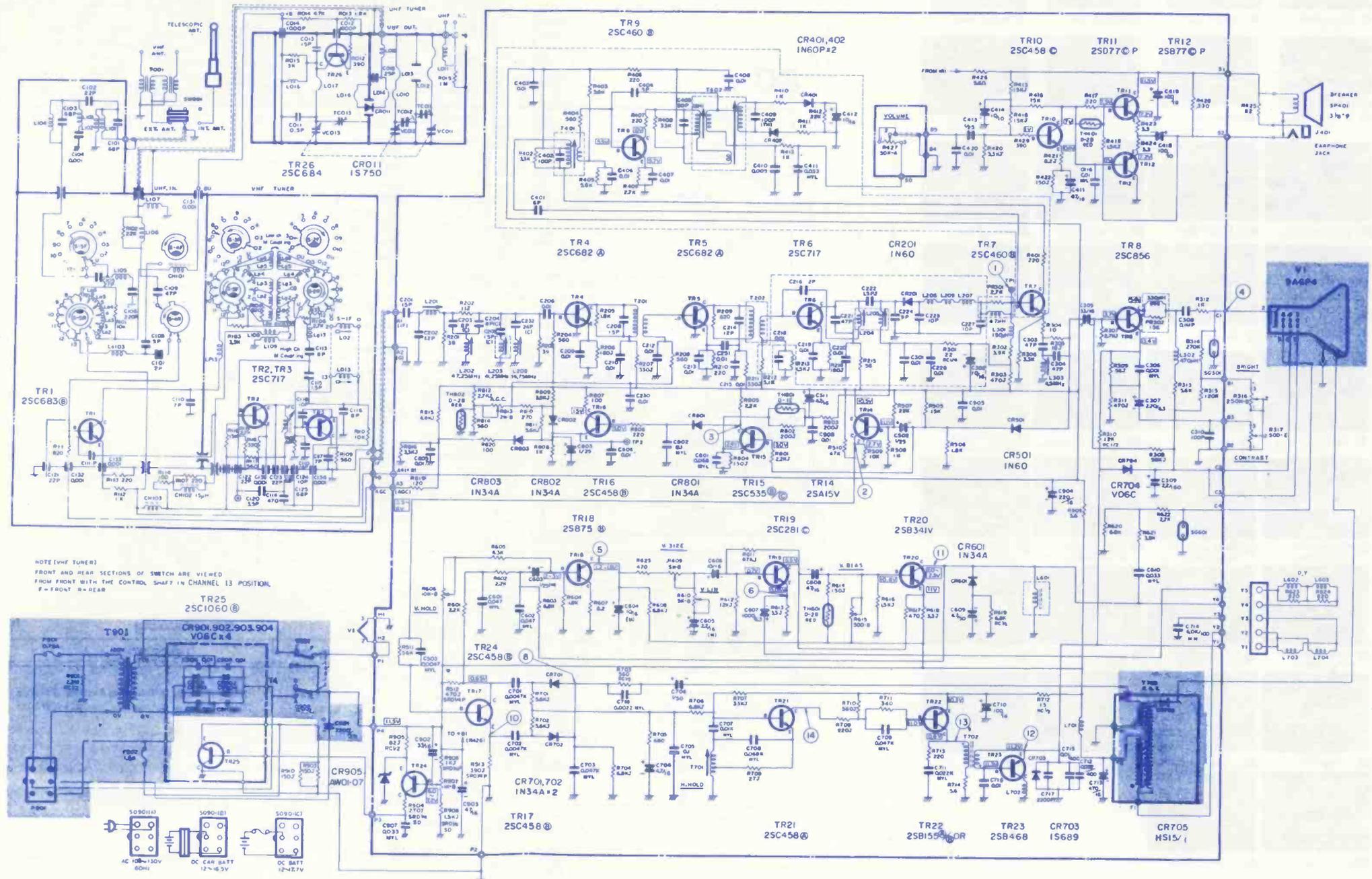




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SYMBOL	DESCRIPTION	GENERAL ELECTRIC PART NO.
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C901	— 2200μf 10% 25v	ES31X37
L204	— IF	ES36X72
L206	— filter	ES36X73
L207	— filter	ES36X74
L701	— horiz filter	ES36X48
L702	— horiz filter	ES36X78
T701	— horiz osc	ES35X5
T702	— horiz drive	ES77X11
T703	— horiz output xformer	ES88X2
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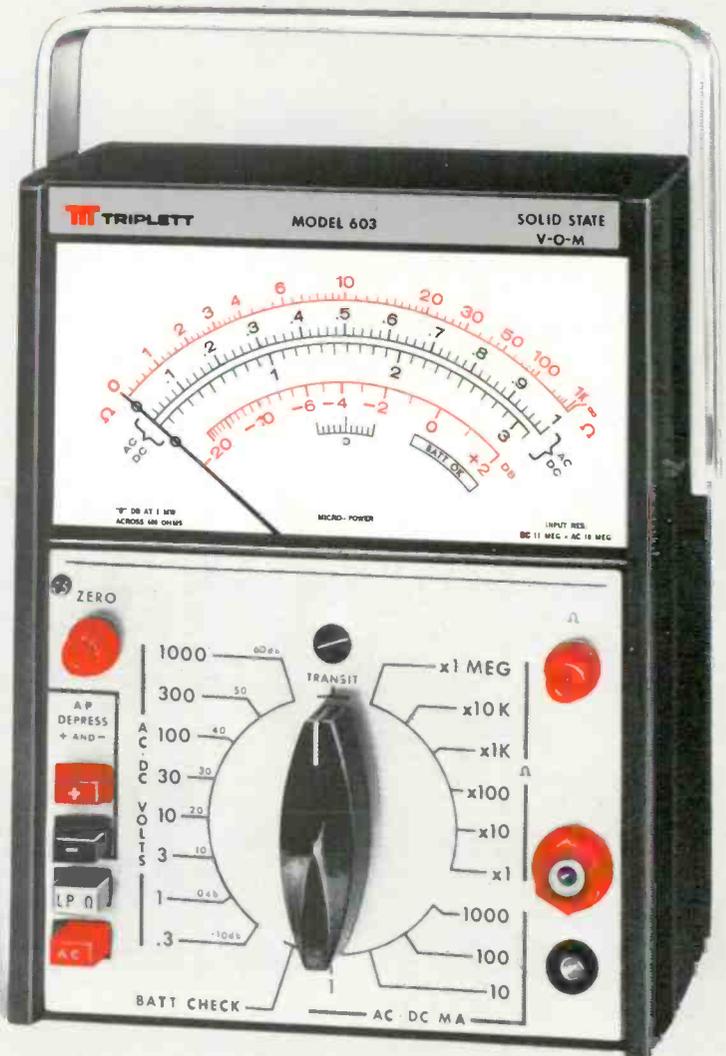
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