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ELECTRONIC TECHNICIAN/DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

Chroma Vector Pattern Analysis

Zenith Color TV 1976

Tech Productivity & Incentive Pay

Checkout Of VHF Marine Transceivers

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ELECTRONIC
TECHNICIAN/DEALER

September 1975 • VOLUME 97 NUMBER 9

THE COVER: Beginning with this issue, the cover of ET/D will be devoted exclusively to photos of unique interior or exterior features of electronic service businesses throughout the country. The cover this month shows the large "message" sign which identifies Central Service Company, Chicago, one of the largest TV contract service firms in the U.S. As revealed by the sign, Central also performs servicing on air conditioners. Central will be the subject of a business-profile article in an upcoming issue of ET/D.

(If your electronic service facility has a unique photogenic exterior or interior, send a professional-quality color slide or color transparency and brief description of it to J.W. Phipps, Editor, ET/D, 1 East First St., Duluth, Minn. 55802.)

A HARCOURT BRACE JOVANOVICH PUBLICATION

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

DON'T GET STUCK WITH THE TAB.

Do your Christmas shopping before midnight Nov. 30th.

If you've been saving Sylvania tube tabs, your time has come.

Unless your tabs are received at award headquarters by midnight Nov. 30th, all you'll have is a bunch of tabs.

And that includes those color picture tube labels that are worth 20 receiving-tube tabs.

But before that magic hour you can have anything in the '75 Save-a-Tab catalog.

After midnight your tabs will be as valuable as Cinderella's pumpkin.

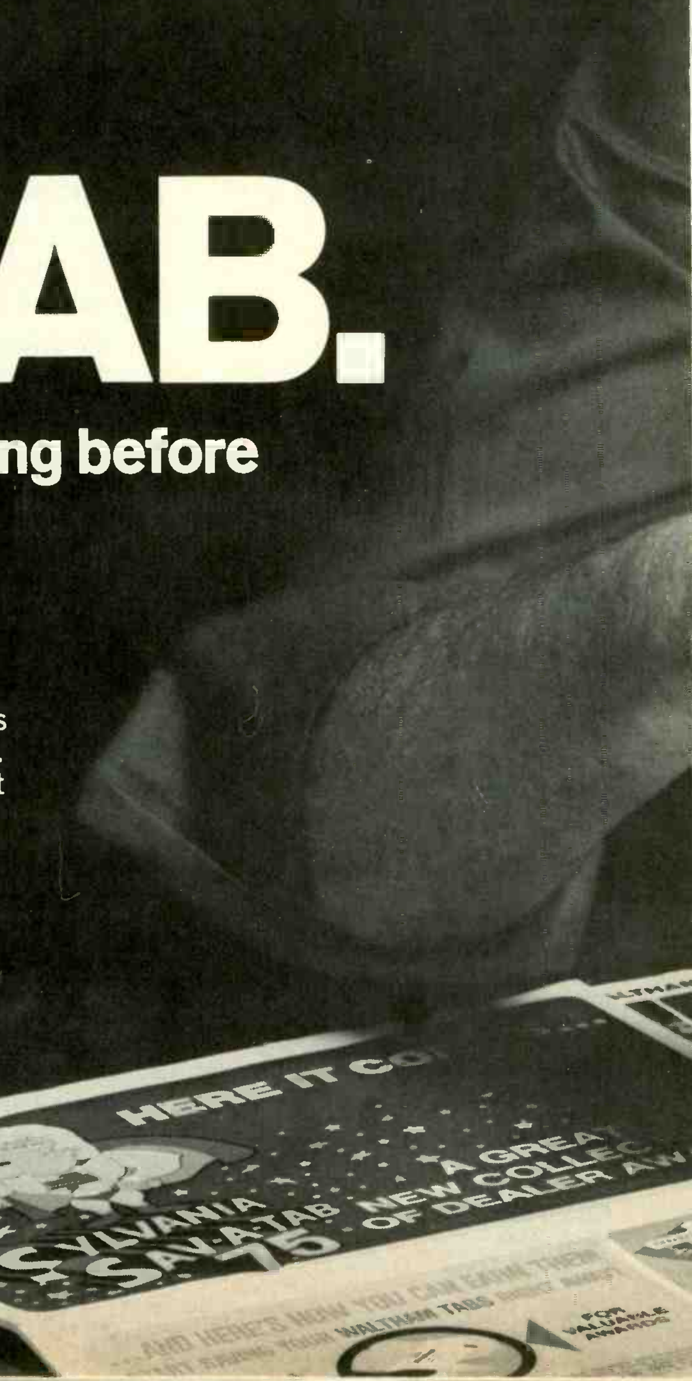
Do your Christmas shopping now for everyone (especially yourself) from the catalog available at your Sylvania distributor.

But have your tabs at award headquarters by midnight Nov. 30th.

Nov. 30th, the world.

Dec. 1st, just tabs.

GTE SYLVANIA




SYLVANIA
electronic tube

EDITOR'S MEMO

On behalf of the entire staff of ET/D, I want to extend to you our sincere thanks for your tremendous response to the reader-preference questionnaire published in the November 1974 issue of ET/D.

From the information revealed by the tabulation of your responses, we have constructed a reader-preference profile which pinpoints the categories of information for which most of you say you have a need and/or in which most of you have expressed a definite interest.

Based on the indications of this reader-preference profile, we have developed a new sectionalized editorial format which focuses in on the following four major categories of information which you, the readers, say are the most important to you: *home entertainment electronics, communications electronics, vehicular and outdoor electronics,* and *business management/shop operations*.

We are not guaranteeing that the entire content of each issue will meet the needs and interests of *all* readers, but we are attempting to insure that each of you will find at least two or more helpful, interesting topics in each issue and that *most* of you will find *most* of the content of each issue both informative and interesting.

In addition to at least one subject-related feature article, each of the four main sections will contain a personable, informal column in which our four "specialty" editors address themselves to developments, trends, solutions to problems and other timely topics directly related to their specialty areas. One such new monthly column, called *COMM CHAT* and written by ET/D Communications Editor David Norman, is introduced in this issue. The three other new columns, which will be introduced next month, are: *BENCH TALK,* by ET/D Managing Editor Joe Zauhar; *CARR TALK,* by ET/D Vehicular & Outdoor Electronics Editor Joe Carr; and *PROFITABLY SPEAKING,* by me.

Another ingredient which we believe is essential to the success of ET/D's new format is *your direct involvement.* If you have an opinion or a solution to a problem which you believe will be helpful and/or of interest to most other ET/D readers, send it to me, J.W. Phipps, Editor, ET/D, 1 East 1st St., Duluth, Minn. 55802. We will not be able to provide personal answers to individual letters, but we will publish as many of your ideas and opinions as space permits.

Again, a big thanks to each of you for the time and effort you generously expended replying to the ET/D reader-preference study. Hopefully, we will be able to repay each of you by making ET/D increasingly more responsive to your needs and interests.

J. W. Phipps

J. W. Phipps

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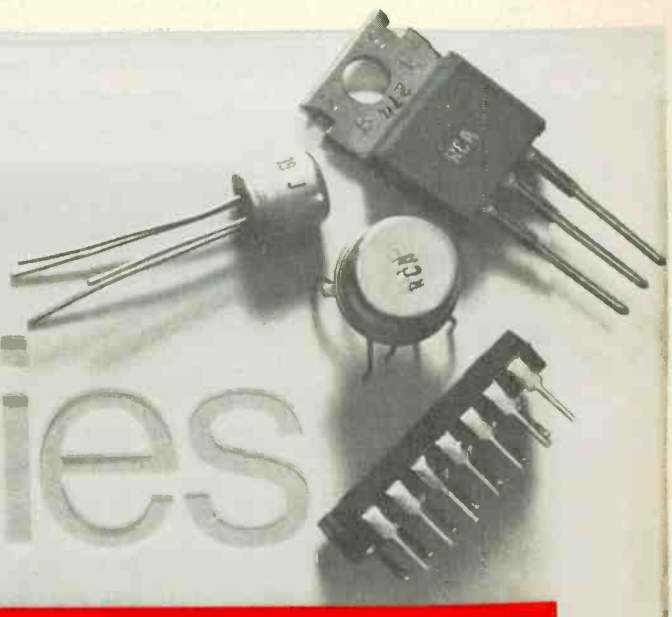
Over 103,200 devices can be replaced by 250 RCA SK Series types. That's 410 to 1! Best ratio in the industry. Which means the odds are, SK is your best, fastest way to get what you need. With minimum inventory.

And RCA provides the top quality you'd expect from a top manufacturer of OEM devices. Same strict AQL standards, same strict Director of Quality Assurance. Get SK devices and your free 1975 SK Series Replacement Guide from your local RCA distributor.

RCA SK Series



It's OK if it's sk

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NEWS OF THE INDUSTRY

FCC Considering Classification of Large MATV Systems As CATV

The Federal Communications Commission (FCC) is reportedly considering classifying as CATV all MATV systems in apartments and condominiums which serve more than 1000 subscribers, according to a recent report in *Television Digest*.

If adopted, this proposal would place such MATV systems under FCC jurisdiction and probably would mean that they would have to meet cablecasting rules related to signal carriage and technical standards. In addition, the FCC probably would establish a rule which would prohibit building owners from preventing their tenants from obtaining reception via CATV.

EIA To Sponsor Personal Communications Two-Way Radio Show In 1976

A new trade show for the personal communications two-way radio industry has been announced by the Citizens Radio Section of the Communications Division of the Electronic Industries Association (EIA).

Sponsored by the Citizens Radio Section, the show will be held at the Las Vegas Hilton, Las Vegas, Nevada, March 30-April 1, 1976.

Exhibited at the show will be CB two-way radio transceivers, antennas, marine two-way radios, amateur radio products and equipment, scanning monitor receivers, testing and maintenance equipment, and most other products, components and services related to personal communications two-way radio.

Color TV Sales During Model Year 1975 Off Over 23 %

Sales of color TV to dealers during the period July 1974-June 1975 were down 23.7 percent from sales during the period July 1973-June 1974.

Model year 1975 monochrome TV sales to dealers fared only slightly better than color, with a decline of 22 percent from the previous model-year sales level.

FM/FM-AM home radio, which registered an increase of 2.5 percent and record total sales of 19.4 million, was the only bright spot in model year 1975 home entertainment electronic sales to dealers.

Class D Citizens Radio License Applications Set New Records During First Five Months Of 1975

A record total of 615,212 applications for Class D Citizens Radio licenses were received by the FCC during the five-month period ending May 31, 1975. This is an increase of 243 percent over the 179,397 applications received during the same period in 1974.

New York City Servicers' Lawsuit Against Dept. Of Consumer Affairs Dismissed By Court

A New York court judge has dismissed a lawsuit filed against the New York City Department of Consumer Affairs by members of the Metropolitan Electronic Television Service Dealers Association (METSDA), who are attempting to have repealed the Department's regulations governing the business practices of New York City home entertainment electronic servicers. (See News Of The Industry items—page 9, April 1975 ET/D and page 9, August 1975 ET/D.

METSDA subsequently has announced plans to appeal the lower court ruling.

New Association Officers

Wisconsin Electronic Service Association: Ted Riviers, CET, Sheboygan Falls, president; R. E. Thomas, CET, LaCrosse, vice president; Mike Modory, Kenosha, secretary; and William Parmentier, Green Bay, treasurer.

Washington State Electronics Council, Inc.: Richard A. Scott, CES, Olympia, president.

Zenith Replaces Motorola As Supplier Of Color TV To Holiday Inns

Zenith recently was named the exclusive supplier of color TV receivers to Holiday Inns' Products Division, a Holiday Inn subsidiary which distributes TV and other products to 1710 owned and franchised Holiday Inns, about 1300 Best Western Motels, and an unknown number of other hotels and motels not directly affiliated with Holiday Inn.

A Holiday Inns Products Division spokesman said the sales agreement probably will involve about 20,000 color TV receivers a year, with an approximate value of $6 million.

Zenith's natonwide netword of about 40,000 service representatives was cited by the spokesman as a significant factor in the selection of Zenith by Holiday Inn. ■

TECHNICAL LITERATURE

CAR STEREO

A 14 - page booklet, listing features and facts about RCA's newly broadened line of car stereo players and speakers, is now available. Entitled "Come Drive With Us," this convenient pocket - sized manual includes illustrations, features and benefits, and technical specifications of all car stereo products in the current line. A wide array of speakers and other accessory items, such as key - lock mounting brackets, also are described in the handy booklet. *RCA Parts and Accessories,* P.O. Box 100, Deptford, NJ. 08096.

COIL REPLACEMENT GUIDE

A 108-page radio and TV coil replacement guide with cross reference directory is now available. New color TV delay lines and some 35,000 replacement coils for 400 manufacturers' names are listed. The Replacement Guide 175 is a complete coil replacement guide for all known domestic and foreign color and black/white TV sets, auto and home radios. *Bell Industries, J.W. Miller Division,* 19070 Reyes Avenue, Compton, CA. 90224.

ANTENNA MOUNTING ACCESSORIES

A 2 - page catalog No. 16 is now available listing brackets, clamps, miscellaneous kits and accessories. *Decibel Products, Inc.,* 3184 Quebec St., Dallas, TX 75247.

ANTENNAS AND ACCESSORIES

A 44-page catalog describes and illustrates the JFD line of color outdoor TV antennas, indoor TV antennas, FM antennas, exact replacement TV antennas, auto, marine and trailer antennas, amplifiers, accessories, hardware, wire, cable, masts, and auto radio antennas. *JFD Electronics Corp.,* Consumer Division, 1462 62nd St., Brooklyn, NY. 11219.

TUBES/COMPONENTS AND TEST EQUIPMENT

A 40-page illustrated discount mail-order catalog, specifically designed as a quick reference ordering guide is now available. Featured are all major brand tubes with five-year guarantee, transistors, diodes, rectifiers, test equipment and many other servicing aids of various manufacturers. All items are listed with their discount prices. The price of the catalog is $1.—refundable with any order. *T & T Sales Co.* 4802 Avenue K, Brooklyn, NY. 11234.

SEMICONDUCTORS

A 20-page cross reference manual No. X74, listing only devices used in Citizen's Band gear is now available. Many exact replacements have been added to the WEP line to round-out coverage of devices not available from domestic replacement lines. Jim Price, Vice President/Marketing, *Workman Electronic Products, Inc.,* P.O. Box 3828, Sarasota, FL. 33578.

VOM

A new 4-page brochure No. 32575, describes the battery-operated Series 60 VOM's with such features as drop-proof, burnout-proof and super-safe combined in each instrument. The ring binder reference punched brochure details the specifications and prices of the Model 60, Model 60-A, Model 60-K kit and optional accessories. *Triplett Corp.,* Dept. PR, Bluffton, OH. 45817.

PROJECTION KINESCOPES

A 4-page brochure, STC-902A, describing Projection Kinescopes for large-screen television is now available. This brochure descibes the use of projection kinescopes, classifies the various tubes by size, tabulates many of the parameters for preliminary selection, and gives a chart of suggested tube sizes for areas from club rooms to coliseums. Building 100, *RCA,* New Holland Ave., Lancaster, PA. 17604.

RF DESIGN GUIDE

A revised and updated 16-page RF Design Guide, RF-2, listing the company's complete offering of RF parts from 2 MHz to 2.0 GHz is now available. The guide shows the latest RF devices used in 22 chains for design into HF and UHF equipment. It concludes with an industry cross-reference list, package outline dimensions and free application literature list/reply card. Technical Information Center, *Motorola Inc.,* Semiconductor Products Division, P.O. Box 20924, Phoenix, AZ. 85036.

RF COMMUNICATIONS PRODUCTS

A 20 - page catalog No. 500 describes the complete line of communication components now available. The TRW RF Semiconductor line includes UHF, VHF and microwave discrete transistors and MICroAMP and RF amplifier modules; a complete line of amplifier and transistor products for mobile radio applications; and hybrid amplifiers and discrete transistors for CATV applications. The catalog includes complete electrical and mechanical specifications for the lines, as well as package dimension drawings and output power curves for all devices. UHF, VHF and single sideband product descriptions include block diagram presentation of typical amplifier and transmitter applications. *TRW RF Semiconductors,* 14520 Aviation Blvd., Lawndale, CA 90260.

MULTIMETERS

A 4-page, two-color brochure is available which describes the various technical specifications, special features, illustrations and the prices of the multimenters offered. Each model has a detailed view of the scale markings shown next to it's technical specifications. *Noble Electronics,* P.O. Box 2536, El Cajon, CA. 92021.

SURPLUS ELECTRONIC PRODUCTS

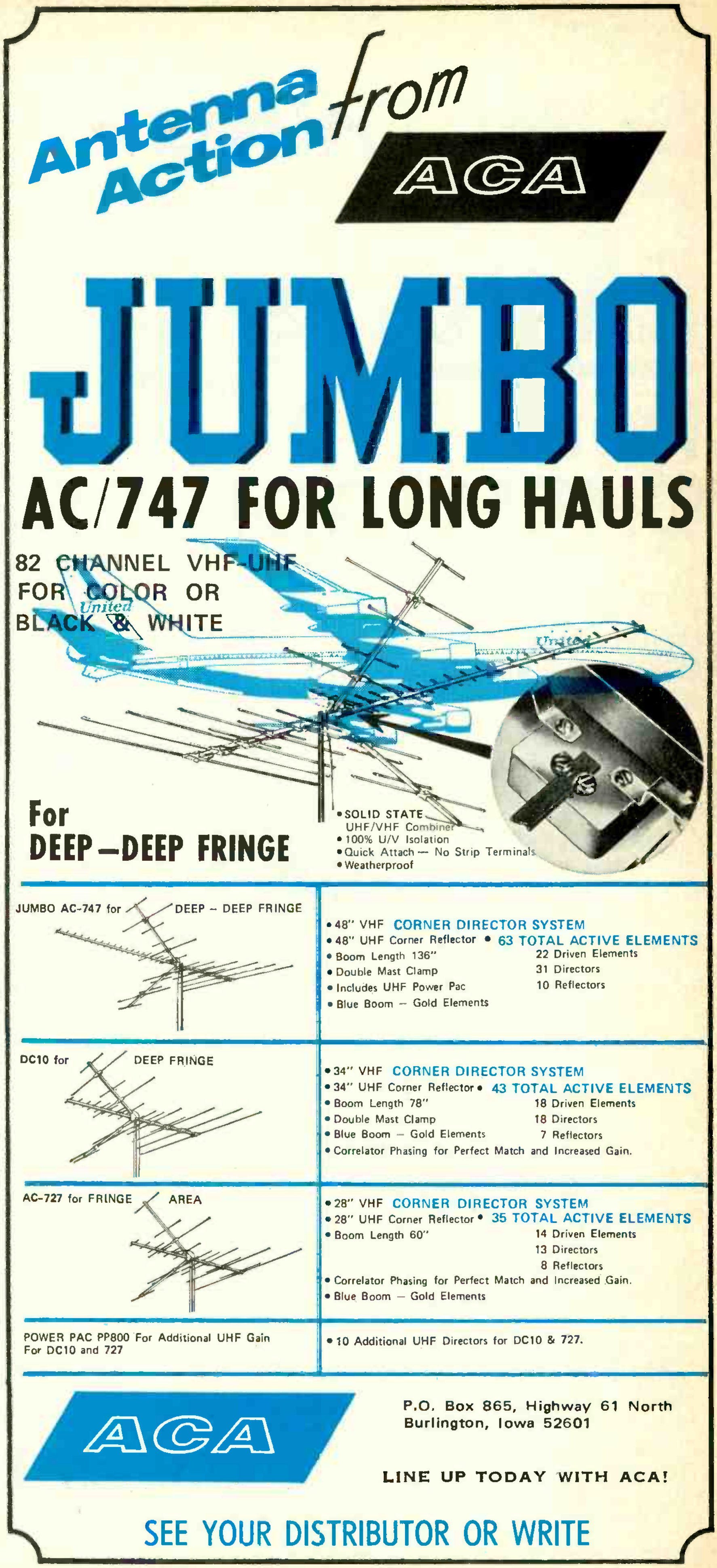
A catalog which lists and describes in detail the optics, electronics, and various miscellaneous products that the company offers is now available. Almost all of the products offered are high grade military or industrial surplus items offered at bargain prices. *B & F Enterprises,* 119 Foster Street, Peabody, MA. 01960.

PANEL METERS & TEST EQUIPMENT

A 60-page instrumentation catalog is available describing a selection of over 2,000 stock ranges, sizes and types of analog, digital and AnaLed panel meters, chart recorders, meter relays, pyrometers, controllers, digital and analog test equipment and variety of portable instrumentation. Each page is devoted to a complete description of the product and is illustrated with photographs, line drawings and charts. Each chart provides specific and detailed information directly related to the product such as voltage ranges, resistance, type of current, calibrations, dimentions, and weights. *Simpson Electric Co.,* 853 Dundee Avenue, Elgin, IL. 60120.

SOLID-STATE PRODUCT GUIDE

An updated, 36 - page guide to RCA commercial solid - state products is available from *RCA*. "RCA Solid State Product Guide," SPG - 201K, lists integrated circuits, power transistors. MOS field - effect transistors, RF and microwave power devices, power hybrid circuits, thyristors, and rectifiers currently available from RCA as stan-



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dard commercial products. Significant ratings and characteristics data are given for each type to aid in the selection of the optimum device for a particular application. The Product Guide shows photographs of device packages and provides references to other RCA publications, *RCA Solid State Division,* Box 3200, Somerville, NJ. 08876.

SPEAKER GRILLE REPLACEMENTS

A new catalogue illustrates a product called Change-A-Grille—a self-stick acoustic fabric that is said to give a fresh appearance when applied to existing speaker grilles. Swatches of six basic patterns are attached to the catalogue and provide the retailer with exact reference as to the quality and high styling of fabrics. The catalogue illustrates how the fabrics are installed by the consumer, and how quick and simple the process is. Other lines of Mellotone grill fabrics are shown on the back cover of the catalogue. *Mellotone Div. of Wendell Fabrics Corp.,* 1229 Broadway, New York, N.Y. 10001.

POWER TUBE SELECTION CHART

A wall chart, PWR - 572, tabulating RCA's recommendations for power tubes by power level and application is announced by RCA Electronic Components. This publication catalogs the various services by frequency from 500 KHz to 1450 MHz and cross - references tube recommendations against power levels from ten watts to 250 kilowatts. Special services are also tabulated. *RCA Commercial Engineering,* Harrison, N.J. 07029. ■

Four good reasons to buy your next scope from Heath.

Looking for a low cost oscilloscope with performance and features that will make it more than just a "visual voltmeter"? Well, your search is over. Heath has a new family of scopes that offer more performance per dollar than the industry has seen in years.

Our 4510 is a dual trace 15 MHz scope that can display high-speed waveforms without losing the leading edge. Both vertical inputs have delay lines for complete waveform display. Sensitivity is 1 mV over the *entire* bandwidth — and it will typically trigger on signals up to 45 MHz! Other features include post-accelerated CRT for brighter trace and faster writing speeds . . . true X-Y operation . . . and easy-to-service design. And the best part is the low price. Only $569.95* kit, $775.00* assembled.

Heath's 4530 sets a new standard for single trace scopes. And it's easy to see why. The DC-10 MHz bandwidth, sensitive 10 mV input and TV coupling give you real versatility at a low price. It's one of the few single trace scopes available with two input channels — a calibrated X-input is provided for X-Y operation. Trigger circuits are digitally controlled, requiring only level control and slope switch adjustments. $299.95* kit, $420.00* assembled.

The 4540 is probably the best general purpose triggered scope value available today. It can quickly provide an accurate display of any waveform from DC to 5 MHz. Vertical input sensitivity is 20 mV with nine calibrated attenuator positions up to 10 V/cm. Special TV coupling allows the 4540 to easily trigger on TV signals, making it an even more valuable service tool. Only $179.95* kit, $275.00* assembled and calibrated.

The Heathkit IO-4560 now makes it possible for everyone to have a high performance scope. It offers DC-5 MHz bandwidth, 100 mV sensitivity, *automatic triggered* sweep from 20 ms to 200 ns/cm, external horizontal input. A great low-cost scope for general design and service work for the unbelievably low price of $119.95*.

Get complete information and specs on the above scopes, and all Heath instruments, in our latest Heathkit and Assembled Instruments catalogs. You may not be aware of what Heath instruments can do for you — and how little they cost. After all, we're not the industry standard . . . yet.

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Vector Pattern Analysis of Chroma Circuits

By J. W. Phipps

How the vector pattern is produced and what it can reveal about the operation of a color receiver

■ If sinusodial signals at the *same frequency* and *same amplitude* but with a *phase difference of 90 degrees* are applied respectively to the horizontal and vertical deflection plates of a scope, a *completely circular* Lissajous pattern like that in Fig. 1A will be produced on the scope screen. If the relative difference in *phase* between the two signals is *increased* to 120 degrees, the scope pattern will become *elliptical* in a *diagonal* direction, as shown in Fig. 1B. If the *amplitude* of either of the two signals is reduced, the scope pattern again will become elliptical, as shown in Fig.'s 1C and 1D. Note that when the amplitude of the signal applied to the *vertical* deflection plate is reduced, the pattern becomes elliptical in a *horizontal* direction (Fig. 1C) and, conversely, when the amplitude of the signal applied to the *horizontal* deflection plate is reduced, the pattern becomes elliptical in a *vertical* direction (Fig. 1D).

A chroma vector pattern is nothing more than a modified version of the circular Lissajous patterns in Fig. 1. It is produced by connecting the output of a keyed color-bar generator to the antenna terminals of a color TV receiver and then applying the receiver's *R-Y* signal to one of the *vertical* deflection plates of a scope and the receiver's *B-Y* signal to one of the horizontal deflection plates. And, as with the shape of the Lissajous patterns in Fig. 1, the shape of the envelope formed by the petals of the chroma vector pattern is dependent on the *relative amplitudes and phases* of the two signals which produce it.

THE IDEAL VECTOR PATTERN

An "idealized" chroma vector pattern and the R-Y and B-Y signals which would produce it are shown in Fig. 2. These R-Y and B-Y signals are representative of those obtained from the picture tube control grids of a receiver in which the phase of the 3.58-MHz reference subcarrier applied to the R-Y demodulator *leads by 90 degrees* the phase of the reference subcarrier applied to the B-Y demodulator. The resultant 90-degree phase difference between the sine-wave envelopes formed by the relative amplitudes of the ten pulses in each of the two signals, plus the fact that the peak-to-peak amplitudes of the two signals are the same, theoretically produces a vector pattern whose petal tips form a *completely circular envelope*.

Also illustrated in Fig. 2 is the fact that each of the ten pulses in the R-Y and B-Y signals corresponds to a specific color bar and phase on the screen of the receiver and to a specific petal and phase in the vector pattern. (The two pulses represented by broken lines in the R-Y and B-Y signals in Fig. 2 occur during the horizontal blanking and sync interval and, because they are blanked out in the receiver, do not produce color bars or vector petals at the 330-and 360/0-degree positions. However, the pulse at the 0 degree position is used as the burst signal, to sync the receiver's chorma reference subcarrier to the color-bar signal at the beginning of each horizontal trace.)

Phase measurement in the vector pattern begins with burst (0 degrees position) and proceeds *clockwise*. The spacing between the centers of adjacent petals represents a nominal phase difference of 30 degrees, just as does the spacing between the centers of the color bars on the screen and the centers of the pulses in the R-Y and B-Y signals.

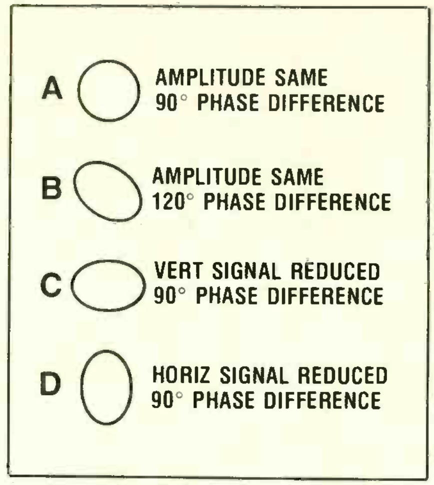

Fig. 1—Representations of the common Lissajous patterns produced by a scope when two different sinusodial signals with the same frequency but with different phases and amplitudes are applied to the horizontal and vertical deflection plates.

If the chroma AFPC system of the receiver is properly adjusted, petal number *3*, which represents R-Y, should be at the *90-degree position* when the tint control is in the middle of its rotational range and, because of the 90-degree phase difference between the reference subcarriers applied to the R-Y and B-Y demodulators in this particular receiver, petal number 6, which represents B-Y, should be at the *180 degree position*. Also, rotation of the tint control to its extreme *CCW* position should move the R-Y petal at least one petal position to the *left* of the 90-degree point, and rotation of the tint control to its extreme *CW* position should move the R-Y petal at least one petal position to the *right* of the 90-degree point.

NORMAL VARIATIONS OF THE IDEAL

To enhance flesh tones, in most late-model color chassis the phase differential between the chroma reference subcarriers applied to the chroma demodulators which produce the R-Y and B-Y signals is *in excess of 90 degrees*. Consequently, the normal vector pat-

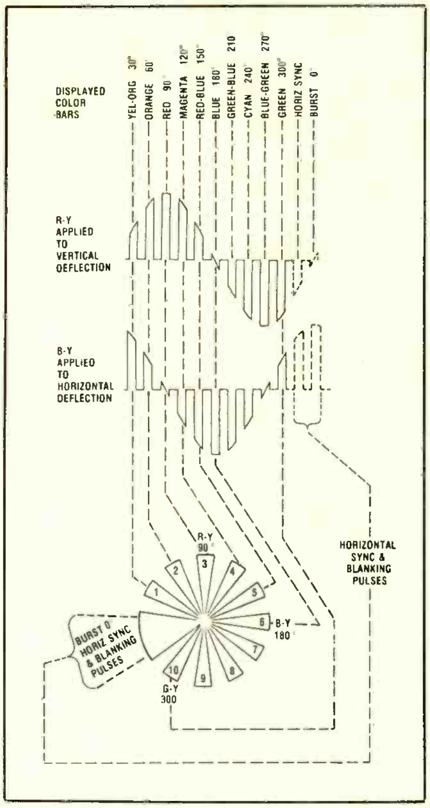

Fig. 2—An ideal chroma vector pattern and the R-Y and B-Y signals which would produce it. Dotted lines illustrate the corresponding relationships between the ten color bars displayed on the screen, the ten pulses of the R-Y and B-Y signals, and the ten petals of the vector pattern.

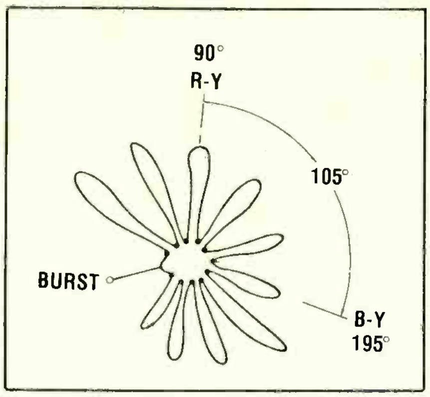

Fig. 3—Representation of the actual vector pattern produced by a color chassis in which the phase difference between the subcarriers applied to the X (R-Y) and Z (B-Y) demodulators is 105 degrees.

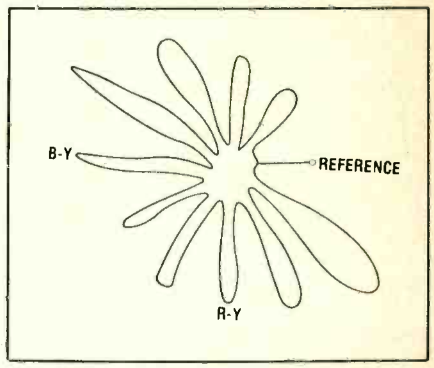

Fig. 4—Representation of the actual vector pattern produced by a color chassis in which the phase difference between the red and bluemodulators is 116 degrees and the R-Y and B-Y signals are obtained from the cathode connections of the picture tube.

terns produced by these chassis should be *elliptical* instead of round. This *normal* deviation from a completely circular vector pattern is illustrated in Fig. 3, which shows the normal pattern produced by a color chassis in which a 105-degree phase differential is employed between the X (R-Y) and Z (B-Y) demodulators.

The same stipulations which apply to the position of the R-Y petal in Fig. 2 and its movement by the tint control also apply to the vector pattern in Fig. 3. However, in the pattern in Fig. 3 the sixth petal, which again represents B-Y, should be at about the 195-degree position.

GRID VS CATHODE DRIVE

The vector patterns shown in Figs. 2 and 3, and variations of them, are produced by color receivers in which the chroma and luminance (Y) are matrixed in the picture tube by application of the luminance signal to the cathodes of the picture tube and application of the chroma signals to their respective control grids. Consequently, the R-Y and B-Y chroma signals used to produce the vector patterns for such receivers are obtained from the connections to the picture tube *control grids.* (Test leads equipped with lead-piercing alligator clips can be used to pick off the R-Y and B-Y signals from the *solid red* and *solid blue* control grid wires, respectively.)

In some color receivers the luminance and chroma signals are matrixed in the *chroma demodulators.* The combined signals then are applied to the *cathodes* of the picture tube, and only a DC potential is applied to the control grids. Consequently, the R-Y and B-Y signals required for production of the vector patterns of these receivers are obtained from the respective *cathode* connections to the picture tube. (First, however, the luminance signal must be bypassed to ground via a 10- to 25-mfd capacitor at some point preceding the chroma demodulators. The outputs of the red and blue demodulators then will be the required R-Y and B-Y signals, respecively.)

Because the R-Y and B-Y signals obtained from the picture tube *cathodes* are *180 degrees out of phase* with the R-Y and B-Y signals obtained from the picture tube control grids of other receivers, the normal vector patterns of these "cathode-driven" receivers, one of which is shown in Fig. 4, are upside down and reversed compared to those produced by "grid-driven" receivers.

The same stipulations which applied to the positions of the R-Y petal and its movement by the tint control and the *relative* positions of the R-Y and B-Y petals in Figs. 2 and 3, also apply to the vector pattern in Fig. 4, except that the normal phase positions of the petals in Fig. 4 are 180 degrees different than those in Figs. 2 and 3.

From the preceding discussions about the vector patterns in Figs. 2, 3 and 4, it is apparent that the normal overall envelope shape and the relative positions of the third and sixth petals of the vector pattern produced by a particular chassis are dependent on the following design characteristics:

1) The phase difference between the reference subcarriers applied to the two chroma demodulators which produce the R-Y and B-Y signals

2) The *relative amplitudes* of the R-Y and B-Y signals

3) Which *element of the picture tube* guns the R-Y and B-Y signals drive.

CONNECTIONS AND ADJUSTMENTS

Because the relative phases and amplitudes of the R-Y and B-Y signals are two of the three principal design factors which determine the overall shape of the vector pattern, it is essential that the scope used for display does not cause any significant shift in the *relative phases* and the *relative amplitudes* of the two signals. For this reason, when a *single-trace* scope is used for vector display, the vertical and horizontal amplifiers, which in most scopes have different frequency responses, gains and phasing, are not used. Instead, the R-Y and B-Y signals are applied *directly* to the respective deflection plates of the scope. Not only do the direct-to-deflection plate connections bypass the phase and gain differences which exists between the two scope amplifiers, but they also provide higher input impedances and lower capacitive reactances. Consequently, because there is less loading of the chroma circuits, there is less probability of distorting the relative amplitudes and phases of the R-Y and B-Y signals—distortion that would produce a misleading display.

Some of the newer dual-trace scopes are equipped with provisions which, in the X-Y (vectorscope) mode of operation, connect the output of the channel 2 vertical amplifier to the horizontal deflection plates. The R-Y signal then is applied to the input of the Channel 1 vertical amplifier, which drives the vertical deflection plates, and the B-Y signal is applied to the input of the Channel 2 vertical amplifier. Because no significant phase difference exists between the two amplifiers and because the gain of the two amplifiers can be equalized by adjustment of their respective gain controls, no significant phase or amplitude distortion is introduced into the vector display.

VECTOR INTERPRETATION

After the equipment connections have been made and before attempting to analyze the resultant vector pattern, be sure the following conditions have been met:
1) Receiver on an unused channel and properly fine tuned
2) Tint control in the *middle* of its rotational range
3) Color-bar generator color level control at 100 percent position, or mid point of rotational range
4) Receiver color level set to produce normal saturation of displayed color bars. (Excessive chroma level will distort the vector pattern.)

As stated previously, the normal overall shape of the envelope formed by the tips of the vector petals is dependent on 1) the relative peak-to-peak amplitudes of the R-Y and B-Y signals, and 2) the phase difference between the reference subcarriers applied to the chroma demodulators which produce the R-Y and B-Y signals. These "design factors" usually can be determined by referring to the service literature.

If the R-Y and B-Y amplitudes are the same and the designed-in phase difference between subcarriers is 90 degrees, the *normal* overall shape of the vector envelope should be *circular,* with the third (R-Y) petal at the 90-degree position and the sixth (B-Y) petal at the 180-degree position, as shown in Fig. 2.

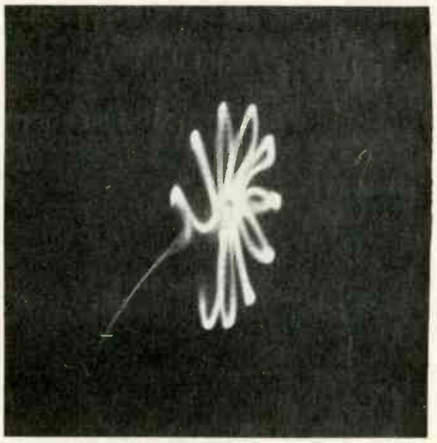

Fig. 5—Insufficient amplitude of the B-Y signal caused the vertically elliptical shape of this normally round vector pattern.

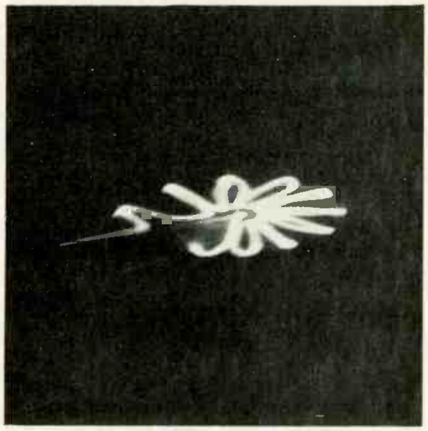

Fig. 6—Insufficient amplitude of the R-Y signal caused the horizontally elliptical shape of this normally round vector pattern.

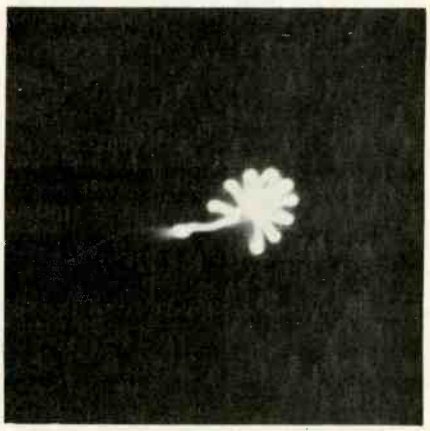

Fig. 7—Insufficient amplitude of both the R-Y and B-Y signals caused this abnormally small vector pattern.

If the R-Y and B-Y amplitudes are the same and the designed -in phase difference between subcarriers is in *excess* of 90 degrees, for example, 105 degrees, the normal overall shape of vector envelope should be *elliptical* in a diagonal direction, with the third (R-Y) petal at the 90-degree position and the sixth (B-Y) petal at the 195-degree position, as shown in Fig. 3. For subcarrier phase differences in excess of 105 degrees, the overall shape of the vector envelope should be correspondingly *more elliptical* in a diagonal direction and, with the position of the third (R-Y) petal at the 90-degree position, the sixth (B-Y) petal should be slightly *beyond* the 195-degree position (or a position which corresponds to the 90 degrees of the R-Y signal *plus* the subcarrier phase difference employed in that chassis design.)

If the overall shape of the vector envelope does not approximately correspond to the preceding "normal" criteria but both the R-Y and B-Y petal positions do, with a scope check the peak-to-peak amplitudes of the R-Y and B-Y signals. A pattern envelope shape like that in Fig. 5 indicates insufficient B-Y amplitude (reduced *horizontal* amplitude). Conversely, a pattern envelope shaped like that in Fig. 6 indicates insufficient R-Y amplitude (reduced *vertical* amplitude). An abnormally small pattern like that in Fig. 7 indicates that *both* the R-Y and B-Y amplitudes are insufficient, possibly caused by incorrect adjustment of the color level controls of the color-bar generator and/or receiver or by a weak chroma bandpass amplifier.

If the third (R-Y) and sixth (B-Y) petals are not properly positioned as described previously or can be positioned correctly only by rotating the tint control to either of its extremes, first perform a chroma AFPC adjustment in accordance with the manufacturer's instructions. If this fails to

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RCA Distributor and Special Products Division correctly position the R-Y and B-Y petals *and* produce a normally shaped vector pattern, check the chroma bandpass alignment.

A whirling pattern like that in Fig. 8 indicates that the 3.58-MHz reference subcarrier oscillator is out of sync. First, adjust the receiver's horizontal hold control. If this fails to produce a stationary vector pattern, perform a color sync adjustment in accordance with the manufacturer's instructions while using the vector pattern as a null indicator. (As the color sync is brought into correct adjustment, the rotation of the vector pattern will slow down and, once the adjustment is completed, it will stop completely.)

Up to this point, we have been concerned principally with obtaining a stable vector pattern in which the relative positions of the third (R-Y) and sixth (B-Y) petals and the overall envelope shape correspond to those which normally should be produced by the particular chassis design being tested. Because the normal deviations of these two characteristics from one chassis design to another are *predictable,* they are relatively easy to evaluate.

However, because the *precise* shapes of the petals in a vector pattern are dependent on so many inter-related variables, it is impossible to predict accurately that a certain petal shape is normal for a certain chassis design. Nevertheless, there are a few general guidelines and standards against which the shapes of the vector petals of all chassis designs can be evaluated.

The shapes and widths of the vector petals are determined by the shape, width, relative amplitudes and relative timing of the corresponding R-Y and B-Y pulses, which, in turn, are determined principally by the bandwidths of the video IFs, chroma bandpass amplifiers and related chroma demodulator systems.

If the bandwidth of the video IFs and/or chroma bandpass amplifiers is reduced, either by misalignment or by a circuit defect, the edges of the R-Y and B-Y pulses will become more rounded and the relative timing between corresponding pulses of the two signals will deviate from normal. The net effects of these two abnormalities are 1) curvature of the sides and 2) rounding off of the tops of some or all of the vector petals. If the bandwidth is radically reduced, the tops of the vector petals will become completely round and the sides will become curved to such an extent that some or all of the petals will overlap, a slight case of which is shown in Fig. 9.

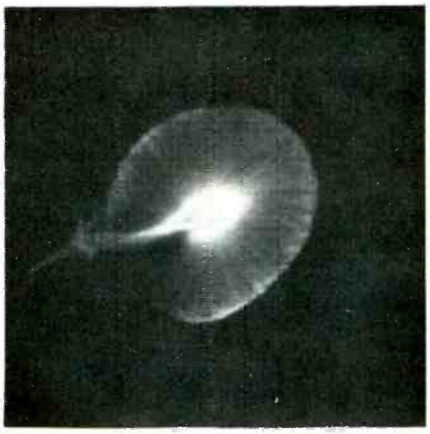

Fig. 8—An out-of-sync chroma reference oscillator causes rapid rotation of the vector pattern.

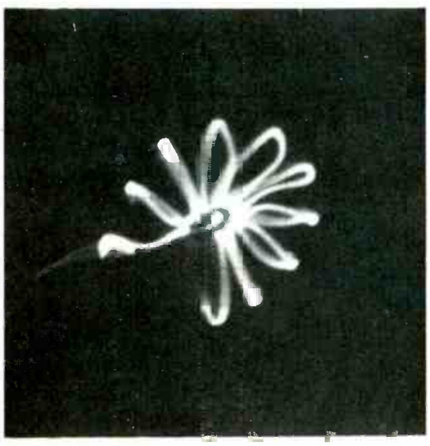

Fig. 9—Excessively curved and overlapped petals, as illustrated here, are usually caused by reduced bandwidth of the chroma bandpass amplifier.

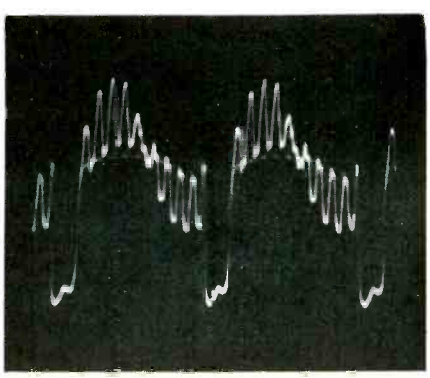

Fig. 10—Abnormal curvature of the baseline of the R-Y and/or B-Y signals, as illustrated here in an R-Y signal, causes the normally round center of the vector pattern to become elliptically shaped.

Although no color receiver is capable of producing vector petals whose tops and sides are perfectly straight like those of the ideal vector pattern in Fig. 2, there should be some flatness at the top of the petals and the curvature of the sides of the petals should be relatively symmetrical and should not extend to the point that the sides of the petals overlap.

The ideal vector in Fig. 2 also reveals that theoretically the area at which the petals nearly converge in the center of the pattern should form a circular pattern. This "inner" pattern is indicative of the *flatness* of the *baselines* of the R-Y and B-Y signals. Any excessive curvature of the baseline of either or both of these signals, such as that of the baseline of the R-Y signal in Fig. 10, will cause the inner pattern to be elliptical instead of round. A prime cause of base line curvature is insufficient bandwidth of the corresponding chroma demodulator circuit.

LIMITATIONS OF VECTOR USAGE

The preceding descriptions of the general characteristics of chroma vector patterns is intended only as an *introduction* to their use as a *diagnostic* aid. The fact that vector analysis usually can be accomplished without removal of the chassis from the cabinet, plus the fact that the *predictable* characteristics of the vector pattern can tell you more about the overall operation of the chroma circuits than any other single test, makes chroma vector analysis a time-saving diagnostic procedure. In addition, it also can be used as an accurate and convenient indicating device during color sync and chroma AFPC adjustments.

However, because some of the characteristics of the vector pattern, particularly the precise shape and widths of the petals, are dependent on so many interdependent variables, in my opinion the vector pattern should *not* be used as an indicating device during chroma take-off and bandpass alignment procedures.■

TV service technicians name Zenith for the two things you want most in color TV.

I. Best Picture.

In a recent nationwide survey of independent TV service technicians, Zenith was named, more than any other brand, as the color TV with the best picture.

Question: In general, of the color TV brands you are familiar with, which one would you say has the best overall picture?

Answers:

Zenith	**36%**
Brand A	20%
Brand B	10%
Brand C	7%
Brand D	6%
Brand E	3%
Brand F	2%
Brand G	2%
Brand H	2%
Brand I	1%
Other Brands	3%
About Equal	11%
Don't Know	4%

Note: Answers total over 100% due to multiple responses.

II. Fewest Repairs.

In the same survey, the service technicians named Zenith as the color TV needing the fewest repairs. By more than 2-to-1 over the next brand.

For survey details, write to the Vice President, Consumer Affairs, Zenith Radio Corporation, 1900 N. Austin Avenue, Chicago, IL 60639.

Question: In general, of the color TV brands you are familiar with, which one would you say requires the fewest repairs?

Answers:

Zenith	**38%**
Brand A	15%
Brand C	8%
Brand D	4%
Brand B	3%
Brand I	2%
Brand F	2%
Brand E	2%
Brand G	1%
Brand H	1%
Other Brands	4%
About Equal	14%
Don't Know	9%

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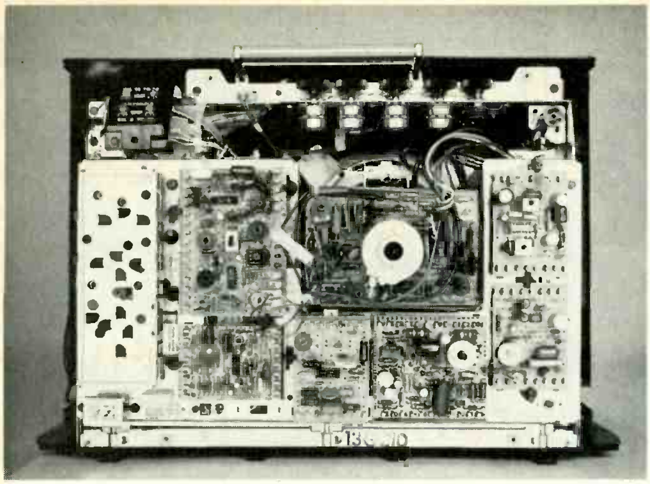

Fig. 1—Rear view of Zenith's new 13-inch (diagonal) TV set which employs a new modular, solid-state 13GC10 color chassis and a new in-line, 110-degree picture tube.

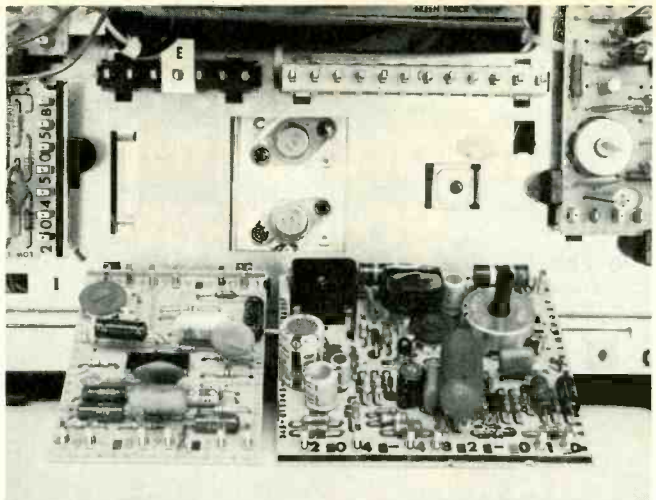

Fig. 2—Removal of the Sync/AGC and Vertical Modules provides easy access to the vertical-output transistors without removing the chassis.

Zenith Color TV 1976

By Joseph Zauhar

A new small-screen color TV set and a ZOOM control feature which enlarges the picture approximately fifty percent are highlighted in the company's 1976 TV line

■ Zenith's small-screen receivers, the company's first, employ the new 13GC10 color TV chassis and a new 110-degree picture tube system. Also offered is an 18-position, one-knob tuning system which provides twelve VHF channel positions and six UHF positions. There is also a *Space Command* model which has a channel-skip feature. In addition to this feature, any of the 18 positions can be programmed to turn off the TV set.

13GC10 Color TV Chassis

The 13GC10 chassis employed in the new 13V (13-inch diagonal screen size) receivers, Fig. 1, uses a vertical, integrated, modular chassis and a new in-line picture tube. The high-voltage system provides 25 kv of second anode voltage for the picture tube.

To gain access to circuitry not located on the modules or vertical portion of the chassis, the chassis can be lowered to a 45-degree position. The vertical-output transistor heat sink and associated circuitry are mounted on the vertical section of the chassis, just below the picture tube neck. Access to the pair of vertical-output transistors mounted behind the modules is simplified by the removal of the AGC/Sync and vertical modules, as shown in Fig. 2.

Power Supply Module

The power supply module (Fig. 3) used in this chassis is similar to the one used in Zenith's E and F line receivers, in that it incorporates the Voltage Regulator Transformer.

The primary winding circuit breaker used in the F-line receivers has been replaced with a 1.7-ampere chemical fuse. The fuse is located on the lower left side of the vertical chassis, for ease of replacement.

Video Output Module

The new color picture tube employs what is commonly called a *unitized* gun. It has the three G1 control grids and three G2 screen grids connected internally. A single lead is brought out for a common set of G1 grids and another for the common set of G2 grids. This construction precludes the conventional method of setting cutoff since the G2 grids can no longer be adjusted independently.

To simplify black-and-white tracking without adding additional controls, a new circuit was designed which reduces the numbers of adjustments to four.

The basic principle employed makes use of the fact that the gain of any one gun will be inversely proportional to its cutoff voltage. The gun with the higher cutoff requirement will also require more drive by a predictable amount. The circuit in Fig. 4 employs this principle. The controls in the emitters of each of the output transistors adjust both the cutoff and the gain of the three stages. The fourth control is the master G2 control, which is common to all three grids.

The luminance signal is common to the bases of each driven stage, and the outputs at each collector are standard R G and B signals. These signals are used to drive the bases of the three output stages, Q1202, Q1204 and Q1206, which are connected in common-emitter configurations.

The Video Output Module, Fig. 5, is mounted on the picture tube socket.

Vertical Module

The vertical deflection system employed in the 13GC10 chassis is

Photos and illustrations supplied through the courtesy of Zenith Radio Corp.

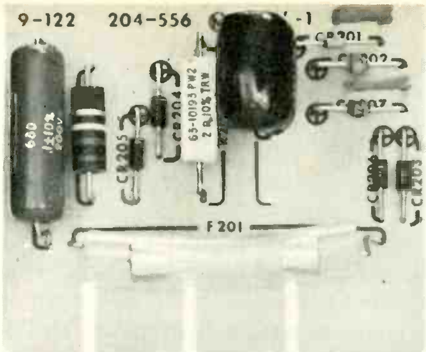

Fig. 3—The Power Supply Module is similar to the one used in Zenith's E-and F-Line receivers, and is used in conjunction with a Voltage Regulator Transformer.

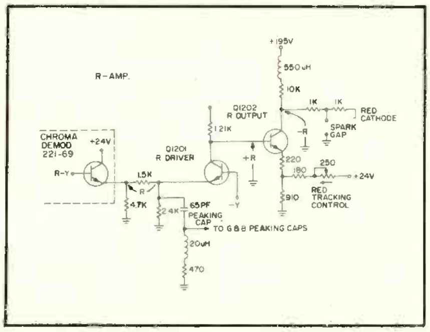

Fig. 4—The controls in the emitters of each of the video-output transistors simultaneously adjust both the cutoff and the gain of the three stages.

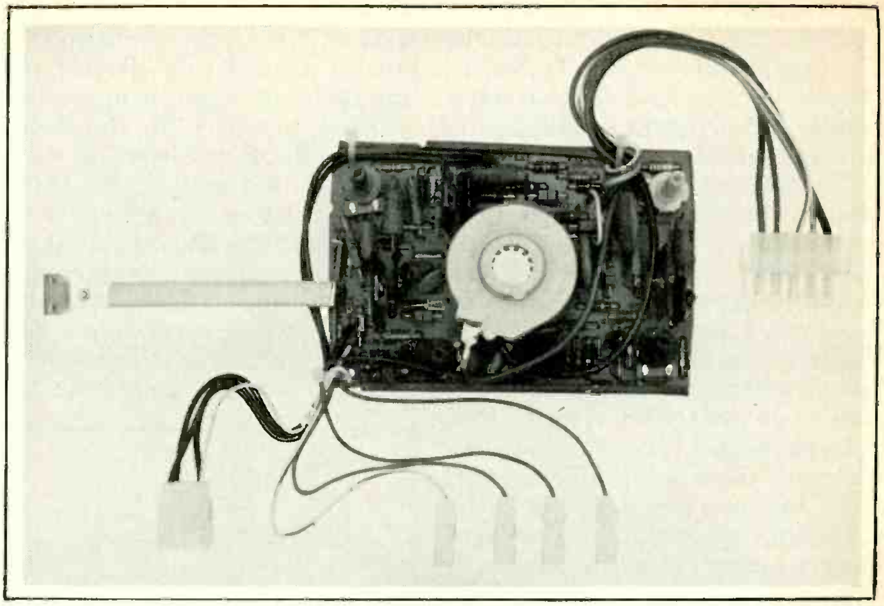

Fig. 5—The new 9-121 Video Output Module, which makes possible a simplified b/w tracking procedure, is mounted on the picture tube socket.

a modified version, both electrically and mechanically, of the vertical module used in the previous E-and F-lines. The basic differences in these two modules are shown in Fig. 6 and include: 1) increased power output to permit scanning of the 110-degree deflection system. 2) Elimination of the necessity for a yoke fuse. 3) An AC-coupled system with familiar servicing characteristics and fail safe operation. 4) Decreased yoke impedance, which decreases yoke current without the necessity of increasing the power supply voltage.

In-Line Picture Tube and Associated Sweep/Convergence Circuits

The 13GC10 chassis used in the new 13V receivers employ a new 110-degree in-line picture tube and associated sweep and convergence circuits.

The picture tube is of the small-neck (29 mm), in-line concept with the neck components mounted in a conventional manner for simplified adjustments.

The 110-degree system offers several advantages: the picture tube is 3.8 inches shorter than a 90-degree delta system with equal screen size. The electron beam travels a shorter distance to the screen, resulting in a smaller spot size for a given beam current, providing better picture detail.

Convergence of the electron beams of the two outside guns (blue and red) upon the beams of the center gun (green) is accomplished by the adjustment of the Static/Purity Device (Fig. 7). This is made possible because the convergence errors on both sides of the screen are equal in the in-line system. Since the phosphor stripes on the screen are continuous, no convergence correction in the vertical direction is needed. As a result, the number of dynamic convergence controls have been reduced, from the twelve controls used in the delta-gun system to just three used in the new in-line system.

ZOOM Picture Enlargement Function

Another new innovation added to Zenith's new color TV line is the *Space Command 1000* with a *ZOOM* (picture enlargement) feature. It allows an instant close-up at the viewers fingertip by pressing the *ZOOM* button on the hand transmitter.

When the *ZOOM* button is pressed, an instantaneous expansion of both the horizontal and vertical size of the picture occurs. Enlargement of the center of the raster is accomplished by increasing both the horizontal and vertical currents through the yoke windings.

Expanding the picture created some problems in overall picture quality which had to be "designed out." For one thing, the color level and contrast seemed weaker. Also, because the picture tube beam is deflected to the funnel around the sides and the top and the bottom of the picture tube, it is reflected back onto the face of the tube, creating a dim white haze. To overcome these problems, increased contrast and color levels are produced during the "ZOOM" mode of operation, and the horizontal and vertical blanking are widened, to eliminate the reflected beam.

ZOOM Relay Circuit

A schematic diagram of *ZOOM* Module 9-126 is shown in Fig. 8. During normal-size picture operation, the *ZOOM* module does not affect the operation of the TV set. When the *ZOOM* button on the SC1000 transmitter is pressed, the drive stage of the *Space Command* Module is energized, permitting current to flow through relay coil K301. The resultant magnetic field closes four sets of contacts, which "energize" the circuits that accomplish the action required for the *ZOOM* function. The relay circuit in Fig. 8 is shown with the relay contacts in the *ZOOM* position.

The contacts shown on the bottom of the schematic, labeled "Horizontal Size," removes the parallel connection of two capacitors —a .27-microfarad and a .1-microfarad capacitor, leaving only the .1-microfarad capacitor in the horizontal circuit of the deflection yoke. A wider deflection of the beam in a horizontal direction is thus provided.

Increase of the vertical deflection is accomplished by another set of contacts labeled *"Vertical Size"* and *"ZOOM LIGHT."* For picture enlargement, two of these contacts close and connect +130 volts to the 220 K resistor and a diode to terminal U18 of the vertical module of the TV chassis. This places the 220 K resistor in parallel with the fixed 330 K resistor. The RC time constant is now decreased, increasing the vertical sweep height. This contact also illuminates the *ZOOM* indicator light on the front panel of the TV set.

Another set of contacts, called *"Contrast Enhance"*, are closed in the *ZOOM* mode of operation, adding two resistors in the contrast control circuit. The video signal level is thus increased and coupled on through to the picture tube.

The remaining contacts of relay K301 activate the "Color Enhance" circuit. During the enlargement operation, a 12 K resistor, R311, is switched across the tap on the *color level* control. This connection reduces the voltage on terminal U4 of the Chroma Module, increasing the chroma level.

When the TV receiver operates in the non-*ZOOM* mode, relay K301 causes the "Color Enhance" contacts to be in the position which grounds the base of transistor Q303. As a result, transistor Q303 is cutoff, thereby killing the output signal and permitting normal blanking pulse operation.

Other circuitry on the Relay Circuit Module widens the vertical and horizontal blanking pulses. Positive-going synchronizing pulses enter the module at pin U4. These pulses are integrated by R303, R304, and C301, resulting in a sawtooth waveshape. The positive portion of this wave is coupled through CR305 to the base of transistor Q301, and is amplified and inverted by Q301. The negative portion of the sawtooth wave is coupled through CR304 to the collector of Q301. As a result, there are two negative-going signals per cycle, separated in time, on the base of Q302. This combination signal is amplified and inverted by transistor Q302, and is then applied to the input of the final stage, transistor Q303, which is an emitter-follower circuit. The output signal from terminal W3 is coupled to terminal W1 of the Luminance Module, cutting off the second video amplifier during the two positive pulse intervals. This action effectively cuts off the picture tube beam at the same time. The normal horizontal blanking pulse through terminal W1 of the Video Output Module cuts off the beam during the period between the pulses from the ZOOM module.

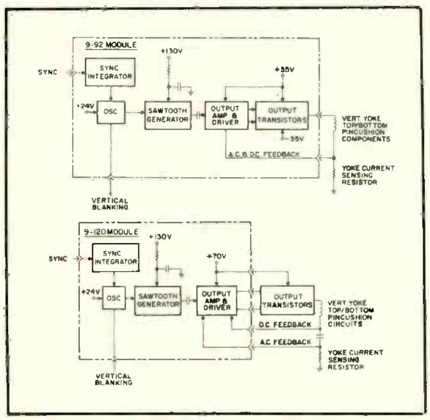

Fig. 6—The 9-120 Vertical Module is similar to the one employed in the previous E-and F-line chassis but with some electrical and mechanical modifications.

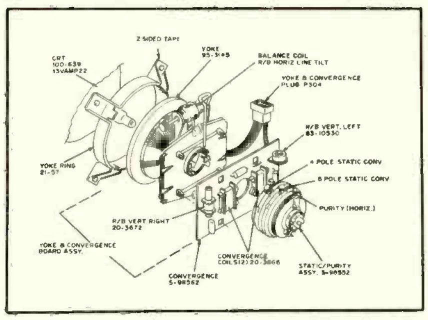

Fig. 7—Shown here are the components mounted on the neck of the new in-line color picture tube.

The result is a continuous, very wide blanking interval that permits beam conduction only within the horizontal limits of the picture tube.

A vertical sawtooth is received at Terminal W1 of the module. The positive portion of this sawtooth is coupled through diode CR302 to the base of transistor Q301, while the negative portion is coupled to the collector of transistor Q301. The rest of the circuit operates the same as for the horizontal signals. The widened vertical blanking pulse cuts off the picture tube beam during the vertical overscan.

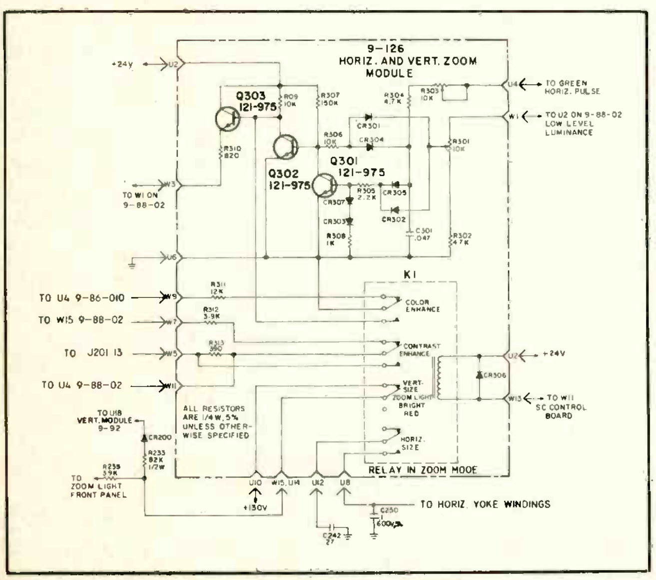

Fig. 8—Schematic diagram of the 9-126 Horizontal and Vertical-*ZOOM* Module.

SC100 18-Position Tuning System

The SC100 18-Position Tuning

continued on page 55

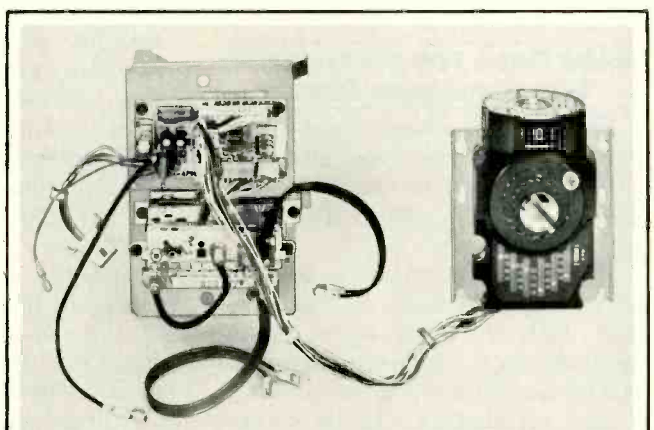

Fig. 9—The 18-Position Electronic Tuning System permits the selection of either VHF or UHF channels with one tuning knob.

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Technician Productivity & Incentive Pay

Realistic approaches to measuring and improving the productivity of your technicians

By J.W. Phipps

John Sperry, Lincoln, Nebraska, owner/manager of Sperry TV, a home entertainment electronic servicing business which is presently grossing about $800,000 annually. Sperry is also the developer and publisher of "TV & Radio Tech's Guide To Pricing," a comprehensive flat-rate pricing system which will be analyzed in an upcoming issue of ET/D.

■ The principal product of an electronic service business is *service labor manhours,* and the "raw material" from which this product is "produced" is the *time* for which the shop pays the technicians it employs.

In any business, the more product that can be produced from a given amount of raw material and labor manhours, the larger the *profit margin.* This business principal, called *productivity,* also applies to electronic service businesses: The more of an electronic technician's payroll time that can be billed *directly* to customers at the shop's hourly service labor rate, the more net profit the shop will realize from its investment in the *technician's time.*

One realistic method of measuring the productivity of a technician is illustrated in Table 1. The total number of hours for which a technician has been paid during a specific period is multiplied by the hourly service labor rate the shop charges its customers. The resultant product is the total gross service labor income the technician would have produced for the shop during the period if every hour for which he was paid could have been billed directly to customers at the shop's hourly service labor rate. This *potential* shop income then is divided into the gross service labor income the technician *actually* produced for the shop during the period. The resultant quotient is a decimal expression which, when converted to a *percentage* expression by moving the decimal point *two places* to the right, reveals precisely what percentage of the potential gross income the technician produced for the shop.

As an example, assume that a shop employs two "outside" technicians, who we shall call Tech A and Tech B, and that the hourly service labor rate the shop owner must charge his customers to recover expenses and realize a reasonable return on his investment is $20 per hour. Further assume that during a four-week period the shop owner pays each technician for 160 hours of service labor and, during this period, Tech A produces $2400 of gross service labor income for the shop and Tech B produces $1600. As shown in Table 2, the maximum potential service labor income the shop would have realized from each tech during this period, if 100 percent of each technician's payroll time could have been billed directly to customers is (160 hrs. x $20), or $3200. The *percentage* of potential service labor income actually realized from Tech A is ($2400 ÷ $3200), or 75 per cent, and that from Tech B is ($1600 ÷ $3200), or 50 percent.

Why wasn't our hypothetical shop able to directly bill customers for 100 percent of each technicians payroll time? Why was Tech A 25 percent more productive than Tech B?

The answer to the first question is obvious: a technician's time spent on coffee breaks, loading and unloading service trucks, completing "paperwork," illness (if you provide paid "sick leave" time), parts handling, training sessions, and paid vacations and holidays, all reduce the percentage of each technician's time that can be *directly* billed to customers.

The answer to the second question is less obvious. The difference in the productivity of the two technicians might be attributable to the fact that Tech A is *more skilled* than Tech B. If this is the reason and if the shop uses flat-rate pricing for all servicing, Tech A should be able to complete more *jobs* per hours, day, week and month than Tech B and, consequently, should produce more service labor gross revenue for the shop than Tech B. (If the shop uses strictly *hourly* pricing, any difference in skill between Tech A and Tech B would probably cause less of a difference in the service labor gross revenue produced by the two because the cost of the additional time required by Tech B to complete a job would merely be passed on to the customer.) Also, if Tech A *is* more skilled than Tech B, it is very probable that Tech B's callback rate is higher and, therefore, a greater percentage of his time is spent on non-revenue-producing "make goods."

Another possible reason for Tech A being more productive than Tech B is *attitude.* Tech A might be conscientious and "self-motivated" while, conversely, Tech B's attitude toward his

TABLE 1
Computation Of Technician Productivity

Technician Wage Hours	×	Shop Hourly Service Labor Rate	=	Technician's Potential Shop Gross Service Labor Revenue

$$\frac{\text{Actual Shop Gross Income Produced By Technician}}{\text{Technician's Potential Shop Gross Service Labor Revenue}} \times 100 = \text{Technician's Productivity (\%)}$$

TABLE 2
Sample Computations Of Technician Productivity

TECH "A":

160 Wage Hours For Which Paid	×	$20 Per Hour Shop Service Labor Rate	=	$3200 Potential Shop Service Labor Revenue From Tech "A"

$$\frac{\$2400 \text{ Actual Gross Revenue}}{\$3200 \text{ Potential Gross Revenue}} \times 100 = 75\% \text{ Technician Productivity}$$

TECH "B":

160 Wage Hours For Which Paid	×	$20 Per Hour Shop Service Labor Rate	=	$3200 Potential Shop Service Labor Revenue From Tech "B"

$$\frac{\$1600 \text{ Actual Gross Revenue}}{\$3200 \text{ Potential Gross Revenue}} \times 100 = 50\% \text{ Technician Productivity}$$

job might be "I get paid for eight hours work whether I hurry or not, so why hurry."

If a difference in *skill* is the *principal* reason for the difference in the productivity of the two technicians, the obvious solution is to improve Tech B's proficiency by additional training, which, unless Tech B can be "motivated" to obtain the required training after hours and at his own expense, will require further investment in him by the shop.

Regardless of whether the difference in productivity of Tech A and Tech B is the result of a difference in skill or the result of a difference in attitude, or a combination of the two, improving the proficiency of Tech B undoubtedly will require some form of *motivation*. Merely *telling* Tech B that he has to produce more if he wants to retain his job *might* be effective if a poor attitude is the *only* reason for his low productivity, but if the reason is a *combination* of poor attitude *and* lack of skill, he *might* try harder but, because of insufficient skill, the net result probably will be more callbacks and a frustrated technician, neither of which will put more dollars in the shop till. And telling him that you expect him to obtain additional training on his own time and at his own expense probably will aggravate any existing attitude problem unless he can see that his additional investment in his job will produce a return in the form of increased personal income for him in the immediate future.

One form of motivation which in most cases seems to work for both the technician and the shop is some form of *incentive pay program*. If a technician knows that his personal income is directly proportional to the amount of service labor revenue he produces for his employer, he will regard his time and his skill as *his* investment in his own income, not just in his employer's income. Consequently, he probably will use his time more efficiently and will be more receptive to the idea of obtaining whatever training is required to become and remain proficient, even if some or all of the time and cost involved is at his own expense. And, equally as important, his *potential personal income* is not limited to the hours he works multiplied by the hourly rate his employer pays him; instead, it is limited principally by *his own* efficiency and skill.

AN ACTUAL EXAMPLE

One of the most realistic of the technician incentive pay programs with which I am familiar is that developed and used by John Sperry, Lincoln, Nebraska, Owner/manager of Sperry TV, a home entertainment electronic servicing firm which is presently grossing about $800,000 a year. (Sperry also is the developer and publisher of *TV & Radio Tech's Guide To Pricing*, a comprehensive flat-rate pricing system which will be analyzed in an upcoming issue of ET/D.)

Sperry presently employs nine outside service technicians, all of whom are on his technician incentive pay program. (Sperry's ten bench technicians are not on the incentive pay plan.)

Under Sperry's incentive pay plan, because of Federal Wage & Hour Law restrictions outside technicians do not receive a guaranteed wage; instead, each is paid a percentage of the actual gross service labor revenue he produces for the shop. However, before the technician's percentage of gross service labor revenue is computed, two "adjustments" are made to the amount for which he receives a commission: *callback* debits and *callback* credits.

Sperry defines a *callback* as "any service call made by the technician which cannot be charged to a customer during the shop's guarantee period."

A *callback debit* is the cost incurred whenever a non-revenue-producing callback has to be performed on a job for which an outside technician is directly responsible. The total cost of all such callbacks during the incentive pay period is *deducted* from the responsible technician's gross service labor revenue *before* his commission is computed.

A *callback credit*, equal to the amount which normally would be received by the shop for the call if it were not a non-revenue-producing callback, is given a technician whenever he performs such a callback on a job for which either he or *another* technician is directly responsible. The total of all such callback *credits* is *added to* a technician's gross service labor revenue *before* his commission is computed.

Thus, a technician always receives both a callback credit and an equal callback debit for each callback on his own work, but, as will be explained subsequently, his total callback debits affects his callback debit percentage, which is used to compute his commission *rate*.

Each technician's *rate of commision* is dependent on the *percentage of callback debits* he incurred during the pay period. This rate-of-commission-determining factor is called the technician's *percentage of callback debits* and, as shown in Table 3, is recomputed each pay period by adding together his actual gross service labor revenue and callback *credits* for the period and then dividing this sum into the total callback debits he incurred during the period. The higher the percentage of callback debits, the lower the commission rate. A technician's commission rate can vary from a high of 42 per cent to a low of 30 percent, depending on his percentage of debits.

Once a technician's commission rate is determined as described previously, it, in turn, is used to compute the amount of commission he actually will receive. As illustrated in Table 4, this is done by adding together the gross service labor revenue the technician actually produced for the shop during the period plus the callback *credits* he received. From this sum is subtracted the total callback *debits* the technician incurred during the period. The resultant amount is then multiplied by the technician's commission rate.

Sperry computes his technician's incentive pay on a monthly basis. Although they receive no guaranteed wage, they are permitted to draw a specified amount against their incentive pay on a biweekly basis. Then, when their commission is computed at the end of the month the amount which they have drawn is deducted from their commission and they receive the difference.

Sperry's incentive pay system is a realistic approach to motivating and compensating technicians because: 1) The compensation a technician receives is *directly proportional* to the amount of gross service labor income *he actually produces* for the shop. 2) Tieing the commission

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TABLE 3
Computations Of Technician's Percentage Of Callback Debits And Commission Rate

CALLBACK DEBITS / (Actual Gross Service Labor Revenue Produced + Callback Credits) = Percentage of Debits

COMMISSION RATE (%)	PERCENTAGE OF DEBITS
42	Up to 7.0
41	Up to 8.0
40	Up to 9.0
39	Up to 10.0
38	Up to 11.0
37	Up to 12.0
36	Up to 13.0
35	Up to 14.0
34	Up to 15.0
33	Up to 16.0
32	Up to 17.0
31	Up to 18.0
30	Up to 19.0

TABLE 4
Computation Of Commission

Actual Gross Service Labor Produced + Callback Credits − Callback Debits = Amount on Which Commission Computed

Amount On Which Commission Computed × Commission % Rate (From Table 3) = Technician's Gross Pay

TABLE 5
Monthly Technician Activity & Incentive Pay Report

Technician	Actual Serv. Labor Rev. Produced	Callback Credit	= Sub-Total	− Callback Debit	= Total On Which Comm Paid	× Comm %	= Total Comm Earned	% Callback Debit
Tech A	$ 2400.28	$ 313.95	$2714.23	$ 167.05	$ 2547.18	42%	$1069.82	6.1%
Tech B	2408.33	536.25	2944.58	356.85	2587.73	37	957.46	12.0
Tech C	2713.68	143.00	2856.68	164.45	2692.20	42	1130.74	5.7
Tech D	2075.33	293.80	2369.13	132.60	2236.53	42	939.34	5.5
Tech E	1391.10	209.30	1600.40	100.75	1499.65	42	629.85	6.3
Tech F	2118.62	312.00	2430.62	328.90	2101.72	35	735.60	13.5
Tech G	1858.55	216.40	2074.95	168.95	1906.00	40	762.40	8.1
Tech H	1798.79	273.00	2071.79	132.60	1939.19	42	814.46	6.4
Tech I	2937.20	235.30	3172.50	154.70	3017.80	42	1267.48	4.8
TOTALS	19701.88	2533.00	22234.88	1706.85	20528.03	—	8307.15	—
AVERAGES	$ 2189.10	$ 281.44	$ 2470.54	$ 189.65	2280.89	40%	$923.02	7.6%

PM & Annual Checkout of VHF Marine Transceivers

By David Norman, ET/D Communications Editor

Preventative maintenance and annual checkout procedures which can detect and head off trouble before it interferes with communications

■ Someone once described a boat as "a hole in the water that you throw money into." It is up to the marine electronics technician to see that the truth of this old saying is minimized, at least as far as his specialty is concerned. Conscientious, proper maintenance to head off trouble before it starts is an inducement for the vessel owner to call on you when replacement or updating is necessary.

When new equipment is sold, it is a good idea to remind the purchaser that a checkout should be made at least annually.

Only certain charter boats and heavier vessels are required by law to have annual radio checkouts, but it's a good idea for everyone. A call to your local Coast Guard and/or FCC Field Office will help you determine whether or not a particular vessel has mandatory radio requirements and, if so, what they are. (The locations of FCC Field Offices are listed in Table 1.)

The equipment used in mandatory installations must meet certain stringent technical requirements. Many of the lower-priced units do not. (See COMM CHAT Column in this issue of ETD.) Be certain that your customer doesn't get a citation because of your ignorance. You need copies of the current FCC Parts 81 and 83 for the latest legal requirements. (A list of the FCC Rules and Regulations and instructions for ordering them are included in Table 2.)

Regardless of the legal requirements, all checkouts should be conducted with the same thoroughness. A properly operating radio is the best insurance policy a boat owner can have.

POWER CONNECTIONS

When VHF transceivers are properly installed by professionals, there should be no major power supply problems. All that should be necessary is a check for loose or corroded connections.

A good idea is to remove all connections and scrape off all signs of corrosion. Coat the connections and terminals with a good grade of water-proof grease (transistor heat-sink compound is excellent), replace faulty terminals, and securely refasten them from the battery to the unit itself.

If the unit seems to have been poorly installed originally, you also might check to determine whether the power cable is large enough to carry 4 or 5 amps without excessive voltage drop. Of course, the longer the run, the larger the wire must be. No. 8 wire is usually sufficient for even the longest runs, and nothing under No. 14 should be used anywhere in the wiring of a vessel.

Check the fuse to see that someone hasn't installed a 30-amp fuse where a 4-amp fuse belongs. A large fuse, small wire, and a dead short is conducive to lots of smoke and fire. Don't let it be your fault.

Remote cables, when used, should also be subjected to close scrutiny. The remote controls are usually mounted outside the main cabin area and are likely to have more exposure to rain and water.

If a remote or power cable passes through a bulkhead or deck, the feed-through hole should be resealed with *Marine-tex* or silicone putty (bathtub caulk). Old putty should be carefully removed, not just covered up with new caulking.

ANTENNAS AND COAXIAL CABLES

Carefully check each component in the entire antenna system. This is a critical area.

Remove and retighten the coax connector at the radio several times to brighten the contacts. Physical integrity of the coaxial cable is quite important, and loose connections should be resoldered or replaced. Use heat-sink compound liberally at every connection.

Coaxial feed-throughs need the same attention as power or remote cables. If water leaks around a coaxial cable, it is likely to run to and even into the radio itself. A small drip loop is good backup protection. Water leaking down the cables won't have a direct path into an expensive piece of gear. Being a little paranoid about water damage is a healthy thing.

Outside connections must be waterproofed and all coax should be taped to something—never left loose to slap in the wind.

Saltwater corrosion has a way of growing like a fungus and spreading to places where even water cannot reach. To check for corrosion out of sight on coax, carefully cut a tiny slot in the outer jacket. Don't damage the shield and don't cut the jacket while the cable is wet. If you see any *green*—any at all—replace the coax. If the shield is still bright and shiny, put a little sealing compound in the slot and tape it securely closed.

Look for pinched, bare, or cut places in the coax. If you have any doubt at all about the quality of the coax, strongly suggest that the customer let you replace it with new coax. (Marine coax is usually heavily tinned and resists corrision better than standard coax.)

Check the antenna for loose or corroded mounting hardware and replace or tighten parts not up to standards. If the mast itself is broken or cracked, it should be replaced. Don't attempt repairs unless you really like call-backs.

TRANSCEIVER CHECKOUT

Now you are down to the nitty gritty of the check. If power is available at the boat, all checks and most adjustments can be made at dockside. If power is not handy, the radio can be checked in the shop—except for final antenna checks.

Check the power supply voltage *at the unit*. Most VHF Marine transceivers are rated at 13.6-13.8 VDC. Higher or lower voltage may require adjustment of the engine's voltage regulator by a qualified mechanic. Make two voltage checks—engine on and engine off—and record them on the transceiver checkout form.

Receiver sensitivity checks require an accurate, attentuated signal source, such as the Lampkin Model 107C or equivalent. Record this and all other readings on your checkout form. (Keep duplicates of all checkouts; even if the customer loses his, you still have one.)

Make two squelch sensitivity checks. For the "minimum" test, adjust the squelch control to the *lowest* setting that will quiet the unit, then advance the generator output until the squelch fully opens. "Tight" squelch checks are made with the squelch at *maximum*. Depending on the unit, one or both of the squelch limit settings might be adjustable internally.

TABLE 1
FCC Field Office Locations*

Alabama, Mobile 36602
Alaska, Anchorage 99501 (P.O. Box 644)
California, Los Angeles 90012
California, San Diego 92101
California, San Francisco 94111
California, San Pedro 90731
Colorado, Denver 80202
District of Columbia, Washington 20554
Florida, Miami 33130
Florida, Tampa 33602
Georgia, Atlanta 30303
Georgia, Savannah 31402 (P.O. Box 8004)
Hawaii, Honolulu 96808
Illinois, Chicago 60604
Louisiana, New Orleans 70130
Maryland, Baltimore 21202
Massachusetts, Boston 02109
Michigan, Detroit 48226
Minnesota, St. Paul 55101
Missouri, Kansas City 64106
New York, Buffalo 14203
New York, New York 10014
Oregon, Portland 97204
Pennsylvania, Philadelphia 19106
Puerto Rico, San Juan 00903 (P.O. Box 2987)
Texas, Beaumont 77701
Texas, Dallas 75202
Texas, Houston 77002
Virginia, Norfolk 23510
Washington, Seattle 98104

* These are also mailing addresses.

(This sequence is merely a suggestion, as long as all items are covered. The checks may be made in any order with which you feel comfortable.)

Frequency checks are usually recorded in one of two ways. Depending on the instrument, frequency variation is read either in parts-per-million or directly in MHz. Use of the latter method requires a little arithmetic to determine if variation is within acceptable limits. Variation of plus or minus .001, or 10 ppm, is according to the manufacturer's instructions and as close to the center of the channels as possible.

At times, a crystal which will not "zero" in one position will do so in another crystal socket. This, of course, is caused by variation in capacitance of the tuning and switching circuitry. It doesn't always work, but it's worth a try before pulling a crystal for replacement.

List each channel or frequency checked, unless all channels check (or can be adjusted to) well within tolerance. Then a simple "all channels less than ± .001% variation @ 13.8 VDC" or similar statement is sufficient. Make sure of output on each channel.

The Bird Model 43 or equivalent is an excellent instrument for measuring output power. Output power is usually measured and adjusted into a "flat" 50-ohm dummy load. The Model 43 produces an accurate readout even if a lot of reflected power exists, but some instruments do not and the dummy load is required. All measurements discussed up to this point, except supply voltages, can be made either on or off of the vessel. Measurement of reflected power or Standing Wave Ratio (SWR), depending on the type of readout, *must* be made with the radio operating *into its normal antenna*. As a rule, commercial VHF marine antennas are broad-band types and offer a good 50-ohm match across the entire band. More than 10 percent reflected power, or VSWR higher than 2:1, usually indicates a problem, probably in the coax or connectors. Another likely cause of antenna mismatch is an antenna's proximity to metal stays or masts.

After the transmitter's output circuitry is adjusted for rated output into a dummy load, no further adjustment should be necessary. (Remember that any in-line wattmeter introduces some minor tuning change.)

If you do encounter an indication of severe antenna mismatch, look everything over carefully. Gently pull and shake all exposed parts. It even might be necessary to temporarily replace the coax and antenna to pinpoint the trouble. Internal corrosion of an antenna can and does occur, particularly now that some of them are getting to be several years old.

The final output check is to ascertain if *reduced* power operation is normal, i.e. below one watt and above .75 watt. FCC regulations require that contact be made on reduced power whenever possible.

The final operations check is the measurement of modulation. A deviation of plus or minus 4.5 KHz is standard and should not be exceeded even with a shout. Remember that if the deviation is much lower than ± 4.5 KHz, output will seem weak to a distant station. Wide-band (more than ± 4.5 KHz) modulation may cause interference to other frequencies.

After the unit has been checked out and is operating properly, look over the whole system. See that the mike cord is not damaged and that the remote, if used, is working properly. Check the transceiver's mounting bracket for physical integrity and look for any sign of early water damage, especially around mounting screws and bolts.

Besides being a good thing for the customer, the annual checkout is good for you. You have a captive audience in a receptive mood (usually) and therefore have a golden opportunity to advise him of what's new in marine electronics. Your customer might have questions about his depthfinder, ignition interference, or how to get more range out of his VHF unit. Answer his questions truthfully and you have a definite advantage over your competitors for his future business—both sales *and* service.

One last word about antennas for VHF marine: Avoid installing an antenna with "gain" in excess of 6dB. Sure, a 9dB antenna is theoretically better in terms of low-angle radiation than a 6dB antenna, but when a small boat is rolling the higher gain antennas tend to sweep above and below the horizon, causing drastic changes in received and transmitted signal levels. Save antennas with gain in excess of 6dB for shore or other fixed installations.

If the customer has a radio maintenance log—most do not—make the proper entries as to date, items checked, etc. If he does not, mark "no log available" on your checkout sheet and give it to him.

The going service labor rate for the checkout and the simple adjustments described in the preceding paragraphs is $15 to $30, and more if coax, etc., must be replaced. An annual checkout can mean much to you in terms of *future business*, and this fact should be taken into consideration when deciding what to charge. ■

TABLE 2

FCC Rules and Regulations

(FCC Rules and Regulations are grouped into ten volumes and are sold in volume units by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The price of the volume entitles the purchaser to receive all page amendments for an indefinite period.)

VOLUME I

Part 0, Commission Organization

Part 1, Practice and Procedure

Part 13, Commercial Radio Operator.

Part 17, Construction, Marking, and Lighting of Antenna Structures

Part 19, Employee Responsibilities and Conduct

VOLUME II

Part 2, Frequency Allocations and Radio Treaty Matters; General Rules and Regulations

Part 5, Experimental Radio Services (Other Than Broadcast)

Part 15, Radio Frequency Devices

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Part 21, Domestic Public Radio Services (Other Than Maritime Mobile)

Part 23, International Fixed Public Radio-communication Services

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Part 31, Uniform System of Accounts for Class A and Class B Telephone Companies

Part 33, Uniform System of Accounts for Class C Telephone Companies

VOLUME IX

Part 34, Uniform System of Accounts for Radiotelegraph Carriers

Part 35, Uniform System of Accounts for Wire-Telegraph and Ocean-Cable Carriers

VOLUME X

Part 41, Telegraph and Telephone Franks

Part 42, Preservation of Records of Communication Common Carriers

Part 43, Reports of Communication Common Carriers and Certain Affiliates

Part 51, Occupational Classification and Compensation of Employees of Telephone Companies

Part 52, Classification of Wire-Telegraph Employees

Part 61, Tariffs

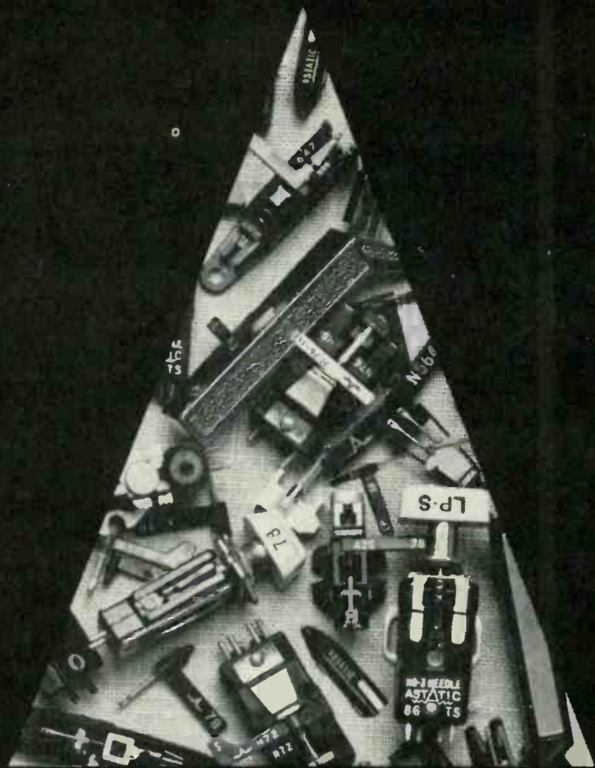
Part 62, Application to Hold Interlocking Directorates

Part 63, Extension of Lines and Discontinuance of Service by Carriers

Part 64, Miscellaneous Rules Relating to Common Carriers

Part 66, Applications Relating to Consolidation, Acquisition, or Control of Telephone Companies

Part 67, Jurisdictional Separations



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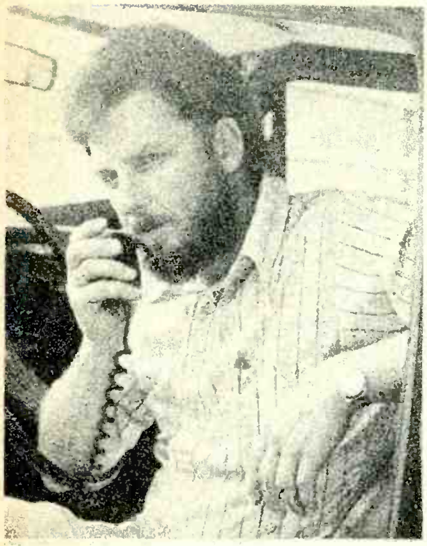
COMM CHAT



With David Norman, ET/D Communications Editor

■ Each month in this column I will explore with you one or more of the many aspects of servicing two-way communications equipment, with emphasis on subjects directly related to Citizens Band, Land Mobile, Avionics, VHF Marine and single-sideband equipment. Along the way I will attempt to keep you posted on changes and probable changes in equipment and FCC rules and regs. Also, I will include at least one service tip applicable to communications products. (If you have a communications service tip you'd like to share with all of us via this column, please send it to me, David Norman, ET/D, 1 East 1st St., Duluth, Minn. 55802.)

THE CB SCENE

For years, most home entertainment electronic servicers and many communications servicers have viewed the Citizens Radio Service (CB) with a jaundiced eye. Comments such as "There ain't no money in it," "There isn't enough of it use to warrant gearing up for it," and "It's nothing but junk, and I don't service junk" were heard whenever the subject of CB servicing was brought up among most groups of electronic servicers.

A few shop owners scattered throughout the country listened to their colleagues' comments, then went right ahead and proved that such comments were a bunch of bull. Servicers such as Kenai Communications in Homer, Alaska; Boyers Two-Way in Hagerstown, Maryland; and Business-CB Radio in Doraville, Georgia all have proved that there *is* money in CB.

The existence of over one million licensed CB operators and a nationwide consumer investment of $1.5 billion in CB (see News of the Industry, June 1975 ET/D) now should make CB appealing to most, in not all, electronic servicers.

Almost any populous area now will profitably support either a new CB sales and service facility or expansion of an existing entertainment electronics service operation into CB.

Although CB service requires at least one licensed (FCC 1st or 2nd Class Radio-telephone Operator) technician and some more or less specialized equipment (frequency meter or counter, stable generator, wattmeter, etc.), progressive electronic service businesses which constantly strive to update both skills and equipment will have no problem breaking into CB service. Merely adding a small notice to existing advertisements often gets the ball rolling. After that, it's largely a matter of word-of-mouth.

During the past few months a number of new rules and regulations concerning CB (FCC Part 95)* have gone into effect. In fact, new rules and resultant changes have come so fast that it's hard to keep up with them. Without going into detail, let's look at some of the changes produced by recently implemented new rules.

The height permitted for omnidirectional antennas has been increased to 60 feet above the ground, and linear amplifiers for CB have been totally outlawed. (Linears never were legal, but the new rules make sales and operation practically a hanging offense).

License fees have dropped from $20 to $4 and a new short-form license application (FCC Form 505)* is out, albeit currently in short supply.

The new rule which probably will have the most significant impact on the average dealer/servicer is the one which prohibits sales of non-type-accepted CB transceivers. This means that if you have ten used but serviceable units on the shelf (or even *some* new ones), you might not be able to sell them legally. The problem is to tell the type-accepted equipment from the non-type-accepted. The *FCC* has lists of the type-accepted equipment, but, as is usual, few copies have gotten into the hands of servicers and dealers. When in doubt about type-acceptance, the safest procedure is to call your local FCC Field Office.*

As if all of this isn't complicated enough, several other changes have been *proposed*. Among them is the long-ending proposal which would establish Class E CB (220) MHz). Additional channels for Class D (27 MHz) and eventual phase-out of AM equipment in favor of SSB also are being ground slowly—always slowly—through the "mills of the gods."

There is much pressure for and against a proposed Communicator License. For some time, the "keep-the code" and the "drop-the-code" groups have been squared off.

I am not going to stick my neck out by making predictions, except for this: Eventually, the 11-meter band will be subject to no enforcement other than out-of-band operation and impropriety (profanity, severe TVI, etc.)

If the FCC gives CB'ers headaches, the CB'ers are giving the FCC apoplexy. Short of acquiring police state powers, I am afraid that the FCC will lose all control of 11-meters and sooner or later will have to face the facts.

In any event CB is here to stay—legally or illegally—and there *is* money in it for properly equipped and competent technicians and dealers.

TIP OF THE MONTH

Technicians have known for some time that some *clear-glass diodes* (1N34, etc.) are light sensitive under certain rather unpre-

continued on page 39

**A list of the FCC Field Offices and their mailing addresses and a list of the FCC Rules and Regulations and the source from which they may be purchased are included in this issue in the article titled "PM & Annual Checkout Of VHF Marine Transceivers."*

Satisfy frequency measurement requirements in Citizens Band Radios

B+K PRECISION MODEL 1801 $230

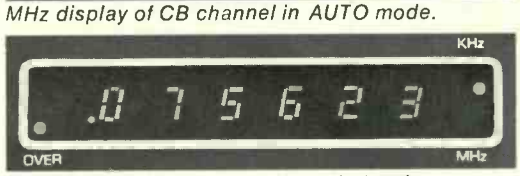
With autoranging 20Hz to 40MHz guaranteed and typical upper limit of 60MHz you can precisely measure the frequency of Citizens' Band transmitters and many other low band radio services. Model 1801's typical accuracy of better than 10PPM is always available for every measurement because there are three decimal point positions automatically selected by the frequency of the signal you are measuring. And you can suppress the first digit for still more resolution above 1MHz by moving the mode switch from Auto to 1 second. This six-digit counter gives you 1Hz resolution!

Discrete, reliable TTL circuitry automatically updates the large, bright readout up to five times per second—which means the 1801 works faster than you can. There's almost no way to make a reading error because Hz or MHz and Overrange are shown by discrete, separate LED's.

If you want to make receiver tests and don't have a signal generator with the required precision, you can measure the output of your generator* with the 1801 and adjust it to the accuracy you need!

If you aren't making measurements as accurately and easily as these, you need a B&K-Precision Model 1801 which is in stock at your electronic distributor. Write for detailed specifications.

MHz display of CB channel in AUTO mode.



KHz display of same CB channel showing supression of leading digits.

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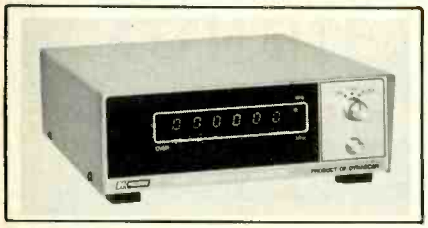
* 30mV or more

...for more details circle 113 on Reader Service Card

TEST INSTRUMENT REPORT



B&K 6-Digit Frequency Counter Model 1801. For more information about this instrument circle 105 on the Reader Service Card.

B&K FREQUENCY COUNTER MODEL 1801

■ Frequency counters, one of the first digital instruments of the past, were difficult to use laboratory type equipment and quite costly. It is now possible to have digital frequency counting accuracy at a moderate cost without sacrificing accuracy.

The B&K Frequency Counter Model 1801 has a guaranteed frequency range of 20 Hz to 40 MHz, but, according to the manufacturer, the unit typically operates with normal accuracy at frequencies from 10Hz to over 60 MHz, typical accuracy is 10 PPM.

The discrete TTL circuitry employed in the instrument automatically updates the six-digit solid state readout up to five times per second.

A *function* switch on the front panel selects either "1 SEC" preset gate interval or "AUTO range." In the latter position, the correct gate interval for maximum resolution is automatically determined and proper frequency unit indicators above and below the readout, indicate either "KHz" or "MHz." The display consists of six 7-segment, solid state numerical display units and three light-emitting diodes, for units and overrange indication.

Resolution to 1 Hz is available in 1 sec mode; the readout is displayed in KHz. In this position, MHz inputs will overrange the six-digit display, causing a red LED overrange indicator to blink. Switching back to the *auto* mode restores the missing significant digits at the expense of the least significant digits. This counter is compatible with all commercially available prescalers to extend its frequency range into the UHF range (100:1 prescaling).

Applications

The instrument can be employed for oscillator tuning, adjusting CB and other radio communications receivers and transmitters, precision audio frequency analysis, frequency monitor and is ideal for educational purposes.

Specifications

Auto Gate Time: 10 msec or 100 msec (MHz reading) or 1 sec (KHz reading), is chosen automatically. *Accuracy:* ±time base accuracy, ± 1 count. *Resolution:* 1 Hz *Display:* input signal frequency, automatically positioned decimal point. Units (KHz, MHz) displayed on front panel by illuminated indicator.

Input Characteristics

Impedance: 1 Meg/25 pf. *Protection:* Diode. *Sine Wave Sensitivity:* 30 mv RMS (guaranteed); 15 mv RMS (typical); 20 Hz-40 MHz. *Max. Input:* (peak AC & DC): 200 volt to 500 Hz; linearly derated to 100 volts at a 1 KHz; 100 volt, 1 KHz to 5 MHz; linearly derated to 50 volts at 40 MHz.

The instrument measures 3.31 inches high by 8.69 inches wide by 10.5 inches deep and weighs 5.5 lbs. The price is $230.

HEATHKIT DIP METER MODEL HD-1250

The Dip Meter can be employed to determine the approximate resonant or operating frequency of either energized or de-energized circuits in the frequency range between 1.6 and 250 MHz. In the oscillation or injection mode, you can use the dip meter to determine the resonant frequency of tuned circuits or as a variable signal source to align receivers. In the absorption mode, it will locate sources and frequencies of RF energy. It also can be used to locate sources of parastic oscillations and harmonics.

Heathkit's Dip Meter Model HD-1250. For more information about this instrument circle 106 on the Reader Service Card.

Any one of the seven frequency ranges can be selected by employing the appropriate plug-in coil.

Its compact size, rugged aluminum case, and battery operation makes the instrument completely portable. A carrying case also is provided with the instrument.

Two circuit boards employing one NPN transistor oscillator, one dual-gate MOSFET amplifier and two diffused silicon hot carrier diode detectors provide compactness and ease of assembly.

Other practical applications of the Dip Meter include: Shunt and series trap adjustment, measure the Q of a tuned circuit, find an unknown capacitor value, find the inductance of RF coils, find the inductance of toroid coils, neutralization, or use as relative field strength meter and antenna.

The meter employs a number of features to simplify its operation. The pickup coils are color-coded to match the large dial scale to indicate the frequency range of any one of the seven pickup coils. A convenient pushbutton *on/off* switch is located on the front panel of the meter. A log or general reference scale is included on the inner ring of the dial scale. A headphone jack is provided for use with the meter. As the tuning dial is moved across a point of resonance, there will be a clicking sound in the phones. There is an exception when an RF circuit is modulated with an audio signal, this audio will be reproduced in the headphones, providing it is of sufficient amplitude.

A clearly illustrated step-by-step assembly manual plus many application notes are provided with the kit.

The instrument (less coils) measures 2 inches high by 2-5/16 inches wide by 5⅞ inches long and the net weight of the instrument including meter, case, and coils is 2 lbs. The price is $59.95.

LEADER AUDIO TESTER MODEL LAV-190

This instrument is a combination of a wideband audio generator and wide-range AC millivoltmeter.

It is very useful in testing and servicing audio circuits, monaural and stereo, frequency response and gain characteristics.

Audio Generator Section

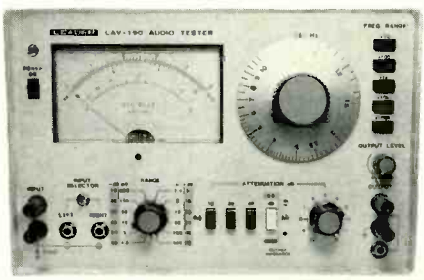
The audio generator frequency range is from 10 Hz to 1 MHz in five decade ranges. Its output is controllable from 0 to −80 dB in 1 dB steps into a 600-ohm load and a 6-ohm output is provided for low impedance loads.

In actual applications of the instrument the output frequency is set with the *frequency* dial and the *frequency range* switches. The *output level* control is used to set the reference output level as required for the test application. The *attenuator* pushbuttons and the rotary *attenuation* switch are set for the proper output signal impedance.

This attenuator system is designed to match a 600 ohm load. The signal attenuation is the sum of the markings on the attenuators. The output of the generator is a sine wave, with a voltage of over 2.5 Vrms into 600 ohms. This output signal is fed into the input of the test circuit.

A frequency response check can be made with the generator by plotting the constant input voltage against the output voltage. The generator frequency is then varied over the desired range and the amplifier output voltage is plotted against the frequency.

When plotting the response in dB, it will be convenient to initially set the generator output so that the voltmeter reading is 0 dB at 400 or 1000 Hz. Then by varying the frequency and noting the dB scale reading, the relative response against the frequency, and then plotting the reading on a semi-log paper.



Leader Audio Tester Model LAV-190. For more information about this instrument circle 107 on the Reader Service Card.

AC Millvoltmeter Section

The AC millivoltmeter section of the instrument covers a voltage range of from 150 µV to 500 Vrms in the 10 Hz to 1 MHz range. In addition to the direct input, two switchable inputs are provided *left* and *right* for stereo circuit measurements. A separate decibel scale, at 0 dB = 0.775 Vrms, can be used when comparing signal levels.

The AC millivoltmeter has an accuracy within ± 3 percent of full scale. The *input impedance:* 10 megohm; less than 50 pf; 1.5—500 mV range: less than 35 pf; 1.5—500 volt range. *Distortion:* Less than 2 percent at 1 KHz, full scale.

The instrument measures 8½ inches high by 12 inches wide by 7¼ inches deep. The price is $374.95.

HICKOK FUNCTION GENERATOR MODEL 270

Hickok Function Generator Model 270. For more information about this instrument circle 108 on the Reader Service Card.

The Hickok Model 270 is a very complete function generator instrument providing Sine, Square, and Triangle waveforms to fulfill the large variety of testing applications.

The DC level of the output waveform may be varied from 0 to at least ± 6 volts by adjusting the *DC level* control. This feature enables waveforms swinging entirely above (or below) ground to be easily obtained. The *DC level* control is independent of the *amplitude* control. Once the DC level of the basic output waveform is set, it will not vary when the *amplitude* control is adjusted, but the pushbutton attenuators will affect the DC level.

The waveform appearing at the output terminals may be attenuated by a fixed divide of 0 dB, −20 dB or −40 dB, depending upon which pushbutton is depressed. The total dynamic range using both the fixed and variable attenuators is −80 dB. The accuracies of the fixed attenuators is ± 0.5 dB. The output impedance is 600 ohms ± 5 percent of all settings of the *amplitude* and *attenuation* controls.

Three *function* pushbuttons are used to select the basic waveforms appearing at the output terminal.

Some of the applications for the waveforms produced by the instrument are as follows:

Sine Waves are generally used when a fundamental frequency (low in harmonics) is desired for checking frequency response gain or distortion in amplifiers, filters, IF stages, and other electronic networks.

Square Waves are generally used when it is desired to test a step-change in voltage. The square waves can be used to determine the phase delay in delay lines.

Triangle Waves are useful in testing the gain linearity of amplifiers, oscilloscopes, chart recorders and, in general, whenever a linear change in voltage is required. It is easier to detect clipping in an amplifier with a Triangle Wave than with a Sine or Square Wave.

The frequency of the output waveform is determined by the setting of the *frequency* dial and the selection of *range* buttons. For example, to obtain a 1,000 Hz output, set the *frequency* dial to 1 and depress the X 1 K pushbutton. The dial accuracy is 1 percent of full range. If manual sweeping of the output frequency is desired, the *frequency* dial will vary the frequency over at least a 100:1 range from stop-to-stop on (Sine and Triangle Waves only).

A PC board connector accessible from the rear of the generator is an important feature for added versatility. By simply adding a resistor and a jumper wire, pulse and ramp waveforms may be obtained. am and FM modulation of the basic waveform also is possible, along with capabilities for Frequency Shift Keying and Phase Shift Keying. In addition, it provides access to the main output

continued on page 39

Servicing Signal-Seeking Auto Radios

By Joseph J. Carr, Vehicular & Outdoor Electronics Editor

Part 1 of this two-installment article analyzes the mechanical functioning of the signal seeker mechanism and the two most common troubles associated with it. In Part 2, the electrical portion will be examined.

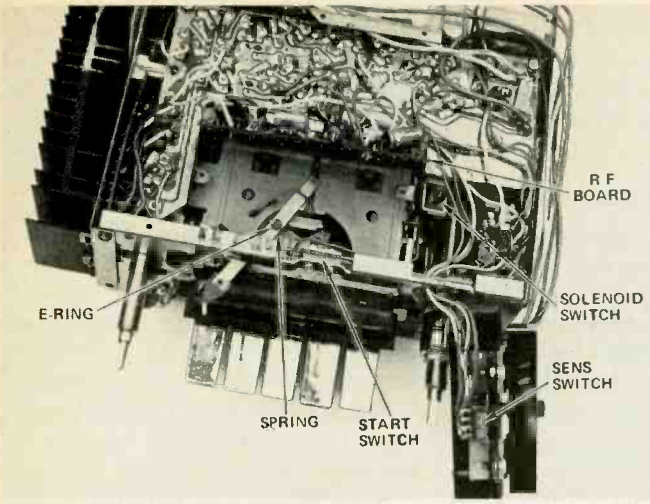


Fig. 1—Top view of Delco-produced signal-seeking car radio. *(Courtesy of Delco Electronics.)*

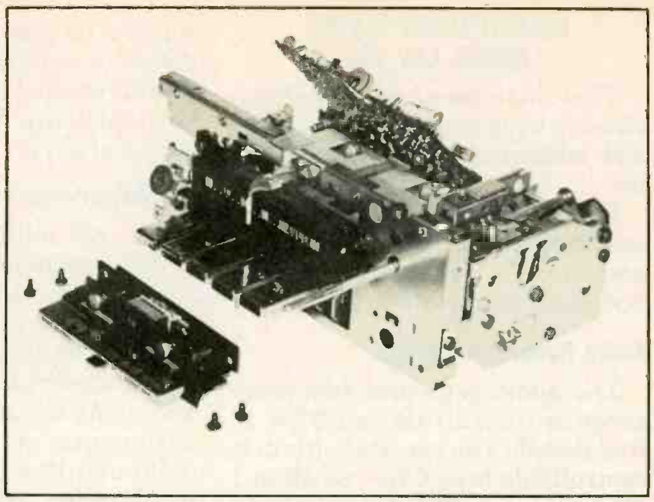


Fig. 2—Partially disassembled signal-seeking car radio. *(Courtesy of Delco Electronics.)*

■ Signal-seeking car radio tuners are equipped with what is probably the most complicated *mechanical* system encountered in consumer electronic servicing.

Delco Electronics (a division of General Motors) is probably the "leader" in signal-seeker design and production. Their signal-seeking radios are found not only in the automobiles made by their parent company, but also in those by Ford and Chrysler.

Fig. 1 shows a typical signal-seeking radio made by Delco. The large printed-circuit (PC) board contains the IF amplifier and detectors. The Permeability Tuning Mechanism (PTM) and the switch which inititates the "seek" cycle can be seen above the pushbuttons. The sensitivity (SENS) switch controls the sensitivity of the RF amplifier during the seek cycle so that, if desired, weak stations are eliminated. In the *least* sensitive position of the switch, only the *strongest* local stations will stop the seeker. In the *most* sensitive position, even *weak, distant* stations can trip the stop circuit.

Fig. 2 is a slightly different view of the radio, with the dial escutcheon and switch subassembly removed. The raised PC board on the top of the unit is the FM tuner RF deck. This subassembly can be raised on hinged connections after removal of two grounding screws. Most of the seeker mechanical assembly is located to the right of the RF deck and behind the manual tuning shaft.

The basic tuner mechanism is shown in Fig. 3. To service the slide mechanism (the one shown in Fig. 4 is from a ten-slide model), it is necessary to first remove the RF deck and then remove three ¼-inch, self-tapping screws and gain access by lifting out the core-slug assembly, as shown in Fig. 3.

The car radio is tuned by movement of ferrite cores in and out of the PTM coils. As shown in Fig. 5, a manual tuning shaft is coupled to an anti-backlash gear which drives a clutch. (The anti-backlash gear is a special type of dual gear which reduces backlash in the *dial* assembly.) The rotation of the tuning shaft and anti-backlash gear are coupled through the clutch to a treadle bar which drives the cores in and out of the PTM coils.

When either a pushbutton or the signal-seeker is operated, the clutch disconnects the manual tuning shaft so that the treadle bar can travel freely without drag from the manual tuning shaft.

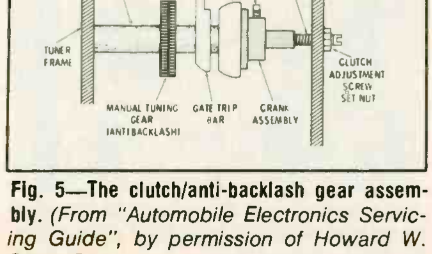


Fig. 5—The clutch/anti-backlash gear assembly. *(From "Automobile Electronics Servicing Guide", by permission of Howard W. Sams Co.)*

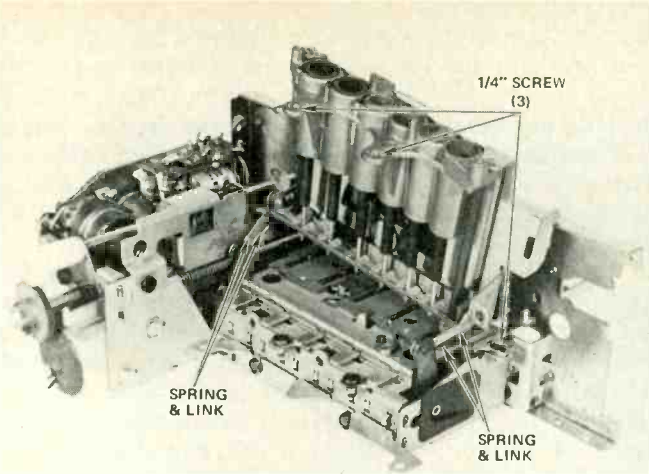


Fig. 3—Back view of signal-seeking car radio with PTM coil housing raised to expose the slide subassembly beneath it. *(Courtesy of Delco Electronics.)*

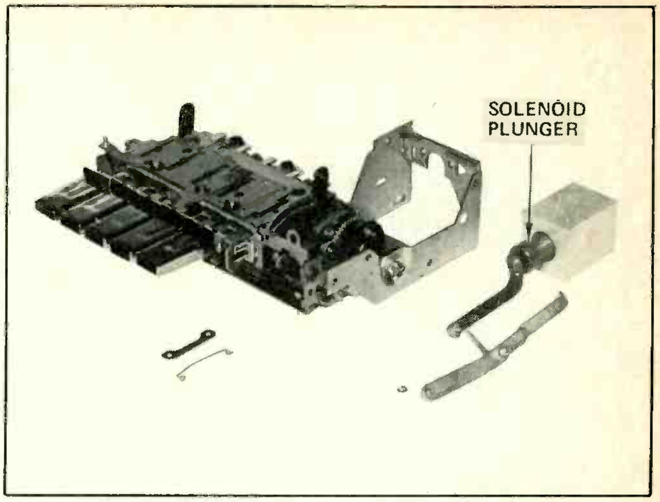


Fig. 4—Slide-pushbutton assembly and power spring solenoid removed from receiver.

When the signal-seeking actuator ("Wonder Bar") is depressed, it closes the signal-seeking START switch (item 2, Fig. 6) and several things begin to happen. One is the opening of the clutch on the manual-tuning shaft, and another is the energizing of the control relay (item 3, Fig. 6). A tang (item 4, Fig. 6) attached to the armature of the control relay normally rests against and jams a lightweight paddle wheel inside the governor gear assembly (Fig. 7). The governor assembly contains three gears and a centrifugal drag mechanism which keeps the gear's speed of rotation constant. The governor drive spline rests against a special traveling rack (item 6, Fig. 6). The rack drives the anti-backlash gear on the Permeability Tuning Mechanism (PTM).

Mechanical power for the seeker tuning mechanism is supplied by a stretch spring (item 7, Fig. 6). When the PTM is tuned to the low end of the band, the cores are all the way inside the tuning coils and the power spring is fully stretched. Depressing the "Wonder Bar" energizes the control relay, thereby removing the tang from the governor paddle wheel. This frees the mechanism and allows the power spring to drive the rack and PTM cores toward the high end of the band. When the cores have reached the high-end stop, the power spring is almost completely compressed.

If a station is encountered, the receiver's AGC voltage will cause the control relay to de-energize. The tang attached to the control relay armature then jams against the governor paddle wheel, causing the PTM core mechanism to stop.

If, on the other hand, the PTM reaches the high-end stop because no station signal is encountered (or is desired by the user), a recock switch will be close by a *turn-on* arm (item 14, Fig. 6). This energizes a solenoid (item 12, Fig. 6) which has its plunger ganged to the traveling rack. When the solenoid is energized, the rack, the PTM and the power spring are pulled to the low end of the dial by the solenoid plunger. At this point, the recock switch is tripped again, this time by the *turn-off* arm (item 10, Fig. 6), and the signal seeker is turned off.

Following is a summary of the actions which occur when the "Wonder Bar" is depressed:

- Relay K1 (Fig. 9) pulls in, freeing the governor gear train, and the clutch is disengaged
- The rack is moved forward by the power spring, dragging the PTM toward the high end of the band
- If a station signal is encountered, the AGC voltage turns off

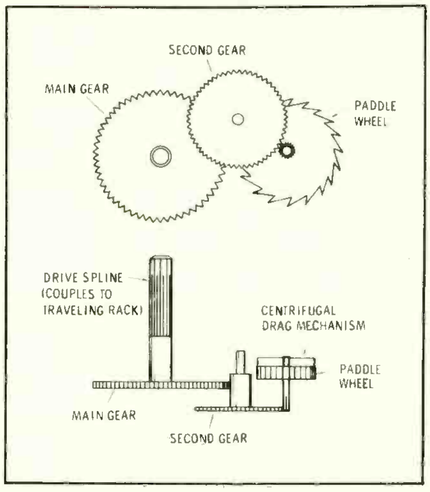


Fig. 6—Top view of signal-seeking mechanism with the following components identified: 1) "Wonder Bar" actuator; 2) Seek Switch, actuated by "Wonder Bar"; 3) Control Relay; 4) Tang, on control relay armature; 5) Governor Gear Train; 6) Traveling Rack; 7) Power Spring, operated by solenoid; 8) Anti-Backlash Gear (actually hidden from view); 9) Dial Pointer; 10) Recock Switch Turn-Off Arm; 11) Recock Switch; 12) Power Spring Solenoid; 13) Tension Spring; 14) Recock Switch Turn-On Arm.

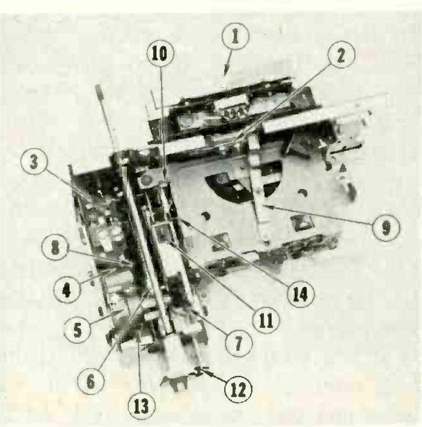


Fig. 7—Governor gear train mechanism. *(From "Automobile Electronics Servicing Guide", by permission of Howard W. Sams Co.)*

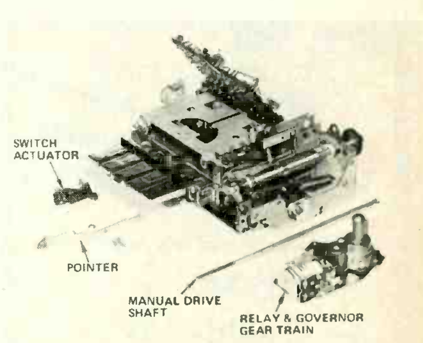


Fig. 8—Exposed view of rack and PTM drive assembly and other principal parts and mechanisms.

the control amplifier, causing relay K1 to drop out and jam the governor

- If the rack reaches the high-end of the dial without encountering a station signal, switch S2 (Fig. 9) is tripped, energizing the solenoid
- Because the plunger of the solenoid is ganged to the rack and PTM, both are abruptly yanked back to the low-end stop and the power spring is recocked. Switch S2 (Fig. 9) is turned off when the rack reaches the low-end stop.

The Delco "Wonder Bar" signal seeker has been in use for almost 20 years. The only really significant change has been the switch to solid-state control amplifiers, which has led to improvement in reliability and reduction of size. In some of the earlier versions of the signal seeker, the governor gear trains alone required half the dash space required for a complete modern auto radio.

One advantage of this longevity of a single basic design is that the service problems, if not actually solved by design changes, have become so familiar to auto radio techs that they can be diagnosed without a lot of time-consuming mental effort and step-by-step checks.

TWO COMMON MECHANICAL TROUBLES

Described in the following paragraphs are a couple of the more common *mechanical* problems. (We will cover other common problems next month after we have analyzed the electrical portion of the tuner.)

Failure to Seek

First, be sure the tang attached to the armature of control relay K1 is pulling out. Make sure that it is pulling *all the way out* so that the governor assembly (Fig. 7) is free to operate. If it is not pulling out at all, check for either a defective START switch (operated directly by "Wonder Bar") or a defective control relay. *Misadjustment* of the *control relay* also might be the cause.

If the control relay is functioning correctly, look for either a jammed governor assembly or a jammed PTM. Differentiating between these possible problems is relatively easy. Slightly depress one pushbutton and move the dial pointer by hand back and forth across the band. If the tuning mechanism moves freely, check the governor. A jammed rack can be uncovered by loosening the governor screws and removing it from the chassis (or at least pull it away from the rack). The rack then should fly forward and rest against the high-end stop. This procedure should be attempted only with the power off or you will unknowingly cause the following problem, which can damage the receiver.

"Machine Gunning"

This is a spectacular fault caused by loss of governor control over the rack. Without the governor to regulate its travel, the rack slams into the high-end stop. This, in turn, trips the recock switch and makes the rack slam back into the low-end stop, which turns off the recock switch. The rack then again flies forward, striking the high-end rack and tripping the recock switch...and so on until it becomes jammed, breaks or both. The usual cause is either a broken or misadjusted governor gear train. This problem must not be allowed to continue or it will damage the PTM, dial or switch.

IN PART 2

Next month, we will analyze the electrical portion of the seeker and the causes of and procedures for dealing with other common troubles, plus service hints regarding the bench supply and other equipment needed for testing. ■

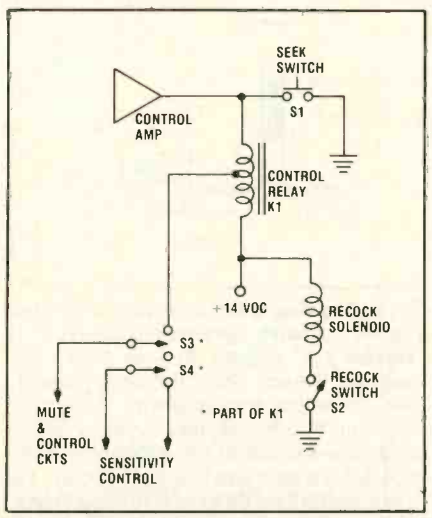


Fig. 9—Simplified schematic diagram of the signal seeker control circuitry.

COMM CHAT...
continued from page 32

dictable circumstances.

I was looking for excessive noise in a solid-state transceiver. Voltages checked normal and cooling spray produced no significant effect. I decided to try heat. The only wide-angle source of heat in this shop was an infra-red heat lamp. As soon as the light from the lamp was focused onto the chassis, the noise became much worse. Acting on a hunch, I began blocking off various sections with my hand. When I had the sensitive area pinned down to a square inch or so, I jury-rigged a paper funnel with an aperture of approximately one-quarter inch.

Presto! The unorthodox device pinpointed a defective diode in the detector-ANL section, and a quick replacement solved the noise problem.■

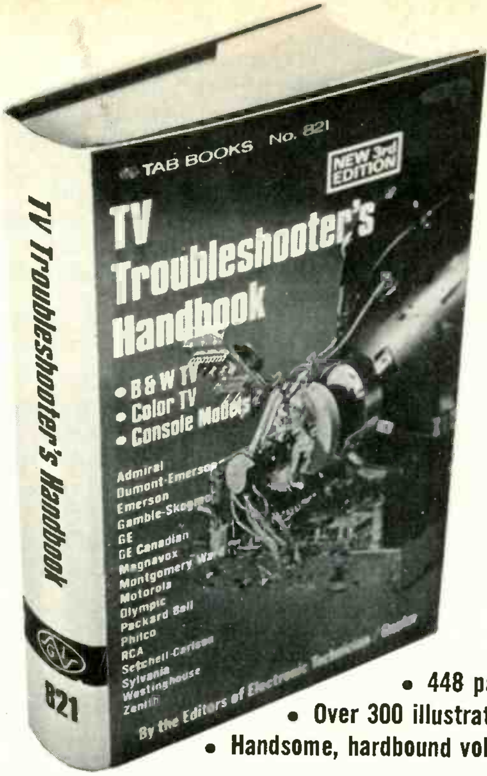
TEST INSTRUMENT...
continued from page 35

amplifier so that the waveforms may be mixed with an external signal. The output amplifier also may be used alone as a wideband amplifier.

Specifications

Frequency Range: 1 Hz to 1 MHz in six pushbutton decade ranges. Output Level: 0 to 24 volts p-p (8.5 Vrms) open circuit, protected against short circuits *Output Impedance:* 600 ohms, ± 5 percent, regardless of attenuator setting *Frequency Stability* (after ½ hours warm-up): With line voltage: ±0.5 per cent with 10 percent line change *Sine Wave Distortion:* Maximum total harmonic distortion from 20 Hz to 20 KHz is 1 percent typical, 1.5 percent maximum *Square Wave Rise/Fall Time:* 0.5 microseconds or less.

The instrument measures 8½ inches wide by 4 inches high by 6 inches deep and weighs 4 lbs. The price is $166.■



TV TROUBLE-SHOOTER'S HANDBOOK

3rd EDITION

- 448 pages
- Over 300 illustrations
- Handsome, hardbound volume

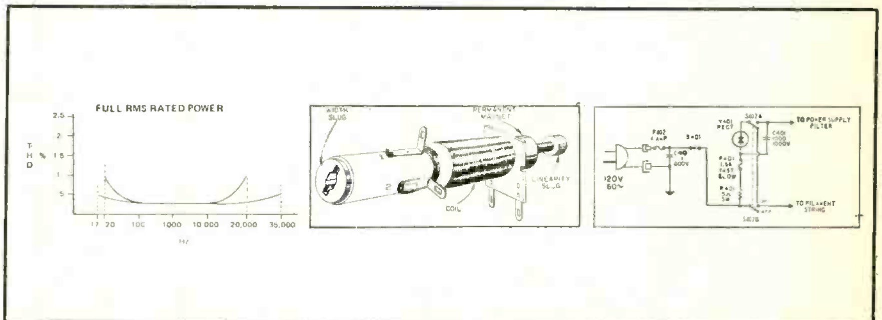
A GIANT quick-reference, fingertip source-book for hundreds of tried-and-tested solutions to "tough-dog" TV troubles. Thumb-indexed for instant reference!

Partial List of Contents

This completely new and up-to-the-minute third edition of one of the most popular TV handbooks ever published is 55% larger than the prior edition, and now provides coverage of consoles. This detailed compilation of practical help is the answer to the need for a well-organized file of troubles and proven cures, field factory changes, design modifications, circuit improvements, service notes, new and unusual circuits and descriptions of how they work, etc., for all major (and several minor) brands, from Admiral to Zenith. This brand-new edition represents the only known up-to-date digest of specific TV troubles and cures, for both color and monochrome sets, up to and including 1974 models. It also contains service data, schematics, special manufacturers' notes, etc., relating to the peripheral equipment found in TV consoles (such as tape players, phonos, FM and AM radios, combinations, etc.).

Despite its increased size and expanded content, you'll find this volume extremely easy to use: just put your thumb on the edge mark representing the TV brand of interest, and you instantly turn to the book section carrying the data you need. The contents of each Section are arranged according to TV type—there's no need to plow through entries not applicable to your own individual needs. Black-and-white models in each section are grouped together, as are color chassis, and console equipment. For easy reference, all troubles are categorized by make and model. Included in the color TV section are hints for troubleshooting chroma circuits, making adjustments, etc. Once you have this book in your hands, you'll wonder how you managed to get by without it for so long.

If you've ever spent time chasing down a malfunction only to find that the schematic didn't agree with the circuit, you'll know the value of *TV Troubleshooter's Handbook*. In these times, we all need to take advantage of every timesaver we can—and if you're a practicing TV technician you already know the kind of time you save when you have a little inside info on a set that comes into your shop. This unique volume will be more valuable to you than any of its predecessors because it's more complete, is fully updated, and is easier than ever to use. It's like having a complete file on each major TV brand—all in a huge volume that's still small enough to fit in your tool-and-tube caddy. We absolutely guarantee it! 448 pps., over 300 illustrations. Hardbound. Publisher's list price $8.95.



Literally hundreds of complete and partial schematics and illustrations make each of the thousands of entries in "TV Troubleshooter's Handbook" easy to understand.

AN EXTRAORDINARY OFFER...

...for more details circle 116 on Reader Service Card

TECHNICAL DIGEST

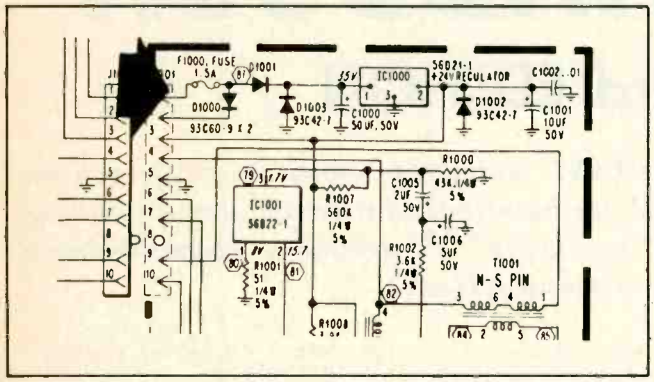
ADMIRAL

Color TV Chassis M10 — Service Hint

If the symptom is no vertical sweep (thin line across) and a raspy buzz coming from the high voltage section of the chassis, the probable cause a open F1000 fuse (1.5a, 84A4-7).

This fuse is located on the component side of the Pincushion board.

As noted in the circuit diagram, the B+ 33 volt and 24 volt supplies are fused by F1000. When the fuse is open, the



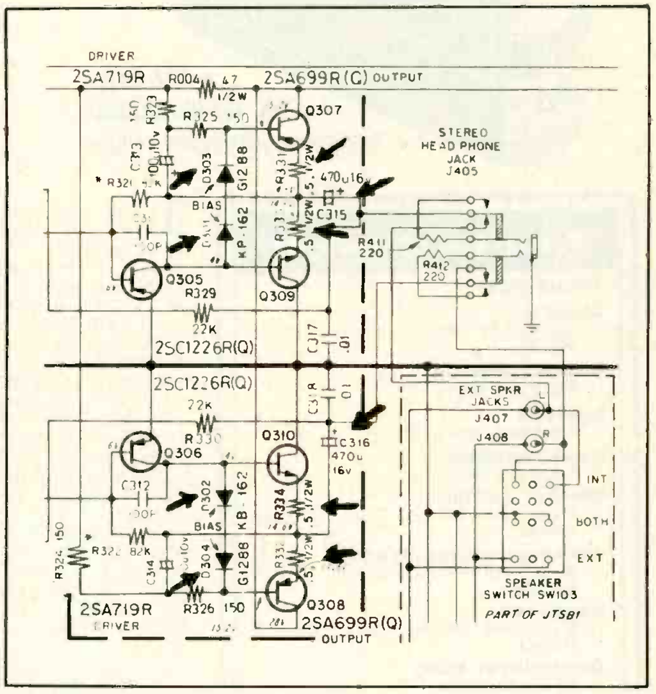
lack of source voltages will result in no vertical sweep and no sound, except for the buzz mentioned above.

You may find that replacement of the fuse restores operation and that there is no apparent problem in the Pincushion board. In some cases the manufacturer found that the blown fuse was caused by excessive current in the vertical output transistors. If you find this condition, check resistor R632 on the M600 Vertical Module; if it is 75 ohms, replace it with 61A172-560 (56 ohms, 5%, ¼ watt). In some early chassis, you may find that R632 is 39 ohms; 56 ohms is the ideal value. Also note that the R632 symbol may not appear on early M600 boards — look for D603. A diode originally planned for this location was replaced by R632, but the board printing change was delayed.

Stereo Chassis 2S2—Service Hint

When you replace shorted audio output transistors (matched pair 2057A100-45) in the 2S2 stereo chassis (used in KS821, KS823, KS828, KS833, KS843, KSKS883- Service Manual S1330), be sure to also check and/or repair the following components to ensure complete repair:

1) Capacitor C315 or C316 (470 mfd, 16 WVDC); usually the capacitor has burst. For replacement, use the 470 mfd;



35 WVDC capacitor, Part No. 2067A64-107. 2) Bias diodes D301 and D303 or D302 and D304. D301 and D302 are Part No. 2093A41-86 silicon diodes; D303 and D304 are 93A27-8 germanium diodes (usually the germanium diode is open). These particular diodes were especially chosen for this application; do not substitute! 3) Check each emitter resistor; R331 and R333 or R332 and R334 (0.5 ohm ½ watt, 2060A54-45).

Also check the power transformer T001 (2080A1-59) by checking for the 28 volt supply; shorted output transistors may have damaged the transformer.

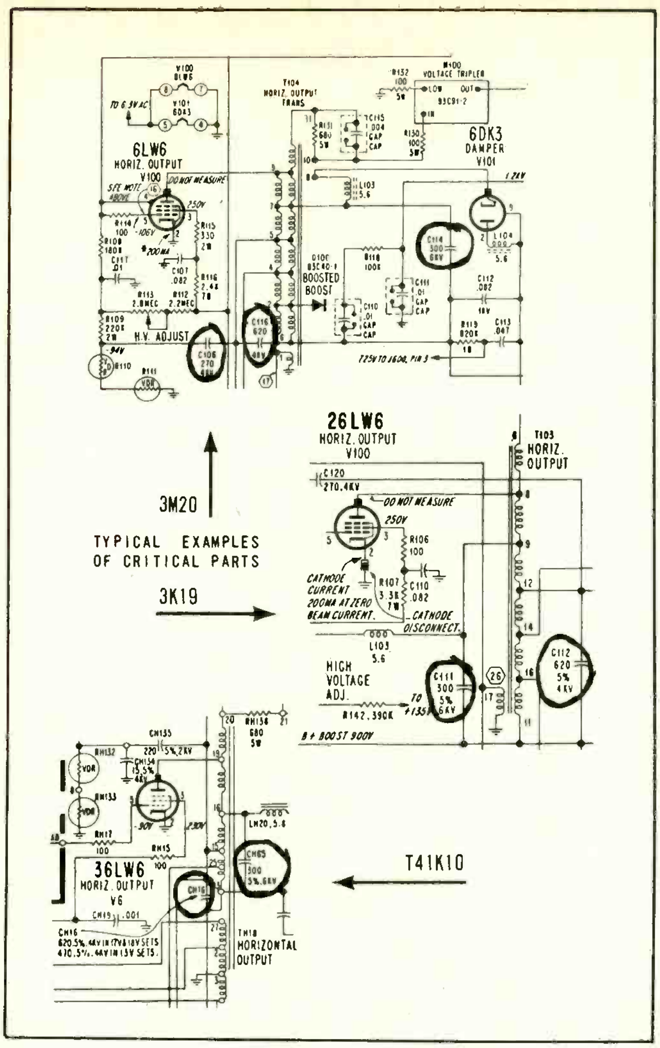
Color TV Chassis 3M20/3K19/T41K10 — Overheating Replacement HV Capacitor

If you find that after replacing a high voltage capacitor and it begins to overheat, the possible cause may be that it was not replaced with the exact replacement part.

The manufacturer received several complaints of overheating replacement capacitors in the high voltage section — usually a part mounted on the high voltage transformer.

Investigation of these complaints has revealed that, in almost every case, the culprit was a general replacement capacitor which did not have the proper temperature coefficient specified for that function.

The manufacturer strongly urges the use of exact Admi-

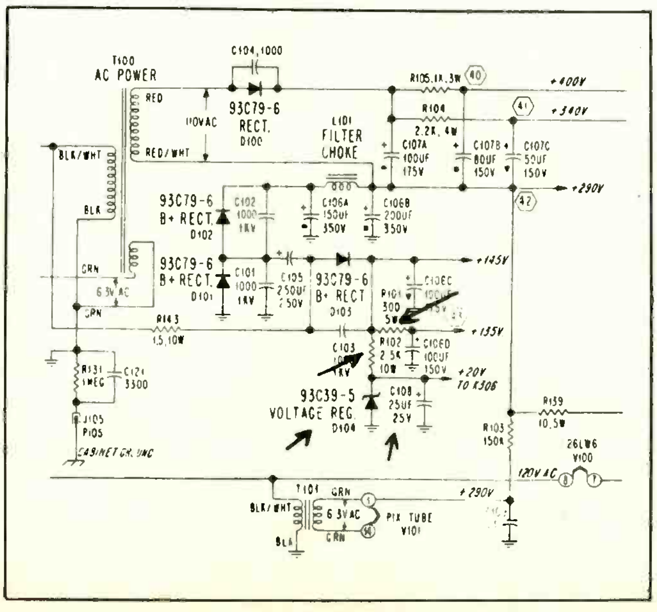


ral replacement parts. Refer to the service manual for the model being serviced to be sure that you get the correct replacement part.

Color TV Chassis K19—Raster, But No Sound Or Video

If you encounter a symptom of raster, but no sound or video, the possible cause could be a defective component in the low voltage B+ supply.

A defective component in the low voltage B+ supply such



as an open R101 (300 ohm, 5 watt resistor, Part No. 61A59-301-150) or open R102 (2.5 K, 10 watt resistor, Part No. 61A20-8) or shorted Zener diode D104, Part No. 93A39-5).

Check the +135 volt and +20 volt supply voltages. When a defective component is found, check all associated components and circuits to avoid repeated failure.

If you encounter a 60 Hz hum symptom with a hum bar floating up through the picture, the possible cause could be an open electrolytic capacitor C108 (25 mfd, 25 volt, Part No. 67A200-250-4).

With capacitor C108 open, the 60 Hz sinewave can be seen at the plate of the 11CH11 Video Amplifier tube with an oscilloscope.

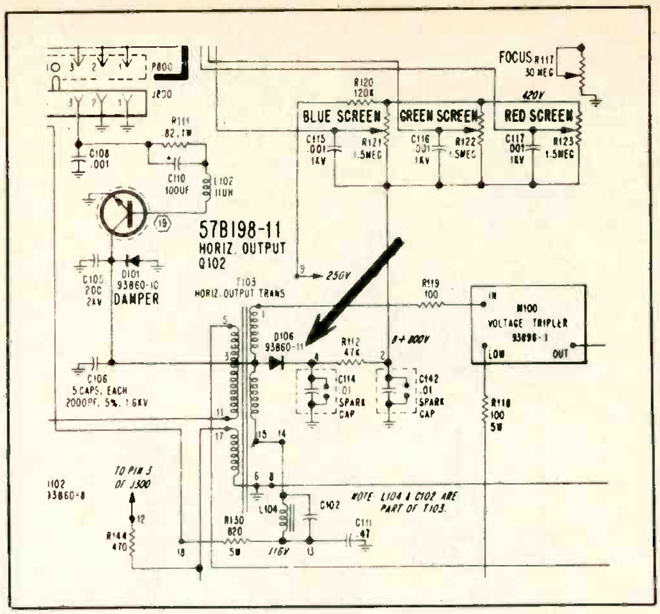
Color TV Chassis M24/M25/M30/1M30—Service Hint

A symptom of low brightness, video smear and the screen controls may work backwards, can be caused by a defective diode in the horizontal output section of the chassis.

A defective D106 diode, located on the high voltage transformer, can cause the 800 volt supply to the high side of screen controls to read low.

Since these same symptoms, low brightness and video smear, could be caused by a defect in the RGB module, check for the failure of diode D106 by measuring the 800 volt supply. Diode D106 provides the 800 volts by rectifying the horizontal pulses.

If the diode is defective, you will measure some B+ on the high side of the screen controls, usually between 130 volts and 250 volts, depending on whether the diode is open or shorted. The screen controls will have no effect if the diode is completely open. If it is not completely open, the screen intensity will decrease as the control is increased—the reverse of normal operation.



Replace the defective diode with the exact Admiral replacement Part No. 93A60-11.

The schematic shown is for the 1M30. If you are servicing the other solid state chassis mentioned, refer to the appropriate service manuals; the terminal numbers for the diode and the 800 volt test point are not the same.

GENERAL ELECTRIC

Color TV Chassis C2 and CD—Chroma Board

Check all channels for a chroma beat interference pattern exhibited as diagonal lines in the picture. If the interference is present, change 4R520 to a 15 μh choke and add C530 (36pf). The location for C530 is marked on the chroma board immediately adjacent to the present location of R520. When installed, C530 will be connected from the choke that replaced R520 to ground.

MAGNAVOX

Color TV Chassis T981/2/7—Horizontal Module and Regulator Module Variations

Later versions of this chassis series use a new Horizontal Oscillator/Driver module, M202, Part No. 703728-1. The original module and the new module are *not* interchangeable. If the incorrect module is placed in one of these chassis, the result is horizontal tearing and instability. The Horizontal Hold control will not stabilize the picture.

The original Horizontal Oscillator/Driver module used was Part No. 703554-1. This module must be used in T981 chassis versions whose high voltage setting is 25 kv and with T982/987 chassis versions whose high voltage setting is 27.5 kv. The new Horizontal Oscillator/Driver module, Part No. 703728-1, must be used in the T981-08, 09, and 11 versions, whose high setting is 27 kv. The 703728-1 module must also be used in the T982-12, 13, 14, 15, and 16 versions as well as the T987-11, and 12 versions. The T982/987 chassis operates at a 28.5 kv high voltage setting.

These later chassis versions also use a new Voltage Regulator/Pincushion module, M300, Part No. 703556-4. This new module has a Pincushion control and must be used as a replacement in all chassis which use the 703728-1 Horizontal Oscillator/Driver module. The original Voltage Regulator/Pincushion module is Part No. 703556-2 and has no Pincushion control. The −4 module may be used in place of the −2, but the −2 cannot be used in place of the −4 or severe pincushioning will result.

Section 4.2-11 of the Service Manual contains an out-

"I could explain in technical terms why I feel this particular brand of TV is inferior, but in laymen's termonology...when you bought this baby, you blew it!"

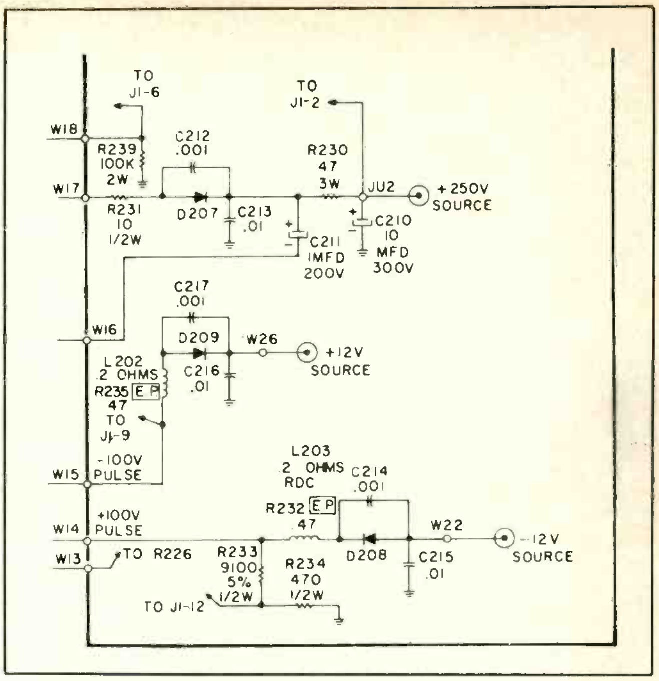
lined notation that the 703728-1 Horizontal Osc/Driver Module contains a High Voltage Protection circuit and no attempt should be made to repair this module. This is why no schematic is shown.

Color TV Chassis T995—Strong Color In Purity and Service Positions Of Service Switch

On non-Videomatic T995 models (T995-03), the chroma signal stays on the screen when the Service Switch is pulled to the Purity or the Service position. The liminance is removed. When setting Purity or White Balance, select an unused channel or turn the Color control all the way down.

This condition occurs because the chroma signal does not pass through the Videomatic module on non-Videomatic sets. Although this module is still referred to as a "Videomatic" module on these models, it contains only luminance circuitry. The Service Switch defeats the chroma on Videomatic sets by interrupting the 24 volt supply to the chroma amps on the Videomatic module. Since no chroma amps are used on the Videomatic module with non-Videomatic sets, the Service Switch does not defeat chroma on these models.

Color TV Chassis T981/982/987 — Failure of Resistors R232 and R235



Resistors R232 and R235 are .47 - ohm, ½w, metal film resistors used in the plus and minus 12v DC vertical power supplies of early production chassis. If either of these resistors fails and replacing the resistor corrects the problem, it is very possible that a previous problem existed and the resistor was overstressed but did not fail at that time. Sometime after the original problem was corrected, the resistor fails.

To prevent this from occurring, R232 and R235 have been changed to RF chokes (part number 361528-1). In this manner, if a problem occurs in the plus or minus 12v DC supplies, the appropriate RF choke will act as a fuse and open. The chokes have been designated L202 and L203. The partial schematic shows these chokes and their electrical location in the 12v DC supplies. If a failure should occur which is directly associated with either 12v DC supply, both R232 and R235 should be replaced with the RF chokes. These resistors are physically located on the right rear

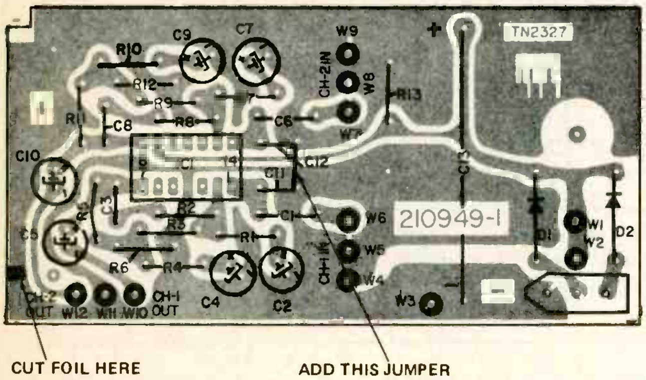
...for more details circle 139 on Reader Service Card

corner of the Scan board, near the flyback transformer.

In addition, resistor R231, located in the 250v DC supply, has been changed to the RF choke for the same reasons. R231 is a 10 - ohm, ½w metal film resistor, shown near W17 in the schematic. The RF choke which replaced this resistor is designated L204 and is not shown on the schematic.

Eight-Track Tape Player Model VE16—Hum Caused By AM/FM RFI

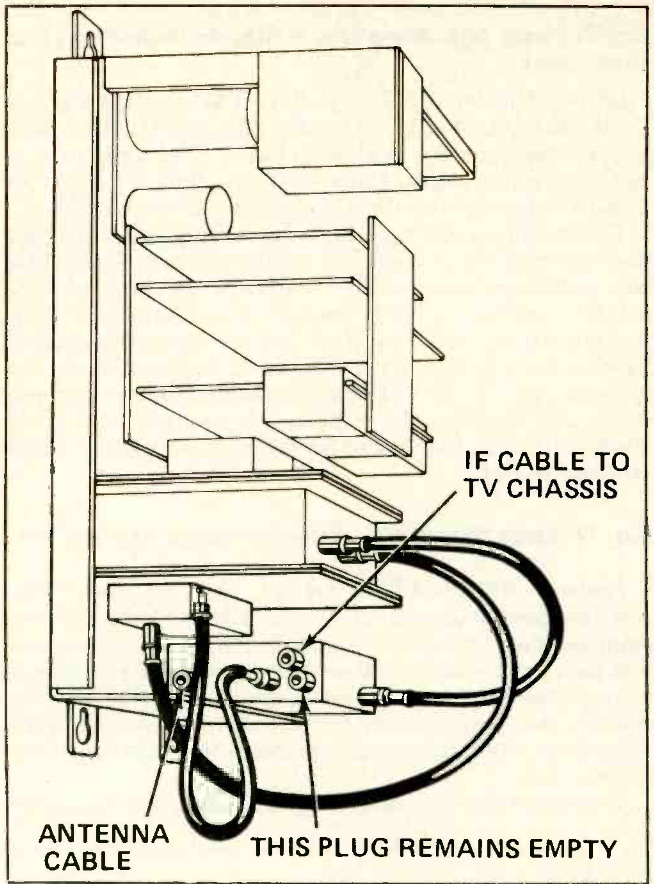
When operated in the vicinity of an AM/FM transmitter, the VE16-01 through -08 has been found to pick up the FM



signal in some cases. The RFI sounds like hum. The signal is picked up by a ground loop foil pattern on the Pre-Amp audio PC board. The solution is to modify the PC board as shown in the accompanying illustration of the copper side of the Pre-Amp board. The modification involves cutting the ground foil and connecting the ground side of C11 and C12 together with a jumper wire.

Star Remote Control — Coax Cable Connections

Replacement of the STAR Tuning Assembly may cause confusion when the coax connectors are reattached to the



VHF tuner. As shown in the illustration, two coax cables connect to the VHF tuner. One is the antenna cable and the other is the IF cable to the TV chassis. Notice that one of the plugs remains empty. If the IF cable is connected to the empty plug, the results will be a snowy picture or no picture. When installing a replacement STAR Tuning Assembly, be sure to connect the IF cable to the correct plug.■

PRODUCTIVITY...

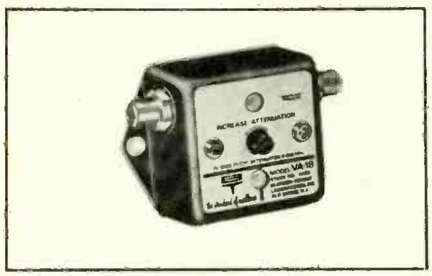
continued from page 26

rate to the percentage of callback debits provides an "incentive" for technicians to maintain the *quality* of their servicing. (Without this provision, some technicians might start "cutting corners" to increase volume, thereby ultimately defeating the purpose of the incentive program by having to spend too much time making non-revenue-producing callbacks.) 3) It provides a method of continuously monitoring the productivity of each technician. Each month Sperry receives from his accounting and payroll department a report similar to that shown in Table 5. (The figures actually are hypothetical but representatives of those of Sperry's business.) By comparing the data on the current monthly report with the corresponding data on previous month's reports, he can detect *trends* in the various factors which affect and reveal the productivity of his technicians, such as callback percentage and actual revenue produced. ■

NEW PRODUCTS

VARIABLE TV/FM SIGNAL ATTENUATOR 140

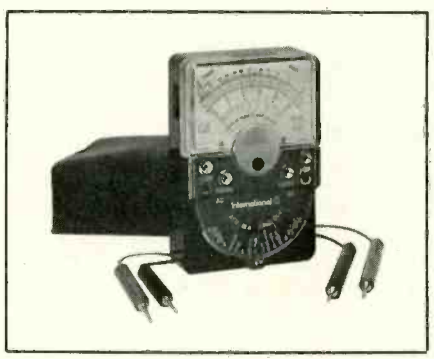
A new variable attenuator, announced by *Blonder-Tongue Laboratories, Inc.*, provides any increment of attenuation up to 18 dB for TV and FM signals (54 to 900 MHz). The Model VA-18 Attenuator employs a rotary attenuation control to permit fine at-



tenuation settings that are not restricted to arbitrary fixed switch-in values, a drawback of switch-type attenuators. The unit utilizes slip-clutch construction so that the slotted adjustment stud cannot be stripped even by excessive rotation in either direction. The unit has a 75-ohm impedance and insertion loss at the minimum setting from DC to 700 MHz is less than 1 dB; at 800 MHz 1.4 dB and at 900 MHz 2.0 dB. The unit measures 2 inches by 2¾-inches by 1-inch and is easily mounted on flat surfaces with the two sheet metal screws supplied. Its connectors are designed for use with standard 75-ohm F-type cable connectors.

VOM 141

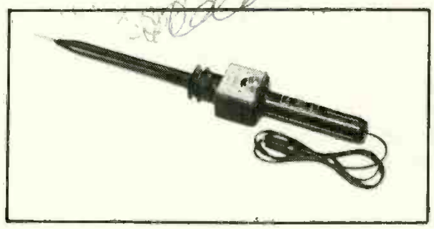
A 20 K ohm/volt pocket VOM, with 16 ranges for testing, checking and maintenance of electronic equipment



has been introduced by *International Components Corp.* The Model IC-210 VOM has features usually found in larger instruments of its type. Clearly printed 3-inch scales are covered by high impact clear acrylic face for legibility and protection. It also has a lever-type positive-switching range selector and reads resistance to 60 Megohms. Voltage sensitivities are 20,000 ohms/volt DC and 10,000 ohms/volt AC. The lowest DC current range of 50 µa full scale is suitable for measuring minute currents. The unit weighs 14 ounces and has a bakelite case measuring 4⅝ inches by 3 inches by 1¼ inches. Price is $29.95.

PROBE METER 142

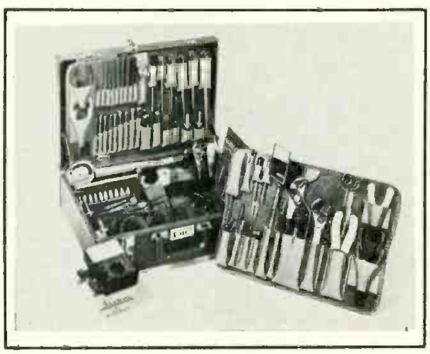
Measurements of DC high voltages to 40 kv can be made with *Heath's* Model 5210 Probe Meter. The meter can be used anywhere a high voltage measurement is needed. To use, the ground clip is attached to the TV chassis, and the probe is placed against the tube's high voltage connector and the meter is switched-on to measure the



voltage. The on-off switch on the handle protects the meter during hookup and when the probe is not in use. The Model 5210 is available in kit form for $17.95 and the assembled Model SM-5210 is priced at $24.95.

MEDICAL SERVICE KIT 143

A medical instrument repair kit designated the JTK-75, has been de-

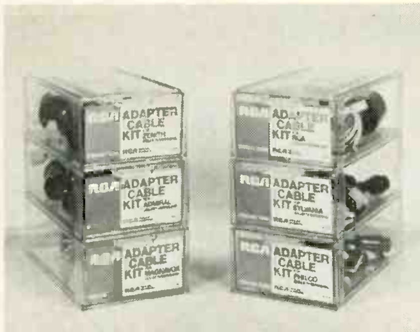


veloped by *Jensen Tools and Alloys.* The kit contains more than 100 tools needed for servicing sophisticated medical and electronic equipment. Included are hemostats, pliers, wrenches, screwdrivers, grounded output tester, alignment tools, soldering equipment, optical aids, spring tools, files, nutdrivers, and an "Introduction to Bio-Medical Electronic" text. Two removable pallets mounted in a deluxe attache case hold most of the tools securely and conveniently. The 17¼ by 12 by 5½ case is constructed of hardwood with brass fittings and a keyless combination lock.

Price is $349.00 complete with meter and probes. Without the meter the price is $269.

TEST JIG CABLES AND ADAPTERS 144

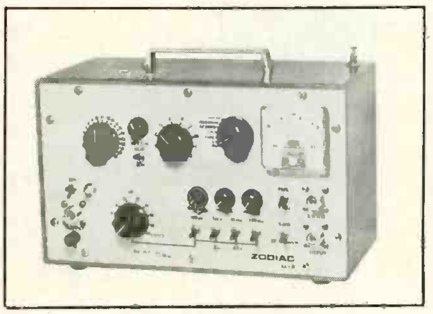
Six new Test Jig Cable and Adapter Kits are available from *RCA*, one each for servicing RCA, Admiral, Mag-



navox, Philco, Sylvania and Zenith color TV. The kits are available individually or in money-saving "Six-Pack" containers at participating RCA Distributors. Each kit is packaged in a sturdy clear plastic case that's stackable. It is shoe box size, with a convenient sliding drawer. The handy case is reusable for storing parts, tools, shoes and other home or shop gear when no longer needed for storing the test jig kit.

CB SERVICE MONITOR 145

The *Zodiac* Model U-2, a precision Citizens Band (CB) service instrument, now is available in the United States and is manufactured in Switzerland. The instrument uses a fre-



quency synthesizer for rapid, accurate testing by manufacturers and service technicians. The portable, easy-to-use instrument, with its telescoping antenna, is particularly useful for independent service technicians in the field, since it is powered by an external 12-volt source. The unit can be used as a RF signal generator, watt meter, modulation meter, SWR meter and field strength meter. It generates 210 frequencies, 5 KHz apart within the 26.49 to 30.11 MHz range, including the existing and proposed CB channel frequencies. It can be used to measure sensitivity at the carrier frequency, passband at + KHz, and adjacent channel selectivity. Power output up to 5 watts can be measured as can modulation up to 100 per cent. In addition, the unit can be used to measure SWR up to 3:1 and as a field strength meter. Price is under $1000.

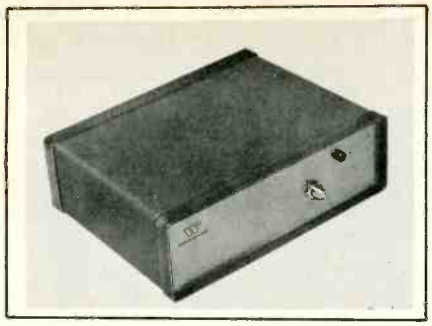
TRANSISTOR TESTER 146

The Model 520 Transistor Tester introduced by *B & K* features what the manufacturer calls its "Dynapeak" system, for fast, in-circuit testing as well as out-of-circuit testing, of semiconductor devices. Both audio and visual indications are used, to automatically provide the test results. Device basing is automatically displayed when the device under test is good. The collector and emitter leads can be identified without charts and silicon or germanium devices are automatically identified by a signal light on the front panel of the instru-

ment. The base (or gate) lead is automatically identified by the color in the small window on the front panel; collector and emitter leads are color identifiable in the same window. With one flip of a lever switch, you can determine if any PNP or NPN device is good, and you also get automatic set-up of lead connections for further testing. The unit measures 8 inches by 7 inches by 3½ inches and is priced at $150.

MATV SPLITTER 147

The first amplified, eight-way MATV splitter in the commercial TV systems industry has been developed by *Winegard Co.* The 75-ohm amplified splitter, AS-8, is designed to divide RF signals on a single trunkline into eight outputs with no signal loss. It is ideal for use in high rise buildings and other applications where multiple trunk lines are needed in a single location. Maximum input level per channel is 44 dBmv for each of 7 VHF channels and 5 UHF channels at 0.5 percent cross modulation. Bandpass on VHF is 30 to 275 MHz and 470 to 806 MHz on UHF covering



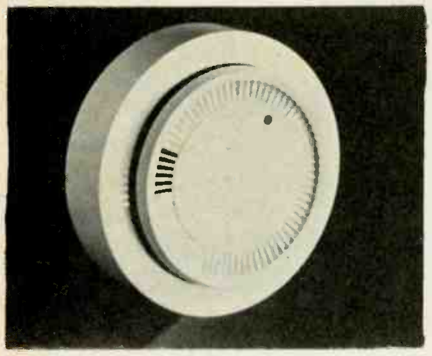
both the mid and super bands for systems using signals from 30 channel CATV. It will pass power from the input to each output to operate line amplifiers or amplified tap-offs.

CB INTERFERENCE FILTERS 148

The new CB interference filters have been developed by *Avanti R&D,* one for the transceiver, and one for the TV set. Interference problems are usually the result of the transceiver radiating harmonics of the same frequency assigned to one or more of the TV channels, especially two and five. If this is the case, installation of the new Low Pass TV Interference Filter on your transceiver should eliminate the probelm. If the interference is still present, the problem is likely to be found at the TV receiver, caused by "front end" overloading. In this case, installation of the 27 MHz CB Signal Rejection Filter on the TV set's lead-in should eliminate the problem. The filter allows the TV signals to be received, while eliminating the unwanted CB signal.

SMOKE DETECTOR 149

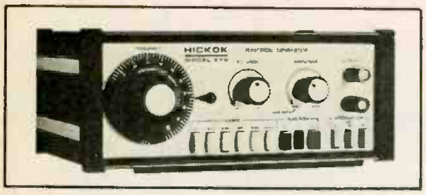
A solid state smoke alarm announced by *Mountain West Alarm* is designed to save lives by detecting smoke at the very early stages of a fire. The Model E5 Smoke Detector should be of special interest to home owners, apartment, motel, or hotel managers. The unit is completely self - contained and a photocell is activated when visible smoke interrupts light from highly reliable light source with a sensitivity of .01 optical density per foot. Solid state circuits operate a loud, steady horn signal which is rated at 85 dB at 10 feet. The system is self - supervised so lamp failure or other troubles will generate a distinctive, pulsating "trouble call". As many as five detectors may be interconnected so that an alarm in any one detector will sound alarm in all units. Input power is 120 v



AC. The white plastic case measures 6¼ inches diameter by 2¼ inches deep and weighs one pound and 12 ounces. Price is $55.

FUNCTION GENERATOR 150

The Model 270 Function Generator from *Hickok* is a versatile service instrument that generates stable, calibrated waveforms in the frequency range from 1 Hz to 500 KHz. In addition to sine, square and triangle waveforms, it can produce pulses down to 10 microsec in width, saw-



tooths, and sweeps or ramps. With external inputs to a PC board edge connector on the rear panel, it also can produce frequency and amplitude modulated waveforms, tone bursts, FSK, VCO and PSK outputs, and mixed signal outputs. Frequency accuracy of basic waveforms is ± 1 percent of full scale up to 200 KHz. Output level is 0 to 24 volts peak-to-peak, flat within ± 0.3 dB from 1 Hz to 100 KHz. Another feature of the unit is a continuously variable control for adjusting the DC level of any waveform between −6 volts and +6 volts without external biasing. All front-panel controls are designed for ease of operation. The use of a large, uncluttered, one-decade frequency dial and six decade range pushbuttons greatly simplifies setting and reading of frequency over the entire range from 1 Hz to 100 Hz.

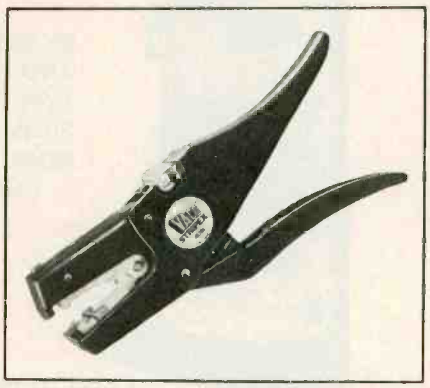
TOOL KITS 151

A line of tool kits for use by technicians in a wide variety of service and maintenance projects is being offered by *Henry Mann, Inc.* A series of five kits is offered, ranging from a starter

technican's kit to a 120-piece deluxe ensemble with virtually every tool required for the installation, maintenance and adjustment of data processing equipment, communications, appliances and office machines. All tools are housed in lightweight cases, including simulated leather fitted brief cases and soft-side zippered cases as well as compartmented steel boxes. Each kit boasts a selection of precision pliers, screwdrivers and soldering aids, plus specialized tools geared to a particular industry.

WIRE STRIPPING TOOL 152

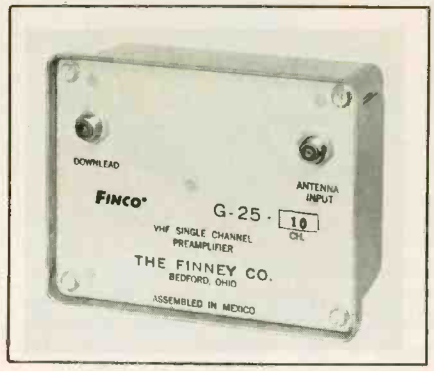
A precision stripping tool called Stripex, has been announced by *Vaco Products Co.* The tool is designed to strip PVC wire and cable to 38 gauge, solid or stranded, without knicking the wire. Other features include a pro-



tected wire cutter and a strip length guide. The tool is packed in a contoured plastic display case with see-thru cover.

VHF SINGLE CHANNEL PRE-AMPLIFIER 153

A new addition to *The Finney Company's* Greenline MATV product line is the Model G-25, VHF Single Channel Pre-amplifier. Its specifications include: gain 30 dB; noise figure on Low Band less than 3.5 dB and less than 4.0 dB on High Band; and good skirt selectivity. Its skirt selectivity of 5.5 MHz at −20 dB from center frequency on Low Band and 7.0 MHz at −20 dB from center frequency on High Band, rejects unwanted TV channels. The unit features a sturdy die cast metal housing to prevent interference from radiated signals. The input and



output inpedance is 75-ohms and the unit is supplied complete with power supply and all mounting hardware.

YOKE AND FLYBACK TESTER 154

Sencore has introduced their all new Model YF33 Ringer, Yoke and Flyback Checker. First it allows a technician to test any yoke and flyback in seconds, in or out of circuit,

in tube or solid state sets, secondly, it is a complete sweep circuit analyzer with back-up peak-to-peak and high voltage tests to completely troubleshoot any horizontal output section. The patent pending "Ringer" circuit tests the coils of a yoke or flyback using a system similar to ringing a coil on a scope. A pulse is applied to the coil, with the number of ringing cycles generated by the coil counted by a digital circuit which converts this to a "Good-Bad" readout. Six buttons are used to achieve a matched impedance that will allow testing of any yoke or flyback including those with extremely low Q ratings, for a reliable test on any presently manufactured yoke or flyback.

The tester is also a complete sweep circuit analyzer. The same ringing test used in the yoke and flyback section, can be used to ring the entire horizontal output circuit. To back the ringing test, two AC peak-to-peak scales of 0 to 30 volts and 0 to 300 volts p-p have been added to measure the horizontal drive pulse signal in both tube and solid state sets. An optional 10 kv probe allows focus and regulator voltage checks, with an adaptor probe that extends the range of the high voltage measuring capabilities to 50 kv. The unit is housed in an acrylic case, with lead storage compartment and sliding meter cover for portability use. The illuminated meter and light weight allows technicians to use the tester in any location. Price is $195.

MULTIMETER 155

A new and versatile 4¼-digit multimeter that combines all the features of a full laboratory grade bench instrument with the added benefits of complete portability—has been introduced by *Data Precision Corp.* The Model 1455 is a full function multimeter featuring ½-inch high, 7-segment planar display, 100 percent overranging and 21 function-range operation. DC volts are measured from 100 microvolts to 1000 volt; AC volts from 100 microvolts to 500 volt RMS; resistance from 100 milliohms to 20 Megohms; current, both AC and DC, from 1 microamp to 2 amps. Frequency response for AC current and voltage is from 30 Hz to 50 KHz. Basic accuracy on DCV is +0.02 percent of reading + 0.01 percent F.S., + 1 digit for six months. Overload protection of + 1000 volts is achieved electronically on all DC ranges; 500 volts on all AC voltage ranges; and 115 V DC or AC on all resistance ranges. Current is protected to 2 amperes with a rear panel mounted fuse. Common mode protec-

tion is 500 V DC or peak AC with CMRR of 120 dB at DC, greater than 100 dB at 50 and 60 Hz. The unit is equipped with its own internal NiCd battery module and recharger. It operates as a conventional bench-mounting laboratory DMM. Operated continuously on AC line power, the batteries remain on charge whether the instrument is off or on. When not line connected, it automatically operates from its batteries for at least six hours. The multimeter measures 8½ inches wide by 3½ inches high by 7½ inches deep without handle assembly. It comes with its own test leads and is equipped with a combination carrying handle/tilt stand, internal battery pack and removable line cord. Price is $355.

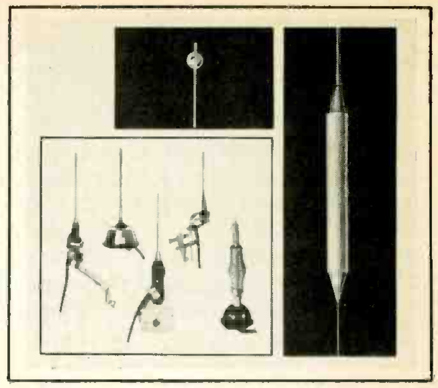
OSCILLOSCOPE 156

A solid state dual channel/dual trace oscilloscope/vectorscope Model LBO-552, which provides a simultaneous left/right wave form display to make general purpose measurements

and audio testing easier is introduced by *Leader Instruments Corp.* This instrument has 20mVp-p/cm sensitivity and permits the user to view two independent signals simultaneously; and side by side on a bright CRT display. It provides two separate, vertical gain controls for independent and joint operation. It also features a single channel display for conventional testing. Vertical bandwidth is DC or 2 Hz to 1.5 MHz. Sweep speeds are from 10 Hz to 100 KHz in four ranges with an input impedance of 1M shunted by 40 pf. Phase differences on the X-Y axis are below 2 degrees at 20 KHz and below 8 degrees at 100 KHz. Left/right channel accuracy level is + 3 percent. It measures 9⅝ inches high by 6⅞ inches wide by 15 inches deep and weighs approximately 15.5 lbs. It sells for $399.95.

CB ANTENNAS 157

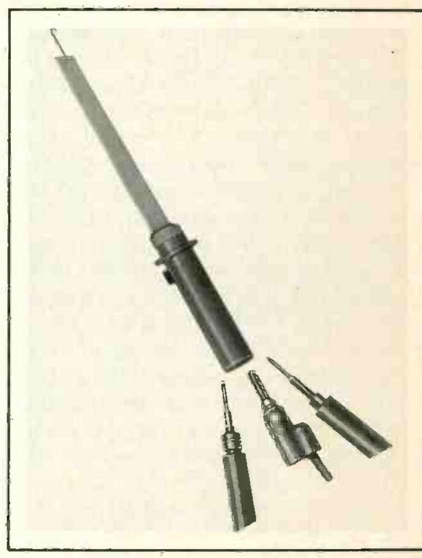
The *Antenna Specialists Co.* has announced the development of a new line of center-loaded CB antennas which offer performance advantages. Called "Range Riders", all models in the line have special tuning tips which allow adjustment without the need for cut-and-try antenna trimming. The "static ball" tuning tip acts electrically as a capacity hat and can be moved up and down on the active element to achieve resonance and optimum performance. Once the desired setting is achieved, the static ball can be secured in position with an Allen wrench that



is supplied with the antenna. The line also features a completely waterproof center-loaded coil assembly. The coil is pressure molded with the active elements into a single shaft which offers resistance to shock and vibration. Included in the line are models for a wide variety of applications, including dual mirror mount types for heavy duty trucks and the A/S "Quick Grip" mount for permanent no-holes installations on passenger car trunk lids. All models are supplied complete with coaxial line and connectors plus phasing harnesses when required.

TEST PROBE 158

"The Hookon", a highly versatile test probe designed to reach into dense wiring areas for safe, sure contact and connections, is now offered by *Herman H. Smith, Inc.* The new product will reach through wire 'jungles' and hook



on to leads, pins and square wire-wraps with the use of a fingertip slide control that includes a self-locking open position and a tensioned 'no hands' spring grip trigger release. The probe accepts and adapts to existing terminations such as banana plugs, phone tips, test prods as well as wire. When used with the test prods, the overall length is increased to further extend reach into deeply restricted areas. Featuring sturdy Lexan construction and a corrosion resistant, steel contact lead, the probe will connect to bare wires—26-14 guage; .025 inch square; and .025 inch by .050 inch wire-wrap terminations. It simplifies touch contact to printed circuit pads, terminals, solder junctions, etc. The Lexan body mold is in an attractive red color and offers a combination of long term durability, heat resistance and high levels of insulation. Price is $3.

ELECTRICAL/ELECTRONIC MAINTENANCE KIT 159

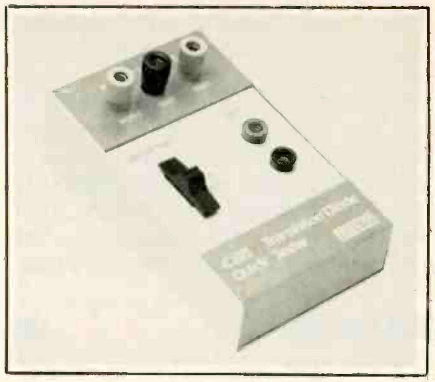
Triplett Corporation's new drop-proof, burnout-proof and super-safe Model 60 V-O-M is being marketed in a versatile kit form designed for industrial, commercial appliance, automotive maintenance and school shop users. The Model 60-K kit will be particularly valuable to those users who measure AC amperes and have to isolate one conductor of a two-conductor cable. The battery-operated, 28-range, general purpose test instrument is a new concept in VOM design. The tester case protects the unit against accidental drops up to five feet and has a non-slip "finger-tread" finish for handling ease. It is diode and fuse protected up to 1000 volts. Of modular construction, it is easily serviced and has an external access, sealed battery compartment. Easily obtained batteries, one 9 volt NEDA 1604 and one 1½ volt "D" type, are used. It is also designed for the safety of the user. The most rigid safety standards were adhered to in manufacturing the instrument to prevent explosive arcs under misuse conditions in circuits up to 1000 volts. It is completely insulated. It comes with newly designed, 48-inch long safety leads and a single selector switch minimizes possibility of error. A special "confidence-Test" also permits periodic reassurance checks of its meter. The new Triplett 60-K kit comes complete with the Model 60 VOM, Model 10 Clamp-On AC Ammeter, Model 10 Attachment lead, Model 101 Line Separator, leather storage case, safety test leads, insulated alligator clips, batteries, spare ⅛ ampere and 1 ampere fuses, and well illustrated instruction manual. Price is $150.

CRT RESTORER/ANALYZER 160

Dynascan Corporation's B & K-Precision test equipment products group has a new improved type CRT Restorer/Analyzer that offers several features of interest. The Model 467 CRT Restorer/Analyzer employs an exclusive "Tri-Dynamic" test method that tests all three guns of a color CRT simultaneously under actual operating conditions. The guns are tested in sequence, 20 times per second, and the results are displayed at once on the three color coded "good-bad" meters. The unit tests for true beam current—current that passes through the G1 aperture to the screen. Also unique is its combination of powerful restoration with minimal danger of cathode stripping. This is done by using the cathode of the CRT to time the restoration. When restoration current is applied, the heater current is shut off. When the cathode cools below the point of emission, restoration current stope. Heavier cathodes automatically get more restoration than fragile cathodes. The same procedures are used to test and restore any type of color or b/w picture tube without calculation or reference to charts. The instrument is said to be the only unit of its type that tests focus electrode continuity. It also provides a tube life indication, finds and removes shorts, identifies and corrects tracking deficiencies in color CRTs. Adapters are available to test all known color and black and white picture tubes. Sixteen adapters, of which six are included with the instrument, are available at this time, for testing Quintrix, domestic and Japanese inline, miniature base tube types. Net price is $279.

TRANSISTOR/DIODE TESTER 161

Until now the only way to test semiconductors was to remove them from the circuit possibly damaging them with a hot soldering iron and then having to replace them if they test "good". Now all you have to do is to connect the new *EICO* Model 688 Tester to your oscilloscope, and touch the semiconductor with the probe. The waveform indicates its condition at a glance. The switch selector for "in" or "out" of circuit testing, assures that the correct amount of current is applied to the semiconductor under test. The tester checks all diodes and transistors (except MOS FETS). Other important features include: five-way binding posts for interconnection between the tester and scope; jacks for rapid batch testing without probes; all test data is included in a handy reference manual. Kit form $14.95 and factory assembled $22.95.



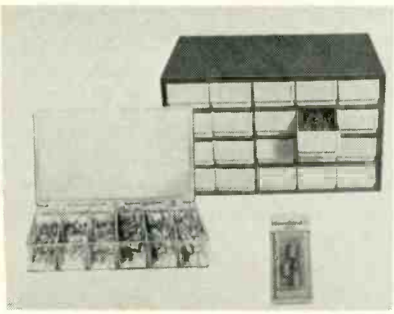
FREQUENCY COUNTER 162

Introduced by *Systron - Donner* is a low cost precision frequency counter with several features designed for very versatile uses in checking communications signals. Designated as Model 6220A, this counter provides 8-digit readings of frequency inputs to 50 MHz. For measuring low frequency tone signals the unique phase lock/multiplier circuit permits the counter to resolve 0.001 Hz in one second and display the measurement directly. This feature eliminates the long delay of 100 or 1000 second time bases, or the often confusing alternate technique of making a period mea-

surement. Another unique feature of this counter is that the upper 50 MHz input limit can be easily expanded to 180 MHz or 512 MHz. As higher frequency measurement requirements develop, it can be frequency up - graded through the use of specially designed frequency expander kits. Standard features include a full 8 - digit readout, input sensitivity of 25 mV rms which can be manually attenuated, and a crystal oscillator with a stability of + 2 parts in 10^6/year. Higher stability TCXOs and oven controlled oscillators are available at extra cost. Price is $650.

COMPONENTS KITS 163

Interkit, a new series of thirty six components kits offering electrolytic, tantalum, metalized polyester film and subminiature polyester film capacitors, carbon composition resistors, plus rectifier, zener and switch-



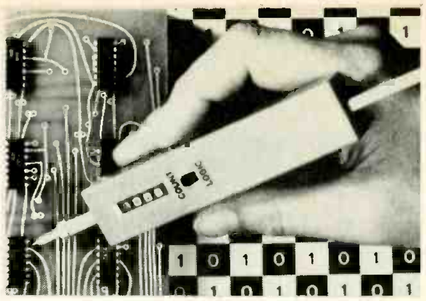
ing diodes is available from *International Components Corp.* The array of values provided permits servicemen to fulfill virtually every circuit need for that type component. Twelve Servicemen kits each resale for $9.95.

FLAMEPROOF FILM RESISTORS 164

RCA has announced it has expanded its Flameproof Film Resistor line to 475 values largely by adding 108 values in the ¼-watt rating, ranging from 10 ohms to 300 kilohms. The ½-watt and 1-watt ratings were increased from 61 to 121 values each, ranging from 10 ohms to 1 megohm. The 2 watt rating was increased from 61 to 125 values, ranging from 10 ohms to 1.5 megohms. All resistors regardless of wattage rating, have a 2 percent tolerance.

DIGITAL LOGIC COUNTER PROBE 165

A versatile logic probe from *Zi - Tech Division of Aikenwood Co.* simplifies testing of digital systems. The instrument has dual capability: it displays logic states and also functions as a fast - pulse counter. As a high/low discriminator, the Model DP - 6000 di-



gital probe indicates logic states and identifies faults in integrated circuits. When switched to the counting mode, it acts as a fast - pulse counter with display. Its self - contained pulse - counting circuitry requiries no accessories or options to detect multiple clock and trigger pulses, and it can indicate the presence of spurious oscillations. The three - bit counter is reset by a push button. The probe may be operated from any five - volt power supply and is protected against overvoltage. The price is $66.60.

OSCILLOSCOPE 166

A new 10 MHz oscilloscope Model 4530 from *Heath* provides versatility and easy operation. Features like TV coupling, DC to 10 MHz bandwidth and wide-band calibrated X-channel input makes it a versatile, easy-to-use instrument for the service technician. The instrument is one of the few single-trace scopes with two input channels. The Y-input has a maximum sensitivity of 10 mV with an 11-position attenuator to set deflection from 10mV/cm to 20 V/cm. For X-Y operation, a calibrated X-input is pro-

vided with maximum sensitivity of 20mV. It's calibrated three-position attenuator can be switched through three AC or DC ranges from 20 mV/cm to 2 V/cm. High or low frequency waveforms cause no problem because the instruments wide range of time bases can be switched from 200 ms/cm to 200 ns/cm. Any sweep speed can be magnified five times. Trigger circuits are digitally controlled, requiring only a level control and a slope switch. In automatic mode, the triggering is at the zero crossing point. In normal mode, the level control is adjustable over the complete 8 cm span. Various trigger signals can be selected: a sample of the vertical input signal, a sample of the line voltage, or an externally applied trigger signal. Signals can be DC coupled, AC coupled or TV coupled to the trigger circuits. In the TV trigger coupling mode, it can easily be triggered on the vertical or horizontal component in a complex TV signal. The oscilloscope is priced at $299.95. The factory assembled and calibrated SO-4530 is $420.

ZENITH

continued from page 22

System uses one channel to select any of the twelve pre-set VHF channels and six UHF channels. This varactor tuning system, employed in the 13V color TV receivers, uses a single ultrasonic frequency signal to operate a "one way" motor which is mounted on the back of the same channel selector indicator assembly that is used for the manual versions. The programmable tabs located on the front of the Channel Selector can be adjusted to provide stopping, skipping, or turning the TV receiver *off* at any channel position.

The Tuner Control Center, 9-124 or 9-124-01, and the VHF and UHF tuners used with the SC100 system are the same as the units used for the same purposes on the manually controlled version of the 18-position Channel Selector. ■

CLASSIFIED

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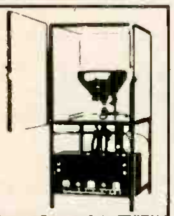

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Educational Courses

REPAIR TV TUNERS-High Earnings; Complete Course Details, 12 Repair Tricks, Many Plans, Two Lessons, all for $2. Refundable. Frank Bocek, Box 3236, Ent., Redding, CA 96001.

Convert any transistorized T.V. tuner to a tuner substituter. Plans $2.00. New accelerated Radio & T.V. course, RADIO TELEVISION TRAINING, Box 279, ET-95, Syracuse, N.Y. 13206. TF

For Sale

PRESSURE sensitive miniature cable for burglar alarm systems. Place under carpet in any contour for intrusion detection or secret switching. $4.95 for twenty feet. Cable Switch Corp., Box 72-ET. West Long Branch, N.J. 07764. 9/75

BUILD THAT ELECTRONIC ORGAN YOU ALWAYS WANTED AT A PRICE YOU CAN AFFORD. Third edition of "Organ Builder's Guide" pictured product kit line, circuits, block diagrams, design rationale using IC divider and independent generators with diode keying. $3.00 postpaid. Also, free brochure on keyboards. DEVTRONIX ORGAN PRODUCTS, Dept. A., 5872 Amapola Dr., San Jose, CA. 95129

CANADIANS SAVE BIG MONEY! SURPLUS, CLEAROUTS AND BANKRUPTCY INVENTORIES. HIFI AND PARTS. CATALOGS $1.00. ETCO-D, ELECTRONICS. Box 741, MONTREAL H3C 2V2.

HARD-TO-GET repair supplies for police radar. Request free list on letterhead. Electronic Specialists, Inc. Box 122-ET, Natick, Mass. 01760. 9/75

KITS. Learn digital circuit design. Beginner kits. Electronic game kits. PC board, all components, screen printed front panel. From $7.75. Send stamp. NBL-T, Box 1115, Richardson, Texas. 75080. 9/75.

RADIO & T.V. TUBES — 36 cents each. Send for free Catalog. Cornell, 4215-17 University, San Diego, Calif. 92105.

DMM? Have it calibrated. 2½ and 3½ digit DMM's. Postcard for details. Xenophonics, P.O. Box 3126, Annapolis, Md 21403. 9/75

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ELECTRONIC TECHNICIAN/DEALER CLASSIFIED

READER SERVICE INDEX

ADVERTISER'S INDEX

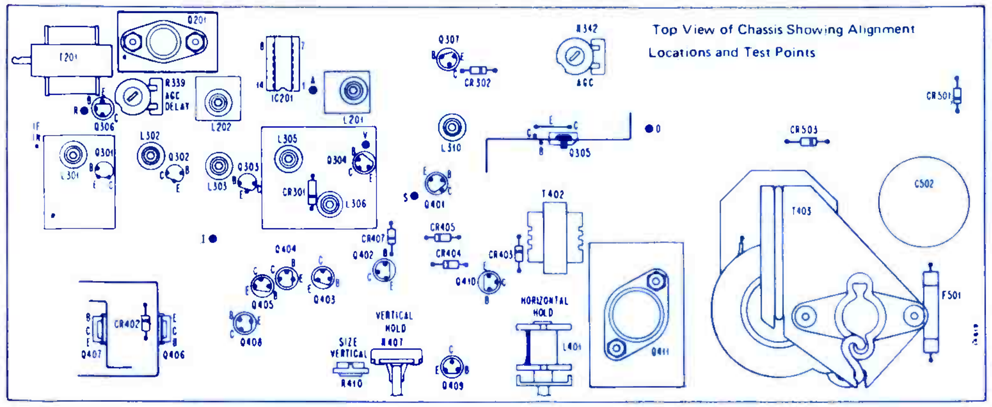
"You said this was an automatic channel changer, but it waits for me to press this button!"

ELECTRONIC TECHNICIAN/DEALER

TEKFAX

COMPLETE MANUFACTURER S' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

GROUP 277

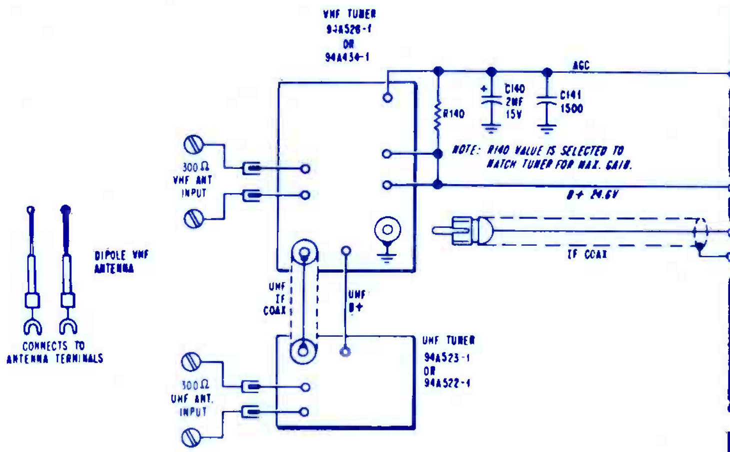


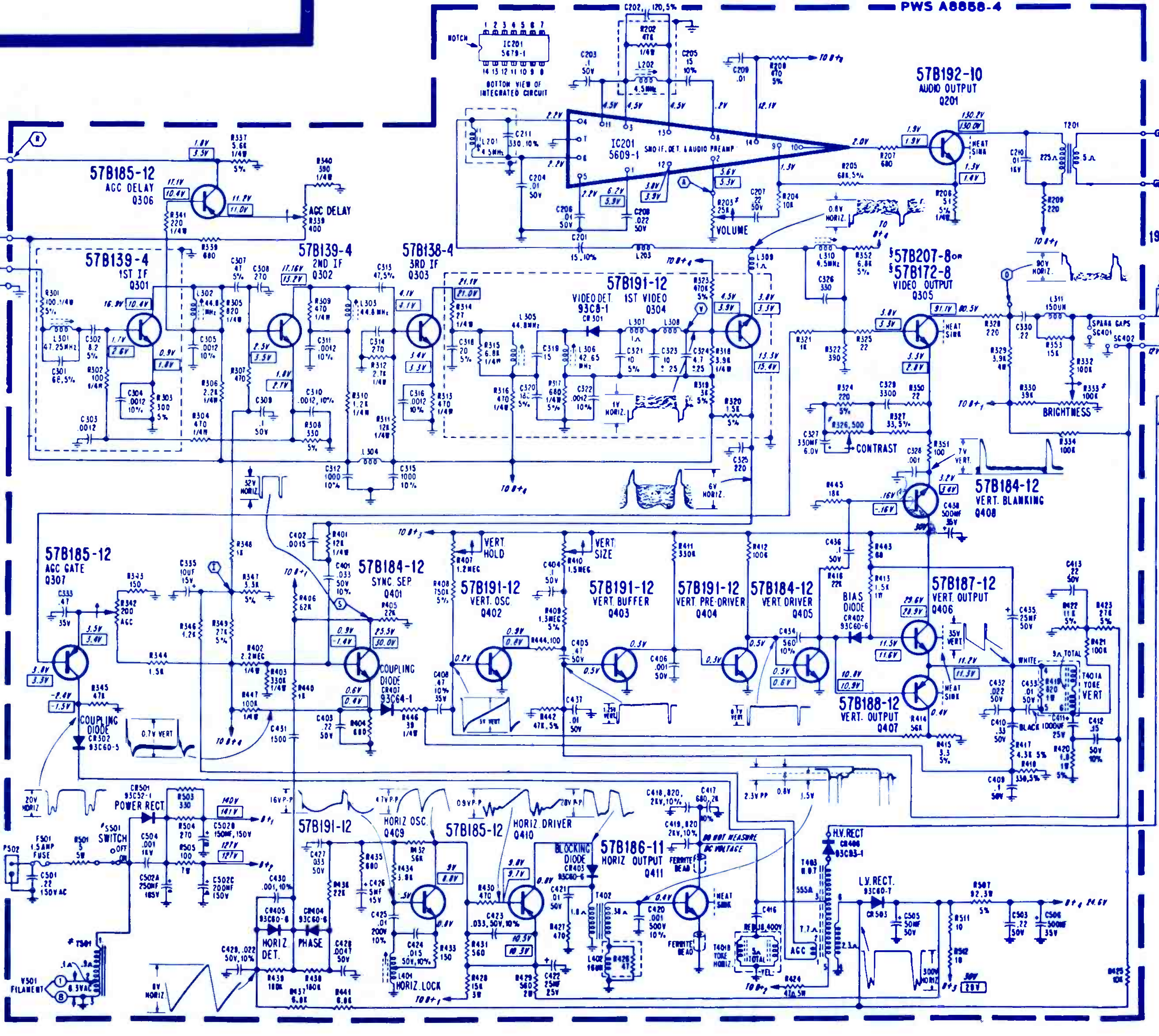
Top View of Chassis Showing Alignment Locations and Test Points

ADMIRAL

TV Chassis TK8

SEPTEMBER • 1975





SCHEMATIC NOTES
UNLESS OTHERWISE INDICATED, RESISTOR VALUES ±10%, 1/2W. CAPACITANCE VALUES 1 OR HIGHER ARE IN PF.
CAPACITANCE VALUES LESS THAN 1 ARE IN MF ±20% UNLESS OTHERWISE INDICATED.
RESISTANCE VALUES OF COILS LESS THAN 1Ω IS NOT SHOWN. HZ INDICATES CYCLES PER SECOND.

VOLTAGE AND WAVEFORM NOTES;
DC VOLTAGES TAKEN WITH VTVM, WITH RESPECT TO COMMON GROUND(B-). DC VOLTAGES, WAVEFORMS & P-P VOLTAGES TAKEN WITH 120V AC LINE & MAY VARY DEPENDING ON CALIBRATION OF TEST EQUIPMENT AND PARTS TOLERANCES. WHERE TWO DC VOLTAGES ARE INDICATED READING TAKEN WITH TV SIGNAL IS SHOWN IN BLOCK, READING TAKEN WITH NO SIGNAL IS SHOWN WITHOUT BLOCK. OFF SIGNAL VOLTAGES TAKEN ON UNUSED VHF CHANNEL WITH ANTENNA TERMINALS SHORTED. VOLUME CONTROL AT MINIMUM. BRIGHTNESS AND CONTRAST CONTROLS AT MAXIMUM. ALL OTHER CONTROLS IN NORMAL OPERATING POSITION. ON SIGNAL VOLTAGES AND WAVEFORMS TAKEN WITH TRANSMITTED NOISE FREE SIGNAL PRODUCING 4 TO 5 VOLTS AGC AT TEST POINT R. CONTRAST AND BRIGHTNESS CONTROLS AT MAXIMUM.

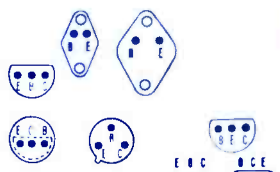
TRANSISTOR CAUTION;
TO AVOID DAMAGE TO TRANSISTORS DO NOT ARC 2ND ANODE LEAD TO COMMON GROUND. DO NOT TURN SET ON WITH TRANSISTOR(S), TUBE(S) OR LEADS REMOVED OR UNSOLDERED. USE CAUTION TO PREVENT ACCIDENTAL SHORT BETWEEN COMPONENT TERMINALS OR TO COMMON GROUND. DO NOT USE AN ORDINARY OHMMETER FOR RESISTANCE MEASUREMENT. USE VTVM ON R x 100 RANGE OR HIGHER.

AGC CAUTION;
DO NOT DISTURB FACTORY SETTING OF AGC CONTROL. IF AGC ADJUSTMENT IS REQUIRED REFER TO SERVICE NOTES.
IF NECESSARY TO DISTURB AGC ADJUSTMENT, MARK ROTOR POSITION SO THAT CONTROL CAN BE RETURNED TO ITS EXACT ORIGINAL SETTING.
ALL WAVEFORMS TAKEN WITH A WIDE-BAND OSCILLOSCOPE. SOME DEGRADATION WILL BE NOTICED IN HORIZ. WAVEFORMS WHEN USING NARROW BANDPASS EQUIPMENT.
* COMPONENT NOT MOUNTED ON PRECISION WIRED SYSTEM.

WARNING:
USE ISOLATION TRANSFORMER WHEN SERVICING WITH CABINET BACK REMOVED.
COMMON GROUND (B-).
§ REPLACE WITH SAME PART NO. AS ORIGINAL.

RUN CHANGES

(10) Start of production



TERMINAL VIEWS OF TRANSISTORS

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1604

ADMIRAL

Color TV Chassis T52K10

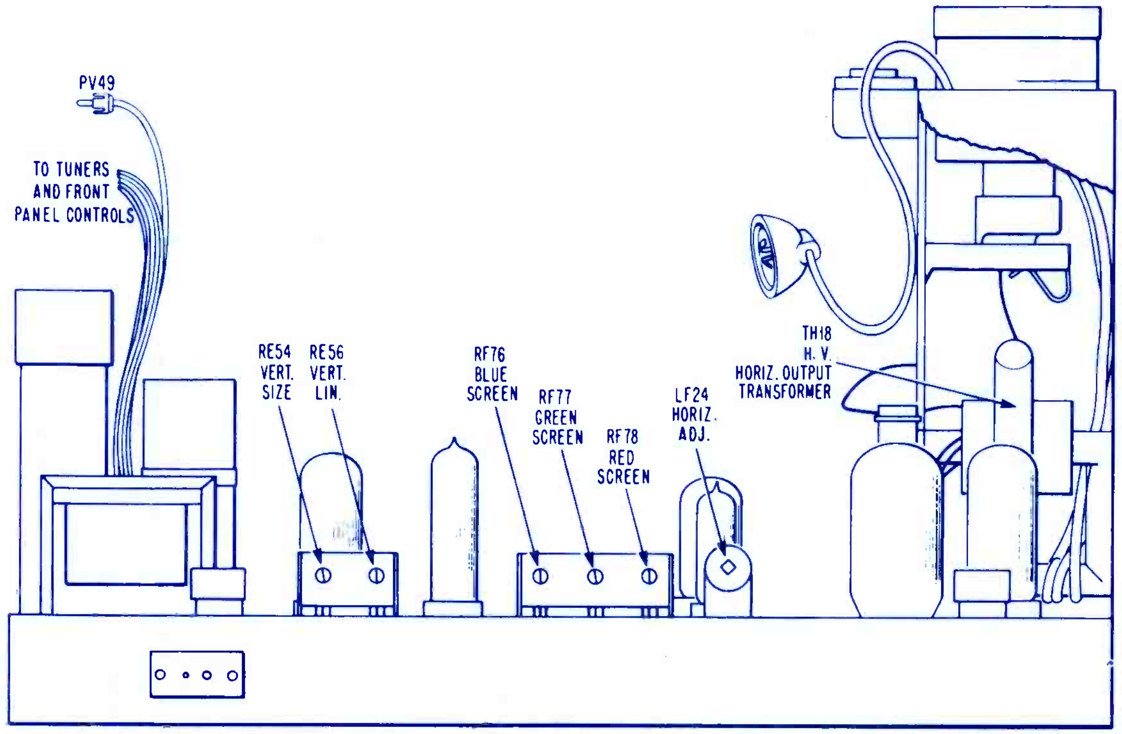
SEPTEMBER • 1975

ELECTRONIC TECHNICIAN/DEALER TEKFAX

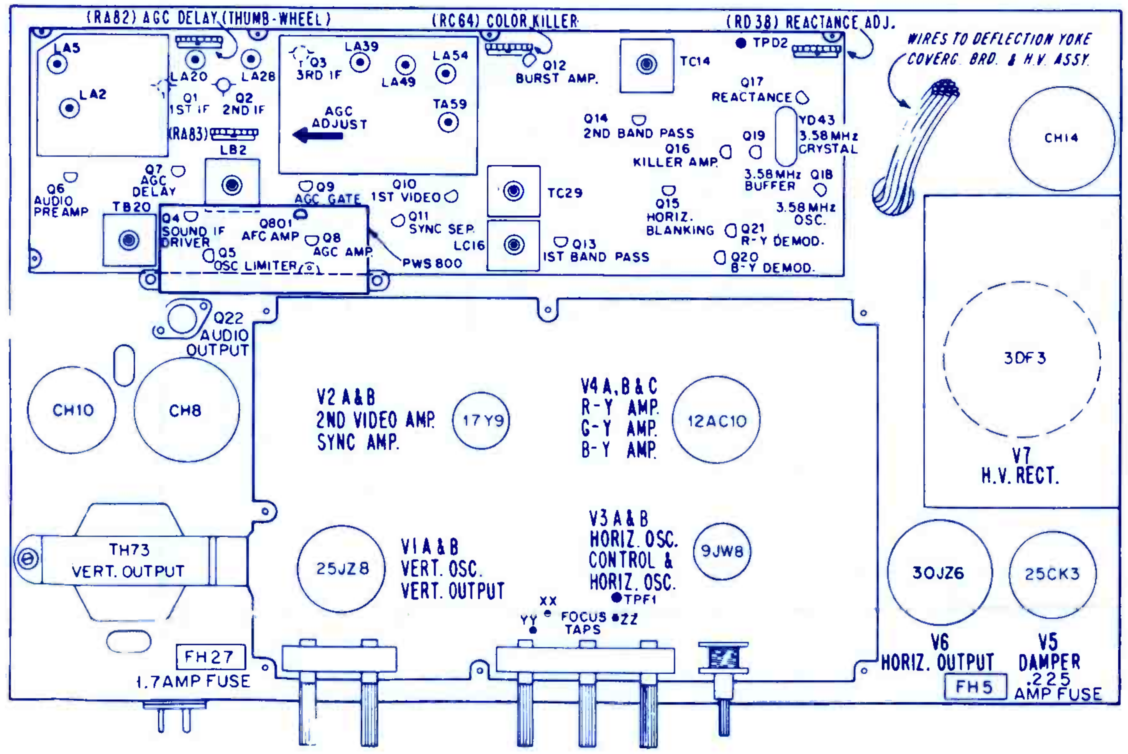
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

MODEL CHART

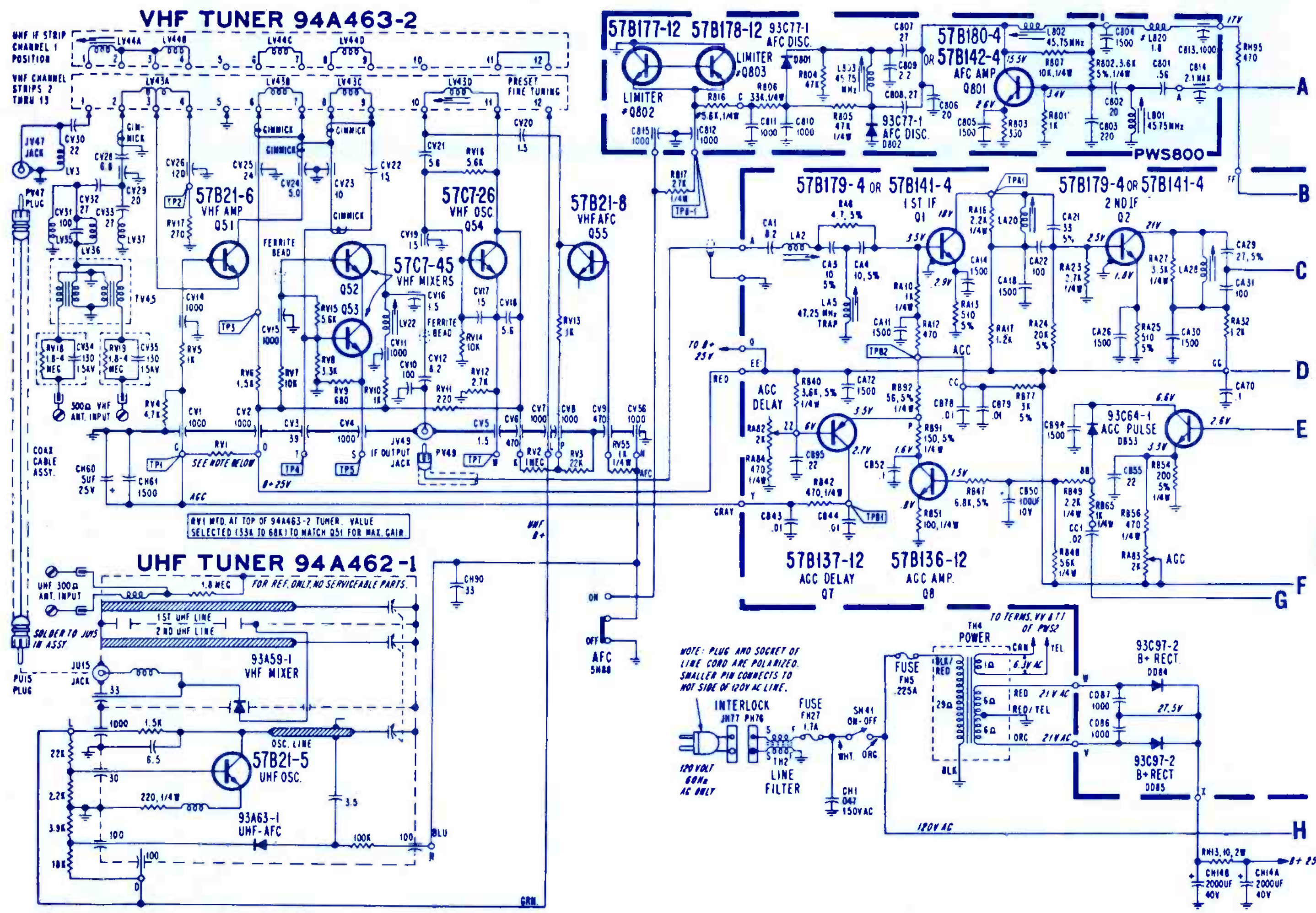
MODEL	FINISH	CRT	VHF	UHF	CHASSIS
6267P	Walnut	16VAUP22 or 16VAXP22	94A463-2 or 94A392-1	94A462-1 or 94A466-1	T52K10-1A



BACK DRAWING OF CHASSIS



TOP DRAWING OF CHASSIS



SAFETY NOTICE

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RUN CHANGES

(10) Start of production

NOTES: UNLESS OTHERWISE SPECIFIED: RESISTANCE VALUES ARE IN OHMS, 10%, 1/2 WATT; CAPACITANCE VALUES 1 OR HIGHER ARE IN PF; CAPACITANCE VALUES LESS THAN 1 ARE IN UF; INDUCTANCE VALUES ARE IN UH. ⏚ INDICATES CHASSIS GROUND. Hz INDICATES CYCLES PER SECOND.

DC VOLTAGES ARE MEASURED WITH VTVM PLACED BETWEEN POINTS INDICATED & CHASSIS GROUND. LINE VOLTAGE SET AT 120V AC & ALL CONTROLS SET FOR NORMAL PICTURE UNLESS OTHERWISE INDICATED. VOLTAGE READINGS ARE TAKEN WITHOUT SIGNAL, WITH VHF TUNER SET AT UNUSED CHANNEL. VOLTAGES SHOWN IN BRACKETS ( ) ARE MEASURED WITH RECEIVER TUNED TO A COLOR SIGNAL.

WARNING: CHASSIS IS CONNECTED DIRECTLY TO ONE SIDE OF AC POWER LINE. USE AN ISOLATION TRANSFORMER WHEN SERVICING TO AVOID THE POSSIBILITY OF ACCIDENTAL ELECTRICAL SHOCK & DAMAGE TO TEST EQUIPMENT.

TRANSISTOR CAUTION: TO AVOID DAMAGE TO TRANSISTORS, DO NOT OPERATE CHASSIS WITH PICTURE TUBE DAG DISCONNECTED FROM CHASSIS GROUND. DO NOT TURN SET ON WITH TRANSISTOR(S), TUBE(S) OR LEADS REMOVED OR UNSOLDERED. DO NOT ARC 2ND ANODE LEAD TO CHASSIS GROUND. DISCHARGE 2ND ANODE ONLY TO PICTURE TUBE DAG OR DAG GROUND. USE CAUTION TO PREVENT ACCIDENTAL SHORT BETWEEN COMPONENT TERMINALS OR TO CHASSIS GROUND. DO NOT APPLY EXCESSIVE HEAT TO TRANSISTOR LEADS. DO NOT USE AN ORDINARY OHMMETER FOR RESISTANCE MEASUREMENT, USE VTVM ON Rx100 RANGE OR HIGHER.

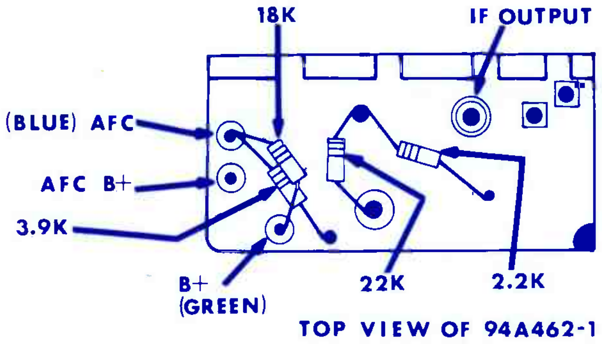
(10) RUN NUMBER INDICATES CHANGE(S) INCORPORATED AS GIVEN UNDER THAT RUN NUMBER, AS WELL AS ALL LOWER RUN CHANGES.

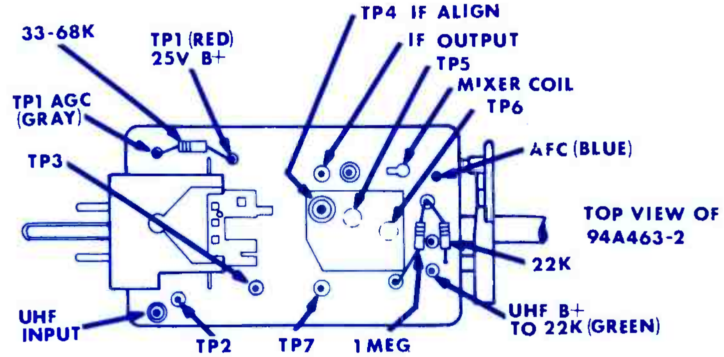
TP SYMBOLS IN RECTANGLES INDICATE TEST POINT CONNECTIONS.

(1) HEXAGONS IDENTIFY WAVEFORM OBSERVATION LOCATIONS. CONDITIONS FOR TAKING WAVEFORM MEASUREMENTS ARE GIVEN WITH WAVEFORM PHOTOGRAPHS.

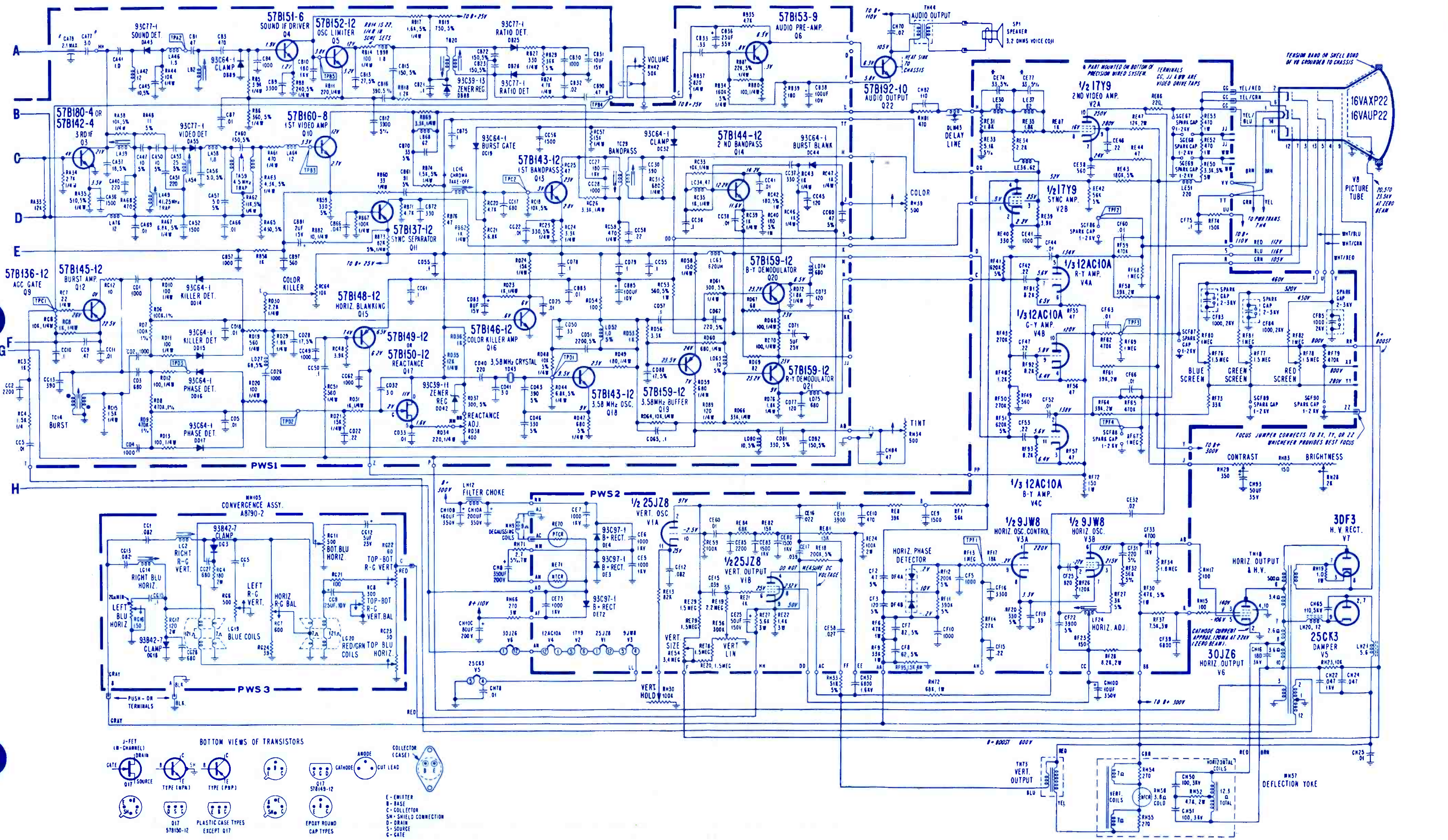
* COMPONENT NOT MOUNTED ON PRECISION WIRED SYSTEM.

ADMIRAL
Color TV Chassis
T52K10





SYMBOL	DESCRIPTION	ADMIRAL PART NO.
CH10A, B, C, D	200mf/350v, 160mf/350v, 80mf/200v, 10mf/350v, electrolytic	67A15-403
CH14A, B	2000mf/40v, 2000mf/40v electro	67A15-413
RA83	2K, AGC	75A101-31
RC64	10K, color kill	75A101-18
RE54	3.4M, vert size	75A107-4
RE56	300K, vert lin	
RH28	2K, brite	75A140-25
RH29	350 ohm, contrast	75A140-26
RH30	100K, vert hold	75A140-27
RH34	500 ohm, tint	75A206-6
RH39	500 ohm, color	75A206-6
RH42, SH41	50K, vol w/on-off switch	75A206-5
LC16	coil, chroma take-off	72A329-1
LF24	coil, horiz adj	94A351-1
TA59	xformer, 4.5MHz trap	72A216-7
TB20	xformer, ratio detect	72A318-1
TC14	xformer, burst	72A325-3
TC29	xformer, bandpass	72A327-1
TH2	xformer, line choke	73A31-16
TH4	xformer, power	80A108-14
TH18	xformer, horiz output	79A158-3
TH44	xformer, audio output	79A141-4
TH73	xformer, vert output	79A165-1
FH5	fuse, .225a chemical	84A28-12
FH27	fuse, 1.7a chemical	84A28-6
	VHF tuner	94A463-2



1605

AIRLINE

Color TV Model
GAI-12335A

ELECTRONIC TECHNICIAN/DEALER TEKFAX

SEPTEMBER • 1975

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

SYMBOL	DESCRIPTION	AIRLINE PART NO.
R306	2.2K AGC	75A199-1
R319	10K AGC delay	75A199-2
R401	22K, tilt	75A199-3
R410	100K, color kill	75A199-4
L404	coil, chroma take-off	73A135-3
L500	coil, sound quad	72A329-4
L501	coil, sound detect	72A329-4
T200	xformer, 4.5MHz trap	72A216-8
T400	xformer, chroma bandpass	73A137-1
T500	xformer, 4.5MHz sound take-off	72A318-6
R741	20K, brite limit	75A101-47
T800	xformer, horiz osc adj	94A351-3
R630	200K, vert size	75A101-28
R631	60K, vert hold	75A191-2
1C1000	1C, +24v regulator	56A21-1
F1000	fuse, 1.5a	36201.5

ELECTRICAL SPECIFICATIONS

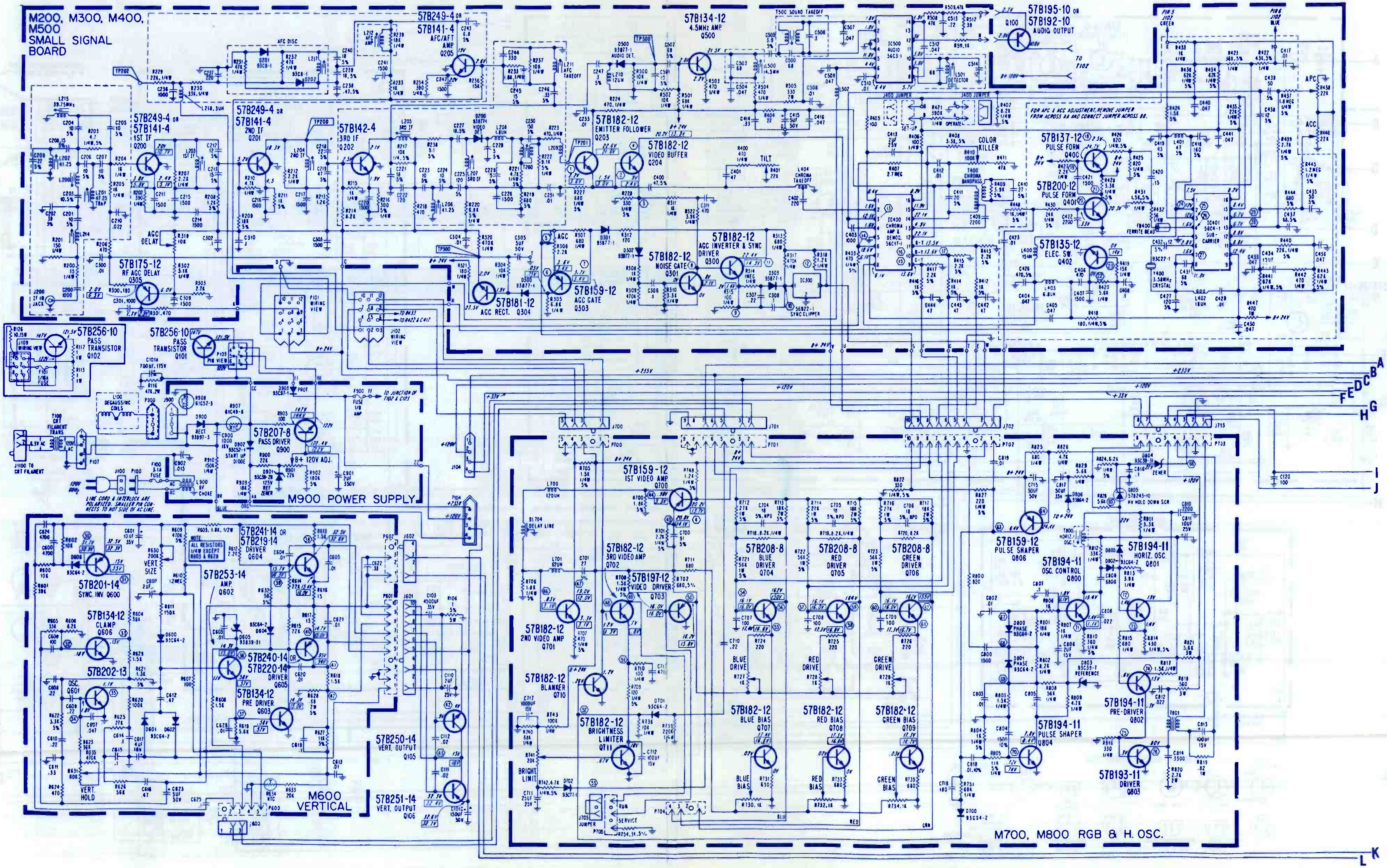
POWER INPUT	120 Volts, 60 Hz
POWER CONSUMPTION	150 Watts Total
PICTURE SIZE	Approximately 90 sq. in.
FOCUS LENS	Bipotential
SWEEP DEFLECTION	Magnetic
CONVERGENCE	Magnetic
PIN CUSHION CORRECTION	Dynamic
AUDIO POWER OUTPUT RATING	2 Watts Max.
SPEAKER	3" x 3", 0.68 oz., Magnet
VOICE COIL IMPEDANCE	3.2 Ohms at 200 Hz
ANTENNA INPUT IMPEDANCE	300 Ohm Balanced

TELEVISION RF FREQUENCY RANGE:

All 12 VHF Channels	54 MHz to 88 MHz and 174 MHz to 216 MHz
Any of 70 UHF Channels	470 MHz to 890 MHz

INTERMEDIATE FREQUENCIES:

Picture IF Carrier Frequency	45.75 MHz
Sound IF Carrier Frequency	41.25 MHz
Color Subcarrier Frequency	42.17 MHz (Nominal)



OSCILLOSCOPE WAVEFORM INFORMATION

Oscilloscope waveform patterns shown have been taken at important observation points throughout the television chassis. Voltage given for each waveform observation point is in peak-to-peak voltage.

All waveforms were taken with a wideband scope using a low capacity probe to prevent loading.

Waveforms taken with a standard color bar generator with the Color control set to 100% or normal.

Receiver was adjusted with the AGC control for a 1 volt peak-to-peak waveform at TP201 using the standard color bar generator as the signal source. This corresponds to a 2 volt peak-to-peak video waveform from an off-the-air station signal. The difference in signal amplitude is due to the lack of luminance information in the color bar signal when switched to the color bar pattern. All receiver controls set for normal picture.

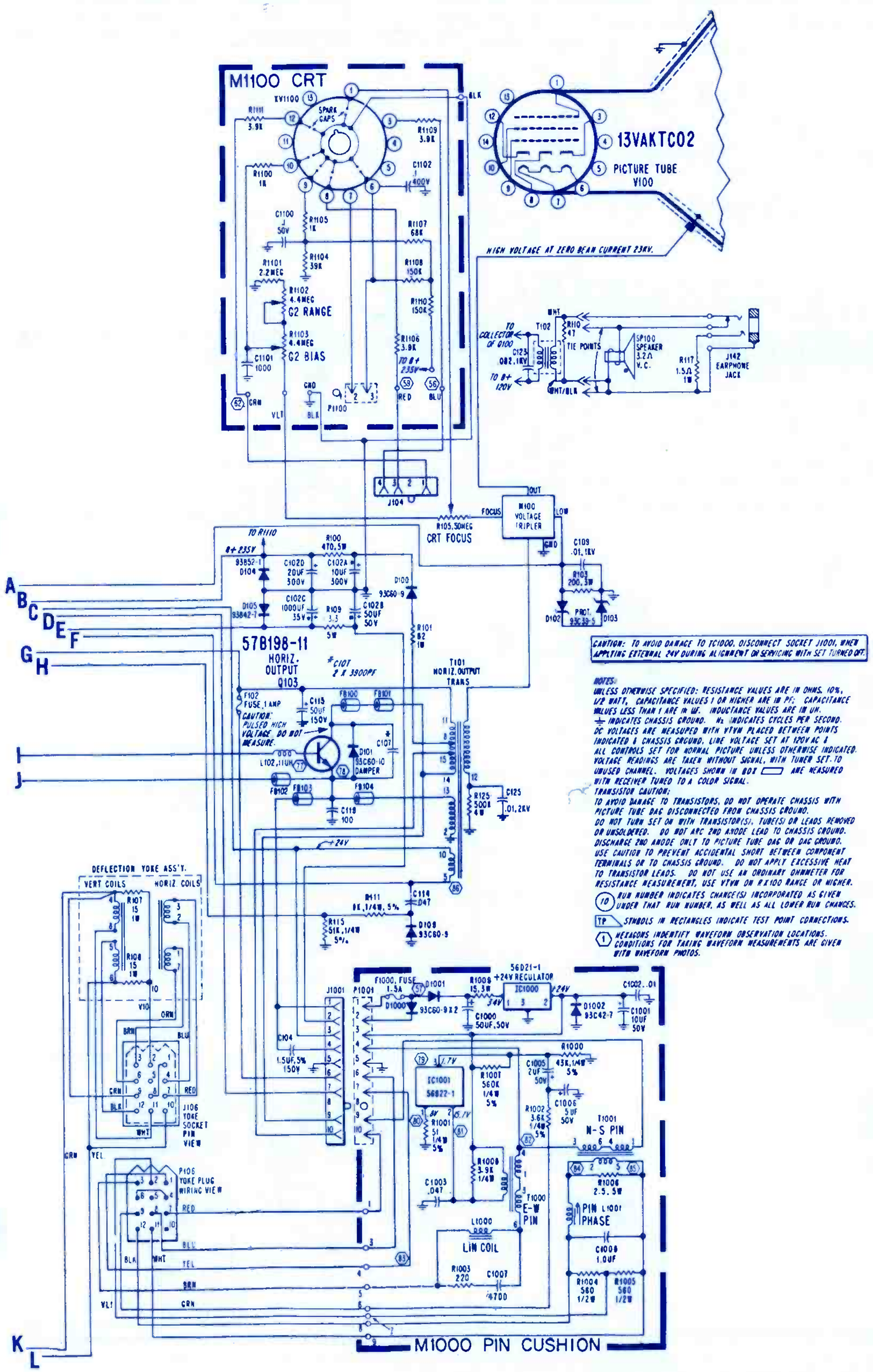
Oscilloscope sweep was set at 30 Hertz or V position for vertical waveforms, and 7,875 Hertz or H position for horizontal and chroma waveforms.

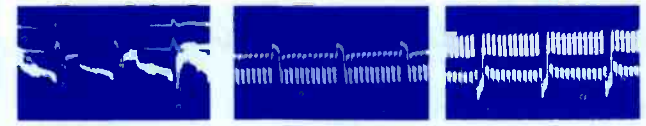
Shape of waveforms should resemble those given, depending upon bandwidth of oscilloscope used. Peak-to-peak voltages may vary, depending on calibration of test equipment, chassis parts tolerances and control settings.

SAFETY NOTICE

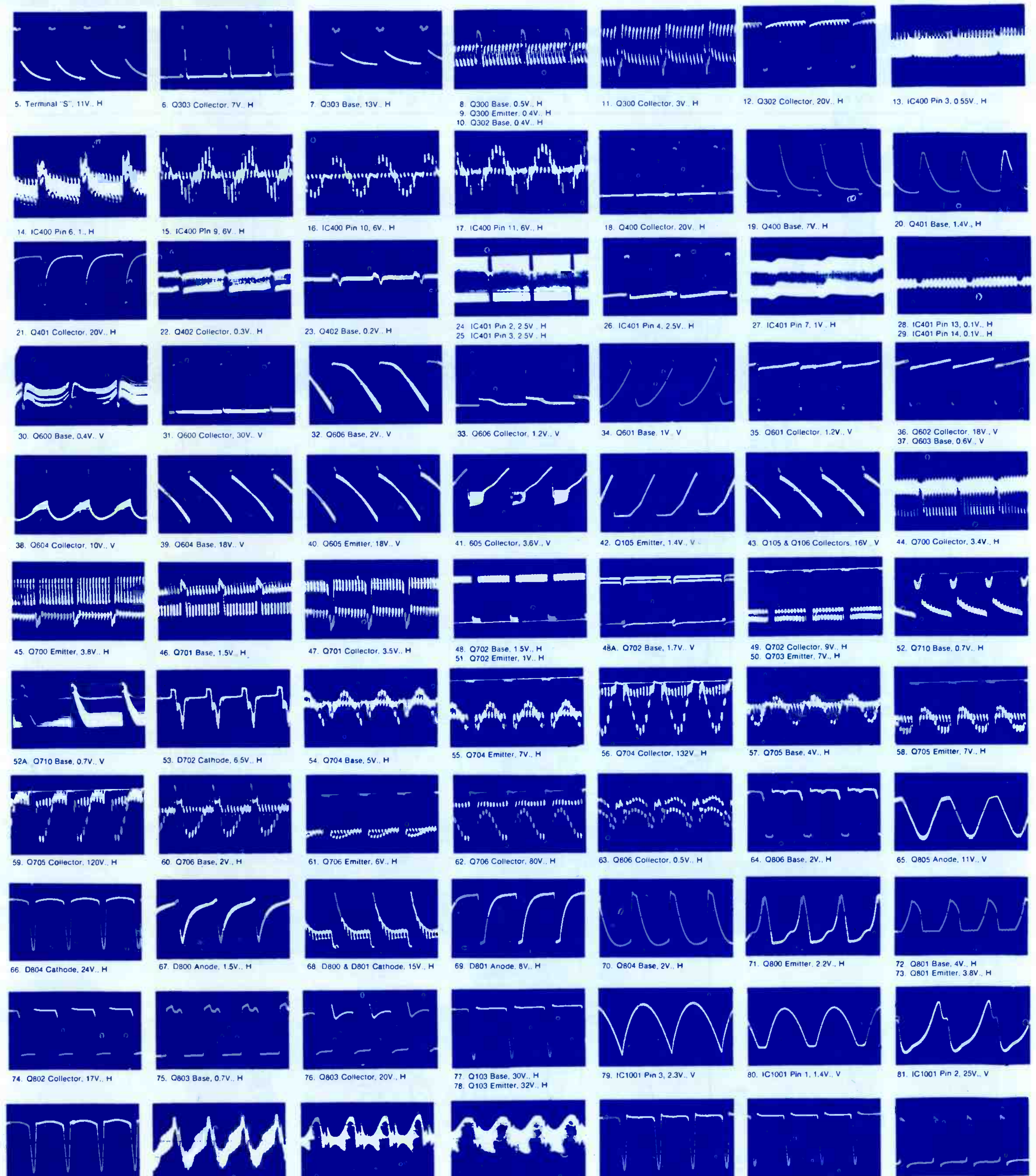
THE DESIGN OF THIS RECEIVER CONTAINS MANY CIRCUITS AND COMPONENTS INCLUDED SPECIFICALLY FOR SAFETY PURPOSES. FOR CONTINUED PROTECTION, NO CHANGES SHOULD BE MADE TO THE ORIGINAL DESIGN. REPLACEMENT PARTS MUST BE IDENTICAL TO THOSE USED IN THE ORIGINAL CIRCUIT. SERVICE SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY.

AIRLINE
Color TV Model
GAI-12335A





1. Q203 Base (TP201), 2V., V (station signal)
1A. Q203 Base, (TP201), 1V., H (Color Bar Generator signal)
2. Q204 Base, 0.8V., H
3. Q203 Emitter, 0.8V., H
4. Q204 Collector, 3V., H
Q700 Base, 3V., H



5. Terminal "S", 11V., H
6. Q303 Collector, 7V., H
7. Q303 Base, 13V., H
8. Q300 Base, 0.5V., H
9. Q300 Emitter, 0.4V., H
10. Q302 Base, 0.4V., H
11. Q300 Collector, 3V., H
12. Q302 Collector, 20V., H
13. IC400 Pin 3, 0.55V., H
14. IC400 Pin 6, 1., H
15. IC400 Pin 9, 6V., H
16. IC400 Pin 10, 6V., H
17. IC400 Pin 11, 6V., H
18. Q400 Collector, 20V., H
19. Q400 Base, 7V., H
20. Q401 Base, 1.4V., H
21. Q401 Collector, 20V., H
22. Q402 Collector, 0.3V., H
23. Q402 Base, 0.2V., H
24. IC401 Pin 2, 2.5V., H
25. IC401 Pin 3, 2.5V., H
26. IC401 Pin 4, 2.5V., H
27. IC401 Pin 7, 1V., H
28. IC401 Pin 13, 0.1V., H
29. IC401 Pin 14, 0.1V., H
30. Q600 Base, 0.4V., V
31. Q600 Collector, 30V., V
32. Q606 Base, 2V., V
33. Q606 Collector, 1.2V., V
34. Q601 Base, 1V., V
35. Q601 Collector, 1.2V., V
36. Q602 Collector, 18V., V
37. Q603 Base, 0.6V., V
38. Q604 Collector, 10V., V
39. Q604 Base, 18V., V
40. Q605 Emitter, 18V., V
41. 605 Collector, 3.6V., V
42. Q105 Emitter, 1.4V., V
43. Q105 & Q106 Collectors, 16V., V
44. Q700 Collector, 3.4V., H
45. Q700 Emitter, 3.8V., H
46. Q701 Base, 1.5V., H
47. Q701 Collector, 3.5V., H
48. Q702 Base, 1.5V., H
51. Q702 Emitter, 1V., H
48A. Q702 Base, 1.7V., V
49. Q702 Collector, 9V., H
50. Q703 Emitter, 7V., H
52. Q710 Base, 0.7V., H
52A. Q710 Base, 0.7V., V
53. D702 Cathode, 6.5V., H
54. Q704 Base, 5V., H
55. Q704 Emitter, 7V., H
56. Q704 Collector, 132V., H
57. Q705 Base, 4V., H
58. Q705 Emitter, 7V., H
59. Q705 Collector, 120V., H
60. Q706 Base, 2V., H
61. Q706 Emitter, 6V., H
62. Q706 Collector, 80V., H
63. Q806 Collector, 0.5V., H
64. Q806 Base, 2V., H
65. Q805 Anode, 11V., V
66. D804 Cathode, 24V., H
67. D800 Anode, 1.5V., H
68. D800 & D801 Cathode, 15V., H
69. D801 Anode, 8V., H
70. Q804 Base, 2V., H
71. Q800 Emitter, 2.2V., H
72. Q801 Base, 4V., H
73. Q801 Emitter, 3.8V., H
74. Q802 Collector, 17V., H
75. Q803 Base, 0.7V., H
76. Q803 Collector, 20V., H
77. Q103 Base, 30V., H
78. Q103 Emitter, 32V., H
79. IC1001 Pin 3, 2.3V., V
80. IC1001 Pin 1, 1.4V., V
81. IC1001 Pin 2, 25V., V
82. T1000 Pin 4, 33V., H
83. P1000 Pin 4, 0.8V., H
84. T1001 Pin 2, 20V., H
85. T1001 Pin 5, 13V., H
86. T1001 Terminal 17, 28V., H
87. D1001 Anode, 250V., H
88. T101 Terminal 4, 120V., H

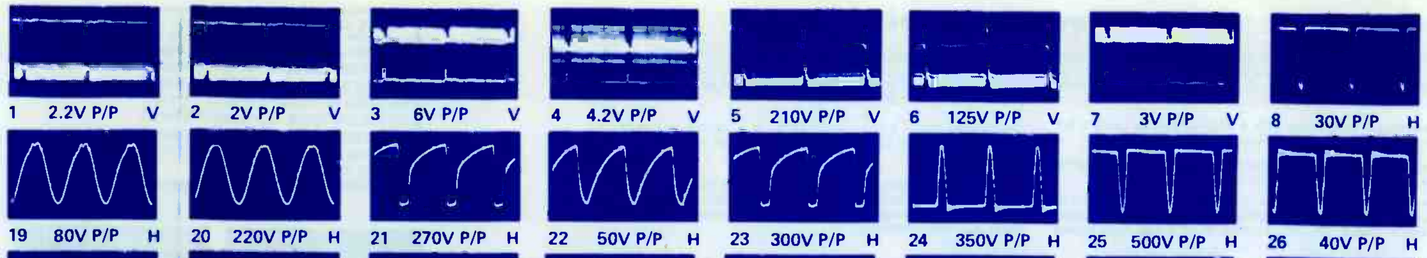
1606

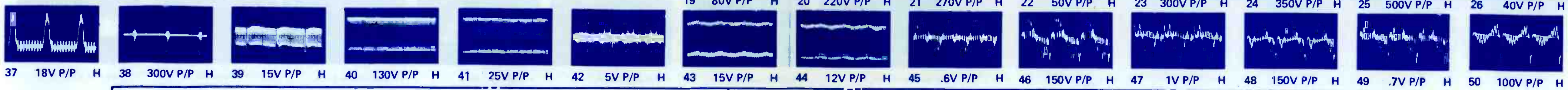
MAGNAVOX
Color TV Chassis
T971

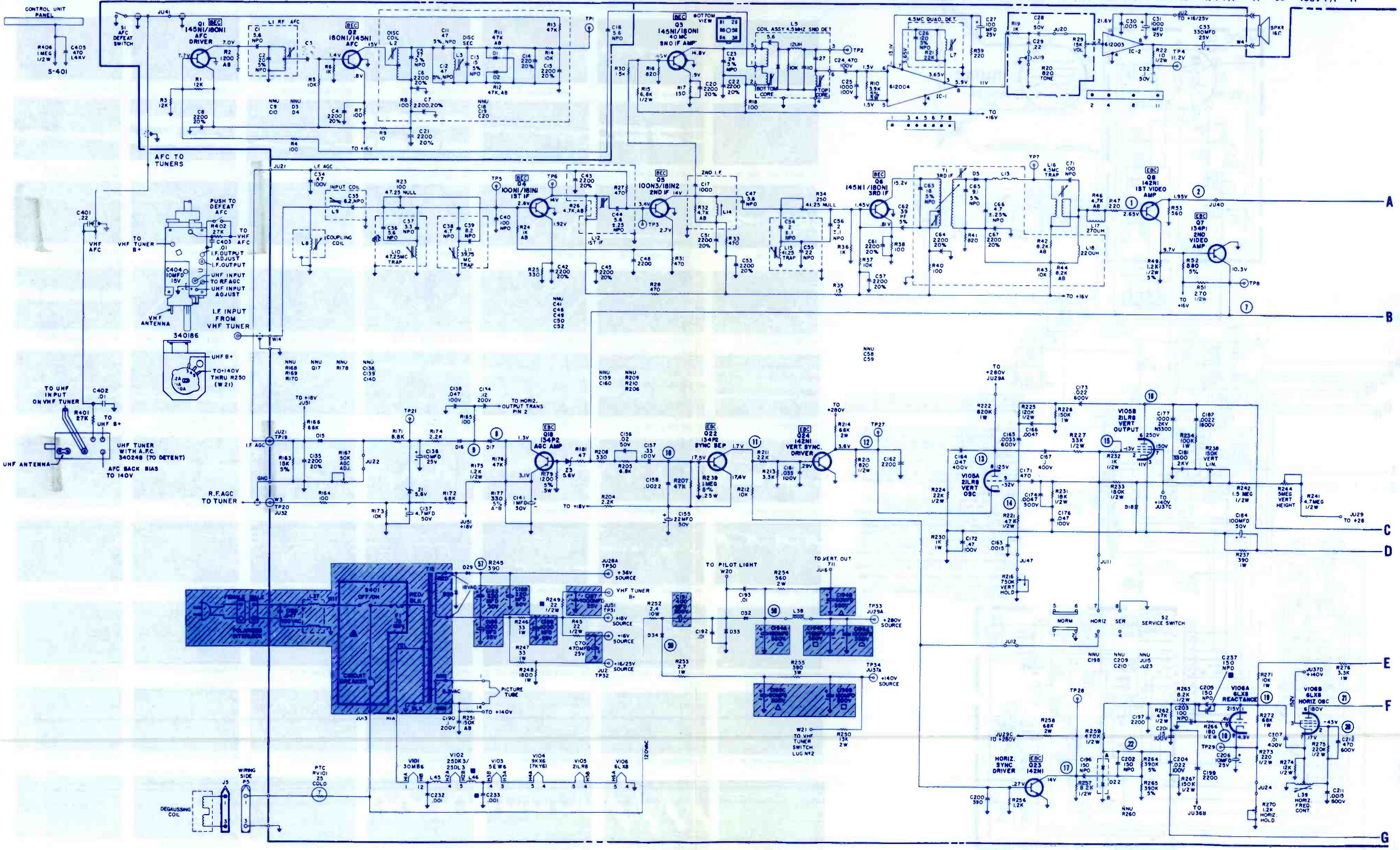
SEPTEMBER • 1975

ELECTRONIC TECHNICIAN/DEALER TEKFAX

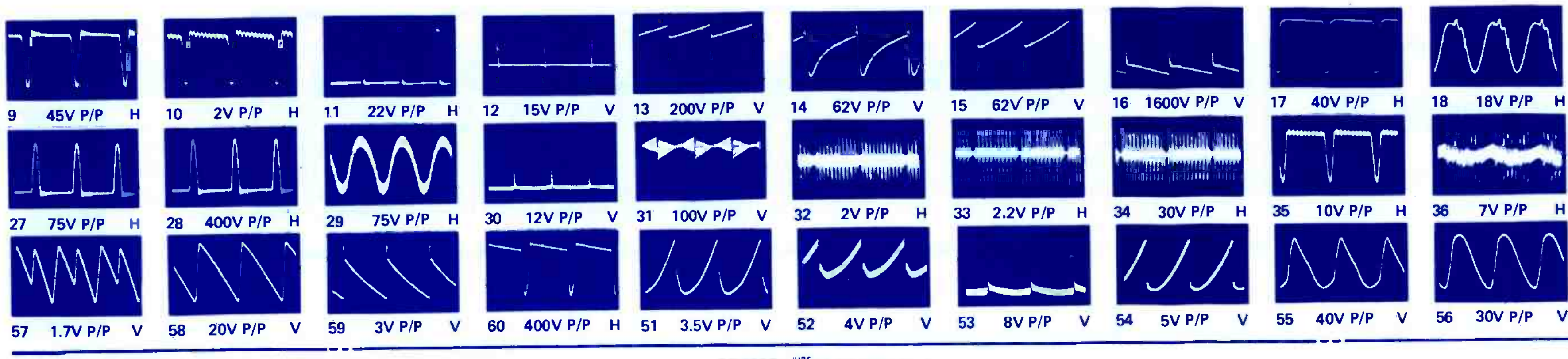
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

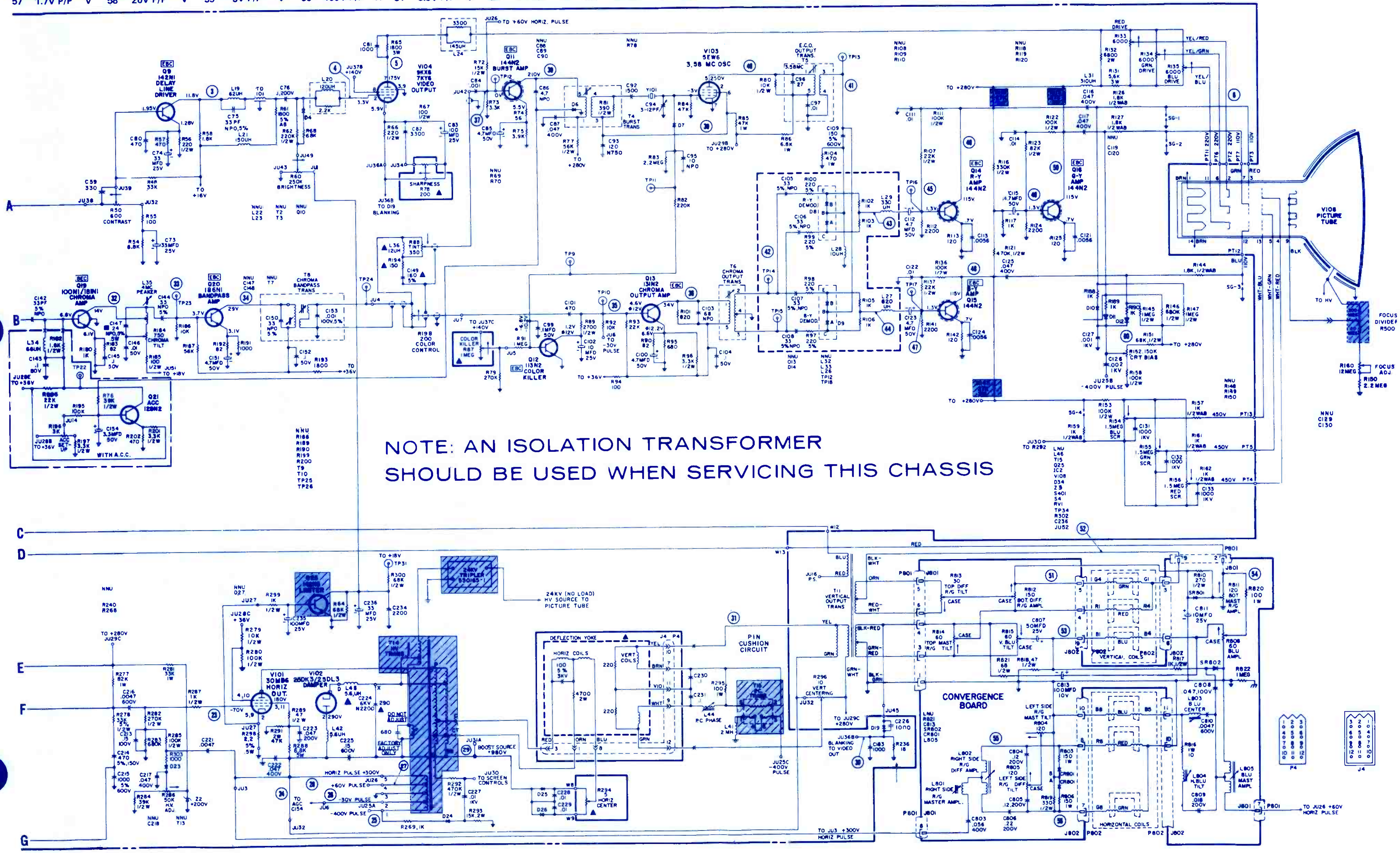






MAGNAVOX
Color TV Chassis
T971





1607

ZENITH

TV Chassis
9FB1X

SEPTEMBER • 1975

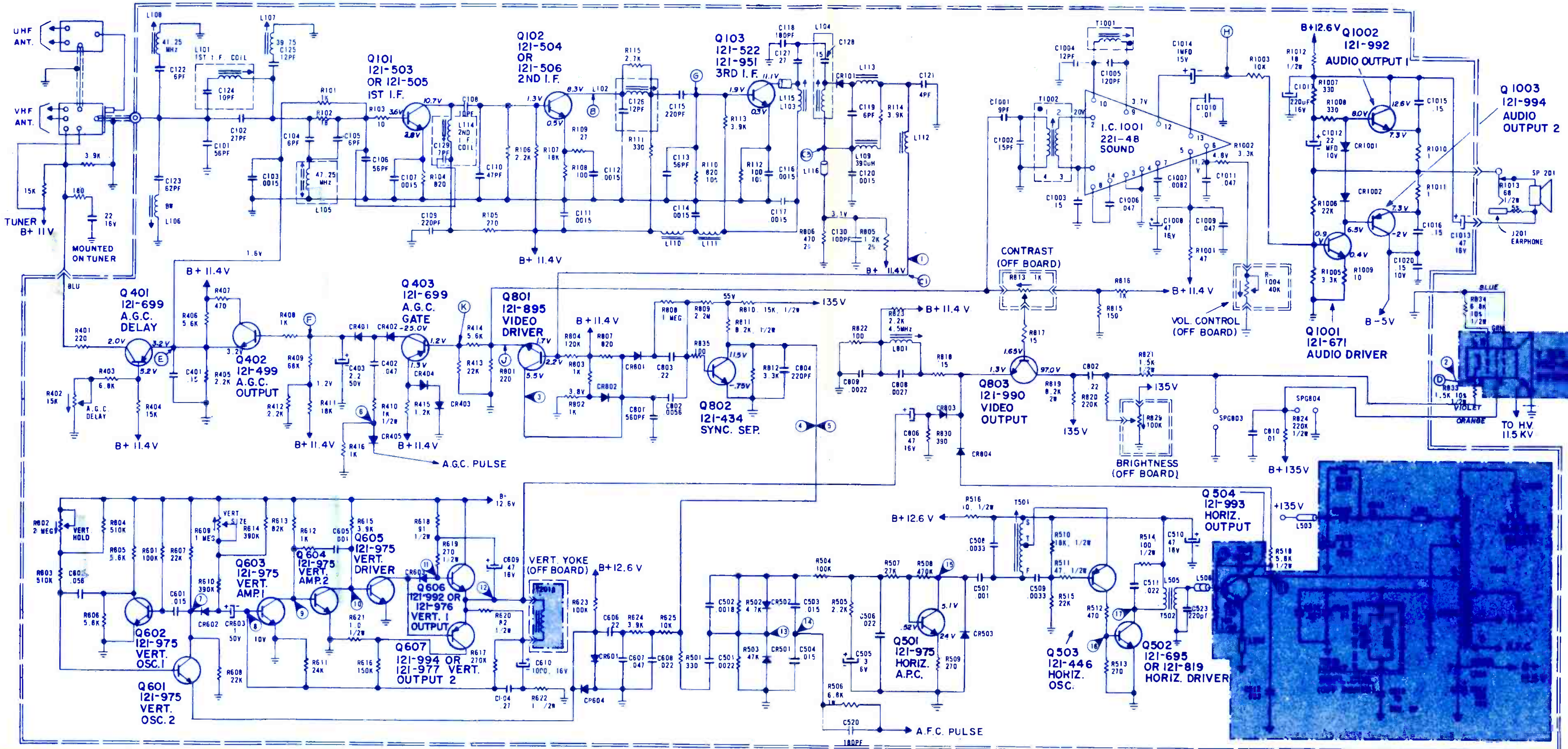
ELECTRONIC TECHNICIAN/DEALER TEKFAX

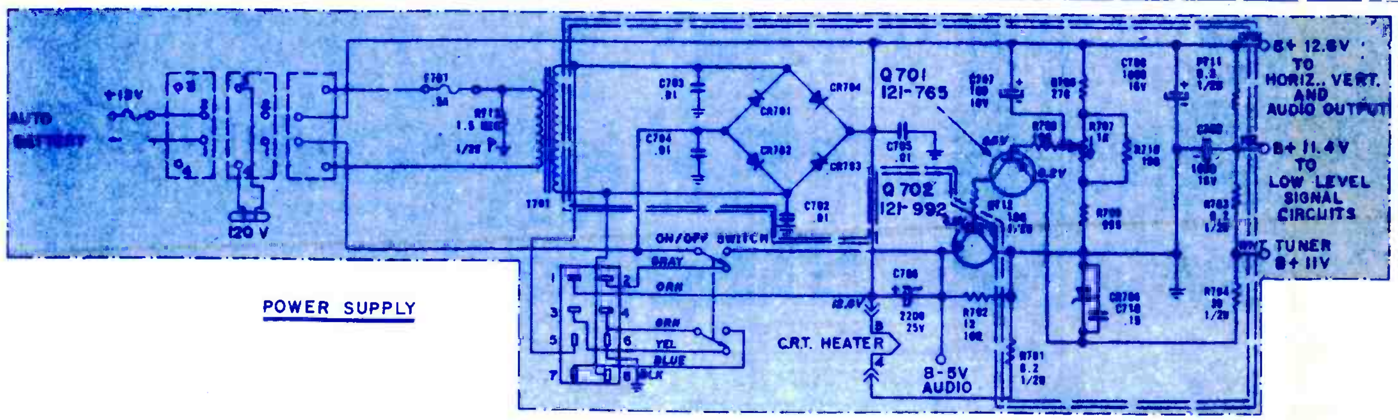
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

SYMBOL	DESCRIPTION	ZENITH PART NO.
R402	15K AGC delay control	63-10501
R602	2M vert hold	63-10505
R609	1M vert size	63-9227
R707	1K control rotary single resistor	63-9959
R813	1K contrast control	63-10603-01
R829	brite control	63-10502
R1004	40K vol control	63-10504
T201A	yoke vert	95-3135
T2018	horiz deflect coil	
T502	horiz driver xformer	95-3136
T503	sweep xformer assm	S-97473
T1001	quad xformer	95-2789
T1002	4.5MHz input coil	95-2620
F701	bel fuse .5a 250v	136-84

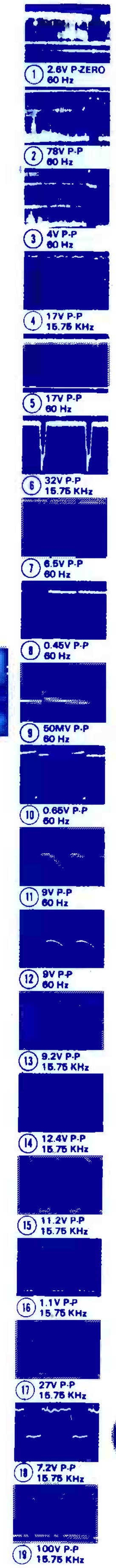
IMPORTANT SAFETY NOTICE

WHEN SERVICING THIS CHASSIS, UNDER NO CIRCUMSTANCES SHOULD THE ORIGINAL DESIGN BE ALTERED WITHOUT PERMISSION FROM THE ZENITH RADIO CORPORATION. COMPONENTS SHOULD BE REPLACED ONLY WITH TYPES IDENTICAL TO THOSE IN THE ORIGINAL CIRCUIT. IN SOME INSTANCES REDUNDANT CIRCUITRY IS INCORPORATED FOR ADDITIONAL CIRCUIT PROTECTION AND X-RADIATION SAFETY. SPECIAL COMPONENTS ALSO ARE USED TO PREVENT SHOCK AND FIRE HAZARD. THESE CRITICAL COMPONENTS ARE SHADED IN THIS DIAGRAM AND PARTS LIST FOR EASY IDENTIFICATION. IT IS IMPERATIVE THAT THE PROPER TYPE FUSE BE USED SO AS NOT TO CREATE A SAFETY HAZARD IN THE FUTURE DUE TO THE USE OF AN IMPROPER FUSE. PROPER FUSE VALUES AND PART NUMBERS ARE LISTED IN THE SERVICE MANUAL.





POWER SUPPLY



TEST POINTS

- C1 DETECTOR OUTPUT
- C3 VIDEO BIAS
- B SECOND IF COLLECTOR
- D VIDEO OUTPUT
- E I.F. A.G.C.
- F A.G.C. OUTPUT
- G 3RD I.F. ALIGNMENT
- H SOUND DISCR. OUTPUT
- J VIDEO DRIVER OUTPUT
- K AGC GATE

NOTES:

1. ALL VOLTAGES MEASURED FROM CHASSIS TO POINTS INDICATED.
2. ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED.
3. ALL VOLTAGE MEASUREMENTS TO BE MADE WITH NO SIGNAL PRESENT WITH CHANNEL SELECTOR SET TO CHANNEL 2.
4. ALL RESISTORS ARE FILM ±5 PERCENT TOLERANCE, 1/4 WATT UNLESS OTHERWISE SPECIFIED. (SEE NOTE 6.)
5. ▶ INDICATES ±20 PERCENT TOLERANCE MAY BE USED.
6. RESISTANCE MEASURED SHOWN WITH COILS DISCONNECTED FROM CIRCUIT.
7. COIL RESISTANCES NOT SPECIFIED ARE UNDER ONE OHM.
8. ALL CAPACITY VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
9. FOR CAPACITY TOLERANCES, SEE LEGEND.
10. ARROWS ON POTENTIOMETERS INDICATE CLOCKWISE ROTATION.
11. MHz = MEGAHERTZ = MEGACYCLE uH = MICROHENRY.
12. INDICATES CHASSIS GROUND.
13. INDICATES VOLTAGE SOURCE.
14. INDICATES ALIGNMENT OR TEST POINT.
15. INDICATES WAVEFORM.
16. ALL WAVEFORMS TAKEN ON AIR SIGNAL DEVELOPING 2.5 VOLTS PEAK TO ZERO AT TEST POINT "C1" AND ALL CONTROLS SET FOR NORMAL VIEWING.
17. TURN POWER OFF BEFORE REPLACING SEMICONDUCTORS.

LEADER Automatic

Dual Channel/Dual Trace 5" Scope/Vectorscope

- **Automatic** Trigger
- **Automatic** Horizontal Sweep
- **Automatic** Vertical Input

Automatic operation is the key and virtually error free accuracy is your bonus with this unique 5" Dual Trace Scope. The advanced design even lets you read between the ranges in any position, as easily as you can with analog VTVM's or VOM's. High reliability PC boards assure long term dependability while a high intensity CRT delivers excellent contrast. It features: separate or simultaneous sweep display, Ch 1 & 2 - alternate, chopped, auto/norm trigger; 10MHz b'width; 10mVp-p/cm to 20Vp-p/cm vert'l sensitivity in 11 calib. steps; 0.5μS/cm to 0.2S/cm sweep range, 18 steps calib.; X5 mag.; XY and vectorscope displays. Compact, lightweight, economical.

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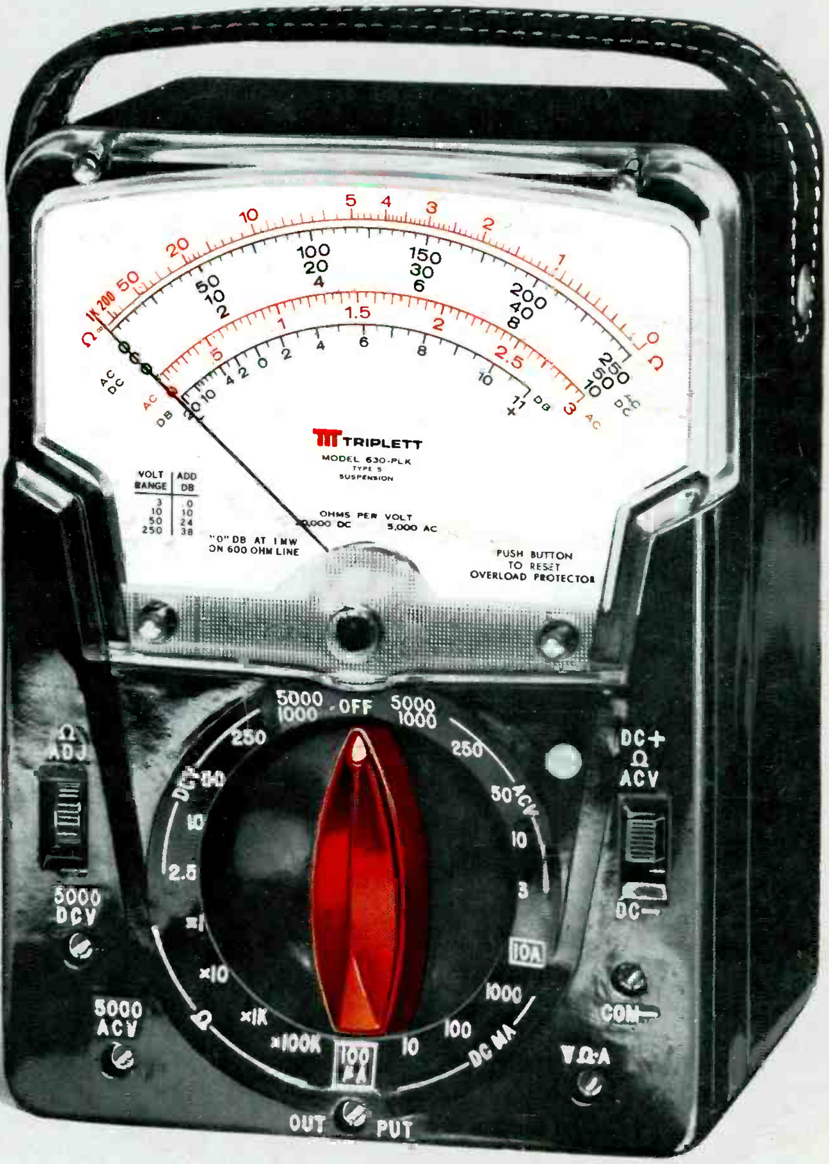
Our 630-PLK won't die of shock.



The Model 630-PLK V-O-M is priced at just $125.

Does everything you'd expect of a high-quality general purpose V-O-M. An exclusive, patented, transistorized switching circuit gives the Triplett Model 630-PLK virtually fail-proof protection against overloads. That makes it very popular with teachers and students, and with professionals where constant switching invites overload errors.

Look at these features:

1. **Burnout-proof solid-state overload protection; suspension movement; 2% DC accuracy.**
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3. **4 ohmmeter ranges with a 4.4 ohms center scale.**

Want all this, but with laboratory accuracy? Then consider the Triplett Model 630-APLK. Exactly the same ranges and protection circuit plus 1½% DC accuracy, a mirrored scale, and a rugged suspension-type meter. Priced at **$135.**

If you don't need overload protection, take a look at Triplett's Model 630-PL at only **$81**, or the 630-APL (with 1½% accuracy, mirrored scale, and suspension-type meter) at **$91.**

See them for yourself. Ask the Triplett distributor or sales representative to give you a free demonstration of the tester that fits your needs. You'll be glad you did. So, do it today. Triplett Corporation, Bluffton, Ohio 45817.

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