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ELECTRONIC TECHNICIAN/DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

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PTS ELECTRONICS

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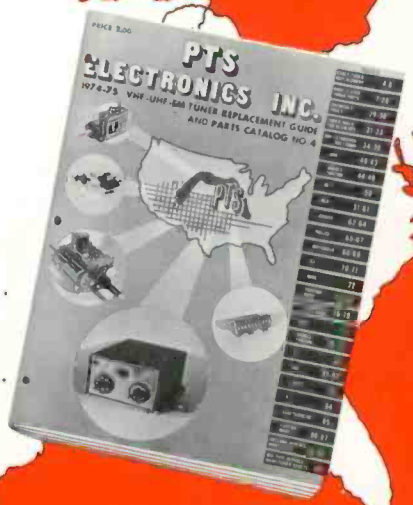

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OKLAHOMA CITY, OKLA. 73106
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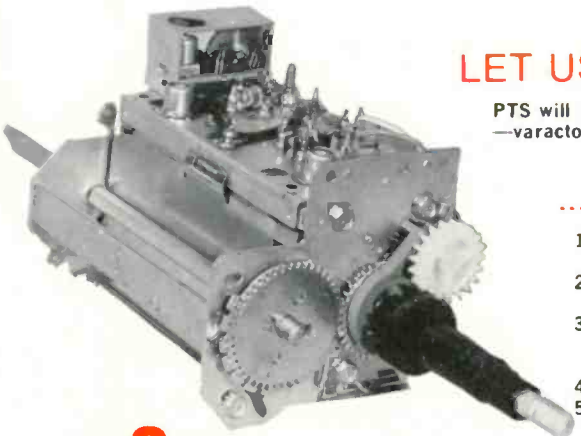

LET US TAKE CARE OF YOUR TUNER PROBLEMS...

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

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1. **Fastest Service—8 hour—in and out the same day. Overnight transit to one of our strategically located plants.**
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3. **PTS uses only ORIGINAL PARTS! No homemade or make-do, inferior merchandise (this is why we charge for major parts!). You get your tuner back in ORIGINAL EQUIPMENT condition.**
4. **PTS is recommended by more TV Manufacturers than any other tuner company.**
5. **PTS is overhauling more tuners than all other tuner services combined.**

Fast **8** hr. Service!

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...Precision Tuner Service

1 YEAR GUARANTEE

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

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

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

ELECTRONICS, INC....

...Number ONE and still trying harder!

(Not a Franchise Company)

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

Now you don't have to turn down jobs just because the sets were made in the Far East.

Your Sylvania Distributor has solved one of your biggest problems in semiconductor replacements for imported equipment.

Until now, unless your shop was around the corner from an import warehouse, you probably had a tough problem. Especially for those non-repairable modules.

But not anymore.

Sylvania's new ECG™ 1000 series gives you over 140 new integrated circuits and modules for imported sets right on your distributor's shelves.

And, thanks to our newest interchangeability guide (ECG 212E-4), those 140 parts add up to a lot more when it comes to the number of types they'll replace.

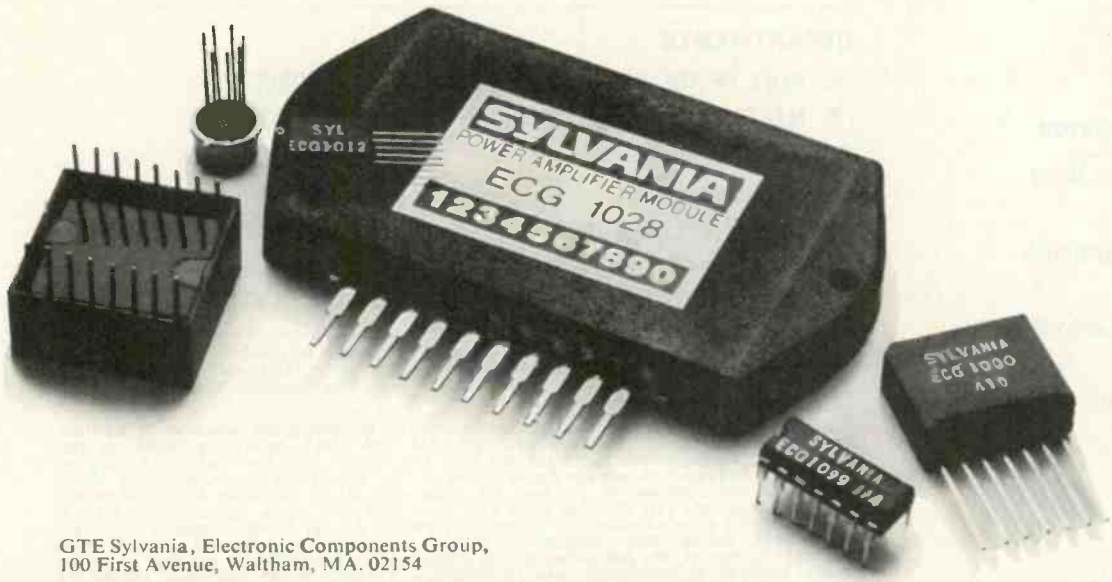
That means you don't have to watch a profitable repair job walk out the door just because getting the parts could make it unprofitable.

It also means that you've got one-stop shopping for all of your repair jobs, foreign or domestic.

Whether you need semiconductors, picture tubes or receiving tubes, you'll find them all at one electronic supermarket.

Your Sylvania Distributor.

GTE SYLVANIA



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

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FEATURES

TEKFAX—Airline Model GEN11965A; General Electric Ch. QB; Quasar Ch. 17-TS—941, C19, E19, 19TS—941; Sylvania Ch. A12-3, -4, 5; and Zenith Ch. 17FC35.

DEPARTMENTS

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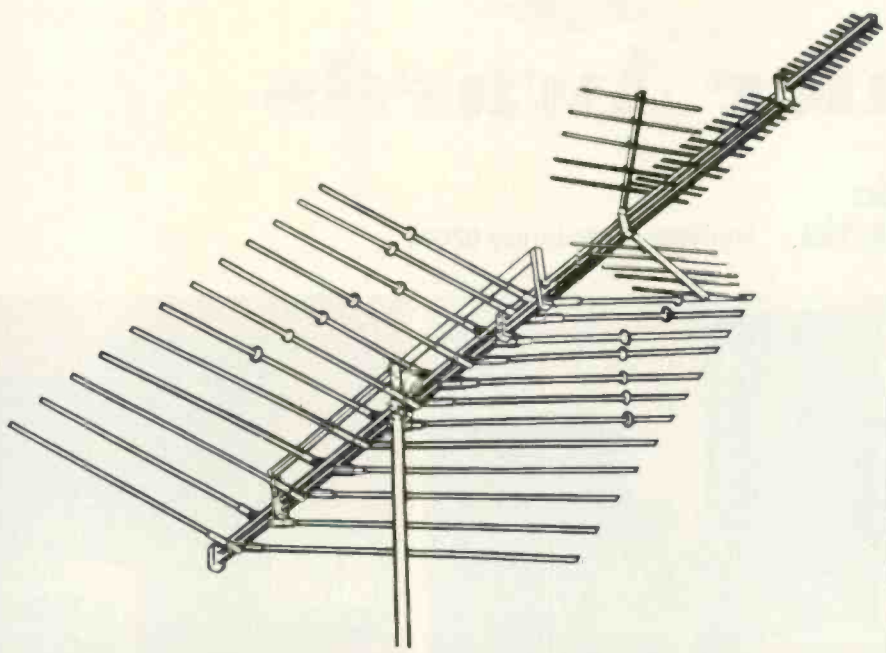
JFD®



OUTDOOR TELEVISION ANTENNAS

INDOOR TELEVISION ANTENNAS

TELEVISION ACCESSORIES

JFD is the way more dealers, installers, and distributors are spelling television antennas these days.

For good reason.

OUTDOOR TV ANTENNAS

They know that JFD antennas assure best possible performance—in color and black-and-white—on all channels (2 to 83). Because only JFD combines the super-sensitive log periodic concept with capacitor coupled dipole design. *All* of the elements (not just some as in other antennas) work together for laser sharp picture brilliance.

And you can select from a *complete* line of models to suit every reception (and budget) need.

INDOOR TV ANTENNAS

You can also look to JFD for the broadest selection of indoor antennas: Top-of-the-set, behind-the-set, in-the-set, O.E.M. . . . we got them. Made right, packaged right, priced right.

TV ACCESSORIES

To deliver picture-perfect reception to the set, team up your JFD antenna with any of the many JFD accessories: amplifiers, splitters, couplers, transformers, mounts, masts, standoffs, hardware or wire—for superior results.

THE LINE OF PROFIT-ABILITY

Only JFD can hand you a line like this—the line of proved performance and profit-ability.

Take our word for it.

The *Best* Reception Starts with A *JFD* Antenna.

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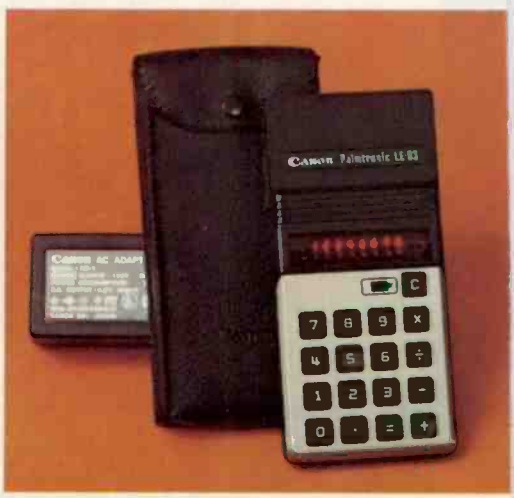
Toastmaster Plug-in Automatic Timer for Lamps and Appliances
Cordless timer plugs directly into outlet. Time cycle extends from 90 minutes to 22½ hours. Turns lamps and appliances *on* or *off* any time of day or night and repeats the operation every 24 hours without resetting.
FE-630

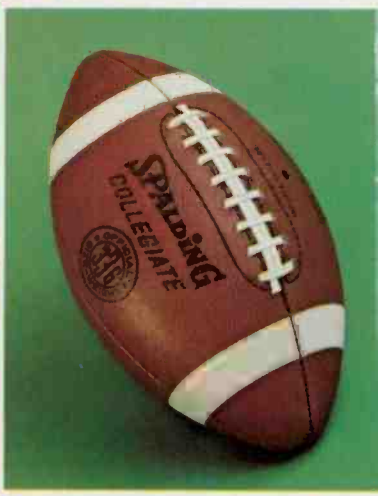
Polaroid Colorpack 5 Land Camera and Kit. Enjoy Instant Photography In Color and Black and White
• Big 3¼ x 4¼ color pictures in one minute • Black and white pictures in seconds • 3-element lens and unique face-in-the-square viewfinder
FE-687 Value: $44.95



Canon Palmtronic LE-83 Calculator
Slender enough to put in your pocket, the Canon Palmtronic LE-83 combines convenience with precision. • Adds, subtracts, multiplies, divides, performs mixed calculations, calculations with a constant and n-th power calculations. • Comes with an AC adapter or can be used with 4 penlight batteries. • Smooth key touch, easy to read LED indication panel.
FE-LE-83 Value: $44.95

Schick Styling Driers, Man's & Lady's Models
For Women: Quick drying with more natural styling
For Men: Dries fast while it styles and grooms
• 2 Speeds, 2 Heats • Dry setting — high airflow and high heat • Style setting — low airflow and low heat • Professional styling brush and styling comb • Air concentrator nozzle
Man's FE-336 Lady's FE-338 Value: $15.98

Spalding "Rebel" Golf Balls (One Dozen)
Spalding is the premier distance ball with indestructible Surlyn cover. Two-piece construction gives you extra yards for the power you pack into your drive. **FE-11117 Value: $14.90**



Spalding "Collegiate" Football
The best value you'll find in a full-grain leather football. Tough butyl rubber bladder. Triple fabric lining with lockstitch construction.
FE-61448 Value: $17.00

When you buy RCA tubes from your participating RCA tube distributor, he delivers the goods the easy way. No muss, no fuss, no constant cutting of carton flaps, no torn cartons on your shelf or in your caddy. Just give your tube order to your RCA distributor and get your premium the free and easy way. The bigger your tube order, the more valuable your gift. So visit him soon and select your Free and Easy RCA award with your purchase of RCA tubes. *(The values are really extra special.)*

No Muss • No Fuss • No Torn Tube Cartons.
Visit Your Participating RCA Tube Distributor.
Place Your RCA Tube Order
and Select Your "Free and Easy" RCA Award!

Remember, the Award Values Are Extra Special!

Omaha Steaks Ten RCA "Steak-out '74" certificates can be redeemed for one package of tender, succulent Omaha steaks as follows:

6 (11 oz.) Boneless Strip Sirloins	1⅛" thick or
8 (6 oz.) Filet Mignons	1¼" thick or
8 (8 oz.) Top Sirloins	1⅛" thick or
6 (8 oz.) Filets of Prime Rib	1" thick

Choice cuts, generous portions and outstanding flavor! **1A2116**

BULOVA...The watch you wear with pride. Bulova... synonymous with quality, craftsmanship, precision and style.

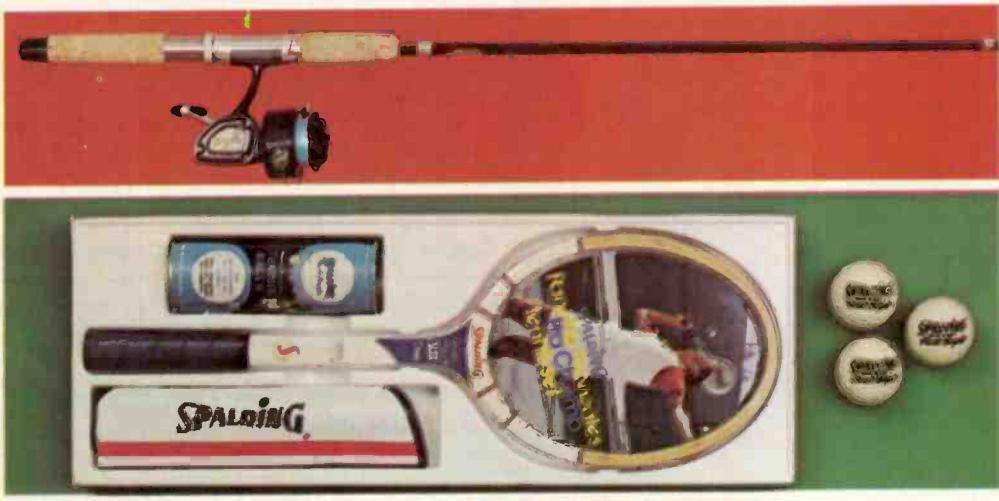
Oceanographer — Highly contemporary 17 jewel, automatic instant change day/date calendar; depth tested to 333 feet. **FE-12604 Value: $110**

La Petite — Stunning feminine timepiece with 23 jewels, 4 diamonds, 10K rolled gold plate case. Adjustable mesh bracelet. **FE-55775 Value: $110**

Sea King — Stalwart Bulova Sea King, 17 jewel precision timepiece, water-resistant with luminous dial. **FE-12280 Value: $65**

Concerto — Prettily sculptured model with 17 jewels, 10K rolled gold plate, stainless steel back and silver dial. **FE-63628 Value: $65**

Compass Binoculars
Perfect for use at the track, at the stadium, in the woods. Field of view is a large 367 Feet at 1000 yards. Hard-coated optics. Complete with case and strap.
FE-3022 Value: $44.95



Shakespeare Deluxe Spinning Combo Balanced Tackle Set
Shakespeare #2210 Marina Green spinning reel, matching Shakespeare SP-160 6′ 6″ Wonderod, 200 yards 6-pound monofilament, box of stainless steel hooks and spinning lure. For fresh and light salt-water fishing. **FE-S460 Value: $42.00**

Spalding Pancho Gonzales "Pro Champ" Tennis Set
Pancho Gonzales "Pro Champ" racket, waterproof racket cover, plus three Pancho Gonzales tennis balls.
FE-531063 Value: $18.65

NEWS OF THE INDUSTRY

RCA, Westinghouse Increase Replacement Color Picture Tube Prices

Price increases averaging about 7.5 percent have been announced by RCA for its all-new and rebuilt replacement color TV picture tubes. The price increases, which became effective September 16, average $5.00-$6.00 per tube.

Westinghouse also has increased the prices of its replacement color TV picture tube line an average of $5.00-$6.00 per tube. Westinghouse's price increase became effective August 6.

Rising costs of labor and materials are cited as the reasons for the increases.

Color TV Sales to Dealers Down 5.2% in First Seven Months of '74

The Electronic Industries Association's (EIA) Marketing Services Department has released statistics which reveal that color TV sales to dealers during the first seven months of 1974 were 5.2 percent below sales during the same period last year. These and other EIA-compiled statistics about sales to dealers of other consumer electronic products during the first seven months of 1974 are shown below:

UNIT SALES TO DEALERS
January-July 1974 Vs. Same Period in 1973
(Source: EIA Marketing Services Dept.)

	1974	1973	% CHANGE
TELEVISION			
Monochrome	3,190,449	3,558,981	−10.4
Color	4,337,656	4,574,940	− 5.2
TOTAL TELEVISION	7,528,105	8,133,921	− 7.5
RADIO			
AM	5,835,678	8,268,866	−29.4
FM	9,381,961	8,656,090	+ 8.4
TOTAL	15,217,639	16,924,956	−10.1
AUTOMOBILE	5,650,633	7,410,262	−23.8
TOTAL RADIO	20,868,272	24,335,218	−14.3
PHONOGRAPH			
Portable & Table*	1,780,576	2,677,699	−33.5
Console	407,678	428,319	− 4.8
TOTAL PHONOGRAPH	2,188,254	3,106,018	−29.6

*Includes compact and component systems.

Zenith Increases Color TV Suggested Retail Prices 10 Dollars

Zenith has upped the suggested retail prices of all models of its present color TV line by $10.00. The price increase, which went into effect September 1, might be followed by further increases during coming months, according to Walter C. Fisher, Zenith executive vice president of sales and marketing.

Price increases of $10-$20 also have been announced by Zenith for its *Allegro*™ series of audio products, along with increases of $25 to $30 for seven models of its console stereo and four-channel audio products.

PTS Opens New Tuner Service Center in Miami

PTS Electronics, Inc., Indiana-based tuner repair company, recently opened a new TV tuner repair center at 12934 NW 7th Avenue, Miami, Florida.

New Minimum Wage Laws Ease Restrictions on Employment of Full-Time Students

Restrictions are eased on the hiring of full-time students at subminimum wages for part-time and summer jobs as a result of the Fair Labor Standards Act (FLSA) amendments which went into effect May 1 of this year.

Secretary of Labor Peter J. Brennan has announced that retail and service employers may now employ up to four full-time students at 85 percent of the minimum wage by filing an application with the Secretary of Labor.

Employers seeking to hire more than four students must still receive prior certification from the Secretary. This is to ensure that student employees do not displace regular full-time workers.

Employers may pay student learners working in bona fide vocational education programs 75 percent of the minimum wage, upon filing proper application with the Secretary.

In all cases, student employment must be in compliance with applicable child labor laws.

Persons needing further information should contact the nearest Employment Standards Administration Wage-Hour Office, listed in most phone books under U.S. Government, Department of Labor.

Independents Honoring Bank Credit Cards Faring Better Than Those Who Do Not Says NFIB Data

Data compiled from 16,000 respondents to a field survey conducted in April by the National Federation of Independent Business (NFIB) indicates that in the current inflationary period, which has resulted in high interest rates and an increase in defaulting creditors, independent business firms honoring bank credit cards appear to be faring a little better than those who do not.

According to the NFIB, this might be due to the fact that those who turn their credit problems over to the banks eliminate the need for borrowing at high interest rates to carry accounts, and, at the same time, reduce their costs of billing and escape credit losses, which seemingly are mounting.

Of the entire sample in April, 21.2 percent report a higher profit, 23.2 percent the same profit level, and 44 percent a lower profit level. But of those who accept bank credit cards, 23.1 percent report a higher profit, 25.5 percent the same level, and 37.2 percent a lower profit.

Of the entire sample, 24.7 percent report a drop in dollar volume, while of those accepting credit cards, 23.4 percent report a dollar volume drop.

There also appears to be a more optimistic attitude toward future business conditions among retailers who honor credit cards than among those who do not. Of those accepting cards, 47 percent anticipate improved conditions, as compared to the 39.2 percent who do not honor bank credit cards, and only 9.5 percent of the card-honoring firms anticipate a worsening condition, as compared to 12.8 percent of those who do not honor cards. The two groups are evenly matched as to anticipations of conditions remaining the same.

Superscope Opens New Service Center in Minnesota

The opening of a new company-owned and operated service center in Burnsville, Minnesota, recently was announced by Superscope.

Superscope—which markets audio components and music systems under the Marantz, Superscope and Sony Superscope brand names—also has "full-service" centers in Chicago, Detroit, Boston, New York and Seattle.

The address of the new Superscope service center is: 12004 12th Ave. South, Burnsville, Minn. 55337.

University Sound Opens Midwest Warranty Repair Center

University Sound, Altec Sound Products Division, recently announced the appointment of *Electronic Engineers*, 1639 W. Evergreen, Chicago, as the midwest center for warranty repair of its electronic and musical sound products.

Weltron Acquired by LCA Corp.

The Weltron Company, Inc., manufacturer of home entertainment electronic products, has been purchased by LCA Corporation, a manufacturer of housewares, home furnishings and lighting products.

RCA Increases Prices of Mobile Communications Products

RCA Mobile Communications Systems increased the prices of its line of two-way radio communications equipment an average of 7 percent, effective September 15. ■

ELECTRONIC ASSOCIATION DIGEST

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

ISCET Technical Library

The International Society of Certified Electronic Technicians (ISCET) has established a technical library in Kansas City, Missouri.

The library, called ISCET TECH (Technical Electronic Clearing House), presently is being stocked with service literature for all types of old and contemporary electronic equipment.

Technicians who have service literature they would like to donate to the library or who are in need of service literature for an older model of electronic equipment are invited to contact the supervisor of the library, Henry Golden, CET, 8015 Paseo, Kansas City, Missouri 64131.

Indiana Attorney General Rules That TV License Board Has Authority to Regulate CATV Installers & Technicians

The Attorney General of Indiana, in response to a request from the Indiana Board of Television and Radio Service Examiners, has issued an official opinion that the Board has statutory authority to regulate CATV installers and technicians in that state.

Following this ruling, the Board of Television and Radio Service Examiners held a fact-finding meeting on June 12, to consider the licensing of CATV installers and technicians. Attending this meeting were representatives of the CATV industry in Indiana and the Indiana Electronic Service Association (IESA).

The IESA representative, Edward T. Carroll, CET, Indianapolis, told the Board that IESA favors the licensing of CATV installers and technicians.

The Board presently regulates electronic service business establishments and licenses TV and radio electronic technicians and installers of home antenna installations.

Illinois Association Changes Name, Requires Membership on Company Instead of Individual Basis

The Illinois Diversified Electronics Association, in a quarterly meeting in July, changed its name to *The National Electronics Service Dealers Association of Illinois* and adopted a new charter which requires that membership be on a company basis instead of individually.

The name of the Association was changed so that members could "more closely align" themselves "with the national association (NESDA) and to give quicker recognition to members wherever they may go in the country."

Indiana Association Elects New Officers

The Indiana Electronic Service Association (IESA), at a meeting on June 9, installed the following new officers: Elbert Powers, CET, president; Dean Moch, CET, Region 1 vice president; Harry L. Robbins, CET, Region 2 vice president; James Candler, Region 3 vice president; Wilmer Lundy, CET, Region 4 vice president; James Smith, Jr., CET, Region 5 vice president; Robert Smith, CET, Region 6 vice president; Claude Desmeules, CET, treasurer; and Edward Paquette, director at large. ■

the price for moving up to a sweep/function generator just came down to $149.50

Exact now offers a laboratory-quality sweep/function generator at a price you'd pay for less-useful sine-square oscillators. And you'll get so much more out of the new Model 195 than traditional audio test equipment, such as sine, square, triangle and swept waveforms . . . even pulses.

This new 2 Hz to 200 kHz instrument is the practical answer to many of your signal source needs, whether you're checking audio equipment, testing breadboarded circuits or teaching at the high school or college level.

An internal sweep generator lets you sweep, either linearly or logarithmically, the entire audio range of amplifiers or speakers without changing ranges or even touching a knob. The Model 195 has three 1000:1 sweep ranges for frequency sweeping plus high and low level sine outputs with amplitude control. Or you can control the frequency by an external voltage (VCF).

The Model 195 is completely portable, operated by a 9-volt transistor battery, so you can forget 60-Hertz hum problems altogether. An optional rechargeable power supply and charger permits continuous operation from Ni-Cad battery power.

This is a true instrument . . . developed by by one of the world's leading designers and manufacturers of laboratory function generators and frequency synthesizers. Find out what the Model 195 can do on *your* bench, and move up to a better source of signals.

Price: Model 195 $149.50
Optional rechargeable power supply, complete with battery and charger $25.00 f.o.b. Hillsboro, Oregon. Instruments stocked in 36 locations across the United States.

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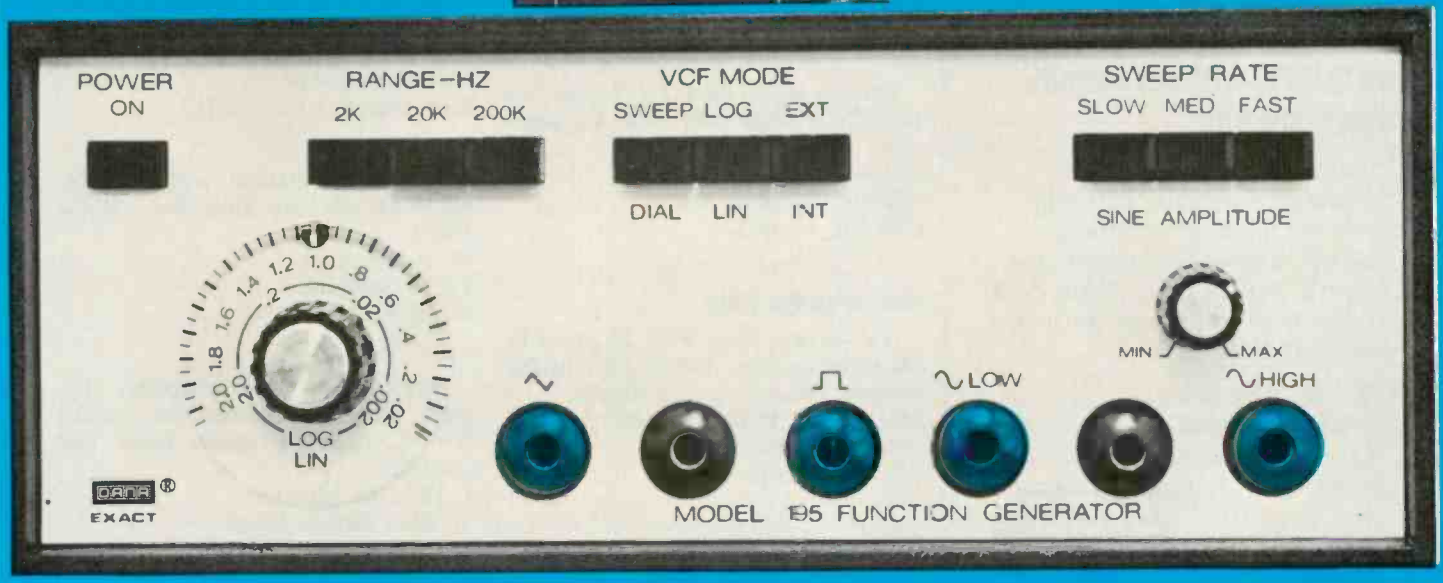

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Large inventory of antique tubes, still in the original "National Union" boxes. Also, an 8-inch Admiral table model TV, chassis 19A11S, manufactured in 1948, in working condition. Please write for details.
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CLIFF BURGESS
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Capacitor, approximate size 1½ inches by ⅜ inch. Value: .0005 mfd at 2 kv DC.
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Knight Tape Deck Models KG-415 or KN-4450.
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M. B. WARREN
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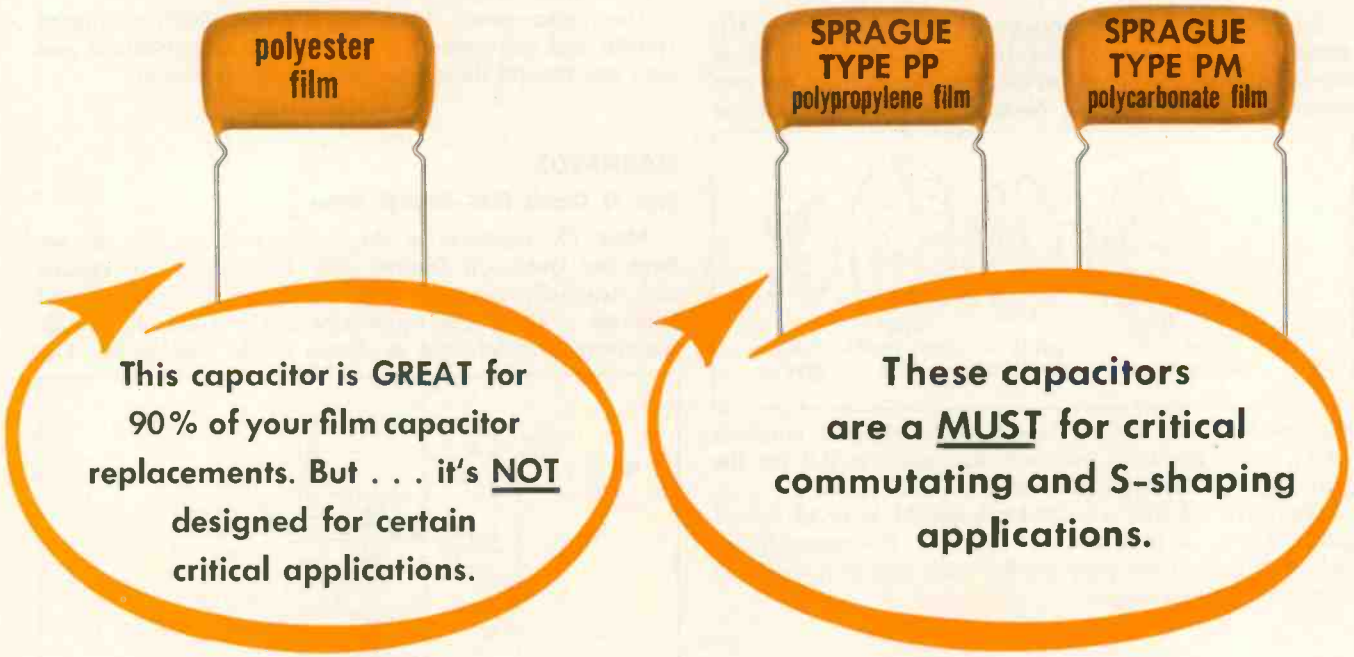
Pontotoc, Miss. 38863

Sanyo Motor, No. KR-M1004, for Steno-Phone Answering Machine.
MAR-SAL'S TV SERVICE
84A Farren Ave.
New Haven, Conn. 06513

Instruction manual and/or schematic for Seeburg Juke Box, Model 100 J.
H. R. PERKINS
11211 Sageland
Houston, Tx. 77034

Service data and schematic diagram for a Transwave Co., Model TW-50, AM/FM stereo tuner and amplifier.
J. HOWARD MILLER
32 Blue Juniata Drive
Lewistown, Pa. 10744 ■

Avoid serious trouble in color TV sets by using the right replacement capacitor!



The next time you replace a dipped tubular in one of the newer color TV sets, don't automatically assume you're replacing an ordinary every-day film or paper capacitor. If it happens to be a deflection capacitor used for commutating or S-shaping, you need a polypropylene or polycarbonate film replacement with (1) high a-c current-carrying capability; (2) close capacitance tolerance; (3) good capacitance stability. The standard replacement capacitors used in the industry, even our superior Type PS dipped tubulars, just won't do the job . . . and they could cause the set to become inoperative again.

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1.5 @ 150	±5%	.800 x .937	PM15-M1.5
.01 @ 400	±5%	.400 x .750	PP4-S10
.015 @ 400	±5%	.450 x .750	PP4-S15
.033 @ 400	±5%	.500 x .750	PP4-S33S
.06 @ 400	±5%	.800 x 1.250	PP4-S60S
.081 @ 400	±2%	.600 x 1.300	PP4-S81S
.2 @ 400	±5%	.700 x 1.700	PP4-P20
.0018 @ 600	±5%	.400 x .750	PP6-D18S
.0022 @ 600	±5%	.400 x .750	PP6-D22S
.0039 @ 600	±5%	.400 x .800	PP6-D39S
.01 @ 600	±5%	.500 x 1.250	PP6-S10S
.066 @ 600	±5%	.800 x 1.250	PP6-S66S
.075 @ 600	±5%	.750 x 1.250	PPS-S75S
.022 @ 800	±3%	.600 x 1.300	PP8-S22S
.047 @ 800	±5%	.700 x 1.250	PP8-S47S
.051 @ 800	±5%	.800 x 1.250	PP8-S51S
.0018 @ 1600	±5%	.500 x 1.300	PP16-D18
.002 @ 1600	±5%	.500 x 1.300	PP16-D20
.0033 @ 1600	±5%	.550 x 1.300	PP16-D33
.0039 @ 1600	±5%	.600 x 1.300	PP16-D39

For cross-reference information on close-tolerance polypropylene and polycarbonate film capacitors, showing original part numbers with correct Sprague replacements, ask your Sprague distributor for Cross-Reference Guide C-873, or write to: Sprague Products Company, 65 Marshall Street, North Adams, Mass. 01247.

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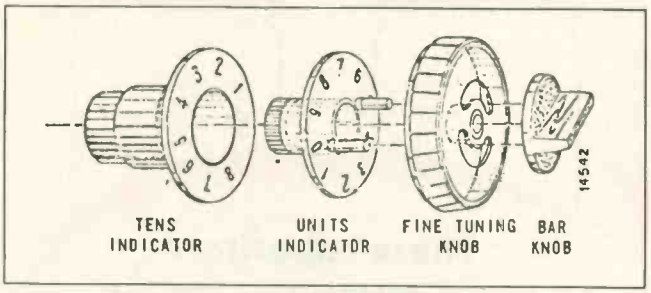
TECHNICAL DIGEST

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

ADMIRAL

Current TV Models—70 Detent UHF Tuner Selector Knobs

In the parts lists for models using the 70-detent UHF tuners, all four parts of the UHF selector are listed as knobs. Actually, as shown in the illustration, there are two knobs and two indicators. Notice that the *tens indicator*

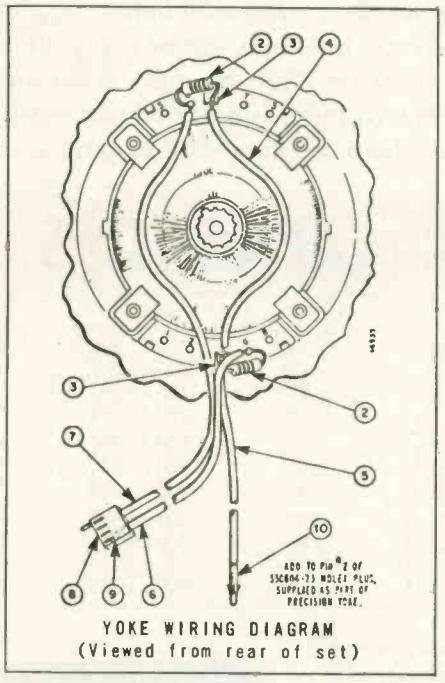


has numbers 1-8 for the tens digit of channel numbers 14-83, while the *units indicator* has numbers 0-9 for the *units digit* of the UHF channel numbers.

The UHF channel selector knob should never be forced past the ends of the band (14 and 83). It is possible not only to break off the posts on the units indicator, but also to break the tuner stops.

Color TV Chassis M10—Picture Tube/Deflection Yoke Replacement

The picture tube used in color TV receivers employing the M10 chassis have a precision yoke permanently bonded to the CRT. Replacement of the picture tube or deflection yoke requires changing the complete assembly. The



replacement picture tube, as supplied by the manufacturer, comes complete with the deflection yoke and wiring harness, except for the parts shown in the accompanying illustration.

When you replace the CRT assembly, remove the parts shown in the illustration and reinstall them on the replacement CRT after it has been mounted in the cabinet.

The CRT you return for warranty adjustment must be complete with exactly the same items that come with the replacement CRT you install in its place.

NOTE: Use a Molex pin extractor to remove the pin (Item 10) from the 12-pin Molex connector.

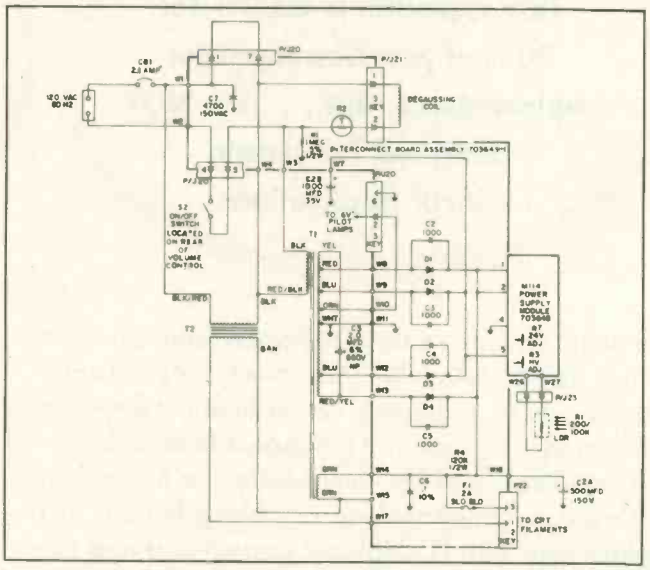
Do not attempt to reposition or remove the deflection yoke from the CRT, because it is permanently bonded to it and serious damage can occur.

The replacement CRT is supplied completely readjusted (purity and convergence) by the tube manufacturer and does not require these adjustments when installed.

MAGNAVOX

Color TV Chassis T995—Quick-On Wiring

Most TV receivers in this year's product line do not have the Quick-On feature. The T995 color TV chassis was originally designed with the Quick-On feature and contains a Quick-On transformer. The function of this transformer is defeated as shown in the illustration. The



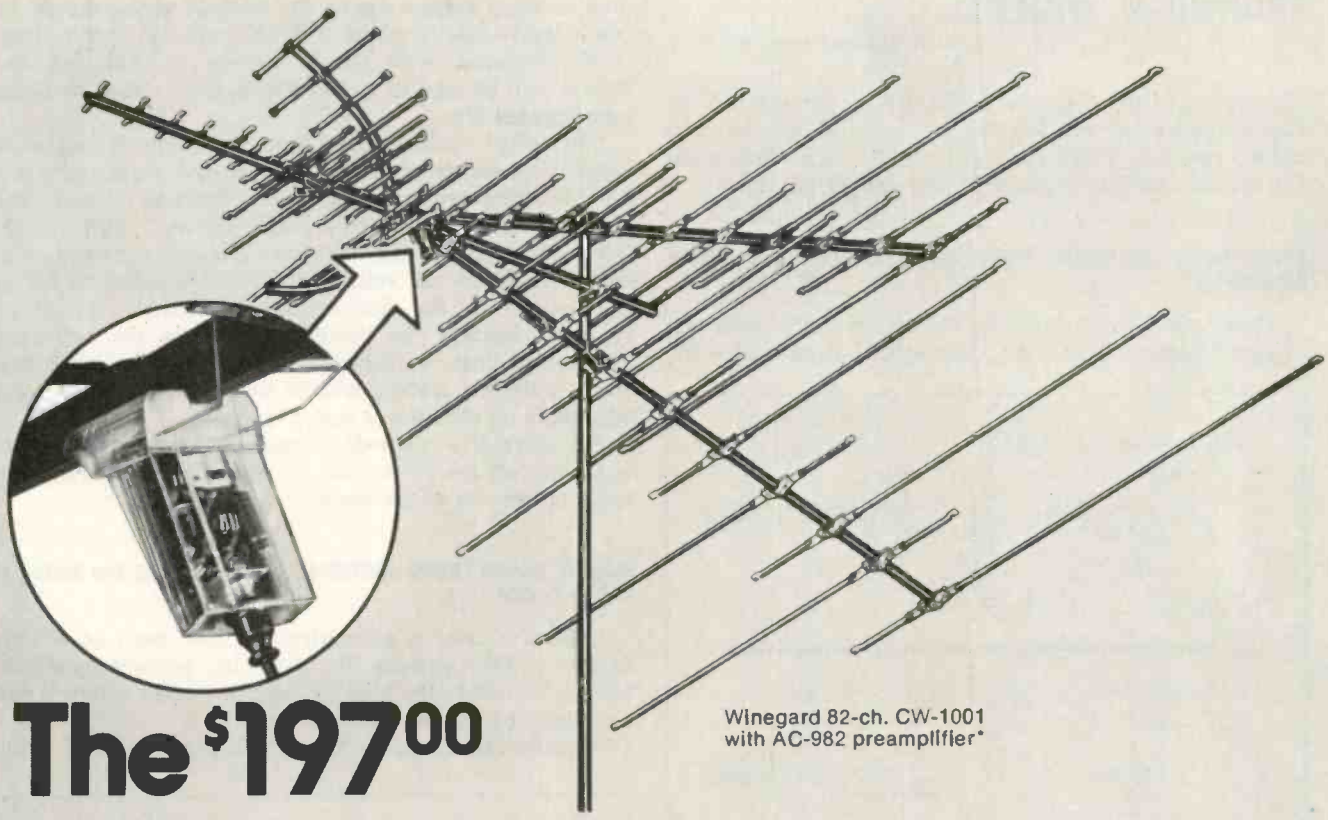
jumper wire from pin 1 to 7 on P/J 20 of the Interconnect board shorts out the primary winding of the Quick-On transformer, T2, and disables the Quick-On option. The filament voltage to the picture tube is provided by the bottom winding on the power transformer, T1 (Part No. 300316-1). However, the Quick-On transformer must remain in the circuit because its secondary winding serves as a load in series with the picture tube filaments.

In the near future, transformer T1 will be changed to part number 300316-2. At that time, the filament winding of T1 will be 6.3 v AC and will be connected to terminals W14 and W17 of the Interconnect board. Transformer T2 will be eliminated.

Color TV Chassis T995—Vertical Shading Bars

Vertical shading bars beginning at the left side of the raster and attenuating in density toward the center of the screen are caused by inadequate ground contact between the vertical and horizontal members of the chassis. This ground contact is made by a U-shaped clip on the vertical chassis member. When the chassis is placed in the upright position, this clip makes ground contact with the horizontal chassis near the flyback transformer. The problem may be corrected by simply bending the ground clip downward slightly to ensure its contact with the horizontal

continued on page 14



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*For VHF only, use CW-2002 with AC-913 preamplifier.

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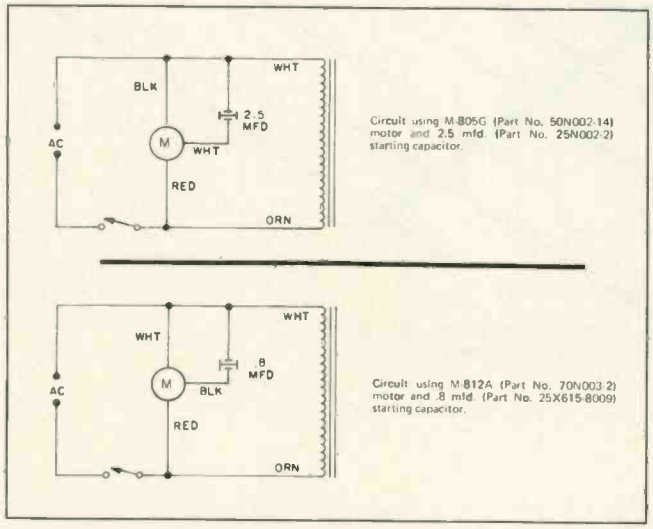
TECHNICAL DIGEST...

continued from page 12

member when the chassis is in the upright position. In the future, production will use two ground clips, one on each chassis member. These clips will contact each other when the vertical member is placed in the upright position.

8-Track Stereo Tape Players 1K8869/701404, 05, 06, 23, 24—Motor Replacement

These units are equipped by the manufacturer with one of two different motors and associated starting capacitors,



as shown in the accompanying illustration. Before ordering a replacement motor and/or starting capacitor for these units, determine which of the two possible motors and/or starting capacitors are used in the unit you are servicing and use the corresponding manufacturer's part number.

PHILCO-FORD

Monochrome TV Chassis—Service Check of Filament Diode Rectifier 34-8054-23

A number of Philco-Ford monochrome receivers have a solid-state rectifier connected in series with the series-string filaments of the tubes and CRT. (The present part number of this rectifier is 34-8054-23. The part number previously was 34-8054-7.)

Because of the action of this half-wave rectifier, the total rectified voltage across the filament string should be considerably less than the 115-120 volt AC line voltage. If the filament diode should become shorted, full line voltage will be applied across the filament string, reducing tube filament life.

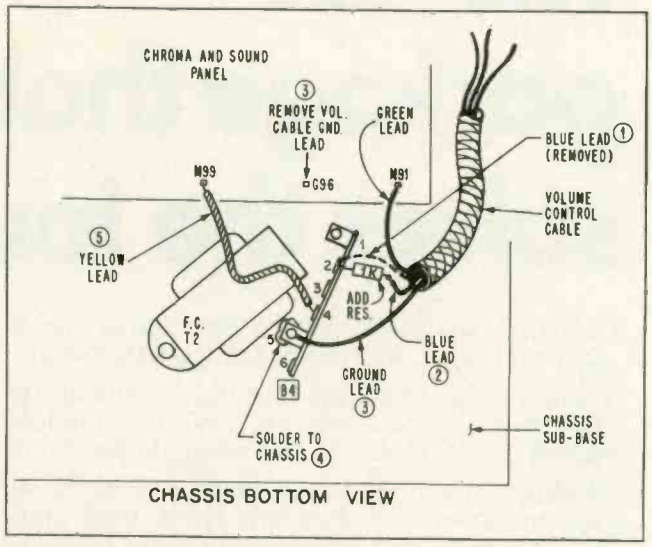
Philco-Ford recommends that the filament diode be checked whenever any tubes are replaced, particularly if a tube is being replaced because of filament failure. The diode can be checked by connecting an AC voltmeter between the output of the diode and ground (across the filament string). If the voltmeter reading is equal to or almost equal to the line voltage, the diode should be replaced. Because the rectified output of the half-wave filament rectifier is neither pure DC nor an RMS sine wave, a normal reading will be between 55 and 80 volts, depending on the type of meter used.

An alternative method of checking the filament diode is to turn off the power and measure the forward and reverse resistances of the diode.

Color TV Chassis 22QT80, 21KT40/41—Buzz or Hum at Low Setting of Volume Control

If hum or buzz is encountered at low levels of volume in any of these chassis, the following procedures should remove or reduce the hum or buzz to a point where it will no longer be objectionable:

1) Remove the blue lead of the volume control cable



from lug 2 on terminal B4.

2) Connect a 1K, ½w resistor between lug 2 and the blue lead.

3) Remove the ground lead of the volume cable from lug G96 on the PW panel and reconnect it to lug 5 (ground) on terminal B4.

4) Securely solder ground lug 5 on terminal B4 to the chassis, for improved mechanical grounding.

5) Dress the yellow lead connected between lug M99 (on PW panel) and B4-4 away from filter choke (T2) and at right angles to the choke core, as shown in the accompanying illustration. ■

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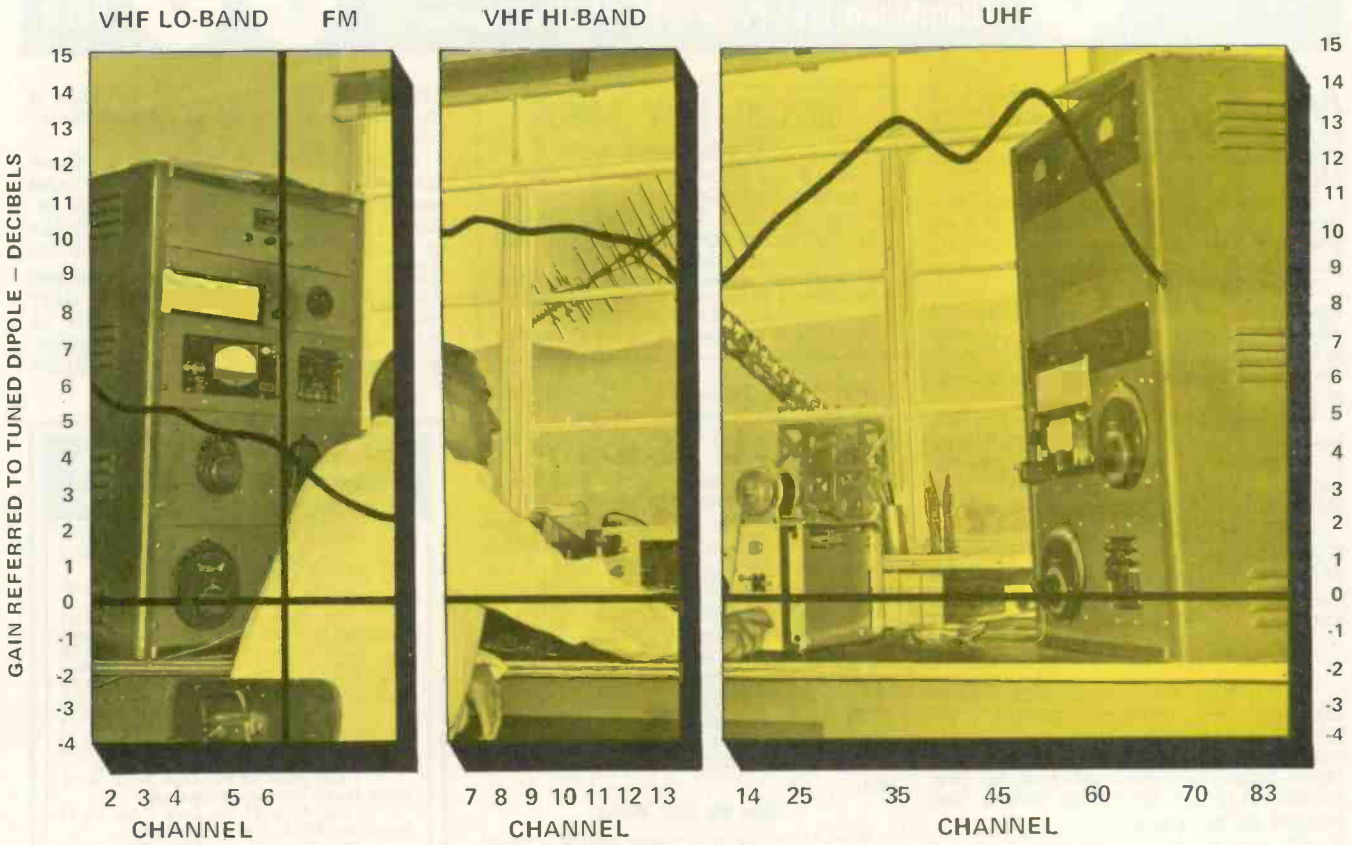

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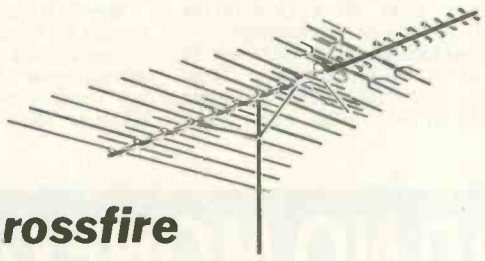

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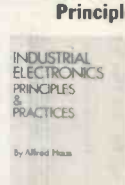

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A Realistic Approach To TV Tuner Troubles

Proper cleaning and lubrication plus tuner substitution techniques and knowing when to turn over the tuner to a specialist are the keys to profitable tuner servicing

By Al Friedman

■ The only real moving part in a TV receiver is the tuner. With families doing so much "channel hopping" these days, the tuner takes quite a beating. It's no wonder, then, that tuners account for so many TV troubles.

Unfortunately, tuner trouble is not particularly easy to spot. It's easy to mistake tuner troubles for IF or AGC troubles, and it is equally easy to mistake trouble in some other circuit for a tuner trouble.

The most common problem caused by tuners is a noisy, or "snowy," picture on one or more channels. Defective tuners can also cause complete loss of sound and picture, picture flashing, picture or sound distortion, picture pulling, or blanking of part of the raster.

The author is president of Chemtronics, Inc.

CLEANING AND LUBRICATION

Most tuner troubles are caused by dirty or corroded contacts. Therefore, if you suspect tuner trouble, clean and lubricate the tuner thoroughly.

Using an extender tube to spray into the hole that gives access to

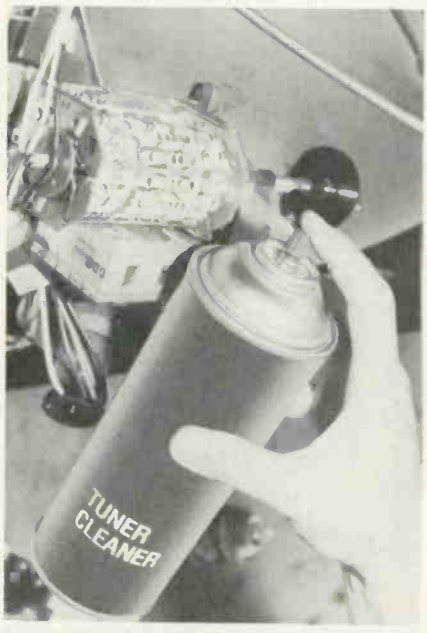
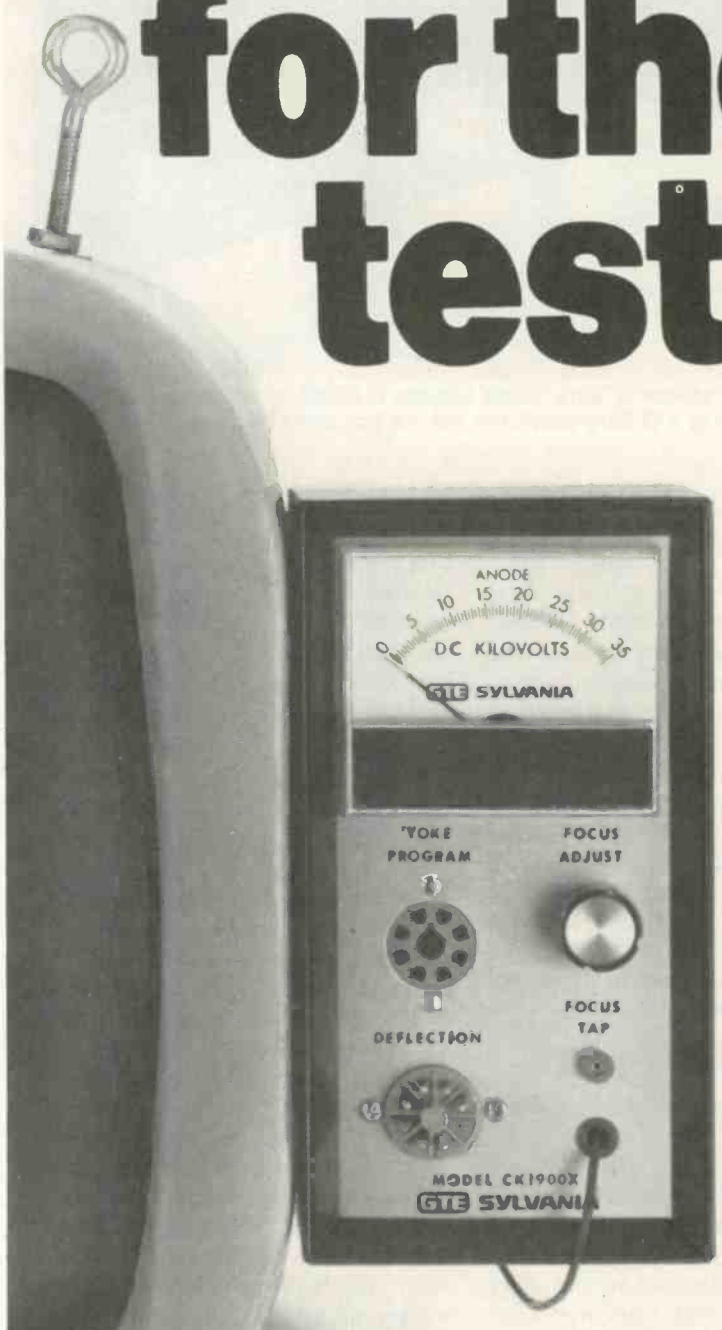


Fig. 1—The first step in proper tuner cleaning and lubrication: Remove the tuner, open it up and carefully spray all of the contacts with a tuner cleaner. Then wipe with a clean, lint-free cloth.

Fig. 2—The second step in proper tuner cleaning and lubrication: Spray all contacts with a cleaner/lubricant and then rotate the rotor a few times while checking to see that the stator contacts press against the rotor contacts with sufficient pressure to insure a positive contact and a good rubbing (cleaning) action.

New life for the old test jig.



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With simple modifications, you can give new life to your old test jig so it can handle sets with 350 to 500 μH SCR sweep, 1 and 3 mH for transformer sweep, or tube and hybrid sets with yoke inductances from 7, 12, and 16 mH. Instruction sheets and set-up manual are also included.

Ask your Sylvania distributor for more information.

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the tuning slug is not the best approach. Sometimes it does the job, sometimes it doesn't. Instead, remove the cover from the tuner and spray all contacts thoroughly. Avoid spraying neutralizing capacitors and other critical parts. Rotate the tuner as you spray, to make sure you hit all contact surfaces.

Cleaning and lubricating a dirty tuner is actually a two-step process. Start with an aerosol tuner cleaner, as shown in Fig. 1. Made primarily of freon or fluorinated solvents, these sprays "degrease" the tuner. That is, they dissolve all petroleum-based products such as oil, grease and the residue of tuner lubricants. Aerosol tuner cleaners also wash away dirt and dust and other foreign matter, leaving contacts clean and dry. If you can wipe tuner contacts after spraying with a tuner wash, do so with a soft, dry, clean, lint-free cloth. However, if tuner contact points are inaccessible, don't worry about it. Most tuner cleaners do an excellent job without wiping.

The second step in restoring a tuner is to use a cleaner/lubricant, as shown in Fig. 2. The most effective types of cleaner/lubricants contain silicons, or tiny, hollow, polishing particles. These particles clean contacts until they are shiny, then collapse to prevent abrasion of precious metals. They are excellent for removing sulfurization and corrosion.

Tuner cleaner/lubricants also contain a light, dry, chemically inert lubricant which protects tuner contacts, prolonging the life of the tuner. Laboratory tests reveal that ordinary tuners typically last about 18,000 revolutions before wearing to the point of causing snow in the picture. Properly lubricated tuners last about 40,000 revolutions (more than twice as long) before showing similar signs of wear.

Remember, even the best tuner cleaner is ineffective unless the contact points rub against something. It is the rotor rubbing the cleaner against the stator that produces cleaning action. In many tuners, it is very hard to see whether spring tension is adequate, but with barrel-type tuners, it's easy. Remove the barrel and check the contact springs. If the springs are bent down too far, use a small screwdriver or solder pick to bend them up again. While you have the barrel out, spray each contact strip and each spring with a washing spray. Wipe dry with a clean cloth. Then, re-spray with a good cleaner/lubricant.

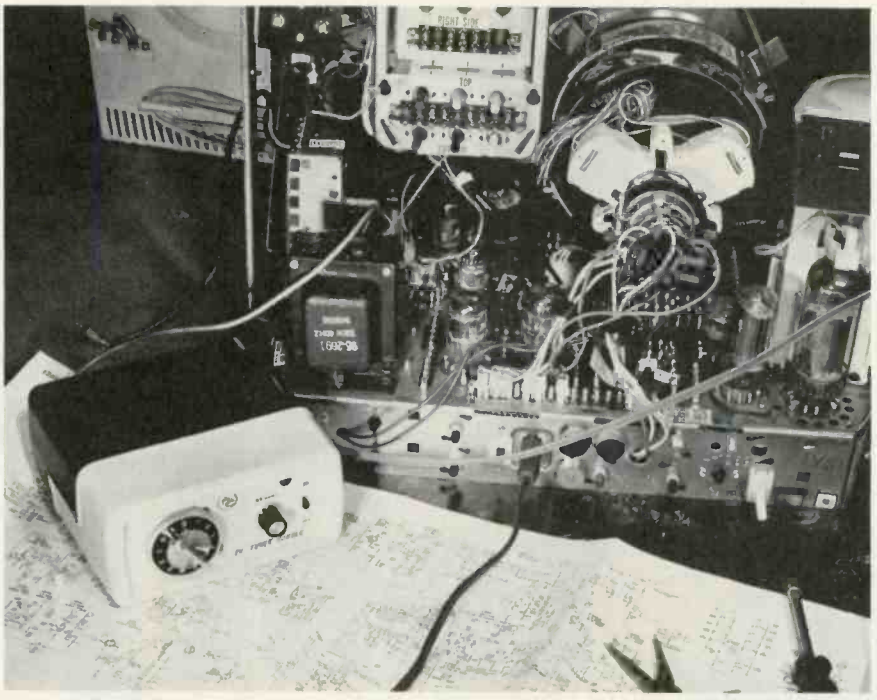


Fig. 3—Determining whether or not a trouble symptom is caused by a defect in the tuner is simplified by the use of a TV tuner substitution unit like that shown here. See text for detailed explanation of use.

In many cases, thorough cleaning restores tuners to like-new performance. Customers who complain of snowy pictures or that they have to wiggle the channel selector knob to get a good picture are pleased to find that you've "made their set operate like new again."

TUBE SUBSTITUTION

If cleaning and lubricating don't do the job, try changing the tuner tubes. Don't bother checking tuner tubes on a tube tester. RF and oscillator tubes frequently check good on a tester but fail to perform in a set. Tube substitution is the only reliable test. In fact, you may have to try several tubes from your caddy before you find one that really operates well.

One word of caution here: If tube substitution restores the tuner to working order, check out the defective tube on a tube tester anyhow. You might find that it is gassy or shorted. Shorted and gassy tuner tubes are often accompanied by a resistor that is burned completely open or the value of which has been changed because it has been overheated. Take a few minutes to make a careful visual check of all tuner resistors, to reduce the possibility of a callback.

TROUBLESHOOTING TECHNIQUES

So far, we have dealt with the two most common and easily spotted tuner troubles—defective tubes and dirty contacts. However, more difficult problems do arise. In fact, the tuner is probably the most difficult part of a TV set to service.

Substitution

When you do encounter a difficult TV tuner problem, your first step should be to isolate the problem definitely to the tuner. Otherwise, you might spend a lot of time poking around in the tuner when the problem actually is in one of the IF stages or in the AGC system.

In the past, the only reliable way to isolate a problem to the tuner was to substitute a known good tuner. Today, TV tuner substitution

units, such as that shown in Fig. 3, do the job better and more easily.

To substitute the tuner subber for the VHF tuner in the TV, disconnect the IF cable from the TV set tuner and connect it to the 40-MHz IF output of the subber. (Most subber manufacturers make this easy by supplying output extension cables.) Connect the antenna lead to the tuner subber input, turn the TV set on and switch through the channels. If the set operates normally with the subber connected, but not with its own tuner, it's a safe bet that the TV tuner is defective. If the subber does not restore normal operation, the tuner in the TV is probably operating normally and the trouble is the AGC, IF, or some subsequent stage. (Tuner subbers can also be used to check out AGC and IF stages.)

You can also check out a UHF tuner with a subber. UHF tuners in today's sets operate in tandem with the VHF tuner. That is, the VHF tuner provides B+ to the UHF tuner and 40-MHz amplification of the UHF tuner output. To localize a trouble to the UHF tuner, disconnect from the VHF tuner the UHF output cable and plug it into the appropriate jack on the tuner subber. Switch the VHF tuner to the "U" position. (The UHF tuner is supplied B+ only when the VHF tuner is in the "U" position.)

Then, connect the tuner subber to the IF cable of the TV and tune the UHF tuner to an operational channel. If the UHF tuner operates normally with the tuner subber but not with the TV VHF tuner, the problem is probably in the 40-MHz amplifier section of the VHF tuner in the TV. If the VHF tuner in the TV operates normally, but the UHF tuner doesn't, even when connected to the subber, the UHF tuner is probably defective.

Allow Yourself 15 Minutes to Find the Fault

Once you isolate the problem to the tuner, you have to decide whether to fix it yourself or to send it to a tuner repair specialist. Your customer might prefer that you fix the tuner yourself, because his set might be restored to operation sooner. On the other hand, tuner repair is not always easy, especially if you don't have the right equipment.

A good, general rule to follow is this: If you can't spot the tuner trouble within 15 minutes, send it to a tuner repair specialist. Otherwise, you might spend an hour or two of your time and then still have to send in the tuner. Besides, your time is worth more than the $10-$15 you pay to have a tuner rebuilt.

Quick Checks

Use your 15 minutes for a quick, visual check of the tuner components. You might notice a relatively obvious problem. Then, use a test socket to make voltage and resistance checks at each of the tube pins. A low value of plate or screen voltage is usually an indication that a capacitor in the plate or screen circuit is leaky or shorted, or that a series resistor has changed value.

Incorrect voltage at the mixer grid means that the oscillator is not operating. The mixer grid voltage in a tube-type tuner usually is between −1.5 to −3.5 volts DC. One of the most common causes of oscillator failure is a faulty plate load resistor. Also, be sure to check out the balun in the tuner input, which is another common source of trouble.

Even if you find the faulty component within 15 minutes, your troubles might not be over. Exact replacement parts for tuners are not always easy to obtain. And some tuner electrical components also are very hard to obtain.

Solid-state tuners, UHF tuners and foreign-built tuners are particularly difficult to service. You're probably better off sending these tuners to a specialist after only the most superficial checks.

Repair Precautions

When replacing tuner components, cut lead lengths to match exactly those of the original part. Solder in the new part very carefully, keeping all lead dress exactly as you found it. Moving coils or leads even a little can cause serious detuning, especially in UHF tuners.

PREPARING THE TUNER FOR SHIPMENT TO A SPECIALIST

If you do decide to send the tuner to a tuner repair specialist, remove it very carefully. *Don't* unsolder leads. Clip them carefully, leaving a little of each colored wire on the terminals. Otherwise, you'll have to mark each lead or make a drawing which shows where each lead is to be connected when the tuner is reinstalled.

Don't send mounting brackets with the tuner. Remove the brackets and fasten them securely to the chassis.

Do send the tubes along with the tuner. Remove them from their sockets, wrap them carefully and package them so they won't break. If you don't send the tubes, or if the tubes break in transit, the tuner repair specialist will have to substitute new ones.

PROFITABLE PREVENTIVE MAINTENANCE

Every tuner should be cleaned and lubricated *at least* once a year. You should offer to perform this service on every call you make.

Whether the original problem was a faulty tuner or a burned out fuse, your first responsibility is to get the set operating again. Once you've accomplished this, simply ask the customer if he or she wants the tuner cleaned. Explain that you will do a thorough, two-step job of degreasing and then lubricating his tuner, so that it will once again operate smoothly.

The charge for this extra service should be $4.00 to $6.00. Normally, it will take you about 10 minutes and 50 cents worth of spray (washer and cleaner/lubricant) to do the job properly. Most customers are willing to pay for this extra service because the results are so obvious. The channel selector turns more smoothly and "snow" tends to "melt" away.

Don't skimp on the sprays you use. Use high-quality electronic chemicals. The few cents you think you save using so-called bargain sprays are definitely not worth what you will lose in call-back time and reputation. ■

New in Color TV for 1975 – Part II

By The ET/D Editorial Staff

Last month, in the first of a series about the new color TV's for 1975, the composition and general features of the 1975 color TV lines were presented. Beginning in this, the second part of the series, the new and significantly changed circuitry in the chassis of each manufacturer's new line will be analyzed, starting with General Electric

■ Six chassis are used in GE's color TV line: The YA and MC chassis are new, modular, all-solid-state types. (The design of the "M" series chassis is similar to that of the MA chassis, which was introduced in 1973.) The MB-'75 and QB are carry-over chassis with some circuit changes. Chassis CD and HE are carry-over hybrid types without any significant changes. Many of the YA circuits are similar to those in the JA/QA chassis.

Modules in which major circuit modifications have been made have been assigned new catalog reference numbers to provide identification in the field.

YA CHASSIS

The new YA chassis employs seven plug-in modules, on which are contained approximately 90 percent of the electric components in the TV receiver.

All five of the integrated circuits used in the YA chassis plug into sockets, to simplify troubleshooting of the chassis. (An additional IC is used in the Automatic Color Averaging and 3.58-MHz subcarrier circuits, compared to the four used in the JA/QA chassis.) Other components which plug into sockets include the audio- and horizontal-output transistors, the high-voltage rectifier and the B+ and AC fuses.

Some of the circuits in the YA chassis are almost identical to those in the discontinued JA and QA chassis. (These chassis were equipped with a large, "standard" circuit board. Adaptation of the "basic" JA and QA chassis to the different sizes of picture tubes and nonstandard features of the various models in which these chassis were used was accomplished by plug-on modules.)

Quadline™ Picture Tube

The new Quadline™ picture tube used with the YA chassis is equipped with a shorter in-line gun assembly, a slotted shadow mask

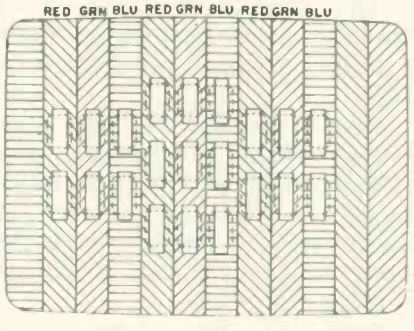


Fig. 1—Front view of the Quadline™ picture tube screen showing "exploded" representations of vertical phosphor stripes, electron beams and matrix openings. *Courtesy of General Electric.*

and a phosphor screen with alternate red, green and blue vertical stripes of phosphor which extend from the top of the screen to the bottom (Fig. 1). In addition, a light-absorbing layer of black material (called a black matrix) is deposited on the inside of the faceplate. This layer has tiny, rectangular open areas (represented in Fig. 1 by the staggered rows of groups of three rectangles) through which the three in-line electron beams excite their respective phosphor stripes. The electron beams (represented in Fig. 1 by broken lines) are *larger* than the matrix openings in the *horizontal* direction and *smaller* in the *vertical* direction.

The gun assembly of the Quadline™ picture tube is smaller because the need for a convergence yoke assembly has been eliminated by the use of a toroidal-wound yoke which is equipped with windings for both deflection and dynamic convergence. Elimination of the convergence yoke assembly, in turn, has eliminated the need for convergence pole pieces in the in-line gun assembly, thereby making possible a shorter picture tube neck.

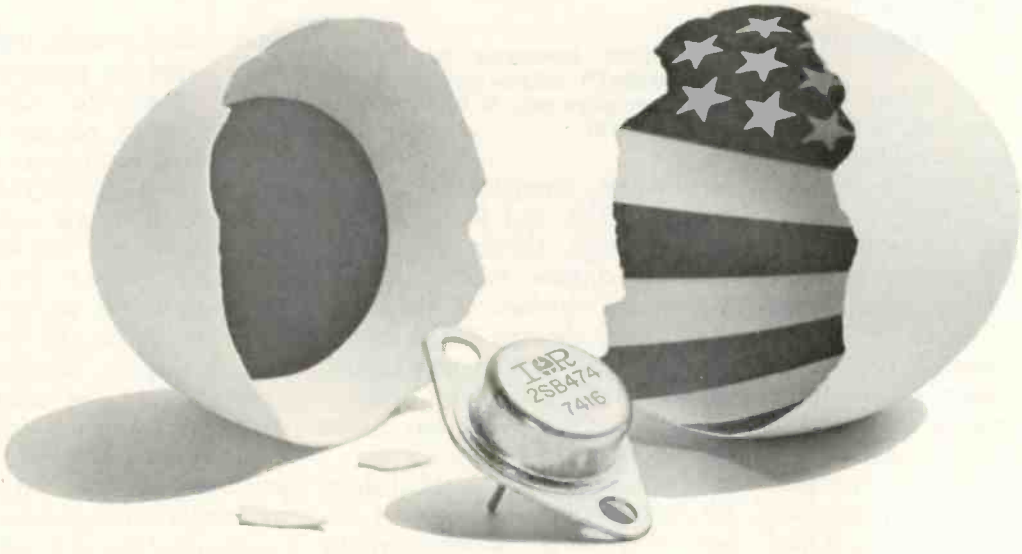
The purity and static convergence magnets have been combined on one assembly, which is positioned on the picture tube neck so that the *static* convergence magnet pole pieces are placed over the space between the focus electrode and second anode.

The arrangement of the phosphors in vertical stripes has eliminated purity problems caused by misregistration of the beam in the vertical direction. Consequently, purity correction is required only in the horizontal direction. (To avoid decentering the raster vertically, move the purity magnet tabs an *equal* amount, and not more than 45 degrees from the vertical plane.)

The purity magnet/static convergence assembly has two sets of static convergence magnets. These are used only for static convergence at the center of the screen. (The convergence at the edges of the raster is accomplished by four dynamic adjustments on the convergence module.) The two magnets of one set move the corresponding *outside* beams *vertically* (Fig. 2A), and the two of the other set move the corresponding outside beams *horizontally* (Fig. 2B).

The small scanning lines on the screen and the horizontal rows of slots in the aperature mask can visually "beat" together, causing intensity modulation which produces weaving lines called *moiré*. If the moiré pattern is too noticeable,

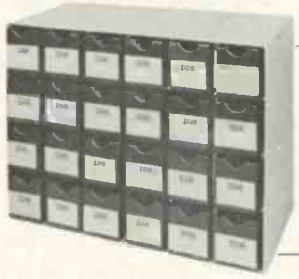
How to crack the Japanese original equipment transistor problem.



Until now, there wasn't much you could do about the long delays in getting original transistor replacements for Japanese TV and audio equipment. IR has changed the picture. Now you can speed customer service with IR's DK22 Kit of 31 OEM transistors most often called out by Sony, Panasonic, Hitachi, JVC, Pioneer and Toshiba, and for many sets made in Japan for Sears, Penney's, Montgomery Ward and others.

These are not "Universal Replacements." They are exactly the same parts used in original equipment. They're made in Japan, but are now as close to you as your local IR Distributor. Each DK22 Kit contains one each of the 31 types listed in the box at right to put exact replacements right at your fingertips.

Last year, more Japanese-built TV's were sold in this country than any single U.S. brand. And the same transistors are used in Japanese stereos, tape recorders and other entertainment equipment. Crack this fast-growing, lucrative service market with a DK22 Kit. Call your local IR Distributor today. You'll get a $42.78 value for only $34.23 . . . less than the price you'd pay Japanese factory distributors.



DK22 Kit Japanese Transistors:

2SA495	2SC281B	2SC535B	2SC710
2SA564A	2SC372	2SC536	2SC717
2SB186	2SC373	2SC537B	2SC772
2SB187	2SC380AO	2SC538A	2SC828A
2SB367A	2SC403A	2SC633A	2SC829B
2SB405	2SC454B	2SC634A	2SC838
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slight adjustment of the HEIGHT control should reduce it. Adjusting the FOCUS control for good highlight focus will moderate any tendency of moiré at the edges of the raster.

YA VHF Tuner

The VHF tuner used in this chassis is a turret type equipped with a MOSFET amplifier, as in the JA/QA color TV chassis. The VHF input impedance of the tuner is 75 ohms.

Custom Picture Control

A new *Custom Picture Control* is featured in conjunction with the *One-Touch Color* system on many of the large and small-screen receivers in GE's 1975 color TV line, including those which are equipped with the YA chassis.

The One-Touch Color circuit consists of the color, tint, and brightness control circuits. These same circuits are used whether the TV set is placed in "manual" or "automatic" operation (determined by the position of the *Auto* button), but *separate sets of controls for each function* are used in the two modes of operation. If the "automatic" controls are switched in, the "manual" controls are switched out of the circuit, and vice versa.

The *Custom Picture Control* permits balanced adjustment of contrast, brightness and color. Once each of the controls have been adjusted for the desired ratio of contrast, brightness and color, this ratio will remain constant during subsequent adjustments of the *Custom Picture Control.*

A differential-pair gain-control circuit is used in the video amplifier circuit. This circuit allows DC control of video amplification, permitting the *Custom Picture Control* to vary the contrast, brightness, and color simultaneously.

The DC-controlled gain circuit used in the YA chassis is shown in Fig. 3. It consists of a current source (transistor Q325), a differential pair (Q320 and Q330), and a DC feedback circuit, which includes transistor Q335. Transistor Q325 is the current source for both Q320 and Q330. When Q320 and Q330 conduct equally, one-half of

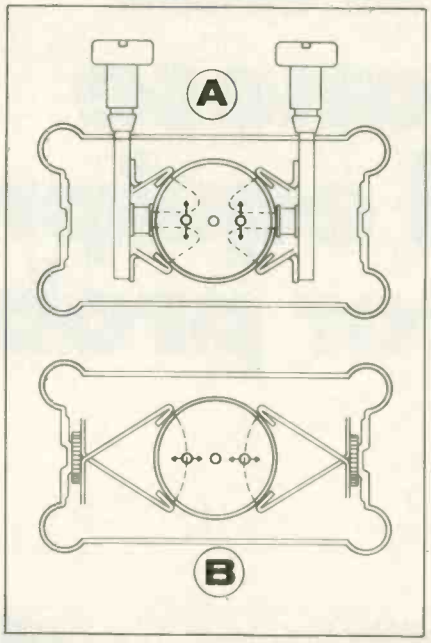

Fig. 2—Static convergence magnets used with Quadline™ picture tube. A) Vertical static convergence pair. B) Horizontal static convergence pair.

the current through Q325 flows through Q320, and the other half flows through Q330. The video signal is coupled to the base of Q325, and one-half of the video signal flows through Q320 and is bypassed back to the power supply, but the half that flows through Q330 is coupled to the final video stages.

The bias of Q320 is fixed at about 7.7 volts, but the voltage at the base of Q330 is controlled by the setting of the *Custom Picture Control.* When this voltage is low, Q330 conducts very little and the majority of the video signal is bypassed through Q320 to the power supply. The signal fed to the final video stages will be small, and the picture will have low contrast. When the voltage is high, Q330 conducts more, and most of the video signal will be fed to the final video stages, and the picture contrast will be high.

The collector of Q330 is connected to the base of Q335, and the emitter of Q335 is connected through resistor R343 to the base of Q330. This inverse DC feedback stabilizes the operation of the circuit.

The DC restoration circuit (Fig. 4) includes capacitor C348, diode Y345, resistor R352, and the

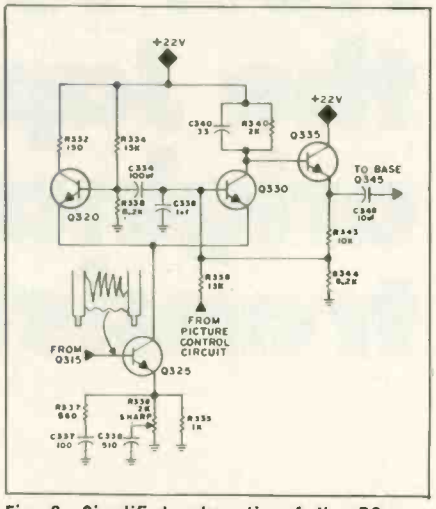

Fig. 3—Simplified schematic of the DC-controlled gain stage used in General Electric's JA color TV chassis. *Courtesy of General Electric.*

BRIGHTNESS control. The composite video signal has positive-going sync pulses. Capacitor C348 charges through Y345 on the tips of the sync pulses and creates a DC voltage at the base of Q345 which is proportional to the peak value of the sync pulses. This DC voltage, along with the AC video signal, is amplified by the succeeding stages. Since the circuit operates on peak sync pulse value, the amount of DC restoration can be more than 100 percent because the voltage difference between the sync pulse tips and the black level varies with signal amplitude. For example, if the video signal has a 2-volt p-p value, the voltage between the pulse tips and black level is 0.5 volts. If the video signal drops to 1 volt p-p, the difference between the pulse tips and black level is only 0.25 volts. If the black level was set properly on the 2-volt p-p signal, the picture will appear too dark on the 1-volt p-p signal. Resistor R352 "softens" the DC restoration and allows capacitor C348 to charge closer to the actual black level. This alleviates the problem of excess DC restoration. The BRIGHTNESS control varies the voltage at the junction of R352 and R391, allowing the screen black level to be set according to the customer's preference. The BRIGHTNESS CENTERING control, R374, varies the range of the BRIGHTNESS control.

The *Custom Picture Control* circuit, Fig. 5, provides a means of

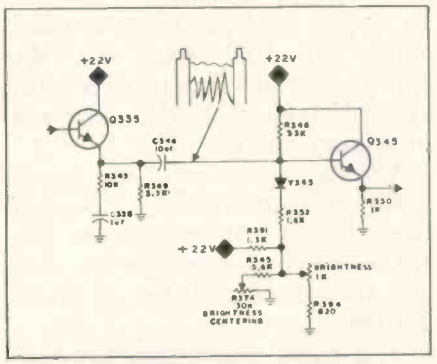

Fig. 4—Simplified schematic diagram of the DC Restoration Circuit used in General Electric's JA color TV chassis. *Courtesy of General Electric.*

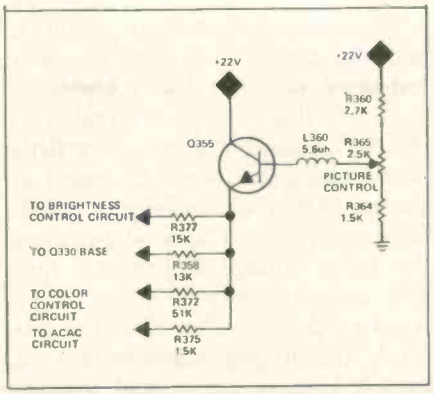

Fig. 5—The Picture Control Circuit provides a method of varying a DC voltage which controls the ratio of video gain, chroma gain, brightness, and the Automatic Color Averaging Circuit (ACAC). *Courtesy of General Electric.*

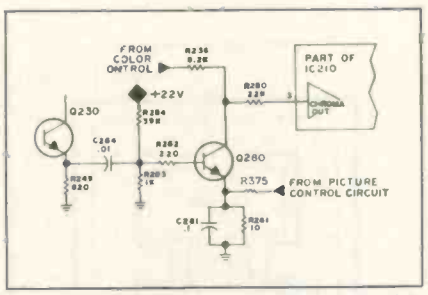

Fig. 6—The Automatic Color Averaging Circuit (ACAC) employed in the General Electric JA color TV chassis detects the average amplitude of the chroma signal and adjusts the chroma gain to provide a more consistent color level. *Courtesy of General Electric.*

varying a DC voltage which controls video gain, chroma gain, brightness, and the Automatic Color Averaging Circuit (ACAC). These circuits are all DC-controlled and are interconnected by resistors R358, R372, R375, and R377, in the emitter circuit of Q355. The *Custom Picture Control* is connected to the base of transistor Q355 by coil L360. Changes in the base voltage of Q355 are fed to the video, chroma, brightness and color averaging circuits through Q355 and the resistors.

Automatic Color Averaging Circuit (ACAC)

Color intensity variations from channel to channel are partly improved by the Automatic Color Control circuit (ACC). The ACC circuit operates on the burst level, and the ratio of burst to chroma level is not the same from channel to channel; consequently, some color variations continue to be present. The YA chassis has a second automatic correction circuit to minimize these variations. It is called the *Automatic Chroma Averaging Circuit (ACAC).*

The ACAC circuit detects the average amplitude of the chroma signal and adjusts the chroma gain to provide a more consistent color level, as shown in Fig. 6. The base of the ACAC transistor, Q280, receives the chroma signal from the emitter of Q230. The collector of Q280 is connected through R280 to the color control terminal of integrated circuit IC210. Resistor R283 and R284 cause the base of Q280 to be biased below its conduction point. The emitter of Q280 is coupled to the *Custom Picture Control* circuit by R375, allowing the *Custom Picture Control* to set the threshold point at which Q280 will conduct. When the chroma signal at the base of Q280 reaches the threshold point, Q280 will conduct and its collector voltage will decrease, lowering the voltage at pin 3 of IC210. This decreases the color gain. The circuit time constants are such that instantaneous color level changes will not change the gain. Only long-term changes will cause the circuit to operate, and the average color level will be more consistent.

"M" SERIES CHASSIS

The design of the "M" series chassis is similar to that of the basic MA chassis and includes the following features:

- "Grouped" construction of the main chassis, which permits removal of individual functional assemblies.
- Plug-in connectors, used in interconnecting wiring.
- Easy access to components, test points and adjustment controls.
- Individual plug-in modules.

Service Adjustment Controls (MC and MB-'75 Chassis)

The service adjustments are placed in the same locations as they are on the MB chassis, with the following exceptions on the MB-'75 and MC chassis.

- The SERVICE SWITCH is eliminated, and the gray scale is set up by viewing the full raster.
- The CHROMA SET, RANGE, and TINT CENTERING controls have been eliminated because of the AUTO-ADJUSTMENT controls, which are customer accessible.
- A new regulation circuit, which is non-adjustable, eliminates the HIGH-VOLTAGE control.

Circuit and Component Modifications (MC Chassis)

A new version of the Low-Voltage Regulator Module, No. EP93-X80, is used in the MC chassis. A diode and capacitor have been added to provide a different 200-volt source, which is necessary in the MC chassis circuitry. This module will function in early "M" series chassis, but the older No. EP93X43 module will *not* function properly in an MC chassis.

The power supply will be stocked as a complete assembly, but the new power transformer will be available separately.

The Video Low Level Module, No. EP93X74, supercedes the EP-93X38 version used on the MB chassis.

A new Signal Interconnect Board is used on the MC chassis, to accommodate the new secondary controls and the 200-volt B+ distribution circuits. The new board is *not* interchangeable with other "M" boards because of the deletion of the High-Voltage Regulator Module.

A new Vertical Module, EP93-X75, replaces previous versions of the vertical module. Many changes have been made in the vertical circuitry, to provide better reliability. The new vertical module can be modified for use in earlier chassis

by clipping open one lead of 1-megohm resistor R730, to electrically remove it from the circuit.

Constant Voltage Power Transformer (CVT) (MC Chassis)

The power supply assembly in the MC chassis physically resembles that in the MB chassis, but a closer inspection will reveal a number of changes. The CVT power transformer is taller than a conventional type and it has a 3.5-mfd, oil-filled, AC capacitor strap-mounted (with two screws) to the right side of the power supply chassis.

The constant voltage power transformer self-regulates all of its secondary voltages. Its primary and secondary windings are loosely coupled by assembling the windings to separate legs of the core, as shown in Fig. 7. The regulating circuit consists of an additional winding connected to the secondary of the transformer, with an AC capacitor shunted across both of the windings.

For self-regulation, a power transformer must operate in a non-linear manner. The secondary voltage must not change even though the primary voltage changes. This is accomplished with the constant voltage transformer, shown electrically in Fig. 8. The primary and secondary windings are isolated by winding them separately, with magnetic shunts between them. When a voltage is applied to the primary winding, current flows and flux is established, as in the conventional transformer, but, in addition, the shunts establish a path for some of the primary flux to return to the primary without coupling to the secondary, and for some of the secondary flux to return to the secondary without coupling to the primary. This isolates the primary from the secondary winding. When a capacitor is shunted across the total secondary, a capacitive current will flow through the entire secondary winding and a flux will be established which will add in-phase flux with the primary flux under the secondary winding. This action causes the core under the secondary winding to saturate without saturating the core under the primary winding, making the device a non-linear transformer. Under a normal load, the saturated secondary will maintain a constant output voltage over a wide range of primary voltages, and the unsaturated primary does not draw excessive line current.

If AC line voltage is applied to the MC chassis through a variable auto-transformer, the AC output at the secondary of the power transformer will be a sine wave when the input voltage is between zero and approximately 2 volts. When input voltage is increased above this level, the output waveshape is a modified square wave, and remains so, with only increases in amplitude, as the line voltage increases to 130 volts AC.

With 70 volts AC applied to the primary of the transformer, its core under the secondary winding is nearly saturated, and the 140-volt DC supply is 80 percent of its rated value. At 105 volts AC, the core is saturated and remains saturated during any further increases in primary voltage.

Voltage regulation of the power supply is approximately 3 percent from 105 volts AC to 130 volts AC. If the line voltage changes, the output voltage will stabilize in about 1.5 Hz.

This power transformer provides high attenuation of high-frequency voltage surges that enter the primary winding.

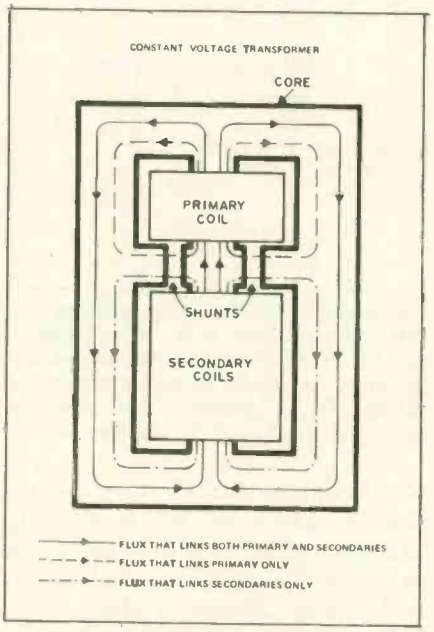

Fig. 7—The primary and secondary windings of the Constant Voltage Transformer are loosely coupled by assembling the windings to separate legs of the core. *Courtesy of General Electric.*

Troubleshooting the Low-Voltage Power Supply (MC Chassis)

If the correct meter is not employed when measuring the square-wave AC output voltages of the CVT, incorrect meter readings will be obtained. The AC circuits used in VTVM's read peak or peak-to-peak voltages, regardless of the waveform of the voltage being measured. When measuring a square-wave voltage, the RMS scale of a VTVM will be inaccurate, because it was calibrated for a sine wave. The peak-to-peak VTVM scale is accurate, but it is not a normal practice to use this scale when measuring power transformer voltages.

Use a meter that will accurately measure the *RMS* of any AC voltage. Since this feature usually is found only in laboratory type meters, the next best is a VOM, which is usually non-peak-reading and measures the *average* value of an AC voltage. (All AC voltages in the MC chassis are measured with a VOM and will be marked and so

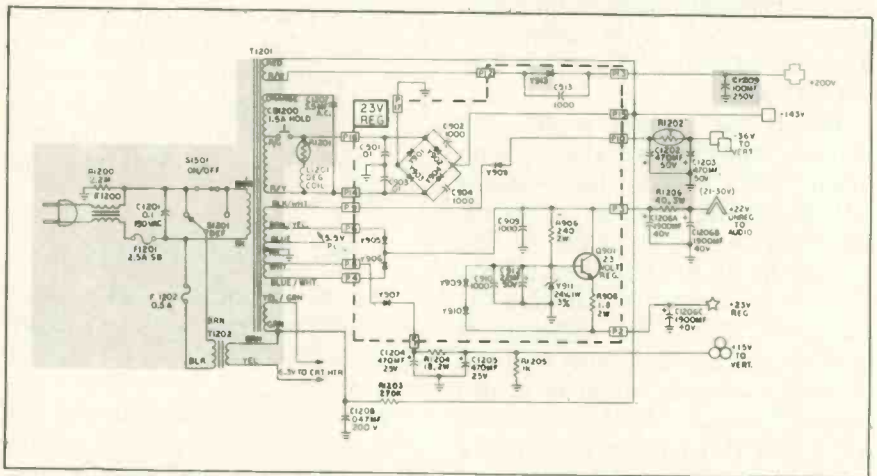

Fig. 8—Schematic diagram of the power supply used in General Electric's MC color TV chassis. *Courtesy of General Electric.*

indicated on the MC chassis schematic diagram.)

High-Voltage System (MC Chassis)

There are significant differences between the high-voltage system in the MC chassis and that used in the MB chassis. These differences are found in the high-voltage generation and regulation circuits, which produce 30 kv of picture tube second anode voltage.

A quadrupler is used for the high-voltage multiplier, instead of the tripler used in the MB chassis. The quadrupler functions the same as the tripler, except that there are two additional diodes and capacitors in the multiplier, to produce the higher level of second anode voltage needed by the picture tube used with the MC chassis.

Boost Voltage Source (MC Chassis)

Another diode at the input of the high-voltage multiplier (same as Y1661 in the MB chassis) rectifies the negative portion of the flyback pulse to produce a voltage at Terminal 6 of T1700, which is filtered by C1602, R1626 and C1661 (Fig. 9), to achieve the 650 volts from the flyback system. The voltage is then boosted by 200 volts through R1628, to produce a total boost voltage of 850 volts. This replaces the function of Y1601, R1602 and C1602 in the MB chassis.

High-Voltage Regulation (MC Chassis)

A saturable reactance high-voltage regulator system is used in the MC chassis, eliminating the need for the Error Amp/High-Voltage Regulator Module used on the MB chassis.

Regulation of the 30-kv second anode voltage is achieved by the Saturable Reactor, T1704, which has three separate windings, as shown in Fig. 9. The control winding is in series with the primary of the high-voltage transformer (T1700) and the 143-volt DC supply to the collector of the horizontal-output transistor, Q1701. A second winding is in parallel with the primary winding of the high-voltage transformer, and the third winding is in series with the horizontal coils of the deflection yoke.

When current flow is increased through the control winding, saturation increases in the core and the inductance of each of the three windings is reduced. If the current is reduced, the inductances will increase.

If the load on the horizontal system is increased by increasing the brightness level of the picture, current flow is increased through the high-voltage transformer primary and the control winding of T1704. The increase in current increases the saturation of the saturable reactor core, thus lowering the inductance of the shunt winding. This, in turn, lowers the total primary circuit inductance, because the primary and shunt windings are in parallel. The lower inductance of the primary circuit shortens the retrace time. This narrows the flyback pulse and increases its amplitude, to maintain a constant high voltage. The inductance of the series winding is also lowered when core saturation is increased. This lower impedance in the yoke circuit increases the yoke current, to maintain correct sweep width. If the brightness is reduced to decrease the load on the horizontal system, the opposite of the preceding occurs.

Because of capacitive effects in the saturable reactor, the control winding has a tendency to ring. Capacitor C1708 lowers the resonant frequency of the control winding, to minimize ringing, and diode Y1701 clamps any residual pulses.

The 143-volt supply is filtered by capacitors C1702A and C1702B and coil L1702. An interlock, between the bridge rectifier and the filter, is opened whenever the high-voltage transformer is disconnected from its receptacle. This protects transistor Q1701 from having 143-volts applied to its collector through the shunt winding of transformer T1704. Resistor R1711 limits current through the shunt winding, and the ferrite bead on the emitter lead of Q1701 suppresses a small "hausen" at the left side of the screen.

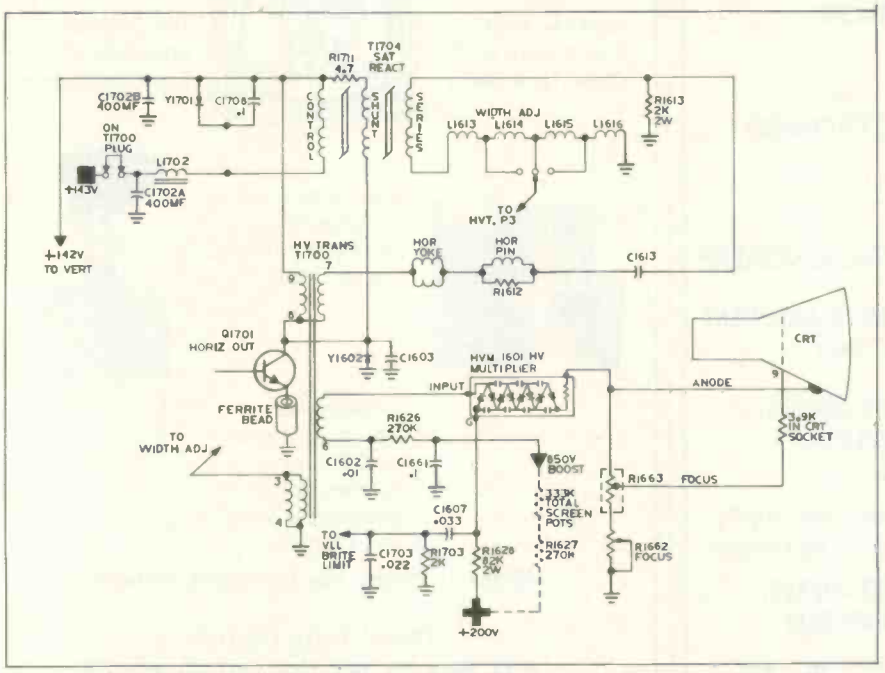

Fig. 9—Schematic diagram of the high-voltage system used in General Electric's MC color TV chassis, which generates and regulates 30 kv of second anode voltage. *Courtesy of General Electric.*

Boost Voltage Regulation (MC Chassis)

Boost voltage regulation is achieved in the MC chassis by selecting the correct value of resistor R1628 (82 K-ohm, 2w). Beam electron flow is through two paths: One is through the anode, the multiplier, the tertiary winding, R1626, all of the screen controls and R1627. The other path is through the anode, the multiplier, the clamp diode and R1628. Since the resistance of R1628 (82 K ohms) is less than the total resistance of the other electron path (873 K ohms), most of the beam current will flow through R1628. When the beam current increases, boost voltage increases, but the B+ voltage added to the boost is reduced by the volt-

age drop across R1628 (caused by the increased beam current), and the total boost voltage is regulated.

The width of the picture is adjusted by selecting the proper tap on series-connected coils L1613, L1614, L1615, and L1616. These coils replace width coil L1613 in the MB chassis.

Because the high-voltage regulation circuit causes the width of the picture to remain constant, the picture height also must be regulated, to maintain the correct aspect ratio. The 23-volt regulated supply provides a "stiff" regulated current source through R730 to the collector of Q702.

Picture Tube

Picture tube type 25VDCP22 is used in the MC chassis. It is constructed of special X-ray absorbent glass "tailored" to the high-voltage capability of the chassis.

You will find X-ray glass certification bars molded in the glass on the funnel and face panel of the picture tube.

Replace the picture tube only with a tube of the same type and number with the three molded bars on the face panel and funnel.

QB CHASSIS

The QB chassis is the next generation of the QA chassis. The QB, like the QA chassis, features all-solid-state circuitry, a HORIZONTAL CENTERING control, and 100-percent restoration of the video signal.

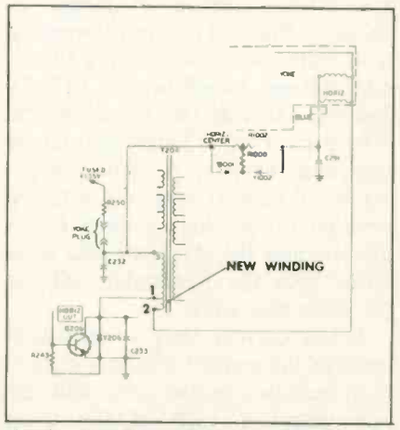

Fig. 10—Simplified schematic diagram of the new high-voltage transformer used in the QB chassis. *Courtesy of General Electric.*

Only the 19-inch (diagonal) screen size is offered in the QB line.

The picture tube second anode voltage has been increased to 29.5 kv, and is not adjustable. The horizontal circuitry remains relatively unchanged from that in the QA chassis, although there are some minor modifications to the high-voltage transformer. A new winding is added to the high-voltage transformer (between pins 1 and 2), as shown in Fig. 10. Also, coil L1000 and resistor R1001, a network in series with the yoke, have been eliminated.

The output of the vertical amplifier has been increased to meet the sweep demands made necessary by the increased high voltage. The vertical amplifier is directly coupled to the yoke. To increase the current applied to the yoke, the voltage swing across the yoke has been increased. This is accomplished by increasing the B− (to −33 volts) and replacing the vertical-output transistor pair with transistors capable of handling the increased voltage swing. ■

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Balancing Channels In MATV Systems

By James E. Kluge

For consistently good picture quality from channel to channel, the signal levels of individual channels must be balanced relative to each other

■ Complaints about poor picture quality from an MATV system can, in a large number of cases, be attributed directly to an unbalanced signal-level condition somewhere in the system. The importance of balancing, or equalizing, signal levels in multichannel MATV systems cannot be overstressed. Carelessness and/or lack of concern in establishing and maintaining a close balance between channel-to-channel signal levels will, more than likely, cost you some rework, callback time and possible follow-on business.

The Importance of Equalization

Equalizing the signals in a multichannel MATV system is important, necessary, easily accomplished and should not be ignored or in any way underestimated by the designer or installer.

Balancing signal levels, or equalizing as it is sometimes called, is essential to good color-TV picture viewing from an MATV system.

Most MATV systems include one or more amplifiers somewhere in the system. Depending on the system size, complexity and the reception area, the system may include antenna preamps, booster couplers, single-channel AGC amplifiers, distribution amplifiers, line-extender amplifiers and, finally, the TV set itself.

Types of Attenuation

Signal levels in the system will be attenuated by 1) cable and tilt compensators as a function of frequency, by 2) splitters as a function of splitter loss, by 3) any component through which the signal must pass as a function of feedthru loss, and by 4) taps as a function of isolation loss. Amplifiers in the system may have a built-in slope control, or tilt compensator, which varies the amplifier gain as a function of frequency.

All of these effects cause wide variations in signal levels from channel to channel throughout the system (i.e., from antenna to tap). By maintaining relatively close balance at every juncture in the system, the signal levels will be easier to control and maintain.

Antenna/Headend Equalization

For best results, initial equalization should be accomplished somewhere between the antenna and the first multichannel or broad-band amplifier. Typically, equalization is accomplished at the headend, ahead of any distribution amplifiers. If done properly, from that point on only tilt compensators should be required.

If antenna preamplifiers are required, try to use single-channel preamps; otherwise, see to it that the signal levels at the preamplifier input are reasonably uniform (i.e., within 6 dB).

Many of the amplifiers used in MATV systems have a relatively narrow range of input levels. Exceeding the maximum input causes cross modulation or sync compression, either of which deteriorates picture quality. Too low an input level tends to deteriorate the signal-to-noise ratio and fails to take advantage of the maximum output capability designed into the amplifier. With unbalanced channel levels applied to the input of a broad-band amplifier, one channel could be overdriving the amplifier, while another channel is well below the amplifier's maximum input-signal-handling capability.

Keeping the levels of all the channels balanced ideally to ±1 dB but at worst to within 6 dB of each other, particularly at the input of any amplifiers, will assure fewer problems, higher efficiency and a better overall performance from the MATV system.

Antenna

Signals from the antenna might vary widely depending on the antenna gain, orientation, distance from the transmitter and reception conditions (i.e., weather, terrain, or time of day). The "antenna" might consist of 1) several antennas oriented in various directions, 2) a single broad-band VHF/UHF antenna, 3) a stacked array of single-channel antennas or 4) a combination of any of these. In multiple-antenna arrays, some antennas might require preamps to boost weak signal levels. Strong local signals might have to be attenuated, to bring their levels more into line with the preamp outputs.

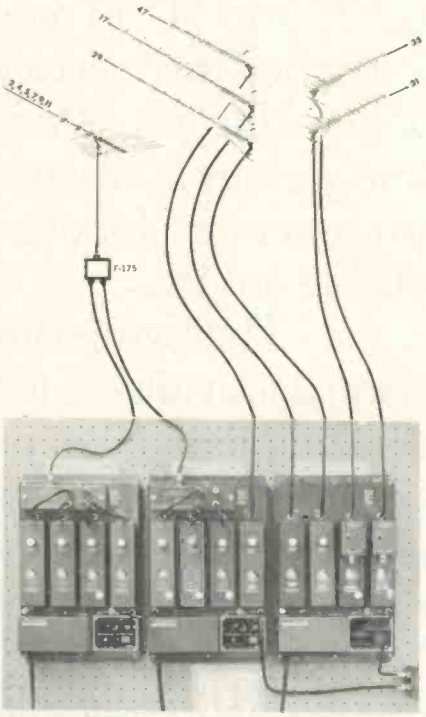


Fig. 1—Ultra-Plex® headend, comprised of power panels and strip amplifiers, offers unlimited capability to number of channels received or TV sets supplied in MATV systems. Signal separators split both low-band, high-band and UHF signals four ways, for strip-amplifier inputs. VHF/UHF separator coupler combines VHF and UHF outputs into one 75-ohm trunk line.

The author is a technical editor for the Winegard Company

Headend

Some signal balancing at the antenna might be desirable in small systems not equipped with a headend. Where a headend exists, route the signals from the antennas and/or preamps to the headend location. At the headend, each channel should be separated and equalized with plug-in pads, to bring their levels to within ±1 dB of each other. Then they can be amplified using single-channel strip amplifiers and then recombined for distribution throughout the system. If properly done, all the signal levels at the output of the headend will be within ±1 dB of each other.

Distribution

From here on, all the signals travel over a single coaxial cable which attenuates the high-frequency channels more than the low-frequency ones. Tilt compensators will adequately correct this type of unbalance. The next amplifier may be a line-extender or it may be the tuner in the TV set. If it's the tuner in the TV (a "single-channel" amplifier), most sets have AGC and accept a wide range of input-signal levels. However, for good-quality TV, voltage levels supplied to the set should not be below 0 dBmv (1000 microvolts) or exceed +40 dBmv, although many sets can handle levels as low as −20 dB or as high as +50 dBmv (316 mv).

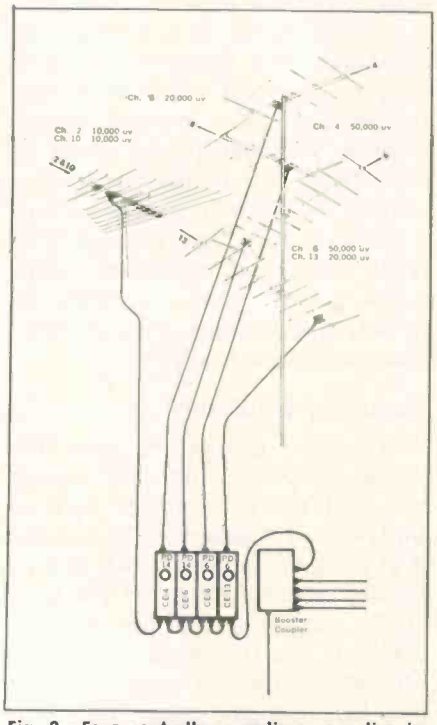


Fig. 2—Four controller equalizers equalize individual signals from separate antennas cut for channels 4, 6, 8 and 13 and combines them with signals from channels 2 and 10 off VHF broad-band antenna. The combined signal fed to the booster coupler, after factoring the coupling losses and insertion losses, consists of six channels, each at a level of approximately 5000 microvolts, for a total of approximately 30,000 microvolts (30 dBmv).

On the other hand, broad-band amplifiers are not equipped with AGC (unless a pilot carrier is employed). AGC is commonly used in tunable or single-channel amplifiers, but in broad-band amplifiers, in which more than one channel is amplified, the AGC circuit would have no way of knowing which channel it should control. Because all channels go off the air from time to time, a pilot carrier serves as an AGC reference level.

Line-extender amplifiers fall in the category of broad-band amplifiers, are usually not equipped with AGC and cannot tolerate as much input-signal-level variation as amplifiers equipped with AGC. In these applications, it becomes imperative that all channels be reasonably balanced. If all channels leaving the headend are balanced and AGC'd, then cable loss is the only significant factor contributing to channel-to-channel unbalance. By employing tilt compensators at the line-extender inputs, channel balance is maintained and the distribution system requires no other equalization.

Tilt Compensation

Tilt compensators inserted ahead of the line-extender input will compensate for signal tilt caused by nonlinear cable attenuation (i.e., higher losses at the higher frequencies). Having just the opposite characteristic, tilt compensators attenuate the low-frequency channels more than the high-frequency channels. If the system were initially equalized, this restores the balance to all channels. After each several hundred feet of coaxial cable, signal tilt should be corrected.

Failure to compensate for tilt results in the low-band levels being excessively higher than the high-band levels. Such a condition might overload a broad-band amplifier at the low-band frequencies. Sometimes, in an attempt to find a solution to this problem, uniform attenuation (pads) or larger amplifier spacings are employed to drop the level of channel 2 down to the amplifier input-level capability. Neither method provides a positive solution; instead, the use of pads attenuates *all channels,* including the high bands, which are already too low, and larger amplifier spacings simply aggravate the signal-tilt situation. Either approach to the problem causes the high-band signals to exit the amplifier at a level well below its maximum-output-capability level. This represents an inefficient use of line amplifiers plus causes low average line levels, both of which are detrimental to good MATV quality and performance.

Antenna Equalization

Variations in channel-to-channel signal strengths at the antenna are many and varied. Most problems can be corrected by proper selection of antennas and application of preamps or couplers.

Stacking identical single-channel antennas will increase the capture area, front-to-back ratio and gain. It will also narrow the beam width, to reduce fading and ghosts.

Employing an antenna-mounted preamp can bring a weak, distant channel up to the levels of local channels.

Channel-control couplers permit multiple antennas to be coupled into a single downlead. Any coupled antenna receiving an excessively strong local signal can then be padded down to a level comparable to the others by inserting, in the channel-control coupler, one of eight values of plug-in attenuator pads, which range from 0 to 20 dB of attenuation.

Headend Equalization

In cases where equalization at the antenna is not feasible, it should be accomplished at the headend or at least at a point preceding the first broad-band distribution amplifier. Equalizating at this point has the added advantage of being able to correct for the nonlinear attenuation of the coaxial downlead at different TV frequencies. For long downleads, tilt compensators might have application.

For example, Winegard offers

MATV designers three choices of methods to equalize signals ahead of the distribution amplifier(s). Each method allows you the flexibility to choose the exact value of attenuation for each channel received after the equipment has been specified and installed. By selecting one of eight values of plug-in attenuators, signal levels can be balanced to a closely predetermined value.

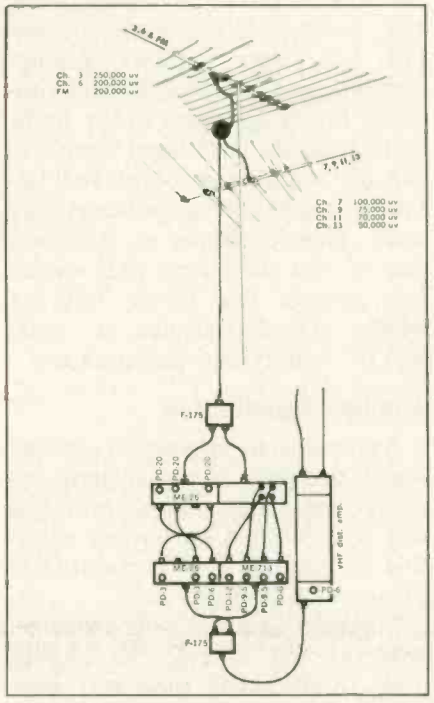


Fig. 3—Mixer equalizers are used to balance the levels of signals from two differently oriented VHF antennas. One mixer equalizer (ME-26) is factory tuned for channels 7, 9, 11 and 13. ME-26's, hooked up back-to-back, provide the necessary 20 dB-plus attenuation required. All high-band channels require less than 20 dB attenuation, so signal separator (DSX-SP) is used to provide four outputs to ME-713. Hi/lo-band separators (F-175) split the two bands and then recombine them for equalization of channels.

Ultra-Plex® Panels

Ultra-Plex®, one of the three Winegard methods, is a solid-state, 82-channel, modular, plug-in distribution system. It gives the installer flexibility and complete signal control. Signal equalization is accomplished by inserting attenuator pads into the single-channel or broad-band strip amplifiers (Fig. 1). Using single-channel amplifiers, any individual channel may be attenuated in eight steps, from 0 to 20 dB, by inserting the appropriate pad.

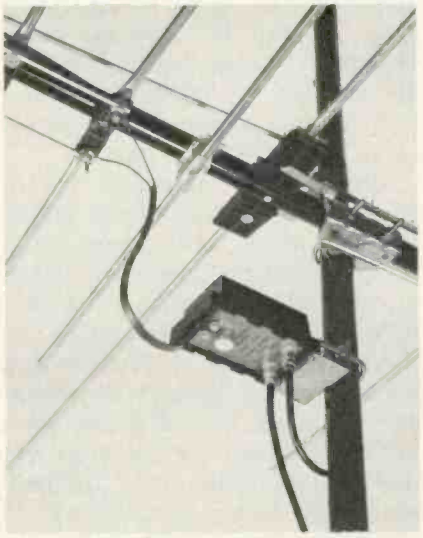


Fig. 4—Channel-control coupler attaches to antenna boom or mast and couples the signal from any single-channel VHF Yagi antenna to another VHF-FM antenna. Plug-in pads attenuate signal from one coupled antenna, to balance it with level of signal from the other. All signals are combined at the output and fed to a single coaxial downlead.

Ultra-Plex® consists of a power panel with provision for plugging in one to four single-channel strip amplifiers (or broad-band amplifiers or converters). Input to each strip amplifier provides for a plug-in attenuator pad, making signal balancing simple. Unless single-channel antennas are employed with individual downleads, a four-way signal separator, mounted on the power panel, splits the multichannel signal from the single antenna downlead and feeds it to each strip amplifier input. Because they are single-channel amplifiers, they will only accept the channel to which they are tuned (and part of the adjacent-channel bandpass), excluding all others. Their outputs are combined in the power panel and made available at the output jack. For monitoring purposes, the combined outputs are attenuated 40 dB and made available at a monitor jack. A booster panel, in a similar configuration, will accommodate four plug-in, non-AGC strip amplifiers, to provide, when needed, single-channel preamplification ahead of *Ultra-Plex®* power panels. Strip-amp outputs on booster panels are not combined; they are jumpered directly into the power panel. Additional power panels, coupled together, will accommodate as many channels as are available.

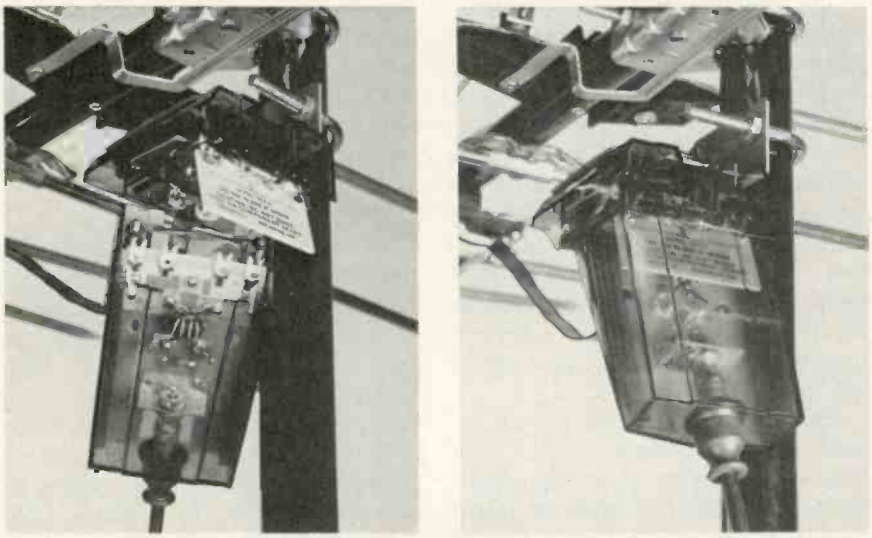
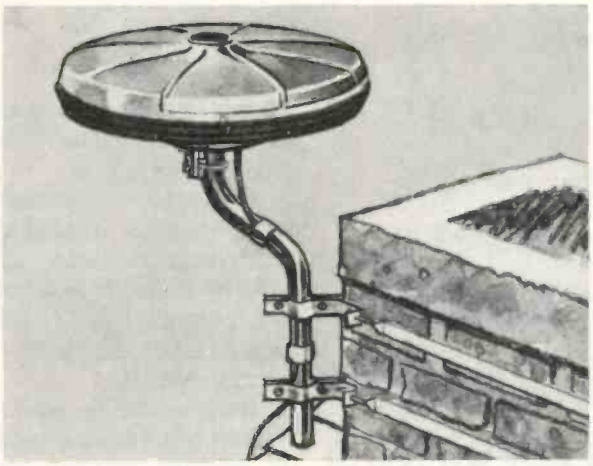


Fig. 5—VHF/FM cartridge traps at the antenna may be used to attenuate, by 15 dB, any VHF channel or FM station, to better balance signal levels at the antenna. A) Cartridge trap partially removed. B) Cartridge trap in operating configuration.

Controller Equalizers

A second method of equalizing signals employs controller equalizers (CE's). CE's accept two inputs, one of which must be a single TV channel to which the unit is factory pretuned (Fig. 2). The level of this single channel can be controlled within the range of 0 to 20 dB attenuation by one of eight plug-in attenuator pads. The coupling input, because there is no provision to attenuate it, should be the weaker signal of the two and may come from another cut-to-channel antenna or a broad-band antenna. After padding down the level of the stronger signal to the level of the

continued on page 57



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TV Antenna System

Electronic Security Systems - A Natural For Electronic Servicers

By Charles Eisenhardt

Intimate, in-home contact with consumers plus his recognized expertise in electronics make the servicer a natural marketer and installer of consumer electronic security systems

■ Crime in the United States has become a statistician's dream come true, and if you like statistics, you'll love crime. A burglary is committed every 13 seconds in the United States, and in 1973, nearly 2½ million homes and businesses were victims.

Throughout 1973 and to date in 1974, the demand for security and the protection of both citizens and property has been expanding beyond the commercial category and is becoming an important consumer product.

This is not to say, however, that you can hang an electronic security product on a rack and expect the consumer to buy it like a set of head phones or a new TV set. Security and protection are *negative* thoughts to typical consumers, and they are not stimulated or motivated by the thought of protection like they are by a new appliance, automobile, or fur coat.

Electronic security equipment is something that must be *sold,* and sold by someone in whom the consumer has confidence. Enter the electronic service dealer.

Because the homeowner and businessman today is thinking security and accepting it as a fact of life, the opportunity is at hand for you to expand your business into the electronic security field.

Many service dealers have responded to the challenge and have taken the time to familiarize themselves with basic electronic security systems and components and their installation.

The principal problem encountered by service dealers is that they have had to purchase directly from one or more of the several leading manufacturers of electronic security equipment on a trial and error basis, and could find no advice or assistance available to them locally. Undoubtedly, many electronic dealers who did not have the time or the willingness to "learn" the electronic security business simply abandoned the idea as "something better off left to the specialists."

INSTALLATION INFORMATION

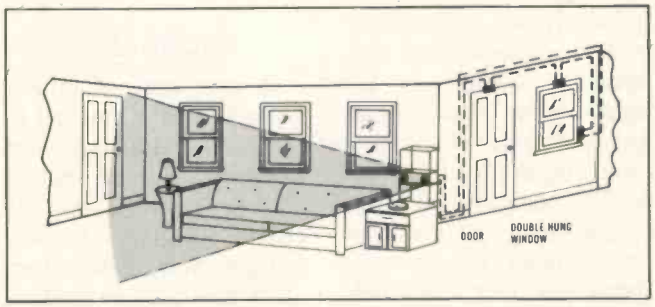
Throughout 1973, however, progress was made in making installation information and alarm equipment more readily available to the electronic service dealer by encouraging the electronic wholesale distributor to accept security equipment as a logical addition to his stock and inventory.

Distributor participation has not been nationwide by any means, so if you do not recall seeing security equipment at your local distributor, it's no surprise. Some distributors have tried stocking a few alarm *components* which they felt were representative of all security equipment, and as such, would provide the technician with "enough" for most jobs. This is not a realistic approach, and can be compared to stocking a single *type* of replacement tube, TV antenna, or stereo speaker. Other distributors handle a single *brand* of security equipment, which is a variation of the component idea except that all of the accessory components are designed for use with the basic alarm control, and must be purchased separately. If one part is out of stock, the system cannot be completed. Here, once again, the equipment in question is designed for an "average" situation, with the result that the installation might be more or less than that actually required.

A third type of distributor approach to electronic security is the series of do-it-yourself type items packaged in see-through packs, which are designed to stimulate impulse response at the consumer level. Such displays also are found in hardware stores, home improvement centers and do-it-yourself departments of major retailers.

The electronic service dealer, being a professional in his own trade, should, of course, continue to associate himself with professional equip-

The author is vice president of PLC Electronics Inc.



Shown here is an example of a packaged electronic security system for use in small businesses and residences. A) Components included in the package. B) Illustration of the intended application of the system, which provides both space and perimeter security.

ment in all facets of his business, including the sale and installation of security equipment.

EQUIPMENT

In the latter part of 1973, many electronic distributors came to realize that there was a growing demand for security equipment and a desire on the part of more and more electronic dealers to obtain information on the installation of alarm equipment. Among the questions in need of answers then, and now, are:

- What type of equipment should be used?
- Is there a difference between residential and commercial security?
- How much does good equipment cost?
- How long will it take to complete the installation?
- How much should I charge for the installation?
- Will I need special tools?

If these are questions you would like to have answered, the chances are your local wholesale distributor can be of some assistance, if he is an authorized distributor for a *total packaged protection system* product line.

In such a line, a series of basic but varied alarm systems are prepackaged for the electronic dealer. A typical system includes:

- Alarm control cabinet
- Tamperproof indoor/outdoor bell
- Alarm circuit wire (minimum 500 feet)
- Indoor horn for fire
- Standby battery
- Magnetic sensors, for doors and windows
- Panic/emergency buttons
- Remote-controlled on/off stations
- Time-delay trip light
- Heat sensors, for fire detection
- Low-voltage, plug-in power supply
- Mounting hardware
- Warning decals
- Full one-year warranty
- Complete step-by-step instructions.

Complete, electronic security *packaged* systems which include all of the components needed for an installation are now available from many wholesale distributors. The electronic service dealer should familiarize himself with them.

Estimating

Manufacturers of these professional, packaged security systems also offer detailed literature suggesting methods of estimating the cost of the installation as well as the approximate installation time for a complete system. While bidding is not a normal requirement for most electronic security jobs, the service dealer usually is better off following the suggestions and guidelines for pricing outlined by the manufacturer.

Space vs. Perimeter Types

Security equipment is designed to detect unauthorized entry. Certain types of equipment such as microwave, ultrasonic and sound detection, among others, are categorized as *space detectors,* because they detect *movement* within the protected *area.*

The most basic type of alarm security protection is that called *perimeter* protection, or the physical wiring of each door or window to detect and warn of any attempt at forced entry, while it is still in progress. This type of system is also available in a wireless version, which uses small radio controls that are mounted at or near each door and window. These transmit a signal to a receiver unit centrally located within the protected premises. As with all types of alarm systems, it's only the end result that counts. Some requirements can be satisfied by the ringing of a bell just outside the building, while others might require greater alarm noise, such as sirens, or even flashing lights. A direct connection to a neighbor or the authorities is also important in security, and one way this can be accomplished is with an *automatic emergency telephone dialer.*

Automatic Emergency Telephone Dialer

For years, the only direct connection to the police or fire department from the protected premises was through a leased telephone line. The leased line is generally connected to a central station board which is monitored 24 hours a day, and the customer pays a mileage charge for the telephone line in addition to the monthly charge for the alarm system. This form of protection is costly and the installation can be delayed for several months because of the continuing shortage of telephone lines. The *automatic emergency telephone dialer* is an inexpensive alternative to the leased line, and the electronic technician can easily add such a device to any alarm installation by following the manufacturer's installation instructions.

IS THIS FOR YOU?

Of course we recognize the fact that many elec-

tronic dealers are unfamiliar with the installation of electronic security equipment because they are busy with their regular business, or possibly because they feel that alarm installations are tricky and should be handled by specialists.

If the reader is in the first category and is unable to undertake additional work, it is suggested that security installations be considered as a possible hedge against business slow downs and market fluctuations caused by spending cutbacks or improved products that might cut down on service in the future.

Because the electronic dealer is an established businessman in the community, he can easily expand his business and income without appreciably changing his organization or overhead. If for example, when the dealer is involved in a new TV installation, service call or antenna replacement, he probably can sell and install a modest electronic security system in the same home, and usually in the same work day, and generate $300 to $500 additional income while doing so. This type of business expansion is practical and profitable because security is rapidly becoming a consumer product, and the buying public is demonstrating its willingness to purchase reasonably priced, dependable security systems from someone they know and trust. That someone is you, the electronic service dealer.

If you feel that security installations are "tricky" and should be handled only by specialists, take the time to acquaint yourself with the professional packaged security systems which are now available at many wholesale electronic distributors. Expertly designed and illustrated installation instructions are also available from the manufacturers of such equipment, and they are included with the complete packaged systems. They give step-by-step instructions for installing the complete installation. Because of their experience with wiring and circuits, most technicians are quite capable of installing most types of electronic security equipment presently available, without getting into really sophisticated applications. The all-important key is the quality and depth of the installation instructions supplied by the manufacturer, and the electronic dealer should investigate this point through his wholesaler before he decides to purchase a specific brand or type.

SALES AIDS

A final area of importance that is of interest to the service dealer is sales literature. Several manufacturers of security equipment make instructional or informative literature available to dealers, for distribution at the consumer level. The dealer should avail himself of such material (particularly if it is free) and use it to announce to past and present customers that he can supply them with professional security equipment, installed at reasonable prices, in addition to his normal electronic services. Some manufacturers also sell inexpensive sales demonstration aids that actually show the function and operation of a complete system.

Security is a natural complement to your existing electronic business, and the time is right for you to investigate this industry at your local electronic distributor. And, he probably has the packaged system in stock that is ideal for your own home or business. There is no better way for you to get some actual installation experience than by choosing and installing an electronic security system for yourself.■

☐ The Electronic Security Profit Picture

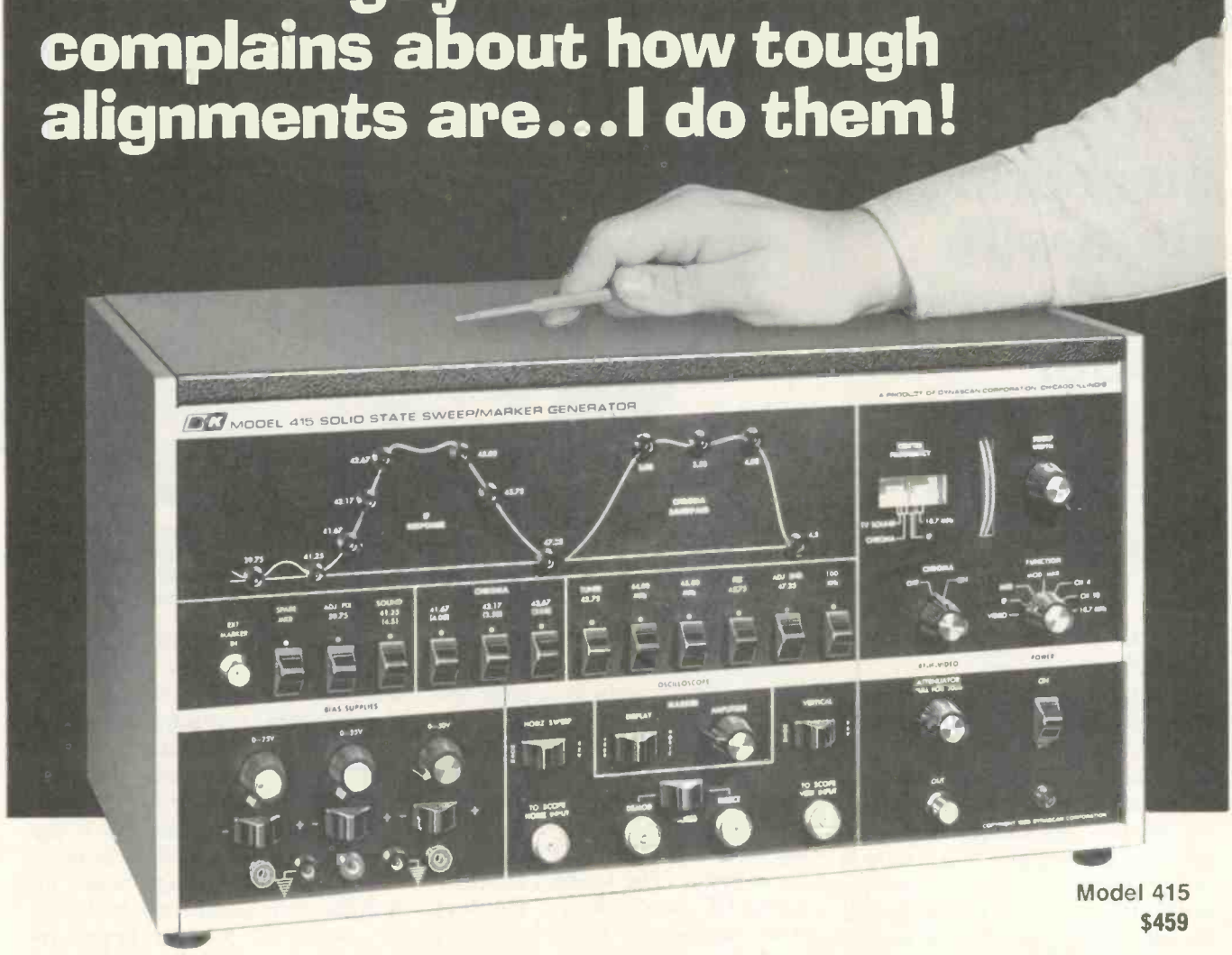
The profit an electronic servicer or dealer can realize from the sale and installation of two typical packaged electronic security systems is computed below, using actual costs and typical installation times.

PLC Model Number	Sugg. Retail Price	Install. Chrg.	Servicer's Unit Cost	Servicer's Profit
740*	$269.99	+ 2 Hrs. @ $15/Hr.	− $175.00	= $124.99
610**	$269.95	+ 5½ Hrs. @ $15/Hr.	− $176.40	= $176.05

*Model 740 is an AC/DC ultrasonic security system which offers a combination of space and perimeter security for small businesses, offices or residences

**Model 610 is a more sophisticated AC/DC commercial security system for space and/or perimeter security of larger businesses and offices. ☐

while the guy down the street complains about how tough alignments are...I do them!



Model 415
$459

I used to hook up a separate sweep generator, marker generator, marker adder and bias supply, hope that everything was properly calibrated and adjusted, and pray that the alignment would hold after I disconnected the cables draped all over the bench.

I didn't do it very often.

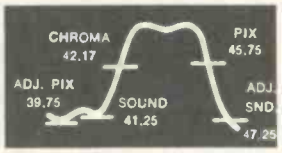
Now, in the time it used to take me just to set up, I can almost complete an alignment. And I'm confident the set will perform as well as it possibly can. My customers notice, too. That's the difference B&K's 415 Solid-State Sweep/Marker Generator made.

Setup is no problem. After I connect the 415's outputs to my scope (there's even low-frequency compensation to eliminate pattern errors), I connect its RF outputs (channel 4 or 10) to the antenna terminals or mixer test point, the direct probe to the video detector test point (or anywhere else after the video detector diode) and the demodulator probe to the bandpass amplifier output.

They're all clip-on connections, and the 415 comes with all the accessories I need. Once I've made the initial signal and bias hookups, there's nothing else to connect or reconnect. All intercabling changes and generator functions are controlled from the front panel. There's even a 15,750Hz filter to eliminate disabling the set's horizontal output section.

Shaping the waveform is easy, because the 415 has 10 crystal-controlled IF markers, each of which lights up on the front-panel waveform diagram as it is used. Markers can be shown either vertically or horizontally on the scope trace. There's a 100kHz modulated marker that makes nulling the traps so easy it's almost automatic. And three low-impedance, reversible-polarity bias supplies—two, 0-25VDC; one, 0-50VDC.

Vertical Markers



Markers Tilted Horizontally

Every step is easy to understand, too, thanks to the comprehensive manual.

Since I have nothing to sell but my time, I have to make the most profitable use of it I can. That's why I have a B&K 415.

In stock now at your local distributor or write Dynascan.

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TEST INSTRUMENT REPORT

Measuring DC Beta with the Heathkit Model IT-121 FET/ Transistor Tester

By J. W. Phipps

Heathkit Model IT-121 FET/Transistor Tester. For more information, circle 900 on the Reader Service Card.

Beta and Its Relationship to Alpha

■ Bipolar transistors are current-operated devices. Their ability to provide current, voltage or power amplification is dependent on the degree to which current in their input element can control current in their output element. This ability is called *forward current transfer ratio* and is referred to as *alpha* if the transistor is connected in a common-base configuration (Fig. 1) and *beta* if the transistor is connected in a common-emitter configuration (Fig. 2).

Alpha and beta both are measures of the *forward current transfer ratio* (current gain) of a bipolar transistor and are mathematically related. Therefore, if the alpha of a transistor is known, the current gain in terms of beta can be computed, and vice versa. Both terms, alpha and beta, are the ratio of input current to output current. The principal difference between the two terms is the *input* element that is used in computing the ratio of input and output currents.

Alpha is determined with the transistor connected in the common-base configuration, as shown in Fig. 1. The *input* element in this configuration is the *emitter,* and the output element is the collector. The formula for computing DC alpha is I_C/I_E. The DC alpha for the transistor in Fig. 1 is .98mA divided by 1mA, or .98. (In the common-base circuit, current gain is always less than 1.)

If the same transistor is connected in the common-emitter configuration in Fig. 2, as it is for beta measurement, the *input* element is the *base,* and the output element is the collector. The formula for computing DC beta is I_C/I_B. The beta of the transistor in Fig. 2 is .98 mA divided by .02mA, or 49.

To convert the alpha measurement to beta, the following formula is used:

$$\text{beta} = \frac{\text{Alpha}}{1 - \text{alpha}}$$

Converting the alpha of the transistor in Fig. 1 to beta, we find that it is:

$$\text{beta} = \frac{.98}{1 - .98} = 49$$

To convert beta to alpha, the following formula is used:

$$\text{Alpha} = \frac{\text{beta}}{1 + \text{beta}}$$

Converting the beta of the transistor in Fig. 2 to alpha, we find that it is:

$$\text{Alpha} = \frac{49}{1 + 49} = .98$$

These computations show that the alpha and beta of a transistor are mathematically related.

The Preference for Beta Over Alpha

Although alpha and beta are mathematically related and measurement of either one provides essentially the same evaluation of the current gain characteristics of a transistor, beta is the transistor gain characteristic measured by most service-type transistor beta testers. The principal reason for this is that changes in transistor characteristics, such as junction leakage, which affect the current gain capabilities of the transistor, produce larger numerical variances of beta than of alpha. Consequently, changes of current gain capabilities are easier to measure and display on meters in terms of beta than they are in terms of alpha, even though such changes usually affect both terms equally. Also, most transistor manuals specify current gain in terms of either AC (H_{fe}) or DC (H_{FE}) beta. (AC beta is computed using the same ratio of input (base) and output (collector) currents except that the base current is varied between two current levels representing the extremes produced by an AC signal. The small change in collector current this produces is then divided by the small change in base current that produced it.)

"Normal" Beta

The principal purpose of measuring the beta of a transistor during troubleshooting is to determine whether or not the transistor is ca-

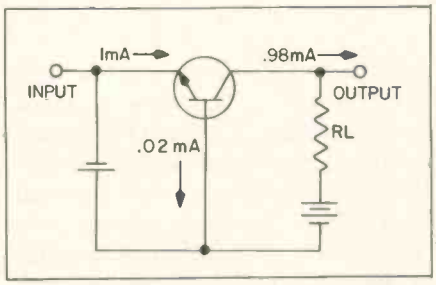


Fig. 1—Transistor connected in common-base circuit.

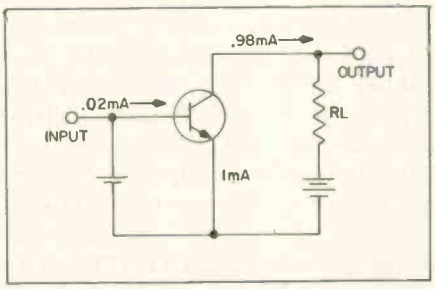


Fig. 2—Transistor connected in common-emitter circuit.

CLASS	APPLICATION	CURRENT CAPABILITY
SIGNAL	AUDIO, RF, IF	1 mA – 10 mA
INTERMEDIATE POWER	AUDIO, SWITCHING	10 mA – 100 mA
POWER	AUDIO, REGULATOR, OUTPUT	100 mA – 1 A

Fig. 3—Three principal classes of bipolar transistors and ranges of collector current at which they typically are operated.

CURRENT RANGE	CALIBRATION SETTING	COLLECTOR CURRENT	BETA MULTIPLICATION FACTOR	BETA MULTIPLICATION FACTOR AFTER SWITCHING TO NEXT LOWER CURRENT RANGE
100 μA	Not Used			
1 mA	CAL X1 CAL X5 CAL X10	.1 mA .5 mA 1 mA	X1 X5 X10	NOT AVAILABLE NOT AVAILABLE NOT AVAILABLE
10 mA	CAL X1 CAL X5 CAL X10	1 mA 5 mA 10 mA	X1 X5 X10	X10 X50 X100
100 mA	CAL X1 CAL X5 CAL X10	10 mA 50 mA 100 mA	X1 X5 X10	X10 X50 X100
1 A	CAL X1 CAL X5 CAL X10	.1 A .5 A 1 A	X1 X5 X10	X10 X50 X100

Fig. 4—Chart of collector current ranges provided by Heathkit Model IT-121 FET/Transistor Tester. Current range is selected by pushing in corresponding pushbutton of RANGE selector. BETA CAL control is adjusted to place meter needle over calibration setting corresponding to collector current level desired. When BETA button of FUNCTION selector is pushed in, beta is value indicated by beta scale of meter multiplied by corresponding multiplication factor. If meter needle deflects off scale, next lower current range is selected and the corresponding higher multiplication factor is used.

pable of producing the current gain (and therefore power and/or voltage gain) required for the application in which it is used.

The beta of a number of properly operating transistors of the same type can vary over a wide range. During the design of a circuit, the "design center" beta of the type of transistor to be used is selected as the beta around which the circuit will be designed, and the "normal" beta values above and below the design center are compensated for by building in additional components which stabilize the operating point of the circuit throughout the wide range of beta values of the type of transistor that will be installed in the circuit during manufacturing or servicing.

Because the "normal" beta of properly operating transistors of the same type is usually a relatively wide range instead of a specific value, beta usually should be evaluated in terms of the *minimum* value specified for that type in transistor manuals. (One exception to this rule is when transistors of the same type must be matched for use in complementary symmetry circuits, etc.) If the beta of a transistor meets the "minimum beta" specification for its type, it usually can be considered to be capable of performing its intended circuit function, if its other characteristics, such as junction leakages, are within normal limits.

If the transistor does not produce at least the minimum beta specified for its type, or if the tester being used to measure its beta cannot be calibrated while it is connected to the tester, the transistor probably is defective. However, if the transistor has been tested only in-circuit, remove it and test it out-of-circuit before discarding it. A defect in the circuit might be causing the abnormal tester indication or the low beta reading.

Performing Beta Tests with the Heathkit IT-121

For an accurate evaluation of the current gain characteristics of a transistor in relation to its type and application, the beta test should be made with the transistor collector current as near as possible to the level it is in the application in which the transistor is used. Fig. 3 shows the three principal classes of bipolar transistors and the ranges of collector current at which they typically are operated. The collector current levels provided by the Model IT-121, shown in the chart in Fig. 4, cover the range from .1mA to 1A. The appropriate current range is selected by pushing in one of five RANGE pushbuttons.

For in-circuit testing, the transistor elements are connected via test leads to corresponding jacks on the top center of the front panel. For out-of-circuit testing, the transistor is plugged into a socket on the top right of the front panel.

To setup the Model IT-121 for beta measurement, the TRANS pushbutton of the MODE selector and the BETA = INFINITY pushbutton of the FUNCTION selector are pushed in and the NPN/PNP pushbutton of the MODE selector is either pushed in (for PNP) or released (for NPN). This establishes the circuit in Fig. 5A, which actually is a bridge configuration, as shown in Fig. 5B. Rt in Fig. 3B represents load resistor R8 and any in-circuit shunt resistances (indicated by Rx in Fig. 3A). The principal purpose of this circuit is to balance out shunt resistances and leakage currents when the transistor is tested in-circuit, and to balance out leakage currents during out-of-circuit testing. This is accomplished by adjusting R11, the SET BETA INFINITY control, so that the meter needle is placed over the BETA INFINITY mark on the beta scale. (Fig. 6).

With the meter needle at this point, the opposing currents in the two legs of the bridge are equal and cancel out each other. Consequently, no current flows through the meter. Any subsequent unbalancing of the bridge, as indicated by movement of the meter needle, will be related only to actual collector current. If, during this setup procedure, the meter needle cannot be placed over the BETA INFINITY meter mark, either the transistor is defective, the NPN/PNP pushbutton is in the wrong position or, if the transistor is being tested in-circuit, a circuit defect exists.

Resistors R1 through R4 in Fig. 5A are meter shunt resistors which change the sensitivity of the meter to correspond to the collector current range selected.

After the bridge has been balanced to cancel out the effects of in-circuit resistances and any leakage inherent in the transistor, the BETA CAL pushbutton of the FUNCTION selector is pressed in, connecting the base of the transistor into the test circuit, as shown in Fig. 7. Variable resistor R12, the BETA CAL control on the front panel, adjusts the emitter-base current of the transistor and, consequently, the transistor collector current. R12 is adjusted to produce sufficient current flow through the meter to place the meter needle over the X10, X5, or X5 meter calibration mark, depending on which collector current range and level have been selected. (Refer again to the chart in Fig. 4.) For example, if a collector current level of 10mA is desired, the 10mA pushbutton of the RANGE selector will have been pushed in and the BETA CAL control will be adjusted to place the meter needle on the CAL X 10 mark. The level of current flowing in the collector at this meter indication is 10mA.

Next, the BETA pushbutton of the FUNCTION selector is pushed in, establishing the circuit shown in Fig. 8. It is identical to that in Fig. 7 except that R10 and the meter are interchanged. This does *not* affect the transistor operating conditions established previously, because the resistance of the meter and R10 are identical (1500 ohms). However, note that the shunt resistance across the meter when it is in the base circuit is *ten* times *larger* than the shunt for the corresponding current range when the meter was in the collector circuit. This *increases* the meter sensitivity by a factor of 10, so that the current required for full-scale deflection of the meter in the base circuit is only 1/10th of what it was in the collector circuit. One reason for this consistent difference of meter sensitivity between collector and base is that the base current of a transistor is inherently much smaller than the collector current and, therefore, requires a more sensitive meter for readable indications. And, if the meter is to be calibrated to read beta directly, as is the meter of the IT-121, the factor by which the meter sensitivity differs between base and collector readings must be consistent for each current range and must relate to the multiplication factor of the current ranges, which for the IT-121 is 10. (Note that the current ranges of the IT-121 shown in Fig. 4 differ by a factor of 10.)

As an example of how the IT-121 meter scale reads out beta directly, suppose that the beta of a small-signal audio transistor is being measured at a collector current level of 1mA. The 1mA pushbutton of the RANGE selector is pushed in

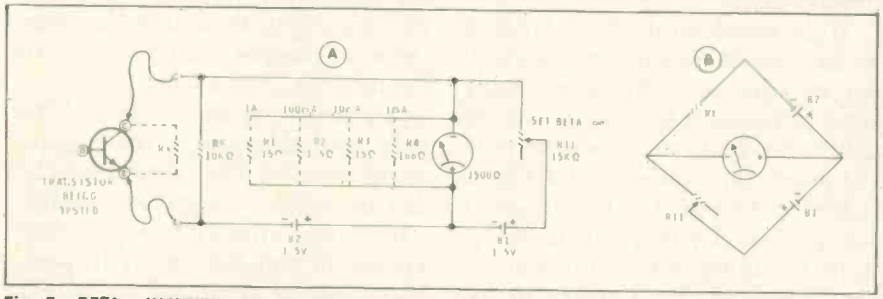


Fig. 5—BETA=INFINITY circuit of Model IT-121. A) Actual circuit. B) Equivalent circuit shows that circuit actually is a bridge configuration.

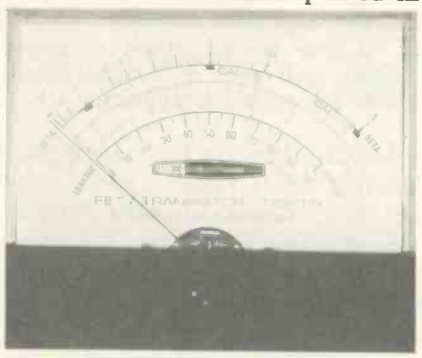


Fig. 6—Meter of Model IT-121. Top scale is direct-reading scale, with corresponding collector current/beta multiplication indicators below it. Middle scale is FET direct-reading transconductance scale, calibrated in micromhos. Bottom scale is for direct measurement of leakage currents.

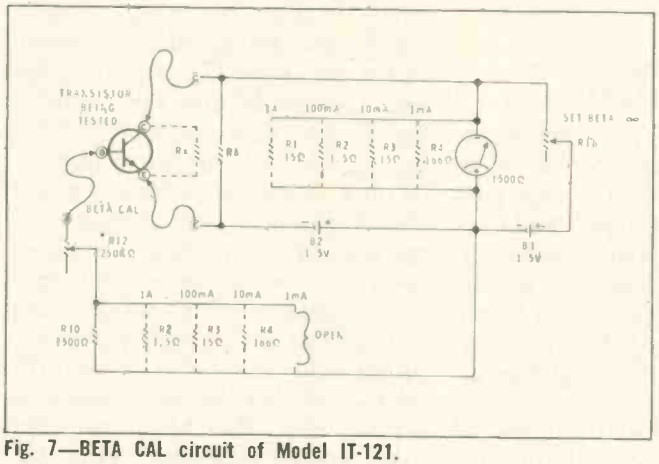


Fig. 7—BETA CAL circuit of Model IT-121.

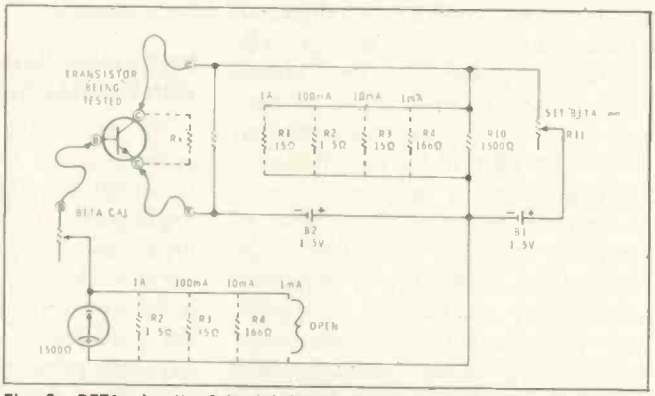


Fig. 8—BETA circuit of Model IT-121. This circuit is same as that in Fig. 7 except that the meter and R10 have been interchanged so that meter now is in base circuit.

and the BETA CAL control is adjusted to place the meter needle over the CAL X 10 mark (Fig. 4). The current now flowing in the collector circuit is 1mA. The meter is then switched to the base circuit by pressing in the BETA button of the FUNCTION selector. Suppose the meter needle swings to the 1 (full-scale) position on the beta scale (Fig. 4). Because the meter sensitivity is now 10 times greater than it was in the collector circuit, the indication represents .1mA of current flowing in the base circuit. Since beta equals I_C/I_B, the beta of the transistor is 1mA/.1mA, or 10. The beta scale reading verifies this (meter reading of 1 multiplied by the calibration factor of 10 = 10).

HEATHKIT MODEL IT-121 FET/TRANSISTOR TESTER Specifications

MEASUREMENTS

Bipolar Transistor DC Beta—Direct reading, in or out of circuit, from 1 to 5000 in five ranges, at collector currents from .1mA to 1A in four ranges; out of circuit accuracy of ±5%.

Bipolar Transistor Leakage—Iceo, Ices, Icbo; direct reading, out of circuit, in five current ranges (0-100mA, 0-1mA, 0-10mA, 0-100mA, 0-1A); ±5% accuracy.

FET Transconductance (Gm)—Direct reading in or out of circuit, from 0 to 50,000 micromhos.

FET Leakage—Idss, Igss; direct reading, out of circuit, in five current ranges (0-100mA, 0-1mA, 0-10mA, 0-100mA, 0-1A); ±5% accuracy.

Diode Tests—Forward and reverse leakage currents; direct reading, out of circuit, in five ranges (0-100mA, 0-1mA, 0-10mA, 0-100mA, 0-1A); ±5% accuracy.

Unijunction Transistor Test—IeB_2s and IB_2es leakage currents plus IB_2B_1s forward current; out of circuit.

SCR and Triac Tests—Proper conduction and blocking, in or out of circuit.

POWER SOURCE
Two 1.5-volt D cells

DIMENSIONS
9-9/16 inches wide X 8-⅝ inches deep X 5-¼ inches high

WEIGHT (Less Batteries)
3 ½ lbs.

PRICE (Kit form only)
$59.95 ■

TECHNICAL LITERATURE

CATV/MATV Cable

A 20-page single-source selection and application guide, No. ED74-2, for CATV/MATV coaxial cable is now available. It covers the full product line and provides technical reference data on shielding methods and efficiency evaluation. The booklet presents complete physical and electrical characteristics of more than 50 standard Belden CATV/MATV cables. The easy-to-read tabular format of the catalog section divides the product line into RG-59/U type, RG-6/U type, and special application classifications. Highlighted are cable constructions utilizing Duobond—an overlapping aluminum foil tape bonded by a special process directly to the insulation core for simplified termination. **Belden Corp.**, Advertising Dept., 2000 S. Batavia Ave., Geneva, Ill. 60134.

Electronic Components

The 1974-75 edition of the IRC Commercial Products catalog is now available. Four new product lines are listed in the 30-page catalog: Japanese "original equipment" transistors, for use in replacing Japanese television and audio equipment parts; high-turnover electrolytic capacitors, with working voltages from 12 to 50 volts; four new, matched-pair transistors, to expand replacement capability; and lighted rocker switches in SPDT and DPDT versions. Also listed are different types of rectifiers, semiconductors, and diodes as well as color TV components and hardware for hobbyists. The brochure shows complete specifications, line drawings, photographs, and price information for the home entertainment electronic equipment. **Commercial Products Division, International Rectifier Corp.**, 233 Kansas Street, El Segundo, Ca. 90245.

TV Repair Manual

A 47-page *Symptom Repair Manual* has been distributed to GE technical publications subscribers by General Electric's Product Service Dept. The manual is step one of the new three-part STC Program, which is designed to help service technicians quickly identify most causes of GE television breakdowns. It lists a variety of symptoms for individual GE TV chassis and outlines what to check, and in what order. The symptoms and repairs were developed from computerized data supplied from actual service technician repair invoices. The manual will be updated periodically to maintain its timeliness as a service tool. Free to subscribers of GE Technical Data, the manual is offered to every non-subscribing technician for $1.00. **General Electric Co.**, Television Products Service, College Boulevard, Portsmouth, Va. 23705.

Soldering Tools and Accessories

A 12-page catalog, No. S711, covers a complete line of soldering tools and accessories. **Excelite-Weller Div. of The Cooper Group**, P.O. Box 728, Apex, N.C. 27502.

Test Equipment

A 16-page catalog, No. 60-T, covers test equipment. The catalog also includes a handy chart to help you select the Triplett VOM for your needs. **Triplett Corp.**, Bluffton, Ohio 45817.

Transformers

A new transformer catalog, No. 407, lists 1,600 standard transformers. It also includes full technical data, mounting dimensions, photographs and other specifications of the complete line of audio transformers, power transformers, chokes and inductors. **Essex International, Inc.**, Controls Division, **Stancor Products**, 3501 W. Addison Street, Chicago, Ill. 60618.

Picture Tubes

An illustrated four-color brochure describing its television picture tube manufacturing capabilities is now available. Called "The Making of #1," it contains 29 pages of background information on the division and illustrated highlights of color television picture tube production. Free copies of the brochure are available from **GTE Sylvania** distributors.

Electronic Test Accessories

A 68-page catalog of electronic test accessories contains more than 500 products, 17 of which are new. It provides illustrations and complete engineering information on all products, including dimension drawings, schematics, specifications, features and operating ranges. **Pomona Electronics Division of ITT**, 1500 East Ninth Street, Pomona, Ca. 91766.

VHF/UHF/FM Tuner Replacement Guide

A new parts catalog, the 1974-75 VHF/UHF/FM Tuner Replacement Guide and Parts Catalog, No. 4, is now available. It illustrates thousands of parts for all kinds of tuners, in addition to "blow-up" photos of many. A complete line of PTS test equipment, tools and chemicals are also introduced. The catalog is available from all PTS locations for a cost of $2.00 (refundable on first order for goods or services). **PTS Electronics, Inc.**, P.O. Box 272, 5233 Hwy. 37 S. Bloomington, Ind. 47401.

Capacitors

Two, 2-page flyers detailing twelve different capacitor kits are now available. Specific types of capacitors included in the kits are axial and radial-lead, low-voltage, miniature aluminum electrolytics, and low- and high-voltage, polyester film, plus polypropylene film. Quantities of capacitors in the kits range from as few as 25, in a compartmentalized plastic container, to as many as 200, in a fourteen drawer metal cabinet. **International Components Corp.**, 10 Daniel Street, Farmingdale, N.Y. 11735.

MATV Systems Equipment

A catalog covering systems equipment which also serves as a reference guide to instruct the beginner. It contains useful reference charts, data, and typical systems diagrams. Everything that goes into the make-up of a MATV system is illustrated and explained in the simplest terminology. The catalog also contains a quantity of planning sheets for laying out systems and work order forms for estimating installations. **RMS Electronics, Inc.**, 50 Antin Place, Bronx, N.Y. 10462.

Digital Megohmmeter

A 4-page data sheet, No. 3J106B, contains specifications and ordering information for a new digital megohmmeter and accessories. The instrument provides measurement capability from 2.0 to 2,000 megohms, with a test voltage of 500 volts DC. **ITT Jennings**, 970 McLaughlin Ave., San Jose, Ca. 95116.

Two-Way Communication Products

A four-color, full-line catalog lists the SBE line of consumer and professional two-way communications products. An important feature of the catalog is the introduction of a new system of transceiver evaluation, to be known as Range Rated Radios. Two pages provide a simple and practical answer to the question "How far can I talk." Also included are two

continued on page 46

WV-517A VOM

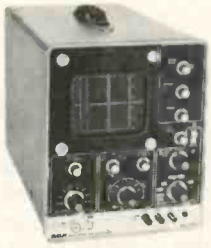
WV-518A VOM

1¢ each

Values up to $44.75*

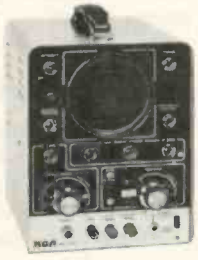
WV-519A VOM

Just buy any one of the eight super RCA Test Instruments illustrated below from your local RCA distributor. Send your warranty card plus one cent and your choice of one of the VOMs illustrated above to: RCA Electronic Instruments Headquarters, 415 South Fifth Street, Harrison, N.J. 07029. We will ship your VOM choice promptly. Act now. Your request must be postmarked by December 15, 1974.



WO-535A — $349.00*
5" Oscilloscope
Triggered Sweep
DC to 10 MHz

WO-505A — $329.00*
5" Oscilloscope
DC to 10 MHz



WO-33B — $229.00*
3" Oscilloscope System

WR-515A — $195.00*
Master Chro-Bar
Signalist

WR-538A — $129.95*
Super Chro-Bar
Generator

WT-524A — $159.00*
FET/Transistor Tester

WT-333A — $199.00*
3-Meter Picture Tube
Tester/Rejuvenator

WV-510A — $139.00*
Solid State AC/Portable
VoltOhmyst

*Optional Price

Specialists demand the best tools of their trade.

RCA Electronic Instruments

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

Technical Literature . . .

continued from page 44

pages of detailed technical specifications which help in determining the features, performance capabilities and installation requirements for the products in the line. **Linear Systems, Inc.**, 220 Airport Boulevard, Watsonville, Ca. 95076.

CATV Equipment

A 45-page catalog describes the equipment manufactured by Sylvania's CATV Equipment and Installation Operation. The catalog, designated ET-1289, contains information on Sylvania Pathmaker wide-band communications equipment. Included are sections on Series 2000 and 1000 trunk amplifier stations, plug-in modules, power supplies, passives, and accessories. Product specifications and ordering information also are given. **Sylvania Advertising Center**, 70 Empire Dr., West Seneca, N.Y. 14224.

Test Jigs and Service Accessories

A 16-page catalog, 1-74, features test jigs, replacement parts and service accessories. This catalog has many new items for the service market. **TELEMATIC Div., U.X.L.**, 2862 Fulton Street, Brooklyn, N.Y. 11207.

Instrument Knobs

A 20-page catalog describes a line of matching knobs offered in a full range of sizes. Each of the styles is presented with illustrations and dimensions. The knob line is offered in four standard colors and all popular configurations, including single-round, pointers, skirted, concentrics, bars, half bars, bar concentrics and spinners. **The Buckeye Stamping Co.**, 555 Marion Road, Columbus, Ohio 43207.

Cable Tie Installation Tool

A new, full-color bulletin, PAT-1, describes a compact, hand-operated, fully automatic, cable tie installation tool for high-volume production requirements. **Panduit Corp.**, 17301 Ridgeland Ave., Tinley Park, Ill. 60477.

Speakers

A 24-page, four-color-illustrated brochure describes hi-fi loudspeaker systems, including raw frame speakers and utility systems. Products shown include two floor standing systems, Stonehenge I and III, the latest speaker additions to the line. The free brochure and a list of local dealers is available by writing to **Altec Sound Products Division**, 1515 S. Manchester Ave., Anaheim, Ca. 92803.

American National Standards Institute Catalog

The 1974 catalog of the American National Standards Institute is now available free of charge. Contact the Institute's Sales Department at 1430 Broadway, New York, N.Y. 10018.

Tape Recorder Care

A free booklet called "Tape Recorder Clinic Procedures" describes step-by-step test methods for conducting a tape recorder servicing clinic using the Ferrograph Ferrotester. **Elpa Marketing Industries, Inc.**, New Hyde Park, N.Y. 11040.

Electronic Chemicals

Offered is the latest catalog of aerosol products which not only includes the company's aerosols available but also depicts, with line drawings, their applications. It includes a "Typical Maintenance Problems" chart which lists the equipment to be maintained, the cleaning problem, the remedy and the aerosol product which will solve the problem. **Miller-Stephenson Chemical Co.**, P.O. Box 628, Danbury, Conn. 06810.

Silicon Rectifiers

A 12-page catalog describing silicon rectifiers such as bridges, axial lead, high voltage packs, cartridges, OEM television, Solid-Tube, and other special device rectifiers is now available. The catalog contains electrical characteristics, dimensional drawings, and photos of the complete product line of silicon rectifiers. Sales Manager, **Electronic Devices Inc.**, 21 Gray Oaks Ave., Yonkers, N.Y. 10710.

Small Tools

A new catalog is available on the complete line of precision small tools for the communications, telephone and electronic industries. **P.K. Neuses, Inc.**, Box 100, Arlington Heights, Ill. 60006.

Needle and Audio Accessories

The new No. 774 Needle Replacement and Audio Accessory Guide is now available to **Fidelitone** distributors and dealers. Contact Mr. John T. Strawa, Marketing Services Manager, 207 North Woodwork Lane, Palatine, Ill. 60067. ■

Meet the Dodge CB 300 KaryVan: It'll handle your big delivery problems.

A NIMBLE, MANEUVERABLE, VERSATILE DOOR

Dodge CB300 is the perfect size—more room than standard compact vans, but smaller than big delivery models. Choose the 127-inch wheelbase with a 10-foot cargo body or the 145-inch-wheelbase van with a 12-foot cargo body. Payload capacities to 3,505 pounds (up to 457-cubic-foot capacity).

Dodge Kary Vans are easy to load. Cargo floor's only 26 inches off the ground. 38-inch-wide swing-out rear cargo doors are standard on all models. (Optional: 70-inch-wide swing-out doors or a 70-inch-wide roll-up door.)

Dodge Kary Vans are easy to drive and are available with convenient options such as power steering and automatic transmission. The low, short engine cover lets you get to the cargo without having to crawl over things.

WIDE CHOICE OF DEPENDABLE ENGINES.

Dodge offers you the smallest six-cylinder engine available in a van—225-cid Six. There's also a 318 V8 plus an optional 360 V8.

FEATURES TO CHECK INTO AT YOUR DODGE TRUCK DEALER'S.

The Dodge CB300 Kary Van is a perfect delivery van or on-the-job maintenance truck. Here's why:

- Electronic Ignition System. It's *standard* on all Dodge Kary Vans. There are no points or condenser (that could wear out or get wet).
- Automatic speed control (only Dodge vans offer this option).
- Optional automatic transmission and power steering.
- Largest standard fuel tank capacity (23 gallons).
- Optional air conditioning.
- Optional steel shelving units.
- Optional partition between driver and cargo.

NEED A LITTLE LESS SPACE? LOOK INTO A TRADESMAN VAN.

Only Dodge gives you so many vans to pick from. Tradesman vans are available on either a 109- or 127-inch wheelbase. There's also a Maxivan—it's the largest compact van built in America.

KARY-VAN
MAXI-VAN

TRADESMAN VAN

Dodge
Dodge Trucks

EXTRA CARE IN ENGINEERING MAKES A DIFFERENCE. DODGE TRUCKS. **DEPEND ON 'EM.**

. . . for more details circle 106 on Reader Service Card

NEW PRODUCTS

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

CHEMICAL CLEANER 700

Safe replacement for carbon tetrachloride

CRC Lectra Clean, from **CRC Chemicals**, degreases and removes oil, wax, dirt, and moisture that cause current leakage and electrical inefficiencies in heavy-duty motors. The stabilizing, fast acting solvent has no flash or fire points. It is extremely low in inhalation toxicity, is non-damaging to internal body organs and is low in skin penetration toxity. Non-staining and non-corrosive to metals, the cleaner removes foreign matter from such things as circuit breakers, fuses and fuse holders, portable tools, transformers, etc.

COLOR TV COMPONENTS KIT 701

Contains 29 components for servicing the RCA XL-100 color TV chassis

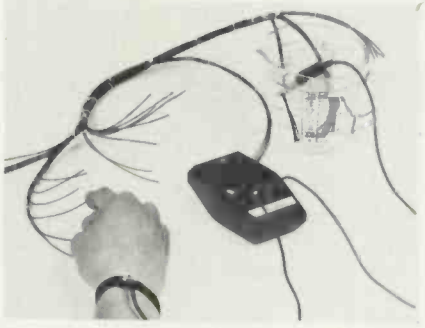
RCA's new XL-100 Components Kit, Stock No. 199006, contains a variety of transistors, diodes and resistors, plus one circuit breaker. There

are 29 components in all. The devices have been selected by RCA Consumer Electronics as being the most important for fast, efficient service of RCA XL-100 color TV chassis. Use of the kit is simplified by a special parts location diagram and a separate cross-reference chart. The diagram, which fits into the kit lid, simplifies parts identification by showing the exact location of each component in the kit. The cross-reference shows usage of each part by chassis and circuit symbol number. Price is $59.60.

CONTINUITY CHECKER 702

Continuity is indicated by a visual display or audible tone

Continuity of a circuit is indicated both audibly and visibly on the E-Z-Coder Tone Tracer, a body conductance continuity checker introduced by **Thomas & Betts**. The unit, which can also be used to locate wires whose origin or termination is not readily

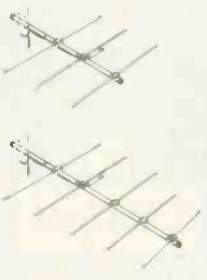


known, is designed so that the user can be connected into the circuit and use his fingers as the probe, for increased efficiency. The dual method of circuit continuity indication provides the user with several optional methods of using the checker. The visual display, indicated by a light on the front of the instrument, is useful in noisy areas or where an audible tone is not desirable. The audio tone indicator is controlled by an on/off volume switch, and may be fed to a speaker on the front of the instrument or to a personal earphone. Powered by a nine-volt battery, the checker is light weight, small, and completely portable.

ANTENNAS 703

VHF point-to-point Yagi antennas

The **Antenna Specialists Co.** announce the development of new three- and five-element Yagi antennas designed principally for point - to - point communications in the 138- to 174-MHz range. The antennas feature bandwidths of greater than 5 MHz. The wide bandwidth, with VSWR of less than 1.5:1, makes field adjustment less critical, and also makes these



antennas particularly suited for multichannel systems. The three-element array, Model ASP-816, has a forward gain of 7 dB and is rated for wind velocities of up to 189 MPH. The five-element array, Model ASP-817, has a forward gain of 9 dB and a 145-MPH wind velocity rating. Both models feature aluminum alloy element and boom construction. They operate at DC ground potential, for lightning protection, and have a power handling capability of 500 w.

MATV DISTRIBUTION AMPLIFIERS 704

The 54 to 300 MHz band makes them compatible with CATV systems

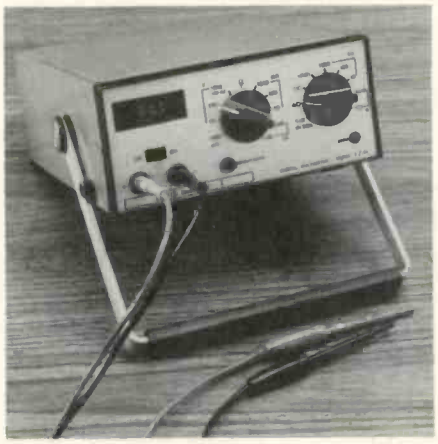
ACA has added two new distribution amplifiers to its MATV and home systems. The "Mini-Mite" Series, Model HS 187 (82 Channel) and Model HSV 17 (VHF-FM), covers the TV mid band and super band. Because of this extended band (54 to 300 MHz), the amplifiers are compatible with CATV systems. The Model HSV 17 has 1.4 volts output and 250,000 mv input capability. The

Model HS 187 provides over one volt of output with an input of 200,000 mv. These units can also be used as line extenders or line amplifiers in large MATV systems. Both units have lightning protection diodes and a low noise figure. Price of the Model HSV is $34.50, and that of the Model HS 187 is $42.95.

DIGITAL MULTIMETER 705

Portable, compact unit provides 300 hr of battery operation

A full three-digit multimeter, Model 3/24, reportedly weighs only 2 lb. complete with internal battery, yet provides 300 hours of operation in normal use. Designed as a time saver for quick and accurate measurements, the unit reportedly has a full five-function measurement capability with 24 ranges: 4 ranges of AC/DC voltage; 5 ranges of ac/dc current and 6 ranges of resistance. On the DC voltage range, accuracies are said to be typically



0.2% ±1 digit. The dimensions of the unit are 5 in. by 2½ in. by 7 in. **Ballantine Laboratories, Inc.**

CABLE STRIPPER 706

Removes the outer covering from most coaxial cable

A tool for removing the outer covering from most types of coaxial cable 5/16 inch to 1½ inches in diameter is introduced by **ITT Holub Industries.** The stripper is called "Roto-Blade" because the cutting blade rotates or swivels and automatically turns in the direction the tool is moved. Insulation can be "rung cut" or "slit" lengthwise. Cable with PVC, neoprene, rubber, polyethylene, nylon, fiberglass and similar types of insulation can be stripped. A spring tension guide holds the cable against the blade for uniform cutting. The blade is adjustable for cutting different cable materials and thickness up to 5/32 inch.

TRANSISTORS 707

Original equipment transistors for Japanese-built entertainment electronic systems

Seven original equipment transistors for replacement use in all major Japanese-built entertainment systems have been added to the existing line available from the Commercial Products Division of **International Rectifier Corporation's** Semiconductor Division. The additional devices are: 2SA564A, 2SB187, 2SC281B, 2SC403A, 2SC535B, 2SC682A, and 2SC772. This expands the Japanese Original Equipment Transistor line to 31 units. The complete line now contains the transistors most often specified by the manufacturers of Japanese stereos, tape recorders, televisions and other electronic equipment.

708 RESISTOR SUBSTITUTION UNIT

Provides resistances from 1 ohm to 11.1 megohm in one-ohm steps

Small enough to be hand-held, a new aluminum-housed resistance substitution unit by **Phipps & Bird** features an 11-million step range, in one-ohm steps. The Model 236-A unit uses one-half watt resistors with 1-percent tolerance. Designed with three binding

continued on next page

NEW PRODUCTS...

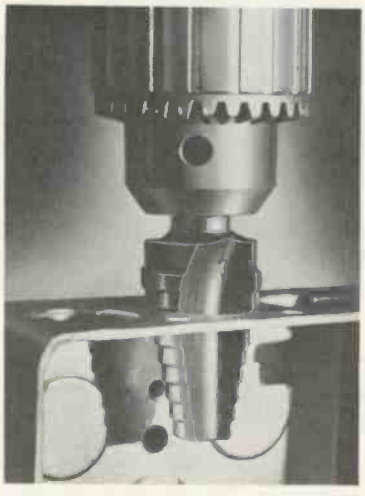
continued from preceding page

posts (one to ground the case), the slide-switch unit provides resistances from 1 to 11,111,110 ohms. Its aluminum case, finished in wrinkle blue, measures 4 inches by 6 inches by 1-3/16 inches. Price is $48.

DRILL BIT 709

Drills eight hole sizes

The Unibit drill bit, Model II, from **Unibit Corp.**, enables the drilling of eight round holes, 9/16-inch to one-inch, with a single bit. The drill bit requires a starting diameter of ½-inch or larger and removes material in 1/16-inch



increments in eight steps. Designed for use with any ½-inch drill chuck, it is especially effective when drilling round holes in thinner gauges of sheet metals. The bit is made of industrial grade, high speed steel, heat treated and tempered to assure maximum strength. It can be easily sharpened without special tools.

MULTI-FUNCTION COUNTER 710

Features autoranging and autoreset

An autoranging, 80-MHz Multi-Counter, Model 1900A, featuring LSI/MOS circuitry, autoreset on all functions, gate times, filter and attenuator, is offered by **John Fluke Mfg. Co.** It has autoranging in both frequency and period measurement modes, and four over-riding gate times for manual selection of resolution to .1 Hz. It can be used to totalize as well as to measure frequency and period, with event counting up to 10^6 events, and has a large, six-digit LED display with leading zero suppression, automatic annunciation and overflow. Signal input conditioning is provided in the unit with a switchable, 1-Mz, low-pass filter and attenuator. The dynamic range is 5 Hz to 80 MHz. The unit has a sensitivity of 25 mv (typically

15 mv) and is available with a number of options, including a rechargeable internal battery pack, capable of providing five hours of continuous operation, and parallel data output, with decimal point and annunciation. Price is $349.

INTEGRATED CIRCUITS AND MODULES 711

Direct replacements for important counterparts

The **Electronic Components Group** of **GTE Sylvania Inc.** has added a series of integrated circuits and solid-state modules, intended as direct replacements for their imported counterparts, to its ECG semiconductor product line. Designated ECG 1000 series, the line consists of silicon monolithic integrated circuits and both thick- and thin-film hybrid encapsulated modules. The line replaces imported products used in color and black and white TV sets, stereos, radios, tape recorders and other types of entertainment electronic equipment available from approximately 127 manufacturers in this country. The ECG semiconductor line and related cross-reference guides are available through authorized GTE Sylvania distributors. The line consists of replacements for more than 90,000 solid-state devices used in entertainment, industrial and commercial electronic equipment.

TV TEST RIG 712

Complete setup for tube and solid-state chassis

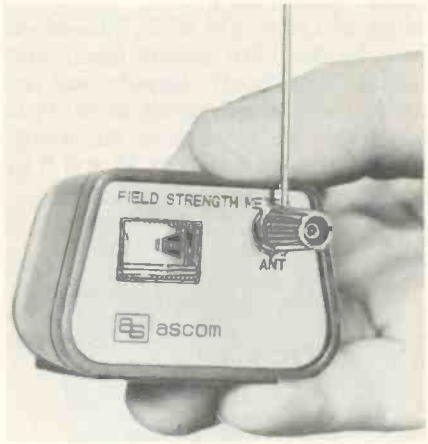
The Master Rig, Model MJ-195, is the newest addition to the **Telematic** line of TV test rigs. This unit is a complete setup for both tube and solid-state chassis. Features of this unit include a built-in high-voltage meter, speaker, front panel connections and metal cabinet. When equipped with the proper picture tube,

they are capable of operating with late-model TV chassis which produce over 30 kv of second anode voltage. The unit comes complete with all components for deflection circuit hookup and four solid-state yoke adaptors. Price is $149.95.

FIELD-STRENGTH METER 713

Designed for portable use

A compact, portable, field-strength meter is introduced by **Ascom Electronic Products.** The unit, known as Model ASM-105, is designed for field checks of antenna radiation. It can be used to tune antennas for peak radiating efficiency, as well as for making compara-



tive tests of various transmitters and antenna system installations. The meter requires no internal power, operating entirely from the RF field, and covers the frequency range from 27 MHz through 225 MHz. This includes the Class D citizens band, low-band and high-band VHF land-mobile channels, as well as the amateur 10-, 6-, 2- and 1¼-meter bands. Price is $15.95.

OSCILLOSCOPE 714

Displays color TV or video waveforms by pushing a button

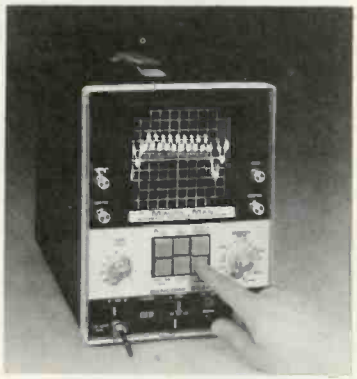
Sencore, Inc., has introduced a completely automatic triggered, pushbut-

continued on next page

NEW PRODUCTS...

continued from preceding page

ton oscilloscope, Model PS29 Minute Man. This scope enables technicians to display commonly used color TV or video waveforms by simply pushing a button. The pushbutton-selected displays include TV Vertical, TV



Horizontal, 3.58-MHz, (for viewing the color subcarrier information), five-times expand and a color vector display. The sixth button sets the scope for 60-Hz line sweep, used in sweep alignment. The unit can be triggered internally on any signal down to 20 mv. Provisions for external triggering also are included. This oscilloscope can also be used as a general purpose unit—with DC coupling; 5000 v AC input protection; 10-MHz bandwidth, with vertical sensitivity from 10 mv/div. direct, to 500 volts 1 division, using the 10 X 1 probe, at 3 percent calibration accuracy. The 3.58/VARISPEED button and the horizontal sweep control provide signal display for non-video frequencies from DC to 10 MHz. Price is $495.00, probe included.

TRANSISTOR/FET TESTER 715

Combines speed and accuracy

A dynamic transistor/field-effect transistor (FET) tester that represents a different design approach in solid-state test instruments is introduced by **RCA Electronic Components.** Featuring a large, 6½-inch meter and two plug-in

transistor socket adapters, the RCA WT-524A combines fast operation and high measurement accuracy for testing all types of bipolar and FET transistors, including Darlington and dual types, with an accuracy of ±3 percent. Transconductance of FET's, including depletion or enhancement types, N- or P-channel types, dual types and dual-gate types, can also be measured up to Gm values of 100,000. Zero bias drain current, DC drain current and out-of-circuit gate leakage measurements can also be made. Operating current levels are adjustable up to 20 mA for all of these tests. The instrument is supplied with complete instructions, two plug-in test adapters —one each for bipolar and FET transistors—as well as a set of clip leads for in-circuit testing. Price is $159.

HEAD DEMAGNETIZER 716

Removes residual magnetism from heads, capstans and guides

Nortronics Company, Inc., is introducing a head demagnetizer which is designed to remove residual magnetism from recording heads, capstans and guides. Designated Model QM-202, the unit generates a controlled 60-Hz

magnetic field which is strong enough to effectively demagnetize, without being so strong that additional residual magnetism is created. Its primary function is to demagnetize active pole pieces and faces in recorder playback heads, preventing hiss, noise and possible erasures which can be caused by magnetized head. It features a flexible probe which will flex to reach usually inaccessible recorder/player parts. The magnetic field radiates from the tip of this probe, which is designed to contact sensitive areas without danger of physical damage.

FIELD-STRENGTH METER 717

Features precision gear drive with 1 dB accuracy

Sadelco, Inc., has introduced the Model FS3B VHF/UHF Professional Field-Strength Meter, which features a built-in speaker and precision gear drive with 1 dB accuracy. Other features include a logarithmic scale that cuts attenuator manipulations in half. Direct-reading VSWR and return-loss scales extend this instrument's capabilities when used in conjunction with Sadelco's Spectrum Analyst. It has a voltage-regulated battery supply, gold-plated attenuator switches and a safety switch that turns off power when

the cover is closed. Another safety feature is built into the on/off switch: When in the off position, the meter is automatically shorted, reducing the possibility of damage during transit.

VHF TEST METER 718

Checks VHF transmitter and antenna operation

A multi-tester designed for testing and monitoring VHF communications systems is announced by **Ascom Electronic Products,** a division of **The Antenna Specialists Co.** The unit, Model ASMR-100, checks both transmitter and antenna operation over a frequency range of 144 to 174 MHz. This range includes the VHF marine band, land mobile "high-band" channels, and the entire two-meter amateur band. Featured on the tester is a dual-range wattmeter function (0 to 25 and 0 to

50 watts). Transmitter output is indicated directly in watts on either scale, with ±8 percent accuracy. Also provided is a function to measure the voltage standing wave ratio (VSWR), for checking antenna operation and adjustments. To monitor overall system operation, a field-strength meter function can be used to indicate that the system is radiating. Price is $69.95. ■

For more information on these NEW PRODUCTS See pages 59 and 60 READERS SERVICE

DEALER SHOWCASE

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

HOME ALARM SETS 719

Offers extra profits to electronics dealers

A new line of "Snap On" Home Alarm Sets is introduced by Master Lock Co. Fast and easy installation is emphasized, every component is pre-wired with exclusive Snap On connectors. There are no wires to cut, strip, solder or splice. The power source is a standard 6- or 12-volt battery. Each unit includes a solid-state control center which is always active, even when the burglar system is turned off; an electronic super siren, with separate

signals for fire or burglary; a key switch which permits the system to be turned on or off from outside of the home; intrusion detectors for doors or windows; fire detectors; 20-ft. extension cords; three-way connectors; an easy-to-follow installation manual; and identifying warning decals. The basic Home Alarm Set price is $69.95, and an expanded deluxe version (shown in photo) is available for $99.50.

AM/FM WEATHER BAND RADIO 720

Pre-set weather band provides 24 hours of continuous weather reports

Panasonic has introduced Model RC-6304, an FM/AM Weather Band Radio with a digital clock. The radio's

special features are a pre-set weather band, which provides 24 hours of continuous weather reports, and a new digital clock. It also offers a lighted radio dial and clock face, an alarm flasher that glows when the alarm is set, a 10 minute doze feature, a chirp alarm, two-step tone control boost for bass and treble, and a three-inch PM synamic speaker. The radio is housed in a wood-grain finish cabinet. Price is $69.95.

ANTENNA DISPLAY 721

Occupies less than two square feet of floor space

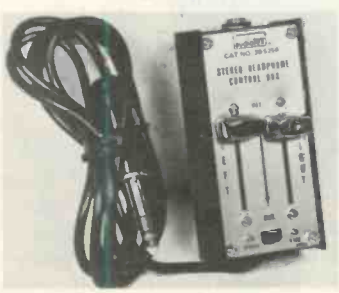
A compact outdoor antenna merchandiser that displays as many as nine boxed RCA Permacolor Antennas

in less than two square feet of floor space is now available from RCA Parts and Accessories. The RCA Outdoor Antenna Merchandiser, MU-1937, is constructed of gold-tone anodized rails and legs and blue and white side panels. Heavy wire rods arranged in a grid pattern hold the boxed antennas in an upright position and the rack is backed up with ¾-inch plywood. Included with the merchandiser are two multi-angle mast brackets, for displaying one or more RCA Permacolor antennas or a 4BG00 antenna mock-up. The display measures only 18½ inches wide by 16½ inches deep by 28½ inches high. The unit is designed for use against a back or side wall, next to the end of a counter, or as a free-standing aisle display.

HEADPHONE CONTROL BOX 722

Allows control of volume and balance

A Stereo Headphone Control Box, Cat. No. 30-5250, is offered by GC Electronics. The unit provides control of



the volume and balance of stereo headphones, without the user leaving

continued on next page

DEALER SHOWCASE . . .

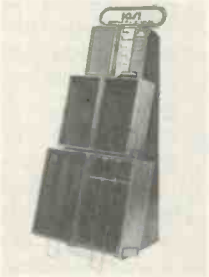
continued from preceding page

his or her chair. The control box plugs directly into the amplifier. Separate control of the volume and balance of each ear piece is provided by noise-free slide controls. The unit comes equipped with a 5-ft. cord and a standard, three-conductor, stereo phone plug. The unit is also equipped with a switch for mono or stereo selection.

STEREO SPEAKER MERCHANDISER 723

On-the-spot comparison of speaker selection made with pushbutton switches

The "Speaker Tree," a self-contained merchandiser that allows customers to compare the performance of five stereo speakers in a new line, is announced by **Innovative Audio Systems, Inc.** By operating a simple pushbutton switch, the customer can make an on-the-spot comparison and select a speaker, with little or no help from sales personnel. The display features five models, ranging from a six-inch, two-way, to a twelve-inch, four-way system. The merchandiser occupies only three square feet of floor space and comes with an initial inventory package consisting of 13 pairs of speakers.



AUTO STEREO SPEAKERS 724

Front panel fabrics can quickly be changed using most materials

Pioneer Electronics has introduced a new line of speakers called Chameleons, featuring a removable, exchangeable front panel that can be modified, mixed or matched to suit the consumer's mood and the car's interior. Variations in design are limited only by the imagination of the purchaser, since just about any material can be used to cover the panel. Sound from the stereo speakers emanates from both around and through the fabric or graphics display panel. An additional advantage of this new concept is that the car owner is not restricted to one design forever, since it only takes about five minutes to change the panel. The 6½ inch speakers fit into a variety of locations within the car's interior.

RECORD CLEANER 725

Electric powered automatic record cleaning device

Vor Industries have developed and patented a new product for the consumer named "VAC-O-REC," an electric-powered, automatic-record-cleaning device which, without harming the record, reaches deep into the grooves to the microscopic level, loosens the microdust particles with its natural mohair brushes, and, via the vacuum cleaning action, removes the dust. When in use, it rotates the inserted record slowly for cleaning. Simultaneously, its static reduction circuit reduces the record's dust-attracting electromagnetism from as high as 20,000 volts to a low, near-neutral, voltage.

TV REMOTE CONTROL 726

Works with any TV set and does not use motors

A new type of remote-control unit that works with any TV set is introduced by the Distributor Sales Division of **Jerrold Electronics**. Completely solid-state and without motors, the new product turns the TV set on and off, changes channels instantly and fine tunes from anywhere in the room, up to 25 ft. from the TV set.

The Universal TV Remote Control, Model TRC-12, consists of two units: a converter and a remote control unit connected together by a thin 25-ft. control cord. The converter can be

located any convenient distance from the TV set. The only wiring necessary is connection of the TV antenna lead-in to the converter, and then connection of the converter output to the antenna terminals on the back of the

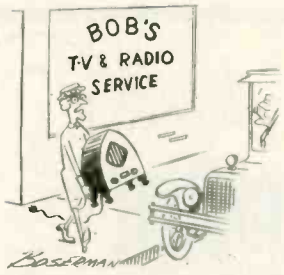
TV set. The remote control unit can be placed anywhere in the room that is convenient. The control cord is small enough to hide under the rug or to run unobtrusively along a baseboard. Remote channel changing is accomplished by a varactor diode oscillator. This makes it possible to change channels without physically rotating the TV tuner. The remote control has no moving parts, except for twelve push-button channel selector switches, a rocker-type on/off switch and the fine tuning control. It converts all incoming VHF channels to either Channel 2 or Channel 3, whichever is unused in the area. After installation, the user leaves the VHF tuner in the TV set tuned to either channel 2 or 3. The AC cord of the TV set is plugged into the convenient outlet on the converter. It also helps eliminate interference caused by direct pickup of signals when the set is connected to an MATV system. Price is $100.

STEREO CASSETTE 727

Features Dolby system and "Memory Rewind"

A stereo cassette play/record deck from Channel Master features the Dolby noise reduction system and a "memory rewind" that permits automatic return to any selected point on the tape. The unit, Model 6622, features automatic shutoff of the amplifier and motor when the tape ends, and a selector switch for chromium dioxide tape. The memory rewind permits continuous playing of tape sections. Other features include two color-coded, il-

continued on next page

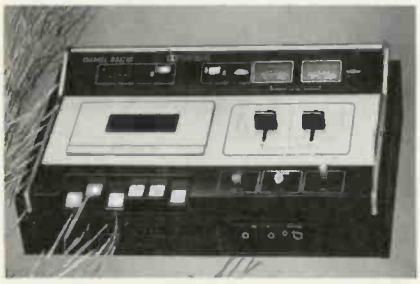


"There sure isn't any professional jealousy among them. Each one highly recommends the others."

DEALER SHOWCASE...

continued from preceding page

luminated, level meters; digital counter with reset button; slide controls for right and left recording levels; dust-free tape head mechanism; and an output jack for headphones. The unit employs 14 transistors, 10 diodes, and



two IC's. It measures 4 inches high, 13⅝ inches wide, and 9⅛ inches deep. There is a four-month, over-the-counter exchange guarantee. Price is $219.95.

FULL LOGIC SQ DECODER 728

Features wave-matching and variable blend

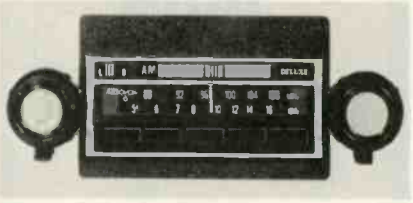
Superscope, Inc., announces the Model SQA-2 full-logic SQ decoder from Marantz. Separation of up to 20 dB is provided by the decoder. The de-

coder fits into a special under-chassis slot built into most Marantz Quadradial receivers. With each improvement in 4-channel sound, only the inexpensive decoder itself need be replaced. Price is $79.95.

AM/FM AUTO RADIO 729

Designed to harmonize with dashboards of late-model cars

The Model ID-200 in-dash, AM/FM, push-button, automobile radio is introduced by **Audiovox Corp.** The radio is designed to harmonize with the dashboards of the latest model cars. A slide-bar band switch changes reception from AM to FM by simply flicking the switch from left to right. All five quick-set, push buttons can be set for either AM or FM reception or any desired configuration. Solid-state components are used exclusively in the circuits. The circuitry employs 12 transistors, one IC, and



10 diodes. Other features include: automatic volume control, AFC, L/D switch, tone control, and push/pull output. Sensitivity: Less than 30 microvolts at 20 dB S/N on AM and less than three microvolts at 30 dB S/N on FM. The radio measures 7⅜ inches wide by 2 inches high by 5⅞ inches deep and weighs 3.4 lb.

PHONE ANSWERING SYSTEM 730

Has unique one-year guarantee

Channel Master is introducing the first automatic telephone answering system backed by a one-year, over-the-counter-exchange guarantee. The Answering System, Model 6000, is designed for general home and business use. It can be set to respond to any number of rings. A "recording" light glows when a message is actually being received, and a built-in monitor permits you to listen in on the caller while his message is being recorded. A "message received" indicator light shows that calls have been received. The device has a 60-second recording cycle, built-in condenser mike, automatic level control, and features simple push-button operation. Price is $129.95. ■

Balancing Channels . . .

continued from page 34

weaker, the signals are combined and made available at the output jack. Several CE's may be used in complex antenna installations. In some installations, the output of one CE may be connected to the coupling input of another (instead of to an antenna lead-in), to combine the signals before applying them to the input of a distribution amplifier.

Mixer Equalizers

The third method of equalizing signals employs mixer equalizers (ME's). ME's are designed to separate or combine four nonadjacent low- or high-band VHF TV channels and to provide 0 to 20 dB of equalization on each channel (Fig. 3). Each ME will combine four nonadjacent channels into one output or it will separate a single combined input into four individual outputs consisting of 3 nonadjacent low-band channels plus FM or four nonadjacent high-band channels.

Each ME unit is factory pretuned for the received channels specified. That is, they can accept several nonadjacent channels carried on a single cable and separate them so that each appears at its own individual output jack. Likewise, an ME can take separate nonadjacent channels, such as the output of four single-channel antennas or strip amplifiers, and combine them into a single output. ME's are ideal when it is necessary to separate and equalize channels from a broad-band antenna, deliver them to be amplified in *Ultra-Plex®* single-channel strip amplifiers and then recombine them for distribution over a trunkline.

Other Methods

The three methods of signal equalization described previously are by no means the only ones available, but they do represent economical and convenient methods of signal equalization in medium and large MATV systems.

For homes and small stores or apartments in which multiple antennas are employed or in which channel-to-channel levels vary widely, the best solution might be channel-control couplers (Fig. 4) or single-channel VHF cartridge traps (Fig. 5) in combination with antenna preamps, where required. ■

"This time why don't you wait and see if his diagnosis jibes with yours before you tell him what's wrong with it?"

READERS SERVICE INDEX

ADVERTISER'S INDEX

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TEST INSTRUMENT

Circle the Reader Service numbers of those items of interest to you.

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104	112	120	128	136	144	152
105	113	121	129	137	145	153
106	114	122	130	138	146	154
107	115	123	131	139	147	155
108	116	124	132	140	148	156

TEST INSTRUMENTS

900	908	916
901	909	917
902	910	918
903	911	919
904	912	920
905	913	921
906	914	922
907	915	923

NEW PRODUCTS

700	708	716	724	732	740
701	709	717	725	733	741
702	710	718	726	734	742
703	711	719	727	735	743
704	712	720	728	736	744
705	713	721	729	737	745
706	714	722	730	738	746
707	715	723	731	739	747

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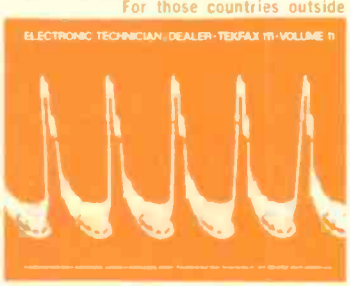

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107	115	123	131	139	147	155
108	116	124	132	140	148	156

TEST INSTRUMENTS

900	908	916
901	909	917
902	910	918
903	911	919
904	912	920
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906	914	922
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NEW PRODUCTS

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707	715	723	731	739	747

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1553

SYLVANIA

TV Chassis
A12-3, -4, 5

ELECTRONIC TECHNICIAN/DEALER **TEKFAX**

OCTOBER • 1974

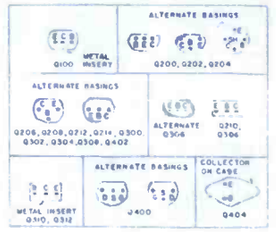
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

SYMBOL	DESCRIPTION	SYLVANIA PART NO.
C504	4 section electrolytic	41-37861-1
A	500-175v	
B	300-150v	
C	20-150v	
D	30-175v	
L100	quad coil	50-33195-2
L102	sound input coil	50-35989-1
L206	1st IF xformer	57-23832-4
L208	snd IF xformer	57-23832-4
L212	4.5MHz trap coil	50-37714-3
L400	horiz hold coil	50-33955-2
T100	audio output xformer	56-37872-1
T400	horiz driver xformer	56-37922-1
T402	horiz output xformer	50-39372-1
R105	100K volume	37-35105-10
R240	1K contrast	37-39237-4
R258	200K brite	37-27242-57
R272	4.7K AGC	37-14576-13
R314	500K vert hold	37-33063-14
F500	fuse 1.5a slo blo	29-27730-3
IC100	integ sound IF/det	15-35059-1

VHF TUNER

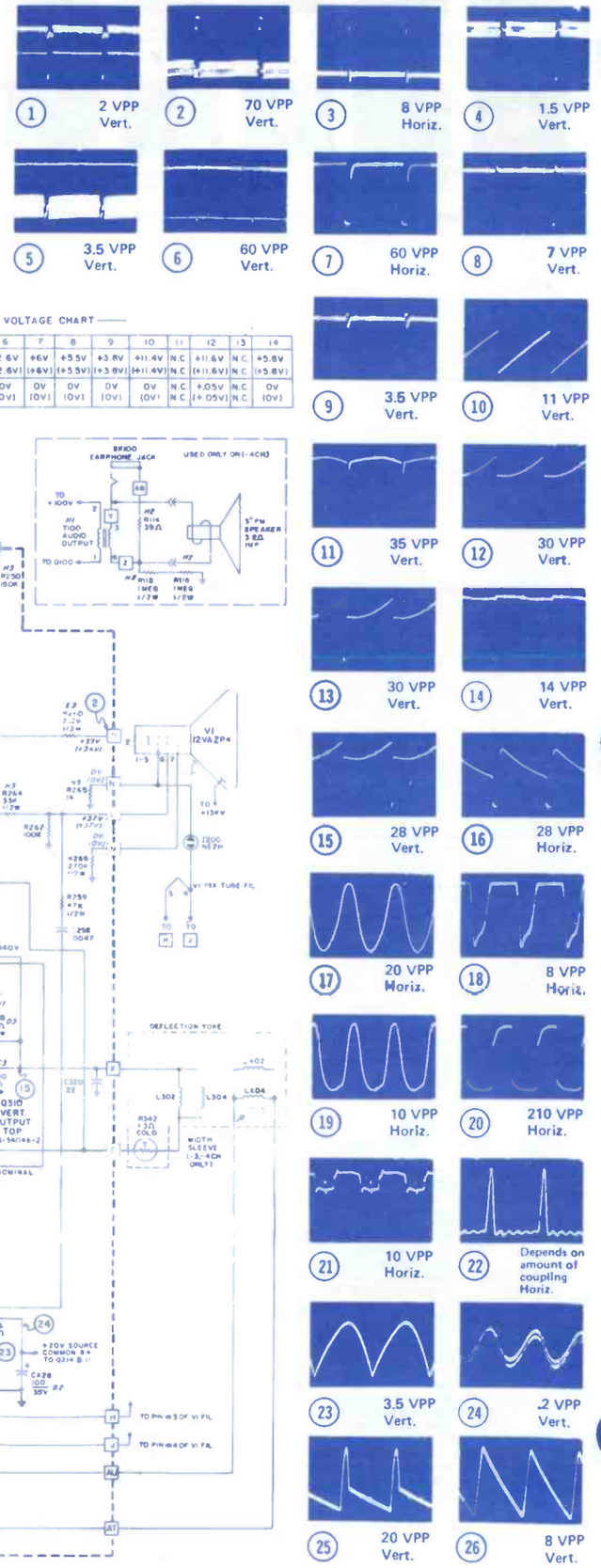
T402 BOTTOM LUG VIEW

— BOTTOM VIEW TRANSISTOR BASINGS —



NOTES:
1. ALL CAPACITORS ARE IN MFD, 500V UNLESS OTHERWISE SPECIFIED
2. ALL RESISTORS ARE 1/4 WATT, 10%, UNLESS OTHERWISE SPECIFIED
3. ARROWS ON CONTROLS INDICATE CLOCKWISE ROTATION.
4. SQUARE WIRE PINS [B] ARE TEST POINTS AND WIRE WRAP CONNECTION.
5. ROUND CONNECTIONS (C) ARE WIRE HOLES IN P/C PANEL.
6. SCHEMATIC SYMBOLS (V)— ARE TEST POINTS.
7. EXAMPLE: E1/K2 (LETTER & NO.) NUMBER NEAR COMPONENT DESIGNATES PRINTED CIRCUIT CO-ORDINATE

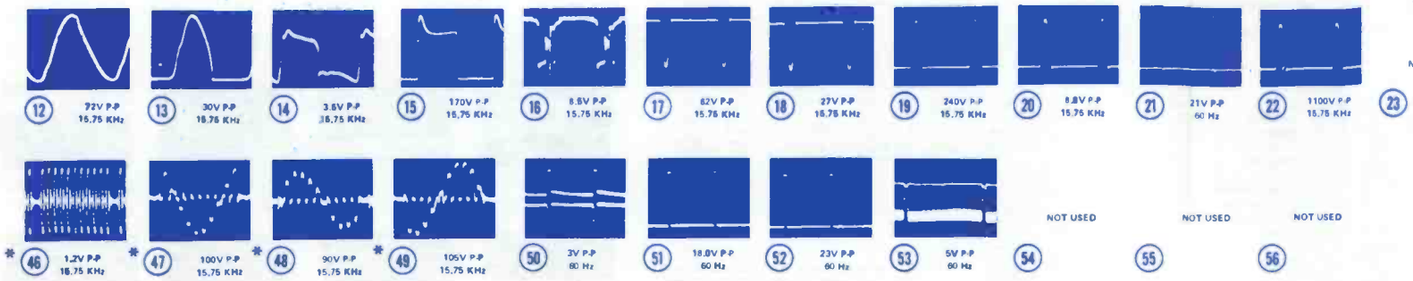
WAVEFORMS



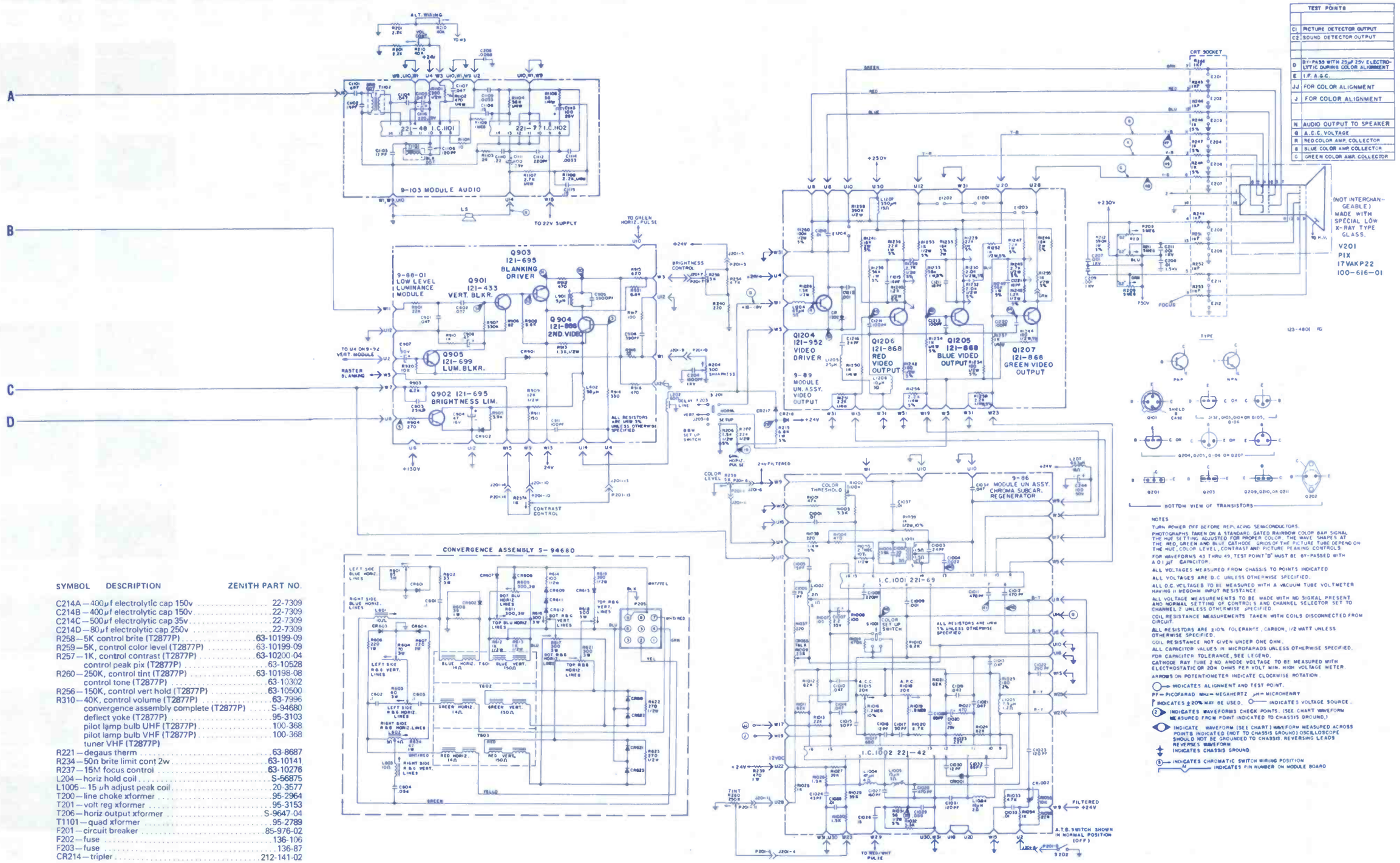
— IC100 VOLTAGE CHART —

PIN NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14
IC CHIP INSERTED	+8.9V (+8.9V)	+1.9V (+1.9V)	0V (0V)	+12V (+12V)	+2.6V (+2.6V)	+2.6V (+2.6V)	+6V (+6V)	+5.5V (+5.5V)	+3.8V (+3.8V)	+11.4V (+11.4V)	N.C. N.C.	+11.6V (+11.6V)	N.C. N.C.	+5.8V (+5.8V)
IC CHIP REMOVED	0V (0V)	0V (0V)	0V (0V)	+26V (+26V)	+26V (+26V)	0V (0V)	0V (0V)	0V (0V)	0V (0V)	0V (0V)	N.C. N.C.	+.05V (+.05V)	N.C. N.C.	0V (0V)

ZENITH
Color TV Chassis
17FC35



* FOR WAVEFORMS 43 THROUGH 49, BYPASS TEST POINT "D" WITH 1.0 MF CAPACITOR.



SYMBOL	DESCRIPTION	ZENITH PART NO.
C214A	400 μf electrolytic cap 150v	22-7309
C214B	400 μf electrolytic cap 150v	22-7309
C214C	500 μf electrolytic cap 35v	22-7309
C214D	80 μf electrolytic cap 250v	22-7309
R258	5K control brite (T2877P)	63-10199-09
R259	5K, control color level (T2877P)	63-10199-09
R257	1K, control contrast (T2877P)	63-10200-04
	control peak pix (T2877P)	63-10528
R260	250K, control tint (T2877P)	63-10198-08
	control tone (T2877P)	63-10302
R256	150K, control vert hold (T2877P)	63-10500
R310	40K, control volume (T2877P)	63-7996
	convergence assembly complete (T2877P)	S-94680
	deflect yoke (T2877P)	95-3103
	pilot lamp bulb UHF (T2877P)	100-368
	pilot lamp bulb VHF (T2877P)	100-368
	tuner VHF (T2877P)	
R221	degaus therm	63-8687
R234	50Ω brite limit cont 2w	63-10141
R237	15M focus control	63-10276
L204	horiz hold coil	S-56875
L1005	15 μh adjust peak coil	20-3577
T200	line choke xformer	95-2964
T201	volt reg xformer	95-3153
T206	horiz output xformer	S-9647-04
T1101	quad xformer	95-2789
F201	circuit breaker	85-976-02
F202	fuse	136-106
F203	fuse	136-87
CR214	tripler	212-141-02

NOTES

TURN POWER OFF BEFORE REPLACING SEMICONDUCTORS.

PHOTOGRAPHS TAKEN ON A STANDARD GATED RAINBOW COLOR BAR SIGNAL THE HUE SETTING ADJUSTED FOR PROPER COLOR. THE WAVE SHAPES AT THE RED, GREEN AND BLUE CATHODE GRIDS OF THE PICTURE TUBE DEPEND ON THE HUE, COLOR LEVEL, CONTRAST AND PICTURE PEAKING CONTROLS.

FOR WAVEFORMS 43 THRU 49, TEST POINT "D" MUST BE BY-PASSED WITH A 0.1 μF CAPACITOR.

ALL VOLTAGES MEASURED FROM CHASSIS TO POINTS INDICATED

ALL VOLTAGES ARE D.C. UNLESS OTHERWISE SPECIFIED.

ALL D.C. VOLTAGES TO BE MEASURED WITH A VACUUM TUBE VOLTMETER HAVING 11 MEGOHM INPUT RESISTANCE

ALL VOLTAGE MEASUREMENTS TO BE MADE WITH NO SIGNAL PRESENT AND NORMAL SETTING OF CONTROLS AND CHANNEL SELECTOR SET TO CHANNEL 2 UNLESS OTHERWISE SPECIFIED.

COIL RESISTANCE MEASUREMENTS TAKEN WITH COILS DISCONNECTED FROM CIRCUIT.

ALL RESISTORS ARE ±10% TOLERANCE, CARBON, 1/2 WATT UNLESS OTHERWISE SPECIFIED.

COIL RESISTANCE NOT GIVEN UNDER ONE OHM.

ALL CAPACITOR VALUES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

FOR CAPACITOR TOLERANCE, SEE LEGEND.

CATHODE RAY TUBE 2 ND ANODE VOLTAGE TO BE MEASURED WITH ELECTROSTATIC OR 20K OHMS PER VOLT MIN. HIGH VOLTAGE METER.

ARROWS ON POTENTIOMETER INDICATE CLOCKWISE ROTATION.

○ INDICATES ALIGNMENT AND TEST POINT.

PF = PICOFARAD MHz = MEGAHERTZ μH = MICROHENRY

INDICATES ±20% MAY BE USED. ○ INDICATES VOLTAGE SOURCE.

(2) INDICATES WAVEFORMS CHECK POINTS. (SEE CHART WAVEFORM MEASURED FROM POINT INDICATED TO CHASSIS GROUND.)

INDICATE WAVEFORM (SEE CHART) WAVEFORM MEASURED ACROSS POINTS INDICATED (NOT TO CHASSIS GROUND) OSCILLOSCOPE SHOULD NOT BE GROUNDED TO CHASSIS. REVERSING LEADS REVERSES WAVEFORM

INDICATES CHASSIS GROUND.

(5) INDICATES CHROMATIC SWITCH WIRING POSITION

A1 INDICATES PIN NUMBER ON MODULE BOARD

1552

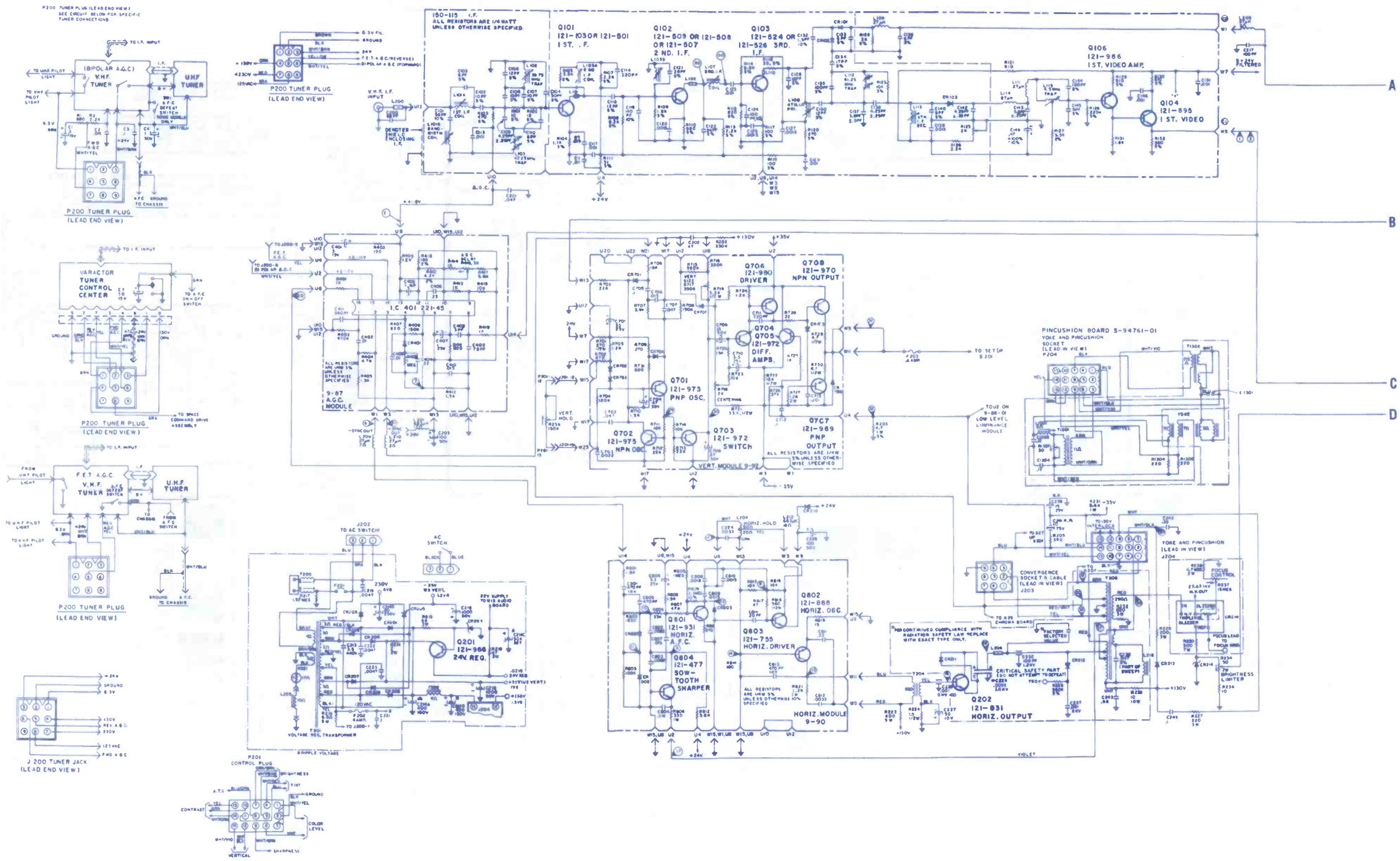
ZENITH

Color TV Chassis
17FC35

ELECTRONIC TECHNICIAN/DEALER TEKFAX

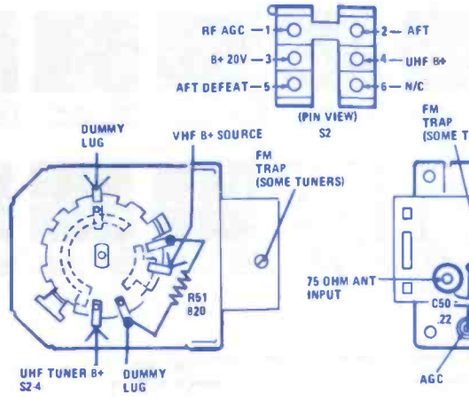
OCTOBER • 1974

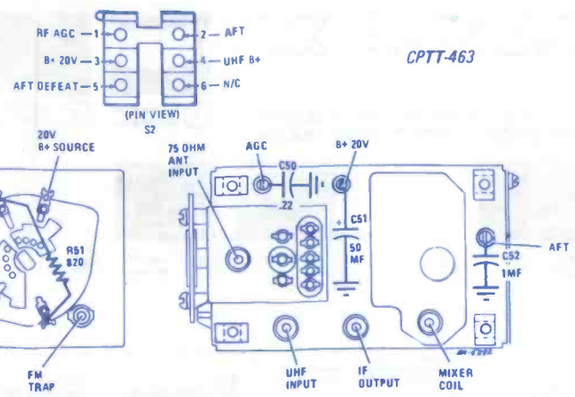
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

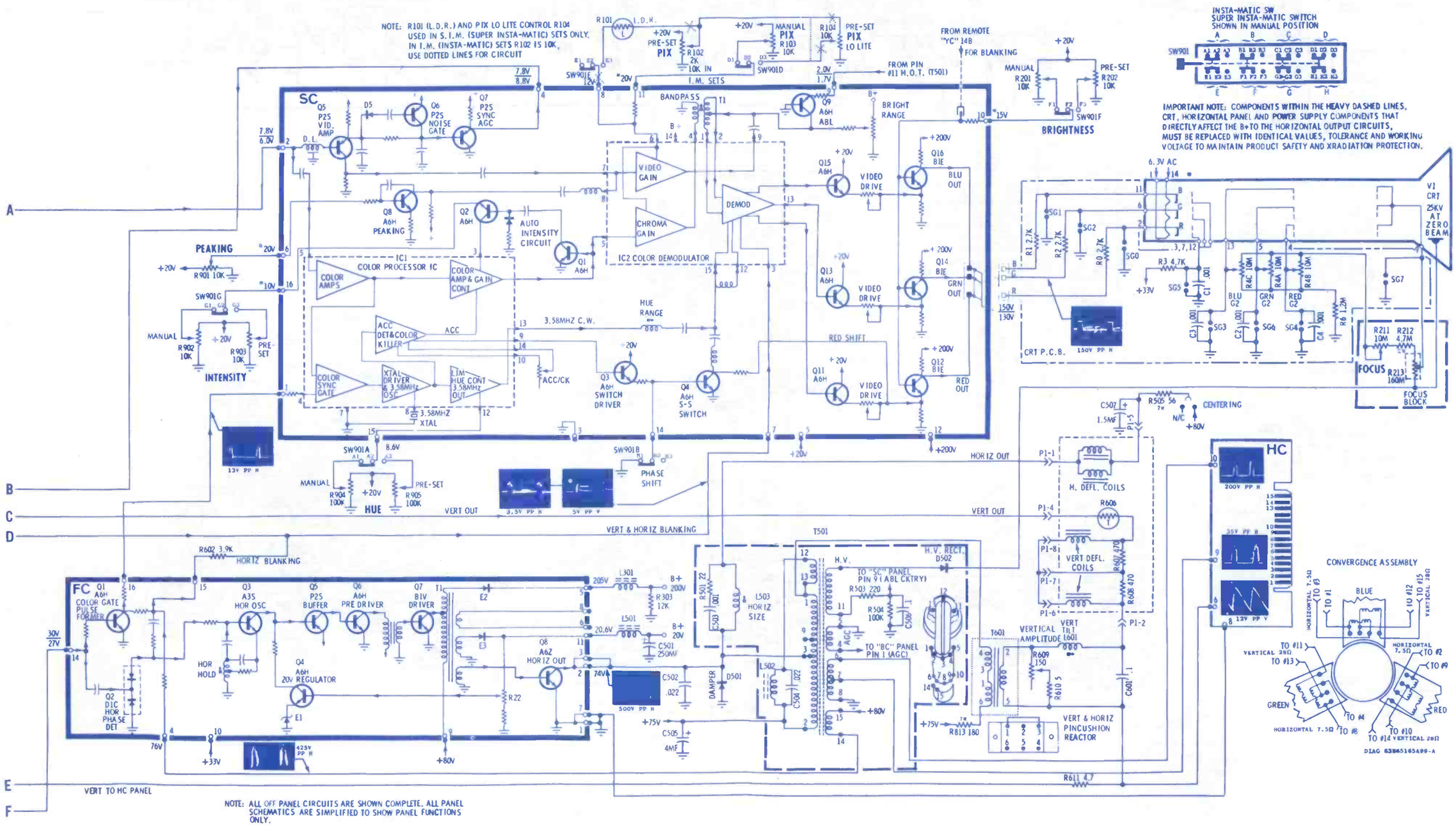


VHF TUNERS TERMINAL DETAILS

QUASAR ELECTRONICS
Color TV Chassis 17TS-941, C19, E19, 19TS-941







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

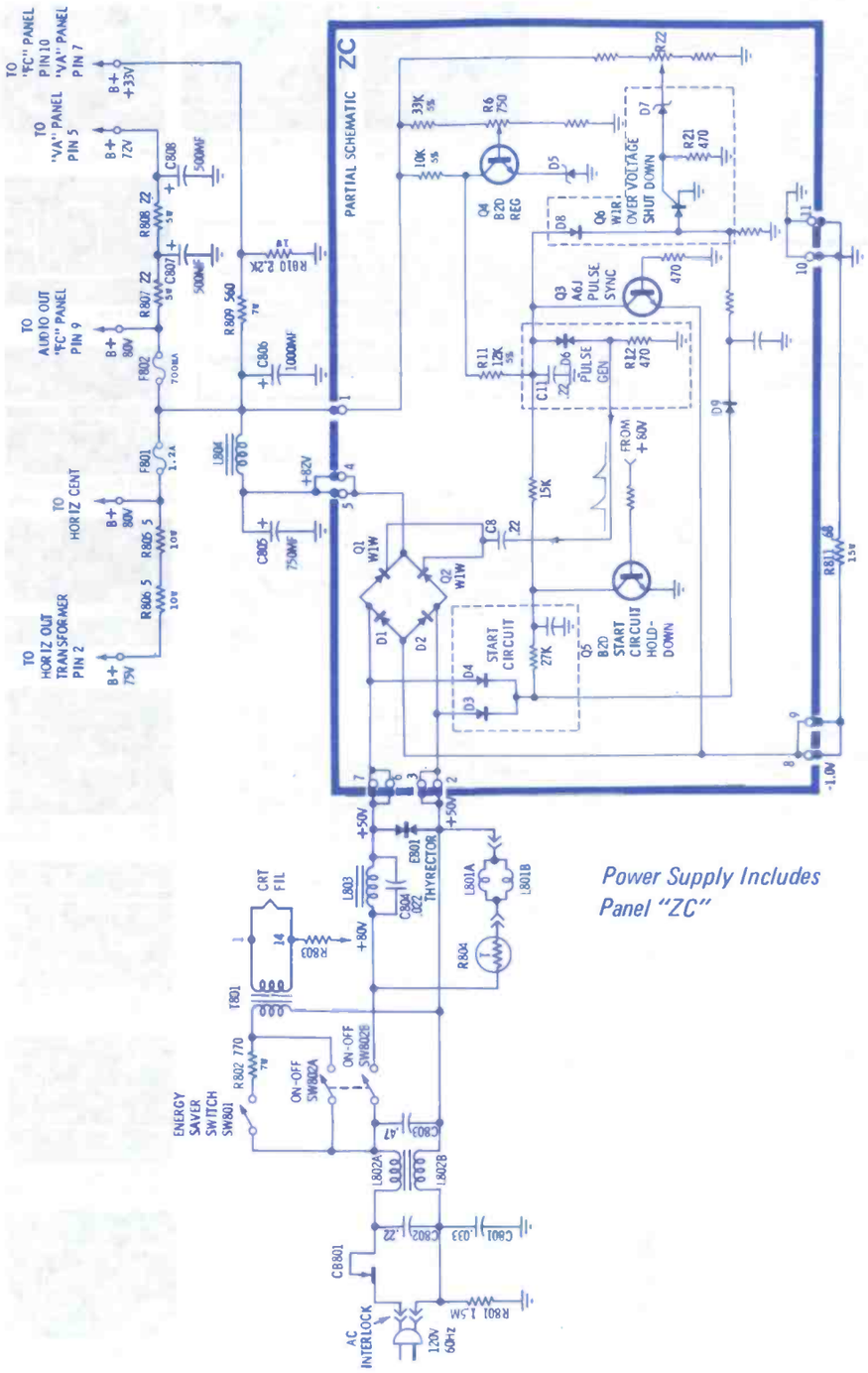
1551

QUASAR
Color TV Chassis
17TS-941, C19, E19,
19TS-941

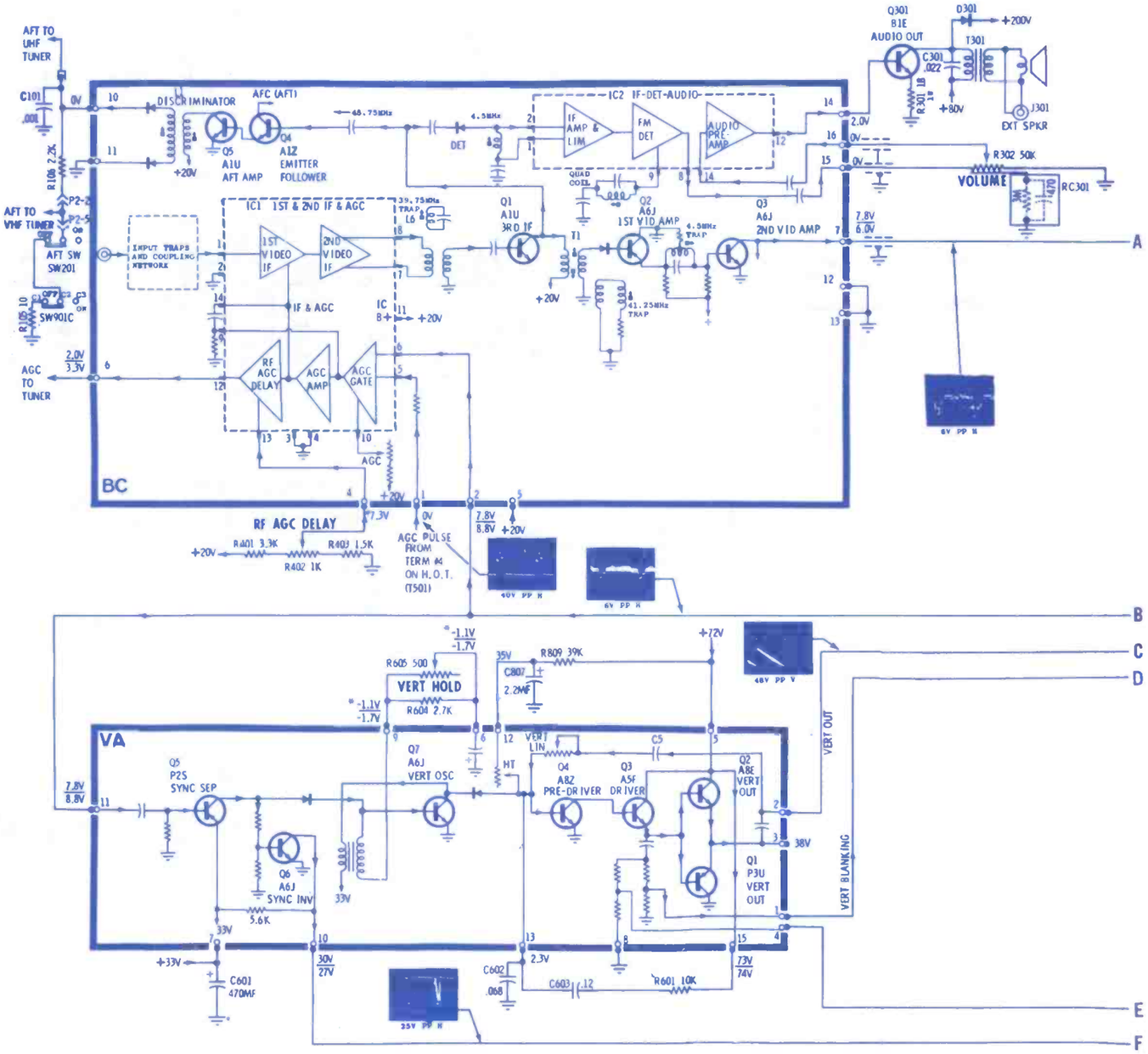
OCTOBER • 1974

ELECTRONIC TECHNICIAN/DEALER TEKFAX

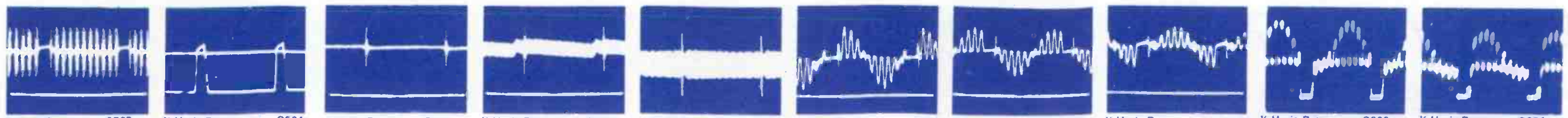
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR 5 NEW SETS



Power Supply Includes Panel "ZC"



GENERAL ELECTRIC
Color TV Chassis
QB



½ Horiz Rate (17) Q503 Collector 1.0 VPP Varies with Color control

½ Horiz Rate (18) Q504 Base 10 VPP

½ Horiz Rate (19) Q504 Collector 4 VPP

½ Horiz Rate (20) Q505 Emitter 0.3 VPP

½ Horiz Rate (21) T502 Pin 3 7 VPP

½ Horiz Rate (22) Q600 Base 4 VPP

½ Horiz Rate (23) Q604 Base 6 VPP

½ Horiz Rate (24) Q606 Base 2 VPP

½ Horiz Rate (25) Q600 Collector 150 VPP

½ Horiz Rate (26) Q604 Collector 150 VPP

½ Horiz Rate (27) Q606 Collector 100 VPP

½ Horiz Rate (28) Q201 Collector 45 VPP

½ Horiz Rate (29) Q207 Base 1.5 VPP

½ Horiz Rate (30) Q207 Collector 7 VPP

½ Horiz Rate (31) Q203 Base 9 VPP

½ Horiz Rate (32) Q203 Collector 35 VPP

½ Horiz Rate (33) Q205 Base 5 VPP

½ Horiz Rate (34) Q205 Collector 135 VPP

½ Horiz Rate (37) Jct. R251 L204 2.5 VPP

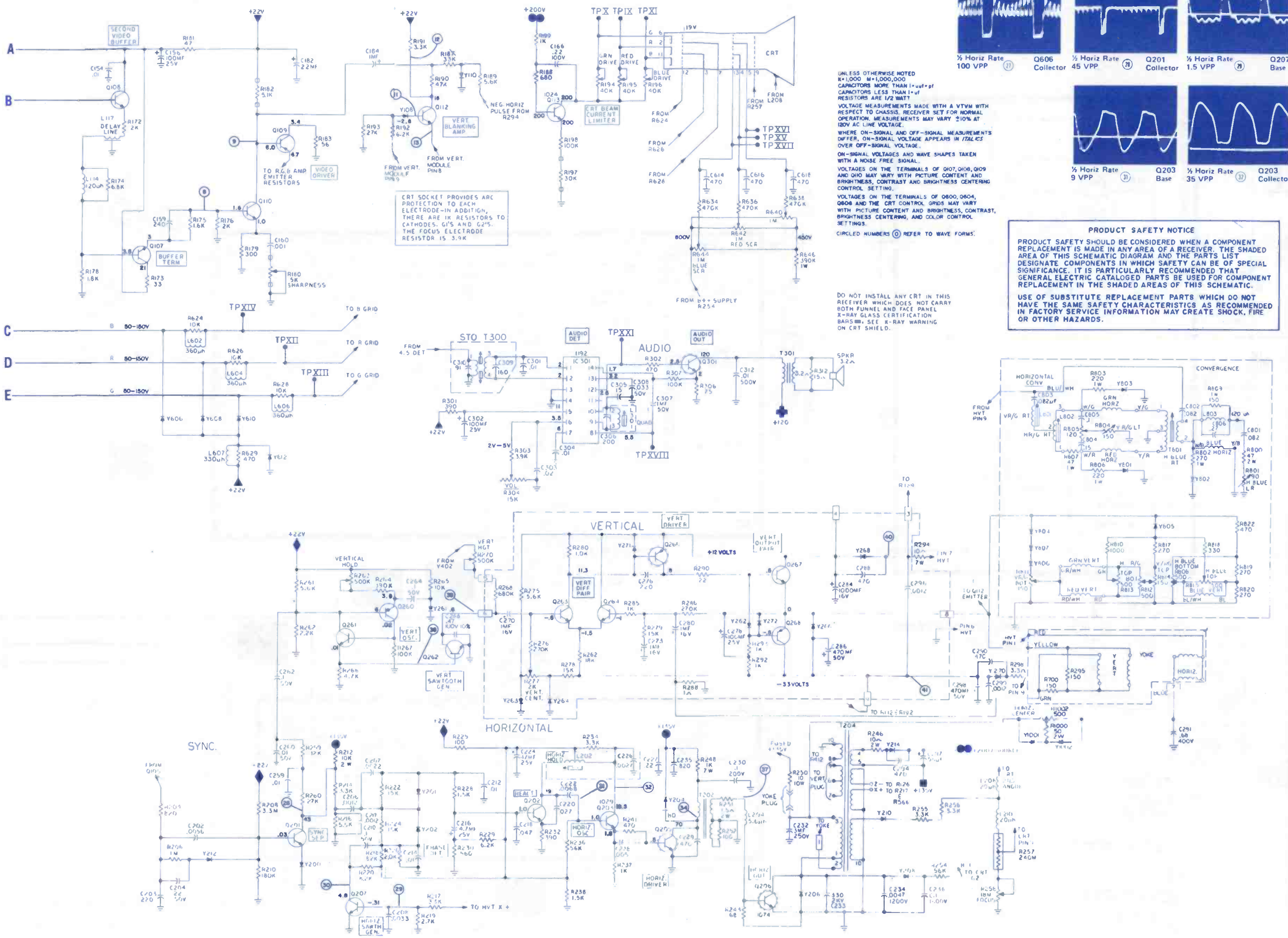
½ Vert Rate (38) Q262 Base 1 VPP

½ Vert Rate (39) Q262 Collector 1 VPP

½ Horiz Rate (40) Y268 Anode 90 VPP

½ Horiz Rate (41) Y270 Cathode 180 VPP

½ Horiz Rate (42) R412 180 VPP



UNLESS OTHERWISE NOTED
K=1,000 M=1,000,000
CAPACITORS MORE THAN 1=uuf=pf
CAPACITORS LESS THAN 1=uf
RESISTORS ARE 1/2 WATT

VOLTAGE MEASUREMENTS MADE WITH A VTVM WITH RESPECT TO CHASSIS. RECEIVER SET FOR NORMAL OPERATION. MEASUREMENTS MAY VARY ±10% AT 120V AC LINE VOLTAGE.

WHERE ON-SIGNAL AND OFF-SIGNAL MEASUREMENTS DIFFER, ON-SIGNAL VOLTAGE APPEARS IN *ITALICS* OVER OFF-SIGNAL VOLTAGE.

ON-SIGNAL VOLTAGES AND WAVE SHAPES TAKEN WITH A NOISE FREE SIGNAL.

VOLTAGES ON THE TERMINALS OF Q107, Q108, Q109 AND Q110 MAY VARY WITH PICTURE CONTENT AND BRIGHTNESS, CONTRAST AND BRIGHTNESS CENTERING CONTROL SETTING.

VOLTAGES ON THE TERMINALS OF Q600, Q604, Q606 AND THE CRT CONTROL GRIDS MAY VARY WITH PICTURE CONTENT AND BRIGHTNESS, CONTRAST, BRIGHTNESS CENTERING, AND COLOR CONTROL SETTINGS.

CIRCLED NUMBERS (O) REFER TO WAVE FORMS.

DO NOT INSTALL ANY CRT IN THIS RECEIVER WHICH DOES NOT CARRY BOTH FUNNEL AND FACE PANEL X-RAY GLASS CERTIFICATION BARS. SEE X-RAY WARNING ON CRT SHIELD.

PRODUCT SAFETY NOTICE

PRODUCT SAFETY SHOULD BE CONSIDERED WHEN A COMPONENT REPLACEMENT IS MADE IN ANY AREA OF A RECEIVER. THE SHADED AREA OF THIS SCHEMATIC DIAGRAM AND THE PARTS LIST DESIGNATE COMPONENTS IN WHICH SAFETY CAN BE OF SPECIAL SIGNIFICANCE. IT IS PARTICULARLY RECOMMENDED THAT GENERAL ELECTRIC CATALOGED PARTS BE USED FOR COMPONENT REPLACEMENT IN THE SHADED AREAS OF THIS SCHEMATIC.

USE OF SUBSTITUTE REPLACEMENT PARTS WHICH DO NOT HAVE THE SAME SAFETY CHARACTERISTICS AS RECOMMENDED IN FACTORY SERVICE INFORMATION MAY CREATE SHOCK, FIRE OR OTHER HAZARDS.

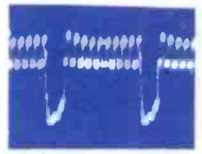
1550

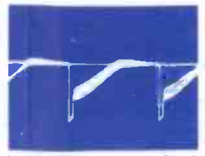
GENERAL ELECTRIC
Color TV Chassis
QB

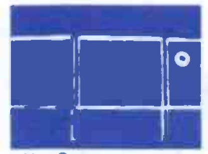
ELECTRONIC TECHNICIAN/DEALER TEKFAX

OCTOBER • 1974

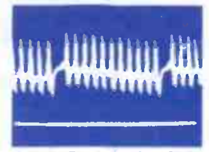
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS


½ Horiz Rate 5 VPP (10) Q109 Emitter

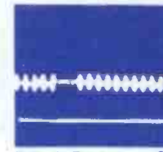

½ Vert Rate 30 VPP (11) Q112 Base

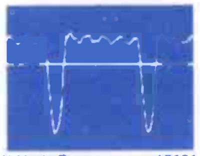

½ Vert Rate 50 VPP (12) Q112 Collector

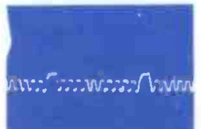

½ Vert Rate 40 VPP (13) Q112 Emitter


½ Horiz Rate 0.3 VPP (14) Q501 Base

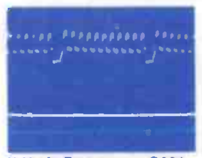

½ Horiz Rate 1.25 VPP (15) Q501 Collector


½ Horiz Rate 0.5VPP (16) Q503 Emitter

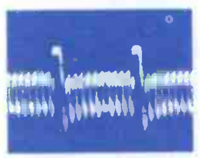

½ Horiz Rate 11 VPP (1) IC101 Pin 5

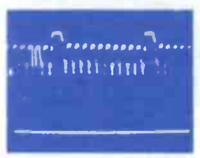

½ Horiz Rate 1 VPP (2) IC101 Pin 10


½ Horiz Rate 3 VPP (3) Q105 Emitter

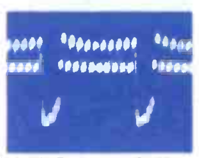

½ Horiz Rate 1.25 VPP (4) Q104 Emitter

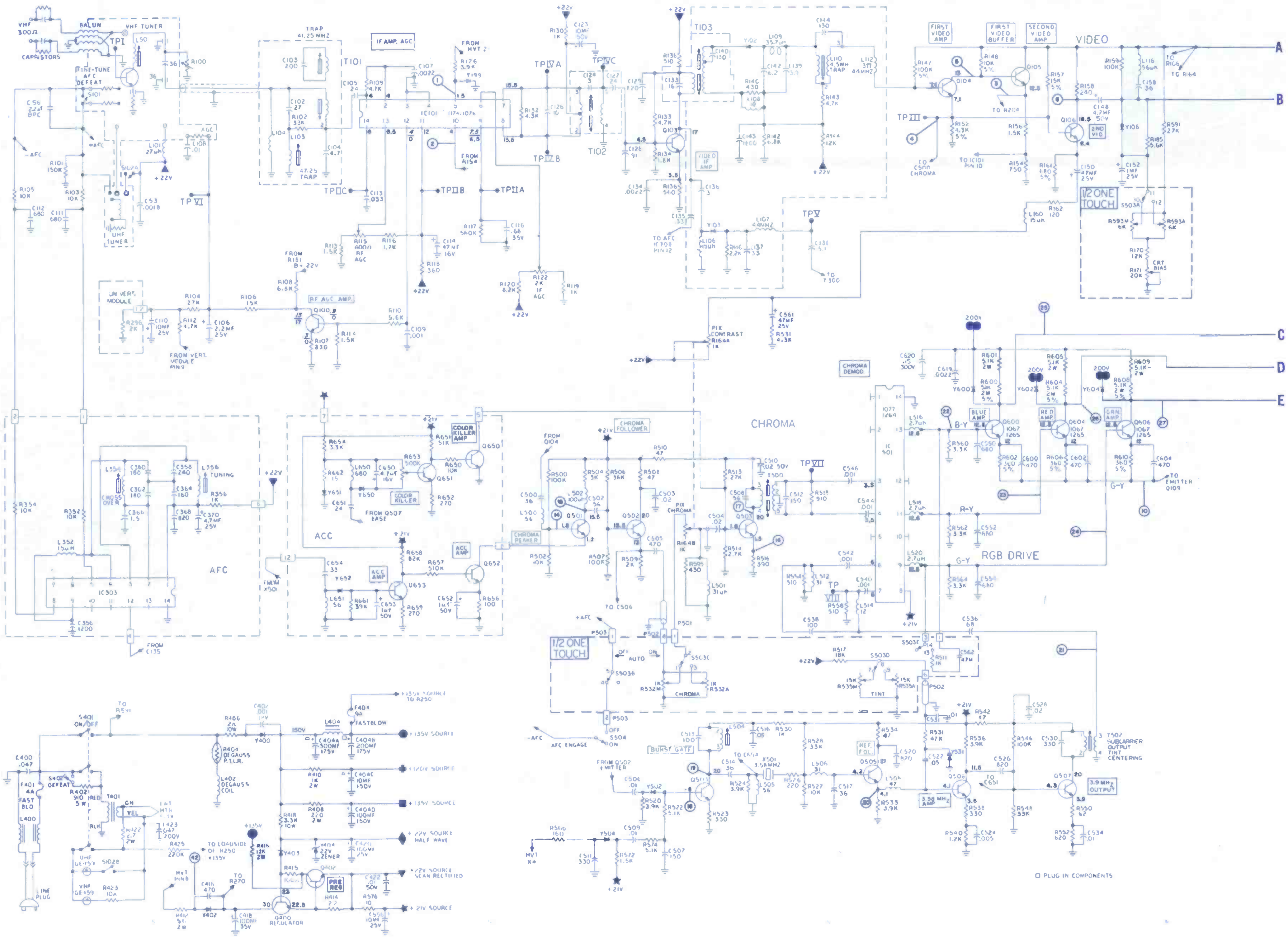

½ Horiz Rate 4VPP (5) Q104 Collector


½ Horiz Rate 1.5 VPP (6) Q106 Collector


½ Horiz Rate 1.5 VPP (7) Q108 Base


½ Horiz Rate 0.5 VPP (8) Q110 Base


½ Horiz Rate 5 VPP (9) Q110 Collector



ELECTRONIC TECHNICIAN/DEALER

TEKFAX

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

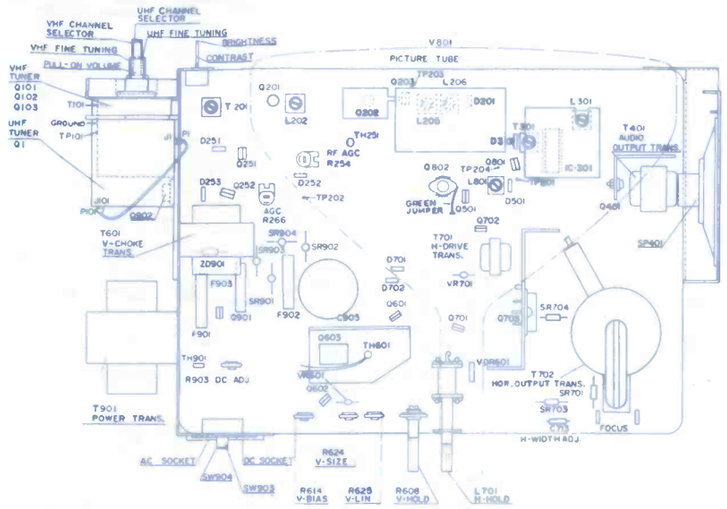
GROUP 266

OCTOBER • 1974

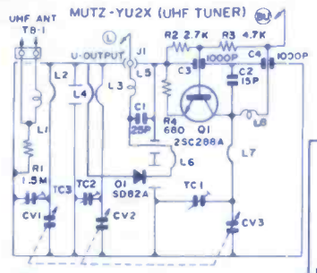
1549

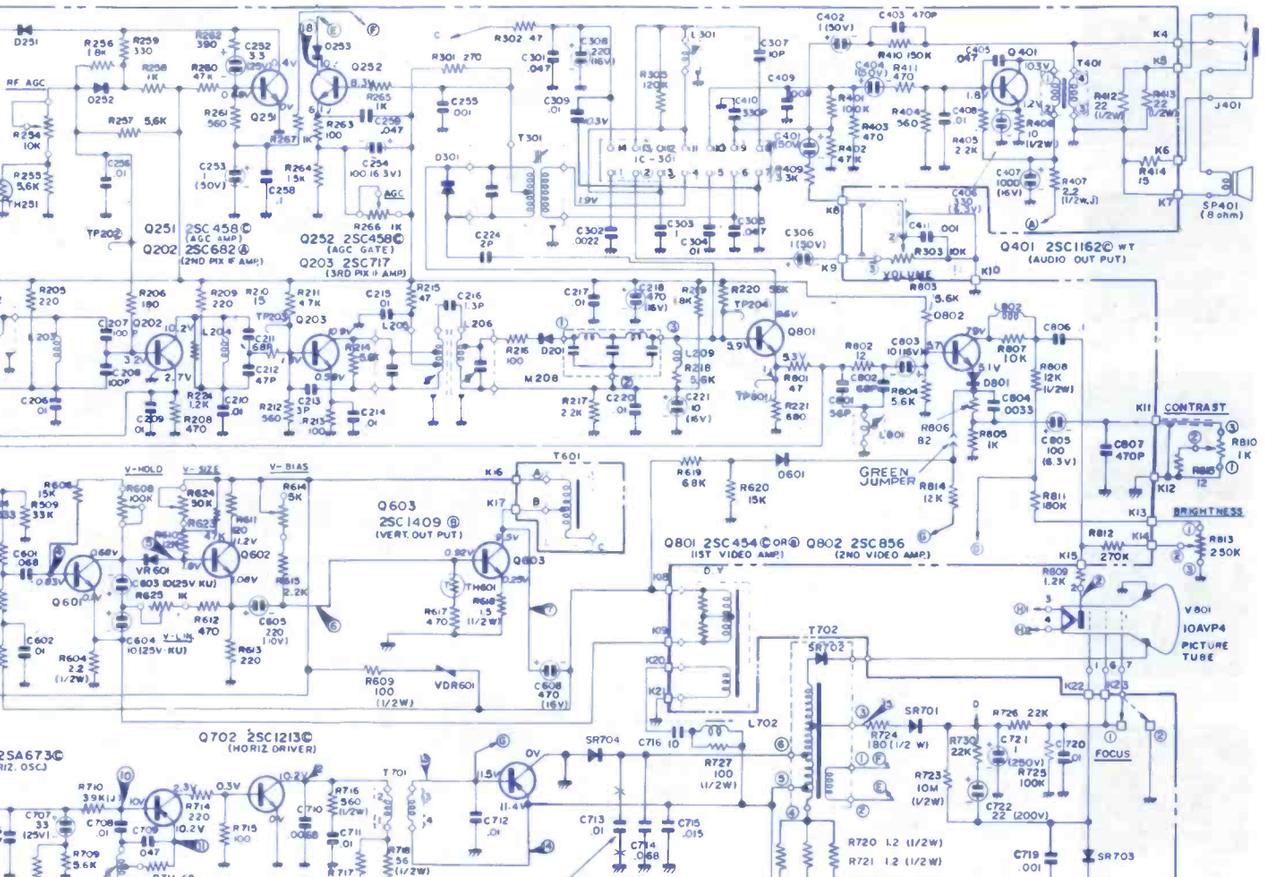
AIRLINE

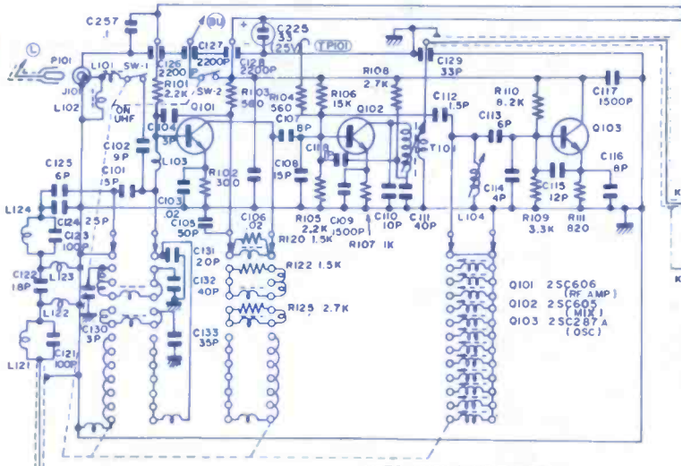
TV Model GEN11965A

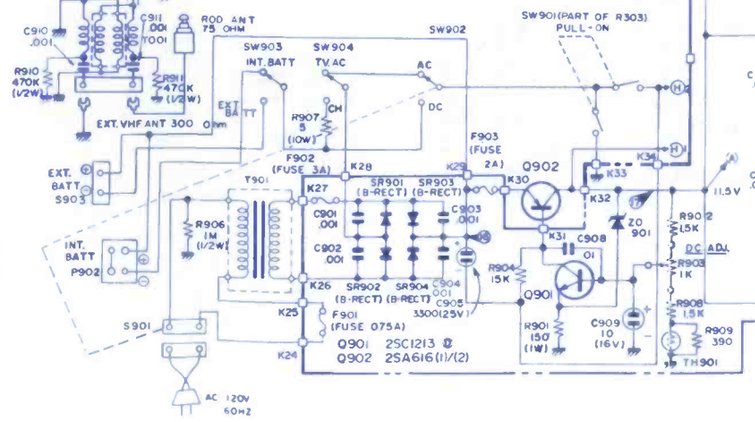


SYMBOL	DESCRIPTION	AIRLINE MODEL NO.
R254	10K RF AGC	J25635
R266	1K AGC	TV25511
R303, SW901	10K volume w/on-off switch	J25636
R608	100K vert hold	J25637
R614	5K vert bias	J25638
R624	50K vert size	J25639
R625	1K vert lin	J25640
R810	1K contrast	J25641
R813	250K brite	J25642
R903	1K voltage adjust	J25643
L301	coil sound detect	J611143
L701	coil horiz hold	J611141
L801	coil 4.5MHz trap	TV62258
T401	xformer audio output	J62762
T601	xformer vert choke	TV11169
T701	xformer horiz driver	J62763
T702	xformer horiz output incl SR702	J62764
T901	xformer power	J62765
M208	filter plx detect	J611140
TH251	therm AGC	J241263
TH601	therm vert	J241264
TH901	therm B +	J241264
VDR601	voltage dependent resistor vert	TV24250
VR601	varistor vert	J241261
VR701	varistor horiz	J241261
F901	fuse 0.75a, 250v, slo-blo pigtail	J18512
F902	fuse 3a, 125v slo-blo pigtail	315003
F903	fuse 2a, 125v slo-blo pigtail	315002
	tuner UHF	J35447
	tuner VHF	J35446
	yoke deflect	J611145









LEADER

'Now' Color Bar Generators

MODEL LCG-384
MINI-PORTABLE, BATTERY-OPERATED, SOLID STATE PRECISION

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THE ULTIMATE IN PATTERN STABILITY THROUGH DIGITAL ACCURACY

MODEL LCG-395
WITH STAIRCASE, WINDOW, CONVERGENCE & WHITE RASTER

MODEL LCG-391
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High quality test patterns through our exclusive digital clock binary system! Uses just four 1.5V penlight cells, is AC adaptable and fits into all tube caddies. Has 2 pushbutton selectable frequencies. 8 basic patterns, with gated rainbow; and temperature change protection. Includes carry case, extra battery comp't and all accessories.

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The finest available thanks to our unique digital clock, binary frequency divider. Features: lab grade performance in 15 patterns for both RF and video frequencies with single dot and crosshatch; two switch selectable channels; regulated DC power supply and ambient temperature control. All accessories incl.

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An exciting solid state first for testing CATV, MATV, CCTV, VTR & NTSC receivers. With 5-step staircase, window, convergence & white purity adj. Offers complete rainbow spectrum, 10 gated rainbow patterns & 3 gated bar patterns. Features IF, RF and composite video outputs and yoke polarity checker. Includes gun killer leads and cables.

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Binary clock, digital IC's delivers 6 extra sharp, extra stable patterns and white raster for purity checks. 2 sw. select freq's, vert & hztl return trace blanking, flickerless hztl lines & square crosshatch for linearity. Uses offset type color bars. Very compact, very lightweight, very practical. With RF cable and carry case.

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. . . for more details circle 119 on Reader Service Card

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The Model 630 V-O-M is priced at a thrifty $72.

The rugged, general purpose Triplett Model 630 is the kind of dependable V-O-M that both teachers and students appreciate. And for the same reasons the electronic and electrical maintenance professionals do. Uncompromising accuracy. Sturdy lightweight (only 3 lbs. with batteries). Simplified single switch operation holds errors to a minimum, and diode overload protection for the meter suspension movement reduces the chance of tester damage when mistakes do occur.

With long, clean scales covering 27 ranges in only four arcs, the Triplett Model 630 is remarkably easy-to-read.

It's packed with major features:

1. **Diode overload-protected suspension movement V-O-M; single range switch minimizes error.**
2. **4 Ohmmeter range with 4.4 ohms center scale.**
3. **Simplified scale—only 4 arcs for all 27 ranges.**

Sensitivity is 20,000 Ohms per Volt DC, 5000 Ohms per Volt AC. Accuracy is an excellent 2% on DC, and 3% on AC. Measures resistance to 100 megohms, with 6,000 Volt AC and DC capability.

Handles DC microamperes 0-60, and DC milliamperes 0-120, both at 250 mV, and can read DC amperes 0-12.

Rugged black molded plastic case with removable black leather carrying strap. All this for just **$72.**

Get the same convenience and operating advantages plus 1½% DC accuracy and mirrored scale with the Triplett Model 630-A, priced at only **$83.**

For more information or a free demonstration, call your Triplett distributor or sales representative. For the name of the representative nearest you, dial toll free (800) 645-9200. New York State, call collect (516) 294-0990. Triplett Corporation, Bluffton, Ohio 45817.

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