JULY 1976 • 75 CENTS A HARCOURT BRACE JOVANOVICH PUBLICATION

ELECTRONIC TECHNICIAN/DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

'76 NESDA Convention August 13-17

(Agenda in this issue)

Troubleshooting TV Sync Separators

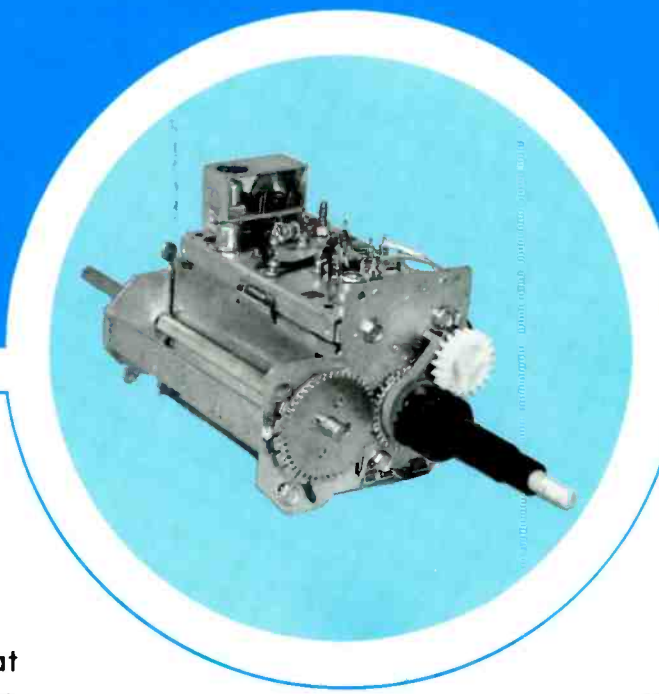
Distortion In Car Radios

State Of The Art Of FM Detectors

CB Theft Prevention: A New Dealer Aftermarket

NEWCOM Wrapup Report

THE BEST OF EVERYTHING HAS ITS PRICE ...EVEN TUNER SERVICE!



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THE COMPLETE LIST OF ALL PTS SERVICE CENTERS APPEARS ON THE NEXT PAGE.

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ELECTRONIC TECHNICIAN/DEALER

JULY 1976 • VOLUME 98 NUMBER 7

THE COVER: The National Electronic Service Dealer Association (NESDA) is staging its annual convention this year, August 13-17, at the Palacio del Rio Hilton Hotel and the Convention Center in San Antonio. A full schedule of business meetings, banquets and seminars is planned (see Page 26) with a lot of fun events included. Our cover this month is a photo taken during a seminar at last year's convention.

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EDITOR'S MEMO

August Is NATESA & NESDA Convention Time—Give Yourself A Tax-Deductible Vacation By Attending Either Or Both Conventions

The National Alliance of Television & Electronic Service Associations (NATESA) and the National Electronic Service Dealers Association (NESDA) will be holding their annual conventions next month.

If you have not already taken your summer vacation and have not yet committed yourself to definite, unalterable vacation plans, we at ET/D suggest that you give serious consideration to including one or both of the national electronic service association conventions in your vacation itinerary.

You don't have to be a member to attend either convention. And, in addition to the obvious benefits of being able to meet and "compare notes" with other owners and managers of electronic sales and service businesses from throughout the nation, your transportation costs to and from the conventions and most of your other convention expenses will qualify as legitimate tax-deductible business expenditures.

NATESA's annual convention is being held Aug. 19-22 at the Pheasant Run resort complex in St. Charles, Illinois, a picturesque river town on Illinois Route 64 about 25 miles west of downtown Chicago. (For those traveling by air, seven-times-per-day limousine service is available between Chicago's O'Hare Airport, the Chicago Loop area and Pheasant Run.)

The Pheasant Run resort complex, which also was the site of the NATESA Convention last year, offers a full range of indoor and outdoor recreational activities, including golf on a championship course, tennis, horseback riding, indoor/outdoor swimming, and a variety of dining and "evening recreational" facilities (including a dinner theatre and an "indoor Bourbon Street").

The registration fee for the four-day NATESA Convention is $25 per person and includes the costs of the convention banquet/floor show, all "sponsored" convention meals, refreshments, hospitality suites and business meetings and seminars. The special daily room rate at Pheasant Run for NATESA Convention attendees is $32 for single or double accommodations.

Complete details about NATESA Convention activities and registration can be obtained by writing or calling Frank Mock, Executive Director, NATESA, 5908 S. Troy St., Chicago, IL 60629 (phone: 312-476-6363).

NESDA's annual convention, which is being held this year in conjunction with the annual conventions of the International Society of Certified Electronic Technicians (ISCET) and the Texas Electronics Association (TEA), is scheduled Aug. 13-17 at the Palacio del Rio Hilton Hotel and the San Antonio Convention Center in San Antonio, Texas.

A complete agenda of the activities scheduled for the joint NESDA/ISCET/TEA Convention appears on pages 26 and 27 of this issue.(Because the NESDA Convention will take place before some of our readers receive their August issue of ET/D, we decided to publish the agenda for it in this issue. Conversely, because the NATESA Convention is scheduled later in August, after all ET/D readers should have received their August issues, a complete agenda of NATESA Convention activities will be published in the August issue.)

The registration fee for the NESDA/ISCET/TEA Convention is $40 per person and includes the costs of all activities listed in the schedule of events in this issue, with the exceptions of the registration fees for the "Profitable Service Management" seminars—which are $20 for NESDA members and $30 for nonmembers—and the entry fee for the NESDA Open Golf Tourney, which is sponsored this year by ET/D Magazine. Daily rates at the Palacio del Rio Hilton are $27 for single and $38 for double accommodations.

Other "optional" activities scheduled for the NESDA/ISCET/TEA Convention include a tour of the WW II Air Museum in nearby Harlingen, Texas, and a special post convention sidetrip on Aug. 18 or 19 to the beautiful Palo Duro Canyon area near Amarillo, Texas, during which tour members will attend a Texas barbeque and musical drama in the canyon's natural amphitheater and, while in Amarillo, will visit the Tech Spray Company, whose president, Dick Pavek, will be your own special host on this post convention sidetrip.

Additional information about NESDA Convention activities and registration can be obtained by writing or calling Dick Glass, Executive Vice President, NESDA, 1715 Expo Lane, Indianapolis, IN 46224 (phone: 317-241-8160).

Details about the Palo Duro Canyon/Amarillo post-convention tour can be obtained by writing to Dick Pavek, President, Tech Spray, P.O. Box 949, Amarillo, TX 79105.

If you decide to include one or both of the national electronic service association conventions in your vacation plans—or make either or both your complete vacation—I can assure you that you will not only broaden and enrich your knowledge of what profitable servicing is all about, but you and your family will also enjoy yourselves and meet a lot of warm and friendly people in the process—plus you'll save a bit of vacation expense because much of your cost of attending the conventions will be tax-deductible.

We at ET/D hope to see you at either the NATESA or NESDA convention, or at both if you have the time.

J.W. Phipps

IN 1970, WE SAID WE WERE GOING TO TAKE OVER IN DIGITAL VOLTMETERS.

At the time, it was not an industry-shaking announcement. In fact, there were a few laughs from our competitors.

Technology-for-technology was still king and everybody bought all the digits, resolution, accuracy and features they could squeeze out of their budget.

We listened. We made some predictions.

A change was on the way.

While our competitors were touting bigger and bigger boxes and more and more digits, we were designing the new DVM for a different electronics industry.

A little while later, we introduced the Fluke 8000A digital voltmeter.

In 1972, it seemed awfully small in comparison to our competitor's behemoths. It only had 3½ digits. It looked different.

The industry's reaction caught everyone by surprise.

Except us.

You could say the Fluke 8000A is just now getting its legs and becoming the performer we always intended it to be.

It's had to. Because of our foresightedness, a whole new segment of the DVM market emerged. Suddenly, everyone was building a low-cost DVM.

Others now ask you to compare them to us.

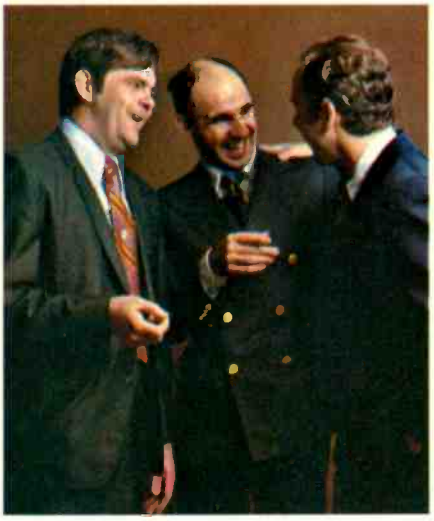
But they're sort of selective about what they ask you to compare.

Problem is that the average DVM lets you down in one performance area or another.

Not the Fluke 8000A.

It's got overload protection for all ranges. Twenty-six ranges of volts, amps and ohms. Common mode rejection of 120 dB with an unbalance resistance of one kilohm. Auto zero. The best accuracy statement of any 3½-digit DVM—0.1% accuracy ±1 digit.

It also performs, day after day. We'll guarantee one year of accuracy on all key parameters. Every unit comes with a one-year, no-nonsense warranty. If something does go wrong, we've got over 30 Fluke service centers that'll guarantee quick turnaround on your repairs.



They laughed.

And while those other DVM's have been scurrying to catch the 8000A, we've been improving and adding important, new options. Options that add additional measurement capability to the basic 8000A. There's a low-ohms model with 0.001-ohm resolution. A high current model for measurement up to 20 amps. A milliamp-second model. An analog meter model for peaking and dipping measurements. A high voltage probe for 1 KV to 40 KV measurements, RF probes for ac measurements to 500 MHz, a clamp-on ac current transformer for 2 to 600 A measurements, rack mount kits, test lead kits, dust covers and carrying cases.

So look at everything. Features. Performance. Reliability. Options. Price.

There's a reason the 8000A is the world leader in DVM sales.

And to all those people out there who are claiming this and that about which DVM you should own, ask them why the 8000A leads in sales at $299.*

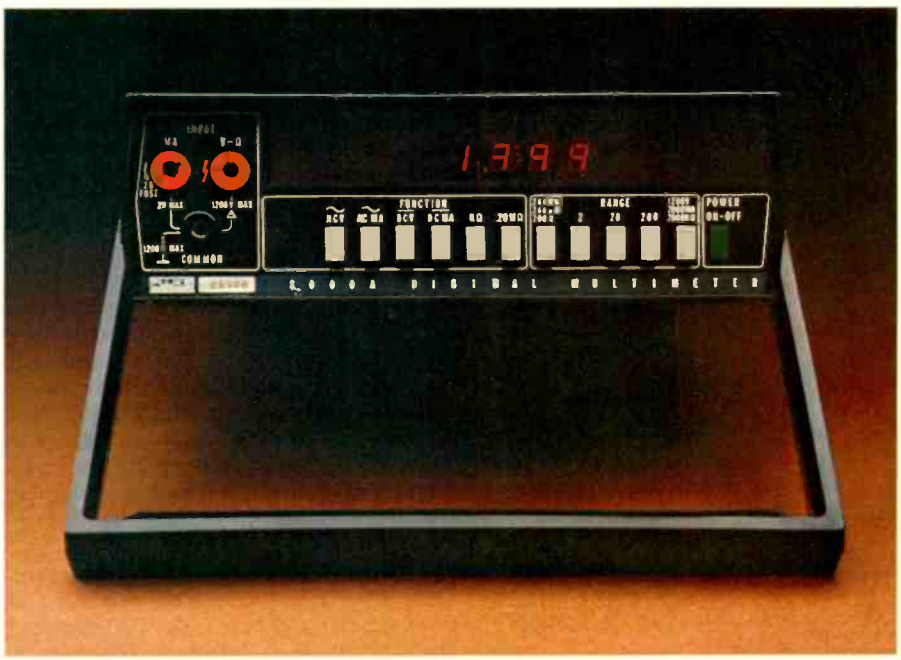
They won't laugh it off.

For data out today, dial our toll-free hotline, 800-426-0361.

John Fluke Mfg. Co., Inc., P.O. Box 43210, MountlakeTerrace, WA 98043

Fluke (Nederland) B.V., P.O. Box 5053, Zevenheuvelenweg 53, Tilburg, Netherlands. Phone: (013) 673-973 Telex: 52237

**Domestic price only.*



STILL THE LEADER. 8000A DVM. FLUKE®

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NEWS OF THE INDUSTRY

CB Manufacturer Predicts End of CB Boom In One Year

The "Boom-type" growth of CB radio will end in 1977, and sales will stabilize to around 15 million to 18 million sets per year, according to a prediction made by William I. Thomas, president of the Pathcom Corporation. In a statement to the company's stockholders, reported in *Electronic News*, Thomas said Pathcom "is diversifying into marine and business two-way radio equipment to prepare for an end to the explosive growth of the past 4 years and to hedge aginst price pressure." He said "he expects that sometime this summer supply will come into balance with demand, and as supplies become more plentiful this fall we will probably have several people drop out of the CB radio business."

Self-adjusting Color Is Major Promotion Point of Three Of The Top TV Set Manufacturers

Three of the major TV set manufacturers—GE, RCA and Sylvania—have included varying forms of automatic color control in their 1977 TV lines, and are utilizing this feature in their major promotional efforts.

GE calls its new feature VIR (vertical interval reference) and has included the feature in five of it's 1977 color sets. "These broadcast-controlled color sets sense a color-reference signal used until today only by broadcasters," said Fred R. Wellner, general manager of GE's Television Business Department. "GE's broadcast-controlled sets now complete the chain from studio to home by sensing when the VIR signal is present; decoding the color intensity and tint information; and automatically producing a broadcast-adjusted color picture," Wellner explained.

RCA's automatic color control system—ColorTrak—was introduced last fall in eight of their console models. This year ColorTrak is now included in 18 RCA consoles and 8 table models. In an advertising campaign recently announced *(from TV Digest)*, RCA offers a simplified explanation of how ColorTrak works, "Before you see the color, the ColorTrak system grabs it, aligns it, defines it, sharpens it, tones it and locks the color on track."

Sylvania has actually included a "self-adjusting color" feature in their TV lines for the past four years. Called "GT-Matic", the control system has now been included—as of this year—in Sylvania's complete color line. According to a report in *TV Digest*, the firm is

"promoting its 4-year-old GT-Matic and newer GT-Matic by claiming it accomplishes more than others and calling its two competitors "johnny-come-latelies" in the automatic color field."

All three firms—GE, RCA and Sylvania—indicate that their "automatic color control" features are part of an effort this year to capture the replacement TV sales market, which, according to *TV Digest*, is estimated at from 33 to 50% of the color TV market.

Fantastic Growth Of CB Is Reflected In Number Of Licenses Granted

In a memo to its distributor members, the Electronic Industries Association (EIA) uses the FCC's monthly CB application reports to indicate the rapid growth of the CB market, pointing out that because of the number of unlicensed operators, multiple sets operating under the same license, etc., the actual volume of new CB sets sold is probably a lot larger. Still, as the Memo says, the FCC monthly figures may "indicate the current status and trends in the marketplace."

According to the Memo, the FCC reported 378,066 CB licenses granted in 1974, compared to 1,727,000 in 1975. A total of 1,040,048 licenses existed in 1974, compared to 2,659,000 in 1975. And to show the ever-increasing growth of applications, here is a comparative breakdown of CB applications in the first three months of 1975 and the first three months of this year:

	JANUARY	FEBRUARY	MARCH
1975	73,000	62,000	146,000
1976	515,000	476,000	566,000

On-The-Job Training In Electronics To Be Available to 600 Jobless Or Underemployed People

In a continuation of a cooperative program with industry, the International Union of Electrical, Radio and Machine Workers is arranging on-the-job training for 600 jobless or underemployed people in 19 states, according to an announcement from Assistant Secretary of Labor William H. Kolberg. Companies with which the IUE has collective bargaining arrangements will train these people for jobs—both entry-level and advance—in electronics, electrical and allied manufacturing. Wages will range from $2.50 to $5.50 per hour. ■

TECHNICAL LITERATURE

A New Solid State Replacement Guide that cross references more than 112,000 domestic and foreign solid-state devices which can be replaced by 313 RCA SK semiconductors is now available from RCA. The guide also features an index of RCA SK-Series semiconductors and accessories, significant characteristic and application information which specifies areas of operation and capability of specific RCA types, line drawings of dimensional outlines and terminal arrangements and a listing of mounting hardware. The 160 page book—SPG-202S—costs $1.00 at RCA distributors or from *RCA Distributor and Special Products Division*, P.O. Box 85, Runnemede, N.J. 08078.

New CB Filters and Communications Accessories are described in a new brochure available from Bell Industries. The filters described have been designed to eliminate or greatly reduce virtually any type of interference that CB operators might encounter. Included are high pass, low pass, audio interference, power line and TV set antenna filters, and alternator and generator suppressor kits. A selection of connectors, plugs and cable assemblies to facilitate easy installation also is described. It's free from Operations Manager, *Bell Industries/J.W. Miller Division*, P.O. Box 5825, Compton, California 90224.

How To Reduce Impulse Noise in CB Transceivers was the subject of a recent presentation of an E.F. Johnson Company executive before the 1976 Automotive Engineering Congress. In his presentation, John W. Foster outlined how a manufacturer of two-way radio communications equipment copes with the problem of electrical impulse noise. He noted that noise is undesirable because it reduces communication range, annoys the listeners, induces operator fatigue and creates dissatisfaction with the product. Copies of Foster's presentation—Paper No. 760277—are available free from the *Society of Automotive Engineers, Inc.*, 400 Commonwealth Drive, Warrendale, Pa. 15906.

A Catalog of Quick-Disconnect Hardware, that provides examples and diagrams for the easy use and ordering of terminal boards, terminated lead assemblies, fuse clips, holders, and other quick-disconnect hardware, is now offered by Keystone Electronics. The new catalog—No. 794—is designed primarily for manufacturers and users of this type of hardware. Available free from *Keystone Electronics Corp.*, 49 Bleecker Street, New York, N.Y. 10012.

Electronic Test Accessories, such as molded banana plugs, molded patch cords, cable assemblies, test socket adaptors, space molded accessories, mold test leads, connecting leads and IC test clips, are illustrated and described in a new 25th Anniversary catalog from ITT. Special charts cover a cross index of UG numbers, cable and wire description, and an alphabetical and numerical index. Available free from *ITT Pomona Electronics*, 1500 E. 9th St., Pomono, Calif. 91766.

A Technical and Do-It-Yourself Catalog, from Tab Books, describes over 400 current and forthcoming books, plus 14 of the firm's Electronic Book/Kits. The 44-page catalog includes books in a wide range of subject areas from: Amateur Radio License Study Guides to Communications—2-Way, Shortwave and CB Radio. Among new and forthcoming titles described are: "Build Your Own Working Robot", "Modern Electronics Math", "VHF/UHF Fire, Police, Ham Scanners—Schematic Servicing Manual", and "The Electronic Musical Instrument Manual." The catalog is free upon request from *Tab Books*, Blue Ridge Summit, Pa. 17214.

An Associate CB Dealer Member program of the Communications Equipment Distributors Association (CEDA) is described in a new brochure being distributed to retailers of CB radio equipment. The brochure highlights the benefits of CEDA membership such as special publications, training programs, seminars and clinics. Also described is the CEDA Clearing House, a program now being developed to act as a mediating and ombudsman service, working with other industry associations. The brochure is free from *CEDA*, P.O. Box 1118, Carbondale, IL 62901.

Electronic and Electric Connecting Devices, and other products for terminating, splicing and programming circuits are illustrated and described in the 1976 edition of quick-reference guide from Amp Special Industries. The 24-page catalog is available free from *Amp Special Industries*, P.O. Box 1776, Paoli, Pa. 19301.

Electronic Test Instruments are illustrated and described in full detail with specifications in a new 40-page catalog available from B & K Precision. The full line of the company's test

Cash in on the booming CB repair business. Get your Mallory big-profit package now.

It's an introductory offer with an unbeatable combination.

A huge assortment. With the Mallory CB parts replacement package, you can service the electronics in almost every type of CB radio made. Because, unlike limited-coverage programs, you get more than 370 of the most commonly used semiconductor and other replacement parts.

And a hefty discount off column pricing. Which can add up to a whopping profit in CB repair — up to 25 times the cost of the parts to you.

Plus, free Mallobin® cabinets, the great space-saving organizers — seven rugged plastic 15-drawer units with each Mallory CB package you buy. And a free CB Component Cross-Reference booklet covering the semiconductors and controls used by the major manufacturers of CB radios.

What a deal for a very modest investment. Under $200, in fact. It's a profit opportunity you just can't afford to pass up.

Act now. Fill in and mail the coupon today.

TO: Dept. 102, Mallory Distributor Products Co.
Box 1284, Indianapolis, IN 46206

☐ I want to take advantage of your introductory offer now. Send one complete CB replacement package through my Mallory distributor. It is my understanding that I will be billed by my Mallory distributor.

☐ Send more information on the Mallory CB profit package.

Name_____

Company_____

Address_____

City_____ State_____ Zip_____

Telephone_____

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instruments is covered in the new catalog, including CB radio test instruments, frequency counters, multimers, oscilloscopes, vectorscopes, signal and marker generators, CRT restorer/analyzers, and transistor testers. Available free from *B & K Precision*, 6460 W. Cortland, Chicago, IL 60635.

A Pager & Communication Battery Catalog is now available that includes specifications and cross-reference information on nickel-cadmium, mercury and alkaline batteries. Available free from *JaBro Batteries, Inc.*, Dept. 176, 4036 Wolf Road, Western Springs, Ill. 60558.

An Antenna Catalog, in full color, illustrates and describes seven base station antennas, a selection of mobile and marine antennas, antenna packages, mounts and accessories. The new 24-page catalog from Avanti also features a description of the companies co-inductive principle for base antennas, a full page of antenna facts, and an illustrated description of the advantages of co-phasing for added mobile performance. Available free from *Avanti Research & Development, Inc.*, 340 Stewart Avenue, Addison, Illinois 60101.

A Catalog Of Small Tools for anyone working in the communications, telephone and electronic industries is now available from P.K. Neuses, Inc. The new catalog contains photos and descriptions of such things as cable and wire tools, "non-residual" contact burnishers, wrenches, screwdrivers, test connecting tools and brushes, and tool kits for cable terminating. Available free from *P.K. Neuses, Inc.*, P.O. Box 100, Arlington Heights, Illinois 60006.

A Sound Reinforcement Component Application Guidebook is being offered now by Shure Brothers. The new 16-page brochure describes how its SR products handle critical sound requirements ranging in size and complexity from Las Vegas showplaces, outdoor concerts, auditoriums and churches to theatres and nightclubs. Available free from *Shure Brothers, Inc.*, 222 Hartrey Avenue, Evanston, Illinois 60204.

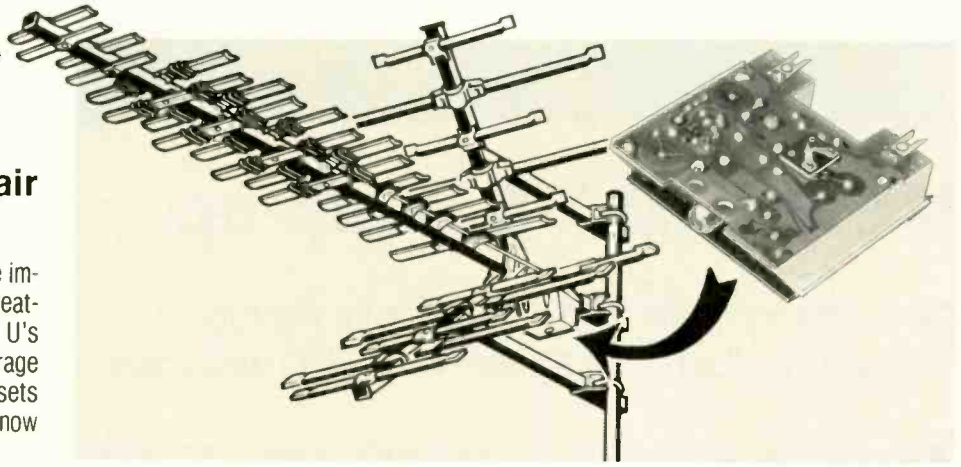
An Electronics Purchasing Manual, for mail order purchase, is available now from Mouser Electronics. The new catalog contains 56 pages of electronic components, test equipment, tools and production aids. It's available free from *Mouser Electronics*, 11511 Woodside Avenue, Lakeside, California 92040. ■

PHENOMENAL BREAKTHROUGH IN UHF RECEPTION!

Don't say you can't get good UHF reception until you've tried this new combination by Winegard

New Super Lo-Noise Preamp With New Antenna Makes Poor Pictures Good and Fair Pictures Excellent

Good reception of UHF stations is more important than ever. Programming has greatly improved in recent years on the U's and many offer exclusive sports coverage viewers so eagerly want. If you sell sets or install antennas in UHF areas, you know what we're talking about.



Winegard AC-4990 Preamplifier Combined With CH-9095 Antenna Delivers Amazing UHF Reception.

The Problem

You also know what we're talking about when we say that reception of UHF stations in most areas is rarely as good as you get on the VHF stations. This is a major, universal problem.

Why the problem? For one thing, many UHF stations are not on full authorized power. And, transmission line losses at UHF frequencies present difficulties. But the biggest culprit of all is the high noise figure of the TV set tuners at UHF frequencies.

Generally speaking, you have to deliver *3 times* as much clean UHF signal to the set as you do VHF signal—in order to get comparable reception.

The quantity and quality of UHF signal you feed the set is greatly determined by the antenna and preamplifier you use.

SPECIFICATIONS	AC-4990
GAIN	
UHF	17.5db
BANDPASS (MHZ)	
VHF-FM	54 to 216
UHF	470 to 890
MAX. TOTAL OUTPUT (Volts)	
UHF	.882
MAX. TOTAL INPUT (Volts)	
UHF	.126
NOISE FIGURE	
UHF	2.2db

The Solution

A few months ago Winegard Company introduced a new line of Chromstar UHF antennas featuring a new Tri-linear director system. This configuration offers the highest gain we've ever seen on a UHF antenna and the field reports we've been getting from professional installers have been most enthusiastic.

Now Winegard Company is introducing another...and even bigger breakthrough. This is a super lo-noise UHF preamplifier, Model AC-4990* It has a 6db signal-to-noise improvement over the best UHF preamps previously available.

Combine the AC-4990 with a Winegard CH-9095 Chromstar UHF antenna and you get a 9db improvement or *3 times cleaner signal.*

This means you can give good UHF pictures to customers who can barely get UHF now. It means you can deliver "excellent" reception to those who now receive just "fair" pictures.

*Pat. Pending.

In actual practice, good reception of all UHF stations is now extended up to 30 additional miles...in many cases nearly doubling the effective reception range.

New Sales Potential

Potential sales of CH-9095's and AC-4990's are greatly increased. This combo can be sold in areas where UHF reception hasn't been good enough to bother with *and,* as a replacement for customers who are only getting "fair" reception now.

Incidentally, the AC-4990 preamp has a VHF bypass so it can also be used with any Winegard V-U Chromstar antenna with excellent results.

Antenna dealers in UHF areas are advised to try this new Winegard antenna-preamp combination as soon as possible. Seeing is believing...and the new profit opportunities are tremendous.

NOTE: Due to demand, the AC-4990 preamp will be in short supply for a few months. An order should be placed now with your Winegard distributor.

WINEGARD COMPANY
3000 Kirkwood • Burlington, Iowa 52601

...for more details circle 132 on Reader Service Card

NEWCOM '76 Wrap-up

New Orleans' new Superdome plays host to successful NEWCOM Show—and ET/D was there

■ Even though the annual NEWCOM Show, held this year in New Orleans May 4-6, is designed to present to the nation's electronic parts distributors the manufacturers newest offerings in a wide range of electronic products, it was obvious after our first walk around the exhibit floor at the huge, recently-completed New Orleans' Superdome that the present "darling" of the electronic industry—CB radio—had captured much of the attention. Although an increase in the number of exhibitors was noted in all the categories—replacement parts, antennas, test instruments and sound and stereo products—the biggest increase occurred in the area of CB/communications, with over 50 companies showing CB transceivers, antennas and accessories.

The NEWCOM show this year was a record breaker on all counts—more exhibits, greater attendance, and 128 brand-new exhibitors. On top of that, NEWCOM '76 was the first major convention to be staged at New Orleans' new Superdome, billed as "the largest 'people place' in the history of man."

The future of NEWCOM as a showplace for CB products is clouded, however, according to *TV Digest*, because "many CB suppliers are saying the pressure of three trade shows (PC-76, NEWCOM, CES) in a 2½ month period is forcing them to reexamine future participation. Pace, who says it will drop out of the 1977 NEWCOM Show and focus attention on PC-77, said, "The needs of our customers can further be served by concentrating their time and efforts, as well as ours, on one or two shows instead of the five major trade shows we have participated in."

Although PC-76, held in Las Vegas just one month before NEWCOM, did steal most of the new CB product "thunder", several new CB items were introduced in New Orleans, including two new PLL CBs and three new scanners from Channel Master, two new PLL CB units from RCA, and a new HED 4-model line from Cerwin-Vega.

In the non-CB categories, acquisitions provided some of NEWCOM's new product and program news. The VIZ Manufacturing Company announced an introduction program of 12 new products in the next 12 months. VIZ, which has manufactured scientific and electronic instruments since 1928, acquired the RCA test instruments business last December. In announcing the new product program, Russel Hurst, VIZ president, said, "We have supplied RCA with many of its famous VOMs, oscilloscopes, signal generators, and test instrument accessories since 1958. Since our takeover of the line, we plan not just to continue, but to expand and improve the line. Among the new products we plan to introduce during the next year are: two new digital multimeters; a FET VOM; signal, pulse, and function generators; an oscilloscope; two wattmeters; a low-price, high-quality VOM; and a power supply."

Another acquisition during the past year—the Sobel Industries' purchase of REM Electronics—provided more "new product" news at NEWCOM. REM products are used for testing and rejuvenating TV picture tubes. According to Jack Williams, national sales manager for Sobel, "REM testers help the service man do a more credible job in the field, which results in extra profits. And the REM line which we acquired in January also includes a line of industrial work lights which includes a "Cool Hand" clamp on light and a magnetic base cool light that operates off a 12-volt car lighter socket." Since the acquisition, Lee Sobel, president, said that "we've now worked the bugs out of the product line, and the REM products displayed at NEWCOM are products with redesigned circuitry which meets our quality control standards."

Among new TV products introduced at NEWCOM is a new line of "carry-home" color antenna kits from the JFD Electronics Corp. The kits include a full-sized TV antenna, with foldable elements, a band splitter, mount, mast, lead-in wire, standoffs and hardware in ready-to-take home carton. A new series of rectifier fuses, designed to protect silicon-controlled rectifiers and similar solid-state devices was also introduced at NEWCOM by Littelfuse, Inc.

The NEWCOM show will return to Las Vegas for a four-year stint as of May 1st, 1977. It'll have to go some to top the success of the New Orleans show, which smashed all records in the 40-year history of the NEWCOM-type shows. Total registration this year was around 10,000, compared to last year's attendance of 7,600, and there were 354 exhibitors compared to 279 at last year's show in Las Vegas.■

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Detectors In FM Receivers—A State-Of-The Art Report

By Joseph J. Carr

■In years past there were only two widely used FM demodulation circuits: The Foster-Seeley discriminator and the ratio detector. While both of these are still widely used, other designs are also seen far more than was previously the case. Some of these are brand new and others are existing designs which have been made economically more appealing and easier to use by advances in integrated circuit technology.

A REVIEW OF FUNDAMENTALS

In frequency modulation (FM) systems, the carrier frequency of a radio transmitter is varied by an audio frequency modulating voltage. Fig. 1 shows the relationship of carrier frequency and the modulating audio voltage.

When the value of the audio sine wave (Va) is zero, the transmitter frequency is at Fc. As the audio signal voltage increases in the positive-going direction, the carrier frequency increases until point F2 is reached, at which the audio voltage is at its maximum value. The carrier frequency then will begin to decrease back to Fc as the audio voltage also decreases back to zero.

On negative-going excursions of the audio signal, the carrier frequency decreases to F1.

The "true FM" transmitter modulating action previously described probably will not be found in actual use. Because of the difficulties in designing a "true" FM transmitter which has the stability the FCC demands of radio transmitters, plus other problems, most FM transmitters use a slightly different (but from the receiver's point of view, functionally equivalent) system called *phase modulation*, or "PM". In this system, the carrier frequency is held constant while its *phase* is varied by the audio modulating signal. This allows the carrier to be generated in a highly stable, oven-controlled crystal oscillator. Phase variations occur in the reactance modulator, which follows the crystal oscillator.

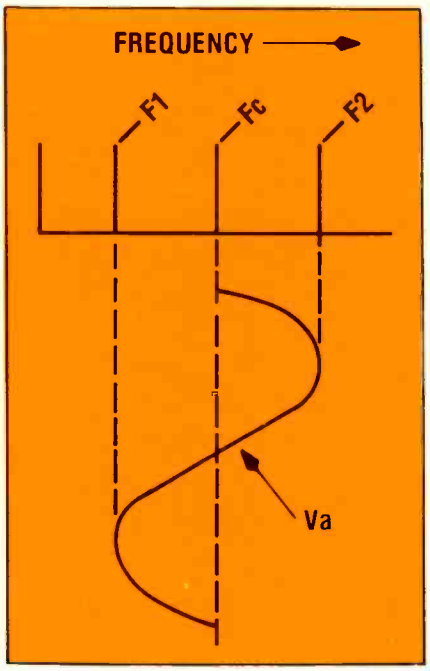

Fig. 1—The frequency of the FM carrier varies from its rest, or unmodulated, value to a maximum at F2 and a minimum at F1 as the audio signal, Va, varies through positive and negative excursions.

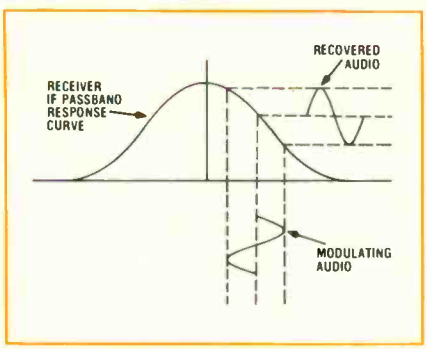

Fig. 2—Slope detection is an FM demodulation method in which the receiver is tuned so that the carrier, Fc, is centered on the descending portion of the IF selectivity curve.

There are several concepts and definitions associated with both FM and PM systems which are often misunderstood. For example, *deviation* is the amount of change in carrier frequency between the unmodulated value, Fc, and one of the extremes, either F1 or F2. Deviation is stated in either Hertz or Kilohertz. *Frequency swing*, on the other hand, is the total frequency shift from the lower to upper extremes (F2-F1) and is a measure of the channel width. The relationship between swing and deviation is dependent upon the symmetry of the modulating signal. For a perfectly symmetrical modulating waveform, like the sinewave in Fig. 1, deviation is exactly *one-half* the total swing.

Neither deviation nor swing is affected by the modulating frequency in a straight FM system, but this is not true of PM. The PM modulator has a 6 dB/octave rising (pre-emphasis) characteristic, while straight FM is essentially flat, unless the audio stage itself is given pre-emphasis. In "true" FM transmitters, the *audio frequency* determines the *rate* at which the carrier swings through its excursion. The *amount of deviation* is a function only of the *amplitude* of the modulating signal.

Full, or 100 percent, modulation of AM transmitters occurs when the audio signal causes the *carrier amplitude* to double on positive peaks and drop to zero on negative peaks. FM, however, has no such easily recognized carrier amplitude features, so the term "100 percent modulation" is dependent on other factors, such as the allowable bandwidth of the modulated FM signal. In the 88-108 MHz FM broadcast band, 100 percent modulation is defined as +75 KHz deviation. For the FM carrier which is the TV sound channel, however, +25 KHz deviation is "100 percent modulation." In the mobile and marine VHF/UHF two-way radio field, a deviation of only +5 KHz is sufficient to be called "100 percent."

Until recently, when specifications were changed to accommodate Dolby, FM transmitters gave

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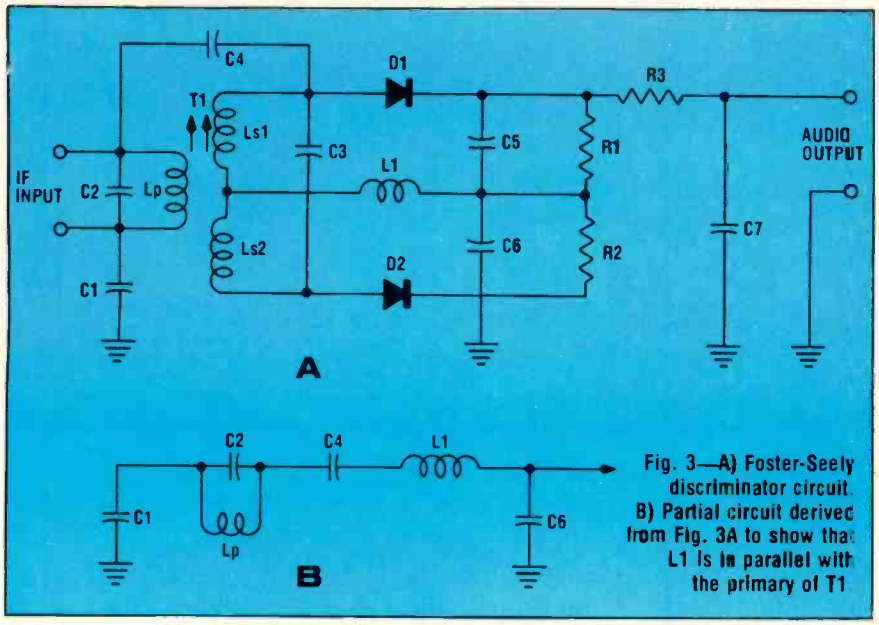

Fig. 3—A) Foster-Seely discriminator circuit. B) Partial circuit derived from Fig. 3A to show that L1 is in parallel with the primary of T1.

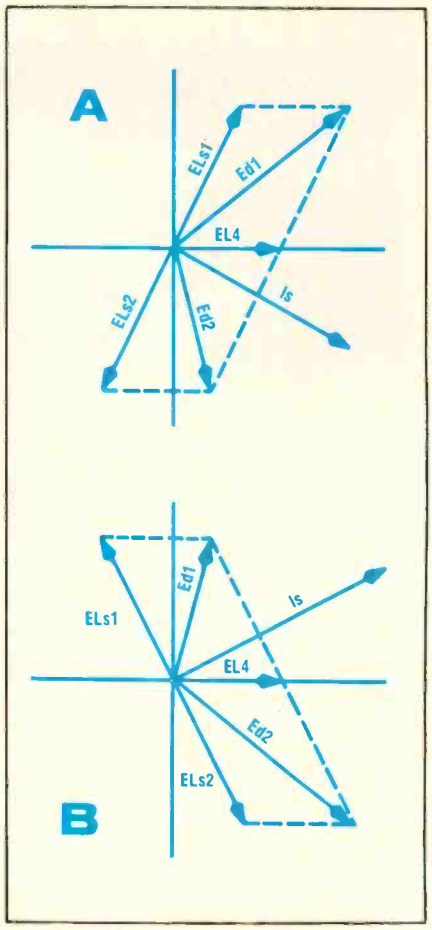

Fig. 4—A) Voltage relationships in the discriminator as the carrier approaches F2. B) Voltage relationships in the discriminator as the carrier approaches F1.

a great deal of pre-emphasis to the higher audio frequencies in an effort to improve the signal-to-noise ratio at the receiver end of the system. The receiver detector circuit includes a 75-microsecond RC de-emphasis network which re-establishes the proper audio frequency response.

SLOPE DETECTION

Fig. 2 illustrates a crude but effective method of FM demodulation which is shown here mostly to emphasize one of the primary requirements of any FM/PM detector: a *frequency response which varies as a function of input frequency*. This method, called "slope detection," requires a receiver with a relatively narrow passband. The center of the carrier is tuned so that it lies on the *downslope* of the IF response curve. The incoming signal then "sees" an IF frequency response which varies as the carrier frequency varies.

FOSTER-SEELEY DISCRIMINATORS

Fig. 3A shows the circuit of the Foster-Seeley discriminator used for many years in a variety of FM receivers. Note that RF choke L1 is common to both the primary and secondary windings of transformer T1. In fact, it is in series with the secondary and in parallel with the primary. (If you doubt this last statement, take a look at Fig. 3B.) This common connection of L1 allows the use of its voltage and current as references. When the IF signal applied to the primary of T1 is unmodulated, it will be at a frequency equal to the resonant frequency of the T1 secondary tank circuit. This causes the voltages across L_{S1} and L_{S2} to be equal and currents I1 and I2 to also be equal. Since these currents flow in opposite directions, however, they tend to cancel each other and the new output voltage is zero.

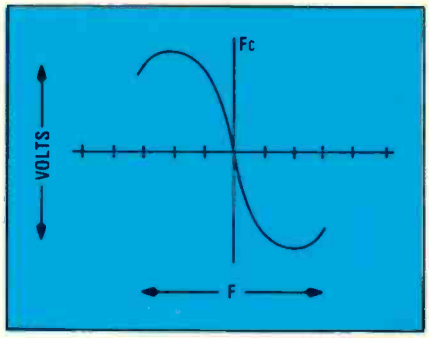

Fig. 5—Frequency response of the typical FM discriminator.

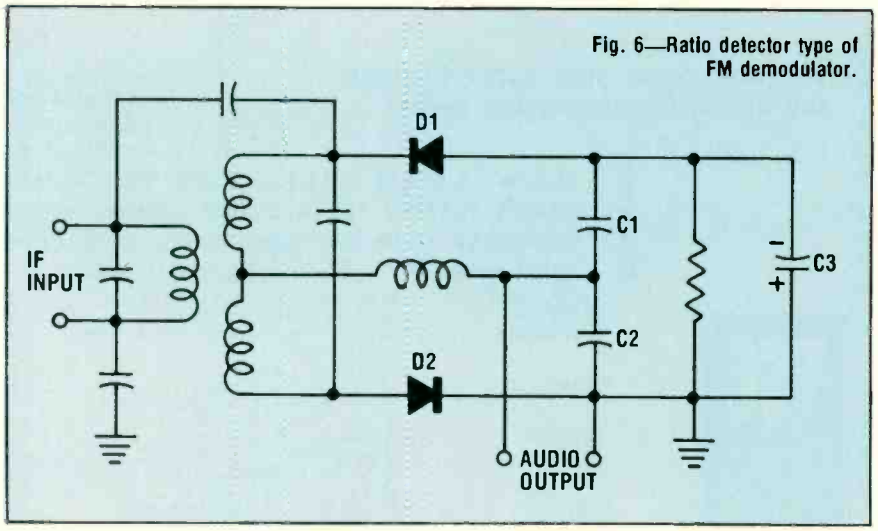

Fig. 6—Ratio detector type of FM demodulator.

Fig. 4A shows the voltage and current vectors relationships in the discriminator when the frequency of the input signal increases *above Fc*. Because the secondary tank circuit takes on inductive properties, secondary current Is lags behind voltages E_{1S1} and E_{1S2} by 90°. Since the voltages and currents in an inductive circuit are out of phase, they must be added vectorily to find the resultant. These are labeled Ed1 and Ed2 in Fig. 4A. In this case, the

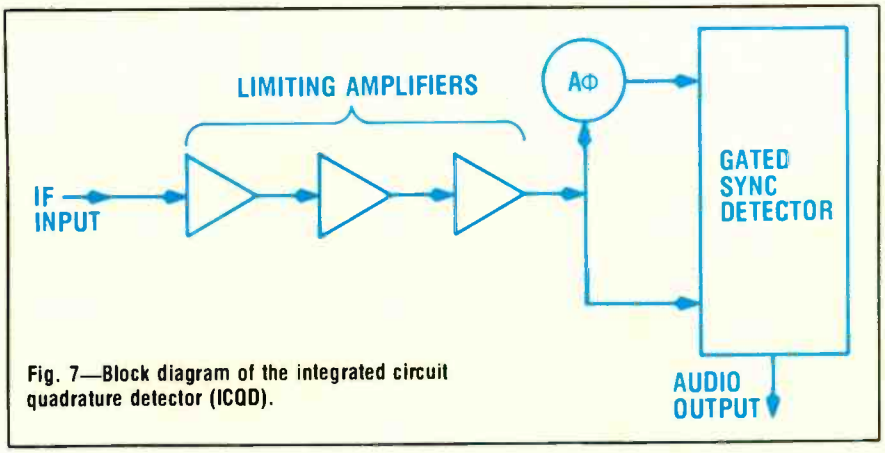

Fig. 7—Block diagram of the integrated circuit quadrature detector (ICQD).

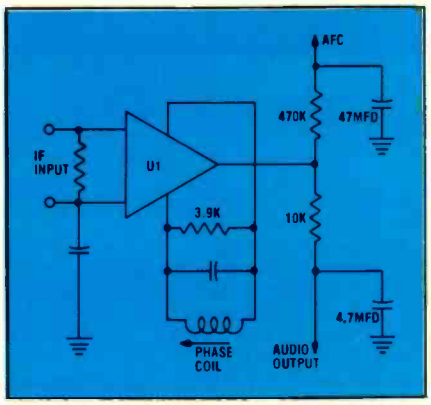

Fig. 8—Partial schematic of an FM detector using the ICQD. This circuit is identified as a quadrature detector by the presence of the "phase coil" and not by the fact that an IC is used.

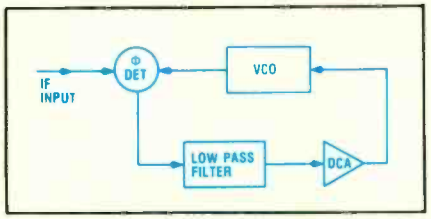

Fig. 9—Block diagram of a typical phase locked loop (PLL) FM detector IC.

voltage applied to D1 is greater than the voltage applied to D2, so current I1 can be expected to be higher than I2. Under these circumstances, the currents no longer totally cancel and an output voltage is generated. Similarly, in Fig. 4B, we see the situation existing when the carrier decreases *below* Fc. The relationships between resultants Ed1 and Ed2 are reversed and the vector Ed2 predominates.

Fig. 5 shows the typical voltage-vs-frequency response curve of a typical discriminator. Part of the technician's task in alignment of an FM receiver is to place Fc right at the zero crossover point on this curve. The bandwidth of this circuit must be such that the expected *deviation* (75, 25 or 5 KHz)

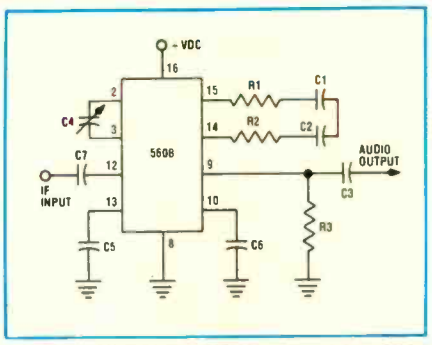

Fig. 10—Circuit of an FM detector equipped with the Signetics 560B IC PLL.

will not drive the signal into the non-linear extremes of this curve.

RATIO DETECTORS

Fig. 6 shows a typical ratio detector circuit. The major difference between this circuit and the Foster-Seeley discriminator is that the diodes are connected in *series* in the ratio circuit. This allows the voltages across C1 and C2 to *add* rather than cancel. When the input signal is at its unmodulated frequency, voltages across these two capacitors will be equal. When the carrier is deviated to a higher frequency, however, the voltage across C2 increases and that across C1 drops. Just the opposite occurs when the deviation is in the other direction: Ec1 rises while Ec2 drops. This, of course, results in a DC voltage level which varies as the modulation causes the frequency of the carrier to deviate above and below the center frequency.

Capacitor C3 has two functions: 1) It stabilizes the voltage across series combination C1/C2 so that the ratio can be taken, and 2) it suppresses any AM, including noise, which may be on the carrier. It is this last function which makes it possible for ratio detector-equipped receivers to function without a limiter.

IC QUADRATURE DETECTOR

Integrated circuit technology has revived for audio products a type of detector once used extensively in TV receivers—the quadrature detector. Once popular using the 6BN6 gated-beam tube, the quadrature detector has made a comeback in the form of several integrated circuits; examples are the MC1357P and the ULN2111.

Fig 7 shows the block diagram of a typical IC quadrature detector (ICQD). The input stages are a wideband, high-gain, limiting preamplifier whose output is a series of square waves. These are fed to two places: to one input of the gated synchronous detector, and to a quadrature (90°) phase shift network external to the IC. The output of this network is brought back inside the IC, as shown in Fig. 8, and is connected to the alternate input of the gated detector. This detector produces output pulses with constant amplitude but whose *periods* vary with the modulating signal. These are integrated to recover audio.

The ICQD has been used extensively by Delco in their car radio designs for the past several years and by a number of hi-fi equipment manufacturers. Be aware, though, that an *IC* FM detector is not always a quadrature detector. A number of ICs are used which are high-gain IF amplifiers and have the diodes needed for ratio detection or a discriminator built into the same IC package. RCA is one manufacturer of this type of IC design. (Philco used the RCA CA3043 in the FM car radios they built for Ford.)

PHASE LOCKED LOOP (PLL) FM DETECTORS

Although developed in the '30s, when oddly enough it was invented as an *AM* detector, the PLL has only come into its own with the recent introduction of PLL integrated circuits. Fig. 9 shows the block diagram of a typical PLL chip. Although it is used for other purposes as well, here we shall describe the circuit action as if it were exclusively an FM detector. A phase detector in the chip recieves two inputs: one from an internal voltage-controlled oscillator (VCO), and the other from

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Partial List of Contents

SMALL APPLIANCE REPAIR GUIDE

Functions and Basic Techniques: Electric Current; Electrical Measurements; Transformers; Using an Appliance on Foreign Current; Converting Ac to Dc; Motors; Dc Motors, Ac Motors; Universal Motors; Motor Controls; Thermostats; Fuses; Solid-State Devices. Test Equipment for the Home Appliance Workshop: Continuity Checkers; Line-Voltage Checks; Power Supplies; Ac Wattmeter; Shock Hazard; Battery Checkers; Radio Interference; Capacitor, Relay, and Solid-State Motor Control Testers; Cleaning and Lubrication. Personal-Care Appliance: Professional Hair Dryers; Portable Hair Dryer; Hand-Held Hair Dryer; Electric Hair Clippers; Electric Wrinkle Remover; Home Manicure Kit; Hair Curlers. Kitchen and Home-Care Appliances: Heating Appliances; Mechanical Kitchen Aids; Floor-Care Appliances; Cordless Appliances. Air Processing and Heating Equipment: Fans; Window Fans; Electric Heaters; Humidifiers; Dehumidifiers; Air Purifiers. Case Histories. Appendix: Safety Index.

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Home Appliance Electronics; Varispeed Thyristor Control Devices; Time-Constant Circuits; Electrostatic Air Cleaner; Failsafe Devices; Grounds and Safety; Photocircuits: Light-Operated Control; When Wiring Acts Up; DC Small-Appliance Motors; Electrical Interference; The Ground-Fault Interrupter; Solid-State Speed Controls; Is the Ground Grounded or Ungrounded; Something Old, Something New; Inside the Clothes Dryer; Use Your Electrical Appliances When Abroad; Interlocks and Mental Blocks; Intermittents: How to Locate Them; All About Timers; Clean Up the Cleaners; Electric Heaters and Safety Devices; Reversing AC Motors; Floor Polishers and Carpet Scrubbers; Hardware Noise; A Type of TVI; Electric Carving Knives; Electronic Matches; Solid-State Ignition for Lawnmowers; Limit Switches; Modular Appliances; Plug-In "Refrigerator Analyzer"; Transistor Testing; Test Instrument Tricks; Phono Amplifier Totem Pole; The SCR Battery Charger; Ignition Problems in Small Engines; Automatic Light Switches; Automatic Coffee Maker; Getting Replacement Parts; Multiple Speed Electric Fans; Exhaust Fans; Small Motors; The VOM Around the Car; Appendix: Multimeters; Index.

Small Appliance Repair Guide—Vol. 2

This truly practical guide to small appliance repair is geared to the needs of those in electronics who are more comfortable around a transistor than a bimetal thermostat. It shows how really easy small appliances are to repair if you know how they work, how they come apart, and how they go back together . . . and how to test them quickly and efficiently.

This new volume covers all these bases and more, beginning with a review of electrical basics, followed by a description of many test equipment items (continuity checkers, power supplies, AC wattmeter, battery checkers, etc.) that can be put together quickly and inexpensively.

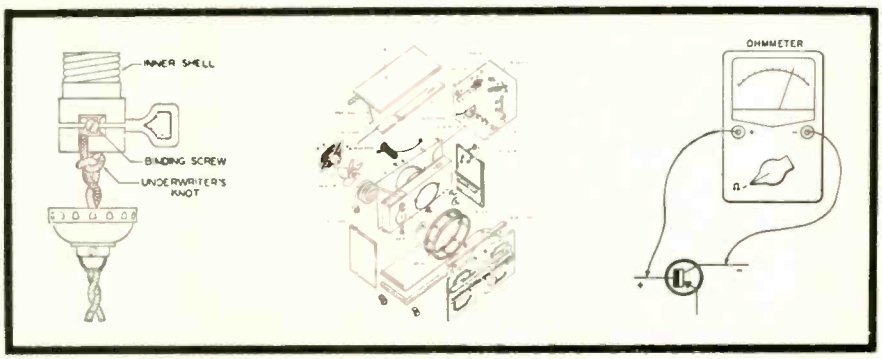
Easy-to-understand text and clear, detailed diagrams show how to troubleshoot and repair personal-care appliances (professional and portable hair dryers, manicure kits, hair clippers, wrinkle-removers) air processing and heating equipment (heaters, fans, humidifiers, and air purifiers), kitchen and home-care units, floor care appliances and even cordless-devices. The last Chapter consists of true-life case histories to enable you to repair appliances just like a pro.

The Home Appliance Clinic: Controls, Cycle Timers, Wiring & Repair

Here's a meaty one-volume treasure trove of hard-to-come-by info on wiring and appliance repair, with emphasis on some traditionally hard-to-fix items that aren't covered in other appliance repair texts.

This isn't the sort of book that requires straight-through reading. Each Chapter is complete in itself, and when you need data on a particular repair job, the Index will locate the specific data you need. Data is included for swimming-pool ground fault indicators, motor speed controllers, clothes dryers, floor scrubbers and polishers, electric carving knives, air cleaners, refrigerator control systems, electronic cigarette lighters, battery chargers, small gas engine ignition systems, furnace control systems and failsafe devices, etc.

Text tells how to determine if wiring problems exist and how to assess wiring requirements according to power needs, wire diameters, lengths of runs, etc., plus how to use the indispensable multimeter.



Over 180 crystal-clear cutaway diagrams, schematics, and drawings put the info in this 2-volume library to immediate use.

...for more details circle 110 on Reader Service Card

AN EXTRAORDINARY OFFER...

the FM IF amplifier. Under conditions where the carrier is unmodulated, the IF and VCO frequencies are equal and the DC output from the phase detector is zero. As the IF signal deviates, this equality is lost and a DC error signal is developed and is proportional to the frequency difference between the IF and VCO signals. This is fed through a low-pass filter, to remove residual RF, and then on to a DC amplifier (DCA). The output of the DCA controls the VCO frequency. This pulls the VCO to the new input frequency from the IF. Since the IF signal is always deviating about the center frequency, the VCO will always be trying to "catch up." The control voltage will be continuously varying at the rate of the audio which modulates the carrier. This voltage is used as the recovered audio.

Fig. 10 shows an actual IC PLL FM demodulator using the Signetics 560B chip. IF signal is coupled to the chip via capacitor C7 and pin 12. The frequency of the VCO is set to its approximate range by capacitor C4. Since internal resistances normally vary + 20 percent,

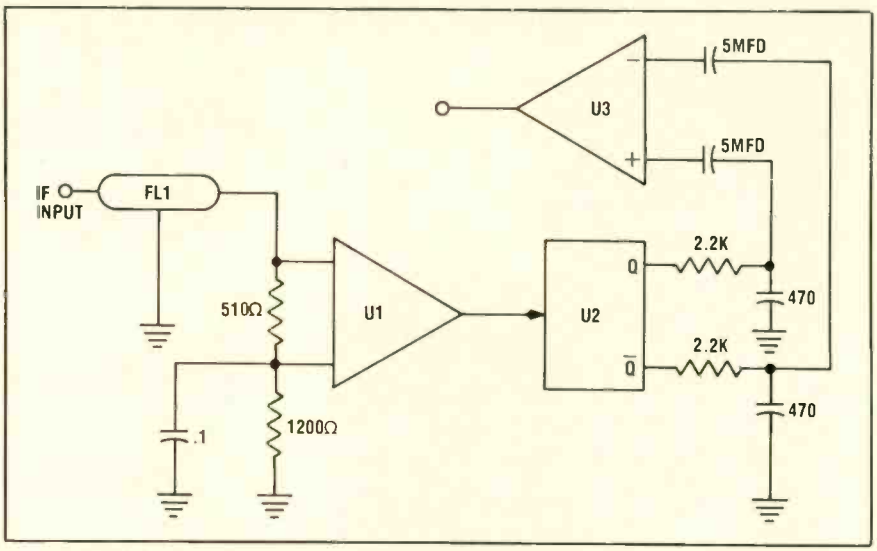


Fig. 11—Partial schematic of a pulse counting, or "digital," FM demodulator. This circuit uses a monostable multibrator and a pair of integrator networks to demodulate the FM signal. It is relatively independent of IF frequency and needs no alignment.

this capacitor will most likely be a trimmer. The input signal level required must be between 2 millivolts and 15 millivolts. Below 2 mV, the PLL may have difficulty in tracking the IF signal, while above about 20 mV the AM suppression is lost. RC networks R1/C1 and R2/C2 form the low-pass filter between the phase detector and DCA. The output signal is obtained from pin 9 and is coupled through RC network R3/C3 to the following circuits. The function of capacitor C6 is de-emphasis. It has a value selected to give the required 75-microsecond time constant when the internal resistor at pin 10 is 8000 ohms.

continued on page 47

FROM FORD: THE BIGGEST PARCEL VAN EVER BUILT

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FORD ECONOLINE VANS

FORD DIVISION Ford

CB Theft Prevention Methods & Equipment

By David Norman

A service to the customer—and a new aftermarket for dealers

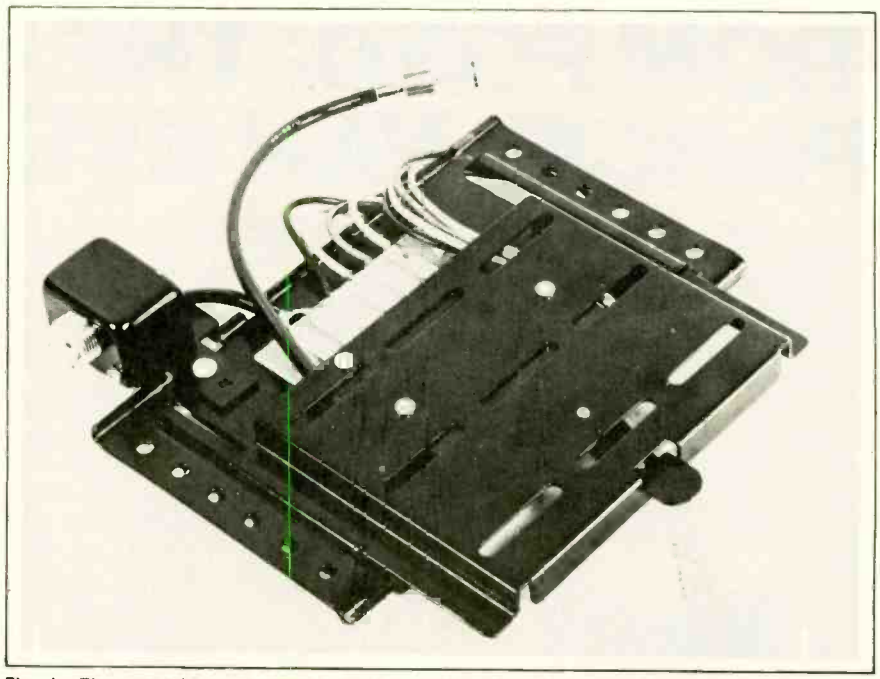

Fig. 1—The new RCA quick release bracket, Model 14T17C, for mounting a CB radio under the dashboard or on the car floor.

■ Everybody's getting into the CB marketing act these days, including thieves. With more than 400,000 new CB applications coming into the FCC each month, this lucrative CB black market for rip-off artists and petty thieves has been created, with the problem now so widespread that CB insurance has become very costly. In fact, some insurance companies now offer no coverage at all. Although this rapidly increasing incidence of CB mobile unit theft is one spin-off of the CB boom we could all do very well without, it does create a new aftermarket, so to speak, for CB dealers in the sale of anti-theft devices.

Not long ago, when someone asked about removing a unit from a car, we would tell them not to bother. The wear and tear of excessive handling was a greater risk than was the risk of loss—but no more. Now our recommendation is to thoroughly *secure* the unit or else remove it. Just locking the doors is no longer a good enough deterrent. In some cases, an owner who has locked his car doors in broad daylight has returned an hour or so later to find himself "10-7". However, locking the car is at least a good beginning. It may not deter a pro, but it will discourage "crimes of opportunity" by amateurs.

Unattended vehicles should be left in well-lighted areas, preferably in plain view of houses and people. Parking an auto containing a CB unit or stereo out of sight behind trees and leaving it there for several days is asking for trouble. In fact, in some areas you would be lucky to find your tires still on the car. If a vehicle must be left for several days and there is no locked garage available, the best compromise might be at the home of a friend—with the electronics removed and stored in a safer place. If the equipment must be left with the car, your best bet is to lock it in the trunk. In other words,

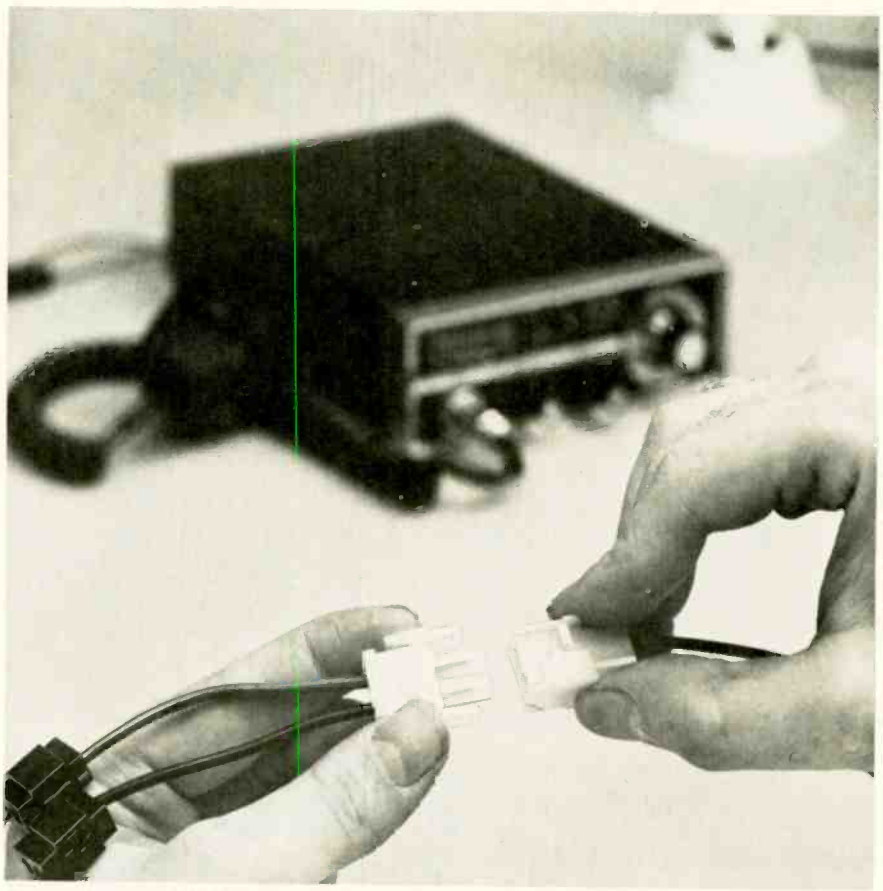

Fig. 2—A new quick-disconnect power source connection from Breaker, for fast removal and installation of CB radios.

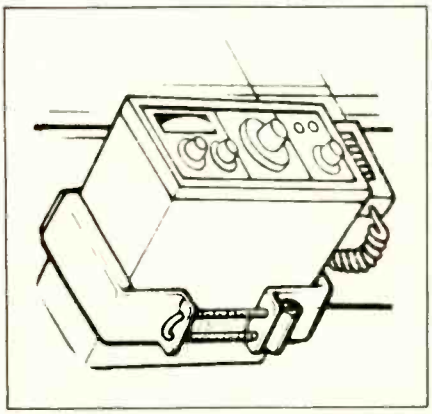

Fig. 3—A new locking CB radio mount for theft prevention. Mounting bolts are concealed by metal cover that is padlocked.

recovery through proper marking of the equipment.

THEFT PREVENTION TECHNIQUES

Each unit should have its serial number recorded in a safe place among the owner's other important papers. However, since so many units are produced with easily removable serial number labels, other steps should be taken. This is where you, as a dealer, can really help your customer. Plainly marked units are stolen far less often than are those units with somewhat hidden markings.

Fig. 4—This burglar alarm reacts to increases in electrical current, to protect both the CB radio and car from theft.

Fig. 5—A burglar alarm that is installed between a CB mobile unit and the antenna. When ground connection to either is broken, the alarm sounds.

the same common sense precautions used to avoid having the automobile itself stolen also apply to accessories.

However, in some cases, theft occurs in spite of reasonable precautions. When this occurs, it is nice to have at least some hope of Few thieves care to risk being caught with something that screams "hot".

Two different marking procedures that can be offered by the dealer—vibro-engraving and ultra-violet marking—improve the recovery chances. But please bear in mind, nothing is foolproof; if it can be bought, it can be stolen and resold. The fact that nothing works all of the time, however, is not excuse for not doing all that can be done.

Few people want to have the case of their new CB radio marked with scratches, even if the "scratches" also make the unit less attractive to a thief. Most people prefer that the marking be done in an out-of-sight place such as the rear of the chassis or inside. Special inks which show up only under ultra-violet light are available at office supply stores and hardware stores. Vibro-engravers are also available from many sources. In fact, many electronic sales and service companies already own one for marking their own equipment.

With the above items available, the enterprising dealer can offer each prospective customer four additional incentives for buying their CB equipment from him rather than from the competition:

1) He can offer to record the units serial numbers, cross-referenced under the customers name for easy access.

2) He can offer to engrave the customer's name, address, phone number, driver's license number, etc. on the unit in the location preferred by the customer.

3) And as a back-up, he can offer to record the same information in an invisible ink, sensitive only to ultra-violet light, in a different location on the unit.

4) He can provide the customer with a decal that states that all equipment in the vehicle is permanently marked. These decals, which would be placed in a conspicuous place on the outside of the vehicle, can be made to order in any form desired, and can be easily sold at a profit.

THEFT PREVENTION EQUIPMENT

With the exception of the marking devices and decals, the steps suggested so far are *preventive* efforts. In some cases—and in some areas—stronger measures are taken. This will entail additional investment for the customer, and it means that the dealer has to become familiar with the many theft-discouraging items and features now making their appearance on the CB accessory market. To be of service to the customer, and to take advantage of this unique aftermarket, it means stocking some of this theft-prevention equipment.

Quick Disconnecting And Locking Mounts

Even before theft prevention became important, a quick-disconnect mount appeared on the market to facilitate the swapping of CB units and stereos between vehicles. Although removal of CB and stereo from standard mountings usually requires removal of just a couple of bolts and the power cable, the new quick-disconnect mounts allow removal or reinstallation in seconds rather than minutes.

To avoid theft of their newly

purchased CB equipment, a lot of CB'ers start with the intention of removing the unit each night when they leave the vehicle. After a few days, with the standard mount, this in-and-out bit gets to be such a hassle that most give up the idea—which explains the increasing popularity of the newer quick-disconnect mounts.

One of the newest quick-disconnect mounts on the market is from RCA—called the quick release mounting bracket, Model 14T170 (Fig. 1). The bracket can be mounted either under the dashboard or on the vehicle's floor. Connection to the power source is made with spring-loaded brass contacts, and the antenna circuit includes a shielded connector for coaxial cable.

At least one CB manufacturer, Craig, is supplying quick-disconnect mounts as standard equipment with several models. Removal is as simple as pulling out on the case and disconnecting the coax connector.

Actually, any unit can be converted to quick-disconnect by simply substituting large knurled bolts for the standard mounting bolts, and then installing one of the new pull-apart electrical connectors that are now available for power source connection (Fig. 2). Another way to provide a safe power connection for a quick-disconnect arrangement is to install male/female crimpons in the power line. If two wires are necessary, simply put the male clip on the lead coming from the vehicle's primary power and the female clip on the other lead. Then, by reversing this male/female hookup on the leads coming from the unit, there is little danger of accidental polarity reversal. All wires look grey in the dark, so color coding of power leads is not enough.

A more sophisticated hookup can be made using trailer connectors which already have several polarized contacts. In fact, trailer connectors will permit the addition of PA or external speaker wires to the hookup. One source of these inexpensive trailer connectors is the local U-Haul or other trailer-rental dealer.

There is another type of mount available now from most elec-

Fig. 7—A locking collar on this removable CB antenna from Antenna Specialists permits only the user to remove the whip and the coil.

Fig. 6—This whip antenna from Breaker has a magnetic base encapsulated in ABS to prevent surface scratching. It is quickly removed for theft prevention.

Fig. 8—This Model M-450 from Antenna Specialists allows only the whip to be removed from a base-loaded antenna. A downward push and twist on the knurled adapter releases the whip.

Fig. 9—Would-be CB thieves should be confused by this antenna that looks like a regular broadcast antenna but works on AM, FM, and CB. The whip is removable.

Figs. 10 & 11—Two somewhat similar antenna-concealment devices for CB that allow the user to lock the antenna inside the car trunk when not in use. Fig. 10 is the Stowit antenna from Holly Enterprises, and Fig. 11 is the Tuk-a-Way antenna from Deep South Marketing.

tronic parts houses, or from 2-Way Radio Lock Co., P.O. Box 4508, Dallas, Texas 75208. It's called a "locking mount" (Fig. 3). The bolts which fasten the unit to the mount are concealed by a metal cover secured by a padlock.

With any locking device, however, the dealer will be wise to point out to the customer that it is only a *deterrent* to theft—not an absolute preventative. It may stop the casual thief, but there is no foolproof way to keep a unit in a vehicle if the thief has the time, the tools, and the ambition. Also, with quick-disconnect devices, the customer should know that they make the thief's job easier if the customer forgets to remove the unit when leaving the vehicle.

CB Burglar Alarms

A different method of discouraging CB and stereo theft from vehicles is provided by a number of devices that warn of tampering with, or removal of, equipment from a vehicle, by sounding the car-horn or other noisemaker. These devices, which can be either dealer or customer-installed, fall into three basic categories:

The first type is the auto burglar alarm which sounds if one of the doors is opened after the device is armed. Expert thieves can circumvent this device if they care to take the time, but all in all, this type is relatively effective. One example of this type, now on the market, is Kar-Safe, manufactured by James Electronics, of Chicago (Fig. 4). This unit operates by detecting increases in electrical current. When the unit is turned "on", opening the car door, hood or trunk, or ground wire interruption will sound the car's horn 60 times per minute. It's programmed, however, to wait for 7 or 12 seconds to assure that false entry has occurred before the car horn sounds off.

The second type is simply a sensitive mercury switch which sounds the alarm when the vehicle is jiggled such as would be the case if someone got into the car. The principle drawback to this type is that it is subject to accidental activation from the wind shaking the car, or someone touching the car quite innocently.

The third type is unique in that it protects only the unit and not the rest of the vehicle. Fig. 5 shows such a device manufactured by Breaker Corporation, the Model 13-188 CB Burglar Alarm. This device is installed between the CB unit and the antenna and sounds the alarm if the ground connection to either is broken. In addition to protecting the unit itself, some protection also is given the antenna. Unfortunately, most antennas can be removed without breaking the coax ground.

Perhaps the best protection against theft is a combination of the devices; for example, a burglar alarm and a locking mount. If an enterprising thief was able to somehow get around the alarm, he would have a second obstacle in his way—the locked mount. It might be enough of a deterrent to discourage him from his goal.

Removable Antennas

Prior to the current wave of CB thefts, the magnetic antenna mount almost died from lack of interest. There was a tendency for it to pull loose from the car body at high speed and go bouncing down the highway by itself—and the coaxial cable tended to chafe the paint job (as does the mount itself); and most magnetic mounts don't perform as well as properly grounded antennas. Without a special design to compensate for a good body ground, the antenna can appear electrically too long for tuning and some standing wave ratio (SWR) remains even after the antenna is trimmed to resonance. This is mostly because the feedpoint impedance is other than 50 ohms.

Some of the newer designs in magnetic-mounted CB antennas seem to have eliminated some of the old problems. For example, a line of 39-inch Liberty series whip antennas from the Breaker Corporation (Fig. 6) feature magnetic bases that have a 40-lb.-holding-power magnet that is said to eliminate crawling or dislodgement—and the magnet is ABS encapsulated to prevent surface scratching.

Other types of removable CB antennas have been introduced recently to help solve the theft problem. Two designs developed by The Antenna Specialists Company allow the user to remove the

continued on page 46

Schedule Of Events/Joint Annual Convention

National Electronic Service Dealer Association (NESDA), *with International Society of Electronic Technicians (ISCET) and Texas Electronics Assoc. (TEA)*

August 13-17, 1976 Palacio del Rio
Hilton Hotel and San Antonio Convention Center
San Antonio, Texas

Friday, Aug. 13

7:00 A.M.—Electronics Manufacturers/Dealers Open Golf Tournament
Place: Pecan Valley Golf Course
Sponsor: Electronic Technician/Dealer Mag.
Host: Al Menegus, Publisher, ET/D
Coordinator: Kurt Wertheim, TEA

2:00 P.M.—Texas Electronics Association (TEA) business meeting
Place: La Vista Room, Palacio del Rio Hilton Hotel

3:00 P.M.—National Electronic Service Dealers (NESDA) executive council meeting
Place: Princesa Room, Palacio del Rio Hilton Hotel

7:30 P.M.—"Welcome To Texas" Barbecue and TEA awards ceremony
Place: To Be Announced*
Master of Ceremonies: Kurt Wertheim, TEA

9:00 P.M.—Cocktails and Hospitality
Place: To Be Announced*
Sponsor: RCA

Saturday, Aug. 14

8:00 A.M.—Keynote Breakfast
Place: Fiesta Room, San Antonio Convention Center (SACC)
Sponsor: GTE Sylvania
Host: James Tobin, Sales Promotion Mgr., GTE Sylvania
Master of Ceremonies: Gerald Hall, Wisconsin Electronic Service Association
Keynote Speaker: Toby Mack, Staff VP, Dist. Prod.'s Div., Electronic Industries Association (EIA)

9:30 A.M.—International Society of Certified Electronic Technicians (ISCET) annual meeting and elections
Place: SACC

11:00 A.M.-5:30 P.M.—"Mercado Electronics '76" Electronic Trade Show
Place: Hemisfair Plaza, SACC
Chairman: Nolan Boone, Arkansas Television Service Association
Refreshments Sponsor: Raytheon

12:30 P.M.—Luncheon
Place: Fiesta Room, SACC
Sponsor: RCA
Master of Ceremonies: Dick Scott, President, Washington State Electronics Council

6:00 P.M.—Cocktail Party
Place: Exhibit Hall, SACC
Sponsor: Howard W. Sams Company
Host: Joseph Groves, Manager, Photofact Div., Howard W. Sams Company

7:00 P.M.—Banquet
Place: Fiesta Room (SACC)
Sponsor: Zenith
Master of Ceremonies: LeRoy Ragsdale, President, NESDA

9:00 P.M.—Cocktails & Hospitality
Place: Palacio del Rio Hilton Hotel
Sponsors: Sony and Zenith

Sunday, Aug. 15

8:00 A.M.—ISCET Breakfast (ISCET awards & installation of officers)
Place: Fiesta Room, SACC
Master of Ceremonies: Larry Steckler, Chairman, ISCET

9:00 A.M.—Manufacturer Panel Discussion
Place: To Be Announced*
Theme: "The Role of 'Service' in Today's Electronic Industry"

10:30 A.M.-5:30 P.M.—Technical & Business Management Seminars

Place: SACC
Seminar Topics:
- Oscilloscope Applications Workshops—Stan Prentiss (AM)
- CB Profits and You—Forest Belt (AM)
- The Parts Disaster—John Sperry (AM)
- Your Salesman: The Service Technician (AM)
- Two-Way Communications: Its Place in Your Business—Chuck Anderson (AM)
- License Board Seminar—Bob Harrison (PM)
- Howard Sams Photofact Tour (slide program)—Joe Groves (PM)
- New TV Service Techniques—Carl Babcoke, Editor, Electronic Servicing magazine (PM)
- Industry Relations—Dick Pavek (PM)
- "Better State Conventions"—Dick Pavek (PM)
- How to Fix CB Radios Fast—Forest Belt (PM)

12:00 NOON—Luncheon & Video Disk Demonstration
Place: Fiesta Room, SACC
Sponsor: Sony
Master of Ceremonies: Tom Thomas, Colorado Professional Electronics Association
Video Disc Demonstration: Jerry McGinty, Sony

1:30 P.M.—NESDA Officer Nominations meeting
Place: SACC

9:00 P.M.—Cocktails & Hospitality
Place: Palacio del Rio Hilton Hotel
Sponsors: Panasonic & Sony

Monday, Aug. 16

8:00 A.M.—Breakfast
Place: International Ballroom, Palacio del Rio Hilton Hotel
Sponsor: Panasonic
Hosts: Gene Jadwin, National Parts Mgr., Panasonic; and George Camp, National Service Mgr., Panasonic
Master of Ceremonies: Dorman McDonald, President, Electronic Technician Association of Georgia

9:00 A.M.—NESDA Annual Business Meeting & Election of Officers
Place: Corte Real Room, Palacio del Rio Hilton Hotel

10:30 A.M.—Technical Seminar
Place: To Be Announced*
Topic: "Digital Logic & Your Test Equipment"
Presenter: Stan Prentiss

12:30 P.M.—Luncheon
Place: International Ballroom, Palacio del Rio Hilton Hotel
Sponsor: Magnavox
Master of Ceremonies: Stewart Leightner, Michigan

7:00 P.M.—"Hall of Fame" Banquet
Place: International Ballroom, Palacio del Rio Hilton Hotel
Activities & Presenters:
NESDA & ISCET Officer Installations—Morris L. Finneburgh, EHF
NESDA Awards—Charles Couch, Jr., Florida
ISCET Man-of-Year Award—Jack Kelly, Treasurer, NESDA
Special Awards—Larry Steckler, Chairman, ISCET
Master of Ceremonies: Don Martin, Publisher, *Dealerscope Magazine*

Tuesday, Aug. 17

8:00 A.M.—NESDA Executive Council Meeting
Place: To Be Announced*

9:30 A.M.-12 NOON—NESDA "Profitable Service Management" Seminars
Place: Palacio del Rio Hilton Hotel (rooms and instructors as indicated below)
PSM-1: La Princesa Room, J. Kelly
PSM-2: La Duquesa Room, J. Hopson
PSM-3: La Reina Room, P. Dontje

10:00 A.M.-12:00 NOON—Women's Business Management Seminars (Free)
Place: To Be Announced*
Topics: "Bookkeeping For A Service Shop" and "Better Telepone Procedure"

12:00 NOON—Luncheon
Place: To Be Announced*

1:00 P.M.-5:00 P.M.—NESDA "Profitable Service Management" Seminars
Place: Palacio del Rio Hilton Hotel (rooms and instructors as indicated below)
PSM-1: La Princesa, G. Simpson
PSM-2: La Duquesa, F. Grabiec
PSM-3: La Reina, B. Villont ■

*Place to be posted at convention

Condensed from a single chapter of a recently introduced TAB book, by permission of TAB BOOKS, Blue Ridge Summit, Pa. 17214

Troubleshooting Sync Separator/Noise Limiters

The following operations are performed by the sync separator/noise limiter system:

1) Removes all picture information from the composite signal and leaves only the sync pulses. Also removes all of the black level pedestals.

2) Amplifies the sync pulses to required level for solid picture locking action.

3) Clips the sync pulses to a uniform value and removes any pulses due to noise or interference. (These circuits are referred to as sync clippers or limiters.)

4) Shapes the horizontal sync pulses into sharp pips in order to operate the horizontal phase detector circuit and control horizontal oscillator frequency.

5) Develops the vertical pulses into relatively long sync pulses which will be used to trigger and lock-in the vertical sweep oscillator. RC differentiating and integrating filters are used for this purpose.

6) Produces the correct sync pulse polarity that is required to trigger the sweep oscillators or AFC control system.

GENERAL TROUBLESHOOTING PROCEDURES

Always keep in mind that the sync and the AGC circuits are very closely related and a sync trouble may look like an AGC problem and vice versa. If adjustments of the contrast and AGC controls do not produce a normal picture, then what looks like sync trouble may actually be a fault in the signal section of the chassis, prior to sync take-off, or an AGC circuit malfunction.

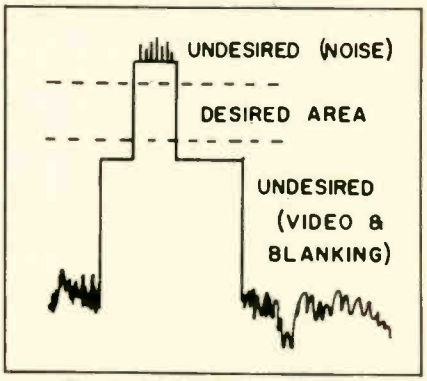

Fig. 1—Horizontal blanking and sync pulse showing portions "clipped out" by sync clipper action.

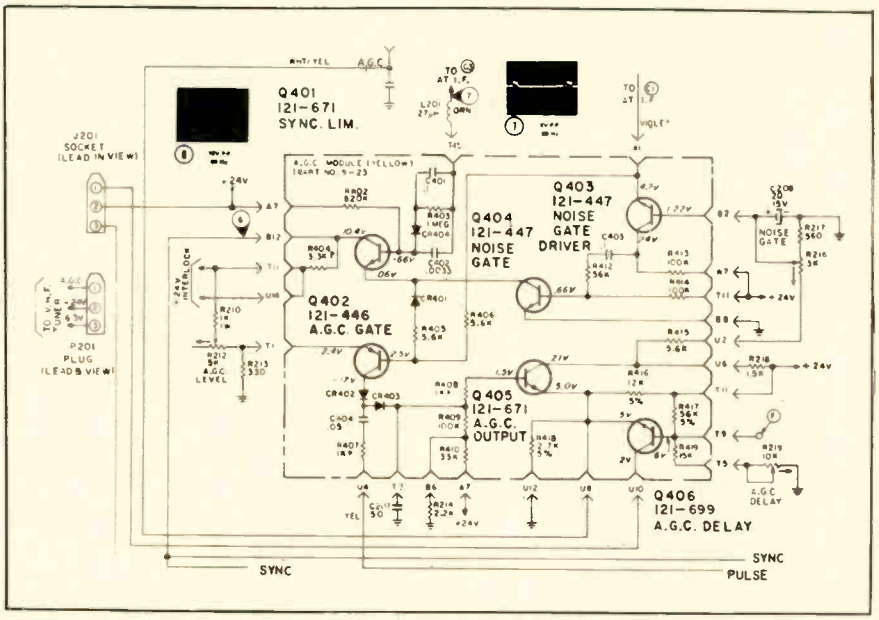

Fig. 2—Typical all-solid state AGC and sync module.

Consider the following factors when troubleshooting the sync system:

1) If *both* the vertical *and* horizontal sync is lost, the trouble is probably in a common sync handling stage, such as the sync separator.

2) If the picture will not lock in horizontally, but is vertically stable, it is then probable the fault is *not* in the common sync stage. The prime suspect would be the horizontal AFC circuits, horizontal oscillator, and any associated feedback circuits.

3) Should the picture be only vertically unstable, then the sync circuits past the sync branch-off stages should be checked first, along with the vertical oscillator or output stage or any of its associated feedback networks.

Because the sync, AGC, and noise control circuits all must work together to keep a stable picture on the screen, you just about have to troubleshoot all three actions at the same time. In some sets, all three circuits are found in one tube or on one module.

In some modular solid-state chassis—Zenith, for example—the sync clipping, AGC, and noise immunity circuits are all located on one module. Several components are used in both systems and the noise immunity system is used by both AGC and clipping circuits. For this reason it becomes very practical to service and observe (with an oscilloscope) the sync clipping action first.

SEPARATING THE SYNC FROM VIDEO

Sync clipping is the action of removing from the composite video those parts not required for the synchronization process. The unwanted portions are as follows:

- All video picture information.
- All blanking information.
- The top and bottom sections of the actual horizontal and vertical sync pulses. (The top section of the pulses is undesirable because noise pulses would be present at this point, while the bottom part would be too close to the blanking and video areas. The only "want-

(From Chapter 3, "Simplified TV Trouble Diagnosis," by Robert L. Goodman, TAB BOOKS, Copyright 1976. A review of the complete book follows this article.)

ed" part is a tiny portion of the sync pulse as illustrated in Fig. 1.)

In many TV receivers the sync clipping action is coupled to the AGC operation. The reason for this can be seen by referring again to Fig. 1. If the DC level of the signal changes, or the amplitude varies, the predetermined clipping action is defeated. In one instance it will include the noise pulses on top of the sync and at another time it will bite into the blanking or even the video portion. These actions should be taken into consideration, for example, when troubleshooting both sync and AGC in the Zenith circuit module shown in Fig. 2.

AGC troubles can be detected by observing the sync information at the output of the sync clipper. The only active component in the sync stage in Fig. 2 is NPN transistor Q401.

In the sync separator system in Fig. 2, the input signals are fed through a dual time constant filter to the base; with proper biasing parameters, sync clipping will occur. The clipped sync (Fig. 3) will be seen at terminal B12, the collector of Q401. There is always a good possibility that, due to an AGC fault, the clipped sync section is not operating properly.

To add more probable faults to these systems, many color sets use noise immunity circuits. In Fig. 2, this circuit has been added around the sync clipper Q401, and consists of noise driver Q403 and noise gate Q404. These transistors and associated circuitry have the specific function of making the horizontal and vertical oscillators less susceptible to noise pulses. However, since these circuits are connected to the sync clipper, they can, if defective, upset the sync clipper action. (More details about this circuit operation later.)

Sync separation and amplification is performed by the sync limiter transistor Q401. During the following description of this sync operation, refer to the circuits in Figs. 2 and 4. The emitter of Q401 is "grounded" (collector of noise gate transistor). The collector is connected to the 24-volt supply through CR404. Composite video (positive-going) appearing at test point C3 is fed to the base of the sync limiter through capacitor C401 and a parallel RC combination consisting of R403/C402 and diode CR404. This dual-time-constant filter provides the sync limiter with a high degree of immunity to aircraft flutter. A small amount of forward base emitter bias is applied to Q401 through R402. However, if the stage were to conduct at all times, video as well as sync information would be coupled to the horizontal and vertical sweep circuits. This is overcome by having a small amount of reverse bias (negative voltage on the base) that is proportional, but not equal to, the amplitude of the incoming sync pulses. This negative voltage is developed as follows:

The positive composite video is coupled through C401 and C402 and appears at the base of Q401. The base-emitter junction acts as a rectifier to the sync pulses, developing a net negative charge on the base side of capacitor C401. The negative charge is reduced somewhat by the positive voltage dropped across the 820K resistor. The negative voltage reduction is designed so that just the uppermost positive excursion of the sync tips overcomes the reverse bias, causing the transistor to conduct and amplify only the sync information.

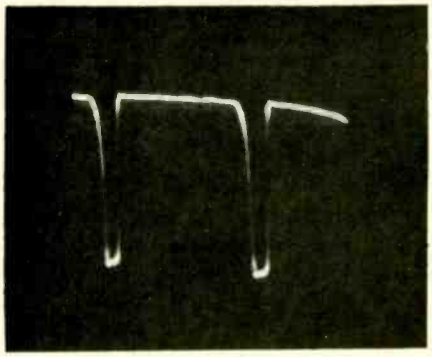

Fig. 3—Clipped horizontal sync waveform.

NOISE LIMITING

Noise immunity for the sync and AGC stages in Figs. 2 and 4 is provided by two transistors, Q403 and Q404, and their associated circuitry. These transistors are termed the "noise gate," and the "noise gate driver."

The bias conditions for the noise gate transistor are as follows: The emitter is returned directly to ground. The base receives a positive voltage coupled through R414, thus keeping the stage in saturation. The collector is coupled to the emitter of the sync limiter and the base circuit of the AGC gate. With the transistor in saturation, the collector voltage is very low (0.6 volt), thus providing a low resistance to ground for normal operation of the sync and AGC stages in absence of any noise pulses.

The emitter of the noise gate driver receives DC bias and video (negative sync) information from test point C1 of the IF module. The collector is returned to +24 volts through R413. The base bias for this stage is developed at the col-

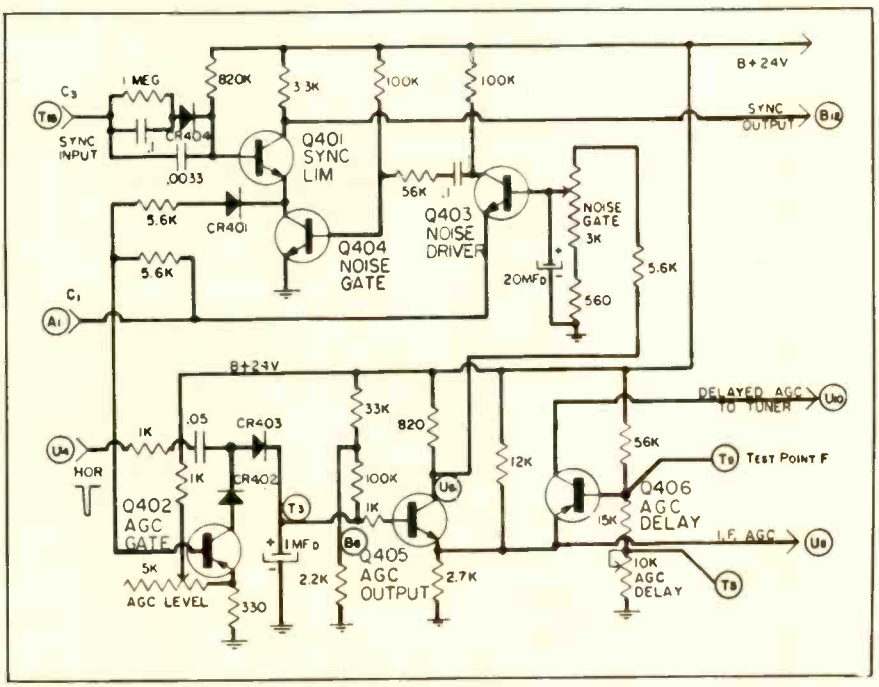

Fig. 4—Simplified version of AGC and sync module circuits shown previously in Fig.2.

lector of the AGC output transistor. The source voltage is divided down through resistor R415, the noise gate control, and R217 to ground. The voltages now established reverse bias the noise gate driver well into cutoff. The noise gate control is adjusted so that the conduction point of the transistor is just beyond sync tip level. When noise pulses just beyond sync tip level appear at the emitter, the transistor is driven into conduction. The noise pulses are amplified and coupled to the noise gate transistor through capacitor C403. The negative pulses momentarily bring the noise gate out of conduction. With the noise gate out of conduction, the collector voltage increases, thus cutting off the sync and AGC functions during the noise pulse duration. (Remember, the collector is the ground return for the AGC and sync stages.) Shutting down the sync limiter in this way keeps the noise pulses from tripping the vertical and horizontal oscillators.

SYNC/NOISE SYSTEM SERVICING

The symptom of complete loss of both vertical *and* horizontal sync usually points to a fault in the sync or AGC circuits. However, in the Zenith chassis in which the circuits in Figs. 2 and 4 are used there is an exception because the first video amplifier stage (which could be defective) is located in the IF module. A voltage check at test point C3 (with lead disconnected at the IF module) will help localize the difficulty. The voltage at C3 should measure +12.5 volts. If this voltage is off by more than two volts, trouble is indicated in the first video amplifier stage. Faults in this area may interrupt the video applied to the sync limiter.

With the problem narrowed down to the sync circuits, make the following checks:

1) Ground the collector of the noise gate transistor. If the sync has been restored, the trouble is in the noise gate system. If the difficulty is still present, go on to the next check.

2) Measure the base voltage on sync limiter Q401 with no signal applied to the receiver. It should measure +0.66 volt. If this voltage is high (more than 1 volt), the transistor is probably open. A shorted transistor will generally be indicated by a low collector voltage reading.

Marginal sync problems such as horizontal pulling may be caused by either the sync limiter of the noise gate system. Again, grounding the collector of the noise gate transistor will narrow down the source of the trouble. Use the scope to look for distorted, missing, or below-par sync pulses. In some instances when this type of marginal symptom is isolated to the sync stage, a check of individual components around the circuit is desirable because voltage checks may not indicate any fault.

The effects of an open noise gate transistor, Q404, is a complete loss of vertical and horizontal sync, plus what appears to be AGC overload. The same effects will appear if the transistor is not receiving forward bias through R414.

A less obvious problem which may develop within this noise gate system is its ability to respond to noise pulses. This will be evident in weak and/or noisy signal areas as unstable sync. To determine if the system is working, turn the noise gate control fully counterclockwise. Next, adjust the AGC level control so that the receiver is about to overload. Then slowly turn the noise gate control clockwise. If the video breaks up, the system is working. If adjusting the noise gate control has no effect, proceed to the following:

Adjust the AGC level control back to "normal," and turn the noise gate control fully counterclockwise. Measure the collector voltage of the noise gate driver. It should be 24 volts. A lower voltage reading indicates a shorted transistor. If the voltage is 24 volts, adjust the AGC level just under overload and turn the noise gate control fully clockwise. This will cause the transistor to conduct on the sync information, and if the transistor is not open, the collector voltage will decrease to about 12 volts. If the collector voltage does decrease, as just described, check for a *shorted* noise gate transistor.

SYNC LIMITER/NOISE BIAS CIRCUIT

Let's look at the operation of the combination sync limiter and noise bias circuit shown in Fig. 5. Sync is extracted from the incoming composite video by Q404. This stage is designed so that the uppermost positive portions of the sync tips cause the transistor to conduct. The sync pulses are clipped from the composite video information and coupled to the vertical and horizontal circuits.

The action of the sync limiter stage will be covered first because the noise bias transistor is essentially a short on a strong signal.

The emitter of Q404 is connected to ground. The collector is connected to the +24 volt supply through R419. Positive-going composite video from the collector of Q406 is coupled through C406 and a parallel RC combination, consisting of C405 and R418, to the base of Q404.

The base-emitter junction acts as a rectifier to the positive sync pulses, producing a negative charge on the base side of capacitor C406. This negative voltage sets the operating point for the

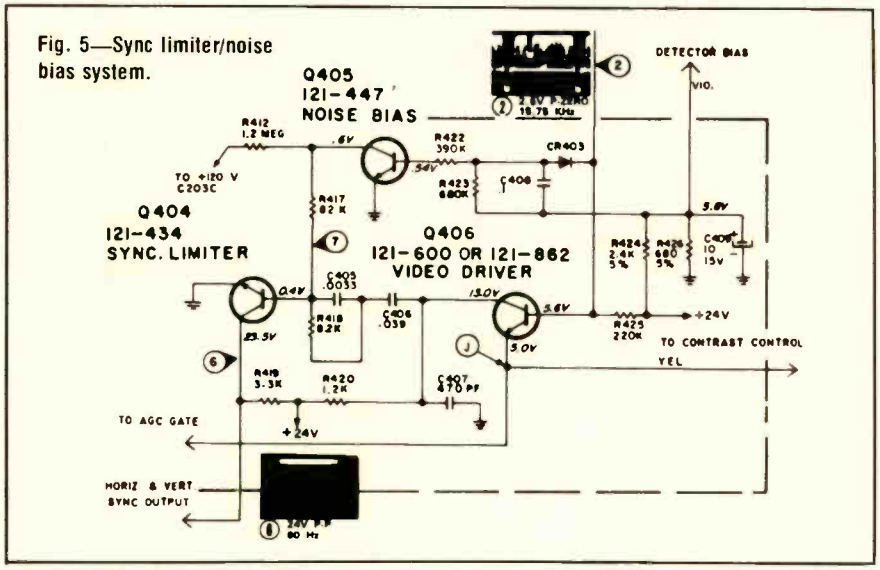

Fig. 5—Sync limiter/noise bias system.

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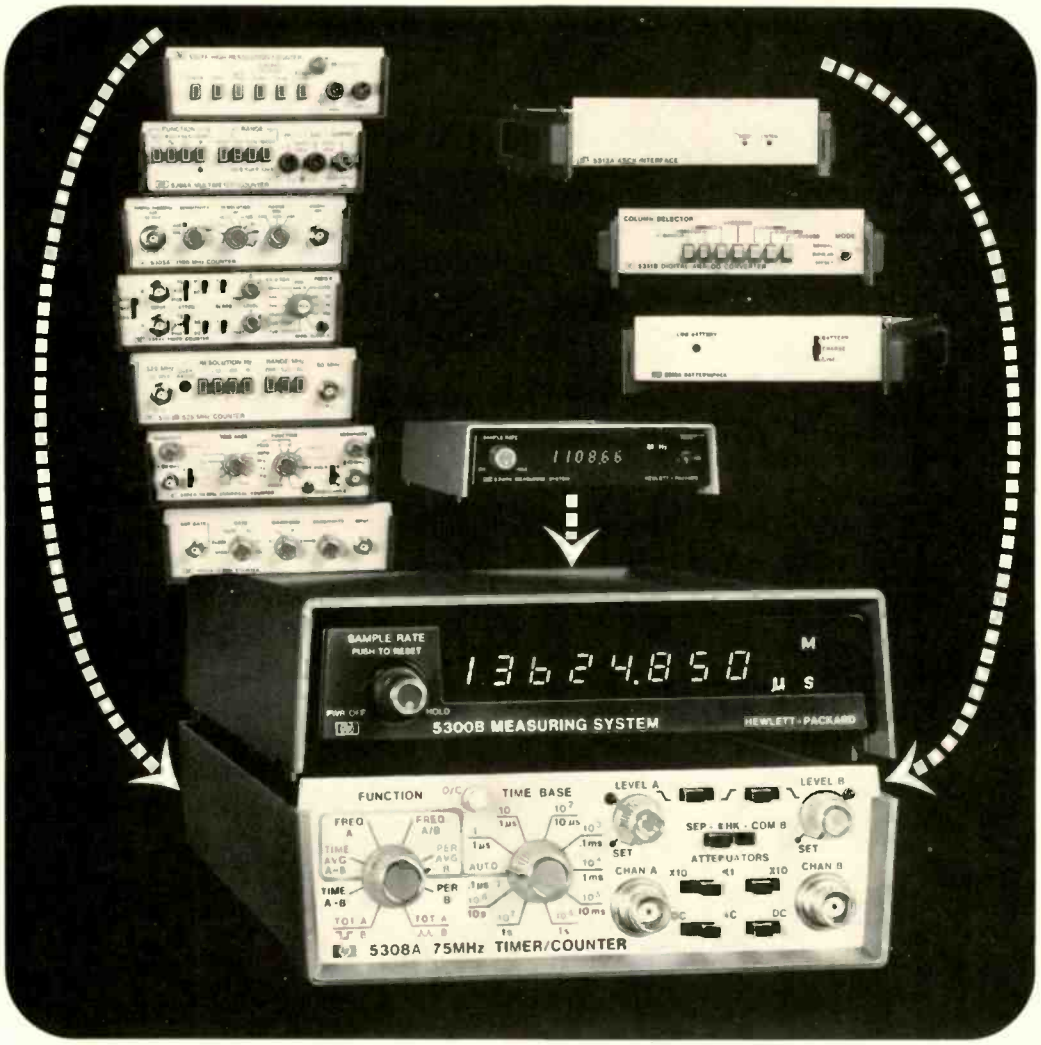

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limiter, so that only the positive parts of the sync tips overcome the reverse bias, causing conduction of the transistor and amplification of only the sync information.

On weak signals, noise pulses riding on the sync can shift the operating point of the sync limiter so that clipping occurs on the noise, and sync is lost. To prevent this from happening, noise bias transistor Q405 is used.

The action of the noise bias transistor is as follows: The voltage divider consisting of resistors R424 and R426 provides about +5.5 volts, which appears on the anode of CR403. The cathode is fed the +5.6 volts from the +24-volt supply via R425. This positive voltage on the base keeps transistor Q405 in saturation, effectively shorting the collector of Q405 to ground. Noise pulses that appear on the sync cause the cathode of CR403 to become negative with respect to the anode. When this happens, CR403 conducts and a bias voltage opposed to the positive bias is fed to the base of Q405 to bring it out of saturation. As conduction decreases, the voltage on the collector increases. This voltage change is fed to the base of the sync limiter to oppose the increase in negative bias caused by the noise on the sync. This bias change keeps the limiter at the proper operating point, so that clipping occurs on the sync and not on the noise pulse.

TROUBLESHOOTING THE SYNC LIMITER/NOISE BIAS SYSTEM

For a symptom of complete loss of both horizontal *and* vertical sync, make the following checks:

Measure the base and collector voltages of sync limiter Q404. With a strong signal, base voltage should be around −2 volts. Collector voltage should be around +23 volts. If voltage on the base is zero or slightly positive, composite video is not reaching the base circuit. Check capacitors C407, C406 and the collector voltage at Q406. If C407 is leaky or the value of R420 has increased, the video driver stage may be clipping on the sync pulses.

For a symptom of marginal horizontal sync accompanied by picture pulling on a strong signal, short the collector of noise bias transistor Q405 to ground. If the problem clears, Q405 may be defective or some other defect exists in the noise bias stage.

With a symptom of poor horizontal and vertical sync on *weak* signals, check Q405, CR403 and associated components.

TECH BOOK REVIEW

Title: Simplified TV Trouble Diagnosis (TAB BOOK No. 633)
Author: Robert L. Goodman
Publisher: TAB BOOKS, Blue Ridge Summit, PA 17214
Size: 320 pages, 292 illustrations
Price: $5.95 paperback; $8.95 hardbound

This service technician-oriented text provides concise yet thorough descriptions of how the circuits in tube, hybrid and all-solid-state color and b/w TV chassis function, what their failure modes and related trouble symptoms are, and how to quickly pin down defects in them when they fail.

For convenient reference use, complete circuit analyses of and troubleshooting procedures for each TV functional section are contained in a single chapter, eliminating the need to switch back and forth among chapters when you are concerned with only one functional section of a receiver.

The text is amply illustrated with schematic diagrams, screened photos and other "real life" illustrations of the actual circuits and waveforms encountered in existing TV receivers, and even includes a special foldout section which contains troubleshooting flowcharts and complete schematic diagrams of four representative color TV chassis.

CONTENTS: Vertical Sweep Circuits—Horizontal Sweep & High-Voltage Systems—Vertical & Horizontal Sync—VHF Tuner Characteristics—Video Amplifier Circuitry—TV AGC Systems—Video IF Circuits—Color CRT Diagnosis, Beam Control & The Trinitron—Color Sync & Associated Circuits—Color TV Crystal Ringing Circuits—Color Killer Circuit Operation—Chroma Demodulator & Amplifier Circuits—Sound Detector & Audio Circuits—Troubleshooting Flow Chart Technique—Low-Voltage Power Supply Functions.■

"Non-Audio" Sources of Distortion In Car Radios

By Joseph J. Carr

■ Most cases of audio distortion in car radios are caused by a defect in the audio amplifier section. However, there are certain types of defects in other stages which can, and occasionally do, cause audio distortion. Following are some of the most frequently encountered types of these "non-audio" sources of audio distortion.

AM DETECTOR DEFECTS

A shorted detector diode usually causes complete loss of audio output. However, if the output of the second IF amplifier is unusually strong, it can feed right through the shorted detector, through the 10-KHz filter (the 10K-ohm and 1K-ohm resistors and .01mfd capacitor in Fig. 1) and be rectified by the "diode" of the base-emitter junction of the audio preamplifier transistor. The result, if the audio amplifier section has sufficient gain, is a weak, distorted output.

Another "non-audio" source of distortion can occur in car radio detector circuits in which the detector diode is normally reverse biased, as shown in Fig. 2. This is done to provide the diode a higher load impedance, which, in turn, develops a higher output voltage. In such designs, if one of the resistors in the reverse-bias supply network changes value, the reverse bias applied to the diode might become sufficiently excessive to prevent rectification except on only the most positive peaks of the second IF output. The result, again, is weak, distorted audio.

DISTORTED FM, NORMAL AM

With the exception of some of the Delco AM/FM receivers produced in the mid-'60s, in which a shorted audio coupling capacitor caused distorted audio during FM reception but did not affect the audio during AM reception, most such cases involving distorted FM reception but normal AM are caused by either a defective diode, open transformer or some other

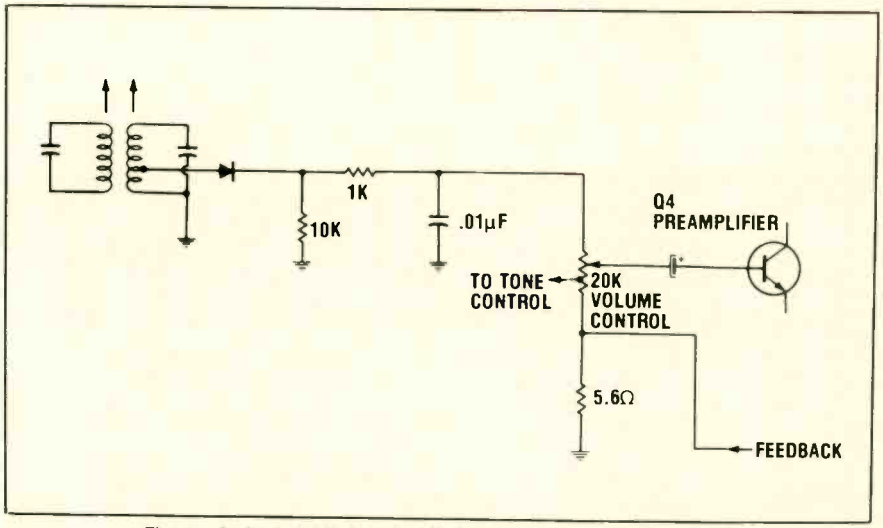


Fig. 1—A shorted AM detector diode does not necessarily mean no audio output. Strong signals can feed through shorted detector, be rectified by the base-emitter "diode" of Q4 and produce weak, distorted audio output.

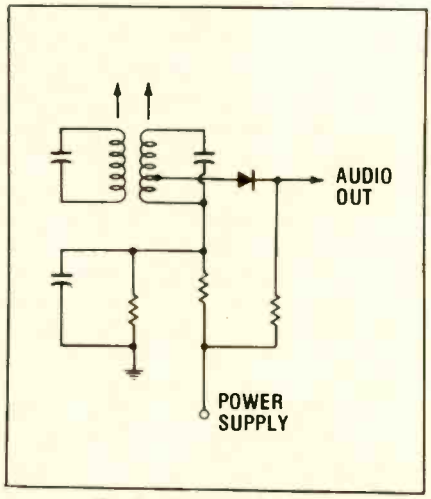


Fig. 2—A defect which increases the reverse bias across the normally-reverse-biased audio detector shown here can cause weak, distorted audio.

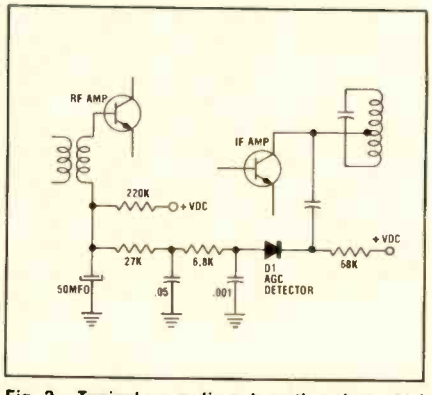


Fig. 3—Typical car radio automatic gain control (AGC) system. Defects in this system can cause audio distortion whose degree varies with received signal strength.

defect in the FM demodulator or, in quadrature detectors, an open phase coil.

AGC-RELATED DISTORTION

An automatic gain control (AGC) system typical of that used in many car radios is shown in Fig. 3. Signals from the IF amplifier collector are applied to a half-wave diode rectifier followed by an RC filter network. This creates a DC level proportional to the signal strength. This control voltage is applied to the base of the RF amplifier and is of a polarity that "bucks" the normal RF amplifier bias current. This reduces the gain of the RF amplifier and, thus, the amplitude of the RF signal. Although any such feedback system may tend to be a little unstable during changes or transitions from one steady state to another, it soon stabilizes and keeps the amplitude of the output signal relatively constant.

AGC-caused audio distortion can be particularly difficult to troubleshoot, especially if there are a number of strong local radio stations. Fortunately, AGC-caused distortion is almost exclusively an AM radio problem and seldom occurs in FM receivers.

The audio distortion produced by AGC defects usually sounds like that produced by an audio amplifier with about 25% total harmonic distortion (THD). Although AGC-related audio distortion often is accompanied by audio "howling" as a result of feedback oscillation, this is not always the case.

If AGC rectifier D1 in Fig. 3 shorts, the result will be audio distortion whose level varies with the strength of the received signal. On strong local stations, the RF amplifier will saturate, producing audio distortion. On weak stations, however, little or no distortion will be produced. Consequently, this type of distortion-causing defect can be pinpointed by simply tuning the receiver across the AM band and noting whether or not the distortion seems to disappear on weak stations. If it does, you probably have a shorted AGC rectifier. If the distorted audio also is accompanied by "zero beat" howling, you have even more evidence of an AGC defect—in many such cases, an open AGC bypass capacitor.

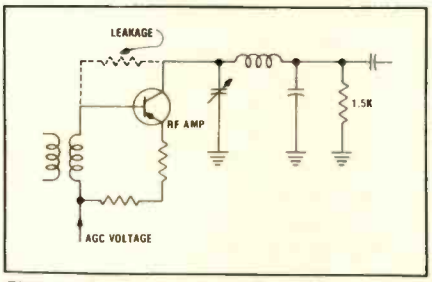


Fig. 4—Collector-to-base leakage in the RF amplifier, illustrated here, also can cause distortion which varies with received signal strength.

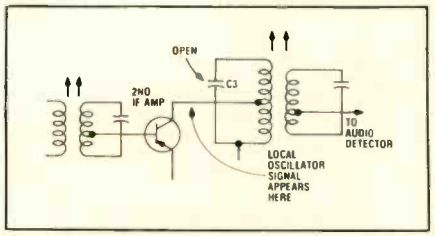


Fig. 5—Defects in IF amplifier section of a car radio can cause non-audible oscillations which, in turn, causes distortion of the audio output. Or if the resonant frequency of the 2nd IF transformer is changed by a defect, the local oscillator signal might feed right through to the collector of the IF amplifier transistor.

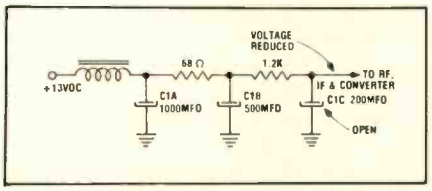


Fig 6—Open C1C in the AM car radio power supply shown here or a "partial short" in the Zener B+ regulator of an FM car radio also can cause distorted audio.

RF AMPLIFIER DEFECTS

Another source of car radio audio distortion which varies with the strength of the received signals is excessive leakage between the collector and base of the RF amplifier transistor (Fig. 4), particularly those which are equipped with PNP germanium types.

As was the case with AGC-related distortion, that caused by excessive leakage between the collector and base of the RF amplifier might be barely perceptable or completely absent during reception of weak stations, yet quite evident during reception of stronger signals. Regardless of whether or not it causes perceptible distortion, RF amplifier collector-base leakage usually produces abnormal DC voltages in that stage.

One of the most information-laden indicators of performance in a car radio is the collector or emitter voltage produced by conduction in the RF amplifier. If it is normal and varies as the radio is tuned across the dial, you can tentatively assume that all is well in the RF, IF and converter stages. In sets equipped with PNP transistors and a negative ground, the degree of conduction is indicated by the RF transistor collector voltage, while in NPN stages it is common to use the emitter-to-ground potential. In PNP radios, incidentally, no other stage will have a resistance value high enough between the collector and ground to produce a measurable voltage. Converter and IF amplifier stages tend to have collector voltages below 1 volt, often only a fraction of a volt. In the RF stage, however, conduction usually produces a voltage up to several VDC between collector and ground (PNP) or between emitter and ground (NPN) and this will vary significantly as the radio is tuned across the AM dial. If the PNP RF amplifier collector voltage does not vary much as the radio is tuned, a defect must be assumed. In the distortion cases discussed so far, the voltage might be near the correct maximum value or a little higher, but it usually does not vary at all as the radio is tuned. In cases where the RF transistor has a high collector-emitter leakage current there will be considerably higher-than-normal voltage on the collector and the radio usually will be inoperative, not just distorted.

IF OSCILLATION

Another difficult-to-find, "non-audio" source of distortion is internally generated oscillation in the IF amplifier, which usually overdrives the RF amplifier sufficiently to cause distortion.

Unlike the audible oscillation produced when an AGC bypass capacitor opens, the oscillation related to defects in the IF amplifier often is not audible because the sum and difference hetrodyne signals produced by it and the output of the converter are above the range of the human ear.

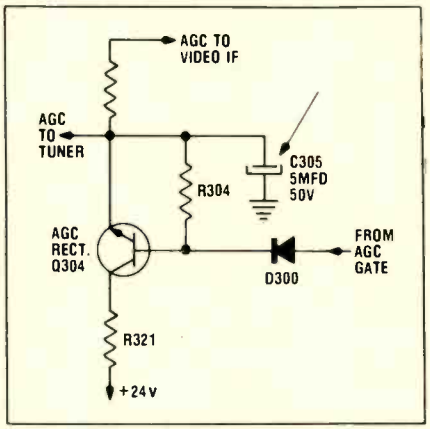
Another non-audible but nevertheless distortion-producing spurious signal would appear in the IF amplifier section if the capacitor inside the 2nd IF trans-

continued on page 46

TECHNICAL DIGEST

CHASSIS: Admiral M10

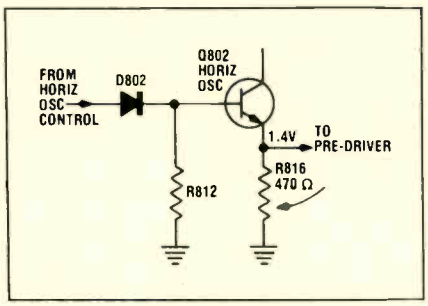
TROUBLE SYMPTOM: Left side of raster darker than right side, possibly accompanied by marginal vertical sync and/or lines streaking or flashing across raster.



CAUSE: Defective capacitor C305 (5mfd, 50WVDC) in AGC circuit. If defect is verified, replace C305 with Admiral Part No. 67A200-509-7.

CHASSIS: Admiral M24, M25 & M30

TROUBLE SYMPTOM: Raster and stable picture takes longer than normal time to appear after receiver is turned on.



CAUSE: Slow stabilization of horizontal oscillator as result of increase in the value of resistor R816 (470 ohm, 10%, ½ watt). Replace R816 with Admiral Part No. 60A105-471 (470 ohm, 5%, ½ watt).

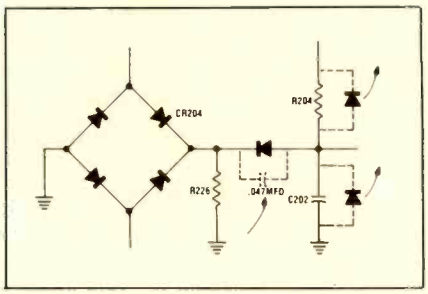
CHASSIS: Zenith 19GB1

TROUBLE SYMPTOM: Bending and/or 60-HZ hum bars in picture.

CAUSE: Inadequate contact between grounding pads on printed-circuit board and the chassis frame. To remedy, remove the board from the frame and clean the grounding pads and, if necessary, use a light soldering iron to make the pads of even height. Additionally, if the circuit board does not already have a jumper wire connected between the grounded sides of C702 and C802, install one. This jumper provides more even distribution of ground circuits.

CHASSIS: Zenith receivers equipped with Space Command 1000 remote-control systems

TROUBLE SYMPTOM: Failure of the remote-control system to function even after the remote transmitter, mic/amplifier assembly, receiver board and power module all have been substituted. In some such cases, the remote-control system will alternate between normal and abnormal operation over a period of time.



CAUSE: Presence of the AC power line of even harmonics (120 Hz and 240Hz) of the 60-Hz power line frequency. The following modifications of the remote system clock circuit will restore normal operation in the presence of such AC power line interference:

Remove	*Add In Same Holes*
R204	Diode Part No. 103-142-02
C202	Diode Part No. 103-142-02
CR207	Capacitor Part No. 22-6447-01

Although these modifications do not prevent normal operation of the remote system in the absence of even-harmonic line interference, they should be made only after it has been determined that failure of the remote system to operate is not caused by other defects. For example, a trouble symptom similar to that caused by line interference will occur if a temperature-affected open occurs in bridge diode CR204; although the receiver can be turned on manually, the remote system will remain inoperative until the diode cools enough to "close." In this and other instances of complete failure of the remote system, restoration of normal operation after substitution of the remote system compo-

TAB ALL-IN-ONE SCHEMATIC/SERVICING MANUALS FOR COLOR & B & W TV, RADIOS, CB, HI-FI, etc.

Here is complete service data, including full-size schematic diagrams, waveforms, setup and alignment instructions, field modification changes, trouble case histories, etc., for the most popular name-brand TV receivers. Each manual contains everything needed to service all models of the brands covered, including full-size schematic diagrams for every model year. In addition, each manual has something special to offer in the way of unique or improved trouble-finding techniques or in other informative material related to TV servicing in general. Most manuals have parts lists included. All are 8½" x 11", 196 or more pages, including schematic diagram foldout.

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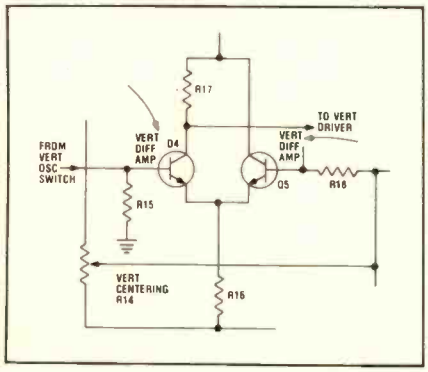
nent assemblies verifies that the failure is not caused by line interference.

CHASSIS: Magnavox T982

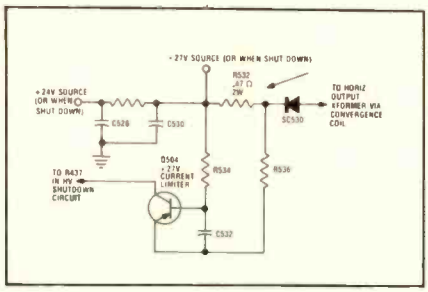
TROUBLE SYMPTOM: Raster gradually shifts either up or down as much as 3 inches after up to two or three hours of operation.



CAUSE: Leakage in either of the differential amplifier transistors, Q4 or Q5, on the vertical module. A limited quantity of transistors of a type subject to leakage after warmup were used in the Q4 and Q5 positions in some of these chassis. These transistors have an unusual rectangular shape, have their part number stamped on the back, and have the letter "H" followed by a four-digit date code stamped on the front. Although Magnavox's service warranty policy stipulates module replacement, in this case Magnavox states that "the servicer may elect to replace these transistors (Q4 or Q5) if they are found to be defective."

CHASSIS: Sylvania E06/E08

TROUBLE SYMPTOM: Intermittent loss of raster; set might operate normally for a period of hours or days between instances of raster loss.



CAUSE: False initiation of high voltage shut down as a result of increase in the value of the sensing resistor, R532, in the high-voltage shutdown circuit.

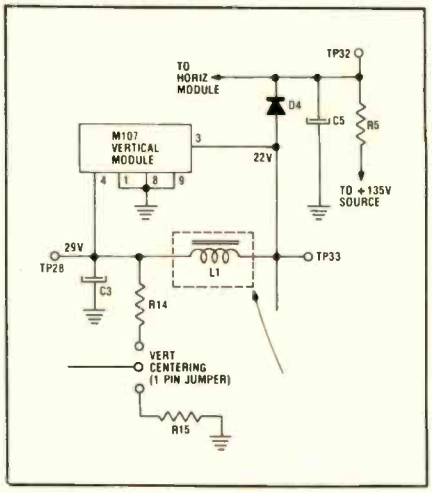
CHASSIS: Any Admiral all-solid-state color chassis

TROUBLE SYMPTOM: Repeated failure of horizontal output transistor, accompanied by overheating of horizontal output transformer.

CAUSE: Excessive current through horizontal output transistor and transformer as result of defective high-voltage tripler. Always check and, if found defective, replace the tripler *before* installing a new output transistor.

CHASSIS: Magnavox T995

TROUBLE SYMPTOM: "Unusual" vertical scan trouble symptoms, including vertical scanning of only one-half the screen, with or without retrace lines. The height and linearity controls produce normal changes in the raster but will not fill out the screen. Positioning the vertical hold control so that the vertical oscillator is off frequency might fill the screen with a single, not double, frame.



CAUSE: Partially shorted vertical output choke, L1 (Magnavox Part No. 320124-23). The resistance of L1 should be 9 to 10 ohms. A resistance reading of less than about 7 ohms indicates a possibly shorted choke. (The resistance of these chokes actually found to be partially shorted measured about 3 ohms.) ■

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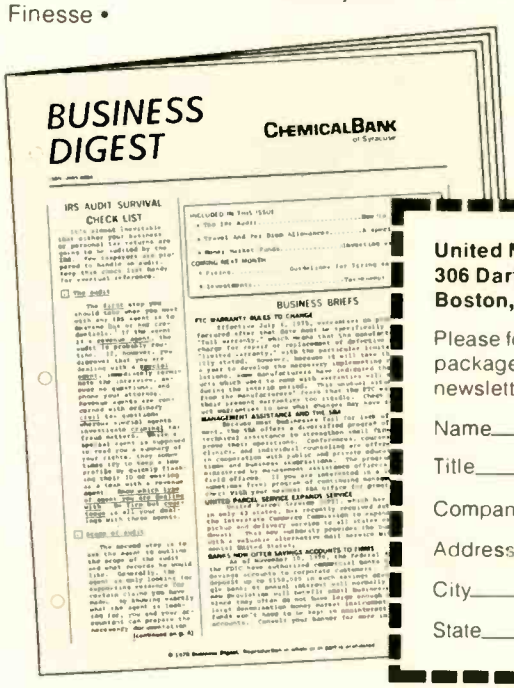

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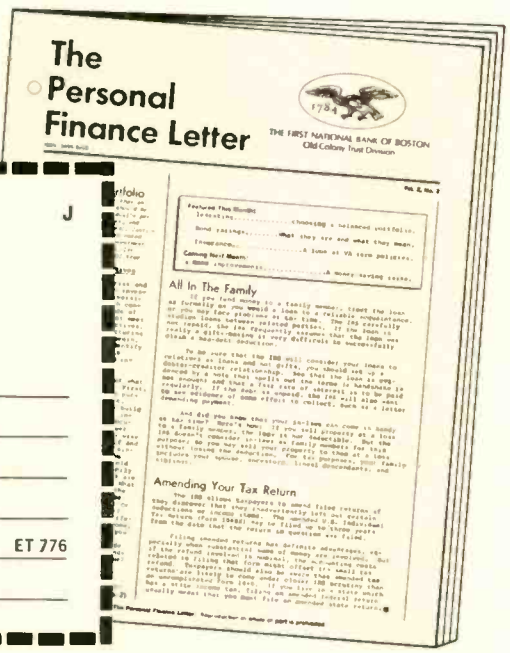

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TEST INSTRUMENT REPORT

FREQUENCY COUNTER

A new 60-MHz frequency counter, Model LDC-821S, has been introduced by Leader Instruments Corp.

Minimum frequency response of the Model LDC-821S, within an accuracy of 5 parts per million over an ambient temperature range of 32°F to 104°F, is 60-MHz, although the instrument will respond to and readout frequencies in excess of 90-MHz with a relatively slight degradation of accuracy. The minimum sensitivity of the LDC-821S is 50 mV and the nominal input impedance is 1 megohm.

Digital readout of frequency is provided by a 2-inch-high Nixie display, which is clearly legible even in high ambient light conditions. Four switch-selectable time bases, which cover the range from 2 milliseconds to 2 seconds, permit seven-digit resolution from the LDC-821's five-digit readout.

The Model LDC-821S is equipped with a dual power supply, which can be operated from either a 115-VAC or 230-VAC source, and is housed in a metal case which prevents spurious radiation and interference from external RF fields. The price of the LDC-821S, complete with all essential accessories, is $299.95.

...for more details circle 134 on Reader Service Card

VOLT-OHM-MILLIAMMETER

A new 30,000 ohm/volt VOM, Model WV-518B, has been introduced by the VIZ Test Instruments Group. The WV-518B is the first of several scheduled new products to be announced since VIZ acquired the RCA test instrument line.

The Model WV-518B measures AC and DC voltages from 0 to 1000 volts with +3% full-scale accuracy. It has four resistance ranges (X1, X10, X100, and X1K) and five DC current ranges, from .05mA up to 5A full scale. All switch-selectable ranges are fuse-protected against burnout. A separate input jack is used for the 5A AC or DC current range.

The VOM has a large, 100°, mirror scale, a taut-band meter, and color-coded scales and function switch. Its ABS high-impact case is equipped with a built-in tilt stand which makes upright use convenient. The easy-open, snap-off back provides screwdriverless access to the instrument's batteries and protective fuse.

The detent-type function-selection switch of the Model WV-518B is equipped with double ball bearings and a double-action wiper.

The VOM is 5-⅛ inches high, 3-½ inches wide, 1-⅞ inches deep and weighs a mere pound. The price is $39.95.

...for more details circle 135 on Reader Service Card

SEMICONDUCTOR TESTER

B&K-Precision's Model 530 Semiconductor Tester combines the versatility of a lab-quality instrument with the ease of operation of a service-oriented test instrument.

The Model 530 performs not only in- and out-of-circuit good/bad tests and lead and type identification of diodes, bipolar transistors field-effect transistors (FETs) and silicon-controlled rectifiers (SCRs)—all without the need for "setup data"—but it also performs more definitive measurements of operating characteristics such as the beta and leakage of bipolar transistors and the transconductance (Gm) of FETs.

In addition, the Model 530 measures and provides an analog meter readout of the cut-off frequency (F_t) of transistors, up to 1500-MHz. This exclusive feature is particularly useful for pre-installation verification of the F_t of replacement transistors employed in circuits which process signals in the HF, VHF and UHF frequency ranges.

High drive currents at a low duty cycle enable the Model 530 to perform reliable in-circuit testing of power transistors—even the new power FETs, both enhancement and depletion types, can be tested with the 530.

During good/bad testing, the illumination of either of two light-emitting diodes (LEDS) indicates the transistor (PNP or NPN) or FET (N- or P-channel) type and, in conjunction with an audible tone, it also indicates that the device is capable of normal operation.

For out-of-circuit tests, the 530 measures transistor beta in two ranges (20-200; 20-600), and Gm of FET's in two ranges (.4-12 millimhos; 4-400 millimhos). The accuracy for beta and Gm tests is to within 10%. Other measurements include F_t, gate leakage and I_{DSS} of FETs; and BV_{CES}, I_{CES} and PIV of diodes. Automatic current limiting prevents damage to the device under test, assuring nondestructive transistor and diode breakdown tests.

Test currents applied to transistor elements by the Model 530 are: collector, 125mA @ 4% duty cycle; base 250mA @ 4% duty cycle (HI drive) and 1mA @ 4% duty cycle (LO drive). The test repetition rate is ten times per second. For high-power transistor beta and FET Gm tests, a special 300 microsec, 1% duty cycles test circuit permits testing at up to 2 amps without over-dissipation of the device under test. Maximum beta of 200 and Gm of 400 millimhos correspond to a test current of 2 amps for power devices. F_t measurements are performed at a collector current of 10mA.

The price is is $250. ■

...for more details circle 136 on Reader Service Card

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"Here's a list of things my husband thinks he found out *weren't* wrong with it!"

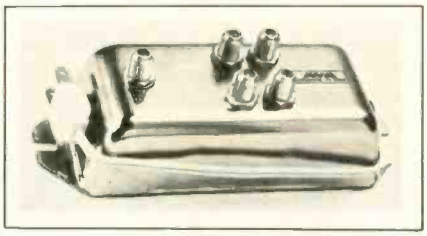
"Hi! It's football time again, so here I am to give your TV it's pre-season physical."

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.

MATV AMPLIFIER 137

A new UHF-VHF-FM with a built-in 4-way splitter for MATV systems is introduced by *AVA Electronics*. With a bandwidth of 50 to 900 MHz, the new amplifier can be used on up to 16 TV sets. It has an input of 75 ohms and output of 75 ohms per splitter, is pow-



ered by a 117V AC 60 Hz transformer isolated with an output capability to 30 dB. Designated the A515-4UV, the new model features built-in surge lighting protection. It lists for $49.95.

ANTENNA INSTALLATION KIT 138

Burr-free holes in autos, trucks, campers, or vans can now be drilled for mobile CB antenna installations with a new Conecut kit introduced by *GC Electronics*. The kit includes two tools that drill holes from 1/4 inch to 13/16

inch and from 5/8 inch to 1-3/16 inches, cutting compound, an assortment of fibre hole gauges and a vinyl carrying pouch. Holes can be drilled in almost any thin material—steel, sheet metal, tubing, conduit, plastic, or formica, and need no center punch or pilot hole.

ATTACHE TOOL CASE FOR FIELD SERVICE 139

An assortment of hand tools and a cordless soldering iron and recharger are contained in a new attache tool case from *Weller-Xcelite* that is designed for in-the-field operation by technicians, servicemen and field engineers. The new case contains 23 in-

dividual tools, interchangeable screwdriver/nutdriver blades and handles, 10 ft. and 50 ft. measuring tapes, soldering iron, solder, and recharger. It has removable pallets in the lid and see-thru plastic tool pouches. Additional tool space is provided in the partitioned base.

CB NOISE SUPPRESSION FILTER 140

A new heavy-duty feed-thru filter to suppress alternator and generator noise in mobile CB radios installed in large trucks, tractors and other farm equipment has been introduced by *Sprague Products*. Designated as Type QX1-600, the new filter is rated .5 mfd @ 600 VDC, and has a current-handling capability of 200 amperes. Capable of suppressing up to 30 dB of unwanted noises at 4-30 MHz, the new filter is hermetically-sealed in a metal case for protection against mechanical damage, moisture, dirt and grease. It is pre-packaged with a 7 ft accessory cable and complete installation instructions.

COPPER-LOADED WIRE SOLDER 141

A new wire solder has been developed by *Multicore Solders* to prevent the dissolving of fine gauge copper wires and thin copper foils used on circuit boards. The new product is a copper-loaded, tin/lead alloy wire sol-

der with 5 separate cores of rosin base flux. According to the manufacturer, the new solder, Savbit, prevents the dissolving action which frequently causes a wire or thin foil to weaken during soldering, embrittle and subsequently break during field use. It is priced at approximately $3 per pound, depending on gauge, quantity and world metals prices.

MATCHING TRANSFORMER FOR SOUND SYSTEMS 142

A new weatherproof, low-loss, 70-volt line-matching autotransformer for professional sound reinforcement applications has been introduced by *Shure Brothers, Inc.* The new unit provides power taps for selecting power, in watts, delivered to the speaker load,

with speaker impedance taps to accommodate various speaker loads. Four power taps (50, 25, 12 and 6 watts) are provided on the model A102-A for connection to the 70-volt speaker line from the power amplifier. It features a weatherproof steel case, an encapsulated autotransformer sealed from moisture, and an integral mounting strap. User net price is $31.50.

RF PRE-AMPLIFIER 143

Improvement of CB weak signal reception and overload protection are offered by a new RF-pre-amplifier now introduced by *Communications Power, Inc.* Called the Range Plus, the new unit is said to enhance fringe signal readability by special FET circuitry with a wide dynamic range contributing substantial gain but very low noise. An attenuator-type control allows smooth gain adjustment over a 38 dB range. As an "add on" unit, the device connects between antenna and transceiver, requires no alterations or adjustments to the CB set, and is easily installed. When transmitting, an On The Air indicator lights and an internal circuit senses RF and operates a relay which by-passes the pre-amplifier. Available in 12 VDC only, or 12 VDC/115 AC.

CB MOBILE ANTENNAS 144

Three new mobile CB antennas, complete with mount, cables and connectors, that are easy to install, are being introduced by *RCA*. The 14T150 is intended for trunk lip mounting and comes with a spring mount which prevents damage to the antenna if it hits an overhead object. The 14T151 has been designed for gutter mounting, and both have removable antenna whips. The 14T152 (shown here), which is a magnetic mount type, develops 21 pounds pull on typical steel automobile roofs and is said to hold securely at all highway speeds. Each antenna comes with weatherproof center loading coil and an adjustable element for resonating to the lowest standing wave ratio.

SERVICING RECORD SYSTEM 145

A new system that provides service shops and technicians with a duplicate permanent record of every incoming service call is now available from the *Bill-A-Pak Company*. With the system, called the Service Call Recordlog, forms contained in a plastic-ring-bound book are filled out at the time of an incoming service call. The original

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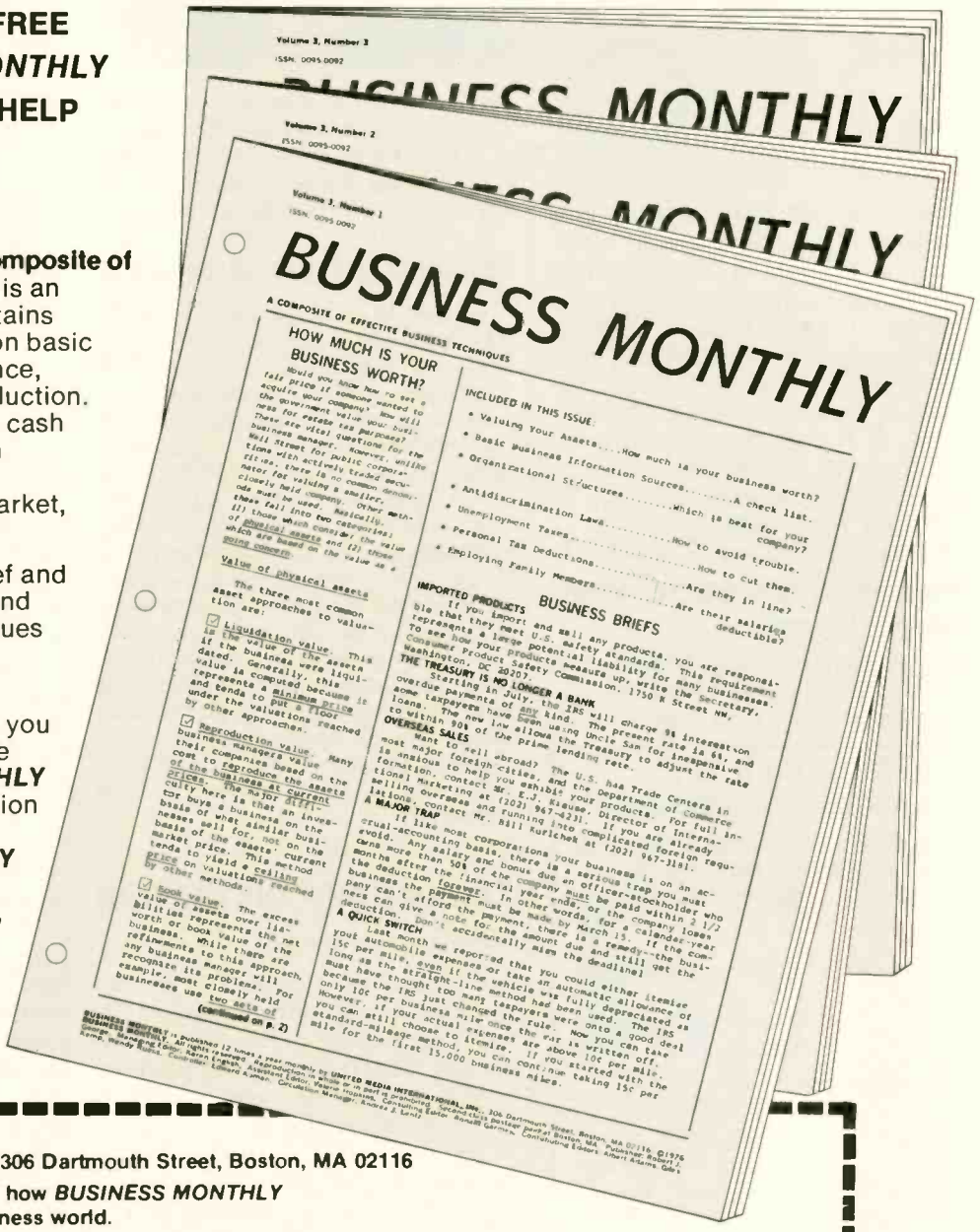

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CB MAGNETIC-MOUNT ANTENNA 146

A new CB antenna with magnetic mount for easy, fast removal is now available from *Hy-Gain Electronics*. The newest addition to the firm's antenna line, the Hellcat Z features a 48 inch stainless steel whip that's tapered for lower wind loading. The whip is mounted on a high impact base that adjusts 360° horizontally and 180° vertically to allow an upright position for efficient radiation and a low take-off angle for mounting on a sloping body panel. The whip can also be laid down for car washes. The antenna base contains an Alnico magnet for all flat, ferrous metal body surfaces. A plastic shield covers the magnet to protect painted surfaces. Comes with 18 feet of coaxial cable and a PL-259 connector.

"NON-AUDIO" DISTORTION

continued from page 35

former in Fig. 5 opened or if the transformer winding attached to the "high" end of the capacitor opened. This type of defect permits the IF amplifier to pass the output of the local oscillator.

Detection of this type of non-audible IF oscillation or spurious signal feedthrough can best be accomplished by placing either a digital frequency counter or scope probe on the collector of the IF transistor and checking for a heterodyne signal at a frequency equal to the sum and/or difference between the car radio IF (usually 262 KHz) and the local oscillator (usually 1200 to 1900 KHz in the top third of the AM broadcast band).

POWER SUPPLY DEFECTS

Audio distortion also can be caused by insufficient operating voltages. For example, if capacitor C1C in the AM car radio power supply in Fig. 6 develops leakage, the power supply output voltage will drop, causing the RF, IF and converter stages to operate non-linearly, which, in turn, produces a distorted audio output.

A similar source of audio distortion can occur in car FM radios, the RF amplifiers of which typically are supplied *regulated* B+ from a Zener-controlled source. If the Zener develops a "partial short," the regulated voltage supplied to the tuner drops below normal, producing not only distorted audio but also a shift in the local oscillator frequency which, in turn, affects the tuner dial calibration.■

CB THEFT

continued from page 25

antenna whip and the coil from the base, for protection against theft and damage from car washes. Model M-460 (Fig. 7) uses a combination lock on the antenna collar with 8 possible settings to discourage theft. The locking collar and base is inserted between the antenna's coil and mount, permitting only the user to remove the coil and whip. Model M-450 (Fig. 8) allows only the whip to be removed from a base-loaded antenna. A downward push and a twist on the knurled adapter causes the antenna's whip to release from its base.

Another design from Antenna Specialists attempts to confuse the would-be CB thief by a new 3-in-1 antenna—Model MR264 (Fig. 9)—which looks like a conventional broadcast antenna but works on AM, FM and CB. The MR264 is said to be identical to the A/S "police disguise" antennas. The stainless steel whip removes easily to accommodate car washes.

A different method of concealing CB antennas when the car is unattended involves a movable bracket which, when attached to the trunk lip of the car, allows the user to either move the antenna into operating position, or stow the antenna in the trunk—out of sight—when not in use. Two versions of this method are shown in Fig. 10 and 11. The product shown in Fig. 10 is the *Stowit*, manufactured by Holly Enterprises of Addison, Texas, and the *Tuk-a-Way*, from the Deep South Marketing

Corporation of Houston, Texas, is shown in Fig. 11.

THE TOTAL THEFT PREVENTION APPROACH

The CB dealer can do much to lower the loss rate from theft and thereby provide a genuine service to his customers if he will take the time to educate his customers, keep an inventory of the various theft prevention items, and keep his own eyes open.

Units which are suspected of having been stolen can be checked in minutes by calling the unit's serial number and description into the nearest *National Crime Information Center* (NCIC), which has computer terminals at most law enforcement agencies. For example, if a stranger brings in a CB unit for repair with a mangled mounting bracket and a missing or broken power lead, and the stranger sounds as if he doesn't know too much about what is wrong with the unit, the dealer would be wise to check the unit out with the NCIC. There is also a new organization in existence now that is in business specifically to reduce CB thefts and to aid law enforcement agencies in the return of recovered CB's to the rightful owners. The new service is called the *National CB Theft & Recovery Bureau*. Headquartered in Baton Rouge, Louisiana, the Bureau will enter, for a fee, the name, address and CB serial number of the registrant into their computers. The registrant receives identification decals for his CB set, antenna and vehicle windshield. In addition, the Bureau maintains a 24-hour national toll-free telephone "hot line", to help any law enforcement agency in the country identify owners of recovered CB sets. CB dealers are invited to become authorized registration stations for the new bureau—and it's a profit-making possibility.

Perhaps, someday, when the novelty and the boom feeling of CB wears off, and it settles down to just a big, successful industry, the threat of massive thievery will also subside. In the meantime, a full cooperative effort by user, dealer, manufacturer and the law enforcement agencies will be necessary to keep the millions of CB units in the possession of their rightful owners.■

FM RECEIVERS

continued from page 20

In actual practice, though, the internal resistor can vary +20 percent, so a .001-mfd capacitor is usually sufficient.

PULSE COUNTING (DIGITAL) FM DETECTORS

Fig. 11 shows a "coil-less" FM detector which, until recently, was pretty much restricted to FM telemetry applications, in which audio frequency carriers are often used. At least one manufacturer, though, uses such an arrangement in a "high-dollar" FM stereo tuner. FL1 is a bandpass filter which might be either an LC or piezoelectric (ceramic) type, depending upon model and manufacturer. Integrated circuit U1 contains a gain stage and limiters. IC U2, however, is a special TTL digital logic type called a "retriggerable monostable multivibrator" (one-shot). This chip will produce a single pulse every time it is triggered by an input pulse from U1. These pulses will have constant amplitudes and durations and only their *repetition rate* will vary in accordance with the IF signal deviation. There are two complementary outputs from U2, designated at Q and $\overline{Q}$ (digital logic terminology for "not-Q"). Each of these opposite outputs is fed to an RC integrator which averages the signals to obtain a "push-pull" audio signal which, in turn, can be fed to the differential inputs of an IC operational amplifier (op-amp). From the output of the operational amplifier the signal is fed to the stereo decoder section.■

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ELECTRONIC TECHNICIAN/DEALER

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COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 4 NEW SETS

GROUP 287

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AIRLINE B/W TV Chassis T3L6-1A, -2A	1649	ZENITH B/W TV Chassis 22GB1	1652

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T3L6-1A, -2A

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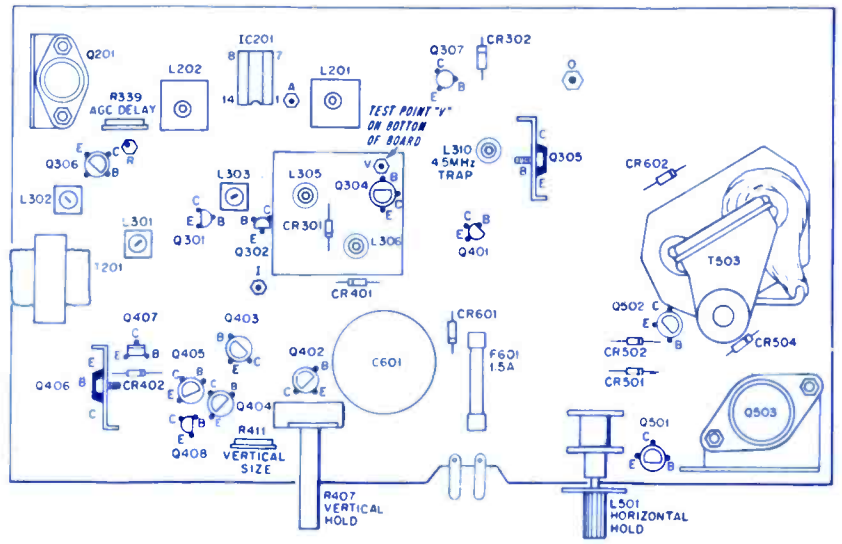

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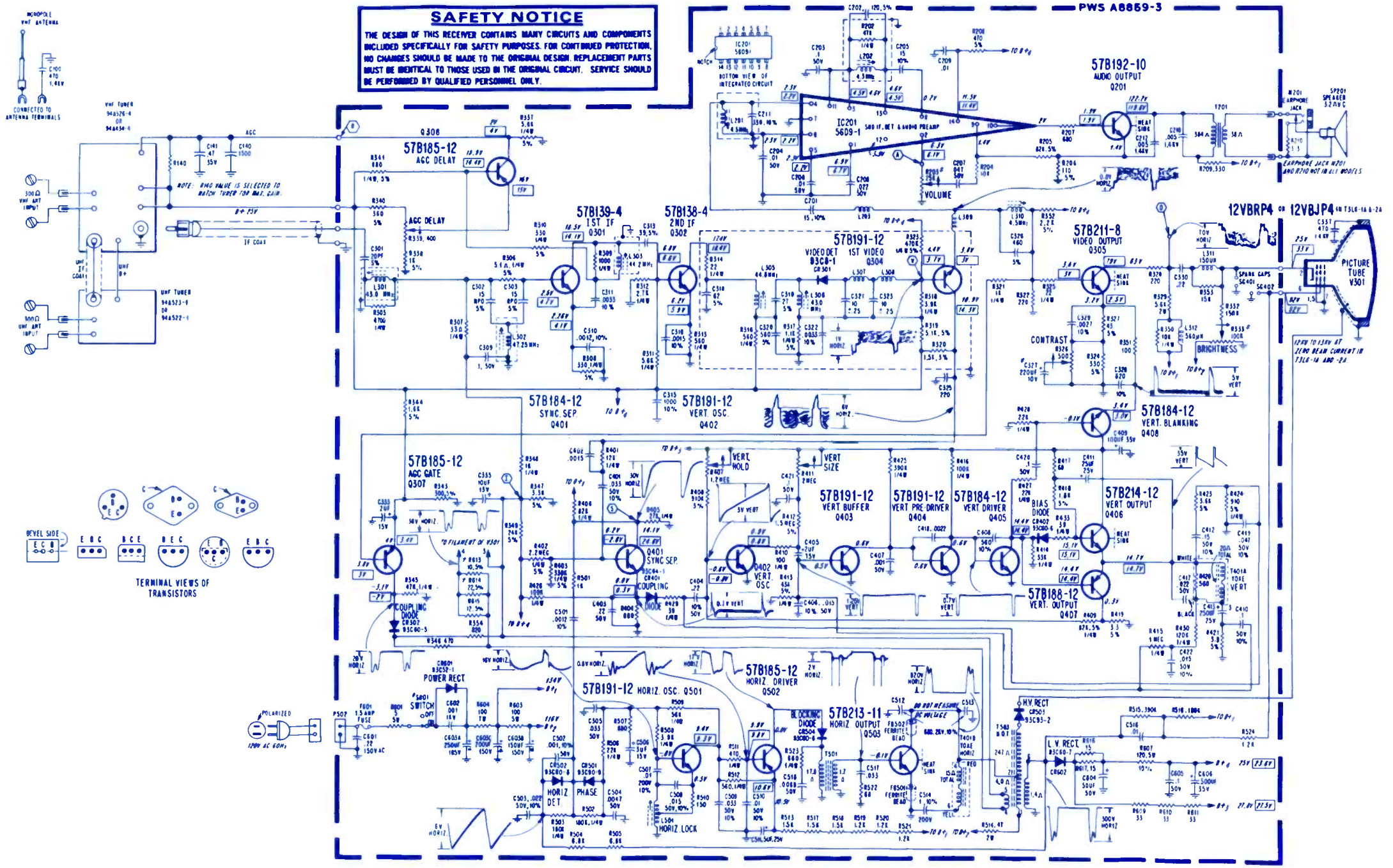

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Color TV Chassis
T46K10

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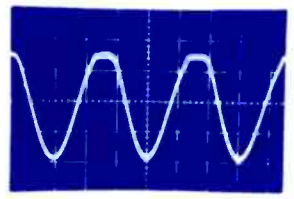
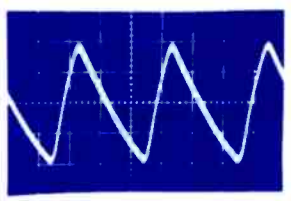
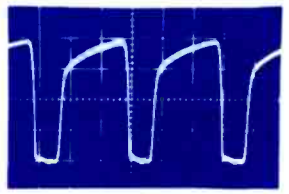


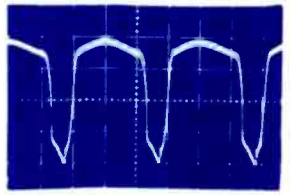
1. Horiz. Osc. V3B, Pin 2, 38V P-P, H



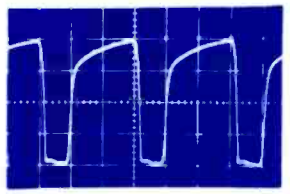
2. Horiz. Osc. Control V3A, Pin 8, 1V P-P, H



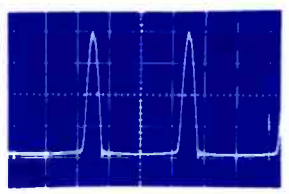
3. Horiz. Osc. V3B, Pin 6, 240V P-P, H



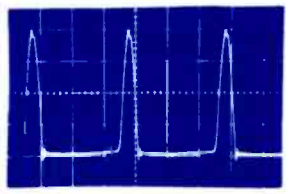
4. Horiz. Osc. V3B, Pin 3, 64V P-P, H



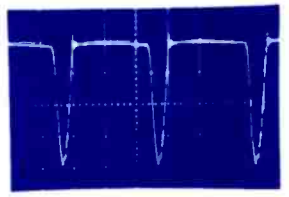
5. Horiz. Output V6, Pin 5, 220V P-P, H



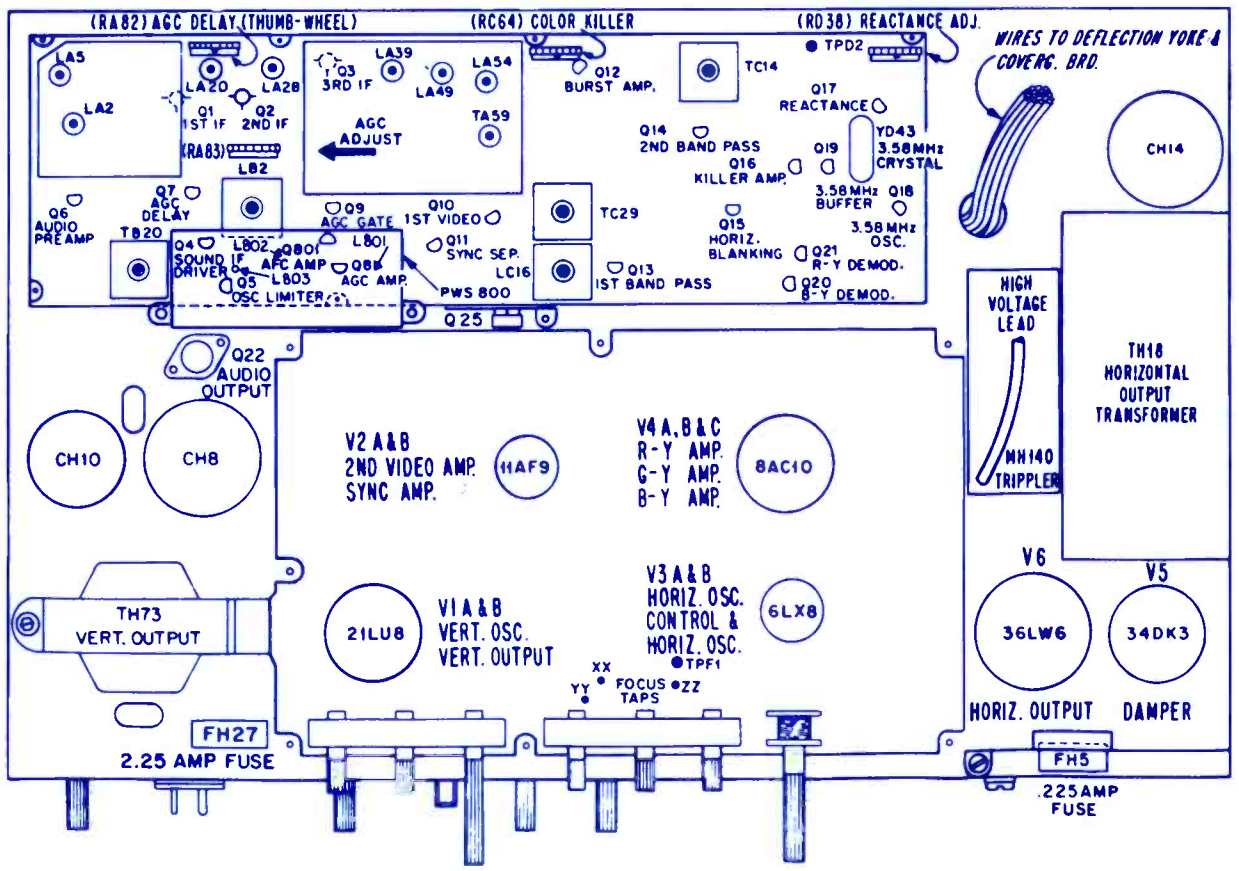
6. Horiz. Output Trans., Pin 27, 290V P-P, H



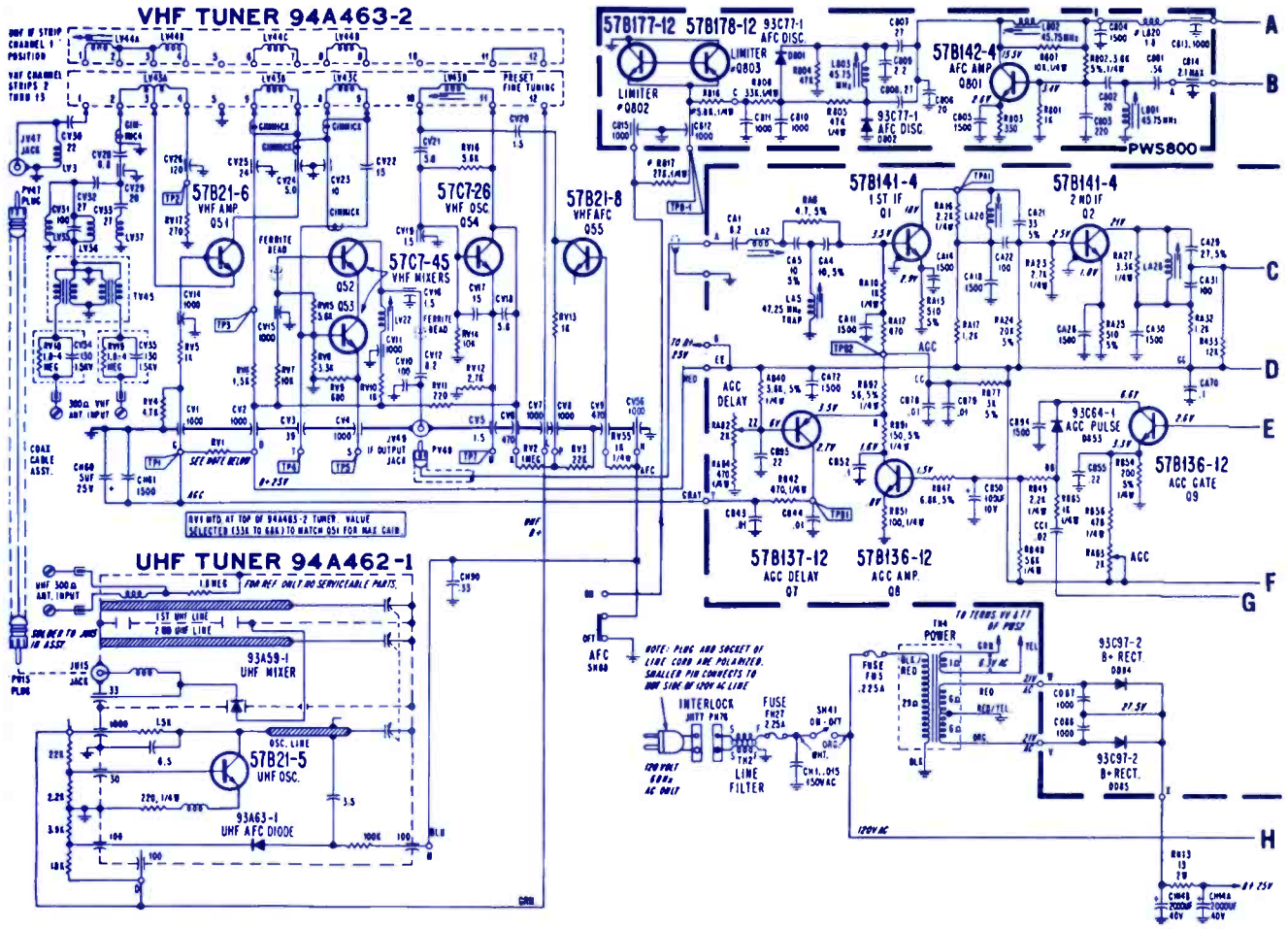
7. Horiz. Output Trans., Pin 2, 32V, H



8. Horiz. Output Trans., Pin 1, 10-15V, H



TOP VIEW OF CHASSIS



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

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

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

TRANSISTOR CAUTION: TO AVOID DAMAGE TO TRANSISTORS, DO NOT OPERATE CHASSIS WITH PICTURE TUBE BAG DISCONNECTED FROM CHASSIS GROUND. DO NOT TURN SET ON WITH TRANSISTOR (S), TUNE (S) OR LEADS REMOVED OR UNSOLDERED. DO NOT ARC 2 KV ANODE LEAD TO CHASSIS GROUND. DISCHARGE 2 KV ANODE ONLY TO PICTURE TUBE BAG OR DAG GROUND. USE CAUTION TO PREVENT ACCIDENTAL SHORT BETWEEN COMPONENT TERMINALS OR TO CHASSIS GROUND. DO NOT APPLY EXCESSIVE HEAT TO TRANSISTOR LEADS. DO NOT USE AN ORDINARY OHMMETER FOR RESISTANCE MEASUREMENT, USE VTVM ON R×100 RANGE OR HIGHER.

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

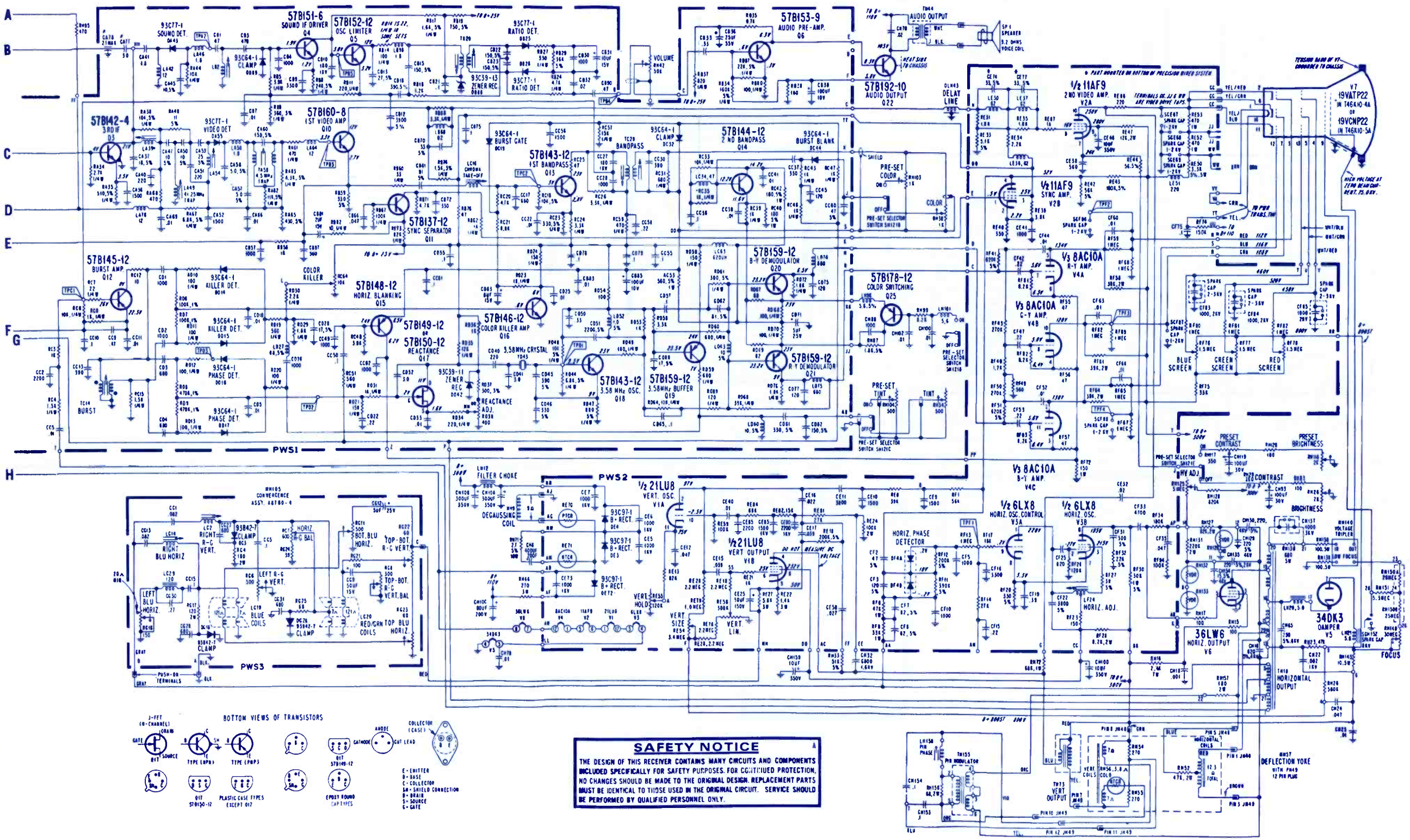
SYMBOLS IN RECTANGLES INDICATE TEST POINT CONNECTIONS.

(!) HEXAGONS INDICATE WAVEFORM OBSERVATION LOCATIONS. CONDITIONS FOR TAKING WAVEFORM MEASUREMENTS ARE GIVEN WITH WAVEFORM PHOTOGRAPHS.

RUN CHANGES:

(10) START OF PRODUCTION

ADMIRAL
Color TV Chassis
T46K10



SAFETY NOTICE

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

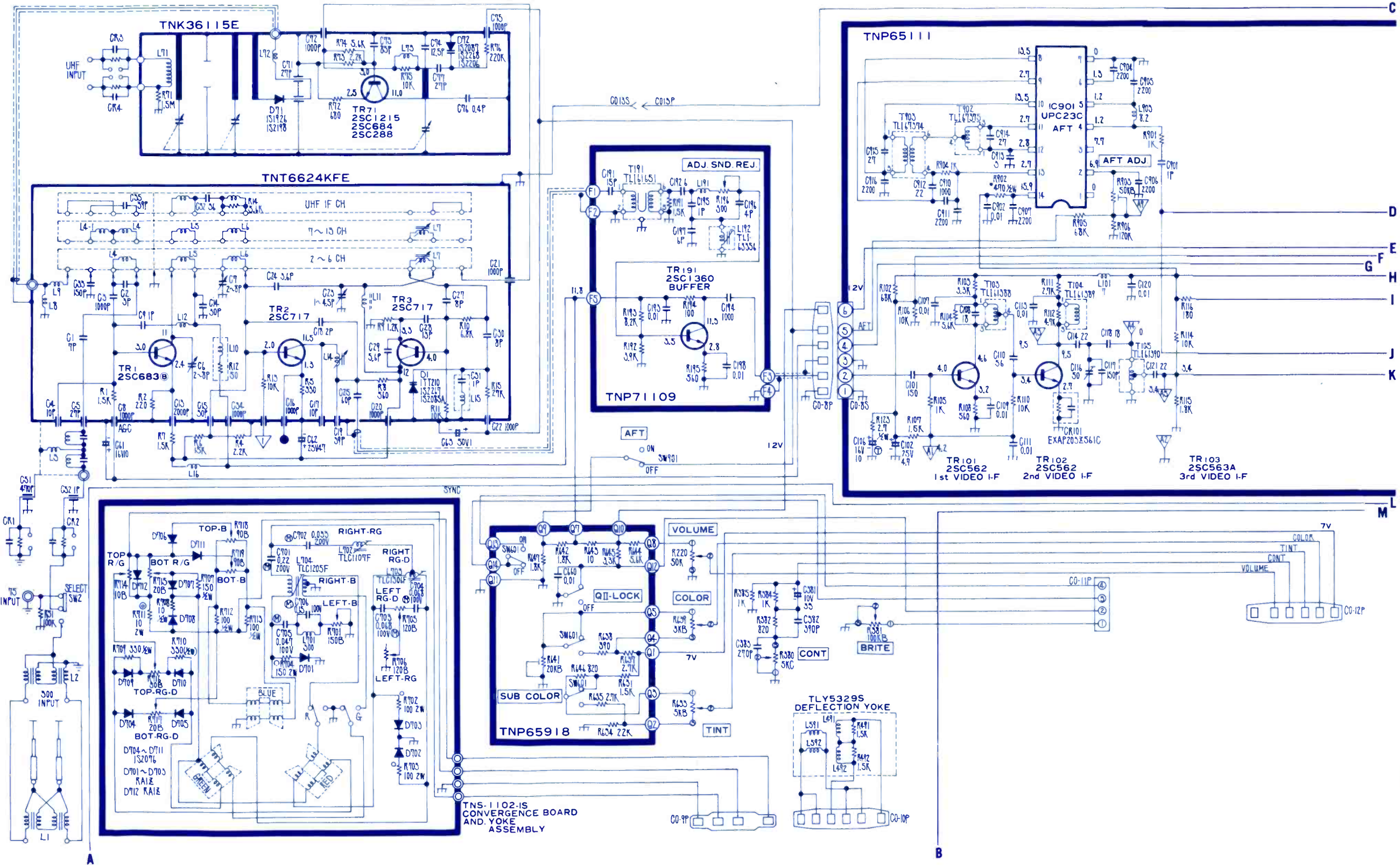
1651

PANASONIC
Color TV Chassis
ETA-12

ELECTRONIC TECHNICIAN/DEALER TEKFAX

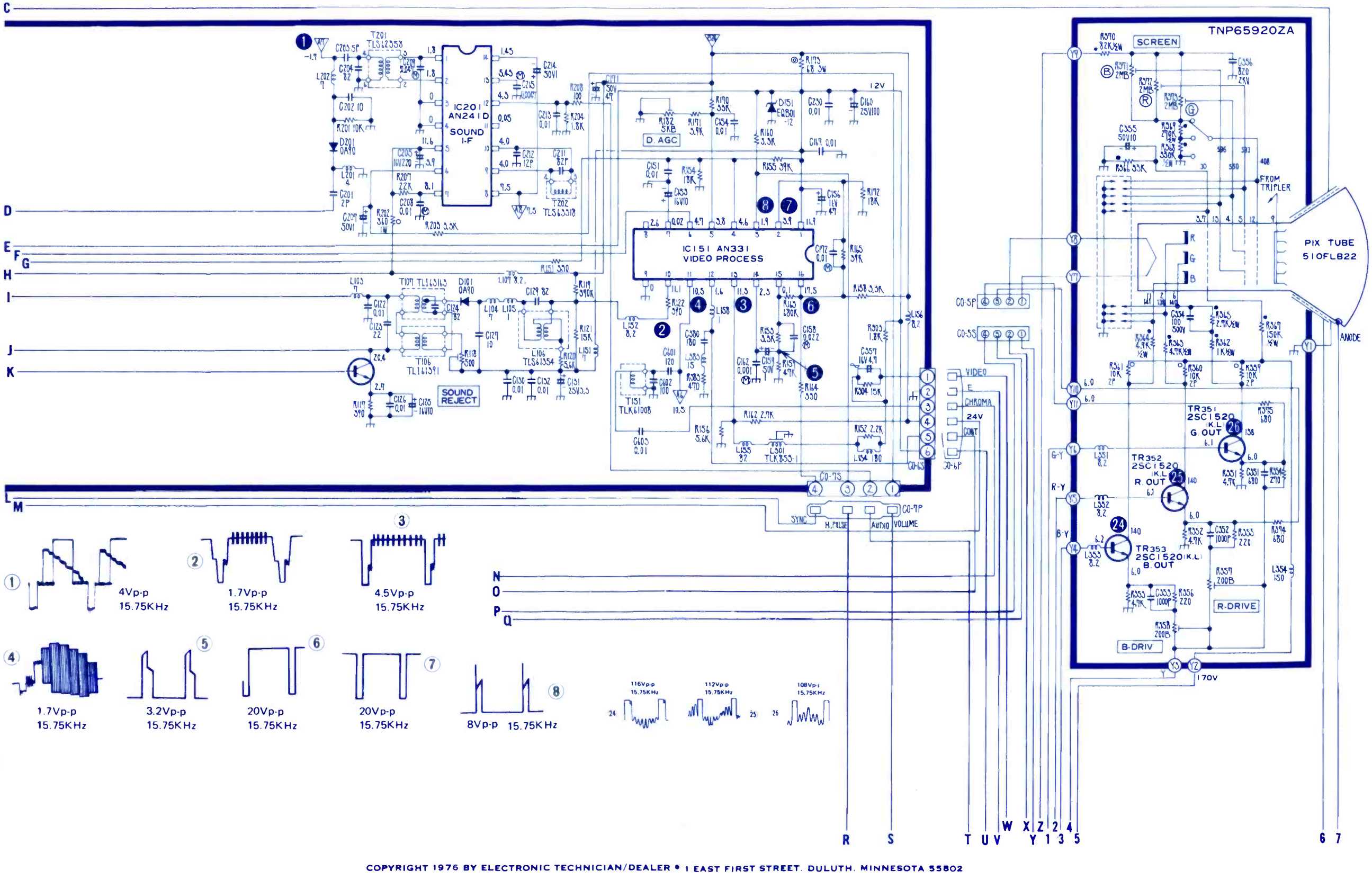
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS
AND TECHNICAL INFORMATION FOR 4 NEW SETS

JULY • 1976



PANASONIC
Color TV Chassis
ETA-12

ADDITIONAL INFORMATION NEXT PAGE



PANASONIC
Color TV Chassis
ETA-12

TNP65316AA

TR451 3SF11 VERT. OSC

TR452 2SC828A(R.S.T) VERT. SWITCHING

TR453 2SC1318 V. DRIVE(P.Q.R.S)

TR454 2SC1448 V. OUT

TR455 2SC1448 V. OUT

TR501 2SA564A (P.Q.R.S.T) PHASE SPLIT

TR502 2SC828A (P.Q.R.S.T) H. OSC

TR503 2SC1446 (P.Q) H. DRIVE

TR504 2SD350 H. OUT

TR505 2SC828(Q.R.S) PULSE AMP.

T501 TLH6302-2

T502 TLH6422

T503(A) TLH6732

T504 TLH6714-2

T505 TLF6511S FBT

L501 5.4MH

L502 EFSM4TW001A

L504 6

L505

L506

L507 TLH6820

L508

L509 TLT 632-10Y

TRIPLER D510 ECX-B1060

D501 0A95

D502 0A95

D503 ERX15D 3K471

D504 FT1M

D505 SB-2C

D506 SB-2C

D507 TD-15

D508 ERB24-06

D509 STB01-02

HEIGHT

V.BAL

SUB.V HOLD

V-HOLD

SUB-LIN

V-LIN

H-HOLD

H.V ADJ

FBT TUNE

FOCUS ADJ

TO CRT FOCUS

24V

B+

HV

ABL

BL

9 0.3Vp-p 60Hz

10 0.4Vp-p 60Hz

11 0.6Vp-p 60Hz

12 1.8Vp-p 60Hz

13 40Vp-p 60Hz

14 2.7Vp-p 15.75KHz

15 13Vp-p 15.75KHz

16 3.5Vp-p 15.75KHz

17 900Vp-p 15.75KHz

T506 (FBT)

T504

T503

T501

T502

T191

M21C

AN331 AN343 AN289

2SC562 2SC563A

AN241D UPC23C

3SF-11

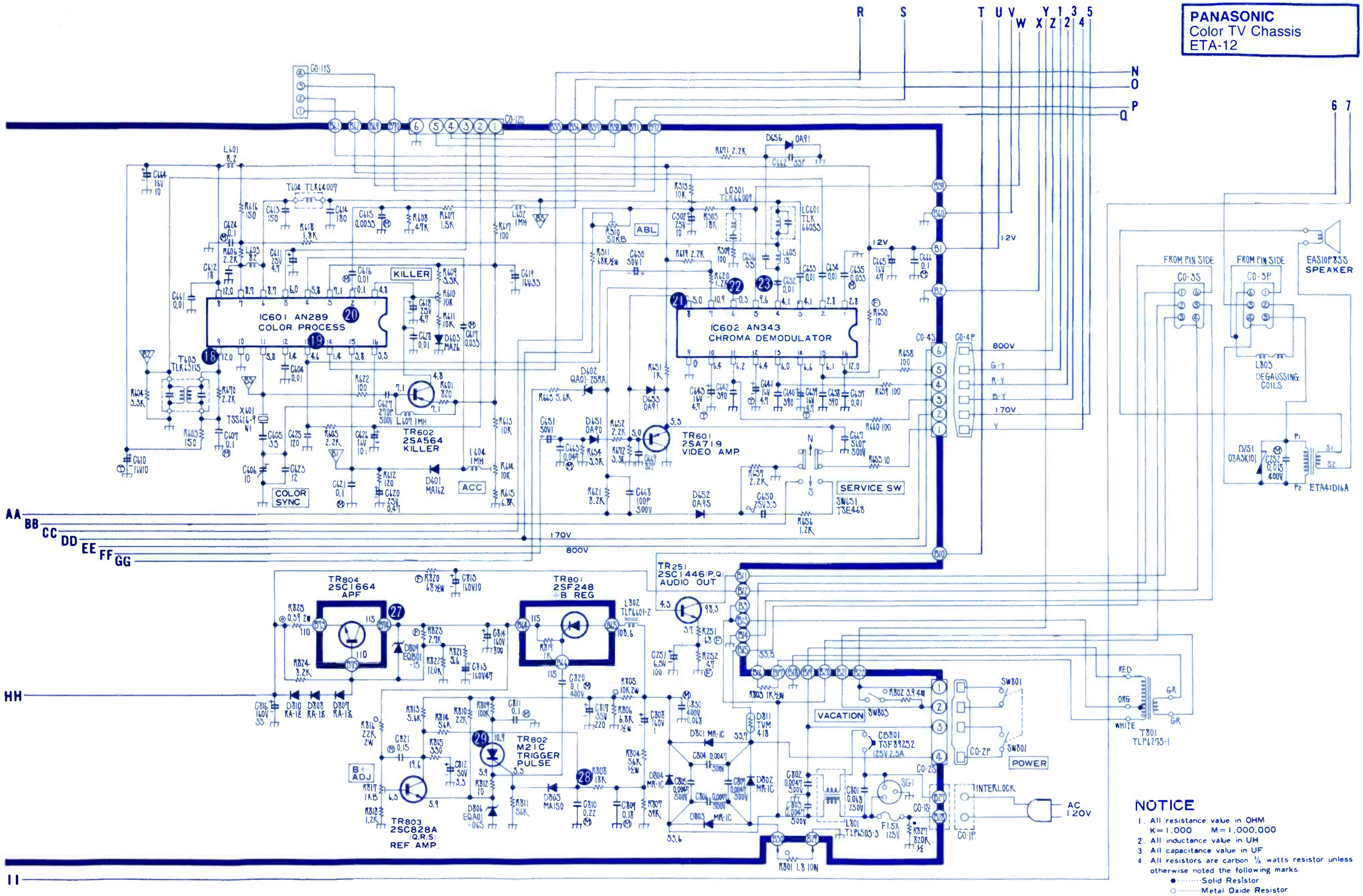
2SC828 2SC828A 2SC1360 2SC1318 2SA719 2SA564 2SA564A

2SD350

2SF248

2SC1446

PANASONIC
Color TV Chassis
ETA-12



18 — 0.4Vp-p 15.75KHz

19 — 0.5Vp-p 15.75KHz

20 — 2.5Vp-p 15.75KHz

21 — 6.5Vp-p 15.75KHz

22 — 5Vp-p 15.75KHz

23 — 2.5Vp-p 15.75KHz

27 — 7Vp-p 60Hz

28 — 2Vp-p 60Hz

29 — 11Vp-p 60Hz

NOTICE

1. All resistance value in OHM
   K=1,000 M=1,000,000
2. All inductance value in UH
3. All capacitance value in UF
4. All resistors are carbon ¼ watts resistor unless otherwise noted the following marks.
   - ●·····Solid Reslstor
   - ○·····Metal Oxide Resistor
   - ◎·····Wire Wound Resistor
   - (F)·····Non Flame Resistor
5. Marks of capacitors
   - (M)·····Polyester Capacitor
   - ○·····Ceramic Capacitor
   - (S)·····Polystyren Capacitor
6. Voltage measurements: Measured by a VTVM when receiving color bar signal.

This schematic diagram is the latest at the time of printing and subject to change without notice.

1652

ZENITH
B/W TV Chassis
22GB1

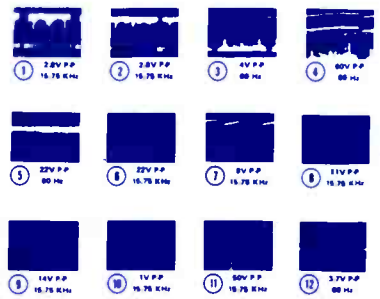
ELECTRONIC TECHNICIAN/DEALER **TEKFAX**

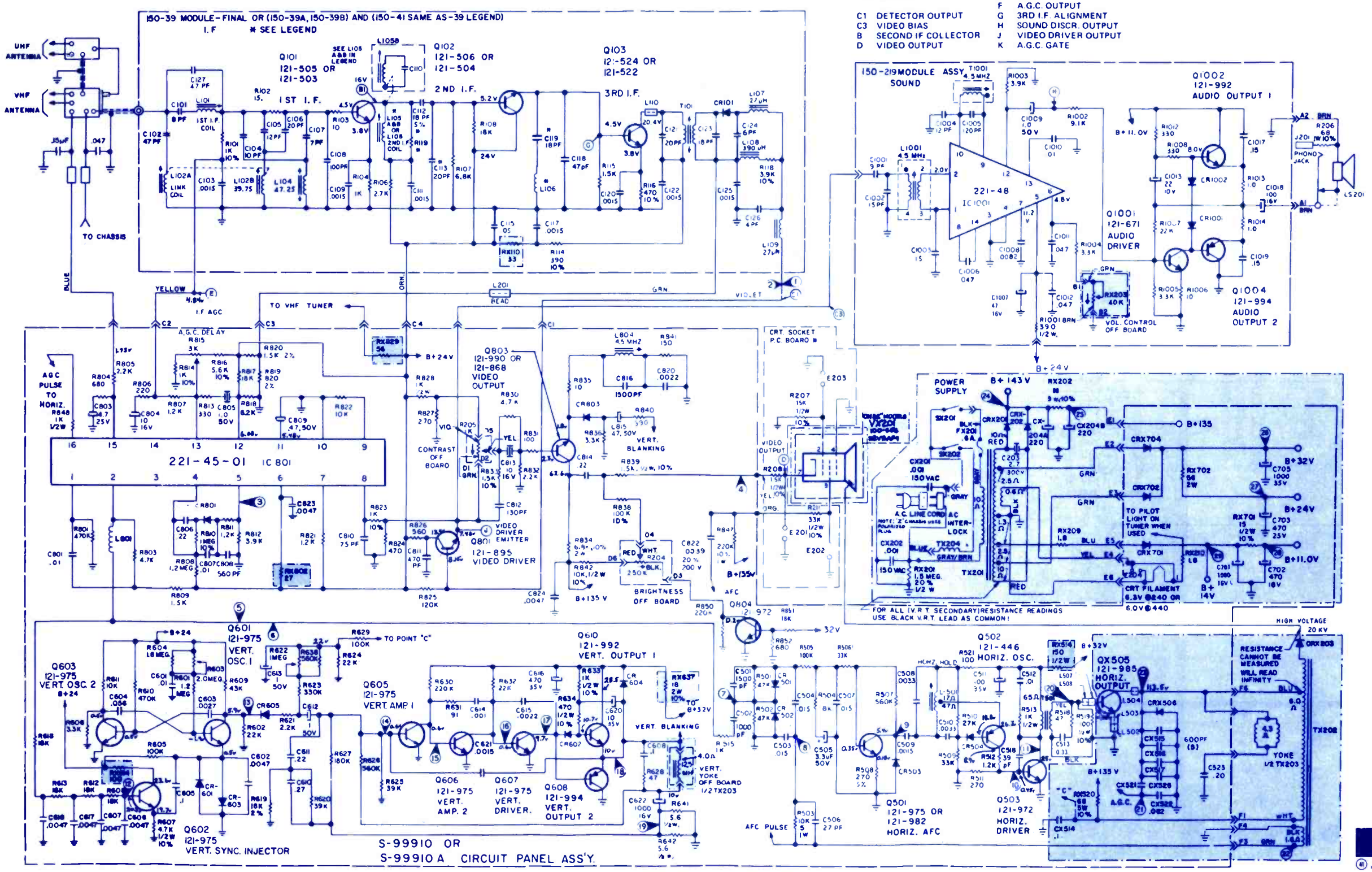
JULY • 1976

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 4 NEW SETS

IMPORTANT SAFETY NOTICE

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





TEST POINTS

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

Riley really rallied to our "rally 'round the tab."

Our 1976 "rally 'round the tab" award program is under way, and a lot of dealers and technicians are already collecting awards ranging from coffeemakers to camping gear.

You can start collecting, too. All you have to do is tear off the tab—the end flap of Sylvania receiving tube boxes with the Waltham, Third Ave. or Broadway address on it.

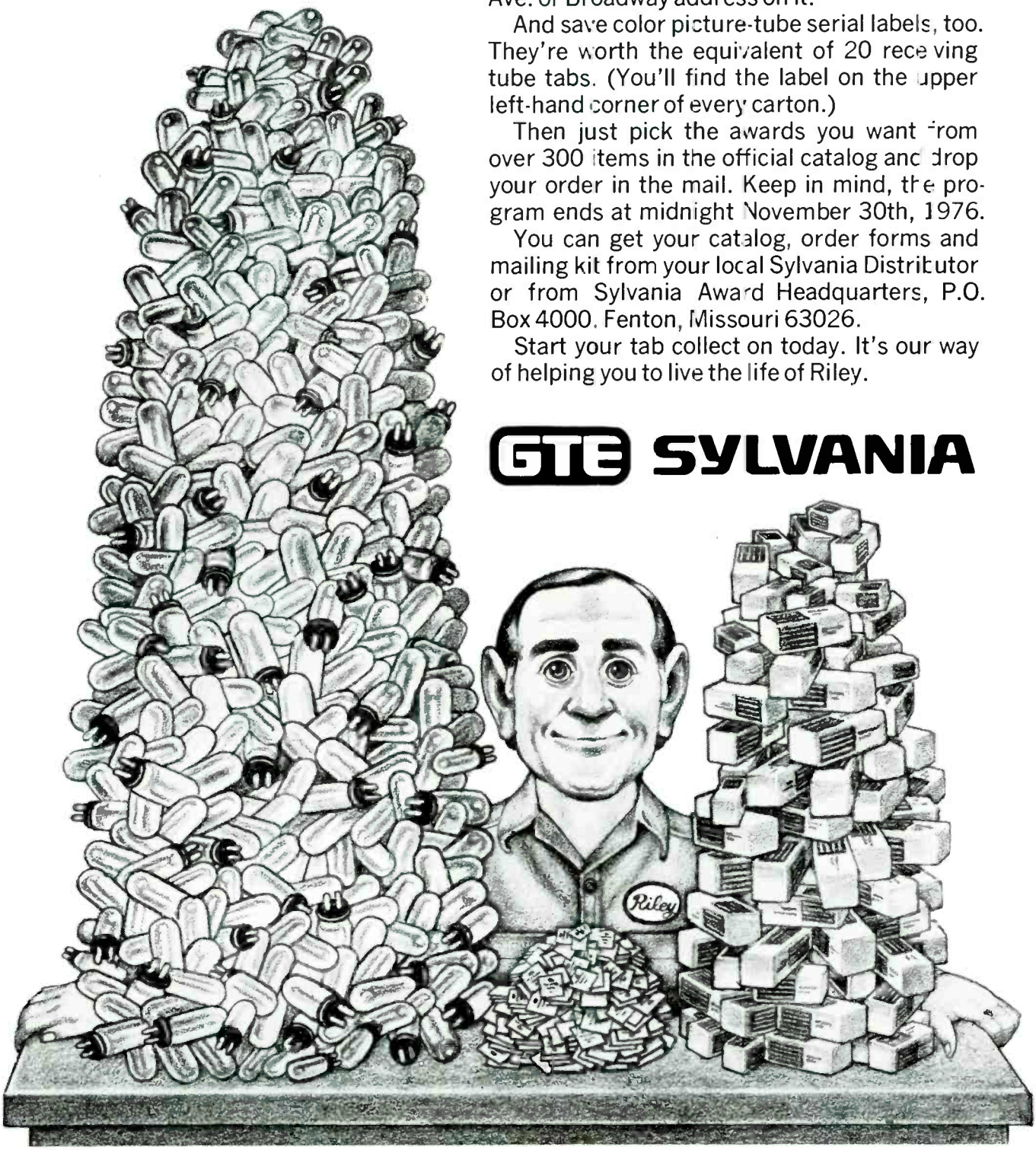
And save color picture-tube serial labels, too. They're worth the equivalent of 20 receiving tube tabs. (You'll find the label on the upper left-hand corner of every carton.)

Then just pick the awards you want from over 300 items in the official catalog and drop your order in the mail. Keep in mind, the program ends at midnight November 30th, 1976.

You can get your catalog, order forms and mailing kit from your local Sylvania Distributor or from Sylvania Award Headquarters, P.O. Box 4000, Fenton, Missouri 63026.

Start your tab collect on today. It's our way of helping you to live the life of Riley.

GTE SYLVANIA



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