

SEPTEMBER 1977 • 75 CENTS

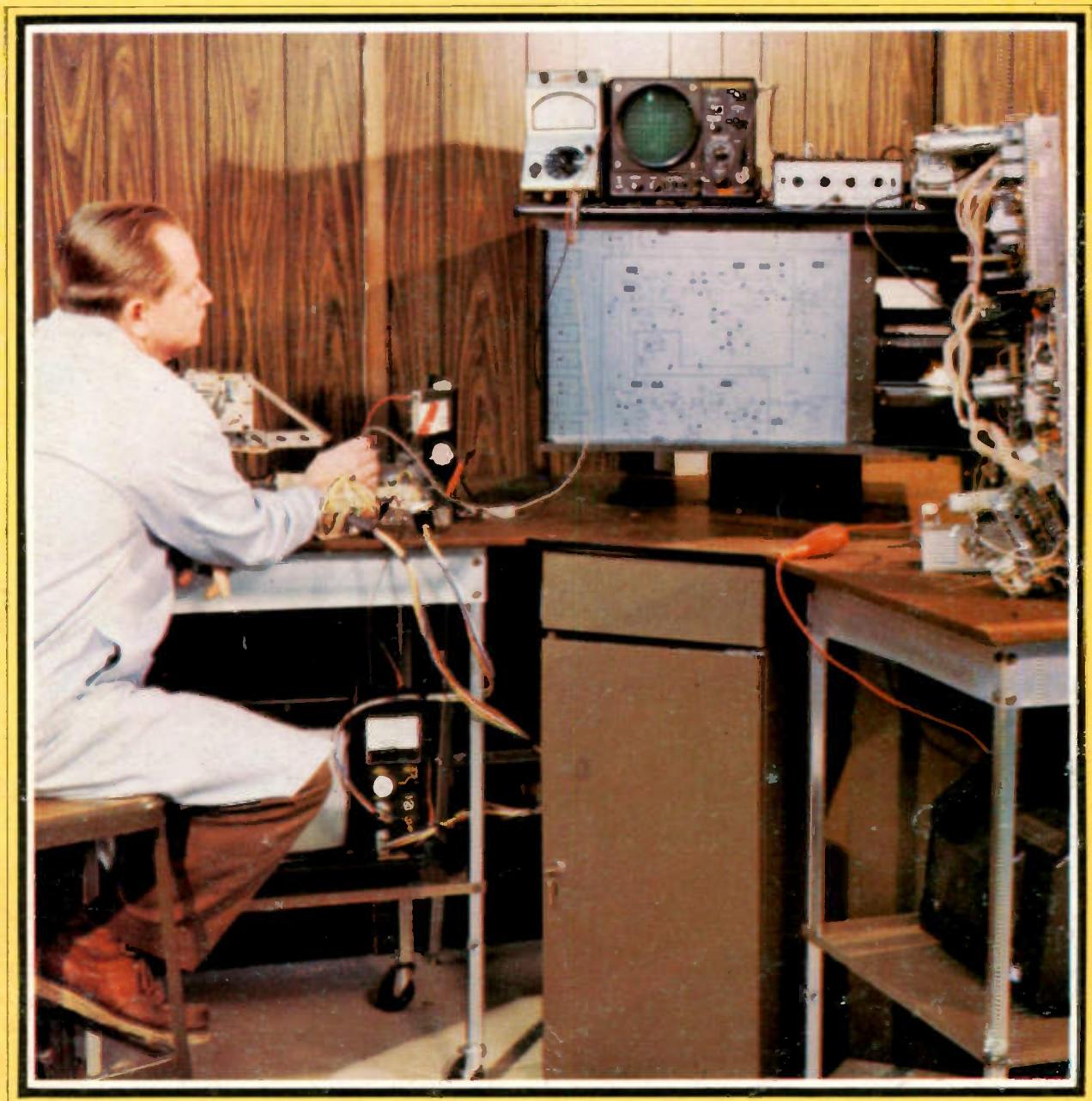


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ELECTRONIC TECHNICIAN/DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

Television '78: Fewer new chassis on line



Service bench setup

Timesaving ideas for you

GE "Infrared" Remote

Goodbye to false triggering?

Phase Lock Loops

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NEWS OF THE INDUSTRY

ET/D Announces Editorial Changes; Hagelin Named General Manager



David J. Hagelin



Richard W. Lay

Electronic Technician/Dealer, a Harcourt Brace Jovanovich publication, has announced new editorial and executive assignments. In addition to maintaining editorial and production facilities in Duluth, Minn., where the magazine has been headquartered, an editorial office also has been opened in Chicago.

David J. Hagelin, formerly Midwest District Manager, has been appointed Associate Publisher and General Manager of the magazine, which serves the home entertainment sales and service industry. Hagelin will continue to be based in Chicago.

According to Publisher Alfred A. Menegus, the Chicago office will be headquarters for newly appointed Editor Richard W. Lay. Lay, who has a technical trade school knowledge of modern electronics, has 10 years experience in trade journals, writing and news gathering. In addition, Menegus said, ET/D will continue to maintain editorial facilities in Duluth under the supervision of Managing Editor Don W. Mason.

Creation of the Chicago editorial office will allow ET/D to upgrade its coverage of the rapidly changing home entertainment electronics industry, Menegus said, in addition to providing closer liaison with major industry sources.

Zenith Suit Goes to Supreme Court

Zenith's battle against low priced Japanese television imports is now in the hands of the U.S. Supreme Court following a federal appeals court's refusal to support the manufacturer's demands for special import duties. At issue are certain taxes which the Japanese government "rebates" to Japanese manufacturers of home entertainment products which are not for use in Japan, but for export only. Zenith had won an earlier Customs Court decision in New York which would have forced the U.S. Treasury Dept. to issue penalty duties, in addition to regular tariffs, against the Japanese to compensate for the alleged imbalance in costs. However, the Carter administration, obviously fearing retaliatory action in a sensitive case that could have far reaching implications in other areas of international trade as well, successfully appealed the ruling in favor of Zenith.

Zenith's First Half Results are Down

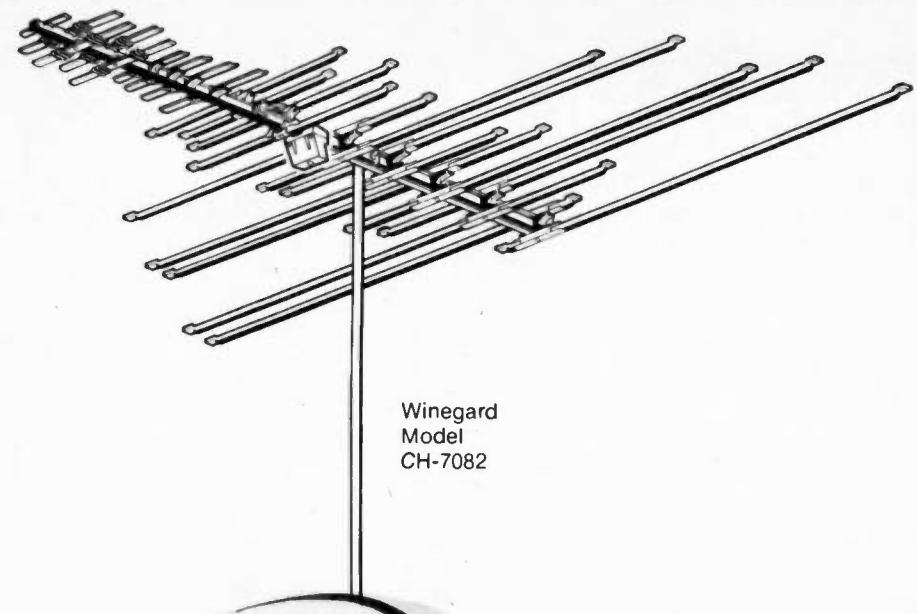
Meanwhile, Zenith released the results of its first half operations which showed per share earnings down 11 per cent from 1976 figures and due, according to Board Chairman John J. Nevin, to "Zenith's continued inability, because of competitive pressure from low priced imports, to recover normal increases in payroll and material costs..." Zenith reported that while sales were up \$33 million for the first six months of this year, pretax profits were \$3.4 million less than for the comparable period a year earlier. Nevin said payroll and materials costs increases of \$16 million for the first half were offset largely by improvement in the sales of color television sets and manufacturing efficiencies totaling \$23 million during the first half but prices were down.

RCA Posts Record Quarter

RCA's earnings for the second quarter of 1977 set a record of 92 cents per share with the foreign production of color television picture tubes playing a major role. Edgar H. Griffiths, president and chief executive officer, said RCA's earnings of \$118.6 million was

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more than full year earnings for either of 1974 or 1975. First half results were \$1.55 a share on record sales of \$2.8 billion. "The quarter's performance reflected profit improvement in six of the company's seven basic reporting segments: Consumer Electronics Products; Commercial Electronics Products and Services, Broadcasting; Vehicle Renting and Leasing; Government Business, and other Products and services," RCA said. Additionally in the first half, earnings from RCA's international operations grew faster than domestic activities with color TV tubes and car rentals leading the way. Domestically, however, RCA shipped more color televisions to dealers than in any comparable period.

PC-78 Merged with Winter CES

Bowing to pressure from numerous sources PC (Personal Communications)-78 has been merged with the Winter CES show after just two years out on its own. Despite opposition from some CB firms who wanted to retain a separate industry identity, EIA execs who negotiated the merger said the decision recognized the industry's concern with the proliferation of trade shows. PC-78 had been scheduled for just five weeks after the Winter CES. This year's Winter CES, scheduled for Jan. 5-8 in Las Vegas, will feature a special area to showcase the new CB radio and other personal communications equipment and the CB radio conference will be sponsored and produced by the EIA Citizens Radio Section, previous sponsors of PC-shows. EIA's Consumer Electronics Group, which sponsors CES, reports unusually enthusiastic support for the winter meeting, previously held in Chicago.

REPCON Widens Format

REPCON-77, previously a manufacturer's showcase for commercial sound equipment, has radically

changed its format for this year, according to a spokesman for the sponsoring Electronic Representatives Association, now calling itself a "miniature" NEWCOM, REPCON-77—scheduled for Sept. 26 and 27 in New York—will encompass the entire field of electronic products. According to show representatives, communications outlets, dealers, buyers and technicians, as well as home entertainment specialists, sound contractors, and audio visual people, will find the 1977 show of interest.

TV-Radio Sales Up for First Six Months

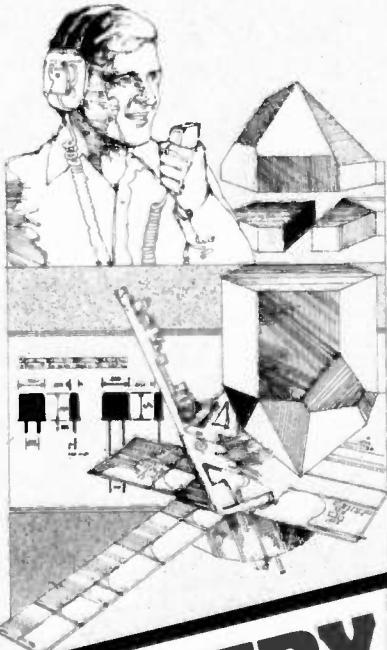
Both television and radio sales for the first six months of 1977 showed substantial improvement over the first six months a year ago, Electronic's Industry Association figures show. For the first 26 weeks, total television sales were up 15.9 per cent from the 5.44 million units sold a year ago. Color television sales boomed by over 21 per cent and totaled 3.88 million units. The total radio market—including AM, exclusive FM, AM/FM and auto, escalated by 31 per cent (from 16.47 to 21.57 million units) over figures from a year earlier.

Final Notes...

A recently released study commissioned by *U.S. News & World Report* says almost half of the people who purchase color television now do so to replace a set no longer working. The special report concluded that 19 per cent of color TV buyers are "first timers;" 32 per cent purchase to add a second color set to their home; but 46 per cent buy to replace an old set;...3M company has announced plans to make and sell a "Scotch" brand VHS-compatible videocassette. Market dates were not announced but the company said the many recent announcements of companies committing to "the home VTR market make the home video revolution a reality." ■

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THE COVER: A sign of the changing times in the electronic service industry is the growing effort to increase efficiency and productivity in the service area. Our cover photo of the new GTE Sylvania Electronic Work Station is a symbol of the industry's effort to improve productivity at the service bench. See our Service Bench article on page 32.

14 Outlook '78

Electronic Technician/Dealer's latest annual survey of the newest in TV receiver design for model year 1978 finds less than the usual number of new chassis. But don't go away, because a deeper look reveals the industry girding for a major plunge into the TV "add on" accessories market, especially with the Fall introduction of more home VTRs. By Richard W. Lay

25 Phased Locked Loops

This popular functional circuitry is found in numerous applications in home entertainment, two-way and CB electronics. In his article Mr. Carr discusses some PLL uses in FM demodulation and as frequency synthesizers for CB channel generation. By Joseph J. Carr, CET

32 Service Bench Setup

The squeeze is on throughout the service industry for greater productivity through faster service and lower overhead. Learn how your service bench can be a key to improved profits as we show the latest on time-saving approaches to service bench setup. By Don W. Mason

38 GE Television, 1978 Part I

Electronic Technician/Dealer takes a closer look at GE's new all solid state portable television chassis for the coming year. We also show you the innovative "infrared" remote transmitter used with the advanced electronic tuning system, how it operates and, some basic troubleshooting hints. By Don W. Mason

DEPARTMENTS

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How many things can you find on this page that start with Sylvania tabs?

You won't have to look very hard. Almost everything you see can come from saving address tabs from Sylvania receiving tube cartons and labels from picture tubes.

The new "Keep Tabs on Sylvania" awards program is now under way, and this year it's even easier to build up a high score. You get a bonus of 50 extra tabs for each Color Bright 85° picture-tube serial number label and 10 extra tabs for every label from other Sylvania color tubes. Pick up your Award Catalog and special tab-saver envelope at your local Sylvania distributor and start collecting your tabs, now.

Put your tabs and award order form in the mail by Nov. 30, 1977 and you'll be able to find a lot of the things in the picture right in your own backyard.



GTE SYLVANIA



TECHNICAL LITERATURE

Exact Replacement Products For CB and TV Equipment are cross-referenced in a new replacement guide from Thordarson-Meissner, Inc. The guide lists 44 flame-retardant flybacks and 14 yokes for the TV replacement market, of which 7 yokes and 19 flybacks are designed for imported TV sets. Also included is information on CB replacement parts, including 19 chokes, 16 driver transformers and 34 output/modulation transformers. The cross reference guides—for TV, TVPG 9, and for CB, CBRG 2—are available free from Thordarson distributors.

Japanese Replacement Parts, for CB radio, TV, and hi-fi equipment are covered in a new 8-page illustrated catalog from Ora Electronics. Featured parts include: integrated circuits, transistors, ceramic filters, and tape and cassette heads. Also included in "Understanding Japanese Semiconductors," a purchasing guide for Japanese parts. Free from Ora Electronics, P.O. Box 7548, Van Nuys, CA 91409.

Replacement Components And Installation Aids For CB are described and illustrated in the latest catalog from Sprague Products Co. Designated the K-1200A, the new guide not only contains CB component replacement information on capacitors, semiconductors, and resistors, but also includes a section devoted to radio interference filters and CB radio installation aids as well. The guide includes a 26-page semiconductor cross reference section listing CB replacements both alpha-numerically by original equipment part number and alphabetically by manufacturer. Available free from *Sprague Products Co.*, 509 Marshall St., North Adams, Massachusetts, 01247.

Two Test Instrument Catalogs are now available from Leader Instruments. The first is their full-line catalog of oscilloscopes, vectorscopes, multimeters, color bar and pattern generators, DVM's, millivolt meters, signal generators, wattmeters, sweep/marker generators and accessories. Photographs, specifications and prices are included. The second catalog is a descriptive, illustrated listing of the test instruments included in the Leader Communication Instruments Performance Test Center. Included are antenna couplers,

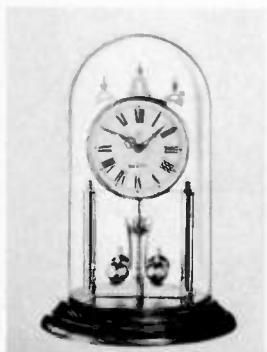
and SWR wattmeter, and RF power meter, dip meter, antenna impedance meter, a CB harmonic meter and 3 inch oscilloscope. Both catalogs are available free to the industry from *Leader Instrument Corp.*, 151 Dupont Street, Plainview, N.Y. 11803.

Hundreds of Terminals, Splices and Disconnects are covered in the latest 60-page color catalog from ITT Cannon Electric. The catalog covers such registered trademark products as Krimptite, Versakrimp, Inslkrimp, Vibrakrimp, Avikrimp and Nylakrimp that are color-coded, annealed and plated and funneled for speed. In addition to 34 photographs, this catalog has dozens of drawings, charts and graphs and includes specifications for high temperature applications up to 1200°F. Available free from ETC Terminal Products Unit, *ITT Cannon Electric*, 29000 Aurora Road, Solon, Ohio 44139.

AC and DC Linear Solenoids used in commercial and consumer appliances, electronic games, and office machinery are described in a new 16-page treatise from Dormeyer Industries, Inc. The guide, which is called "Solenoids...What They Are, How To Use Them," covers the essentials of linear solenoid construction and oper-



Redi-Chec '77 Awards



ation, standard types and typical usage, plus the effects of duty cycles and ambient temperature considerations. A handy reference chart relating the causes and conditions to electrical or mechanical solenoid damage is also included. Free from *Dormeyer Industries, Inc.*, Dept. PR, 3418 Milwaukee Avenue, Chicago, Illinois 60641.

Professional Tape Components are detailed in a new, illustrated brochure from Telex Communications, Inc. Complete product specifications, descriptions and ordering information is included for the firm's products, such as heavy duty open reel tape transports, tape cartridge transports, endless loop NAB type magnetic tape cartridges, plus record/play, playback and power amplifiers for single and multichannel systems. Available free from Professional Audio Dept., *Telex Communications, Inc.*, 9600 Aldrich Avenue South, Minneapolis, Minnesota 55420.

Test Instruments By Mail Order are outlined, listed, illustrated and priced in the latest catalog from Tucker Electronics. The 16-page catalog lists select reconditioned Hewlett-Packard, Tektronix and General Radio instruments and systems. Instruments included are: oscilloscope

main frames and plug-ins, signal generators, wave analyzers, recorders, meters, spectrum analyzers, and frequency counters. The catalog is free from *Tucker Electronics Co.*, P.O. Box 401060, Garland, Texas 75040.

Solid-state Devices For Power-Circuit Applications are featured in a new 48-page brochure from RCA. The new publication is intended as a guide to designers in the selection of the optimum RCA solid-state devices for power-circuit applications. The new brochure, *Power Options From The Powerhouse—2M1169*, offers a broad range of options for power transistors, triacs, and silicon controlled rectifiers (SCR's) for a wide variety of power circuits. The brochure is free from *RCA Solid State Division*, Box 3200, Somerville, N.J. 08876.

High Frequency, Single Sideband Marine Communications are explored in a new handbook produced by Modar Electronics. The new publication provides pleasure boaters and commercial users with a basic understanding of HF-SSB and the firm's line of Triton SSB marine radio, and describes the long distance coverage in the 1.6 to 18 MHz range available HF-SSB radios. Available free from Barbara Bennett, *Motorola Literature*

Distribution Center, 1301 E. Algonquin Road, Schaumburg, IL 60196.

A New CB Accessories Catalog has been published by GC Electronics. The 24-page catalog describes nearly 200 products, including microphones, connectors, audio system accessories, antennas and exact replacement parts, auto alarms, mounts, cables, interference suppressors, maintenance items and performance indicators. The catalog is well-illustrated and features a full-color cover. Individual items are easy to locate in the catalog. All accessories are approved for 23 or 40 channel CB. It's available free from *GC Electronics*, 400 South Wyman, Rockford, Illinois 61101.

"**Wavemakers**" is the topic of a new catalog available now from Krohn-Hite Corporation. The new short-form catalog describes the firm's line of phasemeters, oscillators, function generators, programmable sources, amplifiers and filters. Two new instruments covered in the catalog are: the Model 6200 10Hz to 1MHz digital phasemeter, and the Model 7500 75 watt wideband amplifier. The catalog is free from the *Krohn-Hite Corporation*, Avon Industrial Park, Bodwell St., Avon, Mass. 02322.

continued on page 11



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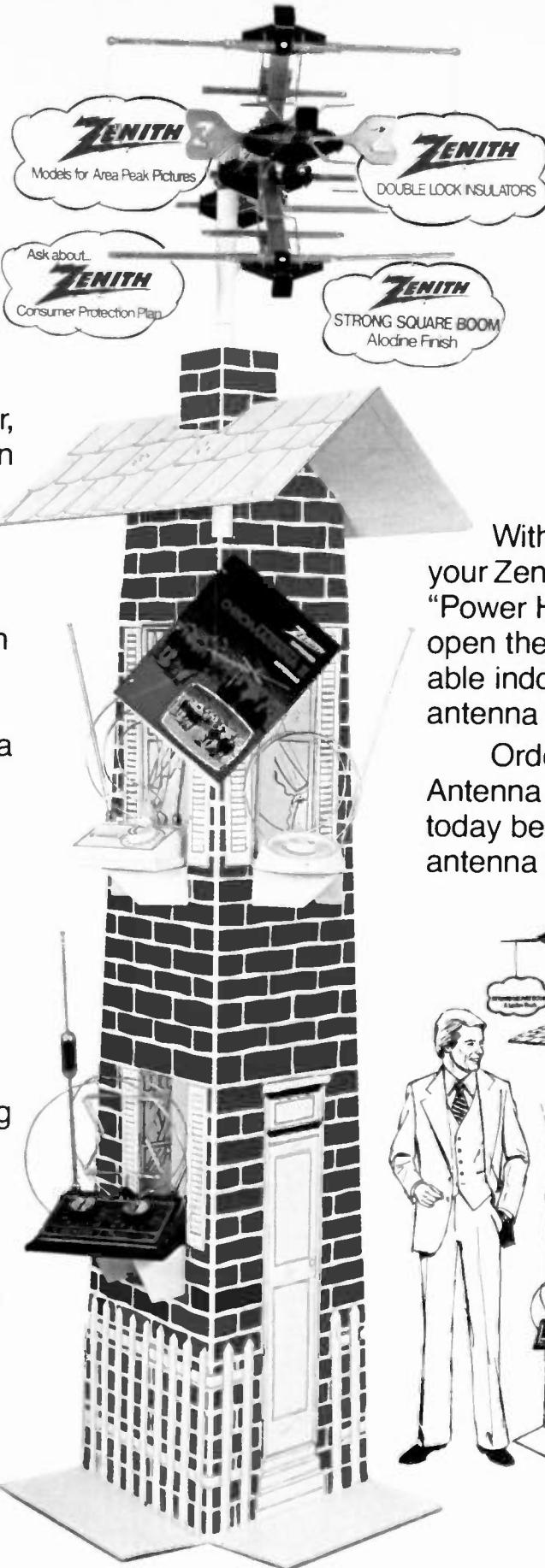
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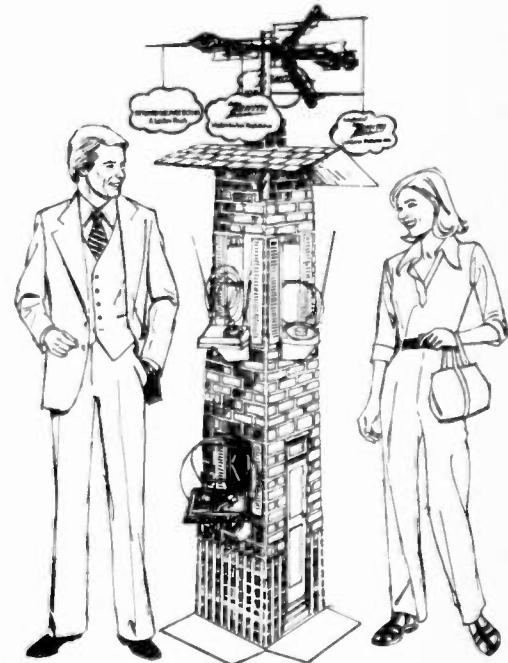
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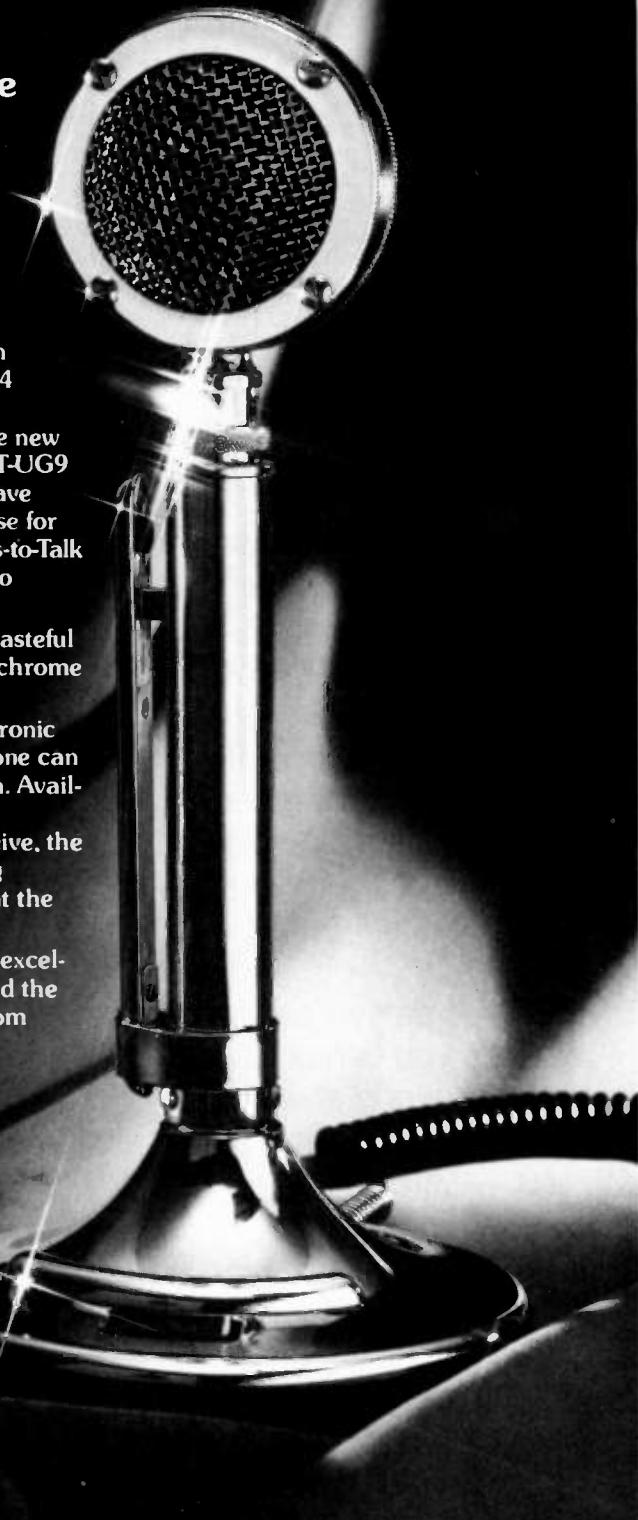
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TECH. LITERATURE

continued from page 7

Audio Accessories And Electronic Parts are fully covered in the September 1977 catalog, now available to dealers, from Qualitone Industries, Inc. The new catalog contains one of the most complete listings of replacement phono needles available, plus every conceivable audio accessory, test equipment and electronic part in a simple follow-up system. The catalog, available only to dealers, clearly describes each item and includes wholesale prices. Available free when requested on business stationery, from Qualitone Industries, Inc., 17 Columbus Avenue, Tuckahoe, New York 10707.

Test Instrument Brochures, describing five new product lines, are now available from Sencore, Incorporated. A total of twenty-five Sencore instruments are grouped into five product lines: Digital Multimeters, Communications and CB instruments, Oscilloscopes, Transistor and Tube Testers, and TV and Radio test equipment. Large, detailed photos, product benefits, uses and applications, and complete specifications are included for each product. Available free from *Sencore, Incorporated*, 3200 Sencore Drive, Sioux Falls, South Dakota 57107.

Wire-wrapping Tools and Equipment are featured in the latest flyer from O.K. Machine and Tool Corporation. The products covered include: manual and battery powered wire-wrapping tools as well as pre-cut and stripped wire, wire rolls, DIP sockets and wire wrapping 'kits' designed for the individual enthusiast, serviceman, and lab technician. The battery powered tools use "C" size NiCad batteries and weighs only 11 ounces. The 12-page flyer is available free from *O.K. Machine and Tool Corporation*, 3455 Conner St., Bronx, New York 10475.

More than 8,000 Electronic Components, available from Mallory Company, are listed in their latest general catalog. The 80-page catalog presents illustrations and ordering information for Mallory and complementary lines of capacitors, controls, switches, semiconductors and other electronic parts, as well as audible signal devices, security products, cassette recording tape and product merchandisers. The catalog is free from James Shaw, Advertising Manager, *Mallory Distributor Products Co.*, P.O. Box 1284, Indianapolis, Indiana 46206.

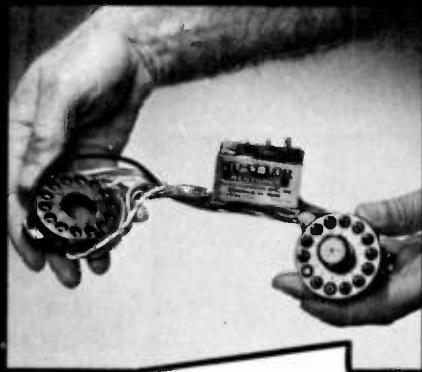
JACK DARR, Service Editor of

Radio-Electronics®

reports on the



NU-COLOR PICTURE TUBE RESTORER



Oneida Model 90A Picture Tube Restorer

ALL THINGS COME TO HIM WHO WAITS. I HAD TO wait for quite a while, but I finally found just the thing I needed: A new device, made by Oneida Electronic Manufacturing Company. This is their model 90A Nu-Color picture tube restorer. This device is designed to restore color to old picture tubes with one or more weak guns.

I had a trade-in Wards TV, with a picture tube so bad it had to be seen to be believed. The blue gun read almost normal emission; the green gun would come up to the bottom end of the BAD sector on the meter; and the red gun just barely wiggled the needle.

The Nu-Color model 90A is a plug-in device that is inserted between the picture tube and socket, like a brightener. However, it is not a brightener, at least in the usual sense of the word. Between its plug and socket is a little box with three color-coded slide controls, one for each color.

Starting with all controls at the OFF position, I plugged the Nu-Color in and turned the set on. As expected, the raster was a bright blue. I adjusted the controls of the Nu-Color and came up with a good-looking color-bar pattern. Twiddling the grey scale and the Nu-Color controls gave an excellent color picture. Reds saturated normally, with the color control all the way up and all other things looked very good! This device lives up to its claims and its name; it certainly did "restore the color" to this old dog.

As Oneida is careful to explain, the Nu-Color is not intended as a "cure-all" for color troubles, but it will help correct problems due to unbalanced picture-tube emission. The device can be installed and adjusted in the home with very little trouble.

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lives up
to its
claims
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FROM THE EDITOR'S DESK

ET/D and you



These are dynamic times in home entertainment electronics. Times of rapid communications, times of rapid technological change and, most importantly, times of opportunity for those able and willing to associate with these developments.

It is within this framework and atmosphere that I have assumed the editorial direction of *Electronic Technician/Dealer*, the trade magazine directed specifically at you, the independent electronic technicians and service shop owners.

All of us who are familiar with home entertainment electronics are aware of the many issues facing the industry in general and, the independent service technician in particular. We see daily the results of the fierce competition among manufacturers battling to increase market shares, especially in the television, stereo and CB fields. Each year new frills and refinements—electronic tuning, new color and tint control circuits, digital screen displays—are added to new and revised models.

Each innovation, each new product, places another demand on the service technician's required list of skills. So how does one cope with the seemingly endless march of information required to effectively compete in the electronics sales and service business today?

This is where *Electronic Technician/Dealer* enters the picture. In the past ET/D has served as a leading source of technical reference and news for you. It will continue to do so. But, ET/D must do more than simply tell you about the products and circuitry you see daily in your shops. There is an obligation on our part to sense the patterns of change within the industry and alert you to new and important trends, before they arrive. Through ET/D you may expect to be made aware of the new technologies and skills which you will need in order to effectively deal with future electronic products.

Many of you who read these pages are shop managers and owners. ET/D has an obligation here too. The function of business is profit, and no business, regardless of size, will long survive in today's complex and competitive world without basic management and marketing skills. In coming issues of ET/D we will be visiting with and talking to some of the successful managers and owners of sales and service shops today. We'll be telling you how someone else found success, why they found it, and how this may apply to your specific type of operation.

In short, the mission of ET/D is to inform, to point, and to lead. As editor, I look forward to helping fulfill this mission. In the meantime, ET/D remains open for your opinions and comments on what we have done and are doing. If you've got an opinion, tell me.

Sincerely

A simple truth about color TV:
You don't have to settle for a color
picture that won't stay right.
Zenith's Color Sentry controls
and corrects your color picture.
Thirty times a second. Think of it
as a TV control room in your set.
To give you that great Zenith
picture—automatically.



ZENITH
COLOR SENTRY

The quality goes in before the name goes on.®

Color Sentry available in 13" through 25" (diagonal) screen sizes.

Shown: The Reynolds, SJ2543E, with Oak veneers on top and ends;
front and base of simulated wood. Simulated TV picture.

Outlook '78

Here is ET/D's capsule review of some of the new circuits and updated models...plus a hint as to why 1978 may prove to be an industry sounding board for future home entertainment products.

By Richard W. Lay

■ Nineteen seventy-eight appears to be a bellwether year for the television industry.

For the first time most of the major television manufacturers—U.S. and Japanese—have decided to test the TV "add on" home entertainment market in a really big way. And their tools are the home video tape recorder/player and TV camera.

This is what became obvious during ELECTRONIC TECHNICIAN/DEALER'S annual survey of the major U.S. television producers to determine what manufacturers are doing with their 1978 consumer lines and how they view the future. (More detailed attention to individual company's 1978 changes will be carried in succeeding issues of ET/D.)

Quite frankly, 1978 is a test market year. For one thing, the number of significant changes to new color or black and white television receivers has diminished from what has been. The number of chassis introductions are off. The major thrust of virtually all TV manufacturers, with the exception of Sharp, has been the upgrading of previously introduced lines and a wider selection of various priced combinations of add on electronic accessories from which the consumer may choose.

Digital electronic tuning systems are the "in" thing. Four major manufacturers, GTE Sylvania, Magnavox, Quasar, and General Electric have introduced completely new designs. RCA is offering lower power chassis for its XL-100 25 and 19 inch color lines. Medium and large scale microcircuitry has made its expected further penetration into new and revised models.

Perhaps the most significant innovations for 1978 are the introduction of a 25-inch, in-line, 100 degree, tripotential CRT by GTE Sylvania and GE's new electronic remote control tuning system which has eliminated the usual ultra sonic means of transmission and replaced it with an infrared system. The new 25 inch, in-line CRTs will be used in sets manufactured by Panasonic, Quasar and Sylvania.

Yet behind the diminished innovations in the 1978 television marketplace lies the realization that manufacturers for the first time are to test in earnest the TV add on market. Practically all major U.S. and



Fig. 5—One of Sylvania's 1978 line of "Superset" color receivers. This model CX7178WR features remote control, GT-Matic self-adjusting color, and the Dark Lite 50 Black Matrix picture tube.



Fig. 6—One of Quasar's new 19-inch "Dynacolor" chassis recently introduced. This Model WT5982PW features "Dynabrite," in-line CRT, plus "Audio Spectrum Sound," a system of four audio speakers for greater acoustical range.

Japanese set makers have entered, or will have by Christmas, the home video tape recording and home "movie" TV camera markets. Only General Electric, which is "studying" the situation, and Admiral—among the major U.S. set makers—have not yet announced.

What's behind the sudden dash to home video tape recorders? Probably the realization that last year almost half the color sets sold in the United States were purchased as a replacement for a set that no longer worked. Only 19 percent who bought color sets were "first timers."

Within the next few years—maybe 1978—the replacement color TV market will be the major market segment. What this means economically and financially to the major manufacturers is not at all certain yet. But the thrust is, and home video recorders are evidence, to develop new markets in the home entertainment electronics field. With video games already here, video tape recorders and video disc players appear to be the next logical candidates for serious market testing.

While the immediate impact on the electronics servicing industry will likely be negligible, the future

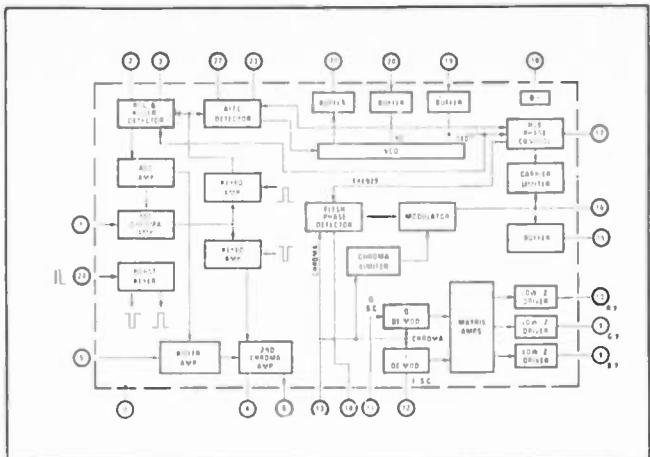


Fig. 1—Block diagram of RCA's new chroma processor IC included on its CTC85 low power chassis.

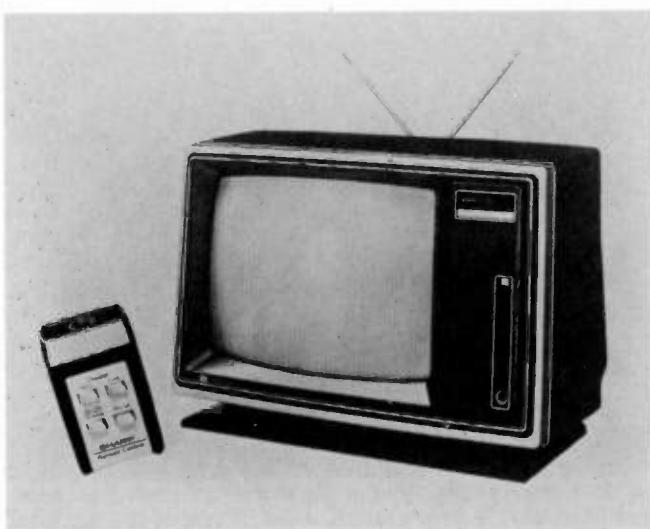


Fig. 7—Sharp Electronic's newly designed Sigma 1000 chassis featuring increased use of microcircuitry supports this "top-of-the-line" 19-inch model. The Model 19B86 features electronic tuning, digital time and channel display, and remote control.

potential is not so clear and depends, obviously, on public acceptance. Industry sources now predict sales of 250,000 units by year's end, with a 1978 potential of 750,000 units.

The two manufacturers, of course, are Sony (with the 2 hour Betamax) and Matsushita with the VHS (four hour format). Quasar, a subdivision of Matsushita, is using a third lower cost version and has already sold 4,000 of them.

Certainly with prices for the two high end units currently in the \$1,200 range, they are repairable items. Additionally, manufacturers are now holding service clinics for technicians on these systems. While much price cautiousness is being displayed among American contractors for these Japanese units, there is not doubt video recorders will maintain price tags to make them serviceably attractive.

With this background in mind, here is a look at what ET/D found in the way of new circuitry, new chassis, and new products which you will be seeing in your service shops more and more as time goes on.

QUASAR ADDS 25 INCH IN-LINE GUN

Quasar is introducing its new TS961 and TS962

color chassis with four innovations for 1978 including its new 25 inch, in-line CRT. Known as "Dynacolor," the 1978 line offers a total of 18 new 25 and 19 inch models. Warranties are unchanged from last year.

In black and white, Quasar is unveiling the new TS484 chassis for 12 and 13 inch portables.

To complement its "Great Time Machine" video tape recorder, which bowed last January with a retail of \$995, Quasar is presenting for the first time this fall its new vidicon "VR100" black and white TV camera, a \$400 addition to the system. Also, the firm is introducing a remote control unit for the video tape system which allows the user to edit out unwanted programming from an easy chair.

The Dynacolor chassis holds a new in-line, 100 degree tri potential CRT—in both 25 and 19 inch sizes; the newly introduced "Audio Spectrum" sound system; a new color control unit designed to monitor and correct for proper flesh tones; and saturation imbalance, plus the "Synthesizer" electronic tuning system.

In the TS484 black and white chassis, Quasar engineers added a video IF amplifying system featuring two separate integrated circuits and a newly designed IC tuner with increased signal-seeking capabilities. Also, a 12-inch AC/DC model with 12-volt negative ground has been added to the line.

For the "Audio Spectrum" sound system, engineers have added a three inch tweeter and 5 by 7 woofer, plus a larger output transformer to extend the range of the four inch mid-range speaker in the sets. In addition to normal volume there are tone and sound "expansion" controls.

Dynacolor's color control is an extension of Quasar's "Sixth Sense" automatic color stabilizer system. It electronically compensates for large color areas which previously tended to oversaturate and create washout picture conditions.

The TS961 and 962 are virtually identical chassis, modified for the 19 and 25 inch CRTs. Both contain six integrated circuits performing AFT, audio output, IF amp, video processing, color processing, and color demodulation functions.

Associated with Dynacolor are the 19 and 25 inch "Dynabrite" in-line CRTs, a step up from the 90 degree deflection CRTs previously used. Dynabrite produces a dot size 40 percent smaller than previously offered in Quasar sets, according to engineers.

The electronic touch tuning "Synthesizer" is available with remote control and contains microcomputer circuitry which Quasar says eliminates the need for fine tuning. The system is based on large scale integrated circuitry and permits random access tuning of all 82 channels or channel hopping, according to preference.

A final Dynacolor feature is the "Slumber Sentry" which automatically turns off the set when the broadcast signal ceases.

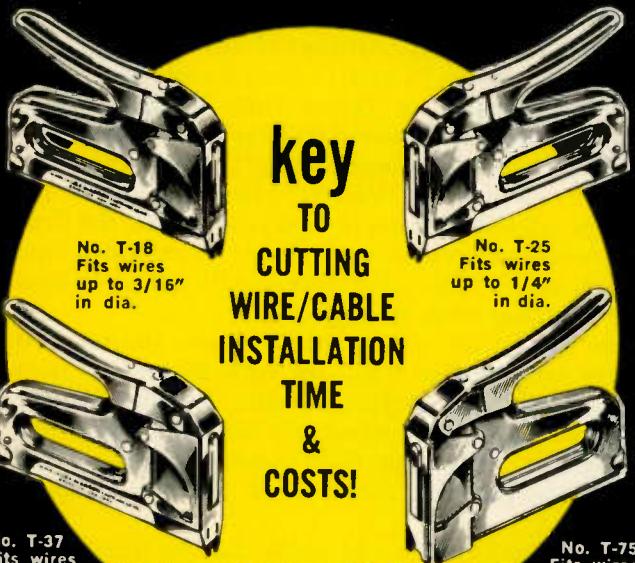
RCA OFFERS TWO NEW CHASSIS

RCA is into 1978 with two lower power and modularized chassis designs for its new 25 and 19 inch XL

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100 series, extension of its previously introduced electronic tuning to all "Color Track" models, and a late August introduction for its video tape recorder and compatible black and white home TV cameras (RCA will offer two cameras).

The company reports its CTC 90 and 85 chassis (for 25 and 19 inch models) are designed to operate 15 to 25 percent cooler than older models. The new 25 inch sets will include three console models in the XL 100 series, two table models and a 23 inch console in the "Color-Track" series.

Both the CTC 90 and 85 feature eight removable plug in modules on which most of the circuitry is mounted. That constitutes a reduction of four modules for the CTC 85, from the previously used 19 inch chassis.

RCA is also offering a carryover 19 inch color receiver on its CTC 74 chassis. Other models in the XL 100 line include a 21 inch model, a 15 inch set, and



Fig. 8—Elliptical styling highlights this 19 inch "slim line" table model from Zenith for 1978. Remote control, in-line, 100 degree CRT, and Space Command with "Zoom" feature are included in this Model SJ1951W.

three 17 inch CRTs. Three new "Color Track" 19 inch receivers have also been added to RCA's top performance "Color Trak" line.

Two features in the CTC 85 and 90, carryovers from the CTC 74 and 81 chassis, are the Automatic Fleshtone Correction and Color Overload Limiting circuitry.

CTC 85, designed for the lowest power consumption of any RCA color chassis (91 watts), embodies significant design changes from previous ones.

With the exception of the horizontal output stage and some power supply components, all of the chassis circuitry is mounted on eight modular boards. The physical shape is also modified to facilitate easier access to almost all components when the back cover is removed.

In addition, the chassis does not use a power transformer and the 150 volt supply is always "hot," even when the rest of the chassis has been isolated from the power line. CTC 85 uses a fullwave bridge rectifier and a new SCR regulator to develop 110 volts DC to operate the horizontal output stage. All other voltage sources are derived from windings on the horizontal output secondaries and associated rectifier circuits.

New to the chassis is the MSI chroma processor. This unit performs color bandpass amplification, 3.58

A product inspired by space technology

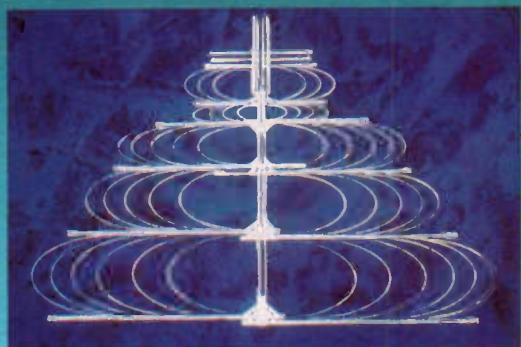
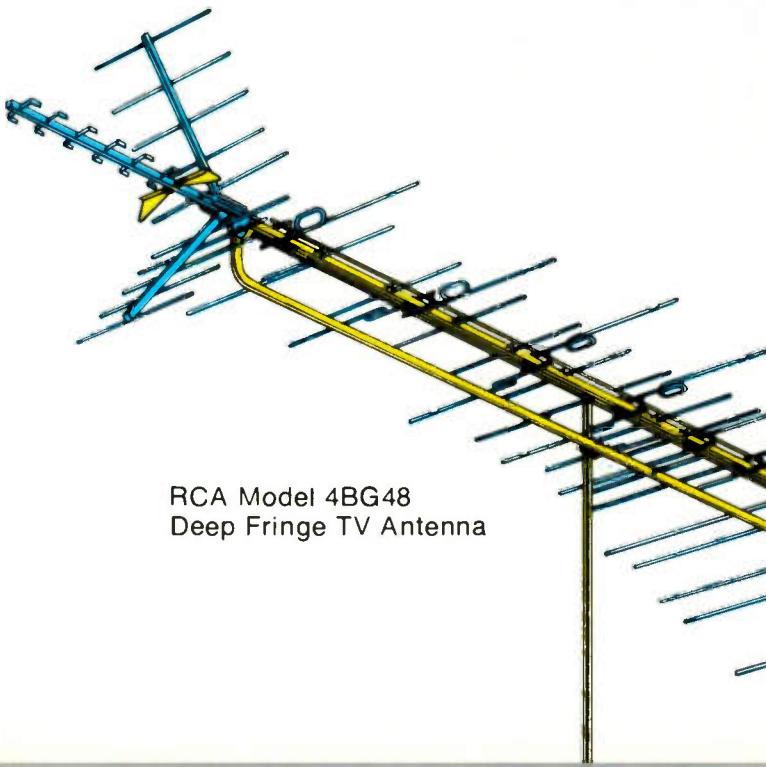
RCA Permacolor Outdoor TV Antennas... designed to provide the best possible picture in the home.

Permacolor is a product of the RCA Distributor and Special Products Antenna Engineering Laboratory, a specialized facility dedicated to the engineering and development of antenna technology. Permacolor . . . designed by the same corporation which developed the microwave antenna used on the Apollo lunar landing missions.

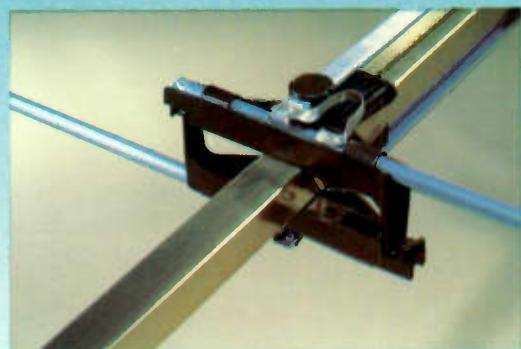
The Permacolor line is a complete line with advanced engineering features that offer the best possible reception in almost any area, from deep fringe to metropolitan locations. The line consists of: 10 UHF-VHF/FM all band combo models, 7 VHF/FM models, 5 UHF models, an FM only model, and a selection of 75 ohm and 300 ohm antenna kits; plus the amazing Mini-State — the first true miniaturized rotating antenna system.

Permacolor is the first antenna with solid, permanent connections from elements to feed line. The first antenna with pivoting, polypropylene insulators. And, the first antenna with a weather-resistant blue and gold vinyl finish.

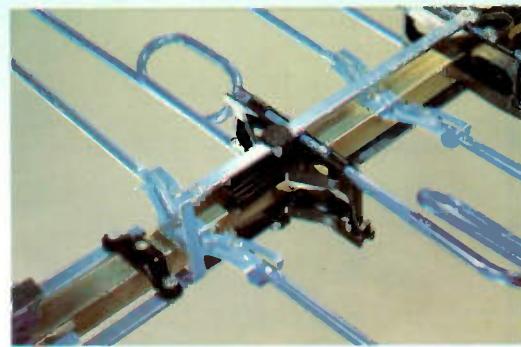
Remember . . . Permacolor Antennas are the only outdoor TV antennas that are designed, engineered, and manufactured by RCA — a world leader in electronics.



Perma-tuned circuits . . . an original RCA development. Arrangement of elements forming tuned circuits results in full-range, all-channel reception which is maintained throughout the life of the antenna by means of solidly riveted connections of flexible aluminum between elements and feed lines.

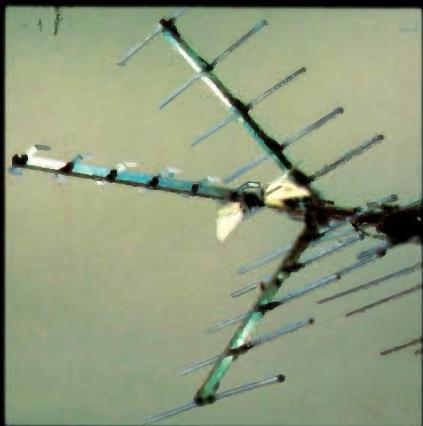


Polypropylene insulators . . . an extremely low loss material that resists weathering for peak performance and long life. Entire insulator pivots and snaps into place. Holds its element over a span of almost 6 inches, for great strength.

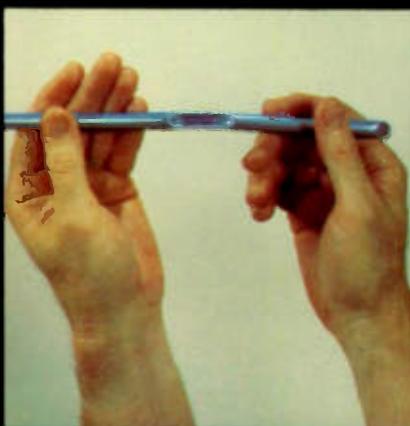


Permanent electrical connections . . . flexible aluminum straps and RCA designed splined rivets provide a positive electrical path for the signal to flow from the elements to the receiver with virtually no chance of any interruption; overcoming a major problem found in other antennas.

RCA Permacolor Outdoor TV Antennas... so advanced you'll never be satisfied with anything less.



Combination bowtie and corner reflector on UHF-VHF/FM models result in full-range, no compromise, all channel reception



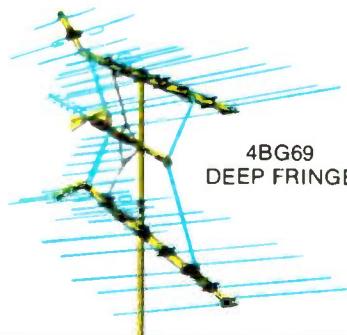
Break-off elements allow you to control FM broadcast reception to suit local conditions. UHF response can be extended to bring in channels 70 to 83 if desired.



V shaped mast clamps... double set of teeth bites into mast, prevents antenna from slipping, and keeps it aimed in the proper direction. Antenna is preassembled, elements unfold with ease and lock into place.

A few of the Permacolor Antenna models available:

UHF-VHF/FM OUTDOOR ANTENNAS

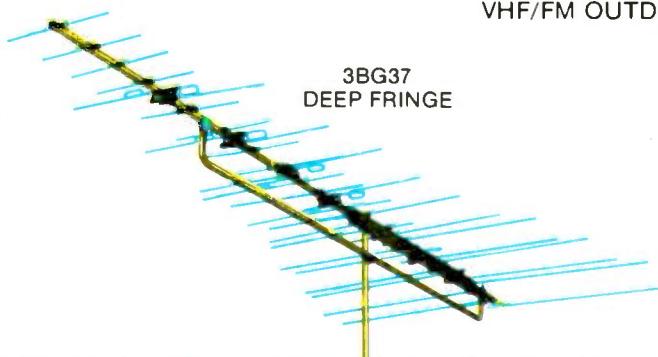


4BG69
DEEP FRINGE

4BG20
SUBURBAN

4BG10
METROPOLITAN

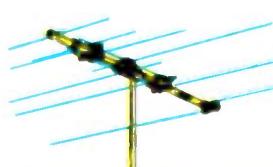
VHF/FM OUTDOOR ANTENNAS



3BG37
DEEP FRINGE

3BG09
METROPOLITAN

UHF ONLY



2BG17

RCA Antenna Mounting Kit

Some models are also available with a kit that includes everything needed for a normal installation - perfect for do-it-yourselfers.

A complete line of quality RCA accessories - including rotators, reception aids, and installation hardware is available.

RCA Permacolor Outdoor Antennas - your TV picture will show you the difference.

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MH carrier regeneration, AFPC, ACC, chroma demodulation, automatic fleshtone correction, and automatic chroma overload control.

Also just reaching consumers is RCA's entry into the video cassettes recorder/player market, plus optional microphone and black and white TV cameras for "live" home recording. This VHS system features VHF and UHF tuners, an electric clock for unattended recording and a mode switch for either two or four hours of recording. Additionally, the company plans to offer a high and low end version of the home black and white TV camera.

MAGNAVOX ADDS NEW ELECTRONIC TUNER AND VCR

Magnavox's newest entry is the addition of its digital Videomatic Touch Tune units to the T995 and T991, 25 and 19 inch color chassis. Previously electronic touch tuning was offered only with the company's Star System.

Magnavox officials have announced that they will enter the Video tape recording market "before Christmas" with Matsushita's VHS format plus optional home TV camera accessory. Again, no pricing information available.

Although announced last year, shipping delays prevented the new tuners from reaching the market until just recently. The electronic tuners feature a 12-button calculator type control panel with a maximum combination of 20 UHF and VHF channels. Although all VHF channels are preprogrammed at the factory, reprogramming is a simple customer oriented operation. Magnavox says the 19 inch Model 4345, plus all 25 inch Touch Tune consoles, are fully remotable. A customer may purchase the units without the remote and later have it "easily" converted in his home by a service technician. The remote units feature a six function transmitter with on/off, volume, up/down and mute.

The entire Touch Tune "subchassis" contains a total of six ICs and uses binary coded decimal logic. Remote controlled units contain a microphone housed behind the front panel which responds to the remote transmitter signals.

ADMIRAL OFFERS NEW "DELTA" COLOR CHASSIS

Admiral has introduced eight new large screen color and four smaller black and white models. The

new color models contain Color Master Control, AFC, detent UHF and VHF tuning, 90 degree Delta CRTs, and the new 25M55M chassis. This is basically an M45 chassis modified to accommodate the dynamic convergence circuitry and for changes in the pincushioning circuitry.

Utilizing the 25M55M are one 23 inch console, a 25 inch table model, and six 25 inch consoles. Five remaining 1978, 25 inch color models, on the 9M50 chassis, are previously introduced systems. They feature the digital electronic ET3RA tuners, Color Master, light sensor, CATV 75 ohm antenna connections, and optional remote control.

The four new black and white sets are a 19 inch model on the T4N3 chassis, a 19 inch model with the T1N3, and two 22 inch models with the T2N3 chassis. Although the T4N3 is new it has basically the same circuitry as the other two black and white chassis except for discrete transistors which have been substituted for signal processing IC701. The transistors serve as the AGC gate, AGC amp, noise canceller, noise inverter, a sync separator and RF AGC delay.

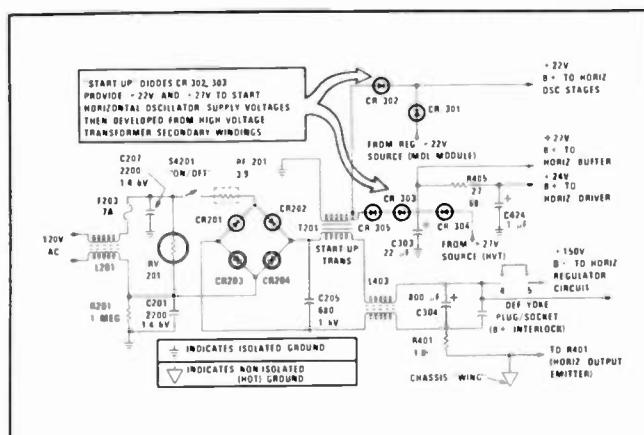
The new color units carry color amplifiers modified for the delta CRTs. Significant variations from the M45 chassis are the use of separate drive controls in the emitter stages of the R,G,B amps; separate screen controls for each gun, use of the +250 volt source for the R,G,B amps—instead of the +145 used in the M45—and elimination of several other unneeded set up controls and components.

GE ADDS INFRARED REMOTE UNIT

The most radical change in electronic tuning this year comes with General Electric's remote transmitter (described in greater detail in another article in this issue). Using a modulated infrared beam as the link with the tuner, GE expects the system to eliminate the false channel change triggering often associated with ultrasonic systems.

In addition to its infrared remote, GE has phased out the last of its 10-inch hybrid color television systems first introduced in 1965. Replacing the hybrids will be a totally solid state line of 10 and 13 inch color portables carried on the completely new AA chassis. This is the fourth all-new color chassis introduced by GE in the past four years.

Called Porta Color II, the 10-inch version features





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higher picture tube voltage (17,000 to 20,000), less power consumption (175 to 85 watts), and addition of automatic color control, automatic frequency control, noise canceller circuitry, and DC restoration.

Both the 10 and 13 inch sets feature in-line picture tubes and the 13 inch model has eliminated the picture control but added GE's automatic color monitor system which automatically adjusts color and tint signals 60 times a second with GE's VIR system (see ET/D, August 1976). The 13 inch Porta Colors also carry 25.5 KV picture tubes.

GE engineers claim the new electronic tuning unit has been designed with the service technician in mind. It features modular construction and any component in the system is replaceable with no set up adjustment necessary. Additionally, although complex digital electronic processes are used to control the tuner, the outputs are basically in the form of DC voltages, allowing most troubleshooting procedures to be accomplished via the VOM, GE contends.

ZENITH UPGRADES MODELS

Zenith has upgraded a number of its color sets for the coming year in the areas of automatic picture adjustment, electronic tuning and remote control, and with the 19 inch, in-line "EFL" CRT. The Chicago based manufacturer is another one of the U.S. firms which has decided to enter the home video recording market, having aligned itself with Sony's Betamax approach. Zenith has the unit on the market for \$1300.00 complete with optional video camera for an additional \$395.00.

The company's color television line is comprised of 55 models this year. Zenith reports its Space Command remote control system has been added to several models and is now available in 22 of the 55. In addition the Chromacolor picture tube with the EFL, 100 degree CRT is now available in five 19-inch models.

Other step-up features are the addition of the Titan 300 chassis to the Model J1930W-P 19 inch set, the addition of Zenith Touch Command 14 position channel selection to the 25 inch J2540 model and the addition of larger speakers in three of its 25 inch remote controlled models with "Zoom."

In the black and white area, Zenith has improved solid state chassis in the 12 inch portable line. Chief among the changes are two new integrated circuits improving horizontal stability in the presence of aircraft, auto ignition or electrical motor interference.

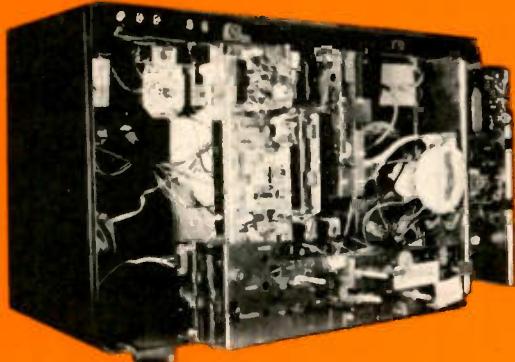
Zenith is entering the video cassette field with the two hour Beta video tape scan technology. It will be offered in two models, the video cassette recorder deck unit for attachment to a TV receiver's antenna terminals and, later this October in a Zenith VCR/TV console combination featuring 25 inch color TV with a simulated drawer which conceals the tape unit. The optional camera unit will include carrying case, camera power unit and cable.

ELECTRONIC TUNING OFFERED BY SYLVANIA

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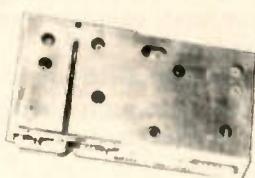
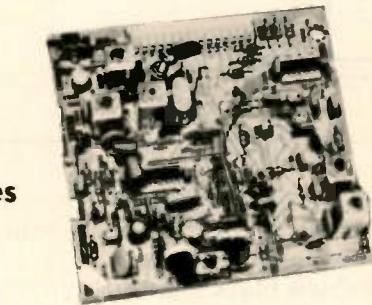
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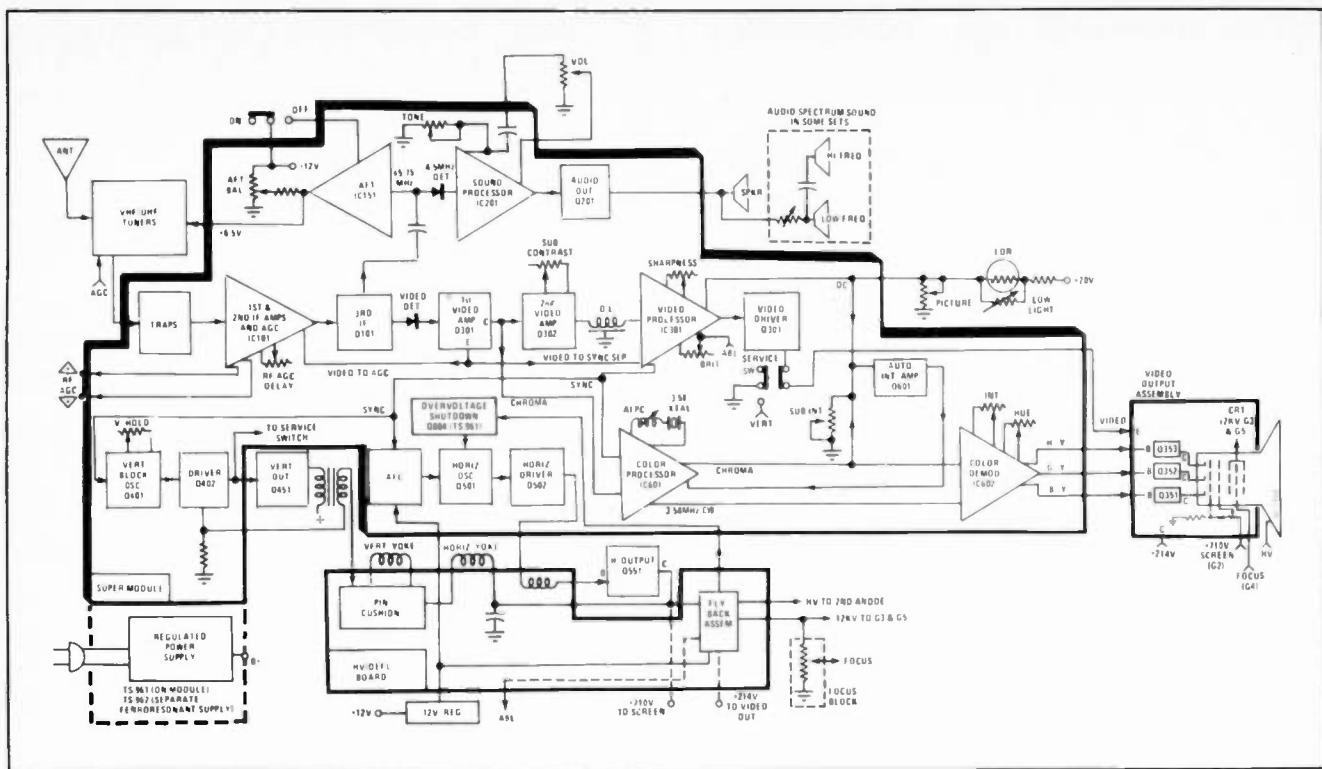


Fig. 3—Block diagram of Quasar's recently introduced TS961/962 chassis.

Matic self-adjusting color, Automatic Sharpness Control circuitry, Dark Lite 50 black matrix picture tube, and the 30,000 volt GT-300 chassis. The series is available in the 19 and 25 inch CRT sizes.

Most of the sets in the 1978 line, Sylvania says, are also equipped with the room light monitor and all solid state chassis which feature plug-in transistors for easier servicing.

Meanwhile, Sylvania is planning to come into the video recording market November 1 with the Matsushita designed VHS system. No prices have been announced yet.

SHARP PRESENTS SIGMA 1000

Sharp Electronics has completely redesigned its color set line and this year is out with 12 new models, eleven of which use the new Sigma 1000 chassis. Sigma 1000, according to Sharp engineers, uses more use of microcircuitry than last year's Sigma 500 chassis.

Additionally, the firm is returning with its seven black and white models from last year, plus it is adding a new 7-inch portable featuring AC or 12-volt DC operation.

In the color line, only the 9-inch model is using Sigma 500. The Sigma 1000 chassis, which Sharp says is designed to reduce power consumption, is being used with three 13 inch models, two 15 inch models, and six 19 inch CRTs.

Five of the color sets have the new Sigma Sonic sound system, which uses a 4-inch heavy magnet speaker to increase vibrations and a widened Acoustical range. Five color sets also have connecting outlets for CATV, and the two high end color models are equipped with electronic tuning and remote control operation.

The remote controlled Model 19B86 features electronic channel and time display, which can be flashed on the screen at any time by the viewer who simply

presses a control button. The remote unit turns the set on and off, provides three volume choice settings, and tunes 18 channels.

The new black and white entry, the Model 3S64 is equipped with a 12 volt cigarette lighter cord for use in car or boat, earphone and jack, and weighs under 10 pounds.

Warranties on the new Color TVs are similar to last year, although the varactor digital electronic tuning unit has a seven year limited warranty, Sharp reports.

All black and white sets have a one year limited warranty on the picture tube and parts and 90 days on labor.

PANASONIC ADDS 14 MODELS AND VCR

Panasonic's entries for the coming year include 14 new color models, seven portables and seven 25 inch consoles all equipped with the in-line, 100 degree Quintrix II CRT.

Panasonic is another manufacturer in the video tape recording game, using the Matsushita VHS format for its entry this fall.

In color sets, the top of the line is the CT2587, 25 inch model equipped with previously introduced Panalock fine tuning and video (light sensor) control, plus the remote 14-position random access "Sensor Touch" electronic tuning.

The color portables range in screen sizes from 10, 15, 17 and 19 inches, with two 15 inch models and three 19 inch sets rounding out the seven. All seven, in addition to Quintrix II, are equipped with Panalock, Quick On, detachable VHF dipole and UHF loop antennas, earphones, and CATV/Master antenna connections.

Panasonic also has added to its black and white lines with two new 19 inch and one 16 inch portables.

Philco is offering a new series of 21 inch table

continued on page 55

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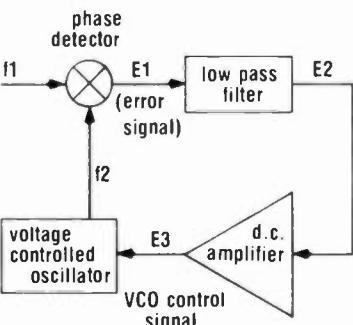


Fig. 1—Block diagram of the simple phase locked loop.

Phased Locked Loops...Some Basic Applications

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

In his article, Mr. Carr takes a look at PLL theory and then discusses some basic applications for these frequency control circuits in FM demodulation and CB broadcasting.

■ *Phase locked loops (PLL)* have been showing up in a number of electronic circuits for the past several years. Applications for the PLL include demodulation of FM and FSK signals, FM stereo decoding, TV and FM receiver tuners, and the control of the master oscillator frequency in radio transmitters and receivers. In this article we will discuss the basic theory of phase locked loop operation, some applications, and service information.

WHAT IS A PLL?

Simply put, a phase locked loop is a feedback system in which a local oscillator locks onto and then tracks any changes of input frequency. Figure 1 shows the block diagram of a simple phase locked loop. This circuit consists of four basic sections: two-part phase detector, low pass filter, d.c. amplifier, and voltage controlled oscillator.

Two frequencies are involved in this circuit. An input frequency (f_1) comes from the outside world or another circuit, while the other (f_2) is generated by the *voltage controlled oscillator (VCO)*. The VCO is in the feedback loop.

If no input signal exists, then the VCO will oscillate at its natural or *free-running frequency*. This frequency is determined as in most oscillators by the RC or LC time constants in the oscillator

circuit. When f_1 is applied to the input, however, the phase detector compares f_1 and f_2 , and issues two output error signals proportional to $(f_1 + f_2)$ and $f_1 - f_2$. These signals are fed to a low pass filter which rejects the sum signal $(f_1 + f_2)$, and passes the difference signal. The difference signal is a d.c. or near d.c. level represented by voltage E_2 in Figure 1.

Voltage E_2 may be fed directly to the VCO in some cases, but it is usually necessary to scale it to a range suitable for the VCO by passing it through a d.c. amplifier. Regardless of which technique is used in any given circuit, though, the error voltage is applied to the d.c. control input of the VCO where it is used to pull the VCO frequency to correct the discrepancy between f_1 and f_2 . This particular circuit seeks the condition where $f_1 = f_2$, and $E_2 = 0$.

PLLs IN FM DEMODULATION

One application for a circuit such as Figure 1 is FM demodulation. Recall basic FM theory which states that the frequency of the carrier varies at a rate that is dependent upon the frequency of the modulating audio signal. Also, please note from the above discussion that the d.c. error voltage varies directly as the input frequency varies. If an FM IF signal is applied to the input (at f_1), then error voltage E_2 will be the audio

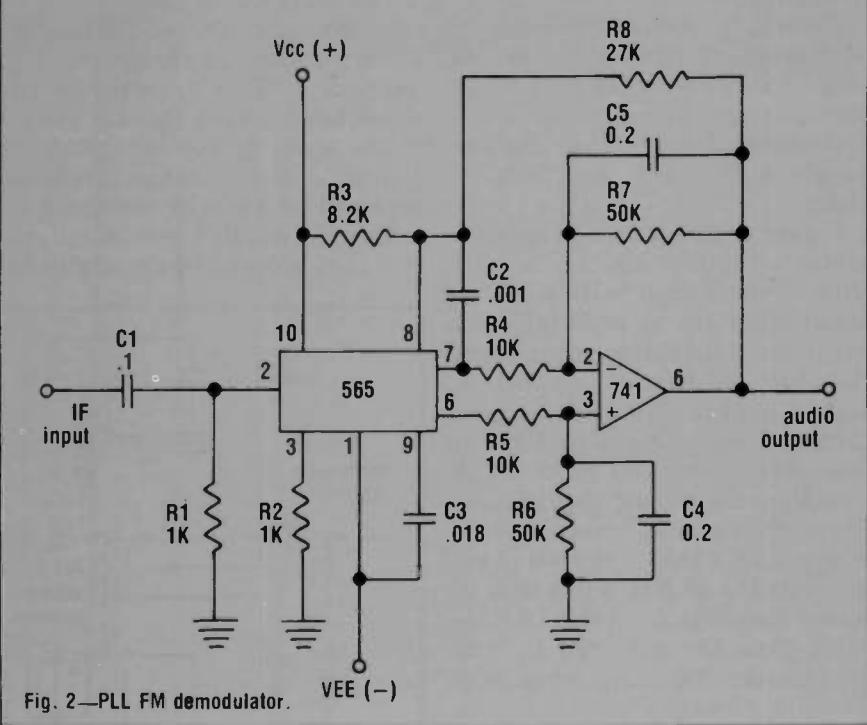


Fig. 2—PLL FM demodulator.

signal that was the modulation.

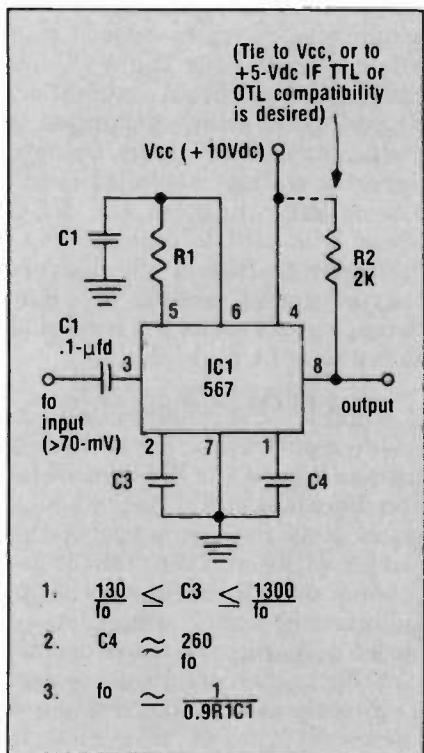
Several integrated circuit manufacturers offer I.C. phase locked loops that are suitable for FM demodulation. Three types have proven popular, and they are the numbers 560, 561, and 565 devices.

Figure 2 shows an FM demodulator circuit using the 565 IC chip. This circuit will work to about 500-KHz, so is suitable for use in communications equipment that has 455-KHz IF amplifiers, and in applications such as subcarrier demodulation in FM/FM telemetry and 67-KHz SCA ("background music") broadcasts. There has been at least one case where such a chip was used to regenerate the 38-KHz subcarrier in stereo receivers from the 19-KHz pilot tone transmitted by the broadcaster. This and other tone decoding jobs are a natural for the PLL chip, so they are also found quite a bit in teletype and data communications equipment.

DIGITAL TIME DECODING

The later application requires that a digital logic signal be created from the existence or non-existence of tone signals. This allows the digital signal to be transmitted as tones over ordinary telephone or radio channels.

In the tone-encoded digital sig-



nals we might find a logic level "1" (usually +5-v.d.c. in digital circuits) represented by one tone, and logic level "0" represented by another tone. A tone decoder can be made using a circuit similar to Figure 2, but with the amplifier replaced by a level comparator.

The 567 is a PLL integrated circuit that is designed especially for

applications such as tone decoding which contains an internal comparator. Figure 3 shows a typical tone decoder using the 567. The component values shown are typical for tones in the 400-Hertz to 2500-Hertz range, but other values may be selected using the formulas given in Figure 3.

Tone decoders find applications

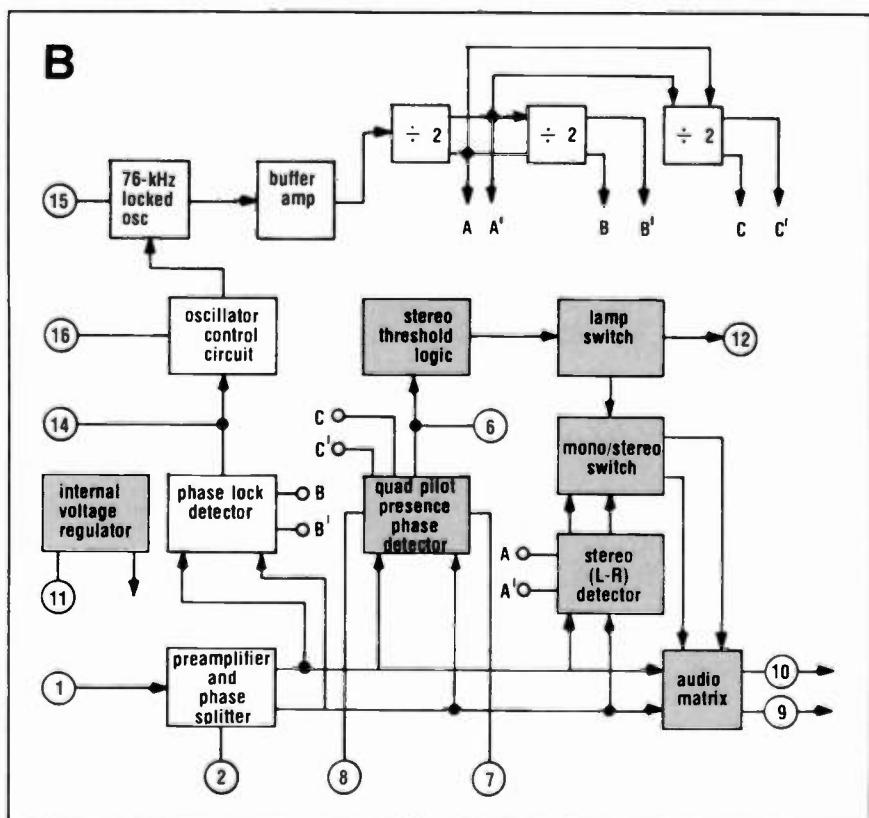
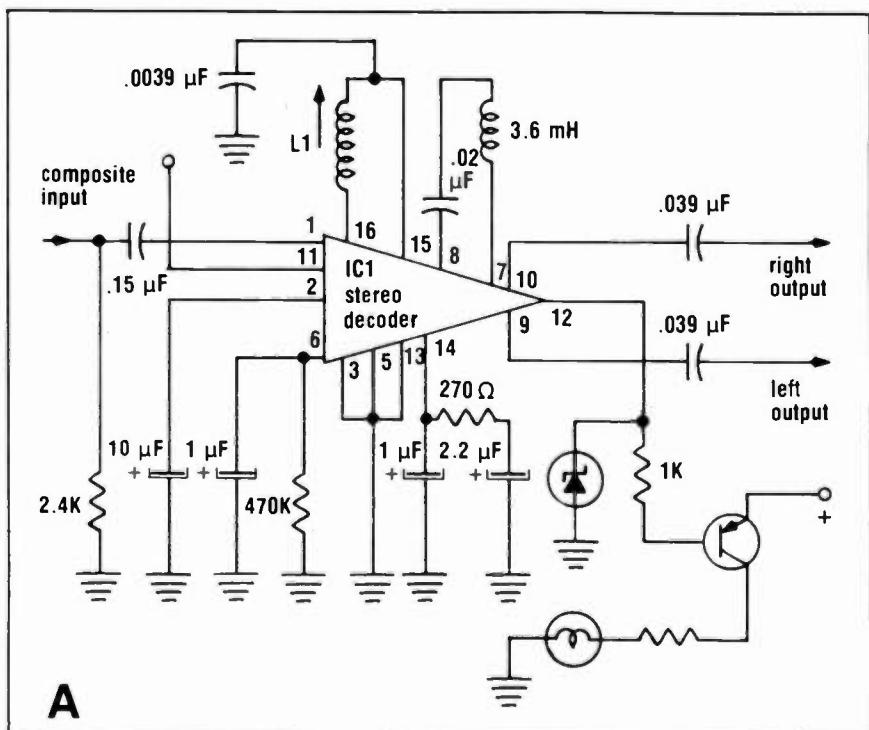


Fig. 3—Tone decoder using the 567 PLL integrated circuit.

**Fig. 4—A) PLL DM-stereo decoder used by Bendix in certain Ford Motor Company OEM radios.
B) Block diagram of the Bendix PLL decoder.**

in communications where they may be used for tone-separated squelch, or in digital data communications that uses one tone for a logic "1" and another for logic "0". A tone decoder might also prove necessary when recording analog or digital signals onto ordinary audio magnetic tape. If the circuit of Figure 3 must be TTL compatible, then connect the output pull-up resistor (R2) to +5-v.d.c. instead of Vcc.

PLL FM STEREO DEMODULATORS

Very few designers would use a PLL chip as a discrete FM stereo decoder because there are several integrated circuits available that include not only the PLL for regenerating the subcarrier signal, but also the rest of the circuit. At least two different IC devices are used in consumer electronics equipment. Examples are shown in Figures 4 and 5.

Demodulation of the left and right channel information in FM stereo requires the regeneration of the 38-KHz subcarrier that was suppressed at the transmitter. The two PLL-based IC stereo decoders use the PLL to recreate the 38-KHz signal from the 19-KHz pilot signal.

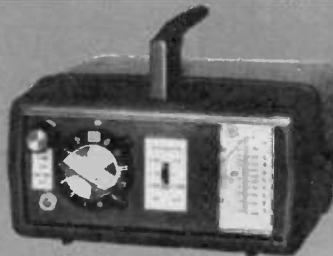
The circuit of Figures 4A and 4B were used in certain Bendix FM stereo radios manufactured as OEM models for the Ford Motor Company. Figure 4A shows the external circuitry while Figure 4B shows the block diagram of the internal circuitry. This diagram, incidentally, is similar to the RCA Semiconductor type CA309AQ.

The complete FM audio signal consists of regular monaural (L+R) information, a 19-KHz pilot signal, and a double sideband suppressed carrier signal called the (L-R). In the decoder IC used by Bendix and RCA, the 19-KHz is selected out in the phase detector circuit that is used to control the frequency of a 76-KHz VCO. In this chip the 76-KHz oscillator is an LC type. The output of the oscillator is frequency divided by a factor of two to produce the 38-KHz signal and by a factor of four to produce the 19-KHz pilot signal. There are actually two divide-by-

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(Both Fig.'s 4A & 4B: From *Automobile Electronics Servicing Guide* by Joseph J. Carr, published by Howard W. Sams & Co., Inc., Cat. #20927.)

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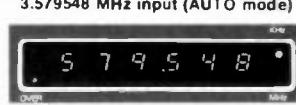


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four sections, but only the one with output B-B's is part of the phase locked loop circuit.

Another version of this philosophy is represented by the Motorola MC1310 integrated circuit shown in Figure 5A and 5B. This is the so-called "coilless" FM stereo decoder that has seen application in many consumer electronic products. Delco uses either this chip or a closely related chip of their own design in most of their modern FM car radio receivers.

In both types of stereo decoder we see alignment instructions published that make use of Lissajous figures on an oscilloscope to be sure the 38-KHz is exactly on frequency. I have found, however,

that this is not usually necessary, and that we can make use of the capture and lock-in features of the PLL to make the adjustment. The stereo indicator lamp is used to tell us when lock-in occurs.

ADJUST OSCILLATOR FREQUENCY

Adjust the oscillator frequency control (L1 in Figure 4 and R5 in Figure 5) until the lamp comes on and stays lighted. Then adjust the main tuning dial of the radio up and down band making sure that the lamp comes on at every stereo station. Be sure to check several stations as you tune from above or below. This "by ear/eye" procedure would be disastrous on non-PLL stereo decoders, but the PLL will

A

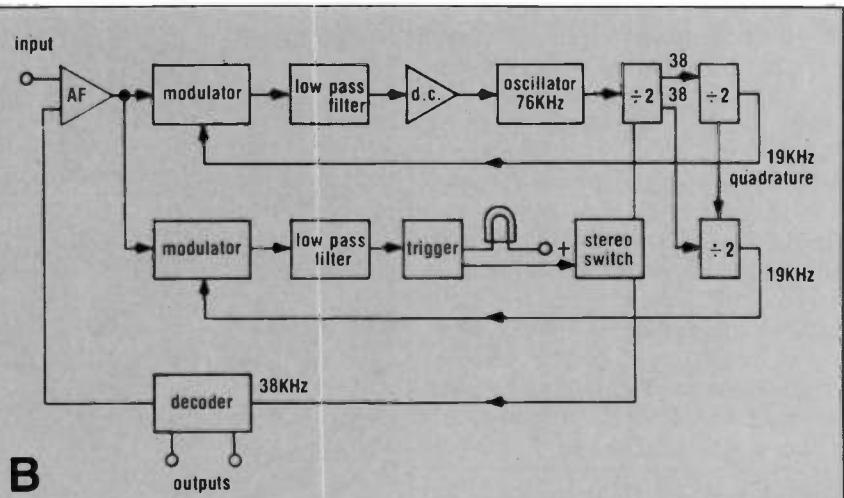
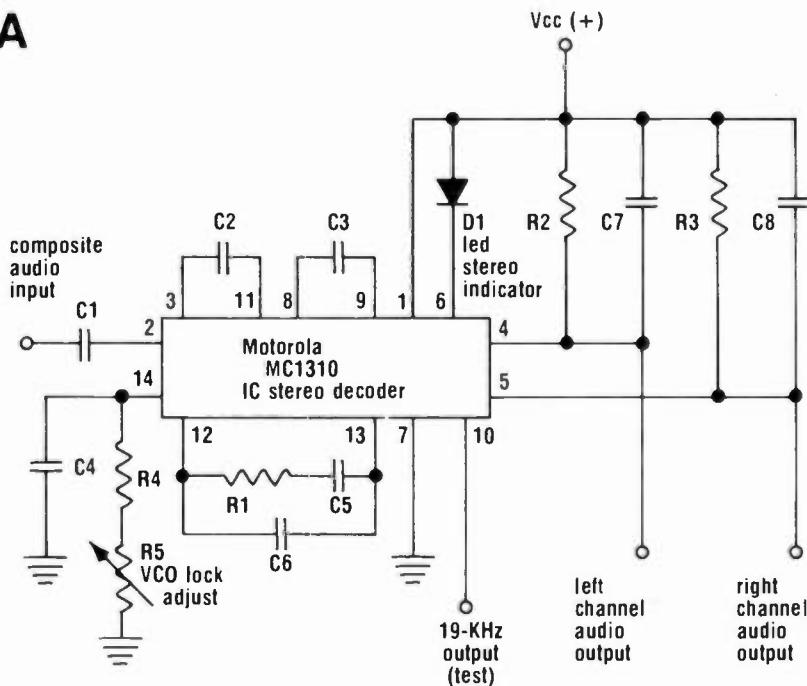


Fig. 5-A) Circuit using the Motorola MC1310P I.C. "coilless" stereo decoder. B) Block diagram of the Motorola MC1310P.

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lock onto the pilot, causing the 76-KHz oscillator to track, even if the VCO free-running frequency is a little off the exact value of the 76-KHz. When the free-running frequency is close enough to insure capture every time, then the adjustment is correct.

TRANSMITTER/RECEIVER FREQUENCY CONTROL

Two-way radio transmitters must be frequency controlled to F.C.C. specifications. Many multichannel C.B., marine, avionic, and landmobile two-way radios use the phase locked loop to control output frequency of the transmitter and the local oscillator frequency in their receivers.

The main reason for the popularity of the PLL is economic. Consider a 23-channel C.B. transceiver using direct frequency control. In that type of radio we needed two crystals for each channel, and they cost on the order of \$8 to \$10 per pair. The customer had to invest \$180 to \$230 to get full coverage, and if the system had been kept, the investment would be over \$400 for a 40-channel rig!

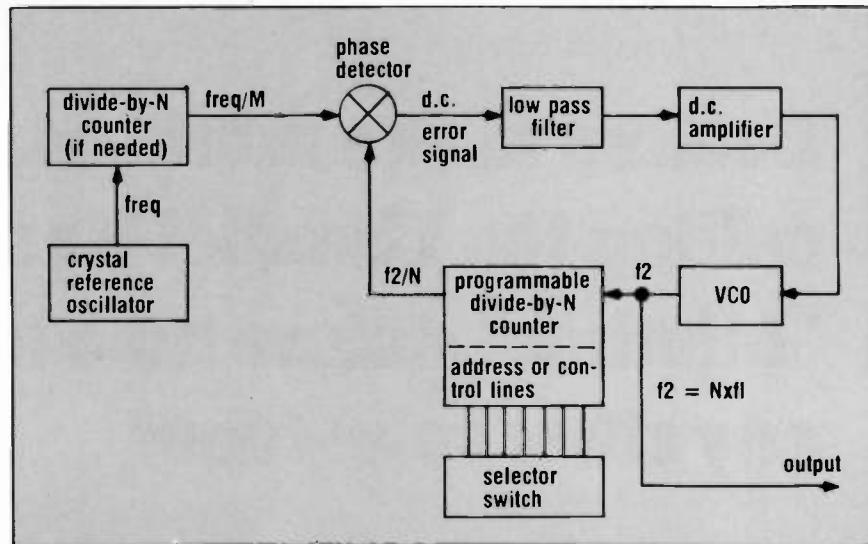


Fig. 6—Block diagram of a multichannel PLL transmitter frequency control section.

This could easily be several times the cost of the rig!

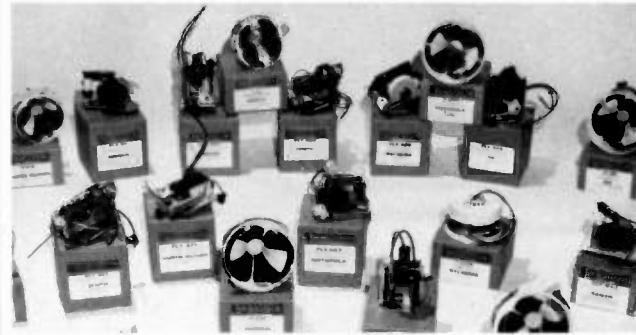
About 1963 C.B. manufacturers partially solved the problem by introduction of the heterodyne type of frequency synthesizer now called the "crystalplexer." This used 12 or so crystals in a heterodyne arrangement to produce the 23-channels then allowed. This would still require a mountain of quartz crystals,

though, since something like 20,000,000 sets have been sold!

MULTI-CHANNEL GENERATION

The modern phase locked loop frequency synthesizer makes use of but one to three crystals to generate either 23- or 40- channels! Figure 6 shows the basic block diagram of a multichannel transmitter frequency control section. This circuit is essentially the same

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Channel Number	C.B. Freq. (KHz)	VCO Freq. (KHz)	Division Ratio (N)
1	26,965	16,370	3274
2	26,975	16,380	3276
3	26,985	16,390	3278
4	27,005	16,410	3282
5	27,015	16,420	3285
6	27,025	16,430	3286
7	27,035	16,440	3288
8	27,055	16,460	3292
9	27,065	16,470	3294
10	27,075	16,480	3296
11	27,085	16,490	3298
12	27,105	16,510	3302
13	27,115	16,520	3304
14	27,125	16,530	3306
15	27,135	16,540	3308
16	27,155	16,560	3312
17	27,165	16,570	3314
18	27,175	16,580	3316
19	27,185	16,590	3318
20	27,205	16,610	3322
21	27,215	16,620	3324
22	27,225	16,630	3326
23	27,255	16,660	3332
24	27,235	16,640	3328
25	27,245	16,650	3330
26	27,265	16,670	3334
27	27,275	16,680	3336
28	27,285	16,690	3338
29	27,295	16,700	3340
30	27,305	16,710	3342
31	27,315	16,720	3344
32	27,325	16,730	3346
33	27,335	16,740	3348
34	27,345	16,750	3350
35	27,355	16,760	3352
36	27,365	16,770	3354
37	27,375	16,780	3356
38	27,385	16,790	3358
39	27,395	16,800	3360
40	27,405	16,810	3362

List of C.B. frequencies, VCO frequencies and division ratios ("N") needed for the circuit of Fig. 7.

as the circuit which we presented earlier, except that the input frequency is not from the outside world, but from a local crystal reference oscillator.

You might think that a PLL is capable of producing only a single output frequency with just one reference and one VCO, but this situation is modified somewhat by the use of a programmable divide-by-N frequency counter between the output of the VCO and the input port of the phase detector.

The VCO output is also sent to the rest of the transmitter where it is used as the master oscillator signal. The VCO signal will have a frequency stability that approaches the stability and accuracy of the crystal reference oscil-

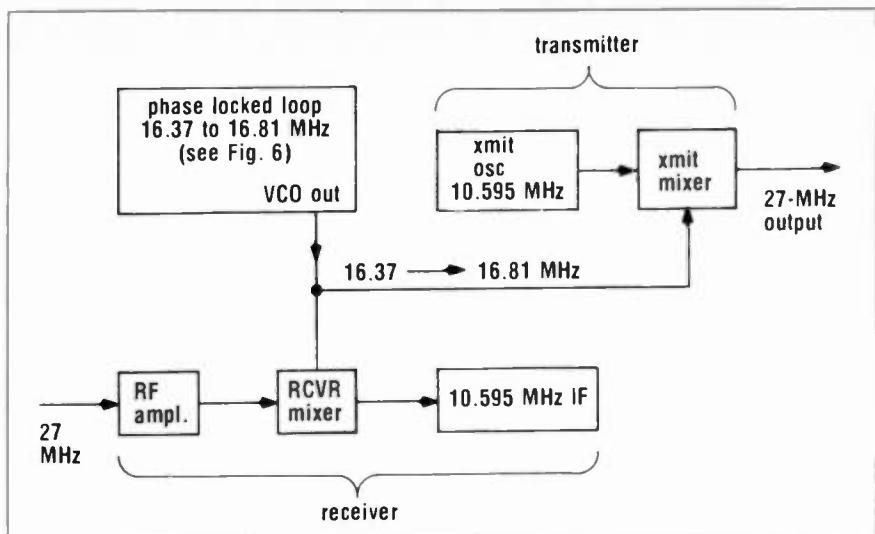


Fig. 7—PLL-controlled C.B. transceiver.

lator. The VCO signal may be used directly, in a heterodyne situation, or as the drive signal for a chain of ordinary frequency multiplier stages.

The key to multichannel operation lies in the programmable divide-by-N frequency counter. The divide ratio is set externally by properly selecting the digital word on the address lines. This is done by the operator's *channel selector* switch which produces the necessary binary codes. This coding also makes it easier to use digital LED readouts to indicate the channel.

A TYPICAL PLL C.B. SET

Figure 7 and Table I show a "typical" design for a PLL-controlled C.B. transceiver. Figure 7 is the block diagram of the transceiver, while Table I gives the frequencies involved and the division ratios required in a PLL circuit designed similarly to Figure 6.

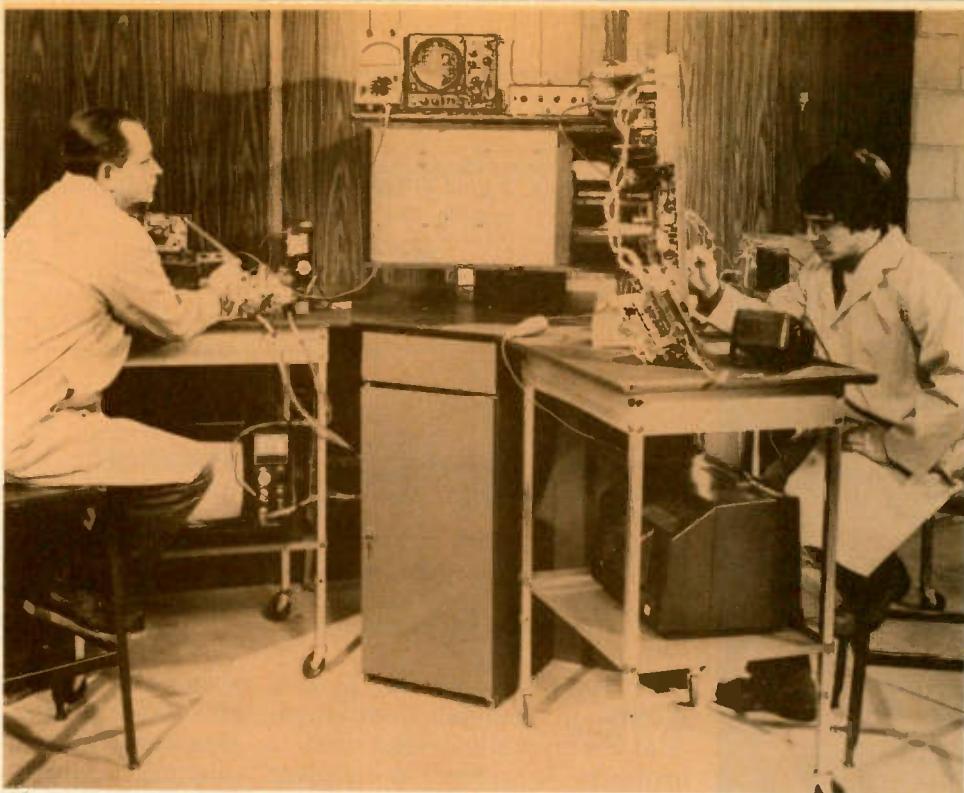
The circuit of Figure 7 uses a phase locked loop with a VCO that will operate over the frequency range 16.370-MHz to 16.810-MHz. When mixed with the output of a 10.595-MHz crystal transmit oscillator, this frequency translates to the 40 C.B. channels between 26.965-MHz and 27.405-MHz. Similarly, when the VCO signal is mixed with 27-MHz signals in the receiver section, the resultant difference frequency is 10.595-MHz, which in this case is the I.F. amplifier frequency.

The phase locked loop must pick certain frequencies in the 16-MHz range to translate into the C.B. This is done using a PLL circuit,

such as Figure 6, in which a bank of selector switches sets the division ratio of a divide-by-N frequency counter/divider circuit. The channels in the Citizens Band are spaced every 10-KHz in some cases, and 20-KHz in others. We must then find a factor which will divide into all C.B. frequencies without leaving fractional remainders. An appropriate factor is 5-KHz. Division of the VCO frequency required at each C.B. channel will result in a division ratio appropriate for that channel. Table I lists the 40 legal C.B. channels, the appropriate VCO frequency for each channel, and the division ratio (i.e., "N") required of the programmable divide-by-N counter.

For example, suppose the channel selector switch was set to channel 1. The C.B. frequency for this is 26.965, and the VCO frequency is (26.965 - 10.595 =) 16.370-MHz. In order to get this system working, it is necessary that the reference oscillator/divider deliver a precise signal at 5-KHz, and the programmable counter reduce the VCO frequency to 5-KHz. 16,370-KHz/5-KHz results in a division ratio of 3,274. When the selector is first placed in the channel-1 position, the VCO frequency will be something different than 16.730-MHz, so the phase detector will issue an error signal that drives the VCO toward the correct frequency. After a brief interval, the VCO will lock onto 16.370-MHz and operation can continue. If the time constants of the loop filter or certain other de-

continued on page 55



This Electronic Work Station has been introduced by GTE Sylvania for service shops desiring a systemized method of electronic servicing. This free-standing, self-contained unit is operated by a two-man servicer team.

The service bench setup

Greater productivity at the service bench means greater profits for today's electronic servicer—and that takes the right method—and the right bench setup.

■ One of the most visual clues as to whether a particular electronic service business is efficient—and profitable—is in the setup of the service bench area.

Tools and test equipment scattered around on a completely disorganized basis and customers' sets all over the work area in various stages of disrepair usually mean a poor flow of repair jobs through the shop. And poor work flow means low volume and usually little profit. In fact, in a poorly organized service department, just *finding* the necessary tools and test equipment can eat up what little profit there might have been.

The object, then, is to arrange your service area to permit the smoothest, fastest flow between repair work coming in and completed jobs ready for pickup by the customer. Obviously, more jobs are completed per day mean a greater cash flow—and if the service labor pricing is right—more profit.

The smooth, efficient flow of service work through the shop is dependent upon two main factors—the *method*, and the *physical arrangement* of the shop.

THE METHOD

The method used for handling the 'flow' of repair work is, of course, dependent on the number of people in your operation, and the type and range of kinds of service work you perform. If you operate a one-man shop, for example, and repair only one or two brands of television, you'll have fewer parts to deal with, a smaller library of service literature to wade through, and many of the problems you are called upon to solve will be 'repeat performances'.

On the other hand, as you add people to your staff and increase the variety of the products you service, the method you use to improve your work flow not only becomes more important for profitability, but more difficult to apply.

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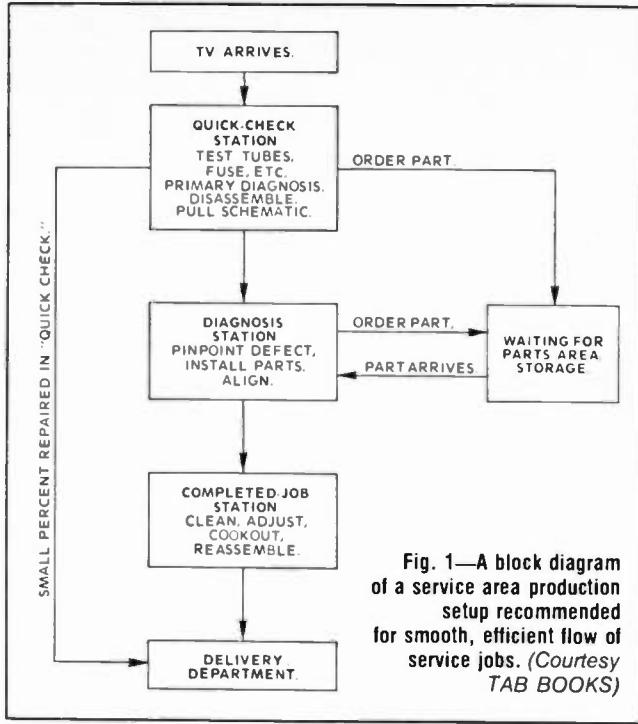


Fig. 1—A block diagram of a service area production setup recommended for smooth, efficient flow of service jobs. (Courtesy TAB BOOKS)

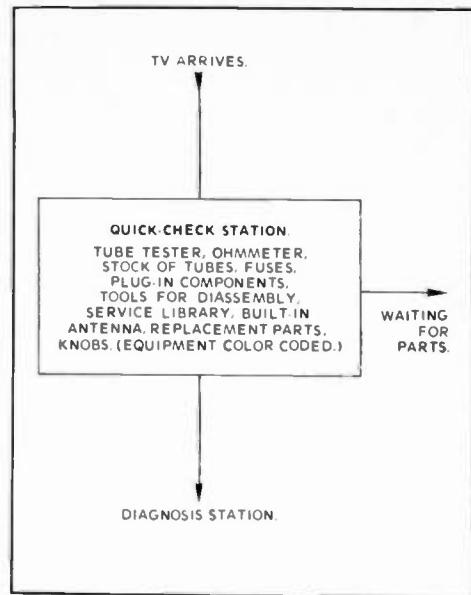


Fig. 2—Block diagram of the "quick-check" station, the first stop in the 'flow' method of electronic servicing. (Courtesy TAB BOOKS)

Whichever method is adopted to improve your work flow, the method must accomplish one thing—it must utilize the services of the right person at the right time. In other words, wherever possible, the person(s) with the

highest technical skills and training should not spend much time on the routine, low profit tasks, such as putting customers tags on repair jobs, answering telephones, testing tubes, making small, simple repairs, dismantling chassis,

reassembly, and cleaning finished repair jobs. The trained technician should be able to concentrate on the tougher jobs requiring thorough diagnosis and sophisticated test equipment.

Even in the typical one-man shop, this proper utilization of tal-

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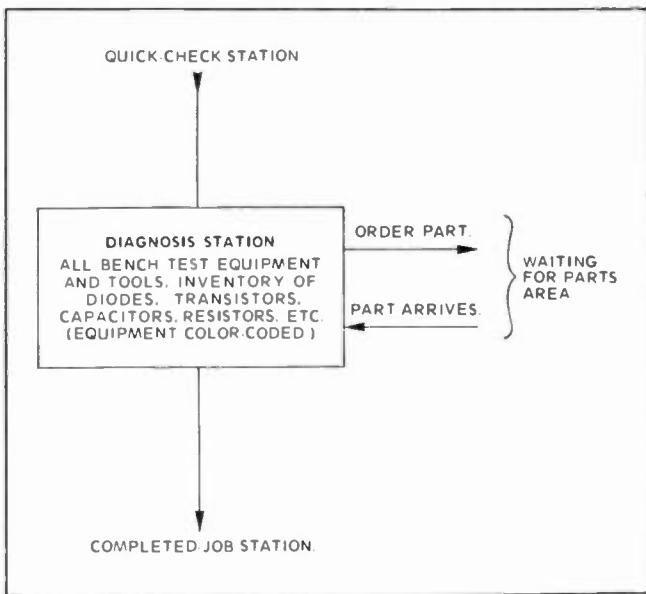


Fig. 3—Block diagram of the "diagnosis" station, manned by a skilled electronic technician, for the solving of the tough-dog problems. (Courtesy TAB BOOKS)

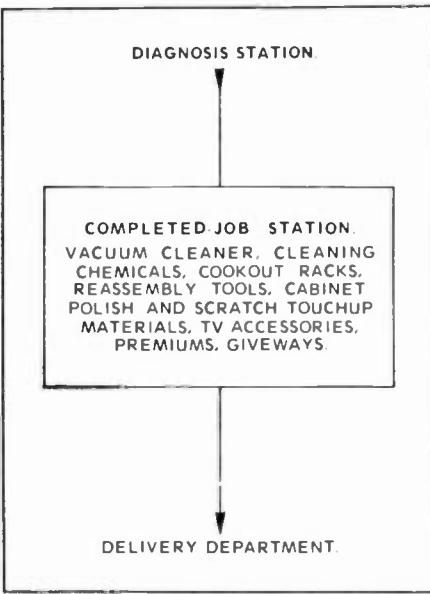


Fig. 4—The "completed-Job" station of the 'flow' method of electronic servicing. All finishing and clean-up jobs are handled here.

ent can be accomplished by employing a properly trained part time helper. The small extra labor cost involved should, in most cases, be easily covered by the extra service volume generated

Service Bench Flow

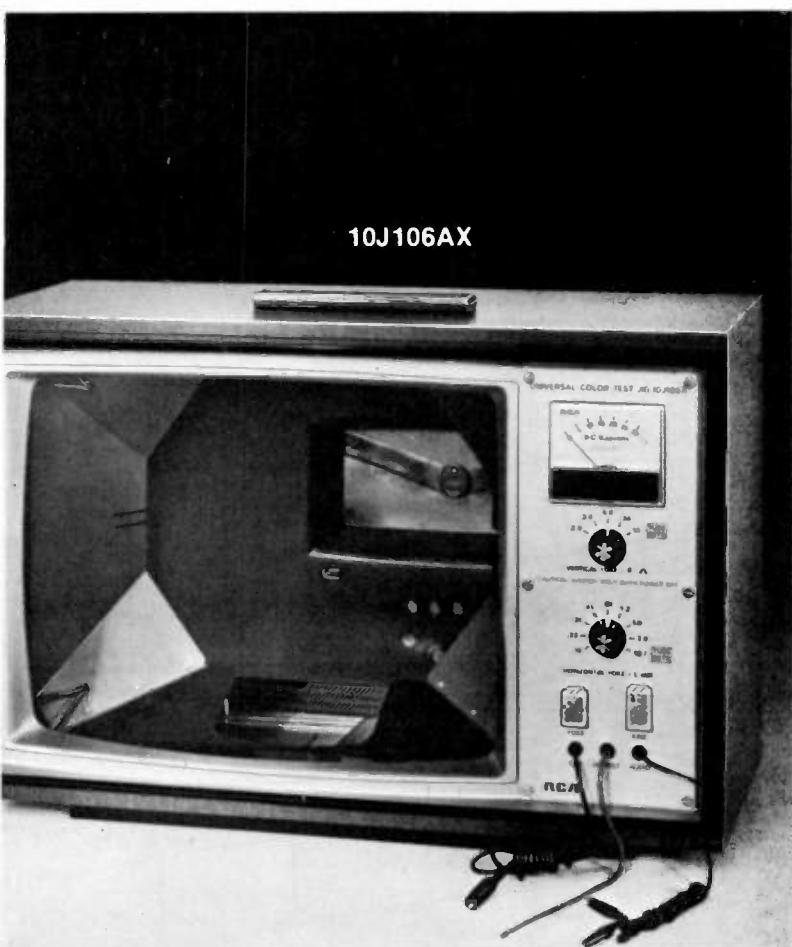
Whatever the size of the busi-

ness, proper utilization of technical talent is best accomplished first, by careful selection of service personnel, and secondly, by the physical arrangement of the service area. Each piece of equipment to be serviced should move (or flow) along an organized, efficient pathway from the incoming

counter to the pickup by, or delivery to, the customer.

One of the best approaches to bench flow improvement is outlined by author-technician Art Margolis in Chapter Two of his book "TV Bench Servicing Techniques" (TAB BOOK No. 682).

In Fig. 1, Margolis illustrates



With the new RCA 10J106A Color TV Test Jig you can troubleshoot a TV chassis without bringing the cabinet and picture tube into the shop. The 10J106A helps you isolate picture tube or chassis malfunctions quickly, and without disturbing your customer's picture-tube alignment.

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The new RCA 10J106AX Color TV Test Jig is exactly the same as the 10J106A except that it comes without a picture tube for those who prefer the economy of installing their own tube.

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the kind of shop layout he feels makes the most efficient use of everyone's skills. As he describes the operation, "All the routine is handled by unskilled but trained helpers, except for the actual pinpointing of a tough-dog defect. That job is performed by the benchman. The benchman also oversees all the routine and, of course, on occasion pitches in when it is necessary and convenient."

When a TV arrives at the shop described by Margolis, it has either been brought in by a customer, or a field technician has determined that the necessary repair can't be accomplished during a housecall. After a preliminary estimate of cost and completion time has been given to the customer, and it has been 'tagged' into the shop's bookkeeping system, the set moves on to a section that Margolis calls the 'quick-check station'.

The quick-check area of the shop is the last stop for the TV repair job before it moves on to the more costly service bench. It is manned by the trained but unskilled helper, and is equipped with tube tester, ohmmeter, stock of tubes, fuses, plug-in components, service literature and some replacement parts (Fig. 2).

At the quick-check station minor repairs can be made, and possibly the set can be repaired at a lower cost than expected by the customer. If the repair can't be completed in the quick check area, the helper pulls the necessary service literature, disassembles the set, and sends it on to the service bench.

At this point, the technician, or benchman, takes over. Margolis calls this the 'diagnosis station' (Fig. 3). "This is the area," Margolis says, "that makes or breaks a shop—where the bottleneck can develop. It is at this spot that the benchman works out the money-making puzzle—which part has the defect?"

"Every tool and piece of test equipment needed is carefully positioned around the chassis. If the benchman reaches for a probe and it's there, and he only has to glance over at a meter or scope for information," Margolis continues, "he works at his best. When he has to keep pulling, tugging, reposition-

ing, and getting into uncomfortable positions, he slows down, loses concentration, and does not work at his best. If he can work undisturbed, his concentration is unaffected."

The last step in service job flow as outlined by Margolis is called the "completed-job station." Here, repaired sets are readied for return to the customer (Fig. 4). Dust is removed with brushes and vacuum equipment. Last minute ad-

justments for linearity and height are made, knobs are tightened, and the cabinet is cleaned and polished. And at this last station, the set can be 'cooked' for an hour or more to check the repairs and uncover any other possible problems. Finally, the job is priced and entered in the shop bookkeeping as "repair completed—ready for pickup by, or delivery to the customer."

continued on page 53



Fig. 5—This is the new GTE Sylvania Electronic Work Station, a free-standing, self-contained unit requiring only electrical and antenna connections.

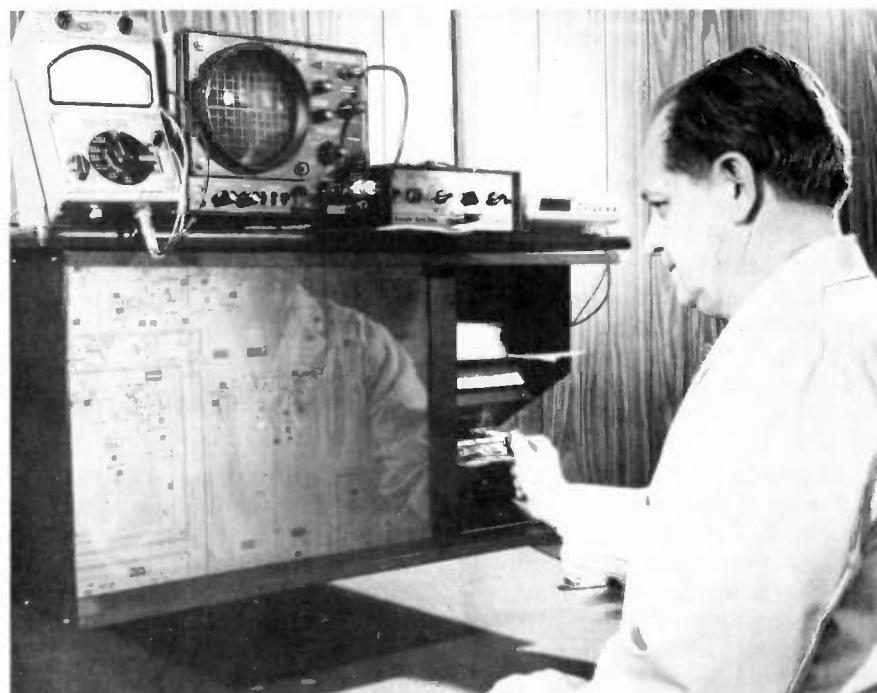


Fig. 6—This is a view of the microfiche system on GTE Sylvania's new Electronic Work Station. The reader projects images one-and-a-half times actual size. It can be rotated on a 'lazy-susan' basis.

GE Color TV for 1978

Part 1

By Don W. Mason

We examine General Electric's new infrared remote controlled electronic tuner—and a new portable color TV chassis



Fig. 1—GE's new remote control unit that uses infrared light to control their new electronic tuning system. Remote unit is on the left. Controls are repeated on the front panel of the receiver (right).



■ A tuning system that is totally electronic, a remote control system that uses infrared light, a new chassis for color portables, and modifications to last year's highly successful VIR "Broadcast Controlled" color system are the highlights in the General Electric color TV line for 1978. Also of interest is the practice introduced of enclosing with every 1978 color TV receiver a "mini-service" manual for use only by the technician.

As described by the general manager of GE's television department, Fred R. Wellner, "The VIR system automatically adjusts the color intensity and tint according to the vertical interval reference signal the set receives from the broadcaster; the electronic tuning system locks onto the channel frequency and requires no

fine tuning; the LDR system added to this year's VIR sets adjusts brightness, contrast and color intensity according to room lighting conditions; and the infrared remote system (Fig. 1) permits across-the-room set control. All the viewer needs to do is sit down in a favorite chair, press a button and enjoy."

ELECTRONIC TUNING & INFRARED REMOTE CONTROL

Based at least on GE's training and service manuals on the new tuning system and remote control unit, eventual service on the equipment should be relatively easy. The system is modular in construction and incorporates plugs and connectors to make servicing easier. A block diagram of the plugs and connectors is shown

in Fig. 2. No channel programming or service adjustments are required with the new system, and all components of the system can be replaced without the need for a service adjustment.

The new tuning system is crystal-controlled and requires no fine tuning. The tuner package is operated by a 15-key remote unit (Fig. 1) which includes an 11-key pad to randomly select any one of the 82 VHF and UHF channels, and four keys to control volume up, volume down, on/off, and mute functions. These controls are repeated on the front panel of the receiver with the exception of mute.

Infrared light commands are transmitted to the receiver rather than the sound waves generated by other remote units. Three infrared light emitting diodes are flashed on and off at specific frequencies by the remote unit. At the receiver, an infrared-sensitive light cell 'sees' the rapidly pulsating invisible light, interprets the command and performs the function called for. The unit has a range of up to 40 feet and is immune to false triggering by sonic signals. This immunity to sonic signals should simplify retail demonstration of the new receivers, as they will not interact with other receiver brands on the market today.

Several design features of the remote control unit make channel selection easier for the viewer. First, the system acts on only the last two channel digits entered. Multiple channel number entries are ignored except for the last two digits. This means the customer doesn't have to get technical assistance to "clear" his system of a series of incorrect entries. If an incorrect channel appears, he simply repeats the entry using the correct digits on his keyboard. This 'last-channel-entered' feature also means that the set remains on the last channel viewed even if it is turned off and on again.

Secondly, the unit features an "automatic zero" entry function. This allows the operator to enter only one number for single digit channels. For example, channel 3 is activated by pressing the

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number 3 key and the ENTER key. It isn't necessary to precede the 3 entry with a leading 0, as with some other random-access systems.

A Working Description Of the Tuner

An overall block diagram of the GE tuning system is shown in Fig. 3. The block diagram shows the inputs, outputs, and B+ distribution for the individual components of the system. As described in the GE training manual, the remote unit works with the tuning system as follows:

The *Remote Transmitter*, powered by a 9 volt battery, provides remote control stimulus via invisible light beam signals. The *Remote Receiver Module* detects the invisible emissions from the *Remote Transmitter*, amplifies them, and connects them to the *Remote Decoder Module*. The *Remote Decoder Module* also receives inputs from the front panel *On/Off/Volume* control assembly. The *Remote Decoder Module* decodes the commands from the *Remote Receiver* and *On/Off/Volume* controls and translates them into voltages and logic states. The *Remote Decoder Module's* outputs are: a DC voltage that activates the receiver's on/off function, a DC voltage that controls volume level, and logic states that initiate channel selection. The *Remote Decoder Module* also contains a low voltage power supply providing +5 and -13 VDC. These source voltages are present at all times and are used to "keep alive" the *Remote Receiver* and *Remote Decoder* when the receiver is turned off. This condition is necessary to allow the receiver to be turned on electronically. In addition, the +5 volt source is used in the *Tuner Control Module* to power the circuitry that remembers the last channel selected before the receiver is turned off.

The *Tuner Control Module* receives channel selection logic from both the *Remote Decoder Module* and from the *Channel Selector Keyboard* mounted on the receiver. The *Tuner Control Module*, as its name implies, provides DC controlling voltages to the UHF and VHF Tuners. The *Tuner Control Module* is connected in a

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Fig. 2—Block diagram of GE electronic tuning system showing plugs and connectors.

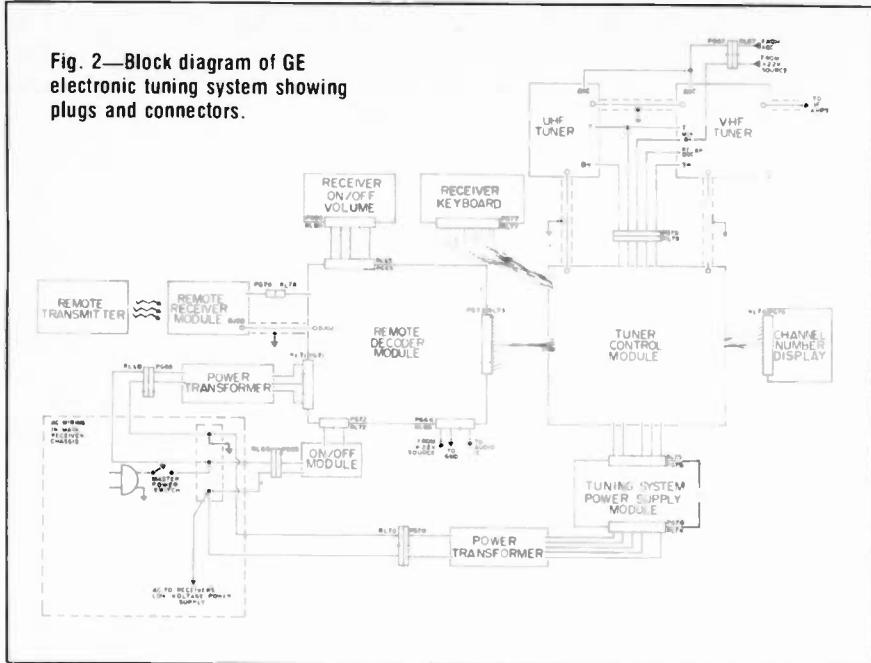
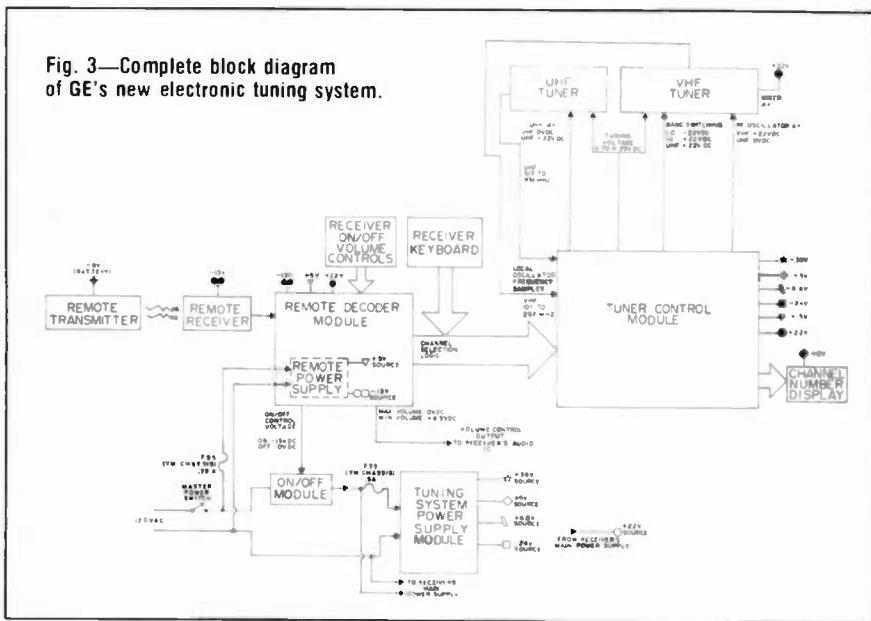


Fig. 3—Complete block diagram of GE's new electronic tuning system.



"closed loop" configuration with the *Tuners*. It samples the local oscillator frequencies from the *Tuners* and develops the necessary DC voltages that accomplish channel selection. The *Tuner Control Module* also provides the logic to program the *Channel Number Indicator*; a dual, seven-segment light-emitting diode display.

The electronic tuning system also contains an *On/Off Module* that controls AC power to the receiver's main power supply. And, finally, an independent *Low Voltage Power Supply Module* develops source voltages for the system's *Tuner Control Module*.

Varactor Diodes Used In Tuners

A device known as a varactor

diode is used in both VHF and UHF tuners in the new GE tuning system to make the frequency changes necessary for channel selection. A varactor diode is a semiconductor that can be used as a variance capacitor. The variance, or change in capacitance, is caused by reverse biasing the diode with a DC voltage. The diagrams in Fig. 4 show the capacitance change effect of varactor diodes.

As reverse bias is applied to a varactor diode, the charge carriers are attracted away from their normal P-N junction. This develops a 'depletion region', forming, in effect, a dielectric. The P and N material then serve as capacitor plates.

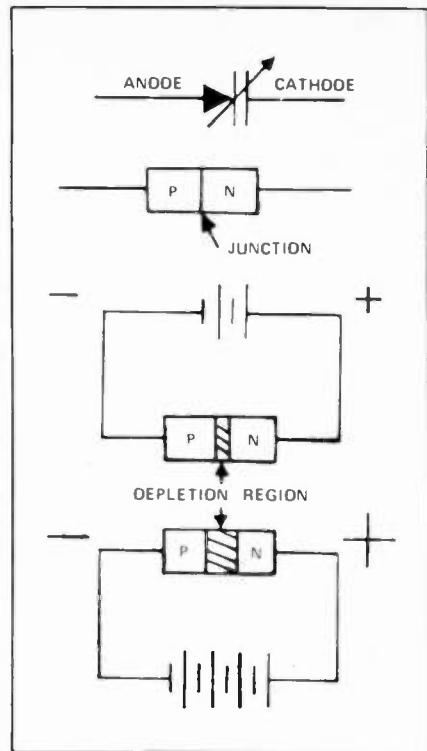


Fig. 4—Diagram of the capacitance change effect on the varactor diodes used in the GE electronic tuning system.

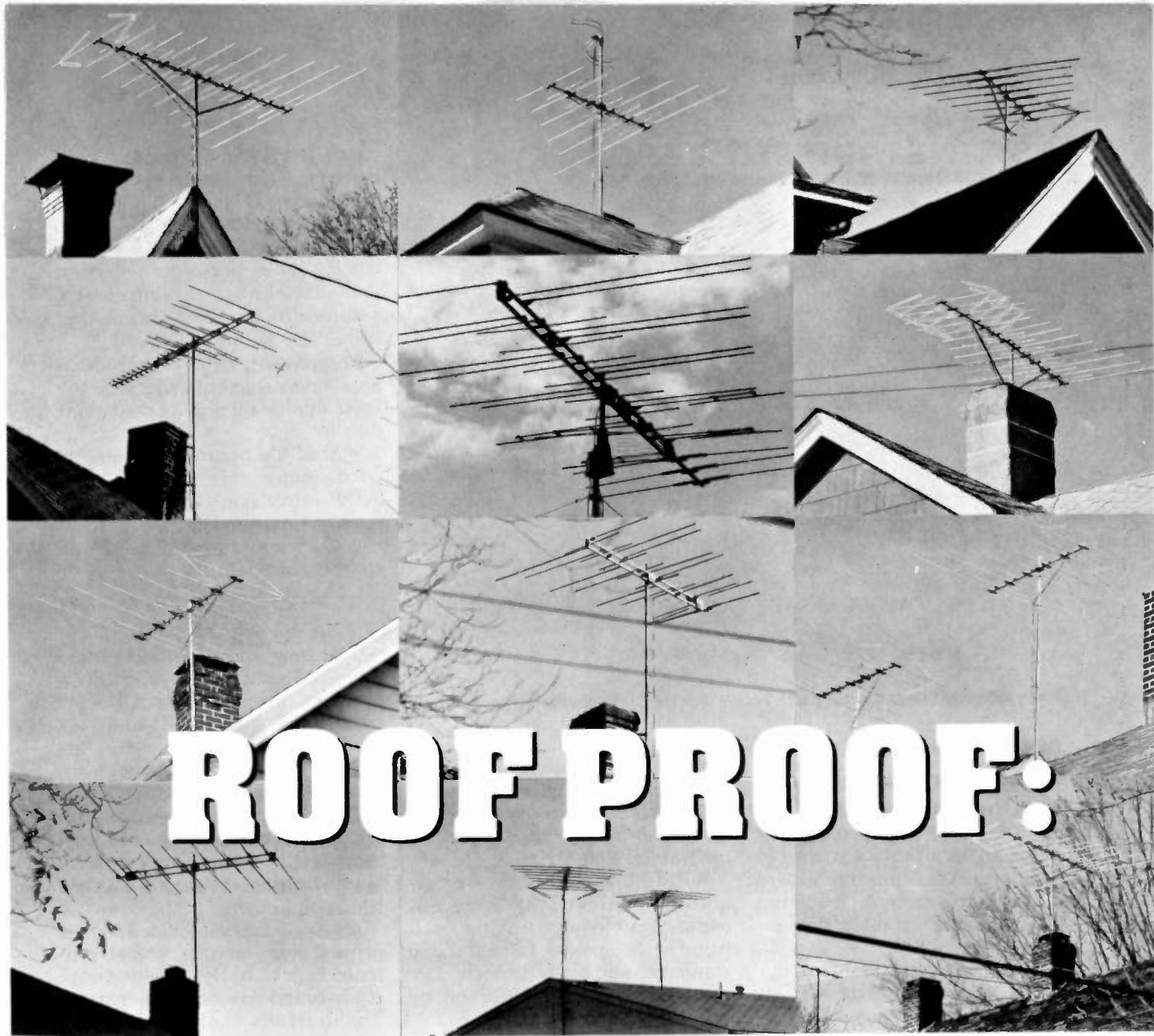
When the reverse bias applied is small, the capacitance is large because the dielectric, or depletion region, is thin. As larger amounts of reverse bias potential are applied, capacitance decreases because the thickness of the dielectric is increased.

In the GE system, the varactor diodes are combined with inductances to form tuned circuits, and thus the tuners become voltage controlled. Changes in the DC tuning applied to the tuners result in changes in the frequency selected by the tuners.

Other DC voltages are used to control the GE tuners, also. The selection of the UHF or VHF mode of operation is accomplished by applying and removing B+ voltages. And the bandswitching needed by the VHF tuner is accomplished by a DC voltage that acts on the diode switching circuitry.

IN PART TWO

Next month we'll take a look at the new "mini-service" manuals packed with each new GE TV for 1978, and what their design engineers have done to make troubleshooting easier. And we'll outline the construction and operation of GE's new portable color TV chassis, designated AA.



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TEST INSTRUMENT REPORT



For more information about this instrument, circle 154 on the Reader Service Card in this issue.

DATA PRECISION MODEL 585 PORTABLE FREQUENCY COUNTER

Data Precision's new Model 585 miniature, portable frequency counter packs a lot of worthwhile measurement features into a mere handful of instrument. Weighing in at less than 1½ pounds, the new counter offers:

- Direct reading and direct counting up to 250 MHz without any pre-scalers, add-ons, or extras.

- An automatically positioned decimal point for resolutions of 10 Hz, 1 Hz, or 0.1 Hz with front panel selectable gate times of 10 seconds, 1 second, or 0.1 second, respectively.

- 4 hours of continuous full performance operation from a fully charged internal battery module.

- Continuous recharge of the battery when AC is connected via a standard (no extra) line-cord charger unit, whether or not the instrument is in use.

- Matching to high or low source impedances with front-panel switchable input impedance of 50 ohms or 1 megohm.

- Wide amplitude range of input signals accommodated by using front-panel switch selectable attenuations of unity, x10, or x100.

- Stable, jitter-free readings

when normal mode noise components of the input signal may be front-panel attenuated below the 10 mVRMS sensitivity threshold up to 50 MHz, and below 20 mVRMS to 250 MHz.

- Reliable, long-life performance, achieved by reduced-parts-count design, using cool-running, low power, LSI chips and standard solid state devices.

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SPECIFICATIONS DATA PRECISION MODEL 585 PORTABLE FREQUENCY COUNTER

FREQUENCY RANGE: 10 Hz to 250 MHz.

DISPLAY: 8 digits, 0.3 inch LED; Decimal point, automatically positioned; gate indicator; overflow indicator; low battery voltage indicator.

SENSITIVITY: 10 mVRMS, 20 Hz to 50 MHz; 50 mVRMS, 50 MHz to 250 MHz.

GATE TIMES: .1 sec, 1 sec, 10 sec.

RESOLUTION: 10 Hz, 1 Hz, 0.1 Hz.

INPUT IMPEDANCE: 50 ohms, 1 megohm.

INPUT ATTENUATOR: x1, x10, x100.

ACCURACY: ± (1 count + time base accuracy)

TIME BASE: Frequency: 6.5536 MHz. Accuracy: ±0.01 ppm/sec; ±0.6 ppm/mo; ±4.0 ppm/yr.

MAXIMUM INPUT LEVELS: @50 ohms input impedance: 500mW; (5 VRMS) @1 megohm input impedance: DC to 10Hz: 200 VRMS; 10Hz to 100 KHz: 250 VRMS; 100 KHz to 5 MHz: 2.5 x 10⁷V x freq.; 5 MHz to 250 MHz: 5 VRMS.

TEMPERATURE: Operating: 0° to 40°C; Storage: -25° to +50°C.
SIZE: 5½ inches x 1-¾ inches x 3½ inches.

PRICE: \$345.00 (including carrying case and charger).

using a crystal-controlled time base generator circuit specified to ± 4 ppm/year and ± 5 ppm over the temperature range of 0 to 40°C.

- Reliable performance from measurement-to-measurement, obtained by the short-time stability of the standard crystal of ± 0.01 ppm/sec, providing repeatable measurements even to the least significant digit of the 8-digit display.

- Absolute accuracy settable to ±0.01 ppm.

Data Precision's Model 585 Frequency Counter is priced, including the vinyl carrying case and charger, at \$345.

EICO MODEL 480 TRIGGERED SWEEP OSCILLOSCOPE

The new Eico 480 solid state triggered oscilloscope offers, at a medium price, DC to 10 MHz bandwidth, AC and DC coupling, an 11-position calibrated attenuator, 10 mV/cm sensitivity, and push-button operation.

The vertical deflection sensitivity, horizontal sweep speeds, and band-width response are said to be ample for the servicing of all electronic equipment.

Major circuitry is located on four printed board circuits with all controls functionally grouped and color-coded for easy operation. Pushbuttons make it easy to change operational modes. And the model 480 features a custom-molded bezel, or front panel, that is designed for standard camera mounting.

The Eico scope offers a built-in TV sync separator that automatically selects frame or line triggering in conjunction with the sweep speed setting. It has a calibrated time base for easy location of problems, and digitally-controlled trigger circuits that require only a level control and a slope switch.

With the Model 480, a reference base-line display is generated even when the trigger signal is absent. And the sweep speed is calibrated in 21 steps with a 1-2-5 sequence (from 0.1µs to 0.5s). A control on the time base switch provides variable (uncalibrated) sweep speed. A calibration voltage of 0.2V p-p square wave is avail-

Pay less, get more.



For more information about this test instrument, circle 165 on the Reader Service Card in this issue.

able for probe adjustment.

The new scope has a fully regulated power supply for the vertical amplifier and horizontal sweep circuit that provides stable voltages regardless of varying line voltage and load conditions.

The model 480 is supplied with a high quality, high impedance, low capacity probe which minimizes circuit load while testing with a 10:1 ratio.

Eico's Model 480 is fully assembled and priced at \$425.00.

SPECIFICATIONS

EICO MODEL 480

TRIGGERED SWEEP OSCILLOSCOPE

VERTICAL AMPLIFIER: Sensitivity; 10mV/cm to 20V/cm, Attenuator; 11 steps in 1-2-5 sequence, Vernier; Continuously variable between all ranges, Accuracy; + 3%, Bandwidth; DC coupling—DC to 10 MHz, AC coupling—2Hz to 10 MHz, Rise Time; 35ns, Overshoot; 5%, Impedance; 1 MΩ shunted by approximately 35 pF, Input Coupling; AC, DC or GND selectable. Max Input; 400V.

TIME BASE/SWEEP: Ranges; From 0.1 us/cm to 0.5 s/cm, 21 steps in 1-2-5 sequence. Accuracy; + 5% in calibrated position, Variable; Continuously or external signal, Baseline; Displayed in absence of input signal.

TRIGGERING: Internal; Approx. 10 Hz to 10 MHz, External; Approx. 10 Hz to 10 MHz, External Impedance; Approx. 1 MΩ shunted by 40 pF, Line; Triggers on line frequency, TV Sync; requires approx. 2 cm of video signal to trigger, automatic frame (0.5 s/cm to 100us/cm) and line (50 us/cm to 0.0 us/cm).

CATHODE-RAY TUBE AND CONTROLS: CRT; Type 130 BEB31 (standard phosphor) flat face, Acceleration Potential; 2kV, Graticule; 6 x 10 cm, Probe Adjustment; Approx. 0.2V p-p 3kHz square wave. Intensity Modulation; + 10V, 2 Hz to 1 MHz.

EXTERNAL HORIZONTAL INPUT: Bandwidth; DC to 1 MHz, Coupling; DC, Deflection Factor; At X mode attenuator in 1:1 pos. 1V/cm, Input Impedance; Approx 1 MΩ shunted by 40 pF, x-y phase shift less than 5° at 100 kHz.

GENERAL: Power; 120 V, 50-60 Hz; Weight, 23 lbs.; Dimensions, 8½ inches by 8¾ inches by 16 inches. Price: \$425.00



Lots more. In fact, the new 8020A digital multimeter has more features and capability than any other DMM at any price.

Once again, it pays to think small. Costing only \$169*, the 8020A is big on features and value.

You get unbelievable field versatility with the 8020A, and it's sized to slip easily into your pocket or service kit. Compact, with big features—like 0.25% dc accuracy and 26 ranges. Conductance ranges for measuring leakage to 10,000 MΩ, or transistor beta. Ten megohm input resistance, ac and dc. Battery powered, with a large liquid crystal display.

For reliability, we've shrunk the number of total parts to only 47, including the world's first custom LSI CMOS multimeter chip.

On-the-job reliability you can't be without. A full-year guarantee. Worldwide parts and service. And more, including the traditional Fluke quality you depend on.

Call (800) 426-0361, toll free. Give us your chargecard number and we'll put an 8020A in your hand immediately. (Or a ten-pack of 8020As for only \$1521*.) Call now for the location of the closest Fluke office or distributor.

*U.S. price only.

Fluke 8020A DMM for Field Service: \$169.

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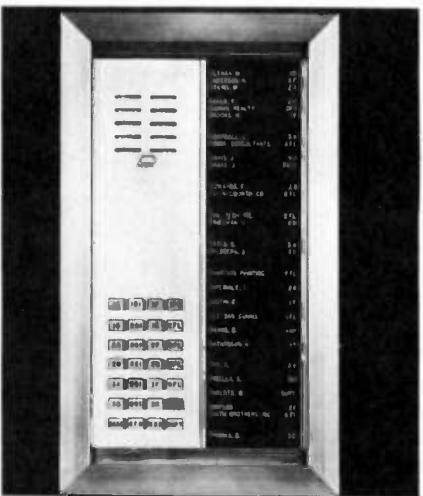
DEALER SHOWCASE

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

INTERCOM PANELS FOR BUILDING LOBBIES

148

A new line of panels for building lobby intercoms has been introduced by Lee Dan Communications. Called



the Van-guard panel, the new product is manufactured from heavy gauge solid aluminum, including the push button. The panel has a swing-away design feature for easy servicing, and a directory panel window of unbreakable Lexan. The panel can be custom-built to your design for use in almost every existing system. Panels feature contemporary styling and are available in most anodized finishes.

INDOOR TV ANTENNAS

149

Three new indoor TV antennas have been added to the RCA TV antenna line—models 2SL20, 2SL40 (shown), and 2SL60. The three models offer

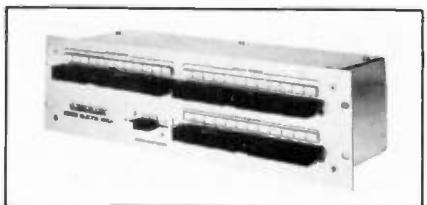


modern coordinated styling, step-up features at important price points and full-color, in-store display packaging. Features such as separate UHF/VHF transmission lines, telescoping VHF FM arms, high-gain UHF loop, multi-position signal-tuning switch, high IMPAC plastic cabinet, and weighted, felt base are included with progressive refinements model to model. Dealer prices are \$7.95 for the 2SL20, \$13.95 for the 2SL40, and \$18.95 for the 2SL60.

CENTRALIZED STEREO DEMONSTRATOR

150

A new centralized system for hi-fi dealers to quickly, conveniently demonstrate over 1,700 combinations of stereo program sources, amplifiers/receivers and speaker systems has



been designed by *Switchcraft, Inc.* The Stereo Selector System Model 640R is a single unit to which up to 12 program sources, 12 amplifier/receivers and 12 speaker systems can be patched. Designed for rack or console mounting, the system features a master control to adjust volume. Full lamp power switching and connecting design provides the option of wire-in lamps to indicate exact position of the speaker enclosures being demonstrated. Priced at \$850.

REMOTE 40-CHANNEL CB RADIO

151

Two new 3-piece remote 40-channel CB radios have been introduced by the *E.F. Johnson Company*. Model 4330 is a three-piece mobile unit consisting of a transceiver chassis which can be mounted under the driver's seat, in the trunk, or virtually any remote location to discourage theft; a speaker/interconnect unit; and a detachable microphone/control head. Model 4330 is priced at \$199.95. Model 4360 is also a three-piece unit with a remote trans-



ceiver chassis, a speaker cabinet/interconnect module and a detachable radiotelephone style handset microphone/control head. It is priced at \$229.95

STEREO EQUIPMENT RACK 152

A new decorative stereo equipment rack called Audio-File has been introduced by *Hammond Industries*. The new 48-inch high rack takes up a floor area of 22 inches by 19 inches. It has a main frame with brushed aluminum finish and black plexiglass panels. The new rack allows the mixing of rack-mounting and free standing equip-



ment with the same unit. It is packed in easy-to-assemble kit form and sells for about \$350.

BATTERY WARMER 153

A battery warmer for all vehicles is being introduced by *Dynamic Instrument Corp.* The new device is said to



keep the battery warm, active and at peak power for cold weather starts, and when you go away or do not use your vehicle for a while. Called the Coldstart, the device plugs into the vehicle's cigarette lighter receptacle and into a 110-volt AC outlet in garage or home. It keeps the battery warm through electrolytic action, and when left on for a long period of time, also trickle charges the battery. Is UL and CSA approved. ■

Smaller makes sense.



In the tradition of mini-computers and mini-skirts, great small products usually evolve from larger packages.

The new 8020A digital multimeter carries on the Fluke tradition of precision bench-top instrumentation, with this handheld, 13-oz. DMM. Same quality and value, smaller package. And only \$169.*

Your 8020A goes on call with you in your pocket, briefcase, or tool kit. Wherever your job takes you and your 8020A, you can count on bench-instrument performance.

Small in size, but big in capability, with features like 2000-count resolution, transient protection to 6000V,

six resistance ranges to 20 MΩ. Plus, an exclusive conductance capability for leakage measurements to 10,000 MΩ!

And, traditional Fluke quality and accuracy are guaranteed for a full year. Parts and service available worldwide. And that's meaningful when it's from the recognized leader in DMMs.

Get your hands on one. Call (800) 426-0361, toll free. Give us your chargecard number for same-day shipment. Or, we'll tell you the location of the nearest Fluke office or distributor. (Where you can save by buying a ten-pack of 8020As for only \$1521.)

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Models available for virtually every communication coaxial cable:

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UT-5800	trims RG-58/U	for PL-259
UT-5900	trims RG-59/U	for "F"
UT-5901	trims RG-59/U	for PL-259 or TV wall plate
UT-6000	trims RG-6/U	for "F"
UT-8000	trims RG-8/U	for PL-259

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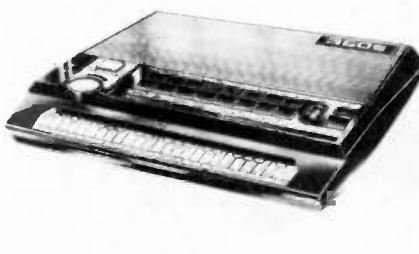
NEW PRODUCTS

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

MINI-SYNTHESIZER

155

A mini-music synthesizer the size of a portable typewriter that is said to be able to provide the sounds of almost every orchestral instrument has been introduced by *Audio Arts*. Called the Stylophone 350S, the new instrument is played by sliding a pencil-like stylus across the numbered areas of a keyboard printed on a flat metal plate to produce 44 notes with a frequency



range of six and one-half octaves. By depressing one or more "tone" switches, sounds of a piano, violin, flute, piccolo, bassoon, church organ, trumpet, clarinet and mandolin can be created, plus totally original sounds. By using both styli, two sounds in harmony can be created. The 350S weighs less than five pounds and is equipped with two batteries.

VEHICULAR TV ANTENNA

156

A new television antenna system for use in recreational vehicles, vans and boats has been introduced by *RCA*. Called the Mini-State antenna, the new system operates from either a



12-volt DC battery or 120-volt AC house current. Since recreational vehicles and boats change direction with respect to TV broadcast antennas, the unidirectional antenna of the Mini-State system can be rotated with a hand-held remote control unit to locate the best signal. The directional

UHF-VHF antenna rotates inside a weather-protected, rugged, polyethylene radome which also houses a solid-state amplifier, interference filter, and motor-driven rotator. Weighing only six pounds, the new antenna comes with a 30-foot coaxial cable with attached connectors combined with three-wire rotator cable. Priced retail at \$99.95.

SOLAR TEMPERATURE CONTROLLER

157

A miniature solar heating temperature controller of modular construction designed for contractors and others who want to develop their own solar heating control systems is being offered by *Pak-Tronics, Inc.* Designated Model 976 Delta "T", the new control module is the heart of a control system for solar heating applications. It provides a 24 volt .1 ampere signal



to close a remote relay when a differential temperature exists between the two remote sensors located in the solar heat collector system. The operating temperature differential is easily field adjustable from 3 to 15°F, with a screwdriver. The module, which is epoxy encapsulated, operates on 50/60 cycle, 120-140 VAC. It sells for \$49.

HEAVY DUTY CB POWER SUPPLY

158

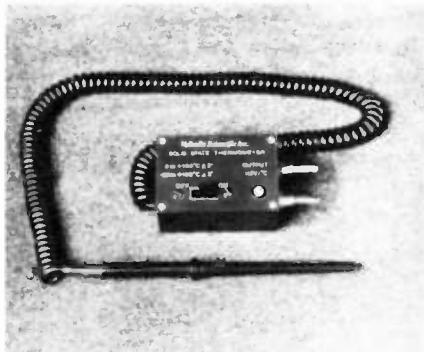
A new heavy duty 13.6 volt DC power supply capable of handling the requirements of CB's new 40-channel AM and SSB radios is now available from *Communications Power, Inc.* Designated the CPI Model PS-5, the new power supply is rated 5 amps continuous and will deliver its full 13.6 volts of power, it is said, under all con-



ditions. The electronically regulated unit features short circuit protection, a heavy gauge aluminum case and a full one-year warranty.

DIGITAL TEMPERATURE PROBE 159

A new temperature probe designed to indicate heat rise in motors, transformers, heat sinks and transistor cases has been introduced by *Valhalla Scientific*. The new probe, called the "Temp", is a constant current battery powered bridge circuit which uses a solid state temperature sensor. An output of $1\text{mV}/^{\circ}\text{C}$ is produced for dis-



play on any digital multimeter having a 200 millivolt DC full scale range. A $\frac{1}{4}$ inch spaced dual banana plug connector body houses the printed circuit assembly and 9 volt battery. The probe is connected to the housing via a spiraled retractable 20 inch cord which has an extended length of six feet. Sensor is embedded in a low mass brass tip for improved thermal response time. Priced at \$125.

IGNITION NOISE FILTER 160

A new filter to correct the problem of transceiver noise from the vehicle's ignition circuitry has been introduced by *Cornell-Dubilier*. The filter, CBFT315D, is said to correct the noise by reducing both radiated and conducted noises from the car's coil/point assembly. The unit mounts directly onto the ignition coil with no additional parts, nuts or bolts. The thread arrangement on the filter is metric on one end and standard on the other so it can be used with either domestic or imported vehicles. It is rated at .1 Mfd, 20 amps and incorporates 600 volt



You have your own calculator. Why not a DMM?



Finally, a digital multimeter that's yours, just like your pocket calculator, and more useful. Only \$169.*

You pack only 13 ozs. in your pocket or service kit, but size is deceptive. The 8020A has more useful features than any other multimeter available—at any price! Features like 26 ranges and seven functions, including *conductance*, 2000-count resolution, Hi/lo power ohms.

And it's rugged. The high-impact case protects a minimum number of component parts (47 in all), and they're all readily available from any of the worldwide Fluke service centers. Your 8020A is factory calibrated by NBS traceable equipment. And we guaran-

tee it'll live up to published specs for a full year.

The 8020A is a true field instrument, designed with a highly readable LCD display, and inexpensive 9V transistor battery power for continuous use up to 200 hours. Reliability, quality and value: *that's Fluke tradition*.

To get your hands on one, call (800) 426-0361, toll free. Give us your charge-card number and we'll ship an 8020A the same day. Or, we'll tell you the location of the closest Fluke office or distributor (where you can save by buying a ten-pack of 8020As for only \$1521*).

*U.S. price only.

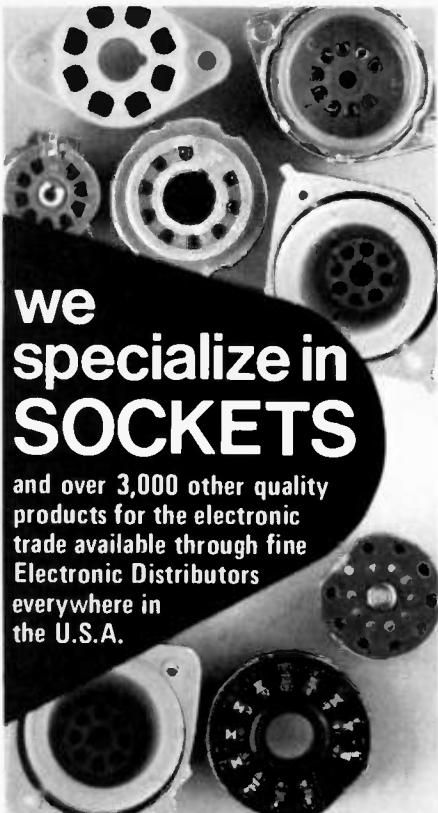
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construction to guard against high voltage inductive "spikes" present at the coil terminal.

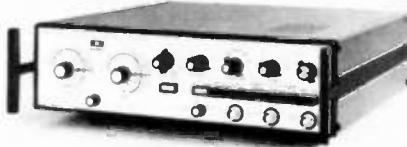
FREQUENCY COUNTER KITS 161

Three new frequency counters in kit form have been introduced by the *Heath Company*. Designated models IM-4110, IM-4120 and IM-4130, the new counters cover the ranges from 5 Hz to 110 MHz, and 5 Hz to 250 MHz, and 5 Hz to 1 GHz respectively. Heath says the new counters offer excellent accuracy and resolution for a number of counting jobs including: CB, AM and FM, hi-fi equipment, marine and aircraft radio, military applications

and land mobile. Frequency readout is provided by a large red 8-digit LED. A switchable attenuator on the 110 MHz input divides the input signal $x1$, $x10$ or $x100$ for measurement of large amplitude signals. The IM-4110 is priced at \$189.95, the IM-4120 at \$329.95 and the IM-4130 at \$529.95. Fully assembled counters at slightly higher prices.

LOG SWEEP FUNCTION GENERATOR 162

A new 5 MHz, 100,000:1 log sweep function generator with a 30V P-P output is now available from *Exact Electronics*. Designated the model 508, the instrument is actually two generators in one. The main generator is a VCF generator covering 0.0001 Hz



to 5.5 MHz and producing sine, square, triangle, pulse, haversine, and havertriangle waveforms. The other is a ramp generator that produces ramps with periods from 10 μ sec to 100 sec, and is used for direct output and for

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sweeping, triggering, and gating the main generator. With the model 508, you may sweep either up or down, linearly (up to 1000:1) or logarithmically (up to 100,000:1). The start and stop frequencies are independently settable and both may be easily set and measured. As a pulse generator, the 508 uses the ramp generator to trigger the main generator. Pulse output of either polarity may be selected. Priced at \$745.

DE-SOLDERING BRAID

163

A new feature has been added to de-soldering braid from *Wik-it Electronics*. A new built-in color in the braid indicates exactly where to snip off used braid with no waste. A typical de-soldering of a connection is said to

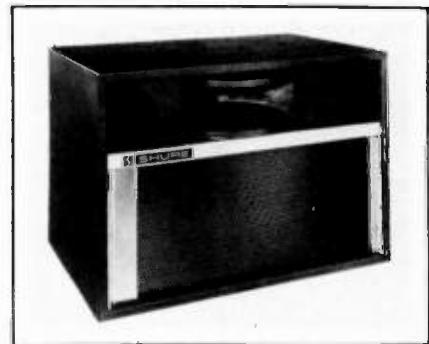


now use only a half cent's worth of the product. The flux coating of the braid is smooth, continuous and non-powdering. The non-spattering metallic substance wicks up solder without leaving corrosive or conductive traces on the part. Wik-it braid is available in 5-foot rolls of 1/16 inch braid at \$1.49, or 1/8 inch braid at \$1.69.

LOUDSPEAKER SYSTEMS

164

Two new loudspeaker systems that feature high output capability, high power handling ability and wide frequency response, have been announced by *Shure Brothers, Inc.* Des-



ignated the SR112 and SR116, the two speakers have identical performance characteristics, but the SR112 is designed for permanent installation in-

SpaceSaver: New RCA Flameproof Film Resistor Kit



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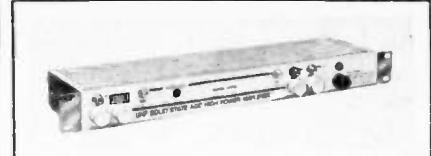
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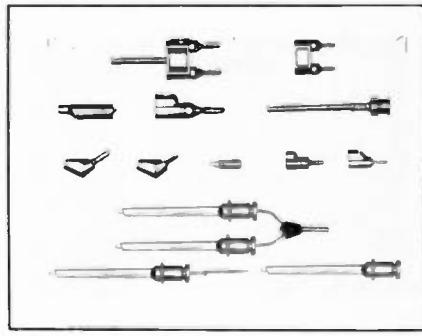


tronics. The amplifiers feature AGC to compensate for fluctuations in incoming signals. A separate unit is available for each UHF channel. Typical output capability at 0.5 dB sync compression is 72 dBmV (4.0 volts). Gain is 60 dB and output range is 63 to 72 dBmV, with full AGC. The AGC holds the output constant, within 1 dB for input variations over a 30 dB range. They are designed for rack or wall mounting, convenient test points are provided for both input and output, and are unit priced at \$350.

HOOKON TEST PROBES

169

A new test probe that permits direct attachment to wires via a number of terminations has been developed by *Herman H. Smith, Inc.* Called the "Hookon, Jr.", the new probe is supplied ready for soldering to existing test leads; with a tinned lead for



attaching user terminations; or complete with different terminations that have 24AWG test lead wire in various lengths from 12 inches to 60 inches. A precision hook-shaped tip extends to attach to bare wires, wire wrap terminations, component leads and pins. Contact can be locked in the extended position for touch-contact to P.C. board solder pads and solder junctions.

TIME/FREQUENCY COUNTER

170

A new frequency counter that also includes a 12 or 24 hour digital chronometer has been introduced by *Pride Electronics*. Designated the TF-1000, the new counter incorporates F.E.T. switching techniques to allow automatic switching from chronometer to counter when transmitting. The chronometer continues to function and its display will return when the transmitter is turned off. Frequency readout is from 1 to 40 MHz, with large $\frac{1}{2}$ inch 6 digit L.E.D.'s with pin-point colons and decimal point. Front panel function includes a

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time/auto switch and rear panel switches are for Fast Set, Slow Set, Hold Time, 12 or 24 hour clock display. Model TF-1000 operates on 115 volts AC at 35 watts. The unit weighs 2 pounds. ■

BENCH SETUP

continued from page 37

Margolis states that in his "25 years of independent service work I have used the same flow procedure working by myself with part-time help, or with up to 20 men." The important thing according to Margolis is to set up the stations in your mind. The stations can be the same bench or separate benches. The procedure naturally has to be adjusted to fit each particular operation.

SERVICE BENCH EQUIPMENT

Take a close, analytical look at your own service shop setup. Chart the flow of service jobs from receipt to completion—and from this determine where the principle of labor utilization and equipment setup can improve the flow.

Every well-organized service

shop we have visited has arrived at somewhat the same "flow" idea of service production—but each has arrived at that point in their own way. Up to now, the construction of the benches or work stations has been mostly a custom-built proposition, with each shop building their own.

Now, a national TV set and component manufacturer, GTE Sylvania, has developed and is ready to market a ready-built work station for electronic servicing (Fig. 5). This new electronic work station is a free-standing, self-contained unit requiring only electrical and antenna connections. It can be operated by a single technician, or using the team concept, by two men. It can be relocated easily, something which cannot be done with fixed one-man work benches. It has been developed on a modular concept so that a shopowner can buy the complete work station or only the portions he thinks he will need.

The Sylvania unit features a microfiche system (Fig. 6) which projects images, one and one-half times actual size, of electronic

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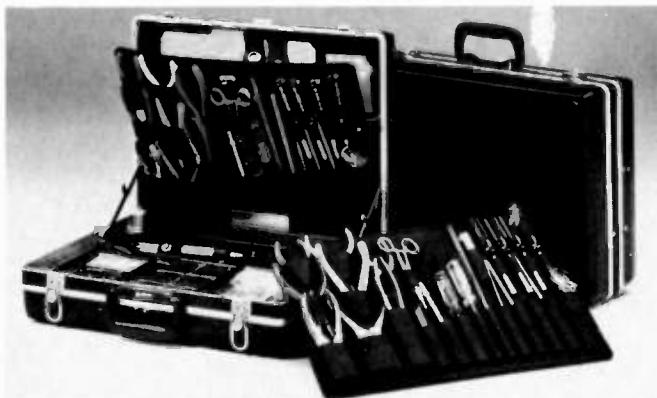
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equipment servicing information, such as schematics, on an easy-to-read screen. The station can accommodate a complete microfiche library of basic servicing and other information for all television sources, conveniently indexed for easy access. The microfiche reader is mounted on a 'lazy susan' type of platform so that it can be made available to all positions of the work station simply by turning.

In addition, the new work station includes: independent swivel-mounts for test instruments; a built-in isolation transformer with 1000 watt primary and 350 watt secondaries; two sets of tool and bin stock drawers, each with six drawers; sufficient space for oscilloscopes, dot/bar and sweep/marker generators, V.O.M. and other test equipment; non-isolated outlets for lights, soldering irons, and power tools; and one isolated outlet for each of three car positions. Attachable TV carts and test figs for chassis diagnosis or "cooking" are available options.

This new Electronic Work Station seems to fit quite well with the 'production line' or 'flow' con-

cept of electronic servicing that we outlined earlier in this article. It can accommodate from one to three technicians working on a 'team' concept of servicing.

One man, using the work station, could be working on one set at one position, have another TV waiting for parts, and a third set, with repairs completed could be cooking.

When the station is used by two technicians, either both could be working together as a team, or each could be working individually. At the same time, the third position of the work station could be used by a field, or road, technician when he finishes his route work early, for 'quick service', or by a supervisor who needs to check out a particular problem.

Conceivably, the new equipment could be easily adapted to the Art Margolis '3-station' service set up outlined earlier. The 'quick-check' station, the 'diagnosis' station and the 'completed-job' station could all be accommodated in a relatively small shop by the new Sylvania work station. Additional work stations could



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simply be added for larger service operations.

The work station is being distributed by GTE Sylvania through their regular distributor network. The suggested dealer price for the entire 3-station unit, including the microfiche reader, is expected to be about \$795. ■

PHASED LOCKED LOOPS

continued from page 31

fects go haywire, then lock-up may tend to take a few seconds, resulting in a hanging condition in which the rig is off frequency. Some PLL C.B. sets are equipped with a LOCK light that will not turn on unless the phase detector indicates a locked condition. Alternatively, some C.B. sets have an UNLOCKED light that turns on for exactly the opposite reason (sigh, standardization anyone?)

Phase locked loops can be expected to be as troublesome to service as any feedback servo-system. This is somewhat less of an aggravation in certain C.B. sets, however, because several I.C. manufacturers, especially the Japanese,

have come up with I.C.'s that will perform almost all PLL frequency control functions in a C.B. transceiver. ■

OUTLOOK '78

continued from page 22

models featuring the improved "Color-Rite" picture control system.

The line includes portables in the 15 and 19 inch sizes, table models with 21 and 25 inch screens, and consoles and home entertainment center units with 25 inch screens.

The Color-Rite system is pre-programmed to automatically help maintain picture quality through the special circuitry which monitors and corrects for proper flesh tones.

Sony, the designer of Betamax, is presenting five Trinitron Plus color models, including a 21 inch model featuring top-of-the-line remote control features. The Japanese company is also offering six black and white AC/DC models, including a new 9-inch portable. ■

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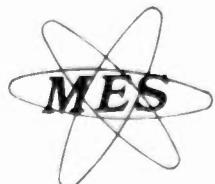
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