
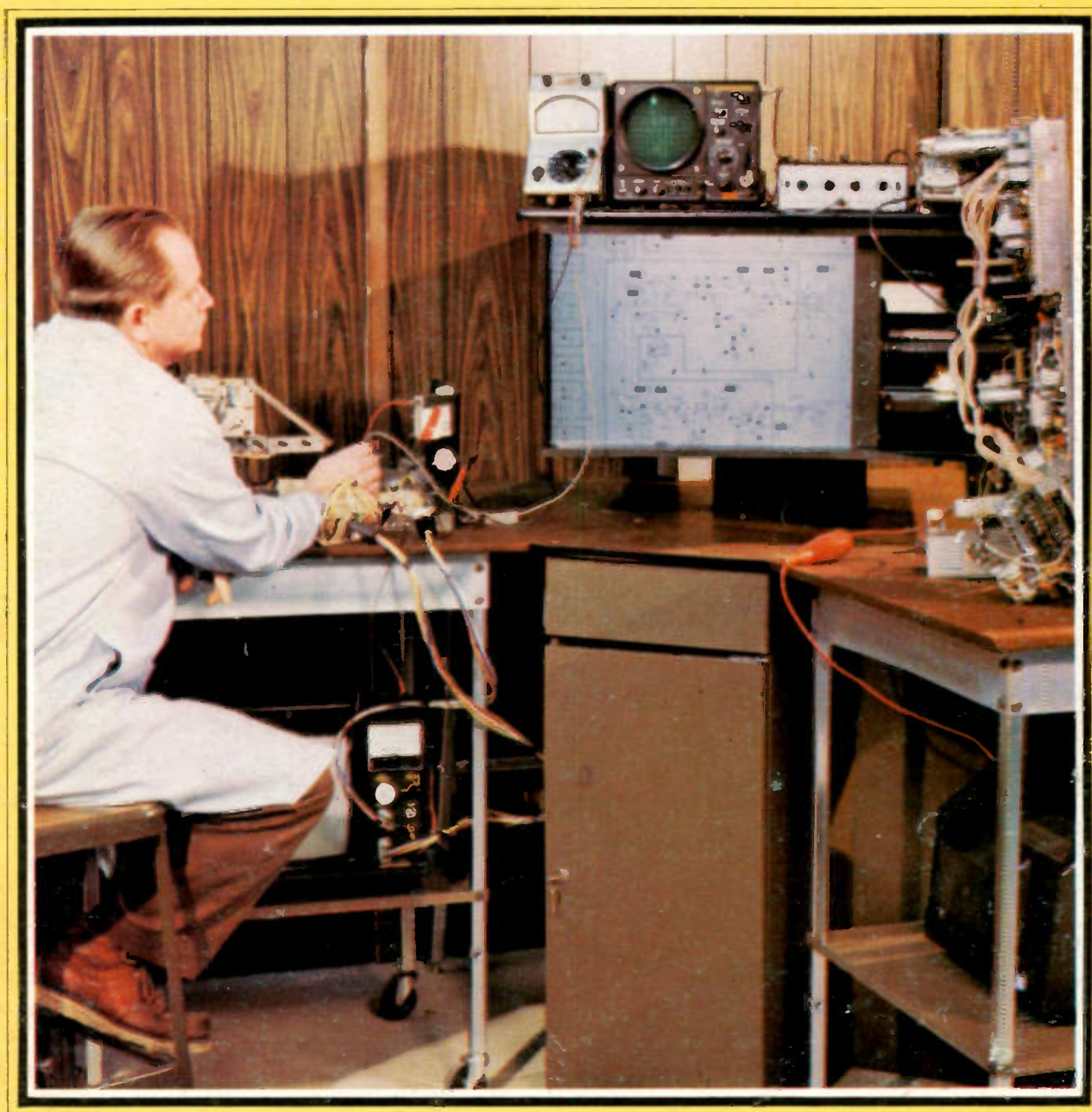


SEPTEMBER 1977 • 75 CENTS  A HARCOURT BRACE JOVANOVIĆ PUBLICATION

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

Some practical applications

ALL IN A DAY'S

WORK

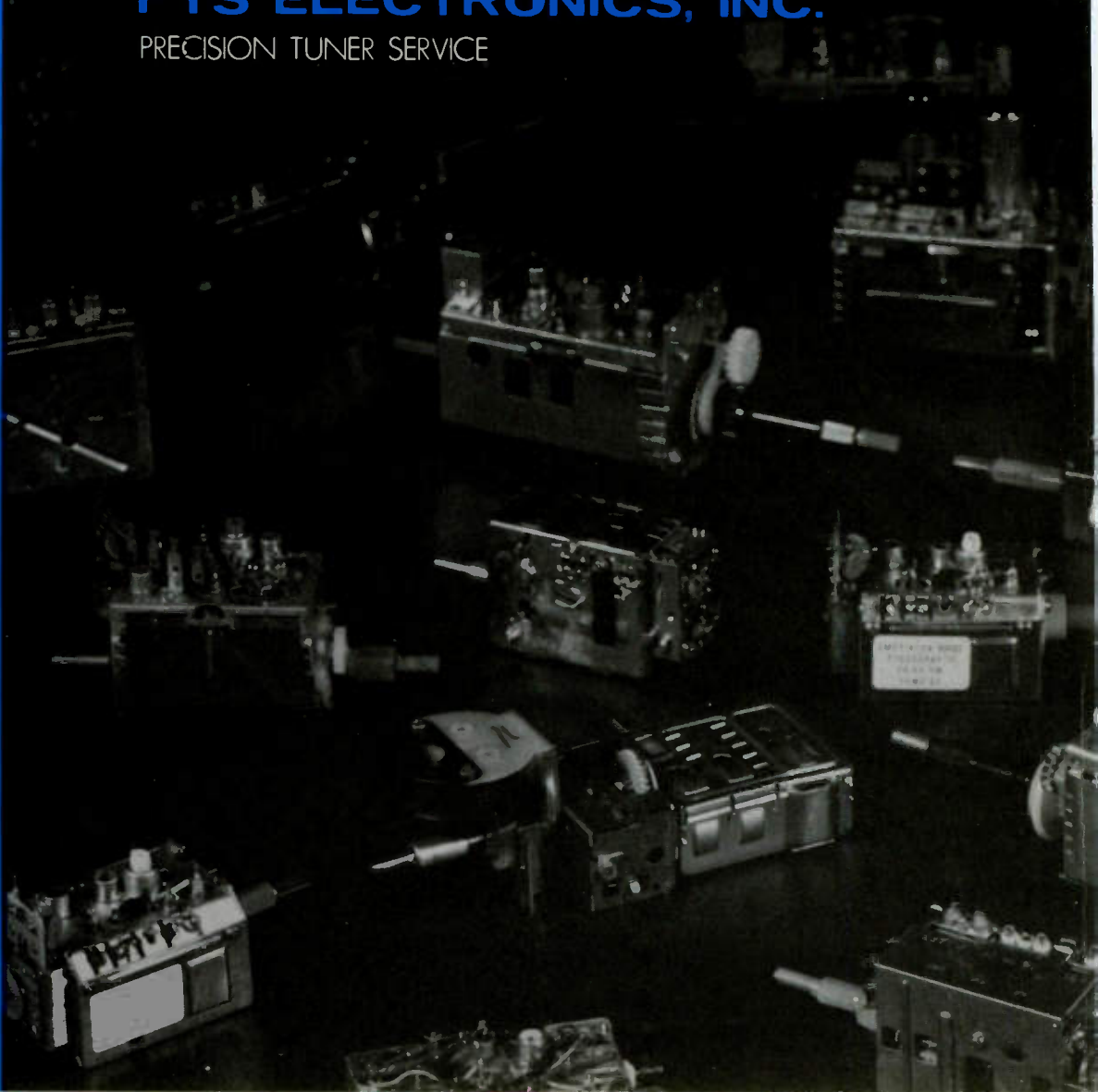
PTS Electronics repairs more tuners than all other tuner repair companies combined. With company-owned Servicenters located throughout the United States and Canada, PTS can provide same-day service on any make or model color, black and white, tube, transistor or electronic/varactor tuner. Our technicians use original parts, and the repaired unit is returned to you in a protective package. Plus, our service is covered by a one year limited warranty on workmanship and parts.



A complete listing of all PTS Servicenters appears on the opposite page.

PTS ELECTRONICS, INC.

PRECISION TUNER SERVICE



PTS THE WORLD'S LARGEST TUNER REPAIR COMPANY

SERVICENTER LOCATIONS

MIDWEST

Home Office
BLOOMINGTON, IN 47401
5233 S. Hwy. 37, P.O. 272
812-824-9331
CLEVELAND, OH 44134
5682 State Road
216-845-4480
KANSAS CITY, KS 66106
3119A Merriam Lane, P.O. 6149
913-831-1222
MINNEAPOLIS, MN 55408
815-W. Lake St., P.O. 8458
612-824-2333
ST. LOUIS, MO 63130
8456 Page Blvd., P.O. 24256
314-428-1299
DETROIT, MI 48235
13707 W. 8 Mile Rd.
313-862-1783
GRAND RAPIDS, MI 49501
1134 Walker Northwest
P.O. 1435
616-454-2754
CINCINNATI, OH 45216
8172 Vine St., P.O. 15491
513-821-2298
MILWAUKEE, WI 53218
7211 Fond du Lac
414-464-0789
COLUMBUS, OH 43227
4005A E. Livingston
614-237-3820
INDIANAPOLIS, IN 46202
28 E. 14th St.
317-631-1551
DAVENPORT, IA 52805
2024 E. River Dr., P.O. 187
319-323-3975
OMAHA, NE 68132
5008 Dodge Street
402-558-1800
CHICAGO
Berkeley, IL 60163
1756 S. Taft Street
312-449-2082

SOUTH

ATLANTA, GA 30311
2180 Campbellton Road
P.O. 42558
404-753-0007
JACKSONVILLE, FL 32210
1918 Blanding Blvd., P.O. 7922
904-389-9952
WASHINGTON, DC
Silver Spring, MD 20910
8880 Brookville Rd.
301-565-0025
CHARLOTTE, NC 28225
726 Seligle Ave., P.O. 5512
704-332-8007
BIRMINGHAM, AL 35201
210 N. 9th St., P.O. 1801
205-323-2657
MEMPHIS, TN 38118
3614 Lamar Ave., P.O. 18053
901-365-1918
NORFOLK, VA 23504
3118 E. Princess Anne Rd.
804-628-2030
NEW ORLEANS
Metairie, LA 70004
3920A Airline Hwy., P.O. 303
504-837-7569
TAMPA, FL 33690
2703 S. Macdill, P.O. 14301
813-839-5521
NASHVILLE, TN 37214
2426 A Lebanon Rd.
615-885-0688

NORTHEAST

SPRINGFIELD, MA 01103
191 Chestnut, P.O. 3189
413-734-2737
PHILADELPHIA
Upper Darby, PA 19082
1742-44 State Rd., P.O. 207
215-352-6609
PITTSBURGH, PA 15202
257 Riverview Ave., W. P.O. 4130
412-761-7648
E. PATERSON, NJ 07407
158 Market St., P.O. 421
201-791-6380
BUFFALO, NY 14212
993 Sycamore St., P.O. 1241
716-891-4935
BOSTON
Arlington, MA 02174
1167 Massachusetts Ave., P.O. 37
617-449-7110
SYRACUSE, NY 13204
418 Solar St., P.O. 207, Salina St.
315-475-2330
BALTIMORE, MD 21215
5505 Reisterstown Rd.
301-358-1186

PACIFIC

SACRAMENTO, CA 95841
4611 Auburn Blvd., P.O. 41354
916-482-6220
SAN DIEGO, CA 92105
5111 University Ave., P.O. 5794
714-280-7070
LOS ANGELES, CA 90023
4184 Pacific Way
213-266-3728
PORTLAND, OR 97213
5220 N.E. Sandy Blvd.
P.O. 13096
503-282-9636
SEATTLE, WA 98109
432 Yale Ave. N., P.O. 9225
206-623-2320

MOUNTAIN

DENVER
Arvada, CO 80001
4958 Allison St., P.O. 672
303-423-7080
SALT LAKE CITY, UT 84106
1233 Willmington Ave.
P.O. 6218
801-484-1451
PHOENIX, AZ 85009
2916 West McDowell Rd.
602-278-1218

SOUTHWEST

LONGVIEW, TX 75601
110 Mapac Rd., P.O. 7332
214-753-4334
OKLAHOMA CITY, OK 73106
3007 N. May, P.O. 60566
405-947-2013
HOUSTON, TX 77207
4326 Telephone Rd., P.O. 26616
713-644-6793

CANADA

MONTREAL, PQ
8400 St. Lawrence Blvd., Rm. 205
514-381-5838



PTS ELECTRONICS, INC.
PRECISION TUNER SERVICE

...for more details circle 102 on Reader Service Card

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

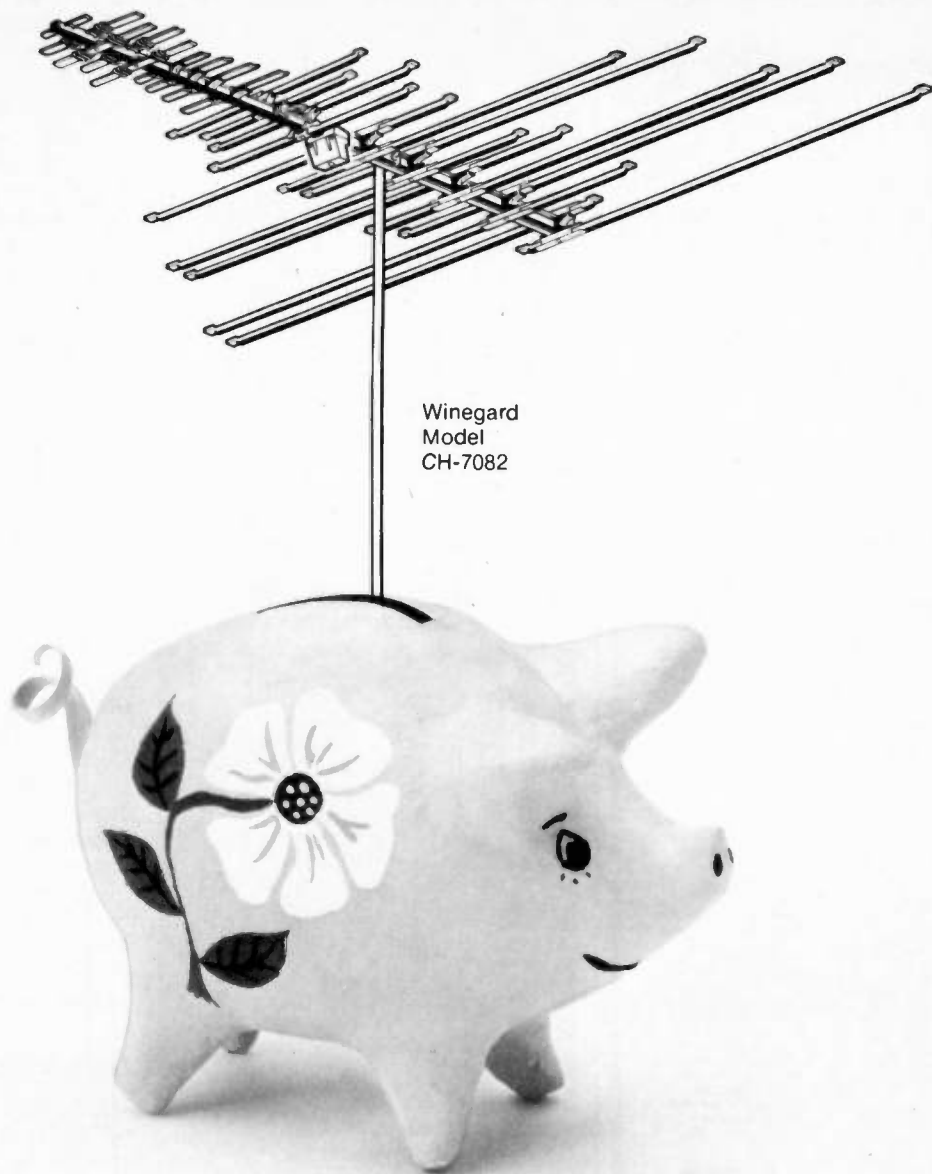
Zenith's battle against low priced Japanese television imports is now in the hands of the U.S. Supreme Court following a federal appeals court's refusal to support the manufacturer's demands for special import duties. At issue are certain taxes which the Japanese government "rebates" to Japanese manufacturers 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



Winegard
Model
CH-7082

TURN VHF-UHF RECEPTION PROBLEMS INTO "MONEY IN THE BANK"

When you're in the tv reception "problem-solving" business Winegard Chromstar performance "brings home the bacon" every time! There are antennas and amplifiers for every application.

Winegard Chromstar VHF-UHF antennas, for example, extend UHF reception up to 30 more

miles—making fair pictures good and good pictures great! Add that to far more powerful VHF performance, rugged construction and weather resistance. You get more sales, more satisfied customers. You can take that to the bank!

Get complete information from your Winegard Distributor or call our Sales Office.



WINEGARD

The Winegard Company • 3002 Kirkwood Street • Burlington, Iowa 52601

...for more details circle 145 on Reader Service Card

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

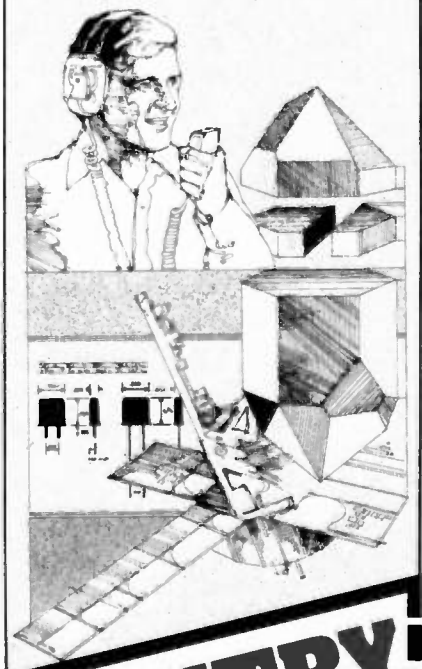
Both television and radio sales for the first six months of 1977 showed substantial improvement over the first six months a year ago, Electronic's Industry Association figures show. For the first 26 weeks, total television sales were up 15.9 per cent from the 5.44 million units sold a year ago. Color 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." ■

Reliability

That's what you get from Sentry. The most reliable precision, commercial, monitor and general purpose AT crystals you can buy. Sentry communication crystals are made from the finest quartz... for frequency stability. Then they're gold-plated... for dependability. Sentry has the most complete file of specifications and requirements for communications equipment—including CB and synthesized CB crystals—in existence... more than 10,000. Since we also have the largest stock of semi-finished crystals in the world, we can fill most orders within 24 hours. Call toll free 1-800-654-8850 to order. Or mail us the coupon below.



SENTRY

the BIG NAME in quartz crystal technology

Sentry Mfg. Co., Crystal Park
Chickasha, Oklahoma 73018



Please send me a complete 1977 Sentry Catalog immediately. Enclosed is a check or money order for \$1.50, which I understand is deductible from my first order. ET-2

Name _____

Address _____

City _____ State _____ Zip _____

Order GENUINE Lear Jet Service Parts.

Write: Service Department
140 Corum Road
Excelsior Springs, Mo. 64024

Warranty station applications invited.



...for more details circle 123 on Reader Service Card

...for more details circle 135 on Reader Service Card
SEPTEMBER 1977, ELECTRONIC TECHNICIAN/DEALER / 3

RICHARD W. LAY
Editor
43 East Ohio Street
Chicago, Ill. 60611
(312) 467-0670

DON W. MASON
Managing Editor
1 East First Street
Duluth, Minn. 55802
(218) 727-8511

ALFRED A. MENEGUS
Publisher
757 Third Avenue
New York, N.Y. 10017
(212) 888-4382

DAVID J. HAGELIN
Associate Publisher
and General Manager

TOM GRENEY
Publishing Director

JOHN PASZAK
Graphic Design

DEBI HARMER
Production Manager

BERNICE GEISERT
Production Supervisor

LILLIE PEARSON
Circulation Fulfillment

GENE BAILEY
Manager, Reader Services

SUSAN HELLERMAN
Classified Ad Manager

ADVERTISING OFFICES

DAVID J. HAGELIN
43 East Ohio Street
Chicago, Ill. 60611
(312) 467-0670

CHUCK CUMMINGS
Ad Space South/West
613 North O'Connor
Irving, Texas 75061
(214) 253-8678

ROBERT UPTON
Tokyo, Japan
C.P.O., Box 1717

ELECTRONIC TECHNICIAN/DEALER

SEPTEMBER 1977 • VOLUME 99 NUMBER 9

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

- | | |
|---------------------------|----------------------|
| 1 NEWS OF THE INDUSTRY | 46 NEW PRODUCTS |
| 6 TECHNICAL LITERATURE | 56 CLASSIFIED ADS |
| 12 FROM THE EDITOR'S DESK | 58 ADVERTISING INDEX |
| 42 TEST INSTRUMENT REPORT | 67 READERS SERVICE |
| 44 DEALER SHOWCASE | 69 TEKFAQ |



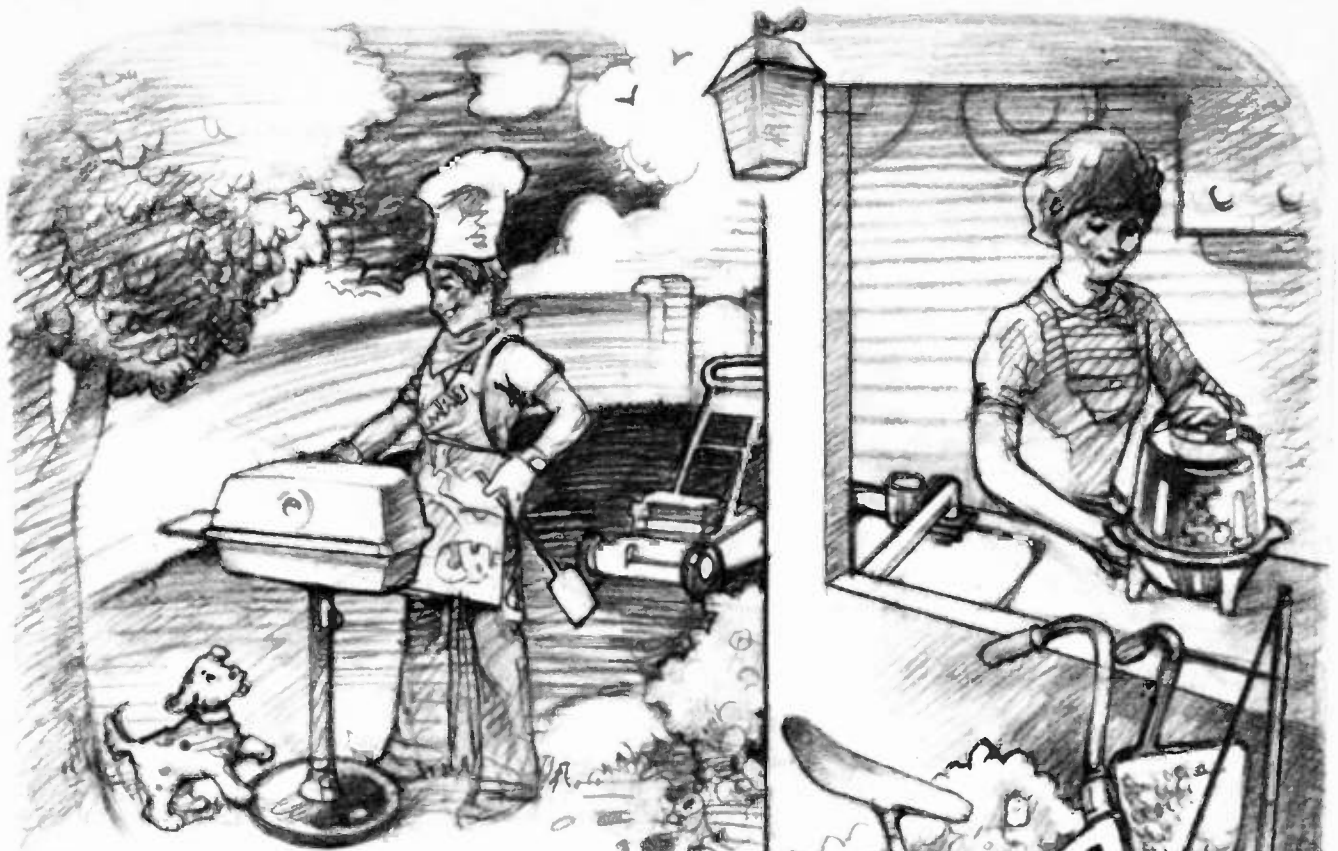
A HARCOURT BRACE JOVANOVIICH PUBLICATION



HARCOURT BRACE JOVANOVIICH PUBLICATIONS, Robert L. Edgell, Chairman, Richard Moeller, President/Treasurer, Lars Fladmark, Senior Vice President, Thomas Greney, Vice President, Ezra Pincus, Vice President, James Gherna, Vice President, Lois Sanders, Vice President, Harry Ramaley, Vice President, Joe Bilderbach, Vice President, George Glenn, Editorial Director.

ELECTRONIC TECHNICIAN/DEALER is published monthly by Harcourt Brace Jovanovich Publications, Corporate offices, 757 Third Avenue, New York, New York 10017. Advertising offices: 43 East Ohio Street, Chicago, Illinois 60611 and 757 Third Avenue, New York, New York 10017. Editorial, Accounting, Advertising Production and Circulation offices: 1 East First Street, Duluth, Minnesota 55802. Subscription rate: one year, \$8; two years, \$14; three years, \$18 in the United States and Canada. Other countries: one year, \$15; two years, \$24; three years, \$30. Single copies: 75¢ in the U.S. and Canada; all other countries: \$2. Second Class postage paid at Duluth, Minnesota 55806 and at additional mailing offices. Copyright © 1977 by Harcourt Brace Jovanovich, Inc. All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without permission in writing from the publisher.

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



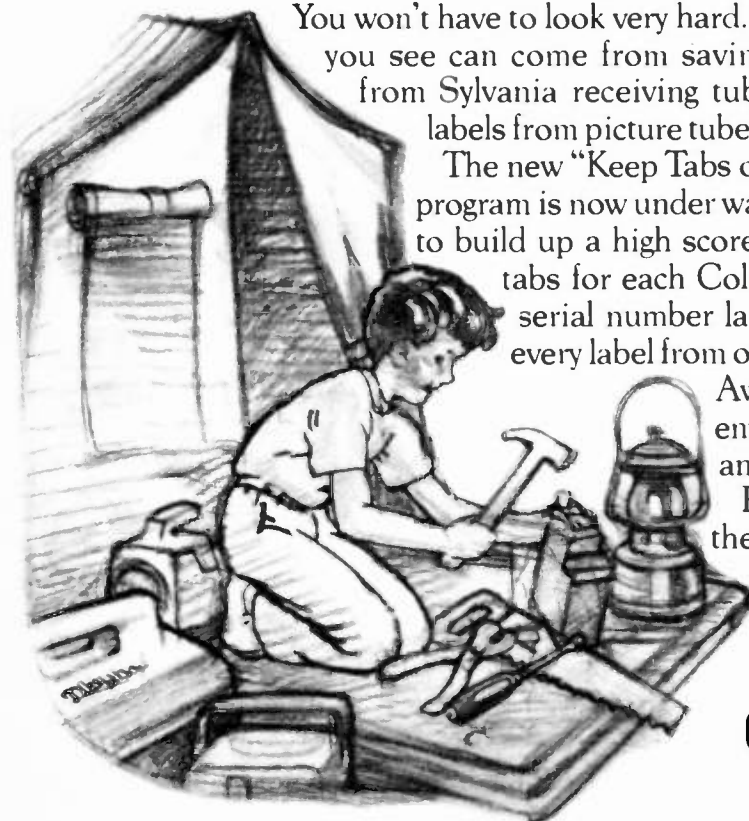
How many things can you find on this page that start with Sylvania tabs?

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,

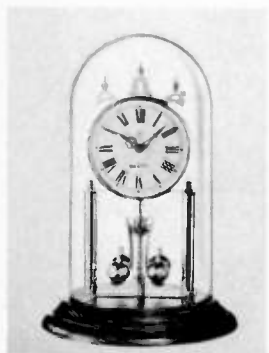
and SWR wattmeter, and RF power meter, dip meter, antenna impedance meter, a CB harmonic meter and 3 inch oscilloscope. Both catalogs are available free to the industry from Leader Instrument Corp., 151 Dupont Street, Plainview, N.Y. 11803.

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, Inslkrim, 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



Valuable free gifts with your purchases of RCA Entertainment Receiving Tubes!

Redi-Chec Award '77 certificates are available to you with your purchases of RCA receiving tubes from your local participating RCA Tube Distributor. Save these certificates. In required quantities, they are redeemable for an assortment of 221 exciting gifts from the RCA Redi-Chec Award '77 Prize Book.

See your participating RCA Tube Distributor for a copy of the Prize Book. Select the award you wish to earn. Buy

RCA receiving tubes and save the Redi-Chec Award '77 certificates you receive until you have the number required for the award of your choice. Fill out the award order form and mail with your Redi-Chec Award '77 certificates to:

RCA Redi-Chec Award '77 Hq.
P. O. Box 154, Dayton, Ohio 45401

Always specify RCA receiving tubes! Quality tubes and great awards go hand in hand at RCA!

Redi-Chec Awards '77

**DEALER
CERTIFICATE**

ISSUED BY _____

Distributor Name _____

City _____ State _____

Specimen

One Valuable
Certificate

4-7501-00

SERIAL NO _____

This certificate is redeemable by mail from RCA Redi-Chec Awards '77 Headquarters, P.O. Box 154, Dayton, Ohio 45401 in required quantities for merchandise as stated in the RCA Redi-Chec Awards '77 Prize Book available from participating RCA Tube Distributors.

Valid for redemption until midnight of April 30, 1978. Good only in the U.S.A. This certificate void where prohibited, taxed or restricted.

(Cash redemption value: 1/20 of 1¢)

RCA Distributor and Special Products Division, Dayton, OH 45401

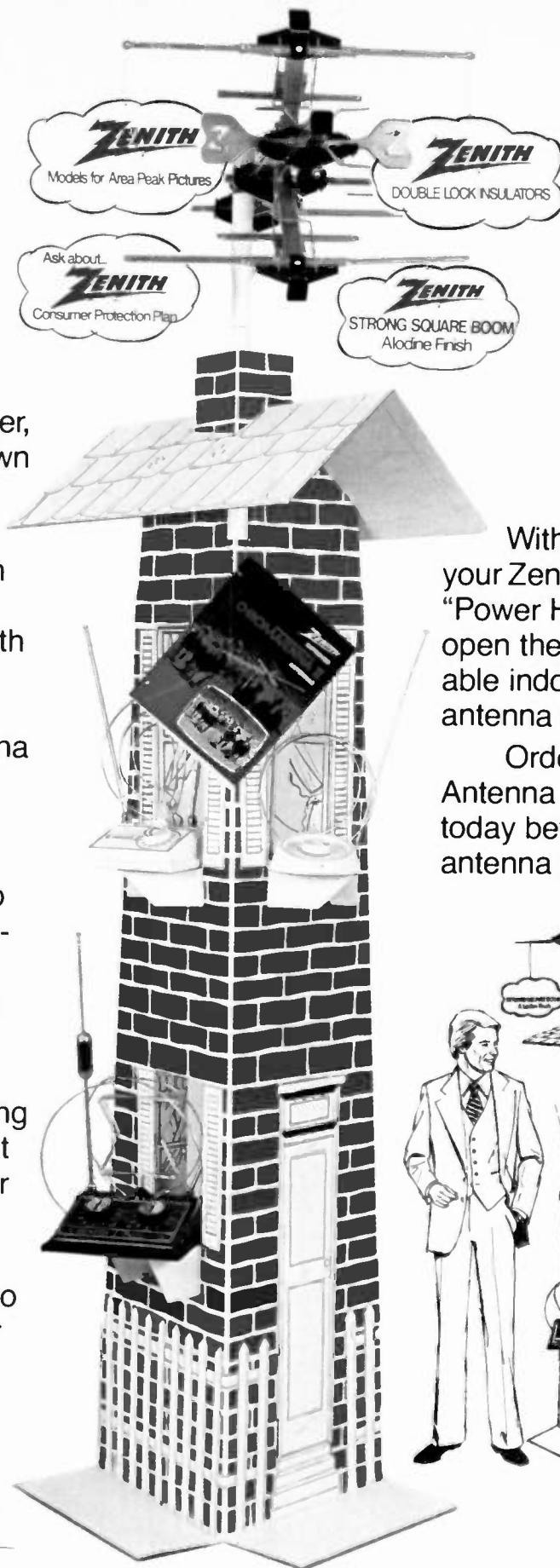
RCA | Distributor and Special Products | Deptford, N.J. 08096

RCA Receiving Tubes

**Only from
Zenith!**

**The first free-standing
floor display for both
indoor and outdoor
antennas!**

**Takes up less than
one square foot
of floor space!**



It's such an eye-catcher, such a profit center in its own right, we've dubbed it the "Power House."

Comes complete with a full-feature miniature of the new, improved Zenith Chromatenna™ II, with four cloud-like hang tags describing the Chromatenna II features, and our new antenna catalog for easy customer selection.

Windows pop open to display three indoor antennas in such a way they're locked in place to prevent theft even in high-traffic areas.

Stands an eye-catching 7½' tall so you can place it in a corner, along a wall, or even in a display window.

Complete assembly instructions are included so you can set up in a matter of minutes.

With just an order to your Zenith distributor for the "Power House," you can open the door to the profitable indoor and outdoor antenna business.

Order a "Power House" Antenna Display, 950-490, today before another antenna prospect goes by!



The quality goes in before the name goes on.®

Zenith Radio Corporation/Service, Parts & Accessories Division/11000 Seymour Avenue/Franklin Park, Illinois 60131

...for more details circle 147 on Reader Service Card

SEPTEMBER 1977, ELECTRONIC TECHNICIAN/DEALER / 9

An Astatic Achievement

Let the Silver Eagle microphone introduce you to innovative operation and exceptional convenience

Once again it's Astatic creating a unique combination of electronic quality, operational efficiency and eye pleasing beauty.

This is the Silver Eagle microphone, a new edition of a world renowned old favorite. The famous D104 microphone is now mounted on our transistorized T-UP9 desk stand. The new desk stand used on the new "Silver Eagle" has all the features of our popular T-UG9 Grip-to-Talk transistorized desk stand PLUS we have added a new feature, a Press-to-Talk bar in the base for your convenience. You may use either the new Press-to-Talk horizontal bar or the traditional Grip-to-Talk bar to activate the mike.

Silver Eagle's bright, vibrant appearance reflects tasteful luxury. All exterior parts plus base and handle are chrome plated to create a jewel-like finish.

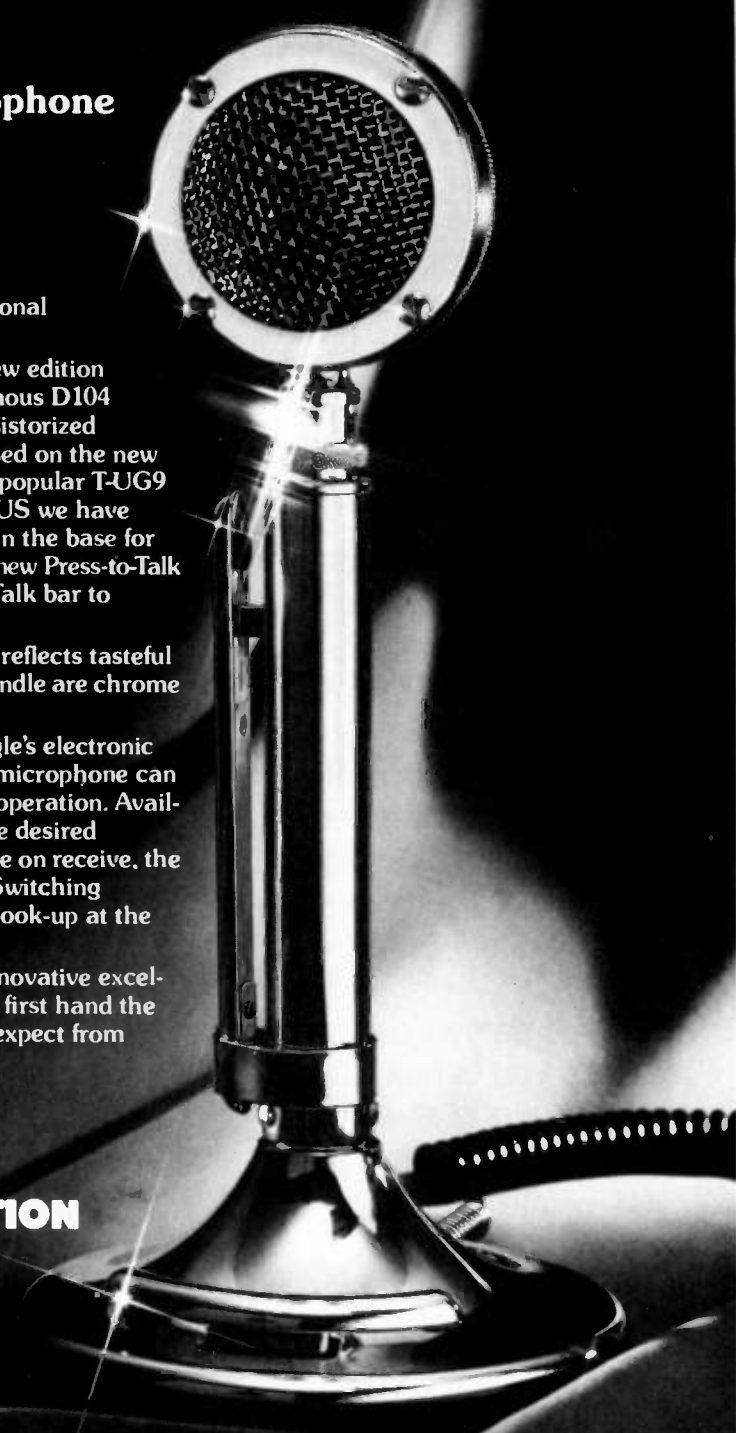
Inherent value abounds within Silver Eagle's electronic technology. Factory wired, the precision microphone can be easily converted to electronic or relay operation. Available high gain provides readily adjustable desired modulation. Wired with an open audio line on receive, the Silver Eagle comes with a 6 wire cable. Switching requirements are determined by proper hook-up at the plug end of the cable.

Visit your Astatic dealer soon. See the innovative excellence of the Silver Eagle. And appreciate first hand the quality and convenience you've come to expect from Astatic. Order Model T-UP9-D104.



THE ASTATIC CORPORATION

CONNEAUT, OHIO 44030



...for more details circle 108 on Reader Service Card

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

Oneida

**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.

**this
device
lives up
to its
claims
and its
name...**

JACK DARR

**Order a
supply today!**

FALL SPECIAL...Buy 6, get the 7th FREE!

Write us direct or call your Oneida distributor for details
Offer expires Dec. 15th 1977

Oneida

ELECTRONIC MFG. INC.

P.O. Box 678, Baldwin Street Ext., Meadville, Pa. 16335 · Phone (814) 336-2125

...for more details circle 127 on Reader Service Card

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

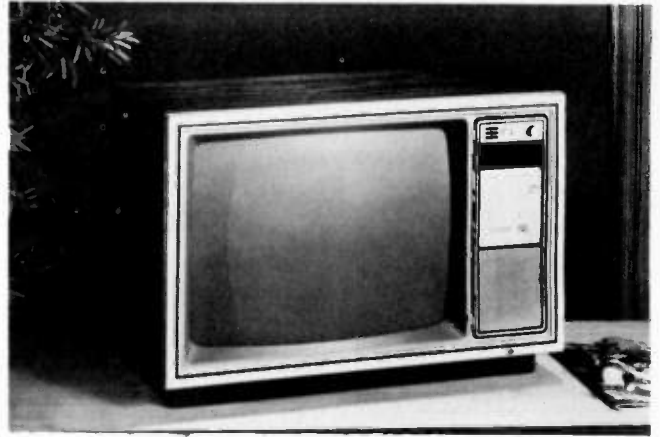


Fig. 5—One of Sylvania's 1978 line of "Superset" color receivers. This model CX7178WR features remote control, GT-Matic self-adjusting color, and the Dark Lite 50 Black Matrix picture tube.

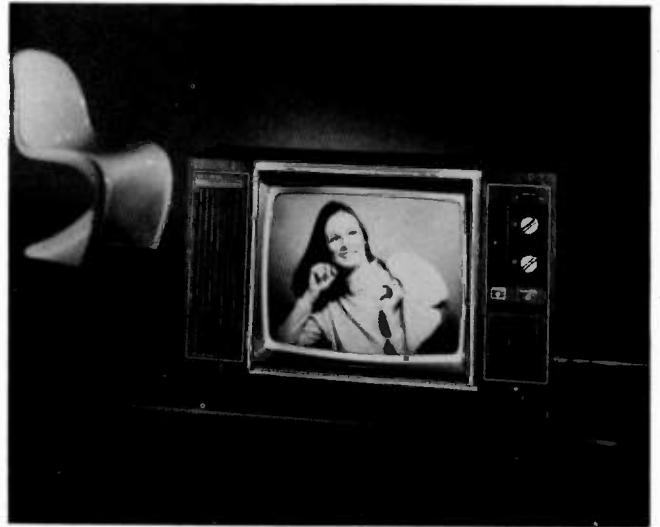


Fig. 6—One of Quasar's new 19-inch "Dynacolor" chassis recently introduced. This Model WT5982PW features "Dynabrite," in-line CRT, plus "Audio Spectrum Sound," a system of four audio speakers for greater accoustical range.

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."

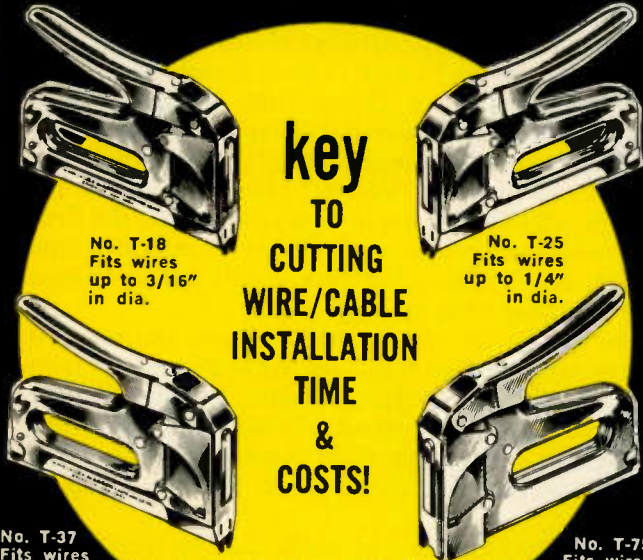
Within the next few years—maybe 1978—the replacement color TV market will be the major market segment. What this means economically and financially to the major manufacturers is not at all certain yet. But the thrust is, and home video recorders are evidence, to develop new markets in the home entertainment 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

ARROW[®]

AUTOMATIC

STAPLE GUNS



No. T-18
Fits wires
up to 3/16"
in dia.

No. T-25
Fits wires
up to 1/4"
in dia.

No. T-37
Fits wires
up to 5/16"
in dia.

No. T-75
Fits wires
& cables
up to 1/2"
in dia.

**key
TO
CUTTING
WIRE/CABLE
INSTALLATION
TIME
&
COSTS!**

Remote Control
Wiring

Thermostat Control
Wiring

Telephone Wiring

Intercom Wiring

Alarm System
Wiring

Radio & TV
Assembly Wiring

Plastic Cable

Wire Conduit

Cable TV

Radiant Tubing
Cable

4

**MODELS
Fit A
WIDE
RANGE
of
WIRE &
CABLE
DIAMETERS**

**For SAFE, FAST
fastening in
TELEPHONE
ELECTRONICS
COMMUNICATIONS
ALARM SYSTEMS
CATV Etc.**

These four basic models, using a total of 12 different staple sizes — speedily and inexpensively meet the needs of wire and cable installers for safe, neat, snug-fit stapling in virtually every field. Arrow Staple Guns are built of all-steel for rugged durability with Patented Jam-proof Mechanisms for continuous, trouble-free performance.

SEND FOR CATALOG AND PRICES TODAY.

ARROW FASTENER COMPANY, INC.
271 Mayhill Street, Saddle Brook, N. J. 07662

...for more details circle 107 on Reader Service Card

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 Flestone 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.

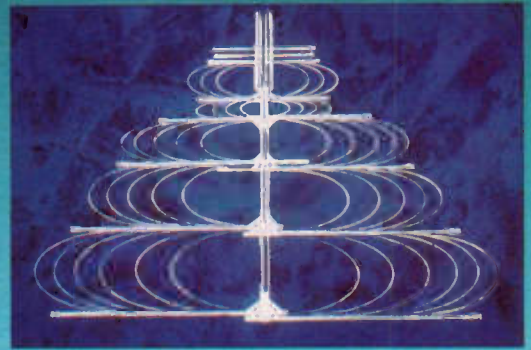
With the exception of the horizontal output stage and some power supply components, all of the chassis circuitry is mounted on eight modular boards. The physical shape is also modified to facilitate easier access to almost all components when the back cover is removed.

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.

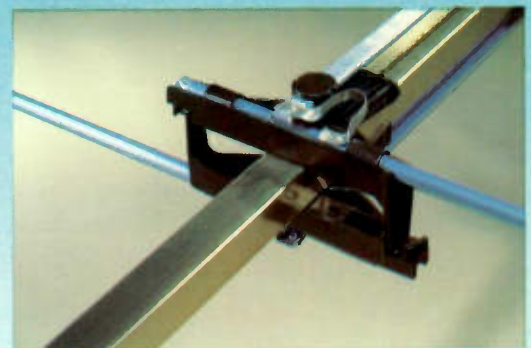
New to the chassis is the MSI chroma processor. This unit performs color bandpass amplification, 3.58

A product inspired by space technology

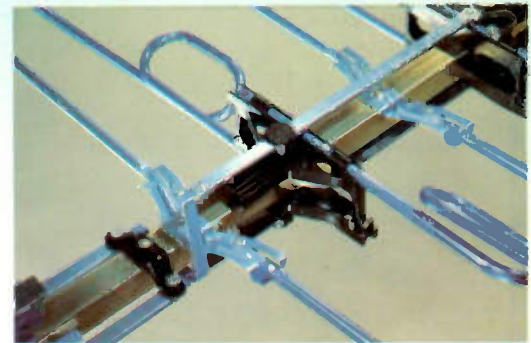
RCA Permacolor Outdoor TV Antennas... designed to provide the best possible picture in the home.



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.



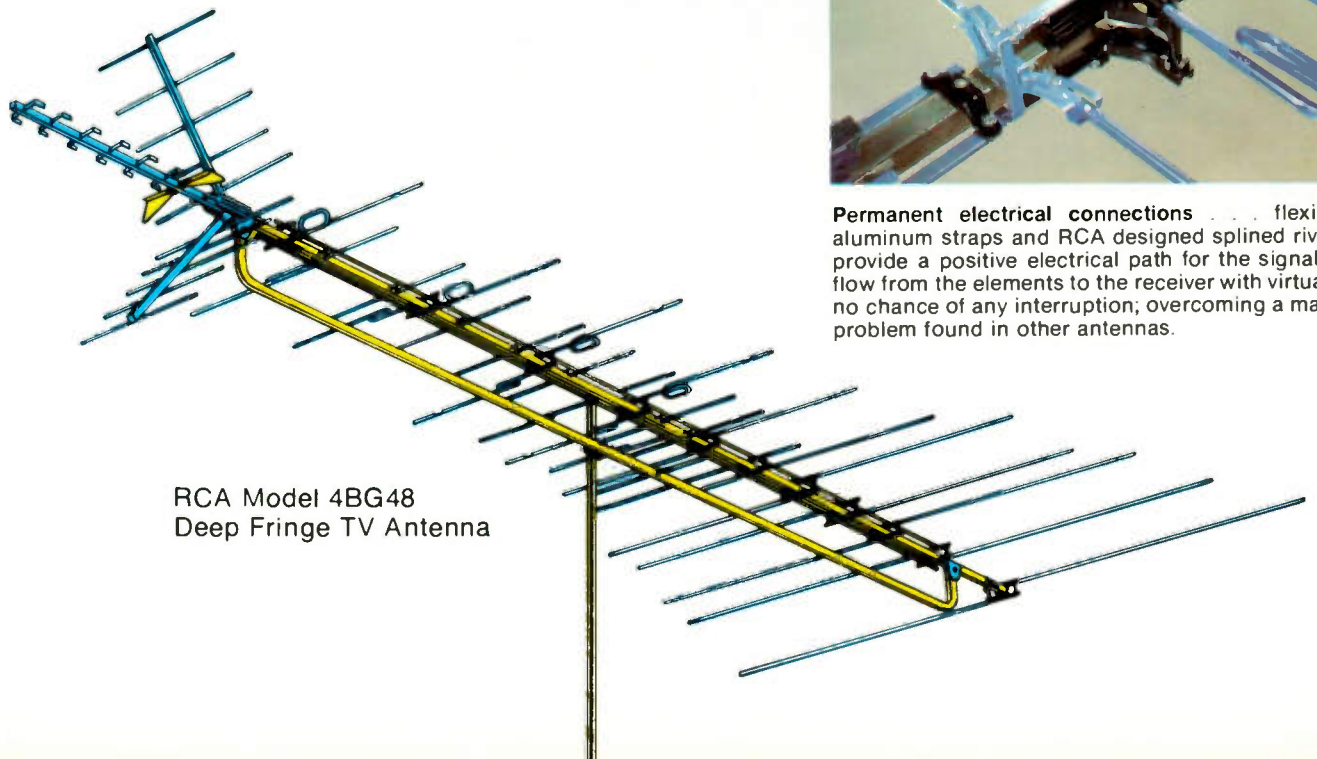
Permanent electrical connections . . . flexible aluminum straps and RCA designed splined rivets provide a positive electrical path for the signal to flow from the elements to the receiver with virtually no chance of any interruption, overcoming a major problem found in other antennas.

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 U-F 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.

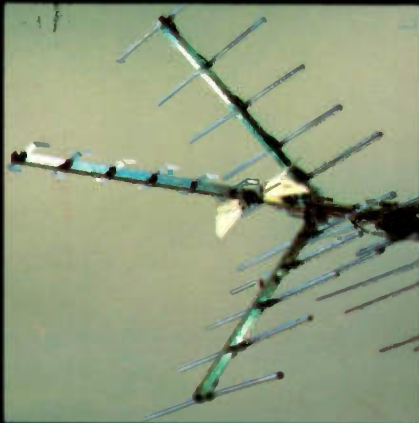
Permacolor is the first antenna with solid, permanent connections from elements to feed line. The first antenna with pivoting, polypropylene insulators. And, the first antenna with a weather-resistant blue and gold vinyl finish.

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

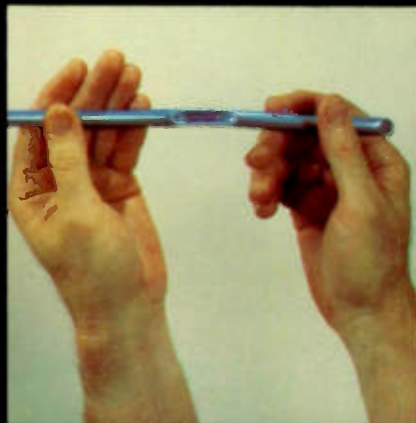


RCA Model 4BG48
Deep Fringe TV Antenna

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



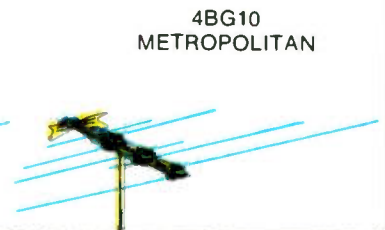
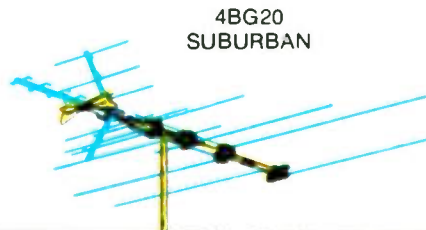
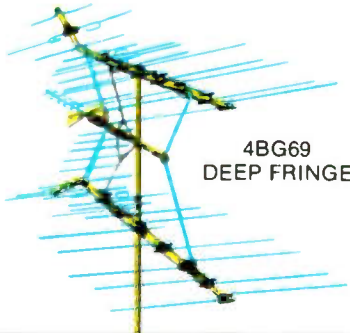
Break-off elements allow you to control FM broadcast reception to suit local conditions. UHF response can be extended to bring in channels 70 to 83 if desired



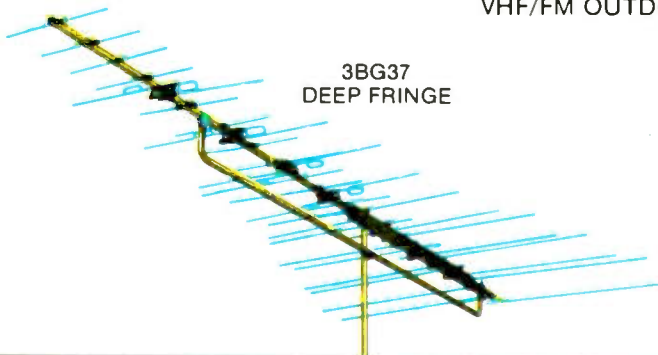
V shaped mast clamps... double set of teeth bites into mast, prevents antenna from slipping, and keeps it aimed in the proper direction. Antenna is preassembled, elements unfold with ease and lock into place.

A few of the Permacolor Antenna models available:

UHF-VHF/FM OUTDOOR ANTENNAS

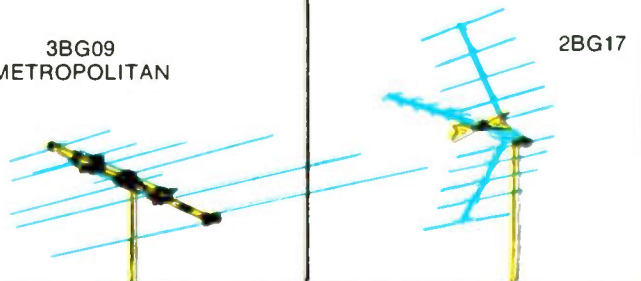


VHF/FM OUTDOOR ANTENNAS



3BG09
METROPOLITAN

UHF ONLY



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.

RCA
Permacolor

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

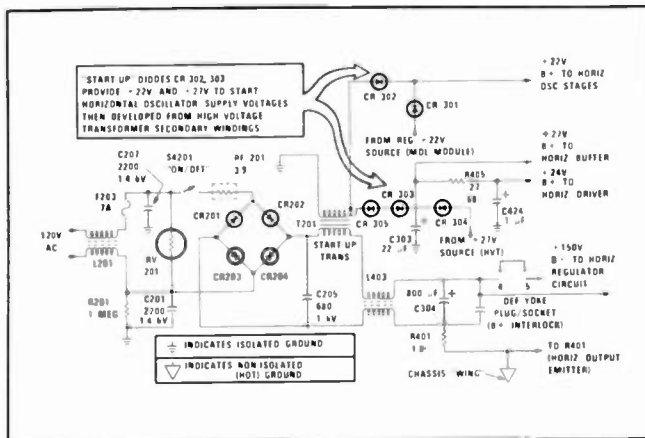


Fig. 2—No power transformer is used in RCA's CTC85 chassis. A full bridge rectifier provides 110 DC to operate the horizontal output stage. All other voltages are derived from rectified pulses from the horizontal transformer's secondaries.

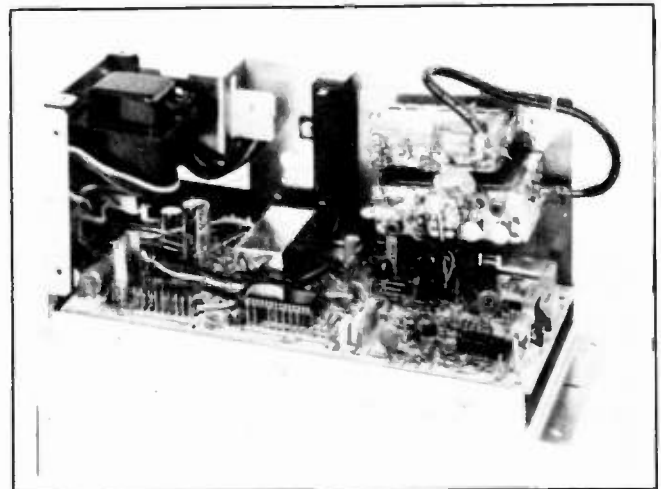


Fig. 4—Magnavox's 70377 Videomatic Touch Tune sub chassis assembly available with the T991 and T995 chassis.



The GE PRO* Award Program will end October 31, 1977.

Time is running out.

Don't miss this opportunity to win free awards while choosing from the new expanded line of replacement semi-conductors from GE. The best value and finest quality is the PRO* Line. So stick with the PROs. You'll be the winner!

Mail your orders to:

GE PRO* Award Headquarters
Box 535
Louisville, KY 40201

*Premium Reward Offer

TUBE PRODUCTS DEPARTMENT
GENERAL ELECTRIC COMPANY
OWENSBORO, KENTUCKY 42301

GENERAL  ELECTRIC

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 \$395.000.

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.

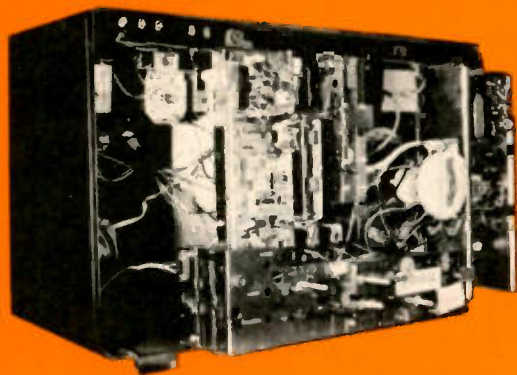
Zenith is entering the video cassette field with the two hour Beta video tape scan technology. It will be offered in two models, the video cassette recorder deck unit for attachment to a TV receiver's antenna terminals and, later this October in a Zenith VCR/TV console combination featuring 25 inch color 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

Sylvania has offered an advanced electronic tuning system with random access entry to any VHF or UHF channel with its 1978 line of "Supersets."

Included in the new line, which provides either pushbutton or single knob electronic tuning, is GT-

Tuner Service Corporation



\$10.95
U.S.A. ONLY

Major Parts and Shipping Charged at Cost

One Year Guarantee

MODULE REPAIRS

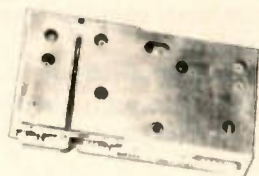
TSC has been repairing private brand TV modules for over 3 years.



Expanded facilities now include modules for

- RCA
- GE
- ZENITH
- W. T. GRANT
- J. C. PENNEY
- WESTERN AUTO
- GAMBLES

as well as Zenith IF subchassis.



For free Price List and complete information write or phone; TSC HEADQUARTERS, BLOOMINGTON, IND. or any of the TSC locations listed below.

PROVIDES YOU WITH A COMPLETE SERVICE FOR ALL YOUR TELEVISION TUNER REQUIREMENTS.

TUNER REPAIRS

VHF OR UHF ANY TYPE (U.S.A. ONLY) \$10.95
UHF/VHF COMBINATION (U.S.A. ONLY) \$17.95

MAJOR PARTS AND SHIPPING CHARGED AT COST

- Fast, efficient service at any of the conveniently located service centers listed below.
- ONLY ORIGINAL FACTORY PARTS USED
- All tuners ultrasonically cleaned, repaired and realigned.

EXACT REPLACEMENT

Exact Replacement Tuners are available at a cost of \$14.95 and up. (U.S.A. Only)

- Send in your original tuner for comparison purposes to any of the Centers listed below.

UNIVERSAL REPLACEMENT

UNIVERSAL REPLACEMENT TUNER (U.S.A. ONLY) \$13.95

- This price buys you a complete new tuner built specifically for this purpose.
- All shafts have a maximum length of 10½" which can be cut to 1½".
- Specify heater type parallel and series 450mA or 600mA.

FLASH

NOW AVAILABLE—TUNER SERVICE PARTS CATALOG OF ALL SARKES TARZIAN VHF AND UHF TUNERS, INCLUDING EXPLODED VIEW DRAWINGS. OVER 200 PAGES. ORDER YOUR COPY TODAY. SEND \$2.50 WITH ORDER TO BLOOMINGTON HEAD OFFICE.



WATCH US GROW

HEADQUARTERS	BLOOMINGTON, INDIANA 47401	537 South Walnut Street	Tel. 812-334-0411
ALABAMA	BIRMINGHAM, ALABAMA 35212	5623 1st Ave. N.	Tel. 205-592-9150
ARKANSAS	LITTLE ROCK, ARKANSAS 72204	4200-C Asher Avenue	Tel. 501-661-0393
CALIFORNIA	NORTH HOLLYWOOD, CALIF. 91601	10654 Magnolia Boulevard	Tel. 213-769-2720
	MODESTO, CALIF. 95351	123 Phoenix Avenue	Tel. 209-521-8051
	SAN MATEO, CALIF. 94402	600 S. Amphlett Blvd.	Tel. 415-348-3292
FLORIDA	TAMPA, FLORIDA 33606	1505 Cypress Street	Tel. 813-253-0324
	FT. LAUDERDALE, FLA. 33309	3516 N.W. 10th Avenue	Tel. 305-566-4882
GEORGIA	ATLANTA, GEORGIA 30310	646 Evans Street S.W.	Tel. 404-758-2232
ILLINOIS	SKOKIE, ILLINOIS 60076	5110 West Brown Street	Tel. 312-675-0230
	URBANA, ILLINOIS 61801	908 E. Main St.	Tel. 217-384-2052
INDIANA	INDIANAPOLIS, INDIANA 46204	112 West St. Clair Street	Tel. 317-632-3493
KENTUCKY	LOUISVILLE, KENTUCKY 40205	2244 Taylorsville Rd.	Tel. 502-452-1191
LOUISIANA	SHREVEPORT, LOUISIANA 71104	2423 Southern Avenue	Tel. 504-833-3027
MASSACHUSETTS	SPRINGFIELD, MASSACHUSETTS 01108	405 Dickinson Street	Tel. 413-788-8206
MISSOURI	ST. LOUIS, MISSOURI 63132	9577 Page Avenue	Tel. 314-429-0633
NEVADA	LAS VEGAS, NEVADA 89102	1114 South Casino Center Blvd.	Tel. 702-384-4235
NEW JERSEY	TRENTON, NEW JERSEY 08638	1139 Pennsylvania Avenue	Tel. 609-393-0999
	JERSEY CITY, NEW JERSEY 07307	454 Central Avenue	Tel. 201-792-3730
	ROCHESTER, NEW YORK 14615	37 Pultman Ave. rd.	Tel. 716-647-9180
NEW YORK	GREENSBORO, N.C. CAROLINA 27405	2714 E. Market St.	Tel. 919-273-6276
NO. CAROLINA	CLEVELAND, OHIO 44109	4525 Pearl Road	Tel. 216-741-2314
OHIO	PORTLAND, OREGON 97210	1732 N.W. 25th Ave., P.O. Box 10141	Tel. 503-222-9059
OREGON	PITTSBURGH, PA. 15209	515 Grant Avenue	Tel. 412-821-4004
PENNSYLVANIA	MEMPHIS, TENNESSEE 38111	3158 Barron Avenue	Tel. 901-458-2355
TENNESSEE	DALLAS, TEXAS 75218	11540 Garland Road	Tel. 214-327-8413
TEXAS	ST. LAURENT, QUEBEC H4N-2L7	305 Decarie Boulevard	Tel. 514-748-8803
CANADA	CALGARY, ALBERTA T2H-1Y3	P.O. Box 5893, St. A	Tel. 403-243-0971

IF YOU WANT TO BRANCH OUT INTO THE TV TUNER REPAIR BUSINESS WRITE TO THE BLOOMINGTON HEADQUARTERS ABOUT A FRANCHISE.

...for more details circle 140 on Reader Service Card

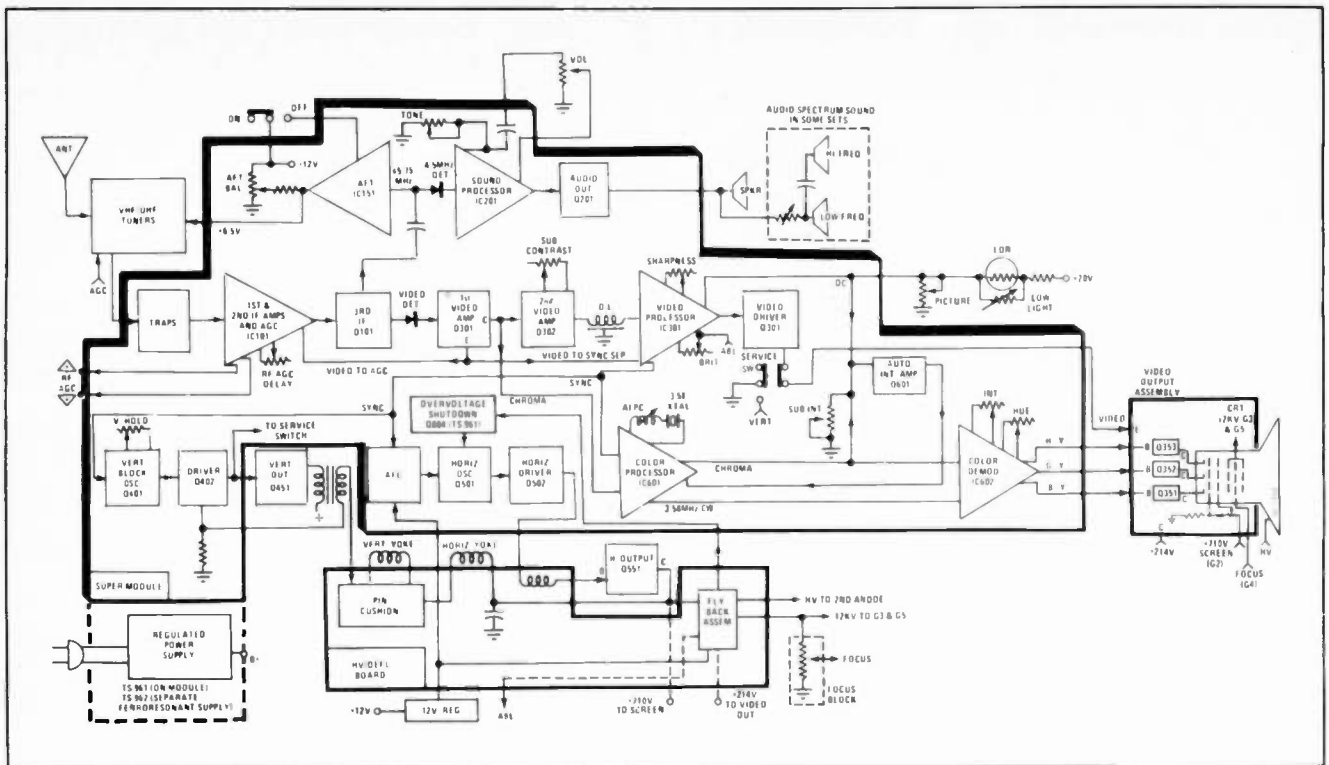


Fig. 3—Block diagram of Quasar's recently introduced TS961/962 chassis.

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 Accoustical 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 Quinrix 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 Quinrix 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

Fill your needs from these 3 winning lines from Mallory.

Each of these Mallory lines of components is bubble-packed, easily identified. Almost all feature basic specs and/or instructions on the back of the cards.

Mallory EPC components consist of the most popular products for technicians, hobbyists and audio enthusiasts.

Mallory PTC semiconductors are of the highest quality. They fill a wide range of consumer and industrial applications. A convenient cross-referencing catalog permits fast selection.

Mallory crimp-type solderless terminals meet virtually all popular applications.

For all the facts and pricing, see your Mallory distributor. Or write Mallory Distributor Products Company, a division of P. R. Mallory & Co. Inc., Box 1284, Indianapolis, Indiana 46206. (317) 856-3731.



Mallory crimp type solderless terminals.

Popular components in Mallory Electronic Parts Center (EPC).

Mallory PTC semiconductors.

MALLORY

Capacitors • Controls • Fastening Devices • Resistors • Security Products • Semiconductors • Solderless Terminals • Switches
...for more details circle 124 on Reader Service Card

THERE'S A Simpson® 260® VOM FOR EVERYONE

- Designers
- Engineers
- Technicians
- Electricians
- Inspectors
- Assemblers
- Scientists
- Environmentalists
- Experimenters
- Students
- Teachers
- Hobbyists



260-6 \$79.50



260-6XL . . . \$93.00



260-6M
with Mirror
Scale
\$82.50



260-6P
Overload
Protected
\$119.00



260-6PRT
Overload
Protected
in Roll Top
Case
\$129.00



260-6XLP
Overload
Protected
\$128.00



260-6RT
in Roll Top
Case
\$89.50



260-6PM
Overload
Protected
with Mirror
Scale
\$122.00



260-6MRT
with Mirror
Scale
in Roll Top
Case
\$92.50



260-6XLP M
Overload
Protected
with Mirror
Scale
\$131.00

COMPLETE LINE OF PROBES,
LEADS, CARRYING CASES AND
OTHER ACCESSORIES AVAILABLE.

SEE THEM ALL AT YOUR LOCAL ELECTRONICS/ELECTRICAL DISTRIBUTOR or Write for Catalog 4500



SIMPSON ELECTRIC COMPANY

853 Dundee Avenue, Elgin, Illinois 60120 • (312) 697-2260

CABLE: SIMELCO • Telex: 72-2416

IN CANADA: Bach-Simpson, Ltd., London, Ontario

IN ENGLAND: Bach-Simpson (U.K.) Ltd., Wadebridge, Cornwall

IN INDIA: Ruttonsha-Simpson Private, Ltd., Vikhroli, Bombay

KATY INDUSTRIES



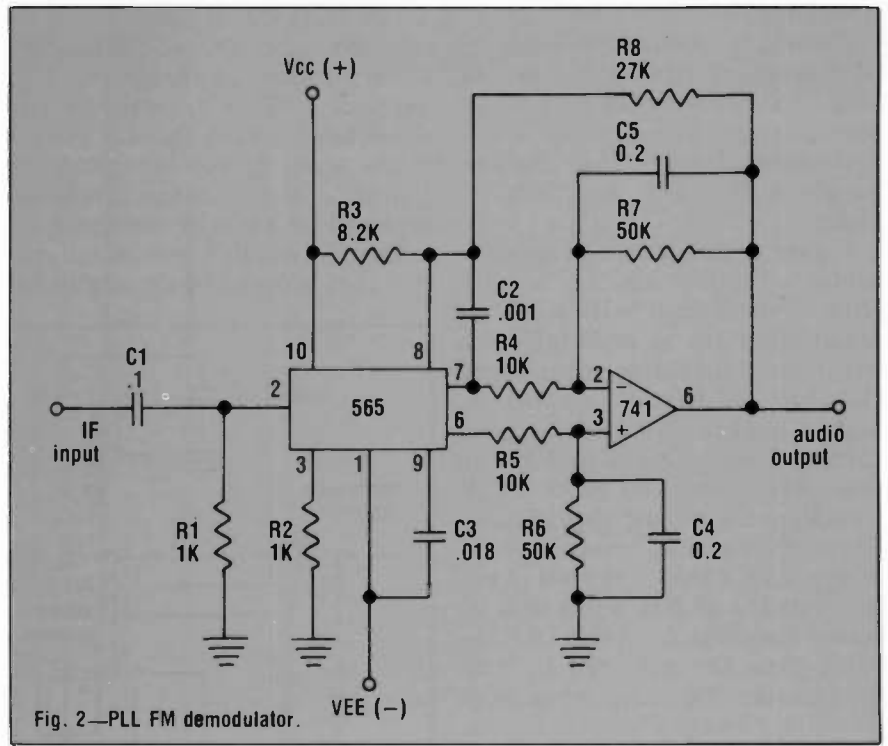
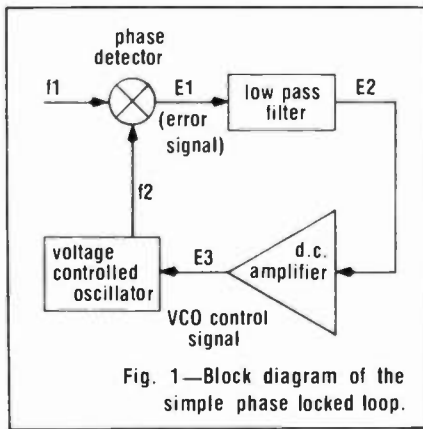
ELECTRICAL EQUIPMENT
GROUP

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

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 E2 in Figure 1.

Voltage E2 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 E2 will be the audio

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 sub-carrier 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 TONE 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-

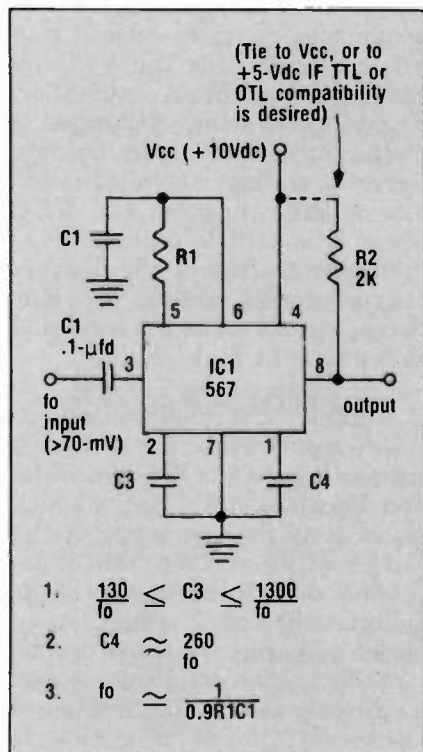


Fig. 3—Tone decoder using the 567 PLL integrated circuit.

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

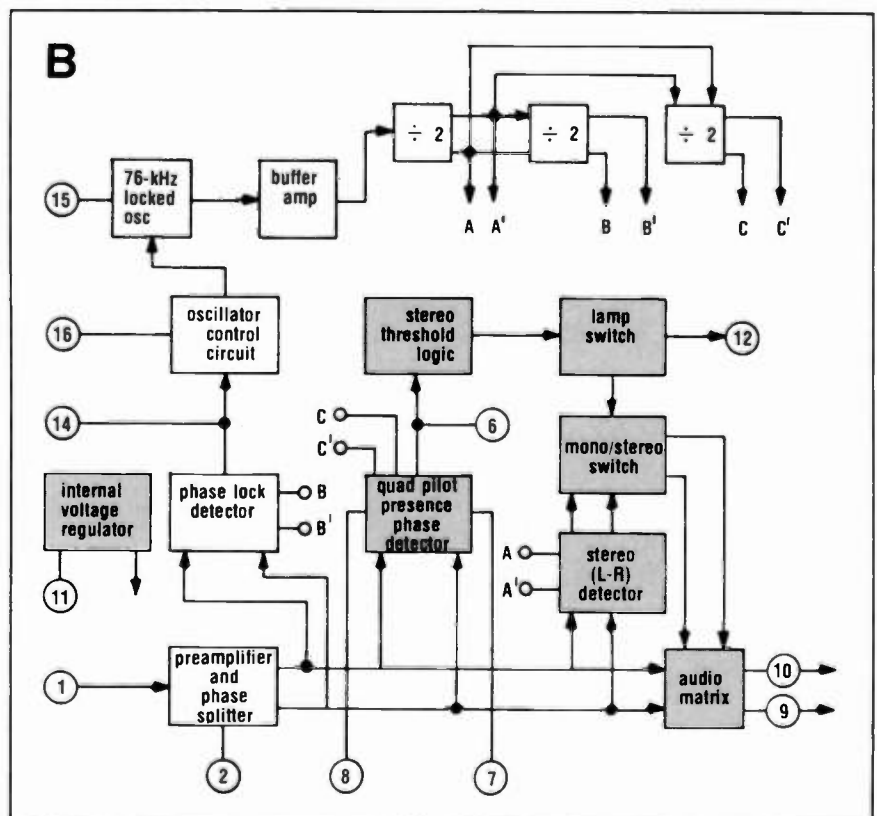
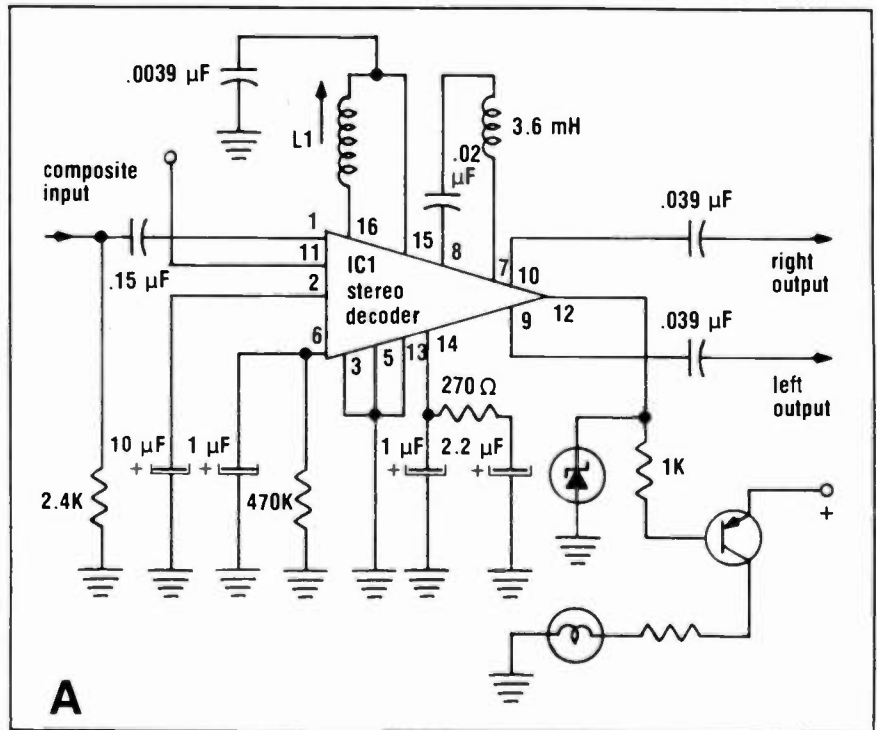


Fig. 4—A) PLL DM-stereo decoder used by Bendix in certain Ford Motor Company OEM radios. B) Block diagram of the Bendix PLL decoder.

in communicatitns 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 discreet 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 4 A and B 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.

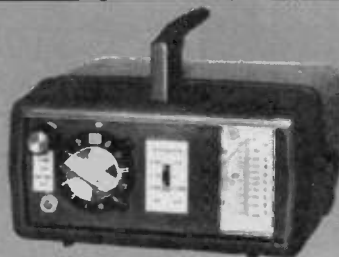
The complete FM audio signal consists of regular monaural (L+R) information, a 19-KHz pilot signal, and a double sideband suppressed carrier signal called the (L-R). In the decoder IC used by Bendix and RCA, the 19-KHz is selected out in the phase detector circuit that is used to control the frequency 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-

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

CASTLE TIMESAVERS FOR THE PROFESSIONAL

Lost time means lost profit. Castle's TV signal analysts provide the time-saving precision you require on the bench or in the customer's home.

MEZZER™ TV FIELD STRENGTH METERS

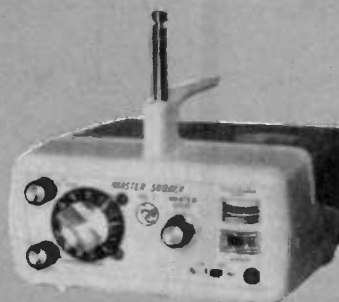


MODEL FSM-V (VHF)

Range: 20 microvolts—100 millivolts Inputs: 75 ohms & 300 ohms
Attenuator: x1, x10, x100 AC-DC (batteries not included)

NET \$137.95

SUBBER® TV SIGNAL CIRCUIT ANALYSTS



MODEL MARK V MASTER SUBBER®

Outputs at video IF, sound IF, video & audio. Built-in monopole antenna. Video carrier level meter. Built-in loudspeaker. Battery indicator meter. Complete with 120 vac/wall plug-in transformer and matched test cables.

NET \$169.95



CASTLE ELECTRONICS

BLOOMINGTON, IN 47401
5233 S. Hwy. 37
Phone: 812-824-9791

For More Details and Specifications
Contact Your Nearest Castle Products Distributor
In Canada: Len Finkler Ltd, Ontario

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

Autoranging Frequency Counting to 60 MHz with 1Hz Resolution



B&K-PRECISION MODEL 1801 \$200

- For laboratory, production line or maintenance applications
- Automatic ranging, 20 Hz to 40 MHz is guaranteed... readout to 60 MHz is typical
- Reliable TTL circuitry updates the six-digit display five times per second
- Resolution to 1 Hz obtained by suppressing digits above 1 MHz when switching to 1 SEC mode



MHz display of 3.579548 MHz input (AUTO mode)



KHz display of overflow of 3.579548 MHz input (1SEC mode)

- Available for immediate delivery, from local B&K-PRECISION distributors
- 10-day free trial offer

BK PRECISION

DYNASCAN CORPORATION

6460 West Cortland Avenue
Chicago, Illinois 60635 • 312/889-9087

In Canada: Atlas Electronics, Ontario
Intl. Sls. Empire Exp., 270 Newtown Rd., Plainville, LI, NY 11803

...for more details circle 109 on Reader Service Card

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's 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

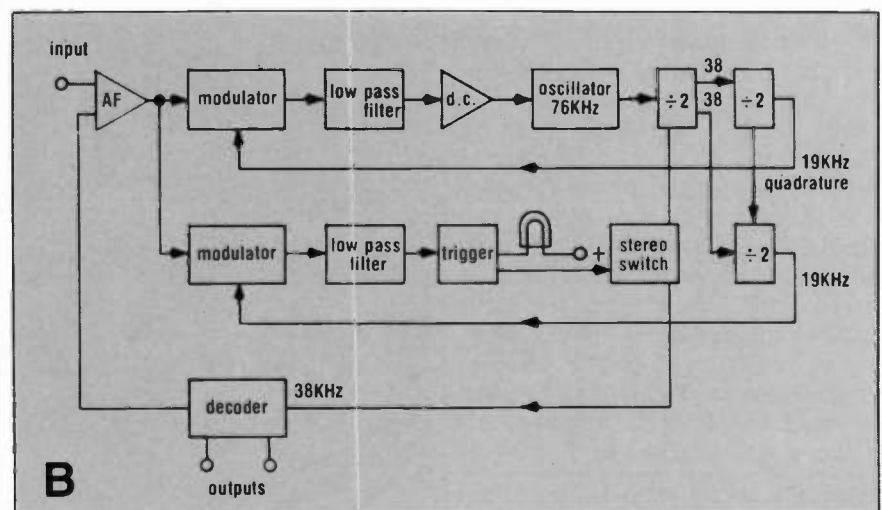
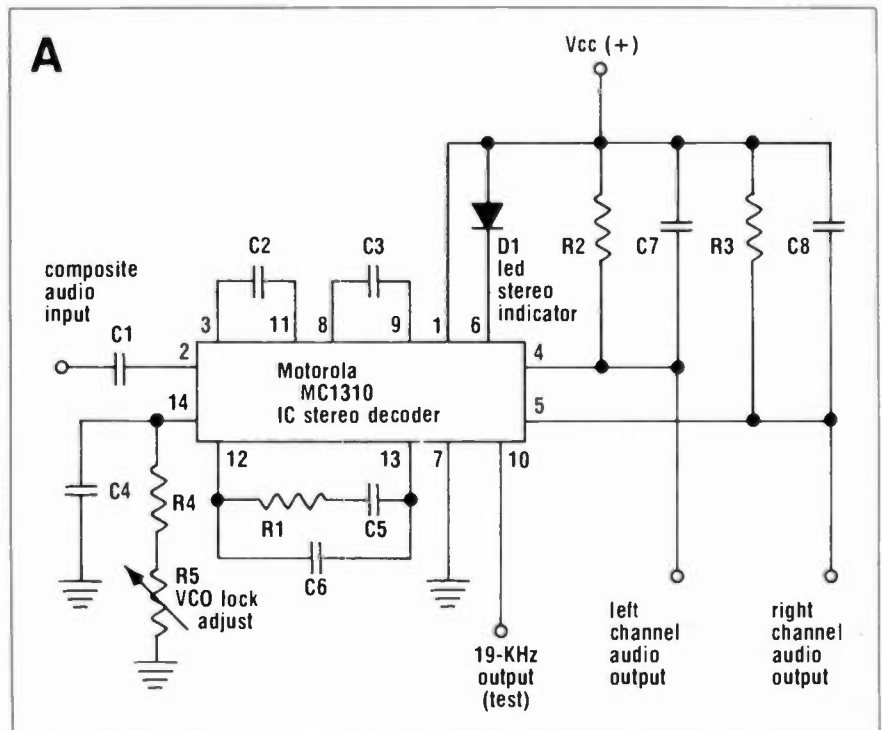


Fig. 5—A) Circuit using the Motorola MC1310P I.C. "coilless" stereo decoder. B) Block diagram of the Motorola MC1310P.

Dealers make more money selling the Channel Master "Lifetime" picture tube than any other color tube!

The "Lifetime Warranty" of the Opti-Vue Plus is a magic phrase in the minds of most consumers....it has helped more dealers close more color picture tube sales than any other selling feature in the CRT business!

And that isn't easy because two color sets are being scrapped for every color tube sold.

WITH OPTI-VUE PLUS, THE ODDS ARE IN YOUR FAVOR!

The "Lifetime Warranty" convinces customers that it pays to save the set. They get peace-of-mind....you get the sale of a top quality tube and all the future service business.

THE CHANNEL MASTER DIFFERENCE

With other warranties, once you've sold the tube, THAT'S IT!tube sales are over. But, with the "Lifetime Warranty," you've an excellent chance of selling another tube under the \$69.95 feature of the warranty after the 3 year standard coverage period is over. You earn a 33% profit on the warranty tube....plus the installation charges! AND, you have a head start in selling a new color set when the time comes, because YOU delivered good service on your customer's old set.

Only Channel Master OPTI-VUE PLUS has a "Lifetime Warranty" feature....it's the reason why dealers made more money selling Channel Master color picture tubes than any other brand!



Channel Master

Div. of Avnet, Inc., ETD977
Ellenville, New York 12428

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

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!

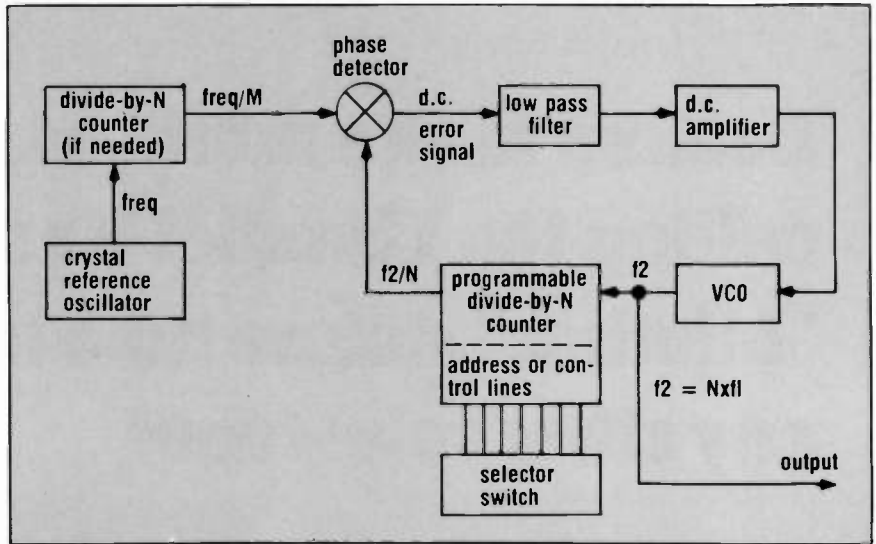


Fig. 6—Block diagram of a multichannel PLL transmitter frequency control section.

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

Survival of the FITTINGEST



THORDARSON FITS

Thordarson replacements fit exactly. And they are designed and built better than the original. Thordarson gives you the industry's widest selection of replacement flame retardant flybacks and yokes. Accurate, constantly updated cross-reference data makes replacement selection fast and easy. These solid reasons, and more, are why Thordarson has survived when most others have failed.

The next time you need a flyback or yoke for any brand see your independent electronic parts distributor for a Thordarson replacement. You'll be dollars and hours ahead!

THORDARSON

THORDARSON MEISSNER, INC.
Electronic Center
Mt. Carmel, Illinois 62863

Support your independent parts distributor... we do! NEDA Associate Member

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

Do You Know?

RAWN
Chemicals
Are The Best

Make Your Own Comparison

RAWN

Service with Confidence

aerosol—Electronic & Industrial—adhesives

...for more details circle 131 on Reader Service Card

TABLE I

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-

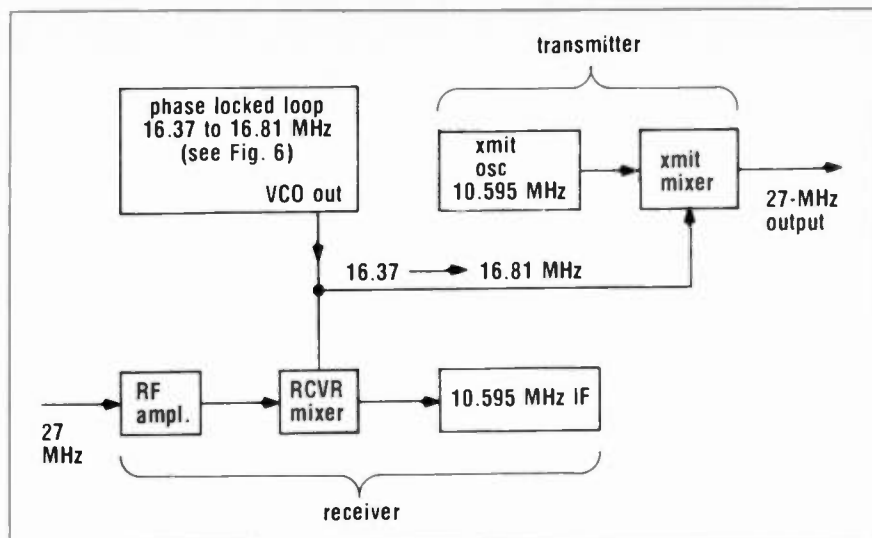


Fig. 7—PLL-controlled C.B. transceiver.

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.

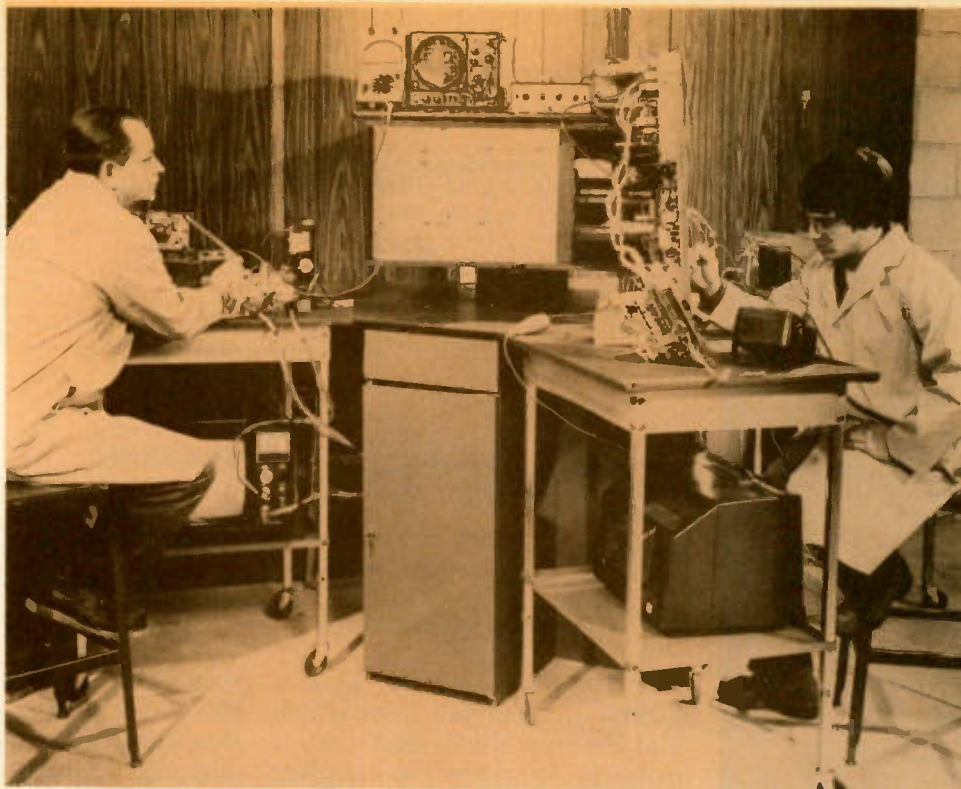
The circuit of Figure 7 uses a phase locked loop with a VCO that will operate over the frequency range 16.370-MHz to 16.810-MHz. When mixed with the output of a 10.595-MHz crystal transmit oscillator, this frequency translates to the 40 C.B. channels between 26.965-MHz and 27.405-MHz. Similarly, when 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.

Here Today, Gone Tomorrow.



At General Electric we're treating every TV parts order like a rush order. Here's how it's paying off: Over 99% of the General Electric TV replacement parts ordered this year were in stock in our national computer-linked parts distribution system. And on the average better than 90% were ready for immediate shipment from the Regional Replacement Parts Centers.

This is why most parts are now shipped the same day an order's received or by the close of business the following day.

But ordering parts from us is more than fast. It's easier than ever before. In almost all areas, our toll-free ordering numbers connect you directly with GE Parts Centers. And you can charge your order to Master Charge, VISA (BankAmericard) or your approved GE Open Credit Account.

What's more, when you order several parts and one isn't immediately available, we don't leave you hanging. Instead, we ship what's in stock and include the expected shipping date for what isn't.

How did General Electric's parts distribution come so far so fast? One factor was the enlargement of stocks at many



GE Parts Centers. But the deciding factor was our determination to build a streamlined, efficient system that simplified the parts ordering process for both of us.

Now comes the easiest part of all. Clipping out and sending in the coupon below. When you do, we'll send you a list of our toll-free numbers and all the information you need to take the easy way out next time you order TV replacement parts from us. It's our business to make your business easier.

"I've got your number."

"DUTCH" MEYER/GENERAL ELECTRIC COMPANY
TELEVISION BUSINESS DEPARTMENT
COLLEGE BOULEVARD/PORTSMOUTH, VA. 23705

Dear "Dutch":

Please send me the items checked below:

- Brochure covering GE toll-free ordering numbers.
- Listing of Parts Distributors.
- Master Charge and VISA (BankAmericard) information.
- GE Open Credit Account information.

Name _____

Service Company _____

Address _____

City _____ State _____ Zip _____

THIS IS GE PERFORMANCE TELEVISION

GENERAL  ELECTRIC

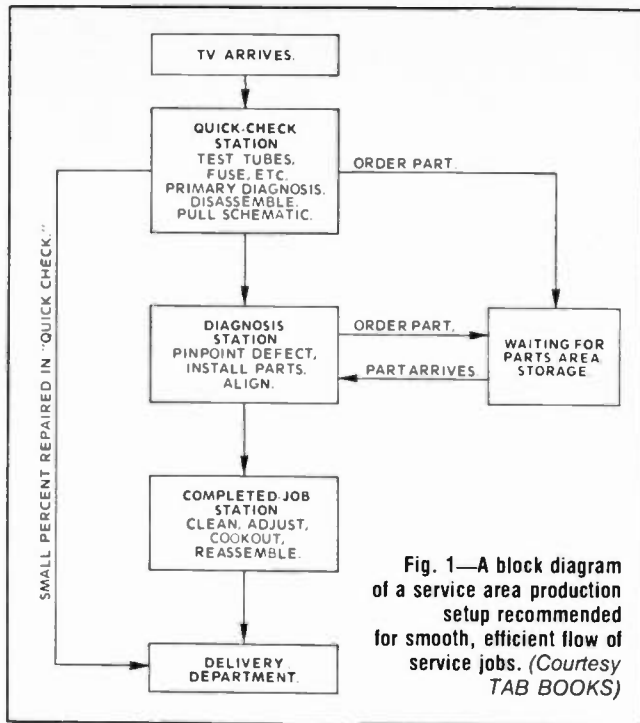


Fig. 1—A block diagram of a service area production setup recommended for smooth, efficient flow of service jobs. (Courtesy TAB BOOKS)

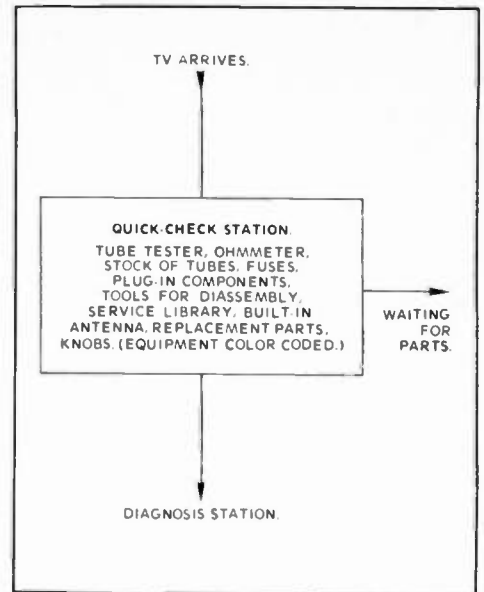


Fig. 2—Block diagram of the "quick-check" station, the first stop in the "flow" method of electronic servicing. (Courtesy TAB BOOKS)

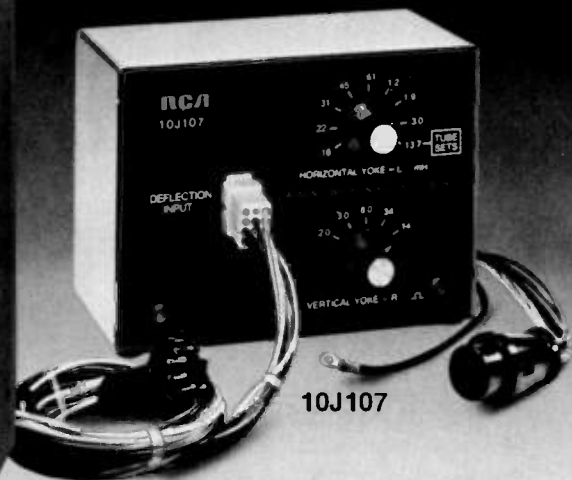
Whichever method is adopted to improve your work flow, the method must accomplish one thing—it must utilize the services of the right person at the right time. In other words, wherever possible, the person(s) with the

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-

Now! RCA offers you three time and money-saving options in Color TV Test Jigs.



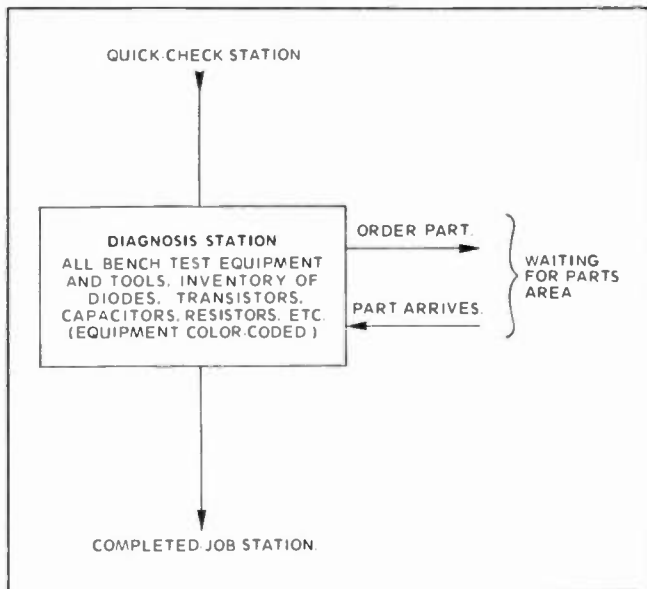


Fig. 3—Block diagram of the "diagnosis" station, manned by a skilled electronic technician, for the solving of the tough-dog problems. (Courtesy TAB BOOKS)

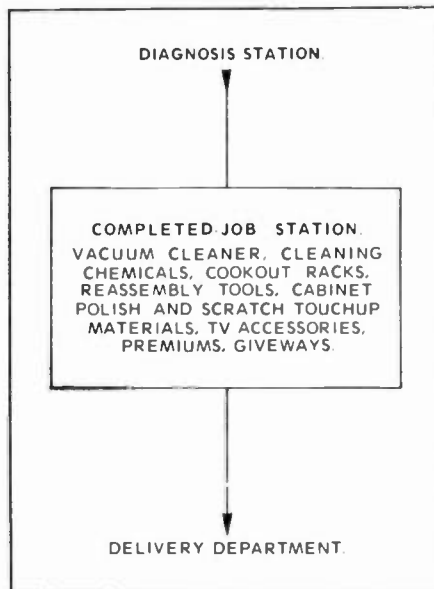


Fig. 4—The "completed-job" station of the 'flow' method of electronic servicing. All finishing and clean-up jobs are handled here.

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

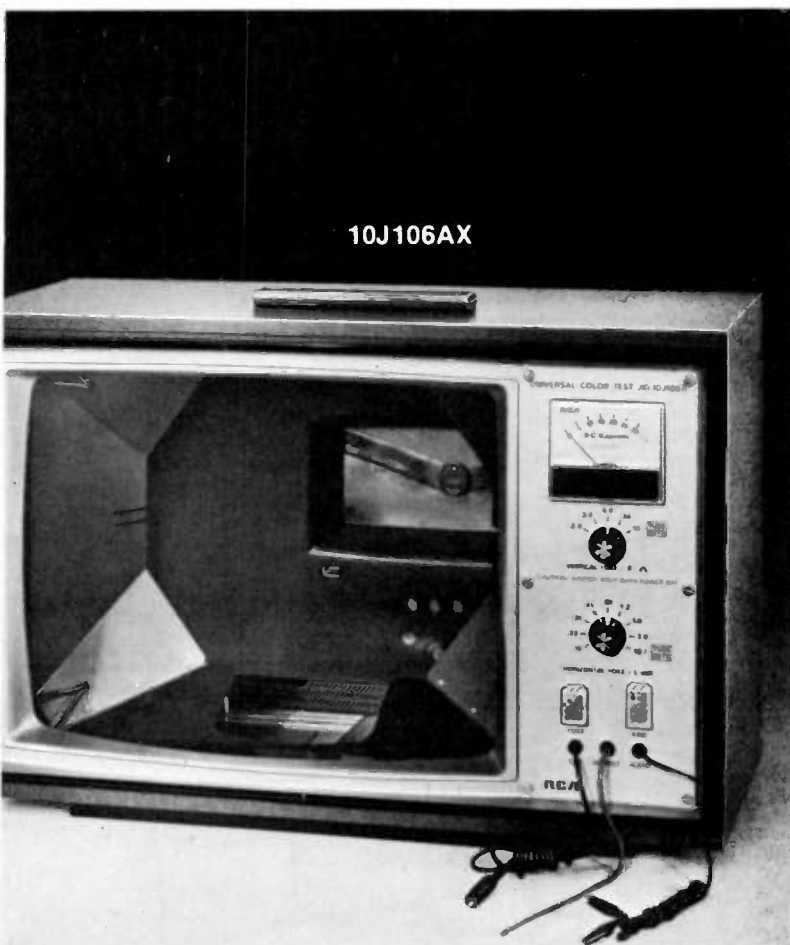
Whatever the size of the busi-

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.

The 10J106A features a 19-inch shielded picture tube; built-in high voltage meter calibrated to 35 kV; two unique front-panel switches for easy changing of yoke impedances; and a built-in speaker. Yoke, picture tube socket, and high-voltage extension cables are supplied, plus a Set-Up Index and instruction book. With the 10J106A you can service thousands of sets whether tube, hybrid or solid-state — including Precision-in-Line types.

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.

The RCA 10J107 Color TV Test Jig Adapter modernizes most older test jigs to perform like the 10J106A. And, if you're a do-it-yourselfer, you can build your own jig from a salvaged TV receiver.

See your RCA Distributor for all the details about which option suits you best. Or contact RCA Distributor and Special Products Division, Deptford, NJ 08096.

RCA Color TV Test Jig

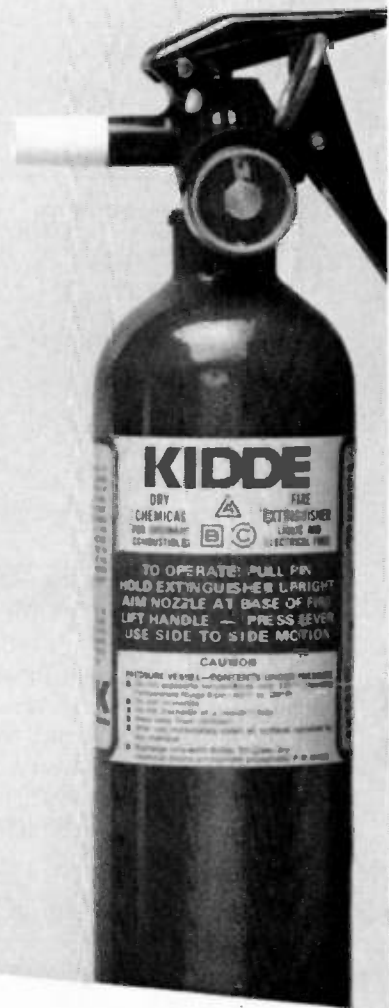
Get 'em while they're hot.

Raytheon is really hot stuff these days. Their RE semiconductors and receiving tubes are super values by themselves. And now with every kit you order, you also get a free Model TPS-2 Kidde dry-chemical fire extinguisher. Now that's one red-hot deal.

The REK-2000 semiconductor kit is a hot item in its own right. It's a new 79 piece SuperRE kit with 24 drawers full of the 24 most popular replacement types, all interchangeable and cross-referenced right on the package. And the

new Raytheon receiving tube kit has been packaged up to contain five each of 10 best selling types . . . and priced down to give you more profit.

Add a free Kidde fire extinguisher and you've got perfect protection for your home, office, boat, service shop or truck. Add it all up and you've got a sure-fire bargain. Order today from your Raytheon distributor or write Raytheon Company, Distributor Products Operation, Fourth Avenue, Burlington, MA 01803.



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

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.

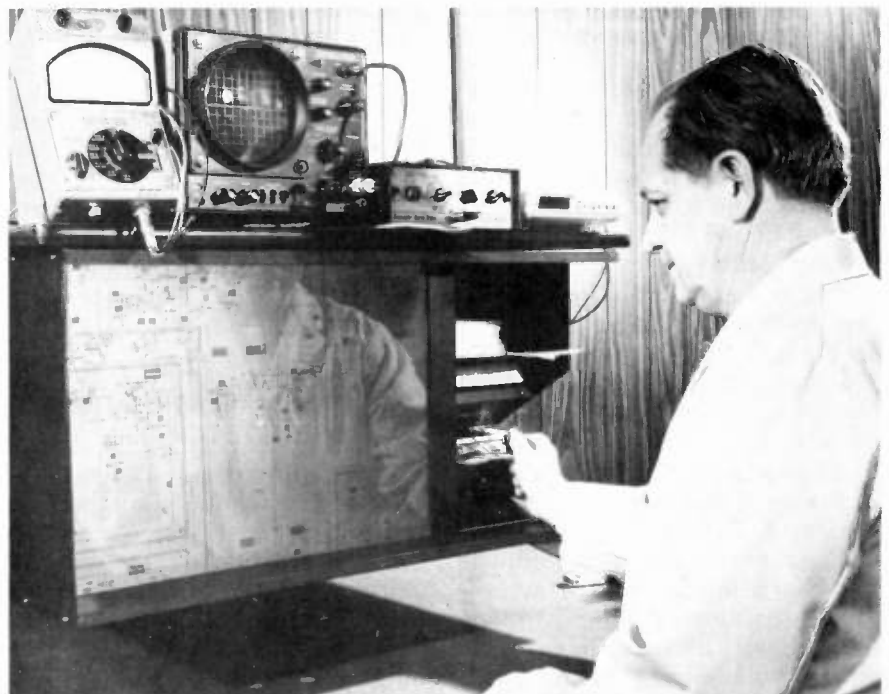


Fig. 6—This is a view of the microfiche system on GTE Sylvania's new Electronic Work Station. The reader projects images one-and-a-half times actual size. It can be rotated on a 'lazy-susan' basis.

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

You can be sure

more times in more circuits in more places
than with any other multimeters on the market today

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

Each Sencore DVM is backed with 15 Megohm input impedance for one third less cir-

cuit loading on every measurement. That means 50% higher accuracy than other DVMs.

DVM38 \$348
3½ DIGIT .1% DCV ACCURACY
AUTO-RANGING DVM

A "prime" standard at your fingertips for measurements you can trust. Auto-ranging for extended low-level range and ease of operation. 15 Megohm input impedance assures .1% reading accuracy is maintained in solid state circuits. Highly sensitive, yet fully protected to 2000 VDC overloads. Hi-Lo Power Ohms circuit simplifies in-circuit resistance measurements.

DVM37 ^{New} \$248
3½ DIGIT .1% DCV ACCURACY
PORTABLE DVM

Prime standard .1% accuracy on the bench or in the field for less than \$250. The DVM37 is the most accurate portable DVM you can buy, with 15 Megohm input impedance for 50% more accuracy. Includes automatic features—Auto Zero, Polarity, Decimal, Overrange. Fully protected inside to over 2000V on all functions, including Ohms, and protected outside with super-rugged case. Full ranges for every test. Fingertip "Push-On" switch in probe saves batteries as power is applied only when needed.

DVM32 \$198
3½ DIGIT .5% DCV ACCURACY
PORTABLE DIGITAL MULTIMETER

Bench and field master for digital accuracy measurements anywhere. 0.5% DCV accuracy, backed with 15 Megohm input impedance. Exclusive battery-saving Auto-Display turns the display on automatically when you make a measurement. 2000V input protection on all functions and ranges—including Ohms.

DVM36 \$158
3½ DIGIT .5% DCV ACCURACY
POCKET PORTABLE DVM

Pocket portable lab accurate performance that fits every budget with highest performance-to-price benefits of any meter. .5% DCV accuracy, backed with 15 Megohm input impedance for lowest circuit loading. Full protection to 1000 V on all functions and ranges—including ohms. Drop-proof case. Battery-saving "Push On" button in probe.

DVM35 \$134
3 DIGIT 1% DCV ACCURACY
POCKET PORTABLE DVM

Fast, direct reading digital accuracy for the man on the go. Same features as DVM36, except 3-digit, 1% DCV accuracy, backed by 15 Megohm input impedance that is ten times more accurate than analog meters.



New DVM37



DVM32



DVM38



DVM36

In stock at your favorite local
Sencore Full Line Distributor.

SENCORE

DIGITAL MULTIMETER SPECIALISTS
3200 Sencore Dr., Sioux Falls, SD 57107 (605) 339-0100

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

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

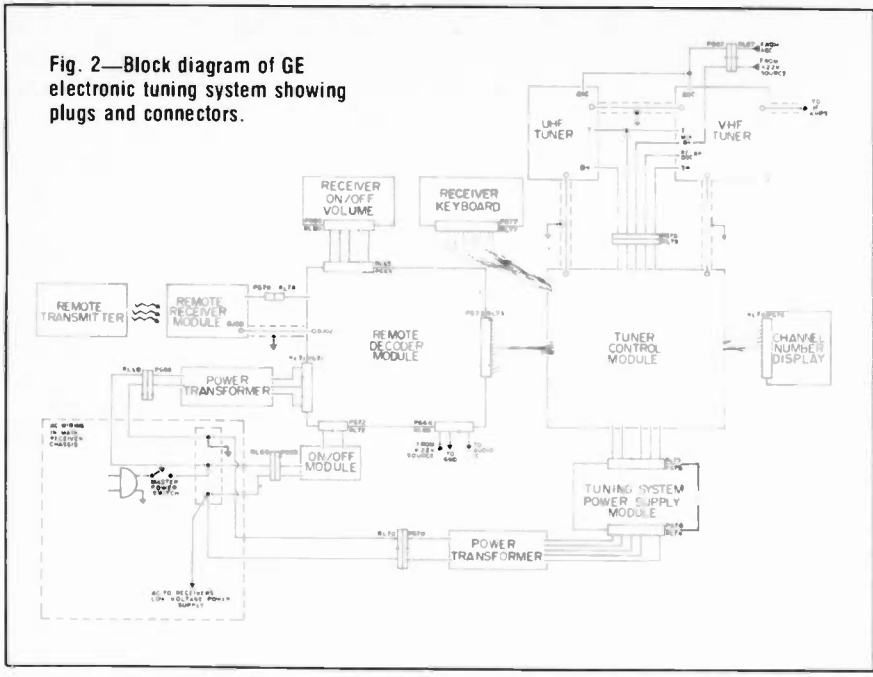


Fig. 3—Complete block diagram of GE's new electronic tuning system.

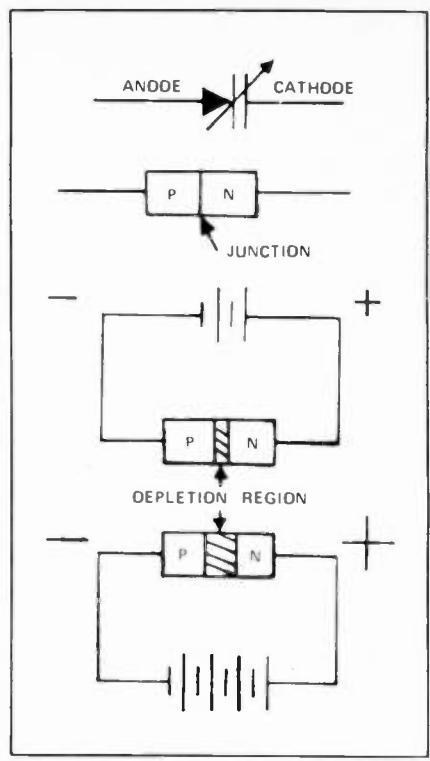
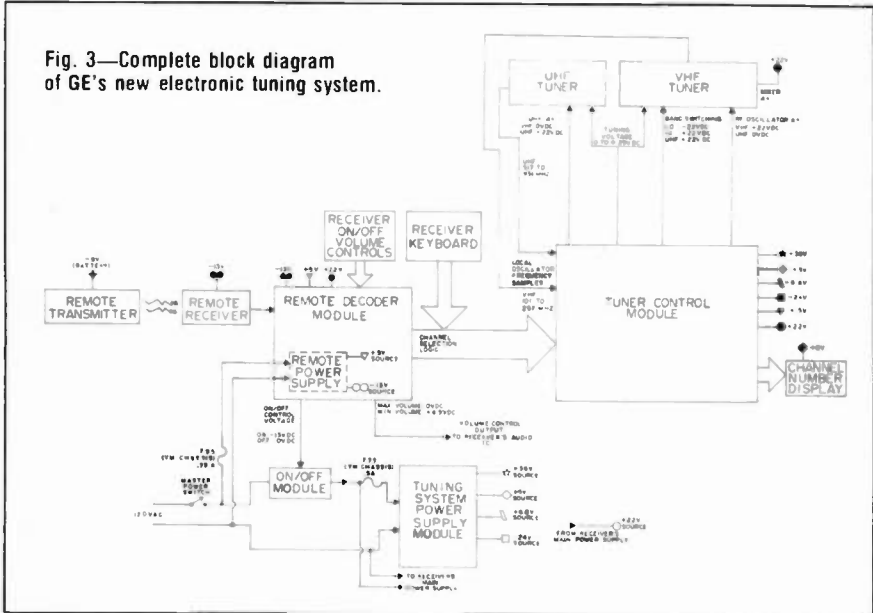


Fig. 4—Diagram of the capacitance change effect on the varactor diodes used in the GE electronic tuning system.

When the reverse bias applied is small, the capacitance is large because the 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.

"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.



ROOF PROOF:

Up where it counts, Channel Master Antennas outnumber every other brand!

And for a very good reason. Channel Master has been manufacturing outdoor UHF, VHF and FM antennas for more than a quarter century. We have the widest selection of antennas, covering every TV region in America...from metropolitan, suburban, fringe, deep fringe to you-name-it. Channel Master makes antennas that pull the picture in! Clear, customer-pleasing reception that can't be beat.

The right combination for every location

Antennas plus rotors, boosters, masting, wire and every accessory you can think of....that's what makes Channel Master **Antenna Headquarters** for dealers and installers throughout

the country. Quantum, Crossfire, Ultra-Hi Crossfire, Channel King, Coloray, Magnadyne..... names to remember when it comes to antennas. All from Channel Master...the best name in reception. Proven on more roof tops than any other brand.

Channel Master

DIVISION OF AVNET, INC., ETD977, ELLENVILLE, N.Y. 12428

...for more details circle 112 on Reader Service Card

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 1¼ 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.
- High accuracy obtained by

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: \pm (1 count + time base accuracy)
TIME BASE: Frequency: 6.5536 MHz. Accuracy: \pm 0.01 ppm/sec; \pm 0.6 ppm/mo; \pm 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: 2.5×10^7 V 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 \pm 4 ppm/year and \pm 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 \pm 0.01 ppm/sec, providing repeatable measurements even to the least significant digit of the 8-digit display.

- Absolute accuracy settable to \pm 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 M Ω 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 M Ω 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 M Ω 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 M Ω , 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.

1807-7006



...for more details circle 118 on Reader Service Card

miniature soldering stations



**NO. 1 ANSWER
FOR
PRINTED CIRCUITS**

BY Weller®

MP Series. Two models, 650°F or 750°F output, designed especially for today's printed circuit electronics. Famous closed loop control protects sensitive components from heat damage. Comfortable pencil-grip iron with non-burnable cord. Power unit operates from line-voltage with step-down transformer. ON/OFF switch and red indicator light. "Non-sinking" tool stand. Tip-cleaning sponge receptacle. Variety of available tips multiply usefulness of this versatile station.

Ask your local distributor or write...

**Weller-Xcelite
Electronics Division**



The Cooper Group

P. O. BOX 728,
APEX, NORTH CAROLINA 27502

...for more details circle 144 on Reader Service Card

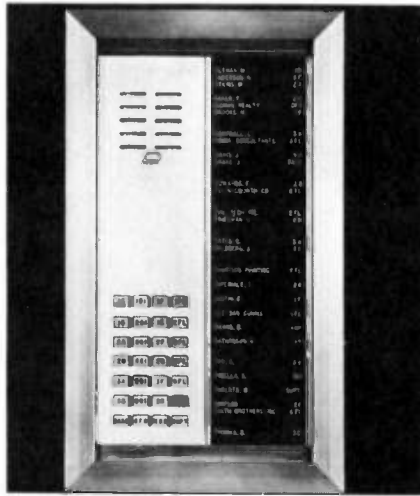
DEALER SHOWCASE

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

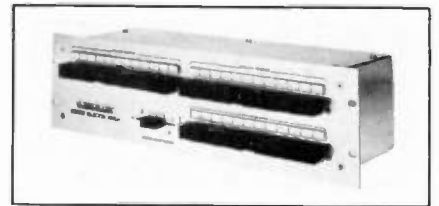


modern coordinated styling, step-up features at important price points and full-color, in-store display packaging. Features such as separate UHF/VHF transmission lines, telescoping VHF/FM arms, high-gain UHF loop, multi-position signal-tuning switch, high IMPAC plastic cabinet, and weighted, felt base 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 64OR 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.*)

*U.S. price only.

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

1807-7005



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

SEPTEMBER 1977, ELECTRONIC TECHNICIAN/DEALER / 45

NEW PRECISION COAX CABLE STRIPPER



Won't nick conductor or your pocketbook!

This little tool can make the big difference in CB reception! Prepares cable for connector perfectly without nicks or scratches and in seconds!

Models available for virtually every communication coaxial cable:

MODEL	CABLE	CONNECTOR
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

Extra precision blades available, #CB-60. Packaged 2 blades per pack.

Available from your local authorized Cablematic distributor.

DEALER INQUIRIES INVITED



UTILITY TOOL CORPORATION

Subsidiary of Ripley Company, Inc.
CROMWELL, CONNECTICUT 06416
Phone: (203) 635-2200

...for more details circle 141 on Reader Service Card

NEW PRODUCTS

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

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

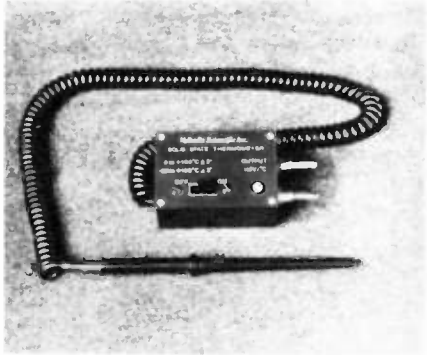
A new heavy duty 13.6 volt DC power supply capable of handling the requirements of CB's new 40-channel AM and SSB radios is now available from *Communications Power, Inc.* Designated the CPI Model PS-5, the new power supply is rated 5 amps continuous and will deliver its full 13.6 volts of power, it 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 1mV/°C is produced for dis-



play on any digital multimeter having a 200 millivolt DC full scale range. A ¼ 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 vehicles 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.

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

1807-7004



...for more details circle 120 on Reader Service Card

we specialize in SOCKETS

and over 3,000 other quality products for the electronic trade available through fine Electronic Distributors everywhere in the U.S.A.

WORKMAN *Electronic*
SARASOTA, FLA. 33578 PRODUCTS, INC.

P.O. Box 3828 (813) 371 4242
TWX 810-864-0401 Workman Sara

...for more details circle 146 on Reader Service Card

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

FREQUENCY COUNTER KITS 161

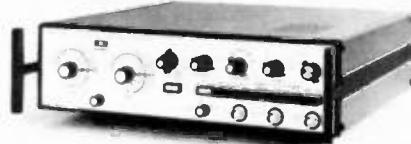
Three new frequency counters in kit form have been introduced by the *Heath Company*. Designated models IM-4110, IM-4120 and IM-4130, the new counters cover the ranges from 5 Hz to 110 MHz, and 5 Hz to 250 MHz, and 5 Hz to 1 GHz respectively. Heath says the new counters offer excellent accuracy and resolution 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

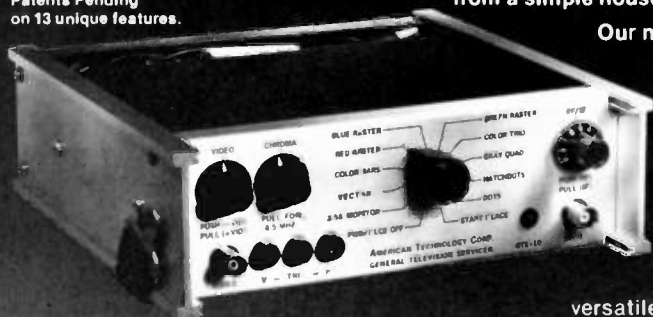
A new 5 MHz, 100,000:1 log sweep function generator with a 30V P-P output is now available from *Exact Electronics*. Designated the model 508, the instrument is actually two generators in one. The main generator is a VCF generator covering 0.0001 Hz



to 5.5 MHz and producing sine, square, triangle, pulse, haversine, and haver-triangle 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

Introducing... GTS-10 our new model of General Television Servicer

Patents Pending
on 13 unique features.



American Technology's model ATC-10, the original General Television Servicer, has earned its reputation for a wide range of useful functions, dependable performance and profit making potential in every imaginable job situation from a simple house call to the toughest dog.

Our new model, the GTS-10, carries on this tradition with added features like 4.5 Mhz Sound Carrier . . . Blue Raster . . . Green Raster . . . Color Trio. Advanced yet sensibly priced the GTS-10 is the ultimate instrument on the TV service equipment market.

Some of GTS-10 features and facts: 3.58 Monitor pattern for oscillator frequency checks with no need to short the AFPC test point / Vector / Color Bars (6th bar marker) / Gray Quad pattern for simplified gray scale tracking checks and adjustments / Red Raster pattern for checking and adjusting purity at the flip of a switch / Hatchdots - versatile composite pattern for static & dynamic convergence / Crystal controlled RF / Wide range RF-IF attenuator / Video and IF outputs for signal injection / Interlace / and more.

Write for comprehensive 6-page full color brochure that describes these and many more features.

Telephone orders on VISA and MASTERCHARGE accepted for same day shipment.

2 year factory warranty against all failures in normal use.

30 day money back guarantee.

ATC
AMERICAN TECHNOLOGY CORPORATION

225 Main Street, Dept. 9B, Canon City, Colorado 81212, (303) 275-8991

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

An Extraordinary Offer to introduce you to the benefits of Membership in

ELECTRONICS BOOK CLUB

take any **3** of these unique electronics books (value to \$5175) for only **99¢** each

with a Trial Membership in the Book Club that guarantees to save you 25% to 75% on a wide selection of electronics books

All two-book sets count as only one of your three Selections.

1010-200 p.—Tower's International Transistor Selector—2nd Edition (\$9.95)



861-252 p.—Display Electronics (\$8.95)

743-224 p.—Electronic Music Circuit Guidebook (\$9.95)

Beginner's Guide to TV REPAIR

INSTALLING TV & FM ANTENNAS by Leo Q. Sands

563/636-344 p.—TWO BOOKS—Beginner's Guide to TV Repair & Installing TV and FM Antennas (\$15.90)

800-602 p.—Master Handbook of 1001 Practical Electronic Circuits (\$12.95)

Master Handbook of 1001 Practical Electronic Circuits

Practical CB Radio Troubleshooting & Repair

microprocessor/microprogramming handbook by brice ward

HOW TO READ ELECTRONIC CIRCUIT DIAGRAMS

INTERNATIONAL TRANSISTOR SELECTOR 2ND EDITION

BUILD-IT BOOK OF DIGITAL ELECTRONIC TIMEPIECES

905-294 p.—Build-It Book of Digital Electronic Timepieces (\$9.95)

510/628-487 p.—TWO BOOKS—How to Read Electronic Circuit Diagrams & Basic Electricity & Beginning Electronics (\$17.90)

785-294 p.—Microprocessor/Microprogramming Handbook (\$9.95)

754-238 p.—Practical CB Radio Troubleshooting and Repair (\$8.95)

913-476 p.—The Complete Handbook of Electrical & House Wiring (\$10.95)

The Complete Handbook of Electrical & House Wiring

COMMERCIAL FCC LICENSE HANDBOOK

80/790-350 p.—TWO BOOKS—111 Digital & Linear IC Projects & 21 Simple Transistor Radios You Can Build (\$15.90)

909-140 p.—How to Build Metal/Treasure Locators (\$7.95)

How to Build Metal/Treasure Locators

111 DIGITAL & LINEAR IC PROJECTS

21 SIMPLE TRANSISTOR RADIOS YOU CAN BUILD

ELECTRONIC CIRCUIT DESIGN HANDBOOK

841-238 p.—Build Your Own Working Robot (\$8.95)

582-444 p.—Commercial FCC License Handbook (\$9.95)

101-416 p.—Electronic Circuit Design Handbook (\$17.95)

919-434 p.—Color TV Trouble Factbook—Problems & Solutions (\$9.95)

May we send you your choice of these 3 practical, time-and-money-saving books as part of an unusual offer of a Trial Membership in Electronics Book Club?

Here are quality hardbound volumes, each especially designed to help you increase your know-how, earning power, and enjoyment of electronics. Whatever your interest in electronics, you'll find Electronics Book Club offers practical, quality books that you can put to immediate use and benefit.

This extraordinary offer is intended to prove to you, through your own experience, that these very real advantages can be yours... that it is possible to keep up with the literature published in your areas of interest, and to save substantially while so doing. As part of your Trial Membership, you need purchase as few as four books during the coming 12 months. You would probably buy at least this many anyway... without the substantial savings offered through Club Membership.

To start your Membership on these attractive terms, simply fill out and mail the coupon today. You will receive the 3 books of your choice for 10-day inspection. YOU NEED SEND NO MONEY! If you are not delighted, return the books within 10 days and your Trial Membership will be cancelled without cost or obligation.

ELECTRONICS BOOK CLUB, P.O. Box 10, Blue Ridge Summit, Pa. 17214

Facts About Club Membership

- The 3 introductory books of your choice carry publishers' retail prices of up to \$51.75. They are yours for only 99¢ each (plus postage and handling) with your Trial Membership.
- You will receive the Club News, describing the current Selection, Alternates and other offerings, every 4 weeks (13 times a year).
- If you want the Selection, do nothing; it will be sent to you automatically. If you do not wish to receive the Selection, or if you want to order one of the many Alternates offered, you simply give instructions on the reply form (and in the envelope) provided, and return it to us by the date specified. This date allows you at least 10 days in which to return the form. If, because of late mail delivery, you do not have 10 days to make a decision and so receive an unwanted Selection, you may return it at Club expense.
- Personal service for your account—no computers used!
- To complete your Trial Membership, you need buy only four additional monthly selections or alternates during the next 12 months. You may cancel your Membership any time after you purchase these four books.
- All books—including the introductory Offer—are fully returnable after 10 days if you're not completely satisfied.
- All books are offered at low Member prices, plus a small postage and handling charge. Prepaid orders shipped postpaid.
- Continuing Bonus: If you continue after this Trial Membership, you will earn a Dividend Certificate for every book you purchase. Three Certificates, plus payment of the nominal sum of \$1.99, will entitle you to a valuable Book Dividend of your choice which you may choose from a list provided Members.

ELECTRONICS BOOK CLUB

P.O. Box 10
Blue Ridge Summit, Pa. 17214

Please open my Trial Membership in ELECTRONICS BOOK CLUB and send me the 3 books circled below. I understand the cost of the books I have selected is only 99¢ each, plus a small shipping charge. If not delighted, I may return the books within 10 days and owe nothing, and have my Trial Membership cancelled. I agree to purchase at least four additional books during the next 12 months, after which I may cancel my membership at any time.

101	563/636	510/628	582	743
780/790	754	785	800	841
861	905	909	913	919
			919	1010

Name _____ Phone _____

Address _____

City _____

State _____ Zip _____

(This offer valid for new Members only. Foreign and Canada add 10¢.) T-97

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

Qualitone

SEND FOR OUR BIG

FREE WHOLESALE CATALOG

FOR DEALERS ONLY!

We do not sell the consumer!

SAVE ON THOUSANDS OF AUDIO AND ELECTRONIC PARTS, TEST EQUIPMENT AND ACCESSORIES.

QUALITONE INDUSTRIES, INC.
696 Locust St., Mt. Vernon, N.Y. 10552
Please send FREE Catalog to:
(Please use your business letterhead.)

Name.....
Company.....
Address.....
City.....State/Zip.....

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

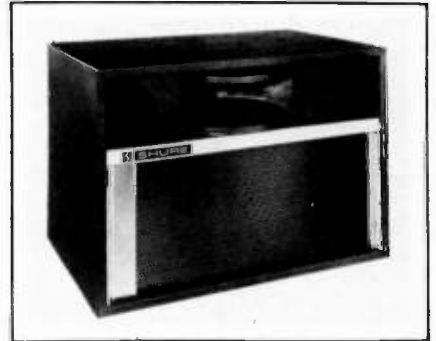
A new feature has been added to de-soldering braid from *Wik-it Electronics*. A new built-in color in the braid indicates exactly where to snip off used braid with no waste. A typical de-soldering of a connection is said to



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.

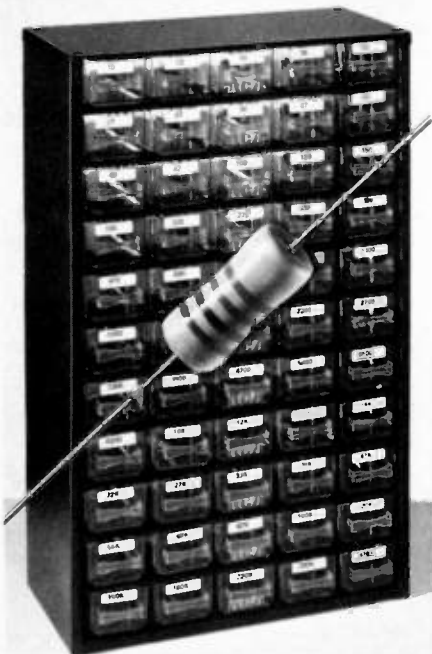
LOUDSPEAKER SYSTEMS 164

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-



igned 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



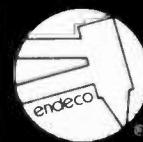
RCA's convenient, preloaded and pre-labeled Flameproof Resistor Kit contains a wide range of the most-needed, standard value resistors in 1/2, 1 and 2 watt ratings. Two of each rating for a total of 330 resistors; all ±2% tolerance. Packed in a sturdy metal-frame cabinet for easy availability.

Service Technicians prefer RCA Flameproof Film Resistors because of their inherent safety characteristics. Design Engineers prefer them because they won't flame or short even under severe conditions. Look to RCA — your best single source for a complete line of flameproof film resistors.

Contact your authorized RCA Parts Distributor for all the details, or write to RCA Distributor and Special Products Division, 2000 Clements Bridge Road, Deptford, NJ 08096.

RCA Flameproof Film Resistors

...for more details circle 133 on Reader Service Card



endeco soldering & desoldering equipment

SOLDERING IRONS



Pencil style. Safety light. Two heats — 20w and 40w. 6 tips. Unbreakable handle. 2 and 3 wire neoprene cords.

DESOLDERING IRONS



Pencil style. Safety light. Some operate at 40w, idle at 20w. 8 tip sizes. 2 and 3 wire neoprene cords.

SOLDERING & DESOLDERING KITS



Everything needed to solder or desolder or both. All in a handy lifetime metal box with hasp.

See your distributor or write...

Enterprise Development Corp.

5127 E. 65th St. • Indianapolis, IN 46220
PHONE (317) 251-1231

...for more details circle 117 on Reader Service Card

doors and the SR116 is a portable unit with a carrying handle. Both speakers, however, feature extra weather protection for limited periods of outdoor use. Both models will operate with high power amplifiers delivering up to 100 watts of continuous power to an 8-ohm load. Frequency response is virtually flat over the usable response range of 45 Hz to 16,000 Hz. Net price of the SR112 is \$340; the SR116 is \$384.00.

NOISE FILTERING CB HOOKUP HARNESS 166

A new noise filtering hookup harness for two-way radio installations has been introduced by *Gold Line Connector*. Designated No. 1106, the new harness is said to reduce the noise picked up by the wiring. Double-



barrelled filtering action is supplied by heavy-duty coaxial cable for the power pickup which shields against unwanted noise. A ferro-magnetic filter further reduces any remaining interference. The 1106 also has an in-line power fuse for additional protection.

FREQUENCY COUNTER ACCESSORIES 167

Two new universal accessories for frequency counters having 1 megohm BNC input connections have been introduced by *Sencore*. They are (1) the PL207 RF pick-up loop for inductive frequency pickup without actual connections into the circuit under test, and (2) the NE206 noise eliminator, which allows noise-free stable counting of digital signals under all types of



conditions. The RF pick-up loop plugs directly into the 1 megohm input and 'sniffs' the circuit frequency when placed near a circuit component, with-

out loading or changing the frequency. The noise eliminator removes all the high frequency pulse interference from the lower frequency digital signal and attenuates counting signals which contain additional frequencies other than the fundamental frequency desired. The pick-up loop sells for \$9.95 and the noise eliminator sells for \$25.

MATV AMPLIFIERS FOR UHF 168

A new series of MATV amplifiers capable of proving 4-volt output on single UHF-TV channels 14 thru 70 has been developed by *Jerrold Elec-*

THE PROFESSIONAL'S STANDARD FOR EXCELLENCE

South River's HEAVY-DUTY, TUBULAR TRI-POD ROOF TOWERS

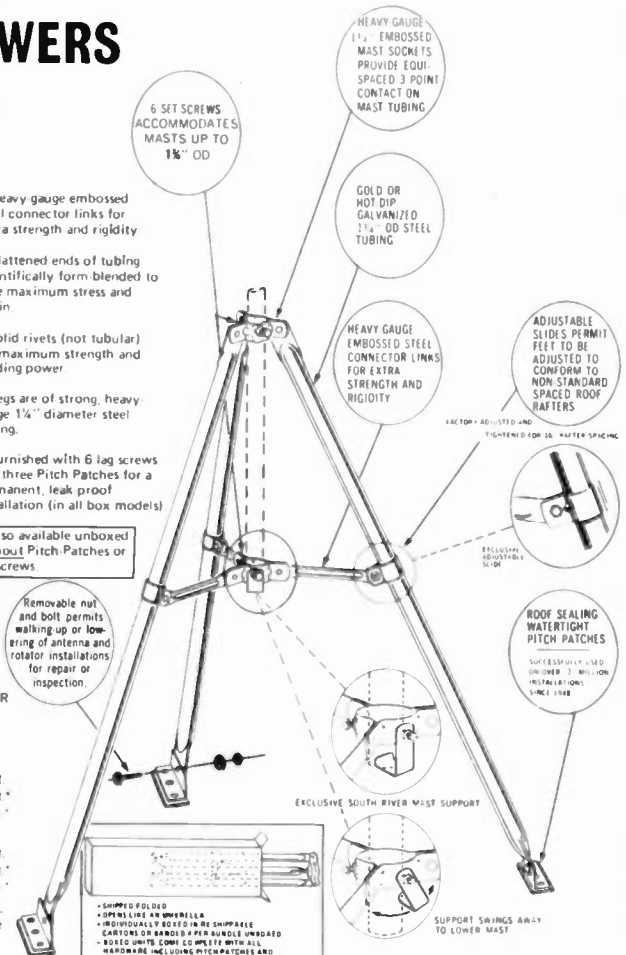
ONLY *South River*
GIVES YOU ALL THESE
PLUS FEATURES TO MAKE
INSTALLATIONS EASIER...
BETTER!

- Exclusive South River mast support holds mast in place while antenna is oriented. Mast support swings aside to permit lowering mast tubing, to work on antenna, rotor, or amplifier.
- Six heavy 5/16" set screws with 12 jam nuts keep mast from turning.
- Heavy gauge steel, 1 1/4" width embossed mast sockets provide equi-spaced three-point contact on mast tubing.
- Removable nut and bolt permits walking up or lowering of antenna and rotor installations for repair or inspection.
- Heavy gauge embossed steel connector links for extra strength and rigidity.
- Flattened ends of tubing scientifically form blended to take maximum stress and strain.
- Solid rivets (not tubular) for maximum strength and holding power.
- Legs are of strong, heavy gauge 1 1/4" diameter steel tubing.
- Furnished with 6 lag screws and three Pitch Patches for a permanent, leak proof installation (in all box models).
- Also available unboxed without Pitch Patches or lag screws.

GOLD BAKED ENAMEL OR HOT-DIP GALVANIZED
CAN BE MOUNTED ON PEAKED OR FLAT ROOFS • ELIMINATES NEED FOR GUY WIRES
• ACCOMMODATES MASTS UP TO 1 1/2" OD • RECOMMENDED FOR COLOR TV INSTALLATIONS WHERE HEAVY MULTI-ELEMENT ANTENNAS ARE USED

GOLD BAKED ENAMEL TOWERS			
HDT-2G	2 ft.	HDT-5G	5 ft.
HDT-25G	2 1/2 ft.	HDT-75G	7 1/2 ft.
HDT-3G	3 ft.	HDT-100G	10 ft.
HOT-DIP GALVANIZED TOWERS			
HDT-2	2 ft.	HDT-5	5 ft.
HDT-25	2 1/2 ft.	HDT-75	7 1/2 ft.
HDT-3	3 ft.	HDT-100	10 ft.

*Exclusive SWING-LOCK feature included permits mast to be placed in sockets from side of tower



Send for latest catalog.

FREE ALARM CATALOG

Huge selection of burglar & fire systems, supplies. Motion detectors, infrared beams, controls, door switches, bells, sirens. 900 items, 64 pp. packed with technical details, notes.
Phone (602) 263-8831



mountain west alarm
4215 n. 16th st., phoenix, az. 85016

...for more details circle 126 on Reader Service Card

SOUTH RIVER METAL PRODUCTS COMPANY, INC./MATAWAN, NEW JERSEY 07747

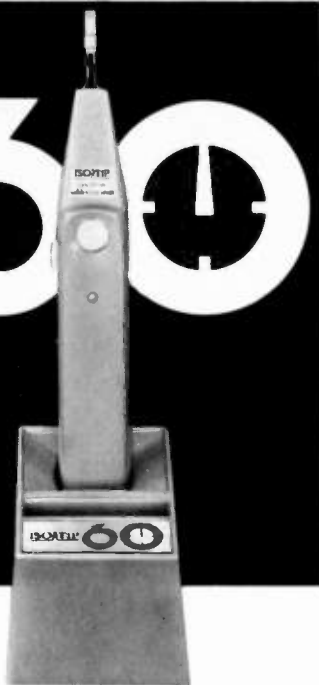
DESIGNERS AND MANUFACTURERS OF THE MOST COMPLETE LINE OF QUALITY ANTENNA MOUNTS AND MOUNTING ACCESSORIES

...for more details circle 137 on Reader Service Card

ISO-TIP®

cordless soldering iron completely recharges in 60 minutes.

MAKES CORDLESS SOLDERING PRACTICAL FOR HEAVY-USE APPLICATIONS.

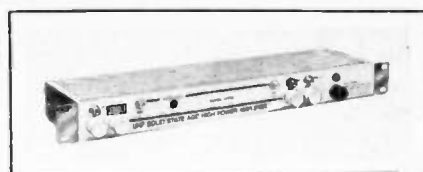
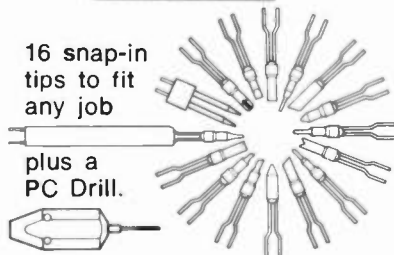


The Iso-Tip 60 can make up to 125 electronic joints or more per charge. When completely discharged, the iron can be recharged and used in a few minutes or fully recharged in an hour. Low voltage, battery powered, ground free isolated tip design. Ask your electronics dealer.

WAHL CLIPPER CORPORATION
 ORIGINATORS OF PRACTICAL CORDLESS SOLDERING
 2902 Locust Street • Sterling, Illinois 61081 • (815) 625-6525
 "Manufacturing Excellence Since 1919"

...for more details circle 143 on Reader Service Card

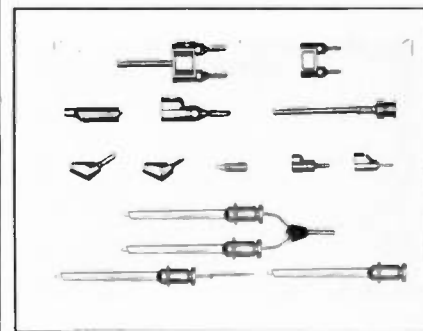
16 snap-in tips to fit any job
 plus a PC Drill.



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 3/8 inch 6 digit L.E.D.'s with pin-point colons and decimal point. Front panel function includes a



Seeking Original Japanese Replacement Parts for CB Repair Use?

CB REPAIR PACKAGE \$77.00 value for only \$59.00

Now repair almost all CB's with this package of Japanese Transistors

ZSK 19 FET	2 pcs	ZSC 1306	4 pcs
ZSD 235	4 pcs	ZSC 1239	3 pcs
ZSC 710	10 pcs	ZSC 1307	4 pcs
ZSC 775	4 pcs	ZSC 756	3 pcs

SPECIAL PACKAGE OF MOST COMMON DRIVERS & FINALS

This kit contains 6 each of:

ZSC 775	ZSC 756
ZSC 1018	ZSC 799
ZSC 1226	ZSC 1239
ZSC 1306	ZSC 1307

\$140.00 value for just \$99.95

CHECK OUR NEW REDUCED PRICES! COD ORDERS WELCOME Under \$500 no deposit required

Original Japanese Transistors, FET, IC, Diodes

TRANSISTORS	ZSB 415	70	ZSC 509	90	ZSC 776	2 65	ZSC 1060	2 25	ZSC 1675	.59	FET	TA 7061AP	1 90
ZSA 495	70	ZSB 471	1 60	ZSC 535	70	ZSC 778	3 60	ZSC 1096	1 00	ZSC 1679	4 25	ZSK 19	1 60
ZSA 562	59	ZSB 474	1 20	ZSC 536	59	ZSC 781	2 65	ZSC 1166	59	ZSC 1684	59	ZSK 30	90
ZSA 628	59	ZSB 492	1 00	ZSC 562	2 15	ZSC 784	59	ZSC 1173	90	ZSC 1728	2 00	ZSK 33	1 10
ZSA 634	90	ZSB 483	59	ZSC 619	59	ZSC 785	70	ZSC 1175	59	ZSC 1760	2 00	ZSK 34	1 10
ZSA 640	59	ZSC 184	59	ZSC 620	59	ZSC 789	1 00	ZSC 1189	1 40	ZSC 1816	4 25	ZSK 47	1 20
ZSA 643	70	ZSC 371	59	ZSC 668	59	ZSC 793	2 80	ZSC 1213	70	ZSC 1908	59	ZSK 49	1 30
ZSA 683	70	ZSC 372	59	ZSC 696	1 95	ZSC 799	3 60	ZSC 1226	1 00	ZSC 1909	4 40	ZSK 55	1 30
ZSA 719	70	ZSC 373	59	ZSC 710	59	ZSC 802	3 60	ZSC 1237	4 25	ZSC 1957	1 20	ZSK 68	1 30
ZSA 720	70	ZSC 380	59	ZSC 711	59	ZSC 815	59	ZSC 1239	3 50	ZSC 1975	4 40	ZSK 22	2 55
ZSA 721	70	ZSC 381	59	ZSC 712	59	ZSC 828	59	ZSC 1306	4 40	ZSD 77	1 00	ZSK 35	2 25
ZSA 733	59	ZSC 387	59	ZSC 717	59	ZSC 829	59	ZSC 1307	4 90	ZSD 142	2 00	ZSK 39	2 25
ZSB 54	59	ZSC 394	59	ZSC 732	59	ZSC 838	59	ZSC 1317	59	ZSD 180	2 50	ZSK 40	2 25
ZSB 75	59	ZSC 403	59	ZSC 733	59	ZSC 839	59	ZSC 1318	59	ZSD 187	66	ZSK 41	2 50
ZSB 77	59	ZSC 454	59	ZSC 734	59	ZSC 900	59	ZSC 1330	1 50	ZSD 188	3 00	ZSK 45	2 50
ZSB 186	59	ZSC 458	59	ZSC 735	59	ZSC 930	59	ZSC 1359	1 40	ZSD 227	59	MK 10	2 00
ZSB 324	70	ZSC 460	59	ZSC 756	2 80	ZSC 943	1 20	ZSC 1364	1 40	ZSD 234	1 00	IC	
ZSB 337	1 60	ZSC 461	59	ZSC 763	59	ZSC 945	59	ZSC 1377	4 90	ZSD 235	1 00		
ZSB 367	1 50	ZSC 481	1 60	ZSC 773	70	ZSC 1014	1 20	ZSC 1449	1 00	ZSD 313	1 10	SN 7410	19
ZSB 368	2 15	ZSC 482	1 50	ZSC 774	1 60	ZSC 1017	1 40	ZSC 1475	1 40	ZSD 325	1 10	SN 7430	60
ZSB 405	70	ZSC 495	1 00	ZSC 775	1 95	ZSC 1018	1 20	ZSC 1674	.59	ZSD 360	1 20	TA 7045M	3 00

PRICES MAY CHANGE WITHOUT NOTICE

IMMEDIATE DELIVERY WITHIN 48 HOURS ON ALL TRANSISTORS IN STOCK

Minimum order \$10.00. Ohio residents add 4% sales tax. Add \$1.00 postage and handling. Quantity discount prices.

ASK FOR OUR COMPLETE PRICE LIST

MANUFACTURER INQUIRIES WELCOMED

All Parts Guaranteed Against Factory Defects

FUJI-SVEA ENTERPRISE

Dept. ET
 P.O. Box 40325
 Cincinnati, OH 45240
 (513) 874-0220
 (513) 874-0223

...for more details circle 122 on Reader Service Card

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

TEST JIGS
FROM \$39.95
YOKE ADAPTORS
ALL \$4.95 EACH
CONV. PLUGS
ALL \$1.50 EACH

PLUS:

**HORZ. AND VERT.
MATCHING SYSTEMS**

**CRT ADAPTORS
FOR ALL TEST JIGS**



DOWD ENTERPRISES

P.O. BOX 315
167 HUNTING HILLS LANE
MEDIA, PA. 19063

**SEE YOUR DIST.
OR WRITE
FOR FREE CATALOG**

...for more details circle 115 on Reader Service Card

Where's the screwdriver?



In a tool box, tools and parts are everywhere. They're hard to find. They get lost. (And they get dirty.)

With a Platt tool case, that wouldn't happen. It's designed so you'll know where everything is. Smaller tools are in individual pockets in our patented one-piece pallet. Larger tools and parts are in compartments. And papers and order book are in lid pockets. (Everything is neat and clean.)

And Platt's tool case helps you look more professional.

It comes in handsome, lightweight, durable ABS Thermoplastic. Or rich looking vinyl reinforced by ABS Thermoplastic.

What's more, it also has a 5 year guarantee.

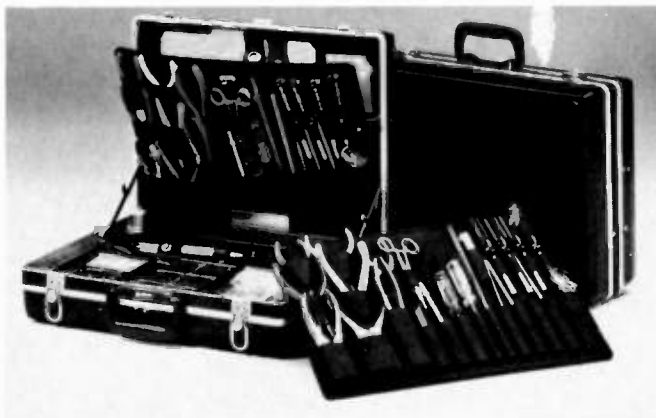
Contact us for complete information on Platt's full line of tool cases and your nearest distributor.

Pat. No. 3,880,285

Cases for business and industry.

2301 S. Prairie Ave., Chicago, Ill. 60616 (312) 225-6670

platt



...for more details circle 129 on Reader Service Card

**You can pay more.
You can pay less.
But you can't buy
a better FET VOM.**

The ultimate VoltOhmyst®

- Measures AC or DC volts. 0.05V to 1500V.
 - Current from 0.15mA to 1.5A
 - Hi- or Lo-power ohms (R X 1 to R X 1 Meg), with pushbutton polarity reversal.
 - Autopolarity, taut-band mirror-scale meter with 3 color-coded scales, separate polarity-indicating meter
 - AC or battery operation.
- WV-534A**
\$150.00



See it at your VIZ distributor
**VIZ Test
Instruments Group**
of VIZ Mfg. Co.

© VIZ
6643 A

335 E. Price St.
Phila. PA 19144

Formerly
VIZ
Instruments

...for more details circle 142 on Reader Service Card

ORIGINAL JAPANESE PARTS

For Hi-Fi, Auto Sound, T.V.,
C.B. and More

Lower Price than a "REPLACEMENT"
Compare Our Prices and Service

I.C.'S	2SC839	.50
AN214Q	2SC867	4.00
AN247P	2SC945	.50
BA511A	2SC1013	1.10
M5115P	2SC1014	1.10
TA7205P	2SC1061	1.30
TA7204P	2SC1098	1.00
uPC554C	2SC1116	4.00
uPC575C2	2SC1172	6.25
TRANSISTORS	2SC1173	.85
2SA102	2SC1211	.60
2SA473	2SC1222	.70
2SA545	2SC1226	.85
2SA564	2SC1306	3.30
2SA606	2SC1674	.75
2SA634	2SC1675	.75
2SA699	2SC1444	2.00
2SA720	2SC1358	7.00
2SA733	2SD213	3.25
2SA748	2SD227	.50
2SB405	2SD234	1.00
2SB463	2SD261	.60
2SB556	2SD361	.95
2SC373	2SD426	4.80
2SC634A	2SD471	.75
2SC710	2SD571	.75
2SC711		
2SC828	8 Track Heads	2.95

The above is a partial list. Ask for a Complete Dealer Catalog. We ship all possible orders Within 24 HRS. Min. order \$10.00. We Pay Shipping on Prepaid Orders Over \$20.00. (We refund all unused money)

ORA
ELECTRONICS

P.O. Box 7548, Van Nuys, CA. 91409

...for more details circle 128 on Reader Service Card

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



**GO
DIGITAL,
GO DANAMETER®**

(The New VOM For Today's Needs.)

- 0.25% Accuracy
- Full Overload Protection
- Really Drop-Proof
- Full One Year Battery Life

DANA®

Dana Laboratories, Inc.

2401 Campus Dr, Irvine, Ca 92715, (714) 833-1234

...for more details circle 114 on Reader Service Card



**INCLUDES
RETARDED CITIZENS**

National Association for Retarded Citizens
2709 Ave. E. East, Arlington, Texas 76011
Area Code: (817) 261-4961

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. ■

SERVICE AIDS



Chemicals, Lubricants,
Cleaners, Coolers,
Adhesives & Solder
For All Service Situations
at
Great Savings

WRITE FOR FREE CATALOG



**Projector-Recorder
Belt Corp.**

414-473-2151

200 Clay St. - Whitewater, WI 53190

...for more details circle 130 on Reader Service Card

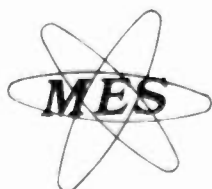
RELY ON THE MODULE REBUILDER

TO REBUILD YOUR MODULES AND SPEED-UP YOUR SERVICE ON MODULAR TV'S

HIGHER PROFITS - NO INVENTORY NEEDED

- WE: - Specialize in all Magnavox & G.E. modules
- Service all Magnavox remote controls
 - Final check all modules on an operating chassis
 - Use only factory specs parts for repairs
 - Have been in TV servicing for 20 years
 - Are factory trained, CET's & state licensed
 - Give you a 1 year limited guarantee

SEND YOUR MODULES NOW - 48 HOURS IN SHOP SERVICE



**MODULAR
ELECTRONICS SERVICES, LTD**

4024 W. 10th St.
Indianapolis, Ind 46222
(317) 243-8347

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

CLASSIFIED

RATES: 40 cents per word (minimum charge, \$10). Bold face words or words in all capital letters charged at 50 cents per word. Boxed or display ads charged at \$46 per column inch (one inch minimum). For ads using blind box number, add \$3 to total cost of ad. Send ad copy with payment to: Susan Hellerman. ELECTRONIC TECHNICIAN/DEALER, 757 Third Avenue, N.Y., N.Y. 10017.

BOX NUMBER REPLIES: Mail box number replies to: ELECTRONIC TECHNICIAN/DEALER, Classified Ad Department, One East First Street, Duluth, MN 55802. Please include box number in address.

Business Opportunities

TV business, shop, equipment, inventory for sale. Located in small town in rural NE Pa. RCA, Quasar, Sylvania. White goods available. Gross income \$42,000 can be greatly increased by good man. For more information write Box 110, ET D. 9 77

Virgin Islands shop expanding TV/Stereo Antenna techs needed, solid state experience required. Resume to Glenn, Box 6-L, Sunny Isle, St. Croix, U.S.V.I. 00820. 9 77

FOR SALE: TV Sales and Service. Sacrifice. Florida East Coast. Retiring—16 years—same location. Reasonable rent—\$18,500 cash or terms. 1-305-723-6161. 9 77

ATTENTION SERVICE DEALERS



Now you can buy directly—at substantial savings—Top-Line PR brand professional Solid-State replacements for all entertainment and industrial types. These are professional devices which replace over 130,000 industry types, and you buy them at savings of approximately 40% below regular dealer cost. To order: Send us the ECG, SK, or GE numbers that you need and we will promptly ship you the premium PR direct replacements—plus a free PR Replacement Guide. Remember, these are all premium, 2-year warranty devices—No Culls, No Seconds—only professional Top-Line quality. Orders over \$20.00 shipped free; orders up to \$20.00 add 75¢ for UPS. Orders over \$100.00 receive 5% discount. To approximate amount of your order, deduct 40% from dealer cost of the ECG, SK, or GE types.

Send your order in now to:

Devco Distributors P.O. Box 270, Garwood, New Jersey, 07027
(201) 688-0300

ELECTRONICS/AVIONICS EMPLOYMENT OPPORTUNITIES. Report on jobs now open. Details FREE. Aviation Employment Information Service, Box 240 Y, Northport, New York 11768. 8 78

FOR FREE LITERATURE TELLING HOW. ELECTRONIC DEVELOP. LAB, DEPT. B, BOX 1535, PINELLAS PARK, FLA. 33565. TF

START ELECTRONIC FACTORY IN YOUR HOME. GET STARTED IN YOUR SPARE TIME. BIG PROFITS. ONE MAN OPERATION. EXPERIENCE NOT NECESSARY. WRITE

TRANSFERRED airline pilot has lucrative TV repair shop in beautiful colonial on 1/2 acre. \$49,900 for home. TV business FREE. Bruce Electronics, 10 White Birch Drive, Centereach, NY 11720, 516-585-6262. 10 77

send a message... ...write here.

1. Number of insertions: (circle) 1 2 3 6 12
2. Start with (month) _____ issue (Copy must be in by 1st of month preceding)
3. Amount enclosed: \$ _____

PAYMENT MUST ACCOMPANY ORDER. WE'LL BILL RATED FIRMS. NO AGENCY COMMISSION.

NAME _____ COMPANY _____

STREET _____

CITY _____ STATE _____ ZIP _____

MAIL AD COPY TO: SUSAN HELLERMAN, ELECTRONIC TECHNICIAN/DEALER, 757 THIRD AVENUE, NEW YORK, N.Y. 10017.

RATES: 40 cents per word (minimum charge, \$10). Bold face words or words in all capital letters charged at 50 cents per word. Boxed or display ads charged at \$46 per column inch (one inch minimum). For ads using blind box number, add \$3 to total cost of ad.

ELECTRONIC TECHNICIAN/DEALER Classified

PICTURE TUBE MACHINE

We buy and sell NEW AND USED CRT rebuilding machinery. COMPLETE TRAINING. Buy with CONFIDENCE from the ORIGINAL MFRG. For complete details, send name, address and zip code to:

LAKESIDE INDUSTRIES

3520 W. Fullerton Ave., Chicago, IL 60647
Phone: 312-342-3399

ELECTRONICS TECHNOLOGY INSTRUCTOR: Teach basic electronics. B.S. degree desirable. Electronics service experience necessary. Contact M. R. Halsey, Head, Electrical/Electronics Department, Ferris State College, Big Rapids, Michigan 49307, (616) 796-9971, Ext. 208. **AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER.** 9/77

SELLING, FLORIDA—ZENITH T.V. SALES & SERVICE: 16 YEARS SAME LOCATION—PARTS, FIXTURES, EQUIPMENT & CUSTOMERS—\$7000.00. BILL ELLIS, 5688 OAKHURST DR., ST. PETERSBURG, FL. 33542. 9/77

Florida T.V. Service for sale. Same location 20 years. Complete Sams, up to date, many other schematics, parts and good customers. \$12,000. George Pappas, 8000-19th Ave., N. W., Bradenton, Fla. 33505. 9/77

TV-RADIO SALES AND SERVICE BUSINESS FOR SALE IN PARKER, ARIZONA. On the Colorado River. Excellent climate. Beautiful new building with 14 x 40 showroom and 28 x 40 shop. RCA franchise. 20 year clientele. Enormous growth potential. Peak gross of \$52,000 can be doubled with good teamwork. \$22,500 cash; which includes \$5,000 floored RCA and \$1,500 floored Hitachi. Retiring at age 70. Chamber of Commerce literature available. Gaither Radio-TV, P.O. Box 624, Parker, AZ 85344. 9/77

Retiring from TV business—Everything goes for one price—3 scopes, meters, generators including sweep and marker, over 1200 tubes (in their boxes) capacitors (several hundred new), many other parts (new), \$1,500.00 freight collect. Sea Jay Electronics, 3209 Glenview Road, Chesapeake, Va. 23321. 9/77

TV tube rebuilding, make 15 tubes per shift. Automatic equipment. Will train new owner. \$7,000 plus stock. Breshears, 2333 South Compton, St. Louis, MO 63104.

Television Sales & Service Business in Sthn. Calif. desert community! Located in newest & largest shopping center in the area. Huge Marine base nearby. Heavy service work. Zenith & RCA lines (no competition in area!). Very comfortable net shown! Owner asking \$59K. Write P. O. Box 91916, L.A., CA 90009. 9/77

For Sale

RECORDACALL—Auto60-up to 120 calls, 24 hours, monitor, dictation, ff, rewind, erase, microphone, warranty. \$130.00 Postage cod. Illinois residents add sales tax. TERRY'S, Box 209A, Park Ridge, Illinois 60068. 12/77

ORIGINAL JAPANESE TRANSISTORS, ICs for Stereo and CB. Repair for less. Example—2SC458 \$.45, 2SC710 \$.45, 2SD313 \$1.10. Ship within 24 hours. Write or call **MCM AUDIO, 639 Watervliet, Dayton, Ohio 45420. (513) 252-5662.** 11/77

TV AND RADIO TUBES. 36¢ EA!! Send for free color parts catalog. Your order free if not shipped in 24 hours. Cornell Electronics 4215-17 University San Diego California 92105. TF

REPLACEMENT COLOR YOKES—DEALERS ONLY. Zenith 95-2501-2532-2638-2667-S89633 etc. \$16.95. Magnavox 361380-1 \$18.95 etc. Sylvania, G.E. etc. \$14.95 to \$19.95. Request for price list on your letterhead. David Sims Enterprises, Inc., 665 Jericho Turnpike, Huntington Station, N.Y. 11746. TF

TRANSISTOR REPLACEMENT. PHYLTRON ELECTRONICS LX REPLACEMENT LINE REPLACES THE MOST POPULAR REPLACEMENT TYPES AT OR BELOW DISTRIBUTOR COST. One year unconditional guarantee. Buy direct and save. Write for free catalog. Phyltron Electronics, 487 Springfield Ave., Summit, N.J. 07901. 10/77

INCREASE YOUR INCOME! Rent, Lease or Sell TV's New or Used; Anyone can! Easy to start and operate, part or full time; even from your home. Basic preliminaries \$4.00. Perry's TV Leasing, 308 N. McClelland, Santa Maria, Calif. 93454. 10/77

19" Portable Color T.V.'s. Excellent condition, late models. Quantities available. R.C.A., G.E., Admiral, Zenith, etc. Kamcor, Ltd., 88 So. Washington Ave., Bergenfield, NJ 07621. 10/77

FOR SALE: UHF TUNERS. Complete line of solid state plus some RCA KRK66AM and Philco UT-51. \$10.00 plus postage and handling. Metropolitan TV, 3341 Kensington Ave., Philadelphia, PA 19134. Phone 215 423-2502. 10/77

ORIGINAL REPLACEMENT JAPANESE SEMICONDUCTORS (Transistors, ICS, etc.). Confidential dealer price list available on request. Write: **NU-TRONICS, P. O. Box 27242, San Antonio, Texas 78227.** 9/77

REPAIR TV TUNERS—High earnings, Complete Course Details, 12 Repair Tricks, Many Plans, Two lessons, all for \$2. Refundable. Frank Bocek, Box 3236, Ent., Redding, CA 96001. T/F

REM CRT TESTER OWNERS: Update your unit to handle new inline CRT's. Send \$2.00 for plans and information on modification service. Write to Box 111, ET/D. 9/77

BUGGING & WIRETAPPING is a growing public concern. Are you equipped to answer your customers' questions—and get your share of the 'de-bugging' profits? 'ELECTRONIC SPYING' is the most simplified and comprehensive book ever written on the subject of electronic surveillance, and will tell you all you need to know. Order direct from publisher for only \$6.00: **MENTOR PUBLICATIONS, Dept. 120, 135-53 No. Blvd., Flushing, N.Y. 11354.** 10/77



AMAZING OFFER RADIO/TV SERVICE DATA

Your best, complete source for all needed early Radio and TV diagrams and helpful servicing data from 1970 back. Old prices; amazing values. Sets sold at 30% discount. Cover all important makes and models. Use this ad as your no-risk order form.

NO-RISK ORDER COUPON

TELEVISION SERVICE MANUALS

Supreme TV manuals are still best for faster, easier TV repairs. Accurate factory data at bargain prices. Complete circuits, all needed alignment facts, printed circuit views, waveforms, voltages and double-page schematics. Issued in large annual manuals. Sold in sets at 30% off, or at \$4 per volume. Send entire ad as your order form.

- Between 1965 and 1970, in 7 large vols., B-W & color, retail \$28, only \$19.60
- Between 1957 and 1964, in 7 handy volumes, regular price \$28, now only \$19.60
- 3 different early 1950's TV manuals, \$9.95

RADIO DIAGRAM MANUALS

These low-priced radio manuals simplify all repairs. Cover everything you may need from recent radios to antiques; all makes radios, stereos, transistor portables, FM-AM, and auto sets. Large schematics, all needed alignment facts, printed boards, voltage data, dial stringing. Volumes are big, 8 1/2 x 11", most have 192 pages. Only \$4 each.

- 1960 through 1969, in 8 volumes, cover all makes, value \$32, only \$22.40
- Between 1951 and 1959, in 7 large vols., data you need, value \$28, only \$19.60
- 1950, 1948, 1942, 1941, each \$4
- FREE Sale Inf. on old Rider, Sams, etc.
- Auto Radio Repair Manual, \$2.50

SUPREME PUBLICATIONS

1760 Balsam Road, Highland Park, IL 60035
Rush TV and Radio manuals checked in no-risk order form above. I am enclosing full price plus \$1 for postage and handling. Satisfaction guaranteed.

Name: _____
Address: _____
City: _____ Zip: _____

COMPUTER FUTURE—We are looking for qualified independently owned radio-television and electronic shops to handle our Educational, Professional and Personal Computers. We provide training and a protected area. S/D Computer Technology, P.O. Box 1283, Albany, NY 12201 9/77

RCA—ZENITH—PANASONIC EXACT REPLACEMENT PARTS. Largest stock. Green Tele-Radio Distributors, 172 Sunrise Highway, Rockville Centre, NY 11570 UPS C.O.D. 10/77

Alarm Systems

CALL THE POLICE (or anyone else) AUTOMATICALLY. Model 672 dialing unit \$29.95. Send today for your free catalog of high quality burglar and fire alarm equipment at low prices. S&S Systems, 5619 E St. John, Kansas City, MO 64123. 9/77

Wanted

WANTED: CB RADIO REPAIR CONTRACT WORK. A & R SERVICE, NORTH HAVEN, CONN. 203-239-0155 (evenings). 10/77

Seeking original Japanese transistors, IC, FET and diodes for CB repair use? Write or call for our list and compare prices. Fuji-Svea Enterprise, Dept. ET, P.O. Box 40325, Cincinnati, OH 45240. (513) 874-0220. 2/78

FORDHAM BEST BUYS

SENCORE TF 40 Pocket Cricket Portable Transistor & FET Tester

- ✓ Solid state
- ✓ Completely portable
- ✓ 100% safe test in seconds



FOR PRICING AND TO PLACE YOUR ORDER:

Call collect for Mr. Louis
(516) 752-0050

Master Charge, BankAmericard
& C.O.D.'s accepted

FREE 148 page catalog of over 3000 items...
test equipment, CB, tools, tubes, components and
a full line of electronic supplies

YOUR ONE STOP DISCOUNT CENTER

FORDHAM

RADIO SUPPLY CO., INC.
855 Conklin St., Farmingdale, N.Y. 11735

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

Watch for

Chroma POWER '78

And watch TV get better.

ACA

Box 865, Burlington, Iowa 52601

Len Finkler LTD.
Downsview, Ontario M3J 2A6

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

READER SERVICE INDEX ADVERTISER'S INDEX

105 American Technology Corp.	48
106 Antenna Corp. of America	58
107 Arrow Fastener Co., Inc.	16
108 Astatic Corp.	10
109 B & K Div., Dynascan Corp.	28
110 Castle Electronics	27
111-112 Channel Master	29, 41
113 Charous & Neibergall, Inc.	58
114 Dana Laboratories, Inc.	54
115 R. J. Dowd Enterprises	53
116 Electronic Book Club	49
117 Enterprise Development Corp.	50
118-120 Fluke Mfg., John	43, 45, 47
121 Fordham Radio Supply Co., Inc.	58
122 Fuji-Svea Enterprise	52
GTE Sylvania	Cover 3, 5
General Electric, Tube Div.	20
General Electric, TV Dealer	33
123 Lear Jet Stereo Sound Systems	3
124 Mallory Distributor Product Co.	23
125 Modular Electronics Services, Ltd.	55
126 Mountain West Alarm Supply Co.	51
127 Oneida Electronic Mfg., Inc.	11
128 Ora Electronics	54
102 PTS Electronics, Inc.	Cover 2, 1
129 Platt Luggage	53
130 Projector-Recorder Belt Corp.	55
Qualitone Industries, Inc.	50
131 Rawn Co., Inc.	30
132 Raytheon Co.	36
101 RCA-Outdoor Antennas	17-18
RCA-Outdoor Antennas	34-35
RCA—Receiving Tubes	6-7
133 RCA—Resistors	50
134 Sencore, Inc.	39
135 Sentry Mfg. Co.	3
136 Simpson Electric Co.	24
137 South River Metal Products Co.	51
138 Texas Tuner Service	58
139 Thordarson Meissner, Inc.	30
104 Triplett Corp.	Cover 4
140 Tuner Service Corp.	21
141 Utility Tool Corp.	46
142 VIZ Manufacturing Co.	53
143 Wahl Clipper Corp.	52
144 Weller-Xcelite Electronics Div.	44
145 Winegard Co.	2
146 Workman Electronic Products Inc.	48
147 Zenith Radio Corp., Service, Parts & Acces. Div.	8-9
Zenith Radio Corp., Consumer Div.	13

This index is furnished for the readers' convenience. However, the publisher can not guarantee its accuracy due to circumstances beyond our control.

APPLIANCE REPAIR BOOKS



Thirteen Handbooks written in easy-to-understand language by experts in the service field with illustrations and diagrams! Acclaimed by instructors and professionals alike! How to diagnose and repair air conditioners, refrigerators, washers, dryers, ranges, microwave ovens, dishwashers, vacuum cleaners, electrostatic air cleaners, RV gas appliances, hair dryers, motors, water heaters, coffeemakers, can openers, floor polishers, steam irons, food mixers, lawn care appliances, electric knives, electric and digital clocks and many others. Also fundamentals of solid state, setting up a shop, using test instruments and more. **Only \$2.65 to \$4.90 ea.**

SEND FOR FREE PRICE LIST

C & N, Dept. ET
5841 W. Montrose Avenue
Chicago, Illinois 60634

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

AC TUNER SUB COMBO \$24.95



This is a wired and tested combination VHF/UHF tuner sub unit that has its own AC power supply and works equally well on color or b/w...tube or transistor sets...The VHF tunes channels 2 thru 13...The UHF is a detent (the kind that clicks for each channel) and tunes 14 thru 83.

It would be very easy to put in a letter file box from the dime store or any other case. It comes with instructions and is transformer powered for isolation safety...The knobs can be scrounged from an old TV.

Really fellows...This unit is not a toy...It works and works well...It will make you money...If you are not completely satisfied, return within 10 days for full refund.

The supply is limited and when these are gone...there will be no more, so order today. Simply say "Send me the tuner sub combo"...All orders will be shipped the same day received.

Send \$24.95 and we pay shipping or we will ship COD.

TEXAS TUNER SERVICE

4210 N.E. 28th St., Fort Worth, TX 76117
Phone: (817) 834-8201

...for more details circle 138 on Reader Service Card

Suddenly, you're the most versatile shop in town.

With this little 25-pound test jig, you can adapt to over 10,000 color sets, 59 different brands. Delta 70° and 90° tube, hybrid, transistor, SCR sweep. Anode voltages to 30kV and more. Regular 4.5kV and 7.1kV focus voltages.

And our new optional In-Line Test Kit lets you handle more than 100

precision in-line chassis, including RCA, Magnavox, Admiral and Sears. (We're the first test-jig manufacturer to offer a kit like this.)

CK3000 comes to you fully assembled, pretested and ready to use. Just plug it in,

and you're in business. See it now, at your Sylvania distributor.

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

The Sylvania CK3000



Simply the most versatile test jig you can buy.

GTE SYLVANIA

The easy-to-read 630 makes learning easy.

The Model 630 V-O-M is priced at a thrifty \$82.

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

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

It's packed with major features:

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

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

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

Rugged black molded plastic case with removable black leather carrying strap. All this for just \$82.

Get the same convenience and operating advantages plus 1½% DC accuracy and mirrored scale with the Triplet Model 630-A, priced at only \$94.

See them for yourself. Just ask a Triplet distributor or sales represen-

tative to give you a free demonstration of the tester that fits your needs. You'll be glad you did. So, do it today. Triplet Corporation, Bluffton, Ohio 45817.

TRIPLET
ALL YOU'LL EVER NEED IN V-O-M'S.



Triplet. The easy readers.

...for more details circle 103 on Reader Service Card
...for FREE demonstration circle 104 on Reader Service Card