

OCTOBER 1976 • 75 CENTS



A HARCOURT BRACE JOVANOVIICH PUBLICATION

# ELECTRONIC TECHNICIAN/DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION



*Vesto Versus Mass Merchandisers:  
Promoting Quality Service, Not Price*

**Test Equipment For CB Servicing**

**Ratio Analysis Of Financial Statements**

**GE's 1977 Color TV Line**

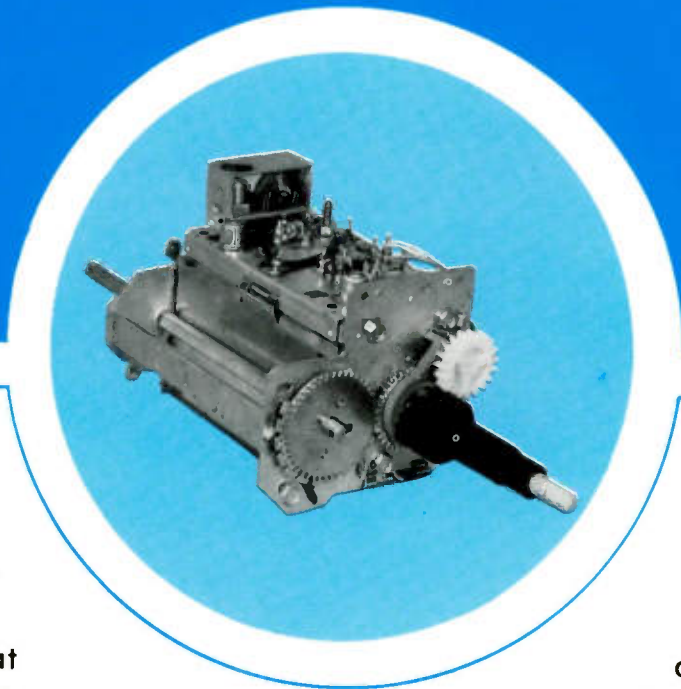
**Troubleshooting 'Dead' Oscillators**

KOMR9724311-1-1-2-  
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THE COMPLETE LIST OF ALL PTS SERVICE CENTERS APPEARS ON THE NEXT PAGE.

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

# PUBLISHER'S MEMO



## FOURTH QUARTER REPORT

As reports come in from the Marketing Services Department of the Electronic Industries Association, I see an upswing in Television and Radio sales this fall and certainly continuing into the first quarter of 1977. This plus a continuing surge in CB aftermarket and accessories sales is good news for the 70,000 professional electronic technicians and service-dealers who read **ELECTRONIC TECHNICIAN/DEALER** regularly. According to the EIA, total U.S. market sales to dealers of television and radio products increased for the month of August, 1976 over August, 1975. Television set sales of 927,049 compared to 913,932 units sold in the same month last year indicate a 1.4% increase. Color-TV set sales were up 12.6% with 571,771 sold in August. Monochrome TV set sales totalled only 355,278 for a drop of 12.5%. This shows the complete swing to color and in most cases the purchase of color for the second set in the American household. Total August radio sales to dealers increased 11.6% with 3,883,791 units sold and total AM sales for August were up

36.8%. To me, this indicates that the American consumer has regained his confidence and is buying. The CB aftermarket and accessories sales should continue to surge in direct proportion to the CB sets sold. In addition to microphone and antenna replacement sales, CB units are unique among consumer electronic products in that several vital components are subject to unusual wear, tear and abuse. Aftermarket opportunities therefore will continue to expand long after the initial CB set selling spree subsides. Our editors recently conducted a survey on the CB market and you should be reading a report about this survey. All I know is that the electronic service technician who does not explore the CB market as a means to augment his income is missing the boat.

In keeping with the marketing opportunities, the editors of **ELECTRONIC TECHNICIAN/DEALER** will make it top priority that our 70,000 professional electronic technicians and service-dealers are kept well informed about everything pertaining to this scope of selling activity.

The ET/D editors' editorial mission is to explain many of the new schematics to our readers engaged not only in the servicing of TV sets, but other home entertainment electronic products as well, including popular CB sets.

I certainly would welcome comments and suggestions from you—the readers—on what you may expect from **ELECTRONIC TECHNICIAN/DEALER** in 1977 and years to come. Thank you.

*Al Menegus*

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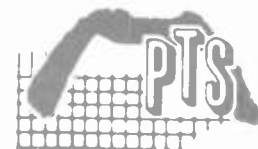
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# **ELECTRONIC TECHNICIAN/DEALER**

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**THE COVER:** A view of the Vesto TV building in Kansas City. The firm was started in 1948 and has successfully competed with price-oriented merchandisers by effectively promoting a "Quality Products Backed By Quality Service" image. (see story on page 11)

## **11 Vesto TV: 28 Years of Quality, Not Price**

This is the story of how one Kansas City TV sales and service dealer competes with price-oriented merchandisers—and has done so successfully for two generations and 28 years. By Grier Lowry & J.W. Phipps

## **16 GE Color Television For 1977**

An overview of the models and chassis in General Electric's new color TV line, with emphasis on the most revolutionary circuits in the all-new 25YM chassis. By Don W. Mason, ET/D Managing Editor.

## **24 Financial Statements Made Easy—Part 2**

A practical explanation of the company balance sheet and how to use it for more efficient management of your electronic sales/service business. By Paul F. Dontje, CET.

## **28 Test Equipment For CB Servicing**

For anyone planning to get into CB servicing, this is a review of equipment needed and costs involved for a successful operation. By John E. Magnusson.

## **32 Troubleshooting the Dead Oscillator**

A review of techniques and equipment for troubleshooting the oscillator circuit. By Joseph J. Carr, C.E.T.

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## Riley really rallied to our "rally 'round the tab!"

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

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

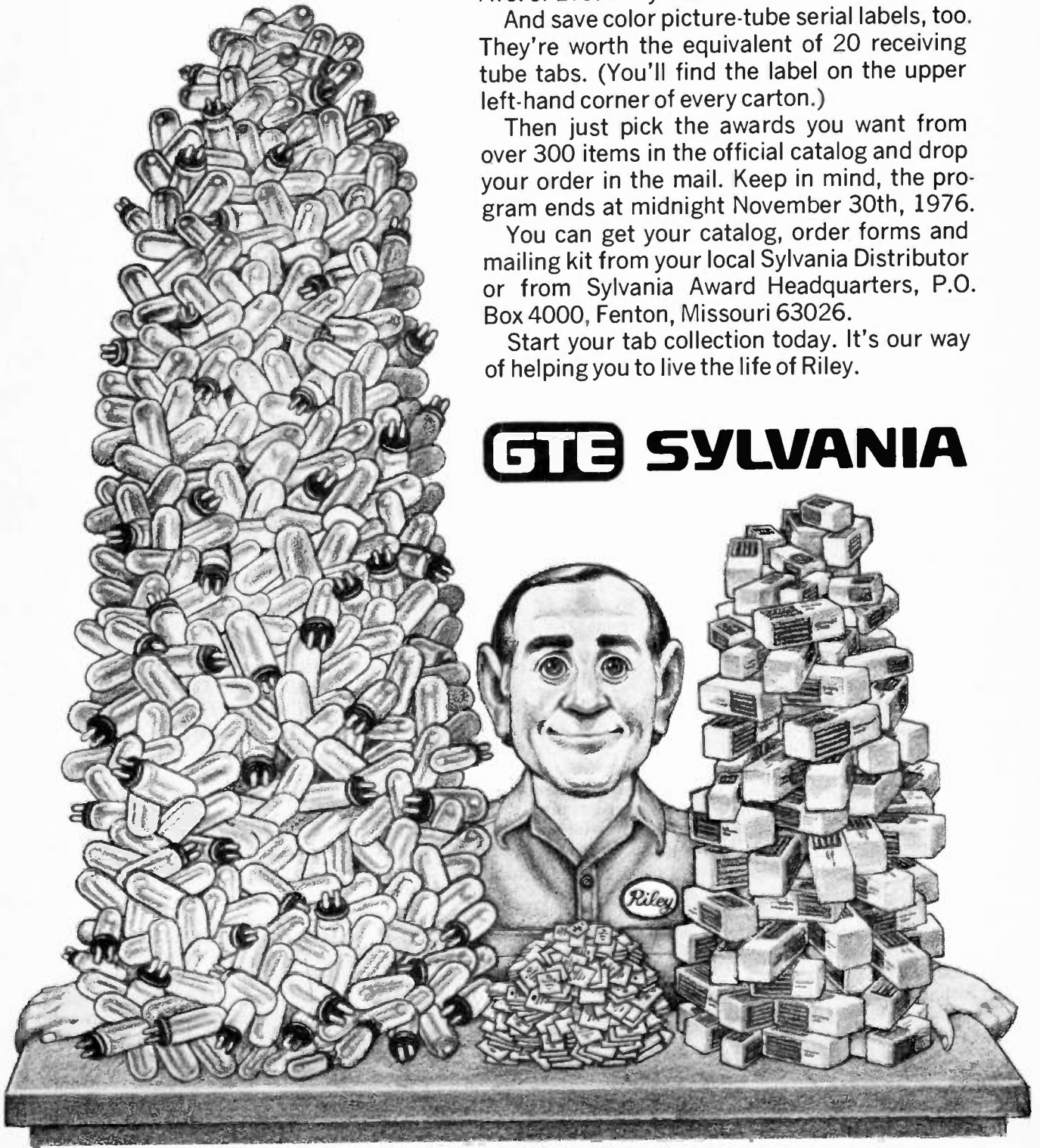
And save color picture-tube serial labels, too. They're worth the equivalent of 20 receiving tube tabs. (You'll find the label on the upper left-hand corner of every carton.)

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

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

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

# GTE SYLVANIA



# TECHNICAL LITERATURE

**A Mail Order Catalog of Test Instruments** and other electronic equipment is available now from Baynton Electronics. The BiCentennial edition of the 64-page catalog lists, illustrates and provides prices for such items as test equipment, coaxial components, power supplies, chart recorders, frequency changers, constant voltage transformers, trimming potentiometers, relays, panel meters, and closed circuit TV equipment. Available free from *Baynton Electronics Corporation*, 2709 North Broad Street, Philadelphia, Pa 19132.

**Antenna Rotor System Literature** is now available from Cornell-Dubilier Electronics. The folder describes their 360° TV/FM antenna rotor system that provides a choice of four different control boxes. The CDE Rotor Bell is said to provide pinpoint rotation under all weather conditions, high tuning power, high reliability and precise control with excellent repeatable performance. Available free from William Carlson, *Cornell-Dubilier*, 150 Avenue L, Newark, N.Y. 07101.

**Home Study Course on Oscilloscope Measurements** is available now from Philips. The course is contained in a 60-page book titled "Zeroing in on Ones and Zeros". The course, which provides detailed theory and operational information on oscilloscope use in digital measurements is divided in 6 parts: Principles, Additional Functions, Measurement, Probes, Digital Features, and Measurement Examples. Available for \$3 from *Philips Test & Measuring Instruments, Inc.*, 400 Crossways Park Drive, Woodbury, N.Y. 11797.

**A New Transistor and Diode Cross-Reference Guide and Selector** is now available from Magnavox. The pocket-sized guide shows a selection of 25 most popular Magnavox transistor and diode replacements cross-referenced to replace 80 different types. Enclosed with the pocket selector is an order form price list, which includes all transistors and diodes in stock. Available free at *Magnavox Parts Centers*.

**Tools and Terminals For CB**, now available in assortment displays for dealers, are illustrated and described

in a new full-color catalog from Vaco Products. Included are descriptions of the Master CB Tool Center, which is a floor standing gondola containing 34 tools and terminals; the CB Jr. Tool Center, a wall panel display with 9 tools and terminals; and a CB Installers tool kit with the five most used CB tools. Catalog SD-201 is free from *Vaco Products Company*, 510 No. Dearborn St., Chicago, ILL 60610.

**Digital Instrumentation** is fully described and illustrated in the latest 12-page catalog available from Data Precision. The catalog features specifications and prices for a broad range of digital multimeters including: 3½ digit and 4½ digit portables, 4½ digit bench and systems instruments, 5½ digit bench and high speed systems multimeters and 7 digit 100 MHz Time/Counter. It also includes a new 3½ digit portable and a new 5½ digit 100 conversions/second systems multimeter. Available free from *Data Precision Corporation*, Audubon Road, Wakefield, MA 01880.

**A Semiconductor Replacement Guide for CB** cross-references 3,600 part numbers for 44 brands of CB radios to GTE Sylvania's line of ECG semiconductors. The new guide, ECG 212F-2, contains a numerical list of Sylvania ECG semiconductors—diodes, integrated circuits, modules, rectifiers and transistors—for use in domestic and imported brands of CB radios. It also includes an alphabetical list of the 44 brands of CB radios with their semiconductor part numbers itemized in numerical order. Available from Sylvania distributors, or for 50 cents, for postage and handling, from: *GTE Sylvania Advertising Services Center*, 70 Empire Drive, West Seneca, N.Y. 14224.

**How To Set Up Video Playback Systems** is the subject of the latest newsletter from Memorex. The current issue describes, through text and simplified diagrams, the various ways to set up a video playback system, including a discussion on the pros and cons of video looping, and tips on how to utilize such aids as a distribution amplifier and an RF adaptor. Volume 2, No. 4 of "Scan" is available free from *Memorex Corporation*, P.O. Box 420, Santa Clara, CA 95052.

**Professional Sound Reinforcement Equipment**, including the SR component group of equipment from Shure Brothers, is described in their newest brochure, AL470B. The SR component group includes: audio con-

soles, mixers, power amplifiers, an electronic crossover, an extended range speaker, a portable speaker column, an all-weather speaker column with permanent mounts, and an array of custom accessories. Available free from *Shure Brothers, Inc.*, 222 Hartrey Avenue, Evanston, IL 60204.

**Unusual and Hard-to-find Tools** are listed and pictured in the latest catalog from Jensen Tools. The catalog describes with photographs, many in full color, over 2800 tools, including micro-tools, power tools, test equipment, soldering equipment, engineering supplies, screwdrivers, pliers, wire strippers, tweezers, and a 30-page section featuring the firm's line of tool kits and cases. Available free from *Jensen Tools and Alloys*, 4117 North 44th St., Phoenix, AZ 85018.

**A Cable Tie Line brochure**, recently revised, has been released by the Panduit Corp. The 8-page literature describes the full line of the firm's Pan-Ty cable ties, clamps, marker ties, push mount ties and lashing ties. Information provided is on 36 different cable tie sizes and types for bundle diameters up to 12 inches and minimum loop tensile strength up to 250 lbs. Included are 24 different cable ties, five clamps, five marker ties and two push mount ties. The booklet is available free from *Panduit Corporation*, 17301 Ridgeland Avenue, Tinley Park, ILL 60477.

**A Multi-Tester Bulletin, SP-73**, is offered now by Sperry Instruments. The literature offers detailed specifications, product descriptions, a list of features, packaging information, and prices for each of the nine Sperry multi-testers. There is also a price list of accessories. Available free from *Sperry Instruments, Inc.*, 245 Marcus Blvd., Hauppauge, N.Y. 11787.

**Signal Analyzer Spec Sheet** that gives oscillator, sinewave, square wave and metering specifications for 3M's Model 6110 Signal Analyzer is now available. Information is provided about this new integrated function test instrument that combines in one unit the capabilities of seven individual pieces of comparable equipment: wideband variable sinewave and squarewave oscillators; automatic ranging voltmeter, decibel meter and automatic frequency tracking ranging counter and wideband tuneable wave analyzer. For free copy write to: *3M Company*, Mincom Division, Department MN6-7, Box 33686, St. Paul, Minn. 55101. ■

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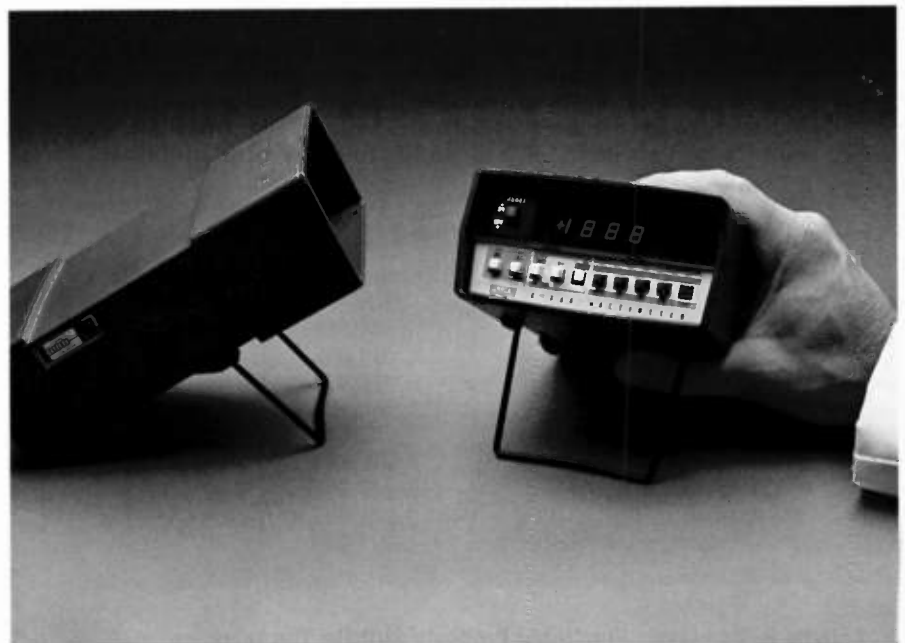
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OCTOBER 1976, ELECTRONIC TECHNICIAN/DEALER / 5

# NEWS OF THE INDUSTRY

## Remanufacturing Program Is Offered to Buyers of 23-channel CB Radios

When the FCC announced in July the decision to expand from 23 to 40 CB channels, there was plenty of worry in the industry that consumers would hold off purchase of a new CB rig until the 40-channel units got on the market sometime after January 1st. The fear of being caught with inventories of *non-moving* 23-channel units caused several major manufacturers to announce programs of remanufacturing existing 23-channel units to handle all 40 channels, even though the FCC channel expansion announcement in July seemed to rule out such a move.

The way was cleared, however, for the remanufacturing program by a subsequent FCC clarification of the expansion rulings. Their clarification notice read, "Although 'add-on' devices are strictly prohibited, a few grantees propose to accept certain of their presently type-accepted, 23-channel radios in trade for their radios having 40 channels. The commission has no objection to such programs, provided that such 40-channel equipment meets all new requirements, and is type-accepted and certified."

At ET/D presstime, the following CB manufacturers had offered their 23-channel customers some form of remanufacturing program or trade-back policy on a 40-channel model: Hy-Gain, Pace/Pathcom, Pierce-Simpson, Sharp, Kris, and Surveyor.

In describing their program, Andrew A. Andros, chairman of Hy-Gain, said, "Our remanufacture plan makes it possible for most previous and future purchasers of the company's 23 channel units to use their equipment for 40 channels." He explained that Hy-Gain units with Phase Lock Loop design qualify, and estimated that the cost for remanufacture would be \$25. Meanwhile, according to *Electronic News*, Pace/Pathcom is "telling customers that the Pace 23-channel sets can be easily and economically updated to 40 channels." Joseph L. Haskins, Pace marketing manager, estimated cost of conversion would be 15 to 20 per cent of the original retail price of the units.

According to the program announced by Sharp Electronics, buyers of Sharp models CB-800, CB-750 and CB-760, if purchased since July 26, will be able to exchange them at participating dealers for a 40-channel set. Cost to the consumer is \$30. Kris, Inc. will offer a trade back credit of up to \$140 on a 40-channel set when they debut in January. Bill Garry, national marketing manager, explained that the offer applies to all Kris transceivers except models XL70 and 23+. "The idea is," Garry said, "remove all doubts in the consumer's mind concerning 23-channel operation, and get that guy or gal on the air now while CB enthusiasm is high."

Surveyor Industries, Inc. has announced what they call a two-part program of exchange. As described by William J. Gannon, Surveyor national sales manager, "For the time period between October 1 and December 31, 1976, Surveyor will allow a 50% distributor inventory exchange of 23-channel units purchased against 40-channel units ordered after January 1, 1977. Also, Surveyor will issue to consumers purchasing a 23-channel unit after September 1 a certificate allowing them to trade the unit in after January 1, 1977 for a new 40-channel unit, at a cost of \$35."

## EIA Figures Show Most Consumer Electronics Sales Increase Over 1975

In all categories of consumer electronics but three, sales to dealers have increased during the first eight months of 1976, as compared to the first eight months of 1975, according to the latest figures from EIA. Black and white television sales are down by 1.8%, AM-only radios are down by 8.9% and portable component phonos are down 21.7%. Car radios leaped ahead in 1976 by 48.1%, color TV is up by 13.3%.

Sales To Dealers (from EIA)

Products	8 months 1976	8 months 1975	% change
Total TV	7,264,151	6,812,119	+6.6
color	4,293,272	3,787,761	+13.3
black/white	2,970,879	3,024,358	-1.8
Total radio	24,246,485	21,178,767	+14.5
home, portable	16,305,048	15,817,713	+3.1
AM-only	4,059,841	4,458,417	-8.9
FM & FM-AM	12,245,207	11,359,296	+7.8
automobile	7,941,437	5,361,054	+48.1
Portable, component phono.	1,621,240	2,070,294	-21.7

## Activity in Consumer Electronic Products Still On The Increase

According to *Gnostic Concepts*, a business information service, overall activity in the consumer electronics industry should show an increase in 1976 of 17.5 per cent over 1975.



# TALK STRONG

Get the most out of your rig with LEADER test equipment

Get stronger, cleaner output . . . Enjoy more air time . . . obtain long-lasting contacts — all with Leader test gear. Monitor output, deviation & audio levels. Match your antenna for maximum radiation. Obtain the right impedance match. These easy-to-use instruments are moderately priced and help you get more power and mileage. Leader . . . your "performance test center".



**(A) LBO-310Ham Oscilloscope  
W/Built-in LA-31 RF Monitor Adapter**

Observe IF circuit waveforms and monitor SSB and AM transmitter signals. The built-in LA-31 Adapter, helps provide continuous monitor of RF output (to 500W). The LBO-310Ham will also indicate tuned condition for RTTY operation. Internal 2-tone generator checks SSB. Vert. sensitivity — 20mVp-p/div. DC-4MHz b'width. It's a sensitive, general purpose scope, too.

**\$269.95**

**LA-31 Adapter for use with our  
LBO-310A or any scope with  
deflection plate conn.**

**\$ 22.95**

**(B) LDM-815 Transistorized Dip Meter**

Checks receiver, x'mitter and antenna in 1.5 to 250MHz range. Determines LC network resonance freq'y. Helps align receivers and find parasitic oscill'tns. Instrument combines with the LIM-870A for proper antenna matching.

**\$99.95**

**(C) LIM-870A Antenna Impedance Meter**

Take your time. Adjust your antenna slowly for perfect matching. This self-contained, battery operated Impedance Meter lets you make adjustments on your roof or at the antenna by combining with the LDM-815 Dip Meter. The combination also measures linear amplifier and receiver input impedance. Compact, lightweight with 1.8 to 150MHz freq. range; 0-1K  $\Omega$  direct-reading impedance range.

**\$99.95**

**(D) LPM-880 RF Watt Meter**

Measure RF x'mitter power output in the 0.5 to 120W range from 1.8 to 500MHz. Features pushbutton range selection with 50  $\Omega$  load impedance. Also measures power losses in low pass filters and coaxial cables. - Complete with sturdy tilt stand.

**\$149.95**

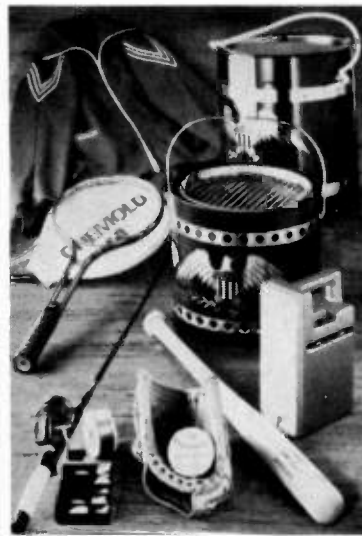
"Performance Test Center"  
**LEADER**  
Instruments Corp.  
Communications Division

See your dealer  
or write direct.

151 Dupont Street  
Plainview, N.Y. 11803  
(516) 822-9300

**Tear  
'n  
Share™**

**RCA**  
Electronic  
Components  
Trade Mark(s) & Registered  
Marca(s) Registrada(s)



"New consumer products are being introduced," the service reports, "at such a fast pace that prices are already declining for some of the more competitive items. Such is the case with video games and digital watches. At the more mature end of the spectrum is the TV, radio and automotive business, where new product expansion has slowed, but improved features, stabilized suppliers and prices best characterize this sector."

### Portable/Table Models Take Bigger Share of Color TV Mix in 76

According to EIA figures on color TV sales for the first half of 1976, the portable and table models increased in their share of the total mix, and the consoles lost some ground. Portables and table models made up to 71% of the total in 1976, compared to 67.3% in 1975. Consoles comprised 32.2% of the total mix in 1975, but dropped to 28.6% in the first half of 1976.

Type	1976		1975	
	Units	% of total	Units	% of Total
Portable-table	2,699,000	71.0	1,833,000	67.3
Console	1,086,000	28.6	878,000	32.2
Combination	15,000	0.4	14,000	0.5
<b>TOTAL</b>	<b>3,800,000</b>	<b>100.0</b>	<b>2,625,000</b>	<b>100.0</b>

### TV Imports Zoom—Inventories Climb—and Prices Drop

The import of TV products in July hit 740,800, according to *TV Digest*, up 135.9% from the same month last year. "And despite cutbacks in domestic production and improved sales to dealers," the *Digest* reports, "continuing record color TV imports begin to make fall price-cutting appear likely." In fact, near the end of August, RCA announced price cuts in their high-end 19-inch ColorTrak models and Quasar dropped prices on a 15-inch and 19-inch model. Then, also according to *TV Digest*, in the first week of September, "Zenith responded to RCA's 19-inch price cuts with increased promotional allowances on selected sets."

## Just Tear and Get your Share.

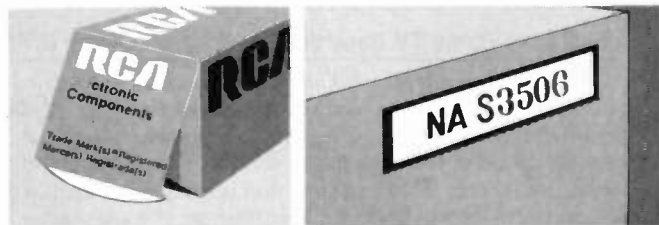
RCA's Super Prize Program is Back by Popular Demand! As before, just save your RCA entertainment receiving tube carton ends and color picture tube warranty serial number stickers\* — to earn valuable awards:

- Lots of great merchandise premiums. Choose from a wide selection for yourself, your family, or your home.



- Money-saving discount certificates, good toward purchases of more RCA receiving and color picture tubes.

Pick up your copy of the RCA "Tear and Share '76" Prize Book, saver envelope and gift order form at your participating RCA distributor. You have until November 30, 1976 to tear 'n share in RCA's bonanza of great gifts. RCA Distributor and Special Products Division, Cherry Hill, N.J. 08101.



\*Save the receiving tube carton end that is *not* marked with the tube type number, and the warranty serial number sticker that appears above the warranty envelope on the upper right hand corner of the color picture tube carton. One warranty serial number sticker is equal in value to 20 receiving tube carton ends.

# RCA

### Looking for Hard-to-get Technical Information? Try the NESDA-ISCET Library

Remember, another source for hard-to-get technical data and information is ISCET-TECH, the technical library operated by NESDA and ISCET in Kansas City, Missouri. The library is maintained by donations of \$10 or more from technicians who want to use the services. The donation buys a sustaining membership for a year, it's tax-deductible, and it makes available to the member the information services of the library, including copying. Librarian Henry V. Golden, CET, CA, invites those interested to send their membership donations to ISCET-TECH, 8015 Paseo, Kansas City, MO, 64131. Golden says also that the library needs old electronics magazines, radio-TV and test equipment service manuals and schematics.

### AM Stereo Is Pushed By Four Top Manufacturers

The National AM Stereophonic Radio Committee, which was formed at the request of the FCC in 1975, has received plans for AM stereo radio systems from RCA, Motorola, Communications Associates, and Sansui. Three panels of the committee evaluated the proposals: the System Specifications panel, the Transmission Systems panel, and the Field Testing panel. The stations meeting criteria set by the committee will be announced at the committee's next meeting. Test facilities will most likely be East Coast stations, to allow for FCC participation.

### Service Associations Elect Officers and Make Awards

The 1976 conventions of the two national electronic service associations, NESDA and NATESA, both held in August, are a matter of history now. New officers for 1976-77 were elected and honors were bestowed on industry leaders by both associations.

The NESDA convention, held in San Antonio, named as president Everett Pershing, owner of Pershing Radio & TV in Burbank, California. Pershing was senior vice president of NESDA last year and had served earlier as 9th region vice president. Other officers elected include: secretary, John McPherson, Yorktown, Virginia; senior vice president, Kurt Wertheim, San Antonio, Texas; and treasurer, Jack Kelly, Litchfield Park, Arizona.

Two industry leaders, Dick Pavek and Miles Sterling were named as co-recipients of NESDA's Man of the Year Award. Pavek, president of Tech Spray Company was cited for

his efforts on behalf of NESDA and the Certified Electronics Technician (CET) program. Sterling, owner of Electro TV, Garden Grove, California, was honored for his efforts on behalf of the nation's independent consumer electronics service dealers.

NATESA held their convention this year at Pheasant Run Resort in St. Charles, Illinois. The newly elected president of NATESA is George J. Weiss, Chicago. Other officers elected were: Paul J. Kelley, Warwick, R.I., vice president; Leo Edmund Cloutier, Los Angeles, Calif., secretary general; and Richard Ebare, Essex Junction, Vt., treasurer. Frank J. Moch was renamed executive director.

NATESA Cooperation Awards were made to GTE-Sylvania, Magnavox, Zenith, GE, RCA, Sams, Sony and Quasar, and the 1976 NATESA Friends of Service Management Award was given to Zenith Radio.

### **New Sony Home TV Recorder To Work with Tape & Paper Sheet**

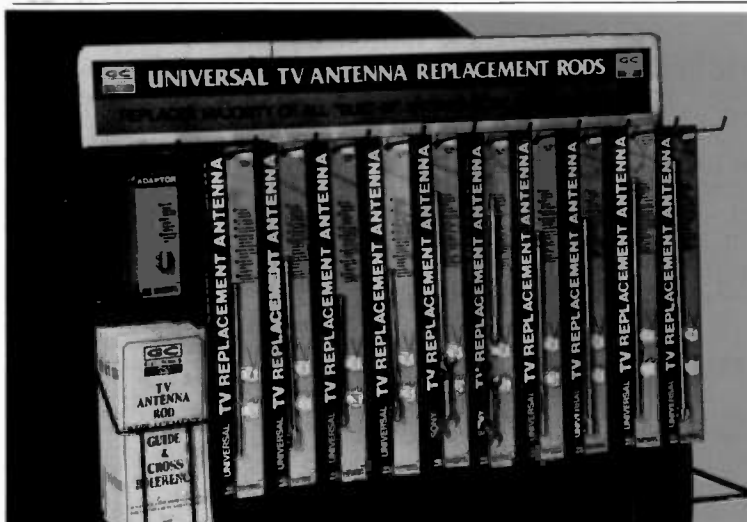
Financial analysts on the West Coast have learned that Sony Corp. is developing a home video cassette recorder that will work with both tape and a paper-like sheet storage medium, according to a report in *Electronic News*. According to Noboru Yoshii, Sony senior advisor, the new paper-like medium "has a greater potential than tapes or disks because it costs less than tape and is erasable, unlike disks." Yoshii would not say when Sony plans to put the new recorder on the market.

### **Tape Recorder Drive Wheels Can Now Have Retread Job**

The Projector-Recorder Belt Corporation of Whitewater, Wisconsin, has announced a new retread service for old tape recorder drive wheels. The company's catalog lists wheels that fit over 3,000 models, but in announcing the new service, Dave Dwinell notes, "what about the 3001st model or the 3010th model requiring a new drive wheel. No matter how hard we try, it is impossible to stock every wheel needed. We hope we can solve this problem through our new retread service."

### **Dynascan Sales For First Half Of '76 Better Than All Of '75**

Sales for the Dynascan Corporation, producer of CB radios & test equipment, exceeded \$55 million in the first six months of 1976, compared to \$48.6 million for all of 1975. And Carl Korn, president, Dynascan, said he expects sales in the second half to bring the 1976 total to more than \$100 million. ■



**PROG. NO. 49-458**  
(27" W x 19 1/4" H x 6 1/2" O)


**COUNTER-TOP DISPLAY CONTAINS:**

- 14 ANTENNA REPLACEMENT RODS- 10 DIFFERENT MODELS
- 2 ROD ADAPTORS
- 5 REPLACEMENT GUIDES
- 1 PRECISION CUTTING TOOL


# we've got you covered!

Handle 90% or more of all TV antenna rod replacements with a minimum of stock! Antenna Replacement Rod Program No. 49-458 features 10 different rods with exclusive adaptor to fit 7mm and 8mm diameter rods, and precision cutting tool. Also included is a pocket-sized TV Antenna Rod Replacement Guide and Cross Reference.


**TV ANTENNA ROD REPLACEMENT GUIDE & CROSS REFERENCE**  
Quick cross reference and replacement method guide for all popular TV antenna rods. 3-5/8" x 8" - fits in your pocket!



**PRECISION CUTTING TOOL**  
Cuts broken antenna fast and easily.  
Cat. No. 1620



**TV ANTENNA ROD REPLACEMENT GUIDE & CROSS REFERENCE**



**GC ELECTRONICS**  
DIVISION OF HYDROMETALS, INC.  
ROCKFORD, ILLINOIS 61101 U.S.A.

**CONTACT YOUR GC DISTRIBUTOR TODAY!**

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



## Vesto TV: 28 Years Of Quality, Not Price

By Grier Lowry & J.W. Phipps

Earning and effectively promoting a 'Quality Products Backed By Quality Service' image has helped this Kansas City sales/service dealer compete successfully with price-oriented merchandisers

■ Vesto TV has been selling and servicing TV and other home entertainment electronic products in the Kansas City, Missouri, area for twenty-eight years.

Founded by Malcolm Magers, Sr., in 1948—when there was only a sprinkling of TV set owners in Kansas City and the nearest TV station was in Omaha—this sales/service dealership not only has survived against the 'discounted prices' of mass merchandisers but has steadily increased its annual gross sales to the point where it now exceeds a million dollars—and from a single operating location.

Although Malcolm Magers, Sr., is presently enjoying the sun in Phoenix, Arizona, Vesto TV is still very much in business at the same

location in Kansas City, but now under the management of Malcolm Magers, Jr.

During a recent visit with Magers, Jr., in Kansas City, we asked him to give ET/D readers an overview of the principal reasons why Vesto, first under his father's guidance and more recently under his, has been able to effectively combat the 'discounted' prices of mass merchandisers and grow during a period in which many other sales/service dealers have been hard pressed to just survive, let alone grow.

### CONSISTENT, IMAGE-ORIENTED ADVERTISING

One of the most significant contributors to Vesto's success, according to Magers, has been and

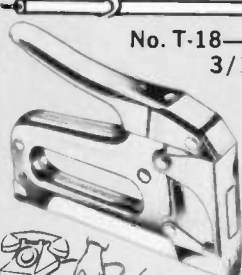
# ARROW AUTOMATIC STAPLE GUNS

## CUT WIRE & CABLE INSTALLATION COSTS

... without cutting into insulation!

**SAFE!** Grooved Guide positions wire for proper staple envelopment! Grooved Driving Blade stops staple at right depth of penetration to prevent cutting into wire or cable insulation!

**No. T-18—Fits wires up to 3/16" in diameter.**



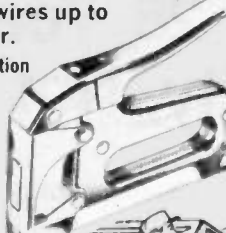
**BELL, TELEPHONE, THERMOSTAT, INTERCOM, BURGLAR ALARM** and other low voltage wiring.

Uses T-18 staples with 3/16" round crown in 3/8" and 7/16" leg lengths.

**No. T-25—Fits wires up to 1/4" in diameter.**

Same basic construction and fastens same wires as No. T-18.

Also used for **RADIANT HEAT WIRE**



Uses T-25 staples with 1/4" round crown in 9/32", 3/8", 7/16" and 9/16" leg lengths

**NEW! Intermediate No. T-37—Fits wires and cables up to 5/16" in diameter.**

Same basic construction as Nos. T-18 & T-25.

Also used for **CATV and DRIVE RINGS** in stringing wires.




Uses T-37 staples with 5/16" round crown in 3/8", 1/2" and 9/16" leg lengths.

**No. T-75—Fits wires and cables up to 1/2" in diameter.**

**RADIANT HEAT CABLE, UF CABLE, WIRE CONDUIT COPPER TUBING** or any non-metallic sheathed cable.

Also used as **DRIVE RINGS** in stringing wires.



Uses T-75 staples with 1/2" flat crown in 9/16", 5/8" and 7/8" leg lengths.

ARROW FASTENER COMPANY, INC.

271 Mayhill Street, Saddle Brook, N. J. 07663

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

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continues to be its consistent, image-oriented advertising program, which emphasizes *quality* of products and service instead of prices.

The senior Magers began the program about 25 years ago. *Each* morning he went to a Kansas City radio station and, after 'rapping' on the air with the disc jockey, read *his own* commercial messages, which always were keyed to quality oriented factors such as 'Vesto sells only major brands,' 'Every product sold by Vesto is promptly and proficiently backed by Vesto's own service department,' and, as the senior Magers summed it up, "We're TV specialists."

The 'personal' approach of the senior Magers, which gave Vesto a 'human' identity among radio listeners, plus the constant emphasis on quality, reinforced by the day-after-day consistency of the advertising program—all produced a cumulative effect which helped make the name 'Vesto' synonymous with 'television' and 'quality' in the minds of large numbers of consumers in the Kansas City market.

Magers, Jr., has continued this consistent, quality-oriented advertising program, but with two updating changes: 1) Instead of using radio as his principal medium, he has switched to TV, and, 2) unlike his father, who never formally budgeted his advertising dollars, Magers now budgets Vesto's promotion program a year in advance.

"Television—sometimes on only two stations, sometimes on all four in our area—is the most effective medium for getting our message across," states Magers, "and the reason I use TV is simple—it pulls.

"I found out years ago that the general impression many dealers have that radio advertising is cheaper than TV is a misconception. I can buy some TV spots for less than I would have to pay for comparable time on 'drive-time' radio. And with over a dozen radio stations operating in this area, the listening audience is so spread out it's impossible to get concentrated coverage without going the multi-station route."

The emphasis of Vesto's TV spots is not much different than the 'quality' emphasis which Ma-



Malcolm Bruce Magers, Jr., owner/manager of Vesto TV, Kansas City, Mo.—"Price is never mentioned in our advertising. It is my opinion that the dealer who makes a big deal about price is in trouble, or soon will be."

gers, Sr., used years ago on radio. And as his father did on radio, Magers, Jr., appears in the commercials and reads the copy himself.

"You can't squeeze a lot of copy into one thirty-second TV spot," Magers points out, "but we always mention our brands—Magnavox, Sony and Zenith—and our capable service department, and we sometimes promote a naturally saleable feature like Magnavox's *Star* tuning system.

"About seven seconds of our TV spot time is consumed by our closing jingle—'See the greatest picture show in Kansas City at Vesto TV'—which cost us several thousand dollars to have composed, but which we believe is worth it because of the added retention and identity it has produced.

"Price is never mentioned in our advertising. It is my opinion that the dealer who makes a big deal about price is in trouble, or soon will be."

### A PROFITABLE APPROACH TO TRADE-INS

Another item which gets a strong play in Vesto's TV advertising is its TV trade-in program. 'Trade in your old TV at Vesto' is a phrase which is inserted in every Vesto TV spot.

"We caught many of our competitors off guard three years ago when we started stressing the trade-in program. It's since become an effective sales tool, in addition to giving our sales and profit pictures a shot in the arm. We've earned a reputation for having a good selection of recon-



Vesto's television showroom has a cozy, home-like atmosphere despite the fact that 70-80 TV models and 25-30 stereos are on display in it. Only essential sales promotion signs are posted—not the one in the foreground which tells the potential buyer that Vesto provides same-day delivery.

ditioned sets, and this pulls in traffic and gives us an out when a buyer on a tight budget can't afford a new set.

"Unlike some dealers who take in trades, we don't wholesale them out. Instead, we recondition them, put them in an appealing display area and then promote them. You can't expect to get realistic prices for reconditioned sets if you hide them away in a dingy backroom

display area.

"Although we automatically junk 'off-brands' and sets obviously beyond economical repair, a high percentage of the trade-ins we receive are suitable for reconditioning. These we equip with new picture tubes and, after replacing any other defective or marginal parts, we place an average price tag of \$229 on them. The picture tubes are guaranteed for



Vesto's reconditioned TV display area typically contains 70-80 sets, all of which are trade-ins that have been reconditioned in Vesto's own reconditioning facility. Says Vesto owner/manager, 'Bruce' Magers: "You can't expect to get realistic prices for reconditioned sets if you hide them away in a dingy backroom display area." The average price tag on Vesto's reconditioned color TV consoles is \$229.

two years and the complete set is covered by our own thirty-day guarantee. Even so, we make a higher margin on our reconditioned sets than we do on some new ones."

Commenting on the use of the trade-in program as an aid in new set sales, Magers cautions that evaluating the worth of a trade-in can be "a bit sticky sometimes." Says Magers: "You don't sell a cus-

## Heat it Cool it

Hot 750°F Air or a cooling breeze at the flick of a switch lets you . . .

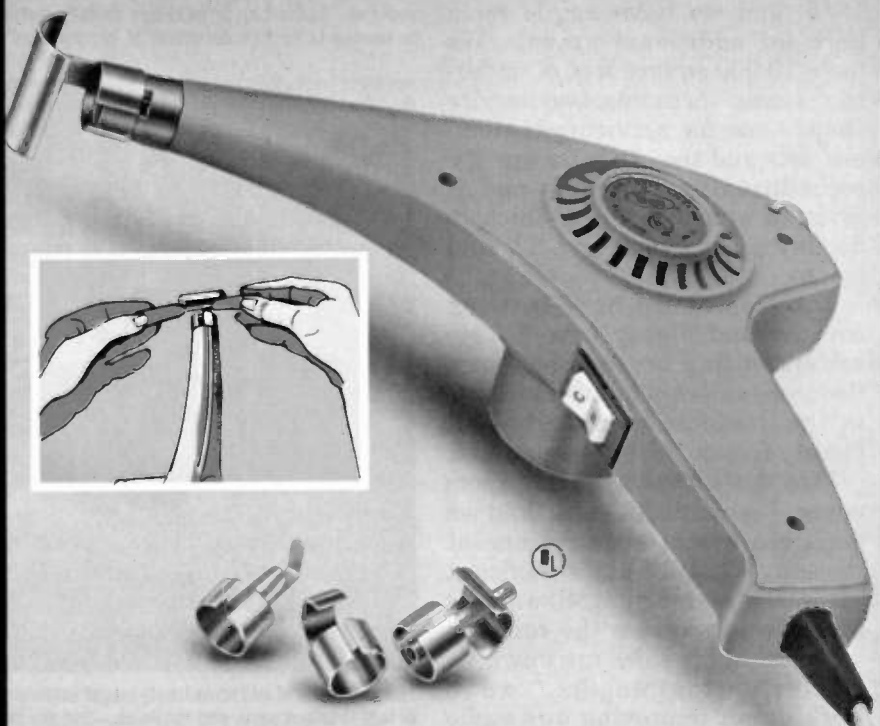
- Shrink most heat shrink tubing
- Cure Epoxies
- Reflow Solder
- Shrink packaging films
- Heat and cool components
- Expand frozen fasteners
- Reflow hot melt adhesive
- Repair vinyl
- Soften conformal coatings

Precisely control the air flow of this compact Ungar Heat Gun. The tool weighs only 13 oz. and is equipped with a 3-way, Hot-Off-Cold switch, a reducing baffle for pin-point heating, and three reflectors for shrink tubing.

See the UNGAR HEAT GUN at your local Authorized Ungar Distributor or call or write us for more information.



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P.O. Box 6005, Compton, Ca. 90220 • (213) 774-5950



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

tomer with an old 'off-brand' that his or her set is worthless. You use a little tact and business sense and give him or her a little something for the trade-in even though it takes a little of the profit out of the sale. His or her repeat business will more than make up for your small profit loss on the first sale. You can't grow without repeat business."

### ONE LARGE STORE HAS MEANT TIGHTER CONTROL

With consistent increases in gross sales year after year, its only natural that Magers has been tempted to add one or more suburban branches. However, so far he's resisted the temptation.

Says Magers about the idea of branch operations: "They inevitably lead to some loss of management control." And tight owner control in every facet of the business is, according to Magers, one of the more significant reasons for Vesto's long-term success.

"Instead of sinking additional capital in a shopping center location, we decided to invest more in advertising and do a better volume job in our present location. After all, we've been in this same location, on the north side of the Missouri River in Kansas City, since 1948, and we have ample room here for additional growth. We have 10,000 square feet of under-roof space, including two service shops—one for servicing customers' sets and the other for our TV reconditioning program—and it gives us ample room in which to display a wide variety of TV and stereo.

"At present we have between seventy and eighty new TV receivers sitting on the showroom floor, about seventy-five used sets in the 'trade-in room' and about twenty-five or thirty stereo units.

"We don't have a 'sound' room per se," explains Magers, "and we don't see a real need for one at present. We still sell a significant volume of stereos but, like many other dealers across the country, our total audio sales are down.

"But," adds Magers, "we're working on improving our audio sales situation, and its already looking up a little. One problem we've had with audio is that we've tied our name and image to televi-

sion, even though we've handled stereo since it began.

"For a while, we followed the line of thinking that console stereos were, for all practical purposes, dead and that component type audio products were replacing them. However, six times we've stocked components, and six times we've phased out.

"Magnavox's Mediterranean style console stereos were big sel-



Prompt, proficient service by its own in-house service department is one of the 'quality' factors stressed in Vesto's consistent, image-oriented advertising program. Shown here is one of Vesto's four bench technicians. Five other 'outside' technicians man Vesto's eight service/delivery vehicles. Same-day or next-day delivery/setup or service is Vesto's definition of 'promptness'.



The necessity of an increasingly larger inventory of replacement parts and modules—and the resultant larger inventory investment and increased inventory space and control costs—is but one of many factors which are causing Vesto's and other sales/service dealers' service-related costs to skyrocket.

lers in our store, and we were real sorry when they quit making them. Now, however, some of the 'high style' stereos are once again beginning to trickle off the production lines, and we couldn't be happier to see them."

### CONCENTRATION ON 'HIGH END' PRODUCT

"Magers is proud of his company's record for selling high-end TV and stereo products. About 50% of Vesto's TV sales are console models.

"We've never attempted to push low-end product," says Magers. "At present, the \$800, 25-inch console is a big seller, although we also are doing a decent job on the medium-price unit as well."

"Selling high-end product requires experienced, professional salespeople, and that," says Magers, "is an appropriate description of our three salesmen. They have a thorough knowledge of our products and sales policies, and they realize and appreciate the fact that bait-and-switch is absolutely forbidden at Vesto."

"Qualifying the buyer with regard to brand and taste in style is our first sales step. Once the salesman determines these, he then escorts the buyer to the showroom area where the different cabinet styles and models in that brand are displayed. Free, same-day-or-next-day delivery and setup are emphasized in the sales routine, as is our prompt-service-when-needed capability.

"And," adds Magers, "Our salesmen make an effort to get the customer to opt for our \$89.95 outdoor antenna/installation package, not just because it is profitable but principally because it will help insure the customer optimum reception. And, the idea of the owner of a remote-equipped console color TV receiver having to jump up and change the position of the rabbit ears on his set every time he changes the channel is a bit absurd—and most buyers agree with this conclusion once it is pointed out to them."

### ESCALATING SERVICE COSTS A MAJOR CONCERN

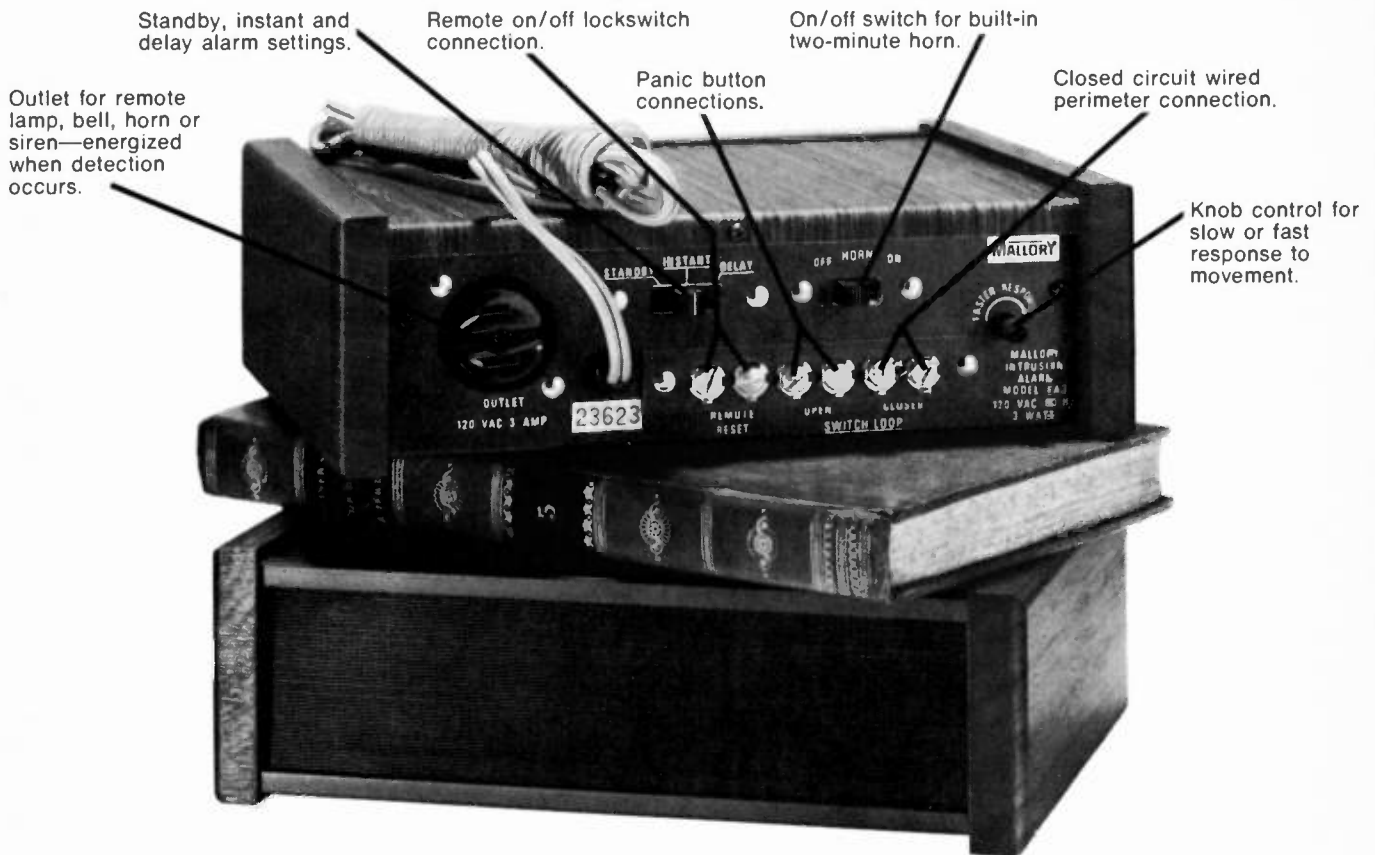
The cost of one of Mager's competitive advantages—quick, profi-

*continued on page 54*



# The new Mallory CA3 Intrusion Alarm.

## Reliable.



## (And inconspicuous.)

This area-and-perimeter device creates and transmits an ultrasonic wavelength field for detection up to a distance of 20 feet. And because of its modern design and walnut-grain finish, the CA3 is attractive and inconspicuous enough to pass as a radio or stereo tuner.

Virtually any movement by an intruder (or a break in the perimeter circuit) activates the built-in horn and the remote outlet for two minutes. An automatic

reset handles the possibility of a new or renewed intrusion. And special CA3 circuitry guards against false alarms from line transients and insects. A variety of companion indoor or outdoor accessory devices is available.

The Mallory CA3 Ultrasonic Intrusion Alarm. From the manufacturer of the most complete line of do-it-yourself security products. Another sound reason to see your Mallory distributor today.

### MALLORY

#### MALLORY DISTRIBUTOR PRODUCTS COMPANY

a division of P. R. MALLORY & CO. INC.

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OCTOBER 1976, ELECTRONIC TECHNICIAN/DEALER / 15

# GE Color Television For 1977

By Don W. Mason, ET/D Managing Editor

An overview of General Electric's color television line for 1977 with a more detailed look at the 25YM chassis

MODULE-CHASSIS INTERCHANGEABILITY GUIDE

Module Function	Cat. No.	Chassis			
		YA	YC	YC-2	YM
IF/Audio	EP93X72	X	X	X	X
Chroma/Video	EP93X10	X	X	X	
	EP93X93	X	X	X	
	EP93X100	X	X	X	X
HORIZ. Osc.	EP93X89	X	X	X	X
	EP93X92	X	X	X	X
Vertical	EP93X67	X	X	X	
	EP93X103	X	X	X	X
Power Supply/ HORIZ. Driver	EP93X68	X	X	X	
	EP93X91	X	X	X	
Diode Rectifier	EP93X95				X
CRT Drive	EP93X86	X	X	X	
RGB Drive	EP93X102				X
Dynamic Convergence	EP93X94	X	X		
	EP93X108			X	
	EP93X100				X
Audio Output	EP93X99				X
"VIR" (Not in all sets)	EP93X101			X	X

Fig. 1—A guide to modules used in GE color TV chassis and their interchangeability.

Two new chassis—the YM and the YC-2—are the stars of the 1977 "Performance Television" line from General Electric. These chassis are used in 25- and 19-inch models, respectively, some of which are equipped on an optional basis with two new GE features—the VIR "Broadcast-Controlled Color" system (described in detail in the past two issues of ET/D), and a digital readout channel indicator system.

The YM chassis employs the same type of modular construction used in GE's YA and YC chassis. Four of the eight modules used in the YM chassis are common to GE's 13-, 17-, and 19-inch Y series chassis, which means that the servicer will have to inventory fewer spare modules for repair of GE color TV (See Fig. 1 for a guide to GE module interchangeability).

The YC-2 chassis, which features a 19-inch, in-line picture tube, is actually the second gener-

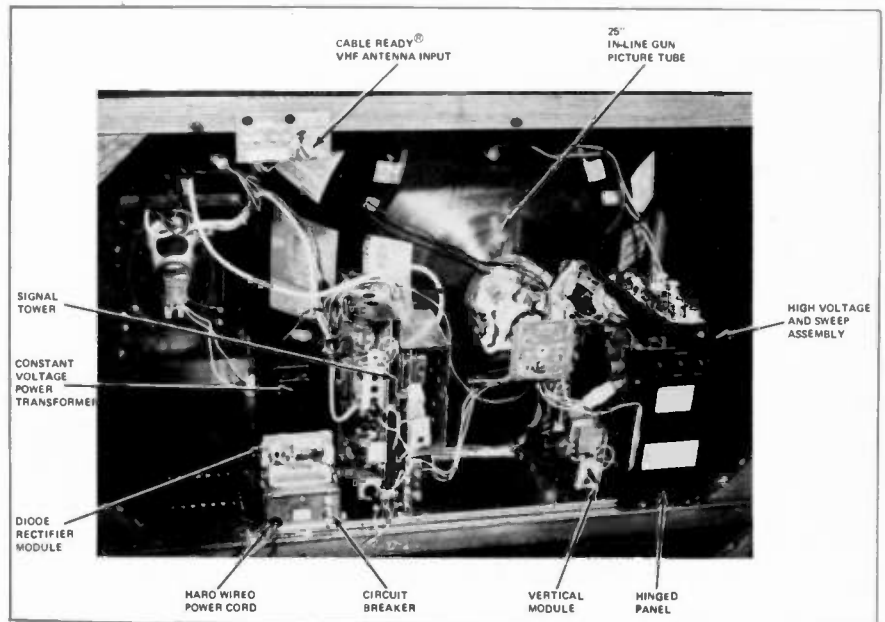


Fig. 2—A technician's view of the new 25YM chassis.

ation of the YC chassis series. The 19-YC-2 chassis differs from the earlier 19 YC chassis in that it has improved convergence and pin-cushion circuitry. And, of course, as mentioned before, some 19 YC-2 models feature VIR "Broadcast Controlled" color and digital channel numbers. In addition, most 19YC-2 models have a 72-ohm 'cable-ready' VHF antenna input.

With the introduction of the YM chassis, the entire GE line of color TV uses in-line picture tubes, and as GE claims, "This is an industry first." This means, of course, that all GE color TV models offer a much simplified convergence procedure afforded by the in-line design. All Y-series chassis have four static adjustments and four dynamic adjustments. In addition, the new YM chassis has 'crossover adjustment'.

In total, then, the GE color line for 1977 includes the 25-inch YM chassis, the 19-inch YC-2 chassis,

the YA chassis, using 19-inch, 17-inch and 13-inch picture tubes, and the HE chassis with a 10-inch picture tube. The YA and HE chassis are updates from previous years.

## THE 25YM CHASSIS

It's obvious that GE's design engineers, in developing the new YM chassis, had serviceability in mind. Disassembly of the new chassis for servicing is relatively easy with a physical layout similar to the older M series chassis. Also, the YM circuitry is nearly identical to circuitry used in the other chassis in GE's color line—YA and YC chassis—and four of the eight modules in the YM chassis are also used in the YA and YC chassis.

A technician's view of the 25YM chassis is shown in Fig. 2. The power supply is at the left, the signal tower assembly is to the right of the power supply, and the sweep and high-voltage assembly is on

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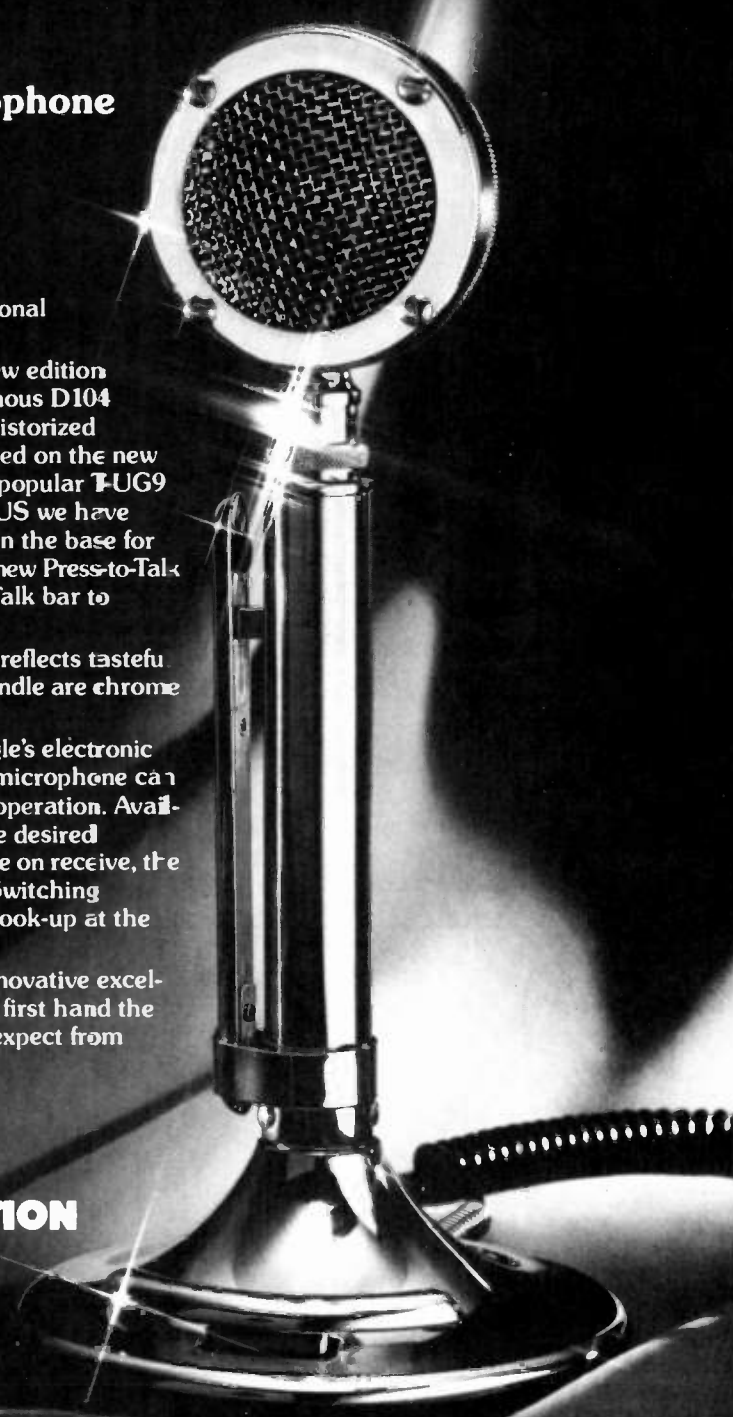
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Each module is also checked for critical lead dress and brought to specifications. Then, environmental tests, simulating extreme temperature conditions, are made to detect intermittents and minimize technician callbacks.

Next, the module is vibrated to simulate the rigors of shipping and to uncover intermittents. Complete alignment (where applicable) is also made in accordance with the latest RCA factory specifications. Included are all IF and chroma sweep alignment and calibration adjustments, and setting of all circuit board pots and adjustments.

After all these steps, RCA Quality Control samples each production lot. If a single module in the lot does not pass our inspection tests, the entire lot is rejected and rerun through the complete remanufacturing cycle. Finally, modules that pass are date-coded with labels.

When you install an RCA remanufactured module, you'll know that it's been processed in the original factory environment where it was made, and that it features performance and reliability worthy of the RCA name.

**RCA** Distributor and Special Products Division

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screw and removing another

- The Focus resistor is held in place by one screw
- Removing just one screw allows a module to be removed. The modules plug-in just as they do on the M series chassis.

All of the chassis in GE's color line this year use the same IF/Audio, Chroma/Video, Horizontal Oscillator and Vertical modules. The major differences between the YM chassis and the YA and YC chassis are in the power supply, RGB output, audio output and pincushion circuitry. In addition, the YM chassis uses a newly designed high-voltage transformer.

## Power Supply

The power supply in the 25YM chassis is similar mechanically and electrically to the power supply used in the MC-2 chassis introduced by GE in 1975, but is different than power supplies used in the YC-2, YA, and HE chassis. The 25YM, like the MC-2 chassis, is equipped with a constant-voltage power transformer circuit that is the only regulating device in the power supply. There are no B+

regulation circuits in the YM chassis. Also, there is no AC interlock in the YM chassis; the power cord is connected directly to the transformer circuit, thus, there is no need for a cheater cord.

There are four secondary windings on the YM's power transformer. Starting at the bottom of

the schematic shown in Fig. 3, the first secondary powers the CRT filaments with 6.3V. The second powers the signal circuits through the full-wave rectifier circuit of Y905 and Y906 (this circuit is protected by a 1-am, fast blow fuse, F901), and taps on this secondary also power the vertical modules

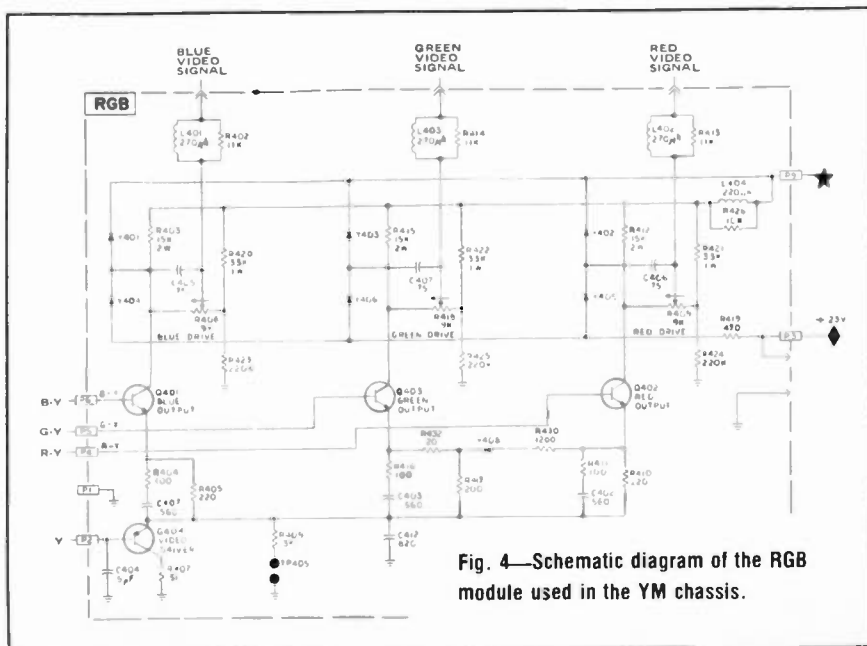


Fig. 4—Schematic diagram of the RGB module used in the YM chassis.

through Y907, Y908, Y914, and Y915. On some models, another tap on this secondary furnishes 5.6V to the pilot lights. A resonating capacitor, C1207, is connected across the third secondary, which includes a tap that powers the horizontal driver, horizontal output, and RGB output circuits through Y901, Y902, Y903, and Y904. This third secondary is protected by circuit breaker CB1200. The fourth secondary powers the Digital Channel Numbers on those models so equipped.

The 1-amp fuse, F901, and all the B+ rectifiers are contained on the plug-in Diode Rectifier Module, EP93X95.

### RGB Drive Module

Although the circuitry of the RGB Drive Module in the 25YM chassis is almost identical to that in the CRT Drive Module used in the YA and YC chassis, the two modules are not interchangeable.

The Module (EP93X102) for the 25YM chassis has four signal inputs and three signal outputs, as illustrated in Fig. 4. The inputs are R-Y, B-Y, G-Y, and Y signals and the outputs are R, B, & G color

signals. Two B+ voltages, +200 VDC and +23 VDC, are applied to the module.

The base of the video driver Q404, is fed by the Y (or luminance) signal. Q404 is an emitter-follower with its emitter connected to the emitters of color amplifiers Q401, Q402, and Q404. The Color Amplifiers look like common-emitter amplifiers to the color difference signal, while to the Y signal the amplifiers look like common-base amplifiers. The Y signal and color difference signals are matrixed in the amplifiers and R, G, and B color signals appear as outputs at the collectors, and then are fed to the picture tube cathodes.

The drive controls, which are a part of this module, can be adjusted without having to readjust the Screen controls. Because each of the Drive controls are connected in a bridge-type circuit, the DC voltage at black level is the same at both ends of the control. This circuitry allows the AC signal to the CRT to be adjusted without changing the DC bias.

### Audio Output

The Audio Output module in the YM chassis is different than that used in the YA and YC chassis because in the console type YM chassis, a wider frequency response and more audio power is required. The circuitry in the YM audio output module, shown in Fig. 5, is complementary class B, using a driver and two output transistors. The module operates from the +26-VDC line, has one signal input and one output. Output power is 2 watts. The same circuit

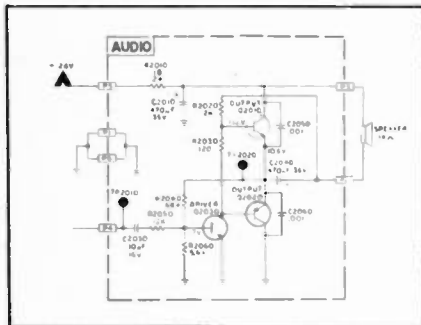


Fig. 5—Diagram of YM chassis' audio output module.

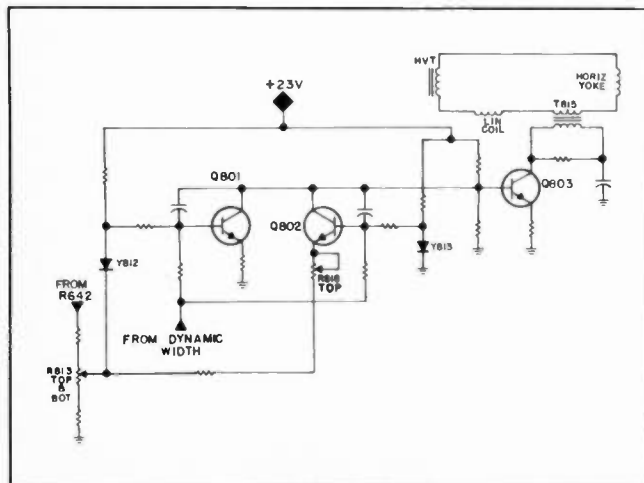
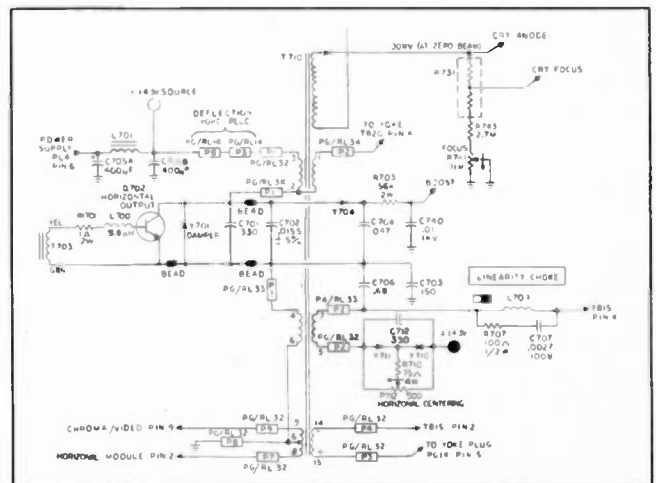


Fig. 7—Block diagram of the side pincushion correction circuit used only in the YM chassis.



Bill Hughes of A-1 TV Service, Florida says:

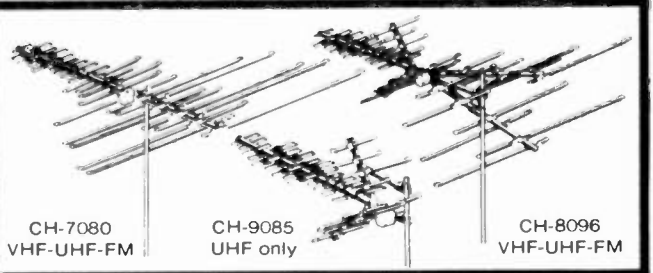
# Customers are asking us for Chromstar™



Bill Hughes' shop is in Niceville, Florida, just 12 miles from the Gulf Coast, Hughes states: "Even though Cable TV is in this area, I sell a lot of Chromstar antennas, many to people who put them up on their own. I help them select the right equipment needed, make all the connections on the antenna wire, and install a preamplifier in the cartridge housing if the customer desires." Hughes also provides customers with the Winegard brochure, "How To Install Your Own TV Antenna," as an added service. "Many customers ask specifically for Chromstar, having seen what it does for a neighbor's TV reception," Hughes explained. He adds, "Customers are happy with my service and with Chromstar, and I like the rugged construction and anodizing. I checked a Chromstar that was installed eight months before, and it still looks new. I've seen some antennas begin to corrode after just a few months, due to the sun and salt spray." Hughes is also happy with Chromstar preamps, which he says "can improve reception up to 35%!"\*

\*A copy of Mr. Hughes statement will be sent to you upon your request.

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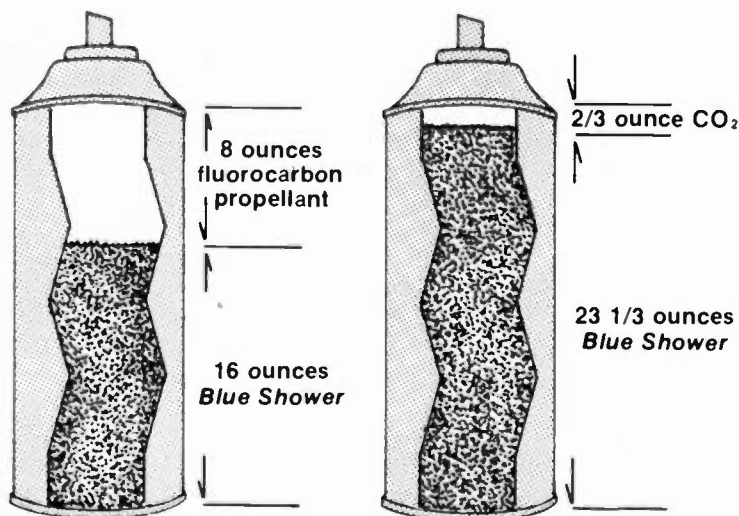
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sweep at the raster corners, is shown in Fig. 7. Transformer T815 is a saturable reactor with one load winding connected in series with the horizontal deflection windings of the yoke. The control winding of the reactor is in the collector circuit of Q803. Load winding inductance varies inversely with control winding current—for example, when inductance is minimum, current is maximum. Thus, when control current is maximum, horizontal sweep current and raster width will also be maximum.

A vertical-rate sawtooth voltage developed across R642, the vertical feedback resistor in the top-and-bottom pincushion correction circuit, is fed to Q801 and Q802. When that voltage becomes positive, Q801 conducts, and when it becomes negative, Q802 conducts. Both transistors are off when voltage is at zero.

The waveform of the collector voltage produced when one or the other transistor is conducting has a parabolic shape because both transistors share a common collector load. This voltage is applied to the base of the transistor, Q803, producing a parabolic shaped current waveform in the control winding of the reactor, T805. This causes the horizontal sweep to be reduced at the top and bottom of the raster because the side pincushion correction current in the horizontal yoke is maximum at the center of the vertical sweep, and minimum at the top and bottom.

The amount of side pincushion correction can be adjusted by controls R813 and R818. Variable resistor R813 affects the sides of the raster at the top and bottom, and R818 affects the raster at the top.

### High-Voltage Transformer

Another new feature that has been incorporated into GE's new 25YM chassis is a newly designed high voltage transformer, shown in Fig. 8. The YM chassis does not have a separate, or discrete, high-voltage multiplier or separate high-voltage rectifier. Instead, the high-voltage rectifier diodes are an integral part of a potted subassembly which also contains the high-voltage transformer tertiary winding. Output voltage is about 30 KV at zero

continued on page 53



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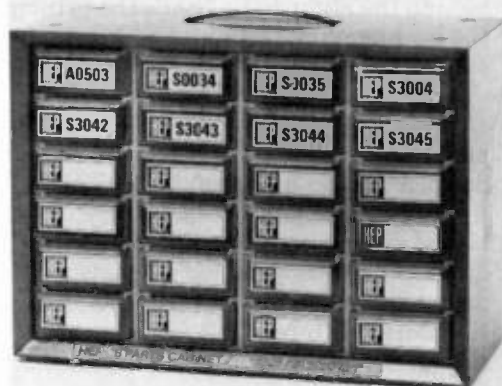
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# Financial Statements Made Easy

By Paul F. Dontje

## Part Two—The Balance Sheet—and Ratio Analysis

■ When you're in business, it's nice to know from time to time whether you're ahead of the game or behind the eight-ball. That's the principal function of the bookkeeping technique of developing financial, or summary, sheets.

Last month in Part One—we covered the formation of the Profit and Loss (or operating) Statement, and analysis of the P & L by ratios or percentages. We defined the P & L technically as a "statement of income and expense"—a history, or summary, of a period of time in the operations of a business covering one month, one year, or whatever period of time is desired. Now, in Part Two we will apply the information derived from our P & L statement to the formation of a typical company's Balance Sheet.

### THE BALANCE SHEET

The Balance Sheet, technically, is a listing of the resources of a business, together with the equities or interests of the owners and creditors of those interests. It is a mirror of the financial condition, good or bad, of the business.

The typical balance sheet contains two basic parts, assets and liabilities. Assets are all the things you own that have a value, such as cash, inventory, trucks, and test equipment. Liabilities are the debts you owe such as bills, payroll, taxes, truck payment, and bank loan. If we look at a balance sheet as a teeter-totter (Fig. 1) and if the assets outweigh the liabilities, it's easy to visualize that the business is healthy. When we over-load the right end of the teeter-totter we are in financial trouble.

As you can see in Fig. 2, we break down the balance sheet into sections, current assets and fixed assets, current liabilities and long term liabilities and other liabilities so we can get a clearer picture of the business.

*Current assets* are those items that are easily converted to cash in a short period of time (30 to 90 days) in the normal course of business, such as cash on hand, bank checking, savings accounts, inventory, and accounts receivable.

*Fixed assets* are those items that do not normally revolve through the business cycle, such as trucks, test equipment, and sometimes long term (or slow) accounts receivables or other items you might have invested in that cannot be quickly converted to cash.

*Current liabilities* are the debts that are due now, or in the next year. For example, suppose that you bought a truck with the payments spread out over the next 3 years. The current debt is the first 12 months of payments, and the next 24 monthly payments are long term liabilities.

*Other liabilities* are such items as income taxes payable.

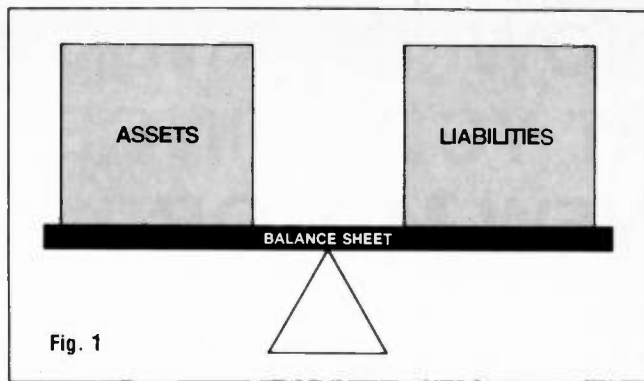


Fig. 1

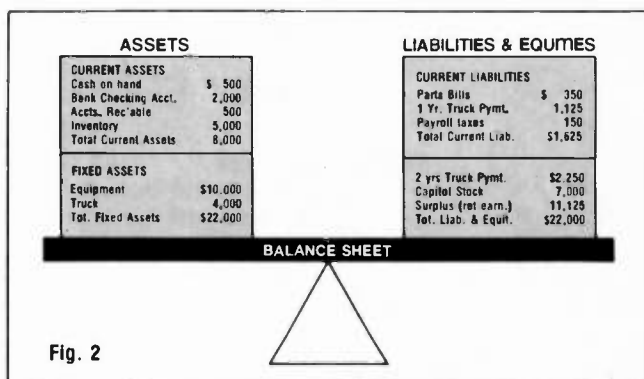


Fig. 2

In Fig. 2 we have again utilized the teeter-totter to represent the principle of the balance sheet. You'll notice that on the liabilities end, below the double line, we show the "capital stock" (your original investment) and an item called "surplus" (retained earnings). Capital stock and surplus are the two items that allow you to make a balance sheet balance. More importantly these two items represent your "Net Worth." Actually, when your accountant works up your company's balance sheet it will look more like Fig. 3.

Although the balance sheet by itself does give us a picture of the financial condition of the business, it doesn't tell us how we got into that position. You must also have the Profit and Loss Statement that we covered in Part One. We could compare balance sheets for two or three years and possibly see some changes but to find out what caused a change in the equity or assets, a P and L statement is necessary for the same two or three year period. Fig. 4 shows how the balance sheet and the P & L relate to each other. The formula is: assets = liabilities + owners equity + income and expense. The "A" line is the profit or loss resulting from the P & L to be added to the assets in either cash or inventory. The "B" line is the profit or loss that will be added to the owners equity.

### RATIO ANALYSIS OF BALANCE SHEET

To further analyze our balance sheet, we'll utilize somewhat the same ratio and percentage method used for analyzing the P & L statement; in other words, we have to pick apart the figures to find how healthy or how sick we are. We should do this for two or three years minimum and compare them, looking for trends and comparing them with the industry averages. To illustrate the ratio analysis method, we'll use the figures from our sample balance sheet in Fig. 3.

The key ratio your banker will look at is the *current*

## A TYPICAL COMPANY BALANCE SHEET

<u>ASSETS</u>			
<b>Current Assets</b>			
Cash on hand	\$ 500.00		
Banking Checking acct.	2,000.00		
Accounts Receivable	500.00		
Inventory	5,000.00		
<b>Total Current Assets</b>		\$ 8,000.00	
<b>Fixed Assets</b>			
Equipment & Office Furniture	\$10,000.00		
Truck	4,000.00		
<b>Total Fixed Assets</b>		14,000.00	
<b>TOTAL ASSETS</b>			\$ 22,000.00
<u>LIABILITIES AND EQUITIES</u>			
<b>Current Liabilities</b>			
Parts Bills	\$ 350.00		
1 year of truck payments	1,125.00		
Payroll Taxes	150.00		
<b>Total Current Liabilities</b>		\$ 1,625.00	
<b>Long Term Liabilities</b>			
2 years of truck payments		2,250.00	
<b>TOTAL LIABILITIES</b>			\$ 3,875.00
<b>Equities</b>			
Capitol Stock	\$ 7,000.00		
Surplus (retained earnings)	11,125.00		
<b>TOTAL EQUITIES</b>			18,125.00
<b>TOTAL LIABILITIES &amp; EQUITIES</b>			\$ 22,000.00

Fig. 3—A typical company balance sheet

*ratio*. This is: current assets divided by current liabilities. So, from our sample balance sheet, \$8,000 divided by \$1,625 equals a ratio of 4.92 to 1. This is an extremely good current ratio. Bankers like to see a minimum current ratio of at least 2 to 1. They also like to look at the *quick ratio*. This is current assets less inventory, divided by current liabilities ( $\$8,000 - \$5,000 + \$1,625 = 1.85$  to 1). This is also a good quick ratio as 1 to 1 is sufficient. This is also called the liquidity ratio and, when converted to a percentage, means our liquidity is 185%. In other words, we have 185% as much quick capital as is required to pay our current bills. Many analysts consider this the real test of the quality of a company's working capital.

Another ratio most bankers look at is the *debt ratio* which is found by dividing the total debt of the business by its total assets. Again using our sample balance sheet, we can develop a debt ratio percentage by dividing our total debt of \$3,975 (current liabilities of \$1,625 plus truck payments of \$2,250) by \$22,000. We wind up with a debt ratio percentage of 17.6%—a super healthy condition—that tells us that our creditors own only 17.6% of the company's assets. Lending institutions get very nervous when they own more than 50% of a company.

As a business manager, another ratio you should be concerned with is the *inventory turnover ratio*; how many times a year your inventory has been sold. Because some of the items you inventory will turn fast and others not so fast, we use the dollar amounts and divide.

To develop the turnover ratio, add your beginning inventory to your closing inventory, divide this by

# November 30 will be here sooner than you think!

November 30th is the deadline to tear off and send in those gray bottom flaps with the GE monogram from GE entertainment receiving tube cartons. Entries postmarked after November 30, 1976 cannot be accepted.

He who hesitates loses an opportunity to choose from 63 exciting gifts or "Go for the Green" in the fabulous world of S&H Green Stamps.

### Tips for fastest delivery.

- 1 Collect gray bottom flaps with the GE monogram from GE tube cartons. Include only these flaps.
- 2 Package them in a good corrugated cardboard container to guard against damage in transit.
- 3 Use registered mail or UPS so you have a traceable receipt for your order and valuable flaps.
- 4 When ordering merchandise, include quantity, award description, award number and the correct number of flaps required.
- 5 Be sure your name and address are legible. Be sure to include your name—use of firm name alone makes awards difficult to trace.



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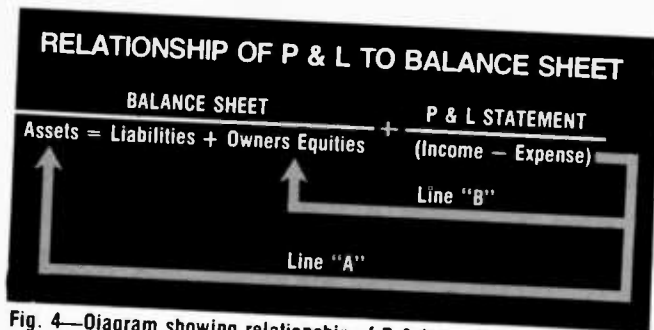


Fig. 4—Diagram showing relationship of P & L to a balance sheet.

two for your average inventory, and then divide this into the cost of parts. In other words: cost of parts divided by average inventory equals the inventory turns. The reason for looking at turns is that the more times (or turns) we buy an item and resell it at a profit, the more profit we can expect at the end of the year, assuming we continue to make the same margin.

### RECONCILIATION OF NET WORTH

Finally, there is another special financial statement that gives a better picture of our business—Reconciliation of Net Worth—which is a simple statement with a big name. Simply, this consists of taking the net worth figure from the previous balance sheet, adding the net profit from your operating statement and subtracting any dividends (owners drawings), if you are a corporation, or owner's draw, if you are a partnership or proprietor. An example of how Reconciliation of Net Worth is developed is shown in Fig. 5. Notice that net worth went down at the end of 1975 because the owner drew out \$25,500, which was \$6,100 more than his net profits, so net worth was reduced by that amount.

We hope we have given you some insight into the theory and use of Profit and Loss Statements, Balance Sheets, and a Reconciliation of Net Worth—and an idea of how the ratio analysis of these bookkeeping documents can guide you towards a successful business operation. Good Luck—and good business. ■

### RECONCILIATION OF NET WORTH

Example:

Net Worth 12-31-73		\$ 16,500.00
Net Profit 1974	+	21,600.00
Less Owner's Draw 1974	-	38,100.00
Net Worth 12-31-74		\$ 25,600.00
Net Profit 1975	+	19,400.00
Less Owner's Draw 1975	-	45,000.00
Net Worth 12-31-75		\$19,500.00

Fig. 5—A statement showing Reconciliation of Net Worth.

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# Once again, TV service technicians give these opinions about Zenith:

## I. Best Picture.

Again this year, in a nationwide survey of the opinions of independent TV service technicians, Zenith was selected, more than any other brand, as the color TV with the best picture.

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

**Answers:**

Zenith	34%
Brand A	21%
Brand B	12%
Brand C	8%
Brand D	7%
Brand E	4%
Brand F	2%
Brand G	2%
Brand H	2%
Other Brands	2%
About Equal	10%
Don't Know	4%

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

## II. Fewest Repairs.

In the same opinion survey, the service technicians selected Zenith, more than any other brand, as the color TV needing the fewest repairs.

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

**Answers:**

Zenith	38%
Brand A	18%
Brand D	9%
Brand B	6%
Brand C	5%
Brand E	3%
Brand F	2%
Brand G	2%
Brand H	2%
Other Brands	2%
About Equal	11%
Don't Know	10%

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



The Celebrity II, Model SH2331X, pictured here. Simulated rosewood with Bermuda Shell white front. Simulated TV picture.

**ZENITH**  
**CHROMACOLOR II**  
The quality goes in before the name goes on.®

■ As a TV service technician, you have probably at least considered the possibility of adding CB servicing to your present operation. Each month the percentage of your customers who are getting into CB radio is increasing, and since they are already coming to you for their TV, stereo, and auto radio servicing, it might make sense to equip your shop for the installation and servicing of their CB equipment, too.

### TEST EQUIPMENT NEEDED

Happily, the additional test equipment needed for CB servicing should not require a great amount of additional capital. However, the test instruments must have the accuracy and stability needed to comply with FCC rules as they apply to the Citizens Band Radio Service. Many of the test instruments you probably already have can be used for CB servicing, such as:

- Volt-ohm milliammeter
- Vacuum tube voltmeter

- Oscilloscope with proper frequency range
- Transistor tester
- Audio distortion measuring equipment
- DC power supply

The additional equipment needed to complete your CB service bench would include the following:

- Frequency counter
- Signal generator
- RF wattmeter
- 50-ohm dummy load
- VSWR bridge
- Regulated DC power supply

#### Frequency Counter

The frequency counter is one of the most valu-

# Test Equipment For CB Servicing

A review of the equipment needed for a professional—and profitable—CB service operation

By John E. Magnusson\*



Fig. 1—Greg Carey, Sencore chief field engineer, points to 45-channel RF tuner section of the CB-42 CB Analyzer, which combines a frequency counter, RF/IF generator, audio generator, digital RF wattmeter, and special CB tester, all in one unit for CB servicing. To the left of the analyzer is Sencore's portable power supply/battery eliminator and the CB automatic performance tester.

able and necessary test instruments on the CB service bench. FCC Rules and Regulations require that frequency measuring equipment used in CB service will provide accurate measurement of the transmitter frequency to plus or minus .005% of the assigned channel frequency for AM operation and .0025% for SSB operation. Although the digital read-out frequency counter is the normal measuring device used in CB service, there are calibrated frequency me-

ters that also meet the accuracy requirements of frequency measurement, but these are more expensive, and are designed more for service of VHF land mobile equipment. To illustrate, approximate costs of a frequency counter are from \$200 to \$1,500 each, while frequency meters run from \$4,000 to \$7,000.

Some examples of frequency measuring equipment now available are:

- Counters:
- B & K 1801

- Hewlett Packard
- Fluke 1941A
- Heath IB-1100
- Heath SM-4100
- Weston-Schlumberger 1252

Meters:

- Lampkin 107C
- Cushman CE-6
- Singer 10-C

#### RF Signal Generator

The RF Signal Generator needed for CB radio servicing must have an adequate RF attenuator that provides control of the output to a level of less than one microvolt. If not, you will be unable to measure the sensitivity of the CB radio receiver section. The present state of the art provides receiver front ends with sensitivities of less than one microvolt. Therefore, the RF signal generator must have an attenuator that provides a 0 : 1 microvolt range with a meter which indicates attenuator settings of less than one microvolt. The attenuator must also provide adequate shielding to prevent the RF signal generator output from radiating, or appearing on the shield of the output cable, thereby destroying the accuracy of the meter reading at these low levels of measurement. As far as the accuracy of the frequency calibration dial is concerned, this is really not critical. The exact frequency can be set by using the frequency counter.

A few representative models of the different RF signal generators available are: Hewlett Packard 606, Measurements Model 80, B&K Model E200D, and B & K Model 2040. The

\*Magnusson is National Service Manager for Hy-Gain Electronics Corporation in Lincoln, Nebraska

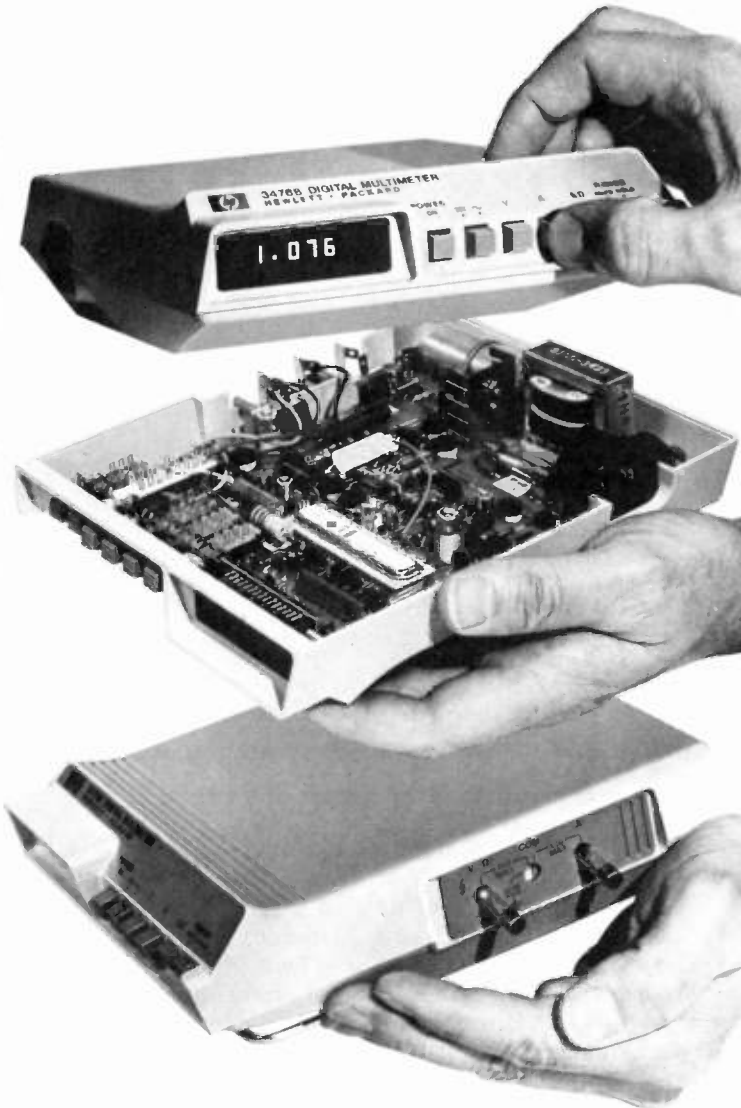
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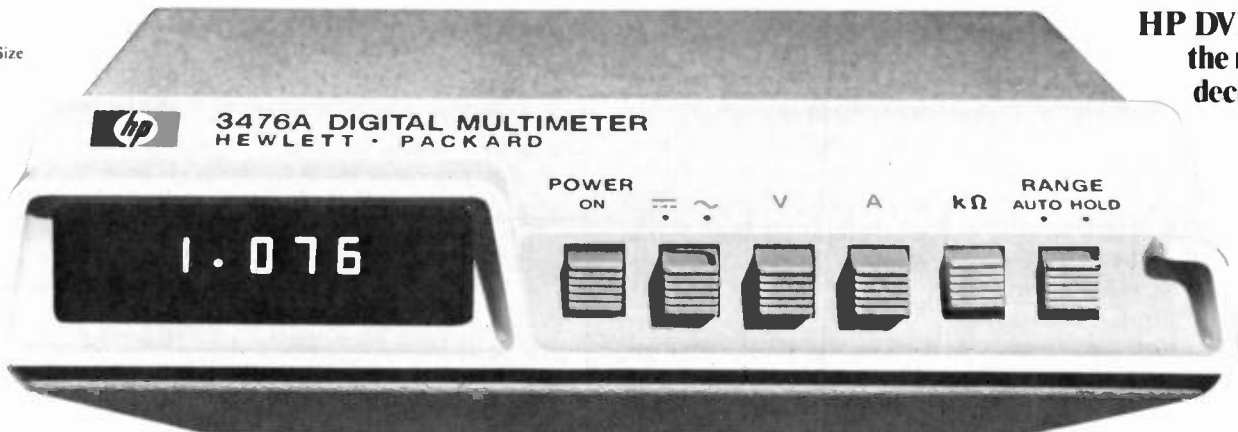
We also put front-end precision resistors on one chip for good reliability, and for better temperature and tracking stability.

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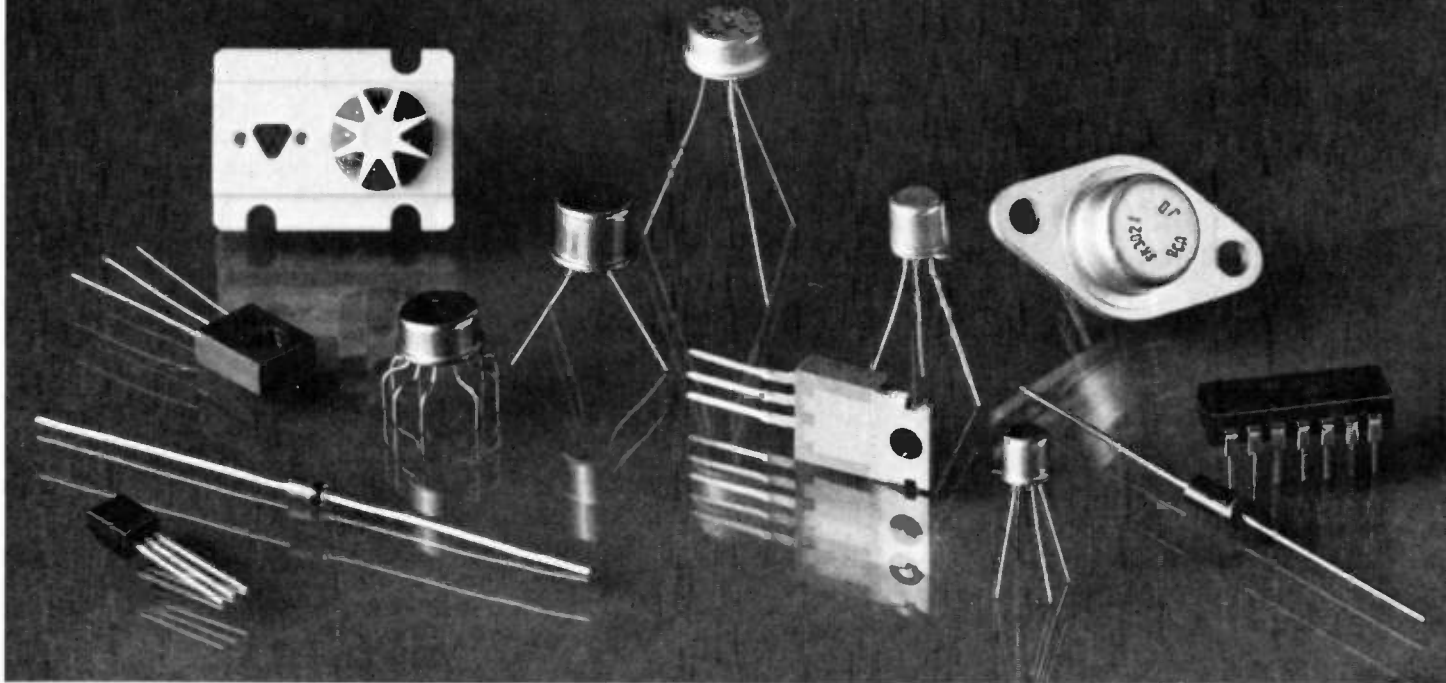
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approximate price range of generators is from \$250 to \$1,500.

## RF Wattmeter

FCC Rules and Regulations for CB radio service also call for measurement of the input and output power of the transmitter section, and this requires an RF wattmeter. Input power can be measured easily by reading DC voltage and current in the final stage. Originally, a measurement of input power was all that was required, but the FCC now requires that output power for CB transmitters not exceed 4 watts—and that's where the RF wattmeter comes in, or a VTVM with an RF probe and an accurate 50 ohm dummy load. Power is then measured by the formula,  $P = E^2 \div R$ .

RF wattmeters are also available that read

the output power across a built-in dummy load, or an RF output meter calibrated in watts can be used. This is, of course, more convenient than having to go through the arithmetic of multiplying the measured RF voltage times itself, and dividing by 50 ohms.

Some examples of the different RF wattmeters available include: B & W 334-A, Bird Model 43 Line, and Sierra Model 164 Line. The approximate price range of RF wattmeters is from \$85 to \$200.

## VSWR Bridge

The VSWR bridge, which measures the Voltage Standing Wave Ratio between CB transceiver and antenna, is another necessary piece of test equipment for CB installation and service. No matter how well the technician services the

transceiver, if the VSWR isn't right, the customer is still going to have trouble.

Two simple measurements made with a VSWR bridge on channels 1 and 23 will indicate if the antenna favors the low end, or the high end of the 23 channel spectrum. If the VSWR reading is lower on channel 1, the antenna is too long and must be shortened. If the reading is lower on channel 23,

the antenna is too short and must be lengthened. By repeating the measurements and making dimensional changes in the antenna length, the antenna can be adjusted for the minimum VSWR on channels 10, 11 and 12, thus providing optimum performance across all 23 channels.

## SOURCES OF CB TEST INSTRUMENTS

Sources for this additional test equipment

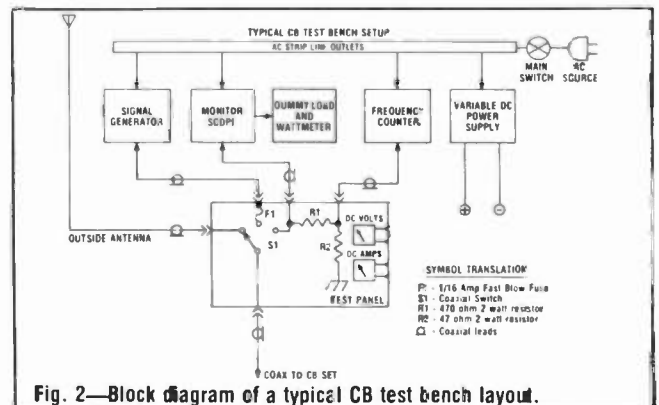
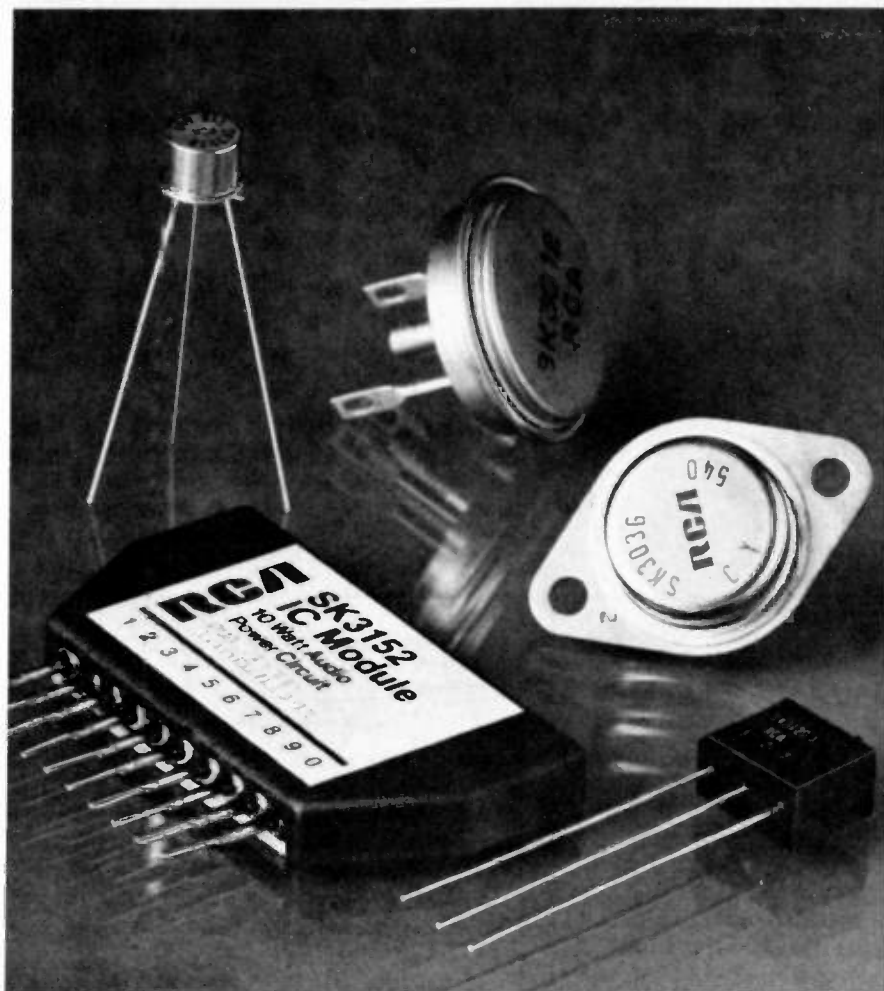


Fig. 2—Block diagram of a typical CB test bench layout.





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## RCA SK Replacement Semiconductors

needed for CB servicing are growing every day. There are many excellent American manufacturers of CB test equipment, and growing with CB's popularity, more imported CB test equipment is becoming available.

Another good, and relatively inexpensive, source of CB test equipment is in the "used" category. This is equipment which has become obsolete after use in our nation's space programs and other sophisticated electronic laboratory programs and by test equipment leasing companies. The leasing companies sell their test instruments after a year or two to upgrade their inventory. Most of this equipment is of excellent laboratory grade and has been completely reconditioned, calibrated, certified and is ready to in-

stall on the service bench.

Within just the past six months or so, several test equipment manufacturers have introduced complete CB test equipment sets consisting of two or three instruments linked together on the service bench to perform all the necessary CB test functions. One of these "CB test sets" is now being marketed by Sencore. (Fig. 1). It includes their CB41 Performance Tester that measures Standing Wave Ratio (SWR), RF power and % modulation; the CB42 Automatic CB Analyzer that combines a frequency counter, an RF/IF generator, an audio generator, a digital RF wattmeter, and a special CB tester, all in one unit; and the PS43 portable power supply/battery eliminator. The 3-unit combination, which will

handle all necessary CB tests in the field or on the bench, sells for under \$1200. Of course, the 3 units can be bought separately—the CB41 tester for \$148, the CB42 analyzer for \$895, and the PS43 power supply/battery eliminator for \$98.

### LAYOUT OF THE CB TEST BENCH

After accumulating the needed test instruments and providing a work area for CB service, organizing the service bench is the remaining task.

All of the test instruments should be connected to a central control panel to avoid the wasted time involved in connecting each test instrument to the transceiver being serviced. Unfortunately, this type of control panel must be built, as there are no

commercial units available at this time. In addition, each servicer may want to add his own refinements to accommodate additional test instruments which may be used. In Figure 2, a block diagram illustrates the suggested bench layout with central control panel.

In the block diagram you will notice a 1/16 amp fast-blow fuse installed between the RF signal generator and the co-ax selector switch. This is needed to prevent burning out the attenuator in the RF signal generator, if you accidentally transmit when the receiver input is connected to the generator. Because of the great variety of push-to-talk circuits, microphones and microphone connectors being used, it is almost impossible to wire a pro-

*continued on page 53*

# Troubleshooting the Dead Oscillator

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

## Methods and equipment for finding and solving oscillator problems

■ How do you troubleshoot an oscillator circuit to tell if it is running? Answering that question is a little more complicated than it sounds because so many of the normal troubleshooting methods can shift the oscillator frequency enough to put it out of action. So much depends on the type of oscillator circuit and the frequency of its operation. As a general rule, the higher the frequency of the oscillator, the more difficult the task becomes.

### USING THE VOLTMETER

In many cases, a simple voltmeter may be used to good advantage, especially if the oscillator is a variable frequency oscillator (VFO), or a crystal oscillator in which the "rock" can be either removed or disabled.

#### Vacuum Tube Oscillators

A partial schematic of a vacuum tube oscillator is shown in Fig. 1. This type of circuit is tuned to resonance by either an LC tank circuit or a crystal. Bias for the tube is supplied partially by the grid leak action of resistor R1 and capacitor C1. As long as a signal, supplied by the oscillator action of the tube, passes through capacitor C1, there will be a small negative voltage on the grid of V1. Furthermore, this voltage will vary as the resonant frequency of the tank circuit is changed by tuning the VFO through its range. In crystal circuits the voltage drops to almost zero when the crystal is removed or disabled.

#### Transistor Oscillator Circuits

A situation similar to tube-type oscillators occurs with transis-

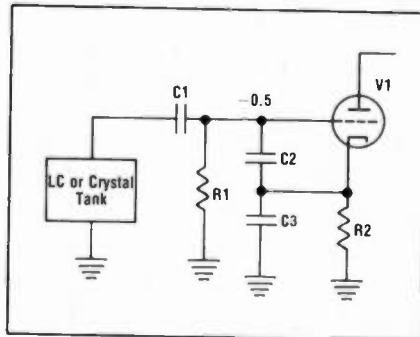


Fig. 1—Typical vacuum tube oscillator, which produces grid leak bias that can be used as indicator of oscillatory action.

torized oscillator circuits. The two transistor circuits shown in Fig. 2 represent typical AM radio converter circuits but they could also be almost any variable oscillator.

To determine if the circuit is oscillating, we would use the standard troubleshooting technique used for almost all solid-state amplifier circuits—that of measuring the voltage drop across the emitter resistor. Just the existence of a voltage drop tells us that the stage is conducting and if the circuit is oscillating, the emitter voltage drop should change as we tune the oscillator through its range.

Start at the low end of the range and tune to the high end while watching the voltmeter connected across the emitter resistor. You should notice a smooth, continuous change in the reading. If the reading does not change, the circuit is not oscillating, and the emitter current is probably the result of a short somewhere in the circuit instead of normal transistor conduction.

In crystal oscillators there will be an abrupt change in the voltage drop as the crystal is either re-

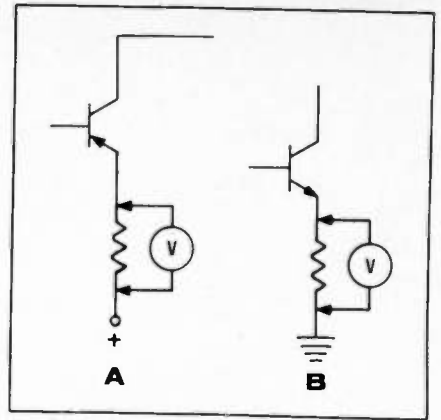


Fig. 2—Typical transistor oscillators, the emitter conduction voltage of which can be used to indicate oscillation. Circuit (A) uses a PNP transistor, and Circuit (B) an NPN transistor.

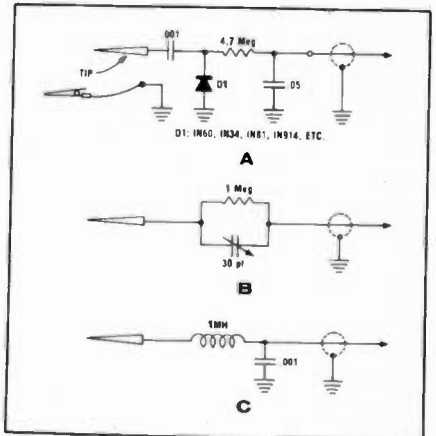


Fig. 3—Representative diagrams of: (A) Demodulator probe, (B) low-capacitance probe, and (C) RF choke used ahead of electronic voltmeters to reduce interference effects.

moved or shorted out. (Be careful when shorting a crystal in some circuits, such as certain versions of the Pierce-type oscillator, as the transistor could be destroyed.) The short should be performed with a 1000-pf capacitor.

When measuring the voltage drop at AM-band frequencies, the capacitance of the probe will detune the oscillator but should not be enough to kill the oscillation. In fact, if that does happen, it indicates that something is wrong somewhere, and that you may have found your problem. When working with the AM band frequencies, try to use either a VTVM or a very high-sensitivity VOM, as cheap voltmeters have a tendency to present too low a resistance to the circuit under test, loading it down so much that it could kill the oscillation. However, high RF fields in transmitters and the horizontal circuits of TV receivers can sometimes get into the VTVM, FETVM, DVM, and other electronic-type voltmeters and

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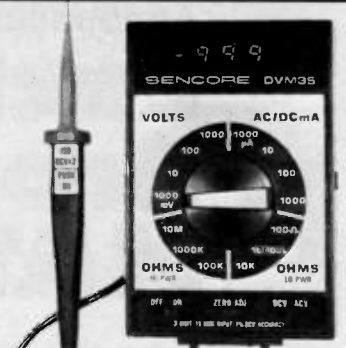
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bias them into a non-linear range or all the way to saturation. The standard advice in these cases is to use a shielded RF choke (Fig. 3A), or limit your selection of voltmeters to the VOM type of instrument.

Another way in which the voltmeter can be used to check the operation of an oscillator circuit is to equip it with an RF demodulation probe. This type of probe (see Fig. 3B) rectifies and filters the RF to produce a DC level. You can either build your own probe, using a circuit like that shown in Fig. 3B, or you can buy one. If the demodulator probe has an output, you may assume the oscillator is operating.

Up to this point we have outlined ways of using a voltmeter to determine simply whether or not an oscillator circuit is working. We still haven't found the method of determining the frequency of the oscillator.

### THE OSCILLOSCOPE

The wideband oscilloscope, which has become a standard part of the inventory of most service

shops, can be used to develop information as to the operation of oscillator circuits, but will not yield much more information about the oscillator frequency than the voltmeter. An oscilloscope can be used to examine the output waveform of an oscillator up to the bandwidth limits of the scope, and thus will indicate whether or not an oscillator signal is present, but the oscilloscope will not yield information as to the frequency of the signal, except, perhaps, that the frequency is "somewhere in the ballpark."

At any frequency above moderately high ultrasonic frequencies, a low-capacitance probe (Fig. 3C) must be used to avoid a change in oscillator frequency as a result of capacitive loading. In addition to capacitive loading problems, there also is a signal-attenuating voltage divider action consisting of the scope input resistance, the circuit impedance, and the capacitive reactance of the probe. Also remember that, although sinewave signals can be displayed up to the practical bandwidth limit of the oscilloscope, more complex

waveforms will be deteriorated if their fundamental frequency is greater than a relatively small fraction of the practical bandwidth of the scope. For example, a 1-MHz time-base oscillator in a counter will appear to be generating sinewaves instead of squarewaves if a 5-MHz oscilloscope is used.

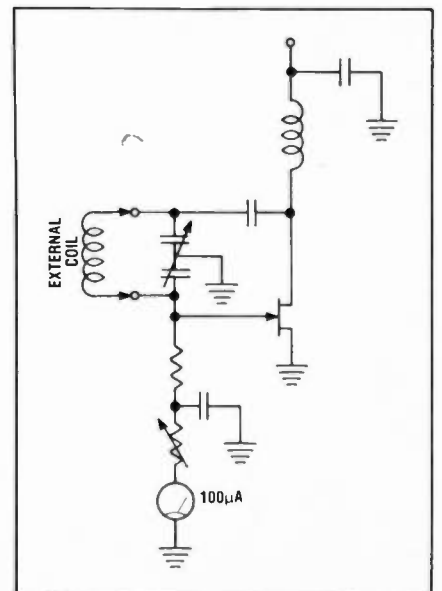


Fig. 4—Diagram of a generic design of dip meter circuit.



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It is worth noting here that a DC-coupled oscilloscope is also a DC voltmeter, with the amount of deflection proportional to the input voltage. Thus, any technique using the voltmeter can also be applied to the DC-coupled oscilloscope.

The problems of oscillator troubleshooting become even more difficult when they involve an FM or TV local oscillator, or any other oscillator in the high HF or VHF categories. Even if you are lucky enough to own one of the newer

Tektronix or Hewlett-Packard 150-MHz oscilloscopes, you will find many circuits in which even the specially designed VHF probes will cause excessive loading of the signal. The answer in these cases is to use an instrument that is not commonly used in the consumer electronics portion of the service industry. It's called the dip meter (formerly grid dip meter), and is used most often in the servicing of amateur radio and two-way communications equipment.

#### USING THE DIP METER

The dip meter operates as an oscillator in which the inductor portion of the resonant tank is mounted external to the case. (See Fig. 4 for a generic dip meter circuit). The dip meter oscillator is a VFO and it has a dial calibrated as to oscillation frequency. In normal operation, the dip meter coil is coupled to the coil of a resonant tank circuit being tested so that some energy is transferred. When the dip meter VFO is tuned to the resonant frequency of the LC tank under examination, a large increase in energy transfer occurs,

and that causes the meter to deflect sharply downward (in other words, it "dips"). The dip meter, then, can be used to find the resonant frequency of a tank circuit, and it will also tell us if the oscillator is oscillating.

There are two ways a dip meter can be used—as a substitute oscillator, or as an oscillating detector.

#### As A Substitute Oscillator

If you are checking the local oscillator of a TV or FM broadcast receiver, couple the oscillator loosely to the inductor of the dip meter (Fig. 5) and note what happens as you tune the dip meter across the appropriate band. You will hear stations if the FM radio oscillator is dead, or see picture information flash across the screen if the receiver is a TV.

On the FM set, tune the dial of the radio to some portion of the band, preferably in the middle of a band which is relatively filled with broadcasting stations. Adjust the VFO, while its coil is loosely coupled to the receiver oscillator, through a range from 98 to 118 MHz. This is the range of local os-

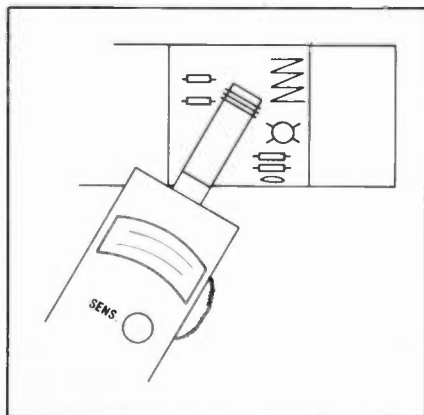


Fig. 5—The coil of the dip meter is coupled loosely to the oscillator under test.

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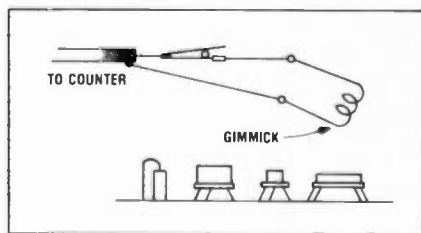


cillator frequencies to expect from an FM radio with a 10.7-MHz IF. If the local oscillator is dead you will be able to tune in FM stations almost normally, although the AFC "thunk" and its attendant stability will be missing. If, on the other hand, the local oscillator is working, no stations will be heard but you might hear some heterodynes, or "birdies".

On a TV set, these heterodynes will show up as black lines on the screen.

### As An Oscillating Detector.

Many dip meters have a provision for replacing the meter with a pair of earphones. You will normally hear only the hiss of thermal noise in the earphones. If the receiver's local oscillator is operating, however, the oscillator will couple energy into the dip meter coil so that when the VFO of the dip meter is tuned to the frequency of the local oscillator, heterodyning will occur and a beat note will be heard in the earphones. Once a beat note is established, turn off the receiver to verify that the beat note is due to local oscillator operation and not another nearby source. At some frequencies, dip meters will pick up oscillation from a distance of several feet. Also, consider the frequency at which the beat note occurs; there are usually several signal sources in a typical receiver, any of which might produce a beat note by interfering with the fundamental or harmonic frequency of the dip



**Fig. 6—**The "gimmick" shown here is used to loosely couple a counter input to sensitive oscillator circuits.

meter VFO. Consequently, sometimes it's wiser to disable the oscillator rather than the whole receiver.

### FINDING THE FREQUENCY

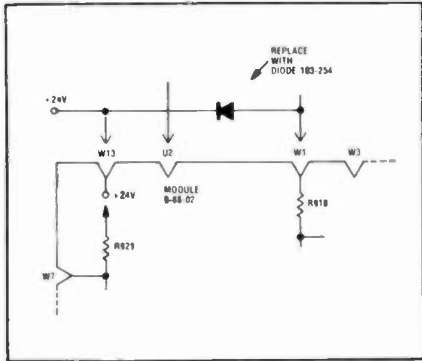
As we have indicated, none of the methods presented—the voltmeter, the oscillator, and the dip meter—really give us any definite

*continued on page 53*

## TECHNICAL DIGEST

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

**CHASSIS:** All Zenith "G" Line Color TV Chassis with a diode connected between pins W1 and W13 of Module 9-88-02.



**TROUBLE SYMPTOM:** Reduced brightness or complete loss of raster

**CAUSE:** Failure of diode (Zenith Part No. 103-142) connected between pins W1 and W13 of Module 9-88-02. (In chassis equipped with the "-02" module, the diode is connected between pins W1 and W13 of the module socket. In chassis equipped with the "-02A" or "-02C" module, the diode is wired between terminals W1 and W13 on the module itself.) For improved reliability, replace this diode, if defective, with a diode having Zenith Part No. 103-254.

**CHASSIS:** RCA CTC68

**TROUBLE SYMPTOM:** Adjustment of BRIGHTNESS control affects height of raster.

**CAUSE:** Open R320 in base circuit of brightness limiter transistor Q302.

**CHASSIS:** Magnavox T991

**TROUBLE SYMPTOM:** Green cast to picture during warmup.

**CAUSE:** If this condition does not last more than 3 to 5 minutes after the receiver is turned on, it should be considered normal and, therefore, no corrective is necessary. (The greenish cast during warmup is an inherent characteristic of the picture tubes used in models equipped with the T991 chassis.) ■

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## TEST INSTRUMENT REPORT



Fig. 1—Sencore's Model DVM36 digital multimeter. 'Touch-On' probe and collapsible bail-type stand are standard equipment. For more information about this test instrument, circle number 147 on Reader Service Card in this issue.



Fig. 2—Rear view of DVM36, with battery compartment cover removed to show battery complement, and tip of 'Touch-On' probe unscrewed from handle to show 2-amp overload protection fuse in probe.

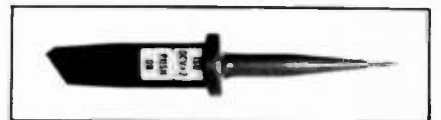


Fig. 3—Close up view of Sencore's Model 39G96 'Touch-On' probe, which is standard equipment on the DVM36 digital multimeter. Button labeled 'PUSH ON' functions as remote on/off switch, which helps conserve battery charge, and button labeled 'ISO-DCVX2' doubles measuring capability of DC voltage ranges and, as a result of doubling input resistance and isolating input capacitance from circuit under test, it also reduces circuit loading.

# Sencore's Model DVM36 Portable Digital Multimeter

■ Sencore's newest digital multimeter, Model DVM36, is a 'pocket-size' portable with a 3½-digit readout, a DC volts measuring accuracy of .5% of reading ( $\pm$  the resolution of the selected range), and an input impedance of 15 megohms shunted by 60pF of capacitance.

The DMV36, shown in Fig. 1, is capable of measuring DC voltages up to 2000 volts, AC voltages up to 1000 volts, AC/DC current up to 2 amps, and resistances up to 20 megohms. (An optional probe extends the DC volts measuring

capability up to 50KV.)

The smallest quantities (maximum resolutions) which can be measured by the DVM36 are: 1mV in the DC and AC volts measuring modes, 1 $\mu$ A in the DC and AC current measuring modes, and .1 ohm in the resistance measuring modes.

The instrument is equipped with two resistance measuring modes:

"LO PWR"—In this mode a maximum of only .2 volt is applied to the device or circuit whose resistance is being measured. Because

this is *below* the level which will forward bias semiconductor junctions, this mode is particularly useful for in-circuit resistance measurements in semiconductor-equipped circuits.

"HI PWR"—This mode applies a maximum of 2 volts to the device or circuit being tested. Because this level of applied voltage is *more* than sufficient to forward bias semiconductor junctions, the "HI PWR" mode is particularly suited for out-of-circuit measurement of the front-to-back resistance ratio of semiconductors.



The DVM36 is protected against input overloads up to 1000 volts (DC + peak) by an internal diode, backed up by a 2-amp, 3AG fast-blow fuse in the probe tip. (Fuse replacement involves merely unscrewing the red tip from the probe handle, as shown in Fig. 2.)

The 3½-digit readout of the DVM36 is provided by four 7-segment, .3-inch-high, red light-emitting diodes (LEDs).

'Automatic' features incorporated in the DVM36 include:

• **Automatic Polarity Indication**—If the DC voltage or current being measured is negative, a negative sign automatically appears to the left of the numerical readout. Absence of this negative sign will indicate positive polarity.

• **Automatic Decimal Placement**—The decimal point in the readout is automatically shifted to the correct position when the function/range switch is rotated to the desired range.

• **Automatic Overrange Indication**—When the measured quantity exceeds the measurement capability of the selected range, a flashing '1888' readout is automatically displayed, indicating the need to switch to the next highest range. (The numeral '1' remains continuously lighted while the '888' portion of the readout flashes on and off.)

Operating power for the DVM36 is provided by six 1.5-volt 'AA' alkaline or rechargeable nickel cadmium batteries, which are housed in a compartment in the

back of the instrument (Fig. 2), or it can be powered indirectly from a 105-130 VAC, 50/60Hz source by use of Sencore's PA202 Power Adapter, which is available on an optional basis for \$9.95. (The output plug of the power adapter is inserted into the 'Power Adapter Jack,' on the side of the DVM36.) If the DVM36 is equipped with rechargeable batteries, the power adapter also functions as a battery charger.

To help prolong battery life and reduce the need for recharging, the DVM36 comes equipped with Sencore's 39G96 Touch-On Probe (Fig 2 and 3), which contains a remote on/off button that removes power from the instrument between measurements, thereby

*continued on page 52*

## SPECIFICATIONS

### Sencore Model DVM36 Portable Digital Multimeter

<b>DC VOLTAGE RANGES:</b>	0 to +2, 20, 200, 1000 Volts	<b>RESOLUTION:</b>	1µA on 2 mA range
<b>ACCURACY:*</b>	+0.5% of reading ±1 digit	<b>VOLTAGE BURDEN:</b>	200 mV, except 1V on 2000 mA range.
<b>RESOLUTION:</b>	1 mV on 2V range	<b>SHUNT RESISTANCE:</b>	100, 10, 1.1 ohms for ranges above.
<b>INPUT IMPEDANCE:</b>	15 megohm shunted by less than 60 pF (30 megohm using isolation resistor)	<b>RESPONSE TIME:</b>	2 sec max.
<b>RESPONSE TIME:</b>	2 sec. max.	<b>POLARITY:</b>	Automatic: negative sign indicator
<b>POLARITY:</b>	Automatic: negative sign indicator	<b>MAX INPUT PROTECTION:</b>	Diode and 2A fuse protection of shunt resistors. Fuse in probe tip.
<b>ISOLATION:</b>	Built-in 15 megohm 1% Isolation resistor in probe. Can also be used for X2 multiplication extending ranges to 4, 40, 400, 2000 volts. Isolation Accuracy: 2%	<b>RESISTANCE RANGES:</b>	0 to 200, 2K, 20K ohms (Low Power); 20JK, 200K, 20 megohm (High Power)
<b>AC REJECTION:</b>	-40 dB at 60 Hz	<b>ACCURACY:*</b>	+1% of reading ±2 digits, except: 200 ohm range: ±1.0% of reading ±2 digits from Full to ¼ scale, +2.0% of reading + digits from 1/4 to 1/10 scale. 20 megohm range: +2.0% of reading ±2 digits.
<b>MAX INPUT PROTECTION:</b>	1000 volts (DC + peak) any range. Internal diode plus back-up fuse protection. Fuse in probe tip.	<b>RESOLUTION:</b>	.1 ohm on 200 ohm range
<b>AC VOLTAGE RANGES:</b>	0 to 2, 20, 200, 1000 volts	<b>MAX VOLTAGE APPLIED:</b>	Low Power: 200mV max. High Power: 2V max.
<b>ACCURACY:*</b>	+1.0% of reading ±2 digits at 50-60 Hz	<b>MAX CURRENT THRU UNKNOWN R:</b>	2 mA, 200 µA, 20µA, 10µA, 1 µA, 100 nA for ranges above.
<b>RESOLUTION:</b>	1 mV on 2V range	<b>RESPONSE TIME:</b>	2 sec max.
<b>INPUT IMPEDANCE:</b>	15 megohm shunted by less than 60 pF	<b>MAX INPUT PROTECTION:</b>	1000 Volts (DC + peak) all ranges, except 500 Volts (DC + peak) on 20 megohm range. Diode and fuse protection of Low Power ranges. Fuse protection of High Power ranges. Fuse in probe tip.
<b>RESPONSE TIME:</b>	2 sec. max		
<b>FREQUENCY RESPONSE:</b>	40 Hz to 1000 Hz, ±5% reading ±1 digit		
<b>AC CONVERSION:</b>	RMS reading, average detecting		
<b>MAX INPUT PROTECTION:</b>	1000 volts (peak + DC) any range. Internal diode plus back-up fuse protection. Fuse in probe tip.		
<b>AC/DC CURRENT</b> (Total average sum of AC and DC current is indicated.)			
<b>RANGES:</b>	0 to ±2, 20, 200, 2000mA		
<b>ACCURACY:*</b>	DC: ±1% of reading ±1 digit AC: ±1.5% of reading ±2 digits		

\*Note: Accuracies are expressed as percentage of reading ± specified number of digits for the given range. All specifications are from full scale to 1/10th full scale.

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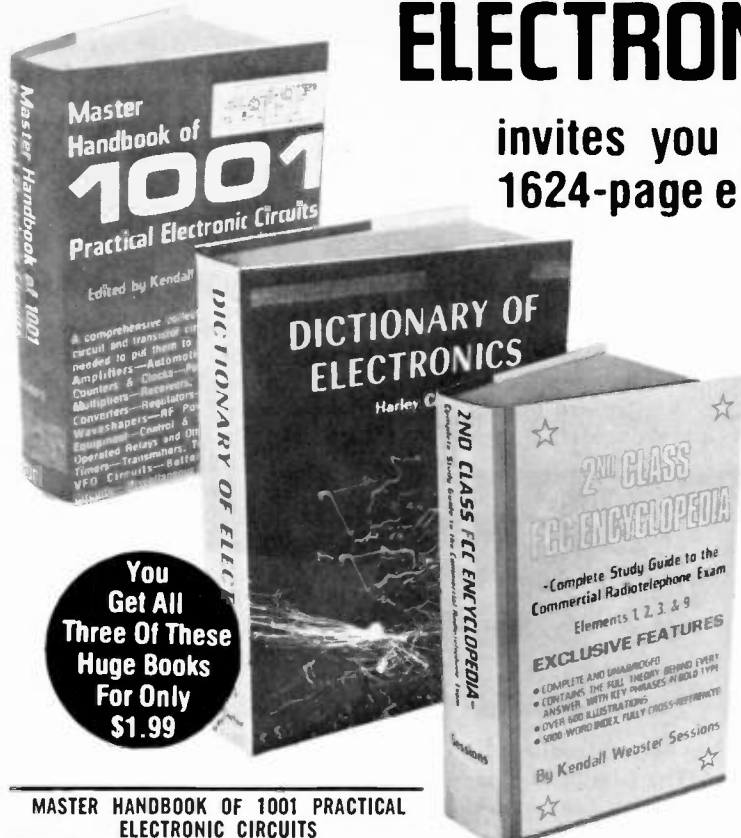
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This is not a book of words. The only reading you'll do when you open the pages of this Master Handbook will be within the captions of only those circuits of direct and specific interest to YOU. The schematics are classified according to general application, and the Sections themselves appear in alphabetical order—Alarm Sensors and Triggering Circuits, Audio Conditioning Circuits, Audio Amplifiers, Automotive Circuits, etc.

The section on test equipment includes circuits for almost any instrument you can imagine, from simple range multipliers for your VOM to sophisticated frequency counters. Build even one of these practical devices and you're saved far more than

you've paid for the book. The Section on receivers and RF preamplifiers gives you a rich choice of circuits from which to choose in order to improve reception of any type of signal in any part of the radio frequency spectrum; it's an extremely simple and effective way to get "metropolitan" performance from a "fringe area" TV installation. If you're in the business of servicing/repairing commercially built electronic equipment (TV receivers, stereo amplifiers, CB transmitters and receivers), you're going to especially appreciate the comprehensive Appendix of IC substitutions, which includes base diagrams for most popular ICs, and gives you all the info you need to adapt the IC packages of one manufacturer to the circuit applications of another. Another Appendix is a pictorial listing of common electronic symbols.

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The volume provides full, complete and easily-understandable explanations of thousands of specific electronics terms (such as transistors, acoustic feedback, alpha particles, beat oscillator, final anode, electrostatic lens, nonlinear resistance, pool cathode, etc.). A unique feature of this selection is the cross-indexing, whereby key words contained in the definitions (words that are defined more fully elsewhere in the book) are printed in small capitals so you are not left in the dark by any definition. An example of this is the definition for "Susceptance," which includes the words "Conductance," "Admittance," "Resistance," and "Reactance," indicating other definitions which go deeper into explaining the basic term and its applications. You'll find yourself following one electronics term to another until you fully and completely understand the term that puzzled you in the beginning.

Appendix material provides you with still more information—an extensive list of units and abbreviations, graphic symbols used in schematics, component color codes, db conversion tables, data on the electromagnetic spectrum, tube base diagrams, etc.

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

## 2ND CLASS FCC ENCYCLOPEDIA

Truly a one-volume electronics library all by itself . . . a supercourse in electronics that belongs on the bookshelf of everyone in electronics! This mammoth 602-page volume is as sweeping and all-encompassing as the FCC exam itself, and is undoubtedly the most thoroughly detailed, elaborately illustrated, and easiest-to-read handbook on the 2nd and 3rd Class FCC license. It's a "quick-guide" to learning the answers to the FCC exams, as well as an intensive, non-nonsense course in radio theory specifically designed to help you obtain your license . . . and to provide you with the knowledge you need for a successful career in the burgeoning fields of CB, business, and 2-way radio. The result is a study guide that is not just a course, but a whole series of courses that can make you the master of any field in radio communication.

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The first Section covers basic exam info: how and where to apply; how and where to take the test; the fees; what the license can do for you; and what you have to know to pass. All material was double-checked at press time for late rule changes, etc. The next Section contains questions and answers for the Third Class radiotelephone operator permit (FCC elements 1 and 2). Then, there's a Section on Element 9, for the broadcast endorsement. Another Section answers the basic electronics theory questions for the Second Class license, and still another covers the advanced questions. An entire Section is devoted to the troubleshooting questions asked on the exam. These carefully programmed step-by-step techniques are designed to enable you to obtain your license as easily as possible.

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**AN EXTRAORDINARY OFFER...**

## 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.

### ELECTRONIC CASE CLEANER 148

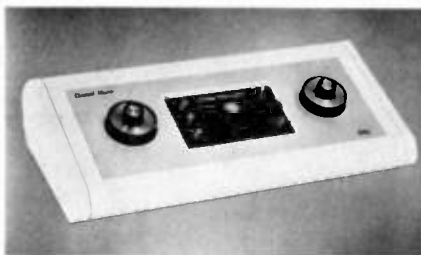
A new, non-aerosol spray cleaner for electronic cabinets, cables, microphones, and face plates has been introduced by *Tech Spray*. Called Face 'N' Case, the new cleaner removes



nicotine stains, grime, fingerprints, dust and dirt from equipment but will not harm plastics or scratch glass. It contains an anti-static agent to help repel dust and dirt, is non-flammable, will not affect the function of S meters, and does not streak or leave unwanted films or residue. Face 'N' Case is available in a 6 ounce, finger pump action can.

### FOUR-IN-ONE VIDEO GAME 149

A new electronic video game, called the Challenger, that offers tennis, squash, hockey and a single challenge,



practice mode has been introduced by *Channel Master*. The Challenger has two features to heighten the sense of realism and excitement—sound is heard through the TV speaker, and 3 different sounds are used, for hit, rebound, and score. Three Pro/AM switches select ball speed, bat size, and ball rebound angle for professional or

amateur play. Scoring is automatically indicated throughout the game on the TV screen. A selector also allows the players to choose either automatic or manual ball service. The unit can be used with any make of TV or screen size in black and white or color. Suggested retail is \$79.95.

### PICTURE TUBE BRIGHTENER 150

A new brightener for Sony color picture tubes is now available from *TeleMatic*. Although especially designed for the Sony Trinitron tube, the new brightener, the CR-260, will service most Sony Chassis. The unit plugs in between the tube base and socket without the need for wire-cutting. It features an 8-pin, button-type base. Outside length is 1½ inches and outside diameter is 1¼ inches. Priced at \$3.50.



### PROXIMITY ALARM SENSOR 151

An alarm device that detects persons approaching safes, file cabinets, desks and other metal objects has been introduced by *GTE Sylvania Inc.* The device, which can protect up to 20 desks or other metal objects, senses electrical energy changes produced when a person comes within a few inches of an object, if the connecting wire is detached, or if a power failure occurs. When turned on, the unit automatically adjusts itself to the characteristic capacitance of the object to which it is connected. Slow chang-



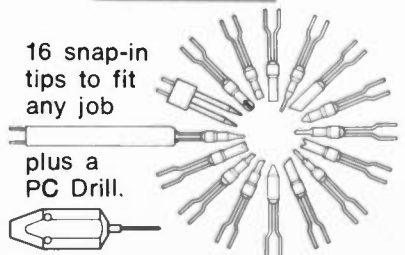
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- SM-5248 IMD Analyzer in assembled form at \$250.00 (add \$2.75 for shipping and handling).
- IM-5258 THD Analyzer in kit form at \$219.95 (add \$3.00 for shipping and handling).
- SM-5258 THD Analyzer in assembled form at \$330.00 (add \$3.00 for shipping and handling).
- IM-5238 AC Voltmeter in kit form at \$89.95 (add \$1.75 for shipping and handling).
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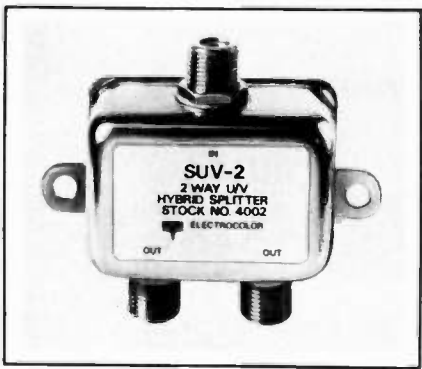
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ing capacitance caused by rising or falling humidity or other environmental forces will not trigger the alarm. Called the CPS-1, the unit employs high reliability integrated circuitry and meets military requirements for shock, vibration, and extended temperature range. Prices range from \$325 each for less than 10 units to \$295 for more than 20.

**UHF/VHF SPLITTER/COUPLERS 152**

A new, economy priced group of 75-ohm uhf/vhf splitter/couplers for home TV, MATV, and CATV systems has been introduced by *Blonder-Tongue*. These new accessories, under the Electrocolor label, permit two, three or four TV receivers or MATV/CATV trunklines to be split from a main feedline for further distribution. Two-way, three-way, and four-way splitters are included in the group with the bandpass on all units from 10 to 900 MHz. Input and output return loss ranges from 7 to 20 dB depending on operating frequency. Insertion loss ranges from 3.5 to 8 dB, and isolation



ranges from 13 to 27dB, depending on frequency and the number of circuit splits. Price range is from \$3.28 to \$6.56.

**CB PREAMPLIFIER 153**

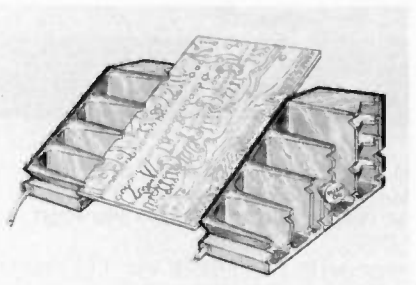
A new preamplifier for CB transceivers that provides 20 dB amplification of incoming signals has been developed by *Chemtronics*. Called the CB Xtender, the new unit amplifies 2 to 30 MHz, with a noise figure of less than 2 dB. It may be used with both AM, and SSB transceivers, and will accommodate the new CB frequencies in the HF band. A time delay circuit prevents the Xtender from cutting in and out during SSB transmissions. The unit is inserted between the antenna



and transceiver, using PL-259 connectors. It draws about 55 MA, operates from 10 to 15 VDC, either negative or positive ground, with internal diode protection against improper DC installation. It is priced at \$39.95.

**VACUUM TABLE VISE 154**

A new vise that utilizes vacuum for holding circuit boards, and other electronic parts of assorted sizes and



shapes is now available from *Edsyn, Inc.* Called the Atmoscope Holding Fixture, the new device will operate from any lab vacuum supply, exerting up to 30 pounds of holding power with a vacuum supply of 18-20 inches of mercury. Each holding fixture can be spaced independently to accommodate a wide assortment of part sizes from transistors to large circuit boards. The fixtures are triangular shaped with a 2 inch by 5 inch base, and are molded from clear see-through plastic. There are also various "V" grooves along two planes for easy positioning of parts. An On/Off button on each fixture permits instant vacuum hold or release.

**FREQUENCY COUNTER 155**

A new frequency counter designed for measurements between 10 Hz and 60 MHz in audio, video, CB ham radio and other communications equipment has been introduced by *VIZ Mfg. Co.*



The new counter, Model WD-752A, features a 1kHz audible side tone with separate on-off volume control for modulating single-sideband transceivers for carrier-frequency measurement. It has a selectable input sensitivity of either 10 or 100mV plus a carefully selected 10.000MHz crystal that creates a time base that en-

sure the accuracy of the 10, 100, and 1000-millisecond gates signals and logic control. The measuring circuit is composed of a six-state IC counter which feeds into a very bright readout made up of six 0.3 inch seven segment LEDs. Dealer price is \$255.

**FET VOLT-OHMMETER 156**

A new solid-state drop-proof, burn-out proof FET volt-ohmmeter has been introduced by the *Triplet Corporation*. The new meter, Model 64, is battery-operated, and features six low power ohms ranges with an open circuit voltage of only 90mV for in-circuit



resistance and continuity measurements without biasing or destroying sensitive diodes, IC's or transistors. Micro-power circuitry permits continuous meter operation with a carbon battery life in excess of one year, it is claimed. The meter has an internal electrical system to prevent explosive arcs in high energy circuits up to the 2 amp/1000V (20kW) fuse capacity. It also features an independent meter module for quick replacement when needed. Sells for \$130.00.

**DIGITAL COLOR BAR GENERATOR 157**

A new color generator that uses an LSS integrated circuit chip and weighs only 12 ounces has been introduced by *Eico Company*. The new unit, Model 388, provides, on channels 2, 3 or 4: gated rainbow



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

pattern for chrominance adjustment with ten color bars, single dot for static convergence adjustment, dot raster for final convergence adjustment, single vertical line, eight vertical lines, single horizontal line, eight horizontal lines, single crossbar and crosshatch pattern. It operates from two 9-volt batteries or with rechargeable cells. It features an LED for on/off, and crystal-controlled oscillator and timing circuits. It is priced at \$99.95.



**CB BOOM MIKE HEADSET**

158

An "over the ear" boom mike headset for CB has been introduced by Telex. Designed for truck drivers and others working in a noisy environment, the new headset features a com-

fortable foam-cushion earpiece that can be worn on either ear. It is adjustable for placement directly in front of

the lips for transmission and for pivoting out of the way when not in use. The push-to-talk switch is provided with a clothing clip. The power mike has a built-in FET amplifier and operates on a long-life 1.4 volt mercury battery. Priced retail at \$59.95.

**UHF AMPLIFIER**

159

An ultra lo-noise UHF amplifier designed to improve UHF reception in primary and near-fringe signal areas is being introduced by the Winegard Company. The indoor UHF amplifier is available in two versions: the UA-4030 with a 300 ohm input and noise figure of 3.1 dB with gain of 8dB, and the UA-4050 with a 75 ohm input de-



vice and noise figure of 2.2dB with gain of 8.6dB. Both models have separate 300 ohm VHF and UHF outputs and by-pass the VHF signals. Comes in easy to carry tube caddy and is quickly installed. Power requirements is 117-VAC, 60MHz and 2.5 watts.

**PROJECTION TV**

160

A new projection console for lifesize television viewing has been introduced by Projection Electronics, Miami, Florida. Called "Super Video", the unit consists of a projection console



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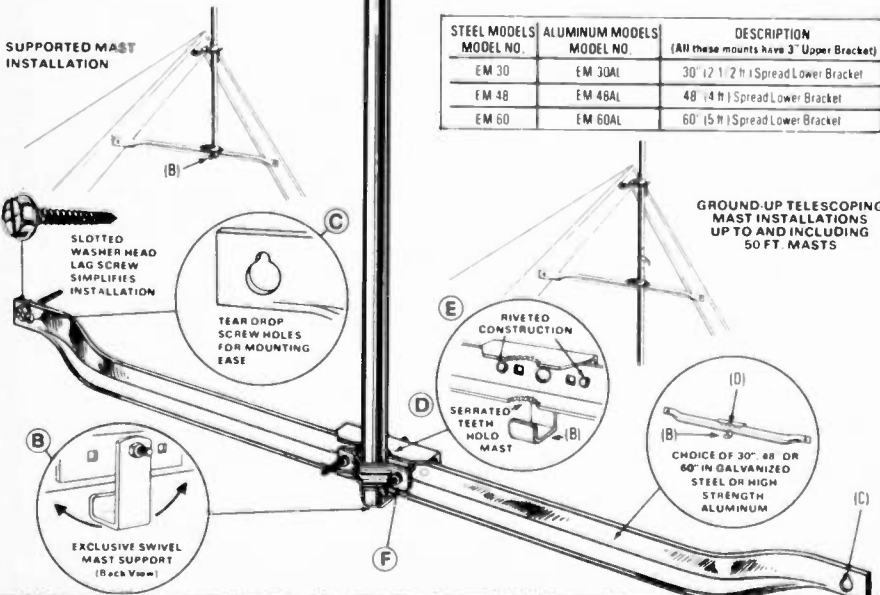
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- Double set of serrated teeth (D) prevents mast from turning in high winds.
- Riveted channel type construction (E) of lower bracket provides maximum rigidity and strength.
- Carriage bolts and clamps (F) permits one hand "Spinrite" tightening of mast.
- Lower bracket made of square cornered angle for additional strength and maximum rigidity.



**SOUTH RIVER METAL PRODUCTS COMPANY, INC.**  
 SOUTH RIVER, NEW JERSEY 08882

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unit with a separate, free-standing 50 inch screen. Projection distance is only 5 feet from a 1280 sq. in. screen. Controls are located on the console for easy adjustment. A custom designed console is available in a wide variety of wood-grain finishes and solid colors. Dealer cost is \$795.

**COMMUNICATIONS COUNTERS 161**

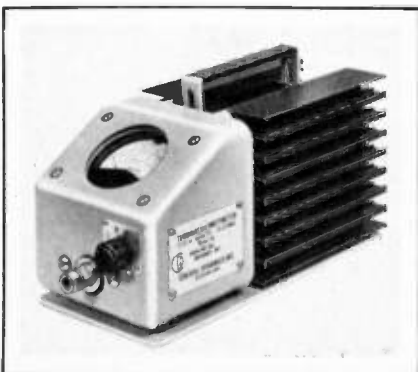
A new series of communications counters that measure frequencies from 20Hz to 1,250 MHz has been introduced by *Systron-Donner Corporation*. Model 6241A measures frequencies from 20 Hz to 100 MHz; Model 6242A measures up to 512 MHz; and



Model 6243A covers the range up to 1,250 MHz. All three models include: 10mV sensitivity, the ability to withstand exceptionally high input signal levels, overload fuse protected RF input, full 8 digit LED display, selectable resolution in decade steps from 10 kHz to 0.1 Hz, and a high stability time base oscillator offering  $\pm 2$  parts in  $10^6$ /year.

**WATTMETER WITH FOUR RANGES 162**

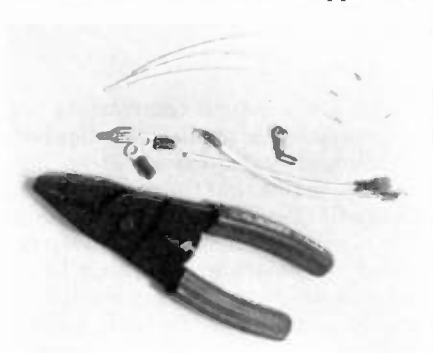
A new termination wattmeter with 4 ranges covering down to 3 watts is being introduced by *Coaxial Dynamics*. The Model 85 will service everything from hand-held portable transmitters to base station installation and covers 20 to 512 MHz. It is designed for use in 50 ohm coaxial systems as an accurate direct reading RF wattmeter and a 150 watt non-radiating dry termination. The multiple, full scale ranges have temperature compensation for flexibility on



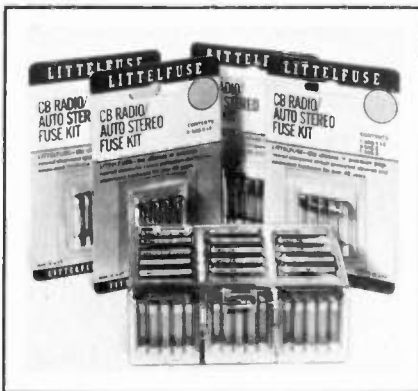
the production line, the laboratory, the service bench and in the field.

**MULTI-PURPOSE MAINTENANCE TOOL 163**

A new multi-purpose hand tool that performs a wide variety of assembly and maintenance chores is being introduced by *Hollingsworth*. The "Multiplier" combines three tool functions into one tool: (1) a wire stripper and



cutter for wire sizes 22-10 AWG; (2) a bolt cutter which cuts six common sizes of bolts and screws; and (3) a terminal crimper for insulated and non-insulated terminals to wire sizes 22-10 AWG, as well as 7-8mm automotive ignition terminals. The tool is equipped with plastic-coated handles, a tapered nose with serrated surfaces which serves as needle-nose pliers, and each wire, bolt and terminal size that the tool handles is engraved in position for fast identification.



**CB FUSE SERVICING KITS 164**

A new line of carded CB-auto stereo fuse kits and caddies for the do-it-yourselfer, CB dealer and serviceman has been announced by *Littelfuse*. The kit contains five 3AG fuses used in CB radios and auto stereos. Four different amperage assortments are available. The fuse caddies for servicemen and dealers contain sixty 3AG 2 amp fuses, and fifteen each of 3AG 1½ amp and 3 amp fuses, all packed five to a box.

**NEEDLE-FINE SOLDER 165**

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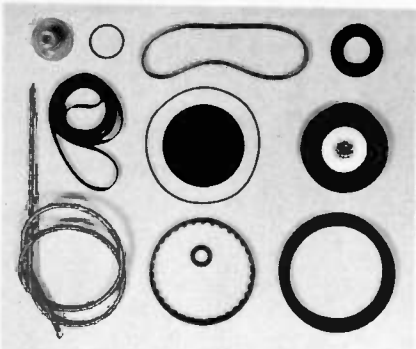
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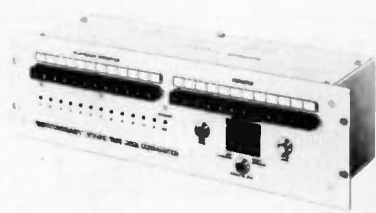
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circuits, miniature components and micro electronic applications has been announced by *Multicore Solders*. With a gauge so fine that the new solder can easily fit through the eye of a needle, the placement, amount of solder and speed of soldering, according to the manufacturer, can be very closely controlled for better joint quality and economical use. Standard gauges available are 22 SWG (.028"), 24 (.022"), 28 (.014), 32 (.010") and 34 (.009") each in 60/40 and 63/37 alloys. Flux cores are a specially formulated extra-active, non-corrosive, non-conductive RA and RMA rosin flux. A one pound reel of 34 SWG is 4,950 feet long, or nearly a mile. Prices range from \$2.50 to \$6.50 per reel depending on gauge and quantity.



## TAPE DECK COMPARATOR 166

A stereo tape deck comparator for demonstration of stereo equipment in hi-fi salons and audio demo rooms has been introduced by *Switchcraft, Inc.* The new device, called Model TC-2000, provides accurate comparison of recording and play-back sound characteristics of up to 12 tape decks and/or cassette recorders/players. Variables, such as amplifier and tape inputs can be adjusted to controlled conditions to allow for accurate evaluation of playback sound quality. The comparator panel is 19 inches wide and can be cabinet or rack mounted. It comes equipped with phono jacks for



inputs such as turntable, FM receiver or tape player. It's solid-state, and is priced at \$675.

## CB INSTALLATION KITS 167

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Instruments

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wire connectors, tab terminals, quick-connect terminals, and in-line fuseholders—is now available in kit form from *Littlefuse, Inc.* Designed for the CB dealer and the do-it-yourselfer,



the kits are available in a "single-pack" version, for one installation, and in a "six-pack" for six complete installations. Complete instructions are included, plus quick-release set disconnectors for quick unit removal.

**TRUNK MOUNT  
CB ANTENNA**

168

A new 48-inch long trunk lid edge mount CB antenna for mobile applications has been introduced by *Breaker Corporation*. The new white fiberglass antenna is said to overcome signal transmission and reception loss usually encountered with lower profile base loaded trunk mounts. The trunk lid edge mount of the new antenna, Model 10-430, permits fast installation without the need for drilling holes in the trunk lid. Two Allen set screws permit easy removal to prevent theft. A VSWR of 1.5:1 is achieved over the 27MHz bandwidth. Priced at \$22.95.



**AUDIO CABLE TESTERS**

169

Audio cables can be checked for continuity, shorts, opens and crossed wiring between terminations with a new cable tester from *Switchcraft, Inc.* Called the Model QC-1001 Q-Chek tester, the device determines performance status of audio cables with over 180 combinations of standard audio terminations—commercial phone

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Ignition Hash



Accessory Interference



Alternator Whine

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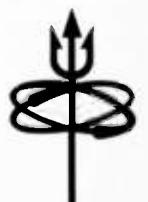
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## TEST INSTRUMENT REPORT

*continued from page 39*

prolonging the life of non-rechargeable batteries and extending the 'between charge' time of chargeable batteries.

However, if needed for continuous measurement or for a series of measurements separated by relatively short time intervals, power can be applied to the DVM36 on a continuous basis merely by placing the front-panel ON/OFF switch in the "ON" position, thereby bypassing the 'remote' on/off button on the probe.

Battery charge can be tested by rotating the function/range switch to the 20VDC position and placing the probe tip on the center pin of the Power Adapter Jack. A reading of less than 4.1 volts indicates that the batteries should be recharged or replaced.

Another feature of the Touch-on Probe is a built-in 15-megohm isolation/multiplier resistor, which is connected in series with the 15-megohm input resistance of the DVM36 when the "ISO-DCVX2" button on the probe is pressed in. This not only halves the input voltage applied to the DVM36, thereby doubling the maximum voltage measuring capability of the DC voltage ranges, but it also reduces circuit loading by doubling the total input resistance and effectively isolating the input capacitance of the DVM36 from the circuit under

test. Thus, when the 'ISO-DCVX2' button is pressed in, the 1000 VDC range of the DVM36 is extended to 2000 volts (the readout is multiplied by 2) and the input impedance of the unit is increased to 30 megohms shunted by a relatively insignificant amount of capacitance.

The maximum DC voltage measuring capability of the DVM36 can be further extended, to 50KV, by use of Sencore's HP200 50-KV High-Voltage Probe, which is available on an optional basis for \$25. This accessory, which slips over the Touch-On Probe of the DVM36, reduces the voltage applied to the input of the instrument by a factor of 100 (the readout is multiplied by 100), thereby extending the DC voltage measuring capability of the unit by the same factor. And, because the HP200 probe multiplies the DVM36's input resistance by 100 (from the 'standard' 15 megs to 1500 megs), it also can be used as an isolation probe, to reduce instrument loading in extremely high-impedance circuits (those with impedances of up to about 150 megohms).

'Pocket-size portable' is an appropriate description of the DVM36—it is a mere 6 inches high by 4 inches wide by 1¼ inches deep, and weighs but 1.1 lbs, including batteries. And it is housed in an insulated, Cylolac® case which, according to Sencore, provides sufficient protection to enable the instrument to withstand a ten-foot drop onto a concrete floor and keep on working.

The price of Sencore's Model DVM36 Portable Digital Multi-meter—complete with Touch-On Probe, built-in bail-type

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stand, a 40-page operation/application/maintenance manual and a 15-minute 'familiarization' cassette tape—is \$148. ■

## TROUBLESHOOTING

*continued from page 36*

information about the frequency of operation of an oscillator. For that a frequency meter or frequency counter is needed.

A heterodyne frequency meter tells us the oscillator frequency by beating against the unknown frequency, and then comparing the point at which zero beat occurs with the known dial calibration.

Today, however, most servicers would rather use one of the lower cost digital frequency counters that are available. Unfortunately, frequency counters also have a tendency to load the circuit and thus shift the oscillator frequency.

The loading tendency of counters can be limited, and accuracy thus improved, through the use of a "gimmick". (see Fig. 6). If the oscillator is really low level, or if a lesser coupling is required to eliminate 'frequency pulling' ef-

fects, you may want to use an amplifier between the gimmick and the counter. A transistorized broadband amplifier (1-150 MHz) for this purpose is available in kit form from International Crystal of Oklahoma City. ■

## CB SERVICING

*continued from page 31*

tection switching circuit that would make it impossible to transmit when the co-ax selector switch is in the "Receiver Test" position, and connected to the signal generator.

The input leads of the frequency counter are normally connected through a variable step attenuator to protect the counter input from the 4-watt output level of the CB transmitter. In addition, the input leads to the counter are normally connected to several points inside the CB set during the testing. Therefore, it would be inconvenient to have them permanently connected to the switches, or to one of the pieces of test equipment.

One last thing—a reminder that the servicing of CB transmitting equipment requires that the servicer, whether it's you or someone you hire, must have an FCC second-class radiotelephone license. The subject of how and where such an FCC license can be obtained will be covered in one of the next articles in this series. ■

## G.E. COLOR TELEVISION

*continued from page 22*

beam current, or minimum brightness. The tertiary winding subassembly has only two leads, one which connects to the Scan Compensation Circuit, and one which connects to the picture tube second anode and the focus divider resistor, R731.

The new transformer has a split primary—one half of which is in the collector circuit of the horizontal-output transistor, Q702, and the other half of which is in the emitter circuit of that transistor. Impedance matching for the yoke is provided by the winding between pins 1 and 2, and the winding between pins 5 and 7.

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many of the YM and YC-2 chassis models in GE's 1977 Color TV line is a digital readout channel indicator equipped with a seven-section, gas discharge display with one-half-inch-high numbers for both VHF and UHF stations.

The digital readout system is made up of two basic sub-assemblies: 1.) a display unit, and 2.) an encoder unit which consists of two inseparable interconnected switching devices. The encoders are non-repairable units, and the display unit, except for current limiting resistors, must also be replaced rather than repaired.

In a future issue of ET/D, we will take a more detailed look at the makeup of the digital readout system with circuit diagrams, the installation and adjustment of the system, and procedures for troubleshooting it. ■

## VESTO TV

*continued from page 14*

cient service—is causing him more than a little worry.

"Service costs are escalating so rapidly," says Magers, "I'm beginning to wonder just how much longer we can afford to keep the service facet of the business operating—yet it has been and still is one of our main competitive strengths.

"Some dealers are farming out their service. It makes sense, considering the skyrocketing costs of labor, insurance, parts inventories and other costs directly related to service. Yet, I don't want to lose the direct control I now have over the quality of the service we offer our customers.

"Not only is the maintenance on our eight van-type service trucks costing a small fortune, but now that insurance companies are running scared about insuring vans, insurance rates are skyrocketing out of sight."

Attracting and retaining proficient technicians is another service-related problem which, ac-

ording to Magers, seems to be worsening. Explains Magers: "Keeping our nine-technician crew intact is getting to be more of a problem that it was in the recent past. Highly qualified technicians like ours are naturally attracted by the higher wages and better benefits reportedly offered by other segments of the electronics industry. Recently, I was lucky enough to find two well-trained technicians to replace two of ours who left us. But no one likes to depend on luck, particularly when it comes to operating his business.

"One answer to the labor problem," speculates Magers, "might be to make independent businessmen out of technicians and just turn the service calls over to them instead of hiring them by the hour. We've thought of going this route, and several of our dealer competitors have found it successful. They lowered their costs and stepped up production—technicians paid by the call instead of by the hour will naturally make more calls. And the dealer gets out from under some of the overhead burden, particularly that in-

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volved in purchasing and maintaining a fleet of service vehicles.

"But I'm reluctant to accept the loss of control over service quality which such a plan inherently involves. You can blow your reputation for fast, dependable service pretty quickly without some effective method of controlling quality—and then service is no longer a competitive sales advantage."

Increasing parts inventory requirements and effectively lower profit margins on parts are two other service-related problem areas pointed out by Magers. "TV manufacturers keep introducing new modularized chassis designs each year," says Magers, "and these inevitably increase our module and parts inventory investment, not to mention the drastic reduction in parts income which low-profit-margin pricing of modules has produced.

"NARDA is actively campaigning to get TV manufacturers to subsidize dealers on parts and put new warranty parts in our shops on consignment. For all of our sakes, lets hope they succeed."

One other method by which Magers, and other dealers, can alleviate the effects of escalating service costs is to increase his rates for home calls and service labor. Says Magers: "We could add \$10 to our service call charge. That would ease the profit squeeze, but probably only temporarily. Right now we charge \$21.95 for service calls, which is higher than some dealers in our market and lower than a few. And, while some dealers limit their service activities to certain parts of town, we feel we have to cover the entire metropolitan area. If we didn't, we would be automatically limiting our retailing market as well."

The latter factor means that Magers—like other sales/service dealers who must rely on a geographically large market area to get the retail volume they need to keep a 'quantity buying edge' with manufacturers and distributors—must remain competitive over a larger market area and therefore against a larger number of retail and service competitors. This makes Magers' profitable- vs-competitive service pricing equation even more complicated—but it nevertheless is an equation

which Magers must somehow balance if he is to continue to offer the *quality* of service that is required to keep service a viable retail sales aid.

#### ANTICIPATING CONSUMER REACTION: A MISTAKE—MAYBE

Magers says that last winter he made what might be one of the worst mistakes he's ever made.

When manufacturers dropped their one-year service labor warranty to ninety days, Magers was sure that consumers would rebel. Anticipating this reaction, Magers jammed his warehouse full of one-year warranty products.

But the consumer rebellion hasn't yet materialized, and Magers is still shaking his head over what appears to be a misjudgment of consumer reaction.

However he isn't yet convinced that the shorter labor warranty won't catch up with the industry. Cautions Magers: "Sets sold during the first six months of this year are now out of service labor warranty, and I have a gut feeling that a lot of those buyers didn't fully realize that they were buying shorter warranty product. Some of them undoubtedly will need service in the next few months, and many probably will insist on free repairs. I don't think we are out of the woods on the abbreviated service warranty yet."

#### SURVIVING SALES/SERVICE DEALERS: LEANER, WISER COMPETITORS

The Kansas City television and audio market during the past five-six years, says Magers, has been tough on sales/service dealers, even the well established, tightly controlled ones like Vesto.

"But those who have survived are leaner and wiser and therefore are better competitors against the so-called 'discount' and 'mass' merchandisers. The survivors are types who maintain comprehensive records, know their costs, and don't engage in a lot of 'price-footballing.'

"Of course, some new razzle-dazzle type is always coming along and employing some 'high-voltage' price-oriented promotion strategy, but most of them aren't around too long, and the dust settles and the rest of us just keep on doing what has been working for us for years." ■

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		Equivalents			
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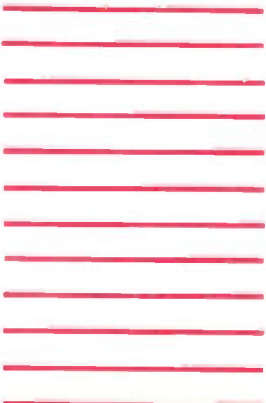
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