

ET/D

FEBRUARY 1981 • \$1.50

ELECTRONIC TECHNICIAN/DEALER
LEADING THE CONSUMER AND
INDUSTRIAL SERVICE MARKETS

CET Quiz

Service Vans

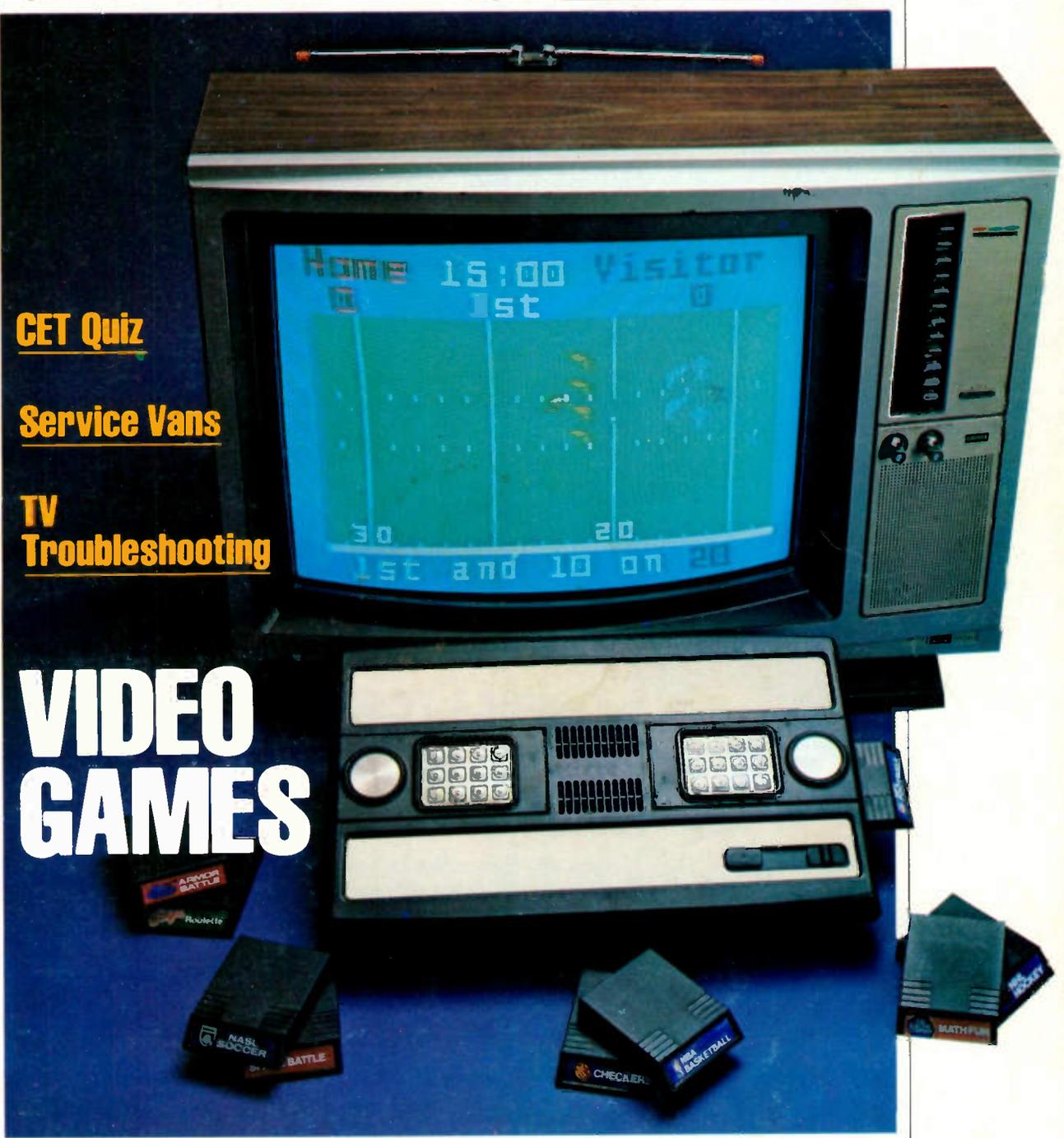
**TV
Troubleshooting**

VIDEO GAMES

KDMR4038013-P2-
4823ADIR -379-
RAY KOWECK
27734 DENMAR
WARREN

MI 48093

AB APR82
-AS



The Tools.



Boker, Crescent, Lufkin, Nicholson, Weller, Wiss, Xcelite.

The right tool makes the job easier.
And Cooper makes the right tool for the job.
Whether you're making or mending, cutting or joining,
measuring or stripping, there's a Cooper tool that's
just right. Don't take chances on tools. Specify Cooper
and get 'em right the first time!

from Cooper The Toolmaker.



The Cooper Group

BOKER * CRESCENT * LUFKIN * NICHOLSON * WELLER * WISS * XCELITE
P.O. Box 728, Apex, North Carolina 27502. Tel: (919) 362-7511. Telex: 579497.

Circle No. 101 on Reader Inquiry Card

ET/D

Walter H. Schwartz, *Editor (Duluth)*

Peter B. Credit,
Assistant Editor (Duluth)

Tom Greney, *Group Vice President
Publishing Director (Chicago)*

Don Fraser, *Graphic Design*

Missy Jersett, *Production Manager*

Debi Harmer, *Production Supervisor*

Lillie Pearson, *Circulation Supervisor*

Gene Bailey, *Reader Service*

Julie Laitin, *Promotion Director*

Dawn Anderson, *Classified Ad Mgr.*

Please submit editorial
manuscripts to:
Editor ET/D, 1 East First Street,
Duluth, Minn., 55802.

ADVERTISING SALES

Please send all advertising material to:
ET/D, Production Mgr.
120 West Second Street
Duluth, Minn. 55802
(218) 727-8511

East Region

Steve Del Duca
757 Third Avenue
New York, N.Y. 10017
(212) 888-4382

Midwest Region

Keith Lewis
111 East Wacker Drive
Chicago, Ill. 60601
(312) 938-2325

Southern Region

Chuck Cummings
613 N. O'Connor
Irving, TX 75061
(214) 253-8678

Western Region

Joyce Amiri
10741 Moorpark St., Suite #21
North Hollywood, CA 91602
(213) 980-7750 or (213) 760-1684

HBJ

HARCOURT BRACE JOVANOVIĆ PUBLICATIONS

Robert L. Edgell, *Chairman*
Richard Moeller, *President*
Lars Fladmark, *Executive Vice President*
Arland Hirman, *Treasurer*
Thomas Greney, *Group Vice President*
Ezra Pincus, *Group Vice President*
Lawrence Witchel, *Group Vice President*
Joe Bilderbach, *Vice President*
James T. Gherna, *Vice President*
George A. Glenn, *Vice President*
Harry D. Ramaley, *Vice President*

INDUSTRY REPORT

NATESA Protests "Exposé"

The following is a letter from Frank Moch, executive director of the National Association of Television and Electronic Servicers of America to WLS-TV of Chicago following an "investigation" by the station's news department.

December 5, 1980

Mr. Thomas E. Kuelbs
News Director
WLS-TV/Channel 7
190 North State Street
Chicago, Illinois 60601
Dear Mr. Kuelbs:

Your response of November 21st to cover letters of November 5th and November 30th, 1980 to Karen Kalish, in no way justifies the phony exposé she conducted for WLS-TV.

First, when Ms. Kalish contacted this office claiming to seek NATESA guidance for set owners seeking honest and ethical service, we responded factually because we thought the request to be ethical. NATESA's credentials in the field of consumer satisfaction activity is recognized by many consumerists, industry and government agencies.

Second, our check of major sources involved in consumer protection activities, reveals no major problem, thus proving that the exposé was merely an unfair act to hype WLS-TV's shrinking Nielsens. All doubt disappeared when she accepted refunds from servicers she accused of being rip-offs.

Third, the modus operandi was totally inept. Breaking a connection going to the picture tube heater was a highly unnatural defect. We know of no such trouble ever occurring naturally. It could even cause serious complications had the wire, in handling, touched other elements of the set. This definitely discredits the credentials of your "expert technician."

Fourth, using three different brands and types of sets, including one at least eight years old, could never develop a norm for judgment. In the case of the old set, it IS logical to check further.

Fifth, when Ms. Kalish called John Sperry, editor of a pricing guide that is far from officially industry accepted, she simply asked, "How much should it cost to solder a wire," rather than how much should it cost to diagnose an open circuit and service a set. We learned, also, that she asked the same limited question of some factory related service managers. There is a vast difference between servicing a set with an alleged problem and

merely soldering a wire. Rather than telephone factory/distributor service managers, a more honest act would be to take the set to them as she did to independent servicers. Obviously this would have blown the exposé when she got invoices higher than she wanted.

Sixth, Ms. Kalish's rank ignorance of TV sets and service was clearly revealed when she charged servicers with such inane phrases as "They charged for THE transistor and condenser," as if there was only one each in any given set -and-another gem, "They charged for the power out," whatever that might be.

Seventh, simultaneous with airing, the Sun-Times printed union labor costs, including \$15.15 for common electricians, and \$11.10 for laborers. Kalish, in her infinite, self attributed wisdom, generously was willing to pay for one hour's time. A generally accepted rule of thumb indicates that for a service business to be viable it must collect from the buyers of services, three to four times direct labor cost, to pay for facilities, equipment, taxes, data libraries, insurance, office personnel and the many legitimate costs. ASSUMING, for the moment, that a technician was only worth laborers' wages, the hour of time should have cost \$33.30 to \$44.40. Total minimum time required to process acceptance of set for servicing, getting into the set, trouble-shooting, reassembly and processing return of set to the customer, almost always exceeds one hour.

Eighth, COMMON sense should indicate that there is a strong mutual interest and responsibility between TV and/or radio stations and servicers, and Kalish's arrogant, illogical, know-it-all handling of the exposé, is like "biting the hand that feeds you." WLS-TV can be sure that without atonement via equal time, servicers in its area of operation will long remember Kalish and her tar brush.

Very truly yours,
NATESA
Frank J. Moch
Executive Director

NAB Asks FCC Set Quad Technical Standards

NAB said that once a clear technical standard is chosen the competitive free enterprise system will swing into full operation. NAB asserted that if there were no standards, the transmitting equipment, broadcasting and receiving equipment markets would suffer from confusion and the public could be deprived of FM quad broadcasting and receivers. In the absence of a clear FCC standard, NAB said, quad service "would be so scarce as to be unable to support the broadcasting or manufacturing of receiving equipment." **ET/D**

ET/D

ELECTRONIC TECHNICIAN/DEALER
LEADING THE CONSUMER AND
INDUSTRIAL SERVICE MARKETS

February 1981, Volume 103, No. 2

WALTER H. SCHWARTZ
Editor

PETER B. CREDIT
Assistant Editor

RAY ALLEGREZZA
Contributing Editor

TOM GRENEY
Publishing Director

DON FRASER
Graphic Design

MISSY JERSETT
Production Manager

LILLIE PEARSON
Circulation Fulfillment

FEATURES

TV Games

You can troubleshoot them 18

Service Vans

Cost considerations 24

Microprocessor Update II

More and more information 35

Functional Analysis

A troubleshooting technique 40

CET Quiz II

More questions 44

DEPARTMENTS

Industry Report 3

Service Seminar 6

Bulletin Board 8

Letters 10

Newsline 12

Security Viewpoint 14

Editors Desk 16

TEKFAK 27

Test Instrument Report 46

Security Products 48

New Products 52

Classified Ads 56

Ad Index 58

Reader Service 59



On The Cover: Video games, both home and commercial, are another of electronics rising stars; many of the games are or will shortly be full-fledged microcomputers. One of the more popular games is football, as shown on our cover. (Courtesy Mattel Electronics).

HBJ A HARCOURT BRACE JOVANOVIĆ PUBLICATION **LABP** **ABC** **EIA**

ELECTRONIC TECHNICIAN/DEALER (ISSN 0192-7175) is published monthly by Harcourt Brace Jovanovich Publications. Corporate offices: 757 Third Avenue, New York, New York 10017. Advertising offices: 757 Third Avenue, New York, New York 10017 and 111 East Wacker Drive, Chicago, Illinois 60601. Accounting, Advertising Production and Circulation offices: 1 East First Street, Duluth, Minnesota 55802. Subscription rates: one year, \$12; two years, \$20; three years, \$26 in the United States and Canada; all other countries: \$40. Single copies: \$1.50 in the United States and Canada; all other countries: \$4.50. Controlled circulation postage paid at Duluth, New York 14437. Copyright © 1981 by Harcourt Brace Jovanovich, Inc. All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording or any information storage and retrieval system, without permission in writing from the publisher. ELECTRONIC TECHNICIAN/DEALER is a registered trademark of Harcourt Brace Jovanovich, Inc.

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

INTRODUCING

ERS™

NEVER BEFORE COULD YOU BUY EXACT REPLACEMENT SEMICONDUCTORS AT SUCH LOW PRICES!



HERE'S PROOF!

**Compare ERS 1-to-1 Prices with ECG*, RCA, GE and REN.
Buy 10 of each and save even more!**

ERS 152	\$1.20
ERS 165	\$3.35
ERS 238	\$4.35
ERS 291	\$1.30
ERS 712	\$2.25

**EXACT
REPLACEMENT
SEMICONDUCTORS**

ERS

ERS 154	\$1.80
ERS 180	\$4.40
ERS 703A	\$1.35
ERS 236	\$2.30
ERS 195A	\$2.00

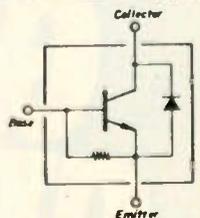
*ECG is a Registered Trademark of the GTE Sylvania Corporation

**SUPER
SPECIAL!**

D903 HORIZONTAL OUTPUT W/DAMPER DIODE

- 50 Watts
- 1,500 Volts
- 7 Amps
- Order 10 or more, and SAVE!

\$4⁹⁵



MCM is first with the Semiconductors you need the most!

1-800-543-4330
National Watts Line

mcm
ELECTRONIC PARTS

858 Congress Park Drive, Centerville, Ohio 45459

1-800-763-4315
Ohio Watts Line

Circle No. 104 on Reader Inquiry Card

ETID - February 1981 / 5

SERVICE SEMINAR

ADMIRAL

9M50RA "Triac" touch tuning models with ER3RA electronic tuning systems incorporate a solid state switch called a Triac (Q501). The only function of the Triac is to turn the 9M50 Color TV chassis on and off. With the main power switch (S171) in the ON position, power is always supplied to the electronic tuning system. When switch S401 (on the keyboard) is pressed, IC201 develops a 9kHz signal which is amplified by Q208 and applied to the pulse transformer (T502) which turns the Triac ON which then supplies ac power to the receiver. The Triac will remain ON as long as the 9kHz signal is present. If the receiver will not turn ON, check for the presence of the 9kHz signal (approx. 3 to 5 VP-P) at point "P" on the ET500 module. If no signal is present, check amplifier Q208 on the logic module. The collector should be approx. 3.4 volts and the base .15 volts. If the correct signal is present at point "P," bypass the Triac by placing a jumper from point "N" to point "O." The receiver should now be ON. Remove the jumper and replace the defective Triac (Q501).

RCA

Recommended lubricants and greases for television service—The following chart lists lubricants and greases that are recommended for use, as necessary, when servicing RCA

television chassis. Proper use of these specific lubricants and greases listed will help ensure the continuing reliability of the chassis being serviced.

Material	Use	Stock Number	Drawing Number
Lubricant	Relubrication of all mechanical tuners	10R215	891997-132
Lubricant	Relubrication of VTCA Dial PC Board	143685	993971-18
Silicone heat sink compound	Power device replacement	138227	990164-170
Silicone grease	Second anode cup	10R116	891997-79
RTV Compound	CTC 68 HV tripler replacement	141729	903434-1

More in it for you than ever before! The biggest, broadest-ever line of Zenith Universal Semiconductors! Now you get



GIFT CERTIFICATES

with every qualifying purchase of Zenith Universal Semiconductors by March 31, 1981 from your participating Zenith distributor.

00 000 0000 0
 Thank You. Please come again!

TEXACO
 PETROLEUM PRODUCTS

ZENITH RADIO CORP
 +
 ANY TEXACO STATION

DATE: _____

TERMS: PAYABLE WITHOUT BUYER'S SIGNATURE
 DISCOUNT UPON RECEIPT OF STATEMENT

AMOUNT: 103790

TOTAL CHARGE: \$ 5.00

NOTICE TO BUYER: Do not sign before reading both sides of this agreement or if any spaces intended for agreed terms are left blank. Retain this copy.

PRODUCTS & SERVICES: SKY SERVICE GREASE LEAD MOTOR OIL TEXACO MOTOR OIL

SERVICE ORDER: _____

TOTAL: _____

SALES TAX: _____

VEHICLE: _____ MILEAGE: _____ ATTENDANT: _____

FORM 5 100 (5/79)

TEXACO Working to keep your trust

ORIGINAL INVOICE

10R215 Tuner Lubricant—The common practice of cleaning and lubricating television tuners with various aerosol sprays formulated for this purpose should be discontinued. Recent tests indicate most of these sprays contain ingredients that will cause stress cracks in plastic parts. In the event a television tuner requires cleaning and relubrication: Option I—Forward the tuner to a tuner repair station for repair and return. The repair stations that perform warranty tuner repair for RCA are equipped to properly clean and lubricate tuners. Contact your RCA Consumer Electronics Distributor for their locations. Option II 1. Clean the entire tuner per instructions on page 5 of VHF/UHF Tuner alignment service data 1976 C-1. 2. Using a pencil eraser carefully rub all wafer rotor contacts until they are shiny. Use air pressure to blow out residue. 3. Lubricate the tuner per service data instructions, except use stock number 10R215 tuner lubricant on all wafers (do not use a different lubricant on the oscillator). 143685 Lubricant Varactor Tuner Control Assemblies (VTCA) used in conjunction with remote control or power tune equipped instruments have a printed circuit board mounted within the dial drum assembly (channel indicator). Use stock number 143685 lubricant only to lubricate the printed wiring surface of this board. In this same general subject area, do not attempt to relubricate motors associated with any of the various remote control or power tune instruments marketed by RCA. If a motor becomes sluggish or tends to stall, replace the motor assembly. 138227 Silicone Heat Sink Compound. When mounting a power device (Transistor, SCR, ITR, etc.) apply 138227 Silicone Heat Sink Compound to both the power device and its heat sink—especially if an insulating washer is used in conjunction with the device. Power devices are dependent on heat dissipation through their respective heat

sinks—be it a specially designed heat sink or the television chassis itself. Proper use of the correct compound ensures optimum heat transfer from the device to the heat sink. 10R116 Silicone Grease. The 10R116 Silicone Grease is to be used when correcting high voltage leakage at the second anode connection as specified in 1976 General Information Goldenrod, Issue No. CTV 11, dated May 13, 1977. Refer to this Goldenrod for detailed instructions as to the use of 10R116 Silicone Grease. 141729 RTV Compound. During production of the CTC 68 chassis all HV tripler solder connections were coated with RTV compound. These connections must be recoated with 141729 RTV Compound if the original coating is removed for any reason (troubleshooting, tripler replacement, etc.). This RTV compound can also be used to suppress corona emissions at any connection where high voltage is present.

SONY

Model TV700, Picture displays triple superimposed vertical images—oscilloscope displays an extra sync pulse at R607 on the end connected to VBT. To correct: Replace C704 at emitter lead of vertical oscillator. James Belanger, Hollis, NH.

SYLVANIA

Chassis B10-6, No picture, no sound (screen lights at the instant set is turned on, then goes off)—No boost, no high voltage, no horizontal. To correct: Replace C430 (.018 capacitor) shorted. Bob Wallman, CET, Beatrice, NEB.

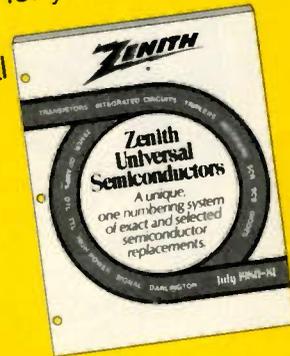
More cross-references, more line items, more support data. There's more in it for you than ever before with Zenith Universal Semiconductors covering Zenith exact replacements... plus the most popular types in the industry.

And now—TEXACO GIFT CERTIFICATES!

With every qualifying purchase from your participating Zenith distributor by March 31, 1981, you get Texaco Gift Certificates to apply against the purchase of gasoline, oil, tires, batteries and many more items at

any Texaco Service Station. Call your Zenith distributor's Parts Manager and learn how you can get Texaco Gift Certificates with your purchase of Zenith Universal Semiconductors.

Call now, too, for your copy of Zenith's latest, greatest Universal Semiconductor cross-reference guide. **There's more in it for you than ever before!**



ZENITH

The quality goes in before the name goes on®

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

Circle No. 105 on Reader Inquiry Card

BULLETIN BOARD

TRW RF Semiconductors has published a new catalog containing detailed information on its family of **15 small signal, low noise transistors**. *Catalog 80* is a large format, 52-page booklet that contains specifications, performance graphs, photographs, circuit diagrams, package drawings and dimensions. All devices in the catalog are NPN silicon bipolar transistors with gold metallization. Copies are available from any authorized TRW RF Semiconductors distributor.

Circle No. 119 on Reader Inquiry Card

The CRT Controller Handbook by Gerry Kane is now available from Osborne/McGraw-Hill. *The CRT Controller Handbook* is a stand alone reference book which can also be used as a supplement to *An Introduction to Microcomputers: Vol. 3 Some Real Support Devices*. This book describes all of the controller devices currently on the market. A tutorial chapter explaining the

principles of CRT operation make this book valuable to anyone who wants to know how a CRT works and what a CRT controller is expected to do. Five devices are indepthly covered including pins, signals, registers, microprocessor interface, screen memory, transparent memory addressing, character generator interface and much more. The five devices covered are the National Semiconductor DP8350, the Intel 8275, the Motorola 6845, the Synertek 6545, and the SMC/Texas Instruments 5027/9927. The price is \$6.99.

Circle No. 120 on Reader Inquiry Card

Sentry Manufacturing Company is offering a new **Microprocessor Crystal Guide** free to its customers. The Guide reportedly contains the most complete line of gold-plated crystals in the microprocessor industry. *The Microprocessor Crystal Guide* provides information on frequencies available and their application. Sentry can also manufacture most frequencies not listed in the guide. Circle No. 121 on Reader Inquiry Card

Micromatics, a book written for the electronic technician who wants to gain a greater understanding of microprocessors and microprocessing equip-

ment is now available from Scelbi Publications. The book assumes that the reader is basically familiar with electronic terminology but it also assumes that the reader knows little or nothing at all about microcomputers. *Micromatics* gives an overview of the basic operation of a practical microcomputer complete with terminology.

Circle No. 122 on Reader Inquiry Card

The 1981 Sams Catalog from Howard W. Sams & Co., is currently available with the addition of twenty-three new titles and over 300 current titles to choose from. Subjects covered in *Sams* books include audio and hi-fi, communications, computers, electronics, industrial, radio and television, motors, engines, electrical and appliances, reference and mathematics, service and troubleshooting, and special interest which includes art and energy.

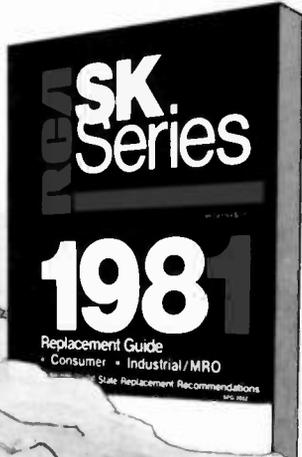
Circle No. 123 on Reader Inquiry Card

A new 12-page, four-color brochure, from *Vector Electronic Company*, describes a complete line of **plug-compatible prototype boards, racks and accessories** for six bus systems employed by 14 microcomputer manufacturers. Called "*The Engineers' Guide to*



Your best guide through the solid state jungle...

The new 1981 RCA SK Series Replacement Guide



Largest Edition Ever - 408 pages

Microcomputer Packaging," the brochure includes six prototype boards and a motherboard for S-100 and IEEE 696 systems; one board for Apple II, Pet Commodore, Expandamem and Superkim; three boards for STD BUS; three for Motorola Exorciser or Rockwell AIM, one for the TI 980; one for the DEC LSI-11, PDP-11, or Heath H-11; and two boards for the Intel SBC '80' and National BLC Series 80. The guide contains 12 horizontal and vertical racks which accommodate cards using the six bus conventions and are fully adjustable to suit many other boards. Also listed are a number of card-edge connectors, wiring posts and terminals, card extenders, tools, and accessories.

Circle No. 124 on Reader Inquiry Card

Wall Industries one of the field's leading manufacturers of modular power supplies, has just released their 1980 **Power Supply Catalog**. This comprehensive, 12-page catalog contains illustrations and charts listing output currents and voltages of single, dual, and triple output power supplies. It also offers complete data sheets for all Wall products, including ac to dc (Series W) and dc to dc (Series H) regulated and non-regulated power supplies. The 1980 catalog

also introduces Wall's Q Series. The Q Series features low output ripple, line and load regulation, short circuit current limiting, and a 3-watt package.

Circle No. 125 on Reader Inquiry Card

Handbook of Electronic Meters—Theory and Application is now available from *Prentice-Hall*. Chapter topics discuss meter basics, testing and calibrating meters, checking circuit functions and basic operating procedures and techniques. Features include discussion of fundamentals, probes and operating procedures including special measurement techniques, plus effective methods for checking individual components as well as complete circuits. Author John D. Lenk assumes no prior familiarity with operating principles and characteristics of electronic meters and writes in a simple yet very thorough manner.

Circle No. 126 on Reader Inquiry Card

An eight-page brochure describing **overvoltage protection components for ac and dc circuits** has just been published by *MCG Electronics*. Detailed information is provided on ac and dc transient suppressors, dc crowbars, and clamping crowbars. In addition to giving

full specifications, the brochure also provides steps for protecting ac and dc lines and answers commonly asked questions about the use and application of protection components. Examples are also provided for protecting switching transistors, transistor/IC inputs, and dc voltage lines.

Circle No. 127 on Reader Inquiry Card

A complete line of **production and electronic work stations** are described in a catalog just published by *Advance Engineering*. Specifications and ordering information on flightline benches, cabinets, panels, shelves and footrests, are included in this catalog.

Circle No. 128 on Reader Inquiry Card

A book on **digital and linear integrated circuit applications** is now available from *Radio Shack*. The *Engineer's Notebook* lists many practical TTL/LS and CMOS/MOS circuits. The *Engineer's Notebook* will prove to be useful to beginners as well as those who are already familiar with digital and linear circuit applications. Only essential information is provided in the *Engineer's Notebook*; therefore it is to be used with other data books. **ETD**

Circle No. 129 on Reader Inquiry Card

The RCA Replacement Guide tells you how to make over 170,000 solid state replacements using fewer than 1,400 SK and KH types.

Solid state is growing fast. So fast that servicing it puts you in a jungle of brands and unfamiliar components with new and different applications.

The 1981 RCA SK Series Replacement Guide takes you through these uncharted parts with confidence and knowledge.

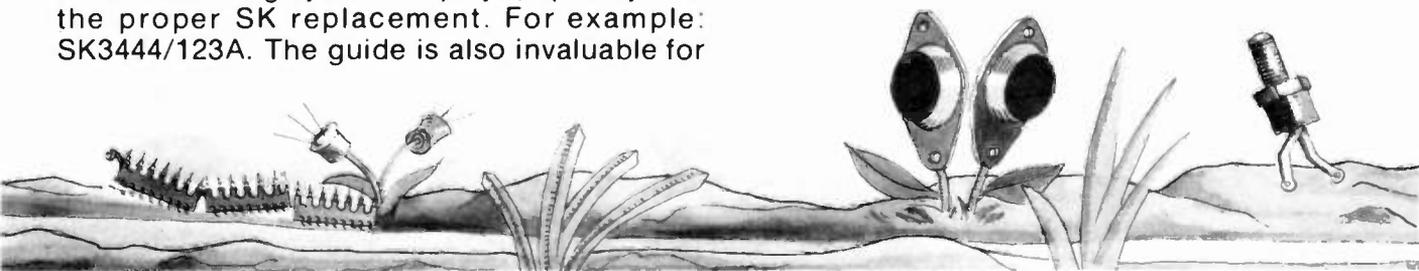
Over 170,000 foreign and domestic replacements are listed in this one handy book. With it, you can find RCA SK replacements for transistors, rectifiers, thyristors, integrated circuits and high-voltage triplers in just seconds.

Clearly indexed and easy to understand, the guide contains 1,382 RCA SK and KH types — including 200 new types for '81. A convenient dual-numbering system helps you quickly find the proper SK replacement. For example: SK3444/123A. The guide is also invaluable for

many industrial applications. Use it to make MRO replacements right from your shelf.

So when you're working in the solid state jungle, get yourself a great guide — the 1981 RCA SK Series Replacement Guide. It definitely leads the way. Pick up your copy now from your RCA SK distributor or send a check or money order for \$2.25 to: RCA Distributor and Special Products Division, P.O. Box 597, Woodbury, N.J. 08096.

RCA SK Replacement Solid State



LETTERS

HELP!

I need a schematic and operating manual for a Precision Apparatus Co. Tube Tester, Series 10-12.

Jacob Landy
11 Gardenia Lane
Hicksville, NY 11801

I have just worked on a Sylvania color TV set Model #CX3176TK-Chassis

#E05-1. It came in with sound and just a thin horizontal line across the screen. While troubleshooting, the probe slipped & caused a whole host of troubles. Set tripping, etc. Found all the faults and corrected them by changing :

Flyback-Xmfr, Horizontal output (shorted several times due to C510C leaking badly), C510, C338 (C338 was open causing no vertical deflection), Q410, Q412, SC521(open) & IC300 which was good anyway.

The set now works beautifully but a strange phenomenon now develops. Whenever the set is turned off, 5 to 10

minutes afterwards a multi-colored spot appears gradually, at the center of the screen. It's not really intense, because with room lights on it's just visible. I have checked all circuits over and can't find possible cause. Please help.

Albert J. Barnes
199 Western Ave.
Cambridge, MA 02139

Editor: I've seen similar spots on CRTs but not five or ten minutes after turn off. I'm sure its not dangerous. Does anyone have an explanation?

I need a power transformer for Wards Airline Stereo Model GTM-2514A. Part Number is 410V054H01 Sams #763. Can't get part from Wards--no longer available.

John Osborne
Winthrop Electronics
Town Hall Lane
Winthrop, ME 04364

I need a couple of Panasonic radio schematics; model numbers RF-567 and RF-569; a panasonic tape player, model number RQ-309AS, and a Bell & Howell tape player model number 3020. Will copy and return or buy.

Timothy John Betten
Box 1000

Oxford, Wisconsin 53052

PS. I could use the manufacturers address.

Editor: Service data for the RQ309AS appears in Sams Photofact TR-168. The others do not appear to have been covered. Panasonic parts and service information are widely available. Superior Radio Parts Company, 1433 East Main St., Madison. Bell and Howell is at 7100 McCormick Rd., Chicago IL 60645. For replacement parts information write the EIA for the *Consumer Electronics Service Technician Replacement Parts Handbook*, Consumer Electronics Group 2001 Eye St. N.W., Washington DC 20006.

ET/D welcomes letters requesting assistance to obtain parts and information for obsolete radios, TV sets and test equipment, but you can save time if you check a Sams Photofact index first. Some large public libraries have older Sams and Riders Manuals. Also the ISCET-TECH Library of obsolete service data is reorganized at 5631 W. Irving Park Rd. Chicago Il 60634. The librarian, George Sopocko, can furnish much information at nominal cost. When we run requests in this column, the time lag is about two months.

TRIAD ALL-STARS

Before a Triad replacement yoke or flyback leaves our factory, we circuit test it. Individual testing takes more time, but we know callbacks due to parts failures aren't in your game plan. That's why we design all our yokes and flybacks to be equal to or better than the original. And we try out every part before it makes our team.

Microwave oven replacement transformers, too. Triad makes more microwave oven transformers than any other manufacturer. Ask your distributor for our Microwave Oven Transformer Replacement Guide.



TRIAD-UTRAD

Litton Distributor Services

305 North Briant Street
Huntington, Indiana 46750
219-356-6500



Circle No. 106 on Reader Inquiry Card

BOUQUETS:

RE: William Joseph's article Generating More Service Business. You sure hit the nail on the head. For us direct mailing is the only way. It pays itself in a week! Our area along Hwy. 4 is about 30 miles long, 1/2 wide in the Sierra Nevada. Above average income, retired or financially secured, covering only 3000 mail boxes that I have covered twice in 8 months. Hope your opinion of the brochure (flyer) is favorable in your experience.

Pat Page
Page TV & Electronics
PO Box 2341
Arnold, CA 95223

Editor: Enclosed with this letter was an example of Page Electronics mailer, a single sheet emphasizing free loaners, rental, antenna work and a policy of repairing all brands. It looks effective.

BRICKBATS:

I am probably not the first to call your attention, unless you have already realized it, to the "skip" in your Tekfax serial numbering and to the errors in your latest "10-year index." These errors are as follows:

1872 should be 1871, 1873 should

be 1872, 1874 should be 1873, 1875 should be 1874, and 1876 should be 1875. There is no #1876. The November "pack" ends with #1875 and the December pack starts with #1877.

Byron Ladue
13 Revere Dr.
Rochester, NY 14724

Editor: Sorry, it's been hard keeping the numbers straight all these years. There simply is no TEKFAK Number 1876. This happened because there was space for only three different sets. 1876 was dropped; the numbers were not changed to reflect this. We'll try harder to avoid mistakes in the future.

*We love the same country.
We care about the same things.
We dream the same dreams.
1981. The International Year
Of Disabled Persons.*

*President's Committee on
Employment of the Handicapped
Washington, D.C. 20210
The School of Visual Arts
Public Advertising System*



RCA Receiving Tubes - for one-trip servicing.

Most callbacks aren't caused by bad servicing. Components are the reason.

That's why you need receiving tubes you can trust, dependable receiving tubes from RCA. We offer over 1,000 types - all produced to exacting specifications.

For miniatures, Novars, Compactrons, Nuvistors, Glass Tubes, Metal Tubes and more, count on your RCA Distributor. He's got the tubes that help you finish the job in just one trip.

Increase your profits with RCA service aids and sales promotion aids.

See your local RCA Tube Distributor for RCA's technical guides, service tools and tube caddies. They all make your service work faster and easier while RCA's in-store signs and eye-catching displays promote your business professionally.

RCA Receiving Tubes



RCA Distributor & Special Products Division,
Deptford, N.J. 08096

NEWSLINE

SANSUI TO OFFER VHD DISC PLAYER. Sansui Electronics indicated in mid-December that it would begin to market VHD capacitance video disc players in the U.S. by September 1981. According to Electronic News the players, produced in Japan and also marketed there would list at about \$550. Discs would be provided by VHD programs, recently organized by Matsushita, G.E., JVC and Thorn EMI. Sansui also is licensed to manufacture RCA's CED disc players but apparently has no immediate plans to do so.

NEW TV'S HAVE CABLE CAPABILITY. Sharp and Panasonic will soon offer models with CATV tuning capability. A new 19 inch Panasonic model reportedly about to be introduced will have a 105 channel CATV capable pushbutton tuner. A Sharp 19 inch is to have the ability to be tuned to 18 CATV channels.

HOME COMPUTER PRICE WAR? According to Television Digest a home computer price war may break out in 1981. TI cut its computer console price by \$300 to \$650 (reportedly available from discounters at \$500); Radio Shack has introduced a \$400 unit; ADF is introducing a game console, expandable to a computer, for \$400 and Commodore is to offer a computer at \$300.

VIDEO SALES GOOD THRU 1980. Total TV sales to dealers, from EIA reports, for 51 weeks of 1980, were 9,857,822 color, 6,030,119 B&W. VCR sales were reported to be 776,478, up almost 67 percent over 1979. Some predictions for the entire year suggest sales of over 10 million color, about 6.2 million B&W and over three quarters of a million VCRs.

VIDEO SALES EXPECTED FLAT IN 1981. Television Digest's forecast of video sales for 1981 projects sales of about 9.6 million color, 6.2 million B&W TV, about 1.2 million VCR's, 85 thousand projection sets and about 375 thousand videodisc players.

RANDOM HOUSE TO DISTRIBUTE TRS-80S. Radio Shack has named Random House, the book publisher, as a distributor of its TRS-80 computer line to the educational market. What's next?--software from Book-of-the-Month Club?

COMPUTER/CATV LINK. A computer-CATV interface was begun in early January by Warner Amex's, Columbus, Ohio cable system and Compuserve and Atari according to Television Digest. Customers can, by adding an Atari 800 computer, gain access to New York Times and Washington Post data banks and other services.

HITACHI OSCILLOSCOPES

Single and dual trace, 15 and 30 MHz. All four high sensitivity Hitachi oscilloscopes are built to demanding Hitachi quality standards and are backed by a 2-year warranty. They're able to measure signals as low as 1mV/division (with X5 vertical magnifier). It's a specification you won't find on any other 15 or 30 MHz scopes. Plus: Z-axis modulation, trace rotation, front panel X-Y operation for all four scope models, and X10 sweep magnification. And, both 30 MHz oscilloscopes offer internal signal delay lines. For ease of operation, functionally-related controls are grouped into three blocks on the color coded front panel. Now here's the clincher: For what you'd expect to pay more, you actually pay less. Suggested list price of our top line V-302B dual trace 30 MHz is only \$995.00. The other models comparably less. Check our scopes before you decide.

Hitachi...The measure of quality.

- V-302B 30 MHz Dual Trace \$995.00
- V-301 30 MHz Single Trace \$745.00
- V-152B 15 MHz Dual Trace \$735.00
- V-151B 15 MHz Single Trace \$570.00

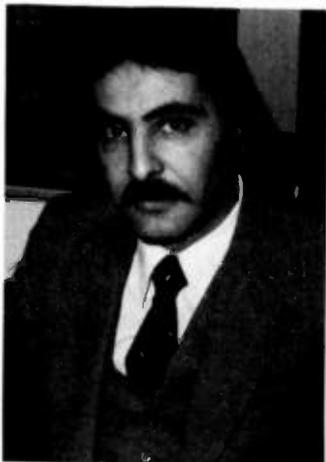


For more information, contact
Hitachi Denshi America, Ltd.,
175 Crossways Park West, Woodbury, N.Y. 11797
(516) 921-7200.



More sensitive to your input.

SECURITY VIEWPOINT



Many times the difference between making a living and running a successful business involves only one key element—motivation. Being involved in residential security is no different. The motivation must come from you in order to filter down to your employees.

Dennis Riley, president of the Beltway Division of Crime Control Inc. (an Indiana based corporation) knew that initiative and motivation are key elements of a successful business.

Beginning in 1979, Beltway started running seminars which were designed to help motivate and educate Beltway employees. After spending the initial money to initiate these programs it was decided to create additional seminars for customers (and potential customers). Attendees ranged in background from locksmiths, to Fire Marshalls. The following is just a partial list of some of the seminars Beltway offered:

Symposium: False Alarms—The emphasis of the seminar was on what business leaders should know about alarm systems, especially false alarms and how to reduce them. This seminar was repeated for police officials to help strengthen the relationship between the police and members of the alarm community.

Another seminar examined Halon and pre-engineered fire protection systems. This particular seminar was offered to representatives from the government, large companies and members of the insurance community to help them understand these types of fire detection systems and their accessories. (An important factor here was that this seminar which was offered in September of 1979 brought in contracts worth over \$100,000).

In 1980, Beltway held several seminars designed with the alarm dealer/installer in mind. In March of 1980 they offered a seminar on the "successful methods of alarm sales". If you are curious about the success that Beltway experienced from the program, Dennis Riley said that when they implemented the program it produced over 100 installations per month.

Also in March of 1980 a seminar was given on how alarm companies can increase sales by entering the fire extinguisher sales and service business.

In addition, Beltway also held seminars dealing with Central Stations and the role computers can play regarding them. Expanding your alarm business by offering additional products and services. How to hire, train and motivate a sales force. Expanding your business by means of acquisitions, and U.L. listings.

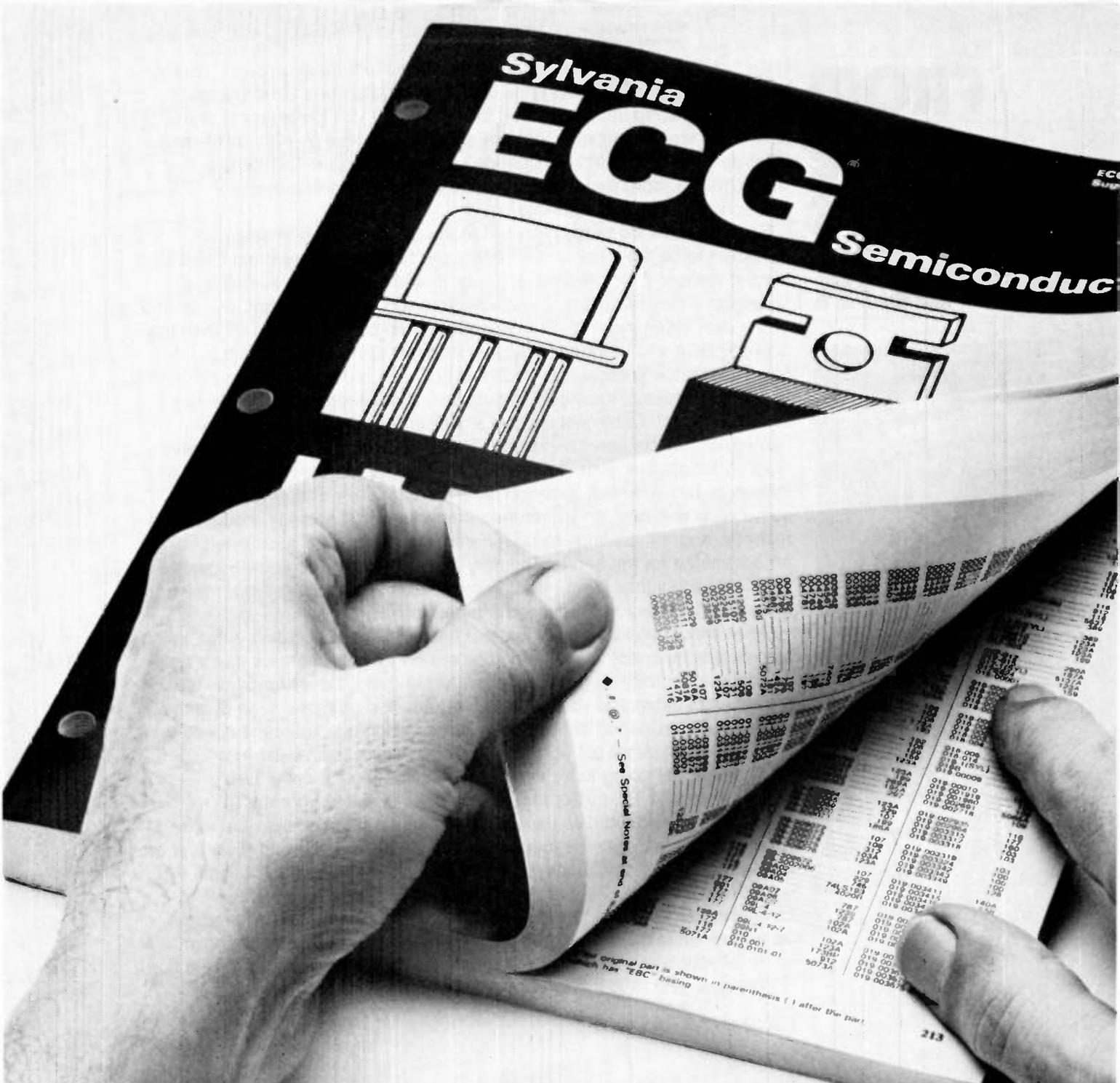
Slated for January of '81 are seminars which will help security directors spec and design alarm systems. Also scheduled will be an overview of the various new product and services that are available.

Security At The Hospital Level is another seminar scheduled for 1981 and will address itself to the specific problems securing a hospital can present.

Additionally, a number of the seminars mentioned earlier in this column will be repeated.

If you are interested in attending one or more of these seminars Dennis Riley can be contacted at the Beltway Division of Crime Control, Inc., Beltsville, Maryland or by telephone at (301) 937-8880.

Ray Allegranza



Your ECG distributor is expanding again.

The new ECG Semiconductor Guide is bigger and better than ever. It provides valuable data and thousands of new cross references. This means that your Sylvania distributor will be able to fill even more of your replacement part needs in just one stop.

In addition to adding the 326 new types in the product line, we've also expanded the technical data section. The text on replacements and substitutions has been updated and revised. There's a section on how to make a step-by-step selection of unlisted transistors. And there are selector charts listing RF transistors by frequency and bipolar transistors by breakdown voltage and case style.

Pick up your copy of the ECG Semiconductor Master Replacement Guide today. You'll find it covers the broadest product line available from the industry's leading supplier. Get it where you get your parts—your local Sylvania distributor.

SYLVANIA

GTE

FROM THE EDITOR'S DESK



Here it is February and it seems I've forgotten to wish everyone a happy and prosperous New Year. While the economy has been in a slump, or worse, depending upon what part of the country you live in, most of the shops I've visited indicate that both sales and service in 1980 were at least as good as in 1979. People do seem to be staying closer to home which means more dependence on the various items of consumer electronics you sell and service.

So what have we to look forward to for 1981? Television sales are predicted to be flat if not down slightly and hi-fi sales have been down for awhile, the mid-fi reportedly is holding up well. VCR sales are up and I understand they require more service than was at first thought. By the end of the year video discs of several kinds should be showing up all over the country; RCA's will reportedly appear at some 5000 RCA dealers in late March. With the political approach the FCC has recently taken to certain technical problems, it is doubtful that we will have stereo AM or Stereo TV sound this year. Cable will expand significantly, with some good and some bad effects on the service industry. The TV dumping suits will probably drag on for another year. It will also take several more years for a Teletext system to be approved, although other parts of the world already have some such services. An expanded number of home security products has recently, and will continue to be, offered to the market. These often have an advantage for the service industry in that they require knowledgeable technicians to install them—and since their electronics is getting more and more complex they will require competent service.

What should you do about some of these things? Education and training are always important. Become competent on VCR's. Learn as much as possible, as quickly as possible, about video discs. Be informed on the principles of cable and your local cable franchise or if your area is in the process of considering cable, know what is going on! You can't speed up the FCC, but it might not hurt to write them an occasional letter.

What is ET/D going to try to do? We will continue to cover new developments in TV, audio, etc., as much as possible from the technician's viewpoint. We expect to have in depth articles on the three (four?) video disc systems, beginning this spring. We hope to have a short series of features on cable systems, their principles and implications. We will cover various aspects of the home/small commercial security business. We will have features on video games, home and commercial, as well as on test equipment applications, and perhaps some on how some of your test equipment works and how to maintain and calibrate it.

This new year, 1981, can be a good one, if we make it so.

Sincerely,

Walter H. Schumtz



MDD Series

CMOS, MOS I.C. DISPENSERS

- MOS, CMOS protected – material is carbon filled
- Dispenser clamp to hold tube firmly in position
- Adjustable stop to suit length of I.C.
- I.C.'s cannot "piggy back"
- Grounding lug fitted
- Available in 1, 5 & 10 channel versions as standard
- Simple yet very effective design
- Capability to handle all known I.C. carrying tubes
- Dispenses I.C.'s of 0.3", 0.4" & 0.6" pitch up to 42 pins
- Empty tubes can be removed with ease
- Easy pick up of I.C.'s
- I.C.'s automatically released – one at a time

MDD-1 \$21.85 MDD-5 \$83.43 MDD-10 \$160.45

WK-7 INSERTION/EXTRACTION KIT

- MOS-1416 14-16 PIN, MOS, CMOS SAFE INSERTER
- MOS-2428 24-28 PIN, MOS, CMOS SAFE INSERTER
- MOS-4036-40 PIN CMOS SAFE INSERTER

For highly sensitive MOS & CMOS I.C.'s. Ground strap may be easily attached. Durable chrome plated ABS construction features precision parts for long life and easy-one-hand operation.

EX-1 EXTRACTOR TOOL

EX-2 CMOS SAFE DIP I.C. EXTRACTOR TOOL

The EX-1 will extract all LSI, MSI and SSI devices from 8 to 24 pins (attach ground strap for CMOS).
The EX-2 extracts all 28-40 pin DIP I.C.'s having standard .600" widths, including MOS and CMOS devices.

EX1 \$1.49 EX2 \$7.95 MOS 1416 \$7.95 MOS 2428 \$7.95 MOS 40 \$7.95 WK7 \$29.95

OK Machine & Tool Corporation

3455 Conner St., Bronx, N.Y. 10475 U.S.A.

Tel. (212) 994-6600 Telex 125091

* Minimum billing \$25.00, add shipping charge \$2.00
New York State residents add applicable tax

I.C. Dispensers

Video Games

People Often Play

The sophisticated video game a forerunner of the computer which in one form or other will be very common before the end of the 80's. It is another reason for understanding the microprocessor.

By Stan Prentiss

Rooted in the '60s and brought to flower in the '70s, video games for young and old are now a \$1 billion business both in the U.S. (\$500 million) and abroad. And while inexpensive versions of \$30 and below have virtually disappeared in this country, they are flourishing in the Far East, with production centering in Hong Kong. But \$30 to \$100 games are "flying high in the rest of the world," according to Ralph Baer of Sanders Associates, Nashua, New Hampshire, who had a strong hand in developing the first units for which manufacturers are still paying license.

Atari (Attack the Aliens, Space Invaders, You're the Man of Steel, X Marks the Spot, and Magnavox (Football, Bowling, Basketball, Dynasty, Pachinko), and Mattel (Boxing, Sea Battle, Roulette, World Fun) are three of the prime manufacturers who initially offered these games in consumer-usable form



and who remain in the marketing lead today. Atari, a division of Warner Communications, Inc., Sunnyvale, Calif., claims it sells more programmable video games than all competition combined. Magnavox and Mattel (Hawthorne, Ca.), on the other hand, just keep selling, and Magnavox's Knoxville and Greenville Tennessee sales and manufacturing divisions turn out a large percentage of this form of entertainment reaching the American home.

Beginning with "two spots chasing each other," motivated by 45 discrete transistors and 60 diodes, these games have now become much more compact and programmable than

originally, and most manufacturers guard their integrated electronics with super care so that additional software over and above what they sell can't be offered on an unrestricted market.

Lots of ICs and the ubiquitous microprocessor, surrounded by ample control logic, the usual subcarrier regenerator, and a channel 3/4 radio frequency modulator, all interconnect to give their software TV images life. The greater the game flexibility the greater the system effectiveness and accommodation of additional software. But once the pieces are in place, electronic changes, except cost cutting, are infrequent. This immediately brings up the question of

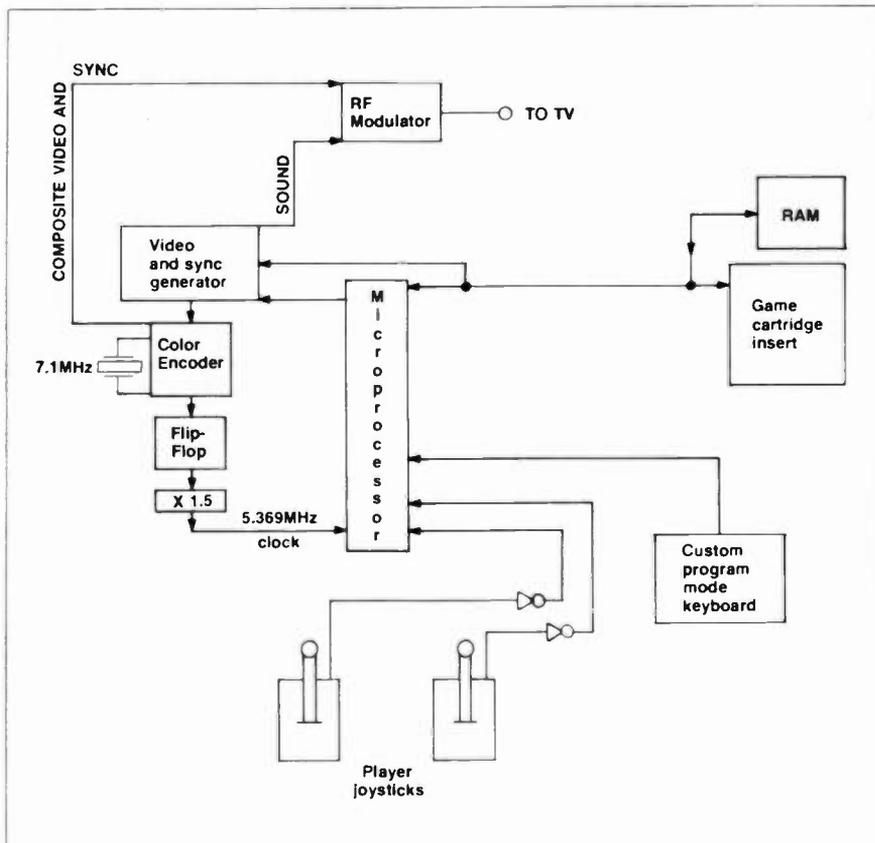


Fig. 1 ODYSSEY II simplified block diagram.

whether these equipments are "field serviceable?" The answer, strange to relate, is both yes and no. A sharp technician could, by following the various signal paths from inputs through the microprocessor, come up with some pretty good solutions, given time, adequate product knowledge, and certain hardware.

Unfortunately, there's the catch. Because of intense competition and patent rights, some game manufacturers will grudgingly offer a sparse block diagram with suspected deletions, but won't normally specify replacement integrated circuits, which are the very heart of the system. Usually, you are required to return said game for "factory maintenance." In the event you're on especially good terms with the factory, however, and there are certain IC defects that are relatively routine, a kind and discerning factory person will occasionally ship a few needed ICs, and Mr. Technician puts a deserved buck in his pocket and retains a happy customer with quick, efficient service. One strongly suspects that more competent shops could have extra replacement ICs if they demonstrated trustworthy competence above and beyond mere mechanical replacements of known problems.

But that's not yet the way of the

overall game world, and the business will have to mature a few more moons before such consumer products will be permitted general field repair—in some instances this will never be. This is especially true of Atari, where even a crude system block diagram is verboten, and engineering refuses to talk to those attempting to gather technical editorial material. Ken Holl and Lowry PR people are both gracious and friendly, but if you think game owners can escape the \$36 Atari repair fee for the console, \$6 for a program, or \$5 for the controller unit after the limited 90-day warranty period expires, forget it! And don't neglect to pay postage and send your repair check in advance. Obviously, Atari makes an opportunistic penny on its breakdowns.

Somewhat the same practice is followed by Mattel, but in a much nicer way, and its engineering department will talk with technical writers because they can use the publicity. But Magnavox, who sells a great many video discs, television receivers, radios, and video cassette recorder/players, is very open, considerate, and cooperative. And some highly regarded repair shops have already discovered a working relationship with Maggie that does, indeed, include a few games parts, an

accommodation that works out very well for both the servicer and the servicee. For all these reasons, we're especially featuring Magnavox Odyssey II in this writeup.

Odyssey II

Let's begin with a simple block diagram of Magnavox's Odyssey game (Fig. 1) and then segue into a little deeper discussion with the schematic. We don't guarantee total information is completely described, but what's there should be relatively accurate and usable.

When dual players are permitted, each has a joystick. Movements up/down, right/left are actual switch closures that move electronic people and objects about on your TV display screen. The microprocessor responds to random access memory, RAM/ROM, part of which is stored in the game cartridge insert and which is, to some extent, programmed by operator instructions from the keyboard.

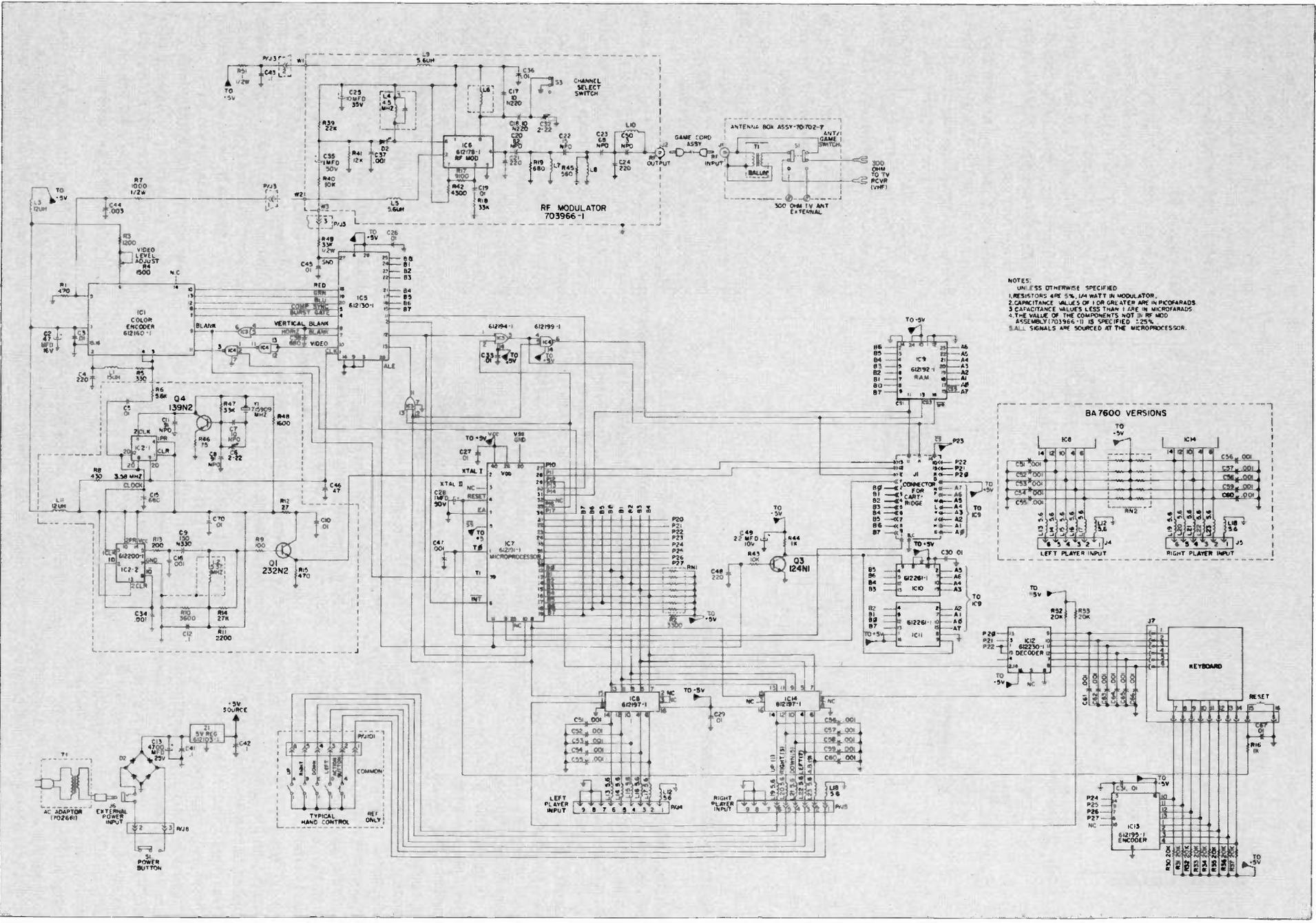
Interplay between the processor and player, keyboard, cartridge insert, and the scratchpad RAM, produces outputs into the video and sync generator which must receive whatever information the microprocessor and/or RAM has been instructed to act upon and pass.

At the same time, the color encoder is busily generating color burst and carrier, along with composite video and sync from its video and timing generator. Output from the color encoder, then, consists of all three signals that are ready to be converted to either channel 3 or 4 frequencies by the RF modulator. Therefore, along with audio from the video and sync generator, a full sight and sound signal is made ready for some RF display device which is usually a television receiver.

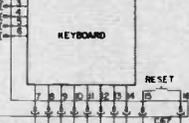
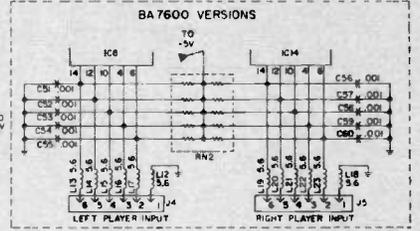
As illustrated on the schematic (Fig. 2), the power supply from Odyssey II is packaged initially as a discrete unit and contains an external ac adaptor with cord and external power transformer input. Thereafter, you see a receiving input jack connecting to an S1 on/off power button, a full wave bridge rectifier, low and high frequency input filters (C13, C41), and a Z1 zener regulator, producing a 5V filtered source—all illustrated on the schematic.

When a game cartridge is inserted in the J1 connector, its read only memory (ROM) is energized by the power supply, while a manual keyboard on the right furnishes the

Fig. 2. Complete schematic of the ODYSSEY II.



NOTES:
 UNLESS OTHERWISE SPECIFIED
 1. RESISTORS ARE 5% 1/4 WATT IN MODULATOR
 2. CAPACITANCE VALUES OF 1 OR GREATER ARE IN MICROFARADS
 3. CAPACITANCE VALUES LESS THAN 1 ARE IN PICOFARADS
 4. THE VALUE OF THE COMPONENTS NOT IN RF MOD ASSEMBLY (703966-1) IS SPECIFIED 1.25%
 5. ALL SIGNALS ARE SOURCED AT THE MICROPROCESSOR



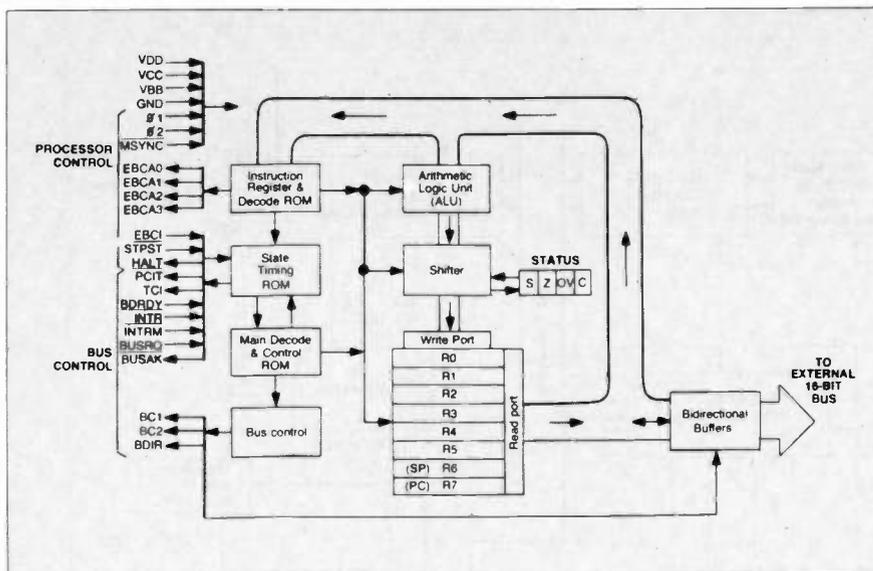


Fig. 3 General Instrument's new 16-bit microprocessor.

one or two operator mode, game speed, and other playing rule conditions. At the same time, the microprocessor programs the RAM above, and flip-flops in IC10 and IC11 are engaged.

The game begins with keyboard 6 x 8 matrix instructions and "typical" hand control operations by one or two players. Up, right, down, left, and action button switch closures tell both left and right player inputs what filtered signals to transmit to the IC8 and IC14 gated inverters. Such instructions are now transferred directly into the microprocessor, which is an Intel 8048 64X 8-bit on-board RAM and a 1K X 8-bit ROM, with special executive instructions.

The microprocessor also receives clock signals from the 7.15909 MHz double frequency oscillator and crystal Y1, which are subsequently divided by IC2-1/IC2-2, then multiplied by 1.5 and peaked by L2, so that the final 5.37 MHz output is emitter followed and coupled by Q1 to the Xtal I IC7 input.

With sync and video generated and coordinated between IC5 and IC7, additional instructions passed to and from the IC9 RAM, digitally generated picture and sound information now becomes encoded by IC1 and routed through IC5 to the RLC networks supplying the IC6 RF modulator. Video, as you can see, is dc coupled through filter-inductor L5, while sound becomes ac coupled through C35, then peaked by L4 and its shunt capacitor.

The RF modulator then accepts these two combined AM and FM signals at carrier frequencies between 60 and 72 MHz, passing them through

the various L and C "tweet" and harmonic filters to the single-ended RF output.

A 16-bit microprocessor

As an introduction to what's here even now, and a hint of what's to come, let's take a look at General Instrument's prime new contribution to the game business, of which they are one of the original manufacturers. This 16-bit microprocessor comes labelled either CP1600 or CP1610 (Fig. 3).

Specifically designed for such applications as TV games, home computer systems, home information centers, programmable calculator operations, etc., these units accept 84 basic instructions, have 2's complement arithmetic, and are TTL compatible, although built of high speed N-MOS logic. With their eight 16-bit registers (R0 through R7), access to 65,536 words is possible and, in combination with another microprocessor, can actually form a fairly sophisticated home computer that could reach the market during 1981.

The first microprocessor, acting in concert with a 14-bit graphics processor, can be programmed by either a games manufacturer or by General Instrument, and can deliver an "unlimited" number of skill challenges such as aggression, football, basketball, gambling, racing, etc.

To understand what a 16-bit microprocessor looks like and what all its various buses do, let's look at the block diagram provided by G.I. in Fig. 3. As you can see there are read and write ports for the 8 storage registers, and arithmetic logic unit delivering

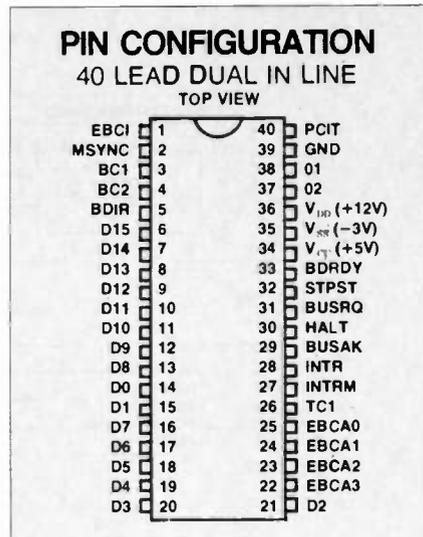


Fig. 4 Pinout of the G.I. 16-bit microprocessor.

information to the shifter, a status check, and then the instruction register and decoder, a timing ROM, main control ROM, and a bus control.

Symbols on the other side of the processor and bus controls mean: MSYNC—microprocessor master sync for phase 1 or 2 (01,02) during power up.

EBCA 0, 1, 2,3—external branch condition addresses.

EBCI—external branch condition input.

STPST—Stop/start edge triggering.

PCIT—input/output and program counter inhibit.

HALT—microprocessor stopped.

TCI—terminate current interrupt output.

BDRDY—bus data ready input.

INTR, INTRM—interrupt & interrupt masked.

BUSRQ—input.

BUSAK—output.

BDIR, BC1, BC2—bus direction and bus controls 1 and 2 outputs. And when you come across this CP1600/CP1610, you'll discover it's a 40-pin dual in-line chip with the pin configuration shown in Fig. 4.

Now that we know what a sophisticated microprocessor and a potentially added subsystem can do, let's continue with a genuinely up-to-date complex game set that could well become shop-serviceable with the right backup and dealer-manufacturer understanding.

Mattel's Intellivision

Which really stands for "intelligent television," where the Master unit is designed to expand into a personal home computer, having a keyboard and a pre-programmed software to

With cartridge insertion and power on (Fig. 5), the AY-3-8900 Standard TV Interface Chip (STIC) generates a master clear signal, synchronizing the CP1610 CPU and graphics ROM and RAM (lower right).

Executive instructions in the RO-3-9502/9504 ROMs begin operating on commands from the CPU, and peripherals such as a cartridge or keyboard are interrogated. Since each peripheral is assigned a special memory address, the CPU will go to a successive starting address if the initial peripheral is not present. Should it find a game cartridge in place, the CPU then extracts information from the cartridge ROM for the RA-3-9600 dual port RAM which, in turn, passes any graphics information to the 14-bit graphics bus. Meanwhile, the STIC decodes this data and supplies video information such as sync, color burst, luminance levels and chroma to the AY-3-8915 color IC. The STIC may also call up a considerable number of special graphic shapes and characters from the ROM/RAM graphics below. The color IC subsequently converts all coded sync and video information from digital to analog, combining this information across precision resistors

R1 through R5 as a "title page" and composite video for the modulators.

The CPU then waits for signals from the two key pad controllers to start the game. The controllers load their commands into 8-bit port registers in the AY-3-8914 Sound Generator and I/O chip. These registers are interrogated once during each 16.68 msec vertical sync period and commands such as game start, speed, players participating, object direction are accepted and executed. Sound, of course, is also generated in the A&-3-8914 IC from subsonic to supersonic, and the three-tone and noise generators can be mixed in any combination, even 3-part harmony, with the output controlled by software, including limited music and some speech. Modulated audio finally reaches the modulator where composite signals are combined on carriers for either channels 3 or 4, as selected.

At present, there are some 25 cartridges available with this sophisticated new game which sells for about \$225.

Comment

Video games—regardless of the

various abilities of those attracted to them—are both a whole new industry and the obvious forerunner of home computers, which will soon become a giant addition to consumer necessity and enjoyment as the '80s progress.

Our old flip-flop and gate friends, plus the 1's and 0's that go with them, are basics for not only the vast digital surge that's sweeping the electronics community, but also the forerunner of both digital video and audio, too. In another few years, almost all entertainment and industrial disciplines will have succumbed to the logic revolution and include some very sophisticated devices, indeed.

So if you plan to continue to livelihood in consumer products or any type of industrial solid state controls, better get back to school and pay strict attention. If not, progressive engineers will certainly devise digital IC trinkets that regressive servicers can't possibly "fix", let alone repair. For your own salvation, then, get back to the classroom. Correspondence schools for microprocessor and pure logic training are poor substitutes for disciplined study and competitive examinations. Tomorrow is too late, the time is now! **ETD**

What would make your business better? We would

You've seen what franchising did for real estate. Franchise companies took struggling independent realtors and put them in the limelight. The result: a greater share of the marketplace.

TRONICS 2000 is doing the same for the electronics service business. We're selecting a limited number of dealers in each community, giving them our name and high-level training in administrative and marketing techniques. And we're advertising as a single organization. In short, we're building a franchise organization that will stand out in a crowd.

Are you eligible to join? Yes, if you own a service dealership or are planning to start one and if you meet our technical requirements. But you must apply before the quota for your area has been filled.

TRONICS 2000 could be the lifeline you've been looking for. Call us. Today.

tronics 2000

2229 South Highway 37 • P.O. Box 2005 • Bloomington, Indiana 47402 • 812/824-2424
Toll free 1-800-457-4507. In Indiana 1-800-822-4763.

Circle No. 109 on Reader Inquiry Card

Low cost tool for design and trouble-shooting

Pocket Size
Slide-Switch
Resistance
Substitution Unit
still only **\$58**

- Over 11 million step range
- 1% accuracy resistors
- Unique in convenient size
- Rugged construction



Small enough to take anywhere in your pocket, this aluminum-housed unit delivers a very broad range of resistance steps. Excellent for both development and repair work.

Half-watt 1% tolerance resistors give an accurate range from 1 to 11,111,110 ohms, in one-ohm steps. Has three binding posts, one to ground case.

Available now from stock. Catalog No. 7092-236. Cash savings available, see coupon. Write, or call (804) 264-7590. Phipps & Bird, Inc.

- Please send _____ Units @ \$58 each. (Check enclosed less 5% cash discount)
- Send _____ Units @ \$58 each C.O.D. (Phipps & Bird will pay C.O.D. charges)

Name _____

Firm _____

Address _____

City, State _____ Zip _____

Ask your dealer, or contact:



PHIPPS & BIRD, INC.

Manufacturers of Scientific Instruments

P.O. Box 27324 • Richmond, Virginia 23261 • Phone: 804/264-7590

Circle No. 110 on Reader Inquiry Card

Choosing a Service Van.

Size vs operating cost.

Your service van is getting more and more expensive to operate. Would a mini-vehicle answer your needs? How much would it save? Is gasoline mileage the only factor?

by William Joseph

Service dealer Paul White had a hunch. "I like to know exactly what my costs of doing business are," he says, "and I had a feeling that my truck operating expenses were running a whole lot higher than I knew."

With the help of his accountant, White analyzed all costs associated with the operation of his fleet of four Econolines and a Chevy G-20. The result was a shocker—just under 40¢ per mile.

They poured over the figures a second time with the same result. The numbers were hard to believe but quite accurate. In fact, the operators of one of the largest fleets of standard sized vans in the country report a current cost of 39¢ per mile.

An idea of how fast this cost is rising can be had by studying the figures in a report published by the Department of Transportation for 1979. In that year, says D.O.T., the cost per mile for suburban based operation of standard sized vans was 36.2¢—an increase of about 5¢ per

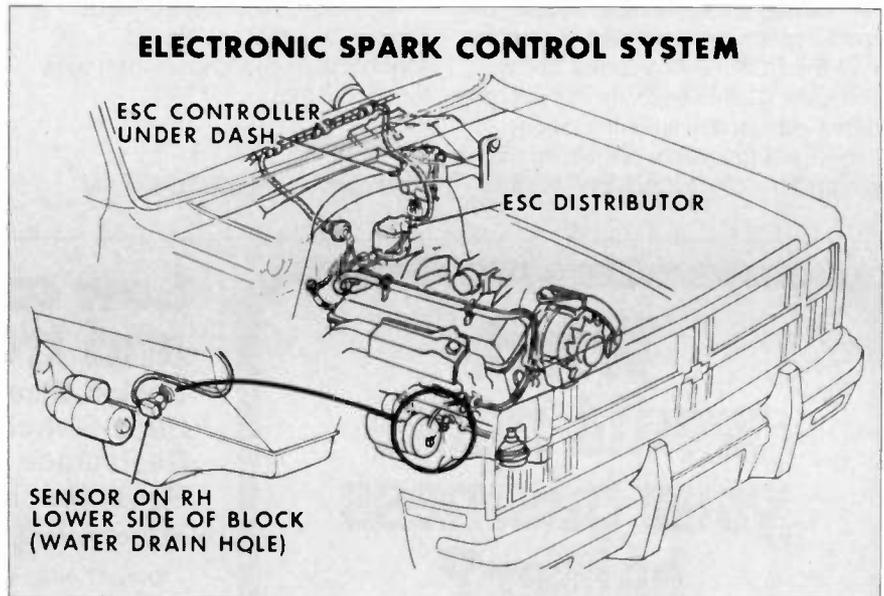


Fig. 1. This electronic spark control is one of the measures van manufacturers are employing to improve the mileage of large size vans. Chevrolet's high-compression 5-liter V8 truck engine operates on regular unleaded gasoline. A sensor mounted on the lower right side of the engine block listens for detonation and relays the signal to a small analog computer in the instrument panel. The computer analyzes the message and instructs the distributor to retard the spark until audible detonation ceases. The high-compression (9.2:1) V8 is reportedly designed to deliver performance rivaling a 5.7-liter engine with the fuel economy inherent in the 5-liter.

mile over the previous year. Obviously, a half-dollar per mile is just around the corner.

How does all of this reflect on the bottom line for a service dealer? Consider this:

Like many service dealers, White allows his technicians to take their trucks home in the evening. Because of this extra mileage, his average miles-per-call is high—about fifteen. Forty cents times fifteen miles comes to about six dollars per call, just for

transportation. Except for technicians' payroll, that's the highest single element in White's cost-per-call.

And most experts agree that transportation costs will continue to rise at an even more rapid pace than most others. Obviously, profitability will be seriously threatened if this part of the cost of doing business is allowed to go unheeded.

Your own costs may be somewhat higher or lower than White's; depending on the age and type of

trucks you operate, where and how they are driven, and how efficiently they are dispatched.

Being a careful manager, White had long since streamlined his routing and dispatching procedures to the point where he felt that significant additional improvements were unlikely. The trucks themselves, he decided, were his best opportunity for savings. He would replace them with foreign "minis" such as the Chevy Luv or the Ford Courier.

Mr. White is not alone in his feeling that mini vans are the next logical step for the service dealer concerned with the skyrocketing costs of transportation for road technicians. Zig Berman of Conshohocken, Pa. says. "I'm getting out of American vans and into minis. American vans are gas guzzlers and they just don't have the quality."

And small dealers aren't the only ones taking a long look at transportation costs. Many operators of huge van fleets such as Montgomery Ward, Sears & Roebuck, and the R.C.A. Service Company are experimenting with alternative service vehicles. The results of some of those tests, however, may come as a surprise to those who feel that the American service van has outlived its usefulness.

While it's not difficult to find service dealers who express satisfaction with such minis as the Luv, Courier, Datsun, and Toyota, a survey of what's happening around the country clearly suggests that the firms with the broadest experience in operating service vans do not like much of what they are finding in their experiments with minis.

For example, the R.C.A. Service Company is testing 300 Ford Couriers at locations throughout the country. The results have been mixed. While there has been a definite improvement in gas mileage, there has also been an increase in maintenance costs. According to an R.C.A. representative, the maintenance costs and the recent increase in the government-imposed import duty have brought a halt to any plans they might have had to purchase more foreign minis.

The import tariff for foreign vehicles was mentioned often in our survey. According to Ed Breslin of the Chevrolet Division of General Motors, last summer's increase from 4% to 25% is now showing up in price increases. This change in the basic price of the vehicle must be

considered in any analysis of potential savings in overall costs.

The Wells Fargo Company operates a nation-wide fleet of vans for service and installation of burglar alarm systems. According to Tom Verderane, Philadelphia area manager, the prevailing feeling in his company is that the foreign compact van simply does not hold up as well under tough usage. "You simply can't push these small vehicles the way you would a full-sized domestic product," he says. According to Verderane, clutch problems are a special worry in the mini vehicles they are using. "The simple fact," he says, "is that drivers tend to abuse the clutch, and clutch repairs are very expensive."

On the plus side, Verderane notes that the minis produce about twice the mileage as their big brothers.

James Kahn, vice-president of Protect-a-Life Corporation reports similar feelings. Says Kahn, "The use of minis is a trade-off. They save you money, but you get significantly less space. Our Chevy Luvs get close to double the mileage of our half-ton Chevys, but not as much as the advertisements would lead you to believe. We expected to get about 23 miles-per-gallon but had to settle for about 17. That compares to 9 or 10 MPG for our full sized vans."

Mr. Kahn also mentioned clutches. While they haven't yet experienced unusual maintenance costs, Kahn carefully points out that all of his vehicles are equipped with automatic transmissions. "We don't believe in standard shifts in any vehicle that is to be driven by an employee," he says. "The typical driver will go through clutches like mad."

Which brings us to one of the thorny problems in the full-sized-versus-mini question. The principal reason for switching to the smaller vehicles, of course, is the potential for lower operating expenses. It follows that best economy clearly calls for the use of standard transmissions. However, catch-22 is that many companies report that clutches in the foreign minis do not hold up as well as their American cousins. The result—higher maintenance costs.

Montgomery Ward, another operator of a large fleet of service vans has been testing a variety of foreign minis. Their fleet now includes several hundred Chevy Luvs, Ford Couriers, and Toyotas. According to a company spokesman, Wards is not now considering the purchase of any

additional minis. Among the problems reported by their technicians was poor stability in strong winds, especially in the New England area.

The General Electric Service Company reports that they have not used any mini vehicles in their service fleet, and do not have any plans to do so in the future.

And so the pattern goes—a look to imported mini vehicles as a logical source of help in the escalating war against rising transportation costs, followed by some second thoughts in the light of actual experience.

One of the most frequently expressed objections to the smaller vehicles was the sharply reduced space and pay load. One local service manager for a national company says that his firm's experiments with minis were discontinued when it was realized that there simply wasn't enough space to accommodate the inventory required for good productivity.

And what does Detroit have to say about all of this?

Plenty.

Ed Breslin, public relations manager for General Motor's Chevrolet division is enthusiastic when he discusses their 1981 line. Says Breslin, "Our full sized half-ton van with a six cylinder engine and a three speed transmission is rated at better gas mileage than Volkswagen's Vanagon—18 MPG versus 17."

Detroit's moguls are not unaware that many operators of service vans are looking unkindly at the costs associated with their use—and they're determined to woo back any customer who has strayed from the fold. How will they do it? By attempting to establish that the American product offers a better value for the money spent.

All of the "big three," Ford, Chrysler's Dodge, and GM's Chevrolet, have incorporated changes designed to improve gas mileage and to increase overall value in their 1981 line.

Without exception, all 1981 vans and pickups from Detroit come with better gasoline mileage than last year's models. With manual transmissions, the lowest E.P.A. mileage estimate for city driving is 15 MPG. Highway estimates go as high as 25 MPG for the lighter vans.

The big secret in the mileage improvements is weight reduction. Typical of the intensity of Detroit's determination to shed pounds is the

experimental effort of the Budd Company. Budd is a major supplier of frames and body panels for Ford's Econoline series. Sales of Econolines have fallen off in recent years due to reports of poor gasoline mileage. The management of both Ford and Budd knew that if lost sales were to be regained, the Econoline must be made lighter and more fuel efficient. Thus, the Lightweight Van (LWV) program was born at Budd.

According to Jim McNeal, Budd's president, the LWV is an "exercise in the adaption of exotic lightweight materials to current vehicle production." By substituting such materials as fiberglass, graphite, aluminum and high-strength, low-alloy steel in place of more traditional materials such as high-carbon, cold-rolled steel, a total weight reduction in the Econoline of 654 pounds was achieved. This would bring the total vehicle weight down to 3620 pounds.

"Of the 654 pounds of weight reduction, about half is practical for manufacture today," McNeal said. He also predicts that some of the technology worked out during the LWV program—fiberglass doors, for instance—will see widespread application in the industry in the next few years.

Even the shape of body panels is coming under scrutiny as automakers attempt to improve aerodynamics as a means for squeezing the last ounce of fuel economy from their vehicles.

Here are some of the features that the big three hope will keep your technicians behind the wheels of domestic vans.

Chevrolet

According to the company, Chevrolet's new vans have been given their most extensive overhaul since 1973 in order to make them "lighter, leaner, and more fuel efficient."

Basically, the '81 line of Chevrolet vans has the same cab size, bed size, and load carrying capacity as those that preceded them. "The important difference is that they can carry these loads a lot more efficiently," says GM vice-president and Chevrolet general manager, Robert D. Lund.

Chevy offers two wheelbases. The 125" model for normal service use, and the 110" model where a tighter turning radius and better maneuverability for city driving is desired. The pay load in the basic series ranges from one-half to one ton.

The standard engine is the six cylinder 4.1 liter (250 CID) V-6. Options include a 5.0 liter (305 CID) V-8, and a big 5.7 liter (350 CID) V-8.

Also new for '81 is what Chevrolet calls Electronic Spark Control. This feature senses a "knock" condition and automatically retards the spark. According to a company spokesman, ESC allows the benefits of a higher compression ratio, more efficiency and economy, with lower octane fuel and no "ping."

Other improvements listed are halogen hi-beam headlights, improved brakes offering lower rolling resistance, and an entirely revised exhaust system that reduces noise and back pressure.

For applications where door sizes are important, Chevy may have an edge. Says Ed Breslin, "We have the widest and highest doors in the industry. We also have a totally flat load floor that makes it easy for one man to slide merchandise in and out."

Ford

Despite a recent lag in sales, a spokesman for Ford reminds us that there are more Econoline vans on the road today than any other make—and they intend to keep it that way.

Again this year, Econolines are available in three basic models; two regular vans and a super van for greater cargo area. The regular van comes in a choice of 124" or 138" wheelbase. The super van is built only on the 138" wheelbase.

The standard Econoline engine is a 4.9 liter (300 CID) in-line six cylinder. Optional choices are a 5.0 liter (302 CID) V-8 and a hefty 5.8 liter (351 CID) V-8. (Don't forget, when choosing your engine size for any make van, those tempting big engines are going to get lower gas mileage than their smaller counterparts.)

All Econoline engines are designed with 28 service check points within easy access of the vehicle's front end when the hood is raised. This feature, Ford says, will cut downtime and thus improve overall value.

As with the other Detroit offerings, a three-speed manual transmission is standard. At Ford, options include a four-speed manual and an automatic transmission. This year, halogen headlamps are included as standard equipment.

Other Econoline features include twin-l-beam suspension for a smoother ride and less transfer of road shock to the cargo, and body-on-

frame construction which allows pay loads of up to two and one-half tons. Front fenders are bolted on to make repair or replacement easier and less costly.

Dodge

The lineup in Dodge vans this year has been designed to place them right in the middle of the competition with Ford and Chevrolet.

As in the past, Dodge vans are available in two basic models. The standard engine is a slant-six with a 225 cubic inch displacement. A 5.2 liter (318 CID) V-8 is available as an option.

According to Dodge, the larger V-8 engine provides performance that approaches that of a 360 CID engine. Chrysler's version of the electronic spark advance contributes to that performance.

Standard features include an automatic speed control, four-speed manual transmission with overdrive, and an instrument panel and dash specially designed for use with two-way business radio. Also featured are major refinements in the air conditioning, heating and electrical systems.

Among the features offered on all models of the "big three" vans from Detroit are much improved corrosion resistance for longer body life, and special body options that allow you to adapt cargo space to the specific needs of your business.

The future

And what do automakers plan for your needs in the future? Well, U.S.-built minitrucks for one thing. According to a report in *Automotive News*, Ford, G.M., and Chrysler all have plans to begin producing American-built minis in 1982-83. Initial plans call for pickup trucks to be the first in the mini-series. Insiders, though, speculate that vans will follow soon after. And don't be surprised if Chevrolet comes up with an optional diesel engine for its vans within a couple of years.

There you have it—the American ammunition designed to convince you to keep your service technicians moving in U.S.-built transportation. Whether you choose the foreign minis or the American product is an urgently important issue in Detroit today. As a result, you may find that those high sticker prices at your local dealer's showroom are not necessarily the last word. Come prepared to dicker—you may be pleasantly surprised. **ETD**

More Microprocessors, Part II

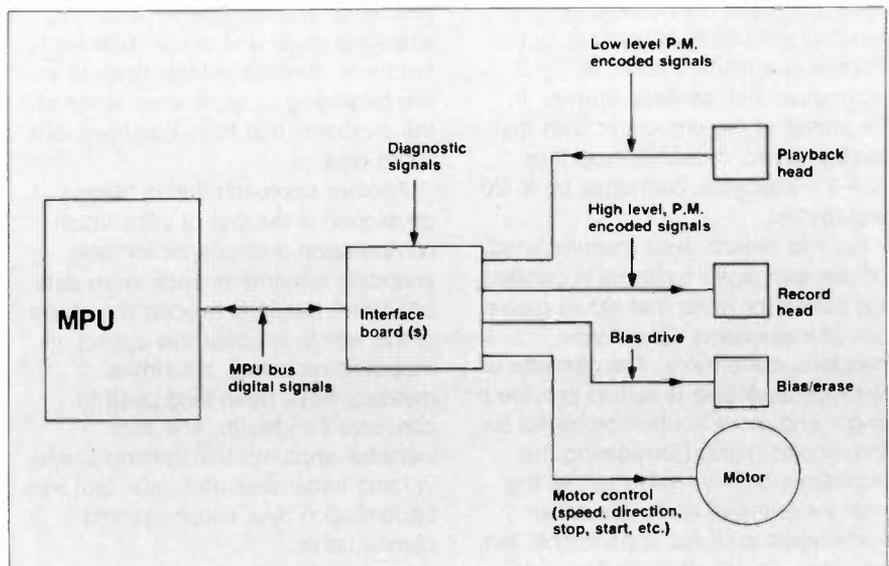
Update continued

The microprocessor is becoming so all pervasive in electronics that a continual process of updating will be necessary; ET/D will try to keep you up to date

by Bernard B. Daien

The newest Microprocessors, including those announced as forthcoming soon, have the capability of addressing megabytes of memory! This results in another change in memory directions. A short time ago, solid state memories were compatible with the MPUs of that time. The speed of solid state memories matched the speed of the MPU, and the relatively limited size of the solid state memory matched the 64 kilobyte memory addressing capability of the MPUs, so the solid state memory and the MPU were well suited to each other for many purposes. Some tape cassette machines were in use, when permanent storage was a must....too, the cassettes offered a low cost solution to the problem of portability....the ability to conveniently carry, or send, the memory to a remote location.

Today the situation is changing....with cassettes and other mass storage memories coming to the fore, since solid state memories with megabytes of storage are very costly.



A block diagram of a basic controller/formatter interface

And, the megabyte addressing capability of the new MPUs is lost if we fail to use megabyte memories. As a result, better cassette and cartridge machines, as well as floppy disc and magnetic disc drives, all at lower cost, are proliferating rapidly in MPU systems. Since these reasonably priced machines are becoming so popular, it is now appropriate to devote some effort to these mass memories for MPU systems.

This article discusses tape, cassette, cartridge, and the magnetic disc type memories. (Solid state memory was discussed in an earlier article, and is not considered again now.) Some of the considerations for

interfacing these mass memories with MPU systems is also covered.

Since MPU systems are relatively useless without some form of memory, the study of MPUs demands a corresponding attention to memories....a fact which has been neglected in many MPU texts which treat memories as a separate subject.

Cassettes and cartridges

To avoid confusion, it must be pointed out at the onset, that there is a lack of standardization in the matter of magnetic memory systems. This is not really a new problem in the digital (computer) field, since the entire industry has been plagued with this

situation ever since it began, and inexcusably so. This is pointed up by the fact that the words, "cassette" and "cartridge" have been loosely and interchangeably used. There is some general trend however....based on the fact that the first cassettes were designed by Phillips for consumer audio use. These cassettes use a tape width of 0.15 inches, and usually have only one, or two magnetic tracks on the tape (although some cassettes designed for digital use have four tracks). All the present cassettes have the capability of putting 800 bits of digital information on each inch of each track (800 bits per inch, or 800 bpi).

Cartridges, on the other hand, generally use a tape width of 0.25 inches, have 40 or more tracks, with up to 10,000 bpi. The cartridge machines are better performers, (cartridges were introduced many years after cassettes, and have the benefit of the experience accumulated by the cassettes). This is important, since a dropout on the tape in entertainment use is not critical, but a dropout in a digital system is information lost, perhaps forever. In the matter of the amount of data that can be stored, cassettes hold less than 2 megabytes, cartridges up to 20 megabytes!

For this reason, tape manufactured for use with digital systems is certified, and tested for faults that would cause loss of information. Digital tape, therefore, costs more. The cassette or cartridge itself also is built to provide a longer and more troublefree useful life and it costs more. Considering the requirements, it is foolish to use the most inexpensive audio consumer grade tapes in digital applications, but the better grades of audio tapes do quite well in non-critical digital uses, such as hobby computers, visual display patterns, etc. For small business use, the digital tapes are preferred, since an error can cost dollars, or mean problems with the Internal Revenue Service at tax time! Irate customers do not appreciate hearing the excuse, "computer error," since it has become a much abused and disliked term.

Some factors to consider...

The more information stored on tape, the longer it takes to retrieve it. One measure of this is the "transfer rate," which is the speed with which we can transfer information off the tape, in kilobits per second. Cassettes run up

to 32 kilobits per second, while cartridges run to 300 kbit/s. It would seem that we should be able to achieve a high kbit/s rate by simply going to more bits per inch...but that leads to some problems. First, more bpi means each bit takes less space on the tape, therefore, a small flaw in the tape can wipe out a few bits. Another way of stating this is "for more bpi, tape quality must increase," and, of course, that means more money. In order to place more bpi on the tape, the recording (and playback) head must have a smaller gap and finer structure. Since we have reached the limits of practical machined heads, state of the art is now going towards "thin film" heads, made the way thin film microcircuits are made, utilizing photo techniques similar to those used in semiconductor integrated circuit manufacture.

Putting more tracks on each tape provides another approach, so we will be seeing 16 track tape, run at higher speed. This causes head alignment problems, and tape skew problems, since the close and critical spacing is harder to maintain. In this respect we are beginning to experience some of the problems that have occurred with video tape.

Another approach that is being developed is the use of information compression methods, which use encoding systems to pack more data into fewer bits. It is beyond the scope of this article to cover this aspect of magnetic recording, but similar methods have been long used to conserve bandwidth, and thus increase apparent transmitting speed in radio transmission of data, and wire transmission over telephone and coaxial cable.

In order to minimize the effects of amplitude variations in the tape recording, and aid in the signal to noise problem, most of the older cassette systems used a form of modified frequency modulation (FM) in the audio signal applied to the tape. With the advent of cartridge machines designed for digital use, there has come about a trend towards more complex methods, such as "groupcode recording" (GCR), and others. Again, these systems are too complicated to detail now, but it is sufficient to state that most of them involve some form of phase modulation along with encoding to reduce errors. All of the above systems are recorded at very high level on the tape, since FM or PM is

utilized, and the amplitude can therefore be maintained at a constant high level.

Reel to reel magnetic tape

Again, the old audio tape, reel to reel recorders, have been developed into digital industrial machines. These machines use 0.50 inch width tape, pulled at around 100 inches per second, with 1600 bits per inch per track, with eight or nine tracks. The transfer rate on the new machines is over one megabit per second, and about 40 megabytes can be stored on one ten inch reel tape! Due to the greater width of the tape, and the drive mechanism, there is more room for improvement in the reel to reel machines than in cassettes or cartridges....and, since the reel to reel is already superior in most aspects, it appears that the reel type machines will continue to be used for large industrial systems despite the fact that they cost more, and require more careful operators. In their applications, the matter of portability is secondary, because the disc, cassette and cartridge machines are often used as "backups" for such purposes. This, in turn, has helped create part of the market for cassette and cartridge systems!

As in the smaller cassette and cartridge systems, the older reel type machines used some form of phase modulation, while the newer machines are using GCR. The wider tape used in the reel type machine, along with the nine tracks, permits another definite advantage. The usual eight bit byte, along with a parity bit, is recorded across the width of the tape, on the nine separate tracks, much the way video is recorded across the width of video tape. Together, the nine tracks record one byte simultaneously. When played back, this system, with the parity bit, and encoding/decoding techniques, provide for a great degree of error detection, and even error correction, for faults in the tape! This cannot be done to such a degree with the cassette/cartridge systems, or discs.

Discs

Discs come in two general types; floppy (flexible) discs made of a plastic material covered with a magnetic oxide layer, and rigid discs which are either covered with an oxide layer, or a metallic "plated" film. The plated film is the latest development,

and since it has a "smoother" surface, the air gap between the head and the surface can be reduced. (Rigid discs do not permit the record/read heads to contact the surface of the disc. The air gap results in a weaker signal, with poorer signal to noise ratios, and other associated problems. These problems will all be reduced by the smaller air gap permitted by the smoother plated metal surface.)

For comparative purposes, a typical floppy disc system falls costwise, the next to the least expensive. Cassettes are the least expensive, then come floppy discs, and at the top of the price list come reel to reel and rigid disc machines. The floppy disc machines typically transfer data at the rate of 500 kilobits per second, with a storage capacity of one megabyte, although this varies depending upon the size of the disc, and whether it is single or double sided. The rigid disc systems store up to 40 megabytes and have transfer rates of over six megabits per second! It's the old story....you get what you pay for, but from the above you can see that both the reel to reel and the rigid disc machines have more memory than MPU systems are likely to need; therefore we will confine the rest of this discussion to cassette, cartridge, and floppy disc machines.

In any product field, volume sales result in lower price, and so it is with cassette, cartridge and floppy disc machines. Not only are they well suited to small MPU systems, but they are also used in big computing systems. These small cassettes, cartridges and floppy discs provide portability for transport to far locations.... They also provide inexpensive back up against loss, provide temporary storage when memories are being reorganized, and because of their small size, take up very little storage space when long term storage is needed for certain sections of memory that are not needed frequently. The low cost, small size, and portability make them very attractive for a host of uses.... The resulting volume of sales has driven prices down to the point where such digital (industrial grade) machines actually cost less than many high grade home entertainment audio recorders!

Controllers and Formatters

It is not possible to take a small audio cassette machine and use it "as is" in MPU systems. For one thing, an audio

machine is controlled by manual switching of some kind, whether it is the result of insertion of the cartridge....the flipping of a switch, or the rotation of a mechanical linkage. In digital systems, *logic signals* are used to direct the machine to start, stop, fast forward, rewind, record, playback, pause, etc. Thus these logic signals must somehow be converted into switch openings or closings, mechanical motions, power levels, etc. Similarly, digital logic levels are not suitable for application to the recording head, and signals from the playback head are not at all useful in a digital system! (Remember, most signals on digital tape are phase modulated audio frequencies....not the "ones" and "zeros" used on the digital bus system. So we need to put the data into a suitable format for the machine to use, on one hand, and the digital system, on the other. This is not a new problem with MPUs....every time the MPU has need to communicate with the outside world, some form of "interface" is required, and mass magnetic memories are no exception.

The interfacing is accomplished by means of "formatters" and "controllers." The two terms overlap in actual usage, with one box performing both functions in many cases. The controller performs the control functions required, while the formatter does the format interfacing between the machine's electronic circuits and the computer buses. This leads to some problems....because it is obvious that the controls for a floppy disc are different from the controls for a cassette, as just one example. Furthermore, computer bus systems are not completely standardized....and there are different logic levels for computers using TTL, ECL, MOS, etc. These different logic families, and bus systems, make up quite a variety of signals, which must be somehow interfaced with the requirements for the different types of magnetic memory machines....AND the different types of signals used on the tapes and discs of these machines! A block diagram of a representative interface is shown.

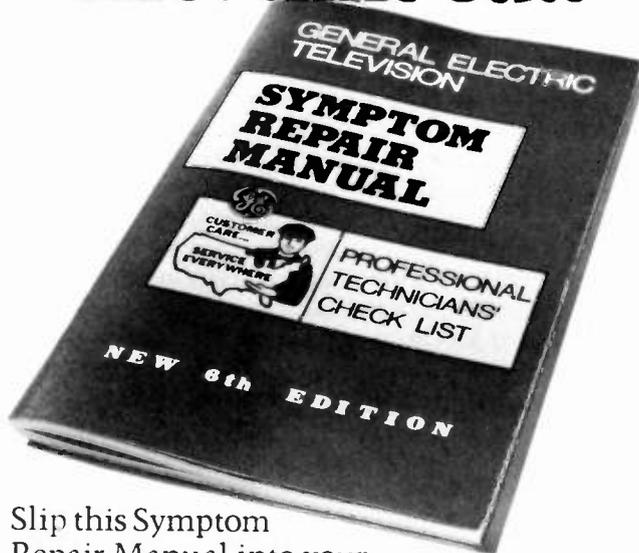
Some of the magnetic memory machine makers provide all the needed interfacing to match their machines to a few of the most popular computers. Some of the computer makers provide the interfacing to match a few of the most popular memory machines. A few custom

controller/formatter makers provide interfaces between *some* of the machines, and *some* of the computers. (A few brave souls design and build their own interfacing equipment!). All of this is at extra cost, of course, since no memory machine maker, or computer manufacturer provides such equipment free. As you can readily see, you just don't buy a memory machine and a computer, hook them up, and run. Thus it is wise to carefully plan, and select ALL of the required equipment, and buy it as a package deal from one source, with the understanding that the source will fully guarantee that the computer, interface, and memory machine, will work properly together. Otherwise each manufacturer will only guarantee his part of the system, and the system may not run as a whole! Unfortunately, until the digital industry gets its act together, this is going to remain a common problem with the more powerful MPU systems which utilize mass memory machines.

One more point....anyone who has been exposed to digital systems knows the difference between serial and parallel format in digital communication. The bus system in all MPUs runs in parallel format....but the data in most magnetic memory machines is in serial format. Not only that....but it is not in the usual form of changes in level (ones and zeros), but rather is in the form of phase modulated audio tones of fixed levels....a fairly high level in recording, and a fairly low level from the playback head in reading. The need for specialized interfacing becomes immediately apparent in light of the the above. The conventional interfaces such as peripheral interface adapters, universal asynchronous receiver/transmitter, etc., were not designed for this task, so you cannot simply take a few building block integrated circuits, pop them on a board, and solve the problem.

To interface the mass memory machine used, and the computer used, requires knowing what sort of bus signals the MPU uses, what sort of signals the memory machine uses (including the particular encoding used on the tape itself), and what sort of controls are required to operate the machine. While this is being done, it is advantageous to add some sort of test signals which can be used for diagnostic purposes in case of malfunctions, and this is usually done
continued on next page

The one tool that pays for itself first time out.



Slip this Symptom Repair Manual into your tool caddy. It lists all sorts of symptoms for individual GE TV chassis and tells you what to check and in what order. You can save hours of frustrating (and unprofitable) diagnostic time.

The new Sixth Edition manual packs the combined experience of hundreds of service technicians into a 5½" by 8½," 104 page package. It's free to subscribers of GE Technical Data, but non-subscribing technicians may obtain a copy by paying a \$2.00 handling fee. You can make that back in the first few minutes it saves.

"DUTCH" MEYER ET/D 81
 GENERAL ELECTRIC COMPANY
 PORTSMOUTH, VA 23704

Please check items desired:

One Symptom Repair Manual (\$2.00 Enclosed)
 Two Symptom Repair Manuals (\$3.00 Enclosed)

Enclosed is Check Cash or
 Money Order (No C.O.D. Please)

Name _____

Service Company _____

Address _____

City _____ State _____ Zip _____

IT'S OUR BUSINESS TO MAKE YOUR BUSINESS EASIER.

GENERAL  ELECTRIC

continued from previous page
in the better interfaces.

Where are they going?

Since the mass memory situation has changed so much in the last few years, many MPU system users are wondering what the near future holds in the way of further changes. Happily, all the foreseeable changes indicate that cassettes, cartridges and floppy discs will continue to be more than adequate for the MPU systems coming up. This is so because there are some improvements now on the design boards that will make these memory systems even better, more than keeping pace with MPU trends. For example; cassettes and cartridges will have longer tapes, more tracks, more bits per inch per track, driven at more inches per second, and thin film heads, all combined to push cassette transfer rate to almost 50 kilobits per second, and total capacity to over six megabytes, while cartridges will similarly increase their storage capacity to over 100 megabytes! The eight inch floppy discs will store ten megabytes.

You can see that these systems all have more than enough capacity for the next generation of MPUs' addressing capability, and therefore insure that the use of cassettes, cartridges, or floppy discs will continue for some time into the future, barring some radically new development in memories. (It is possible, but not probable, that magnetic bubble memories of such large capacity will appear, at competitive cost some time in the future.) Since the life of the machines is around five years in average use, a machine bought now would probably be at the end of its useful life before it became technologically obsolete.

Costs

At the present time cassette machines can be bought for less than five hundred dollars, cartridge machines run between one thousand and two thousand dollars, floppy discs run between five hundred and one thousand dollars....all good industrial grade quality. The cassette itself costs about five dollars, cartridges about twenty dollars, floppy discs over ten dollars....again computer grade type, etc.

But, don't forget the interface discussed earlier! Even a ball park figure is not feasible, since these

continued on page 54

UNIVOLT'S DT-810 DIGITAL MULTIMETER

The unique space age digital multimeter with transistor gain (hFE) measurement capability should be the only multimeter you own.

Ora Electronics has offered in the past many fine Digital Multimeters (D.M.M.'S). We still sell the famous D.M.M.'S such as Beckman, Fluke, Hickok, and others. We have always followed the advance in technology used in D.M.M.'S, and we always wanted to supply our many good customers with the most Ideal Multimeter, at a price they can afford. In the past we had to sell good, but expensive Multimeters, expensive but "fair" Multimeters, and plain "cheap" Multimeters.

WE FOUND IT!

Several months ago, a famous Test Equipment Manufacturer, walked in to our headquarters with a Prototype of a Digital Multimeter. We were very impressed it had almost everything we wanted plus a bonus, the only question remaining was "how expensive is it?" When we heard the answer, a big smile appeared on our faces. After several improvements we are proud to offer it. After you read the features (and price!) I am sure you are going to order one or more, of these fine D.M.M.'S that we call the "UniVolt".

LCD DISPLAY.

The unit has a 3.5 Digit liquid crystal display. The sharp digits are 14mm high and have a viewing angle of 140°.

HIGH ACCURACY.

The basic D.C. accuracy of the UniVolt is 0.5% of reading +1 digit, which makes it one of the more accurate instruments in its class. The input impedance is very high, 10 mega- Ohms (10,000,000) Ohms, which helps in measurements of low voltage and high frequency signals.

MEASUREMENT RANGES.

The UniVolt has D.C. voltage range of 100uv to 1000V in five steps, A.C. voltage range of 100mV to 1000V, current measurement range of 100mA to 10A (DC) and resistance range of 1 to 2,000,000 Ohms.

CONTINUITY & DIODE TEST.

A fast and accurate continuity test mode utilizes a built-in buzzer to indicate continuity. The same mode is used to check diodes and their approximate forward voltage.

EASE OF OPERATION.

The UniVolt is small, it measures 6½" x 3¾" x 1¼". It's light weight, only 9.87 oz. including battery! It utilizes push buttons, for easy one-hand operation and the front panel has a unique color coding for reduced errors.



OVERLOAD PROTECTION

The unit has an extensive overload protection on all ranges. On D.C. current ranges it uses a .5A GMA type fuse. A spare fuse is supplied with the unit at no extra cost.

MAINTENANCE FREE

The heart of the UniVolt Multimeter is a 40 pin L.S.I. chip; the Intersil ICL710G. This space ages chip has proven to be one of the most sophisticated and reliable micro-electronic circuit in use, it is supported by minimum amount of external parts, which are over specified to insure failure safe instrument. Of course, Ora Electronics stands by this instrument and guarantees it for one year (See specific warranty information).

ORA ELECTRONICS

A division of Alliance Research Corp.

**OUR SERVICE
MAKES THE DIFFERENCE**

18215 PARTHENIA ST. NORTHRIDGE, CA 91325
(213) 701-5848 Telex 181011

© 1980 ORA ELECTRONICS

OTHER FEATURES

It uses one 9 volt carbon battery (included), which last approximately 200 hours of continuous use. Its sampling time is 0.4 seconds, operating temperatures of 30°F to 104°F, and operating humidity of less than 80% R.H.

BONUS!!

We left the best to the end. The UniVolt DT-810 has something unique. It has a transistor gain (hFE) measurement mode! This unique feature enables you to measure hFE values of 0-1000 of either P.N.P. or N.P.N. transistors.

SPECIAL PRICE

We had originally decided to sell the unit for \$119.95, but in order to promote the new advancement in D.M.M. design, represented by the UniVolt, for a limited time only you can buy this incredible unit for only \$99.95 including: standard red & black test leads, a fresh 9v carbon battery, a spare 0.5A GMA type fuse and an instruction manual.



FREE CASE

We have worked long on the UniVolt project and we hate to see scratches or bad looking units. So we decided to go all the way, when you buy the UniVolt DT-810 Multimeter (and for a limited time only!) we will give you absolutely free a hard vinyl leatherette, carrying case, with felt padding and a compartment for your test leads. The regular selling price for this case mode CC-01 is \$8.00.

ACCESSORIES AVAILABLE.

The only two accessories available are: UP-11, hFE probe with special plug and 3 color codes alligator clip, and the UP-12 I.C. clip adaptor, which will help you hook your multimeter to any I.C. pins. (You can buy both probes for only \$6.00, but only when you purchase the UniVolt DT-810 now.)

ORDER NOW!

It's very easy to order your UniVolt DT-810 multimeter. Send \$99.95 (California residents add 6% sales tax) plus \$2.50 delivery charge to the address below, if you want the optional accessories, please add \$6.00 (California residents add 6% sales tax). A cashier check or money order will help speed your order. Credit card holders (master card or visa) can call our toll free number (800) 423-5336, in California it's (800) 382-3663. C.O.D. orders will be accepted, but you must pay by cash or money order and a C.O.D. charge of \$1.40 will be added. If you decided to buy another brand of Multimeter, please call us too, we carry many other types of multimeters and test equipment at low prices.

Circle No. 111 on Reader Inquiry Card

Analyzing Functional Techniques

A method of troubleshooting

A number of troubleshooting/analysis methods can be used to localize problems in a television receiver (or any other electronic device). A step-by-step method not necessarily rigidly adhered to, but used as a general procedure can speed up the process and increase your troubleshooting efficiency.

by Robert L. Goodman

In this article we will look at Functional Analyzing in order to divide and conquer a defective television receiver and cut down the number of steps required for circuit diagnosis. This technique uses signal injection in order to quickly locate the faulty stage. With this system you need not chase electrons around or make voltage and resistance measurements needlessly. You will actually be able to pin-point the problem to a specific area and then make a few more checks to find the defective component.

If you are not now using the Functional Analyzing technique, you probably will find that your set repair completion rate will be greatly increased, when you do.

Even though we will be zeroing in on TV service in this article, you will find that the efficiency of Functional Analyzing will apply to virtually all facets of electronics. Thus, computer, radio communications, industrial

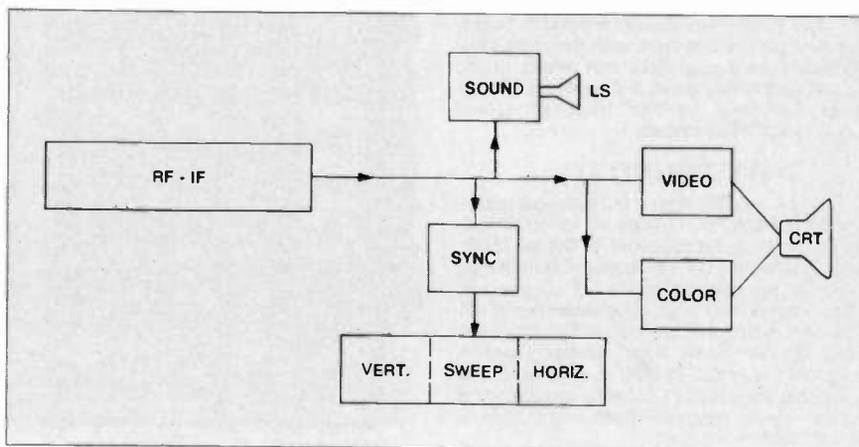


Fig. 1. Basic color TV block diagram

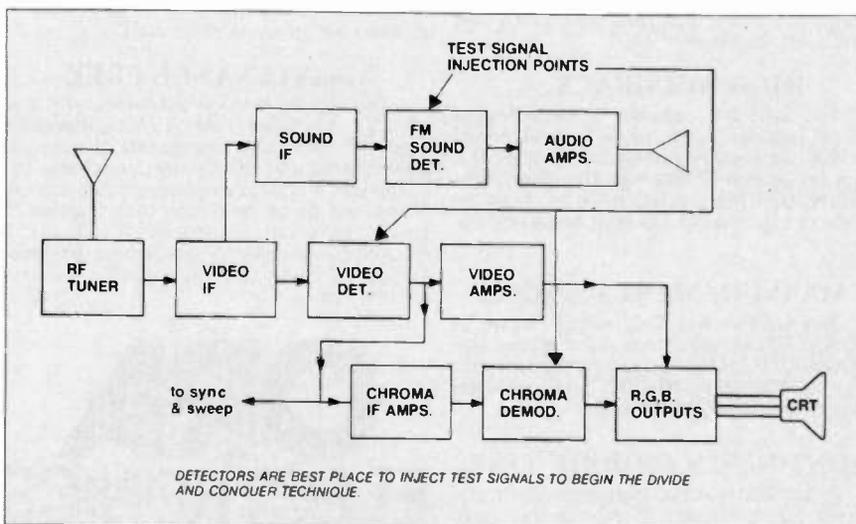


Fig. 2. Block diagram illustrating detectors as the best place to initially inject test signals.

technicians, TV station, and design engineers should glean helpful tips from these techniques.

Logical, functional analyzing

Functional Analyzing involves

analyzing the circuit function in a logical, sequential manner in order to isolate the circuit defect, rather than analyzing every component in several circuits in a helter-skelter way.

When starting troubleshooting with Functional Analyzing, you concentrate

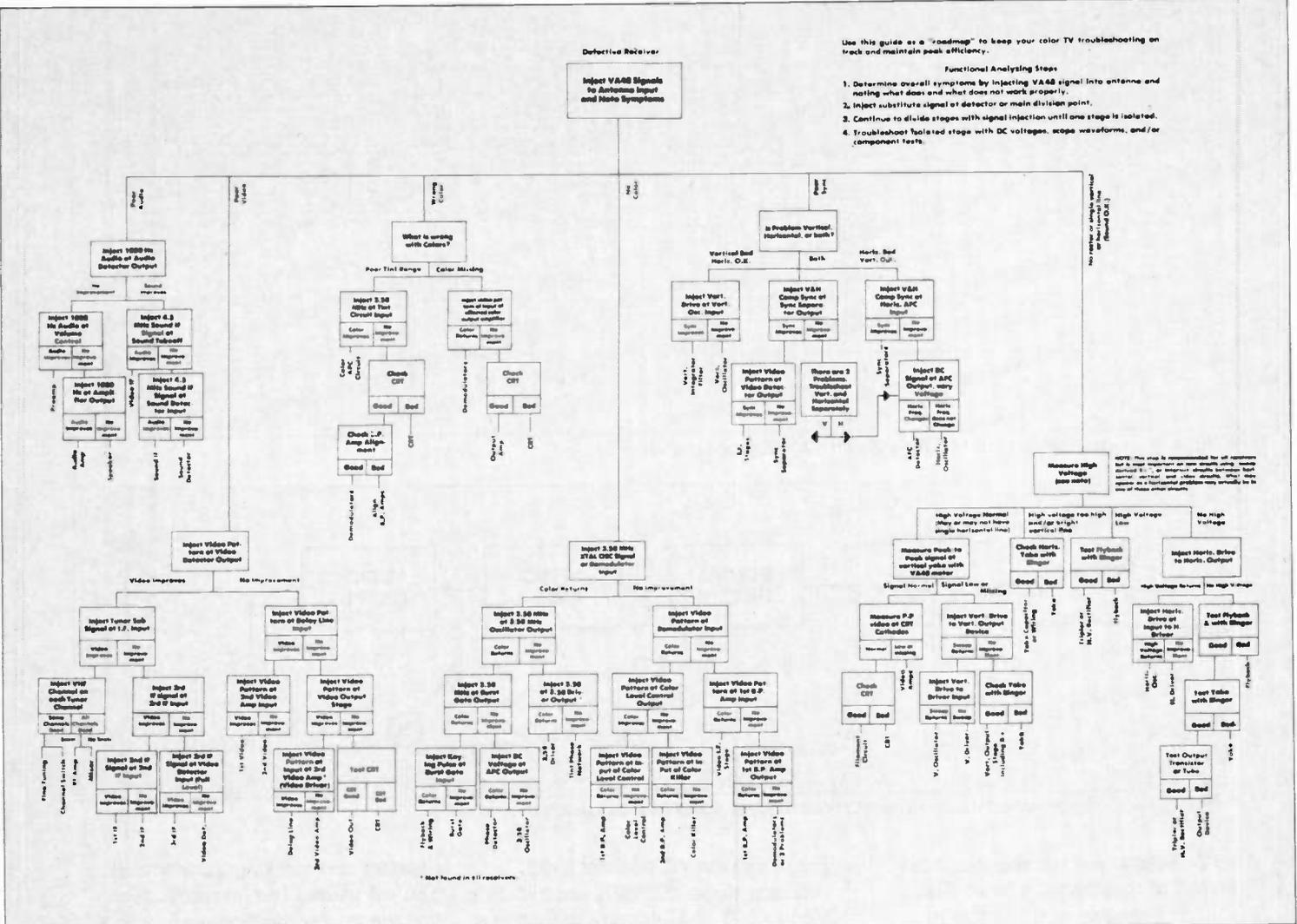


Fig. 3. Functional analyzing troubleshooting guide. (courtesy of Sencore, Inc.)

on the circuit function to narrow the fault down to one block or stage and not individual circuits, voltages, or components.

Functional Analyzing differs from other types of troubleshooting in that the first step is not proving which stage is faulty, but rather confirming which stages are operating properly—in a logical, sequential manner, until the fault is narrowed down to one functional block of the total receiver. It is only after the fault has been isolated, with signal injection, that meters, scopes, transistor testers and other instruments are used to isolate the component within the stage. And if at all possible, avoid shotgunning the components in this stage in order to find the faulty one.

Five basic TV blocks

The five main sections or blocks of any TV receiver are the sound, video, sync, sweep (vertical and horizontal), and the chroma. See the (Fig. 1) block diagram. Generally, you will usually listen to, or view, these basic

functions of the TV receiver to identify the good or bad functions to establish a troubleshooting starting point. One thing you may forget to do, however, is to see which circuits are common to each other. If you would do this, it would eliminate some of the good circuits in this first Functional Analyzing step.

An audio problem, for example, may involve only the audio circuits, or it may also involve the tuner and video IF stages as well. The 4.5MHz inter-carrier sound signal is processed by the same circuits as the video signals up to the sound take-off point in the video IF stages. If you have a picture, but no sound, you can be fairly certain that the fault is not in the RF (tuner) or IF stages.

Similarly, if you have good horizontal sync, and poor vertical sync, (or vice versa) you can be fairly certain that the problem is after the sync separator stage since it is common to both the vertical and horizontal circuits. If, on the other hand, the TV set does not sync

vertically and horizontally, you know that the problem is in a circuit common to both signals. The defect could be in the sync separator, the circuits between the video detector and the sync separator, or caused by sync compression in the IF amplifiers.

Up to a point, isolating TV receiver problems to specific functions and common circuits is a general Functional Analyzing procedure. However, you can obtain a greater efficiency by using all steps of the Functional Analyzing techniques.

You may have top-notch technical knowledge but your troubleshooting techniques may not be the most efficient or quite up to par. Let's now go on and put this system to work for you.

Detectors—the dividing point

As we start dividing the functional blocks in a TV set, you will note that the detectors cause the greatest change in the signals. As shown in the (Fig. 2) block diagram of a color

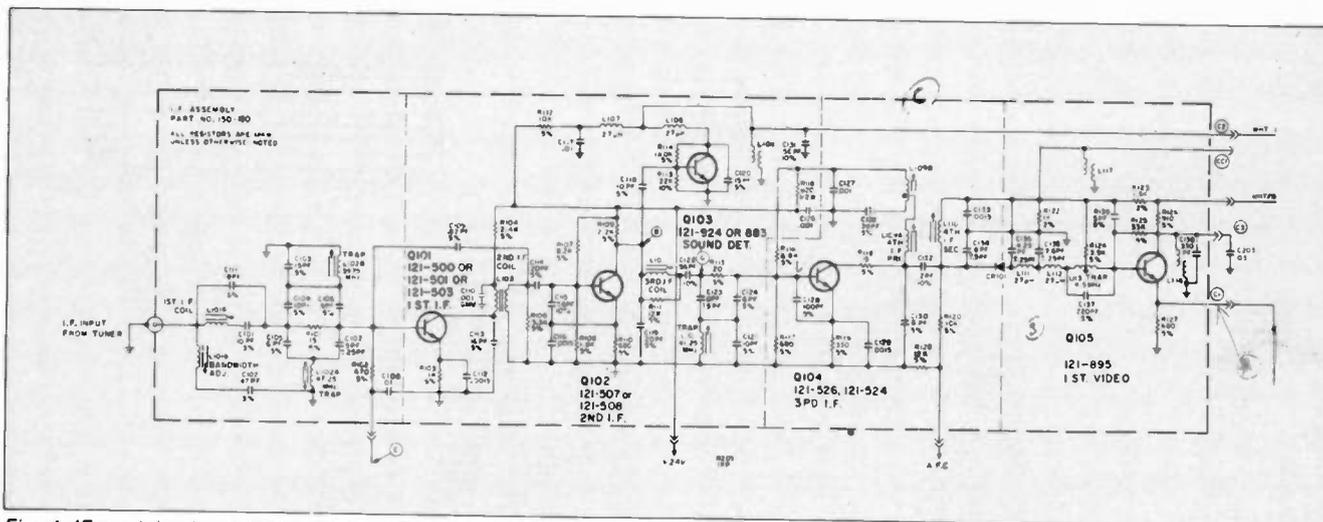


Fig. 4. IF module circuit (150-180) for a Zenith 19DC22 color chassis.

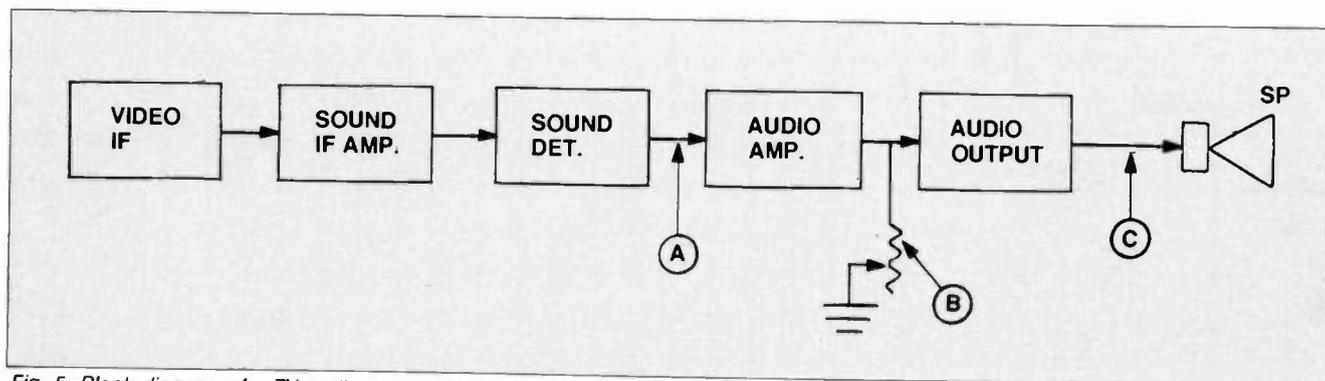


Fig. 5. Block diagram of a TV audio system indicating test signal injection points.

TV chassis, you will see that three types of detectors are used. The Video Detector must change the amplitude modulated IF signal to composite video, the Audio Detector must change the frequency modulated 4.5MHz sound IF signal to audio, and the Chroma Demodulators must change the phase-modulated composite chroma signal to individual red, blue and green outputs. The detectors are the most logical points to begin signal injection because these circuits operate much differently than the circuits after the detectors. In each case, the detector results in a division by two of the total number of stages that could be a problem. Also, the test injection signals must be different before and after the detectors, too.

Of course, to use this divide and conquer technique you will need an instrument that will supply the various required signals for test injection. For TV troubleshooting you may want to consider the B&K Precision Television Analyst model 1077B or the Sencore VA48 Video Analyzer. * Editor: Several other new video pattern generators will supply most if not all of the most useful signals for this method of television troubleshooting.

These include VIZ's Model 515B, Leader's Model LCG397, and Hickok's Models 240 and 246; any unit with an output amplitude control and video as well as RF output is most useful.

After dividing the circuits into two parts, you then determine the detector point which has the general symptoms first noted and then inject the appropriate substitute signal. For video and sound, inject at the detector output. For Chroma symptoms, inject at the demodulator input. Should the set's operation return to normal, you know that the fault is somewhere before the detector. If faulty operation persists, with an injected signal at the detector output, you know the defect is somewhere between the detector and output stages.

The troubleshooting guide or tree shown in (Fig. 3), courtesy of Sencore, Inc., illustrates the efficiency of Functional Analyzing. The chart shows 63 different problems isolated to a single stage. All but two of the problems are isolated to a single stage with four steps or less, and the last two require only 5 steps. You can occasionally skip a step or two in the analyzing process, based on past experience in another chassis or obvious clues such as charred

resistors and smoking transformers. You will usually find, in most cases, that the troubleshooting guide works like a "road map" to keep you on track as you isolate the problem with the highest possible efficiency.

Different types of test signals will be required for signal substitution at the three detectors. To troubleshoot audio problems, you will need both FM modulated audio and detected audio signals. To isolate video problems, you need amplitude modulated RF and IF signals plus detected composite video signals. However, to isolate color defects, two signals are required. These are a phase modulated 3.5MHz Chroma Signal and a Zero-Phase-Referenced 3.5MHz subcarrier. The subcarrier signal should be phase-locked to both the phase-modulated chroma signal and the horizontal sync pulses to work properly in the color circuits.

Effective IC troubleshooting

Modern color TV systems that use IC's are another good reason for you to be using functional circuit analyzing. Functional Analyzing not only isolates faults in conventional circuits in quick order, but is also the best way to track down problems

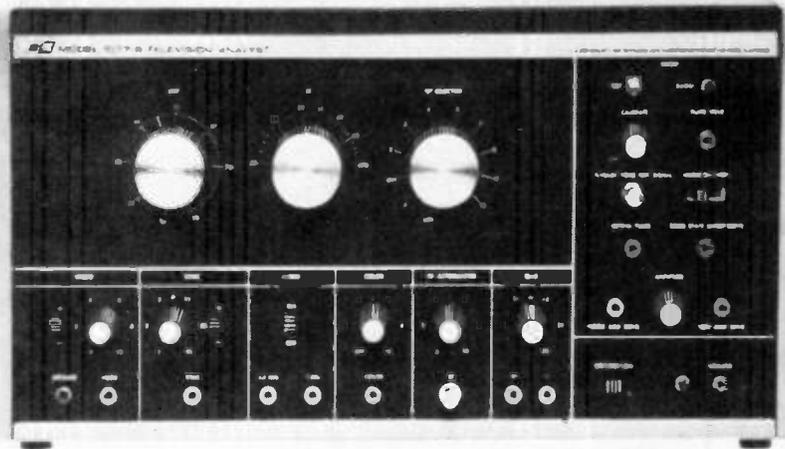


Fig. 6. B&K-Precision's 1977-B analyst. Its flying spot scanner and other features produce almost any test signal needed.

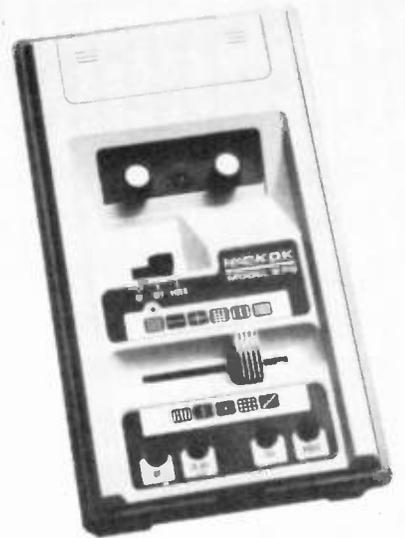


Fig. 8. Hickok's Model 240. This handful of generator has adjustable RF and video outputs and can supply a staircase video grey scale signal very useful for video troubleshooting and CRT adjustment.



Fig. 7. Sencore's VA48 in action on the author's VCR bench. The VA48 can supply just about any signal needed in any sort of video servicing.

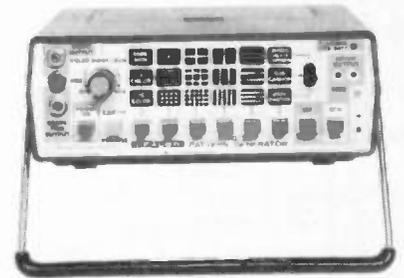


Fig. 9. Leader's Model LCG397 offers a wide variety of video patterns at video or RF.



Fig. 10. VIZ's Model WR-515B has video and RF outputs; adjustable video, chroma, and RF output levels and a variety of patterns available.

quickly in the newer integrated circuits found in today's sets. About the only other way to find a defective IC is the expensive and timeconsuming procedure of IC component swapping.

You may not realize it, but integrated circuits are complete circuits with-in-themselves. They must be tested for their *function* to be absolutely sure they are defective before you would go to the trouble of unsoldering, ordering, and waiting for an IC to be used for test purposes only. Because these special IC's must be tested as a functional block, I do not see an IC tester for them in the foreseeable future. Thus, with these modern IC's you can not use the "ole tyne" electron circuit chaser techniques.

Let's now look at two actual "real world" TV service problems that were

solved very quickly with the functional analyzing divide technique.

A video problem

On this Zenith solid-state set the picture was good when the set was first turned on, but after about 5 minutes the picture would develop lines, streaks and become very unstable. The sound was good. The picture symptoms told us the trouble could be due to faults in the tuner, IF stages, video or sync/AGC sections. So, the first step was to divide.

With the Sencore VA48 Analyzer, we injected a composite video signal at the C1 pin on the IF module. This is our test point A in the (Fig. 4) video IF circuit diagram. The picture showed very good on the screen with this test. To clear the tuner, the Analyzer's RF tuner signal was fed into the IF

module input and the same faulty picture symptoms were present. A tuner subber can also be used for this test. Now the cover was removed from the IF module and the same test signal inject at point B which is the output of the video detector. The picture was still good, clearing the first video stage.

For the next step we set the Analyzer for the 3rd IF input RF signal

continued on page 55

CET Quiz,

Part II

Here's another twenty-five questions on basic electronics. See how you do this time.

by Frank R. Egner, CET

Here's another electronic quiz to review your knowledge of fundamental electronics. You should score at least 75½ without peeking at the answers. There are no trick questions. See how well you can do.

1. A 2-resistor voltage divider has R1 and R2 connected between the positive voltage source and ground. A 50v, 20ma load is connected from the R1-R2 junction to ground. R1 is 3K and drops 90v. What is the value of R2?
 - a. 5000 ohms.
 - b. 3000 ohms.
 - c. 2500 ohms.
 - d. None of these.
2. A resistor, color coded orange, orange, gold, silver, is within tolerance if it measures:
 - a. 335 ohms.
 - b. 3.6 ohms.
 - c. 34 ohms.
 - d. 0.32 ohms.
3. 12 ma of current is passing through a 1000 ohm resistor. The power dissipated by the resistor is:
 - a. 1440 mw.
 - b. 14.4 mw.
 - c. 0.144 w.
 - d. 1.44 w.
4. Three 100K resistors are connected in series across a 48vdc source. Disregarding resistor and meter tolerances, the voltage on the 50v range will be about:
 - a. 15 vdc.
 - b. 16 vdc.
 - c. 9.6 vdc.
 - d. 15.4 vdc.
5. The time/division switch of a calibrated oscilloscope is set at 50 microseconds. One cycle of a displayed waveform extends 6.4 divisions. The signal frequency is:
 - a. 312.5 Hz.
 - b. 3,125 Hz.
 - c. 31,250 Hz.
 - d. 312,500 Hz.
6. What is the sensitivity in ohms-per-volt of a dc meter that has a meter resistance of 150 ohms and requires 1 ma of current for full scale deflection?
 - a. 1000 ohms-per-volt.
 - b. 850 ohms-per-volt.
 - c. 20,000 ohms-per-volt.
 - d. 1150 ohms-per-volt.
7. Normal diode operation is indicated by:
 - a. 0.6v across a conducting germanium diode.
 - b. 0.3v across a conducting silicon diode.
 - c. Both a and b indicate normal operation.
 - d. Neither a nor b indicate normal operation.
8. An oscilloscope is calibrated for 20v/div. What deflection will be provided by 30v RMS?
 - a. 4.2 divisions.
 - b. 1.5 divisions.
 - c. 2.1 divisions.
 - d. 1.1 divisions.
9. A given transformer has a turns-ratio of 25:1 step-down. The secondary load impedance is 16 ohms. What is the value of impedance reflected into the primary?
 - a. 400 ohms.
 - b. 80 ohms.
 - c. 1,280 ohms.
 - d. 10,000 ohms.
10. A dc resistive circuit dissipates 7.5 watts of power. To change the input to ac voltage and dissipate the same amount of power:
 - a. A higher value of ac voltage will be required.
 - b. The ac voltage level must be 1.414 times the dc voltage.
 - c. The effective ac voltage must equal the dc voltage.
 - d. The ac voltage level must be 0.707 times the dc voltage.
11. The reactance of a 6 mh coil operating in a 75 KHz circuit is:
 - a. 28K ohms.
 - b. 2.8K ohms.
 - c. 0.28K ohms.
 - d. 1.53K ohms.
12. An oscilloscope displays a vertical figure 8 Lissajous pattern. This display indicates:
 - a. H frequency equals V frequency.
 - b. V frequency equals 2H frequency.

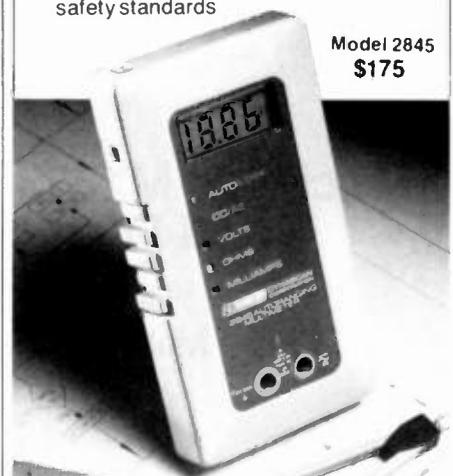
- c. H frequency equals 2V frequency.
d. Frequency measurement is only valid with a circle.
13. A dc meter movement has a resistance of 1250 ohms and a full-scale current of 1 ma. What value multiplier resistor is required for the 10v range?
a. 10,000 ohms.
b. 11,250 ohms.
c. 2,250 ohms.
d. 8,750 ohms.
14. A series RL circuit is connected so that the output is taken across the resistor. The half-power (cut-off) frequency occurs when:
a. $XL = R$.
b. $XL = 0.7R$.
c. $0.7XL = R$.
d. None of these.
15. The 500vdc range of a 20,000 ohms-per-volt VOM is to be increased to 50KV with an external multiplier resistor. What value external resistor must be used?
a. 1000 megohm.
b. 500 megohm.
c. 990 megohm.
d. 499.5 megohm.
16. A series RC circuit is arranged so that the output is taken across the capacitor. This circuit is identified as a (an):
a. Phase-splitter.
b. Coupling circuit.
c. Differentiator.
d. Integrator.
17. The reactance of a 1000 pf capacitor in a 25KHz circuit will be about:
a. 0.63K ohms.
b. 6.3K ohms.
c. 63K ohms.
d. None of these.
18. A 250 microfarad capacitor is connected to a 100vdc source through a 100K ohm resistor. How long does it take the capacitor to charge to 50vdc?
a. 17.5 seconds.
b. 25 seconds.
c. 62.5 seconds.
d. 125 seconds.
19. A triangular waveform is applied to an RC differentiator network. The output waveform will be a:
a. Triangular wave.
b. Series of positive and negative pulses.
c. Squarewave.
d. Sinewave.
20. The cutoff (half-power) frequency of an RC coupling circuit occurs when:
a. $XC = R$.
b. $0.7XC = R$.
c. $XC = 0.7R$.
d. Cannot be calculated.
21. A 0.01 and a 0.02 microfarad capacitor are connected in series as an ac voltage divider.
a. The 0.02 μ f capacitor will have a larger voltage drop because of its larger capacity.
b. Equal voltage drops appear across each capacitor.
c. The maximum applied voltage cannot exceed the voltage rating of the 0.01 μ f capacitor.
d. The 0.01 μ f capacitor will have a larger voltage drop because of its smaller capacity.
22. A 0.001 μ f capacitor is connected in series with a 2.5 mh coil. The combination is resonant at about:
a. 100 MHz.
b. 318 MHz.
c. 100 KHz.
d. 318 KHz.
23. A bandpass filter can be defined as a circuit which:
a. Passes all frequencies falling beyond the half-power points.
b. Discriminating against those frequencies beyond both upper and lower half-power frequencies.
c. Passes all frequencies above a cutoff frequency established by component values.
d. Discriminates against all frequencies between both upper and lower half-power frequencies.
24. A vacuum tube triode amplifier has an input signal but no output signal. Voltage tests indicate: $E_b = B+$, $E_g = 0v$, and $E_c = -18v$. The trouble is most likely:
a. An open anode circuit.
b. A grounded grid circuit.
c. An open cathode circuit.
d. A gassy tube.

You'll find the answers on page 54.

Computer power in a DMM!

An autoranging DMM breakthrough from B&K-PRECISION

- Microcomputer autoranging speeds operation and stabilizes readings
- Auto-skip program for best resolution in least time
- Easiest, fastest-to-use DMM available
- 0.1% basic DC accuracy
- 3½ digit, 0.5" LCD display
- Continuity test "beeper"
- Range-lock, holds selected range
- Measures AC/DC voltage; AC/DC current; resistance
- Meets tough U.L. 1244 safety standards



Model 2845
\$175

B&K-PRECISION's new 2845 is a major advance in digital multimeter technology. At a price comparable to ordinary manually operated units the 2845 brings micro-computer intelligence to a handheld portable DMM. When applied to a circuit, its computer selects the range providing maximum resolution without the slow "hunting" action characteristic of many bench-type autoranging DMMs.

The 2845 is certainly the most user oriented hand-held DMM available. No other DMM can match its speed and simplicity of operation. With tilt stand optional AC power adapter, it becomes a remarkably inexpensive bench DMM.

For additional information and your local B&K Precision distributor, call toll-free 800-621-4627.

BK PRECISION
DYNASCAN
CORPORATION

6460 West Cortland Street
Chicago, Illinois 60635 • 312/889-9087
Int'l. Sls.: 6460 W. Cortland St., Chicago, IL 60635
Canadian Sales: Atlas Electronics, Ontario

TEST INSTRUMENT REPORT

With the flood of digital multimeters on the market I'm sure the designers have a problem finding new and/or unique features with which to hopefully find a place in that market.

With the MX333 Hickok has to a considerable extent succeeded in producing something unique. The combination of its case shape, VARI-PITCH audio,

TRAK reportedly will typically respond to 5 ns pulses, is tested at 8 ns and is useful, with an appropriate probe to 80MHz.

The MX333 also has the standard ranges and features one would expect of a DMM. Its dc accuracy rating is 0.1% of reading +1 digit; its ac accuracy is 1% of reading +2 digits over a 45 to 1kHz range and 5% of reading +5 digits up to 5kHz (on the 200mv to 20V ranges). Resistance accuracy is 0.1% on most of the ranges (+1 digit on the 20 megohm range, 0.2% on the 200 ohm range). It has, unlike most meters, a special 20 ohm range with a resolution of .01 ohm and an accuracy of 3%. All ohmmeter ranges are low voltage; that is, the measurement voltage will not forward bias a semiconductor junction. A separate diode test function is supplied. This range measures the forward voltage drop of a diode at a nominal current of 2 millamperes. The MX333 has both ac and dc current ranges from 2 ma to 10 a. The dc accuracy is rated at $\pm 1\%$ on the lower ranges and $\pm 1.5\%$ on the two higher ranges (all +1 digit). The ac ranges offer accuracies of $\pm 1.5\%$ + 2 digits (45Hz to 400Hz) except the 2 ma range which is 2.5% + 2 digits. Overload protection is 1000V dc/peak ac and up to 6kV transients on all dc ranges; it will take ac overloads of 1000V dc/750V RMS ac on all ranges except the 200mV range where it will withstand 200V RMS for 15 seconds. The ohmmeter will withstand 500V dc/RMS on all ranges. The 20 ohm range also has a 2 ampere fuse.

We put the MX333 to general shop use for a couple of months—along with several other DMM's—and found it very convenient. Its accuracy checks out. It is convenient; I liked the angle of the display; but I advise an ac adapter for bench use; I kept forgetting it was on and while the battery life is fairly long, leaving it on over a weekend unnecessarily diminishes battery life.

The friend of the MX333, and of other Hickok DMMs, and potentially of many DMMs with one millivolt resolution, is the TP20 temperature probe. This device is capable of measuring temperature over a range of -67° to $+302^{\circ}$ F (a Celsius model is also available) and has an output of one millivolt per degree. Its accuracy is $\pm 2.3^{\circ}$ F in the range of $+32^{\circ}$ to $+212^{\circ}$ (where you'd most need it) and about $\pm 4.5^{\circ}$ above and below this. It will take a tip voltage of 200 volts (dc or ac + ac peak) and is a great gadget for watching transistor case temperatures, etc.

The price of the MX333 is \$235 and the TP20 is priced at \$49.95. **ETD**



The Hickok MX333. For more information circle No. 150 on the reader service card.

Hickok's MX333 and Friend

A "Universal Digital Multimeter"

By Walter H. Schwartz

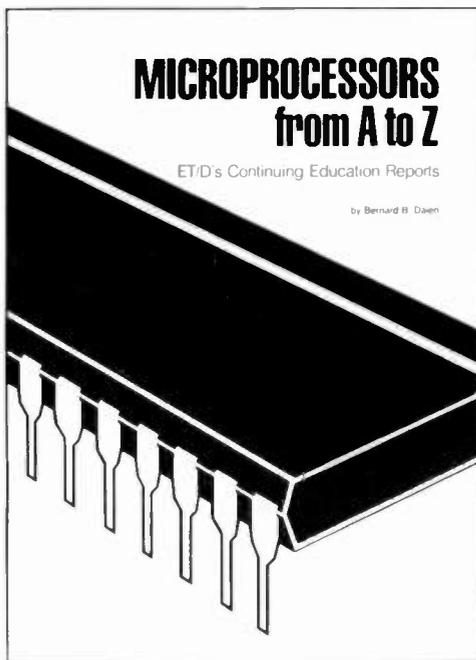
and logic functions make it just a little different from anything else I've seen.

The first thing that catches your eye when you see the MX333 is the display at a 45 degree angle. Hickok says it catches the light from an optimum angle and it is at a convenient angle for reading on either the bench or from a shelf above the bench or when the MX333 is hung from a belt clip.

The MX333 has audible continuity on voltage or current indication. But unlike some similar features, the pitch of the sound varies proportionally to the input or resistance, low pitch at low voltage, current, or resistance, high pitch at high voltage, current, or resistance. The LOGI-TRAK feature uses this audible indication to check logic states. Using a 10:1 scope probe the display will read any voltage from 10 mv to 19.99 volts; the high impedance scope probe minimizes circuit loading. The display will now read logic states directly and will read the average dc level of pulses. Pulses are detected and indicated by the momentary appearance of a colon above the display decimal point. An individual edge change will blink the colon, continuous pulsing will keep the colon on. With the VARI-PITCH audible indication in use the audio pitch is a low tone for zeros and a high tone for ones. Slow pulses cause the sound to chirp; they result in a burst of high tone corresponding to each pulse. The LOGI-

MICROPROCESSORS from A to Z

by Bernard B. Daien



An introduction to the conceptual world of microprocessors-brought to you by the publishers of **ELECTRONIC TECHNICIAN/DEALER**

only **\$9.95** per copy

YOU LEARN:

- What a microprocessor is
- How it works
- How to use it

AND . . .

- How to apply this knowledge when you're dealing with the installation, use, troubleshooting and programming of microprocessors

The optimum time to enter the world of digital electronics is now! Technicians who understand the microprocessor can literally take their pick of jobs in this expanding field. The demand is great for trained personnel. Let MICROPROCESSORS FROM A TO Z help you adapt to this evolving new industry.

A whole new world can open to you for only \$9.95. Order your copy of MICROPROCESSORS FROM A TO Z today!

**COPIES
LIMITED—
DON'T
DELAY!**

Microprocessors • Book Dept., One East First St., Duluth, MN 55802

YES! Please send me _____ copies of ET/D's MICROPROCESSORS FROM A TO Z at \$9.95* each. My payment is enclosed.

*Please add \$1.50 per order and, if ordering multiple copies, also add 25¢ per additional copy to cover postage and handling costs.

NAME _____

FIRM NAME _____

STREET ADDRESS _____

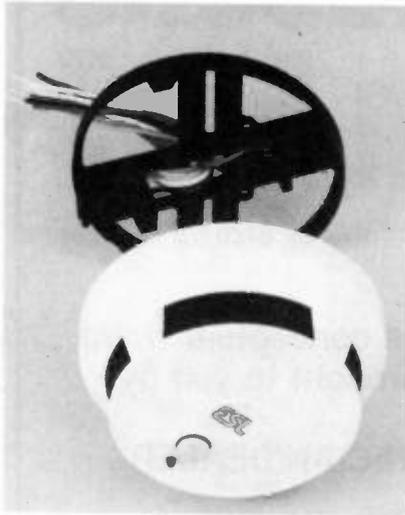
CITY _____ STATE _____ ZIP _____

PHONE NUMBER _____

SIGNATURE _____ DATE _____

Scheduled for publication on October 1, 1980. Orders will be fulfilled within 60 days of the publication date or within 60 days of the date of order if received after the publication date.

SECURITY PRODUCTS



Photoelectronic Smoke Detectors

Circle No. 130 on Reader Inquiry Card
ESL's new 500 series is a 4 wire system smoke detector which uses a pulsed infrared LED as its light source, and a high speed photodiode as the sensing ele-

ment. Each unit has one set of Form A contacts for connection to the alarm initiating circuit, and a set of extra Form C contacts for other alarm functions. 500 series detectors are available in 6vdc, 12vdc, 24vdc, and 120vac. The 500 series features solid state photoelectronic circuitry, plug-in head/base assembly, and no radioactive materials. Photoelectronic smoke detectors reportedly provide excellent response to both smoldering and flaming fires at a sensitivity setting that provides a high degree of immunity to nuisance alarms.

Microwave Security System

Circle No. 131 on Reader Inquiry Card
An outdoor microwave security system that reportedly has a coverage zone up to 75 feet long is available from *Racon, Inc.* The new short range Model 13000-



05 includes a transmitter and receiver that can be field adjusted for best detection sensitivity and pattern size. The system is housed within an aluminum case and operation is reportedly not affected by power fluctuations, temperature changes, air motion, sounds nor weather conditions. A built-in standby battery system keeps the 13000-05 operating if primary power fails.

Elevator Security Camera

Circle No. 132 on Reader Inquiry Card
Total viewing of elevators or confined areas is now available from *Visual Methods, Inc.* with the Cyclops 2000 TV System using the new unmodified RCA 2000 camera. 100% viewing of four walls and floor are said to be accomplished by combining a 2/3 inch TV camera with a 100 degree wide field of view lens, in a 10-1/2 inch high, stainless steel lockable enclosure. The RCA 2000 camera reportedly has a 100,000 to 1 light level control and 600 line resolution. Included in the viewing area of the Cyclops 2000 TV System are all walls and doors, the corner directly below the camera, plus a six foot man at the far end of the elevator. The lockable stainless steel housing is only 5 inches from

Fall '80 TEST EQUIPMENT Electronic Component Catalog

FREE 128 Page Book

We carry the Following:

TEST EQUIPMENT

- B & K
- LEADER
- VIZ
- BECKMAN
- HITACHI
- GLOBAL SPECIALTIES
- DATA PRECISION
- HICKOK

ELECTRONIC COMPONENTS

- JAPANESE & MOTOROLA Transistors
- IC's, FET, Diodes
- Capacitors
- Resistors
- Connectors, Cables

TOOLS

- Weller, Ungar, Xcellite, Vaco, etc.



- Over 10 million components in stock to serve you
- Over 20,000 sq. ft. of warehouse in the East & West
- NO MINIMUM/NO SHIPPING on orders over \$100



FUJI-SVEA®
P.O. Box 40325 Cincinnati OH 45240
Dept. ETD

CALL TOLL FREE
800-421-2841
Local: 513-874-0220
Telex: 182 392

Name _____ Phone _____
Company _____
Address _____
City _____ State _____ Zip _____

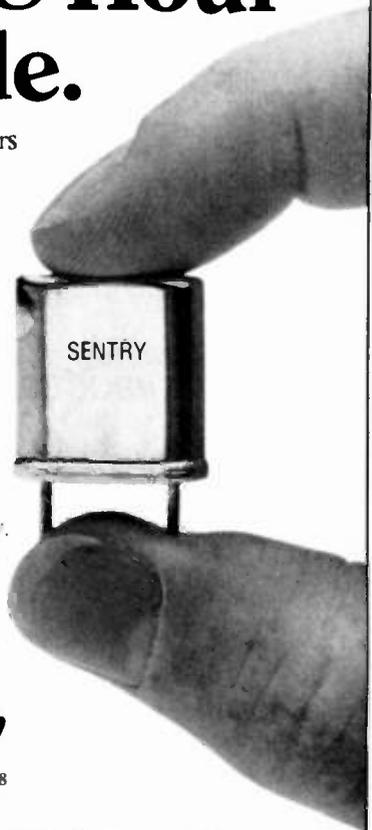
Circle No. 113 on Reader Inquiry Card

The 48 Hour Miracle.

From our hands to yours in record time. Like two days or less.* But there's more to the miracle than Emergency Service and Guaranteed Shipment.

Sentry produces the highest quality crystal made. Anywhere. Each crystal is a work of art, made from the finest raw materials, utilizing state-of-the-art technology.

Put a miracle in your hands. Just call Sentry's toll free number, 1-800-654-8850.



Sentry

Crystal Park, Chickasha, Oklahoma 73018

*Available on some models. Please verify delivery times at point of order.

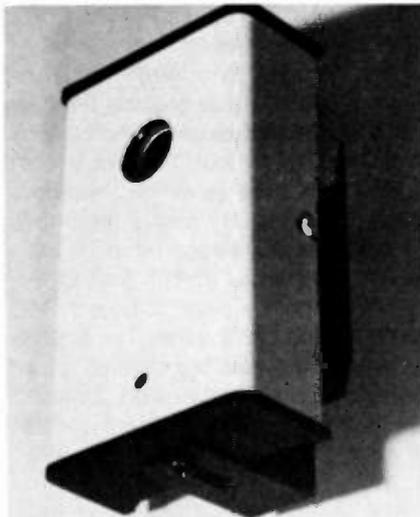
Circle No. 114 on Reader Inquiry Card



the side wall and can be modified with wood grained material to match individual building decors. The Cyclops reportedly meets fire regulations since it can be installed without disturbing existing fire walls. A label "Warning Area Protected By Television" on the housing conforms with the Right to Privacy Act. In operation, a person entering a lobby looks at a TV monitor in the lobby and sees a picture of the interior of the elevator from the elevator mounted Cyclops system. Depending on the monitor scene, the person has the option of taking the elevator or not. Additional elevator passenger protection is obtained by others waiting for the elevator or the doorman.

Passive Infrared Intrusion Sensors

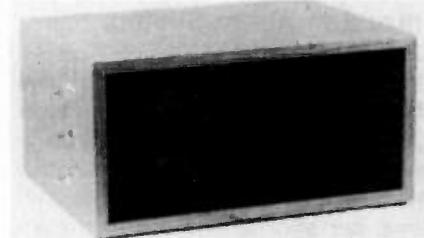
Circle No. 133 on Reader Inquiry Card
Colorado Electro-Optics, Inc. has introduced two passive infrared intrusion sensors. The Model IP-25, which reportedly protects an area approximately 35 feet long and 25 feet wide, is used where wide-area surveillance is re-



quired. The Model IP-50 is said to provide a detection pattern which is about 50 feet long and 20 feet wide. It is particularly suited for installation in halls and corridors. The IP-25 and IP-50 intrusion sensors are identical in outside size and appearance. Each is mounted on a bracket that attaches to a wall surface. Designed for industrial and commercial security applications, each unit has a metal base-plate, and a germanium lens to help protect the IR detector cell from abuse and vandalism. In operation, the infrared sensor detects rapid changes in infrared (heat) radiation that occur within its field of view. Such changes occur when a person, or an object, with a body temperature different from the surrounding area, enters the protected area. Because the passive IR detectors do not transmit any energy or radiation, they are harmless to pets and humans. For the same reason, they cannot interfere with each other when multiple units are installed. Both units are designed to operate from a dc power source within a range of 6 to 18 volts.

Sound Discriminator

Circle No. 134 on Reader Inquiry Card
MRL, Inc. has added a new feature to its Sound-Alert sound discriminator burglar deterrent system. Model #1100 has second act noise activation. When first break-in sound occurs, lights only are turned on. Unit begins to listen again after 3 to 4 seconds and for whatever time the cycle time is set; if second break-in sound occurs during this time, unit turns on noise and, if desired, ac-

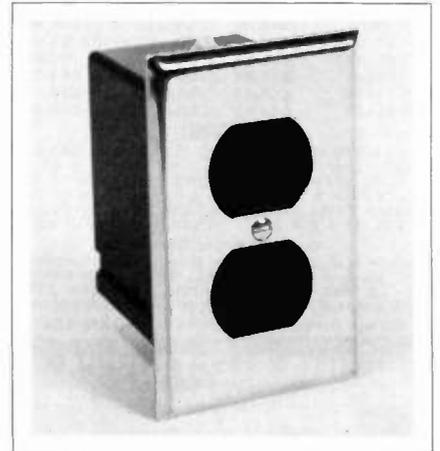


tivates a dialer to call neighbors, another number, police, etc. A second act pilot light comes on and stays on until turned off, if second act action occurs. If there is no second act, unit re-arms for regular protection. Sound-Alert is sensitive to hostile noises but reportedly does not alarm to ordinary noises outside or inside. Model #1100 comes in speaker type cabinet and requires no installation and has sensitivity adjustment and alarm duration control with provision for standby power and 900 watts of power for additional accessories. Sound-Alert comes with an unconditional one year service guarantee. Has switches on side

for activation of unit and horn and switched receptacles.

Photoelectric Systems

Circle No. 135 on Reader Inquiry Card
 The Series S1900 REE-TransmitterTM from *Arrowhead Enterprises, Inc.* employs a special retransmit circuit in its transmitter to which a two or four-wire conventional protective loop, monitoring other sensors, can be connected. An open or short in this protective loop causes the transmitter to cease transmitting, thereby forcing the corresponding receiver to go into alarm condition



reportedly as far as 150 feet away. The pulsed infra-red beam thus serves as an alternative to a supervised protective circuit, where the running of wires is difficult or impossible, and at the same time reduces or eliminates the cost of long protective loop wiring. Other features of the Series S1900 are, loop in-



AC LINE—WATTMETER-VOLTMETER-AMMETER
 True RMS power readings with complex waveforms. Unity to zero power factor. Self contained models to 280VAC, 3,000 watts, 30 AMPS. Higher ratings with external current and potential transformers. Priced from \$449. For QA, Engineering, and production testing of:
 Instruments
 Power Supplies
 Motors
 Appliances
 Communications
 Computer Products
 Pumps
 Shop Equipment
 AC Valves
 Many others
DIEGO SYSTEMS
 6992 Convooy Ct., San Diego, CA 92111
 714-292-0282

Circle No. 115 on Reader Inquiry Card
 ET/D - February 1981 / 49

OPTIMA VALUE SALE

TO ORDER CALL TOLL FREE 1-800-327-0224

G. E., SYLVANIA, ZENITH 75% Off LIST NEW-BOXED

<input type="checkbox"/> 3A3	5 for \$10.81	<input type="checkbox"/> 6HV5	5 for \$23.81
<input type="checkbox"/> 6BK4	5 for \$20.00	<input type="checkbox"/> 6JE6	5 for \$22.50
<input type="checkbox"/> 6CJ3	5 for \$10.06	<input type="checkbox"/> 6LB6	5 for \$21.83
<input type="checkbox"/> 6FQ7	5 for \$ 8.13	<input type="checkbox"/> 6LF6	5 for \$21.50
<input type="checkbox"/> 6GF7	5 for \$14.25	<input type="checkbox"/> 17JZ8	5 for \$11.80
<input type="checkbox"/> 6GH8	5 for \$ 8.50	<input type="checkbox"/> 38HE7	5 for \$18.69

All Tubes Not Advertised. Write In at 75% off list. Sleeves Only. Singles 72% off list.

TRANSISTORS & I.C.'s . . . MIN. 5

<input type="checkbox"/> 2SC1172 Toshiba	\$2.20	3 Year Guarantee	
<input type="checkbox"/> 2SC867A Sony	\$3.95	<input type="checkbox"/> 2SC1172B	\$1.95
<input type="checkbox"/> TA7222 Toshiba	\$1.50	<input type="checkbox"/> 2SC1308K	\$1.95
<input type="checkbox"/> TA7204P Toshiba	\$1.00	<input type="checkbox"/> 2SC1358A	\$1.95
<input type="checkbox"/> TA7205P Toshiba	\$1.00	<input type="checkbox"/> 165	\$1.95
<input type="checkbox"/> 1166 BA521	\$1.25	<input type="checkbox"/> 298	\$1.95

REPLACEMENT FOR ECG

<input type="checkbox"/> 130	\$.75	<input type="checkbox"/> 196	\$.59	<input type="checkbox"/> 791	\$1.50
<input type="checkbox"/> 152	\$.49	<input type="checkbox"/> 197	\$.59	<input type="checkbox"/> 792	\$1.50
<input type="checkbox"/> 153	\$.49	<input type="checkbox"/> 230	\$2.84	<input type="checkbox"/> 793	\$2.00
<input type="checkbox"/> 171	\$.59	<input type="checkbox"/> 291	\$.69	<input type="checkbox"/> 819	\$1.50
<input type="checkbox"/> 182	\$1.50	<input type="checkbox"/> 292	\$.69	<input type="checkbox"/> 822	\$2.00
<input type="checkbox"/> 183	\$1.50	<input type="checkbox"/> 329	\$1.60	<input type="checkbox"/> 820	\$2.00
<input type="checkbox"/> 186	\$.65	<input type="checkbox"/> 712	\$1.00	<input type="checkbox"/> 1167	\$1.95
<input type="checkbox"/> 195A	\$.75	<input type="checkbox"/> 731	\$1.00		

ZENITH, RCA & SYLVANIA MODULES

<input type="checkbox"/> 9-92	\$ 8.95	<input type="checkbox"/> 145256	\$11.56
<input type="checkbox"/> 9-147	\$10.50	<input type="checkbox"/> 145262	\$18.95
<input type="checkbox"/> 150-190	\$12.95	Rep. ECG500A	\$9.95
<input type="checkbox"/> 138697	\$13.23	ECG523	\$9.95
<input type="checkbox"/> 139546	\$17.36	32-39202-3	\$14.95
<input type="checkbox"/> 141154	\$19.60	32-43068-1	\$14.95
<input type="checkbox"/> 141427	\$19.53	32-41658-3	\$14.95

GENERAL

<input type="checkbox"/> VEH070 VIDEO HEAD	\$49.95
<input type="checkbox"/> 2 1/2 Amp 1000 PIV	100 for \$ 8.00
<input type="checkbox"/> 15 ft. STEREO HEADPHONE Ext. 10	for \$4.90
<input type="checkbox"/> STEREO Y ADAPTER 1/4"	10 for \$4.90
<input type="checkbox"/> Color Focus Rectifiers 6.5KV	10 for \$7.50
<input type="checkbox"/> 8 ft. 59U F-F 79c	10 ft. 59U F-F 89c

Quantity Prices Available.

Letters of credit and all checks placed on deposit with Bank of Hallandale, FL. VISA/Bank Americard & Master Charge accepted. Min. order \$75 FOB Dania, FL. Catalog \$3, refundable upon order.

SEND CHECK OR MONEY ORDER TO:

OPTIMA ELECTRONICS

2022 Tigertail Blvd., Dania, FL 33004

Phone (305) 920-3550

TOLL FREE 1-800-327-0224

Circle No. 139 on Reader Inquiry Card

Quietrole

The Original...

A First in the industry, with over thirty years of use by satisfied customers.



Spray Pack Mark II gets into places of close tolerance and washes out the dirt, leaving a thin film of lubricant which lasts indefinitely, with zero effect upon current capacity and resistance.

Spray Pack Mark II has been tested and proven in the Space Age and is still the finest lubri-cleaner available. It is quick, safe, effective - a MUST for every tool caddy.

Available from LEADING jobbers.



Circle No. 116 on Reader Inquiry Card

50 / ETID - February 1981

indicator on the transmitter lights up when the protective loop is open or has a short, and a choice of 12vac or 12vdc models for best system design. The Series S1900 uses standard single gang, chrome plated faceplates.

Alert Unit

Circle No. 136 on Reader Inquiry Card

The Ademco No. 800LR Assist Alert permits a request for assistance to be initiated from various locations in a home and automatically transmitted over the standard telephone line to a central monitoring station. It is packaged in a wood grained table top cabinet. The heart of the unit is a No. 669 Digital

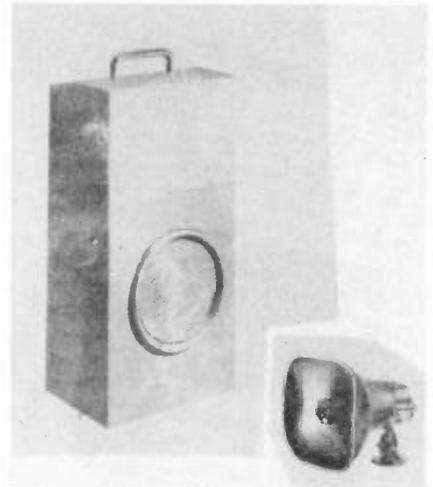


Communicator which can be actuated either by "hard wired" emergency switches (such as Ademco No. 219) or "wireless" panic buttons or transmitters such as Ademco Nos. 1692, 1691, or 1693. A built-in sander audibly alerts the user that the Assist Alert has been activated. Rechargeable standby power supply powers both the digital dialer and optional wireless receiver (No. 1690) and reportedly can provide up to 60 hrs. standby power.

Intrusion Alarm System

Circle No. 137 on Reader Inquiry Card

Alarm Systems and Devices announces the ASD 2100 Teletale Portable Motion Detection System. The device contains everything necessary to not only sense the motion of an intruder in a protected area, but also generates a loud electronic warble alarm (warble alarm power is stated to be total 70w rms) to eject the intruder. The ASD 2100 operates with the same patented low frequency sound emitting feature and electronics as the Model 2001 Teletale which has been used for many years. Unlike the WDS 2001, the Portable system incorporates complete circuitry in one self-contained unit. The system does not require remote devices but will accept up to seven additional remote sensors (WDS 1007) if necessary. The main unit reportedly will cover 1600 to 3600 square feet (depending upon acoustics) and additional sensors will cover approxi-



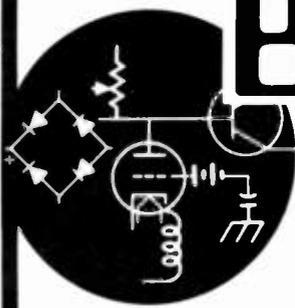
mately 500 to 1200 square feet each. Remote sensors also transmit a loud electronic alarm signal if required. The ASD 2100 contains 3 gel type electrolyte, 6 volt, 7.5 ampere hour batteries which are said to provide auxiliary power for over four days. The ASD 2100 is protected by a built-in tamper loop, which causes an automatic alarm to alert the owner should anyone try to tamper with the unit by cutting wires, etc. Door contacts, other motion sensors, etc. can be connected as inputs to trigger an alarm or floodlights, telephone dialers or remote sirens can be connected as auxiliary outputs for local or central station applications. Also included is a 90 second exit delay and a variable (10 to 40 second) entrance delay. A remote arming key switch is available for disarming the unit (the tone remains on until off at the unit). Controls include an on/off key switch, on/off entrance delay switch, a variable entrance delay time switch, a sensitivity control switch and a warble volume control. A battery condition indicator (LED) indicates when the unit's batteries are 90% charged, and a pilot light on the front of the unit monitors ac power.

Electronic Siren Driver

Circle No. 138 on Reader Inquiry Card

Alarm Supply Company, Inc. announces its new dual channel 2402 siren driver. Manufacturers specifications state that up to four, 30 watt 8 ohm speakers can be driven to their near maximum capacity using the much higher current provided by the 24 volt plug-in transformer (Q-10). Standby requirement power is said to be only 100 ma @ 12vdc per speaker. The 2402 is fused, and provides two variable potentiometers for rate and tone adjustments. Burglary channel is warble; fire channel is steady. The unit measures 4" x 2" x 2". **ETD**

ELECTRONICS BOOK CLUB



Take 6 great books for **\$2⁹⁵**
(values to \$100.70)

Start saving now with discounts up to 75% on hundreds of interesting, info-packed volumes . . . PLUS special Members' Bonus Benefits!



1203 List \$14.95



1123 List \$9.95



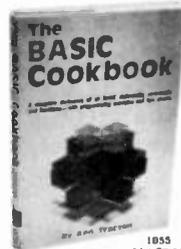
1201 List \$15.95



1187 List \$14.95



1241 List \$12.95



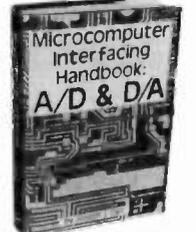
1055 List \$7.95



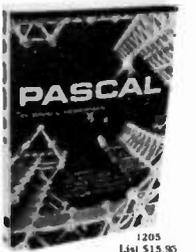
1250 List \$16.95



1236 List \$14.95



1271 List \$14.95



1205 List \$15.95



1243 List \$13.95



1169 List \$15.95



1199 List \$15.95

More fine books to pick from . . .

- Master Handbook of Electronic Tables & Formulas—3rd Edition. List \$14.95. No. 1225
- Display Electronics. List \$9.95. No. 861
- Towers' International OpAmp Linear-IC Selector. List \$12.95 (vinyl). No. 1216
- Master Handbook of 1001 Practical Electronic Circuits. List \$15.95. No. 800
- Programs in BASIC for Electronic Engineers, Technicians & Experimenters. List \$8.95. No. 1095
- The Power Supply Handbook. List \$15.95. No. 806
- All About Telephones. List \$8.95. No. 1097
- Practical Electronics Math. List \$15.95. No. 1136



1133 List \$9.95



1076 List \$12.95



1066 List \$19.95



Join now, and get a 1981 Electronics Projects Calendar . . . FREE!! (List \$4.95)

7 very good reasons to try Electronics Book Club . . .

- **Reduced Member Prices.** Save up to 75% on books sure to increase your know-how
- **Satisfaction Guaranteed.** All books returnable within 10 days without obligation
- **Club News Bulletins.** All about current selections—mains, alternates, extras—plus bonus offers. Comes 13 times a year with dozens of up-to-the-minute titles you can pick from
- **"Automatic Order"**. Do nothing, and the Main selection will be shipped to you automatically! But . . . if you want an Alternate selection—or no books at all—we'll follow the instructions you give on the reply form provided with every News Bulletin
- **Continuing Benefits.** Get a Dividend Certificate with every book purchased after fulfilling Membership obligation, and qualify for discounts on many other volumes
- **Bonus Specials.** Take advantage of sales, events, and added-value promotions
- **Exceptional Quality.** All books are first-rate publisher's editions, filled with useful, up-to-the-minute info

ELECTRONICS BOOK CLUB Blue Ridge Summit, PA 17214

Please accept my Membership in Electronics Book Club and send the 6 volumes circled below, plus a free copy of 1981 Electronics Project Calendar. I understand the cost of the books selected is \$2.95 (plus shipping/handling). If not satisfied, I may return the books within ten days without obligation and have my Membership cancelled. I agree to purchase 4 or more books at reduced Club prices during the next 12 months, and may resign any time thereafter.

800 806 861 1055 1066 1076 1095 1097
1123 1133 1136 1169 1187 1199 1201 1203
1205 1216 1225 1236 1241 1243 1250 1271

Name _____ Phone _____

Address _____

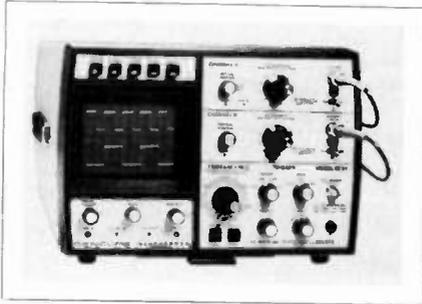
City _____

State _____ Zip _____

(Valid for new members only. Foreign and Canada add 15%).

ETD-281

NEW PRODUCTS



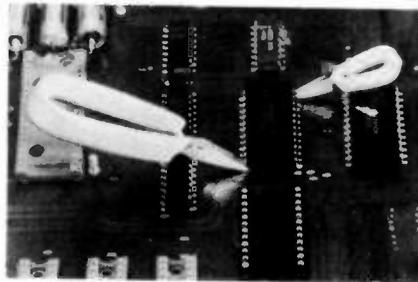
60MHz Oscilloscope

Circle No. 140 on Reader Inquiry Card
The new SC60 "Widebender" dual-trace oscilloscope has been introduced by Sencore. A new development in the triggering circuits is said to provide solid waveforms on hard to hold digital signals, even under the most adverse conditions. The use of ECL (Emitter Coupled Logic) and differential amplifiers throughout the triggering circuits reportedly produces solid sync, with as little as one centimeter of signal, through all settings of the timebase switch. The

SC60 "Widebender" oscilloscope (with 60MHz bandwidth, useable to 100MHz) is said to cover virtually all digital logic families in use today. The SC60's features include a six nanosecond risetime, a post deflected CRT, reported sensitivity of 5 millivolts per centimeter on both channels, measurement capability up to 1600 volts peak-to-peak, and protection to 2000 volts. Delayed signal trace permits viewing the leading edge of waveforms on both channels. You can add, subtract, or view the two input channels separately with the SC60. The SC60 features 5MHz vector (X-Y) response (at 3° phase shift or less). Front panel design features include large sized control knobs and pushbuttons, eliminating unnecessary bumping of adjacent knobs or controls. The price of the SC60 is \$1,695 and is sold with Sencore's 30-day "Proof of Performance" guarantee and backed by Sencore's 100% Made Right Lifetime Guarantee.

Heat Sink Clamps

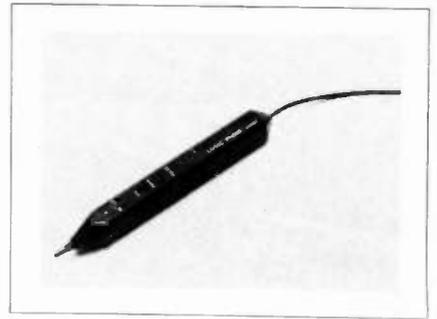
Circle No. 141 on Reader Inquiry Card
Desco Industries, Inc. has announced the development of six new heat sink clamps made of beryllium copper for hand soldering operations. The parallel jaw construction can hold various shaped component leads. Two sizes are available with overall lengths of 1-1/2 in. and 2-1/2 in. The tools are available in solid Beryllium copper with a plastic coating



to resist oxidation, chrome plated for the addition of anti-wetting properties, and chrome plated with a Plastisol coating for both anti-wetting and increased heat dissipation.

600MHz Prescaler

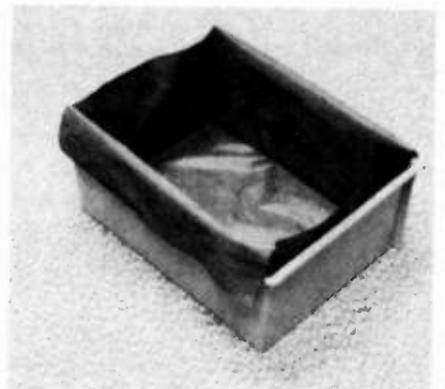
Circle No. 142 on Reader Inquiry Card
Sinclair-Thandar's TP 600 is a prescaler which is said to extend the upper frequency limit of most frequency meters by a factor of 10 times, up to a maximum of at least 600MHz. Input and output are via 50 ohm BNC connectors. Input impedance is nominally 50 ohms and input sensitivity reportedly is better than 10mv from 40MHz to 600MHz. Power



requirements are 6vdc to 9vdc from an external power supply or optional ac adapter. A lead is supplied fitted with the correct connectors to allow the unit to be powered from the auxilliary power socket fitted to Thandar frequency meters. Current consumption is 150ma nominal, 170ma maximum. The Case size of the TP 600 is 4.5" (114 mm) x 1.70" (43 mm) x 1.10" (28 mm) and the weight is 4.3 oz. (120 gms). The price of the TP 600 is \$98.

Electrically Conductive Tote Box Liners

Circle No. 143 on Reader Inquiry Card
Electrically conductive nylon tote box liners, for packaging static sensitive components are being introduced by *Charleswater Products, Inc.* Charleswater CP302L Staffree conductive tote box liners are electrically conductive nonwoven nylon liners that protect CMOS and MOS loaded printed circuit boards and other delicate electronic parts from static electricity. CP302L liners are reusable and eliminate the need for antistatic or conductive tote boxes. They are 5 mils thick and surface resistivity is stated to be less than 30×10^3 ohms/sq. Charleswater CP302L liners reportedly have a tear strength in excess of 3000 gms/mil and a tensile strength in excess of 7500 psi. Standard sizes range from 15 in. x 9 in. x 5 in. to 19 in. x 14 in. x 9 in. Custom sizes may be accommodated. Charleswater CP302L staffree conductive tote box liners are priced from \$2.25 each in lots of 100.



**NO ONE,
BUT NO ONE
SELLS TEST
EQUIPMENT
FOR LESS**

**B&K, CSC, EICO, HITACHI,
LEADER, NLS, BECKMAN,
DATA PRECISION, FLUKE,
HICKOK, SIMPSON, VIZ**

plus a complete line of tubes,
tools and electronic supplies

For pricing . . .

**CALL TOLL FREE
800 645-9518**

N.Y. State call (516) 752-0050

FORDHAM

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

Pick-up Truck Cargo Rack

Circle No. 144 on Reader Inquiry Card
A cargo rack for pick-ups that permits complete access to the bed, and accommodates ladders, long loads, or parts chests is being introduced by *Vanguard Manufacturing Company*. The Vanguard Truck Caddy Model TCR features a locking rear end bar that swings in or out for complete bed access. A ladder



positioner and load stabilizer is built into the overhang while a heavy metal screen protects the cab. Four basic parts bolt together for assembly. Made of structural tubing (50,000 p.s.i. yield strength), the Vanguard Truck Caddy Model TCR reportedly has a load capacity of 1,000 lbs., uniformly distributed. Measuring 12' by 4' H x 70" W, the 180 lb. rack fits most full-size pickups; mini and custom models are available. The Vanguard Truck Caddy Model TCR is priced at \$290.

PC Board Repair Kit

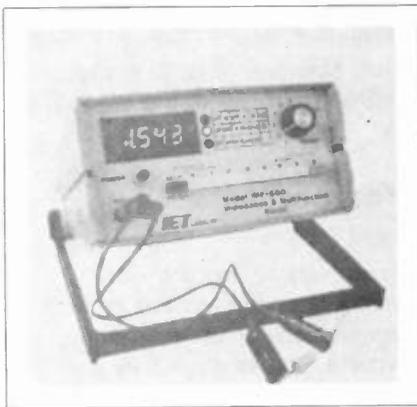
Circle No. 145 on Reader Inquiry Card



Pace, Inc. introduces CIR-KIT™, its new pc board repair kit that repairs and/or replaces lifted, damaged or missing pads or tracks on pc boards. The kit includes a selection of pre-tinned and scored eyelets, abrasive stick, pre-tinned sheets of various pad diameters and track widths, setting tool with base, up-setting tool, and instructions for use.

Digital Impedance and Multifunction Meter

Circle No. 146 on Reader Inquiry Card
IET Labs, Inc., has announced its new impedance and multifunction meter, the IMF-600. The Model IMF-600 measures

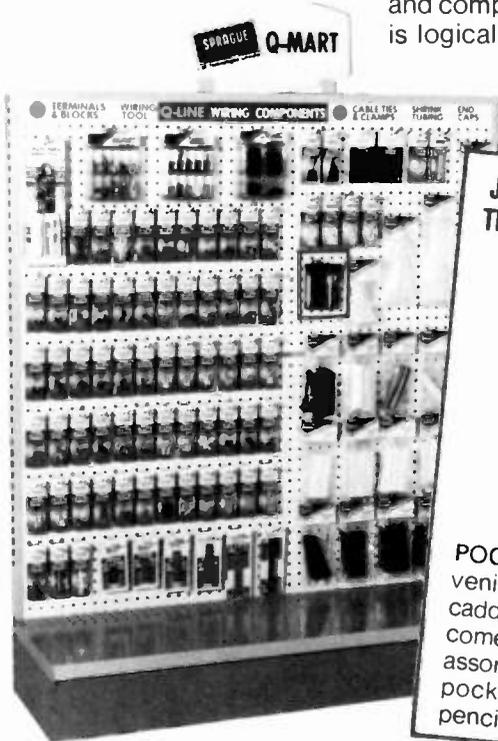


voltage and current (dc or rms), resistance, capacitance, inductance and I/Q

for inductors. The Model IMF-600F has the added capability to measure frequency. Measurements for all functions are displayed on a 3-1/2 digit display with a measurement reading rate said to be 4 measurements per second. The IMF-600 reportedly can handle charged capacitors and active powered devices on all functions and automatically determines the value and quality of any passive component, simple or complex, such as simultaneously measuring a resistor in parallel with a capacitor. The manufacturers specifications indicate accuracy to be .25% for impedance measurement and .1% for multimeter

You'll find MORE in wiring components at a Sprague Q-LINE™ Distributor

Look for the Q-LINE wiring component display. You'll find exactly what you want in solderless terminals and wiring component accessories . . . shrink tubing, cable ties, cable clamps, terminal blocks, butt connectors, bullet connectors, quick-splices, end caps, soldering aids, wiring tools, and component assortments. Everything is logically arranged for quick location.



JUST ONE OF DOZENS OF PRODUCTS
THAT CAN SAVE YOU TIME EVERY DAY.



POCKET TYPAK™: Here's convenience *plus!* Combination tie caddy and pocket saver. One side comes prefilled with 30 ties in 5 assorted colors. Other side is a pocket-saver pouch for pens, pencils, rules, etc.

For detailed information on all Q-LINE products (capacitors, switches, chassis boxes, optoelectronic devices, DIP/SIP components, resistors, wiring components, etc.) write for 40-page Catalog C-652 to Sprague Products Co., Distributors' Division of the Sprague Electric Co., 65 Marshall St., North Adams, Mass. 01247.

Where MORE is more than a promise.



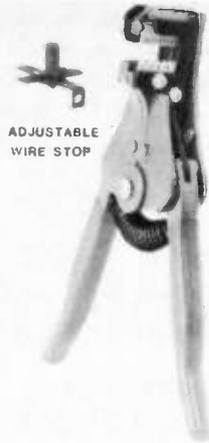
a subsidiary of GK Technologies

Circle No. 118 on Reader Inquiry Card

functions. Autoranging, analog and digital outputs, and a companion comparator unit are optional. All IMF-600 meters are supplied with 4 terminal test leads. The price of the models IMF-600 and IMF-600F are \$695.00 and \$789.00 respectively.

Wire Stripper

Circle No. 148 on Reader Inquiry Card



O.K. Machine and Tool introduces a new manual wire stripper ST-300 with an adjustable stop for consistency in wire strip lengths. The Model ST-300 strips 14 to 22 AWG solid and stranded wire, kynar, vinyl, polyethylene, rubber,

neoprene, and irradiated vinyls. The ST-300 reportedly won't damage or nick wire and can remove up to 3/4 inch of insulation. The price of the ST-300 is \$9.95.

Microprocessors

continued from page 38

interfaces vary all over the lot, depending upon the features in them, the source (high or low volume production), etc. As a rule they cost several hundred dollars for a stock controller....a custom job costs lots more! Since controllers do not wear out like machines, it is sometimes a good deal to buy a used controller, IF it hasn't been "modified," and IF it was originally designed for the use you intend to put it to.

This update summary of mass

memory trends for small systems (MPU) use, is part of ETD's ongoing effort to take the pain out of MPU systems, and enable you to continue an easy self study program. Too often, bits and pieces of study courses do not combine to yield a clear overview of what is happening, why it is happening, what the implications are, and where the trend is going. The study of a subject that is headed towards obsolescence is a pitiful exercise that occurs all too often. Since the student's future depends upon a clear overview, it is essential to seek out the overview during the study of the subject. This is particularly true in a fast changing field, such as the MPU, where the overview must be updated at fairly close intervals. **ETD**

***When Eileen Frischman
isn't on a horse,
she's in a wheelchair.***

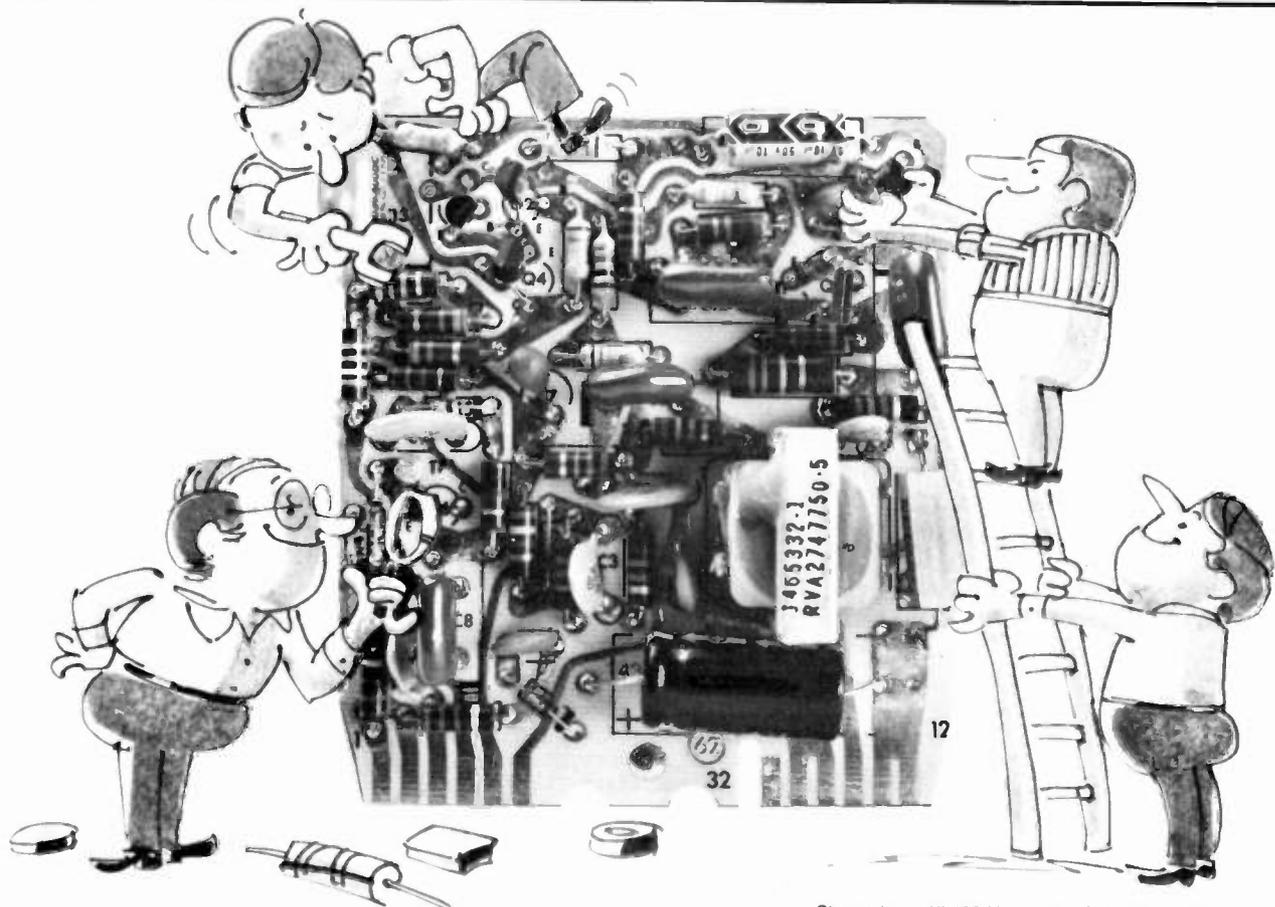
President's Committee on
Employment of the Handicapped
Washington, D.C. 20210

1981. The International Year of Disabled Persons.

ANSWERS TO ELECTRONICS QUIZ

- | | | | | |
|-------|--------|--------|--------|--------|
| 1. a. | 6. a. | 11. b | 16. d. | 21. d. |
| 2. b. | 7. d. | 12. c. | 17. b. | 22. c. |
| 3. c. | 8. a. | 13. d. | 18. a. | 23. b. |
| 4. a. | 9. d. | 14. a. | 19. c. | 24. d. |
| 5. b. | 10. c. | 15. c. | 20. a. | 25. c. |

19 correct is passing. If you missed more than 6 perhaps you should think about a review of your electronic fundamentals.



Shown here: XL100 Horizontal Color TV Module

Analyzing Techniques

continued from page 43

and injected this test signal at the base of the 3rd IF transistor, Q104. This is our test point C on the IF circuit schematic. The set's screen now indicated the lines, streaks and the unstable picture. Thus, the fault must now be between test point B and C. When the 3rd IF transistor was cooled down with freon, the picture returned to normal, but would act-up again in about 5 minutes. When a new 121-526 transistor was installed the set's problem was solved. In about 5 steps and 20 minutes of troubleshooting time, the job was completed.

A sound problem

A TV receiver with distorted sound would be checked out by Functional Analysis as follows:

If the picture is good the most likely stages for audio problems are the 4.5MHz sound detector, the 4.5MHz tuned IF circuit, the audio detector, and the audio amplifier stages including speaker.

You should begin troubleshooting by injecting a 1000Hz sinewave test

signal at the audio detector output. This would be our test point A as shown in the (Fig. 5) audio block diagram. If the sound is still distorted, this tells you the problem is somewhere between the audio detector and the output stage. The next step is to divide these circuits in half again.

The output of the volume control is about in the center of the remaining circuits. You now inject the audio test signal at the volume control (very easy to find test point B) and in this case note that the audio is still distorted. You now know that the problem will be found after the volume control.

You now continue to move a step closer to the output stage. Late model TV sets use a single IC for all audio amplification, so you now inject a test signal at the chip output test point C. The distortion is still present which leaves only the speaker to cause the distortion. A new speaker was installed and clear audio reproduction was the result. Thus, you were able to tie down this audio distortion problem in a 1, 2, 3 order, fast.

Functional circuit Analyzing can be broken down to the following points:

Look at the total system as blocks. This procedure is somewhat like using a troubleshooting tree diagram. Do not attempt to track down the defective stage, but confirm which stages are good, first. See which sections are common to each other. Develop a detective type logical system technique for trouble diagnosis. Then zero-in on the defective component after the stage has been pinned down.

Electronics detective work

If you work like a super sleuth, leads or clues can be followed until proven wrong. In a sense detective work as with circuit troubleshooting is a process of elimination. The last lead that is followed and the person that committed the crime or the component that's faulty are located when the case or problem is solved. And as we all well know the last item or clue to be checked leads us to the culprit.

These sleuth techniques call for a look at all small details or clues and for you to be very careful with your observations.

Who knows, you may become a famous electronics detective just as Agatha Christie or Sherlock Holmes are in the classic detective novels. **ETD**

RCA remanufactured modules are as good as new, or even better.

You can be sure you're using a product of the highest quality when you install RCA remanufactured modules.

Each dud module returned to RCA is critically inspected. Those that don't meet factory standards for remanufacturing are scrapped. Accepted units are then cleaned and repaired. If any engineering improvements have been made in the module design, they are incorporated, where feasible, to make sure the module meets or exceeds original specifications for performance and reliability.

Included in RCA's rigid remanufacturing process are all IF and chroma sweep alignment adjustments, and setting of all circuitboard pots. Other tests include extreme temperature cycling of all modules, and vibration testing of selected types to disclose intermittent problems.

Finally, the modules are sample-tested by RCA Quality Control Engineering. If only a single module

fails to meet the original manufacturing specifications for performance, the entire lot is rejected.

In many cases, an RCA module can replace one or more earlier versions because it is designed to be compatible in older applications. This RCA design-improvement policy minimizes the number of types you need for servicing, reduces the amount of your investment, and improves instrument performance. The remanufactured module shown here, for example, can be used in place of five different modules.

RCA's remanufacturing process assures you of the most dependable replacement modules you can buy. You can be sure they are as good as new — or even better.

RCA Distributor and
Special Products Division

CLASSIFIED

RATES: 50 cents per word (minimum charge, \$15). Bold face word or words in all capital letters charged at 65 cents per word. Boxed or display ads charged at \$60 per column inch (one inch minimum). Agency commissions will be given only when camera-ready art is provided by agency. For ads using blind box number, add \$5 to total cost of ad. Send ad copy with payment to Dawn Anderson, ELECTRONIC TECHNICIAN/DEALER, 1 East First Street, Duluth, MN 55802.

BOX NUMBER REPLIES: Mail box number replies to: ELECTRONIC TECHNICIAN/DEALER, Classified Ad Department, 120 W. 2nd St., Duluth, MN 55802. Please include box number in address.

BUSINESS OPPORTUNITIES

MECHANICALLY INCLINED INDIVIDUALS Assemble electronic devices in your home. Knowledge or experience not necessary. Get started in spare time. Above average profits. \$300-\$600/wk. possible. Sales handled by others. No investment—Write for free details. ELECTRONIC DEVELOPMENT LAB, Box 1560B, Pinellas Park, FL 33565. TF

Established television repair shop in Omaha, Nebraska, for sale with large inventory of parts. Many regular customers. Grosses \$175,000. Located in small busy shopping center. Contact owner at 9709 Elliston, Omaha, Nebraska 68134, or call 1-402-571-0806 for information. 2/81

YOUR OWN Newspaper humor 'Column' carries YOUR byline, your photograph, your tie-in. Wows folks, brings business, makes you a celebrity. Inexpensive, effective PR. Details free. Simon Co., 1280-ETD Sawmill, Yonkers, NY 10710.

Extremely successful TV repair business in Ft. Lauderdale. Running over 50 calls weekly plus walk-in low overhead. Van & inventory & electronic equipment. Over 5000 customers, lots of repeat business. Call 305-587-5825 nights. 3/81

SOUTHERN NEW HAMPSHIRE

Complete TV retail and service center with 6 room home, in-grd. pool plus Quasar/Sylvania Dealer. Prime hi-traffic location in rapid growth area. NO state sales or income tax. No competition. Turnkey operation. Excellent business climate. \$155,000. Call or write:

Hal Warner, Warner Associates, Realtors, P.O. Box 3, Amherst, NH 03031 603-673-7000

Florida's Sun Coast. TV sales & service. New Showroom attached to modern 2 bedroom home in nice area. Plus separate rental house. \$90,000. For details call 1-813-541-2039. Or write shop owner: 7744 46 Ave., St. Petersburg, Fla. 33709

FOR SALE

For Sale,, Sencore VA-48 Analyzer and a B & K 1474 Dual Trace Oscilloscope. High Bridge, NJ 08829. Call (201) 638-8025. After 6pm.

DECODER KIT, TV, (sine wave encoder system) Los Angeles chan. 52, Chicago chan. 44, Detroit chan. 20, Florida chan. 50, etc. Latest model, complete kit \$139. Distributors wanted, quantity discounts. Catalog free. Write Simple Simon Electronic Kits, Div.-Les Gaskell Enterprises, 11852 S. Hawthorne Blvd., Hawthorne, CA 90250. Tel. (213) 675-2335.

"SUPREME" Diagram Manuals, Radio-Television, useful 15 volumes, \$56.00 value, special only \$19.95! Beltman, 1760 Balsam, Highland Park, IL 60035. 2/81

RESISTORS ¼ watt 5% carbon film factory fresh \$1.65 per hundred, \$12.00 per thousand. Integrated circuits 4116 dynamic RAM 8 for \$30.00, 2716 \$11.00, 2732 \$29.50, IC sockets, capacitors, trim pots, and more. Free catalog. WESTLAND ELECTRONICS, 34245 Ford Rd., Westland, MI 48185. Phone orders welcome. (313) 728-0650.

SAM'S 221-470 COMPLETE. ANY REASONABLE OFFER - INCLUDE POSTAGE. DELMAN T.V., 651 E. PARK AVE. LONG BEACH, NY 11561. 2/81

Automobile radio and tape replacement parts: Delco, Chrysler, Philco-Ford, Motorola, Panasonic and many others. Large inventory. Laran Electronics Inc. 3768 Boston Road, Bronx, NY 10469 (212) 881-9600 out of New York state (800) 223-8314. TF

MICRO WAVE SYSTEM, RECEIVE UNEDITED MOVIES, SUPER SPORTS, LAS VEGAS SHOWS, ETC. COMPLETE INCLUDING CABLE SWITCH \$225.00. 212-436-0673. 4/81

SONY-PANASONIC-RCA-ZENITH-EXACT REPLACEMENT PARTS-LARGE INVENTORIES-SEND PART OR MODEL NUMBERS-WILL UPS OR COD-GREEN TELE RADIO DISTRIBUTORS, 172 SUNRISE HIGHWAY, ROCKVILLE CENTRE, N.Y. 11570. TF

WHOLESALE ELECTRONICS — Factory Direct Prices — New parts and electronic merchandise. 'Wholesale' catalogs, pricing, and monthly specials for 6 months only \$7.50 or \$10. for a full year! INCREDIBLE ELECTRONICS CO., Box 117, Troy, N.Y. 12180 — (518) 272-0300.

SUPER-WINTER-SPECIALS. FULL SIZED-3 SPEED-CERAMIC-CARTRIDGE BSR CHANGER WITH BASE COVER AND CABLES. INDIVIDUALLY BOXED—\$31.95. WHILE THEY LAST!!! 100 LOT ONLY NONPOL CHEATER CORD & POL CHEATER CORD WITH CLIP \$55 PER 100. MICROWAVE HOME BOX OFFICE UNITS WITH OUTSIDE ANTENNA, COMPLETE, FULL WARRANTY—\$149. REDCOAT ELECTRONICS, 66-15 THORNTON PLACE, FOREST HILLS, NY 11374. 212-261-9479.

WHOLESALE TV PARTS—transistors (TM/PTC/ECG) Thordson Yokes & Flies; Resistors; Capacitors; Triplers; Tools; Tubes 72% off; Sams 5.95; Video Tapes. Video Movies bought, sold, rented. Send for free catalog. Astro Electronics, Old Grand Union Shopping Ctr., Rt. 9W, Stony Point N.Y. 10980. 914-942-2173. 3/81



39⁹⁵
ADD \$2.50 FOR POSTAGE

30 CHANNEL CABLE TV CONVERTER

FREE!
UNUSUAL 96 PAGE ELECTRONIC PARTS & IDEAS CATALOG!

ORDER No. 182AE047
ETCO ROUTE 9N.
PLATTSBURGH, N.Y. 12901
Tel.: (618) 561-8700

SAMS Photofacts #300-600, \$300.00; B & K Model 415-Sweep, Marker Gen., \$200.00; RCA Voltohmysts, Model WV97A and Model WV77A \$30.00 ea. Louis Sventona, Fastronic Service Inc., 321 Portson Road, Lake Ronkonkoma, NY 11779. Phone 516-588-4855.

ALARM SUPPLY COMPANY

It's easy to order from Alarm Supply. The one source for over 3000 WHOLESALE SECURITY PRODUCTS from more than 100 manufacturers—
DETROIT—CHICAGO—ATLANTA
12551 Globe Road Livonia, MI 48150
(313) 591-9100 (800) 521-6100

TV AND RADIO TUBES 49¢ EA!! Send for free color parts catalog. Your order free if not shipped in 24 hours. Cornell Electronics 4215-17 University San Diego California 92105. TF

TV TROUBLE ANALYSIS TIPS. Over 300 symptoms/remedies by circuit area. Tough ones I found in years of servicing. e.g. Poor sync-C66 shorted-Wards-GEN-12349A-SAMS 995-2. Save time and money. Due to demand, send only \$12.50 to CHAN TV, 8151 Grandview Rd., Chanhassen, MN 55317.

SATELLITE TELEVISION — movies, sports, etc. Build or buy your own earth station. Article gives alot of hard-to-find, necessary information. Send \$4.00 for article to Satellite Television, R. D. 3, Box 140, Oxford, NY 13830.

SCRAMBLED-TV WHAT IT IS-HOW IT WORKS. New publication explains how the two encoding/decoding systems used today work. Theory, circuits, etc. Send \$9.95 to: Workshop, Box 393ETG, Bethpage NY 11714 TF

BSR full size deluxe changer \$28. BSR changer with base & cover & cables \$32. Original boxed ECG 523 only \$15.95. Speaker cabinets open back with feet worth \$25. only \$10. a pair. J. Tauber, Redcoat Electronics, 66-15 Thornton Pl., Forest Hills, NY 11374. Tele. 212-261-9479.

RAMPART SECURITY SYSTEMS DEALERS' sales are booming. The Rampart Dealer Program offers ENORMOUS PROFIT POTENTIAL PLUS EXCITING RESIDUAL INCOME. Our success and reputation are a result of a total business format approach for the residential, small commercial market. Product, marketing and management training with complete backup has made success a reality for over 50 dealers. If you qualify, it can do the same for you. Investment only \$12,500, backed by inventory. No experience necessary, just a strong desire to succeed. Call Franchise Director collect (215) 752-2210 or write RAMPART INDUSTRIES, INC., 1 Oxford Valley, Suite 317, Langhorne, PA 19047.

4 one CAPACITANCE METER 1pF to 999K μ F
 in FREQUENCY COUNTER 35MHz
 kit SQUARE WAVE GEN. 1Hz to 99KHz—
 OHMMETER—3.58MHz Xtal—Regulated PS—Five
 8" Readouts—Low cost TTL Circuits—Automatic
 Decimal Placement—Be **AMAZED**—Build it for
 \$50 or less. Purchase the plans, etched P.C.
 board 4-3/4" by 6-3/4" and front panel decal
 for \$15.29! **BAGNALL ELECTRONICS, Refund**
 179 May Street, Fairfield, Conn. 06430 **any kit!**

TUBES—Receiving, Industrial and Semi-conductors, factory boxed. Free price list. Low, low prices. **TRANSELETRONIC INC.** 1365-39th Street, Brooklyn, N.Y. 11218E 800-221-5802, 212-633-2800.

FOR SALE: Sams, Television Test Equipment, Sylvania Color Jig, Tubes and Modules, Misc. Antique Tubes. Write for itemized list. Telecom TR, 412 10th St. Box E, Gothenburg, Ne. 69138, (308) 537-2552.

Go-No-Go Transistor Tester \$16.95 Test Probe Housing with test tip \$6.95. 2 channel wire tracer \$45.95. Send for free catalog quantity discount, dealership. King Electronics, Inc. 600 Tremont St., Boston, MA 02118. 7/81

PICTURE TUBE REBUILDING EQUIPMENT capable of producing four high quality tubes per day (**WILL TRAIN TO OPERATE**) \$4600.00 Call or Write Atoll Television, 6425 Irving Park, Chicago, Illinois 60634. ph. 312-545-6667.

PASS FCC EXAMS

The Original FCC Tests—Answers exam manual that prepares you at home for FCC First and Second class Radiotelephone licenses. Newly revised multiple choice exams cover all areas tested on the actual FCC exam. Plus "Self Study Ability Test" Proven! \$9.95 postpaid. Moneyback Guarantee.



COMMAND PRODUCTIONS
Radio Engineering Division

P.O. Box 26348 W
San Francisco, CA 94126

"Howard Sam's Potofacts # 1-1822 \$3,200 at no extra charge. 15 Sam's file cabinets, 1 full suspension 4 drawer cabinet, many other schematics, service manuals, etc. from various manufacturers. George Pappas, 8000-19th Ave. N.W., Bradenton, FL 33529. 813/792-8631.

Complete picture tube rebuilding equipment. Never used. Write or call Electronics Repair, 616 Grand St., Brooklyn NY 11211. Phone (212) 387-2744.

ELECTRONIC BARGAINS, CLOSEOUTS, SURPLUS! Parts, equipment, stereo, industrial, educational. Amazing values! Fascinating items unavailable in stores or catalogs anywhere. Unusual **FREE** catalog. ETCO-013, Box 762, Plattsburgh, NY 12901. TF

FOR RENT

GOLDCOAST COMPUTER RENTAL CLUB. Has thousands of programs free. Also TV management programs for the Apple Family and the TRS 80 Model II. For free details send (SAE) to; Box 181, Bremen, KY 42325.

SCHEMATICS — LIBRARY SERVICE. 30 day rental fee \$2.00. Application fee for library card \$10.00 **All RIDERS** manuals and **SAMS** available for your use. Send application and order to: **THE TV SHOP**, 530 Minnesota Ave., Fallbrook, California 92028 (Telephone 1-714-723-1302).

WANTED

WANTED: PICTURE TUBE REBUILDING EQUIPMENT working or not. Write or call Atoll Television, 6425 Irving Park, Chicago, Illinois 60634. Phone 312-545-6667.

"I'M SAVING 15¢ ON EVERY GALLON OF GAS I BUY."



"I'm doing four simple things to save gasoline—and it's like getting a 15¢ discount on every gallon!"

"Slowing down from 70 to 55 mph on the highway saves me 6¢ a gallon. Keeping my car tuned saves 4¢ a gallon. And I'm saving another nickel a gallon by using radial tires and keeping them correctly inflated."

For a free booklet with more ways to save energy and money, write "Energy," Box 62, Oak Ridge, TN 37830.

ENERGY.
We can't afford to waste it.

U.S. Department of Energy

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

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

PAYMENT MUST ACCOMPANY ORDER. WE'LL BILL RATED FIRMS

NAME _____ COMPANY _____

STREET _____

CITY _____ STATE _____ ZIP _____

MAIL AD COPY TO: DAWN ANDERSON, ELECTRONIC TECHNICIAN/DEALER, 1 EAST FIRST STREET, DULUTH, MN. 55802.

RATES: 50 cents per word (minimum charge, \$15). Bold face words or words in all capital letters charged at 65 cents per word. Boxed or display ads charged at \$60 per column inch (one inch minimum). For ads using blind box number, add \$5 to total cost of ad.

DON'T LET INFLATION BLOW IT!



Use your "Dollars and Sense"
Send for this free booklet, and information on how to obtain bulk copies.



George W. Hayden
The Advertising Council
825 Third Avenue, New York, N.Y. 10022

Please send me a free copy of "Dollars and Sense," and information for ordering bulk copies.

NAME _____

TITLE _____

ORGANIZATION _____

STREET _____

CITY _____

STATE _____ ZIP _____

SIGNATURE _____

AD INDEX

Circle No.	Page No.
112 B & K Precision Dynascan Corp.	45
101 Cooper Group, The	Cv. 2
115 Diego Systems	49
117 Electronic Book Club	51
103 Fluke Manufacturing, John Fordham Radio Supply Co., Inc.	Cv. 4 52
113 Fuji-Svea Enterprises	48
General Electric Co.	38
GTE Sylvania, EGC Consumer Renewal	15
107 Hitachi Denshi America, Ltd.	13
104 MCM Audio Inc.	5
108 OK Machine and Tool	17
139 Optima Electronics	50
111 Ora Electronics	39
110 Phipps & Bird, Inc.	23
102 Pomona Electronics	Cv. 3
116 Quietrole Company	50
RCA Dist. & Spec. Prod. Div. (receiving tubes)	11
RCA Dist. & Spec. Prod. Div. (SK's)	8-9
RCA Dist. & Spec. Prod. Div. (QT Parts)	54-55
114 Sentry Manufacturing Co.	48
118 Sprague Products Company	53
106 Triad-Utrad	10
109 Tronics 2000	23
105 Zenith Radio Corporation	6-7

TEST INSTR. RPT.

Circle No.	Page No.
150 Hickok MX333	46

BULLETIN BOARD

Circle No.	Page No.
119 TRW RF Semiconductors	8
120 CRT Controller Handbook	8
121 Sentry Manufacturing Co.	8
122 Scelbi Publications	8
123 Howard W. Sams & Co.	8
124 Vector Electronic Co.	8
125 Wall Industries	9
126 Prentice-Hall	9
127 MCG Electronics	9

128 Advance Engineering	9
129 Radio Shack	9

SECURITY PROD.

Circle No.	Page No.
130 ESL	48
131 Racon Inc.	48
132 Visual Methods	48
133 Colorado Electro-Optics, Inc.	49
134 MRL, Inc.	49
135 Arrowhead Enterprises	49
136 Ademco	50
137 Alarm Systems and Devices	50
138 Alarm Supply Co.	50

NEW PRODUCTS

Circle No.	Page No.
140 Sencore	52
141 Desco Industries, Inc.	52
142 Sinclair-Thandar	52
143 Charleswater Products, Inc.	52
144 Vanguard Manufacturing Co.	53
145 Pace, Inc.	53
146 IET Labs, Inc.	53
147 Universal Enterprises, Inc.	54
148 OK Machine and Tool	54

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

Can anyone do what you do any better?

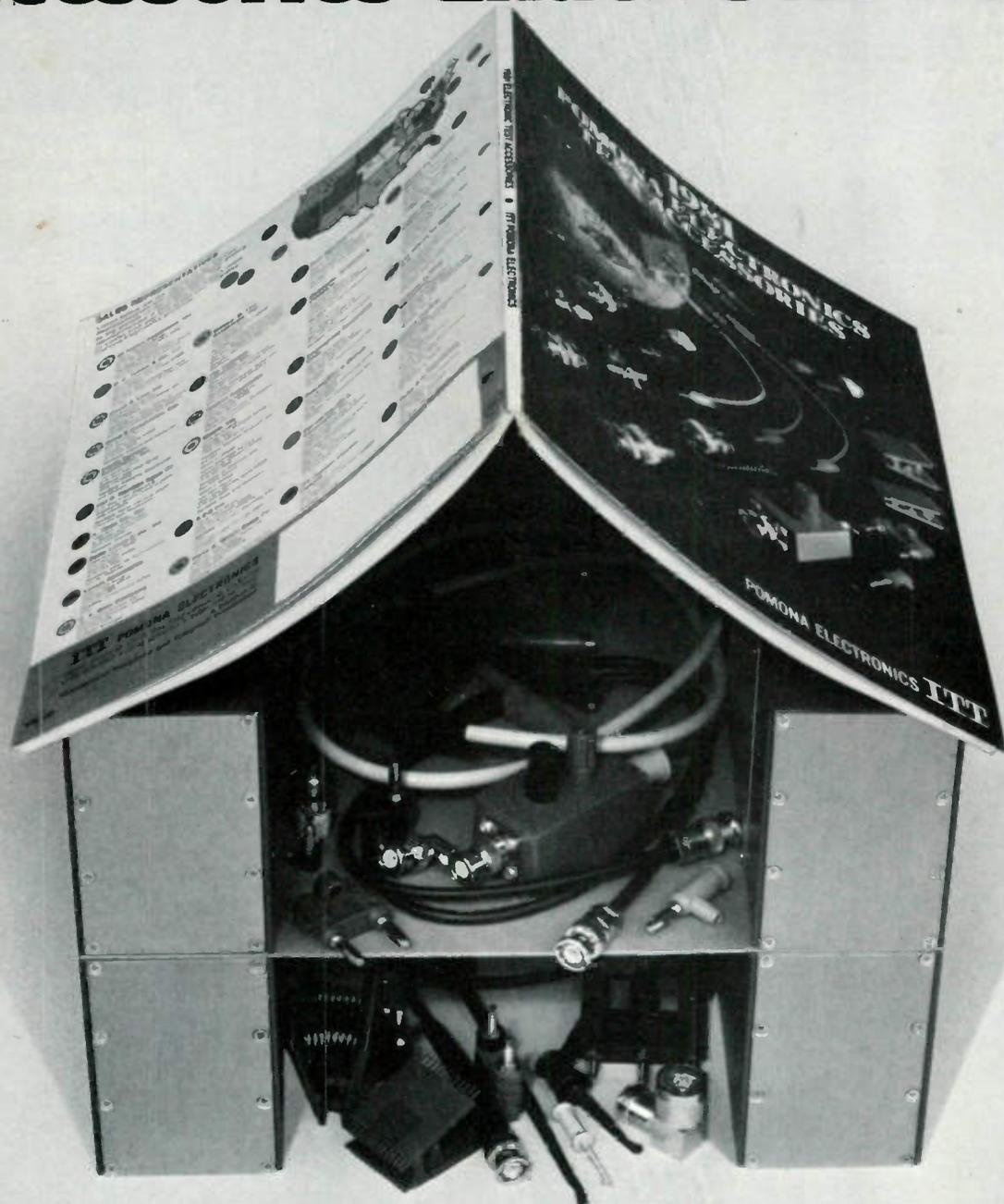
You're pretty darn good at your job. But today, we all have to consider how we can do our work a little better. That's how each of us can help keep our jobs here in America. For now and for the future.

America. It only works as well as we do.



The National Commission on Productivity, Washington, D.C.

Hundreds of Quality Test Accessories Under One Roof.



Your 1981 Pomona Electronics catalog is ready. And it covers more than 650 high-quality test accessories.

Bushels of black boxes.
Dozens of Dip Clip™ test clips.
Carloads of connectors.
Grosses of Grabber™ clips.
Armloads of adapters.
Pounds of pin tips.
Bunches of bananas. And much, much more.
Refer to your copy of the Electronic Engineers Master (EEM) catalog for complete product in-

formation, or ask us for a free catalog today.

ITT Pomona electronics, 1500 E. Ninth St., P.O. Box 2767, Pomona, CA 91766. Phone (714) 623-3463.

In Europe, ITT Industries Belgium S.A., Pomona Division, 250 Avenue Louise, Box 121, Brussels, Belgium. Phone 02/640.34.00.

AVAILABLE THROUGH YOUR FAVORITE ELECTRONIC PARTS DISTRIBUTOR

Consistent quality for a complex world.

Pomona Electronics

ITT

Circle No. 102 on Reader Inquiry Card

"Here's great news for electronics enthusiasts on small budgets.

Now you can take home a Fluke DMM for \$125*"

Whether you're just starting out in electronics or moving up from an analog VOM to a digital multimeter, you'll be smart to make sure that you're getting your money's worth.

In your search for a basic-performance DMM, be sure to consider the new D 800 from Fluke. Priced at only \$125*, this dependable six-function handheld DMM is available now at select electronics supply stores throughout the U.S.

The D 800 offers 0.5% basic dc accuracy (five times better than analog voltmeters), a razor-sharp 3½-digit LCD readout, unsurpassed overload protection, and true, one-hand operation.

This hard-working basic measurement multimeter is designed from the inside out for long life and reliability. All D 800 specifications are traceable to the National Bureau of Standards.

As part of Fluke's new Series D line of low-cost digital multimeters, the D 800 carries a limited one-year parts and labor warranty and comes complete with the battery, and safety-designed test leads.

Ask your supplier about the D 800, then compare it feature-for-feature with any other low-cost DMM. You'll find that for only \$125*, there's never been more multimeter than the new D 800 from Fluke.



From the world leader in DMM's. Now we've designed one for you.



*Suggested U.S. list price

If your dealer doesn't carry Series D Multimeters yet, call this number. We'll be happy to tell you who does. 1-800-426-9182
For technical data circle #103 on reader service card

