

ET/D

APRIL 1979 • \$1.00

ELECTRONIC TECHNICIAN/DEALER
LEADING THE CONSUMER AND
INDUSTRIAL SERVICE MARKETS

Using digital counters
Hitachi TV
Triggered scope tricks



Frequency
Counters
Frequency
Counters

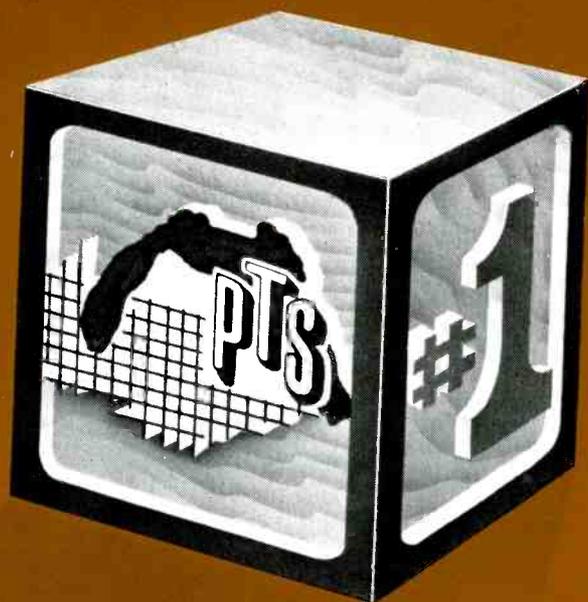
DENEZ2647580-P2-
4813A81U
FMIL J DE NAGEL
BDX 92A
IPON RIVER

AA

APR81
-AS
**

WI 54847

PTS...
The Only
Name You
Need To Know



ET/D

ELECTRONIC TECHNICIAN/DEALER

LEADING THE CONSUMER AND
INDUSTRIAL SERVICE MARKETS

APRIL 1979, VOL. 101, NO. 4

RICHARD W. LAY
Editor

WALTER H. SCHWARTZ
Managing Editor

JOHN GOOLEY
Contributing Editor

ALFRED A. MENEGUS
Senior Publisher

DAVID J. HAGELIN
Publisher

TOM GRENEY
Publishing Director

JOHN PASZAK
Graphic Design

KATHY TARNOWSKI
Production Manager

LILLIE PEARSON
Circulation Fulfillment

FEATURES

Portable counters

Some basic design theory 15

Digital counters

A closer look at our newest "essential" instrument 16

How to buy replacement parts

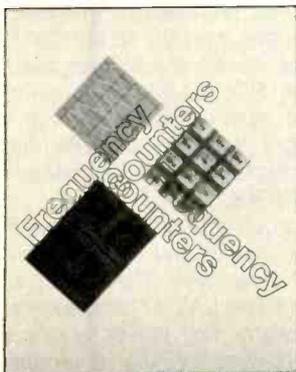
From three points of view 22

Hitachi's latest TV chassis

ET/D takes a look at the two basic types 30

Using the triggered sweep scope

Some new tricks for making life easier 34



On the cover: The Digital Frequency Counter/Timer is fast becoming one of the industry's most utilitarian pieces of portable test gear. Our cover this month is artist Mario Rossetti's symbolic representation of our lead feature on counters.

DEPARTMENTS

INDUSTRY REPORT	2
FROM THE EDITOR'S DESK	6
NEWSLINE	8
LETTERS	10
SERVICE SEMINAR	12
BULLETIN BOARD	41
TEST INSTRUMENT REPORT	44
DEALERS SHOWCASE	46
NEW PRODUCTS	50
CLASSIFIED ADS	56
AD INDEX	58
READERS SERVICE	59
TEKFAX	61

HBJ A HARCOURT BRACE JOVANOVIH PUBLICATION



ELECTRONIC TECHNICIAN/DEALER [ISSN 0363-5821] 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 43 East Ohio Street, Chicago, Illinois 60611. Editorial offices: 43 East Ohio Street, Chicago, Illinois 60611. Accounting, Advertising Production and Circulation offices: 1 East First Street, Duluth, Minnesota 55802. Subscription rates: one year, \$10, two years, \$16, three years, \$20, in the United States and Canada. All other countries: \$45. Single copies: \$1 in the United States and Canada; all other countries: \$3. Controlled Circulation postage paid at Dansville, New York 14437. Copyright © 1979 by Harcourt Brace Jovanovich, Inc. All rights reserved. No part of this publication may be transmitted or reproduced 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, MN 55806.

INDUSTRY REPORT

Leader Shows New Products

Leader Instruments Corporation has announced the introduction of seven new products to its line of electronic test gear for 1979, including three new oscilloscopes and a 520MHz frequency counter.

Unveiled for the first time during a special 25th anniversary reception for

members of the trade press in New York City, the units cover the spectrum of service industry requirements from home entertainment and consumer to industrial applications.

In addition, Leader announced it was holding the line on price increases on most of its 50 product types. Only two products, a high voltage meter/probe and a 20Kohm per volt VOM were increased by \$4 each. The other two price changes, on communications test instruments, were reductions, a Leader spokesman said.

Noting results of the past year, Corporate Vice President William L. Brydia said a significant growth in sales was led

by "a virtual doubling in demand for our oscilloscopes." He added the firm, which has been established in the United States for 10 years, is "running well ahead of our planned expansion rate for the third straight year."

Brydia also said work on the organization's new 10,000 square foot headquarters building at Hauppauge, N.Y., is progressing and occupancy is expected this June.

Among the newest of Leader's test gear shown at the press reception was its new portable 3-inch, dual trace, 20MHz scope. Designed for field or lab use, this AC/DC unit retails for \$950.

This instrument features 2mV/division sensitivity, times five magnification and .1 μ s/division maximum sweep speed.

Also introduced was Leader's newest counter, the LDC-824S, 520MHz with sensitivity specified at 20mV and temperature stability to one part per million. The unit has selectable gate time and frequency/period modes as well as 1 Megohm input impedance. Suggested retail on the 824S is \$550.

Leader also showed two new low cost 10MHz scopes, the LBO 13 and LBO 14, single and double trace units respectively. The LBO14, Leader reports, provides front panel x-y operation, channels 1 or 2 trigger selection, and alternate or chopped display modes. List prices are \$499 and \$649.

A new group of audio test instruments for both industrial and service applications was shown also. These units were the LAT 45 and LAT 47 attenuators for use in determining power levels and gain/loss characteristics in amplifiers and filters.

A new semi-conductor tester most applicable to industrial and service applications, the LTC-905 curve tracer, was displayed with a \$200 price tag.

The unit is designed with a sweep frequency of 120Hz and sweep voltage selectable in eight steps from 10 to 100 volts

Microwave Market to to Increase 2½ Times by '87

Microwave equipment, defined as that operating at 1GHz and above, will reach a dollar value of \$2.9 billion by 1987, according to a study by Frost and Sullivan, Inc.

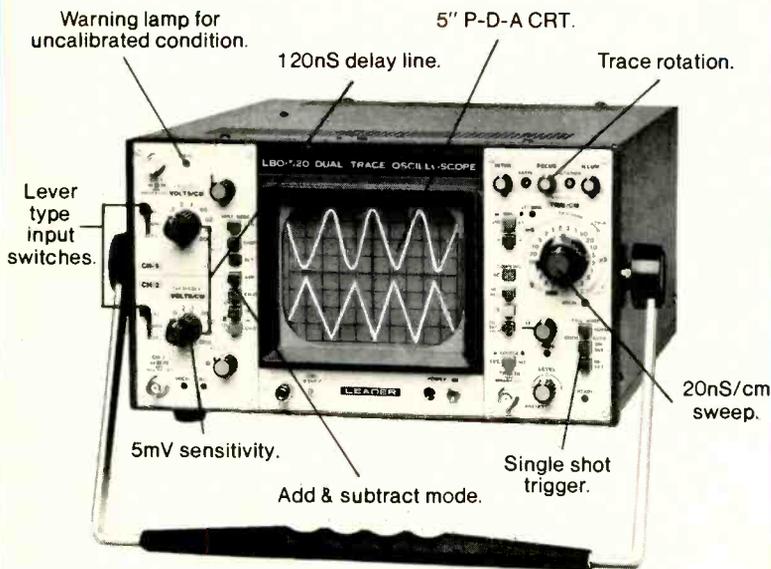
Microwave ovens are expected to be a major contributor to this growth at \$643 million. Produced by 32 manufacturers, the report states, microwave ovens have reached a market penetration of only 14 percent, which will climb to 20 percent by year end 1979 and 26 percent by year end 1980.

Sony Exporting to Japan

Sony, the first Japanese electronics company to build manufacturing facilities in the U.S., has become the first

NEW FROM LEADER

The 30MHz Dual Trace Scope with Delay Line.



High Sensitivity. P-D-A CRT. Single Shot Trigger.

Model LBO-520 . . . \$1050. with accessories

Send For Complete Catalog

All Leader Instruments Are Backed By A **Two Year Warranty!**

When Quality Counts . . .

LEADER
Instruments Corp.

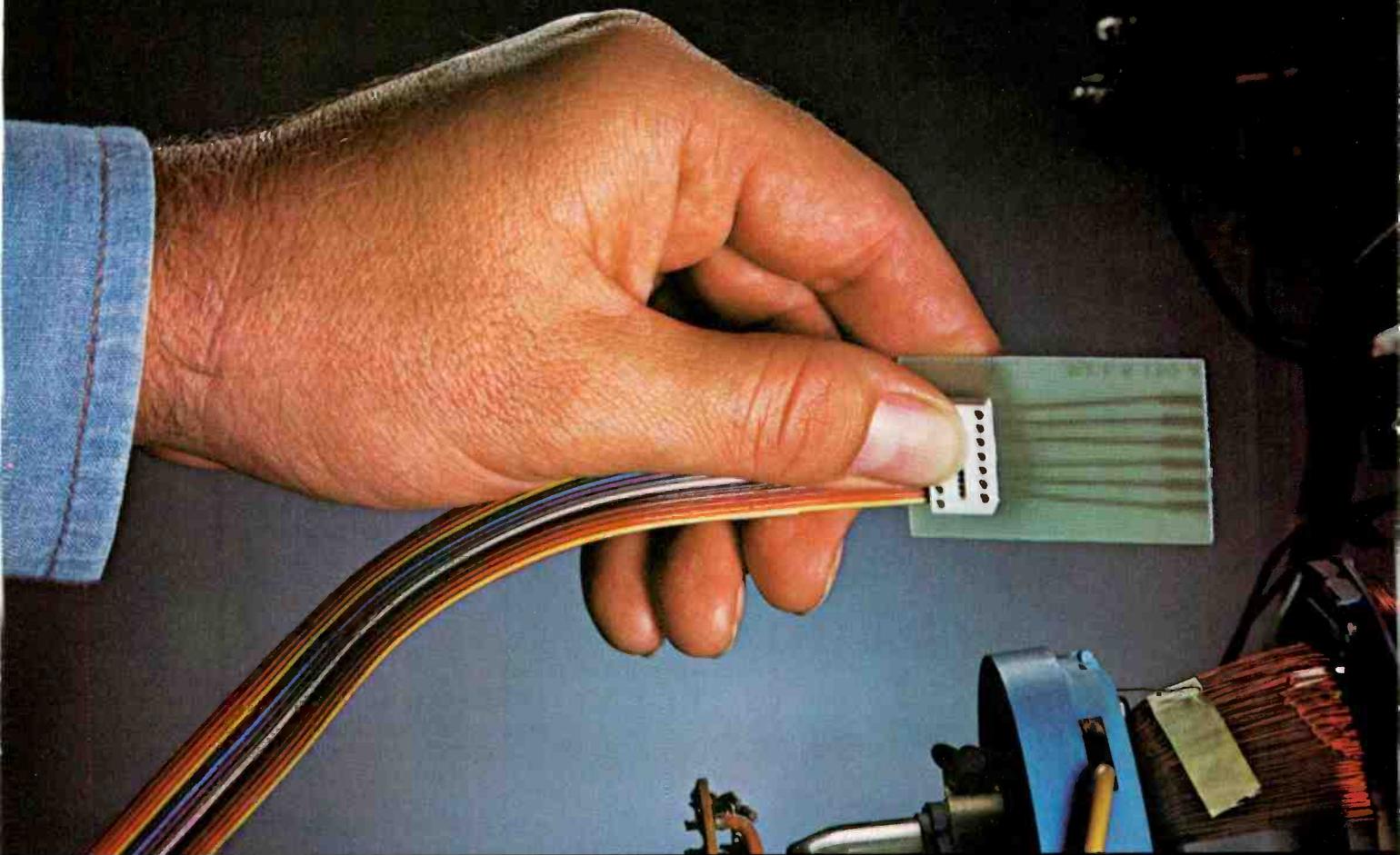
151 Dupont Street, Plainview, N.Y. 11803

Regional Offices Chicago & Los Angeles

East Coast (516) 822-9300 West Coast (213) 882-4335

Call Toll Free: (800) 645-7120 For the Name of Your Nearest Distributor

SYLVANIA WILL TELL YOU WHAT'S WRONG WITH RCA AND ZENITH.

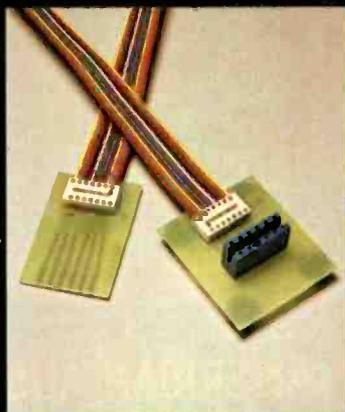


Now when an RCA or Zenith TV module breaks down you don't have to be nervous. Because Sylvania makes Chek-A-Board® module extension kits that let you pinpoint the problem without pulling the chassis. Once you know what's wrong, there's a Sylvania ECG® semiconductor to make it right.

When it comes to replacement parts the right place to

come is Sylvania. Your Sylvania distributor carries a complete line of test equipment, ECG semiconductors, picture tubes, and receiving tubes designed to make any brand work like it's brand new.

Sylvania. The easy way to get even the hardest part.



SYLVANIA

GTE

Chek-A-Board and ECG are registered trademarks of GTE SYLVANIA

See Us at Electronic Distribution Show—Booths F-6, 8, 10, 12

to export a finished product back to Japan. Sony is exporting Betamax videocassettes to Japan from its plant in Dotham, AL, it was announced February 20 by Morton J. Fink, Senior Vice President. Fink stated the Dotham plant represents a \$50 million investment and is the largest videocassette facility in the world. Employment could reach 1,000 when the plant reaches full capacity, he stated.

Porter Resigns NESDA Post; Administrator Hired

More changes have swept the offices of the National Electronic Service Dealer's Association (NESDA) as the organization continues to grapple with organiza-

tional and financial difficulties that helped spawn the birth of the upstart Electronic Technician's Association (see ET/D, Jan., Feb. '79).

In the latest move, Executive Director of 14-months Charles Porter resigned his post and will not be replaced. Instead, NESDA officials have hired Marti McPherson, a professional administrator and former consultant in convention and meeting planning and public relations.

She will also serve as administrator of the International Society of Certified Electronic Technicians, according to NESDA President Bob Villont. "It does not matter how well we and our members do our jobs, if no one knows about it

but us," Villont said. "One prime project Miss McPherson faces . . . is developing a program to upgrade the image of servicing."

Porter's resignation followed a special meeting of NESDA's House of Representatives in San Diego. "The decision was difficult," Villont said, "but we appreciate his dedication and substantial contribution . . . and trust his judgement in this matter."

Porter said several former fiscal policies which placed NESDA in precarious financial and cash flow situations were, the confusion over IS CET and poor cash flow. Temporarily eliminating the executive vice president's salary should help "immeasurably" in the latter case, Porter said.

RCA Announces 145 SK Devices

RCA's solid state division reports the availability of 145 new SK types that will replace some 13,000 industry solid state devices.

According to the company, the new group consists of six rectifier/dampér tube replacements; eight NPN transistors; eight PNP transistors; seven SCR/Triac devices; one matched diode set; one P-channel FET; two hybrid power amplifier modules; 29 linear ICs, 16 digital ICs, and 60 zeners.

These additions, RCA reports, bring the RCA solid state replacement line to 900 devices that replace over 150,000 industry devices.

After Market Autosound Products Sales to Reach \$1 Billion

Total sales of car radios, radio/tape players, speakers and accessories, in the after market are expected to reach \$1 billion for 1979 at the factory level, James J. Badaracco, Division Vice President and General Manager, RCA Distributor and Special Products Division, predicted. This is stated to be an approximate increase of 10% over last year. The market has doubled in size over the last five years and there is a steady increase in the number of cars ordered without factory sound systems. This number has increased from 19% in 1974, to 32% in 1978.

Beckman Enters Test Gear Market

Beckman Instruments, a high technology company in microcircuitry, components, and medical instrumentation, has announced it is entering the electronic test equipment market with five entries in the liquid crystal digital multimeter field.

All units, two aimed at the electronic technician marketplace and three at the design engineer field, are currently available through Beckman's nationwide link of 75 OEM distributors or through recently added specialty and general line distributors.

According to John Blanke, product line marketing manager for the new

75% OFF LIST ON ORIGINAL JAPANESE SEMICONDUCTORS

Why buy expensive American replacement semiconductors When you can buy Japanese semiconductors for much less.

TYPE	1-9	TYPE	1-9	TYPE	1-9	TYPE	1-9	TYPE	1-9
2SA 102	.34	2SC 620	.50	2SC 1383	.40	2SD 359	.90	STK 435	5.50
2SA 473	.55	2SC 632A	.40	2SC 1384	.40	2SD 427	2.15	STK 439	8.75
2SA 484	2.30	2SC 634A	.45	2SC 1448A	1.15	2SD 525	1.10	TA 7045M	2.40
2SA 495	.30	2SC 710	.25	2SC 1475	.90	2SD 526	.75	TA 7055P	2.40
2SA 497	1.20	2SC 711	.25	2SC 1509	.60	2SK 19	.50	TA 7060P	1.10
2SA 509	.35	2SC 712	.25	2SC 1567A	.70	2SK 23	1.00	TA 7061P	1.10
2SA 562	.30	2SC 717	.40	2SC 1675	.30	2SK 30	.45	TA 7062P	1.30
2SA 564A	.34	2SC 730	3.30	2SC 1678	1.50	2SK 33	.70	TA 7063P	1.45
2SA 634	.40	2SC 732	.25	2SC 1687	.45	2SK 34	.55	TA 7074P	3.95
2SA 643	.35	2SC 733	.25	2SC 1728	.95	2SK 41	.55	TA 7089P	2.40
2SA 673	.40	2SC 734	.25	2SC 1760	1.05	2SK 55	.70	TA 7120P	1.80
2SA 678	.50	2SC 735	.25	2SC 1775	.35	3SK 22Y	1.75	TA 7203P	2.80
2SA 683	.50	2SC 756	1.90	2SC 1816	1.90	3SK 35	1.45	TA 7204P	2.40
2SA 684	.50	2SC 756A	2.15	2SC 1908	.35	3SK 37	2.25	TA 7205P	1.90
2SA 695	.50	2SC 778	3.25	2SC 1909	2.70	3SK 40	1.50	TA 7310P	1.50
2SA 699A	.60	2SC 781	2.40	2SC 1945	5.45	3SK 41	1.50	T8A 8105H	2.30
2SA 706	1.00	2SC 784	.35	2SC 1957	.75	3SK 45	1.50	TC 5080P	5.55
2SA 720	.35	2SC 789	.90						
2SA 733	.25	2SC 793	2.40						
2SA 747	4.80	2SC 799	2.40						
2SB 22	.50	2SC 828	.25						
2SB 54	.35	2SC 829	.25						
2SB 77	.40	2SC 839	.35						
2SB 175	.40	2SC 867A	4.45						
2SB 186	.25	2SC 900	.25						
2SB 187	.25	2SC 930	.25						
2SB 324	.35	2SC 945	.25						
2SB 367	1.30	2SC 1000BL	.40						
2SB 405	.30	2SC 1013	.60						
2SB 407	.90	2SC 1014	.60						
2SB 463	1.10	2SC 1018	.80						
2SB 474	.85	2SC 1030	2.30						
2SB 507	.85	2SC 1060	.80						
2SB 511	.80	2SC 1061	.85						
2SB 557	2.70	2SC 1096	.50						
2SC 183	.50	2SC 1114	3.75						
2SC 184	.50	2SC 1116A	3.75						
2SC 372	.25	2SC 1124	.90						
2SC 373	.25	2SC 1127	.90						
2SC 380	.25	2SC 1162	.80						
2SC 382	.40	2SC 1166	.35						
2SC 387A	.40	2SC 1172B	3.80						
2SC 394	.30	2SC 1173	.65						
2SC 458	.25	2SC 1209	.35						
2SC 460	.50	2SC 1226	.65						
2SC 481	1.40	2SC 1226A	.65						
2SC 482	1.40	2SC 1237	2.10						
2SC 485	1.40	2SC 1239	2.80						
2SC 495	.55	2SC 1306	1.80						
2SC 509	.40	2SC 1307	2.80						
2SC 517	3.20	2SC 1318	.40						
2SC 535	.35	2SC 1364	.40						
				2SC 1960	4.25	3SK 48	3.65	TC 5081P	3.25
				2SC 1973	.65	3SK 49	1.50	TC 5082P	3.75
				2SC 1974	1.80	AM 2140	1.80	UHC 001	5.55
				2SC 1975	1.80	AN 239	4.75	UHC 002	5.55
				2SC 2028	.60	AN 247P	2.85	UHC 003	5.55
				2SC 2029	1.90	AN 274	1.85	UHC 004	5.55
				2SC 2076	.60	AN 313	4.55	UHC 005	5.55
				2SC 2091	1.10	AN 315	2.15	UPC 20C	2.65
				2SC 2092	2.15	8A 511A	2.10	UPC 554C	1.75
				2SC 2098	3.40	8A 521	2.30	UPC 555H	1.75
				2SD 72	.60	HA 1151	1.80	UPC 575C2	1.50
				2SD 91	1.50	HA 1156W	1.90	UPC 576	2.30
				2SD 92	1.70	HA 1306W	2.35	UPC 592HZ	.90
				2SD 180	1.90	HA 1322	2.85	UPC 1001HZ	2.30
				2SD 187	.40	HA 1339	2.90	UPC 1008C	5.70
				2SD 218	3.40	HA 1399A	2.90	UPC 1020H	2.30
				2SD 234	.75	LA 4031P	2.15	UPC 1025H	2.30
				2SD 235	.75	LA 4032P	2.15	UPC 1156H	2.30
				2SD 261	.35	LA 4400	2.30	UPD 857C	9.35
				2SD 287	2.80	M 51513L	2.40	UPD 858C	7.15
				2SD 291	2.70	PLL 01A	4.50	UPD 861C	9.05
				2SD 313	.65	PLL 02A	5.75	C 3001	1.60
				2SD 315	.75	PLL 03A	8.65	2SC FB	2.90
				2SD 325	.70	SE 613	5.80	4004	2.40
				2SD 330	.84	STK 011	4.30	4005	2.50
				2SD 356	.75	STK 013	8.75	78L05	1.10
				2SD 358	.85	STK 015	4.75	MPS U31	1.90
								SN 7400	.19

FREE CATALOG BEFORE YOU BUY CHECK OUR QUANTITY DISCOUNT PRICES

AMERICAN AUDIO
Semiconductor Division
P.O. Box 142 Dayton, Ohio 45459
Hours Mon - Fri 10-7 (EST)

HOTLINE 800-543-1645
IMMEDIATE DELIVERY
Add \$1.00 postage and handling Ohio residents 4% sales tax
ASK FOR OUR COMPLETE PRICE LIST
COD ORDERS WELCOME

ET/D

Richard W. Lay, *Editor*
(Chicago)

Walter H. Schwartz, *Managing Editor*
(Duluth)

Alfred A. Menegus, *Senior Publisher*
(New York)

David Hagelin, *Publisher*
(Chicago)

Tom Greney, *Group Vice President*
(Chicago)

John Paszak, *Graphic Design*

Kathy Tarnowski, *Production Manager*

Debi Harmer, *Prod. Supervisor*

Lillie Pearson, *Circulation Supervisor*

Gene Bailey, *Reader Service*

Dawn Anderson, *Classified Ad Mgr.*

Please submit editorial
manuscripts to:
Editor, ET/D, 43 East Ohio St.
Chicago, Ill., 60611

ADVERTISING SALES

Please send advertising material to:
ET/D,
Production Mgr.
1 East First Street
Duluth, Minn. 55802
(218) 727-8511

East Region

Alfred A. Menegus
757 Third Avenue
New York, N.Y. 10017
(212) 888-4382

Midwest Region

David J. Hagelin and
Thomas P. Kavooras, Jr.
43 East Ohio Street
Chicago, Ill. 60611
(312) 467-0670

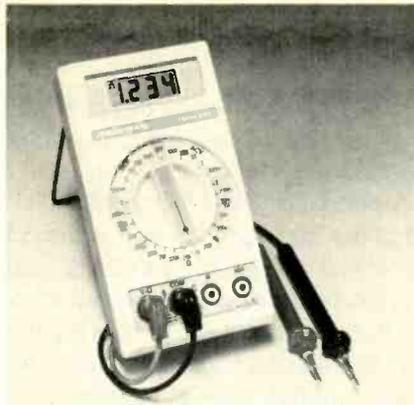
Southern & Western Region

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



HARCOURT BRACE JOVANOVIĆ PUBLICATIONS

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



3½-digit line, the DMMs will be the first of a series of other types of test gear to eventually be designed and produced by Beckman. However, he would not comment on the specifics of future product introductions or their timing.

Blanke said Beckman has established the Instrumentation Products Department to develop and make the new DMMs. Based in Fullerton, Calif., the department is part of the company's Advanced Electro-Products Division (AEPD), which also includes Beckman's hybrid microcircuits and passive resistor network departments. Philip Strauss heads the newly created department.

Blanke said that Beckman is entering the test equipment market to fill a void which the company feels exists between widely divergent high and low end pricing strategies.

The five new Beckman units range in price from \$100 to \$190.

In addition, Blanke said, the company achieves an economic advantage because many of the components for test gear are already manufactured by Beckman. He pointed out these include the LCD display, trimmers, resistor networks, and even the custom designed LSI chip used to eliminate many of the discrete components in the new DMMs.

The new line of DMMs, which ET/D viewed during an interview with Beckman representatives in Chicago recently, carries several unique features.

The first, of course, is the custom designed LSI, CMOS, chip with a total power limit of 250 μ A. This chip contains the ac converter circuitry, a Bessel filter, the main A/D converter circuitry, all timing and control logic and the display drivers. It permits reduction of the number of discrete components to about 40, Beckman reports.

Additionally, according to Beckman, the combination of low power consumption and the LCD display allow the expected average battery life of one of these units to be in the neighborhood of 2,000 hours. That's from a typical 9-volt "transistor" battery.

The final 200 hours of battery life, according to the firm, is indicated by a blinking decimal point in the display.

Finally, the new Beckman units are

designed to permit virtually instantaneous continuity checking, Blanke said. Called "Insta-Ohms," a small "ohms" symbol in the left hand corner of the display is activated instantaneously when continuity (or a short circuit) is detected, eliminating the time usually needed for a meter to range downward from the indicated display to "zero" ohms.

Typical of the new line is the TECH 310 model, priced at \$130. This unit features .25 per cent accuracy on five DC ranges (200 millivolts to 1500 volts) with an input impedance of 22 megohms. AC bandwidth is 10KHz with measurements in five ranges on both current and voltage with a maximum of 2 amps AC.

The DC maximum is 10 amps.

According to Blanke, "While we are not prepared to discuss those products at this time," Beckman is now "investigating several other test instrument products where we may have a competitive advantage due to our engineering, manufacturing and distribution capabilities."

RCA Introduces More Remotes

RCA has announced that for the first time it will offer remote control capabilities in everyone of its color television screen sizes.

According to RCA General Manager Jack Sauter, the industry can expect a "sharp" growth in the remote control section of the color TV industry. "With our new models featuring remote control, RCA expects to double its remote control sales this year," he said.

He added that the color industry will sell some 1.8 million remote units this year, largely due to replacement buyers and multiple set owners. "We estimate that these experienced buyers now account for more than 75 percent of the business," Sauter said.

The new RCA remote control models are included in nine XL-100 color chassis introduced to distributors in late February.

Projection TV from Sony

Sony has announced the introduction of two separate home projection television systems which will retail in the \$4,000 area.

New from Sony is the KP 5000 and KP 7200, with 50-and-72-inch diagonal screen sizes respectively. According to Sony, eight-inch projection tubes in a two-lens system provide a bright, high resolution picture on washable screens.

The electronic tuning functions of both systems carry an integrated circuit memory for pre-setting channel frequencies and pre-set channels remain in the memory even if AC power is shut off. Additionally, Sony's remote control system is designed around the use of infrared light to prevent false triggering problems usually associated with ultrasonic transducer systems. **ETD**

FROM THE EDITOR'S DESK



With state-of-the-art electronics being what it is, the once formidable barrier between "bench" test equipment and "field" test gear is rapidly disappearing. Not only in size, bulk, and weight, but in accuracy, dependability and ruggedness.

While all of the ramifications of this trend may not be clear, the fact is that it is here, it is real, and as far as I can tell, it will continue.

Certainly, the potential exists, however impractical it may seem from an economic standpoint, to fully equip a technician in the field for all of the sophisticated kinds of electronic tests heretofore reserved for the bench back at the shop.

The changing character of modern electronic test equipment; that is, its unceasing march toward portability is of such importance to the professional technician, that ET/D will be taking a closer look at this phenomenon in an upcoming issue in the very near future.

Meanwhile, our belief that we expect to find some very remarkable developments in the march toward miniaturization when we do look around at the industry as a whole, is only reinforced by some recent developments on the electronic test equipment home front of which we have recently become aware.

For instance, the combination of low power microcircuitry in conjunction with low power liquid crystal displays, now permits us the luxury of an average 2,000 hours of use from one 9-volt battery, according to one brand new entrant into the digital multimeter field (Beckman, see Industry Report).

But, DMMs and counters have been portable for some time, so portability here is not really so surprising...anymore.

The symbol of the last bastion of bench top immobility, insofar as the TV service industry is concerned, is--and has been--the oscilloscope. Yet, even this barrier is now crumbling in the wake of the frontal assault presented by the advance of LSI technology and modern design theory.

Leader Instruments (see Industry Report), B & K Precision, and Phillips now carry portable, battery operated 3-inch oscilloscopes of varying capabilities. Meanwhile, Non-Linear Systems has out miniaturized everything to date with its 1¼-inch dual trace unit.

As you can see, things aren't really getting bigger and better but smaller and better.

The whole point is, that with today's technology, we can--in the field--approach laboratory accuracy in our test gear. And that has got to be a big plus, when one considers the sophistication of the new technologies the technician of the future will encounter inside of all of the new consumer products being sold now to be serviced later.

Sincerely

Richard M. Lay

**One Call.
Your Mallory distributor's
got them all.**

Take the search and wait out of your electronic parts finding.

Go straight to your Mallory distributor, by phone or in person.

Get to know the convenience and economy of simplified single-source buying. To

deliver exactly what you want in parts, quality, and quantity. Immediately from stock on hand, or in most cases within 24 hours from the factory.

Your Mallory distributor goes all out for his Number 1 VIP . . . you. Get in touch with him soon. Mallory Distributor Products Company, a division of P. R. Mallory & Co. Inc., Box 1284, Indianapolis, Indiana 46206. (317) 856-3731.



MALLORY

Circle No. 122 on Reader Inquiry Card

NEWSLINE

PHILIPS PLANS U.S. EXPANSION. Philips Test and Measuring Instruments has announced plans for a major U.S. expansion this year. According to V.P. and General Manager Albert Katz, Philips plans introductions of "low cost" oscilloscopes, counters, function generators, multimeters "and other instruments" during the coming months. What's most significant about the announcement, however, is the fact that Philips for the first time will be marketing through the electronic distributor network. According to Katz: "We are planning...exciting new product lines which Philips will be marketing in the United States and Canadian markets for the first time."

MAJOR SHOW CANCELLED. Lack of support from manufacturers has resulted in cancellation of the Institute of High Fidelity's second annual convention, scheduled April 20-22 in St. Louis. IHF President Jerry Kalov, in a news release, said: "Manufacturers...are reassessing their budgets in the light of uncertain economic conditions and are unable to commit to the exposition." Last year's first convention was held in Atlanta. Plans are now underway for a 1980 exposition in Anaheim, California.

NESDA SETS PROGRAM THEME. "Meeting the Challenge of Change" is the theme for this year's National Electronics Service Convention August 13-18 in Tucson, Az. Sponsored jointly by NESDA and ISCET, this year's technical sessions are slated toward successfully handling and keeping pace with the rapidly advancing technology in electronics. NESDA also reports the convention will again host an all-day business management session.

ELECTRONICS IMPORTS RISE. Electronic Industries Association figures reveal that imports of most consumer electronics products increased in 1978 over the previous year. EIA statistics show total television imports rose 16.9 per cent last year with color television imports showing a 9.3 per cent gain to 2,538,696. On a product by product basis, televisions, phonographs, record players, changers and turntables, tape recorder/players and auto tape players all showed import gains in 1978 compared with 1977.

VCR MARKET ON UPSWING. EIA figures also show the home video cassette recorder/player market is moving forward. Imports of these units in 1978 rose to 509,155 units, up 103.3 per cent over the 250,450 imported in 1977. And February "sales to dealers" reported by the EIA showed 32,881 units sold, up 119.9 per cent over the 14,954 units sold in February of last year. For the first eight weeks of the year VCR sales amounted to 56,211 units, up 97.1 per cent.

ZENITH OFFERS NEW MODELS. Zenith has introduced three new 17-inch model color television receivers. Using the System 3 all modular chassis introduced previously for this model year, the new 17-inch models come with varying accessories such as Power Sentry and Color Sentry plus the 100 degree tri-focus in-line CRT.



SERVICE ORDER FORMS

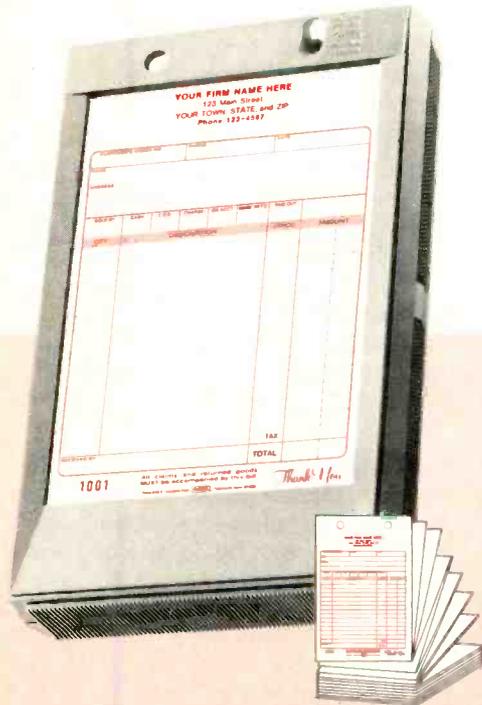
"carbonless" SALES SLIP and Portable Register

Speeds sales handling — provides clean, clear copies without carbons to insert, position or throw away.

Simplifies your paperwork — this one form serves as: Sales Slip, Charge Slip, Cash Receipt, Invoice, Service Order, etc.

Saves steps — have Portable Registers in several locations, on counter, by phone, in truck, etc. Cuts down customer waiting time.

Helps you collect your money — Promissory Note printed on back of all copies. Have doubtful accounts sign.



PORTABLE REGISTER

Compact, lightweight, easy-to-operate. Holds up to 75 "carbonless" Register Forms in duplicate or triplicate. Durable, virtually unbreakable . . . made of silver-gray, high-impact Cyclocac® plastic. Used copies can be stored in back of register.

#925 — For 5½" X 8½" "carbonless" Register Forms. Each. \$7.95

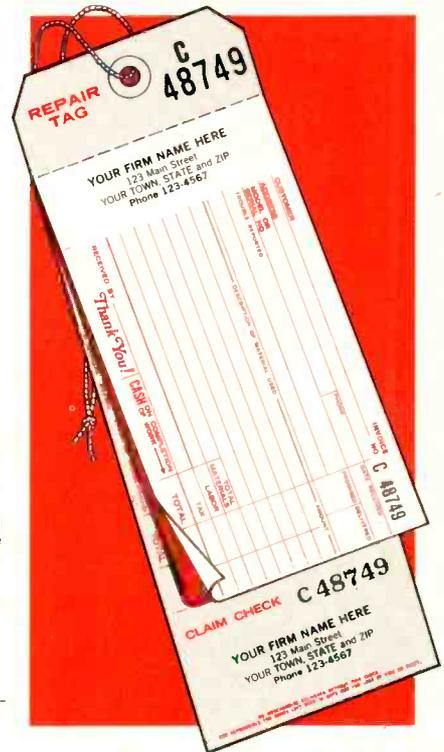
SERIES 610 SALES SLIP REGISTER FORM — Size 5½" X 8½". Designed for use in NEBS Registers #925 and #927 or other Portable Registers for 5½" X 8½" forms with two, ¾" dia. round holes, 2¼" center-to-center. Duplicate sets have white original, canary copy. Triplicate sets are white, canary and pink. Prices include your heading printed in blue ink and consecutive numbering (please specify).

DUPLICATE 610-2		TRIPLICATE 610-3	
20,000	\$230.00	20,000	\$365.00
10,000	139.00	10,000	225.00
6,000	98.00	6,000	149.00
4,000	77.50	4,000	108.00
2,000	42.50	2,000	59.50
1,000	24.95	1,000	34.95
500	15.95	500	21.50
250	10.95	250	14.50

Prices for forms do not include Portable Register.

Save time and money with this 4 in 1 INVOICE-REPAIR TAG

- 1 PERMANENT OFFICE RECORD** — A carbon copy of all entries on customer invoice . . . saves recopying.
- 2 CLAIM CHECK** — Printed with your heading and numbered consecutively.
- 3 COMPLETE JOB RECORD** — Tag remains tied to article — space to list parts and labor.
- 4 CUSTOMER INVOICE** — Printed with your heading and numbered consecutively.



Provides quick, easy identification of work left for service — all parts consecutively numbered

Tags are pre-strung with extra long looped string — permits fast, secure attachment to merchandise.

Saves money — this one form serves as: Service Order, Claim Check, Identification Tag, Invoice, Job Record, Office Record.

MONEY-BACK GUARANTEE

If for any reason you are not satisfied, your money will be promptly refunded.

SINGLE TAG (#301-1) Heavy manila tag (no copies). **DUPLICATE TAG (#300-2)** White bond, heavy yellow tag. Carbons pasted in. **TRIPLICATE TAG (#303-3)** White & canary bond, heavy salmon tag. Carbons pasted in. All sizes 3½" X 9" overall. Prices include: Firm name and address printed in red ink in two locations; consecutive numbering on all parts. (Note: Tags are pre-numbered, no specific starting numbers possible.)

QUANTITY	#301-1 SINGLE	#300-2 DUPLICATE	#303-3 TRIPLICATE
4,000	\$95.00	\$142.00	\$183.00
2,000	54.95	76.50	102.95
1,000	32.95	43.95	58.50
500	21.95	27.50	36.50



**FAST SERVICE BY MAIL
OR PHONE TOLL FREE 1 (800) 225-6380**

Mass. residents
1 (800) 252-9226

CODE 66245

DATE _____ 19__

QTY.	ITEM NUMBER & DESCRIPTION	PRICE	START CONSECUTIVE NUMBERING AT:
			<input type="checkbox"/> NO. 1001
			<input type="checkbox"/> NO. _____
			<input type="checkbox"/> DO NOT NUMBER

NAME AND ADDRESS TO BE PRINTED ON ITEMS (Please print or type)

STREET _____

CITY and STATE _____ ZIP CODE _____

PHONE _____

BILL AND SHIP TO (If different from above)

AUTHORIZED SIGNATURE _____ PHONE NUMBER _____



New England Business Service, Inc.
Townsend, Massachusetts 01470

LETTERS

HELP NEEDED

I am trying to find an address for the following company: CROMPTON Instruments, Elk Grove Village, IL. The letter I sent to them came back to me.

Paul Capito
Capitol Radio Service
637 W. 21st St.
Erie, PA 16502

We have an old spectrum chart you sent us several years ago with a subscription to ELECTRONIC TECHNICIAN/DEALER. We would like to obtain a new one. Also, we would like to obtain some kind of study manual on the theory, installation and maintenance of equipment for earth satellite television communications.

L. Powers
Powers TV & Music Co.
129 N. 3rd St.
Okemah, OK 74859

EDITOR: The spectrum chart has been out of print for many years and there are no immediate plans to reprint it. Revision

would not be possible until after the '79 WARC, the frequency allocation conference which will take place later this year, in any case. We do not have a good reference on satellite television communications. Perhaps one of our readers could help.

I need information on the following test instrument. Preferably schematic and operating instructions. Flyback Tester Model FT100 by Teletest Instrument Corp. of New York.

S. M. Van Zant
Van's Radio & TV Repair
14870 W. Clinton Ave.
Kerman, CA 93620

Does anyone have a duplicate TEKFAK 113 that I can obtain?

William L. Vogler
901 Maple Ave.
Washington, PA 15301

Needed—A schematic and deflection yoke for an Amcrest Television, Model 5P108.

Luba Service Co.
17 E. Mountain Rd.
Sparta, NJ 07811

I need instruction sheet and schematics on a Win-Tronix Dynamic Sweep Circuit Analyzer and an EICO R/C Bridge Model 950-A. Both need repair. Help!

Roderick Wilson
1019 47
Emeryville, CA 94608

EDITOR: EICO should be able to help you on the 950-A R/C Bridge. When we contacted them, they said that they would supply information on any current instrument for a nominal price. The Win-Tronix unit is something else—hope one of our readers can help.

Would you please run the following in the letters column. I need an instruction and service manual for a R/C Bridge, PACO Model C-20, Paco Electronics Co., Inc. Will buy a copy or copy and return. Any help will be appreciated.

Harlan H. Reager
Reager Electronics Repair
1729 N. Seventh St.
Lebanon, PA 17042

I'm writing you to see if you can help me find a diagram with parts of an old Simpson Model 479 -FM sweep generator. Simpson does not seem to have it any longer.

Bernard Kustich
1521 North Salina St.
Syracuse, NY 13208

I need a power transformer for a PACO resistor/capacitor tester Model C-20. The numbers on the transformer are P18-168 and 682007. A new or used transformer would be okay.

Carlton Garner
Garner's TV Country
Rt. 2, Box 262G
Pensacola, FL 32506

Please list the following in your letters column. I need a schematic and any available service data for an AKAI Model X200D stereo tape deck. Will buy or copy and return.

Jo-Henry Pier
Hap's Services
Rt. 2, Box 451
Shreveport, LA 71129

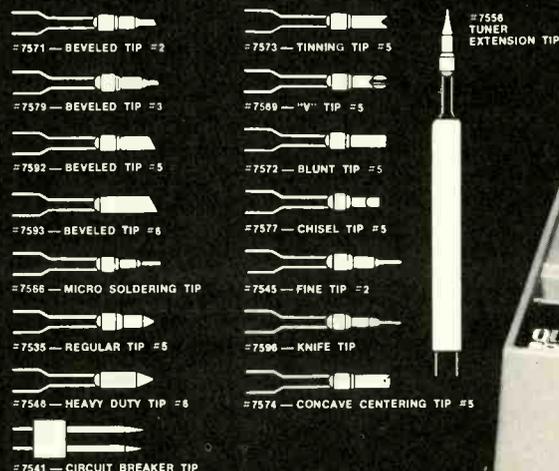
NEEDED DESPERATELY
Switch and control assembly, AFC-chroma-tint-volume for a Zenith Model D4512-W2 (chassis 23DC14). Can't get it from Zenith.

Nielsen Electronics
Rt. 6 Box 137
Idaho Falls, Idaho 83401 ETD

QUICK CHARGE IRON- QUICK CHANGE TIPS

ISO-TIP® Quick Charge Cordless Soldering Iron recharges in 3-4½ hours. Uses any of Wahl's 16 snap-in tips.

Low voltage, battery powered, ground free isolated tip design.



See New ISO-IIP Products in Newcom Booth G-3

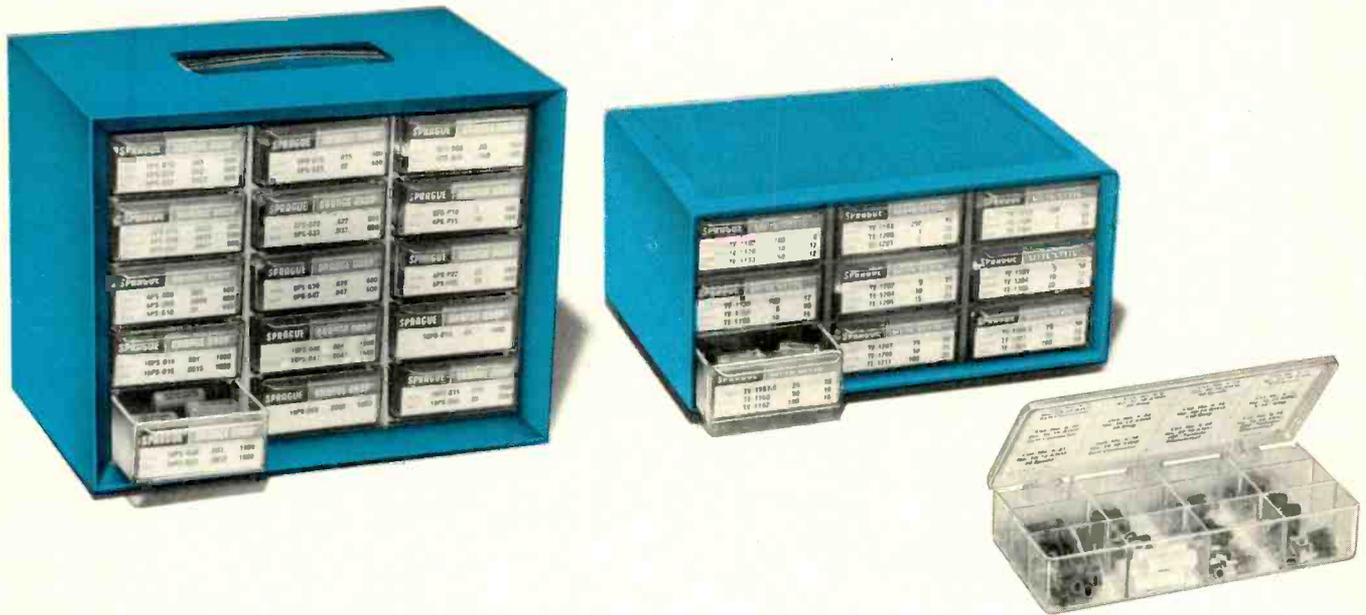


WAHL CLIPPER CORPORATION

ORIGINATORS OF PRACTICAL CORDLESS SOLDERING.
Sterling, Illinois 61081 (815) 625-6525
"Manufacturing Excellence Since 1919"

Circle No. 135 on Reader Inquiry Card

Reach for SPRAGUE components instead of running for them.



Choose from 24 packaged assortments to get a balanced inventory of capacitors, resistors, or solderless terminals for service work.

You don't have to buy a huge quantity of electronic components to build and maintain a practical-sized inventory. Nor do you have to put a big strain on your budget. Take a look at the assortments listed here. Each contains a practical selection of ratings and types most frequently used in day-to-day servicing.

Larger capacitor and resistor assortments are supplied in 15-drawer blue metal cabinets, fitted with a retractable carrying strap. Smaller capacitor and resistor assortments come in stackable 9-drawer blue plastic cabinets. Clear plastic drawers have adjustable dividers. Pre-labeled drawer fronts identify contents.

Solderless terminal assortments are supplied in compartmented, clear plastic storage cases.

Component	Assortment No.	No. of Components	No. of Ratings/Types
9-DRAWER PLASTIC CABINET			
Temperature-stable Ceramic Disc Capacitors	KC-23	215	27
G-A & High-K Ceramic Disc Capacitors	KC-24	215	27
Aluminum Electrolytic Tubular Capacitors	KE-11	61	27
Epoxy-dipped Mylar® Film Capacitors	KF-19	136	18
Film-wrapped Mylar Tubular Capacitors	KF-33	36	18
Polypropylene/Polycarbonate Film Capacitors	KF-34	44	18
Miniature Axial-lead Mylar Capacitors	KF-35	72	27
Film-wrapped Metallized Mylar Capacitors	KF-36	18	18
Ultra-miniature Single-ended Mylar Capacitors	KF-37	110	22
Dipped Radial-lead Mica Capacitors	KM-11	64	22
Radial-lead Solid Tantalum Capacitors	KT-11	90	25
Carbon-film Resistors, 1/4 Watt	KR-16	171	27
Carbon-film Resistors, 1/2 Watt	KR-17	171	27
15-DRAWER STEEL CABINET			
Vertical-mounting Miniature Electrolytics	KE-21	102	42
Aluminum Electrolytic Tubular Capacitors	KE-22	93	30
Aluminum Electrolytic Tubular Capacitors	KE-23	30	30
Dipped Tubular Radial-lead Film Capacitors	KF-32	139	33
Flameproof Film Resistors, 1/4 Watt	KR-18	180	30
Flameproof Film Resistors, 1/2 Watt	KR-19	180	30
Flameproof Film Resistors, 1 & 2 Watt	KR-20	90	30
HINGED-LID CLEAR PLASTIC STORAGE CASES			
Terminals (Rings, Spades, Butts, Disconnects)	KST-1	80	12
Terminals (Rings, Spades, Butts, Disconnects)*	KST-5	121	13
Terminals (Bullets, Disconnects, Taps, Splices)*	KST-7	79	13
Terminals (Butts, Rings, Spades, Disconnects)	KST-10	400	24

*Also includes All-purpose Wiring Tool

YOU PAY FOR COMPONENTS ONLY...CABINETS ARE YOURS AT NO EXTRA COST

For detailed information and current prices, call or write Woody Boillat, Sprague Products Company, 65 Marshall St., North Adams, Mass. 01247.

SPRAGUE PRODUCTS COMPANY Distributors' Division of Sprague Electric Co.

THE FOREMOST SUPPLIER OF ELECTRONIC COMPONENTS
Circle No. 132 on Reader Inquiry Card



Sprague and ® are registered trademarks of the Sprague Electric Co.

	RF401—fusible resistor screen supply	<i>No or insufficient vertical deflection</i>	MDG—vertical module CR404—40V (source) R4206—vertical hold control R19—height control PW800 or convergence plug, P402
<i>Set inoperative, momentary blast of sound when set is switched on</i>	MDH—horizontal module MDR—regulator module SCR401—regulator		
<i>Poor contrast, poor AGC action, noisy picture or no video/sound</i>	MCK—module +22V Source—(on MDL)	<i>Vertical linearity poor</i>	MDG—vertical module Deflection yoke and associated components
<i>No control of contrast No video/sound ok No control of brightness</i>	MDL—luminance/sync module MDD—kine driver module R4202—brightness control	<i>No or insufficient horizontal sync</i>	MDH—Horizontal module MCK—IF/AFT module MDL—luminance/sync module MDR—regulator module R4205—horizontal hold control
<i>Distorted video Colored raster Loss of set-up capabilities</i>	PW600—kine bias circuit board S301—service switch		
<i>No or weak color Distorted color No control of color No control of tint</i>	MDC—chroma module MDL—luminance/sync module	<i>No weak or distorted sound</i>	MDS—sound module MCK—picture IF module R4201—volume control Speaker
<i>No or weak vertical sync</i>	MDG—vertical module MDL—luminance/sync module MCK—IF module Vertical hold control	<i>Picture noise, weak picture crossmodulation "beats" in picture, loss of color, fine tuning drift</i>	MCK—picture IF/AFT module Tuner problem

ET/D

... RCA SKs make it easy for you to offer reliable service at a profit.

New Numbering System

All SKs now feature, where applicable, the product numbers of the other leading system used by ECG,* REN and TM. For example, whenever an SK device replaces an ECG device, the ECG number is now part of the SK number. (SK 3444, a direct replacement for ECG 123A, is now listed as SK 3444/123A.) The new 1979 RCA SK Solid State Replacement Guide is the only guide you need. You can buy and install RCA SK devices with confidence that the replacement is right and the quality is right too.

Best of all, RCA Top of the Line quality means fewer costly call-backs and more profitable customer servicing for you. See your RCA SK distributor for all your solid state replacement needs and ask for your copy of the new authoritative RCA SK Replacement Guide, SPG 202X; or send your request with check or money order for \$1.50 to RCA Distributor and Special Products, P.O. Box 597, Woodbury, N.J. 08096.

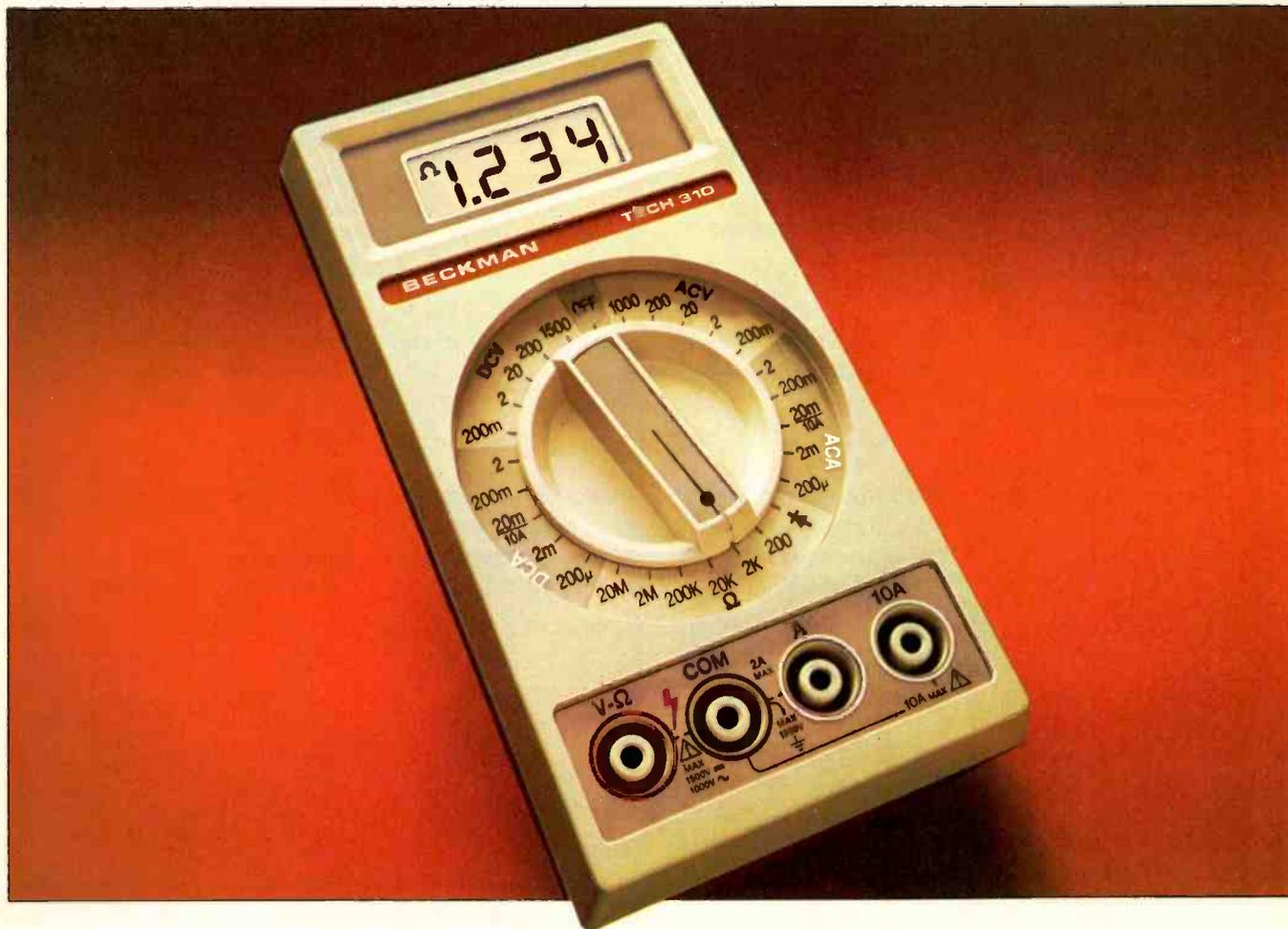
*ECG is a trademark of GTE Sylvania



Circle No. 130 on Reader Inquiry Card

ET/D - April 1979 / 13

WHEN THE GOING GETS TOUGH, BECKMAN'S NEW DIGITAL MULTIMETERS KEEP GOING.



Featuring new continuity function.

If you've ever been troubled by a faulty multimeter—or had to use one that wasn't quite up to the tougher jobs—your troubles are over. Now there's the Beckman line of digital multimeters. A new generation of 3½-digit models that combine superior reliability with highly versatile features.

Features like a unique continuity test function. With Beckman's new Insta-Ohms™ quick continuity indicator, you no longer need an analog VOM for fast, convenient continuity checks.

There's also 10-amp current ranges, in-circuit resistance measurement capability in all six-ohm ranges, a dedicated diode test function, and up to two years normal operation from a common 9V battery.

The Model TECH 310 with all these features,

7 functions, 29 ranges, and 0.25% Vdc accuracy is only \$130.

The Model TECH 300 with 0.5% Vdc accuracy, but without the continuity function or the 10-amp current ranges, is just \$100.

Whichever model you choose, you get a multimeter that won't let you down. There's exceptional overload and 6kV transient protection, plus ruggedness to take a 6-foot fall and to come up working.

So get the Beckman digital multimeter that performs and keeps on performing. No matter how tough the going gets. For information on the complete line and accessories, write or call your local distributor or the Advanced-Electro Products Division, Beckman Instruments, Inc., 2500 Harbor Boulevard, Fullerton, CA 92634, (714) 871-4848, ext. 3651.

BECKMAN

Circle No. 108 on Reader Inquiry Card

Portable counters

Gaining greater accuracy

Modern technology has now reached the point where accuracy thought unobtainable just a few short years ago, is now available in field test gear.

The increasing number of applications of electronics requiring in-the-field servicing has led to a growing demand for portable instruments. But often to achieve portability, some accuracy has had to be sacrificed. This has been particularly striking with portable counters and counter/timers.

The basic accuracy of such instruments is related to the accuracy of a crystal-oscillator timebase. Meaningful use of high-stability crystal oscillators requires a constant

temperature. So the crystal oscillator should be mounted in an oven enclosure.

Stand-by operation of the oven-enclosed oscillator insures instantaneous high stability whenever the instrument is switched on. But this requires a lot of power—just not practicable for the battery operation necessary for field work.

However, the development of oven-contained crystal oscillators with extremely low power consumption—less than 1 watt—now permits the extension of the instantaneous high stability of laboratory instruments to field applications. Typical of such designs is the Philips PM 6610 series of counters.

Such high-stability timebases can therefore now be used with an internal battery pack. No warm-up time is

needed when changing locations because such counters have much higher stability than those containing a TCXO—temperature-compensated crystal oscillator. The battery provided in the PM 6610 series is sufficient for 24 hours of operation.

The oscillator is mounted inside the oven with the heating element—a transistor—and the oven control circuit as shown in Figure 1. The heating element is driven by an operational amplifier which detects the difference between a reference value set by two highly-accurate resistors in one leg of a resistance bridge and the level set by a third resistor and a thermistor in the second leg of the bridge.

All parts are mounted on a thin film inside the oven enclosure, and hybrid circuits are used to keep the unit as small as possible. Provision is made for external adjustment. **ET/D**

Courtesy Philips Test & Measuring Instruments, Inc.

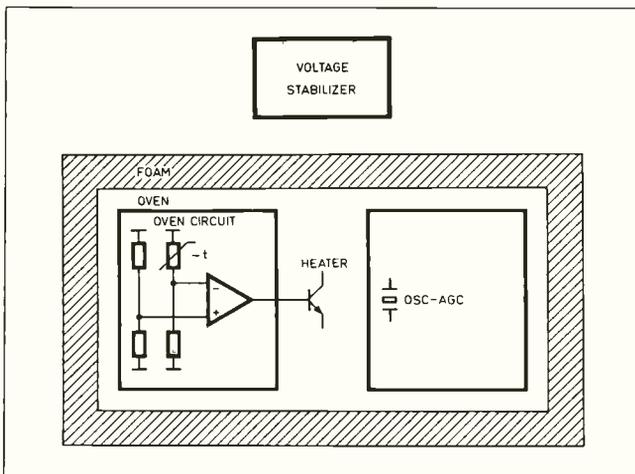


Fig. 1—This simplified block diagram of a crystal oscillator oven in the Philips PM 6610 counter shows the oven control circuit, the transistor heating element, and the crystal mounting, inside the oven enclosure.

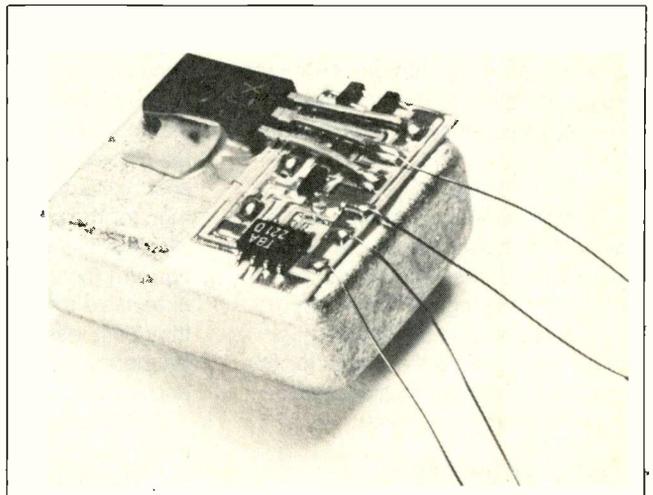


Fig. 2—A view of the operational amplifier, the heating element transistor and crystal assembly which is mounted inside of the enclosure.

Digital frequency counters:

The newest "essential instrument"

Today's Modern LSI "chip" counters are as sophisticated and accurate as many lab counters just a few years ago. Yet they can produce chaotic readings for the uninitiated. In this article you'll learn the secret of their proper use.

By Bernard B. Daien

Recent technological advances have reduced the size and cost of digital frequency counters, while improving performance. As a result, even the smallest lab or shop can now afford this very useful instrument.

New circuitry has been adopted by electronic manufacturers, which requires the use of frequency counters, and some of the new techniques for servicing are useful even with older equipment. For example, phase locked loops are now used in the sweep portion of TV sets. Troubleshooting a phase locked loop without a frequency counter is working "blind."

This article explains the use of modern frequency counters. Just as the color bar generator became a common and essential instrument in color TV servicing, so the frequency counter is now the latest essential instrument, making life easier for the technician, and saving time and money for the shop owner.

Highly versatile

Most technicians think of the frequency counter as a sort of "digital readout frequency meter," useful only

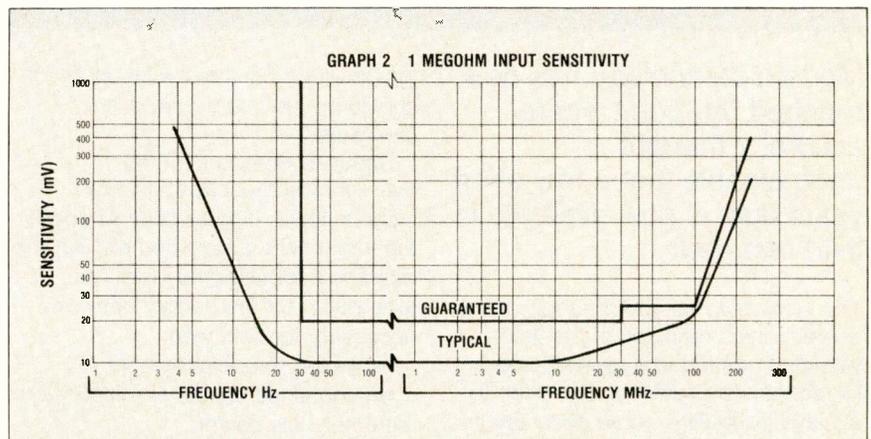


Fig. 1—A counter sensitivity chart showing the guaranteed and "typical" response. (Courtesy Sencore)

for checking the output frequency of transmitters, or oscillator frequency of a superheterodyne receiver. This is a very limited view of an extremely flexible and useful instrument. There are many money and time saving applications of a frequency counter. Here's an example: Most shops and labs have inexpensive general purpose signal generators, of limited accuracy and poor long term stability. A good "frequency meter" is accurate, stable, but fairly expensive, and usually slow in use. By using your low cost digital frequency counter to monitor the output frequency of your low cost signal generator, it can perform most of the functions of an expensive frequency meter. Together, they cost less than one good frequency meter, are more flexible, and will be used more often!

The frequency counter is useful in most types of service work, including TV. The horizontal sweep frequency may increase, and all voltages will read reasonably close to normal, except the high voltage, which may

virtually disappear, causing loss of raster. Without a raster there is no visual indication of a high sweep frequency, and most shop scopes do not have sufficient accuracy of sweep calibration to reliably indicate what the sweep "period" is. Note that we said "period," and not "frequency." If you think about it, you'll realize that scopes measure time, not frequency, and for each measurement, you will have to convert period to frequency, using the formula, $frequency = \frac{1}{period}$. This gets to be a slow and error prone procedure. (Try obtaining the frequency of a wave whose period is 115 microseconds, for example!) The counter neatly solves this problem, by giving you a direct readout of the frequency ... no calculations, no errors ... and fast.

In digital work a signal source called a "clock" is used to control the timing and sequencing of many operations. If clocking is erratic, the digital system goes berserk. It is difficult to determine some aspects of clocking with a scope, since any "skips" must

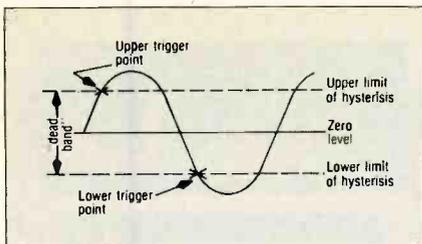
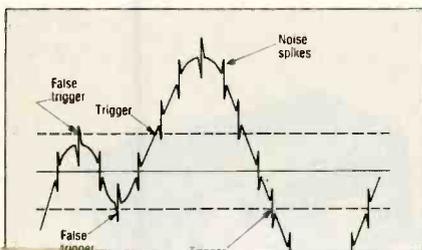


Fig. 2—Illustration of the hysteresis band and the count triggering points on a "clean" signal.



SIGNAL CONNECTION SELECTOR GUIDE

SIGNAL SOURCE	1 Meg Direct	1 Meg ISO	50 Ohm Direct	50 Ohm ISO	10:1 Scope Probe	PL207 Pick-Up Loop	NE206 Noise Eliminator
FREQUENCY RANGE	30 Hz-230 MHz	30 Hz-230 MHz	100 KHz-230 MHz		30-Hz-50 MHz		30 Hz-10 MHz
Audio Circuits	•						•
CB Transmitter Outputs			•				
Digital Square Wave Signals	•						
Digital Pulses				•	•		•
IF Stages		•			•	•	
RF Oscillators (transmit or receive)		•				•	
Signal Tracing	•	•				•	
UHF Transmitter Outputs						•	
VHF Transmitter Outputs (Under 12 Watts)			•				
VHF Transmitter outputs (Over 12 Watts)						•	
High Voltage Signals					•	•	

ET/D's new Modern Serviceshop Management Manual

Just what you need to keep your business running smoothly and profitably!

Filled with ideas and advice on situations faced in owning your own serviceshop, this manual is perfect in helping you cope with your day-to-day business problems.

CATEGORIES INCLUDED ARE:

Business Management

Chapters on basic accounting procedures, ratio analysis, planning for profit in the business environment and current asset management

Service of Electronics Equipment

Chapters on troubleshooting transistorized circuits, modern test equipment, digital electronics, industrial control systems, and modern serviceshop layout

New Business Horizons

Chapters on whether to expand your business contract service, business opportunities in medical electronics and service business opportunities in small industrial settings

Please send me _____ copy(ies) of
ET/D's MODERN SERVICESHOP MANAGEMENT
MANUAL at \$12.95 per copy. (Please add
\$1.50 per order to cover postage and handling.
On multiple copy orders add 25¢ for each
additional copy.)

MAIL TO:
ET/D Magazine/Book Dept.
1 East First St.
Duluth, MN 55802

6

Name _____
Company Name _____
Street Address _____
(we ship by United Parcel Service which does not deliver to P.O. Boxes)
City _____ State _____ Zip _____

Publication Date: Now available! Orders will be fulfilled within 60 days of the date of order.

ORDER ET/D'S MODERN SERVICESHOP MANAGEMENT MANUAL TODAY!

ORDER YOUR COPY OF THIS
LATEST INDUSTRY REFERENCE WORK TODAY!

s of

if

is

re

he

t.

or

it

ved

not

ined

If

able

the

nters

nger

Its.

uld

ed

ou

o

d

It is

e

ners



Fig. 6—The Phillips' PM 6610 series of counters and counter/timers covers the range from 80MHz to 1.3GHz.



Fig. 7—Simpson's Model 7026, 50MHz counter goes to 512MHz with prescaler, measuring frequency, period, ratio and time interval.



Fig. 8—Accurate from 5Hz to 100MHz, the Data Precision 5740 measures frequency, period, period average or totalized the period averages.



Fig. 9—Leader's 80MHz, seven digit LDC-822 features period function and 10MHz time base.



Fig. 10—Hickok's auto ranging counters, the 380 and 385, eliminate the need for overload indications with automatic switching modes.



Fig. 11—The VIZ Model WD752A, with selectable automatic or manual gate time, and a light to indicate that the signal is within "readable" limits.



Fig. 12—The MAX-550MHz, about the size of a hand-held calculator, is currently offered by Continental Specialties Corp.



Fig. 13—Non-Linear Systems offers a complete line of counters, and this 512MHz, 10-to-1 prescaler which NLS says is compatible with almost any 50MHz meter with a 50 ohm input.

permissible often decreases, thus a counter which can accommodate a 100 volt peak (ac plus dc) signal at 1 KHz may be derated to 25 volts peak at 10 MHz. And, besides noting that the input is "ac plus dc level" when calculating peak ... remember that modulated waves have a peak, at 100% modulation, which is twice the carrier level. Many technicians forget this little fact when checking the output of transmitters ... all goes well until someone whistles into the microphone!

To further complicate matters, there is also the factor of standing waves, when a transmitter is mismatched to the load via a transmission line. Often a standing wave ratio of two to one is tolerated as acceptable limits. This results in a still higher peak voltage ... and the combination of modulation

plus a high standing wave ratio can easily triple the calculated peak voltage, if one assumes the unmodulated carrier at a one to one standing wave ratio.

There is also the matter of transients, which occur in many circuits, due to switching, etc. Power inverters and converters are particularly prone to this. A good rule is to look at the waveform carefully with an oscilloscope before hooking up your counter. If the voltage is too high, use an attenuator as supplied, or as recommended, by the counter manufacturer. Remember that at high frequencies, a couple of resistors do not make a good attenuator.

Use attenuators

High frequency attenuators that match the input of your counter can be easily

whipped up with a resistor or two, and a small variable trimmer capacitor, similar to the circuitry in a "Times 10" scope probe. The exact values will vary with the input impedance of the counter, and therefore cannot be covered here, but with the aid of the counter specifications, and any attenuator technical text, the job can be simply and quickly done. An attenuator with several steps, such as X2, X5, X10, etc., is very handy, and increases the utility of the counter greatly.

Know the signal

By now you have the idea that input voltage is not as simple a problem as it seems with solid state instruments in general. You will have to devote a little time and thought to what you are hooking into, if you expect reliable



Fig. 14—A dual channel counter/timer, Systron Donner's Model 6361A. Both channels are identical and capable of counting to 100MHz.

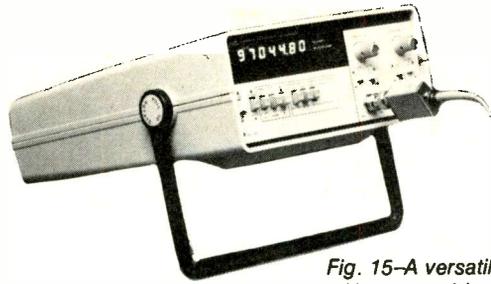


Fig. 15—A versatile counter/timer capable of counting frequency to 100MHz, period, pulse width, time between events, and logic timing, Hewlett-Packard 5314A.

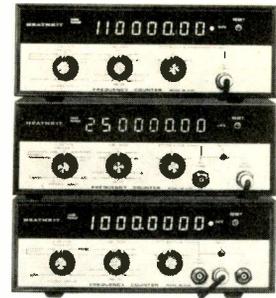


Fig. 16—Heath's Models 1M-4110, and 1M4120 and 1M4130 count to 110MHz, 250MHz and 1000MHz respectively.



Fig. 17—Sencore's FC51, 1000MHz counter, can also count frequencies as low as 10Hz with up to .01Hz resolution.



Fig. 18—Ballantine's 5725C is a 225MHz counter with four selectable gate times.



Fig. 19—B & K Precision's Model 1820 80Mhz counter also measures period and elapsed time and totalizes.



Fig. 20—A counter capable of .01MHz resolution with one second gate time at audio frequencies is the Ballantine 5720A.



Fig. 21—The Phillips PN6620 series offers counting capability to 1000MHz and time base stabilities to 5×10^{-10} per 24 hours.



Fig. 22—Sabtronics Model 8100 100MHz counter available in kit form only.

performance from your frequency counter. It is a fact that the technician who carefully checks and rechecks when setting a signal generator, will spend only a few seconds in setting up for a frequency counter reading!

It is good practice when checking the output frequency of a transmitter, to use a *dummy load* set-up. This is not only to meet Federal Communications Commission Rules and Regulations, but also to insure that you are not working with a very high voltage standing wave ratio. On an improperly terminated transmission line, the R.F. voltage can reach very high (arc-over) levels if the antenna system is defective.

In digital systems which use square wave pulses, often at very high frequencies, a similar problem can exist. In this case a high standing

wave ratio does not usually reach very high levels which can damage the counter ... but the reflected wave is delayed in time by the length of the connecting cabling ... and the combination of signals, and reflected signals, on improperly terminated lines, results in false counting. It is correct practice here to use short connecting cables, and proper resistive terminations, as you would with any transmission system.

Extending the range

Many of the inexpensive counters can have their range extended by means of a "Prescaler," which is a form of frequency divider. If you already own a frequency counter, it is probable that you can add on one of several available prescalers to reach higher frequencies as needed. The

manufacturer of the counter, or the prescaler can advise you regarding compatibility of their units. Thus you can start out with a 30 MHz unit for C.B., TV, and audio use, and add on a prescaler later for other uses.

Speaking of other uses, many audio uses exist for counters. The phase locked loops in electronic organs require counters for fast servicing ... and there is no surer way to tune an organ than with the counter. Since the counter does not require an audible output, it avoids the annoyance of audible tuning in busy shops.

Counter calibration

Most counters use a stable crystal oscillator, which requires a periodic check, and possible adjustment. Some means is generally provided for this

Buying replacement parts:

Or, finding out what wholesale means

Somebody's "wholesale" may be another man's "retail." Knowing your sources of supply and how many there are can sometimes save you big dollars.

By Joseph J. Carr, CET

As a retail businessman you probably think that you buy small parts *wholesale*, right? But it may surprise you to know that there is *wholesale*, then there is *wholesale*. If a business management consultant came into your business place this morning and offered to show you how to save 15 to 500 percent on some of your parts purchases, you would probably think he was a con man out to take your bank account for a one way ride. But he could be right! Few small business people realize that the national *industrial* electronics distributors frequently sell common electronic components at prices that are considerably lower than prices charged by local distributors geared to serving the TV shop industry.

Part of the price difference reflects the difference in services provided by the distributor. If you need same-day truck delivery on moments notice, or the ability to buy \$3 worth of widgeits on account, then forget about the industrial distributor. The industrial distributor is not usually in a position to offer same day delivery, and in fact, may not have truck delivery at all. Most of these houses use either the U.S. Postal Service or U.P.S. The

Type	Specifications	Price Ea. (100s)	Price Ea. (1000s)
Servicer distributor House Brand	1000 piv, @ 1 amperes	\$0.62	0.62
1N4007	1000 piv, @ 1 amperes	\$0.48	\$0.28
Servicer distributor house brand	1000 piv, @ 2.5 amperes	\$0.95	\$0.88
1N5399	1000 piv, @ 1.5 amperes	\$0.54	\$0.47
1N4001	100 piv, @ 1 amperes	\$0.19	\$0.10
1N4002 (Signal diodes)	200 piv, @ 1 amperes	\$0.20	\$0.11
1N914	(Silicon signal diodes		
1N4148	to UHF region)	\$0.09	\$0.08

Table 1 Comparison of quoted prices for several types of commonly used rectifier types. Note that servicer distributor "house brand" types were typically priced higher than those supplied through industrial/MRO distributors. The difference may be attributed to the level of service, i.e., same day delivery or over-the-counter pickup.

type of distributor who serves the service shop industry usually provides a walk-in showroom where bins and blister-pack offerings tempt the browser while they wait for a sales counter person. The industrial distributor on the other hand, may not have *any* walk-in facilities! Their location may be buried in a warehouse district, or industrial park, and they will do all of their business through telephones and outside salesmen. Most industrial electronic component sales are by catalog number, so a telephone will suffice. One major semiconductor wholesaler, who has locations all over the country, only allows *will-call* pick-ups between 11 AM - 12 Noon and 4 to 5 PM,

daily. The customer walks in to a small vestibule that is closed off from the main floor area by a partition and a teller's cage type of window. They may have only 60 sq. ft. in the walk-in area, but they consistently quote the lowest prices on standard semiconductors, provided that you order in quantity.

Buy in quantity

There is another key word: *quantity*. An industrial wholesaler is not terribly interested in selling one of anything to anybody. They deal in bulk. If you are a good, consistent customer, and are hard up for a single example of an unusual (for you) component, then some of them will oblige you by *giving*

it away free as an "engineering sample." But don't expect that courtesy if you haven't been doing business with them regularly, or if you ask too often. But on an occasional basis they will cooperate.

There are only a dozen or so national distributors, and perhaps a couple of hundred regional houses. They are listed in the Yellow Pages (usually) under "Electronic Equipment and Supplies." Although there are many others, some of the most widely known are Wilshire Electronics, Hamilton-AVNET, Hall-Mark, Pioneer-Standard, Cramer, Schweber, Kierluff, and others. These companies have plants in many cities, and often advertise in other cities with either a local telephone number or an "800" number.

distributors is to know *what* you want. It is not usually sufficient to call up and ask for a "0.001 μ f disc @ 1000 WVDC." They will want a manufacturer's part number. For most components such as resistors, capacitors, and fuses this is not too much trouble because most of these distributors issue catalogs, and will give you one free for the asking.

These catalogs reproduce the component manufacturer's specification sheets. Although it is handy to have a small collection of catalogs from several houses, it is often the case that one is sufficient because of a lot of similarity in product lines.

When dealing with the industrial distributor for semiconductors, however, a little more cleverness is

distribution is costly. Note that you can often identify suitable replacements for these parts by looking for the 1N/2N numbers that they replace, and then apply the theory that "things (nearly) equal to the same thing, are (probably) equal to each other." Some experimentation may prove necessary, but it is quite possible to come up with a few numbers.

"Quality" costs more

Another point to "buying wholesale" is to not overbuy your specifications. Premium spec'd parts cost premium prices. Consider the matter of rectifiers, for example. Service shops often stock either 1000 piv @ 1 ampere or 2.5 ampere rectifiers for use in everything. On a day while this article was being researched a service shop oriented distributor quoted me a price of \$62/100 (i.e., 62¢ each) for the 1 ampere model, while an industrial distributor quoted (on the same day, same city) a price of \$48/100 (i.e., 48 cents each) for 1N4007 rectifiers with the same ratings. In quantities of 1000 each, the industrial distributor could offer a price of \$28/100, or 28 cents each! Some shop owners question the wisdom of buying 100 rectifiers at a time, wondering if they would "ever use them," or how they could store them. Your own invoices will tell you how many are used, and it is a good bet that 100 would not be a year's or even six month's supply! Since most servicers store rectifiers in a drawer of a plastic parts cabinet, then it is no more difficult to store 100 or even 500, then it is to store 10.

Table 1 shows the breakdown of prices for several types of rectifier. All prices were quoted in the same city on the same day. If you use the 2.5 ampere type for everything, then you are costing yourself money. The heavy current type is only justified on color TV chassis (and then not all of them!) and a few makes of audio equipment that boast medium to high power. But in applications where a lesser rectifier is usable, then some savings are possible.

Using lesser specs is not limited to the current rating. Notice the 1N4001 and 1N4002 types listed in Table 1. These are 1 ampere diodes which have 100 volt and 200 volt piv ratings, respectively. These rectifiers would suffice in equipment that uses 9 to 28 volt power supplies, and they cost only 20 cents each in 100s and 10

continued on 53

TABLE 2

Type No.	Use	1-99 per Ea.	Replacement line cost
2N3904	NPN AM rf/osc/audio	\$0.21	\$1.25
2N3906	PNP AM rf/osc/audio	\$0.19	\$1.32
2N3053	NPN audio driver, medium or low power audio output (TO-5 case).	\$0.50	\$1.50
2N3055	NPN high power audio output (TO-3 case)	\$0.80	\$2.09
2N2222	NPN audio/low power output/driver	\$0.25	\$1.09
TIP30/RCA	NPN power transistor (audio output) in "P-66" plastic case. Used in auto radio output stages	\$0.64	\$1.70
2N5249	(see TIP30 and RCA30)	\$0.48	\$1.70

Table 2 The above table shows a comparison between the prices of one industrial supplier of semiconductors compared to the replacement line costs charged by the supply houses for original equipment manufacturers. Note disparities in pricing of up to 694%, or almost sevenfold (for the 2N3906).

When asked whether they would deal with small service shops as customers (they *won't* deal with *your* customers!) all replied in the affirmative for COD and CWO (cash with order) provided that a minimum dollar order was placed. That minimum was typically around \$20, with the range being \$10 - \$30. All but two of twelve that were asked also indicated that they would also deal on *open account*, or by *purchase order* with any firm that had a decent D&B rating, or bank credit references. Although the minimum charge order was usually \$20 - \$35.

Be specific

The secret to dealing with industrial

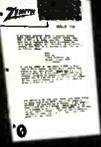
required. Don't even bother using a set manufacturer's part number, or the part number used by a replacement semiconductor manufacturer. The industrial distributor won't know what they mean! Just because a distributor wholesales Motorola, RCA, or GE semiconductors doesn't mean that they know anything at all about the replacement lines offered by the same companies! Those are different departments. You *must* know the 1N or 2N number, or the special house-number (i.e. Motorola's MJE-series or RCA's five digit 40000-series). The replacement lines are high priced because of the cross-reference guide, blister pack or box packaging, and "onesy-twosy"

Six ways to be as smart and make as much money servicing Zenith products as any technician in town!

If you are really serious about being the best Zenith service technician in town, sign up now for Zenith's 1979/80 Service Literature Subscription Program.

For a full year beginning June 1, you will receive the latest information on how to service Zenith products.

And we will keep on sending you fresh information thru May 31, 1980 as new Zenith products are introduced...and new techniques for servicing Zenith products are developed.

-  First of all, you will receive individual service manuals with step-by-step instructions, diagrams, charts, exploded views and photographs covering everything you need to know to service Zenith's newest product lines.
-  Periodically thru the year, you will receive up-dated information, tips on servicing short cuts, and other important data as they develop.
-  New product announcements will be sent to you, too...plus news of any new components kits and accessory items that could help improve your efficiency and your profit picture.
-  Chassis parts lists will be simplified and your inventory requirements reduced, because we will group into a much smaller list of chassis families all parts that are identical in one or more chassis.

5



The same for parts lists covering all cabinet models. They will be organized for you by model family to reduce the size of your cabinet parts lists as much as 90%...and greatly simplify your stocking procedures.

6



But that's not all.

Also included with this wealth of technical information will be a unique self-training manual with audio cassettes that focus on engineering innovations incorporated in the 1979/1980 product year.

There's simply no easier, more convenient, more economical way for you to be as well informed and position yourself to make as much money servicing Zenith products as any technician in town.

Sign up now for Zenith's 1979/1980 Service Literature Subscription Program by completing and mailing the coupon below!



Technical Subscription Service,
Zenith Radio Corporation
11000 Seymour Avenue,
Franklin Park, Illinois 60131

Please enter my order for your 1979/80 Service Literature Subscription Program on receipt of check (or money order) enclosed in the amount of \$31.95 (plus tax applicable in States of Arkansas, California, Florida, Illinois & Iowa).

Name _____

Company Name _____

Address _____

City _____ State _____ Zip _____

Buying from your distributor

Service is the key

Your local distributor offers personal service with a broad line of products and can supply application information and alternative and equivalent products.

By Jim Jordan*

By choice, a distributor representative carves out a geographic territory and nails himself to it. Then, he represents his knowledge of the territory as a major element of his services to his principals. This knowledge is a product which often improves with age. In due course he becomes completely familiar with customer companies, programs, policies and personnel. This is a potent advantage when compared to the factory man who will be transferred and replaced by another man who, despite all records and personal introduction, will have to learn the territory.

Territories too lean to support a factory man can be covered very well by a representative. It's obvious that a portfolio of lines, each too thin on its own, can add up to adequate business to support a representative.

Many distributor representatives maintain larger quarters and more complete offices to serve their customers than can be justified in a company sales office. Some provide services such as repair, calibration, etc., which a company office may not be equipped to provide. Others provide: direct mailing; collection and credit; application engineering; service, demonstration room and warehouse. Your representative can literally tailor make the services you require to meet your specific needs.

Aggressive men with a drive for

Jim Jordan is President of Moxon Electronics



Jordan

independence and earnings proportionate to effort are attracted to this profession. Few "reps" are supported by principals until they mature. The representative has to sell if he wants to eat.

The jungle law of the survival of the fittest continues the selection process. Of course there are some mediocre

representatives ... but grade for grade, representatives are more successful salesmen. Some major manufacturers find this a potent argument for staying with the independent distributor representative system even at high sales volume.

The representative does not change jobs. Because of his tenure in his territory, he is well known by the customers—which lends stability to the relationship between the account and the factory. Reps make for solidarity.

Remember that the distributor representative is a full fledged businessman. While representing many lines of products, he is running his own business. He's become conversant with many business problems—many of which are quite similar to your own. His opinions and experiences may have value to you. Most of all, he is a marketing expert in his own backyard. He can be quite cogent about products, your markets and your methods. Business maturity is far more common among representatives than among factory salesmen. And the beauty of it is that the representative is usually begging to have his brains picked. **ET/D**

The only thing you need to know about Quartz Crystals is...1-405-224-6780

When you call that number, you reach an expert who is backed by the world's largest stock of crystals and who can give you info-advice-and service second to none.

Sentry gives you:

- Best Delivery plus Emergency Service with Guaranteed Delivery
- Highest Quality with gold MIL-C-3098 Process
- Ask for Sentry Technology Manual



SENTRY®
Manufacturing Company
Crystal Park Chickasha, Oklahoma 73018



Toll Free Order Line 1-800-654-8850

Circle No. 131 on Reader Inquiry Card

GOULD PROFESSIONAL OSCILLOSCOPES AT PRICES YOU CAN AFFORD.

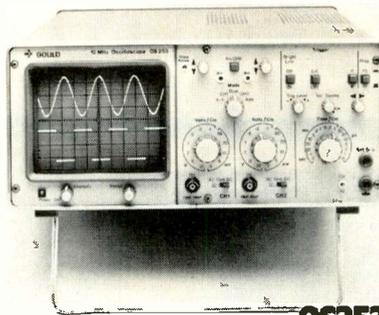
Whatever your interest in electronics, you know that a quality oscilloscope with a broad range of features and functions can make your work a lot easier. Gould oscilloscopes are built to solve your problems and priced so you can afford the professional equipment you need right now. All are complete, ready for use, including passive probes, input leads and a comprehensive maintenance and operation manual.



OS245A

List Price \$595.00

The OS245A is a compact, dual trace instrument with a 10MHz bandwidth and 5mV/div sensitivity. It has exceptional trigger performance and a full complement of facilities for industrial, educational, and field service applications.



OS253

List Price \$695.00

The OS253 is a 12MHz dual-channel scope with all the features of the OS245A plus a larger display area, more sensitivity and channel sum and difference.

The dual trace OS255 weighs only 15 lbs. yet offers features normally found in more expensive instruments such as flexible triggering facilities and 2mV/cm sensitivity across its full 15MHz bandwidth.



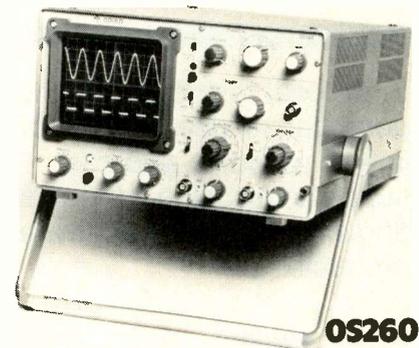
OS255

List Price \$795.00

The dual beam OS260 gives true representation of two separate signals on the same time frame without beam chopping or alternating. Features include a high brightness CRT operating at 10kV

Circle No. 117 on Reader Inquiry Card

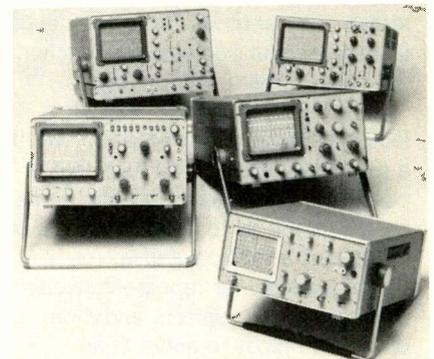
allowing a clear display of all waveforms.



OS260

List Price \$995.00

For additional information on this exciting new line of sensibly priced, professional oscilloscopes or for sales locations in your area: call toll free (800) 325-6400 Ext. 77. In Missouri call (800) 342-6600.



Gould also manufactures an additional line of general purpose oscilloscopes for industrial, scientific and laboratory applications.

 **GOULD**

Buying direct

It can be cheaper!

Buying direct from the manufacturer can give you access to complete stocks, and by eliminating a middle man, lower prices.

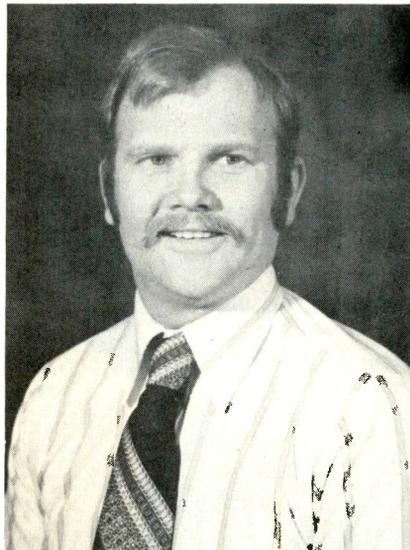
By John F. Dwinell

In discussing the merits of buying from a distributor or buying direct from the manufacturer, a small service shop owner must decide what are the most important priorities to his business.

These priorities will be determined by the owner's objectives that he wishes to achieve in his business, and the means by which he plans to achieve them.

For instance, if the owner is doing the technical work himself, he may not be too concerned how fast the job is being finished. His pay is going to be determined by how profitable his shop is. So if his time can be spent in a more profitable way, then obviously he will spend his time where he can make the most money. If this is the case, then he can afford to have the torn down machine sit with its disassembled parts and wait for the parts that must be ordered. On the other hand, if he is hiring a technician to do the technical work, then time spent on each job is of the utmost importance. The technician's time becomes part of the owner's overhead, so the efficiency with which this technician can turn over jobs will directly affect how profitable the shop is.

If a torn down machine has to sit too long waiting for parts, then the owner is not getting paid for a job not complete, as well as taking up storage space. The longer he has to wait, the more space is being used for the torn down machines and the more technicians' time is invested in the work order. If the owner wishes to tie up more capital, he can stock spare parts to make his technicians' time more efficient, but this



Dwinell

takes additional resources.

This is one of the many decisions an owner must make. These decisions are going to be partially determined by the service that his local suppliers can provide him, the cost of the spare parts that he wants to stock and the speed of delivery that his local supplier can provide. So one can see that the regional supplier plays a very important role in the decisions that any small service shop owner makes. The regional supplier, sometimes known as a distributor, is usually supplied directly from the manufacturer or from a super distributor who handles a large variety of products to supply the regional areas. A shop owner could not buy from these super distributors because they have to buy minimum quantities that are usually larger than he can use in a reasonable amount of time.

These regional suppliers (distributors) were originally set up by the manufacturers through a network of manufacturers' representatives. This particular form of distribution was used by the manufacturers because in the past there was not the technological advancements in data processing that there are today to process a large

number of orders with a small dollar volume that are generated by small service shops. These shops also found it difficult to communicate with manufacturers concerning problems of quality, price, deliveries and returns, etc. Manufacturers, especially small ones, usually did not maintain large and aggressive sales forces because their expertise was in manufacturing, not sales. They relied on the manufacturers' representatives to market their products. To allow this system to function, the manufacturers raised their prices to give the distributors a profit margin as well as the manufacturer's representative.

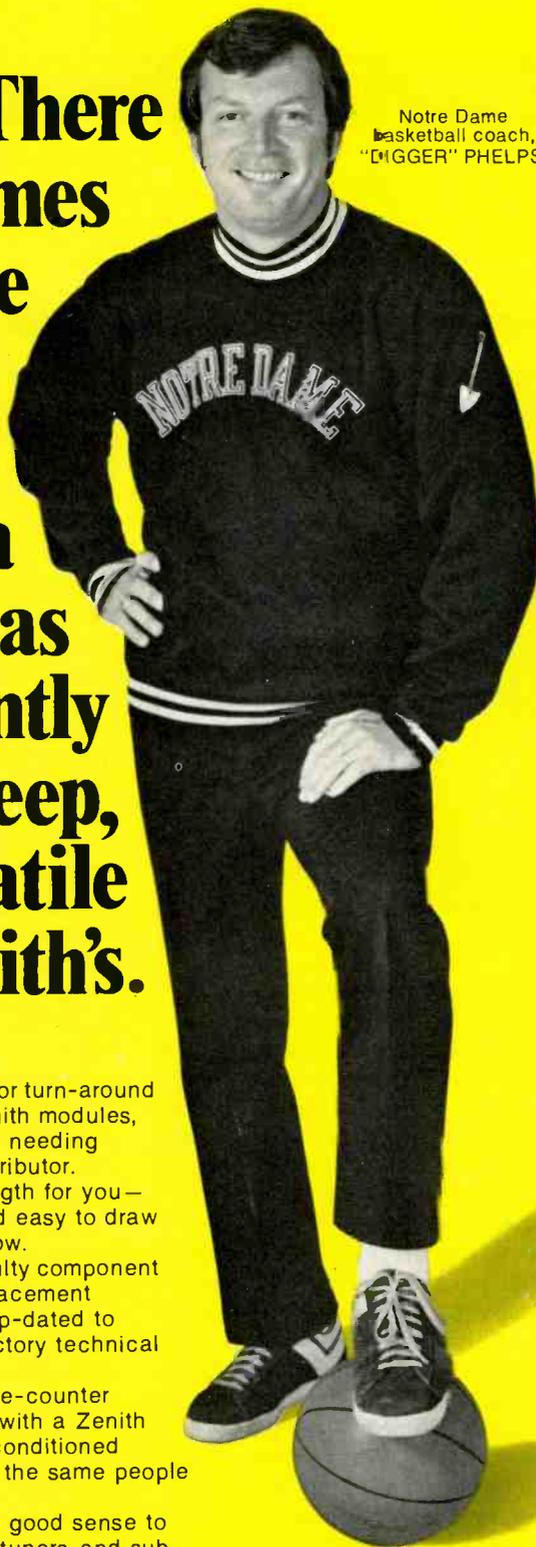
The purpose was to give personalized care to smaller accounts and to reduce the impact of large freight bills for heavy and bulky items. Not only would the distributor take care of these problems, but he also would give the small service shop owner personalized service because the distributor would have a sales force that would periodically call on small owners to take care of their orders and keep them informed of the newest products on the market. A distributor would also improve delivery time because the merchandise would be shipped from a regionally located warehouse instead of the manufacturer's warehouse.

A distributor also gives instant market penetration for the manufacturer's newest products because he has a sales force "pushing" the product. If, however, there were any problems with the quality, the distributor was at a disadvantage because he would have to go back to the manufacturer to get satisfaction. This could cause problems depending on the people involved.

The obvious result has been that the prices for the products are higher than necessary and the small service shop owner is at the mercy of these people if there is no other supplier. In effect, the consumer pays for the lack of sophistication of a system that was originated before the advent of the

John F. Dwinell is President of Projector-Recorder Belt Corp.

**There
are times
he'd give
anything
to draw
on a
bench as
consistently
strong, deep,
and versatile
as Zenith's.**



Notre Dame
basketball coach,
"DIGGER" PHELPS

There's no waiting or turn-around time when you bring Zenith modules, tuners or sub-assemblies needing repair to your Zenith distributor.

That's bench strength for you—as deep, dependable, and easy to draw on as any you'll ever know.

Not only will the faulty component be replaced, but the replacement module will have been up-dated to incorporate the latest factory technical improvements.

And it's an over-the-counter exchange. You walk out with a Zenith factory repaired and re-conditioned replacement serviced by the same people who made the original.

So it simply makes good sense to exchange your modules, tuners, and sub-assemblies with those from the original source.

That's with your Zenith distributor, of course, for modules, tuners and sub-assemblies...and a bench that never quits!

For your own reputation and in your customers' best interest, always specify Zenith exact replacement parts and accessories.

ZENITH
The quality goes in before the name goes on.

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

computer. This system has served the manufacturer well over the years and he is reluctant to change because he does not want to be bothered with the small billings or the hassle that would be involved to change over to a direct billing system.

However, another conclusion which might not be as obvious is that this form of distribution can be energy wasteful. The whole system is based on personalized contact which requires gasoline and vehicles to accomplish. As the cost of fuel goes up, the distributor's overhead increases. So do the prices.

There is no question that this form of distribution has served the industry well for certain products which are conducive to this form of distribution. Yet, in other cases, the story is different.

With the advances in computer technology, toll free telephone numbers, United Parcel Service and increasing fuel costs, there is often a better—less expensive way—to deliver high quality products and services to small service shops.

This method is direct buying from the manufacturer.

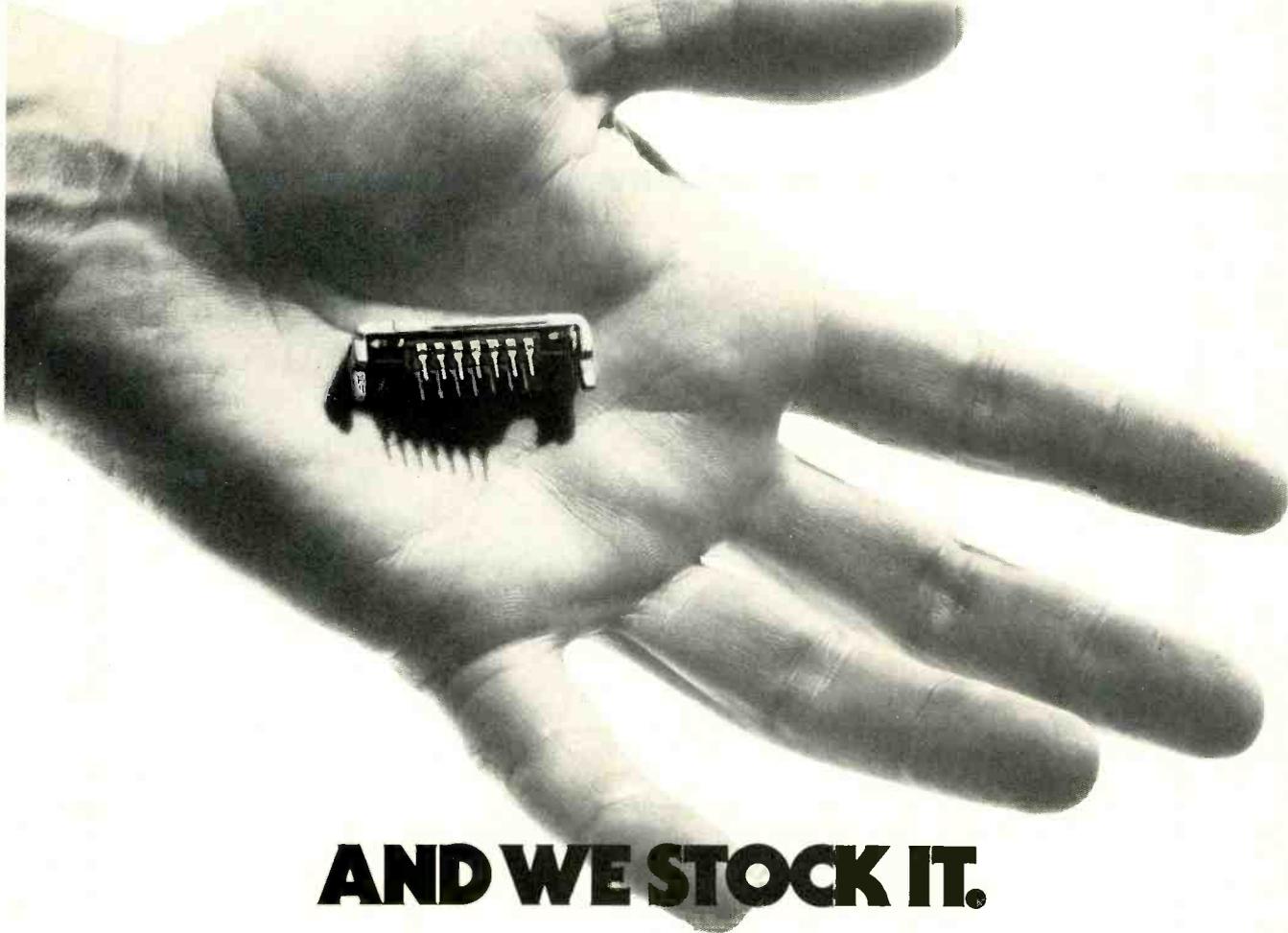
With the revolution of miniaturization, the power of the computer is becoming more widely available to everyone. The computer can store the credit and buying history of a large number of customers at a relatively small cost, compared to the cost of doing it by hand. This enables one person to handle the accounts where, originally, many people were required. The computer can also do all of the necessary typing of invoices and automatically tabs inventory control and shipping for the manufacturer.

When the telephone company introduced the toll free number as an additional service, this enabled the manufacturer to communicate with the small service shop directly as to his needs. The telephone also becomes a "free" direct line for complaints or information on new products. Because the customer is *not paying* for the call, he is not so reluctant to use this method.

One potential disadvantage of buying direct from the manufacturer, is that deliveries tend to be slower because of problems with the Postal Service, United Parcel Service or trucking, to deliver the product. However, this delay can be minimized by using the toll free number. Also, the manufacturer can design his order entry system to process, fill and ship the order the same day.

If the direct customer is willing to learn how to use the catalog, the order placing usually goes smoothly, and he may use *continued on page 54*

GENERAL ELECTRIC KNOWS WHICH REPLACEMENT YOU NEED.



AND WE STOCK IT.

Take this IC audio amplifier, for instance. And others to fit equipment brands like SANYO and RCA... PANASONIC, TOSHIBA and HITACHI. Replacements for such popular types as AN214, TA7205P, UPC1025H and HA1306.

A case style that's unique and/or power requirements ranging from .5W to 8W audio output on low voltage input (12V) power supply—

GE has a shelf filled with just what you need! And each one matches OEM specs for a particular application, whether automotive radio, tape unit or general recording equipment.

See your General Electric distributor for over 65 hard-to-find (but immediately available from GE) IC audio amplifiers. Off-our-shelf replacements are just another example of what we mean by service.

WE'RE AT YOUR SERVICE.

Tube Products Department • Owensboro, Kentucky 42301

GENERAL  ELECTRIC

A look at Hitachi

IC's and thick film modules

ET/D's first look at Hitachi reveals a chassis which is relying on integrated circuits to cut component count and cost and simultaneously produce better performance.*

By Walter H. Schwartz

The current Hitachi TV line consists of two chassis, one black and white, the SU chassis and one color, the NP8X.

The SU chassis

The black and white SU chassis is used in a compact 12 inch set and uses 15 bipolar transistors and three integrated circuits. Signal processing, except for the tuners, uses integrated circuits while the sweep circuits and power supply use discrete transistors. Tuners are conventional wafer switch and capacitor tuned VHF and UHF, respectively. The first IC, an HA1144, functions as two stages of IF and an AGC processor. The second IC, and HA1167, has a third IF amplifier stage, a synchronous video detector, sync circuitry, and develops the AGC for the HA1144 to process. The third IC, an HA11224, contains all the audio circuitry except for the output stage.

Part of the HA11224 and some external circuitry form a phase shift FM detector (Fig. 1). The input is, of course, amplitude limited 4.5MHz FM. When no deviation is present, the phase-shift is approximately $\pi/2$. Any frequency deviation is converted to phase deviation. Current, through RL1 and RL2, from the constant current source IO, is switched by the phase difference at

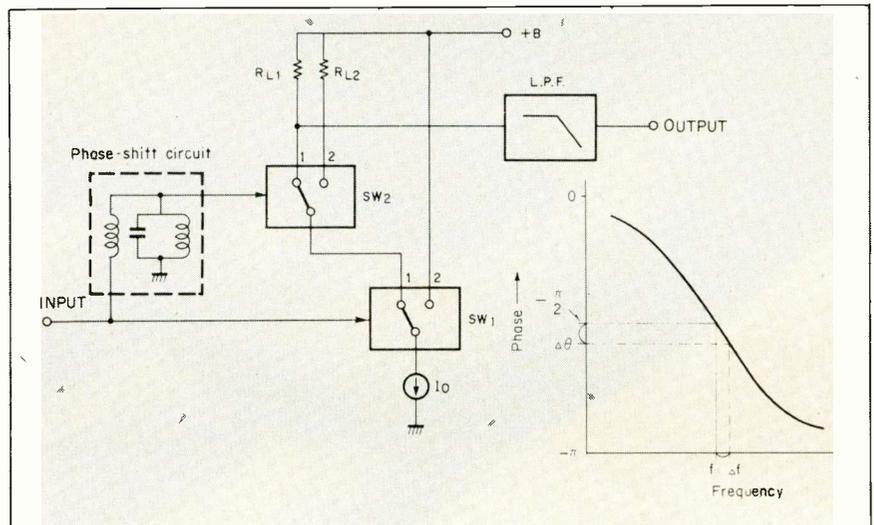


Fig. 1—Phase-shift FM detector and frequency-phase response curve.

SW1 and SW2 producing an audio component in the voltage across RL1, which after passing through a low pass filter, is fed to the audio output stage—a discrete power transistor. The sweep systems are quite straight-forward. Output from the sync separator, part of the HA1167 IC, controls the vertical and horizontal oscillators. The vertical sweep uses five transistors, the horizontal sweep only two. The horizontal output transformer includes the high voltage rectifier in a single unit.

The SU chassis power supplies are: first, a regulated 100 volt supply derived from a half wave rectifier and the ac line, which supplies the horizontal oscillator and output, the vertical output, the audio output, the video output, and the CRT screen, and second, a scan derived 11.6 volt source, which supplies the rest of the set including the CRT heater. The 100v supply has short circuit protection which shuts off the regulator pass transistor, if a short occurs on the B+ line.

Another interesting feature is the

sealed horizontal oscillator coil—there is no horizontal hold control or coil adjustment. Any component replacement in the horizontal oscillator circuit, resulting in off frequency operation, requires replacement of the coil, readjustment and then resealing.

Color chassis, NP8X

Hitachi's present color chassis, the NP8X, is used in 12, 13, 15, and 19 inch sets with little more than deflection yoke changes.

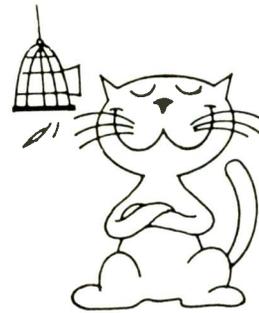
The NP8X uses four IC's to perform most of the low level functions and bipolar transistors for sweep, video, audio output and power supply regulators. Thick film modules are used in the power supply, the vertical sweep, and the high voltage hold down circuitry.

Power supplies

The basic power supply for the NP8X chassis is half wave rectified line current, filtered and then regulated by a transistor in the negative line (Fig. 2). A thick film resistor in parallel with the

*All illustrations courtesy Hitachi Sales Corporation of America

I'VE GOT A SECRET.



DID YOU KNOW THAT WE ARE "THE" MODULE REBUILDERS?

M.E.S. WILL GIVE YOU A HIGHER GUARANTEED PROFIT RETURN. PLUS, WE'LL THROW IN THAT WORKMANSHIP WE'RE BECOMING FAMOUS FOR!

WE...Specialize in all MAGNAVOX & G.E. MODULES.

- SERVICE ALL MAGNAVOX REMOTE CONTROLS, INCLUDING THE STAR.
- FINAL CHECK ALL MODULES ON AN OPERATING CHASSIS.
- USE ONLY FACTORY SPECS PARTS FOR REPAIRS.
- HAVE BEEN IN TV SERVICING FOR 20 YEARS.
- ARE FACTORY TRAINED, CET's & STATE LICENSED.
- GIVE YOU A 1 YEAR LIMITED GUARANTEE.

SEND YOUR MODULES NOW...! 48 HOURS IN SHOP SERVICE

RELY ON THE MODULE REBUILDER



MODULAR ELECTRONICS SERVICES, LTD

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

Circle No. 123 on Reader Inquiry Card

ETID - April 1979 / 31

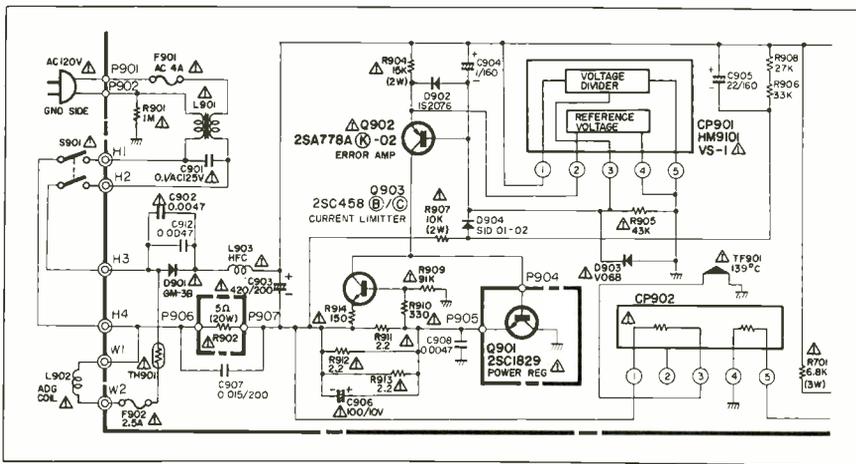


Fig. 2—The regulated +115v power supply.

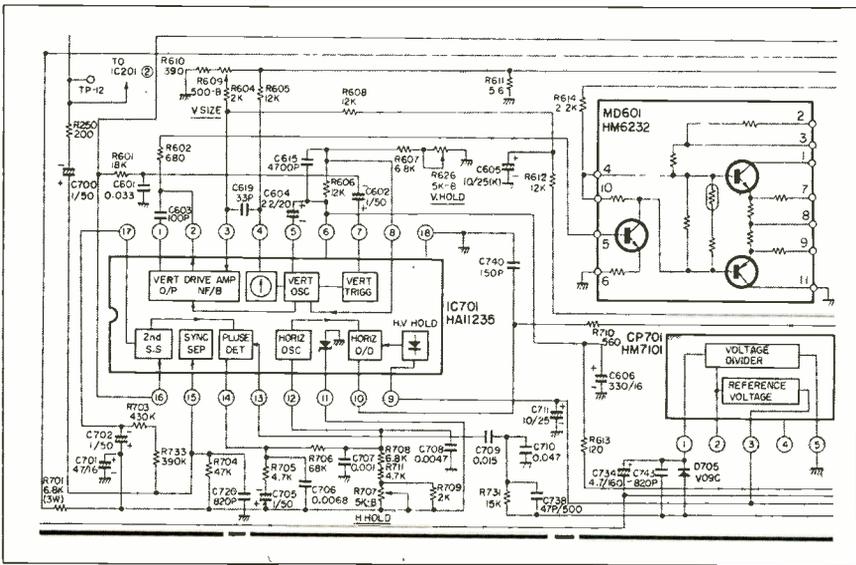


Fig. 3—Sync, horizontal and vertical oscillator circuitry.

regulator transistor, Q401, carries much of the load current and a thermal fuse protects the supply against short circuits. The fuse is in series with the thick film resistor—not the regulator transistor which is protected by Q903, the current limiter. Abnormal load current through R911-913 is sensed by Q903, which tends to turn off Q901, preventing excessive current flow and consequent load or supply damage.

The voltage divider and voltage reference are a thick film module, CP901, which contains the divider resistors and reference zener diode. The +115 volt supply furnishes power to the audio output, the vertical output, and the horizontal oscillator and output.

The +200v supply for the R, B and G output transistors, is obtained by adding a scan derived 85v to the +115v supply. CRT screen voltage is rectified pulse taken directly from the horizontal output transistor collector.

The CRT heater is supplied from the horizontal output transformer and the +12v supply, which powers all of the low

level stages of the chassis, is also scan derived.

Horizontal sweep

The NP8X sweep circuits use a new IC, the HA11235, IC 701, which contains the sync separator, sync amplifier, horizontal oscillator and AFC, vertical oscillator and drivers and the high voltage hold down circuit (Fig. 3).

Sync is applied to pin 15, processed and fed internally to the horizontal phase detector and via pin 16 to the vertical trigger input. The horizontal AFC uses a "synchronizing gate differential pulse width system." The horizontal pulse is compared to the reference pulse inside the IC and a voltage corresponding to the phase difference is produced during the horizontal synchronization period. This is applied to the horizontal oscillator pin 12 through an RC lowpass filter.

The horizontal oscillator is an RC oscillator controlled by components external to the IC. Its output is shaped to a square wave and emerges from pin 10 as horizontal signal for the horizontal

The easiest, fastest, most convenient way for you to learn to service Zenith's System 3 Triple-Plus TV!



Get yours now!

It's all here—in this one manual and three audio cassettes—the basic info you need to know to service Zenith's System 3 Triple-Plus TV!

Facts, figures, diagrams, schematics, illustrations—they're all here with a clear, intelligible narration tying-in what you read and see with what you hear.

There's simply no easier, faster, more convenient way for you to capitalize on this latest Zenith innovation in TV design and engineering.

Practically overnight, you'll change yours from a trial-and-error servicing operation to a direct-to-the-heart-of-the-problem business.

You'll save time, increase your volume—just what you need to improve your profit picture.

So, for your own reputation and in your customers' best interest, order Zenith's System 3 Triple-Plus TV self-training manual and cassettes.

Just complete and mail the coupon below.

Preserving your reputation and your customers' trust could depend on it!



Technical Subscription Service, Zenith Radio Corporation,
11000 Seymour Avenue, Franklin Park, Illinois 60131

Please send your System 3 Triple-Plus TV self-training program on receipt of check (or money order) enclosed in the amount of \$19.95 (plus tax applicable in States of Arkansas, California, Florida, Illinois and Iowa).

Name _____

Company Name _____

Address _____

City _____ State _____ Zip _____

driver transistor.

The high voltage limiter also uses a thick film module. It senses an abnormally high flyback pulse and develops a proportional voltage to trigger an SCR in IC701 (the gate connection is pin 9). The SCR disables the horizontal oscillator. Power to IC701 is obtained from the +115v supply through a dropping resistor and is regulated by a zener in the IC, giving it an independent 13.5v supply. Consequently, interruption of the sweep does not turn off the SCR and the set must be turned off long enough for the supply capacitors to discharge before the oscillator can start again. This independent source also allows the horizontal oscillator to operate without sweep and without any special startup circuit.

Vertical sweep

Sync from pin 16 of IC701 is applied to the vertical sync input, pin 7, through an integrating network. The driver output is a sawtooth at pin 2 of IC701. Feedback from the yoke to pin 4 and the vertical size control eliminates the vertical linearity control.

The vertical output circuitry is contained on *another* thick film module. It is a new high efficiency system with, according to Hitachi, about one third the power consumption of the vertical output stage of their previous NP7X chassis. The output transistors require a much higher supply voltage during retrace than during scan. Therefore, a vertical output switch, Q601, is used to switch the vertical output between the +115v and +56v supply lines at appropriate times (Fig. 4)

Video IF

A new multi-function IC, the HA11238, provides the video IF amplifiers, video detector, AFT and AGC (Fig. 5). Signal from the tuner passes through a bandpass filter the output of which is balanced for the IC input, pins 5 and 6. The HA11238 supplies three stages of amplification before the signal is internally coupled to the synchronous detector.

Synchronous video detector

The synchronous detector is a double balanced demodulator consisting of a differential amplifier and constant current source and two carrier operated switching pairs (Fig. 6).

The video IF signal is fed in balanced form to points a and b. Video carrier, filtered and limited, is fed to c and d and serves as a switching signal. When b and

d go positive and a and c negative, Q1 and Q4 turn on, Q2 and Q3 turn off, and the collector current of Q5 increases, causing the voltage across RL1 to increase, producing a negative going signal at g, and a positive at f.

Conversely, when b and d go negative, and a and c positive, Q1 and Q4 turn off and Q2 and Q3 turn on, and again, g goes negative, and f positive. Filtered by distributed capacity, this is the detector *continued on page 53*

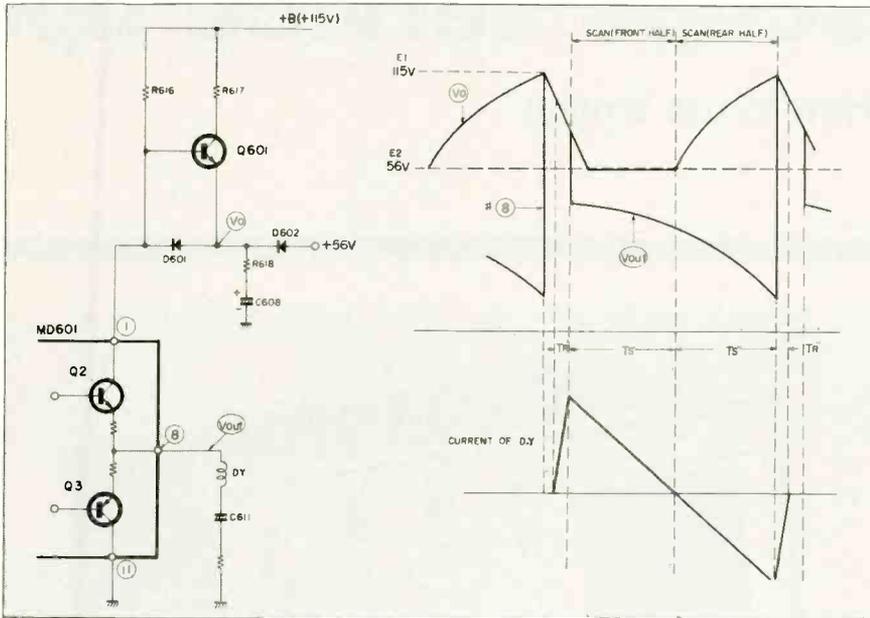


Fig. 4—The high efficiency vertical sweep power switching circuit and waveforms.

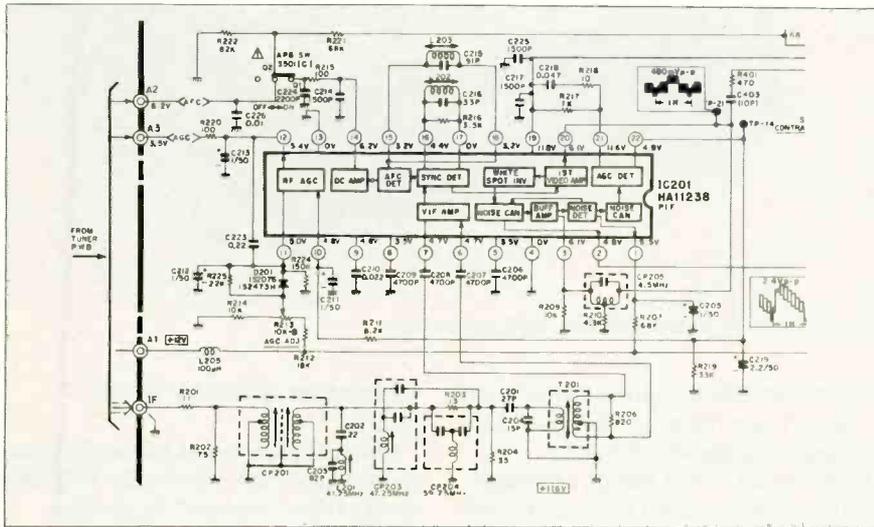


Fig. 5—Video IF IC.

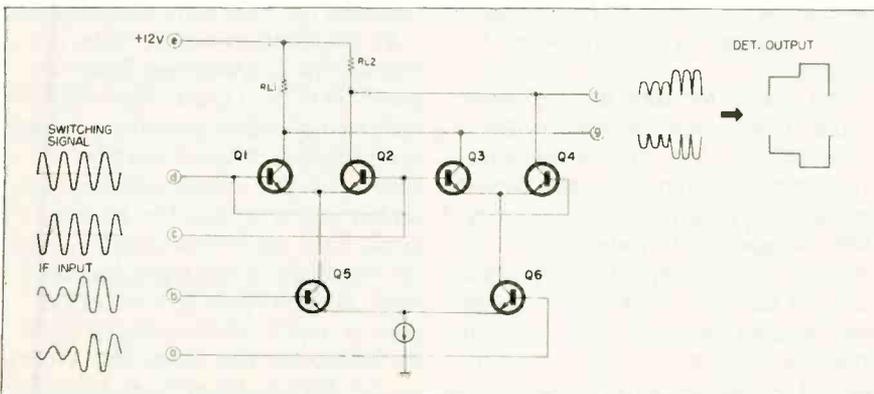


Fig. 6—Synchronous detector—simplified schematic.

Have you read our BELT BIBLE?



FOR SIMPLE AND
EXACT
BELT REPLACEMENT
We thought you should
know about . . .

THE "PRB SYSTEM"

Our copyrighted system of describing the exact replacement belts for over 4,000 models of virtually ALL Audio and Visual equipment.

- Eliminate Belt Inventory
- Order all your belts from 1 Source
- Eliminate Guessing - Exact Replacement

For Same Day Service
Call Toll Free
1-800-558-9572

SEND FOR
OUR
FREE DEALER-PROVEN
CATALOG
TODAY!

"If it's a belt,
we've got it"



**PROJECTOR
RECORDER
Belt Corporation**

200 Clay Street, P.O. Box 176
Whitewater, WI 53190

Circle No. 128 on Reader Inquiry Card

Triggered-sweep scope service tips

How to use it right!

The triggered-sweep oscilloscope is a most versatile instrument. Unfortunately many technicians do not understand its uses and even the experienced can learn new tricks.

By Robert L. Goodman

Some of the information in this article was taken from my scope seminar slide presentations that have been given at various state service conventions this year. It is hoped that some of these tips will help you isolate and track down faults in electronic devices more rapidly.

While traveling to these conventions on my lectures, I have noted a tremendous interest on the service technicians part to acquire more knowledge about how to use the triggered-sweep oscilloscope.

There is a great quest for knowledge about how to use these sophisticated instruments, but a void of troubleshooting information about how to put them to work. Thus, the objective of this article is to hopefully fill some of that void.

There are now many triggered-sweep scopes on the market with most features the technician would require and at a reasonable cost. One such scope, shown in Fig. 1, is the dual-trace triggered-sweep model OS245A-Gould. This scope has a 10 MHz bandwidth dual vertical amplifier. Without a doubt, the triggered-sweep scope is the most powerful and versatile test instrument that the technician will ever own. *Now let's put it to work!*

Spike or glitch locator

Here is a trick with the triggered-sweep scope that may help you locate an

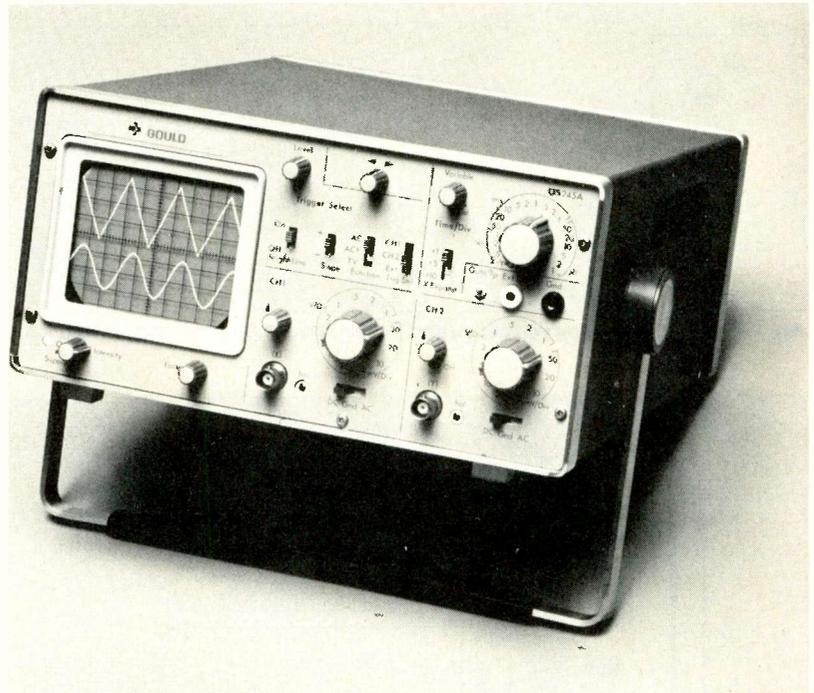


Fig. 1—Photo of Gould, OS245A, dual-trace scope.

intermittent spike or pulse that at times may be found riding on the regulated dc voltage supplies in solid state equipment. For this testing technique you will need a scope that has a single sweep mode or a "one-shot" sweep mode. This feature will usually be found on a scope with a delaying time base of an "A" delayed by "B" time base generator.

The reason for using this technique is that these spikes are very narrow (may only be 10 or 20 nano-seconds in duration) which makes them difficult to see even on a wideband (30 to 50 MHz) scope and they are usually random in nature. With this set-up you can use the ready light—which shows the one-shot has been armed—for an indicator that the spike has occurred, even if you are not looking at the scope screen. Thus, the scope

becomes an automatic "glitch" monitor.

Set the scope up as follows to catch or "see" an intermittent spike that may occur on the regulated dc voltage power supply line. Obviously, this technique cannot be used on circuit lines that normally carry pulse signals.

To set-up the one-shot mode, depress the single sweep button as shown in (Fig. 2) photo. The "READY" light will now come on and the sweep is now armed. When a spike is detected in the vertical amplifier, the sweep will be triggered on for one single trace and the ready light will go off. Punch the single sweep button again and the ready light will come back on again, which indicates that the sweep has been re-armed. What we are doing is using the ready light as a visual monitor indicator, to let you

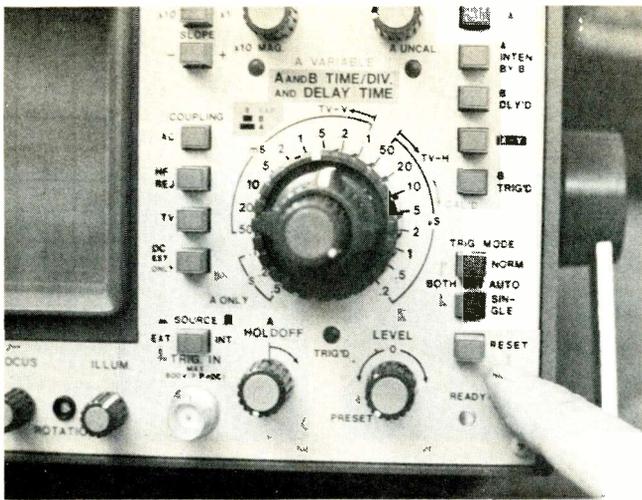


Fig. 2—Location of single-sweep and reset buttons.

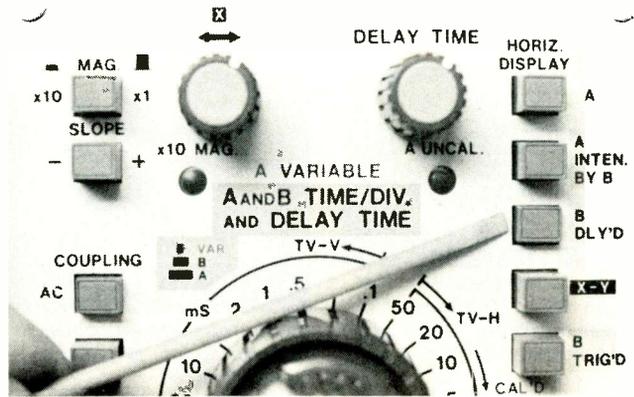


Fig. 3—Delayed sweep scope, control locations.

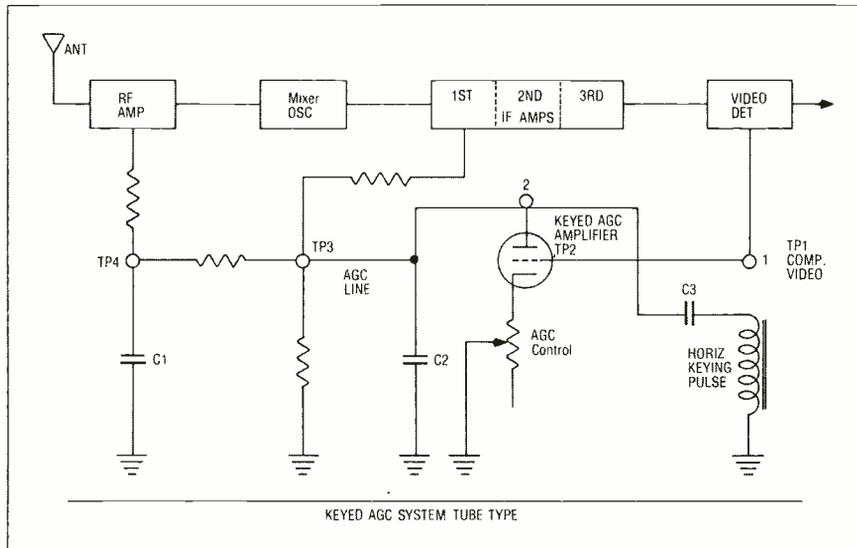


Fig. 4—Block diagram of keyed AGC system.

know that a spike has occurred in the circuit under test. In this way, you do not have to watch the scope screen all of the time and can do other service work on the bench. Also, because the spike may be so narrow you may not see it on the scope, but you will know there has been some action when the single sweep mode has been fired.

You may have to try various time base generator settings, negative or positive slope (sync) and vertical amplifier gain levels in order to obtain the spike that will trigger on the single sweep trace. Some scopes will have a trigger level control that may have to be varied. The CRT intensity control level should also be adjusted for a bright trace as there will only be one sweep across the screen. Thus, the one shot sweep enables you to know a spike has occurred that you may not normally be able to see on the scope trace.

Delayed sweep scope mode

As previously mentioned, most triggered-sweep scopes that have a

single-sweep feature (one-shot) also have the delayed-sweep functions.

The controls, as we can see in the (Fig. 3) photo, will include "A" & "B" time base generator controls, "A" main sweep, "A" intensified by "B", "B" delayed sweep and delay time control. The "A" & "B" delay sweep modes can be used to look at digital logic pulses and any other complex waveforms that you must observe in great detail. This delayed sweep will stretch out digital pulses and Vits signals, located in the TV picture's vertical interval blanking bar, much better than an X10 expander mode.

We will now use some square-wave pulses to see how the delayed sweep control settings operate. The bottom trace (Fig. 5) is a normal pulse as you would see it using the "A" time-base generator. Now the top trace was obtained by pushing the "A" intensified by "B" time base generator. Note that two pulses are much brighter than the other pulses. These, of course, are the ones that are intensified. You may now rotate the

delay time control and the brightened portion will move smoothly across the display. The brightened portion represents the delayed sweep, and occurs according to the SEC/DIV. switch setting. The delayed sweep speed is independent of the main sweep speed, and may be set to any speed equal to or faster than the main "A" time base sweep generator.

Now press the "B" delayed sweep button—note top trace (Fig. 6)—and the intensified portion of the triggered waveform is now displayed across the entire scope screen. Another feature, when using the delayed sweep mode is that the trace does not have the jitter that usually occurs when you use the X10 magnified mode on the single time-base oscilloscope.

Keyed AGC system

The only signal information (pulses) that does not change amplitude in the composite video signal is the horizontal sync pulse, unless the signal strength changes. This is fortunate, as the keying pulse can now be used to sample the horizontal sync pulse in order to develop a controlled-dc AGC voltage.

Refer to the block diagram of the keyed AGC system (Fig. 4). In the keyed AGC system, the control voltage is developed by the AGC amplifier tube. The control grid of this amplifier receives a composite video signal from the video detector. The plate of the amplifier has no dc plate voltage, but receives a narrow positive going pulse from the horizontal sweep pulse winding. The correct timing of these two signals is shown in Fig. 7. Now hold this information in your mind for future reference a little later in this article.

When there is not any circuit fault, the keying pulse and the horizontal sync pulse appear at the amplifier at

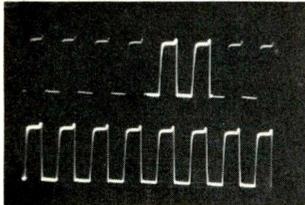


Fig. 5—Bottom trace is normal scope setting. Top trace is obtained with the "A" sweep intensified by the "B" time base generator.

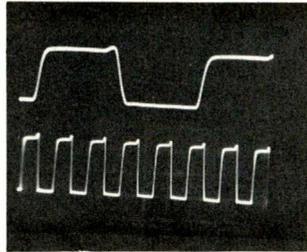


Fig. 6—Top trace was obtained by pressing the "B" delayed sweep button.

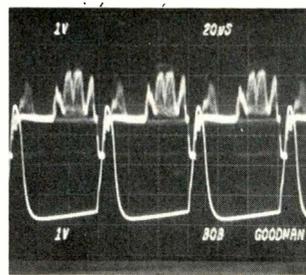


Fig. 7—Correct timing of the keyer pulse.

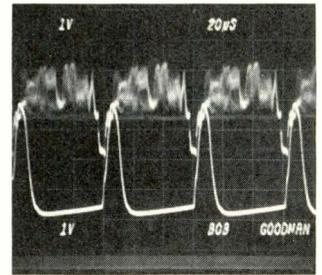


Fig. 8—Keying pulse delayed about 5 microseconds.

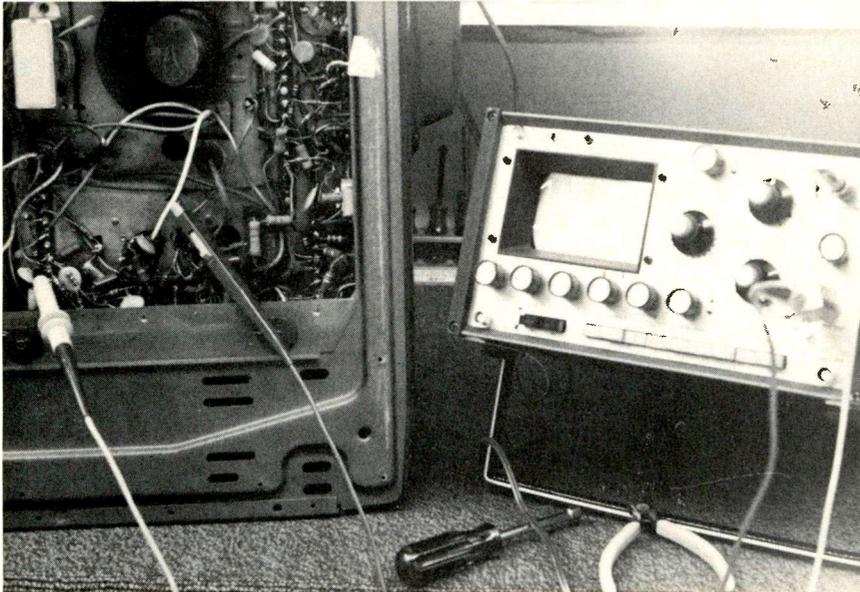


Fig. 9—Scope set-up to check out the keying pulse timing.

the same time. The amplifier conducts only when the horizontal keying pulse appears on the plate, and the AGC voltage developed is due to the sync pulse amplitude of the composite video signal and the dc bias on the control grid. Thus, any noise pulses which may occur on the video signal between sync pulses will not operate the AGC amplifier. The reason for this is because there is no keying pulse at the plate. In this way impulse noise signals will not affect the AGC output. Hence, the circuit is immune to noise pulses that may occur between horizontal sync pulses.

AGC scope checks

The dual-trace scope may be used to check the AGC keying pulse and the horizontal sync for correct coincidence. This is an ideal instrument for comparing any two pulses or signal waveforms simultaneously.

To check out the keying pulse timing or phase, refer to the block

diagram (Fig. 4) again. Connect the "A" channel scope probe to the control grid TP-1. This will give you the composite video signal. The "B" scope probe is then connected to the plate, TP-2. This is the point where the horizontal keying pulse is injected. The scope is set to the dual-trace alternate mode to 10 or 20 micro-seconds per divisions. The "A" and "B" scope signals have been superimposed in the (Fig. 7) dual-trace pattern to illustrate the correct pulse coincidence. You will note in the (Fig. 8) dual-trace photo the keying pulse is delayed about 5 micro-seconds. The keying pulse could be delayed for various reasons. Some reasons are coupling capacitor faults, defective pulse windings on the sweep transformer or trouble in the horizontal AFC oscillator control circuit state.

Horizontal sync and keying pulses that do not coincide may cause the TV picture to bend, weave or be overloaded due to an incorrect AGC

keying pulse. If the pulse is too wide, this can cause wrong AGC voltage to be developed due some video or 3.58 MHz burst information being amplified along with the sync pulse to be sampled. Thus, it may be worth your time to note or measure the width of the AGC keying pulse.

For proper phase comparison checks feed the "known standard pulse" into the scope's "A" vertical channel (in this case horizontal sync pulse from the TV station) which is contained in the composite video signal for a correct timing evaluation. If you should feed the horizontal sweep keying pulse into the "A" channel, this could be incorrect (wrong phase), thus giving you a false indication between the two waveforms in regard to timing.

Note that most scopes have the vertical "A" or "1" channel selected for the internal trigger synchronizing of the trace. However, on some scopes you can switch the internal sync lock to either the "A" or "B" vertical amplifier scope channel. For these scopes make sure you feed the "known standard pulse" into the channel selected for the internal trigger sync signal source.

Note photo (Fig. 9) of the dual-trace scope set-up to check for correct keyed AGC pulse timing.

AGC picture symptoms

Some AGC picture symptoms troubles are as follows:

- Weak, washed out picture
- Negative picture
- A very snowy picture
- No picture, with or without sound
- Very contrasty picture, with or without bending and rolling; poor picture with buzz in sound

AGC line filtering checks

For proper set operation and good picture reproduction the AGC control

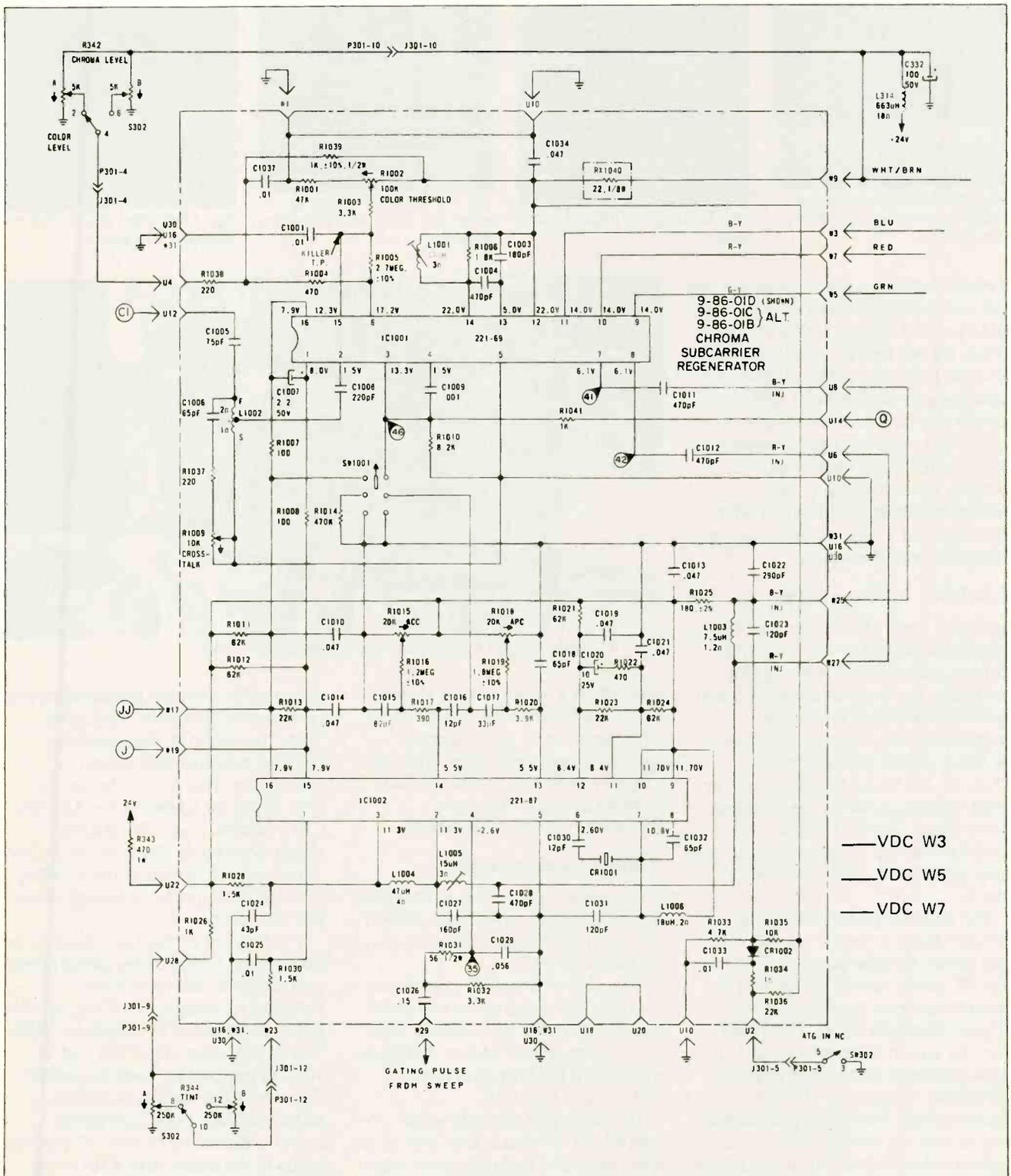


Fig. 10—Zenith 9-86-01 color module circuit.

line must have a pure dc voltage. The AGC line requires filters (C1 & C2, Fig. 6) to smooth out the horizontal keying pulses that are applied to the plate of the AGC amplifier. If these AGC line filters become open the picture may bend and weave. When

you check the AGC line with the scope, you should see a smooth line as shown in the upper dual-trace scope photo in Fig. 11. If one or both of the AGC line filters would open, the scope would indicate some horizontal pulse hash as shown on the lower

scope trace of Fig. 11.

Chroma circuit phase checks

The dual-trace scope is a natural for solving some otherwise difficult chroma circuit problems. Should pulse phase timing be shifted in the chroma

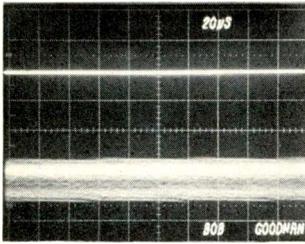


Fig. 11—Bottom trace shows hash due to open AGC filter capacitors.

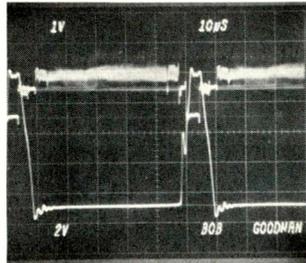


Fig. 12—Correctly aligned gating pulse.

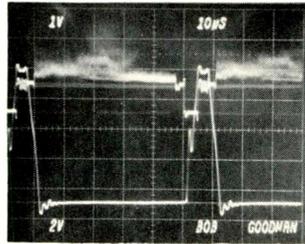


Fig. 13—A mis-timed gating pulse due to an AFC circuit problem.

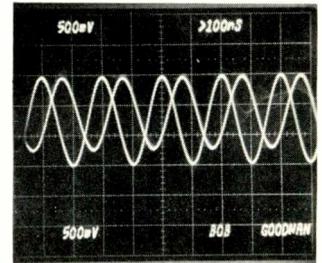


Fig. 14—Correct phase shift for 3.58MHz CW signal.

system then the reproduced colors will not be correct and there may be color fade out or a complete loss of color. Thus, we will look at ways to check chroma burst and gating pulse timing, plus observe the 3.58MHz CW signal phase used by the demodulator. A dual-trace triggered-sweep scope will give correct information when the relative phase (timing) of two waveforms must be known, or when the condition of two signals must be compared simultaneously.

Locking in the sweep

Because many of the color processing circuits are keyed to the horizontal flyback pulse for timing and gating purposes, an accurate check of these pulses for timing and phase is imperative. The following information is given, should you choose to "lock-in" the scope waveform with an external sync pulse for these phase comparison checks. However, as noted elsewhere in this article you can use the internal scope sync-lock-in mode.

For accurate phase checks the "known standard pulse", in this case the horizontal sync pulse generated at the TV studio, should be fed into the scope's external sync jack for the proper reference signal. This pulse may be picked off at the output of the sync separator and should have an amplitude of from 5 to 10 volts peak-to-peak. Blanking pulses should not be used as most of these have a built-in delay. Horizontal sweep output pulses should not be used either as they have a long duration (very wide) and would cause measurement errors. Of course, the best reason not to use these sweep output pulses is they may have a timing error already due to a circuit malfunction. In fact, this circuit trouble may well be the reason you are using the dual-trace scope in order to locate a phase shift problem.

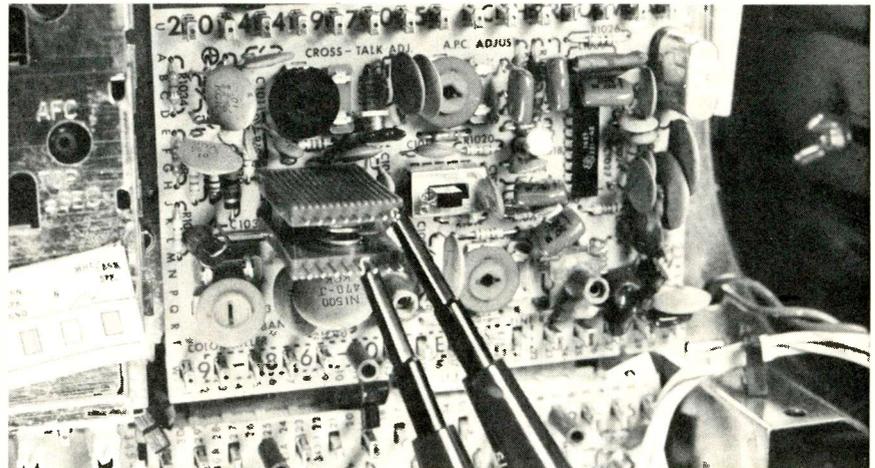


Fig. 15—Clip-on test pin adaptor for checking signals on an IC.

It would be a waste of time to make a phase shift check with an improperly timed pulse fed into the scope's external trigger jack. Thus, when the scope is locked in properly you will have an accurate "real-time" comparison of the pulse phase.

Comparison checks

To illustrate some of these dual-trace scope techniques the Zenith 9-86-01 chroma module circuit shown in Fig. 10 will be utilized.

One scope comparison procedure is to check the timing of the horizontal gating pulse with the 3.58MHz color burst. Various color picture symptoms will occur if the burst and gating pulses do not coincide.

To understand why this would happen we will take a brief look at the burst separator and color sync action. The first operation in the color sync process is to separate the burst from the composite video signal. This is the function of the burst separator. It could be tube type, transistor or within an IC. The separation of the burst is based on its time location within the transmitted signal. To achieve separation, an amplifier is used that is normally cut off, but is turned on by a

gating pulse from the horizontal sweep section only during the burst time. Thus, the output of this amplifier contains only the color burst information. This burst is fed to the AFC circuit for control of the 3.58MHz CW oscillator. This CW reference signal, after being phase shifted, is fed to the chroma demodulators in order to develop the proper color signals for the CRT guns.

The first comparison procedure is to observe the timing of the gating pulse with regard to the color burst. Referring to module circuit Fig. 10, the gating pulse is fed in at terminal W29. The gating pulse enters pin 4 of IC 1002 to be used for burst separation. For comparison on the dual-trace scope the color burst (composite video) is picked up by the "A" channel probe of the scope (use X10) at pin U12 of the module. The "B" channel probe of the scope is connected to W29 of the module. With the time-base generator set at 10μs per div. the color burst and gating pulse should be aligned as in the Fig. 12 dual-trace photo. At the same time check for correct shape (gating pulse width) and peak-to-peak amplitude.

Should timing of the horizontal

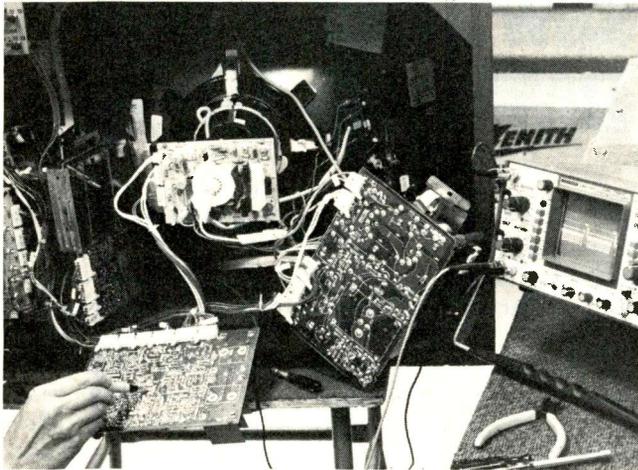


Fig. 16—Using a scope to troubleshoot a new Zenith X chassis.

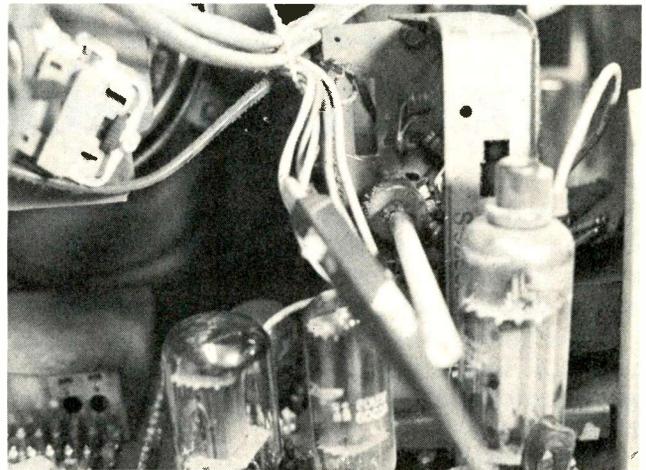


Fig. 17—Current probe clipped on a yoke lead.

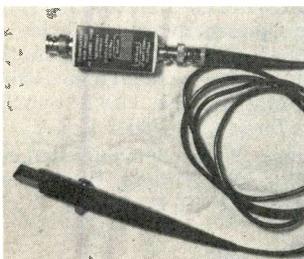


Fig. 18—Photo of ac current probe used with a scope.

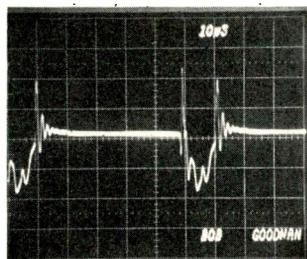


Fig. 19—Horizontal yoke current waveform.

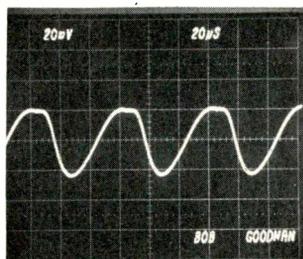


Fig. 20—Current being fed into the convergence system.

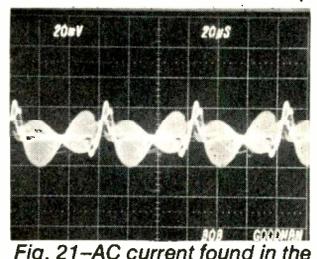


Fig. 21—AC current found in the pincushion correction circuit. Note the bow-tie pattern.

gating pulse be "off" the color will fade out or change (intermittently) in various areas of the color picture. Should timing be way off there will be a complete loss of color. The mis-timed gating pulse shown in the Fig. 13 dual-trace photo was caused by a fault in the (AFC) horizontal phase detector stage. The gating pulse can occur too soon, as in this case, or be late. Perhaps leakage in a coupling capacitor, a noisy resistor or a faulty pulse coil winding could cause these same symptoms. Usually, in these cases, the gating pulse will appear to jitter back and forth on the scope trace.

For proper color demodulation the 3.58MHz CW signal must be shifted from 90 to 120 degrees. The comparison of this phase shift is a natural task for the dual-trace scope. For this check connect the scope probes (use X10) to module terminals W25 and W27. Set the scope time-base generator to 100 ns per div. and then superimpose the two CW signals as shown in (Fig. 14) for an exact analysis. Note the 120 degree phase shift. This lets you test for any fault in the phase shift network and also for the amplitude of the CW

signal. The chroma signal enters at pin 2 of IC 1001 and is amplified within the "chip," and then exits at pin 3. The chroma signal is then coupled via capacitor C1009 to pin 4 of the IC for more amplification. After some more amplification the signal exits at pin 14 and is shaped by the chroma bandpass circuit and goes back into the "chip" at pin 13 for color demodulation. The scope can now be connected to these various check points to look at the chroma signal as it goes in and out various stages of the IC. When checking signals on the IC pins with any test instrument probes, use a clip-on test pin adaptor that is pictured in Fig. 15. A slip of a probe tip can quickly blow out an IC.

With many brands of color TV sets now going back to one large board (circuit panels) or larger modules you will need to get out the scope and bone up on circuit troubleshooting. Also, you may want to think about repairing some of the older modules and earn some extra \$\$\$\$\$. The photo Fig. 16, illustrates how the new Zenith X chassis (K models) can be swung out on the bench without using any extension cables and the scope being used for tracing signals on the

module circuit boards.

Oscilloscope current probe

The service technician may want to consider using an ac current probe to check on some current waveforms. The ac current probe can be quickly clipped around an insulated wire (note current probe on yoke lead wire in Fig. 17) to check ac current without cutting into a lead wire or going to a test terminal. An ac current probe with its termination block is shown in Fig. 18.

A typical ac current oscilloscope waveform found in the horizontal yoke lead of a color set is shown in the Fig. 19 scope trace. Convergence and pincushion correction circuits may also be checked with the ac current-scope probe. In Fig. 20 we see the horizontal current that is fed into the convergence circuit in order to correct the scan of the three electron beams. While in the Fig. 21 scope current waveform (note bow-tie pattern) is the ac current found in the pincushion correction circuit. Because most service information does not give the current scope waveforms you will need to look at a properly operating TV set and draw or photograph your own set of scope current waveforms. **ETD**

The last time you saw a really new bench/portable DMM was 1972.

That's the year our 8000A was introduced. Its custom LSI and solid owner benefits quickly established it as the world's leading DMM.

Now, look at the new 8010A and 8012A: single-chip CMOS designs for problem-solving in the eighties!

RAZOR-SHARP LCD for large, no-strain answers at first glance — in any light.

TOUCH AND HOLD probe option, so you can thread your way through a component jungle and capture the reading you need.

FUNCTIONPOWER: 22 ranges of AC and DC volts and current, six ranges of resistance, and three ranges of conductance — the missing function on other bench multimeters.

CONDUCTANCE RANGES for noise-free leakage measurements to 10,000 M Ω . A valuable function for bench-testing boards and components, conductance also measures transistor beta (using a bias resistor) and light intensity (by using a photocell).

OVERLOAD-PROTECTED — like no other DMM, including rejection of 6000V transients and up to 600V applied to the current terminals.

HONEST AC ANSWERS derived from a Fluke hybrid true rms converter. You'll even see the difference on your AC line between the correct value and what your average-responding meter reads. And 50 kHz bandwidth won't let any significant distortion products go unmeasured. Plus, 10 times the basic response you may be limited to now!

SPECS YOU EXPECT from Fluke — like $\pm 0.1\%$ on DC for one year. Both models available with rechargeable batteries, and backed by the same solid warranty and worldwide service that helped make the 8000A the industry standard.

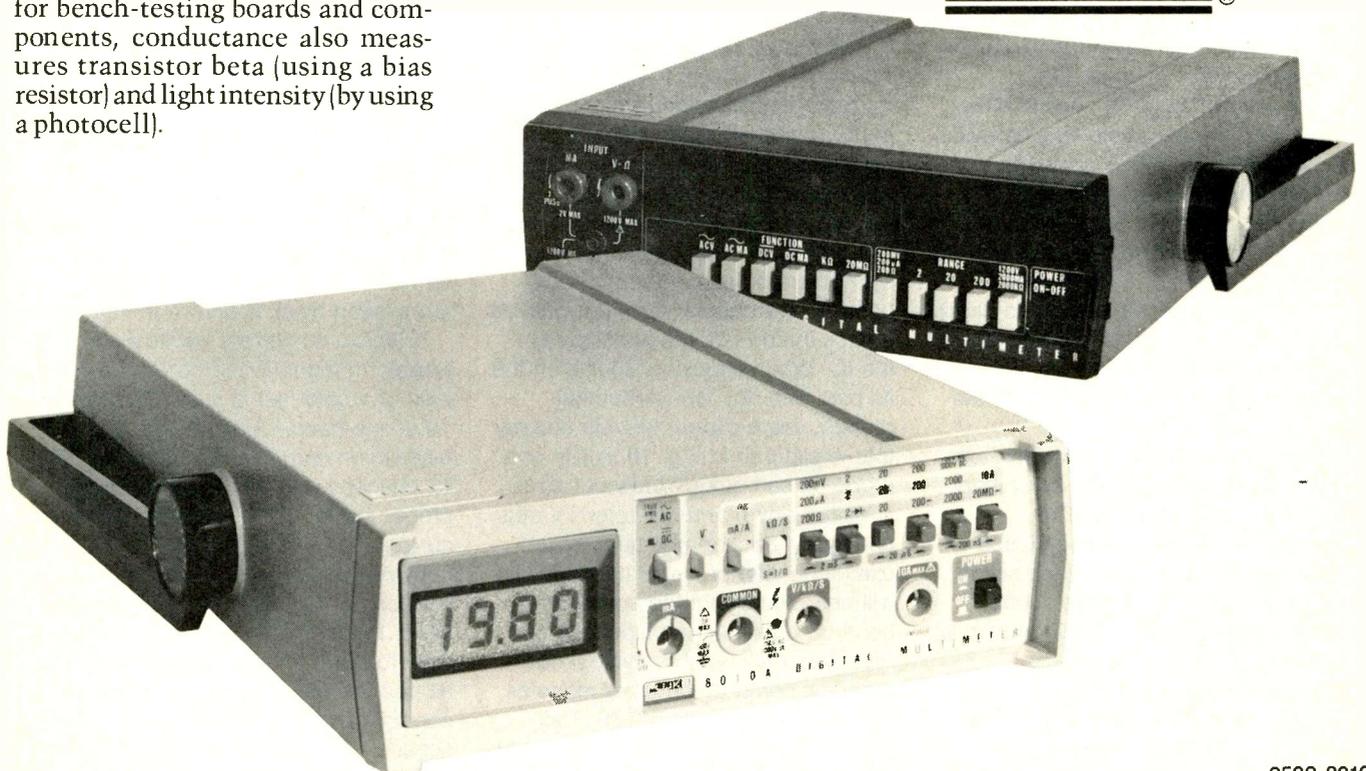
LEADERSHIP HAS TO BE EARNED. And we're committed to keeping the price of your confidence as realistic as possible. Like \$239 for the 8010A with a 10A current range, and \$299 for the 8012A with two extra-low ohms ranges that allow measurements from 0.001 Ω to 10,000 M Ω — making it the widest range ohmmeter available!

Contact one of the more than 100 Fluke offices and representatives, worldwide, or CALL (800) 426-0361* TOLL FREE. In the U.S., and all countries outside Europe, write: John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043, U.S.A.

In Europe, contact Fluke (Nederland) B.V., P.O. Box 5053, Tilburg, The Netherlands. Telephone: (013) 673973. Telex: 52237.

Prices U.S. only.

*Alaska, Hawaii, Washington residents — please call (206) 774-2481.



...Circle No. 139 for information
...Circle No. 140 for demonstration

2502-8010

BULLETIN BOARD

An "Annotated Directory of Parts and Services For Audio-Visual Equipment," has been produced by the *Association of Audio-Visual Technicians and the EPIE Institute*. This directory lists sources of parts and service information for more than 800 brands of AV equipment. It covers the equipment by brand name and lists sources of parts and companies that currently distribute various makes and models of AV equipment. The directory is \$12 to members and \$22 to non-members from AAVT, PO Box 9716, Denver, CO 80209.

Outdoor TV Antennas are the subject of three full-color wall charts from RCA. One covers the complete line of UHF-VHF/FM, VHF/FM, UHF and FM antennas. The second covers UHF-VHF/FM and FM antennas and the third covers VHF/FM and FM antennas. The appropriate version is available for local market conditions. Contact your local RCA antenna distributor, or, *RCA, Distributor and Special Products Division*, Depford, NJ 08096, Attn: Sales Promotion Services.

"**Electronic Games; Design, Programming, Troubleshooting,**" by Walter H. Buchsbaum and Robert Mauro, is a mid-level treatment, with a minimum of mathematics of those increasingly popular electronic games. It should contribute much more to the technicians understanding than service data alone can, since it goes into theory of video effects, sound effects, microprocessors and their programming and then considers their application to games. It explains design examples, the flow charts, software, programming necessary for a

typical game of blackjack. "Electronic Games" covers background information on commercial games and troubleshooting techniques for many of them. "Electronic Games," Buchsbaum and Maure, *McGraw-Hill*, hardbound \$17.50.

"**How to Repair Movie & Slide Projectors,**" *TAB BOOKS* No. 1011, by Robert Villastrigo, is a step by step guide to repairs on 8, 16, and 35 mm film strip, slide, overhead and opaque projectors and film viewers. It gives some general, and a great deal of specific, information on Kalart Victor, Bell and Howell, Elmo, Eastman, Leitz, Kodak, GAF, including those sold under other brand names, DuKane, Besler, AV Concepts, Califone and Prima projectors. Schematics of the electrical-electronic systems are presented along with information on replacing mechanical components. \$12.95 hardbound, \$7.95 paperback from *TAB BOOKS*, Blue Ridge Summit, PA 17214.

Reconditioned Test Equipment is the subject of a new 64-page catalog published by *Tucker Electronics Company*. Instrument categories include amplifiers, analyzers, bridges, frequency measuring equipment, signal generators, laboratory standards, meters, oscilloscopes, recorders, RFI/EMI equipment and more. Over 1200 individual items are described and priced. All are reconditioned and calibrated to manufacturer's original specifications. Tucker also offers repair, calibration, and overhaul services for test equipment. Write: *Tucker Electronics Company*, PO Box 401060, Garland, TX 75040.

A new television signal distribution equipment catalog is now available from *Blonder-Tongue Laboratories*. The catalog covers everything necessary for CATV and MATV systems; antennas, amplifiers and preamplifiers, converters, audio and video modulators, filters, traps, outlets, splitters, connectors, coa-

xial cable and test instruments. The catalog is available from your *Blonder-Tongue distributor* or *Blonder-Tongue Laboratories Inc.*, One Jake Brown Rd., Old Bridge, NJ 08857.

A winter parts, tools and service aids catalog has just been published by *Ora Electronics*. It reportedly features hundreds of original replacement parts such as IC's, transistors, capacitors and others used in Japanese and other Far-Eastern made equipment as well as tools and hardware needed in consumer electronics service. A free copy of the catalog is available from: *ORA Electronics*, 7235 Canby Ave., Reseda, CA 91335.

Projector-Recorder Belt Corp. has announced their new 1979 catalog containing replacement belts for video tape recorders, audio cassettes, 8-track players, and turntables. The catalog also contains updated cross-referenced information on over 4000 models of electronic entertainment equipment. Also featured is a complete line of aerosol chemicals, lubricants, adhesives, patch cords, needles, and record care accessories all at factory direct prices. Write or call toll free (1-800-558-9572) for your free copy of this valuable servicemen's aid and comprehensive cross reference

MICROWAVE SURVEY METER

RECOMMENDED BY ALL MAJOR MICROWAVE OVEN MANUFACTURERS FOR MICROWAVE OVEN LEAKAGE MEASUREMENTS

Model
HI-1501
Price \$240



Immediate Delivery - 90 Day Warranty

- Meets H.E.W. requirements
- Operates on two 9 volt alkaline batteries, included
- 3 ranges, 0-2, 0-10, 0-100 mw/cm²
- Calibrated at 2450 MHz
- Accuracy: ±1 db
- Maximum power density: 1.5 W/cm²
- Temperature compensated
- Attractive Carrying Case with foam insert

Order from:
HOLADAY INDUSTRIES, INC.
7509B Washington Ave. South
Edina, MN 55435 (612) 941-5100

Circle No. 119 on Reader Inquiry Card

A Classroom In Your Mailbox!

STUDY
Two-Way Radio

THROUGH THE
REVISED

MTI

Home Study Course

Send coupon below for free course outline
No obligation - No salesman will call

Professional Training in a Unique Career Field

Providing Training to the Industry Since 1960

study FM two-way radio at home!

I am interested in learning more about professional FM two-way radio. Please send me full details on the MTI training program.

Name _____
Address _____
City/State/Zip _____

MTI

Mobile Training Institute

Box 735, Camp Hill, PA 17011-U.S.A.

Circle No. 124 on Reader Inquiry Card

ET/D - April 1979 / 41

Nobody does it better than VIZ

NEW SIGNALYST™ Color Bar Generator

Model WR-515B \$249



**EVERY COLOR TV TEST
SIGNAL YOU NEED.
A PRICE NOBODY ELSE
CAN MATCH.**

There's absolutely nothing else on the market like this new VIZ Color Bar Signalyst. Use it to service TV sets, video recorders, CATV, MATV, CCTV, etc. Compact enough to carry with you on house calls. Complete enough for every shop test—at a price you can afford. Look what it does for you:

Patterns supplied. Superpulse; regular color bars; color bars with luminance; color bars less burst; red, green or blue primary color rasters; color trio; gray quad; hatchdots; dots—all with progressive or interlaced scanning and 4.5 megahertz sound carrier.

Outputs. Video (pos. or neg. polarity) 0-1.7 volts into 75 ohm line. RF and IF continuously adjustable from snow-low 20 microvolts to 200,000 microvolts (enough to drive a whole hotel full of TV sets). All outputs crystal controlled.

Scope triggers. Two separate 3.7 V peak-to-peak pulses for H & V trigger.

Comes complete with 75 ohm output cable and 300 ohm snap-on head and excellent text on application. See your local VIZ distributor.

VIZ Test Equipment Group
335 E. Price St., Philadelphia, PA 19144
The VoltOhmyst company

chart. Projector Recorder Belt Corp., 200 Clay St., PO Box 176, Whitewater, WI 53190.

A catalog of mobile communications antennas has recently been released by *Decibel Products, Inc.* Catalog M-101 covers a variety of UHF and VHF mobile antennas, parts and accessories and new developments for the 800MHz band. Decibel Products also offers base station antenna diplexers, filters, combiners and other radio communication accessories. For information write to Decibel Products, Inc., 3184 Quebec, Dallas, TX 75247.

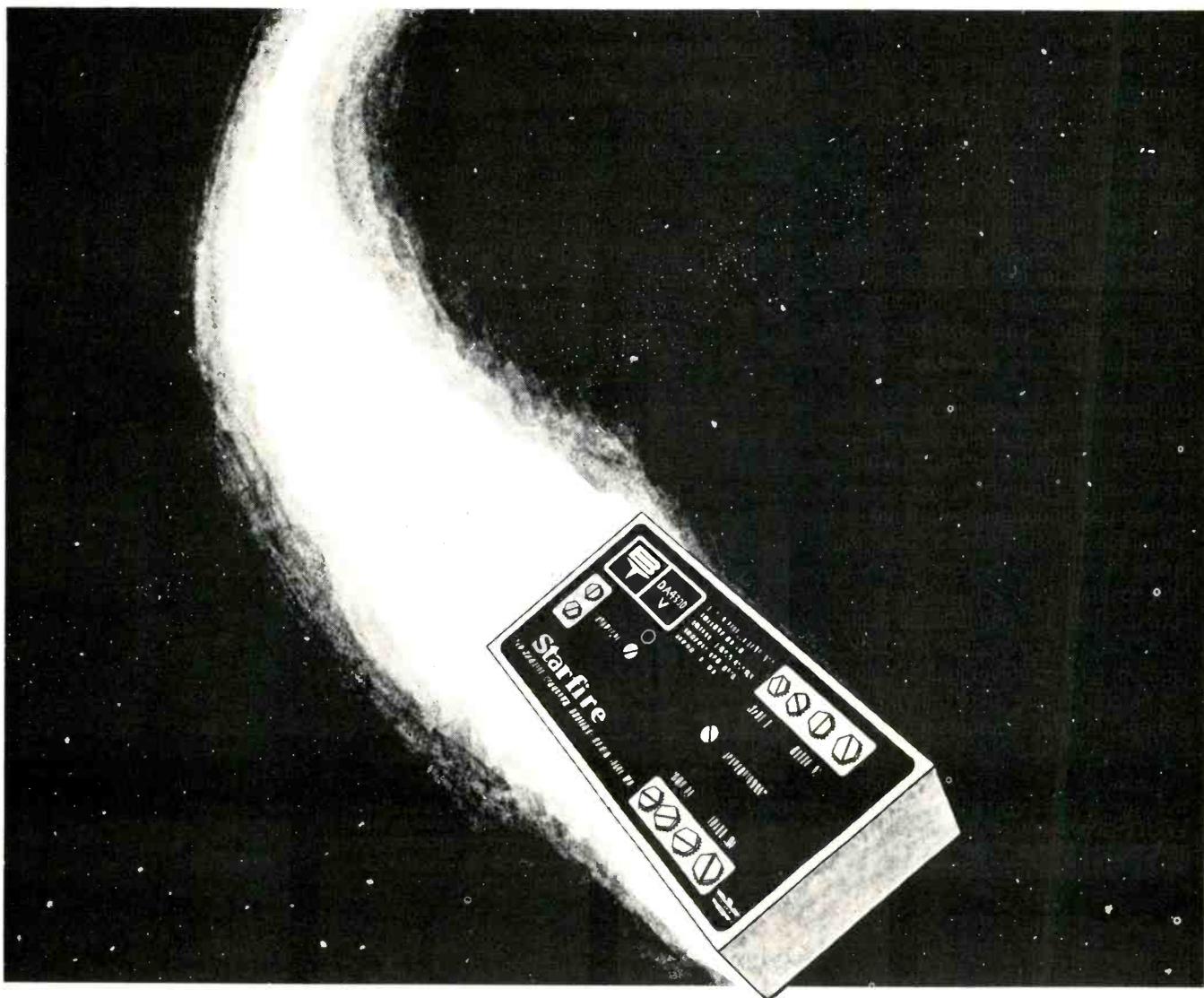
A new catalog of small tools and precision instruments for photographic and electronic repairs has just been published by *National Camera, Inc.* This 1979 catalog contains 64 pages of hand tools, kits and accessories, measuring instruments, electronic and camera test instruments, photo technical supplies, optics and other tools and supplies. For a free copy, write to National Camera, Inc., 2000 W. Union Ave., Englewood, CO 80110.

Flameproof resistors are the subject of a 10-page brochure recently published by *GTE Sylvania*. It lists the characteristics and construction features of Sylvania ECG flameproof resistors in one-fourth, one-half, one and two watt sizes with resistances ranging from 1 ohm to 100 megohms, depending upon wattage. This brochure is available from Sylvania distributors or GTE Sylvania, 1025 Westminster Dr., Williamsport, PA 17701.

Original Japanese semiconductors are the subject of a catalog from *MCM Audio, Inc.* Covered is a large selection of transistors, integrated circuits, diodes, fuse type pilot lights, resistors, capacitors, replacement motors and other Japanese parts and a Japanese transistor substitution manual. MCM states if they don't have the item you want, they will supply a guaranteed substitute or get an exact replacement. For a free copy write: MCM Audio, Inc., 634 Watervliet Ave., Dayton, OH 45420.

New and used test instrument catalog No. 106 has just been issued by *Lectronic Research Laboratories*. This catalog lists 48 pages of test equipment and components including laboratory quality instruments and items such as vacuum and oil capacitors, timers, industrial tubes and relays. For a free copy write *Lectronic Research Labs, Inc.*, Atlantic and Ferry Ave., Camden, NJ 08104. **ETD**

Light years away from the competition.



The Starfire Series.

Our competition can't give it to you. But we can. Introduce your customers to Blonder-Tongue's new Starfire line of distribution amplifiers, and watch your sales blast-off.

For residential and small commercial indoor installation, the Starfire distribution amplifier accommodates four TV and/or FM receivers. Its patented ICEF* circuit provides extra wide dynamic range. A tunable FM trap attenuates strong interfering FM signals, and when not in use permits full band FM amplification (same as VHF TV signals).

And, we've maintained the same engineering excellence that made our Galaxy series an industry leader six months after its introduction.

The same solid-state construction.

The same built-in power transformer for safety and line surge protection.

The same performance, reliability, stability and ease of service that you expect from Blonder-Tongue.

*U.S. Patent No. 3413563


BLONDER TONGUE
LABORATORIES, INC.

One Jake Brown Road Old Bridge, New Jersey 08857 (201) 679-4000

Circle No. 110 on Reader Inquiry Card

TEST INSTRUMENT REPORT

It really isn't very long ago that carrying a full set of test instruments along on service calls required plenty of space in the service vehicle and strong arms and occasionally plenty of time while the pattern from your color bar generator settled down after coming in from a cold van. Solid state devices have shrunk instrument sizes and digital techniques

Current ranges (dc) are from 10nA to 100mA full scale. Accuracy on most ranges is $\pm 0.5\%$, $\pm 0.5\%$ of full scale.

The 100mV dc range has an overload capability of 500V. The other dc voltage ranges will withstand 1KV. The ac ranges are rated at 600V RMS, notwithstanding the X1KV multiplier. For extra protection and extended range on dc volts, a 90 megohm X10 probe extension may be slipped over the red test prod.

The LX-303 is apparently intended to be hand held. It fits the palm of the hand easily—at least, my hand—and can be range switched by the thumb. The red test lead must be moved when function is changed, reportedly to simplify switching and also to require a conscious effort on the part of the user to help avoid errors in function and range selection.

The test leads do not replace easily for storage in the instrument case, but store very easily in the accessory carrying case.

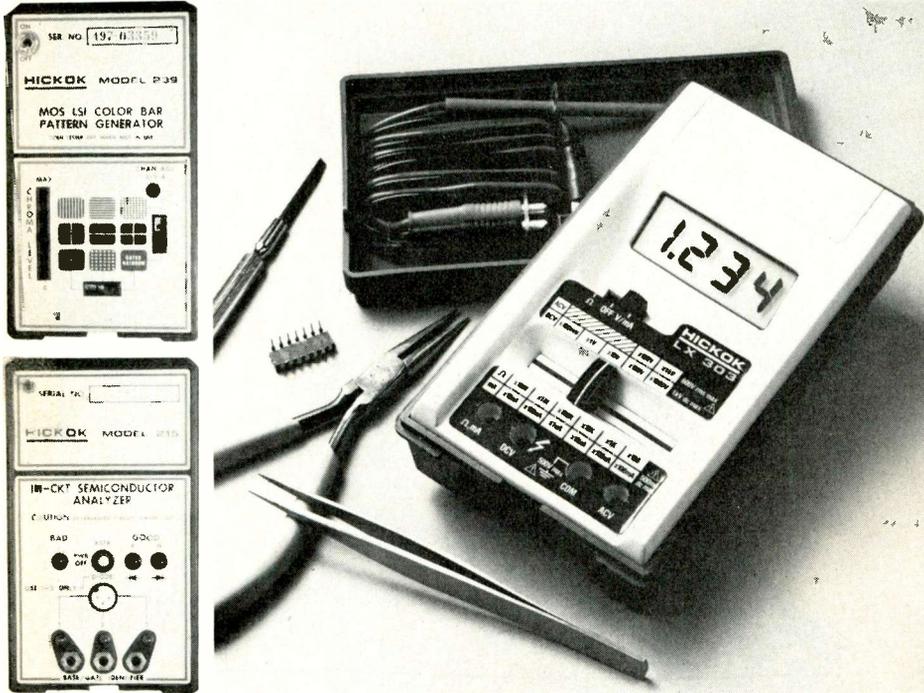
Accessories for the LX-303, in addition to the VP-10 probe and the CC-3 carrying case, are the RC-3 ac adapter, the VP-40, 40KV dc probe, and the CS-1, a 10 ampere dc current shunt.

The Model 239 Color Bar Generator supplies nine different patterns for adjustment or troubleshooting color television receivers, including gated rainbow, lines, dots and cross hatch. RF output is front panel adjustable to channels 2, 3 or 4. Chroma level is variable from 0 to about 150% of normal.

The circuit of the 239 uses a custom MOS IC designed by Hickok specifically for this instrument. It contains the equivalent of approximately 1000 transistors and performs all the digital logic to produce the various patterns. The 239 uses 2 other ICs and 5 transistors, including 3 in the power regulator. Power consumption is such that a pair of standard 9V transistor batteries last about 30 hours of operation. An automatic shut off switch conserves the batteries when the cover is closed.

The 215 automatic semiconductor Analyzer also uses MOS ICs to very cleverly scan the connections to the transistor under test to determine which is which—it will identify the base—and then reads good or bad and PNP or NPN. No matter how a transistor is inserted in the socket or connected, it will determine the right test connections. It will test in circuit as long as shunting impedances are greater than 500 ohms at 1KHz. It will test bipolar transistors, junction FETs, unijunction transistors, and diodes directly; it can test other devices

continued on page 54



Hickok LX-303 DMM, the Model 1239 Color Bar Generator and the Model 215 Portable Semiconductor Tester. For more information circle Number 150 this issue.

Hickok's Mini-Instruments

Small in size, but big at heart

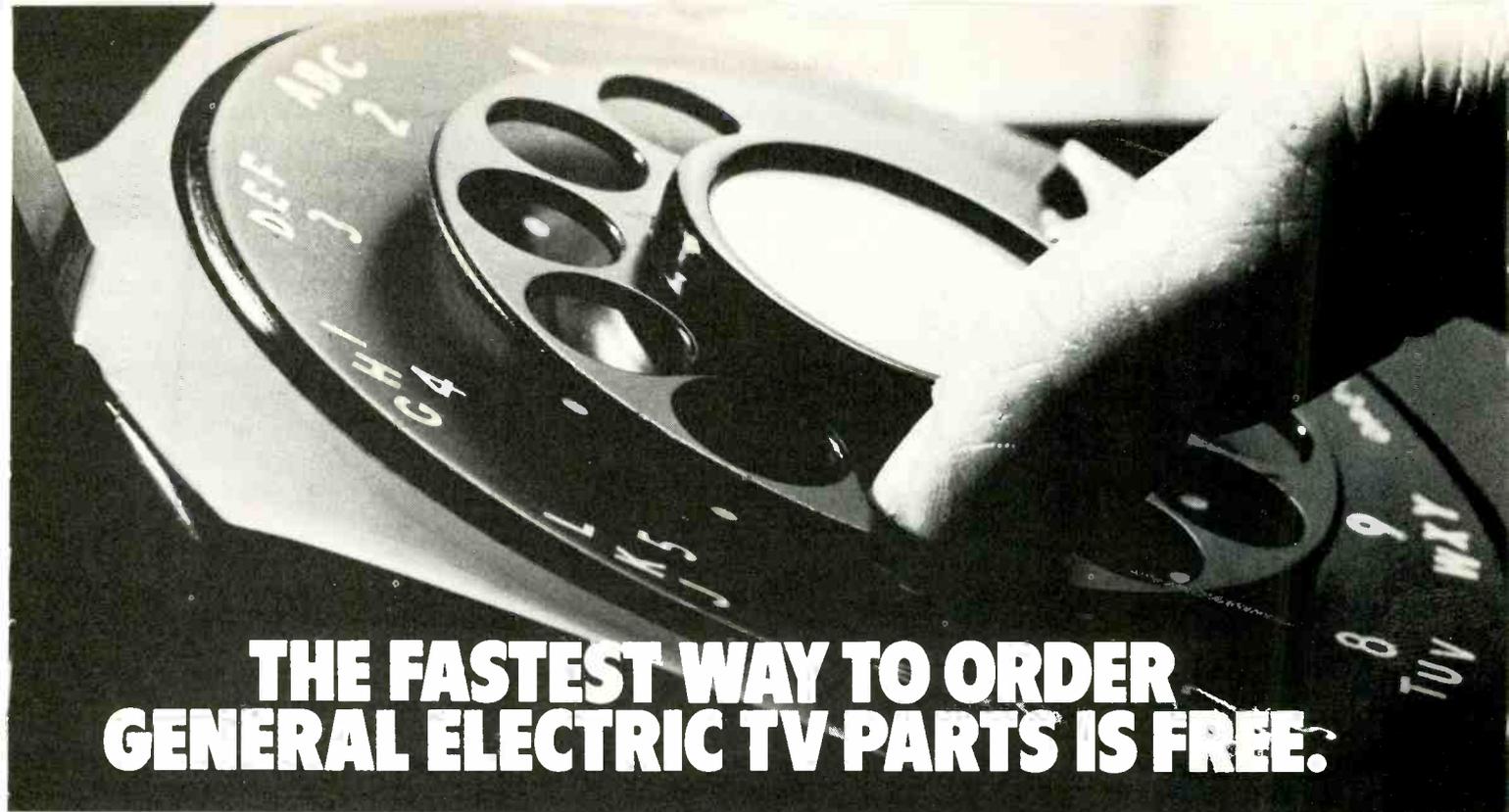
By Walter H. Schwartz

have stabilized the pattern generator.

The three instruments reviewed this month are Hickok's new LX-303 Digital Multimeter, and two Hickok instruments that have been available for some time, the pocket sized Model 215 Semiconductor Analyzer and the Model 239 Color Bar Generator. Each of these measures 3 $\frac{1}{2}$ by 5 $\frac{1}{4}$ by 1 $\frac{1}{8}$ inches, weighs 12 oz or less, and is battery operated for completely portable use.

The LX-303 is a 3 $\frac{1}{2}$ digit liquid crystal display instrument based on the Intersil ICL7106 integrated circuit. This allows a multimeter to be designed with a LCD readout device, an input divider (in the LX-303 a thick film unit), a few other resistors, capacitors, and diodes, and of course, the ICL7106.

Features of the LX-303 include, auto polarity, auto zero, and over range indication. DC ranges are 100mV, 1, 10, 100, and 1000 volts; ac ranges are X100 and X1000 volts; ohms ranges are X100, X1K, X10K, X1Meg, and X10Meg. Actually, all of these ranges except the 1KV ac will safely read to 1.999 times the appropriate multiplier.



THE FASTEST WAY TO ORDER GENERAL ELECTRIC TV PARTS IS FREE.

General Electric has the magic number. A toll-free hotline connecting you directly with the GE Parts Center in most all areas. And the simple key to using it is charging your order to VISA, Master Charge or an approved GE Open Credit Account.

That's one way we're making your business easier. But it's not the only way. We're continuing to increase stocks throughout our national computer-linked parts distribution system. And striving to fill orders faster than ever before.

To make GE Performance Television even easier to service, we're packing a new Mini Manual into the back of every color set. It gives

you the right schematic diagram, parts list, symptom repair information and safety features for the set you're working on. Which makes your job a lot easier.

For our list of toll-free numbers and everything you need to order GE TV parts fast fill out and send in the coupon below. **It's our business to make your business easier.**

"DUTCH" MEYER
GENERAL ELECTRIC TELEVISION
ONE COLLEGE BOULEVARD
PORTSMOUTH, VIRGINIA 23705

ETD 79

Please send the following:

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

Name _____

Service Company _____

Address _____

City _____ State _____ Zip _____

GENERAL  ELECTRIC

DEALER'S SHOWCASE



AM-FM Scanner

Circle No. 141 on Reader Inquiry Card

Electra Company has announced a new development in scanner technology that allows a single scanning monitor to receive not only public safety, marine, "ham", and other FM frequencies, but also the AM aircraft frequencies. The new Bearcat 220 scanner is reportedly the first scanning monitor which combines AM and FM reception capability. Six VHF and UHF FM Public Service bands plus the AM aircraft band are covered by this radio.

Crystal-less, pushbutton frequency entry is used in the Bearcat! 20. Up to 20 frequencies can be in any sequence or mix of bands. A priority function is also provided, instantly alerting the listener when a call is made on the priority frequency programmed into the channel one position. Channels can also be activated in banks of ten, permitting the operator to "call up" a group of ten channels with one pushbutton.

Other features included in the Bearcat 220 are patented selective scan delay, scan speed selection, AC/DC operation, automatic and manual squelch, individual channel lockout, and direct access to any programmed channel without the need to manually step through channels. *Electra Company's* patented "track tuning" is used to provide optimum reception across entire frequency bands. The suggested retail price of the new Bearcat 220 scanner is \$379.95.

Record and Tape Care Products

Circle No. 142 on Reader Inquiry Card

Renaclean, Germany's largest selling line of audio maintenance products, will soon be available to U.S. consumers, according to the distributor, *Renaclean*, U.S.A.

Products being marketed include liquid cleaners for tape heads and discs, cassette head cleaners, tape cleaning guides and a new introduction—a liquid-filled tracking arm for phonograph records.

Anti-static fluid within the tracking arm is fed to a special fiber cleaning pad and applied to the record automatically as it is played. According to the manufacturer, the result is better fidelity and longer wear because records stay cleaner. The reservoir in the tracking arm refills easily and holds up to a three-month supply of anti-static treatment fluid.

Gas Sentry

Circle No. 143 on Reader Inquiry Card

The 15-500 Home Gas Sentry, introduced by *CG Electronics*, reportedly warns of the presence of smoke and of the build up of gases, including butane, propane (LP-gas), methane and the products of combustion. A newly developed gas sensing element detects a higher than normal gas concentration before it reaches the dangerous level, where an explosion could occur or a person could be overcome by fumes. The suggested retail price is \$32.95.

Portable Miniscopes for Electronic Professionals on the Go!!!

The standout oscilloscope development of the decade!!!

Now—single & dual trace models. Compare the performance, then compare the price.



Circle No. 148

MS-15

\$318



Circle No. 149 on Reader Inquiry Card

MS-215

\$435

- 15-megahertz bandwidth. ● Accuracy—3% full scale.
- Internal, line or external trigger. ● Batteries and charger/transformer unit included. ● Graticule: 4 x 5 divisions, each division 0.25". ● Weight: Less than 3 lbs with batteries. ● Size: 2.9" H x 6.4" W x 8.0" D.

NLS products are available from Nationwide Electronic Distributors. Send for our brochure today!



Non-Linear Systems, Inc.

Originator of the digital voltmeter.

Box N, Del Mar, California 92014 Telephone (714) 755-1134



Videodisc Player

Circle No. 144 on Reader Inquiry Card

The Magnavision optical videodisc player by *Magnavox* is a record player that shows pictures. Now available for the first time to American consumers are low cost video programs for home entertainment. Ranging in price from \$5.95 to \$15.95, an initial catalog of videodisc programming includes a mix of enter-

TUNER SERVICE

All overhauls guaranteed two full years.

Give us a try - you'll like the way we do business.

Call TOLL FREE 1-800-433-7124

In Texas call 1-817-834-8201

TEXAS TUNER SERVICE

4210 N.E. 28th St., Ft. Worth, TX 76117

Circle No. 133 on Reader Inquiry Card

Let's face it. The longer a set sits in your shop, the less profit you make. And call backs hurt even more. If you have to work on a set again because a replacement part failed, your profit is gone. Maybe even your customer.

We've been working with technicians for years to help solve these problems. So when you order WEP semiconductors, we make you two simple promises:

1. No back orders. Your

distributor won't do that to you, because we won't do it to him. And you'll get sets out faster.

2. Fewer call backs. When you install WEP semiconductors, you're installing the best quality parts available. We know they're good, so we promise you fewer part-failure related call backs with WEP.

In addition you get great margins, and complete

technical information on every package.

Next time you need semiconductors, or any replacement parts, ask for WEP/Workman. You'll most likely end up with a few less sets "waiting on parts," and a few more happy customers.

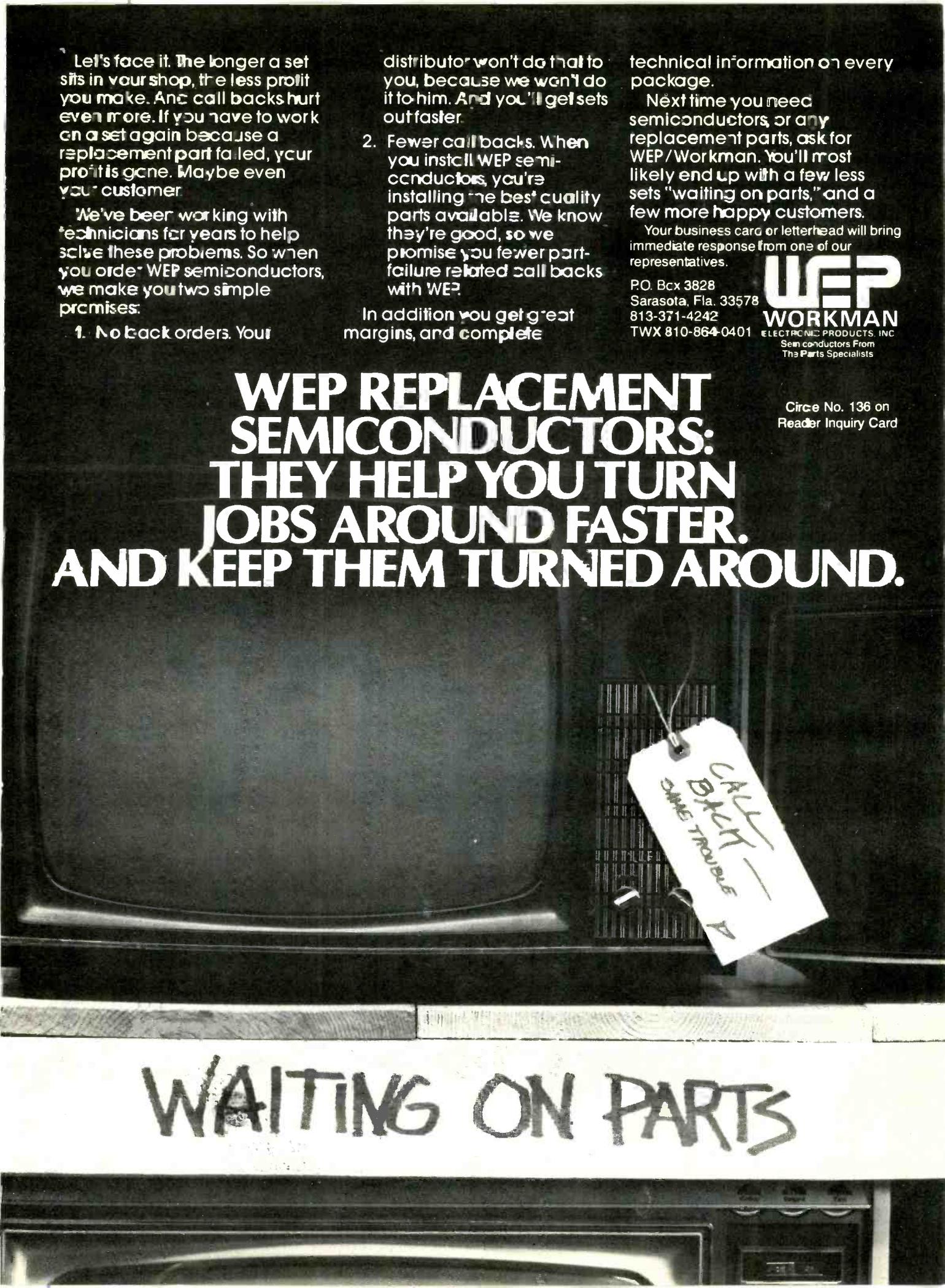
Your business card or letterhead will bring immediate response from one of our representatives.

P.O. Box 3828
Sarasota, Fla. 33578
813-371-4242
TWX 810-864-0401

WEP
WORKMAN
ELECTRONIC PRODUCTS, INC.
Semiconductors From
The Parts Specialists

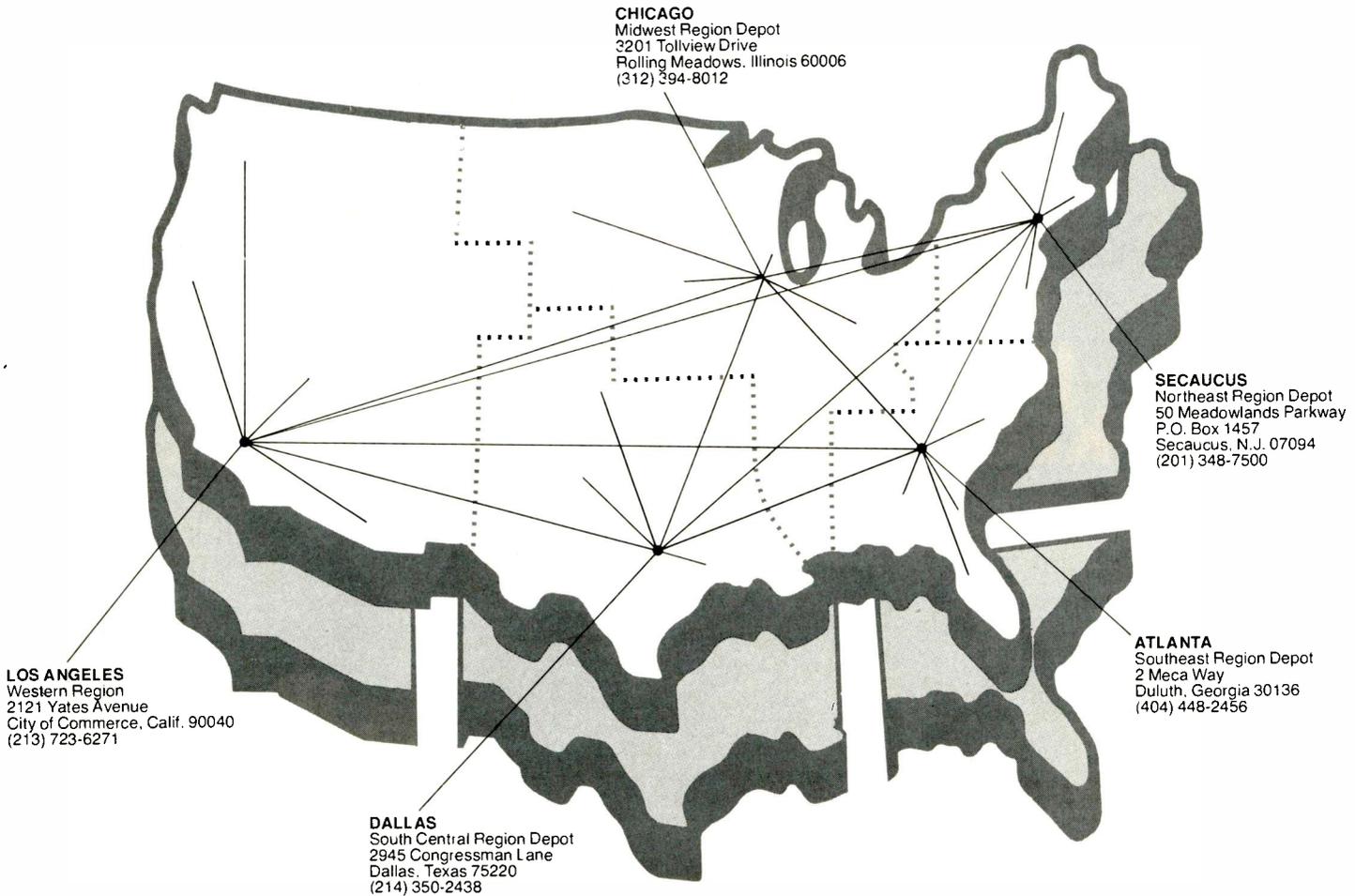
Circle No. 136 on
Reader Inquiry Card

**WEP REPLACEMENT
SEMICONDUCTORS:
THEY HELP YOU TURN
JOBS AROUND FASTER.
AND KEEP THEM TURNED AROUND.**



WAITING ON PARTS

Eight years ago we split the country today we've got it all together and we made it smaller



Last year Panasonic Company made the following improvements in its computerized distribution network:

- Automatic drop shipment from any one of our five regional depots regardless of where the order originates from
- Automatic substitutions
- Automatic replenishment of regional stocks
- On line status information
- Panafax facsimile network linking the regional depots together

The overall result was a binding together of our resources in order to service you better. In addition we have:

Our system is designed to get parts to a customer more quickly and easily than ever before. First we got the country together, then we made it smaller. For more information, write:

Panasonic
just slightly ahead of our time

Attn: SUPPORT SERVICE DEPT.
Panasonic Consumer Parts Division
50 Meadowlands Parkway
Secaucus, N.J. 07094

Circle No. 127 on Reader Inquiry Card



tainment, educational, and instructional programs.

Using a tiny laser light beam, the player relays images and sound from the videodisc to the TV screen. No needle or stylus ever touches the disc and a plastic coating on the disc protects it from fingerprints, dust, or surface scratches. Discrete audio channels permit stereophonic sound when the player is connected to a home stereo unit.

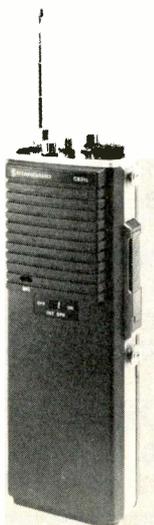
Other features of the player include stop action, slow motion, fast motion, and frame indexing. The player attaches to any home color or black and white TV. Suggested retail price for Magnavision is \$695.

Two-Way Hand-Held

Circle No. 146 on Reader Inquiry Card

A new, reasonably priced, six channel two-way hand-held radio, designed for land mobile applications, is now available from *Standard Communications Corp.* of Carson, CA.

The 831L produces up to three watts RF output power. It requires 12 Vdc ($\pm 20\%$) for operation, supplied internally by a battery pack, or externally



through a jack on the side. A built-in light monitors the condition of the battery.

The 831L is ruggedly built and is equipped with a high quality internal microphone and separate speaker located behind the front grille. A jack on top permits use of an external microphone.

Economy AM CB

Circle No. 147 on Reader Inquiry Card

NDI's recently introduced AM, CB unit, the economy Model PC-102, offers appearance and essential performance features at a suggested price of \$99.95.

The frequency synthesized Model PC-102 provides 40 channel operation with single knob control and bright LED digital readout. Control functions include volume, adjustable squelch and an automatic noise limiter.

Operational monitors include a back-lighted panel meter reading relative "s" units on receive and power output on transmit. In addition, a green "RX" lamp shows receiver status and a red "TX" light serves as AM modulation indicator.

PA/Hailer operation is also available using auxiliary speaker. The set operates on 13.8 Vdc, positive or negative ground. **ETD**

Take the Hassle Out of Wow and Flutter Measurements



It's Easy...When You Have the RE 402/403 System

RE 402 for Measurements

YOU

- read Wow & Flutter with the six range Analog Display.
- read Actual Drift-frequency or %—with the Digital Display.
- get Results Fast...without leveling problems.
- choose the Standard DIN, CCIR, IEC, NAB or JIS.
- have IEEE 488 bus interface provisions for remote control.

RE 403 for Analysis

YOU

- have a unique real time frequency analysis from 0.2 to 200 Hz in 30, 1/3 octave steps.
- read a 30 column LED display of frequency distribution intensities.

YOU

can get full information and specifications from—



Radiometer Electronics U.S., Inc.

811 Sharon Drive Cleveland, Ohio 44145
Telephone (216) 871-7617

NEW PRODUCTS

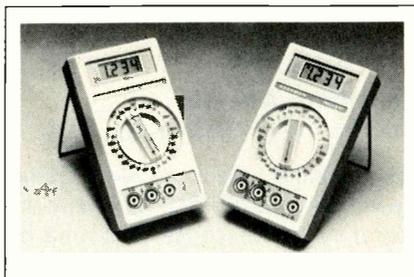
TORX® Screwdriver

Circle No. 154 on Reader Inquiry Card

For those who have to disassemble automotive trim and dash components to remove or install auto radios, CB's and tape equipment, a new Vaco five-in-one screwdriver should be welcome. This



screwdriver has available interchangeable bits including those for the new TORX® drive system which has been adopted for 1979 for most American automobiles.



Digital Multimeters

Circle No. 155 on Reader Inquiry Card

Beckman Instruments' two new 3½ digit portable multimeters—the TECH 300 and the TECH 310—for technicians and hobbyists, feature two-year battery life, a special semiconductor test function, and reportedly, exceptional overload protection. The TECH 310 features a quick continuity test function allowing the user to check continuity with the speed and ease of an analog volt-ohm meter. The new multimeters are part of a complete line of multimeters recently introduced by Beckman.

20MHz Portable Scope

Circle No. 156 on Reader Inquiry Card

Leader Instruments has just introduced the Model LBO-308, a compact, dual trace, 3 inch, 20MHz bandwidth, portable oscilloscope which can be operated from an optional rechargeable battery pack. Features of the LBO-308 are 2mV/div sensitivity sweep speed to 0.1 µsec/div with a X5 magnifier available, 17.5 nanosecond rise time and an eight by ten division display. Two direct/X10 probes are standard equipment, a carrying case and the battery pack are optional. The price is \$950 including a two year warranty.

Digital Multimeter

Circle No. 157 on Reader Inquiry Card

Sinclair Radionics latest digital multimeter, the DM350 is a 3½ digit instrument

NEW TUNERS

NOT universal or customized. NOT seconds, culls, dogs, or oddballs. Only \$29.95 for ANY new tuner. Over 5,000 in stock including Philco TT192.

CALL TOLL FREE 1-800-433-7124

TEXAS TUNER SUPPLY

4210 N.E. 28th St., Ft. Worth, TX 76117

Circle No. 134 on Reader Inquiry Card

ATTENTION SERVICE DEALERS

We Are No. 1 In Top Line Solid Replacements,
Original Japanese Transistors and Integrated Circuits



PARTIAL LIST • MONTHLY SPECIALS

Part Number	Your Cost						
AN 214	1.70	2SA 495	.35	2SC 710	.25	2SC 1358	3.25
AN 239Q	4.50	2SA 564	.35	2SC 756	1.80	2SC 1383	.25
BA 521	2.25	2SA 643	.35	2SC 799	1.90	166 4A	2.50
LA 4031P	1.75	2SA 733P	.25	2SC 867A	4.30	2SD 350	4.50
LA 4400	1.85	2SB 407	.85	2SC 945	.25	2SD 669	1.50
SID 30-15	1.50	2SB 474	.70	2SC 1014	.60	2SD 733	2.60
STK 439	7.25	2SB 507	.80	2SC 1096	.50	2SK 23A	.70
TA 7205P	1.80	2SB 618	2.95	2SC 1124	.90	121-831	4.50
UPC 1025H	2.05	2SB 649	1.80	2SC 1172B	3.75	ECG 500A	9.95
UPC 1156H	2.20	2SC 460	.30	2SC 1308K	3.50		

Send for our complete list of Japanese parts and prices

Our Professional Replacement parts are top quality and replace over 130,000 industry types at a substantial saving to you over most other replacement lines.

To order, just send us the ECG, SK, GE, or other part number and we will promptly ship you the premium PR direct replacement, plus a free PR replacement guide. Remember—these are first quality parts—no culls, no seconds! 2 year warranty on all parts.

Orders over \$25.00 shipped free, under \$25 add \$1 UPS.C.O.D. orders are welcome. To approximate the cost of a replacement part order, deduct 40% from the dealer cost of ECG or other types. All orders shipped within 24 hours.

Special OEM Pricing Available

Write or Call—Toll Free
1-800-526-4463

DEVCO

P.O. Box 270, Garwood NJ 07027
(201) 688-0300

Circle No. 138 on Reader Inquiry Card

with 0.1% basic accuracy, adjustable intensity LED display and 34 ranges. The DM350 measures from 100 μ V to 1200V dc, 100 μ V to 750V ac, ac and dc current from 1nA to 10A and resistance from 10m ohms to 20M ohms. The price is \$139.



TV Wall Brackets

Circle No. 158 on Reader Inquiry Card

A line of Appolo TV wall brackets for commercial and industrial users are available from Neosonic Corp. of America. These brackets are useful for hotels, hospitals, bars and clubs. They are designed to clamp the TV receiver without being screwed into the TV cabinet and are adjustable to any horizontal angle. The brackets are steel and black nylon and will support up to 154 pounds.

DIGITAL COUNTERS

continued from page 21

adjustment, usually in the form of a small capacitive trimmer, or an inductive slug adjustment.

It is usually assumed that in order to use radio signals for calibration purposes, one must have a short wave receiver which can be tuned to a Bureau of Standards frequency broadcast station, or else one must ship the unit to a calibration service agency. This is not necessary.

A simple calibration procedure is as follows: using proper caution to avoid trouble with line connected chassis TV receivers, connect the counter to the output of a color TV's 3.58 MHz color oscillator. Take care to insure the use of color oscillator output, not burst amplifier output; remember burst is intermittent and serves to lock the oscillator to proper frequency. Make sure there is sufficient isolation between the counter and the oscillator to prevent a shift in frequency or phase (indicated by a shift in picture color). Make sure you are properly tuned to a local station which is locked to network color burst, and the set is properly color locked. The



Fig. 23—Racal-Dana's Model 9313 200MHz counter has packaged the equivalent of over 5000 components on a single chip.

frequency of the color oscillator is 3.579545 MHz and is extremely accurate. In fact, the Bureau of Standards has published a bulletin on using color burst as a reference.

Double check

If your counter does not agree with this frequency, you can adjust the calibration trimmer a *very little bit*, and see if the error increases or decreases. When you are moving in the right direction, continue a bit at a time, until the error is within acceptable limits. Do not overshoot on your adjustments, since you may have to take the retrace error out of the system before you start moving back, it is much easier to creep up on the

HICKOK TEST INSTRUMENTS

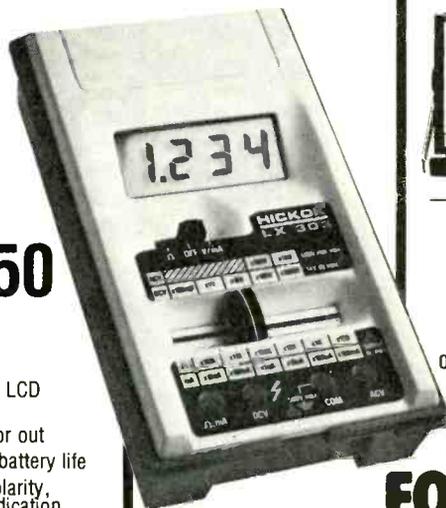
HICKOK New Digital Mini-Multimeter

Reg
\$74.95
Our Price

\$69.50

MODEL LX303

- Big 1/2" high LCD display
- Use indoors or out
- 200 hour 9V battery life
- Auto zero, Polarity, Overrange Indication
- 100 mV DC F.S. sensitivity
- 19 ranges and functions



Call TOLL FREE

(800) 645-9518

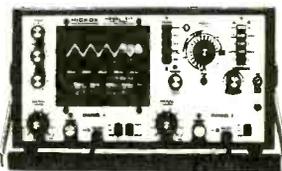
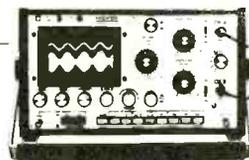
In N.Y. State call (516) 752-0050

Oscilloscopes

30 MHz Dual Trace

MODEL 532

Reg. \$995.00
Our Price **\$845.75** incl. probes



15 MHz Dual Trace

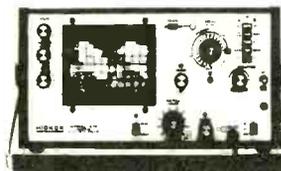
MODEL 517

Reg \$695.00
Our Price **\$590.00** incl. probes

15 MHz Triggered Sweep

MODEL 515

Reg \$495.00
Our Price **\$425.75** incl. probes



Before you buy, check our prices...

FORDHAM

YOUR ONE STOP DISCOUNT CENTER

Master Charge, Bank Americard, Visa, C.O.D.'s accepted.

FREE

Send for new 1979 catalog of over 3,000 items ... 164 pages of test equipment, CB tools, tubes, components and electronic supplies.

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



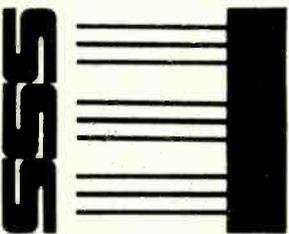
ADD \$3.00 TO COVER
SHIPPING, HANDLING
& INSURANCE. N.Y.
Res. add approx.
sales tax

**YOU HAVE AN ALTERNATIVE
TO THE HEADACHE OF DUPLICATED ORDERS,
UNINFORMED SALES PEOPLE, FORGOTTEN
BACKORDERS, 10 DAY DELIVERY TIMES,
AND ALL THOSE PHONE CALLS GETTING
A PRICE QUOTE AND DELIVERY SCHEDULE!**

That's right. We at **Solid State Systems** can offer you that alternative and much more. We have the largest supply of American and Japanese transistors, diodes, thyristors and integrated circuits all under one roof.

We feature Texas Instruments, Fairchild, RCA, Sanyo, Panasonic, Sony and others — plus our strict "quality controlled" private label brand at a substantial savings.

So give us a call now. Not only won't you hear a sales pitch from a salesman who has a sales quota to meet, but you'll get qualified technical expertise from the president of the company. (Can you remember the last time you spoke to the president of your present supplier?)



**SOLID STATE SYSTEMS.
THE ALTERNATIVE.**

403 Chestnut Street, Union, N.J. 07083

201-688-0222

Circle No. 113 on Reader Inquiry Card

right frequency and do it on the first attempt.

Replacement of parts often requires calibration, so it is essential to check out your counter after any repair involving the internal circuitry. Two counters not only insure having one handy at all times, but also provides the most inexpensive and *convenient* means of periodically checking your counter. Any time you suspect one counter of failing in accuracy you can check it against the other. It is most unlikely that both counters would develop identical errors at the same time. I also discovered that two counters are as useful as a dual trace oscilloscope. By varying one factor in a system it is possible to watch a resulting frequency variation, which in turn should affect another frequency, as for example, with voltage controlled oscillator circuits in control loops, or phase locked loops. This is very handy, and a real time saver. Sometimes it is the only practical way to diagnose a malfunctioning circuit. **ETD**

BUYING REPLACEMENTS

continued from 23

cents each in 1000s. If you do a lot of service on radios, medium power audio equipment, phonographs, and other low power consumption products, then it may well pay to stock *both* high and low piv rectifiers. Just remember the rule for selecting the piv rating of a rectifier, it must be greater than $3 \times E_{rms}$ or $2 \times E_{dc}$ (in capacitor filtered supplies).

Shop around

Many small shop owners complain about high parts prices, but do little to try and obtain a better deal. One chap will diagnose a shorted 0.047/600 WVDC mylar capacitor, and order just *one*! Another buys half-watt resistors in five packs at 12¢ each. The *same* servicer-oriented distributor will also sell the same grade of resistor in lots of 50 per value (pre-bagged by TRW) for 6.3¢ each. It takes the same plastic parts cabinet drawer to stock 5 as it does to stock 50, so why not save?

Table 2 shows the relative replacement line and industrial 2N-numbered prices for some popular transistors. Note that a considerable price difference exists, yet when you buy a 2N5249 to replace the output transistor in an auto radio, it is the same transistor that was used by the manufacturer! The price ratio is 3.5:1!

Integrated circuits is another area where some savings are possible. A friend of mine was servicing a modular Hi-Fi that used a certain dual operational amplifier that is described as an audio, or stereo preamplifier. The equipment maker "wholesaled" the IC to servicers for \$8, but it turned out to be a common Motorola MC1303P, or Fairchild μ A739 (same device), which cost only \$2.20 in unit quantities and \$1.78 in 10s. There are only a few semiconductor makers, and they all have limited product lines, especially in ICs. If you survey their databooks and spec sheets, or the *IC Master*, it is often possible to identify the component specified by the set maker. Alternatively, you could also look in replacement guides for the LM-, μ A, MC-, CA-, CD- or 74xx number that *also* crosses to the set makers IC. Chances are good that there will be only *one* or *two*.

Once you are convinced that buying in quantity on some items is justified, then don't just call up the distributor and order the parts. Do it by *bid*, that's what industrial customers do. Even if you are dealing with local, servicer-oriented distributors (who can also offer quantity discounts), send a

request for bid to several different distributors, and ask for *quotations*. In a few days or weeks the figures will come back, and you can decide who gets the order! Buy each part at the best price, even if it means splitting the order (remember the minimum order figure!) up between several houses. **ETD**

HITACHI

continued from 33

output to the video amplifier.

Video, AGC

The video is then amplified and output appears on pin 20. A 4.5MHz trap takes off sound IF and the video returns to the HA11238 noise canceler, and the AGC circuits. RF AGC is available on pin 12. AFT is developed by applying the switching carrier coupled into L203, and the video IF carrier from the synchronous detector, to the AFT phase detector. AFT control voltage is available at pin 14. AFT center frequency is set by L203 adjustment.

The luminance and chroma are separated after emerging from the HA11238. The luminance channel consists of three discrete transistor



Buried in Belts . . .

We've got the solution for lowering
your cost of doing business

Low Factory Direct prices on:

- **OEM Audio Visual Belts**
Replacement Belts for Sony, Beta-max, virtually all 8-tracks & other popular video tape recorders.
- **Chemicals, Adhesives, Lubricants**
Check our low, low prices on your everyday repair supplies.

SAME DAY SHIPMENT

Buy Direct From:



PROJECTOR RECORDER Belt Corp.

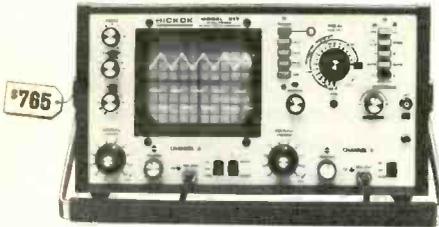
200 Clay Street, Box 176
Whitewater, WI 53190

1-800-558-9572

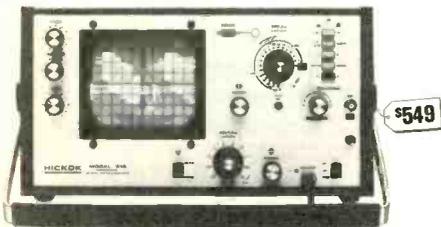
ACCURACY MADE EASY



DUAL TRACE MODEL 532 - 30 MHz



DUAL TRACE MODEL 517 - 15 MHz
USABLE TO 27 MHz



SINGLE TRACE MODEL 515 - 15 MHz

Put Hickok Scope reliability on your side and get things done easier, faster, better and with complete assurance that you're doing them right.

Economically priced Hickok push-button-triggered Scopes are quick and easy to set up and use. A color-coded front panel speeds up and simplifies operation. Triggering is practically fool-proof, well in excess of the MHz rating. And excellent pulse responses virtually eliminate overshoot and ringing.

Call your nearby Hickok distributor and set up a demonstration today. See for yourself how a modestly priced Hickok single or dual trace 15 MHz, or dual trace 30 MHz, Scope will save you time and exasperation.

If you're outside of Ohio, call us toll free at 800-321-4664 for the name of your nearest Hickok distributor.

HICKOK

the value innovator

INSTRUMENTATION & CONTROLS DIVISION
THE HICKOK ELECTRICAL INSTRUMENT CO.
10514 Dupont Avenue • Cleveland, Ohio 44108
(216) 541-8060 • TWX: 810-421-8286
Circle No. 118 on Reader Inquiry Card

stages of amplification, ultimately driving the emitters of the R, B, and G outputs.

Chroma

A large 24 pin IC, a HA11580, contains the bandpass amplifier and demodulators, killer circuitry, ACC, and 3.5MHz oscillator and AFPC.

A three axis demodulation system produces B-Y, R-Y, and G-Y signals to be fed to the bases of the corresponding B, R, and G output transistors.

Audio

Another IC, an HA1124D, contains a 4.5MHz IF, and FM detector and an audio amplifier. Sound IF output from pin 20 of the video IF IC is fed through ceramic filter to the sound IF input of the HA1124D. Its output then drives the audio output stage.

Miscellaneous notes

The various NP8X chassis are rated at less than 100 watts power consumption, depending on picture tube size and tuning option. The NP8X-52 uses varactor tuners and remote control. The NP8X-51 and L use wafer VHF and capacitor tuned UHF tuners.

The horizontal output transformer in the NP8X is of the integral high voltage rectifier type and has a built in focus divider and control. **ET/D**

BUYING DIRECT

continued from 28

the toll free number to discuss any problems which may arise.

An obvious distinct advantage to the customer of buying direct is that if there are any quality or delivery problems, the customer is able to go directly to the source without having to deal with an intermediary.

Perhaps the biggest advantage to buying direct, however, and this is

implicit in all of the preceding discussion, is that the price for both the repair parts and service aids are lower. There is less overhead in the forms of commissions, road expenses, and the like, and thus, the customer pays less for the parts he needs. These parts are generally as good or better than the original equipment part. The customer makes his living by selling the skill and labor for servicing the equipment properly and by marking up the replacement parts that he uses. Lower cost replacement parts that are just as good as the original, put more money in his pocket and keep costs low to his customers.

TEST INSTRUMENT

continued from 44

by the "diode present" method.

Power for the 215 is, again, 2 standard 9 volt transistor batteries, which should last for about 20 hours of operation. It also has an automatic switch operated when the cover is closed.

All three instruments were left outside in the Minnesota winter long enough to chill them thoroughly—about -5°F—the only one that showed any ill effects was the LX-303. Its LCD display took several minutes to respond again. This is common to all present LCD displays, no permanent damage results and the LX-303 accuracy did not seem to be affected; it was on the nose as soon as the display appeared. The Model 215 continues to check transistors at -5°F and the Model 239's patterns were stable when connected to a TV set and did not change as the instrument returned to room temperature.

The price of the LX-303 is \$74.95, the prober case is \$7.50 and the X10 dc crabs is \$14.95. The 239 Color Bar Generator is priced at \$99 and the 215 Semiconductor Analyzer is \$109. The only accessory for these is the nicad battery/recharger kit at \$27.50. **ET/D**

CORNELL ELECTRONICS COMPANY

4213 N. UNIVERSITY AVE. SAN DIEGO CALIF. 92105

THE ORIGINAL HOME OF

36¢

PER TUBE
UNLESS OTHERWISE PRICED
100 TUBES OR MORE
33¢ PER TUBE

Same Low Price East or West Coast!

- ★ Bargain Tools
- ★ Transistor Tester
- ★ Technician's Library

SPECIAL OFFER

ON ALL ORDERS OVER \$10.00

25¢

PER TUBE (NO LIMIT)
FROM THIS LIST

6AG5	6CB6
6AU6	6J6
6AX4	6SN7

ONE YEAR GUARANTEE

INDIVIDUALLY BOXED

5 DAY MONEY BACK OFFER

LAB TESTED USED

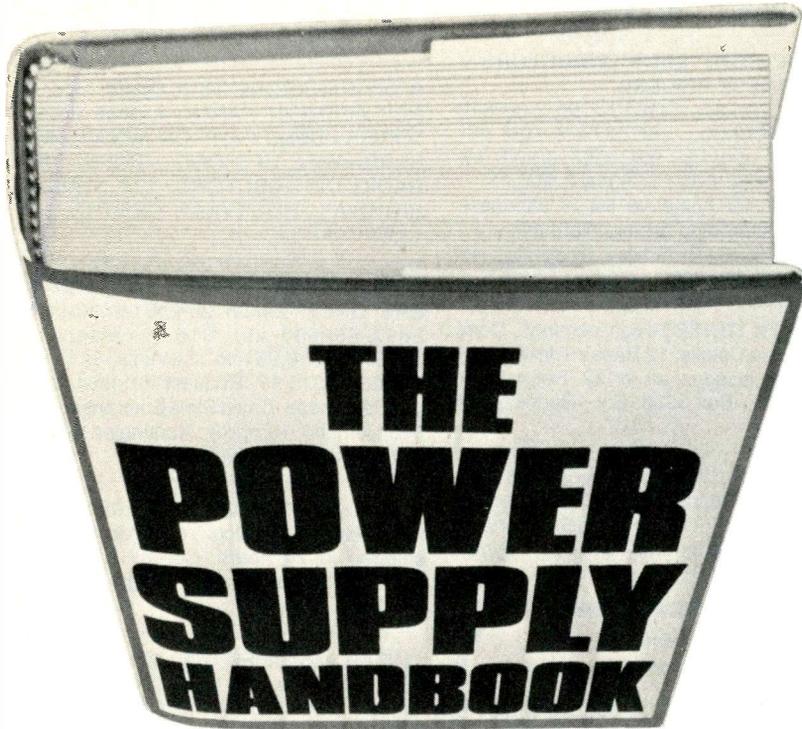
SEND FOR FREE NEW 48 PAGE COLOR CATALOG

- ★ Dumont Picture Tubes
- ★ Diodes—Transistors—Kits
- ★ Tube Cartons

Your Order FREE if Not Shipped in 24 Hours

Circle No. 111 on Reader Inquiry Card

ELECTRONICS BOOK CLUB invites you to take a copy of "THE POWER SUPPLY HANDBOOK" (list \$12.95)



absolutely
FREE!

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

The Power Supply Handbook

A broad, rich, and varied collection of ready-to-build power sources for electronics technicians, hams, engineers, and hobbyists!

This is THE complete power supply book...the all-in-one Answerbook with ALL the data you need to build, design, test, and customize virtually any power supply system you want—from AC-to-DC converters to linear amplifier filament transformers, from simple dual-voltage systems to hefty 3000V DC powerhouses, from low-voltage units to precision 10,000V DC references, from sine wave inverters to failsafe superchargers! It contains 420 pages of solid how-to info, stripped clean of irrelevancies, packed with practical instructions on how to create just the unit you need for that special application. You get a brief course in power supply theory, some basic schooling in testing, a thorough guide to power supply design, and section after section of pretested power supply cir-

cuits you can build and modify. Projects like 13V mobile systems, 12V 20A brute supplies, voltage sextuplers for SSB, 115V 60 Hz sine wave inverters, regulated nicad chargers, precision 10,000V DC references, adjustable low-voltage regulated supplies, 117V AC to 24V DC converters, and lots of special-purpose AC supplies. And precisely because this manual is so comprehensive, you'll be able to build PS systems that are as good as any you can buy, systems that meet your specifications.

Probably the most remarkable thing about this volume is the sheer variety and quality of the projects it offers...each one is reliable, pretested, easy to build, and you can construct most of them from inexpensive salvaged or surplus parts. It would have to be a very unusual PS indeed not to be covered in this manual, for here you'll find everything from simple get-the-job-done units to highly refined adjustable supplies. Step-by-step instructions tell you how to put together voltage doublers for MOS LSI, super low-voltage supplies, 78MG voltage regulators, 13V supplies for mobile equipment, 110V 600 Hz inverters,

polarity changers, 12V to 300V converters, solid-state car alternator/regulators, silver-zinc cell battery chargers, zero to 30V lab supplies, simple four-voltage bench supplies, and many more. The projects come with all the data you need to insure flawless no-hitch construction—concise analyses of special circuits, easy-to-follow directions, detailed schematic diagrams, complete parts lists, and special discussions of construction safety precautions.

The scope of this handbook is broad—broad enough to include construction info on tested circuits that'll help you make the most of any power supply you put together—circuits that'll allow you to interface, modify, and test your own PS designs. The authors show you how to construct voltage splitters, IC protection circuits, smoke testers, two-terminal current limiters, voltage limit sensors, active voltage dividers, microfarad multipliers, capacitor rejuvenator-leakage testers, and many, many others. 420 pps., 292 illus. Hardbound. List \$12.95.

ELECTRONICS BOOK CLUB, Blue Ridge Summit, Pa. 17214

May we send you this practical time-and-money-saving book absolutely FREE as part of an unusual offer of a Trial Membership in Electronics Book Club.

Like all Club offerings, this is a quality hardbound volume, especially designed to help you increase your know-how, earning power, and enjoyment of electronics. Whatever your interest in electronics, you'll find Electronics Book Club offers practical, quality books that you can put to immediate use and benefit.

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

To start your Membership on these attractive terms, simply fill out and mail the coupon today. You will receive "The Power Supply Handbook" absolutely FREE. If you're not delighted, return the book within 10 days and your Trial Membership will be cancelled without any obligation whatsoever.

Facts About Club Membership

- "The Power Supply Handbook" lists for \$12.95. It is yours absolutely FREE with your Trial Membership.
- You will receive the Club News, describing the current Selection, Alternates, and other books, every 4 weeks (13x a year).
- If you want the Selection, do nothing, it will be sent to you automatically. If you do not wish to receive the Selection, or if you want to order one of the many Alternates offered, you simply give instructions on the reply form (and in the envelope) provided, and return it to us by the date specified. This date allows you at least 10 days in which to return the form. If, because of late mail delivery, you do not have 10 days to make a decision and so receive an unwanted Selection, you may return it at Club expense.
- To complete your Trial Membership, you need buy only four additional monthly Selections or Alternates during the next 12 months. You may cancel your Membership anytime after you purchase these four books.
- All books—including the Introductory Offer—are fully returnable after 10 days if you're not completely satisfied.
- All books are offered at low Member prices, plus a small postage and handling charge.
- Continuing Bonus: If you continue after this Trial Membership, you will earn a Dividend Certificate for every book you purchase. Three Certificates plus payment of the nominal sum of \$1.99 will entitle you to a valuable Book Dividend of your choice which you may choose from a list provided Members.

ELECTRONICS BOOK CLUB

Blue Ridge Summit, Pa. 17214

Please open my Trial Membership in ELECTRONICS BOOK CLUB and send my copy of "THE POWER SUPPLY HANDBOOK" ABSOLUTELY FREE! If not delighted, I may return the book within 10 days and have my Trial Membership cancelled. I agree to purchase at least four books during the next 12 months, after which I may cancel my Membership at any time.

Name _____ Phone _____

Address _____

City _____

State _____ Zip _____

(Valid for new Members only.)

T-49

Circle No. 114 on Reader Inquiry Card

CLASSIFIED

RATES: 40 cents per word (minimum charge, \$10). Bold face words or words in all capital letters charged at 50 cents per word. Boxed or display ads charged at \$50 per column inch (one inch minimum). 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, One East First Street, Duluth, MN 55802. Please include box number in address.

FOR SALE

PICTURE TUBE MACHINE

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

LAKESIDE INDUSTRIES

4069-71 N. Elstone Ave., Chicago, IL 60618
Phone: 312-583-6565

Complete color, b/w picture tubes rebuilding equipment. Never used. Phone (212) 387-2744, Brooklyn, NY 11211. #FLOE308506302. 4/79

TELEPHONES UNLIMITED, equipment, supplies, all types, regular, decorator, keyed, modular. Box 1147T, San Diego, California 92112. 4/79

Video Tape Recorders Shibaden SV-700-UC. New in factory cartons. 400.00 FOB Loveland. Write for details Loveland Engineering Electronics, 6651 Epworth Road, Loveland Ohio 45140.

GENUINE SONY SEMICONDUCTORS—CHECK THESE PRICES!!

EG. 1-9/ 10-24—SG613-8.50/7.30-SID 30-15 2.60/2.30, -2SC867A 5.10/4.90-2SC1114 5.50/4.80-2SC1358 6.50/5.70, -2SC1124 1.50/1.30-2SC634A 0.45/0.41. Contact us for complete list of Japanese semiconductors and pricing information. Bescor, 547 S. Broadway, Hickville, NY 11801 (516) 822-3988

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

Save Hundreds; American Made (AGC Optional) quality Head-Ends, V/V, U/V Converters, Camera Modulators. Factory prices. Send \$5.00 (or letterhead). Box 809, Boynton Beach, Fla. 33435.

From - Antennas Unlimited®

ONLY \$6.00 buys Antul® parts

All - \$6.00 - Postpaid - 30 Day Guarantee

- 1 - 2 way 82 ch. 75 OHM coupler - indoor
- 1 - 2 way 82 ch. 300 OHM coupler - low loss
- 1 - 10 DB coax attenuator pad - inline

Send \$6.00 to: Antennas Unlimited®
P.O. Box 30142 • Chicago, IL 60630
(USA only)

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.

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

REPLACEMENT COLOR YOKES-DEALERS ONLY. Zenith 95-2501-2532-2638-2667-S89633 etc. \$16.95. Magnavox 361380-1 \$18.95 etc. Sylvania, G.E. etc. \$14.95 to \$19.95. Request for price list on your letterhead. David Sims Enterprises, Inc., 665 Jericho Turnpike, Huntington Station, N.Y. 11746, 516-549-3925 TF

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

LINEAR AMPLIFIER, 2-30 MHz, 100 or 200 watt solid state. 300 MHz COUNTER. Modulation BOOSTER. Omnidirectional BASE ANTENNA. Plans \$3.00 each. \$10.00/all. Catalog of others. Panaxis, Box 130-ET4, Paradise, CA 95969

Sams Photofacts from #1000 to 1724... \$1400.00. John Sisson, Willason Radio & TV, 247 Klein Ave., Glasgow, MT 59230.

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: 40 cents per word (minimum charge, \$10). Bold face words or words in all capital letters charged at 50 cents per word. Boxed or display ads charged at \$50 per column inch (one inch minimum). For ads using blind box number, add \$5 to total cost of ad.

Do you want to make more profit servicing televisions in 1979? We will show you how to increase your profit by Forty Percent. Send \$20.00 cash, check, or money order to Electronics Profit, 4803 Gen. Scott, Bossier City, La. 71112. 4/79

THERE'S NO NEED TO BUY ORIGINAL JAPANESE TRANSISTORS WHEN OUR REPLACEMENTS WILL DO THE JOB of many original types. Phyltron's LX123A replaced over 50 Japanese types in our catalog. Don't tie yourself up with excessive inventory, buy Phyltron Electronics replacement transistors and save.

Write for free catalog. One year unconditional guarantee. Phyltron Electronics, 487 Springfield Ave., Summit, NJ 07901. TF

Sam's Photofacts, Series 300 thru 1689. Have two sets must sell one. First \$1000.00 gets it. Rick's TV Service, 2121 N. Hobart, Pampa, Texas 79065, 806-669-3536. 5/79

Build the portable burglar alarm. 8 bell in steel cabinet with keylock, all solid state. Fast seller, send three dollars for plans. Parts on hand at wholesale prices. Jack Ross, Ross Alarm Co., 6206 N. Francisco, Chicago, IL 60659.

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

OSCILLOSCOPES Dual Trace 22MHZ Triggered Scopes Calibrated, guaranteed \$350.00. Send for catalog. A-OK ELECTRONICS, 1445 N. W. 9th Street, Homestead, Fla. 33030 (305) 247-6349. 4/79

Selling Rider's Radio manuals 1-15, eleven volumes, \$175. Also, 27 Television volumes, \$295. Early Sams' Photofacts, singles, sets. Lawrence Beitman, Box 46, Highland Park, IL 60035.

COLOR PICTURE TUBE REBUILDING EQUIPMENT. SEMI AUTOMATIC ELECTRONICALLY CONTROLLED PROCESS. COMPLETE TRAINING. Call or write Atoll Television, 6425 W. Irving Park, Chicago, IL 60634. Phone 312-545-6667. 5/79

Loudspeakers. Auto. Stereo. Replacement. Free Catalog. Squires. Maxatawny PA 19538 4/79

TUBES—Receiving, Industrial and Semiconductors, factory boxed. Free price list. Low, low prices. **TRANSLETTERONIC INC.** 1365-39th Street, Brooklyn, N.Y. 11218E 800-221-5802, 212-633-2800. 4/79

MECHANICALLY INCLINED INDIVIDUALS—BUILD ELECTRONIC DEVICES IN YOUR HOME. GET STARTED IN YOUR SPARE TIME. \$300 TO \$600/WK POSSIBLE. EXPERIENCE NOT NECESSARY. WRITE FOR FREE LITERATURE. ELECTRONIC DEVELOPMENT LAB., BOX 1535 (B), PINELLAS PARK, FLA., 33565. TF

BROADCAST STATION. Start your own, any type! Unique Cable FM station operation—investment/experience unnecessary! Receive free tapes, records. Get your FCC license! Much more. Free details. "Broadcasting", Box 130-ET4, Paradise, CA 95969

BUSINESS OPPORTUNITIES

WORK AND PLAY ON CAPE COD. Established RCA sales and service business for sale. Fully equipped shop. Excellent growth potential. Good reputation. Write: P. O. BOX 533, East Dennis, Mass. 02641. 4/79

Move to progressive front-range Colorado community. Established, growing TV sales and service. 1978 gross \$120,000. All equipment new within last 18 months. Asking \$35,000. Write ET/D Box 126. 6/79

MOVING TO FLORIDA? TV SERVICE AND RENTAL BUSINESS FOR SALE ON FLORIDA'S WEST COAST. DOING \$40,000 - \$50,000 PER YEAR. ALL REASONABLE OFFERS CONSIDERED, ALSO BUILDING AVAILABLE. CONTACT: MR. SOTHERN, 1-813-535-2026 AFTER 7 PM OR WRITE: 1834 SUNRISE BLVD., CLEARWATER, FLORIDA 33520 TF

MOVE TO BEAUTIFUL SO. CALIF., (VENTURA COUNTY) ESTABLISHED (3 YEARS) T.V. & STEREO SHOP EXCELLENT DOWNTOWN LOCATION, LOW MONTHLY LEASE \$11,000.00 BUYS ALL INCLUDING TUBES, PARTS, FURNITURE, TEST EQUIPMENT, USED TV'S, 1972 DODGE VAN—REDUCED IN PRICE FROM \$15,000.00 FOR MORE DETAILS WRITE SIMMS REALTY, 481 E. PLEASANT RD., PT HUENEME, CALIF. 93041. ATTN: DON R. KURTZ, OR CALL 805-487-7529 OR 482-3594.

ELECTRONICS/AVIONICS EMPLOYMENT OPPORTUNITIES. Report on jobs now open. Details FREE. Aviation Employment Information Service, Box 240Y, Northport, New York 11768. 8/79

Excellent Auto Stereo Sales & Installation Shop, trained staff. Only business in area servicing stereos. Doing \$60,000.00 to \$70,000.00 a year. Owner has other interest. **SOUND SERVICE**, 1514 Chattanooga Road, Dalton, GA 30720. (404) 278-1271.

RADIO & TV service business. 3 bedroom living quarters mobile home hookup, storage buildings, on lot 260 x 203 on a busy street. For more information write: **TOM LUDGATE** P.O. BOX 448, SHOW LOW ARIZ 85901.

Orlando-Mobile T.V. sales and service business for sale. No inventory or test equipment included. Grosses \$60,000 per year. Nets \$40,000. No vehicle included. Price \$4,500. 1616 Hinckley Road, Orlando, FL 32808.

WANTED

MANUFACTURERS: New Electronic Distributor needs tube, transistor, antenna and other lines. **ELECTRONIC MERCHANDISE WANTED.** Elect. Dept. P.O. Box 4013, Delaware City, DE 19706. 8/79

WANTED: Receiving and industrial tubes including obsolete types. Payment by L/C Tsutomu Yoshihara, CI-105, Deguchi-cho 34, Suita-shi, Osaka 564, Japan. 5/79

As they grow, so grows the nation.

The green thumb of the financial world. U.S. Savings Bonds.

With every Bond you buy, you plant the seed for your own future. And you help keep America strong.

Bonds are an easy way to save for most anything. Whether it's a college education or a memorable family vacation. Even a down payment on a new house. Savings Bonds will help you harvest the future.

And while they're growing for you, your Bonds are helping the U.S.A. 'Cause every time you buy a Bond, you take stock in America.

So buy Bonds today through the Payroll Savings Plan at work. They're the automatic way to make *your* money grow and keep America growing too.



Take
stock
in America.

Ad Council A public service of this publication and The Advertising Council.

Accurate in RF fields!

B&K-PRECISION portable and lab DMM's

For field or lab applications, your DMM should stay accurate—even in the presence of strong RF fields. Most DMMs can't pass this test, but the B&K-PRECISION 2830 lab DMM and the 2810 portable DMM easily meet the challenge.

In addition, both of these instruments feature 3½ digit readout, 0.5% DC accuracy, auto-zeroing/auto polarity, selectable high/low power ohms and really complete overload protection. Special features of each include:



Model 2830—\$235

- AC operation; battery pack optional
- 100 μ V, 100nA, 01 Ω resolution
- Reads to 20 amps
- Push button range and function selection
- 0.5" high efficiency LED display

Model 2810—\$130

- Battery operation standard
- 100 μ V, .01 Ω resolution
- AC charger optional
- Bright .3" LED display



Available for immediate delivery at your local B&K-PRECISION distributor

BK PRECISION DYNASCAN CORPORATION

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

In Canada: Atlas Electronics, Ontario
Int'l. Sls. Empire Exp., 270 Newtown Rd., Plainville, L.I., NY 11803

Circle No. 107 on Reader Inquiry Card

AD INDEX

Circle No.	Page No.
106 American Audio	4
107 B & K Precision/Dynascan Corp.	58
108 Beckman Instruments	14
110 Blonder-Tongue Labs, Inc.	43
111 Cornell Electronics	54
112 Creative Electronics	58
138 Devco	50
114 Electronic Book Club	55
139 John Fluke Manufacturing (for information)	40
140 John Fluke Manufacturing (for demonstration)	40
116 Fordham Radio Supply Co. Inc.	51
Fuji-Svea Enterprises	Cov. 3
General Electric, TV Division	45
General Electric, Tube Division	29
GTE Sylvania, EGC Consumer Renewal	3
117 Gould, Inc.	26
118 Hickock Electrical Inst. Co.	54
119 Holaday Industries Inc.	41
120 Leader Instruments Corp.	2
122 Mallory Distributor	7
123 Modular Electronics Services	31
124 MTI	41
New England Business Service	9
148 Non-Linear Systems	46
149 Non-Linear Systems	46
126 Optima Electronics	58
102 PTS Electronics, Inc.	Cov. 2
127 Panasonic	48
128 Projector-Recorder Belt Corp.	33
129 Projector-Recorder Belt Corp.	53
130 RCA Distributor & Special Prods.	12-13
121 Radiometer Electronics	49
131 Sentry Manufacturing Co.	25
113 Solid State Systems	52
132 Sprague Products Co.	11
133 Texas Tuner Service	46
134 Texas Tuner Service	50
104 Triplet Corp. (for info)	Cov. 4
105 Triplet Corp. (for demo)	Cov. 4
Viz Manufacturing Co.	42
135 Wahl Clipper Corp.	10
136 Workman Electronic Products	47
137 Zenith Radio Corp.	28
Zenith Radio Corp.	24 & 32

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

OPTIMA VALUE SALE

G. E., SYLVANIA, ZENITH
70 PLUS 25% OFF LIST NEW-BOXED

<input type="checkbox"/> 3A3	5 for \$7.26	<input type="checkbox"/> 6HV5	5 for 15.98
<input type="checkbox"/> 6BK4	5 for 13.43	<input type="checkbox"/> 6JE6	5 for 15.07
<input type="checkbox"/> 6CJ3	5 for \$8.75	<input type="checkbox"/> 6LB6	5 for 14.51
<input type="checkbox"/> 6F7	5 for \$5.46	<input type="checkbox"/> 6LF6	5 for 14.40
<input type="checkbox"/> 6GF7	5 for \$9.56	<input type="checkbox"/> 17JZ8	5 for 7.65
<input type="checkbox"/> 6GH8	5 for \$5.69	<input type="checkbox"/> 38HE7	5 for 13.22

SPECIAL

100 GE 6GH8—80% Off List NET \$95.00
All Tubes Not Advertised, Write In at 77% off list. Sleeves Only. Singles 72% off list.

TRANSISTORS

Minimum 20 of the Number.			
<input type="checkbox"/> 2N5655 ea.	\$.45	<input type="checkbox"/> 2SD235 ea.	\$.35
<input type="checkbox"/> 2SB474 ea.	\$.49	<input type="checkbox"/> TA7204 ea.	\$1.25
<input type="checkbox"/> 2SC1061 ea.	\$.79	<input type="checkbox"/> AN247 ea.	\$1.75
<input type="checkbox"/> 2SC1096 ea.	\$.69	REP. ECG	
<input type="checkbox"/> 2SC1306 ea.	\$.79	<input type="checkbox"/> 195A ea.	\$.90
<input type="checkbox"/> 2SC1816 ea.	\$.79	<input type="checkbox"/> 196	ea. \$.35
<input type="checkbox"/> 2SC1172 ea.	\$2.25	<input type="checkbox"/> 197	ea. \$.35

GENERAL

<input type="checkbox"/> Y88 YOKE	\$3.95 Min.	10
<input type="checkbox"/> 2.5 1000 PIV RECT.	\$.05 Min.	1000
<input type="checkbox"/> 3.5 CRYSTAL OSC	\$.50 Min.	20
<input type="checkbox"/> 66 MEG. RESISTOR	\$.19 Min.	100

ZEN - RCA - MODULES

<input type="checkbox"/> 9-121-01	\$7.95	<input type="checkbox"/> 9-147	\$7.95
<input type="checkbox"/> 9-50		<input type="checkbox"/> 9-59	\$2.95

NEEDLES MIN. 5

<input type="checkbox"/> N44	<input type="checkbox"/> N75	<input type="checkbox"/> N91—BOXED	\$1.69
<input type="checkbox"/> SHURE M-81MC Cart. Inc. Needle			\$5.95

We Now Carry a Full Line of SK, ECG, and Zenith.

Transistors and Modules at 50% Off List.

Distributor of B/K Equipment.

Quantity Prices Available.

WANTED: Electronic Merchandise.

WILL PAY CASH . . .

Letters of credit and all checks placed on deposit with Manufacturers Hanover Trust Bank, N.Y.C. C.O.D.'s 50% dep. Min. order \$75 FOB Brooklyn, N.Y. Catalogue \$3, refundable upon order.

SEND CHECK OR MONEY ORDER TO:

OPTIMA ELECTRONICS

Box 372 Ryder Street Station
Brooklyn, New York 11234
Phone (212) 439-7434

Circle No. 126 on Reader Inquiry Card



NEW! AN IN-CIRCUIT ELECTROLYTIC CAPACITOR TESTER THAT REALLY WORKS!

The Creative Electronics ESR METER!
(Equivalent Series Resistance)

Checks capacitors from 1 to 10,000 MFD in-circuit, charged or not!

Tells you how close to failure the capacitor is by measuring the dryness of the electrolyte - the major reason for electrolytic failures.

Plainly shows up intermittent opens resulting from bad terminations.

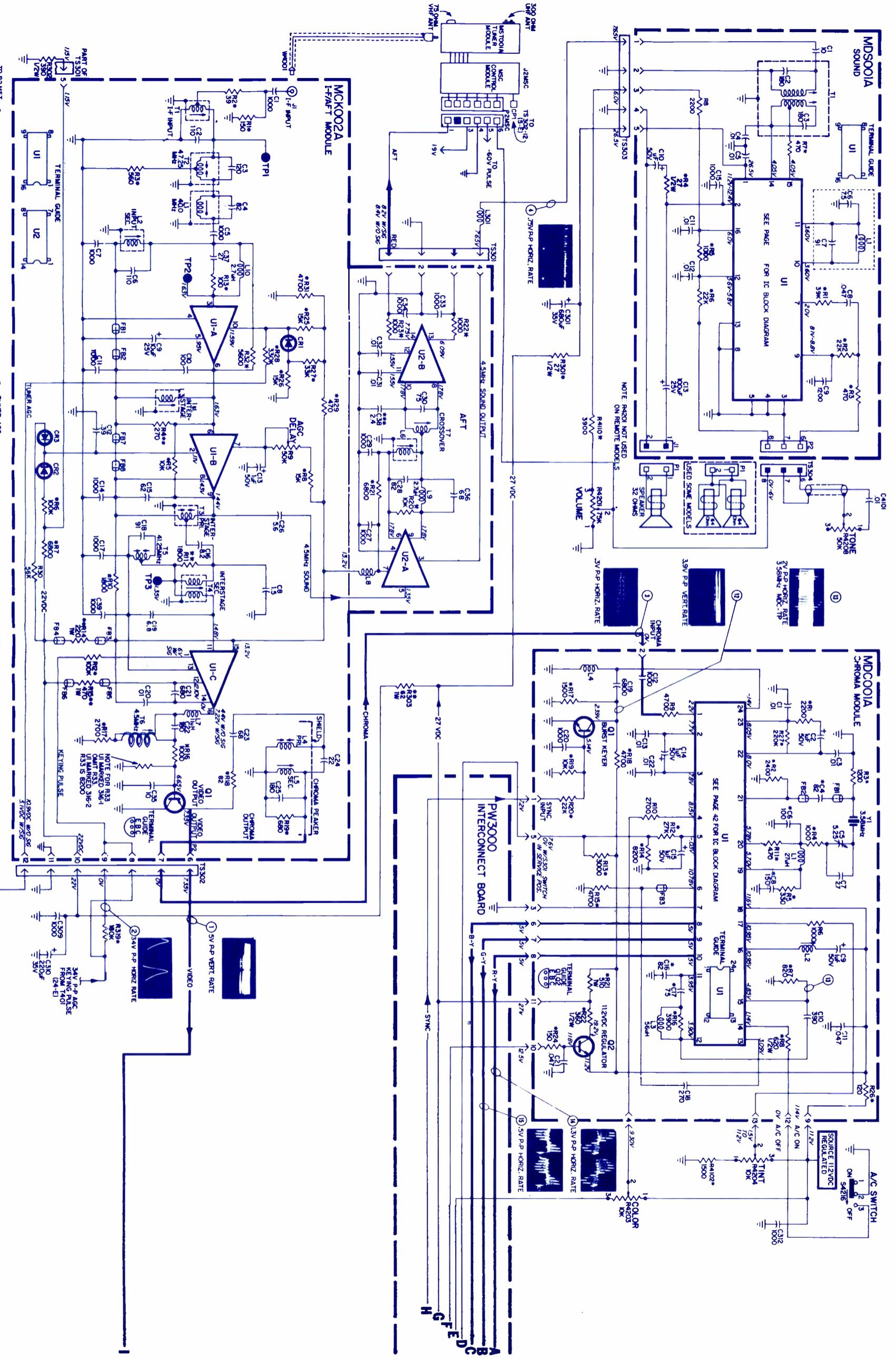
Research shows that both problems account for 99% of today's electrolytic failures. Both can be located instantly with our ESR Meter!

Increases the productivity & profit of the typical service shop by 5%. Patent pending. For free brochure, just send name & address to:

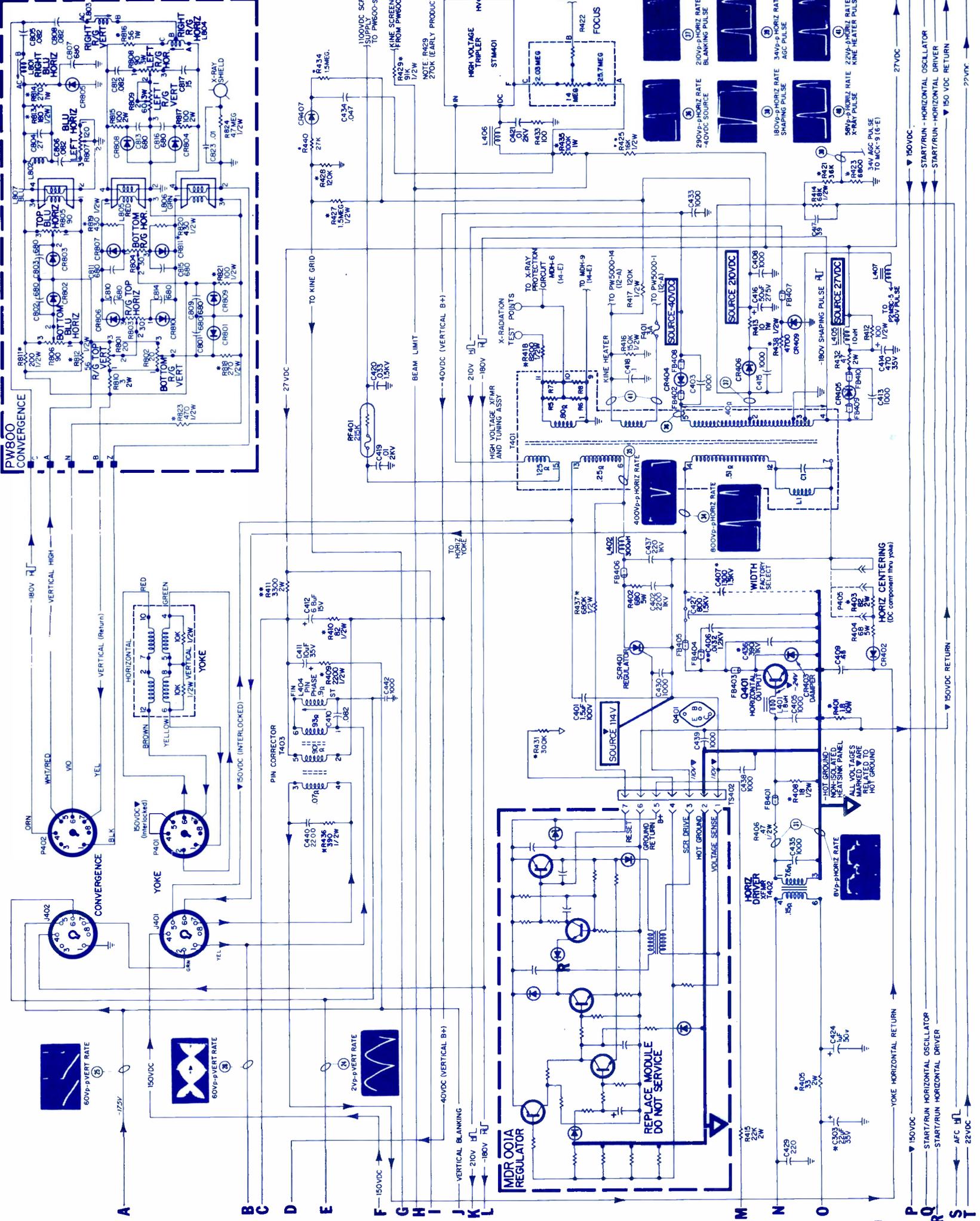
Creative Electronics Only
ESR Brochure \$88.00
1417 N. Selfridge
Clawson, Mich. 48017 postpaid

30-day Satisfaction Guaranteed.

Circle No. 112 on Reader Inquiry Card



RCA
Color TV Chassis
CTC92



PRODUCT SAFETY NOTE
SHADE COMPONENTS MAY BE NEARLY IDENTICAL. IMPORTANT TO SAFETY BEFORE REPLACING ANY OF THESE COMPONENTS, READ CAREFULLY THE PRODUCT SAFETY NOTICE IN THIS SERVICE DATA. DO NOT DEGRADE THE SAFETY OF THE SET THROUGH IMPROPER SERVICING.

SERVICE TECHNICIAN WARNING
CAUTION: RADIATION PROTECTION
THIS PRODUCT CONTAINS CRITICAL MECHANICAL AND ELECTRICAL PARTS SPECIFIED FOR X-RADIATION PROTECTION. SEE SERVICE DATA FOR ESSENTIAL REPLACEMENT PARTS. NOMINAL 2ND ANODE VOLTAGE IS 28 KV. OPERATING CONDITIONS: THIS INSTRUMENT CONTAINS NO HIGH VOLTAGE ADJUSTMENT. SEE SERVICE DATA FOR OTHER SERVICE ADJUSTMENTS.

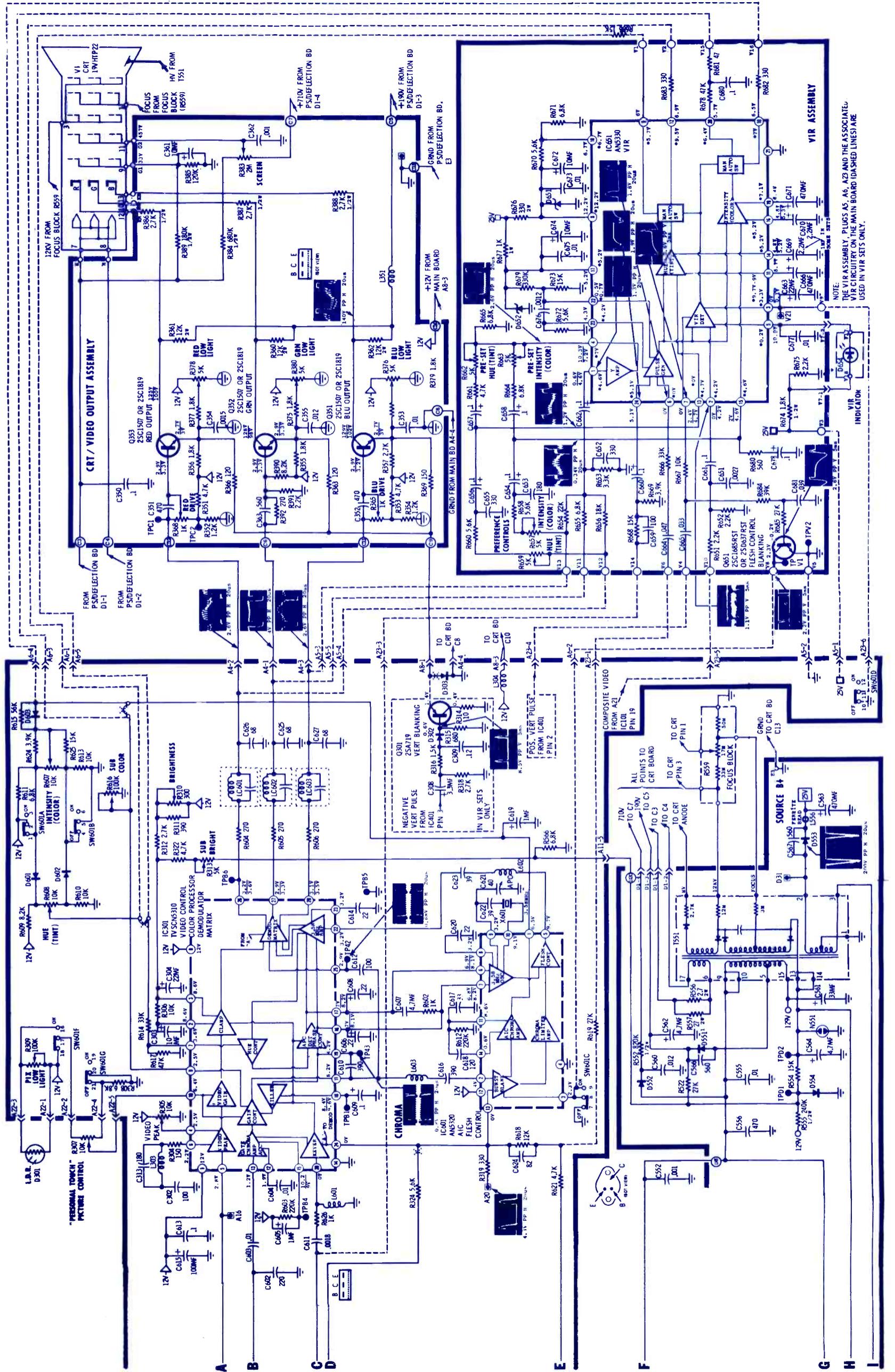
SCHEMATIC SYMBOLS AND NOTES

- RELATES TO DIRECTION OF SIGNAL OR VOLTAGE PATH
- RELATES TO PIN AND JACK CONNECTIONS ON MODULE
- RELATES TO AN INTERRUPTED LINE, FOLLOWED BY DESCRIPTION AND ZONING
- INDICATES A PERMANENT CONNECTION-WIREWRAP OR SOLDER
- TEST POINT RELATES TO TEST POINTS
- INDICATES A POSITIVE (+) OR NEGATIVE (-) PULSE
- EITHER (V) VERTICAL OR (H) HORIZONTAL
- INDICATES LINE ISOLATED GROUND IN MAIN CHASSIS FRAME
- INDICATES NON-ISOLATED (HOT) GROUND IN HEATSINK PANEL RELATED TO HORIZONTAL OUTPUT STAGE

CAUTION: BE SURE TO RELATE VOLTAGE MEASUREMENT TO CORRECT GROUND, UNLESS NOTED BY (HOT) GROUND SYMBOL. ALL VOLTAGES ARE MEASURED TO MAIN CHASSIS (ISOLATED) GROUND.

ALL VOLTAGES SHOWN ON SCHEMATIC ARE MEASURED WITH AC INPUT OF 120VAC 60Hz NO SIGNAL CONDITION.
ALL VOLTAGES SHOULD HOLD WITHIN 20%.
WAVEFORMS ARE TAKEN USING SIGNAL FROM A COLOR BAR GENERATOR ADJUSTED FOR 100% MODULATION.
RESISTOR VALUES ARE IN OHMS, K=1000 OHMS
INDICATES 5% TOLERANCE
INDICATES 2% TOLERANCE
CAPACITOR VALUES GREATER THAN 10µF 5% ON CAPS ABOVE 10µF ARE UP UNLESS OTHERWISE SPECIFIED

QUASAR
Color TV Chassis
TS967



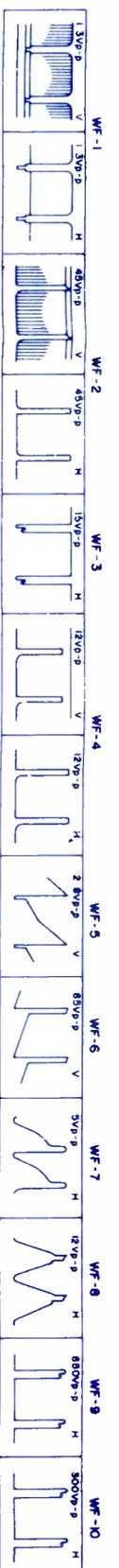
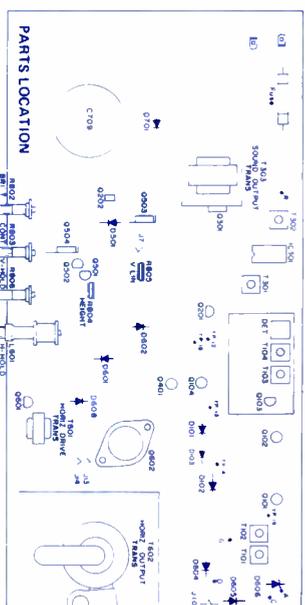
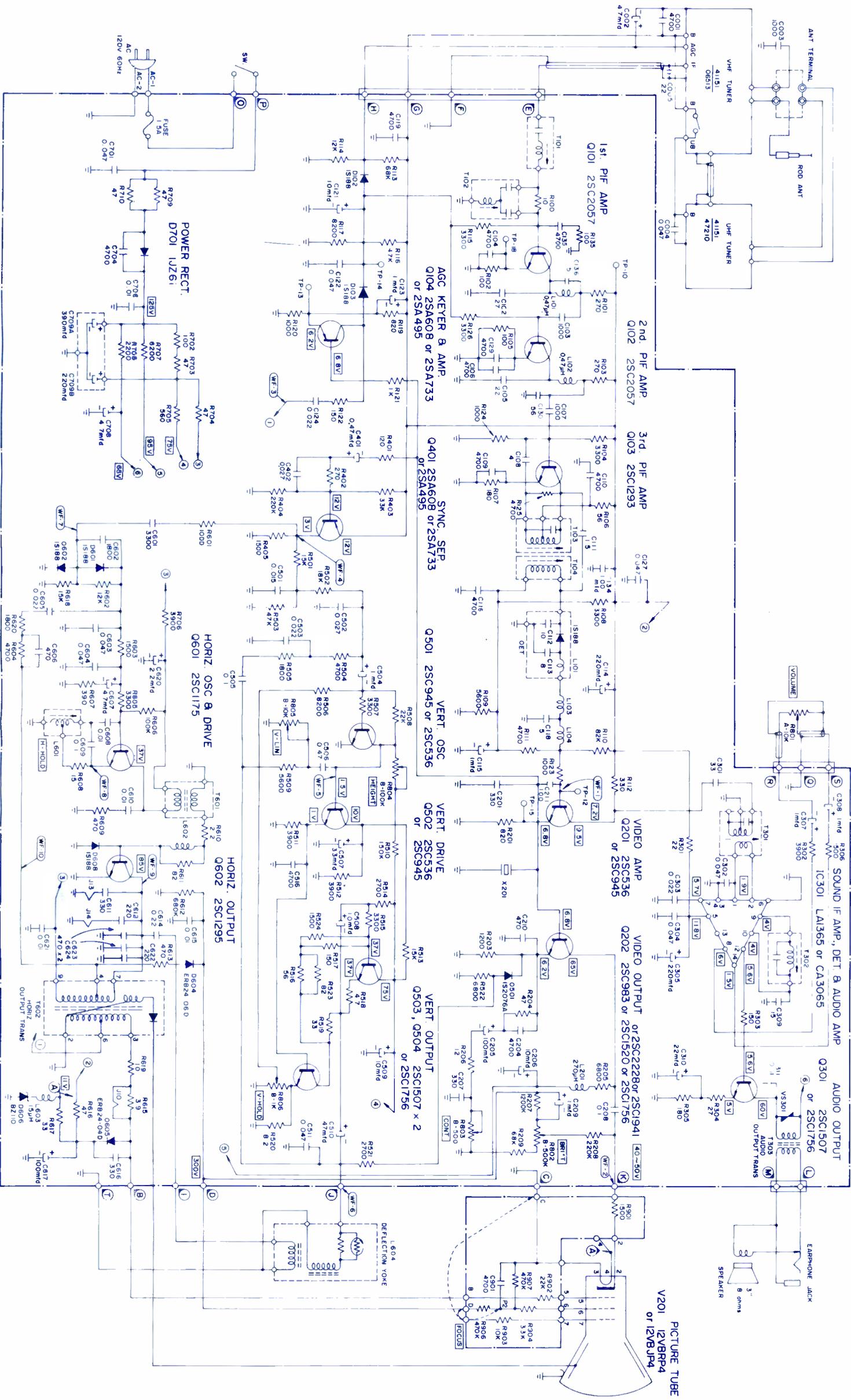
NOTE: THE VTR ASSEMBLY, PLUGS A5, A6, A23 AND THE ASSOCIATED VTR CIRCUITRY ON THE MAIN BOARD (DASHED LINES) ARE USED IN VTR SETS ONLY.

PRODUCT SAFETY NOTICE

The shaded areas of this schematic diagram designate components whose value and tolerance are of special significance to product safety. Should the components in the shaded areas need to be replaced, only parts designated on the parts list are to be used. No deviations from resistance, wattage and voltage rating may be made for replacement items in the shaded areas.

NOTES:

1. All resistance values in ohm.
2. All resistance values in ohm.
3. All resistance values in ohm.
4. All waveforms measured with strong signal input, contrast set to give normal picture.
5. Voltage reading may vary $\pm 20\%$.
6. This is a fundamental circuit diagram. Some production changes may be made without revision of this diagram.



AVAILABLE NOW!

ONLY \$3.95
Add \$1.00 for shipping.

JAPANESE TRANSISTOR SUBSTITUTION MANUAL



An invaluable Japanese to Japanese substitution guide for approximately 3000 transistors

- * Covers the 2SA, 2SD, 2SC and 2SD series
- * Introduction includes a guide to understanding Japanese transistors
- * A 90 page 8 1/2" by 11" soft cover book

PARTS PROCUREMENT PROBLEMS

FUJI-SVEA Has the Largest Inventory of Original Japanese Parts Anywhere

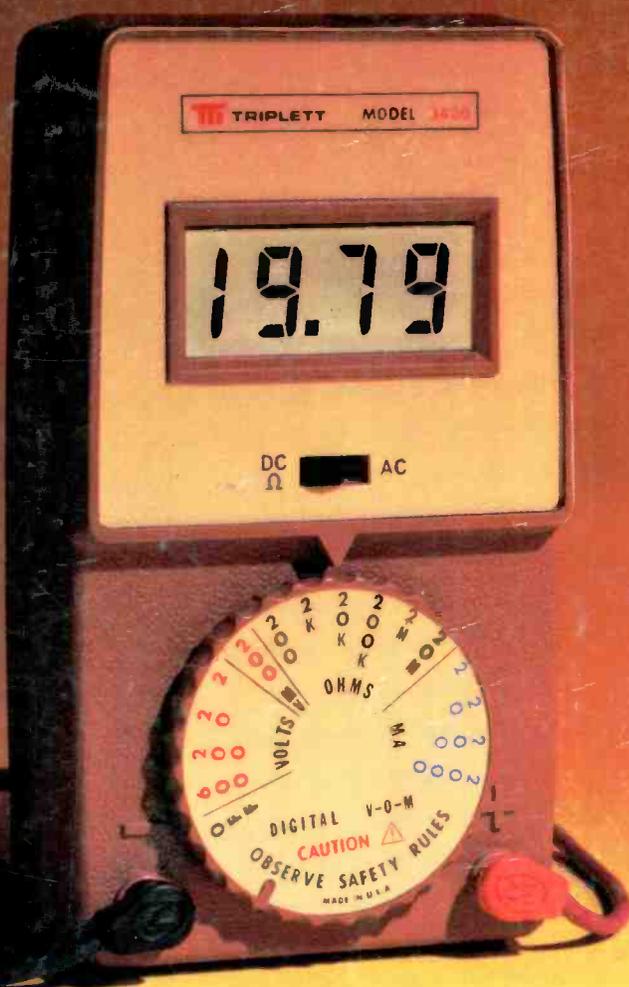
Seeking Original Japanese Replacement Parts for CB, TV and Stereo Repair Use?

TYPE	25-UP	10-24	1-9	TYPE	25-UP	10-24	1-9	TYPE	25-UP	10-24	1-9	TYPE	25-UP	10-24	1-9	TYPE	25-UP	10-24	1-9
2SA 473	.45	.55	.60	2SB 346	.30	.35	.40	2SC 693F	.20	.27	.30	2SC 1226A	.50	.55	.60	2SD 234	.60	.70	.80
2SA 483	2.00	2.20	2.50	2SB 367	1.10	1.25	1.40	2SC 696F	1.00	1.20	1.30	2SC 1237	1.80	2.00	2.25	2SD 235	.60	.70	.80
2SA 484	1.50	1.75	1.95	2SB 368B	1.80	2.00	2.25	2SC 708	1.30	1.45	1.60	2SC 1239	2.20	2.70	2.90	2SD 261	.35	.40	.45
2SA 485	1.40	1.60	1.80	2SB 379	.70	.80	.90	2SC 710	.20	.27	.30	2SC 1279	.50	.55	.60	2SD 267	2.50	2.70	2.90
2SA 489	1.10	1.25	1.40	2SB 381	.30	.35	.40	2SC 711	.20	.27	.30	2SC 1306	1.30	1.45	1.60	2SD 300	4.50	5.00	5.60
2SA 490	.70	.80	.90	2SB 400	.80	.90	1.00	2SC 712	.20	.27	.30	2SC 1307	1.90	2.10	2.40	2SD 313	.60	.70	.80
2SA 493	.45	.55	.59	2SB 405	.30	.35	.40	2SC 715	.30	.35	.40	2SC 1310	.20	.27	.30	2SD 315	.60	.70	.80
2SA 495	.30	.35	.40	2SB 407	.80	.90	1.00	2SC 717	.35	.40	.45	2SC 1312	.20	.27	.30	2SD 325	.60	.70	.80
2SA 496	.50	.64	.70	2SB 415	.30	.35	.40	2SC 727	1.00	1.20	1.30	2SC 1313G	.20	.27	.30	2SD 330	.60	.70	.80
2SA 497	1.00	1.20	1.30	2SB 434	.80	.90	1.00	2SC 730	3.00	3.20	3.40	2SC 1316	4.20	4.40	4.90	2SD 350	3.00	4.00	4.40
2SA 505	.50	.64	.70	2SB 435	.90	1.10	1.20	2SC 731	2.50	2.70	2.90	2SC 1317	.20	.27	.30	2SD 350	3.00	4.00	4.40
2SA 509	.30	.35	.40	2SB 440	.40	.53	.59	2SC 732	.20	.27	.30	2SC 1318	.35	.40	.45	2SD 380	5.20	5.40	5.95
2SA 525	.50	.64	.70	2SB 449	1.30	1.45	1.60	2SC 733	.20	.27	.30	2SC 1325A	6.50	6.90	7.60	2SD 424	3.80	4.00	4.40
2SA 530	1.50	1.70	1.90	2SB 461	.90	1.10	1.20	2SC 734	.20	.27	.30	2SC 1327	.20	.27	.30	2SD 425	2.90	3.20	3.40
2SA 537A	1.50	1.70	1.90	2SB 463	.90	1.10	1.20	2SC 735	.20	.27	.30	2SC 1330	.50	.55	.60	2SD 426	3.10	3.30	3.60
2SA 539	.40	.45	.50	2SB 471	1.10	1.25	1.40	2SC 738	.20	.27	.30	2SC 1335	.50	.55	.60	2SD 427	1.80	2.00	2.25
2SA 545	.45	.53	.59	2SB 472	2.10	2.50	2.80	2SC 756	1.50	1.80	2.00	2SC 1342	.45	.53	.59	2SD 525	9.00	1.10	1.20
2SA 561	.30	.35	.40	2SB 473	.80	.90	1.00	2SC 756A	1.50	1.80	2.00	2SC 1344	.45	.53	.59	2SD 526	.60	.70	.80
2SA 562	.30	.35	.40	2SB 474	.70	.80	.90	2SC 763	.35	.40	.45	2SC 1358	4.20	4.40	4.90	2SK 19BL	.50	.55	.60
2SA 564A	.20	.27	.30	2SB 481	.90	1.10	1.20	2SC 772	.30	.35	.40	2SC 1359	.30	.35	.40	3SK 22Y	1.40	1.60	1.80
2SA 565	.70	.80	.90	2SB 492	.60	.70	.80	2SC 773	.35	.40	.45	2SC 1360	.50	.55	.60	3SK 39	.90	1.10	1.20
2SA 566	2.50	2.70	3.00	2SB 507	.80	.90	1.00	2SC 774	1.00	1.20	1.30	2SC 1362	.35	.40	.45	3SK 40	.90	1.10	1.20
2SA 606	1.00	1.20	1.30	2SB 509	1.10	1.20	1.30	2SC 775	1.40	1.60	1.80	2SC 1364	.35	.40	.45	3SK 41	1.30	1.45	1.60
2SA 607	1.10	1.25	1.40	2SB 514	.70	.80	.90	2SC 776	2.00	2.20	2.50	2SC 1377	3.20	3.40	3.70	3SK 45	1.30	1.45	1.60
2SA 624	.30	.35	.40	2SB 523	.70	.80	.90	2SC 777	3.00	3.25	3.50	2SC 1383	.30	.35	.40	AN 203	1.40	1.60	1.80
2SA 627	3.10	3.30	3.60	2SB 527	.70	.80	.90	2SC 778	2.90	3.20	3.40	2SC 1384	.35	.40	.45	AN 214Q	1.50	1.70	1.90
2SA 628	.30	.35	.40	2SB 526C	.70	.80	.90	2SC 781	1.90	2.10	2.40	2SC 1396	.45	.53	.59	AN 239	4.20	4.40	4.90
2SA 634	.40	.45	.50	2SB 527	.90	1.10	1.20	2SC 783	2.10	2.50	2.80	2SC 1398	.70	.80	.90	AN 247	2.50	2.70	3.00
2SA 640	.30	.35	.40	2SB 528D	.70	.80	.90	2SC 784	.30	.35	.40	2SC 1400	.35	.40	.45	AN 274	1.50	1.75	1.95
2SA 642	.30	.35	.40	2SB 529	.70	.80	.90	2SC 785	.35	.40	.45	2SC 1402	3.00	3.25	3.40	AN 313	3.00	3.20	3.40
2SA 643	.30	.40	.45	2SB 530	3.20	3.40	3.70	2SC 789	.80	.90	1.00	2SC 1403	3.20	3.40	3.70	AN 315	1.80	2.00	2.25
2SA 643	1.90	2.10	2.40	2SB 531	1.80	2.00	2.25	2SC 790	.80	.90	1.00	2SC 1407	.50	.55	.60	BA 511A	1.80	2.00	2.25
2SA 653	.35	.40	.45	2SB 536	1.00	1.20	1.30	2SC 793	2.00	2.20	2.50	2SC 1419	.60	.70	.80	BA 521	1.90	2.10	2.40
2SA 661	.50	.64	.70	2SB 537	1.00	1.20	1.30	2SC 799	2.00	2.20	2.50	2SC 1444	1.60	1.80	2.00	HA 1151	1.50	1.75	1.95
2SA 663	3.65	3.80	4.20	2SB 539	3.20	3.40	3.70	2SC 828	.20	.27	.30	2SC 1445	2.50	2.70	2.90	HA 1156W	1.60	1.80	2.00
2SA 666	.35	.40	.45	2SB 541	3.20	3.40	3.70	2SC 829	.20	.27	.30	2SC 1478	.60	.70	.80	HA 1306W	2.00	2.20	2.50
2SA 671	.80	.90	1.00	2SB 544	5.00	6.00	6.60	2SC 830H	2.50	2.70	3.00	2SC 1479	.60	.70	.80	HA 1339	2.50	2.70	3.00
2SA 672	.30	.35	.40	2SB 556	3.20	3.40	3.70	2SC 838	.35	.40	.45	2SC 1448	.70	.80	.90	HA 1339A	2.50	2.70	3.00
2SA 673	.35	.40	.45	2SB 557	2.10	2.50	2.80	2SC 839	.30	.35	.40	2SC 1451	1.00	1.10	1.20	HA 1342A	2.50	2.70	3.00
2SA 678	.35	.40	.45	2SB 561B	.35	.40	.45	2SC 853	.70	.80	.90	2SC 1454	3.20	3.40	3.70	HA 1366W	2.50	2.70	3.00
2SA 679	4.20	4.40	4.90	2SB 564	.40	.53	.59	2SC 867	3.20	3.40	3.70	2SC 1475	.80	.90	1.00	HA 1366W	2.50	2.70	3.00
2SA 680	4.20	4.40	4.90	2SB 595	1.10	1.40	1.50	2SC 867A	3.20	3.40	3.70	2SC 1478	.50	.55	.60	LA 4031P	1.80	2.00	2.25
2SA 682	.80	.90	1.00	2SB 596	1.10	1.40	1.50	2SC 870	.35	.40	.45	2SC 1509	.50	.55	.60	LA 4032P	1.80	2.00	2.25
2SA 683	.35	.40	.45	2SB 600	5.00	6.00	6.60	2SC 871	.35	.40	.45	2SC 1567	.60	.70	.80	LA 4051P	1.80	2.00	2.25
2SA 684	.35	.40	.45	2SC 183	.40	.53	.59	2SC 895	4.20	4.40	4.90	2SC 1567A	.60	.70	.80	LA 4400	1.90	2.10	2.40
2SA 695	.40	.53	.59	2SC 184	.40	.53	.59	2SC 897	2.00	2.20	2.50	2SC 1584	6.00	6.30	7.00	LA 4400Y	2.00	2.20	2.50
2SA 697	.40	.53	.59	2SC 281	.30	.35	.40	2SC 898	2.50	2.70	3.00	2SC 1586	6.50	6.90	7.60	LA 4420	2.00	2.20	2.50
2SA 699A	.50	.64	.70	2SC 283	.40	.53	.59	2SC 900	.20	.27	.30	2SC 1624	.60	.70	.80	LD 3001	2.00	2.20	2.50
2SA 705	.40	.53	.59	2SC 284	.80	.90	1.00	2SC 929	.20	.27	.30	2SC 1626	.60	.70	.80	M5 1513L	2.00	2.20	2.50
2SA 715	1.00	1.10	1.20	2SC 117	.40	.53	.59	2SC 929	.20	.27	.30	2SC 1628	.60	.70	.80	STK 011	3.80	4.00	4.40
2SA 716	.60	.70	.80	2SC 352A	2.00	2.20	2.50	2SC 930	.20	.27	.30	2SC 1647	.70	.80	.90	STK 015	7.60	8.00	8.80
2SA 719	.30	.35	.40	2SC 353A	1.40	1.60	1.80	2SC 941	.20	.27	.30	2SC 1667	3.00	3.20	3.40	STK 015	4.20	4.40	4.90
2SA 720	.30	.35	.40	2SC 367	.60	.70	.80	2SC 943	.35	.40	.45	2SC 1669	.90	1.00	1.10	STK 435	4.50	5.00	5.60
2SA 721	.30	.35	.40	2SC 369	.30	.35	.40	2SC 945	.20	.27	.30	2SC 1674	.30	.35	.40	STK 439	7.90	8.00	8.80
2SA 725	.30	.35	.40	2SC 370	.20	.27	.30	2SC 959	1.00	1.20	1.30	2SC 1675	.20	.27	.30	TA 7045M	2.00	2.20	2.50
2SA 726	.30	.35	.40	2SC 371	.30	.35	.40	2SC 971	.70	.80	.90	2SC 1678	1.10	1.25	1.40	TA 7055P	2.00	2.20	2.50
2SA 733	.20	.27	.30	2SC 372	.20	.27	.30	2SC 982	.70	.80	.90	2SC 1679	3.00	3.20	3.40	TA 7061AP	.90	1.10	1.20
2SA 738	.40	.53	.59	2SC 373	.20	.27	.30	2SC 983	.50	.64	.70	2SC 1681	.30	.35	.40	TA 7062P	1.10	1.25	1.40
2SA 740	1.50	1.70	1.90	2SC 374	.30	.35	.40	2SC 1000	.35	.40	.45	2SC 1682	.30	.35	.40	TA 7203P	2.50	2.70	2.90
2SA 743A	.85	1.00	1.10	2SC 375	.30	.35	.40	2SC 1012	1.20	1.40	1.50	2SC 1684	.30	.35	.40	TA 7204P	2.00	2.20	2.50
2SA 744	4.20	4.40	4.90	2SC 377	.30	.35	.40	2SC 1013	.50	.64	.70	2SC 1687	.40	.45	.50	TA 7205P	1.60	1.80	2.00
2SA 745F	3.80	4.00	4.40	2SC 380	.20	.27	.30	2SC 1014	.50	.64	.70	2SC 1688	.35	.40	.45	TA 7222P	3.40	3.55	3.90
2SA 747	4.20	4.40	4.90	2SC 381	.35	.40	.45	2SC 1017	.80	.90	1.00	2SC 1708	.30	.35	.40	TA 7310P	1.30	1.45	1.60
2SA 748	.70	.80	.90	2SC 382	.35	.40	.45	2SC 1018	.60	.70	.80	2SC 1728	.70	.80	.90	TBA 8105H	1.90	2.10	2.40
2SA 750	.35	.40	.45	2SC 383	.35	.40	.45	2SC 1030	1.80	2.10	2.40</								

THE NEW

performer.

Model 3400 has features that
upstage other compact DVOMs.



Built to fit your hand and budget, the new Model 3400 (shown actual size) is loaded with features. Like a color coded single range switch for one-hand selection of all functions . . . overload protection for all ranges and 200 hour minimum battery life . . . time-saving automatics including auto-zeroing, auto-polarity, auto low-battery and auto-overrange indication . . . easy to read .5" LCD readout.

Six functions and 24 ranges, typical DC accuracy .5% Rdg, including High and Low Power Ohms for sensitive IC testing, makes the Model 3400 ideal for design, production and maintenance testing, vocational tech training schools, commercial electronic equipment test and measurement use.

1. HAND SIZE, 3½ digit, single range switch —6 function, 24 ranges with Hi and Low Power Ohms, Auto-zero and Auto-polarity.
2. OVERLOAD PROTECTION—Protected up to 600 volts on all ranges with special 2 fuse arrangement.
3. BATTERY LIFE—200 hour minimum with 9V battery, display includes low battery indication.

ONLY \$140

Includes test leads, new screw-on insulated alligator clips for the probe, 9V alkaline battery, plus instruction book and 1 year warranty.

For a demonstration, contact your Triplet distributor, Mod Center or representative.
Triplet Corporation, Bluffton, Ohio 45817
(419) 358-5015, TWX (810) 490-2400.



Triplet performance... a tough act to follow

...Circle No. 104 for information
...Circle No. 105 for FREE demonstration

TRIPLET

See It at the Electronic Distribution Show, Las Vegas, Booths F28, 30, 32.