

THE MAGAZINE FOR CONSUMER ELECTRONICS SERVICING PROFESSIONALS

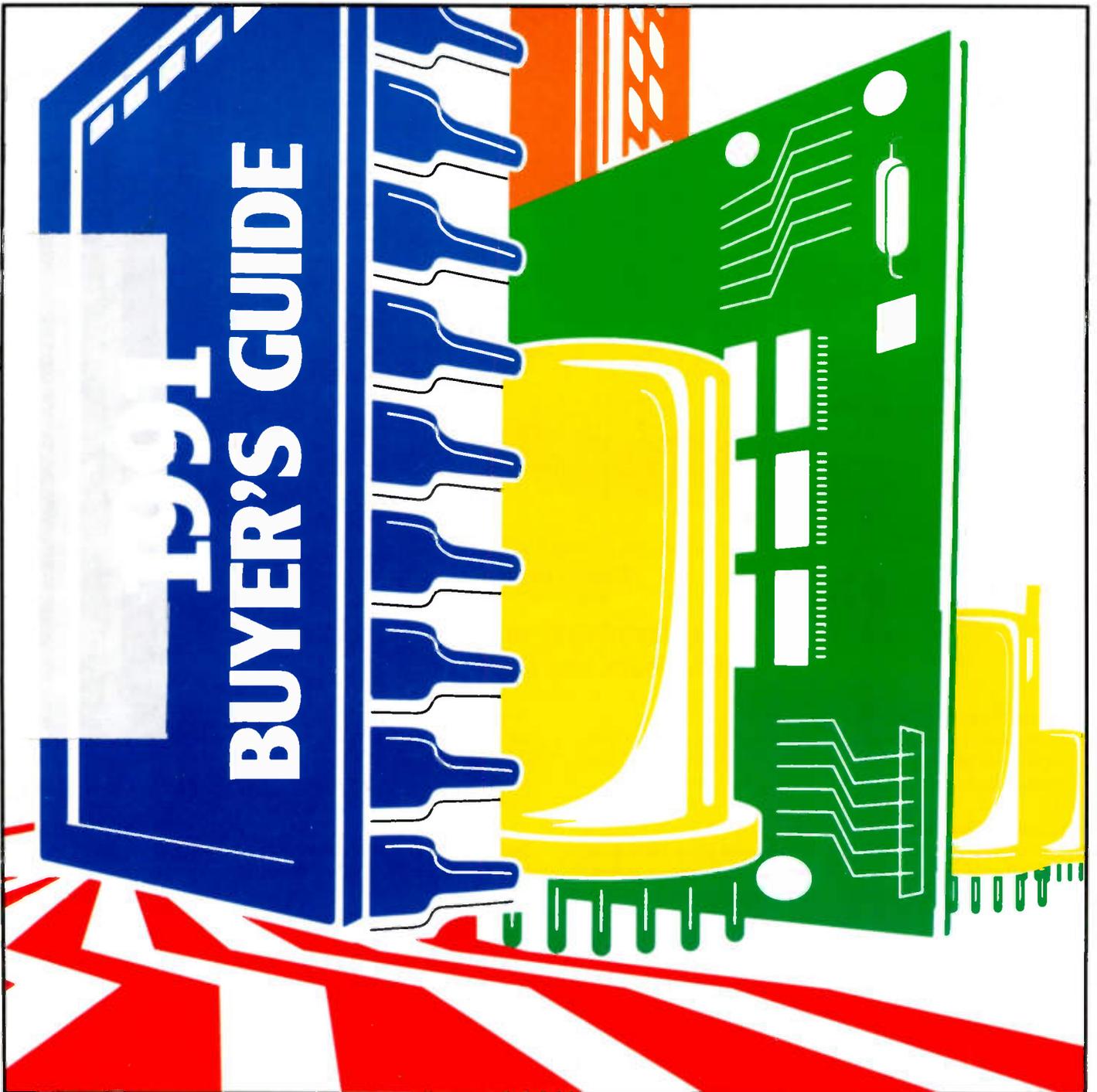
ELECTRONic^{T.M.}

Servicing & Technology

March 1991/\$3.00

Product directory • Services directory • Mailing addresses

Replacement parts/Components directory



*Introducing a new companion to your
VA62A Universal Video Analyzing System!*

Isolate All Playback Or Record Problems In All VCRs . . . Now And In The Future, Or Your Money Back!

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Patent Pending**

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video, audio, and servo problems.**

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Automatically determine if the VCR has a capstan servo, cylinder servo, luminance/chrominance circuit defect in virtually the time it takes to connect to the video and audio line outputs.*

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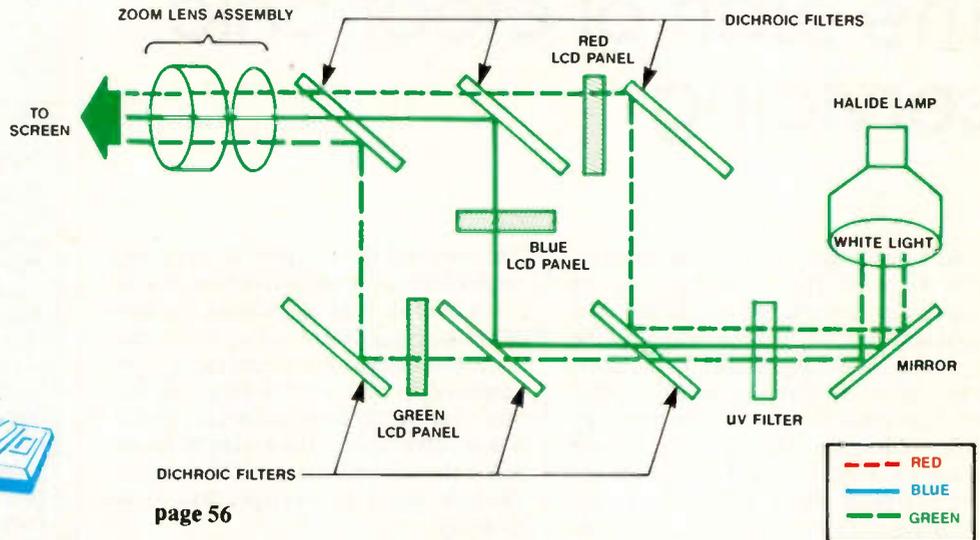
**Using the optional Servo Performance Test Leads and Servo Performance Test Tape.*

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Circle (84) on Reply Card



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1991 BUYERS' GUIDE

Every year the changing business of servicing of consumer electronics products requires that the service facility expand its circle of suppliers of test equipment, tools, replacement parts, education, information and services. Simply identifying and locating these suppliers can be a challenge. This Fifth Annual Buyer's guide is designed to help you locate the suppliers you'll need to contact during the coming year, so that you can concentrate on the business you do best: servicing the products.

6 Product Directory

There was a time when a servicing facility could get along with a meter, scope, tube tester, soldering gun and a few basic tools. Today the selection of tools and test equipment needed for servicing has grown. This directory provides information on suppliers of all these products to make the job of selection a little easier.

20 Replacement Parts/Components Directory

Today, the number of replacement parts and components that a service facility must keep track of seems to be approaching infinity. This directory lists manufacturers, distributors and others who

supply the huge variety of parts needed to keep consumers' electronic products in operation.

37 Software/Services Directory

Another characteristic of consumer electronics servicing today is the availability of supporting software and services. There is general-purpose computer software, software for managing the servicing facility, and more. There are specialized services like board rework/repair, disk drive refurbishment and more. If you need this kind of software or service, look in this directory.

38 Association/Educational Services Directory

Operating a consumer electronics servicing facility today means continuing education to remain abreast of the almost daily advances in the technology. Another way to keep up with what's going on is to associate with others who are doing the same kind of work. This directory will provide you with information on what associations exist, and what kinds of education are available.

39 Company Mailing Addresses

Once you have used one of the directories in this Buyers' Guide and identified the company or organization that you wish to contact, look in this directory to find out where to send your letter to, or what number to call.

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ON THE COVER

These graphic elements represent just a few of the thousands of components that a service center has to be aware of and keep track of. This 1991 Buyers' Guide can help in that effort by providing the service center management and technicians with the names and addresses of suppliers, and information about the products they supply.

The craft of electronic servicing

As I was paging through the January 1991 issue of IEEE Spectrum to see what's new in the world of electronics, I came across an ad for something quite the opposite; a reproduction of an old timepiece offered by the Franklin Mint, called the Universal Ring dial. The ad copy says: "Measure time the way George Washington did . . . with this fine precision timepiece. The Father of Our Country always treasured the precisely calibrated timepiece given to him by his close friend the Marquis de Lafayette.

"It was the Universal Ring Dial, the fine instrument preferred by the wealthy and powerful for over 150 years. Now this precision is re-created in etched solid brass to inaugurate the official collection of the National Maritime Historical Society.

"Pick it up. Turn the dial until sunlight coming through the pinhole focuses on the hour ring. And experience how Washington must have felt as he measured each dramatic moment in the birth of our nation."

"Every numeral and letter—as well as the acanthus leaf design—is deeply etched into the imported brass. Priced at \$100.00."

Then follows a series of instructions, with pictures. "Begin by setting the suspension ring to the local latitude. Next adjust the movable index to the current date. Finally, turn the entire dial until sunlight coming through the pinhole in the index is focused on the hour ring."

Isn't it amazing though, that in this age of electronics so advanced that you can have your time served up digitally, precisely, in such a number of ways and in such a number of places; microwave oven, TV, VCR, computer screen, that there would be a market for a timepiece that requires not only quite a bit of information to use, but that even requires that you be outside and that the sun be shining. And at a cost of \$100.00, when you can buy an electronic clock or watch accurate to the second for about \$10.00.

So what makes this particular, old-fashioned, inaccurate timepiece attractive? Of course it really has nothing to do with keeping time. It has to do with craftsmanship, beauty and elegance. For starters there's the craftsmanship in its manufacture. Even though, I suspect

that there's some mass production in this batch of these timepieces, they're beautiful to look at. And considering the level of achievement of technology at the time these were designed, they appear to be elegant in their function and design. In fact that's part of their attraction; the design is not superfluous, there simply to enhance the attractiveness of the product. The function of the timepiece flows from its design.

Compare this to a watch or clock, or any electronics device of today. There's really little or no craftsmanship in evidence. Oh, of course, if you look at some of the expensive products, like projection TVs, or expensive electronic watches, the case, the package, may be beautifully crafted, but that has nothing to do with the function of the product. In fact in these days of inexpensive, highly sophisticated, highly reliable electronics, as often as not the only difference between a \$10.00 electronic watch and a \$1,000 electronic watch is that the \$1,000 gold watch has a beautiful gold case. There is no difference in the electronics simply because the two of three dollars worth of electronics components is very high quality electronics goods, manufactured very inexpensively. Spending 10 or 100 times as much to manufacture the working parts would not result in any visible improvement.

It's interesting, then to think on the status of craftsmanship in today's electronics products. The engineers design them, efficient machines mass produce them, and even the elegant looking case of high end products may be machine carved, fitted and finished.

So where is the craftsmanship? It may very well be that the consumer-electronics servicing technician is the last craftsman still performing a craft in the consumer electronics business. To be able to diagnose a problem in one of these complex products, locate the defective component or components and to skillfully remove and replace them; that's a craft in a world in which there are very few crafts remaining, and one of which every technician should be proud.

Nils Conrad Persson

THE MAGAZINE FOR CONSUMER ELECTRONICS SERVICING PROFESSIONALS

ELECTRONIC

Servicing & Technology

Electronic Servicing & Technology is edited for servicing professionals who service consumer electronics equipment. This includes service technicians, field service personnel and avid servicing enthusiasts who repair and maintain audio, video, computer and other consumer electronics equipment.

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30 MS/s DSO PLUS A TEST BENCH OF FUNCTIONS TIED UP IN ONE PORTABLE PACKAGE.

Leader's new battery-powered DSO/DMM weighs only 2.6 lbs., yet performs the functions of four different pieces of test equipment. Two functions the Model 300 offers are those of a DSO and DMM, with simultaneous display of each—including channels 1 and 2 peak-to-peak voltage and frequency. Two additional functions are an 8-bit logic analyzer, which lets you compare 8 signals at once, and a data logger for recording long-term phenomena.



forwarding it to a lab for analysis. Although our new portable DSO is compact, it's also feature-packed. Included are: HF rejection, add and subtract, and full auto setup for vertical sensitivity, sweep speed, vertical position, and trigger level. For documentation purposes the 300 can interface with an optional dedicated printer (Leader Model 710). A supertwist LCD display (a full 2 1/2" x 4 1/2") provides high contrast and



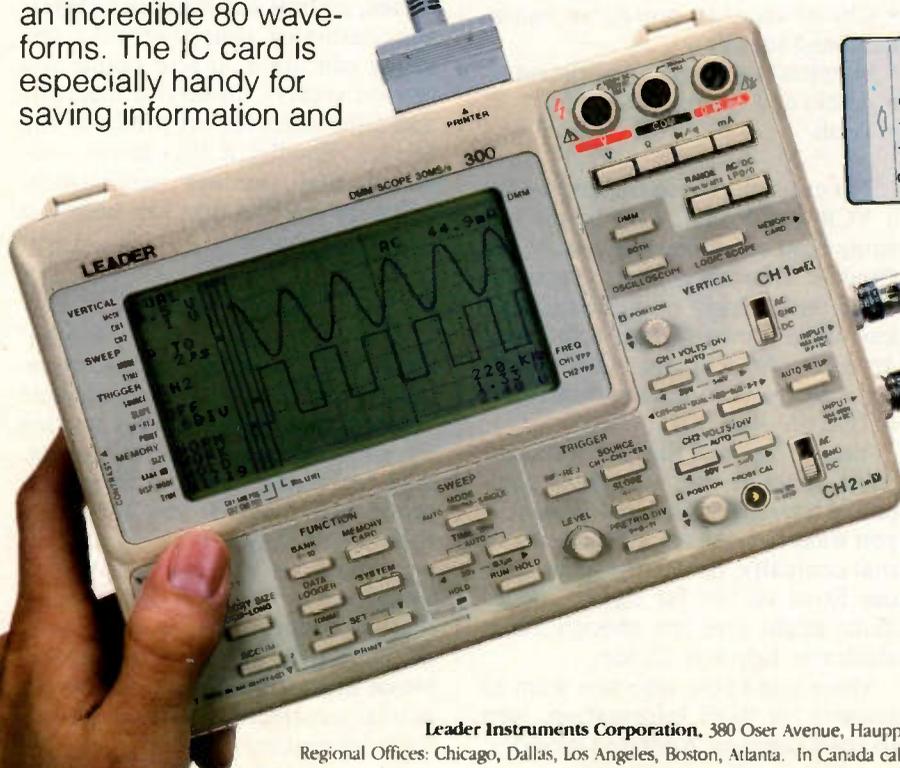
The 300 has a remarkable sampling rate of 30 MS/s, giving you the ability to observe 10-MHz signals. A powerful 1.8k word/channel

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Regional Offices: Chicago, Dallas, Los Angeles, Boston, Atlanta. In Canada call Omniflex Ltd., 416 828-6221.

For information Circle (71) on Reply Card
For demonstration Circle (72) on Reply Card

1991 Buyer's Guide

Back in the good old days of TV servicing, determining which replacement component was needed to repair a consumer electronics product (almost invariably a TV) was not much of a problem. If it was a tube you needed, you pulled out a new tube and replaced the faulty one. And almost certainly you had the right replacement on hand. It didn't matter which manufacturer made the tube; the identification number was the same and the characteristics were the same. It was no problem keeping track of addresses and phone numbers of the mere handful of manufacturers. You practically knew them by heart.

Today the unit being repaired might be a TV, VCR, camcorder or CD player, probably imported from another country, made by one of 20 different manufacturers under one of a hundred national and private brands. If you need a transistor or an integrated circuit, you might have to cross-reference among several component manufacturers or suppliers before you can identify one that you either have on hand or can get without too much trouble. Just keeping track of the names and addresses of suppliers can be a major task.

Here's help. This fifth annual **ES&T Buyers' Guide** contains information on hundreds of manufacturers and distributors who make or sell thousands of products. The guide will tell you who makes what, and it will give you addresses and phone numbers to contact. Save this issue. We get long-distance calls every day from readers who need an address. One look in the **Buyers' Guide** is usually all it takes to help them. If the callers had looked for themselves, they could have saved time and a toll call.

Using the Buyers' Guide

If you're in the market for a new oscilloscope this year, you would probably know the names of some of the major oscilloscope manufacturers, and you might have some of those companies' addresses somewhere in your files. Or maybe you would like to learn how to service computer disk drives, or compact disc players, but you have no idea who offers a course on that subject.

If you figure the EIA is your source, you still have to figure out where to find that eternally misplaced address.

That's why we put together this **Buyers' Guide**—all the information you need is gathered together in one place. No need to search through stacks of papers. Here's your one-source alternative.

If you want an oscilloscope, turn to the **Product Directory** and look up oscilloscopes. Every company that responded to our questionnaire will be listed there, and every company's address will be listed in the **Company Address Directory**.

We've broken down this information into five categories:

- **Product Directory** page 6.
- **Replacement Parts/Components Directory** page 21.
- **Services Directory** page 39.
- **Association/Educational Sources Directory** page 39.
- **Company Address Directory** page 40.

Finding a product or part

We have subdivided the product directory according to certain types of products:

- Test equipment.
- Test equipment accessories.
- Circuit damage protective equipment and supplies.
- Supplies/accessories equipment.
- Audio and video accessories.
- Tools

For example, if you are looking for a VCR test jig kit, turn to the test equipment accessories section of the **Product Directory**. The companies listed there all say they offer test jig kits. If the company name is followed by a *D, that tells you this company is a distributor, not a manufacturer, of that product.

You will notice that certain company names are in blue. Those companies have advertised in this issue. If you want to learn a little more about that company, turn to the page number listed to the far right. The ad alone might give you enough information to help you decide.

Once you know who you want to contact for more information, turn to the **Company Address Directory**.

The address, telephone number and fax number for each company are listed there. (Of course, if the company you are interested in has advertised in this issue, you can just pull out your **Reader Service** card and circle the reply number listed under the advertisement.)

The **Replacement Parts/Components Directory** works the same way. Just look up the type of component you need, then turn to the **Company Address Directory** to find out how to contact a company that supplies that product. The **Company Address Directory** lists information on more than 450 companies and associations that offer products or services for the electronics servicer.

Checking out services

Consult the **Services Directory** if you need to contact a consultant, get a disk drive or head refurbished, plug into an on-line service, find a company to repair or rework a PC board, rent or lease equipment, calibrate your older test equipment, or repair a tuner.

Your source for continuing education

The **Association and Educational Sources Directory** helps you find books, schools and training seminars for continuing your electronics servicing education. It also points you toward sources for service literature and schematics for the products you service. Finally, it lists those companies that produce management software systems that can help you run your business.

Keep in touch

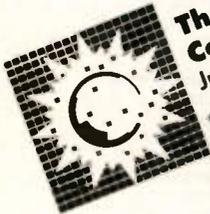
Although the annual **Buyers' Guide** is a year in the making, we realize it can't be absolutely complete—new companies are always starting up, going out of business, or moving. And technology keeps adding new products to track. If you know of a company that you think other readers should be aware of, or if you would like us to extend our coverage to new product areas, drop us a line. Of course, if you find a mistake, please contact us immediately. We'll publish a correction in the next **Feedback** department.

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To obtain your badge by mail, we must receive this form no later than May 3, 1991. Be sure to attach your business card. If we receive this form after May 3 but before May 17, 1991, you may pick up your badge at the "Advance Registration Pick-Up" Desk in the Main Registration Area of McCormick East and McCormick North. Two forms of ID will be required. Registration Forms received after May 17 will not be processed. Please register on site after paying \$30 (U.S.). To register more than one qualified individual, please duplicate this form and attach a business card for each individual.

Please mail this form to the following address: **Consumer Electronics Shows, c/o CompuSystems, Inc., P.O. Box 6579, Broadview, Illinois 60153-6579.**

You will receive your badge within 6 weeks. Complete Show Information, including a housing form, will be sent separately. Please **do not** pre-register, if you have already done so.

FULL NAME _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP CODE _____

COUNTRY _____ PHONE/TELEX _____

Last four digits of your Social Security Number (for internal use only) _____

For the trade only. No one under 18 years of age will be admitted. Over-the-counter sales are not permitted. Badge replacement fee — \$30.00.

Please check only one badge category:

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| <input type="checkbox"/> 1 Retailer | <input type="checkbox"/> 5 Manufacturer's Rep. | <input type="checkbox"/> 11 Consultant: | <input type="checkbox"/> 12 Analyst: |
| <input type="checkbox"/> 2 Distributor | <input type="checkbox"/> 6 Manufacturer | <input type="checkbox"/> A Advertising | <input type="checkbox"/> A Financial |
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RAG Electronics Inc.*D
Tektronix, Inc.

FREQUENCY COUNTERS

- Acculex Corp. A MetraByte Co.
- Accutest Instruments*D
- Allied Electronics, A Div. of Hall-Mark Electronics*D
- American Reliance Inc.
- Analogic Corp.
- Arrow Electronics Inc. Catalog Sales Div.*D
- Atrix, Inc.*D
- Beckman Industrial Corp. An Affiliate of Emerson Electric Co.
- B&K-Precision Maxtec International Corp. 51**
- Brunelle Instruments Inc.
- Bursma Electronic Distributing*D
- Colorado Data Systems
- Consolidated Electronics, Inc.*D 57**
- Contact East, Inc.*D 47**
- Cooper Associates*D
- Createc Signal Computer*D
- C&S Sales*D 45**
- Daetron
- Datel, Inc.
- Electronic Parts Supply*D
- Electronics Warehouse Corp.*D
- Elenco Electronics, Inc.
- EMCO Electronics
- Exttech Instruments Corp.
- John Fluke Mfg. Co. Inc.
- Fordham Radio Supply Co.*D
- Global Specialties A Div. of Interplex
- GoldStar Precision Co. Ltd.
- Hameg, Inc.
- Heath Co.
- HMC-Hub Material Co.*D
- HSC Electronic Supply*D
- The Instrument Mart, Inc.*D
- JDR Micro*D

- W.S. Jenks & Son*D
- Jensen Tools Inc.*D 50**
- Joseph Electronics*D
- Kelvin Electronics*D
- Kenwood U.S.A. Corp.
- Kikusui International Corp.
- Leader Instruments Corp. 3**
- Leotron Research Labs*D
- M.A.T. Electronics*D 55**
- MCM Electronics*D
- Mercer Electronics
- Omnitron Electronics*D
- Orion Instruments, Inc.
- Pacer Industries, Inc.
- Phillips Consumer Electronics Service Co.*D
- Racal-Dana Instruments Inc.
- RAG Electronics Inc.*D
- Ramsey Electronics Inc.
- RNJ Electronics Inc.*D
- Rochester Instruments Systems
- Salen Enterprises*D
- Sencore Electronics IFC**
- Sibex Inc.
- Simpson Electric Co.
- Spanta, Inc.
- Specialized Products Co.*D
- Techni-Tool Inc.*D
- Tektronix, Inc.
- Tool Kit Specialists, Inc.*D
- Tucker Electronics Co.*D
- Vector-Viz Instrument Div. a Vector Group Co.

FUNCTION GENERATORS

- Accutest Instruments*D
- Allied Electronics, A Div. of Hall-Mark Electronics*D
- American Reliance Inc.
- Analogic Corp.
- Arrow Electronics Inc. Catalog Sales Div.*D

- Beckman Industrial Corp. An Affiliate of Emerson Electric Co.
- B&K-Precision Maxtec International Corp. 51**
- Brunelle Instruments Inc.
- Bursma Electronic Distributing*D
- Colorado Data Systems
- Consolidated Electronics, Inc.*D 57**
- Contact East, Inc.*D 47**
- Cooper Associates*D
- C&S Sales*D 45**
- Electronic Parts Supply*D
- Electronics Warehouse Corp.*D
- Elenco Electronics, Inc.
- EMCO Electronics
- John Fluke Mfg. Co. Inc.
- Fordham Radio Supply Co.*D
- Gage Applied Sciences Inc.
- Global Specialties A Div. of Interplex
- GoldStar Precision Co. Ltd.
- Hameg, Inc.
- Heath Co.
- HMC-Hub Material Co.*D
- HSC Electronic Supply*D
- The Instrument Mart, Inc.*D
- JDR Micro*D
- W.S. Jenks & Son*D
- Jensen Tools Inc.*D 50**
- Joseph Electronics*D
- Kelvin Electronics*D
- Kenwood U.S.A. Corp.
- Leader Instruments Corp. 3**
- Leotron Research Labs*D
- MCM Electronics*D
- Mercer Electronics
- MetraByte Corp.
- Omnitron Electronics*D
- Orion Instruments, Inc.
- Pacer Industries, Inc.
- Phillips Consumer Electronics Service Co.*D
- RAG Electronics Inc.*D
- Rapid Systems

- RNJ Electronics Inc.*D
- Rochester Instruments Systems
- Salen Enterprises*D
- Sibex Inc.
- Simpson Electric Co.
- Spanta, Inc.
- Specialized Products Co.*D
- Techni-Tool Inc.*D
- Tektronix, Inc.
- Teledata Systems
- Tucker Electronics Co.*D

GAUGES: HEAD PROTRUSION/SPRING TENSION/STYLUS FORCE/OTHER

- Contact East, Inc.*D 47**
- Cooper Associates*D
- Electronics Warehouse Corp.*D
- HMC-Hub Material Co.*D
- Hunter Products, Inc.
- Jonard Industries Corp.
- Joseph Electronics*D
- Leotron Research Labs*D
- Moody Tools, Inc.
- Omnitron Electronics*D
- Phillips Consumer Electronics Service Co.*D
- Techni-Tool Inc.*D
- Tentel Corp. 56**

GENERATORS, AUDIO

- Accutest Instruments*D
- B&K-Precision Maxtec International Corp. 51**
- Brunelle Instruments Inc.
- Consolidated Electronics, Inc.*D 57**
- C&S Sales*D 45**
- Electronic Parts Supply*D
- Electronics Warehouse Corp.*D
- Elenco Electronics, Inc.
- EMCO Electronics
- Hameg, Inc.
- Heath Co.
- HSC Electronic Supply*D
- The Instrument Mart, Inc.*D
- W.S. Jenks & Son*D
- Joseph Electronics*D
- Kelvin Electronics*D
- Kenwood U.S.A. Corp.
- Leader Instruments Corp. 3**
- Leotron Research Labs*D
- MCM Electronics*D
- Omnitron Electronics*D
- Orion Instruments, Inc.
- RAG Electronics Inc.*D
- RNJ Electronics Inc.*D
- Sencore Electronics IFC**
- Specialized Products Co.*D
- Tektronix, Inc. TV Products Div.
- Teledata Systems

GENERATORS, SIGNAL

- Accutest Instruments*D
- Audiovisual Inc. (Video Midwest/AVC Systems Divs.)*D
- B&K-Precision Maxtec International Corp. 51**
- Bursma Electronic Distributing*D
- Consolidated Electronics, Inc.*D 57**
- C&S Sales*D 45**
- Digitech Industries Inc.
- Electronic Parts Supply*D
- Electronics Warehouse Corp.*D
- Elenco Electronics, Inc.
- EMCO Electronics
- John Fluke Mfg. Co. Inc.
- Fordham Radio Supply Co.*D
- Gage Applied Sciences Inc.
- Global Specialties A Div. of Interplex
- Hameg, Inc.
- Heath Co.
- HMC-Hub Material Co.*D
- HSC Electronic Supply*D
- The Instrument Mart, Inc.*D
- JDR Micro*D
- W.S. Jenks & Son*D
- Jensen Tools Inc.*D 50**

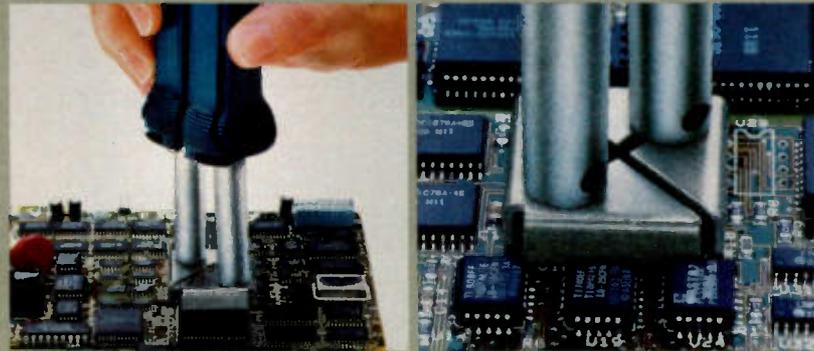
THERMOTWEEZ POWER for Controlled SMD Removal

PACE's new TT 65 ThermoTweez Handpiece provides safe, one-handed reflow and removal of PLCCs and other components in just seconds. Unlike other methods, its high thermal capacity and targeted heat makes quick work of large SMDs *without* damage to the board or adjacent components -- even on heavy multilayer assemblies.

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The new ThermoTweez Handpiece ... Just one of the family of SensaTemp accessories and systems from PACE!

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Lectronic Research Labs*D
Marconi Instruments
MCM Electronics*D
NCM Electronics
Omnitron Electronics*D
Orion Instruments, Inc.
RAG Electronics Inc.*D
Ramsey Electronics Inc.
Rapid Systems
RNJ Electronics Inc.*D
Rochester Instruments Systems
Sibex Inc.
Specialized Products Co.*D
Tektronix, Inc.
Teledata Systems
Tucker Electronics Co.*D
Vector-Viz Instrument Div. a Vector Group Co.

GENERATORS, VIDEO

Accutest Instruments*D
Audiovisual Inc. (Video Midwest/AVC Systems Divs.)*D
B&K-Precision Maxtec International Corp. 51
BTC Test & Measurement*D
Bursma Electronic Distributing*D
Consolidated Electronics, Inc.*D 57
C&S Sales*D 45
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Elenco Electronics, Inc.
Heath Co.
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kelvin Electronics*D
Leader Instruments Corp. 3
Lectronic Research Labs*D
MCM Electronics*D
NCM Electronics
Network Technologies, Inc.
Omnitron Electronics*D
Orion Instruments, Inc.
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Sencore Electronics IFC
Tektronix, Inc. TV Products Div.

HV PROBES

Accutest Instruments*D
Bursma Electronic Distributing*D
Consolidated Electronics, Inc.*D 57
Electro-Metrics, Inc.
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
EMCO Electronics
Hameg, Inc.
Herman Electronics*D
The Instrument Mart, Inc.*D
Interconnect Devices, Inc.
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Joseph Electronics*D
Kelvin Electronics*D
KeyTek Instrument Corp.
M.A.T. Electronics*D 55
MCM Electronics*D
Omnitron Electronics*D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Sencore Electronics IFC
Simpson Electric Co.
Tektronix, Inc.
Test Probes, Inc.

LOGIC ANALYZERS: SIGNATURE/STATE

Accutest Instruments*D
Allied Electronics, A Div. of Hall-Mark Electronics*D
Analogic Corp.
Arlum Corp.
Becktron
BitWise Designs, Inc
Bursma Electronic Distributing*D

Electronic Parts Supply*D
Electronics Warehouse Corp.*D
John Fluke Mfg. Co. Inc.
Fordham Radio Supply Co.*D
Global Specialties A Div. of Interplex Hameg, Inc.
Heath Co.
Herman Electronics*D
JDR Micro*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kelvin Electronics*D
Lectronic Research Labs*D
MetaByte Corp.
Micromax Corp.
Omnitron Electronics*D
Orion Instruments, Inc.
Pacific Electro Data, Inc.
Philips Consumer Electronics Service Co.*D
RAG Electronics Inc.*D
Rapid Systems
A.W. Sperry Instruments, Inc.
Techni-Tool Inc.*D
Tektronix, Inc.
Tucker Electronics Co.*D

LOGIC PROBES

Accutest Instruments*D
Allied Electronics, A Div. of Hall-Mark Electronics*D
American Design Components*D
American Reliance Inc.
Arrow Electronics Inc. Catalog Sales Div.*D
Atrix, Inc.*D
Beckman Industrial Corp. An Affiliate of Emerson Electric Co.
B&K-Precision Maxtec International Corp. 51
Brunelle Instruments Inc.
Bursma Electronic Distributing*D
Consolidated Electronics, Inc.*D 57
Contact East, Inc.*D 47
C&S Sales*D 45
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Elenco Electronics, Inc.
Fieldpiece Instruments
Fordham Radio Supply Co.*D
Global Specialties A Div. of Interplex Heath Co.
Herman Electronics*D
HMC-Hub Material Co.*D
HSC Electronic Supply*D
Interconnect Devices, Inc.
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Joseph Electronics*D
Kelvin Electronics*D
Kenwood U.S.A. Corp.
Kobetron Inc.
Lectronic Research Labs*D
Lil' Bitty Tester, Inc.
MCM Electronics*D
Mercer Electronics
Mouser Electronics*D
O.K. Industries Inc.
Omnitron Electronics*D
Philips Consumer Electronics Service Co.*D
Philips ECG 41
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Salen Enterprises*D
Simpson Electric Co.
Specialized Products Co.*D
Techni-Tool Inc.*D
Tektronix, Inc.
Tool Kit Specialists, Inc.*D
Universal Enterprises

LOGIC PULSERS

Accutest Instruments*D
American Reliance Inc.
Beckman Industrial Corp. An Affiliate of Emerson Electric Co.
Brunelle Instruments Inc.
Bursma Electronic Distributing*D
Consolidated Electronics, Inc.*D 57

Contact East, Inc.*D 47
C&S Sales*D 45
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Elenco Electronics, Inc.
Global Specialties A Div. of Interplex Hameg, Inc.
Herman Electronics*D
HMC-Hub Material Co.*D
HSC Electronic Supply*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Joseph Electronics*D
Kelvin Electronics*D
Kobetron Inc.
Lectronic Research Labs*D
MCM Electronics*D
Mercer Electronics
Omnitron Electronics*D
Philips Consumer Electronics Service Co.*D
Philips ECG 41
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Salen Enterprises*D
Simpson Electric Co.
Spanta, Inc.
Tool Kit Specialists, Inc.*D

MAGNETRON TESTERS

Electronic Parts Supply*D
W.S. Jenks & Son*D
Lectronic Research Labs*D
Omnitron Electronics*D
Philips Consumer Electronics Service Co.*D
Plastic Capacitors Inc.

METERS, CAPACITANCE/INDUCTANCE

ABB Metrawatt Inc.
Accutest Instruments*D
American Design Components*D
American Reliance Inc.
Analogic Corp.
Arrow Electronics Inc. Catalog Sales Div.*D
Beckman Industrial Corp. An Affiliate of Emerson Electric Co.
Brunelle Instruments Inc.
Bursma Electronic Distributing*D
Consolidated Electronics, Inc.*D 57
Contact East, Inc.*D 47
Cooper Associates*D
Creative Electronics
C&S Sales*D 45
Daetron
Diversified Parts*D
EDS, Inc.
Electromatic Controls/ Soar Instruments
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Elenco Electronics, Inc.
EMCO Electronics
Extech Instruments Corp.
Fieldpiece Instruments
Fordham Radio Supply Co.*D
Global Specialties A Div. of Interplex Herman Electronics*D
HMC-Hub Material Co.*D
HSC Electronic Supply*D
IET Labs, Inc.
The Instrument Mart, Inc.*D
Itera/Belmoor*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Joseph Electronics*D
Kelvin Electronics*D
Leader Instruments Corp. 3
Lectronic Research Labs*D
M.A.T. Electronics*D 55
MCM Electronics*D
Mercer Electronics
Milo Associates, Inc.*D
Mouser Electronics*D
Nu-Data Inc.
Omnitron Electronics*D

Philips Consumer Electronics Service Co.*D
Philips ECG 41
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Salen Enterprises*D
Sencore Electronics IFC
Simpson Electric Co.
Specialized Products Co.*D
Speco Div.
A.W. Sperry Instruments, Inc.
Start International*D
Techni-Tool Inc.*D
TIF Instruments, Inc.
Tool Kit Specialists, Inc.*D
Tucker Electronics Co.*D
Universal Enterprises
Vector-Viz Instrument Div. a Vector Group Co.

METERS, CLAMP ON

ABB Metrawatt Inc.
Accutest Instruments*D
AEMC Corp.
American Reliance Inc.
Amprobe Instrument
Arrow Electronics Inc. Catalog Sales Div.*D
Beckman Industrial Corp. An Affiliate of Emerson Electric Co.
Biddle Instruments
B&K-Precision Maxtec International Corp. 51
Brunelle Instruments Inc.
Bursma Electronic Distributing*D
Consolidated Electronics, Inc.*D 57
Contact East, Inc.*D 47
Cooper Associates*D
C&S Sales*D 45
Diversified Parts*D
Electromatic Controls/ Soar Instruments
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Elenco Electronics, Inc.
EMCO Electronics
Extech Instruments Corp.
Fieldpiece Instruments
GoldStar Precision Co. Ltd.
Heath Co.
HMC-Hub Material Co.*D
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Joseph Electronics*D
Kelvin Electronics*D
Kyoritsu Electrical Instruments Works
Lectronic Research Labs*D
MCM Electronics*D
Mercer Electronics
Milo Associates, Inc.*D
Mouser Electronics*D
Omega Engineering Inc.
Omnitron Electronics*D
Pacer Industries, Inc.
Philips Consumer Electronics Service Co.*D
Philips ECG 41
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Rochester Instruments Systems
Simpson Electric Co.
Specialized Products Co.*D
A.W. Sperry Instruments, Inc.
Techni-Tool Inc.*D
TIF Instruments, Inc.
Tool Kit Specialists, Inc.*D
Tucker Electronics Co.*D
Universal Enterprises
Yokogawa Corp. of America

METERS, FIELD STRENGTH

Accutest Instruments*D
BMI-Basic Measuring Instruments
Channel Master Div. of Avnet, Inc.
Cooper Associates*D
Diversified Parts*D
Electro-Metrics, Inc.
Electro-Tech Systems, Inc.
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Herman Electronics*D

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The Instrument Mart, Inc.*D
 Intelco Corp.
 W.S. Jenks & Son*
 Joseph Electronics*
 Kelvin Electronics*
Leader Instruments Corp. 3
 Lectronic Research Labs*
 MCM Electronics*
 NRD Inc. Static Control Products
 Omnitron Electronics*
 Philips Consumer Electronics Service
 Co.*
Sencore Electronics IFC
 Tool Kit Specialists, Inc.*
 Triplett Corp.
 Tucker Electronics Co.*

METERS, SIGNAL LEVEL

Accutest Instruments*
 American Reliance Inc.
 Beckman Industrial Corp. An Affiliate
 of Emerson Electric Co.
 Channel Master Div. of Avnet, Inc.
 Cooper Associates*
 Diversified Parts*
 Electronic Parts Supply*
 Electronics Warehouse Corp.*
 Herman Electronics*
 The Instrument Mart, Inc.*
 W.S. Jenks & Son*
 Joseph Electronics*
 Kelvin Electronics*
Leader Instruments Corp. 3
 Lectronic Research Labs*
 Omnitron Electronics*
 Philips Consumer Electronics Service
 Co.*
 RAG Electronics Inc.*
 RNJ Electronics Inc.*
 Speco Div.
 Tool Kit Specialists, Inc.*

METERS, SOUND LEVEL

Accutest Instruments*
 Allied Electronics, A Div. of Hall-Mark
 Electronics*
 Brunelle Instruments Inc.
Consolidated Electronics,
Inc.* 57
 Cooper Associates*
 Diversified Parts*
 Electronic Parts Supply*
 Electronics Warehouse Corp.*
 Exttech Instruments Corp.
 Herman Electronics*
 HMC-Hub Material Co.*
 Hunter Products, Inc.
 The Instrument Mart, Inc.*
 W.S. Jenks & Son*
 Joseph Electronics*
 Lectronic Research Labs*
 Omnitron Electronics*
 Pacer Industries, Inc.
 Philips Consumer Electronics Service
 Co.*
 RAG Electronics Inc.*
 RNJ Electronics Inc.*
Sencore Electronics IFC
 Simpson Electric Co.
 Speco Div.
 Start International*
 Tool Kit Specialists, Inc.*

METERS, VOLTMETERS, AC

ABB Metrawatt Inc.
 Accutest Instruments*
 AEMC Corp.
 AESI/Stedl Watt
 Allied Electronics, A Div. of Hall-Mark
 Electronics*
 American Design Components*
 American Reliance Inc.
 Amprobe Instrument
 Analogic Corp.
 Arrow Electronics Inc. Catalog Sales
 Div.*
 Atrix, Inc.*
 Beckman Industrial Corp. An Affiliate
 of Emerson Electric Co.
 Biddle Instruments

B&K-Precision Maxtec
International Corp. 51
 BMI-Basic Measuring Instruments
 Bursma Electronic Distributing*
 Classic Components Supply Inc.*
 Com-Kyl Inc.*
Consolidated Electronics,
Inc.* 57
Contact East, Inc.* 47
 Cooper Associates*
 Datel, Inc.
 Diversified Parts*
 Electro-Tech Systems, Inc.
 Electromatic Controls/ Soar
 Instruments
 Electronic Design Specialists
 Electronic Parts Supply*
 Electronics Warehouse Corp.*
 EMCO Electronics
 Esterline Angus Instrument Corp.
 Exttech Instruments Corp.
 Fieldpiece Instruments
 John Fluke Mfg. Co. Inc.
 Fordham Radio Supply Co.*
 GMB/dba Fox International*
 GoldStar Precision Co. Ltd.
 Hameg, Inc.
 Hand Tool Industries, Inc.
 Herman Electronics*
 HMC-Hub Material Co.*
 HSC Electronic Supply*
 IET Labs, Inc.
 The Instrument Mart, Inc.*
 Itera/Belmoor*
 JDR Micro*
 W.S. Jenks & Son*
Jensen Tools Inc.* 50
 Joseph Electronics*
 Kelvin Electronics*
 Kenwood U.S.A. Corp.
 Kyoritsu Electrical Instruments Works
Leader Instruments Corp. 3
 Lectronic Research Labs*
 Marconi Instruments
M.A.T. Electronics* 55
 MCM Electronics*
 MetraByte Corp.
 Milo Associates, Inc.*
 Mouser Electronics*
 Nu-Data Inc.
 Omega Engineering Inc.
 Omnitron Electronics*
 Philips Consumer Electronics Service
 Co.*
Philips ECG 41
 RAG Electronics Inc.*
 R & K Supply Co.
 RNJ Electronics Inc.*
 Rochester Instruments Systems
 Simpson Electric Co.
 Specialized Products Co.*
 Speco Div.
 A.W. Sperry Instruments, Inc.
 Start International*
 Techni-Tool Inc.*
 Tegam, Inc.
 TIF Instruments, Inc.
 Tool Kit Specialists, Inc.*
 Triplett Corp.
 Tucker Electronics Co.*
 Universal Enterprises
 Vector-Viz Instrument Div. a Vector
 Group Co.
 WestCon Div. of Sycon Corp.
 Yokogawa Corp. of America

METERS, WOW AND FLUTTER

ABB Metrawatt Inc.
 Accutest Instruments*
 Diversified Parts*
 Electronic Parts Supply*
 Electronics Warehouse Corp.*
 The Instrument Mart, Inc.*
 W.S. Jenks & Son*
 Joseph Electronics*
 Kenwood U.S.A. Corp.
Leader Instruments Corp. 3
 Lectronic Research Labs*
 Omnitron Electronics*
 Philips Consumer Electronics Service
 Co.*
 RAG Electronics Inc.*
 RNJ Electronics Inc.*
 Tucker Electronics Co.*

MICROWAVE LEAKAGE TESTERS

Accutest Instruments*
Consolidated Electronics,
Inc.* 57
 Cooper Associates*
 Displaytek Corp.
 Diversified Parts*
 Electronic Parts Supply*
 The Instrument Mart, Inc.*
 W.S. Jenks & Son*
 Joseph Electronics*
 Lectronic Research Labs*
 Omnitron Electronics*
 RAG Electronics Inc.*
 Simpson Electric Co.
 A.W. Sperry Instruments, Inc.
 Techni-Tool Inc.*
 Universal Enterprises

MULTIMETERS: ANALOG/DIGITAL

ABB Metrawatt Inc.
 Accutest Instruments*
 AEMC Corp.
 Allied Electronics, A Div. of Hall-Mark
 Electronics*
 American Reliance Inc.
 Amprobe Instrument
 Analogic Corp.
 Arrow Electronics Inc. Catalog Sales
 Div.*
 Atrix, Inc.*
 Beckman Industrial Corp. An Affiliate
 of Emerson Electric Co.
 Biddle Instruments
B&K-Precision Maxtec
International Corp. 51
 Brunelle Instruments Inc.
 Bursma Electronic Distributing*
 Classic Components Supply Inc.*
Consolidated Electronics,
Inc.* 57
Contact East, Inc.* 47
 Cooper Associates*
C&S Sales* 45
 Daetron
 Diversified Parts*
 Electromatic Controls/ Soar
 Instruments
 Electronic Design Specialists
 Electronic Parts Supply*
 Electronics Warehouse Corp.*
 Elenco Electronics, Inc.
 EMCO Electronics
 Esterline Angus Instrument Corp.
 Exttech Instruments Corp.
 Fieldpiece Instruments
 John Fluke Mfg. Co. Inc.
 Fordham Radio Supply Co.*
 GC Electronics Div. of GC Thorsen Co.
 Global Specialties A Div. of Interplex
 GoldStar Precision Co. Ltd.
 Hameg, Inc.
 Hand Tool Industries, Inc.
 Heath Co.
 Herman Electronics*
 Hitachi Denshi America, Ltd.
 HMC-Hub Material Co.*
 HSC Electronic Supply*
 IET Labs, Inc.
 The Instrument Mart, Inc.*
 Itera/Belmoor*
 JDR Micro*
 W.S. Jenks & Son*
Jensen Tools Inc.* 50
 Joseph Electronics*
 Kelvin Electronics*
 Kenwood U.S.A. Corp.
 Kyoritsu Electrical Instruments Works
Leader Instruments Corp. 3
 Lectronic Research Labs*
 MCM Electronics*
 Mercer Electronics
 MetraByte Corp.
 Milo Associates, Inc.*
 Mouser Electronics*
 Nu-Data Inc.
 Omega Engineering Inc.
 Omnitron Electronics*
 Philips Consumer Electronics Service
 Co.*
Philips ECG 41

Prime Electronics Co.* 59
 Racial-Dana Instruments Inc.
 RAG Electronics Inc.*
 R & K Supply Co.
 RNJ Electronics Inc.*
 Salen Enterprises*
 Simpson Electric Co.
 Solder Absorbing Technology, Inc.
 Specialized Products Co.*
 Speco Div.
 A.W. Sperry Instruments, Inc.
 Start International*
 Techni-Tool Inc.*
 Tegam, Inc.
 TIF Instruments, Inc.
 Tool Kit Specialists, Inc.*
 Tucker Electronics Co.*
 Universal Enterprises
 Vector-Viz Instrument Div. a Vector
 Group Co.
 Yokogawa Corp. of America

OSCILLOSCOPES

ABB Metrawatt Inc.
 Accutest Instruments*
 Allied Electronics, A Div. of Hall-Mark
 Electronics*
 Analogic Corp.
 Arrow Electronics Inc. Catalog Sales
 Div.*
 Audiovisual Inc. (Video Midwest/AVC
 Systems Divs.)*
 Beckman Industrial Corp. An Affiliate
 of Emerson Electric Co.
B&K-Precision Maxtec
International Corp. 51
 Brunelle Instruments Inc.
 Bursma Electronic Distributing*
Consolidated Electronics,
Inc.* 57
Contact East, Inc.* 47
 Createc Signal Computer*
C&S Sales* 45
 Electronic Parts Supply*
 Electronics Warehouse Corp.*
 Elenco Electronics, Inc.
 EMCO Electronics
 John Fluke Mfg. Co. Inc.
 Fordham Radio Supply Co.*
 Gage Applied Sciences Inc.
 Global Specialties A Div. of Interplex
 GoldStar Precision Co. Ltd.
 Gould Inc. Test & Measurement
 Group
 Hameg, Inc.
 Hand Tool Industries, Inc.
 Heath Co.
 Herman Electronics*
 Hitachi Denshi America, Ltd.
 HI-Techniques Inc.
 HMC-Hub Material Co.*
 HSC Electronic Supply*
 The Instrument Mart, Inc.*
 JDR Micro*
 W.S. Jenks & Son*
Jensen Tools Inc.* 50
 Joseph Electronics*
 Kelvin Electronics*
 Kenwood U.S.A. Corp.
 Kikusui International Corp.
Leader Instruments Corp. 3
 Lectronic Research Labs*
M.A.T. Electronics* 55
 MCM Electronics*
 MetraByte Corp.
 Mouser Electronics*
 Nicolet Test Instruments
 O.K. Industries Inc.
 Omnitron Electronics*
 Orion Instruments, Inc.
 Philips Consumer Electronics Service
 Co.*
Prime Electronics Co.* 59
 RAG Electronics Inc.*
 Rapid Systems
 RNJ Electronics Inc.*
 Salen Enterprises*
Sencore Electronics IFC
 Soltec Corp.
 Specialized Products Co.*
 Speco Div.
 A.W. Sperry Instruments, Inc.
 Techni-Tool Inc.*
 Tektronix, Inc.

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Tool Kit Specialists, Inc.*D
Tucker Electronics Co.*D
Yokogawa Corp. of America

PERSONAL COMPUTER REPAIR/TEST EQUIPMENT

Accutest Instruments*D
American Design Components*D
American Reliance Inc.
Aristo Computers, Inc.
Atrix, Inc.*D
Beckman Industrial Corp. An Affiliate of Emerson Electric Co.
Brian Instruments, Inc.
Colorado Data Systems
Computer Doctors
Contact East, Inc.*D 47
Datatran Corp.
Electronics Warehouse Corp.*D
Fieldpiece Instruments
Hand Tool Industries, Inc.
HMC-Hub Material Co.*D
Hy-Tronix Instruments, Inc.
The Instrument Mart, Inc.*D
IQ Technologies, Inc.
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
MCM Electronics*D
MetraByte Corp.
Milo Associates, Inc.*D
M-Test Equipment
Network Technologies, Inc.
Nu-Concept Systems, Inc.
Omnitron Electronics*D
Orion Instruments, Inc.
Rapid Systems
Sencore Electronics IFC
Specialized Products Co.*D
Speco Div.
Sprague Magnetics, Inc.*D
Tool Kit Specialists, Inc.*D
Vu-Data Corp.

RECEPTACLE CIRCUIT TESTERS

Atrix, Inc.*D
Contact East, Inc.*D 47
Electronics Warehouse Corp.*D
Herman Electronics*D
HMC-Hub Material Co.*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Joseph Electronics*D
Lectronic Research Labs*D
MCM Electronics*D
Omega Engineering Inc.
Omnitron Electronics*D
R & K Supply Co.
Techni-Tool Inc.*D
Tool Kit Specialists, Inc.*D
Vaco Products
Vortec Corp.

SEMICONDUCTOR TESTERS

Accutest Instruments*D
Allied Electronics, A Div. of Hall-Mark Electronics*D
American Design Components*D
American Reliance Inc.
Arrow Electronics Inc. Catalog Sales Div.*D
Bursma Electronic Distributing*D
Computer Doctors
Consolidated Electronics, Inc.*D 57
Cooper Associates*D
EDS, Inc.
Electronic Design Specialists
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
GlobeTech International, Inc.
Hameg, Inc.
Herman Electronics*D
HMC-Hub Material Co.*D
Hy-Tronix Instruments, Inc.
IET Labs, Inc.
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50

Joseph Electronics*D
Kobatron Inc.
Leader Instruments Corp. 3
Lectronic Research Labs*D
Lil' Bitty Tester, Inc.
Omnitron Electronics*D
Philips Consumer Electronics Service Co.*D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Speco Div.

SPECTRUM ANALYZERS

Accutest Instruments*D
Analogic Corp.
B&K-Precision Maxtec International Corp. 51
Contact East, Inc.*D 47
Cooper Associates*D
Ecooper-Metrics, Inc.
Electronic Parts Supply*D
W.L. Gore & Associates, Inc.
Hameg, Inc.
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Lectronic Research Labs*D
Marconi Instruments
Omnitron Electronics*D
Penntek Instruments
Philips Consumer Electronics Service Co.*D
RAG Electronics Inc.*D
Ramsey Electronics Inc.
Rapid Systems
Schlumberger Technologies Instruments Div.
Tektronix, Inc.
Tucker Electronics Co.*D

TELEPHONE ANALYZERS/TESTERS

Accutest Instruments*D
Advanced Measurement Technologies
B&K-Precision Maxtec International Corp. 51
Bursma Electronic Distributing*D
Consolidated Electronics, Inc.*D 57
Contact East, Inc.*D 47
Datacom Technologies, Inc.
Digitech Industries Inc.
EDS, Inc.
Electronic Design Specialists
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Hand Tool Industries, Inc.
HMC-Hub Material Co.*D
The Instrument Mart, Inc.*D
International Data Sciences
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Joseph Electronics*D
Kelvin Electronics*D
L-Com Inc.
MCM Electronics*D
Nu-Data Inc.
Omnitron Electronics*D
Orion Instruments, Inc.
Philips Consumer Electronics Service Co.*D
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Specialized Products Co.*D
Tekelec
Telecommunications Techniques Corp.
3M Private Network Products

TEMPERATURE SENSORS

Acculex Corp. A MetraByte Co.
Accutest Instruments*D
AEMC Corp.
Allied Electronics, A Div. of Hall-Mark Electronics*D
Analogic Corp.
Anritsu Meter Co. of America
Beckman Industrial Corp. An Affiliate of Emerson Electric Co.
Brunelle Instruments Inc.
Bursma Electronic Distributing*D

Consolidated Electronics, Inc.*D 57
Cooper Associates*D
Electromatic Controls/ Soar Instruments
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Extch Instruments Corp.
Herman Electronics*D
HMC-Hub Material Co.*D
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Joseph Electronics*D
Kelvin Electronics*D
Lectronic Research Labs*D
MetraByte Corp.
Omega Engineering Inc.
Omnitron Electronics*D
Pacer Industries, Inc.
Philips Consumer Electronics Service Co.*D
RAG Electronics Inc.*D
Rapid Systems
RNJ Electronics Inc.*D
Rochester Instruments Systems
Simpson Electric Co.
Solder Absorbing Technology, Inc.
Solomat Instrumentation
Tegam, Inc.
Tektronix, Inc.
Universal Enterprises
WestCon Div. of Sycon Corp.

TRANSISTOR TESTERS

Accutest Instruments*D
B&K-Precision Maxtec International Corp. 51
Bursma Electronic Distributing*D
Consolidated Electronics, Inc.*D 57
Cooper Associates*D
C&S Sales*D 45
EDS, Inc.
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Elenco Electronics, Inc.
Hameg, Inc.
HMC-Hub Material Co.*D
Hy-Tronix Instruments, Inc.
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Joseph Electronics*D
Kelvin Electronics*D
Leader Instruments Corp. 3
Lectronic Research Labs*D
Lil' Bitty Tester, Inc.
MCM Electronics*D
Mouser Electronics*D
Omnitron Electronics*D
Philips Consumer Electronics Service Co.*D
Prime Electronics Co.*D 59
RAG Electronics Inc.*D
RNJ Electronics Inc.*D
Sencore Electronics IFC
Speco Div.

VECTORSOPES

Accutest Instruments*D
Audiovisual Inc. (Video Midwest/AVC Systems Divs.)*D
BTC Test & Measurement*D
C&S Sales*D 45
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Elenco Electronics, Inc.
Hameg, Inc.
Hitachi Denshi America, Ltd.
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kelvin Electronics*D
Kenwood U.S.A. Corp.
Leader Instruments Corp. 3
Lectronic Research Labs*D
Omnitron Electronics*D
Philips Consumer Electronics Service Co.*D
RAG Electronics Inc.*D

RNJ Electronics Inc.*D
Tektronix, Inc.
Tektronix, Inc. TV Products Div.

WAVEFORM MONITORS

Accutest Instruments*D
Audiovisual Inc. (Video Midwest/AVC Systems Divs.)*D
BMI-Basic Measuring Instruments
BTC Test & Measurement*D
C&S Sales*D 45
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Elenco Electronics, Inc.
Fordham Radio Supply Co.*D
Gage Applied Sciences Inc.
Hitachi Denshi America, Ltd.
Hi-Techniques Inc.
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kelvin Electronics*D
Kenwood U.S.A. Corp.
Leader Instruments Corp. 3
Lectronic Research Labs*D
Omnitron Electronics*D
Philips Consumer Electronics Service Co.*D
RAG Electronics Inc.*D
Rapid Systems
RNJ Electronics Inc.*D
Tektronix, Inc.
Tektronix, Inc. TV Products Div.
Tucker Electronics Co.*D
Yokogawa Corp. of America

OTHER TEST EQUIPMENT

Accutest Instruments*D
ACL
Advanced Measurement Technologies
AEMC Corp.
American Reliance Inc.
Amprobe Instrument
Analogic Corp.
Anritsu Meter Co. of America
A R Div. of Telenex Corp.
Aristo Computers, Inc.
Audiovisual Inc. (Video Midwest/AVC Systems Divs.)*D
Beckman Industrial Corp. An Affiliate of Emerson Electric Co.
Behlman Electronics
Biddle Instruments
B&K-Precision Maxtec International Corp. 51
BMI-Basic Measuring Instruments
Brunelle Instruments Inc.
BTC Test & Measurement*D
Channel Master Div. of Avnet, Inc.
Colorado Data Systems
Computer Service Technology, Inc.
Consolidated Electronics, Inc.*D 57
Contact East, Inc.*D 47
Daetron
Datacom Technologies, Inc.
Direct Conversion Technique, Inc.
EDS, Inc.
Electronic Design Specialists
Electronics Warehouse Corp.*D
EM Corp.
Global Specialties A Div. of Interplex
GMB/dba Fox International*D
Gould Inc. Test & Measurement Group
Hameg, Inc.
Hand Tool Industries, Inc.
Herman Electronics*D
HMC-Hub Material Co.*D
H&S Industries*D
In-Circuit Test, Inc.
The Instrument Mart, Inc.*D
Intelco Corp.
International Data Sciences
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Joseph Electronics*D
Kelvin Electronics*D
Kenwood U.S.A. Corp.
KeyTek Instrument Corp.
Kikusui International Corp.
Klein Tools, Inc.

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Yokoritsu Electrical Instruments Works L-Com Inc.	
Lelectronic Research Labs* ^D	
MCM Electronics* ^D	
Moody Tools, Inc.	
Mouser Electronics* ^D	
M-Test Equipment	
Nutrix Inc.	37
Omnitron Electronics* ^D	
Orion Instruments, Inc.	
Pacer Industries, Inc.	
Pacific Power Source	
Performance Technologies	
Philips Consumer Electronics Service Co.* ^D	
Philips ECG	41
PrimeLine A Div. of Soltec Corp.	
Prorachi Electronics Corp.	52
Racal-Dana Instruments Inc.	
RAG Electronics Inc.* ^D	
Ramsey Electronics Inc.	
Rapid Systems	
RNJ Electronics Inc.* ^D	
Schlumberger Technologies Instruments Div.	
Simpson Electric Co.	
Soltec Corp.	
Spanta, Inc.	
Specialized Products Co.* ^D	
Speco Div.	
A.W. Sperry Instruments, Inc.	
Static Control Services, Inc.	
Tegam, Inc.	
Tektronix Redmond Div.	
Telecommunications Techniques Corp.	
Temptron Corp.	
Tentel Corp.	56
3M Photodyne Inc.	
TIF Instruments, Inc.	
Tool Kit Specialists, Inc.* ^D	
Tucker Electronics Co.* ^D	
Universal Enterprises	
Vaco Products	
Vector Electronics	
WestCon Div. of Sycon Corp.	
Yokogawa Corp. of America	

Test equipment accessories

AUDIO DUMMY LOADS

Accutest Instruments* ^D	
Electronic Parts Supply* ^D	
Electronics Warehouse Corp.* ^D	
The Instrument Mart, Inc.* ^D	
Joseph Electronics* ^D	
Leader Instruments Corp.	3
Lelectronic Research Labs* ^D	
MCM Electronics* ^D	
Omnitron Electronics* ^D	
ORA Electronics	
Sencore Electronics	IFC

DECADE BOXES: CAPACITANCE/INDUCTANCE/RESISTANCE

Accutest Instruments* ^D	
Arrow Electronics Inc. Catalog Sales Div.* ^D	
Brunelle Instruments Inc.	
Consolidated Electronics, Inc.*^D	57
Contact East, Inc.*^D	47
Cooper Associates* ^D	
C&S Sales*^D	45
Daetron	
Electromatic Controls/ Soar Instruments	
Electronics Warehouse Corp.* ^D	
Elenco Electronics, Inc.	
Fordham Radio Supply Co.* ^D	
HMC-Hub Material Co.* ^D	
IET Labs, Inc.	
The Instrument Mart, Inc.* ^D	
W.S. Jenks & Son* ^D	
Jensen Tools Inc.*^D	50
Joseph Electronics* ^D	

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Kenwood U.S.A. Corp.	
Lelectronic Research Labs* ^D	
Omnitron Electronics* ^D	
Plastic Capacitors Inc.	
RAG Electronics Inc.* ^D	
RNJ Electronics Inc.* ^D	
Specialized Products Co.* ^D	
Vector-Viz Instrument Div. a Vector Group Co.	
Yokogawa Corp. of America	

IC TEST CLIPS

Allied Electronics, A Div. of Hall-Mark Electronics* ^D	
Arrow Electronics Inc. Catalog Sales Div.* ^D	
Atrix, Inc.* ^D	
B&K-Precision Maxtec International Corp.	51
Classic Components Supply Inc.* ^D	
Consolidated Electronics, Inc.*^D	57
Contact East, Inc.*^D	47
Cooper Associates*^D	45
C&S Sales*^D	45
Electronic Parts Supply* ^D	
Electronics Warehouse Corp.* ^D	
Elenco Electronics, Inc.	
Emulation Technology Inc.	
Fordham Radio Supply Co.* ^D	
GC Electronics Div. of GC Thorsen Co.	
Global Specialties A Div. of Interplex	
HMC-Hub Material Co.* ^D	
HSC Electronic Supply* ^D	
Hy-Tronix Instruments, Inc.	
ITT Pomona Electronics	
JDR Micro* ^D	
W.S. Jenks & Son* ^D	
Jensen Tools Inc.*^D	50
Joseph Electronics* ^D	
Kelvin Electronics* ^D	
MCM Electronics* ^D	
Mouser Electronics* ^D	
O.K. Industries Inc.	
Omnitron Electronics* ^D	
ORA Electronics	
Philips Consumer Electronics Service Co.* ^D	
Specialized Products Co.* ^D	
Techni-Tool Inc.* ^D	
Tektronix, Inc.	
Tool Kit Specialists, Inc.* ^D	

POWER SUPPLIES, BENCH

Accutest Instruments* ^D	
Allied Electronics, A Div. of Hall-Mark Electronics* ^D	
American Reliance Inc.	
Arrow Electronics Inc. Catalog Sales Div.* ^D	
Behlman Electronics	
B&K-Precision Maxtec International Corp.	51
Brunelle Instruments Inc.	
Bursma Electronic Distributing* ^D	
Classic Components Supply Inc.* ^D	
Consolidated Electronics, Inc.*^D	57
Contact East, Inc.*^D	47
Cooper Associates* ^D	
C&S Sales*^D	45
Electro-Tech Systems, Inc.	
Electronic Parts Supply* ^D	
Electronics Warehouse Corp.* ^D	
Elenco Electronics, Inc.	
Fordham Radio Supply Co.* ^D	
Global Specialties A Div. of Interplex	
Heath Co.	
Herman Electronics* ^D	
HMC-Hub Material Co.* ^D	
HSC Electronic Supply* ^D	
The Instrument Mart, Inc.* ^D	
Itara/Belmoor* ^D	
W.S. Jenks & Son* ^D	
Jensen Tools Inc.*^D	50
Joseph Electronics* ^D	
Kelvin Electronics* ^D	
Kenwood U.S.A. Corp.	
Kikusui International Corp.	
Leader Instruments Corp.	3
Lelectronic Research Labs* ^D	
MCM Electronics* ^D	

	See Adv. Page
O.K. Industries Inc.	
Omnitron Electronics* ^D	
Philips Consumer Electronics Service Co.* ^D	
Plastic Capacitors Inc.	
RAG Electronics Inc.* ^D	
RNJ Electronics Inc.* ^D	
Salen Enterprises* ^D	
SL Waber, Inc.	
Sorensen Co.	
Specialized Products Co.* ^D	
Speco Div.	
Techni-Tool Inc.* ^D	
Tripp Lite	
Tucker Electronics Co.* ^D	
Vector-Viz Instrument Div. a Vector Group Co.	

TEST JIGS AND FIXTURES

Contact East, Inc.*^D	47
Direct Conversion Technique, Inc.	
Diversified Parts* ^D	
Electronic Parts Supply* ^D	
Electronics Warehouse Corp.* ^D	
Emulation Technology Inc.	
Factron Test Fixture Group	
Fordham Radio Supply Co.* ^D	
GMB/dba Fox International* ^D	
HMC-Hub Material Co.* ^D	
In-Circuit Test, Inc.	
W.S. Jenks & Son* ^D	
Joseph Electronics* ^D	
Lelectronic Research Labs* ^D	
MCM Electronics* ^D	
Omnitron Electronics* ^D	
Philips Consumer Electronics Service Co.* ^D	
Sony Service Co.	
TeleMatic Div. of UXL Corp.	
Temco Instruments Inc.	
Tentel Corp.	56

TEST LEADS AND PROBES

Accutest Instruments* ^D	
Allied Electronics, A Div. of Hall-Mark Electronics* ^D	
American Design Components* ^D	
Amprobe Instrument	
Arrow Electronics Inc. Catalog Sales Div.* ^D	
Atrix, Inc.* ^D	
Beckman Industrial Corp. An Affiliate of Emerson Electric Co.	
Biddle Instruments	
Brian Instruments, Inc.	
Brunelle Instruments Inc.	
Bursma Electronic Distributing* ^D	
Classic Components Supply Inc.* ^D	
Consolidated Electronics, Inc.*^D	57
Contact East, Inc.*^D	47
Cooper Associates* ^D	
C&S Sales*^D	45
Diversified Parts* ^D	
Electro Standards Lab, Inc. Data Communications Products Div.	
Electromatic Controls/ Soar Instruments	
Electronic Design Specialists	
Electronic Parts Supply* ^D	
Electronics Warehouse Corp.* ^D	
Emulation Technology Inc.	
Everett/Charles Contact Products	
Factron Test Fixture Group	
Fieldpiece Instruments	
Fordham Radio Supply Co.* ^D	
GC Electronics Div. of GC Thorsen Co.	
GoldStar Precision Co. Ltd.	
Hameg, Inc.	
Heath Co.	
Herman Electronics* ^D	
HMC-Hub Material Co.* ^D	
HSC Electronic Supply* ^D	
The Instrument Mart, Inc.* ^D	
Interconnect Devices, Inc.	
Itara/Belmoor* ^D	
ITT Pomona Electronics	
JDR Micro* ^D	
W.S. Jenks & Son* ^D	
Jensen Tools Inc.*^D	50
Joseph Electronics* ^D	
Kelvin Electronics* ^D	

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Kenwood U.S.A. Corp.	
Keystone Electronics Corp.	
Leader Instruments Corp.	3
Lelectronic Research Labs* ^D	
M.A.T. Electronics*^D	55
MCM Electronics* ^D	
Mercer Electronics	
MetraByte Corp.	
Milo Associates, Inc.* ^D	
Mouser Electronics* ^D	
Omnitron Electronics* ^D	
Ostby-Barton Test Probes	
Philips Consumer Electronics Service Co.* ^D	
Philips ECG	41
RAG Electronics Inc.* ^D	
Ramsey Electronics Inc.	
RNJ Electronics Inc.* ^D	
Schurter, Inc.	
Sencore Electronics	IFC
Simpson Electric Co.	
Specialized Products Co.* ^D	
Speco Div.	
Techni-Tool Inc.* ^D	
Tegam, Inc.	
Tektronix, Inc.	
Test Probes, Inc.	
TIF Instruments, Inc.	
Tool Kit Specialists, Inc.* ^D	
Tucker Electronics Co.* ^D	
Universal Enterprises	
Vaco Products	
Vector-Viz Instrument Div. a Vector Group Co.	

TRANSFORMERS: ISOLATION/VARIABLE

American Design Components* ^D	
Arrow Electronics Inc. Catalog Sales Div.* ^D	
Classic Components Supply Inc.* ^D	
Consolidated Electronics, Inc.*^D	57
Controlled Power Co.	
Electronic Parts Supply* ^D	
Electronics Warehouse Corp.* ^D	
Fordham Radio Supply Co.* ^D	
Herman Electronics* ^D	
HMC-Hub Material Co.* ^D	
HSC Electronic Supply* ^D	
Itara/Belmoor* ^D	
JDR Micro* ^D	
W.S. Jenks & Son* ^D	
Jensen Tools Inc.*^D	50
Joseph Electronics* ^D	
Kelvin Electronics* ^D	
Lelectronic Research Labs* ^D	
MCM Electronics* ^D	
Milo Associates, Inc.* ^D	
Omnitron Electronics* ^D	
Philips Consumer Electronics Service Co.* ^D	
Plastic Capacitors Inc.	
RAG Electronics Inc.* ^D	
RNJ Electronics Inc.* ^D	
Sencore Electronics	IFC
Tripp Lite	
Tycor International Inc.	
Vector-Viz Instrument Div. a Vector Group Co.	

VCR TEST JIG KITS

Consolidated Research Group	
Diversified Parts* ^D	
Electronic Parts Supply* ^D	
Electronics Warehouse Corp.* ^D	
Joseph Electronics* ^D	
Lelectronic Research Labs* ^D	
M.A.T. Electronics*^D	55
Omnitron Electronics* ^D	
Philips Consumer Electronics Service Co.* ^D	
RNJ Electronics Inc.* ^D	
Sony Service Co.	
Tentel Corp.	56

OTHER TEST EQUIPMENT ACCESSORIES

Accutest Instruments* ^D	
Amprobe Instrument	

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Anritsu Meter Co. of America B&K-Precision Maxtec International Corp. 51	BMI-Basic Measuring Instruments Brunelle Instruments Inc. Contact East, Inc.*D 47	GMB/dba Fox International* Herman Electronics* HMC-Hub Material Co.* HSC Electronic Supply* The Instrument Mart, Inc.* Itera/Belmoor* JDR Micro* W.S. Jenks & Son* Jensen Tools Inc.*D 50	Thordarson/Meissner Tripp Lite Tycor International Inc. Viteq Corp.
Brian Instruments, Inc. Consolidated Electronics, Inc.*D 57	Controlled Power Co. Cooper Associates* Electronics Warehouse Corp.* Gage Applied Sciences Inc. Herman Electronics* HMC-Hub Material Co.* The Instrument Mart, Inc.* JDR Micro* W.S. Jenks & Son* Jensen Tools Inc.*D 50	Joseph Electronics* Kalgio Electronics Co. Inc. M.A.T. Electronics*D 55	VOLTAGE REGULATORS
Contact East, Inc.*D 47	Mendon Electronics Corp. Nu-Data Inc. Omniatron Electronics* RNJ Electronics Inc.* Rochester Instruments Systems Safe Power Systems Div. of Acme Electric Corp. Specialized Products Co.* The Superior Electric Co. Techni-Tool Inc.* Tool Kit Specialists, Inc.* Tycor International Inc. Vector-Viz Instrument Div. a Vector Group Co.	MCG Electronics, Inc. MCM Electronics* Milo Associates, Inc.* Mouser Electronics* Nu-Data Inc. Omega Engineering Inc. Omniatron Electronics* OmniCorp. ORA Electronics Panamax Para Systems Perma Power Electronics, Inc. Phillips ECG 41	Accutest Instruments* Allied Electronics, A Div. of Hall-Mark Electronics* Arrow Electronics Inc. Catalog Sales Div.* Classic Components Supply Inc.* Computer Power, Inc. Contact East, Inc.*D 47
Dandy Mfg. Co. Electronic Specialists, Inc. Electronics Warehouse Corp.* Emulation Technology Inc. Fieldpiece Instruments Gemini Inc. GMB/dba Fox International* Hand Tool Industries, Inc. HMC-Hub Material Co.* Hy-Tronix Instruments, Inc. In-Circuit Test, Inc. The Instrument Mart, Inc.* Interconnect Devices, Inc. Itera/Belmoor* ITT Pomona Electronics JDR Micro* W.S. Jenks & Son* Jensen Tools Inc.*D 50	Specialized Products Co.* The Superior Electric Co. Techni-Tool Inc.* Tool Kit Specialists, Inc.* Tycor International Inc. Vector-Viz Instrument Div. a Vector Group Co.	Plastic Systems, Inc. RNJ Electronics Inc.* Safe Power Systems Div. of Acme Electric Corp. Shape Electronics SL Waber, Inc. Sola Specialized Products Co.* The Superior Electric Co. Sutton Designs, Inc. Computer Power Div. Techni-Tool Inc.* Thomson Consumer Electronics, Inc. Distributor & Special Products* Tool Kit Specialists, Inc.* Tripp Lite Tycor International Inc. Verite Winders & Geist	Allied Electronics, A Div. of Hall-Mark Electronics* Arrow Electronics Inc. Catalog Sales Div.* Datel, Inc. Electronic Parts Supply* Electronic Specialists, Inc. Electronics Warehouse Corp.* Herman Electronics* HMC-Hub Material Co.* HSC Electronic Supply* Itera/Belmoor* JDR Micro* W.S. Jenks & Son* Joseph Electronics* Kalgio Electronics Co. Inc. Lectronic Research Labs* MCM Electronics* Omniatron Electronics* Pacific Power Source Performance Technologies Perma Power Electronics, Inc. RNJ Electronics Inc.* Shape Electronics Sola The Superior Electric Co. Thordarson/Melssner Tripp Lite Tycor International Inc.
Klein Tools, Inc. Kyoritsu Electrical Instruments Works Kyros Corp. Lectronic Research Labs* MCM Electronics* Mercer Electronics Milo Associates, Inc.* Mouser Electronics* Omniatron Electronics* Ostby-Barton Test Probes Philips Consumer Electronics Service Co.* Phillips ECG 41	STANDBY POWER SYSTEMS	Philips ECG 41	
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Racal-Dana Instruments Inc. RAG Electronics Inc.* RNJ Electronics Inc.* Simpson Electric Co. Techni-Tool Inc.* Tegam, Inc. TeleMatic Div. of UXL Corp. Tentel Corp. 56	Controlled Power Co. Cooper Associates* Electronics Warehouse Corp.* Elgar Corp. Herman Electronics* HMC-Hub Material Co.* JDR Micro* W.S. Jenks & Son* Joseph Electronics* Kalgio Electronics Co. Inc. Meirick Inc. Milo Associates, Inc.* Omniatron Electronics* Pacific Power Source Para Systems Performance Technologies Perma Power Electronics, Inc. Safe Power Systems Div. of Acme Electric Corp. SL Waber, Inc. Sola Sutton Designs, Inc. Computer Power Div. Thordarson/Melssner Tripp Lite Tycor International Inc.		
Test Probes, Inc. Tool Kit Specialists, Inc.* Universal Enterprises Viziflex Seels, Inc. Keyboard Cover Div. Vortec Corp.	UNINTERRUPTIBLE POWER SUPPLIES		
	Allied Electronics, A Div. of Hall-Mark Electronics* American Design Components* American Power Conversion Corp. Arrow Electronics Inc. Catalog Sales Div.* Audiovisual Inc. (Video Midwest/AVC Systems Divs.)* Behlman Electronics Best Power Technology Bursma Electronic Distributing* Clary Corp. Classic Components Supply Inc.* Computer Power, Inc. Contact East, Inc.*D 47		
	Controlled Power Co. Deltron, Inc. Electronics Warehouse Corp.* Elgar Corp. General Power Corp. Herman Electronics* HMC-Hub Material Co.* Horizon Technology, Inc.* HSC Electronic Supply* ICS, Inc. Electro-Pac Div. JDR Micro* W.S. Jenks & Son* Joseph Electronics* Kalgio Electronics Co. Inc. Lowell Corp.* Milo Associates, Inc.* Omniatron Electronics* Pacific Power Source Panamax Para Systems Performance Technologies Perma Power Electronics, Inc. Phitek Power Corp. RNJ Electronics Inc.* Safe Power Systems Div. of Acme Electric Corp. SL Waber, Inc. Sola Specialized Products Co.* The Superior Electric Co. Sutton Designs, Inc. Computer Power Div.		
	ELECTROSTATIC DISCHARGE PROTECTION		
	Accutest Co. ACL Allied Electronics, A Div. of Hall-Mark Electronics* Atrix, Inc.* Bursma Electronic Distributing* Charleswater Products, Inc. Chemtronics Inc. IBC		
	ANTISTATIC CHEMICALS		
	Clean Room Products Inc. Com-Kyl Inc.* Contact East, Inc.*D 47		
	Cooper Associates* Dow Chemical USA Echelon Industries* Electronics Warehouse Corp.* GC Electronics Div. of GC Thorsen Co. Herman Electronics* HMC-Hub Material Co.* H&S Industries* Itera/Belmoor* JDR Micro* W.S. Jenks & Son* Joseph Electronics* Klein Tools, Inc. Master Bond M.A.T. Electronics*D 55		
	POWER CONDITIONING EQUIPMENT		
	MCM Electronics* Micro-Circuits Co., Inc. Miller-Stephenson Chemical Co. Milo Associates, Inc.* Omniatron Electronics* PerfectData Corp. Philips Consumer Electronics Service Co.* Phillips ECG 41		
	GROUNDING SYSTEMS		
	Rawn Co. Inc., (Subsidiary of the Triangle Corp.) RemGrt Corp. RNJ Electronics Inc.* Rogers Anti-Static Chemicals The Simco Co., Inc. Start International* Prime Electronics Co.*D 59		
	Atrix, Inc.* Electronics Warehouse Corp.* Herman Electronics* HMC-Hub Material Co.* W.S. Jenks & Son* Jensen Tools Inc.*D 50		
	POWER LINE MONITORS		
	Accutest Instruments* Allied Electronics, A Div. of Hall-Mark Electronics* Arrow Electronics Inc. Catalog Sales Div.* Atrix, Inc.*		
	SURGE/SPIKE PROTECTORS		
	AESI/Stedi Watt Allied Electronics, A Div. of Hall-Mark Electronics* American Design Components* Arrow Electronics Inc. Catalog Sales Div.* Atrix, Inc.* Bursma Electronic Distributing* Computer Power, Inc. Consolidated Electronics, Inc.*D 57		
	Contact East, Inc.*D 47		
	Controlled Power Co. Cooper Associates* Electro Standards Lab, Inc. Data Communications Products Div. Electronic Parts Supply* Electronic Specialists, Inc. Electronics Warehouse Corp.* Elgar Corp. EM Corp. Fordham Radlo Supply Co.* GC Electronics Div. of GC Thorsen Co.		

Circuit damage protective equipment/supplies

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Andrews Electronics (C/V/M/A) • 25158 Avenue Stanford, Valencia 91355 • 800-289-0300 • FAX 800-289-0301

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Blakeman Wholesale Distributors (V) • 17370 Mount Herrman St., Fountain Valley 92708 • 714-540-8710 • FAX 714-957-8703

Cass Electronics (C/V/M/A) • 801 Seventh Ave., Oakland 94606 • 415-839-2277 • FAX 415-465-5927

Chuck Hurley Electronics (C/M/A) • 2557 Albatross Way, Sacramento 95815 • 916-927-5891 • FAX 916-927-5956

E and K Parts, Inc. (C/V/M/A) • 2115 Westwood Blvd., Los Angeles 90025 • 213-475-6848 • FAX 213-474-0846

Hurley Electronics (C/M) • 730 W. Spruce, San Bernardino 92410 • 714-885-0721 • FAX 714-888-3811

Hurley Electronics (C/V/M) • 318 16th St., San Diego 92101 • 619-235-6245 • FAX 619-235-0436

Hurley Electronics (C/M) • 2101 N. Fairview, Santa Ana 92706 • 714-971-2992 • FAX 714-971-5033

Pacific Coast Parts (C/V/M/A) • 15024 Staff Court, Gardena 92048 • 213-515-0207 • FAX 800-782-5747

Wholesale Vacuum (V) • 5811 Rose Ave., Long Beach 90813 • 213-428-6411

COLORADO

Denver Walker Wlntronic (C/M) • 1001 W. Arizona Ave., Denver, 80223 • 303-744-9505 • FAX 303-777-9357

CONNECTICUT

Signal Electronics Supply, Inc. (C/M/A) • 589 New Park Ave., West Hartford 06110 • 203-233-8551 • FAX 203-233-8554

FLORIDA

Herman Electronics (C/V/M/A) • 1365 N.W. 23rd St., Miami 33142 • 305-634-6591 • FAX 305-634-6247

Layco, Inc. (C/V/M) • 501 South Main St., Crestview 32536 • 904-682-0321 • FAX 904-682-8820

Vance Baldwin (C/A/M) • 2207 S. Andrews Ave., Fort Lauderdale 33316 • 305-523-3461 • FAX 305-523-3464

Vance Baldwin (C/M/A) • 1801 NE 2nd Ave., Miami 33132 • 305-379-4794 • FAX 305-373-8855

Vance Baldwin (C/V/M/A) • 1007 N. Himes Ave., Tampa 33607 • 813-870-2606 • FAX 813-870-1088

Vance Baldwin (C/V/M) • 500 Clematis St., West Palm Beach 33401 • 407-832-5671 • FAX 407-833-8191

GEORGIA

Buckeye Vacuum Cleaner (V) • 2870 Plant Atkinson Rd., Smyrna 30080 • 404-351-7300 • FAX 404-351-7307

Wholesale Industrial (C/M/A) • 5925 Peachtree Corners East, Norcross 30071 • 404-447-8436 • FAX 404-447-1078

HAWAII

Panasonic Hawaii, Inc. (C/V/M) • 99859 Iwaiwa St., PO Box 774, AIEA, HI 96701 • 808-488-1996

ILLINOIS

B-B & W, Inc. (C/V/M) • 2137 S. Euclid Ave., Berwyn 60402 • 708-749-1710 • FAX 708-749-0325

Hesco, Inc. (V) • 6633 North Milwaukee Ave., Niles 60648 • 708-647-6700 • FAX 708-647-0534

Joseph Electronics, Inc. (C/M/A) • 8830 N. Milwaukee Ave., Niles 60648 • 708-297-4208 • FAX 708-297-6923

Union Electronic Dist. (C/V/M/A) • 16012 S. Cottage Grove, South Holland 60473 • 708-333-4100 • FAX 708-339-2777

INDIANA

Electronic Service Parts (C/V/M) • 2901 E. Washington St., Indianapolis 46201 • 317-269-1527 • FAX 317-269-1529

IOWA

Jones Distributing Co. (C/V/M/A) • 2650 Bridgeport Dr., Sioux City 51111 • 712-277-8600 • FAX 712-252-5645

KANSAS

G & A Distributors, Inc. (C/V/M/A) • 635 N. Hydraulic St., Wichita 67214 • 316-262-3707 • FAX 316-262-6494

KENTUCKY

Major Distributing Company (C/M/A) • 449 S. 16th St., Paducah 42003 • 502-443-5345 • FAX 502-444-6237

Service Electronics Supply (C) • 1046A New Circle Rd., NE, Lexington 40505 • 606-254-5786 • FAX 606-231-9684

MARYLAND

Fairway Electronics (C/V/M) • 3040 Waterview Drive, Baltimore 21230 • 301-576-8555 • FAX 800-955-2119

Fairway Electronics (C/V/M/A) • 4210 Howard Ave., Kensington 20895 • 301-564-1440 • FAX 800-955-1358

Tritronics, Inc. (C/V/M/A) • 1306 Continental Dr., Abingdon 21009-2334 • 301-676-7300 • FAX 301-676-7658

MASSACHUSETTS

MIL Electronics (C/V/M/A) • 1500 Main St., Waltham 02154 • 617-891-6730 • FAX 617-891-6733

Signal Electronics Supply, Inc. (C) • 484 Worthington St., Springfield 01105 • 413-739-3893 • FAX 203-233-8554

Tee Vee Supply Co. (C/V/M/A) • 407 R Mystic Avenue, PO Box 649, Medford 02155 • 617-395-9440 • FAX 617-391-8020

MICHIGAN

G.M. Popkey Co. (C/V/M/A) • 4477 East Paris Ave. S.E., Grand Rapids 49512 • 616-698-2390 • FAX 616-698-0794

Remcor Electronics (C/M/A) • 10670 Nine Mile Rd., Oak Park 48237 • 313-541-5666 • FAX 313-398-1016

MINNESOTA

Ness Electronics, Inc. (C/V/M/A) • 441 Stinson Blvd. NE, Minneapolis 55413 • 612-623-9505 • FAX 612-623-9540

Mid America Vacuum Cleaner Supply Co. (V) • 666 University Ave., St. Paul 55104 • 612-222-0763 • FAX 612-224-2674

MISSISSIPPI

Tri-State Electronics (C/V/M) • 605 W. Fortification St., Jackson 39203 • 601-355-3431 • FAX 601-353-1567

MISSOURI

Cititronix, Inc. (C/V/M/A) • 1641 Dielman Rd., St. Louis 63132 • 314-427-3420 • FAX 314-427-3360

Manhattan Electronics, Inc. (C/V/M) • 1101C E. 76th Terrace, Kansas City 64131 • 816-361-9440 • FAX 800-255-6239

Tacony Corp. (V) • 1760 Gillsinn Lane, Fenton 63026 • 314-349-3000 • FAX 314-349-2333

NEW HAMPSHIRE

Tee-Vee Supply Co. (C/V/M/A) • 51 1/2 Kinsley St., Nashua 03060 • 603-889-4171 • FAX NH-603-889-8887

NEW JERSEY

Nidisco Electronics (C/V/M/A) • 181 Route 46 W. Lodi 07644 • 201-773-1771 • FAX 201-773-5292

NEW YORK

Dale Electronics (C/V/M/A) • 7 E. 20th St., New York City 10003 • 212-475-1124 • FAX 212-475-1963

Green Tele-Radio Dist. (C/M/A) • 84-00 73rd Avenue, Glendale 11385 • 718-821-1114 • FAX 718-821-3987

GMB Sales (C/V/M/A) • 140 Terminal Rd., Setauket 11733 • 516-689-3400 • FAX 800-635-0596

Mill Electronic Supply (C/V/M/A) • 2026 McDonald Ave., Brooklyn 11223 • 718-336-4575 • FAX 718-627-4023

Pago Appliance Parts (C/M/A) • 700 Broadway, Buffalo 14212 • 716-856-8133 • FAX 716-854-3530

Panson Electronics (C/V/M/A) • 268 Norman Avenue, Greenpoint 11222 • 718-383-3400 • FAX 718-383-2425

Radio Equipment Corp. (C/A) • 196 Vulcan St., Buffalo 14207 • 716-874-2690 • FAX 716-874-2698

Star for Parts (V) • 250 Rabro Drive East, Hauppauge 11788-0255 • 800-525-6046 • FAX 516-348-7160

United Teletronic Parts (C/M) • 3860 10th Ave., New York 10034 • 212-569-2330 • FAX 212-567-3725

NORTH DAKOTA

Westech Distributing (C/V) • 1345 Main Ave., Fargo 58103 • 701-237-4885 • FAX 701-232-4082

OHIO

Fox International, Inc. (C/V/M/A) • 23600 Aurora Rd., Bedford Heights 44146 • 216-439-8500 • FAX 800-445-7991

OREGON

Diversified Parts (C/V/M/A) • 2104 S.E. 9th Ave., Portland 97214 • 800-338-6342 • FAX 800-962-0602

The Moore Co. (C/V/M) • 333 SE 2nd, Portland 97214 • 503-234-5000 • FAX 503-731-0105

PENNSYLVANIA

CRS Electronics (C/M) • 818 Brownsville Rd., Pittsburgh 15210 • 412-431-7700 • FAX 412-431-5666

Linwood Wholesale, Inc. (C/M) • 1139 Sumner Ave., Whitehall 18052 • 215-820-0357 • FAX 800-876-5488

S.E.I. Electronics, Inc. (C/V/M/A) • 2520 N. Broad St., Philadelphia 19132 • 215-223-9400 • FAX 215-223-9423

Steel City Vacuum Co., Inc. (V) • 522 E. Ohio St., Pittsburgh 15212 • 412-231-1199 • FAX 412-231-3205

RHODE ISLAND

Jabbour Electronics (C/V/M/A) • 1744 Cranston St., Cranston 02920 • 401-944-2570 • FAX 401-944-8570

SOUTH CAROLINA

Wholesale Industrial (C/V/M) • 515 E. Bay St., Charleston 29403 • 803-722-2634 • FAX 803-723-8182

TENNESSEE

Currey's, Inc. (C/V/M) • 1027 8th Ave., S. Nashville 37203 • 615-242-4221 • FAX 615-242-4223

Mills Morris Co. (C/V/M/A) • 677 Phelan Ave., Memphis 38101 • 901-774-9810 • FAX 901-946-5603

Shields Electronics Supply, Inc. (C/V/M/A) • 4722 Middlebrook Pike, Knoxville 37921 • 615-588-2421 • FAX 615-588-3431

TEXAS

Electronic Component (C/V/M/A) • 2401 Bissonnet, Houston 77005 • 713-528-1543 • FAX 713-528-1046

Fox International (C/V/M) • 752 So. Sherman, Richardson 75081 • 214-231-1826 • FAX 214-231-0177

M-Tronics (C/V/M/A) • 3201 West Ave., San Antonio 78213 • 512-340-4069 • FAX 512-340-4569

Porter Burgess Co. (C/V/M) • 1233 Levee St., Dallas 75207 • 214-741-5161 • FAX 214-744-9430

Sherman Electronics (C/V/M) • 702 San Pedro Ave., San Antonio 78212 • 512-224-1001 • FAX 512-226-9926

Sherman Electronics (C/V/M) • 1701 Morgan Ave., Corpus Christi 78404 • 512-888-9454 • FAX 512-888-4942

Southwest Manufacturers, Inc. (V) • 3243 S. Jones St., Fort Worth, 76110-4397 • 817-926-8281 • FAX 817-924-6311

VCP International Inc. (V) • 2285 Merritt Dr., Garland 75040 • 214-271-7474 • FAX 214-278-5981

VIRGINIA

Avec Electronics Corp. (C/M) • 711 Granby St., Norfolk 23510 • 804-627-3502 • FAX 804-627-1710

Avec Electronics Corp. (C/M) • 2002 Staples Mill Rd., Richmond 23230 • 804-359-6071 • FAX 804-359-5609

Avec Electronics Corp. (C/M) • 2009 Williamson Rd., Roanoke 24012 • 703-344-6288 • FAX 703-344-0081

Fairway Electronics, Inc. (C/V/M) • 2304 Chamberlayne Ave., Richmond 23222 • 804-321-7255 • FAX 800-955-7043

WISCONSIN

Dealer Office Equipment Inc. (A) • 19300 W. Janacek Court, Waukesha 53186 • 414-784-7850 • FAX 414-784-3241

G.M. Popkey Company (C/V/M/A) • 2035 Larsen Ave., Green Bay 54307-2237 • 414-497-0400 • FAX 414-497-4894

CODING:

(C)...Consumer Electronic Parts
(V)...Vacuum Parts
(M)...Major Appliance Parts
(A)...Accessories

(as of 1/2/91)

Matsushita Services Company, 50 Meadowland Parkway, Secaucus, NJ 07094

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Static Prevention Inc.
Tech Spray, Inc.
Techni-Tool Inc.*D
The Texwipe Co.
Gregory Thomas, Inc.
Thomson Consumer Electronics, Inc.
Distributor & Special Products*D
The Triangle Tool Group, Inc.
Wescorp

ANTISTATIC IONIZATION DEVICES

Accutech Co.
Allied Electronics, A Div. of Hall-Mark Electronics*D
Atrix, Inc.*D
Chapman Corp.
Charleswater Products, Inc.
Clean Room Products Inc.
Com-Kyl Inc.*D
Contact East, Inc.*D 47
Cooper Associates*D
Desco Industries
HMC-Hub Material Co.*D
W.S. Jenks & Son*D
Joseph Electronics*D
NRD Inc. Static Control Products
Omniatron Electronics*D
Philips Consumer Electronics Service Co.*D
Plastic Capacitors Inc.
Plastic Systems, Inc.
Semtronics Corp.
The Simco Co., Inc.
Start International*D
Static Control Services, Inc.
Static Prevention Inc.
Techni-Tool Inc.*D
Gregory Thomas, Inc.
Vortec Corp.
Wescorp
Westward Electronics, Inc.

ANTISTATIC MATS/BENCHTOPS/WRISTS-TRAPS/OTHERS

Accutech Co.
Advance Unit of Zero Corp.
Airmold/W.R. Grace Co.
Allied Electronics, A Div. of Hall-Mark Electronics*D
Atrix, Inc.*D
Bursma Electronic Distributing*D
Charleswater Products, Inc.
Claus Cutlery Co.
Clean Room Products Inc.
Colonial Glove & Garment Inc.
Com-Kyl Inc.*D
Contact East, Inc.*D 47
Cooper Associates*D
Desco Industries
Electronics Warehouse Corp.*D
C.H. Ellis Co., Inc.
GC Electronics Div. of GC Thorsen Co.
Global Kitting
Herman Electronics*D
HMC-Hub Material Co.*D
H&S Industries*D
ITT Pomona Electronics
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Joseph Electronics*D
MCM Electronics*D
Melmat Inc.
Mouser Electronics*D
NRD Inc. Static Control Products
Nu-Concept Systems, Inc.
Oak Technical Inc.
O.K. Industries Inc.
Omniatron Electronics*D
Omniom Corp.
Pace, Inc. 8
Parts Express International Inc.*D 49
Philips Consumer Electronics Service Co.*D
Philips ECG 41
Plastic Systems, Inc.
Plato Products, Inc.
Prime Electronics Co.*D 59

R & K Supply Co.
RNJ Electronics Inc.*D
Seco Industries
Semtronics Corp.
Sentinel Foam Products
The Simco Co., Inc.
Solder Absorbing Technology, Inc.
Sony Service Co. National Parts Div.*D
Specialized Products Co.*D
Start International*D
Static Prevention Inc.
Tech Spray, Inc.
Techni-Tool Inc.*D
Gregory Thomas, Inc.
Thomson Consumer Electronics, Inc.
Distributor & Special Products*D
3M Electrical Specialties Div.
Tool Kit Specialists, Inc.*D
Trace Racks
The Triangle Tool Group, Inc.
Ungar, Div. Eldon Industries, Inc.
Wescorp
Brian R. White Co., Inc.*D
Winders & Geist

ESD FLEXIBLE PACKAGING

Accutech Co.
Advance Unit of Zero Corp.
Airmold/W.R. Grace Co.
Armand Mfg. Inc.
Atrix, Inc.*D
Charleswater Products, Inc.
Com-Kyl Inc.*D
Contact East, Inc.*D 47
Electronics Warehouse Corp.*D
C.H. Ellis Co., Inc.
Global Kitting
Highland Products, Inc.
HMC-Hub Material Co.*D
H&S Industries*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Joseph Electronics*D
MCM Electronics*D
NRD Inc. Static Control Products
Omniatron Electronics*D
Philips Consumer Electronics Service Co.*D
Plastic Systems, Inc.
Quality Packaging Supply Corp.*D
Republic Packaging Corp.
RNJ Electronics Inc.*D
Seco Industries
Semtronics Corp.
Sentinel Foam Products
The Simco Co., Inc.
Start International*D
Gregory Thomas, Inc.
3M Electrical Specialties Div.
Wescorp

STATIC DETECTION METERS

Accutech Co.
ACL
Advance Unit of Zero Corp.
AEMC Corp.
Atrix, Inc.*D
Chapman Corp.
Charleswater Products, Inc.
Clean Room Products Inc.
Com-Kyl Inc.*D
Contact East, Inc.*D 47
Desco Industries
Electro-Metrics, Inc.
Electro-Tech Systems, Inc.
HMC-Hub Material Co.*D
H&S Industries*D
The Instrument Mart, Inc.*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Joseph Electronics*D
Monroe Electronics, Inc.
NRD Inc. Static Control Products
Omniatron Electronics*D
Philips Consumer Electronics Service Co.*D
Plastic Systems, Inc.
Semtronics Corp.
The Simco Co., Inc.
Specialized Products Co.*D
Start International*D
Static Control Services, Inc.

Tech Spray, Inc.
Techni-Tool Inc.*D
Temco Instruments Inc.
Gregory Thomas, Inc.
3M Electrical Specialties Div.
Vortec Corp.
Wescorp

Supplies/accessories equipment

BATTERIES

All Electronics Corp.*D
Allied Electronics, A Div. of Hall-Mark Electronics*D
Ambico
American Design Components*D
Amprobe Instrument
Arrow Electronics Inc. Catalog Sales Div.*D
Atrix, Inc.*D
Audiovisual Inc. (Video Midwest/AVC Systems Divs.)*D
Battery Specialties*D
Batt-Tronic
Bursma Electronic Distributing*D
Classic Components Supply Inc.*D
Com-Kyl Inc.*D
Consolidated Electronics, Inc.*D 57
Contact East, Inc.*D 47
Diversified Parts*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
GMB/dba Fox International*D
Herman Electronics*D
HMC-Hub Material Co.*D
HSC Electronic Supply*D
Itera/Belmoor*D
JDR Micro*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kelvin Electronics*D
Leader Instruments Corp. 3
M.A.T. Electronics*D 55
Matsushita Services Co. 14-15,53
MCM Electronics*D
Mouser Electronics*D
Omniatron Electronics*D
Parts Express International Inc.*D 49
Philips ECG 41
Prime Electronics Co.*D 59
RNJ Electronics Inc.*D
Sanyo Energy Corp.
Sony Service Co. National Parts Div.*D
Specialized Products Co.*D
Speco Div.
Techni-Tool Inc.*D
Tool Kit Specialists, Inc.*D

BENCHES/CABINETS

Advance Unit of Zero Corp.
Allied Electronics, A Div. of Hall-Mark Electronics*D
A R Div. of Telenex Corp.
Arrow Electronics Inc. Catalog Sales Div.*D
Clean Room Products Inc.
Com-Kyl Inc.*D
Consolidated Electronics, Inc.*D 57
Contact East, Inc.*D 47
Electronic Parts Supply*D
Gemini Inc.
Hand Tool Industries, Inc.
HMC-Hub Material Co.*D
W.S. Jenks & Son*D
Joseph Electronics*D
Klein Tools, Inc.
Mouser Electronics*D
Omniatron Electronics*D
Parts Express International Inc.*D 49
The Rex Co.
Specialized Products Co.*D
Start International*D
Techni-Tool Inc.*D

Workplace Systems
Zero Corp., East Div.

CHEMICALS

ACL
All Electronics Corp.*D
Allied Electronics, A Div. of Hall-Mark Electronics*D
Atrix, Inc.*D
Bursma Electronic Distributing*D
Calg Labs, Inc.
Channel Master Div. of Avnet, Inc.
Chemtronics Inc. IBC
Com-Kyl Inc.*D
Consolidated Electronics, Inc.*D 57
Contact East, Inc.*D 47
Cooper Associates*D
CRC Industries, Inc.
Diversified Parts*D
Dow Chemical USA
Echelon Industries*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Falcon Safety Products, Inc. 43
Fordham Radio Supply Co.*D
GC Electronics Div. of GC Thorsen Co.
GMB/dba Fox International*D
Herman Electronics*D
HMC-Hub Material Co.*D
HSC Electronic Supply*D
Itera/Belmoor*D
JDR Micro*D
W.S. Jenks & Son*D
Joseph Electronics*D
Klein Tools, Inc.
M.A.T. Electronics*D 55
MCM Electronics*D
Micro Care Corp.
Micro-Circuits Co., Inc.
Miller-Stephenson Chemical Co.
Milo Associates, Inc.*D
Mouser Electronics*D
Omniatron Electronics*D
Parts Express International Inc.*D 49
Philips Consumer Electronics Service Co.*D
Philips ECG 41
Prime Electronics Co.*D 59
Prorachi Electronics Corp. 52
Quietrole Co.
Rawn Co. Inc., (Subsidiary of the Triangle Corp.)
RemGrit Corp.
RNJ Electronics Inc.*D
Sony Service Co. National Parts Div.*D
Specialized Products Co.*D
Start International*D
Tech Spray, Inc.
Techni-Tool Inc.*D
The Triangle Tool Group, Inc.

CLEANING SUPPLIES

ACL
Atrix, Inc.*D
Audiovisual Inc. (Video Midwest/AVC Systems Divs.)*D
Bursma Electronic Distributing*D
Calg Labs, Inc.
Chemtronics Inc. IBC
Clean Room Products Inc.
Com-Kyl Inc.*D
Consolidated Electronics, Inc.*D 57
Contact East, Inc.*D 47
Cooper Associates*D
CRC Industries, Inc.
Diversified Parts*D
Echelon Industries*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Falcon Safety Products, Inc. 43
Fordham Radio Supply Co.*D
Herman Electronics*D
HMC-Hub Material Co.*D
HSC Electronic Supply*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Joseph Electronics*D
Klein Tools, Inc.

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Diversified Parts*D
Electron Processing
Electronic Parts Supply*D
Electronic Specialists, Inc.
Electronics Warehouse Corp.*D
Itera/Belmoor*D
Joseph Electronics*D
M.A.T. Electronics*D 55
MCM Electronics*D
Microwave Filter Co., Inc.
Milo Associates, Inc.*D
Mouser Electronics*D
Multiplex Technology, Inc.
Omnitron Electronics*D
Philips Consumer Electronics Service Co.*D
RNJ Electronics Inc.*D
Schurter, Inc.
Sony Service Co. National Parts Div.*D
Speco Div.

RF SWITCHERS

Allied Electronics, A Div. of Hall-Mark Electronics*D
Ambico
Bursma Electronic Distributing*D
Channel Master Div. of Avnet, Inc.
Consolidated Electronics, Inc.*D 57
Diversified Parts*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
GMB/dba Fox International*D
Herman Electronics*D
International Components Corp.
Itera/Belmoor*D
Joseph Electronics*D
L-Com Inc.
M.A.T. Electronics*D 55
MCM Electronics*D
Omnitron Electronics*D
ORA Electronics
Philips Consumer Electronics Service Co.*D
Prime Electronics Co.*D 59
RNJ Electronics Inc.*D
Sony Service Co. National Parts Div.*D

SIGNAL MIXERS

Ambico
Audio-Technica U.S., Inc.
Audiovisual Inc. (Video Midwest/AVC Systems Divs.)*D
Bursma Electronic Distributing*D
Channel Master Div. of Avnet, Inc.
Consolidated Electronics, Inc.*D 57
Diversified Parts*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Itera/Belmoor*D
Joseph Electronics*D
Multiplex Technology, Inc.
Omnitron Electronics*D
Philips Consumer Electronics Service Co.*D
RNJ Electronics Inc.*D
Sony Service Co. National Parts Div.*D

SOLDERING/DESOLDERING EQUIPMENT

All Electronics Corp.*D
Allied Electronics, A Div. of Hall-Mark Electronics*D
American Design Components*D
Anritsu Meter Co. of America
A.P.E. Corp.
Arrow Electronics Inc. Catalog Sales Div.*D
Atrix, Inc.*D
The Boardworks
Bursma Electronic Distributing*D
Caig Labs, Inc.
Com-Kyl Inc.*D
Consolidated Electronics, Inc.*D 57
Contact East, Inc.*D 47
Cooper Associates*D
Cooper Tools
C&S Sales*D 45
Digi-Key Corp.*D
Diversified Parts*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Elenco Electronics, Inc.
Elvo Div. of Zumbach Electronics Corp.
Eraser Co., Inc. Wybar Div.
ESP Solder Plus a Div. of EFD, Inc.
Fordham Radio Supply Co.*D
GC Electronics Div. of GC Thorsen Co.
GMB/dba Fox International*D
The Granite Corp.
Grobet USA
Hand Tool Industries, Inc.
Heath Co.
Herman Electronics*D
Hexacon Electric Co.
HMC-Hub Material Co.*D
HSC Electronic Supply*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
Itera/Belmoor*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Jonard Industries Corp.
Joseph Electronics*D
Kelvin Electronics*D
Leads Metal Products, Inc. (ENDECO)
M.A.T. Electronics*D 55
MCM Electronics*D
Milo Associates, Inc.*D
Mouser Electronics*D
P.K. Neuses Inc.*D
M.M. Newman Corp.
O.K. Industries Inc.
Omega Engineering Inc.
Omnitron Electronics*D
ORA Electronics
Pace, Inc. 8
Parts Express International Inc.*D 49
Philips Consumer Electronics Service Co.*D
Planned Products
Plato Products, Inc.
Portasol, Inc.
Prime Electronics Co.*D 59
The Rex Co.
RNJ Electronics Inc.*D
Royal Soldering Systems, Inc.
Solder Absorbing Technology, Inc.
Solder Removal Co.
Sony Service Co. National Parts Div.*D
Specialized Products Co.*D
Start International*D
Tech Spray, Inc.
Techni-Tool Inc.*D
Tool Kit Specialists, Inc.*D
Ungar, Div. Eldon Industries, Inc.
Brian R. White Co., Inc.*D

Chicago Case Co.
Com-Kyl Inc.*D
Consolidated Electronics, Inc.*D 57
Contact East, Inc.*D 47
Cooper Associates*D
Cooper Tools
Diversified Case
Electronics Warehouse Corp.*D
C.H. Ellis Co., Inc.
Fordham Radio Supply Co.*D
GC Electronics Div. of GC Thorsen Co.
Gemini Inc.
GMB/dba Fox International*D
Grobet USA
Hand Tool Industries, Inc.
Herman Electronics*D
Highland Products, Inc.
HMC-Hub Material Co.*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Jonard Industries Corp.
Joseph Electronics*D
Kelvin Electronics*D
Klein Tools, Inc.
M.A.T. Electronics*D 55
Melmat Inc.
Milo Associates, Inc.*D
Mouser Electronics*D
P.K. Neuses Inc.*D
Omega Engineering Inc.
Omnitron Electronics*D
Philips Consumer Electronics Service Co.*D
Prime Electronics Co.*D 59
R & K Supply Co.
RNJ Electronics Inc.*D
Sony Service Co. National Parts Div.*D
Specialized Products Co.*D
Techni-Tool Inc.*D
Thomson Consumer Electronics, Inc. Distributor & Special Products*D
Tool Kit Specialists, Inc.*D
Vaco Products
Brian R. White Co., Inc.*D
Zero Corp., East Div.

Tools

HEAT GUNS

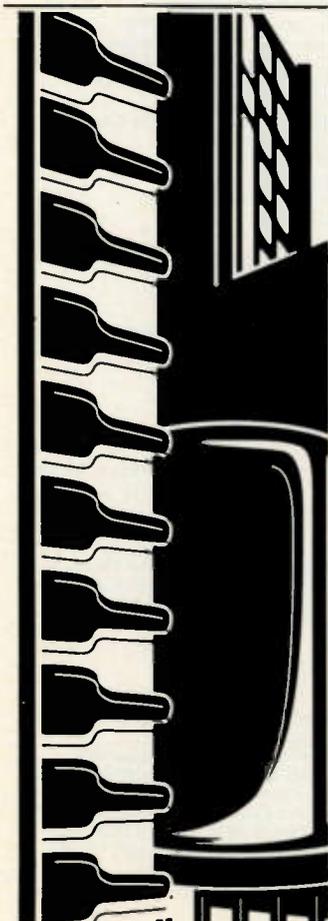
All Electronics Corp.*D
Arrow Electronics Inc. Catalog Sales Div.*D
Brunelle Instruments Inc.
Classic Components Supply Inc.*D
Com-Kyl Inc.*D
Contact East, Inc.*D 47
Cooper Associates*D
Electronics Warehouse Corp.*D
GC Electronics Div. of GC Thorsen Co.
Hand Tool Industries, Inc.
Herman Electronics*D
HMC-Hub Material Co.*D
HSC Electronic Supply*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Joseph Electronics*D
Kelvin Electronics*D
MCM Electronics*D
Omnitron Electronics*D
Paladin Corp.
Parts Express International Inc.*D 49
Philips Consumer Electronics Service Co.*D
Portasol, Inc.
RNJ Electronics Inc.*D
Sony Service Co. National Parts Div.*D
Specialized Products Co.*D
Start International*D
Techni-Tool Inc.*D
3M Electrical Specialties Div.
3M Private Network Products
Tool Kit Specialists, Inc.*D
Ungar, Div. Eldon Industries, Inc.
Brian R. White Co., Inc.*D

JIGS/FIXTURES/VISES

Com-Kyl Inc.*D
Consolidated Electronics, Inc.*D 57
Contact East, Inc.*D 47
Diversified Parts*D
Electronics Warehouse Corp.*D
GMB/dba Fox International*D
Grobet USA
Hand Tool Industries, Inc.
HMC-Hub Material Co.*D
HSC Electronic Supply*D
HSC Service Co. Div. of Hitachi Sales Corp. of America
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Joseph Electronics*D
MCM Electronics*D
Omnitron Electronics*D
PanaVise Products, Inc. 23
Parts Express International Inc.*D 49
Philips Consumer Electronics Service Co.*D
Sony Service Co. National Parts Div.*D
Start International*D
Techni-Tool Inc.*D
Tool Kit Specialists, Inc.*D

TOOL KITS

Allied Electronics, A Div. of Hall-Mark Electronics*D
American Design Components*D
Arrow Electronics Inc. Catalog Sales Div.*D
Atrix, Inc.*D
Brunelle Instruments Inc.
Com-Kyl Inc.*D
Consolidated Electronics, Inc.*D 57
Contact East, Inc.*D 47
Cooper Associates*D
Cooper Tools
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Eraser Co., Inc. Wybar Div.
Fordham Radio Supply Co.*D
GC Electronics Div. of GC Thorsen Co.
Grobet USA
Hand Tool Industries, Inc.
Heath Co.
Herman Electronics*D
HMC-Hub Material Co.*D
HSC Electronic Supply*D
Itera/Belmoor*D
ITT Pomona Electronics
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D 50
Jonard Industries Corp.
Joseph Electronics*D
Kelvin Electronics*D
Klein Tools, Inc.
M.A.T. Electronics*D 55
Moody Tools, Inc.
Mouser Electronics*D
P.K. Neuses Inc.*D
Nu-Data Inc.
O.K. Industries Inc.
Omega Engineering Inc.
Omnitron Electronics*D
Ornium Corp.
Paladin Corp.
Parts Express International Inc.*D 49



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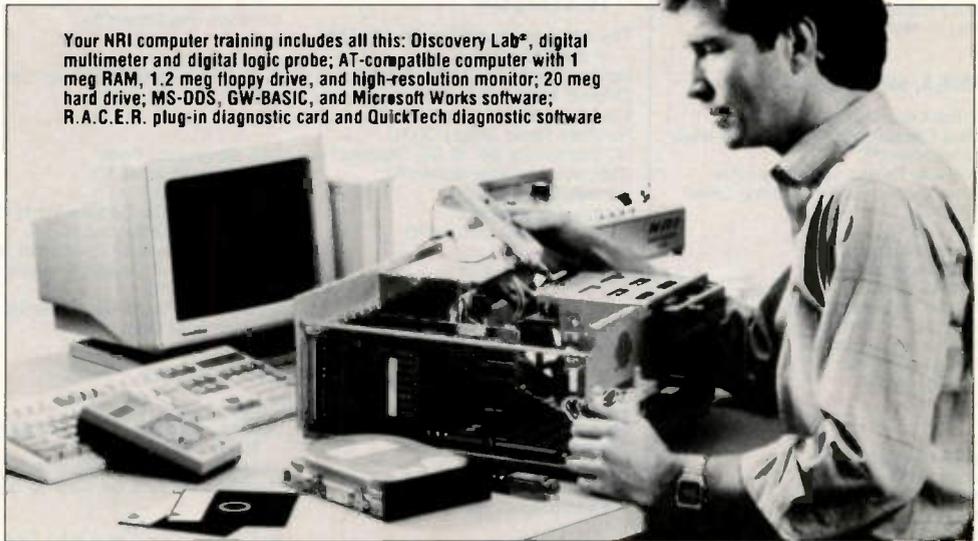
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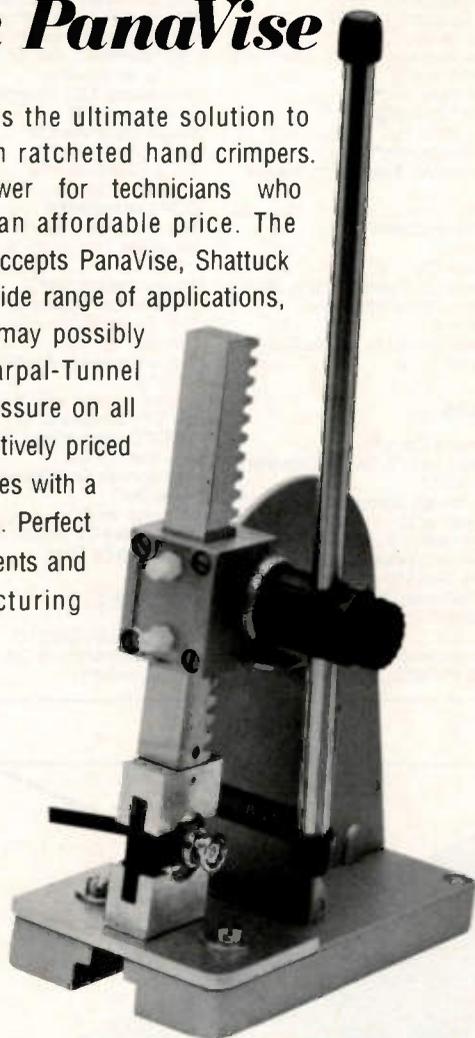
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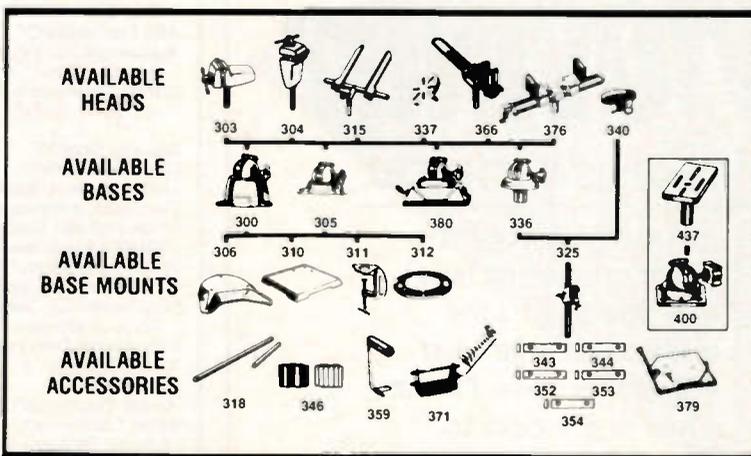
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February 1991

Profax Number

RCA/GE
 CTC 168 Chassis Color TV 3074

SIGNAL SCHEMATIC

Product safety should be considered when component replacement is made in any area of an electronics product. A star next to a component symbol number designates components in which safety is of special significance. It is recommended that only exact cataloged parts be used for replacement of these components.

Use of substitute replacement parts that do not have the same safety characteristics as recommended in factory service information may create shock, fire, excessive x-radiation or other hazards.

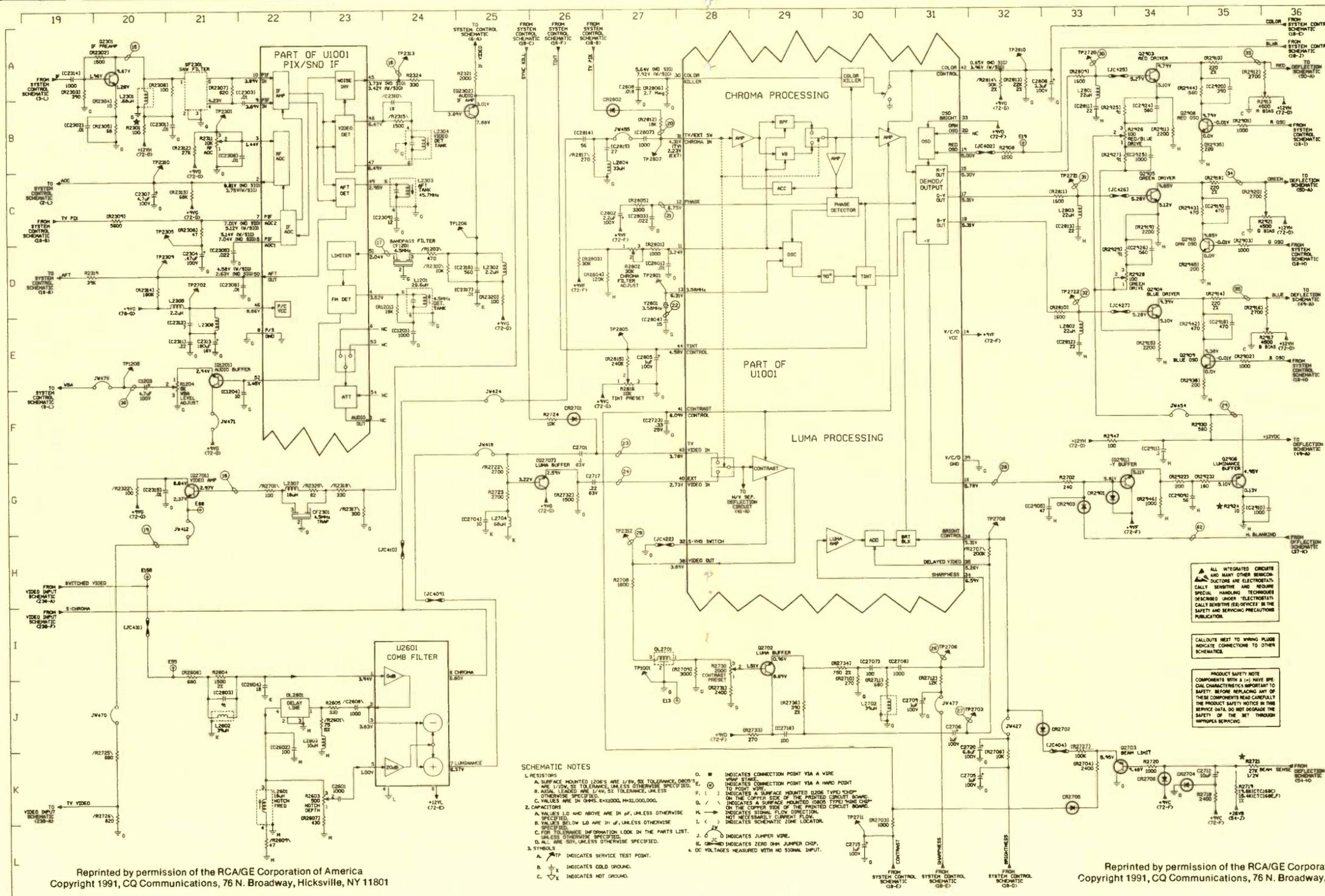
This schematic is for the use of qualified technicians only. This instrument contains no user-serviceable parts.

SIGNAL SCHEMATIC

This schematic is for the use of qualified technicians only. This instrument contains no user-serviceable parts.

The other portions of this schematic may be found on other Profax pages.

All integrated circuits and many other semiconductors are electrostatically sensitive and require special handling techniques.



- SCHEMATIC NOTES**
- 1. RESISTORS
 - A. SURFACE MOUNTED (206) ARE 1/10% 0603, 0805, 0903, 1206, 1209, 35 TO 100% TOLERANCE, UNLESS OTHERWISE SPECIFIED.
 - B. AXIAL LEADED ARE 1/4W, 5% TOLERANCE, UNLESS OTHERWISE SPECIFIED.
 - C. VALUES ARE IN OHMS, K=1000, M=1,000,000.
 - 2. CAPACITORS
 - A. VALUES 1.0 AND ABOVE ARE IN μ F, UNLESS OTHERWISE SPECIFIED.
 - B. VALUES BELOW 1.0 ARE IN pF, UNLESS OTHERWISE SPECIFIED.
 - C. FOR TOLERANCE INFORMATION LOOK IN THE PARTS LIST, UNLESS OTHERWISE SPECIFIED.
 - D. ALL ARE 50V, UNLESS OTHERWISE SPECIFIED.
 - 3. SYMBOLS
 - A. TP INDICATES SERVICE TEST POINT.
 - B. $\frac{1}{2}$ INDICATES COLD GROUND.
 - C. $\frac{1}{2}$ INDICATES NOT GROUND.
 - D. $\frac{1}{2}$ INDICATES CONNECTION POINT VIA A WIRE WRAP STAKE.
 - E. \odot INDICATES CONNECTION POINT VIA A HAWK POINT TO POINT WIRE.
 - F. \square INDICATES A SURFACE MOUNTED (206) TYPE CHIP ON THE COPPER SIDE OF THE PRINTED CIRCUIT BOARD.
 - G. \square INDICATES A SURFACE MOUNTED (206) TYPE CHIP ON THE COPPER SIDE OF THE PRINTED CIRCUIT BOARD.
 - H. \rightarrow INDICATES SIGNAL FLOW DIRECTION.
 - I. \rightarrow NOT NECESSARILY CURRENT FLOW DIRECTION.
 - J. \rightarrow INDICATES SCHEMATIC ZONE LOCATOR.
 - K. \circ INDICATES JUMPER WIRE.
 - L. \circ INDICATES ZERO OHM JUMPER CHIP.
 - M. \circ DC VOLTAGE MEASURED WITH NO SIGNAL INPUT.

POWER SUPPLY SCHEMATIC

Product safety should be considered when component replacement is made in any area of an electronics product. A star next to a component symbol number designates components in which safety is of special significance. It is recommended that only exact cataloged parts be used for replacement of these components.

Use of substitute replacement parts that do not have the same safety characteristics as recommended in factory service information may create shock, fire, excessive x-radiation or other hazards.

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The other portions of this schematic may be found on other Profax pages.

All integrated circuits and many other semiconductors are electrostatically sensitive and require special handling techniques.

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This schematic is for the use of qualified technicians only. This instrument contains no user-serviceable parts.

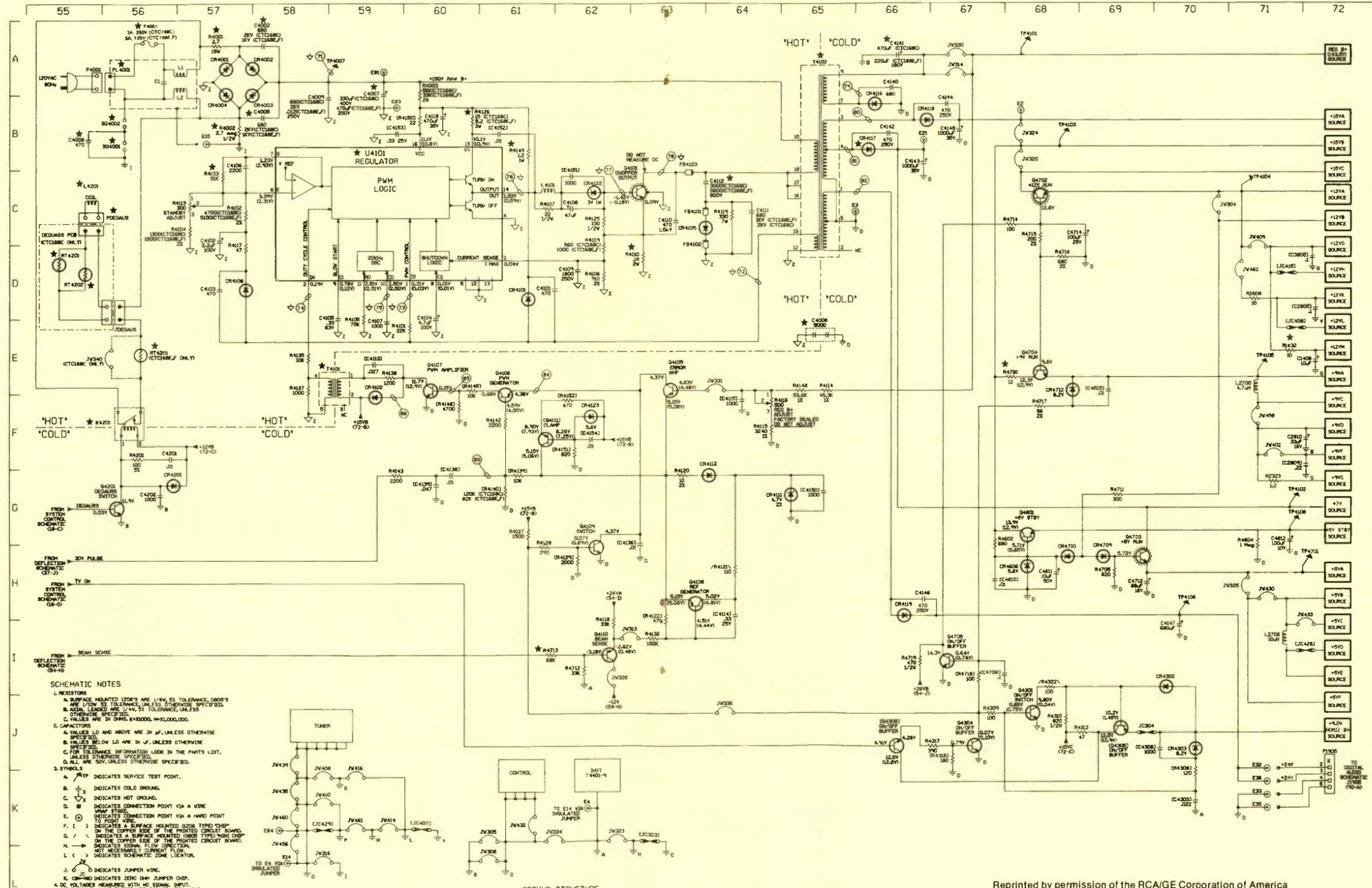
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CALLOUTS NEXT TO WIRING PLUGS INDICATE CONNECTIONS TO OTHER SCHEMATICS.

PRODUCT SAFETY NOTE: COMPONENTS WITH A (*) HAVE SPECIAL CHARACTERISTICS 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.



- SCHEMATIC NOTES**
- RESISTORS**
 - A. SURFACE MOUNTED (SMT) PARTS ARE 1/8W, 5% TOLERANCE, UNLESS OTHERWISE SPECIFIED.
 - B. AXIAL LEADED PARTS ARE 1/4W, 5% TOLERANCE, UNLESS OTHERWISE SPECIFIED.
 - C. VALUES ARE IN OHMS, KILOHMS, MEGOHMS, OR GIGAOHMS.
 - CAPACITORS**
 - A. VALUES 1.0 AND ABOVE ARE IN μ F, UNLESS OTHERWISE SPECIFIED.
 - B. VALUES BELOW 1.0 ARE IN nF, UNLESS OTHERWISE SPECIFIED.
 - C. FOR TOLERANCE INFORMATION, LOOK IN THE PARTS LIST, UNLESS OTHERWISE SPECIFIED.
 - D. ALL ARE 50V, UNLESS OTHERWISE SPECIFIED.
 - SYMBOLS**
 - A. TP INDICATES SERVICE TEST POINT.
 - B. $\frac{1}{2}$ INDICATES COLD GROUND.
 - C. $\frac{1}{2}$ INDICATES HOT GROUND.
 - D. $\frac{1}{2}$ INDICATES CONNECTION POINT VIA A WIRE WIRE STRAP.
 - E. $\frac{1}{2}$ INDICATES CONNECTION POINT VIA A HARD POINT TO POINT WIRE.
 - F. $\frac{1}{2}$ INDICATES A SURFACE MOUNTED (SMT) TYPED CHIP ON THE TOP SIDE OF THE PRINTED CIRCUIT BOARD.
 - G. $\frac{1}{2}$ INDICATES A SURFACE MOUNTED (SMT) TYPED CHIP ON THE BOTTOM SIDE OF THE PRINTED CIRCUIT BOARD.
 - H. $\frac{1}{2}$ INDICATES SIGNAL FLOW DIRECTION, NOT NECESSARILY CURRENT FLOW.
 - I. $\frac{1}{2}$ INDICATES SCHEMATIC ZONE LOCATOR.
 - J. $\frac{1}{2}$ INDICATES JUMPER WIRE.
 - K. $\frac{1}{2}$ INDICATES ZERO OHM JUMPER CHIP.
 - L. DC VOLTAGE MEASURED WITH NO SIGNAL INPUT. VOLTAGES IN PARENTHESES ARE FOR STANDBY MODE.

SYSTEM CONTROL SCHEMATIC

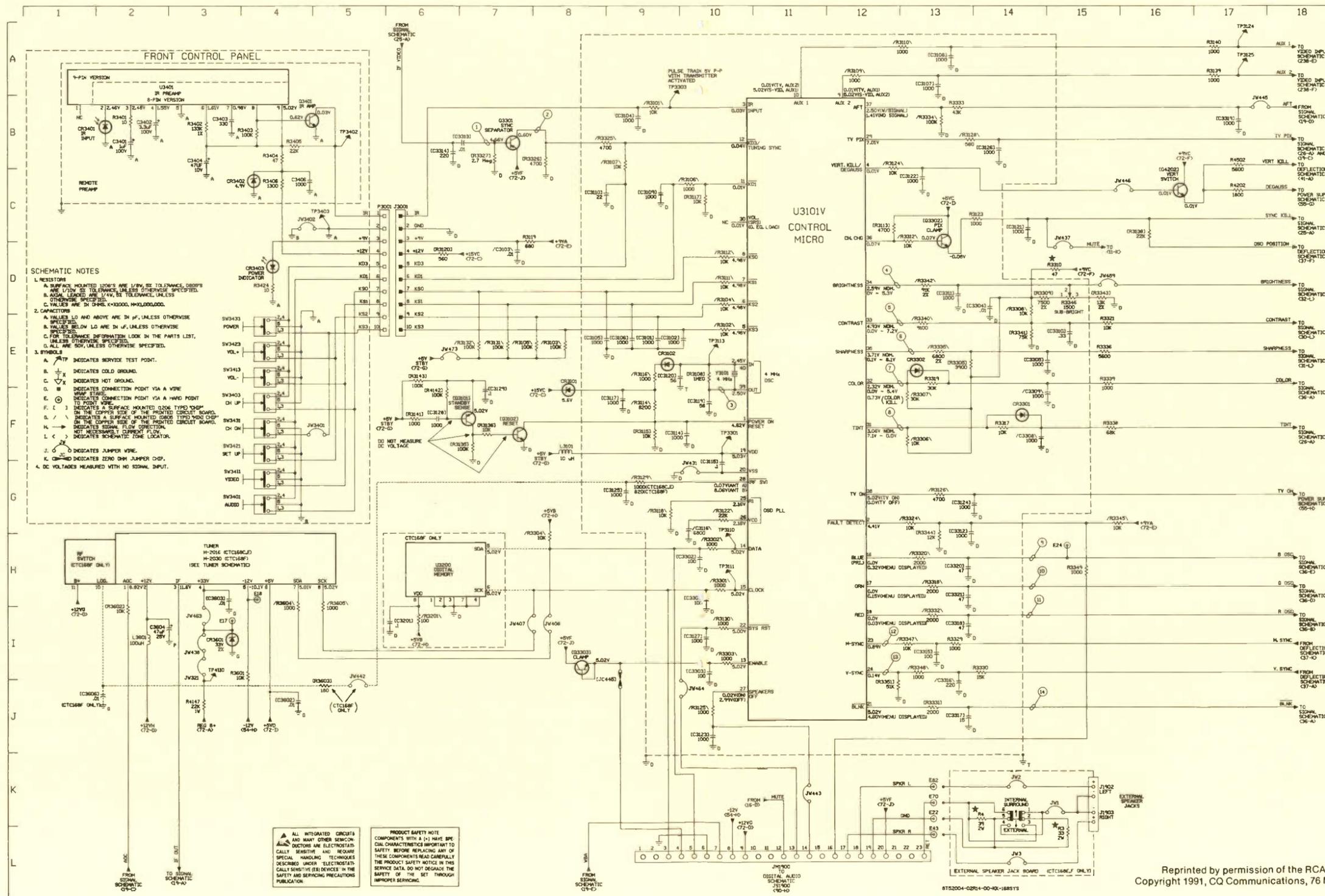
Product safety should be considered when component replacement is made in any area of an electronics product. A star next to a component symbol number designates components in which safety is of special significance. It is recommended that only exact cataloged parts be used for replacement of these components.

Use of substitute replacement parts that do not have the same safety characteristics as recommended in factory service information may create shock, fire, excessive x-radiation or other hazards.

This schematic is for the use of qualified technicians only. This instrument contains no user-serviceable parts.

The other portions of this schematic may be found on other Profax pages.

All integrated circuits and many other semiconductors are electrostatically sensitive and require special handling techniques.



RCA/GE
CTC 168
CHASSIS
COLOR TV

Product safety should be considered when component replacement is made in any area of an electronics product. A star next to a component symbol number designates components in which safety is of special significance. It is recommended that only exact cataloged parts be used for replacement of these components.

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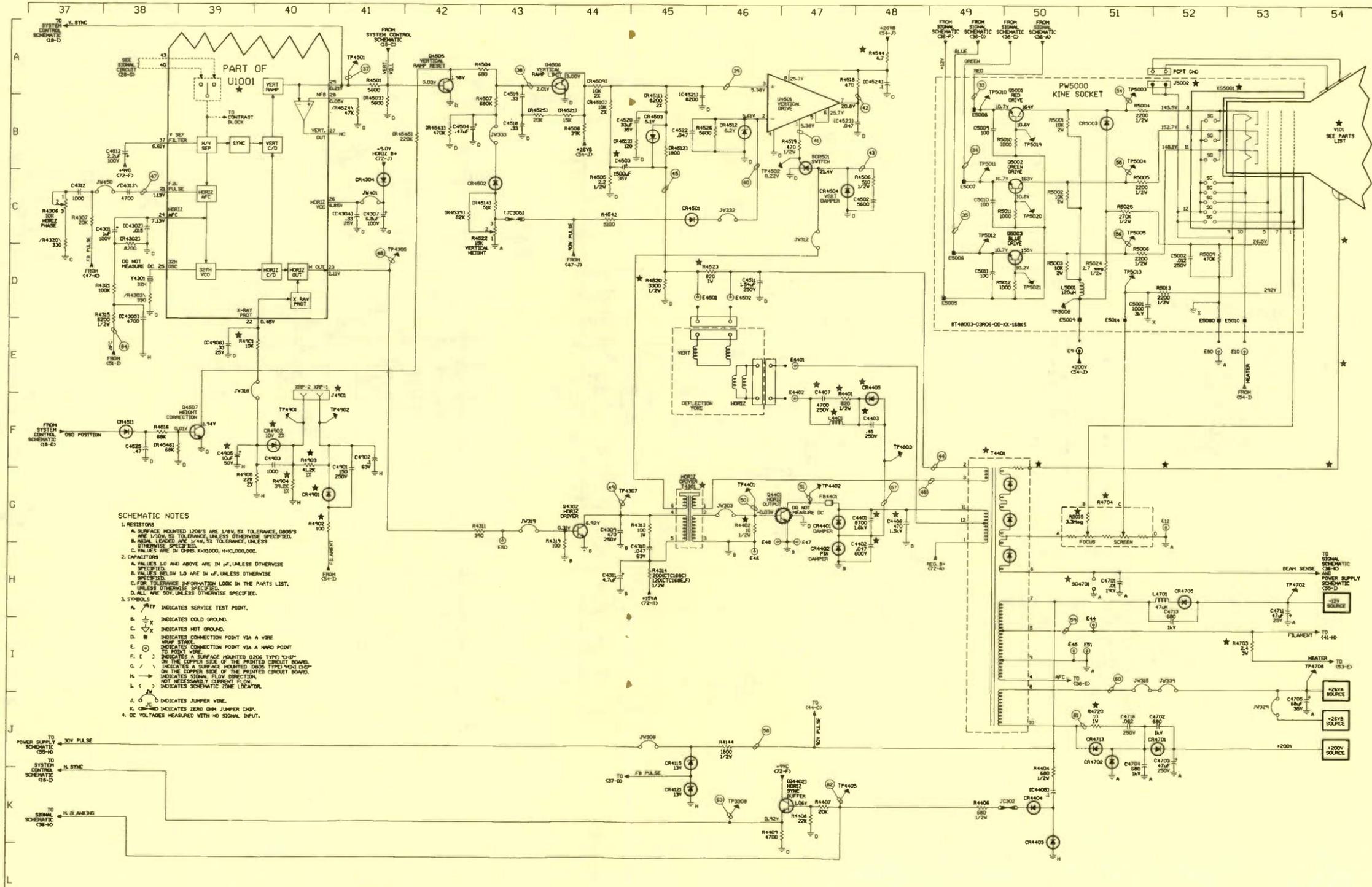
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All integrated circuits and many other semiconductors are electrostatically sensitive and require special handling techniques.

ALL INTEGRATED CIRCUITS AND MANY OTHER SEMICONDUCTORS ARE ELECTROSTATICALLY SENSITIVE AND REQUIRE SPECIAL HANDLING TECHNIQUES DESCRIBED UNDER "ELECTROSTATICALLY SENSITIVE DEVICES" IN THE SAFETY AND SERVICING PRECAUTIONS PUBLICATION.

CALLOUTS NEXT TO WIRING PLUGS INDICATE CONNECTIONS TO OTHER SCHEMATICS.

PRODUCT SAFETY NOTE
COMPONENTS WITH A (*) HAVE SPECIAL CHARACTERISTICS 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.



- SCHEMATIC NOTES**
- RESISTORS**
 - A. SURFACE MOUNTED 100K'S ARE 1/4W, 5% TOLERANCE, 0805'S ARE 1/10W, 5% TOLERANCE, UNLESS OTHERWISE SPECIFIED.
 - B. AGILEX LEADED ARE 1/4W, 5% TOLERANCE, UNLESS OTHERWISE SPECIFIED.
 - C. VALUES ARE IN OHMS, K=1000, M=1,000,000.
 - CAPACITORS**
 - A. VALUES LG AND ABOVE ARE IN μ F, UNLESS OTHERWISE SPECIFIED.
 - B. VALUES BELOW LG ARE IN nF, UNLESS OTHERWISE SPECIFIED.
 - C. FOR TOLERANCE INFORMATION LOOK IN THE PARTS LIST, UNLESS OTHERWISE SPECIFIED.
 - D. ALL ARE 50V, UNLESS OTHERWISE SPECIFIED.
 - SYMBOLS**
 - A. ∇ TP INDICATES SERVICE TEST POINT.
 - B. \square X INDICATES COLD GROUND.
 - C. ∇ X INDICATES HOT GROUND.
 - D. \square INDICATES CONNECTION POINT VIA A WIRE WRAP STAKE.
 - E. \square INDICATES CONNECTION POINT VIA A WIND POINT TO POINT WIRE.
 - F. () INDICATES A SURFACE MOUNTED (0208 TYPE) CHIP ON THE COPPER SIDE OF THE PRINTED CIRCUIT BOARD.
 - G. / / INDICATES A SURFACE MOUNTED (0208 TYPE) CHIP ON THE COPPER SIDE OF THE PRINTED CIRCUIT BOARD.
 - H. \rightarrow INDICATES SIGNAL FLOW DIRECTION.
 - I. \leftarrow INDICATES SIGNAL FLOW DIRECTION.
 - J. ∇ INDICATES JUMPER WIRE.
 - K. \square INDICATES ZERO OHM JUMPER CHIP.
 - L. DC VOLTAGES MEASURED WITH NO SIGNAL INPUT.

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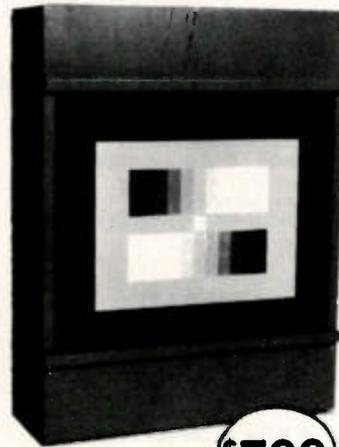
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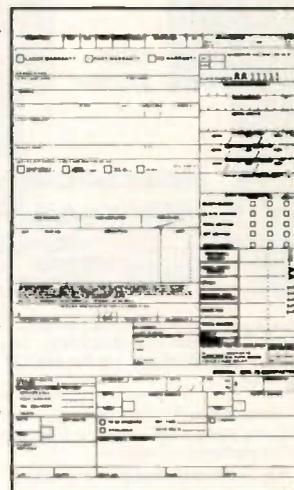
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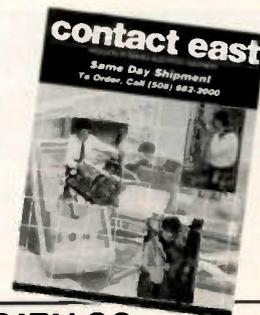
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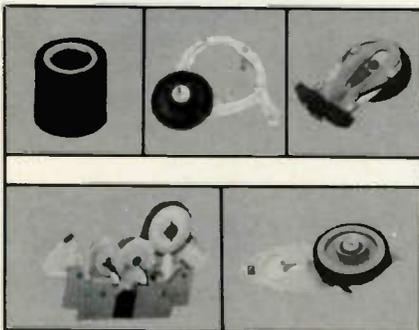
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Beware when adding new equipment

By Conrad Persson

A friend of mine has an IBM compatible computer. When he bought it it was equipped with 1 megabyte of memory, a hard disk drive designated as C:, and a 5¼ inch floppy disk drive designated as A: Because he does a lot of work with memory intensive programs he decided to add another meg of memory. Because he

also had a need to be able to read and write to a 3½ inch floppy disk, at the same time he added a 3½ inch disk drive.

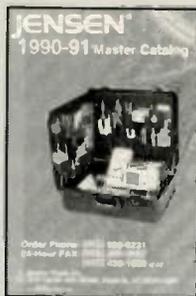
After he added these enhancements, and went through the computer's resident setup program, everything seemed to work pretty well. When he got to the steps having to do with disk drives it even told him he had three drives: A: B: and C:. However, when he tried to format the new 3½ inch drive, designated B, it wouldn't format. When he tried to

Persson is editor of ES&T

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format the drive he got a "DIVIDE OVERFLOW ERROR" message on the screen.

When he went through another setup program that he had available, the program recognized the disk as a 5¼ floppy disk, and even allowed him to format the disk at 1.2Mega-bytes. This would have had some value as a floppy disk, as he could have written to and read from the disks on this computer. He was also able to read some other disks that had been written to on another computer. He believes that those were disks that had been formatted at 720Kbytes. The problem was that he could not read disks that had been formatted at 1.4Mbytes on another computer, and no other 3½ inch floppy disk drive would read disks that came from his computer.

The next obvious step was to check his newly configured system out using a diagnostic disk. This diagnostic program thoroughly checked out the new memory board, as well as all the electronics that was in the computer originally. Everything checked out just fine, except that when the program checked out the newly installed drive it gave him an indication that the drive was bad.

As the new drive was the only thing giving him a problem, it seemed logical that the problem was that the drive was in fact bad, so he sent it back to the supplier. The supplier checked the disk drive out thoroughly, then returned it to him. There was no problem with the drive.

Up to this point, nothing seemed to point to where the problem actually was, but this next step changed that trend. Suspecting that there might be some problem with the DOS program that was installed on the hard drive, he turned the computer off, then rebooted it with a floppy disk drive with the operating system and a higher version of DOS on it. When he tried to format, and read and write using the 3½ inch disk drive, it performed flawlessly. Apparently the problem was not in the disk or any other hardware, but with the operating software. ■

The solution to the problem now seemed to be within reach, so he attempted to reinstall DOS onto the hard disk from the floppy disk that contained the higher version of DOS. The result was a message that there was insufficient room on the hard disk.

Actually, there was more than enough room, but again some software problem was causing this message.

There might have been an alternative way to get around this new problem, but not knowing what it might be, my friend decided to use the brute force method: he backed up the hard disk onto 5¼ inch floppy disks, reformatted the hard disk with the FORMAT C: command, and then RESTORED the information to the hard disk. Everything seemed to work fine after that; for a while.

The next day, when he turned the computer on, he got the indication on the screen that the computer had gone through the power on self test, but nothing happened beyond that. The computer sat there not looking at the hard disk drive, not looking at the keyboard.

Realizing that he had not repartitioned the hard disk before formatting it, he proceeded to repartition the hard disk using the FDISK command, then reformatted it and then restored the backup data from the floppy disks. Everything is now working fine. Actually, as often happens in a case like this, my friend is not exactly sure what the problem was. He suspects that perhaps the two hidden files became corrupted. Or perhaps the older version of DOS would not support the 3½ inch floppy disk drive.

The lessons that he learned from this experience (and which we hope will be of value to you as well) is 1. that it is possible for a diagnostic program to misdiagnose a problem, and 2. when there is a problem that might be software related, it's always a good idea to try turning off the computer and then rebooting it from a known good system floppy disk to see if the problem goes away. ■

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Test your electronics knowledge

Sam Wilson

Important! See "What Do You Know About Electronics?" in this issue. There is a new contest and explanation of errors in the December issue!

1. For the circuit of Figure A the RMS voltage multiplied by the RMS current equals

- (a) the peak power.
- (b) the true power.
- (c) the average power.
- (d) the RMS power.

2. If you double the voltage across a thermistor

- (a) the current through it will double.
- (b) the current through it will be halved.
- (c) the current through it will not change.
- (d) you cannot determine the resulting current by ohm's law.

Wilson is the electronics theory consultant for ES&T.

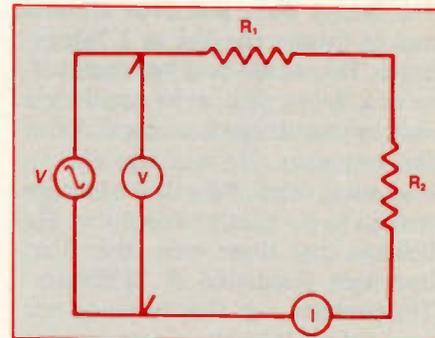


Figure A.

3. The amplifier in Figure B is being operated

- (a) class A.
- (b) class B.
- (c) class AB.
- (d) class C.

4. In an unregulated power supply the output of a bridge rectifier is delivered to an LC filter. Better supply regulation occurs if

- (a) it is a choke-input filter.
- (b) it is a capacitor-input filter.

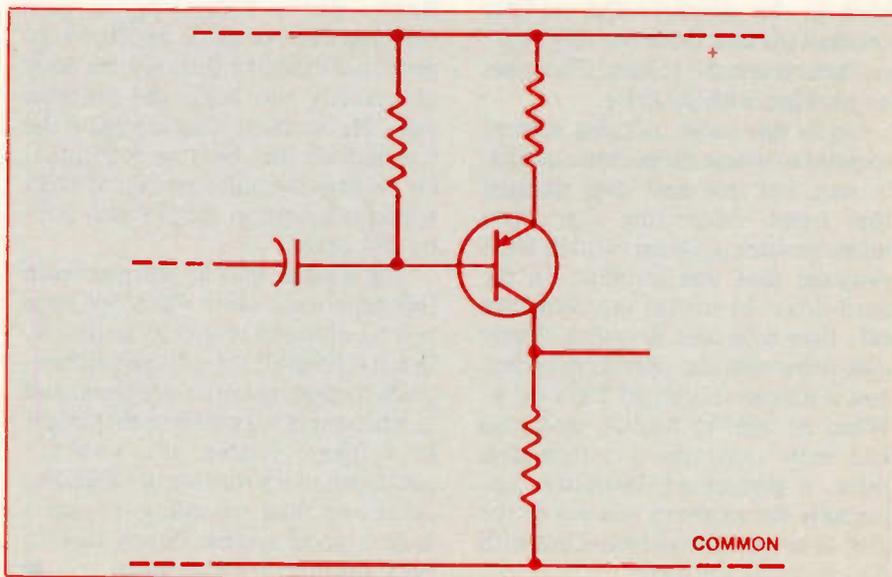


Figure B.

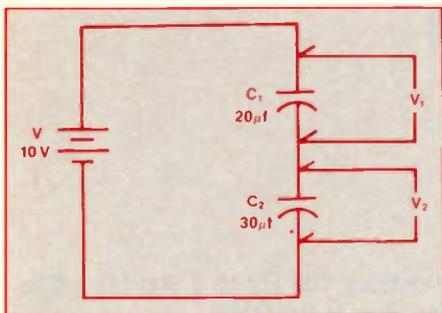


Figure C.

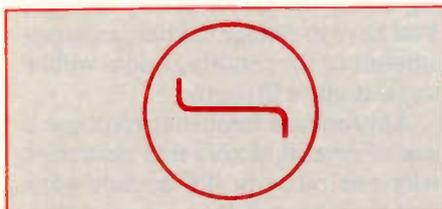


Figure D.

5. Assume the RMS voltage in the circuit of Figure A is exactly 10.0 volts. Also, the color codes of the resistors are:

R_1 - Orange, Orange, Brown, Gold and

R_2 - Orange, Orange Brown, Silver

What is the maximum possible RMS current if the resistors are in tolerance?

$I =$ _____ milliamperes.

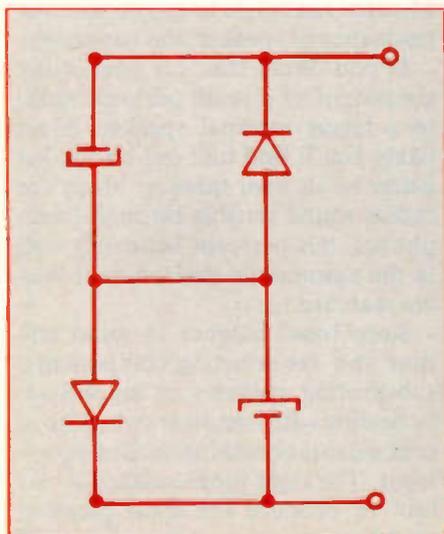


Figure E.

6. Give the values of DC voltage across C_1 and C_2 in the circuit of Figure C. Assume perfect (no leakage) capacitors and exact capacitor values.

$V_1 =$ _____ volts

$V_2 =$ _____ volts

7. Line 21 of the VITS signal is marked on drawings as "framing code." What is it used for?

8. A technician connects a light-emitting diode to a diode curve tracer and gets the curve of Figure D. Which if the following is correct?

- (a) The LED has been destroyed.
- (b) The curve shows the LED is not operating properly.
- (c) The test shows that the LED is working properly.

9. Maybe you can make a non-polarized electrolytic capacitor using the connections shown in Figure E. May-

be not. Are the diodes properly connected?

- (a) yes
- (b) no

10. Which of the following components would you expect to find in a voltage-controlled oscillator circuit?

- (a) variac
- (b) varactor
- (c) variometer
- (d) (None of these choices is correct.)

I feel guilty about having two wrong answers in the December issue, so, here is a bonus question worth 10 easy points -

11. Who invented the Wheatstone bridge?

- (a) Wheatstone
- (b) Edison
- (c) Christie
- (d) Wilson

(Continued on page 58)

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Frequency response and tonal balance

By John Shepler

Tonal balance occurs when you adjust an audio system to have just the right degree of treble, bass, and mid-range. Clock radios, portables, loudspeakers, and automobile sound systems are all designed to have a balanced sound. The tone controls exist to compensate for everyone's particular taste.

Preserving tonal balance is important when matching components. Any time you substitute one loudspeaker for another or change amplifiers, you run the risk of upsetting the tonal balance of the system. You also run the risk of upsetting the customer.

Tonal balance and frequency response are closely related. For voices and music to sound natural, the frequency response has to be such that for every low frequency note that can be produced a corresponding high frequency note is available. Otherwise, the sound will be described as "tinny," "boomy," "muddy," or "dull."

Shepler is an electronics engineering manager and broadcast consultant. He has more than 20 years experience in all phases of electronics.

Surprisingly, it is not important that all audio systems have a flat response from 20 Hz to 20 kHz. Many applications such as two-way radio, telephones, PA systems, and intercoms would not work so well with a wide response. Wide frequency responses make equipment more susceptible to noise. For systems that are voice only, like paging equipment, you want to tailor the response to the voice range to achieve maximum intelligibility.

What is important is that the frequency response of any audio system be tailored for tonal balance. Figure 1 shows the general idea.

Old timers in audio engineering used something called the "Rule of 500,000" to guide them. It works like this: for natural sounding audio, the lower frequency limit times the upper frequency limit should equal approximately 500,000.

Let's see how this works. If a home stereo system has a response of 25 Hz to 20 kHz, then 25 times 20,000 equals 500,000. This also works for a typical AM radio with a response

covering 100 Hz to 5,000 Hz. The product is 500,000.

This says that if you want to cut high frequency noise and hiss, turning down the treble is not enough. You have to reduce the bass an equal amount or the resulting audio will be unpleasant to listen to.

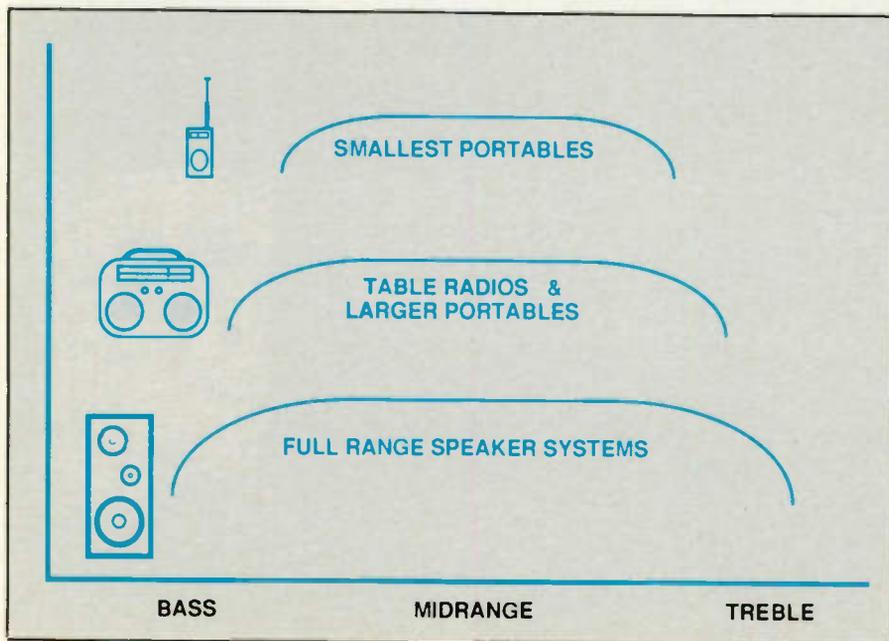
Appropriate frequency response is one of several factors that determine why one radio or TV sounds good and another sounds bad. Low distortion is also important. You must have enough power to drive the loudspeakers to a comfortable volume without clipping. You also need some reserve power for audio peaks for someone who likes to listen at high volumes.

Be careful when replacing speakers. Not only is the tonal balance of speakers different, the power requirements vary as well. Most speakers designed to be built into equipment are reasonably efficient. Acoustic suspension speakers, such as those you see in automobiles, require a lot more power. You can't just substitute one type for the other.

Another key factor in audio equipment design is the speaker enclosure. The combination of speaker and enclosure is tuned for best response. Much of the magic has to do with the resonance of speaker and enclosure.

If you doubt this, try connecting the output of a small portable radio to a larger external speaker. Most likely you'll find that radio sounded better on its own speaker. Many car radios sound terrible through headphones, but perform extremely well in the automobile environment they are matched to.

Keep tonal balance in mind any time you are selecting components, substituting speakers or amplifiers, or dealing with customers who like to create unique combinations of equipment. The right tonal balance is certain to produce the most pleasing sound. ■



Have an advertising audit, have an advertising plan.

By William J. Lynott

How are you doing with marketing your business? Is it growing as fast as you'd like? Do you have a comprehensive marketing plan? Or does an ad in the Yellow Pages pretty much constitute your entire marketing effort? One of the pitfalls facing entrepreneurs who enter the business world with plenty of technical skills but little or no formal business training is a failure to appreciate the critical importance of marketing. Very few businesses of any size can maintain fiscal health without it. On the other hand, skillful marketing opens the door to unlimited growth.

Too many small service dealers start their businesses on the premise that offering top-notch service at competitive prices is all they will need to succeed. Unfortunately, that is far from the truth. Of course, these things are a critical part of the recipe for success; but they alone cannot generate the growth that is needed to keep a service business on solid financial ground.

On average, an electronics service dealer will lose about 20% of his customers each year. No matter how good the service offered, a number of people will move away, die, or simply decide to try a competitor. Just staying where you are requires replacing those customers with new ones. Growing larger obviously requires even more aggressive marketing.

While Yellow Page advertising is able to provide a large measure of this customer replacement, particularly for those companies whose YP ads are skillfully done, it is seldom enough to sustain long-term growth.

I spoke with a service dealer this

morning who told me that with tough times coming up, he is planning to triple his YP ad budget. I advised him to proceed with caution before making such a major commitment. He has been advertising in the Yellow Pages for years—and that is just about his entire marketing effort. In my view, given those circumstances, it is unlikely that such a huge increase in that medium will produce proportionate results. I advise him instead to conduct what I call a marketing audit.

Critical self-examinations called audits are common practice in other parts of our businesses. They are no less important in marketing. And a marketing audit need not be conducted by an outside consulting firm or a CPA. You can easily do it yourself.

While an audit should be customized for each individual business, there are key questions that are common to all. Here are the ones I consider to be most important for your business:

- Has there been a significant gain or loss in number of customers in the past year? In total dollar volume?
- Where are your revenue dollars coming from? Which types of service produce the highest dollar volume? The lowest? Do you have a record of trends and a budget for sales for each of the major classifications of service that you perform? Do you set specific sales goals or quotas for each form of income?
- What are the major strengths and weaknesses of your chief competitors. How do you stack up against their strengths? What can you do to exploit their weaknesses? What ac-

(Continued on page 58)

Lynott is president of W.J. Lynott, Associates, a management consulting firm specializing in profitable service management and customer satisfaction.

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The LCD projection system

By the ES&T staff.

Over the years the number of changes in television technology has been staggering, perhaps as only an electronics servicing technician can truly appreciate. First the picture tube increased gradually in size. Then color was added to the picture. Gradually vacuum tubes were replaced with transistors, then with integrated circuits. In fact, until only recently, the only vacuum tube in the TV set that has not been replaced with some kind of solid state has been the picture tube.

That has begun to change. Many small sets, both monochrome and color, have begun to feature liquid crystal display (LCD) systems, not entirely unlike the faces of today's digital watches.

There are a number of advantages of LCDs as TV display that suit them for use not only in small TVs, but in larger TVs as well. 1. They are relatively rugged. 2. They don't consume a great deal of power. 3. They are compact. 4. They don't require a source of high voltage.

At the moment, LCDs also have disadvantages: they are costly to pro-

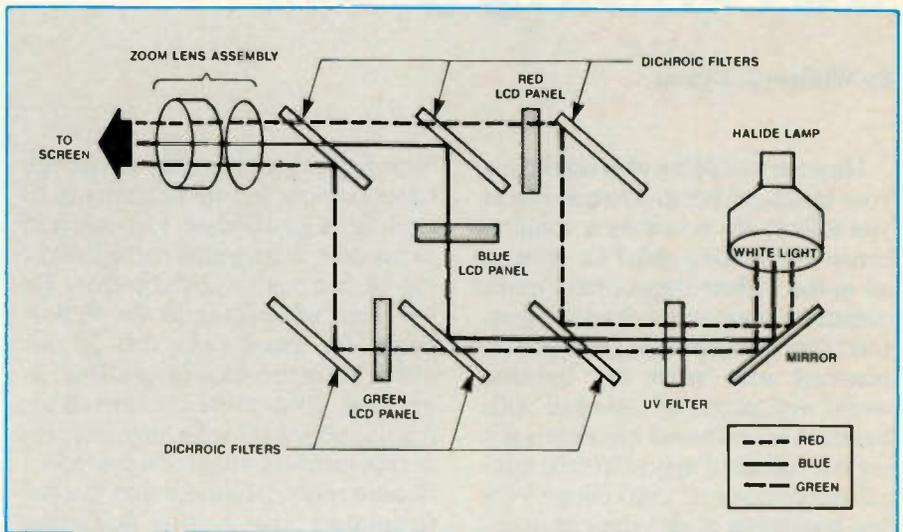


Figure 1. In the LCD TV, a halide lamp provides the light source. Dichroic filters separate the white light into its green, blue and red components. Each of these beams of colored light is projected through an LCD panel, and the three separate modulated light beams are combined in the lens assembly for projection of the picture. (Drawing courtesy Sharp)

duce, and their size is limited. So far the largest LCD screen produced has been around 14 inches. And that was prohibitively expensive.

As is the case with all technology, however, we can expect the cost of

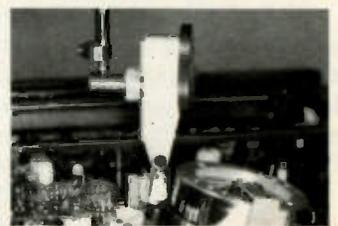
these units to come down, and the practical upper limit on size to increase, as the technology advances. In fact, LCD is, as noted earlier, practical today for the hand held sizes of TV, and as will be described

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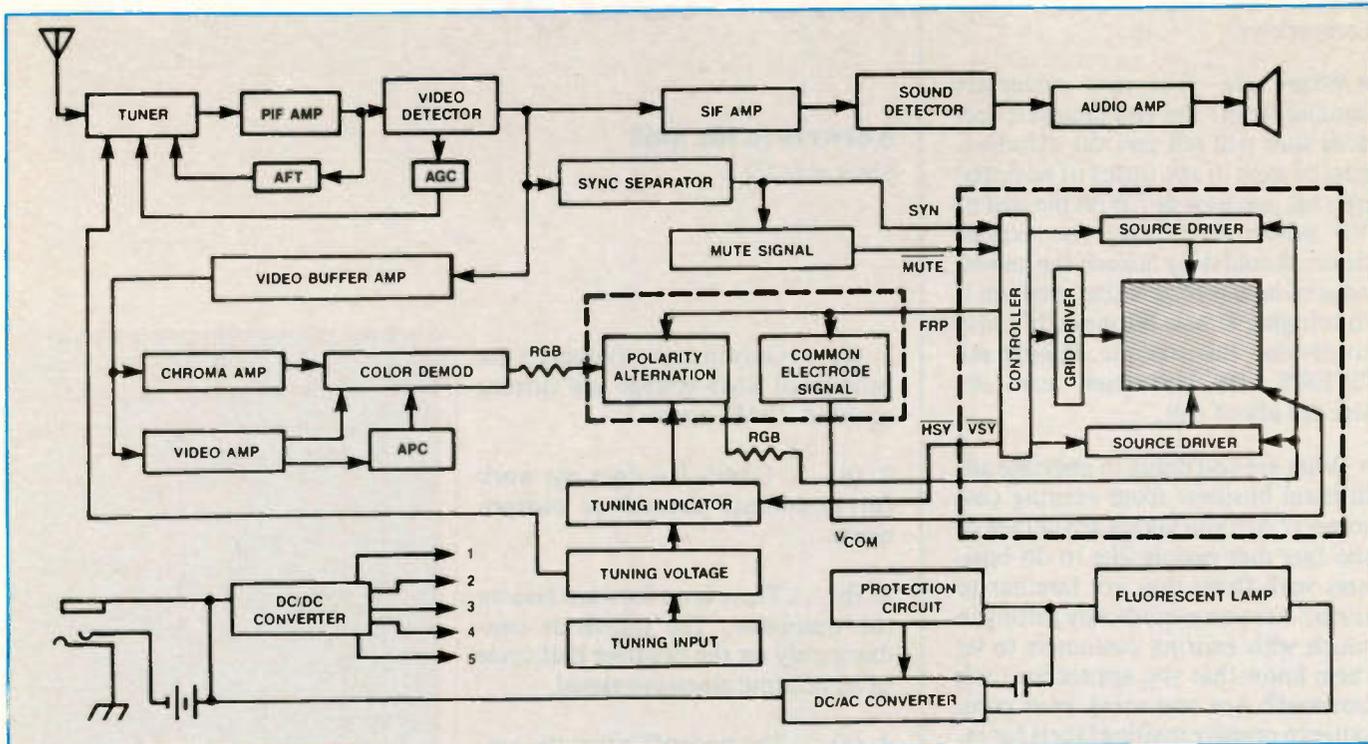


Figure 2. The block diagram of the LCD projection TV looks considerably different from that of a standard CRT based TV.
(Drawing courtesy Sharp)

here also for projection TV.

In fact Sharp makes a projection TV today, based on LCD technology, that rivals other projection TVs in terms of picture quality, but has the advantage of being relatively small in size and light in weight. Actually, to call it a TV is not quite correct. It has no internal tuner, and so is actually a monitor, and requires a signal source such as a TV tuner or a VCR. But it is so small and so lightweight that the average adult can pick it up and carry it around in one hand by the slide out handle. The picture can be varied in size using the zoom lens up to 100 inches diagonally. As it's likely that LCD technology, and probably LCD projection technology, will be used more extensively in the future, we'll present a little about it here. If readers find that this kind of information is useful, we'll publish some more detailed articles in the future.

The projection TV uses three of the same LCD panels as used in the 3-inch color TV. The important difference is that one panel is used for each primary color (red, green and blue). This projection "TV" is actu-

ally more correctly a monitor, as it does not have an internal tuner. It therefore does not require the 35V tuner voltage.

The individual LCD panels in the LCD projection unit do not have built-in color filters as in the 3-inch TV. Instead, dichroic filters are used to divide white light (in the case of the Sharp projection unit, halide lamp light) into three primary colors: red, green and blue. Each LCD panel

modulates one of these colors. The three color images are recombined at the zoom lens assembly, and projected onto a screen. The image size may be enlarged up to 100 inches diagonally. The red and green LCD modules are identical and interchangeable. The blue LCD module is unique.

Figure 1 illustrates the path of the light through the optical path. Figure 2 is the overall block diagram of the LCD TV. ■

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tions can you take to become more competitive?

- Where are your new customers coming from? Do you maintain records that will tell you the effectiveness of each of the forms of advertising that you now do? With the cost of YP advertising today, no service dealer should deny himself the knowledge of how effective that medium is in bringing in new business. It's easy to develop this statistic. Simply ask EVERY new customer how she learned about you.

- What are you doing to generate additional business from existing customers? Are you taking advantage of the fact that people like to do business with firms that are familiar to them? Are you periodically getting in touch with existing customers to let them know that you appreciate their business? Are you using your computer to prepare mailing labels for inexpensive direct mail promotions to existing customers?

- Is your pricing format a help or a hindrance to your marketing efforts?

- Are you taking advantage of such free or low-cost marketing techniques as community involvement, clean and brightly-painted service trucks, and cross-promotion with non-competing local companies?

- Finally, do you have an overall marketing plan with specific objectives and a diversified approach to spending your advertising dollars.

As I said earlier, each marketing audit must be tailored to suit the company's particular circumstances. Questions and topics will vary depending on the age and size of the business, the owner's short and long-term objectives and other considerations. In the main, however, the questions outlined above will provide the basis for an effective audit for most small electronics servicers.

I know that to some dealers this whole business will seem too much bother and much too theoretical. I hope you don't feel that way. A practical, carefully thought out marketing plan is one of the surest roads I know to success for service dealers. ■

Test your electronics knowledge

Answers to the quiz

(from page 53)

1. (c) . . . Only in audio systems is the product of RMS voltage and current equal to "RMS power."

2. (d) . . . Ohm's law does not work for non-linear circuits or components.

3. (b) . . . There is no forward bias on the transistor. The transistor conducts only on the negative half cycle of an ac input sinewave signal.

4. (a) . . . The tradeoff is that the output DC voltage is lower for a choke-input filter when compared with a capacitor-input filter connected to the same rectifier output.

5. $I = 16.38$ milliamperes . . . For the 330-ohm resistor the lowest allowable value for the 5% resistor is:

$$330 - (0.05)(330) = 313.5\Omega.$$

For the 10% resistor it is:

$$330 - (0.1)(330) = 297\Omega.$$

Adding those values gives 610.5Ω . Then, by ohm's law: $I = V/R = 10/610.5 = 16.38$ milliamperes.

6. The equations and solutions are given here:

$$V_1 = V[C_2/(C_1 + C_2)] = 10[30/(20 + 30)] = 6V$$

$$V_2 = V[C_1/(C_1 + C_2)] = 10[20/(20 + 30)] = 4V$$

Note that the higher voltage is across the lower capacitance value.

7. Line 21 is used for a hearing-impaired signal.

8. The curve is correct, so the LED is OK. ■

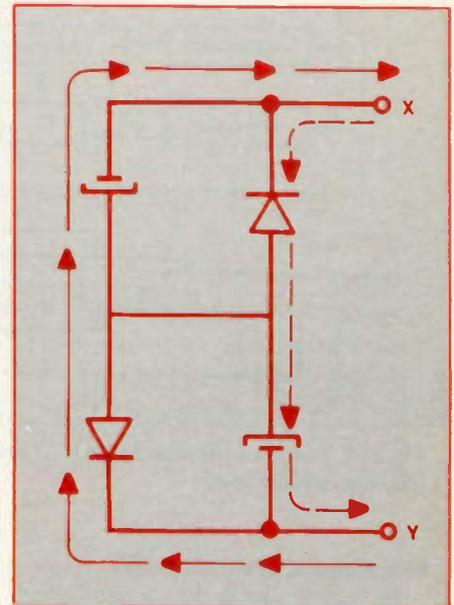


Figure F.

9. (a) . . . Figure F shows electron flow for two half-cycles of sinewave ac voltage across the circuit. Note that one of the capacitors is charged during each half cycle.

10. (b) . . . Varactor is an acronym for voltage variable capacitor. It has also been called a varicap. It is used in modern VCO circuits. Back in the old days - when Hector was a pup - a reactance tube was used for the same purpose - that is, to control the oscillator frequency.

11. (c) . . . (this information was obtained from an article by Robert G. Middleton.) Christie was the first to use the circuit. Wheatstone gave full credit to Christie when he did his work on the circuit 10 years later. ■

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