

THE MAGAZINE FOR CONSUMER ELECTRONICS SERVICING PROFESSIONALS

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Servicing & Technology

MARCH 1990/\$3

Product directory • Services directory • Mailing Addresses

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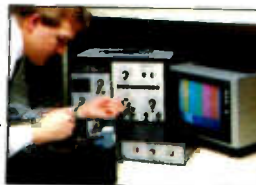
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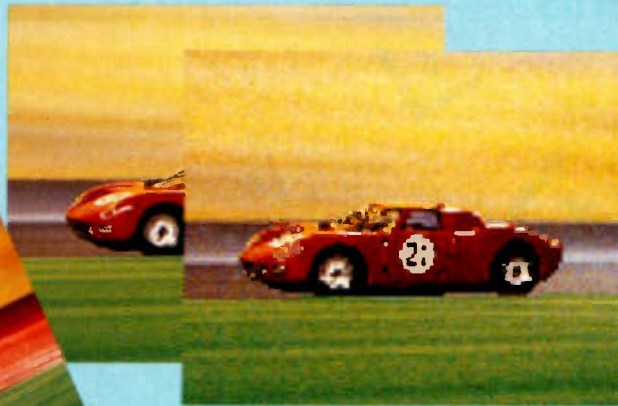
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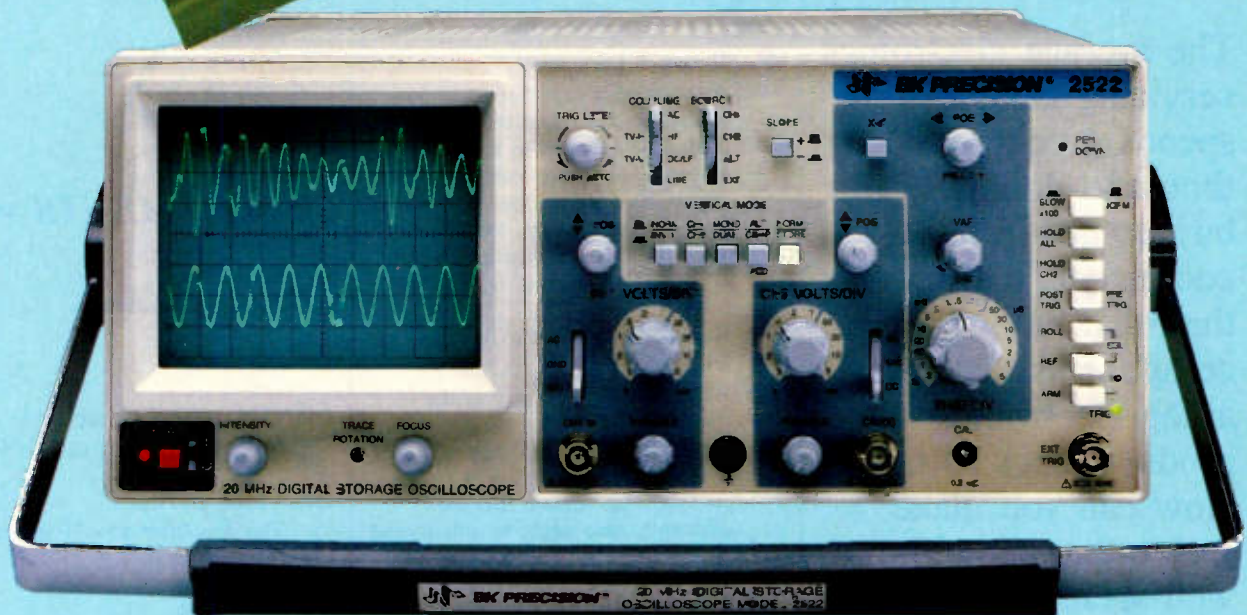


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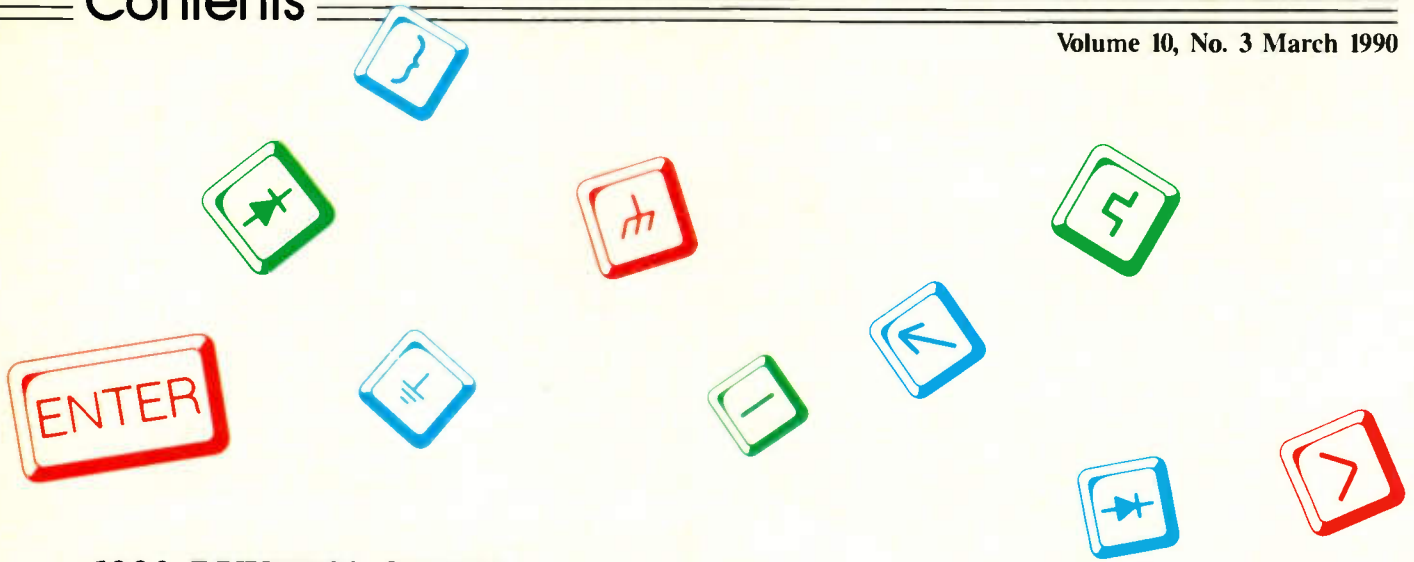
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1990 BUYERS' GUIDE

The average electronics servicing facility spends a couple of thousand dollars a year buying new test equipment, and more than that buying the components that bring ailing electronics products back to life. How can you make sure every penny is well-spent? By doing your homework — contact several companies, compare costs, compare features and service. This fourth annual Buyers' Guide is designed to help you locate the services you'll need in the next year faster and easier, with just one source of reference.

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- 9 Product Directory**
As new technology becomes more complicated, so does the test equipment required to keep new technologies up and running. If you simply have to have the newest gizmo on the market, we'll bring the marketplace to you in this part of the Buyers' Guide.
- 37 Replacement Parts/Components Directory**
What's the toughest part of the servicer's job? Fixing the product? That's the easy part. The tough part is finding the right parts to fix the product. This section lists the companies that might be able to end your search.
- 44 Software/Services Directory**
Maybe you don't actually need to buy anything. You just want to rent some equipment or get your test equipment recalibrated. Step right up to the services section. Here's where you'll find companies to do specialty rework or repair, consulting and calibration.
- 44 Association/Educational Sources Directory**
Trying to keep on top of new technology? Or maybe you just want to share some experiences with others who know the trials and tribulations of electronics servicing. This section puts you in contact with people who can help you find your way around the servicing industry.
- 45 Company Mailing Addresses**
Now turn to the addresses section of the Buyers' Guide. The products or services you need are now just a phone call away.

DEPARTMENTS

- 6 Editorial**
Home Automation
- 27 Profax**
- 54 Computer Corner**
"Where Do I Plug in This Cable?"
- 56 Video Corner**
The Amplifier as a Troubleshooting Aid — Part II
- 57 Feedback**
- 58 Audio Corner**
Solving RFI Complaints — Part II
- 60 Advertisers' Index**

ON THE COVER

Some terms have a crossover in other fields that is especially apt — for example, a computer "menu" of functions. The Buyers' Guide isn't yet offered as a computer menu that lets you press key number 1 to order a diode or capacitor. (in the future — who knows?) However, the 1990 Buyers' Guide "product menu" can certainly offer some specials you might want to order in 1990. (Graphic design by Barbara Miles)

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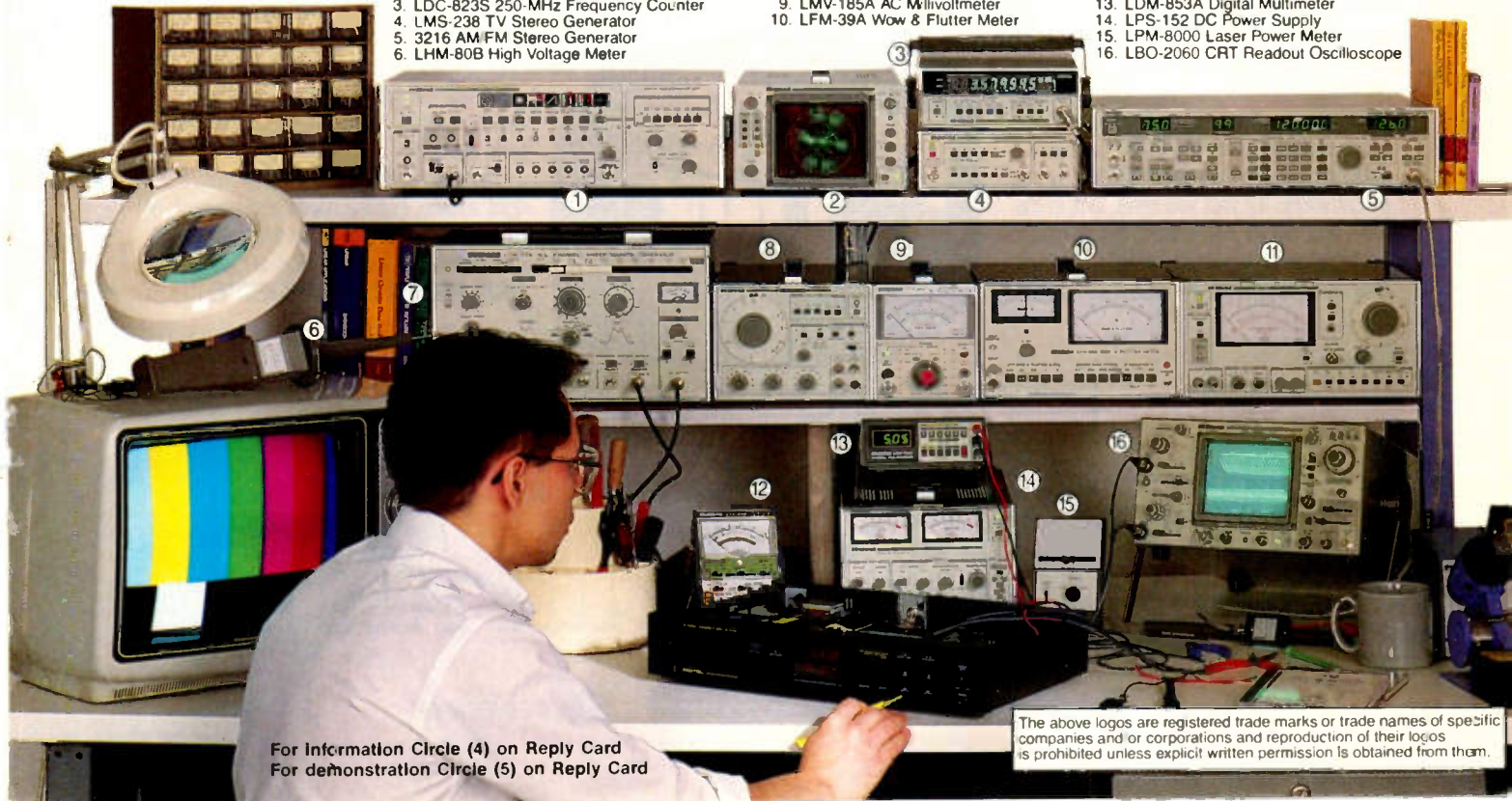
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Home automation

Home automation is the latest buzzword in the consumer electronics business. It's "the integration of home appliances through centralized and/or distributed intelligence," according to a spokesman for the Electronic Industries Association Consumer Electronics Group (EIA/CEG).

As an example of what home automation might one day mean to consumers, it may eventually be possible to call your home and turn on your VCR to record a TV program. Or you might be able to program your clothes washer and dishwasher to operate during the nighttime hours when electricity is less expensive. Not only that, but your dishwasher might be able to communicate with the hot water heater to make sure the water is hot enough before it turns on.

When you're first confronted with this extension of technology, it seems as if maybe it's overkill. Who needs to have their appliances talking to one another? On the other hand, if you consider the changes in home electrical and electronics technology that have taken place in just the past century, the advances represent a degree of change that not even the most prescient observer could have predicted.

A scant 100 years ago, electric power was introduced, and then only for two applications: lighting and traction engines. Electricity was a marvel, but no one could conceive of homes full of the electrical servants we enjoy today. Lighting at that time was produced by oil, gas or candles. Keeping food cool was accomplished by using ice that nature created during the winter months. Heating was managed manually, with wood or coal as the fuel, in fireplaces, stoves or primitive central heating units. Everything was mechanical and manually powered: clocks, drills, saws. There were no vacuum cleaners, radios, TVs, VCRs, video games, personal computers.

Considering the almost incomprehensible growth and development of electrical and electronic products in what amounts to just a few years, the development of a technology that allows them to communicate with each other seems a small step, one that's almost inevitable

and makes you wonder why it wasn't developed sooner.

The nature of home automation might take one of several forms. One possibility is a central unit from which you could program all of the appliances. An alternative is a distributed system with intelligence at each appliance. An engineering standard for one approach to home automation, called CEBus (*consumer electronics bus*), was announced at this year's winter Consumer Electronics Show.

There are a number of ways in which such a system would benefit consumers and help to justify the added cost of such a system:

- Energy cost savings would accrue by affording finer control of home heating and allowing the homeowner to keep the hot water heater at lower temperatures.
- Security could be enhanced by allowing the homeowner to monitor the front door through the TV or program the lights to go on and off when no one is in the house.
- Convenience could be enhanced through a battery-operated clock that could automatically reset all of the digital clocks in the home, including those in appliances.

Here is a technology that consumer electronics servicing companies might want to keep track of. The opportunities of servicing the technology seem great. Consumer electronics products that break down provide a lot of opportunity for servicing technicians. Consumer products with some degree of intelligence that are interlinked through some kind of network present a degree of complexity that may provide a great deal of opportunity for service organizations that want to install, service and even counsel consumers in the use of these systems.

This opportunity is not without pitfalls. Soon many consumer electronics complaints may be caused simply by a failure to communicate. When that happens, the problems servicers face will be compounded: Is the problem in appliance A, appliance B, the software, or is it the communications path? When this type of problem occurs, it may take some uncommon diagnostic procedures to get to the root of the problem.

This magazine will be providing increased coverage of home automation as developments are announced.

Nils Conrad Persson

THE MAGAZINE FOR CONSUMER ELECTRONICS SERVICING PROFESSIONALS

ELECTRONIC

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- DC current • Resistance • Diode test • 300 hrs. battery life
- Overload protection: DC-500V, AC-350V, ohms - 250V DC/AC

Model
DVM-630
Reg. \$50.00

\$32⁵⁰



SCOPE Hand-Held 3 1/2 Digit LCR Meter

- Measure capacitance, resistance and inductance • Overload protection • Includes test leads, test clips, 9V battery and spare fuse

Model
LCR-680

\$129⁹⁵



SCOPE Pocket Size Audio Signal Generator

- Sine/square wave patterns • 20Hz to 150 KHz • Battery operated
- Frequency accuracy ±3% (or less)
- Output 1.2V rms max. (no load)
- Low battery indicator • Test leads & 9V battery included

Model
RC-555
Reg. \$69.95

\$64⁹⁵

DUAL TRACE OSCILLOSCOPES



A.W. SPERRY 20 MHz OSCILLOSCOPE

- Built-in component checker
- Z-axis input • Low power consumption • TV Video sync filter
- High-sensitivity XY mode
- Front panel trace rotator
- Includes 2 test probes

Model
620C

\$369⁹⁵

HITACHI 35 MHz OSCILLOSCOPE

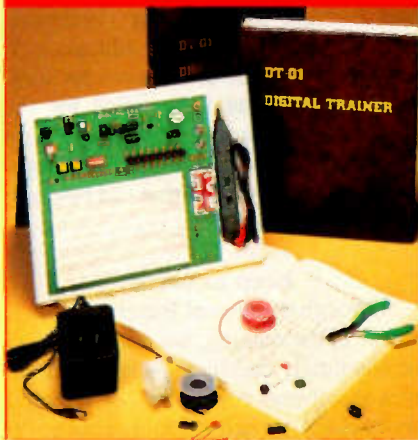
- 19 calibrated sweeps • 6" CRT with internal graticule, scale illumination & photographic bezel
- Auto focus • XY operation • TV sync separation
- Includes 2 probes (10:1 and 1:1)

Model
V-355
Reg. \$899.95

\$598⁰⁰



TRAINERS AND TOOLS



SCOPE DIGITAL TRAINER

- Learn logic circuits and equipment design • Connects to oscilloscopes, signal generators and more
- Logic probe included • Solderless breadboard and crib sheets help you build almost any circuit
- Runs off 4 "AA" batteries or AC adapter (included)

Model
DT-01

Reg. \$149.95

\$110⁰⁰

ATTACHE-STYLE TOOL CASE

- 53 individual tools • 31 interchangeable screwdriver/nutdriver blades and handles
- 2 specialty screwdriver/nutdriver sets and kits
- Removeable 3-panel, hinged pallet and tray
- Partitioned bottom compartment
- 19 1/2" x 13 1/2" x 6 3/4"

Model
TCM-100/ST

\$499⁹⁵



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Hauppauge, New York 11788



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Continental U.S.A.

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\$25-50	\$4.50
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\$101-200	\$7.00
\$201-300	\$8.00
\$301-400	\$9.00
\$401-500	\$10.00
\$501-750	\$12.50
\$751-1000	\$15.00
\$1,001-1,250	\$17.50
\$1,251-1,500	\$20.00
\$1,501-2000	\$25.00
\$2,001 and Up	\$30.00

Not too many years ago, determining which replacement component you 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 tube. It didn't matter who made the tube; the identification number was the same and the characteristics were the same. With the handful of manufacturers, it was no problem keeping track of addresses and phone numbers. You practically knew them by heart.

Today the unit being repaired might be a TV, VCR, camcorder or CD player, 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

somewhere in that stack of paperwork. Or maybe you would like to attend an electronics servicing seminar, but you have no idea who offers one. 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 pulled together in one place. No need to hang on to stacks of papers. Here's your one-source alternative.

If you want a multimeter, turn to the Product Directory and look up multimeters. Every company that responded to our questionnaire will be listed there, and every company's address will be listed in the Address Directory.

We've broken down this information into five categories:

- Product Directory page 9.
- Replacement Parts/

you this company distributes, not manufactures, that product.

You will notice that certain company names are in blue. Those companies have advertised in this issue. If you want to see the actual piece of equipment or read a detailed description, 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 on page 36 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 make your contact. The Company Address Directory lists information on approximately 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.

Keeping up with the Joneses

The Association/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 popping up or moving, and technology keeps adding new products to track. If you know a company the 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. ■

BUYERS' Guide



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 fourth 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. Don't forget to 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.

Using the Buyers' Guide

If you need to buy a new multimeter this year, you would probably know the names of some of the big multimeter manufacturers, and you might have some of those companies' addresses

Components Directory . . . page 37.

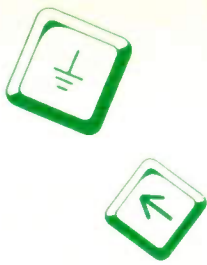
- Software/Services Directory page 44.
- Association/Educational Sources Directory page 44.
- Company Address Directory page 45.

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



Product directory



See Adv. Page

See Adv. Page

See Adv. Page

See Adv. Page

Test equipment

AC LEAKAGE TESTERS

Accutest Instruments*D
 AEMC Corp.
 Amprobe Instrument
 CG Instruments Inc.
Consolidated Electronics, Inc.*D 56
 Electronic Parts Supply*D
Fordham Radio Supply Co.*D 7
 GC Electronics Div. of GC Thorsen Co.
 GMB/dba Fox International*D
 The Instrument Mart, Inc.*D
 Kelvin Electronics*D
 Kikusui International Corp.
 Kyoritsu Electrical Instruments Works, Ltd.
 MCM Electronics*D
 Omega Engineering Inc.
 Omnitron Electronics*D
 Philips Consumer Electronics Service Co.*D
 RAG Electronics Inc.*D
Sencore Electronics IFC
 Simpson Electric Co.
 Specialized Products Co.*D
 TIF Instruments, Inc.
 Transcat*D

AUTOMATED TEST EQUIPMENT

Advanced Measurement Technologies
 Allied Electronics, A Div. of Hall-Mark Electronics*D
 Amprobe Instrument
 Analogic Corp.
 Anasco Corp.*D
 Anritsu Meter Co. of America
 BMI-Basic Measuring Instruments
 Brian Instruments, Inc.
 BTC Test & Measurement*D
 Colorado Data Systems
 CSTS Inc.
 Elgar Corp.
 EM Corp.
 Fiskars Electronics Corp. AC Power Div.
 John Fluke Mfg. Co. Inc.
 GenRad, Inc.
 Genstar Rental Electronics Inc.*D
 GlobeTech International, Inc.
 W.L. Gore & Associates, Inc.
 Heath Co.
 Hilevel Technology, Inc.
 Hy-Tronix Instruments, Inc.
 IET Labs, Inc.
 The Instrument Mart, Inc.*D
 Intelco Corp.
 Joseph Electronics*D
 KeyTek Instrument Corp.
 Kikusui International Corp.
Leader Instruments Corp. 3
 Markenrich Corp.
 Moody Tools, Inc.
 Omnitron Electronics*D
 Racal-Dana Instruments Inc.
 RNJ Electronics Inc.*D
 Schlumberger Instruments
Sencore Electronics IFC
 Soltec Corp.
 Spanta, Inc.
 A.W. Sperry Instruments, Inc.
 Tektronix, Inc.
 Temco Instruments Inc.
 3M/Photodyne Inc.
 TIF Instruments, Inc.
 Triplett Corp.
 Verite
 Wandel & Goltermann, Inc.

Wavetek Corp.

BREAKOUT BOXES

American Reliance Inc.
 Anasco Corp.*D
 A R Div. of Telenex Corp.
 Arrow Electronics Inc. Catalog Sales Div.*D
 Atrix, Inc.*D
 B&B Electronics Mfg., Co.
Beckman Industrial Corp. An Affiliate of Emerson Electric Co. 39,41
 Black Box Corp.*D
Consolidated Electronics, Inc.*D 56
 Contact East, Inc.*D
 Convex Corp.
 Datacom Technologies, Inc.
 Datatran Corp.
 Electro Standards Lab, Inc. Data Communications Products Div.
 Electronic Parts Supply*D
Fordham Radio Supply Co.*D 7
 GC Electronics Div. of GC Thorsen Co.
 Hall-ComSec, Inc.
 HMC-Hub Material Co.*D
 International Data Sciences
 IQ Technologies, Inc.
 JDR Micro*D
 W.S. Jenks & Son*D
 Jensen Tools Inc.*D
 Joseph Electronics*D
 Kelvin Electronics*D
 Kobetron Inc.
 L-Com Inc.
 Marconi Instruments
 MCM Electronics*D
 MetraByte Corp.
 Milo Associates, Inc.*D
 M-Test Equipment
 P.K. Neuses Inc.*D
 Nu-Data Inc.
 Omnitron Electronics*D
 ORA Electronics
Parts Express International Inc.*D 51
 Patton Electronics Co.
 RAG Electronics Inc.*D
 RNJ Electronics Inc.*D
 Scooter Products Ohm Electrics, Inc.*D
 Specialized Products Co.*D
Techni-Tool Inc.*D 19
 Tektronix Communications Network Analyzers Div.
 Transcat*D
 Tucker Electronics Co.*D
 Wandel & Goltermann, Inc.

CELLULAR TELEPHONE TEST EQUIPMENT

Allied Electronics, A Div. of Hall-Mark Electronics*D
Consolidated Electronics, Inc.*D 56
 Direct Conversion Technique, Inc.
 The Instrument Mart, Inc.*D
 Marconi Instruments
 Omnitron Electronics*D
 Rapid Systems
 RNJ Electronics Inc.*D
 Sony Service Co.

CONTINUITY TESTERS

Accutest Instruments*D
 AEMC Corp.
 Atrix, Inc.*D
Beckman Industrial Corp. An Affiliate of Emerson Electric Co. 39,41

B&K-Precision Maxtec International Corp. 1
 The Boardworks
 Brunelle Instruments Inc.
Consolidated Electronics, Inc.*D 56
 Contact East, Inc.*D
 CSTS Inc.
 Desco Industries
 EDS, Inc.
 Electronic Design Specialists
 Electronic Parts Supply*D
 Electronics Warehouse Corp.*D
 EMCO Electronics
Fordham Radio Supply Co.*D 7
 GC Electronics Div. of GC Thorsen Co.
 GenRad, Inc.
 HMC-Hub Material Co.*D
 Itera/Belmoor*D
 JDR Micro*D
 W.S. Jenks & Son*D
 Jensen Tools Inc.*D
 Joseph Electronics*D
 Kelvin Electronics*D
 Klein Tools, Inc.
 Kyoritsu Electrical Instruments Works, Ltd.
 L-Com Inc.
 Lii' Bitty Tester, Inc.
 MCM Electronics*D
 Microtest, Inc.
 Milo Associates, Inc.*D
 Miltex Supply Corp.*D
 Nu-Data Inc.
 Omega Engineering Inc.
 Omnitron Electronics*D
 Patton Electronics Co.
 RNJ Electronics Inc.*D
 Salen Enterprises*D
 Scooter Products Ohm Electrics, Inc.*D
 Simpson Electric Co.
 Specialized Products Co.*D
 Speco Div.
 A.W. Sperry Instruments, Inc.
Techni-Tool Inc.*D 19
 TIF Instruments, Inc.
 Tool Kit Specialists, Inc.*D
 Tool-Tronics, Inc.*D
 Universal Enterprises
Vaco Products 21
 Yokogawa Corp. of America

CRT TESTERS/RESTORERS

Accutest Instruments*D
 Bursma Electronic Distributing*D
Consolidated Electronics, Inc.*D 56
 Dandy Mfg. Co.
 Electronic Parts Supply*D
 Electronics Warehouse Corp.*D
Fordham Radio Supply Co.*D 7
 GMB/dba Fox International*D
 HMC-Hub Material Co.*D
 The Instrument Mart, Inc.*D
 Itera/Belmoor*D
 W.S. Jenks & Son*D
 Joseph Electronics*D
 Kelvin Electronics*D
 MCM Electronics*D
 Omnitron Electronics*D
 Philips Consumer Electronics Service Co.*D
 RAG Electronics Inc.*D
 RNJ Electronics Inc.*D
Sencore Electronics IFC
 Sony Service Co.
Techni-Tool Inc.*D 19

CURVE TRACERS

Accutest Instruments*D

Allied Electronics, A Div. of Hall-Mark Electronics*D
 Brunelle Instruments Inc.
 Bursma Electronic Distributing*D
Consolidated Electronics, Inc.*D 56
 Electronic Parts Supply*D
 Electronics Warehouse Corp.*D
 IET Labs, Inc.
 The Instrument Mart, Inc.*D
 Joseph Electronics*D
 Kelvin Electronics*D
Leader Instruments Corp. 3
 Lectronic Research Labs*D
 Omnitron Electronics*D
 Performance Technologies
 RAG Electronics Inc.*D
 RNJ Electronics Inc.*D
 Tektronix, Inc.
 Tucker Electronics Co.*D

DATA COMMUNICATION ANALYZERS/MONITORS/TESTERS

Accutest Instruments*D
 Advanced Measurement Technologies
 A R Div. of Telenex Corp.
 Arium Corp.
 Atrix, Inc.*D
 B&B Electronics Mfg., Co.
 Black Box Corp.*D
 Colorado Data Systems
 Contact East, Inc.*D
 Convex Corp.
 Datacom Technologies, Inc.
 Datatran Corp.
 Digitech Industries Inc.
 Direct Conversion Technique, Inc.
 Electro Standards Lab, Inc. Data Communications Products Div.
 Frederick Engineering, Inc.
 Genstar Rental Electronics Inc.*D
 HMC-Hub Material Co.*D
 International Data Sciences
 IQ Technologies, Inc.
 JDR Micro*D
 W.S. Jenks & Son*D
 Jensen Tools Inc.*D
 Joseph Electronics*D
 Kobetron Inc.
 MCM Electronics*D
 MetraByte Corp.
 Micromax Corp.
 Microtest, Inc.
 M-Test Equipment
 Nu-Data Inc.
 Omnitron Electronics*D
 Patton Electronics Co.
 RAG Electronics Inc.*D
 Solomat Instrumentation
 Soltec Corp.
 Sony Service Co.
 Specialized Products Co.*D
Techni-Tool Inc.*D 19
 Tekelec
 Tektronix Communications Network Analyzers Div.
 Tektronix, Inc.
 Telecommunications Techniques Corp.
 3M/Photodyne Inc.
 Wandel & Goltermann, Inc.

DISC DRIVE ANALYZERS/TESTERS

Analogic Corp.
 Applied Memory Technology
 Arium Corp.
 AVA Instrumentation, Inc.
 Brian Instruments, Inc.
 Computer Doctors
 Contact East, Inc.*D
 Data Tech Reliance, Inc.

Product directory

See Adv. Page	See Adv. Page	See Adv. Page	See Adv. Page
HMC-Hub Material Co.*D JDR Micro*D W.S. Jenks & Son*D Jensen Tools Inc.*D Kenwood U.S.A. Corp. IBC Kobetron Inc. Omnitron Electronics*D Philips Consumer Electronics Service Co.*D Pioneer Research RAG Electronics Inc.*D Sony Service Co. Specialized Products Co.*D Windsor Technologies, Inc.	Philips Consumer Electronics Service Co.*D Racal-Dana Instruments Inc. RAG Electronics Inc.*D Ramsey Electronics Inc. Rapid Systems RNJ Electronics Inc.*D Salen Enterprises*D Scooter Products Ohm Electrics, Inc.*D Sencore Electronics IFC Sibex Inc. Simpson Electric Co. Spanta, Inc. Specialized Products Co.*D A.W. Sperry Instruments, Inc. Techni-Tool Inc.*D 19 Tool Kit Specialists, Inc.*D Transcat*D Triplett Corp. Tucker Electronics Co.*D VIZ Test Equipment Div. of Kappa Networks Inc.	GAUGES: HEAD PROTRUSION/SPRING TENSION/STYLUS FORCE/OTHER Accutest Instruments*D Electronics Warehouse Corp.*D HMC-Hub Material Co.*D Hunter Associates Jonard Industries Corp. Moody Tools, Inc. P.K. Neuses Inc.*D Omnitron Electronics*D Philips Consumer Electronics Service Co.*D Techni-Tool Inc.*D 19 Tentel Corp. TIF Instruments, Inc.	HSC Electronic Supply*D The Instrument Mart, Inc.*D JDR Micro*D W.S. Jenks & Son*D Jensen Tools Inc.*D Joseph Electronics*D Kelvin Electronics*D Kikusui International Corp. Leader Instruments Corp. 3 Lectronic Research Labs*D Marconi Instruments MarKenrich Corp. MCM Electronics*D Milo Associates, Inc.*D NCM Electronics Omnitron Electronics*D Orion Instruments, Inc. Power-Science Industries RAG Electronics Inc.*D Ramsey Electronics Inc. RNJ Electronics Inc.*D Rochester Instruments Systems Scooter Products Ohm Electrics, Inc.*D Sencore Electronics IFC Sibex Inc. Specialized Products Co.*D Techni-Tool Inc.*D 19 Teledata Systems 3M/Photodyne Inc. Tucker Electronics Co.*D VIZ Test Equipment Div. of Kappa Networks Inc. Wandel & Goltermann, Inc. Wavetek Corp.
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RICK BRUSH,
NRI PROGRAMMER/ANALYST

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READ this for all RCA & GE TV, VCR and audio models using remote

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Title _____

Firm _____

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See Adv. Page	See Adv. Page	See Adv. Page	See Adv. Page
Electronic Parts Supply* Electronics Warehouse Corp.* Extech Instruments Corp. GenRad, Inc. Genstar Rental Electronics Inc.* GMB/dba Fox International* HMC-Hub Material Co.* HSC Electronic Supply* The Instrument Mart, Inc.* W.S. Jenks & Son* OmniTron Electronics* Pacer Industries, Inc. Philips Consumer Electronics Service Co.* RAG Electronics Inc.* RNJ Electronics Inc.* Simpson Electric Co. Speco Div. Techni-Tool Inc.* 19 Transcat* Yokogawa Corp. of America	Start International* Tegam, Inc. TEP, Inc. TIF Instruments, Inc. Tool Kit Specialists, Inc.* Tool-Tronics, Inc.* Transcat* Triplett Corp. Tucker Electronics Co.* Universal Enterprises VIZ Test Equipment Div. of Kappa Networks Inc. Wavetek Corp. WestCon Div. of Sycon Corp. Yokogawa Corp. of America	Fordham Radio Supply Co.* 7 GC Electronics Div. of GC Thorsen Co. Genstar Rental Electronics Inc.* GoldStar Precision Co. Ltd. 23 Hameg, Inc. Heath Co. 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.* Joseph Electronics* Kelvin Electronics* Kenwood U.S.A. Corp. IBC Kyoritsu Electrical Instruments Works, Ltd. Leader Instruments Corp. 3 Lelectronic Research Labs* MCM Electronics* Mercer Electronics MetaByte Corp. Milo Associates, Inc.* Mouser Electronics* P.K. Neuses Inc.* Omega Engineering Inc. OmniTron Electronics* Philips Consumer Electronics Service Co.* Phillips ECG PrimeLine A Div. of Soltec Corp. Racal-Dana Instruments Inc. RAG Electronics Inc.* RNJ Electronics Inc.* Salen Enterprises* Schlumberger Instruments Scooter Products Ohm Electrics, Inc.* Sencore Electronics IFC Soltec Corp. Specialized Products Co.* Speco Div. Solder Absorbing Technology, Inc. Specialized Products Co.* Speco Div. A.W. Sperry Instruments, Inc. Start International* Techni-Tool Inc.* 19 Tegam, Inc. Tektronix, Inc. TIF Instruments, Inc. Tool Kit Specialists, Inc.* Tool-Tronics, Inc.* Transcat* Triplett Corp. Tucker Electronics Co.* Universal Enterprises VIZ Test Equipment Div. of Kappa Networks Inc. Yokogawa Corp. of America	Global Specialties A Div. of Interplex GMB/dba Fox International* GoldStar Precision Co. Ltd. 23 Gould Inc. Test & Measurement Group Hameg, Inc. Heath Co. 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.* Joseph Electronics* Kelvin Electronics* Kenwood U.S.A. Corp. IBC Kikusui International Corp. Leader Instruments Corp. 3 Lelectronic Research Labs* M.A.T. Electronics* 60 MCM Electronics* MetaByte Corp. Milo Associates, Inc.* Mouser Electronics* Nicolet Test Instruments OmniTron Electronics* Orion Instruments, Inc. Philips Consumer Electronics Service Co.* PrimeLine A Div. of Soltec Corp. RAG Electronics Inc.* Rapid Systems RNJ Electronics Inc.* Salen Enterprises* Scooter Products Ohm Electrics, Inc.* Sencore Electronics IFC Soltec Corp. Specialized Products Co.* Speco Div. A.W. Sperry Instruments, Inc. Techni-Tool Inc.* 19 Tektronix, Inc. Tool Kit Specialists, Inc.* Transcat* Tucker Electronics Co.*
METERS, VOLTMETERS, AC	METERS, WOW AND FLUTTER		
ABB Metrawatt Inc. Accutest Instruments* AEMC Corp. Allied Electronics, A Div. of Hall-Mark Electronics* Amprobe Instrument Analogic Corp. Anasco Corp.* Atrix, Inc.* Ballantine Labs, Inc. Beckman Industrial Corp. An Affiliate of Emerson Electric Co. 39,41 Biddle Instruments B&K-Precision Maxtec International Corp. 1 Bursma Electronic Distributing* CG Instruments Inc. Classic Components Supply Inc.* Com-Kyl Inc.* Consolidated Electronics, Inc.* 56 Contact East, Inc.* Cooper Associates* Electro-Tech Systems, Inc. Electronic Parts Supply* Electronics Warehouse Corp.* EMCO Electronics Esterline Angus Instrument Corp. Extech Instruments Corp. John Fluke Mfg. Co. Inc. Fordham Radio Supply Co.* 7 GMB/dba Fox International* GoldStar Precision Co. Ltd. 23 Hameg, Inc. 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.* Joseph Electronics* Kelvin Electronics* Kenwood U.S.A. Corp. IBC Kikusui International Corp. Kyoritsu Electrical Instruments Works, Ltd. Leader Instruments Corp. 3 Lelectronic Research Labs* M.A.T. Electronics* 60 MCM Electronics* MetaByte Corp. Milo Associates, Inc.* Mouser Electronics* Nu-Data Inc. Omega Engineering Inc. OmniTron Electronics* Pacer Industries, Inc. Philips Consumer Electronics Service Co.* RAG Electronics Inc.* RNJ Electronics Inc.* Scooter Products Ohm Electrics, Inc.* Sencore Electronics IFC Simpson Electric Co. Specialized Products Co.* Speco Div. A.W. Sperry Instruments, Inc.	ABB Metrawatt Inc. Accutest Instruments* Consolidated Electronics, Inc.* 56 Electronic Parts Supply* Electronics Warehouse Corp.* The Instrument Mart, Inc.* W.S. Jenks & Son* Joseph Electronics* Kenwood U.S.A. Corp. IBC Kikusui International Corp. Leader Instruments Corp. 3 OmniTron Electronics* Philips Consumer Electronics Service Co.* RAG Electronics Inc.* RNJ Electronics Inc.* Tucker Electronics Co.*		
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See Adv. Page

See Adv. Page

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See Adv. Page

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Atrix, Inc.*D
Consolidated Electronics, Inc.*D 56
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HMC-Hub Material Co.*D
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Jensen Tools Inc.*D
Joseph Electronics*D
Kobetron Inc.
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MCM Electronics*D
Milo Associates, Inc.*D
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Omnitron Electronics*D
Techni-Tool Inc.*D 19
3M/Electronic Products Div.
Transcat*D
Vaco Products 21
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Penntek Instruments
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Ramsey Electronics Inc.
Rapid Systems
Schlumberger Instruments
Techni-Tool Inc.*D 19
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Tucker Electronics Co.*D
Wandel & Goltermann, Inc.

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B&K-Precision Maxtec International Corp. 1
Bursma Electronic Distributing*D
Consolidated Electronics, Inc.*D 56
Contact East, Inc.*D
Datacom Technologies, Inc.
Digitech Industries Inc.
EDS, Inc.
Electronic Design Specialists
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
HMC-Hub Material Co.*D
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Nu-Data Inc.
Omnitron Electronics*D
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RNJ Electronics Inc.*D
Simpson Electric Co.
Specialized Products Co.*D
Techni-Tool Inc.*D 19
Tektronix Communications Network Analyzers Div.
Telecommunications Techniques Corp.
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3M/Electrical Products Div.
Triplet Corp.

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Bursma Electronic Distributing*D
CG Instruments Inc.
Consolidated Electronics, Inc.*D 56
Cooper Associates*D
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Extech Instruments Corp.
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
Joseph Electronics*D
Kelvin Electronics*D
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Bursma Electronic Distributing*D
Consolidated Electronics, Inc.*D 56
Cooper Associates*D
C&S Sales*D
EDS, Inc.
Electronic Design Specialists
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Elenco Electronics, Inc.
Hameg, Inc.
HMC-Hub Material Co.*D
HSC Electronic Supply*D
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IET Labs, Inc.
The Instrument Mart, Inc.*D
JDR Micro*D
W.S. Jenks & Son*D
Jensen Tools Inc.*D
Kelvin Electronics*D
Kobetron Inc.
Kyoritsu Electrical Instruments Works, Ltd.
Leader Instruments Corp. 3
Lil' Bitty Tester, Inc.
MCM Electronics*D
Milo Associates, Inc.*D
Mouser Electronics*D
Omnitron Electronics*D
Philips Consumer Electronics Service Co.*D
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Sencore Electronics IFC
Speco Div.

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Hitachi Denshi America, Ltd.
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Kelvin Electronics*D
Kenwood U.S.A. Corp. IBC
Leader Instruments Corp. 3
Lectronic Research Labs*D
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Electronics Warehouse Corp.*D
Fordham Radio Supply Co.*D 7
Gage Applied Sciences Inc.
Genstar Rental Electronics Inc.*D
Gould Inc. Test & Measurement Group
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Hi-Techniques Inc.
HSC Electronic Supply*D
The Instrument Mart, Inc.*D
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Joseph Electronics*D
Kelvin Electronics*D
Kenwood U.S.A. Corp. IBC
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
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Anasco Corp.*D
A R Div. of Telenex Corp.
Ballantine Labs, Inc.
Beckman Industrial Corp. An Affiliate of Emerson Electric Co. 39,41
Biddle Instruments
B&K-Precision Maxtec International Corp. 1
Black Box Corp.*D
Brunelle Instruments Inc.
BTC Test & Measurement*D
Colorado Data Systems
Computer Doctors
Computer Service Technology, Inc.
Consolidated Electronics, Inc.*D 56
Contact East, Inc.*D
Datacom Technologies, Inc.
Datel, Inc.
Delta Electronics, Inc.
Direct Conversion Technique, Inc.
EDS, Inc.
Electron Processing
Electronic Design Specialists
Electronics Warehouse Corp.*D
EM Corp.
Extech Instruments Corp.
Genstar Rental Electronics Inc.*D
Global Specialties A Div. of Interplex
GoldStar Precision Co. Ltd. 23
Hameg, Inc.
Heath Co.
Hilevel Technology, Inc.
HMC-Hub Material Co.*D
HSC Electronic Supply*D
Ideal Industries
IET Labs, Inc.
In-Circuit Test, Inc.
The Instrument Mart, Inc.*D
Intelco Corp.
JDR Micro*D
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Jensen Tools Inc.*D
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Joseph Electronics*D
Kelvin Electronics*D
Kenwood U.S.A. Corp. IBC
KeyTek Instrument Corp.
Klein Tools, Inc.
Kobetron Inc.

Product directory

See Adv. Page

Kyoritsu Electrical Instruments Works, Ltd.
 Kyros Corp.
Leader Instruments Corp.3
 Electronic Research Labs*^D
 Marconi Instruments
 MCM Electronics*^D
 Milo Associates, Inc.*^D
 Moody Tools, Inc.
 Mouser Electronics*^D
 M-Test Equipment
 Nu-Data Inc.
Nutronix Inc. 19
 Omnitron Electronics*^D
 Orion Instruments, Inc.
 Pacer Industries, Inc.
 Pacific Power Source
 Performance Technologies
 Philips Consumer Electronics Service Co.*^D
 Power-Science Industries
 PrimeLine A Div. of Soltec Corp.
 Racal-Dana Instruments Inc.
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Sencore ElectronicsIFC
 Simpson Electric Co.
 Soltec Corp.
 Spanta, Inc.
 Specialized Products Co.*^D
 Speco Div.
 A.W. Sperry Instruments, Inc.
 Static Control Services, Inc.
 Static Prevention Inc.
Techni-Tool Inc.*^D19
 Tegam, Inc.
 Tekelec
 Tektronix Communications Network Analyzers Div.
 Telecommunications Techniques Corp.
 Temco Instruments Inc.
 Temptronic Corp.
 Tentel Corp.
 3M/Electronic Products Div.
 3M/Electrical Products Div.
 3M/Photodyne Inc.
 Transcat*^D
 Triplett Corp.
 Tucker Electronics Co.*^D
 Universal Enterprises
Vaco Products 21
 Vector Electronics
 Verite
 VIZ Test Equipment Div. of Kappa Networks Inc.
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Test equipment accessories

AUDIO DUMMY LOADS

Electronic Parts Supply*^D
 Electronics Warehouse Corp.*^D
 Joseph Electronics*^D
Leader Instruments Corp. 3
 MCM Electronics*^D
 Omnitron Electronics*^D
Parts Express International Inc.*^D 51
 RAG Electronics Inc.*^D
Sencore ElectronicsIFC

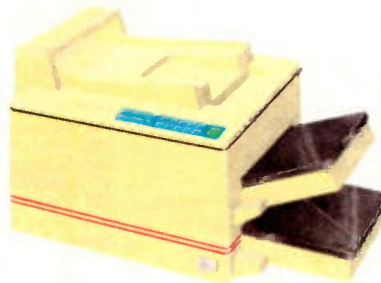
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 AEMC Corp.
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Company mailing addresses begin on page 45

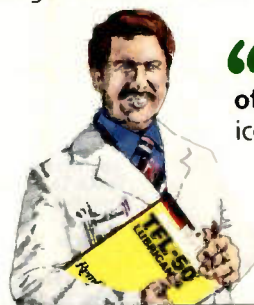
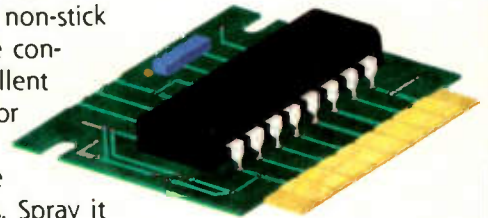
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March 1990 *Electronic Servicing & Technology* 17

See Adv. Page

See Adv. Page

Omnitron Electronics*
 Ostby-Barton Test Probes
 Pacer Industries, Inc.
**Parts Express International
 Inc.*D** 51
 Philips Consumer Electronics Service
 Co.*D
 Probe Master Inc.
 Racal-Dana Instruments Inc.
 RAG Electronics Inc.*D
 RNJ Electronics Inc.*D
Sencore Electronics IFC
 Simpson Electric Co.
 The Superior Electric Co.
Techni-Tool Inc.*D 19
 TeleMatic Div. of UXL Corp.
 Tentel Corp.
 TEP, Inc.
 Test Probes, Inc.
**Thomson Consumer
 Electronics, Inc. Distributor
 & Special Products***D**** 13
 3M/Electronic Products Div.
 3M/Electrical Products Div.
 3M/Photodyne Inc.
 TIF Instruments, Inc.
 Tool Kit Specialists, Inc.*D
 Triplett Corp.
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 Div.
Techni-Tool Inc.*D 19
 Transcat***D**
 Tycor International Inc.
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**Consolidated Electronics,
 Inc.*D** 56
 Contact East, Inc.***D**
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 Electronic Specialists, Inc.
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**Consolidated Electronics,
 Inc.*D** 56
 Contact East, Inc.***D**
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 Datatran Corp.
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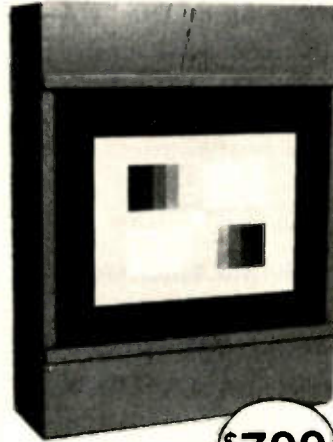
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 Joseph Electronics***D**
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 JDR Micro***D**
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See Adv. Page

See Adv. Page

See Adv. Page

See Adv. Page

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 Itera/Belmoor*
 JDR Micro*
 W.S. Jenks & Son*
 Joseph Electronics*
 Kalglo Electronics Co. Inc.
 Kobatron Inc.
 L-Com Inc.
M.A.T. Electronics* 60
 MCG Electronics, Inc.
 MCM Electronics*
 Mllo Associates, Inc.*
 Mouser Electronics*
 Nu-Data Inc.
 Omega Engineering Inc.
 Omnitron Electronics*
 Omnium Corp.
 ORA Electronics
 Panamax
 Para Systems
 PerfectData Corp.
 Perma Power Electronics, Inc.
 Philips ECG
 Plastic Systems, Inc.
 Power Distribution Inc.
 Power-Science Industries
 RAG Electronics Inc.*
 RNJ Electronics Inc.*
 Safe Power Systems Div. of Acme
 Electric Corp.
 Scooter Products Ohm Electrics,
 Inc.*
 SL Waber, Inc.
 Sola
 Specialized Products Co.*
 The Superior Electric Co.
 Support Systems International Cables
 & Accessories Div.
 Sutton Designs, Inc. Computer Power
 Div.
Techni-Tool Inc.* 19
**Thomson Consumer
 Electronics, Inc. Distributor
 & Special Products* 13**
 Thordarson/Meissner
 Transcat*
 Tripp-Lite
 Tritronics Inc.*
 Tycor International Inc.
 Verite
 Winders & Geist
**Zenith Sales Co. A Div. of
 Zenith Electronics Corp. BC**

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 Clary Corp.
 Classic Components Supply Inc.*
 Computer Power, Inc.
**Consolidated Electronics,
 Inc.* 56**
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 Cooper Associates*
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 General Power Corp.
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 HSC Electronic Supply*
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 JDR Micro*
 W.S. Jenks & Son*
 Joseph Electronics*
 Kalglo Electronics Co. Inc.
 L-Com Inc.
 Lowell Corp.*
 MCM Electronics*
 Milo Associates, Inc.*
 Omnitron Electronics*
 Pacific Power Source
 Panamax
 Para Systems

Performance Technologies
 Perma Power Electronics, Inc.
 Philtek Power Corp.
 Power-Science Industries
 RAG Electronics Inc.*
 Safe Power Systems Div. of Acme
 Electric Corp.
 Scooter Products Ohm Electrics,
 Inc.*
 SL Waber, Inc.
 Sola
 Specialized Products Co.*
 The Superior Electric Co.
 Sutton Designs, Inc. Computer Power
 Div.
Techni-Tool Inc.* 19
 Thordarson/Meissner
 Transcat*
 Tripp-Lite
 Tycor International Inc.
 Viteq Corp.

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 Arrow Electronics Inc. Catalog Sales
 Div.*
 BMI-Basic Measuring Instruments
 Classic Components Supply Inc.*
 Computer Power, Inc.
**Consolidated Electronics,
 Inc.* 56**
 Contact East, Inc.*
 Controlled Power Co.
 Cooper Associates*
 Electronic Parts Supply*
 Electronic Specialists, Inc.
 Electronics Warehouse Corp.*
 HMC-Hub Material Co.*
 Itera/Belmoor*
 JDR Micro*
 W.S. Jenks & Son*
 Jensen Tools Inc.*
 Joseph Electronics*
 Kalglo Electronics Co. Inc.
 Lectronic Research Labs*
 MCM Electronics*
 Milo Associates, Inc.*
 Omnitron Electronics*
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 Performance Technologies
 Perma Power Electronics, Inc.
 Power Distribution Inc.
 Power-Science Industries
 RAG Electronics Inc.*
 Salen Enterprises*
 Scooter Products Ohm Electrics,
 Inc.*
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 Sola
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 Tycor International Inc.
 Verite

Electrostatic discharge protection

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 Chemtronics Inc.
 Clean Room Products Inc.
 Com-Kyl Inc.*
**Consolidated Electronics,
 Inc.* 56**
 Contact East, Inc.*
 Cooper Associates*
 Davle Tech Inc.
 Dow Chemical USA
 Echelon Industries*
 Electronics Warehouse Corp.*
 GC Electronics Div. of GC Thorsen Co.
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 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* 60
 MCM Electronics*
 Micro Care Corp.
 Miller-Stephenson Chemical Co.
 Milo Associates, Inc.*
 Miltex Supply Corp.*
 P.K. Neuses Inc.*
 Omnitron Electronics*
 ORA Electronics
**Parts Express International
 Inc.* 51**
 Patlon Industries, Inc.
 PerfectData Corp.
 Philips Consumer Electronics Service
 Co.*
 Plastic Systems, Inc.
 Rawn Co., Inc.
ReaGrit Corp. 17
 Richmond Technology
 RNJ Electronics Inc.*
 Rogers Anti-Static Chemicals
 Semtronics Corp.
 The Simco Co., Inc.
 Start International*
 Static Prevention Inc.
 Statikil, Inc.
 Tech Spray, Inc.
Techni-Tool Inc.* 19
 The Twexico Co.
 Gregory Thomas, Inc.
**Thomson Consumer
 Electronics, Inc. Distributor
 & Special Products* 13**
 3M/Electrical Specialties
 Tool Kit Specialists, Inc.*
 Tool-Tronics, Inc.*
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 Ideal Industries
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 Melmat Inc.
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 P.K. Neuses Inc.*
 NRD Inc. Static Control Products
 Nu-Concept Systems, Inc.
 Oak Technical Inc.
 Omnitron Electronics*
 Omnium Corp.
 Partfolio, Inc.
**Parts Express International
 Inc.* 51**
 Patlon Industries, Inc.
 Philips Consumer Electronics Service
 Co.*
 Plastic Systems, Inc.
 Plato Products, Inc.
Prime Electronics Co.* 54
 The Rex Co.
 Richmond Technology
 RNJ Electronics Inc.*
 Scooter Products Ohm Electrics,
 Inc.*
 Seco Industries
 Semtronics Corp.
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 The Simco Co., Inc.
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 Start International*
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 Tech Spray, Inc.
Techni-Tool Inc.* 19
 Gregory Thomas, Inc.
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 Electronics, Inc. Distributor
 & Special Products* 13**
 3M/Electrical Specialties
 Tool Kit Specialists, Inc.*
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Product directory

See Adv. Page

See Adv. Page

Astec Co. Div. of Static Solutions Inc.
 Atrix, Inc.*D
 Charleswater Products, Inc.
 Colonial Glove & Garment Inc.
 Com-Kyl Inc.*D
 Contact East, Inc.*D
 C.H. Ellis Co., Inc.
 Highland Products, Inc.
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 Static Inc. A Sealed Air Co.
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Atrix, Inc.*D
 Battery Specialties*
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 Bursma Electronic Distributing*
 Classic Components Supply Inc.*
 Com-Kyl Inc.*
**Consolidated Electronics,
 Inc.*D** 56
 Contact East, Inc.*
 Davle Tech Inc.
 Electronic Parts Supply*
 Electronics Warehouse Corp.*
 GMB/dba Fox International*
 HMC-Hub Material Co.*
 HSC Electronic Supply*
 Itera/Belmoor*
 JDR Micro*
 W.S. Jenks & Son*
 Joseph Electronics*
 Kelvin Electronics*
Matsushita Services Co. 4 5
 MCM Electronics*
 Miltex Supply Corp.*
 Mouser Electronics*
 Omnitron Electronics*
**Parts Express International
 Inc.*D** 51
Prime Electronics Co.*D 54
 RNJ Electronics Inc.*
 Sanyo Energy Corp.
 Scooter Products Ohm Electric,
 Inc.*
 Sony Service Co. National Parts Div.*
 Specialized Products Co.*
 Speco Div.
 A.W. Sperry Instruments, Inc.
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 Monroe Electronics, Inc.
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 Omnitron Electronics*
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 Semtronics Corp.
 The Simco Co., Inc.
 Specialized Products Co.*
 Start International*
 Static Control Services, Inc.
 Static Inc. A Sealed Air Co.
 Static Prevention Inc.
 Statikil, Inc.
 Tech Spray, Inc.
Techni-Tool Inc.*D 19
 Gregory Thomas, Inc.
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 Clean Room Products Inc.
 Com-Kyl Inc.*
**Consolidated Electronics,
 Inc.*D** 56
 Contact East, Inc.*
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 HMC-Hub Material Co.*
 Isles Industries
 W.S. Jenks & Son*
 Joseph Electronics*
 Klein Tools, Inc.
 MCM Electronics*
 Mouser Electronics*
 Omnitron Electronics*
 Scooter Products Ohm Electric,
 Inc.*
 Specialized Products Co.*
Techni-Tool Inc.*D 19
 Tool Kit Specialists, Inc.*
 Video Midwest & AVC Divisions of
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 Chemtronics Inc.
 Com-Kyl Inc.*
**Consolidated Electronics,
 Inc.*D** 56
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 Cooper Associates*
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Supplies/accessories equipment

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See Adv. Page	See Adv. Page	See Adv. Page	See Adv. Page
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OmniTron Electronics* Parts Express International Inc.*D 51 Philips Consumer Electronics Service Co.* Philips ECG Planned Products Plato Products, Inc. Prime Electronics Co.*D 54 Rawn Co., Inc. RNJ Electronics Inc.* Scooter Products Ohm Electrics, Inc.* Solder Absorbing Technology, Inc. Solder Removal Co. Sony Service Co. National Parts Div.* Specialized Products Co.* Start International* Tech Spray, Inc. Techni-Tool Inc.*D 19	Thomson Consumer Electronics, Inc. Distributor & Special Products*D 13 3M/Electrical Products Div. Tool Kit Specialists, Inc.* Tool-Tronics, Inc.* Tritrronics Inc.* Ungar, Div. Eldon Industries, Inc. TUBING Allied Electronics, A Div. of Hall-Mark Electronics* Arrow Electronics Inc. Catalog Sales Div.* Bursma Electronic Distributing* Classic Components Supply Inc.* Consolidated Electronics, Inc.*D 56 Contact East, Inc.* Electronic Parts Supply* Electronics Warehouse Corp.* GMB/dba Fox International* HSC Electronic Supply* W.S. 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OmniTron Electronics* ORA Electronics Parts Express International Inc.*D 51 Philips Consumer Electronics Service Co.* Prime Electronics Co.*D 54 RNJ Electronics Inc.* Scooter Products Ohm Electrics, Inc.* SHOGYO International Corp. Support Systems International Cables & Accessories Div. Tappan Wire & Cable Thomson Consumer Electronics, Inc. Distributor & Special Products*D 13 3M/Electrical Products Div. Tritrronics Inc.* Video Midwest & AVC Divisions of Vaughn Communications* Winegard Co. Zenith Sales Co. A Div. of Zenith Electronics Corp. BC

See Adv. Page

See Adv. Page

See Adv. Page

See Adv. Page

Audio/video accessories

A/B SWITCHES

- All Electronics Corp.*D
- Allied Electronics, A Div. of Hall-Mark Electronics*D
- Ambico
- Atrix, Inc.*D
- Bursma Electronic Distributing*D
- Channel Master Div. of Avnet, Inc. **Consolidated Electronics, Inc.*D** 56
- Cooper Associates*D
- Electro Standards Lab, Inc. Data Communications Products Div.
- Electronic Parts Supply*D
- Electronics Warehouse Corp.*D
- GC Electronics Div. of GC Thorsen Co.
- GMB/dba Fox International*D
- HSC Electronic Supply*D
- International Components Corp.
- Itera/Belmoor*D
- JDR Micro*D
- Joseph Electronics*D
- Kelvin Electronics*D
- L-Com Inc.
- M.A.T. Electronics*D** 60
- MCM Electronics*D
- Milo Associates, Inc.*D
- Omega Engineering Inc.
- OmniTron Electronics*D
- ORA Electronics
- Parts Express International Inc.*D** 51
- Patton Electronics Co.
- Philips Consumer Electronics Service Co.*D
- Prime Electronics Co.*D** 54
- RNJ Electronics Inc.*D
- SHOGYO International Corp.
- Sony Service Co. National Parts Div.*D
- Support Systems International Cables & Accessories Div.
- Tritronics Inc.*D
- Video Midwest & AVC Divisions of Vaughn Communications*D
- Winegard Co.
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COUPLERS/SPLITTERS

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- Allied Electronics, A Div. of Hall-Mark Electronics*D
- Bursma Electronic Distributing*D
- Channel Master Div. of Avnet, Inc. **Consolidated Electronics, Inc.*D** 56
- Cooper Associates*D
- Electro Standards Lab, Inc. Data Communications Products Div.
- Electron Processing
- Electronic Parts Supply*D
- Electronics Warehouse Corp.*D
- GC Electronics Div. of GC Thorsen Co.
- GMB/dba Fox International*D
- HSC Electronic Supply*D
- International Components Corp.
- Itera/Belmoor*D
- JDR Micro*D
- Joseph Electronics*D
- Kelvin Electronics*D
- M.A.T. Electronics*D** 60
- MCM Electronics*D
- Milo Associates, Inc.*D
- Mouser Electronics*D
- Multiplex Technology, Inc.
- Omega Engineering Inc.
- OmniTron Electronics*D
- ORA Electronics
- Parts Express International Inc.*D** 51
- Philips Consumer Electronics Service Co.*D
- Prime Electronics Co.*D** 54
- RNJ Electronics Inc.*D
- Scoter Products Ohm Electrics, Inc.*D
- Sony Service Co. National Parts Div.*D

Company mailing addresses begin on page 45

- Spectrum 2000, Inc.
- 3M/Photodyne Inc.
- Tritronics Inc.*D
- Video Midwest & AVC Divisions of Vaughn Communications*D
- Winegard Co.
- Zenith Sales Co. A Div. of Zenith Electronics Corp.** BC

FILTERS

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- Bursma Electronic Distributing*D
- Channel Master Div. of Avnet, Inc.

- Classic Components Supply Inc.*D
- Clean Room Products Inc.
- Consolidated Electronics, Inc.*D** 56
- Cooper Associates*D
- Datel, Inc.
- Electronic Parts Supply*D
- Electronic Specialists, Inc.
- Electronics Warehouse Corp.*D
- GMB/dba Fox International*D
- HSC Electronic Supply*D
- International Components Corp.
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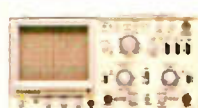
- Milo Associates, Inc.*D
- Mouser Electronics*D
- Multiplex Technology, Inc.
- OmniTron Electronics*D
- Parts Express International Inc.*D** 51
- PerfectData Corp.
- Philips Consumer Electronics Service Co.*D
- RNJ Electronics Inc.*D
- Sony Service Co. National Parts Div.*D
- Speco Div.
- Tripp-Lite
- Video Midwest & AVC Divisions of Vaughn Communications*D
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20MHz, DUAL TRACE



•OS-8020R
20MHz, DUAL TRACE
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•FC-7052: 550MHz
•FC-7102: 1GHz



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MEMORY, HOLD,
TR, hFE CHECK
FUNCTION,
BAR GRAPHIC
DISPLAY



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TR, hFE CHECK
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FREQUENCY
FUNCTION



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TR, hFE CHECK
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Circle (13) on Reply Card

	See Adv. Page	See Adv. Page	See Adv. Page	See Adv. Page
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	56			
Cooper Associates* ^D				
Delta Electronics, Inc.				
Electronic Parts Supply* ^D				
Electronics Warehouse Corp.* ^D				
GMB/dba Fox International* ^D				
International Components Corp.				
Itera/Belmoor* ^D				
Joseph Electronics* ^D				
M.A.T. Electronics*^D	60			
MCM Electronics* ^D				
Omnitron Electronics* ^D				
Parts Express International Inc.*^D	51			
Philips Consumer Electronics Service Co.* ^D				
Prime Electronics Co.*^D	54			
RNJ Electronics Inc.* ^D				
Sony Service Co. National Parts Div.* ^D				
Video Midwest & AVC Divisions of Vaughn Communications* ^D				
Wavetek Corp.				
SIGNAL MIXERS				
Allied Electronics, A Div. of Hall-Mark Electronics* ^D				
Ambico				
Audio-Technica U.S., Inc.				
Bursma Electronic Distributing* ^D				
Channel Master Div. of Avnet, Inc.				
Consolidated Electronics, Inc.*^D	56			
Cooper Associates* ^D				
Electronic Parts Supply* ^D				
Electronics Warehouse Corp.* ^D				
GMB/dba Fox International* ^D				
Itera/Belmoor* ^D				
Joseph Electronics* ^D				
Multiplex Technology, Inc.				
Omnitron Electronics* ^D				
Parts Express International Inc.*^D	51			
Philips Consumer Electronics Service Co.* ^D				
RNJ Electronics Inc.* ^D				
Sony Service Co. National Parts Div.* ^D				
3M/Photodyne Inc.				
Video Midwest & AVC Divisions of Vaughn Communications* ^D				
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Allied Electronics, A Div. of Hall-Mark Electronics* ^D				
Arrow Electronics Inc. Catalog Sales Div.* ^D				
Brunelle Instruments Inc.				
Classic Components Supply Inc.* ^D				
Com-Kyl Inc.* ^D				
Consolidated Electronics, Inc.*^D	56			
Contact East, Inc.* ^D				
Davle Tech Inc.				
Dremel				
Electronics Warehouse Corp.* ^D				
GC Electronics Div. of GC Thorsen Co.				
Hand Tool Industries, Inc.				
HMC-Hub Material Co.* ^D				
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RNJ Electronics Inc.* ^D				
Scotter Products Ohm Electrics, Inc.* ^D				
Sony Service Co. National Parts Div.* ^D				
Specialized Products Co.* ^D				
Techni-Tool Inc.*^D	19			
Tool Kit Specialists, Inc.* ^D				
Tool-Tronics, Inc.* ^D				
Ungar, Div. Eldon Industries, Inc.				
Brian R. White Co., Inc.* ^D				
JIGS/FIXTURES/VISES				
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Com-Kyl Inc.* ^D				
Consolidated Electronics, Inc.*^D	56			
Contact East, Inc.* ^D				
Data Tech Reliance, Inc.				
Electronics Warehouse Corp.* ^D				
Grobet USA				
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HMC-Hub Material Co.* ^D				
HSC Electronic Supply* ^D				
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Mitsubishi Electric Sales America, Inc.				
Omnitron Electronics* ^D				
PanaVise Products, Inc.	37			
Philips Consumer Electronics Service Co.* ^D				
Sony Service Co. National Parts Div.* ^D				
Start International* ^D				
Techni-Tool Inc.*^D	19			
Tentel Corp.				
Tool-Tronics, Inc.* ^D				
SOLDERING/DESOLDERING EQUIPMENT				
All Electronics Corp.* ^D				
Allied Electronics, A Div. of Hall-Mark Electronics* ^D				
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Atrix, Inc.* ^D				
The Boardworks				
Bursma Electronic Distributing* ^D				
Caig Labs, Inc.				
Com-Kyl Inc.* ^D				
Consolidated Electronics, Inc.*^D	56			
Contact East, Inc.* ^D				
Cooper Associates* ^D				
CooperTools				
C&S Sales* ^D				
Davle Tech Inc.				
Digi-Key Corp.* ^D				
Dremel				
Electron Processing				
Electronic Parts Supply* ^D				
Electronics Warehouse Corp.* ^D				
Elenco Electronics, Inc.				
Elvo Div. of Zumbach Electronics Corp.				
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Fordham Radio Supply Co.*^D	7			
GC Electronics Div. of GC Thorsen Co.				
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Omega Engineering Inc.				
Omnitron Electronics* ^D				
Partfolio, Inc.				
Parts Express International Inc.*^D	51			
Philips Consumer Electronics Service Co.* ^D				
Prime Electronics Co.*^D	54			
R & K Supply Co.				
RNJ Electronics Inc.* ^D				
Scotter Products Ohm Electrics, Inc.* ^D				
Sony Service Co. National Parts Div.* ^D				
Specialized Products Co.* ^D				
Techni-Tool Inc.*^D				
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Clauss Cutlery Co.				
Com-Kyl Inc.* ^D				
Consolidated Electronics, Inc.*^D	56			
Contact East, Inc.* ^D				
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Davle Tech Inc.				
Dremel				
Electronic Parts Supply* ^D				
Electronics Warehouse Corp.* ^D				
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Fordham Radio Supply Co.*^D	7			
GC Electronics Div. of GC Thorsen Co.				
GMB/dba Fox International* ^D				
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JDR Micro* ^D				
W.S. Jenks & Son* ^D				
Jensen Tools Inc.* ^D				
Jonard Industries Corp.				
Joseph Electronics* ^D				
Kelvin Electronics* ^D				
Klein Tools, Inc.				
M.A.T. Electronics*^D	60			
MCM Electronics* ^D				
Milo Associates, Inc.* ^D				
Miltex Supply Corp.* ^D				
Moody Tools, Inc.				
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P.K. Neuses Inc.* ^D				
Nu-Data Inc.				
Omega Engineering Inc.				
Omnitron Electronics* ^D				
Omnium Corp.				
Paladin Corp.				
Parts Express International Inc.*^D	51			
Philips Consumer Electronics Service Co.* ^D				
R & K Supply Co.				
RNJ Electronics Inc.* ^D				
Rostra Tool Co.				
Scotter Products Ohm Electrics, Inc.* ^D				
Sony Service Co. National Parts Div.* ^D				
Specialized Products Co.* ^D				
Techni-Tool Inc.*^D	19			
Thomson Consumer Electronics, Inc. Distributor & Special Products*^D				
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3M/Photodyne Inc.				
Tool Kit Specialists, Inc.*^D				
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Assembly Systems Group				
Atrix, Inc.* ^D				
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Black Box Corp.* ^D				
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Continued on page 37.

3062

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chassis
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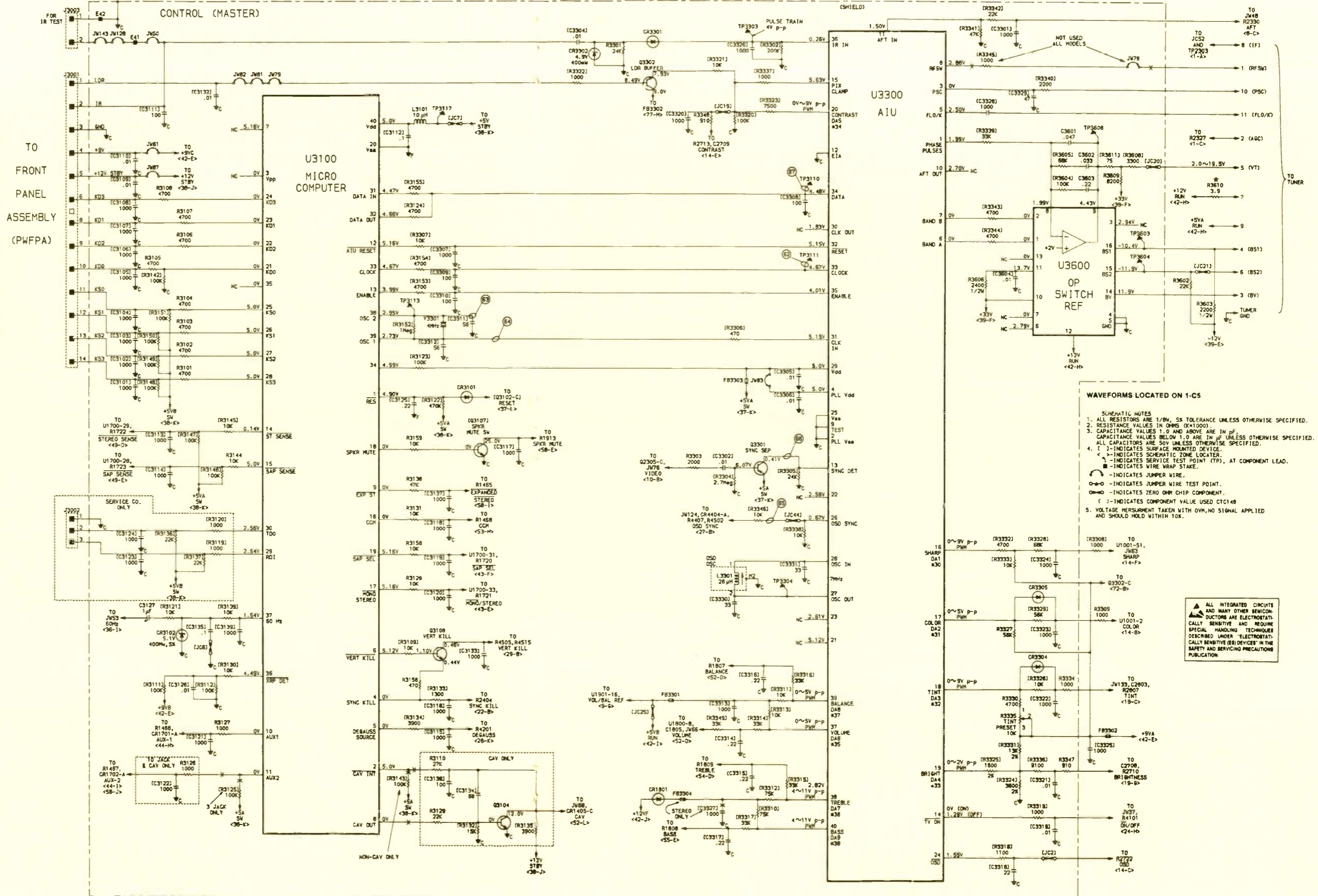
SYSTEM CONTROL SCHEMATIC (STEREO) (USED CTC148A,P,Q/CTC149A,B,E,Q CHASSIS)

Product safety should be considered when component replacement is made in any area of a receiver. Components marked with a ★ and shaded areas of the schematic diagram designate sites where 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.



- WAVEFORMS LOCATED ON 1-C5**
- ALL RESISTORS ARE 1/8W, 5% TOLERANCE UNLESS OTHERWISE SPECIFIED.
 - RESISTANCE VALUES IN OHMS (Ω) UNLESS OTHERWISE SPECIFIED.
 - CAPACITANCE VALUES 1.0 AND ABOVE ARE IN μF UNLESS OTHERWISE SPECIFIED. CAPACITANCE VALUES BELOW 1.0 ARE IN pF UNLESS OTHERWISE SPECIFIED.
 - () - INDICATES SURFACE MOUNTED DEVICE.
 - () - INDICATES SERVICE TEST POINT (TP), AT COMPONENT LEAD.
 - () - INDICATES WIRE WRAP STAKE.
 - () - INDICATES JUMPER WIRE.
 - () - INDICATES JUMPER WIRE TEST POINT.
 - () - INDICATES ZERO OHM CHIP COMPONENT.
 - () - INDICATES COMPONENT VALUE USED CTC148.
 - VOLTAGE MEASUREMENT TAKEN WITH OHM, NO SIGNAL APPLIED AND SHOULD HOLD WITHIN 10%.

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**SIGNAL CIRCUIT SCHEMATIC (NON-COMB)
(USED CTC148A,P/CTC149A CHASSIS)**

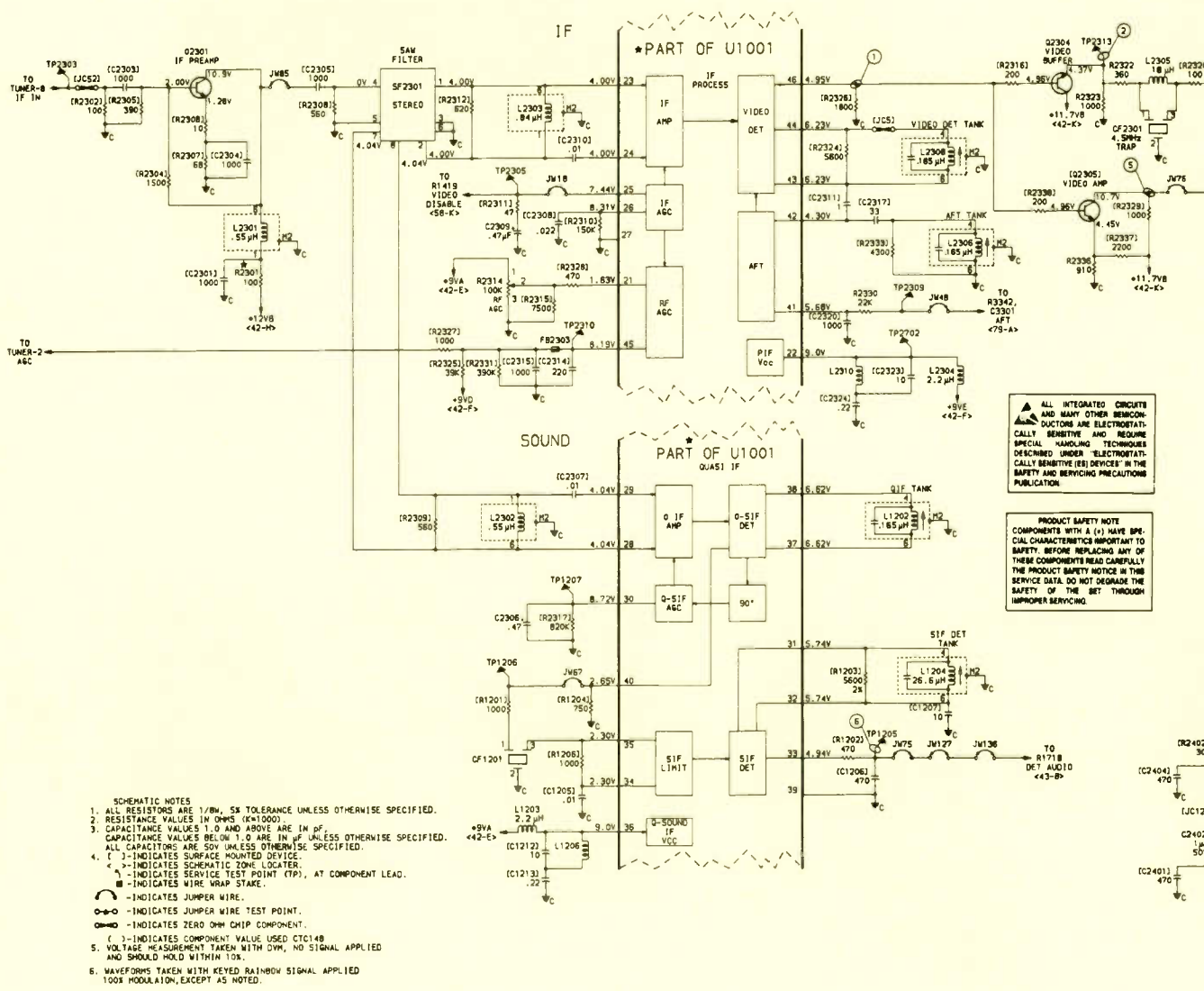
Product safety should be considered when component replacement is made in any area of an electronics product. A star (★) next to a component symbol number designates components in which safety is of special significance. It is recommended that only exact cataloged parts be used for replacement of these 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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All integrated circuits and many other semiconductors are electrostatically sensitive and require special handling techniques.



**SIGNAL CIRCUIT SCHEMATIC (NON-COMB)
(USED CTC148A,P/CTC149A CHASSIS)**

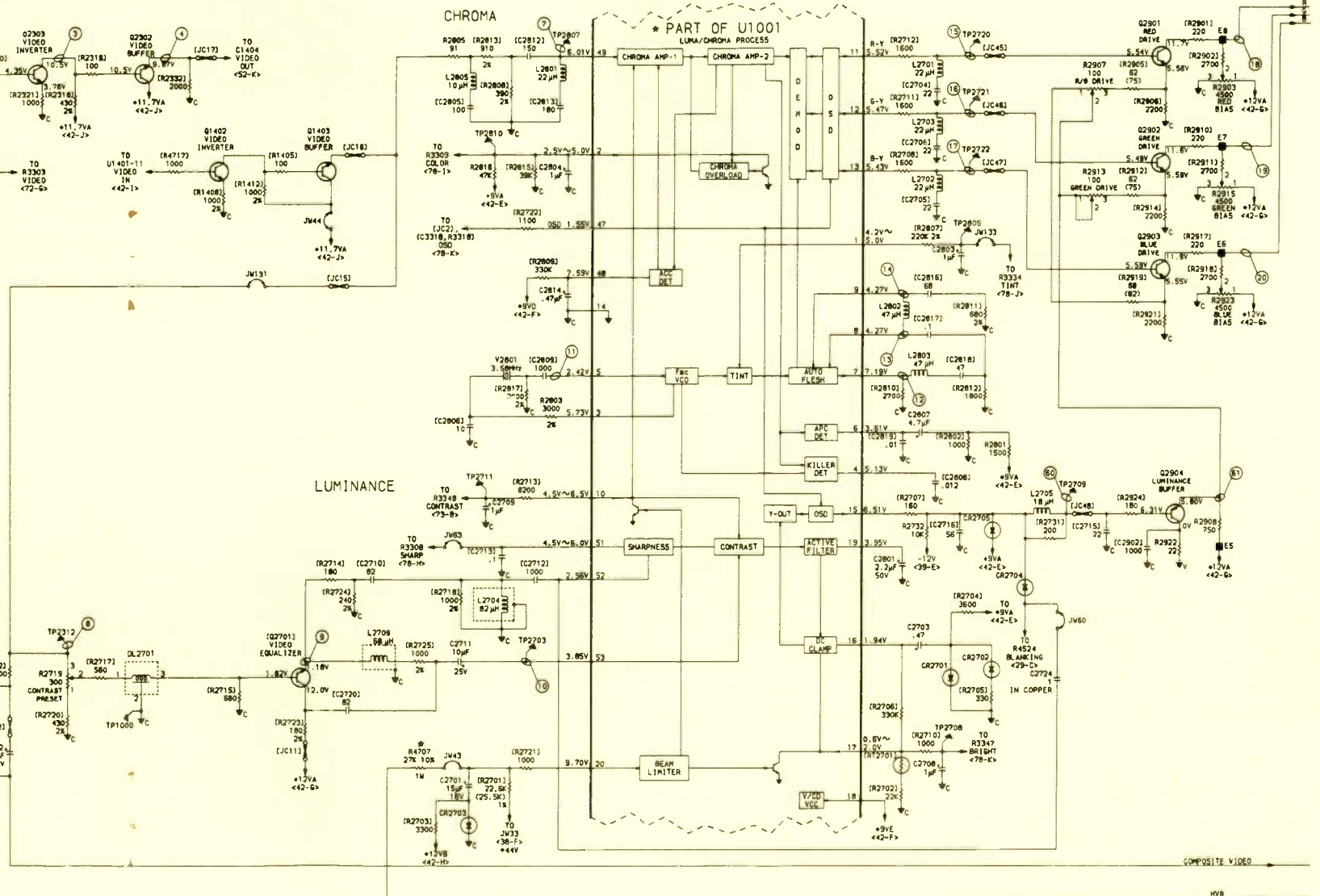
Product safety should be considered when component replacement is made in any area of an electronics product. A star (★) next to a component symbol number designates components in which safety is of special significance. It is recommended that only exact cataloged parts be used for replacement of these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

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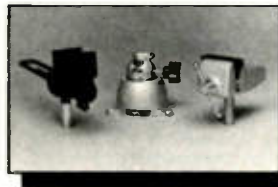
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Inc.*D** 51

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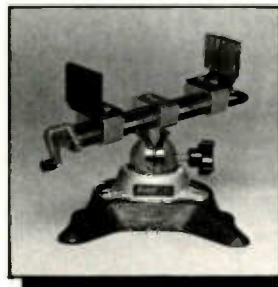
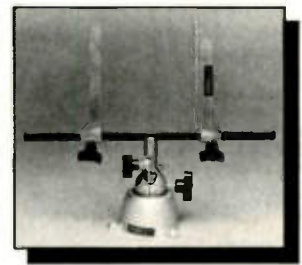
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Prime Electronics Co.* D 54	MCM Electronics* Milo Associates, Inc.* Mitsubishi Electric Sales America, Inc. Mouser Electronics* NTE Electronics, Inc. 15	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	PTC Electronics Corp. 53,55
RNJ Electronics Inc.* Sony Service Co. Sony Service Co. National Parts Div.* Thomson Consumer Electronics, Inc. Distributor & Special Products* D 13	Omniatron Electronics* JC Penney National Parts Center* Philips Consumer Electronics Service Co.* PTS Electronics Corp. 53,55	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	PTC Electronics Corp. 53,55
Tritronics Inc.* Video Midwest & AVC Divisions of Vaughn Communications* PICTURE TUBES/CRTS American Design Components* Bursma Electronic Distributing* Clinton Electronics Corp. Electronic Parts Supply* GMB/dba Fox International* Herman Electronics HSC Service Co. Div. of Hitachi Sales Corp. of America Joseph Electronics* Matsushita Services Co. 4-5	Omniatron Electronics* Parts Express International Inc.* D 51	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	PTC Electronics Corp. 53,55
Mitsubishi Electric Sales America, Inc. JC Penney National Parts Center* Philips Consumer Electronics Service Co.* Sony Service Co. Sony Service Co. National Parts Div.* Thomson Consumer Electronics, Inc. Distributor & Special Products* D 13	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	PTC Electronics Corp. 53,55
Tritronics Inc.* TSC/Centec Video Midwest & AVC Divisions of Vaughn Communications* RELAYS All Electronics Corp.* Allied Electronics, A Div. of Hall-Mark Electronics* Arrow Electronics Inc. Catalog Sales Div.* Classic Components Supply Inc.* Consolidated Electronics, Inc.*D 56	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	PTC Electronics Corp. 53,55
Cooper Associates* Data Tech Reliance, Inc. Digi-Key Corp.* Electronic Parts Supply* Electronics Warehouse Corp.* GMB/dba Fox International* Herman Electronics HSC Electronic Supply* HSC Service Co. Div. of Hitachi Sales Corp. of America IC Master Hearst Business Communications	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	PTC Electronics Corp. 53,55
Cooper Associates* Data Tech Reliance, Inc. Digi-Key Corp.* Electronic Parts Supply* Electronics Warehouse Corp.* GMB/dba Fox International* Herman Electronics HSC Electronic Supply* HSC Service Co. Div. of Hitachi Sales Corp. of America International Components Corp. Itera/Belmoor* JDR Micro* Joseph Electronics* Kelvin Electronics* M.A.T. Electronics* D 60	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	PTC Electronics Corp. 53,55
Matsushita Services Co. 4-5	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	PTC Electronics Corp. 53,55
MCM Electronics* Milo Associates, Inc.* Mitsubishi Electric Sales America, Inc. Mouser Electronics* NTE Electronics, Inc. 15	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	PTC Electronics Corp. 53,55
Omniatron Electronics* JC Penney National Parts Center* Philips Consumer Electronics Service Co.* PTS Electronics Corp. 53,55	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	PTC Electronics Corp. 53,55
Scooter Products Ohm Electrics, Inc.* Sony Service Co. Sony Service Co. National Parts Div.* Tritronics Inc.* Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	PTC Electronics Corp. 53,55
Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	Video Midwest & AVC Divisions of Vaughn Communications* Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	PTC Electronics Corp. 53,55

See Adv. Page	See Adv. Page	See Adv. Page	See Adv. Page
Itera/Belmoor*D	Allied Electronics, A Div. of Hall-Mark Electronics*D	Thomson Consumer Electronics, Inc. Distributor & Special Products*D 13	Mitsubishi Electric Sales America, Inc. Mouser Electronics*D
JDR Micro*D	Arrow Electronics Inc. Catalog Sales Div.*D	Tritronics Inc.*D	NTE Electronics, Inc. 15
Joseph Electronics*D	ARS Electronics*D	Video Midwest & AVC Divisions of Vaughn Communications*D	Omniatron Electronics*D
Kelvin Electronics*D	Bursma Electronic Distributing*D	Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	ORA Electronics
M.A.T. Electronics*D 60	Classic Components Supply Inc.*D	SEMICONDUCTORS, TRANSISTORS	Parts Express International Inc.*D 51
Matsushita Services Co. 4-5	Consolidated Electronics, Inc.*D 56	All Electronics Corp.*D	JC Penney National Parts Center*D
MCM Electronics*D	Cooper Associates*D	Allied Electronics, A Div. of Hall-Mark Electronics*D	Philips Consumer Electronics Service Co.*D
Milo Associates, Inc.*D	Data Tech Reliance, Inc.	American Design Components*D	Philips ECG
Mitsubishi Electric Sales America, Inc.	Digi-Key Corp.*D	Arrow Electronics Inc. Catalog Sales Div.*D	Power Technology Components Microsemi Co.
Module Exchange	Electronic Parts Supply*D	ARS Electronics*D	Prime Electronics Co.*D 54
Mouser Electronics*D	Electronics Warehouse Corp.*D	Bursma Electronic Distributing*D	PTS Electronics Corp. 53,55
NCM Electronics	GMB/dba Fox International*D	Classic Components Supply Inc.*D	RNJ Electronics Inc.*D
NTE Electronics, Inc. 15	HSC Electronic Supply*D	Consolidated Electronics, Inc.*D 56	Scooter Products Ohm Electrics, Inc.*D
Omniatron Electronics*D	HSC Service Co. Div. of Hitachi Sales Corp. of America	Cooper Associates*D	Sony Service Co.
ORA Electronics	Itera/Belmoor*D	Data Tech Reliance, Inc.	Sony Service Co. National Parts Div.*D
Parts Express International Inc.*D 51	JDR Micro*D	Digi-Key Corp.*D	Thomson Consumer Electronics, Inc. Distributor & Special Products*D 13
JC Penney National Parts Center*D	Joseph Electronics*D	Electronic Parts Supply*D	Tritronics Inc.*D
Philips Consumer Electronics Service Co.*D	Kelvin Electronics*D	Electronics Warehouse Corp.*D	Video Midwest & AVC Divisions of Vaughn Communications*D
Philips ECG	M.A.T. Electronics*D 60	GMB/dba Fox International*D	Zenith Sales Co. A Div. of Zenith Electronics Corp. BC
Prime Electronics Co.*D 54	Matsushita Services Co. 4-5	Herman Electronics	SOCKETS
PTS Electronics Corp. 53,55	MCM Electronics*D	HSC Electronic Supply*D	All Electronics Corp.*D
RNJ Electronics Inc.*D	Milo Associates, Inc.*D	HSC Service Co. Div. of Hitachi Sales Corp. of America	Allied Electronics, A Div. of Hall-Mark Electronics*D
Scooter Products Ohm Electrics, Inc.*D	Mitsubishi Electric Sales America, Inc.	International Components Corp.	AMP Inc.
Sony Service Co.	Mouser Electronics*D	Itera/Belmoor*D	Arrow Electronics Inc. Catalog Sales Div.*D
Sony Service Co. National Parts Div.*D	NTE Electronics, Inc. 15	JDR Micro*D	ARS Electronics*D
Thomson Consumer Electronics, Inc. Distributor & Special Products*D 13	Omniatron Electronics*D	Joseph Electronics*D	Classic Components Supply Inc.*D
Tritronics Inc.*D	Parts Express International Inc.*D 51	Kelvin Electronics*D	Cooper Associates*D
Video Midwest & AVC Divisions of Vaughn Communications*D	JC Penney National Parts Center*D	M.A.T. Electronics*D 60	Davile Tech Inc.
Zenith Sales Co. A Div. of Zenith Electronics Corp. BC	Philips Consumer Electronics Service Co.*D	Matsushita Services Co. 4-5	Electronic Parts Supply*D
SEMICONDUCTORS, SCRs/TRIACS	Philips ECG	MCM Electronics*D	
All Electronics Corp.*D	RNJ Electronics Inc.*D	Milo Associates, Inc.*D	
	Scooter Products Ohm Electrics, Inc.*D		
	Sony Service Co.		
	Sony Service Co. National Parts Div.*D		

Company mailing addresses begin on page 45

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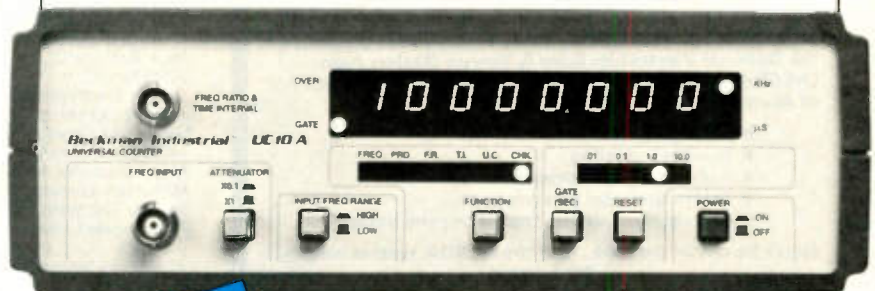
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Replacement parts/components directory


See Adv. Page	See Adv. Page	See Adv. Page	See Adv. Page
Electronics Warehouse Corp.*D	Audio-Technica U.S., Inc.	Arrow Electronics Inc. Catalog Sales	Universal Enterprises
Emulation Technology Inc.	Bursma Electronic Distributing*D	Div.*D	Video Midwest & AVC Divisions of
Everett/Charles Contact Products	Consolidated Electronics,	Bursma Electronic Distributing*D	Vaughn Communications*D
Fordham Radio Supply Co.*D 7	Inc.*D 56	Classic Components Supply Inc.*D	Zenith Sales Co. A Div. of
GC Electronics Div. of GC Thorsen Co.	Cooper Associates*D	Consolidated Electronics,	Zenith Electronics Corp. BC
GMB/dba Fox International*D	Electronic Parts Supply*D	Inc.*D 56	
HSC Electronic Supply*D	Electronics Warehouse Corp.*D	Cooper Associates*D	
HSC Service Co. Div. of Hitachi Sales	Fordham Radio Supply Co.*D 7	Digi-Key Corp.*D	
Corp. of America	GMB/dba Fox International*D	Electronic Parts Supply*D	
Interconnect Devices, Inc.	HSC Service Co. Div. of Hitachi Sales	Electronics Warehouse Corp.*D	
Itera/Belmoor*D	Corp. of America	Fordham Radio Supply Co.*D 7	
JDR Micro*D	International Components Corp.	GC Electronics Div. of GC Thorsen Co.	
E.F. Johnson Co.	Itera/Belmoor*D	GMB/dba Fox International*D	
Joseph Electronics*D	Joseph Electronics*D	HSC Electronic Supply*D	
Kelvin Electronics*D	M.A.T. Electronics*D 60	HSC Service Co. Div. of Hitachi Sales	
Keystone Electronics Corp.	Matsushita Services Co. 4-5	Corp. of America	
M.A.T. Electronics*D 60	MCM Electronics*D	Itera/Belmoor*D	
Matsushita Services Co. 4-5	Milo Associates, Inc.*D	JDR Micro*D	
Milo Associates, Inc.*D	Mitsubishi Electric Sales America, Inc.	Joseph Electronics*D	
Mouser Electronics*D	Mouser Electronics*D	Kelvin Electronics*D	
Omniatron Electronics*D	Parts Express International	Matsushita Services Co. 4-5	
JC Penney National Parts Center*D	Inc.*D 51	MCM Electronics*D	
Philips Consumer Electronics Service	JC Penney National Parts Center*D	Milo Associates, Inc.*D	
Co.*D	Philips Consumer Electronics Service	Mitsubishi Electric Sales America, Inc.	
PTS Electronics Corp. 53,55	Co.*D	Mouser Electronics*D	
Schurter, Inc.	Prime Electronics Co.*D 54	NKK Switches	
Scouter Products Ohm Electrics,	RNJ Electronics Inc.*D	Omniatron Electronics*D	
Inc.*D	SHOGYO International Corp.	ORA Electronics	
SL Waber, Inc.	Sony Service Co.	Parts Express International	
Sony Service Co.	Sony Service Co. National Parts Div.*D	Inc.*D 51	
Sony Service Co. National Parts Div.*D	Speco Div.	JC Penney National Parts Center*D	
3M/Electronic Products Div.	Tritronics Inc.*D	Philips Consumer Electronics Service	
Vaco Products 21	Video Midwest & AVC Divisions of	Co.*D	
Video Midwest & AVC Divisions of	Vaughn Communications*D	Prime Electronics Co.*D 54	
Vaughn Communications*D	Zenith Sales Co. A Div. of	RNJ Electronics Inc.*D	
Zenith Sales Co. A Div. of	Zenith Electronics Corp. BC	Schurter, Inc.	
Zenith Electronics Corp. BC		Scouter Products Ohm Electrics,	

SPEAKERS

All Electronics Corp.*D
 Allied Electronics, A Div. of Hall-Mark
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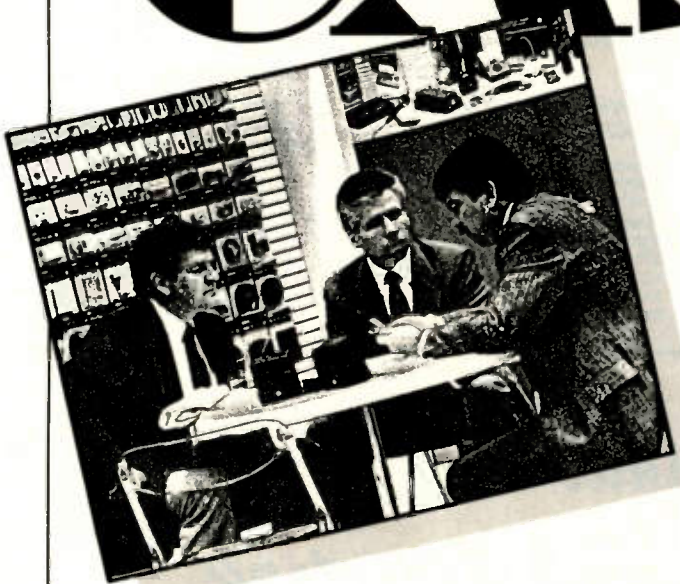
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Div.*D	Video Midwest & AVC Divisions of
Bursma Electronic Distributing*D	Vaughn Communications*D
Classic Components Supply Inc.*D	Zenith Sales Co. A Div. of
Consolidated Electronics,	Zenith Electronics Corp. BC
Inc.*D 56	
Cooper Associates*D	VACUUM TUBES
Digi-Key Corp.*D	Allied Electronics, A Div. of Hall-Mark
Electronic Parts Supply*D	Electronics*D
Electronics Warehouse Corp.*D	ARS Electronics*D
Fordham Radio Supply Co.*D 7	Bursma Electronic Distributing*D
GC Electronics Div. of GC Thorsen Co.	Consolidated Electronics,
GMB/dba Fox International*D	Inc.*D 56
HSC Electronic Supply*D	Electronics Warehouse Corp.*D
HSC Service Co. Div. of Hitachi Sales	Fordham Radio Supply Co.*D 7
Corp. of America	GMB/dba Fox International*D
Itera/Belmoor*D	Herman Electronics
JDR Micro*D	HSC Electronic Supply*D
Joseph Electronics*D	International Components Corp.
Kelvin Electronics*D	Joseph Electronics*D
Matsushita Services Co. 4-5	Kelvin Electronics*D
MCM Electronics*D	MCM Electronics*D
Milo Associates, Inc.*D	Milo Associates, Inc.*D
Mitsubishi Electric Sales America, Inc.	Omniatron Electronics*D
Mouser Electronics*D	JC Penney National Parts Center*D
Parts Express International	Philips Consumer Electronics Service
Inc.*D 51	Co.*D
JC Penney National Parts Center*D	Scouter Products Ohm Electrics,
Philips Consumer Electronics Service	Inc.*D
Co.*D	Sony Service Co. National Parts Div.*D
Prime Electronics Co.*D 54	Thomson Consumer
RNJ Electronics Inc.*D	Electronics, Inc. Distributor
SHOGYO International Corp.	& Special Products*D 13
Sony Service Co.	Tritronics Inc.*D
Sony Service Co. National Parts Div.*D	Video Midwest & AVC Divisions of
Speco Div.	Vaughn Communications*D
Tritronics Inc.*D	Zenith Sales Co. A Div. of
Video Midwest & AVC Divisions of	Zenith Electronics Corp. BC
Vaughn Communications*D	
Zenith Sales Co. A Div. of	VIDEO HEADS
Zenith Electronics Corp. BC	Consolidated Electronics,
	Inc.*D 56
	Electronic Parts Supply*D
	Electronics Warehouse Corp.*D
	Fordham Radio Supply Co.*D 7
	GMB/dba Fox International*D
	Herman Electronics
	HSC Service Co. Div. of Hitachi Sales
	Corp. of America
	Joseph Electronics*D
	M.A.T. Electronics*D 60
	Matsushita Services Co. 4-5
	MCM Electronics*D
	Mitsubishi Electric Sales America, Inc.
	Nippon Shokuhin Sangyo
	Omniatron Electronics*D
	JC Penney National Parts Center*D
	Philips Consumer Electronics Service
	Co.*D
	Prime Electronics Co.*D 54
	RNJ Electronics Inc.*D
	Sony Service Co.
	Sony Service Co. National Parts Div.*D
	Sprague Magnetics, Inc.*D
	Thomson Consumer
	Electronics, Inc. Distributor
	& Special Products*D 13
	Tritronics Inc.*D
	Video Midwest & AVC Divisions of
	Vaughn Communications*D
	Zenith Sales Co. A Div. of
	Zenith Electronics Corp. BC
	YOKES
	Consolidated Electronics,
	Inc.*D 56
	Electronic Parts Supply*D
	Electronics Warehouse Corp.*D
	Fordham Radio Supply Co.*D 7
	GMB/dba Fox International*D
	HSC Service Co. Div. of Hitachi Sales
	Corp. of America
	Joseph Electronics*D
	Matsushita Services Co. 4-5
	Mitsubishi Electric Sales America, Inc.
	JC Penney National Parts Center*D
	Philips Consumer Electronics Service
	Co.*D
	Sony Service Co.
	Sony Service Co. National Parts Div.*D
	Thomson Consumer
	Electronics, Inc. Distributor
	& Special Products*D 13
	Tritronics Inc.*D
	Video Midwest & AVC Divisions of
	Vaughn Communications*D
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See Adv. Page

See Adv. Page

See Adv. Page

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PTS Electronics Corp. 53,55
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TSC/Centec
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Zenith Electronics Corp. BC**

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Video Midwest & AVC Divisions of
Vaughn Communications*D

SERVICE BULLETIN SOFTWARE

Designer Technology
Electronics Warehouse Corp.*D

SERVICE MANAGEMENT SOFTWARE

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Database Dimensions
Frederick Engineering, Inc.
Magic Solutions, Inc.
Management Technix Inc.
Micro Design, Inc.
NESDA 21, 42
Nu-Data Inc.
Sperry Tech Inc.

TEST EQUIPMENT REPAIR/CALIBRATION

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Brunelle Instruments Inc.
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Electro Rent Corp.
Electronics Warehouse Corp.*D
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Lectionic Research Labs*D
PTS Electronics Corp. 53,55
RAG Electronics Inc.*D
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Triplett Corp.
Tucker Electronics Co.*D
United States Instrument Rentals
Vortec Corp.

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Bursma Electronic Distributing*D
Electrodyn, Inc.
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
Module Exchange
JC Penney National Parts Center*D
PTS Electronics Corp. 53,55
Sera Service Independent Electronic
Rebuilder
Sprague Magnetics, Inc.*D
**Zenith Sales Co. A Div. of
Zenith Electronics Corp. BC**

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Publishing
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Black Box Corp.*D
Bursma Electronic Distributing*D
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**Consolidated Electronics,
Inc.*D 56**
Contact East, Inc.*D
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Electronic Industries Associates
Consumer Electronics Group
Electronic Parts Supply*D
Electronic Technology Today*D
Electronics Warehouse Corp.*D
ETA-Electronics Technicians
Association
GMB/dba Fox International*D
Heath Co.
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Communications
IS CET 54
JDR Micro*D
W.S. Jenks & Son*D
Joseph Electronics*D
Kelvin Electronics*D
Learning Tree International
W.J. Lynott, Associates
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McGraw-Hill Publishing Co.
MCM Electronics*D

Mllo Associates, Inc.*D
Mitsubishi Electric Sales America, Inc.
NASD, A Div. of NARDA
NESDA 21, 42
Omega Engineering Inc.
Pace, Inc.
**Parts Express International
Inc.*D 51**
JC Penney National Parts Center*D
Phillips Consumer Electronics Service
Co.*D
Prentice-Hall
Rapid Systems
RNJ Electronics Inc.*D
Howard W. Sams & Co.
Scooter Products Ohm Electrics,
Inc.*D
Sencore Electronics IFC
Sony Service Co.
Specialized Products Co.*D
Sperry Tech Inc.
TAB Books Inc.
**Thomson Consumer
Electronics, Inc. Distributor
& Special Products*D 13**
United Techbook Co.
Viejo Publications 39

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Matsushita Services Co. 4-5
McGraw-Hill Publishing Co.
Mitsubishi Electric Sales America, Inc.
NASD, A Div. of NARDA
National Advancement Corp.
NESDA 21, 42
Omega Engineering Inc.
Pace, Inc.
Phillips Consumer Electronics Service
Co.*D
Rapid Systems
Sencore Electronics IFC
Sharp Electronics, Corp.
Sony Service Co.
Ucando VCR Educational Products
Windsor Technologies, Inc.

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NRI School of Electronics 11
Phillips Consumer Electronics Service
Co.*D

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**Consolidated Electronics,
Inc.*D 56**
Craig Consumer Electronics
Electronic Parts Supply*D
Electronics Warehouse Corp.*D
HSC Service Co. Div. of Hitachi Sales
Corp. of America
Joseph Electronics*D
Allen J. Loeb*D
Matsushita Services Co. 4-5
Mitsubishi Electric Sales America, Inc.
**Parts Express International
Inc.*D 51**
JC Penney National Parts Center*D
Phillips Consumer Electronics Service
Co.*D
RNJ Electronics Inc.*D
Howard W. Sams & Co.
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Tustin, CA 92680
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Fax 714-730-6928

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Springfield, VA 22153
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Fax 703-644-9011

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Fax 503-626-6492

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Van Nuys, CA 91406
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800-422-4250
Fax 818-997-6158

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201-595-7001

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800-222-6154
Fax 612-894-6256

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Stow, OH 44224
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Fax 216-688-3752

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8010 Highway 9
Ben Lomond, CA 95005
408-336-2281
Fax 408-336-5049

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Suite LL01
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815-434-0846
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Riverton, WY 82501
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412-746-5500

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Fax 415-574-2176

Company mailing addresses

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703-450-0311
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601-371-1351

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Fax 412-941-3410

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North Lauderdale, FL 33068
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Fax 202-835-8939

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Fax 402-467-3545

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Fax 516-845-7082

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Indianapolis, IN 46224
317-244-7611
Fax 317-247-4749

ETA-Electronics Technicians
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Greencastle, IN 46135
317-653-3849
800-359-6706
Fax 317-653-3849

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Fax 514-337-8411

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Fax 507-263-5987

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Concord, MA 01742
508-369-4400
800-828-8890
Fax 508-369-6974

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Woodland Hills, CA 91367
818-887-4000
800-227-8409
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Laguna Hills, CA 92653
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Fax 203-468-0060

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602-298-6900
800-654-7314
Fax 602-298-1913

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Setauket, NY 11733
516-689-5400
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Newark, DE 19711
302-368-3700
Fax 302-738-5993

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3631 Perkins Ave.
Cleveland, OH 44114
216-361-3315

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24200 Burbank Blvd.
Woodland Hills, CA 91367
818-887-5533
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201-939-6700
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Fax 201-939-5067



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Fax 516-883-3894

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1933 Lake St.
Kent, OH 44240
216-678-8787
Fax 216-678-9011

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Company mailing addresses

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800-327-8378
Fax 305-634-6247

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161 W. Clay Ave.
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Fax 201-245-6176

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Fax 201-366-6665

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714-727-2100
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Woodbury, NY 11797
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617-821-1870
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San Dimas, CA 91773
714-599-6090
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408-732-1573
800-442-5833
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Compton, CA 90220
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201-526-8440
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Newton, KS 67114
316-283-5730
800-835-1005



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Garden City, NY 11530
516-227-1330
Fax 516-227-1901

ICS, Inc.
Electro-Pac Div.
520 Interstate Road
Addison, IL 60101
312-543-6200

Ideal Industries
Becker Place
Sycamore, IL 60178
815-985-5181

IET Labs, Inc.
534 Main St.
Westbury, NY 11590
516-334-5959
Fax 516-334-5988

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One Fairchild Square
Clifton Park, NY 12065
518-877-7042
Fax 518-877-7052

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800-IDS-DATA
Fax 401-333-3584

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Bellevue, WA 98005
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800-227-2817
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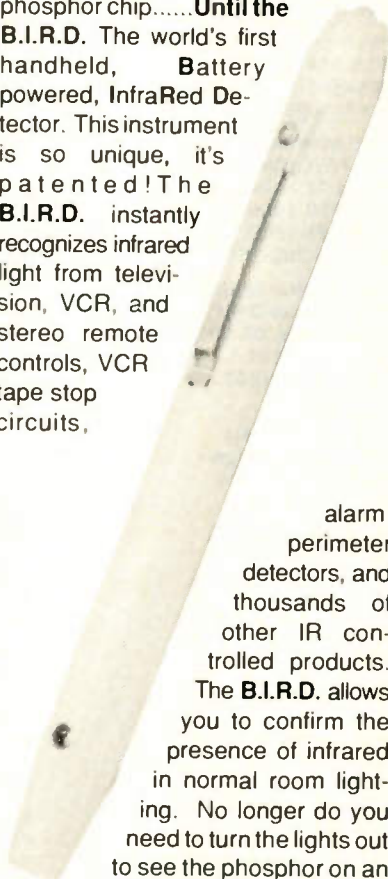
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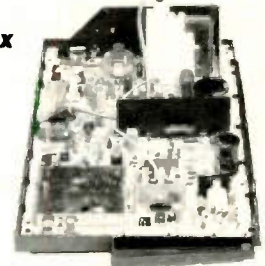
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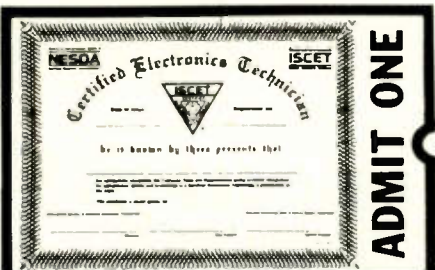


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Computer Corner

"Where do I plug in this cable?"

By Glenn R. Patsch

The back of a personal computer (PC) can be a confusing maze of cables and connectors. Although cable connections are a basic part of PC servicing, not immediately knowing which cable goes where can slow you down, whether you're reconnecting a repaired PC, adding peripherals or just cleaning up someone else's connection mess.

Figure 1 shows a typical PC back panel for the IBM PC, PC/XT and PC/AT. Most of the connections are pretty straightforward. On the left side of the panel is the ac power cord (1). Some PCs also have a 120V ac power connector (2) for the IBM monochrome monitor. This power connector allows the monochrome monitor to be turned on and off with the power switch on the PC. To the right of the power cord is the 5-pin DIN connector (3) for the keyboard. On older PCs, a second 5-pin DIN connector (4) was used to connect to a cassette tape deck.

On the right side of the panel are the expansion card slots. The older PCs had five slots; the newer PC/XTs and PC/ATs have eight slots. Each of the slots can hold an expansion card that may have a connector. Serial and parallel port expansion cards have connectors. Hard disk controller cards and

Patsch is a consultant specializing in the selection, evaluation and installation of IBM PC and compatible hardware and software.

memory expansion cards usually don't.

The main bulk of the PC's connectors can be found in the expansion card slots. Connecting cables to the PC — or figuring out problems with improperly connected cables — isn't difficult if you understand which connector should be used for which peripheral. Here's a run-down on the connectors you'll use with each peripheral.

Floppy drives

A 37-pin female D connector is used to connect to one or two external floppy drives. This is the largest connector you will usually find, but it is rarely used. Many non-IBM floppy disk controller cards do not include the connector and cannot operate external floppy drives. The IBM PS/2 uses this connector to attach to an external 5.25-inch floppy drive.

Printers

A 25-pin female D connector is a parallel port. The parallel port is normally connected to a printer, or it may be connected to a scanner that uses the parallel port. The 25-pin connector can be used alone or with a 9-pin D connector.

A female 9-pin D connector is connected to a video monitor. A male 9-pin D connector is a serial port. The IBM and Hercules monochrome video adapter cards combine the 9-pin female D

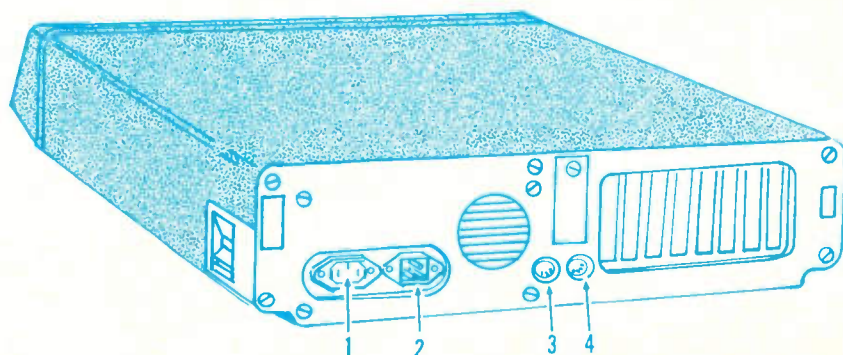


Figure 1. A typical PC back panel for the IBM PC, PC/XT and PC/AT. The numbers show connections for (1) the ac line cord, (2) an ac power connector for a monochrome monitor, (3) the keyboard, (4) a cassette tape deck and, to the right, expansion card slots.

connector for the video monitor with a 25-pin female parallel printer D connector in one slot.

A 25-pin or 9-pin male D connector also is a serial port. The 9-pin male D connector was used more with the PC/AT to allow both a 25-pin female parallel port and a serial port connector to fit in one expansion slot. A 9-pin-to-25-pin adapter or cable is used to connect to the 9-pin serial connector. This combination can also be found on several multifunction cards, such as the AST I/O mini card.

Modems

A modular telephone connector is a modem card. The expansion card usually has a 1,200- or 2,400-baud modem. Many modem cards have two modular telephone connectors, allowing you to connect one to the incoming telephone line jack and the other to a telephone.

Monitors

Video monitors will use two types of connectors: A 9-pin female D connector or a 15-pin female D connector.

With the 9-pin female D connector, the monitor used could be one of three types:

- **Monochrome:** If it is paired with a 25-pin female D connector parallel port, it is usually for a monochrome monitor.
- **Color graphics (CGA):** If there is one RCA-type phono jack right above the 9-pin D connector, it is usually the IBM CGA card. The RCA-type phono jack provides a 1.5V composite video signal.
- **Enhanced graphics (EGA):** The EGA monitor also uses a 9-pin female connector. If there are two RCA phono jacks above the 9-pin female D connector, it is usually an EGA card. The two RCA-type phono jacks are the EGA feature jacks and are not usually connected to anything. On the IBM EGA card, four DIP configuration switches are visible through a small square hole at the top of the card.

All of these video connectors use standard TTL levels to drive the monitors. Be sure to connect the video mon-

itor to the correct adapter card. If you still cannot tell which video monitor to use, open up the PC and look at the video adapter card. It usually has the manufacturer's name and monitor type printed on the edge of the adapter card. Most PCs have only one video monitor, and figuring out which type of video adapter is in use is not a problem.

The 15-pin female D connector (pins in three rows of five) is used for the VGA video monitor. This is the video connector that is standard on the PS/2. The VGA uses an analog direct drive 75 Ω , 0.7V video signal.

As a guideline, the older PCs and PC/XTs most often use the monochrome and CGA monitors. The PC/AT uses the monochrome, CGA and EGA monitors. The VGA monitors are usually found on the newer 386 PCs and the IBM PS/2s. Most of the older monochrome monitors are being replaced by EGA and VGA monitors.

Other connectors

If the pins of a 15-pin female D connector are arranged in two rows, it is a game control adapter and is used to connect to one or two joysticks. The game control adapters are not common.

A coax connector is found on local area network (LAN) cards and expansion cards that connect to a mainframe, allowing the PC to act as a 3270-type terminal.

You may find more than one parallel and serial connectors. There is no simple way to find which connector is for the first parallel printer and which is for the second parallel printer and so on. You could open up the PC and check how the DIP switches on each card are configured to determine which connector is for which port. An easier method is to connect the printer to one of the parallel connectors and try it. If it does not work, you can switch the cables to the other connector or use DOS commands to direct output to LPT1 (first parallel), LPT2 (second parallel), COM1 (first serial), COM2 (second serial) and so on. ■

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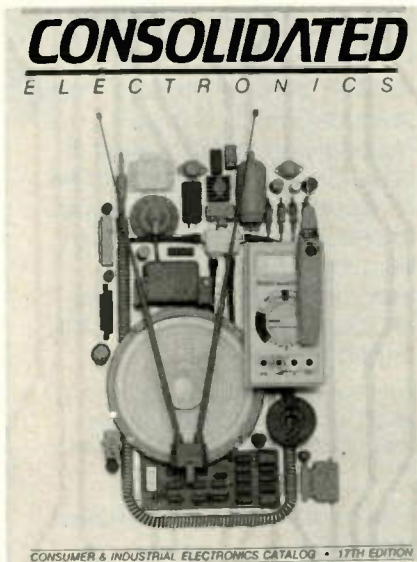
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Video Corner

The amplifier as a troubleshooting aid – Part II

By Stephen J. Miller

Last month, we looked at a useful little amplifier, the Radio Shack mini-amp (catalog number 277-1008C). This month, we will continue to investigate uses for this versatile amplifier. The myriad of uses for this amp will surprise you.

I have successfully used this amp to test PG and FG pick-up sensors in VCR motor circuits. Often these sensors have low-level output signals that are difficult to check without a scope pre-amplifier. Because these sensors are usually an integral part of the motor, the entire motor must be replaced when the sensor is bad. Therefore, to test the sensor by substitution, you would have to order an entire motor assembly, which is usually quite expensive. By using the mini-amp as a pre-amp, I have been able to test these low-level sensors with my scope.

Testing audio circuits

The audio circuits in the new VCR models are becoming very complicated. Units today have built-in stereo decoders, multiple inputs and outputs, and both linear and hi-fi audio capabilities. With so many audio signal paths, problems can be difficult to track down. However, by using the mini-amp as a signal tracer, you can sample the audio at various points and quickly track down

the problem. Just be sure to include a dc blocking capacitor in the input lead of the mini-amp.

To prevent the loading down of sensitive circuits, I use the divide-by-3 probe shown in Figure 1. This probe reduces the loading effect of the mini-amp by increasing its input impedance from 5k Ω to 15k Ω . Because of the amp's high gain, the divide-by-3 probe can be used in most instances. I only use the direct probe for very low-level signals.

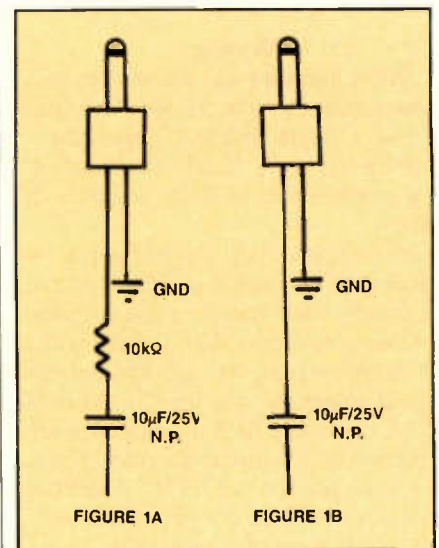


Figure 1. To prevent the loading down of sensitive circuits, use the divide-by-3 probe shown in Figure 1A. Because of the amp's high gain, the divide-by-3 probe can be used in most instances. Only use the direct probe (Figure 1B) for very low-level signals.

Miller is a senior bench technician for a Lancaster, PA, repair company.

Feedback

Avoiding bouncing checks

Mr. Lynott's article "Business Corner" in the December 1989 issue failed to mention the easiest way to solve the problem of collecting bounced checks: having a cash-only policy!

If a shop is going to call Mr. and Mrs. X and let them know their repaired set is ready, then surely the customer will have ample time to get his check cashed at the bank before coming to pick up the unit. What could be simpler?

Does this approach work? A fellow technician friend who runs a full-time repair shop uses this approach. He has a sign, placed conspicuously where the customer will see it, that says his shop is cash only. He reminds the customer of this fact when he gives him a receipt and when he calls to advise the customer that his set is ready. The only exceptions are persons known personally to him.

Usually the best solution to a problem is to avoid the problem in the first place. In the past 16 months, my friend has had more than 1,500 units dropped off for repair (he is basically a 1-man shop) with this policy, and it hasn't caused any problems.

Another costly way to prevent the problem is to use a check-verification plan in which the company offering the plan backs up any checks if the repair company calls in each check as it is received. Again, this avoids the problem in the first place, but it obviously cuts into the shop's profits.

In my own case, I operate only on a part-time basis and by word of mouth, so virtually all of my customers are known to me. Accepting checks has not proved to be a problem — no bounced checks in 14 years of operation.

M.B. Danish
Aberdeen Proving Ground, MD

I read with interest William Lynott's Business Corner in the December 1989 issue, and I would like to pass along a procedure I have been using for years: When the customer tenders a check, instead of asking for a driver's license, I ask for a Visa or MasterCard. I write down not only the account number, but also the expiration date. If the check is not honored for any reason, I write up a charge slip and deposit it.

Kenneth E. Hull, CET
Aurora, IL

Both probes are shown in Figure 1.

A common audio complaint is an audio warble or garbled playback audio. These symptoms can be caused by either audio amp problems or mechanical problems in the tape-transport mechanism. To determine whether the problem is mechanical or electrical, I connect the direct probe across the audio head. If the problem can be heard in the mini-amp's speaker, then a mechanical problem exists. By using this technique, you will not waste valuable time troubleshooting the wrong area.

The most common mechanical problem that causes audio warble is oxide buildup on the video head cylinder. Often these lumps of oxide will not affect the video, but will cause momentary tape stretching and audio distortion. Therefore, when a mechanical problem is indicated, give the VCR a good inspection and thorough cleaning.

Another common cause of audio distortion is a defective takeup clutch. A VCR with a bad clutch will usually produce audio in which the actors sound as if they're under water. Problems in the back-tension system can affect the audio as well. Finally, because of the slow tape speed, some warble in the linear track audio is normal in the EP speed. Although the warble can be minimized, it cannot be eliminated in the slow speed.

Next month, we'll finish this series with the amplifier as an IR device tester.

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Circle (21) on Reply Card

Solving RFI complaints – Part II

By John Shepler

When a customer's radio, which glitches and distorts at home, works just fine in the shop, one of the first things to suspect is radio frequency interference (RFI).

Last month's column detailed the easiest and least expensive solution — shielding and grounding the equipment — as well as the brute-force method — filtering and bypassing. However, external methods might not be enough; internal filtering may be necessary.

Internal filtering

Sometimes an external bypass cap or commercial filter isn't enough. This is especially true when the signal is getting through a non-metallic case, such as phono equipment or a guitar amplifier

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

or telephone. In these instances, the fix has to be applied directly to the circuit board.

The first line of defense is at the amplifier input. In microphone, musical instrument, phono or tape pre-amps, a small ceramic bypass cap from the input connector to chassis will keep the RF from reaching the first amplifier stage. Figure 1 shows a complete input filtering. The bypass cap will usually be in the range of 10pF to 470pF. The value of the cap varies with the frequency you are trying to filter and also the impedance of the input. For audio, you can find the maximum value by increasing the capacitor until the response of the amplifier is affected at frequencies above the audio band.

The following formula is also handy for picking an appropriate capacitor:

$$f=1/(6.28 \times R \times C)$$

R is the input impedance in megohms, C is the bypass capacitor in picofarads, and f is the frequency in MHz where the high-frequency response is down by 3dB.

Input filtering is most effective at FM, 2-way and TV frequencies. You want to use very small (5pF or 10pF) capacitors on pre-amp inputs because tape heads and magnetic phono cartridges are sensitive to capacitive loading. Be sure to carefully measure the response of any amp or pre-amp after you add filtering.

Figure 1 also shows a couple of other handy techniques. A ferrite bead slipped over a wire lead will inductively block higher frequencies. You can also coil the wire from the input to the first stage to create an inductor that will block very high frequencies but not affect audio.

Next month, we'll finish this series with a look at desensitizing the amp.

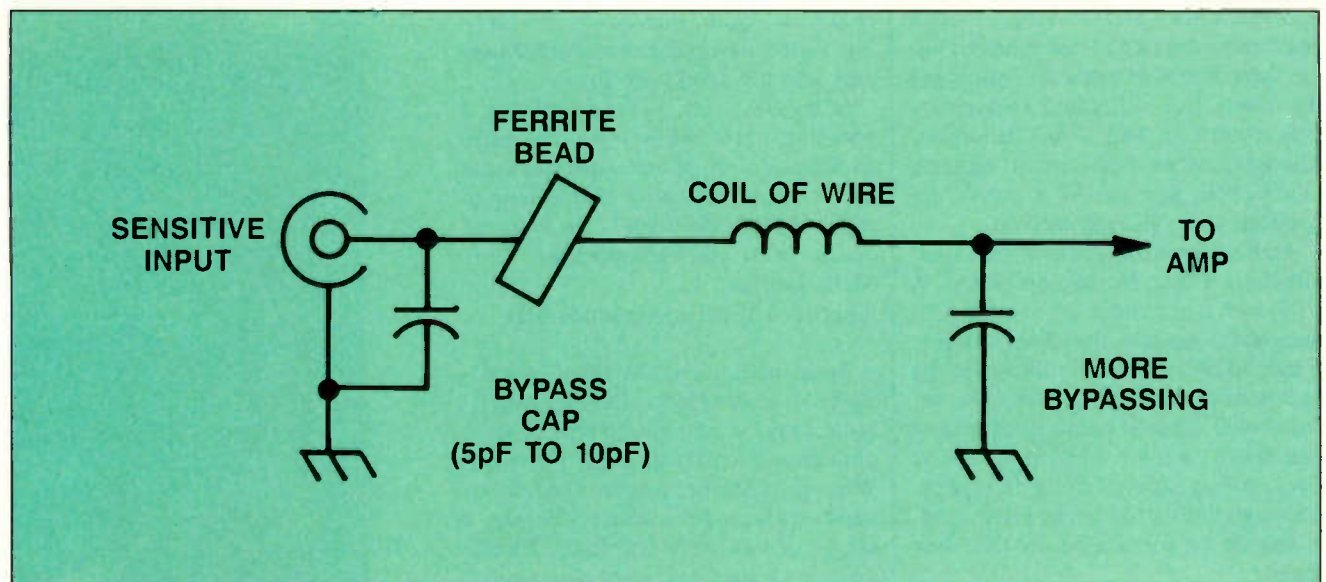


Figure 1. In microphone, musical instrument, phono or tape pre-amps, a 10pF to 470pF ceramic bypass cap from the input connector to chassis will keep the RF from reaching the first amplifier stage. A ferrite bead slipped over a wire lead will inductively block higher frequencies. You can also coil the wire from the input to the first stage to create an inductor that will block very high frequencies but not affect audio.

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