

THE MAGAZINE FOR CONSUMER ELECTRONICS SERVICING PROFESSIONALS


ELECTRONIC^{T.M.}

Servicing & Technology

MARCH 1992/\$3.00

Product directory • Services directory • Mailing addresses

Replacement parts/Components directory



1992 Electronic Servicer's Buyer's Guide

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- Big 1" Display

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- Current, Capacitors, Transistors and Diodes / with case

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A must for VCR work

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with Freq. Counter and Deluxe Case

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Freq Counter .1 - 10MHz
Int/Ext operation

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Function Generator Blox



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- +12VDC @ 1 Amp
- +5VDC @ 1 Amp
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Analog - Section

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- Amplitude adjust
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- Modulation FM-AM

Digital - Section

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- Two no bounce logic switches
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- Clock amplitude 5VPP square wave

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Model

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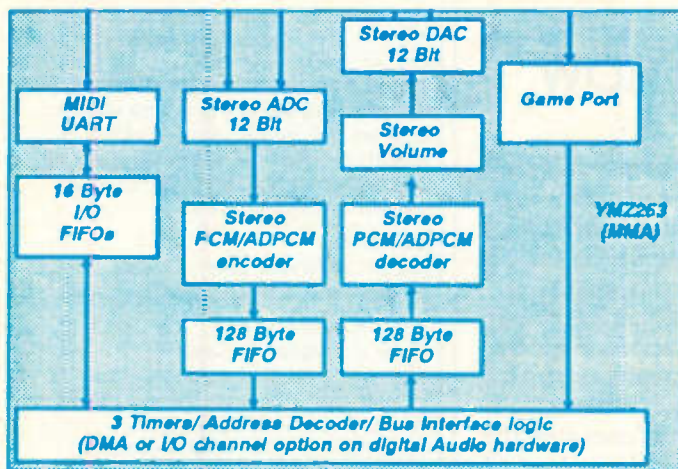


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WRITE FOR FREE CATALOG

Circle (3) on Reply Card



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1992 BUYER'S GUIDE

The business of servicing of consumer electronics products continues to change every year. Newly introduced consumer electronics technology requires new knowledge and skills, new test equipment, new tools and supplies and new replacement components. This kind of change requires that the service facility expand and change its circle of suppliers. Simply identifying and locating these suppliers can be a challenge. This Sixth Annual Buyer's Guide will help you locate the suppliers you'll need to contact during the coming year, so that you can concentrate on the business of servicing the products.

6 Product Directory

The selection of tools and test equipment needed for consumer electronics servicing has grown to keep pace with the expanding list of those products, and the technology that makes them work. This directory provides information on suppliers of all of these products to make the job of selection a little easier.

18 Replacement Parts/ Components Directory

Today, the number of replacement components that a consumer electronics service facility must keep track of seems to be growing without limit. This directory lists manufacturers, distributors and others who

supply the huge variety of parts needed to service these products when they fail.

23 Software/Services Directory

While the job of servicing consumer electronics products continues to become more difficult, a number of products and services that aid the service center in getting the job done has been developing; things such as service center management software, computer diagnostic software, and depot level printed circuit board repair/rework services. If you need this kind of software or service, check out this directory.

24 Association/Educational Services Directory

The profession of consumer electronics servicing today demands continuing education for technicians and managers to remain abreast of the almost daily advances in the technology. Membership in associations is another way to keep up with what's going on by meeting regularly with others who are doing the same kind of work. This directory will provide you with information on what associations exist, and what kinds of education are available.

37 Company Mailing Addresses

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

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ON THE COVER

These graphic elements are just a few of today's consumer electronics products that represent thousands of replacement components that a service center has to keep track of. This 1992 Buyer's Guide can help in that effort by providing the service center management and technicians with the names and addresses of suppliers, and information about the products they supply.

A report from the Consumer Electronics Show

The Winter Consumer Electronics Show that took place in Las Vegas in January provided some interesting insights for anyone who was able to attend. Here are some of the things that were there that would be of interest to the consumer electronics servicing community.

One product area that seems to be growing is the concept of home theater. TV screens are getting larger, and the sound of high quality stereo through a good stereo system installed in conjunction with the large-screen set is adding to the enjoyment of watching either broadcast TV or movies on videotape. The availability of surround sound makes it even more enjoyable for the viewer. Almost like being in a movie theater.

These systems are quite complex for the average viewer, and many businesses have either been opened, or updated to encompass the installation of this kind of custom electronics system in the home. We have been wondering if this is an area that many consumer electronics service centers have gotten into. If any readers of *ES&T* are involved in, or are contemplating becoming involved in doing this kind of work, please write or call the *ES&T* editorial office in Kansas. We'd be interested in finding out a little more about it.

If significant numbers of readers are involved in this kind of thing, it might be worthwhile to provide some articles on the subject. By the same token, if there are any readers who don't feel that performing this kind of work is part of the business of consumer electronics servicing, and are opposed to coverage of it in *ES&T*, also please contact us with your point of view.

Here comes "multimedia"

Something else that was in evidence at the show was multimedia. Multimedia is the term for a system that consists of a personal computer, a high density source of data, such as a CD-ROM (compact disc read only memory), and a good sound source. As detailed in this month's "Computer

Corner," this type of product provides the user with an interactive system that is capable of producing high quality video and sound. The video is even capable of moving images.

One application of this technology that I saw was a Commodore system. It was an Amiga computer system together with a CD player in a single enclosure. The operator operated the unit via a remote control unit that had a full array of controls. The company spokesman at the booth referred to the remote control unit as a "brick."

The software that was running at the time had the image of a children's book on screen. The book image contained written words, as well as illustrations typical of a children's book. What made this different from an ordinary book is that the user could highlight a word or phrase, and a voice generated by the computer would say the word or phrase. In addition, if a single word was highlighted, the user could push another button and the computer would say the meaning of the word. It seemed to make an interesting learning tool.

The only distressing thing about this product from the point of view of the potential servicers of this product is the way the company plans to provide service for the product. According to a company spokesman at the booth, the product is fully warranted for one year. During that year, if it fails, the owner has merely to call the company and they will arrange with a package service to have the product picked up. It will then be shipped to the factory service center for service. Beyond the initial warranty, the owner may choose to pay to continue the service contract, and service will be provided in the same manner. Not much room for independent service here.

Whatever else that attendees may have experienced at this consumer electronics show, it's always a fascinating look at the latest useful electronics products and electronic toys.

Nils Conrad Persson

THE MAGAZINE FOR CONSUMER ELECTRONICS SERVICING PROFESSIONALS

ELECTRONIC

Servicing & Technology

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

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The world of technology has become much less simple than in times past. Equipment once run from a single composite feed may now be driven by S-VHS, Hi-8, or component signals, not to mention VHF, UHF, and CATV. To meet all these expanding signal source needs — and more — Leader introduces the Model 408 general-purpose video test generator.

The GENLOCKable 408 also produces multiburst and video sweep to 15 MHz, as well as many more precision test signals. And on-screen programming provides for easy signal creation for wide-ranging test situations. For routine testing, create up to 100 preset test setups. And there's much more to this uniquely feature-rich generator. There's even a PAL version available.

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Leader Instruments Corporation, 380 Oser Avenue, Hauppauge, New York 11788
Regional Offices: Chicago, Dallas, Los Angeles, Atlanta. In Canada call Omnitronix Ltd., 416 828-6221.

Circle 32 For Product Information Only

Circle 33 For Product Information & Demonstration

1992 Buyer's Guide Introduction

The business of servicing consumer electronics products, never an easy way to make a living, just continues to get more and more difficult. The range of products that falls within the category of consumer electronics products continues to grow. Just as you learn to service, say, a VCR, along come a new category of products, like camcorders, or fax machines, and you have to go to school all over again, buy some new test equipment, and locate a source of supply for replacement components.

A unit taken in for service was likely imported from another country, made by one of 20 different manufacturers under one of a hundred national and private brands. If you need a transistor or an integrated circuit, you might have to cross-reference among several component manufacturers or suppliers before you can identify one that you either have on hand or can get without too much trouble. Just keeping track of the names and addresses of suppliers can be a major task.

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

Using the Buyers' Guide

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

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

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

We've broken down this information into five categories:

- Product Directory page 6
- Replacement Parts/Components Directory . . . page 18
- Software Services Directory page 23
- Association/Educational/Sources Directory page 24
- Company Address Directory page 37

Finding a product or part

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

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

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

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

Once you know who you want to contact for more information, turn to

the Company Address Directory. The address, telephone number and fax number for each company are listed there. (Of course, if the company you are interested in has advertised in this issue, you can just pull out your Reader Service card 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 find out how to contact a company that supplies that product. The Company Address Directory lists information on more than 450 companies and associations that offer products or services for the electronics servicer.

Checking out services

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

Your source for continuing education

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

Keep in touch

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

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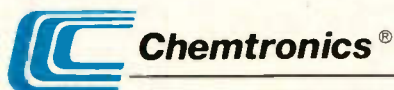
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Circle (62) on Reply Card

Product directory

See Adv. Page

See Adv. Page

See Adv. Page

See Adv. Page

Test equipment

AC LEAKAGE TESTERS

AEMC Corp.
 AT&T Capital Corp. Instrument Services Div.
 Computer Componet Source *D
Consolidated Electronics, Inc.*D 58
 Cooper Associates*D
 Electronics Warehouse Corp.*D
 Fordham Radio Supply Co.*D
Fox International*D 45
 Herman Electronics*D
 The Instrument Mart, Inc.*D
Jensen Tools Inc.*D 21
 Joseph Electronics*D
 Kikusui International Corp.
 Lectronic Research Labs*D
 Omega Engineering Inc.
Print Products International *D 44
 RAG Electronics Inc.*D
 RNJ Electronics Inc.*D
Sencore Electronics IBC
 Simpson Electric Co.
 Specialized Products Co.*D
 A.W. Sperry Instruments, Inc.
 Techni-Tool Inc.*D
 TIF Instruments, Inc.
 Tool Kit Specialists, Inc.*D
 Tri State Electronics*D
 Vector-Viz Instrument Div. a Vector Group Co.
 Verite
 Yokogawa, Corp. of America

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 AT&T Capital Corp. Instrument Services Div.
 B&K-Precision Maxtec International Corp.
 Brian Instruments, Inc.
 Colorado Data Systems
 Computer Service Technology, Inc.
 Dranetz Technologies
 Electro-Metrics, Inc. A Penril Corp.
 Electronics Warehouse Corp.*D
John Fluke Mfg. Co. Inc. BC
 GenRad, Inc.
 GlobeTech International, Inc.
 Hy-Tronix Instruments, Inc.
 IET Labs, Inc.
 The Instrument Mart, Inc.*D
 Joseph Electronics*D
 Keithley Instruments
 Kelvin Electronics*D
 KeyTek Instrument Corp.
Leader Instruments Corp. 3
 Lectronic Research Labs*D
 National Instruments
 Orion Instruments, Inc.
Print Products International *D 44
 Racal-Dana Instruments Inc.
 Rapid Systems
 RNJ Electronics Inc.*D
 Schlumberger Technologies Instruments Div.
 Soltec Corp.
 Tektronix Test & Measurement Group
 Tektronix TV Products Div.
 Temco Instruments Inc.
 3M Photodyne Inc.
 Verite
 Vu-Data Corp.

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 AT&T Capital Corp. Instrument Services Div.
 B&B Electronics Mfg., Co.
 B-B&W Electronics*D
 Beckman Industrial Corp. An Affiliate of Emerson Electric Co.
 Colorado Spectrum, Inc.
Consolidated Electronics, Inc.*D 58
 Contact East, Inc.*D
 Datacom Technologies, Inc.
 Datatran Corp.
 Electro Standards Lab, Inc. Data Communications Products Div.
 Fordham Radio Supply Co.*D
 GC Electronics Div. of GC Thorsen Co.
 Hand Tool Industries, Inc.
 Heath Co.
 HMC-Hub Material Co.*D
 The Instrument Mart, Inc.*D
 International Data Sciences
 JDR Micro*D
 W.S. Jenks & Son*D
Jensen Tools Inc.*D 21
 Joseph Electronics*D
 Kelvin Electronics*D
 Kobetron Inc.
 L-Corn Inc.
 MCM Electronics*D
 MetraByte Corp.
 M-Test Equipment
 Nu-Data Inc.
 ORA Electronics
Print Products International *D 44
 RNJ Electronics Inc.*D
 Specialized Products Co.*D
 Techni-Tool Inc.*D
 Tool Kit Specialists, Inc.*D
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 Tucker Electronics Co.*D

CELLULAR TELEPHONE TEST EQUIPMENT

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 AT&T Capital Corp. Instrument Services Div.
 Cooper Associates*D
 Direct Conversion Technique, Inc.
 Electronics Warehouse Corp.*D
Jensen Tools Inc.*D 21
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Leader Instruments Corp. 3
 Lectronic Research Labs*D
 Marconi Instruments
Print Products International *D 44
 Schlumberger Technologies Instruments Div.
Sony Service Co. 55
 Techni-Tool Inc.*D
 Triplett Corp.
 Vector-Viz Instrument Div. a Vector Group Co.

CONTINUITY TESTERS

Accutest Instruments*D
 AEMC Corp.
 All Electronics Corp.*D
American Reliance Inc. 54
 Atrix, Inc.*D
 AT&T Capital Corp. Instrument Services Div.
 B-B&W Electronics*D
 Beckman Industrial Corp. An Affiliate of Emerson Electric Co.
 Behlman Electronics
 Biddle Instruments
 Bursma Electronic Distributing*D

Com-Kyl Inc.*D
 Computer Componet Source *D
Consolidated Electronics, Inc.*D 58
 Contact East, Inc.*D
 Cooper Associates*D
 CSTS Inc.
 Datatran Corp.
 Desco Industries
 Electronics Warehouse Corp.*D
 Fieldpiece Instruments
 Fordham Radio Supply Co.*D
 GC Electronics Div. of GC Thorsen Co.
 Hand Tool Industries, Inc.
 Herman Electronics*D
 HMC-Hub Material Co.*D
 HSC Electronic Supply*D
 Hy-Tronix Instruments, Inc.
 The Instrument Mart, Inc.*D
 International Data Sciences
 JDR Micro*D
 W.S. Jenks & Son*D
Jensen Tools Inc.*D 21
 Jit Resources
 Joseph Electronics*D
 Kelvin Electronics*D
 Kikusui International Corp.
 Klein Tools, Inc.
 Kyoritsu Electrical Instruments Works L-Corn Inc.
Leader Instruments Corp. 3
 Lectronic Research Labs*D
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 MCM Electronics*D
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 Speco Div.
 A.W. Sperry Instruments, Inc.
 Techni-Tool Inc.*D
 Tool Kit Specialists, Inc.*D
 Tri State Electronics*D
 Triplett Corp.
 Tucker Electronics Co.*D
 Universal Enterprises
 Yokogawa Corp. of America

CRT TESTERS/RESTORERS

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 B-B&W Electronics*D
 B&K-Precision Maxtec International Corp.
 Bursma Electronic Distributing*D
 Computer Componet Source *D
Consolidated Electronics, Inc.*D 58
 Contact East, Inc.*D
 Conway Mfg.
 Electronic Parts Supply*D
 Electronics Warehouse Corp.*D
 Fordham Radio Supply Co.*D
 HMC-Hub Material Co.*D
 The Instrument Mart, Inc.*D
 W.S. Jenks & Son*D
Jensen Tools Inc.*D 21
 Joseph Electronics*D
 Lectronic Research Labs*D
 MCM Electronics*D
Print Products International *D 44
 RNJ Electronics Inc.*D
Sencore Electronics IBC
Sony Service Co. 55
 Tri State Electronics*D

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 B&K-Precision Maxtec International Corp.
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 Computer Componet Source *D
 Contact East, Inc.*D
 Electronics Warehouse Corp.*D
 The Instrument Mart, Inc.*D
Jensen Tools Inc.*D 21
 Joseph Electronics*D
Leader Instruments Corp. 3
 Lectronic Research Labs*D
Print Products International *D 44
 RAG Electronics Inc.*D
 RNJ Electronics Inc.*D
 Tektronix Test & Measurement Group
 Tucker Electronics Co.*D

DATA COMMUNICATION ANALYZERS/MONITORS/TESTERS

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 Allied Electronics, Inc. Subsidiary of Hall-Mark*D
American Reliance Inc. 54
 Anritsu Meter Co. of America
 Atrix, Inc.*D
 AT&T Capital Corp. Instrument Services Div.
 B&B Electronics Mfg., Co.
 Beckman Industrial Corp. An Affiliate of Emerson Electric Co.
 Computer Componet Source *D
 Datacom Technologies, Inc.
 Datatran Corp.
 Digitech Industries Inc.
 Direct Conversion Technique, Inc.
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 Frederick Engineering, Inc.
 HMC-Hub Material Co.*D
 Hy-Tronix Instruments, Inc.
 The Instrument Mart, Inc.*D
 International Data Sciences
 JDR Micro*D
 W.S. Jenks & Son*D
Jensen Tools Inc.*D 21
 Joseph Electronics*D
 Kobetron Inc.
 L-Corn Inc.
 Lectronic Research Labs*D
 MetraByte Corp.
 M-Test Equipment
 Nu-Data Inc.
 Philips CEC Technical Training Service Co.*D
Print Products International *D 44
 Soltec Corp.
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 Specialized Products Co.*D
 Techni-Tool Inc.*D
 Tekelec
 Tektronix Test & Measurement Group
 Tektronix Redmond Div.
 3M Photodyne Inc.
 3M Private Network Products
 Tool Kit Specialists, Inc.*D
 Tucker Electronics Co.*D

DISC DRIVE ANALYZERS/TESTERS

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 AVA Instrumentation, Inc.
 Brian Instruments, Inc.
 Computer Componet Source *D
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RAG Electronics Inc.*D	Rochester Instruments Systems	Cooper Associates*D	NCM Electronics
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Bursma Electronic Distributing*D	Tektronix Test & Measurement Group	Moody Tools, Inc.	Rochester Instruments Systems
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Dragnetz Technologies	Tri State Electronics*D	Tentel Corp. 49	Specialized Products Co.*D
Electronics Warehouse Corp.*D	Tucker Electronics Co.*D	GENERATORS, AUDIO	Techni-Tool Inc.*D
The Instrument Mart, Inc.*D	Vector-Viz Instrument Div. a Vector Group Co.	Accutest Instruments*D	Tektronix Test & Measurement Group Teledata Systems
Joseph Electronics*D	FUNCTION GENERATORS	Alfa Electronics	Tri State Electronics*D
Leader Instruments Corp. 3	Accutest Instruments*D	AT&T Capital Corp. Instrument Services Div.	Tucker Electronics Co.*D
Lectronic Research Labs*D	Alfa Electronics	B-B&W Electronics*D	Yokogawa Corp. of America
Print Products International *D 44	Allied Electronics, Inc. Subsidiary of Hall-Mark*D	Brunelle Instruments Inc.	
RAG Electronics Inc.*D	American Reliance Inc. 54	Bursma Electronic Distributing*D	GENERATORS, VIDEO
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Tucker Electronics Co.*D	Arrow Electronics Inc. Catalog Sales Div.*D	Consolidated Electronics, Inc.*D 58	AT&T Capital Corp. Instrument Services Div.
Yokogawa Corp. of America	AT&T Capital Corp. Instrument Services Div.	Contact East, Inc.*D	Audiovisual Inc. (Video Midwest/AVC Systems Divs.)*D
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Bursma Electronic Distributing*D	Electronics Warehouse Corp.*D	Leader Instruments Corp. 3	Extch Instruments Corp.
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Computer Componet Source *D	Fordham Radio Supply Co.*D	MCM Electronics*D	Fox International*D 45
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Specialized Products Co.*D			
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HMC-Hub Material Co.*D	Computer Componet Source *D	Herman Electronics*D	W.S. Jenks & Son*D
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The Instrument Mart, Inc.*D	Cooper Associates*D	The Instrument Mart, Inc.*D	Kenwood U.S.A. Corp.
JDR Micro*D	Electro-Metrics, Inc. A Penril Corp.	JDR Micro*D	Leader Instruments Corp. 3
W.S. Jenks & Son*D	Electronics Warehouse Corp.*D	W.S. Jenks & Son*D	Letronic Research Labs*D
Jensen Tools Inc.*D 21	The Instrument Mart, Inc.*D	Jensen Tools Inc.*D 21	Phillips CEC Technical Training Service Co.*D
Joseph Electronics*D	W.S. Jenks & Son*D	Joseph Electronics*D	Print Products International *D 44
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Print Products International *D 44	Pennetek Instrument's	Phillips ECG 23	Tucker Electronics Co.*D
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Vu-Data Corp.	Schlumberger Technologies Instruments Div.	Solder Absorbing Technology, Inc.	
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Contact East, Inc.*D	Tri State Electronics*D	Tektronix Test & Measurement Group	
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Herman Electronics*D	Tucker Electronics Co.*D	Tri State Electronics*D	
HMC-Hub Material Co.*D	TELEPHONE ANALYZERS/TESTERS	Universal Enterprises	
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Joseph Electronics*D	B&K-Precision Maxtec International Corp.		
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Omega Engineering Inc.	Consolidated Electronics, Inc.*D 58		
Phillips CEC Technical Training Service Co.*D	Contact East, Inc.*D		
Print Products International *D 44	Conway Mfg.		
Specialized Products Co.*D	Datacom Technologies, Inc.		
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Tool Kit Specialists, Inc.*D	Electronic Design Specialists		
Vortec Corp.	Electronics Warehouse Corp.*D		
Yokogawa Corp. of America	Hand Tool Industries, Inc.		
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Herman Electronics*D	Specialized Products Co.*D		
HMC-Hub Material Co.*D	Techni-Tool Inc.*D		
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IET Labs, Inc.	3M Private Network Products		
The Instrument Mart, Inc.*D	Tri State Electronics*D		
JDR Micro*D	Triplett Corp.		
W.S. Jenks & Son*D	Tucker Electronics Co.*D		
Jensen Tools Inc.*D 21	TEMPERATURE SENSORS		
Joseph Electronics*D	Acculex Corp. A MetraByte Co.		
Keithley Instruments	Accutest Instruments*D		
Leader Instruments Corp. 3	AEMC Corp.		
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Lil' Bitty Tester, Inc.			
MAI/Prime Parts*D			

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Digitech Industries Inc.	
Direct Conversion Technique, Inc.	
Diversified Parts*	
Dranetz Technologies	
Electron Processing	
Electronics Warehouse Corp.*D	
Elenco Electronics, Inc.	
Global Specialties A Div. of Interplex	
GMB/dba Fox International*D	
Gould Inc. Test & Measurement Group	
Hameg, Inc.	
Hand Tool Industries, Inc.	
Herman Electronics*D	
HMC-Hub Material Co.*D	
In-Circuit Test, Inc.	
The Instrument Mart, Inc.*D	
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KeyTek Instrument Corp.	
Kikusui International Corp.	
Klein Tools, Inc.	
Kobetron Inc.	
Kyoritsu Electrical Instruments Works	
L-Com Inc.	
Leader Instruments Corp.	3
Lectionic Research Labs*D	
MAI/Prime Parts*D	
Marconi Instruments	
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Test equipment accessories

AUDIO DUMMY LOADS

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Joseph Electronics*D	
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Arrow Electronics Inc. Catalog Sales Div.*D	
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Cooper Associates*D	
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Elenco Electronics, Inc.	
Fordham Radio Supply Co.*D	
HMC-Hub Material Co.*D	
IET Labs, Inc.	
The Instrument Mart, Inc.*D	
W.S. Jenks & Son*D	
Jensen Tools Inc.*D	21
Joseph Electronics*D	
Kenwood U.S.A. Corp.	
Lectionic Research Labs*D	
MAI/Prime Parts*D	
Plastic Capacitors Inc.	
Print Products International *D	44
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RNJ Electronics Inc.*D	
Specialized Products Co.*D	
Speco Div.	
Techni-Tool Inc.*D	
Trl State Electronics*D	
Tucker Electronics Co.*D	
Vector-Viz Instrument Div. a Vector Group Co.	
Yokogawa Corp. of America	

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POWER SUPPLIES, BENCH

Accutest Instruments*D	
Alfa Electronics	

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Cooper Associates*D	
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Diversified Parts*D	
Electronic Parts Supply*D	
Electronics Warehouse Corp.*D	
Elenco Electronics, Inc.	
Elgar Corp.	
Fordham Radio Supply Co.*D	
Hameg, Inc.	
Heath Co.	
Herman Electronics*D	
HMC-Hub Material Co.*D	
HSC Electronic Supply*D	
The Instrument Mart, Inc.*D	
W.S. Jenks & Son*D	
Jensen Tools Inc.*D	21
Joseph Electronics*D	
Kelvin Electronics*D	
Kenwood U.S.A. Corp.	
Kikusui International Corp.	
Leader Instruments Corp.	3
Lectionic Research Labs*D	
MAI/Prime Parts*D	
MCM Electronics*D	
Minuteman	
O.K. Industries Inc.	
Pacific Power Source	
Phillips CEC Technical Training Service Co.*D	
Plastic Capacitors Inc.	
Print Products International *D	44
RAG Electronics Inc.*D	
RNJ Electronics Inc.*D	
Salen Enterprises*D	
Sorensen Co.	
Specialized Products Co.*D	
Speco Div.	
Techni-Tool Inc.*D	
Tool Kit Specialists, Inc.*D	
Trl State Electronics*D	
Tucker Electronics Co.*D	
Vector-Viz Instrument Div. a Vector Group Co.	

TEST JIGS AND FIXTURES

American Reliance Inc.	54
Andrews Electronics *D	
B-B&W Electronics*D	
Dandy Mfg. Co.	
Direct Conversion Technique, Inc.	
Diversified Parts*D	
Electronics Warehouse Corp.*D	
Electronix, Inc.*D	
E-Z Hook	
Fordham Radio Supply Co.*D	
GMB/dba Fox International*D	
HMC-Hub Material Co.*D	
In-Circuit Test, Inc.	
W.S. Jenks & Son*D	
Jensen Tools Inc.*D	21
Leader Instruments Corp.	3
Lectionic Research Labs*D	
Phillips CEC Technical Training Service Co.*D	
Polaris Div. of UXL Corp.	
Sony Service Co.	55
Techni-Tool Inc.*D	
Temco Instruments Inc.	
Tentel Corp.	49

TEST LEADS AND PROBES

Accutest Instruments*D	
Allied Electronics, Inc. Subsidiary of Hall-Mark*D	
American Design Components*D	
American Reliance Inc.	54
Amprobe Instrument	
Anritsu Meter Co. of America	

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Atrix, Inc.*D	
Avex Probes Inc.	
B-B&W Electronics*D	
Beckman Industrial Corp. An Affiliate of Emerson Electric Co.	
Brunelle Instruments Inc.	
Bursma Electronic Distributing*D	
Com-Kyl Inc.*D	
Computer Component Source *D	
Consolidated Electronics, Inc.*D	58
Contact East, Inc.*D	
Cooper Associates*D	
C&S Sales*D	IFC
CUI Stack, Inc.	
Dandy Mfg. Co.	
Diversified Parts*D	
Electro Standards Lab, Inc. Data Communications Products Div.	
Electromatic Controls/ Soar Instruments	
Electronic Design Specialists	
Electronics Warehouse Corp.*D	
Elenco Electronics, Inc.	
Emulation Technology Inc.	
E-Z Hook	
Fieldpiece Instruments	
Fordham Radio Supply Co.*D	
GC Electronics Div. of GC Thorsen Co.	
Hameg, Inc.	
Heath Co.	
Herman Electronics*D	
HMC-Hub Material Co.*D	
HSC Electronic Supply*D	
The Instrument Mart, Inc.*D	
Interconnect Devices, Inc.	
ITT Pomona Electronics	
JDR Micro*D	
W.S. Jenks & Son*D	
Jensen Tools Inc.*D	21
Joseph Electronics*D	
Kelvin Electronics*D	
Kenwood U.S.A. Corp.	
Keystone Electronics Corp.	
Leader Instruments Corp.	3
Lectionic Research Labs*D	
MAI/Prime Parts*D	
M.A.T. Electronics*D	57
Mercer Electronics	
MetraByte Corp.	
Mouser Electronics*D	
Oldaker Corp.	
Ostby-Barton Test Probes	
Phillips CEC Technical Training Service Co.*D	
Phillips ECG	23
Print Products International *D	44
Probe Master	
RAG Electronics Inc.*D	
Ramsey Electronics Inc.	
RNJ Electronics Inc.*D	
Schurter, Inc.	
Sencore Electronics	IBC
Simpson Electric Co.	
Southgate Distributors*D	
Specialized Products Co.*D	
Techni-Tool Inc.*D	
Tegam, Inc.	
Test Probes, Inc.	
Tool Kit Specialists, Inc.*D	
Tri State Electronics*D	
Tucker Electronics Co.*D	
Universal Enterprises	
Vector-Viz Instrument Div. a Vector Group Co.	

TRANSFORMERS: ISOLATION/VARIABLE

Accutest Instruments*D	
Allied Electronics, Inc. Subsidiary of Hall-Mark*D	
American Design Components*D	
Arrow Electronics Inc. Catalog Sales Div.*D	
B-B&W Electronics*D	
Bursma Electronic Distributing*D	
Computer Power, Inc.	
Consolidated Electronics, Inc.*D	58
Contact East, Inc.*D	
Electronic Parts Supply*D	
Electronics Warehouse Corp.*D	
Fordham Radio Supply Co.*D	
Fox International*D	45
Herman Electronics*D	
HMC-Hub Material Co.*D	

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HSC Electronic Supply*D The Instrument Mart, Inc.*D JDR Micro*D W.S. Jenks & Son*D Jensen Tools Inc.*D 21 Joseph Electronics*D Kelvin Electronics*D Lectronic Research Labs*D MAI/Prime Parts*D Philips CEC Technical Training Service Co.*D Plastic Capacitors Inc. Print Products International *D 44 RAG Electronics Inc.*D RNJ Electronics Inc.*D Sencore Electronics IBC Specialized Products Co.*D Tri State Electronics*D Universal Enterprises Vector-Viz Instrument Div. a Vector Group Co. Yokogawa Corp. of America	RAG Electronics Inc.*D Ramsey Electronics Inc. RNJ Electronics Inc.*D Simpson Electric Co. A.W. Sperry Instruments, Inc. Techni-Tool Inc.*D Tentel Corp. 49 Test Probes, Inc. Tool Kit Specialists, Inc.*D Tucker Electronics Co.*D Verite Viziflex Seels, Inc. Keyboard Cover Div. Vortex Corp. Winders & Geist Yokogawa Corp. of America	Vector-Viz Instrument Div. a Vector Group Co. Winders & Geist STANDBY POWER SYSTEMS AESI/Stedi Watt Allied Electronics, Inc. Subsidiary of Hall-Mark*D American Design Components*D American Power Conversion Corp. Arrow Electronics Inc. Catalog Sales Div.*D Best Power Technology Computer Power, Inc. Consolidated Electronics, Inc.*D 58 Contact East, Inc.*D Controlled Power Co. Cooper Associates*D Electronic Specialists, Inc. Electronics Warehouse Corp.*D Elgar Corp. Herman Electronics*D HMC-Hub Material Co.*D JDR Micro*D W.S. Jenks & Son*D Joseph Electronics*D Kalgio Electronics Co. Inc. MAI/Prime Parts*D MCM Electronics*D Meirick Inc. Minuteman Perma Power Electronics, Inc. Print Products International *D 44 Safe Power Systems Div. of Acme Electric Corp. SL Waber, Inc. Sola Specialized Products Co.*D Sutton Designs, Inc. Computer Power Div. Techni-Tool Inc.*D Thordarson/Meissner Tri State Electronics*D Tripp Lite Winders & Geist	Mouser Electronics*D Nu-Data Inc. Omega Engineering Inc. ORA Electronics Panamax Perma Power Electronics, Inc. Philips ECG 23 Plastic Systems, Inc. Print Products International *D 44 RNJ Electronics Inc.*D Safe Power Systems Div. of Acme Electric Corp. Shape Electronics SL Waber, Inc. Sola Specialized Products Co.*D The Superior Electric Co. Sutton Designs, Inc. Computer Power Div. Techni-Tool Inc.*D Thomson Consumer Electronics, Inc. Distributor & Special Products*D Tri State Electronics*D Tripp Lite Verite Winders & Geist UNINTERRUPTIBLE POWER SUPPLIES AESI/Stedi Watt Allied Electronics, Inc. Subsidiary of Hall-Mark*D American Design Components*D American Power Conversion Corp. Arrow Electronics Inc. Catalog Sales Div.*D Audiovisual Inc. (Video Midwest/AVC Systems Divs.)*D B-B&W Electronics*D Behlman Electronics Best Power Technology Clary Corp. Computer Power, Inc. Consolidated Electronics, Inc.*D 58 Contact East, Inc.*D Controlled Power Co. Deltron, Inc. Electronics Warehouse Corp.*D Elgar Corp. General Power Corp. Herman Electronics*D HMC-Hub Material Co.*D Horizon Technology, Inc.*D HSC Electronic Supply*D ICS, Inc. Electro-Pac Div. JDR Micro*D W.S. Jenks & Son*D Joseph Electronics*D Kalgio Electronics Co. Inc. MAI/Prime Parts*D MCM Electronics*D Meirick Inc. Minuteman Pacific Power Source Panamax Perma Power Electronics, Inc. Phitek Power Corp. Print Products International *D 44 Safe Power Systems Div. of Acme Electric Corp. SL Waber, Inc. Sola Specialized Products Co.*D The Superior Electric Co. Sutton Designs, Inc. Computer Power Div. Techni-Tool Inc.*D Thordarson/Meissner Tri State Electronics*D Tripp Lite Tucker Electronics Co.*D Viteq Corp. Winders & Geist VOLTAGE REGULATORS Accutest Instruments*D Allied Electronics, Inc. Subsidiary of Hall-Mark*D Arrow Electronics Inc. Catalog Sales Div.*D Computer Power, Inc. Consolidated Electronics, Inc.*D 58 Contact East, Inc.*D Electronics Warehouse Corp.*D Elgar Corp. General Power Corp. Herman Electronics*D HMC-Hub Material Co.*D Horizon Technology, Inc.*D HSC Electronic Supply*D ICS, Inc. Electro-Pac Div. JDR Micro*D W.S. Jenks & Son*D Joseph Electronics*D Kalgio Electronics Co. Inc. MAI/Prime Parts*D MCM Electronics*D Meirick Inc. Minuteman Pacific Power Source Panamax Perma Power Electronics, Inc. Phitek Power Corp. Print Products International *D 44 Safe Power Systems Div. of Acme Electric Corp. SL Waber, Inc. Sola Specialized Products Co.*D The Superior Electric Co. Sutton Designs, Inc. Computer Power Div. Techni-Tool Inc.*D Thordarson/Meissner Tri State Electronics*D Tripp Lite Tucker Electronics Co.*D Viteq Corp. Winders & Geist
VCR TEST JIG KITS Andrews Electronics *D B-B&W Electronics*D Consolidated Research Group Diversified Parts*D Electronic Parts Supply*D Electronics Warehouse Corp.*D Electronix, Inc.*D Fox International*D 45 Joseph Electronics*D Lectronic Research Labs*D M.A.T. Electronics*D 57 MCM Electronics*D Nippon Shokuhin Sangyo USA Ltd. Philips CEC Technical Training Service Co.*D Philips ECG 23 Premium Parts + Electronics Co.*D .. 55 RNJ Electronics Inc.*D Sony Service Co. 55 Tentel Corp. 49	Circuit damage protective equipment/supplies POWER CONDITIONING EQUIPMENT GROUNDING SYSTEMS Arrow Electronics Inc. Catalog Sales Div.*D Atrix, Inc.*D Bursma Electronic Distributing*D Consolidated Electronics, Inc.*D 58 Herman Electronics*D HMC-Hub Material Co.*D W.S. Jenks & Son*D Joseph Electronics*D MAI/Prime Parts*D Plastic Systems, Inc. Print Products International *D 44 RNJ Electronics Inc.*D Specialized Products Co.*D Static Prevention Inc. Verite	POWER LINE MONITORS Accutest Instruments*D Allied Electronics, Inc. Subsidiary of Hall-Mark*D American Power Conversion Corp. Arrow Electronics Inc. Catalog Sales Div.*D Atrix, Inc.*D BMI-Basic Measuring Instruments Brunelle Instruments Inc. Computer Power, Inc. Consolidated Electronics, Inc.*D 58 Contact East, Inc.*D Cooper Associates*D Dragnet Technologies Eastern Time Designs, Inc. 2626 Brown Ave. Electronics Warehouse Corp.*D Elgar Corp. Extech Instruments Corp. Herman Electronics*D HMC-Hub Material Co.*D JDR Micro*D W.S. Jenks & Son*D Jensen Tools Inc.*D 21 Joseph Electronics*D Kobetron Inc. MAI/Prime Parts*D MCM Electronics*D Mendon Electronics Corp. Minuteman Nu-Data Inc. Print Products International *D 44 Rochester Instruments Systems Safe Power Systems Div. of Acme Electric Corp. SL Waber, Inc. Specialized Products Co.*D The Superior Electric Co. Sutton Designs, Inc. Computer Power Div. Techni-Tool Inc.*D	SURGE/SPIKE PROTECTORS Accutest Instruments*D AESI/Stedi Watt All Electronics Corp.*D Allied Electronics, Inc. Subsidiary of Hall-Mark*D American Design Components*D American Power Conversion Corp. Arrow Electronics Inc. Catalog Sales Div.*D Atrix, Inc.*D B-B&W Electronics*D Best Power Technology Bursma Electronic Distributing*D Com-Kyl Inc.*D Computer Component Source *D Computer Power, Inc. Consolidated Electronics, Inc.*D 58 Contact East, Inc.*D Cooper Associates*D Datatran Corp. Diversified Parts*D Eiger Electronics*D Electro Standards Lab, Inc. Data Communications Products Div. Electron Processing Electronic Parts Supply*D Electronic Specialists, Inc. Electronics Warehouse Corp.*D Fordham Radio Supply Co.*D Fox International*D 45 GC Electronics Div. of GC Thorsen Co. GMB/dba Fox International*D Herman Electronics*D HMC-Hub Material Co.*D Hosfelt Electronics*D HSC Electronic Supply*D JDR Micro*D W.S. Jenks & Son*D Jensen Tools Inc.*D 21 Joseph Electronics*D Kalgio Electronics Co. Inc. L-Com Inc. MAI/Prime Parts*D M.A.T. Electronics*D 57 MCG Electronics, Inc. MCM Electronics*D
OTHER TEST EQUIPMENT ACCESSORIES AEMC Corp. Amprobe Instrument B&K-Precision Maxtec International Corp. Brian Instruments, Inc. Bursma Electronic Distributing*D Computer Component Source *D Consolidated Electronics, Inc.*D 58 C&S Sales*D IFC Diversified Parts*D Electro Standards Lab, Inc. Data Communications Products Div. Electron Processing Electronic Parts Supply*D Electronics Warehouse Corp.*D Elenco Electronics, Inc. C.H. Ellis Co., Inc. Emulation Technology Inc. E-Z Hook Fox International*D 45 Gemini Inc. GMB/dba Fox International*D Hand Tool Industries, Inc. HMC-Hub Material Co.*D Hy-Tronix Instruments, Inc. In-Circuit Test, Inc. The Instrument Mart, Inc.*D ITT Pomona Electronics JDR Micro*D W.S. Jenks & Son*D Jensen Tools Inc.*D 21 Joseph Electronics*D Kenwood U.S.A. Corp. Kikusui International Corp. Kyoritsu Electrical Instruments Works Kyros Corp. Lectronic Research Labs*D MAI/Prime Parts*D Mouser Electronics*D Ostby-Barton Test Probes Philips CEC Technical Training Service Co.*D Print Products International *D 44 Probe Master Prorachi Electronics Corp. Racal-Dana Instruments Inc.			

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Controlled Power Co.
Cooper Associates*^D
Datel, Inc.
Diversified Parts*^D
Eiger Electronics*^D
Electronic Parts Supply*^D
Electronic Specialists, Inc.
Electronics Warehouse Corp.*^D
Herman Electronics*^D
HMC-Hub Material Co.*^D
Hosfelt Electronics*^D
HSC Electronic Supply*^D
JDR Micro*^D
W.S. Jenks & Son*^D
Joseph Electronics*^D
Kelvin Electronics*^D
Lectronic Research Labs*^D
MAI/Prime Parts*^D
MCM Electronics*^D
Minuteman
Perma-Power Electronics, Inc.
Philips CEC Technical Training Service Co.*^D
Print Products International *^D 44
RNJ Electronics Inc.*^D
Shape Electronics
SL Waber, Inc.
Sola
Specialized Products Co.*^D
The Superior Electric Co.
Sutton Designs, Inc. Computer Power Div.
Tri State Electronics*^D
Trlpp Lite
Winders & Gelst

The Texwipe Co.
Gregory Thomas, Inc.
Thomson Consumer Electronics, Inc.
Distributor & Special Products*^D
Tool Kit Specialists, Inc.*^D
Tri State Electronics*^D
Wescorp

ANTISTATIC IONIZATION DEVICES

Allied Electronics, Inc. Subsidiary of Hall-Mark*^D
Atrix, Inc.*^D
Chapman Corp.
Charleswater Products, Inc.
Com-Kyl Inc.*^D
Cooper Associates*^D
Desco Industries
HMC-Hub Material Co.*^D
W.S. Jenks & Son*^D
Joseph Electronics*^D
NRD Inc. Static Control Products
Plastic Capacitors Inc.
Plastic Systems, Inc.
Print Products International *^D 44
Semtronics Corp.
The Simco Co., Inc.
Specialized Products Co.*^D
Start International*^D
Static Control Services, Inc.
Static Prevention Inc.
Techni-Tool Inc.*^D
Gregory Thomas, Inc.
Vortec Corp.
Wescorp

Thomson Consumer Electronics, Inc.
Distributor & Special Products*^D
3M Electrical Specialties Div.
Tool Kit Specialists, Inc.*^D
Trace Racks
Tri State Electronics*^D
Verite
Wescorp
Winders & Geist

ESD FLEXIBLE PACKAGING

Alrmold/W.R. Grace Co.
Allied Electronics, Inc. Subsidiary of Hall-Mark*^D
Armand Mfg. Inc.
Atrix, Inc.*^D
Charleswater Products, Inc.
Com-Kyl Inc.*^D
Desco Industries
Electronics Warehouse Corp.*^D
Global Kitting
Highland Products, Inc.
HMC-Hub Material Co.*^D
W.S. Jenks & Son*^D
Jensen Tools Inc.*^D 21
Jit Resources
Joseph Electronics*^D
MAI/Prime Parts*^D
MCM Electronics*^D
NRD Inc. Static Control Products
Plastic Systems, Inc.
Print Products International *^D 44
Republic Packaging Corp.
RNJ Electronics Inc.*^D
Seco Industries
Semtronics Corp.
Sentinel Products Div. Packaging Industries Group
The Simco Co., Inc.
Specialized Products Co.*^D
Start International*^D
Techni-Tool Inc.*^D
Gregory Thomas, Inc.
3M Electrical Specialties Div.
Wescorp

Allied Electronics, Inc. Subsidiary of Hall-Mark*^D
Ambico
American Design Components*^D
Amprobe Instrument
Andrews Electronics *^D
Arrow Electronics Inc. Catalog Sales Div.*^D
Atrix, Inc.*^D
Audiovisual Inc. (Video Midwest/AVC Systems Divs.)*^D
Avex Probes Inc.
B-B&W Electronics*^D
Bursma Electronic Distributing*^D
Com-Kyl Inc.*^D
Computer Componet Source *^D
Computer Power, Inc.
Consolidated Electronics, Inc.*^D 58
Contact East, Inc.*^D
Diversified Parts*^D
Electronic Parts Supply*^D
Electronics Warehouse Corp.*^D
Fox International*^D 45
GMB/dba Fox International*^D
Herman Electronics*^D
HMC-Hub Material Co.*^D
Hosfelt Electronics*^D
HSC Electronic Supply*^D
JDR Micro*^D
W.S. Jenks & Son*^D
Joseph Electronics*^D
Kelvin Electronics*^D
MAI/Prime Parts*^D
M.A.T. Electronics*^D 57
Matsushita Services Co.
MCM Electronics*^D
Minuteman
Mouser Electronics*^D
Panasonic Industrial Co.
Parts Express International Inc.*^D 52
Pfanstiehl Corp.
Philips ECG 23
Philtex Power Corp.
Premium Parts + Electronics Co.*^D .. 55
RNJ Electronics Inc.*^D
Russell Industries
Sanyo Energy Corp.
Sony Service Co. National Parts Div.*^D
Specialized Products Co.*^D
Techni-Tool Inc.*^D
Tool Kit Specialists, Inc.*^D
Tri State Electronics*^D
Universal Enterprises
Zenith Sales Co. A Div. of Zenith Electronics Corp.

Electrostatic discharge protection

ANTISTATIC CHEMICALS

ACL
Allied Electronics, Inc. Subsidiary of Hall-Mark*^D
Atrix, Inc.*^D
B-B&W Electronics*^D
Bursma Electronic Distributing*^D
Caig Labs, Inc.
Chapman Corp.
Charleswater Products, Inc.
Chemtronics Inc. 5
Com-Kyl Inc.*^D
Computer Componet Source *^D
Consolidated Electronics, Inc.*^D 58
Contact East, Inc.*^D
Cooper Associates*^D
Diversified Parts*^D
Dow U.S.A.
Electronic Parts Supply*^D
Electronics Warehouse Corp.*^D
Four Star Chemical
Fox International*^D 45
GC Electronics Div. of GC Thorsen Co.
Herman Electronics*^D
HMC-Hub Material Co.*^D
JDR Micro*^D
W.S. Jenks & Son*^D
Jit Resources
Joseph Electronics*^D
Klein Tools, Inc.
MAI/Prime Parts*^D
Master Bond
M.A.T. Electronics*^D 57
Micro-Circuits Co., Inc.
Miller-Stephenson Chemical Co.
PerfectData Corp.
Philips ECG 23
Plastic Systems, Inc.
Premium Parts + Electronics Co.*^D .. 55
Print Products International *^D 44
Rawn Co. Inc., (Subsidiary of the Triangle Corp.)
RemGrlt Corp.
RNJ Electronics Inc.*^D
Rogers Anti-Static Chemicals
The Simco Co., Inc.
Specialized Products Co.*^D
Start International*^D
Static Prevention Inc.
Tech Spray, Inc.
Techni-Tool Inc.*^D

ANTISTATIC MATS/BENCHTOPS/WRISTSTRAPS/OTHERS

Airmold/W.R. Grace Co.
Allied Electronics, Inc. Subsidiary of Hall-Mark*^D
Atrix, Inc.*^D
B-B&W Electronics*^D
Bursma Electronic Distrbluting*^D
Charleswater Products, Inc.
Claus Cutlery Co.
Colonial Glove & Garment Inc.
Com-Kyl Inc.*^D
Computer Componet Source *^D
Contact East, Inc.*^D
Cooper Associates*^D
Desco Industries
Diversified Parts*^D
Electronics Warehouse Corp.*^D
C.H. Ellis Co., Inc.
GC Electronics Div. of GC Thorsen Co.
Global Kitting
The Granite Corp.
Herman Electronics*^D
HMC-Hub Material Co.*^D
ITT Pomona Electronics
JDR Micro*^D
W.S. Jenks & Son*^D
Jensen Tools Inc.*^D 21
Jit Resources
Joseph Electronics*^D
MAI/Prime Parts*^D
MCM Electronics*^D
Melmat Inc.
Mouser Electronics*^D
NRD Inc. Static Control Products
Nu-Concept Systems, Inc.
Oak Technical Inc.
O.K. Industries Inc.
Parts Express International Inc.*^D 52
Philips ECG 23
Plastic Systems, Inc.
Print Products International *^D 44
RNJ Electronics Inc.*^D
Semtronics Corp.
Sentinel Products Div. Packaging Industries Group
The Simco Co., Inc.
Solder Absorbing Technology, Inc.
Sony Service Co. National Parts Div.*^D
Specialized Products Co.*^D
Start International*^D
Static Prevention Inc.
Tech Spray, Inc.
Techni-Tool Inc.*^D
Gregory Thomas, Inc.

STATIC DETECTION METERS

ACL
AEMC Corp.
Allied Electronics, Inc. Subsidiary of Hall-Mark*^D
Atrix, Inc.*^D
Chapman Corp.
Charleswater Products, Inc.
Com-Kyl Inc.*^D
Contact East, Inc.*^D
Desco Industries
Electro-Metrics, Inc. A Penril Corp.
HMC-Hub Material Co.*^D
W.S. Jenks & Son*^D
Jensen Tools Inc.*^D 21
Jit Resources
Joseph Electronics*^D
Monroe Electronics, Inc.
NRD Inc. Static Control Products
Plastic Systems, Inc.
Print Products International *^D 44
RNJ Electronics Inc.*^D
Semtronics Corp.
The Simco Co., Inc.
Specialized Products Co.*^D
Start International*^D
Static Control Services, Inc.
Tech Spray, Inc.
Techni-Tool Inc.*^D
Temco Instruments Inc.
Gregory Thomas, Inc.
3M Electrical Specialties Div.
Tool Kit Specialists, Inc.*^D
Vortec Corp.
Wescorp

BENCHES/CABINETS

Allied Electronics, Inc. Subsidiary of Hall-Mark*^D
Arrow Electronics Inc. Catalog Sales Div.*^D
Com-Kyl Inc.*^D
Contact East, Inc.*^D
Hand Tool Industries, Inc.
HMC-Hub Material Co.*^D
W.S. Jenks & Son*^D
Jensen Tools Inc.*^D 21
Joseph Electronics*^D
Klein Tools, Inc.
MAI/Prime Parts*^D
Mouser Electronics*^D
Parts Express International Inc.*^D 52
The Rex Co.
RNJ Electronics Inc.*^D
Specialized Products Co.*^D
Start International*^D
Techni-Tool Inc.*^D
Tri State Electronics*^D
Workplace Systems
Zero Corp., East Div.

CHEMICALS

ACL
Allied Electronics, Inc. Subsidiary of Hall-Mark*^D
Andrews Electronics *^D
Arrow Electronics Inc. Catalog Sales Div.*^D
Atrix, Inc.*^D
B-B&W Electronics*^D
Bursma Electronic Distributing*^D
Caig Labs, Inc.
Chemtronics Inc. 5

Supplies/accessories equipment

BATTERIES

All Electronics Corp.*^D

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W.S. Jenks & Son* Jensen Tools Inc.*D 21	Tool Kit Specialists, Inc.*D Tri State Electronics* Brian R. White Co., Inc.*D	Cooper Tools Diversified Parts* Dremel Elger Electronics* Electronic Parts Supply* Electronics Warehouse Corp.* Electronix, Inc.* Elenco Electronics, Inc. Eraser Co., Inc. Wybar Div. Fox International* D 45	Mouser Electronics* P.K. Neuses Inc.* O.K. Industries Inc. Omega Engineering Inc. ORA Electronics Paladin Corp. PanaVise Products, Inc. 22 Parts Express International Inc.*D 52 Philips CEC Technical Training Service Co.*D
Jonard Industries Corp. Joseph Electronics* Kelvin Electronics* Klein Tools, Inc. MAI/Prime Parts* M.A.T. Electronics* D 57	TOOLS, MISCELLANEOUS All Electronics Corp.* Allied Electronics, Inc. Subsidiary of Hall-Mark* American Design Components* AMP Inc. Andrews Electronics * Arrow Electronics Inc. Catalog Sales Div.* Atrix, Inc.* Aven International, Inc. B-B&W Electronics* The Boardworks Bondhus Corp. Bursma Electronic Distributing* Caig Labs, Inc. Cementex Products, Inc. Channel Master Div. of Avnet, Inc. Claus Cutlery Co. Com-Kyl Inc.* Computer Component Source * Consolidated Electronics, Inc.*D 58	GC Electronics Div. of GC Thorsen Co. GMB/dba Fox International* The Granite Corp. Hand Tool Industries, Inc. Herman Electronics* HMC-Hub Material Co.* HSC Electronic Supply* JDR Micro* W.S. Jenks & Son* Jensen Tools Inc.*D 21	Portasol, Inc. Premium Parts + Electronics Co.*D .. 55 Print Products International *D 44 Prorachi Electronics Corp. The Rex Co. R & K Supply Co. RNJ Electronics Inc.* Snap-On Tools Corp. Snap-On Tools Corp. Solder Removal Co. Sony Service Co. National Parts Div.* Specialized Products Co.* Techni-Tool Inc.* Thomson Consumer Electronics, Inc. Distributor & Special Products* Tool Kit Specialists, Inc.* Tri State Electronics* Zero Corp., East Div.
Melmat Inc. Mouser Electronics* P.K. Neuses Inc.* Omega Engineering Inc. Philips CEC Technical Training Service Co.* Platt Luggage Premium Parts + Electronics Co.*D .. 55 Print Products International *D 44	Arrow Electronics Inc. Catalog Sales Div.* Atrix, Inc.* Aven International, Inc. B-B&W Electronics* The Boardworks Bondhus Corp. Bursma Electronic Distributing* Caig Labs, Inc. Cementex Products, Inc. Channel Master Div. of Avnet, Inc. Claus Cutlery Co. Com-Kyl Inc.* Computer Component Source * Consolidated Electronics, Inc.*D 58	Johnson Electronic Technologies Jonard Industries Corp. Joseph Electronics* Kelvin Electronics* Klein Tools, Inc. MAI/Prime Parts* MCM Electronics* Micro-Circuits Co., Inc. Moody Tools, Inc.	Print Products International *D 44 Prorachi Electronics Corp. The Rex Co. R & K Supply Co. RNJ Electronics Inc.* Snap-On Tools Corp. Solder Removal Co. Sony Service Co. National Parts Div.* Specialized Products Co.* Techni-Tool Inc.* Thomson Consumer Electronics, Inc. Distributor & Special Products* 3M Electronic Products Div. Tool Kit Specialists, Inc.* Tool Tron Industries Tri State Electronics* Ungar, A Rubbermaid Co.
R & K Supply Co. RNJ Electronics Inc.* Snap-On Tools Corp. Sony Service Co. National Parts Div.* Specialized Products Co.* Spencer Industries Techni-Tool Inc.* Thomson Consumer Electronics, Inc. Distributor & Special Products* Tool Kit Specialists, Inc.* Tri State Electronics* Zero Corp., East Div.	Consolidated Electronics, Inc.*D 58		

TOOL KITS

Allied Electronics, Inc. Subsidiary of Hall-Mark*
American Design Components*
AMP Inc.
Andrews Electronics *
Arrow Electronics Inc. Catalog Sales Div.*
Atrix, Inc.*
Brunelle Instruments Inc.
Bursma Electronic Distributing*
Com-Kyl Inc.*
Computer Component Source *
Consolidated Electronics, Inc.*D 58
Contact East, Inc.*
Cooper Associates*
Cooper Tools
Diversified Parts*
Elger Electronics*
Electro Standards Lab, Inc. Data Communications Products Div.
Electro Tool, Inc. *
Electronic Parts Supply*
Electronics Warehouse Corp.*
Fordham Radio Supply Co.*
Fox International* D 45
GC Electronics Div. of GC Thorsen Co.
Hand Tool Industries, Inc.
Heath Co.
Herman Electronics*
HMC-Hub Material Co.*
HSC Electronic Supply*
ITT Pomona Electronics
JDR Micro*
W.S. Jenks & Son*
Jensen Tools Inc.*D 21
Jonard Industries Corp.
Joseph Electronics*
Kelvin Electronics*
Klein Tools, Inc.
MAI/Prime Parts*
M.A.T. Electronics* D 57
MCM Electronics*
Moody Tools, Inc.
Mouser Electronics*
P.K. Neuses Inc.*
Nu-Data Inc.
O.K. Industries Inc.
Omega Engineering Inc.
Pace, Inc.
Paladin Corp.
Parts Express International Inc.*D 52
Philips CEC Technical Training Service Co.*
Print Products International *D 44
R & K Supply Co.
RNJ Electronics Inc.*
Snap-On Tools Corp.
Sony Service Co. National Parts Div.*
Specialized Products Co.*
Spencer Industries
Techni-Tool Inc.*
Thomson Consumer Electronics, Inc. Distributor & Special Products*
Tool Kit Specialists, Inc.*
Tool Tron Industries
Tri State Electronics*
Ungar, A Rubbermaid Co.

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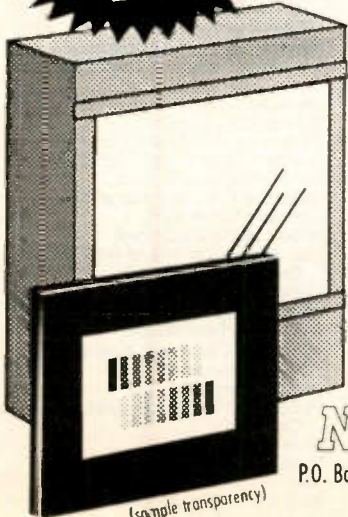
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Use of substitute replacement parts that do not have the same safety characteristics as recommended in factory service information may create shock, fire, excessive x-radiation or other hazards.

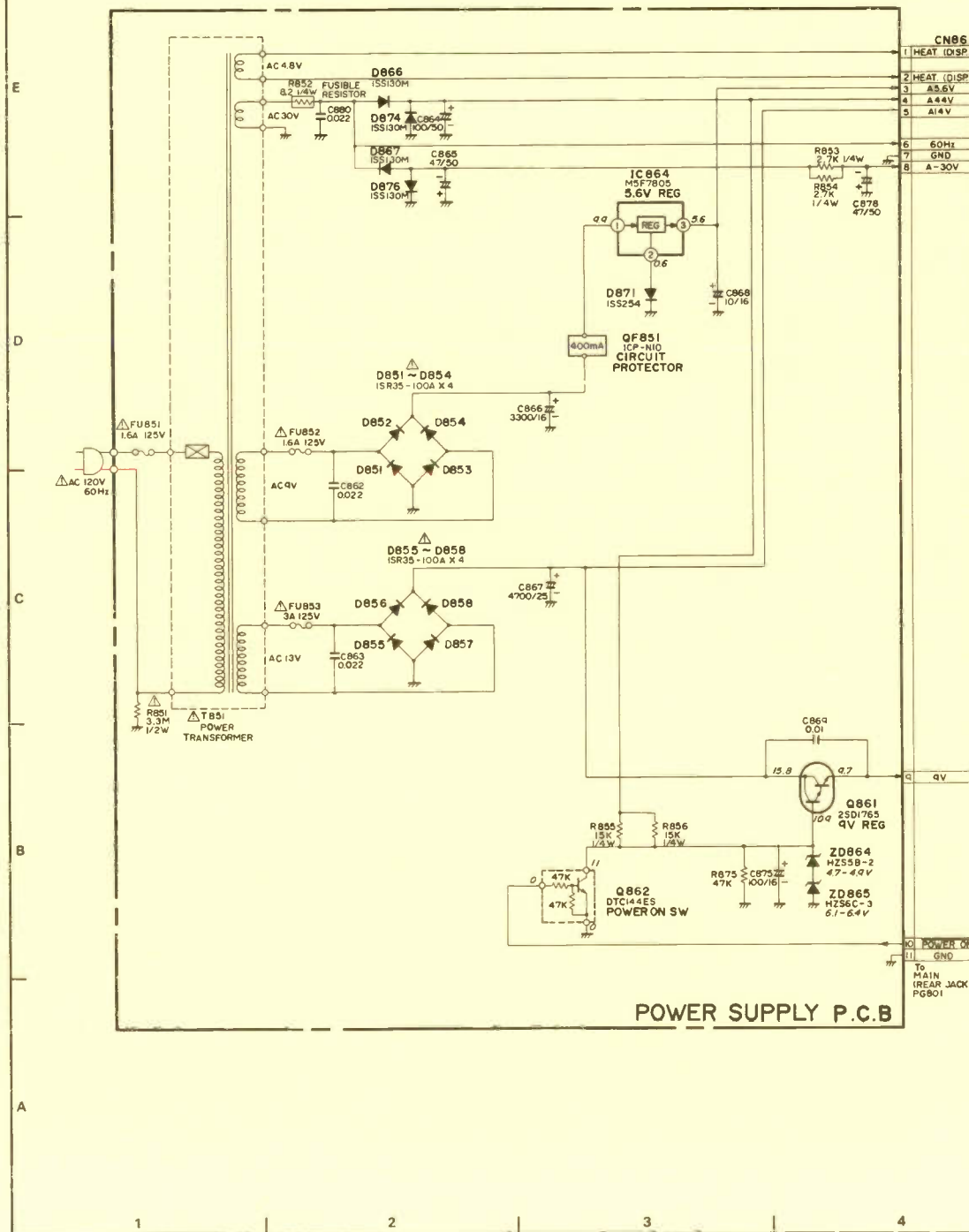
This schematic is for the use of qualified technicians only. This instrument contains no user-serviceable parts.

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

MARCH 1992

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Hitachi
VT-M140A/M141A VHS, VCR.....3086



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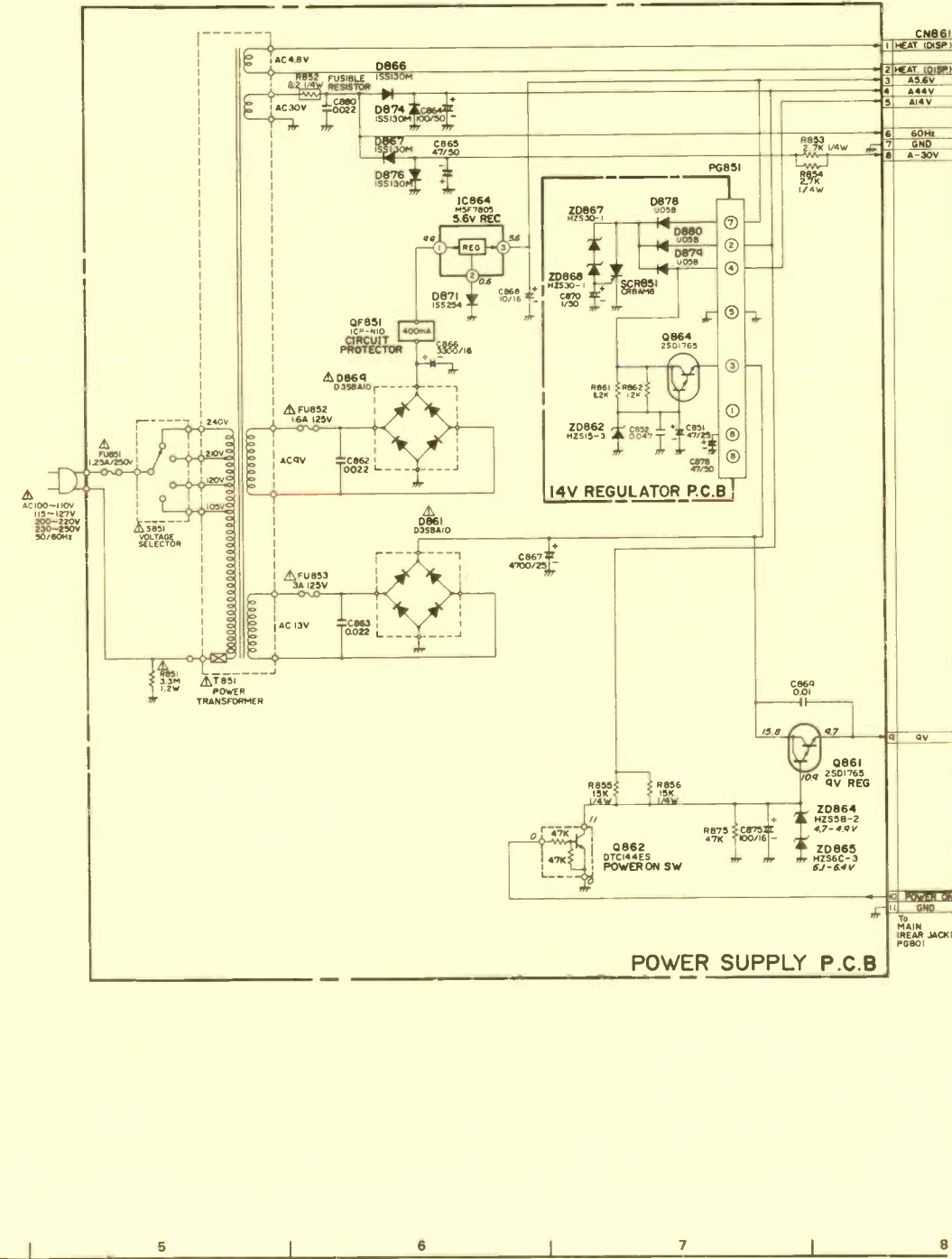
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Use of substitute replacement parts that do not have the same safety characteristics as recommended in factory service information may create shock, fire, excessive x-radiation or other hazards.

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

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

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



SYS. CON./TIMER SCHEMATIC DIAGRAM

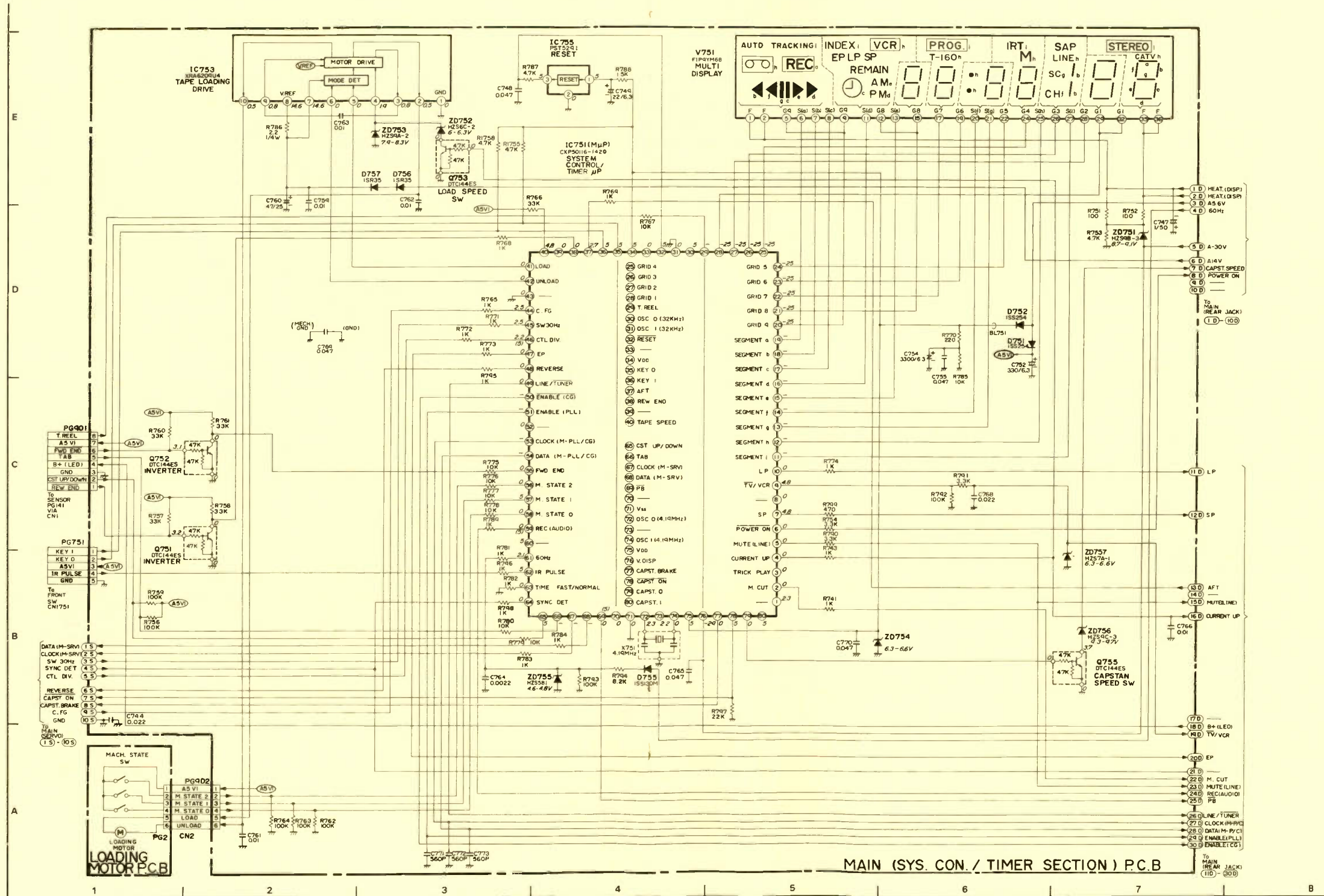
Product safety should be considered when component replacement is made in any area of an electronics product. A star next to a component symbol number designates components in which safety is of special significance. It is recommended that only exact cataloged parts be used for replacement of these components.

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SERVO SCHEMATIC DIAGRAM

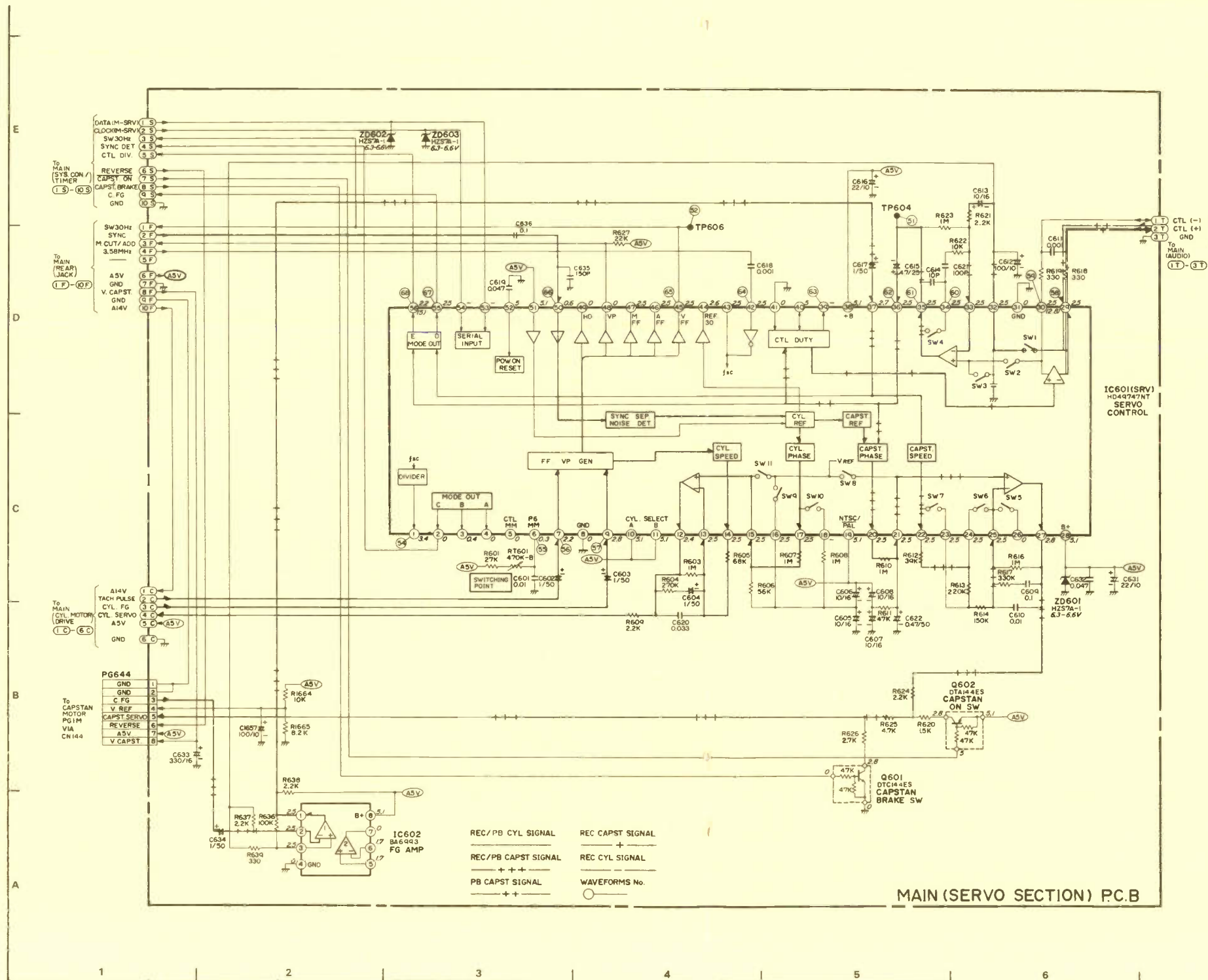
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Table of component values and waveforms. Columns include component ID (e.g., 31-A TP604), value (e.g., 1.0u-p), and waveform diagrams. Includes a legend for signal types like REC-PLAY and PLAY.

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VT-M140A/M141A
VHS, VCR

MARCH 1992

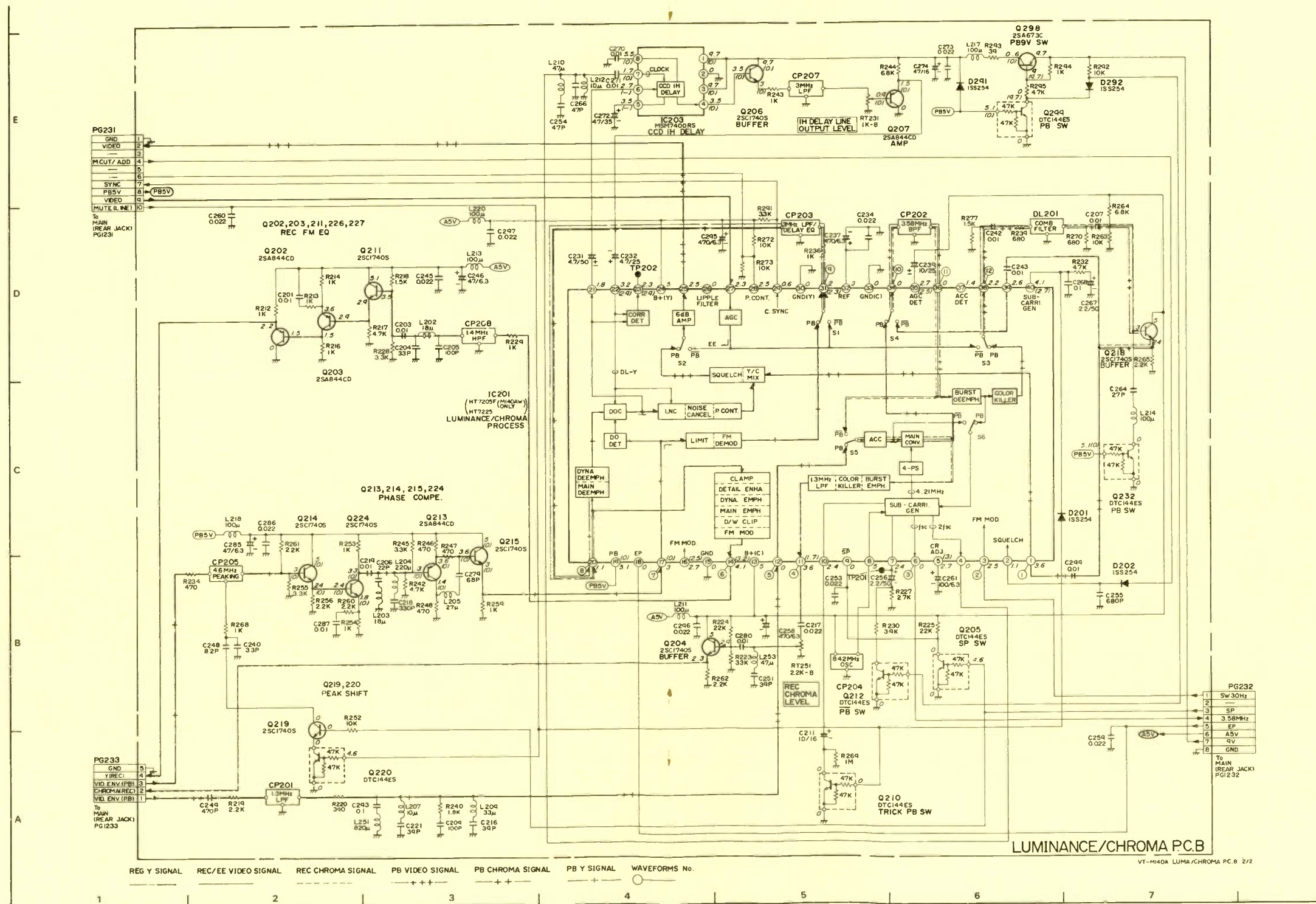
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Fax 815-968-9731

Gemini Inc.
103 Mensing Way
Cannon Falls, MN 55009
507-263-3957
800-533-3631
Fax 507-263-5987

General Power Corp.
P.O. Box 65008
Anaheim, CA 92815
714-956-9321
800-854-3469
Fax 714-491-8644

GenRad, Inc.
300 Baker Ave.
Concord, MA 01742
508-369-4400
800-4-GENRAD
Fax 508-369-6974

Gibson Research Corp.
22991 La Cadena
Laguna Hills, CA 92653
714-830-2200
800-736-0637
Fax 714-830-0300

Global Kitting
P.O. Box 1757
Roseburg, OR 97470
503-672-5332
Fax 503-672-0614

Global Specialties
A Div. of Interplex
P.O. Box 1942
New Haven, CT 06509
203-624-3103
Fax 203-468-0060

GlobeTech International, Inc.
1705 S. Research Loop
Tucson, AZ 85710
602-298-6900
800-654-7314
Fax 602-298-1913

GMB/dba Fox International*^D
140 Terminal Road
Setauket, NY 11733
516-689-5400
800-874-1765
Fax 800-635-0596

GoldStar Precision Co. Ltd.
13013 East 166th St.
Cerritos, CA 90701
310-404-0101
Fax 310-921-6227

Gould Inc.
Test & Measurement Group
8333 Rockside Road
Valley View, OH 44125
216-328-7000
Fax 216-328-7400

The Granite Corp.
24200 Burbank Blvd.
Woodland Hills, CA 91367
818-887-5533
Fax 818-883-5188

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Hameg, Inc.
1939 Avenida Plaza Real
Oceanside, CA 92056
619-630-4080
800-247-1241
Fax 619-630-6507

Hand Tool Industries, Inc.
1933 Lake St.
Kent, OH 44240
216-678-8787
Fax 216-678-9011

Company mailing addresses

Heath Co.
455 Riverview Drive
Benton Harbor, MI 49022
800-444-3284 Request Catalog
800-253-0570 Order Desk
Fax 616-982-5577

Herman Electronics*D
1365 N.W. 23rd St.
Miami, FL 33142
305-634-6591
800-327-8378
Fax 305-634-6247

Hexacon Electric Co.
161 W. Clay Ave.
Roselle Park, NJ 07204
908-245-6200
Fax 908-245-6176

High Tech Electronic Services
1623 Aviation Blvd.
Redondo Beach, CA 90278
310-379-2026
800-289-3001
Fax 310-379-9608

Highland Products, Inc.
P.O. Box 794
Dover, NJ 07801
201-366-0156
Fax 201-366-6665

Hitachi Denshi America, Ltd.
150 Crossways Park Drive
Woodbury, NY 11797
516-921-7200
Fax 516-921-0993

Hitachi Home Electronics
401 W. Artesia Blvd.
Compton, CA 90220
800-HITACHI

Hi-Techniques Inc.
152 Owen Road
Madison, WI 53716
608-221-7500
800-248-1633
Fax 608-221-7509

HMC-Hub Material Co.*D
33 Springdale Ave.
Canton, MA 02021
617-821-1870
800-482-4440
Fax 617-821-4133

Horizon Technology, Inc.*D
650 International Parkway, Suite
180
Richardson, TX 75081
800-888-9600
Fax 214-690-8648

Hosfelt Electronics*D
2700 Sunset Blvd.
Steubenville, OH 43952-1158
614-264-6464
800-524-6464
Fax 614-264-5414

Howe Industries
P.O. Box 1040
Sanford, FL 32772

HSC Electronic Supply*D
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Santa Clara, CA 95051
408-732-1573
800-4-HALTED
Fax 408-732-6428

HSC Service Co.
Div. of Hitachi Sales Corp. of
America
401 W. Artesia Blvd.
Compton, CA 90220
800-447-2882

Hunter Products, Inc.
P.O. Box 6795
Bridgewater, NJ 08807
908-526-8440
800-524-0692
Fax 908-526-8348

Huntron
15720 Mill Creek Road
Mill Creek, WA 98012

Hurley Electronics*D
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Santa Ana, CA 92706
714-971-2992
800-4-HURLEY
Fax 714-971-5033

Hy-Tronix Instruments, Inc.
P.O. Box 827
Newton, KS 67114
316-283-5730
800-835-1005
Fax 316-283-6662

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Hearst Business Communications
645 Stewart Ave.
Garden City, NY 11530
516-227-1330
Fax 516-227-1901

ICS
925 Oak St.
Scranton, PA 18515

ICS, Inc.
Electro-Pac Div.
520 Interstate Road
Addison, IL 60101
708-543-6200
Fax 708-543-6244

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

Impact Printhead Services
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Austin, TX 78754

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

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St. Louis, MO 63103

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Hackensack, NJ 07601
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Fax 201-489-6911

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5376 52nd St. S.E.
Grand Rapids, MI 49512
616-698-8688
800-253-4623
Fax 616-698-0325

The Instrument Mart, Inc.*D
295 Community Drive
Great Neck, NY 11021
516-487-7430
800-645-6535

Interconnect Devices, Inc.
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Kansas City, KS 66106
913-342-5544
Fax 913-342-7043

International Components Corp.
105 Maxess Road
Melville, NY 11747
516-293-1500
800-645-9154
Fax 516-293-4983

International Data Sciences
501 Jefferson Blvd.
Warwick, RI 02886-1317
401-737-9900
800-IDS-DATA
Fax 401-737-9911

ISCET
2708 W. Berry
Fort Worth, TX 76109
817-921-9101
Fax 817-921-3741

ITT Pomona Electronics
1500 E. Ninth St.
Pomona, CA 91766
714-623-3463
Fax 714-629-3317

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2233 Branham Lane
San Jose, CA 95124
408-559-1200
800-538-5000
Fax 408-559-0250

W.S. Jenks & Son*D
1933 Montana Ave. N.E.
Washington, DC 20002
202-529-6020
Fax 202-832-3411

W.S. Jenks & Son*D
6632 Electronic Drive
Springfield, VA 22151
703-750-5406

Jensen Tools Inc.*D
7815 South 46th St.
Phoenix, AZ 85044
602-968-6241
Fax 602-438-1690

Jit Resources
402 W. Arrow Highway, Suite 14
San Dimas, CA 91773
714-599-6090
Fax 714-592-9960

Johnson Electronic Technologies
5 Kane Industrial Drive
Hudson, MA 01749
508-562-1157

Jonard Industries Corp.
134 Marbledale Road
Tuckahoe, NY 10707
914-793-0700
Fax 914-793-4527

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8830 N. Milwaukee Ave.
Niles, IL 60648
708-297-4200
800-323-5925
Fax 708-297-6923

Kalglo Electronics Co. Inc.
6584 Ruch Road
Bethlehem, PA 18017-9359
215-837-0700
Fax 215-837-7978

Keithley Instruments
28755 Aurora Road
Cleveland, OH 44139

Kelvin Electronics*D
10 Hub Drive
Melville, NY 11747
516-349-7620
800-645-9212

Kenwood U.S.A. Corp.
2201 E. Dominguez St.
Long Beach, CA 90810
213-639-4200

Key Prestigee
11065 Knott Ave., Suite B
Cypress, CA 90630

Keystone Electronics Corp.
31-07 20th Road
Astoria, NY 11105-2017
718-956-8900
Fax 718-956-9040

KeyTek Instrument Corp.
260 Fordham Road
Wilmington, MA 01887
508-658-0880
Fax 508-657-4803

Kikusui International Corp.
1980 Orizaba Ave.
Signal Hill, CA 90804-1203
800-545-8784
Fax 310-986-1624

Klein Tools, Inc.
P.O. Box 599033
Chicago, IL 60659-9033
708-677-9500

Kobetron Inc.
2271 Arbor Blvd.
Dayton, OH 45439
513-299-0990
Fax 513-299-0990 Ext. 218

**Kyoritsu Electrical Instruments
Works**
62 N. Coleman Road
Centereach, NY 11720
516-736-0601
Fax 516-732-4650

Kyros Corp.
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Madison, WI 53701
608-238-3587

La Guardia Enterprises
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Yorba Linda, CA 92686
714-579-1276

L-Com Inc.
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North Andover, MA 01845
508-682-6936
800-343-1455
Fax 508-689-9484

Leader Instruments Corp.
380 Oser Ave.
Hauppauge, NY 11788
516-231-6900
800-645-5104
Fax 516-231-5295

**Leads Metal Products, Inc.
(ENDECO)**
1125-C Brookside Ave.
Indianapolis, IN 46202-2748
317-631-7200
Fax 317-631-7237

Company mailing addresses

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P.O. Box 45028
Los Angeles, CA 90045-0028
703-709-9019
800-421-8166
Fax 703-709-6405

Learning Group International
1805 Library St.
Reston, VA 22090
703-709-9019
800-421-8166
Fax 703-709-6405

Lectionic Research Labs*^D
1423 Ferry Ave.
Camden, NJ 08104-1396
609-541-4200
800-358-8378
Fax 609-541-7852

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P.O. Box 358
Trumbull, CT 06611

Lil' Bitty Tester, Inc.
3154 Main St.
Chula Vista, CA 91911
619-425-1472
619-284-0210
Fax 619-284-4567

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414 Chestnut Lane
East Meadow, NY 11554
516-481-4380

W.J. Lynott, Associates
1552 Old York Road
Abington, PA 19001
215-657-0776



Magic Solutions, Inc.
180 Franklin Turnpike
Mahwah, NJ 07430
201-529-5533
Fax 201-529-2955

MAI/Prime Parts*^D
5736 N. Michigan Road
Indianapolis, IN 46208-1729
317-257-6811
Fax 317-257-1590

Marconi Instruments
3 Pearl Court
Allendale, NJ 07401
201-934-9050
800-233-2955
Fax 201-934-9229

Marshall Industries
9320 Telstar Ave.
El Monte, CA 91731

Master Bond
154 Hobart St.
Hackensack, NJ 07601
201-343-8983
Fax 201-343-2132

M.A.T. Electronics*^D
975 Jaymor
Southampton, PA 18966
215-364-7667
800-628-1118
Fax 215-364-8554

Matsushita Services Co.
50 Meadowland Parkway
Secaucus, NJ 07094
201-348-7000
800-447-4700

MCG Electronics, Inc.
12 Burt Drive
Deer Park, NY 11729
516-586-5125
800-851-1508
Fax 516-586-5120

MCM Electronics*^D
650 Congress Park Drive
Dayton, OH 45459
513-434-0031
800-543-4330
Fax 513-434-6959

Meirick Inc.
P.O. Box 298
Frisco, CO 80443
303-668-3251
Fax 303-668-5752

Melmat Inc.
24030 Frampton Ave.
Harbor City, CA 90710
310-325-1625
800-MELMAT-9
Fax 310-325-0603

Mendon Electronics Corp.
3800 Monroe Ave.
Pittsford, NY 14534
716-248-8480
800-227-6937
Fax 716-248-3021

Mercer Electronics
859 Dundee Ave.
Elgin, IL 60120
708-697-2260
Fax 708-697-2272

MetraByte Corp.
440 Myles Standish Blvd.
Taunton, MA 02780
508-880-3000
Fax 508-880-0179

Metro Data Vac
P.O. Box 149
Suffern, NY 10901
914-357-1600
800-822-1602
Fax 914-357-1640

Micro Care Corp.
34 Ronzo Road
Bristol, CT 06010
203-585-7912
800-638-0125
Fax 203-585-7378

Micro-Circuits Co., Inc.
10800 Maudlin Road
New Buffalo, MI 49117
616-469-2727
Fax 616-469-2742

Microwave Filter Co., Inc.
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East Syracuse, NY 13057
315-437-3953
800-448-1666
Fax 315-463-1467

Mill Electronics
2026 McDonald Ave.
Brooklyn, NY 11223

Miller-Stephenson Chemical Co.
George Washington Highway
Danbury, CT 06810
203-743-4447
800-992-2424
Fax 203-791-8702

Mindshare
2202 Buttercup Drive
Richardson, TX 75082

Mini Computer Software Specialists
20975 Swenson Drive, Suite 160
Waukesha, WI 53186

Minuteman
P.O. Box 815188
Dallas, TX 75381
214-446-7363
800-238-7272
Fax 214-446-9011

Mitsubishi Electronics America, Inc.
P.O. Box 6007
Cypress, CA 90630-0007
714-220-2500
800-553-7278
Fax 800-825-6655

Module Exchange
706 Space Way
Duncanville, TX 75137
800-632-6637

Monitech
2 Caesar Place
Moonachie, NJ 07074

Monroe Electronics, Inc.
100 Housel Ave.
Lyndonville, NY 14098
716-765-2254
Fax 716-765-9330

Moody Tools, Inc.
P.O. Box 230
East Greenwich, RI 02818
401-885-0911
800-223-9036
Fax 401-885-4565

Mouser Electronics*^D
2401 Highway 287 N.
Mansfield, TX 76063
817-483-4422
800-346-6873
Fax 817-483-0931

M-Test Equipment
P.O. Box 77440
San Francisco, CA 94107
415-882-4100
800-334-4293
Fax 415-882-1988

Mueller Electric
1583 East 31st St.
Cleveland, OH 44114

Multiflex Seals, Inc.
Viziflex Keyboard Seals Div.
16 E. Lafayette St.
Hackensack, NJ 07601
201-487-8080
Fax 201-487-6637

Multiplex Technology, Inc.
3200 E. Birch
Brea, CA 92621
714-996-4100
800-999-5225
Fax 714-996-4100



National Advancement Corp.
2730-J S. Harbor
Santa Ana, CA 92704
714-754-7110
800-832-4784
Fax 714-754-7166

National Association of Service Dealers (NASD)
10 East 22nd St., Suite 310
Lombard, IL 60148
708-953-8950
800-621-0298
Fax 708-953-8957

National Electronics Warranty Corp.
44873 Falcon Place, Suite 174
Sterling, VA 22170

National Instruments
6504 Bridge Point Parkway
Austin, TX 78730
512-794-0100
800-433-3488
Fax 512-794-8411

NCM Electronics
1500 Wyatt Drive, Suite 9
Santa Clara, CA 95054
408-496-0290
Fax 408-496-0388

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Fort Worth, TX 76109
817-921-9061
Fax 817-921-3741

Network Technologies, Inc.
7322 Pettibone Road
Chagrin Falls, OH 44022
216-543-1646
800-742-8324
Fax 216-543-5423

P.K. Neuses Inc.*^D
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Rolling Meadows, IL 60008
708-253-6555
Fax 708-253-6652

M.M. Newman Corp.
P.O. Box 615
Marblehead, MA 01945
617-631-7100
Fax 617-631-8887

Nicolet Test Instruments
5225 Verona Road
Madison, WI 53711
608-273-5008
800-356-3090
Fax 608-273-5061

Nippon Shokuhin Sangyo USA Ltd.
1633 Bayshore Highway, Suite 206
Burlingame, CA 94010
415-697-1558
Fax 415-697-2890

Northern Magnetics, Inc.*^D
P.O. Box 16409
Minneapolis, MN 55416
612-333-3071
Fax 612-333-3978

NRD Inc.
Static Control Products
2937 Alt Blvd.
Grand Island, NY 14072
716-773-7634
Fax 716-773-7744

NRI School of Electronics
4401 Connecticut Ave. N.W.
Washington, DC 20008
202-244-1600
Fax 202-244-2047

NTE Electronics, Inc.
44 Farrand St.
Bloomfield, NJ 07003
201-748-5089
800-631-1250
Fax 201-748-6224

Nu-Concept Systems, Inc.
P.O. Box 587
Colmar, PA 18915
215-822-8400
800-762-4278
Fax 215-822-1427

Nu-Data Inc.
32 Fairview Ave.
Little Silver, NJ 07739-1515
908-842-5757
Fax 908-842-1161

Company mailing addresses

Nutronix Inc.
P.O. Box 77103
Sterling Heights, MI 48077
313-726-1278
Fax 313-726-9150



Oak Technical Inc.
219 S. Sycamore St.
Ravenna, OH 44266-1203
216-296-3416
Fax 216-296-6117

O.K. Industries Inc.
4 Executive Plaza
Yonkers, NY 10701
914-969-6800

Oldaker Corp.
301 N. Main St.
Dunkirk, OH 45836
419-759-3551
Fax 419-759-3312

Omega Engineering Inc.
P.O. Box 4047
Stamford, CT 06907
203-359-1660
800-826-6342
Fax 203-359-7700

ORA Electronics
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Chatsworth, CA 91311
818-772-2700
Fax 818-718-8626

Orion Instruments, Inc.
180 Independence Drive
Menlo Park, CA 94025
415-327-8800
800-729-7700
Fax 415-327-9881

Ostby-Barton Test Probes
487 Jefferson Blvd.
Warwick, RI 02886
401-739-7310
800-654-7180
Fax 401-732-4937



Pace, Inc.
9893 Brewers Court
Laurel, MD 20723-1990
301-490-9860
Fax 301-498-3252

Pacer Industries, Inc.
1450 First Ave.
Chippewa Falls, WI 54729
715-723-1141
800-283-1141
Fax 715-723-7890

Pacific Electro Data, Inc.
14 Hughes, Suite B205
Irvine, CA 92718
714-770-3244
800-676-2468
Fax 714-770-7281

Pacific Power Source
15122 Bolsa Chica St.
Huntington Beach, CA 92649
714-898-2691
800-854-2433
Fax 714-891-1928

Paladin Corp.
3543 Old Conejo Road, Suite
101-102
Newbury Park, CA 91320
805-499-0318
800-272-8665
Fax 800-272-5257

Panamax
150 Mitchell Blvd.
San Rafael, CA 94903
415-499-3900
800-472-5555
Fax 415-472-5540

Panasonic Industrial Co.
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Secaucus, NJ 07094
201-348-7000

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1485 Southern Way
Sparks, NV 89431
702-353-2900
Fax 702-353-2929

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Greenpoint, NY 11222
800-321-4870

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340 E. First St.
Dayton, OH 45402
513-222-0173
800-338-0531
Fax 513-222-4644

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717-248-2507

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Fax 805-522-5788

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312-763-0763
Fax 312-763-8330

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Waukegan, IL 60085
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800-323-9446
Fax 708-623-9107

**Philips CEC Technical Training
Service Co.*^D**
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Jefferson City, TN 37760
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Fax 615-475-0221

Philips ECG
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Williamsport, PA 17701
717-323-4691
800-526-9354
Fax 717-323-4691

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4320 Sweet Road, Unit B
Blaine, WA 98230-9755
206-332-7252
800-727-4877
Fax 206-332-7253

Pioneer Research
1745 Berkeley St.
Santa Monica, CA 90404
310-829-6751
800-233-1745
Fax 310-453-3929

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303 Potrero St., Suite 53
Santa Cruz, CA 95060
408-459-8088
Fax 408-459-0426

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312-489-2229
Fax 312-489-0496

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261 Cedar Hill St.
Marlboro, MA 01752
508-485-7390
Fax 508-480-0257

Platt Luggage
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Chicago, IL 60616
312-225-6670
Fax 312-225-2900

Polaris Div. of UXL Corp.
108-02 Otis Ave.
Corona, NY 11368
718-271-5200
Fax 718-271-5738

Portasol, Inc.
7422 Carmel Executive Park
Charlotte, NC 28226
704-543-6239
Fax 704-543-6839

**Power Technology Components
Microsemi Co.**
23201 S. Normandie Ave.
Torrance, CA 90501
310-534-3737
Fax 310-530-5609

Prelco Electronics
605 Chestnut St.
Union, NJ 07083

Premium Parts + Electronics Co.*^D
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Whitewater, WI 53190
414-473-2151
800-558-9572
Fax 414-473-4727

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12977 Arroyo St.
San Fernando, CA 91340
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Fax 818-365-0800

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Silver Spring, MD 20910
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800-638-2020
Fax 800-545-0058

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800-772-1519
Fax 619-560-7354

Professional Business Systems
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San Oiams, CA 91733

Prorachi Electronics Corp.
2343 N.W. 20th St.
Miami, FL 33142
305-638-5032
800-759-6767

Protek
P.O. Box 59
Norwood, NJ 07648

PTS Electronics Corp.
P.O. Box 272
Bloomington, IN 47402
812-824-9331
800-333-PTS1



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50 Meadowlands Parkway
Secaucus, NJ 07094
800-447-4700

Quietrole Co.
P.O. Box 389
Spartanburg, SC 29304
803-576-4627



Racal-Dana Instruments Inc.
4 Goodyear St.
Irvine, CA 92718
714-859-8999
800-RAC-DANA
Fax 714-859-2505

RAG Electronics Inc.*^D
21418 Parthenia St.
Canoga Park, CA 91304
818-998-6500
800-732-3457
Fax 818-407-5559

Ramsey Electronics Inc.
793 Canning Parkway
Victor, NY 14564
716-924-4560
Fax 716-924-4555

Rapid Systems
433 North 34th St.
Seattle, WA 98103
206-547-8311
Fax 206-548-0322

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Spooner, WI 54801
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800-826-6791
Fax 715-635-2200

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Bridgeport, CT 06608
203-336-2525
Fax 203-576-6769

RepairPro
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300
Houston, TX 77065
713-890-2257
800-BOARD FX

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Chicago, IL 60620
312-233-6530
Fax 312-233-6005

Research Specialists Inc.
1816 Settlers Reserve Oval
Westlake, OH 44145
216-871-8909

The Rex Co.
744 Salem St.
Glendale, CA 91203
818-241-1100

Reztek Electronics Systems Integration

23342 Madero, Suite D
Mission Viejo, CA 92691
714-454-9204
Fax 714-454-9206

Richardson Electronics*D

40W267 Keslinger Road
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708-208-2200
800-348-5580
Fax 708-208-2550

R & K Supply Co.

1854 Hinckley Hills Road
Hinckley, OH 44233
216-278-7018
800-362-6780
Fax 216-278-2434

RNJ Electronics Inc.*D

P.O. Box 528
Lindenhurst, NY 11757
516-226-2700
800-645-5833
Fax 516-957-9142

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March 1992 *Electronic Servicing & Technology* 45

What's multimedia?

By the ES&T Staff

Based on information provided by Yamaha.

The integration of the personal computer into the family of consumer electronics products is well under way. The ability of the computer to store and retrieve information, from inventories of the family valuables to recipes, makes it a welcome appliance in many homes. The ability of a computer to accommodate leisure time activities, whether playing arcade-style games or providing the weekend pilot with an inexpensive flight simulator, extends its usefulness.

One limitation of many computers that has limited their appeal has been their inability to produce high quality

sound. Recent developments in consumer electronics technology have improved that situation considerably.

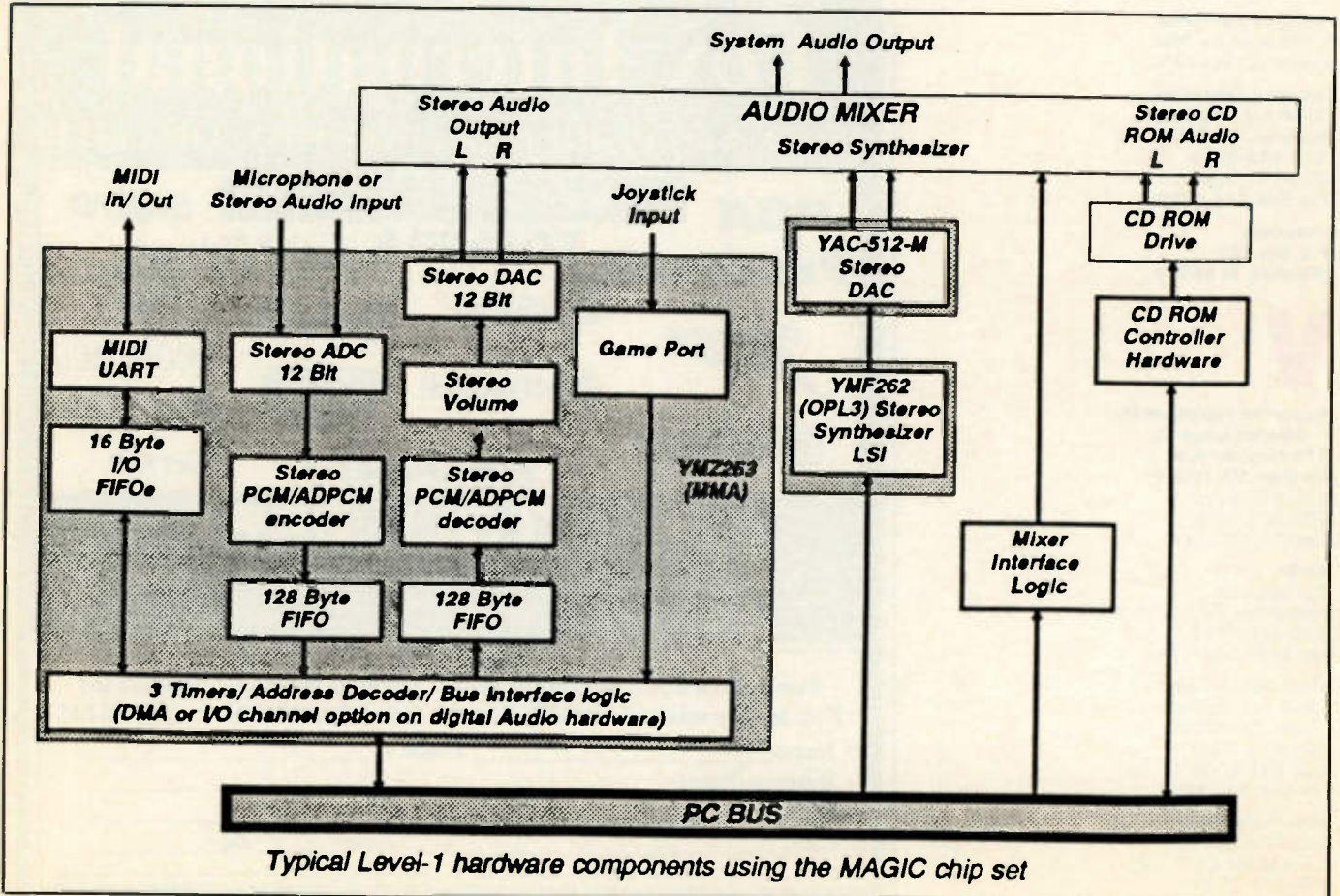
One application of computers that feature a good source of sound and a high capacity storage device such as the compact disk is as a sort of "living" encyclopedia. For example, at the winter consumer electronics show in Las Vegas in January, one manufacturer had a computer with a CD ROM (compact disk read-only memory) input and good sound output. When the name "Mozart" was keyed in, a picture of Mozart appeared on the screen, and a piece composed by Mozart began playing through the speakers. The press of a key brought up the text typical of an encyclopedia

description of the composer.

This is a technology that service centers may soon be coming into contact with, therefore this seems to be a good time to begin coverage of this new technology.

PC's have been capable of producing sound and color graphics for quite some time. Recently the combination of interactive video and audio has gained enough momentum to be called by its own name - multimedia.

The announcement of Microsoft's Multimedia Windows was the first step towards the standardization of hardware and software for PC video and sound. This article will take a look at the pieces that comprise a standard multimedia platform.



Multimedia Level-1 hardware

At the November 1990 Microsoft Multimedia Developers Conference, which took place in San Jose, CA, Microsoft and Tandy jointly proposed that a minimal platform for delivering sound in a PC-based multimedia presentation should include:

- a MIDI interface (MIDI stands for musical instrument digital interface)
- a PCM digital audio channel
- a CD ROM drive with audio capability
- an analog mixer

This basic level of multimedia is referred to as the "Level-1" hardware upgrade specification (see Figure 1). The term "Multimedia PC," or MPC is used to describe a PC so equipped.

The level-1 hardware specification enables software vendors to assume that end users with an MPC can take advantage of the sound and video capabilities designed into multimedia software.

MIDI

MIDI provides a convenient means of creating high-quality music with minimal data storage overhead (see "MIDI fundamentals"). An MPC's MIDI port can be used to record music in the form of MIDI data that can be played back via external synthesizers.

In a typical multimedia presentation, an MPC may need to manipulate complex video and digital audio information while transmitting and receiving time-sensitive MIDI data as a background task. Because of this, the MIDI interface hardware should not add significantly to system overhead while transmitting or receiving MIDI data.

Digital audio fundamentals

Multimedia PC's convert between analog and digital audio by using analog to digital (A/D) converters and digital to analog (D/A) converters. The most common conversion method is called PCM (pulse code modulation). In this process, the analog signal is sampled at a fixed rate and the level measured at each sample point is converted into an equivalent digital number. The number of times per second

this conversion occurs is called the "sampling rate."

For instance, an 8-bit A/D converter can convert a sampled analog value into one of 256 numbers, while a 12-bit A/D converter can break the same sample down into a finer resolution of over 4,000 levels. The dynamic range of the converted signal is directly dependent upon the number of bits in the conversion process. Each bit of resolution provides 6dB of dynamic range. Thus an 8-bit converter provides 48dB of dynamic range, while 12-bit and 16-bit converters provide 72dB and 96dB respectively.

Disk storage requirements for the resulting digital audio file depend upon the sampling rate and bit resolution of the hardware used. For example, a stereo signal sampled at a 16 bit resolution at 44.1kHz creates a file that expands at approximately 170kb/second. Thus 1 minute of stereo, CD quality PCM music could consume as much as 10Mb of hard disk space.

Data compression schemes such as ADPCM (adaptive differential pulse code modulation) can significantly reduce the data storage requirements of straight PCM audio. As with any data compression method, however, ADPCM inherently causes a certain amount of signal degradation. Depending upon the ADPCM method used, the loss of signal quality can be minimal. Thus ADPCM is more than adequate for all but the most demanding audio requirements. Since ADPCM can reduce storage requirements by about 3:1 over straight PCM recording, ADPCM is often used for distributing digital audio files with an application and for digital voice annotation.

Because there are several ADPCM encoding schemes in use, compressed audio files are usually compatible only with the hardware on which they were created. Although no industry-wide ADPCM standard has been adopted, the most common is the CCITT algorithm which offers a 2:1 compression ratio (8 bit to 4 bit). A more recent device uses a modified version of this algorithm to achieve a 3:1 compression ratio (12 bit to 4 bit).

MIDI Fundamentals

MIDI (musical instrument digital

interface) is a hardware/software protocol developed in the early 1980's by a consortium of synthesizer manufacturers to provide a standard means of connecting multiple synthesizers. Since then, MIDI has evolved into the industry-standard software/hardware protocol used to connect computers to synthesizers.

PC's have been making music with MIDI for nearly 10 years with software products from PC MIDI pioneers. This MIDI software typically turns the PC into a sophisticated MIDI record/playback device that is used to control external synthesizers which in turn generate music.

Today, virtually every synthesizer includes a MIDI port. A PC equipped with a MIDI interface can control an array of MIDI synthesizers, lighting controllers, tape decks, sound effects processors, etc., to create an "electronic orchestra" completely under software control.

The benefits of using MIDI as a multimedia sound source include:

- MIDI offers the most compact way to store song data. In fact, a MIDI song file of well under 20kb can play a song that would take many megabytes of hard disk space if saved in high-quality digital audio format.
- PC-controlled MIDI music offers the performer complete control over tempo, length, orchestration, rhythm, and other musical attributes so that a performance may be customized for any application. This unique ability to manipulate musical parameters in a detailed way is probably the most powerful aspect of PC-generated music.
- A PC MIDI port also provides a means of recording MIDI data. The MIDI music represented by this data is stored as "MIDI files," an industry-standard format for saving MIDI song data.
- MIDI synthesizers of professional quality can create music that is virtually indistinguishable from real instruments. This can make the resulting music sound more dramatic and realistic than is possible with simpler PC bus based synthesizers.

Future installments will carry more information about this new, sure to grow, technology. ■

Understanding comb filters

By the ES&T staff

A color television receiver recreates the picture and audio information from the TV broadcast signal. The picture information is made up of the luminance (brightness) signal and the chrominance (color) signal.

In the case of the NTSC system, the luminance signal and the chrominance signal share the same frequency band. In order to prevent interference caused by this sharing, the frequency spectrum of each of these components is broadcasted by interleaving, as shown in Figure 1.

Usually, when a color television receiver recreates the picture by receiving the luminance and chrominance signals, separation of the original two components is not carried out in accordance with the frequency spectrum of each signal.

For this reason, interference between the two signals may occur. The luminance signal may interfere with the chrominance signal causing "barber pole" interference in the picture. Conversely, the chrominance signal may interfere with the luminance signal causing "dot interference" in the picture.

In order to prevent these interferences, a trap corresponding to the chrominance signal frequency is usually installed in the luminance channel to block the chrominance signal.

This trap also blocks the high frequency portion of the luminance signal component, which occupies the same band-pass. As a result, the high

Based on the service manual for the Hitachi NP80LX chassis.

frequency portion of the luminance information will be lost, and the resolution of the reproduced picture will be reduced (Figure 2).

By employing a comb filter circuit, the luminance signal and the chrominance signal can be separated completely in a comb waveform (the frequency spectrum of each component, luminance and chrominance, resembles the teeth of a comb) corresponding to each frequency spectrum, and the interference between the luminance signal and the chrominance signal can be eliminated.

Moreover, because of this comb filter circuit eliminates the need to install a chroma signal trap (a 3.58MHz trap) in the luminance signal path, the bandwidth of the luminance signal is not reduced, and thus the resolution of the reproduced picture is improved (Figure 3).

The objects of employing a comb filter circuit

The objects of employing a comb filter circuit are:

1. To eliminate 3.58MHz dot interference from the chrominance signal to the luminance signal.
2. To eliminate barber pole interference from the luminance signal to the chrominance signal.
3. To improve the resolution of the picture.

The principle of operation of the comb filter

Since the contents of the luminance signal before a horizontal scanning pe-

riod is almost identical with the contents of the luminance signal after the horizontal scanning period, it is possible to add these two signals to obtain a signal that is twice as strong. Conversely, it is also possible to subtract to delete them.

The chroma signal, on the other hand, is in the form of amplitude modulation of the subcarrier signals ($f_s = 455/2f_H = 3.579545\text{MHz}$), in many cases, and the subcarrier phase is reversed at every 1 horizontal scanning period. For that reason, it is possible to subtract the signals to obtain a signal that is twice as strong, and conversely to add to delete them.

By using the above mentioned technique, and by combining the 1 horizontal period delay circuit with both the summation and the subtraction paths as shown in Figure 4, it is possible to derive from the composite video signal, the luminance signal without chrominance and the chrominance signal without luminance, thus eliminating the interference between the luminance signal and the chrominance signal.

Because there is no need to employ a trap conventionally used for eliminating 3.58MHz dot interference, the bandwidth of the luminance signal circuit is not reduced, which results in improved resolution.

An actual comb filter circuit

The comb filter circuit employed in the Hitachi NP80LX2 chassis is shown in Figure 5. The circuit consists of 1H (one horizontal sweep period) delay

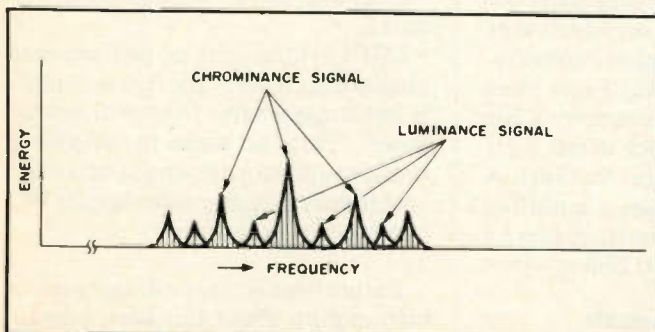


Figure 1.

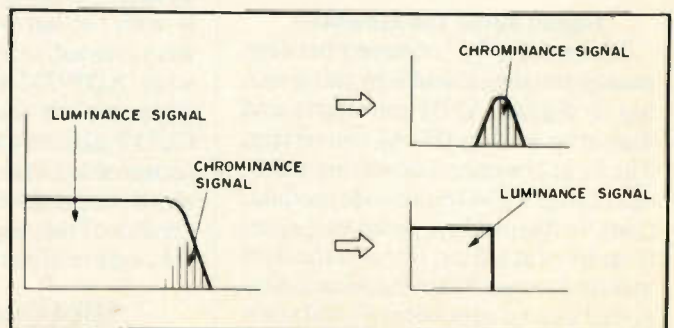


Figure 2.

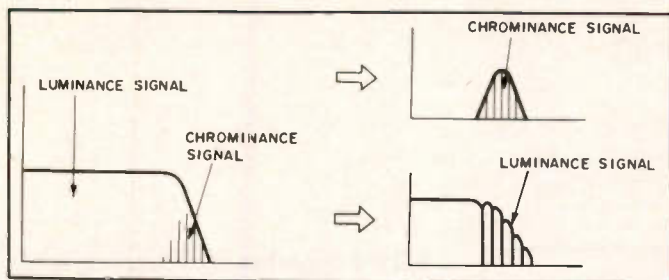


Figure 3.

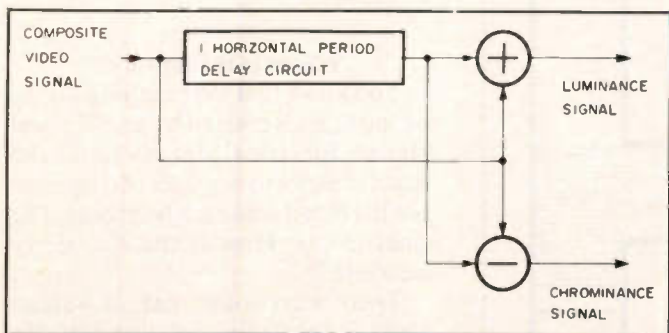


Figure 4.

line, video amplifier Q302 (used to compensate the insertion loss of the 1H delay line), variable resistor R305 to eliminate the variations of the insertion loss of the 1H delay line, and L303 whose function is to add and subtract the delayed signal and the undelayed signal.

Operation of the comb filter circuit

The composite video signal is applied to the base of Q302, and only

components in the range of 3-4MHz appear at the collector of Q302, as shown in Figure 5. Output from the collector of Q302 is passed through the 1H delay line (DL301), which causes a time lag of one horizontal period to the signals that arrive at terminals 3 and 4. When the non-delayed signal is applied to this delayed signal at terminal 3 through R307, the outputs are the luminance component of the composite video signal to the base of Q304,

and the color component without the luminance signal of 3-4MHz out of the composite video signal to the base of Q303.

Here the function of R305 is a gain adjustment for Q302 to compensate for insertion loss caused by the 1H delay line installation.

L303 operates both adding and subtracting signals and provides phase adjustment for the delayed and non-delayed signals. ■

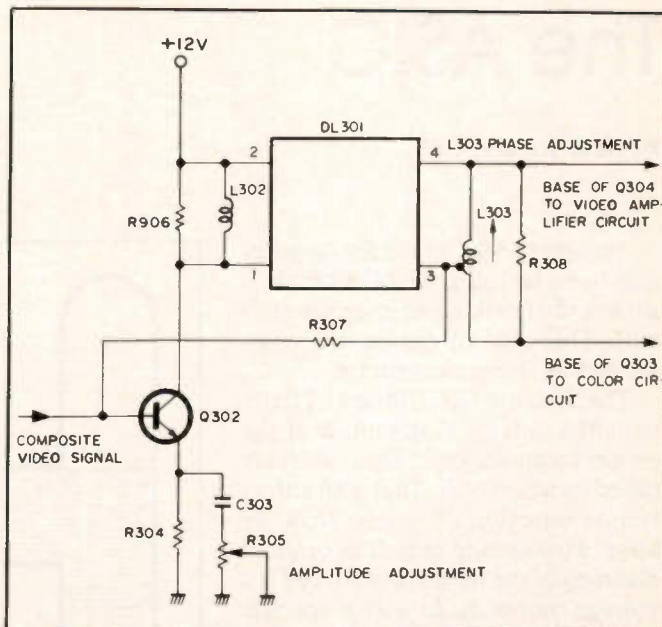


Figure 5.

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What do you know about electronics?

The ASIC

By Sam Wilson, CET

The letters ASIC stand for Application Specific Integrated Circuit. It is a method of making an integrated circuit. This type of design is accomplished by using a computer.

The designer has a library of basic circuits available at the touch of the proper computer keys. The circuits are called standard cells. That is an unfortunate selection of terms. Now we have two standard cells. The original meaning of the term standard cell is a voltage source made with a specific construction and chemicals. See Figure 1. The terminal voltage of a standard cell is provided by the manufacturer - accurate to five decimal places.

Standard cells are used as very accurate voltage references.

Incidentally, if you happen to run across one don't touch the leads! These cells cannot provide any current above 0.0001A. If a standard cell is subjected to any greater current flow they can be destroyed. That's expensive!

The standard cell in ASICs is a self-contained analog circuit or digital circuit, (or, some other basic unit of electronics). Using a computer, the designer selects the desired standard cell and moves it on the screen into the system.

The library of standard cells available to the designer may consist of any number of basic units - depending upon the manufacturer. In one example, the library consists of about 100 standard cells. It has both analog and digital standard cells.

An important advantage of the ASIC design is that the designer doesn't need to know anything about how integrated circuits are fabricated. The design procedure is given clearly by the computer software.

Another advantage is the very fast turnaround between an idea and the final product. The cost is low - even for small quantities. Also, competing

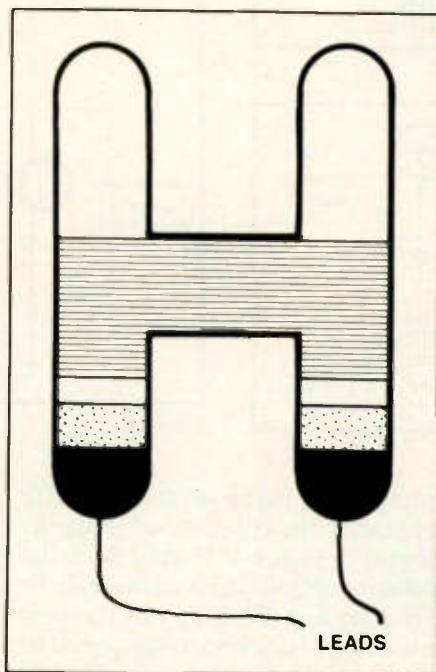


Figure 1.

companies will find it difficult to copy a design. Many ASIC designs have more than ten thousand transistors.

When integrated circuits were first introduced, some technicians were reluctant to give up the idea of analyzing circuits by chasing electrons through individual components. That idea has been out of favor for a long time. (However, it is still an important method of understanding the theory of operation of circuits. This theory is taught in basic electronics courses.)

Chasing electrons through an ASIC design could turn out to be a lifetime job in a design with over 10,000 transistors. Even if you could do it, you wouldn't get any useful troubleshooting information. You can't replace transistors in any integrated circuit.

At the manufacturer's location the approach is to use ATE (Automatic Test Equipment) to test ASICs.

In the field you have to troubleshoot by chasing signals not electrons. Quality test equipment and knowledge of how to use it are important parts of your future in troubleshooting. There

will still be outboard circuits - especially those that handle high currents and/or voltages.

Where is the battery?

You know that the pumping action of the heart is created by an electrical signal. Electrical signals cause the heart muscles to contract and squeeze out the blood with each heartbeat. The question is: How is the electricity generated?

There is no doubt that the human body is fearfully and wonderfully made. Men have spent lifetimes trying to fathom the depths of this complicated organism. Many of the mysteries of life have been solved by equating them to the electrical and chemical systems. However, the meaning of life is still elusive and has been left to the mental gymnastics performed by philosophers. We are not interested in that for this particular article.

A chemist might look at the human body as a chemical manufacturing plant. The complicated chemical structures of the blood, tissues and cells have been well documented by chemists. The chemist may see the electrical activity in the human body as being incidental to the chemical activity.

An electrical engineer may look at the human body as being a very complicated system of feedback networks, electrical conductors and electric generators. A complete electrical analysis of the human body has not been accomplished because of the staggering number of cells, transport systems, feedback networks and generators present.

The fact is that neither a complete chemical or electrical analysis is possible, at least at the present time. Each cell in the body has both electrical and chemical activity.

When you stop to think that there are over 60 trillion cells in the human body you begin to realize the complication. Add that to the fact that each of these cells is interacting with other

Wilson is the electronic theory consultant for ES&T.

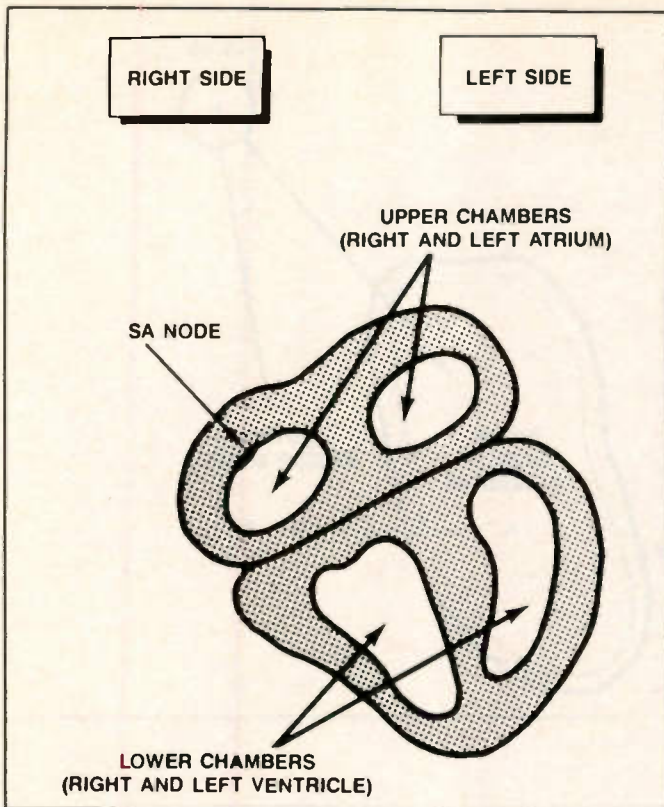
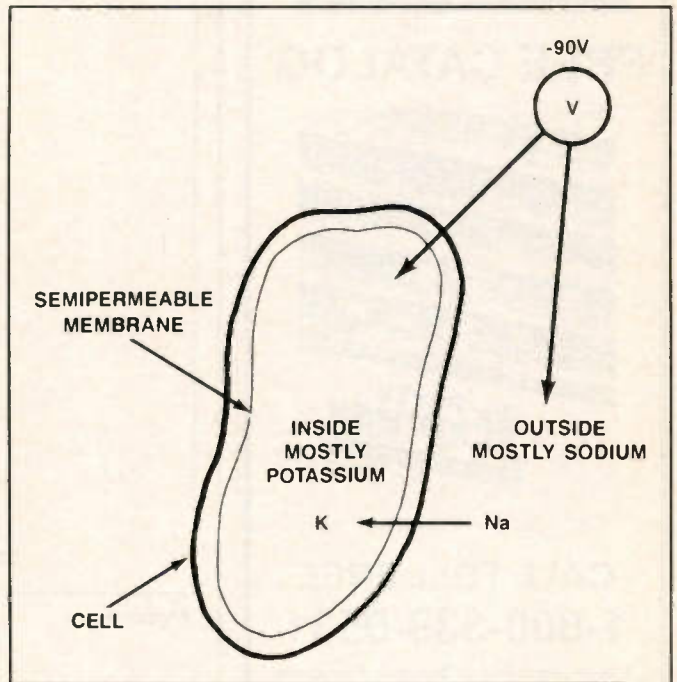


Figure 2.

Figure 3.



cells in ways that are not always fully understood.

In this article we are interested in where the electric signal comes from that causes the heart to beat. More important at this time, how is that signal generated? Let me say this at the start - I am going to make full use of some models that enable us to picture what is happening. I do this because I don't believe electronics technicians are really interested in a detailed study of chemical activities involved in producing a heartbeat. However, the models are quite accurate and give a good concept of what is happening.

A good place to start is to review some of the basic ideas related to the heart and its activity. The heart is a pump. In a human adult the heart is divided into four chambers - two upper chambers and two lower chambers. These chambers hold blood and they are used to pump the blood through the 60,000 miles of blood vessels. In one single day the equivalent of approximately 4,000 gallons of blood is pumped by this remarkable organ.

Figure 2 is a rough drawing of the heart and the chambers. The blood goes out from the lower chambers of the heart by way of arteries. The blood returns to the heart through veins into the upper chambers. In the upper

right chamber, called the right atrium, there is a very small region where the heart beat begins. If you are a name dropper you might want to remember that this small region is called the central (AS) node. It is the pacemaker that generates pulses of 60 to 80 beats per minute. Signals from the brain can increase that to as high as 150 beats per minute under conditions of hysteria and shock.

OK, so we know where the voltage is generated, but how is that voltage generated? To understand this, we have to go to the basic construction of the cells of SA node.

This discussion does not include the common activities of all cells. The cells we are interested in are constructed somewhat like the simplified illustration in Figure 3. There is an inside chamber and a semi-permeable membrane that separates it from the outside world surrounding the cell. The semi-permeable membrane consists of very, very tiny holes which permit certain ions to pass through.

In our first glance at the cell it will be considered to be in the resting condition. There are two concentrations of ions. (see Figure 3). When the cell is in the resting state there is approximately a 90 millivolt difference of potential between the inside of the cell and the outside. This difference in po-

tential occurs because of the ionic imbalance between two points.

You may think of it as being a battery. The resting state just described is called the polarized state. In this state the difference in the chemical makeup of the inside and outside of the cell, and also the difference in potential is shown in Figure 3. The combination of these chemical and electrical signals is called a gradient.

That gradient affects the passage of tiny potassium ions through the membrane. The larger sodium atoms are not able to pass readily through the membrane, but the potassium ions can pass. You can think of it this way - the potassium ions are smaller than the sodium ions so they can pass through the very tiny holes in the membrane.

Starting from the resting state the potassium atoms pass through the membrane. That eventually causes the different concentration of sodium and potassium ions inside and outside of the cell shown in Figure 4. Observe the difference in potential compared with the voltage in the resting state. Under this condition the cell is considered to be depolarized.

To summarize, in the polarized state there is a -90 millivolt potential between the inside and outside of the cell. In the depolarized state the potential changes to +20 millivolts. Figure

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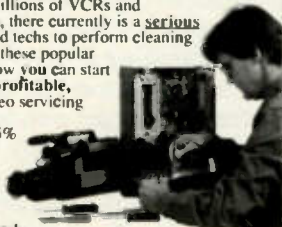
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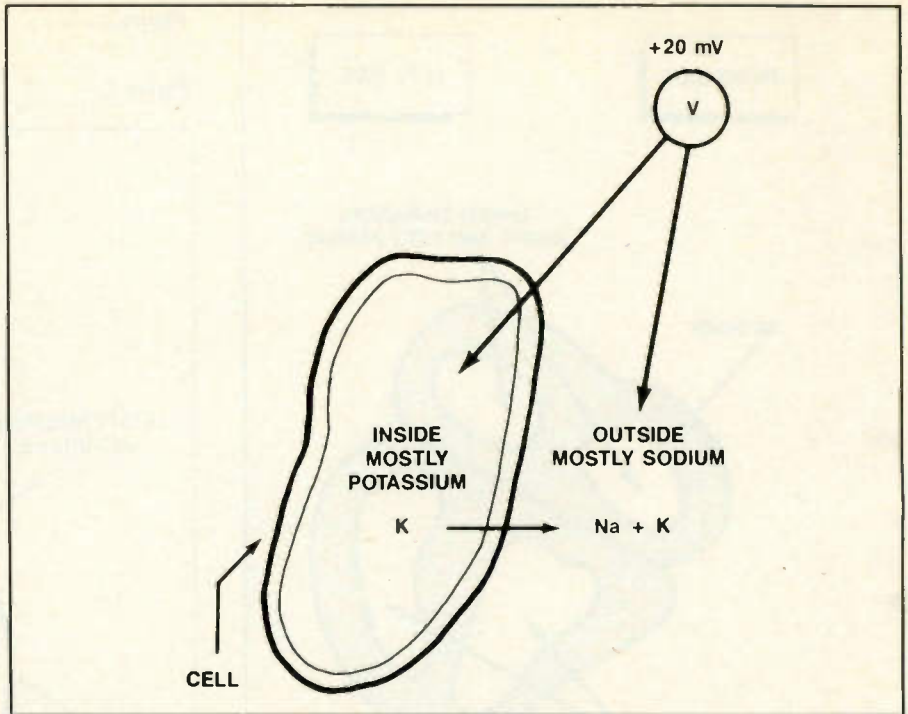


Figure 4.

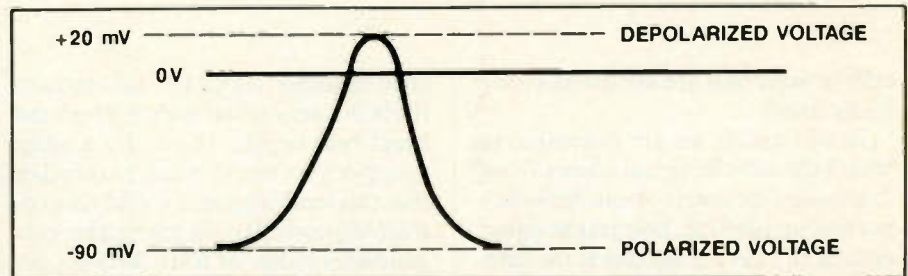


Figure 5.

5 shows a graph of the potential as it would appear on an oscilloscope.

The potential difference occurs because of motion of ions through the semi-permeable membrane. Once the voltage is generated it produces a motion of ions in the reverse direction to return the cell to the polarized state. If you have a high number of these cells in a small region, as in the SA node, there is some kind of mysterious signal that occurs between the cells. They all become polarized at nearly the same instant and all become depolarized at the same time.

The electric impulse flows first into the upper chambers and later into the lower chambers. That way, the return blood from the veins is first squeezed into the lower chambers, then out of the lower chambers into the arteries.

Let me summarize the action
The cell has two states of electrical

potential, In the polarized or resting state the potential between the inside and outside of the cell is -90V. In the depolarized state the difference in potential between the inside and outside of the cell is 20V. You can think of the cell as being a very tiny battery that switches between the two voltages. The reason it turns on and off is that ions are able to pass through the cell surface membrane in such a way that the voltages are generated.

The rate at which the polarization-depolarization-polarization pulse occurs is dependent upon a number of factors. One is the membrane construction itself. Another is the electrical potential between the inside and outside of the cell. Not to be denied is the fact that the human brain can cause chemicals to be delivered to the cell to speed up their activity - that is, to change the rate of ion migration. That, in turn, changes the rate of the heartbeat.

Test your electronics knowledge

By Sam Wilson, CET

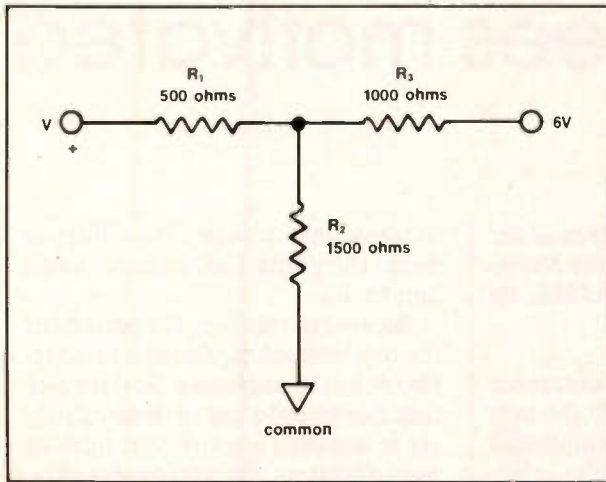


Figure 1.

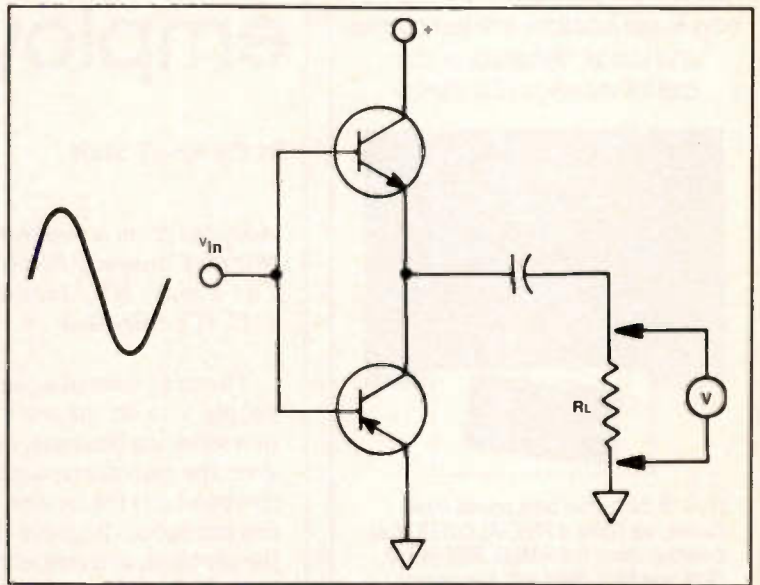


Figure 4.

1. What is the value of input voltage (V) in Figure 1?
2. For the 500 Hertz sinewave voltage shown in Figure 2 the time marked (t) is _____.

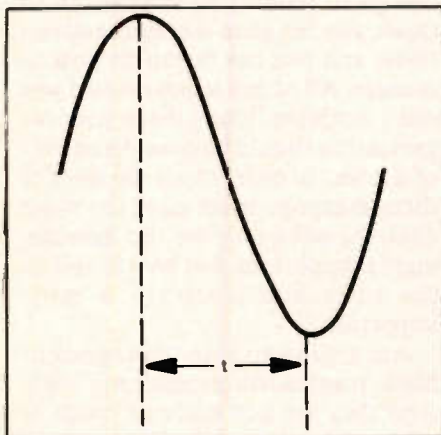


Figure 2.

3. Convert 230_{10} to a binary number _____.
4. A signal that indicates a hardware condition or the program status is called a _____.
5. 10 decibels = _____ neper.

Wilson is the electronics theory consultant for ES&T.

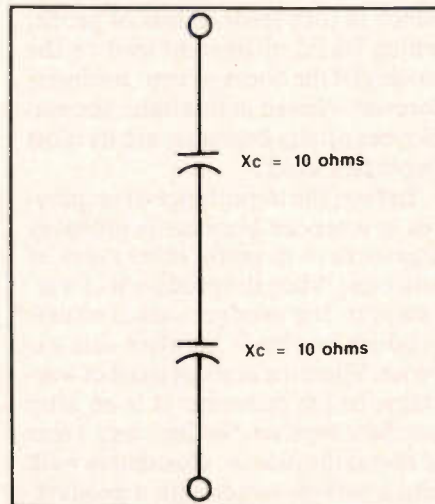


Figure 3.

6. Each capacitor in Figure 3 has a reactance of 10Ω . The capacitive reactance of the combination is
 - A. 5 ohms
 - B. 20 ohms
 - C. 7.5 ohms
 - D. (Cannot be determined from information given)
7. With a 10 kHz sinewave, 10V input signal in the circuit of Figure 4, the VOM should read
 - A. about 10V
 - B. about 5V
 - C. about 0V
 - D. (none of these choices is correct)

- A. VARS
- B. watts
- C. volt-amperes
- D. darafs

8. Apparent power in an R-L circuit is measured in

- A. an inductor
- B. a capacitor
- C. a resistor
- D. a gyrator

9. Two insulated wires twisted together make a "gimmick." It is used as

10. Using two or more interconnected processors to simultaneously perform different parts of an application is called _____.

BONUS QUESTION

The Morse Code was invented by

- A. Samuel Morse
- B. Sam Wilson
- C. Alfred Vail
- D. Morison Trapp

(Answers on page 56)

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Keeping your employees motivated

By the ES&T Staff

Adapted from a seminar given at the Winter Consumer Electronics Show, Las Vegas, NV, January 1992, by C.C. (Connie) Bell

The employees of a company are the people who do the work. In the case of a servicing business, the employees greet the customers, accept the defective products for service, disassemble the products, diagnose the nature of the problem, and reassemble the products. If those employees are not performing their jobs right, the consequences will be dissatisfied customers, which in turn leads to loss of profit, which could ultimately lead to the closing of the doors of your business, forever. Viewed in this light, the employees of any business, are its most important asset.

In fact, the importance of employees in a service business is probably greater than in many other types of business. When the product is in warranty, to the product manufacturer product service is an after sale expense. When the product is out of warranty, to the consumer it is an after purchase expense. Neither party wants to spend the money. Customers walk into a service center with a product. They walk out with the same product. In the eyes of the customer, the service center doesn't do anything for them.

Because the employees of a service business are so important, it's important that they be properly motivated, educated and compensated. Many top level managers may not even realize that they are motivators for every individual in the organization, but they are. If a manager is perceived by anyone in the service department as being in control of their working conditions, their employment, their salary, even if he rarely comes in contact with them, then that manager is a motivator for that person. That person will try

to please the manager. He will try to do the things that that manager wants him to do.

Because of this fact, the attitude of the top level management will be reflected by the employees. So if the attitude expressed by any of those managers is negative toward customers or manufacturers, the employees will reflect that attitude. If Mrs. Smith is a pain to you, then she will be a pain throughout the entire organization. Sooner or later, she will probably become aware of this fact, and take her business elsewhere. Obviously, you don't want that to happen.

As soon as you hire people, your success in the service industry will depend on how well you communicate, how well you motivate.

Managing is a learned ability. You can go to school, you can listen to tapes, you can go to seminars and lectures, and you can be taught how to manage. All of that is to no avail if you can't motivate. Everyone in your organization should be considered part of a team. In order to get the most of them everyone must have the same goal, the same purpose. So management is important, but how to follow the rules and motivate is most important.

According to one management book, true leaders are made not born. And they are not made as much as others as by themselves. So we make ourselves what we are. and if we are aware that we are motivators we can do a better job. We can instill a team concept in our unit, motivating employees through collective goals.

Some ways to let the technicians know they're important

One way to let the employees know that they're important, and that their contributions are appreciated is to provide them with opportunities to

improve their skills, and to do so in such a manner that it will be remembered. For example, Bell mentioned that in the early days of his service center, whenever they had a service meeting, they had the field service representative come in at noon, then shut down to have the meeting, which would last until five. At five o'clock the company paid to have a fine meal catered in. This treatment told the employees "you're important".

Good test equipment is an important motivator too. Every technician would like to have absolutely the best test equipment, so he might come and say "Hey, I need XYZ scope." This particular instrument might be a little over the budget. So give him the book and say choose whatever oscilloscope you want. Our budget is this. Let him make his own choice for your approval, but keep it within reason. Again, you're letting him know he's important. You're saying to him, "Whatever you want we'll try to provide, because you're helping us. You're part of the team."

Another recommendation is that managers attend in-house or local service meetings. You probably won't even know what they're talking about, but go. Let your employees know that you care.

Ride with an outside technician at least every six months, for a whole day. Let him know that you understand his problems. And you'll learn more about his problems and when he has a problem take care of it.

These are just a few of the many ways to motivate good employees. In these turbulent times when good technical people are hard to find, and the competition to hire them is intense, it only makes good sense to let them know that they are appreciated, and to do everything you can to keep them on the payroll.



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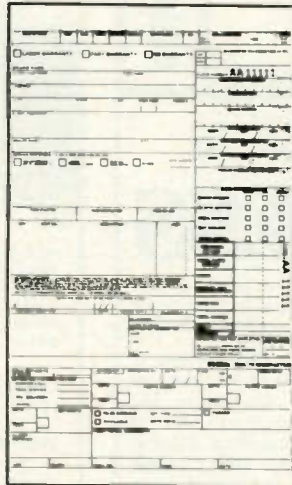
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Test your electronics knowledge

(from page 53)

1. Answer: 8V - Current through $R_2 = I = V/R = 6/1500$
Voltage across $R_1 = V_1 = IR_1 = 6/1500 \times 500 = 2V$
 $V = V_1 + V_2 = 2V + 6V = 8V$ (answer)

2. Answer: 1 millisecond - The period of the wave is
 $T = 1/f = 1/500 = 0.002$ second
 $t = 1/2T = 0.001$ second = 1 millisecond

3. Answer: 11100110

Proof:

1	1	1	0	0	1	1	0
0 ⁰	2 ¹	2 ²	0 ³	0 ⁴	2 ⁵	2 ⁶	2 ⁷
0	2	4	0	0	32	64	128

4. Answer: flag (by definition)

5. Answer: 1.151 nepers
Number of dB $\times 0.1151 =$ number of nepers (a neper is the foreign equivalent of decibels.)

6. Answer: B - Capacitors in series combine as reciprocals the same way as resistors in parallel. However, the reactances combine in simple addition.

7. Answer: C - The meter deflects to the average value of the sinewave voltage across the load resistor (R_L). The average value of a sinewave voltage is zero volts. This is true even though there is crossover distortion.

8. Answer: C - Apparent power = volts X amps

9. Answer: B - The capacity is, of course, a very low value. If you have a capacitor meter or bridge you can trim this capacitor to the desired number of picofarads.

10. Answer: parallel processing (by definition)

Answer to the Bonus Question

C - Alfred Vail

Test accessory catalog

Pomona Electronics has introduced their new, 140-page 1992 catalog of electronic test accessories. Highlights include two new lines of test probes and clips for miniature and heavy-duty applications and an expanded line of oscilloscope probe kits. Additional accessories for testing of SMT devices and high-density leaded components rounds out this growing area.

The catalog also features new IC clip kits, coax/BNC universal adapter kits, digital multimeter test lead kits, cable and patch accessories and jumper kits.

Ten major product categories are presented with an easy-to-use index and includes the company's most popular selection of jumpers and cables, boxes, plugs and jacks, connectors, adapters, single-point test clips and static control devices.

Circle (1) on Reply Card

New spring 1992 catalog

Contact East now has a 196 page catalog which comes packed with hundreds of new test instruments and tools for engineers, managers, technicians, and hobbyists.

Featured are quality products from brand-name manufacturers for testing, repairing, and assembling electronic equipment. Product highlights include new: DMMs, EPROM programmers, power supplies, adhesives, tool kits, and portable digital scopes. Also included are our popular lines of DMMs, communication test equipment, soldering/desoldering systems, static protection products, ozone safe cleaners, magnifiers, inspection equipment, workbenches, precision hand tools, tool kits, cases and more. All products are fully guaranteed, and orders placed by 4 p.m. are shipped by 5 p.m.

Circle (2) on Reply Card

PC instrumentation and data acquisition catalog

Global Specialties is offering a new 16-page color catalog containing PC instrumentation and data acquisition products. The catalog features virtual instruments on a card, plus analog and digital I/O cards for IBM-PC compat-

ibles. The boards, which plug directly into the PC I/O slots, include several multi-channel analog/digital combination cards, opto-isolated Darlington output card, 48-channel PIO card, thermocouple input cards, plus two virtual instrument boards. The virtual instruments include PCI-DMM, an intelligent digital multimeter, and PCI-GEN, which is equivalent to a function generator, pulse generator, waveform generator, and counter/timer. Each PCI instrument includes the card and a software graphics package for operating the instrument. The catalog also contains several pages of accessory items which simplify application interfacing. All the products come with extensive user documentation and program examples in BASIC and "C".

Circle (3) on Reply Card

Catalog of software and hardware

National Instruments Corporation has announced that its new 544 page, full-color 1992 catalog is available now. The catalog describes the company's comprehensive line of software and hardware products used by engineers and scientists to develop instrumentation systems. The 1992 catalog contains products for developing systems that use signal conditioning accessories with plug-in PC data acquisition boards and GPIB, VXI, or RS-232 instruments, in any combination, on PC/XT/AT, Micro Channel, EISA, Macintosh, Sun DEC, and other computer platforms. The new catalog is color-coded by section - Application Software, GPIB, Data Acquisition, VXI/MXI, and training. The first four sections feature comprehensive tutorials to help readers learn more about IEEE-488.2, SCPI, plug-in data acquisition systems, VXI and MXI. The tutorials contain examples of applications, presented graphically with diagrams, that the reader can use as templates to create similar systems for applications involving instrument control, data acquisition and analysis, test and measurement, laboratory automation, process control and monitoring digital signal processing, and signal conditioning.

Circle (4) on Reply Card

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B&K telephone analyzer model 1050 with manuals. Like new condition original \$1700.00 asking 850.00. *Joe Silver, 260 Candlewood Rd. Rochester, NY 14609. (716) 288-1520.*

Sencore VA 62A with VC63, NT 64 and accessory jack expander, \$3100. B&K 480 CRT tube tester and restorer, like new \$300. Bell and Howell micro-fiche SR-II, \$50. Call 803-647-1002, after 5. *Tom Burkett Rt 3 Box 775 Westminster SC 29693.*

B&K 467 picture tube restorer/analyzer and all adaptors \$200.00; B&K 667 Solid State Tube Tester \$80.00; Heathkit 10-12 Oscopoe \$100.00. They are in excellent condition. *Liem Mguym 2373 Pruneridge Ave., Santa Clara, CA 95050 408-241-5420.*

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Tenma 72-740 scope. Dual trace-delayed sweep. Dual time 9 month old-original box and papers. COD OK \$500.00 *Ray Dorsner 303-686-7204.*

24 ES&T books complete 1990-1991 \$20.00. *ME Andrews 89 Ten Run PO Box 91 Exeter, RI 02822.*

Training kits- VCR-Fax-Cd's - \$100.00 All or \$40 each. These are videos with workbooks. *Ray Dorsner 303-686-7204. Call for more info.*

WANTED

Transistor radios (Motorola, Zenith Etc.) and small tube portables. *S. Martin 815 N. Hayden Rd., B-204 Scottsdale AZ 85257 602-994-3162.*

Schematic/service manual for telequipment D54 oscilloscope and Hughes Memo-Scope 105A. Will buy or copy. *Joe Silver 260 Candlewood Rd. Rochester, NY 14609.*

Tekfax manuals 100, 102, 104, and 119. *Charles T. Huth, 229 Melmore St., Tiffin, OH 44883 419-448-0007.*

FM generator, 415 sweep marker, B&K 1077B analyst with all manuals. *John Waskowitz 5800 83rd Street Brooklyn, NY 11209.*

Schematic diagram and service data on an old Gibson guitar amplifier. (SKYLARK GA 5) Amplifier uses 5 miniature tubes. *Elmer J. Alderman Route 2 - Box 139 Madison, NC 27025.*

Need thick film voltage divider Part No. 1906 for Sylvania CK3000 test Jig. *Happy Valley TV, 501 Roosevelt St. Exeter, PA 18643 717-693-2820.*

B&K 466 CRT tester, parts only. Repairable Sencore Z meter. *William Weathers, P.O. Box 51412, New Orleans, LA 70151 504-483-7685.*

Service information: Sams 100-1930. RCA/Zenith complete 196000 thru mid 1980's includes VCR's, Audio etc. Lots P.O. Box 160, Eureka, NV 89316 702-237-5367.

Hickok 225 meter, Mhf and Riders manuals. Send list and price to *Harold Klotzle 773 Midland Avenue Ravenna, Ohio 44266.*

Need service manual, schematic or Sams Photo-fact MHF-239 for a Marantz Model 2500 stereo receiver. *Rick Menzel, 901 Hickory Sandpoint, ID 83864 208-265-4247.*

Any free personal case history's or information to help me at my small TV and VCR repair shop. *Larry Johnson, RT2 Box 739, Clarksburg, WV 26301 304-623-1025.*

Schematic service info or power transformer for Curtis Mathes stereo system model -AE100. *John J. Impellizzeri, 45294 Universal Ct., Utica, MI 48317 (313) 254-3946.*

Diagram for a Hammand Organ M-2 will pay for copies. *Arthur Vickery The Music Shop, 548 Main Street Torrington, CT 06790.*

Schematic for Sencore FE 160 Meter. *David Benes 1628 Grandview Ave. N. Braddock, PA 15104 (412) 823-0765.*

Schematic or service info for Pioneer RG-2 Dynamic Processor. *Kentucky Home Electronics, 564 Green Lane, Bardstown, KY 40004 (502) 348-4983.*

Variable isolation transformer B&K #1655. Sencore PR57 or equivalent. *Chuck Hancuff RD3 Box 664 Meadville, PA. 16335 (814) 724-8626.*

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SAMS: 689 thry 1988 with skips. COD \$35 plus shipping. Mr. Smith, Wichita Falls, TX 76301. 817-723-2442. 3-91-1t

TELEVISION/MONITOR: troubleshooting. Don't spend big bucks on troubleshooting tips. Only \$4.00 for 600 symptoms/cures. Jones Enterprises, Box 702, Niceville, FL 32588-0702. 3-92-3t

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Manufacturers Parts and Literature Directory

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<p>Thomson Consumer Electronics 2000 Clements Bridge Road Deptford, NJ 08096 800-257-7946 fax 800-524-1498</p>	<p>Zenith Electronics Corp. 1900 N. Austin Avenue Chicago, IL 60634 312-745-2000</p>	<p>Call Jonathan Kummer at 516-681-2922 to reserve space in this special section.</p>

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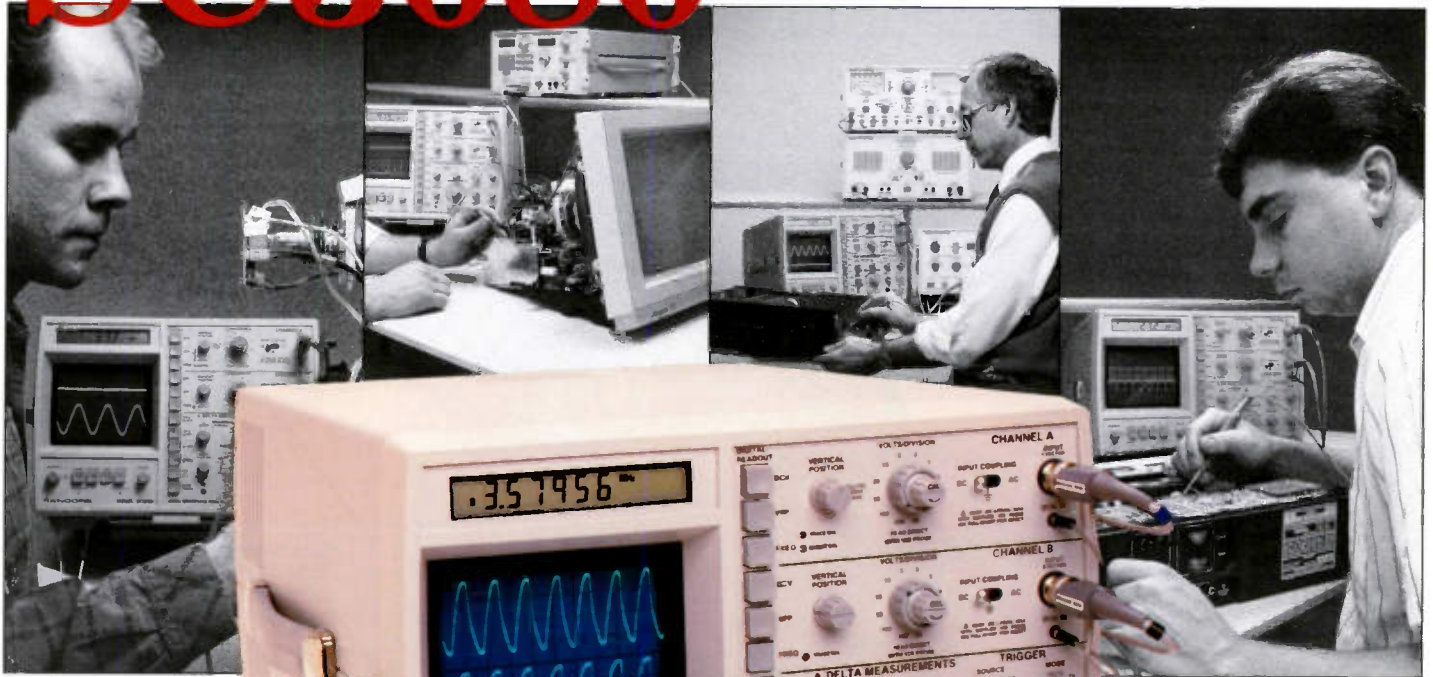
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4000 count digital display	V Chek™	V Chek™
1.5% basic dc volts accuracy	Capacitance, .001 to 9999 μF	Min/Max recording with relative time stamp
2.9% basic ac volts accuracy	4000 count digital display	Continuity Capture™
1.5% basic ohms accuracy	0.9% basic dc volts accuracy	Capacitance, .001 to 9999 μF
Fast continuity beeper	1.9% basic ac volts accuracy	4000 count digital display
Diode Test	0.9% basic ohms accuracy	0.9% basic dc volts accuracy
Sleep Mode	Fast continuity beeper	1.9% basic ac volts accuracy
Two-year warranty	Diode Test	0.9% basic ohms accuracy
	Sleep Mode	Fast continuity beeper
	Two-year warranty	Diode Test
		Sleep Mode
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Optional holster with tilt-stand available.



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